



YASKAWA

Extruder Line Updated With AC Vector Drives

One of the largest plastic extrusion houses in the Midwest manufactures custom mono and multi-layered tubing for the pharmaceutical, automotive and other OEM markets. "We're considered an innovator in extrusion processing and specialize in close-tolerance custom plastic extrusions," said the manufacturer's spokesperson.

In late 1992, this plastics company recognized the need to modernize and upgrade one of its medical tubing lines. The line utilizes three extruders feeding into a single die to produce multi-layered tubing, which requires precise speed control and the need for the extruder drive/motor to produce large amounts of torque at very low speed.

In the past, the typical drive choices for handling such requirements would have been hydraulic or DC drives. Hydraulics can generate large amounts of torque very rapidly but take up a lot of space, require considerable maintenance and lack the repeatability of modern digital electronics. DC presents commutator maintenance problems in applications such as plastic extrusion. "In the past, choosing a DC drive was often tied more to tradition than to performance needs," according to the spokesperson. "Selection of Yaskawa's AC vector control drive was based on matching the capabilities of the drive to our specific application."

New AC Capabilities

Although traditional AC drive technology hadn't been able to provide the levels of torque control available from DC drives, Yaskawa's introduction of the vector controlled drive brought changes to what had been considered conventional AC drive wisdom.

Yaskawa's Vector Control Drive is a pulse-width-modulated, adjustable frequency AC drive that utilizes a special control technique to regulate induction motor air gap flux, motor current and rotor slip. It is designed for high-performance applications requiring precise control of speed and torque and for operating environments where DC motors fail or are difficult to maintain. It provides speed and torque performance, which, in most cases, is superior to that of general purpose and brushless DC, drives.

The drive features a motor-mounted pulse generator encoder for speed feedback and stator thermistor for winding temperature feedback. By monitoring motor current, temperature and speed and comparing them to a mathematical motor performance model stored in the drive's microprocessor, the drive achieves speed and torque control that was previously not available from a PWM drive.



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Drive Matched to Application

The extrusion company produces multi-layered tubing in diameters ranging from .100" to 3.5" and single-layer tubing in diameters from .100" to 6.5". Line speeds vary with stock size and material but can run up to 250 feet per minute. Because of the diversity of their product, they need full torque over the total speed range. "Our need for high torque at low speed is common to the industry and comes from the fact that our extruders are often started with the barrels full of plastic," the spokesperson said. "Precise control of speed is also important. Under normal operating conditions, the extruder may be run at anywhere from 20 to 100 percent of motor base speed, depending on the material and product being processed."

Additionally, diverse product lines often include short, custom production runs, creating a need for flexibility, versatility, quick product changeover and small incremental changes during production runs.

Drives Solve Operational Problems

The company specified its first Yaskawa vector control drive on a non-portable extruder for a medical tubing line. "The features that were most important in specifying the drive were speed range, regulation and the elimination of brush and commutator motor maintenance," according to the spokesperson.

"The first installation showed us that we could achieve better speed and torque regulation than was possible on our DC analog systems. Additionally, the switch to AC motors helped us

to eliminate many motor maintenance problems." Within months, the user converted two other machines on the line to Yaskawa vector controlled AC drives.

"Based on the results we received from the first drive, we ordered a second extruder and again specified the Yaskawa drive." They then completed a retrofit of a 5hp, 230V drive on a third machine.

Additional retrofits have since been carried out on three additional units. This retrofit involved the replacement of 30 and 40hp DC motors and controls with 40hp, 460V Yaskawa vector control drives

The new drives have provided increased quality and a significant reduction in scrap, according to the user. "We have also experienced significant energy savings, which reflect the difference in efficiency of an AC vector motor and drive compared to standard."

Yaskawa Vector Control Drives Offered

Late in 1993, the extruder manufacturer began offering Yaskawa Vector Control Drives for several of its high-performance lines. The manufacturer's decision to offer the Yaskawa drive for high-performance applications such as medical tubing lines was based on the drive's ability to provide precise speed and torque control through a 1,000:1 speed range and speed regulation of 0.01 percent. The drive's ability to tie into a PLC network is also valuable in such high-performance applications.



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Programmed on Installation

The drive's setup and adjustments are accomplished in software rather than expensive hardware. Real-time programming also allows fine-tuning of drive functions while the motor is running.

"All vector programming is carried out when the drive is installed," the spokesperson said. "The operators never see or touch the drive. We require only start, stop and speed reference control. Stop and start buttons are installed remote from the drive, as is a ten-turn potentiometer. Programming doesn't need to be adjusted to the type or dimension of stock. "When we specified the first vector drive, we considered ordering a 15hp unit for added power. However, we decided not to install an oversized drive so that we could compare the vector's performance to a DC motor and control of the same size. As it turned out, the 10hp vector supplied all the power we needed."

Adjustable Frequency Drives Replace Hydrostatics

During the course of its ongoing modernization program, a series of hydrostatic drives were replaced with Yaskawa general purpose Adjustable Frequency AC Drives (AFD). The Yaskawa AFD is a versatile, high-performance AC PWM drive with a 16-bit microprocessor to provide the flexibility, features and performance for a wide range of operational requirements. The popular drive is easy to install and program, with the versatility to adapt to simple or complex applications.

"We have installed ten Yaskawa AFDs on ten different lines, where they are used to regulate speed as tubing is pulled through the line and cooling tanks which establish the final dimension of the tubing". "We needed to find a variable speed drive to replace our hydro units because of their high maintenance costs and long turnaround time on repairs. Through a series of capability studies, we found we could achieve slightly better speed regulation with the Yaskawa AFD for a reasonable cost. Additionally, the drive requires very little maintenance. Repairs ceased to be a factor. "We are now looking into replacing a hydro drive with a Vector to achieve even better speed control and thus increase our productivity even further," stated the spokesperson.

Extrusion Company Envisions More AC Drives in Its Future

"In the future, depending on the long-term performance of the Vector drive and our needs, AC drives will definitely be considered to replace existing DC drives and motors in a wide variety of applications."