APPLICATION GUIDELINE #45

(Toshiba Solution Guideline: Maintaining Torque above Base Frequency)

Low Temperature Circulating Blower Application

Problem:

A manufacturer of flash freezing equipment required a variable speed blower to circulate an oxygen nitrogen gas mixture at temperatures ranging from -150° F to -250° F (-101 to -156° C). During the flash freeze process, the velocity of the gas mixture often exceeds 250 mph to insure reduction of the product temperature as rapidly as possible. The system was designed using a competitors 10Hp-motor and drive combination. At temperatures greater than -200°F, the system operated with minimal problems. When gas temperature was lower than -200°F, the density of the gas increased requiring additional torque or a reduction in blower speed. Reducing blower speed reduced gas velocity causing flash freeze time to increase beyond acceptable limits. Maintaining blower speed with low gas temperatures caused the existing drive to trip.

Toshiba G7 & EQP Motor Solution:

This is a classic problem. It simply requires more torque to push or pull cold air compared to hot air or gas. The flexibility and overload capabilities of the G7 and the robustness of the Toshiba EQPIII motor allowed the distributor to install a 10Hp 460V G7 drive on a 7.5Hp/230V EQPIII motor. Drive base frequency was set for 120Hz providing a linear V/Hz relationship from 0 to 120Hz/0 to 460V. When operating at 60Hz, the motor will operate at its rated voltage (230V), drawing the full load ampacity, while developing rated torque and horsepower. As the frequency command increases above 60Hz to 120Hz, the drive will linearly increase voltage to 460V. From 60 to 120Hz, the available motor Hp increases linearly from 7.5 to 15Hp at rated current. Wired for 230V, the 7.5Hp motor draws 18.6 amps. The 10Hp 460V G7 is capable of providing 16.5 amps continuous and 22.5 amps for up to 120 seconds. Taking advantage of the short cycle time and the G7s overload capabilities allowed the use of a 10Hp product where other manufacturers would require a 20Hp drive for the application. During testing, the manufacturer was able to produce temperatures as low as -297°F while maintaining the required gas velocity with no trips on the G7. The manufacturer has indicated they intend to set the Toshiba G7 and EQPIII as the standard for their product offering.

Planer Application

A planer mill takes rough dimensional lumber and planes the four sides to a smooth finish. Typically, the lumber being planed is either 2 x 4's, 2 x 6's, 2 x 8's or 2 x 10's.

Smaller lumber, 2 x 6's for example, provide less loading on the planer heads than 2 x 10's therefore, 2 x 6's can be run through the planer machine at a faster rate than 2 x 10's. In order to provide consistent board finish at different feed speeds, the planer heads need to be run at a higher speed, for example, when processing 2 x 6's than when planing 2 x 10's. The objective is to maintain a specific number of cuts per inch at all feed speeds which maximizes the machine's throughput while maintaining optimum finish. For softwood lumber 5 cuts per inch is the typical goal.

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On one specific customer location in B.C. the Planer machine that they purchased utilized a 200HP, 3600RPM motor on the planer top head. In order to get 5 cuts per inch at maximum feed speeds, the motor would have to rotate at 4500RPM or 76 Hz. It was determined that a 250HP, 3600RPM would be required.

The Planer Manufacturer came back and decided that the additional weight of the 250HP motor could not be supported without a significant structural re-design at substantial cost. The solution involved using a Toshiba 125HP, 230V, 1800RPM motor powered by a standard G3 series 460V drive with a few modifications including reprogramming the V/Hz "curve" to output maximum voltage at 120Hz. This allowed the 125HP, 1800RPM, 60Hz motor to produce 250HP at 3600RPM at 120Hz. A few other settings were required to optimize performance. The weight saving was in the magnitude of 1200lbs.

For consistency sake, it was decided to use all 230V motors powered by 460V drives on the machine.

The system works very well. Although the motor / ASD system is designed to operate up to 4500RPM the customer rarely operates the motors above 4000RPM with occasional operation up to 4200RPM.

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