

Carefully read and understand this Instruction Manual prior to installation, operation and maintenance of your motor.

1. SAFETY DEPENDS ON YOU

Inverter and Vector Duty motors are designed and manufactured by Lincoln with safety in mind. However, your overall safety can be increased by properly installing, operating and maintaining the motor. Read and observe all instructions, warnings and specific safety precautions included in this manual and **THINK BEFORE YOU ACT!**

2. RECEIVING AND INSPECTION

Check packing list and inspect motor to make certain no damage has occurred in shipment. Claims for any damage done in shipment must be made by the purchaser against the transportation company.

Turn the motor shaft by hand to be certain that it rotates freely. Be careful not to cut yourself on the shaft keyway; it is razor sharp!

Check the nameplate for conformance with power supply and control equipment requirements.

3. HANDLING

WARNING



FALLING EQUIPMENT can injure.

- **Lift only with equipment of adequate lifting capacity.**
- **If so equipped, use lift ring(s) on the motor to lift ONLY the motor and accessories mounted by Lincoln.**

If so equipped, use lift ring(s) on the motor to lift only the motor and accessories mounted by Lincoln. Do not use the lift ring(s) to lift the motor along with additional equipment such as pumps, compressors or other driven machinery.

In case of assemblies on a common base, the motor lift ring(s) CANNOT be used to lift the assembly and base but, rather, the assembly should be lifted by a sling around the base or by other lifting means provided on the base. In all cases, care should be taken to assure lifting in the direction intended in the design of the lifting means. Likewise, precautions should be taken to prevent hazardous overloads due to deceleration, acceleration or shock forces.

4. STORAGE

Motor stock areas should be clean, dry, vibration free and have a relatively constant ambient temperature. For added bearing protection while the motor is in storage, turn the motor shaft every six months.

A motor stored on equipment and component equipment prior to installation should be kept dry and protected from the weather. If the equipment is exposed to the atmosphere, cover the motor with a water-proof cover. Motors should be stored in the horizontal position with drains operable and positioned in the lowest point. CAUTION: Do not completely surround the motor with the protective covering. The bottom area should be open at all times.

Windings should be checked with a megohm-meter (Megger) at the time equipment is put in storage. Upon removal from storage, the resistance reading must not have dropped more than 50% from the initial reading. Any drop below this point necessitates electrical or mechanical drying. Note the sensitivity of properly connected megohm-meters can deliver erroneous values. Be sure to carefully follow the megohm-meter's operating instructions when making measurements.

All external motor parts subject to corrosion, such as shaft and other machined surfaces, must be protected by applying a corrosion-resistant coating.

5. INSTALLATION

For maximum motor life, place the motor in a clean, dry, well ventilated place easily accessible for inspecting, cleaning and lubricating. The temperature of the surrounding air should not exceed 104°F (40°C) except for motors with nameplates indicating a higher allowable maximum ambient temperature.

WARNING



MOVING PARTS can injure.

- **BEFORE starting motor, be sure shaft key is captive.**
- **Consider application and provide guarding to protect personnel.**

5.1 INSTALLATION – MECHANICAL

Base

Mount the motor on a firm foundation or base sufficiently rigid to prevent excessive vibration. On foot-mounted motors use bolts through all four feet and if necessary properly shim to prevent undue stress on the motor frame and to precision align the unit.

Position

Standard Inverter Duty and Vector Duty motors may be mounted in any position. The radial and thrust load capacity of the motor's bearing system provides for this feature.

Drains

All motors have drain holes located in the end brackets. As standard, drains are in place for the horizontal with feet down mounting position. Other positions may require either rotation of the end brackets or drilling additional holes to attain proper drainage. Be sure existing drain or vent holes do not permit contaminant entry when motor is mounted in the other positions.

Additional drain holes exist near bearing cartridge in both end brackets of 280T - 440T steel frame motors. The drain holes are closed with a plastic plug. When the motor is vertically mounted, the plug located in the lower end bracket must be removed. TEFC motors: to access the plug on blower end, simply remove the shroud; on some models, it is necessary to also take off the blower. To take off the blower, loosen and remove the nut and washer(s) on the shaft. Note the blower is keyed to the shaft. Reverse the process to assemble.

Drive – Power Transmission

The pulley, sprocket, or gear used in the drive should be located on the shaft as close to the shaft shoulder as possible. Do not drive the unit on the shaft as this will damage the bearings. Coat the shaft lightly with heavy oil before installing pulley.


Belt Drive: Align the pulleys so that the belt(s) will run true. Consult the belt manufacturer's catalog for recommended tension. Properly tension the belt; excessive tension will cause premature bearing failure. If possible, the lower side of the belt should be the driving side. On multiple belt installations be sure all belts are matched for length.

Chain Drive: Mount sprocket on the shaft as close to the shaft shoulder as possible. Align the sprockets so that the chain will run true. Avoid excessive chain tension.

Gear Drive and Direct Connection: Accurate alignment is essential. Secure motor and driven unit rigidly to the base. Shims may be needed to achieve proper alignment.

Excessive motor vibration may result if the full length of the motor shaft key is not completely engaged by the coupling or sheave. For these situations, adjustment of the key length is required.

⚠ WARNING



ELECTRIC SHOCK can kill.

- **Disconnect input power supply before installing or servicing motor.**
- **Motor lead connections can short and cause damage or injury if not well secured and insulated.**

- **Use washers, lock washers and the largest bolt size which will pass through the motor lead terminals in making connections.**
- **Insulate the connection, equal to or better than the insulation on the supply conductors.**
- **Properly ground the motor — see GROUNDING.**

5.2 INSTALLATION – ELECTRICAL

Check power supply to make certain that voltage, frequency and current carrying capacity are in accordance with the motor nameplate.

The proper branch circuit supply to a motor should include a disconnect switch, short circuit current fuse or breaker protection, motor starter (controller) and correctly sized thermal elements or overload relay protection.

Short circuit current fuses or breakers are for the protection of the branch circuit. Starter or motor controller overload relays are for the protection of the motor.

Each of these should be properly sized and installed per the National Electrical Code and local codes.

Properly ground the motor – See 5.3 GROUNDING.

Terminal Box – Standard

Remove the appropriate knockout. For terminal boxes without a knockout, either a threaded power-conduit entry hole is provided or the installer is responsible for supplying a correctly sized hole.

The majority of terminal boxes can be rotated in place to allow power lead entry from the 3, 6, 9 or 12 o'clock position.

Terminal Box – Oversized (option)

The oversized terminal box for 143T thru 256T frame motors may be rotated in 180° increments. Conduit entry hole diameter is suitable for conduit per Table 1.

Table 1 — Conduit Entry Hole Sizes

Frame Size	Nominal Size of Conduit
143T-184T	0.75"
213T-215T	1.00"
254T-256T	1.25"

The installer is responsible for adding the appropriate conduit entry hole in oversized terminal boxes on frames 284T-445T. Care must be taken to avoid damaging the motor leads and to keep foreign objects from entering the motor. The terminal box cannot be rotated in place.

Terminal Strip (option)

The oversized terminal box may be supplied with motor leads connected to a terminal strip. This feature facilitates terminal connections.

Drive Motor Connection

Reference the lead connection diagram located on the motor nameplate or inside the terminal box cover.

Contact Motor Customer Service at 1-800-668-6748 (phone), 1-888-536-6867 (fax) or motors@lincolnelectric.com (e-mail) for a copy of across-the-line and reduced voltage start connection diagrams.

Blower Motor and Connection

The blower motor is designed for use with single or three phase, utility generated, sinusoidal (**non-inverter**) power. Check the blower motor nameplate for voltage and phase capability.

Frame sizes 182T-256T only: The blower (fan) should always turn in a counter-clockwise direction when looking at the blower (fan) end of the

motor. Counter-clockwise rotation of the blower directs air through the motor with the air exiting at the shaft end. If the rotation is not correct, disconnect the power and correct as follows:

1. Single phase blower motors – check for correct wiring of the run capacitor.
2. Three phase blower motors – interchange any two input phases to the blower motor.

Single Phase Blower Motor

The single phase motor is a capacitor run design. It is necessary to provide this capacitor rated for 400 VAC in the control cabinet. Capacitor sizes and other performance data are given in Table 2. Connect motor to input power per diagram inside conduit cover. NOTE: Motor has automatic thermal overload protection.

Three Phase Blower Motor

Check the blower motor nameplate for voltage ratings and appropriate connection diagrams. Leads for built-in thermostat are yellow in color. Performance data is given in Table 2.

Table 2 — Blower Motor Ratings

Frame Size	115/1/60			230/460/3/60	
	Run Cap μ F	FLA	LRA	FLA	LRA
182T-215T	8	0.7	2.4	0.22/0.11	1.2/0.6
254T-256T	16	1.7	6.3	0.50/0.25	2.0/1.0
284T-326T	X	X	X	1.32/0.66	11.0/5.5
364T-445T	X	X	X	3.8/1.9	26.4/13.2

Space Heater (option)

Leads for space heaters are identified as H1 and H2. Heater voltage and watts are marked on the motor nameplate and should be checked prior to connection to power source.

Feedback – Encoder or Digital Tachometer (option)

The encoder is a precision industrial electronic shaft feedback device. Care should be taken when wiring this device to insure reliable operation. This is done to isolate the low level feedback signals from the electrical “noise” induced by the power leads to the motor and blower motor. It is important that the feedback wires be run in a separate conduit from other wiring to insure reliable operation. Follow the wiring specification and practices of the drive supplier.

Table 3 — Feedback Device Characteristics

Characteristic	Feedback Device		
	Dynapar H25 Dynapar H20	Dynapar HS 35	BEI H25
Operating Temp.	-40° to +85°C	0° to +100°C	0° to +80°C
Minimum Storage Temp.	-40° to +90°C	-40° to +100°C	-25° to +90°C
Enclosure	NEMA 4		
Code	Incremental		
Power Supply	5 to 26 VDC, 120mA Max.	5 to 26 VDC, 100mA Max.	5 VDC, 150mA Max.
Output Current	Differential line driver: 40mA Sink/Source	Differential line driver: 40mA Sink/Source	Differential line driver: 40mA Sink/Source
Output Format	2 channel quadrature with marker and complements	2 channel quadrature with marker and complements	2 channel quadrature with marker

⚠ CAUTION

- DO NOT TAMPER WITH FEEDBACK DEVICE MOUNTING MECHANISMS BECAUSE IT MAY CAUSE MALFUNCTION OF FEEDBACK DEVICE.

**Connection Diagram 1 -
BEI Encoders**

ABZ (C)	LEAD
A	YEL
B	BLUE
Z	ORN
+V	RED
OV	BLK
CASE	GRN
\bar{A}	W-YEL
\bar{B}	W-BLUE
\bar{Z}	W-ORN

**Connection Diagram 2 -
Dynapar Encoder**

Function	Color
A	BRN
B	ORN
Z	YEL
+VOLTAGE	RED
N/C	-
COMMON	BLK
CASE GND	GRN
A NOT	BRN/WHT
B NOT	ORN/WHT
Z NOT	YEL/WHT

Thermostat (standard)

Leads for thermostats (normally closed, automatic reset contacts) are identified as P1 and P2. Connect these to a relay or signaling device. Motor line current cannot be handled by the thermostat. Failure to connect the thermostat leads to the proper relay or signaling device will void the motor warranty.

Table 5 — Thermostat Contact Ratings

Voltage (60 Hz)	110V	220V
Max. Cont. Current (amps)	3.0	1.5
Min. Cont. Current (amps)	0.2	0.1

Thermistor (option)

Leads for thermistors are identified as P3 and P4. Thermistors require connection to Texas Instruments® Control Module Model 32AA or its equivalent for proper operation. This item may be purchased from Lincoln.

Brake (option)

Carefully read and fully understand the instructions supplied by the brake manufacturer (see inside of brake housing or separate sheet). Contact the brake manufacturer for additional information.

5.3 GROUNDING

⚠ WARNING



ELECTRIC SHOCK can kill.

- Connect the motor frame to a good earth ground per the National Electrical Code and local codes to limit the potential to ground in the event of contact between live electrical parts and the metal exterior.

Lincoln motors may be electrically connected to earth ground using a terminal box mounting screw or a separate grounding screw when provided. Both are accessible inside the mounted terminal box. When a bronze mounting screw is supplied, always use it as the grounding point. In making the ground connection, the installer should make certain that there is a good electrical connection between the grounding lead and the motor.

6. OPERATION

⚠ WARNING



MOVING PARTS can injure.

- Before starting the motor, remove all unused shaft keys and loose rotating parts to prevent them from flying off and causing bodily injury.
- Keep away from moving parts.

ELECTRIC SHOCK can kill.

- Do not operate with covers removed.
- Do not touch electrically live parts.

Three-phase squirrel-cage induction motors will operate on *sinusoidal power* successfully, but not necessarily in accordance with nameplate ratings, at voltages $\pm 10\%$ nameplated value at the design frequency.

After checking that the shaft key is secure, operate the motor free of load and check the direction of rotation. If the motor rotates in the wrong direction, interchange any two supply leads. Also, check the input current to make sure it is approximately the same as the idle amps value listed on the nameplate. If everything appears to be satisfactory, continue to next paragraph.

Couple the motor to its load and operate it for a minimum of one hour. During this period, check for any unusual noise or thermal conditions. Check the actual operating current to be sure that the nameplate current times service factor is not exceeded for steady continuous loads.

MAXIMUM SAFE SPEED

The maximum mechanically safe operating speed is stamped on the nameplate and must not be exceeded under any condition. The drive system must hold the maximum speed, under any load condition including no load, within the maximum safe speed. Drive systems whose design characteristics inherently prevent the motor from exceeding the Motor Maximum Safe Operating Speed must prevent the motor from exceeding the Maximum Safe Speed if a single component failure should occur.

⚠ WARNING



MOVING PARTS can injure.

- Do not operate the motor at speeds above the motor maximum safe speed.
- Operating the motor above maximum safe speed may cause parts to be ejected resulting in bodily injury.
- All motor driven components must be designed by the machine builder to operate safely at the motor maximum safe speed listed on the nameplate.

MACHINERY AND ALL DRIVETRAIN MECHANISMS NOT SUPPLIED BY LINCOLN ELECTRIC AND PROCESS LINE MATERIAL ARE CAPABLE OF SAFE OPERATION AT THE MOTOR MAXIMUM SAFE SPEED.


VOLTS/HERTZ SETTINGS

Motor overheating may be caused by improper "boost" or "volts/hertz" settings of the drive. Care should be taken when adjusting these parameters that the motor does not become magnetically saturated. Signs of magnetic saturation are increased motor "electrical" noise (humming), increased current draw and rapid motor heating.

Inverter Duty and Vector Duty motors are designed and manufactured

7. MAINTENANCE

⚠ WARNING



ELECTRIC SHOCK can kill.

- Internal parts of the motor may be at line potential even when it is not rotating.
- Disconnect all input power to the drive and motor before performing any maintenance.

with long motor life expectancy and trouble-free operation in mind.

Periodically inspect the motor for excessive dirt, friction or vibration. Dust may be blown from an inaccessible location using compressed air. Keep the ventilation openings clear to allow free passage of air. Make sure the drain holes in the motors are kept open and the shaft slinger is positioned against the end bracket. Grease or oil can be wiped by using a petroleum solvent.

Overheating of the bearings caused by excessive friction is usually caused by one of the following factors:

1. Bent shaft.
2. Excessive belt tension.
3. Excessive end or side thrust from the gearing, flexible coupling, etc.
4. Poor alignment.
5. Contamination.

Damaging vibrations can be caused by loose motor mountings, motor misalignment resulting from the settling or distortion of the foundation, or it may be transmitted from the driven machine. Vibration may also be caused by excessive belt or chain tension.

7.1 BEARING SYSTEM – SIZES AND LUBRICATION

Lincoln Inverter Duty motors have a high quality, premium design bearing system. Bearing sizes and enclosures are identified on most motor nameplates. The majority are double-shielded, deep-groove ball bearings. Double-sealed ball bearings are used on some motors in frame sizes 56, 143T and 145T.

Lubrication instructions and/or grease specifications provided on the motor supersede the following information.

⚠ CAUTION

- LUBRICANT SHOULD BE ADDED AT A STEADY MODERATE PRESSURE. IF ADDED UNDER HEAVY PRESSURE BEARING SHIELD(S) MAY COLLAPSE.
- DO NOT OVER GREASE.

In general, the motor's bearing system has sufficient grease to last indefinitely under normal service. Where the motor is used in dirty, wet or corrosive atmospheres, it is advisable to add one-quarter ounce of grease per bearing every three months. Use a good quality, rust inhibited polyurea-based grease, such as Chevron SRI #2. A lithium-based greases are not compatible with polyurea based greases; mixing the two types may result in the loss of lubrication.

When adding lubricant, keep all dirt out of the area. Wipe the fitting

completely clean and use clean grease dispensing equipment. More bearing failures are caused by dirt introduced during greasing than from insufficient grease.

If the motor is equipped with a relief port or tube, make certain it is open and free of caked or hardened grease. Before replacing relief plugs, allow excess grease or pressure to vent by running the motor for several minutes after lubrication.

7.2 PARTS

All parts should be ordered from Authorized Motor Warranty Stations. Call your Lincoln Sales Office for location and phone number. A "Service Directory" geographically listing all Authorized Motor Warranty Stations is available; request Bulletin SD-6. These shops stock GENUINE Lincoln replacement parts and have factory trained personnel to service your motor.

8. WHO TO CALL

For the location and phone number of the Lincoln Sales and Technical Support Office nearest you, check your local Yellow Pages (consumer and business-to-business) or call 1-800-MOTOR-4-U (1-800-668-6748) or visit our web site at www.lincolnelectric.com/motors.

9. WARRANTY

The Lincoln Electric Company, the Seller, warrants all standard new Inverter Duty and Vector Duty motors and accessories thereof against defects in workmanship and material, provided the equipment has been properly cared for, and operated under normal conditions. All warranty periods begin on the date of shipment to the original purchaser and are as follows:

Product Description	Warranty Period
Inverter Duty and Vector Duty motors	Five Years
Factory installed feedback devices and cooling fan motors	Two Years

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If the Buyer gives the Seller written notice of any defects in equipment within any period of the warranty and the Seller's inspection confirms the existence of such defects, then the Seller shall correct the defect or defects at its option, either by repair or replacement F.O.B. its own factory or other place as designated by the Seller. The remedy provided Buyer herein for breach of Seller's warranty shall be exclusive.

No expense, liability or responsibility will be assumed by the Seller for repairs made outside of the Seller's factory without written authority from the Seller.

The Seller shall not be liable for any consequential damages in case of any failure to meet the conditions of any warranty. The liability of the Seller arising out of the supplying of said equipment or its use by the Buyer, whether on warranties or otherwise, shall not in any case exceed the cost of correcting defects in the equipment in accordance with the above guarantee. Upon the expiration of any period of warranty, all such liability shall terminate.

The foregoing guarantees and remedies are exclusive and except as above set forth there are no guarantees or warranties with respect to accessories or equipment, either expressed or arising by option of law or trade usage or otherwise implied, including with limitation the warranty of merchantability, all such warranties being waived by the Buyer.



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For more information call:
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