

**TECHNICAL FIELD SERVICE DIVISION**

Special Projects Group

**Client Information**

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

**High Voltage Air/Load Break Switch****Nameplate Data**

<b>Manufacturer</b>	S&C	<b>Voltage</b>	27.6	<b>kVolts</b>
<b>Type</b>	SM Alduti Indoor	<b>Current</b>	600	<b>Amps</b>
<b>Style #</b>		<b>B.I.L.</b>	150	<b>kVolts</b>
<b>Cat #</b>	34563R4-T2	<b>Serial #</b>		

**Mechanical Inspections**

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

**Electrical Tests**

<i>Test Description</i>	$\phi A$	$\phi B$	$\phi C$	<i>A/B</i>	<i>B/C</i>	<i>C/A</i>
<b>Insulation Resistance (M<math>\Omega</math>)</b>	780	540	755	3420	3280	4080
<b>Contact Resistance (<math>\mu\Omega</math>)</b>	38	36	36			
<b>Arc Interrupter Res.(<math>\Omega</math>)</b>	0.7	1.4	0.8			
<b>Results Satisfactory</b>	OK					

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# TECHNICAL FIELD SERVICE DIVISION

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
Type	SM-5	Current	300	Amps
Style/Cat #	86641R1	Serial #		

### Fuse Link Nameplate Data

Type	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	$\phi A$	$\phi B$	$\phi C$	A/B	B/C	C/A
Insulation Resistance (M $\Omega$ )	>999	>999	>999	>999	>999	>999
Contact Resistance ( $\mu\Omega$ )	1760	1733	1760			

Results Satisfactory OK

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**TECHNICAL FIELD SERVICE DIVISION****Special Projects Group****Client Information**

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

**Power Transformer -Electrical****Nameplate Data**

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

**Insulation Tests**

<b>Insulation Resistance @ 5k / 1k VDC</b>	<b>Prim. With Sec. Grounded</b>	<b>Sec. With Prim. Grounded</b>	<b>Prim. &amp; Sec. To Ground</b>		
<b>MΩ</b>	27.2	27.8			
<b>Corrected to 20 °C.</b>	76.2	77.8			
	<b>CH-L + G</b>	<b>CH-G</b>	<b>CH-L</b>	<b>CL-G</b>	<b>CL-H + G</b>
<b>Cap (pF)</b>					
<b>Corr. 20 °C</b>					
<b>Dis. Fact.(%)</b>					
<b>Corr. 20 °C.</b>					

**Turns Ratio Tests**

<b>Tap</b>	<b>Primary Volts</b>	<b>Calculated Ratio</b>	<b><u>X0-X1</u> H0-H1</b>	<b><u>X0-X2</u> H0-H2</b>	<b><u>X0-X3</u> H0-H3</b>
1					
2					
3	27,600	0.754	0.747	0.747	0.747
4					
5					
<b>Tap Position Found &amp; Left</b>		3 (27,600V)			
<b>Results Satisfactory</b>		OK			

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# 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., Scarborough, 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 (H <sub>2</sub> )			
Oxygen & Argon			
Nitrogen (N <sub>2</sub> )			
Methane (CH <sub>4</sub> )			
Carbon Monoxide (CO)			
Carbon Dioxide (CO <sub>2</sub> )			
Ethylene (C <sub>2</sub> H <sub>4</sub> )			
Ethane (C <sub>2</sub> H <sub>6</sub> )			
Acetylene (C <sub>2</sub> H <sub>2</sub> )			
Total Gas Content			

### Comments

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

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# TECHNICAL FIELD SERVICE DIVISION

## Special Projects Group

### Client Information

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

### Power Transformer -Mechanical

#### Mechanical Inspections

<i>Description of Inspection</i>	<i>Status</i>	<i>Comments</i>
<b>Breather &amp; Silica Gel</b>	N/A	
<b>Explosion Vent Gaskets</b>	N/A	
<b>Pressure Relief Device</b>	OK	
<b>Conservator Tank Gaskets</b>	N/A	
<b>Inspection Cover Gaskets</b>	OK	
<b>Main Cover Gaskets</b>	N/A	
<b>Primary Bushing Gaskets</b>	OK	
<b>Primary Bushing Porcelain</b>	OK	
<b>Primary Bushing Connections</b>	OK	
<b>Secondary Bushing Gaskets</b>	OK	
<b>Secondary Bushing Porcelain</b>	OK	
<b>Secondary Bushing Connections</b>	OK	
<b>Secondary Throat Gaskets</b>	OK	
<b>Radiator</b>	OK	
<b>Pressure Gauge</b>	OK	-7 PSI Vacuum
<b>Gas Relay</b>	N/A	
<b>Oil Level</b>	OK	
<b>Oil Leaks</b>	OK	None visible
<b>Tank Valves</b>	OK	
<b>Oil Temperature Gauge</b>	OK	
<b>Oil Temperature Run/Max</b>	35   45°C	
<b>Winding Temperature Gauge</b>	N/A	
<b>Winding Temperature Run/Max</b>		
<b>Tap Changer</b>		Unit Locked: Inoperable
<b>Paint Condition</b>	OK	
<b>Pad</b>	OK	
<b>Grounding</b>	OK	
<b>Fan Operation</b>	N/A	
<b>Control Wiring</b>	N/A	
<b>Results Satisfactory</b>	OK	

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# TECHNICAL FIELD SERVICE DIVISION

## 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

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	$\phi A$	$\phi B$	$\phi C$	N	A/B	B/C	C/A
Insulation Resistance (M $\Omega$ )	1170	1570	1920	---	1080	1980	3180

Comments

Results Satisfactory    OK

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# TECHNICAL FIELD SERVICE DIVISION

## 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

	Settings		$\phi A$		$\phi B$		$\phi C$	
	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	$\phi A$	$\phi B$	$\phi C$	A/B	B/C	C/A
Insulation Resistance (M $\Omega$ )	>999	>999	>999	>999	>999	>999
Contact Resistance ( $\mu\Omega$ )	40/ 70	49/ 50	49/ 48			

Results Satisfactory *NO. See Deficiencies.*

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***Technical Field Service Department***

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

**Entrance/ Administration  
Building**

**TECHNICAL FIELD SERVICE DIVISION****Special Projects Group****Client Information**

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

**High Voltage Air/Load Break Switch****Nameplate Data**

<b>Manufacturer</b>	S&C	<b>Voltage</b>	27.6	<b>kVolts</b>
<b>Type</b>	Alduti Indoor	<b>Current</b>	600	<b>Amps</b>
<b>Style #</b>		<b>B.I.L.</b>	150	<b>kVolts</b>
<b>Cat #</b>	CDT-2765378	<b>Serial #</b>		

**Mechanical Inspections**

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

**Electrical Tests**

<i>Test Description</i>	$\phi A$	$\phi B$	$\phi C$	<i>A/B</i>	<i>B/C</i>	<i>C/A</i>
<b>Insulation Resistance (G<math>\Omega</math>)</b>	>505	>505	>505	>505	>505	>505
<b>Contact Resistance (<math>\mu\Omega</math>)</b>	58	61	65			
<b>Arc Interrupter Res.(<math>\Omega</math>)</b>	2.0	0.4	1.9			
<b>Results Satisfactory</b>	OK					

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# TECHNICAL FIELD SERVICE DIVISION

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	$\phi A$	$\phi B$	$\phi C$	A/B	B/C	C/A
Insulation Resistance (G $\Omega$ )	>505	>505	>505	>505	>505	>505
Contact Resistance ( $\mu\Omega$ )	77	83	86			
Arc Interrupter Res.( $\Omega$ )	0.43	0.40	0.40			
Results Satisfactory	OK					

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# TECHNICAL FIELD SERVICE DIVISION

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		
Substation	Entrance/ Administration Building		

## High Voltage Air/Load Break Switch

### Nameplate Data

Manufacturer	S&C	Voltage	27.6	kVolts
Type	SM Alduti	Current	600	Amps
Style #		B.I.L.	150	kVolts
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

Test Description	$\phi A$	$\phi B$	$\phi C$	A/B	B/C	C/A
Insulation Resistance (G $\Omega$ )	>505	>505	>505	>505	>505	>505
Contact Resistance ( $\mu\Omega$ )	28	28	35			
Arc Interrupter Res.( $\Omega$ )	0.3	0.3	0.5			
Results Satisfactory	OK					

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# TECHNICAL FIELD SERVICE DIVISION

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 #		

### Fuse Link Nameplate Data

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	Fair	One only in cell door

### Electrical Tests

Test Description	$\phi A$	$\phi B$	$\phi C$	A/B	B/C	C/A
Insulation Resistance (G $\Omega$ )	>505	>505	>505	>505	>505	>505
Contact Resistance ( $\mu\Omega$ )	780	802	802			

Results Satisfactory      OK. Spare Links Required.

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# TECHNICAL FIELD SERVICE DIVISION

## 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
Type	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	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	$\phi A$	$\phi B$	$\phi C$	A/B	B/C	C/A
Insulation Resistance (G $\Omega$ )	>505	>505	>505	>505	>505	>505
Contact Resistance ( $\mu\Omega$ )	71	72	75			
Arc Interrupter Res.( $\Omega$ )	0.4	0.2	0.2			
Results Satisfactory	OK					

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# TECHNICAL FIELD SERVICE DIVISION

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 Nameplate Data

Manufacturer	S&C	Voltage	34.5	kVolt
Type	SM-5S	Current	300E	Amps
Style/Cat #	86644R1	Serial #		

### Fuse Link Nameplate Data

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	
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	$\phi A$	$\phi B$	$\phi C$	A/B	B/C	C/A
Insulation Resistance (G $\Omega$ )	>505	>505	>505	>505	>505	>505
Contact Resistance ( $\mu\Omega$ )	5276	5318	5400			

Results Satisfactory OK

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# TECHNICAL FIELD SERVICE DIVISION

## 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	Entrance/ Administration Building		

### Power Transformer - Electrical

#### Nameplate Data

Manufacturer	Westinghouse	Vector Group	Wye Wye		
Type	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	$\phi$	Secondary Voltage	120/ 208	Volt
Frequency	60	Hz	BIL	150	kVolt

#### Insulation Tests

Insulation Resistance @ 5k / 1k VDC	Prim. With Sec. Grounded	Sec. With Prim. Grounded	Prim. & Sec. To Ground		
M $\Omega$	30	30			
Corrected to 20 °C.					
	CH-L + G	CH-G	CH-L	CL-G	CL-H + G
Cap (pF)					
Corr. 20 °C					
Dis. Fact.(%)					
Corr. 20 °C.					

#### Turns Ratio Tests

Tap	Primary Volts	Calculated Ratio	$\frac{X0-X1}{H0-H1}$	$\frac{X0-X2}{H0-H2}$	$\frac{X0-X3}{H0-H3}$
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				

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**TECHNICAL FIELD SERVICE DEPARTMENT**

Special Projects Group

**Client Information**

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

**Oil Analysis****Transformer Data**

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

**Laboratory Tests**

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

**Comments**

<b>Chemical Properties</b>	OK
<b>PCB Content</b>	PCB Insulating Fluid
<b>Dissolved Gas Content</b>	

T.S.

# TECHNICAL FIELD SERVICE DIVISION

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 Data

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

<i>Description of Inspection</i>	<i>Status</i>	<i>Comments</i>
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

<i>Test Description</i>	$\phi A$	$\phi B$	$\phi C$	<i>A/B</i>	<i>B/C</i>	<i>C/A</i>
Insulation Resistance (G $\Omega$ )	>505	>505	>505	>505	>505	>505
Contact Resistance ( $\mu\Omega$ )	43	49	43			
Arc Interrupter Res.( $\Omega$ )	0.3	0.3	0.4			
Results Satisfactory	OK					

T.S.

**TECHNICAL FIELD SERVICE DIVISION**

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 Nameplate Data**

Manufacturer	S&C	Voltage	34.5	kVolt
Type	SM-5S	Current	300E	Amps
Style/Cat #	86644R1	Serial #		

**Fuse Link Nameplate Data**

Type	SM-5	TCC	153-4
Style/Cat #	13440R4	Amps	25E

**Mechanical Inspections**

<i>Description of Inspection</i>	<i>Status</i>	<i>Comments</i>
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**

<i>Test Description</i>	$\phi A$	$\phi B$	$\phi C$	<i>A/B</i>	<i>B/C</i>	<i>C/A</i>
Insulation Resistance (G $\Omega$ )	>505	>505	>505	>505	>505	>505
Contact Resistance ( $\mu\Omega$ )	2439	2412	2451			

Results Satisfactory OK

T.S.

# TECHNICAL FIELD SERVICE DIVISION

## 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

#### Nameplate Data

Manufacturer	Westinghouse	Vector Group	Wye Wye		
Type	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	$\phi$	Secondary Voltage	600	Volt
Frequency	60	Hz	BIL	150	kVolt

#### Insulation Tests

Insulation Resistance @ 5k / 1k VDC	Prim. With Sec. Grounded	Sec. With Prim. Grounded	Prim. & Sec. To Ground		
M $\Omega$	32	32			
Corrected to 20 °C.					
	CH-L + G	CH-G	CH-L	CL-G	CL-H + G
Cap (pF)					
Corr. 20 °C					
Dis. Fact.(%)					
Corr. 20 °C.					

#### Turns Ratio Tests

Tap	Primary Volts	Calculated Ratio	$\frac{X0-X1}{H0-H1}$	$\frac{X0-X2}{H0-H2}$	$\frac{X0-X3}{H0-H3}$
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.

**TECHNICAL FIELD SERVICE DEPARTMENT**

Special Projects Group

**Client Information**

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

**Oil Analysis****Transformer Data**

<b>Manufacturer</b>	Westinghouse	<b>Primary Volts</b>	27.6/ 16	<b>kVolts</b>
<b>Type</b>	LNAN	<b>Rating</b>	225	<b>kVA</b>
<b>Serial No.</b>	850912	<b>Liquid Volume</b>	240	<b>Gals.</b>

**Laboratory Tests**

Type of Test	ASTM No.	Acceptable Limits	Test Results
			99
<b>Dielectric Breakdown</b>	D877	30 kV	49.0
<b>Neutralization Number</b>	D974	0.05 Max. Mg Koh/G	0.004
<b>Interfacial Tension</b>	D971	32 Dynes/ Cm Min.	N/A
<b>Specific Gravity</b>	D1298	0.84 - 0.91	1.520
<b>Colour</b>	D1500	≤3.5	0.5
<b>Visual Condition</b>	D1524	Clear	Clear
<b>Water Content</b>	D1533	30 ppm (<69kV)	
<b>Power Factor</b>	D924	1.0 % Max @ 25 °C	
<b>PCB Content</b>	D4059	50 ppm Max.	
<b>Inhibitor</b>	D2668	≥0.20%	
<b>Furans</b>	D5837	<100 ppb	
<b>Hydrogen (H<sub>2</sub>)</b>			
<b>Oxygen &amp; Argon</b>			
<b>Nitrogen (N<sub>2</sub>)</b>			
<b>Methane (CH<sub>4</sub>)</b>			
<b>Carbon Monoxide (CO)</b>			
<b>Carbon Dioxide (CO<sub>2</sub>)</b>			
<b>Ethylene (C<sub>2</sub>H<sub>4</sub>)</b>			
<b>Ethane (C<sub>2</sub>H<sub>6</sub>)</b>			
<b>Acetylene (C<sub>2</sub> H<sub>2</sub>)</b>			
<b>Total Gas Content</b>			

**Comments**

<b>Chemical Properties</b>	OK
<b>PCB Content</b>	PCB Insulating Fluid
<b>Dissolved Gas Content</b>	

T.S.

**TECHNICAL FIELD SERVICE DIVISION**

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 Data**

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

**Mechanical Inspections**

<i>Description of Inspection</i>	<i>Status</i>	<i>Comments</i>
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**

<i>Test Description</i>	$\phi A$	$\phi B$	$\phi C$	<i>A/B</i>	<i>B/C</i>	<i>C/A</i>
Insulation Resistance (M $\Omega$ )						
Contact Resistance ( $\mu\Omega$ )	60	58	56			
Arc Interrupter Res.( $\Omega$ )	1.3	1.1	1.5			
Results Satisfactory	OK					

T.S.

# TECHNICAL FIELD SERVICE DIVISION

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 Power Fuse

### Fuse Holder Nameplate Data

Manufacturer	S&C	Voltage	34.5	kVolt
Type	SM-5	Current	600	Amps
Style/Cat #	86644R2	Serial #		

### Fuse Link Nameplate Data

Type	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

### Electrical Tests

Test Description	$\phi A$	$\phi B$	$\phi C$	A/B	B/C	C/A
Insulation Resistance (M $\Omega$ )	>999	>999	>999	>999	>999	>999
Contact Resistance ( $\mu\Omega$ )	5130	4865	5065			

Results Satisfactory      OK

T.S.

**TECHNICAL FIELD SERVICE DIVISION****Special Projects Group****Client Information**

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

**Pad-Mounted Distribution Transformer****Transformer Nameplate Data**

<b>Manufacturer</b>	CARTE	<b>Year Built</b>	1985		
<b>Type</b>	ONAN	<b>Serial #</b>	NO790-1		
<b>Neutral</b>	Solid	<b>Liquid Type/Vol</b>	Oil	872	Litres
<b>Rating</b>	300	kVA	<b>Total Weight</b>	1909	Kg
<b>Impedance</b>	4.58	%	<b>Primary Voltage</b>	27.6/ 16	KVOLT
<b>Phase(s)</b>	3	φ	<b>Secondary Voltage</b>	208/ 120	VOLT
<b>Frequency</b>	60	Hz	<b>BIL</b>	150	kVOLT
<b>Insulation Resistance (MΩ)</b>					

**Oil Analysis****Laboratory Tests**

Type of Test	ASTM No.	Acceptable Limits	Test Results
			1999
<b>Dielectric Breakdown</b>	<b>D877</b>	<b>30 kV Min.</b>	36.3
<b>Neutralization Number</b>	<b>D974</b>	<b>0.05 Max. Mg Koh/G</b>	0.014
<b>Interfacial Tension</b>	<b>D971</b>	<b>32 Dynes/ Cm Min.</b>	31.3
<b>Specific Gravity</b>	<b>D1298</b>	<b>0.84 - 0.91</b>	0.859
<b>Colour</b>	<b>D1500</b>	<b>≤3.5 Max.</b>	<0.5
<b>Visual Condition</b>	<b>D1524</b>	<b>Clear</b>	Clear

**Observations & Comments**

<b>Comments:</b>	
<b>Results Satisfactory:</b>	OK

T.S.



***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**

# 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., Scarborough, Ontario		
Equipment I.D.	Feeder to Main Switchgear		
Substation	Service Building		

### High Voltage Air/Load Break Switch

#### Nameplate Data

Manufacturer	S&C	Voltage	27	kVolts
Type	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	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	$\phi A$	$\phi B$	$\phi C$	A/B	B/C	C/A
Insulation Resistance (M $\Omega$ )						
Contact Resistance ( $\mu\Omega$ )	58	59	57			
Arc Interrupter Res.( $\Omega$ )	0.3	0.3	0.3			
Results Satisfactory	OK					

T.S.

# 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., Scarborough, Ontario		
Equipment I.D.	Feeder to North America Pavilion		
Substation	Service Building		

## High Voltage Air/Load Break Switch

### Nameplate Data

Manufacturer	S&C	Voltage	27	kVolts
Type	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	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	$\phi A$	$\phi B$	$\phi C$	A/B	B/C	C/A
Insulation Resistance (M $\Omega$ )						
Contact Resistance ( $\mu\Omega$ )	56	55	57			
Arc Interrupter Res.( $\Omega$ )	0.5	0.6	0.5			

Results Satisfactory      OK

T.S.

# 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., 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
Type	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 (MΩ)					
Contact Resistance (μΩ)	57	60	---		
Arc Interrupter Res.(Ω)	0.6	0.7	---		
Results Satisfactory	OK. Single phase feeds x2				

T.S.

# 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., Scarborough, Ontario		
Equipment I.D.	Paddock Feeder WEST/ EAST		
Substation	Service Building		

### High Voltage Power Fuse

#### Fuse Holder Nameplate Data

Manufacturer	S&C	Voltage	34.5	kVolt
Type	SM-5S	Current	300	Amps
Style/Cat #		Serial #		

#### Fuse Link Nameplate Data

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	

#### Electrical Tests

Test Description	WEST	EAST				
Insulation Resistance (GΩ)	>505	>505	---	---	---	---
Contact Resistance (μΩ)	830	859	---			

Results Satisfactory      OK

T.S.

**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., 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
Type	Alduti	Current	600	Amps
Style #		B.I.L.	150	kVolts
Cat #	34563R4-T2	Serial #		

**Mechanical Inspections**

<i>Description of Inspection</i>	<i>Status</i>	<i>Comments</i>
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**

<i>Test Description</i>	$\phi A$	$\phi B$	$\phi C$	<i>A/B</i>	<i>B/C</i>	<i>C/A</i>
Insulation Resistance (M $\Omega$ )						
Contact Resistance ( $\mu\Omega$ )	51	50	46			
Arc Interrupter Res.( $\Omega$ )	0.3	0.3	0.3			
Results Satisfactory	OK					

T.S.

# 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.	Feeder to Service Building X-Former #4		
Substation	Service 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 #		

Fuse Link Nameplate Data			
Type	SM-5	TCC	153-4
Style/Cat #	134100R4	Amps	65E

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	

Electrical Tests						
Test Description	$\phi A$	$\phi B$	$\phi C$	A/B	B/C	C/A
Insulation Resistance (G $\Omega$ )	>505	>505	>505	>505	>505	>505
Contact Resistance ( $\mu\Omega$ )	1136	1044	1021			
Results Satisfactory	OK					

T.S.

# 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., Scarborough, Ontario		
Equipment I.D.	T1 27.6kV-600V 3 $\phi$ 4W From HV Board		
Substation	Service Building		

### Power Transformer -Electrical

#### Nameplate Data

Manufacturer	Hammond	Vector Group	Wye Wye		
Type	ANN/ AFN	Serial #.	DB93F		
Neutral	Solid	Liquid Type/Vol	Dry	Type	Gal
Rating	1500/ 2000	kVA	Total Weight	16500	lbs.
Impedance	5.7	%	Primary Voltage	27.6/ 15.935	kVolt
Phase	3	$\phi$	Secondary Voltage	600/ 347	Volt
Frequency	60	Hz	BIL	150	kVolt

#### Insulation Tests

Insulation Resistance @ 5k / 1k VDC	Prim. With Sec. Grounded	Sec. With Prim. Grounded	Prim. & Sec. To Ground		
M $\Omega$	10,000	10,000	10,000		
Corrected to 20 °C.					
	CH-L + G	CH-G	CH-L	CL-G	CL-H + G
Cap (pF)					
Corr. 20 °C					
Dis. Fact.(%)					
Corr. 20 °C.					

#### Turns Ratio Tests

Tap	Primary Volts	Calculated Ratio	<u>X0-X2</u> H1-H2	<u>X0-X3</u> 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

T.S.



# 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

### Nameplate Data

Manufacturer	FPE	Voltage	600	Volts
Type	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

	Settings		$\phi A$		$\phi B$		$\phi C$	
	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	OK	
Manual Operation	OK	
Electrical Operation	N/A	

### Electrical Tests

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

T.S.

***Technical Field Service Department***

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

**Eurasia Pavilion**

**TECHNICAL FIELD SERVICE DIVISION****Special Projects Group****Client Information**

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

**High Voltage Air/Load Break Switch****Nameplate Data**

<b>Manufacturer</b>	S&C	<b>Voltage</b>	27	<b>kVolts</b>
<b>Type</b>	Alduti	<b>Current</b>	600	<b>Amps</b>
<b>Style #</b>		<b>B.I.L.</b>	150	<b>kVolts</b>
<b>Cat #</b>	34063R2	<b>Serial #</b>		

**Mechanical Inspections**

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

**Electrical Tests**

<i>Test Description</i>	$\phi A$	$\phi B$	$\phi C$	<i>A/B</i>	<i>B/C</i>	<i>C/A</i>
<b>Insulation Resistance (G<math>\Omega</math>)</b>	236	232	278	>505	>505	>505
<b>Contact Resistance (<math>\mu\Omega</math>)</b>	48	52	61			
<b>Arc Interrupter Res.(<math>\Omega</math>)</b>	1.2	1.3	1.6			
<b>Results Satisfactory</b>	OK					

T.S.

**TECHNICAL FIELD SERVICE DIVISION****Special Projects Group****Client Information**

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

**High Voltage Air/Load Break Switch****Nameplate Data**

<b>Manufacturer</b>	S&C	<b>Voltage</b>	27	<b>kVolts</b>
<b>Type</b>	Alduti	<b>Current</b>	600	<b>Amps</b>
<b>Style #</b>		<b>B.I.L.</b>	150	<b>kVolts</b>
<b>Cat #</b>	34063R2	<b>Serial #</b>		

**Mechanical Inspections**

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

**Electrical Tests**

<i>Test Description</i>	<i><math>\phi A</math></i>	<i><math>\phi B</math></i>	<i><math>\phi C</math></i>	<i>A/B</i>	<i>B/C</i>	<i>C/A</i>
<b>Insulation Resistance (G<math>\Omega</math>)</b>	236	232	278	>505	>505	>505
<b>Contact Resistance (<math>\mu\Omega</math>)</b>	39	42	40			
<b>Arc Interrupter Res.(<math>\Omega</math>)</b>	3.1	2.0	3.6			
<b>Results Satisfactory</b>	OK					

T.S.

# TECHNICAL FIELD SERVICE DIVISION

## 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 Voltage Air/Load Break Switch

#### Nameplate Data

Manufacturer	S&C	Voltage	27	kVolts
Type	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 Tests

Test Description	$\phi A$	$\phi B$	$\phi C$	A/B	B/C	C/A
Insulation Resistance (G $\Omega$ )						
Contact Resistance ( $\mu\Omega$ )	60	---	58			
Arc Interrupter Res.( $\Omega$ )	1.9	---	0.6			
Results Satisfactory	See Deficiencies.					

T.S.

# TECHNICAL FIELD SERVICE DIVISION

## 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 Voltage Power Fuse

#### Fuse Holder Nameplate Data

Manufacturer	S&C	Voltage	34.5	kVolt
Type	SM-5S	Current	300E	Amps
Style/Cat #		Serial #		

#### Fuse Link Nameplate Data

Type	SM-5	TCC	153-4
Style/Cat #	134125R	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	Fair	Only One Spare Present in Cell

#### Electrical Tests

Test Description	$\phi A$	$\phi B$	$\phi C$	A/B	B/C	C/A
Insulation Resistance (M $\Omega$ )						
Contact Resistance ( $\mu\Omega$ )	966	---	1286			

Results Satisfactory      Fair. See Recommendations.

T.S.

# TECHNICAL FIELD SERVICE DIVISION

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 Air/Load Break Switch

### Nameplate Data

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

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	$\phi A$	$\phi B$	$\phi C$	A/B	B/C	C/A
Insulation Resistance (G $\Omega$ )	236	232	278	>505	>505	>505
Contact Resistance ( $\mu\Omega$ )	41	42	44			
Arc Interrupter Res.( $\Omega$ )	0.9	1.2	0.4			
Results Satisfactory	OK					

T.S.

# TECHNICAL FIELD SERVICE DIVISION

## 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 Nameplate Data

Manufacturer	S&C	Voltage	34.5	kVolt
Type	SM-5S	Current	300E	Amps
Style/Cat #	86644R1	Serial #		

#### Fuse Link Nameplate Data

Type	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

#### Electrical Tests

Test Description	$\phi A$	$\phi B$	$\phi C$	A/B	B/C	C/A
Insulation Resistance (M $\Omega$ )	>999	>999	>999	>999	>999	>999
Contact Resistance ( $\mu\Omega$ )	6020	5940	6080			

Results Satisfactory      OK

T.S.



# TECHNICAL FIELD SERVICE DIVISION

## 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 LD.	Eurasia Pav. Trans. T-1		
Substation	Eurasia Pavilion		

### Power Transformer -Electrical

#### Nameplate Data

Manufacturer	Westinghouse	Vector Group	Y-Y		
Type	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	$\phi$	Secondary Voltage	208/ 120	Volt
Frequency	60	Hz	BIL	150/ 45	kVolt

#### Insulation Tests

Insulation Resistance @ 5k / 500 VDC	Prim. With Sec. Grounded	Sec. With Prim. Grounded	Prim. & Sec. To Ground		
M $\Omega$	40.0	34.2			
Corrected to 20 °C.	112.0	95.8			
	CH-L + G	CH-G	CH-L	CL-G	CL-H + G
Cap (pF)					
Corr. 20 °C					
Dis. Fact.(%)					
Corr. 20 °C.					

#### Turns Ratio Tests

Tap	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	0.754	0.746	0.746	0.746
4					
5					
Tap Position Found & Left		3 (27,600V)			
Results Satisfactory		OK			

T.S.

# 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	kVolts
Type	LNAN	Rating	225/ 252	kVA
Serial No.	849380	Liquid Volume	200	Gals.

### Laboratory Tests

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	≥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 fluid
Dissolved Gas Content	---

T.S.

# TECHNICAL FIELD SERVICE DIVISION

Special Projects Group

## Client Information

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

## Power Transformer -Mechanical

### Mechanical Inspections

Description of Inspection	Status	Comments
Breather & Silica Gel	N/A	
Explosion Vent Gaskets	N/A	
Pressure Relief Device	OK	
Conservator Tank Gaskets	N/A	
Inspection Cover Gaskets	OK	
Main Cover Gaskets	N/A	
Primary Bushing Gaskets	OK	
Primary Bushing Porcelain	POOR	H3 top skirt split/ cracked
Primary Bushing Connections	OK	
Secondary Bushing Gaskets	OK	
Secondary Bushing Porcelain	OK	
Secondary Bushing Connections	OK	
Secondary Throat Gaskets	OK	
Radiator	OK	
Pressure Gauge	OK	-0.8 PSI Vacuum
Gas Relay	N/A	
Oil Level	OK	
Oil Leaks	OK	None Visible
Tank Valves	OK	
Oil Temperature Gauge	OK	
Oil Temperature Run/Max	34   41°C	
Winding Temperature Gauge	N/A	
Winding Temperature Run/Max		
Tap Changer		Unit Locked: Inoperable
Paint Condition	OK	
Pad	OK	
Grounding	OK	One-point grounding
Fan Operation	N/A	
Control Wiring	N/A	
Results Satisfactory	Fair. See Deficiencies.	

T.S.



**TECHNICAL FIELD SERVICE DIVISION**

Special Projects Group

**Client Information**

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

**Bus Duct****Nameplate Data**

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

**Mechanical Inspections**

<i>Description of Inspection</i>	<i>Status</i>	<i>Comments</i>
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**

<i>Test Description</i>	$\phi A$	$\phi B$	$\phi C$	<i>N</i>	<i>A/B</i>	<i>B/C</i>	<i>C/A</i>
Insulation Resistance (M $\Omega$ )	2060	1990	2250	—	4780	4980	5500
Comments							
Results Satisfactory	OK						

T.S.

# TECHNICAL FIELD SERVICE DIVISION

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
Type	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		$\phi A$		$\phi B$		$\phi C$	
	P/U	T.D.	P/U	T.D.	P/U	T.D.	P/U	T.D.
Long Time	800A	Inst.						
Short Time	3200A							
Instantaneous								
			P/U	T.D.				
Ground Fault	—							

### Mechanical Inspections

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

### Electrical Tests

Test Description	$\phi A$	$\phi B$	$\phi C$	A/B	B/C	C/A
Insulation Resistance (M $\Omega$ )	>999	>999	>999	>999	>999	>999
Contact Resistance ( $\mu\Omega$ )	58	64	52			

Results Satisfactory      OK

T.S.

**TECHNICAL FIELD SERVICE DIVISION**

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****Transformer Nameplate Data**

Manufacturer	Federal Pioneer	Year Built	1976		
Type	ONAN	Serial #	A11808-1		
Neutral	Solid	Liquid Type/Vol	Oil	260	Gal
Rating	225	kVA	Total Weight	4650	lbs.
Impedance		%	Primary Voltage	27.6/ 16	kVolt
Phase(s)	3	φ	Secondary Voltage	208/ 120	Volt
Frequency	60	Hz	BIL		kVolt
Insulation Resistance (MΩ)					

**Oil 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.
- This station's switchgear was reported to be in POOR condition*

Results Satisfactory: *FAIR/ Poor*

T.S.

*Technical Field Service Department*

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

**Indo-Malaya Pavilion**



# TECHNICAL FIELD SERVICE DIVISION

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

### Nameplate Data

Manufacturer	S&C	Voltage	27	kVolts
Type	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	Bφ terminator skirt broken off.
Phase Barrier Condition	OK	
Support Structure Condition	OK	

### Electrical Tests

Test Description	$\phi A$	$\phi B$	$\phi C$	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			

Results Satisfactory OK/ Fair. *See Deficiencies.*

T.S.

**TECHNICAL FIELD SERVICE DIVISION**

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
Type	Alduti	Current	600	Amps
Style #		B.I.L.	150	kVolts
Cat #	34063	Serial #		

**Mechanical Inspections**

<i>Description of Inspection</i>	<i>Status</i>	<i>Comments</i>
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**

<i>Test Description</i>	$\phi A$	$\phi B$	$\phi C$	<i>A/B</i>	<i>B/C</i>	<i>C/A</i>
Insulation Resistance (M $\Omega$ )						
Contact Resistance ( $\mu\Omega$ )	62	56	52			
Arc Interrupter Res.( $\Omega$ )	0.6	0.7	0.5			
Results Satisfactory	OK					

T.S.

# TECHNICAL FIELD SERVICE DIVISION

## 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.	Indo-Malaya Paddock Feeder		
Substation	Indo-Malaya Pavilion		

### High Voltage Air/Load Break Switch

#### Nameplate Data

Manufacturer	S&C	Voltage	27.6	kVolts
Type	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	Poor	Operator is defective
Connector Condition	OK	
Insulator Condition	OK	
Phase Barrier Condition	OK	
Support Structure Condition	OK	

#### Electrical Tests

Test Description	$\phi A$	$\phi B$	$\phi C$	A/B	B/C	C/A
Insulation Resistance (M $\Omega$ )						
Contact Resistance ( $\mu\Omega$ )	---	---	62			
Arc Interrupter Res.( $\Omega$ )	---	---	*			
Results Satisfactory	Fair. See Deficiencies.					

**TECHNICAL FIELD SERVICE DIVISION**

Special Projects Group

**Client Information**

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

**High Voltage Power Fuse****Fuse Holder Nameplate Data**

<b>Manufacturer</b>	S&C	<b>Voltage</b>	34.5	<b>kVolt</b>
<b>Type</b>	SM-5	<b>Current</b>	300	<b>Amps</b>
<b>Style/Cat #</b>	86644R1	<b>Serial #</b>		

**Fuse Link Nameplate Data**

<b>Type</b>	SM-5	<b>TCC</b>	
<b>Style/Cat #</b>		<b>Amps</b>	

**Mechanical Inspections**

<i>Description of Inspection</i>	<i>Status</i>	<i>Comments</i>
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	Poor	No Spares in Cell

**Electrical Tests**

<i>Test Description</i>	$\phi A$	$\phi B$	$\phi C$	<i>A/B</i>	<i>B/C</i>	<i>C/A</i>
Insulation Resistance (M $\Omega$ )						
Contact Resistance ( $\mu\Omega$ )			1015			

<b>Results Satisfactory</b>	Fair. Spare links required.
-----------------------------	-----------------------------

T.S.

# TECHNICAL FIELD SERVICE DIVISION

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.	Indo-Malaya Transformer T2		
Substation	Indo-Malaya Pavilion		

## High Voltage Air/Load Break Switch

### Nameplate Data

Manufacturer	S&C	Voltage	27	kVolts
Type	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	

### Electrical Tests

Test Description	$\phi A$	$\phi B$	$\phi C$	A/B	B/C	C/A
Insulation Resistance (M $\Omega$ )						
Contact Resistance ( $\mu\Omega$ )	50	46	48			
Arc Interrupter Res.( $\Omega$ )	1.0	0.5	0.8			
Results Satisfactory	OK					

T.S.

**TECHNICAL FIELD SERVICE DIVISION**

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.	Indo-Malaya Transformer T2		
Substation	Indo-Malaya Pavilion		

**High Voltage Power Fuse****Fuse Holder Nameplate Data**

Manufacturer	S&C	Voltage	27.6	kVolt
Type	SM-5S	Current	300E	Amps
Style/Cat #		Serial #		

**Fuse Link Nameplate Data**

Type	SM-5	TCC	153-4
Style/Cat #	134040R4	Amps	25E

**Mechanical Inspections**

<i>Description of Inspection</i>	<i>Status</i>	<i>Comments</i>
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**

<i>Test Description</i>	$\phi A$	$\phi B$	$\phi C$	<i>A/B</i>	<i>B/C</i>	<i>C/A</i>
Insulation Resistance (M $\Omega$ )						
Contact Resistance ( $\mu\Omega$ )	3024	3055	3148			
Results Satisfactory	OK					

T.S.

# TECHNICAL FIELD SERVICE DIVISION

## 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.	Indo-Malaya Pavilion Trans. T-2		
Substation	Indo-Malaya Pavilion		

### Power Transformer -Electrical

#### Nameplate Data

Manufacturer	Westinghouse	Vector Group	Y-Y		
Type	LNAN	Serial #.	795156		
Neutral	Solid	Liquid Type/Vol	Askarel	220	Gal
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

Insulation Resistance @ 5k / 1k VDC	Prim. With Sec. Grounded	Sec. With Prim. Grounded	Prim. & Sec. To Ground		
MΩ	28.0	24.2			
Corrected to 20 °C.	78.4	67.8			
	CH-L + G	CH-G	CH-L	CL-G	CL-H + G
Cap (pF)					
Corr. 20 °C					
Dis. Fact.(%)					
Corr. 20 °C.					

#### Turns Ratio Tests

Tap	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	0.754	0.746	0.746	0.746
4					
5					
Tap Position Found & Left		3 (27,600V)			
Results Satisfactory		OK			

T.S.

# 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		
Substation	Indo-Malaya Pavilion		

## Oil Analysis

### Transformer Data

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

### Laboratory Tests

Type of Test	ASTM No.	Acceptable Limits	Test Results
			1999
Dielectric Breakdown	D877	30 kV	48.1
Neutralization Number	D974	0.05 Max. Mg Koh/G	0.012
Interfacial Tension	D971	32 Dynes/ Cm Min.	N/A
Specific Gravity	D1298	0.84 - 0.91 (Oil)	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 fluid
Dissolved Gas Content	---

T.S.



**TECHNICAL FIELD SERVICE DIVISION****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****Mechanical Inspections**

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

T.S.

**TECHNICAL FIELD SERVICE DIVISION****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****Nameplate Data**

Manufacturer	FPE	Voltage	120/208	Volts
Type	Power Clad	Current	1600	Amps
Style	3 Phase, 4 Wire	B.I.L.		kVolts
Cat #	08-01599	Serial #		

**Mechanical Inspections**

<i>Description of Inspection</i>	<i>Status</i>	<i>Comments</i>
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**

<i>Test Description</i>	$\phi A$	$\phi B$	$\phi C$	<i>N</i>	<i>A/B</i>	<i>B/C</i>	<i>C/A</i>
Insulation Resistance (M $\Omega$ )	1260	1140	1090	---	1980	2160	3280

Comments

Results Satisfactory OK

T.S.

# TECHNICAL FIELD SERVICE DIVISION

## 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
Type	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 Results

	Settings		$\phi A$		$\phi B$		$\phi C$	
	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

Description of Inspection	Status	Comments
Main & Arcing Contacts	OK	
Arc Chutes	OK	
Phase Barriers	Fair/ Poor	Front Barrier Missing
Bus & Grounding Stabs	OK	
Interlocks	OK	Rack Out Only
Manual Operation	OK	
Electrical Operation	N/A	

#### Electrical Tests

Test Description	$\phi A$	$\phi B$	$\phi C$	A/B	B/C	C/A
Insulation Resistance (M $\Omega$ )	>999	>999	>999	>999	>999	>999
Contact Resistance ( $\mu\Omega$ )	14	17	22			

Results Satisfactory	OK/ Fair
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T.S.

**TECHNICAL FIELD SERVICE DIVISION**

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**

	Settings		$\phi A$		$\phi B$		$\phi C$	
	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	$\phi A$	$\phi B$	$\phi C$	A/B	B/C	C/A
Insulation Resistance (M $\Omega$ )	>999	>999	>999	>999	>999	>999
Contact Resistance ( $\mu\Omega$ )	32	24	28			

Results Satisfactory      Fair as found.

T.S.

***Technical Field Service Department***

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

**Cable Tests**

**TECHNICAL FIELD SERVICE DIVISION****Special Projects Group****Client Information**

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

**Power Cable Inspection****Cable Nameplate Data**

<b>Manufacturer</b>		<b>Voltage</b>	28	<b>kVolts</b>
<b>Insulation Type</b>	XLPE	<b>Ambient Temp.</b>		OC
<b>Conductor Type</b>	Copper (CU)	<b>Humidity</b>		%

**Electrical Test**

<b>Feeder Identification</b>	<b>Insulation Resistance (M<math>\Omega</math>)</b>					
	$\phi$ A	$\phi$ B	$\phi$ C	A/B	B/C	C/A
Incoming Outdoor 27.6kV Feeder	68,000	7,700	725	18,100	4,900	34,000
Main Switchgear to Eurasia Pavilion	750	790	785	3,960	4,080	3,920
Main Switchgear to Service Building	805	800	680	4,180	3,700	3,760
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 (with Lightning Arrestors connected)	386	396	402	2,040	2,100	2,040
Ent./ Admin. to Indo-Malaya Pavilion	760	810	760	4,080	3,980	3,940

**Results Satisfactory**

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# TECHNICAL FIELD SERVICE DIVISION

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 ( <i>tested after <math>\phi B</math> splice repair</i> )		
Substation	Africa Pavilion		

## Cable High-Potential Test

### Cable Nameplate Data

Manufacturer		Voltage	28	kVolts
Insulation Type	XLPE	Conductor Size	3/0	MCM
Conductor Type	Copper (CU)	Temp. & Hum.	28	OC

### Electrical Test

Test Voltage @ 25 kVdc. Voltage Increments	Leakage Current		
	$\phi A$	$\phi B$	$\phi C$
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
<b>Time at Test Voltage</b>			
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			

Test Description	$\phi A$	$\phi B$	$\phi C$	A/B	B/C	C/A
Insulation Resistance (M $\Omega$ )	675	436	1270	1210	1530	1880
Results Satisfactory	$\phi C$ in best condition of 3 cables tested.					

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# TECHNICAL FIELD SERVICE DIVISION

## 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 ( <i>tested after <math>\phi B</math> splice repair</i> )		
Substation	Africa Pavilion		

### Cable High-Potential Test

#### Cable Nameplate Data

Manufacturer	Pirelli	Voltage	28	kVolts
Insulation Type	XLPE	Conductor Size	3/0	MCM
Conductor Type	Copper (CU)	Temp. & Hum.	28	OC

#### Electrical Test

Test Voltage @ 25 kVdc. Voltage Increments	Leakage Current		
	$\phi A$	$\phi B$	$\phi C$
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			

Test Description	$\phi A$	$\phi B$	$\phi C$	A/B	B/C	C/A
Insulation Resistance (M $\Omega$ )						
Results Satisfactory	$\phi C$ in best condition of 3 cables tested.					

T.S.

T.S. HV\_Hypot



***Technical Field Service Department***

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

**SUBMERSIBLE  
Distribution Transformers**

**TECHNICAL FIELD SERVICE DIVISION****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****Transformer Nameplate Data**

Manufacturer	Westinghouse	Year Built	1973		
Type	ONAN	Serial #	971935		
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	∅	Secondary Voltage	120/ 240	Volt
Frequency	60	Hz	BIL	125	kVolt
Insulation Resistance (MΩ)					

**Oil Analysis****Laboratory 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:	<ul style="list-style-type: none"> <li>H1B elbow burnt.</li> <li>Elbow &amp; transformer bushing insert should be replaced.</li> </ul>
Results Satisfactory:	<i>POOR</i>

T.S.

**TECHNICAL FIELD SERVICE DIVISION****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****Transformer Nameplate Data**

Manufacturer	McGraw Edison	Year Built			
Type	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	φ	Secondary Voltage	120/ 240	Volt
Frequency	60	Hz	BIL	125	kVolt
Insulation Resistance (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 tank. -IFT is borderline. Monitor for deterioration.
Results Satisfactory:	OK/ Fair

**TECHNICAL FIELD SERVICE DIVISION**

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****Transformer Nameplate Data**

Manufacturer	Westinghouse	Year Built	1973		
Type	ONAN	Serial #	861979		
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	φ	Secondary Voltage	120/ 240	Volt
Frequency	60	Hz	BIL	125	kVolt
Insulation Resistance (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:

Results Satisfactory: OK

T.S.

**TECHNICAL FIELD SERVICE DIVISION****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****Transformer Nameplate Data**

Manufacturer	Westinghouse		Year Built	1973		
Type	ONAN		Serial #'s	Red Ø: 861975 White Ø: 861980 Blue Ø: 871930		
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	φ	Secondary Voltage	120/ 240	Volt	
Frequency	60	Hz	BIL	125	kVolt	
Insulation Resistance (MΩ)						

**Oil Analysis****Laboratory Tests**

Type of Test	ASTM No.	Acceptable Limits	Test Results		
			Red	White	Blue
Dielectric Breakdown	D877	30 kV Min.	45.1	37.7	49.4
Neutralization Number	D974	0.05 Max. Mg Koh/G	0.028	0.021	0.014
Interfacial Tension	D971	32 Dynes/ Cm Min.	31.9	31.4	31.7
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:	• Below marginal oil levels on all units.
Results Satisfactory:	Fair.

T.S.

**TECHNICAL FIELD SERVICE DIVISION**

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****Transformer Nameplate Data**

Manufacturer	Westinghouse	Year Built	1973		
Type	ONAN	Serial #'s	Red Ø: 871939 White Ø: 871938 Blue Ø: WO383007		
Neutral	Solid	Liquid Type/Vol	Oil	27	Gal
Rating	50	kVA	Total Weight	770	Lbs.
Impedance	1.9	%	Primary Voltage	16	KVolt
Phase(s)	1	φ	Secondary Voltage	120/ 240	Volt
Frequency	60	Hz	BIL	125	KVolt
Insulation Resistance (MΩ)					

**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:	<ul style="list-style-type: none"> <li>-Red phase oil level is marginal.</li> <li>-Blue phase vault initially inaccessible. The water level in this vault does cover the transformer at times.</li> <li>-Blue phase IFT is borderline.</li> <li>-White phase vault ground to lid is off.</li> </ul>
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Results Satisfactory: OK/ Fair

**TECHNICAL FIELD SERVICE DIVISION**

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****Transformer Nameplate Data**

Manufacturer	Westinghouse	Year Built	1973		
Type	ONAN	Serial #	861953		
Neutral	Solid	Liquid Type/Vol	Oil	34	Gal
Rating	75	kVA	Total Weight	1080	lbs.
Impedance	20	%	Primary Voltage	16	kVolt
Phase(s)	1	$\phi$	Secondary Voltage	120/ 240	Volt
Frequency	60	Hz	BIL	125	kVolt
Insulation Resistance (M $\Omega$ )					

**Oil Analysis****Laboratory Tests**

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	$\leq 3.5$ Max.	0.5
Visual Condition	D1524	Clear	Clear

**Observations & Comments**

Comments:	<ul style="list-style-type: none"> <li>No lock on lid</li> <li>Both hinges broken</li> </ul>
Results Satisfactory:	OK

T.S.

**TECHNICAL FIELD SERVICE DIVISION**

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****Transformer Nameplate Data**

Manufacturer	Carte	Year Built	1988		
Type	ONAN	Serial #	Q1431-28		
Neutral	Solid	Liquid Type/Vol	Oil	186	Lit
Rating	75	kVA	Total Weight	451	Kg
Impedance	2.29	%	Primary Voltage	16	kVolt
Phase(s)	1	φ	Secondary Voltage	120/ 240	Volt
Frequency	60	Hz	BIL	125	kVolt
Insulation Resistance (MΩ)					

**Oil Analysis****Laboratory Tests**

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.



**TECHNICAL FIELD SERVICE DIVISION****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 #12		

**Submersible Distribution Transformer****Transformer Nameplate Data**

Manufacturer	Westinghouse	Year Built	1974		
Type	ONAN	Serial #'s	Red Ø: 861968 White Ø:861963 Blue Ø: 861987		
Neutral	Solid	Liquid Type/Vol	Oil	27	Gal
Rating	50	kVA	Total Weight	770	lbs.
Impedance	1.9	%	Primary Voltage	16	kVolt
Phase(s)	1	φ	Secondary Voltage	120/ 240	Volt
Frequency	60	Hz	BIL	125	kVolt
Insulation Resistance (MΩ)					

**Oil Analysis****Laboratory Tests**

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

**Observations & Comments**

Comments:	- Oil levels marginal.
Results Satisfactory:	OK

T.S.

## 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

## Transformer Nameplate Data

Manufacturer	Westinghouse	Year Built	1973		
Type	ONAN	Serial #'s	Red Ø: 861950 White Ø: 861-954 Blue Ø: 861951		
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	φ	Secondary Voltage	120/ 240	Volt
Frequency	60	Hz	BIL		125lt
Insulation Resistance (MΩ)					

## Oil Analysis

## Laboratory Tests

Type of Test	ASTM No.	Acceptable Limits	Test Results		
			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 &amp; Comments

Comments:	- Blue phase oil level below manufacturer's indication line.
Results Satisfactory:	OK

T.S.

T.S. P\_Trans\_Elect

**TECHNICAL FIELD SERVICE DIVISION**

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****Transformer Nameplate Data**

Manufacturer	Westinghouse	Year Built	1982		
Type	ONAN	Serial #'s	Red Ø: LG37989 White Ø: LG37991 Blue Ø: LG37990		
Neutral	Solid	Liquid Type/Vol	Oil	70	Gal
Rating	25	kVA	Total Weight	240	lbs.
Impedance	1.8	%	Primary Voltage	16	kVolt
Phase(s)	1	φ	Secondary Voltage	120/ 240	Volt
Frequency	60	Hz	BIL	125	kVolt
Insulation Resistance (MΩ)					

**Oil Analysis****Laboratory Tests**

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:	<ul style="list-style-type: none"> <li>The oil levels of these units were noted as marginal during the inspection.</li> <li>Note the marginal White φ IFT.</li> <li>The White phase unit subsequently failed and was replaced. (See following Oil test sheet for new unit lab results)</li> </ul>
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Results Satisfactory: OK/ Fair

**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 (H <sub>2</sub> )			
Oxygen & Argon			
Nitrogen (N <sub>2</sub> )			
Methane (CH <sub>4</sub> )			
Carbon Monoxide (CO)			
Carbon Dioxide (CO <sub>2</sub> )			
Ethylene (C <sub>2</sub> H <sub>4</sub> )			
Ethane (C <sub>2</sub> H <sub>6</sub> )			
Acetylene (C <sub>2</sub> H <sub>2</sub> )			
Total Gas Content			

**Comments**

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

**TECHNICAL FIELD SERVICE DIVISION**

Special Projects Group

**Client Information**

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

**Submersible Distribution Transformer****Transformer Nameplate Data**

<b>Manufacturer</b>	Westinghouse	<b>Year Built</b>	1973		
<b>Type</b>	ONAN	<b>Serial #</b>	861970		
<b>Neutral</b>	Solid	<b>Liquid Type/Vol</b>	Oil	16	Gal
<b>Rating</b>	25	kVA	<b>Total Weight</b>	465	lbs.
<b>Impedance</b>	1.9	%	<b>Primary Voltage</b>	16	kVolt
<b>Phase(s)</b>	1	φ	<b>Secondary Voltage</b>	120/ 240	Volt
<b>Frequency</b>	60	Hz	<b>BIL</b>	125	kVolt
<b>Insulation Resistance (MΩ)</b>					

**Oil Analysis****Laboratory Tests**

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

**Observations & Comments**

<b>Comments:</b>	
<b>Results Satisfactory:</b>	OK

T.S.

**TECHNICAL FIELD SERVICE DIVISION**

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****Transformer Nameplate Data**

Manufacturer	Westinghouse	Year Built	1973		
Type	ONAN	Serial #'s	Red Ø: 861969 White Ø: 861978 Blue Ø: 861977		
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	φ	Secondary Voltage	120/ 240	Volt
Frequency	60	Hz	BIL	125	kVolt
Insulation Resistance (MΩ)					

**Oil Analysis****Laboratory Tests**

Type of Test	ASTM No.	Acceptable Limits	Test Results		
			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:	
Results Satisfactory:	OK

T.S.

T.S. P\_Trans\_Elect

**TECHNICAL FIELD SERVICE DIVISION****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****Transformer Nameplate Data**

Manufacturer	Westinghouse	Year Built	1974		
Type	ONAN	Serial #	861966		
Neutral	Solid	Liquid Type/Vol	Oil	27	Gal
Rating	50	kVA	Total Weight	770	lbs.
Impedance	1.9	%	Primary Voltage	16	kVolt
Phase(s)	1	φ	Secondary Voltage	120/ 240	Volt
Frequency	60	Hz	BIL	125	kVolt
Insulation Resistance (MΩ)					

**Oil Analysis****Laboratory Tests**

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

T.S.

**TECHNICAL FIELD SERVICE DIVISION**

Special Projects Group

**Client Information**

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

**Submersible Distribution Transformer****Transformer Nameplate Data**

Manufacturer	Westinghouse	Year Built	1973		
Type	ONAN	Serial #	861974		
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	$\phi$	Secondary Voltage	120/ 240	Volt
Frequency	60	Hz	BIL	125	kVolt
Insulation Resistance (M $\Omega$ )					

**Oil Analysis****Laboratory Tests**

Type of Test	ASTM No.	Acceptable Limits	Test Results
			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	$\leq 3.5$ Max.	0.5
Visual Condition	D1524	Clear	Clear

**Observations & Comments**

Comments:	• Oil level is acceptable
Results Satisfactory:	OK

T.S.



**TECHNICAL FIELD SERVICE DIVISION****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.	Vault #18 - Admin/Entrance Fed		

**Submersible Distribution Transformer****Transformer Nameplate Data**

Manufacturer	Carte	Year Built	1983		
Type	ONAN	Serial #	L0721-1		
Neutral	Solid	Liquid Type/Vol	Oil	35	Gal
Rating	75	kVA	Total Weight	889	lbs.
Impedance	2.4	%	Primary Voltage	16	kVolt
Phase(s)	1	$\phi$	Secondary Voltage	120/ 240	Volt
Frequency	60	Hz	BIL	125	kVolt
Insulation Resistance (M $\Omega$ )					

**Oil Analysis****Laboratory Tests**

Type of Test	ASTM No.	Acceptable Limits	Test Results
			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	$\leq 3.5$ Max.	1.0
Visual Condition	D1524	Clear	Clear

**Observations & Comments**

Comments:	IFT is marginal
Results Satisfactory:	Fair

**TECHNICAL FIELD SERVICE DIVISION****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****Transformer Nameplate Data**

Manufacturer	Westinghouse	Year Built	1973		
Type	ONAN	Serial #	861944		
Neutral	Solid	Liquid Type/Vol	Oil	38	Gal
Rating	100	kVA	Total Weight	1300	lbs.
Impedance	1.8	%	Primary Voltage	16	kVolt
Phase(s)	1	$\phi$	Secondary Voltage	120/ 240	Volt
Frequency	60	Hz	BIL	125	kVolt
Insulation Resistance (M $\Omega$ )					

**Oil Analysis****Laboratory Tests**

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	$\leq 3.5$ Max.	0.5
Visual Condition	D1524	Clear	Clear

**Observations & Comments**

Comments:	
Results Satisfactory:	

T.S.

**TECHNICAL FIELD SERVICE DIVISION****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 #21		

**Submersible Distribution Transformer****Transformer Nameplate Data**

Manufacturer	Westinghouse	Year Built	1973		
Type	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	$\phi$	Secondary Voltage	120/ 240	Volt
Frequency	60	Hz	BIL	125	kVolt
Insulation Resistance (M $\Omega$ )					

**Oil Analysis****Laboratory 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	$\leq 3.5$ Max.	0.5
Visual Condition	D1524	Clear	Clear

**Observations & Comments**

Comments:	<ul style="list-style-type: none"> <li>Had to pump water out of vault</li> <li>Dielectric of oil is borderline</li> </ul>
Results Satisfactory:	OK

T.S.

**TECHNICAL FIELD SERVICE DIVISION**

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****Transformer Nameplate Data**

Manufacturer	Westinghouse	Year Built	1973		
Type	ONAN	Serial #	861973		
Neutral	Solid	Liquid Type/Vol	Oil	16	Gal
Rating	25	kVA	Total Weight	463	lbs.
Impedance	1.9	%	Primary Voltage	16	kVolt
Phase(s)	1	φ	Secondary Voltage	120/ 240	Volt
Frequency	60	Hz	BIL	125	kVolt
Insulation Resistance (MΩ)					

**Oil Analysis****Laboratory 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.
Results Satisfactory:	OK

T.S.

**TECHNICAL FIELD SERVICE DIVISION****Special Projects Group****Client Information**

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

**Submersible Distribution Transformer****Transformer Nameplate Data**

Manufacturer	Westinghouse	Year Built			
Type	ONAN	Serial #	871931		
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	$\phi$	Secondary Voltage	120/ 240	Volt
Frequency	60	Hz	BIL	125	kVolt
Insulation Resistance (M $\Omega$ )					

**Oil Analysis****Laboratory Tests**

Type of Test	ASTM No.	Acceptable Limits	Test Results
			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	$\leq 3.5$ Max.	0.5
Visual Condition	D1524	Clear	Clear

**Observations & Comments**

Comments:

Results Satisfactory: OK

T.S.

**TECHNICAL FIELD SERVICE DIVISION**

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****Transformer Nameplate Data**

Manufacturer	Westinghouse	Year Built	1974		
Type	ONAN	Serial #	861964		
Neutral	Solid	Liquid Type/Vol	Oil	27	Gal
Rating	50	kVA	Total Weight	770	lbs.
Impedance	1.9	%	Primary Voltage	16	kVolt
Phase(s)	1	$\phi$	Secondary Voltage	120/ 240	Volt
Frequency	60	Hz	BIL	125	kVolt
Insulation Resistance (M $\Omega$ )					

**Oil Analysis****Laboratory 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	$\leq 3.5$ Max.	0.5
Visual Condition	D1524	Clear	Clear

**Observations & Comments**

Comments:	<ul style="list-style-type: none"> <li>Slight mark/ burn on H1B elbow.</li> <li>Some secondary cables were found cut off. These ends were taped off by our personnel.</li> </ul>
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Results Satisfactory:	OK (as left)
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T.S.

T.S. P\_Trans\_Elect

**TECHNICAL FIELD SERVICE DIVISION**

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****Transformer Nameplate Data**

Manufacturer	Westinghouse	Year Built	1974		
Type	ONAN	Serial #	861962		
Neutral	Solid	Liquid Type/Vol	Oil	27	Gal
Rating	50	kVA	Total Weight	770	lbs.
Impedance	1.9	%	Primary Voltage	16	kVolt
Phase(s)	1	φ	Secondary Voltage	120/ 240	Volt
Frequency	60	Hz	BIL	125	kVolt
Insulation Resistance (MΩ)					

**Oil Analysis****Laboratory Tests**

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.

**TECHNICAL FIELD SERVICE DIVISION****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****Transformer Nameplate Data**

Manufacturer	Westinghouse	Year Built	1973		
Type	ONAN	Serial #	871926		
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	∅	Secondary Voltage	120/ 240	Volt
Frequency	60	Hz	BIL	125	kVolt
Insulation Resistance (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.	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:	<ul style="list-style-type: none"> <li>• Elbows taped by our personnel.</li> <li>• Vault lid has no securing nuts holding grate.</li> </ul>
Results Satisfactory:	OK

T.S.



**TECHNICAL FIELD SERVICE DIVISION**

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****Transformer Nameplate Data**

Manufacturer	Westinghouse	Year Built	1973		
Type	ONAN	Serial #	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	$\phi$	Secondary Voltage	120/ 240	Volt
Frequency	60	Hz	BIL	125	kVolt
Insulation Resistance (M $\Omega$ )					

**Oil Analysis****Laboratory Tests**

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	$\leq 3.5$ Max.	0.5
Visual Condition	D1524	Clear	Clear

**Observations & Comments**

Comments:	
Results Satisfactory:	OK

T.S.

**TECHNICAL FIELD SERVICE DIVISION****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****Transformer Nameplate Data**

Manufacturer	Westinghouse		Year Built			
Type	ONAN		Serial #	861972		
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	$\phi$	Secondary Voltage	120/ 240		Volt
Frequency	60	Hz	BIL	125		kVolt
Insulation Resistance (M $\Omega$ )						

**Oil Analysis****Laboratory 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	$\leq$ 3.5 Max.	0.5
Visual Condition	D1524	Clear	Clear

**Observations & Comments**

Comments:	
Results Satisfactory:	OK

T.S.

**TECHNICAL FIELD SERVICE DIVISION**

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.	Vault #30		

**Submersible Distribution Transformer****Transformer Nameplate Data**

Manufacturer	Westinghouse	Year Built	1973		
Type	ONAN	Serial #'s	Red Ø: 861976 White Ø: 871932 Blue Ø: 871933		
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	φ	Secondary Voltage	120/ 240	Volt
Frequency	60	Hz	BIL	125	kVolt
Insulation Resistance (MΩ)					

**Oil Analysis****Laboratory Tests**

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

**Observations & Comments**

Comments:	
Results Satisfactory:	OK

T.S.

**TECHNICAL FIELD SERVICE DIVISION**

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****Transformer Nameplate Data**

Manufacturer	Westinghouse	Year Built	1973		
Type	ONAN	Serial #'s	Red Ø: 861940 White Ø: 861941 Blue Ø: 861943		
Neutral	Solid	Liquid Type/Vol	Oil	38	Gal
Rating	100	kVA	Total Weight	1300	lbs.
Impedance	1.8	%	Primary Voltage	16	kVolt
Phase(s)	1	φ	Secondary Voltage	120/ 240	Volt
Frequency	60	Hz	BIL	125	kVolt
Insulation Resistance (MΩ)					

**Oil Analysis****Laboratory Tests**

Type of Test	ASTM No.	Acceptable Limits	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:	
Results Satisfactory:	OK

T.S.

T.S. P\_Trans\_Elect

# TECHNICAL FIELD SERVICE DIVISION

## 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

#### Transformer Nameplate Data

Manufacturer	Westinghouse	Year Built	1973		
Type	ONAN	Serial #'s	Red Ø: 861949 White Ø: 961955 Blue Ø: 861952		
Neutral	Solid	Liquid Type/Vol	Oil	34	Gal
Rating	75	kVA	Total Weight	1080	lbs.
Impedance	2	%	Primary Voltage	16	kVolt
Phase(s)	1	φ	Secondary Voltage	120/ 240	Volt
Frequency	60	Hz	BIL	125	kVolt
Insulation Resistance (MΩ)					

### Oil Analysis

#### Laboratory Tests

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:	<ul style="list-style-type: none"> <li>Red &amp; Blue phases' oil level marginal.</li> <li>Red φ manhole gasket should be replaced.</li> </ul>
Results Satisfactory:	OK/ Fair

T.S.

**TECHNICAL FIELD SERVICE DIVISION**

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****Transformer Nameplate Data**

Manufacturer	Westinghouse	Year Built	1973		
Type	ONAN	Serial #	871937		
Neutral	Solid	Liquid Type/Vol	Oil	16	Gal
Rating	25	kVA	Total Weight	463	lbs.
Impedance	1.9	%	Primary Voltage	16	kVolt
Phase(s)	1	$\phi$	Secondary Voltage	120/ 240	Volt
Frequency	60	Hz	BIL	125	kVolt
Insulation Resistance (M $\Omega$ )					

**Oil Analysis****Laboratory Tests**

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	$\leq 3.5$ Max.	0.5
Visual Condition	D1524	Clear	Clear

**Observations & Comments**

Comments:	Vault fills over top with water
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Results Satisfactory:	OK
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T.S.

**TECHNICAL FIELD SERVICE DIVISION**

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****Transformer Nameplate Data**

Manufacturer	Westinghouse	Year Built	1973		
Type	ONAN	Serial #'s	Red Ø: 861971 White Ø: 871927 Blue Ø: 871936		
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	φ	Secondary Voltage	120/ 240	Volt
Frequency	60	Hz	BIL	125	kVolt
Insulation Resistance (MΩ)					

**Oil Analysis****Laboratory 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:	<ul style="list-style-type: none"> <li>Blue &amp; White phases' oil levels are marginal. Blue is lower.</li> <li>Signs of "corona" on White φ elbow. Water apparently dropping from above.</li> <li>Red φ vault ground broken off grate. This has been repaired by our personnel.</li> </ul>
Results Satisfactory:	FAIR

T.S.

T.S. P\_Trans\_Elect

**TECHNICAL FIELD SERVICE DIVISION**

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		

**Submersible Distribution Transformer****Transformer Nameplate Data**

Manufacturer	Westinghouse	Year Built	1973		
Type	ONAN	Serial #'s	Red Ø: 971929 White Ø: 871928 Blue Ø: 871925		
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	φ	Secondary Voltage	120/ 240	Volt
Frequency	60	Hz	BIL	125	kVolt
Insulation Resistance (MΩ)					

**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
Visual Condition	D1524	Clear	Clear	Clear	Clear

**Observations & Comments**

Comments:	<ul style="list-style-type: none"> <li>Red Ø – oil level is low</li> <li>Blue Ø – oil is marginal</li> </ul>
Results Satisfactory:	Fair

T.S.

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**APPENDIX 20**

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



***Technical Field Service Division***

31 Pullman Court, Scarborough, Ontario M1X 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

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Dear Sir:

Further to the power interruption that occurred on May 18<sup>th</sup>, 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  $\cong 3.5M\Omega$ . Industry standards require a minimum value of  $100M\Omega$  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**

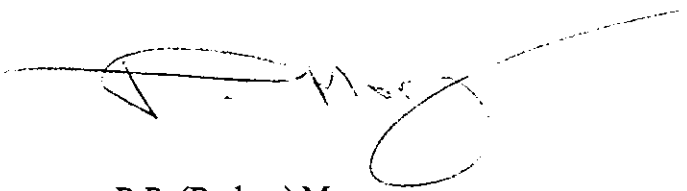
31 Pallman Court, Scarborough, Ontario M1X 1E4. Phone: (416)-298-9977 Fax: (416)-298-2907

**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

# TECHNICAL FIELD SERVICE DIVISION

## 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	Westinghouse	Vector Group	240/ 120 Centre Tapped		
Type	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	φ	Secondary Voltage	240/ 120	Volt
Frequency	60	Hz	BIL	125	kVolt

#### Insulation Tests

Insulation Resistance @ 5k / 500 VDC	Prim. With Sec. Grounded	Sec. With Prim. Grounded	Prim. & Sec. To Ground		
MΩ	87,000	3.46	65,500		
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					
Dis. Fact.(%)	11.22	13.00	-	>39.99	>39.99
Corr. 20 °C.					

#### Turns Ratio Tests

Tap	Primary Volts	Calculated Ratio	X0-X2 H1-H2	X0-X3 H2-H3	X0-X1 H3-H1
1					
2					
3					
4					
5					
Tap Position Found & Left					
Results Satisfactory			NO		

T.S.

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