

DIRECT CONNECTED DRIVE

Flexible or solid shaft couplings must be properly aligned for satisfactory operation. On flexible couplings, the clearance between the ends of the shafts should be in accordance with the coupling manufacturer's recommendations or NEMA standards for end play and limited travel in coupling. Misalignment between direct connected shafts will cause increased bearing loads and vibration even when the connection is made by means of a flexible coupling. Excessive misalignment will decrease bearing life. Proper alignment, per the specifications of the coupling being used, is critical.

ELECTRICAL CONNECTIONS

1. All wiring, fusing, and grounding must comply with National Electrical Codes and local codes.
2. To determine proper rotation and voltage connections, refer to the information and diagram on the nameplate, separate connection plate or decal if the plate or decal has been removed, contact the manufacturer for assistance.
3. Use the proper size of line current protection and motor controls as required by the National Electrical Code and local codes. Recommended use is 125% of full load amps as shown on the nameplate for motors with 40°C ambient and a service factor over 1.0. Recommended use is 15% of full load amps as shown on the nameplate for all other motors. Do not use protection with larger capacities than recommended. Three phase motors must have all three phases protected.

Motor	Wire Size For 115 & 230 Volt Single Phase Circuits									
	100 Ft. Distance - Motor To Fuse or Meter Box - Feet		200 Ft.		300 Ft.		500 Ft.		230V.	
HP	115V.	230V.	115V.	230V.	115V.	230V.	115V.	230V.	115V.	230V.
1/4	#14	#14	#10	#12	#8	#10	#6	#8	#8	#8
1/3	#12	#12	#10	#12	#6	#10	#4	#8	#8	#8
1/2	#10	#12	#10	#12	#6	#8	#4	#8	#8	#8
3/4	#10	#12	#6	#10	#4	#8	#2	#6	#6	#6
1	#8	#10	#6	#8	#4	#6	#4	#4	#4	#4
1-1/2	#4	#10	#0	#8	#6	#10	#6	#4	#2	#2
2		#8	#8	#6	#6	#4	#4	#2	#2	#2
3		#8	#8	#6	#6	#4	#4	#2	#2	#2
5		#6	#6	#4	#4	#2	#2	#0	#0	#0



Disconnect power before working on motor driven equipment.

Motors with automatic thermal protectors will automatically restart when the protector cools. Do not use motors with automatic thermal protectors in applications where automatic restart will be hazardous to personnel or equipment.

Motors with manual thermal protectors may start unexpectedly after protector trips. If manual protector trips disconnect motor from power line. After protector cools (five minutes or more) it can be reset and power may be applied to motor.

THERMAL PROTECTOR INFORMATION

The nameplate will indicate one of the following:

1. Motor is thermally protected
2. Motor is provided with overheat protective device

For example:

1. Motors without thermal protection have nothing stamped on nameplate about thermal protection.
2. Motors equipped with built-in thermal protection have "THERMALLY PROTECTED" stamped on the nameplate. Thermal protectors open the motor circuit electrically when the motor overheats or is overloaded. The protector cannot be reset until the motor cools. If the protector is automatic, it will reset itself. If the protector is manual, press the red button to reset.
3. Motors that are provided with overheat protective device that does not open the motor circuit directly will indicate "WITH OVERHEAT PROTECTIVE DEVICE" See motor connection diagram for details.

CHANGING ROTATION

1. Keep hands and clothing away from rotating parts.
2. Before the motor is coupled to the load, determine proper rotation.
3. Check rotation by jogging or bumping. Apply power to the motor leads for a short period of time, enough to just get motor shaft to rotate a slight amount to observe shaft rotating direction.
4. Three phase - Interchange any two (2) of the three (3) line leads. Single phase - reconnect per the connection diagram on the motor

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REDUCED VOLTAGE STARTING

Motors used on reduced voltage starting, should be carefully selected based upon power supply limitations and driven load requirements. The motors starting torque will be reduced when using reduced voltage starting. The elapsed time on the start step should be kept as short as possible and should not exceed 5 seconds. It is recommended that this time be limited to 2 seconds. Refer to the manufacturer for application assistance.

OPERATION

BEFORE INITIAL STARTING

1. If a motor has become damp in shipment or in storage, measure the insulation resistance of the stator winding. Minimum Insulation Resistance = 5 Megohms (use 500 volt megger!) Do not attempt to run the motor if the insulation resistance is below this value. Have the motor inspected, dried and/or cleaned. Contact a qualified motor repair shop.
 2. See that voltage and frequency stamped on motor and control nameplates correspond with that of the power line.
 3. Check all connections to the motor and control with the wiring diagram.
 4. Be sure rotor turns freely when disconnected from the load. Any foreign matter in the air gap should be removed.
 5. Leave the motor disconnected from the load for the initial start (see following caution). Check for proper rotation. Check for correct voltage (within $\pm 10\%$ of nameplate value) and that it is balanced within 1% at the motor terminals. After the machine is coupled to the load, check that the nameplate amps are not exceeded. Recheck the voltage level and balance under load per the above guidelines.
- Shut down the motor if the above parameters are not met or if any other noise or vibration disturbances are present. Consult NEMA guidelines or the equipment manufacturer if any questions exist before operating equipment.

ALLOWABLE VOLTAGE AND FREQUENCY RANGE

If voltage and frequency are within the following range, motors will operate, but with somewhat different characteristics than obtained with correct nameplate values.

1. Voltage: Within 10% above or below the value stamped on the nameplate. On three phase systems the voltage should be balanced within 1%. A small voltage unbalance will cause a significant current unbalance.
2. Frequency: Within 5% above or below the value stamped on the nameplate.
3. Voltage and Frequency together: Within 10% (providing frequency above is less than 5%) above or below values stamped on the nameplate.

CLEANLINESS

Keep both the interior and exterior of the motor free from dirt, water, oil and grease. Motors operating in dirty places should be periodically disassembled and thoroughly cleaned.

NOTE

Motors should be disassembled only by an authorized service station. DO NOT disassemble hazardous duty motors: see warning below.

CONDENSATION DRAIN PLUGS

All explosion proof and some totally enclosed motors are equipped with automatic drain plugs, they should be free of oil, grease, paint, grit and dirt so they don't clog up. The drain system is designed for normal floor (feet down) mounting. For other mounting positions, modification of the drain system may be required, consult the manufacturer.

SERVICE



1. Motors nameplated for hazardous locations should be disassembled only by the original equipment manufacturer or by a facility is UL listed under UL's category: "Motors & Generators, Rebuilt for Use in Hazardous Locations."
2. Disconnect power before working on motor or driven equipment. Motors with automatic reset thermal protectors will automatically restart when the protector cools. Do not use motors with automatic reset thermal protectors in applications where automatic restart will be hazardous to personnel or equipment.



Overgreasing bearings can cause premature bearing and/or motor failure. The amount of grease added should be carefully controlled.

INSTALLATION, OPERATION & MAINTENANCE INSTRUCTIONS FOR 320 FRAME AND SMALLER MOTORS



These instructions must be followed to ensure safe and proper installation, operation and maintenance of the motor. They should be brought to the attention of all persons who install, operate or maintain this equipment. Failure to follow instruction and safe electrical procedures could result in serious injury or fatality. Disconnect all power and discharge all capacitors before servicing. Install and ground per local and national codes. Consult qualified personnel with questions or if repairs are required.

INSTALLATION UNCRATING AND INSPECTION

After uncrating, check for any damage which may have been incurred in handling. The motor shaft should turn freely by hand. Repair or replace any loose or broken parts before attempting to use the motor. Check to be sure that motor has not been exposed to dirt, grit, or excessive moisture in shipment or storage before installation.

Measure insulation resistance (see operation) Clean and dry the windings as required
Never start a motor which has been wet without having it thoroughly dried.

SAFETY

Motors should be installed, protected and fused in accordance with latest issue of National Electrical Code, NEMA Standard Publication No. MG 2 and local codes.

Eyebolts or lifting lugs are intended for lifting the motor only. These lifting provisions should never be used when lifting or handling the motor with other equipment (i.e. pumps, gear boxes, fans or other driven equipment) as a single unit. Be sure the eyebolt is fully threaded and tight in its mounting hole.

Eyebolt lifting capacity rating is based on a lifting alignment coincident with the eyebolt centerline. Eyebolt capacity decreases as deviation from this alignment increases. See NEMA MG 2.

Frames and accessories of motors should be grounded in accordance with National Electrical Code (NEC) Article 430. For general information on grounding refer to NEC Article 250.

Rotating parts such as pulleys, couplings, external fans, unusual shaft extensions should be permanently guarded. Keep hands and clothing away from moving parts. Electrical repairs should be made by trained, qualified personnel only.

LOCATION

In selecting a location for the motor, consideration should be given to environment and ventilation. A motor with the proper enclosure for the expected operating condition should be selected.

The ambient temperature of the air surrounding the motor should not exceed 40°C (104°F) unless the motor has been especially designed for high ambient temperature applications. The free flow of air around the motor should not be obstructed.

The motor should never be placed in a room with a hazardous process, or where flammable gases or combustible material may be present, unless it is specifically designed for this type of service.

1. Dripproof (open) motors are intended for use indoors where atmosphere is relatively clean, dry and non-corrosive.
2. Dripproof (open) fire pump motors are to be installed in a Type 2 dripproof environment as defined in NEMA 250.
3. Totally enclosed motors may be installed where dirt, moisture and corrosion are present.
4. Totally enclosed - severe duty motors are recommended for extreme environmental conditions.
5. Explosion proof motors are built for use in hazardous locations as indicated by Underwriters' label on motor. Consult UL, NEC, and local codes for guidance.

FLOOR MOUNTING

Motors should be provided with a firm, rigid foundation, with the plane of four mounting pads flat within 0.10" for 56 to 210 frame; 0.15" from 250 through 320 frame. This may be accomplished by shims under the motor feet.

V-BELT DRIVE

1. Align sheaves carefully to avoid axial thrust on motor bearing. The drive sheave on the motor should be positioned toward the motor so it is as close as possible to the bearing.
2. When adjusting belt tension, make sure the motor is secured by all mounting bolts before tightening belts.
3. Adjust belt tension to belt manufacturers recommendations. Excessive tension will decrease bearing life.
4. Sheaves should be in accordance to NEMA Spec. MG-1 or as approved by the manufacturer for a specific application.

NOTE

If lubrication instructions are shown on the motor nameplate, they will supersede this general instruction.

Motors are pregreased with a mineral oil polyurea NGL1 grade 2 type grease unless stated otherwise on the motor nameplate. Some compatible brands of mineral polyurea base type grease are: Chevron SRI#2, Rykon Premium #2, Shell Oil Dolum R, Texaco Polystar RB, or Polyrex EM.

Motors are properly lubricated at the time of manufacture. It is not necessary to lubricate at the time of installation unless the motor has been in storage for a period of 12 months or longer (refer to lubrication procedure that follows).

LUBRICATION PROCEDURES

1. Stop motor. Disconnect power and lock out of service.
2. Remove contaminants from grease intel area.
3. Remove filler and drain plugs.
4. Check filler and drain holes for blockage and clean as necessary.
5. Add proper type and amount of grease. See the Relubrication Time Intervals table for services schedule and Relubrication Amounts table for volume of grease required.
6. Wipe off excess grease and replace filler and drain plugs (see following warning).
7. Motor is ready for operation.



If motor is nameplated for hazardous locations, do not operate motor without all of the grease or drain plugs installed.

RELUBRICATION TIME INTERVAL (For motors with regreasing provisions).

Service Condition and less	NEMA FRAME SIZE			
	140-180	210-360	400-510	Over 1800 RPM
Standard	Over 1800 RPM and less	Over 1800 RPM and less	Over 1800 RPM and less	Over 1800 RPM
Severe	2 yrs.	6 months	1 yr.	3 months
Seasonal	3 months	3 months	6 months	1 months

See Note 2.

NOTES

1. For motors nameplated as "belted duty" only divide the above intervals by 3.
2. Lubricate at the beginning of the season. The follow service schedule above.

SEASONAL SERVICE: The motor remains idle for a period of 6 months or more.

STANDARD SERVICE: Up to 16 hours of operation per day, indoors, 40°C maximum ambient

SEVERE SERVICE: Greater than 16 hours of operation per day, Continuous operation under high ambient temperatures (40° to 65.5°C) and/or any of the following: dirty, moist locations, high vibration (above NEMA standards), heavy shock loading, or where shaft extension end is hot.

RELUBRICATION AMOUNTS

(For motors with regreasing provisions).

NEMA FRAME SIZE	VOLUME cu. in. (fluid oz.)	NEMA FRAME SIZE	VOLUME cu. in. (fluid oz.)
140	.25 (.14)	320	1.50 (.83)
180	.50 (.28)	360	1.75 (.97)
210	.75 (.42)	400	2.25 (1.2)
250	1.00 (.55)	440	2.75 (1.5)
280	1.25 (.69)	500	3.00 (1.7)