

BULLETIN 295B

TECHNICAL MANUAL

MOTOR UNITS

(MU, LMU AND YMU)



TELETYPE[®]
CORPORATION

5555 TOUHY AVENUE, SKOKIE, ILLINOIS



INTRODUCTION

Bulletin 295B is a technical manual that provides descriptive and maintenance information for the Motor Units.

The bulletin is made up of a group of appropriate independent sections. They are separately identified by title and section number, and the pages of each section are numbered consecutively, independent of other sections. The identifying number of a section, a 9-digit number, appears on each page of the section, in the upper left corner of left-hand pages and the upper right corner of right-hand pages.

To locate specific information, refer to the table of contents. Find the name of the involved component in column one and the title of the section in column two. The correct 9-digit section will then be found in column three. The sections are arranged in the order shown in the table of contents. Turn to page one of the section indicated where the contents of that section will be found (except where a section is small and does not require a listing of contents).

The sections comprising this bulletin are stocked separately and may be ordered individually if the entire bulletin is not required.



TABLE OF CONTENTS

<u>Equipment</u>	<u>Contents</u>	<u>Section</u>	<u>Issue</u>
Motor Units	Description and Principles of Operation	570-220-100TC	4
Motors and Motor Units	Requirements and Adjustments	570-220-700TC	5
Motor Units	Lubrication	570-220-701TC	5
Motor Units	Disassembly and Reassembly	570-220-702TC	1
Motor Units	Parts	570-220-800TC	4



MOTOR UNITS

DESCRIPTION AND PRINCIPLES OF OPERATION

CONTENTS	PAGE
1. GENERAL	1
2. DESCRIPTION	1
SYNCHRONOUS MOTOR UNITS	1
A. Miniature Synchronous Motor Units	1
B. Standard and Heavy Duty Synchronous Motor Units	2
SERIES GOVERNED MOTOR UNITS	3
A. 1/20 Horsepower Motor Units (AC/DC and AC Only)	3
B. 1/20 Horsepower Motor Units Variable Speed (AC/DC and AC Only)	4
C. 1/15 Horsepower Motor Units (AC/DC and AC Only)	5
D. 1/15 Horsepower Motor Units (DC)	5
3. PRINCIPLES OF OPERATION	13
SYNCHRONOUS MOTOR UNITS	13
SERIES GOVERNED MOTOR UNITS	15
SERIES GOVERNED MOTOR UNITS VARIABLE SPEED	17

1. GENERAL

1.01 This section provides description and principles of operation for motor units. It is reissued to include additional information on synchronous, series governed, and series governed variable speed motor units. Since it is a general revision, marginal arrows that indicate changes and additions have been omitted.

1.02 The motor units that provide electro-mechanical rotating motion for operating various teletypewriter apparatus are of two basic types: synchronous and series governed. Both types are self-contained motor units, with characteristics adaptable for use with standard power sources.

1.03 The synchronous type motor units (Figures 1, 2, and 3) are available in miniature (25 millihorsepower), standard, and heavy duty ratings. These motor units must be operated from a standard, single-phase, regulated power source with specifications as listed in Tables A and B.

1.04 The series governed type motor units (Figure 4) are available in standard and heavy duty horsepower ratings and may be operated from regulated or unregulated, standard, single-phase power sources, or dc (direct current). The series governed type motor unit is also available for operation with 48 volts dc only. Specifications are given in Tables C, D, and E.

2. DESCRIPTION

2.01 In general, the synchronous motor units consist of a motor and mounting arrangement, and the required starting and protective devices. Variations of this type are described below.

SYNCHRONOUS MOTOR UNITS

A. Miniature Synchronous Motor Units (Figure 1)

2.02 The 25 millihorsepower miniature synchronous motor units consist of a two-pole wound stator and two end shields that support a squirrel cage type rotor. The motor is secured to its bracket-type cradle by means of resilient mounts at each end, which tend to reduce the transmission of vibrations from the motor to the driven apparatus. A starting relay, capacitor and thermostatic cutout switch are mounted under the cradle. The thermostatic

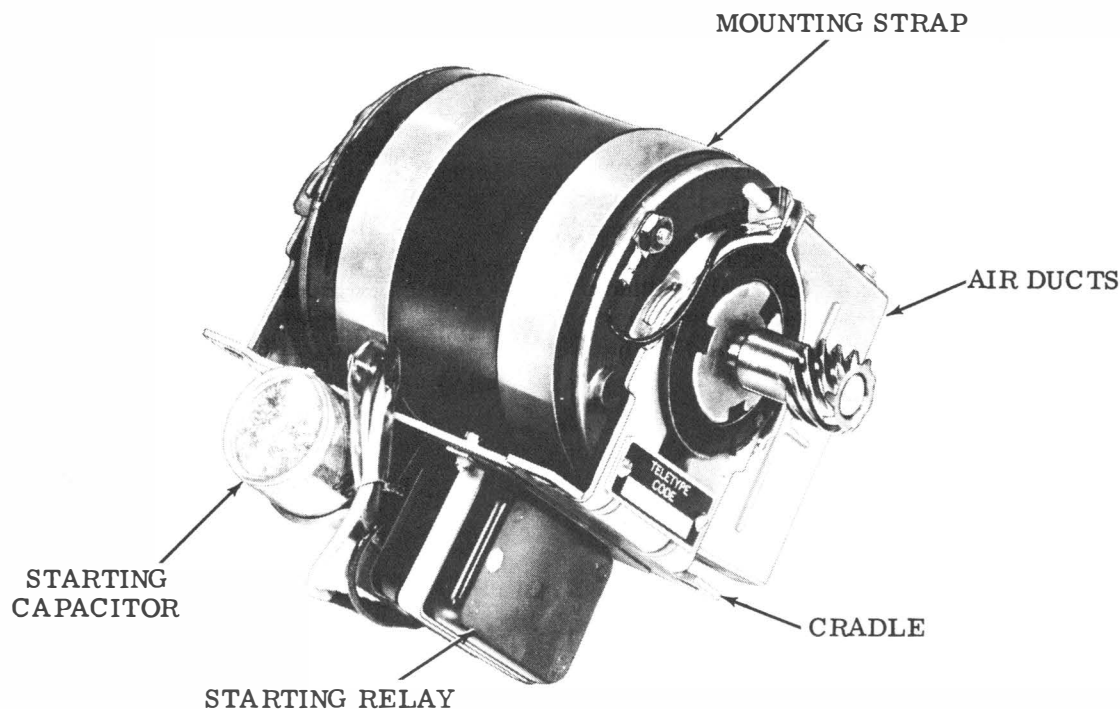


Figure 1 - Typical Miniature Synchronous Motor Unit

cutout switch protects the motor windings from excessive current drawn by the motor. It can be reset manually.

2.03 The variations of the miniature synchronous include 3600 rpm (60 hertz units) and 3000 rpm (50 hertz units) operation; an external fuse instead of the thermostatic cut-out switch; single or dual air ducts to improve ventilation, or an air shield to isolate the incoming cool air from the outgoing heated air; and mounting of control parts on the side of the motor instead of under the cradle.

B. Standard and Heavy Duty Synchronous Motor Units

2.04 The standard and heavy duty synchronous motor units (Figure 2) consists of a two-pole wound stator and two end shields that support a ball bearing rotor. A combination handwheel and fan (new-style handwheel and fan is made of plastic — Figure 3) is mounted on the motor shaft, and two fans are mounted at each end of

the rotor within the end shields. The opposite end of the shaft contains a tapped hole for mounting the driving gear. A motor starting relay, starting capacitor, and thermostatic cutout switch are mounted in a compartment of the motor mounting bracket. The thermostatic cut-out switch, which is reset manually, protects the motor winding from excessive current drawn by the motor. The motor is supported by resilient mounts which are part of the end shields and which are held in place by straps attached to the mounting bracket. The resilient mounts tend to reduce the transmission of vibration from the motor to the driven associated apparatus.

2.05 Variations of the standard and heavy duty synchronous motor units include: 3600 rpm (60 hertz units) and 3000 rpm (50 hertz units) operation; 1/20 and 1/12 horsepower ratings; replacement of the fan with a gear to reverse the direction of rotation for such applications as the high speed punch unit; inverted mounting for installation in the Wall Mounted Page Printer Set, for example; re-location of control parts to meet varying installation re-

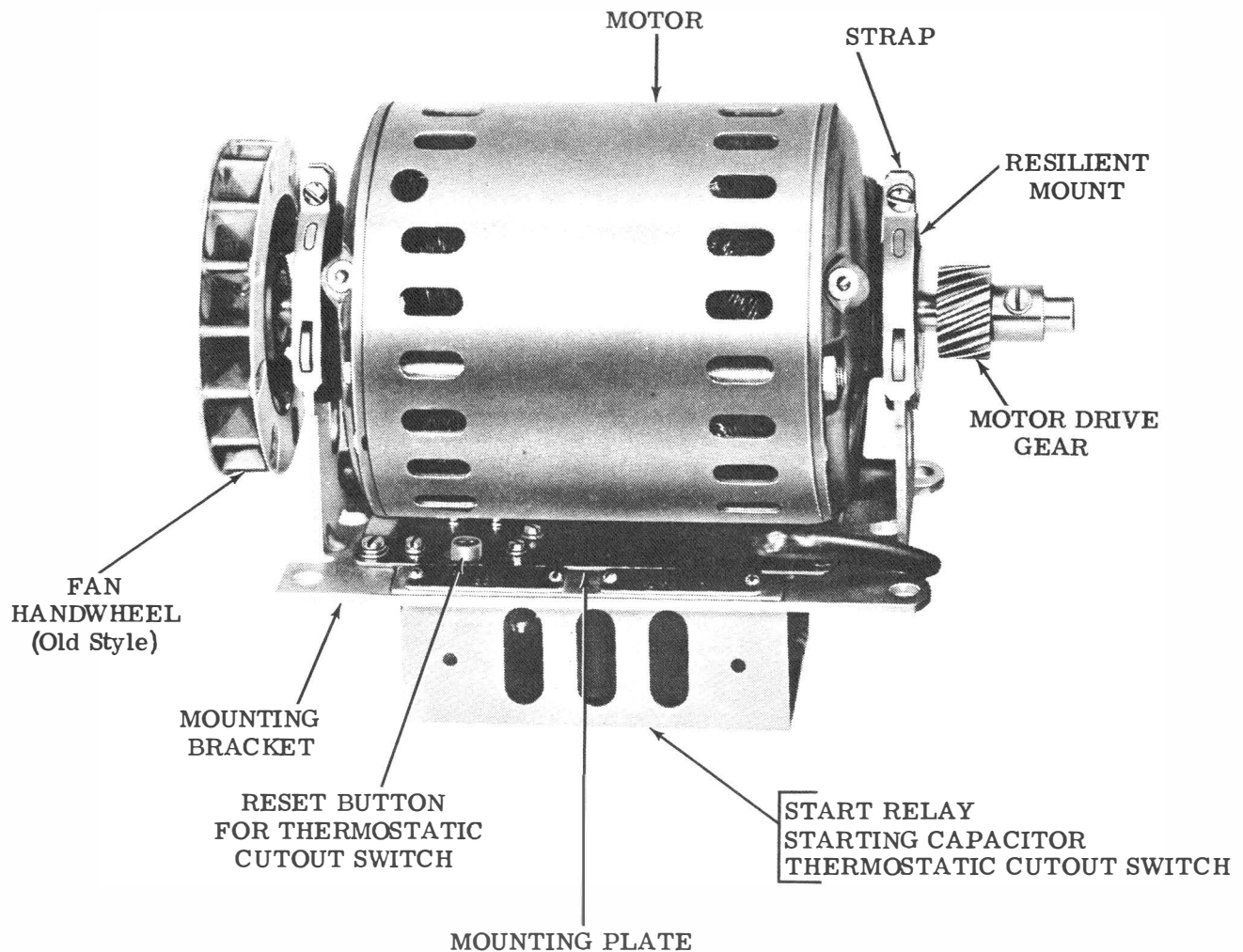


Figure 2 - Typical Standard or Heavy Duty Synchronous Motor Unit

quirements as in the Multiple KSR and RO Set where the control parts are mounted in a compartment at the rear of the fan. Some standard and heavy duty synchronous motor units have the start relay and start capacitor held in position with springs by hooking the ends of the springs through the projections in the sides of the mounting bracket.

SERIES GOVERNED MOTOR UNITS (Figure 4)

2.06 The series governed motor units typically consist of a motor, speed regulator (governor), protective and control devices, and a mounting. Variations of this type are described below.

A. 1/20 Horsepower Motor Units (AC/DC and AC Only)

2.07 The 1/20 hp series governed motor unit consists of a series type motor, speed governor, motor mounting bracket, and a housing for the governor resistors and spark suppression capacitor. The governor is mounted on an extension of the armature shaft and includes a fan that circulates air through the motor. The opposite end of the shaft contains a tapped hole for mounting the driving gear. Targets for speed checking purposes are provided on the governor cover. The motor is mounted by means of resili-

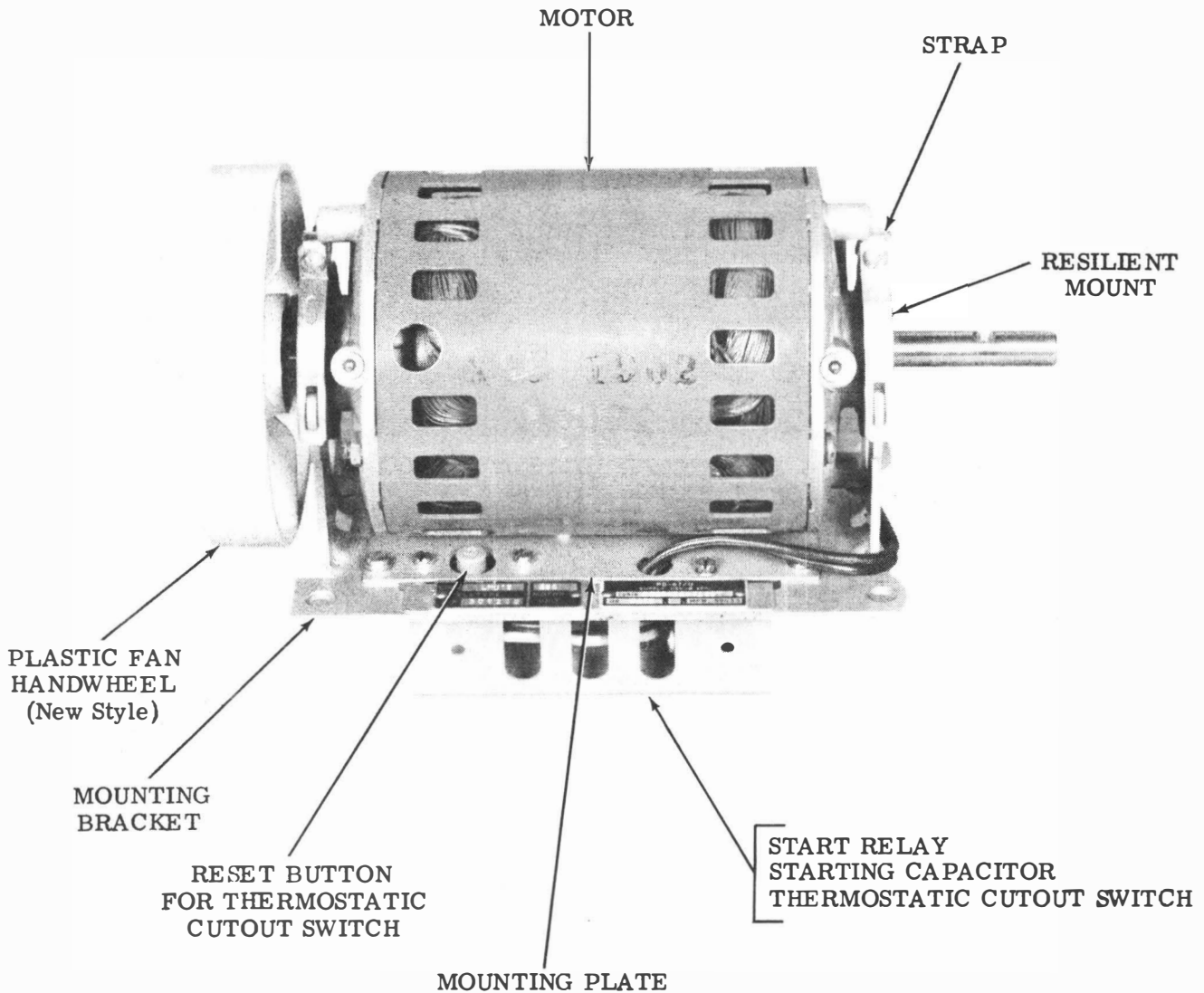


Figure 3 - Typical Standard or Heavy Duty Synchronous Motor Unit With New-Style Plastic Handwheel

ent mounts at each end shield that are fastened to the mounting bracket by straps. The ac only motor unit is furnished with a bidirectional switch controlled governor.

2.08 A variation of the motor unit described in 2.07 is available with electrostatic shielding and radio frequency noise suppression.

B. 1/20 Horsepower Motor Units Variable Speed (AC/DC and AC Only)

2.09 These motor units are similar to the units described in 2.07 and 2.08 but have a gear arrangement permitting changing the motor speed manually while the motor is in operation. The ac only motor unit is furnished with a bidirectional switch controlled governor.

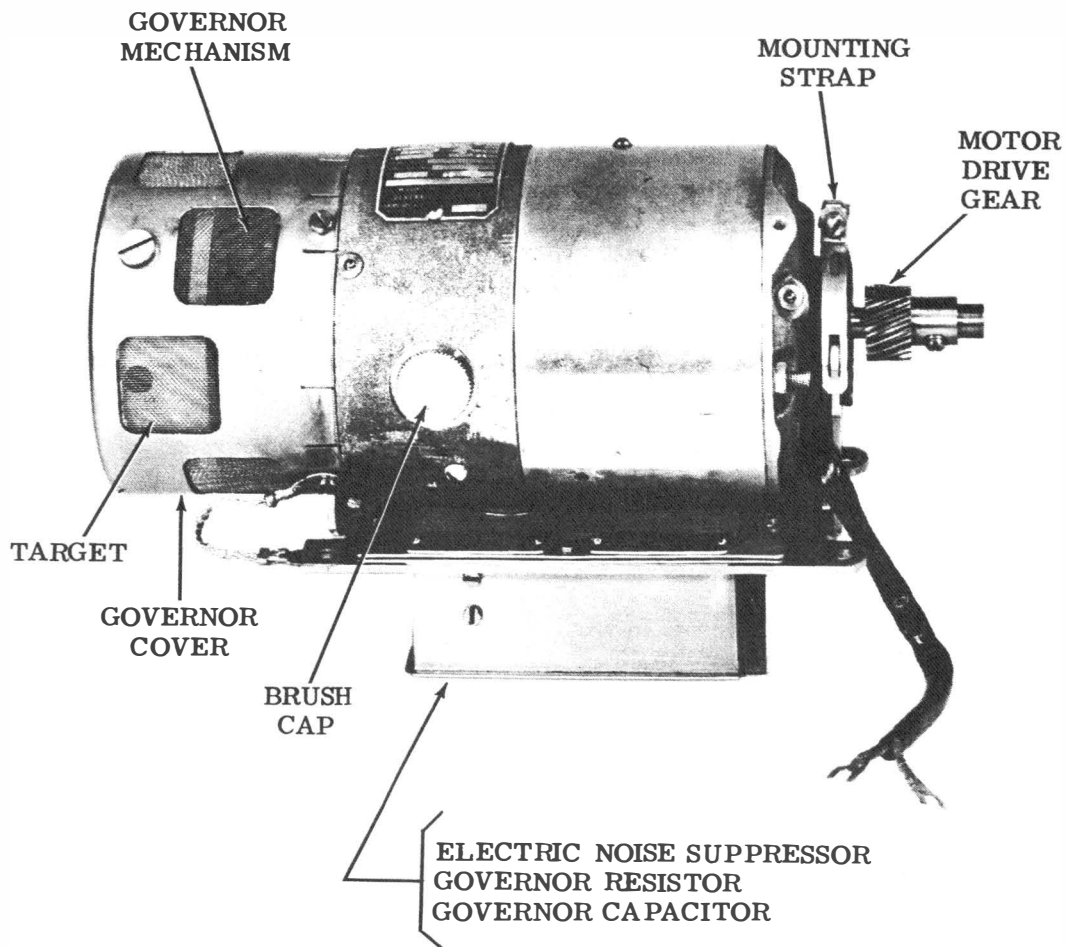


Figure 4 - Typical Series (Governed) Motor Unit

C. 1/15 Horsepower Motor Units (AC/DC and AC Only)

2.10 These motor units are similar to the units described in 2.07, but are equipped with electrostatic shielding and radio frequency noise suppression. The ac only motor unit is furnished with a bidirectional switch controlled governor.

The higher horsepower rating accommodates, for example, the requirements of the Automatic Send-Receive Set.

D. 1/15 Horsepower Motor Units (DC)

2.11 These motor units are designed to operate with 48 volts dc only and are equipped with electrostatic shielding and radio frequency noise suppression.

TABLE A
TECHNICAL CHARACTERISTICS OF MINIATURE SYNCHRONOUS MOTOR UNITS

CHARACTERISTICS	LMU19, LMU20, LMU24, LMU26, LMU31, LMU45, MU43, LMU56	LMU35
Rated Horsepower	25 Millihorsepower	25 Millihorsepower
Input Voltage	115 \pm 10% AC	115 \pm 10% AC
Phase	Single	Single
Frequency	60 hertz, \pm 0.75%	50 hertz, \pm 1%
Input Current (Full Load - Amperes)		
Starting	5.0	3.0
Running	1.25	0.47
Power Factor (Full Load)	56%	89%
Watts Input (Full Load)	76	50
Start Capacitor	88-108 UF	64-77 UF
Run Capacitor	-	7.0 UF
Speed	3600 RPM	3000 RPM
Rotation	Clockwise viewed from pinion end	Clockwise viewed from pinion end
Mounting	Upright	Upright
Other Distinguishing Characteristics	<p>LMU19 - Relay, capacitor, and thermostatic cutout switch mounted on motor bracket.</p> <p>LMU20, LMU26 - Relay, capacitor, and thermostatic cutout switch mounted on motor bracket. LMU20 has a ventilator bracket, LMU26 none.</p> <p>LMU24 - Twin exhaust ducts. Relay and capacitor mounted on motor bracket. No thermostatic cutout switch. Fused externally. Latest design have double shaft.</p> <p>LMU31 - Capacitor and thermostatic cutout switch mounted on motor bracket. Relay mounted on bracket assembly.</p> <p>LMU45, MU43 - Relay, thermostatic cutout switch mounted on motor bracket. Capacitor mounted on motor shield. Wiring for external start switch noise suppressor (LMU45 only).</p> <p>LMU56 - Has double shaft. Similar to LMU24 except no ventilator brackets.</p>	<p>LMU35 - Contains no thermostatic cutout device. Fused (0.8A) externally. Relay and capacitors mounted on motor mounting bracket. Equipped with a ventilator bracket and bidirectional switch.</p>

TABLE B
TECHNICAL CHARACTERISTICS OF STANDARD AND HEAVY DUTY SYNCHRONOUS MOTOR UNITS

CHARACTERISTICS	LMU3, LMU15, LMU21, LMU30, LMU37, LMU42, LMU46, LMU49, YMU2, YMU4	LMU33, LMU36, LMU38, LMU51, LMU52, LMU55, YMU3	LMU11, LMU12	LMU50
Rated Horsepower	1/20	1/20	1/12	1/12
Input Voltage	115 ±10%, AC	115 ±10%, AC (230 ±10% AC, LMU55)	115 ±10%, AC	115 ±10%, AC
Phase	Single	Single	Single	Single
Frequency	60 hertz, ±0.75%	50 hertz, ±0.75%	60 hertz, ±0.75%	50 hertz, ±0.75%
Input Current (Amperes)				
Starting	9.0, (7.0, YMU2)	8.3, (4.3, LMU55), (8.0, YMU3)	12.25	14.5
Running	1.85	2.4, (1.25, LMU55)	2.8	2.68
Power Factor (Full Load)	30%	35%	44.75%	34.4%
Watts Input (Full Load)	65, (90, YMU2), (90, YMU4)	107, (105, LMU55)	132.9	148
Heat Dissipation (Watts)	50	70	70.6	62
Start Capacitor Rating	43-52 UF	43-52 UF (15-18 UF, LMU55)	170-226 UF	161-193 UF
Speed	3600 RPM	3000 RPM	3600 RPM	3000 RPM
Rotation	LMU42 *CW, others *CCW viewed from fan or short shaft end.	CCW viewed from fan or short shaft end.	CCW viewed from fan end.	CCW viewed from fan end.
Mounting	All upright except LMU30 which is inverted.	All upright except LMU36 which is inverted.	LMU11 - Inverted LMU12 - Upright	Upright
Other Distinguishing Characteristics	LMU3 - Control parts in compartment under motor. Fan cooled. Thermostatic cutout switch.	LMU33 - Similar to LMU3. No fan. LMU36 - Similar to LMU3 except for inverted mounting with control parts above motor.	LMU11 - Control parts located above motor for inverted mounting. Fan cooled. Thermostatic cut out switch.	Similar to LMU11 but with control parts in motor mounting cradle. Starting relay is voltage sensitive type mounted on bracket externally and attached to side of mounting cradle.

*CW - Clockwise

*CCW - Counterclockwise

TABLE B
 TECHNICAL CHARACTERISTICS OF STANDARD AND HEAVY DUTY SYNCHRONOUS MOTOR UNITS (Continued)

CHARACTERISTICS	LMU3, LMU15, LMU21, LMU30, LMU37, LMU42, LMU46, LMU49, YMU2, YMU4	LMU33, LMU36, LMU38, LMU51, LMU52, LMU55, YMU3	LMU11, LMU12	LMU50
<p>Other Distinguishing Characteristics (continued)</p>	<p>LMU15 - Same as LMU3 except no fan. Pinion on short shaft end.</p> <p>LMU21 - Same as LMU3 except control parts at rear of fan.</p> <p>LMU30 - Same as LMU3 except for inverted mounting with control parts above motor.</p> <p>LMU37 - Same as LMU3 except for cradle and mounting arrangement. Control parts on side of motor.</p> <p>LMU42 - Same as LMU3 except cradle and mounting arrangement and control parts are in a bracket on side of motor and has CW rotation.</p> <p>LMU46 - Same as LMU3 except for external wiring for motor start relay arc suppressor.</p> <p>LMU49 - Same as LMU3 but with speed sensing device.</p>	<p>LMU38 - Differs from LMU3 only in power frequency.</p> <p>LMU51 - Similar to LMU3 except for more compact cradle and mounting arrangement. Fan reversed (solid side adjacent to end bell).</p> <p>LMU52 - Similar to LMU3 except control parts mounted at rear of fan.</p> <p>LMU55 - Similar to LMU3 except has 230 v input.</p> <p>YMU3 - Same as YMU2 except thermostatic cutout switch for 50 hertz.</p>	<p>LMU12 - Same as LMU11 but with control parts located in motor mounting cradle and end shields rotated 180° for upright mounting.</p>	

TABLE B
TECHNICAL CHARACTERISTICS OF STANDARD AND HEAVY DUTY SYNCHRONOUS MOTOR UNITS (Continued)

CHARACTERISTICS	LMU3, LMU15, LMU21, LMU30, LMU37, LMU42, LMU46, LMU49, YMU2, YMU4	LMU33, LMU36, LMU38, LMU51, LMU52, LMU55, YMU3	LMU11, LMU12	LMU50
Other Distinguishing Characteristics (continued)	<p>YMU2 - Similar to LMU3 except has control parts mounted at rear of fan. Has suppressor network.</p> <p>YMU4 - Similar to LMU3 except network assembly mounted on side of mounting bracket.</p>			

TABLE C
TECHNICAL CHARACTERISTICS OF SERIES GOVERNED MOTOR UNITS FOR
LMU6, 13, 28, 29, 39, 41

CHARACTERISTICS	LMU6, LMU28, LMU41				LMU13, LMU39				LMU29
	25	50	60	DC	25	50	60	DC	
Rated Horsepower	1/20				1/15				1/15
Input Voltage	115 ±10%, AC/DC				115 ±10%, AC/DC				48 ±10%, DC
Phase	Single				Single				-
Frequency	25, 50, or 60 hertz, or DC				25, 50, or 60 hertz, or DC				-
Input Current (Full Load - Amperes)	Hertz				Hertz				
Starting	2.4	2.7	1.9	1.8	4.5	4.0	2.8	3.4	13
Running	1.18	1.34	1.12	0.93	2.1	2.3	1.8	1.7	2.5
Power Input (Watts)	123	114	92	1.07	235	200	190	195	120
Power Factor (Full Load)	90%	74%	71%	-	96.8%	87%	79%	-	-
Heat Dissipation (Watts)	86	87	55	70	130	97.2	94.2	111	66
Series Resistor (Ohms)	25	-	-	50	12	-	-	20	-
Target Indicator	4, 6, and 35 Spot				4, 6, and 35 Spot				4, 6, and 35 Spot
Governed Speed	3600 RPM				3600 RPM				3600 RPM
Rotation	CCW viewed from commutator end				CCW viewed from commutator end				CCW viewed from governor end
Mounting	Upright				LMU13 - Inverted LMU39 - Upright				LMU29 - Upright
RF Shielding	LMU28, LMU41				LMU39				LMU29
RF Suppression	LMU28, LMU41				LMU39				LMU29
Other Distinguishing Characteristics	Control parts com- partment rectangular on LMU6, LMU28, and LMU41 governor resistor mounted on heat sink in stepped compartment.				LMU39 governor resistor mounted on a heat sink in stepped compartment. LMU13 cradle compartment is rectangular.				No screened governor cover on LMU29 with stepped com- partment.

TABLE D
 TECHNICAL CHARACTERISTICS OF SERIES GOVERNED MOTOR UNITS FOR
 LMU57, 61, 63, 64, YMU5

CHARACTERISTICS	LMU61, YMU5	LMU57, LMU63, LMU64																												
Rated Horsepower	1/15	1/20																												
Input Voltage	115 \pm 10%, AC only	115 \pm 10%, AC only																												
Phase	Single	Single																												
Frequency	25, 50, 60 hertz	25, 50, 60 hertz																												
Input Current (Full Load Amperes)	<table border="1"> <thead> <tr> <th colspan="3">Hertz</th> </tr> <tr> <th>25</th> <th>50</th> <th>60</th> </tr> </thead> <tbody> <tr> <td>Starting</td> <td>4.5</td> <td>5.0</td> <td>3.8</td> </tr> <tr> <td>Running</td> <td>2.5</td> <td>2.3</td> <td>2.4</td> </tr> </tbody> </table>	Hertz			25	50	60	Starting	4.5	5.0	3.8	Running	2.5	2.3	2.4	<table border="1"> <thead> <tr> <th colspan="3">Hertz</th> </tr> <tr> <th>25</th> <th>50</th> <th>60</th> </tr> </thead> <tbody> <tr> <td>Starting</td> <td>2.8</td> <td>3.1</td> <td>2.2</td> </tr> <tr> <td>Running</td> <td>1.2</td> <td>1.3</td> <td>1.2</td> </tr> </tbody> </table>	Hertz			25	50	60	Starting	2.8	3.1	2.2	Running	1.2	1.3	1.2
Hertz																														
25	50	60																												
Starting	4.5	5.0	3.8																											
Running	2.5	2.3	2.4																											
Hertz																														
25	50	60																												
Starting	2.8	3.1	2.2																											
Running	1.2	1.3	1.2																											
Power Input (Watts)	135 130 133	82 61 63																												
Power Factor (Full Load)	45% 48% 54%	67% 43% 52%																												
Heat Dissipation (Watts)	72 72 75	53 34 36																												
Series Resistor (Ohms)	12 — —	25 — —																												
Target Indicator	4, 6, and 35 spot	4, 6, and 35 spot																												
Governor Speed	3600 RPM	3600 RPM																												
Rotation	CCW viewed from com- mutator end	CCW viewed from com- mutator end																												
Mounting	Upright	Upright																												
RF Shielding	LMU61, YMU5 Motor Only	LMU63, LMU64																												
RF Suppression	LMU61	LMU63, LMU64																												
Other Distinguishing Characteristics	<p>LMU61 control parts mounted within end shield. Has bidirectional switch.</p> <p>YMU5 control parts mounted within end shield. Has bidirectional switch.</p>	<p>LMU57, LMU63, and LMU64 have control parts mounted within end shield. LMU63 noise suppressor mounted in square container.</p> <p>LMU64 noise suppressor mounted in rectangular container.</p> <p>LMU57, 63, and 64 have bidirectional switch.</p>																												

TABLE E
TECHNICAL CHARACTERISTICS OF SERIES GOVERNED MOTOR UNITS FOR LMU47, 60

CHARACTERISTICS	LMU47				LMU60		
Rated Horsepower	1/20				1/20		
Input Voltage	115 \pm 10%, AC/DC				115 \pm 10%, AC only		
Phase	Single				Single		
Frequency	25, 50, 60 hertz, DC				25, 50, 60 hertz		
Input Current (Full Load Amperes)	Hertz				Hertz		
	<u>25</u>	<u>50</u>	<u>60</u>	<u>DC</u>	<u>25</u>	<u>50</u>	<u>60</u>
Starting	2.4	2.7	1.9	1.8	2.4	2.8	2.1
Running	1.18	1.34	1.12	0.93	1.2	1.3	1.2
Power Input (Watts)	123	114	92	107	70	70	65
Power Factor (Full Load)	90%	74%	71%	—	90%	74%	71%
Heat Dissipation (Watts)	86	87	55	70	86	87	55
Series Resistor (Ohms)	25	—	—	50	25	—	—
Target Indicator	—				—		
Governor Speed	3600 RPM				3600 RPM		
Rotation	CCW viewed from com- mutator end				CCW viewed from com- mutator end		
Mounting	Upright				Upright		
RF Shielding	LMU47				LMU60		
RF Suppression	LMU47				LMU60		
Other Distinguishing Characteristics	Variable speed control parts mounted in stepped compartment.				Variable speed control parts mounted within end shield. Noise suppressor mounted in rectangular cradle compartment. Has bidirectional switch.		

3. PRINCIPLES OF OPERATION

SYNCHRONOUS MOTOR UNITS (Figures 1, 2, and 5)

3.01 The following description of operation applies to the miniaturized, standard, and heavy duty synchronous motor units.

3.02 The stator of the synchronous motor has two windings: a starting winding and an operating (or run) winding. The starting winding, starting capacitor and the normally-open contacts of the starting relay are connected in series. The coil of the current-operated starting relay is connected in series with the operating winding. When power is applied, the initial current through the operating winding (and also the starting relay coil) energizes the relay, and its contacts close the circuit to the starting winding. As the speed of the rotor increases, the current in the operating winding decreases and, when the current has decreased to a pre-

determined magnitude, the starting relay de-energizes. Its contacts open and remove the starting winding from the operating circuit. The rotor continues to accelerate until it reaches the synchronous operating speed. Rotation is in the counterclockwise direction, as viewed from the fan or short-shaft end of the motor.

3.03 The thermostatic cutout switch is connected in series with both stator windings. This temperature operated device opens the circuit to these windings whenever excessive current is drawn, such as may occur if the motor is stalled, thereby preventing overheating and damage to the motor and control parts. The switch may be reset after the unit has cooled by depressing a pushbutton.

3.04 In some motor units a suppression network is wired in parallel with the starting winding to suppress arcing of the relay contacts (Figure 5).

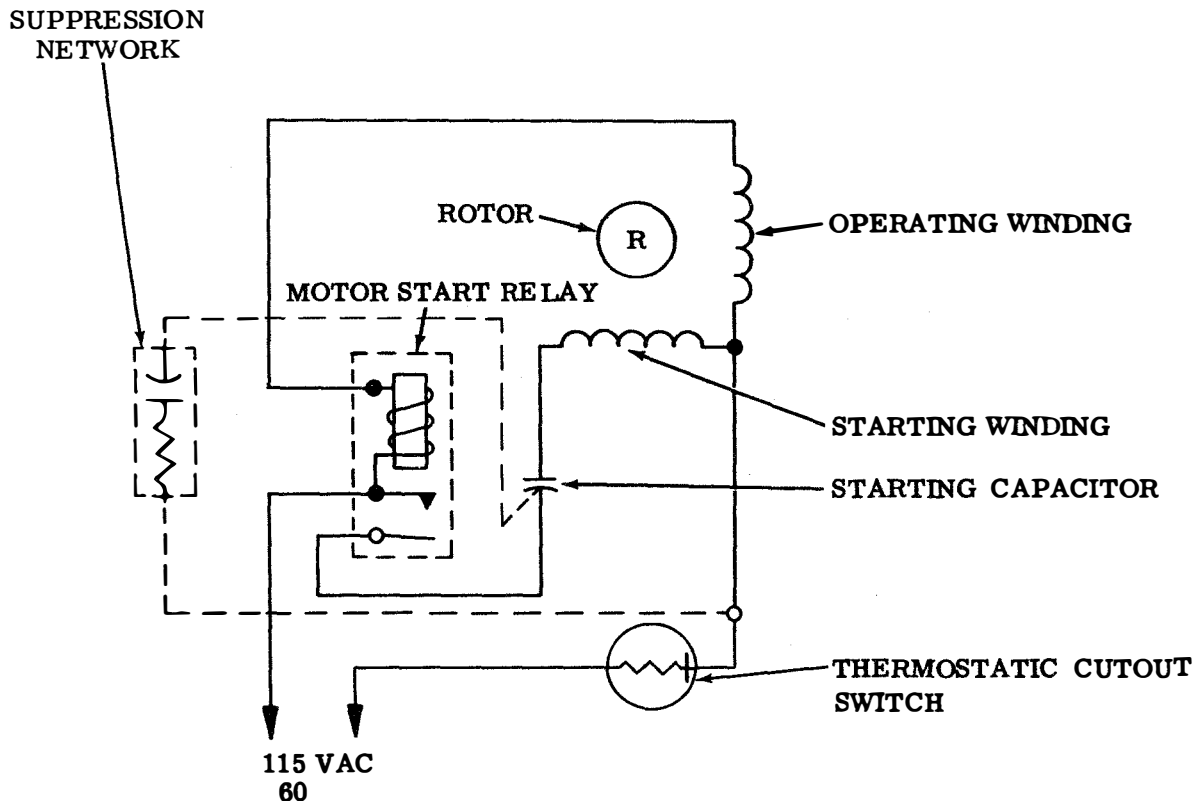


Figure 5 - Typical Synchronous Motor Unit Schematic Diagram

3.05 The following description of operation applies to synchronous motors with a bidirectional switch (Figure 6).

3.06 The stator of the synchronous motor has two windings: a starting winding and an operating (or run) winding. When power is applied to the motor terminals, the initial current through the relay coil, in series with the operating (or run) winding, energizes the relay. Its contacts close applying current to the gate of the bidirectional switch through a resistor, thus

applying power to the start capacitor. As the speed of the rotor increases, current through the operating winding decreases and, when the current has decreased to a predetermined magnitude, the starting relay de-energizes. The contacts then open, breaking the flow of current supplied to the gate of the bidirectional switch, and disconnect the starting winding and start capacitor from the line. The rotor continues to accelerate until it reaches the synchronous operating speed. Rotation is in the counterclockwise direction, as viewed from the leads end of the motor.

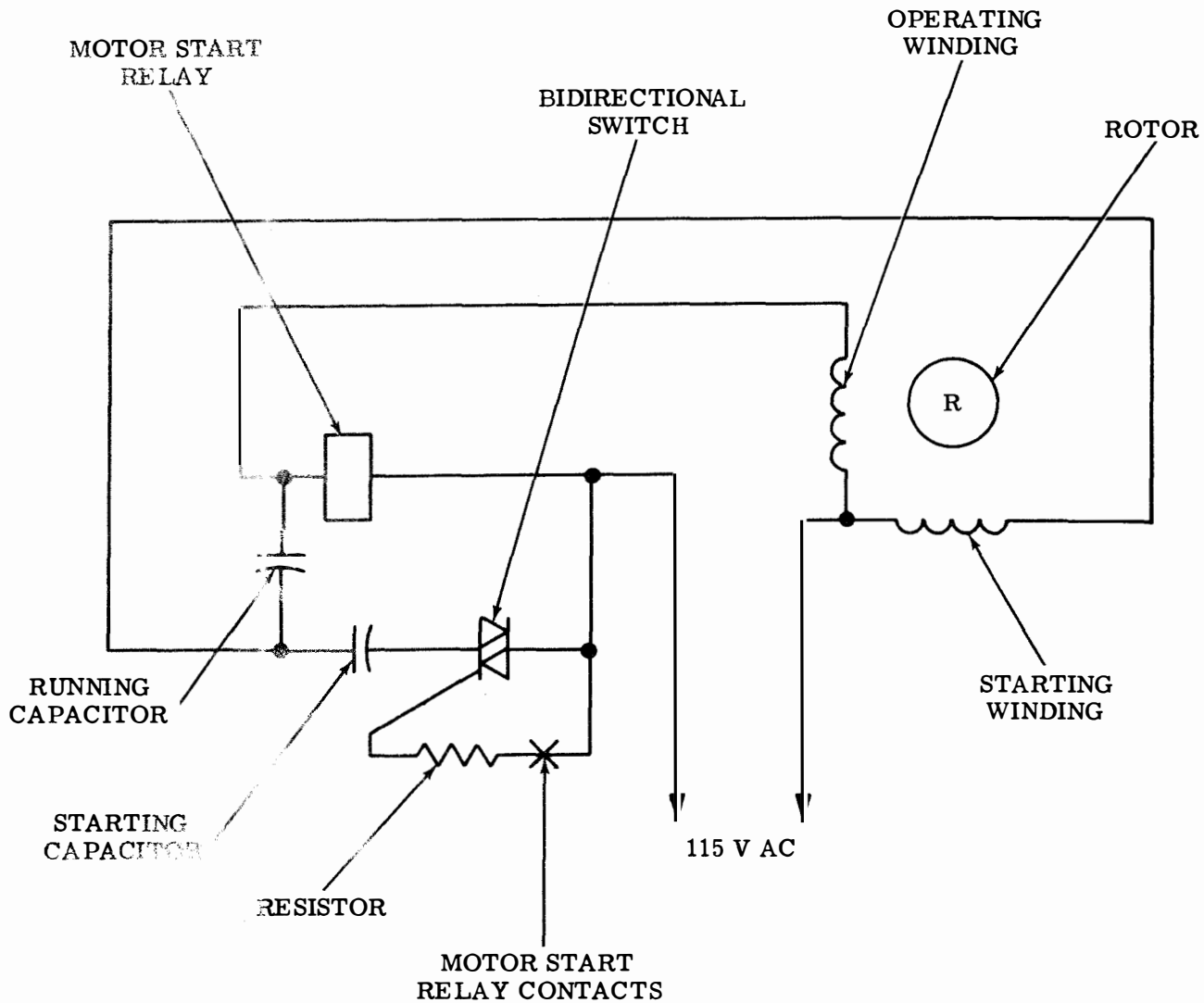


Figure 6 - Typical Synchronous Motor Unit Schematic Diagram With Bidirectional Switch

SERIES GOVERNED MOTOR UNITS

3.07 The following description of operation is applicable to ac/dc series governed motor units Figures 3 and 7.

3.08 The series wound motor utilizes an electro-mechanical governor for speed regulation. The governor regulates the speed at 3600 rpm, ± 1 percent, by alternately increasing and decreasing the current in the series connected field windings and armature, which are also in series with a governor contact. A

resistor (high-wattage) and capacitor are connected in parallel with the governor contact. The contact is held closed under the tension of a spring which is adjusted to maintain this condition during speeds up to a predetermined rate. With the contact closed, the resistors are shorted out. When the speed of the motor exceeds the predetermined rate, the centrifugal force acting upon the contact momentarily overcomes the spring tension and the contact is opened. This removes the short from the resistors and they then appear in series with the field windings and armature, reducing their current, and consequently reducing the speed of the motor.

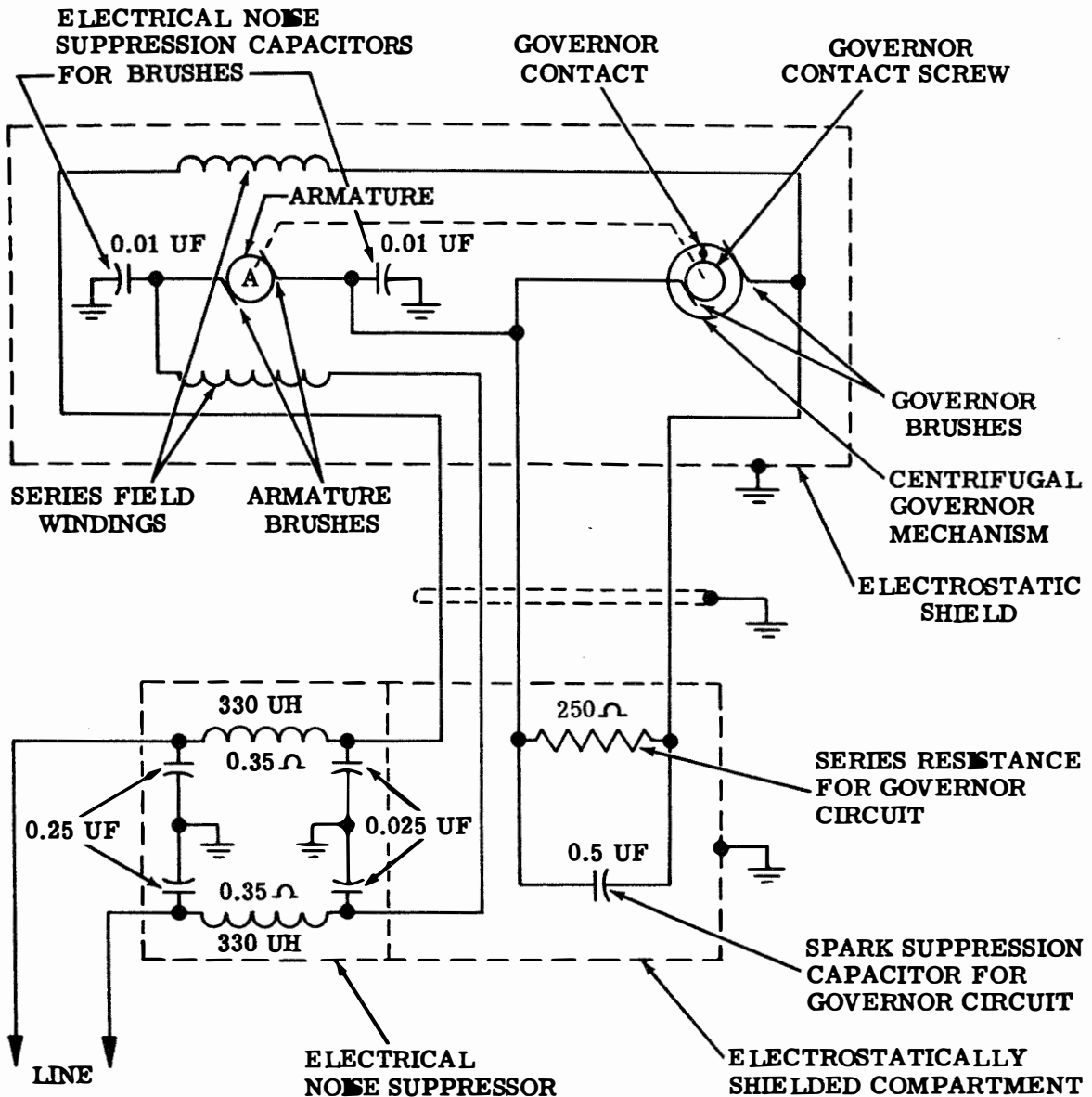


Figure 7 - Typical AC/DC Series Governed Motor Unit Schematic Diagram

3.09 The tension on the contact spring is adjustable to maintain the motor speed at 3600 rpm. To make this adjustment, a target is provided to compare the motor speed with a standard. The outside surface of the governor cover is finished in white with three rows of

black spots equally spaced about its periphery. The outer, center, and inner rows contain four, six, and thirty-five spots, respectively. The four spot row is a target which should remain essentially stable at 3600 rpm, when viewed through the moving shutter of a 120 vibrations

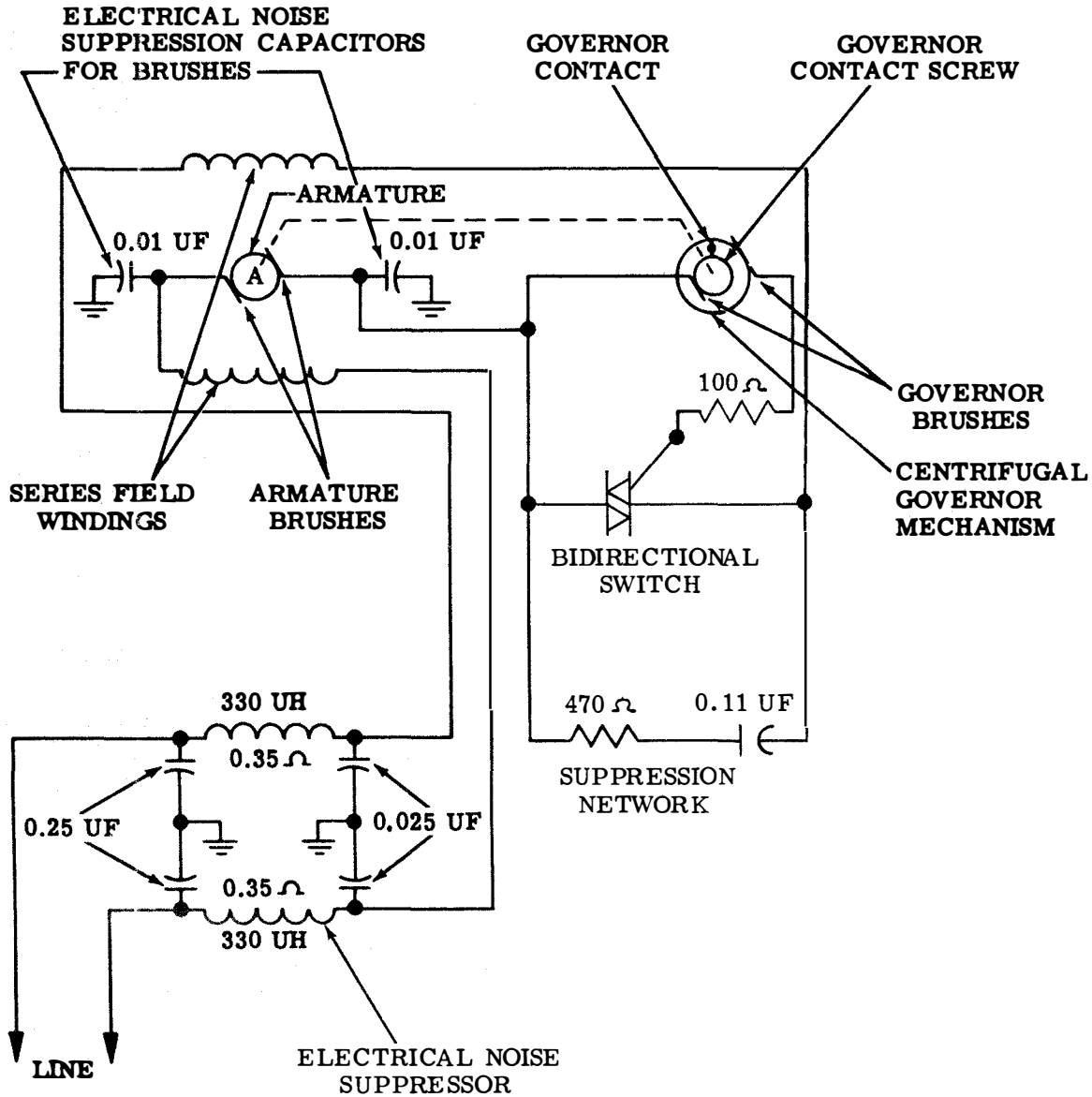


Figure 8 - Typical AC Only Governed Motor Unit Schematic Diagram With Bidirectional Switch

per-second tuning fork. The six spot and thirty-five spot rows serve as targets when using an 87.5 vibration-per-second tuning fork. The six spot row is used to approach an on-speed setting and the thirty-five spot row is used to arrive at an accurate setting of 3600 rpm.

3.10 The following description of operation is applicable to ac series governed motor units furnished with a bidirectional switch (Figure 8).

3.11 The series wound motor utilizes an electromechanical governor for speed regulation. The governor regulates the speed 3600 rpm ± 1 percent by alternately increasing and decreasing the current in the series connected field windings and armature, which are also in series with a bidirectional switch controlled by the governor contacts. Normally the governor contact spring holds the governor contact against the contact screw. When the speed of the motor exceeds a predetermined rate, the centrifugal force developed on the governor contact overcomes the pull of the governor spring, and the governor contact opens, removing the trigger of the bidirectional switch, and therefore, decreasing the speed of the motor. The switch will then go into and remain in the blocking or non-conducting state when the alternating current crosses the zero reference point. Therefore, no power is applied to the motor until such time that the contacts again close and gate triggers the switch back into the conducting state. This will occur for either polarity of applied voltage. For motor speed adjustments see 3.09.

SERIES GOVERNED MOTOR UNITS VARIABLE SPEED

3.12 The variable speed motor units are not equipped with governor control linkage, tachometer, or gears. The parts are supplied in modification kit TP173518.

3.13 The variable speed motor has a range of 1800 to 4150 rpm and can be adjusted to within ± 1 percent of a specific speed while the motor is running. In this externally controlled governor, the adjusting screw is turned by a gear train actuated by the rotation of the motor. The gear train at its driven end is divided into two branches with an odd number of gears (three) in one branch and an even number of gears (four) in the other. This provides for turning the adjusting screw in either direction to increase or decrease the tension of the governor spring. The pinion of each branch of the gear train is located on the same center as the motor shaft. The pinions are part of the brake disc assembly; an assembly which is free to idle on the stud to which it is mounted. When the speed is not being changed the gears do not rotate but merely revolve with the governor on which they are mounted. However, if a brake shoe is moved against either brake disc, by operating the lever SLOW or FAST that brake disc and its associated pinion turn the spring tension and adjusting screw. Changing of the spring tension causes the motor speed to change. For governor operation for ac/dc motor units refer to 3.08. For motor units operating on ac (with bidirectional switch) refer to 3.09.



MOTORS AND MOTOR UNITS
REQUIREMENTS AND ADJUSTMENTS

CONTENTS	PAGE	CONTENTS	PAGE
1. GENERAL	1	Motor positioning	18
2. REQUIREMENTS AND ADJUSTMENTS — OTHER THAN 28, 35, AND 37 TYPE MOTOR UNITS	2	Motor shield	19
Common Requirement	2	Standard and Heavy Duty Synchronous Motor Units	
Governors		Centrifugal switch	22
Adjusting-wheel friction washer (single-speed governor).....	8	Motor adjusting stud.....	21
Center-contacting-type Governors	9	Motor positioning.....	21
Edge-contacting-type Governors	14	Series Governed Motor Units	
Governor contacts.....	7	Governor brush spring	24
Speed-adjusting-lever stop plate	8	Governor contact	23
Governed Motors		Governor contact backstop.....	23
Cleaning brush and brush holder	6	Motor positioning.....	23
Commutator	6	Motor speed	24
Motor bearings	7	Series Governed Variable Speed Motor Units	
Motor brush	5	Brake shoe slide	25
Motor-brush spring	5	Governor spur gear train . . .	26,27
Refacing motor brush	6	Speed control linkage bearing plate	25
Synchronous Motors		Plastic Type Axial Fan for Models 28 and 35 Teletypewriter Sets	
Three-brush starting switch on G. E. motor.....	3	Cable clamp interference	28
Three-brush starting switch (Old-style on H. C. motor)	4		
3. REQUIREMENTS AND ADJUSTMENTS — 28, 35, AND 37 TYPE MOTOR UNITS	18	1. GENERAL	
Miniaturized Synchronous Motor Units		1.01 This section contains the requirements and adjustments for motors and motor units used with various teletypewriters and associated apparatus. This section and the section covering general teletypewriter requirements and adjustments provide the information necessary for maintenance of motors and motor units. It is reissued to change the title and to include the requirements and adjustments for the 14, 15, 19, and 20 type motor units, variable speed	
Air ducts	20		
Capacitor position	20		
Motor gear	18		

SECTION 570-220-700TC

series governed motor units, centrifugal switch, and plastic type axial fan. Since this a general revision, marginal arrows used to indicate changes and additions have been omitted.

1.02 Also included in this section are the requirements and adjusting procedures for the maintenance of motors, motor units, and governors used with 28, 35, and 37 teletypewriter apparatus.

1.03 Routine maintenance of a motor unit is ordinarily confined to wiping oil, grease, and dust from its exterior portions. If it becomes necessary to dismantle the motor unit, consideration should be given to substituting a new motor, since motor repair and maintenance can be done more efficiently in a repair shop than on the subscriber's premises.

1.04 The figures in this section show the adjusting tolerances, positions of moving parts, and spring tensions. For requirements and procedures for adjusting the relationship between the motor pinion and the gear, refer to the particular section for the type of apparatus involved.

CAUTION: THE ELECTRIC POWER SHALL BE DISCONNECTED BEFORE THE APPARATUS IS REMOVED FROM ITS PROTECTIVE HOUSING. WHERE OPERATION OF THE APPARATUS AFTER ITS REMOVAL FROM THE HOUSING IS REQUIRED, POWER SHALL BE APPLIED WITH APPROPRIATE PRECAUTIONARY MEASURES TAKEN TO PREVENT ACCIDENT.

1.05 The cleaning materials specified in this section are those listed in the section covering the general requirements for cleaning teletypewriter apparatus.

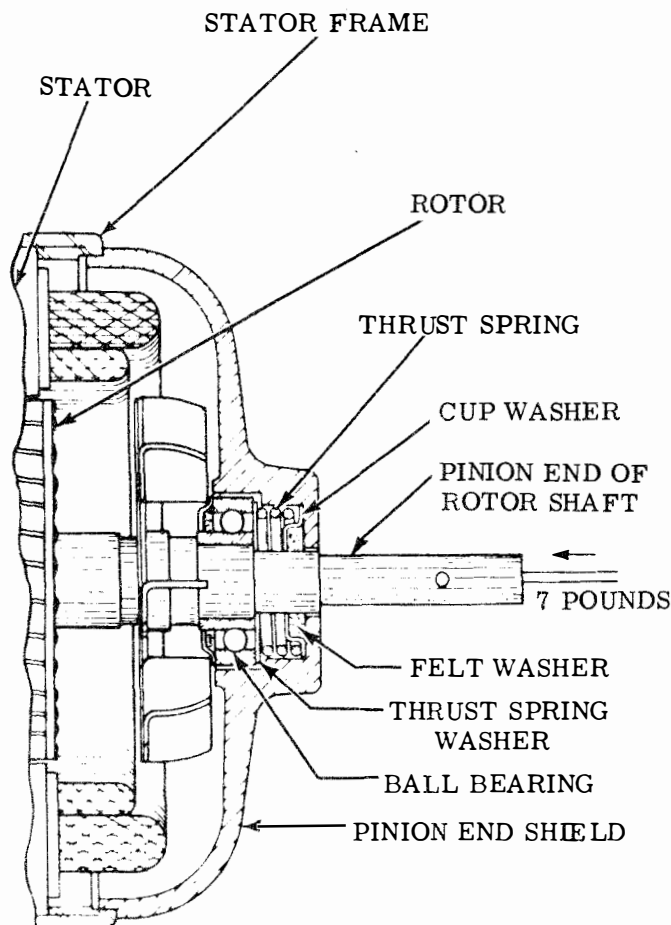


Figure 1 - Rotor Thrust Spring Tension

2. REQUIREMENTS AND ADJUSTMENTS — OTHER THAN 28, 35, AND 37 TYPE MOTOR UNITS

2.01 Common Requirement - Rotor Thrust-spring Tension: It shall require at least 7 pounds to push the shaft endwise. Upon releasing the tension, the shaft should return to its normal position. (See Figure 1.)

Note: All General Electric motors have thrust springs, but some Holtzer-Cabot motors do not.

(a) To gauge, remove the motor from the teletypewriter and place the push end of the 15 pound scale against the switch end of

the rotor shaft and apply the pressure in line with the shaft.

(b) If springs do not meet this requirement, remove the pinion end shield and clean the bearing housing. If necessary, replace the spring. Reassemble the end shield.

2.02 Synchronous Motors:

Note: These requirements need not be checked unless there is reason to believe the starting switch is causing trouble or the motor is disassembled for other reasons.

(a) Three-brush Starting Switch on G. E. Motor (See Figure 2): To disassemble,

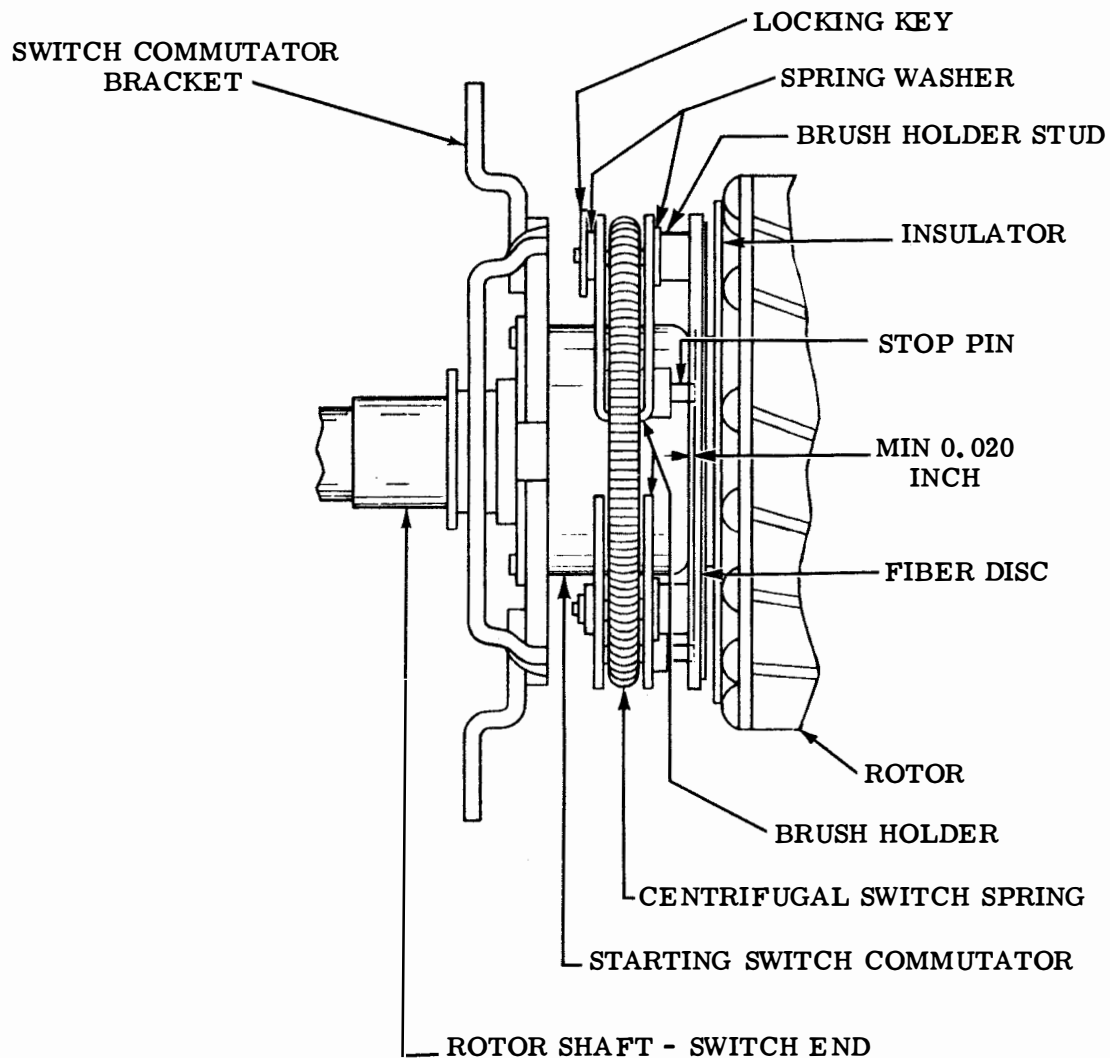


Figure 2 - Three-brush Starting Switch on G. E. Motor

detach motor from its associated apparatus, and remove pinion, motor fan (if provided), and the end shield on the starting-switch end of the motor. Pull out the rotor until the starting switch is easily accessible. Unhook and remove the centrifugal-switch spring.

- (1) Brush holders shall be mounted by their center mounting holes with their spring washers and locking keys securely in place, and shall be free from bind.
- (2) Brush-holder stop pins shall be safely within the elongated holes of the fiber disc on which the brush holders are mounted (minimum 0.020 inch), when all the play has been taken up to reduce the engagement to a minimum. Gauge by eye.
- (3) Centrifugal-switch Spring Tension: It shall require minimum 1-3/4 ounce, maximum 2 ounces for 50 hertz motors, minimum 2 ounces, maximum 2-1/2 ounces for 60 hertz motors to extend the spring to a length of 5 inches.
- (4) The fiber mounting disc shall be securely fastened to the metal sleeve that secures the assembly to the rotor shaft. Loosening of the fiber disc on the metal sleeve may cause failure of the brushes to disengage from the commutator.
- (5) The starting-switch commutator shall be free from excessive burns or pits and its wires securely soldered in place and in good condition.

To Adjust: If the commutator is burned or pitted, remove the rotor bearing, unsolder the wires attached to the commutator, and slip the commutator from the rotor shaft. Wrap a piece of 400A Aloxite around the commutator and rotate back and forth until the burned spots or pits are removed. If the burns or pits are too deep, discard the commutator. Before reassembling, make sure that the gaps between the segments of the commutator are free from metal particles and dirt.

- (6) To reassemble, replace the centrifugal-switch spring, making certain that the spring eyes are fully engaged with each other. Slide the end shield on the rotor shaft and fasten the switch commutator to the end shield, tightening the screws alter-

nately, a little at a time, until both are tight. Fasten the end shield to the motor frame tightening the screws in the same manner as above.

- (b) Three-brush Starting Switch (Old-style) on H.C. Motor (See Figure 3): To disassemble, detach motor from its associated apparatus, and remove pinion and motor fan (if provided). Remove the starting-switch split-ring screws, the end-shield screws, the bearing retainer screws, and the end shield. Remove the bearing-retainer screws from the pinion end shield of the motor and pull out the rotor until the starting-switch is easily accessible.

- (1) Brush-arm Spring Tension: It shall require minimum 5 ounces, maximum 8 ounces, to just pull the brush arm against its stop when the brushes are resting on the commutator (split ring) and the rotor is held so that the spring being checked is in a horizontal position. Repeat check for each brush-arm spring.

- (2) Brush arms shall be free and without bind, the retaining washers in place, and the end of the brush-arm mounting post safely riveted to secure the retaining washer. If retaining washers are missing or the mounting post is not safely flattened, do not attempt to flatten the mounting post but replace the assembly.

- (3) The starting-switch split ring shall be free from excessive pits or burns, the gap between its segments minimum 1/32 inch and the mica insulator on its inner surface securely glued and intact. If the split ring is burned or pitted, remove the rotor bearing, unsolder the wires attached to the split ring, and slip the split ring from the rotor shaft. Wrap a piece of 400A Aloxite around the split ring and rotate back and forth until the burned spots or pits are removed. If burns or pits are too deep, the mica insulator is loose or mutilated, or the gap between the segments is less than 1/32 inch, replace the commutator. Place the split ring on the rotor shaft and reassemble the rotor bearing.

- (4) Starting-switch brush-assembly mounting screws shall be tight and their fiber insulators free of breaks or cracks. Broken or cracked insulators shall be replaced.

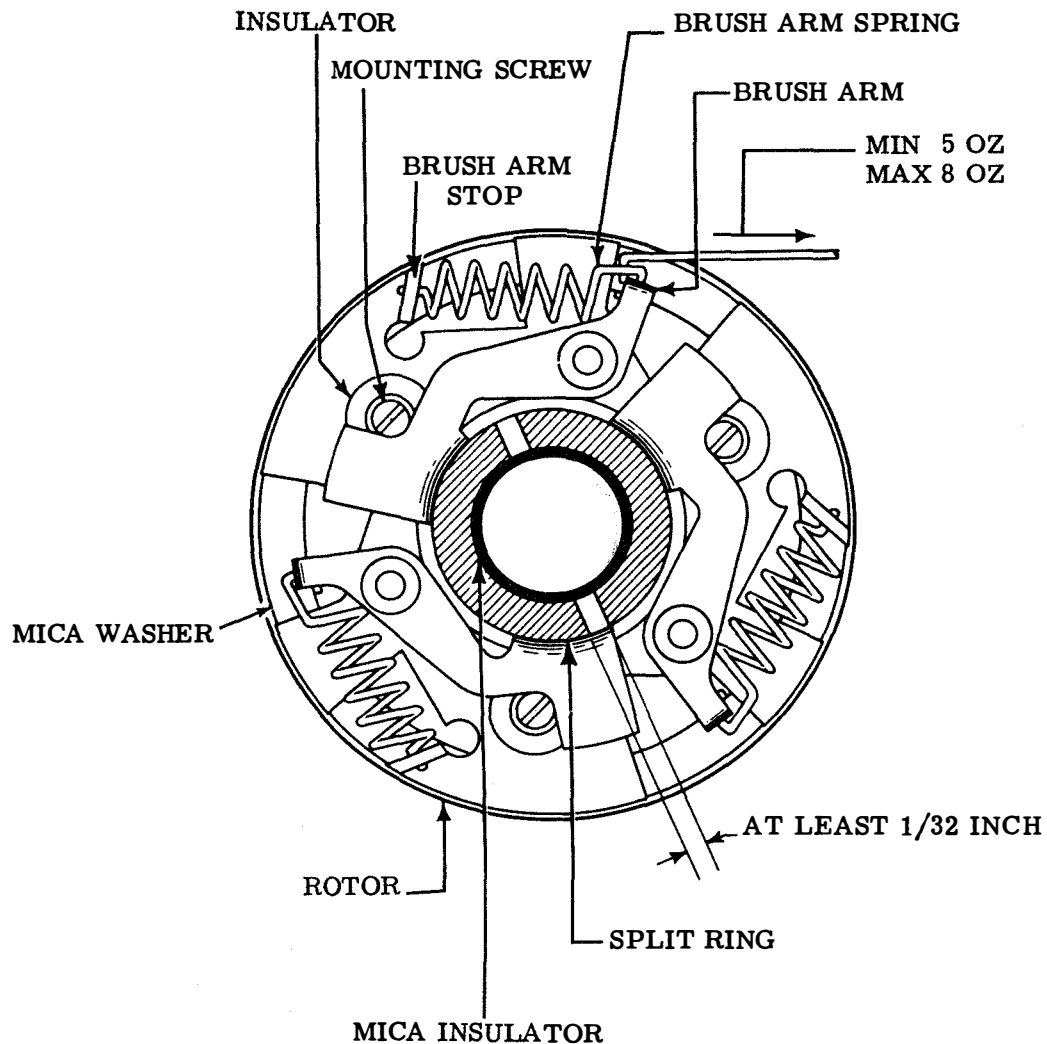


Figure 3 - Old-style Starting Switch on H.C. Motor

Note: The above old-style three-brush starting switch on the Holtzer-Cabot motor has been replaced by a starting switch which works by centrifugal action but employs no brushes. The installation of this newer style switch is covered in 5770S.

2.03 Governed Motors:

(a) **Motor-brush Spring:** Remove brush spring cap. It shall require minimum 5 ounces, maximum 8 ounces to press the motor-brush

spring to its normal position (about 1/8 inch inside the outer edge of the insulator on the brush holder). Springs not meeting this requirement shall be replaced. Avoid the tendency to keep brush spring tension low, because it results in grooving of the collector, copper picking, and loss in brush life.

(b) **Motor Brush (See Figure 4):** Remove the brush assembly (brush and brush spring) from its holder, noting its position and the side from which it was removed, and mark

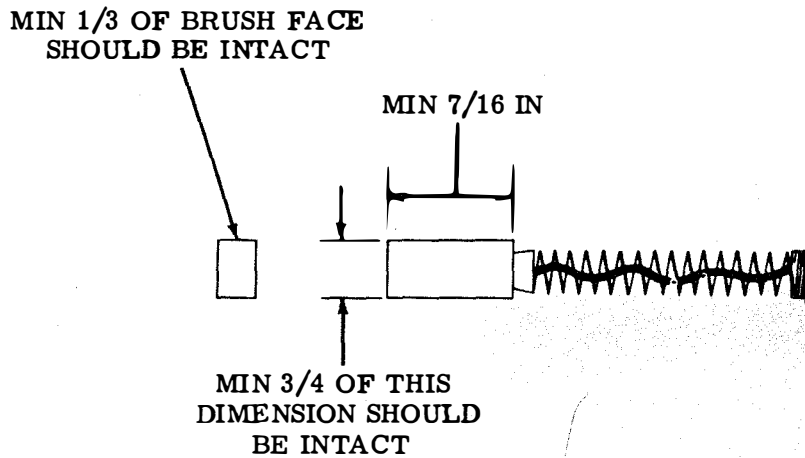


Figure 4 - Motor Brush

the brush so that it may be reassembled in the same position. Where the brush has a number stamped on the carbon, this may be used as a guide in putting the brush back in place.

- (1) There shall be minimum 7/16 inch of brush material remaining, and the contact surface of the brush bearing on the commutator shall constitute minimum 1/3 of the brush face, and extend minimum 3/4 of the long dimension.
- (2) There shall be no copper pickings imbedded in the face of the brush.
- (3) Note that the stranded wire inside the brush spring is intact and free from kinks which may prevent the spring from extending properly and that the wire is securely fastened to the brush and the contact disc.

(c) **Cleaning Brush and Brush Holder:** The brush shall be wiped with a clean KS-2423 cloth dampened with KS-19578, List 1 trichloroethane. The brush holder shall be wiped out with a KS-2423 cloth dampened with KS-19578, List 1 trichloroethane and wrapped around an orange stick.

CAUTION: USE KS-19578, LIST 1 TRICHLOROETHANE ONLY IN A WELL-VENTILATED AREA. AVOID PROLONGED OR REPEATED BREATHING OF VAPOR. AVOID PROLONGED OR REPEATED CONTACT WITH THE SKIN. USE IN SMALL QUANTITIES ONLY. DO NOT TAKE INTERNALLY.

(d) **Refacing Motor Brush:** Where it is necessary to reface a brush, the following method shall be used: Wrap a piece of 400A Aloxite around a section of the commutator under the brush holder, with the abrasive side toward the brush. Place the brush in its proper position in the holder and put back the spring cap. Turn the armature and Aloxite back and forth by hand until the brush face has the proper curvature. The last turn shall be in the normal direction of rotation. Remove the brush and bevel the edges slightly with the Aloxite. Extreme care shall be taken to remove all traces of grit and carbon from the commutator slots and adjacent windings after the above operation. Insert the brush in its holder with the identified side up. Note that the brush slides freely, but not too loosely, in the holder.

(e) **Commutator:** A smooth, even, bronze-colored or chocolate-brown glaze is a desirable condition, and the commutator shall not be disturbed unless there is excessive sparking at the brushes under load, or unless it is noted that the commutator is grooved due to wear in excess of 0.010 inch deep, as gauged by eye. Do not attempt to remove any grooves or pits from the commutator.

- (1) **Sparking:** Not all sparking under load may be of a destructive nature. To determine whether damage is being done,

examine the commutator closely. If in doubt as to whether any marks on the commutator are caused by destructive copper etching, or are merely flecks (a carbon deposit often found on the leaving edges of the bars), rub the commutator with a pencil eraser. If the marks are erased the bar is only flecked and it may be assumed that the sparking is not destructive.

(2) **Cleaning Commutator:** If small pits or streaks still remain on the leaving edges of the bars, the sparking is probably caused by destructive copper etching. In this case, remove the brushes and clean the commutator with a KS-2423 cloth dampened with KS-19578, List 1 trichloroethane, turning the shaft by hand.

(3) **Resurfacing Commutator:** If sparking is still excessive after the commutator has been cleaned, remove the armature. With a piece of 400A Aloxite paper wrapped lightly around the commutator, the armature shall be rotated in one direction only. No attempt shall be made to remove grooves or pits. If the commutator is pitted or grooved in excess of 0.010 inch, it should be sent to a repair shop equipped to turn down the commutator on a lathe. Clean out all particles that remain in the gaps between the commutator segments.

(f) **Motor Bearings:** Examine the motor bearings. If necessary, clean and repack the bearings in accordance with the instructions outlined in the section covering the general requirements for the lubrication of teletypewriter apparatus.

(g) **Reassemble the motor.** Avoid touching the commutator with the hands or fingers as grease and perspiration may cause burned spots or poor contacts.

2.04 Governors:

(a) **Governor Contacts:** These requirements are common to single-speed and two-speed governors. They need not be checked unless there is evidence that the contacts are causing trouble or unless the governor is disassembled for other reasons.

(1) **Contact Surface:** A uniform surface over the greater portion of the contact face is a desirable condition. Where the

contact surfaces are deeply pitted or have buildups, no attempt shall be made to remove pits or buildups, but the contacts shall be replaced. See Figures 5, 7, and 16(A).

(2) **Contact-spring Block:** With the speed-adjusting spring removed, there shall be at least 0.010-inch clearance between the contact-spring block clamp and the inner rim of the governor shell. Gauge by eye.

To Adjust: Position the contact-spring block by means of its mounting screws. On governors having peripheral or edge-contacting slip rings, note that this gap is free of dirt and metal particles which may tend to short-circuit the rings and the governor contacts. See Figures 7 and 16(B).

(3) **Governor Contact Clearance:** With the speed-adjusting (retractile) spring removed, there shall be a gap of minimum 0.015 inch, maximum 0.040 inch between the governor contacts.

To Adjust: Bend the governor contact spring. See Figures 5, 7, and 16(A).

(4) **Governor Contact Alignment:** With the speed-adjusting (retractile) spring in place, governor contacts shall be in line and meet squarely so that the maximum contact surface is provided. Gauge by using a 0.002-inch gauge (or smaller, if available) on all sides of the contacts. If the contacts are adjusted correctly, the gauge shall not enter between the contacts on any side.

To Adjust: Adjust the speed-adjusting spring until the contacts just make, or to the minimum tension allowed by the adjusting wheel and its screw. Line up the edges of the contacts by loosening the screw in the contact-spring clamp and reposition the contact spring so that the edge of its contact coincides with the edge of the fixed contact. In order to align the contacts so that their faces are parallel from front to back, twist the contact-spring hinge with a pair of long-nose pliers by applying pressure to the contact spring near the contact. In order to align the contacts so that their faces are parallel side to side, one of the two options given as follows shall be used.

Option 1: Where the governor shell is provided with elongated holes for the fixed-

contact-block mounting screws, loosen the screws and move the block up or down as shown in Figure 5 until the contact faces are parallel. Tighten the mounting screws.

Option 2: Where the governor shell does not have elongated holes for the fixed-contact-block mounting screws, loosen the screws and move the block from side to side as shown in Figure 5 until the contact faces are parallel. Tighten the mounting screws. If the contact faces cannot be made parallel by either of the two options given above, remove the contact spring and check with the TP95960 tape gauge used as a straightedge as shown in Figure 6. When necessary, bend the contact spring at the first bend from the contact. (See Figures 5, 6, 7, and 16.)

(b) Adjusting-wheel Friction Washer (Single-speed Governor): It shall require minimum 16 ounces, maximum 24 ounces to start the adjusting wheel moving.

To Gauge: Rotate the adjusting wheel to a point where the governor-contact pressure is minimum 13 ounces, maximum 14 ounces

when the pull end of the 32-ounce scale is hooked over the contact spring at the contact and pulled parallel to the speed-adjusting spring and the contacts just opened. Insert a common pin radially into the leather rim of the adjusting wheel and hook the pull-end of the 32-ounce scale over the pin at the leather and pull at a tangent to the circumference of the adjusting wheel.

To Adjust: Remove the friction washer and bend the large projections. (See Figure 7.)

(c) Speed-adjusting-lever Stop Plate: On all governed motors equipped with speed-adjusting lever TP7661, there shall be from minimum 0.006-inch, maximum 0.050-inch clearance between the adjusting lever wearing strip and the governor, when the speed-adjusting lever is held against the stop plate.

To Adjust: Position the adjusting lever stop plate by means of its elongated mounting holes. (See Figure 9.)

CAUTION: DO NOT ATTEMPT TO CHECK THE ABOVE REQUIREMENT OR MAKE THE ABOVE ADJUSTMENT WITH THE MOTOR RUNNING.

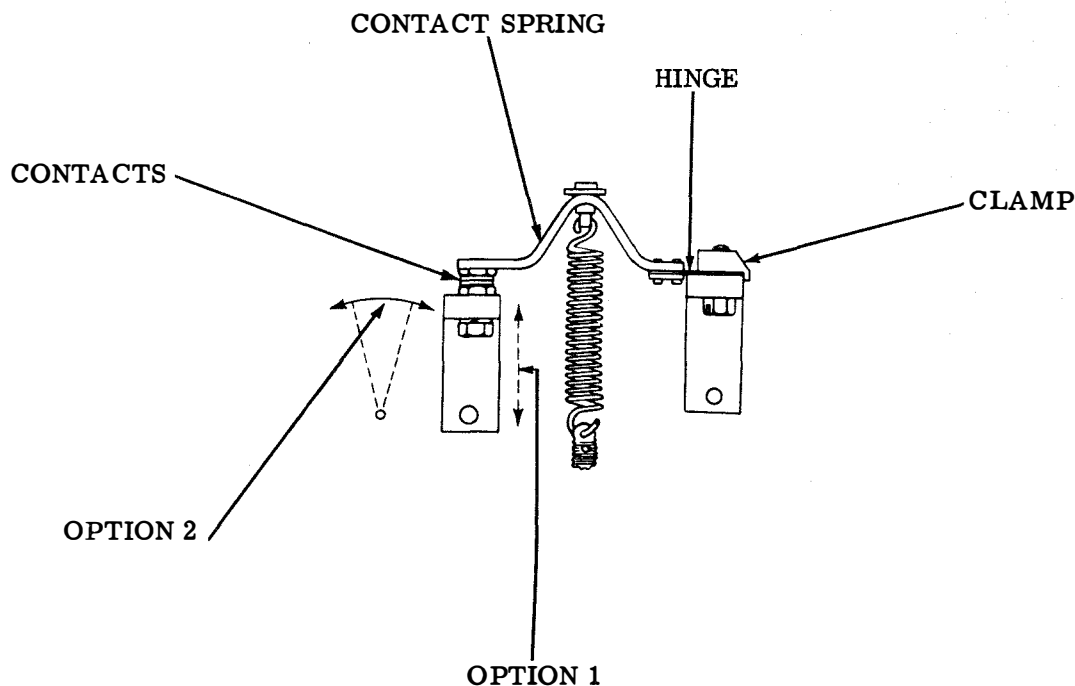


Figure 5 - Governor Contacts

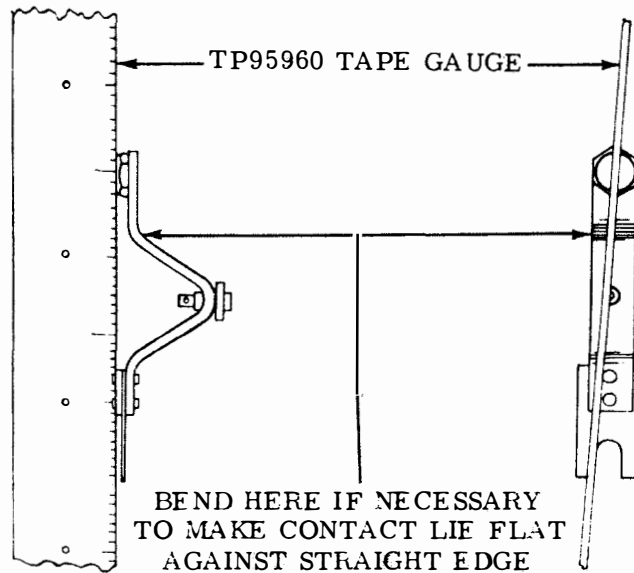


Figure 6 - Tape Gauge

(d) Center-contacting-type Governors

(1) Contact Springs: The distance from the inner surface of the governor cover to the highest point on the contact springs shall be minimum $25/32$ inch, maximum $27/32$ inch.

To Adjust: Bend the springs. (See Figure 8.)

(2) Inner-disc Contact Spring: With the TP135678 socket wrench placed over the nut which holds the contact springs in place, the distance from the outer surface of the wrench to a point where the TP95960 tape gauge, used as a ruler, touches the curved surface of the inner-disc contact spring shall be minimum $17/32$ inch, maximum $19/32$ inch.

To Gauge: Place the end of the TP95960 tape gauge against the outer surface of the wrench so that the edge of the $1/32$ -inch

scale is resting against the curved surface of the inner-disc contact spring.

To Adjust: Bend the spring. Recheck (1). (See Figure 8.)

(3) Outer-disc Contact Spring: With the socket wrench in position as in (2), the distance from the outer surface of the wrench to a point where the tape gauge touches the curved surface of the outer-disc contact spring shall be minimum $7/16$ inch, maximum $1/2$ inch. To gauge, place the end of the TP95960 tape gauge against the outer surface of the wrench so that the edge of the $1/32$ -inch scale is resting against the curved surface of the outer-disc contact spring.

To Adjust: Bend the spring. Recheck (1). (See Figure 8.)

(4) Governor-brush-spring-plate Bracket: The inner surface of the bracket shall

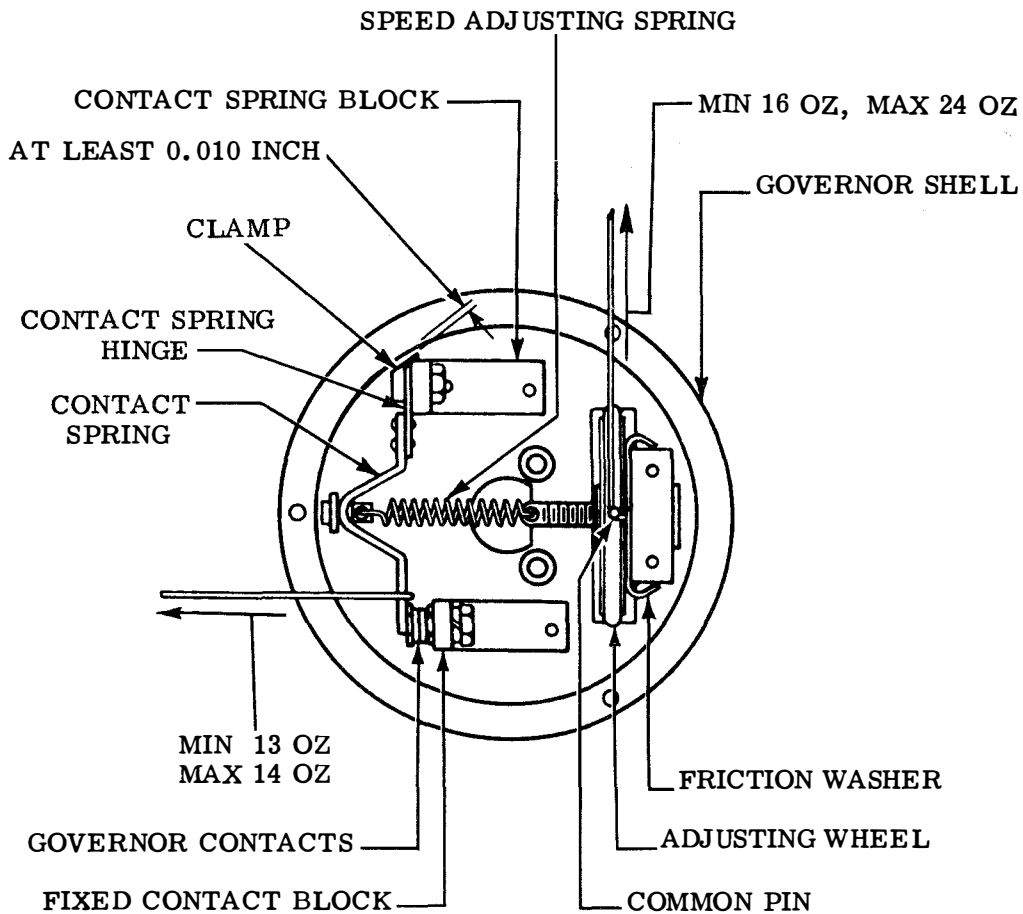


Figure 7 - Center Contact Governor Assembly

be parallel to the governor cover. Gauge by eye.

To Adjust: Loosen the brush-spring-plate mounting screws and reposition the bracket. Tighten the screws. (See Figure 9.)

(5) **Contact Discs:** A smooth, even, bronze-colored glaze is a desirable condition for the contact surfaces of the discs and they shall not be disturbed unless there is excessive sparking under the

brushes. Gauge by eye. When it is necessary to clean the discs, a KS-2423 cloth, wrapped around an orange stick and moistened with KS-19578, List 1 trichloroethane, shall be held on each disc while the motor is being rotated by hand and the brushes have been removed. If the discs are pitted or burned, a piece of 400A Aloxite wrapped around an orange stick shall be held against each disc while the motor is being rotated by hand. Badly grooved discs shall be replaced. (See Figure 8.)

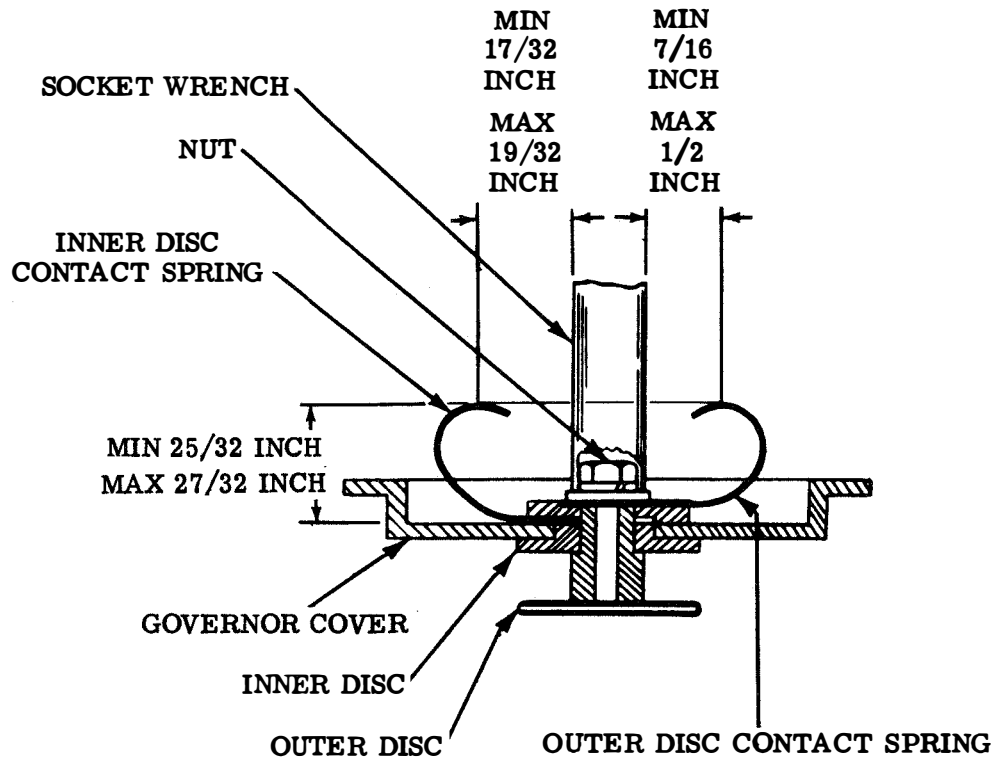


Figure 8 - Governor Cover Contact Spring Disc Assembly

(6) Governor brushes shall lie flat against their discs and there shall be minimum $3/32$ inch of the brush material remaining. Gauge by eye.

To Adjust: Level off the brush by passing a piece of 400A Aloxite between the brush and the disc. If there is less than $3/32$ inch of the brush remaining, replace the brush. (See Figure 10.)

(7) Inner-disc Brush-spring Tension: It shall require minimum 4-1/2 ounces, maximum 5-1/2 ounces to start the brush moving away from its disc.

To gauge: Hook the pull end of the 8-ounce scale over the brush spring at the brush and pull horizontally away from the motor.

To Adjust: Remove and bend the brush spring. Reassemble the spring and recheck (6). (See Figure 9.)

(8) Outer-disc Brush-spring Tension: It shall require minimum 4-1/2 ounces, maximum 5-1/2 ounces to start the brush moving away from its disc.

To Gauge: Apply the push end of the 8-ounce scale to the brush spring at the brush and push horizontally toward the motor.

To Adjust: Remove and bend the brush spring. Reassemble the spring and recheck (6). (See Figure 9.)

(9) Governor-brush Alignment: The outer edge of the brushes shall be within $3/64$ inch of the outer edge of the discs throughout one revolution of the governor; and a line established by the center of the outer disc and the center of one of the brushes shall pass through some portion of the other brush.

To Gauge: Remove the governor-adjusting bracket.

To Adjust: Reposition the brush spring by means of its mounting slot. Reassemble the governor-adjusting bracket. (See Figure 11.)

(10) Governor-adjusting Bracket: There shall be a clearance of minimum 0.020 inch, maximum 0.060 inch between the

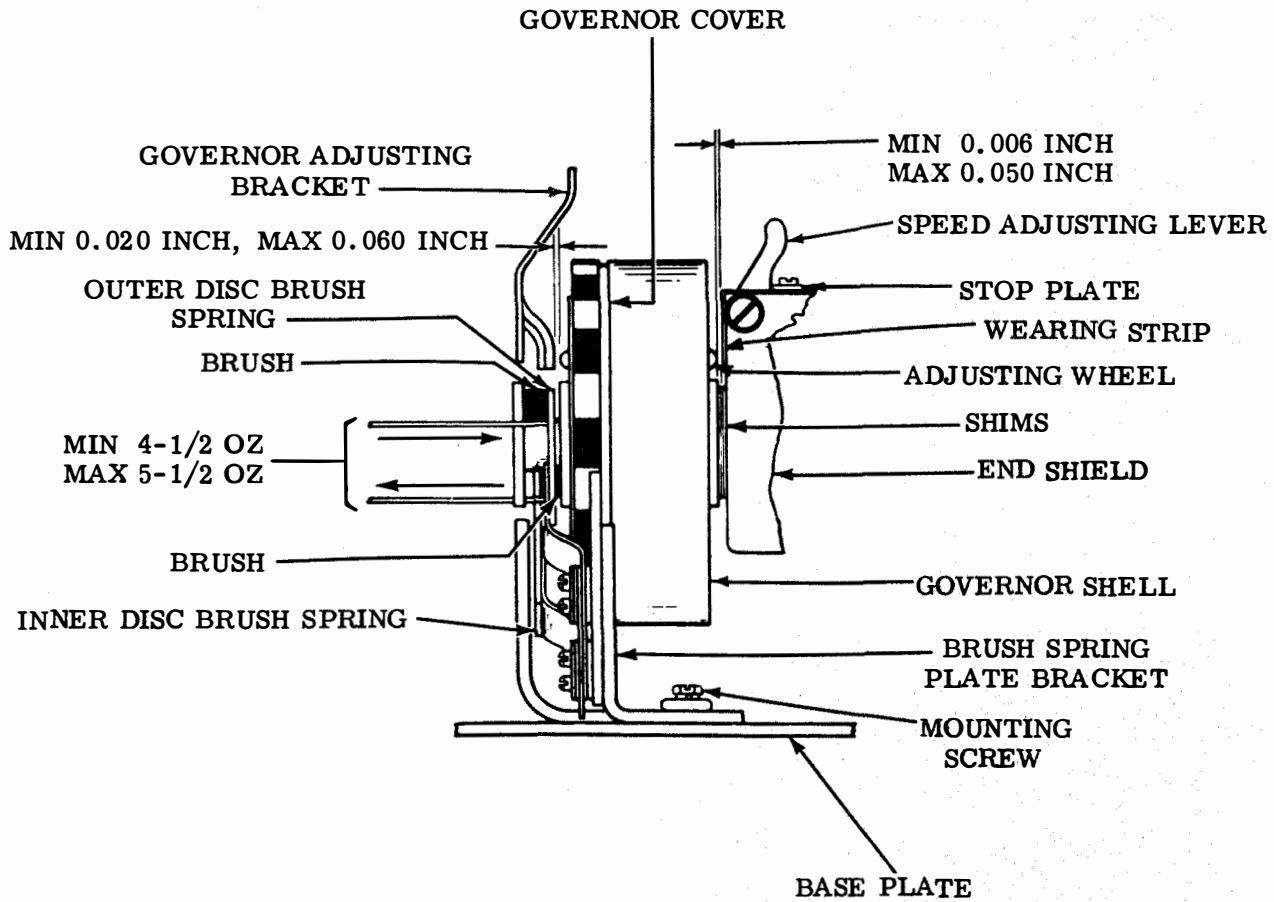


Figure 9 - Governor Brush Spring Plate Bracket Assembly

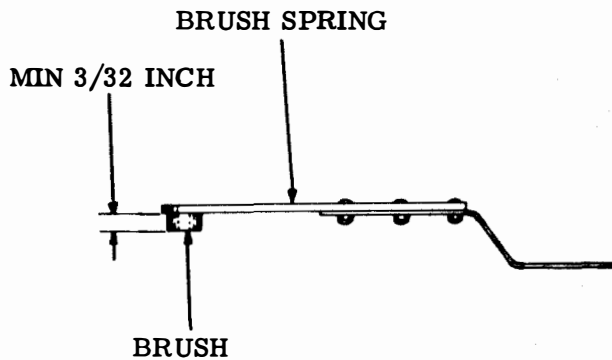


Figure 10 - Brush Spring Assembly

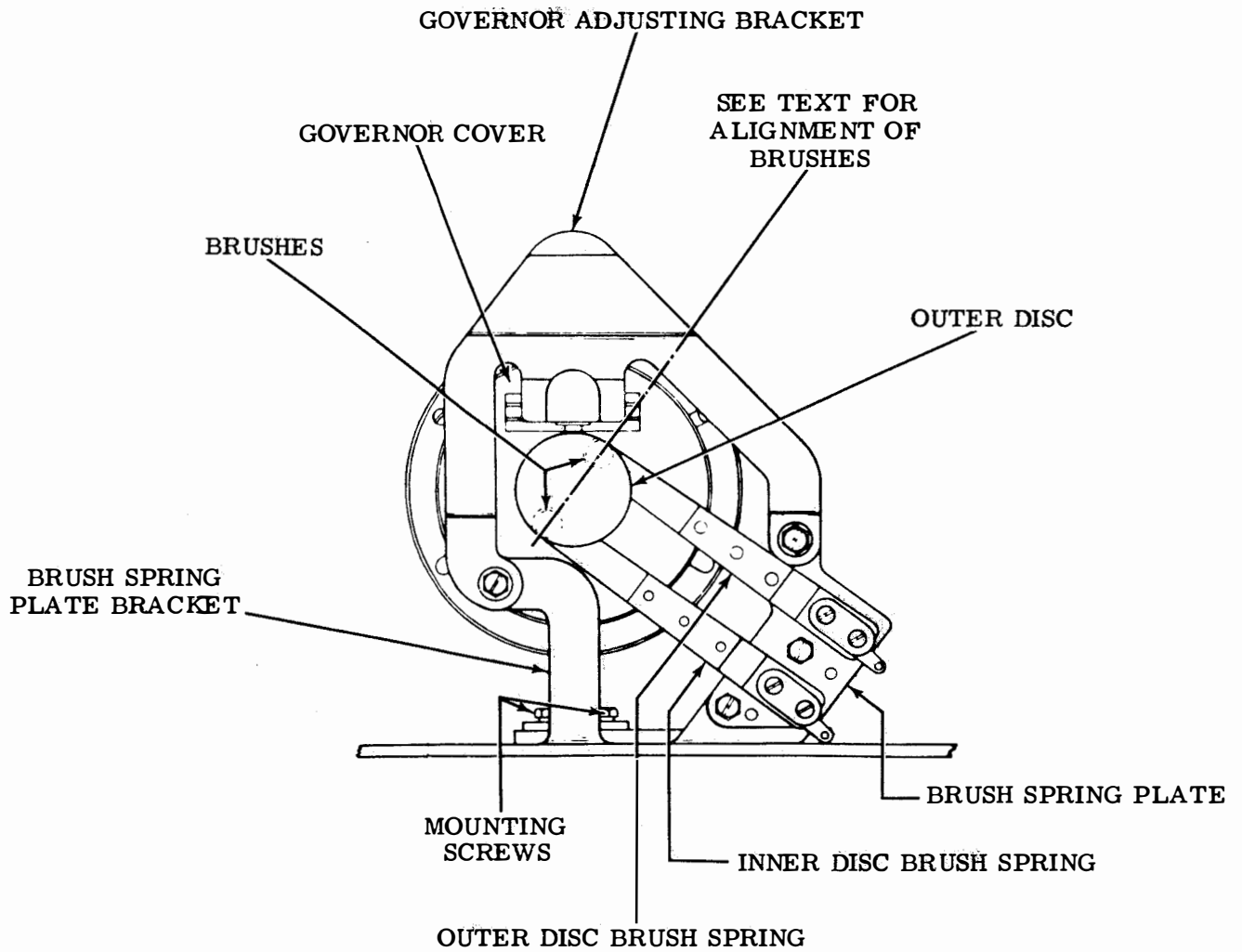


Figure 11 - Governor Adjusting Bracket Assembly

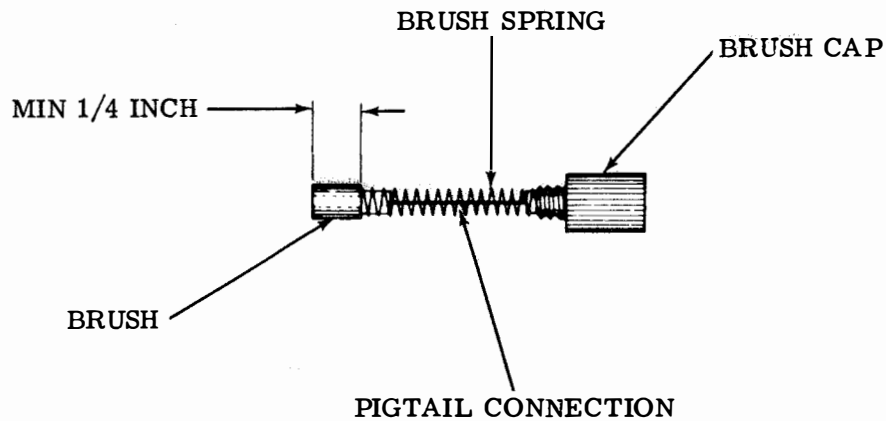


Figure 12 - Governor Brush

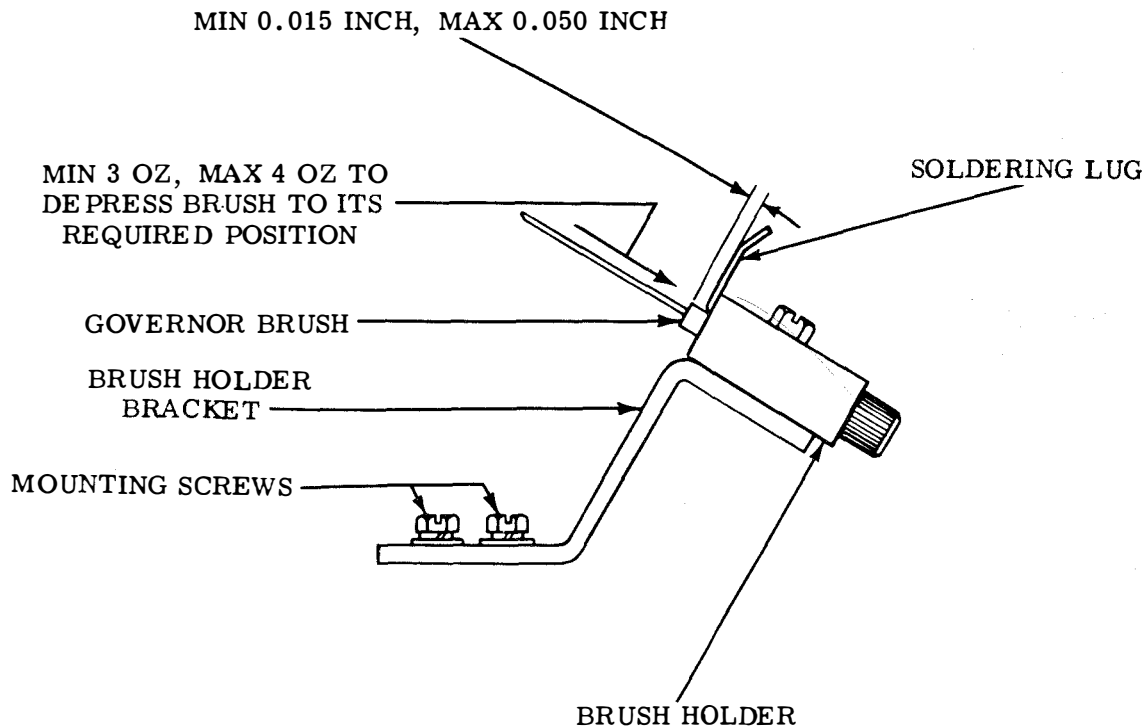


Figure 13 - Governor Brush Bracket Assembly

adjusting wheel and the governor-adjusting bracket. This requirement shall be ignored if the bulge near the center of the adjusting bracket is omitted in manufacture.

To Gauge: Rotate the governor until the adjusting wheel is opposite the adjusting surface of the governor-adjusting bracket.

To Adjust: Bend the governor-adjusting bracket. (See Figure 9.)

(e) **Edge-contacting-type Governors:** The following brush requirements are also applicable to the TP138598 auxiliary brush holder assembly (specification 3125S and 5332S).

(1) **Governor Brushes:** There shall be minimum 1/4 inch of the brush material remaining on each brush, the braided wire pigtail connection inside the brush spring shall be free from kinks which may prevent the spring from extending properly, and the wire shall be securely fastened to the brush and the brass insert of the brush cap. Gauge by eye. If the brush has less

than 1/4 inch of its material remaining or if the spring is mutilated, replace the brush. (See Figure 12.)

(2) **Alignment of Governor Brushes:** The governor brushes shall ride approximately in the center of the governor rings. Check for a full revolution.

To Adjust: Reposition bracket by means of its mounting screws. (See Figure 14.)

(3) **Governor-brush Spring Tension:** It shall require minimum 3 ounces, maximum 4 ounces to hold the brush in its normal position (within minimum 0.015 inch, maximum 0.050 inch of the brush holder).

To Gauge: Remove the brush holder from the brush holder bracket, remove the brushes from the holder, and clean each brush with a KS-2423 cloth moistened with KS-19578, List 1 trichloroethane. Clean out the holes in the holder into which the brushes are placed and reinsert the brushes, making sure that the brushes move freely in the holder. Using the push end of the 8-ounce

scale, depress that portion of the brush which extends beyond the holder until the end of the brush is within minimum 0.015 inch, maximum 0.050 inch of the holder. Where springs do not meet the requirement, replace the governor-brush-spring assembly. Reassemble the brush holder. (See Figure 13.)

(4) Brush Holder: There shall be minimum 0.015-inch, maximum 0.050-inch clearance between the brush holder and the rings through one complete revolution of the governor.

To Adjust: Loosen the brush-holder mounting screws and reposition the brush holder. Tighten the mounting screws. (See Figure 14.)

(5) Two-speed Governor-adjusting-wheel Detent-spring Pressure: The detent spring shall rest on the adjusting wheel; (1) in all positions of the adjusting wheel,

(2) at the point of minimum pressure with a minimum 2-ounce, maximum 4-ounce pressure.

To Gauge the Pressure: With the detent spring resting between the notches on the adjusting wheel, hook the 8-ounce scale to the spring near the adjusting wheel as shown by (A) in Figure 15. With the scale in a horizontal position, pull at right angles to the spring. To determine the minimum pressure point, the check shall be made at three points approximately equally spaced around the periphery with the wheel in its final revolution at each end of its travel.

To Adjust: Loosen the clamping screw and lock-nut and shift the detent spring as required. Moving the spring higher up on the rim of the wheel increases the tension and shifting the spring lower on the wheel decreases the tension. If satisfactory pressure cannot be obtained in this way, remove the clamping screw and locknut and bend

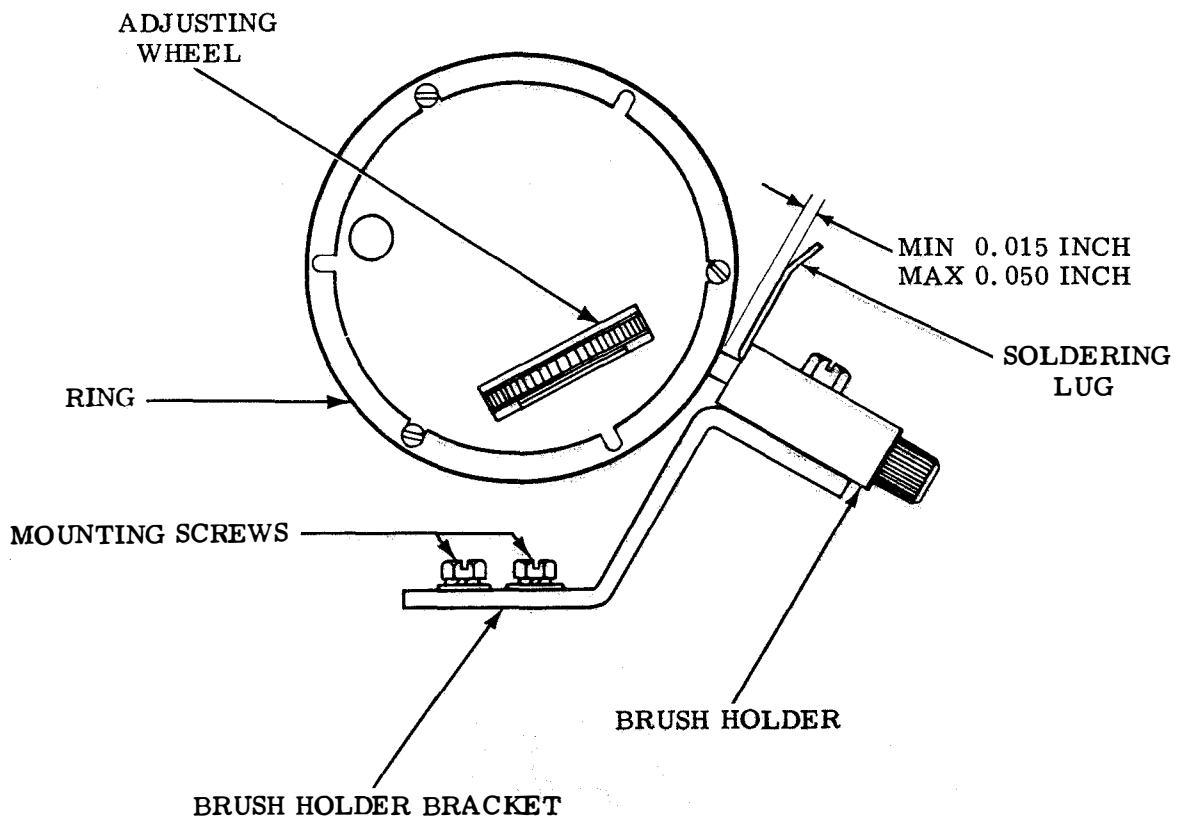


Figure 14 - Governor Adjusting Wheel

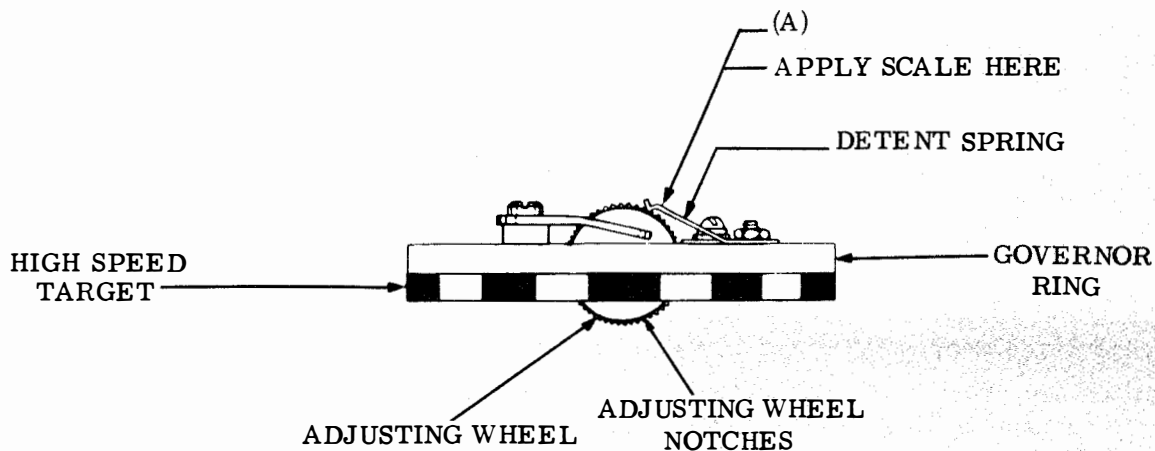


Figure 15 - Half of Two-speed, Edge-contacting Governor

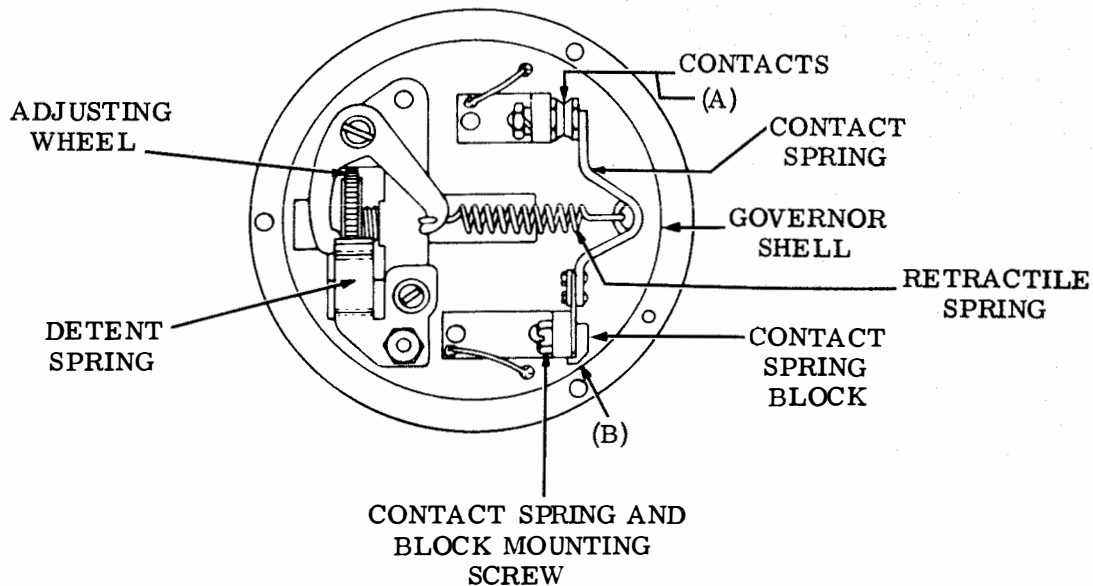


Figure 16 - Two-speed Edge-contacting Governor-Interior View of Half of Governor

the detent spring as required. Position the spring on the wheel and tighten the screw and nut. (See Figure 15.)

(6) Governor Rings: A smooth, even, bronze-colored glaze is a desirable condition for the contact surface of the rings and they shall not be disturbed unless there is excessive sparking under the brushes. Gauge by eye. When it is necessary to clean the rings, a KS-2423 cloth moistened with KS-19578, List 1 trichloroethane shall be

held against the rings while the motor is in motion. To remove burned spots from the rings, a piece of 400A Aloxite held lightly against the rings while the motor is in motion, along with a KS-2423 cloth to immediately wipe off the cuttings and sand, may be used. (See Figure 15.)

(7) Governor-brush contact surface shall be curved to fit the contour of the rings. Gauge by eye. To resurface the brushes, hold a piece of 400A Aloxite around the

outer shell of the governor between the brushes and the shell and rotate the governor back and forth by hand. The last rotation shall be in the normal direction of travel. (See Figure 14.)

(8) Adjusting Governor Speed: With the motor at rest, turn the adjusting wheel (Figure 7 or 16) as indicated by the letters S and F to decrease or increase the speed respectively. On two-speed governors, the

outer adjusting wheel is for adjusting the high speed, and the inner adjusting wheel is for adjusting the low speed. As the inner adjusting wheel is not very accessible, a screwdriver or other slender object should be used to engage it. Tuning fork TP103628 (87.5 V. P. S.) is recommended for setting the speeds, as explained in the section covering the speed regulation of teletypewriter apparatus. (See Figures 7 and 16.)

3. REQUIREMENTS AND ADJUSTMENTS — 28, 35, and 37 TYPE MOTOR UNITS

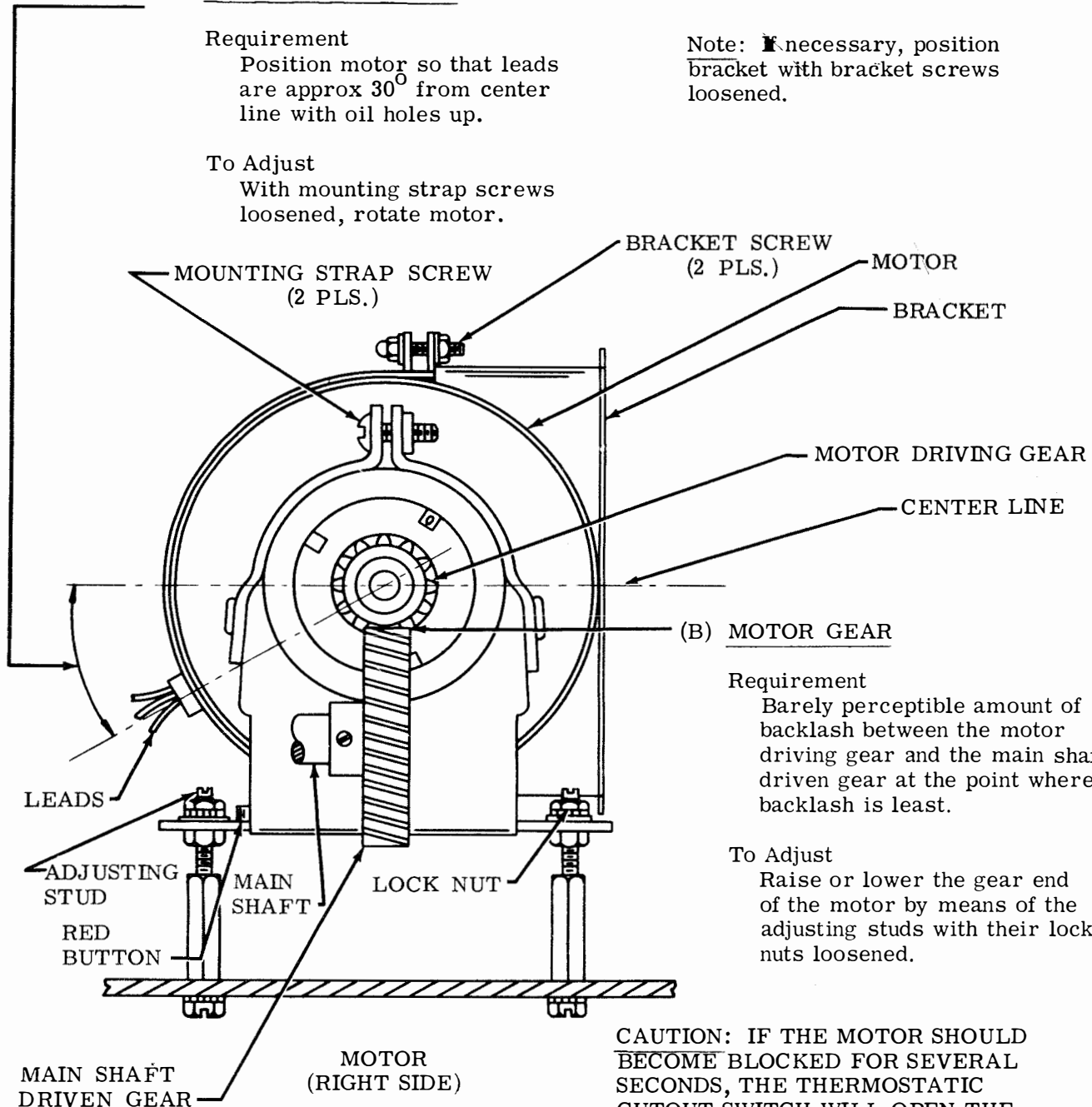
3.01 Miniaturized Synchronous Motor Units

(A) MOTOR POSITIONING

Requirement
Position motor so that leads are approx 30° from center line with oil holes up.

Note: If necessary, position bracket with bracket screws loosened.

To Adjust
With mounting strap screws loosened, rotate motor.



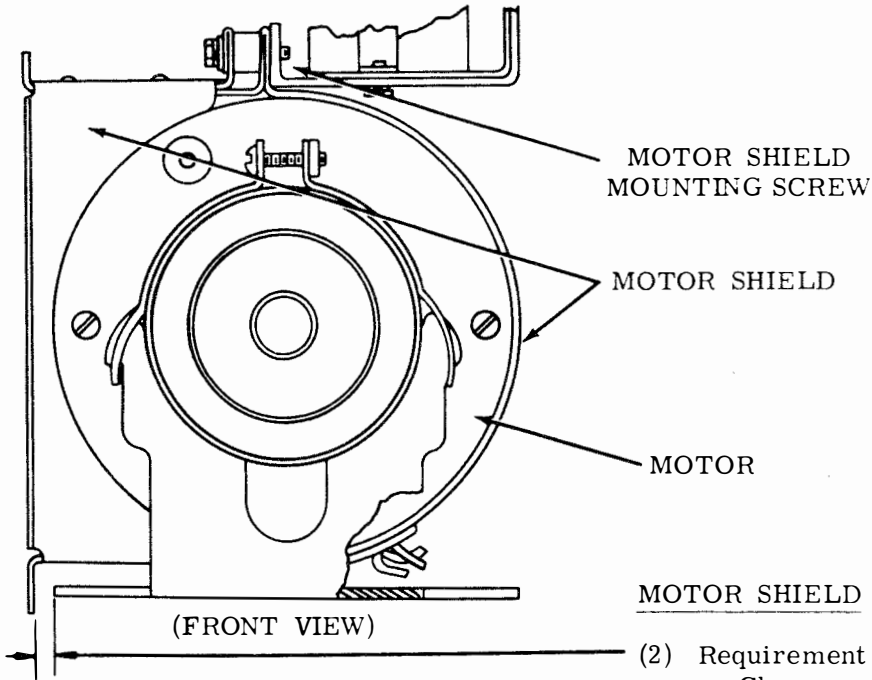
(B) MOTOR GEAR

Requirement
Barely perceptible amount of backlash between the motor driving gear and the main shaft driven gear at the point where backlash is least.

To Adjust
Raise or lower the gear end of the motor by means of the adjusting studs with their lock nuts loosened.

CAUTION: IF THE MOTOR SHOULD BECOME BLOCKED FOR SEVERAL SECONDS, THE THERMOSTATIC CUTOUT SWITCH WILL OPEN THE CIRCUIT. SHOULD THIS HAPPEN, ALLOW MOTOR TO COOL AT LEAST 5 MINUTES BEFORE MANUALLY RESETTING THE SWITCH BY DEPRESSING THE RED BUTTON. AVOID REPEATED RESETTING.

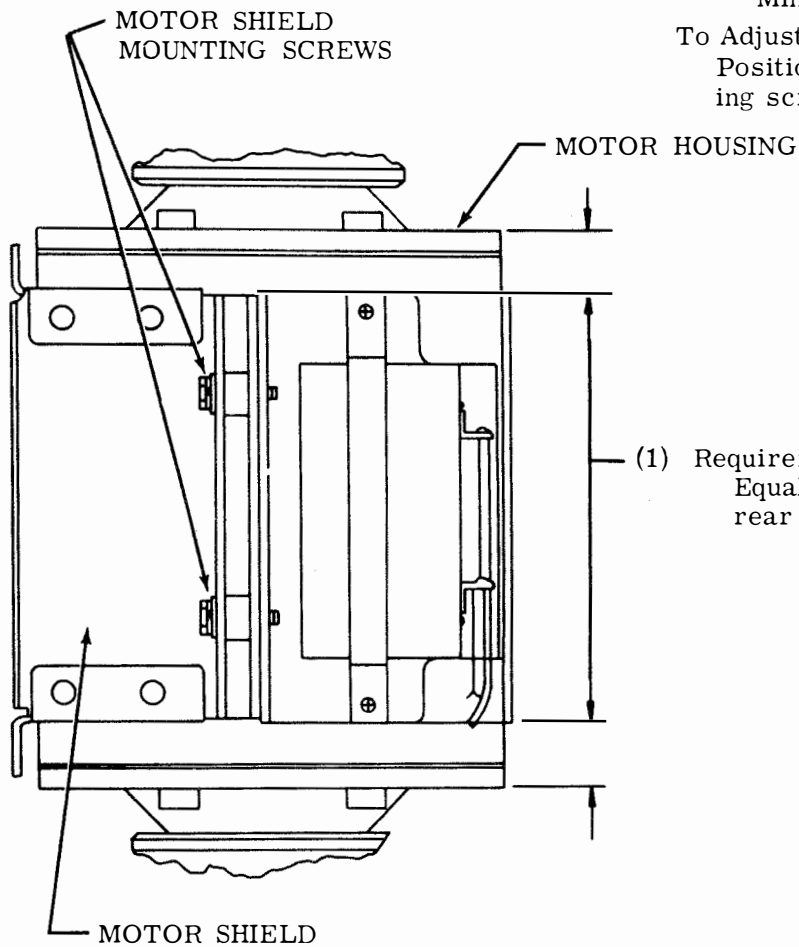
3.02 Miniaturized Synchronous Motor Units (continued)



MOTORSHIELD (IF SO EQUIPPED)

(2) Requirement
 Clearance between motor shield and
 motor mounting bracket should be
 Min 0.062 inch

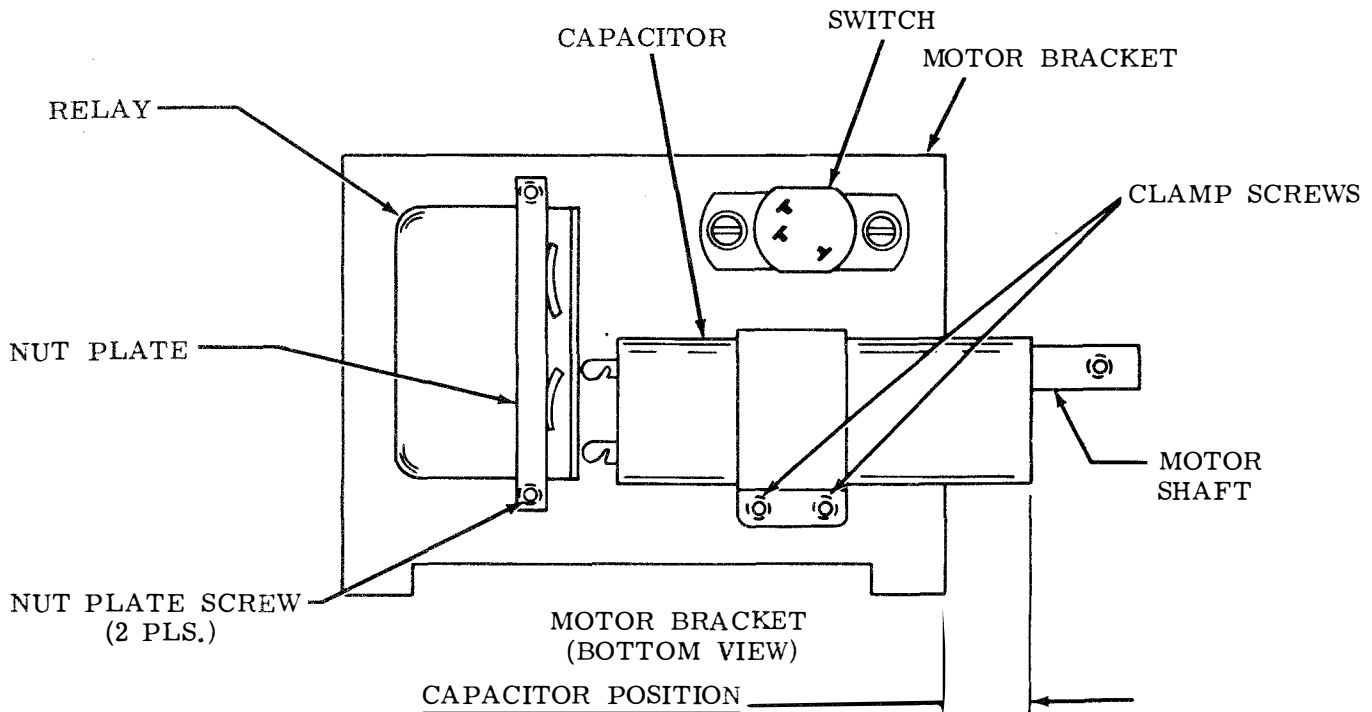
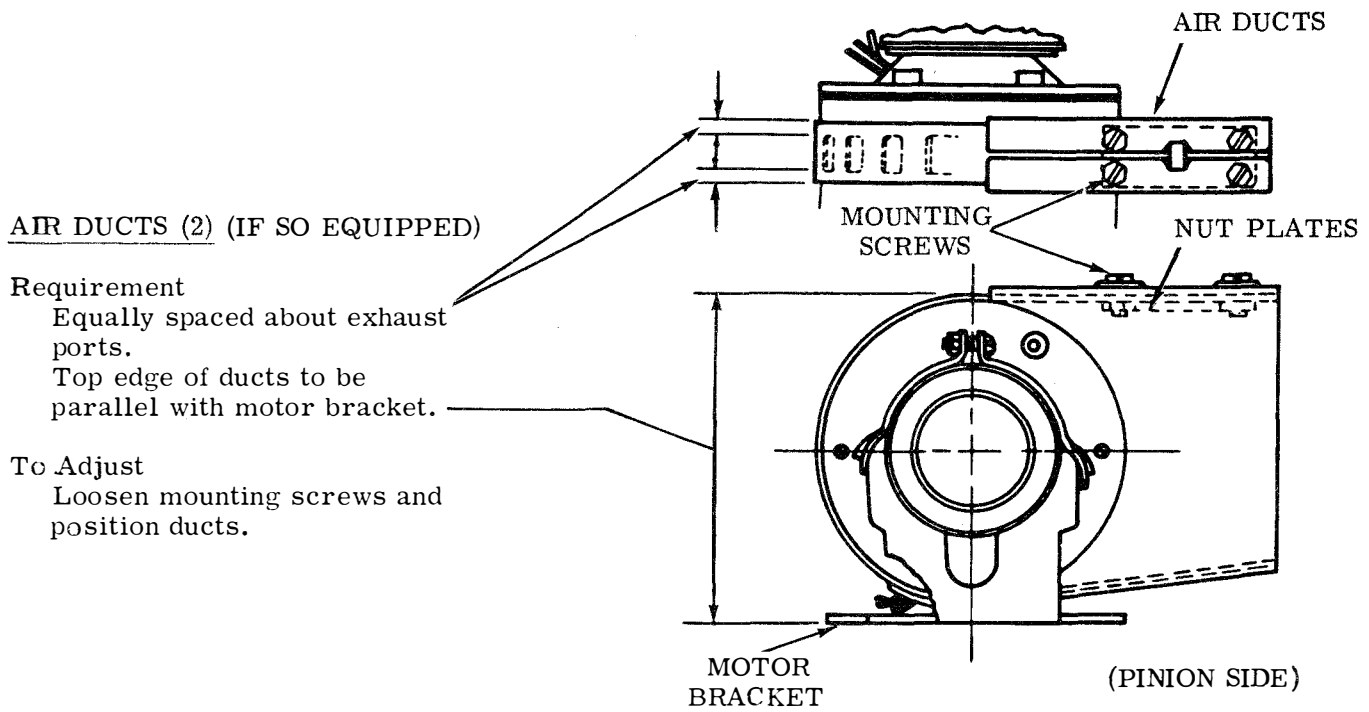
To Adjust
 Position motor shield with its mount-
 ing screws loosened.



(1) Requirement
 Equal clearance between front and
 rear ends of motor and motor shield.

(TOP VIEW)

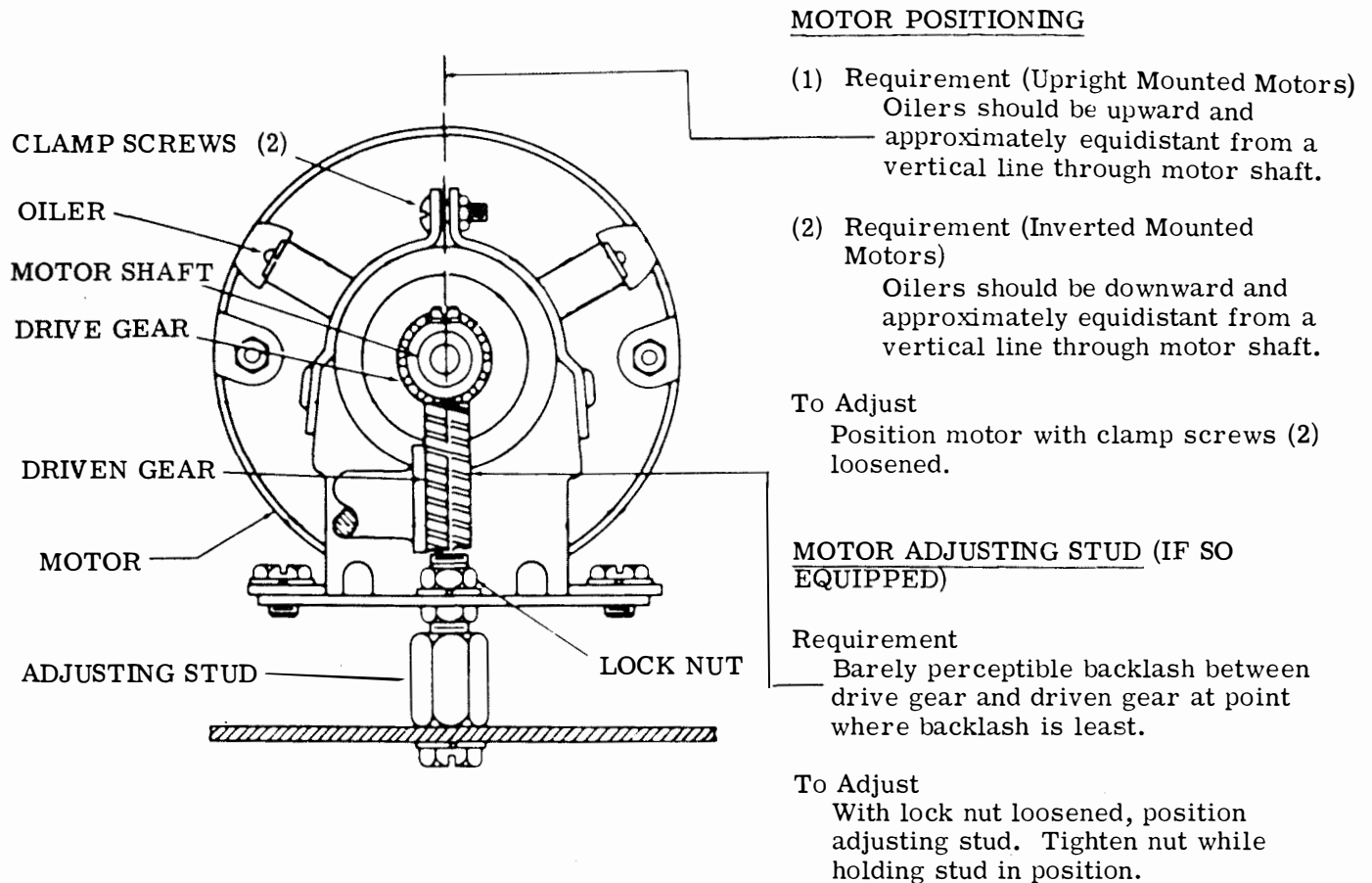
3.03 Miniaturized Synchronous Motor Units (continued)



Requirement
Max 1/2 inch between motor bracket and end of capacitor.

To Adjust
Position relay and capacitor with motor removed from motor bracket and nut plate and clamp screws loosened.

3.04 Standard and Heavy Duty Synchronous Motor Units



CAUTION: IF MOTOR BECOMES BLOCKED FOR SEVERAL SECONDS, THERMOSTATIC CUTOFF SWITCH (ON UNITS SO EQUIPPED) WILL BREAK CIRCUIT. SHOULD THIS HAPPEN, ALLOW MOTOR TO COOL AT LEAST 5 MINUTES BEFORE DEPRESSING RED RESET BUTTON. AVOID REPEATED RESETTING.

3.05 Standard and Heavy Duty Synchronous Motor Units (continued)

CENTRIFUGAL SWITCH

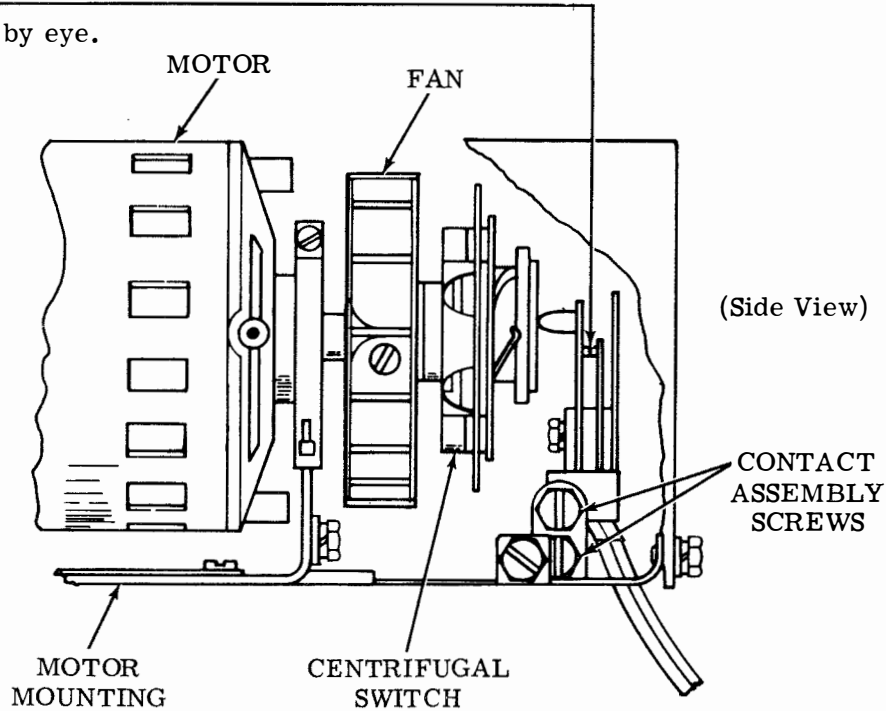
(1) Requirement

With motor stopped (centrifugal switch extends toward contacts) and contact assembly closed there should be

Min 0.020 inch
of overtravel as gauged by eye.

To Adjust

With contact assembly screws friction tight, adjust contact assembly to meet requirements. Tighten screws.



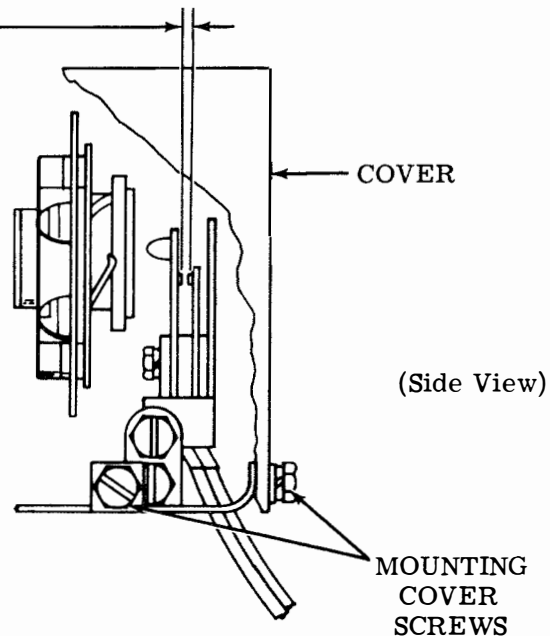
(2) Requirement

With motor running (centrifugal switch toward motor) there should be

Min 0.015 inch---Max 0.025 inch
clearance between contacts.

To Adjust

With motor stopped and contact assembly screws friction tight, adjust contact assembly to meet requirement (1). Tighten screws. If requirement (2) is not met, refine requirement (1).



(3) Requirement

Clearance between centrifugal switch assembly and metal cover should be

Min 0.050 inch.

To Adjust

With mounting cover screws friction tight, lower cover until interference is felt; then raise cover to meet requirement. Tighten screws.

3.06 Series Governed Motor Units

MOTOR POSITIONING (NOT ILLUSTRATED)

Requirement

Motor should be centrally positioned in its rubber mounts so as to provide at least 0.020 clearance between the motor housing and the cradle at the governor end. The cable should also clear the grommet in the screen by at least 0.030 inch.

(A) GOVERNOR CONTACT BACKSTOP

Requirement

Clearance between the movable contact arm and its eccentric backstop.

Min 0.020 inch---Max 0.040 inch

To Adjust

Rotate the eccentric backstop with clamping screw loosened.

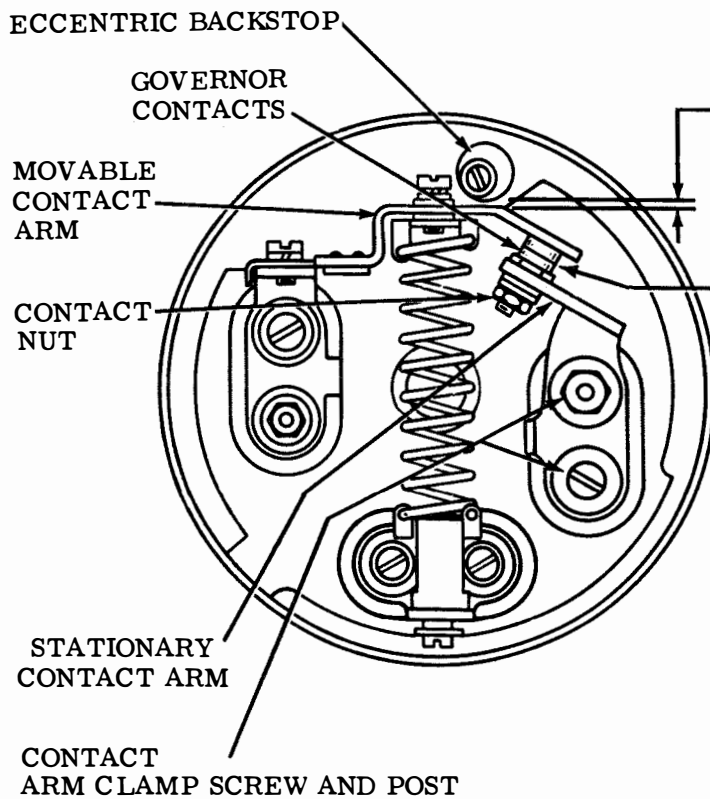
(B) GOVERNOR CONTACT

Requirement

The contacts should meet squarely and not overlap more than 0.010 inch.

To Adjust

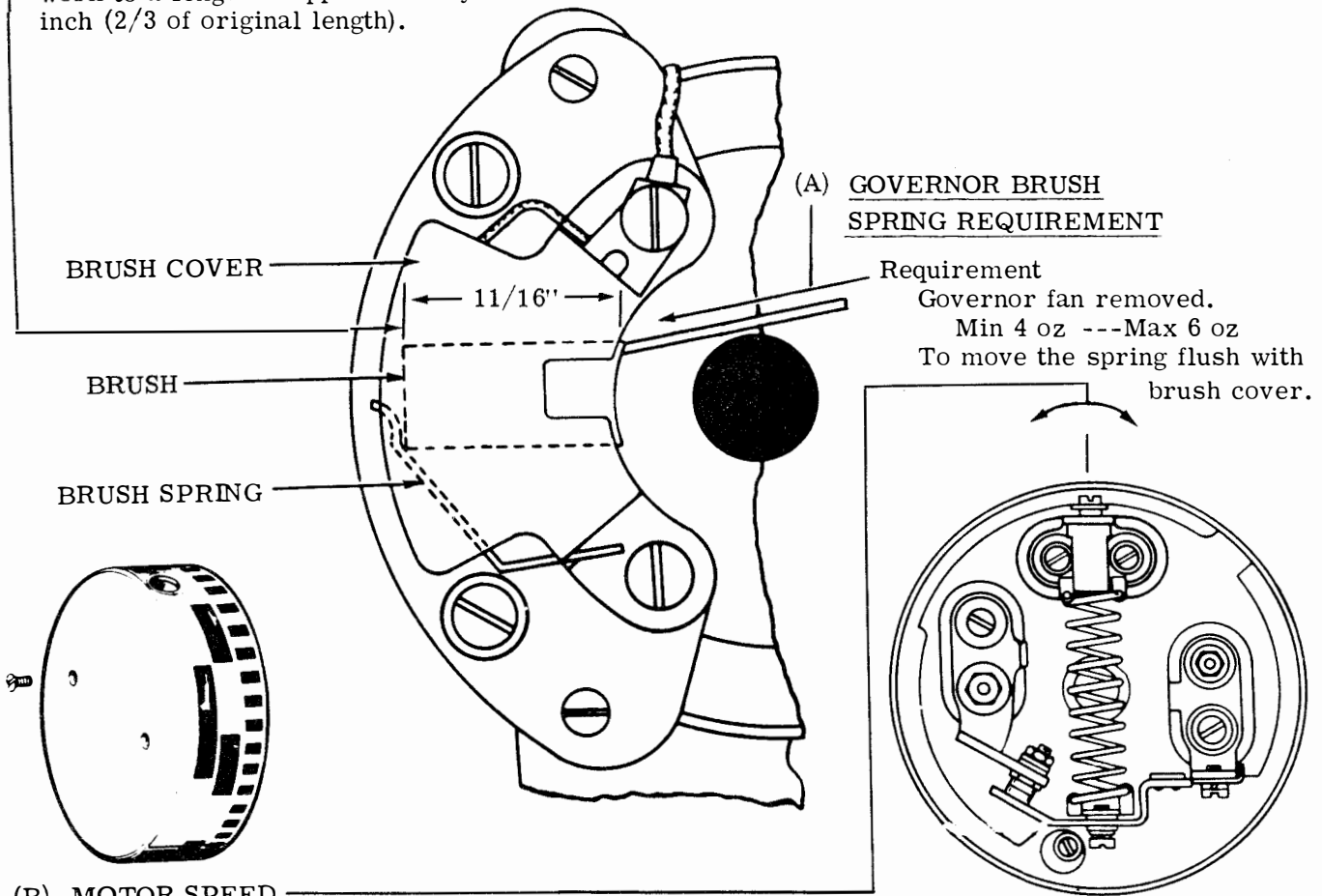
Position the stationary contact and contact arm with the clamp screw and post loosened.



**CAUTION: EXCESSIVE PRESSURE
AGAINST GOVERNOR COVER
ASSEMBLY DURING REMOVAL
MAY DAMAGE SCREENED WINDOW.**

3.07 Series Governed Motor Units (continued)

Note: Replace governor brushes that have worn to a length of approximately 15/32 inch (2/3 of original length).



(B) MOTOR SPEED

Requirement

With target illuminated and viewed through the vibrating shutters of a 120 vps turning fork the spots on the 4-spot target should appear stationary while rotating. With target illuminated and viewed through the vibrating shutters of an 87.6 vps tuning fork the spots on the 6-spot target should appear stationary while rotating and with speed slightly increased the spots on the 35 spot target should appear stationary.

To Adjust

Stop the motor and turn the adjusting screw as indicated on governor cover. For units with screened governor covers, stop the motor, remove the TP152035 plug from cover. Turn adjusting screw as indicated on periphery of target.

Note: It is possible to adjust the motor at some multiple of the correct speed. To check motor speed when used with a page printer, return typebox carriage to left margin, set up any character in selector and manually trip typebox clutch trip lever. Printing should occur as follows:

WPM	PRINTED CHARACTERS	REQUIRED TIME
60	70	10 seconds
75	44	5 seconds
100	57	5 seconds

3.08 Series Governed Variable Speed Motor Units

BRAKE SHOE SLIDE

(1) Requirement

Clearance between engaging surface of respective disc and associated shoe should be
Min 3/32 inch---Max 1/8 inch

To Adjust

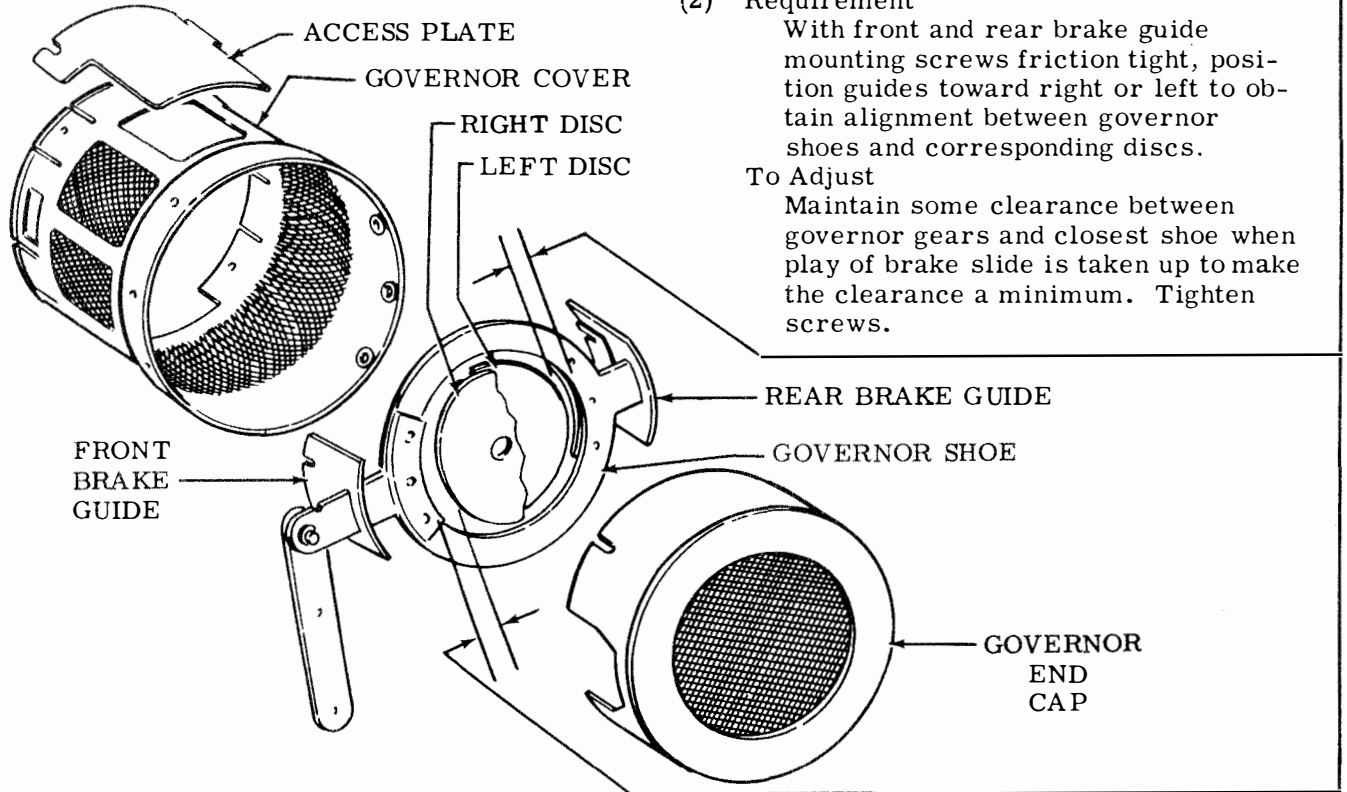
With bearing plate mounting screws friction tight, position the plate toward front or rear to centrally locate shoe assembly.

(2) Requirement

With front and rear brake guide mounting screws friction tight, position guides toward right or left to obtain alignment between governor shoes and corresponding discs.

To Adjust

Maintain some clearance between governor gears and closest shoe when play of brake slide is taken up to make the clearance a minimum. Tighten screws.



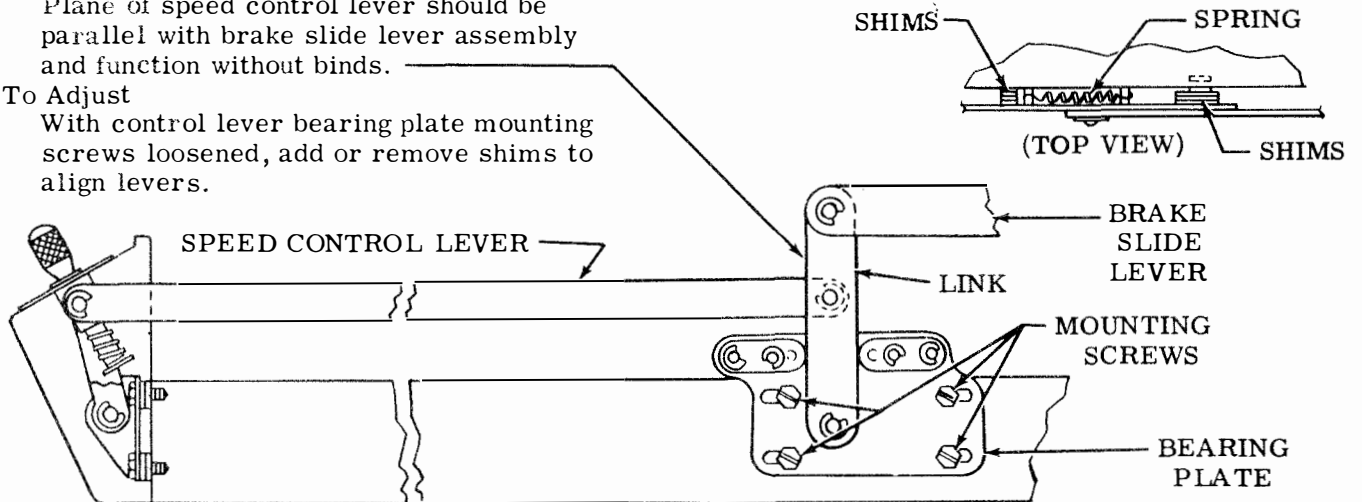
SPEED CONTROL LINKAGE BEARING PLATE (PART OF BASE)

Requirement

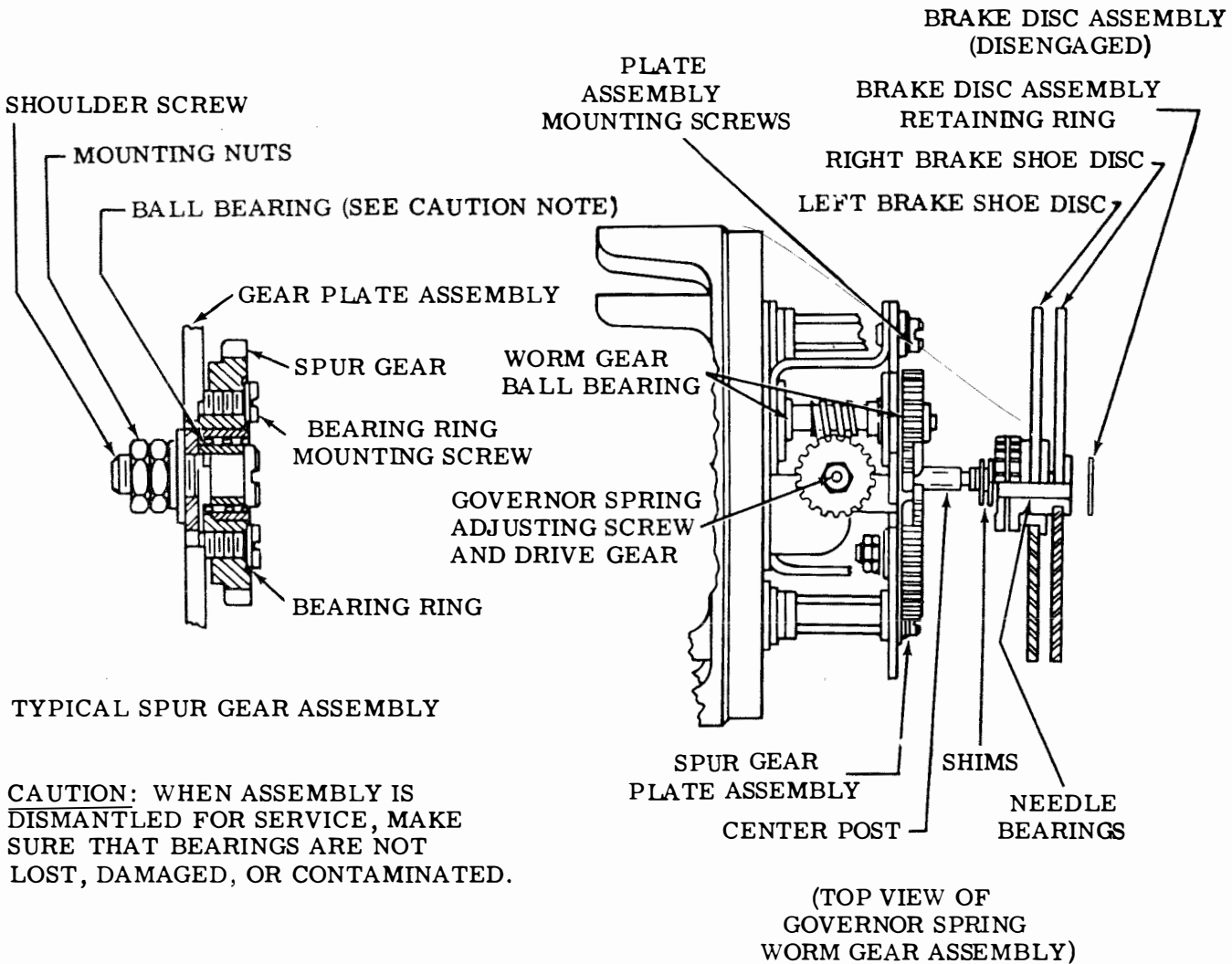
Plane of speed control lever should be parallel with brake slide lever assembly and function without binds.

To Adjust

With control lever bearing plate mounting screws loosened, add or remove shims to align levers.



3.09 Series Governed Variable Speed Motor Units (continued)



CAUTION: WHEN ASSEMBLY IS DISMANTLED FOR SERVICE, MAKE SURE THAT BEARINGS ARE NOT LOST, DAMAGED, OR CONTAMINATED.

GOVERNOR SPUR GEAR TRAIN

(1) Requirement

Backlash between the six mating spur gears should be barely perceptible. Do not mistake side play of gear mounting for backlash.

Preliminary Procedure

Remove brake disc assembly with its retaining ring removed from center post of gear plate. Remove spur gear plate assembly hardware from the four posts and remove the assembly. Note the location of fibre washers, etc. Remove bearing screw locknuts from spur gears B and C; then remove each gear, post, and bearing intact (see 3.10).

CAUTION: MAKE SURE BALL BEARINGS ARE NOT DAMAGED, LOST, OR CONTAMINATED.

Loosen locknuts on spur gear D.

To Adjust

Position bearing screw of spur gear on gear plate to provide perceptible backlash for spur gears A and D.

(2) Requirement

With brake disc assembly replaced in the spur gear plate assembly, backlash between spur gear D and mating gear in brake disc assembly should be barely perceptible.

To Adjust

Refine position of spur gear D mounting screw (Requirement (1) above).

3.10 Series Governed Variable Speed Motor Units (continued)

GOVERNOR SPUR GEAR TRAIN (continued)

(3) Requirement

With brake disc assembly removed and spur gear B replaced in gear plate assembly, backlash between spur gear A and spur gear B should be barely perceptible.

To Adjust

Refine position of spur gear B mounting screw.

(4) Requirement

Replace spur gear C in plate assembly. Backlash between spur gears B and C should be barely perceptible.

To Adjust

Refine position of spur gear C mounting screw.

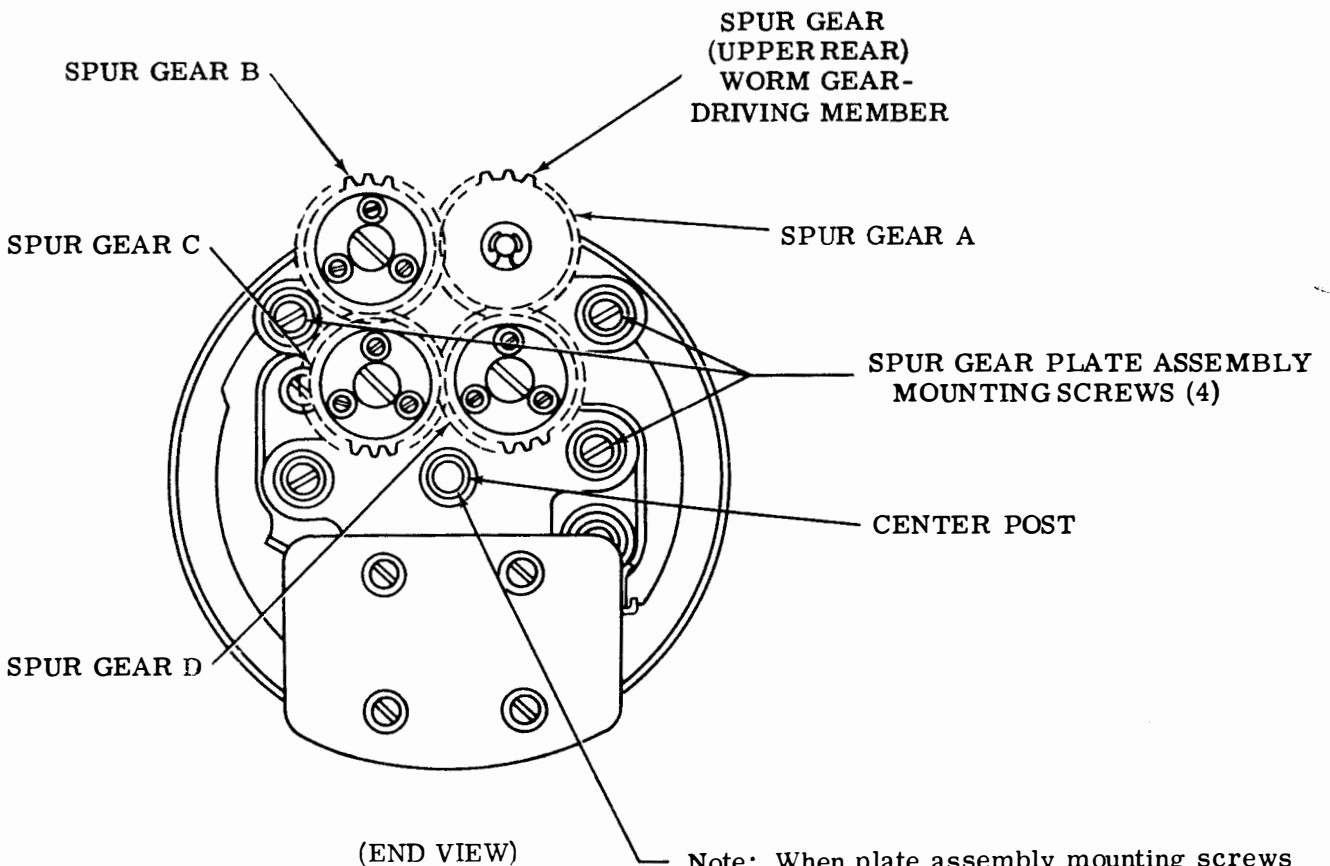
(5) Requirement

Replace brake disc assembly. Backlash between spur gear C and its mating gear on disc assembly should be barely perceptible.

To Adjust

Refine requirements (4) and (5).

(6) Remove the brake disc assembly and replace spur gear assembly.



Note: When plate assembly mounting screws are replaced make sure center post is aligned with axis of motor shaft to avoid wobble.

3.11 Plastic Type Axial Fan for 28 and 35 Teletypewriter Sets

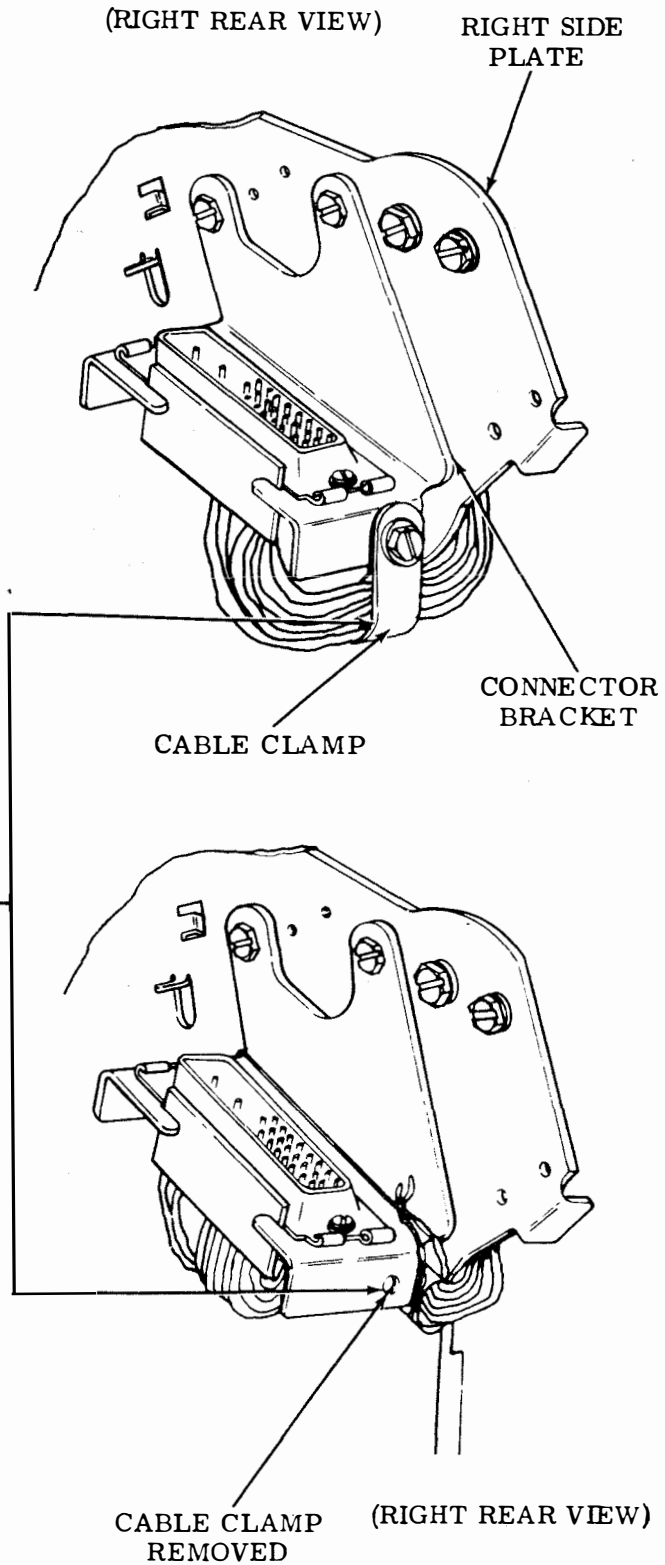
CABLE CLAMP INTERFERENCE

Requirement

When installing a plastic type axial fan or a motor with a plastic type axial fan, there may be interference between the fan and cable clamp on the typing unit.

To Adjust

Remove the cable clamp and tie cable up under the connector bracket and flat against the side plate to prevent possible interference with the plastic type axial fan.



MOTOR UNITS

LUBRICATION

CONTENTS	PAGE
1. GENERAL.	1
2. LUBRICATION.	2
14 AND 15 TYPE MOTOR UNITS.	2
28, 35, AND 37 TYPE MOTOR UNITS	3
Motor bearings — miniature motors	3
Motor bearings — standard motors.	3
32 AND 33 TYPE MOTOR UNITS.	4
Motor bearings — miniature motors	4
GEAR TRAIN AND GOVERNOR.	5
Gear train and governor assembly.	7

repacked, if required, with TKS103 grease (2.04 and 2.05). The bearings of the 32 and 33 type motors do not contain TKS103 grease and therefore must be lubricated with KS7470 oil (2.06). The lubricating interval is 750 consecutive operating hours or 3 months, whichever occurs first.

Note: The 28, 35, and 37 type motor units are furnished with ball type oilers or oil holes; however, they are not to be oiled or greased.

1.04 The exposed motor shaft should be covered with a thin film of grease to prevent rust.

1.05 The gear train and governor assembly uses KS7470 oil at all locations where the use of oil is indicated. Use KS7471 grease on all surfaces where grease is indicated.

1.06 The governor regulator gear train requires a thin film of grease on the teeth of each gear.

CAUTION: NOTE LOCATION OF NEEDLE TYPE AND BALL TYPE BEARINGS ON GOVERNOR SPUR GEAR ASSEMBLY (2.08) AND EXERCISE CARE IN DISASSEMBLING UNIT. MAKE SURE THAT BEARINGS ARE NOT LOST OR DAMAGED AND THAT UNIT OPERATES WITHOUT BINDING WHEN ASSEMBLED.

1.07 The governor should be lubricated after every 1500 hours of operation, or after 2000 adjustment cycles (governor speed changes using the "Slow-Fast" speed adjusting lever), whichever occurs first.

Note: Check governor brushes for wear; any accumulation of carbon dust should be removed.

1. GENERAL

1.01 This section provides lubrication information for motor units used with various teletypewriters and associated apparatus. It is reissued to include engineering changes and additions, 14 and 15 type motor units, series governed motors, and variable speed gear train governor assembly. Since it is a general revision, marginal arrows used to indicate changes and additions have been omitted.

1.02 For complete lubrication of the pinion gear and intermediate gear assembly, refer to the section covering the application in which the motor is being used.

1.03 The motor ball bearings of the 28, 35, and 37 type motor units are packed with a wide range temperature lubricant by the manufacturer and normally will not require relubrication. However, if the motor is disassembled at any time, the bearings should be examined and

SECTION 570-220-701TC

1.08 The following list of symbols applies to the specific lubrication instructions shown in the line drawings:

<u>Symbol</u>	<u>Meaning</u>
02	Apply 2 drops of oil
06	Apply 6 drops of oil
G	Apply thin film of grease

motor for a few minutes to work out excess grease. Stop motor and wipe off excess grease.

CAUTION: TOO MUCH GREASE CAUSES STARTING SWITCH TROUBLE ON THE SYNCHRONOUS MOTORS, COMMUTATOR TROUBLE AND FALSE GROUNDING ON DC MOTORS, AND ON AC SERIES MOTORS.

2. LUBRICATION

14 AND 15 TYPE MOTOR UNITS

2.01 Motor Bearings: Depress ball oilers (2) with nozzle of grease gun and lubricate bearings with one stroke of the plunger. Run

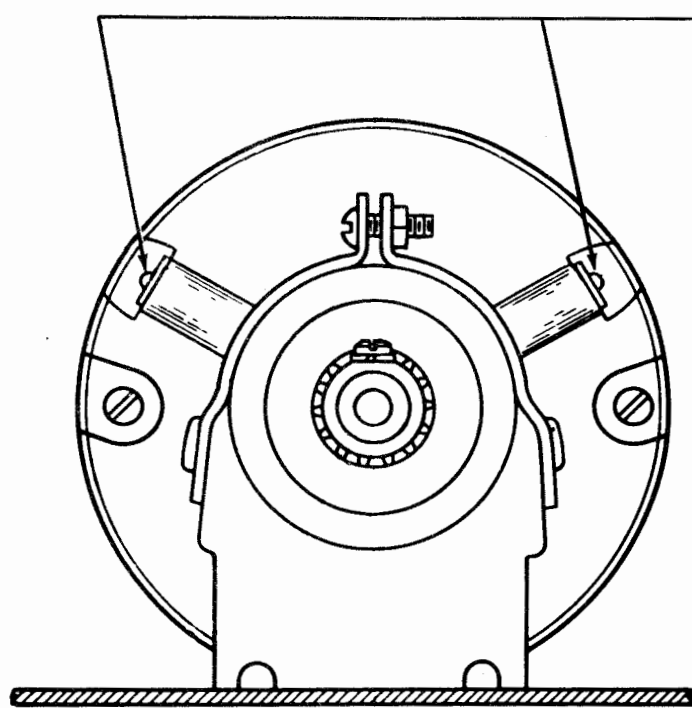
2.02 Motor Pinon: Apply thin film of grease to prevent rust.

2.03 Motor Speed Adjusting Lever (Governed Motors): Apply oil on pilot screw.

28, 35, AND 37 TYPE MOTOR UNITS

CAUTION: DO NOT USE GREASE GUN ON MOTOR UNITS.

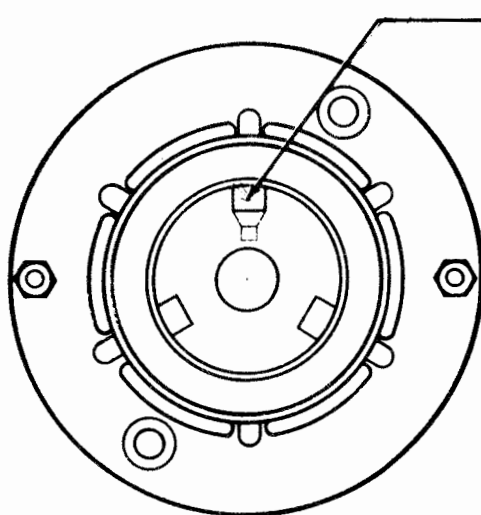
2.04 Motor Bearings — Standard Motors



Ball Oilers

(Motors are furnished with ball type oilers; however, they are not to be oiled. Motor ball bearings are packed with a wide range temperature TKS103 grease.)

2.05 Motor Bearings — Miniature Motors



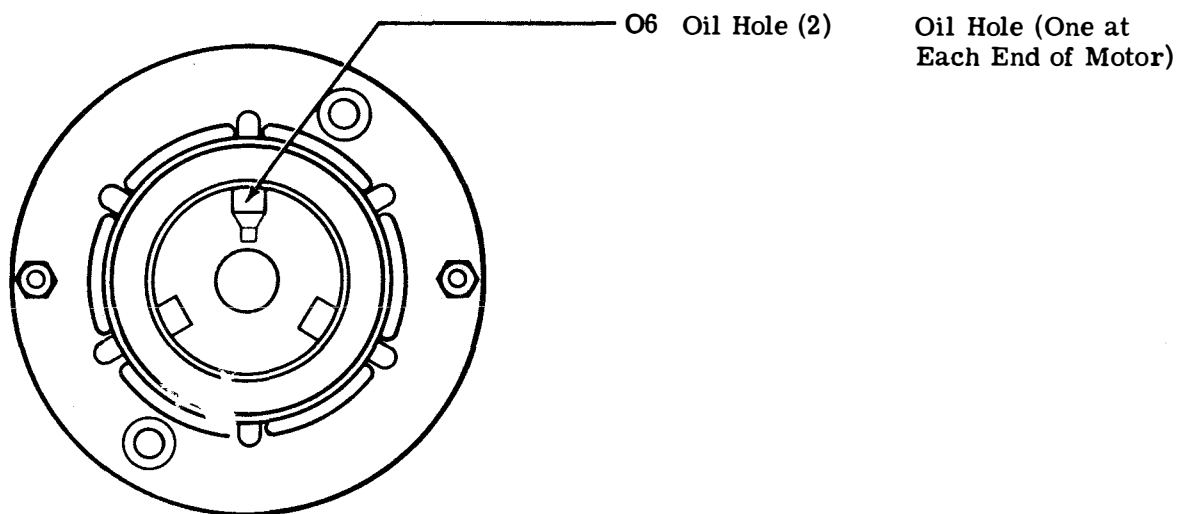
Oil Hole

(Motors are furnished with oil holes; however, they are not to be oiled. Motor ball bearings are packed with a wide range temperature TKS103 grease.)

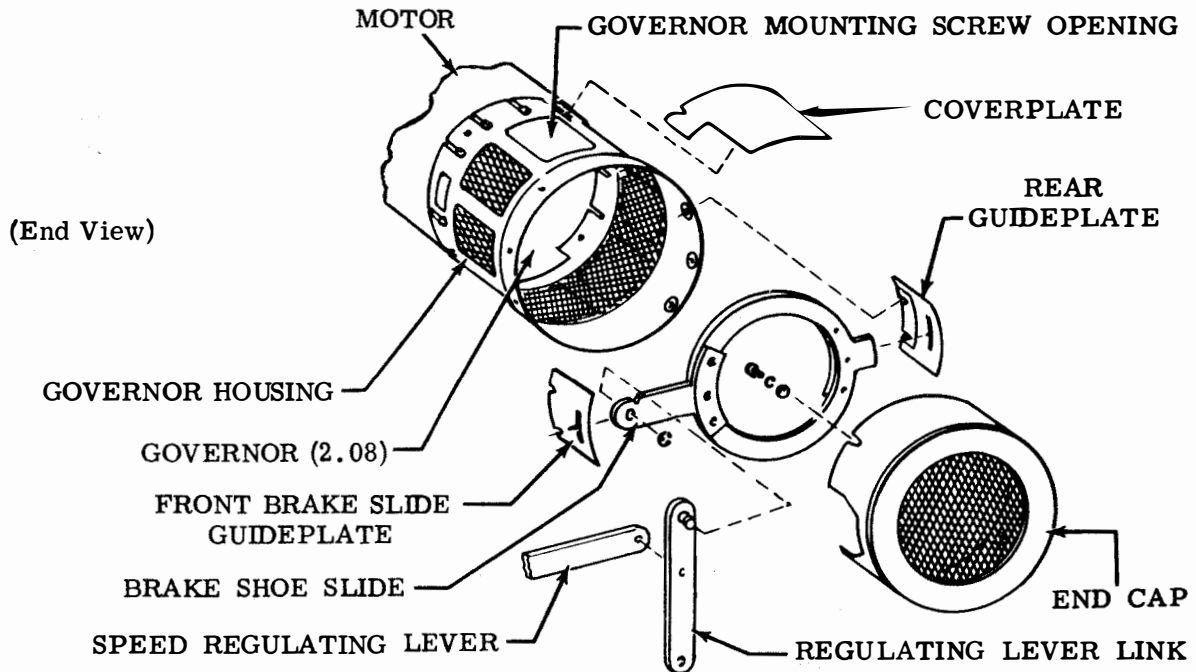
32 AND 33 TYPE MOTOR UNITS

2.06 Motor Bearings — Miniature Motors

CAUTION: DO NOT USE GREASE GUN ON MOTOR UNITS.



GEAR TRAIN AND GOVERNOR



2.07 To lubricate gear train and governor assembly:

- (1) Remove end cap of governor housing with its mounting screws (4) loosened.
- (2) Remove front and rear guideplates of brake shoe slide; remove the retaining ring that secures the regulating lever link with brake shoe slide.
- (3) Remove coverplate from top of governor housing; remove governor mounting screw, and slide governor out of housing.
- (4) Remove brake discs from center shaft by removing its retaining ring and sliding disc assembly outward. Apply grease to shaft and bearing (2.08).

CAUTION: AVOID LOSS OF NEEDLE BEARINGS IN HANDLING.

- (5) Remove spur gear plate assembly by removing its mounting screws (4) attached to respective posts. Grease the worm gear bearing (located opposite shaft driving gear) (2.08).

CAUTION: AVOID LOSS OF BALL BEARING IN HANDLING.

- (6) Remove worm gear driving (spur) gear by removing retaining ring from worm gear shaft. Remove ball bearing, fill cavity with grease and replace bearing. Wipe off excessive grease and replace spur gear (2.08).

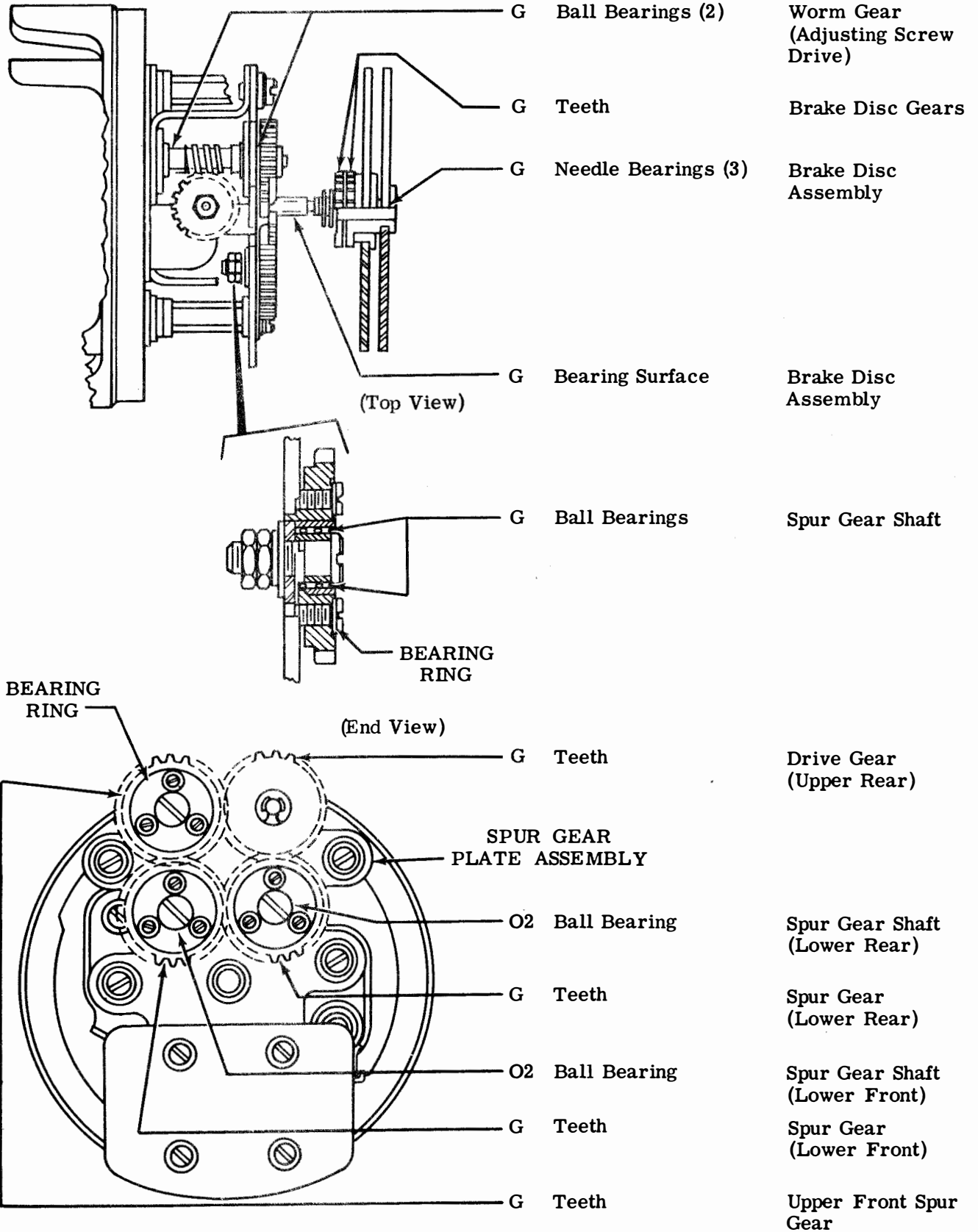
CAUTION: EXERCISE CARE IN HANDLING BEARINGS.

- (7) Remove remaining spur gears (3) by removing respective bearing rings. Grease upper front gear bearing and apply oil to lower left and right gear bearings as directed. Replace bearing rings (3).

SECTION 570-220-701TC

- (8) Rotate worm gear manually to expose threads of spring tension adjusting screw. Grease threads inside governor spring assembly.
- (9) Remove adjusting screw drive gear by removing its locknut and lockwasher. Grease bearing surface of spring assembly and replace parts. Push adjusting screw downward to expose bearing surface while greasing.
- (10) Apply thin film of grease to teeth of all gears in the assembly.
- (11) Recheck spur gear requirements given in Section 570-220-700TC, replace the spur gear plate assembly and grease the center post.
- (12) Replace the shims on center post, slide the disc assembly in place and secure by the retaining ring.
- (13) Check for wear of governor brushes, replace if necessary. Hold brushes away from motor shaft and slide governor assembly in place. Reposition the brushes on the slip rings.
- (14) Replace brake shoe slide assembly and governor housing in the reverse order. Exercise care to make sure that all components move freely and all coverplates, etc are secured to shut out rfi noise.

2.08 Gear Train and Governor Assembly





MOTOR UNITS

DISASSEMBLY AND REASSEMBLY

CONTENTS	PAGE
1. GENERAL	1
2. MINIATURE SYNCHRONOUS MOTORS	1
DISASSEMBLY	1
REASSEMBLY	2
3. STANDARD AND HEAVY DUTY SYNCHRONOUS MOTORS	2
DISASSEMBLY	2
REASSEMBLY	3
4. SERIES GOVERNED MOTORS	3
DISASSEMBLY	3
REASSEMBLY	4
5. SERIES GOVERNED VARIABLE SPEED MOTORS	4
DISASSEMBLY	4
REASSEMBLY	5

1. GENERAL

1.01 This section provides the disassembly and re-assembly procedures for miniature, standard, heavy duty synchronous motor units, and series governed and series governed variable speed motor units. It is issued to describe removal and replacement of the motor units from their associated teletypewriter apparatus.

1.02 Reference should be made to the exploded views found in the appropriate parts literature for an illustration of the mechanism to be disassembled, for location and visual identification of parts, and detailed disassembly and reassembly features. Refer to maintenance tool Section 570-005-800TC for necessary tools.

1.03 When disassembling a motor unit, carefully note the location of springs, spring washers, and shims on the rotor shaft and other motor components, so that reassembly can be done correctly.

1.04 Retaining rings are made of spring steel and have a tendency to release suddenly when being removed. Loss of the retainer can be minimized as follows: Hold the retainer with the left hand to prevent it from rotating. Place the blade of a suitable screwdriver in one of the slots of the retainer. Rotate the screwdriver in a direction to increase the diameter of the retainer for removal.

1.05 To help identify the motor unit that is to be disassembled refer to Motor Unit Identification Table. First find the motor unit code number on the identification plate located on the motor bracket, then find the code number in the table. (For example: an LMU28 motor is found under the heading Series Governed Motor Units.)

2. MINIATURE SYNCHRONOUS MOTORS

DISASSEMBLY

CAUTION: REMOVE ELECTRICAL POWER FROM SET BEFORE STARTING DISASSEMBLY.

2.01 Remove any shaft extension or hardware attached to the motor shaft that would prevent removal of the motor unit.

2.02 Loosen screws and remove motor power line leads from base terminal block.

2.03 Remove four screws and lockwashers that secure the motor unit to the base. Lift motor unit off the base.

2.04 To remove the motor from its cradle bracket, loosen mounting strap screw on each end of motor and remove motor.

2.05 Loosen air duct screws and remove air duct(s) from motor.

MOTOR UNIT IDENTIFICATION TABLE

MINIATURE SYNCHRONOUS MOTOR UNITS	STANDARD AND HEAVY DUTY MOTOR UNITS	SERIES GOVERNED MOTOR UNITS	SERIES GOVERNED VARIABLE SPEED MOTOR UNITS
MU43, LMU19, LMU20, LMU24, LMU26, LMU31, LMU35, LMU45, LMU56	LMU3, LMU15, LMU21, LMU30, LMU33, LMU36, LMU37, LMU38, LMU42, LMU46, LMU49, LMU51, LMU52, LMU55, YMU2, YMU3, YMU4	LMU6, LMU13, LMU28, LMU29, LMU39, LMU41, LMU57, LMU61, LMU63, LMU64, YMU5	LMU47, LMU60

2.06 When the motor is completely removed from the mounting bracket, the remaining motor components can be removed by loosening the screws and clamps that secure them to the mounting bracket.

2.07 To remove end shields and rotor:

- (1) Remove screw and lockwasher that mount pinion to the shaft. Remove pinion from shaft.
- (2) Remove the two nuts and the two bolts that secure the end shields to the stator.
- (3) Remove the end shields. Remove the rotor and note the positioning of spring washer and shims on the rotor shaft so that the parts when replaced are positioned correctly.

REASSEMBLY

Note: The pinion end of the rotor is positioned opposite the leads end of the stator.

- 2.08 To assemble motor, reverse the disassembly procedure.
- 2.09 For the adjustment of motor, components, and air duct(s), refer to Section 570-220-700TC.
- 2.10 When replacing the motor unit on the mounting base, reverse the removal procedure given in 2.01 through 2.03, and make sure the ground strap is attached to the mounting screw.

3. STANDARD AND HEAVY DUTY SYNCHRONOUS MOTORS

DISASSEMBLY

CAUTION: REMOVE ELECTRICAL POWER FROM SET BEFORE STARTING DISASSEMBLY.

- 3.01 If the set contains a typing unit it must be removed to gain access to the motor unit, as follows:
- (1) Remove electrical cable connector(s) from the right side of the typing unit.
 - (2) Remove four screws and lift typing unit off the base.
- 3.02 Remove any shaft extensions or hardware attached to the motor shaft that would prevent removal of the motor unit.
- 3.03 Loosen screws and remove motor power line leads from the base terminal block.
- 3.04 Remove four screws and lockwashers that secure the motor unit to the base. Remove motor unit from base.
- 3.05 To remove motor from the cradle:
- (1) Loosen mounting strap screw on each end of motor and remove motor unit.

(2) Remove the remaining motor components by loosening the screws and clamps that secure them to the mounting bracket. On some units the motor components are secured by tension springs. Unhook the ends of the springs to remove motor components.

(3) For components mounted in a compartment below the motor and secured to a mounting plate, loosen four screws and remove mounting plate. The motor components are now exposed for removal.

3.06 To remove end shields and rotor:

- (1) Remove fan from the shaft if furnished.
- (2) Remove screw and lockwasher that mount pinion to shaft. Remove pinion from shaft.
- (3) Remove the two nuts and two bolts that secure the end shields to the stator. Remove end shields, rotor, spring, and washer.

REASSEMBLY

Note: Position the spring with the tapered end down. Place washer on top of the spring in the end shield bearing recess located at the leads end of the stator. The pinion end of the rotor, which is the longest shaft end from the ball bearing, is positioned opposite to the leads end of the stator.

3.07 To reassemble motor, reverse the disassembly procedure.

3.08 For the adjustment of motor and components, refer to Section 570-220-700TC.

3.09 When replacing the motor unit on the base, reverse the removal procedure shown in 3.01 through 3.04, and make sure the ground strap is attached to the mounting screw.

4. SERIES GOVERNED MOTORS

DISASSEMBLY

CAUTION: REMOVE ELECTRICAL POWER FROM SET BEFORE STARTING DISASSEMBLY.

4.01 Remove the typing unit from the base to gain access to the motor unit, as follows:

- (1) Remove electrical cable connector(s) from the right side of typing unit.
- (2) Remove four screws and lift typing unit off the base.

4.02 Remove gear guard and connections that prevent removal of motor unit.

4.03 Loosen screws and remove motor power line leads from base terminal block.

4.04 Remove four screws and lockwashers that secure the motor mounting bracket to the base and lift motor unit off the base.

4.05 Remove four screws that secure the screened cover on the motor end. Remove cover.

Note: To avoid damaging the screen do not grip cover over screened openings.

4.06 Remove two screws on the rear face of governor cover. Remove governor cover.

4.07 To remove governor, remove screw and lockwasher that is threaded through the shaft.

4.08 Remove motor brush caps and motor brushes. The positioning of each brush should be noted or marked so that each brush may be inserted in the same holder with the same side up. Make sure the insulators are kept inside each of the brush caps.

4.09 Loosen mounting strap on governor end and unhook from cradle. Do not remove mounting strap. Loosen and remove mounting strap on opposite end of motor. Remove motor from cradle.

Note: In some units the motor can be removed from the cradle for only a short distance due to the length of the cable stored in the bracket compartment.

4.10 To remove end shield and armature:

- (1) Remove screw and lockwasher that mount pinion to the shaft. Remove pinion from shaft.
- (2) Remove the two nuts and lockwashers securing the end shield to the stator.
- (3) When removing the end shield, it may be necessary to pry it loose from the stator.
- (4) Remove the armature. Remove the washers and spring that are found in the end shield bearing recess on the governor end. The spring is positioned with the tapered end in the end shield bearing recess with the washers on top of the spring.

REASSEMBLY

4.11 Hold motor in upright position being careful not to damage governor brushes. Place tapered end of spring downward into bearing recess and place washers on top of the spring.

Note: Before pushing armature shaft completely through end shield on governor end, the governor brushes must be pushed into their respective spring loaded brush holders and held depressed so that armature shaft can clear the brushes.

4.12 Place armature into stator with commutator end down and make sure the armature shaft clears the governor brushes as indicated in note (4.11).

4.13 Assemble end shield with ball oilers in line with oilers on governor end. Most of the motor units have ball oilers positioned upward (opposite leads out location). For inverted mounting, ball oilers are positioned downward (same side as leads out location). Place washer and nut on each end shield bolt. Tighten nuts.

4.14 Place motor on cradle mounting bracket and position both mounting straps making sure the mounting strap screw heads face to the right while viewing the governor end. Tighten mounting strap screws. Check tightness of both screws on governor brush terminals.

4.15 Replace motor brushes making sure they are properly assembled (see 4.08). Insulators must be in brush caps. The pigtails of the brushes should be free from kinks and move freely in the spring coils.

4.16 When replacing the governor, retract each carbon brush as the governor is pushed on the shaft. Align the hole in the flat side of the governor hub with the threaded hole in the shaft. Place lockwasher and screw through governor hub hole and thread into the shaft. Tighten screw.

Note: Make sure the governor brush leads do not interfere with governor fins. Push leads down to allow ample clearance. Position each brush pigtail terminal to allow free travel of the brush in its guide.

4.17 For the adjustments of motor and components refer to Section 570-220-700TC.

4.18 Assemble governor cover and tighten both screws.

4.19 Replace screened cover and tighten four screws.

Note: To avoid damaging the screen, do not grip cover over screened openings.

4.20 Assemble motor unit to mounting base as follows:

- (1) Place motor unit on mounting base.
- (2) Assemble ground strap and four mounting screws to base. Tighten screws.

4.21 Replace typing unit and four mounting screws. Tighten screws.

4.22 Replace electrical cable connector(s) on right side of typing unit.

5. SERIES GOVERNED VARIABLE SPEED MOTORS

DISASSEMBLY

CAUTION: REMOVE ELECTRICAL POWER FROM SET BEFORE STARTING DISASSEMBLY.

5.01 Remove the typing unit from the base to gain access to motor unit, as follows:

- (1) Remove electrical cable connector(s) from the right side of typing unit.
- (2) Remove four screws and lift the typing unit off the base.

5.02 Remove the retaining ring and stud from brake shoe slide.

5.03 Remove gear guard and connections that would prevent removal of motor assembly.

5.04 Loosen screws and remove motor power line leads from base terminal block.

5.05 Remove four screws and lockwashers that secure the motor unit to the base. Remove the motor unit from the base.

5.06 Remove the governor screened end cap by loosening but not removing the four screws.

5.07 To remove governor brake shoe assembly, loosen but do not remove the two screws on the front brake guide and the rear brake guide. Remove governor brake shoe assembly.

5.08 Remove access plate from governor cover by loosening two screws.

5.09 To remove governor gear train assembly, use access hole to locate screw by rotating the shaft. Remove screw and lockwasher. Remove governor gear train assembly.

- 5.10 Remove four screws and lockwashers around the screened cover. Remove screened cover.
- 5.11 Remove motor brush caps and motor brushes. The position of each brush should be noted or marked so that each brush may be inserted in the same holder with the same side up. Make sure the insulators are kept inside the brush caps.
- 5.12 Loosen mounting strap on governor end and unhook from cradle, but do not remove mounting strap. Loosen and remove mounting strap on opposite end of motor.
- 5.13 Motor units that do not have their motor components soldered to the bracket compartment may be completely removed by loosening the motor components mounting screws, lockwashers, and clamps.
- 5.14 To remove end shield and armature:
- (1) Remove pinion screw and lockwasher. Remove pinion from shaft.
 - (2) Remove the two nuts and lockwashers securing the end shield to the stator.
 - (3) When removing the end shield it may be necessary to pry it loose from the stator.
 - (4) Remove the armature. Remove the washers and spring that are nested in the end shield bearing recess on the governor end. The spring is positioned, tapered end down, with washer on top of the spring.

REASSEMBLY

- 5.15 Hold motor in upright position being careful not to damage governor brushes. Place tapered end of spring downward into bearing recess and place washers on top of spring.

Note: Before pushing armature shaft completely through end shield on governor end, the governor brushes must be pushed into their respective spring loaded brush holders and held depressed so that armature shaft can clear the brushes.

- 5.16 Place armature into stator with commutator end down and make sure the armature shaft clears the governor brushes as indicated in note (5.15).
- 5.17 Assemble end shield with ball oilers in line with ball oilers on governor end. Place lockwashers and nuts on end shield bolts. Tighten nuts.

- 5.18 Place motor on cradle and position both mounting straps making sure the mounting strap screw heads face to the right while viewing the governor end. Tighten mounting strap screws. Check tightness of both screws on governor brush terminals.
- 5.19 Replace pinion on shaft with lockwasher and screw. Tighten screw.
- 5.20 Replace motor brushes making sure they are properly assembled (5.11). Insulators must be in brush caps. The pigtailed of the brushes should be free from kinks and move freely in the spring coils.
- 5.21 Replace screened cover with access hole facing up (opposite from leads out location in motor).
- 5.22 When replacing governor gear train assembly, retract each carbon brush as governor is pushed on the shaft. Align the hole in the flat side of the governor hub with the threaded hole in the shaft. Use a tweezer to position lockwasher and screw. Tighten screw.

Note: Make sure the governor brush leads do not interfere with governor fins. Push leads down to allow ample clearance. Position each brush pigtail terminal to allow free travel of the brush in its guide.

- 5.23 For the adjustments of motor and components refer to Section 570-220-700TC.
- 5.24 Position access plate on screened cover and replace four screws, lockwashers, and flat washers. Tighten screws.
- 5.25 Replace brake shoe slide assembly with brake slide lever to the left while viewing governor end. Tighten the screws on the front brake guide and rear brake guide friction tight. Make sure governor gear train assembly clears the governor shoes by rotating motor shaft. Adjust brake guides if required. Tighten the screws on front and rear brake guides.
- 5.26 Replace governor screened end cap and tighten screws.
- 5.27 To assemble motor unit to mounting base:
- (1) Place motor unit on mounting base.
 - (2) Assemble ground strap and four mounting bolts to base. Tighten mounting bolts.
- 5.28 Align the hole in the brake slide lever and link. Assemble stud and retainer ring.
- 5.29 Replace typing unit and four mounting screws. Tighten screws.
- 5.30 Replace electrical cable connector(s) on the right side of the typing unit.



MOTOR UNIT (MU, LMU AND YMU)
PARTS

FIGURE	CONTENTS	PAGE
1	Motor Unit Application Chart	2
2	Synchronous Motor Cross-Reference Chart	3
3	Synchronous Motor Assemblies (Standard or Heavy Duty)	4
4	Relay and Capacitor Mounting (Synchronous)	5
5	Relay and Capacitor Mounting (Synchronous)	6
6	Relay and Capacitor Mounting	7
7	Relay and Capacitor Mounting (Synchronous)	8
8	Relay and Capacitor Mounting (Synchronous)	9
9	Synchronous Motor Assemblies (Miniature)	10
10	Relay and Capacitor Mounting (Synchronous)	11
11	Relay, Capacitor Mounting and Bracket (Synchronous)	12
12	Synchronous Motor Mounting with Centrifugal Switch Assembly	13
13	Relay and Capacitor Mounting (Synchronous)	14
14	Series Motor Cross-Reference Chart	15
15	Series Motor Assemblies	16
16	Brush Assemblies	17
17	150845 and 324116 Governor Assemblies	18
18	154628 Governor Assembly	19
19	Series Motor Mounting Parts	20
20	Series Motor Mounting Parts with RF Suppression	21
21	Series Motor Mounting Parts with RF Suppression	22
22	Series Motor Mounting Parts	23
23	Series Motor Mounting Parts with RF Suppression	24
24	Series Motor Mounting Parts with RF Suppression	25
25	174546 Modification Kit to Provide Motor Running Contacts	26
26	174551 (less cable) 175198 (with cable) Modification Kits to Provide Motor Running Contacts	26
27	Triac Switch	27
28	Motor Covers	27
	Modification Kits	28
	Modification Kits (Continued)	29
	Numerical Index	30

Units Covered	Operating Characteristics	General Usage												
		ASR Set	RT Set	High Speed Punch	High Speed Reader	Miniature Trans-Dist.	Miniature Reperf.	Miniature Rec. Selector	Compact Page Printer	Tape Printer (Ticker)	Multiple Mounted Units	Variable Speed	Stack Mounted	Wall Mounted
Teletype Code														
LMU3	AC Synchronous, 1/20 HP, 115V/60 Hertz/3600RPM	X												
LMU4	Series, 1/20 HP, 115V/60 Hertz/3600 RPM, RF Sup.	X												
LMU6	Series, 1/20 HP, 115V/60 Hertz/3600 RPM	X												
ⓐ LMU10	Series, 1/20 HP, 115V/60 Hertz/3600 RPM, RF Sup.											X		
LMU11	AC Synchronous, 1/12 HP, 115V/60 Hertz/3600 RPM			X										
LMU12	AC Synchronous, 1/12 HP, 115V/60 Hertz/3600 RPM		X									X		
LMU13	Series, 1/15 HP, 115V/60 Hertz/3600 RPM			X										
LMU14	Series, 1/15 HP, 115V/60 Hertz/3600 RPM, RF Sup.		X									X		
LMU15	AC Synchronous, 1/20 HP, 115V/60 Hertz/3600 RPM	X												
LMV19	AC Synchronous, 25 MHP, 115V/60 Hertz/3600 RPM					X		X						
LMU20	AC Synchronous, 25 MHP, 115V/60 Hertz/3600 RPM													
LMU21	AC Synchronous, 1/20 HP, 115V/60 Hertz/3600 RPM												X	
LMU23	DC Series, 1/15 HP, 48V/3600 RPM			X										
LMU24	AC Synchronous, 25 MHP, 115V/60 Hertz/3600 RPM							X						
LMU26	AC Synchronous, 25 MHP, 115V/60 Hertz/3600 RPM							X	X					
LMU27	AC Synchronous, 1/20 HP, 115V/60 Hertz/3600 RPM												X	
LMU28	Series, 1/20 HP, 115V/60 Hertz/3600 RPM												X	
LMU29	DC Series, 1/15 HP, 48V/3600 RPM	X												
LMU30	AC Synchronous, 1/20 HP, 115V/60 Hertz/3600 RPM			X										
LMU31	AC Synchronous, 25 MHP, 115V/60 Hertz/3600 RPM								X					
LMU32	Series, 1/15 HP, 115V/60 Hertz/3600 RPM, RF Sup.			X										
LMU33	AC Synchronous, 1/20 HP, 115V/50 Hertz/3000 RPM				X									
LMU35	AC Synchronous, 25 MPH, 115V/50 Hertz/3000 RPM				X									
LMU36	AC Synchronous, 1/20 HP, 115V/50 Hertz/3000 RPM			X										
LMU37	AC Synchronous, 1/20 HP, 115V/60 Hertz/3600 RPM								X					
LMU38	AC Synchronous, 1/20 HP, 115V/50 Hertz/3000 RPM	X												
LMU39	Series, 1/15 HP, 115V/60 Hertz/3600 RPM, RF Sup.		X									X		
LMU41	Series, 1/20 HP, 115V/60 Hertz/3600 RPM, RF Sup.	X												
LMU42	AC Synchronous, 1/20 HP, 115V/60 Hertz/3600 RPM									X				
LMU43	AC Synchronous, 25 MHP, 115V/60 Hertz/3600 RPM					X								
LMU45	AC Synchronous, 25 MHP, 115V/60 Hertz/3600 RPM					X								
LMU46	AC Synchronous, 1/20 HP, 115V/60 Hertz/3600 RPM			X										
ⓐ LMU47	Series, 1/20 HP, 115V/60 Hertz/3600 RPM, RF Sup.											X		
LMU49	AC Synchronous, 1/20 HP, 115V/60 Hertz/3600 RPM	X												
LMU50	AC Synchronous, 1/12 HP, 115V/50 Hertz/3000 RPM		X											
LMU51	AC Synchronous, 1/20 HP, 115V/50 Hertz/3000 RPM								X					
LMU52	AC Synchronous, 1/20 HP, 115V/50 Hertz/3000 RPM												X	
LMU55	AC Synchronous, 1/20 HP, 230V/50 Hertz/3000 RPM	X												
LMU56	AC Synchronous, 25 MPH, 115V/60 Hertz/3600 RPM								X					
LMU57	Series, 1/20 HP, 115 V/60 Hertz/3600 RPM	X												
LMU60	Series, 1/20 HP, 115V/60 Hertz/3600 RPM											X		
LMU61	Series, 1/15 HP, 115V/60 Hertz/3600 RPM		X											
LMU63	Series, 1/20 HP, 115V/60 Hertz/3600 RPM, RF Sup.	X												
LMU64	Series, 1/20 HP, 115V/60 Hertz/3600RPM, RF Sup.												X	
YMU2	AC Synchronous, 1/20 HP, 115V/60 Hertz/3600 RPM													X
YMU3	AC Synchronous, 1/20 HP, 115V/60 Hertz/3600 RPM													X
YMU4	AC Synchronous, 1/20 HP, 115V/60 Hertz/3600 RPM													X
YMU5	Series, 1/15 HP, 115V/60 Hertz/3600 RPM													X

ⓐ Requires 173518 Modification Kit for special variable speed application.

FIGURE 1. MOTOR UNIT APPLICATION CHART

SYNCHRONOUS MOTOR UNITS

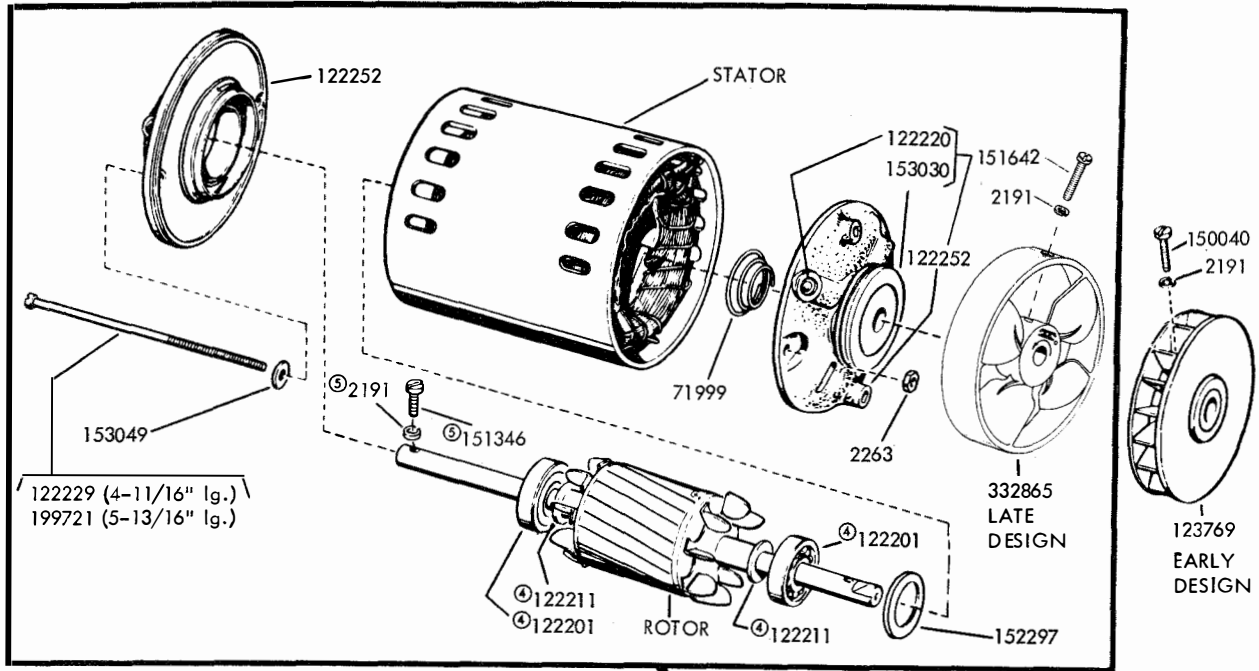
FIGURE 2. SYNCHRONOUS MOTOR CROSS — REFERENCE CHART

Teletype Code	Motor Assembly	Motor Bracket	Mounting Plate	Thermostatic Switch	Fixed Capacitor	Spring or Clamp	Relay	Relay Insulator	Spring or Clamp	Cable Assembly	Jumper
LMU3	151795	305661	305660	122249	122245	305658	151923	305659	305658	151927	96264R (5" lg. Red)
LMU11	155595	305661	305660	160304	160299	305658	160303	305659	305658	151927	96264R (5" lg. Red)
LMU12	159739	305661	305660	160304	160299	305658	160303	305659	305658	151927	96264R (5" lg. Red)
LMU15	170764	305661	305660	122249	122245	305658	151923	305659	305658	151927	96264R (5" lg. Red)
LMU19	161984	142589		174471	162072	151922	173425	162196	151925	161099	96264R (5" lg. Red)
LMU20	161984	142589		174471	162072	151922	173425	162910	160302	162911	96264R (5" lg. Red)
LMU21	151795	164612		122249	122245	151922	151923	164603	151925	151927	96264R (5" lg. Red)
LMU24 and LMU56	310295	142589		fused	162072	151922	173425	162196	151925		176137 (9-1/4" lg. Black w/320410(Terminal)) 96264R (5" lg. Red)
LMU26	161984	142589		174471	162072	151922	173425	162910	160302	162911	96264R (5" lg. Red)
LMU27	178500	176948	176947	122249	122245	151922	151923	151924	151925		
LMU30	178500	305661	305660	122249	122245	305658	151923	305659	305658	151927	96264R (5" lg. Red)
LMU31	161984	142589		174471	162072	151922	173425	162196	151925	179016	96274R (10" lg Red)
LMU33	170764	305661	305660	①193781	122245	305658	151923	305659	305658	151927	96264R (5" lg. Red)
② LMU35	194924	171749		fused	①195172	171702	①195173	171704	171703	195178	
LMU36	178500	305661	305660	①193781	122245	305658	151923	305659	305658	151927	96264R (5" lg. Red)
LMU37	151795	194897		122249	122245	151922	151923	310341	151925	194899	96264R (5" lg. Red)
LMU38	151795	305661	305660	①193781	122245	305658	151923	305659	305658	151927	96264R (5" lg. Red)
LMU42	196830	196839		122249	122245	151922	151923	196794	151925	151927	96264R (5" lg. Red)
MU43	161984	171749		174471	162072	171702	173425	171704	171703	171810	96264R (5" lg. Red)
LMU45	161984	171749		174471	162072	171702	173425	171704	171703	193181	
LMU46	151795	305661	305660	122249	122245	305658	151923	305659	305658	193236	96264R (5" lg. Red)
LMU49	170764	172795	151920	122249	122245	151922	151923	151924	151925	151927	96264R (5" lg. Red)
③ LMU50	199718	304538	151920	307281	304793	151922	304792		304537	151927	312573 (6" lg. Red w/320418(Terminal)) 312574 (6" lg. Blackw/320418(Terminal))
LMU51	151795	194897		①193781	122245	151922	151923	310341	151925	194899	96264R (5" lg. Red)
LMU52	151795	164612		①193781	122245	151922	151923	164603	151925	151927	96264R (5" lg. Red)
LMU55	306063	305661	305660	320269	320270	305658	320271	305659	305658	151927	96264R (5" Lg. Red)
YMU2	170764	312979		122249	122245	151922	151923	312977	151925	306320	96262R (4" lg. Red)
YMU3	170764	312979		334877	122245	151922	151923	312977	151925	306320	96262R (4" lg. Red)
YMU4	170764	305661	305660	122249	122245	305658	151923	305659	305658	306320	96274 (10" lg. Red)

① For use with motor unit operating on 50 Hertz current

② See page 10 for parts peculiar to LMU35

③ See page 6 for parts peculiar to LMU50



SYNCHRONOUS MOTOR ASSEMBLY - STANDARD OR HEAVY DUTY

SYNCHRONOUS MOTORS - Standard or Heavy Duty				
DUTY	MOTOR ASSEMBLY	STATOR	ROTOR	MOTOR DATA
Standard	151795	122251	128874	AC Synchronous, 1/20 HP, 115V: 50/60 Hertz, 3000/3600 RPM
Heavy	155595	③160306	160305	AC Synchronous, 1/12 HP, 115V: 60 Hertz, 3600 RPM
Heavy	159739	160306	160305	AC Synchronous, 1/12 HP, 115V: 60 Hertz, 3600 RPM
Standard	①170764	122251	④128874	AC Synchronous, 1/20 HP, 115V: 50/60 Hertz, 3000/3600 RPM
Standard	178500	③122251	④128874	AC Synchronous, 1/20 HP, 115V: 60 Hertz, 3600 RPM
Standard	②196830	196831	④128874	AC Synchronous, 1/20 HP, 115V: 60 Hertz, 3600 RPM
Heavy	199718	199720	199719	AC Synchronous, 1/12 HP, 115V: 50 Hertz, 3000 RPM
Standard	306063	320272	④128874	AC Synchronous, 1/20 HP, 230V: 50/60 Hertz, 3000/3600 RPM

- ① Without fan
- ② CW rotation (all others CCW rotation)
- ③ Arranged for inverted mounting
- ④ Common to all rotors
- ⑤ Not part of motor assemblies
- ⑥ New style has flat at end of rotor shaft

FIGURE 3. SYNCHRONOUS MOTOR ASSEMBLIES (STANDARD OR HEAVY DUTY)

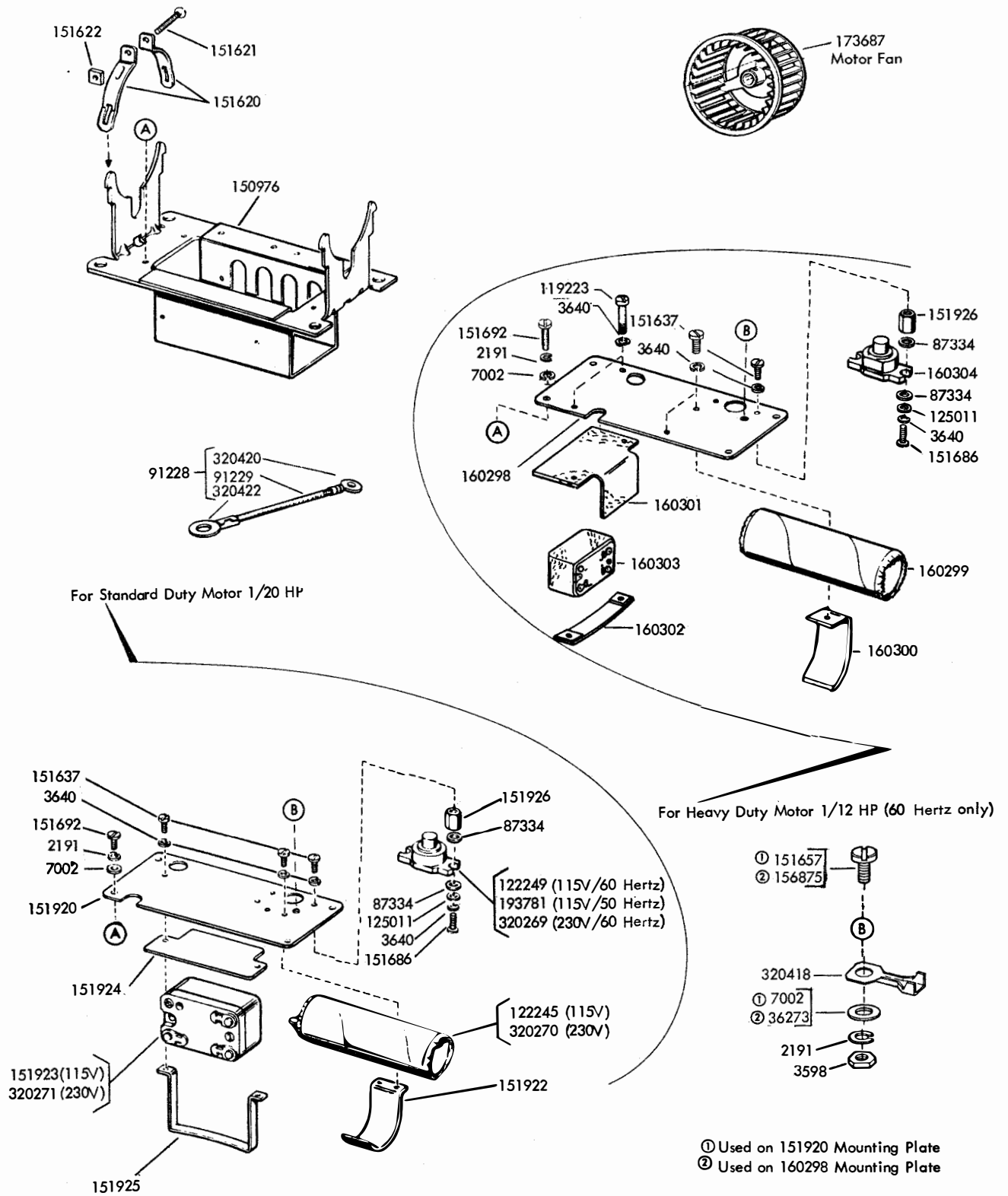


FIGURE 4. RELAY AND CAPACITOR MOUNTING (SYNCHRONOUS)

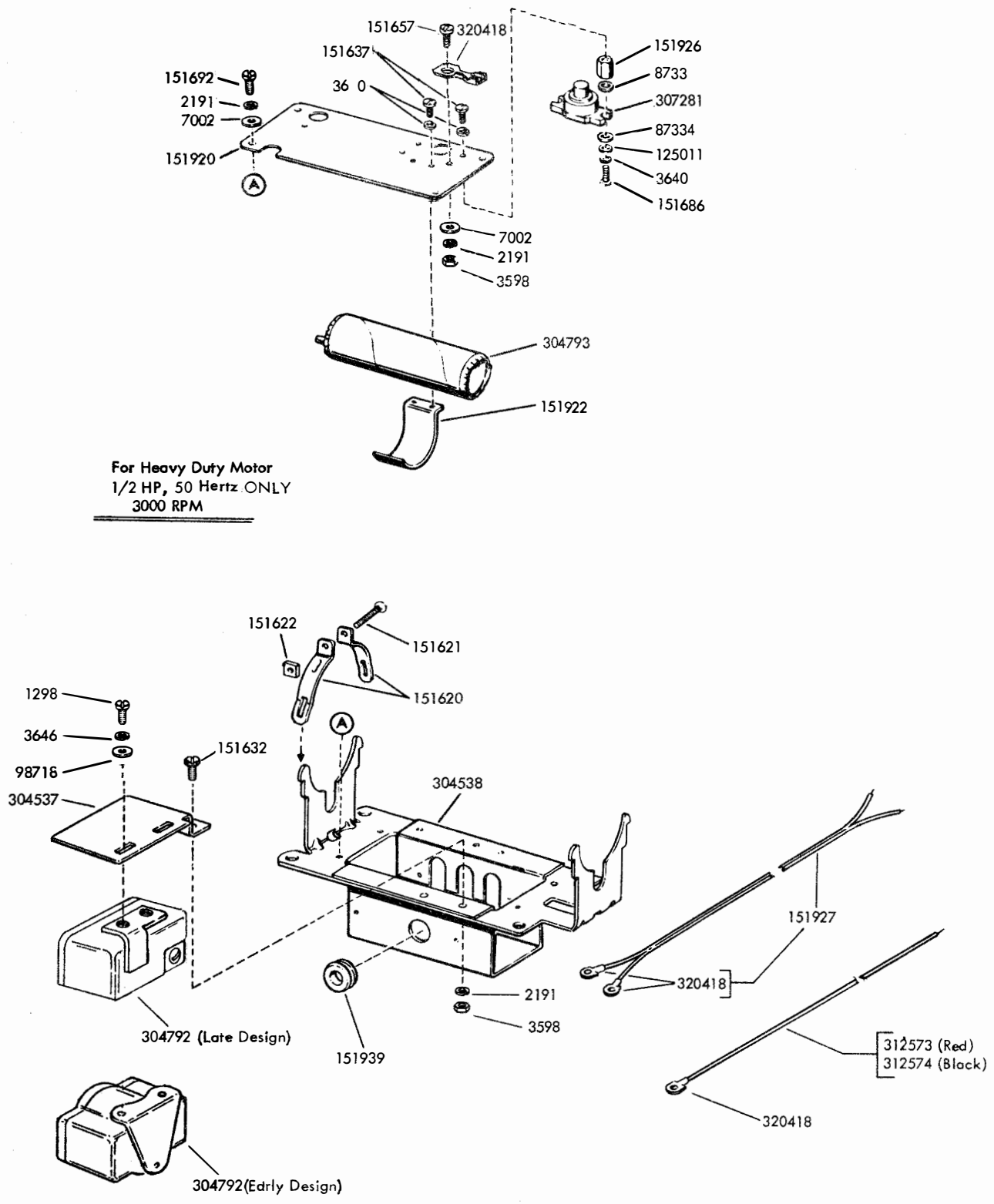


FIGURE 5. RELAY AND CAPACITOR MOUNTING (SYNCHRONOUS)

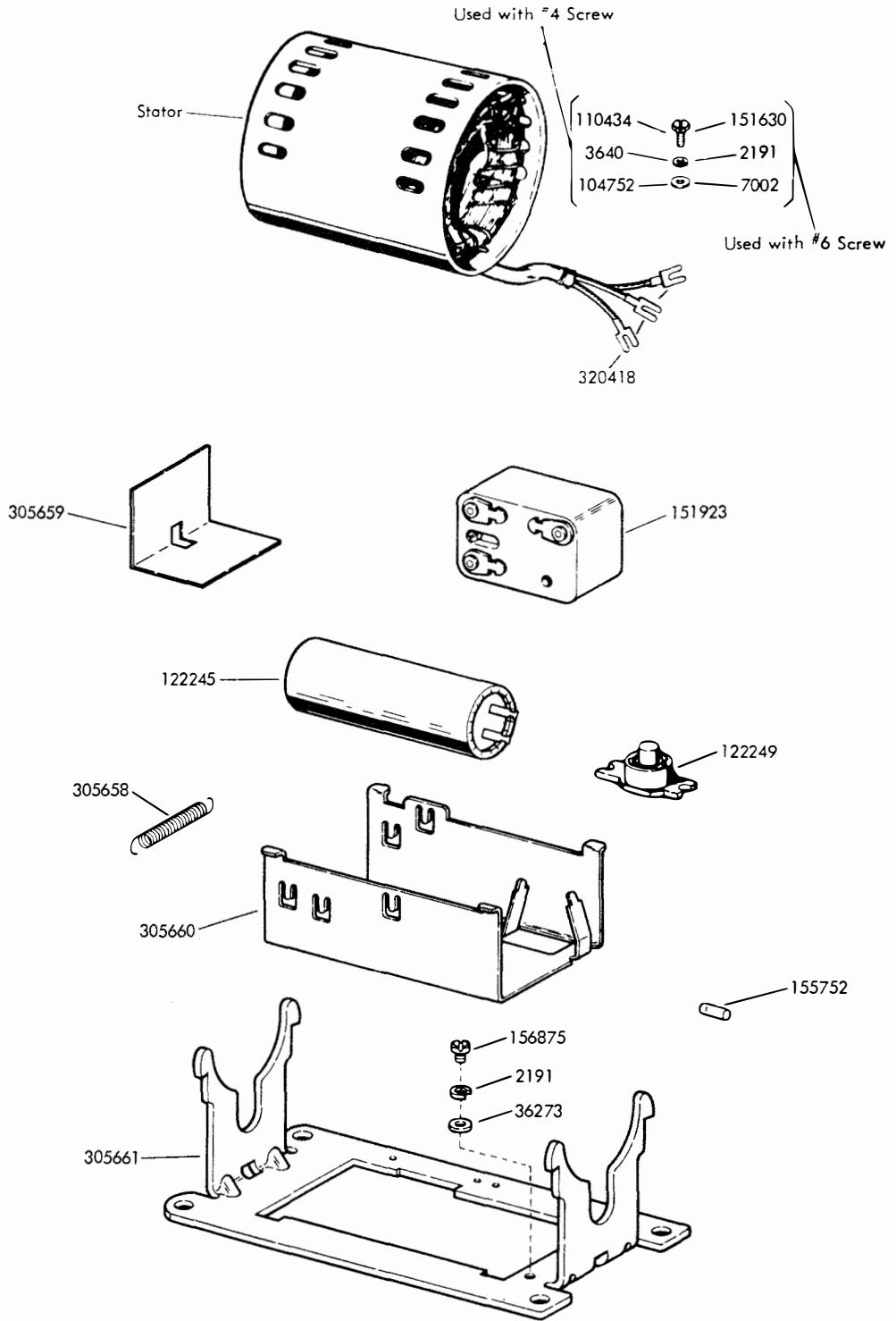


FIGURE 6. RELAY AND CAPACITOR MOUNTING

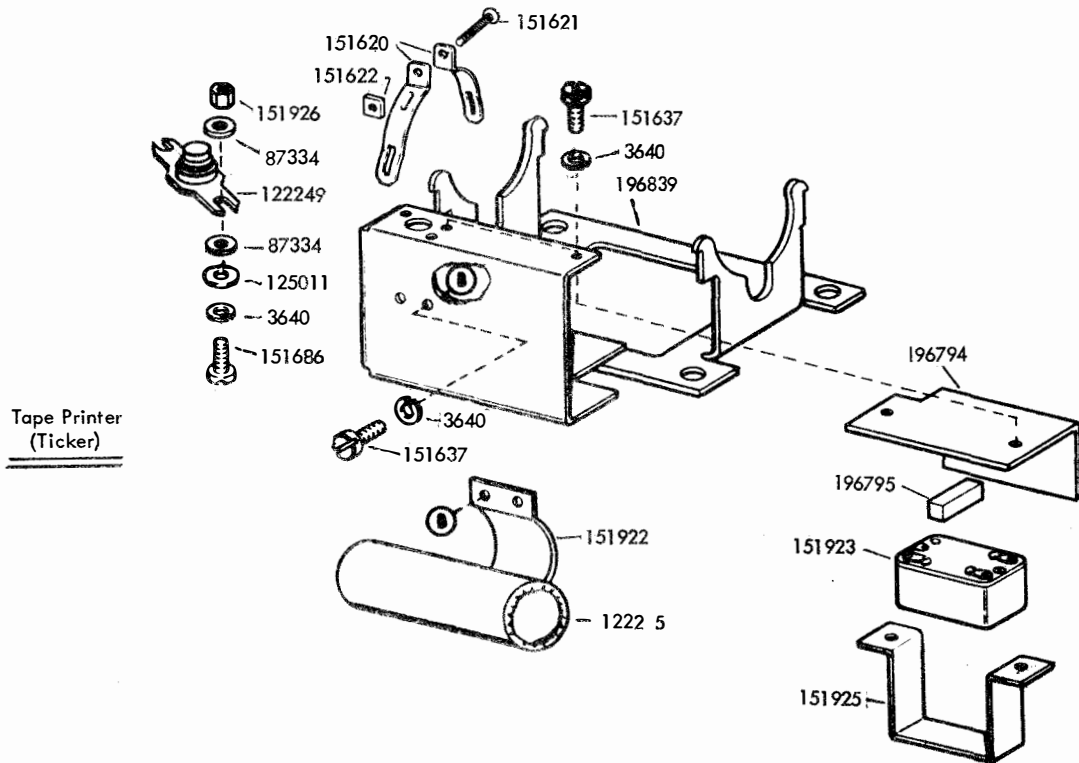
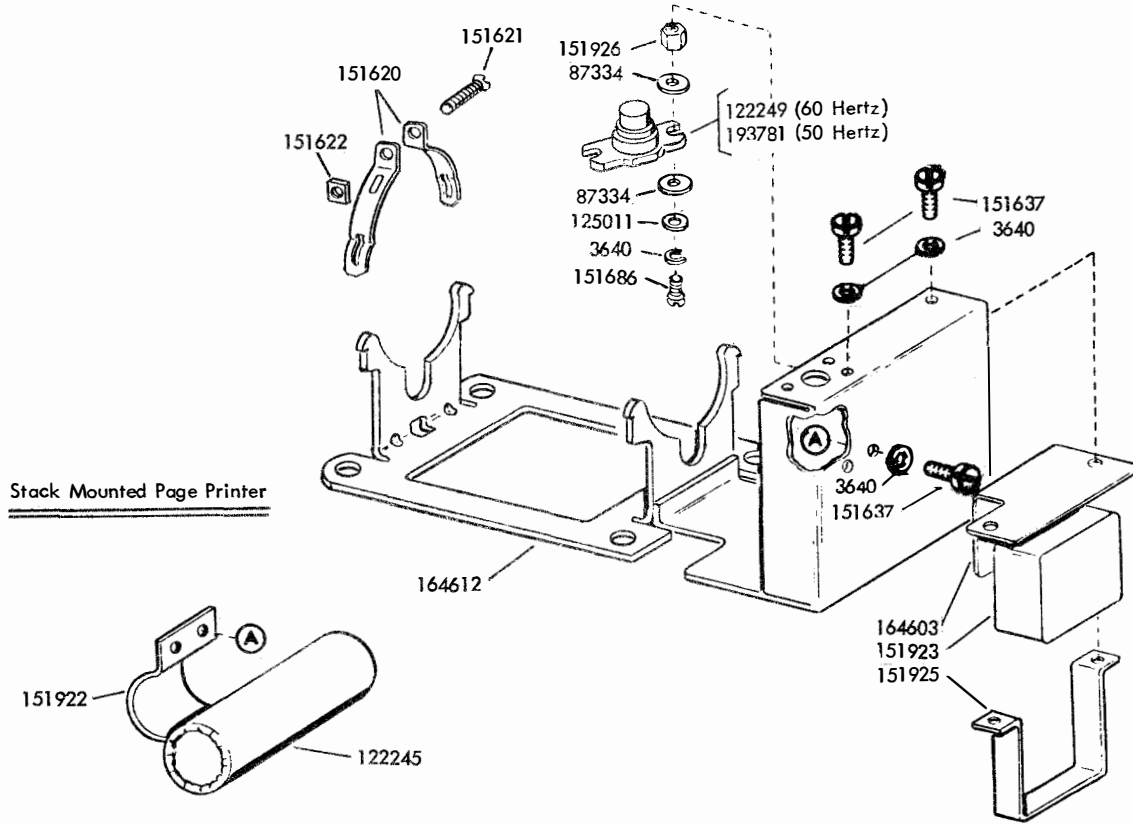
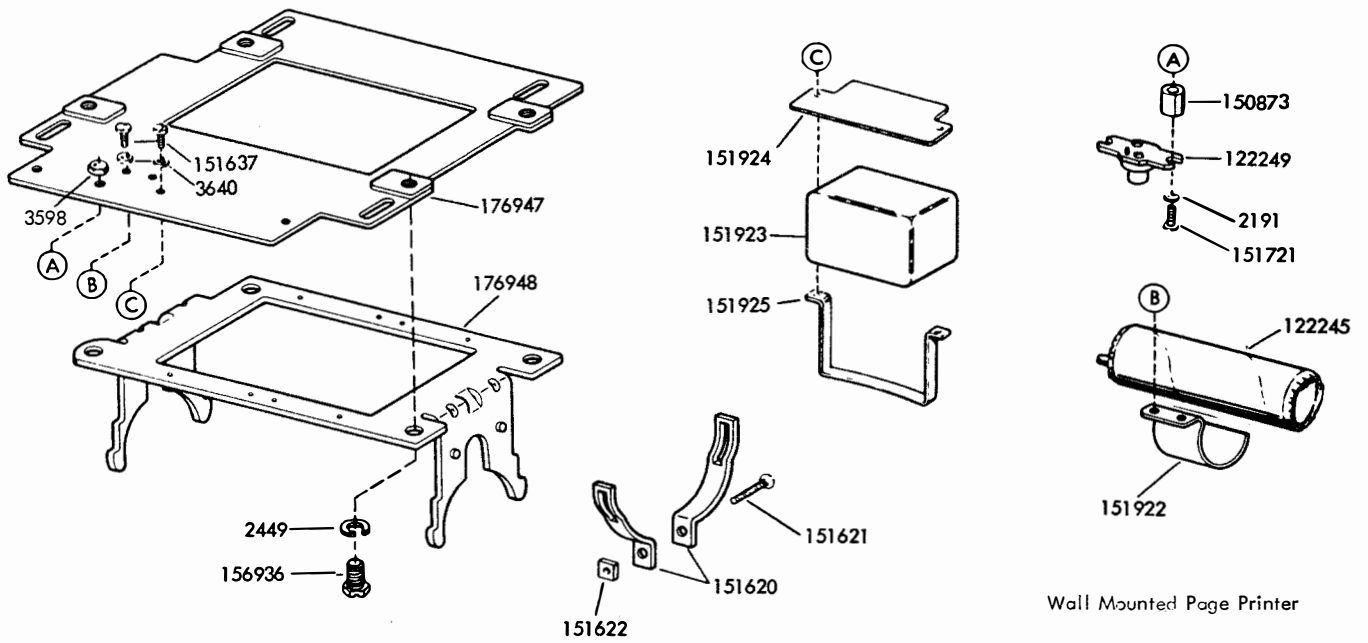
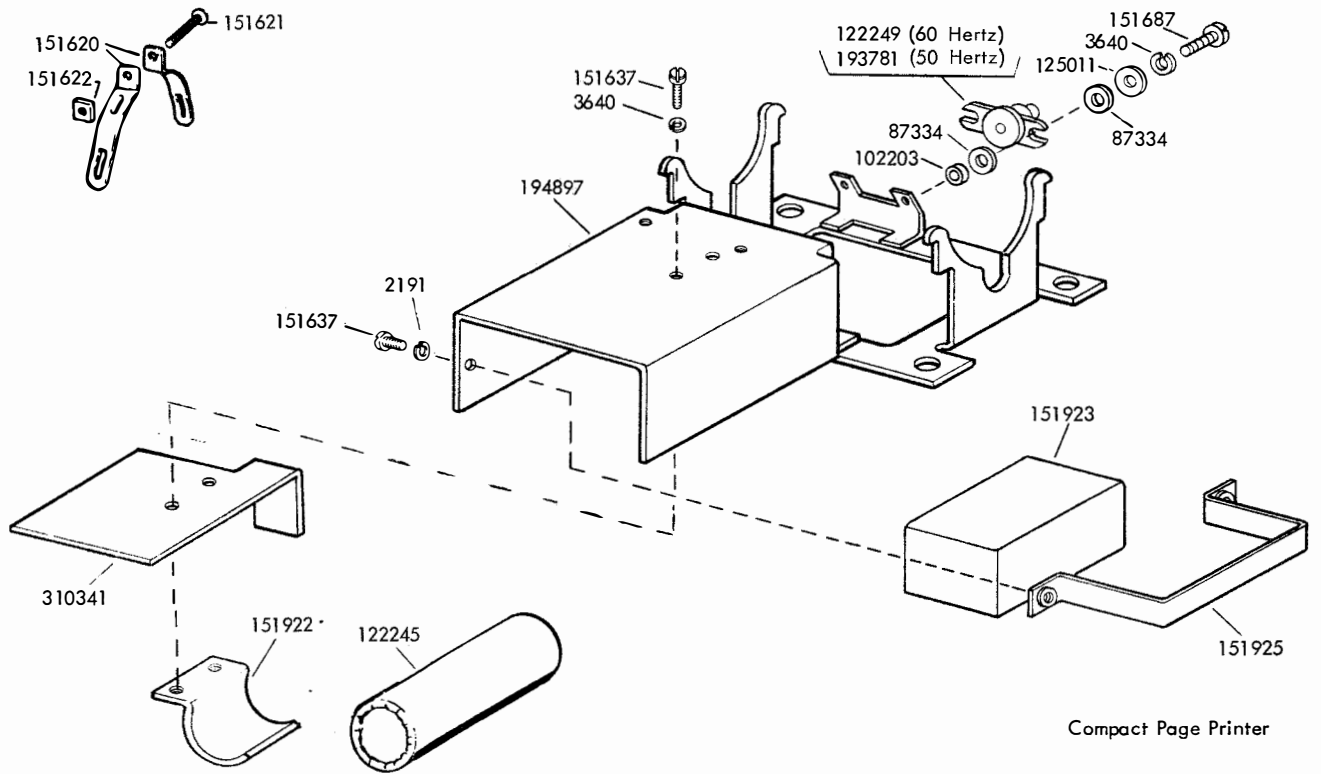


FIGURE 7. RELAY AND CAPACITOR MOUNTING (SYNCHRONOUS)

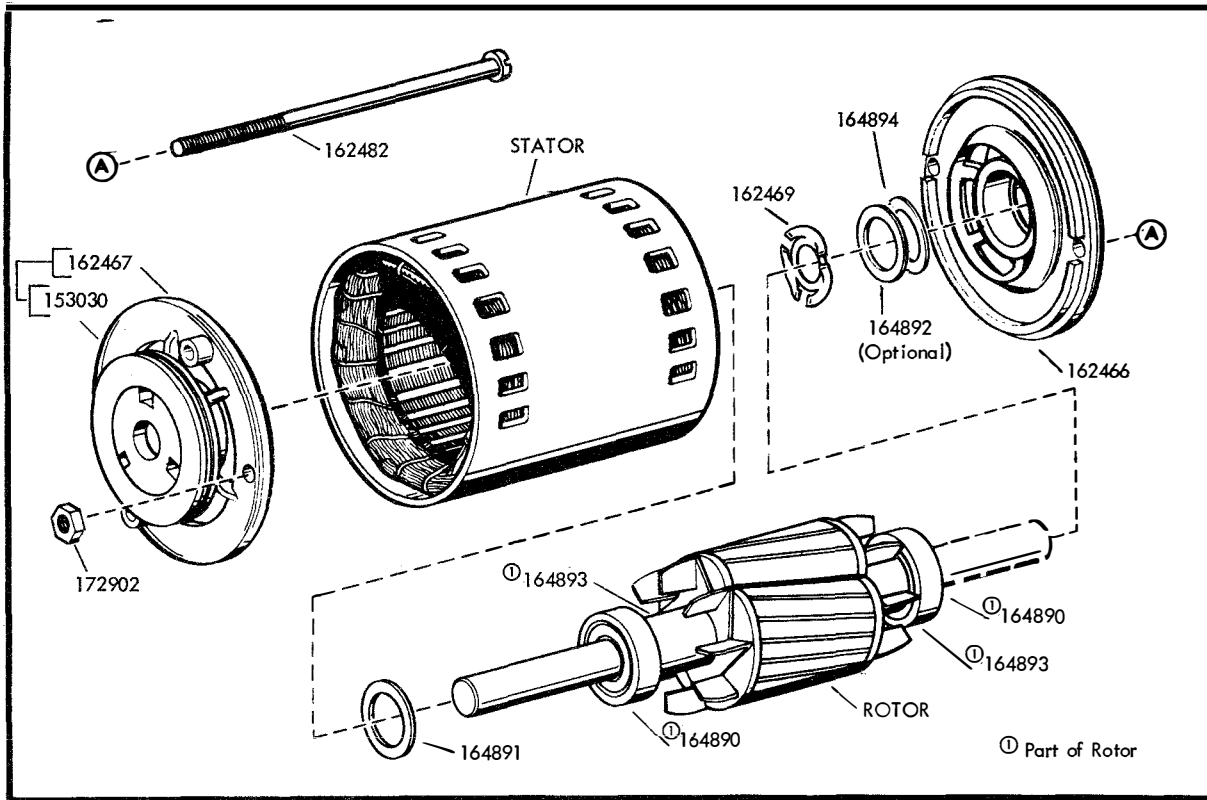


Wall Mounted Page Printer



Compact Page Printer

FIGURE 8. RELAY AND CAPACITOR MOUNTING (SYNCHRONOUS)



MINIATURE MOTOR ASSEMBLY

SYNCHRONOUS MOTORS - Miniature			
MOTOR ASSEMBLY	STATOR	ROTOR	MOTOR DATA
161984	162464	330564	AC Synchronous, 25 MHP, 115V: 60 Hertz, 3600 RPM
194924	195214	330564	AC Synchronous, 25 MHP, 115V: 50 Hertz, 3000 RPM
310295	162464	② 330565	AC Synchronous, 25 MHP, 115V: 60 Hertz, 3600 RPM

② Has double shaft extension

FIGURE 9. SYNCHRONOUS MOTOR ASSEMBLIES (MINIATURE)

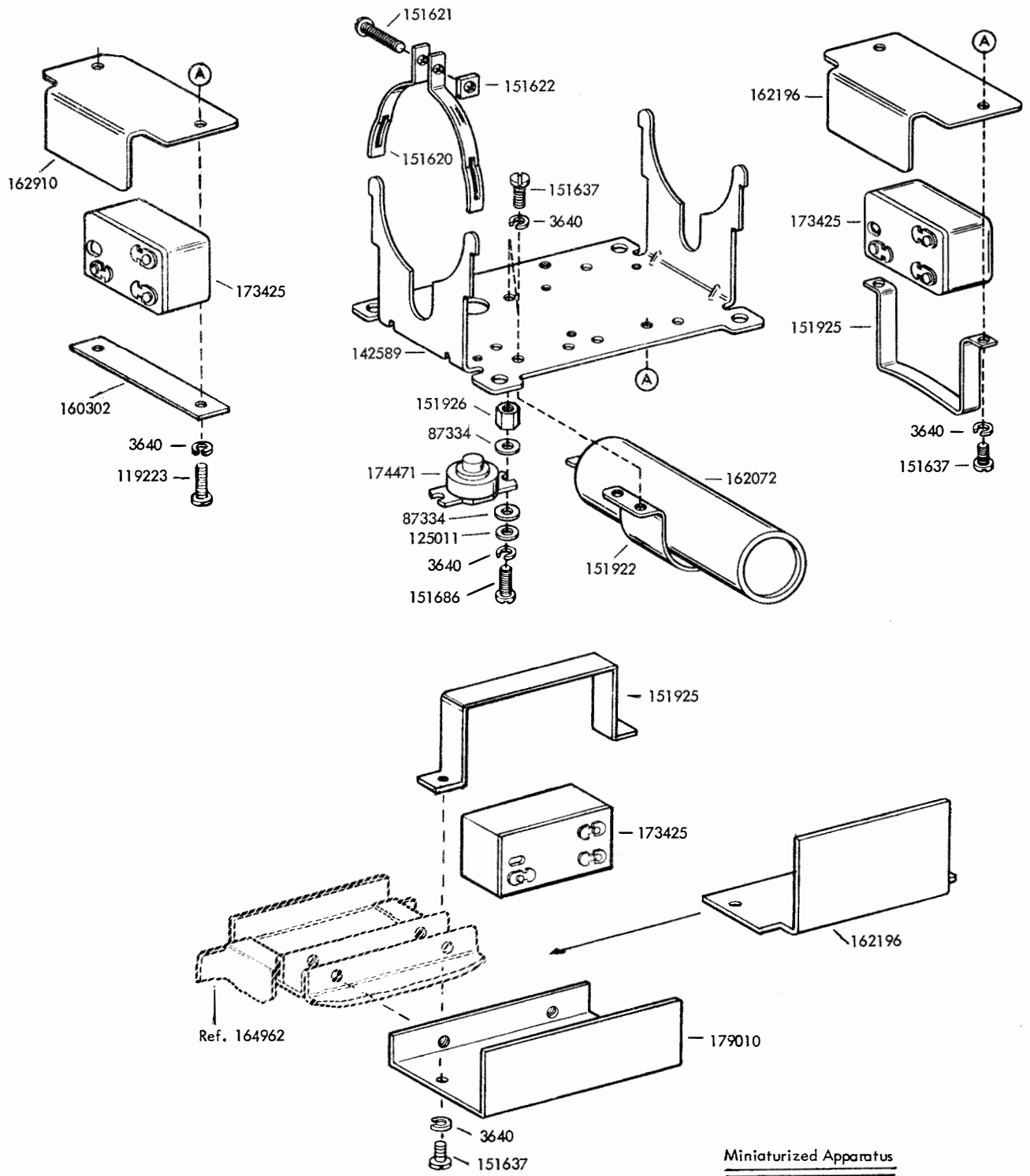


FIGURE 10. RELAY AND CAPACITOR MOUNTING (SYNCHRONOUS)

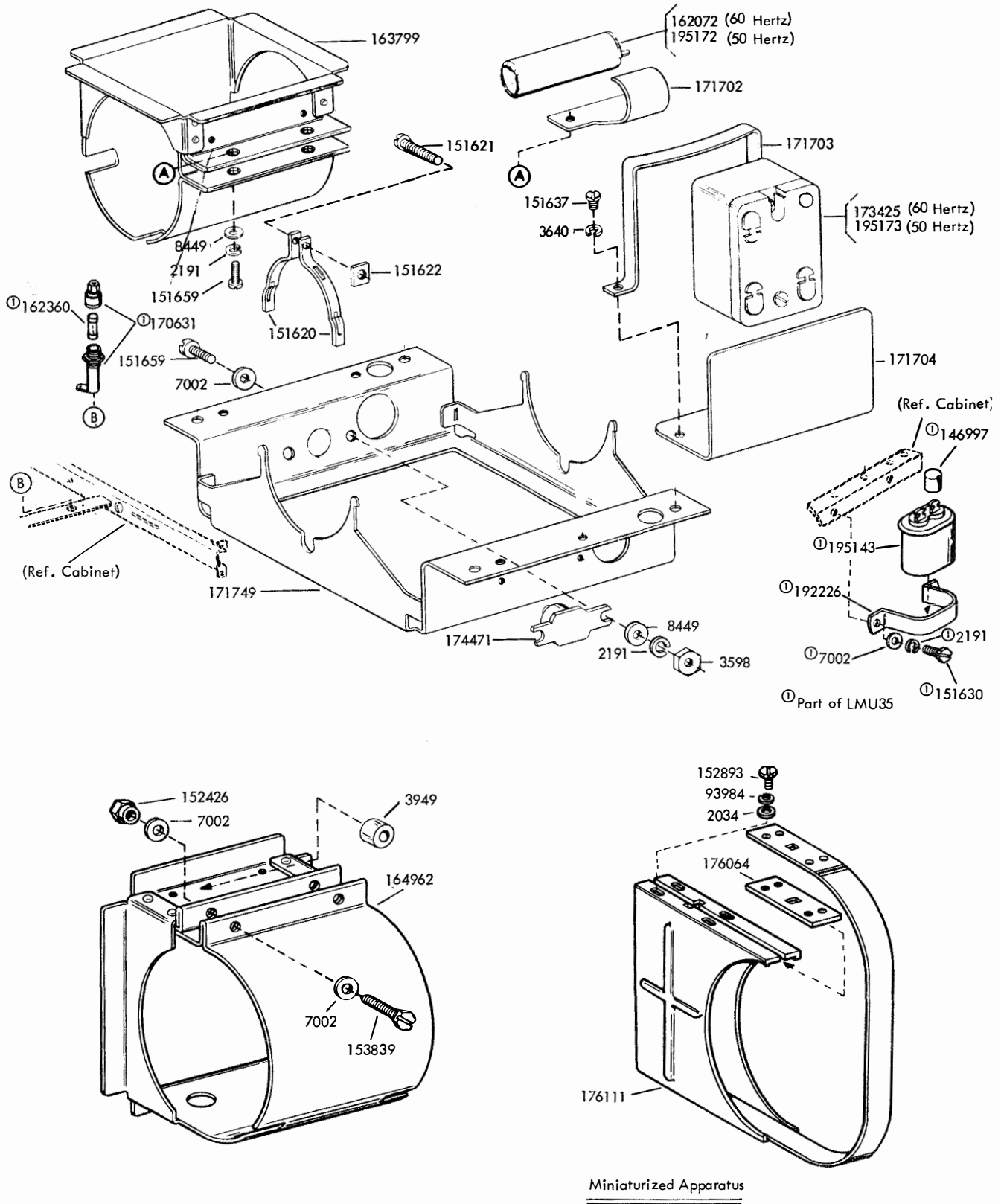
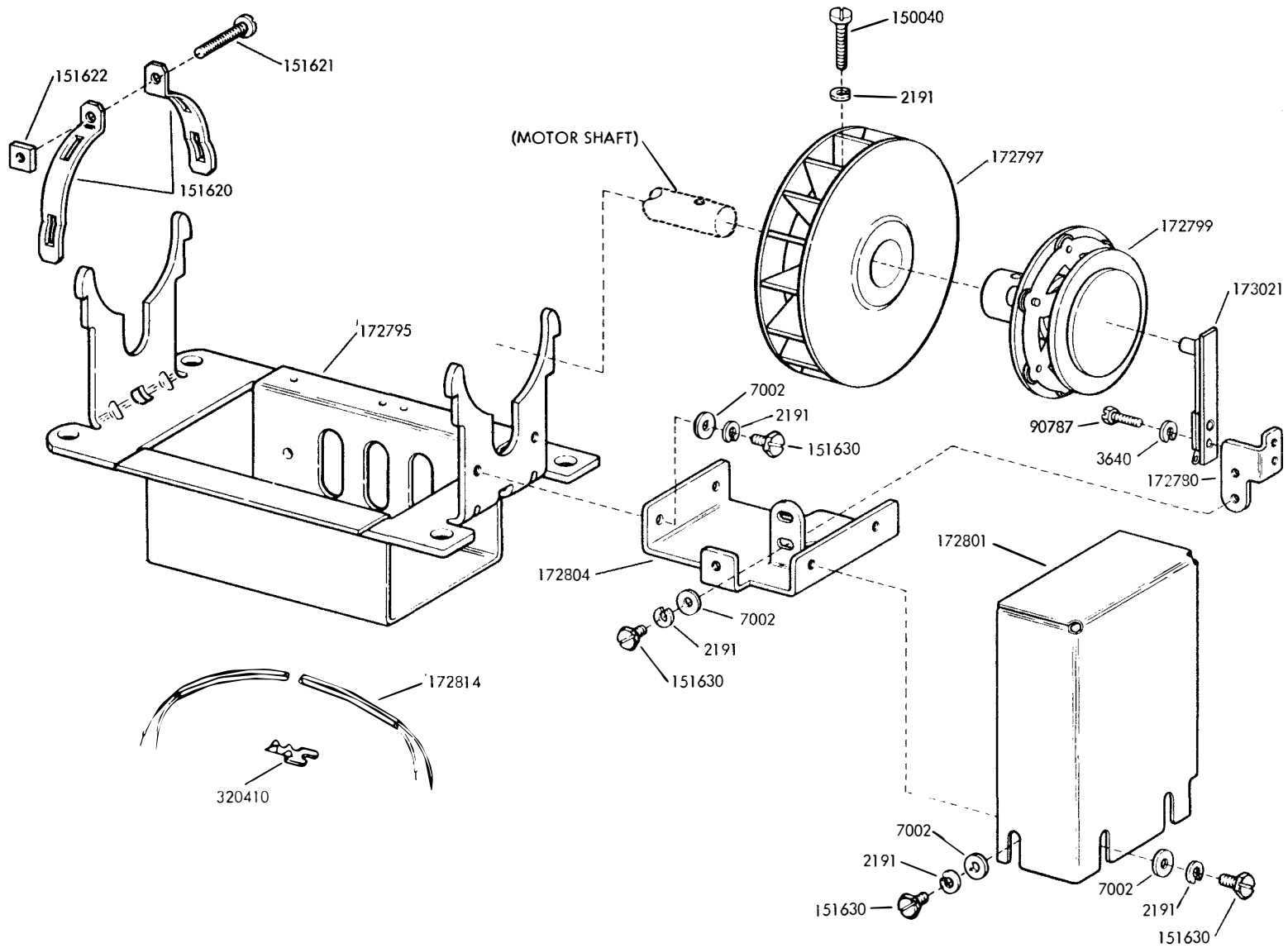


FIGURE 11. RELAY, CAPACITOR MOUNTING AND BRACKET (SYNCHRONOUS)

FIGURE 12. SYNCHRONOUS MOTOR MOUNTING WITH CENTRIFUGAL SWITCH ASSEMBLY



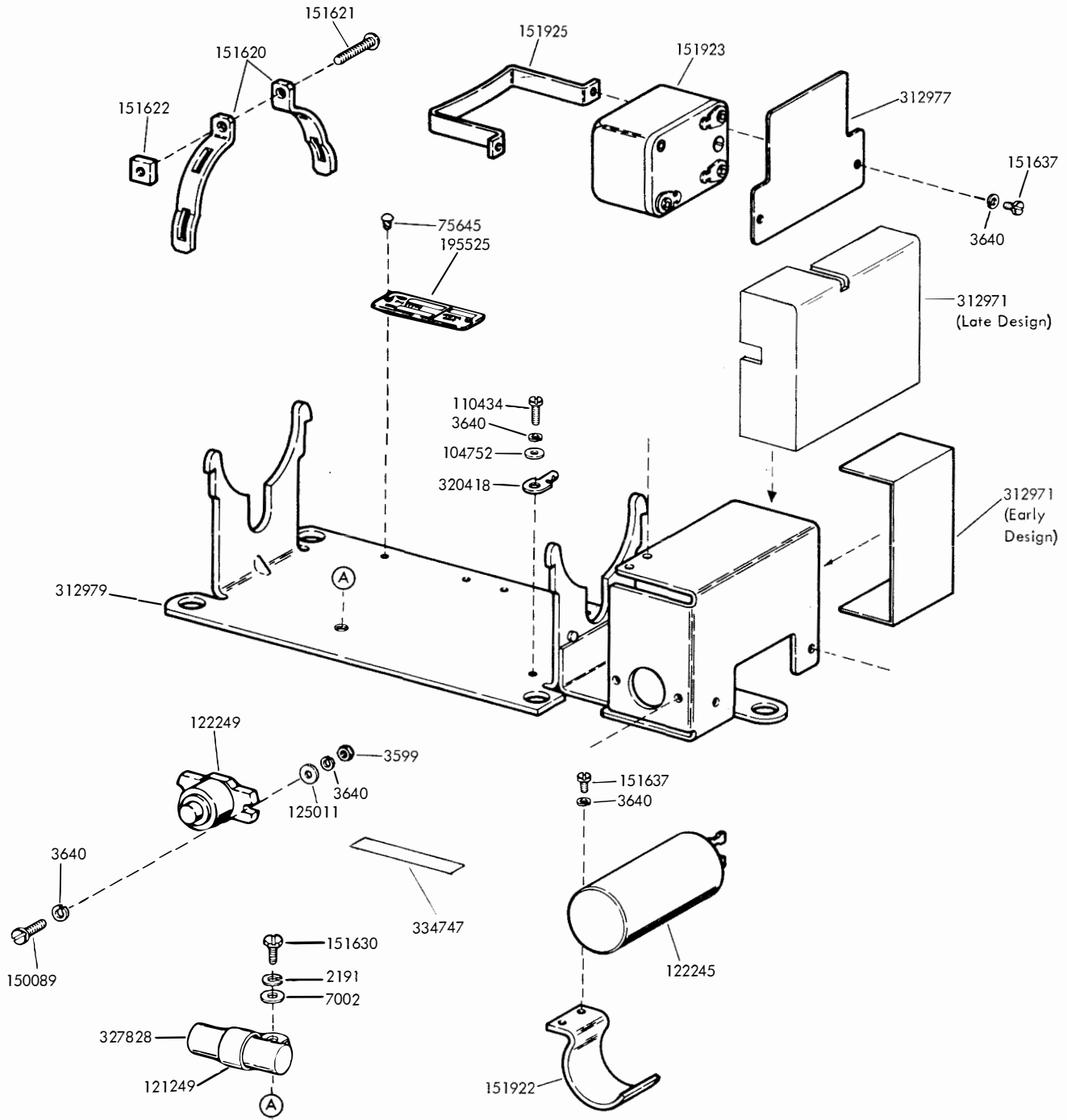
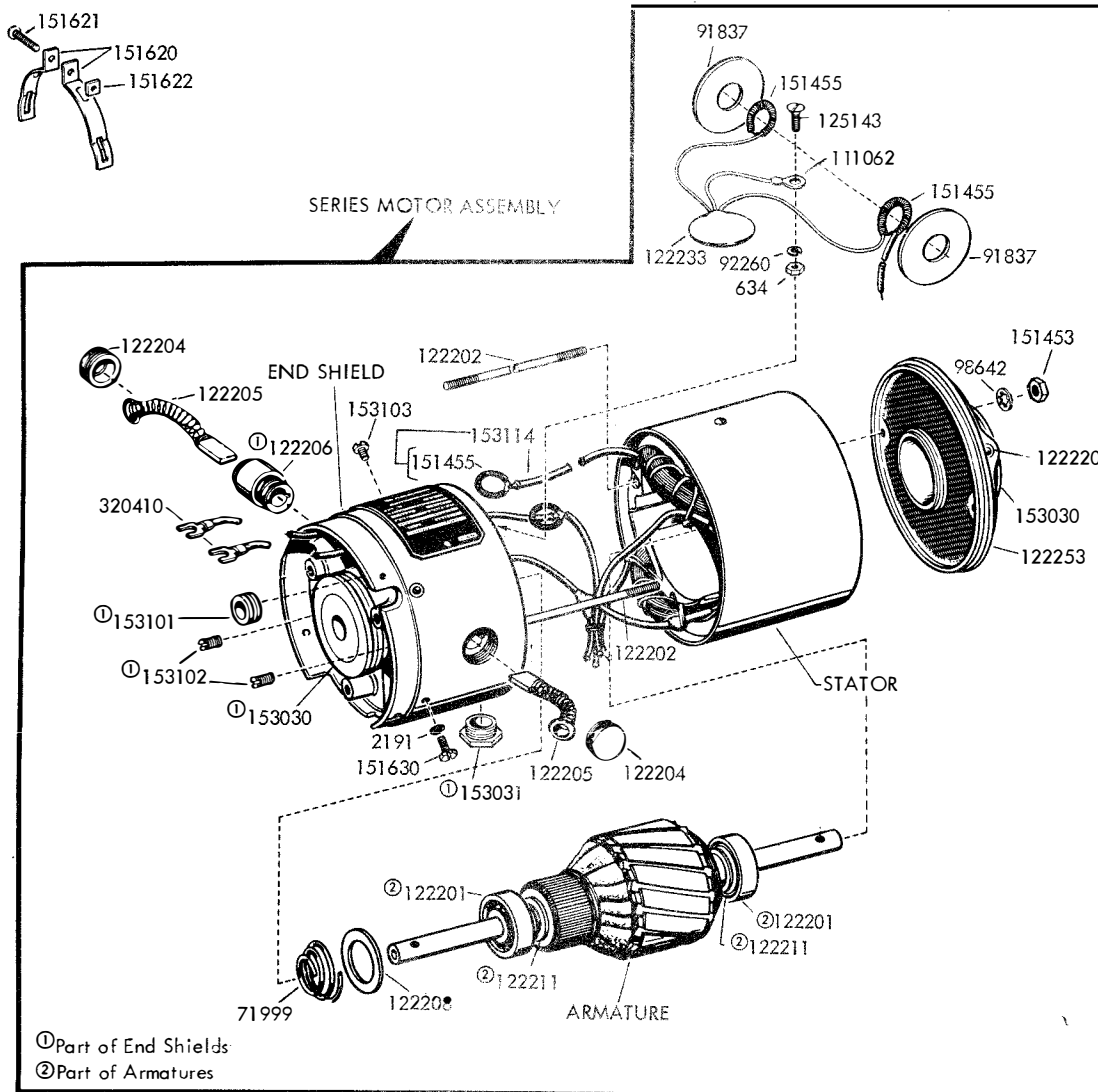


FIGURE 13. RELAY AND CAPACITOR MOUNTING (SYNCHRONOUS)

SERIES MOTOR UNITS

Teletype Code	Motor Assembly	Motor Bracket	Container	Lid	Nipple	Capacitor	Resistor	Electrical Noise Suppressor	Cable Assembly	Jumper
LMU4	150701	152046	152039	152040	152067	161579	161580	161578	152059	91228 (2-1/2"lg. w/320420 and 320422 Terminals) 162684 (2-3/4"lg.w/164479 Terminal) 162685 (4"lg. w/164479 Terminal)
LMU6	150701	150976				161579	161580			91228 (2-1/2"lg. w/320420 and 320422 Terminals) 162684 (2-3/4"lg. w/164479 Terminal) 163268 (6-1/2"lg. White w/164479 Terminal) 163269 (2"lg. w/164479 Terminal)
LMU10	150701	152046	152039	152040	152067	161579	161580	161578	152059	91228 (2-1/2"lg.w/320420 and 320422 Terminals) 162684 (2-3/4" lg. w/164479 Terminal) 162685 (4" lg. w/164479 Terminal)
LMU13	163272	150976				161579	161580			91228 (2-1/2" lg. w 320420 and 320422 Terminals) 162684 (2-3/4" lg. w/164479 Terminal) 163268 (6-1/2" lg. White w/164479 Terminal) 163269 (2" lg. 2/164479 Terminal)
LMU14	161577	152046	152039	152040	152067	161579	161580	161578	152059	91228 (2-1/2" lg. w/320420 and 320422 Terminals) 162684 (2-3/4" lg. w/164479 Terminal) 162685 (4" lg. w/164479 Terminal)
LMU23	164758	173751				173003	173004			91228(2-1/2"lg. w/320420 and 320422 Terminals)
LMU28	179100	152046	179105	179106	179282	161579	179103	161578	179283	91228(2-1/2"lg. w/320420 and 320422 Terminals)
LMU29	179190	152046	179420	179424	152067	179421	173004	179422	152059	91228(2-1/2"lg. w/320420 and 320422 Terminals)
LMU32	194060	152046	194057	179424	194063	161579	179103	161578	152059	91228(2-1/2"lg. w/320420 and 320422 Terminals)
LMU39	161577	152046	179420	179424	152067	161579	179103	161578	152059	91228(2-1/2"lg. w/320420 and 320422 Terminals)
LMU41	150701	152046	179420	179424	152067	161579	179103	161578	152059	91228(2-1/2"lg. w/320420 and 320422 Terminals)
LMU47	150701	152046	179420	179424	152067	161579	179103		152059	91228(2-1/2"lg. w/320420 and 320422 Terminals)
LMU57	324111	152046								91228(2-1/2"lg.w/320420 and 320422 Terminals)
LMU60	324111	150976						161578	152059	91228(2-1/2"lg.w/320420 and 320422 Terminals)
LMU61	321580	150976						161578	152059	91228(2-1/2"lg.w/320420 and 320422 Terminals)
LMU63	324111	152046	179105	179106	179282			161578	179283	91228(2-1/2"lg.w/320420 and 320422 Terminals)
LMU64	324111	150976						161578	152059	91228(2-1/2"lg.w/320420 and 320422 Terminals)
YMU5	321580	152046								91228(2-1/2"lg.w/320420 and 320422 Terminals)

FIGURE 14. SERIES MOTOR CROSS-REFERENCE CHART



SERIES MOTORS STANDARD OR HEAVY DUTY					
	MOTOR ASSEMBLY	STATOR	ARM-ATURE	END SHIELD	MOTOR DATA
Standard	150701	122221	122210	122200	Series, 1/20 HP, 115V: 60 Hertz, 3600 RPM
Heavy	161577	161576	161575	122200	Series, 1/15 HP, 115V: 60 Hertz, 3600 RPM
Heavy	①163272	161576	161575	163273	Series, 1/15 HP, 115V: 60 Hertz, 3600 RPM
Heavy	①164758	164756	164757	163273	DC Series, 1/15 HP, 48V: 3600 RPM
Standard	179100	122221	122210	179101	Series, 1/20 HP, 115V: 60 Hertz, 3600 RPM
Heavy	179190	164756	164757	122200	DC Series, 1/15 HP, 48V: 3600 RPM
Heavy	③194060	161576	161575	194062	Series, 1/15 HP, 115V: 60 Hertz, 3600 RPM
Heavy	321580	312270	161575	312269	Series, 1/15 HP, 115V: 60 Hertz, 3600 RPM
Standard	324111	324112	1222210	324113	Series, 1/20HP, 115V: 50/60 Hertz, 3600RPM

● Arranged for Inverted Mounting

FIGURE 15. SERIES MOTOR ASSEMBLIES

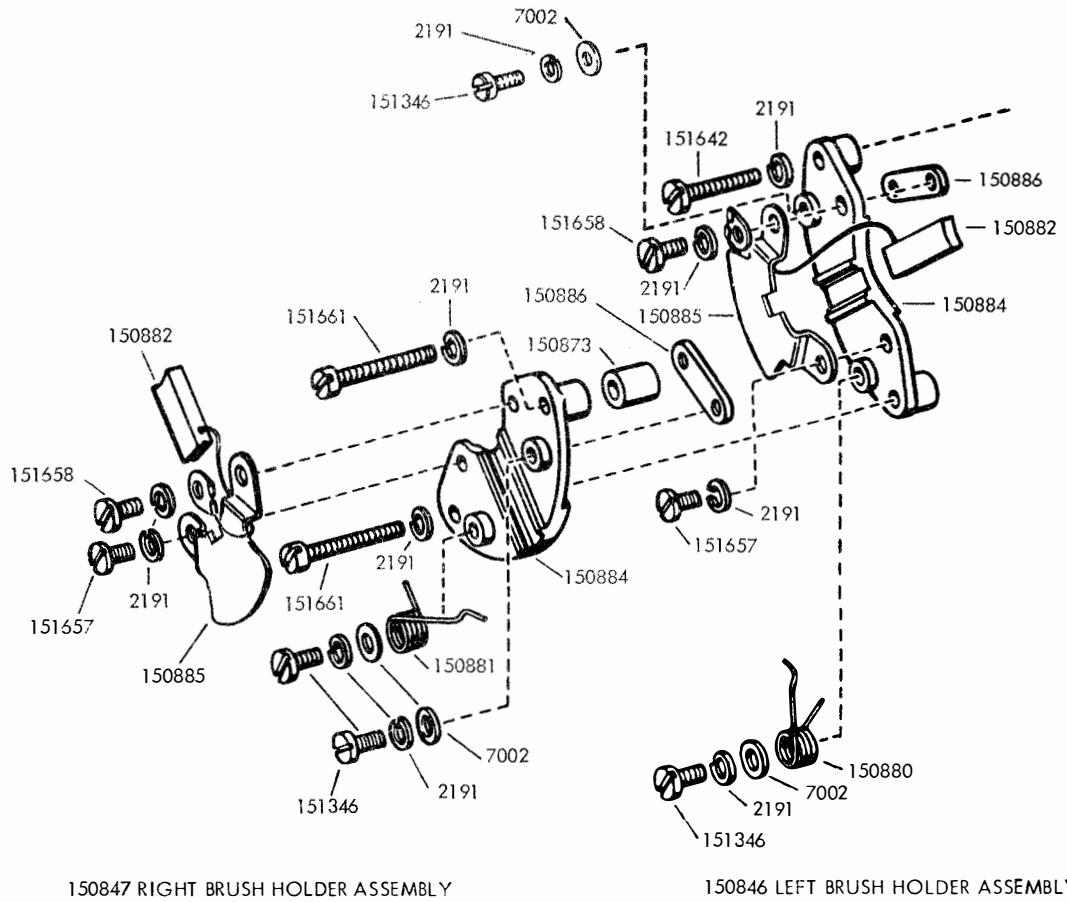


FIGURE 16. BRUSH ASSEMBLIES

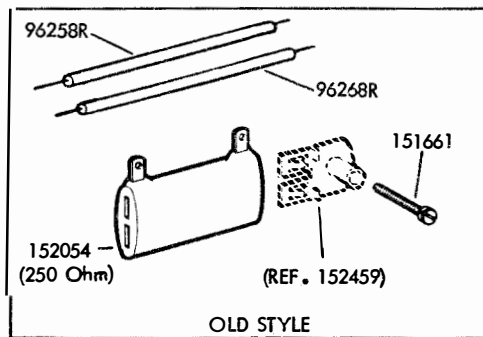
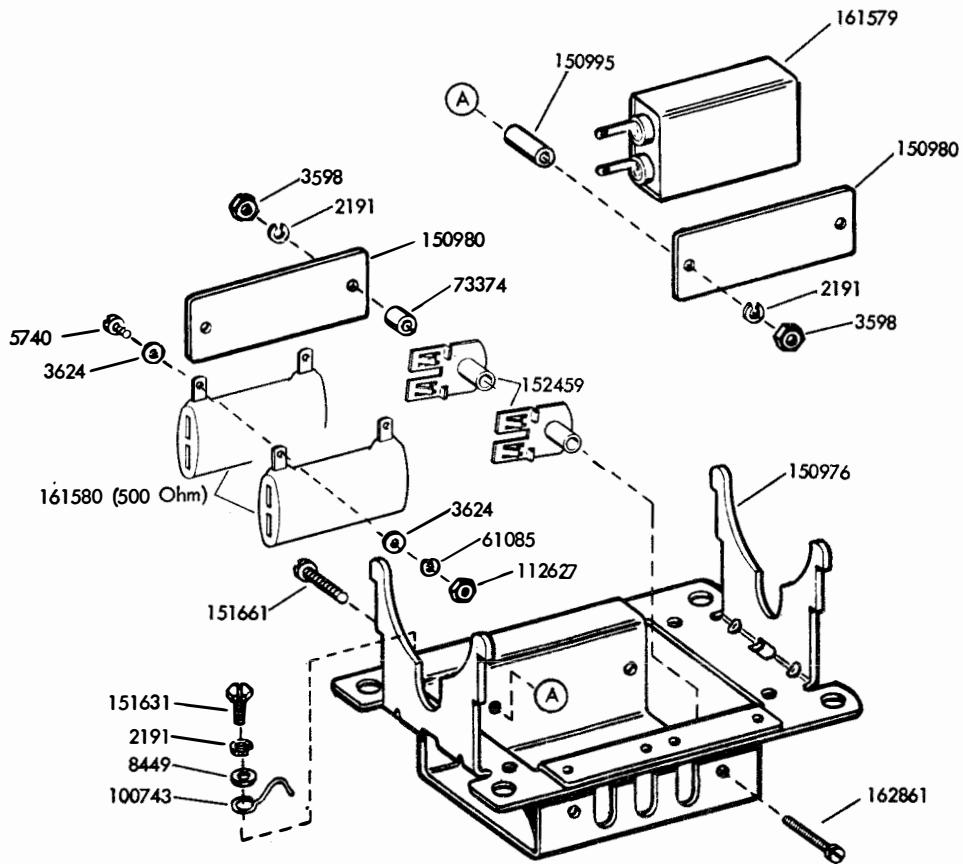
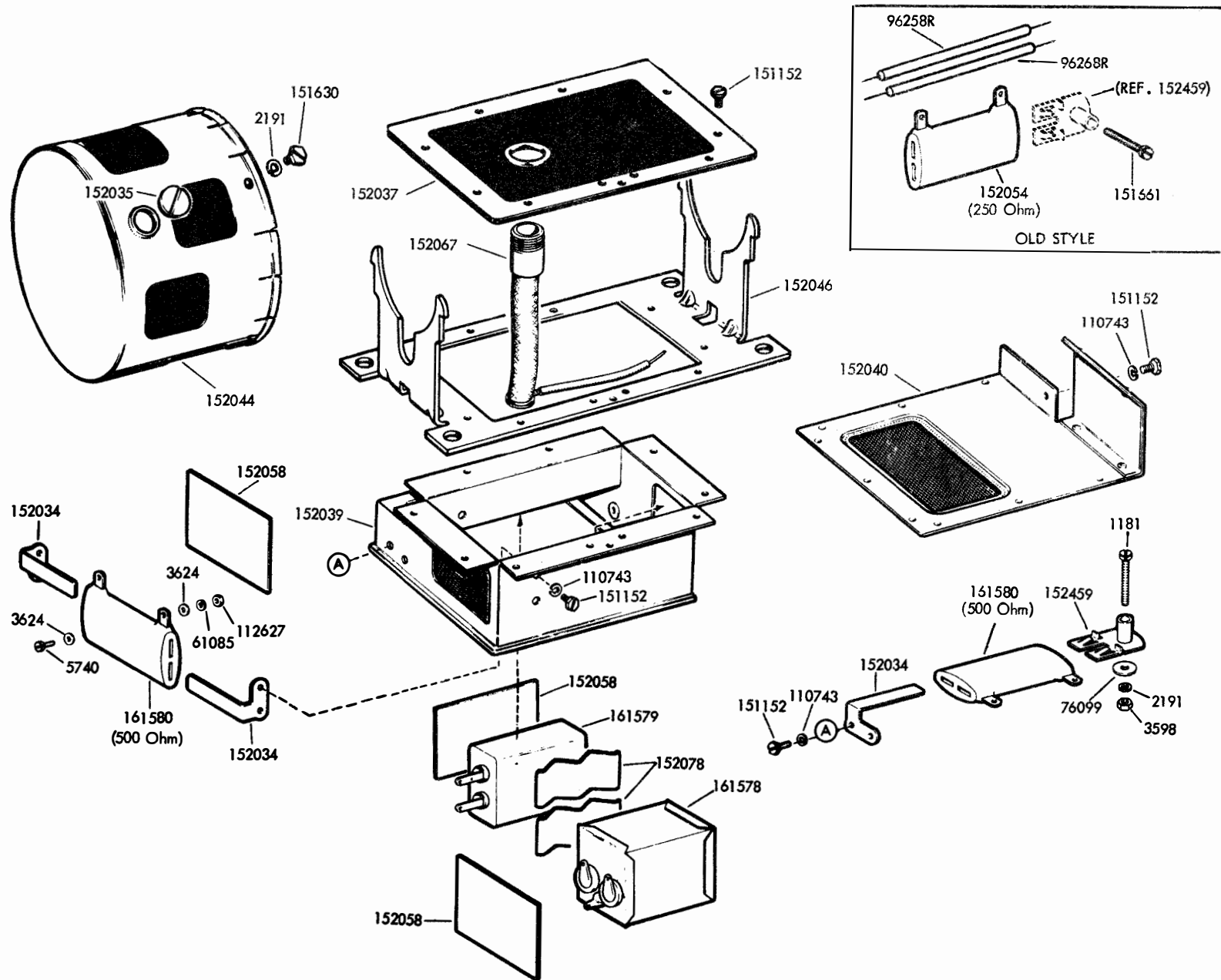


FIGURE 19. SERIES MOTOR MOUNTING PARTS

FIGURE 20. SERIES MOTOR MOUNTING PARTS WITH RF SUPPRESSION



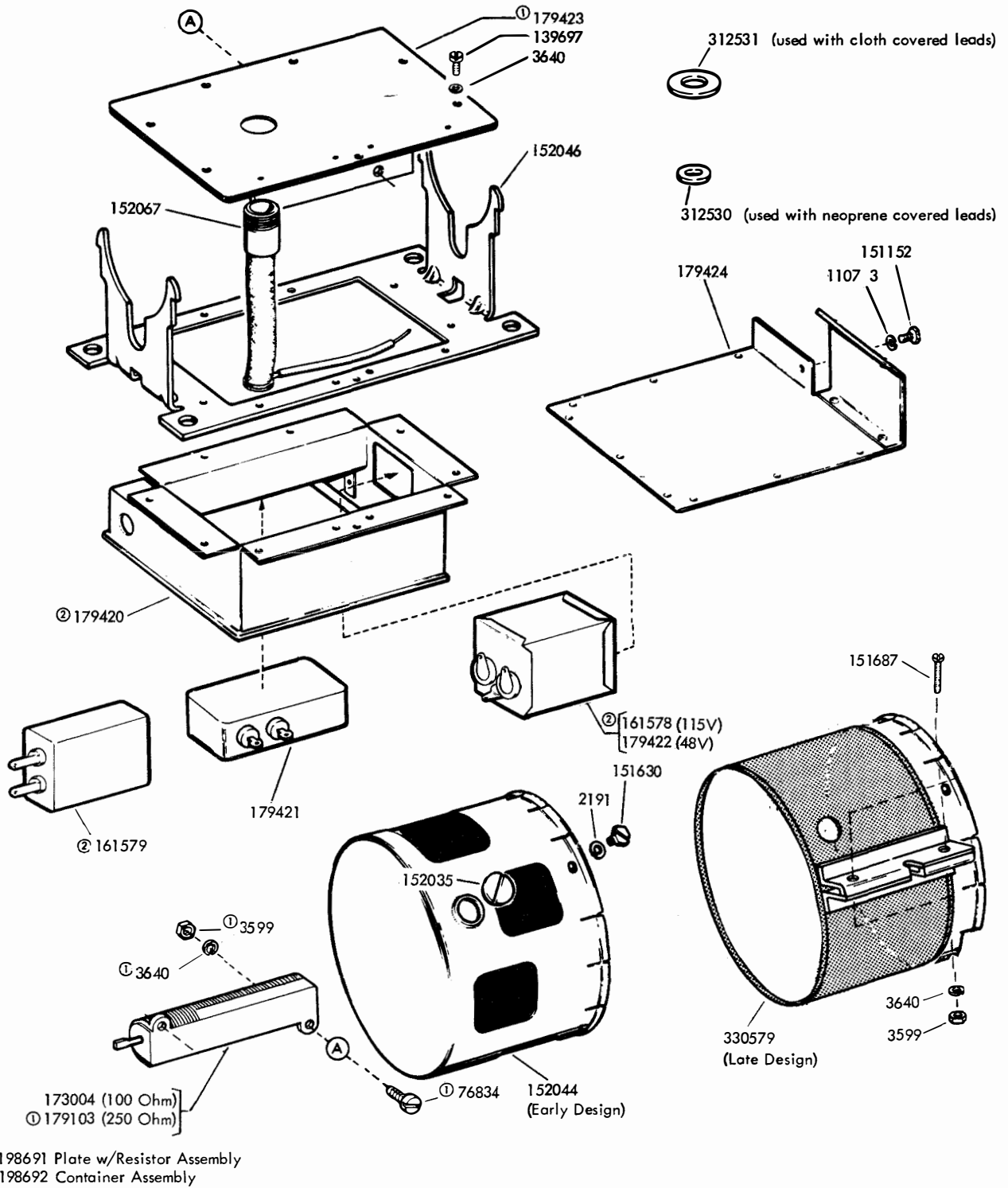


FIGURE 21. SERIES MOTOR MOUNTING PARTS WITH RF SUPPRESSION

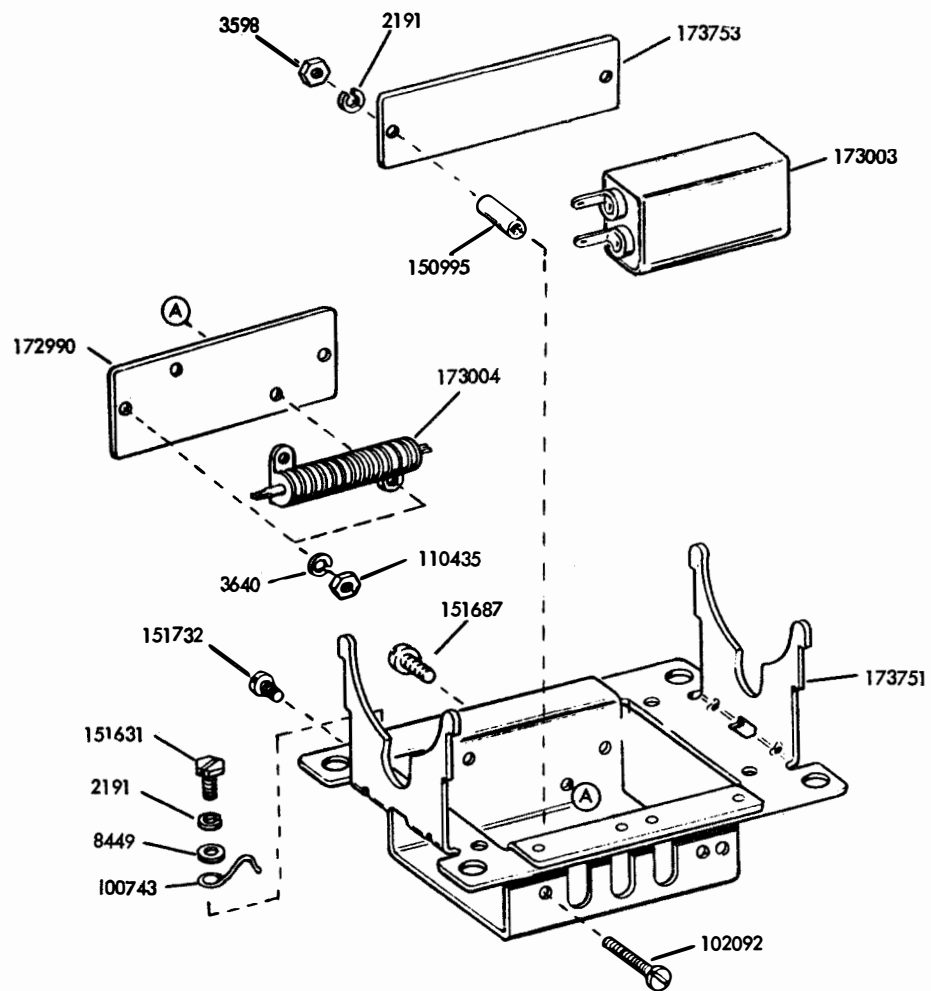
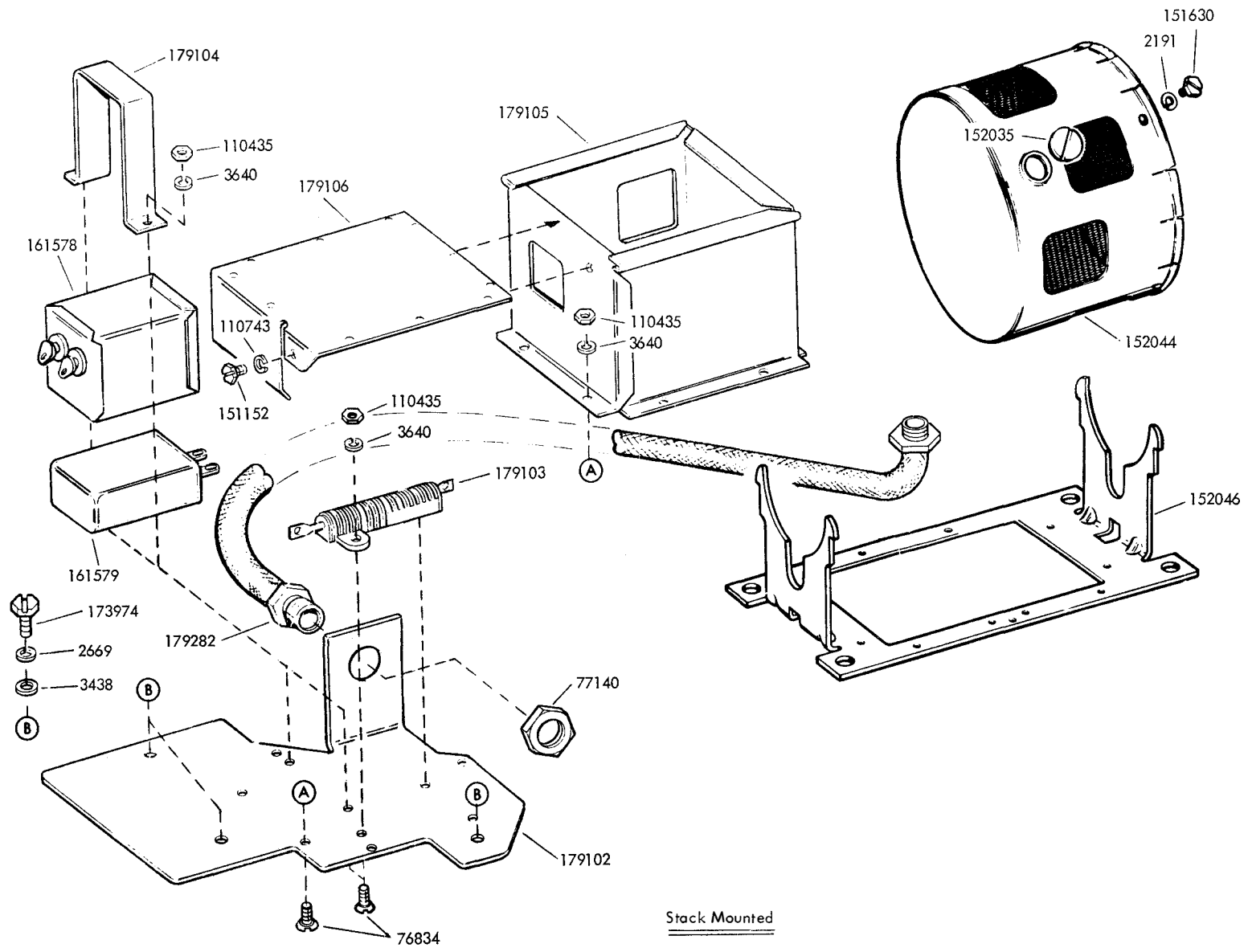


FIGURE 22. SERIES MOTOR MOUNTING PARTS

FIGURE 23. SERIES MOTOR MOUNTING PARTS WITH RF SUPPRESSION



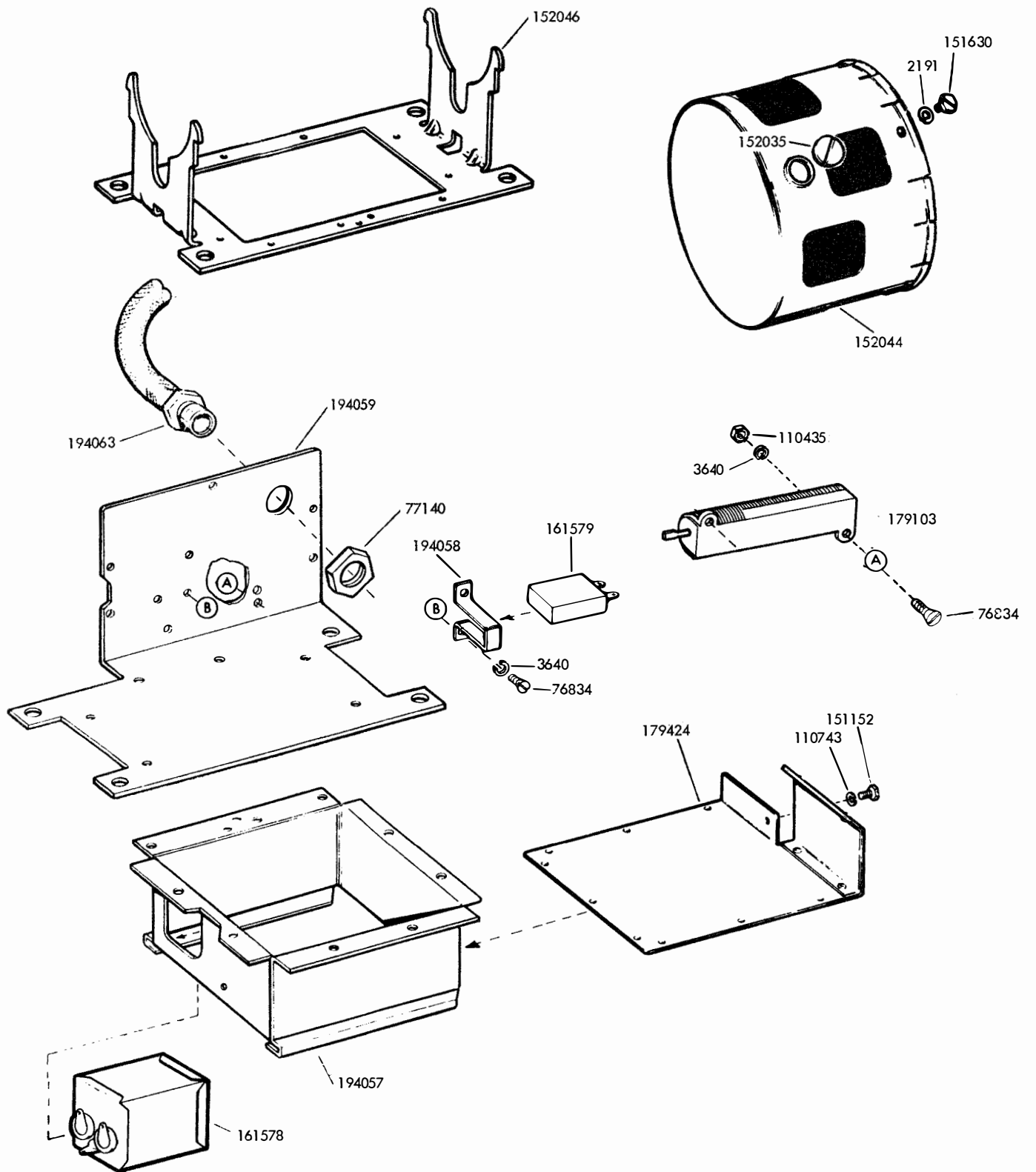


FIGURE 24. SERIES MOTOR MOUNTING PARTS WITH RF SUPPRESSION

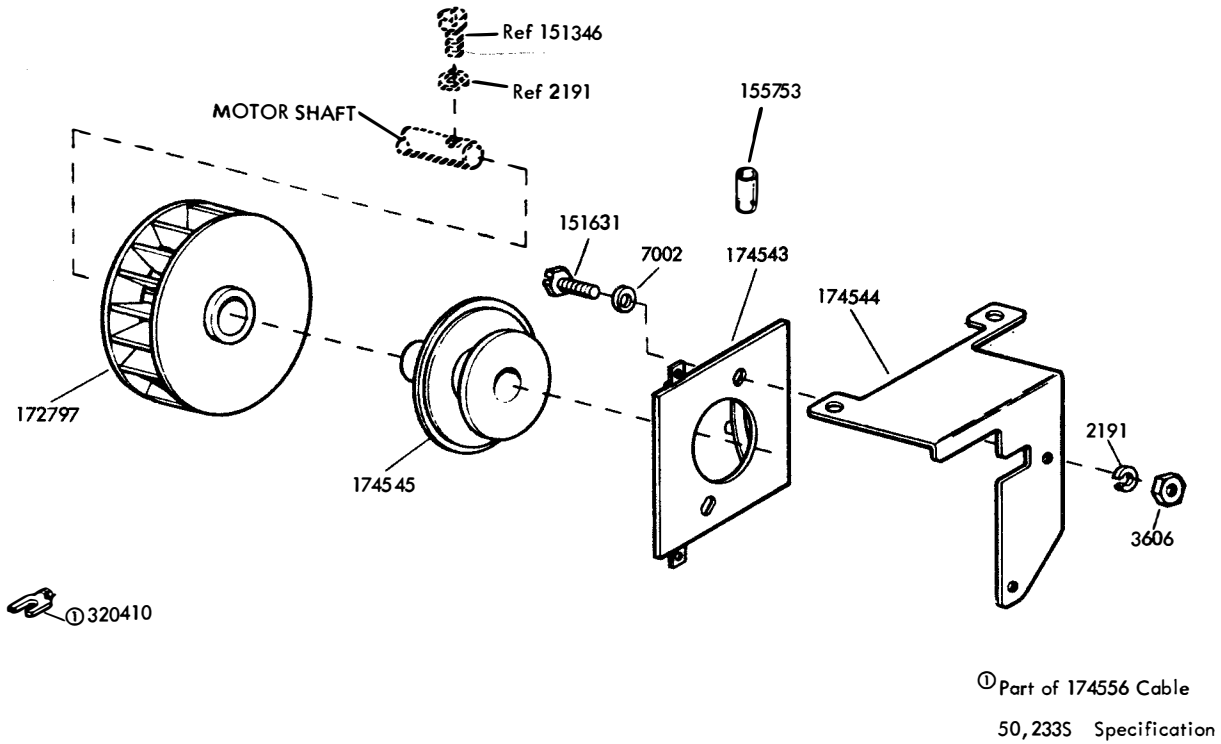


FIGURE 25. 174546 MODIFICATION KIT TO PROVIDE MOTOR RUNNING CONTACTS

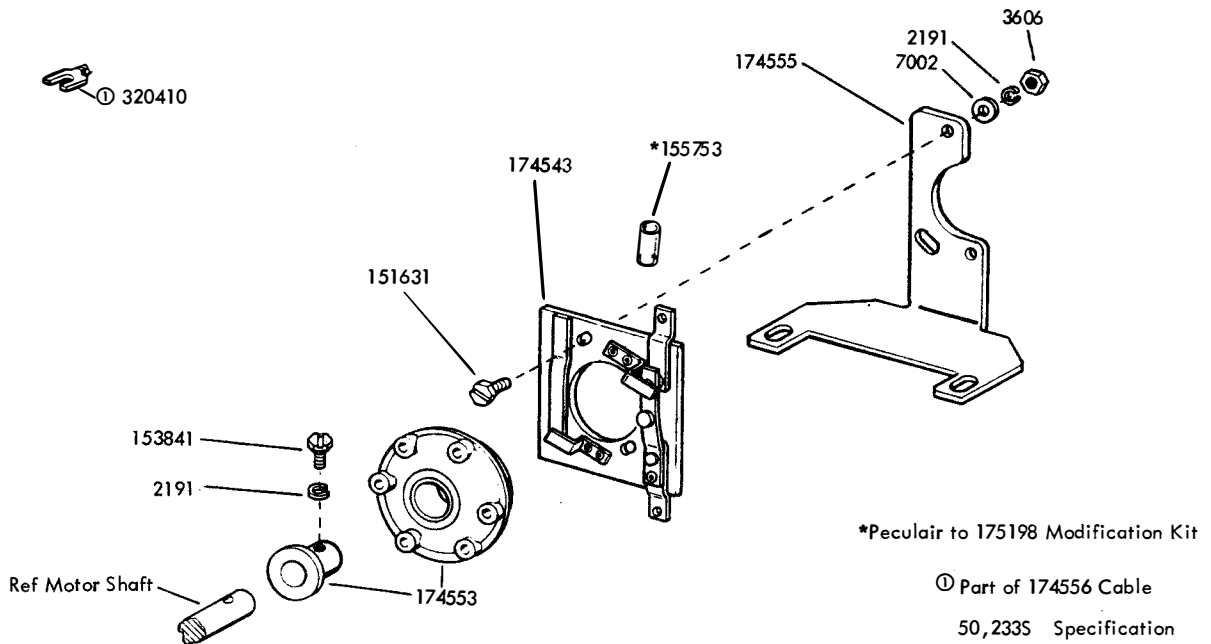
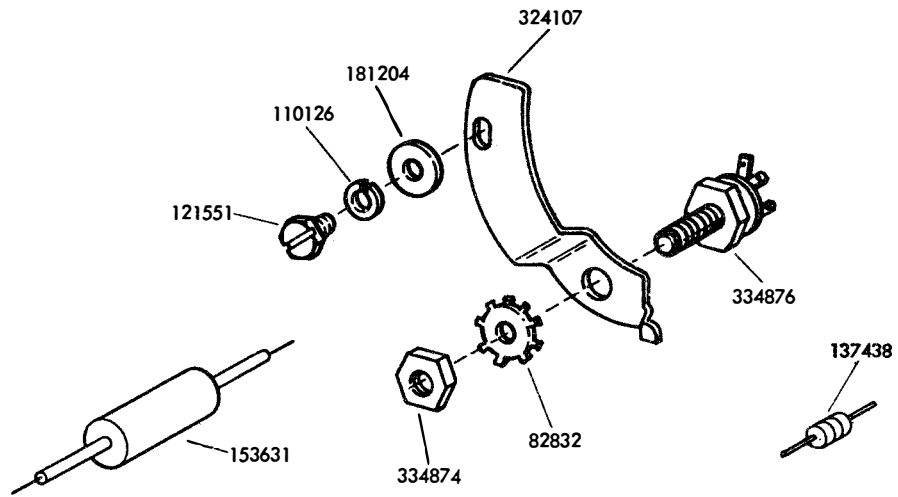


FIGURE 26. 174551 (LESS CABLE) 175198 (WITH CABLE) MODIFICATION KITS TO PROVIDE MOTOR RUNNING CONTACTS



Note: Part of 321580 and 324111 Motor Assemblies

FIGURE 27. TRIAC SWITCH

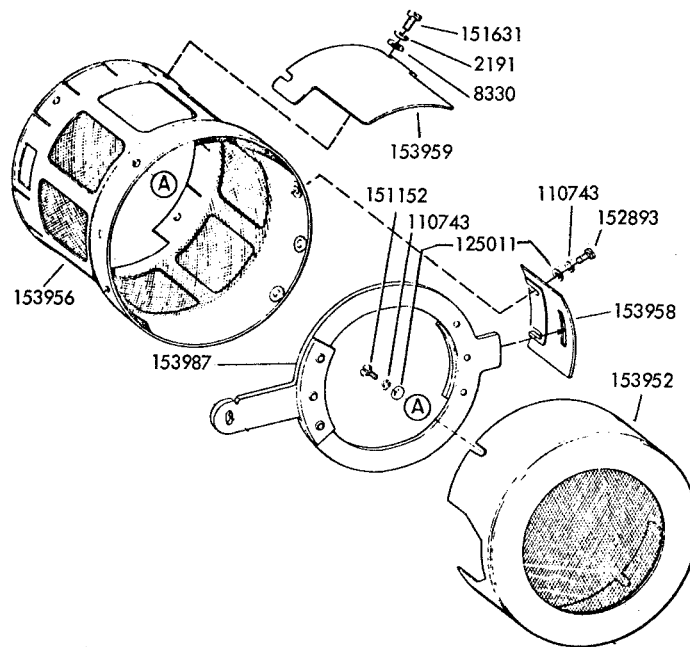


FIGURE 28. MOTOR COVERS

MODIFICATION KITS
(Parts are illustrated on the pages indicated)

Modification Kit-Number	Part Number	Description	Quantity	Figure Number	Specification Number
198693	Modification Kit to Convert and LMU14 to and LMU39.				50,376S
	3640	Lockwasher	7	19	
	75646	Screw, Drive	4		
	122233	Capacitor Assembly	1	13	
	139697	Screw, 4-40 x 9/32 Fil	7	19	
	320410	Terminal	1	13	
	152067	Nipple	1	19	
	161576	Stator, Motor	1	13	
	179424	Lid w/Insulator	1	19	
	198691	Plate w/Resistor Assembly	1	19	
	198692	Container Assembly	1	19	
	309431	Plate, Code (LMU39X)	1		
	312530	Washer, Textolite	1	19	
	312531	Washer, Fiber	1	19	
304739	Modification Kit to Convert an LMU46 to an LMU41.				50,376S
	2191	Lockwasher	4	19	
	3640	Lockwasher	8	19	
	75646	Screw, Drive	4		
	110743	Lockwasher	1	19	
	122221	Stator, Motor	1	13	
	122233	Capacitor Assembly	1	13	
	139697	Screw, 4-40 x 9/32 Fil	7	19	
	151152	Screw, 4-40 x 3/16 Hex	1	19	
	320410	Terminal	1	13	
	151630	Screw, 6-40 x 1/4 Hex	4	19	
	152035	Plug	1	19	
	152044	Cover	1	19	
	152046	Bracket w/Cradle, Motor	1	19	
	152067	Nipple	1	19	
	179424	Lid w/Insulator	1	19	
	198691	Plate w/Resistor Assembly	1	19	
	198692	Container Assembly	1	19	
	309432	Plate, Code (LMU41X)	1		
	312530	Washer, Textolite	1	19	
	312531	Washer, Fiber	1	19	
306708	Modification Kit to Conver an LMU10 to an LMU47.				50,376S
	3640	Lockwasher	7	19	
	75646	Screw, Drive	4		
	122221	Stator, Motor	1	13	
	122233	Capacitor Assembly	1	13	
	139697	Screw, 4-40 x 9/32 Fil	7	19	
	320410	Terminal	1	13	
	152067	Nipple	1	19	
	179424	Lid w/Insulator	1	19	
	198691	Plate w/Resistor Assembly	1	19	
	198692	Container Assembly	1	19	
	309433	Plate, Code (LMU47X)	1		
	312530	Washer, Textolite	1	19	
	312531	Washer, Fiber	1	19	
306709	Modification Kit to Convert an LMU4 to an LMU41.				50,376S
	3640	Lockwasher	7	19	
	75646	Screw, Drive	4		
	122221	Stator, Motor	1	13	
	122233	Capacitor Assembly	1	13	
	139697	Screw, 4-40 x 9/32 Fil	7	19	
	320410	Terminal	1	13	
	152067	Nipple	1	19	
	179424	Lid w/Insulator	1	19	

MODIFICATION KITS (Continued)
(Parts are illustrated on the pages indicated)

Modification Kit-Number	Part Number	Description	Quantity	Figure Number	Specification Number
	198691	Plate w/Resistor Assembly	1	19	
	198692	Container Assembly	1	19	
	309432	Plate, Code (LMU41X)	1		
	312530	Washer, Textolite	1	19	
	312531	Washer, Fiber	1	19	

NUMERICAL INDEX

Part Number	Description and Page Number	Part Number	Description and Page Number	Part Number	Description and Page Number
1030	Screw, Shoulder 6-40 19	90787	Screw, 4-40 x 3/8 Hex 13	122233	Capacitor Assembly 16,28
1181	Screw, 6-40 x 11/16 Fil 21	91228	Strap, 2-1/2" Braided 5,15	122245	Capacitor, 43 to 48 Mfd 3,5,7,8,9,14
1298	Screw, 8-32 x 1/4 Fil 6	91229	Strap, 2" Braided 5	122249	Switch, Thermosiatc 3,5, 7,8,9,14
2034	Washer, Flat 12	91837	Washer, Insulating 16	122251	Stator, Motor 4
2191	Lockwasher 4,5,6,7,9,12, 13,14,16 to 28	92260	Lockwasher 16	122252	Shield Assembly, End 4
2263	Nut, 8-32 Hex 4	93118	Lockwasher 19	122253	Shield Assembly, End 16
2449	Lockwasher 9	93984	Lockwasher 12	123769	Fan, Motor 4
2669	Lockwasher 24	96258R	Jumper, 3" Red 20,21	125011	Washer, Flat 5,6,8,9,11, 14,18,19,27
3438	Washer, Flat 24	96262R	Jumper, 4" Red 3	125143	Screw, 6-32 x 3/8 Flat 16
3598	Nut, 6-40 Hex 5,6,9,12, 20,21,23	96264R	Jumper, 5" Red 3	125802	Washer, Flat 19
3599	Nut, 4-40 Hex 14,19,22	96268R	Jumper, 7" Red 20,21	128874	Rotor, Motor 4
3606	Nut, 6-40 Hex 19,26	96274R	Jumper, 10" Red 3	137438	Resistor, 100 Ohm 27
3624	Washer, Flat 20,21	98642	Lockwasher 16	139697	Screw, 4-40 x 9/32 Fil 22,28
3640	Lockwasher 5,6,7,8,9,11, 12,13,14,19,22,23,24,25, 28	98712	Screw, 4-40 x 1/4 Flat 18	142589	Bracket w/Cradle, Motor 3,11
3646	Lockwasher 6	98718	Washer, Flat 6	146997	Cap, Bushing 12
3949	Spacer, .160" Thk 12	100743	Clamp, Cable 20,23	150040	Screw, 6-40 x 5/8 Fil 4,13
5740	Screw, 2-56 x 1/4 Fil 20,21	102092	Screw, 6-40 x 1-17/32 Rd 23	150089	Screw, 4-40 x 1/2 Fil 14
6320	Screw, 6-32 Contact 18,19	102203	Bushing 9	150701	Motor, 115V AC Series 15,16
6345	Nut, 6-32 Hex 16,18,19	104752	Washer, Flat 7,14	150845	Governor Assembly 1,18
7002	Washer, Flat 5,6,7,12,13, 14,17,18,19,26	104807	Washer, Flat 19	150846	Holder Assembly, Left Brush 17
8330	Washer, Flat 19,27	110126	Lockwasher 27	150847	Holder Assembly, Right Brush 17
8449	Spacer, .094" Thk 12,20, 23	110434	Screw, 4-40 x 3/16 Fil 7,14	150849	Washer, Insulating 18,19
36273	Washer, Flat 5,7	110435	Nut, 4-40 Hex 19,23,24,25	150850	Insulator, .031" Thk 18,19
42823	Washer, Flat 19	110475	Screw, 2-64 x 5/64 Rd 19	150856	Arm, Contact 18,19
61085	Lockwasher 20,21	110743	Lockwasher 18,19,21,22, 24,25,27,28	150857	Clamp 18,19
71999	Spring, Motor Thrust 4,16	111017	Screw, 6-40 x 5/16 Fil 19	150858	Bracket, Contact 18,19
73374	Spacer, .250" 20	111062	Terminal 16	150859	Bracket, Mounting 18,19
75645	Screw, No. 0 x 1/8 Drive 14	112627	Nut, 2-56 Hex 20,21	150865	Screw, 4-40 Clamping 18
75646	Screw, No. 0 x 3/16 Drive 28	119223	Screw, 4-40 x 1-15/32 Fil 5,11	150866	Clamp 18
76099	Washer, Flat 21	119648	Ring, Retaining 19	150868	Bushing, Insulating 18,19
76461	Washer, Flat 19	119651	Ring, Retaining 19	150869	Spring 18
76834	Screw, 4-40 x 3/8 Flat 22,24,25	121249	Clamp, 5/8 ID Cable 14	150872	Stud 18
77140	Nut, Lock 9/16 - 32 Hex 24,25	121551	Screw, 8-32 x 1/4 Hex 27	150873	Collar 9,17
82392	Shim, .004" Thk 19	122200	Shield Assembly, End 16	150877	Bracket, Guide 18
82832	Lockwasher 27	122201	Rearing, Ball 4,16	150879	Cover, Governor 18
86736	Plate, Clamping 19	122202	Stud 16	150880	Spring, Governor Brush 17
87334	Washer, Insulating 5,6,8, 9,11	122204	Cap, Brush 16	150881	Spring, Governor Brush 17
90560	Washer, Flat 19	122205	Brush w/Spring 16	150882	Brush, Contact 17
		122206	Holder, Brush 16	150884	Mounting, Brush 17
		122208	Washer, Flat 16	150885	Plate, Brush 17
		122210	Armature, Motor 16		
		122211	Washer, Pull 4,16		
		122220	Oiler, Ball 4,16		
		122221	Stator 16,28		
		122229	Bolt, 8-32 x 4-11/16 Fil 4		

NUMERICAL INDEX (Continued)

Part Number	Description and Page Number	Part Number	Description and Page Number	Part Number	Description and Page Number
150886	Plate, Clamp 17	151924	Insulator, .031" Thk 3,5,9	153965	Bracket 19
150976	Bracket, w/Cradle, Motor 5,15,20	151925	Clamp 3,5,8,9,11,14	153966	Gear Assembly 19
150980	Plate, Clamping 20	151926	Nut, 4-40 Spl 5,6,8,11	153967	Gear, 28 T 19
150995	Bushing 20,23	151927	Cable w/Terminals 3,6	153968	Gear Assembly 19
150997	Fan, Governor 18	151939	Grommet, Rubber 6	153976	Gear, 32 T 19
151152	Screw, 4-40 x 3/16 Hex 18,19,21,22,24,25,27,28	151939	Grommet, Rubber 6	153977	Worm 19
151346	Screw, 6-40 x 3/8 Fil 4, 17,26	152034	Bracket, Resistor 21	153979	Post 19
151453	Nut, 10-32 Hex 16	152035	Plug 21,22,24,25,28	153987	Brake, Slide 27
151455	Spring, Helical Clip 16	152037	Cover 21	154375	Backstop 18,19
151620	Strap, Motor Mounting 5,6,8,9,11,12,13,14,16	152039	Container 15,21	154628	Governor Assembly 1,19
151621	Screw, 6-32 x 3/4 Rd 5,6, 8,9,11,12,13,14,16	152040	Lid 15,21	154674	Gear, 20 T 19
151622	Nut, 6-32 Sq 5,6,8,9,11, 12,13,14,16	152044	Cover 21,22,24,25,28	154676	Disc Assembly 19
151630	Screw, 6-40 x 1/4 Hex 7, 12,13,14,16,21,22,24,25, 28	152046	Bracket w/Cradle, Motor 15,21,22,24,25,28	154680	Bearing, Roller 19
151631	Screw, 6-40 x 5/16 Hex 20,23,26,27	152054	Resistor, 250 Ohm 20,21	154684	Insulator 19
151632	Screw, 6-40 x 3/8 Hex 6	152058	Separato 21	154685	Fan Assembly 18
151637	Screw, 4-40 x 1/4 Fil 5, 6,8,9,11,12,14,18	152059	Cable w/Terminals 15	154693	Bracket 19
151642	Screw, 6-40 x 3/4 Fil 4,17	152067	Nipple 15,21,22,28	155585	Bearing, Ball 19
151657	Screw, 6-40 x 1/4 Fil 5,6,17	152078	Spring, Separator 21	155593	Bearing, Ball 19
151658	Screw, 6-40 x 5/16 Fil 17	152297	Washer, Bearing 4	155594	Screw, 4-40 Shoulder 19
151659	Screw, 6-40 x 1/2 Fil 12, 18,19	152426	Nut, 6-40 Hex Self-Locking 12	155595	Motor, Synchronous 3,4
151661	Screw, 6-40 x 1" Fil 17, 18,20,21	152459	Bracket, Mounting 20,21	155600	Bracket 19
151686	Screw, 4-40 x 3/8 Fil 5,6,8,11,19	152495	Bushing 18,19	155601	Plate, Gear Train 19
151687	Screw, 4-40 x 7/16 Fil 9,22,23	152893	Screw, 4-40 x 1/4 Hex 12,27	155602	Gear, 28 T 19
151692	Screw, 6-40 x 3/16 Fil 5,6,19	153030	Mount, Vibration 4,10,16	155603	Gear, 28 T 19
151693	Screw, 6-40 x 9/16 Fil 19	153031	Bushing, Lead 16	155605	Bearing, Ball 19
151721	Screw, 6-40 x 3/4 Hex 9	153049	Washer, Insulating 4	155611	Ring, Bearing 19
151732	Screw, 4-40 x 11/32 Fil 23	153101	Grommet, Rubber 16	155613	Gear, 28 T 19
151795	Motor, Synchronous 3,4	153102	Screw, Set 8-32 16	155752	Sleeve, 5/64 ID x 1/2 Lg Insulating 7
151920	Plate, Mounting 3,5,6	153103	Screw, 4-40 Self-Tapping 16	155753*	Sleeve, 1/8 ID x 1/2" Lg Insulating 26
151922	Clamp 3,5,6,8,9,11,14	153114	Jumper, 8-1/2" Black 16	156875	Screw, 6-40 x 5/32 Fil 5,7
151923	Relay, Motor Starting 3, 5,7,8,9,14	153342	Screw, 6-40 x 15/16 Hex 19	156936	Screw, 1/4-32 x 5/16 Hex 9
		153535	Screw, 6-40 Shoulder 19	157987	Washer, Insulating 19
		153536	Gear Assembly 19	159739	Motor, Synchronous 3,4
		153631	Network, Spark Suppression 27	160298	Plate, Mounting 5
		153839	Screw, 6-40 x 5/8 Hex 12	160299	Capacitor, 226 MFD 3,5
		153841	Screw, 6-40 x 9/16 Hex 26	160300	Clamp 5
		153885	Spring Assembly 19	160301	Plate, Insulating 5
		153952	Cover, Motor 27	160302	Plate, Nut 3,5,11
		153956	Cover 27	160303	Relay 3,5
		153958	Guide Plate 27	160304	Switch, Thermostatic 3,5
		153959	Coverplate 27	160305	Rotor, Motor 4
		153962	Disk 19	160306	Stator, Motor 4
		153963	Disk 19	161099	Cable w/Terminals 3
		153964	Counterweight 19	161575	Armature, Motor 16
				161576	Stator, Motor 16,28
				161577	Motor, 115V AC Series 15,16

NUMERICAL INDEX (Continued)

Part Number	Description and Page Number	Part Number	Description and Page Number	Part Number	Description and Page Number
161578	Suppressor, Noise 15,21, 22,24,25	172780	Bracket, Contact Mounting 13	179104	Bracket, Clamp 24
161579	Capacitor, .5 MFD 15,20, 21,22,24,25	172795	Bracket w/Cradle, Motor 3,13	179105	Container 15,24
161580	Resistor, 500 Ohm 15,20,21	172797	Fan 13,26	179106	Lid w/Insulator 15,24
161984	Motor, AC Synchronous 3,10	172799	Switch, Centrifugal 13	179190	Motor, 48V DC Series 15, 16
162072	Capacitor, 88 to 108 MFD 3,11,12	172801	Cover, Switch 13	179282	Nipple 15,24
162196	Insulator 3,11	172804	Plate, Adapter 13	179283	Cable w/Terminals 15
162360	Fuse, SL-BL .8 Amp 12	172814	Cable w/Terminals 13	179420	Container 15,22
162464	Stator, Motor 10	172902	Nut, 6-32 Hex 10	179421	Capacitor, 1 MFD 15,22
162466	Shield, Rear End 10	172990	Plate 23	179422	Suppressor, Noise 15,22
162467	Shield, Front End 10	173003	Capacitor, 1 MFD 15,23	179423	Plate w/Bracket 22
162469	Washer, Spring 10	173004	Resistor, 100 Ohm 15,22, 23	179424	Lid w/Insulator 15,22,25, 28
162482	Bolt, 6-32 x 3-1/2 Fil 10	173021	Contact, Spring 13	181204	Washer, Flat 27
162684	Jumper, 2-3/4" White 15	173425	Relay, Motor Starting 3, 11,12	192226	Bracket, Capacitor Mounting 12
162685	Jumper, 4" White 15	173518	Modification Kit 2	193181	Cable w/Terminals 3
162861	Screw, 6-40 x 1-7/16 Fil 20	173687	Fan, Motor 5	193236	Cable w/Terminals 3
162910	Insulator 3,11	173751	Bracket w/Cradle, Motor 15,23	193781	Switch, Thermostatic 3,5,8,9
162911	Cable w/Terminals 3	173753	Plate 23	194057	Container 15,25
163268	Jumper, 6-1/2" White 15	173974	Screw, 10-32 x 5/16 Hex 24	194058	Clamp 25
163269	Jumper, 2" White 15	174471	Switch, Thermostatic 3, 11,12	194059	Bracket 25
163272	Motor, 115V AC Series 15,16	174543	Switch 26	194060	Motor, 115V AC Series 15, 16
163273	Shield Assembly, End 16	174544	Bracket 26	194062	Shield Assembly, End 16
163799	Bracket 12	174545	Rotor 26	194063	Nipple 15,25
164479	Terminal 15	174546	Modification Kit 1,26	194897	Bracket w/Cradle, Motor 3,9
164603	Insulator 3,8	174551	Modification Kit 1,26	194899	Cable w/Terminals 3
164612	Bracket w/Cradle, Motor 3,8	174553	Rotor 26	194924	Motor, 115V AC Synchronous 3,10
164756	Stator, Motor 16	174555	Bracket, Switch 26	195143	Capacitor, 7 MFD 12
164757	Armature, Motor 16	174556	Cable w/Terminals 26	195172	Capacitor, Motor Start 64 to 77 MFD 3,12
164758	Motor, 48V DC Series 15, 16	175198	Modification Kit 1,26	195173	Relay 3,12
164890	Bearing, Ball 10	176064	Plate, Nut 12	195178	Cable w/Terminals 3
164891	Shim, .032" Thk 10	176111	Duct 12	195214	Stator 10
164892	Shim, .018" Thk 10	176137	Jumper, 9-1/4" Black 3	195525	Plate, Identification 14
164893	Collar, Thrust 10	176947	Plate w/Pads 3,9	196794	Insulator 3,8
164894	Shim, .018" Thk 10	176948	Bracket w/Cradle, Motor 39	196795	Block, Mounting 8
164962	Bracket 11,12	178500	Motor, AC Synchronous 3,4	196830	Motor, Synchronous 3,4
170631	Holder, Fuse 12	179010	Bracket, Relay 11	196831	Stator, Motor 4
170764	Motor, AC Synchronous 3,4	179016	Cable w/Terminal 3	196839	Bracket w/Cradle, Motor 3,8
171702	Clamp 3,12	179100	Motor, 115V AC Series 15,16	198691	Plate w/Resistor Assembly 22,28,29
171703	Clamp 3,12	179101	Shield Assembly, End 16	198692	Container Assembly 22,28, 29
171704	Insulator 3,12	179102	Plate, Mounting 24	198693	Modification Kit 28
171749	Bracket, w/Cradle, Motor 3,12	179103	Resistor, 250 Ohm 15,22, 24,25		
171810	Cable w/Terminals 3				

NUMERICAL INDEX (Continued)

Part Number	Description and Page Number	Part Number	Description and Page Number	Part Number	Description and Page Number
199718	Motor, 115V AC 50 Hertz Synchronous 3,4	307281	Switch, Thermostatic 3,6	320410	Terminal, Spade Type 3, 13,16,26,28
199719	Rotor, Motor 4	309431	Plate, Code 28	320418	Terminal, Ring Type 3,5, 6,7,14
199720	Stator, Motor 4	309432	Plate, Code 28,29	320420	Terminal, Ring Type 5,15
199721	Bolt, 8-32 x 5-13/16 Fil 4	309433	Plate, Code 28	320422	Terminal, Ring Type 5,15
304537	Bracket 3,6	310295	Motor, Synchronous 3,10	321580	Motor Series 15,16,27
304538	Bracket 3,6	310341	Insulator 3,9	324107	Bracket 27
304739	Modification Kit 28	312269	Shield, End 16	324111	Motor Assembly 15,16,27
304792	Relay 3,6	312270	Stator 16	324112	Stator 16
304793	Capacitor, 161 to 193 MFD 3,6	312530	Washer, Textolite 22,28, 29	324113	Shield Assembly, End 16
305658	Spring 3,7	312531	Washer, Fiber 22,28,29	324115	Fan, Governor 18
305659	Insulator 3,7	312573	Jumper, 6" Red 3,6	324116	Governor Assembly 1,18
305660	Plate, Mounting 3,7	312574	Jumper, 6" Black 3,6	327828	Filter w/Network 14
305661	Bracket w/Cradle, Motor 3,7	312971	Shield 14	330564	Rotor 10
306063	Motor, 230V AC Synchronous 3,4	312977	Insulator 3,14	330565	Rotor 10
306320	Cable Assembly 3	312979	Bracket w/Cradle, Motor 3,14	330579	Screen w/Brackets 22
306708	Modification Kit 28	320269	Switch, Thermostatic 3,5	332865	Fan 4
306709	Modification Kit 28	320270	Capacitor, 15 to 18 MFD 3,5	334747	Label 14
		320271	Relay, Motor Starting 3,5	334874	Nut, 1/4-28 Hex 27
		320272	Stator 4	334876	Switch 27
				334877	Switch 3

