ELECTRIC MOTORS ONLINE

In Partnership With

Unipower

"Dry pump, dead head, jammed impellers and even premature bearing wear can lead to motor and pump failure"

Motor management & control devices, or overloads protect motors…

"but what is protecting the machine ?"

Fig1. ACMotor

A majority of motor driven machines are not being protected adequately from unforeseen malfunctions caused by a variety of possible issues that can occur during operation. Motor driven machines that continue to operate during abnormal conditions caused by a jam or blockage will result in irreparable damage not only to the motor continuing to drive the system but also to the machine itself. In the past the extent of damage to the machine has been understated compared to the damage to the motor itself regardless of whether a variable speed drive is being used or not.

Motor management and control devices, or overloads can protect motors but the question here lays with what is protecting your machine. In pump installations for example when there's a jam or suction loss long before the thermal overloads trip, serious damage can be incurred by the machine as well as the motor. Reality here is any abnormal operating condition can have a detrimental effect on the life of the system. Dry pump, dead head, jammed impellers and even premature bearing wear can lead to motor and pump failure. To save upfront costs many motor driven systems are installed without any means to continually monitor operations. As a result, frequent inspections of the motor and the operation of the machine becomes a necessity for maintenance and repair.

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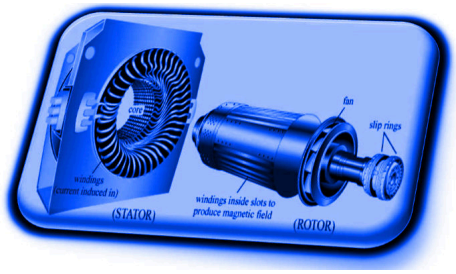

Fig2. Stator & Rotor

If failure becomes apparent without warning it can mean irreparable damage to the machine and possibly the motor. These unforeseen issues can be eliminated with the use of simple but effective monitoring and control techniques to protect the motor driven systems. Adding a small cost to the installation will pay for itself a few times over the first time a fault is detected, and the machine or motor is saved.

This article will examine the importance of torque and power consumption by the motor, the proportionality between power and torque giving invaluable feedback in many industrial applications.

To fully analyze a motor's health, one must consider all aspects that can affect it under normal operational conditions. Incoming power quality is one area that is often overlooked, correct and safe operation of motors will depend on power conditions. As voltage levels alter during the day there can be unbalances. Raising voltage levels to decrease current and achieve the motors name plate ratings causes excessive heat hence degrading the insulation. Harmonic distortion also affects the power quality, much of which is caused by variable frequency drives (VFD) and other facilities within the vicinity which go undetected a majority of times.

Typically, during each start motors tend to draw six to ten times the rated current levels and with hot starts this is even more– detrimental to the windings due to excessive heat generated causing insulation degradation. Besides normal operating data if voltage, current and torque level information was captured at motor start, it would be realized the amount of stress a motor is subjected to and hence as a result in many cases motors fail during this start up period.

During fluctuating loads and power condition problems rotors come under a tremendous amount of stress typically at startups. Monitoring these conditions are vitally important in determining the motors ability to continue operating. Losses in efficiency can be due to cracked or broken rotor bars which can cause dramatic increase in thermal stress.

Load, % of load, horsepower demand, kilowatt usage, and power factor are all important elements that help to deduce the motors health. If motors are forced to carry out load demands above their capacity, this can cause the windings to run at unsafe temperature levels even though the current is at nameplate current ratings. A Motor running above its nameplate horsepower rating can also suffer from higher torque demands putting greater stress it's rotor.

In the real-world motors are commonly oversized and occasionally undersized with both having their own cost implications. If oversized Initial cost, energy consumption and repair costs will be higher. Undersized perform poorly, suffer from higher losses and will fail earlier.

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Some of these problems can be detected, avoided, and corrected quickly by the sophisticated digital motor load monitors designed & manufactured by UNIPOWER in Denmark. Having a broad range of quality products for specific and general applications aimed at motor driven systems, chances are Unipower has a solution.

A load monitor from Unipower measures the load on the motor electronically. The motor is acting as its sensor to detect the state of the equipment the motor is driving. This is primarily to protect the machine from damage but can also protect the motor. In an abnormal running condition the Load Monitor measures the load drawn by the motor and compares it to what it was when normal.

The most common use would be pump dry run detection. As discussed earlier many pumps cannot be allowed to dry run, particularly in Petrochemical, Agrochemical and Pharmaceutical industries where hazardous chemicals are being pumped. In the water industries dry running and dead heading due to impeller being jammed will also show an abnormal motor load.

Unipower Load monitors calculate Watts/Kilo Watts (kW) which is the only electrical measurement of work that is linear with and proportional to load, using the formula:

$P = \sqrt{3} \times I \times V \times \cos\varphi$.

Many products are claimed to achieve the same by measuring the current. This is a particularly problem when the motor is over sized which does happen often as discussed earlier. In such cases the motor will never reach its rated Load as the motor is too large for the job and hence will operate where current is a flat line, so you cannot measure current for variations in work being done by the motor.

Phase angle detection was another way round this however with the advancement of technology and the increased efficiency of newer motors phase angle detection is also not a reliable alternative for measuring work done by the motor.

Supervision and control are uniquely offered by the Unipower family of Motor Load Monitors, replacing friction clutches, ball detent clutches, shearpins, tacho controllers etc. Typical applications include belt and screw conveyors, elevators, fans, pumps, filtration screens, macerators, etc. Depending on the application a unit with one or two trip points can be useful. With two speed motors two trip points are typically used, one for each speed. Unipower product designs recognise that in order to use power consumption as an indirect torque measurement the power must be measured by the use of formula mentioned, measurement must be fast and accurate, reaction time must be short, measurements must be valid for none sine–shaped currents i.e. AFTER? frequency inverters generating very high and short current peaks (crest factor up to 10) and include support functions such as start timer, reaction delay timer, peak detectors for max/min load, and Shock Load monitoring dP/dt with voltage spike compensation dU/dt.

Unipower, Danish family of intelligent power control units and measurement transducers for power, available in both din rail and panel mount

Offering kW meters, sophisticated control units and unique advanced tool monitoring systems

"Supervision and control are uniquely offered by the Unipower product family"

Leadership in Load Monitoring and Measurement

Unipower

Product Variants

APM10

APM100B

APM110

APM300B

APM380

APM382

APM382MON

HPL110

HPL110A

HPL500

HPL530

HPL540

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Fig3. APM110

Fig4. APM380

Fig5. HPL500

The APM110 (fig.3) is designed to measure loads of 0.01kW to 70kW thanks to 4-quadrant multiplier and precision current sensor. For larger loads an external CT can be used. This unit accepts crest factors up to 5 and is therefore suitable to be used before the frequency inverters. It can be used almost anywhere in the world without special supply voltage types as it accepts supply voltages of 380V - 500 Vac and measure currents up to 80A directly.

Low cost, manual and auto reset capability with start surge and trip delay timers are just some of APM110 features. Typical applications for this unit would include dry run/overload protection of pumps, under/overload protection of; filtration screens, macerators, scrapers, conveyors, cranes and hoists.

The APM380 (fig.4) is another unique product, an electronic measurement transducer that measures power in kW on 3 phased asymmetric loads, including frequency inverter outputs in accordance to the formula for power mentioned above. Suitable for mains voltage of 3 x 230V to 3 x 575V, measures after frequency inverter; PWM 10Hz to 1kH (between VFD & motor), 10 ranges of current up to 80A. With programmable filter function, control functions and serial comms, kW input of motor power to PLC's, PC's and SCADA systems.

The APM382 is the combined electronic power measurement transducer and load monitor that measures power in kW on 3-phase asymmetric loads, including frequency inverter outputs in accordance with the power formula mentioned earlier. This unit has a software utility for setting up and visualization - showing actual power measurement with max & min peak values. The utility program can be saved and loaded onto other APM382 devices for speed and a software library can be created for different machines and applications

The latest product range of the Unipower family is the HPL500 series (power supply patent pending, fig.5). This remarkable unit has many features that allows it to be aligned with many applications including supervision of pumps, fans, belt and screw conveyors, Filtration Screens, Macerators, Scrapers Etc., The HPL500 features measurement and display of load in kW or kW% with analogue output of kW, user configurable alarm output functions and a shaft output power feature. For further in depth information please visit:
https://www.electric-motors.online/_webedit/uploaded-files/All%20Files/Charter%20Controls/HPL500.pdf

Other HPL500 series Load Monitors include the HPL540 which is a dedicated Screw Conveyor monitor which auto-reverses the motor to unblock the conveyor, with a programmable number of attempts (0-25 attempts) and programmable Fwd/Rev pause period and the HPL530 which is a true electronic shear-pin featuring shock-load monitoring(dP/dt)

…. Unipower Load Monitors without digital screen;

APM10 – load Transducer with 0(2) – 10V or 0(4)–20mAoutput
APM100B – symmetrical load measurement transducer with analogue outputs
APM110 – load monitor with 2 limits and 1 output relay
APM300B – asymmetric load measurement transducer with analogue outputs
APM380 – frequency inverter output load measurement transducer
APM382 – frequency inverter output combined load monitor& measurement transducer
APM382MON – monitor software for APM382

…. Unipower Load Monitors with digital screen;

HPL110 – load monitor with max./min. limit
HPL110A –load monitor with max./min. limit
HPL500 – Advanced digital motor load (kW) monitor
HPL530 – Advanced digital motor load monitor with true electronic shear–pin action
HPL540 – Advanced digital motor load monitor with auto–reverse function optimised for screw–conveyor supervision

For more information please contact us at

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Bibliography:

1. Crowder, R., 2006. Electric Drives And Electromechanical Systems. Oxford: Elsevier.
2. Megger.com. 2020. Electrical Test Equipment Application Solutions From Megger. [online] Available at: <https://megger.com/applications> [Accessed 2 April 2020].
3. greenhill, m., 2020. Motor Load (Kw) Monitors & Transducers | Charter Controls. [online] Charter–controls.com. Available at: <https://charter–controls.com/product–category/motor–load–kw–monitors–transducers/> [Accessed 1 April 2020].
4. Pumps and Systems Magazine. 2020. Protect Pump Motors With Simple Current Monitoring Techniques. [online] Available at: <https://www.pumpsandsystems.com/protect–pump–motors–simple–current–monitoring–techniques> [Accessed 4 April 2020].
5. Unipower.dk. 2020. Unipower. [online] Available at: <http://www.unipower.dk/> [Accessed 5 April 2020].