Instructions for Large AC Motors - Vertical Frames 504 through 688.5 - Dripproof - WPI Construction Squirrel Cage and Wound Rotor

I.L. 3100-26

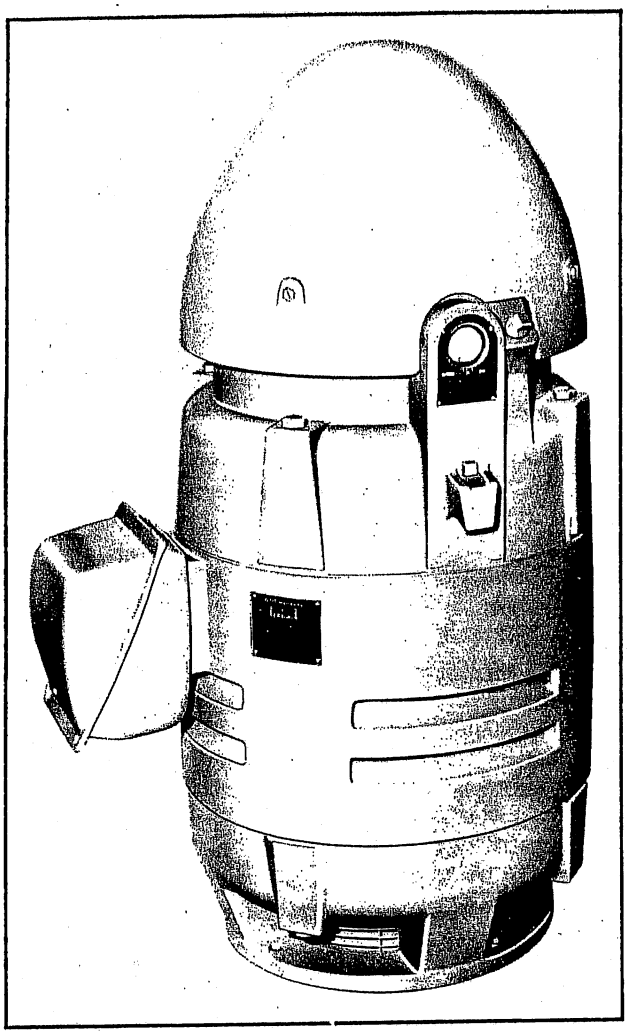

Figure 1 Typical Motor Frame 504 to 509

Large AC vertical normal thrust or high thrust motors either squirrel cage or wound rotor type in NEMA frame sizes 500 through 688.5 are either solid shaft or hollow shaft squirrel cage induction motors specifically designed to drive vertical pumps. The stator core is enclosed in a specially designed, ventilated, dripproof, steel frame. The ends of the frame are protected by cast brackets which carry the bearings.

A hood protects the upper parts from the elements. It is of one piece, reinforced Fiberglas construction.

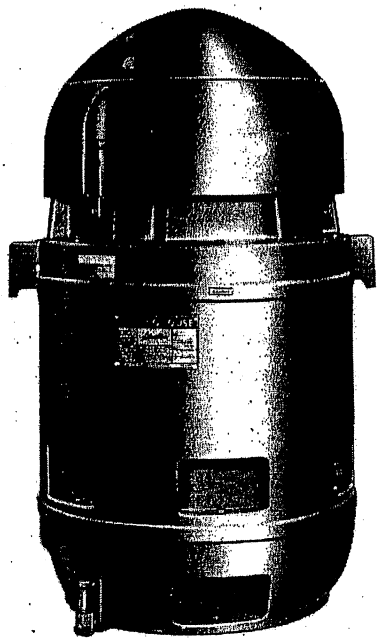

Figure 2 Typical Motor Frame 584 to 688.5

WARRANTY

Westinghouse warrants that the equipment delivered by it will be of the kind and quality described in the order or contract and will be free of defects in workmanship or material. Should any failure to conform to this warranty appear within one year after date of initial operation, not to exceed 18 months after date of shipment, Westinghouse shall, upon prompt notification from the purchaser, and provided that (1) the equipment has been stored, installed, operated and maintained in accordance with the order or contract, generally acceptable industry practices and Westinghouse instructions, and (2) that the equipment has not been subjected to alteration, misapplication or misuse, correct such nonconformity by repair or replacement f.o.b. point of shipment, of the nonconforming part or parts. Westinghouse shall not be responsible for providing working access to the defect. Correction of nonconformities, in the manner and for the period of time provided above, shall constitute

fulfillment of all liabilities of Westinghouse with respect to the quality of the equipment. The foregoing warranty is exclusive and in lieu of all other warranties of quality whether written, oral, or implied including any warranty of merchantability or fitness for purpose.

Any defects that may develop should be referred to the nearest Westinghouse Sales Office for complete servicing information.

Unauthorized Repairs

In the event that the customer sends his motor to an unauthorized Repair Shop, the coverage of this warranty policy is automatically terminated.

RECEIVING

Unpack the motor and make certain that it was not damaged during shipment.

Check to see that the nameplate data agrees with the voltage and frequency of the power supply provided for the motor.

On solid shaft motors, the extension is coated with a slushing compound to prevent rusting during shipment and storage. This slushing compound may be removed by wiping with turpentine or any petroleum solvent such as benzine, gasoline, Stoddard solvent, etc. See precautions under "Maintenance" for use of these solvents.

STORAGE

If motor must be stored temporarily, place it under cover in a clean dry location; it is recommended that space heaters or other reliable heating means be used to protect windings from excessive moisture absorption. Bearing oil reservoirs should be filled with a good grade of rust inhibiting oil and shaft should be rotated at one month intervals. See also page 9 "Guard against moisture."

If storage is to be prolonged, motor should be prepared for long-term storage; refer to nearest Westinghouse Sales office for assistance.

INSTALLATION

Mounting

Locate the motor in a place that is well ventilated. If protecting shields or guards are used, they must not obstruct the free flow of air around the motor. The external air temperature should not exceed 40°C. or 104°F., unless the motor has been specially designed or otherwise cleared for use in higher ambient.

Fasten to rigid foundation using bolts or screws of the largest size permitted by the drilling in the flange mounting.

After line-up is complete, dowel motor to the foundation using two dowel bolts approximately 90° apart.

Accurate alignment between motor and pump is of extreme importance. Misalignment will result in bearing trouble. The foundation or pump column on which the motor is mounted must be rigid enough to prevent excessive vibration. These motors are suitable for vertical mounting only.

Install motors on a non-combustible surface. Never install where hazardous, inflammable or combustible vapors or dust are present.

Method of Drive

A. Solid Shaft

Motor shaft must be coupled to the pump shaft through a rigid coupling so that pump thrust will be transmitted to the thrust bearing. These motors are designed to take the momentary up thrust often present during pump start up. This momentary up thrust is taken by the guide bearing in the lower bracket. If momentary up thrust is present, the motor shaft must move axially to accommodate it; this axial movement will be from 0.020 inches minimum to 0.040 inches maximum. For those pumps where the normal operating thrust may be either up or down, taking the up thrust on the lower bearing is not desirable and a thrust bearing

capable of taking thrust in either direction must be used; motors for driving such pumps will have no end play.

NOTE

Coupling halves should fit tight on the shaft extension and must be securely locked to avoid hammering out in operation. If it is necessary to drive the part into position, it is important, that the end of the shaft opposite the extension be backed up so that the force of the blow is not taken in the bearing. Use a pinion puller for removing tight couplings.

B. Hollow Shaft

The pump shaft extends through the hollow motor shaft and is coupled to the motor at the upper end through the coupling supplied with the motor. This coupling can be used as a disengaging clutch if up thrust is present or if the disengaging feature is not desired, it can be solidly bolted to the motor drive hub. Up thrust provisions are the same as for the solid shaft motors and are discussed in the paragraph on Solid Shaft Drives. On hollow shaft drives, a small flinger (See Figure 3) should be installed on the pump shaft between the pump shaft gland and the base of the motor to keep water that might spray from the gland from entering the lower bearing of the motor.

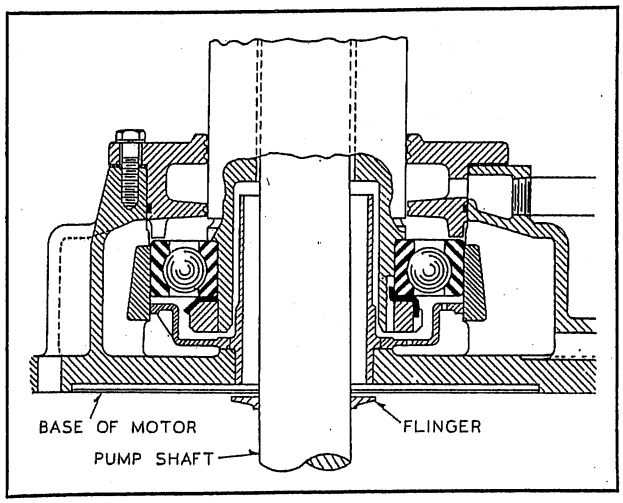

Figure 3 Cross Sectional View of Lower Bearing

The motor may be equipped with either ratchet or clutch type couplings (as specified by purchaser) as follows:

1. Ratchet Type - These motors are equipped with non-reverse ratchet that permits rotation in the CCW direction only. The ratchet consists of a stationary member with teeth or steps cast into it and a rotating member with pins operating in vertical holes. When the motor starts in the forward or CCW direction, the inclined faces of the ratchet teeth throw the pins upward where they are held by centrifugal force and friction. When the motor stops, the pins drop and prevent CW or reverse rotation by striking the vertical faces of the teeth. Refer to Figure 4.

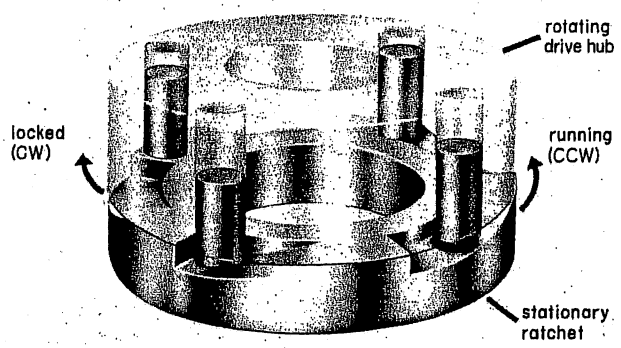

Figure 4 Ratchet Assembly

2. Clutch Type - These motors are equipped with a disengaging clutch that consists of a coupling and a drive hub. The drive hub is keyed to the motor shaft, and the coupling is keyed to the pump shaft and attached through a screw to the adjusting nut. The coupling centers on the drive hub by means of a machined fit. The coupling is driven by two pins attached to the coupling and engaging corresponding holes in the drive hub. Disengagement of the clutch is caused by a lifting of the pump shaft which separates the pins in the coupling from the holes in the drive hub. Refer to Figure 5.

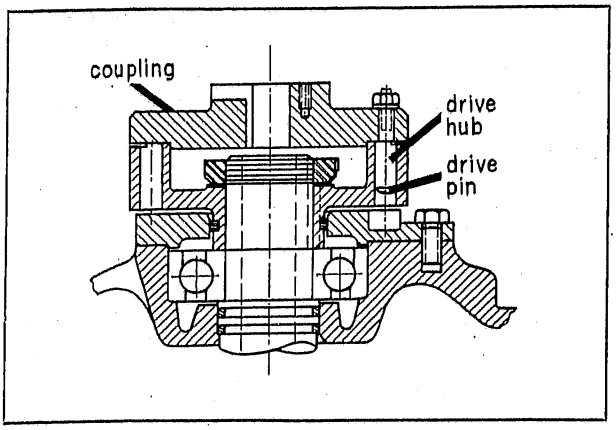

Figure 5 Pin Type Coupling

Both types of couplings shown in Figures 4 and 5 are bolted to the drive hub at the factory for shipping purposes.

Electrical Connections

Be sure the motor is connected as shown on the nameplate diagram, and that the power supply (voltage, frequency, and number of phases) corresponds with the nameplate data. Connect the motor to the power supply through a suitable switch and overload protection. Install all wiring and fusing in accordance with the National Electric Code and local requirements.

For wound rotor motors check the secondary voltage on the nameplate with the control and with the service intended. Motors with secondary voltage above 300 volts should not be connected to a reversing controller.

OPERATION

Before starting motor, check for lubrication. Normal thrust motors (See Description Page 4) are grease lubricated and need no additional lubrication but the other motors need to have the oil reservoirs filled with the proper lubricant. See description on page 6 for detailed instructions.

Run the motor without load to check the connections and the direction of rotation. Motors suitable for only one direction of rotation will have a directional arrow denoting proper rotation. If it is desirable to operate contrary to the indicated rotation, refer to the nearest sales office as it may involve changing the blowers and or clutch arrangements.

To change the direction of rotation

Three phase motors - interchange any two line leads.
Two phase motors - interchange the line leads of either phase.

Repeated starts on jogs greatly reduce the life of the winding. (See NEMA Standards MG1-20.43).

The motor will operate satisfactorily with a 10 percent variation in voltage, a 5 percent variation in frequency or a combined voltage and frequency variation of 10 percent, but not necessarily in accordance with the standards of performance established for operation at normal rating.

Never start a wound rotor motor without secondary resistance in the circuit or brushes and collector rings will be burned and pitted. Be sure brushes are contacting slip rings and are free to slide in the holders before applying power to operate a wound rotor motor.

DESCRIPTION OF BEARINGS AND LUBRICATION

Vertical motors have several different types of bearing assemblies depending on the thrust capacity specified on the order. There are two basic types - Normal Thrust and High Thrust. Refer to nearest Sales Office for thrust capacities of each type.

1. Normal Thrust Bearing

Description - On orders for normal thrust where high thrust is not specified, the thrust bearing is located in the lower

bracket. This is a ball bearing and is locked on the shaft; it takes thrust in both directions. The upper bearing is also a ball bearing and acts as a guide bearing and does not take any vertical thrust.

Lubrication - On normal thrust designs, both bearings are grease lubricated. When shipped from the factory, the bearings have sufficient grease of the right grade to last for a limited period. However, a charge of grease should be added soon after the motor is put into operation and thereafter at suitable intervals, as determined by experience.

Too much grease will cause churning, overheating and grease leakage. Guard against introduction of dirt when regreasing by keeping fittings clean at all times. If high pressure guns are used, great care should be taken to avoid overlubrication.

As a guide to the amount of grease to be added and the frequency of greasing, see the following charts.

Greasing Schedule

Method of Drive	Hours Operation	Greasing Intervals		
		8 Hr. Day	16 Hr. Day	24 Hr. Day
Belt, Chain or Gear (1800 RPM or less)	1000	4 Mo.	2 Mo.	1-1/3 Mo.
Coupled (1800 RPM or less)	2000	8 Mo.	4 Mo.	2-1/3 Mo.
Coupled (3600 RPM)	1000	4 Mo.	2 Mo.	1-1/3 Mo.

Note: For severe dirt, weather exposed, high humidity or high ambient, cut time intervals to 1/2 of the above schedule.

Guide to Amount of Grease

Shaft Diameter at Bracket	Amount of Grease to Add
Up to 2-3/8	1-1/4 cu. in.
Above 2-3/8 to 3	2
Above 3 to 4	3
Above 4 to 5	4

Note: 1 oz. = 1-1/4 cu. in.

Standard Westinghouse Grease #55272-BA
Ordering Data

8 oz. tube	S# 1781386
1 lb. can	S# 1781387
5 lb. can	S# 1781388
35 lb. can	S# 1781389

NOTE

Some motors for special applications (such as motors exposed to higher than normal temperature conditions) will require a special grade of grease. These motors will be identified by having a special nameplate giving special greasing instructions. In such cases do not use the standard grease.

When regreasing the motor it is preferable to stop the motor. To regrease, proceed as follows: Remove drain plug - add new grease - operate motor for at least ten minutes to allow excess grease to drain out - replace drain plug. On motors using long grease pipes, the pipes should be cleaned to remove any hardened grease. This applies to both inlet and outlet pipes.

It is desirable for the most satisfactory service, to open the bearing housing once a year, or after every 5000 hours operation, to check the condition of the housing and grease. If difficult to inspect the pulley or pinion end bearing, the condition of the bearing at the opposite end will usually be representative of both. If grease deterioration has occurred or if dirty, the bearing and housing parts should be thoroughly cleaned out and new grease added. Clean with suitable solvent such as Trichloroethylene. In some cases, it may be necessary to entirely remove the bearing from the shaft to clean it properly. For disassembly of the bearing housing see notes under "Removal of Brackets and Removal of Bearings".

2. High Thrust Bearings

Description - For the motors designed to take high thrust, the thrust bearing is located in the top bracket. It may be an angular contact ball bearing mounted singularly, in duplex tandem or duplex back to back, but more likely it will be a spherical roller thrust bearing. In general, motors with speed of 1200 RPM or less will have spherical roller bearings while those with higher speeds will have angular contact ball bearings. To obtain very high thrust capacities, spherical roller bearings are required and are used with water cooling at speeds up to 1800 RPM. Bearings are normally cooled by the motor cooling air drawn in over the bearing pot. Where water cooling is required, it is accomplished with a continuous copper tube immersed in the oil with water connections brought out the bottom of the pot so that the coil will drain. Where water cooling is necessary approximately three gallons per minute of water is required; either connection can be used as the inlet. Use only clean water unless motor was specifically ordered to withstand corrosive water. When shut down during freezing weather, blow any remaining water out of the coil.

Spherical roller thrust bearings require a small thrust load at all times to prevent separation of the bearing and smearing of the rollers. This thrust load is provided by die springs inserted in a plate which forms the seat of the outer race of the bearing. These springs are compressed during assembly and tend, at all times, to lift the outer race of the bearing thus placing a thrust load on the bearing. If the spring load is greater than the rotor weight, the excess is taken on the guide bearing. This arrangement also permits taking momentary up thrust on the bottom bearing. When operating normally with down thrust, the springs under the bearing are completely compressed and the lower guide bearing is fully relieved and runs free and the springs impose no extra load on the thrust bearing; they merely form part of its seat. Where the thrust bearing is an angular contact ball bearing, springs are used under it to provide a light thrust load during up thrust operation to prevent looseness and vibration of the bearing.

CAUTION

Motors with spherical roller thrust bearing must never be operated unless the springs under the bearing are in place and the lower bearing cap is securely bolted down with the

proper number of shims in place under it.

The lower or guide bearing in these motors is a standard radial type ball bearing. It is oil lubricated and air cooled.

NOTE

On some motors requiring very high thrust capacity, a tilting pad thrust bearing is supplied. A description and operating instructions is given on supplemental leaflet I.L. 3830-11.

Lubrication

All bearings are oil lubricated. Where the thrust bearing is a spherical roller type a good quality lubricating oil with a viscosity of 1000 to 1300 SSU at 100 degrees F should be used. If the thrust bearing is an angular contact ball bearing, the oil should have a viscosity of 180 to 220 SSU at 100 degrees F. The lubrication instruction plate on the motor will specify the correct grade of lubricant. The oil level when running will vary from that at standstill. The oil level should be checked only at standstill or a comparison of the levels at standstill and running should be made and noted. The oil should be changed at six month intervals. There should be no need to add oil between changes; if a drop in oil level is noted, then the motor should be carefully examined for signs of a leak.

CAUTION

Do not fill beyond the level marked on the gauges. Overfilling may result in syphoning of oil around the shaft with consequent soaking of the windings with oil and possibly failure of the bearing.

On motors equipped with constant level oilers, fill the bottle with oil, insert quickly into place. Repeat until bottle remains partially filled. It is necessary that oil be visible in the bottle for proper bearing lubrication. Do not operate motor unless bottle is partially filled with oil.

If any oil is accidently spilled on the bracket, it should be wiped off with a rag. Do not allow oil to get on the windings which may lead to deterioration of the insulation.

DISASSEMBLY OF MOTOR

1. Remove hood (only center piece need be removed), top cover plate, ratchet hub or drive hub, and ratchet plate or splash plate. Do not remove the plate supporting water coils in water-cooled bearings unless coils need repair.

2. Loosen the lower bearing cap and support the lower end of the shaft with a jack or blocks.

3. Remove nut and lock washer from upper end of shaft and pull runner with bearings from the shaft. Runner fit on shaft is a light tapping to sliding fit, .0005 to .0022" loose. Remove key from shaft.

4. Remove bolts securing upper bracket to stator frame and lift upper bracket from frame.

5. Lift shaft, rotor and lower bearing assembly out of stator, and separate frame and lower bracket.

ASSEMBLY OF MOTOR

1. Bolt frame to lower bracket.

2. If lower bearing was removed from shaft, make sure bearing cap is slipped over shaft before bearing is replaced. To replace bearings, heat in a bearing oven or oil bath for 1/2 hour at temperature of approximately 190 degrees F, but not exceeding 212 degrees F. Slip hot bearing on shaft or runner and hold bearing in place until it cools enough to grip shaft or runner. Do not proceed with assembly until completely cooled.

3. Place shaft, rotor and lower bearing assembly in stator and put upper bracket in place and bolt to frame.

4. Remove springs from under outer race of upper bearing leaving the spring plate in place. Replace bearing and runner and with a jack under lower end of shaft, raise shaft until lower bearing cap lifts approximately 1/4 inch, tighten nut holding runner to shaft to pull runner snug against shaft shoulder; do not bend lock washer to lock in place.

5. Release jack; rotor assembly is now in normal running position. Check to be sure bearing is seated, can be made through feeler gauge holes inside of upper bearing seat. Pull O-ring back over top of lower bearing cap so that it is out of the way and remove all shims. Let bearing cap rest on lower bearing making sure that it touches bearing. With a feeler gauge, check gap between lower bearing cap and bracket and record value. Check at several spots around to insure that cap is even. To the value obtained with the feeler gauge, add .025" and divide by .016"; the resultant, dropping any fraction, gives the number of .016" thick shims required for correct end play adjustment. Example: The gap between cap and bracket measures 0.037"; .037" + .025" = 0.062"; 0.062" ÷ 0.016" = 3-7/8. Use three 0.016" thick shims under bearing cap to give correct end play. This system will give a clearance of 0.010" to 0.025" between lower cap and bearing.

6. Replace jack under shaft, remove upper bearing runner and bearing, replace springs in spring plate under upper bearing and put upper bearing runner and bearing back on shaft. Put the drive or ratchet hub on the runner but do not bolt to runner; put the ratchet plate or splash plate over the runner letting it rest on the drive hub. Put six 4-1/2" long 1/2" bolts through the holes in the ratchet plate and engage them in the corresponding holes in the bearing pot arms. Tighten these bolts evenly to draw the runner down on the shaft against the springs to a snug seat on the shaft shoulder. When the runner is seated, tighten the lock nut holding it to the shaft and lock the lock washer and remove the jack.

7. Replace the O-ring in its groove in the lower bearing cap, insert the proper number of shims under the cap as determined in step 5 and bolt the lower bearing cap in place.

8. Remove the bolts holding ratchet plate down and remove ratchet plate. Using a dial indicator, check the face runout of both inner and outer bearing races. For ball bearings, the runout should not exceed 0.001" on the inner race or 0.0025" on the outer race. For roller bearings, the runout should not exceed 0.0003" on the inner race; runout of outer race of roller bearings need not be checked.

9. Install ratchet plate or splash plate in correct position; bolt drive hub to runner (it is extremely important that drive hub and runner be bolted together securely), replace ratchet pins and ratchet pin cover plate and replace bearing housing cover, coupling, and hood.

MAINTENANCE

Inspection

Although Life-Line® motors require a minimum of attention in service, they should be inspected at regular intervals to check for excessive (1) dirt, (2) moisture, (3) friction and (4) vibration, which account for 90% of all motor failures.

1. Guard against dirt. Prevent excessive build-up of dirt on the motor exterior by blowing it off or brushing it clean.

Do not inspect the motor interior unless the motor is dismantled for other reasons. If necessary to dismantle a motor in the field for servicing, upon reassembly, it is imperative that the factory assembly be duplicated in all respects.

When grease or oil is present, wipe with a cloth moistened (but not dripping) with a petroleum solvent of a "safety type" such as Stoddard solvent or similar materials available under various trade names. Wear

suitable gloves to prevent skin irritation when using these petroleum solvents.

Petroleum solvents are flammable but relatively non-toxic.

2. Guard against moisture. The insulation resistance of stand-by motors should be checked with a "megger" at regular intervals to detect the presence of moisture in the windings. If the insulation resistance shows an appreciable decrease, the windings should be dried out by any suitable means before applying power to the motor. This is particularly important in installations where the ambient temperature is subject to frequent, sharp fluctuations, or where the atmosphere is unusually damp. For less severe locations, running stand-by motors, at least once a week, should protect the windings from moisture absorption or condensation.

3. Guard against vibration. To avoid failures due to vibration, a few simple checks should be made regularly.

Check for misalignment such as may be caused by foundation setting or heavy floor loading. These may be causing vibration through misalignment.

Check to see if vibration from the pump is being transmitted to the motor.

Check the motor mounting bolts and bracket bolts to sure they are tight.

Coils

Revarnishing the windings when motors are overhauled will lengthen their life. Suitable varnish may be obtained from the nearest Westinghouse Sales Office.

For Wound Rotors Only

Guard against excessive brush wear. Excessive brush wear may result from brushes too tight in holders. A free sliding fit should be maintained between brushes and brushholders by cleaning both when necessary.

Brushes should make good contact with the slip rings along the whole face of the brush. If necessary, grind by attaching a strip of sandpaper to the slip rings with gummed tape on one end and turn the motor over slowly by hand. Use care to remove dust from motor. Maintain the brush spring tension at the correct value. A correct pressure per square inch is between 2 and 3 pounds for carbon or graphite brushes and between 3 and 5 pounds for metallic brushes, the lower pressure being favored in each case if a good brush to slip ring contact is obtained. Each brush should bear equal pressure.

NEVER LUBRICATE BRUSHES OR SLIP RINGS. Use the correct grade and size of brush which may be obtained by contacting the nearest Westinghouse Sales Office.

Guard against grooved, rough or eccentric slip rings. Slip rings should be maintained smooth and true but not necessarily at a bright metallic color (brown oxide color indicates good brush and slip ring life.) Grind or turn slip rings if necessary to restore a smooth and true surface.

If slip rings become pitted or burned, check for improper functioning of secondary control or for open in motor rotor circuit.

Pump Seals

For satisfactory service the motor lower bearing must be protected from the liquid being pumped. If the pump seals cannot be adequately maintained to prevent the liquid striking the lower bracket it may be necessary to mount a flinger on the shaft just below the motor to deflect such leakage.

RENEWAL PARTS

Renewal Parts information may be obtained from the nearest Westinghouse Sales Office. Be sure to name the part or parts required (see Figure 5) and give the complete nameplate reading on the motor for positive identification.

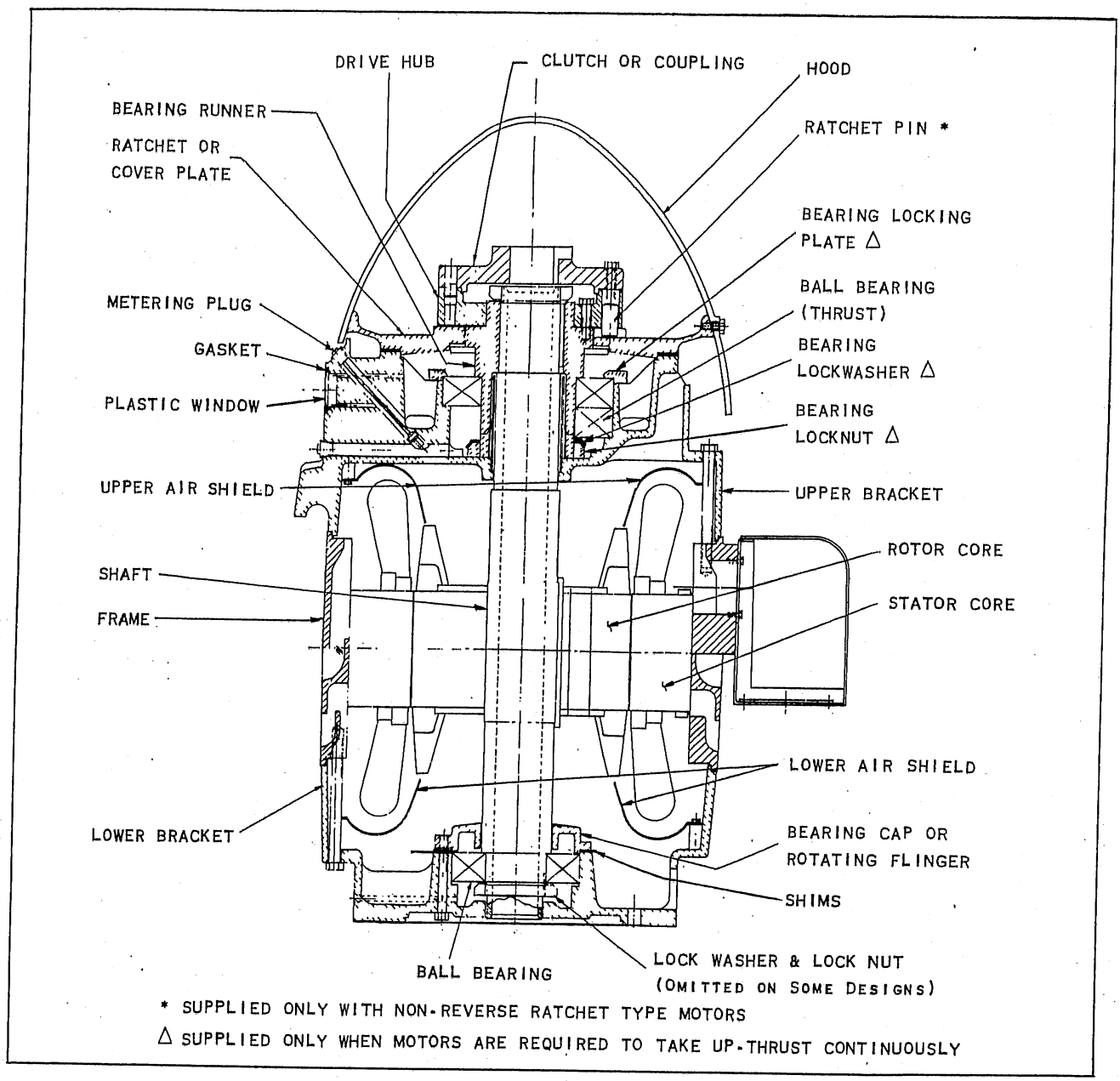

Figure 6 Frame 504 to 509 Construction (Hollow Shaft Illustrated but solid shaft motors have same construction except top coupling omitted).

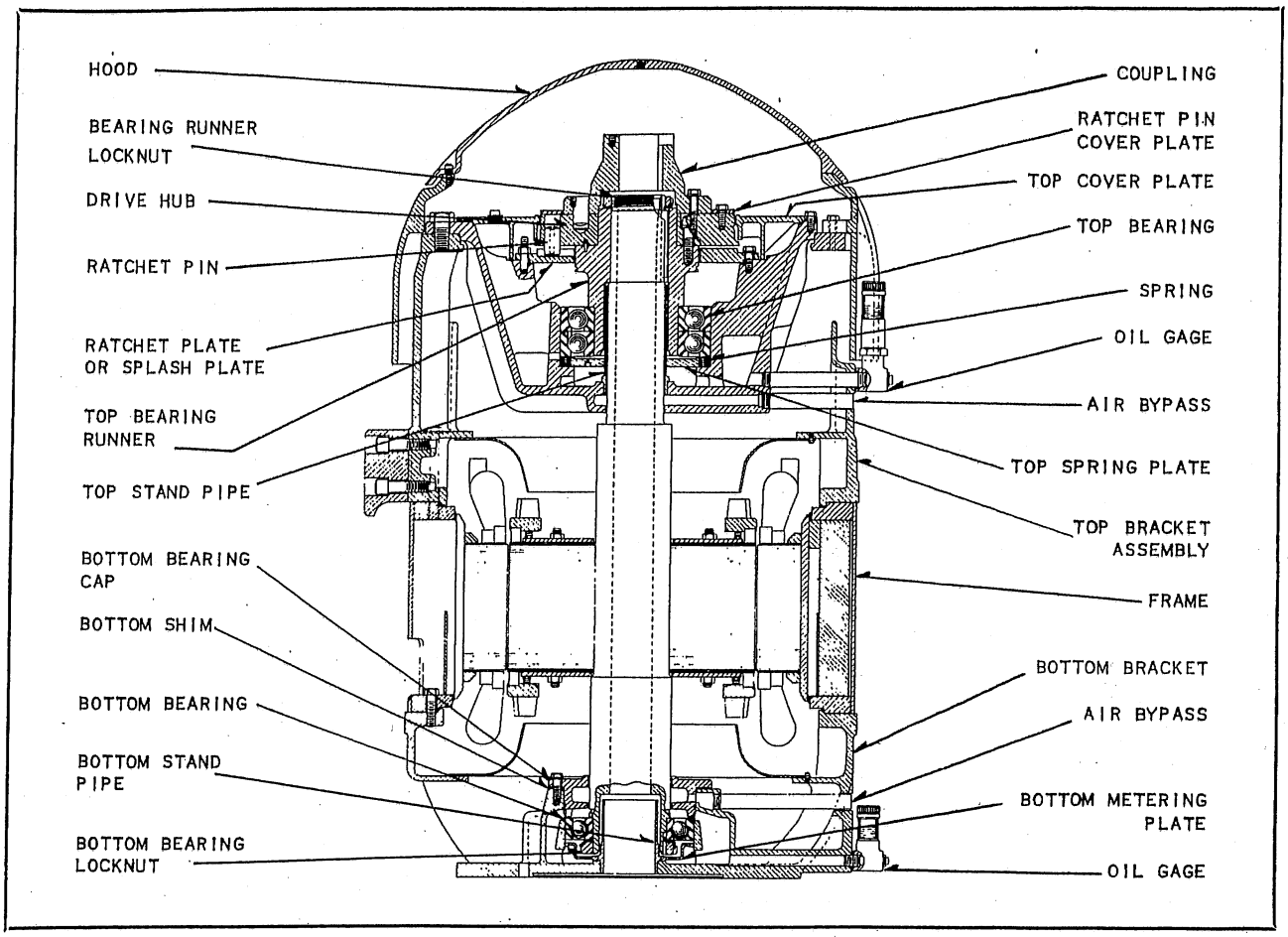

Figure 7 Frame 584 to 688.5 - Ball Bearing Construction (Hollow shaft illustrated but solid shaft motors have same construction except top coupling omitted).

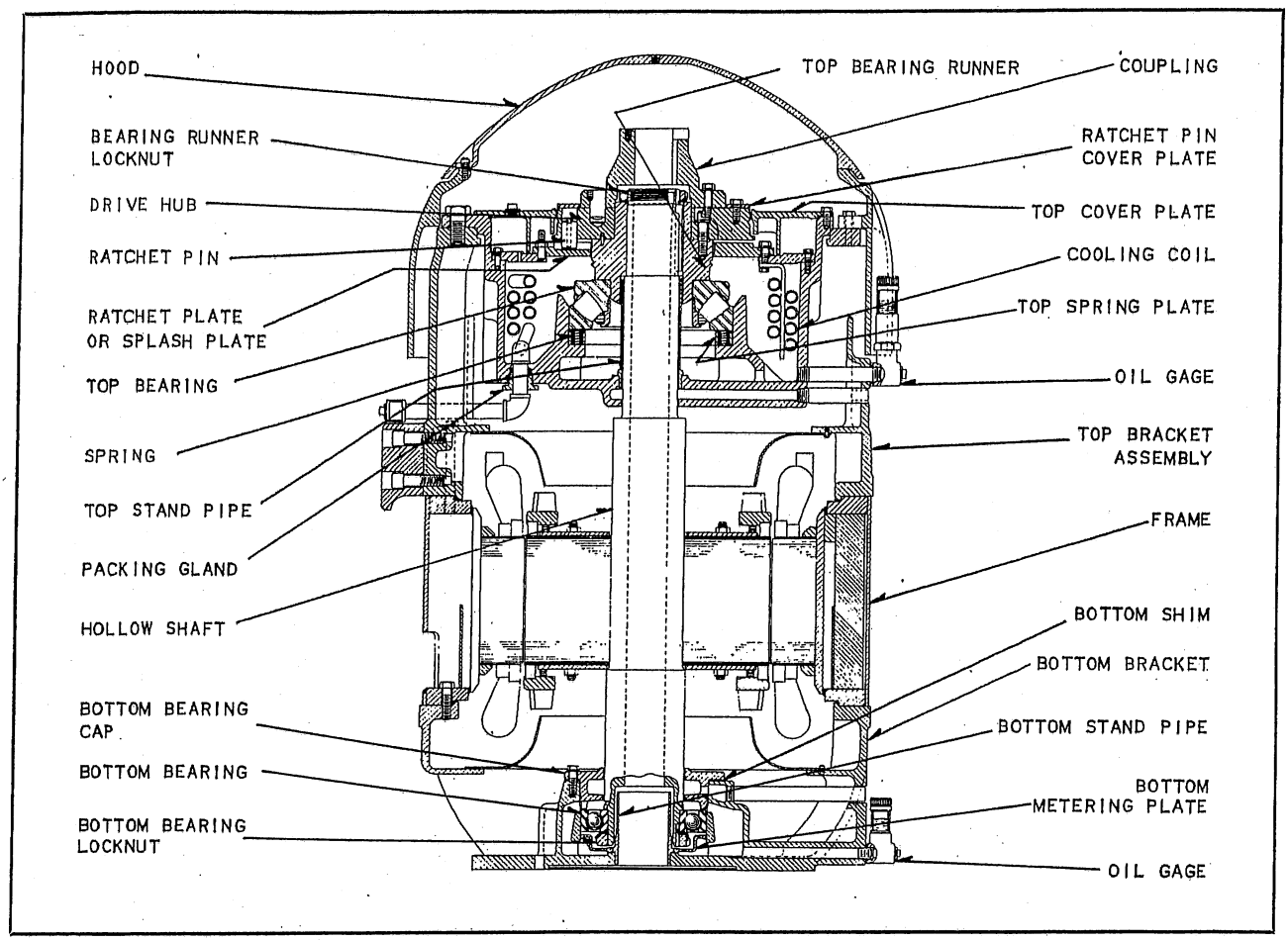

Figure 8 Frame 584 to 688.5 - Roller Bearing Construction (Hollow shaft illustrated but solid shaft motors have same construction except top coupling omitted).

Assembly Procedure for Frames 580 & 680 CSP Vertical

1. Build up bottom bracket, frame, rotor, shaft, bottom bearing, upper bracket and pot, spring plate (inserting springs), upper bearing and runner, bearing lock nut and washer.

2. Put clamping fixture over upper runner and pull runner down until springs are fully compressed and bearing seated.

3. Jack up shaft from lower end and tighten lock nut holding upper bearing runner to shaft. Release jack. Rotor is now in normal running position.

4. Pull O-Ring back over top of lower bearing cap and put bearing cap in place; cap should rest lightly on outer race of lower bearing. Check gap between cap and bearing housing with feeler gauge and record value. Check should be made at several points to insure that cap is resting evenly on lower bearing outer race. To the value obtained with the feeler gauge add 0.025" and divide this sum by 0.016"; the resultant, dropping any fraction, gives the number of 0.016" thick shims required for correct end play adjustment. Example: the gap between cap and pot measures 0.037"; 0.037 + 0.025 = 0.062"; 0.062 ÷ 0.016" = 3-7/8; use three 0.016" thick shims. This will give a free clearance of 0.010" to 0.025" between lower cap and lower bearing when upper bearing is seated under thrust.

5. Insert correct number of shims as determined in step 4 above under cap, return O-Ring to its groove and bolt lower cap in place.

6. Place dial indicator on upper bearing runner so that it will measure upward travel of shaft and runner and release the clamping plate holding upper bearing seated. Jack up shaft with jack on lower end until motor starts to lift. The total movement of the shaft should be .020" to .045" inches. The discrepancy between this value and the 0.010 to 0.025 end play calculated in step 4 is due to the looseness in the bearing and deflection of shaft, brackets, frame, etc.

7. Complete assembly by installing ratchet plate or splash plate, drive hub, ratchet pins, ratchet pin cover and upper bearing cover. NOTE: Particular attention must be given to the cap screws holding the drive hub to the runner; this is a friction coupling and these cap screws must not bottom. It is imperative that they be pulled tightly to exert the proper clamping force between runner and hub.

S. O.	Dates	D.	Dftm.	Check	E. E.	Ins. E.	Weld. E.	M. E.
FUTURE	7/8/55	530107	RGK					7/19/55

2 S.O. FUTURE PARAGRAPH 4, LINE 10 — 0.025" WAS 0.25" 5/4/59

WESTINGHOUSE ELECTRIC CORPORATION BUFFALO DIVISIONS, BUFFALO, N. Y.

DIMENSIONS IN INCHES A.C. MOTOR - FRAME 580 & 680 'CSP' VERTICAL DWG. NO. 52-D-9500

JUN 18 1960

52-D-9500