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Motor Energy Controller

Field Test Results

- ***Advanced all-in-one solution for controlling electric motors***
- ***Reduces motor Life Cycle Cost (LCC)***
- ***Field test results show significant improvements in Power (KW), Current(A), CosF, KVA and KVAR measurements***
- ***Enhanced energy savings and efficiency with uncompromising performance***

Overview

This case study presents measurements and explains the results of a field test conducted with the advanced Motor Energy Controller (MEC) developed by Power Electronics Systems (PES). The MEC 20HP/15KW model was installed at the Vered Quarry in Israel to control an inductive electric motor of 20HP (15 KW/30A) which operates a conveyer.

Background – Electrical Motors

In many industrial applications, electric motors are designed to develop the maximum torque during the startup sequence (for example: to start a fully loaded conveyer, mixer or other equipment). However, after the startup sequence is completed, and the requirement to the torque and power decreases, the motor usually works at partial load. It is very common that under these conditions the motor is loaded at only 30%- 60% of its nominal power. In this mode, motor efficiency decreases (low Cos F and relatively high working current), creating an energy efficiency problem for manufacturers, plants and production sites such as the Vered Quarry.

The Motor Energy Controller

The MEC system improves the parameters of electric induction motors operating in partial load mode. This substantial improvement is achieved through providing reduced SINUSOIDAL voltage when the motor is running at partial capacity. Controlled by a powerful microprocessor, the MEC continuously measures the motor load and automatically switches from SAVING mode to BYPASS mode when the motor load increases above the certain threshold. This enables enhanced energy savings and efficiency improvement without compromising operational performance.

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The MEC has been designed and developed using a proprietary technological platform for controlling line voltage. .The MEC provides pure **SINUSOIDAL** voltage waveform when the motor starts and while it runs. Unlike other solutions based on phase-control methods, the MEC does not generate harmonic distortions or electromagnetic interference, which are harmful for the motor. Moreover, it does affect motor torque and limits motor wear which results in further prevention of energy losses.

Moreover, the MEC offers more than energy savings; it is an all-in-one solution for improving efficiency and controlling electric motors. The MEC system integrates Reduced Voltage Start (RVS™) mechanism that enables starting electric motor at the maximum torque and at a reduced current (typically 1.5 -2.5 times the nominal)

Test Methodology

In order to measure motor performance with and without the MEC system, the MEC installed at the Vered Quarry was programmed to switch automatically between SAVE and BYPASS modes every one minute. The measurements of Voltage, Current, CosF, VA and Power were recorded into the power meter with two-seconds resolution. After one hour of data recording the log files were uploaded onto a computer for analysis and results calculations.

The results of this test are presented in the table below:

	Vin	**A**	**W**	**CosF**	**VAR**	**VA**
Bypass mode	409	16.5	5,045	0.43	10,429	11,641
Save mode	409	8.5	4,155	0.68	4,334	6,029
Improvement		48%	18%	58%	58%	48%

The motor was loaded at about 30%.

In addition, the startup current was measured when motor starts with and without MEC. With the MEC the motor started smoothly with the start up current being only 1.6 times the nominal current while developing the maximum torque needed. Without the MEC, the startup current can reach levels of 6-8 times the nominal current.

Conclusions

While a moderate reduction of Power (18%) was observed during this test, all other parameters (A, CosF, VA and VAR) were significantly improved. This also results in additional indirect savings which offer added benefits to the direct energy savings.

1) Direct Savings

Assuming 6000 annual operating hours, the direct energy savings will be 5,340KWh.
Saving = (5,045W - 4,155W) x 6000H

2) Conduction Losses

Estimated conductivity losses in industrial sites are about 7%. Power losses are proportional to the square of current **($P_{loss} = RI^2$**). Therefore, reducing current by 48% results in reduction of power losses by 73%. This means additional saving of over 5% in electricity.

3) Maintenance Cost Reduction

Using the MEC reduces thermal stress and iron losses while optimizing motor performance, therefore reducing motor Life Cycle Cost (LCC) and extending its life span.