

Electronically Commutated Motor (ECM)

Technology Description

Permanent-Split Capacitor (PSC) Motors have been the industry standard for the last 50 years. PSC motors utilize copper wound stators and rotors to generate the magnetic field required to operate the motor. These motors have moderate starting torque with low starting current. They typically range from 50 to 500 watts. Although they used to be the lowest cost motors available, Electronically Commutated Motors (ECM) described below have been found to actually be cheaper than PSC motors.



New ECM Green Motor Installed in Blower Prior to Demonstration

PSC motors are considered an outdated technology due to their inability to achieve higher levels of energy efficiency. Typically the maximum efficiency of standard PSC motors is 50%. PSC motors use high levels of copper and steel in the motor construction and do not have electronics to control motor operation in order to optimize their energy use.

ECM products achieve energy efficiency levels that are 33% to 50% higher than standard PSC motors. ECM's are up to 90% efficient and are designed to maintain high efficiency levels over a broad range of operating speeds.

ECM's include various intelligent functions that maximize energy savings and provide their users with features not available on PSC motors. Certain types of ECM's include programs that automatically size their output (horsepower) to the equipment in which it is installed. This feature, called "Autosizing" gives technicians the ability to use an ECM as a drop in replacement for a PSC motor without having to reconfigure the system and simplifies field replacement work.

Value to the Warfighter

The advantages of the ECM are:

- a. Simple Retrofit – Factory training is not required to perform a retrofit as the mount, shaft and basic wiring connections are designed to enable simple replacement. The User's Installation Manual is very helpful and is provided with each ECM Green motor.
- b. Retrofits and installations of ECM technology in regions with higher electrical utility rates will have the greatest energy savings and fastest payback compared to other regions.
- c. Uses less energy at all motor speeds than PSC motors.
- d. Cheaper than PSC motors.

Economics of the Technology: ROI or Payback

Where an EC motor is installed in lieu of a new PSC motor, the payback is instantaneous since the per-unit cost of the EC motors tested (\$228.95) were significantly lower than the per-unit cost of a new PSC motor of the same make and model (\$330.92).

In the second scenario, where a theoretical installation is retrofitted by an EC motor, we defined the “Simple Payback Period” as the point in time where the cumulative return of an investment to be equal to the total cumulative cost of the investment. A table of payback periods based on retrofits in different geographical regions is shown below:

Simple Payback for Retrofits at Different Theoretical Installation Sites

Installation Location	Cost per kWh (USD)	Payback Period (Years)
Naval Submarine Base New London (Groton, CT)	\$0.1297	7.4
Naval Station Norfolk (Norfolk, VA)	\$0.0621	15.9
Naval Station Everett (Everett, WA)	\$0.0588	26
Joint Base Pearl Harbor - Hickam (Pearl Harbor, HI)	\$0.1981	3.1
Naval Base Ventura County (Port Hueneme, CA)	\$0.1220	18.3

It should be noted that two main factors determine the payback, run hours and utility rates. Therefore it can be seen that locations with short run hours, especially in the summertime ventilation mode and/or low utility rates have long paybacks, i.e. Naval Station Everett, Naval Base Ventura County and Naval Station Norfolk. Locations that have high utility rates even though the run hours are average have moderate paybacks, i.e. Naval Submarine Base New London. Locations with both long run hours, especially in the summer and high utility rates have very good paybacks, i.e. Joint Base Pearl Harbor.

Technology Transition Documentation

Category 4. The transition of Research knowledge into products that provide information for the NAVFAC community to purchase services for SRM, special projects and energy performance performing contractual mechanisms.

Site Implementation

For the field demonstration, two of eight nearly identical furnaces installed at NBVC Pt. Hueneme were retrofitted for testing, and have been operating as pilot installations with EC motors-Indoors since September 2012. These installations are available for long-term monitoring and assessment by contacting NAVFAC EXWC.

Specific Applications

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