INSTALLATION • OPERATION • MAINTENANCE

INSTRUCTIONS

SINGLE-PHASE *Life-Line* MOTORS

OPEN DRIP-PROOF, TYPES CAP AND CAP-2

(¾ to 10 HP—Frames 203 Through 326 With Prelubricated Ball Bearings)

LIFE-LINE OPEN DRIP-PROOF single phase motors in Nema frame sizes 203 through 326 are furnished in type CAP, capacitor-start induction-run, and type CAP-2, capacitor-start capacitor-run machines. These motors have two stator windings—one being connected in series with the capacitors and a switching mechanism.

In the type CAP motor, when a predetermined speed is reached, the starting capacitor and its winding are disconnected from the circuit by the switching mechanism. The motor then operates on the running winding.

In the type CAP-2 motor when the transfer speed is reached, the switching mechanism operates and disconnects the starting capacitor but the running capacitor and its winding remain in the circuit and the motor is thus described as the capacitor-start capacitor-run type.

Both types of motor utilize a simple, rugged squirrel-cage rotor. The switching mechanism may be either a centrifugal switch or a voltage type relay.

Warranty. The Corporation in connection with apparatus sold agrees to correct any defect or defects in workmanship or material which may develop under proper or normal use during the period of one year from the date of shipment, by repair or replacement f.o.b. factory of the defective part or parts, and such correction shall constitute a fulfillment of all the Corporation's liabilities in respect to said apparatus, unless otherwise stated in the quotation.

Any defects that may develop should be referred to the nearest Westinghouse Sales Office for complete servicing information. Many of these motors are subject to a liberal exchange plan, details on which may also be obtained from your nearest Westinghouse Sales Office.

Motor Terminology. Since motor terminology varies somewhat in its meanings, the terms as used in this leaflet are defined as follows:

1. Brackets or end bells are called brackets.

2. Capacitors or condensers are called capacitors.

3. The end of a motor opposite the shaft extension end is known as the front end, the other or pulley end is known as the rear end.

4. On double extension shaft motors, the right end of the motor when facing the conduit box is known as the rear end.

RECEIVING

Unpack the motor and make certain that it has not been damaged during shipment. Turn the shaft by hand to see that it rotates freely.

Check to see that the nameplate data agrees with the voltage and frequency of the power supply provided for the motor and that the horsepower rating is correct for the load.

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

INSTALLATION

Mounting. Locate the motor in a clean, dry, well ventilated place. 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.

Fasten the motor to a rigid foundation using bolts or screws of the largest size permitted by the holes drilled in the mounting feet. The motor must rest evenly on all pads.

Unless otherwise specified when ordering, all motors are assembled for floor mounting. If the motor is to be mounted on a side wall or ceiling, the end brackets should be loosened and rotated 90° or 180° so that the vent holes are at the bottom. Rotate the brackets on the front end carefully since there are leads connecting the switch in the front bracket to the conduit box. These leads must not touch any rotating part when the motor is running.

The type CAP and CAP-2 motors are equipped with prelubricated bearings and will operate in any position.

Method of Drive. Any of the following drive methods may be used depending on the particular motor application.

1. **Flat Belt Drive.** Mount the motor on slide rails or a bedplate which allows for adjusting belt tension. Avoid excessive belt tension. Use a belt wide enough to carry the load without excessive tension. Wide single ply belts are preferable to double ply belts due to the lower bearing pressures which result.

The smallest pulley should not be less in diameter than that recommended by the belt manufacturer and in no case smaller than indicated in table.

Align the pulleys so that the belt runs true and tighten the belt just enough to prevent slippage.

Where the pulleys are not of approximately the same diameter, the distance between shaft centers should be greater than twice the diameter of the largest pulley.

Table No. 1.

PULLEY SIZE FOR FLAT BELT DRIVES

MOTOR FRAME	PULLEY DIMENSIONS	
	MIN. DIAM. (inches)	MAX. WIDTH (inches)
203-204	2½	3
224	2½	3½
225	3	3½
254	3½	4½
284	4	5½
324	5	6¾
326 (Above 2000 RPM)	5	6¾
326 (2000 and Below)	6	7¾

2. **V-Belt Drive.** Mount the motor on the slide rails or bedplate which allows for adjusting the belt tension.

Mount the motor sheave close to the bearing housing, allowing sufficient clearance for rotor end play.

The smallest sheave should not be smaller in diameter than that recommended by the belt manufacturer, and in no case smaller than indicated in Table 2.

Sheaves should be carefully aligned. Belt tension should be just sufficient to eliminate excessive sag in the slack of the belt. V-belts do not require as much tension as flat belts.

Table No. 2.

SHEAVE SIZE FOR V-BELT DRIVES

MOTOR FRAME	SHEAVE DIMENSIONS	
	MIN. PITCH DIAM. (inches)	MAX. WIDTH (inches)
203-204	2¼	3
224	2¼	3½
225	2½	3½
254	2¾	4½
284	3	5½
324	3¾	6¾
326	4½	7¾

3. **Chain Drive.** Mount the motor on the slide rails or bedplate, which allows for adjusting the chain tension.

Mount the motor sprocket close to the bearing housing, allowing sufficient clearance for rotor end play, and align the sprockets accurately.

4. **Gear Drive.** Mount the motor and driven unit so as to maintain accurate alignment. The gears must mesh accurately to prevent vibration.

Mount the motor gear close to the bearing housing to minimize the overhang, allowing sufficient clearance for rotor end play.

Dowel the motor to the base.

5. **Direct Drive.** The motor shaft and the driven shaft must be carefully aligned.

Dowel the motor to the base.

Note: Pulley, pinions, or coupling halves should have a close sliding fit on the shaft extension and must be securely locked to avoid hammering out in operation. It it is necessary to drive the part into position, it is important, on ball bearing motors, that the end of the

shaft opposite the extension be backed up so that the force of the blow is not taken by the bearing. Use a pinion puller for removing tight pulleys.

Electrical Connections. Be sure the motor is connected as shown on the nameplate diagram and that the voltage and frequency correspond to the nameplate data. Always refer to the nameplate for rotation connections. Type CAP and CAP-2 motors will run in either direction.

Connect the motor to the line through a suitable switch and overload protector.

Install all wiring and fusing in accordance with the National Electric Code and local requirements. Motor frames should be grounded in accordance with the requirements of the National Electric Code.

Conduit Box. If the conduit box is desired on the opposite side of the motor, remove the brackets and rotor, reverse the frame and reassemble. A stationary switch is mounted in the front bracket with leads running to the conduit box. These leads can be pulled out of the conduit box after disconnecting the capacitors, and re-entered from the opposite end of the frame. See instructions under "Disassembly".

When it is desired to extend conduit from above, loosen the four screws and disconnect the capacitor leads. The box can then be turned 180° so that a knockout or hole will be on top.

When the motor is mounted on a bedplate or on slide rails for belt adjustment, use flexible metallic conduit to protect the leads to the motor. Attach the flexible conduit to the conduit box with squeeze connectors.

OPERATION

Run the motor without load to check the connections and direction of rotation.

The motor will operate satisfactorily with a 10% variation in voltage, a 5% variation in frequency, or a combined voltage and frequency variation of 10%, but not necessarily in accordance with the standards of performance established for operation at normal rating. Low voltage reduces the torque. High voltage lowers the power factor.

The motor should quickly attain full speed under conditions of normal line voltage and rated load.

Thermal Protection. For protection against common causes of failure, these motors are sometimes equipped with a Thermoguard which is an inherent protection type device. The Thermoguard, when provided with the motor, is mounted in the frame behind the conduit box and may be removed by detaching the conduit box from the motor. See Fig. 1. There are two types as described below.

Automatic Thermoguard. The automatic Thermoguard opens the circuit to the motor under conditions of dangerous heat and recloses the circuit when the motor has cooled to a safe temperature.

This Thermoguard protects against:

1. Continuous or frequently repeated overloads.
2. Excessive temperatures.
3. Failure of ventilation.

Manual Reset Thermoguard. This Thermoguard opens the circuit automatically but the reset button must be pressed to reclose the circuit. This button is conveniently located on thec onduit box cover and extends through the conduit box to the Thermoguard.

This Thermoguard protects against:

1. Continuous or frequently repeated overloads.
2. Jamming of motor drive.
3. Inability to start or run due to low voltage.
4. Excessive temperature.
5. Failure of ventilation.

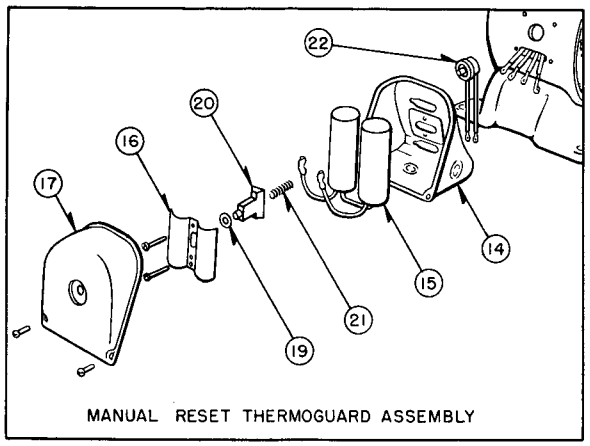
These two types of Thermoguard are interchangeable on many ratings. Consult the nearest Westinghouse District Office for instructions and procurement of the required type of Thermoguard. They are supplied as complete units only.

MAINTENANCE

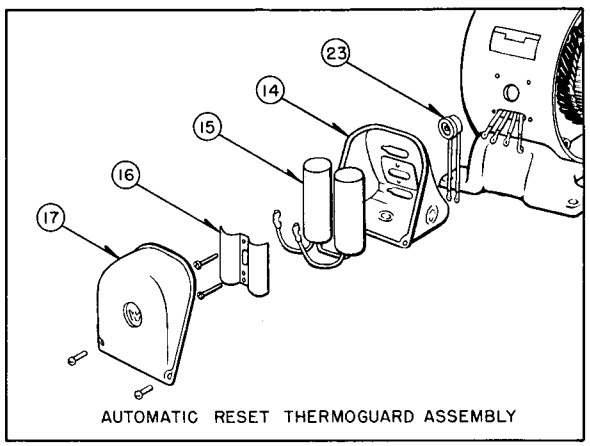
Inspection. Although Life-Line motors require a minimum of attention in service, they should be inspected at regular intervals to guard against excessive (1) dirt, (2) moisture, (3) friction and (4) vibration, which account for 90% of all motor failures.

Inspect at regular intervals noting particularly whether the mounting bolts, bracket bolts, and coupling or pulley are tight.

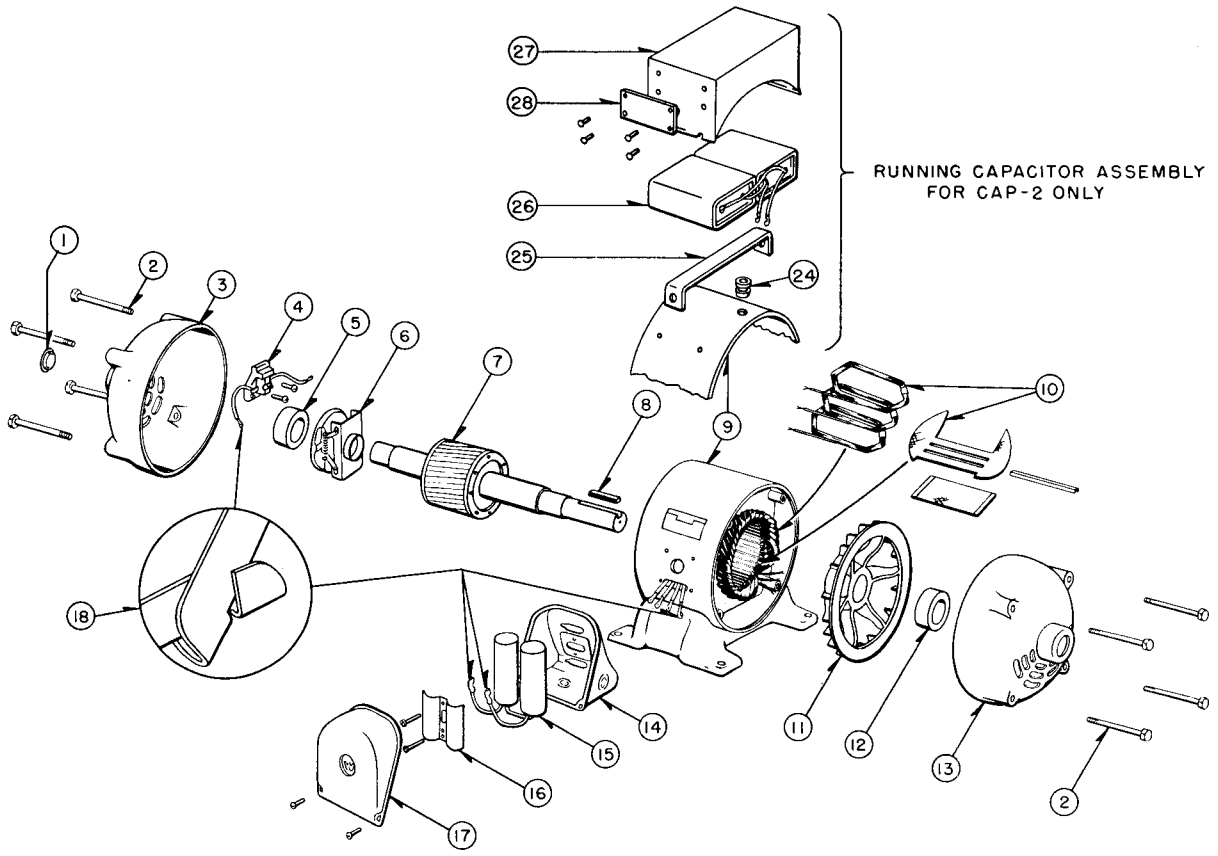
1. Guard Against Dirt. Keep the insulation and mechanical parts of the motor clean. Dust that is free from oil or grease may be removed by wiping with a clean, dry cloth, or preferably, by suction. Dust may be blown from inaccessible parts with clean, dry air, using not more than 30 to 50 lbs. pressure. Use care to prevent personal injury from the air hose; use goggles to avoid eye injury from flying particles.



MANUAL RESET THERMOGUARD ASSEMBLY



AUTOMATIC RESET THERMOGUARD ASSEMBLY



1. FRONT BEARING CAP
2. BRACKET BOLTS
3. FRONT BRACKET
4. STATIONARY SWITCH
5. FRONT BEARING
6. GOVERNOR MECHANISM
7. ROTOR
8. KEY
9. FRAME
10. COILS AND INSULATION
11. BLOWER
12. REAR BEARING
13. REAR BRACKET
14. CONDUIT BOX
15. CAPACITORS
16. CAPACITOR CLAMPS
17. CONDUIT BOX COVER
18. KNIFE DISCONNECTS
19. RUBBER WASHER
20. MANUAL RESET PLUNGER
21. PLUNGER SPRING
22. MANUAL RESET THERMOGUARD
23. AUTOMATIC RESET THERMOGUARD
24. INSULATING BUSHING
25. CAPACITOR SUPPORT
26. RUNNING CAPACITOR
27. CAPACITOR COVER
28. NAMEPLATE

FIG. 1. Arrangement of Parts—Open-Protected Type CAP Motor (Frames 203-225 with Centrifugal Switch)

When grease or oil is present, wipe with a cloth moistened (but not dripping) with a solvent such as Stoddard solvent or similar materials available, under various trade names. When a material is difficult to remove, carbon tetrachloride may be more effective than a petroleum solvent. Wear neoprene gloves to prevent skin irritation when using petroleum solvents or carbon tetrachloride.

Petroleum solvents are flammable and comparatively nontoxic.

Carbon tetrachloride is nonflammable, but is highly toxic. Suitable ventilation should be provided to avoid breathing vapors. When ventilation is not sufficient to prevent a distinct odor of carbon tetrachloride, a chemical cartridge respirator or gas mask must be used.

2. Guard Against Moisture. Water should be prevented from accidentally splashing or splattering into drip proof motors.

Standby motors should be run at least once a week to remove any moisture from condensation.

Before motor windings are blown out with compressed air, make sure water has not condensed in the air line.

3. Guard Against Friction. Excessive friction or overheating of bearings is usually traced to one of the following causes.

a. Excessive belt tension.

b. Poor alignment causing excessive vibration or binding.

c. Bent shaft.

d. Excessive end or side thrust due to gearing, flexible coupling, etc.

Guard Against Vibration. To avoid failures due to vibrations, a few simple checks should be made regularly.

Check for misalignment such as may be caused by foundation settling or heavy floor loading.

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

Check for excessive belt or chain tension or the push-apart effect inherent in spur gears.

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

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

Bearings. The bearings used in Life-Line motors are packed at the factory with the proper amount of lubricant; no further lubrication is needed for the normal life of the bearings.

A grease having a high degree of stability is permanently sealed in the bearings. This grease has been proven by tests both in the laboratory and field for long service.

Bearings from several suppliers are used in Life-Line motors; for a given motor size the bearings of all suppliers are interchangeable. The details of the seal construction vary somewhat depending upon the bearing manufacturer, but each type of seal is effective in keeping out foreign material and retaining the lubricant. A typical seal construction is shown in Fig. 2.

Disassembly. The type CAP and CAP-2 motors in many frame sizes are equipped with a ventilation blower. Since the blower is larger than the stator bore, the rotor is best removed in the following manner.

First ascertain at which end of the motor the blower is located. If the blower is located at the shaft extension end, remove the front bracket dust cap with a screw driver. Then remove the four bolts holding the rear bracket. Insert a bolt or length of shaft made of some soft material in the front bracket shaft opening and strike a few times with a mallet. This will loosen the rear bracket from the frame and drive the front bearing free of its bearing fit. The rear bracket, and rotor complete with bearings and blower can then be withdrawn by hand.

If the blower is located at the end opposite to the shaft extension proceed as follows. Remove the four bolts holding the front bracket. Strike

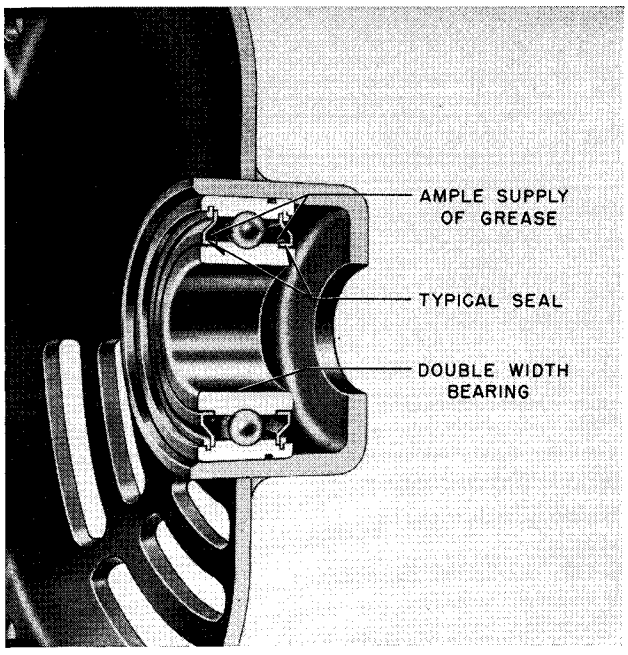


FIG. 2. Sectional View—Prelubricated Ball Bearing

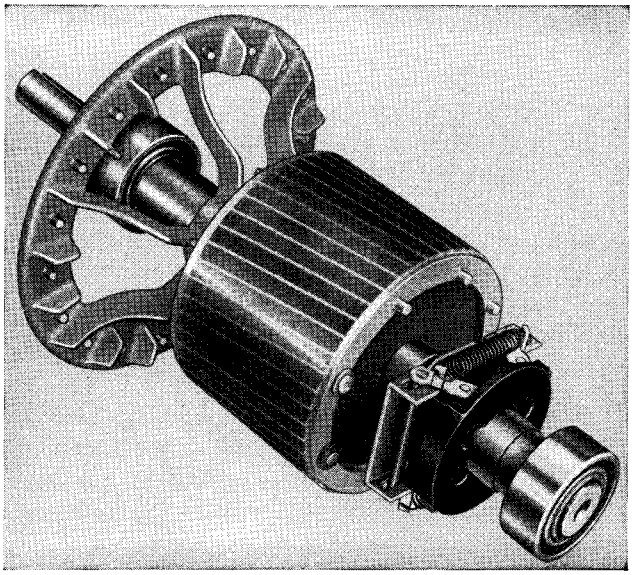


FIG. 3. Complete Rotor with Governor Mechanism of the Centrifugal Switch in Place

the front bracket on its top surface with a mallet a few glancing blows until the bracket has been freed from the frame fit. Then tap the end of the shaft extension until the rear bearing is free of the bracket housing. It will then be possible to withdraw the rotor and front bracket complete by hand.

When removing the rotor be sure to support it so that the shaft extension does not rub on the stator windings and damage them.

Remove the four bolts holding the remaining bracket. This bracket can then be removed by reaching through the stator bore and tapping the bracket with a mallet handle. Observe the number and location of any shims or spacers present in the brackets.

When reassembling the motor, wipe all excessive grease, dirt, or foreign material out of the bracket bearing housing. Replace shims or spacers exactly as found and reassemble. Turn the shaft by hand. If the shaft turns freely the assembly is correct.

Capacitors. The type CAP motor is furnished with starting capacitors only, located in the conduit box. Most motors have only two but a few will have four. These capacitors are in insulated tubes or containers held in place in the conduit box by a clamp. This insulation is essential to the proper operation of the motor. Continuous, frequent starting may damage the starting capacitors. The nominal rating of these capacitors is twenty starts per hour, when each start has a three second duration.

The type CAP-2 motor is furnished with both starting and running capacitors. The starting capacitors are located as previously described, and the running capacitors are located in a housing attached to the top of the motor frame. The leads from the running capacitors terminate in the conduit box and all connections to them are made in the conduit box.

Centrifugal Switch. On those motors where the switching mechanism is a centrifugal switch, it functions to disconnect the starting capacitors when the motor has reached a predetermined speed. On the type CAP the starting winding is also disconnected. On the type CAP-2 motor the running capacitor and winding remain in the circuit and function during the normal operation of the motor. Figure 3 shows the complete rotor with the governor mechanism in place, while the contacts part of the switch can be seen in Fig. 4.

The centrifugal switch consists of two parts: contacts and governor mechanism. The contacts are stationary and are located in the front bracket The governor mechanism is pressed on the shaft. and rotates with it. When a predetermined speed is reached, the governor opens the contacts and disconnects the starting capacitors as previously described.

The governor mechanism has a definite location on the shaft, which is held to a close tolerance necessary for correct operation. If this part is ever replaced, the new one must be installed in the exact location of the old one. Care must be taken not to bend it. The contacts part can easily

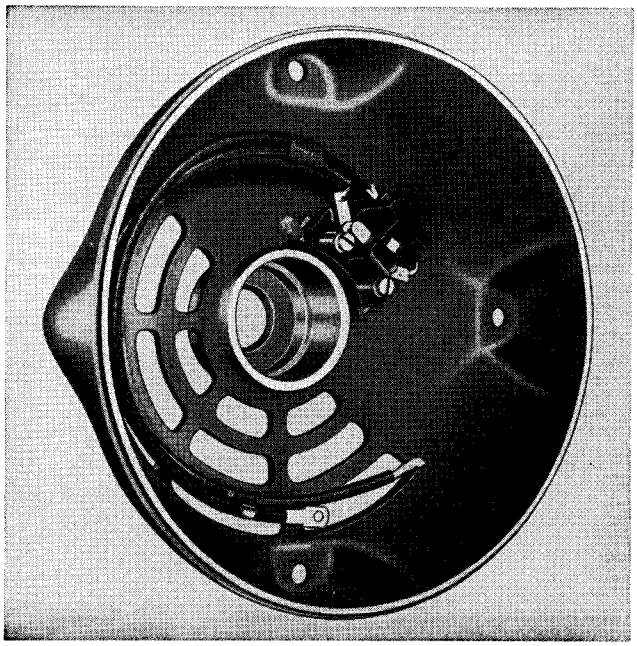


FIG. 4. Front Bracket Showing the Contacts Part of the Centrifugal Switch

be replaced by soldering on two wires and attaching it to the bracket with two small screws. These parts are designed for long life and should rarely need to be replaced.

Relay. Many type CAP and CAP-2 motors are equipped with starting relays instead of centrifugal switches. When the relay is used, it, together with the starting capacitors are mounted in the conduit box lid as shown in Fig. 5. This relay is a multiple unit consisting of a sensitive relay which is energized from the starting winding and a power contactor which it actuates when a predetermined speed is reached. The contactor disconnects the starting capacitors from the power source.

The relay is built in this manner so that the sensitivity to change of speed is handled independently of the circuit interruption which requires a heavy set of contacts. The splitting of these functions also eliminates undesirable dynamic braking.

The relay is adjusted at the factory and should not be disturbed. If it does not function properly, call an authorized service man.

RENEWAL PARTS

Renewal Parts information may be obtained from the nearest Westinghouse Sales Office. Be sure to name the part or parts required (See Fig. 1) and give complete nameplate reading on the motor for positive identification.

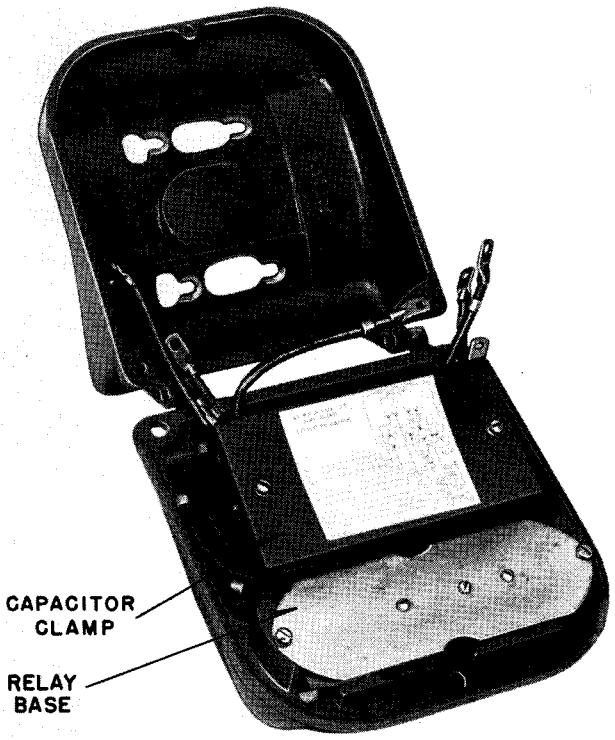


Fig. 5. Relay and Capacitors are Mounted in the Lid of Conduit Box.

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