

# READ These INSTRUCTIONS Before INSTALLING

## INSTRUCTIONS

### HORIZONTAL, POLYPHASE INDUCTION MOTORS

SQUIRREL CAGE AND WOUND ROTOR—OPEN AND SPLASHPROOF

FRAMES 203 TO 579 INCLUSIVE AND FRAMES 6323 TO 6339 INCLUSIVE

*These instructions do not purport to cover all details or variations in equipment nor to provide for every possible contingency to be met in connection with installation, operation or maintenance. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to the General Electric Company.*

### INSTALLATION

#### Location

1. OPEN MOTORS. Install in a clean, well-ventilated place. If motors are stored, store in a clean, dry place.
2. SPLASHPROOF MOTORS. Where a choice of locations is possible, locate the motor so that it will be subjected to the least amount of splashing.

#### Lifting

When lifting a motor, it is advisable to lift by means of slings placed under the bearing housings.

#### Floor Mounting

1. FOUNDATION should be rigid and solid. Level the motor base (or motor). A motor base on a concrete foundation should be grouted in place.

#### Wall or Ceiling Mounting

1. OIL-LUBRICATED, SLEEVE-BEARING MOTORS (may be identified by spring-cover sight hole on top of bearing housing): End shields should be located with oil-filler gage in horizontal position below the center of the shaft.
2. GREASE-LUBRICATED, BALL-BEARING MOTORS (may be identified by pressure-grease fitting on top of bearing housing): End shields should be located with pressure-gun fitting on top as close to vertical as the bolt holes permit.

NOTE: Screenless open type textile motors are not designed to permit end shield rotation for wall or ceiling mounting.

#### Tilted and Vertical Mounting

1. SLEEVE-BEARING, OIL-LUBRICATED MOTORS should always be mounted with the shaft horizontal.
2. GREASE-LUBRICATED, BALL-BEARING MOTORS in Frames 203-326 (incl) may be operated in any position, provided excessive thrust loads are not imposed.

Motors in Frames 365 and larger should have the bearings modified for vertical operation.

#### Mounting a Motor Having Wool-yarn-packed Sleeve Bearings

A motor having wool-yarn-packed sleeve bearings should always be mounted so that the load will never be applied on the side of the bearing lining in which the opening for oil feeding appears.

#### Face or Flange Mounting

Carefully align the motor with the driven unit and securely bolt into place.

#### Alignment

Always align accurately with the driven unit. When aligning an adjustable base, allow for movement, and locate the adjusting screwhead away from the driven unit.

#### Coupled Drive

When the motor and driven unit together have four or more bearings, flexible couplings may be used to facilitate alignment. Three-bearing construction requires rigid coupling.

#### Flat Belt Drive

Arrange the location of the driving and driven shaft so that they are parallel. Adjust belt tension just enough to prevent slippage; excess tension unnecessarily loads the bearings. Avoid a vertical drive; an angle of 45 deg or less between the line of shaft centers and the horizontal is desirable. Distance between centers should be at least  $2\frac{1}{2}$  times the diameter of the larger pulley unless a belt-tightener attachment is used. Pulley ratio should not exceed 5 to 1. Belt speed should not exceed 5000 feet per minute. If possible, make the lower side of belt the driving side. Run the grain or smooth side of the belt on the pulleys. Check the recommendations of the belt manufacturer for the diameter of the smallest pulley to use for a particular belt thickness.

#### "V" Belt Drive

Align the sheaves carefully to avoid thrust on the bearings. Adjust belt tension just enough to prevent excessive sag of the slack side. If possible, make the lower side the driving side. Pulley ratio should not exceed 8 to 1. Belt speeds should not exceed 5000 ft per minute, unless otherwise recommended by belt manufacturer. Check recommendations of belt manufacturer for the diameter of the smallest sheave which should be used.

#### Chain Drive

Align sprockets and adjust chain just enough to permit a slight sag on the slack side. Avoid vertical drive; an angle of 45 deg or less between the line of shaft centers and the horizontal is desirable. The distance between shaft centers should not be less than the diameter of the larger sprocket plus the radius of the smaller. If possible, make the lower side the driving side. Consult the chain manufacturer for maximum ratio and speed of chain, minimum sprocket diameter, and lubrication of the chain.

#### Gear Drive

Motor should be ball-bearing type for helical gears since they impose axial thrust on the bearings. The pinion diameter should not be less than that recommended by the General Electric Company. When quiet gear drive is desired, Textolite pinions with helical teeth should be used. Consult the nearest sales office of the General Electric Company for recommendation.

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#### Position of Oil Filler Gage

Oil filler gages on sleeve-bearing motors may be located on the most convenient side of the bearing housing. However, it is desirable to locate the gage on the side of the housing on which the oil ring enters the oil. Use oil sealing compound (such as G-E No. 1201 Glyptal compound) on threads on pipe plug and oil filler gage when interchanging.

#### Position of Conduit Box

It is standard practice to locate the conduit box on the left-hand side of the motor viewed from the driving end. The conduit box may be located on the opposite side by removing the end shields and rotor, turning the stator frame around, and reassembling.

Relocating the position of the secondary leads of wound-rotor motors requires redrilling and rethreading the end shield at the desired point.

#### Connection of Stator Winding

Single-speed motors with three leads (three phase) or four leads (two phase) for single voltage should have leads connected one to each line.

Single-speed motors with nine leads (three phase) or eight leads (two phase) for dual voltage should be connected in accordance with the connection diagram plate on the motor.

Multispeed motors should be connected in accordance with the diagram, the number of which is stamped on the nameplate.

#### Wiring and Grounding

Motor and control wiring, overload protection, and grounding should be done in accordance with the National Electrical Code and local requirements.

## OPERATION

#### Before Initial Starting

1. If a motor has become damp in shipment or in storage, it is advisable to measure insulation resistance of the stator winding with an insulation-resistance meter; this value should be not less than:

$$\frac{\text{Rated voltage}}{(0.75 \times \text{hp rating}) + 1000} \text{ megohms}$$

2. If insulation resistance is lower than this value, it is advisable to dry out the moisture in one of the following ways:
  - a. Bake motor in oven at temperature not exceeding 90 C until insulation resistance becomes practically constant.
  - b. Enclose motor with canvas or similar covering, leaving a hole at the top for moisture to escape, and insert heating units or lamps.
  - c. Pass a current at low voltage (rotor locked) through the stator windings. Increase the current gradually until winding temperature, measured with a thermometer, reaches 90 C. Do not exceed this temperature.
3. See that the voltage and frequency stamped on motor and control nameplates correspond with that of the line.
4. Check all connections to the motor and control with the wiring diagrams.
5. For sleeve-bearing motors fill each sleeve-bearing reservoir, through the oil filler gage to within  $\frac{1}{8}$  inch of the gage overflow level, with a good grade of mineral oil.

**NOTE:** Oil-lubricated, sleeve-bearing motors in frames covered by these instructions are shipped without oil.

Grease-lubricated, ball-bearing motors are shipped with bearing housings packed with grease.

6. Be sure rotor turns freely, and does not rub when disconnected from load. Any foreign material in the air gap should be removed.
7. Leave the motor disconnected from the load for the initial start; it is desirable to operate the motor without load for about one hour to test for any unusual localized heating in bearings and windings. Be sure that the oil ring on sleeve-bearing motor turns freely. Check for proper rotation.

#### Reversal of Rotation

Three-phase: Interchange any two line leads.  
Two-phase: Interchange lines of either phase.

#### Heating

Open and splashproof motors are rated 40 C rise and 50 C rise respectively. The actual operating temperature of the motor, however, is this rise plus the temperature of the surrounding air. An open motor operating in a 30 C (86 F) temperature, for example, may reach a total temperature of  $40 + 30 = 70$  C (158 F). These motors will withstand a maximum observable temperature of 90 C (194 F) without harm to the insulation if encountered infrequently.

#### 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 per cent above or below the value stamped on the nameplate.
2. Frequency: Within 5 per cent above or below the value stamped on the nameplate.
3. Voltage and Frequency together: Within 10 per cent (providing frequency alone is less than 5 per cent) above or below values stamped on the nameplate.

## MAINTENANCE

#### Oil Sleeve Bearings

For average indoor temperatures, use a good grade of mineral oil having a viscosity of 150 to 200 seconds Saybolt at 100 F. For higher temperatures and for slow-speed belted motors, slightly heavier oil with a viscosity of 250 to 350 seconds Saybolt at 100 F may be required. (In automotive terms, the above viscosities correspond to SAE No. 10 and SAE No. 20 respectively, but turbine oil rather than automotive oil is recommended.) Reputable oil companies should be consulted regarding special lubricants for unusual operating conditions.

#### Cleaning Sleeve Bearings

Sleeve-bearing housings are provided with liberal settling chambers into which dust, dirt, and oil sludge collect. The only cleaning necessary is to remove the drain plug and drain the oil, which will flush out most of the settled material with it.

**NOTE:** Frames 203, 204, 224, and 225 do not have drain plugs, and may be flushed through the oil filler gage. After draining, seal the threads of the drain plug with an oil sealing compound (such as G-E No. 1201 Glyptal compound) and refill the oil reservoir.

Whenever the motor is disassembled for general cleaning, the bearing housing may be washed out with a solvent such as carbon tetrachloride. Dry the bearing lining and cover the shaft with a film of oil before assembling.

#### Wool-yarn-packed, Oil-lubricated Sleeve Bearings

##### Oiling:

Wool-yarn-packed, oil-lubricated, sleeve-bearing motors are shipped less oil but with a packing of good grade coarse wool yarn in place in the bearing housings.

Before starting the motor initially remove the drain plug and pour a liberal quantity of oil over the yarn and bearing lining, allowing the excess oil to drain off. Replace the drain plug, coating it with an oil-sealing compound (such as G-E No. 1201 Glyptal compound). Add oil through the oil filler gage before starting the motor and at regular intervals\* thereafter, maintaining a level approximately  $\frac{1}{8}$ -inch below the top of the gage. For average indoor temperature a good grade of mineral oil as described on page 2 under Oil Sleeve Bearings should be used. Pick up and repack the yarn occasionally\* to prevent its becoming matted.

\* NOTE: The length of time intervals must be determined by the motor user since it depends upon the severity of operating conditions. Wipe housings dry after any spillage or overflow.

##### Cleaning:

Used oil should be drained off and new oil added occasionally as outlined above.

Whenever the motor is disassembled for general cleaning and reconditioning, the yarn packing should be removed, the bearing housing washed clean with a solvent such as carbon tetrachloride, and the housing repacked with clean wool yarn. The new yarn should be saturated with oil as outlined above.

#### Removal of Sleeve-bearing Lining (Tri-Clad Motors)

- (a) Remove baffle inside end shield. (For Frames 203 to 326. On larger frames, this is unnecessary.)
- (b) Remove oil well cover plate.
- (c) Remove oil ring retaining clip.
- (d) With oil ring disengaged, bearing lining can now be tapped out.

#### Greasing Ball Bearings

Ball-bearing motors covered by these Instructions are usually shipped with the bearing housings packed with G-E grease. However, to be sure there is sufficient grease present before placing the motors in operation, more grease should be added to each bearing, using the procedure outlined below. After the initial start, the length of time before adding grease again depends upon operating conditions.

These ball-bearing motors are equipped with pressure-gun grease fittings and pressure-relief plugs which, if used according to instructions, provide convenience in greasing. The grease should be added as often as operating conditions demand with a hand-operated (not pedal- or air-operated) pressure gun as follows:

1. Wipe clean the pressure gun fitting and the regions around the fitting and relief plug.
2. Remove relief plug.
3. Free the relief hole of any hardened grease.
4. Add grease with the motor running until it is expelled through the relief hole. (If fittings are not safely accessible with motor running, grease may be added sparingly with motor at rest.)

Adding until new grease is expelled purges the housing of old grease.

5. Run the motor for about 20 minutes with the relief plug removed to expel excess grease.
6. Clean and replace the relief plug.

Exclusion of dirt from the housings and the lubricant is very important.

A good grade of grease should be used, having the following characteristics:

- a. ASTM worked consistency 300-330 with minimum change over the range of operating temperatures.
- b. Melting point preferably above 150 C.
- c. Freedom from separation of oil and soap.
- d. Freedom from abrasive matter and acidity.

For the convenience of motor users, the General Electric Company can supply special G-E greases in cans and drums.

#### Cleaning Ball Bearings

Since the method of greasing ball bearings tends to purge the housing of used grease, removal of all grease should be required infrequently. Whenever the motor is disassembled for general cleaning, however, the bearings and housings should be cleaned of old grease by washing with carbon tetrachloride.

If desired, ball bearings of horizontal motors only can be cleaned without disassembly of the motor as follows:

1. Remove pressure fitting and relief plug.
2. Free both holes of any hardened grease.
3. Replace bottom relief plug and fill housing with flushing liquid, with the motor running. After about 10 minutes, drain off. Repeat this process adding enough liquid to partly fill the housing each time, until the liquid being drained comes out clear, showing that most of the grease has been removed.
4. Rinse housing free of carbon tetrachloride with small amounts of light mineral oil **only** if carbon tetrachloride was used for flushing. Replace relief plug.

#### Removal of Ball Bearings

Ball bearings can be removed from the rotor shaft by using a puller, or by tapping against the bearing cartridge or cap located on the shaft between the bearing and the rotor.

#### Cleaning Assembled Motor

The interior and exterior of the motor should be kept free from dirt, oil, and grease. Motors may be blown out with dry compressed air of moderate pressure. If possible, however, clean by suction because of the danger of moisture in compressed air and blowing metal chips, etc., into the insulation. Motors operating in dirty places should be disassembled and cleaned periodically.

#### Cleaning Insulation

Whenever the motor is disassembled for general cleaning, the insulation may be cleaned as follows:

1. Brush windings free of dust, and wash with cloth or brush wetted with carbon tetrachloride. Carbon tetrachloride is very volatile, and will not soak or injure the insulation if not applied too generously. Allow plenty of ventilation, to avoid toxic effects.
2. Dry the insulation by one of the methods explained under OPERATION.

- When winding is dry and still warm, apply a high-grade insulating varnish by brushing, spraying, or dipping. Bake for 6 or 7 hours at a temperature not exceeding 90 C, or merely allow the winding to dry if a quick and air-drying varnish is used. More than one coat of varnish may be required, depending on the condition of the winding.

The General Electric Company can furnish insulating varnish best suited for definite operating conditions. Consult the nearest G-E office.

#### Collector Rings (Wound-rotor Motors Only)

The collector rings are sometimes slushed at the factory to protect them while in stock and during shipment. The brushes have been fastened in a raised position. Before putting the motor into service, the brushes should be set down on the collector surface.

Keep the rings clean and maintain their polished surfaces. Ordinarily the rings will require only occasional wiping with a piece of canvas or nonlinting cloth. Do not let dust or dirt accumulate between the collector rings.

#### Brushes (Wound-rotor Motors Only)

See that the brushes move freely in the holders and at the same time make firm, even contact with the collector rings. The pressure should be between 2 and 3 lb per square inch of brush surface.

When installing new brushes, fit them carefully to the collector rings. Be sure that the copper pigtail conductors are securely fastened to, and make good contact with the brush holders.

#### Air Gap (Sleeve-bearing Motors)

When the air gap of a sleeve-bearing motor, as measured with a tapered air-gap gage, is less than the minimum value given in the table below, the bearing linings may need replacement:

#### APPROXIMATE MINIMUM AIR GAP

Frame Number	Minimum Air Gap in In.
203 to 326 incl	0.008
364 to 559 incl	0.014
6323 to 6339 incl	0.014
561 to 579 incl	0.020

#### (Ball-bearing Motors)

Ball bearings do not wear gradually; rather, if they fail, they do so completely in a very short time. Therefore, there is no need to check air gap on a ball-bearing motor.

#### Locating Troubles

If trouble is experienced in the operation of a motor, make sure that:

- The bearings are in good condition and are lubricated properly.
- There is no mechanical obstruction preventing rotation.
- The air gap is substantially uniform.
- All bolts and nuts are tightened securely.

In checking for electrical troubles, be sure:

- That voltage is actually available in all phases at the motor terminals.
- That line voltage and frequency correspond to the values stamped on the motor nameplate. (Refer to paragraph on "Allowable Voltage and Frequency Range.")
- That the overload protective devices are in proper condition.
- That all connections and contacts are properly made in the circuits between the control apparatus and the motor.
- That the motor is not excessively overloaded. This may be checked by comparing line amperes with the full-load ampere rating stamped on the nameplate.

#### Renewal Parts

When ordering renewal parts give quantity, catalog number if available, description of each item required, and the model number of the motor.

Requests for additional copies of these instructions or inquiries for specific information should be addressed to the nearest sales office of the General Electric Company.

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