



TRANSFORMER IEC 61378-1



OWNER Example Owner
 PLANT Example Plant
 SUBSTATION TRANSFORMERS
 POSITION AUTOMATED

PAGE 1
 DATE 10/13/2014
 AMBIENT TEMP. _____ °F
 HUMIDITY _____ %
 JOB # TRANSFORMERS
 ASSET ID _____

NAMEPLATE DATA

MFR _____ CLASS _____ PHASES _____
 SER NO _____ COOLANT OIL REASON _____
 YEAR _____ BIL _____ kV WEIGHT _____ lb
 WINDING MATERIAL Cu
 OIL VOLUME _____ GAL
 OIL TEMP _____ °C
 IMPEDANCE _____ %
 WEATHER _____
 TANK TYPE SEALED
 ALLOWED ERROR 0.05 %
 Winding Type _____

BUSHING NAMEPLATE						
DSG	SERIAL NUM	MFR.	TYPE/CLASS	kV	AMPS	YEAR
H1						
H2						
H3						
X1						
X2						
X3						

	VOLTAGE (kV)	kVA	RATED I	# TAPS	NOMINAL	CHANGER	TAP SETTING
PRIMARY:				5	3	DETC	
SECOND:				1			

COMMENTS: _____

#	TAP H/L	Voltage H/L	Test V	TTR	Actual TTR	% error	Phase Angle (deg)
1							

COMMENTS: _____
 DEFICIENCIES: _____

TEST EQUIPMENT USED: _____ TESTED BY: Default Administrator
 Serial Number: _____ Firmware Information: _____ Calibration Date: _____



TRANSFORMER WINDING RESISTANCE QUICK TEST



OWNER Example Owner PAGE 2
 PLANT Example Plant AMBIENT TEMP. _____ °F DATE 10/13/2014
 SUBSTATION TRANSFORMERS HUMIDITY _____ % JOB # TRANSFORMERS
 POSITION AUTOMATED ASSET ID _____

Asset ID: _____

MANUAL WINDING RESISTANCE

First Winding Units: Ohms Second Winding Units: Ohms Winding Material: Cu

Please select the First (and Second) Winding to test

Test #	Description	Current (amp)	First Winding	First Winding Reading	Second Winding	Second Winding Reading	Reading Stability %	
							First	Second
1			None		None			

TEST EQUIPMENT USED: _____ TESTED BY: Default Administrator

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



TRANSFORMER POLARIZATION INDEX (PI) TEST



OWNER Example Owner
 PLANT Example Plant
 SUBSTATION TRANSFORMERS
 POSITION AUTOMATED

PAGE 3
 AMBIENT TEMP. _____ °F DATE 10/13/2014
 HUMIDITY _____ % JOB # TRANSFORMERS
 ASSET ID _____

NAMEPLATE DATA

MFR _____ CLASS _____ PHASES _____
 SER NO _____ COOLANT OIL REASON _____
 YEAR _____ BIL _____ kV WEIGHT _____ lb
 WINDING MATERIAL Cu
 OIL VOLUME _____ GAL
 OIL TEMP _____ °C
 IMPEDANCE _____ %
 WEATHER _____
 TANK TYPE SEALED

BUSHING NAMEPLATE						
DSG	SERIAL NUM	MFR.	TYPE/CLASS	kV	AMPS	YEAR
S						
L						
SL						



Diagram # 43 (ANSI)

	VOLTAGE (kV)	kVA	RATED I	# TAPS	NOMINAL	CHANGER	TAP SETTING
PRIMARY:				5	3	DETC	
SECOND:				1			

TEST FREQUENCY: 60

COMMENTS: _____

TEST VOLTAGE: HIGH TO LOW+GND _____ KVDC LOW TO HIGH+GND _____ KVDC HIGH+LOW TO GND _____ KVDC
 CORE/COIL TEMPERATURE _____ °C Enter TCF Manually: TEMP. CORR. FACTOR TO 20°C, TCF DRY _____ LIQUID _____
 Use Instrument PI / DAR Value:

MINUTES	TRANSFORMER					
	High to Low (Low Grounded)		Low to High (High Grounded)		High + Low to Ground	
	READING (megohms)	CORR. VALUE (megohms)	READING (megohms)	CORR. VALUE (megohms)	READING (megohms)	CORR. VALUE (megohms)
0.25						
0.50						
0.75						
1.00						
2.00						
3.00						
4.00						
5.00						
6.00						
7.00						
8.00						
9.00						
10.00						
P. I.						
D. A. R.						

INSULATION CONDITION	POLARIZATION INDEX (PI)
DANGEROUS	< 1.0
POOR	1.0 to 1.1
QUESTIONABLE	1.1 to 1.25
FAIR	1.25 TO 2.0
GOOD	> 2.0

NOTES:
 PI ranges from IEEE C57.152-2013
 Polarization Index should not be used to assess insulation in new power transformers (IEEE C57.152-2013)
 The polarization index for insulation liquid is always close to 1. Therefore, the polarization index for transformers with low conductivity liquids (e.g. new mineral oil) may be low in spite of good insulation condition. (IEEE C57.152-2013)

INSULATION CONDITION	DAR 60/30 SEC
QUESTIONABLE	1.0 - 1.25
GOOD	1.4 to 1.6
EXCELLENT	> 1.6

NOTES:
 DAR ranges from A Stitch In Time (Megger, 2006)
 These values must be considered tentative and relative - subject to experience, over time

TEST EQUIPMENT USED: _____

TESTED BY: Default Administrator

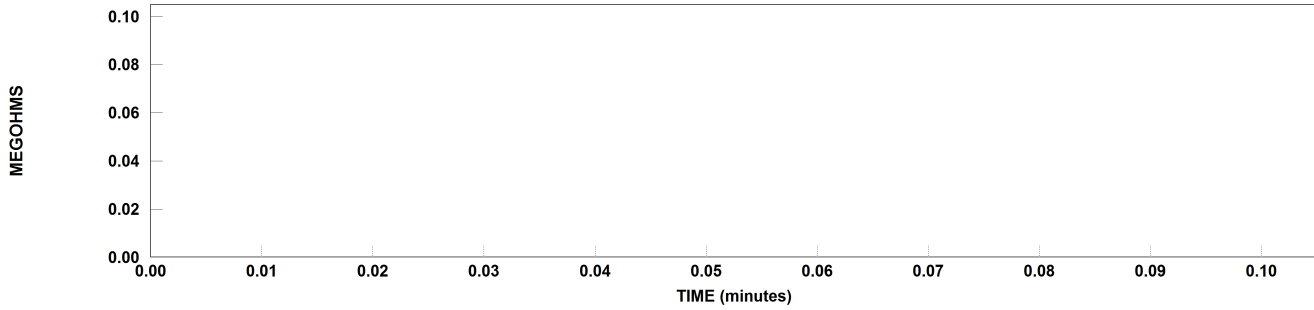


TRANSFORMER POLARIZATION INDEX (PI) TEST

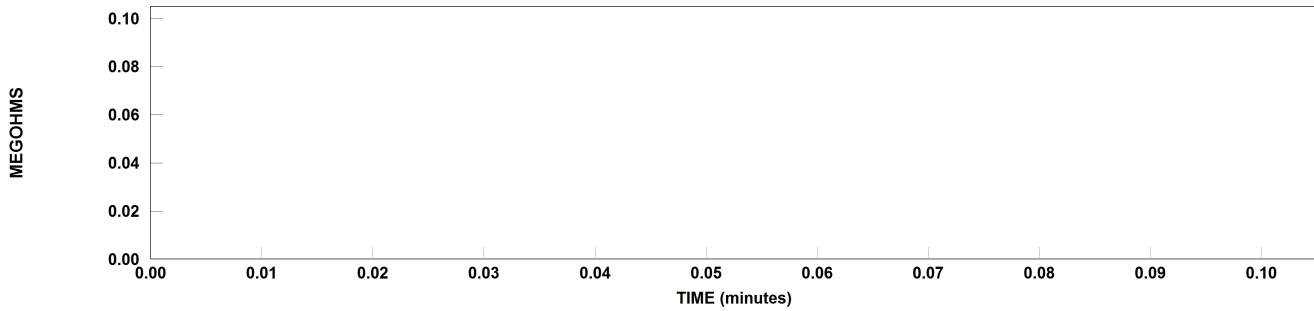


DATE 10/13/2014 TEMPERATURE _____ °F HUMIDITY _____ % EQPT. LOCATION _____
SUBSTATION TRANSFORMERS POSITION AUTOMATED

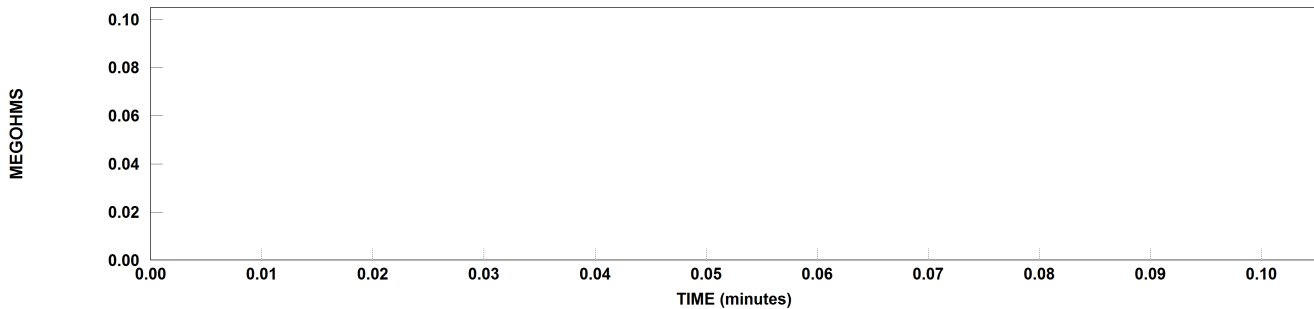
POLARIZATION CURVE High to Low (Low Grounded) : Red Square



POLARIZATION CURVE Low to High (High Grounded) : Blue Circle



POLARIZATION CURVE High + Low to Ground : Green Triangle



COMMENTS: _____
DEFICIENCIES: _____



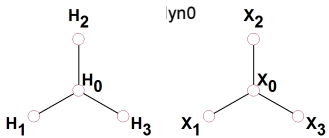
MAGNETIC BALANCE



OWNER Example Owner PAGE 5
 PLANT Example Plant AMBIENT TEMP. °F DATE 10/13/2014
 SUBSTATION TRANSFORMERS HUMIDITY % JOB # TRANSFORMERS
 POSITION AUTOMATED ASSET ID

Nameplate Data

Serial Number <u> </u>	Year <u> </u>	Class <u> </u>	BIL <u> </u> kV
Manufacturer <u> </u>	Phases <u> </u> <u>3</u>	Coolant <u> </u> <u>OIL</u>	Impedance <u> </u> %
Winding Material <u> </u> <u>Cu</u>	Reason <u> </u>	Oil Volume <u> </u> <u>GAL</u>	Weather <u> </u>
Allowed Error <u> </u> %	Weight <u> </u> <u>lb</u>	Oil Temp <u> </u> °C	Tank Type <u> </u> <u>SEALED</u>



	Voltage (kV)	kVA	Rated I	# Taps	Nominal	Changer	Tap Setting
Primary	/			5	3	Off Load	
Secondary	/			1			

Diagram # 7 (ANSI)**Transformer Turns Ratio**

#	Tap H/L		Voltage H/L	Test V	TTR	H ₁ - H ₀ / X ₁ - X ₀				H ₂ - H ₀ / X ₂ - X ₀				H ₃ - H ₀ / X ₃ - X ₀				
						Actual TTR	% error	I exc mA	Phase (Deg)	Actual TTR	% error	I exc mA	Phase (Deg)	Actual TTR	% error	I exc mA	Phase (Deg)	
1	Nomina	Nomina																
2	H1	H0																
3	H2	H0																
4	H3	H0																

Magnetic Balance Test

Applied Voltage to High Voltage Side B/W	Measured Percentage (%)		
	H1-H0	H2-H0	H3-H0
H1-H0	0.0000	0.0000	0.0000
H2-H0	0.0000	0.0000	0.0000
H3-H0	0.0000	0.0000	0.0000

COMMENTS:
 DEFICIENCIES:

TEST EQUIPMENT USED: TESTED BY: Default Administrator
 Serial Number: Firmware Information: Calibration Date:

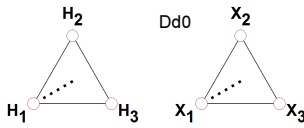


Diagram # 3 (ANSI)

Detect Transformer Type

ASSET ID: _____

TEST DATE: 10/13/2014

#	TAP H/L	Voltage H/L	Test V	TTR	$H_1 - H_3 / X_1 - X_3$				$H_2 - H_1 / X_2 - X_1$				$H_3 - H_2 / X_3 - X_2$				
					Actual TTR	% error	I exc mA	Phase (Deg)	Actual TTR	% error	I exc mA	Phase (Deg)	Actual TTR	% error	I exc mA	Phase (Deg)	
1																	

COMMENTS: _____
 DEFICIENCIES: _____

TEST EQUIPMENT USED: _____

TESTED BY: Default Administrator

Serial Number: _____

Firmware Information: _____

Calibration Date: _____



TRANSFORMER TURNS RATIO TEST



OWNER Example Owner PAGE 7
 PLANT Example Plant AMBIENT TEMP. _____ °F DATE 10/13/2014
 SUBSTATION TRANSFORMERS HUMIDITY _____ % JOB # TRANSFORMERS
 POSITION AUTOMATED ASSET ID _____

Company: _____	Step: _____	Rating: _____
Location: _____	MFR: _____	Serial #: _____
Circuit: _____	Device: _____	Max Deviation %: _____
Operator: _____	Type: _____	Test Voltage: _____
Comment: _____	Model: _____	Asset ID: _____

#	High Side		Low Side		Test Volt	Calc Ratio	H ₁ - H ₃ / X ₂ - X ₁					H ₂ - H ₁ / X ₃ - X ₂					H ₃ - H ₂ / X ₁ - X ₃				
	Tap #	Voltage	Tap #	Voltage			Actual Ratio	% error	P/F	I exc mA	Phase (degrees)	Actual Ratio	% error	P/F	I exc mA	Phase (degrees)	Actual Ratio	% error	P/F	I exc mA	Phase (degrees)
1																					

COMMENTS: _____
 DEFICIENCIES: _____

TEST EQUIPMENT USED: _____ TESTED BY: Default Administrator



INSULATION TESTS AUTO TRANSFORMER WITHOUT TERTIARY



OWNER Example Owner
 PLANT Example Plant
 SUBSTATION TRANSFORMERS
 POSITION AUTOMATED

PAGE 8
 DATE 10/13/2014
 AMBIENT TEMP. _____ °F
 HUMIDITY _____ %
 JOB # TRANSFORMERS
 ASSET ID _____

MFR _____ REASON _____
 SER NO _____ WEIGHT _____ lb
 YEAR _____ WINDING MATERIAL _____ Cu
 CLASS _____ OIL VOLUME _____ GAL
 COOLANT OIL OIL TEMP _____ °C
 BIL _____ kV IMPEDANCE _____ %
 PHASES 3 WEATHER _____
 CONFIGURATION _____
 TYPE SEALED

BUSHING NAMEPLATE						
DSG	SERIAL NUM	MFR.	TYPE/CLASS	kV	AMPS	YEAR
H1						
H2						
H3						
X1						
X2						
X3						

	VOLTAGE (kV)	kVA	RATED I	# TAPS	NOMINAL	CHANGER	TAP SETTING
PRIMARY:	/			5	3	Off Load	
SECOND:	/			1			

TEST FREQUENCY: 60 COMMENTS: _____

TRANSFORMER OVERALL TESTS														
TEST NO	INSULATION TESTED	TEST MODE	TEST LEAD CONNECTIONS				TEST kV	CAPACITANCE C (pF)	POWER FACTOR %			DIRECT		IR
			HV	RED	BLUE	GND			MEASURED	@ 20°C	CORR FACTOR	mA	WATTS	
1	CH	GST-GND	H+L	T		G								

Transformer - Bushing C1 Tests														
Test No.	Bushing Nameplate					Test Mode	TEST kV	Capacitance C (pF)	POWER FACTOR %			DIRECT		IR
	Dsg.	SERIAL #	CAT. #	PF	Cap. (pF)				Measured	@ 20°C	Corr Factor	mA	WATTS	
11	H1					UST-R								
12	H2					UST-R								
13	H3					UST-R								
14	N/A					UST-R								
15	X1					UST-R								
16	X2					UST-R								
17	X3					UST-R								
18						UST-R								
19	OIL TEST						UST-R							

TEST EQUIPMENT USED: _____ TESTED BY: Default Administrator
 Serial Number: _____ Firmware Information: _____ Calibration Date: _____



INSULATION TESTS AUTO TRANSFORMER WITHOUT TERTIARY



Transformer - Bushing C2 Tests															
Test No.	Bushing Nameplate					Test Mode	TEST kV		Capacitance C (pF)	POWER FACTOR %			DIRECT		IR
	Dsg.	SERIAL #	CAT. #	PF	Cap. (pF)					Measured	@ 20°C	Corr Factor	mA	WATTS	
20	H1					GSTg-R									
21	H2					GSTg-R									
22	H3					GSTg-R									
23	N/A					GSTg-R									
24	X1					GSTg-R									
25	X2					GSTg-R									
26	X3					GSTg-R									
27						GSTg-R									

Transformer - Surge Arresters Tests														
	Location	Serial #	Mfr	Overall Catalog	Unit Catalog	Type	Rated kV	Order	Test Mode	Test kV		DIRECT		IR
												mA	Watts	
28									GST-GND		<input type="checkbox"/>			
29									GST-GND		<input type="checkbox"/>			
20									GST-GND		<input type="checkbox"/>			
22									GST-GND		<input type="checkbox"/>			
22									GST-GND		<input type="checkbox"/>			
24									GST-GND		<input type="checkbox"/>			
26									GST-GND		<input type="checkbox"/>			
26									GST-GND		<input type="checkbox"/>			
26									GST-GND		<input type="checkbox"/>			

Transformer - Hot Collar Tests														
Test No.	Dsg	Serial #	Designation	Test Mode	Test kV		DIRECT		IR					
							mA	Watts						
37	H1			GST-GND										
38	H2			GST-GND										
39	H3			GST-GND										
40	X1			GST-GND										
41	X2			GST-GND										
42	X3			GST-GND										
43				GST-GND										
44				GST-GND										
45				GST-GND										
46				GST-GND										

EXCITING CURRENT TESTS

CONNECTIONS:		PHASE A: Enter connection					PHASE B: Enter connection					PHASE C: Enter connection					IR
TEST kV	LTC	L(H) / C (pF)	mA	EQUIV. 10 kV		TEST kV	L(H) / C (pF)	mA	EQUIV. 10 kV		TEST kV	L(H) / C (pF)	mA	EQUIV. 10 kV			
				mA	WATTS				mA	WATTS				mA	WATTS		
38																	
39																	
40																	
41																	
42																	



INSULATION TESTS AUTO TRANSFORMER WITHOUT TERTIARY



URNS RATIO TEST

47	kV		REF [TTR] CAP (pF)
----	----	--	--------------------

						PHASE A				PHASE B				PHASE C					
DETC	LTC	H Voltage	L Voltage	Calc. ratio		kV	Cap. (pF)	Turns Ratio	% Error		kV	Cap. (pF)	Turns Ratio	% Error		kV	Cap. (pF)	Turns Ratio	% Error
					48					49					49				

COMMENTS:
DEFICIENCIES:



TRANSFORMER TURNS RATIO TEST



OWNER Example Owner

PLANT Example Plant

SUBSTATION TRANSFORMERS

POSITION AUTOMATED

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DATE 10/13/2014

JOB # TRANSFORMERS

ASSET ID _____

AMBIENT TEMP. _____ °F

HUMIDITY _____ %

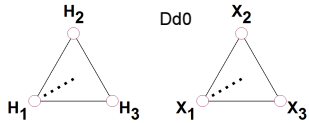


Diagram # 3 (ANSI)
Detect Transformer Type

	PRIMARY	SECONDARY
VOLTAGE (kV)		
KVA		
RATED I		
# TAPS	5	1
NOMINAL	3	
CHANGER	Off Load	

ALLOWED ERROR: 0.05 %

HIGH SIDE TAPS TO LOW SIDE NOMINAL TURNS RATIO TESTS

#	TAP H/L	Voltage H/L	Test V	TTR	$H_1 - H_3 / X_1 - X_3$				$H_2 - H_1 / X_2 - X_1$				$H_3 - H_2 / X_3 - X_2$			
					Actual TTR	% error	I exc mA	Phase (Deg)	Actual TTR	% error	I exc mA	Phase (Deg)	Actual TTR	% error	I exc mA	Phase (Deg)
1																
2																
3																
4																
5																

COMMENTS:
DEFICIENCIES:

TEST EQUIPMENT USED: _____

TESTED BY: Default Administrator

Serial Number: _____

Firmware Information: _____

Calibration Date: _____



TRANSFORMER WINDING RESISTANCE TEST



OWNER Example Owner
 PLANT Example Plant
 SUBSTATION TRANSFORMERS
 POSITION AUTOMATED

PAGE 12
 DATE 10/13/2014
 AMBIENT TEMP. _____ °F
 HUMIDITY _____ %
 JOB # TRANSFORMERS
 ASSET ID _____

MFR _____ WEIGHT _____ lb
 SER NO _____ WEATHER _____
 YEAR _____ BIL _____ kV
 TYPE SEALED IMPEDANCE _____ %
 CLASS _____ REASON _____
 PHASES 3 Max Wdg Diff (%): 1

OIL VOLUME _____ GAL
 OIL TEMP _____ °C
 WINDING TEMP _____ °C
 CORRECT TO 85 °C
 COOLANT OIL

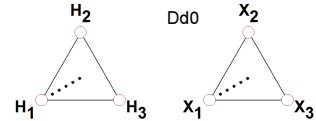


Diagram # 3 (ANSI)

	VOLTAGE (kV)	kVA	RATED I	# TAPS	NOMINAL	CHANGER	TAP SETTING	WINDING MATERIAL	SHOW RESULTS
PRIMARY:				5	3	DETC		Cu	<input checked="" type="checkbox"/>
SECOND:				1				Cu	<input checked="" type="checkbox"/>

HIGH VOLTAGE WINDING RESISTANCE

Show Graph

Units: Ohms

#	TAP	Current (amp)	Nameplate Voltage	Measured Resistance			Reading Stability %	Winding Difference %	
				H ₁ - H ₃	H ₂ - H ₁	H ₃ - H ₂			
1	1		0						
2	2		0						
3	Nominal		0						
4	4		0						
5	5		0						

LOW VOLTAGE WINDING RESISTANCE

Show Graph

Units: Ohms

#	TAP	Current (amp)	Nameplate Voltage	Measured Resistance			Reading Stability %	Winding Difference %	
				X ₁ - X ₃	X ₂ - X ₁	X ₃ - X ₂			
1	Nominal		0						

COMMENTS: _____
 DEFICIENCIES: _____

TEST EQUIPMENT USED: _____ TESTED BY: Default Administrator

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



LEAKAGE REACTANCE AND CAPACITANCE TEST



OWNER Example Owner PAGE 13

PLANT Example Plant AMBIENT TEMP. _____ °F DATE 10/13/2014

SUBSTATION TRANSFORMERS HUMIDITY _____ % JOB # TRANSFORMERS

POSITION AUTOMATED ASSET ID _____

Test Delete All Data Delete All (Leakage) Delete All (Capacitance) Show (Leak) Show (Cap)

LEAKAGE REACTANCE TEST Base KVA _____ Base Voltage _____ % Impedance _____ % Reactance _____ T.O.C. _____

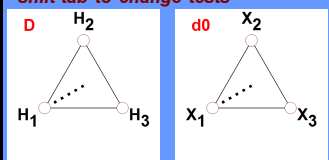
#	Type	Voltage (volts)	Current (amps)	Power (watts)	Power Factor (%)	Impedance (ohms)	Resistance (ohms)	Reactance (ohms)	Inductance (mH)	Impedance (%)	Delta % Impedance	Reactance (%)	Delta % Reactance
1													

CAPACITANCE TEST Base KVA _____ Base Voltage _____ % Impedance _____ % Reactance _____ T.O.C. _____

#	Type	Voltage (volts)	Current (amps)	Power (watts)	Power Factor (%)	Impedance (ohms)	Resistance (ohms)	Reactance (ohms)	Capacitance (uF)	Impedance (%)	Delta % Impedance	Reactance (%)	Delta % Reactance
1													

COMMENTS: _____

DEFICIENCIES: _____



ASSET ID:

HIGH: LOW:

TAP:

VOLTAGE (V):

Diagram # (ANSI)

TEST VOLTAGE (V):

CALCULATED RATIO:

Windings	Actual Ratio	% ERROR	EXCITATION CURRENT (mA)	Phase Deviation (deg)
Ha - Hb / Xa - Yb	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
H ₂ - H ₁ / X ₂ - X ₁	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
H ₃ - H ₂ / X ₃ - X ₂	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Comment:



MULTIPLE POWER FACTOR QUICK TESTS



ASSET ID: _____

TEST FREQUENCY:

COMMENTS: _____

TEST NO	INSULATION TESTED	TEST MODE	SUPPRESS.	TEST KV	Test Freq	L(H) CAP.(pF)	POWER FACTOR %			DIRECT		%VDF	IR
							MEAS.	@ 20°C	CORR.	mA	WATTS		
1		UST-R	On										

TEST EQUIPMENT USED: _____

TESTED BY: Default Administrator

Serial Number: _____

Firmware Information: _____

Calibration Date: _____



VOLTAGE REGULATOR TURNS RATIO TEST



OWNER Example Owner
 PLANT Example Plant
 SUBSTATION TRANSFORMERS
 POSITION AUTOMATED

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 DATE 10/13/2014
 AMBIENT TEMP. _____ °F
 HUMIDITY _____ %
 JOB # TRANSFORMERS
 ASSET ID _____

NAMEPLATE DATA

MFR _____ CLASS _____ PHASES 1
 SER NO _____ COOLANT OIL REASON _____
 YEAR _____ BIL _____ kV WEIGHT _____ lb
 VREG _____ WINDING MATERIAL Cu
 OIL VOLUME _____ GAL
 OIL TEMP _____ °C
 IMPEDANCE _____ %
 WEATHER _____
 TANK TYPE SEALED
 ALLOWED ERROR 1 %

BUSHING NAMEPLATE						
DSG	SERIAL NUM	MFR.	TYPE/CLASS	kV	AMPS	YEAR
S						
L						
SL						



Diagram # 43 (ANSI)

	VOLTAGE (kV)	kVA	RATED I	# TAPS	NOMINAL	CHANGER	TAP SETTING
PRIMARY:				5	3	DETC	
SECOND:				1			

COMMENTS: _____

#	High Side		Low Side		Test Volt	$H_1 - H_2 / X_2 - X_1$				Phase (Degrees)
	Tap #	Voltage	Tap #	Voltage		Calculated Ratio	Actual Ratio	Percent Error	Excitation Current (mA)	
1										
2										
3										
4										
5										

COMMENTS: _____
 DEFICIENCIES: _____

TEST EQUIPMENT USED: _____ TESTED BY: Default Administrator
 Serial Number: _____ Firmware Information: _____ Calibration Date: _____



THREE-WINDING TRANSFORMERS CAPACITANCE AND POWER FACTOR TESTS



OWNER Example Owner
 PLANT Example Plant
 SUBSTATION TRANSFORMERS
 POSITION AUTOMATED

PAGE 17
 DATE 10/13/2014
 AMBIENT TEMP. _____ °F
 HUMIDITY _____ %
 JOB # TRANSFORMERS
 ASSET ID _____

NAMEPLATE DATA

MFR _____ CLASS _____ PHASES _____
 SER NO _____ COOLANT OIL _____ REASON _____
 YEAR _____ BIL _____ kv _____ WEIGHT _____ lb
 WINDING MATERIAL Cu
 OIL VOLUME _____ GAL
 OIL TEMP _____ °C
 IMPEDANCE _____ %
 WEATHER _____
 TANK TYPE SEALED

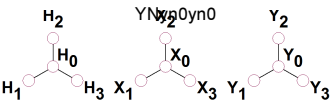


Diagram # 7 (ANSI)

BUSHING NAMEPLATE						
DSG	SERIAL NUM	MFR.	TYPE/CLASS	kv	AMPS	YEAR
H1						
H2						
H3						
H0						
X1						
X2						
X3						
X0						
Y1						
Y2						
Y3						
Y0						

	VOLTAGE (kV)	kVA	RATED I	# TAPS	NOMINAL	CHANGER	TAP SETTING
PRIMARY:	/			5	3	DETC	
SECOND:	/			1			
TERTIARY:	/			1			

TEST FREQUENCY: 60 COMMENTS: _____

TRANSFORMER OVERALL TEST SET UP							TRANSFORMER OVERALL TEST RESULTS							
Test No.	INSULATION TESTED	Test Mode	Test Lead Connections				TEST kv	Capacitance C (pF)	POWER FACTOR %			DIRECT		IR
			HV	Red	Blue	Gnd			Measured	@ 20°C	Corr Factor	mA	Watts	
1	C _{HG} + C _{HL}	GSTg-B	H	L	T	G								
2	C _{HG}	GSTg-RB	H	L	T	G								
3	C _{HL}	UST-R	H	L	T	G								
4	C _{HL}		Test 1 Minus Test 2											
5	C _{LG} + C _{LT}	GSTg-R	L	H	T	G								
6	C _{LG}	GSTg-RB	L	H	T	G								
7	C _{LT}	UST-B	L	H	T	G								
8	C _{LT}		Test 5 Minus Test 6											
9	C _{TG} + C _{HT}	GSTg-B	T	H										
10	C _{TG}	GSTg-RB	T	H										
11	C _{HT}	UST-R	T	H										
12	C _{HT}		Test 9 Minus Test 10											
13	C _{HG'}		C _{HG} Minus H Bushings											
14	C _{LG'}		C _{LG} Minus L Bushings											
15	C _{TG'}		C _{TG} Minus T Bushings											
11	C _H + C _L + C _T	GSTg-RB	H	-	-									
12	C _H + C _L + C _T		Test 2 + 6 + 10											

TEST EQUIPMENT USED: _____ TESTED BY: Default Administrator
 Serial Number: _____ Firmware Information: _____ Calibration Date: _____



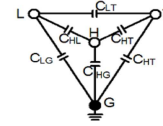
THREE-WINDING TRANSFORMERS CAPACITANCE AND POWER FACTOR TESTS



INSULATION RATING KEY
 G=GOOD
 D=DETERIORATED
 I=INVESTIGATE
 B=BAD

NOTE:
 SHORT EACH WINDING
 ON ITSELF

EQUIVALENT CIRCUIT



Transformer - Bushing C1 Tests														
Test No.	Bushing Nameplate					Test Mode	TEST kV	Capacitance C (pF)	POWER FACTOR %			DIRECT		IR
	Dsg.	SERIAL #	CAT. #	PF	Cap. (pF)				Measured	@ 20°C	Corr Factor	mA	WATTS	
HI kV	16	H1				UST-R								
	17	H2				UST-R								
	18	H3				UST-R								
	19	H0				UST-R								
LOW kV	20	X1				UST-R								
	21	X2				UST-R								
	22	X3				UST-R								
	23	X0				UST-R								
T kV	24	Y1				UST-R								
	25	Y2				UST-R								
	26	Y3				UST-R								
	27	Y0				UST-R								
28	OIL TEST					UST-R								

Transformer - Bushing C2 Tests														
Test No.	Bushing Nameplate					Test Mode	TEST kV	Capacitance C (pF)	POWER FACTOR %			DIRECT		IR
	Dsg.	SERIAL #	CAT. #	PF	Cap. (pF)				Measured	@ 20°C	Corr Factor	mA	WATTS	
HI kV	29	H1				GSTg-R								
	30	H2				GSTg-R								
	31	H3				GSTg-R								
	32	H0				GSTg-R								
LOW kV	33	X1				GSTg-R								
	34	X2				GSTg-R								
	35	X3				GSTg-R								
	36	X0				GSTg-R								
LOW kV	37	Y1				GSTg-R								
	38	Y2				GSTg-R								
	39	Y3				GSTg-R								
	40	Y0				GSTg-R								

COMMENTS:

DEFICIENCIES:



POWER TRANSFORMER TESTS



OWNER Example Owner
 PLANT Example Plant
 SUBSTATION TRANSFORMERS
 POSITION AUTOMATED

PAGE 19
 AMBIENT TEMP. _____ °F
 DATE 10/13/2014
 HUMIDITY _____ %
 JOB # TRANSFORMERS
 ASSET ID _____

Nameplate Data

UpdatePage

Serial Number _____
 Manufacturer _____
 Winding Material _____

Year _____
 Phases _____
 Reason _____
 Weight _____ lb

Class _____
 Coolant _____
 Oil Volume _____ GAL
 TEMP _____ °C

BIL _____ kV
 Impedance _____ %
 Weather _____
 Tank Type _____

Edit Highside

Edit Lowside

VREG



			Rated I	# Taps	Nominal	Changer	Tap Setting
Primary							
Secondary							

Diagram # 43 (ANSI)

Test Frequency

Comments:

TEST EQUIPMENT USED: _____

TESTED BY: Default Administrator



TRANSFORMER WINDING RESISTANCE TEST



OWNER Example Owner PAGE 20
 PLANT Example Plant AMBIENT TEMP. _____ °F DATE 10/13/2014
 SUBSTATION TRANSFORMERS HUMIDITY _____ % JOB # TRANSFORMERS
 POSITION AUTOMATED ASSET ID _____

MFR _____ WEIGHT _____ lb OIL VOLUME _____ GAL
 SER NO _____ WEATHER _____ OIL TEMP _____ °C
 YEAR _____ BIL _____ kV WINDING TEMP 20 °C
 TYPE SEALED IMPEDANCE _____ % CORRECT TO 85 °C
 CLASS _____ REASON _____ COOLANT OIL
 PHASES 3 Max Wdg Diff (%): 1

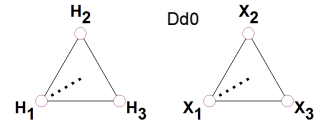


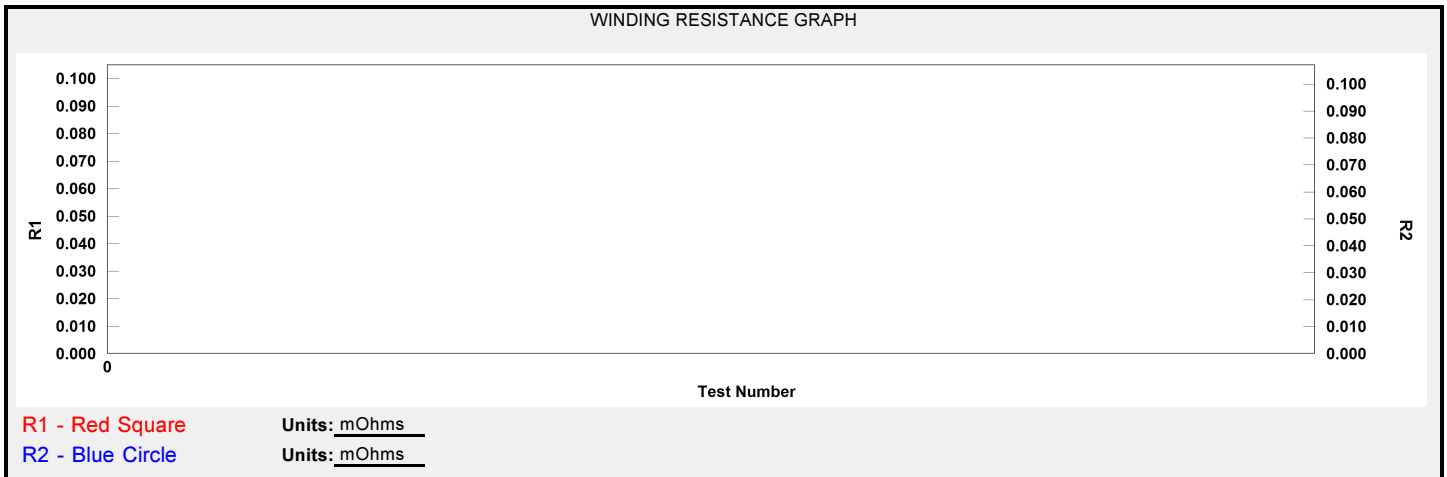
Diagram # 3 (ANSI)

	VOLTAGE (kV)	kVA	RATED I	# TAPS	NOMINAL	CHANGER	TAP SETTING	WINDING MATERIAL	SHOW RESULTS
PRIMARY:				5	3	DETC		Cu	<input type="checkbox"/>
SECOND:				1				Cu	<input type="checkbox"/>

Winding Temperature 20 °C Correct to 85 °C

R1 Units: _____ R1 Winding Material: Cu R2 Units: _____ R1 Winding Material: Cu

TEST RESULTS								
TEST#	DESCRIPTION	DATE	TIME	R1	R2	CURRENT(A)	BBM	
1								



COMMENTS: _____
 DEFICIENCIES: _____

TEST EQUIPMENT USED: _____ TESTED BY: Default Administrator
 Serial Number: _____ Firmware Information: _____ Calibration Date: _____

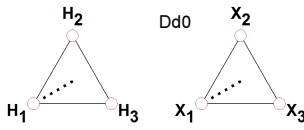


Diagram # 3 (ANSI)

Detect Transformer Type

ASSET ID: _____

TEST DATE: 10/13/2014

Windings	Test Voltage (V)	Actual TTR	Excitation Current (mA)	Phase Deviation (degrees)
H ₁ - H ₃ / X ₁ - X ₃				
H ₂ - H ₁ / X ₂ - X ₁				
H ₃ - H ₂ / X ₃ - X ₂				

Test 1 of 1

TEST EQUIPMENT USED: _____

TESTED BY: Default Administrator

Serial Number: _____

Firmware Information: _____

Calibration Date: _____



THREE PHASE TTR TEST WITH TAP CHANGER



OWNER Example Owner
 PLANT Example Plant
 SUBSTATION TRANSFORMERS
 POSITION AUTOMATED

PAGE 22
 DATE 10/13/2014
 AMBIENT TEMP. °F
 HUMIDITY %
 JOB # TRANSFORMERS
 ASSET ID

NAMEPLATE DATA

MFR _____ CLASS _____ PHASES _____
 SER NO _____ COOLANT OIL _____ REASON _____
 YEAR _____ BIL _____ kV _____ WEIGHT _____ lb _____
 H₂ Dd0 X₂ WINDING MATERIAL Cu _____
 H₁ H₃ X₁ X₃ OIL VOLUME _____ GAL _____
 OIL TEMP _____ °C _____
 IMPEDANCE _____ % _____
 WEATHER _____
 TANK TYPE SEALED
 Diagram # 3 (ANSI) ALLOWED ERROR 1 %
 Detect Transformer Type HAS TERTIARY

BUSHING NAMEPLATE						
DSG	SERIAL NUM	MFR.	TYPE/CLASS	kV	AMPS	YEAR
H1						
H2						
H3						
X1						
X2						
X3						

	VOLTAGE (kV)	kVA	RATED I	# TAPS	NOMINAL	CHANGER	TAP SETTING
PRIMARY:				5	3	DETC	
SECOND:				1			

COMMENTS:

HIGH SIDE TAPS TO LOW SIDE NOMINAL TURNS RATIO TESTS

#	TAP H/L	Voltage H/L	Test V	TTR	H ₁ - H ₃ / X ₁ - X ₃				H ₂ - H ₁ / X ₂ - X ₁				H ₃ - H ₂ / X ₃ - X ₂				
					Actual TTR	% error	I exc mA	Phase (Deg)	Actual TTR	% error	I exc mA	Phase (Deg)	Actual TTR	% error	I exc mA	Phase (Deg)	
1																	
2																	
3																	
4																	
5																	

COMMENTS:
 DEFICIENCIES:

TEST EQUIPMENT USED: _____ TESTED BY: Default Administrator
 Serial Number: _____ Firmware Information: _____ Calibration Date: _____

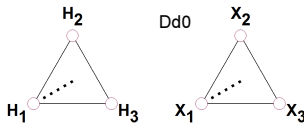


Diagram # 1 (ANSI)

Detect Transformer Type

ASSET ID: _____

TEST DATE: 10/13/2014

#	High Side		Low Side		H - H / X - X					
	Tap #	Voltage	Tap #	Voltage	Test Volt	Calculated Ratio	Actual Ratio	Percent Error	Excitation Current (mA)	Phase (Degrees)
1										

COMMENTS:

DEFICIENCIES:

--	--

TEST EQUIPMENT USED: _____

TESTED BY: Default Administrator

Serial Number: _____

Firmware Information: _____

Calibration Date: _____



INSULATION TESTS TWO-WINDING TRANSFORMERS



OWNER Example Owner
 PLANT Example Plant
 SUBSTATION TRANSFORMERS
 POSITION AUTOMATED

PAGE 24
 DATE 10/13/2014
 AMBIENT TEMP. _____ °F
 HUMIDITY _____ %
 JOB # TRANSFORMERS
 ASSET ID _____

NAMEPLATE DATA

MFR _____ CLASS _____ PHASES _____
 SER NO _____ COOLANT OIL REASON _____
 YEAR _____ BIL _____ kV WEIGHT _____ lb
 WINDING MATERIAL Cu
 OIL VOLUME _____ GAL
 OIL TEMP _____ °C
 IMPEDANCE _____ %
 WEATHER _____
 TANK TYPE SEALED

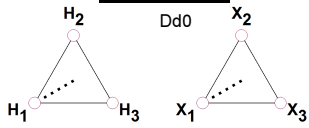


Diagram # 3 (ANSI)

BUSHING NAMEPLATE						
DSG	SERIAL NUM	MFR.	TYPE/CLASS	kV	AMPS	YEAR
H1						
H2						
H3						
X1						
X2						
X3						

	VOLTAGE (kV)	kVA	RATED I	# TAPS	NOMINAL	CHANGER	TAP SETTING
PRIMARY:				5	3	DETC	
SECOND:				1			

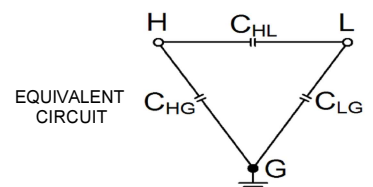
TEST FREQUENCY: 60 COMMENTS: _____

TRANSFORMER OVERALL TEST SET UP							TRANSFORMER OVERALL TEST RESULTS							
Test No.	INSULATION TESTED	Test Mode	Test Lead Connections				TEST kV	Capacitance C (pF)	POWER FACTOR %			DIRECT		IR
			HV	Red	Blue	Gnd			Measured	@ 20°C	Corr Factor	mA	Watts	
1	C _{HG} + C _{HL}	GST-GND	H	L		G								
2	C _{HG}	GSTg-RB	H	L		G								
3	C _{HL}	UST-R	H	L		G								
4	C _{HL'}		Test 1 Minus Test 2											
5	C _{LG} + C _{HL}	GST-GND	L	H		G								
6	C _{LG}	GSTg-RB	L	H		G								
7	C _{HL}	UST-R	L	H		G								
8	C _{HL'}		Test 5 Minus Test 6											
9	C _{HG'}		C _{HG} Minus H Bushings											
10	C _{LG'}		C _{LG} Minus L Bushings											

NOTE: SHORT EACH WINDING ON ITSELF

INSULATION RATING KEY
 G = GOOD
 D = DETERIORATED
 I = INVESTIGATE
 B = BAD

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



TEST EQUIPMENT USED: _____ TESTED BY: Default Administrator

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



INSULATION TESTS TWO-WINDING TRANSFORMERS



Transformer - Bushing C1 Tests														
Test No.	Bushing Nameplate					Test Mode	TEST kV	Capacitance C (pF)	POWER FACTOR %			DIRECT		IR
	Dsg.	SERIAL #	CAT. #	PF	Cap. (pF)				Measured	@ 20°C	Corr Factor	mA	WATTS	
11	H1					UST-R								
12	H2					UST-R								
13	H3					UST-R								
14	X1					UST-R								
15	X2					UST-R								
16	X3					UST-R								
17						UST-R								
18						UST-R								
19	OIL TEST					UST-R								

Transformer - Bushing C2 Tests														
Test No.	Bushing Nameplate					Test Mode	TEST kV	Capacitance C (pF)	POWER FACTOR %			DIRECT		IR
	Dsg.	SERIAL #	CAT. #	PF	Cap. (pF)				Measured	@ 20°C	Corr Factor	mA	WATTS	
20	H1					GSTg-R								
21	H2					GSTg-R								
22	H3					GSTg-R								
23	X1					GSTg-R								
24	X2					GSTg-R								
25	X3					GSTg-R								
26						GSTg-R								
27						GSTg-R								

COMMENTS:

DEFICIENCIES:



WINDING RESISTANCE REPORT



OWNER Example Owner PAGE 26
 PLANT Example Plant AMBIENT TEMP. _____ °F DATE 10/13/2014
 SUBSTATION TRANSFORMERS HUMIDITY _____ % JOB # TRANSFORMERS
 POSITION AUTOMATED ASSET ID _____

TRANSFORMER INFORMATION

COMPANY _____ STATION _____
 DESIGNATION _____ MANUFACTURER _____
 SERIAL NO. _____ TIME _____
 TEMPERATURE _____ INSTRUMENT S/N _____

CHANNEL A			CHANNEL B			Current	Interval	Total Time
Tap	Winding	Resistance	Tap	Winding	Resistance			

COMMENTS: _____
 DEFICIENCIES: _____

TEST EQUIPMENT USED: _____ TESTED BY: Default Administrator



TRANSFORMER HEAT RUN TEST



OWNER Example Owner
 PLANT Example Plant
 SUBSTATION TRANSFORMERS
 POSITION AUTOMATED

PAGE 27
 AMBIENT TEMP. _____ °F
 HUMIDITY _____ %
 ASSET ID _____
 DATE 10/13/2014
 JOB # TRANSFORMERS

MFR _____ WEIGHT _____ lb
 SER NO _____ WEATHER _____
 YEAR _____ BIL _____ kV
 TYPE SEALED IMPEDANCE _____ %
 CLASS _____ REASON _____
 PHASES 3

OIL VOLUME _____ GAL
 COOLANT OIL

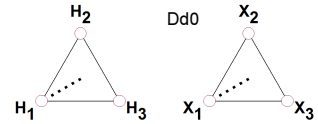
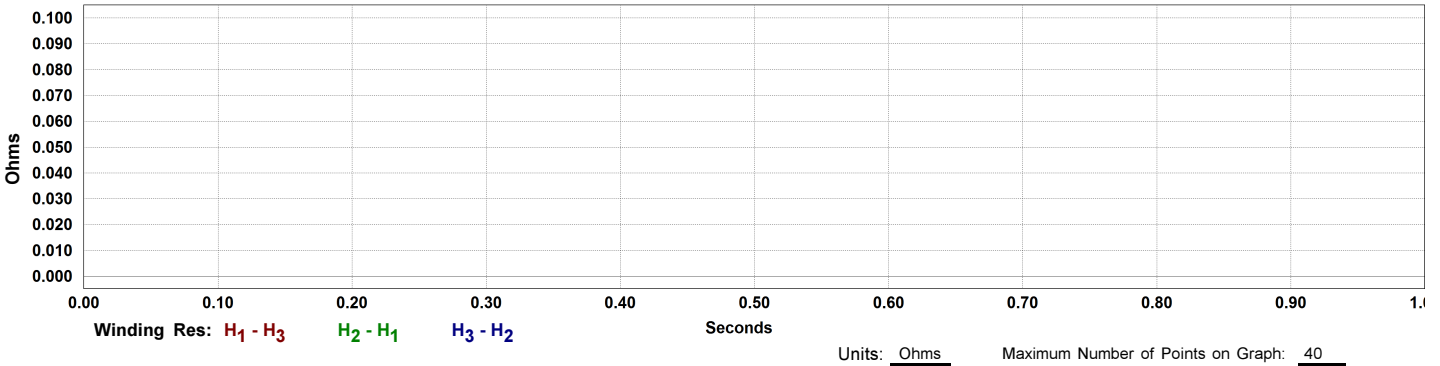


Diagram # 3 (ANSI)

	VOLTAGE (kV)	kVA	RATED I	# TAPS	NOMINAL	CHANGER	TAP TO BE TESTED	WINDING MATERIAL	SHOW RESULTS
PRIMARY:				5	3	DETC		Cu	<input checked="" type="checkbox"/>
SECOND:				1				Cu	<input checked="" type="checkbox"/>

HIGH VOLTAGE WINDING RESISTANCE

Ambient Temperature	Ambient Resistance Data for Tap		
	H ₁ - H ₃	H ₂ - H ₁	H ₃ - H ₂
C			



Time	Current	Measured Resistance Data for Tap			Reading Stability %	Calculated Winding Temperature (C)
		H ₁ - H ₃	H ₂ - H ₁	H ₃ - H ₂		

TEST EQUIPMENT USED: _____ TESTED BY: Default Administrator
 Serial Number: _____ Firmware Information: _____ Calibration Date: _____

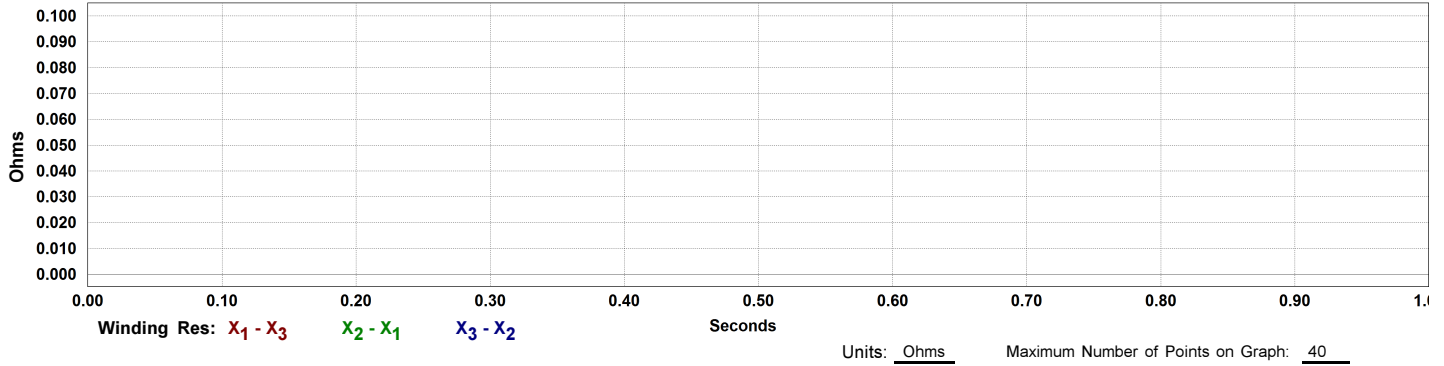


TRANSFORMER HEAT RUN TEST



LOW VOLTAGE WINDING RESISTANCE

Ambient Temperature	Ambient Resistance Data for Tap		
	X ₁ - X ₃	X ₂ - X ₁	X ₃ - X ₂
C			



Time	Current	Measured Resistance Data for Tap			Reading Stability %	Calculated Winding Temperature (C)
		X ₁ - X ₃	X ₂ - X ₁	X ₃ - X ₂		

COMMENTS: _____
 DEFICIENCIES: _____



INSULATION TESTS AUTO TRANSFORMERS WITH TERTIARY



OWNER Example Owner
 PLANT Example Plant
 SUBSTATION TRANSFORMERS
 POSITION AUTOMATED

PAGE 29
 DATE 10/13/2014
 AMBIENT TEMP. _____ °F
 HUMIDITY _____ %
 JOB # TRANSFORMERS
 ASSET ID _____

MFR _____	REASON _____	BUSHING NAMEPLATE						
SER NO _____	WEIGHT _____ lb	DSG	SERIAL NUM	MFR.	TYPE/CLASS	kV	AMPS	YEAR
YEAR _____	WINDING MATERIAL _____ Cu	H1						
CLASS _____	OIL VOLUME _____ GAL	H2						
COOLANT <u>OIL</u>	OIL TEMP _____ °C	H3						
BIL _____ kV	IMPEDANCE _____ %	X1						
PHASES <u>3</u>	WEATHER _____	X2						
CONFIGURATION _____		X3						
TYPE <u>SEALED</u>		Y1						
		Y2						
		Y3						

	VOLTAGE (kV)	kVA	RATED I	# TAPS	NOMINAL	CHANGER	TAP SETTING
PRIMARY:	/			5	3	Off Load	
SECOND:	/			1			
TERTIARY:				1			

TEST FREQUENCY: 60 COMMENTS: _____

TRANSFORMER OVERALL TEST SET UP							TRANSFORMER OVERALL TEST RESULTS							
Test No.	INSULATION TESTED	Test Mode	Test Lead Connections				TEST kV	Capacitance C (pF)	POWER FACTOR %			DIRECT		IR
			HV	Red	Blue	Gnd			Measured	@ 20°C	Corr Factor	mA	Watts	
1	C _H + C _{HT}	GST-GND	H+L	T		G								
2	C _H	GSTg-RB	H+L	T		G								
3	C _{HT} (UST)	UST-R	H+L	T		G								
4	C _{HT} '		Test 1 Minus Test 2											
5	C _T + C _{HT}	GST-GND	T	H+L		G								
6	C _T	GSTg-RB	T	H+L		G								
7	C _{HT} (UST)	UST-R	T	H+L		G								
8	C _{HT} '		Test 5 Minus Test 6											
9	C _H '		C _{HG} Minus H Bushings											
10	C _T '		C _{LG} Minus L Bushings											

TEST EQUIPMENT USED: _____ TESTED BY: Default Administrator
 Serial Number: _____ Firmware Information: _____ Calibration Date: _____



INSULATION TESTS AUTO TRANSFORMERS WITH TERTIARY



Transformer - Bushing C1 Tests														
Test No.	Bushing Nameplate					Test Mode	TEST kV	Capacitance C (pF)	POWER FACTOR %			DIRECT		IR
	Dsg.	SERIAL #	CAT. #	PF	Cap. (pF)				Measured	@ 20°C	Corr Factor	mA	WATTS	
HI kV	16	H1				UST-R								
	17	H2				UST-R								
	18	H3				UST-R								
	19	N/A				UST-R								
LOW kV	20	X1				UST-R								
	21	X2				UST-R								
	22	X3				UST-R								
	23	Y1				UST-R								
T kV	24	Y2				UST-R								
	25	Y3				UST-R								
	26	Y2				UST-R								
	27	Y3				UST-R								
28	OIL TEST					UST-R								

Transformer - Bushing C2 Tests														
Test No.	Bushing Nameplate					Test Mode	TEST kV	Capacitance C (pF)	POWER FACTOR %			DIRECT		IR
	Dsg.	SERIAL #	CAT. #	PF	Cap. (pF)				Measured	@ 20°C	Corr Factor	mA	WATTS	
HI kV	29	H1				GSTg-R								
	30	H2				GSTg-R								
	31	H3				GSTg-R								
	32	N/A				GSTg-R								
LOW kV	33	X1				GSTg-R								
	34	X2				GSTg-R								
	35	X3				GSTg-R								
	36	Y1				GSTg-R								
LOW kV	37	Y2				GSTg-R								
	38	Y3				GSTg-R								
	39	Y2				GSTg-R								
	40	Y3				GSTg-R								

HOT COLLAR TESTS

Test No.	Dsg	Serial #	Designation	Test Mode	Test kV	DIRECT		IR
						mA	Watts	
41	H1			GST-GND				
42	H2			GST-GND				
43	H3			GST-GND				
44	X1			GST-GND				
45	X2			GST-GND				
46	X3			GST-GND				
47	Y1			GST-GND				
48	Y2			GST-GND				
49	Y3			GST-GND				
50				GST-GND				
51				GST-GND				
52				GST-GND				
53				GST-GND				
54				GST-GND				
55				GST-GND				
56				GST-GND				
57				GST-GND				
58				GST-GND				
59				GST-GND				
60				GST-GND				



INSULATION TESTS AUTO TRANSFORMERS WITH TERTIARY



SURGE ARRESTERS

	Location	Serial #	Mfr	Overall Catalog	Unit Catalog	Type	Rated kV	Order	Test Mode	Test kV	Freq Sweep	DIRECT		IR
												mA	Watts	
61									GST-GND		<input type="checkbox"/>			

EXCITING CURRENT TESTS

	CONNECTIONS:		PHASE A: Enter connection					PHASE B: Enter connection					PHASE C: Enter connection					IR
	DETC	LTC	TEST kV	L(H) / C (pF)	mA	EQUIV. 10 kV		TEST kV	L(H) / C (pF)	mA	EQUIV. 10 kV		TEST kV	L(H) / C (pF)	mA	EQUIV. 10 kV		
						mA	WATTS				mA	WATTS				mA	WATTS	
62																		
63																		
64																		
65																		
66																		

TURNS RATIO TEST

47	kV		REF [TTR] CAP (pF)	
----	----	--	--------------------	--

	DETC	LTC	PHASE A				PHASE B				PHASE C							
			H Voltage	L Voltage	Calc. ratio	kV	Cap. (pF)	Turns Ratio	% Error	kV	Cap. (pF)	Turns Ratio	% Error	kV	Cap. (pF)	Turns Ratio	% Error	
						48					49				49			

COMMENTS:

--

DEFICIENCIES:

--



TRANSFORMER LIQUID COOLANT TRENDING



OWNER Example Owner
 PLANT Example Plant
 SUBSTATION TRANSFORMERS
 POSITION AUTOMATED

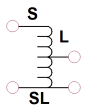
PAGE 32
 AMBIENT TEMP. _____ °F
 HUMIDITY _____ %
 DATE 10/13/2014
 JOB # TRANSFORMERS
 ASSET ID _____

NAMEPLATE DATA

MFR _____ CLASS _____ PHASES _____
 SER NO _____ COOLANT OIL _____ REASON _____
 YEAR _____ BIL _____ kV _____ WEIGHT _____ lb
 WINDING MATERIAL Cu
 OIL VOLUME _____ GAL
 OIL TEMP _____ °C
 IMPEDANCE _____ %
 WEATHER _____
 TANK TYPE SEALED

VREG _____

BUSHING NAMEPLATE						
DSG	SERIAL NUM	MFR.	TYPE/CLASS	kV	AMPS	YEAR
S						
L						
SL						



	VOLTAGE (kV)	kVA	RATED I	# TAPS	NOMINAL	CHANGER	TAP SETTING
PRIMARY:				5	3	DETC	
SECOND:				1			

TEST FREQUENCY: 60

COMMENTS: _____

FLUID QUALITY						
WATER CONTENT (PPM)						
INTERFACIAL TENSION (D/CM)						
ACIDITY (MG KOH/G)						
DIELECTRIC STRENGTH (kV)						
VISUAL EXAM						
ASTM COLOR NO.						
OIL TEMP (C)						
SPECIFIC GRAVITY						

DISSOLVED GAS ANALYSIS						
* HYDROGEN (H2)						
* METHANE (CH4)						
* ETHANE (C2H6)						
* ETHYLENE (C2H4)						
* ACETYLENE (C2H2)						
* CARBON MONOXIDE (CO)						
CARBON DIOXIDE						
NITROGEN						
OXYGEN						
TOTAL GAS						
TOTAL COMBUSTIBLE GAS						
* COMBUSTIBLE GAS						



DISSOLVED GAS ANALYSIS



USER _____
 SUBSTATION TRANSFORMERS POSITION AUTOMATED
 SERIAL NO. _____

PAGE 33
 JOB # TRANSFORMERS

* HYDROGEN
(H2)

1.0e-3
0.5e-3
0.0e-3
-0.5e-3

* METHANE
(CH4)

1.0e-3
0.5e-3
0.0e-3
-0.5e-3

* ETHANE
(C2H6)

1.0e-3
0.5e-3
0.0e-3
-0.5e-3

* ETHYLENE
(C2H4)

1.0e-3
0.5e-3
0.0e-3
-0.5e-3

* ACETYLENE
(C2H2)

1.0e-3
0.5e-3
0.0e-3
-0.5e-3

* CARBON MONOXIDE
(CO)

1.0e-3
0.5e-3
0.0e-3
-0.5e-3

CARBON DIOXIDE
(CO2)

1.0e-3
0.5e-3
0.0e-3
-0.5e-3

NITROGEN
(N2)

1.0e-3
0.5e-3
0.0e-3
-0.5e-3

OXYGEN
(O2)

1.0e-3
0.5e-3
0.0e-3
-0.5e-3

TOTAL
COMBUSTIBLE GAS

* COMBUSTIBLE GAS

1.0e-3
0.5e-3
0.0e-3
-0.5e-3

HISTORICAL DATA WITH
AVERAGE (SOLID LINES) AND
2-SIGMA (DOTTED LINES)



DISSOLVED GAS ANALYSIS



USER _____ PAGE 34
SUBSTATION TRANSFORMERS POSITION AUTOMATED JOB # TRANSFORMERS
SERIAL NO. _____

DIELECTRIC STRENGTH
(KV)

0.8e-3
0.4e-3
0.0e-3
-0.4e-3

INTERFACIAL TENSION
(D/CM)

0.8e-3
0.4e-3
0.0e-3
-0.4e-3

ACIDITY
(MG KOH/G)

WATER CONTENT
(PPM)

0.8e-3
0.4e-3
0.0e-3
-0.4e-3

SPECIFIC GRAVITY

0.8e-3
0.4e-3
0.0e-3
-0.4e-3

HISTORICAL DATA WITH
AVERAGE (SOLID LINES) AND
2-SIGMA (DOTTED LINES)



DISSOLVED GAS ANALYSIS



USER _____ PAGE 35
SUBSTATION TRANSFORMERS POSITION AUTOMATED JOB # TRANSFORMERS
SERIAL NO. _____

COMMENTS: _____
DEFICIENCIES: _____

ASSET ID: _____

DESCRIPTION: _____

MODE: UST:MEAS RED, GND BLUE

TEST VOLTAGE	% POWER FACTOR	DIRECT	
		MILLIAMPS	WATTS
CAPACITANCE: 0.00 pF			



TRANSFORMER POLARITY TEST



OWNER Example Owner PAGE 37
 PLANT Example Plant AMBIENT TEMP. _____ °F DATE 10/13/2014
 SUBSTATION TRANSFORMERS HUMIDITY _____ % JOB # TRANSFORMERS
 POSITION GENERAL ASSET ID _____

NAMEPLATE DATA

MANUFACTURER _____ SERIAL NO. _____
 SPECIFICATION NO. _____ KVA _____ / _____ / _____ TYPE _____ CLASS _____
 PHASE 3 TEMPERATURE RISE _____ °C IMPEDANCE _____ % B.I.L. RATING _____ KV PRI. _____ KV SEC. _____
 COOLANT _____ CAPACITY _____ GALLONS TOTAL WEIGHT _____
 WINDING POLARITY SUBTRACTIVE WINDING MATERIAL _____ K FACTOR _____ NA
 PRIMARY VOLTAGE _____ DELTA WYE RATED CURRENT _____ / _____ / _____ AMPERES
 SECONDARY VOLTAGE _____ / _____ 0 DELTA WYE RATED CURRENT _____ / _____ / _____ AMPERES
 TAP VOLTAGES _____
 TAP CONNECTIONS _____
 TAP SETTING _____ VOLTS # FANS _____ TAP CHANGER: INTERNAL EXTERNAL DRY TYPE

H ₁ TIED TO X ₁	INPUT VOLTAGE	H ₁ -H ₂	H ₁ -H ₃	H ₂ -H ₃
---------------------------------------	---------------	--------------------------------	--------------------------------	--------------------------------

H ₁ -X ₁	
H ₁ -X ₂	
H ₁ -X ₃	

H ₂ -X ₁	
H ₂ -X ₂	
H ₂ -X ₃	

H ₃ -X ₁	
H ₃ -X ₂	
H ₃ -X ₃	

VECTOR DIAGRAM

A	D	G	K
B	E	H	L
C	F	I	M
		J	N

PRI. VECTOR: A
 SEC. VECTOR: D

TEST RESULTS INDICATE SUBTRACTIVE POLARITY

COMMENTS: _____
 DEFICIENCIES: _____

TEST EQUIPMENT USED: _____ TESTED BY: Default Administrator



TRANSFORMER WINDING RESISTANCE TEST



OWNER Example Owner PAGE 38
 PLANT Example Plant AMBIENT TEMP. _____ °F DATE 10/13/2014
 SUBSTATION TRANSFORMERS HUMIDITY _____ % JOB # TRANSFORMERS
 POSITION GENERAL ASSET ID _____

NAMEPLATE DATA

MANUFACTURER _____ SERIAL NO. _____
 SPECIFICATION NO. _____ KVA _____ / _____ / _____ TYPE _____ CLASS _____
 PHASE 3 TEMPERATURE RISE _____ °C IMPEDANCE _____ % B.I.L. RATING _____ KV PRI. _____ KV SEC.
 COOLANT _____ CAPACITY _____ GALLONS TOTAL WEIGHT _____
 WINDING POLARITY SUBTRACTIVE WINDING MATERIAL _____ K FACTOR NA
 PRIMARY VOLTAGE _____ DELTA WYE RATED CURRENT _____ / _____ / _____ AMPERES
 SECONDARY VOLTAGE _____ / _____ 0 DELTA WYE RATED CURRENT _____ / _____ / _____ AMPERES
 TAP VOLTAGES _____
 TAP CONNECTIONS _____
 TAP SETTING _____ VOLTS # FANS _____ TAP CHANGER: INTERNAL EXTERNAL DRY TYPE

PRIMARY WINDING:

MEASURED RESISTANCE

H - H	OHMS
H - H	OHMS
H - H	OHMS

PRIMARY WINDING MATERIAL _____

SECONDARY WINDING:

MEASURED RESISTANCE

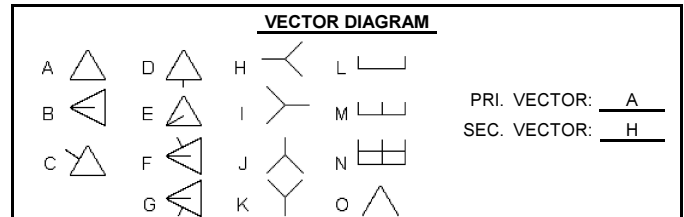
X - X	OHMS
X - X	OHMS
X - X	OHMS

SECONDARY WINDING MATERIAL _____

WINDING TEMPERATURE _____ °C

CALCULATED RESISTANCE CORRECTED TO 85°C

PRIMARY R _T	OHMS
SECONDARY R _T	OHMS



R_T = TOTAL WINDING RESISTANCE AT 85°C
 R_M = TOTAL WINDING RESISTANCE AT TEST TEMPERATURE
 T_S = TEMPERATURE FOR DESIRED RESISTANCE (85°C)
 T_M = WINDING TEMPERATURE
 T_K = TEMP. RESISTANCE CONSTANT (°C)

COPPER + 234.5°C
 ALUMINUM = 226.0°C (STD. C57.12.91)

DELTA WINDING MULTIPLIER = 3/2X
 WYE WINDING MULTIPLIER = 3X

$$R_T = R_M \frac{T_S + T_K}{T_M + T_K}$$

COMMENTS: _____
 DEFICIENCIES: _____

TEST EQUIPMENT USED: _____ TESTED BY: Default Administrator



INSULATION TESTS TWO-WINDING TRANSFORMERS



OWNER Example Owner
 PLANT Example Plant
 SUBSTATION TRANSFORMERS
 POSITION GENERAL

PAGE 39
 AMBIENT TEMP. _____ °F
 DATE 10/13/2014
 HUMIDITY _____ %
 JOB # TRANSFORMERS
 ASSET ID _____

TRANSFORMER _____ MFR _____ SERIAL NO. _____ WEATHER _____ TEMP _____
 MFR YEAR _____ TYPE/CLASS _____ KVA 500 GALLONS OF OIL _____ DATE LAST TEST _____ LAST SHEET NO. _____
 OIL ASKAREL AIR GAS SILICONE FREE BREATHING SEALED GAS BLANKETED CONSERVATOR
 COPIES TO _____ MFR. _____ TYPE / CLASS _____ DWG. NO. _____ CAT. NO. _____ KV _____ YEAR _____
 HIGH SIDE: KV 12 WYE DELTA
 LOW SIDE: KV _____ WYE DELTA
 NEUTRAL _____

BUSHINGS

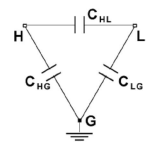
TRANSFORMER OVERALL TESTS														
TEST NO	INSULATION TESTED	TEST MODE	TEST CONNECTIONS (WINDINGS)				TEST KV	CAPACITANCE C (PF)	% POWER FACTOR			EQUIV		INSULATION RATING
			ENG	GND	GAR	UST			MEASURED	20 °C	CORR FACTOR	mA	WATTS	
1	C _{HG} + C _{HL}	GST GND	H	L										
2	C _{HG}	GST	H		L									
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 _{HG} '		C _{LG} MINUS HIGH BUSH.											

BUSHING TESTS												
TEST NO.	BUSHING		Ph.	TEST MODE	TEST KV	CAPACITANCE C (PF)	% POWER FACTOR MEASURED	20 °C	CORR FACTOR	EQUIV mA	EQUIV WATTS	INSULATION RATING
	NO.	SERIAL #										
HI KV	11			UST								
	12			UST								
	13			UST								
	14			UST								
LOW KV	15			UST								
	16			UST								
	17			UST								
	18			UST								
19	OIL TEST											

INSULATION RATING KEY

- G = GOOD
- D = DETERIORATED
- I = INVESTIGATE
- B = BAD

EQUIVALENT CIRCUIT



NOTE: SHORT EACH WINDING ON ITSELF

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

COMMENTS: _____
 DEFICIENCIES: _____

TEST EQUIPMENT USED: _____

TESTED BY: Default Administrator



TRANSFORMER PRIMARY WINDING RESISTANCE TESTS



OWNER Example Owner PAGE 40
 PLANT Example Plant AMBIENT TEMP. _____ °F DATE 10/13/2014
 SUBSTATION TRANSFORMERS HUMIDITY _____ % JOB # TRANSFORMERS
 POSITION GENERAL ASSET ID _____

NAMEPLATE DATA

MANUFACTURER _____ SERIAL NO. _____

SECONDARY CONFIGURATION _____ WYE _____ WINDING MATERIAL _____ COPPER _____ WINDING TEMPERATURE _____ °C

TAP POSITION	RESISTANCE IN OHMS						CALCULATED RESISTANCE CORRECTED TO 85°C
	H	-H	H	-H	H	-H	
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							

COMMENTS: _____
 DEFICIENCIES: _____

TEST EQUIPMENT USED: _____ TESTED BY: Default Administrator



TRANSFORMER HIGH POTENTIAL TEST



OWNER Example Owner PAGE 41
 PLANT Example Plant AMBIENT TEMP. _____ °F DATE 10/13/2014
 SUBSTATION TRANSFORMERS HUMIDITY _____ % JOB # TRANSFORMERS
 POSITION GENERAL ASSET ID _____

NAMEPLATE DATA

MANUFACTURER _____ SERIAL NO. _____
 SPECIFICATION NO. _____ KVA _____ / _____ / _____ TYPE _____ CLASS _____
 PHASE 3 TEMPERATURE RISE _____ °C IMPEDANCE _____ % B.I.L. RATING _____ KV PRI. _____ KV SEC.
 COOLANT _____ CAPACITY _____ GALLONS TOTAL WEIGHT _____
 WINDING POLARITY SUBTRACTIVE WINDING MATERIAL _____ K FACTOR _____ NA
 PRIMARY VOLTAGE _____ DELTA WYE RATED CURRENT _____ / _____ / _____ AMPERES
 SECONDARY VOLTAGE _____ / _____ 0 DELTA WYE RATED CURRENT _____ / _____ / _____ AMPERES
 TAP VOLTAGES _____
 TAP CONNECTIONS _____
 TAP SETTING _____ VOLTS # FANS _____ TAP CHANGER: INTERNAL EXTERNAL DRY TYPE

TEST VOLTAGE:

PRIMARY TO GROUND _____ kV AC DC CORE / COIL TEMPERATURE _____ °C
 SECONDARY TO GROUND _____ kV AC DC TEST VOLTAGE FREQUENCY _____ HZ

ALL PRIMARY WINDINGS AND ALL SECONDARY WINDINGS MUST BE EXTERNALLY JUMPERED PRIOR TO PERFORMING HIGH POTENTIAL TEST.

MINUTES	PRIMARY TO GROUND SECONDARY GUARDED MICRO/MILLIAMPERES	SECONDARY TO GROUND PRIMARY GUARDED MICRO/MILLIAMPERES
0.25	mA	mA
0.50	mA	mA
0.75	mA	mA
1.00	mA	mA

µA = MICROAMPERES

mA = MILLIAMPERES

COMMENTS:
DEFICIENCIES:

TEST EQUIPMENT USED: _____

TESTED BY: Default Administrator



TRANSFORMER MAINTENANCE TEST



OWNER Example Owner
 PLANT Example Plant
 SUBSTATION TRANSFORMERS
 POSITION GENERAL

PAGE 42
 AMBIENT TEMP. _____ °F DATE 10/13/2014
 HUMIDITY _____ % JOB # TRANSFORMERS
 ASSET ID _____

NAMEPLATE DATA

MANUFACTURER _____ YR MFR _____ SERIAL NO. _____
 IMPEDANCE _____ % CAPACITY _____ GALLONS TYPE _____ CLASS _____ / _____ / _____
 KVA _____ / _____ / _____ WINDING MATERIAL _____ TEMPERATURE RISE _____ °C B.I.L. RATING _____
 PRIMARY KV _____ Δ --- --- DELTA
 SECONDARY KV _____ / _____ Δ --- --- WYE
 TAP VOLTAGES _____ INSULATING MEDIUM _____
 TAP POSITION _____ TANK TYPE Free Breathing
 TAP SETTING _____ VOLTS DRY TYPE CONSERVATOR

VISUAL AND MECHANICAL INSPECTION

INSPECTION REPORT		INSPECTION REMARKS
INSPECT PHYSICAL AND MECHANICAL CONDITION	<input type="checkbox"/> PASS <input type="checkbox"/> FAIL	
VERIFY FANS OPERATE	<input type="checkbox"/> PASS <input type="checkbox"/> FAIL	
INSPECT ANCHORAGE, ALIGNMENT AND GROUNDING	<input type="checkbox"/> PASS <input type="checkbox"/> FAIL	

ELECTRICAL TESTS (OPTIONAL FOR L.V. TRANSFORMERS OR BELOW 500 KVA)

MAINTENANCE

INSULATION RESISTANCE IN MEGOHMS			
MINUTES	PRIMARY TO GROUND	SECONDARY TO GROUND	PRIMARY TO SECONDARY
Test kV			
0.50			
1.00			
10.00			
P. I.			

P.I. = 10 min/1 min

ACCEPTANCE

WINDING RESISTANCE TEST IN OHMS	
H1-H2 _____	X0-X2 _____
H2-H3 _____	X0-X3 _____
H3-H1 _____	X0-X1 _____

TRANSFORMER TURN RATIO TEST				
TAP	CALC	PHASE A	PHASE B	PHASE C

WORKING TAP AF _____ AL _____

COMMENTS:

DEFICIENCIES:

TEST EQUIPMENT USED: _____

TESTED BY: Default Administrator



TRANSFORMER DISSIPATION FACTOR TEST



OWNER Example Owner PAGE 43
 PLANT Example Plant AMBIENT TEMP. _____ °F DATE 10/13/2014
 SUBSTATION TRANSFORMERS HUMIDITY _____ % JOB # TRANSFORMERS
 POSITION GENERAL ASSET ID _____

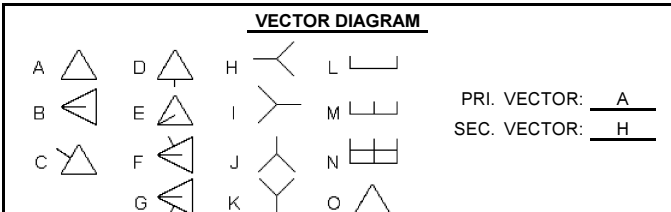
NAMEPLATE DATA

MANUFACTURER _____ SERIAL NO. _____
 SPECIFICATION NO. _____ KVA _____ / _____ / _____ TYPE _____ CLASS _____
 PHASE 3 TEMPERATURE RISE _____ °C IMPEDANCE _____ % B.I.L. RATING _____ KV PRI. _____ KV SEC. _____
 COOLANT _____ CAPACITY _____ GALLONS TOTAL WEIGHT _____
 WINDING POLARITY SUBTRACTIVE WINDING MATERIAL _____ K FACTOR _____ NA
 PRIMARY VOLTAGE _____ DELTA WYE RATED CURRENT _____ / _____ / _____ AMPERES
 SECONDARY VOLTAGE _____ / _____ 0 DELTA WYE RATED CURRENT _____ / _____ / _____ AMPERES
 TAP VOLTAGES _____
 TAP CONNECTIONS _____
 TAP SETTING _____ VOLTS # FANS _____ TAP CHANGER: INTERNAL EXTERNAL DRY TYPE

TEST	TYPE OF TEST	TEST KV	SW. POS.	CAPACITANCE					% DISSIPATION FACTOR					CALC. % P.F. 20°C	
				DIAL READING		CALC. AVG.	MULTIPLIER	CAP. pF	DIAL READING		CALC. AVG.	MULTIPLIER	MEAS. %		20° %
				NORM.	REV.				NORM.	REV.					
P	(5)GST-L GUARDED														
R	(4)GST-L GROUNDED														
I	(3)UST														
S	(5)GST-H GUARDED														
E	(4)GST-H GROUNDED														
C	(3)UST														

TRANSFORMER TEMPERATURE _____ °C TEMPERATURE CORRECTION FACTOR TO 20°C, TCF _____ DRY _____ LIQUID

CONVERSION



$$PF = \frac{DF}{\sqrt{1 + DF^2}}$$

COMMENTS: _____
 DEFICIENCIES: _____

TEST EQUIPMENT USED: _____ TESTED BY: Default Administrator



TRANSFORMER WINDING RESISTANCE TEST

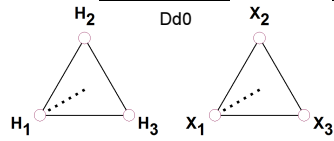


OWNER Example Owner
 PLANT Example Plant
 SUBSTATION TRANSFORMERS
 POSITION GENERAL

PAGE 44
 AMBIENT TEMP. _____ °F
 HUMIDITY _____ %
 DATE 10/13/2014
 JOB # TRANSFORMERS
 ASSET ID _____

NAMEPLATE DATA

MFR _____ CLASS _____ PHASES _____
 SER NO _____ COOLANT OIL REASON _____
 YEAR _____ BIL _____ kV WEIGHT _____ lb
 WINDING MATERIAL Cu
 OIL VOLUME _____ GAL
 OIL TEMP _____ °C
 IMPEDANCE _____ %
 WEATHER _____
 TANK TYPE SEALED



BUSHING NAMEPLATE						
DSG	SERIAL NUM	MFR.	TYPE/CLASS	kV	AMPS	YEAR
H1						
H2						
H3						
X1						
X2						
X3						

	VOLTAGE (kV)	kVA	RATED I	# TAPS	NOMINAL	CHANGER	TAP SETTING
PRIMARY:				5	3	DETC	
SECOND:				1			

TEST FREQUENCY: 60 COMMENTS: _____

PRIMARY WINDING TEST CURRENT _____ mA

TEST #	TAP POSITION	WINDING TESTED			% Variance
		H1 - H2	H3 - H1	H1 - H2	
1					

SECONDARY WINDING TEST CURRENT _____ mA

TEST #	TAP POSITION	WINDING TESTED			% Variance
		X1 - X2	X1 - X2	X1 - X2	
1					

TERTIARY WINDING TEST CURRENT _____ mA

TEST #	TAP POSITION	WINDING TESTED			% Variance
		Y1 - Y2	Y1 - Y2	Y1 - Y2	
1					

COMMENTS: _____
 DEFICIENCIES: _____

TEST EQUIPMENT USED: _____ TESTED BY: Default Administrator



TRANSFORMER LIQUID COOLANT ANALYSIS

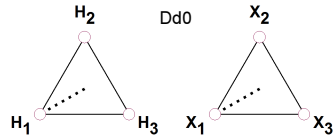


OWNER Example Owner
 PLANT Example Plant
 SUBSTATION TRANSFORMERS
 POSITION GENERAL

PAGE 46
 AMBIENT TEMP. _____ °F
 DATE 10/13/2014
 HUMIDITY _____ %
 JOB # TRANSFORMERS
 ASSET ID _____

NAMEPLATE DATA

MFR _____ CLASS _____ PHASES _____
 SER NO _____ COOLANT OIL REASON _____
 YEAR _____ BIL _____ kV WEIGHT _____ lb
 WINDING MATERIAL Cu
 OIL VOLUME _____ GAL
 OIL TEMP _____ °C
 IMPEDANCE _____ %
 WEATHER _____
 TANK TYPE SEALED



BUSHING NAMEPLATE						
DSG	SERIAL NUM	MFR.	TYPE/CLASS	kV	AMPS	YEAR
H1						
H2						
H3						
X1						
X2						
X3						

	VOLTAGE (kV)	kVA	RATED I	# TAPS	NOMINAL	CHANGER	TAP SETTING
PRIMARY:				5	3	DETC	
SECOND:				1			

TEST FREQUENCY: 60

COMMENTS: _____

TEST RESULTS

		ASTM
PARTICLES	_____	D-1524
DIELECTRIC STRENGTH	_____ kV	D-877
INTERFACIAL TENSION	_____ D/CM	D-971
ACIDITY	_____ MG KOH/G	D-974
ASTM COLOR NO.	_____	D-1500
PCB CONTENT	_____ PPM	D-4059
E.P.A. CLASSIFICATION	_____	
POWER FACTOR	_____ %	D-924
WATER CONTENT	_____ PPM	D-1533B
SPECIFIC GRAVITY	_____	D-287

TRANSFORMER INSPECTION

TEMPERATURE GAUGE PRESENT READING _____ °C
 TEMPERATURE GAUGE HIGH READING _____ °C
 PRESSURE/VACUUM GAUGE READING _____ #
 PAINT CONDITION _____
 GASKETS _____
 BUSHINGS _____
 LIQUID LEVEL _____

PLUMBING TABLE

	P	S	OTHER
TOP			
BOTTOM			
VENT			
ACCESS PORT			
SAMPLE VALVE			

DISSOLVED GAS ANALYSIS

ASTM D-3612C

* HYDROGEN (H2)	_____	PPM
* METHANE (CH4)	_____	PPM
* ETHANE (C2H6)	_____	PPM
* ETHYLENE (C2H4)	_____	PPM
* ACETYLENE (C2H2)	_____	PPM
* CARBON MONOXIDE (CO)	_____	PPM
CARBON DIOXIDE (CO2)	_____	PPM
NITROGEN (N2)	_____	PPM
OXYGEN (O2)	_____	PPM
TOTAL GAS	<u>0</u>	PPM
TOTAL COMBUSTIBLE GAS	<u>0</u>	PPM
EQUIVALENT TCG READING	_____	%
* COMBUSTIBLE GAS	_____	

ANALYSIS OF TEST RESULTS

CONDITION

- EXCELLENT
 GOOD
 INVESTIGATE
 POOR
 FAILED UNIT

SERVICE

- NO SERVICE REQUIRED
 RETEST IN _____ MONTHS:
 SERVICE REQUIRED
 SERVICE IMMEDIATELY
 REFER TO COMMENTS

COMMENTS:

DEFICIENCIES:

SAMPLED BY: Default Administrator

TESTED BY: WEIDMANN - ACTI



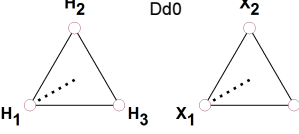
TRANSFORMER LIQUID COOLANT TRENDING



OWNER Example Owner
 PLANT Example Plant
 SUBSTATION TRANSFORMERS
 POSITION GENERAL

PAGE 48
 AMBIENT TEMP. °F DATE 10/13/2014
 HUMIDITY % JOB # TRANSFORMERS
 ASSET ID

NAMEPLATE DATA

MFR CLASS PHASES
 SER NO COOLANT OIL REASON
 YEAR BIL kV WEIGHT lb
 H₂ Dd0 X₂ WINDING MATERIAL Cu

 OIL VOLUME GAL
 OIL TEMP °C
 IMPEDANCE %
 WEATHER
 TANK TYPE SEALED

BUSHING NAMEPLATE						
DSG	SERIAL NUM	MFR.	TYPE/CLASS	kV	AMPS	YEAR
H1						
H2						
H3						
X1						
X2						
X3						

	VOLTAGE (kV)	kVA	RATED I	# TAPS	NOMINAL	CHANGER	TAP SETTING
PRIMARY:				5	3	DETC	
SECOND:				1			

TEST FREQUENCY: 60COMMENTS:

FLUID QUALITY	10/13/2014								
PARTICLES									
DIELECTRIC STRENGTH (kV)									
INTERFACIAL TENSION (D/CM)									
ACIDITY (MG KOH/G)									
ASTM COLOR NO.									
PCB CONTENT (PPM)									
E.P.A. CLASSIFICATION									
POWER FACTOR (%)									
WATER CONTENT (PPM)									
SPECIFIC GRAVITY									

DISSOLVED GAS ANALYSIS	10/13/2014								
* HYDROGEN (H2)									
* METHANE (CH4)									
* ETHANE (C2H6)									
* ETHYLENE (C2H4)									
* ACETYLENE									
* CARBON MONOXIDE									
CARBON DIOXIDE									
NITROGEN									
OXYGEN									
TOTAL GAS	0								
TOTAL COMBUSTIBLE GAS	0								

* COMBUSTIBLE GAS

SAMPLED BY: Default AdministratorTESTED BY: WEIDMANN - ACTI

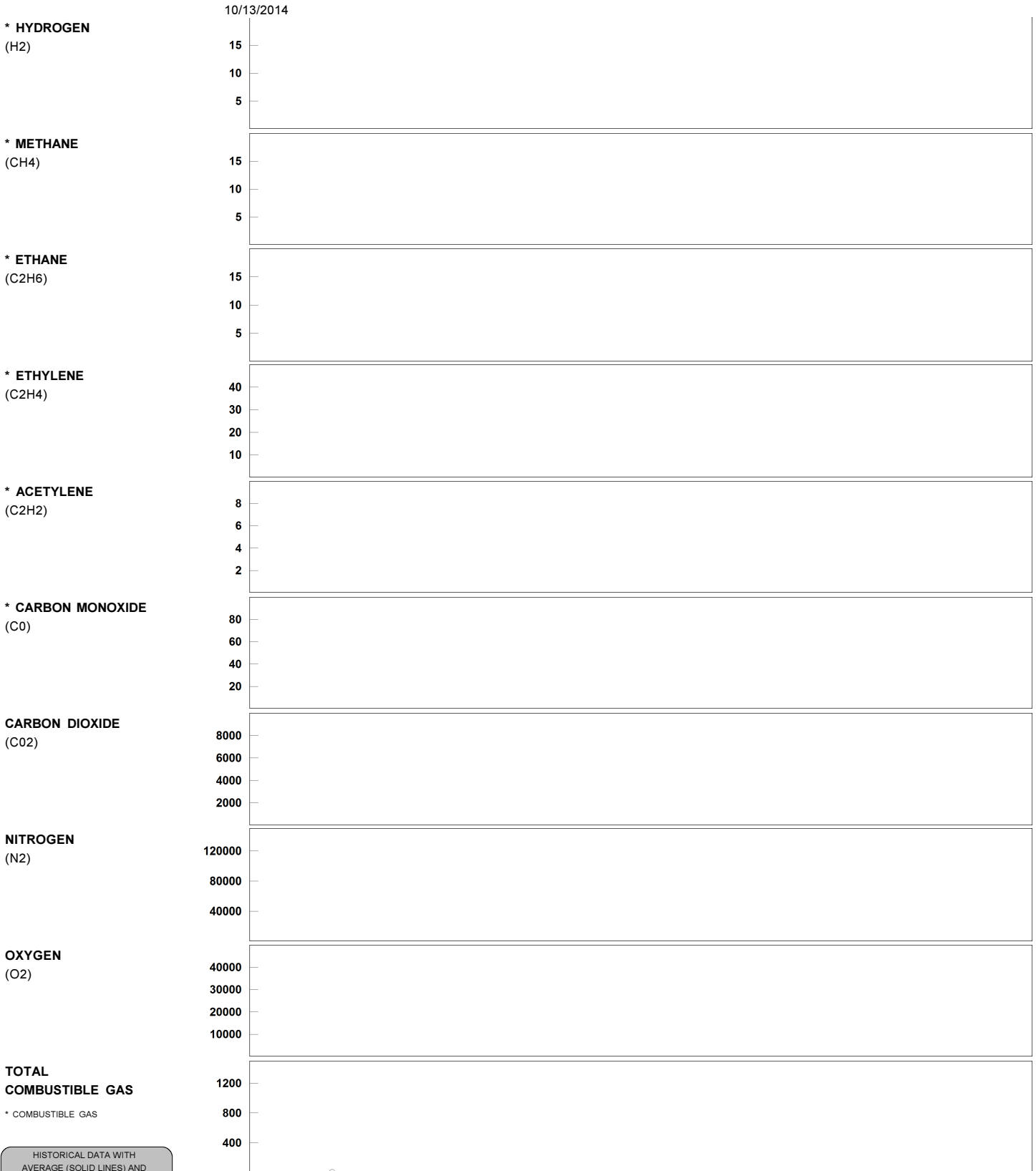


TRANSFORMER LIQUID COOLANT TRENDING DISSOLVED GAS ANALYSIS



USER _____
 SUBSTATION TRANSFORMERS POSITION GENERAL
 SERIAL NO. _____

PAGE 49
 JOB # TRANSFORMERS



HISTORICAL DATA WITH
 AVERAGE (SOLID LINES) AND
 2-SIGMA (DOTTED LINES)

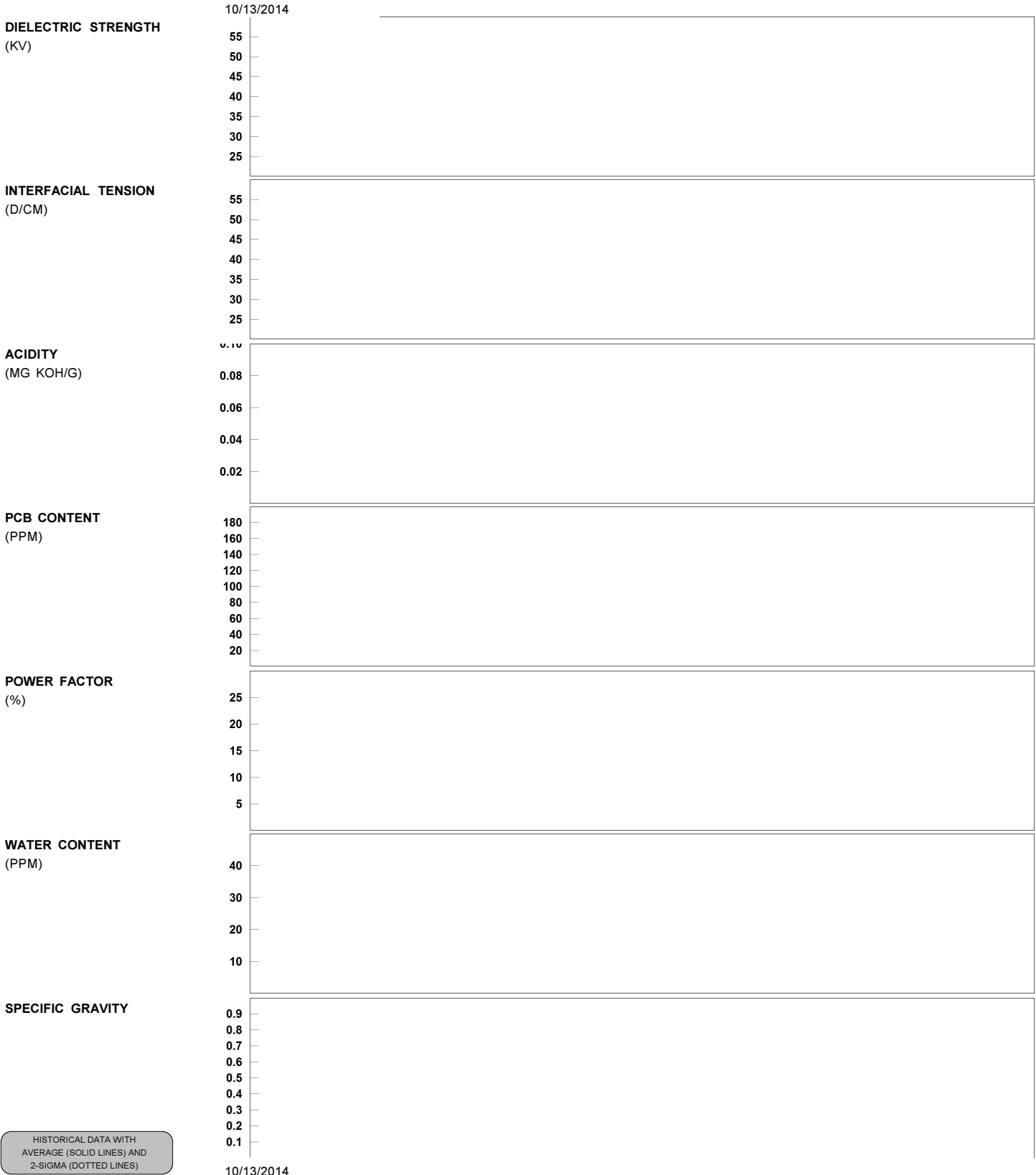


TRANSFORMER LIQUID COOLANT TRENDING FLUID QUALITY



USER _____
 SUBSTATION TRANSFORMERS POSITION GENERAL
 SERIAL NO. _____

PAGE 50
 JOB # TRANSFORMERS



HISTORICAL DATA WITH
 AVERAGE (SOLID LINES) AND
 2-SIGMA (DOTTED LINES)



TRANSFORMER LIQUID COOLANT TRENDING FLUID QUALITY



USER _____ PAGE 51
SUBSTATION TRANSFORMERS POSITION GENERAL JOB # TRANSFORMERS
SERIAL NO. _____

COMMENTS: _____
DEFICIENCIES: _____



TRANSFORMER TURNS RATIO TEST



OWNER Example Owner PAGE 52
 PLANT Example Plant AMBIENT TEMP. _____ °F DATE 10/13/2014
 SUBSTATION TRANSFORMERS HUMIDITY _____ % JOB # TRANSFORMERS
 POSITION GENERAL ASSET ID _____

NAMEPLATE DATA

MANUFACTURER _____ SERIAL NO. _____
 SPECIFICATION NO. _____ KVA _____ / _____ / _____ TYPE _____ CLASS _____
 PHASE 3 TEMPERATURE RISE _____ °C IMPEDANCE _____ % B.I.L. RATING _____ KV PRI. _____ KV SEC. _____
 COOLANT _____ CAPACITY _____ GALLONS TOTAL WEIGHT _____
 WINDING POLARITY SUBTRACTIVE WINDING MATERIAL _____ K FACTOR _____ NA
 PRIMARY VOLTAGE _____ ● DELTA ○ WYE RATED CURRENT _____ / _____ / _____ AMPERES
 SECONDARY VOLTAGE _____ / _____ 0 ○ DELTA ● WYE RATED CURRENT _____ / _____ / _____ AMPERES
 TAP VOLTAGES _____
 TAP CONNECTIONS _____
 TAP SETTING _____ VOLTS # FANS _____ TAP CHANGER: ● INTERNAL ○ EXTERNAL DRY TYPE

TRANSFORMER TURNS RATIO TESTS

TAP NUMBER	WINDING VOLTAGES (volts)	CALCULATED RATIO	MEASURED RATIO		
			$H_3 H_1 / X_0 X_1$	$H_1 H_2 / X_0 X_2$	$H_2 H_3 / X_0 X_3$
1	/				
2	/				
3	/				
4	/				
5	/				
6	/				
7	/				
8	/				

VECTOR DIAGRAM

PRI. VECTOR: A
 SEC. VECTOR: H

CORRECTION FACTOR FOR UNACCESSIBLE NEUTRAL

PHASE TESTED	BLACK	RED	BLACK	RED	JUMPER	READING MULTIPLIER	TEST SHEET DESIGNATION
DELTA-WYE							
A	H1	H3	X1	X2	H2H3	1.1547	H1-H3 X1-X2
B	H2	H1	X2	X3	H1H3	1.1547	H2-H3 X2-X3
C	H3	H2	X3	X1	H1H2	1.1547	H3-H2 X3-X1

COMMENTS: _____
 DEFICIENCIES: _____

TEST EQUIPMENT USED: _____ TESTED BY: Default Administrator



TRANSFORMER INFORMATION & HISTORY

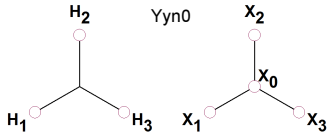


OWNER Example Owner
 PLANT Example Plant
 SUBSTATION TRANSFORMERS
 POSITION GENERAL

PAGE 53
 AMBIENT TEMP. _____ °F
 DATE 10/13/2014
 HUMIDITY _____ %
 JOB # TRANSFORMERS
 ASSET ID _____

NAMEPLATE DATA

MFR _____ CLASS _____ PHASES _____
 SER NO _____ COOLANT OIL _____ REASON _____
 YEAR _____ BIL _____ kV _____ WEIGHT _____ lb
 WINDING MATERIAL Cu
 OIL VOLUME _____ GAL
 OIL TEMP _____ °C
 IMPEDANCE _____ %
 WEATHER _____
 TANK TYPE SEALED



BUSHING NAMEPLATE						
DSG	SERIAL NUM	MFR.	TYPE/CLASS	KV	AMPS	YEAR
H1						
H2						
H3						
X1						
X2						
X3						
X0						

	VOLTAGE (kV)	kVA	RATED I	# TAPS	NOMINAL	CHANGER	TAP SETTING
PRIMARY:	/			5	3	DETC	
SECOND:	/			1			

TEST FREQUENCY: COMMENTS: _____

Transformer Photo



Nameplate Photo



ASSET HISTORY

Location:	Date Installed:	Date Removed:	NOTES



TRANSFORMER WINDING RESISTANCE TEST

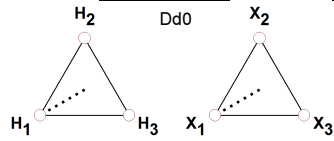


OWNER Example Owner
 PLANT Example Plant
 SUBSTATION TRANSFORMERS
 POSITION GENERAL

PAGE 54
 AMBIENT TEMP. _____ °F DATE 10/13/2014
 HUMIDITY _____ % JOB # TRANSFORMERS
 ASSET ID _____

NAMEPLATE DATA

MFR _____ CLASS _____ PHASES _____
 SER NO _____ COOLANT OIL REASON _____
 YEAR _____ BIL _____ kV WEIGHT _____ lb
 WINDING MATERIAL Cu
 OIL VOLUME _____ GAL
 OIL TEMP _____ °C
 IMPEDANCE _____ %
 WEATHER _____
 TANK TYPE SEALED



BUSHING NAMEPLATE						
DSG	SERIAL NUM	MFR.	TYPE/CLASS	kV	AMPS	YEAR
H1						
H2						
H3						
X1						
X2						
X3						

	VOLTAGE (kV)	kVA	RATED I	# TAPS	NOMINAL	CHANGER	TAP SETTING
PRIMARY:				5	3	DETC	
SECOND:				1			

TEST FREQUENCY: 60 COMMENTS: _____

WINDING TEMPERATURE: _____ °C

PRIMARY WINDING:

MEASURED RESISTANCE

H	- H	OHMS	% Variance
H	- H	OHMS	
H	- H	OHMS	

SECONDARY WINDING:

MEASURED RESISTANCE

X	- X	OHMS	% Variance
X	- X	OHMS	
X	- X	OHMS	

PRIMARY WINDING MATERIAL COPPER

SECONDARY WINDING MATERIAL COPPER

CALCULATED TOTAL RESISTANCE CORRECTED TO 85°C

PRIMARY R _T	OHMS
SECONDARY R _T	OHMS

$$R_T = R_M \frac{T_S + T_K}{T_M + T_K}$$

R_T = TOTAL WINDING RESISTANCE AT 85°C
 R_M = TOTAL WINDING RESISTANCE AT TEST TEMPERATURE
 T_S = TEMPERATURE FOR DESIRED RESISTANCE (85°C)
 T_M = WINDING TEMPERATURE
 T_K = TEMP. RESISTANCE CONSTANT (°C)
 COPPER + 234.5°C
 ALUMINUM = 226.0°C (IEEE C57.12.91)
 DELTA WINDING MULTIPLIER = 1.5X
 WYE WINDING MULTIPLIER = 1X

COMMENTS: _____
 DEFICIENCIES: _____

TEST EQUIPMENT USED: _____

TESTED BY: Default Administrator



TRANSFORMER INSPECTION



OWNER Example Owner PAGE 55
 PLANT Example Plant AMBIENT TEMP. _____ °F DATE 10/13/2014
 SUBSTATION TRANSFORMERS HUMIDITY _____ % JOB # TRANSFORMERS
 POSITION GENERAL ASSET ID _____

NAMEPLATE DATA

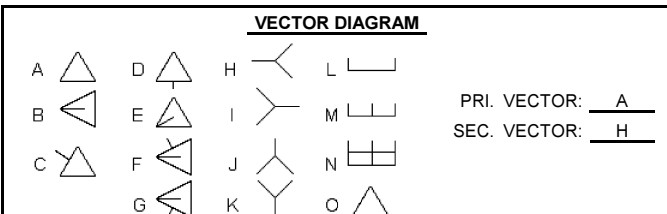
MANUFACTURER _____ SERIAL NO. _____
 SPECIFICATION NO. _____ KVA _____ / _____ / _____ TYPE _____ CLASS _____
 PHASE 3 TEMPERATURE RISE _____ °C IMPEDANCE _____ % B.I.L. RATING _____ KV PRI. _____ KV SEC. _____
 COOLANT _____ CAPACITY _____ GALLONS TOTAL WEIGHT _____
 WINDING POLARITY SUBTRACTIVE WINDING MATERIAL _____ K FACTOR _____ NA _____
 PRIMARY VOLTAGE _____ DELTA WYE RATED CURRENT _____ / _____ / _____ AMPERES
 SECONDARY VOLTAGE _____ / _____ 0 DELTA WYE RATED CURRENT _____ / _____ / _____ AMPERES
 TAP VOLTAGES _____
 TAP CONNECTIONS _____
 TAP SETTING _____ VOLTS # FANS _____ TAP CHANGER: INTERNAL EXTERNAL DRY TYPE

GAUGES:

WINDING TEMPERATURE _____ °C MAXIMUM WINDING TEMPERATURE _____ °C
 COOLANT TEMPERATURE _____ °C MAXIMUM COOLANT TEMPERATURE _____ °C RESET TEMPERATURE GAUGES
 COOLANT LEVEL _____ PRESSURE VACUUM _____ # LCR COUNTER _____
 OTHER GAUGES _____

VISUAL INSPECTION:

BUSHINGS _____ SUPPORT INSULATORS _____ CONNECTIONS _____
 PAINT _____ RADIATORS _____ FANS _____
 NO-LOAD TAP CHANGER _____ LEAKS _____
 FAN PUMP CONTROLS _____
 ADDITIONAL EQUIPMENT _____
 GROUND CONDUCTOR SIZE _____ AWG/KCM NO. OF GROUND CONDUCTORS _____ GROUND CONDUCTOR CONDITION _____



POST TEST VOLTAGES

NO LOAD SECONDARY VOLTAGE			
X1 - X2	V	X0 - G	V
X1 - X3	V	X0 - X1	V
X2 - X3	V	X0 - X2	V
		X0 - X3	V

COMMENTS: _____
 DEFICIENCIES: _____

TEST EQUIPMENT USED: _____ TESTED BY: Default Administrator



TRANSFORMER SINGLE PHASE PRIMARY WINDING RESISTANCE TESTS



OWNER Example Owner
 PLANT Example Plant
 SUBSTATION TRANSFORMERS
 POSITION GENERAL

PAGE 56
 AMBIENT TEMP. _____ °F
 DATE 10/13/2014
 HUMIDITY _____ %
 JOB # TRANSFORMERS
 ASSET ID _____

NAMEPLATE DATA

MANUFACTURER _____ SERIAL NO. _____
 SECONDARY CONFIGURATION _____ WYE _____ WINDING MATERIAL COPPER WINDING TEMPERATURE _____ °C

TAP POSITION	RESISTANCE IN OHMS		CALCULATED RESISTANCE CORRECTED TO 85°C
	H	- H	
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

COMMENTS: _____
 DEFICIENCIES: _____

TEST EQUIPMENT USED: _____ TESTED BY: Default Administrator



TRANSFORMER EXCITATION CURRENT TEST



OWNER Example Owner PAGE 57
 PLANT Example Plant AMBIENT TEMP. _____ °F DATE 10/13/2014
 SUBSTATION TRANSFORMERS HUMIDITY _____ % JOB # TRANSFORMERS
 POSITION GENERAL ASSET ID _____

NAMEPLATE DATA

MANUFACTURER _____ SERIAL NO. _____
 SPECIFICATION NO. _____ KVA _____ / _____ / _____ TYPE _____ CLASS _____
 PHASE 3 TEMPERATURE RISE _____ °C IMPEDANCE _____ % B.I.L. RATING _____ KV PRI. _____ KV SEC. _____
 COOLANT _____ CAPACITY _____ GALLONS TOTAL WEIGHT _____
 WINDING POLARITY SUBTRACTIVE WINDING MATERIAL _____ K FACTOR _____ NA _____
 PRIMARY VOLTAGE _____ DELTA WYE RATED CURRENT _____ / _____ / _____ AMPERES
 SECONDARY VOLTAGE _____ / _____ DELTA WYE RATED CURRENT _____ / _____ / _____ AMPERES
 TAP VOLTAGES _____
 TAP CONNECTIONS _____
 TAP SETTING _____ VOLTS # FANS _____ TAP CHANGER: INTERNAL EXTERNAL DRY TYPE

TEST	TAP CHANGER POSITION	TEST KV SEE NOTE 2	MILLIAMPERES			REMARKS
			PHASE A	PHASE B	PHASE C	

TEST LEAD CONNECTION

SINGLE PHASE				THREE-PHASE WYE (1)		
ENERGIZE	RETURN (RED)			ENERGIZE	RETURN	PHASE
H1	H2 (OR HO)			H1	HO	A
H2 (OR HO)	H1			H2	HO	B
				H3	HO	C
THREE-PHASE DELTA (1)				THREE-PHASE AUTO		
ENERGIZE	RETURN	GRD	PHASE	ENERGIZE	RETURN	PHASE
H3	H1	H2	A	H1	HOXO	A
H1	H2	H3	B	H2	HOXO	B
H2	H3	H1	C	H3	HOXO	C

TEST NOTES:

- IF THE LOW VOLTAGE WINDING IS WYE CONNECTED, THEN XO IS CONNECTED AS IN SERVICE (USUALLY, THIS WOULD MEAN GROUNDING XO).
- ALL TESTS SHOULD BE PERFORMED ROUTINELY AT THE SAME VOLTAGES.
- INDICATE STEP POSITION FOR LOAD TAP CHANGERS: RAISED, LOWERED OR NEUTRAL. SEE FORM 5640C.
- ON SINGLE PHASE TRANSFORMERS THE WINDING IS NORMALLY ENERGIZED ALTERNATELY FROM OPPOSITE ENDS. THIS SHOULD BE DONE ON THREE PHASE TRANSFORMERS IF THE EXCITATION CURRENT IS ABNORMAL.

COMMENTS: _____
 DEFICIENCIES: _____

TEST EQUIPMENT USED: _____ TESTED BY: Default Administrator



REGULATOR MAINTENANCE REPORT



OWNER Example Owner
 PLANT Example Plant
 SUBSTATION TRANSFORMERS
 POSITION GENERAL

PAGE 58
 DATE 10/13/2014
 AMBIENT TEMP. _____ °F
 HUMIDITY _____ %
 JOB # TRANSFORMERS
 ASSET ID _____

NAMEPLATE DATA

CAT # _____ MANUFACTURER _____ YR. MFR. _____ SERIAL NO. _____
 TYPE _____ PRIMARY kV _____ SECONDARY kV _____ GALLONS OF OIL _____
 WEIGHT _____ CLASS _____ AMPS _____ CT RATIO _____
 LAST TEST DATE _____ NEXT TEST DATE _____ COUNTER READING BEFORE _____ AFTER _____

TCUL TURNS RATIO TEST

	TAP	RATIO	TAP	RATIO	TAP	RATIO
LOWER	1	16	1	16	1	16
	2	15	2	15	2	15
	3	14	3	14	3	14
	4	13	4	13	4	13
	5	12	5	12	5	12
	6	11	6	11	6	11
	7	10	7	10	7	10
	8	9	8	9	8	9
	9	8	9	8	9	8
	10	7	10	7	10	7
	11	6	11	6	11	6
	12	5	12	5	12	5
	13	4	13	4	13	4
	14	3	14	3	14	3
	15	2	15	2	15	2
	16	1	16	1	16	1
NEUTRAL	17	N	17	N	17	N
RAISE	18	1	18	1	18	1

MEGGER TEST VOLTAGE _____ Volts OIL TEMPERATURE _____ °F _____ °C

RESISTANCE (megohms)				
MINUTES	1 MIN	3 MIN	5 MIN	10 MIN
PRIMARY TO GROUND				
PRIMARY TO SECONDARY				
SECONDARY TO GROUND				

COMMENTS:
DEFICIENCIES:

TEST EQUIPMENT USED: _____ TESTED BY: Default Administrator



TWO-WINDING TRANSFORMER



OWNER Example Owner
 PLANT Example Plant
 SUBSTATION TRANSFORMERS
 POSITION GENERAL

PAGE 59
 AMBIENT TEMP. _____ °F
 DATE 10/13/2014
 HUMIDITY _____ %
 JOB # TRANSFORMERS
 ASSET ID _____

NAMEPLATE DATA

MANUFACTURER _____ YR MFR _____ SERIAL NO. _____
 IMPEDANCE _____ % CAPACITY _____ GALLONS TYPE _____ CATALOG NUMBER _____
 KVA _____ / _____ / _____ CLASS OA FA FOA FOW OW FOW _____

	VOLTS	CONNECTIONS	WINDING MATERIAL
PRIMARY	/	<input checked="" type="radio"/> DELTA <input type="radio"/> WYE <input type="radio"/> SINGLE PHASE	<input type="radio"/> ALUMINUM <input type="radio"/> COPPER
SECONDARY	/ 0	<input type="radio"/> DELTA <input checked="" type="radio"/> WYE <input type="radio"/> SINGLE PHASE	<input type="radio"/> ALUMINUM <input type="radio"/> COPPER

TAP VOLTAGES _____
 TAP POSITION _____
 TAP POSITION LEFT _____ / _____ (VOLTS PERCENT)
 MEDIUM TYPE SILICONE OIL AIR PCB RTEMP WESCOL GAS _____
 INSULATING MEDIUM LIQUID-FILLED GAS-FILLED AIR FIELD SAMPLE YES NO
 PRESSURE _____ PSI _____ MEDIUM LEVEL _____ CAPACITY GALLONS _____
 TEMPERATURE RISE _____ °C MAXIMUM TEMPERATURE INDICATOR _____ °C
 TEMPERATURE GAUGE _____ °C MAXIMUM TEMPERATURE INDICATOR RESET TO _____ °C
 WINDING TEMPERATURE _____ °C FAN SET TO _____ °C

ENVIRONMENTAL DATA

WEATHER CONDITIONS _____ AMBIENT TEMPERATURE _____ HUMIDITY _____ %
 LOCATED ON POLE PAD INDOOR OUTDOOR

VISUAL INSPECTION

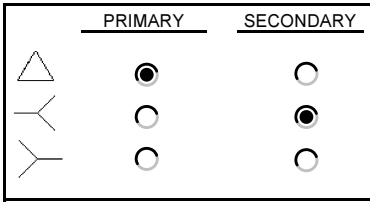
FANS	<input type="checkbox"/> GOOD	<input type="checkbox"/> FAIR	<input type="checkbox"/> POOR	EXPLAIN: _____
CONTROLS	<input type="checkbox"/> GOOD	<input type="checkbox"/> FAIR	<input type="checkbox"/> POOR	EXPLAIN: _____
CONTROL VOLTAGE _____ VOLTS				
PAINT	<input type="checkbox"/> GOOD	<input type="checkbox"/> FAIR	<input type="checkbox"/> POOR	EXPLAIN: _____
CONNECTIONS	<input type="checkbox"/> GOOD	<input type="checkbox"/> FAIR	<input type="checkbox"/> POOR	EXPLAIN: _____
GROUNDINGS	<input type="checkbox"/> GOOD	<input type="checkbox"/> FAIR	<input type="checkbox"/> POOR	EXPLAIN: _____
LEAKS	<input type="checkbox"/> LIQUID	<input type="checkbox"/> GAS	<input type="checkbox"/> AIR	<input type="checkbox"/> NONE DETECTED <input type="checkbox"/> YES DESCRIBE: _____
DESCRIBE OPERATING ENVIRONMENT _____				



TWO-WINDING TRANSFORMER



WINDING RESISTANCE TESTS



WINDING TESTED	TAP POSITION					
H1-H2						
H2-H3						
H3-H1						
X0-X1						
X0-X2						
X0-X3						

ARE WINDING POLARITIES AS PER NAMEPLATE? YES NO

IF NO, DESCRIBE: _____

INSULATION RESISTANCE TEST

WINDINGS TESTED	TEST VOLTAGE (VOLTS DC)	RESISTANCE (MEGOHMS)			RECOMMENDED MINIMUM (MEGOHMS)	ACCEPTABLE <input type="checkbox"/> YES <input type="checkbox"/> NO
		0.5 MINUTE	1.0 MINUTE	10 MINUTES		
PRIMARY TO SECONDARY AND GROUND						<input type="checkbox"/> YES <input type="checkbox"/> NO
SECONDARY TO PRIMARY AND GROUND						<input type="checkbox"/> YES <input type="checkbox"/> NO

TEMPERATURE CORRECTION FACTOR: AIR MEDIUM TEMPERATURE WAS _____ MULTIPLY RESULT BY CORRECTION FACTOR _____

	PRIMARY WINDING	SECONDARY WINDING	ACCEPTABLE <input type="checkbox"/> YES <input type="checkbox"/> NO
DIELECTRIC ABSORPTION: (RATIO OF 1 MINUTE TO 0.5 MINUTE RESULT)			<input type="checkbox"/> YES <input type="checkbox"/> NO
POLARIZATION INDEX: (RATIO OF 10 MINUTE RESULT TO 1 MINUTE RESULT)			<input type="checkbox"/> YES <input type="checkbox"/> NO

TRANSFORMER TURNS RATIO TESTS

TAP	NAMEPLATE VOLTAGE	CALCULATED RATIO	MEASURED H1-H2	% DEVIATION		MEASURED H2-H3	% DEVIATION		MEASURED H3-H1	% DEVIATION	
				TO CALCULATED	PASS/FAIL		TO CALCULATED	PASS/FAIL		TO CALCULATED	PASS/FAIL

TURNS RATIO RESULTS: ARE THEY WITHIN +/- 0.5% OF ADJACENT PHASES AND/OR CALCULATED RATIO. YES NO

ASTERICK (*) DENOTES RESULTS NOT WITHIN TOLERANCE

AC OVERPOTENTIAL TEST

WINDINGS TESTED	TEST VOLTAGE (VOLTS AC)	TEST DURATION (MINUTES)	RESULTS (PASS / FAIL)	LEAKAGE CURRENT (AMPERES AC)	ACCEPTABLE <input type="checkbox"/> YES <input type="checkbox"/> NO
PRIMARY TO GROUND WITH SECONDARY GROUNDED			<input type="checkbox"/> PASS <input type="checkbox"/> FAIL		<input type="checkbox"/> YES <input type="checkbox"/> NO
SECONDARY TO GROUND WITH PRIMARY GROUNDED			<input type="checkbox"/> PASS <input type="checkbox"/> FAIL		<input type="checkbox"/> YES <input type="checkbox"/> NO

COMMENTS: _____
DEFICIENCIES: _____

TEST EQUIPMENT USED: _____

TESTED BY: Default Administrator



TRANSFORMER SECONDARY WINDING RESISTANCE TESTS



OWNER Example Owner PAGE 61
 PLANT Example Plant AMBIENT TEMP. _____ °F DATE 10/13/2014
 SUBSTATION TRANSFORMERS HUMIDITY _____ % JOB # TRANSFORMERS
 POSITION GENERAL ASSET ID _____

NAMEPLATE DATA

MANUFACTURER _____ SERIAL NO. _____
 SECONDARY CONFIGURATION _____ WYE _____ WINDING MATERIAL _____ COPPER _____ WINDING TEMPERATURE _____ °C

TAP POSITION	RESISTANCE IN MILLIOHMS						CALCULATED RESISTANCE CORRECTED TO 85°C
	X	- X	X	- X	X	- X	
16L							
15L							
14L							
13L							
12L							
11L							
10L							
9L							
8L							
7L							
6L							
5L							
4L							
3L							
2L							
1L							
N							
1R							
2R							
3R							
4R							
5R							
6R							
7R							
8R							
9R							
10R							
11R							
12R							
13R							
14R							
15R							
16R							

COMMENTS: _____
DEFICIENCIES: _____

TEST EQUIPMENT USED: _____ TESTED BY: Default Administrator

