Regal Beloit

In 2004, Regal Beloit acquired the GE ECM division. At that time the brand name for these products changed from GE to GE ECM by Regal Beloit. In 2009, Regal Beloit changed the brand name of these products to Genteq. In 2012, Regal Beloit acquired the A.O. Smith ECM division and migrated those products to the Genteq brand.

SNTech

DEVELOPMENT OF THE CONSTANT-AIRFLOW ECM

The first application of ECM technology in HVAC was the OEM indoor blower motor. Commonly called “variable-speed” motors, these communicated ECMs were and still are predominantly programmed with a constant-airflow operating program. Constant-airflow ECMs provide increased energy efficiency, operational versatility, and improved airflow control compared to the industry workhorse PSC (permanent split-capacitor) induction motor.

The constant-airflow indoor blower ECM is designed with three defining characteristics that really changed the industry:

- The constant-airflow operating program gives the ECM the ability to adjust torque and speed automatically in order to maintain the desired airflow (cfm) within a wide range of total external static pressure (TESP) values.
- The unique communication method utilizes DIP switches or jumper pins (located on the HVAC system control board) for airflow adjustment.
- The programmable motor control can store unique application-specific data, thus providing numerous selectable airflow options for multistage or modulating heating and cooling, continuous fan operation, dehumidification, and zoning.

Due to the engineering required to match an application-specific program and communication method to the design and controls of a particular HVAC system, constant-airflow ECMs are used only in OEM applications. They provide the highest level of airflow control, functional versatility, and precise operation for indoor blower applications.

In the early years of this technology, there were a couple of designs built that no longer fit the “norm” of today’s constant-airflow indoor blower ECMs. The first two generations of ECMs (built by GE) were very different from today’s widely used 16-pin or 4-pin communication designs (see Figure 2-1). The first model, which appeared in
1987, had a very large motor control board located remotely from the motor, as shown in Figure 2-3. The second generation, Model 1.0, was much smaller. It brought the motor control and the motor together (see Figure 2-4), but was still larger and very different from current models. Both of these first two designs, which have been out of production since the early 1990s, had jumper wires for adjusting airflow located at the motor control, rather than at the HVAC system control.

Both of the indoor blower motors discussed in the following paragraphs are also out of production, although they still may be operating in the field today. These motors are not, strictly speaking, ECMs. However, they were commonly called “variable-speed” motors and may have been listed in various literature as EFMs (electronic frequency modules) or simply dc motors.

A.O. Smith produced a variable-speed induction motor (VSIM) from the middle to late 1990s. This motor was used predominantly
by the HVAC manufacturer Armstrong. The VSIM has the same functionality as the ECM, and the motor control has almost all the same components. The main difference between a VSIM and an ECM is in the motor itself. The VSIM uses an induction motor (no permanent magnets). The motor control can still adjust the frequency to the motor, but the motor does not run at synchronous speed like an ECM. Thus, the VSIM is more efficient than a PSC motor, but not as efficient as an ECM. This motor is also different in that it was operated with a constant-speed program. This program does provide better airflow control than a PSC in response to changes in the TESP, but it is not as good as a constant-airflow program. Another unique characteristic of this motor was its communication protocol. The motor control simply received the 24-V ac inputs from the thermostat. DIP switches for airflow adjustment were located on the motor control. The separate line-voltage connections were powered continuously (similar to an ECM). There were two versions of this motor control—one with six DIP switches and one with eight (see Figure 2-5 below). For troubleshooting or replacement support regarding this motor, contact the manufacturer of the HVAC system in which it is used.

Emerson also produced a VSIM (trade name Magellan) from the mid-1990s to the early 2000s. This motor was similar to the A.O. Smith motor described above in that the DIP switches were located at the motor control—however, the motor control was
located remotely, next to the HVAC system control board (see Figure 2-6). This motor also differed from the A.O. Smith model in that it operated with a constant-torque operating program, which provided better airflow control than a PSC in response to changes in TESP (but again, not as good as a constant-airflow program). The Magellan motor was used by the HVAC manufacturer International Comfort Products (ICP), and possibly other HVAC OEMs. For troubleshooting or replacement support regarding this motor, contact the manufacturer of the HVAC system in which it is used.

*Note:* After these motors were taken out of production, both the A.O. Smith and Emerson VSIM products were followed up with a replacement kit from the HVAC system OEM that included a Genteq ECM, control board, and harness. These kits may or may not be available based on the current date compared to the last production date of the equipment they support.

*Figure 2-6. Motor control connections and DIP switch layout for Emerson VSIM used in ICP equipment*
The term “variable speed” has become synonymous with a high-efficiency motor that uses communication instead of speed taps, has numerous and varying airflow and comfort selections (typically located on the HVAC system’s control board), and has the ability to adjust motor operation in response to changes in the TESP. Between 1987 and 2005, there were a few variations of what was and still is called a variable-speed motor. Today, this indoor blower ECM is programmed predominantly for constant-airflow applications and designed with either 24-V ac/dc, PWM, or serial communication.

DEVELOPMENT OF THE CONSTANT-TORQUE ECM

In 2006, the constant-torque multi-tap OEM indoor blower ECM was introduced. Prior to this design, most variable-speed ECMs or VSIMs where built with distinguishable motor controls that were either connected directly to the motor or remotely located. In this new design, the motor control is located inside the motor shell. This makes it look more like a PSC motor with a large endshield. The large “endshield” is actually the base of the motor control (see Figure 2-7). Some in the industry wondered if it really was an ECM, or if it should be called a variable-speed motor. There are three main differences between constant-airflow communicated ECMs and constant-torque, multi-tap indoor blower ECMs:

- The constant-torque operating program only regulates torque as needed due to changes in the TESP. This provides better airflow control than a PSC induction motor, but not as good as a constant-airflow motor.
- A constant-torque ECM is typically built with five 24-V ac enabled tap selections at the motor control, similar to the speed selections of an induction motor.
- The output of the motor is adjusted by changing the tap selection according to the HVAC system demand (heat, cool, or continuous fan). The application-specific data relate a specific torque value (selected by the OEM) to each tap.