Extruder Retrofit
Considerations & Preparation

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Introduction

DC motors have been used for years in extruder application because of their wide constant torque speed range allowing flexibility in manufacturing for extruded products. Although, within the last ten years, new extruder equipment manufacturers have used AC Vector technology as the new standard because of higher performance and lower cost. The change has been welcomed by industrial manufacturers because of the reduced maintenance and higher efficiencies. Based on these advantages, many manufacturers have made the decision to retrofit their existing DC motors with the newer AC Vector technology. Such a project requires good planning to reduce overall time and installation costs that can occur during a retrofit. This paper is written as an aid to engineering and maintenance personnel in the project planning portion of an extruder drive and motor retrofit.

Drive and Motor Sizing

Torque is the main element in an extruder retrofit. This means that the drive and the motor must be considered as a torque producing system. As mentioned previously, the performance of the AC Vector system has surpassed the DC motor technology in both constant speed range and speed regulation. Therefore, a horsepower to horsepower retrofit is possible assuming that you replace the DC motor with an AC Vector motor with the same base speed. In some extruder applications, the DC motors in use may have very low base speeds, such as 850 rpm. In this case, the motor produces twice as much torque as a standard 1750 rpm motor. This makes motor selection the most important part of the retrofit sizing. In some situations, right sizing can be done for the extruder that would reduce the overall cost of the system. A good rule of thumb is if the system is operating at less than 60% speed or 60% load a reduction in the base speed and horsepower is possible.

Physical Considerations as it relates to the Drive

There are physical differences between the AC drive and motor and the DC drive and motor. The AC drive is often times larger than the DC drive and unable to fit inside the existing enclosure. In such cases, a pre-configured drive package from the drive manufacturer would be best solution. These packages are available in NEMA 12 enclosures with circuit breakers or line disconnects along with various other options. Packages larger than 100 Hp, are usually free-standing and proper dimensions should be obtained to find a suitable place for installation within 300 feet of the motor.

When mounting AC Vector Drives in existing enclosures or a standard electrical enclosure, there are more considerations than just its physical dimensions. AC drive produce more heat than a typical DC drive of similar rating, therefore thermal considerations are important when placing a drive inside an enclosure. Heat is a result of the watt loss of the drive and this information

can be obtained from a drive product manual. Then a complete thermal analysis should be performed to ensure that the drive can properly dissipate the heat that it generates eliminating premature failure. In addition, all drives must be mounted vertically as specified by their manufacturers.

Physical Considerations as it relates to the Motor

AC and DC motors are built in different frames. DC motor frames are usually a lower profile with lower center shaft heights although they are longer than an AC motor. Most AC motors use NEMA frames as a standard which have a higher shaft height and are wider in diameter but shorter in length. In motor retrofits this can be a problem, especially if the motor is mounted underneath the extruder barrel. A possible solution if height is an issue is the use of the Reliance RPM-AC motor which is an AC Vector motor constructed in a DC frame. This solution could eliminate extra cost that would be associated with machining down a base to fit the AC Motor. In the case of a frame size change, proper shaft alignment techniques should be employed to extend motor bearing life. Height is usually not an issue when a motor is belt-driven, although the AC Vector motors should have optional Roller Bearings to withstand the increased radial load.

Conduit side mounting is also an important physical consideration in retrofitting an Existing DC motor. All too often, this simple item is overlooked in emergency retrofits. F-1 assembly is standard with AC motors with F-2 being optional. For blower-cooled motors, fan mounting should be noted as to whether it is on top or the side of the motor.

Electrical Connections

There should be no change required on input wiring if the horsepower and voltage rating is the same as before. The motor connections are the largest consideration in a DC to AC motor retrofit. The DC motor utilizes two armature conductors for the majority of the current and two smaller conductors for the field current. AC Motors have three phases and a ground connection for power. There is a possibility that some of the existing wire can be used for retrofit purposes, although it is important to note that ***any wire added to obtain the desired current rating per phase should be the same size as the existing wire***. An audit of the existing wires and conduit or wire tray space available should be noted. Distance from the drive to the motor should also noted and if distances are more than 300 feet, Load Reactors should be used to minimize negative effects caused by a reflected wave generated through capacitance build up in the wire. If Radio Frequency interference of instrumentation is a concern, then the use of shielded cable is recommended. Recommended wire sizes are usually within the product manuals although a good rule of thumb is 1.5 times the Full Load Amps of the AC Drive.

Control wire should always be run in a separate conduit from power wiring reducing the chance for false control signals.

Encoder Feedback

Many DC motors utilize DC tachometer feedback which can provide a 0.5% speed regulation. Although Open-Loop AC Vector control can achieve as much as 0.2% speed regulation if

properly configured. This would alleviate the need for a encoder feedback in the majority of extruder applications

Start-up and Drive Configuration

Although AC Vector Drives can be wired up and turn a shaft without any programming, it doesn't guarantee good motor performance. Proper drive configuration and motor tuning would be required in order to maximize torque performance throughout the entire speed range of the motor.