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Evaluation of Power Efficiency Corporation's Power Commanders™

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Introduction

The Power Efficiency Corporation (PEC) of Hackensack, New Jersey requested that the Electric Machinery Laboratory at the Oak Ridge National Laboratory (ORNL) perform testing of two of their Power Commander™ devices which are intended to reduce power requirements for electric motors. ORNL agreed to test the units with funding provided by the Technical Transfer Partnership (TTP) program. The test was designed to demonstrate, using an independent laboratory, how effective the Power Commanders™ are in providing energy savings to users/customers.

Background

Electric motors in United States' industries consume a high percentage of the total electric load while performing valuable and diverse service in manufacturing operations and to consumers directly. Over the last several years, high emphasis has been placed on increasing the energy efficiency of motors and promoting their sales in order to realize national energy savings measured in Megawatts. Some applications of electric motors require that the motors operate a significant percentage of the time under light loads or at idle. In these cases, efficiency is either very low or meaningless whether the motor be standard or premium efficiency. Generally, the performance of such motors while idling has been considered to be of secondary importance to having the motors immediately available and/or preventing frequent start-ups. In these instances, it would be desirable to make use of a power conditioning box located between the motor starter and the motor if such a device would save energy during idle while maintaining immediate availability of the motor for use under full load conditions.

Several manufacturers are now marketing devices advertised to save energy in one and three phase electric motors. PEC is one such supplier and states that their Power Commander™ is effective in reducing voltage, current, and power in three phase induction motors and that their device will maintaining torque and speed under load and provide soft-starts.

Test Description

PEC supplied ORNL with two motors (i.e., 10 hp and 50 hp) and two Power Commander™ devices sized to match the two motors. A representative of PEC, Mr. Norbert Mayer, was present at the Electric Machinery Laboratory at ORNL for the testing of the 10 hp device.

The motors and Power Commanders™ arrived in good condition and were installed. The 10 hp motor was coupled to a generator and the shafts were precisely aligned to within 5 mils. The 50 hp motor was coupled to a dynamometer and its shaft was aligned with equal precision. The Power Commanders™ were inspected and two adjustment potentiometers were noted, one for the level of energy savings and the other for the degree of soft start. The internal layout of the devices were well thought out and an internal analog meter was provided to aid in adjusting the level of energy savings.

The Power Commander™ devices can be uniquely identified as indicated in Table 1 and the motors used in the testing are described in Table 2.

Table 1 Power Commanders™ used in testing

	10 hp Power Commander™	50 hp Power Commander™
Manufacturer	Power Efficiency Corp.	Power Efficiency Corp.
Model	PC3-46-15-11-21	PC3-46-50-11-65
Serial	072298-3	012798-26
Voltage	460/480v, three phase	480v, three phase
Max FLA amps	14	65
Max hp	10	50
Date of manufacture	7/22/98	1/27/98

Table 2 Motors used in testing

	10 hp Motor	50 hp Motor
Manufacturer	Lincoln Electric	Lincoln Electric
General type	Ultimate El Hostile Duty	High Efficiency
Model	AF4P10T61	D-5U5150
Serial number	U3990209094	U3961110713
Speed (rpm)	1750	1780
Voltage and Current	460V, 14A	460V, 62A
Service factor	1.25	1.15
Efficiency (nominal)	89.5	92.4

Both of the Power Commanders™ was tested in a similar manner and the tests included the following:

1. Operating the motors without the Power commander™ at load levels ranging from no-load operation to full load in several steps. Electrical input data and mechanical output speed and torque were recorded using various transducers and a specialized program developed at ORNL using LabView.™ The electrical input data included voltage (three phases) and current (three phases) at the power input to the Power Commander™ with the device switched to "bypass."

2. Operating the motors with the Power commander™ in-line and functioning (i.e., switched to "normal"). Identical types of data at the same load levels were obtained as described in paragraph 1 above (i.e., using the same transducers and software).

3. A small adjustment (i.e., about a 5° cw rotation) of the potentiometer was made to increase energy savings and the next set of in-line data was obtained as in paragraph 2 above.

4. During one set of load tests with both Power Commanders™ bypassed and then with the devices in-line, measurements of total harmonic distortion (THD) were made of one voltage phase and recorded.

5. The soft start feature was tested by recording a continuous scan of motor data while the motor was started up under no load with the Power Commander™ bypassed and then in-line.

6. Thermal data was obtained using a thermocouple inserted into the stator core. Temperature readings were measured and recorded after several hours of operation at no load with the Power Commander™ bypassed and data was again recorded with device in-line.

Test Results and Discussion

Energy savings for 10 hp system

The energy efficiency, current, and power were determined based on measurements taken at the power input to the Power Commander™ with the device in normal operation (i.e., in-line) and with it switched to the bypass mode. In this way, the device can be characterized from the perspective of a potential user to show what practical differences can be expected from using the device. The data recorded during the different load tests are provided in Appendix A. Most of the voltage, current, and power data are plotted and presented in this section. Some sets of data were not plotted because they were superfluous (i.e., would clutter the charts without providing additional useful information).

Figures 1, 2, and 3 show the power, current, and power factor of the 10 hp Power Commander™ for varying loads in steps of 1 hp. "Inline #1" refers to performance using the factory setting of the energy control, "Inline #2" shows performance after increasing the energy setting about 5° toward the "max" setting, and "Inline #3" is an additional data set taken near the setting of "Inline #2" data. The power consumption plots (Figure 1) show slight divergence at both extremes (i.e., near no load and full power) and the significance of the divergent extremes is, perhaps, greater than suggested by the chart. For instance, the no-load power data from Appendix A indicates that 427 watts are used when the unit is bypassed vs 332 watts, 349 watts, and 345 watts when the device is in-line. Therefore, the average power savings is a very significant 20%. At full load the device causes an additional power loss of 1.7% based on the two data points available at full power.

Figure 2 shows that the 10-hp Power Commander™ is effective in significantly reducing current especially at no load and at very low load levels. Current is slightly higher at full load. Figure 3 shows improved power factor at low load levels. At no load there is some doubt regarding the signal obtained from the current sensors (i.e., at very low current and power factor) therefore it is quite possible that the power factor is improved at that operating condition also. The increased power factor at low load levels enables the current to be significantly lower while the power level is, in some cases, only slightly reduced.

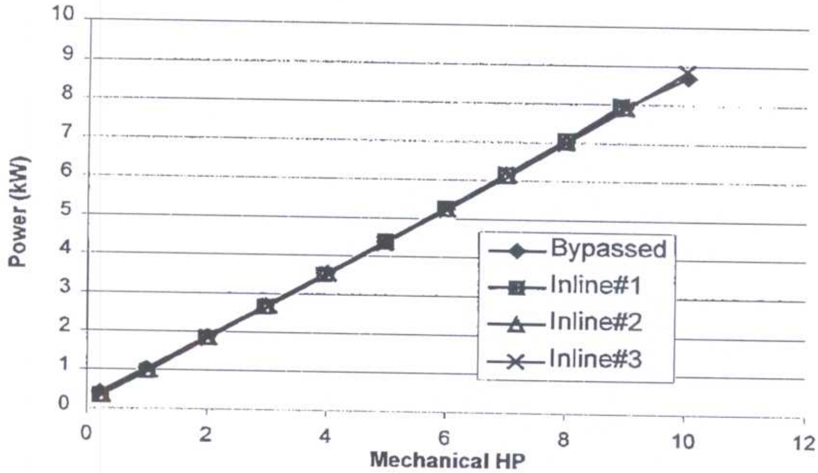

Figure 1 - Electrical power input vs mechanical power – 10 hp

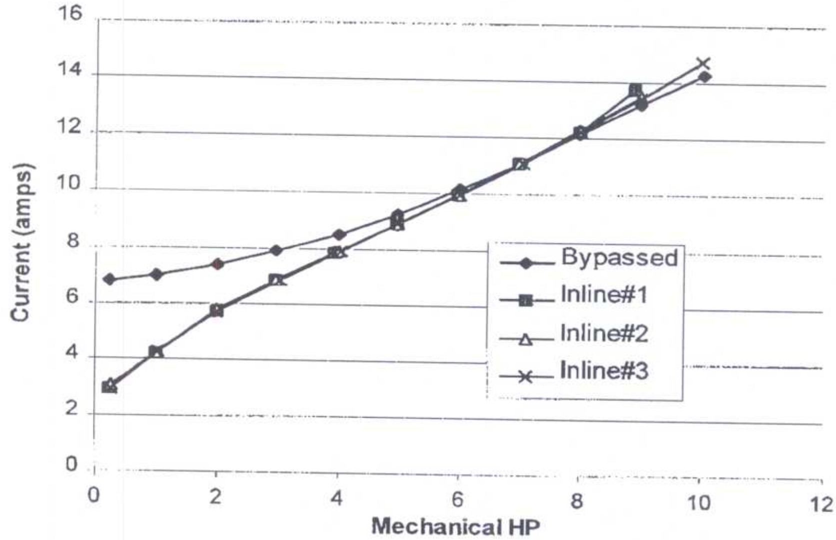

Figure 2 – Input current vs. mechanical power – 10 hp

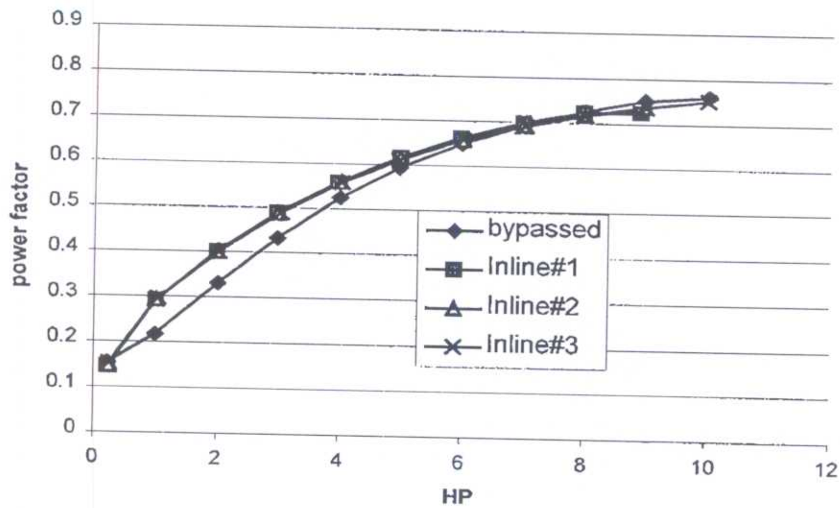

Figure 3 – Power factor vs mechanical power – 10 hp

Energy savings for 50 hp system

The relative power, current, and power factors were determined for the 50 hp Power Commander™ in a similar manner. The 50 hp test data are provided in Appendix A.

Figures 4, 5, and 6 show the power, current, and power factor of the 50 hp Power Commander™ for loads varied in steps of 5 hp. "Inline #1" refers to performance using the factory setting of the energy control, "Inline #2" shows performance after increasing the energy setting about 5° toward the "max" setting, and "Inline #3" is an additional data set taken near the setting of "Inline #2" data. The power consumption plot (Figure 4) shows a slight divergence at both extremes (i.e., near no load and full power) and the significance of the divergent extreme at no load is much greater than suggested by the chart. For instance, the no-load power data from Appendix A indicates that 1139 watts are used when the unit is bypassed vs. 608 watts, 751 watts, and 601 watts when the device is in-line. Therefore, the average power reduction is a very significant 43% and increases to 47% when considering the two lowest in-line data points (608 watts and 601 watts). The power reduction at 10% load is only 0.4% based on the data in the Appendix. At full load, the difference in power level between having the devices bypassed and in-line is not significant (well under 1%).

Figure 5 shows that the Power Commander™ is effective in significantly reducing current especially at no load (i.e., 65% reduction) and at low load levels. Current is 5.6% *higher* at full load. Figure 6 shows improved power factor at low load levels. As with the 10-hp system, the increased power factor at low load levels enables the current to be much lower while the power level is reduced to a lesser extent.

Figure 7 indicates that the motor speed is reduced by the Power Commander™ over the entire load range. However, the speed reduction is quite small and, in comparing the bypass and inline #1 data, the speed reduction did not exceed 0.2% at any load level.

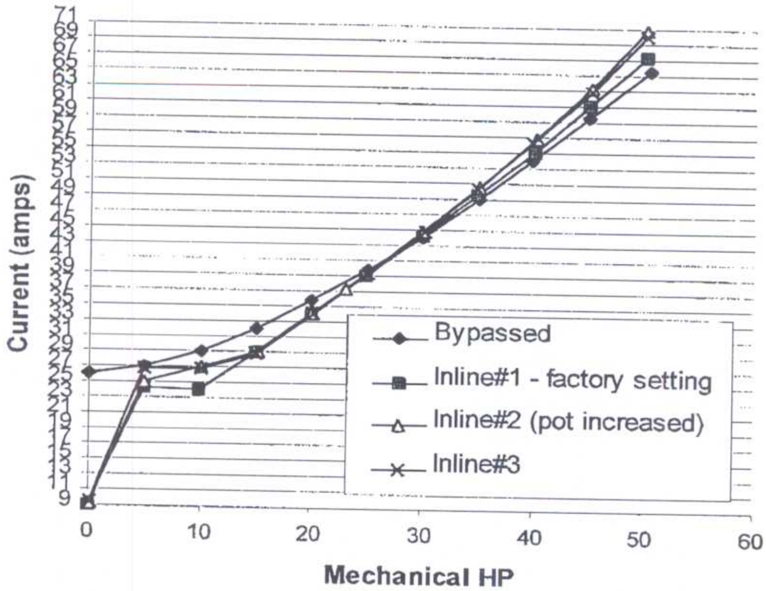

Figure 4 – Mechanical power vs. electrical power input – 50 hp

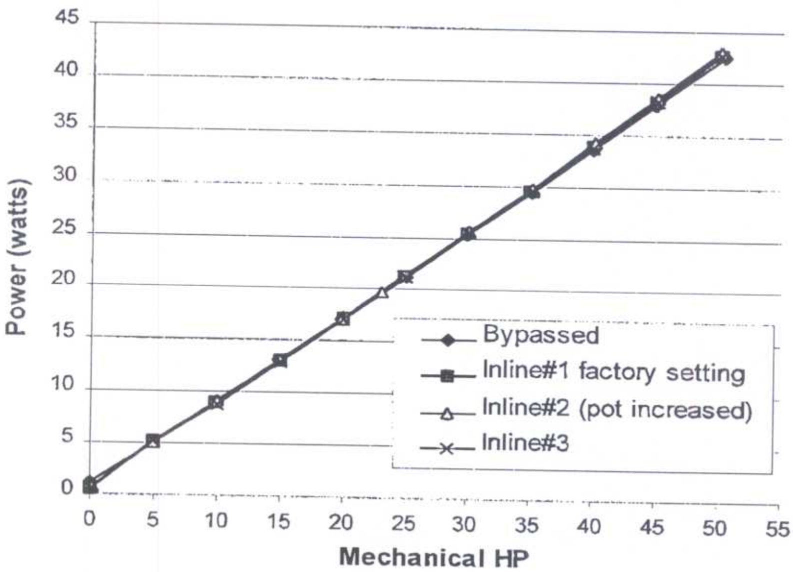

Figure 5 Mechanical power vs. current

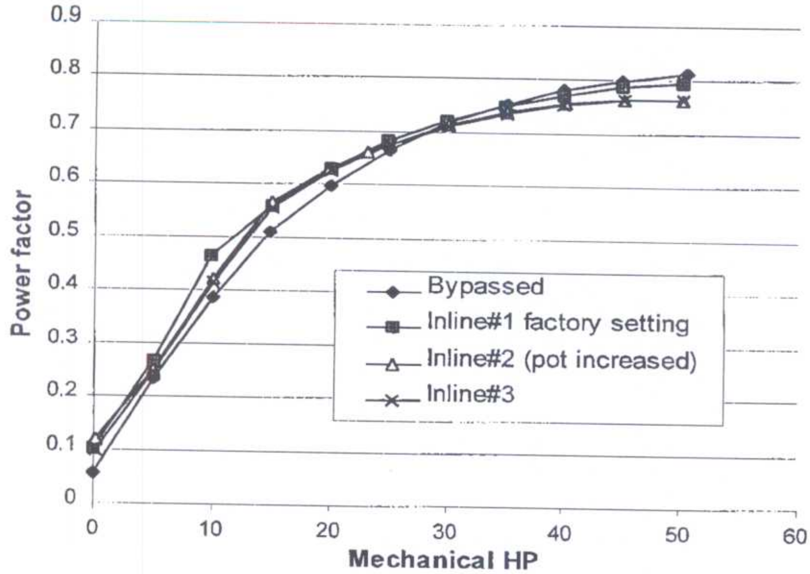

Figure 6 – Power factor vs. mechanical power – 50 hp

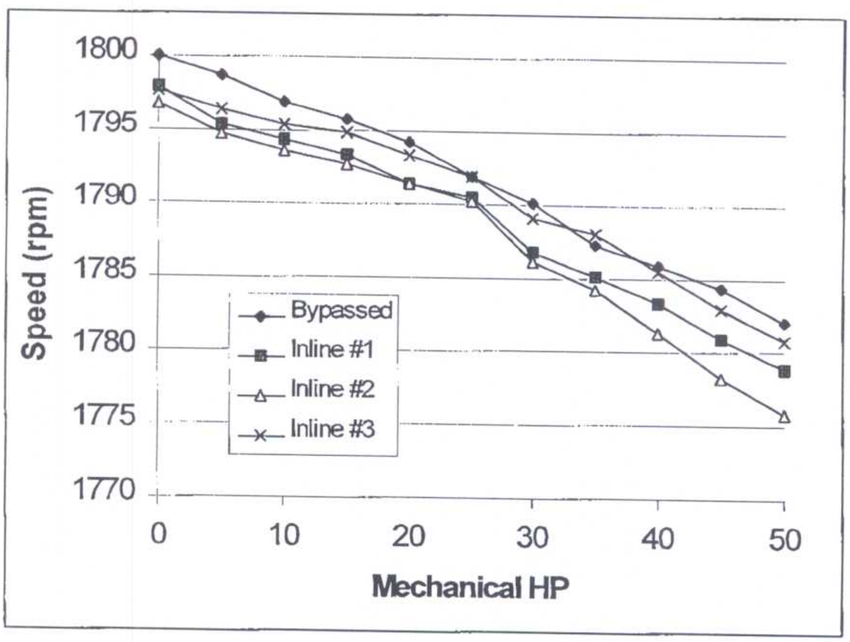

Figure 7 Motor speed vs. mechanical power – 50 hp

Harmonic Distortion

The three phase voltage input to the Power Commanders™ was monitored for total harmonic distortion with the devices bypassed and with the devices in line. The bypassed and inline tests were performed within several minutes of each other to minimize the possibility that other electrical equipment connected to the same bus might cause a change in THD. As it was, the THD on the lines appeared to be constant. Table 3 shows the percent THD readings at the input to the 10-hp device obtained using a Fluke power meter (Model 41B) connected to the

Table 3 Total harmonic distortion at the input to the 10 hp Power Commander™

	THD (%)	
HP (nominal)	Bypassed	Inline #1
30 to 50	1.4	1.5
25	1.4	1.6
20	1.4	1.6
15	1.4	1.7
10	1.4	1.7
5	1.4	1.6
0	1.4	1.3

Phase A lead. Generally the percent of distortion was slightly higher with the unit in-line however the significance of this is questionable since it represents only one data set that may have been affected by other electrical equipment on the power bus unrelated to the test.

Table 4 shows similar data obtained at the power input to the 50 hp Power Commander™. These measurements of percent THD do not indicate any significant difference in THD whether the device is in the circuit or not.

Table 4 Total harmonic distortion at the input to the 50 hp Power Commander™

	THD (%)	
HP (nominal)	Bypassed	Inline #3
9 to 10	1.5	1.5
3 to 8	1.5	1.6
0 to 2	1.6	1.6

Thermal Performance

A cursory examination was performed of the thermal performance of the 10 hp Power Commander™ with it in-line and bypassed. Without the Power Commander™ and with the motor unloaded, the stator temperature stabilized (i.e., after overnight operation) at 88.8°F.

When the Power Commander™ was put in the circuit and operated for several hours the temperature became 81.6 °F (an 8% decrease). Although the actual temperature *rise* data were not recorded, the lower temperature was very likely obtained in a warmer ambient temperature (based on typical time-of-day temperature cycles) that strengthens the case that the Power Commander™ caused a significant reduction in stator heating.

More rigorous data collection was performed for the 50-hp system (Table 5) in order to examine the temperature rise. In this case, the temperature rise in the stator with the Power Commander™ bypassed was 17.4 °F and, with the device in-line, only 4.9 °F. If the in-line case was corrected for the lower ambient temperature (relative to the bypassed case), the stator temperature would be 74.7 °F which is a 14.3% decrease in temperature compared to the bypassed case. Thus, the temperature decrease in the 50-hp motor is greater than the 8% decrease seen in the 10-hp motor.

Table 5 Thermal performance of the 50 hp system under no load

Configuration	**Ambient temperature (°F)**	**Stator temperature (°F)**	**Temperature rise (°F)**
Bypassed	69.8	87.2	17.4
In-line	65.4	70.3	4.9

Soft start

Figure 8 shows the current vs. number of data scans plot for the hard start and the soft start of the 10 hp motor. The Power Commander™ clearly was effective in reducing the start-up current for the motor. Because of the data scan rate, it is believed that the actual current peak during the hard start was likely somewhat higher than shown (e.g., about 90 amps). During soft start, the current rose no higher than half or less than half of the hard start peak current. The soft start adjustment in the Power Commander™ was left in the factory setting for this test.

The soft start test of the 50 hp Power Commander™ and motor was performed with increased rigor due to the very fast hard start performance of the motor. Because the peak current of the hard start occurred in 0.03 seconds, high speed recording of binary data was necessary. The data obtained in the hard start and soft start are shown in Figure 9. The maximum current in the hard start was 360 amps and for the soft start 92.5 amps which represents a 74% decrease. Full speed was obtained in less than 1 s in the hard start while more than 4.5 s were required in the soft start. The soft start adjustment in the Power Commander™ was left in the factory setting for this test.

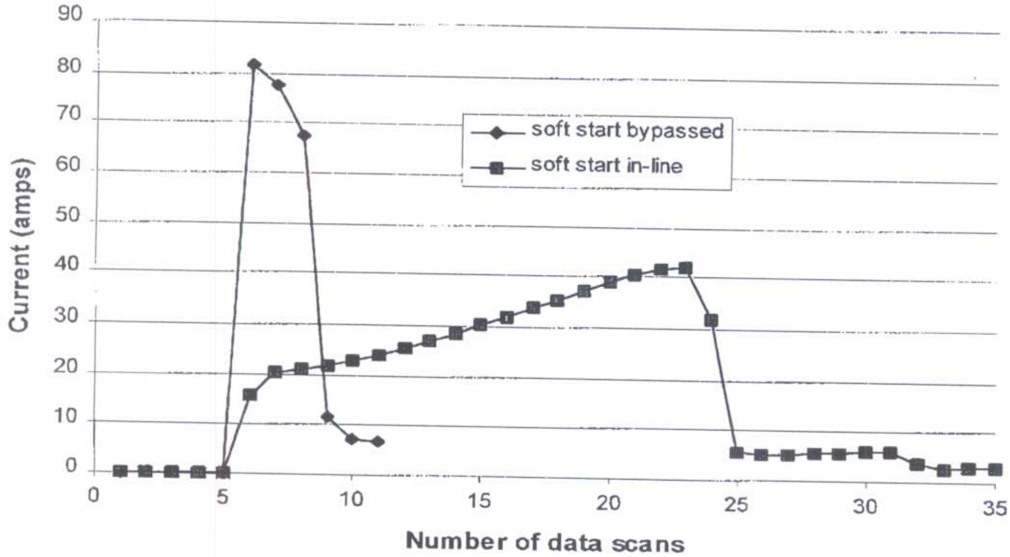

Figure 8 Hard start and soft start current plots vs. data scans (10 hp)

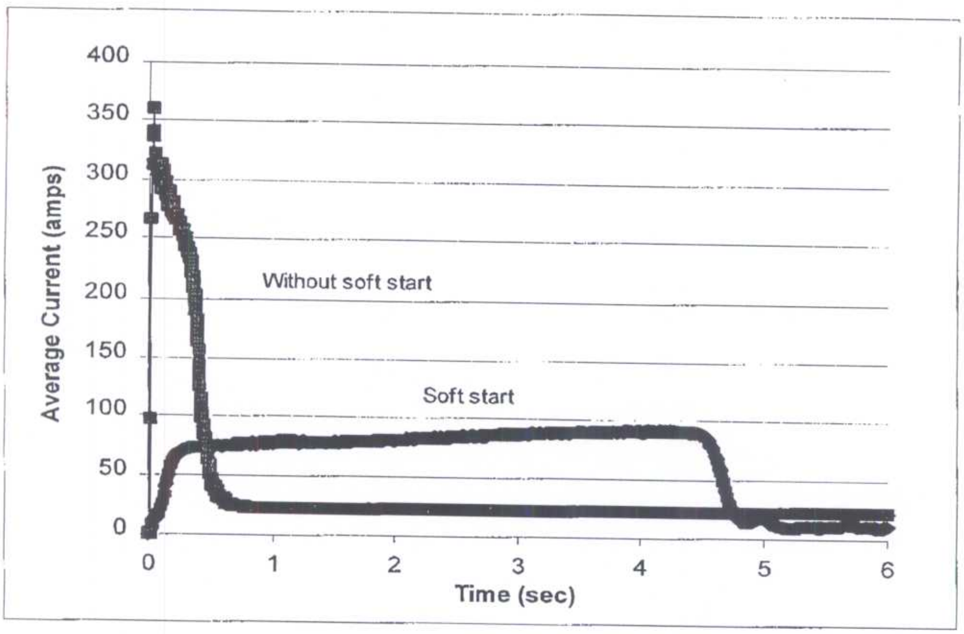

Figure 9 Hard start and soft start current plots vs. time in sec. (50 hp)

Conclusions and Recommendations

Based on electrical data measured at the input to the Power Commander™ units, the devices increase the power factor at low load conditions allowing the current to be reduced while power remains nearly unchanged at low loads (recognizing that power may be reduced considerably at no load). This reduction in current reduces the I^2R losses in the stator and in the feeder cables. The reduced current could result in significant savings in large motor applications where low power operation and idling is common. One indication of the potential of this savings is the stator temperature of the 50-hp test motor. The temperature rise under no load conditions was only 4.9°F (stator=70.3°F, ambient =65.4°F) compared to 17.4°F rise (stator=87.2°F, ambient=69.8°F) without the Power Commander™. Even aside from I^2R loss reduction, significant energy savings due to lower electrical power demand can clearly be obtained in medium-sized and especially large-sized motor applications where the motor is frequently operating with no load.

Power consumption at no load conditions is determined primarily by friction and windage loads present in the motor and cannot be reduced beyond certain small limits unless speed is reduced. In fact, if the device could be designed provide a significant reduction in speed at no load conditions, it may prove very advantageous and the speed reduction would mostly likely be tolerated by a wide range of motor applications.

The soft start performance of both Power Commanders™ was found to be smooth and reliable. The reduction in peak current was impressive and should have a positive effect on contactor life and should permit the use of improved thermal protection for motors by permitting lower current limits and faster response times.

A review of the Power Commander™ User Guides published by PEC revealed that their claims regarding reductions in voltage, current, power, and temperature are accurate/reasonable and their claims regarding soft start inrush current reduction were conservative. ORNL also concurs that the Power Commander™ produces no *significant* effect (i.e., change) in motor speed. PEC states in the Systems Requirements section that the load on the motor should be "cyclical" and that the motor should "exhibit low power factor for a portion of the cycle. (lower, longer is better)." This is also true however it would be helpful to purchasers if a clarification that indicates that the power savings may be limited almost entirely to no-load operation be included in the User Guide.

ORNL acknowledges that, in the testing of the 10-hp system, 100 amp current transducers were relied on to make measurements as low as 3 amps. The transducers are hall-based and At this low current condition (i.e., no-load operation) a 20% reduction in power was measured. It may be useful to repeat this test at some time in the future with better-suited instrumentation to gain additional assurance regarding the power savings.

PEC believes that power savings from the Power Commanders™ are significant at *low* load levels and are not limited to only *no* load levels. They have stated that power measuring equipment they have been using has clearly shown this to be the case. ORNL therefore recommends that a PEC representative return to ORNL with their equipment for additional testing and side-by-side comparisons of different power measuring devices of well-established accuracy [i.e., traceable to National Institute of Standards and Technology (NIST)].

Appendix

Tabular Data Obtained During Power Commander™ Testing

Table A-1 and Table A-2 summarize the electrical and mechanical output data obtained from the 10-hp motor and 50-hp motor, respectively. Certain no-load data obtained from the 10 hp motor are suspect since the power factor was quite low (i.e., near 0.15) and because the current sensors were operating at a small percentage of full scale.

Table A-1 10 hp Data Summary

Note	Avg. phase-to-phase volts	Torque (lb-in)	Speed (rpm)	HP - mechanical	Avg. current (amps)	Efficiency, %	Total power (kWe)	Average pf, rms	THD (%)
Bypassed #1	461.394	356.313	1773.233	10.025	**14.27**	**86.07**	8.685	0.762	
(10 hp)	461.252	322.026	1758.38	8.984	**13.20**	**84.55**	7.924	0.752	
4/27/99	460.973	285.935	1764.351	8.005	**12.12**	**84.88**	7.032	0.727	
	461.624	249.339	1770.162	7.003	**11.10**	**85.13**	6.135	0.692	
	461.432	213.087	1774.989	6.001	**10.16**	**85.14**	5.256	0.649	
	460.75	175.928	1779.927	4.968	**9.26**	**84.82**	4.368	0.593	
	460.767	141.242	1784.39	3.999	**8.52**	**84.25**	3.54	0.524	
	461.893	104.944	1790.21	2.981	**7.90**	**82.71**	2.688	0.432	
	461.574	70.569	1795.029	2.01	**7.36**	**79.87**	1.876	0.331	
	461.118	34.798	1799.624	0.994	**6.95**	**71.26**	1.04	0.216	
	461.875	7.883	1802.551	0.225	**6.79**	**39.39**	0.427	0.154	
This data set has irregular load points and therefore was not plotted:									
Bypassed #2	460.583	349.846	1770.025	9.825	**14.07**	**85.88**	8.532	0.761	1.5
(10 hp)	461	301.362	1776.344	8.494	**12.59**	**86.28**	7.341	0.731	1.5
4/28/99	460.561	251.881	1781.977	7.122	**11.20**	**86.46**	6.143	0.688	1.5
	461.528	249.217	1781.721	7.045	**11.13**	**86.41**	6.08	0.685	1.5
	462.096	197.136	1788.297	5.594	**9.83**	**86.24**	4.837	0.617	1.5
	462.411	131.319	1795.868	3.742	**8.44**	**84.87**	3.288	0.491	1.5
	462.055	104.688	1797.782	2.986	**7.96**	**83.83**	2.656	0.422	1.5
	461.989	68.043	1801.43	1.945	**7.44**	**80.35**	1.805	0.315	1.6
	461.706	35.597	1804.932	1.019	**7.04**	**72.51**	1.048	0.211	1.6
	461.836	8.752	1807.892	0.251	**6.87**	**42.40**	0.441	0.145	1.6
	461.435	320.036	1754.339	8.908	**13.74**	**83.46**	7.959	0.725	
Inline #1 (10 hp)	461.295	285.651	1763.234	7.992	**12.21**	**84.42**	7.059	0.724	
4/27/99	461.131	249.35	1768.22	6.996	**11.06**	**84.66**	6.162	0.698	
	461.369	212.603	1772.943	5.981	**9.94**	**84.80**	5.259	0.662	
	462.234	176.789	1777.683	4.987	**8.89**	**84.71**	4.39	0.617	
	462.816	140.038	1782.503	3.961	**7.83**	**84.33**	3.502	0.558	
	462.584	104.939	1786.686	2.975	**6.82**	**83.24**	2.665	0.488	
	462.364	70.222	1790.199	1.995	**5.73**	**80.96**	1.837	0.401	
	462.219	35.348	1791.932	1.005	**4.20**	**76.83**	0.975	0.292	
	463.123	8.153	1798.639	0.233	**2.94**	**52.29**	0.332	0.146	
Inline #2 (10 hp)	460.371	321.778	1760.325	8.987	**13.45**	**84.70**	7.912	0.738	
adjusted pot	460.559	285.708	1765.19	8.002	**12.25**	**85.06**	7.015	0.718	
4/27/99	460.885	249.185	1769.332	6.996	**11.09**	**85.27**	6.118	0.691	
	460.803	213.049	1773.509	5.995	**9.99**	**85.30**	5.241	0.657	
	461	176.716	1778.128	4.986	**8.92**	**85.06**	4.371	0.614	
	461.172	141.97	1781.811	4.014	**7.91**	**84.69**	3.534	0.559	
	461.229	105.228	1785.558	2.981	**6.84**	**83.53**	2.661	0.487	
	461.559	70.938	1788.868	2.013	**5.76**	**81.51**	1.842	0.4	
	461.913	35.673	1790.07	1.013	**4.21**	**77.01**	0.981	0.293	
	462.087	8.788	1797.036	0.251	**3.05**	**53.57**	0.349	0.147	
	460.535	358.433	1759.945	10.009	**14.71**	**84.52**	8.831	0.753	1.5
Inline #3 (10 hp)	460.641	321.254	1765.405	8.999	**13.42**	**85.05**	7.89	0.737	1.5
4/28/99	461.071	284.51	1770.644	7.993	**12.20**	**85.48**	6.973	0.716	1.6
	460.92	249.82	1775.455	7.038	**11.10**	**85.68**	6.125	0.691	1.6
	461.053	212.967	1780.104	6.015	**9.98**	**85.74**	5.231	0.657	1.6
	461.94	175.52	1784.436	4.97	**8.87**	**85.68**	4.325	0.61	1.6
	461.774	141.912	1788.824	4.028	**7.89**	**85.27**	3.522	0.558	1.6
	461.904	106.387	1792.821	3.026	**6.86**	**84.26**	2.678	0.488	1.6
	461.914	70.878	1796.149	2.02	**5.73**	**82.16**	1.833	0.4	1.6
	462.006	36.415	1797.775	1.039	**4.22**	**78.14**	0.991	0.296	1.6
	462.01	8.89	1804.925	0.255	**2.92**	**55.09**	0.345	0.153	1.6

Table A-2 50 hp Data Summary

Note	Avg. phase-to-phase volts	Torque (lb-in)	Speed (rpm)	HP - mechanical	Avg. current (amps)	Efficiency, %	Total power (kWe)	Average pf, rms	THD (%)
Bypassed	460.201	1783.962	1782.014	50.441	**65.616**	**88.496**	42.504	0.813	1.4
4/29/99	461.121	1589.128	1784.394	44.992	**59.392**	**88.699**	37.825	0.798	1.4
	460.906	1410.326	1785.922	39.964	**53.949**	**88.83**	33.548	0.779	1.4
	460.888	1236.392	1787.357	35.063	**48.928**	**88.849**	29.428	0.754	1.4
	461.915	1055.212	1790.091	29.971	**44.047**	**88.655**	25.21	0.716	1.4
	462.083	879.467	1791.972	25.006	**39.677**	**88.177**	21.147	0.666	1.4
	462.483	701.699	1794.186	19.976	**35.667**	**87.395**	17.044	0.597	1.4
	461.427	524.761	1795.729	14.952	**32.061**	**85.617**	13.022	0.509	1.4
	461.96	349.943	1796.931	9.977	**29.075**	**82.791**	8.987	0.387	1.4
	462.02	173.431	1798.674	4.95	**27.006**	**73.96**	4.99	0.232	1.4
	461.986	2.699	1800.005	0.077	**26.123**	**5.048**	1.139	0.058	1.4
Inline #1	459.659	1774.008	1778.846	50.07	**67.263**	**87.575**	42.635	0.796	1.5
4/29/99	460.631	1593.917	1780.841	45.038	**60.969**	**87.801**	38.251	0.786	1.5
	460.746	1412.917	1783.364	39.98	**55.062**	**87.948**	33.899	0.771	1.5
	461.686	1235.564	1785.125	34.996	**49.514**	**87.995**	29.657	0.749	1.5
	461.394	1057.011	1786.789	29.967	**44.151**	**87.89**	25.425	0.721	1.5
	461.566	878.305	1790.477	24.952	**38.999**	**87.554**	21.251	0.682	1.6
	461.8	703.116	1791.386	19.985	**34.024**	**86.992**	17.131	0.63	1.6
	462.084	526.429	1793.348	14.979	**29.116**	**85.745**	13.027	0.559	1.7
	462.588	348.917	1794.383	9.934	**23.933**	**83.305**	8.892	0.465	1.7
	462.338	173.424	1795.409	4.94	**24.297**	**71.699**	5.138	0.267	1.6
	463.029	1.833	1797.938	0.052	**8.954**	**6.415**	0.608	0.102	1.3
Inline #2	460.208	1778.826	1775.82	50.121	**70.723**	**86.866**	43.026	0.763	
(adjusted for	460.906	1601.405	1778.269	45.184	**63.282**	**87.31**	38.591	0.764	
increased	461.567	1422.24	1781.246	40.196	**56.728**	**87.594**	34.219	0.755	
savings)	462.217	1240.698	1784.191	35.123	**50.539**	**87.768**	29.842	0.738	
4/29/99	461.881	1060.626	1786.15	30.058	**44.818**	**87.712**	25.555	0.713	
	461.51	813.523	1790.285	23.109	**37.251**	**87.526**	19.688	0.661	
	461.667	701.842	1791.384	19.949	**33.973**	**86.987**	17.101	0.63	
	462.18	530.604	1792.689	15.093	**28.895**	**86.085**	13.074	0.566	
	462.893	353.922	1793.603	10.072	**26.898**	**82.636**	9.089	0.423	
	461.403	176.334	1794.766	5.021	**25.026**	**75.767**	4.942	0.249	
	462.431	4.861	1796.843	0.139	**9.351**	**13.752**	0.751	0.119	
Inline #3	461.032	1772.808	1780.774	50.091	**69.94**	**87.527**	42.676	0.764	
4/30/99	461.422	1594.007	1782.942	45.094	**62.747**	**87.934**	38.24	0.763	
	461.021	1408.97	1785.528	39.917	**56.179**	**88.229**	33.737	0.752	
	461.536	1234.583	1788.078	35.026	**50.325**	**88.386**	29.551	0.735	
	461.358	1062.026	1789.138	30.149	**44.835**	**88.374**	25.439	0.71	
	461.267	882.198	1791.967	25.083	**39.334**	**88.294**	21.184	0.674	
	462.197	705.452	1793.386	20.074	**34.083**	**87.847**	17.04	0.625	
	462.813	526.804	1794.881	15.003	**28.834**	**86.978**	12.862	0.557	
	463.088	351.02	1795.392	9.999	**26.752**	**84.153**	8.861	0.414	
	462.198	176.455	1796.435	5.03	**26.871**	**71.351**	5.257	0.246	
	462.685	6.019	1797.7	0.172	**9.432**	**21.294**	0.601	0.098	