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WANLASS MOTORS

AUTHOR: G. Dann

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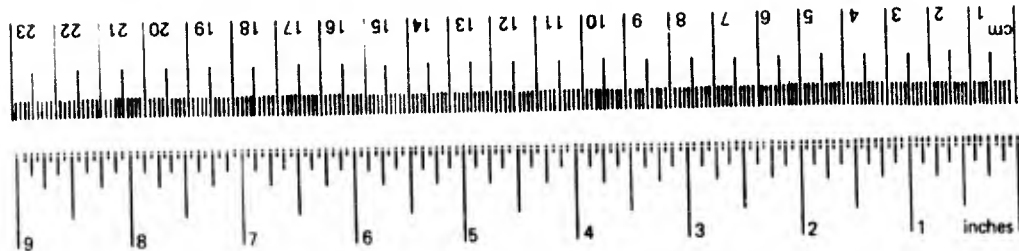
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When You Know	Multiply by	To Find	Symbol
LENGTH			
millimeters	0.04	inches	in
centimeters	0.4	inches	in
meters	3.3	feet	ft
meters	1.1	yards	yd
kilometers	0.6	miles	mi
AREA			
square centimeters	0.16	square inches	in ²
square meters	1.2	square yards	yd ²
square kilometers	0.4	square miles	mi ²
hectares (10,000 m ²)	2.5	acres	
MASS (weight)			
grams	0.035	ounces	oz
kilograms	2.2	pounds	lb
tonnes (1,000 kg)	1.1	short tons	
VOLUME			
milliliters	0.03	fluid ounces	fl oz
liters	2.1	pints	pt
liters	1.06	quarts	qt
liters	0.26	gallons	gal
cubic meters	35	cubic feet	ft ³
cubic meters	1.3	cubic yards	yd ³
TEMPERATURE (exact)			
Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F



Approximate Conversions to Metric Measures

When You Know	Multiply by	To Find	Symbol
LENGTH			
inches	*2.5	centimeters	cm
feet	30	centimeters	cm
yards	0.9	meters	m
miles	1.6	kilometers	km
AREA			
square inches	6.5	square centimeters	cm ²
square feet	0.09	square meters	m ²
square yards	0.8	square meters	m ²
square miles	2.6	square kilometers	km ²
acres	0.4	hectares	ha
MASS (weight)			
ounces	28	grams	g
pounds	0.45	kilograms	kg
short tons (2,000 lb)	0.9	tonnes	t
VOLUME			
teaspoons	5	milliliters	ml
tablespoons	15	milliliters	ml
fluid ounces	30	milliliters	ml
cups	0.24	liters	l
pints	0.47	liters	l
quarts	0.95	liters	l
gallons	3.8	liters	l
cubic feet	0.03	cubic meters	m ³
cubic yards	0.76	cubic meters	m ³
TEMPERATURE (exact)			
Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

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reduction in current flow and a corresponding improvement in power factor can be expected with the Wanlass rewind. A small improvement in efficiency — a reduction in power consumption — is possible but not certain. It was recommended that Wanlass rewinds not be purchased on the basis of energy savings or power factor improvement.

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MOTORS (Final), by G. Dann
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Electric motors are a major part of the load at Naval shore facilities. The Naval Civil Engineering Laboratory (NCEL) investigated the Wanlass motor as a means of reducing power consumption, reducing current flow, and improving power factor, as compared to standard motors. NCEL surveyed the literature on single-phase and poly-phase Wanlass motors and tested poly-phase Wanlass motors. Efficiency, current, power factor, load sharing, temperature rise, vibration and noise, torque-speed, and reliability were judged. A reduction in current flow and a corresponding improvement in power factor can be expected with the Wanlass rewind. A small improvement in efficiency — a reduction in power consumption — is possible but not certain. It was recommended that Wanlass rewinds not be purchased on the basis of energy savings or power factor improvement.

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BACKGROUND

The Navy, like all consumers, is looking for ways to reduce energy consumption. Electricity is a major energy source at shore facilities. Motors are a major part of the electric load--75% of the electric consumption of American industries, according to the Department of Energy. Many Navy facilities, in particular shipyards, have similar consumption ratios. The Wanlass technology, advertised as offering significant improvements in the efficiency of alternating current (AC) induction motors, was investigated as a means of reducing this energy consumption.

A Wanlass motor is an AC induction motor, with capacitors added. For single-phase motors the capacitor is in series with one of the two windings. Figure 1 is a basic single-phase Wanlass motor configuration. For three-phase motors the motor is rewound so that it contains two sets of windings. One set is connected directly to the power source. The other set is in series with the capacitors. There is a capacitor, or group of capacitors, for each of the three phases. Figure 2 is a basic three-phase Wanlass motor configuration. The Wanlass technology is also applicable to induction generators and to synchronous motors and generators, according to Don Asp, vice president of Wanlass Research, Inc., and the person who assisted Mr. Wanlass throughout the development of his motors.

The Wanlass technology dates back to 1975, when Cravens Wanlass, former head of research for several large corporations, devised a motor that he claimed had significantly better efficiency than conventional motors. Mr. Wanlass obtained a patent for this motor and formed a company to market it. Around 1977 the company began retrofitting existing single-phase motors. The Naval Civil Engineering Laboratory (NCEL) then issued an interim report outlining the Wanlass theory, history, and claims (Ref 1). For reasons not clear, the company went out of business. Later, another company was formed to retrofit three-phase motors. The motors tested by NCEL at San Diego (Appendix A), and a motor now in use at NCEL, were rewound by this company. This company also went out of business before the last of NCEL's test motors was completed in 1981. Mr. Wanlass has since moved from Orange County, Calif., to Carson City, Nev. He has started a new company, which sells three-phase motor retrofits through independent licensed shops.

WANLASS MOTOR THEORY

The following is the author's understanding of the way the Wanlass three-phase motor works, based on reading Wanlass literature and discussions with Wanlass Research Company personnel.

The "Wanlass technology" is a method of winding and connecting AC induction motors, invented and patented by Cravens Wanlass. The purpose of the Wanlass motor is to reduce power consumption, reduce current flow, and improve power factor, as compared to standard motors. The

technology is applicable to single-phase and poly-phase motors. It is now available only as a remanufacture of existing three-phase motors by independent shops under license from the Wanlass Research Company.

Three-phase induction motors are typically 80 to 90% efficient at full load and less efficient at low loads. The sources of inefficiency are:

Magnetic hysteresis (iron loss)	- varies with current
Resistive heating (copper loss)	- varies with current
Friction and windage	- fixed

The Wanlass design is claimed to lower iron and copper losses.

Construction

The stator has two sets of windings, where a standard motor has one set. One set, called the control winding, is connected directly to the power line. The other set, called the main winding, is connected in series with a capacitor to the power line (see Figure 2). The main and control windings for a given phase are physically displaced by an angle of 60 degrees. (The reason for this displacement will be explained below.) The two winding sets are laid one on top of the other in the slots in the motor frame.

Wanlass rewinds cost about twice as much as conventional rewinds. Wanlass motors now are equipped with foil capacitors. For NCEL's test motors of 40 to 100 hp, capacitances ranged from 75 to 300 μ F.

Wanlass motors are usually designed for a single-voltage application. Dual-voltage Wanlass motors require additional windings and capacitors. A three-phase Wanlass motor has 12 wires connecting the motor to the capacitor box. This compares with three wires for a standard single-voltage motor and nine wires for a standard dual-voltage motor.

Theory of Operation

It is claimed that the Wanlass motor works almost the same as a standard motor at high loads, but it uses much less current than a standard motor at low loads. Current in the main winding is almost constant in magnitude and phase angle, with respect to the power supply, regardless of the load. This is because the capacitor limits the current. Current in the control winding, however, varies in magnitude and phase angle as the load varies, the same as current in the one winding of a standard motor. At full load, the ratio of I_{control} to I_{main} is in the range of 1.3 to 1.8. The main and control winding currents are equal at about 60% of full load.

Each of these currents creates a magnetic field. The vector sum of these two magnetic fields is the field that drives the rotor. The combination of 60-degree physical displacement, phase displacement due to the capacitor, and variable phase angle causes the two magnetic fields and currents to be nearly in phase at high loads and somewhat out of phase at low loads. Thus, the total magnetic field varies with the load. In other words, the magnetic flux density is controlled automatically. Greater effective flux density but lower peak flux density

gives lower iron losses. Figure 3 shows flux density as a function of time, according to Wanlass theory. Another way of stating the theory: The main winding (with capacitor) transfers energy to the rotor at a level that is constant, regardless of load. The control winding (without capacitor) transfers energy to the rotor at a variable rate, depending on load. At light loads, the control winding is a generator. Since the net magnetic field is reduced at low loads, the magnetization level of the iron core and therefore the iron losses should be reduced, as compared to a standard motor. More copper (about 7 to 10%) is usually installed in a Wanlass rewind than was in the original motor, so copper losses should be lower also. At all load levels, the vector sum of currents should be very close in phase angle to the applied voltage, so the power factor should be high--nearly unity--and the total current drawn by the motor should be minimized.

Installation and Application Information

According to some people who have worked with Wanlass motors, including the manager of the shop that remanufactured the motors for the NCEL/Puget Sound Naval Shipyard (PSNSY) tests, the capacitance must be adjusted for the precise voltage in use in order to optimize the Wanlass motor's characteristics. However, according to the Wanlass Company, the Wanlass motor will operate properly over a wide range of voltage, as much as $\pm 20\%$, without need for change of capacitance. One of NCEL's test motors at PSNSY was operated with two different values of capacitance. No significant difference in current flow, power factor, or efficiency could be detected.

Reversing the direction of rotation of a Wanlass motor is more complex than reversing a conventional motor. A Wanlass three-phase motor will run in the reverse direction at lower than optimum efficiency and torque if two of the power leads are exchanged as would be done with a conventional motor. For optimum operation, all 12 leads from the motor must be rearranged. The wiring diagram is part of the Wanlass nameplate mounted on the capacitor box. It is possible to install a multi-pole reversing switch on a Wanlass motor. The motor should come to a full stop before power is applied in a reverse direction, according to Wanlass representatives.

SUMMARY OF WANLASS MOTOR TESTS

Single-Phase (Ref 2)

Single-phase tests demonstrated that significant improvements in efficiency are possible for many single-phase, fractional-horsepower motors. However, there is usually a trade-off between efficiency and other motor attributes, such as breakdown torque.

Poly-Phase

The first NCEL test of Wanlass motors was at the Naval Station, San Diego in 1981. Reference 3 (Appendix A) is a report on this test. Applications were selected where two identical motors were installed

with identical loads, such as a pair of pump units. One motor of each pair was rewound by Wanlass, then both motors of each pair were run under identical conditions. NCEL tested two such pairs. One of the two Wanlass motors showed reduced power consumption compared to an identical, unmodified motor. Both motors showed reduced temperature rise.

The second NCEL test was at the Puget Sound Naval Shipyard (PSNSY), Bremerton, Wash. (Details of this are in Appendix B). Five motors were selected, tested on a dynamometer, converted to Wanlass motors, and retested. The tests followed method B of Reference 4. Two of these motors were also monitored in their regular applications before and after the conversion. This series of tests showed negligible improvement in most attributes as a result of the conversion.

The tests by the Massachusetts Institute of Technology (MIT) (Ref 4) and the University of Colorado (Ref 6) demonstrated a reduction in efficiency as a result of Wanlass motor conversions. The MIT report also contains a theoretical analysis of the Wanlass motor.

Motor Parameters

Efficiency--Efficiency of the motors NCEL tested on a dynamometer improved for some motors at some load points and decreased for others. Overall, improvement was not significant.

Current--Current flow in a Wanlass motor is significantly less than in the same motor before conversion.

Power Factor--Power factor (PF) of the Wanlass motors NCEL tested was improved significantly. At light loads, the Wanlass motors in the dynamometer tests had leading power factor. This can be attributed to the capacitance in the circuit. If a capacitor of the same size used in the Wanlass circuit would be connected in parallel with the equivalent standard motor, a power factor improvement of approximately the same amount would result. For example, the required capacitance and resulting power factor are calculated below for one of the test motors, a 50-hp, 1,800-rpm, 460-volt model. The Wanlass version of this motor had unity power factor at 75% of full load, so that load point is the basis for the capacitance calculation:

<u>Motor</u>	<u>Voltage, V</u>	<u>kW</u>	<u>kVA</u>	<u>Power Factor, PF</u>	<u>Current, I (amp)</u>
Standard	447	32.5	38.8	0.84	50.5
Wanlass	448	33.0	32.8	1.01	42.9

$$(\text{Reactive power})^2 = (\text{Apparent power})^2 - (\text{Real power})^2$$

For the standard motor,

$$PR = 21.2 \text{ KVAR}$$

Capacitance to consume a given reactive power:

$$C = \frac{PR \times 1,000}{2 \pi F(V)^2}$$

where: PR = reactive power, kVAR
V = voltage, kV
C = capacitance, μ F
F = frequency, Hz

For the Wanlass motor, C = 281 μ F total, or 94 μ F/phase.

The power factor obtained by adding this much capacitance in parallel with the standard motor is shown in Table 1. The Wanlass motor in the tests had a capacitance per phase of 75 μ F. The power factor expected by applying this capacitance in parallel with the standard motor is shown in Table 2 (reactive power for 75 μ F/phase at 447 volts is, by the above formulas, 16.9 kVAR). Note that the theoretical power factor for the standard motor plus 75- μ F/phase capacitance is about the same as the power factor measured for the Wanlass motor.

Load Sharing--In the "after rewind" field tests at Puget Sound Naval Shipyard, each of two blower motors tested (50 and 75 hp) was returned to service where it and another motor, identical except for not having been Wanlass-converted, drove blowers drawing exhaust from a common plenum. The current drawn by each motor and each motor's speed were measured. Using the curves drawn from the dynamometer tests, it was estimated that the Wanlass motor was assuming less of the load than the unmodified motor in both cases. Attempts to measure the air flow through each fan were unsuccessful due to the shape of the ductwork. Details of these tests are in Appendix B.

Temperature Rise--Changes measured in NCEL's tests at San Diego show an improvement (lower temperature rise above ambient temperature) due to the Wanlass rewind. On one of the test motors, the change was significant, from 57°C rise for the standard motor down to 35°C rise for the Wanlass motor. For the other motor tested, the change was negligible. For both of the blower motors field tested at PSNSY, temperature rise was higher after the Wanlass rewinds for loads that were approximately the same before and after rewind. Temperature rise tests on the dynamometer were not run. Temperature rise, like efficiency, may be improved or degraded as a result of the Wanlass rewind. There is no way for the purchaser to predict which will happen. The temperature rise was not a problem in any of NCEL's test samples. (One motor did overheat after rewind, but the problem was a faulty bearing.)

Vibration and Noise--Noise levels were measured in the tests at Puget Sound Naval Shipyard, and it was determined that noise attributable to the windings of the motor is less than, and masked by, noise and vibration due to bearings, couplings, and machinery.

Torque-Speed--Torque-speed curves of the motors tested on the dynamometer were not significantly affected by the Wanlass rewind.

Reliability--Reliability of Wanlass motors is the same as that of standard motors, as well as can be determined. The motors converted for the San Diego and Bremerton tests, plus one motor installed in a machine tool at NCEL in 1981, have all performed without problems.

CONCLUSIONS

A reduction in current flow and a corresponding improvement in power factor can be expected with the Wanlass rewind. A small improvement in efficiency--a reduction in power consumption--is possible but not certain.

RECOMMENDATION

Wanlass rewinds should not be purchased on the basis of energy savings or power factor improvement.

ACKNOWLEDGMENTS

The author thanks the following people who contributed to this project:

Brian Milner, formerly of NCEL, for conceiving and planning all the Wanlass Motor tests conducted by NCEL.

Jim Sura and Bob Walicki, of Puget Sound Naval Shipyard (PSNSY), for assisting in the planning of the tests at PSNSY, coordinating the myriad of people and organizations within the shipyard involved in the tests, running most of the dynamometer and field tests, arranging for visits of NCEL people and others to the shipyard, suggesting some very worthwhile improvements to the test procedures, and taking a genuine interest in the project.

All the people of PSNSY who participated in the project, particularly those of the electric motor shop, for their hospitality, patience, and the training they gave the author in the practical aspects of motor testing.

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Table 1. Calculated Power Factor, 50-hp Motor, 94 μ F

Load (%)	Power (kW)	Apparent Power (kVA)	Motor Reactive Power (kVAR)	Net Reactive Power (kVAR)	New Apparent Power (kVA)	New Power Factor
0	5.8	17.0	16.0	5.2 ^a	7.8	0.74 ^a
25	12.5	19.3	14.7	6.5 ^a	14.1	0.89 ^a
50	23.0	27.0	14.1	7.1 ^a	24.1	0.96 ^a
75	32.5	38.8	21.2	--	32.5	1.00
100	44.3	49.3	21.6	0.4 ^b	44.3	1.00
125	53.5	61.3	29.9	8.7 ^b	54.2	0.99 ^b
150	64.5	75.0	38.3	17.1 ^b	66.7	0.97 ^b

^aCapacitive (leading).

^bInductive (lagging).

Table 2. Calculated Power Factor, 50-hp Motor, 75 μ F

Load (%)	Net Reactive Power (kVAR)	New Apparent Power (kVA)	New Power Factor	Wanlass Motor Power Factor
0	0.9 ^a	5.9	0.99 ^a	0.62 ^a
25	2.2 ^a	12.7	0.98 ^a	1.06 ^b
50	2.8 ^a	23.2	0.99 ^a	0.99 ^a
75	4.3 ^c	32.8	0.99 ^c	1.01 ^d
100	4.7 ^c	44.6	0.99 ^c	1.02 ^d
125	13.0 ^c	55.1	0.97 ^c	0.97 ^c
150	21.4 ^c	68.0	0.95 ^c	0.94 ^c

^aCapacitive (leading).

^bError probable in reading of ammeter.

^cInductive (lagging).

^dCalculated power factor excessive due to meter tolerance.

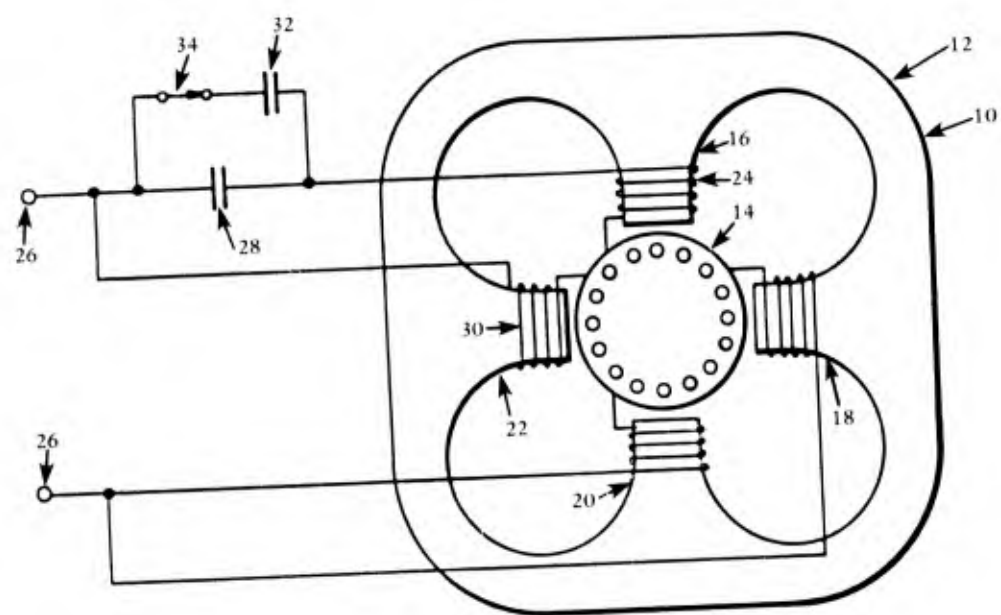
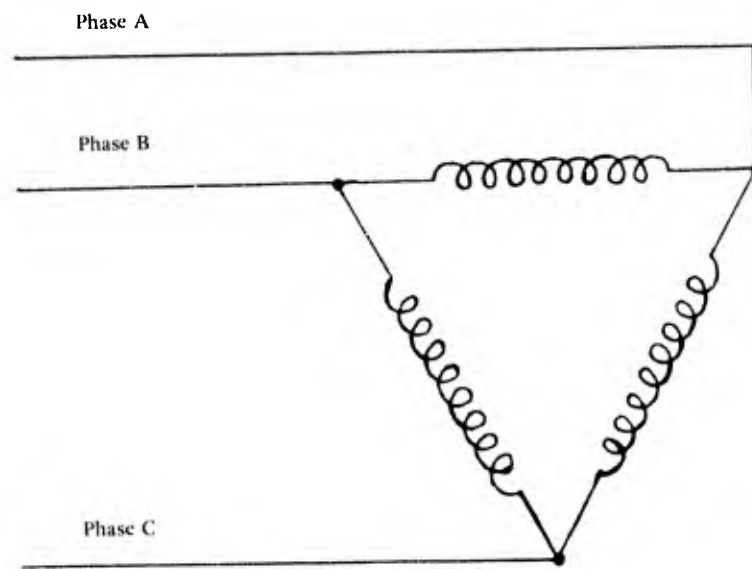
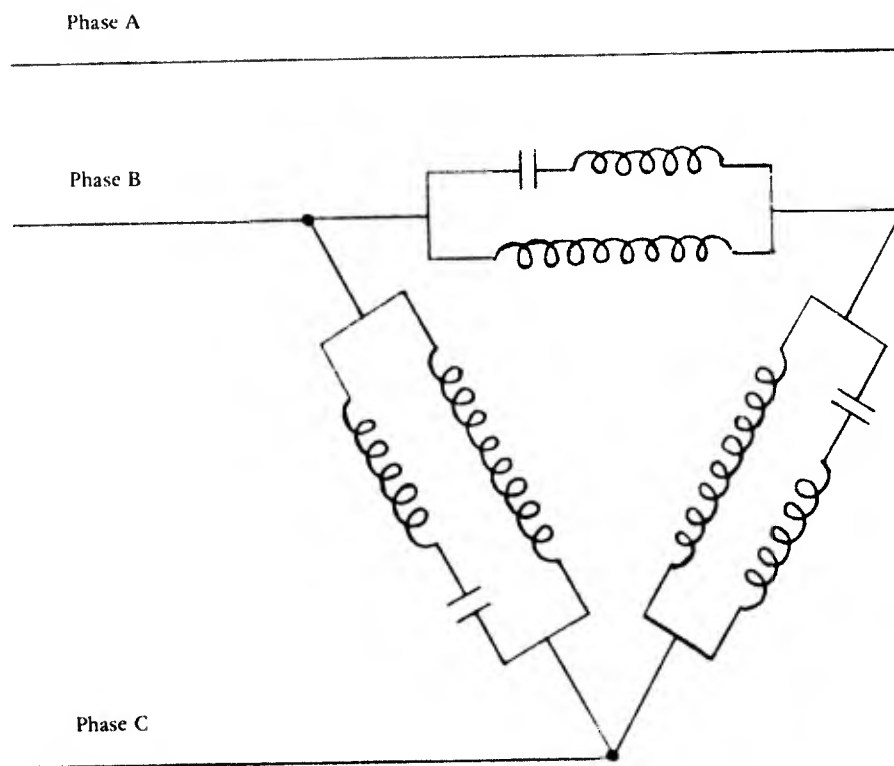


Figure 1. Single-phase Wanlass motor.



(c) Conventional motor.



(b) Wanlass motor.

Figure 2. Three-phase motors.

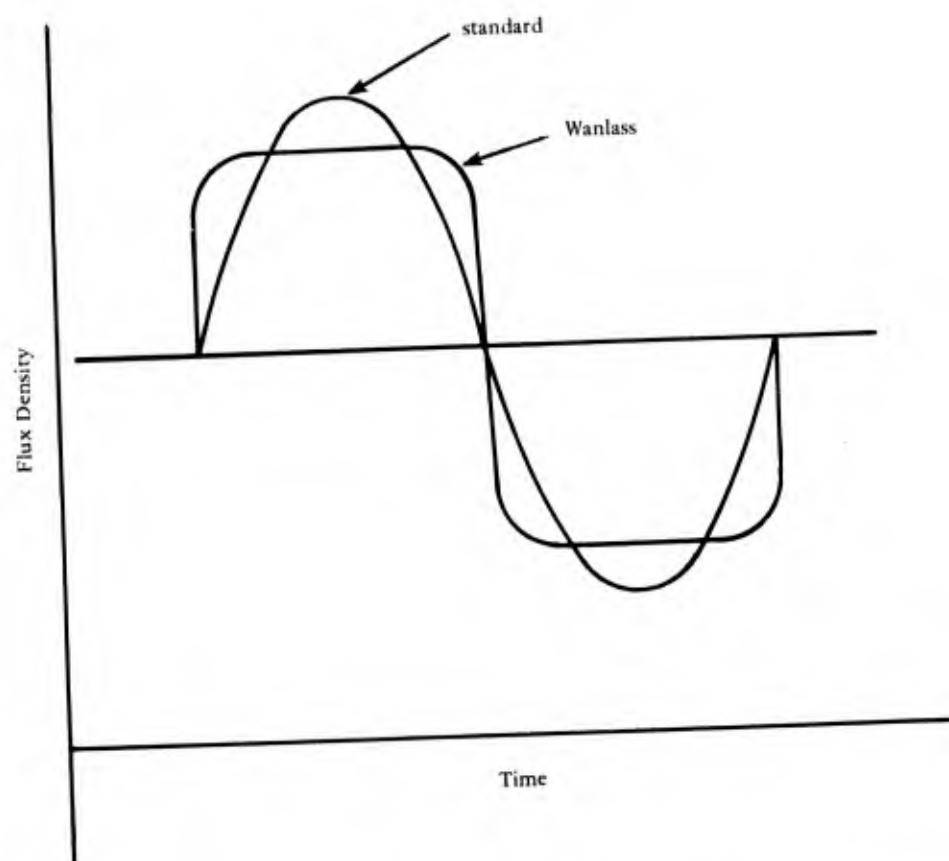


Figure 3. Magnetic flux density in motors.

Appendix A
FIELD DEMONSTRATION OF THREE-PHASE WANLASS
MOTORS: AN INTERIM REPORT

by
Brian R. Milner

INTRODUCTION

Electric energy costs at Navy shore facilities in FY80 exceeded \$343 million (1). Electric motors are estimated to account for nearly two-thirds of the Navy's electricity consumption. Therefore, there is significant incentive to pursue methods of reducing energy consumption in the Navy's electric motors. One of the most obvious ways to reduce motor energy consumption is to increase the efficiency of the motors. Since 1977, Wanlass Corporation has been developing a technology for high-efficiency motors. Although conventional motor technology for high-efficiency motors has existed for many years, Wanlass has successfully obtained patents for this new technology. The Wanlass technology appeared to have sufficient potential for energy savings to warrant an investigation. This report describes field evaluations of three-phase Wanlass motors as of 1 September 1981.

This memorandum was prepared as an internal working document; therefore, its distribution is limited to U. S. Government agencies only, and disclosure of all or part of its contents outside the Government must have prior approval of the Naval Civil Engineering Laboratory or the sponsor of the work reported.

BACKGROUND

In 1977, Wanlass Corporation announced development of a new electric motor technology aimed at reducing energy consumption through increased motor efficiency. This technology was initially available for single-phase motors and was evaluated in a laboratory environment at the U. S. Army Mobility Equipment Research and Development Command under the sponsorship of the U. S. Department of Energy (2). The results confirmed the feasibility of significant efficiency improvement when a conventional single-phase induction motor was modified per the Wanlass technology. However, there are practical limitations for the retrofitting of single-phase motors. Wanlass did not pursue implementation of the single-phase technology on a large scale, reportedly because of economic reasons.

During 1979 Wanlass announced the capability to remanufacture three-phase motors with the new technology. This process is described briefly in Attachment I. Since three-phase motors generally have a larger ratio of energy (operating) cost to equipment (capital) cost than single-phase motors, it was felt that there was better potential for economic justification of the three-phase Wanlass method if the motor performance was satisfactory. In the absence of an independent source of field performance evaluations of the three-phase Wanlass motor, a field demonstration of remanufactured three-phase Wanlass motors was planned at Navy facilities.

SCOPE

The basis for the Navy's field demonstration was to study the impact of remanufactured, three-phase Wanlass motors in a realistic, operational environment. This allowed the opportunity to assess factors such as energy consumption, temperature rise, power factor, current harmonics, installation logistics and operational side-effects in actual Navy facilities. The inability to precisely control the operating conditions makes the task of determining actual efficiency

changes by the remanufacturing process difficult. However, it was felt that this was a worthwhile trade-off to make in return for analysis in a field environment. Laboratory testing of the motors before and after remanufacturing was not planned due to lack of readily available test facilities and logistical problems involving the large motors which could not be out-of-service for extended periods. A controlled laboratory test should be performed on some three-phase Wanlass motors but this could be accomplished much more easily independent of a field demonstration, and is considered to be outside the scope of this effort. Laboratory tests may be added to the test program at a later time if deemed necessary, provided that such results are unavailable from another independent source at that time.

One goal of this test program was to obtain reasonably accurate comparisons of standard and Wanlass motors in the field environment. To accomplish this, eight installations were selected where there were duplicate motors operating side-by-side on identical or similar loads. A variety of motor sizes from 15 horsepower (hp) to 100 hp were identified for the tests. The motor loads consisted of pumps and air compressors, including some continuous and some intermittent operation.

One motor at each installation was identified for remanufacture by Wanlass. After modification, the Wanlass motor was to be compared with an unmodified companion (standard) motor at the same site.

Conversion of the first two motors was accomplished smoothly; the rebuilt Wanlass motors were reinstalled within one to two weeks after removal. However, the third motor was held by Wanlass for approximately five weeks. According to the Wanlass Corporation, there was some difficulty in obtaining the expected performance from the rebuilt motor. At least three rewinds were made, none of which met the level of performance expected by Wanlass. The motor was then reinstalled at the request of the Naval facility in order to meet operational requirements. Wanlass Corporation expressed a desire to rebuild that motor after they resolved their technical problems with the winding design of that motor. A fourth motor was rewound by Wanlass before the company suspended its remanufacturing operations, reportedly to resolve technical problems similar to that mentioned above.

Tests of the remanufactured Wanlass motors were performed with the exception of the third motor, which was out of service at the time of the tests due to an unrelated construction project. This reduced the program to three motors, considered to be an insufficient number for a conclusive test. However, significant delays were expected before the eight motors could be completed, so it was decided to proceed with testing and report the initial findings at this time.

TEST PROCEDURE

Each Wanlass motor and its standard companion motor were instrumented for the following data:

- a. Voltage
- b. Current

- c. Power (input)
- d. Energy usage
- e. Frame temperature (external)
- f. Speed
- g. Operating time
- h. Current harmonics
- i. Current waveform

A typical circuit diagram is shown in Figure A-1. The instruments used for each data item are as follows:

- a, b, c - Digital AC meter, Yokogawa Electric Works (YEW) Model 2505, S/N 00325 with portable current transformers YEW type 2241, S/N 04545, 04546, 04463.
 - d - Integrator module, YEW type 2513, S/N 00362.
 - e - Thermocouple, Type T, Hy-Cal Engineering Model TC-2345-A-T-10-6.
 - f - Digital phototachometer, Cole-Parmer Instr. Co. Model 8205, S/N 979662.
 - g - Timer, operated by current sensing relay.
 - h - Wave analyzer, Hewlett-Packard, Model 3581A, S/N 1351A00222.
 - i - Oscilloscope, Tektronix Type 564, S/N 004276.
- a, b, c, d, e - Data Acquisition System, Analog Devices MACSYM 2, S/N 2157.

The MACSYM 2 was programmed to log all parameters at a specified interval (15 or 30 sec.) throughout the test period. These data provided the basis for the analysis. Where possible, parameters indicative of the motor load or work done were noted (e.g., flow, pressure).

Each motor was monitored for one day of normal operation. Care was taken to ensure that operation during the test was typical for each installation. Wanlass and standard motor pairs were monitored on consecutive weekdays to minimize the chance of load variations due to weather, utility system demand, etc.

TEST RESULTS

Building 247, Submarine Support Facility, San Diego, CA
Air Compressor Motors 1 and 2.

These two 20 hp motors drive separate air compressors (reciprocating type)

as shown in Figure A-2. Table A-1 shows the nameplate data for the standard motor (#1) and the Wanlass motor (#2) before and after rewinding. Although the two original motors are not identical, there is enough similarity to provide useful information. The compressors cycle on and off on demand, primarily supplying air to sewage lines to balance the line pressure on the output side of the sewage pump check valve. During normal operation compressor #1 is the primary unit, turning on at 240 psig and off at 300 psig. Compressor #2 operates between 235 psig and 300 psig. For these tests one unit was disconnected while the other was being monitored.

Table A-2 summarizes the motors' performance data. Current waveforms and harmonic content are shown in Figures A-3 and A-4, respectively. Temperature rise of the two motors is depicted in Figure A-5. During the tests the ambient temperature varied between 22°C and 27°C.

On the basis of the test data, it appears that the two motors operate quite similarly, except for the current and power factor. The higher energy usage by the Wanlass motor can be attributed to more operating cycles and longer running time. The difference in running time was due to any of several reasons: Different air demands, compressor performance, motor efficiency, etc. It was most likely due to a difference in compressor performance since the compressed air demand seemed to be unchanged. If there was a significant difference in efficiencies of the motors, one might expect to see more dramatic evidence than shown in Table A-2. Also, the similarity in temperature rise would tend to indicate similar losses for the two motors. Finally, the Wanlass motor exhibited higher harmonic current levels, but not to a serious extent.

Building 63, Ream Field, Imperial Beach, CA
Fresh Water Pump Motors 1 and 2.

Two 30 hp motors (see Figure A-6) drive pumps to supply fresh water to the base in event of failure of the city water supply. Normally these motors run a few hours per week for circulation/chlorination of water in the storage tank. During this test each motor was run continuously for about five hours. Nameplate information for the motors is given in Table A-3. The motors were identical prior to the Wanlass modification. This location also afforded an opportunity to duplicate the operation of the two motors quite closely.

The performance data for this test are summarized in Table A-4. Figures A-7 and A-8 show current waveforms and harmonic content. Figure A-9 shows the temperature rise of the two motors during the tests. The ambient temperature ranged from 25°C to 29°C.

In this test the Wanlass motor used about five percent less energy, ran much cooler, and had a much better power factor. Some of the "apparent" higher efficiency of the Wanlass motor here could be due to the difference in pump efficiencies for the two cases. It was noted that the Wanlass unit maintained a slightly lower water pressure on the output side of the pump (43.7 psi vs. 46.7 psi) while turning the pump at a higher speed. The fact that the Wanlass motor runs more than 20°C cooler is a good indication that its losses are lower than the standard motor losses. The Wanlass motor also exhibited slightly lower current harmonic content than the unmodified motor.

Building 72, Ream Field, Imperial Beach, CA
Sewage Pump Motors 1 and 2.

These 25 hp motors drive pumps that lift sewage from a well in response to a float limit switch controller. Motor nameplate data is listed in Table A-5, and the pumping station is shown in Figure A-10. One motor was disconnected when monitoring the other in order to isolate the performance of each. When this test was conducted, it was discovered that the pump driven by the Wanlass motor was not functioning properly. The test was terminated prior to completion since little could be determined from the data under the existing circumstances. It was obvious, however, that the Wanlass motor operated at a higher power factor than the standard motor (approximately 1.0 versus 0.5). This test will have to be repeated after the pump is repaired.

DISCUSSION

The planned test of four Wanlass motors was inhibited by field operational problems which allowed valid testing of only two installations. While it is difficult to make solid conclusions based on this limited test program, some worthwhile observations are possible. First, the Wanlass motor technology exhibited the capability to provide motor operation at very high power factor and lower temperature rise. These factors could provide some indirect cost avoidance with respect to utility power factor penalties and longer motor lifetimes. The Wanlass motor current harmonic content differs from the standard motors, but it can be higher or lower than for standard motors.

The Wanlass technology was possibly responsible for reduced energy consumption at Building 63. If such a motor operated eight hours per day, the energy savings could pay back the Wanlass rewind cost in three to four years. This assumes electricity charges at \$.07 per KWh and a 30 hp Wanlass rewind cost of \$1,098.00. Both cost figures will undoubtedly be higher in the future (and may be higher at the present time).

Although no obvious harmful side-effects have been observed in connection with the Wanlass motor, Public Works personnel have expressed some maintenance concerns. Since capacitors are considered to be less reliable than most other electrical power components, the Wanlass modification is viewed by some as having the potential for increased maintenance. Concern was also expressed about possible water damage to capacitors in pumping applications which are susceptible to flooding. Emergency repair service would be difficult to obtain for a proprietary motor such as the Wanlass, unless the technology becomes familiar to a number of local motor repair facilities. As a final recourse, a failed Wanlass motor could be rebuilt as a standard motor by most repair facilities. These concerns would have to be addressed prior to any large scale implementation of the Wanlass technology.

RECOMMENDATIONS

Since the Wanlass technology still shows potential for energy savings, the test program should be completed for eight motors. This will afford a better opportunity to assess the merits of the Wanlass motor technology irrespective of the possible operational peculiarities of one or two installations. The remaining motors will be scheduled for remanufacture when

Wanlass resumes normal rewind operations, which is expected in late 1981 or early 1982. Until further test results are known, no action should be taken regarding widespread implementation of the Wanlass technology.

ACKNOWLEDGMENTS

The author expresses his appreciation to the personnel of the Navy Public Works Center, San Diego, and the San Diego Gas and Electric Company for their cooperation and assistance in the execution of the Wanlass motor field demonstration. Furthermore, the assistance of NCEL personnel Messrs. J. Franchi, S. Cortez and D. Weeks in the preparation of test instrumentation, data gathering, and data reduction efforts is gratefully acknowledged.

REFERENCES

1. Defense Energy Information System (DEIS-II) Quarterly Reports.
2. "Test and Evaluation of the Cravens Wanlass Modification for Selected Single Phase Fractional Horsepower Motors," U. S. Army MERADCOM, prepared for the U. S. Department of Energy under Contract No. EC-77-A-01-8295, March 1978.

Table A-1. Building 247 SUBSUPPFAC Motor Nameplate Data

	<u>Motor #1</u>	<u>Motor #2 Original</u>	<u>Motor #2 Rewound</u>
Manufacturer	Lincoln	Ajax	Wanlass
Frame	256T	256T	256T
Type		A	
Serial	1594289	9406572-458	L-1219902-184
Horsepower	20	20	20
Phase	3	3	3
Hz	60	60	60
RPM	1750	1750	1768
Voltage	230/460	230/460	460
Amps	50/25	54/27	21
Design	B	B	B
Code	G	G	
Insulation	B	B	
Service Factor	1.15	1.15	1.25
Rating	Continuous	Continuous	
^o C max. ambient	40	40	

Table A-2. Building 247 SUBSUPPFAC

	<u>Standard</u>	<u>Wanlass</u>
Total Test Time (Hrs.)	24.263	24.263
Total Running Time (Hrs.)	2.903	3.579
Number of Cycles	146	152
Energy Used (KWH)	42.31	52.39
Average Power (KW)	14.35	14.27
Average Current (A)	23.2	16.9
Average Voltage (V)	492	492
Average Power Factor (%)	72.4	98.7
Speed (RPM)	1780	1775
Max. Temp. Rise (^o C)	22	22.4
Average Temp. Rise (^o C)	20	19.7

Table A-3. Building 63, Ream Field Motor Nameplate Data

	<u>Motor #1</u>	<u>Motor #2</u>
Manufacturer	Wanlass	Fairbanks Morse
Frame	S365	RS365
Type		QZK
Serial	FM-106955-146	483997
Horsepower	30	30
Phase	3	3
Hz	60	60
RPM	1778	1765
Voltage	460	440/220
Amps	30	37/74
Design	B	
Code		F
Insulation		
Service Factor	1.25	1.15
Rating		Continuous
°C Rise		40

Table A-4. Building 63, Ream Field

	<u>Standard</u>	<u>Wanlass</u>
Total Test Time (Hrs.)	5.062	5.062
Total Running Time (Hrs.)	5.062	5.062
Energy Used (KWH)	147.72	140.38
Average Power (KW)	29.17	27.79
Average Current (A)	41.7	34.4
Average Voltage (V)	470	472
Average Power Factor (%)	86.0	98.8
Speed (RPM)	1755	1773
Max. Temp. Rise (°C)	58.9	36.1
Average Temp. Rise (°C)	56.9	35.4

Table A-5. Building 72, Ream Field Motor Nameplate Data

	<u>Motor #1</u>	<u>Motor #2</u>
Manufacturer	Wanlass	U.S. Electrical Motors
Frame	286T	286T
Type	R	R
Serial	US-829942-140	P4167794
Horsepower	25	25
Phase	3	3
Hz	60	60
RPM	1778	1760
Voltage	208	208
Amps	54.03	69.5
Design	B	B
Code		G
Insulation		F
Service Factor	1.25	1.0
Rating		Continuous
°C Max. Ambient		40

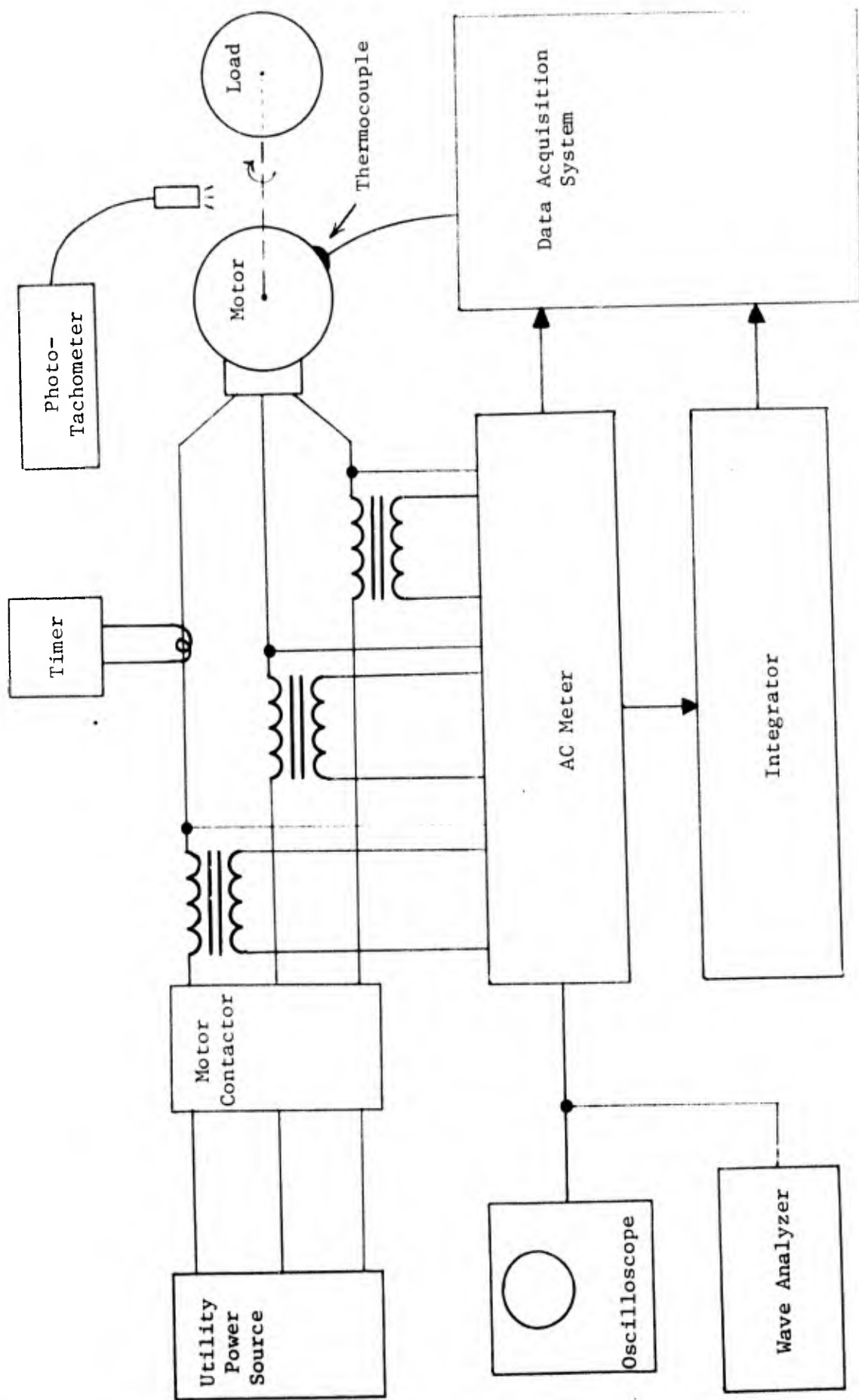


Figure A-1. Instrumentation diagram.

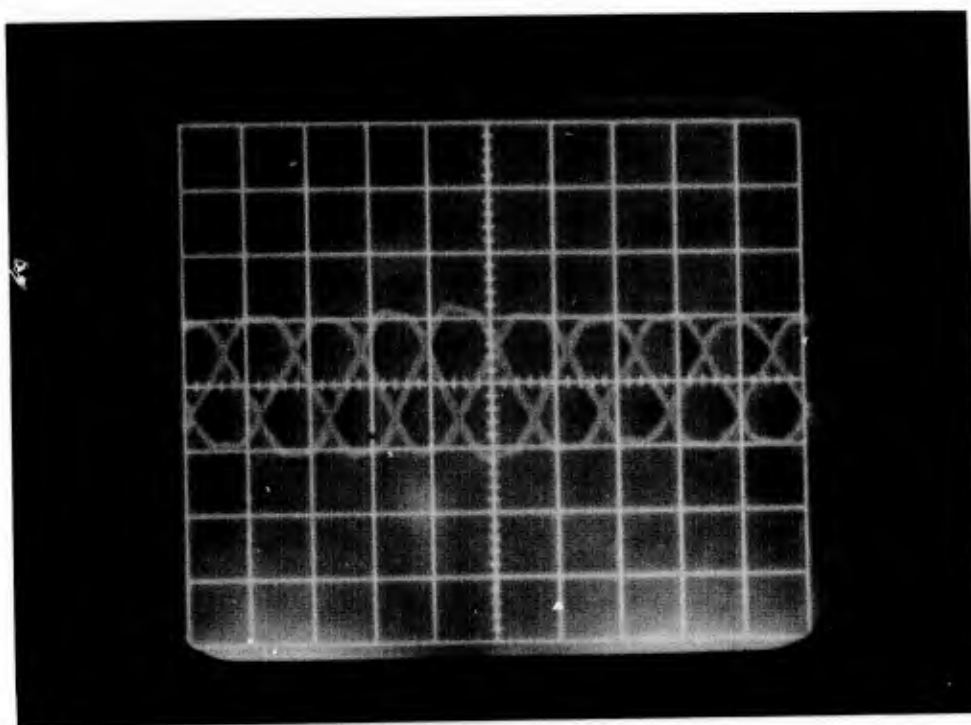


(a) "Standard" Motor Installation

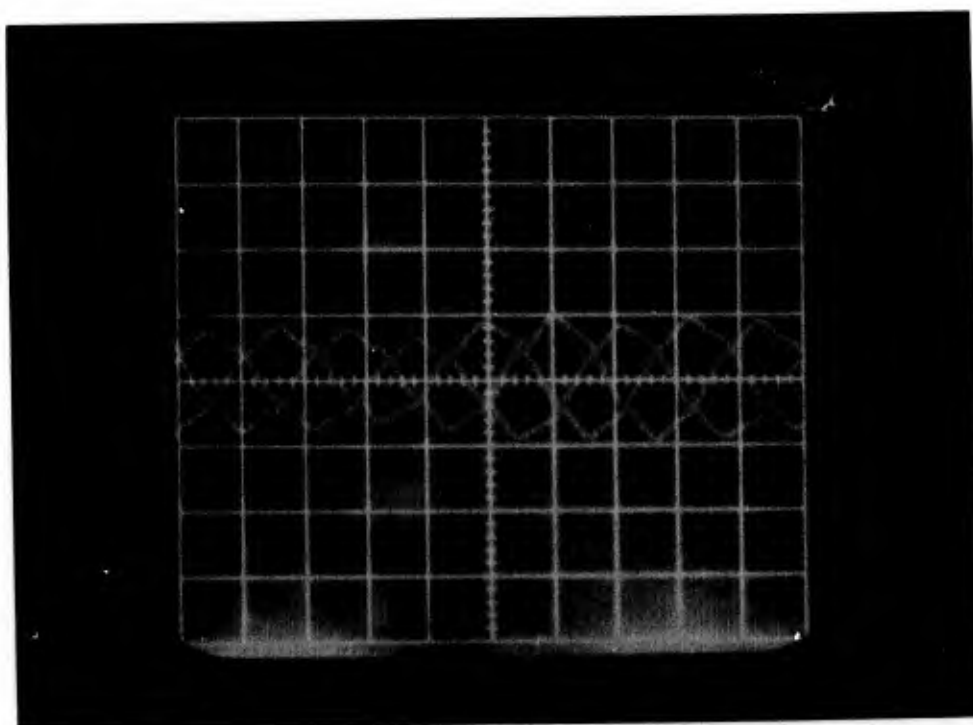


(b) Wanlass Motor Installation

Figure A-2. Test motors at Building 247, SUBSUPPFAC.



(a) "Standard" Motor



(b) Wanlass Motor

Figure A-3. Current waveforms for test motors at Building 247, SUBSUPPFAC. (30 amps per division versus 5 msec per division.)

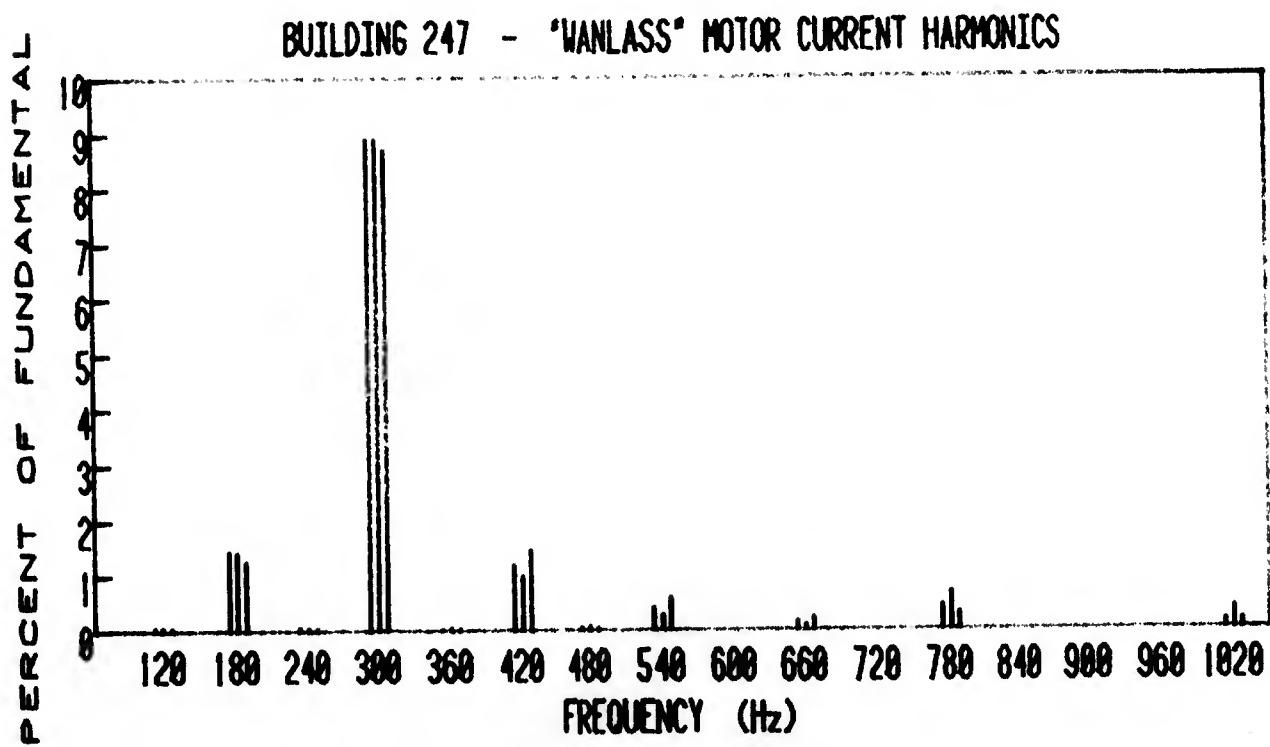
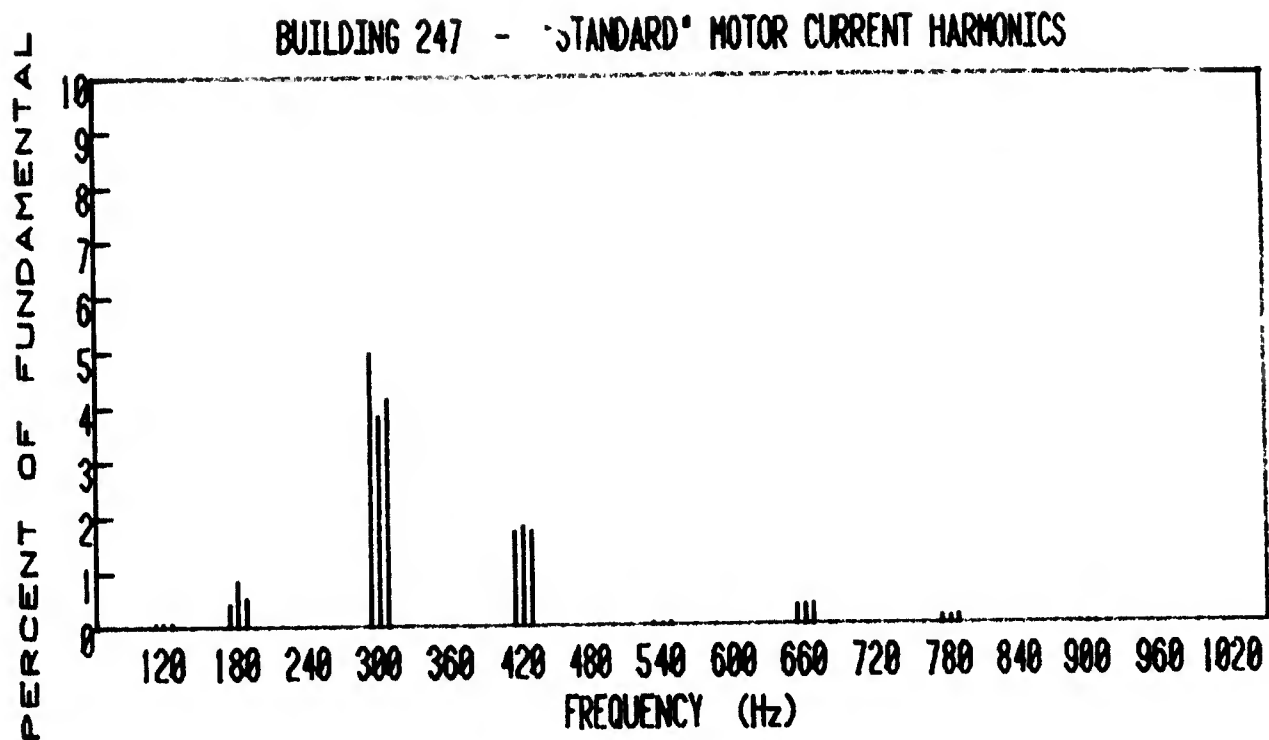


Figure A-4. Current harmonics for motors at Building 247, SUBSUPPFAC. Harmonic content is shown for each of the three phases at multiples of 60 Hz.

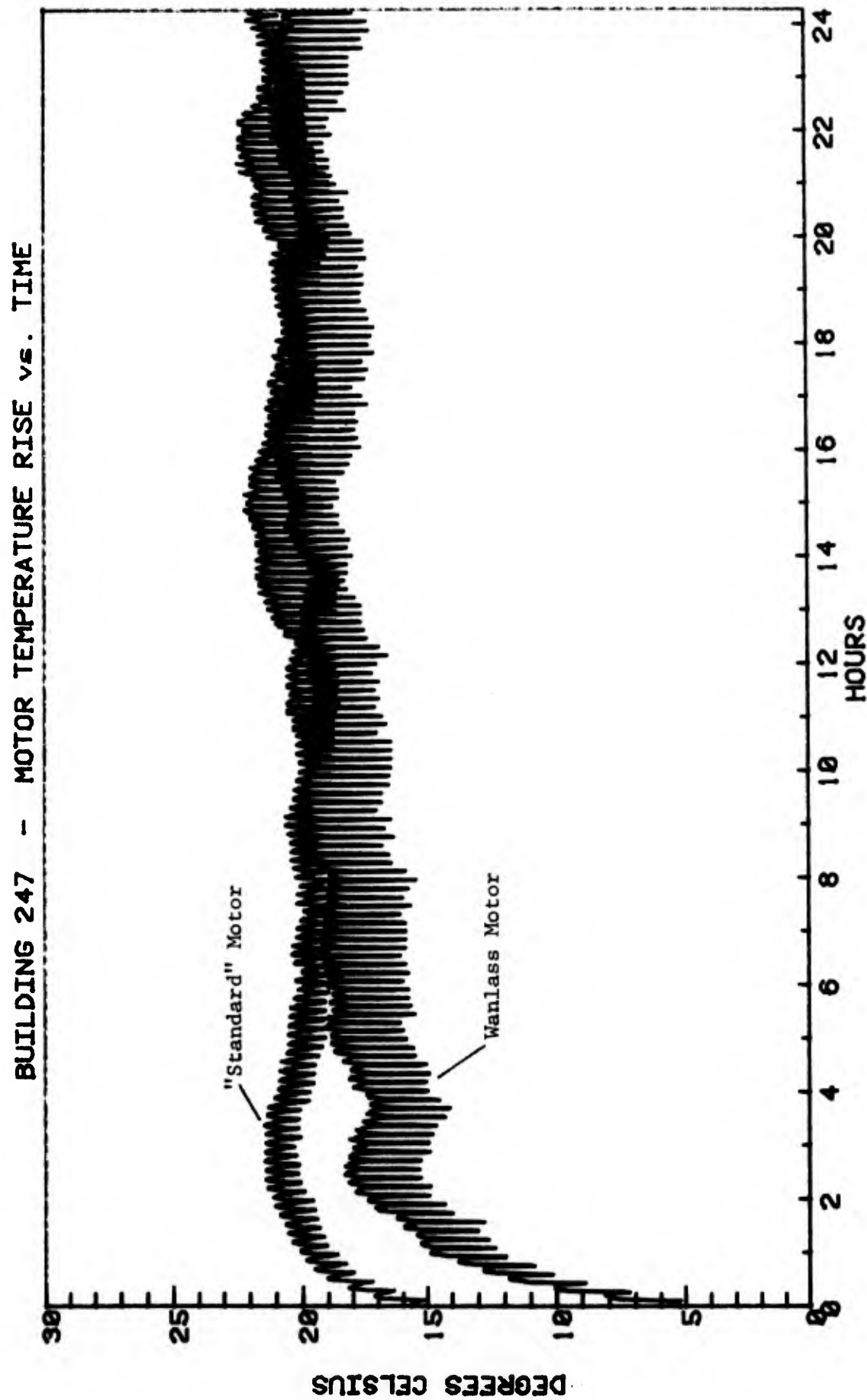
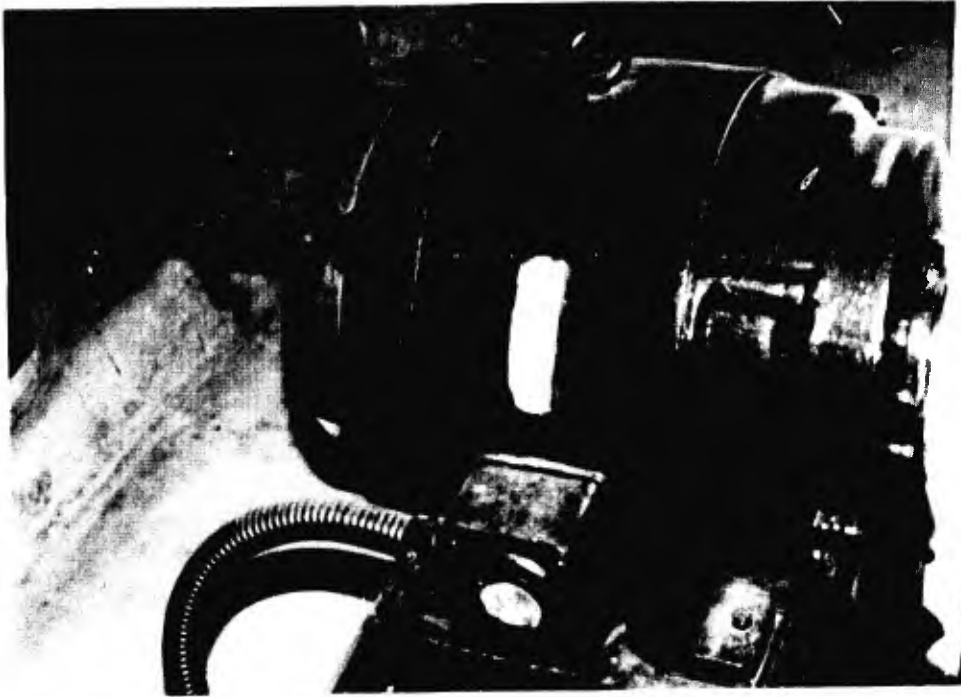
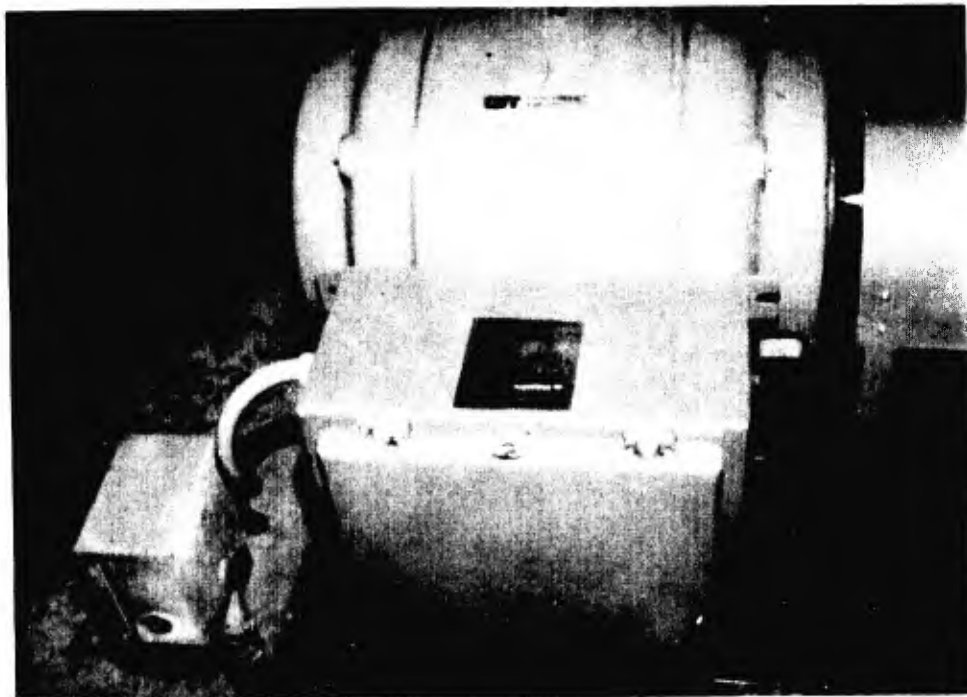


Figure A-5. Temperature rise above ambient for motors during tests at Building 247, SUBSUPPFAC.

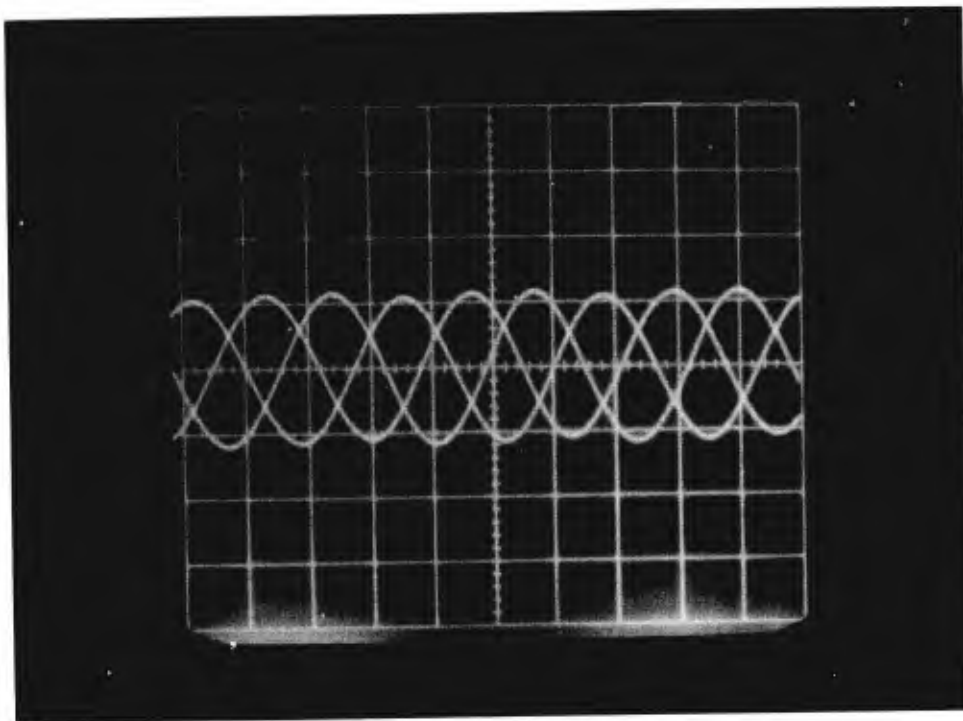


(a) "Standard" Motor

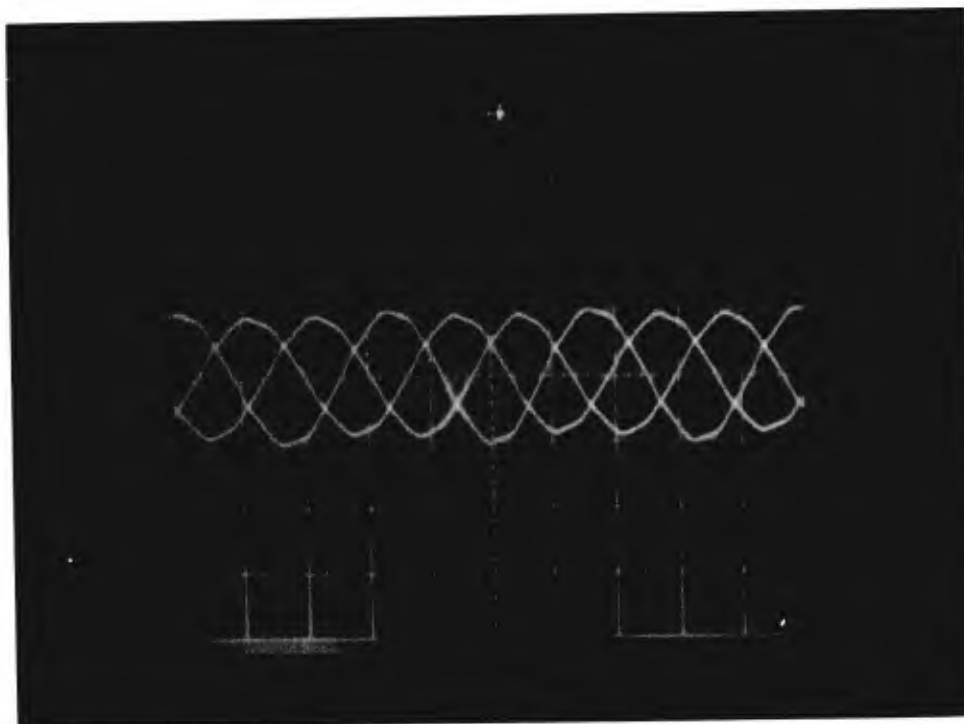


(b) Wanlass Motor

Figure A-6. Test motors at Building 63, Ream Field.



(a) "Standard" Motor



(b) Wanlass Motor

Figure A-7. Current waveforms for test motors at Building 63, Ream Field.
(50 amps per division versus 5 msec per division.)

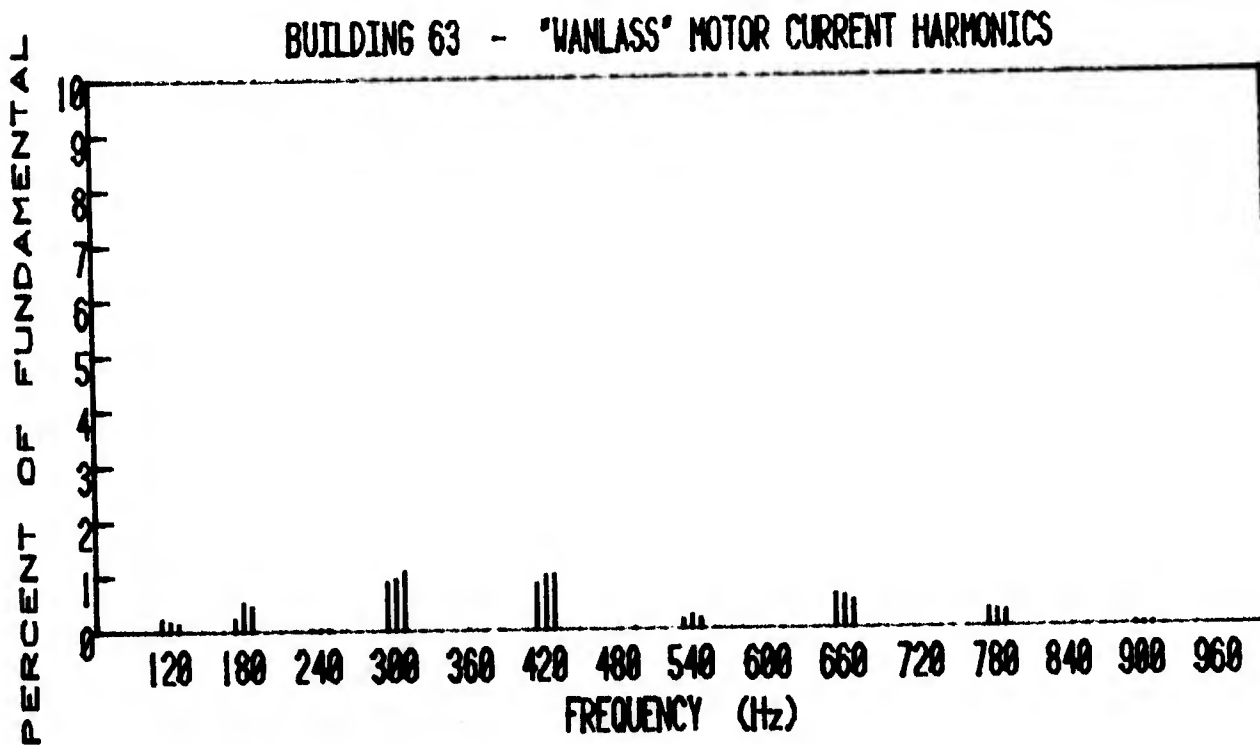
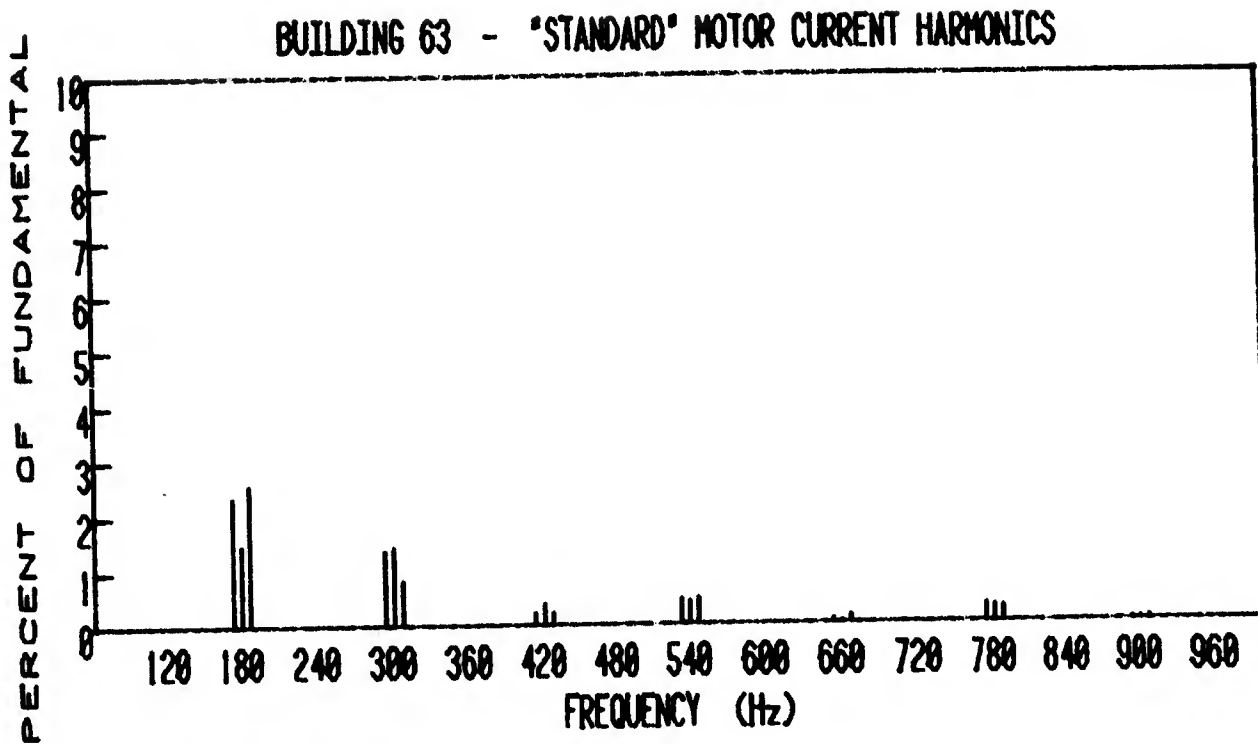


Figure A-8. Current harmonics for motors at Building 63, Ream Field. Harmonic content is shown for each of the three phases at multiples of 60 Hz.

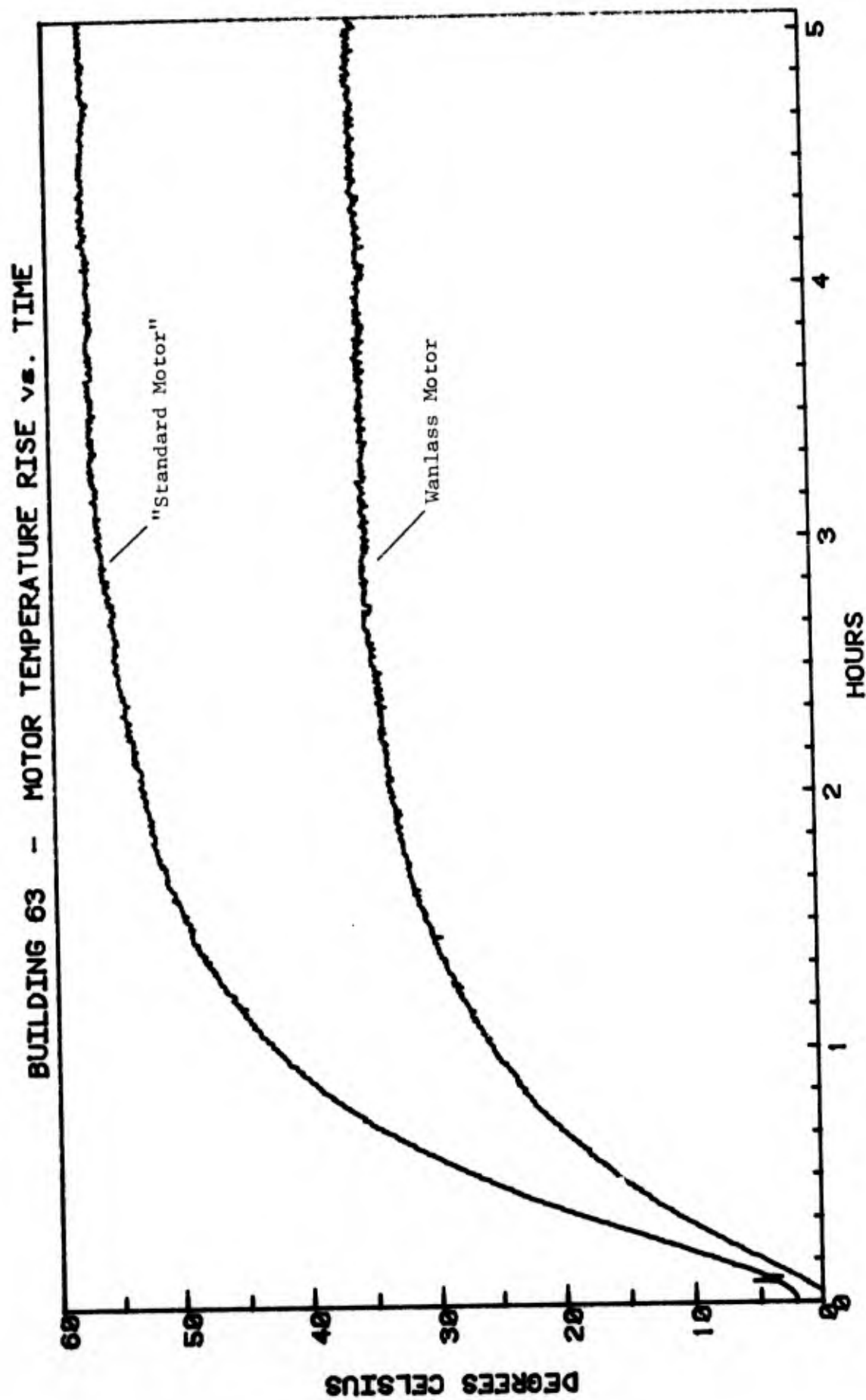


Figure A-9. Temperature rise above ambient for motors during tests at Building 63, Ream Field.



Figure A-10. Test motors at Building 72, Ream Field. The Wanless motor is at the left; standard motor is at right.

Attachment I

THREE-PHASE WANLASS MOTORS

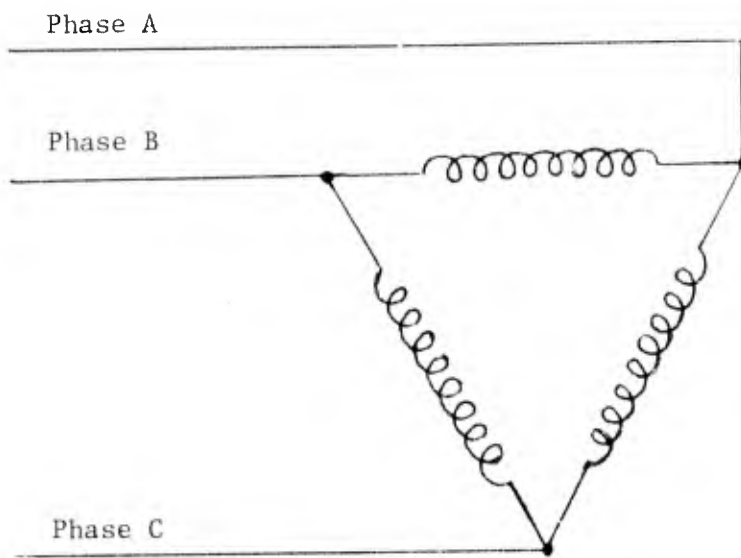
Three-phase Wanlass motors are presently available in significant quantity only as remanufactured motors. The essence of the remanufacturing process is the removal of the stator windings from a conventional motor and replacement by a new set of stator windings. Figure I-1 shows typical winding configurations for three-phase conventional and Wanlass motors. The Wanlass motor actually has six windings (two per phase). Capacitors are connected in series with one winding of each phase and are mounted externally (in an enclosure), on or near the motor. See Figures A-2, A-6, and A-10 in the report. Wanlass uses computer programs to assist in the design of the actual windings for the remanufactured losses.

According to Wanlass, a portion of the efficiency improvement can be attributed to the winding technology itself. However, some of the improvement is merely due to the use of more copper in the windings which reduces the resistance losses.

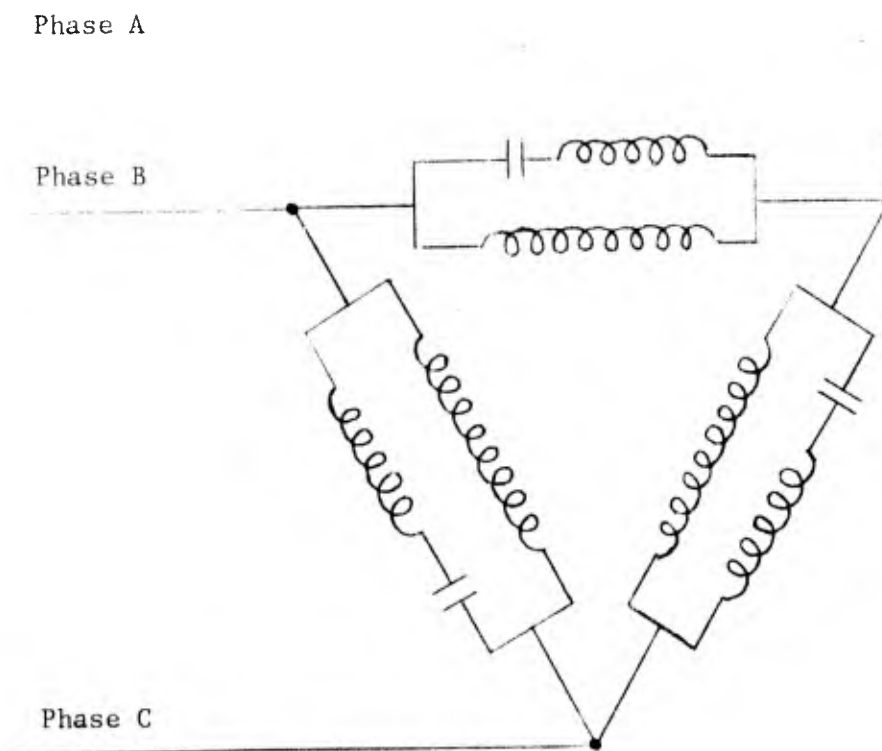
Table I-1 indicates the remanufacturing price schedule in effect at the time this test program was planned. Current figures are not available; however, when the Wanlass Corporation rewinding facility resumes operation, the costs are expected to be somewhat higher.

Table I-1. Wanlass Remanufacturing Costs (1979).

<u>HP Rating</u>	<u>Price</u>	<u>HP Rating</u>	<u>Price</u>
5	\$ 684	60	\$1,700
7½	746	75	1,906
10	782	100	2,395
15	814	125	2,714
20	892	150	3,092
25	972	200	3,695
30	1,098	250	4,266
40	1,334	300	4,910
50	1,576		



(a) Conventional Motor



(b) Wanlass Motor

Figure I-1. Motor Stator windings.

Appendix B

REPORT ON PUGET SOUND NAVAL SHIPYARD TESTS

INTRODUCTION

The Naval Civil Engineering Laboratory (NCEL) tested five large (40-to 100-hp) induction three-phase motors with the assistance, personnel, and facilities of the Puget Sound Naval Shipyard (PSNSY). These tests were a followup of tests at San Diego in August 1981. Five motors were tested on a dynamometer in standard configuration and after rewinding with the Wanlass method. Three of these motors were also monitored in their field applications. The emphasis of these tests was to measure changes in efficiency, power factor, and current.

HISTORY

This, the second series of NCEL's Wanlass three-phase motor tests, was conceived and planned by representatives from NCEL, PSNSY, and Wanlass Research Company (WRC).

The initial planning meeting was held in May 1982. Participants were:

<u>Name</u>	<u>Shop/Code/Company</u>	<u>Phone</u>
Jim Sura	PSNSY/440.8	(206) 476-3515
Brian Milner	NCEL/L62	(805) 982-3328
Dave Mainwaring	PSNSY/381.3	(206) 476-7792
Fred Dengler	PSNSY/051	(206) 476-7139
Howard R. Hinkle	PSNSY/051	(206) 476-7139
Don Asp	Wanlass	(702) 885-8074
Dennis Mihalka	Wanlass	(702) 885-8074
Ed Lyons	PSNSY/03	(206) 476-3616

The plan agreed at that meeting:

- PSNSY identify five motors for tests
- PSNSY provide dynamometer and other measuring equipment
- NCEL provide measuring equipment not available at PSNSY
- NCEL engineer direct tests
- NCEL provide money for labor of PSNSY people working on tests

- WRC teach PSNSY electric shop people how to rewind motors by the Wanlass method
- PSNSY rewind the five motors to Wanlass specifications
- PSNSY remove, reinstall, field test, dynamometer test the five motors

To rewind the motors in the PSNSY shop, a temporary license agreement with Wanlass was needed. All the legal questions were never resolved, so the plan was changed: The motors would be rewound by an independent shop that already had a Wanlass license. A contract to pick up, rewind, and deliver the motors was awarded to Center Electric, Tacoma, Wash. (point of contact: John Morrell), in August 1982.

Chronology of Tests

1982

16-17 Aug	Set up first field tests
13-24 Sep	Dynamometer tests
15 and 27 Sep	Motors picked up for rewinding
4 Oct	Motors delivered after rewinding
5-14 Oct	Dynamometer tests - Wanlass configuration
9-16 Nov	Visit to PSNSY by WRC and NCEL representatives Repeat of three dynamometer tests*

1983

18 Mar	Final field tests completed**
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Motors Tested

The initial plan for this series of tests called for about five motors from 20 to 100 hp. PSNSY Public Works engineers surveyed the shipyard and found five motors:

*The November meeting and repeat of tests was arranged at the request of Wanlass Research Co. (WRC). The dynamometer test results for Wanlass motors in October showed no improvement in efficiency. WRC wanted to verify that the motors were connected properly. Details of these tests are included in the following sections.

**The final field tests of the two blower motors were delayed because the chemical scrubber facility was out of operation for repairs.

- Two blower motors, 50 and 75 hp. Part of a chemical scrubber system at Building 873. The blower system contains eight motors arranged in pairs. Each pair is two identical motors; the test motors were from different pairs. Two examples of a Wanlass motor working along with a standard motor of the same size were observed.
- 50-hp motor, drives a hydraulic pump, part of a bender in the machine shop, Building 460.
- 40-hp motor, drives a flywheel, part of a metal brake in the machine shop, Building 460.
- 100-hp motor, drives a direct current (DC) generator that supplies power to a boring lathe. This motor was not used because the shop decided it could not afford to have this machine out of operation for over 1 week. A second 100-hp motor was identified. It was part of an integral motor-generator set that provided direct current for a planer. Field data were taken on this motor-generator set. It was not used in subsequent tests because: (1) the motor could not be separated from the generator for dynamometer testing; (2) testing the motor by loading its generator was considered; however, the generator was only rated to 50 kW, which is not enough for a 150% load on the motor; and (3) the motor-generator set was deteriorated; extensive repairs would have been necessary before conducting any tests. A third 100-hp motor was found in storage. It was used for dynamometer tests. No field data were taken for it.

Nameplate data for the five motors used in the tests are in Table B-1. The capacitance connected to each motor as part of the Wanlass remanufacture is listed in Table B-2.

FIELD TESTS

Instrumentation

For each of the motors, recording instruments were connected for:*

line voltage (one-phase)	B
line current (one-phase)	B
power (three-phase)	A
reactive power (three-phase)	A
power factor (three-phase)	A
temperature (motor case)	C

Periodic readings were taken of:*

speed	D
line voltage	K
line current	K
sound level (motor case and bearing)	E

Procedure

Blower Motors. The motors ran for 1 day each. Readings of voltage, current, speed, and sound level were taken at regular intervals. After the rewind, the same parameters were measured, and also current readings for the other, unmodified motors of each pair were taken.

50-hp Bender Motor. Public Works engineers performed several routine tasks with the bender while watching the instruments. All of the loads were of such short duration that no meaningful readings could be made. Therefore, the field test was not repeated after the rewind.

Discussion of Blower Motors

Current in both test motors after the rewind was less than it was before the rewind. Average power consumption, measured with a watt-hour meter and a clock, was about the same. In the 50- and 75-hp motors, the second, unaltered motor of each pair drew more current than the Wanlass motor and more than the test motor drew before the rewind. According to the dynamometer torque-speed, and torque-current curves the unaltered motor of each pair was taking more of the mechanical load than the test motor.

Air flow in the ductwork is not necessarily uniform, which was demonstrated with anemometer probes. Therefore, a precise comparison of the blower loads is not possible. However, the electrical measurements do indicate that two nonidentical motors will not share a load equally.

Temperature rise before and after the Wanlass remanufacture was about the same. A precise comparison cannot be made because: (1) the ambient temperature was different, and (2) the load conditions were not precisely known. Field test measurements are tabularized at the end of this appendix.

It was found that sound level readings were influenced greatly by the position of the meter's microphones, which were not precisely repeatable. Therefore, sound level readings were discontinued. Sound level differences between motors were not perceptible. Any valid sound level comparison will have to be made in a special chamber.

*Letter code indicates instrument used (from Table B-3).

DYNAMOMETER TESTS

Instrumentation

The following parameters were measured:*

line voltage	F, H
line current	F, H
power	F, H
power factor	A, F, G, H
apparent power	A
speed	D
torque	J
temperature	
case	C
ambient	C

Procedure

For each motor test sequence, the motor was mounted on the dynamometer and aligned with the dynamometer shaft. Power and instrumentation were connected, the dynamometer load torque was set to zero and the motor was started. Readings of all meters were taken, the load was increased to 150% in 25% steps, and readings were taken at each step. The load was then decreased to zero in 25% steps, and readings were taken at each step, for a total of 13 readings. The standard for this test is Reference 4, method B and form B, page 27. For three of the motors, the tests were repeated in the Wanlass configuration, with Wanlass Company personnel present. The repeated tests are described in separate curves on the plots.

Calculations

The main calculation steps are:

- instrument corrections
- average of three-phase values

*Letter key indicates instrument used (listed in Table B-3).

- calculation of:

mechanical output in:

foot-pounds
horsepower
kilowatts

apparent power input, kilovolt-amperes

real power input, kilowatts

power factor

efficiency

- average of readings taken at each load point

Mechanical Output. The dynamometer scale is in pounds and the lever arm is 1.75 feet (21 inches).

$$\begin{aligned}\text{Torque (ft-lb)} &= \text{reading} \cdot 1.75 \\ \text{Power (hp)} &= \text{reading} \cdot \text{speed}/3,000 \\ \text{Power (kW)} &= \text{power (hp)} \cdot 0.7456\end{aligned}$$

Power Input. Power input was read from the Weston Industrial Analyzer wattmeter section.

Apparent Power Input. Apparent power input was calculated from averaged three-phase voltage and current readings:

$$PA = V \cdot I \cdot \sqrt{3}$$

where: PA = apparent power
V = voltage
I = current

Apparent power, in kVA, was read directly from the digital display of the Esterline-Angus meter as a check.

Power Factor. Power factor (PF) was calculated from the real and apparent power values:

$$PF = P/PA$$

We also took power factor meter readings for comparison and to determine the direction (leading or lagging) of the current's phase shift.

Efficiency.

$$\text{Efficiency} = \text{Power out/Power in}$$

Dynamometer Tests Before Conversion

The first motor tested was the 50-hp bender. On the first run, seven data points were taken--0, 25, 50, 75, 100, 125, and 150% of full load. These load points were determined by the dynamometer's torque-power-speed equation, using the motor's rated power and assuming synchronous speed. In the test, the dynamometer load controls were adjusted to obtain the desired torque. On subsequent runs, 13 data points were taken--0 to 150% and back to 0 in 25% steps.

Temperature data were recorded at the beginning and end of each run. All the tests (except repeat tests in November) were run twice: immediately after startup and after a 1- to 2-hour warmup period with the motor running at partial load. No significant differences were noticed between data for cold and warm motors.

Sound level was recorded at each load point for the first motor. There was negligible difference in successive readings, so for the remaining motors, sound level data were recorded at the beginning and end of each test. When changing operators it was discovered that the sound meter's reading was influenced greatly by the way the microphone was held. No two people could consistently duplicate the same reading. Also, some vibration was noticed on a few of the motors when they were first mounted on the dynamometer. Some of this vibration was eliminated by aligning the shafts more closely. It was decided to discontinue sound level readings, since any differences in measured noise level would be due to causes other than the type of winding in the motor.

Dynamometer Tests After Rewind

The same method was followed as before rewind. After four motors were tested (all except the 50-hp bender), the Weston Industrial Analyzer with the nonfunctioning power factor meter was exchanged for a fully functioning unit. This change was not originally planned. It was assumed, at the time of the change, that no significant loss of measurement accuracy would be caused by the change. In retrospect, the change of meters did affect the measurements of power, voltage, and current. No overall energy savings were noticed from the first four tests. The fifth test, and all subsequent tests using the replacement Industrial Analyzer, showed a noticeable energy savings. Calibration curves for each meter were drawn after the tests as an effort to compensate for the differences between the meters. The method for obtaining these curves is described under Measuring Equipment Calibration.

Temperature. Ambient temperature during the "after" tests was about 15°F lower than temperature during the "before" tests. Warmup time and load level were not standardized, so no true comparison of temperature rise could be made from these tests.

One case of extreme temperature rise occurred: the 75-hp blower motor, after rewind. A misconnection of the capacitors was immediately suspected; however, all electrical measurements were within expected ranges and the wiring was verified as correct. One of the bearings appeared to be binding. The bearing was replaced, and afterwards the motor ran normally.

During the Wanlass motor tests, the rewind shop manager, John Morrell, attempted to "fine-tune" the motors for optimum efficiency by disconnecting and reconnecting capacitors. The first set of "after rewind" data for the 75-hp blower motor is based on running with a small capacitor removed from each phase. The difference in efficiency, current flow, and power factor caused by the capacitor adjustment is not noticeable in the test results.

Power Factor Meters. Three power factor meters were connected for most of the tests: (1) part of the Weston Industrial Analyzer; (2) part of the Esterline-Angus Miniservo; and (3) part of the Chauvin-Arnoux "V-A-Phi" meter. On many occasions, a significant difference existed between their readings. Since it was intended to calculate power factor from the volt, amp, and watt readings, the tests were not delayed to ascertain problems with the power factor meters. Over the course of the tests, it was found that the errors were caused by:

- Defective power factor section of the Weston Industrial Analyzer, which was used on most of the tests. During the "after rewind" tests, another meter was substituted. This meter, unfortunately, had amp, volt, and wattmeter sections with slightly different calibrations from the first meter. These differences are discussed under Measuring Equipment Calibration.
- Part way through the tests, the Esterline-Angus Miniservo meter malfunctioned, and its readings of power factor and apparent power became erroneous. A replacement unit was obtained from the rental agency and no further problems occurred.
- The single-phase Chauvin-Arnoux volt-amp-power factor meter has connections that are easy to connect improperly. It was suspected that on some occasions it was connected wrong. No errors occurred later in the tests after some experience at using this equipment was gained.

Meter readings that are obviously erroneous are listed in the data as 99.9.

Measuring Equipment Calibration

The measuring instruments used in the tests had been inspected and were within calibration requirements. However, the Weston Industrial Analyzer (ser 5346) used in the initial ("standard") motor tests and the first four Wanlass motor tests had a defective power factor meter section. The entire unit was exchanged for one that was fully functional (ser 1088). The fifth Wanlass motor test (the 50-hp bender) and all subsequent tests were made with this replacement meter.

During data reduction, two trends of apparent error were noticed:

- For low values of motor load, calculated apparent power (kVA) was in many cases less than real power, an impossible situation. It was suspected that the voltmeter or ammeter sections were indicating lower-than-actual values.

- Efficiency values derived from readings on the replacement meter were higher than those from the original meter for three motors. It was suspected that the replacement unit's wattmeter section was indicating slightly lower than the original unit's wattmeter.

Such errors were within the manufacturer's specifications for the instruments. It was noticed, and later confirmed, that each meter had an individual calibration curve. This curve, when applied to the meter's readings, gives a corrected data value whose tolerance is less than half the manufacturer's specified tolerance. In order to obtain realistic data values and fair comparisons, calibration curves were created for the two Industrial Analyzers and these curves were used in the data reduction.

Both meter units were shipped to NCEL, where a Yokogawa Model 2505, Serial 00325, digital volt-amp-wattmeter was used as a reference standard. The Yokogawa meter and one Weston meter at a time were connected to various loads, including resistors, resistor-inductor combinations, and a motor-generator set, without using current transformers. The voltage, current, and power readings on each meter were recorded for each load. The difference between the standard's and the test meter's readings versus the test meter's readings were plotted. These differences were applied to the raw data from the motor tests. The different data from which these error curves were drawn are the basis for stating that the Weston meters have a tolerance, after correction, of roughly half the manufacturer's specified tolerance.

Results of Using Calibration Curves

The largest corrections needed are to the ammeters at the low end of their scales. Small corrections to the voltmeters and wattmeters were also needed. Test motor data, corrected by calibration curves, yielded credible values for calculated power factor and apparent power. However, a significant discrepancy remains in the power readings. For three Wanlass motors, efficiency curves were drawn based on each of the two Weston wattmeters. In all three cases the curve based on the replacement meter is higher than the curve based on the original meter. There are two possible explanations for this difference: (1) misconnection of the motors for the tests with one of the meters, and (2) a difference in meter response that was not identified by the calibration curve procedure. Since all motor and meter connections were doublechecked on the Wanlass motor tests, the second explanation--meter difference--is the most likely explanation for the differences between the efficiency curves.

Dynamometer Correction

The standard test procedure (Ref 5) calls for a dynamometer correction to be applied to all readings. This correction accounts for friction and windage losses in the dynamometer. The correction is:

$$\frac{(A - B)}{K n} - C$$

where: A = power required to run motor when coupled to dynamometer with dynamometer torque set at zero, W

B = power required to run motor when uncoupled, W

C = torque output registered by dynamometer during test A

K = constant (0.1047 for torque in N-m, 0.1420 for torque in lb-ft)

n = rotation speed, rpm

This value was calculated for each of the motors tested. The correction values obtained were inconsistent, in some cases negative, because the difference in motor power consumption was so small and the wattmeter was being read at the low end of its scale (typically 0.025 on a scale of 0.0 to 1.0). Therefore, dynamometer correction was not considered in the data reduction. The omission does not affect the results, since before-and-after motors of the same rotational speed and the same amount of dynamometer correction were compared.

CONCLUSIONS

For the tests conducted at Puget Sound Naval Shipyard:

- Energy efficiency of the five motors was not significantly affected by the Wanlass rewind. Apparent improvement is most likely due to the change of measuring equipment (wattmeter).
- Current flow was reduced and power factor was improved. An improvement of similar magnitude could have been made by installing capacitors in parallel with the standard motors. The parallel capacitors would need to be about the same capacitance as the Wanlass motor's capacitors.

DATA TABLES AND PLOTS

Field data and calculated values are shown in Tables B-4, B-5, and B-6. Dynamometer test data are in four sets of tables for each motor:

Table B-7: Raw data.

Table B-8: Corrected data (meter corrections applied).

Table B-9: Results for each test run. Includes calculated values of power output, efficiency, and power factor.

Table B-10: Averaged results for each motor.

The efficiency, current, and power factor information from Table B-10 is plotted in Figures B-1 through B-5.

Table B-1. Motor Nameplate Data

Item	Motor Designations				
	A	B	C	D	E
Nameplate Data					
Horsepower	100	75	50	40	50
Phase	3	3	3	3	3
Hertz	60	60	60	60	60
rpm	1,165	1,780	1,770	1,620	875
Voltage	440	460	230/460	220/440	220/440
Amps	121	90	122/61	102/51	130/65
Design	C	B	B	-	B
Code	-	G	G	F	F
Class	A	B	B	-	-
Service Factor	-	1.0	1.0	-	1.15
Temperature, °C	40	40	40	50	40
Manufacturer	Electrodynamic	G.E.	Delco	G.E.	G.E.
Frame	584-5	365T	326T	405	444US
Type	TH	K	-	KR	K
Model	D99-945-8	5K365BK208	2*5150	5KR-1405-AF1	5K4444A41B1
Serial	10100528A1	FL-244078	B-75	5743654	EB232090
Usage Data					
Application		Blower	Blower	Brake	Bender
Voltage	Spare	460	460	220	220
Shaft Axis	-	Vertical	Vertical	Horizontal	Horizontal

Table B-2. Capacitance Used in Wanlass Motors,
PSNSY Tests Sep-Nov 1982

Motor	Capacitance (μ F)	Voltage
40-hp brake	240	220
50-hp bender	300	220
100-hp spare	150	450
50-hp blower	75	450
75-hp blower	115	450

Table B-3. List of Measuring Equipment

Code	Instrument	Remarks
A	Recording wattmeter, Esterline-Angus S-22904 "Miniservo"	Strip-chart readout of watts, VAs, VARs, PF (any 3); digital readout of VAs, PF, watt-hours; rented from Genstar Rental Electronics, Inc.; Serial 059829 used initially.
B	Dual pen strip-chart recorder, Gulton Industries Model 2113, Serial 298158	Measures line voltage and current (through clamp-on probe); property of PSNSY Code 440.8.
C	Hybrid recorder, Yokogawa Model ER-250	Digital readout, printed and strip-chart hard copy; used with Type T thermocouples; rented from General Electric.
D	Digital photo-tachometer, Cole-Parmer Instrument Co., Model 8205, Serial 979662	Property of NCEL Code L62.
E	Sound level meter, General Radio Model 1551C	Rented from Continental Resources.
F	Industrial Analyzer, Weston Model 639, Type 2, Serial 5346 (used initially), Serial 1088 (issued as replacement)	Scales: voltage 0-150, 300, 600, line-to-line; amps 0-5, 25, 125; kilowatts reads 0-1 with 9 scale multipliers determined by volt and amp scales; power factor - lead 0.80 - lag 0.30.
G	Voltage-current-power factor meter, Chauvin-Arnoux "V-A-Phi"	Measures three-phase voltage plus current or power factor on one phase of a three-phase circuit; Navy ID 400 MP 0950; property of PSNSY Code 440.8.
H	Current transformers, Weston Model 461, Type 2	Capacity: 15 VA; frequency: 25-500 Hz; line volts: 250; ASA accuracy class at 60 Hz: 0.33-0.5; Serial 28831, Navy ID 11042 used in Phase A; Serial 28829, Navy ID 11040 used in Phase C.

continued

Table B-3. Continued

Code	Instrument	Remarks
I	Ohmeter, Kelvin Bridge, Catalogue 4288, Navy ID E09054	Used for stator resistance measurements.
J	Horizontal dynamometer, General Electric, Navy inventory 009805 of Jan 81	Torque readout: Toledo "no springs" scale, Style 9700PD, Serial 716368; capacity: 1,000 lb (scale reads 0-500 lb in 1-lb increments).
K	Portable multimeter, Fluke Model 8022A, Serial N2245405	

Table B-4. Field Test, Bldg 460, 50-hp Bender, Pre-Rewind

Date (yr/mo/day)	Time	Clock (min)		kW-hr	Average Power (kW)	Power Factor	Speed (rpm)	Sound (db)	Current (amp)			Volts			Temperature (°F)		
		Total	Run						A	B	C	A-B	B-C	A-C	Ambient	Motor	Difference
82/8/30	0950	0	0	0	--	0.40	900	96 ^a , 90 ^b , 91 ^c	51	50	52	232	236	234	65.5	70.9	5.4
82/8/30	1242	169.8	169.8	12.5	4.42	0.34	900	96 ^a , 92 ^b , 91 ^c	51	50	51	233	235	233	66.2	76.1	9.9
82/8/30	1512	322	322	22.6	4.21	0.33	900	96 ^a , 92 ^b , 91 ^c	50	50	52	232	234	234	70.3	80	9.7

^aCoupling end parallel to shaft.

^bMotor case flat part, opposite wire input connection box.

^cEnd parallel to shaft.

Table B-5. Field Test, Bldg 873, 75-hp Scrubber Exhaust Fan

Date (yr/mo/day)	Time	Clock (min)		kW-hr	Average Power (kW)	Power Factor	Speed (rpm)	Sound (db)	Current (amp)			Volts			Temperature (°F)		
		Total	Run						A	B	C	A-B	B-C	A-C	Ambient	Motor	Difference
Pre-Rewind																	
82/8/18	0945	81.2	81.2	46.2	34.1	0.78	1,792	98.5 101 ^a , 112 ^b 102 ^a , 112 ^b	57	57	57	464	466	467	67.1	96.6	29.5
82/8/18	1253	270.0	270.0	155.9	34.6	0.77	1,792		56	57	56	463	466	465	71.3	108.4	37.1
82/8/18	1540	439.7	439.7	250.6	34.2	0.76	1,791		56	57	57	466	469	468	64.1	95.1	31.0
82/9/19	0910	1,482.3	1,482.3	846.4	34.3	0.77	1,791		56	57	57	466	469	468	64.1	95.1	31.0
After Rewind																	
83/3/15	0925	0	0	0	--	0.98	--	--	40	41	41	470	470	470	46.2	80.4	34.2
83/3/15	1005	43.6	43.6	24.1	33.2	0.98	1,792	--	42	43	42	470	470	470	46.2	80.0	33.8
83/3/15	1441	316.7	316.7	179.8	34.1	0.99	1,792	--	42	44	42	470	470	470	54.4	94.6	40.2
Other Motor of Pair																	
83/3/15	0930	--	--	--	--	--	--	--	66	66	66	470	470	470	--	--	--
83/3/15	1010	--	--	--	--	--	1,788	--	66	66	66	470	470	470	--	--	--
83/3/15	1439	--	--	--	--	--	1,788	--	66	68	66	470	470	470	--	--	--
Total of Two Motors																	
83/3/15	1005	--	--	--	--	--	--	--	107	110	107	470	470	470	--	--	--

^aReading taken on top of motor (outer circumference of sheave).

^bTaken on nameplate (full shield bearings).

Table B-6. Field Test, Bldg 873, 50-hp Scrubber Exhaust

Date (yr/mo/day)	Time	Clock (min)		kW-hr	Average Power (kW)	Power Factor	Speed (rpm)	Sound (db)	Current (amp)			Volts			Temperature (°F)		
		Total	Run						A	B	C	A-B	B-C	A-C	Ambient	Motor	Difference
Pre-Rewind																	
82/8/19	1046	0	0	0	--	0.75	1,786	110 ^a , 102 ^b	35	38	35	466	471	465	75.6	28.4	28.4
82/8/19	1400	187.9	187.9	73.8	23.6	0.74	1,786	110 ^a , 102 ^b	34	37	34	467	470	465	78.6	110.6	32.0
82/8/19	1551	297.6	297.6	116.0	23.4	0.74	1,786	111 ^a , 102 ^b	35	37	35	464	468	464	76.1	105.7	29.6
82/8/20	0800	1,279.4	1,279.4	499	23.4	0.75	1,787	114 ^a , 102 ^b	35	37	35	465	469	464	68.6	92.8	24.2
82/8/20	1015	1,406.8	1,406.8	548	23.4	0.75	1,787	114 ^a , 103 ^b	35	37	35	462	465	464	77	102.6	25.6
82/8/20	1404	1,632.2	1,632.2	635.2	23.4	0.75	1,787	114 ^a , 103 ^b	35	37	35.5	465	467	465	82.7	113.4	30.7
After Rewind																	
83/3/14	1030	0	0	0	--	0.98	1,786	--	32	32	32	470	470	470	51.0	106.8	55.8
83/3/14	1330	171	171	70	24.6	0.98	1,786	--	30	31	30	470	470	470	52.2	101.4	49.2
83/3/14	1530	299	299	123.6	24.8	0.98	1,786	--	31	32	31	473	473	473	46.0	93.0	47.0
83/3/15	0815	1,297	1,297	534	24.7	0.98	--	--	31	32	31	472	472	472	--	--	--
Other Motor of Pair																	
83/3/14	1330	--	--	--	--	--	--	--	40	41	41	470	470	470	--	--	--
Total of Two Motors																	
83/3/14	1330	--	--	--	--	--	--	--	67	69	69	470	470	470	--	--	--

^a Taken on full shield bearings nameplate.

^b Taken on upper bearing.

Table B-7. Raw Data

40 HP BRAKE MOTOR
DYNAMOMETER TEST RAW DATA

BEFORE CONVERSION - "STANDARD" - 82 SEP 14
(BEFORE WARMUP)
(USING WESTON INDUSTRIAL ANALYZER SER. 5346)

PCT	SPD	FORCE	VOLTAGE			CURRENT			PWR	PF	PF	PF	AP.PWR
LOAD	RPM	LBS	AB	BC	CA	A	B	C	*	WES	C-A	E-A	KVA
0	1790	3.5	227.0	227.0	227.0	25.0	25.0	25.0	0.047	0.42	0.40	0.48	6.90
25	1765	19.0	225.0	225.0	225.0	36.0	37.0	36.0	0.120	0.71	0.56	0.78	13.20
50	1733	37.0	224.0	224.0	225.0	56.0	58.0	56.0	0.200	0.77	0.73	0.86	21.50
75	1695	56.0	222.0	223.0	223.0	79.0	81.0	79.0	0.280	0.78	0.82	0.88	30.80
100	1649	74.5	220.0	220.0	221.0	106.0	107.0	105.0	0.380	0.79	0.81	0.89	41.00
125	1594	94.0	218.0	218.0	219.0	135.0	136.0	134.0	0.470	0.81	0.75	0.88	51.60
150	1528	112.0	215.0	216.0	216.0	166.0	167.0	165.0	0.570	0.82	0.68	0.88	62.00
125	1584	94.0	217.0	218.0	218.0	136.0	136.0	135.0	0.480	0.82	0.75	0.89	51.90
100	1640	75.0	220.0	220.0	220.0	107.0	108.0	106.0	0.380	0.82	0.82	0.89	41.20
75	1689	56.0	222.0	223.0	223.0	80.0	81.0	79.0	0.290	0.82	0.84	0.88	30.90
50	1731	36.0	225.0	225.0	225.0	56.0	57.0	55.0	0.200	0.82	0.75	0.86	21.20
25	1764	19.0	226.0	226.0	226.0	36.0	36.0	36.0	0.120	0.82	0.55	0.79	13.10
0	1790	4.0	228.0	228.0	228.0	25.0	26.0	25.0	0.050	0.82	0.37	0.50	7.00

BEFORE CONVERSION - "STANDARD" - 82 SEP 14
(AFTER WARMUP)
(USING WESTON INDUSTRIAL ANALYZER SER. 5346)

PCT	SPD	FORCE	VOLTAGE			CURRENT			PWR	PF	PF	PF	AP.PWR
LOAD	RPM	LBS	AB	BC	CA	A	B	C	*	WES	C-A	E-A	KVA
0	1790	4.5	226.0	226.0	226.0	26.0	26.0	26.0	0.045	0.81	0.42	0.47	6.80
25	1766	18.5	225.0	225.0	225.0	35.0	36.0	35.0	0.150	0.81	0.56	0.77	12.60
50	1731	37.0	223.0	223.0	224.0	57.0	58.0	57.0	0.200	0.81	0.76	0.85	21.50
75	1693	55.0	222.0	222.0	222.0	79.0	81.0	79.0	0.283	0.81	0.82	0.88	30.60
100	1647	74.5	220.0	220.0	220.0	105.0	106.0	104.0	0.380	0.81	0.82	0.88	40.50
125	1588	94.0	217.0	217.0	217.0	136.0	137.0	135.0	0.470	0.81	0.76	0.89	51.60
150	1515	112.0	214.0	215.0	215.0	167.0	168.0	165.0	0.560	0.81	0.68	0.88	62.00
125	1580	94.0	216.0	217.0	217.0	136.0	137.0	135.0	0.470	0.81	0.76	0.89	51.50
100	1637	74.5	218.0	219.0	220.0	107.0	107.0	106.0	0.380	0.81	0.82	0.89	41.20
75	1688	56.0	221.0	221.0	222.0	80.0	80.0	79.0	0.290	0.81	0.83	0.89	30.80
50	1730	37.0	223.0	223.0	224.0	57.0	57.0	55.0	0.200	0.81	0.75	0.86	21.20
25	1766	18.5	225.0	225.0	225.0	35.0	35.0	34.0	0.110	0.81	0.56	0.78	12.20
0	1792	4.0	226.0	226.0	226.0	25.0	25.0	25.0	0.045	0.81	0.44	0.46	6.60

AFTER CONVERSION - "WANLASS" - 82 OCT 07
(BEFORE WARMUP)
(USING WESTON INDUSTRIAL ANALYZER SER. 5346)

PCT	SPD	FORCE	VOLTAGE			CURRENT			PWR	PF	PF	PF	AP.PWR
LOAD	RPM	LBS	AB	BC	CA	A	B	C	*	WES	C-A	E-A	KVA
0	1790	4.0	227.0	227.0	227.0	11.0	11.0	11.0	0.050	9.00	0.85	1.02	3.60
25	1763	19.0	226.0	226.0	226.0	29.0	29.0	29.0	0.120	9.00	0.88	0.95	7.50
50	1733	36.5	225.0	225.0	225.0	50.0	50.0	49.0	0.200	9.00	0.97	0.88	12.10
75	1695	54.5	223.0	223.0	223.0	71.0	72.0	71.0	0.280	9.00	1.01	0.82	17.50
100	1644	75.0	221.0	222.0	222.0	101.0	100.0	98.0	0.390	9.00	1.02	0.75	24.20
125	1580	95.0	218.0	218.0	218.0	129.0	129.0	129.0	0.480	9.00	1.03	0.68	30.90
150	1513	111.0	217.0	217.0	217.0	155.0	155.0	155.0	0.570	9.00	1.05	0.62	37.20
125	1575	94.0	218.0	218.0	218.0	126.0	126.0	126.0	0.480	9.00	1.05	0.68	30.60
100	1635	76.0	221.0	221.0	221.0	98.0	98.0	97.0	0.390	9.00	1.02	0.75	24.00
75	1688	56.0	222.0	222.0	222.0	72.0	72.0	73.0	0.290	9.00	1.00	0.82	17.60
50	1731	36.0	224.0	224.0	224.0	50.0	50.0	50.0	0.200	9.00	0.97	0.89	12.00
25	1763	19.5	225.0	225.0	225.0	29.0	29.0	29.0	0.120	9.00	0.85	0.96	7.40
0	1791	4.0	227.0	227.0	227.0	11.0	11.0	11.0	0.050	9.00	0.80	1.02	3.60

AFTER CONVERSION - "WANLASS" - 82 OCT 07
(AFTER WARMUP)
(USING WESTON INDUSTRIAL ANALYZER SER. 5346)

PCT	SPD	FORCE	VOLTAGE			CURRENT			PWR	PF	PF	PF	AP.PWR
LOAD	RPM	LBS	AB	BC	CA	A	B	C	*	WES	C-A	E-A	KVA
0	1790	4.0	227.0	227.0	227.0	11.0	11.0	11.0	0.050	9.00	0.81	1.02	3.70
25	1761	19.5	226.0	226.0	226.0	30.0	30.0	30.0	0.120	9.00	0.95	0.96	7.60
50	1728	38.0	225.0	225.0	225.0	50.0	50.0	50.0	0.200	9.00	0.98	0.88	12.60
75	1689	56.0	223.0	222.0	222.0	72.0	72.0	72.0	0.290	9.00	1.00	0.82	18.00
100	1639	75.0	221.0	221.0	221.0	100.0	100.0	97.0	0.390	9.00	1.02	0.75	24.00
125	1582	93.5	219.0	219.0	219.0	126.0	126.0	126.0	0.480	9.00	1.03	0.69	30.50
150	1502	111.5	217.0	217.0	217.0	157.0	157.0	155.0	0.570	9.00	1.04	0.63	37.40
125	1571	94.0	219.0	219.0	219.0	125.0	125.0	125.0	0.480	9.00	1.03	0.70	30.30
100	1633	74.0	221.0	221.0	221.0	99.0	99.0	96.0	0.380	9.00	1.02	0.76	23.60
75	1684	56.5	222.0	222.0	222.0	73.0	73.0	71.0	0.300	9.00	0.99	0.82	17.80
50	1728	37.0	225.0	225.0	225.0	50.0	50.0	50.0	0.200	9.00	0.98	0.90	12.30
25	1761	19.5	226.0	226.0	226.0	29.0	29.0	29.0	0.120	9.00	0.95	0.97	7.70
0	1790	4.0	227.0	227.0	227.0	11.0	11.0	11.0	0.050	9.00	0.80	1.02	3.80

50 HP BENDER MOTOR
DYNAMOMETER TEST RAW DATA

BEFORE CONVERSION - "STANDARD" - 82 SEP 13
(BEFORE WARMUP)
(USING WESTON INDUSTRIAL ANALYZER SER. 5346)

PCT	SPD	FORCE	VOLTAGE			CURRENT			PWR	PF	PF	PF	AP.PWR
LOAD	RPM	LBS	AB	BC	CA	A	B	C	*	WES	C-A	E-A	KVA
0	900	3.0	227.0	226.0	226.0	22.5	22.5	23.0	0.030	9.00	9.00	0.20	8.50
25	897	41.5	225.0	224.0	224.0	56.0	57.0	56.0	0.117	0.52	9.00	0.85	12.50
50	894	83.0	223.0	223.0	223.0	75.0	76.0	74.0	0.220	0.71	9.00	0.97	20.50
75	890	125.0	221.0	221.0	221.0	99.0	101.0	98.0	0.310	0.75	9.00	0.99	29.50
100	886	168.0	218.0	218.0	219.0	128.0	129.0	128.0	0.420	0.78	9.00	1.00	39.50
125	879	210.0	216.0	216.0	217.0	163.0	164.0	163.0	0.520	0.53	9.00	1.00	50.00
150	873	250.0	216.0	217.0	217.0	200.0	202.0	202.0	0.620	0.80	9.00	1.00	61.00

BEFORE CONVERSION - "STANDARD" - 82 SEP 13
(AFTER WARMUP)
(USING WESTON INDUSTRIAL ANALYZER SER. 5346)

PCT	SPD	FORCE	VOLTAGE			CURRENT			PWR	PF	PF	PF	AP.PWR
LOAD	RPM	LBS	AB	BC	CA	A	B	C	*	WES	C-A	E-A	KVA
0	900	3.5	226.0	226.0	226.0	21.5	22.5	22.5	0.030	9.00	0.20	0.19	9.00
25	897	42.0	224.0	224.0	224.0	56.0	57.0	56.0	0.120	0.54	0.48	0.85	12.00
50	894	82.5	221.0	221.0	222.0	74.0	75.0	74.0	0.210	0.66	0.61	0.97	20.00
75	890	125.0	221.0	221.0	221.0	98.0	100.0	98.0	0.310	0.68	0.69	0.99	30.00
100	885	167.5	217.0	218.0	218.0	128.0	129.0	127.0	0.410	0.71	0.74	0.99	39.00
125	880	208.0	214.0	215.0	215.0	162.0	164.0	162.0	0.520	0.71	0.77	1.00	50.00
150	872	249.5	212.0	213.0	213.0	202.0	203.0	200.0	0.630	0.75	0.78	0.99	60.00
125	879	207.0	215.0	215.0	215.0	162.0	161.0	161.0	0.520	0.75	0.78	0.99	50.00
100	884	167.0	216.0	217.0	217.0	128.0	130.0	128.0	0.420	0.75	0.75	0.99	40.00
75	889	125.0	219.0	220.0	220.0	100.0	102.0	100.0	0.320	0.75	0.70	0.99	31.00
50	893	83.0	222.0	222.0	223.0	75.0	76.0	75.0	0.220	0.75	0.62	0.96	21.00
25	817	42.0	223.0	223.0	223.0	55.0	57.0	56.0	0.120	0.75	0.48	0.85	13.00
0	900	4.0	225.0	225.0	225.0	22.5	23.0	23.0	0.030	0.74	0.20	0.19	9.00

AFTER CONVERSION - "WANLASS" - 82 OCT 13
(BEFORE WARMUP)
(USING WESTON INDUSTRIAL ANALYZER SER. 1088)

PCT	SPD	FORCE	VOLTAGE			CURRENT			PWR	PF	PF	PF	AP.PWR
LOAD	RPM	LBS	AB	BC	CA	A	B	C	*	WES	C-A	E-A	KVA
0	899	4.0	229.0	229.0	229.0	10.0	10.0	10.0	0.030	0.88	1.02	0.45	1.80
25	897	42.0	228.0	228.0	228.0	30.0	30.0	30.0	0.110	0.96	1.02	0.70	7.40
50	894	82.5	225.0	225.0	225.0	55.0	55.0	54.0	0.200	0.97	1.02	0.70	13.40
75	890	124.5	223.0	223.0	223.0	82.0	82.0	82.0	0.300	0.97	0.99	0.66	20.20
100	885	166.0	220.0	220.0	220.0	111.0	111.0	111.0	0.400	0.96	0.93	0.63	27.00
125	879	207.0	218.0	218.0	218.0	145.0	145.0	145.0	0.500	0.93	0.92	0.58	35.00
150	870	249.0	215.0	215.0	215.0	190.0	190.0	190.0	0.620	0.90	0.90	0.50	43.70
125	879	206.0	219.0	219.0	219.0	144.0	142.0	144.0	0.500	0.94	0.92	0.58	34.40
100	885	167.0	220.0	220.0	220.0	110.0	112.0	110.0	0.400	0.95	0.93	0.62	27.00
75	889	126.5	223.0	223.0	223.0	84.0	84.0	82.0	0.300	0.97	0.99	0.67	20.20
50	893	84.0	225.0	225.0	225.0	58.0	58.0	58.0	0.200	0.97	1.01	0.70	13.50
25	897	43.0	226.0	226.0	226.0	30.0	30.0	30.0	0.110	0.97	1.02	0.70	7.30
0	900	4.0	228.0	228.0	228.0	10.0	10.0	10.0	0.030	0.87	1.02	0.41	1.80

AFTER CONVERSION - "WANLASS" - 82 OCT 13
(AFTER WARMUP)
(USING WESTON INDUSTRIAL ANALYZER SER. 1088)

PCT	SPD	FORCE	VOLTAGE			CURRENT			PWR	PF	PF	PF	AP.PWR
LOAD	RPM	LBS	AB	BC	CA	A	B	C	*	WES	C-A	E-A	KVA
0	900	4.0	227.0	227.0	227.0	10.0	10.0	10.0	0.030	0.89	1.05	0.43	1.70
25	897	42.5	226.0	226.0	226.0	30.0	30.0	30.0	0.110	0.97	1.05	0.70	7.40
50	893	84.0	225.0	225.0	225.0	55.0	55.0	55.0	0.200	0.97	1.01	0.70	13.40
75	889	126.0	222.0	222.0	222.0	85.0	83.0	82.0	0.300	0.97	0.99	0.66	20.40
100	884	168.0	220.0	220.0	220.0	114.0	112.0	112.0	0.400	0.95	0.93	0.62	27.50
125	878	208.0	217.0	217.0	217.0	147.0	146.0	145.0	0.500	0.93	0.92	0.57	34.70
150	869	249.0	215.0	215.0	215.0	190.0	190.0	190.0	0.620	0.90	0.91	0.50	44.60
125	878	206.0	217.0	217.0	217.0	145.0	143.0	143.0	0.500	0.94	0.92	0.58	34.20
100	884	168.0	220.0	220.0	220.0	112.0	112.0	110.0	0.400	0.95	0.93	0.63	27.40
75	889	124.5	222.0	222.0	222.0	82.0	82.0	82.0	0.300	0.97	0.99	0.66	20.00
50	893	84.0	225.0	225.0	225.0	56.0	56.0	55.0	0.200	0.97	1.02	0.70	13.70
25	897	43.0	227.0	227.0	227.0	30.0	30.0	30.0	0.110	0.97	1.07	0.70	7.60
0	900	4.0	227.0	227.0	227.0	10.0	10.0	10.0	0.030	0.88	1.04	0.40	1.80

100 HP SPARE MOTOR
DYNAMOMETER TEST RAW DATA

BEFORE CONVERSION - "STANDARD" - 82 SEP 15
BEFORE WARMUP
USING WESTON INDUSTRIAL ANALYZER SER. 5346

PCT	SPD	FORCE	VOLTAGE			CURRENT			PWR	PF	PF	PF	AP.PWR
LOAD	RPM	LBS	AB	BC	CA	A	B	C	*	WES	C-A	E-A	KVA
0	1200	3.0	442.0	442.0	442.0	35.0	36.0	36.0	0.025	9.00	0.48	0.11	29.00
25	1193	64.0	444.0	444.0	444.0	48.0	50.0	48.0	0.120	9.00	0.48	0.58	38.00
50	1185	129.0	442.0	442.0	442.0	69.0	70.0	69.0	0.220	9.00	0.62	0.78	53.00
75	1179	193.0	442.0	442.0	442.0	93.0	94.0	92.0	0.310	9.00	0.73	0.84	71.00
100	1169	258.0	440.0	442.0	442.0	121.0	122.0	120.0	0.420	9.00	0.79	0.88	91.00
125	1159	321.0	436.0	438.0	438.0	150.0	151.0	149.0	0.520	9.00	0.82	0.89	112.00
150	1147	383.0	434.0	436.0	436.0	182.0	184.0	183.0	0.625	9.00	0.83	0.88	137.00
125	1159	317.0	436.0	438.0	438.0	148.0	148.0	147.0	0.510	9.00	0.82	0.88	110.00
100	1168	259.0	440.0	440.0	440.0	122.0	122.0	120.0	0.420	9.00	0.78	0.88	92.00
75	1177	194.0	440.0	440.0	440.0	95.0	95.0	94.0	0.320	9.00	0.73	0.85	72.00
50	1185	131.5	440.0	440.0	440.0	71.0	71.0	69.0	0.220	9.00	0.63	0.79	52.00
25	1193	64.0	442.0	442.0	442.0	50.0	50.0	48.0	0.120	9.00	0.50	0.58	37.00
0	1199	3.0	442.0	442.0	442.0	36.0	37.0	36.0	0.025	9.00	0.45	0.10	30.00

BEFORE CONVERSION - "STANDARD" - 82 SEP 15
AFTER WARMUP
USING WESTON INDUSTRIAL ANALYZER SER. 5346

PCT	SPD	FORCE	VOLTAGE			CURRENT			PWR	PF	PF	PF	AP.PWR
LOAD	RPM	LBS	AB	BC	CA	A	B	C	*	WES	C-A	E-A	KVA
0	1199	3.0	448.0	446.0	444.0	36.0	37.0	37.0	0.025	9.00	0.57	0.10	30.00
25	1193	64.0	444.0	444.0	444.0	48.0	50.0	48.0	0.120	9.00	0.52	0.58	37.00
50	1185	129.0	442.0	442.0	442.0	69.0	70.0	69.0	0.220	9.00	0.65	0.78	53.00
75	1177	193.5	442.0	442.0	442.0	94.0	95.0	93.0	0.320	9.00	0.73	0.85	71.00
100	1169	258.5	440.0	440.0	440.0	122.0	122.0	120.0	0.420	9.00	0.77	0.88	91.00
125	1158	323.5	440.0	440.0	440.0	151.0	152.0	150.0	0.520	9.00	0.81	0.88	113.00
150	1147	386.0	438.0	438.0	438.0	182.0	183.0	181.0	0.660	9.00	0.82	0.88	136.00
125	1157	323.0	440.0	440.0	440.0	152.0	152.0	150.0	0.520	9.00	0.81	0.88	114.00
100	1168	258.0	440.0	440.0	440.0	122.0	123.0	121.0	0.420	9.00	0.78	0.88	92.00
75	1177	193.0	442.0	442.0	442.0	94.0	95.0	93.0	0.320	9.00	0.73	0.85	71.00
50	1185	129.0	442.0	442.0	444.0	70.0	70.0	69.0	0.220	9.00	0.64	0.78	53.00
25	1192	64.0	446.0	446.0	446.0	50.0	50.0	49.0	0.120	9.00	0.52	0.58	37.00
0	1199	3.0	446.0	446.0	446.0	37.0	38.0	37.0	0.025	9.00	0.58	0.10	30.00

AFTER CONVERSION - "WANLASS-1" - 82 OCT 06
BEFORE WARMUP
USING WESTON INDUSTRIAL ANALYZER SER. 5346

PCT	SPD	FORCE	VOLTAGE			CURRENT			PWR	PF	PF	PF	AP.PWR
LOAD	RPM	LBS	AB	BC	CA	A	B	C	*	WES	C-A	E-A	KVA
0	1200	4.0	445.0	445.0	445.0	10.0	10.0	10.0	0.030	9.00	9.00	1.07	4.20
25	1193	65.0	445.0	445.0	445.0	28.0	28.0	28.0	0.120	9.00	9.00	1.01	22.00
50	1186	129.0	442.0	442.0	442.0	55.0	55.0	55.0	0.220	9.00	9.00	1.00	41.00
75	1178	193.5	440.5	440.5	440.5	82.0	81.0	81.0	0.320	9.00	9.00	0.99	60.80
100	1168	253.5	440.5	440.5	440.5	110.0	110.0	110.0	0.420	9.00	9.00	0.98	81.80
125	1160	312.5	440.0	440.0	440.0	138.0	138.0	138.0	0.520	9.00	9.00	0.97	105.00
150	1146	378.0	439.0	439.0	439.0	170.0	170.0	170.0	0.620	9.00	9.00	0.93	131.00
125	1159	323.0	440.0	440.0	440.0	140.0	138.0	138.0	0.520	9.00	9.00	0.96	103.00
100	1168	259.5	440.0	440.0	440.0	110.0	110.0	109.0	0.420	9.00	9.00	0.98	83.00
75	1177	195.5	440.0	440.0	440.0	83.0	82.0	81.0	0.320	9.00	9.00	1.00	62.30
50	1185	131.5	441.0	441.0	441.0	56.0	55.0	54.0	0.220	9.00	9.00	1.00	42.00
25	1193	64.0	443.0	443.0	443.0	29.0	29.0	29.0	0.120	9.00	9.00	1.00	22.00
0	1200	3.5	445.0	445.0	445.0	10.0	10.0	10.0	0.030	9.00	9.00	1.07	3.90

AFTER CONVERSION - "WANLASS-1" - 82 OCT 06
AFTER WARMUP
USING WESTON INDUSTRIAL ANALYZER SER. 5346

PCT	SPD	FORCE	VOLTAGE			CURRENT			PWR	PF	PF	PF	AP.PWR
LOAD	RPM	LBS	AB	BC	CA	A	B	C	*	WES	C-A	E-A	KVA
0	1199	4.0	441.0	441.0	441.0	10.0	10.0	10.0	0.030	9.00	0.98	1.08	4.00
25	1193	67.0	441.0	441.0	441.0	30.0	30.0	30.0	0.120	9.00	0.99	1.00	22.60
50	1186	129.0	441.0	441.0	441.0	55.0	55.0	55.0	0.220	9.00	1.00	1.00	41.40
75	1177	192.0	440.5	440.5	440.5	81.0	81.0	81.0	0.320	9.00	1.03	1.00	61.50
100	1168	255.5	440.0	440.0	440.0	109.0	108.0	107.0	0.420	9.00	1.04	0.98	81.80
125	1160	317.5	440.0	440.0	440.0	140.0	139.0	139.0	0.520	9.00	1.06	0.96	104.30
150	1144	384.0	440.0	440.0	440.0	172.0	171.0	171.0	0.630	9.00	1.05	0.93	131.70
125	1158	315.0	440.0	440.0	440.0	140.0	138.0	138.0	0.520	9.00	1.05	0.96	103.50
100	1168	255.5	441.0	441.0	441.0	109.0	108.0	107.0	0.420	9.00	1.03	0.98	82.10
75	1176	195.0	440.0	440.0	440.0	82.0	80.0	80.0	0.320	9.00	1.00	0.99	62.30
50	1185	133.0	442.0	442.0	442.0	56.0	55.0	55.0	0.220	9.00	0.98	1.00	42.60
25	1193	64.0	441.0	441.0	441.0	28.0	28.0	28.0	0.120	9.00	0.99	1.00	22.00
0	1200	4.0	445.0	445.0	445.0	10.0	10.0	10.0	0.030	9.00	0.94	1.07	4.00

AFTER CONVERSION - "WANLASS-2" - 82 NOV 10
BEFORE WARMUP
USING WESTON INDUSTRIAL ANALYZER SER. 1088

PCT	SPD	FORCE	VOLTAGE			CURRENT			PWR	PF	PF	PF	AP.PWR
LOAD	RPM	LBS	AB	BC	CA	A	B	C	*	WES	C-A	E-A	KVA
0	1199	3.5	445.0	446.0	446.0	3.0	4.0	3.0	0.025	1.14	1.07	1.09	3.20
25	1193	65.0	445.0	445.0	445.0	29.0	30.0	28.0	0.117	1.01	1.06	0.94	14.00
50	1186	126.5	444.0	445.0	445.0	54.0	54.5	53.5	0.213	1.00	1.00	0.84	26.70
75	1179	188.5	441.0	443.0	442.0	80.5	80.5	79.5	0.310	0.99	0.97	0.79	39.20
100	1170	257.5	440.0	441.0	441.0	108.0	108.0	108.0	0.405	0.99	0.96	0.75	52.20
125	1159	323.0	438.0	439.0	439.0	139.0	138.0	138.0	0.512	0.97	0.84	0.69	67.10
150	1147	387.0	432.0	434.0	434.0	173.0	172.0	173.0	0.615	0.95	0.78	0.64	83.50
150	1147	360.5	438.0	439.0	439.0	157.0	155.0	156.0	0.570	0.96	0.90	0.90	9.00

50 HP BLOWER MOTOR
DYNAMOMETER TEST RAW DATA

BEFORE CONVERSION - "STANDARD" - 82 SEP 24
BEFORE WARMUP
USING WESTON INDUSTRIAL ANALYZER SER. 5346

PCT	SPD	FORCE	VOLTAGE			CURRENT			PWR	PF	PF	PF	AP.PWR
LOAD	RPM	LBS	AB	BC	CA	A	B	C	*	WES	C-A	E-A	KVA
0	1799	4.0	445.0	443.0	443.0	18.0	18.0	18.0	0.025	9.00	0.42	0.21	15.10
25	1794	21.0	445.0	443.0	443.0	20.0	22.0	20.0	0.060	9.00	0.49	0.55	18.80
50	1788	41.8	444.0	442.0	442.0	33.0	33.0	33.0	0.110	9.00	0.57	0.75	26.60
75	1781	63.5	443.0	443.0	443.0	48.0	50.0	48.0	0.160	9.00	0.66	0.83	36.50
100	1774	84.5	443.0	443.0	443.0	64.0	64.0	62.0	0.220	9.00	0.73	0.85	48.00
125	1764	105.0	443.0	443.0	443.0	78.0	80.0	78.0	0.260	9.00	0.77	0.86	59.20
150	1753	126.8	442.0	441.0	441.0	95.0	97.0	94.0	0.320	9.00	0.78	0.89	73.10
125	1764	105.5	442.0	442.0	442.0	77.0	78.0	76.0	0.260	9.00	0.77	0.85	58.30
100	1772	84.5	443.0	443.0	443.0	63.0	62.0	61.0	0.215	9.00	0.77	0.86	47.20
75	1780	63.0	442.0	442.0	443.0	48.0	50.0	48.0	0.160	9.00	0.71	0.83	36.20
50	1787	42.3	443.0	443.0	443.0	34.0	33.0	33.0	0.110	9.00	0.57	0.76	26.60
25	1794	20.9	444.0	443.0	443.0	23.0	23.0	22.0	0.060	9.00	0.48	0.55	18.60
0	1799	4.0	443.0	443.0	443.0	18.0	18.0	18.0	0.021	9.00	0.36	0.20	14.90

BEFORE CONVERSION - "STANDARD" - 82 SEP 24
AFTER WARMUP
USING WESTON INDUSTRIAL ANALYZER SER. 5346

PCT	SPD	FORCE	VOLTAGE			CURRENT			PWR	PF	PF	PF	AP.PWR
LOAD	RPM	LBS	AB	BC	CA	A	B	C	*	WES	C-A	E-A	KVA
0	1799	3.0	443.0	443.0	443.0	18.0	18.0	18.0	0.030	9.00	0.32	0.20	14.60
25	1793	21.0	442.0	442.0	442.0	21.0	22.0	21.0	0.060	9.00	0.47	0.58	18.60
50	1785	41.5	442.0	442.0	441.0	32.0	32.0	31.0	0.110	9.00	0.56	0.77	26.30
75	1777	63.5	442.0	442.0	442.0	49.0	51.0	49.0	0.160	9.00	0.72	0.83	37.30
100	1767	84.5	440.0	439.0	439.0	63.0	64.0	63.0	0.220	9.00	0.66	0.85	47.70
125	1756	105.5	441.0	440.0	440.0	80.0	80.0	79.0	0.270	9.00	0.70	0.86	60.00
150	1743	127.0	441.0	440.0	440.0	96.0	99.0	97.0	0.320	9.00	0.70	0.84	73.50
125	1756	106.0	442.0	441.0	441.0	79.0	79.0	78.0	0.270	9.00	0.67	0.86	59.20
100	1766	84.5	442.0	441.0	441.0	63.0	64.0	62.0	0.220	9.00	0.68	0.85	47.90
75	1776	63.5	442.0	441.0	441.0	48.0	48.0	48.0	0.160	9.00	0.63	0.84	36.50
50	1785	42.5	443.0	442.0	441.0	33.0	33.0	32.0	0.120	9.00	0.55	0.77	26.60
25	1793	21.0	443.0	442.0	442.0	22.0	22.0	22.0	0.060	9.00	0.43	0.57	18.50
0	1799	4.0	443.0	442.0	443.0	18.0	18.0	18.0	0.030	9.00	0.43	0.20	14.70

AFTER CONVERSION - "WANLASS-1" - 82 OCT 05
BEFORE WARMUP
USING WESTON INDUSTRIAL ANALYZER SER. 5346

PCT	SPD	FORCE	VOLTAGE			CURRENT			PWR	PF	PF	PF	AP.PWR
LOAD	RPM	LBS	AB	BC	CA	A	B	C	*	WES	C-A	E-A	KVA
0	1798	4.0	445.0	445.0	445.0	10.0	10.0	10.0	0.030	9.00	0.98	0.99	2.40
25	1794	21.0	446.0	445.0	445.0	11.0	11.0	11.0	0.060	9.00	0.85	0.97	6.70
50	1788	42.5	445.0	444.0	444.0	28.0	28.0	28.0	0.120	9.00	0.65	0.99	20.60
75	1781	63.5	444.0	444.0	444.0	41.0	41.0	41.0	0.160	9.00	0.43	0.99	31.00
100	1784	84.5	444.0	444.0	444.0	56.0	56.0	56.0	0.215	9.00	0.20	0.99	42.00
125	1782	106.0	443.0	443.0	443.0	71.0	71.0	71.0	0.270	9.00	9.00	0.95	53.00
150	1765	127.0	442.0	442.0	442.0	89.0	90.0	88.0	0.320	9.00	9.00	0.92	67.30
125	1780	105.5	443.0	443.0	443.0	71.0	71.0	71.0	0.270	9.00	9.00	0.95	53.50
100	1778	84.5	443.0	443.0	443.0	57.0	56.0	56.0	0.220	9.00	0.20	0.98	42.30
75	1781	64.0	444.0	444.0	444.0	41.0	41.0	41.0	0.170	9.00	0.40	0.99	31.50
50	1787	43.0	446.0	446.0	446.0	28.0	28.0	28.0	0.120	9.00	0.55	0.99	21.00
25	1792	21.0	446.0	446.0	446.0	13.0	12.0	11.0	0.065	9.00	0.82	1.00	11.00
0	1799	4.5	447.0	446.0	446.0	8.0	8.0	8.0	0.030	9.00	0.97	0.88	4.10

AFTER CONVERSION - "WANLASS-1" - 82 OCT 05
 AFTER WARMUP
 USING WESTON INDUSTRIAL ANALYZER SER. 5346

PCT	SPD	FORCE	VOLTAGE			CURRENT			PWR	PF	PF	PF	AP.PWR
LOAD	RPM	LBS	AB	BC	CA	A	B	C	*	WES	C-A	E-A	KVA
0	1798	4.0	445.0	445.0	445.0	10.0	10.0	10.0	0.030	9.00	0.98	0.99	2.40
25	1794	21.0	446.0	445.0	445.0	11.0	11.0	11.0	0.060	9.00	0.81	0.97	6.70
50	1788	42.5	445.0	444.0	444.0	28.0	28.0	28.0	0.120	9.00	0.65	0.99	20.60
75	1781	63.5	444.0	444.0	444.0	41.0	41.0	41.0	0.160	9.00	0.43	0.99	31.00
100	1784	84.5	444.0	444.0	444.0	56.0	56.0	56.0	0.215	9.00	0.20	0.99	42.00
125	1782	106.0	443.0	443.0	443.0	71.0	71.0	71.0	0.270	9.00	9.00	0.95	53.00
150	1765	127.0	442.0	442.0	442.0	89.0	90.0	88.0	0.320	9.00	9.00	0.92	67.30
125	1780	105.5	443.0	443.0	443.0	71.0	71.0	71.0	0.270	9.00	9.00	0.95	53.50
100	1778	84.5	443.0	443.0	443.0	57.0	56.0	56.0	0.220	9.00	0.20	0.98	42.30
75	1781	64.0	444.0	444.0	444.0	41.0	41.0	41.0	0.170	9.00	0.40	0.99	31.50
50	1787	43.0	446.0	446.0	446.0	28.0	28.0	28.0	0.120	9.00	0.55	0.99	21.00
25	1792	21.0	446.0	446.0	446.0	13.0	12.0	11.0	0.065	9.00	0.82	1.00	11.00
0	1799	4.5	447.0	446.0	446.0	8.0	8.0	8.0	0.030	9.00	0.97	0.88	4.10

AFTER CONVERSION - "WANLASS-2" - 82 NOV 15
 NO WARMUP
 RE-TEST AFTER WANLASS COMPANY VISIT TO BREMERTON
 USING WESTON INDUSTRIAL ANALYZER SER. 1088

PCT	SPD	FORCE	VOLTAGE			CURRENT			PWR	PF	PF	PF	AP.PWR
LOAD	RPM	LBS	AB	BC	CA	A	B	C	*	WES	C-A	E-A	KVA
0	1798	4.0	447.0	448.0	447.0	3.5	2.5	2.5	0.027	1.04	9.00	1.18	4.10
25	1794	22.0	444.0	445.0	445.0	15.0	15.0	13.0	0.066	1.01	9.00	1.02	11.70
50	1788	43.0	443.0	445.0	444.0	27.0	28.0	27.0	0.117	0.99	9.00	0.99	21.20
75	1781	64.0	442.0	444.0	443.0	42.0	43.0	42.0	0.162	0.99	9.00	0.98	31.20
100	1774	85.0	444.0	445.0	445.0	55.0	55.0	54.0	0.213	0.98	9.00	0.97	41.20
125	1764	106.0	443.0	445.0	444.0	70.5	72.0	70.5	0.263	0.97	9.00	0.94	53.30
150	1752	127.5	442.0	443.0	441.0	89.5	88.0	89.5	0.321	0.92	9.00	0.91	66.60
125	1764	106.0	443.0	445.0	444.0	70.0	70.0	69.5	0.264	0.95	9.00	0.94	53.10
100	1774	84.5	443.5	445.0	445.0	54.5	54.0	54.0	0.210	0.97	9.00	0.96	41.40
75	1781	63.5	444.0	446.0	445.0	42.0	42.0	40.0	0.160	0.99	9.00	0.98	30.60
50	1788	42.0	445.0	447.0	446.0	26.0	27.0	25.0	0.113	0.99	9.00	0.99	20.50
25	1794	22.0	446.0	447.0	446.0	13.0	13.0	13.0	0.063	1.01	9.00	1.01	11.50
0	1798	4.5	447.0	448.5	448.0	5.0	4.0	4.0	0.025	1.04	9.00	1.17	4.00

75 HP BLOWER MOTOR
DYNAMOMETER TEST RAW DATA

BEFORE CONVERSION - "STANDARD" - 82 SEP 23
BEFORE WARMUP
USING WESTON INDUSTRIAL ANALYZER SER. 5346

PCT	SPD	FORCE	VOLTAGE			CURRENT			PWR	PF	PF	PF	AP.PWR
LOAD	RPM	LBS	AB	BC	CA	A	B	C	*	WES	C-A	E-A	KVA
0	1800	3.0	447.0	446.0	446.0	22.0	22.0	22.0	0.025	0.82	0.38	0.19	18.00
25	1796	31.4	444.0	443.0	443.0	32.0	32.0	32.0	0.090	0.82	0.52	0.62	25.40
50	1792	63.0	443.0	443.0	443.0	51.0	52.0	50.0	0.160	0.82	0.62	0.79	38.10
75	1787	94.4	443.0	443.0	443.0	72.0	72.0	70.0	0.240	0.82	0.70	0.84	53.80
100	1782	126.8	441.0	441.0	441.0	95.0	96.0	94.0	0.320	0.82	0.74	0.84	71.50
125	1775	158.2	440.0	440.0	440.0	122.0	122.0	120.0	0.395	0.82	0.73	0.83	90.90
150	1766	189.0	439.0	439.0	439.0	153.0	153.0	151.0	0.475	0.82	0.70	0.83	125.10
125	1774	158.0	440.0	440.0	440.0	121.0	122.0	119.0	0.395	0.82	0.73	0.84	91.10
100	1781	125.0	441.0	441.0	441.0	94.0	95.0	93.0	0.315	0.82	0.74	0.85	71.80
75	1786	94.5	442.0	442.0	442.0	72.0	72.0	71.0	0.240	0.82	0.72	0.83	54.50
50	1792	63.0	444.0	442.0	442.0	51.0	52.0	50.0	0.160	0.82	0.64	0.79	38.70
25	1796	31.5	443.0	442.0	442.0	31.0	32.0	32.0	0.090	0.82	0.52	0.64	25.60
0	1799	4.0	444.0	443.0	443.0	22.0	22.0	22.0	0.025	0.82	0.37	0.18	17.80

BEFORE CONVERSION - "STANDARD" - 82 SEP 23
AFTER WARMUP
USING WESTON INDUSTRIAL ANALYZER SER. 5346

PCT	SPD	FORCE	VOLTAGE			CURRENT			PWR	PF	PF	PF	AP.PWR
LOAD	RPM	LBS	AB	BC	CA	A	B	C	*	WES	C-A	E-A	KVA
0	1799	3.0	446.0	446.0	445.0	21.0	21.0	21.0	0.030	0.82	0.37	0.18	17.60
25	1796	31.5	446.0	443.0	443.0	31.0	32.0	32.0	0.085	0.82	0.54	0.63	25.70
50	1791	63.5	446.0	444.0	444.0	52.0	52.0	51.0	0.160	0.82	0.64	0.79	38.70
75	1786	94.5	443.0	442.0	442.0	73.0	73.0	71.0	0.240	0.82	0.72	0.83	54.70
100	1780	126.5	442.0	441.0	441.0	96.0	95.0	93.0	0.320	0.82	0.74	0.85	71.60
125	1772	158.0	441.0	440.0	440.0	122.0	121.0	120.0	0.395	0.82	0.76	0.83	91.40
150	1761	189.0	440.0	439.0	439.0	154.0	155.0	152.0	0.480	0.82	0.72	0.73	127.00
125	1770	158.0	441.0	441.0	440.0	123.0	122.0	121.0	0.450	0.82	0.74	0.83	92.40
100	1779	126.5	443.0	442.0	442.0	96.0	96.0	94.0	0.320	0.82	0.74	0.83	72.70
75	1785	94.5	443.0	443.0	442.0	73.0	72.0	71.0	0.240	0.81	0.72	0.83	55.00
50	1791	63.5	444.0	443.0	442.0	53.0	52.0	51.0	0.160	0.81	0.66	0.80	39.50
25	1795	31.5	445.0	444.0	444.0	31.0	31.0	30.0	0.090	0.81	0.53	0.62	25.70
0	1799	3.0	445.0	444.0	444.0	21.0	21.0	21.0	0.030	0.81	0.37	0.78	17.60

AFTER CONVERSION - "WANLASS-1" - 82 OCT 08
BEFORE WARMUP
USING WESTON INDUSTRIAL ANALYZER SER. 5346

PCT	SPD	FORCE	VOLTAGE			CURRENT			PWR	PF	PF	PF	AP.PWR
LOAD	RPM	LBS	AB	BC	CA	A	B	C	*	WES	C-A	E-A	KVA
0	1799	4.0	445.0	445.0	445.0	10.0	10.0	10.0	0.030	9.00	1.07	1.10	6.80
25	1796	32.5	442.0	442.0	442.0	22.0	22.0	22.0	0.090	9.00	1.13	0.96	12.50
50	1792	61.5	442.0	442.0	442.0	40.0	40.0	40.0	0.160	9.00	1.02	0.86	21.50
75	1788	93.5	442.0	442.0	442.0	59.0	59.0	59.0	0.240	9.00	0.99	0.79	32.00
100	1782	125.5	441.0	441.0	441.0	83.0	83.0	83.0	0.320	9.00	0.96	0.70	43.20
125	1775	158.0	440.5	440.5	440.5	109.0	109.0	109.0	0.400	9.00	0.92	0.60	58.00
150	1765	187.5	440.0	440.0	440.0	138.0	138.0	138.0	0.480	9.00	0.87	0.50	72.30
125	1775	156.0	441.0	441.0	441.0	106.0	106.0	106.0	0.400	9.00	0.92	0.63	57.00
100	1782	125.5	441.0	441.0	441.0	82.0	83.0	82.0	0.320	9.00	0.95	0.70	44.00
75	1786	96.0	441.0	441.0	441.0	61.0	61.0	61.0	0.240	9.00	0.99	0.78	32.70
50	1792	63.8	442.0	442.0	442.0	40.0	40.0	40.0	0.160	9.00	1.01	0.87	22.30
25	1795	32.5	442.0	442.0	442.0	21.0	20.0	20.0	0.090	9.00	1.15	0.97	12.80
0	1798	4.0	443.0	443.0	443.0	10.0	10.0	10.0	0.030	9.00	1.07	1.11	6.70

AFTER CONVERSION - "WANLASS-1" - 82 OCT 08
AFTER WARMUP
USING WESTON INDUSTRIAL ANALYZER SER. 5346

PCT	SPD	FORCE	VOLTAGE			CURRENT			PWR	PF	PF	PF	AP.PWR
LOAD	RPM	LBS	AB	BC	CA	A	B	C	*	WES	C-A	E-A	KVA
0	1798	4.0	445.0	445.0	445.0	10.0	10.0	10.0	0.030	9.00	1.15	1.14	7.00
25	1796	33.0	445.0	445.0	445.0	21.0	22.0	21.0	0.100	9.00	1.15	0.96	13.20
50	1791	63.5	442.0	442.0	442.0	40.0	40.0	40.0	0.160	9.00	1.01	0.86	22.30
75	1776	96.0	442.0	442.0	442.0	60.0	62.0	60.0	0.220	9.00	0.99	0.78	33.30
100	1777	125.5	441.0	441.0	441.0	83.0	83.0	83.0	0.320	9.00	0.92	0.69	44.40
125	1768	158.0	440.0	440.0	440.0	110.0	110.0	110.0	0.400	9.00	0.92	0.60	59.00
150	1755	188.0	439.0	439.0	439.0	143.0	143.0	143.0	0.490	9.00	0.87	0.50	74.00
125	1766	159.0	440.0	440.0	440.0	110.0	109.0	109.0	0.400	9.00	0.92	0.60	58.60
100	1776	126.5	441.0	441.0	441.0	83.0	83.0	82.0	0.320	9.00	0.94	0.68	44.70
75	1783	96.0	442.0	442.0	442.0	60.0	60.0	60.0	0.240	9.00	0.99	0.78	33.20
50	1789	64.0	442.0	442.0	442.0	40.0	40.0	40.0	0.160	9.00	1.01	0.86	22.30
25	1794	30.5	442.0	442.0	442.0	20.0	20.0	20.0	0.090	9.00	1.15	0.97	12.00
0	1799	4.0	445.0	445.0	445.0	10.0	10.0	10.0	0.030	9.00	1.06	1.14	7.00

AFTER CONVERSION - "WANLASS-2" - 82 OCT 14
AFTER WARMUP
AFTER REPLACEMENT OF BEARINGS
USING WESTON INDUSTRIAL ANALYZER SER. 1088

PCT	SPD	FORCE	VOLTAGE			CURRENT			PWR	PF	PF	PF	AP.PWR
LOAD	RPM	LBS	AB	BC	CA	A	B	C	*	WES	C-A	E-A	KVA
0	1800	4.0	449.0	448.0	448.0	18.9	18.4	18.0	0.030	1.20	1.07	1.11	7.00
25	1795	31.0	448.0	448.0	448.0	28.3	27.0	27.0	0.090	1.03	1.15	0.97	12.70
50	1792	64.0	448.0	446.0	447.0	42.3	42.8	41.3	0.160	1.01	1.01	0.87	21.50
75	1788	96.0	446.0	445.0	445.0	63.1	63.7	62.5	0.230	0.99	0.99	0.77	32.60
100	1782	127.0	445.0	444.0	444.0	86.2	86.2	84.6	0.300	0.97	0.96	0.70	44.00

AFTER CONVERSION - "WANLASS-3" - 82 NOV 09
NO WARMUP
DURING VISIT BY WANLASS COMPANY REPS.
USING WESTON INDUSTRIAL ANALYZER SER. 1088

PCT	SPD	FORCE	VOLTAGE			CURRENT			PWR	PF	PF	PF	AP.PWR
LOAD	RPM	LBS	AB	BC	CA	A	B	C	*	WES	C-A	E-A	KVA
75	1788	94.0	443.0	443.0	443.0	58.0	59.0	58.0	0.225	0.99	0.99	9.00	9.00
100	1782	124.0	441.0	441.0	441.0	79.0	80.0	79.0	0.298	9.00	9.00	9.00	9.00
125	1776	159.0	441.0	441.0	441.0	103.0	104.0	104.0	0.377	9.00	9.00	9.00	9.00
150	1761	190.0	440.0	440.0	440.0	137.0	136.0	137.0	0.470	0.89	0.87	9.00	9.00
100	1782	124.0	443.0	443.0	443.0	82.0	82.0	82.0	0.310	0.97	0.95	9.00	9.00

AFTER CONVERSION - "WANLASS-3" - 82 NOV 16
NO WARMUP
USING WESTON INDUSTRIAL ANALYZER SER. 1088

PCT	SPD	FORCE	VOLTAGE			CURRENT			PWR	PF	PF	PF	AP.PWR
LOAD	RPM	LBS	AB	BC	CA	A	B	C	*	WES	C-A	E-A	KVA
0	1799	4.0	446.0	448.0	447.0	11.0	11.0	11.0	0.028	9.00	9.00	1.57	9.50
25	1796	32.0	445.0	447.0	447.0	23.0	23.0	21.0	0.088	1.03	9.00	1.07	17.30
50	1793	63.0	444.0	447.0	446.0	42.0	42.0	40.0	0.160	1.01	9.00	1.01	30.30
75	1789	95.5	443.0	446.0	445.0	60.0	61.0	59.0	0.235	0.99	9.00	0.99	45.10
100	1784	126.0	443.0	445.0	444.0	81.5	82.0	81.0	0.311	0.97	9.00	0.97	61.20
125	1777	159.0	439.5	440.5	440.0	108.0	107.5	107.0	0.392	0.95	9.00	0.94	79.80
150	1766	190.0	437.0	438.0	439.0	140.5	139.5	140.0	0.475	0.90	9.00	0.89	102.00
125	1776	158.0	439.0	441.0	440.0	107.0	107.5	107.0	0.390	0.95	9.00	0.94	79.50
100	1781	126.0	440.0	441.0	440.5	81.5	80.5	81.0	0.308	0.98	9.00	0.97	60.50
75	1788	96.0	441.0	443.0	442.0	60.0	61.0	59.5	0.235	0.99	9.00	0.98	45.50
50	1793	63.0	445.0	447.0	446.0	41.0	40.5	40.5	0.158	1.00	9.00	1.02	30.50
25	1797	32.0	445.0	446.0	445.0	23.0	23.0	22.0	0.087	1.03	9.00	1.07	17.40
0	1799	4.5	446.0	447.0	446.0	12.0	10.0	10.0	0.027	9.00	9.00	1.59	9.35

Table B-8. Corrected Data

40 HP BRAKE MOTOR
CORRECTED & AVERAGED DATA

PCT LOAD	SPD RPM	FORCE LBS	VOLT	CURR AMPS	POWER KW	PF	PF	PF	AP.PWR KVA
0	1790	3.5	227.5	28.5	4.950	0.42	0.40	0.48	6.90
25	1765	19.0	225.5	39.0	12.250	0.71	0.56	0.78	13.20
50	1733	37.0	224.8	58.1	20.250	0.77	0.73	0.86	21.50
75	1695	56.0	223.2	81.1	28.250	0.78	0.82	0.88	30.80
100	1649	74.5	220.8	107.4	38.250	0.79	0.81	0.89	41.00
125	1594	94.0	218.8	136.4	47.250	0.81	0.75	0.88	51.60
150	1528	112.0	216.2	167.4	57.250	0.82	0.68	0.88	62.00
125	1584	94.0	218.2	137.1	48.250	0.82	0.75	0.89	51.90
100	1640	75.0	220.5	108.4	38.250	0.82	0.82	0.89	41.20
75	1689	56.0	223.2	81.4	29.250	0.82	0.84	0.88	30.90
50	1731	36.0	225.5	57.4	20.250	0.82	0.75	0.86	21.20
25	1764	19.0	226.5	38.7	12.250	0.82	0.55	0.79	13.10
0	1790	4.0	228.5	28.9	5.250	0.82	0.37	0.50	7.00

PCT LOAD	SPD RPM	FORCE LBS	VOLT	CURR AMPS	POWER KW	PF	PF	PF	AP.PWR KVA
0	1790	4.5	226.5	29.5	4.750	0.81	0.42	0.47	6.80
25	1766	18.5	225.5	38.1	15.250	0.81	0.56	0.77	12.60
50	1731	37.0	223.8	58.7	20.250	0.81	0.76	0.85	21.50
75	1693	55.0	222.5	81.1	28.550	0.81	0.82	0.88	30.60
100	1647	74.5	220.5	106.4	38.250	0.81	0.82	0.88	40.50
125	1588	94.0	217.5	137.4	47.250	0.81	0.76	0.89	51.60
150	1515	112.0	215.2	168.1	56.250	0.81	0.68	0.88	62.00
125	1580	94.0	217.2	137.4	47.250	0.81	0.76	0.89	51.50
100	1637	74.5	219.5	108.1	38.250	0.81	0.82	0.89	41.20
75	1688	56.0	221.8	81.1	29.250	0.81	0.83	0.89	30.80
50	1730	37.0	223.8	57.7	20.250	0.81	0.75	0.86	21.20
25	1766	18.5	225.5	37.5	11.250	0.81	0.56	0.78	12.20
0	1792	4.0	226.5	28.5	4.750	0.81	0.44	0.46	6.60

PCT LOAD	SPD RPM	FORCE LBS	VOLT	CURR AMPS	POWER KW	PF	PF	PF	AP.PWR KVA
0	1790	4.0	227.5	15.6	5.250	9.00	0.85	1.02	3.60
25	1763	19.0	226.5	32.3	12.250	9.00	0.88	0.95	7.50
50	1733	36.5	225.5	51.2	20.250	9.00	0.97	0.88	12.10
75	1695	54.5	223.5	72.7	28.250	9.00	1.01	0.82	17.50
100	1644	75.0	222.2	101.1	39.250	9.00	1.02	0.75	24.20
125	1580	95.0	218.5	130.4	48.250	9.00	1.03	0.68	30.90
150	1513	111.0	217.5	156.4	57.250	9.00	1.05	0.62	37.20
125	1575	94.0	218.5	127.4	48.250	9.00	1.05	0.68	30.60
100	1635	76.0	221.5	99.1	39.250	9.00	1.02	0.75	24.00
75	1688	56.0	222.5	73.7	29.250	9.00	1.00	0.82	17.60
50	1731	36.0	224.5	51.4	20.250	9.00	0.97	0.89	12.00
25	1763	19.5	225.5	32.3	12.250	9.00	0.85	0.96	7.40
0	1791	4.0	227.5	15.6	5.250	9.00	0.80	1.02	3.60

PCT LOAD	SPD RPM	FORCE LBS	VOLT	CURR AMPS	POWER KW	PF	PF	PF	AP.PWR KVA
0	1790	4.0	227.5	15.6	5.250	9.00	0.81	1.02	3.70
25	1761	19.5	226.5	33.2	12.250	9.00	0.95	0.96	7.60
50	1728	38.0	225.5	51.4	20.250	9.00	0.98	0.88	12.60
75	1689	56.0	222.8	73.4	29.250	9.00	1.00	0.82	18.00
100	1639	75.0	221.5	100.4	39.250	9.00	1.02	0.75	24.00
125	1582	93.5	219.5	127.4	48.250	9.00	1.03	0.69	30.50
150	1502	111.5	217.5	157.7	57.250	9.00	1.04	0.63	37.40
125	1571	94.0	219.5	126.4	48.250	9.00	1.03	0.70	30.30
100	1633	74.0	221.5	99.4	38.250	9.00	1.02	0.76	23.60
75	1684	56.5	222.5	73.7	30.250	9.00	0.99	0.82	17.80
50	1728	37.0	225.5	51.4	20.250	9.00	0.98	0.90	12.30
25	1761	19.5	226.5	32.3	12.250	9.00	0.95	0.97	7.70
0	1790	4.0	227.5	15.6	5.250	9.00	0.80	1.02	3.80

50 HP BENDER MOTOR
CORRECTED & AVERAGED DATA

PCT LOAD	SPD RPM	FORCE LBS	VOLT	CURR AMPS	POWER KW	PF	PF	PF	AP.PWR KVA
0	900	3.0	226.8	26.4	3.250	9.00	9.00	0.20	8.50
25	897	41.5	224.8	57.7	11.950	0.52	9.00	0.85	12.50
50	894	83.0	223.5	76.4	22.250	0.71	9.00	0.97	20.50
75	890	125.0	221.5	100.7	31.250	0.75	9.00	0.99	29.50
100	886	168.0	218.8	129.7	42.250	0.78	9.00	1.00	39.50
125	879	210.0	216.8	164.7	52.250	0.53	9.00	1.00	50.00
150	873	250.0	217.2	202.7	62.250	0.80	9.00	1.00	61.00

PCT LOAD	SPD RPM	FORCE LBS	VOLT	CURR AMPS	POWER KW	PF	PF	PF	AP.PWR KVA
0	900	3.5	226.5	25.9	3.250	9.00	0.20	0.19	9.00
25	897	42.0	224.5	57.7	12.250	0.54	0.48	0.85	12.00
50	894	82.5	221.8	75.7	21.250	0.66	0.61	0.97	20.00
75	890	125.0	221.5	100.1	31.250	0.68	0.69	0.99	30.00
100	885	167.5	218.2	129.4	41.250	0.71	0.74	0.99	39.00
125	880	208.0	215.2	164.1	52.250	0.71	0.77	1.00	50.00
150	872	249.5	213.2	203.1	63.250	0.75	0.78	0.99	60.00
125	879	207.0	215.5	162.7	52.250	0.75	0.78	0.99	50.00
100	884	167.0	217.2	130.1	42.250	0.75	0.75	0.99	40.00
75	889	125.0	220.2	102.1	32.250	0.75	0.70	0.99	31.00
50	893	83.0	222.8	76.7	22.250	0.75	0.62	0.96	21.00
25	817	42.0	223.5	57.4	12.250	0.75	0.48	0.85	13.00
0	900	4.0	225.5	26.5	3.250	0.74	0.20	0.19	9.00

PCT LOAD	SPD RPM	FORCE LBS	VOLT	CURR AMPS	POWER KW	PF	PF	PF	AP.PWR KVA
0	899	4.0	229.5	17.2	3.000	0.88	1.02	0.45	1.80
25	897	42.0	228.5	33.0	11.000	0.96	1.02	0.70	7.40
50	894	82.5	225.5	56.9	20.000	0.97	1.02	0.70	13.40
75	890	124.5	223.5	84.0	30.000	0.97	0.99	0.66	20.20
100	885	166.0	220.5	112.7	40.000	0.96	0.93	0.63	27.00
125	879	207.0	218.5	146.3	50.000	0.93	0.92	0.58	35.00
150	870	249.0	215.5	190.9	62.000	0.90	0.90	0.50	43.70
125	879	206.0	219.5	144.7	50.000	0.94	0.92	0.58	34.40
100	885	167.0	220.5	112.4	40.000	0.95	0.93	0.62	27.00
75	889	126.5	223.5	85.3	30.000	0.97	0.99	0.67	20.20
50	893	84.0	225.5	60.2	20.000	0.97	1.01	0.70	13.50
25	897	43.0	226.5	33.0	11.000	0.97	1.02	0.70	7.30
0	900	4.0	228.5	17.2	3.000	0.87	1.02	0.41	1.80

PCT LOAD	SPD RPM	FORCE LBS	VOLT	CURR AMPS	POWER KW	PF	PF	PF	AP.PWR KVA
0	900	4.0	227.5	17.2	3.000	0.89	1.05	0.43	1.70
25	897	42.5	226.5	33.0	11.000	0.97	1.05	0.70	7.40
50	893	84.0	225.5	57.2	20.000	0.97	1.01	0.70	13.40
75	889	126.0	222.5	85.3	30.000	0.97	0.99	0.66	20.40
100	884	168.0	220.5	114.3	40.000	0.95	0.93	0.62	27.50
125	878	208.0	217.5	147.3	50.000	0.93	0.92	0.57	34.70
150	869	249.0	215.5	190.9	62.000	0.90	0.91	0.50	44.60
125	878	206.0	217.5	145.0	50.000	0.94	0.92	0.58	34.20
100	884	168.0	220.5	113.0	40.000	0.95	0.93	0.63	27.40
75	889	124.5	222.5	84.0	30.000	0.97	0.99	0.66	20.00
50	893	84.0	225.5	57.9	20.000	0.97	1.02	0.70	13.70
25	897	43.0	227.5	33.0	11.000	0.97	1.07	0.70	7.60
0	900	4.0	227.5	17.2	3.000	0.88	1.04	0.40	1.80

100 HP MOTOR
CORRECTED & AVERAGED DATA

PCT LOAD	SPD RPM	FORCE LBS	VOLT	CURR AMPS	POWER KW	PF	PF	PF	AP.PWR KVA
0	1200	3.0	446.5	38.4	5.500	9.00	0.48	0.11	29.00
25	1193	64.0	448.5	50.4	24.500	9.00	0.48	0.58	38.00
50	1185	129.0	446.5	70.7	44.500	9.00	0.62	0.78	53.00
75	1179	193.0	446.5	94.4	62.500	9.00	0.73	0.84	71.00
100	1169	258.0	445.8	122.4	84.500	9.00	0.79	0.88	91.00
125	1159	321.0	441.8	151.4	104.500	9.00	0.82	0.89	112.00
150	1147	383.0	439.8	184.4	125.500	9.00	0.83	0.88	137.00
125	1159	317.0	441.8	149.1	102.500	9.00	0.82	0.88	110.00
100	1168	259.0	444.5	122.7	84.500	9.00	0.78	0.88	92.00
75	1177	194.0	444.5	96.1	64.500	9.00	0.73	0.85	72.00
50	1185	131.5	444.5	71.7	44.500	9.00	0.63	0.79	52.00
25	1193	64.0	446.5	50.9	24.500	9.00	0.50	0.58	37.00
0	1199	3.0	446.5	39.0	5.500	9.00	0.45	0.10	30.00

PCT LOAD	SPD RPM	FORCE LBS	VOLT	CURR AMPS	POWER KW	PF	PF	PF	AP.PWR KVA
0	1199	3.0	450.5	39.4	5.500	9.00	0.57	0.10	30.00
25	1193	64.0	448.5	50.4	24.500	9.00	0.52	0.58	37.00
50	1185	129.0	446.5	70.7	44.500	9.00	0.65	0.78	53.00
75	1177	193.5	446.5	95.4	64.500	9.00	0.73	0.85	71.00
100	1169	258.5	444.5	122.7	84.500	9.00	0.77	0.88	91.00
125	1158	323.5	444.5	152.4	104.500	9.00	0.81	0.88	113.00
150	1147	386.0	442.5	183.4	132.500	9.00	0.82	0.88	136.00
125	1157	323.0	444.5	152.7	104.500	9.00	0.81	0.88	114.00
100	1168	258.0	444.5	123.4	84.500	9.00	0.78	0.88	92.00
75	1177	193.0	446.5	95.4	64.500	9.00	0.73	0.85	71.00
50	1185	129.0	447.2	71.1	44.500	9.00	0.64	0.78	53.00
25	1192	64.0	450.5	51.2	24.500	9.00	0.52	0.58	37.00
0	1199	3.0	450.5	40.0	5.500	9.00	0.58	0.10	30.00

PCT LOAD	SPD RPM	FORCE LBS	VOLT	CURR AMPS	POWER KW	PF	PF	PF	AP.PWR KVA
0	1200	4.0	449.5	14.7	6.500	9.00	9.00	1.07	4.20
25	1193	65.0	449.5	31.3	24.500	9.00	9.00	1.01	22.00
50	1186	129.0	446.5	56.4	44.500	9.00	9.00	1.00	41.00
75	1178	193.5	445.0	82.7	64.500	9.00	9.00	0.99	60.80
100	1168	253.5	445.0	111.4	84.500	9.00	9.00	0.98	81.80
125	1160	312.5	444.5	139.4	104.500	9.00	9.00	0.97	105.00
150	1146	378.0	443.5	171.4	124.500	9.00	9.00	0.93	131.00
125	1159	323.0	444.5	140.1	104.500	9.00	9.00	0.96	103.00
100	1168	259.5	444.5	111.1	84.500	9.00	9.00	0.98	83.00
75	1177	195.5	444.5	83.4	64.500	9.00	9.00	1.00	62.30
50	1185	131.5	445.5	56.4	44.500	9.00	9.00	1.00	42.00
25	1193	64.0	447.5	32.3	24.500	9.00	9.00	1.00	22.00
0	1200	3.5	449.5	14.7	6.500	9.00	9.00	1.07	3.90

PCT LOAD	SPD RPM	FORCE LBS	VOLT	CURR AMPS	POWER KW	PF	PF	PF	AP.PWR KVA
0	1199	4.0	445.5	14.7	6.500	9.00	0.98	1.08	4.00
25	1193	67.0	445.5	33.2	24.500	9.00	0.99	1.00	22.60
50	1186	129.0	445.5	56.4	44.500	9.00	1.00	1.00	41.40
75	1177	192.0	445.0	82.4	64.500	9.00	1.03	1.00	61.50
100	1168	255.5	444.5	109.4	84.500	9.00	1.04	0.98	81.80
125	1160	317.5	444.5	140.7	104.500	9.00	1.06	0.96	104.30
150	1144	384.0	444.5	172.7	126.500	9.00	1.05	0.93	131.70
125	1158	315.0	444.5	140.1	104.500	9.00	1.05	0.96	103.50
100	1168	255.5	445.5	109.4	84.500	9.00	1.03	0.98	82.10
75	1176	195.0	444.5	82.1	64.500	9.00	1.00	0.99	62.30
50	1185	133.0	446.5	56.7	44.500	9.00	0.98	1.00	42.60
25	1193	64.0	445.5	31.3	24.500	9.00	0.99	1.00	22.00
0	1200	4.0	449.5	14.7	6.500	9.00	0.94	1.07	4.00

PCT LOAD	SPD RPM	FORCE LBS	VOLT	CURR AMPS	POWER KW	PF	PF	PF	AP.PWR KVA
0	1199	3.5	447.7	11.1	5.000	1.14	1.07	1.09	3.20
25	1193	65.0	447.0	32.2	23.400	1.01	1.06	0.94	14.00
50	1186	126.5	446.7	56.3	42.600	1.00	1.00	0.84	26.70
75	1179	188.5	444.0	82.2	62.000	0.99	0.97	0.79	39.20
100	1170	257.5	442.7	109.7	81.000	0.99	0.96	0.75	52.20
125	1159	323.0	440.7	139.7	102.400	0.97	0.84	0.69	67.10
150	1147	387.0	435.3	173.7	123.000	0.95	0.78	0.64	83.50
150	1147	360.5	440.7	157.2	114.000	0.96	9.00	9.00	9.00

50 HP BLOWER MOTOR
CORRECTED & AVERAGED DATA

PCT LOAD	SPD RPM	FORCE LBS	VOLT	CURR AMPS	POWER KW	PF	PF	PF	AP.PWR KVA
0	1799	4.0	448.2	22.1	5.500	9.00	0.42	0.21	15.10
25	1794	21.0	448.2	24.5	12.500	9.00	0.49	0.55	18.80
50	1788	41.8	447.2	36.0	22.500	9.00	0.57	0.75	26.60
75	1781	63.5	447.5	50.4	32.500	9.00	0.66	0.83	36.50
100	1774	84.5	447.5	64.7	44.500	9.00	0.73	0.85	48.00
125	1764	105.0	447.5	80.1	52.500	9.00	0.77	0.86	59.20
150	1753	126.8	445.8	96.7	64.500	9.00	0.78	0.89	73.10
125	1764	105.5	446.5	78.4	52.500	9.00	0.77	0.85	58.30
100	1772	84.5	447.5	63.4	43.500	9.00	0.77	0.86	47.20
75	1780	63.0	446.8	50.4	32.500	9.00	0.71	0.83	36.20
50	1787	42.3	447.5	36.3	22.500	9.00	0.57	0.76	26.60
25	1794	20.9	447.8	26.4	12.500	9.00	0.48	0.55	18.60
0	1799	4.0	447.5	22.1	4.700	9.00	0.36	0.20	14.90

PCT LOAD	SPD RPM	FORCE LBS	VOLT	CURR AMPS	POWER KW	PF	PF	PF	AP.PWR KVA
0	1799	3.0	447.5	22.1	6.500	9.00	0.32	0.20	14.60
25	1793	21.0	446.5	25.2	12.500	9.00	0.47	0.58	18.60
50	1785	41.5	446.2	34.7	22.500	9.00	0.56	0.77	26.30
75	1777	63.5	446.5	51.3	32.500	9.00	0.72	0.83	37.30
100	1767	84.5	443.8	64.7	44.500	9.00	0.66	0.85	47.70
125	1756	105.5	444.8	81.1	54.500	9.00	0.70	0.86	60.00
150	1743	127.0	444.8	98.7	64.500	9.00	0.70	0.84	73.50
125	1756	106.0	445.8	80.1	54.500	9.00	0.67	0.86	59.20
100	1766	84.5	445.8	64.4	44.500	9.00	0.68	0.85	47.90
75	1776	63.5	445.8	49.8	32.500	9.00	0.63	0.84	36.50
50	1785	42.5	446.5	35.6	24.500	9.00	0.55	0.77	26.60
25	1793	21.0	446.8	25.8	12.500	9.00	0.43	0.57	18.50
0	1799	4.0	447.2	22.1	6.500	9.00	0.43	0.20	14.70

PCT LOAD	SPD RPM	FORCE LBS	VOLT	CURR AMPS	POWER KW	PF	PF	PF	AP.PWR KVA
0	1798	4.0	449.5	14.7	6.500	9.00	0.98	0.99	2.40
25	1794	21.0	449.8	15.6	12.500	9.00	0.85	0.97	6.70
50	1788	42.5	448.8	31.3	24.500	9.00	0.65	0.99	20.60
75	1781	63.5	448.5	43.4	32.500	9.00	0.43	0.99	31.00
100	1784	84.5	448.5	57.4	43.500	9.00	0.20	0.99	42.00
125	1782	106.0	447.5	72.4	54.500	9.00	9.00	0.95	53.00
150	1765	127.0	446.5	90.4	64.500	9.00	9.00	0.92	67.30
125	1780	105.5	447.5	72.4	54.500	9.00	9.00	0.95	53.50
100	1778	84.5	447.5	57.7	44.500	9.00	0.20	0.98	42.30
75	1781	64.0	448.5	43.4	34.500	9.00	0.40	0.99	31.50
50	1787	43.0	450.5	31.3	24.500	9.00	0.55	0.99	21.00
25	1792	21.0	450.5	16.5	13.500	9.00	0.82	1.00	11.00
0	1799	4.5	450.8	12.8	6.500	9.00	0.97	0.88	4.10

PCT LOAD	SPD RPM	FORCE LBS	VOLT	CURR AMPS	POWER KW	PF	PF	PF	AP.PWR KVA
0	1798	4.0	449.5	14.7	6.500	9.00	0.94	0.85	4.30
25	1795	21.6	449.5	16.5	12.500	9.00	0.92	1.00	11.80
50	1783	42.5	449.5	30.4	22.500	9.00	0.99	0.99	21.40
75	1777	63.5	446.5	42.4	32.500	9.00	1.00	1.00	31.20
100	1772	84.5	445.5	56.4	44.500	9.00	1.03	0.98	42.50
125	1757	104.4	445.5	71.4	52.500	9.00	1.04	0.96	54.50
150	1760	126.0	445.0	91.4	66.500	9.00	1.06	0.92	69.00
125	1759	105.5	445.5	71.4	54.500	9.00	1.05	0.96	54.00
100	1766	85.0	446.5	56.4	44.500	9.00	1.03	0.98	42.30
75	1777	64.0	449.5	42.4	32.500	9.00	1.00	0.98	31.30
50	1784	42.5	447.5	31.3	22.500	9.00	0.98	1.00	21.00
25	1791	21.2	449.5	15.6	12.500	9.00	0.92	0.99	11.20
0	1799	4.0	449.5	14.7	6.500	9.00	0.94	0.85	4.30

PCT LOAD	SPD RPM	FORCE LBS	VOLT	CURR AMPS	POWER KW	PF	PF	PF	AP.PWR KVA
0	1798	4.0	449.3	10.6	5.400	1.04	9.00	1.18	4.10
25	1794	22.0	446.7	20.7	13.200	1.01	9.00	1.02	11.70
50	1788	43.0	446.0	30.9	23.400	0.99	9.00	0.99	21.20
75	1781	64.0	445.0	44.7	32.400	0.99	9.00	0.98	31.20
100	1774	85.0	446.7	56.9	42.600	0.98	9.00	0.97	41.20
125	1764	106.0	446.0	73.1	52.600	0.97	9.00	0.94	53.30
150	1752	127.5	444.0	90.9	64.200	0.92	9.00	0.91	66.60
125	1764	106.0	446.0	71.9	52.800	0.95	9.00	0.94	53.10
100	1774	84.5	446.5	56.4	42.000	0.97	9.00	0.96	41.40
75	1781	63.5	447.0	43.7	32.000	0.99	9.00	0.98	30.60
50	1788	42.0	448.0	29.9	22.600	0.99	9.00	0.99	20.50
25	1794	22.0	448.3	19.6	12.600	1.01	9.00	1.01	11.50
0	1798	4.5	449.8	12.0	5.000	1.04	9.00	1.17	4.00

75 HP BLOWER MOTOR
CORRECTED & AVERAGED DATA

PCT LOAD	SPD RPM	FORCE LBS	VOLT	CURR AMPS	POWER KW	PF	PF	PF	AP.PWR KVA
0	1800	3.0	450.8	25.8	5.500	0.82	0.38	0.19	18.00
25	1796	31.4	447.8	35.0	18.500	0.82	0.52	0.62	25.40
50	1792	63.0	447.5	52.4	32.500	0.82	0.62	0.79	38.10
75	1787	94.4	447.5	72.7	48.500	0.82	0.70	0.84	53.80
100	1782	126.8	445.5	96.4	64.500	0.82	0.74	0.84	71.50
125	1775	158.2	444.5	122.7	79.500	0.82	0.73	0.83	90.90
150	1766	189.0	443.5	153.7	95.500	0.82	0.70	0.83	125.10
125	1774	158.0	444.5	122.1	79.500	0.82	0.73	0.84	91.10
100	1781	125.0	445.5	95.4	63.500	0.82	0.74	0.85	71.80
75	1786	94.5	446.5	73.1	48.500	0.82	0.72	0.83	54.50
50	1792	63.0	447.2	52.4	32.500	0.82	0.64	0.79	38.70
25	1796	31.5	446.8	34.7	18.500	0.82	0.52	0.64	25.60
0	1799	4.0	447.8	25.8	5.500	0.82	0.37	0.18	17.80

PCT LOAD	SPD RPM	FORCE LBS	VOLT	CURR AMPS	POWER KW	PF	PF	PF	AP.PWR KVA
0	1799	3.0	450.2	24.8	6.500	0.82	0.37	0.18	17.60
25	1796	31.5	448.5	34.7	17.500	0.82	0.54	0.63	25.70
50	1791	63.5	449.2	53.1	32.500	0.82	0.64	0.79	38.70
75	1786	94.5	446.8	73.7	48.500	0.82	0.72	0.83	54.70
100	1780	126.5	445.8	96.1	64.500	0.82	0.74	0.85	71.60
125	1772	158.0	444.8	122.4	79.500	0.82	0.76	0.83	91.40
150	1761	189.0	443.8	155.1	96.500	0.82	0.72	0.73	127.00
125	1770	158.0	445.2	123.4	80.500	0.82	0.74	0.83	92.40
100	1779	126.5	446.8	96.7	64.500	0.82	0.74	0.83	72.70
75	1785	94.5	447.2	73.4	48.500	0.81	0.72	0.83	55.00
50	1791	63.5	447.5	53.4	32.500	0.81	0.66	0.80	39.50
25	1795	31.5	448.8	33.8	18.500	0.81	0.53	0.62	25.70
0	1799	3.0	448.8	24.8	6.500	0.81	0.37	0.78	17.60

PCT LOAD	SPD RPM	FORCE LBS	VOLT	CURR AMPS	POWER KW	PF	PF	PF	AP.PWR KVA
0	1799	4.0	449.5	14.7	6.500	9.00	1.07	1.10	6.80
25	1796	32.5	446.5	25.8	18.500	9.00	1.13	0.96	12.50
50	1792	61.5	446.5	42.4	32.500	9.00	1.02	0.86	21.50
75	1788	93.5	446.5	60.4	48.500	9.00	0.99	0.79	32.00
100	1782	125.5	445.5	84.4	64.500	9.00	0.96	0.70	43.20
125	1775	158.0	445.0	110.4	80.500	9.00	0.92	0.60	58.00
150	1765	187.5	444.5	139.4	96.500	9.00	0.87	0.50	72.30
125	1775	156.0	445.5	107.4	80.500	9.00	0.92	0.63	57.00
100	1782	125.5	445.5	83.7	64.500	9.00	0.95	0.70	44.00
75	1786	96.0	445.5	62.4	48.500	9.00	0.99	0.78	32.70
50	1792	63.8	446.5	42.4	32.500	9.00	1.01	0.87	22.30
25	1795	32.5	446.5	24.2	18.500	9.00	1.15	0.97	12.80
0	1798	4.0	447.5	14.7	6.500	9.00	1.07	1.11	6.70

PCT LOAD	SPD RPM	FORCE LBS	VOLT	CURR AMPS	POWER KW	PF	PF	PF	AP.PWR KVA
0	1798	4.0	449.5	14.7	6.500	9.00	1.15	1.14	7.00
25	1796	33.0	449.5	25.2	20.500	9.00	1.15	0.96	13.20
50	1791	63.5	446.5	42.4	32.500	9.00	1.01	0.86	22.30
75	1776	96.0	446.5	62.1	44.500	9.00	0.99	0.78	33.30
100	1777	125.5	445.5	84.4	64.500	9.00	0.92	0.69	44.40
125	1768	158.0	444.5	111.4	80.500	9.00	0.92	0.60	59.00
150	1755	188.0	443.5	144.4	98.500	9.00	0.87	0.50	74.00
125	1766	159.0	444.5	110.7	80.500	9.00	0.92	0.60	58.60
100	1776	126.5	445.5	84.1	64.500	9.00	0.94	0.68	44.70
75	1783	96.0	446.5	61.4	48.500	9.00	0.99	0.78	33.20
50	1789	64.0	446.5	42.4	32.500	9.00	1.01	0.86	22.30
25	1794	30.5	446.5	23.9	18.500	9.00	1.15	0.97	12.00
0	1799	4.0	449.5	14.7	6.500	9.00	1.06	1.14	7.00

PCT LOAD	SPD RPM	FORCE LBS	VOLT	CURR AMPS	POWER KW	PF	PF	PF	AP.PWR KVA
0	1800	4.0	452.8	22.5	6.500	1.20	1.07	1.11	7.00
25	1795	31.0	452.5	30.8	18.500	1.03	1.15	0.97	12.70
50	1792	64.0	451.5	44.4	32.500	1.01	1.01	0.87	21.50
75	1788	96.0	449.8	64.5	46.500	0.99	0.99	0.77	32.60
100	1782	127.0	448.8	87.1	60.500	0.97	0.96	0.70	44.00

PCT LOAD	SPD RPM	FORCE LBS	VOLT	CURR AMPS	POWER KW	PF	PF	PF	AP.PWR KVA
75	1788	94.0	445.0	60.5	45.000	0.99	0.99	9.00	----
100	1782	124.0	443.0	81.3	59.600	9.00	9.00	9.00	----
125	1776	159.0	443.0	105.4	75.400	9.00	9.00	9.00	----
150	1761	190.0	442.0	138.1	94.000	0.89	0.87	9.00	----
100	1782	124.0	445.0	84.0	62.000	0.97	0.95	9.00	----

PCT LOAD	SPD RPM	FORCE LBS	VOLT	CURR AMPS	POWER KW	PF	PF	PF	AP.PWR KVA
0	1799	4.0	449.0	18.0	5.600	9.00	9.00	1.57	9.50
25	1796	32.0	448.3	27.0	17.600	1.03	9.00	1.07	17.30
50	1793	63.0	447.7	43.7	32.000	1.01	9.00	1.01	30.30
75	1789	95.5	446.7	62.2	47.000	0.99	9.00	0.99	45.10
100	1784	126.0	446.0	83.5	62.200	0.97	9.00	0.97	61.20
125	1777	159.0	442.0	109.2	78.400	0.95	9.00	0.94	79.80
150	1766	190.0	440.0	141.4	95.000	0.90	9.00	0.89	102.00
125	1776	158.0	442.0	108.9	78.000	0.95	9.00	0.94	79.50
100	1781	126.0	442.5	83.0	61.600	0.98	9.00	0.97	60.50
75	1788	96.0	444.0	62.4	47.000	0.99	9.00	0.98	45.50
50	1793	63.0	448.0	43.1	31.600	1.00	9.00	1.02	30.50
25	1797	32.0	447.3	27.3	17.400	1.03	9.00	1.07	17.40
0	1799	4.5	448.3	17.7	5.400	9.00	9.00	1.59	9.35

Table B-9. Results for Each Test Run

40 HP BRAKE MOTOR
RESULTS OF EACH TEST RUN

PCT LOAD	SPD RPM	TORQUE LB-FT	PWR.OUT HP	VOLT	CURR AMP	AP.PWR KVA	PWR.IN KW	PWR.OUT KW	EFF CALC	PF CALC	PF WES	PF C-A	PF E-A	AP.PWR E-A
0	1790	6.1	2.1	227.5	28.5	11.00	4.95	1.56	0.315	0.450	0.420	0.400	0.480	6.90
25	1765	33.3	11.2	225.5	39.0	15.00	12.25	8.33	0.680	0.817	0.710	0.560	0.780	13.20
50	1733	64.8	21.4	224.8	58.1	22.00	20.25	15.94	0.787	0.920	0.770	0.730	0.860	21.50
75	1695	98.0	31.6	223.2	81.1	31.00	28.25	23.59	0.835	0.911	0.780	0.820	0.880	30.80
100	1649	130.4	41.0	220.8	107.4	41.00	38.25	30.53	0.798	0.933	0.790	0.810	0.890	41.00
125	1594	164.5	49.9	218.8	136.4	51.00	47.25	37.24	0.788	0.926	0.810	0.750	0.880	51.60
150	1528	196.0	57.0	216.2	167.4	62.00	57.25	42.53	0.743	0.923	0.820	0.680	0.880	62.00
125	1584	164.5	49.6	218.2	137.1	51.00	48.25	37.01	0.767	0.946	0.820	0.750	0.890	51.90
100	1640	131.3	41.0	220.5	108.4	41.00	38.25	30.57	0.799	0.933	0.820	0.820	0.890	41.20
75	1689	98.0	31.5	223.2	81.4	31.00	29.25	23.51	0.804	0.944	0.820	0.840	0.880	30.90
50	1731	63.0	20.8	225.5	57.4	22.00	20.25	15.49	0.765	0.920	0.820	0.750	0.860	21.20
25	1764	33.3	11.2	226.5	38.7	15.00	12.25	8.33	0.680	0.817	0.820	0.550	0.790	13.10
0	1790	7.0	2.4	228.5	28.9	11.00	5.25	1.78	0.339	0.477	0.820	0.370	0.500	7.00

PCT LOAD	SPD RPM	TORQUE LB-FT	PWR.OUT HP	VOLT	CURR AMP	AP.PWR KVA	PWR.IN KW	PWR.OUT KW	EFF CALC	PF CALC	PF WES	PF C-A	PF E-A	AP.PWR E-A
0	1790	7.9	2.7	226.5	29.5	11.00	4.75	2.00	0.421	0.432	0.810	0.420	0.470	6.80
25	1766	32.4	10.9	225.5	38.1	14.00	15.25	8.12	0.532	1.089	0.810	0.560	0.770	12.60
50	1731	64.8	21.3	223.8	58.7	22.00	20.25	15.92	0.786	0.920	0.810	0.730	0.850	21.50
75	1693	96.3	31.0	222.5	81.1	31.00	28.55	23.14	0.811	0.921	0.810	0.820	0.880	30.60
100	1647	130.4	40.9	220.5	106.4	40.00	38.25	30.50	0.797	0.956	0.810	0.820	0.880	40.50
125	1588	164.5	49.8	217.5	137.4	51.00	47.25	37.10	0.785	0.926	0.810	0.760	0.890	51.60
150	1515	196.0	56.6	215.2	168.1	62.00	56.25	42.17	0.750	0.907	0.810	0.680	0.880	62.00
125	1580	164.5	49.5	217.2	137.4	51.00	47.25	36.91	0.781	0.926	0.810	0.760	0.890	51.50
100	1637	130.4	40.7	219.5	108.1	41.00	38.25	30.31	0.792	0.933	0.810	0.820	0.890	41.20
75	1688	98.0	31.5	221.8	81.1	31.00	29.25	23.49	0.803	0.944	0.810	0.830	0.890	30.80
50	1730	64.8	21.3	223.8	57.7	22.00	20.25	15.91	0.786	0.920	0.810	0.750	0.860	21.20
25	1766	32.4	10.9	225.5	37.5	14.00	11.25	8.12	0.722	0.804	0.810	0.560	0.780	12.20
0	1792	7.0	2.4	226.5	28.5	11.00	4.75	1.78	0.375	0.432	0.810	0.440	0.460	6.60

PCT LOAD	SPD RPM	TORQUE LB-FT	PWR.OUT HP	VOLT	CURR AMP	AP.PWR KVA	PWR.IN KW	PWR.OUT KW	EFF CALC	PF CALC	PF WES	PF C-A	PF E-A	AP.PWR E-A
0	1790	7.0	2.4	227.5	15.6	6.00	5.25	1.78	0.339	0.875	99.000	0.850	1.020	3.60
25	1763	33.3	11.2	226.5	32.3	12.00	12.25	8.33	0.680	1.021	99.000	0.880	0.950	7.50
50	1733	63.9	21.1	225.5	51.2	19.00	20.25	15.72	0.776	1.066	99.000	0.970	0.880	12.10
75	1695	95.4	30.8	223.5	72.7	28.00	28.25	22.96	0.813	1.009	99.000	1.010	0.820	17.50
100	1644	131.3	41.1	222.2	101.1	38.00	39.25	30.64	0.781	1.033	99.000	1.020	0.750	24.20
125	1580	166.3	50.0	218.5	130.4	49.00	48.25	37.30	0.773	0.985	99.000	1.030	0.680	30.90
150	1513	194.3	56.0	217.5	156.4	58.00	57.25	41.74	0.729	0.987	99.000	1.050	0.620	37.20
125	1575	164.5	49.3	218.5	127.4	48.00	48.25	36.80	0.763	1.005	99.000	1.050	0.680	30.60
100	1635	133.0	41.4	221.5	99.1	38.00	39.25	30.88	0.787	1.033	99.000	1.020	0.750	24.00
75	1688	98.0	31.5	222.5	73.7	28.00	29.25	23.49	0.803	1.045	99.000	1.000	0.820	17.60
50	1731	63.0	20.8	224.5	51.4	19.00	20.25	15.49	0.765	1.066	99.000	0.970	0.890	12.00
25	1763	34.1	11.5	225.5	32.3	12.00	12.25	8.54	0.697	1.021	99.000	0.850	0.960	7.40
0	1791	7.0	2.4	227.5	15.6	6.00	5.25	1.78	0.339	0.875	99.000	0.800	1.020	3.60

PCT LOAD	SPD RPM	TORQUE LB-FT	PWR.OUT HP	VOLT	CURR AMP	AP.PWR KVA	PWR.IN KW	PWR.OUT KW	EFF CALC	PF CALC	PF WES	PF C-A	PF E-A	AP.PWR E-A
0	1790	7.0	2.4	227.5	15.6	6.00	5.25	1.78	0.339	0.875	9.000	0.810	1.020	3.70
25	1761	34.1	11.4	226.5	33.2	13.00	12.25	8.53	0.697	0.942	9.000	0.950	0.960	7.60
50	1728	66.5	21.9	225.5	51.4	20.00	20.25	16.32	0.806	1.012	9.000	0.980	0.880	12.60
75	1689	98.0	31.5	222.8	73.4	28.00	29.25	23.51	0.804	1.045	9.000	1.000	0.820	18.00
100	1639	131.3	41.0	221.5	100.4	38.00	39.25	30.55	0.778	1.033	9.000	1.020	0.750	24.00
125	1582	163.6	49.3	219.5	127.4	48.00	48.25	36.76	0.762	1.005	9.000	1.030	0.690	30.50
150	1502	195.1	55.8	217.5	157.7	59.00	57.25	41.62	0.727	0.970	9.000	1.040	0.630	37.40
125	1571	164.5	49.2	219.5	126.4	48.00	48.25	36.70	0.761	1.005	9.000	1.030	0.700	30.30
100	1633	129.5	40.3	221.5	99.4	38.00	38.25	30.03	0.785	1.007	9.000	1.020	0.760	23.60
75	1684	98.9	31.7	222.5	73.7	28.00	30.25	23.65	0.782	1.080	9.000	0.990	0.820	17.80
50	1728	64.8	21.3	225.5	51.4	20.00	20.25	15.89	0.785	1.012	9.000	0.980	0.900	12.30
25	1761	34.1	11.4	226.5	32.3	12.00	12.25	8.53	0.697	1.021	9.000	0.950	0.970	7.70
0	1790	7.0	2.4	227.5	15.6	6.00	5.25	1.78	0.339	0.875	9.000	0.800	1.020	3.80

50 HP BENDER MOTOR
RESULTS OF EACH TEST RUN

PCT LOAD	SPD RPM	TORQUE LB-FT	PWR.OUT HP	VOLT	CURR AMP	AP.PWR KVA	PWR.IN KW	PWR.OUT KW	EFF CALC	PF CALC	PF WES	PF C-A	PF E-A	AP.PWR E-A
0	900	5.3	0.9	226.8	26.4	10.00	3.25	0.67	0.206	0.325	9.000	9.000	0.200	8.50
25	897	72.6	12.4	224.8	57.7	22.00	11.95	9.25	0.774	0.543	0.520	9.000	0.850	12.50
50	894	145.3	24.7	223.5	76.4	29.00	22.25	18.44	0.829	0.767	0.710	9.000	0.970	20.50
75	890	218.8	37.1	221.5	100.7	38.00	31.25	27.65	0.885	0.822	0.750	9.000	0.990	29.50
100	886	294.0	49.6	218.8	129.7	49.00	42.25	36.99	0.876	0.862	0.780	9.000	1.000	39.50
125	879	367.5	61.5	216.8	164.7	61.00	52.25	45.88	0.878	0.857	0.530	9.000	1.000	50.00
150	873	437.5	72.8	217.2	202.7	76.00	62.25	54.24	0.871	0.819	0.800	9.000	1.000	61.00

PCT LOAD	SPD RPM	TORQUE LB-FT	PWR.OUT HP	VOLT	CURR AMP	AP.PWR KVA	PWR.IN KW	PWR.OUT KW	EFF CALC	PF CALC	PF WES	PF C-A	PF E-A	AP.PWR E-A
0	900	6.1	1.0	226.5	25.9	10.00	3.25	0.78	0.241	0.325	9.000	0.200	0.190	9.00
25	897	73.5	12.6	224.5	57.7	22.00	12.25	9.36	0.764	0.557	0.540	0.480	0.850	12.00
50	894	144.4	24.6	221.8	75.7	29.00	21.25	18.33	0.863	0.733	0.660	0.610	0.970	20.00
75	890	218.8	37.1	221.5	100.1	38.00	31.25	27.65	0.885	0.822	0.680	0.690	0.990	30.00
100	885	293.1	49.4	218.2	129.4	48.00	41.25	36.84	0.893	0.859	0.710	0.740	0.990	39.00
125	880	364.0	61.0	215.2	164.1	61.00	52.25	45.49	0.871	0.857	0.710	0.770	1.000	50.00
150	872	436.6	72.5	213.2	203.1	74.00	63.25	54.07	0.855	0.855	0.750	0.780	0.990	60.00
125	879	362.3	60.7	215.5	162.7	60.00	52.25	45.22	0.865	0.871	0.750	0.780	0.990	50.00
100	884	292.3	49.2	217.2	130.1	48.00	42.25	36.69	0.868	0.880	0.750	0.750	0.990	40.00
75	889	218.8	37.0	220.2	102.1	38.00	32.25	27.62	0.856	0.849	0.750	0.700	0.990	31.00
50	893	145.3	24.7	222.8	76.7	29.00	22.25	18.42	0.828	0.767	0.750	0.620	0.960	21.00
25	817	73.5	11.4	223.5	57.4	22.00	12.25	8.53	0.696	0.557	0.750	0.480	0.850	13.00
0	900	7.0	1.2	225.5	26.5	10.00	3.25	0.89	0.275	0.325	0.740	0.200	0.190	9.00

PCT LOAD	SPD RPM	TORQUE LB-FT	PWR.OUT HP	VOLT	CURR AMP	AP.PWR KVA	PWR.IN KW	PWR.OUT KW	EFF CALC	PF CALC	PF WES	PF C-A	PF E-A	AP.PWR E-A
0	899	7.0	1.2	229.5	17.2	6.00	3.00	0.89	0.298	0.500	0.880	1.020	0.450	1.80
25	897	73.5	12.6	228.5	33.0	13.00	11.00	9.36	0.851	0.846	0.960	1.020	0.700	7.40
50	894	144.4	24.6	225.5	56.9	22.00	20.00	18.33	0.917	0.909	0.970	1.020	0.700	13.40
75	890	217.9	36.9	223.5	84.0	32.00	30.00	27.54	0.918	0.938	0.970	0.990	0.660	20.20
100	885	290.5	49.0	220.5	112.7	43.00	40.00	36.51	0.913	0.930	0.960	0.930	0.630	27.00
125	879	362.3	60.7	218.5	146.3	55.00	50.00	45.22	0.904	0.909	0.930	0.920	0.580	35.00
150	870	435.8	72.2	215.5	190.9	71.00	62.00	53.84	0.868	0.873	0.900	0.900	0.500	43.70
125	879	360.5	60.4	219.5	144.7	55.00	50.00	45.00	0.900	0.909	0.940	0.920	0.580	34.40
100	885	292.3	49.3	220.5	112.4	42.00	40.00	36.73	0.918	0.952	0.950	0.930	0.620	27.00
75	889	221.4	37.5	223.5	85.3	33.00	30.00	27.95	0.932	0.909	0.970	0.990	0.670	20.20
50	893	147.0	25.0	225.5	60.2	23.00	20.00	18.64	0.932	0.870	0.970	1.010	0.700	13.50
25	897	75.3	12.9	226.5	33.0	12.00	11.00	9.59	0.871	0.917	0.970	1.020	0.700	7.30
0	900	7.0	1.2	228.5	17.2	6.00	3.00	0.89	0.298	0.500	0.870	1.020	0.410	1.80

PCT LOAD	SPD RPM	TORQUE LB-FT	PWR.OUT HP	VOLT	CURR AMP	AP.PWR KVA	PWR.IN KW	PWR.OUT KW	EFF CALC	PF CALC	PF WES	PF C-A	PF E-A	AP.PWR E-A
0	900	7.0	1.2	227.5	17.2	6.00	3.00	0.89	0.298	0.500	0.890	1.050	0.430	1.70
25	897	74.4	12.7	226.5	33.0	12.00	11.00	9.47	0.861	0.917	0.970	1.050	0.700	7.40
50	893	147.0	25.0	225.5	57.2	22.00	20.00	18.64	0.932	0.909	0.970	1.010	0.700	13.40
75	889	220.5	37.3	222.5	85.3	32.00	30.00	27.84	0.928	0.938	0.970	0.990	0.660	20.40
100	884	294.0	49.5	220.5	114.3	43.00	40.00	36.91	0.923	0.930	0.950	0.930	0.620	27.50
125	878	364.0	60.9	217.5	147.3	55.00	50.00	45.39	0.908	0.909	0.930	0.920	0.570	34.70
150	869	435.8	72.1	215.5	190.9	71.00	62.00	53.78	0.867	0.873	0.900	0.910	0.500	44.60
125	878	360.5	60.3	217.5	145.0	54.00	50.00	44.95	0.899	0.926	0.940	0.920	0.580	34.20
100	884	294.0	49.5	220.5	113.0	43.00	40.00	36.91	0.923	0.930	0.950	0.930	0.630	27.40
75	889	217.9	36.9	222.5	84.0	32.00	30.00	27.51	0.917	0.938	0.970	0.990	0.660	20.00
50	893	147.0	25.0	225.5	57.9	22.00	20.00	18.64	0.932	0.909	0.970	1.020	0.700	13.70
25	897	75.3	12.9	227.5	33.0	13.00	11.00	9.59	0.871	0.846	0.970	1.070	0.700	7.60
0	900	7.0	1.2	227.5	17.2	6.00	3.00	0.89	0.298	0.500	0.880	1.040	0.400	1.80

100 HP MOTOR
INPUT & OUTPUT FOR EACH TEST

PCT LOAD	SPD RPM	TORQUE LB-FT	PWR.OUT HP	VOLT	CURR AMP	AP.PWR KVA	PWR.IN KW	PWR.OUT KW	EFF CALC	PF CALC	PF WES	PF C-A	PF E-A	AP.PWR E-A
0	1200	5.3	1.2	446.5	38.4	29.00	5.50	0.89	0.163	0.190	9.000	0.480	0.110	29.00
25	1193	112.0	25.5	448.5	50.4	39.00	24.50	18.98	0.775	0.628	9.000	0.480	0.580	38.00
50	1185	225.8	51.0	446.5	70.7	54.00	44.50	37.99	0.854	0.824	9.000	0.620	0.780	53.00
75	1179	337.8	75.8	446.5	94.4	73.00	62.50	56.55	0.905	0.856	9.000	0.730	0.840	71.00
100	1169	451.5	100.5	445.8	122.4	94.00	84.50	74.96	0.887	0.899	9.000	0.790	0.880	91.00
125	1159	561.8	124.0	441.8	151.4	115.00	104.50	92.46	0.885	0.909	9.000	0.820	0.890	112.00
150	1147	670.3	146.4	439.8	184.4	140.00	125.50	109.18	0.870	0.896	9.000	0.830	0.880	137.00
125	1159	554.8	122.5	441.8	149.1	114.00	102.50	91.31	0.891	0.899	9.000	0.820	0.880	110.00
100	1168	453.3	100.8	444.5	122.7	94.00	84.50	75.18	0.890	0.899	9.000	0.780	0.880	92.00
75	1177	339.5	76.1	444.5	96.1	73.00	64.50	56.75	0.880	0.884	9.000	0.730	0.850	72.00
50	1185	230.1	51.9	444.5	71.7	55.00	44.50	38.73	0.870	0.809	9.000	0.630	0.790	52.00
25	1193	112.0	25.5	446.5	50.9	39.00	24.50	18.98	0.775	0.628	9.000	0.500	0.580	37.00
0	1199	5.3	1.2	446.5	39.0	30.00	5.50	0.89	0.163	0.183	9.000	0.450	0.100	30.00

PCT LOAD	SPD RPM	TORQUE LB-FT	PWR.OUT HP	VOLT	CURR AMP	AP.PWR KVA	PWR.IN KW	PWR.OUT KW	EFF CALC	PF CALC	PF WES	PF C-A	PF E-A	AP.PWR E-A
0	1199	5.3	1.2	450.5	39.4	30.00	5.50	0.89	0.163	0.183	9.000	0.570	0.100	30.00
25	1193	112.0	25.5	448.5	50.4	39.00	24.50	18.98	0.775	0.628	9.000	0.520	0.580	37.00
50	1185	225.8	51.0	446.5	70.7	54.00	44.50	37.99	0.854	0.824	9.000	0.650	0.780	53.00
75	1177	338.6	75.9	446.5	95.4	73.00	64.50	56.60	0.878	0.884	9.000	0.730	0.850	71.00
100	1169	452.4	100.7	444.5	122.7	94.00	84.50	75.10	0.889	0.899	9.000	0.770	0.880	91.00
125	1158	566.1	124.9	444.5	152.4	117.00	104.50	93.10	0.891	0.893	9.000	0.810	0.880	113.00
150	1147	675.5	147.6	442.5	183.4	140.00	132.50	110.04	0.830	0.946	9.000	0.820	0.880	136.00
125	1157	565.3	124.6	444.5	152.7	117.00	104.50	92.88	0.889	0.893	9.000	0.810	0.880	114.00
100	1168	451.5	100.4	444.5	123.4	95.00	84.50	74.89	0.886	0.889	9.000	0.780	0.880	92.00
75	1177	337.8	75.7	446.5	95.4	73.00	64.50	56.46	0.875	0.884	9.000	0.730	0.850	71.00
50	1185	225.8	51.0	447.2	71.1	55.00	44.50	37.99	0.854	0.809	9.000	0.640	0.780	53.00
25	1192	112.0	25.4	450.5	51.2	39.00	24.50	18.96	0.774	0.628	9.000	0.520	0.580	37.00
0	1199	5.3	1.2	450.5	40.0	31.00	5.50	0.89	0.163	0.177	9.000	0.580	0.100	30.00

PCT LOAD	SPD RPM	TORQUE LB-FT	PWR.OUT HP	VOLT	CURR AMP	AP.PWR KVA	PWR.IN KW	PWR.OUT KW	EFF CALC	PF CALC	PF WES	PF C-A	PF E-A	AP.PWR E-A
0	1200	7.0	1.6	449.5	14.7	11.00	6.50	1.19	0.184	0.591	9.000	9.000	1.070	4.20
25	1193	113.8	25.8	449.5	31.3	24.00	24.50	19.27	0.787	1.021	9.000	9.000	1.010	22.00
50	1186	225.8	51.0	446.5	56.4	43.00	44.50	38.02	0.854	1.035	9.000	9.000	1.000	41.00
75	1178	338.6	76.0	445.0	82.7	63.00	64.50	56.65	0.878	1.024	9.000	9.000	0.990	60.80
100	1168	443.6	98.7	445.0	111.4	85.00	84.50	73.59	0.871	0.994	9.000	9.000	0.980	81.80
125	1160	546.9	120.8	444.5	139.4	107.00	104.50	90.09	0.862	0.977	9.000	9.000	0.970	105.00
150	1146	661.5	144.4	443.5	171.4	131.00	124.50	107.66	0.865	0.950	9.000	9.000	0.930	131.00
125	1159	565.3	124.8	444.5	140.1	107.00	104.50	93.04	0.890	0.977	9.000	9.000	0.960	103.00
100	1168	454.1	101.0	444.5	111.2	85.00	84.50	75.33	0.891	0.994	9.000	9.000	0.980	83.00
75	1177	342.1	76.7	444.5	83.4	64.00	64.50	57.19	0.887	1.008	9.000	9.000	1.000	62.30
50	1185	230.1	51.9	445.5	56.4	43.00	44.50	38.73	0.870	1.035	9.000	9.000	1.000	42.00
25	1193	112.0	25.5	447.5	32.3	25.00	24.50	18.98	0.775	0.980	9.000	9.000	1.000	22.00
0	1200	6.1	1.4	449.5	14.7	11.00	6.50	1.04	0.161	0.591	9.000	9.000	1.070	3.90

PCT LOAD	SPD RPM	TORQUE LB-FT	PWR.OUT HP	VOLT	CURR AMP	AP.PWR KVA	PWR.IN KW	PWR.OUT KW	EFF CALC	PF CALC	PF WES	PF C-A	PF E-A	AP.PWR E-A
0	1199	7.0	1.6	445.5	14.7	11.00	6.50	1.19	0.183	0.591	9.000	0.980	1.080	4.00
25	1193	117.3	26.6	445.5	33.2	25.00	24.50	19.87	0.811	0.980	9.000	0.990	1.000	22.60
50	1186	225.8	51.0	445.5	56.4	43.00	44.50	38.02	0.854	1.035	9.000	1.000	1.000	41.40
75	1177	336.0	75.3	445.0	82.4	63.00	64.50	56.16	0.871	1.024	9.000	1.030	1.000	61.50
100	1168	447.1	99.5	444.5	109.4	84.00	84.50	74.17	0.878	1.006	9.000	1.040	0.980	81.80
125	1160	555.6	122.8	444.5	140.7	108.00	104.50	91.53	0.876	0.968	9.000	1.060	0.960	104.30
150	1144	672.0	146.4	444.5	172.7	132.00	126.50	109.18	0.863	0.958	9.000	1.050	0.930	131.70
125	1158	551.3	121.6	444.5	140.1	107.00	104.50	90.66	0.868	0.977	9.000	1.050	0.960	103.50
100	1168	447.1	99.5	445.5	109.4	84.00	84.50	74.17	0.878	1.006	9.000	1.030	0.980	82.10
75	1176	341.3	76.4	444.5	82.1	63.00	64.50	56.99	0.884	1.024	9.000	1.000	0.990	62.30
50	1185	232.8	52.5	446.5	56.7	43.00	44.50	39.17	0.880	1.035	9.000	0.980	1.000	42.60
25	1193	112.0	25.5	445.5	31.3	24.00	24.50	18.98	0.775	1.021	9.000	0.990	1.000	22.00
0	1200	7.0	1.6	449.5	14.7	11.00	6.50	1.19	0.184	0.591	9.000	0.940	1.070	4.00

PCT LOAD	SPD RPM	TORQUE LB-FT	PWR.OUT HP	VOLT	CURR AMP	AP.PWR KVA	PWR.IN KW	PWR.OUT KW	EFF CALC	PF CALC	PF WES	PF C-A	PF E-A	AP.PWR E-A
0	1199	6.1	1.4	447.7	11.1	8.00	5.00	1.04	0.209	0.625	1.140	1.070	1.090	3.20
25	1193	113.8	25.8	447.0	32.2	24.00	23.40	19.27	0.824	0.975	1.010	1.060	0.940	14.00
50	1186	221.4	50.0	446.7	56.3	43.00	42.60	37.29	0.875	0.991	1.000	1.000	0.840	26.70
75	1179	329.9	74.1	444.0	82.2	63.00	62.00	55.23	0.891	0.984	0.990	0.970	0.790	39.20
100	1170	450.6	100.4	442.7	109.7	84.00	81.00	74.88	0.924	0.964	0.990	0.960	0.750	52.20
125	1159	565.3	124.8	440.7	139.7	106.00	102.40	93.04	0.909	0.966	0.970	0.840	0.690	67.10
150	1147	677.3	148.0	435.3	173.7	130.00	123.00	110.32	0.897	0.946	0.950	0.780	0.640	83.50
150	1147	630.9	137.8	440.7	157.2	119.00	114.00	102.77	0.901	0.958	0.960	9.000	9.000	9.00

50 HP BLOWER MOTOR
INPUT & OUTPUT FOR EACH TEST

PCT LOAD	SPD RPM	TORQUE LB-FT	PWR.OUT HP	VOLT	CURR AMP	AP.PWR KVA	PWR.IN KW	PWR.OUT KW	EFF CALC	PF CALC	PF WES	PF C-A	PF E-A	AP.PWR E-A
0	1799	7.0	2.4	448.2	22.1	17.00	5.50	1.79	0.325	0.324	9.000	0.420	0.210	15.10
25	1794	36.8	12.6	448.2	24.5	19.00	12.50	9.36	0.749	0.658	9.000	0.490	0.550	18.80
50	1788	73.1	24.9	447.2	36.0	27.00	22.50	18.57	0.826	0.833	9.000	0.570	0.750	26.60
75	1781	111.1	37.7	447.5	50.4	39.00	32.50	28.11	0.865	0.833	9.000	0.660	0.830	36.50
100	1774	147.9	50.0	447.5	64.7	50.00	44.50	37.26	0.837	0.890	9.000	0.730	0.850	48.00
125	1764	183.8	61.7	447.5	80.1	62.00	52.50	46.03	0.877	0.847	9.000	0.770	0.860	59.20
150	1753	221.9	74.1	445.8	96.7	74.00	64.50	55.24	0.856	0.872	9.000	0.780	0.890	73.10
125	1764	184.6	62.0	446.5	78.4	60.00	52.50	46.25	0.881	0.875	9.000	0.770	0.850	58.30
100	1772	147.9	49.9	447.5	63.4	49.00	43.50	37.21	0.855	0.888	9.000	0.770	0.860	47.20
75	1780	110.3	37.4	446.8	50.4	39.00	32.50	27.87	0.858	0.833	9.000	0.710	0.830	36.20
50	1787	74.0	25.2	447.5	36.3	28.00	22.50	18.79	0.835	0.804	9.000	0.570	0.760	26.60
25	1794	36.6	12.5	447.8	26.4	20.00	12.50	9.32	0.745	0.625	9.000	0.480	0.550	18.60
0	1799	7.0	2.4	447.5	22.1	17.00	4.70	1.79	0.381	0.276	9.000	0.360	0.200	14.90

PCT LOAD	SPD RPM	TORQUE LB-FT	PWR.OUT HP	VOLT	CURR AMP	AP.PWR KVA	PWR.IN KW	PWR.OUT KW	EFF CALC	PF CALC	PF WES	PF C-A	PF E-A	AP.PWR E-A
0	1799	5.3	1.8	447.5	22.1	17.00	6.50	1.34	0.206	0.382	9.000	0.320	0.200	14.60
25	1793	36.8	12.6	446.5	25.2	19.00	12.50	9.36	0.749	0.658	9.000	0.470	0.580	18.60
50	1785	72.6	24.7	446.2	34.7	26.00	22.50	18.41	0.818	0.865	9.000	0.560	0.770	26.30
75	1777	111.1	37.6	446.5	51.3	39.00	32.50	28.04	0.863	0.833	9.000	0.720	0.830	37.30
100	1767	147.9	49.8	443.8	64.7	49.00	44.50	37.11	0.834	0.908	9.000	0.660	0.850	47.70
125	1756	184.6	61.8	444.8	81.1	62.00	54.50	46.04	0.845	0.879	9.000	0.700	0.860	60.00
150	1743	222.3	73.8	444.8	98.7	76.00	64.50	55.02	0.853	0.849	9.000	0.700	0.840	73.50
125	1756	185.5	62.0	445.8	80.1	61.00	54.50	46.26	0.849	0.893	9.000	0.670	0.860	59.20
100	1766	147.9	49.7	445.8	64.4	49.00	44.50	37.09	0.833	0.908	9.000	0.680	0.850	47.90
75	1776	111.1	37.6	445.8	49.8	38.00	32.50	28.03	0.862	0.855	9.000	0.630	0.840	36.50
50	1785	74.4	25.3	446.5	35.6	27.00	24.50	18.85	0.770	0.907	9.000	0.550	0.770	26.60
25	1793	36.8	12.6	446.8	25.8	19.00	12.50	9.36	0.749	0.658	9.000	0.430	0.570	18.50
0	1799	7.0	2.4	447.2	22.1	17.00	6.50	1.79	0.275	0.382	9.000	0.430	0.200	14.70

PCT LOAD	SPD RPM	TORQUE LB-FT	PWR.OUT HP	VOLT	CURR AMP	AP.PWR KVA	PWR.IN KW	PWR.OUT KW	EFF CALC	PF CALC	PF WES	PF C-A	PF E-A	AP.PWR E-A
0	1798	7.0	2.4	449.5	14.7	11.00	6.50	1.79	0.275	0.591	9.000	0.980	0.990	2.40
25	1794	36.8	12.6	449.8	15.6	12.00	12.50	9.36	0.749	1.042	9.000	0.850	0.970	6.70
50	1788	74.4	25.3	448.8	31.3	24.00	24.50	18.89	0.771	1.021	9.000	0.650	0.990	20.60
75	1781	111.1	37.7	448.5	43.4	33.00	32.50	28.11	0.865	0.985	9.000	0.430	0.990	31.00
100	1784	147.9	50.2	448.5	57.4	44.00	43.50	37.47	0.861	0.989	9.000	0.200	0.990	42.00
125	1782	185.5	63.0	447.5	72.4	56.00	54.50	46.95	0.861	0.973	9.000	9.000	0.950	53.00
150	1765	222.3	74.7	446.5	90.4	69.00	64.50	55.71	0.864	0.935	9.000	9.000	0.920	67.30
125	1780	184.6	62.6	447.5	72.4	56.00	54.50	46.67	0.856	0.973	9.000	9.000	0.950	53.50
100	1778	147.9	50.1	447.5	57.7	44.00	44.50	37.34	0.839	1.011	9.000	0.200	0.980	42.30
75	1781	112.0	38.0	448.5	43.4	33.00	34.50	28.33	0.821	1.045	9.000	0.400	0.990	31.50
50	1787	75.3	25.6	450.5	31.3	24.00	24.50	19.10	0.779	1.021	9.000	0.550	0.990	21.00
25	1792	36.8	12.5	450.5	16.5	12.00	13.50	9.35	0.693	1.125	9.000	0.820	1.000	11.00
0	1799	7.9	2.7	450.8	12.8	9.00	6.50	2.01	0.310	0.722	9.000	0.970	0.880	4.10

PCT LOAD	SPD RPM	TORQUE LB-FT	PWR.OUT HP	VOLT	CURR AMP	AP.PWR KVA	PWR.IN KW	PWR.OUT KW	EFF CALC	PF CALC	PF WES	PF C-A	PF E-A	AP.PWR E-A
0	1798	7.0	2.4	449.5	14.7	11.00	6.50	1.79	0.275	0.591	9.000	0.940	0.850	4.30
25	1795	37.8	12.9	449.5	16.5	12.00	12.50	9.64	0.771	1.042	9.000	0.920	1.000	11.80
50	1783	74.4	25.3	449.5	30.4	23.00	22.50	18.83	0.837	0.978	9.000	0.990	0.990	21.40
75	1777	111.1	37.6	446.5	42.4	32.00	32.50	28.04	0.863	1.016	9.000	1.000	1.000	31.20
100	1772	147.9	49.9	445.5	56.4	43.00	44.50	37.21	0.836	1.035	9.000	1.030	0.980	42.50
125	1757	182.7	61.1	445.5	71.4	55.00	52.50	45.59	0.868	0.955	9.000	1.040	0.960	54.50
150	1760	220.5	73.9	445.0	91.4	70.00	66.50	55.11	0.829	0.950	9.000	1.060	0.920	69.00
125	1759	184.6	61.9	445.5	71.4	55.00	54.50	46.12	0.846	0.991	9.000	1.050	0.960	54.00
100	1766	148.8	50.0	446.5	56.4	43.00	44.50	37.31	0.838	1.035	9.000	1.030	0.980	42.30
75	1777	112.0	37.9	449.5	42.4	33.00	32.50	28.27	0.870	0.985	9.000	1.000	0.980	31.30
50	1784	74.4	25.3	447.5	31.3	24.00	22.50	18.84	0.838	0.938	9.000	0.980	1.000	21.00
25	1791	37.1	12.7	449.5	15.6	12.00	12.50	9.44	0.755	1.042	9.000	0.920	0.990	11.20
0	1799	7.0	2.4	449.5	14.7	11.00	6.50	1.79	0.275	0.591	9.000	0.940	0.850	4.30

PCT LOAD	SPD RPM	TORQUE LB-FT	PWR.OUT HP	VOLT	CURR AMP	AP.PWR KVA	PWR.IN KW	PWR.OUT KW	EFF CALC	PF CALC	PF WES	PF C-A	PF E-A	AP.PWR E-A
0	1798	7.0	2.4	449.3	10.6	8.00	5.40	1.79	0.331	0.675	1.040	9.000	1.180	4.10
25	1794	38.5	13.2	446.7	20.7	16.00	13.20	9.81	0.743	0.825	1.010	9.000	1.020	11.70
50	1788	75.3	25.6	446.0	30.9	23.00	23.40	19.11	0.817	1.017	0.990	9.000	0.990	21.20
75	1781	112.0	38.0	445.0	44.7	34.00	32.40	28.33	0.874	0.953	0.990	9.000	0.980	31.20
100	1774	148.8	50.3	446.7	56.9	44.00	42.60	37.48	0.880	0.968	0.980	9.000	0.970	41.20
125	1764	185.5	62.3	446.0	73.1	56.00	52.60	46.47	0.883	0.939	0.970	9.000	0.940	53.30
150	1752	223.1	74.5	444.0	90.9	69.00	64.20	55.52	0.865	0.930	0.920	9.000	0.910	66.60
125	1764	185.5	62.3	446.0	71.9	55.00	52.80	46.47	0.880	0.960	0.950	9.000	0.940	53.10
100	1774	147.9	50.0	446.5	56.4	43.00	42.00	37.26	0.887	0.977	0.970	9.000	0.960	41.40
75	1781	111.1	37.7	447.0	43.7	33.00	32.00	28.11	0.878	0.970	0.990	9.000	0.980	30.60
50	1788	73.5	25.0	448.0	29.9	23.00	22.60	18.66	0.826	0.983	0.990	9.000	0.990	20.50
25	1794	38.5	13.2	448.3	19.6	15.00	12.60	9.81	0.779	0.840	1.010	9.000	1.010	11.50
0	1798	7.9	2.7	449.8	12.0	9.00	5.00	2.01	0.402	0.556	1.040	9.000	1.170	4.00

75 HP BLOWER MOTOR
RESULTS OF EACH TEST RUN

PCT LOAD	SPD RPM	TORQUE LB-FT	PWR.OUT HP	VOLT	CURR AMP	AP.PWR KVA	PWR.IN KW	PWR.OUT KW	EFF CALC	PF CALC	PF WES	PF C-A	PF E-A	AP.PWR E-A
0	1800	5.3	1.8	450.8	25.8	20.00	5.50	1.34	0.244	0.275	0.820	0.380	0.190	18.00
25	1796	54.9	18.8	447.8	35.0	27.00	18.50	14.02	0.758	0.685	0.820	0.520	0.620	25.40
50	1792	110.3	37.6	447.5	52.4	40.00	32.50	28.06	0.863	0.813	0.820	0.620	0.790	38.10
75	1787	165.2	56.2	447.5	72.7	56.00	48.50	41.93	0.864	0.866	0.820	0.700	0.840	53.80
100	1782	221.9	75.3	445.5	96.4	74.00	64.50	56.16	0.871	0.872	0.820	0.740	0.840	71.50
125	1775	276.8	93.6	444.5	122.7	94.00	79.50	69.79	0.878	0.846	0.820	0.730	0.830	90.90
150	1766	330.8	111.3	443.5	153.7	118.00	95.50	82.95	0.869	0.809	0.820	0.700	0.830	125.10
125	1774	276.5	93.4	444.5	122.1	94.00	79.50	69.66	0.876	0.846	0.820	0.730	0.840	91.10
100	1781	218.8	74.2	445.5	95.4	73.00	63.50	55.33	0.871	0.870	0.820	0.740	0.850	71.80
75	1786	165.4	56.3	446.5	73.1	56.00	48.50	41.95	0.865	0.866	0.820	0.720	0.830	54.50
50	1792	110.3	37.6	447.2	52.4	40.00	32.50	28.06	0.863	0.813	0.820	0.640	0.790	38.70
25	1796	55.1	18.9	446.8	34.7	26.00	18.50	14.06	0.760	0.712	0.820	0.520	0.640	25.60
0	1799	7.0	2.4	447.8	25.8	20.00	5.50	1.79	0.325	0.275	0.820	0.370	0.180	17.80

PCT LOAD	SPD RPM	TORQUE LB-FT	PWR.OUT HP	VOLT	CURR AMP	AP.PWR KVA	PWR.IN KW	PWR.OUT KW	EFF CALC	PF CALC	PF WES	PF C-A	PF E-A	AP.PWR E-A
0	1799	5.3	1.8	450.2	24.8	19.00	6.50	1.34	0.206	0.342	0.820	0.370	0.180	17.60
25	1796	55.1	18.9	448.5	34.7	26.00	17.50	14.06	0.803	0.673	0.820	0.540	0.630	25.70
50	1791	111.1	37.9	449.2	53.1	41.00	32.50	28.27	0.870	0.793	0.820	0.640	0.790	38.70
75	1786	165.4	56.3	446.8	73.7	57.00	48.50	41.95	0.865	0.851	0.820	0.720	0.830	54.70
100	1780	221.4	75.1	445.8	96.1	74.00	64.50	55.96	0.868	0.872	0.820	0.740	0.850	71.60
125	1772	276.5	93.3	444.8	122.4	94.00	79.50	69.58	0.875	0.846	0.820	0.760	0.830	91.40
150	1761	330.8	110.9	443.8	155.1	119.00	96.50	82.72	0.857	0.811	0.820	0.720	0.730	127.00
125	1770	276.5	93.2	445.2	123.4	95.00	80.50	69.50	0.863	0.847	0.820	0.740	0.830	92.40
100	1779	221.4	75.0	446.8	96.7	74.00	64.50	55.93	0.867	0.872	0.820	0.740	0.830	72.70
75	1785	165.4	56.2	447.2	73.4	56.00	48.50	41.92	0.864	0.866	0.810	0.720	0.830	55.00
50	1791	111.1	37.9	447.5	53.4	41.00	32.50	28.27	0.870	0.793	0.810	0.660	0.800	39.50
25	1795	55.1	18.8	448.8	33.8	26.00	18.50	14.05	0.760	0.712	0.810	0.530	0.620	25.70
0	1799	5.3	1.8	448.8	24.8	19.00	6.50	1.34	0.206	0.342	0.810	0.370	0.780	17.60

PCT LOAD	SPD RPM	TORQUE LB-FT	PWR.OUT HP	VOLT	CURR AMP	AP.PWR KVA	PWR.IN KW	PWR.OUT KW	EFF CALC	PF CALC	PF WES	PF C-A	PF E-A	AP.PWR E-A
0	1799	7.0	2.4	449.5	14.7	11.00	6.50	1.79	0.275	0.591	9.000	1.070	1.100	6.80
25	1796	56.9	19.5	446.5	25.8	19.00	18.50	14.51	0.784	0.974	9.000	1.130	0.960	12.50
50	1792	107.6	36.7	446.5	42.4	32.00	32.50	27.39	0.843	1.016	9.000	1.020	0.860	21.50
75	1788	163.6	55.7	446.5	60.4	46.00	48.50	41.55	0.857	1.054	9.000	0.990	0.790	32.00
100	1782	219.6	74.5	445.5	84.4	65.00	64.50	55.58	0.862	0.992	9.000	0.960	0.700	43.20
125	1775	276.5	93.5	445.0	110.4	85.00	80.50	69.70	0.866	0.947	9.000	0.920	0.600	58.00
150	1765	328.1	110.3	444.5	139.4	107.00	96.50	82.25	0.852	0.902	9.000	0.870	0.500	72.30
125	1775	273.0	92.3	445.5	107.4	82.00	80.50	68.82	0.855	0.982	9.000	0.920	0.630	57.00
100	1782	219.6	74.5	445.5	83.7	64.00	64.50	55.58	0.862	1.008	9.000	0.950	0.700	44.00
75	1786	168.0	57.2	445.5	62.4	48.00	48.50	42.61	0.879	1.010	9.000	0.990	0.780	32.70
50	1792	111.6	38.1	446.5	42.4	32.00	32.50	28.41	0.874	1.016	9.000	1.010	0.870	22.30
25	1795	56.9	19.4	446.5	24.2	18.00	18.50	14.50	0.784	1.028	9.000	1.150	0.970	12.80
0	1798	7.0	2.4	447.5	14.7	11.00	6.50	1.79	0.275	0.591	9.000	1.070	1.110	6.70

PCT LOAD	SPD RPM	TORQUE LB-FT	PWR.OUT HP	VOLT	CURR AMP	AP.PWR KVA	PWR.IN KW	PWR.OUT KW	EFF CALC	PF CALC	PF WES	PF C-A	PF E-A	AP.PWR E-A
0	1798	7.0	2.4	449.5	14.7	11.00	6.50	1.79	0.275	0.591	9.000	1.150	1.140	7.00
25	1796	57.8	19.8	449.5	25.2	19.00	20.50	14.73	0.719	1.079	9.000	1.150	0.960	13.20
50	1791	111.1	37.9	446.5	42.4	32.00	32.50	28.27	0.870	1.016	9.000	1.010	0.860	22.30
75	1776	168.0	56.8	446.5	62.1	48.00	44.50	42.37	0.952	0.927	9.000	0.990	0.780	33.30
100	1777	219.6	74.3	445.5	84.4	65.00	64.50	55.43	0.859	0.992	9.000	0.920	0.690	44.40
125	1768	276.5	93.1	444.5	111.4	85.00	80.50	69.43	0.862	0.947	9.000	0.920	0.600	59.00
150	1755	329.0	110.0	443.5	144.4	110.00	98.50	82.00	0.832	0.895	9.000	0.870	0.500	74.00
125	1766	278.3	93.6	444.5	110.7	85.00	80.50	69.79	0.867	0.947	9.000	0.920	0.600	58.60
100	1776	221.4	74.9	445.5	84.1	64.00	64.50	55.84	0.866	1.008	9.000	0.940	0.680	44.70
75	1783	168.0	57.1	446.5	61.4	47.00	48.50	42.54	0.877	1.032	9.000	0.990	0.780	33.20
50	1789	112.0	38.2	446.5	42.4	32.00	32.50	28.46	0.876	1.016	9.000	1.010	0.860	22.30
25	1794	53.4	18.2	446.5	23.9	18.00	18.50	13.60	0.735	1.028	9.000	1.150	0.970	12.00
0	1799	7.0	2.4	449.5	14.7	11.00	6.50	1.79	0.275	0.591	9.000	1.060	1.140	7.00

PCT LOAD	SPD RPM	TORQUE LB-FT	PWR.OUT HP	VOLT	CURR AMP	AP.PWR KVA	PWR.IN KW	PWR.OUT KW	EFF CALC	PF CALC	PF WES	PF C-A	PF E-A	AP.PWR E-A
0	1800	7.0	2.4	452.8	22.5	17.00	6.50	1.79	0.275	0.382	1.200	1.070	1.110	7.00
25	1795	54.3	18.5	452.5	30.8	24.00	18.50	13.83	0.748	0.771	1.030	1.150	0.970	12.70
50	1792	112.0	38.2	451.5	44.4	34.00	32.50	28.50	0.877	0.956	1.010	1.010	0.870	21.50
75	1788	168.0	57.2	449.8	64.5	50.00	46.50	42.66	0.917	0.930	0.990	0.990	0.770	32.60
100	1782	222.3	75.4	448.8	87.1	67.00	60.50	56.25	0.930	0.903	0.970	0.960	0.700	44.00

PCT LOAD	SPD RPM	TORQUE LB-FT	PWR.OUT HP	VOLT	CURR AMP	AP.PWR KVA	PWR.IN KW	PWR.OUT KW	EFF CALC	PF CALC	PF WES	PF C-A	PF E-A	AP.PWR E-A
0	1788	164.5	56.0	445.0	60.5	46.00	45.00	41.77	0.928	0.978	0.990	0.990	9.000	9.00
100	1782	217.0	73.7	443.0	81.3	62.00	59.60	54.92	0.921	0.961	9.000	9.000	9.000	9.00
125	1776	278.3	94.1	443.0	105.4	80.00	75.40	70.18	0.931	0.942	9.000	9.000	9.000	9.00
150	1761	332.5	111.5	442.0	138.1	105.00	94.00	83.16	0.885	0.895	0.890	0.870	9.000	9.00
100	1782	217.0	73.7	445.0	84.0	64.00	62.00	54.92	0.886	0.969	0.970	0.950	9.000	9.00

PCT LOAD	SPD RPM	TORQUE LB-FT	PWR.OUT HP	VOLT	CURR AMP	AP.PWR KVA	PWR.IN KW	PWR.OUT KW	EFF CALC	PF CALC	PF WES	PF C-A	PF E-A	AP.PWR E-A
0	1799	7.0	2.4	449.0	18.0	13.00	5.60	1.79	0.319	0.431	9.000	9.000	1.570	9.50
25	1796	56.0	19.2	448.3	27.0	20.00	17.60	14.28	0.812	0.880	1.030	9.000	1.070	17.30
50	1793	110.3	37.7	447.7	43.7	33.00	32.00	28.07	0.877	0.970	1.010	9.000	1.010	30.30
75	1789	167.1	56.9	446.7	62.2	48.00	47.00	42.46	0.903	0.979	0.990	9.000	0.990	45.10
100	1784	220.5	74.9	446.0	83.5	64.00	62.20	55.87	0.898	0.972	0.970	9.000	0.970	61.20
125	1777	278.3	94.2	442.0	109.2	83.00	78.40	70.22	0.896	0.945	0.950	9.000	0.940	79.80
150	1766	332.5	111.8	440.0	141.4	107.00	95.00	83.39	0.878	0.888	0.900	9.000	0.890	102.00
125	1776	276.5	93.5	442.0	108.9	83.00	78.00	69.74	0.894	0.940	0.950	9.000	0.940	79.50
100	1781	220.5	74.8	442.5	83.0	63.00	61.60	55.77	0.905	0.978	0.980	9.000	0.970	60.50
75	1788	168.0	57.2	444.0	62.4	47.00	47.00	42.66	0.908	1.000	0.990	9.000	0.980	45.50
50	1793	110.3	37.7	448.0	43.1	33.00	31.60	28.07	0.888	0.958	1.000	9.000	1.020	30.50
25	1797	56.0	19.2	447.3	27.3	21.00	17.40	14.29	0.821	0.829	1.030	9.000	1.070	17.40
0	1799	7.9	2.7	448.3	17.7	13.00	5.40	2.01	0.373	0.415	9.000	9.000	1.590	9.35

Table B-10. Averaged Results for Each Motor

40 HP BRAKE MOTOR
DYNAMOMETER TEST RESULTS

BEFORE CONVERSION - "STANDARD" - 82 SEP 14
(PWR & EFF calculated from Weston Ind. An. #5346)

PCT LOAD	SPD RPM	TORQUE LB-FT	PWR. OUT HP	VOLT	CURR AMP	AP. PWR KVA	PWR. IN KW	PWR. OUT KW	EFF CALC	PF CALC	PF WES	PF C-A	PF E-A	AP. PWR E-A
0	1790	7.0	2.4	227.3	28.8	11.00	4.92	1.78	0.362	0.448	0.715	0.407	0.477	6.82
25	1765	32.8	11.0	225.8	38.3	14.50	12.75	8.22	0.653	0.882	0.787	0.557	0.780	12.77
50	1731	64.3	21.2	224.5	58.0	22.00	20.25	15.81	0.781	0.920	0.802	0.747	0.857	21.35
75	1691	97.6	31.4	222.7	81.2	31.00	28.82	23.43	0.813	0.930	0.805	0.827	0.882	30.77
100	1643	130.6	40.9	220.3	107.6	40.75	38.25	30.48	0.796	0.939	0.807	0.817	0.887	40.97
125	1586	164.5	49.7	217.9	137.1	51.00	47.50	37.06	0.780	0.931	0.812	0.755	0.887	51.65
150	1521	196.0	56.8	215.7	167.7	62.00	56.75	42.35	0.746	0.915	0.815	0.680	0.880	62.00

AFTER CONVERSION - "WANLASS" - 82 OCT 07
(PWR & EFF calculated from Weston Ind. An. #5346)

PCT LOAD	SPD RPM	TORQUE LB-FT	PWR. OUT HP	VOLT	CURR AMP	AP. PWR KVA	PWR. IN KW	PWR. OUT KW	EFF CALC	PF CALC	PF WES	PF C-A	PF E-A	AP. PWR E-A
0	1790	7.0	2.4	227.5	15.6	6.00	5.25	1.78	0.339	0.875	9.000	0.815	1.020	3.67
25	1762	33.9	11.4	226.3	32.5	12.25	12.25	8.48	0.693	1.001	9.000	0.907	0.960	7.55
50	1730	64.5	21.3	225.3	51.3	19.50	20.25	15.85	0.783	1.039	9.000	0.975	0.887	12.25
75	1689	97.6	31.4	222.8	73.4	28.00	29.25	23.40	0.800	1.045	9.000	1.000	0.820	17.72
100	1637	131.3	40.9	221.7	100.0	38.00	39.00	30.52	0.783	1.026	9.000	1.020	0.752	23.95
125	1577	164.7	49.4	219.0	127.9	48.25	48.25	36.89	0.765	1.000	9.000	1.035	0.687	30.57
150	1507	194.7	55.9	217.5	157.0	58.50	57.25	41.68	0.728	0.978	9.000	1.045	0.625	37.30

50 HP BENDER MOTOR
DYNAMOMETER TEST RESULTS

BEFORE CONVERSION - "STANDARD" - 82 SEP 13
(PWR & EFF calculated from Weston Ind. An. #5346)

PCT LOAD	SPD RPM	TORQUE LB-FT	PWR. OUT HP	VOLT	CURR AMP	AP. PWR KVA	PWR. IN KW	PWR. OUT KW	EFF CALC	PF CALC	PF WES	PF C-A	PF E-A	AP. PWR E-A
0	900	6.1	1.0	226.3	26.3	10.00	3.25	0.78	0.241	0.325	-----	0.200	0.193	8.83
25	870	73.2	12.1	224.3	57.6	22.00	12.15	9.05	0.745	0.552	0.603	0.480	0.850	12.50
50	893	145.0	24.7	222.7	76.3	29.00	21.92	18.40	0.840	0.756	0.707	0.615	0.967	20.50
75	889	218.8	37.1	221.1	101.0	38.00	31.58	27.64	0.875	0.831	0.727	0.695	0.990	30.17
100	885	293.1	49.4	218.1	129.7	48.33	41.92	36.84	0.879	0.867	0.747	0.745	0.993	39.50
125	879	364.6	61.1	215.8	163.8	60.67	52.25	45.53	0.871	0.862	0.663	0.775	0.997	50.00
150	872	437.0	72.6	215.2	202.9	75.00	62.75	54.15	0.863	0.837	0.775	0.780	0.995	60.50

AFTER CONVERSION - "WANLASS" - 82 OCT 13
(PWR & EFF calculated from Weston Ind. An. #1088)

PCT LOAD	SPD RPM	TORQUE LB-FT	PWR. OUT HP	VOLT	CURR AMP	AP. PWR KVA	PWR. IN KW	PWR. OUT KW	EFF CALC	PF CALC	PF WES	PF C-A	PF E-A	AP. PWR E-A
0	899	7.0	1.2	228.3	17.2	6.00	3.00	0.89	0.298	0.500	0.880	1.032	0.422	1.77
25	897	74.6	12.8	227.3	33.0	12.50	11.00	9.50	0.863	0.881	0.967	1.040	0.700	7.42
50	893	146.3	24.9	225.5	58.0	22.25	20.00	18.56	0.928	0.899	0.970	1.015	0.700	13.50
75	889	219.4	37.1	223.0	84.6	32.25	30.00	27.71	0.924	0.931	0.970	0.990	0.662	20.20
100	884	292.7	49.3	220.5	113.1	42.75	40.00	36.76	0.919	0.935	0.952	0.930	0.625	27.22
125	878	361.0	60.6	218.3	145.8	54.75	50.00	45.14	0.903	0.913	0.935	0.920	0.577	34.57
150	869	435.8	72.1	215.5	190.9	71.00	62.00	53.81	0.867	0.873	0.900	0.905	0.500	44.15

100 HP MOTOR
DYNAMOMETER TEST RESULTS

BEFORE CONVERSION - "STANDARD" - 82 SEP 15
(PWR & EFF calculated from Weston Ind. An. #5346)

PCT LOAD	SPD RPM	TORQUE LB-FT	PWR. OUT HP	VOLT	CURR AMP	AP. PWR KVA	PWR. IN KW	PWR. OUT KW	EFF CALC	PF CALC	PF WES	PF C-A	PF E-A	AP. PWR E-A
0	1199	5.3	1.2	448.5	39.2	30.00	5.50	0.89	0.163	0.183	9.000	0.520	0.102	29.75
25	1192	112.0	25.5	448.5	50.7	39.00	24.50	18.97	0.775	0.628	9.000	0.505	0.580	37.25
50	1185	226.9	51.2	446.2	71.0	54.50	44.50	38.17	0.858	0.816	9.000	0.635	0.782	52.75
75	1177	338.4	75.9	446.0	95.3	73.00	64.00	56.59	0.884	0.877	9.000	0.730	0.847	71.25
100	1168	452.2	100.6	444.8	122.8	94.25	84.50	75.03	0.888	0.896	9.000	0.780	0.880	91.50
125	1158	562.0	124.0	443.1	151.4	115.75	104.00	92.44	0.889	0.898	9.000	0.815	0.882	112.25
150	1147	672.9	147.0	441.1	183.9	140.00	129.00	109.61	0.850	0.921	9.000	0.825	0.880	136.50

AFTER CONVERSION - "WANLASS" - 82 OCT 06
(PWR & EFF calculated from Weston Ind. An. #5346)

PCT LOAD	SPD RPM	TORQUE LB-FT	PWR. OUT HP	VOLT	CURR AMP	AP. PWR KVA	PWR. IN KW	PWR. OUT KW	EFF CALC	PF CALC	PF WES	PF C-A	PF E-A	AP. PWR E-A
0	1199	6.6	1.5	448.3	14.0	10.40	6.20	1.13	0.184	0.598	-----	0.960	1.076	3.86
25	1193	113.8	25.8	447.0	32.1	24.40	24.28	19.27	0.794	0.995	-----	0.990	0.990	20.52
50	1185	227.2	51.3	446.1	56.4	43.00	44.12	38.25	0.867	1.026	-----	0.990	0.968	38.74
75	1177	337.6	75.7	444.6	82.6	63.20	64.00	56.44	0.882	1.013	-----	1.015	0.954	57.22
100	1168	448.5	99.8	444.4	110.2	84.40	83.80	74.43	0.888	0.993	-----	1.035	0.934	76.18
125	1159	556.9	123.0	443.7	140.0	107.00	104.08	91.67	0.881	0.973	-----	1.055	0.908	96.58
150	1145	670.3	146.3	441.1	172.6	131.00	124.67	109.05	0.875	0.951	-----	1.050	0.833	115.40

AFTER CONVERSION - "WANLASS" - 82 NOV 10
(PWR & EFF calculated from Weston Ind. An. #1088)

PCT LOAD	SPD RPM	TORQUE LB-FT	PWR. OUT HP	VOLT	CURR AMP	AP. PWR KVA	PWR. IN KW	PWR. OUT KW	EFF CALC	PF CALC	PF WES	PF C-A	PF E-A	AP. PWR E-A
0	1199	6.1	1.4	447.7	11.1	8.00	5.00	1.04	0.209	0.625	1.140	1.070	1.090	3.20
25	1193	113.8	25.8	447.0	32.2	24.00	23.40	19.27	0.824	0.975	1.010	1.060	0.940	14.00
50	1186	221.4	50.0	446.7	56.3	43.00	42.60	37.29	0.875	0.991	1.000	1.000	0.840	26.70
75	1179	329.9	74.1	444.0	82.2	63.00	62.00	55.23	0.891	0.984	0.990	0.970	0.790	39.20
100	1170	450.6	100.4	442.7	109.7	84.00	81.00	74.88	0.924	0.964	0.990	0.960	0.750	52.20
125	1159	565.3	124.8	440.7	139.7	106.00	102.40	93.04	0.909	0.966	0.970	0.840	0.690	67.10
140	1147	630.9	137.8	440.7	157.2	119.00	114.00	102.77	0.901	0.958	0.960	9.00	9.00	-----
150	1147	677.3	148.0	435.3	173.7	130.00	123.00	110.32	0.897	0.946	0.950	0.780	0.640	83.50

50 HP BLOWER MOTOR
DYNAMOMETER TEST RESULTS

BEFORE CONVERSION - "STANDARD" - 82 SEP 24
(PWR & EFF calculated from Weston Ind. An. #5346)

PCT LOAD	SPD RPM	TORQUE LB-FT	PWR. OUT HP	VOLT	CURR AMP	AP. PWR KVA	PWR. IN KW	PWR. OUT KW	EFF CALC	PF CALC	PF WES	PF C-A	PF E-A	AP. PWR E-A
0	1799	6.6	2.2	447.6	22.1	17.00	5.80	1.68	0.297	0.341	9.000	0.382	0.202	14.82
25	1793	36.7	12.6	447.3	25.5	19.25	12.50	9.35	0.748	0.650	9.000	0.467	0.562	18.62
50	1786	73.5	25.0	446.8	35.6	27.00	23.00	18.65	0.812	0.852	9.000	0.562	0.762	26.52
75	1778	110.9	37.6	446.6	50.5	38.75	32.50	28.01	0.862	0.838	9.000	0.680	0.832	36.62
100	1769	147.9	49.8	446.1	64.3	49.25	44.25	37.17	0.840	0.898	9.000	0.710	0.852	47.70
125	1760	184.6	61.9	446.1	79.9	61.25	53.50	46.14	0.863	0.873	9.000	0.727	0.857	59.17
150	1748	222.1	73.9	445.3	97.7	75.00	64.50	55.13	0.854	0.860	9.000	0.740	0.865	73.30

AFTER CONVERSION - "WANLASS" - 82 OCT 05
(PWR & EFF calculated from Weston Ind. An. #5346)

PCT LOAD	SPD RPM	TORQUE LB-FT	PWR. OUT HP	VOLT	CURR AMP	AP. PWR KVA	PWR. IN KW	PWR. OUT KW	EFF CALC	PF CALC	PF WES	PF C-A	PF E-A	AP. PWR E-A
0	1798	7.2	2.5	449.8	14.2	10.50	6.50	1.84	0.284	0.624	9.000	0.957	0.892	3.77
25	1793	37.1	12.7	449.8	16.0	12.00	12.75	9.45	0.742	1.063	9.000	0.877	0.990	10.17
50	1785	74.6	25.4	449.1	31.1	23.75	23.50	18.91	0.806	0.989	9.000	0.792	0.992	21.00
75	1779	111.5	37.8	448.3	42.9	32.75	33.00	28.19	0.855	1.008	9.000	0.707	0.990	31.25
100	1775	148.1	50.0	447.0	57.0	43.50	44.25	37.33	0.843	1.017	9.000	0.615	0.982	42.27
125	1769	184.3	62.1	446.5	71.9	55.50	54.00	46.33	0.858	0.973	9.000	5.022	0.955	53.75
150	1762	221.4	74.3	445.8	90.9	69.50	65.50	55.41	0.846	0.942	9.000	5.030	0.920	68.15

AFTER CONVERSION - "WANLASS" - 82 NOV 15
(PWR & EFF calculated from Weston Ind. An. #1088)

PCT LOAD	SPD RPM	TORQUE LB-FT	PWR. OUT HP	VOLT	CURR AMP	AP. PWR KVA	PWR. IN KW	PWR. OUT KW	EFF CALC	PF CALC	PF WES	PF C-A	PF E-A	AP. PWR E-A
0	1798	7.4	2.5	449.5	11.3	8.50	5.20	1.90	0.366	0.615	1.040	9.000	1.175	4.05
25	1794	38.5	13.2	447.5	20.1	15.50	12.90	9.81	0.761	0.832	1.010	9.000	1.015	11.60
50	1788	74.4	25.3	447.0	30.4	23.00	23.00	18.88	0.821	1.000	0.990	9.000	0.990	20.85
75	1781	111.5	37.8	446.0	44.2	33.50	32.20	28.22	0.876	0.961	0.990	9.000	0.980	30.90
100	1774	148.3	50.1	446.6	56.6	43.50	42.30	37.37	0.883	0.972	0.975	9.000	0.965	41.30
125	1764	185.5	62.3	446.0	72.5	55.50	52.70	46.47	0.881	0.949	0.960	9.000	0.940	53.20
150	1752	223.1	74.5	444.0	90.9	69.00	64.20	55.52	0.865	0.930	0.920	9.000	0.910	66.60

75 HP BLOWER MOTOR
DYNAMOMETER TEST RESULTS

BEFORE CONVERSION - "STANDARD" - 82 SEP 23
(PWR & EFF calculated from Weston Ind. An. #5346)

PCT LOAD	SPD RPM	TORQUE LB-FT	PWR. OUT HP	VOLT	CURR AMP	AP. PWR KVA	PWR. IN KW	PWR. OUT KW	EFF CALC	PF CALC	PF WES	PF C-A	PF E-A	AP. PWR E-A
0	1799	5.7	1.9	449.4	25.3	19.50	6.00	1.45	0.245	0.308	0.817	0.372	0.332	17.75
25	1795	55.0	18.8	448.0	34.5	26.25	18.25	14.05	0.770	0.695	0.817	0.527	0.627	25.60
50	1791	110.7	37.7	447.8	52.8	40.50	32.50	28.16	0.866	0.803	0.817	0.640	0.792	38.75
75	1786	165.3	56.2	447.0	73.2	56.25	48.50	41.94	0.864	0.862	0.817	0.715	0.832	54.50
100	1780	220.9	74.9	445.9	96.1	73.75	64.25	55.84	0.869	0.871	0.820	0.740	0.842	71.90
125	1772	276.6	93.4	444.7	122.6	94.25	79.75	69.63	0.873	0.846	0.820	0.740	0.832	91.45
150	1763	330.8	111.1	443.6	154.4	118.50	96.00	82.83	0.863	0.810	0.820	0.710	0.780	126.05

AFTER CONVERSION - "WANLASS-1" - 82 OCT 08
(PWR & EFF calculated from Weston Ind. An. #5346)
(one capacitor removed fm each phase)

PCT LOAD	SPD RPM	TORQUE LB-FT	PWR. OUT HP	VOLT	CURR AMP	AP. PWR KVA	PWR. IN KW	PWR. OUT KW	EFF CALC	PF CALC	PF WES	PF C-A	PF E-A	AP. PWR E-A
0	1798	7.0	2.4	449.0	14.7	11.00	6.50	1.79	0.275	0.591	9.000	1.087	1.122	6.87
25	1795	56.2	19.2	447.3	24.8	18.50	19.00	14.33	0.755	1.027	9.000	1.145	0.965	12.62
50	1791	110.6	37.7	446.5	42.4	32.00	32.50	28.13	0.866	1.016	9.000	1.012	0.862	22.10
75	1783	166.9	56.7	446.3	61.6	47.25	47.50	42.27	0.891	1.006	9.000	0.990	0.782	32.80
100	1779	220.0	74.5	445.5	84.1	64.50	64.50	55.61	0.862	1.000	9.000	0.942	0.692	44.07
125	1771	276.1	93.1	444.9	110.0	84.25	80.50	69.43	0.862	0.956	9.000	0.920	0.607	58.15
150	1760	328.5	110.1	444.0	141.9	108.50	97.50	82.13	0.842	0.898	9.000	0.870	0.500	73.15

AFTER CONVERSION - "WANLASS-2" - 82 OCT 14
(PWR & EFF calculated from Weston Ind. An. #1088)
(one capacitor removed fm each phase)

PCT LOAD	SPD RPM	TORQUE LB-FT	PWR. OUT HP	VOLT	CURR AMP	AP. PWR KVA	PWR. IN KW	PWR. OUT KW	EFF CALC	PF CALC	PF WES	PF C-A	PF E-A	AP. PWR E-A
0	1800	7.0	2.4	452.8	22.5	17.00	6.50	1.79	0.275	0.382	1.200	1.070	1.110	7.00
25	1795	54.3	18.5	452.5	30.8	24.00	18.50	13.83	0.748	0.771	1.030	1.150	0.970	12.70
50	1792	112.0	38.2	451.5	44.4	34.00	32.50	28.50	0.877	0.956	1.010	1.010	0.870	21.50
75	1788	168.0	57.2	449.8	64.5	50.00	46.50	42.66	0.917	0.930	0.990	0.990	0.770	32.60
100	1782	222.3	75.4	448.8	87.1	67.00	60.50	56.25	0.930	0.903	0.970	0.960	0.700	44.00

AFTER CONVERSION - "WANLASS-3" - 82 NOV 09 & 16
(PWR & EFF calculated from Weston Ind. An. #1088)
(capacitors all connected)

PCT LOAD	SPD RPM	TORQUE LB-FT	PWR. OUT HP	VOLT	CURR AMP	AP. PWR KVA	PWR. IN KW	PWR. OUT KW	EFF CALC	PF CALC	PF WES	PF C-A	PF E-A	AP. PWR E-A
0	1795	7.4	2.5	448.7	17.9	13.87	5.50	1.87	0.339	0.397	0.990	-----	1.580	9.28
25	1796	56.0	19.2	447.8	27.1	20.50	17.50	14.28	0.816	0.854	1.030	-----	1.070	17.35
50	1793	110.3	37.7	447.8	43.4	33.00	31.80	28.07	0.882	0.964	1.005	-----	1.015	30.40
75	1788	167.5	57.0	445.3	62.3	47.50	47.00	42.56	0.905	0.989	0.990	0.990	0.985	45.30
100	1782	218.8	74.3	444.1	82.9	63.25	61.35	55.37	0.902	0.970	0.970	0.950	0.970	60.85
125	1776	277.7	93.9	442.3	107.8	82.00	77.27	70.05	0.907	0.942	0.950	-----	0.940	79.65
150	1763	332.5	111.6	441.0	139.7	106.00	94.50	83.27	0.881	0.891	0.895	0.870	0.890	102.00

NOTES FOR TABLES B-7 - B-10:

1. Metered power factor values not obtained are listed as "9.00".
2. Metered power factor values that are leading are listed as numbers greater than 1.0: (Tabulated value) = 2.0 - (metered value)
(e.g. 0.96 leading is tabulated as 1.04).

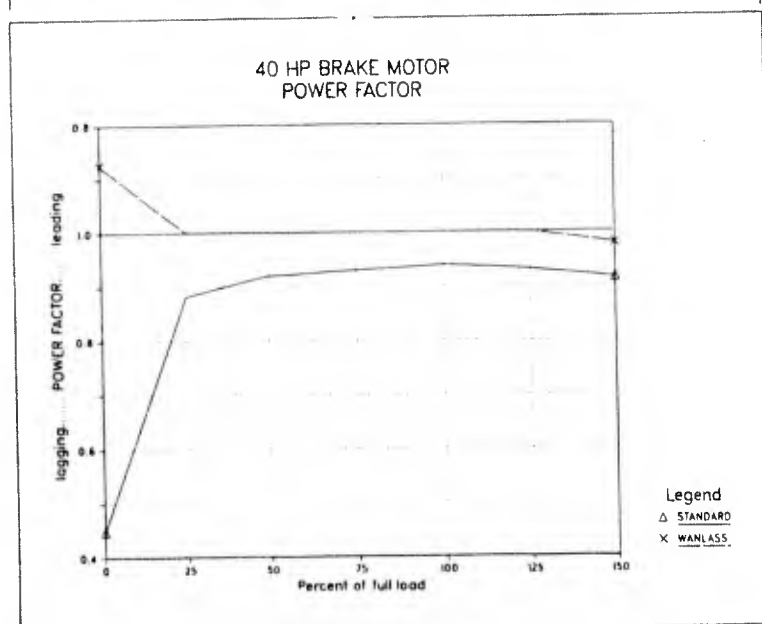
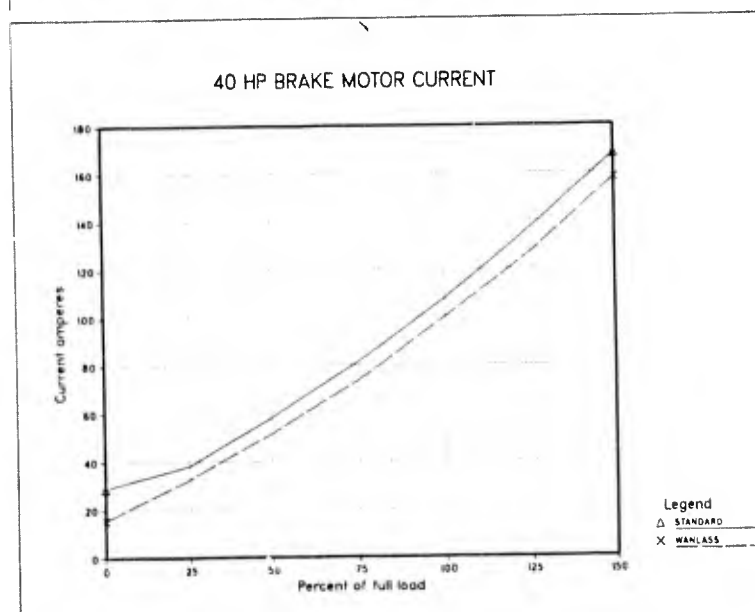
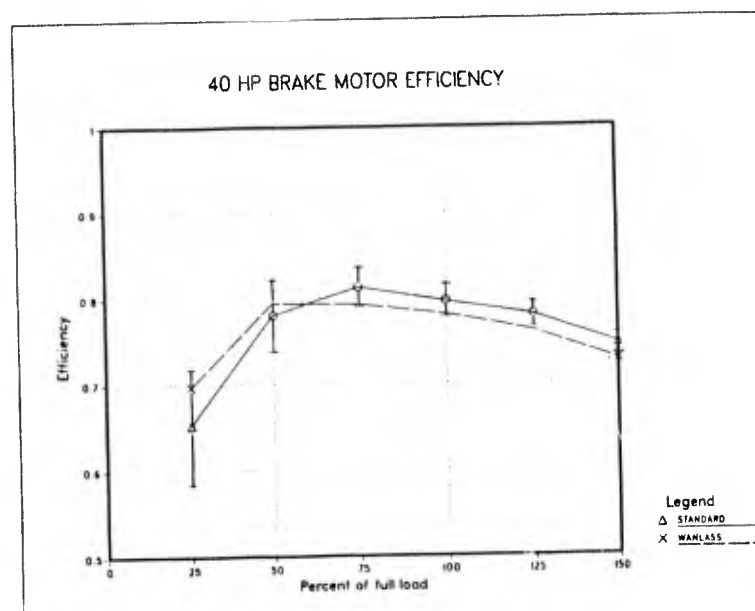


Figure B-1. Dynamometer curves — 40-hp brake motor.

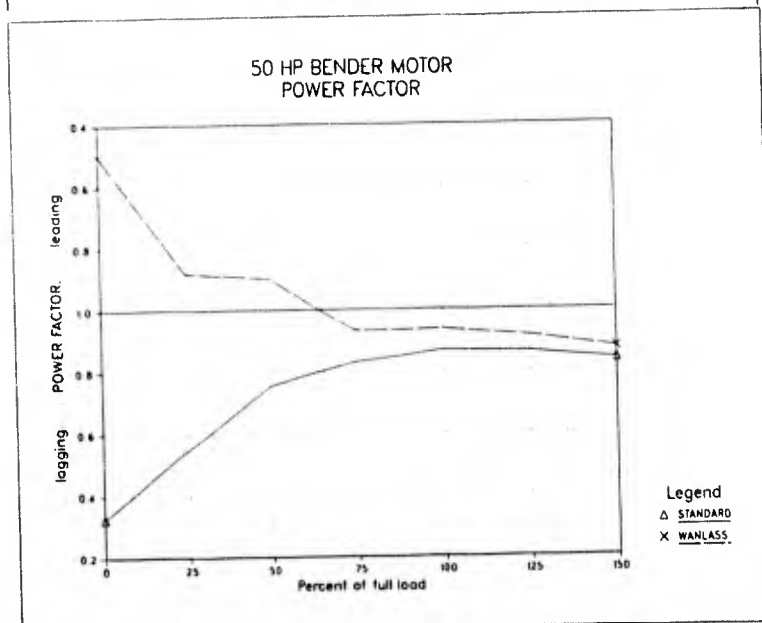
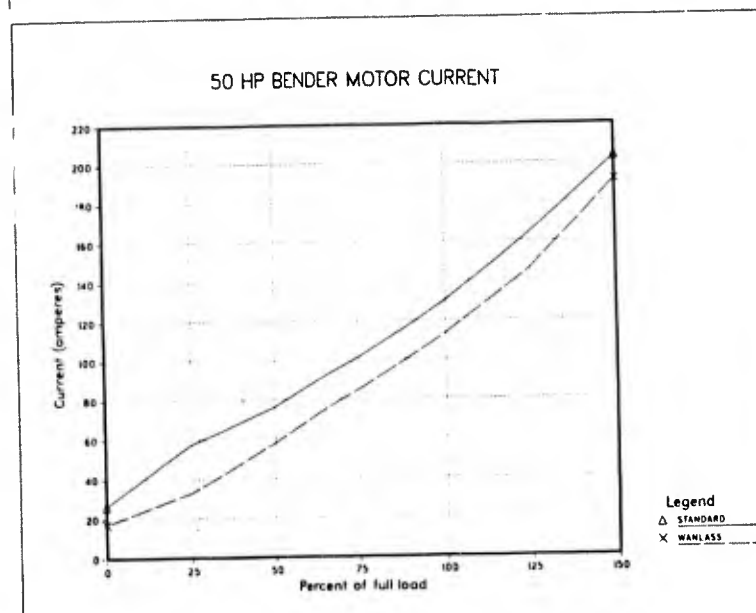
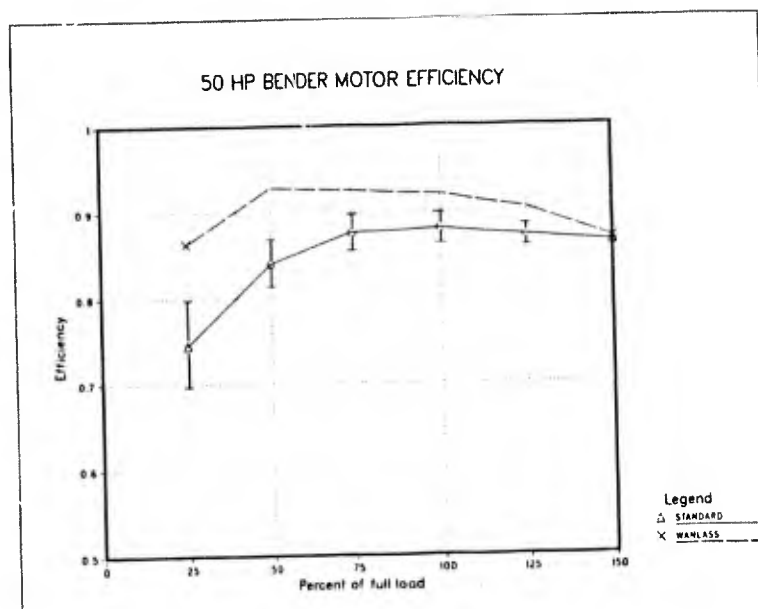


Figure B-2. Dynamometer curves — 50-hp bender motor.

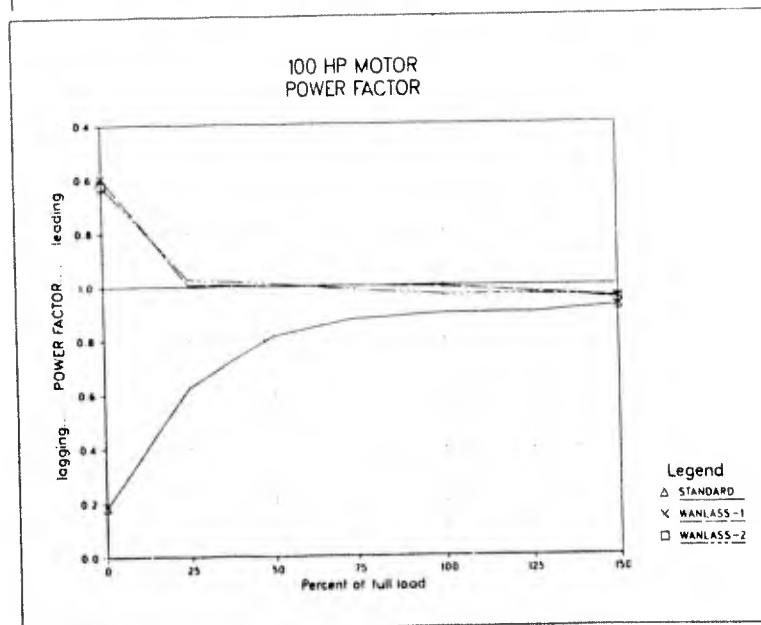
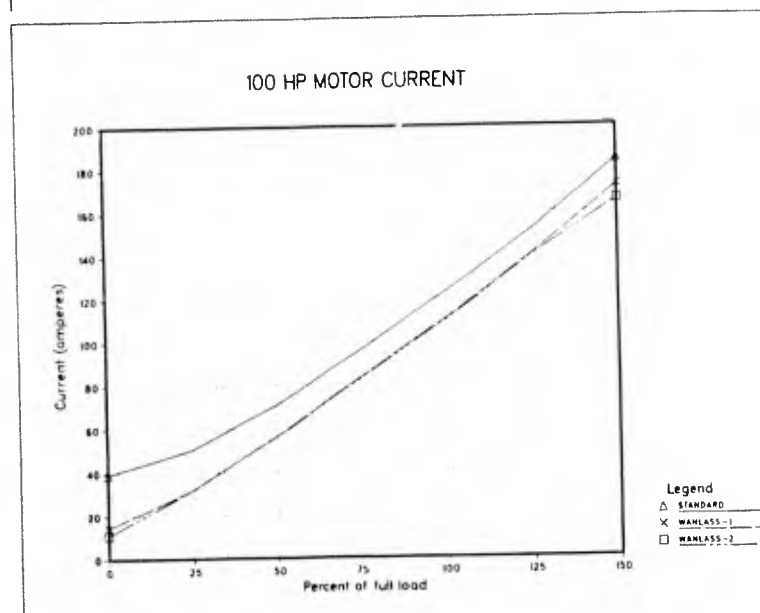
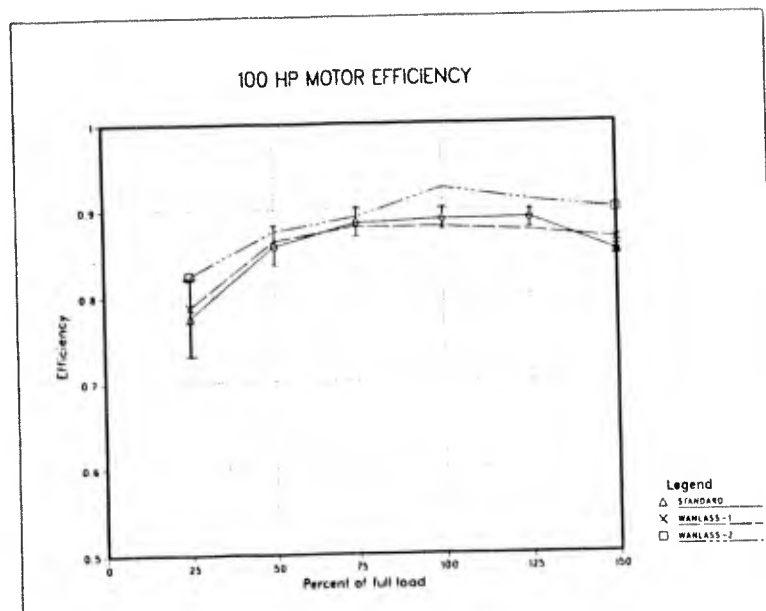


Figure B-3. Dynamometer curves — 100-hp motor.

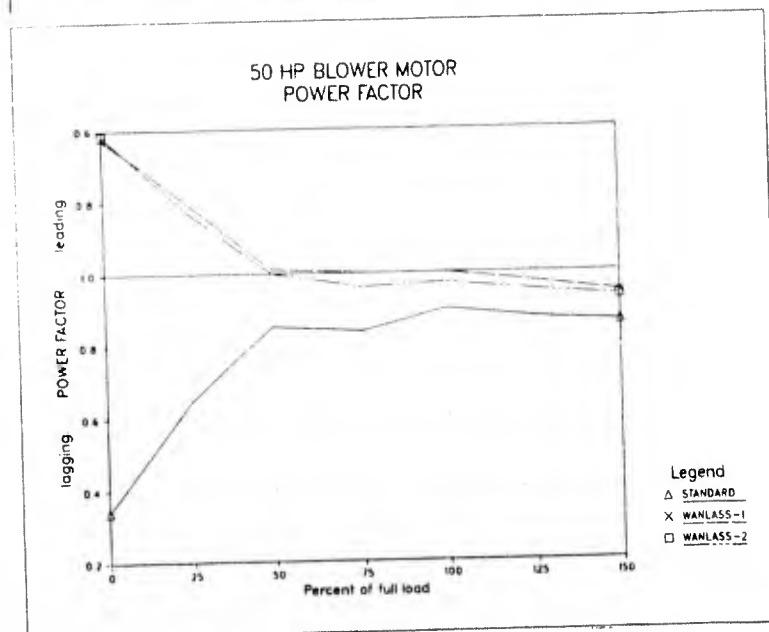
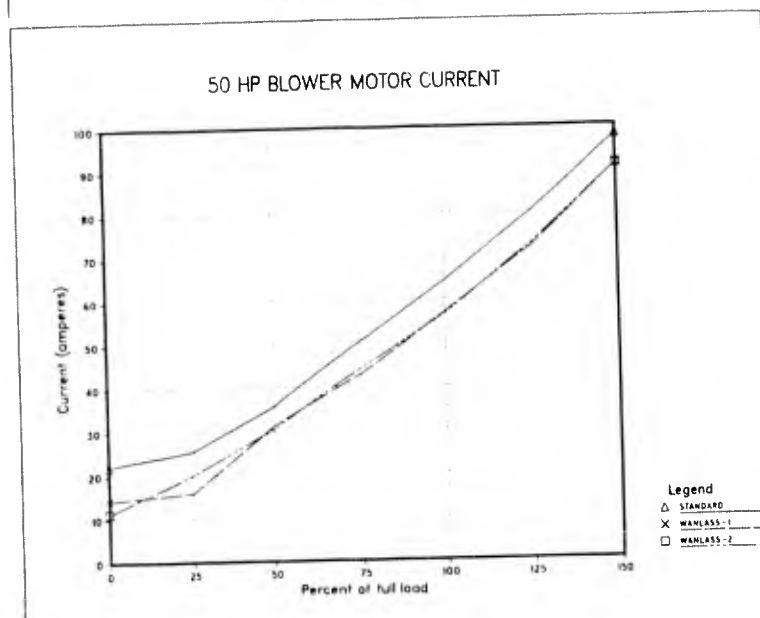
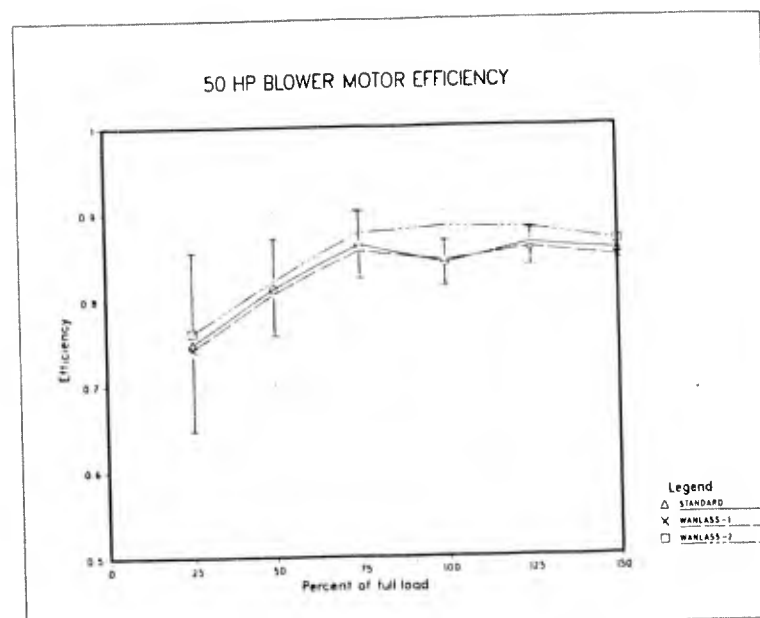


Figure B-4. Dynamometer curves — 50-hp blower motor.

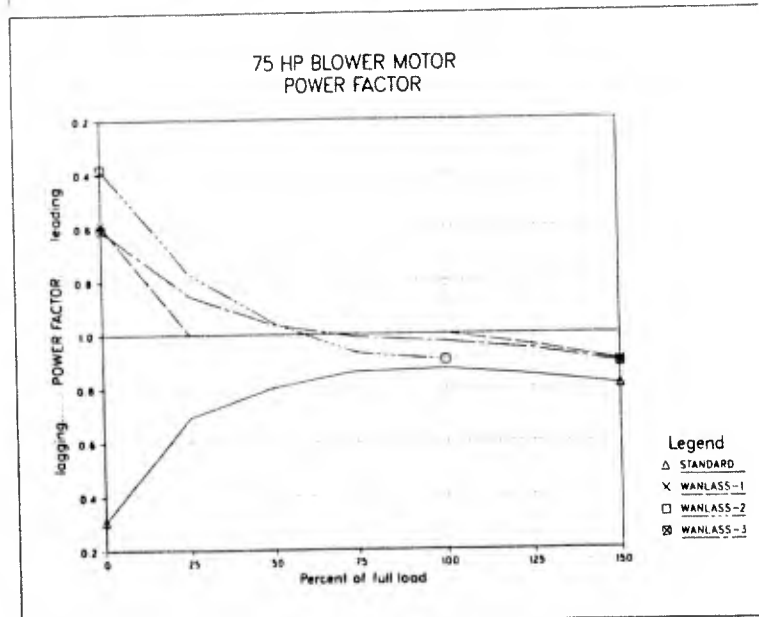
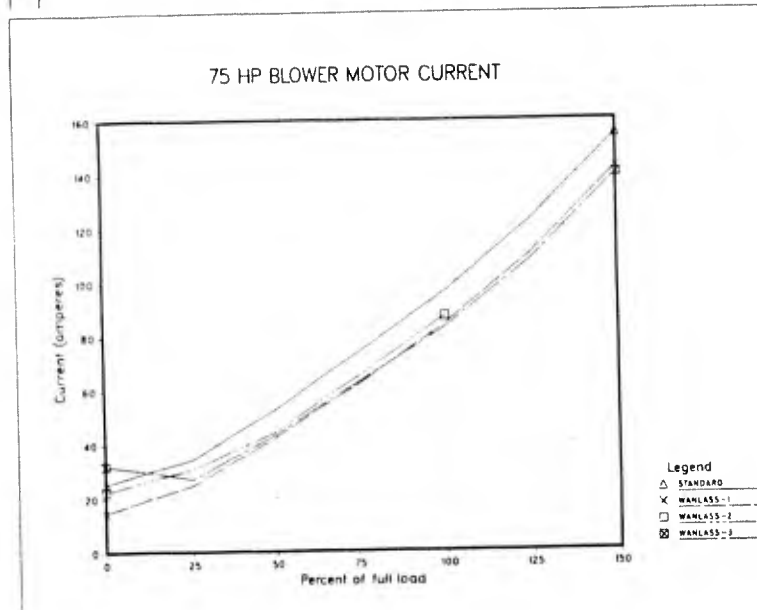
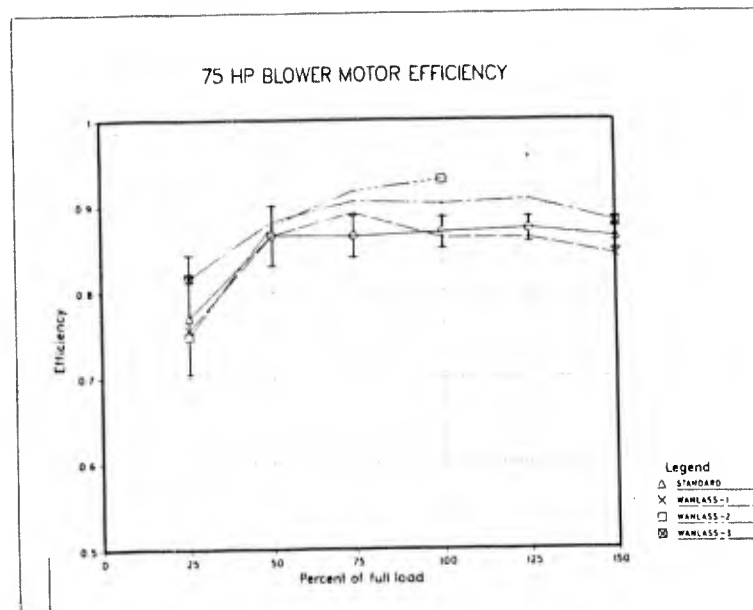


Figure B-5. Dynamometer curves — 75-hp blower motor.

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