

## How EnviroStart Works

The EnviroStart is a fixed speed motor energy control, the use of the product in no way changes the normal rotational speed of the motor as it is not an inverter/variable speed drive. The system operation relies on the simple principal, inherent in all induction motors, in that they only effectively convert electrical power, current, into rotational power, torque, when operating at full plated power rating. (This ignoring the normal design overheads that would be included as they are not relevant at this level of understanding).

As the majority of induction motors operate at lower than their plated power rating for most of their operational life, although the load attached to the motor may be at full load, there is a waste of energy created by the generation of unwanted magneto helical flux within the stator - rotor interface. This excess flux manifests itself primarily as heat and secondarily as vibration. It is possible by monitoring the motor condition continuously and adjusting the flux density to minimise the losses so generated.

The EnviroStart system uses a sophisticated algorithmic approach to the problem. Rotational speed is established by examining the minor aberrations that are created on the supply waveform(s) as a result of the ongoing rise and fall of the flux formation at each nodal point in the rotor, this flux formation generates a regularized pattern defined by the shaft rotation speed. Because the rotor speed is, to all realistic intents, constant, the time interval between these aberrations is also constant and forms the reference for EnviroStart to use as the "template" for the motor. Following the establishment of this "speed" of rotation the Voltage and current waveforms are continuously monitored to establish the local power factor of the motor, this provides a measure of the "load" on the motor at any given point in time and allows the software to establish, on a dynamic basis, a starting point for energy saving if such is possible. This energy saving is created by reducing the current provided to the stator consistent with maintaining the rotational speed of the rotor. The operational frequency of this "adjustment" is based on the core processor timing of 48MHz and means that the maximum elapsed time between identification of capability and determination of change to be made to the current provided is  $<8\mu s$ . The peak to peak voltage to the motor is not changed as this would detriment the EMF and detriment the ability of the motor to respond to any changes in load.

As the kW consumed by the motor is the product of the integral of the Amperage, the integral of the Voltage and the static CosPsi the reduction in the current creates a real and not an imaginary, (actual current not apparent current), change in the consumption of the motor. There is no actual change in the power factor of the motor but there is a change of current consumed.

The EnviroStart is a dynamic system, as already stated, and constantly changes the effective savings dependant on the motors ability to sustain those changes to its current consumed without detrimenting the torque demand made on it by the load.

The EnviroStart also provides soft start capability however in the case of modern three phase refrigeration systems the high torque start determines that generally this soft start is set to a low time period with a high initial start torque to ensure starting without impediment to the overall system integrity.

EnviroStart only interfaces with the motor driving the "system" be that "system" refrigeration, fluid pumping, air compression or whatever. The type of load may determine the characteristics of the start but then in no way effects the running operation of the unit. There is no interface or change made to the operation of the driven system as the shaft speed of the motor is maintained as it was prior to the installation of the EnviroStart.

In operation the unit is a 50Hz-in 50Hz-out interface, as the waveform is not being reformed in any way the harmonic contribution of EnviroStart is minimal and well within the confines of all national standards including G5 -4/2. There are no requirements for filtering or other expensive peripheral systems. All units are manufactured to be run at full rated rating continuously and require no bypass or other cut out systems for their operation to be effective. MTBF, (Mean Time Between Failures), is determined to be >130,000 on all three phase systems. All the units are designed and manufactured in the UK complying with all necessary BS, BSIE, IEN and CE standards applicable to low voltage systems.

Dr. Jonathan Hughes  
For and on behalf of EMS (European) Ltd

February 2011