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Energy *focus*

ALL-TEST *Pro*
YOUR GUIDE TO ENERGY SAVINGS

According to the U.S Department of Energy, Industrial Technologies Program– Best Practices website, “Motor-driven equipment accounts for 64 percent of the electricity consumed in the U.S. industrial sector.” Moreover, “...improvements to motor systems could yield dramatic energy and cost savings. The key to these savings is applying energy-efficiency equipment or implementing sound energy management practices.”

For more information about this website go to <http://www1.eere.energy.gov/industry/bestpractices/>

Helping you achieve better motor system energy efficiency

On-Line Motor System Testing

The ATPOL II™ is an on-line electrical motor system testing instrument for evaluating motor systems while they are running. This energized test utilizes Electrical Signature Analysis and Power Analysis to provide information about incoming power, mechanical and electrical health of the motor, and analysis of the driven load (gear boxes, belted applications, bearing, etc). Energized on-line testing will provide valuable information for AC induction and DC motors, generators, wound rotor motors, synchronous motors, servo motors, etc.

Power Monitoring with the ATPOL II will provide answers to these types of questions:

We need to document energy savings- How are the energy savings measures we have implemented performing?

We need to reduce energy consumption – I need to perform an energy audit to evaluate energy savings opportunities.

We need to trouble-shoot incoming power- This transformer is very hot – is it overloaded or are high harmonics the cause?

We need to add more loads- Will my panels and circuits support the new additions?

The ATPOL II answers:

We need to document energy savings- *Monitor energy use prior to the upgrade and then after the upgrade. Then use simple software tools to generate a before and then after action report.*

Choose the report type. Report types consist of either a summary or a comparison. A comparison can either be between two logs or different time periods within the same log.

Report Type

Summary

Comparison

Since you chose the "comparison" type, the report will summarize and contrast two different groups of data, two different "data sets". Summaries of each data set will be arranged in two columns, one for each data set. Each column needs a column heading.

Software generates a simple Microsoft® Word report documenting energy savings.

20 Ton Air Handler

<p>Before Upgrade File 20TonAirHandler.log Test began at 9/23/02 10:17:00 Test ended at 9/24/02 10:15:00</p>	<p>After Upgrade File 20TonAirHandler.log Test began at 9/24/02 1:55:00 Test ended at 9/25/02 1:55:00</p>
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Measurement	Before	After	Units	Change	%Change
Voltage, Phase 1, Ave:	266.8	267.7	volts	0.9	0.3 %
Voltage, Phase 2, Ave:	269.5	270.7	volts	1.2	0.4 %
Voltage, Phase 3, Ave:	267.0	267.9	volts	0.9	0.3 %
Current, Phase 1, Ave:	15.3	15.0	amps	-0.3	-2.0 %
Current, Phase 2, Ave:	14.2	14.2	amps	0.0	-0.2 %
Current, Phase 3, Ave:	15.1	14.9	amps	-0.3	-1.7 %
Current, Neutral, Ave:	0.0	0.0	amps	0.0	0.0 %
Current, Neutral, Max:	0.0	0.0	amps	0.0	0.0 %
Current, Neutral, Min:	0.0	0.0	amps	0.0	0.0 %
Total True Power:	10124.6	10005.4	Watts	-119.2	-1.2 %
Total VA Power:	11945.0	11831.5	VA	-113.5	-0.9 %
Power Factor, Phase 1, Ave:	0.84	0.83		-0.00	-0.1 %
Power Factor, Phase 2, Ave:	0.84	0.84		-0.00	-0.4 %
Power Factor, Phase 3, Ave:	0.87	0.86		-0.01	-0.9 %
Energy, Total Elapsed:	242.992	240.129	KWH	-2.863	-1.2 %
Cost, Total Elapsed:	\$48.60	\$48.03		\$-0.57	-1.2 %
Cost, estimated per month: (at \$0.20000/KWH)	\$1481.27	\$1461.78		\$-19.49	-1.3 %

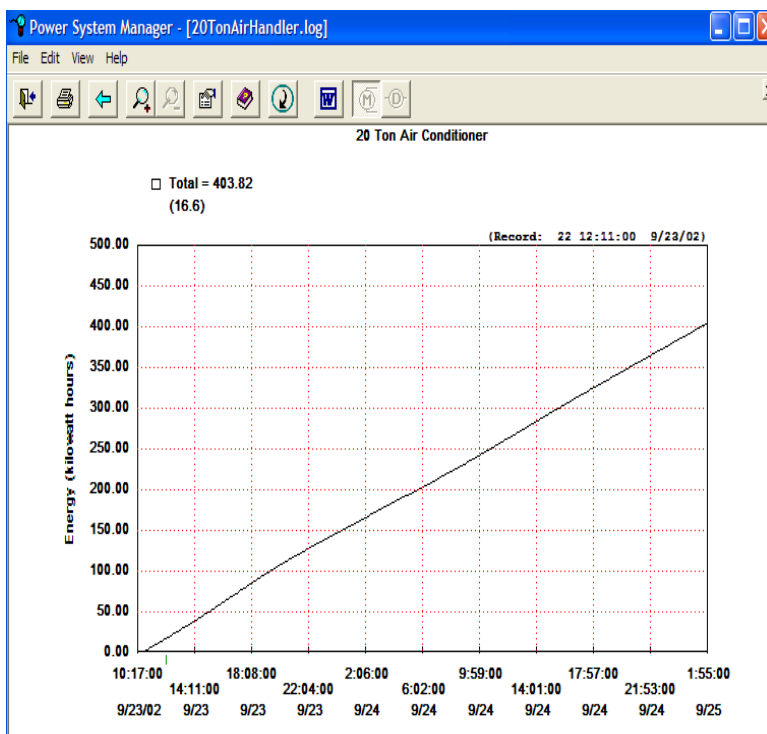
Report Prepared By:

Phone:

Email:

The ATPOL II answers:

Energy Audit: *Monitor actual energy used while the system is operational. Report energy used in actual dollars and not just engineering units (KWh).*



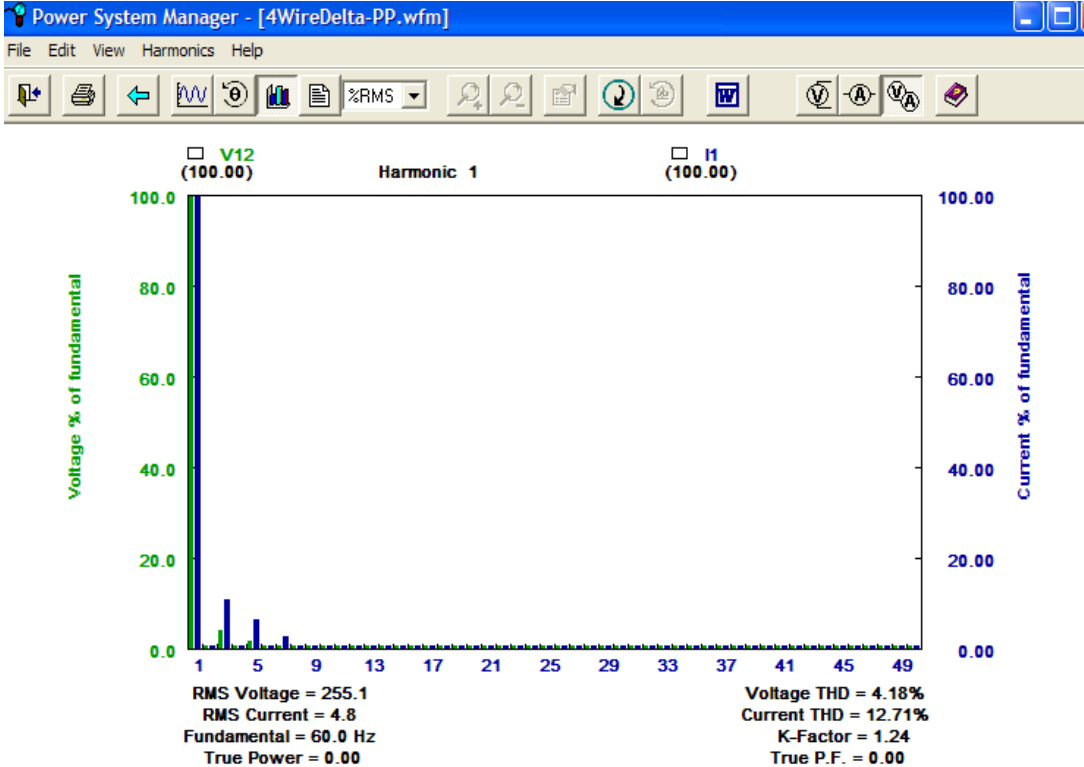
Energy Consumption

File C:\ATPOL\20TonAirHandler.log
 Test began at 9/23/02 10:17:00
 Test ended at 9/25/02 1:55:00

Measurement	Value	Units
Total True Power Ave:	10159.4	Watts
Total VA Power Ave:	11981.6	VA
Total Power Factor:	0.85	
Energy, Total Elapsed:	402.98686	KWH
Energy, estimated per month:	7427.6	KWH
Cost, Total Elapsed:	\$51.18	\$
Cost, estimated per month:	\$943.31	\$

ATPOL II answers:

We need to trouble-shoot incoming power– Monitor and report harmonic distortion of voltage and current. Can be reported graphically or as a Microsoft® Word report.



File: 4WireDelta-PP.wfm

RMS Voltage = 255.1 RMS Current = 4.8 Fundamental = 60.0 Hz True Power = 0.00					Voltage THD = 4.18% Current THD = 12.71% K-Factor = 1.24 True P.F. = 0.00				
Hrm	V12 RMS Voltage Mag	Phase	I1 RMS Current Mag	Phase	Hrm	V12 RMS Voltage Mag	Phase	I1 RMS Current Mag	Phase
1	100.00	0.0	100.000	-86.6	2	0.223	-41.3	0.314	-120.7
3	3.83	130.3	10.557	27.7	4	0.058	0.0	0.282	-177.5
5	1.51	-32.1	6.427	-134.0	6	0.085	0.0	0.162	0.0
7	0.36	-157.9	2.645	99.9	8	0.217	4.5	0.130	0.0
9	0.22	-30.1	0.917	-136.3	10	0.168	0.0	0.180	0.0
11	0.11	0.0	0.570	-24.7	12	0.062	0.0	0.097	0.0
13	0.07	0.0	0.354	86.5	14	0.048	0.0	0.112	0.0
15	0.04	0.0	0.269	-147.9	16	0.045	0.0	0.137	0.0
17	0.06	0.0	0.252	-150.6	18	0.022	0.0	0.040	0.0
19	0.16	0.0	0.053	0.0	20	0.018	0.0	0.055	0.0
21	0.00	0.0	0.060	0.0	22	0.059	0.0	0.038	0.0
23	0.05	0.0	0.083	0.0	24	0.057	0.0	0.024	0.0
25	0.02	0.0	0.034	0.0	26	0.100	0.0	0.078	0.0
27	0.02	0.0	0.056	0.0	28	0.143	0.0	0.091	0.0
29	0.07	0.0	0.042	0.0	30	0.037	0.0	0.059	0.0
31	0.08	0.0	0.025	0.0	32	0.030	0.0	0.049	0.0
33	0.04	0.0	0.022	0.0	34	0.057	0.0	0.025	0.0
35	0.08	0.0	0.075	0.0	36	0.037	0.0	0.015	0.0
37	0.04	0.0	0.049	0.0	38	0.017	0.0	0.041	0.0
39	0.01	0.0	0.028	0.0	40	0.036	0.0	0.030	0.0
41	0.02	0.0	0.016	0.0	42	0.050	0.0	0.044	0.0
43	0.02	0.0	0.048	0.0	44	0.055	0.0	0.026	0.0
45	0.02	0.0	0.025	0.0	46	0.076	0.0	0.037	0.0
47	0.04	0.0	0.037	0.0	48	0.025	0.0	0.043	0.0
49	0.04	0.0	0.052	0.0	50	0.048	0.0	0.002	0.0

This information is provided from the Industrial Technologies Program Website www.industry.energy.gov

Improve Motor System Efficiency with MotorMaster+ Version 4.0 Software Aids Replace/Rewind Decisions

Whether you're a novice or an expert at managing motor systems, MotorMaster+ is designed for you. Developed by the U.S. Department of Energy (DOE) Industrial Technologies Program, this software tool handles everything from calculating the simple payback on a single motor purchase to comprehensive, integrated motor system management.

MotorMaster+ allows users to create or import an inventory of in-plant operating and spare motors. Motor load, efficiency at the load point, annual energy use, and annual operating costs can be determined after taking field measurements. The software quickly identifies inefficient or oversized facility motors and computes the savings that can be achieved by replacing older, standard efficiency motors with premium efficiency models. The software runs on local or wide-area networks for access by multiple users.

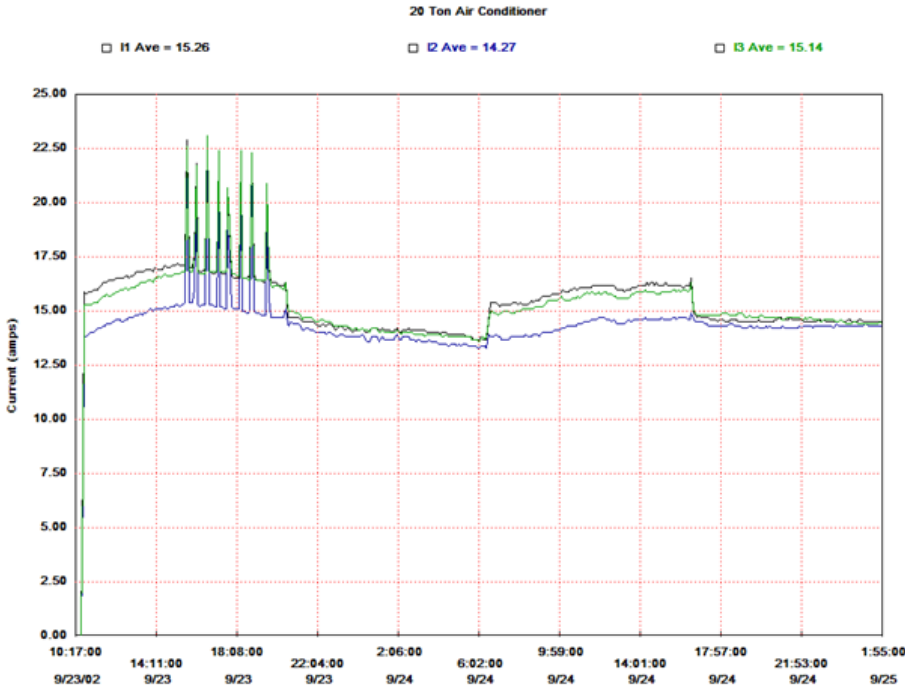
For More Information, please contact: Industrial Technologies Program www.industry.energy.gov EERE Information Center- 1-877-337-3463 www.eere.energy.gov/informationcenter

Prepared by NREL, a national laboratory of the U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, operated by the Alliance for Sustainable Energy, LLC.

ATPOL II ESA software calculates efficiency for AC induction & DC motors. Can be used with MotorMaster+ software program for making repair or replace decisions. MM+ will also calculate payback if upgrading to energy efficient motor.

ATPOL II answers:

We need to add more loads– *Monitor current, voltage, etc. and then generate an easy to read report.*



ATPOL II for Power Analysis

- Power Data Logging
- 3 channels of voltage and 4 channels of current logging
- Waveform capture of events $\geq \frac{1}{2}$ cycle
- Transient detection of events ≥ 8 micro-seconds
- Energy data logging
- Harmonic analysis to 63rd (V & I)
- Phasor graphs
- Pre-set and easy to use report templates
- Report energy savings using a before and after analysis function

On-Line Electrical Motor Testing 101

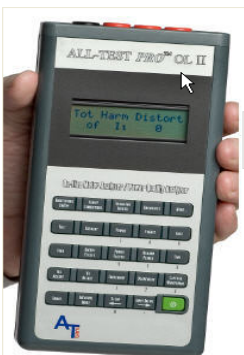
Electrical Signature Analysis (ESA) is an on-line test method where voltage and current waveforms are captured while the motor system is running and then, via a Fast Fourier Transform (FFT), a spectral analysis is done by the provided software. From this FFT, faults related to incoming power, the control circuit, the motor itself, and the driven load are detected and can then be trended for Condition Based Maintenance/Predictive Maintenance purposes. Our particular ESA instrument is handheld, portable and battery operated.

All ESA analysis systems require motor nameplate information of voltage, running speed, full load current, and horsepower (or kW). Additionally, optional information such as rotor bar and stator slot count, bearing numbers, and information for driven load components, such as blade count for a fan or tooth count for a gear box application can be entered for a more detailed and accurate analysis.

Energized on-line testing will provide valuable information for AC induction and DC motors, generators, wound rotor motors, synchronous motors, machine tool motors, etc. Since ESA is new to many people, the chart below illustrates ESA's evaluation capabilities of the major components within a motor system.

	Power Quality	Controls	Connections	Cables	Stator Elec	Stator Mech	Rotor	Air Gap	Insulation	Bearings	Alignment	Load	Drives
ESA	X	X	L	-	L	X	X	X	-	X	X	X	L

*Green indicates that a developing fault can be both detected and trended for Condition Based Maintenance or Predictive Maintenance purposes. Yellow indicates a fault can be detected, but not at its earliest stage.



Interested in Motor Diagnostics Training?

Learn to be more proactive than reactive in your predictive maintenance program. We offer both public training courses and in-plant training courses worldwide. Go to our website www.alltestpro.com and then click on the link titled Training and Support.



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