

Inverter Drives for Electric Motors

Introduction

Matching the requirements of motors and the available electricity supply can pose a problem to motor users, especially farmers. On many farms only single phase power is available when three phase is required and sometimes the starting current of the motor is greater than the supply can provide.

The fixed voltage, frequency and number of phases of the electricity supply are major constraints when specifying or installing motors. Inverter drives offer a solution to these problems.

What is an Inverter Drive?

An inverter drive is an electronic device which is able to take electric power with the fixed characteristics of the mains supply and convert it to a three phase supply of variable frequency and voltage.

How can an Inverter Help?

- An inverter drive allows farmers to use machinery fitted with three phase motors which are smaller, cheaper, more efficient and reliable than their single phase equivalents.
- A motor coupled to an inverter drive can be worked at its maximum efficiency irrespective of its speed or load conditions, saving energy.
- For loads which are difficult to start the inverter drive enables the motor to produce the required starting torque without stressing the electricity supply with high starting currents.

- An electric motor can be run at lower speed, or in some cases, backwards, without causing undue stress on the motor or supply.
- Inverters can be powered from single phase, split phase or three phase supplies to give a three phase output. They can therefore be a great help to isolated farms which do not have a three phase supply.

Inverters and Equipment Control

Electrical induction motors are generally fixed speed devices. This is determined by the design of the motor. Where equipment needs a number of speeds or output levels, the standard solution is to use a gear box or similar mechanical device. In many cases this is very inefficient.

Inverters provide an alternative through their ability to generate a variable frequency supply allowing motors to be operated at any speed. They do this efficiently, with stepless speed control from zero to full. Feedback control systems allow the inverter drive to be controlled automatically to deliver constant flow or constant pressure for fluid handling applications.

Inverters and Energy Saving

Most motors are sized to cope with the highest likely load conditions but for much of their operational time are more lightly loaded. Inverter drives can sense the load conditions and can tailor the input of electricity to suit. Energy savings will vary with the application but savings of 10 to 15% are not uncommon.



In addition, the inverter can use extra sensors to measure key equipment output parameters to control the speed of the motor and hence the energy used. For example, a pump sized to deliver water at a fixed pressure will run inefficiently if water outlets are closed and the pressure increases. An inverter using a pressure transducer can slow the motor down, keeping the pressure at the optimum level and delivering the water flow required. In this way significant energy savings are made.

Is an Inverter the same as a 'Soft-Starter'?

- Soft starters are based on a rather more simple electronic system which has the ability to change input voltage only (voltage ramping). This allows gradual starting of motors but at the expense of torque. So for 'high-torque' applications like refrigeration and pumping, this type of starter offers only limited benefits.
- Inverter drives, in addition to voltage ramping, can vary the frequency of the supply. This helps the motor to generate high torque at low speeds and allows starting at current no higher than the normal full load running even for the most difficult of applications.

Inverters and Single Phase

Inverters are always used to provide a three phase supply. But they can do this from both three phase and single phase mains. This means that farmers with single phase can in many cases consider three phase equipment without having to spend money on an uprated supply. What is more, the better starting characteristics provided by an inverter mean that larger motors can be used compared with other converter techniques.

Who benefits?

Inverters are applicable to any farm task that involves starting and running large single phase motors. Typical examples include the following:

Pumping	Refrigeration	Fans	Machinery
irrigation	dairy - milk cooling	grain drying	conveyors
slurry handling	crop storage	crop storage	augers
water supply	processed food stores	ventilation	graders cranes

Limitations, Drawbacks

Generally an inverter drive is assigned to a single motor rather than being available to power a variety of machines such as those in a workshop.