[redacted]

Transformer Test Report

[redacted]

[redacted]

[redacted]

Type:	OA	/ FA /	FOA					
MVA Rating HV	180	240	300	Volts	230000	Wye	Taps:	5
MVA Rating LV	180	240	300	Volts	138000	Wye	Taps:	33
MVA Rating TV	49	49	49	Volts	13800	Delta	Taps:	None
Phase: 3		Hertz: 60		Temp Rise 65 °C			Oil Insulated	

Losses, efficiencies, and regulations are based on three wattmeter measurements. The error of the loss measurement system used to test this transformer is less than +/- .3% for no load losses and +/- .5% for load losses. The accuracy of our system is verified in accordance with the proceedures outlined in National Institute of Standards and Technology (formerly N.B.S.) Technical Note 1204.
Losses, efficiencies, regulation, % exciting current, impedances, and resistances are based on the normal rating unless otherwise stated.
For three phase transformers, the resistances reported are the sum of the three phases in series.

	Tested	
LOSSES FROM HV-LV AT 85°C AND RATED VOLTAGE:		
No Load Losses at 100% Voltage	153.07	KWatts
Exciting Current at 100% Voltage	0.66	Percent
Load Losses at 180.00 MVA	166.98	KWatts
Total Losses at 180.00 MVA	320.05	KWatts
IMPEDANCE AT RATED VOLTAGE:		
Impedances at 180.00 MVA	4.31	Percent
RESISTANCES AT 85°C AND RATED VOLTAGE:		
Total HV Resistance	0.315	Ohms
Total LV Resistance	0.53077	Ohms
Total TV Resistance	0.02890	Ohms

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EFFICIENCIES:

% Efficiency at 85°C, 100% P.F., and		Percent
	1/4 Load	99.637
	1/2 Load	99.784
	3/4 Load	99.817
	Full Load	99.822
	5/4 Load	99.816

REGULATION:

Regulation at 85°C and 100% load at		Percent
	80% P.F.	2.715
	85% P.F.	2.412
	90% P.F.	2.033
	95% P.F.	1.515
	100% P.F.	0.185

DIELECTRIC TESTS:

Impulse Tests: This transformer has successfully passed A.N.S.I. Impulse Tests. See attached Transformer Impulse Test Report.

Applied Potential Tests: This transformer successfully passed the Applied Potential Test. Voltage applied to each winding with all other windings, tank, and core grounded.

Winding Tested	Applied KV	Duration
HV & LV	50	60 Seconds
TV	34	60 Seconds

INDUCED POTENTIAL TESTS:

Test voltage at 160 hertz, 416 KV line to line, for 7200 periods.

Test voltage at 160 hertz, 364 K

This transformer successfully passed the induced potential test as outlined in - ANSI/IEEE C57.12.00 AND C57.12.90, 1987.

The maximum R.I.V. level recorded was 6.6 uV.

See attached Transformer R.I.V. Test Report.

ZERO-PHASE SEQUENCE IMPEDENCE

Test performed in the rated position at a base of 180.0 MVA.

Calculated Network Impedences	Percent Impedences
Z1	2.603
Z2	1.174
Z3	20.424

Refer to ANSI / IEEE C57.12.90-1987 page 30 for the definations of Z1, Z2, Z3.

CAPACITANCE AND DISSIPATION FACTOR:
Capacitance and dissipation factor per A.N.S.I. Test Method 1 at 20°C.

Connection	Capacitance Picofarads	Dissipation Factor Percent
HV AND LV TO TV AND GROUND	18600	0.190
HV, LV, AND TV TO GROUND	28765	0.154
TV TO HV, LV, AND GROUND	23935	0.141

NO LOAD LOSSES:

	Watts		Percent Exciting Current	
Voltage	Before Impulse	After Impulse	Before Impulse	After Impulse
90%	107700	112320	0.295	0.295
100%	153070	160460	0.664	0.662
110%	221800	228870	1.916	1.835

LOAD LOSSES AND IMPEDANCES AT 85°C:

HV Winding to LV winding

Position HV – LV	Load Loss MVA Base	Load Loss Watts	Impedance MVA Base	Percent Impedance
1 – 17	180.00	181279	180.00	4.88
3 – 17	180.00	166979	180.00	4.31
5 – 17	180.00	154039	180.00	3.80

HV Winding to TV Winding

Position HV – TV	Load Loss MVA Base	Load Loss Watts	Impedance MVA Base	Percent Impedance
3 – 1	29.50	28301	29.50	5.04

LV Winding to TV Winding

Position LV – TV	Load Loss MVA Base	Load Loss Watts	Impedance MVA Base	Percent Impedance
33 – 1	29.50	27835	29.50	3.69
17 – 1	29.50	29466	29.50	4.13
1 – 1	29.50	32871	29.50	4.73

Transformer Test Report

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RATIO TEST:

The H Winding Is Wye Connected
The X Winding Is Wye Connected

Test Position (HV-LV)	Calculated Voltage Ratio	Measured Ratios			% Deviation		
		A Phase	B Phase	C Phase	A Phase	B Phase	C Phase
1 - 17	1.750	1.750	1.752	1.750	0.010	0.090	0.010
2 - 17	1.708	1.710	1.711	1.710	0.075	0.160	0.075
3 - 17	1.667	1.668	1.670	1.668	0.090	0.170	0.085
4 - 17	1.625	1.628	1.629	1.628	0.160	0.250	0.160
5 - 17	1.583	1.587	1.589	1.587	0.240	0.330	0.235
3 - 33	1.515	1.514	1.516	1.518	-0.055	0.025	0.170
3 - 32	1.524	1.524	1.525	1.523	0.010	0.090	-0.060
3 - 31	1.532	1.532	1.533	1.532	-0.010	0.070	-0.010
3 - 30	1.542	1.542	1.543	1.542	0.000	0.075	0.000
3 - 29	1.550	1.550	1.552	1.550	-0.005	0.080	-0.005
3 - 28	1.559	1.561	1.562	1.561	0.090	0.170	0.085
3 - 27	1.568	1.569	1.570	1.569	0.035	0.120	0.030
3 - 26	1.578	1.579	1.580	1.579	0.070	0.150	0.065
3 - 25	1.587	1.588	1.589	1.588	0.035	0.120	0.030
3 - 24	1.597	1.598	1.599	1.598	0.085	0.165	0.080
3 - 23	1.606	1.607	1.609	1.607	0.065	0.150	0.060
3 - 22	1.616	1.618	1.620	1.618	0.120	0.205	0.120
3 - 21	1.626	1.627	1.628	1.627	0.060	0.145	0.060
3 - 20	1.636	1.638	1.639	1.638	0.135	0.220	0.135
3 - 19	1.646	1.647	1.649	1.647	0.090	0.175	0.085
3 - 18	1.656	1.659	1.661	1.659	0.175	0.260	0.170
3 - 17	1.667	1.668	1.671	1.668	0.090	0.270	0.085
3 - 16	1.677	1.680	1.682	1.680	0.180	0.270	0.180

The H Winding Is Wye Connected
The Y Winding Is Delta Connected.

Test Position (HV-YV)	Calculated Voltage Ratio	Measured Ratios			% Deviation		
		A Phase	B Phase	C Phase	A Phase	B Phase	C Phase
3	16.667	16.690	16.700	16.687	0.140	0.200	0.125

The X Winding Is Wye Connected
The Y Winding Is Delta Connected.

Test Position (XV-YV)	Calculated Voltage Ratio	Measured Ratios			% Deviation		
		A Phase	B Phase	C Phase	A Phase	B Phase	C Phase
17	10.000	10.004	9.994	9.993	0.040	-0.060	-0.065

TRANSFORMER R.I.V. TEST REPORT:

HV Winding Rated Voltage: 230000 L-L
LV Winding Rated Voltage: 138000 L-L
TV Winding Rated Voltage: 13800 L-L

Test Freq: 160 Hz.
Voltage Applied To The TV Winding

Tested in HV Tap Position: 1
Tested in LV Tap Position: 17
Tested in TV Tap Position: 1

VOLTS RMS L-L	Percent of Maximum Rated Voltage	Time Held	R.I.V. (uV) A PHASE	B PHASE	C PHASE
0	0	-----	0.7	0.7	0.7
121	50	-----	0.7	0.7	0.7
181	75	-----	1.0	0.7	0.7
242	100	-----	0.7	0.7	1.0
302	125	-----	0.7	0.7	1.0
364	150	-----	0.7	0.7	1.0
416	172	45 SEC.	-----	-----	-----
364	151	0 MIN.	2.0	1.7	5.3
364	151	5 MIN.	1.0	1.7	5.3
364	151	10 MIN.	1.0	1.7	6.7
364	151	15 MIN.	1.0	1.7	6.7
364	151	20 MIN.	1.0	1.7	6.7
364	151	25 MIN.	0.7	1.3	1.3
364	151	30 MIN.	0.7	1.3	0.7
364	151	35 MIN.	0.7	1.3	0.7
364	151	40 MIN.	0.7	1.3	4.0
364	151	45 MIN.	0.7	1.3	4.0
364	151	50 MIN.	0.7	1.3	4.0
364	151	55 MIN.	0.7	1.3	4.0
364	151	60 MIN.	0.7	1.3	4.0
302	125	-----	0.7	0.7	0.7
242	100	-----	0.7	0.7	0.7
181	75	-----	0.7	0.7	0.7
121	50	-----	0.7	0.7	0.7
0	0	-----	0.7	0.7	0.7

MAGNETEK

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TRANSFORMER IMPULSE TEST REPORT

OSCILLOGRAM NO.	TEST	SURGE APPLIED TO TERMINAL NO.	AMPLITUDE (KILOVOLTS)		TIME (MICROSECONDS) TO	
			REQUIRED	APPLIED	CREST	FLASHOVER
0	RFW	H3	375	365	1.3	
01	CW		825	847		3.0
02	CW		825	814		3.5
03	FW		750	752	1.3	
04	RFW	H2	375	375	1.3	
05	CW		825	828		3.0
06	CW		825	823		3.0
07	FW		750	754	1.3	
08	RFW	H1	375	376	1.3	
09	CW		825	824		3.0
10	CW		825	827		3.5
11	FW		750	755	1.3	
14	RFW	X1	275	282	1.3	
15	CW		605	608		6.0
16	CW		605	582		5.0
18	FW		550	574	1.3	
22	RFW	X2	275	277	1.3	
24	CW		605	557		4.5
25	CW		605	592		4.0
26	FW		550	601	1.3	
29	RFW	X3	275	277	1.3	
31	CW		605	563		4.0
32	CW		605	600		4.0
33	FW		550	553	1.3	
39	RFW	HoXo	75	72	1.3	
40	FW		150	150	1.3	
41	FW		150	150	1.3	
45	RFW	Y1	55	56	1.3	
46	CW		120	103		2.0
47	CW		120	111		2.0
48	FW		110	110	1.3	
49	RFW	Y2	55	54	1.3	
50	CW		120	117		2.0
51	CW		120	117		2.0
52	FW		110	106	1.3	

NOTE: RFW - REDUCED FULL WAVE
FW - FULL WAVE
FOW - FRONT OF WAVE
CW - CHOPPED WAVE
SRW - SWITCHING REDUCED WAVE
SFW - SWITCHING FULL WAVE

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