OVERVIEW

This manual contains general procedures that apply to Baldor EC Titanium Motor product and is not intended to include a comprehensive listing of all details for all procedures required for installation, operation and maintenance. Be sure to read and understand the Safety Notice statements and caution statements for your protection. Do not install, operate, or attempt to perform maintenance procedures until you understand the Warning and Caution statements. A Warning statement indicates a possible unsafe condition that can cause harm to personnel. A Caution statement indicates a condition that can cause damage to equipment.

The EC Titanium are IEs5 efficient motor specifically designed for operation on adjustable speed permanent magnet ac drive controls and is not designed for across the line operation. Information required for proper control and setup of the separate drive is provided on the nameplate of the motor. Detailed information can be found in the EC Titanium Installation Manual MN451 available for download at http://www.baldor.com/support/product_manuals.asp. Be sure to read and understand all of the Safety Notice statements in MN451 EC Titanium Manual for your motor. The basic design includes Class F insulation, Class B temperature rise, 1.5 service factor motor only (10.5 SF integrated motor drive designs), 40°C ambient, continuous duty. Standard enclosures are totally enclosed fan cooled foot mounting. It is important that motors be installed in locations that are compatible with motor enclosure and ambient conditions. Improper selection of the motor enclosure and ambient conditions can lead to reduced operating life of the motor. Proper ventilation for the motor must be provided. Obstructed airflow can lead to reduction of motor life.

RECEIVING AND INSPECTION

The EC Titanium is thoroughly tested at the factory and carefully packaged for shipment. When you receive your motor or the integrated motor and drive, there are several things you should do immediately:
1. Carefully Unpack the EC Titanium and check for any signs of damage. Notify the shipper immediately if any exist.
2. Check the motor and/or motor drive and rating label to ensure it is of the correct type and power requirements for the application.
3. If the motor is to be stored for several weeks before use, be sure that it is stored in a clean and dry environment and within a temperature range of –40°C to +60°C.
4. After storage or after unstacking and inspection to see that all parts are in good condition, rotate the motor shaft by hand to be sure there are no obstructions to free rotation. Motor leads must be isolated before the shaft will turn freely on permanent magnet motors.

On motors received from the factory with the shaft blocked, remove blocking before operating the motor. If the motor is to be reshipped alone or installed to another piece of equipment, the shaft block must be installed to prevent axial movement and prevent brinelling of the bearings on shipment.

SAFETY

This equipment contains high voltage! Electrical shock can cause serious or fatal injury. Only qualified personnel should attempt installation, operation and maintenance of electrical equipment. Unsafe installation or use can cause conditions that lead to serious or fatal injury. Only qualified personnel should attempt the installation, operation and maintenance of this equipment. Be sure that you are completely familiar with safety standards for selection, installation and use of electric motors and generators and local codes and practices. Become familiar with the following:
- NEMA Publication MG-2, Safety Standard for Construction and guide for Selection, Installation and Use of Electric Motors and Generators
- IEC 60034-1 Electrical and IEC60072-1 Mechanical specifications
- NFPA 70E National Electrical Code (NEC) and local codes and practices

INSTALLATION OUTSIDE THE USA:

Refer to MN408 and MN3383 for Compliance with European Directives. Copies are available at: http://www.baldor.com/support/product_manuals.asp

MOTOR ENCLOSURE

TEFC, totally enclosed motors are intended for use where moisture, dirt and/or corrosive materials are present. The EC Titanium motor only is rated for indoor and outdoor locations. Integrated drive motor units with plastic covers are indoor use and not rated for direct sunlight or outdoor use.

GENERAL

The user must select a ac drive suitable for permanent magnet motor control. The ABB ACH580 is suggested and designed to automatically ID run the EC Titanium motor. For all other ac drive controls, the drive must be capable of permanent magnet motor control. Values identified on the motor nameplate must be available to enter into drive parameters. These are shown in the previous section of this guide and include Motor Rated Amps, Motor Back EMF Voltage, Rs (motor stator resistance), Ld (d-axis inductance), Lq (q-axis inductance) and motor rated frequency. Ensure the drive is sized properly for the current rating of the motor and set appropriate overcurrent protection suitable for this motor and its application.

Speed Range

EC Titanium Motors are rated for a 10:1 Constant Torque Speed range below base speed. 140 and 180 Frame motors may be operated to a maximum safe speed of 4000 RPM and 210 Frame motors 3000 RPM.

TESTING

If the motor has been in storage for an extensive period or has been subjected to adverse moisture conditions, check the motor insulation resistance with a meg ohm meter. Depending on storage conditions it may be necessary to rotate or change rusted bearings. Contact your local sales office if resistance is less than 5 meg ohms.

WARNING: Do not touch electrical connections before you first ensure that power has been disconnected. Electrical shock can cause serious or fatal injury.

WARNING: Be sure the system is properly grounded before applying power. Electrical shock can cause serious or fatal injury.

ELECTRICAL INSTALLATION

This motor must be installed in accordance with National Electric Code, NEMA MG-2, IEC standards or local codes.

WARNING: EC Titanium permanent magnet motors can induce voltage and current in the motor leads by rotating the motor shaft. Electrical shock can cause serious or fatal injury. Therefore, do not couple the load to the motor shaft until all motor connections have been made. During any maintenance inspections, be sure the motor shaft will not rotate.

WIRING

Connect the motor as shown in the connection diagrams. If this motor is installed as part of a motor control drive system, connect and protect the motor according to the control manufacturers diagrams. Refer to MN408 for additional details on lead marking. The wiring, fusing and grounding must comply with the National Electrical Code or IEC and local codes. When the motor is connected to the load for proper direction of rotation and started, it should start quickly and run smoothly. If not, stop the motor immediately and determine the cause. Possible causes are: low voltage at the motor, motor connections are not correct or the load is too heavy. Check the motor current after a few minutes of operation and compare the measured current with the nameplate rating.

GROUNDING

Ground the motor according to NEC and local codes. In the USA consult the National Electrical Code, Article 430 for information on grounding of motors and generators, and Article 250 for general information on grounding. In making the ground connection, the installer should make certain that there is a solid and permanent metallic connection between the ground point, the motor or generator terminal housing, and the motor or generator frame. In non-USA locations consult the appropriate national or local code applicable.

Noise

For specific sound power or pressure level information, contact your local sales office.

VIBRATION

This motor is balanced to NEMA MG1, Part 7 standard.

WARNING: Guards must be installed for rotating parts such as couplings, pulleys, external fans, and unused shaft extensions, should be permanently guarded to prevent accidental contact by personnel. Accidental contact with body parts or clothing can cause serious or fatal injury.

DRAIN PLUGS

One or more condensation drain fittings are provided on each endplate for various motor mounting configurations. The fittings allow drainage and prevent insertion of a 1mm wire probe per the IP54 rating requirements. To avoid condensation inside the motor, do not unpack until the motor has reached room temperature. (Room temperature is the temperature of the room in which it will be installed). The packing provides insulation from temperature changes during transportation.

MOUNTING

Mount the motor on a foundation sufficiently rigid to prevent excessive vibration. Standard stock EC Titanium motors are provided with feet for mounting at any angle. Mounting provisions may also be provided on custom design motors to allow for direct coupled (c-face) or flange mounting at any angle. After careful alignment, bolt motor securely in place. For foot mounted motors, use shim to fill any unevenness in the foundation. Motor feet should sit solidly on the foundation before mounting bolts are tightened.

EC Titanium Stock Motors are designed to be mounted by the “Mounting Feet”. Use appropriate hardware (not furnished). The motor should be installed in a location compatible with the motor enclosure and specific ambient. The motor must be securely installed to a rigid foundation or mounting surface to minimize vibration and maintain alignment between the motor and shaft load. Failure to provide a proper mounting surface may cause vibration, misalignment and bearing damage. All hold down bolts must be the correct grade for the type of mounting and must be torqued to their recommended value. The standard motor base is designed for horizontal or vertical mounting.
Belts and Drive
Motor slide bases or rails, when used, must be securely anchored to the foundation with the proper bolts. The motor shaft and the load shaft must be parallel and the sheaves aligned. For V-belt drive, mount the sheave pulley close to the motor housing. Allow clearance for end to end movement of the motor shaft. Do not overtighten belts as this may cause premature bearing failure or shaft breakage.

Coupled Drive
Machines should be carefully aligned and the shaft should rotate freely without binding. Standard EC Titanium Motors will operate successfully mounted on the floor, wall or ceiling, and with the shaft at any angle from horizontal to vertical. Special mountings may have duty or thrust demands that may require a different bearing system.

Flange Mount
Machines should be properly seated and aligned. Note: If improper rotation direction is detrimental to the load, check rotation direction prior to coupling the load to the motor shaft.

LIFTING PROVISIONS
The EC Titanium motors provided in 180 and 210 frames are provided with lifting provisions. Always lift the motor by the lifting bolt eye or lugs provided. 140 Frame Motors do not require lifting provisions and can be set in place manually.

Caution: Do not lift the motor and its driven load by the motor lifting hardware. The motor lifting hardware is adequate for lifting only the motor. Disconnect the driven load from the motor shaft before lifting the motor.

Caution: Do not lift the motor by the shaft. The motor is designed to drive a load but it is not intended to have lifting forces and stresses applied to the motor shaft. Damage to the motor may result.

Caution: If eye bolts are used for lifting a motor, be sure they are securely tightened. The lifting direction should not exceed a 20° angle from the shank of the eye bolt or lifting lug. Excessive lifting angles can cause damage.

Single Lifting Bolt Dual Offset Lifting Bolts
180, 210 Frames EC Motors 180, 210 Frames EC Motor & Axial Units
20° maximum angle

IP (Ingress Protection)
IP designations include two numerals, the first characteristic numeral is for ingress of solid bodies and from dust. The second for ingress protection from liquid - water. EC Titanium Motors are marked IP54 for general protection from dust and splashing water when mounted horizontally. Other orientations such as shaft up or down may require additional sealing, contact the local ABB District Office to review non-horizontal mounting requirements and ingress protection.

GUARDING
After motor installation is complete, a guard of suitable dimensions must be constructed and installed around the motor/gearmotor. This guard must prevent personnel from coming in contact with any moving parts of the motor or drive assembly but must allow sufficient cooling air to pass over the motor. If a motor mounted brake is installed, provide proper safeguards for personnel in case of brake failure. Brush inspection plates and electrical connection cover plates or lids, must be installed before operating the motor.

STARTING
Before starting motor remove all unused shaft keys and loose rotating parts to prevent them from flying off. Check direction of rotation before coupling motor to load. The motor should start quickly and run smoothly and with little noise. If the motor should fail to start the load may be too great for the motor, the voltage is low or the motor has been miss-wired. In any case immediately shut motor off and investigate the cause.

ROTATION
To reverse the direction of rotation, disconnect and lockout power and interchange any two of the three AC power leads for three phase motors. For two-phase four wire, disconnect and lockout power and interchange the AC line leads on any one phase. For two phase three wire, disconnect and lockout power and interchange phase one and phase two AC line leads.

Lubrication Information
EC Titanium Motors use double-shielded sealed bearings and do not require re-lubrication. Non-Regreaseable motors when not in normal operation, should have the motor shaft rotated 15 times to redistribute the grease within the bearing every 3 months or more often.

ELECTRICAL INSTALLATION
Flying Leads
Motors with flying lead construction must be properly terminated, connected with bolt, lock washer and nut and wrapped with two full layers of electrical grade tape or heat shrink tubing.

Figure 1-1 Connection Diagram

1. Single Voltage/Three Lead Motors. Connect leads marked U/T1, V/T2 and W/T3 to the appropriate control output terminals (refer to the Controller Instruction Manual). See Figure 1-1.
2. Dual Voltage Motors
   Be sure the motor leads are connected properly for “Low” or “High” voltage connection, see Figure 1-1.

Connect leads marked U/T1, V/T2 and W/T3 to the appropriate control output terminals (refer to the Controller Instruction Manual). For motors supplied with temperature protection, leads P1 & P2 are thermostat leads. They are to be connected in series with the holding coil of the motor controller, which uses a manual momentary start switch. These are not standard with stock EC Titanium motors.
Quick Startup Guide

When delivered, the EC Titanium™ is pre-programmed to run from remote inputs wired to the terminal strip. This default digital input configuration provides a general purpose I/O setup with a hard wired start / stop enable, forward / reverse input and a selection between an analog speed reference or preset speed input.

Parameter 1103 = 0 defines control from the terminal strip (for Keypad Control 1103 =1) and Parameter 9902 = 0 sets up the configuration for the inputs and outputs as shown below.

Step 1 Connect a control switch between the control terminals 1 & 2 and ensure that the contact is open (drive disabled). Connect a potentiometer (1kΩ min to 10 kΩ max) between terminals 5 & 7 with the wiper to terminal 6 of the control terminal. With the potentiometer set to zero, switch on the supply to the drive.

Step 2 The status LED is slow flashing green and a connected EC100L Keypad will display 5sOP. Close the control switch, terminals 1-2, the drive is now ‘enabled’ and the output frequency is zero, switch on the supply to the drive.

Step 3 The display shows zero speed in Hertz as H 0.0, with the potentiometer turned to minimum. If the display is not showing H 0.0, change it with the navigate key. Adjust the speed using the potentiometer, the motor will accelerate to the speed set by the potentiometer up to the value set in parameter 2008 (maximum frequency limit.).

Step 4 Stop the motor, disable the drive by opening the control switch (terminal 1-2).

Keypad Operation

Setting parameter 1103 to a value of 1 enables keypad mode with forward direction only, while a value of 2 enables keypad mode with forward and reverse rotation.

Set parameter 1100 to 1 or 3 to enable the drive to start from the set keypad reference speed.

While the drive is stopped, press the STOP key. The value of the digital potentiometer will be displayed, indicating the target speed. Use the UP and DOWN keys to select the required target speed.

Press the STOP key to return to the real time display showing 5sOP or the START key to start the drive ramping up to the target speed. To reverse direction, press the START key again.

Keypad Display Screens

Prior to operation the keypad will show 5sOP, pressing the STOP key allows setting the preset speed on the display [H x.x]. While in operation the following displays can be accessed by briefly pressing the Navigate Key.

- **5sOP**: Drive power applied and no Enable or Run signal
- **Drive Running**: Output Frequency (Hz) Press Navigate to select display
- **Motor Current (Amps)** Press again to cycle display
- **Motor Power (kW)**

**Drive Running, Speed Reference = 0**

- **5sOP**: Enable / disable switch open drive will decelerate to stop and display shows 5sOP
- **5stdby**: A zero reference and enable/disable closed the display with show H 0.0 (0.0Hz) ~60 seconds at zero speed drive standby mode 5stdby waiting for a speed reference
Control Terminals

- **Control Terminal**
  - 1 +24V User Output, 100mA
  - 2 Digital Input 1
  - 3 Digital Input 2
  - 4 Digital Input 3 / Analog Input 2
  - 5 +10VDC (10mA) 1kΩ maximum Reference for Potentiometer
  - 6 Analog Input 1 / Digital Input 4
  - 7 0V common, internally connected to terminal 9
  - 8 Analog Output (0 to 10V) Digital Output (0 to 24V) 20mA maximum
  - 9 0V
  - 10 Modbus RTU -
  - 11 Modbus RTU +

- **Signal**
  - PLT-A Relay Common
  - PLT-B Relay NO Contact 250Vac, 6A / 30Vac, 5A

Customizing your Application

Factory settings may give satisfactory performance however certain adjustment.

- **Parameter Name**
- **Parameter**
- **Adjustment**
  - Minimum Frequency Limit
    - 2007
    - Minimum output frequency
  - Maximum Frequency Limit
    - 2008
    - Maximum output frequency
  - Primary Command Source
    - 1103
    - Selects the reference input for the drive.
  - Digital Input Function Select
    - 9902
    - Defines the function of the digital inputs
  - Stop Mode
    - 2102
    - Select method of stopping required when drive is disabled.
  - Acceleration Ramp
    - 2202
    - Adjust as need for your application. Short Acceleration or Deceleration times may cause excess motor current and may result in it tripping or the motor stalling.
  - Deceleration Ramp
    - 2203
    - Set as required by the application (0-10V, 0-5V, 4-20mA)
  - Analog Input Format
    - 1300
    - Any hard to start load will benefit from voltage boost. Permits a boost of up to 25% of full motor voltage to be applied.
  - Voltage Boost
    - 2603
    - Adjusts the Analog Input Value scales with the maximum output frequency setting in 2008.

- **NOTE:**
  - The Analog Input Value scales with the maximum output frequency setting in 2008.
  - Example: The motor will run at 1800 RPM with a 10V DC reference and when parameter 2008 = 60 HZ.

Motor Nameplate Information

The EC Titanium Motor nameplate is located on the side of the motor and includes NEMA rating, appropriate marking, a type designation and a serial number, which allow identification of each unit. The motor nameplate contains electrical information necessary for proper setup of a drive control.

- **Region**
- **Description**
- **Factory Set Parameters**
  - 1 Catalog Number
  - 2 General Motor Information
  - 3 Motor Rated Amps
  - 4 BEMF (Back EMF) Voltage
  - 5 Motor Stator Resistance (Rsl)
  - 6 IQ (mH) Motor Inductance (Zsq)
  - 7 LIq (mH) Motor q-axis Inductance (Lsq)
  - 8 Motor Rated Frequency
  - 9 Motor Maximum Frequency
  - 10 PM Motor Warning Information
  - 11 Shaft Ground Provision Marking
  - 12 QR Code for motor information
  - 13 GE Marking
  - 14 UL Agency Listing

- **Additional Factory Preset Parameters**
  - Start Stop Mode 1 = Coast to Stop
  - Minimum Speed
  - Control Mode

Motor values shown on the nameplate are utilized for proper control and setup of a drive used to run the EC Titanium motor.

- **NOTE:**
  - Integrated units are factory programmed and parameters do not need to be adjusted unless a software reset was implemented.

Additional Connection Examples

3-Wire Start/Stop with Forward/Reverse Terminal Control Mode (1103 = 0)

- **Digital input configuration when the drive is controlled using momentary push-buttons. It provides a general purpose I/O setup with a momentary input for start, forward / reverse, stop interlock and an analog speed reference.**

- **Parameter 9902 = 11**
  - A momentary input on terminal 2 will start the drive in the forward direction with a closed input on terminal 3.
  - A momentary open input to I/O terminal 3 will stop the drive as specified in 2101 (Stop Mode).
  - A momentary input on terminal 4 will reverse the drive direction.

- **Parameter Navigation**
  - Press and hold the NAVEGATE key for more than 1 second when the drive is displaying SEOP.
  - The display changes to PR S, indicating the short (S) parameter group. Use the (UP) and (DOWN) keys to select between the S, L or P parameter groups.
  - To enter a parameter group, press and release the NAVEGATE key while the group letter is flashing. Use the (UP) and (DOWN) keys to change to the desired parameter number.
  - To change parameter values, press and hold the NAVEGATE key then use the (UP) and (DOWN) keys to change to the required value. Press and release the NAVEGATE key once more to store the change.
  - Press and hold the NAVEGATE key for more than 1 second to return to real-time mode. The display shows SEOP if the drive is stopped or the real-time information (e.g. speed, current or power) if the drive is running.
  - To access Read Only Parameters, navigate to PR L Group and scroll to Parameter 0000, then press and release the navigate key.