INSULATION RESISTANCE

Jamaica Public Service Company Limited
CHANGING LIVES WITH OUR ENERGY

Substation/Location:	ORANGE BAY
Date:	20-Nov-17
Transformer S.N.:	88.2.4020
MVA Rating	25
Manufacturer:	PAUWEL TRAFO
Voltage Rating HV/LV, kV:	69/24

Test Equipment	MEGGER
Model	S1-1568

Ambient Temperature:		Deg. C
Temperature Correction Factor:	20	
Winding Temp, Deg. C	39	
Oil Temp, Deg. C	39	
Humidity:		

D-1816 1MM GAP

Oil Dielectric Test (KV)	
Test 1	40.6
Test 2	32.9
Test 3	44
Test 4	26.2
Test 5	25.9
Average	34

Item No.	Test	Test Volts	Resistance Readings - M Ohms					
			Duration	Measured	Corrected to 20 deg. C	Duration	Measured	PI
1	**Megger - Insulation**			Ω			Ω	
1.1	HV to LV and ground	5 KV	1 Min	**4.34 GΩ**		10 Min	**6.58 GΩ**	**1.58**
1.2	HV and LV to Ground	5 KV	1 Min	**3.33 GΩ**		10 Min	**4.93 GΩ**	**1.48**
1.3	LV to HV and Ground	5 KV	1 Min	**4.82 GΩ**		10 Min	**6.99 GΩ**	**1.45**
1.4	HV to LV	5 KV	1 Min	**5.43 GΩ**		10 Min	**9.40 GΩ**	**1.73**
2	**Core Insulation Res.**							
2.1	Core ground strap - tank ground	500V	2 Min	**1.87 GΩ**				

Tested By N. Griffiths/S. Watson Date: 21 Nov. 2017

Checked by: Date: 21 Nov. 2017

Approved by: Date:

Authorized to Energize by: Date: 21/11/2017

Megger
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INSULATION TESTS
TWO-WINDING TRANSFORMERS

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DATE 11/20/2017 PAGE 1

AMBIENT TEMP. 31 °C JOB # 2.4020

SUBSTATION Orange Bay HUMIDITY 68.1 % ASSET ID 88,2,4020

POSITION 69000 / 24000 V TEST STATUS Pass

EQUIPMENT LOCATION Westmoreland, Orange Bay

MANUFACTURER DATA

MFR Pauwels Trafo CLASS OA PHASES 3
SER NO 88,2,4020 COOLANT OIL REASON Retest
YEAR 1988 BIL 350/150 kV WEIGHT 63.5 tn
WINDING MATERIAL Cu
OIL VOLUME 15.8 tn
OIL TEMP 32 °C
IMPEDANCE 12.29 %
WEATHER Sunny
TANK TYPE SEALED

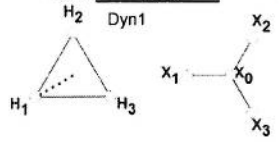

Diagram # 5 (ANSI)

	VOLTAGE (V)	MVA	RATED I	# TAPS	NOMINAL	CHANGER	TAP SETTING
PRIMARY:	69,000	25	209.18	5	3	DETC	
SECOND:	24,000 / 3,856.4(	25	601.41	1			

COMMENTS: Test for Acceptance

TRANSFORMER OVERALL TEST SET UP / **TRANSFORMER OVERALL TEST RESULTS**

☐ ITC ☑ Temp Corr. Table

Test No.	Insulation Tested	Test Mode	Test Lead Connections HV	Red	Blue	Gnd	Test kV	DFR	Capacitance C (pF)	POWER FACTOR % Measured	@ 20°C	Corr Factor	DIRECT mA	Watts	%VDF	IR
1	C_{HG} + C_{HL}	GST-GND	H	L		G	10.00	☑	13,132.45	0.24	0.22	0.940	41.2358	0.9738	0.02	G
2	C_{HG}	GSTg-RB	H	L		G	10.00	☑	3,619.47	0.35	0.33	0.940	11.3628	0.3974	0.01	G
3	C_{HL}	UST-R	H	L		G	10.00	☑	9,539.79	0.19	0.18	0.940	29.7716	0.5656	0.02	G
4	C_{HL}'		Test 1 Minus Test 2						9,512.98				29.8729	0.5763		Valid
5	C_{LG} + C_{HL}	GST-GND	L	H		G	10.00	☑	20,396.32	0.29	0.27	0.940	64.0574	1.8458	0.02	G
6	C_{LG}	GSTg-RB	L	H		G	10.00	☑	10,892.31	0.37	0.35	0.940	34.1816	1.2631	0.02	G
7	C_{HL}	UST-R	L	H		G	10.00	☑	9,538.86	0.19	0.18	0.940	29.9266	0.5603	0.02	G
8	C_{HL}'		Test 5 Minus Test 6						9,504.01				29.8758	0.5827		Valid
9	C_{HG}'		C_{HG} Minus H Bushings						3,425.89				10.7542	0.8498		
10	C_{LG}'		C_{LG} Minus L Bushings													
Oil Test 1	Overall Oil Test	UST-R	L	H		G						0.580				
Oil Test 2	LTC Chamber Oil Test	UST-R	L	H		G						0.580				

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INSULATION TESTS
TWO-WINDING TRANSFORMERS

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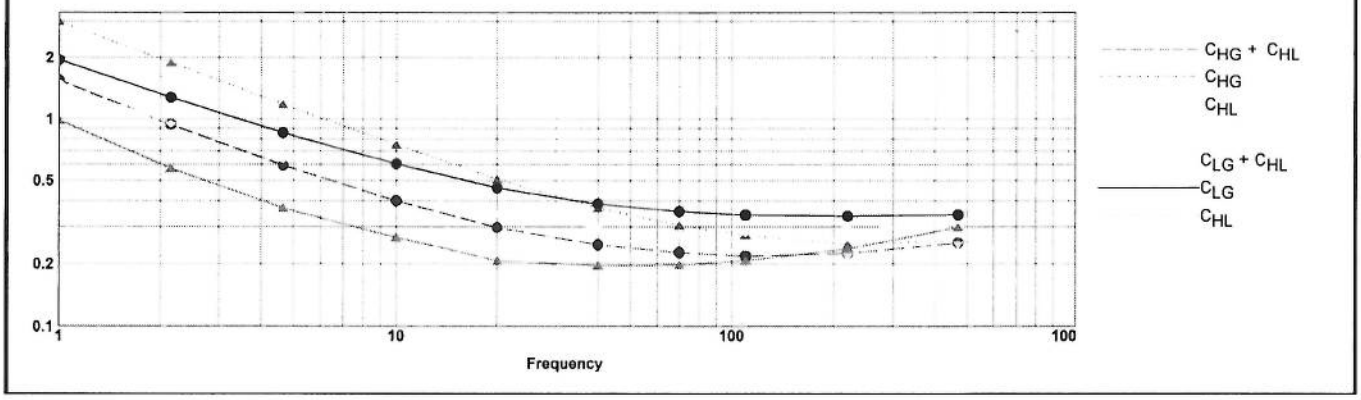
FREQUENCY SWEEP GRAPH

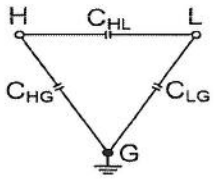


NOTE: SHORT EACH WINDING ON ITSELF

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

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

EQUIVALENT CIRCUIT



Transformer - Bushing C1 Tests Connector Issues ☐ ITC ☑ Temp Corr. Table

Test No.	Bushing Nameplate					Test Mode	Test kV	DFR	Capacitance C (pF)	POWER FACTOR %			DIRECT		%VDF	IR
	Dsg.	SERIAL #	CAT. #	PF	Cap. (pF)					Measured	@ 20°C	Corr Factor	mA	WATTS		
11	H1	225214				UST-R	10.00	☑	193.58	-7.47	-6.35	0.850	0.6087	-0.4523	2.25	G
12	H2	225212				UST-R	10.00	☑				0.850				
13	H3	225211				UST-R	10.00	☑				0.850				
14	N/A	225212				UST-R	10.00	☐								
15	X1					UST-R	10.00	☐								
16	X2					UST-R	10.00	☐								
17	X3					UST-R	10.00	☐								
18	X0					UST-R	10.00	☐								
19		225214				UST-R		☐								

Transformer - Bushing C2 Tests Connector Issues

Test No.	Bushing Nameplate					Test Mode	Test kV	Capacitance C (pF)	POWER FACTOR %			DIRECT		%VDF	IR
	Dsg.	SERIAL #	CAT. #	PF	Cap. (pF)				Measured	@ 20°C	Corr Factor	mA	WATTS		
20	H1	225214				GST-GND	0.50				0.850				
21	H2	225212				GST-GND	0.50				0.850				
22	H3	225211				GST-GND	0.50				0.850				
23	N/A	225212				GST-GND	0.50								
24	X1					GST-GND	0.50								
25	X2					GST-GND	0.50								
26	X3					GST-GND	0.50								
27	X0					GST-GND	0.50								

See Hot Collar Test - Next Page.
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Transformer - Surge Arresters Tests

	Location	Serial #	Mfr	OVERALL CATALOGUE	Unit Catalog	Type	Rated kV	Order	Test Mode	Test kV	DIRECT		IR
											mA	Watts	
28	HV	7775312	ABB	XAQ72A3/60			72		GST-GND	10.00	0.2490	0.145	G
29	HV	7776310	ABB	XAQ72A3/60			72		GST-GND	10.00	0.2538	0.147	G
30	HV	7776311	ABB	XAQ72A3/60			72		GST-GND	10.00	0.2490	0.139	G
31	LV	7776307	ABB	XAR24A3/26			26		GST-GND	10.00	0.2138	0.174	G
32	LV	7776308	ABB	XAR24A3/26			26		GST-GND	10.00	0.2131	0.168	G
33	LV	7776307	ABB	XAR24A3/26			26		GST-GND	10.00	0.2072	0.199	G

Transformer - Hot Collar Tests

Test No.	Dsg	Serial #	Designation	Test Mode	Test kV	DIRECT		IR
						mA	Watts	
37	H1	225214	0; Yr.-1993;_ LF 123,185-K; - 100K	GST-GND	10.00	0.1040	0.017	G
38	H2	225212	GOB-380; LF-123_185-K	GST-GND	10.00	0.1044	0.018	G
39	H3	225211	LF-123_ 185-K; - 100KV- 800A	GST-GND	10.00	0.1127	0.022	G
40	N/A	225212		UST-R	10.00	0.0347	0.124	G
41	X1			GST-GND	10.00	0.1195	0.016	G
42	X2			GST-GND	10.00	0.1125	0.016	G
43	X3			GST-GND	10.00	0.1142	0.015	G
44	X0			GST-GND	10.00	0.1120	0.016	G
45	H1	225214		UST-R	10.00	0.0647	0.012	G
46	H3	225211		UST-R	10.00	0.0603	0.016	G

EXCITING CURRENT TESTS

CONNECTIONS:			PHASE L: Enter connection			UST-R			PHASE B: Enter connection			UST-R			PHASE L: Enter connection			UST-R		
	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		IR
							mA	WATTS					mA	WATTS					mA	WATTS	
44		17	10.00	925.97	H	47.0252	47.16	321.46	10.00	890.30	H	49.1998	49.21	336.77	10.00	1,127.97	H	37.5906	37.61	247.46	G

COMMENTS: Transformer tested OK. Measured values are Accepted.
DEFICIENCIES:

Form Number and Date: 93500, REVISED 07/14/2015
Serial Number: 1574 0114
Firmware Information:
Calibration Date:

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TRANSFORMER WINDING RESISTANCE TEST

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AMBIENT TEMP. 31 °C JOB # 2.4020

SUBSTATION Orange Bay HUMIDITY 68.1 % ASSET ID 88,2,4020

POSITION 69000 / 24000 V TEST STATUS Pass

EQUIPMENT LOCATION Westmoreland, Orange Bay

MFR	Pauwels Trafo	WEIGHT	63.5 tn	OIL VOLUME	5.800000190734 tn		
SER NO	88,2,4020	WEATHER	Sunny	OIL TEMP	32 °C		
YEAR	1988	BIL	350/150 kV	WINDING TEMP	32 °C		
TYPE	SEALED	IMPEDANCE	12.29 %	CORRECT TO ☑	85 °C		
CLASS	OA	REASON	Retest	COOLANT	OIL		
PHASES	3	Max Wdg Diff (%):	5				

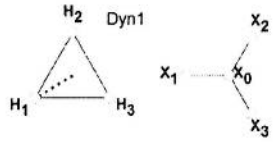

Diagram # 5 (ANSI)

	VOLTAGE (V)	MVA	RATED I	RECOMMENDED TEST I	# TAPS	NOMINAL	CHANGER	TAP SETTING	WINDING MATERIAL
PRIMARY:	69,000	25	209.18	10.0A	17	9	DETC		Cu
SECOND:	24,000 / 13,856.40	25	601.41	10.0A	1				Cu

HIGH VOLTAGE WINDING RESISTANCE

Show Graph ☑

Corrected Resistance to 85°C

Units: mΩ

#	TAP	Current (amp)	Nameplate Voltage	$H_1 - H_3$	$H_2 - H_1$	$H_3 - H_2$	Reading Stability %	Winding Difference %	
1	1	10.08	75,900	581.6	584.0	581.1	99.91	0.498	
2	2	10.08	75,037	565.7	568.3	565.1	99.92	0.558	
3	3	10.08	74,175	549.9	552.5	549.5	99.91	0.548	
4	4	10.07	73,312	534.3	537.5	533.7	99.92	0.707	
5	5	10.07	72,450	518.5	520.7	517.9	99.90	0.535	
6	6	10.07	71,587	502.6	505.8	502.1	99.87	0.737	
7	7	10.07	70,725	486.9	489.0	486.1	99.91	0.578	
8	8	10.07	69,862	471.5	473.5	470.6	99.91	0.607	
9	Nominal	10.07	69,000	455.3	457.7	454.7	99.88	0.636	
10	10	10.07	68,137	438.3	441.0	438.0	99.88	0.666	
11	11	10.07	67,275	455.2	457.1	454.6	99.91	0.546	
12	12	10.07	66,412	470.7	473.0	470.1	99.89	0.617	
13	13	10.07	65,550	486.2	488.0	485.6	99.92	0.511	
14	14	10.06	64,687	501.6	504.2	501.0	99.93	0.620	

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TRANSFORMER WINDING RESISTANCE TEST

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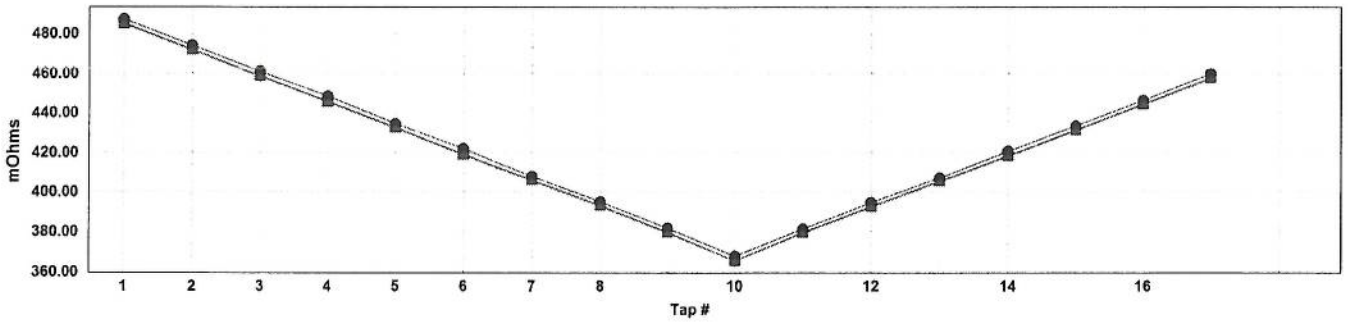
HIGH VOLTAGE WINDING RESISTANCE

Show Graph ☑

Units: mΩ

#	TAP	Current (amp)	Nameplate Voltage	Corrected Resistance to 85°C $H_1 - H_3$	$H_2 - H_1$	$H_3 - H_2$	Reading Stability %	Winding Difference %	
15	15	10.06	63,825	517.2	519.5	516.6	99.95	0.544	
16	16	10.07	62,962	532.8	534.9	532.3	99.95	0.495	
17	17	10.07	62,100	549.0	551.3	548.0	99.93	0.592	



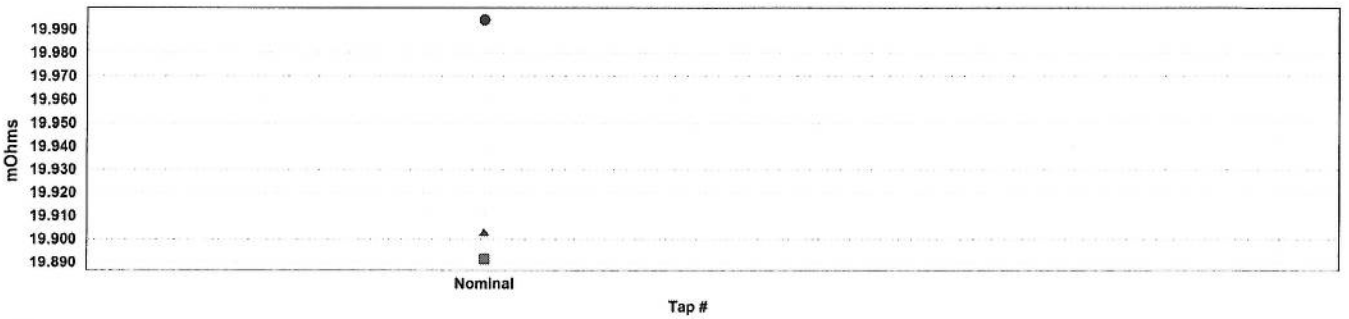
$H_1 - H_3$
$H_2 - H_1$
$H_3 - H_2$

LOW VOLTAGE WINDING RESISTANCE

Show Graph ☑

Units: mΩ

#	TAP	Current (amp)	Nameplate Voltage	Corrected Resistance to 85°C $X_1 - X_0$	$X_2 - X_0$	$X_3 - X_0$	Reading Stability %	Winding Difference %	
6	Nominal	10.06	23,900	23.85	23.97	23.86	99.82	0.515	



$X_1 - X_0$
$X_2 - X_0$
$X_3 - X_0$

COMMENTS: Transformer measured values Accepted.
DEFICIENCIES:

Form Number and Date: 56353, REVISED 09/16/2015
Serial Number: 3995_1016
Firmware Information: 310
Calibration Date: 11/14/2016

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TRANSFORMER TEST RESULTS

DATE: 11/20/17 TIME: 17:53:05

COMPANY: JPS
STATION: ORANGE BAY
CIRCUIT: T1
MFR: PAUWELS TRAFO
MODEL:
S/N: SS 2 4020
KVA RATING: 25000
OPERATOR: S WATSON

TEST VOLTAGE = 40 VOLTS

TYPE: DELTA to Y XFORMER

TEST H1-H3 AND X1-XO

NAME PLATE VOLTAGE:

H VOLTAGE: 075,900
H TAP SETTING:

X VOLTAGE: 023,900
X TAP SETTING:

CALCULATED RATIO: 5.5007

MEASURED RATIO: 5.5040

DIFFERENCE: 00.06 %

XFMR TURNS RATIO: 5.5040

VOLTAGE RATIO: 3.1777

MEASURED PHASE-ANGLE: 359.688 DEG

MEASURED CURRENT: 0002 mA

TEST H2-H1 AND X2-XO

NAME PLATE VOLTAGE:

H VOLTAGE: 075,900
H TAP SETTING:

X VOLTAGE: 023,900
X TAP SETTING:

CALCULATED RATIO: 5.5007

MEASURED RATIO: 5.5040

DIFFERENCE: 00.06 %

XFMR TURNS RATIO: 5.5040

VOLTAGE RATIO: 3.1777

MEASURED PHASE-ANGLE: 000.000 DEG

MEASURED CURRENT: 0002 mA

TEST H3-H2 AND X3-XO

NAME PLATE VOLTAGE:

H VOLTAGE: 075,900
H TAP SETTING:

X VOLTAGE: 023,900
X TAP SETTING:

CALCULATED RATIO: 5.5007

MEASURED RATIO: 5.5089

DIFFERENCE: 00.15 %

XFMR TURNS RATIO: 5.5089

VOLTAGE RATIO: 3.1806

MEASURED PHASE-ANGLE: 359.844 DEG

MEASURED CURRENT: 0003 mA

?E: DELTA to Y XFORMER

TEST H1-H3 AND X1-XO

1E PLATE VOLTAGE:

)OLTAGE: 075,037
'AP SETTING:

)OLTAGE: 023,900
'AP SETTING:

.CULATED RATIO: 5.4381

ISURED RATIO: 5.4412

DIFFERENCE: 00.06 %

IR TURNS RATIO: 5.4412

.TAGE RATIO: 3.1415

ISURED PHASE-ANGLE: 359.844 DEG

ISURED CURRENT: 0002 mA

TEST H2-H1 AND X2-XO

IE PLATE VOLTAGE:

'OLTAGE: 075,037
'AP SETTING:

'OLTAGE: 023,900
'AP SETTING:

CULATED RATIO: 5.4381

SURED RATIO: 5.4413

DIFFERENCE: 00.06 %

R TURNS RATIO: 5.4413

TAGE RATIO: 3.1415

SURED PHASE-ANGLE: 359.688 DEG

SURED CURRENT: 0002 mA

TEST H3-H2 AND X3-XO

E PLATE VOLTAGE:

OLTAGE: 075,037
AP SETTING:

OLTAGE: 023,900
AP SETTING:

CULATED RATIO: 5.4381

SURED RATIO: 5.4461

DIFFERENCE: 00.15 %

R TURNS RATIO: 5.4461

TAGE RATIO: 3.1443

SURED PHASE-ANGLE: 359.844 DEG

SURED CURRENT: 0003 mA

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YPE: DELTA to Y XFORMER 4

TEST H1-H3 AND X1-X0

AME PLATE VOLTAGE:

VOLTAGE:	073,312
TAP SETTING:	
VOLTAGE:	023,900
TAP SETTING:	
ALCULATED RATIO:	5.3131
EASURED RATIO:	5.3154
DIFFERENCE:	00.04 %
FMR TURNS RATIO:	5.3154
OLTAGE RATIO:	3.0688
EASURED PHASE-ANGLE:	359.844 DEG
EASURED CURRENT:	0002 mA

TEST H2-H1 AND X2-X0

AME PLATE VOLTAGE:

VOLTAGE:	073,312
TAP SETTING:	
VOLTAGE:	023,900
TAP SETTING:	
ALCULATED RATIO:	5.3131
EASURED RATIO:	5.3157
DIFFERENCE:	00.05 %
FMR TURNS RATIO:	5.3157
OLTAGE RATIO:	3.0690
EASURED PHASE-ANGLE:	359.844 DEG
EASURED CURRENT:	0002 mA

TEST H3-H2 AND X3-X0

NAME PLATE VOLTAGE:

H VOLTAGE:	073,312
H TAP SETTING:	
X VOLTAGE:	023,900
X TAP SETTING:	
CALCULATED RATIO:	5.3131
MEASURED RATIO:	5.3202
DIFFERENCE:	00.13 %
XFMR TURNS RATIO:	5.3202
VOLTAGE RATIO:	3.0716
MEASURED PHASE-ANGLE:	359.844 DEG
MEASURED CURRENT:	0003 mA

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YPE: DELTA to Y XFORMER 5

TEST H1-H3 AND X1-X0

NAME PLATE VOLTAGE:

H VOLTAGE:	074,175
H TAP SETTING:	
X VOLTAGE:	023,900
X TAP SETTING:	
CALCULATED RATIO:	5.3757
MEASURED RATIO:	5.3777
DIFFERENCE:	00.04 %
XFMR TURNS RATIO:	5.3777
VOLTAGE RATIO:	3.1048
MEASURED PHASE-ANGLE:	000.000 DEG
MEASURED CURRENT:	0002 mA

TEST H2-H1 AND X2-X0

NAME PLATE VOLTAGE:

H VOLTAGE:	074,175
H TAP SETTING:	
X VOLTAGE:	023,900
X TAP SETTING:	
CALCULATED RATIO:	5.3757
MEASURED RATIO:	5.3791
DIFFERENCE:	00.06 %
XFMR TURNS RATIO:	5.3791
VOLTAGE RATIO:	3.1056
MEASURED PHASE-ANGLE:	000.000 DEG
MEASURED CURRENT:	0002 mA

TEST H3-H2 AND X3-X0

NAME PLATE VOLTAGE:

H VOLTAGE:	074,175
H TAP SETTING:	
X VOLTAGE:	023,900
X TAP SETTING:	
CALCULATED RATIO:	5.3757
MEASURED RATIO:	5.3824
DIFFERENCE:	00.12 %
XFMR TURNS RATIO:	5.3824
VOLTAGE RATIO:	3.1075
MEASURED PHASE-ANGLE:	359.844 DEG
MEASURED CURRENT:	0003 mA

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TYPE: DELTA to Y XFORMER 6

TEST H1-H3 AND X1-X0

NAME PLATE VOLTAGE:

H VOLTAGE: H TAP SETTING:	071,587
X VOLTAGE: X TAP SETTING:	023,900
CALCULATED RATIO:	5.1881
MEASURED RATIO:	5.1904
DIFFERENCE:	00.04 %
XFMR TURNS RATIO:	5.1904
VOLTAGE RATIO:	2.9967
MEASURED PHASE-ANGLE:	000.000 DEG
MEASURED CURRENT:	0002 mA

TEST H2-H1 AND X2-X0

NAME PLATE VOLTAGE:

H VOLTAGE: H TAP SETTING:	071,587
X VOLTAGE: X TAP SETTING:	023,900
CALCULATED RATIO:	5.1881
MEASURED RATIO:	5.1907
DIFFERENCE:	00.05 %
XFMR TURNS RATIO:	5.1907
VOLTAGE RATIO:	2.9969
MEASURED PHASE-ANGLE:	359.687 DEG
MEASURED CURRENT:	0002 mA

TEST H3-H2 AND X3-X0

NAME PLATE VOLTAGE:

H VOLTAGE: H TAP SETTING:	071,587
X VOLTAGE: X TAP SETTING:	023,900
CALCULATED RATIO:	5.1881
MEASURED RATIO:	5.1952
DIFFERENCE:	00.14 %
XFMR TURNS RATIO:	5.1952
VOLTAGE RATIO:	2.9994
MEASURED PHASE-ANGLE:	359.687 DEG
MEASURED CURRENT:	0003 mA

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TYPE: DELTA to Y XFORMER 5

TEST H1-H3 AND X1-X0

NAME PLATE VOLTAGE:

H VOLTAGE: H TAP SETTING:	072,450
X VOLTAGE: X TAP SETTING:	023,900
CALCULATED RATIO:	5.2507
MEASURED RATIO:	5.2519
DIFFERENCE:	00.02 %
XFMR TURNS RATIO:	5.2519
VOLTAGE RATIO:	3.0322
MEASURED PHASE-ANGLE:	000.000 DEG
MEASURED CURRENT:	0002 mA

TEST H2-H1 AND X2-X0

NAME PLATE VOLTAGE:

H VOLTAGE: H TAP SETTING:	072,450
X VOLTAGE: X TAP SETTING:	023,900
CALCULATED RATIO:	5.2507
MEASURED RATIO:	5.2531
DIFFERENCE:	00.05 %
XFMR TURNS RATIO:	5.2531
VOLTAGE RATIO:	3.0329
MEASURED PHASE-ANGLE:	359.687 DEG
MEASURED CURRENT:	0002 mA

TEST H3-H2 AND X3-X0

NAME PLATE VOLTAGE:

H VOLTAGE: H TAP SETTING:	072,450
X VOLTAGE: X TAP SETTING:	023,900
CALCULATED RATIO:	5.2507
MEASURED RATIO:	5.2569
DIFFERENCE:	00.12 %
XFMR TURNS RATIO:	5.2569
VOLTAGE RATIO:	3.0351
MEASURED PHASE-ANGLE:	359.844 DEG
MEASURED CURRENT:	0003 mA

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TYPE: DELTA to Y XFORMER 8

TEST H1-H3 AND X1-X0

NAME PLATE VOLTAGE:	
H VOLTAGE:	069,862
H TAP SETTING:	
X VOLTAGE:	023,900
X TAP SETTING:	
CALCULATED RATIO:	5.0631
MEASURED RATIO:	5.0647
DIFFERENCE:	00.03 %
XFMR TURNS RATIO:	5.0647
VOLTAGE RATIO:	2.9241
MEASURED PHASE-ANGLE:	000.000 DEG
MEASURED CURRENT:	0003 mA

TEST H2-H1 AND X2-X0

NAME PLATE VOLTAGE:	
H VOLTAGE:	069,862
H TAP SETTING:	
X VOLTAGE:	023,900
X TAP SETTING:	
CALCULATED RATIO:	5.0631
MEASURED RATIO:	5.0650
DIFFERENCE:	00.04 %
XFMR TURNS RATIO:	5.0650
VOLTAGE RATIO:	2.9243
MEASURED PHASE-ANGLE:	359.843 DEG
MEASURED CURRENT:	0002 mA

TEST H3-H2 AND X3-X0

NAME PLATE VOLTAGE:	
H VOLTAGE:	069,862
H TAP SETTING:	
X VOLTAGE:	023,900
X TAP SETTING:	
CALCULATED RATIO:	5.0631
MEASURED RATIO:	5.0680
DIFFERENCE:	00.10 %
XFMR TURNS RATIO:	5.0680
VOLTAGE RATIO:	2.9260
MEASURED PHASE-ANGLE:	359.687 DEG
MEASURED CURRENT:	0003 mA

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TYPE: DELTA to Y XFORMER 1

TEST H1-H3 AND X1-X0

NAME PLATE VOLTAGE:	
H VOLTAGE:	070,725
H TAP SETTING:	
X VOLTAGE:	023,900
X TAP SETTING:	
CALCULATED RATIO:	5.1256
MEASURED RATIO:	5.1278
DIFFERENCE:	00.04 %
XFMR TURNS RATIO:	5.1278
VOLTAGE RATIO:	2.9605
MEASURED PHASE-ANGLE:	000.000 DEG
MEASURED CURRENT:	0003 mA

TEST H2-H1 AND X2-X0

NAME PLATE VOLTAGE:	
H VOLTAGE:	070,725
H TAP SETTING:	
X VOLTAGE:	023,900
X TAP SETTING:	
CALCULATED RATIO:	5.1256
MEASURED RATIO:	5.1279
DIFFERENCE:	00.04 %
XFMR TURNS RATIO:	5.1279
VOLTAGE RATIO:	2.9606
MEASURED PHASE-ANGLE:	359.844 DEG
MEASURED CURRENT:	0002 mA

TEST H3-H2 AND X3-X0

NAME PLATE VOLTAGE:	
H VOLTAGE:	070,725
H TAP SETTING:	
X VOLTAGE:	023,900
X TAP SETTING:	
CALCULATED RATIO:	5.1256
MEASURED RATIO:	5.1319
DIFFERENCE:	00.12 %
XFMR TURNS RATIO:	5.1319
VOLTAGE RATIO:	2.9629
MEASURED PHASE-ANGLE:	359.844 DEG
MEASURED CURRENT:	0003 mA

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TYPE: DELTA to Y XFORMER 10

TEST H1-H3 AND X1-X0

NAME PLATE VOLTAGE:	
H VOLTAGE:	068,137
H TAP SETTING:	
X VOLTAGE:	023,900
X TAP SETTING:	
CALCULATED RATIO:	4.9381
MEASURED RATIO:	4.9385
DIFFERENCE:	00.01 %
XFMR TURNS RATIO:	4.9385
VOLTAGE RATIO:	2.8512
MEASURED PHASE-ANGLE:	000.000 DEG
MEASURED CURRENT:	0003 mA

TEST H2-H1 AND X2-X0

NAME PLATE VOLTAGE:	
H VOLTAGE:	068,137
H TAP SETTING:	
X VOLTAGE:	023,900
X TAP SETTING:	
CALCULATED RATIO:	4.9381
MEASURED RATIO:	4.9392
DIFFERENCE:	00.02 %
XFMR TURNS RATIO:	4.9392
VOLTAGE RATIO:	2.8516
MEASURED PHASE-ANGLE:	000.000 DEG
MEASURED CURRENT:	0002 mA

TEST H3-H2 AND X3-X0

NAME PLATE VOLTAGE:	
H VOLTAGE:	068,137
H TAP SETTING:	
X VOLTAGE:	023,900
X TAP SETTING:	
CALCULATED RATIO:	4.9381
MEASURED RATIO:	4.9420
DIFFERENCE:	00.08 %
XFMR TURNS RATIO:	4.9420
VOLTAGE RATIO:	2.8533
MEASURED PHASE-ANGLE:	359.687 DEG
MEASURED CURRENT:	0004 mA

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TYPE: DELTA to Y XFORMER 9

TEST H1-H3 AND X1-X0

NAME PLATE VOLTAGE:	
H VOLTAGE:	069,000
H TAP SETTING:	
X VOLTAGE:	023,900
X TAP SETTING:	
CALCULATED RATIO:	5.0006
MEASURED RATIO:	5.0017
DIFFERENCE:	00.02 %
XFMR TURNS RATIO:	5.0017
VOLTAGE RATIO:	2.8877
MEASURED PHASE-ANGLE:	000.000 DEG
MEASURED CURRENT:	0003 mA

TEST H2-H1 AND X2-X0

NAME PLATE VOLTAGE:	
H VOLTAGE:	069,000
H TAP SETTING:	
X VOLTAGE:	023,900
X TAP SETTING:	
CALCULATED RATIO:	5.0006
MEASURED RATIO:	5.0016
DIFFERENCE:	00.02 %
XFMR TURNS RATIO:	5.0016
VOLTAGE RATIO:	2.8877
MEASURED PHASE-ANGLE:	359.686 DEG
MEASURED CURRENT:	0002 mA

TEST H3-H2 AND X3-X0

NAME PLATE VOLTAGE:	
H VOLTAGE:	069,000
H TAP SETTING:	
X VOLTAGE:	023,900
X TAP SETTING:	
CALCULATED RATIO:	5.0006
MEASURED RATIO:	5.0055
DIFFERENCE:	00.10 %
XFMR TURNS RATIO:	5.0055
VOLTAGE RATIO:	2.8899
MEASURED PHASE-ANGLE:	000.157 DEG
MEASURED CURRENT:	0004 mA

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PE: DELTA to Y XFORMER 12

TEST H1-H3 AND X1-X0

ME PLATE VOLTAGE:

VOLTAGE:	066,412
TAP SETTING:	
VOLTAGE:	023,900
TAP SETTING:	
LCULATED RATIO:	4.8131
ASURED RATIO:	4.8136
DIFFERENCE:	00.01 %
MR TURNS RATIO:	4.8136
-TAGE RATIO:	2.7791
ASURED PHASE-ANGLE:	000.000 DEG
ASURED CURRENT:	0003 mA

TEST H2-H1 AND X2-X0

IE PLATE VOLTAGE:

OLTAGE:	066,412
AP SETTING:	
OLTAGE:	023,900
AP SETTING:	
CULATED RATIO:	4.8131
SURED RATIO:	4.8136
DIFFERENCE:	00.01 %
R TURNS RATIO:	4.8136
TAGE RATIO:	2.7791
SURED PHASE-ANGLE:	000.157 DEG
SURED CURRENT:	0002 mA

TEST H3-H2 AND X3-X0

E PLATE VOLTAGE:

LTAGE:	066,412
P SETTING:	
LTAGE:	023,900
P SETTING:	
ULATED RATIO:	4.8131
URED RATIO:	4.8174
DIFFERENCE:	00.09 %
TURNS RATIO:	4.8174
AGE RATIO:	2.7813
URED PHASE-ANGLE:	359.687 DEG
URED CURRENT:	0004 mA

TYPE: DELTA to Y XFORMER 11

TEST H1-H3 AND X1-X0

NAME PLATE VOLTAGE:

H VOLTAGE:	067,275
H TAP SETTING:	
X VOLTAGE:	023,900
X TAP SETTING:	
CALCULATED RATIO:	4.8756
MEASURED RATIO:	4.8760
DIFFERENCE:	00.01 %
XFMR TURNS RATIO:	4.8760
VOLTAGE RATIO:	2.8152
MEASURED PHASE-ANGLE:	000.000 DEG
MEASURED CURRENT:	0003 mA

TEST H2-H1 AND X2-X0

NAME PLATE VOLTAGE:

H VOLTAGE:	067,275
H TAP SETTING:	
X VOLTAGE:	023,900
X TAP SETTING:	
CALCULATED RATIO:	4.8756
MEASURED RATIO:	4.8761
DIFFERENCE:	00.01 %
XFMR TURNS RATIO:	4.8761
VOLTAGE RATIO:	2.8152
MEASURED PHASE-ANGLE:	000.157 DEG
MEASURED CURRENT:	0002 mA

TEST H3-H2 AND X3-X0

NAME PLATE VOLTAGE:

H VOLTAGE:	067,275
H TAP SETTING:	
X VOLTAGE:	023,900
X TAP SETTING:	
CALCULATED RATIO:	4.8756
MEASURED RATIO:	4.8798
DIFFERENCE:	00.09 %
XFMR TURNS RATIO:	4.8798
VOLTAGE RATIO:	2.8174
MEASURED PHASE-ANGLE:	000.000 DEG
MEASURED CURRENT:	0004 mA

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YPE: DELTA to Y XFORMER 14

TEST H1-H3 AND X1-X0

AME PLATE VOLTAGE:

VOLTAGE:	064,687
TAP SETTING:	
VOLTAGE:	023,900
TAP SETTING:	
ALCULATED RATIO:	4.6880
EASURED RATIO:	4.6883
DIFFERENCE:	00.01 %
FMR TURNS RATIO:	4.6883
OLTAGE RATIO:	2.7068
EASURED PHASE-ANGLE:	359.843 DEG
EASURED CURRENT:	0003 mA

TEST H2-H1 AND X2-X0

AME PLATE VOLTAGE:

VOLTAGE:	064,687
TAP SETTING:	
VOLTAGE:	023,900
TAP SETTING:	
ALCULATED RATIO:	4.6880
EASURED RATIO:	4.6883
DIFFERENCE:	00.01 %
FMR TURNS RATIO:	4.6883
OLTAGE RATIO:	2.7068
EASURED PHASE-ANGLE:	359.687 DEG
EASURED CURRENT:	0002 mA

TEST H3-H2 AND X3-X0

AME PLATE VOLTAGE:

VOLTAGE:	064,687
TAP SETTING:	
VOLTAGE:	023,900
TAP SETTING:	
ALCULATED RATIO:	4.6880
EASURED RATIO:	4.6918
DIFFERENCE:	00.08 %
FMR TURNS RATIO:	4.6918
OLTAGE RATIO:	2.7088
EASURED PHASE-ANGLE:	000.000 DEG
EASURED CURRENT:	0004 mA

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TYPE: DELTA to Y XFORMER 15

TEST H1-H3 AND X1-X0

NAME PLATE VOLTAGE:

H VOLTAGE:	065,550
H TAP SETTING:	
X VOLTAGE:	023,900
X TAP SETTING:	
CALCULATED RATIO:	4.7506
MEASURED RATIO:	4.7511
DIFFERENCE:	00.01 %
XFMR TURNS RATIO:	4.7511
VOLTAGE RATIO:	2.7430
MEASURED PHASE-ANGLE:	000.157 DEG
MEASURED CURRENT:	0003 mA

TEST H2-H1 AND X2-X0

NAME PLATE VOLTAGE:

H VOLTAGE:	065,550
H TAP SETTING:	
X VOLTAGE:	023,900
X TAP SETTING:	
CALCULATED RATIO:	4.7506
MEASURED RATIO:	4.7511
DIFFERENCE:	00.01 %
XFMR TURNS RATIO:	4.7511
VOLTAGE RATIO:	2.7430
MEASURED PHASE-ANGLE:	000.157 DEG
MEASURED CURRENT:	0002 mA

TEST H3-H2 AND X3-X0

NAME PLATE VOLTAGE:

H VOLTAGE:	065,550
H TAP SETTING:	
X VOLTAGE:	023,900
X TAP SETTING:	
CALCULATED RATIO:	4.7506
MEASURED RATIO:	4.7547
DIFFERENCE:	00.09 %
XFMR TURNS RATIO:	4.7547
VOLTAGE RATIO:	2.7451
MEASURED PHASE-ANGLE:	000.000 DEG
MEASURED CURRENT:	0004 mA

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TYPE: DELTA to Y XFORMER 16

TEST H1-H3 AND X1-X0

NAME PLATE VOLTAGE:	
H VOLTAGE:	062,962
H TAP SETTING:	
X VOLTAGE:	023,900
X TAP SETTING:	
CALCULATED RATIO:	4.5630
MEASURED RATIO:	4.5632
DIFFERENCE:	00.00 %
XFMR TURNS RATIO:	4.5632
VOLTAGE RATIO:	2.6346
MEASURED PHASE-ANGLE:	359.843 DEG
MEASURED CURRENT:	0003 mA

TEST H2-H1 AND X2-X0

NAME PLATE VOLTAGE:	
H VOLTAGE:	062,962
H TAP SETTING:	
X VOLTAGE:	023,900
X TAP SETTING:	
CALCULATED RATIO:	4.5630
MEASURED RATIO:	4.5629
DIFFERENCE:	00.00 %
XFMR TURNS RATIO:	4.5629
VOLTAGE RATIO:	2.6344
MEASURED PHASE-ANGLE:	000.000 DEG
MEASURED CURRENT:	0003 mA

TEST H3-H2 AND X3-X0

NAME PLATE VOLTAGE:	
H VOLTAGE:	062,962
H TAP SETTING:	
X VOLTAGE:	023,900
X TAP SETTING:	
CALCULATED RATIO:	4.5630
MEASURED RATIO:	4.5668
DIFFERENCE:	00.08 %
XFMR TURNS RATIO:	4.5668
VOLTAGE RATIO:	2.6366
MEASURED PHASE-ANGLE:	000.000 DEG
MEASURED CURRENT:	0004 mA

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TYPE: DELTA to Y XFORMER 15

TEST H1-H3 AND X1-X0

NAME PLATE VOLTAGE:	
H VOLTAGE:	063,825
H TAP SETTING:	
X VOLTAGE:	023,900
X TAP SETTING:	
CALCULATED RATIO:	4.6256
MEASURED RATIO:	4.6255
DIFFERENCE:	00.00 %
XFMR TURNS RATIO:	4.6255
VOLTAGE RATIO:	2.6705
MEASURED PHASE-ANGLE:	359.686 DEG
MEASURED CURRENT:	0003 mA

TEST H2-H1 AND X2-X0

NAME PLATE VOLTAGE:	
H VOLTAGE:	063,825
H TAP SETTING:	
X VOLTAGE:	023,900
X TAP SETTING:	
CALCULATED RATIO:	4.6256
MEASURED RATIO:	4.6256
DIFFERENCE:	00.00 %
XFMR TURNS RATIO:	4.6256
VOLTAGE RATIO:	2.6706
MEASURED PHASE-ANGLE:	359.843 DEG
MEASURED CURRENT:	0003 mA

TEST H3-H2 AND X3-X0

NAME PLATE VOLTAGE:	
H VOLTAGE:	063,825
H TAP SETTING:	
X VOLTAGE:	023,900
X TAP SETTING:	
CALCULATED RATIO:	4.6256
MEASURED RATIO:	4.6289
DIFFERENCE:	00.07 %
XFMR TURNS RATIO:	4.6289
VOLTAGE RATIO:	2.6725
MEASURED PHASE-ANGLE:	359.843 DEG
MEASURED CURRENT:	0004 mA

TYPE: DELTA to Y XFORMER 17

TEST H1-H3 AND X1-X0

NAME PLATE VOLTAGE:	
H VOLTAGE: H TAP SETTING:	062,100
X VOLTAGE: X TAP SETTING:	023,900
CALCULATED RATIO:	4.5006
MEASURED RATIO:	4.5011
DIFFERENCE:	00.01 %
XFMR TURNS RATIO:	4.5011
VOLTAGE RATIO:	2.5987
MEASURED PHASE-ANGLE:	000.000 DEG
MEASURED CURRENT:	0003 mA

TEST H2-H1 AND X2-X0

NAME PLATE VOLTAGE:	
H VOLTAGE: H TAP SETTING:	062,100
X VOLTAGE: X TAP SETTING:	023,900
CALCULATED RATIO:	4.5006
MEASURED RATIO:	4.5010
DIFFERENCE:	00.01 %
XFMR TURNS RATIO:	4.5010
VOLTAGE RATIO:	2.5987
MEASURED PHASE-ANGLE:	000.157 DEG
MEASURED CURRENT:	0003 mA

TEST H3-H2 AND X3-X0

NAME PLATE VOLTAGE:	
H VOLTAGE: H TAP SETTING:	062,100
X VOLTAGE: X TAP SETTING:	023,900
CALCULATED RATIO:	4.5006
MEASURED RATIO:	4.5046
DIFFERENCE:	00.09 %
XFMR TURNS RATIO:	4.5046
VOLTAGE RATIO:	2.6007
MEASURED PHASE-ANGLE:	000.000 DEG
MEASURED CURRENT:	0004 mA

DATE: 11/20/17 TIME: 18:19:25

HT Power 21/11/17