

Line Side and Load Side Current Measurement of Variable Frequency Drives

Application Summary

Variable frequency drives provide more output current to the motor than the line current drawn from the source. While this may seem surprising, there is a natural explanation. The current supplied to the motor has two components, magnetizing current and torque producing current. The magnetizing current, which is typically one third of the motor full load current, circulates between the DC capacitor bus and the motor. The line and load currents are isolated within the drive by the DC capacitor bus so that the magnetizing current, which produces no real work, places no demand on the source.

The result is that at no load, the line current will be very small, typically around 5-10% of rated while the load current may be 30-40% of rated. The line produces only enough current to overcome windage, friction, motor and drive losses. While large, the no load current will be almost 90 degrees out of phase with the motor voltage and produces only enough power to overcome windage, friction and motor inefficiencies. As load is applied to the motor, both the line and load currents will increase. The increases will not be exactly equal due to the isolation of the DC bus capacitors.

One further benefit provided by the inverter's DC bus isolation is the improved power factor seen by the line. Utilities charge for the "apparent" power provided to loads with a low power factor. AC induction motors run across the line will result in a lagging power factors from 0.70 to 0.85. An inverter will improve the power factor to near unity, typically from 0.95 to 0.97.

So, while the extra current on the output side of the drive may appear unusual, the benefit is the reduced demand on the distribution system and the improved power factor.



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Additional Help

In the US or Canada: please contact the Technical Resource Center at 1-877-ETN-CARE or 1-877-326-2273 option 2, option 6.

All other supporting documentation is located on the Eaton web site at www.eaton.com/Drives

