Drive Application Notes

Constant Torque Applications

For constant torque loads, the load torque remains constant throughout the speed range, as shown in Figure 1. The horsepower changes linearly with speed for these loads.

Machines that are high impact loads or duty cycle loads typically fall into the constant torque classification.

Conveyors, process lines (strip, web, and sheet), augers, positive displacement pumps, extruders, crushers, screw compressors, reciprocating compressors, and ball mills are examples of constant torque.

In special cases, an extended speed range above base speed at constant torque is possible. For example, with a standard squirrel cage motor wound for 230 Volts at 60 Hertz, the Volts-per-Hertz ratio can be maintained constant when 460 Volts is applied at 120 Hertz. The motor will produce its rated torque at twice base speed, and the horsepower output will be doubled.

Speed Regulation - This may or may not be a consideration, depending on the particular installation. In most cases, the inverter slip compensation feature providing \( \pm 1\% \) regulation should be adequate unless a higher degree of regulation is specified.

Breakaway Torque - The current limit capability of the inverter must be checked to be high enough to enable the motor to provide sufficient breakaway torque for the worst case, such as a motor 100% fully loaded with usual load conditions. A fully loaded jammed conveyor might be an example. Normally, 150% current limit is available with the inverter to provide 150% torque at locked rotor.

Accelerating Time - The amount of load and its inertia will determine whether or not the current limit capabilities of the inverter will permit the motor to accelerate in the minimum time setting. For a fully loaded condition and high inertia, a larger size inverter may be required. For high inertia loads requiring accelerating time longer than 40 seconds, the thermal rating of the inverter must be evaluated also.

Decelerating Time - Similar to accelerating time, the amount of load and its inertia will determine whether or not the regeneration capabilities of the inverter will permit the motor to decelerate in the minimum time setting. For a fully loaded condition, and high inertia, dynamic braking or regenerative braking may be required.

Motor Heating and Ventilation Considerations

Motor heating and ventilation may be a consideration for this type of load depending on the speed range and size of the load.

For a motor fully loaded, operating between 30 Hertz and 60
with Class F insulation. Either case should be confirmed with the motor manufacturer.

For a motor fully loaded at speeds below 30 Hertz, there is insufficient ventilation from the motor fan to dissipate the motor losses. Some means must be provided to accommodate this such as forced ventilation, higher temperature rated insulation, oversized motor, etc. This should be confirmed with the motor manufacturer.

For a motor only lightly loaded at speeds below 30 Hertz, the standard open dripproof motor with a 1.15 service factor may be adequate depending on the amount of load, the lowest operating speed, the duty, and the specific manufacturer’s design. This should be confirmed with the motor manufacturer also.