

Forms



MSF005
Form No. 227

Maintenance Standard Report Form CIRCUIT BREAKERS

Revised: 2012-07-30

Substation/Location:	Work Order Number:	ID Number:	
Manufacturer:	Serial Number:	Type:	Rated Voltage:

Check each item with a \checkmark for OK, X to indicate a problem, N/A for not applicable, or N/D for not done. All entries must be completed during a Maintenance IV, unless otherwise indicated. Initial each entry. Once work is done, the Maintenance man and the Maintenance Supervisor must sign it off.

#	Type of Maint.		Task	Status or Results	Initial
	I	III			
General					
1,2,3	X	X	Appropriate Documentation Reviewed		
6	X		ID Number Installed (N/A for Maintenance IV)		
7	X	X	Nameplate Information Recorded		
8	X	X	Counter: Start Value Finish Value		
9	X	X	External Visual Inspection		
10	X	X	Check for Presence of Abnormal Noise or Heat		
11	X	X	Leveled, Grounded and Anchored		
12		X	CT Operation Verified Via Ammeters		
13		X	Painting Done as Required		
Oil Filled Units Only					
14	X	X	PCB Level Checked; Recorded (PPM)		
15	X	X	Check Oil Level/Leaks		
16	X	X	Check Breather		
17	X	X	Oil Dielectric		
SF6 Units Only					
18	X	X	Gas Pressure/Density Check (psi)	Phase 1:	
				Phase 2:	
				Phase 3:	
				Ambient Temp. (°C):	
General					
19	X	X	Heaters Operational		
20	X	X	Operating Mechanism Cleaned and Lubricated		
21	X	X	External Mechanism Check		
22	X	X	Breaker Operated Locally and Remotely		
23	X	X	Megger Test Results	°C	
				kV	
				MΩ	
				Phase to Phase:	
				Phase to Ground:	
Ductor Test Results (micro-ohms)					
24	X	X		Across Contacts	
				Bushing-Bushing	
				Phase 1:	
				Phase 2:	
Motion Analyzer Test Results					
25	X	X	Motion Analyzer Test Results	Opening Velocity (ft/sec)	
				Closing Velocity (ft/sec)	
				Contact Wipe (In.)	
				Stroke (In.)	
				Contact Part Time (cycles)	

W.O. Number: _____

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#	Type of Maint.		Task	Status or Results	Initial
	I	III			
				Reclose Time (cycles)	
				Trip Free Time (cycles)	
				Overtravel (cycles)	
26	X	X	Visual Check of Bushings and Bushing Gaskets		
27	X		Power Factor Test	No. 1: _____ No. 2: _____ No. 3: _____	No. 4: _____ No. 5: _____ No. 6: _____
28	X		CT Ratio Test (N/A for Maintenance IV)		
29	X		CT Polarity Test (N/A for Maintenance IV)		
30	X		Megger Results: Secondary Winding	°C _____ kV _____	MΩ _____
Bulk Oil and Minimum Oil Units Only					
31			Oil Filtered		
32			Oil Removed for Inspection		
33			Tank/Interrupter Chamber Opened for Inspection		
34			Internal Components Cleaned and Tank Flushed		
35			Internal Visual Inspection		
36			Energy Absorbing Components Sound and Secure		
37			Tank Liners Inspected		
38			Moving Contacts Inspected		
39			Interrupter and Grading Resistor Examined/Cleaned		
40			Contact Synchronization Checked		
41			Internal Operating Mechanism Check		
42			Internal CTs Inspected		
43			Oil Level Indicators		
44			Gaskets and Seals Inspected		
45		X	Conduits and Wiring Okay		
46		X	Internal Heaters and Thermostats Checked		
48			Interrupting Chamber Refilled with Oil		
49			Oil Dielectric (kV)		
Metal Clad Units Only					
50	X	X	Box Barriers Okay		
51	X	X	Insulating Parts Clean		
52		X	Primary Contacts Inspected		
53	X		Primary Contact Wipe		
54	X		Primary Contact Gap		
55			Arcing Contacts Okay		
56			Arcing Contact Wipe		
57			Arc Chutes Inspected and Cleaned		
58		X	Blow Out Devices Inspected		
59	X	X	Interlocks Operating Properly		
60		X	Mechanism Cleaned and Lubricated		
61		X	Operating Mechanism Wipes, Clearances and Gaps		
62	X	X	Lifting Mechanism and Limit Switches Okay		
63		X	Breaker Checked in 'test' and 'operate' Positions		
SF6 Units Only					
64			Interrupters Opened		
65			Poles Refilled With Sf6 Gas		
66			Check for SF6 Leaks using Sniffer and/or Leak Check		
67		X	Pole Unit Heaters Inspected		
68	X		External Capacitors Checked		
Units With Air Compressors Only					
69	X	X	Pneumatic Mechanism Checked		
70	X	X	Connections Tight		
71	X	X	Pneumatic Mechanism Wiring Inspected		
72		X	Condensation Drained From Compressor Tank		
73	X	X	Compressor Oil Level Checked		

W.O. Number: _____

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#	Type of Maint.		Task	Status or Results	Initial
	I	III			
74		X	Compressor Oil Changed		
75		X	Air Filter Cleaned		
76	X	X	Safety Valves and Pressure Switches Operational		
77	X	X	Condition and Tightness of Belts		
78	X	X	Inflation Time Checked	Cutoff Pressure (psi): Inflation Time (sec):	
79		X	Operation Rundown (N/A for Maint. IV)	Operations before low pressure cutoff: Operations after low-pressure cutoff:	
80	X	X	Motor Load Current (A)		
81	X	X	Rate of Air Leakage Okay		
82		X	Minimum Pneumatic Mechanism Voltages (N/A for Maint. IV)	Trip: Close:	
83		X	Pneumatic Mechanism Dimensional Checks		
84	X	X	Pressure Vessel Permit Expiry Date (yyyy-mm-dd)		
85		X	Tank Repaired		
ASEA Minimum Oil Units Only					
86			Burning of Plug Contact Checked		
87	X		Extinguishing Chamber and Fixed Contact Checked		
88			Gas Discharge Valves Checked		
89	X		Breaker Dismantled, Cleaned and Inspected		
90	X		Breaker Trips on Trip Coils Checked		
General					
91			Final Megger Test Results	°C	kV
			Phase to Phase:		MΩ
			Phase to Ground:		
			Across Open Contacts:		
92			Final Ductor Test Results (micro-ohms)	Phase 1: Phase 2: Phase 3:	
93			Final Motion Analyzer Test Results	Opening Velocity (ft/sec) Closing Velocity (ft/sec) Contact Wipe (In.) Stroke (In.) Contact Part Time (cycles) Reclose Time (cycles) Trip Free Time (cycles) Overtravel (cycles)	
94			Operating Mechanism Checks		
95	X		Bushing Connectors Tight		
96		X	Oil Sample Taken (Bulk Oil Units Only)		
97	X	X	Avantis Updated		
98	X	X	Documentation Distributed		
99	X	X	Deficiencies Flagged in Avantis		

Remarks:

(attach copies of MSF018 as required for further remarks)

Type of Maintenance: _____ Date: _____ (YYYY-MM-DD) Inspected By: _____



MSF006
Form No. 167a

Maintenance Standard Report Form **RECLOSERS**

Revised: 2007-10-01

Substation/Location:	Work Order No.:	Manufacturer:	Control:	ID Number:
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Section 1: Check each item with a \checkmark for OK, X to indicate a problem, N/A for not applicable, or N/D for not done. All entries must be completed during a Maintenance IV, unless otherwise indicated. Initial each entry. Once work is done, the Maintenance man and the Maintenance Supervisor must sign it off.

#	Type of Maint.		Task	Status or Results	Initial
	I	III			
1,2,3	X	X	Maintenance History, Standards and Manufacturer's Information Reviewed		
6	X	X	ID Number Installed		
7	X	X	Nameplate Information Recorded		
8	X	X	Counter: Start Value Finish Value		
9	X	X	External Visual Inspection		
10	X	X	Check Presence of PCB; Record Level (PPM) Lab Sample Taken: Yes <input type="checkbox"/> No <input type="checkbox"/>		
11	X	X	Leveled, Grounded and Anchored (N/A for Maintenance IV)		
12	X	X	Check Oil Levels and Leaks		
13	X	X	Oil Dielectric (kV)		
14	X	X	Bushings and External CTs		
15	X	X	External Mechanism Checks		
16	X*		Meggered Unit		
17	X*		Ductored Unit		
18	X*		CT Ratio Tests		
19	X*		CT Polarity Test		
20	X*		Functional Checks Performed		
21	X*		Tank Lowered for Inspection		
22			Oil Filtered or Removed		
23			Tank and Components Cleaned		
24	X*		Internal Visual Inspection		
25	X*		Liners and Foam Pads		
26			Tank Repaired as Required		
27			Moving Contacts Inspected		
28			Interrupters and Contacts Disassembled, Inspected and Repaired		
29			Bushings Disassembled and Repaired and Gaskets Replaced		
30			Hydraulic Control Units Cleaned		
31	X*		Closing Coil: Resistance (Ohms) Voltage (kV)		
32	X*		Closing Contacts: Inspected Fuse Rating Checked		
33	X*		Trip Coil: Inspected Coil Size		
34			Mechanism Dropped and Checked		
35	X*		Hydraulic Fluid Levels		
36	X*		Single Operation to Lockout on "F"		
37	X*		Hydraulic Settings and Ratings Match Nameplates		
38	X		Visual of Components on Head, Frame and Mechanism		
39			Electrical Check of Components on Head, Frame and Mechanism		
40	X*		Operating Levers and Counter		
41			Internal Mechanism Checks		
42		X	Head and Auxiliary Gaskets		
43	X*		Final Ductor Test Results (micro-ohms):	Across Contacts	Bushing- Bushing
			Phase 1		
			Phase 2		
			Phase 3		

MSF006

#	Type of Maint.		Task	Status or Results	Initial		
	I	III					
44	X*		Tank Lip Painted and Bolts Sealed or Lubricated as Required				
45			Oil Filled to Correct Level				
46			Re-Check Oil Dielectric (kV)				
48	X	X	Manually Operated to Expel Air				
49			Control Cable Electrical Check				
50	X	X	Control Cable and Connector				
51	X	X	Devices and Cards Secure				
52		X	Control Accessories				
53	X	X	Quick Battery Check (N/A for Maintenance IV)				
54			Battery Discharge Test				
55	X*	X	Terminations Clean and Tight				
56	X	X	Position Indicator and Lights				
57	X	X	Auxiliary Switches and Relays				
58	X	X	Charging Motor Brushes, Commutator and Mounting				
59	X	X	Charging Motor Current (A)				
60	X	X	Capacitive Trip Devices				
61	X	X	Reclose Block Switch Reset				
62	X	X	Ammeter Sockets and Wiring				
63a	X*	X	CTs, Relays and Ammeters Numbered; Meter Operation Checked; Multiplier Labeled				
63b	X*	X	CT Ratio				
64	X*	X	Cabinet Heaters				
65	X	X	Ground Trip Switch				
66	X	X	Final Megger Test Results:	°C	kV	MΩ	
				3Φ - Ground			
				2Φ - 1&3Φ			
				1Φ Cont.			
				2Φ Cont.			
67	X	X	Functional Check				
68	X	X	Control Settings Recorded				
69	X		Recloser at Correct Height				
70	X	X	Painting				
71	X	X	PCB Sticker Installed				
72	X	X	Risers, Disconnects and Switches (N/A for Maintenance IV)				
73	X	X	Documentation Distributed				
74	X	X	Maintenance Record Updated in Avantis				
75	X	X	Deficiencies Flagged in Avantis				

* - Required for new installation only

Section 2: Complete the following.

Recloser Settings: Operations to Lockout _____
 Fast Operations _____
 Time Delay Curve (Hydraulic) _____
 Reclosing Interval Delays:
 First _____ Second _____ Third _____
 Fast Operations on Ground Trip (Hydraulic) _____
 Ground Trip Plugs (Electronic): 1 _____ 2 _____
 Ground Trip Mechanism (Hydraulic) set for:
 Inverse _____ Definite _____ Time Delay _____
 Phase Trip Plugs (Electronic): 1st _____ 2nd _____
 Reset Delay Interval: _____ seconds
 Minimum Trip Resistor (Electronic): Phase _____ Ground _____
 Ground Trip Solenoid (Hydraulic): Series _____ Parallel _____
 Overcurrent Relay Tap Block: Phase _____ Ground _____
 Overcurrent Relay Time Dial: Phase _____ Ground _____
 Overcurrent Relay Instantaneous: Phase _____ Ground _____
 Checked Settings on all Relays _____

Enter Details of Faults Found and Corrective Actions: _____

(attach copies of MSF018 for additional comments as required)

Maint. Type: _____ Date _____ (YYYY-MM-DD) Maintenance man _____ Supervisor _____



MSF009
Form No. 353

Maintenance Standard Report Form POWER TRANSFORMERS

Revised: 2010-10-27

Substation/Location:	Work Order Number:	ID Number:	
Manufacturer:	Serial Number:	Rated Voltage (kV):	KVA:

Complete the following:

Dew Point (if required): _____ °C
 Oil Dielectric: _____ kV
 PCB Level _____ PPM

Megger Test (in oil):

Core – Ground _____ at 250V

Two-Winding Transformers

- a) H – L&G _____ at _____ V
- b) L – H&G _____ at _____ V
- c) H&L – G _____ at _____ V

Three-Winding Transformers

- a) H – LT&G _____ at _____ V
- b) L – HT&G _____ at _____ V
- c) T – HL&G _____ at _____ V
- d) H&L – T&G _____ at _____ V
- e) H&T – L&G _____ at _____ V
- f) L&T – H&G _____ at _____ V
- g) HL&T – G _____ at _____ V

Weather Conditions and Temperature at Time of Oil Testing and Meggering _____

If Tank was Open to Atmosphere:

Time Duration Open _____
 Weather Conditions While Open _____

Voltage Connection _____

Megger Test Control Wiring For:

- Oil Level Gauge _____ at 250V
- Oil Temperature Gauge _____ at 250V
- Winding Temperature Gauge _____ at 250V
- Gas Detector Relay _____ at 250V
- Pressure Relief Device _____ at 250V

Oil Temperature _____ °C

Oil Temperature Alarm Setting _____ °C

Oil Temperature Trip Setting _____ °C

Temperature Gauge Setting to Start Fans:

1st Stage _____ °C 2nd Stage _____ °C

Winding Temperature _____ °C

Winding Temperature Alarm Setting _____ °C

Winding Temperature Trip Setting _____ °C

Oil Level Gauge Reading _____

Mark the appropriate block with an X:

	<u>Yes</u>	<u>No</u>
Tank Opened	<input type="checkbox"/>	<input type="checkbox"/>
Humidity Absorbent Packet Installed in Gas Detector Relay	<input type="checkbox"/>	<input type="checkbox"/>
Core Exposed to Atmosphere	<input type="checkbox"/>	<input type="checkbox"/>
Spill Pan Free of Oil	<input type="checkbox"/>	<input type="checkbox"/>
Vacuum Pulled	<input type="checkbox"/>	<input type="checkbox"/>
Oil Sample Obtained for Gas Analyses	<input type="checkbox"/>	<input type="checkbox"/>
Tank Ground Connections Tight	<input type="checkbox"/>	<input type="checkbox"/>
Evidence of Oil Leakage	<input type="checkbox"/>	<input type="checkbox"/>
Lubricant Applied to Off-Load Tapchanger Handle	<input type="checkbox"/>	<input type="checkbox"/>
All Nuts and Bolts Tight	<input type="checkbox"/>	<input type="checkbox"/>
All Gauges in Good Physical Condition	<input type="checkbox"/>	<input type="checkbox"/>
Fan Motor Drains Open	<input type="checkbox"/>	<input type="checkbox"/>
Fan and Exerciser Operating Properly	<input type="checkbox"/>	<input type="checkbox"/>
Conduits Properly Fastened	<input type="checkbox"/>	<input type="checkbox"/>
Control Wiring in Good Condition	<input type="checkbox"/>	<input type="checkbox"/>
Transformer Protection Devices Inspection Completed	<input type="checkbox"/>	<input type="checkbox"/>
All Junction Boxes Inspected	<input type="checkbox"/>	<input type="checkbox"/>
Oil Added	<input type="checkbox"/>	<input type="checkbox"/>
Pressure Relief Device on Transformer	<input type="checkbox"/>	<input type="checkbox"/>
If So, Operation Indicator and Alarm Switch Required Resetting	<input type="checkbox"/>	<input type="checkbox"/>
Internal Inspection of Transformer Made	<input type="checkbox"/>	<input type="checkbox"/>
<i>If So, Complete Remainder of This Section</i>		
Loose or Damaged Parts	<input type="checkbox"/>	<input type="checkbox"/>
Tools or Debris Found	<input type="checkbox"/>	<input type="checkbox"/>
Explosion Vent Lower Diaphragm Intact	<input type="checkbox"/>	<input type="checkbox"/>
Main Tank Oil-Level Gauge Checked	<input type="checkbox"/>	<input type="checkbox"/>
Spray Nozzles Installed	<input type="checkbox"/>	<input type="checkbox"/>
Bushing Leads in Good Condition	<input type="checkbox"/>	<input type="checkbox"/>
CT Leads and Control Wiring Good and in Place	<input type="checkbox"/>	<input type="checkbox"/>
Tapchanger Leads Good and Connections Tight	<input type="checkbox"/>	<input type="checkbox"/>
All Nuts and Bolts in Place and Tight	<input type="checkbox"/>	<input type="checkbox"/>
Core Laminations and Supports in Place	<input type="checkbox"/>	<input type="checkbox"/>
Off-Load Tapchanger in Good Condition	<input type="checkbox"/>	<input type="checkbox"/>
Terminal Board structure Good	<input type="checkbox"/>	<input type="checkbox"/>
Any Sign of Carbon or Tracking	<input type="checkbox"/>	<input type="checkbox"/>
Shipping Braces (if any) Removed	<input type="checkbox"/>	<input type="checkbox"/>
CTs, PTs and Auxiliary Transformers Properly Mounted	<input type="checkbox"/>	<input type="checkbox"/>
Coils and Insulation in Good Condition	<input type="checkbox"/>	<input type="checkbox"/>
Bottom of Tank Free From Debris or Loose Parts	<input type="checkbox"/>	<input type="checkbox"/>
Any Sign of Moisture	<input type="checkbox"/>	<input type="checkbox"/>
Cracks in Tank Wall, Especially in Welding	<input type="checkbox"/>	<input type="checkbox"/>

MSF009

Type of Maintenance _____ **Date** _____ **Inspected By** _____



MSF011
Form No. 351b

Maintenance Standard Report Form POTENTIAL TRANSFORMERS

Revised: 2005-09-13

Substation/Location:	Work Order Number:	ID Number:
Manufacturer:	Serial Number:	Type:

Enter details of faults found and corrective actions in the Remarks section.

Section 1: Check each item with a 3 for OK, X to indicate a problem, N/A for not applicable, or N/D for not done. All entries must be completed during Maintenance IV, unless otherwise indicated. Initial each entry. Once work is done, the Maintenance man and the Maintenance Supervisor must sign it off.

#	Type of Maint.		Task	Status or Results	Initial	
	I	III				
1	X		ID Number Installed (N/A for Maintenance IV)			
2	X		Nameplate Information Recorded			
3	X	X*	External Visual Inspection			
4	X	X	PCB Labeled and Tested (PPM)			
5	X	X	Thermo Scan Information Reviewed			
6	X	X*	Oil Indicators and Levels			
7	X	X*	Evidence of Oil Leaks			
8	X	X*	Megger Test Results:			
			H-Ground:	°C	kV	MΩ
			L-Ground:			
			H-Low:			
9	X	X*	Power Factor H-Ground (%)			
10	X		Ratio Tested Okay			
11			Oil Dielectric (kV)			
12			Moisture Sensitive Components Placed In Oil While Out			
13			Internal Cleaning and Inspection			
14			Bushings, Gaskets, etc. Okay			
15			Welding Done As Required			
16			Drying Carried Out			
17			Maximum Time That Moisture Sensitive Components Were Out of Oil (hrs)			
18	X		Continuity Checks Okay			
19			Final Megger Test:			
			H-Ground:	°C	kV	MΩ
			L-Ground:			
			H-Low:			
20			Final Power Factor Test H-Ground (%)			
21			Final Ratio Test			
22	X	X*	High Voltage Terminals Clean and Tight			
23	X	X	Secondary Junction Box Okay			
24	X	X*	Tank Rust-Free and Painted			
25	X	X*	Ground Terminal Clean and Secure			
26	X	X	Secondary Wiring and Connectors			
27	X	X	Secondary Fuses			
28	X		Back Energized 15 Minutes at _____ kV			
29	X	X	Mounting, Grounding and Risers Okay (N/A for Maintenance IV)			
30	X	X	Secondary Voltages Checked Okay (N/A for Maintenance IV)			
31	X	X	Primary Fuse and Fuse Holder Okay (N/A for Maintenance IV)			
32	X	X	No Abnormal Noises Present (N/A for Maintenance IV)			
34	X	X	Maintenance Entered in Avantis			
35	X	X	Forms Distributed as Required			

MSF011

(attach copies of MSF018 as Required for Further Remarks)

Maint. Type: ____ Date: _____ (YYYY-MM-DD) Maintenceman: _____ Supervisor: _____



MSF012
Form No. 230b

Maintenance Standard Report Form VOLTAGE REGULATORS

Revised: 2005-09-13

Substation/Location:	Work Order No.:	Control:	ID Number:
Amps:	Volts:	Manufacturer:	

Check each item with \checkmark for OK, X to indicate a problem, N/A for not applicable, or N/D for not done. Initial each entry. Maintenance III procedures are indicated in column 2. Maintenance IV requires all steps to be completed, unless indicated otherwise.

#	Maint. I	Maint. III	Task	Status/Results	Initial
1	X		ID Number Installed (N/A for Maintenance IV)		
2	X		Nameplate Information Recorded		
4	X	X	Counter Reading:	Start: Finish:	
5	X	X	Control Panel Settings:	Set Point (V): Bandwidth (V): Time Delay (s): Real Compensation (Ohms): Reactive Compensation (Ohms):	
6	X	X	General Condition (N/A for Maintenance IV)		
7		X	Unit Operated Two Steps Up and Down (N/A for Maintenance IV)		
8	X	X	Oil Indicators and Levels		
9			Oil Level Indicators Replaced		
10	X	X	Evidence of Oil Leaks		
11	X		PCB Labeled, Level (ppm)		
12	X	X	Oil Dielectric (kV)		
13	X		Continuity Between Bushings		
14	X		Megger Test:	Megger Reading (M Ω): Megger Voltage (Volts): Insulation Temperature ($^{\circ}$ C):	
15	X*		Regulator Tank Removed		
16	X*		Internal Components Cleaned		
17	X		Internal Inspection		
18	X		Windings and Control Wiring		
19	X		All Contacts OK		
20	X		Nuts and Connections Tight		
21	X		Visual of Contact Operation		
22	X		Drive Mechanism OK		
23	X		Position Indicator Assembly		
24	X	X	Neutral Position Indicators		
25	X		Surge Bypass Device		
26	X		Bushings and Associated Parts		
27	X		All Gaskets and Seals Tight		
28	X		Time Unit Out of Oil (hrs)		
29	X*		Repeat Megger Test:	Megger Reading (M Ω): Megger Voltage (Volts): Insulation Temperature ($^{\circ}$ C):	
30	X*		Motor Current (amps)		
31	X		Ratio Test Carried Out	(Attach TTR Results)	
32	X		PT Ratio Test Carried Out	(Attach TTR Results)	
33	X		CT Ratio Test Carried Out	(Attach TTR Results)	
35	X	X	Control Functions Checked		
36	X	X	Position Indicator Functions		



MSF015
Form No. 362

Maintenance Standard Report Form MISCELLANEOUS EQUIPMENT

Revised: 2005-02-16

Substation/Location:	Division:
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Mark the appropriate blocks with an X to indicate the equipment covered by this report:

	<u>Yes</u>	<u>No</u>		<u>Yes</u>	<u>No</u>		<u>Yes</u>	<u>No</u>
Structure	<input type="checkbox"/>	<input type="checkbox"/>	Metering Tank	<input type="checkbox"/>	<input type="checkbox"/>	Yard	<input type="checkbox"/>	<input type="checkbox"/>
Buswork	<input type="checkbox"/>	<input type="checkbox"/>	Company Number _____			Station Service Transformer	<input type="checkbox"/>	<input type="checkbox"/>
Insulators	<input type="checkbox"/>	<input type="checkbox"/>	Foundations	<input type="checkbox"/>	<input type="checkbox"/>	AC and DC Distribution	<input type="checkbox"/>	<input type="checkbox"/>
Yard Lighting	<input type="checkbox"/>	<input type="checkbox"/>	Grounding	<input type="checkbox"/>	<input type="checkbox"/>	Other	<input type="checkbox"/>	<input type="checkbox"/>
Lightning Arresters	<input type="checkbox"/>	<input type="checkbox"/>	Control Cables	<input type="checkbox"/>	<input type="checkbox"/>	Specify _____		
ID Number _____			Control Building	<input type="checkbox"/>	<input type="checkbox"/>			

Mark the appropriate block with an X:

Structures:

	<u>Yes</u>	<u>No</u>
All Nuts and Bolts in Place and Tight	<input type="checkbox"/>	<input type="checkbox"/>
Sufficient Back-Filling Around Footings	<input type="checkbox"/>	<input type="checkbox"/>
Structure Solid and True	<input type="checkbox"/>	<input type="checkbox"/>
Paint Condition Good	<input type="checkbox"/>	<input type="checkbox"/>
Crossarms in Good Condition	<input type="checkbox"/>	<input type="checkbox"/>

Buswork:

Ample Phase-to-Phase & Phase-to-GND Clearances	<input type="checkbox"/>	<input type="checkbox"/>
Bus Securely Supported	<input type="checkbox"/>	<input type="checkbox"/>
Insulators Good and Clean	<input type="checkbox"/>	<input type="checkbox"/>
Dissimilar Metals Used	<input type="checkbox"/>	<input type="checkbox"/>
All Nuts and Bolts in Place and Tight	<input type="checkbox"/>	<input type="checkbox"/>

Insulators:

Any Sign of Contamination or Flashover	<input type="checkbox"/>	<input type="checkbox"/>
Any Cracked or Broken Porcelain	<input type="checkbox"/>	<input type="checkbox"/>
All Pins in Place	<input type="checkbox"/>	<input type="checkbox"/>

Lightning Arresters:

Securely Mounted	<input type="checkbox"/>	<input type="checkbox"/>
Any Broken or Cracked Porcelain	<input type="checkbox"/>	<input type="checkbox"/>
Line and Ground Connections Tight	<input type="checkbox"/>	<input type="checkbox"/>
Cement in Flanges in Good Condition	<input type="checkbox"/>	<input type="checkbox"/>

Metering Tank:

Securely Mounted	<input type="checkbox"/>	<input type="checkbox"/>
Vent Plug Removed	<input type="checkbox"/>	<input type="checkbox"/>
Primary and Secondary Connections Tight	<input type="checkbox"/>	<input type="checkbox"/>
Any Sign of Oil Leakage	<input type="checkbox"/>	<input type="checkbox"/>
Bushings in Good Condition	<input type="checkbox"/>	<input type="checkbox"/>
Paint Condition Good	<input type="checkbox"/>	<input type="checkbox"/>
Tank Properly Grounded	<input type="checkbox"/>	<input type="checkbox"/>

Yard Lighting:

	<u>Yes</u>	<u>No</u>
Fixtures Securely Mounted	<input type="checkbox"/>	<input type="checkbox"/>
All Lights Operating Properly	<input type="checkbox"/>	<input type="checkbox"/>
Lenses and Enclosures in Good Condition	<input type="checkbox"/>	<input type="checkbox"/>

Foundations:

Level	<input type="checkbox"/>	<input type="checkbox"/>
Any Sign of Breakage or Moving	<input type="checkbox"/>	<input type="checkbox"/>

Station Service Transformer:

Any Sign of Oil Leakage	<input type="checkbox"/>	<input type="checkbox"/>
Bushings in Good Condition	<input type="checkbox"/>	<input type="checkbox"/>
Paint Condition Good	<input type="checkbox"/>	<input type="checkbox"/>
Tank Properly Grounded	<input type="checkbox"/>	<input type="checkbox"/>
Secondary Leads Enter Bushing Terminal	<input type="checkbox"/>	<input type="checkbox"/>
Connectors at the Top (if outside)		
Oil Dielectric _____ kV (if requested)		

Grounding:

Any Damaged or Broken Wire	<input type="checkbox"/>	<input type="checkbox"/>
Grounding Done as per Current Practices	<input type="checkbox"/>	<input type="checkbox"/>
All Equipment Grounded as Required	<input type="checkbox"/>	<input type="checkbox"/>
All Connections Tight	<input type="checkbox"/>	<input type="checkbox"/>

Control Cables:

In Place and Properly Protected	<input type="checkbox"/>	<input type="checkbox"/>
Connections Tight	<input type="checkbox"/>	<input type="checkbox"/>
Any Sign of Corrosion at Terminals	<input type="checkbox"/>	<input type="checkbox"/>

AC and DC Distribution:

Panels Mounted Securely	<input type="checkbox"/>	<input type="checkbox"/>
Breakers Installed Correctly	<input type="checkbox"/>	<input type="checkbox"/>
Wiring Connections Tight	<input type="checkbox"/>	<input type="checkbox"/>
Cables/Conduits Properly Connected/Supported	<input type="checkbox"/>	<input type="checkbox"/>
Current Loading Within Panel Rating	<input type="checkbox"/>	<input type="checkbox"/>
Any Sign of Corrosion on Breaker Terminals	<input type="checkbox"/>	<input type="checkbox"/>
Any Sign of Overheating	<input type="checkbox"/>	<input type="checkbox"/>
Battery Charger and/or Other Such Essential Equipment on Separate Breaker	<input type="checkbox"/>	<input type="checkbox"/>



MSF016
Form No. 167b

Maintenance Standard Report Form NU-LEC RECLOSERS

Revised: 2011-05-24

Substation/Location:	Work Order No.:	Manufacturer:	Control:	ID Number:
----------------------	-----------------	---------------	----------	------------

Check each item with a \checkmark for OK, X to indicate a problem, N/A for not applicable, \rightarrow indicates a value required or N/D for not done. Initial each entry. Once work is done, the Maintenance man and the Maintenance Supervisor must sign it off. Complete all steps for a Maintenance A, B, III, or Maintenance V, unless otherwise indicated. This unit never requires a Maintenance IV.

Proc. #	Task	Status or Results	Initial
1,2,3	Maintenance History, Standards and Manufacturer's Information Reviewed		
6	ID Number Installed		
7	Nameplate Information Recorded		
8	Counter: Start Value \rightarrow Finish Value \rightarrow		
9	Cubicle Louvers and Water Drainage Holes Free; Unit Cleaned		
10	Rubber Door Seal Checked		
11	Install AC Supply Cord		
12	Check Cabinet Receptacle Polarity		
13	Cabinet Thermostat and Heaters Checked		
14	Megger Test Results: \rightarrow	$^{\circ}\text{C}$	kV
	3 Φ - Ground		M Ω
	2 Φ - 1&3 Φ		
	1 Φ Cont.		
	2 Φ Cont.		
	3 Φ Cont.		
15	Ductor Test Results (micro-ohms): \rightarrow	Phase 1	
	Circle whether ductored via lead or bushing	Phase 2	
		Phase 3	
16	Check Sharepoint For Latest File Versions		
17	Ensure Proper Computer Software Version Installed		
18	Record Existing Firmware \rightarrow		
18	Load and Record Latest Firmware \rightarrow		
19	Load EMC Test Settings File for Testing		
20	Load IOEX File; Record File Name \rightarrow		
21	Load DNP3 File; Record File Name \rightarrow		
22	Load OCP File; Record File Name \rightarrow		
23	Print and Install New OCP label		
	OCP File Load Checks		
24	Setting Group A,B,C,D and Indication		
25	Ground Fault Protection		
26	Live Load Blocking		
27	Local ON		
27	Remote ON		
28	Auto Reclose ON		
28	Auto Reclose OFF		
29	Hold Off ON		
29	Hold Off OFF		
30	Check for English (USA) and Imperial Units		
31	Control Cable Check		
32	Check and Record SF6 psi \rightarrow		
33	Contact Life Check; Record Values (Φ A, Φ B, Φ C) \rightarrow		

Maintenance Type: _____ Date: _____ (YYYY-MM-DD) Maintenance man: _____ Supervisor: _____

MSF016

34	Battery Labelled and Date Recorded →		
35	Record Amp Hour Rating of Battery →		
36	Battery Tested		
37	Battery Replaced		
	Function Checks		
38	Local Trip		
39	Close Isolate Switch		
41	Local Close		
40	Trip Isolate Switch		
42	Mechanical Trip by External Trip Lever		
43	Local Close Fails With HOLD OFF ON (Hot Line Tag)		
44	Low Gas Alarm Checked		
	IOEX Checks		
44	Trip Nulec From IOEX		
45	Close Nulec From IOEX		
46	No Close From IOEX with HOLD OFF ON (Hot Line Tag)		
47	Close From IOEX with AUTO RECLOSE OFF		
48	A Contact		
49	B Contact		
50	Protection On / Off		
	Primary Injection Checks		
51	Phase A , B, C and Ground Primary Current Minimum Trips		
52	Trip and Reclose Sequence Correct and Goes to Lockout		
53	Phase Target, Check Event Log For Correct Phase Max Fault Value		
54	Display Shows Correct Phase and Ground Amps		
55	Verify When Reclose is Off Unit Goes to Lockout, No Reclose		
56	Operation of Cold Load Function Checked		
57	Inrush Restraint Function Checked		
58	Reset after Elapsed Time on Successful Reclose		
59	Ground Trip Block Functional		
60	Substation Equipment Designation Attached		
61	Laminated Operating Procedures in Cabinet		
62	Documentation Distributed		
63	Maintenance Record Updated in Avantis		
64	Deficiencies Flagged in Avantis		

Enter Details of Faults Found and Corrective Actions:

(add copies of MSF018 for additional comments as required)

Maint. Type: _____ Date _____ (YYYY-MM-DD) _____
 Maintenance man _____ Supervisor _____



MSF017
Form No.

Maintenance Standard Report Form BATTERY DISCHARGE

Revised: 2005-02-16

Substation/Location:	Manufacturer:	Work Order Number:	ID Number:
-----------------------------	----------------------	---------------------------	-------------------

Time:									
Start O/C Volts:									
Bank Load Volts:									
Load Current:									
Discharge Time:									
Electrolyte Temp.:									
Pilot Cell SPG:									

Cell #	SPG at Start	Volts at Specified Time Interval							
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
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35									
36									
37									
38									
39									

Date: _____
(YYYY-MM-DD)

Completed By: _____



BOA™ Breaker Oil Analysis

Oil Circuit Breaker

Sample Data



H₂b

ANALYTICAL SERVICES
INCORPORATED

RETURN CONTAINERS TO: Phone: _____ Fax: _____	REPORT & INVOICE TO: Glenn Samms Newfoundland Power Box 8910, 55 Kenmount Road St. John's, NF A1B 3P6 Phone: (709) 737-5702 Fax: (709) 737-2926	REPORT TO: Phone: _____ Fax: _____
--	--	---

P.O. # _____ **Sampled By:** _____

Sample Location (Substation/PH/PP)	Notes:		
Equipment / Company Number			
Serial Number (Nameplate)			
Manufacturer (Nameplate)			
Date of Manufacture (Nameplate)			
Model Number /Type (Nameplate)			
Voltage Rating (Nameplate)			
Fluid Volume (Nameplate)			
Pole (Tank) <input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3	Tank No. 1	Tank No. 2	Tank No. 3
Phase	<input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C	<input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C	<input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C
Interrupting Rating (KA) (KVA) (MVA)			
Amp Rating			
Present Counter Reading			
Oil Temperature			
No. of switching operations since last internal inspection			
Number of fault operations since last internal inspection			
Present Accumulated Fault Count (ACC)	%		
Date of last internal inspection			
Date oil was last filtered			
Date oil was last replaced			
Sample Date			
DGA Syringe Sample No.			
Oil Quality Sample No.			
Status:	<input type="checkbox"/> Routine	<input type="checkbox"/> Routine	<input type="checkbox"/> Routine
Lab Use Only			

All Tests below are Required for BOA Diagnostics <ul style="list-style-type: none"> <input type="checkbox"/> Dissolved Gas Analysis (D-3612) <input type="checkbox"/> Particle Counts <input type="checkbox"/> Moisture in Oil (D-1533B) <input type="checkbox"/> Dielectric Breakdown (D-1816) <input type="checkbox"/> Interfacial Tension (D-971) <input type="checkbox"/> Acid Number (D-974) <input type="checkbox"/> Color (D-1500) 	Optional Tests <ul style="list-style-type: none"> <input type="checkbox"/> PCB (EPA-8080) <input type="checkbox"/> Metals (D-3635 ICP) <input type="checkbox"/> Microscopy <input type="checkbox"/> Other _____
---	--

Instructions: All DGA samples are taken using a glass syringe or stainless steel cylinder. All oil quality tests samples are taken using a 1 qt plastic bottle. OCBs containing more than 350 gallons of oil require one gallon of oil to be flushed through the fill/drain valve prior to collecting samples. OCBs containing less than 350 gallons of oil require one quart of oil to be flushed through the fill/drain valve prior to collecting samples.

Send Samples to: TJH2b Analytical Services Canada Inc.
Bay #1, 2835-19 Street NE
Calgary, AB **Phone (403) 282 8542**
T2E 7A2 **Fax (403) 282 8593**



BOA™ Breaker Oil Analysis Oil Circuit Breaker Sample Data



H₂b

ANALYTICAL SERVICES
INCORPORATED

Routine Test

Retest

This is a Return to Service Test

Send Samples to: TJH2b Analytical Services Canada Inc.
Bay #1, 2835-19 Street NE
Calgary, AB
T2E 7A2

Phone (403) 282 8542
Fax (403) 282 8593



TASA™ Tapchanger Activity Signature Analysis

LTC Fluid Sample Data



RETURN CONTAINERS TO: Phone: _____ Fax: _____	REPORT & INVOICE TO: Glenn Samms Newfoundland Power Box 8910, 55 Kenmount Road St. John's, NF A1B 3P6 Phone: (709) 737-5702 Fax: (709) 737-2926	REPORT TO: Phone: _____ Fax: _____
--	--	---

P.O. # _____ **Sampled By:** _____

Sample Location	(Substation/PH/PP)			
Equipment Number				
Bank and Phase				
Serial Number	(Nameplate)			
Manufacturer	(Nameplate)			
Model	(Nameplate)			
Tank/Compartment				
Breathing/Ventilation				
Selector Contact Type				
Transfer Contact Type				
LTC Location				
Tap to Tap Rating				
Current Rating				
Fluid Volume				
Counter				
Oil Filtered/Unit Serviced	(Yes/No)			
Reason for test				
Xfrmr Oil Temperature				
LTC Oil Temperature				

Sample Date			
Syringe No.			
Bottle No.			
Status:			
Lab Use Only			

All Tests below are Required for TASA Diagnostics			
<input type="checkbox"/> Dissolved Gas Analysis (D-3612)	<input type="checkbox"/> Acid Number (D-974)		
<input type="checkbox"/> Particle Profile	<input type="checkbox"/> Interfacial Tension (D-971)		
<input type="checkbox"/> Moisture in Oil (D-1533B)	<input type="checkbox"/> Color (D-1500)		
<input type="checkbox"/> Dielectric Breakdown (D-1816)			

Instructions: All DGA samples are taken using a glass syringe or stainless steel cylinder. All oil quality test samples are taken using a 1 qt plastic bottle. LTCs containing more than 350 gallons of oil require one gallon of oil to be flushed through the fill/drain valve prior to collecting samples. LTCs containing less than 350 gallons of oil require one quart of oil to be flushed through the fill/drain valve prior to collecting samples.

- Routine Test
 Retest
 This is a Return to Service Test

Send Samples to: TJH2b Analytical Services Canada Inc.
Bay #1, 2835-19 Street NE
Calgary, AB
T2E 7A2

Phone (403) 282 8542
Fax (403) 282 8593

ALPH-10 POWER FACTOR INSULATION TEST
"TWO WINDING TRANSFORMERS"

APPARATUS INFORMATION

MEGGER LIMITED
TYPE: 01-A10 TWO WINDING XFRMS

DATE: _____ / _____ / _____ (MM/DD/YY)
COMPANY: _____
TRANSFORMER LOCATION: _____ DESIGNATION: _____

ENVIRONMENT

WEATHER: _____
AIR TEMP: _____ °C
OIL TEMP: _____ °C
WINDING TEMP: _____ °C
REL. HUMIDITY: _____ %

TRANSFORMER NAME PLATE DATA

MFGR: _____ S/N: _____ YEAR: _____
TYPE: _____ KVA _____ FORM: _____
HIGH SIDE KV: _____ Y _____ Δ _____ LOW SIDE KV: _____ Y _____ Δ _____

TEST NO.	TEST CONNECTIONS			Menu Select	EQUIVALENT 10KV TEST RESULTS						Insulation Rating
	H.V.	CxRED			Voltage (V)	Current (mA)	Power (mW)	Power Factor (%)		CAP. (pf)	
								Measured	Correct to 20°C		
1	High	Low		1R[G+B]							
2	High	Low		5G[R+B]							
*3	High	Low		6R+G[B]							
**4	High	Low		1R[G+B]							
5	Low	High		5G[R+B]							
6	Low	High		6R+G[B]							

* Compare the Capacitance and Watts readings of this test to the sum of the Capacitance and Watts readings for Test No's 1+2+4. Ideally they should be the same.

** Compare the results of this test with the results of Test No. 1. Ideally they should be the same.

*** Compare the Capacitance and Watts readings of this test against the sum of the Capacitance and Watts readings for Test No's 5&6. Ideally they should be the same.

OIL RESULTS:

DIELECTRIC STRENGTH TEST		INSULATION POWER FACTOR						
STD USED: 1816 <input type="checkbox"/> 877 <input type="checkbox"/>		TEST RESULTS						
AVG. BREAKDOWN	STD. DEV.	VOLTAGE (KV)	CURRENT (mA)	Power (mW)	Power Factor %		CAP. (pf)	Insulation Rating
					Measured	Corr to 20°C		

REASON FOR TESTING: _____ OIL CELL S.N. _____

WORK ORDER NO: _____ ALPH-10 S/N: _____

TESTED BY: _____ LAST DATE TESTED: _____ / _____ / _____ (MM/DD/YY)

CHECKED BY: _____ DATE CHECKED: _____ / _____ / _____ (MM/DD/YY)

COMPANY: _____

DEPARTMENT: _____ SHEET NO: _____

REMARKS: _____

OIL CIRCUIT BREAKERS

Capacitance and Power Factor Tests

COMPANY				DATE			
TEST LOCATION				TESTED BY			
BREAKER IDENT.				TEST SET NO.			
BREAKER SERIAL NO.				AIR TEMPERATURE			
BREAKER MFR.		TYPE		OIL TEMPERATURE			
BREAKER KV		AMPS		% RH			
BUSHING MFR.		TYPE		KV		WEATHER	

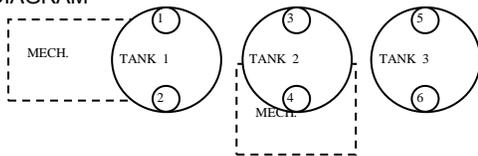
CIRCUIT BREAKER OVERALL TESTS

TEST NO.	CB	INSULATION TESTED	ϕ	TEST MODE	TEST CONNECTIONS BUSHINGS				TEST KV	CAPACITANCE C(PF)	% POWER FACTOR			10KV		2.5KV		INSULATION RATING	
					ENG	GND	GAR	UST			MEASU RED	20°C %PF	CORR FCTR	mA	watts	mA	watts		
1	OPEN	C _{1G}		GST GND	1														
2		C _{2G}		GST GND	2														
3		C _{3G}		GST GND	3														
4		C _{4G}		GST GND	4														
5		C _{5G}		GST GND	5														
6		C _{6G}		GST GND	6														
7	CLOSED	C _{1G} + C _{2G}		GST GND	1&2														
8		C _{3G} + C _{4G}		GST GND	3&4														
9		C _{5G} + C _{6G}		GST GND	5&6														

BUSHING & OIL TESTS

TEST NO.	BUSHING		ϕ	TEST MODE	ENG	GND	GAR	UST	TEST KV	CAPACITANCE C(PF)	% POWER FACTOR	10KV	2.5KV	INSULATION RATING
	NO.	SER. NO.												
10	1			UST	1			TAP						
11	2			UST	2			TAP						
12	3			UST	3			TAP						
13	4			UST	4			TAP						
14	5			UST	5			TAP						
15	6			UST	6			TAP						
16		TANK 1 OIL		UST										
17		TANK 2 OIL		UST										
18		TANK 3 OIL		UST										

DIAGRAM



Note: Circuit breaker open: bushing tests
(Test No. 1, 2, 3, 4, 5 and 6).
Circuit breaker closed: Tank tests
(Test No. 7, 8 and 9)

REMARKS;

INSULATION RATING KEY

- G = GOOD
- D = DETERIORATED
- I = INVESTIGATE
- B = BAD (REMOVE OR RECONDITION)

INSULATION TESTED

- 1 TO 6 = BUSHING TERMINALS
- G = GROUND

TANK LOSS INDEX

- TANK 1 = $W_7 - (W_1 + W_2) =$
- TANK 2 = $W_8 - (W_3 + W_4) =$
- TANK 3 = $W_9 - (W_5 + W_6) =$

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Valley Forge, PA 19484-9007

Note: No. in ENG column is bushing energized, all other bushings must be floating.

Note: Subscripts are test no's. index may be positive or negative

TWO WINDING TRANSFORMER

Capacitance and Power Factor Tests

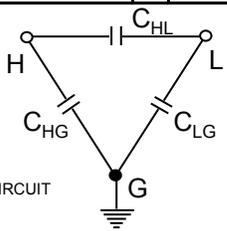
COMPANY				DATE			
TEST LOCATION				TESTED BY			
XFMR IDENT.				TEST SET NO.			
XFMR SERIAL NO.				AIR TEMPERATURE			
XFMR MFR.		TYPE		KVA		OIL TEMPERATURE	
HIGH KV		SGL <input type="checkbox"/>		Y <input type="checkbox"/>		Δ <input type="checkbox"/>	
HIGH KV BUSH				WEATHER			
LOW KV		SGL <input type="checkbox"/>		Y <input type="checkbox"/>		Δ <input type="checkbox"/>	
LOW KV BUSH				TERTIARY KV			
				SGL <input type="checkbox"/>			
				Y <input type="checkbox"/>			
				Δ <input type="checkbox"/>			
				TERTIARY BUSH			

TRANSFORMER OVERALL TESTS

TEST #	INSULATION TESTED	TEST MODE	TEST CONNECTIONS (WINDINGS)				TEST KV	CAPACITANCE C(PF)	% POWER FACTOR			EQUIV. 10KV		EQUIV. 2.5KV		INSULATION RATING
			ENG	GND	GAR	UST			MEASURED	20°C %PF	CORR FCTR	Ma	WATTS	Ma	WATTS	
1	$C_{HG} + C_{HL}$	GST GND	H	L												
2	C_{HG}	GST	H		L											
3	C_{HL}	UST	H			L										
4	C_{HL}	<>	TEST 1 MINUS TEST 2				<>									
5	$C_{LG} + C_{HL}$	GST GND	L	H												
6	C_{LG}	GST	L		H											
7	C_{HL}	UST	L			H										
8	C_{HL}	<>	TEST 5 MINUS TEST 6				<>									
9	$C_{HG'}$	<>	C_{HG} MINUS HIGH BUSH.				<>									
10	$C_{LG'}$	<>	C_{LG} MINUS HIGH BUSH.				<>									

BUSHING TESTS

TEST #	BUSHING		UST													
	SER. NO.	φ														
HI KV	11	A	UST													
	12	B	UST													
	13	C	UST													
	14	N	UST													
LO KV	15	A	UST													
	16	B	UST													
	17	C	UST													
	18	N	UST													
19	OIL TEST		UST													



EQUIVALENT CIRCUIT

INSULATION RATING KEY

- G = GOOD
- D = DETERIORATED
- I = INVESTIGATE
- B = BAD (REMOVE OR RECONDITION)

REMARKS

- H = HIGH - VOLTAGE WINDING
- L = LOW - VOLTAGE WINDING
- G = GROUND
- N = NEUTRAL BUSHING

Test No. 4, 8, 9, 10 are calculated intercheck values.

NOTE: SHORT EACH WINDING ON ITSELF
letter in ENG column = winding energized.

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P.O. Box 9007
Valley Forge, PA 19484-9007

THREE WINDING TRANSFORMER

Capacitance and Power Factor Tests

COMPANY				DATE			
TEST LOCATION				TESTED BY			
XFMR IDENT.				TEST SET NO.			
XFMR SERIAL NO.				AIR TEMPERATURE			
XFMR MFR.	TYPE	KVA		OIL TEMPERATURE			
HIGH KV	SGL	<input type="checkbox"/>	Y	<input type="checkbox"/>	Δ	<input type="checkbox"/>	% RH
HIGH KV BUSH				WEATHER			
LOW KV	SGL	<input type="checkbox"/>	Y	<input type="checkbox"/>	Δ	<input type="checkbox"/>	TERTIARY KV
LOW KV BUSH				TERTIARY BUSH			

TRANSFORMER OVERALL TESTS

TEST #	INSULATION TESTED	TEST MODE	TEST CONNECTIONS (WINDINGS)				TEST KV	CAPACITANCE C(PF)	% POWER FACTOR			EQUIV. 10KV		EQUIV. 2.5KV		INSULATION RATING	
			ENG	GND	GAR	UST			MEASURED	20°C %PF	CORRECTED	Ma	WATTS	Ma	WATTS		
1	$C_{HG} + C_{HL}$	GST	H	L	T												
2	C_{HG}	GST	H		L&T												
3	C_{HL}	UST	H	T		L											
4	C_{HL}	<>	TEST 1 minus TEST 2				<>										
5	$C_{LG} + C_{LT}$	GST	L	T	H												
6	C_{LG}	GST	L		T&H												
7	C_{LT}	UST	L	H		T											
8	C_{LT}	<>	TEST 5 minus TEST 6				<>										
9	$C_{TG} + C_{HT}$	GST	T	H	L												
10	C_{TG}	GST	T		H&L												
11	C_{HT}	UST	T	L		H											
12	C_{HT}	<>	TEST 9 minus TEST 10				<>										
13	C_{HG}'	<>	C_{HG} minus HIGH BUSH.				<>										
14	C_{LG}'	<>	C_{LG} minus LOW BUSH.				<>										
15	C_{TG}'	<>	C_{TG} minus TERTIARY BUSH.				<>										

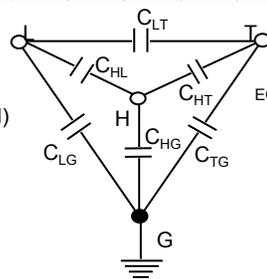
BUSHING TESTS

TEST #	BUSHING																	
	SER. NO.	φ	UST															
HI KV	16	A	UST															
	17	B	UST															
	18	C	UST															
	19	N	UST															
LO KV	20	A	UST															
	21	B	UST															
	22	C	UST															
	23	N	UST															
T KV	24	A	UST															
	25	B	UST															
	26	C	UST															
	27	N	UST															
28	OIL TEST		UST															

INSULATION RATING KEY
 G = GOOD
 D = DETERIORATED
 I = INVESTIGATE
 B = BAD (REMOVE OR RECONDITION)

Test No. 4, 8, 12, 13, 14 & 15 are calculated intercheck values.

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 P.O. Box 9007
 Valley Forge, PA 19484-9007



REMARKS

EQUIVALENT CIRCUIT

H = HIGH - VOLTAGE WINDING
 L = LOW - VOLTAGE WINDING
 G = GROUND
 N = NEUTRAL BUSHING

NOTE: SHORT EACH WINDING ON ITSELF

Letter in ENG column = winding energized.



MSF027
Revised 2011-02-08

Maintenance Standard Report Form VOLTAGE TRANSDUCER CHECK FORM

SUBSTATION: _____ EQUIP MONITORED: _____ TRANSDUCER SERIAL No: _____

NOTE: Please review test procedure MST018 before completing this form

1. AC VOLTAGE MEASUREMENT (Range: 110 to 125 Volts, 1 Decimal Place X.X):

AC VOLTAGE (Vin)

2. DC VOLTAGE MEASUREMENT/CALCULATION (Range: 0 to 5 Volts, 3 decimal places, X.XXX):

VDC meas	VDC calc	% ERROR

3. SCADA VOLTAGE READING (Ask SCADA Tech. to force poll RTU or Gateway to refresh readings):

RESULTS

4. a) PANEL METER VOLTAGE READING:

RESULTS

4. b) RELAY VOLTAGE READING:

RESULTS

Required Equations:

Voltage Transducer Full Scale: **150 VAC in = 1 mA or 5 VDC across RTU point**

Calculated VDC out: **VDCcalc = (Vin/150)*5**

Measured VDC out: **Step 2**

Calculated VDC out should equal measured VDC out across transducer or RTU input

Percent Error Calculation: **% Error = (VDCmeas – VDCcalc) / VDCcalc*100**

NOTE: If % Error is 1% or less, then transducer is ok

Signature: _____

Date Completed: _____

SCC operator and/or SCADA Technician: _____

- 1. PLEASE MAKE ANY COMMENTS OR REMARKS ON THE REVERSE OF THIS FORM**
- 2. COMPLETED FORM TO BE SCANNED AND FORWARDED TO PLANNER**
- 3. PLANNER WILL ENTER A WORK REQUEST TO OPERATIONAL SUPPORT FOR ADDITIONAL INVESTIGATION IF THE TRANSDUCER PASSED THE TEST**



MSF028
Revised 2011-03-29

Maintenance Standard Report Form POWER TRANSDUCER CHECK FORM

SUBSTATION: _____ EQUIP MONITORED: _____ TRANSDUCER SERIAL No: _____

NOTE: Please review test procedure MST019 before completing this form

1. a) AC VOLTAGE MEASUREMENTS (Range: 110 to 125 Volts, 1 Decimal Place X.X):

AC VOLTAGE VALUE		
Phase A	Phase C	V Avg

1. b) AC CURRENT MEASUREMENTS (Range: 0 to 5 Amps, 3 Decimal Places X.XXX):

AC CURRENT VALUE			
Phase A	Phase B	Phase C	I Avg

2. DC VOLTAGE MEASUREMENT/CALCULATION (Range: 0 to 5 Volts, 3 Decimal Places X.XXX):

TRANSDUCER VDC OUTPUTS		
Output Watt (VDCw)	Output VAR (VDCv)	VDCt

3. SCADA POWER READINGS (Ask SCADA Tech. to force poll RTU or Gateway to refresh readings):

MW	MVAR

4. CALCULATIONS:

VA Expected (VAcalc)	VA Measured (Vameas)	% Error

5. a) PANEL METER READINGS:

MVA	MVA Multiplier

5. b) RELAY READINGS:

3 Phase MW	3 Phase MVAR

Required Equations:

Expected VDC out of transducer: $VDCt = \sqrt{(VDCw)^2 + (VDCv)^2}$
Percent Error: $\%Error = (Vameas - VAcalc) / VAcalc * 100$

Expected VA input: $VAcalc = (VDCt * 1500) / 5$
Measured VA input: $Vameas = 3 * Vavg * Iavg$

NOTE: If % Error is 5% or less, then transducer is ok

Signature: _____

Date Completed: _____

SCC Operator and/or SCADA Technician: _____

- 1. PLEASE MAKE ANY COMMENTS OR REMARKS ON THE REVERSE OF THIS FORM**
- 2. IF TRANSDUCER PASSED RECORD ADDITIONAL WORK FOR OPERATIONS SUPPORT GROUP ON AVANTIS WORK REQUEST. 3. COMPLETED FORM TO BE SCANNED AND FORWARD TO PLANNER**



MSF029
Revised 5-30-2006

Padmount Information Form

Company Number: _____

Serial Number: _____

Manufacturer: _____

Manufacture Date: _____

Old Company No.: _____
(If Applicable)

Rating (kVA): _____ Weight (kg): _____ Oil Capacity (litres): _____

Primary Voltage (kV): _____ Secondary Voltage (kV): _____

Primary Connections:

Elbows

Open Lugs

Primary Configuration:

Delta

Wye

Single Phase

PCB Level (PPM): _____

Lab Tested

Clor-N-Oil

White Label

Tests:

Dielectric Oil Pass

Fail

Ratio

Megger

Notes:

Tested By: _____

Date: _____

Keyed in Avantis:

Kings Bridge Substation



MSF030 - KBR
Revised: 2006/12/08

Maintenance Standard Report Form
SWITCHGEAR PARTIAL DISCHARGE TESTING

Substation/Location: Kings Bridge Substation	Manufacturer: Temperature: _____ °C	Work Order Number: Weather: Wet or Dry
--	--	---

Form to be completed for Partial Discharge tests using UltraTEV.

Please indicate (√) LED status color for each cubicle. (G - Green A - Amber R - Red)

Cubicle	Front					Back					Comments	
	Ultrasonic		TEV			Ultrasonic		TEV				
	G	R	G	A	R	G	R	G	A	R		
KBR-AUX												
KBR-01-B												
KBR-02-B												
KBR-08-B												
KBR-04-B												
KBR-T1-B												
KBR-T2-B												
KBR-03-B												
KBR-07-B												
KBR-06-B												
KBR-05-B												
KBR-TB-3-5												
KBR-12-B												
KBR-11-B												
KBR-10-B												
KBR-09-B												
KBR-T3-B												
KBR-TB-3-4												

Type of Maintenance: _____ Date: _____ Inspected By: _____
(YYYY-MM-DD)



MSF030

Maintenance Standard Report Form METERING TANKS

Revised: 2009-06-23

Substation/Location:		Work Order No.:		ID Number:	
Amps:	Volts:	Manufacturer:		Serial #:	

Check each item with a ✓ for OK, X to indicate a problem, N/A for not applicable, or N/D for not done. Initial each entry.

#	Task	Status or Results	Initial																														
1	Maintenance history reviewed																																
2	Maintenance standards reviewed																																
3	Manufacturer information reviewed																																
4	Nameplate info recorded																																
5	External visual inspection																																
6	Chlor-N-Oil Test																																
7	PCB Lab Test Results (If Necessary)																																
8	Checked Oil Levels & Leaks																																
9	Initial Oil Dielectric _____ kV																																
10	Meggered OK																																
11	CT Ratio Test																																
12	PT Ratio Test																																
13	Oil removed for inspection																																
14	Tank & components cleaned																																
15	Tank vents cleaned																																
16	Internal visual inspection																																
17	Tank repaired & prepared for painting																																
	Bushings & gaskets																																
	Cover gasket																																
	Secondary terminals gasket																																
	Secondary terminations clean, tight and identified																																
	Bushing & ground terminals clean and tight																																
18	HV Bushings identified																																
19	Drain valve present & secure																																
20	Finish refilling to correct level																																
25	Final Megger Test Results: <table style="margin-left: 20px; border-collapse: collapse;"> <tr> <td style="width: 20px;"></td> <td style="width: 100px;">3φ - Ground</td> <td style="width: 50px; text-align: center;">°C</td> <td style="width: 50px; text-align: center;">kV</td> <td style="width: 50px; text-align: center;">MΩ</td> </tr> <tr> <td></td> <td>2φ-1&3φ</td> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td>PT HV-LV</td> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td>CT HV-LV</td> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td>PT LV-Ground</td> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td>CT LV-Ground</td> <td></td> <td></td> <td></td> </tr> </table>		3φ - Ground	°C	kV	MΩ		2φ-1&3φ					PT HV-LV					CT HV-LV					PT LV-Ground					CT LV-Ground					
	3φ - Ground	°C	kV	MΩ																													
	2φ-1&3φ																																
	PT HV-LV																																
	CT HV-LV																																
	PT LV-Ground																																
	CT LV-Ground																																
26	Final Oil Dielectric _____ kV																																
27	Final CT Ratio																																
28	Final PT Ratio																																
30	Painting																																
31	PCB Sticker Installed for _____ ppm																																
32	ID # Installed																																
33	Shipping plugs installed and identified prior to shipping																																
34	Documentation distributed																																

Memorial Substation



MSF030 - MUN
Revised: 2006/12/08

Maintenance Standard Report Form
SWITCHGEAR PARTIAL DISCHARGE TESTING

Substation/Location: Memorial Substation	Manufacturer: Temperature: _____ °C	Work Order Number: Weather: Wet or Dry
--	--	---

Form to be completed for Partial Discharge tests using UltraTEV.

Please indicate (√) LED status color for each cubicle. (G - Green A - Amber R - Red)

Cubicle	Front					Back					Comments	
	Ultrasonic		TEV			Ultrasonic		TEV				
	G	R	G	A	R	G	R	G	A	R		
MUN-T2-B												
MUN-10												
MUN-09-B												
MUN-08-B												
MUN-07												
MUN-PT												
MUN-TIE												
MUN-06-B												
MUN-05-B												
MUN-04-B												
MUN-03-B												
MUN-02-B												
MUN-01-B												
MUN-SS												
MUN-T1-B												

Type of Maintenance: _____ Date: _____ Inspected By: _____
(YYYY-MM-DD)

Ridge Road Substation



MSF030 - RRD
Revised: 2006/12/08

Maintenance Standard Report Form
SWITCHGEAR PARTIAL DISCHARGE TESTING

Substation/Location: Ridge Road Substation	Manufacturer: Temperature: _____ °C	Work Order Number: Weather: Wet or Dry
--	--	---

Form to be completed for Partial Discharge tests using UltraTEV.

Please indicate (√) LED status color for each cubicle. (G - Green A - Amber R - Red)

Cubicle	Front					Back					Comments	
	Ultrasonic		TEV			Ultrasonic		TEV				
	G	R	G	A	R	G	R	G	A	R		
RRD-SS												
RRD-06-B												
RRD-01-B												
RRD-T1-B												
RRD-TB-2-3												
RRD-05-B												
RRD-04-B												
RRD-T2-B												
RRD-03-B												
RRD-02-B												
RRD-TIE-2-3-D												
RRD-T3-B												
RRD-07-B												
RRD-08-B												
RRD-09-B												
RRD-10-B												
RRD-TB-3-4												

Type of Maintenance: _____ Date: _____ Inspected By: _____
(YYYY-MM-DD)

Seal Cove Substation

(YYYY-MM-DD)

St Johns Main Substation



MSF030 - SJM
Revised: 2006/12/08

Maintenance Standard Report Form
SWITCHGEAR PARTIAL DISCHARGE TESTING

Substation/Location: St Johns Main Substation	Manufacturer: Temperature: _____ °C	Work Order Number: Weather: Wet or Dry
---	--	---

Form to be completed for Partial Discharge tests using UltraTEV.

Please indicate (√) LED status color for each cubicle. (G - Green A - Amber R - Red)

Cubicle	Front					Back					Comments	
	Ultrasonic		TEV			Ultrasonic		TEV				
	G	R	G	A	R	G	R	G	A	R		
SJM-02-B												
SJM-03-B												
SJM-04-B												
SJM-06-B												
SJM-07-B												
SJM-08-B												
SJM-09-B												
SJM-11-B												
SJM-T1-B												
SJM-T2-B												
SJM-AUX												
SJM-S/S												
SJM-TB-1-2												
SJM-TB-1-3												
SJM-TIE-1-3-D												
SJM-10-B												
SJM-13-B												
SJM-14-B												
SJM-15-B												

Type of Maintenance: _____ Date: _____ Inspected By: _____
(YYYY-MM-DD)

Walbournes Substation

Type of Maintenance: _____

Date: _____
(YYYY-MM-DD)

Inspected By: _____



Revised: 2010-10-27

Maintenance Standard Report Form TRANSFORMER PROTECTION DEVICES

MSF031

Page 1 of 2

Substation/Location:	Work Order Number:	Transformer ID Number:
Date:	Work Performed by:	Temperature: _____ °C Weather: Wet: <input type="checkbox"/> Dry: <input type="checkbox"/>

Power Transformer:

Conduits Inspected (Y/N): _____ *Water or Corrosion(Y/N):* _____ *Remarks:* (Use Reverse)

Voltage Measurement Across: (Ensure meter set to DC volts)

Coil of Transformer Gas Trip Aux. Relay _____ mV
Trip Coil of Transformer Low Voltage Breaker _____ mV

Megger Test For Gas Detector Relay: (250V for 5 min.)

Building to Device	Cabinet to Device (If Applicable)	Building to Cabinet (If Applicable)
Lead #1 to GND _____ Ω	Lead #1 to GND _____ Ω	Lead #1 to GND _____ Ω
Lead #2 to GND _____ Ω	Lead #2 to GND _____ Ω	Lead #2 to GND _____ Ω
Across Contacts _____ Ω	Across Contacts _____ Ω	

Megger Test for Winding Temp. Gauge: (250V for 1 min.)

Building to Device	Cabinet to Device (If Applicable)	Building to Cabinet (If Applicable)
Lead #1 to GND _____ Ω	Lead #1 to GND _____ Ω	Lead #1 to GND _____ Ω
Lead #2 to GND _____ Ω	Lead #2 to GND _____ Ω	Lead #2 to GND _____ Ω
Across Contacts _____ Ω	Across Contacts _____ Ω	

Megger Test for Oil Temp. Gauge: (250V for 1 min.)

Building to Device	Cabinet to Device (If Applicable)	Building to Cabinet (If Applicable)
Lead #1 to GND _____ Ω	Lead #1 to GND _____ Ω	Lead #1 to GND _____ Ω
Lead #2 to GND _____ Ω	Lead #2 to GND _____ Ω	Lead #2 to GND _____ Ω
Across Contacts _____ Ω	Across Contacts _____ Ω	

Megger Test for Pressure Relief Device: (250V for 1 min.)

Building to Device	Cabinet to Device (If Applicable)	Building to Cabinet (If Applicable)
Lead #1 to GND _____ Ω	Lead #1 to GND _____ Ω	Lead #1 to GND _____ Ω
Lead #2 to GND _____ Ω	Lead #2 to GND _____ Ω	Lead #2 to GND _____ Ω
Across Contacts _____ Ω	Across Contacts _____ Ω	

Tap Changer (If Applicable):

Megger Test For Gas Detector Relay: (250V for 5 min.)

Building to Device	Cabinet to Device (If Applicable)	Building to Cabinet (If Applicable)
Lead #1 to GND _____ Ω	Lead #1 to GND _____ Ω	Lead #1 to GND _____ Ω
Lead #2 to GND _____ Ω	Lead #2 to GND _____ Ω	Lead #2 to GND _____ Ω
Across Contacts _____ Ω	Across Contacts _____ Ω	

Megger Test for Pressure Relief Device: (250V for 1 min.)

Building to Device	Cabinet to Device (If Applicable)	Building to Cabinet (If Applicable)
Lead #1 to GND _____ Ω	Lead #1 to GND _____ Ω	Lead #1 to GND _____ Ω
Lead #2 to GND _____ Ω	Lead #2 to GND _____ Ω	Lead #2 to GND _____ Ω
Across Contacts _____ Ω	Across Contacts _____ Ω	

All Wiring Returned to Original Termination Points (Y/N): _____

