Monitoring drives with asynchronous motors

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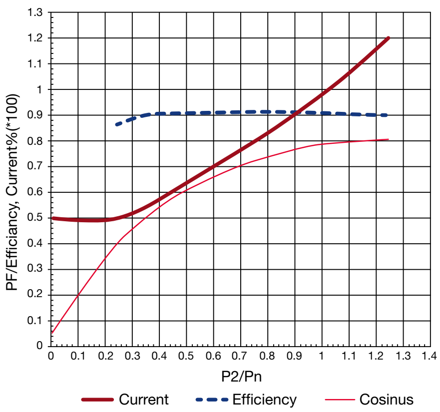
Many vital items of equipment are driven with standard asynchronous motors. These are reliable and long-lasting, frequently removing the need for costly control systems using frequency converters and the like. With rather larger drives, the star delta starter or a simple soft-starter (e.g. from ComatReleco's **CTC**, **CCC**, **CCM** product family) is usually sufficient both to master the inrush peak in order to meet the technical requirements of energy suppliers, and also to avoid mechanical stresses such as those on joints, V-belts, etc.

Merely monitoring the functioning drive and the correct function is not enough, however: a pump can run dry, the intake channel of a fan may be clogged, or the fan may turn due to the chimney effect alone without a motorised drive, for instance.

Monitoring the electrical energy consumed by the motor is a simple, efficient and low-cost solution to this problem. However, the unique features of asynchronous motors need to be taken into consideration. If the motor is only operated at partial loads, for instance, simply measuring the current can lead to incorrect results. One of the properties of asynchronous motors is that the absolute current consumption figure remains almost constant after acceleration and into the range of 50% of the rated load (see graph below: current consumption remains at 0.5 for a long time). What changes significantly with the load in this partial load range, however, is the power factor (cosφ). Only towards the rated load, i.e. above approx. 50% of the load, does the current rise, while the power factor rises aysmptotically towards its end value at P_N of approx. 0.78 ÷ 0.92, depending on the motor.

It can be seen that only from approx. 0.4 P_N does the current begin to rise linearly as the load increases. A current minimum can be observed at approx. 0.15 P_N.



Up to approx. 0.5 P_N, a sharp increase in the power factor from approx. 0.1 towards 0.6 can be observed. At the rated load the power factor is approx. 0.8. The optimum efficiency is reached at 0.7 ÷ 0.8 of P_N. With an asynchronous motor, the power factor will always remain inductive due to the field winding and the unavoidable air gap.

Conclusion

For reliable monitoring of the system, the cosφ is thus clearer and more suitable as a reference value than current monitoring. There is an even better way, though: the optimum solution for detecting overloads is to monitor both the current and the power factor. What is more, single-phase monitoring is sufficient. As regards the overload, the principle is the same as for transformers; the rated load and the overload must be seen as a function of the ambient and operating conditions. An overload is not a problem as long as the winding temperature does not rise beyond permitted limits (see manufacturer's specifications). In other words, the current that is recorded is not the critical factor.

The only ultimate solution for overloads is to record and analyse the temperature. Larger motors have such sensors for each winding built in (PTC; NTC).

The **MRM11** is suitable for monitoring the current power factor (cosφ), as is the three-phase variant, **MRM32**. They monitor **U, I, f, P, S, cosφ**. The current input is configured for 5 A, i.e. appropriate transformers may need to be interposed. In the case of higher-rated motors, it is recommended that the temperature of the winding is also monitored. The **TSR19** is the best choice in this scenario. The temperature has a determinative effect on the life of the motor.

MRM11 from ComatReleco

MRM32 from ComatReleco

TSR19 from ComatReleco

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