Application Note

Introduction to Energy Saving Control

Applicable Product: V1000

INTRODUCTION

WHAT IS THE MEANING OF "ENERGY SAVING"?

Energy Saving Control takes advantage of the basic characteristics of an induction motor, allowing the drive to "operate at maximum efficiency even when the load fluctuates". Adding an inverter to an application greatly reduces energy consumption, which in turn makes it possible to cut energy costs, while operating at maximum performance. Energy Saving Control is a standard feature on the V1000 Compact Current Vector AC Drive 1/8 to 25 Hp.

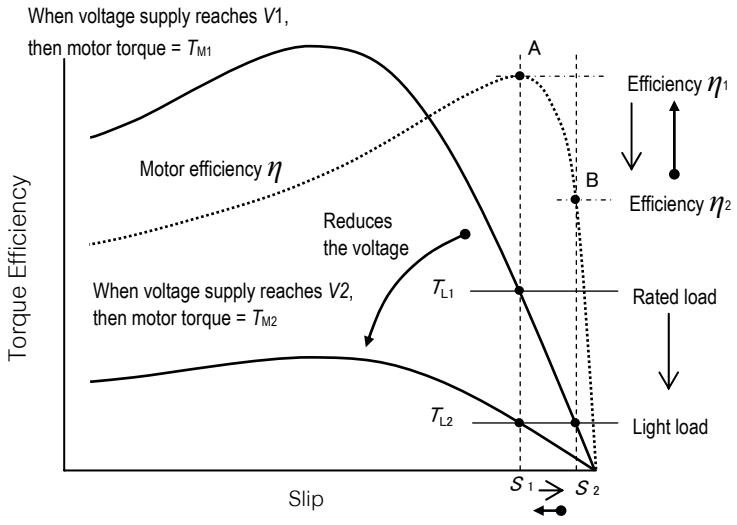
THE PURPOSE OF ENERGY SAVING IS TO REDUCE ENERGY COSTS

Motors size is often increased by 1.2 to 1.5 times for load applications such as fans, blowers and pumps. Consequently, the motors in such applications are generally operating at about 70% capacity when the rated output for the equipment is reached. Therefore, with even lighter loads, efficiency drops as the motor is supplied with the rated voltage. This wastes energy and potentially causes damage to the motor itself as the unused energy is dissipated into the motor windings. The Energy Saving Control eliminates these problems, operating the motor with the amount of voltage and current appropriate for any changes in the load. It also allows the user significant savings in energy costs.

PRINCIPLES OF ENERGY SAVING

Basic Induction Motor Principles (standard motor)

Induction motors possess the right amount of slip to allow for maximum performance efficiency. They are designed to operate at the rated slip, while the motor operates at its rated load. The amount of slip will decrease as the load lightens, causing the motor to speed up. As the slip strays from its ideal lag behind the flux, the motor performance also drops. It is possible to return to optimal performance by simply supplying the proper amount of voltage to maintain the right amount of slip.



- Maximum efficiency (η_1) is generally found when the motor reaches the rated slip (S_1).
- The amount of slip (S_2) decreases with lighter loads (T_{L2}), and the efficiency (η_2) drops as the "point of optimum efficiency" moves from A to B.
- In order to get the torque from T_{M1} to T_{M2}, the drive lowers the amount of voltage supplied to the motor. It can then bring the maximum efficiency back to A.

Motor Efficiency Principles

Motor efficiency η is based on calculations that use functions frequency f and slip s.

$$\text{Motor Efficiency } (\eta) = f\ (f, s)$$

Regardless of any fluctuations in the load, the drive will provide the optimum voltage as it performs high-speed calculations on the slip to keep the motor running at maximum efficiency.

Operating Efficiency Principles

The following four (4) steps allow the motor to continuously run at maximum efficiency by responding to changes in the load.

1. When started, the drive accelerates up to the designated frequency along the regular V/f pattern.
2. Once the motor reaches the designated frequency (i.e., the frequency reference), the drive checks the amount of power being output and then calculates how much power should be supplied to the motor.
3. The proper amount of power to operate the drive at maximum efficiency is achieved by calculating the right amount of slip that will produce maximum efficiency based on the frequency range and the motor parameters. The drive then supplies the optimum voltage to the motor.
4. As the motor begins to operate at a stable level, changes in temperature that affect motor parameters can still cause fluctuation in the amount of slip. This can result in less efficient motor performance. The drive is constantly checking operations and recalculating the output voltage in order to maintain optimal performance and efficiency.

CONCLUSION

System Efficiency Improves with the Drive Energy Saving Control

- **Efficiency will increase until the drive/motor system reaches the theoretical maximum efficiency rate.** With the Energy Saving Control of the drive enabled, the energy costs required to operate the motor will be reduced to an absolute minimum.
- **The Energy Saving Control fully matches every type of load due to high-speed response.** Due to highly accurate drive power detection circuitry and high-speed calculations, the Energy Saving Control is perfect for applications running variable loads.
- **Real time tuning allows for high efficiency performance**. The Energy Saving Control of the drive can maintain high efficiency performance because of the real-time speed search used to check for changes in the motor parameters due to temperature and load fluctuations.
- The Energy Saving Control function in the drive is available for use with any type of motor.
  Note: To enable drive Energy Saving Control in the V1000 set parameter b8-01=1.