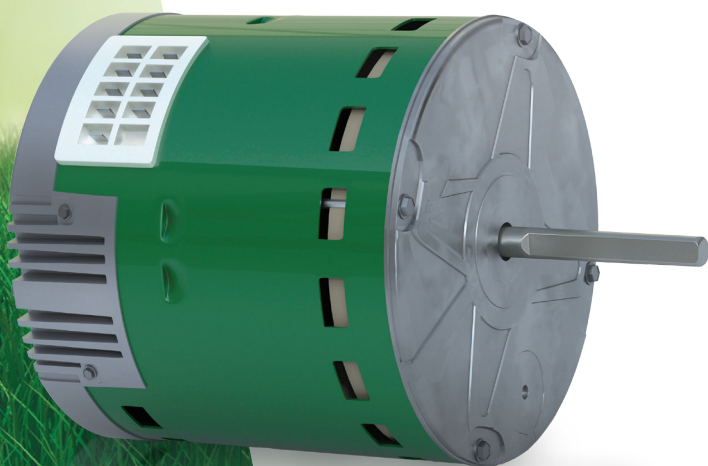


The Evergreen logo, a green circle containing a white stylized five-petaled flower.

Evergreen® • CM
Installation Guide



A Regal Brand

REGAL



In 1987 General Electric introduced ECM technology to the residential HVAC industry. This technology is predominantly used in variable speed indoor blower motors, constant speed induced draft motors and condensing fan motors. These innovative motors changed the industry by providing unmatched efficiency as well as comfort options not possible with PSC induction motors.

In 2004 the Regal Beloit Corporation acquired General Electric's Commercial and HVACR Motors and Capacitors businesses with the right to use the GE brand through 2009. These divisions were named GE ECM by Regal Beloit, GE Commercial Motors by Regal Beloit and GE Capacitors by Regal Beloit. In 2009, Regal Beloit announced the rebranding of those GE branded businesses under the name Genteq, for markets that include residential and commercial HVAC equipment and electrical applications that utilize capacitors. With this rebranding, the Genteq logo took the place of GE ECM, GE Commercial Motors and GE Capacitors logos on all branded products, sales and marketing materials, Web sites, communications documents, signage and other related items. This rebranding reflects the company's reputation for innovation and speaks to the future.

1325 Heil Quaker Blvd
LaVergne, TN 37086
1-866-503-8566
thedealertools.com

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**Please read the entire instruction manual
before starting the installation.**

Safety Considerations

The following definitions are used as safety considerations on the Evergreen CM motor and in this manual. Please read and observe all of these safety concerns.

SAFETY SYMBOLS

⚠ WARNING Warning indicates a hazardous situation which, if not avoided, could result in death or serious injury.

⚠ CAUTION Caution indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

Installation and service of this motor should be performed only by trained service technicians familiar with the Evergreen CM motor.

This motor should be installed in accordance with accepted practices and installation instructions, and in compliance with all national and local codes.

The Evergreen CM has a power switching control. On 4-wire, 3-phase systems where multiple Evergreen motors are connected to a shared Neutral, a Power Factor Correction choke may be required to reduce 3rd harmonic currents in the Neutral. Installer must verify that the shared Neutral wire is sized properly to comply with national and local electric codes. Information regarding Power Factor Correction chokes is available at thedealertools.com

⚠ WARNING

Always disconnect the main power from the unit being serviced before making any wiring connections to the Evergreen CM. It is also a good practice to confirm that the power is off with an electric voltmeter.

⚠ WARNING

Improper installation, adjustment, alteration, service, maintenance, or use can cause explosion, fire, electrical shock, or other conditions which may cause personal injury, death, or property damage. Consult a qualified installer, service agency, or your distributor or branch for information or assistance. The qualified installer or agency must use the supplied or recommended parts when installing or servicing this product.

Introduction and Features

The ultra-high-efficiency ECM has become the preferred motor for use in energy-saving HVAC systems. Evergreen CM is made with the same field-proven, high-efficiency ECM technology that has been used for more than 20 years in new HVAC equipment. It features flexible control methods to help the installer balance airflow in HVAC systems such as VAV (Variable Air Volume) boxes and Packaged HVAC systems. The Evergreen CM is designed as a direct replacement for OEM (Original Equipment Manufacturer) Genteq model X13 (Constant Torque ECM) or as a field replacement for existing PSC (Permanent Split Capacitor) motors.

Features:

- Multi-speed, constant torque, brushless DC motor
- Available in 1/3, 1/2, 3/4 and 1HP ratings for the 208-230/277VAC models
- Available in 1/2, 3/4 and 1HP ratings for the 460VAC models
- Automatically determines motor direction using Genteq's Rotation Sensing Technology (See Rotation Sensing on page 11 for details)
- Shielded ball bearings
- Direct drive applications only
- Efficiency up to 80% maximum nominal efficiency
- 5 Discrete speeds using 24VAC (3 using 18VDC) signal inputs
- Variable speed, torque control using a PWM Signal. (Motor switches to variable speed mode when a PWM input is detected)
- Designed to replace PSC motors with typical nameplate of 900-1100 RPM.
- Operating speed range of 600-1200 RPM
- NEMA 48-frame (5.6 inch diameter) Belly Band Mount with 4-inch long, ½ inch diameter shaft.
- Class B insulation
- Electronic thermal overload protection
- UL and CSA recognized component
- Soft start and off ramp for quieter operation
- Encapsulated electronics
- Improved high static airflow performance versus standard PSC
- * 2 year warranty (See page 16)

This installation/service manual enables a qualified technician to install, service, repair and maintain the Evergreen CM motor. This manual is to be left near the HVAC system for future reference.

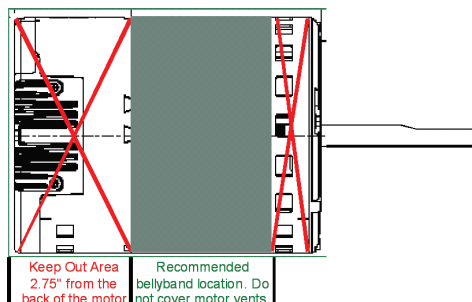
Mounting

! WARNING

Always disconnect the main power from the unit being serviced before disconnecting any wiring or removing any components. It is also a good practice to confirm that the power is off with a meter.

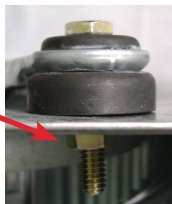
The frame size of the Evergreen CM motor is NEMA 48 (5.6" Diameter). This is the most common frame size for indoor blower motors. The Evergreen CM requires a belly band style mounting bracket.

- If the motor being replaced has the same frame size and a belly band style mount, it should work on the Evergreen CM.
- If the motor mount is welded to the motor, bolted directly to the motor, or attaches to the bearing assembly on the motor, it will not work on the Evergreen CM.
- **Torsion flex belly band mounts can be used on the 1/3 and 1/2 HP motors. These mounts should not be used on the 3/4 or 1 HP motor due to noise and reliability concerns.**
- Universal belly band motor mounts in multiple sizes are available through your local distributor. See page 4 for mounting options.
- If the mounting bracket must be replaced, selecting one with the same mounting pattern on the blower housing will save drilling new holes in the blower section.
- The belly band must fit the new motor properly. It should be tight enough to prevent the motor from shifting on start-up and located according to the diagram below.

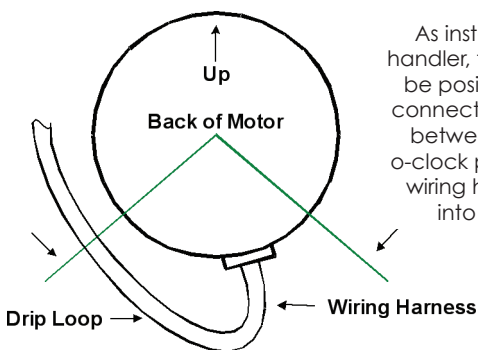


Mounting (CONT'D)

If a new motor mount is required and the legs do not line up with the original holes in the blower housing, it is required to use a bolt with either a lock washer and nut or a locking nut through the drilled hole(s). Self tapping or sheet metal screws are not sufficient for a long term installation when a new hole is drilled through the thin wall of the blower housing.



When positioning the legs of the bellyband on the motor, make sure that once the motor is mounted into the blower section, the wires exit the bottom of the motor as installed in the air handler. This will insure that a proper drip loop can be made with the signal and power lines.



As installed in the air handler, the motor should be positioned with the connectors facing down between the 4 and 8 o'clock position, with the wiring harness formed into a drip loop.

The Regal belly band motor mounts listed below are available from your local distributor or thedealertools.com if needed. Torsion flex mounts should not be used on 3/4 or 1 HP motors.



Catalog # A556
9-10" bolt circle - Torsion Flex
NEMA 48 Frame (5.6" dia.) 3 legs



Catalog # 5K003 (10" bolt circle)
Catalog # 5K004 (11" bolt circle)
NEMA 48 Frame (5.6" dia.) 3 legs



Catalog # 5K005
13" bolt circle
NEMA 48 Frame (5.6" dia.) 4 legs

Electrical Connections

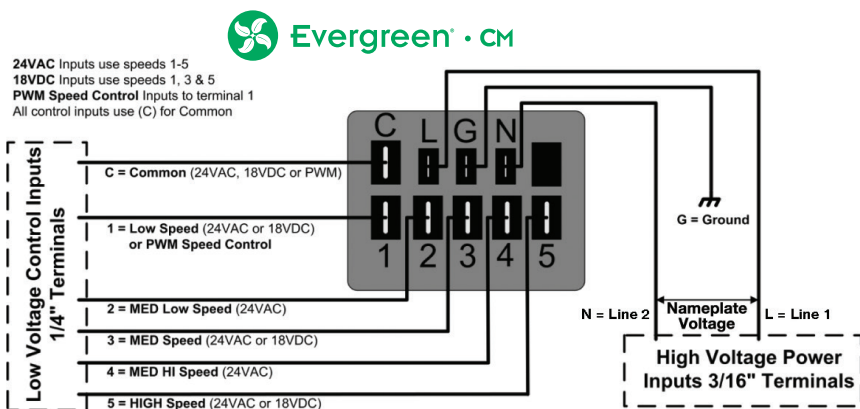
The unique design of the Evergreen CM allows for multiple speed operation using either 24VAC (18VDC) discrete inputs or variable speed, torque control using a PWM controller.

Unlike a PSC motor, the high voltage power terminals (L) and (N) are connected to a continuous, un-switched power supply.

The motor on/off operation and speed/torque selections are connected using the low voltage (C) and (1-5) terminals.

- With 24VAC, the Evergreen CM provides 5 speed operation using terminals (C) and (1-5).
- With 18VDC, the Evergreen CM provides 3 speed operation using terminals (C), (1), (3), and (5)
- With the addition of a PWM controller, the Evergreen CM provides variable speed torque control using terminals (C) and (1).

The Evergreen CM will automatically recognize the connected low voltage input and operate accordingly. Each motor provides all three low voltage control operations.



Detailed wiring for the High Voltage Power Connections and each unique Low Voltage Signal Connections are covered in the following sections.

Electrical Connections

High Voltage Power Connections

The Evergreen CM is designed for continuous un-switched connection to its rated high voltage power supply. Motor operation is controlled by low voltage signal inputs.

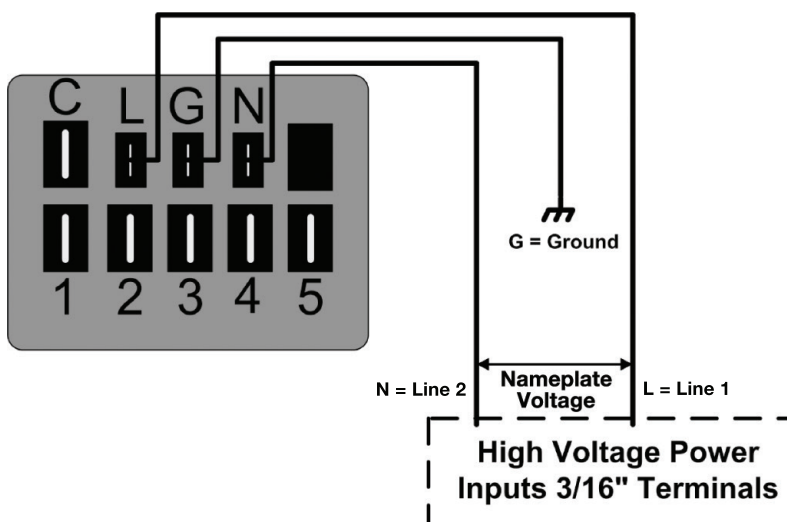
Always confirm the rating on the motor matches the power supply of the system it is applied to and/or the motor it is replacing.

If a door safety switch is present, wire after the switch so power will be disconnected when the door is removed for maintenance or service.

WARNING

Always disconnect the main power from the unit being serviced before making any wiring connections to the Evergreen CM. It is also a good practice to confirm that the power is off with a meter.

1. Using 3/16" Female Quick Connect Terminals and 18 AWG wire, connect the (L) and (N) terminals on the motor to any un-switched line voltage L1 and L2, Nameplate Voltage power supply.
2. Using a 3/16" Female Quick Connect Terminal and 18 AWG wire, connect the (G) terminal on the motor to the system ground.



Electrical Connections

Low Voltage Signal Connections

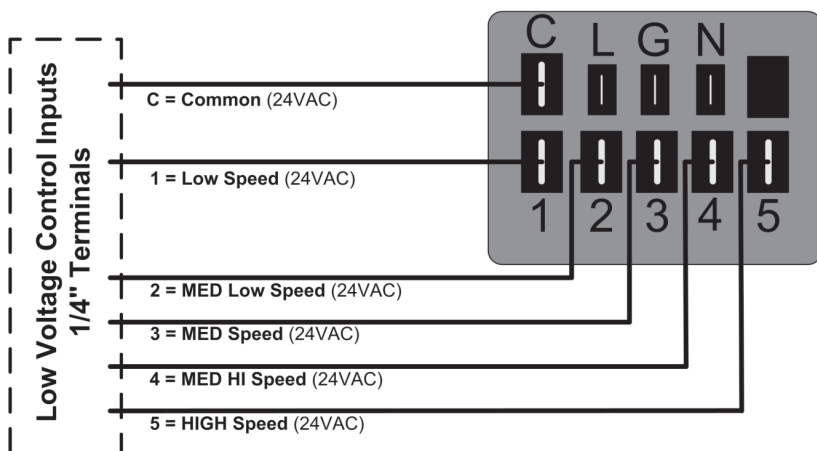
- (24VAC) Discrete Speed Operation

The Evergreen CM has 5 available speeds using 24VAC control inputs. The inputs of the Evergreen can connect directly to the 24VAC thermostat terminal strip for each demand, a 24VAC signal output from the HVAC systems relays or control board.

WARNING

DO NOT connect the Low Voltage SIGNAL (speed) connections to the existing PSC motor connections on the HVAC system. Any voltage above 30VAC connected to these terminals will cause permanent damage to the motor.

1. Using a 1/4" Female Quick Connect Terminal and 22-18 AWG wire, connect the (C) Common terminal on the motor to the 24VAC common (C) thermostat terminal or 24VAC common side of the transformer on the HVAC System. Make sure that this line is not connected to the side of the transformer connected to the thermostat 24VAC (R). If it is connected to the (R) high side of the transformer, the motor will not operate.
2. Select operating speeds by using 1/4" Female Quick Connect Terminal(s) and 22-18 AWG wire to connect terminals (speeds) 1-5 to any 24VAC thermostat demand or 24VAC HVAC system relay or control board output.



Electrical Connections

Low Voltage Signal Connections

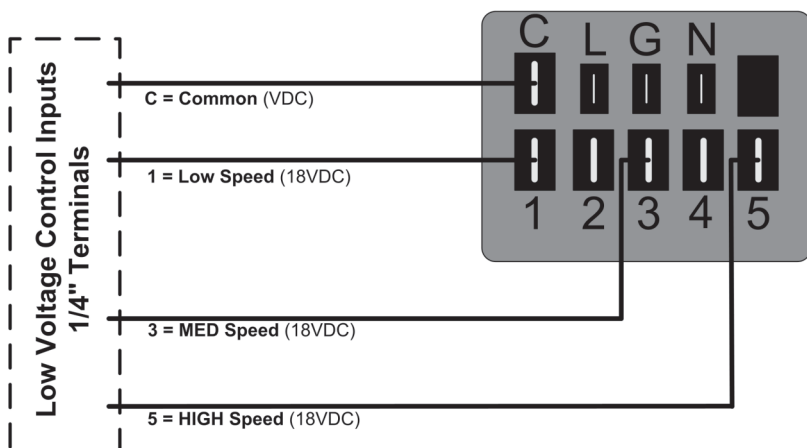
- (18VDC) Discrete Speed Operation

The Evergreen CM has 3 available speeds using 18VDC control inputs.

WARNING

DO NOT connect the Low Voltage SIGNAL (speed) connections to the existing PSC motor connections on the HVAC system. Any voltage above 23VDC connected to these terminals will cause permanent damage to the motor.

1. Using a 1/4" Female Quick Connect Terminal and 22-18 AWG wire, connect the (C) Common terminal on the motor to the DC common on the HVAC System control.
2. Select operating speeds by using 1/4" Female Quick Connect Terminal(s) and 22-18 AWG wire to connect terminals (speeds) 1, 3, or 5 to any 18VDC HVAC system control board output.



Electrical Connections

Low Voltage Signal Connections

- Variable Torque Speed Control Option

The Evergreen CM can be controlled in a Variable Speed Torque control mode using a PWM (Pulse Width Modulation) control on terminals (C) and (1). The motor will operate from 10% to 100% of output depending on the input from the ECM PWM speed controller.

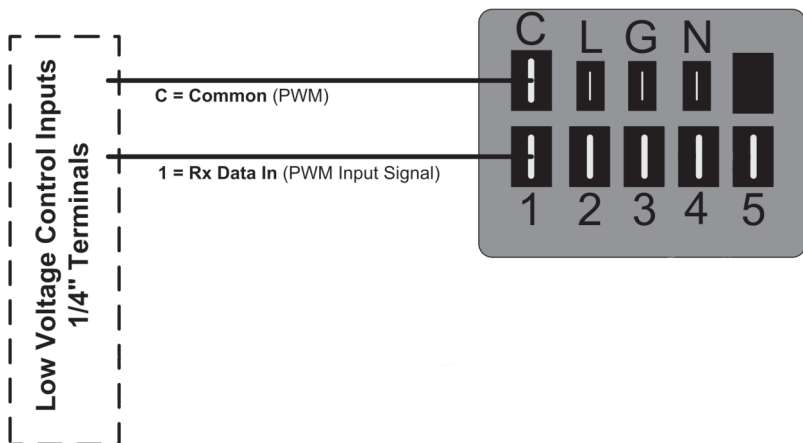
A PWM control suitable for ECM motors must meet the following specifications:

- **15-23 VDC at 67-93Hz or 127-199Hz**
- **10% Guaranteed On and 5% Guaranteed Off Duty Cycle**

WARNING

DO NOT connect the Low Voltage SIGNAL (speed) connections to the existing PSC motor connections on the HVAC system. Any voltage above 23VDC connected to these terminals will cause permanent damage to the motor.

1. Using a 1/4" Female Quick Connect Terminal and 22-18 AWG wire, connect the (C) Common terminal on the motor to the common on the PWM controller.
2. Using a 1/4" Female Quick Connect Terminal and 22-18 AWG wire, connect terminal (1) on the motor to the PWM signal on the PWM controller. Terminal (1) is setup for AUTOSWITCH. If a PWM signal is present, the motor will switch from Discrete Speed outputs to Variable output torque based on the PWM Duty Cycle.



Electrical Connections

Final Notes

Retrofit ECM PWM controllers are available from manufacturers, some of which are listed on **thedealertools.com**. Any control that meets the specifications listed on page 9 should operate the Evergreen CM properly. If there are questions regarding a particular add-on control or building automation system, please call Evergreen technical support at **866-503-8566**. Visit our website at **thedealertools.com** for support. Genteq is committed to helping with any special application question you may have. A spec sheet may be available for the control you want to use.

Once all connections are made from the Evergreen CM to the HVAC system, ensure a proper drip loop is in place and verify it will not interfere with the blower wheel or other system wiring.

Install the System ID Label on the HVAC system near the existing wiring diagram and enter the Evergreen CM data. Record the Horse Power (HP) of the motor and the Date of Installation for future reference. The HP rating can be found on the label located on the box or the motor.

Always verify the HVAC System operates in all applicable demand modes. For VAV systems, adjustments should be made to the speed taps or ECM PWM control input to balance the airflow per the OEM specifications.

Sequence of Operation

Nameplate Voltage line voltage is connected to the High Voltage POWER terminals of the motor at all times. This voltage powers the micro-processor and the controls that drive the motor; however, the motor will only operate when there is demand on the Low Voltage Signal connections.

24VAC operation – When using 24VAC, the motor will turn on and off at the speed selected with a 24VAC input. Multiple low voltage inputs can be sent to the motor at the same time (if needed) due to the hierarchy built into the control. Simply stated, multiple terminals can be energized at the same time. The motor will always operate at the highest speed tap (terminals 1-5) that is energized. There is no need to isolate one demand input from another.

18VDC operation – When using 18VDC, the motor will turn on and off at the speed selected with a 18VDC input. Multiple low voltage inputs can be sent to the motor at the same time (if needed) due to the hierarchy built into the control. Simply stated, multiple terminals can be energized at the same time. The motor will always operate at the highest speed tap (terminals 1, 3 or 5) that is energized. There is no need to isolate one demand input from another.

Variable Speed Torque Control operation – When using a PWM controller the motor will operate at the selected setting anytime there is a PWM signal present on terminal 1.

Rotation Sensing

The first time the Evergreen CM is powered up and receives a signal on one of the “Low Voltage Control Inputs”, it will perform its Rotation Sensing process. With this feature the motor will automatically determine the proper operating direction of the blower wheel by running the motor for several seconds in each direction.

Do not turn off the “High Voltage Power” or the “Low Voltage Control Inputs” to the motor until the motor continues to run in one direction. During Rotation Sensing, the motor will run in both directions, up to four times if necessary, to determine the proper operating direction. If the proper direction cannot be determined after the forth sequence, the motor will operate in the default direction of counter clock-wise (CCW).

Once the motor continues to run in one direction, Rotation Sensing is complete and the feature is locked out. The motor will continue to start and run in this direction without performing Rotation Sensing even if the “High Voltage Power” is disconnected.

If the final operating direction of the motor is not the proper direction for the blower wheel, refer to the “Troubleshooting Guidelines” on page 14; “Wrong Rotation”.

Maintenance

The Evergreen CM motor is permanently lubricated and requires no maintenance.

Any indication of water damage on the replaced PSC motor, in the HVAC system, or on the Evergreen CM should be taken very seriously. Repair the water issues immediately. If there are any signs of water damage to the Evergreen CM motor, it should be replaced to prevent serious injury to the occupants and the property.

All HVAC systems require annual maintenance for proper operation and to maintain maximum efficiency and capacity. See the HVAC system manufacturer's manual for proper inspection and maintenance requirements. To keep the Evergreen CM motor and the airside components clean, install and regularly maintain high-quality, properly sized filters.

Reliability

The Evergreen CM is built with over 20 years of field experience with ECM indoor blower motors from Genteq, the leader in ECM technology. This 6th generation product includes the following reliability improvements:

- 4kV surge protection for the 208-230/277 VAC models
- 6kV surge protection for the 460 VAC models
- Speed limited for over current protection
- Encapsulated electronics to prevent moisture damage
- Ball bearings
- EMI filter

Troubleshooting Guidelines

The **High Voltage Power** terminals (L) and (N) must be connected to nameplate rated voltage at all times. The acceptable high voltage input range is 180-305VAC for 208-230/277VAC and 414-505VAC for the 460VAC models. If the motor does not operate, confirm this voltage is present at the motor and make repairs to the HVAC system if it is not. This voltage alone will not operate the motor. A low voltage input to terminals (C) and (1-5) is required for motor operation. **The (G) terminal on the motor should always be connected to earth ground for safety.**

24VAC will operate the motor at the respective speed when connected properly to terminals (C) and (1-5). When troubleshooting the motor, always check for voltage between terminals (1-5) and the (C) terminal at the motor.

- The (C) Common terminal on the motor must be connected to the 24VAC common (C) thermostat terminal or 24VAC common side of the transformer on the HVAC System. Make sure that this line is not connected to the side of the transformer connected to the thermostat 24VAC (R). If it is connected to the (R) high side of the transformer, the motor will not operate.
- If the motor does not operate or does not appear to operate at the desired speed, check the voltage between the applied terminal (1-5) and (C) at the motor. The acceptable voltage range is (12-30VAC). Correct any voltage issues. Do not assume the motor is failed unless you have confirmed proper high and low voltage inputs at the motor.

18VDC will operate the motor at the respective speed when connected properly to terminals (C) and (1, 3 or 5). When troubleshooting the motor, always check for voltage between terminals (1, 3 or 5) and the (C) terminal at the motor.

- The (C) Common terminal on the motor must be connected to DC common
- If the motor does not operate or does not appear to operate at the desired speed, check the voltage between the applied terminal (1, 3 or 5) and (C) at the motor. The acceptable voltage range is (15-23VDC). Correct any voltage issues. Do not assume the motor is failed unless you have confirmed proper high and low voltage inputs at the motor.
If 18VDC is applied to terminals (2) or (4), the motor will still operate.
Applying 18VDC to terminal (2) will operate the motor at MED speed.
Applying 18VDC to terminal (4) will operate the motor at HIGH speed.



- 15-23VDC at 67-93Hz or 127-199Hz
- 10% Guaranteed On and 5% Guaranteed Off Duty Cycle



All control inputs use (C) for Common



Troubleshooting Guidelines (CONT'D)

Wrong Rotation

If the motor is not operating in the proper direction for the blower wheel, the rotation sensing decision will need to be altered. Following this procedure will allow the rotation direction to be changed several times.

WARNING

ALWAYS DISCONNECT MAIN HVAC SYSTEM POWER BEFORE DISCONNECTING OR RE-CONNECTING ANY WIRES OR CONNECTORS TO THE EVERGREEN MOTOR.

1. Disconnect the main power to the HVAC system.
2. Disconnect the Low Voltage Control Input connections(s) from the motor.
3. Connect motor terminals 1, 3, & 5 to either 24VAC or 18VDC and Common to terminal C.

Note: The line voltage terminals (L) and (N) must remain properly connected to the HVAC system

4. Reconnect the main power to the HVAC system.
5. Energize motor terminals 1, 3, & 5 with either 24VAC or 18VDC and Common to terminal C continuously for a minimum of 5 minutes.
6. Disconnect the main power to the HVAC system for a minimum of 3 minutes.
7. Disconnect the 24VAC or 18VDC from motor terminals 1, 3, & 5 and Common from terminal C.
8. Reconnect the Low Voltage Control Input connection(s) to the motor.
9. Reconnect the main power to the HVAC system.

If the motor continues to operate in the wrong direction, repeat this procedure carefully and confirm all timings. If after several attempts, changing the rotation has not been successful, please call the **Evergreen Hotline at 866-503-8566**.

Troubleshooting Guidelines (CONT'D)

Replacing the Evergreen CM

If the motor does not operate with proper High Voltage Power and low voltage communication present at the motor, it is failed and will require replacement. Before replacing the motor, please call the Contractor Hotline to confirm your diagnostics if possible. **The Evergreen CM is a single component replacement. The control cannot be replaced separately from the motor.** Contact the distributor where the motor was purchased or any authorized Evergreen distributor for replacement.

If the troubleshooting guidelines provided here do not solve the problem or you have a problem not listed here, please contact the **Evergreen Contractor Hotline 1-866-503-8566**. Additional support is available at thedealertools.com.

Terms and Conditions of Sale and Limited Warranty

Sales of the products described in this Installation Manual are subject to the "Regal Beloit Terms and Conditions of Sale" current at the time of sale. They are accessible on [RegalBeloit.com](http://www.regalbeloit.com/what-we-do/products-brands/) – <http://www.regalbeloit.com/what-we-do/products-brands/> (click "Regal Terms and Conditions of Sale").

The full Limited Warranty, including the scope and period, remedies, exclusions and disclaimers current is described in Section 10 "Limited Warranty" of the Regal Terms and Conditions of Sale.

The following is the "Scope and Period" (Section 10(a)(1)) portion of the Limited Warranty applicable to the products described in this Installation Manual:

Seller warrants that the Products shall be delivered free from defects in material, workmanship and title and shall conform to Seller's written specification agreed upon by Buyer and Seller in written and signed agreement, if applicable, for the Products. This warranty shall expire twenty-four (24) months from the first use of the Product or thirty (30) months from date of shipment of the Product, whichever occurs first.

Motors Specifications

The following specifications are common to all Evergreen CM models listed below.

- UL and CSA recognized
- NEMA 48 Frame (5.6" diameter)
- Shaft length 4" with single flat, 1/2" diameter
- Open Air Over (OAO) enclosure
- Shielded ball bearings

Stock/Cat #	HP	Voltage	Max Current	Dim A	Dim B	Appx. Weight
6703	1/3	208-230/277	2.8/2.6	9.17"	5.25"	9.2 lbs
6705	1/2	208-230/277	4.1/3.6	9.67"	5.75"	12.3 lbs
6707	3/4	208-230/277	6/4.9	10.42"	6.5"	15.2 lbs
6710	1	208-230/277	7.6/6.6	11.17"	7.25"	19.0 lbs

Note: The acceptable operating range for all 208-230/277VAC models is 180-305VAC

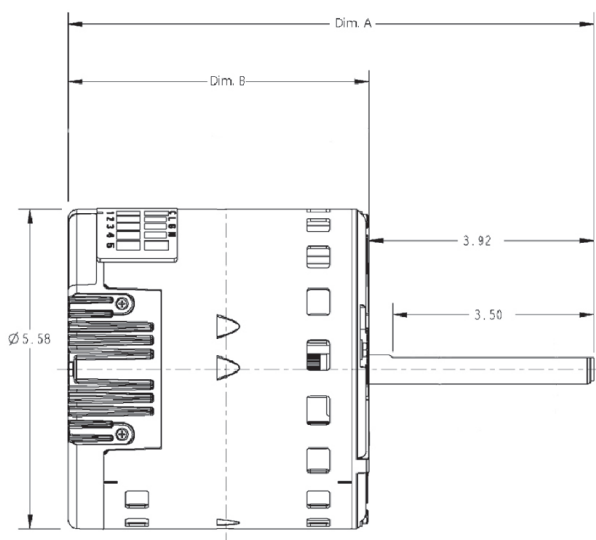
Stock/Cat #	HP	Voltage	Max Current	Dim A	Dim B	Appx. Weight
6405	1/2	460V	2.1	10.53"	6.61"	12.8 lbs
6407	3/4	460V	3.2	11.28"	7.36"	16.1 lbs
6410	1	460V	4	12.03"	8.11"	19.8 lbs

Note: The acceptable operating range for all 460VAC models is 414-506VAC

See the motor drawing on page 18 for each motor's respective dimension from end shield to end shield (Dim. B) and end shield to shaft end (Dim. A).

Motors Specifications (CONT'D)

- Speed (RPM) ratings. Note: Actual RPM will vary depending on load.
 - High = 1075 RPM
 - Med High = 1025 RPM
 - Med = 975 RPM
 - Med Low = 900 RPM
 - Low = 825 RPM



Ambient Temperature of all motors listed here.

Storage: -40 to +85 degrees Celsius (-40 to 185 degrees Fahrenheit)

Powered, not operating: -20 to +65 degrees Celsius (-4 to 149 degrees Fahrenheit)

Operating (1/2 Hp): -20 to +55 degrees Celsius (-4 to 131 degrees Fahrenheit)

Operating (3/4 and 1 Hp): -20 to +45 degrees Celsius (-4 to 113 degrees Fahrenheit)

Notes

Notes

Need Additional Help?



Evergreen[®]

Powered by ECM Technology

Contractor Hotline:
1.866.503.8566

thedealertoolbox.com



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