HIGH EFFICIENCY MOTORS AND MOTOR REPLACEMENT MANAGEMENT

ATB MORLEY

Technology in Motion

Interchangeability considerations

When replacing old machines with new a significant consideration is mechanical interchangeability. Users often operate critical plant without spare machines making the down time stakes high.

In order to make the transfer from old to new as quick and trouble free as possible it is necessary to make the replacement motor mechanically interchangeable with respect to foot fixing or flange dimensions, the drive shaft extension, the terminal box cable entry position and the need to avoid interfering with other plant that may already be fitted to the base plate / skid so that the new units fits in as a direct replacement.

Professional assistance

Induction motors are very reliable machines with long service lives and users commonly operate electric motors for many years. Many large industrial sites such as power stations, chemical plants and refineries operate hundreds of electric motors on each site. In these cases the potential energy savings become very considerable so it makes good economic sense to conduct a survey so that users are aware of exactly what potential savings are available at each site.

Motor management policies operate at their best when users periodically assess their motors and possible high efficiency replacements before they reach a breakdown situation so that a predetermined plan of action can be in place ready for when an emergency does occur. The task of managing a replacement programme can be daunting but professional advise from an experienced drives manufacturer is available.

Morley Electric Motors Ltd – Leeds, UK

Morley Electric Motors Ltd offer ranges of induction motors that have been specifically designed for the more arduous industrial applications. The range includes high efficiency air-cooled and water jacket cooled motors as well as open ventilated and hazardous area machines.

All motors are specifically engineered by working with customers to match the requirements of the driven equipment and drive train. Morley engineers will attend site to offer free, friendly advise regarding the most appropriate drive solution and conduct a site survey of the potential savings that are available to an individual user.

Motors are manufactured from fabricated steel enabling complete flexibility and mechanical interchangeability.

Morley can offer and test engineered variable speed drive packages enabling the user to place a single contract.

✔ EXPERIENCED

Established in 1897 the company can demonstrate comprehensive reference lists detailing numerous high profile global installations. Customers include packagers, original equipment manufacturers and end users. The company's product range and experience embraces most duties, applications and environments.

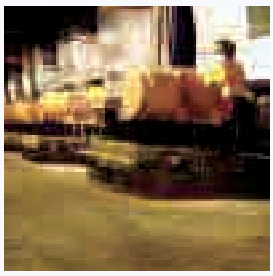
✔ PROFESSIONAL

Morley is ISO9001:2000 and EECS approved, and is a strong, focused and expanding organisation that prides itself on its design expertise, technical innovation and having the flexibility to understand and react to customers needs.

✔ LOCAL

A network of overseas offices and service and repair companies offering local consultation and product support demonstrates the company's commitment to extending an already strong position both in the UK and internationally.

If you want to take advantage of our experience, if you want performance and proven reliability that exceeds your expectations and peace of mind, then take control by installing a Morley motor.



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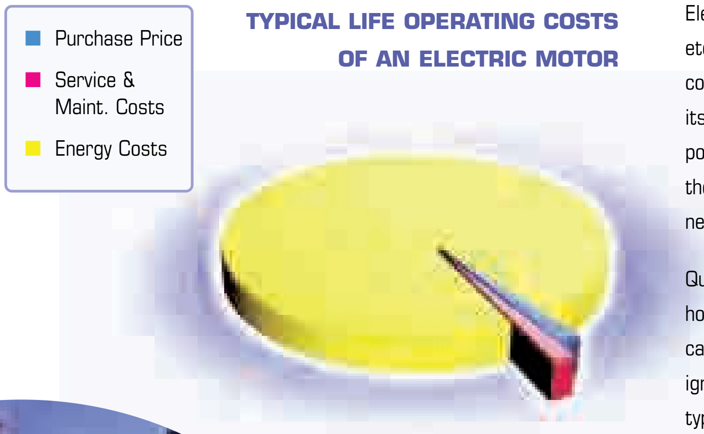
High Efficiency Motors and Replacement Motor Management

TYPICAL LIFE OPERATING COSTS OF AN ELECTRIC MOTOR

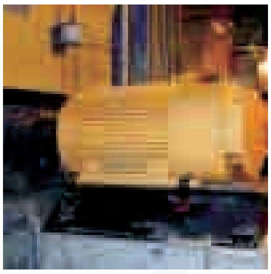


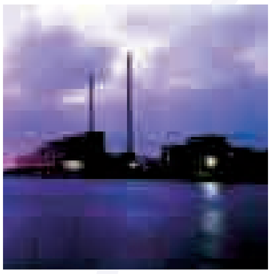
Electric motors used to drive pumps, fans, compressor's and mills etc. account for approximately 60% of all industrial energy consumption. When an electric drive motor is approaching the end of its design life or suffers a failure that requires a major overhaul – possibly a rewind, then the user is faced with deciding whether to have the old machine repaired and rewound or to replace the motor with a new machine.

Quite often the decision is based purely on immediate capital cost, however, the operating cost of an electric motor far outweighs the capital cost and servicing and maintenance costs and cannot be ignored. The life operating cost of a motor based on 20 years is typically made up of; the initial purchase price (approx. 1%), servicing and maintenance costs (approx. 1%) - the remaining 98% represents the energy cost.

Replacing an aging and often inefficient drive motor with a new, high efficiency machine rather than repairing the old unit is often the most economical solution in the long term. Large modern machines are often in the order of 3% more efficient than machines that were built 10 or more years ago.

In addition, many papers have been published that discuss what effect a rewind has on the efficiency of a motor. It may be possible to maintain the motors original design efficiency, or the efficiency may be reduced by up to 2%(note 1) each time it is rewound dependant on the size and type of motor, the original motor design and the quality of the materials, workmanship and methods used in the rewind. This reduction in efficiency can have significant and potentially long terms effects on energy costs.





CASE STUDY TABLE

OLD MOTOR		REPLACEMENT MOTOR	
Efficiency (prior to rewind)	94.0%	Efficiency	97.0%
Overhaul / rewind cost	£19,500 (Note 1)	Purchase price new	£30,000
Efficiency (following rewind)	93.0%	-	-
First year capital cost	£19,500	First year capital cost	£30,000
Additional energy cost in first year (due to reduced efficiency)	£3,889	Energy **SAVING** in first year	£15,076
Total cost first year	**£23,389**	**Total cost first year**	**£14,924**
Additional annual energy cost	£3,889	Annual energy **SAVING**	£15,076

Note 1: Figures based on information published by the United States Government, Department of Energy.

Case study (see table above)

Using a simplified example of a 1000kW fan drive that operates for 8500 hrs per year (10 days shutdown per year) where the user is paying £0.04p per unit for electricity.

The rewound machine would then continue to cost an additional £3,889 per annum for the remainder of its life. The old motor will also naturally have a shorter life expectancy and be less reliable than a new replacement motor. The new replacement motor on the other hand will continue to save £15,076 in energy costs every year. On this basis the new motor would "pay for itself" before the end of the second year and over its operating life of say twenty years will save £301,520 in energy costs.

In the above typical example, even if the rewind company could maintain the original design efficiency, the new machine still remains the most economical option in the first and subsequent years.

Speed and load considerations

Electric motors are commonly designed to perform at their best when running at full load, however, many industrial applications do not operate at full load all of the time and some times not at all. It is typical for a drive to operate between 60% and 85% load for most of the time. Motors can also be designed to provide high efficiencies at part load and users that recognise this can benefit from further considerable energy savings.

Similarly, most industrial drives incorporate fixed speed induction machines that continuously run at just below synchronous speed. Operating a machine at a more appropriate speed that is matched to the load and process requirements can further dramatically reduce energy costs.

Speed control of induction machines can be altered using gearboxes, belts and couplings for example. However, although these can have benefits they can all add inefficiencies into the drive train and therefore add to the running cost. Replacement of old fixed speed drive motors with new high efficiency motors that have been designed with 'flatter' efficiency characteristics, connected to modern frequency inverters can effect very significant energy savings.

The use of water

Most industrial drives manufactured today including "high efficiency" drives are air-cooled. Where water is available as a cooling medium water jacket cooled machines can be used.

Water jacket cooled machines are constructed using two substantial concentric steel barrels and an internal water labyrinth enabling water to pass over the motor frame. Water consumption is modest and if necessary closed circuit cooling systems are available. Water jacket cooling obviates the need for using heat exchanger type water-cooled machines with for example expensive materials such as titanium. Heat exchanger type machines commonly require auxiliaries such as drip trays, leak detectors, flow sensors and water temperature detectors – none of which are necessary when using water jacket cooled motors.

Water jacket cooled motors do not have any fans fitted internally or externally so the fan loss that is inevitably present on an air-cooled motor is eliminated. Water jacket cooled machines are therefore typically 0.5% to 1% more efficient than "high efficiency" air-cooled machines and they also offer higher efficiencies at part load.

In addition water jacket cooling offers many other benefits that are detailed in the Morley 'Environ' brochure.