

BULLETIN 295B

TECHNICAL MANUAL

MOTOR UNITS

(MU, LMU AND YMU)

CONTENTS

**DESCRIPTION AND
PRINCIPLES OF OPERATION**

ADJUSTMENTS

LUBRICATION

PARTS



TELETYPE®
CORPORATION

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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. 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 on right-hand pages.

The sections are arranged as shown in the table of contents on a following page. They are in ascending numerical order except where this is contrary to a logical presentation of material.

To locate specific information proceed as follows:

- Find the involved equipment in the first column of the table of contents.
- Find the type of information in the second column.
- The correct 9-digit number can then be found in the third column.
- Turn to Page 1 of the section where its contents can be found.

April, 1968
Change 2

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FILING INSTRUCTIONS

1. The following filing instructions apply to changes sent to the field.
2. Asterisks (*) in the table of contents indicate changes.
3. When the issue of a section changes, replace the old issue with the attached new one.
4. In the case of addendums, turn to the affected section and follow the instructions on the first page of the attached addendum.
5. Replace the old table of contents with this new one.

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MOTOR UNITS

DESCRIPTION AND PRINCIPLES OF OPERATION

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1. GENERAL

1.01 This section is reissued to include additional synchronous motor information, and to revise the section number appearing on each page. With the exception of the section number, which changed on every page, all other changes and/or additions are indicated by marginal arrows, or by arrows placed within the illustration or table.

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 and 2) 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 I and II.

1.04 The series (governed) type motor units (Figure 3) 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 Table III.

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 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-cycle units) and 3000 rpm (50-cycle units) operation; an external fuse instead of the thermostatic cutout switch; single or dual air ducts to improve

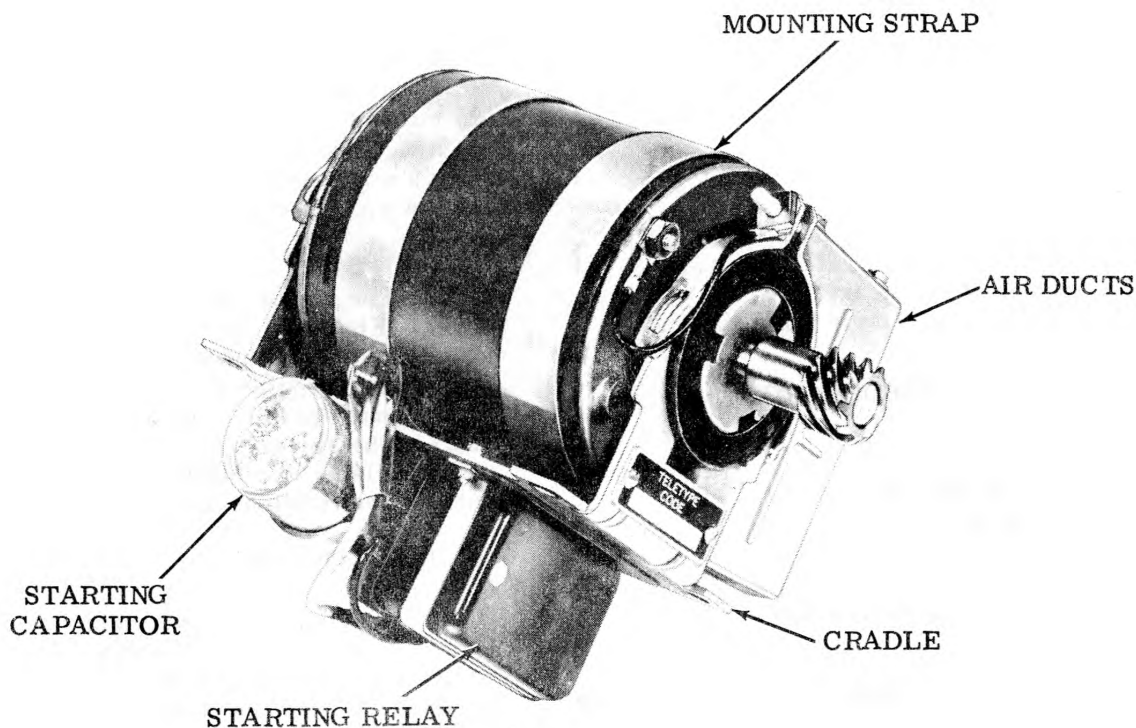


Figure 1 - Typical Miniature Synchronous Motor Unit

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 (Figure 2)

2.04 The standard and heavy duty synchronous motor units consist of a two pole wound stator and two end shields that support a ball bearing rotor. A combination hand wheel and fan 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 cutout switch, which is reset manually, protects the motor windings

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 cycle units) and 3000 rpm (50 cycle 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 requirements as in the Multiple KSR and RO Set where the control parts are mounted in a compartment at the rear of the fan.

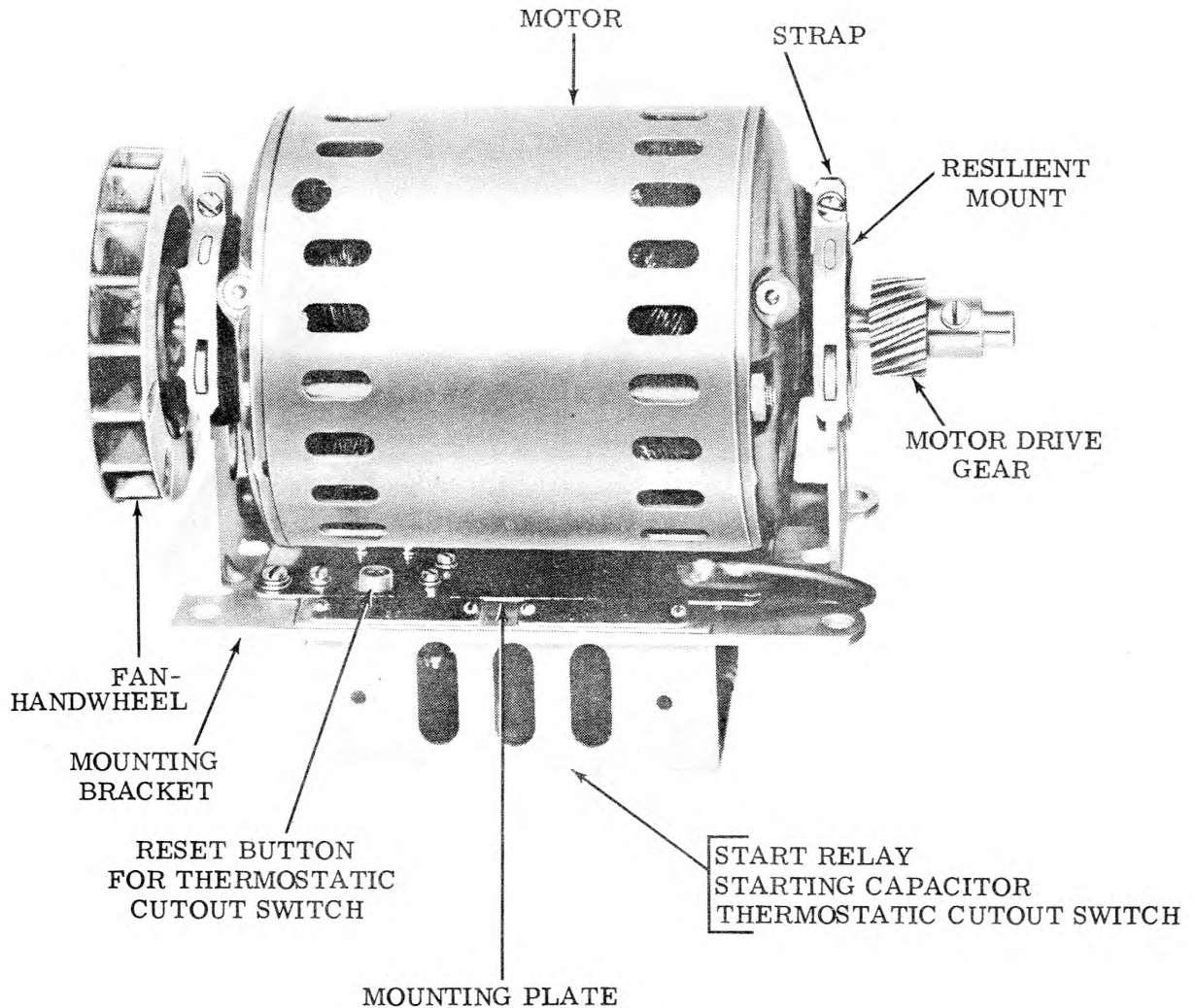


Figure 2 - Typical Standard or Heavy Duty Synchronous Motor Unit

SERIES (GOVERNED) MOTOR UNITS (Fig. 3)

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)

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 resilient mounts at each end shield that are fastened to the mounting bracket by straps.

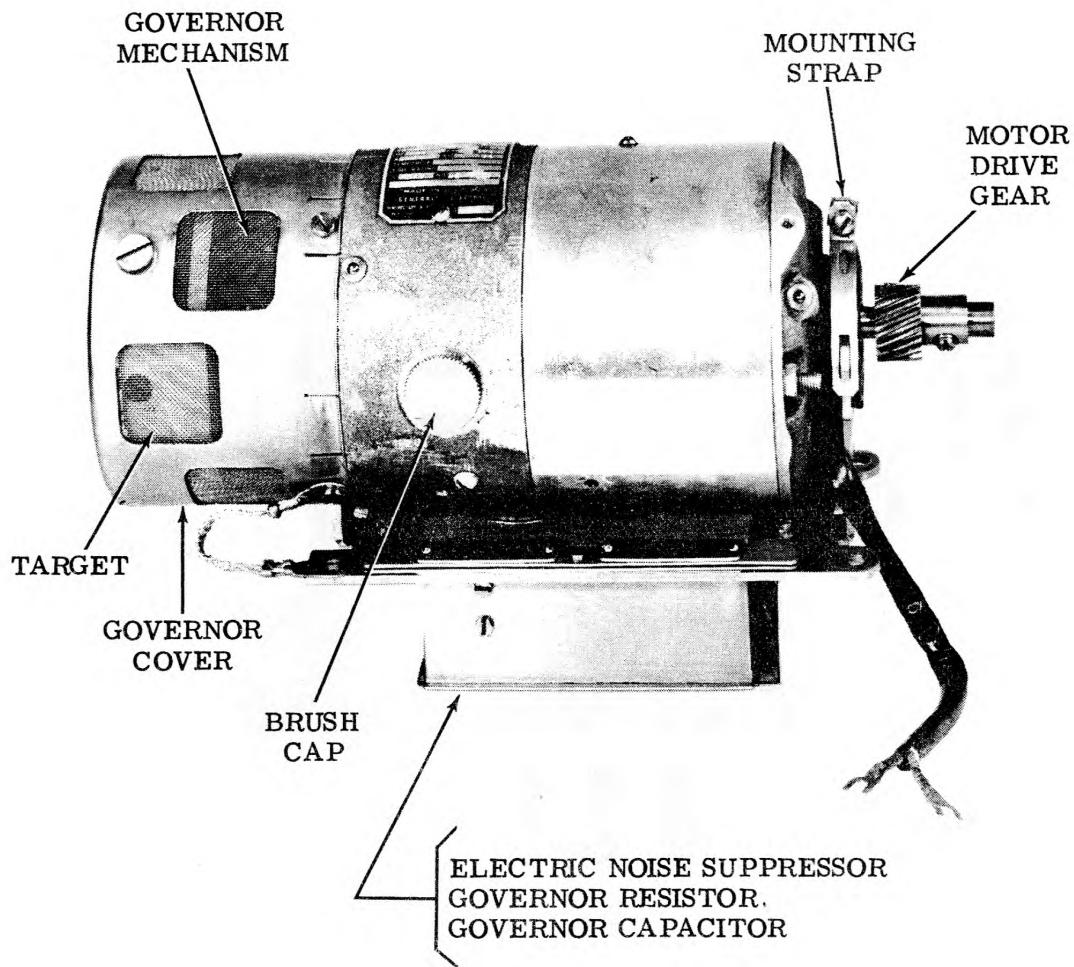


Figure 3 - Typical Series (Governed) Motor Unit

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

B. 1/15 Horsepower Motor Units (AC/DC)

2.09 These motor units are similar to the units described in 2.07, but are equipped with electrostatic shielding and radio frequency

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

C. 1/15 Horsepower Motor Units (DC)

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

TABLE 1. TECHNICAL CHARACTERISTICS OF MINIATURE SYNCHRONOUS MOTOR UNITS

CHARACTERISTICS	LMU19, LMU20, LMU24, LMU26, LMU31, LMU45, MU43 (Bell 28F)	LMU35, LMU40
Rated Horsepower	25 Millihorsepower	25 Millihorsepower
Input Voltage	115 \pm 10% AC	115 \pm 10% AC
Phase	Single	Single
Frequency	60 Cycles, \pm 0.75%	50 Cycles, \pm 1%
Input Current (Full Load - Amperes)		
Starting	4.0-5.0	3.0
Running	1.25	0.47
Power Factor (Full Load)		89%
Watts Input (Full Load)		50
Start Capacitor	88-108UF (130-156UF, MU43 (Bell 28F))	64-77
Run Capacitor	-	7.0
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 single ventilator, 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 (Bell 28F) - Relay, thermostatic cutout switch mounted on motor bracket. Capacitor mounted on motor shield. Wiring for external start switch noise suppressor (LMU45 only).</p>	<p>LMU35, LMU40 - Contain no thermostatic cutout device. Fused (0.8A) externally. Relay and capacitors mounted on motor mounting bracket. Equipped with an air shield.</p>

TABLE 2. TECHNICAL CHARACTERISTICS OF STANDARD AND HEAVY DUTY SYNCHRONOUS MOTOR UNITS

CHARACTERISTICS	LMU3 (Bell 28A), LMU15 (Bell 35A), LMU21 (Bell 28LA), LMU30, LMU37, LMU42, LMU46	LMU33, LMU36, LMU38, LMU51, LMU52	LMU11, LMU12 (Bell 28C), YMU-1	LMU50
Rated Horsepower	1/20	1/20	1/12	1/12
Input Voltage	115 \pm 10%, AC	115 \pm 10%, AC	115 \pm 10%, AC	115 \pm 10%, AC
Phase	Single	Single	Single	Single
Frequency	60 Cycles, \pm 0.75%	50 Cycles, \pm 0.75%	60 Cycles, \pm 0.75%	50 Cycles, \pm 0.75%
Input Current (Amperes)				
Starting	9.0	9.0	12.25	14.5
Running	1.85	2.4	2.8	2.8
Power Factor (Full Load)	30%	35%	44.75%	46.8%
Watts Input (Full Load)	65	107	132.9	150
Heat Dissipation (Watts)	50	70	70.6	63.38
Start Capacitor Rating	43-48 UF	43-48 UF	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 LMU27 and LMU30 which are inverted.	All upright except LMU36 which is inverted.	LMU11 - Inverted LMU12 (Bell 28C) - Upright	Upright
Other Distinguishing Characteristics	LMU3 (Bell 28A) - Control parts in compartment under motor. Fan cooled. Thermostatic cut-out switch. Latest design have more compact control parts arrangement.	LMU33 - Similar to LMU3 (Bell 28A). No fan. LMU36 - Similar to LMU3 (Bell 28A) 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.

TABLE 2. TECHNICAL CHARACTERISTICS OF STANDARD AND HEAVY DUTY SYNCHRONOUS MOTOR UNITS - Continued

CHARACTERISTICS	LMU3 (Bell 28A), LMU15 (Bell 35A), LMU21 (Bell 28LA), LMU30, LMU37, LMU42, LMU46	LMU33, LMU36, LMU38, LMU51, LMU52	LMU11, LMU12 (Bell 28C), YMU-1	LMU50
Other Distinguishing Characteristics - Continued	<p>LMU15 (Bell 35A) - Same as LMU3 (Bell 28A) except no fan. Pinion on short shaft end.</p> <p>LMU21 (Bell 28LA) - Same as LMU3 (Bell 28A) except control parts at rear of fan.</p> <p>LMU30 - Same as LMU3 (Bell 28A) except for inverted mounting with control parts above motor.</p> <p>LMU37 - Same as LMU3 (Bell 28A) except for more compact cradle and mounting arrangement. Control parts on side of motor.</p> <p>LMU42 - Same as LMU3 (Bell 28A) except cradle and mounting arrangement is more compact and control parts are in a bracket on side of motor.</p> <p>LMU46 - Same as LMU3 (Bell 28A) except for wiring for motor start relay arc suppressor.</p> <p>LMU49 - Same as LMU3 (Bell 28A) but with speed sensing device.</p>	<p>LMU38 - Differs from LMU3 (Bell 28A) only in power frequency.</p> <p>LMU51 - Similar to LMU3 (Bell 28A) 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>LMU12 (Bell 28C) - Same as LMU11 but with control parts located in motor mounting cradle and end shields rotated 180° for upright mounting.</p> <p>YMU-1 - Control parts are located in a compartment of the motor mounting cradle.</p>	

TABLE 3. TECHNICAL CHARACTERISTICS OF SERIES (GOVERNED) MOTOR UNITS

CHARACTERISTICS	LMU6 (Bell 28B), LMU28, LMU41	LMU13, LMU32, LMU39	LMU23, LMU29 (Bell 28E)																																				
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 cycles, or DC	25, 50, or 60 cycles, or DC	-																																				
Input Current (Full Load - Amperes)	<table><tr><th colspan="4">Cycles</th></tr><tr><th>25</th><th>50</th><th>60</th><th>DC</th></tr><tr><td>Starting</td><td>2.4</td><td>2.7</td><td>1.9</td><td>1.8</td></tr><tr><td>Running</td><td>1.18</td><td>1.34</td><td>1.12</td><td>0.93</td></tr></table>	Cycles				25	50	60	DC	Starting	2.4	2.7	1.9	1.8	Running	1.18	1.34	1.12	0.93	<table><tr><th colspan="4">Cycles</th></tr><tr><th>25</th><th>50</th><th>60</th><th>DC</th></tr><tr><td>Starting</td><td>4.5</td><td>4.0</td><td>2.8</td><td>3.4</td></tr><tr><td>Running</td><td>2.1</td><td>2.3</td><td>1.8</td><td>1.7</td></tr></table>	Cycles				25	50	60	DC	Starting	4.5	4.0	2.8	3.4	Running	2.1	2.3	1.8	1.7	
Cycles																																							
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Cycles																																							
25	50	60	DC																																				
Starting	4.5	4.0	2.8	3.4																																			
Running	2.1	2.3	1.8	1.7																																			
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, LMU32 - Inverted LMU39 - Upright	LMU23 - Inverted LMU29 - Upright																																				
RF Shielding	LMU28, LMU41	LMU32, LMU39	LMU29 (Bell 28E)																																				
RF Suppression	LMU28, LMU41	LMU32, LMU39	LMU29 (Bell 28E)																																				
Other Distinguishing Characteristics	Control parts com- partment rectangular on LMU6 (Bell 28B) and LMU28 and LMU41 governor resistor mounted on heat sink.	LMU39 governor resistor mounted on a heat sink. LMU13, LMU32 cradle com- partments are rectangular.	No screened governor cover on LMU29 (Bell 28E)																																				

3. PRINCIPLES OF OPERATION

SYNCHRONOUS MOTOR UNITS (Figs. 1, 2, and 4)

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 predetermined 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.

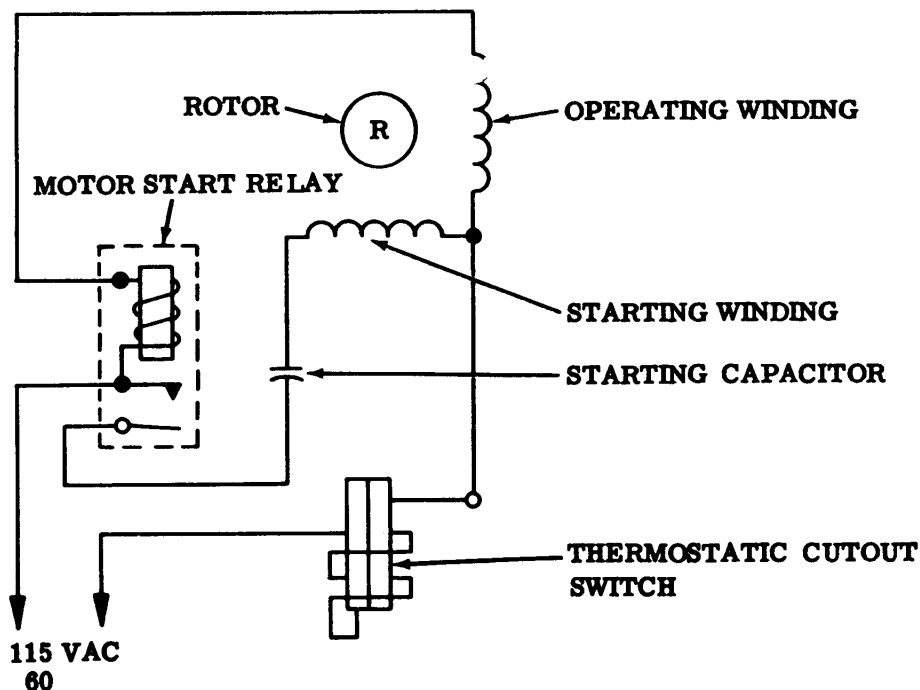


Figure 4 - Typical Synchronous Motor Unit Schematic Diagram

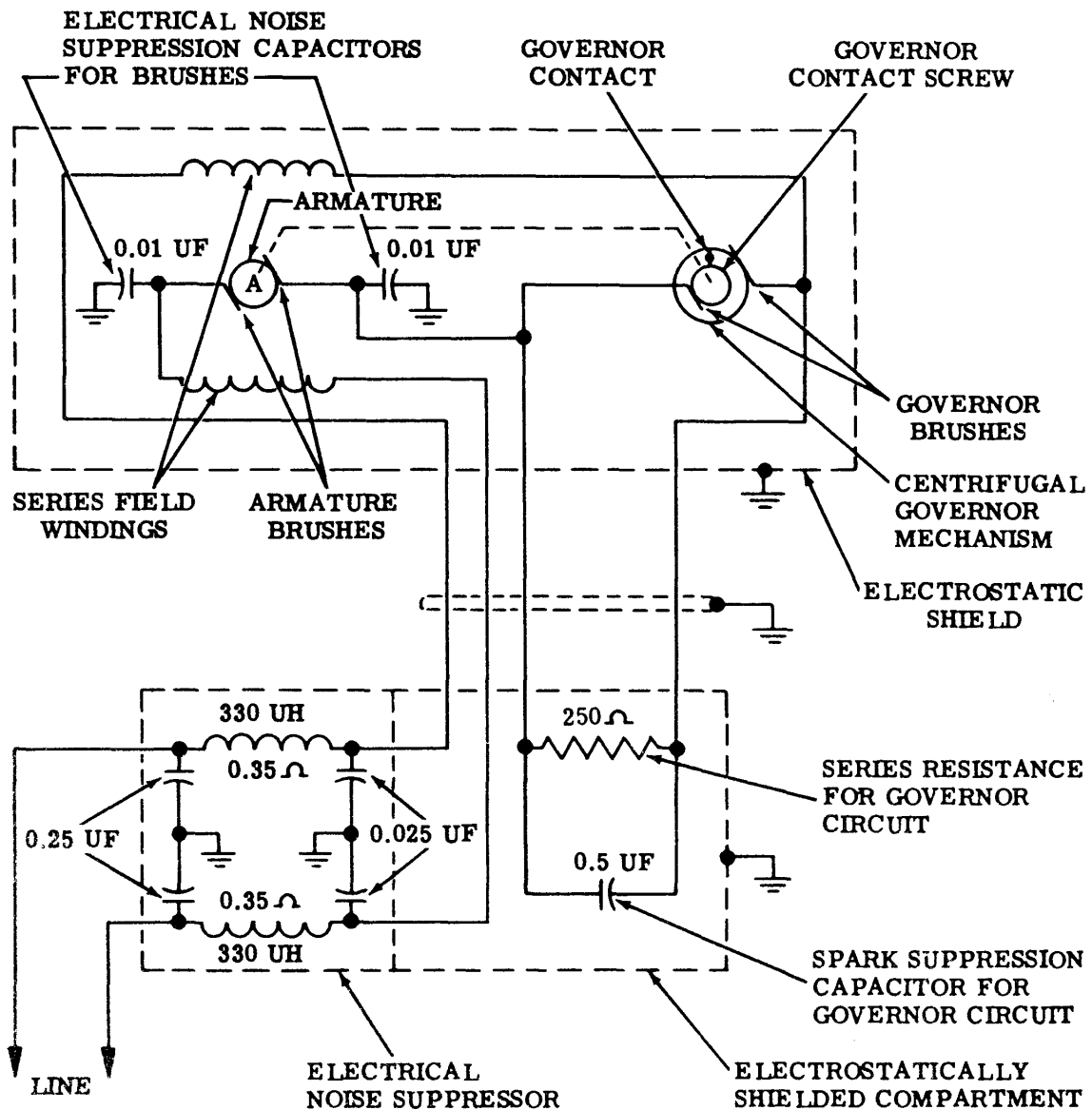


Figure 5 - Typical Series (Governed) Motor Unit Schematic Diagram

SERIES (GOVERNED) MOTOR UNITS (Figs. 3 and 5)

3.04 The following description of operation is applicable to all series (governed) motor units.

3.05 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.

3.06 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 per-second tuning fork. The six spot and thirty-five spot rows serve as targets when using an 87.6 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.

MOTOR UNITS
ADJUSTMENTS

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Air ducts	4	Motor speed	7
Capacitor position	4	1. GENERAL	
Motor gear	2	1.01 This section is reissued to include ad- justments formerly given in other sec- tions, to include the latest engineering informa- tion, and to change the title. Since this revision is of a general nature, marginal arrows which indicate changes have been omitted.	
Motor positioning	2	1.02 The adjustment information given in this section and the section covering general teletypewriter requirements and adjustments provide the information necessary for mainte- nance of the motor unit.	
Motor shield	3	1.03 The illustrations in this section show the adjusting tolerances, positions of moving parts, and spring tensions.	
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Governor brush spring	7		
Governor contact	6		

2. MINIATURIZED SYNCHRONOUS MOTOR UNITS

2.01 Motor Positioning

(A) MOTOR POSITIONING

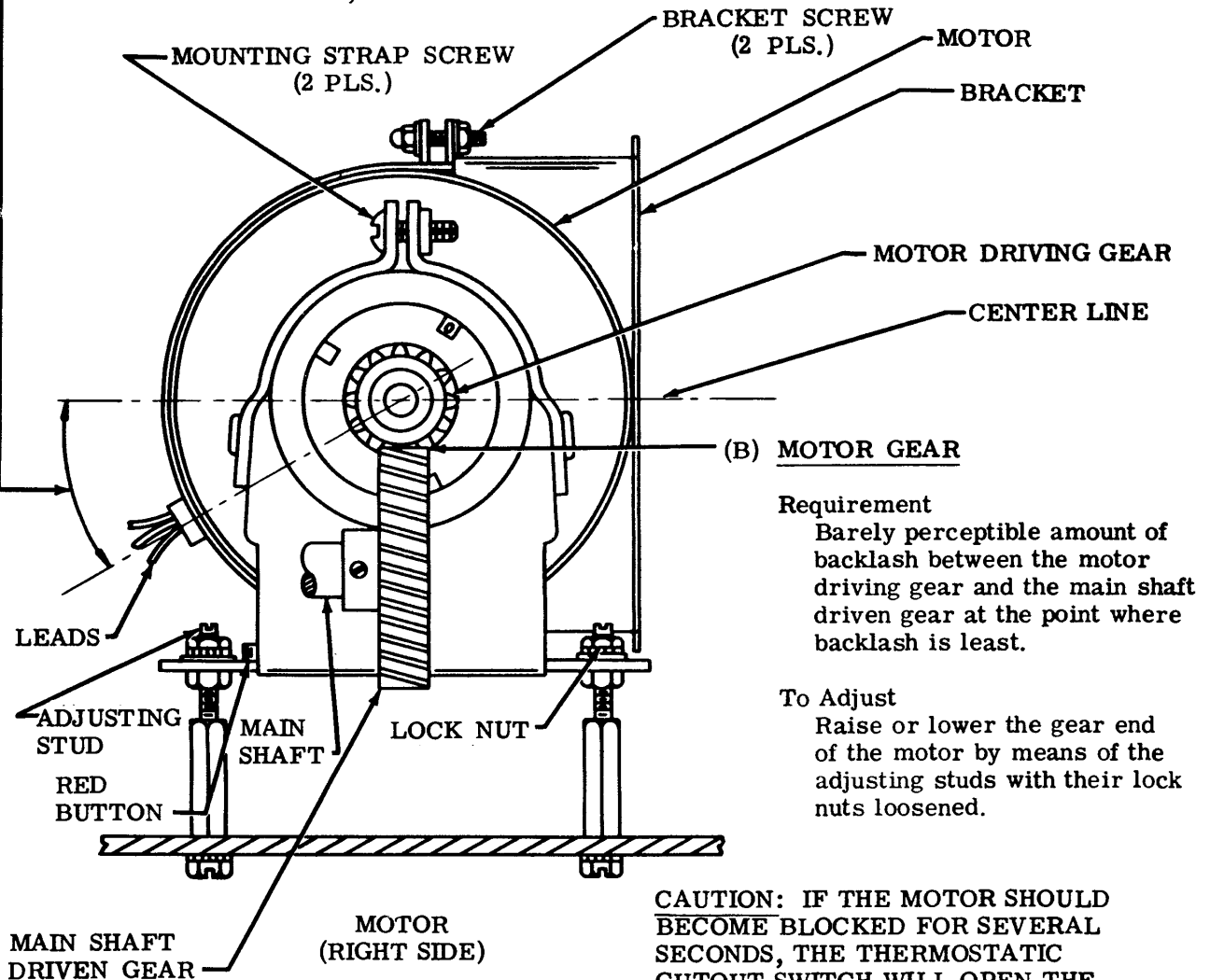
Requirement

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

To Adjust

With mounting strap screws loosened, rotate motor.

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



(B) MOTOR GEAR

Requirement

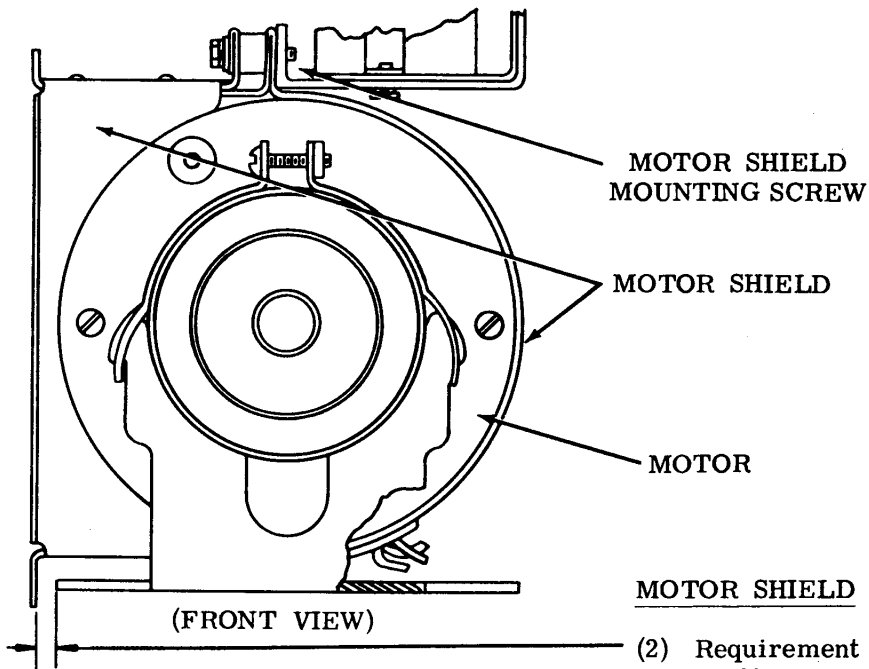
Barely perceptible amount of backlash between the motor driving gear and the main shaft driven gear at the point where backlash is least.

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 RESETTNG THE SWITCH BY DEPRESSING THE RED BUTTON. AVOID REPEATED RESETTNG.

2.02 Motor Shield

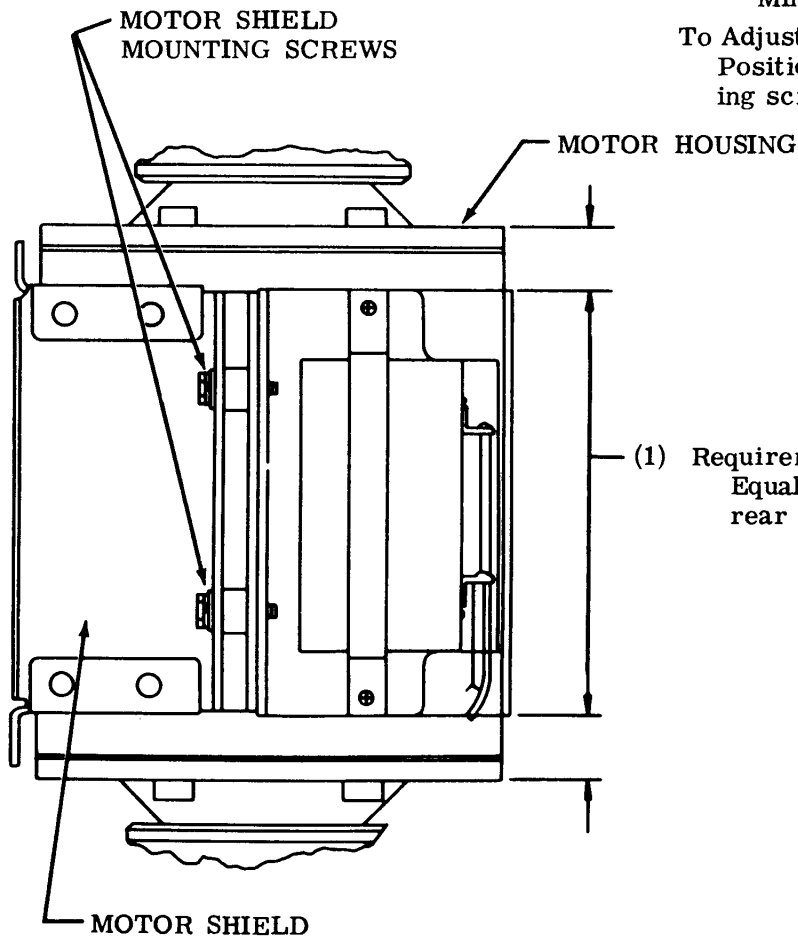
MOTOR SHIELD (IF SO EQUIPPED)

(2) Requirement

Clearance between motor shield and
motor mounting bracket should be
Min 0.062 inch

To Adjust

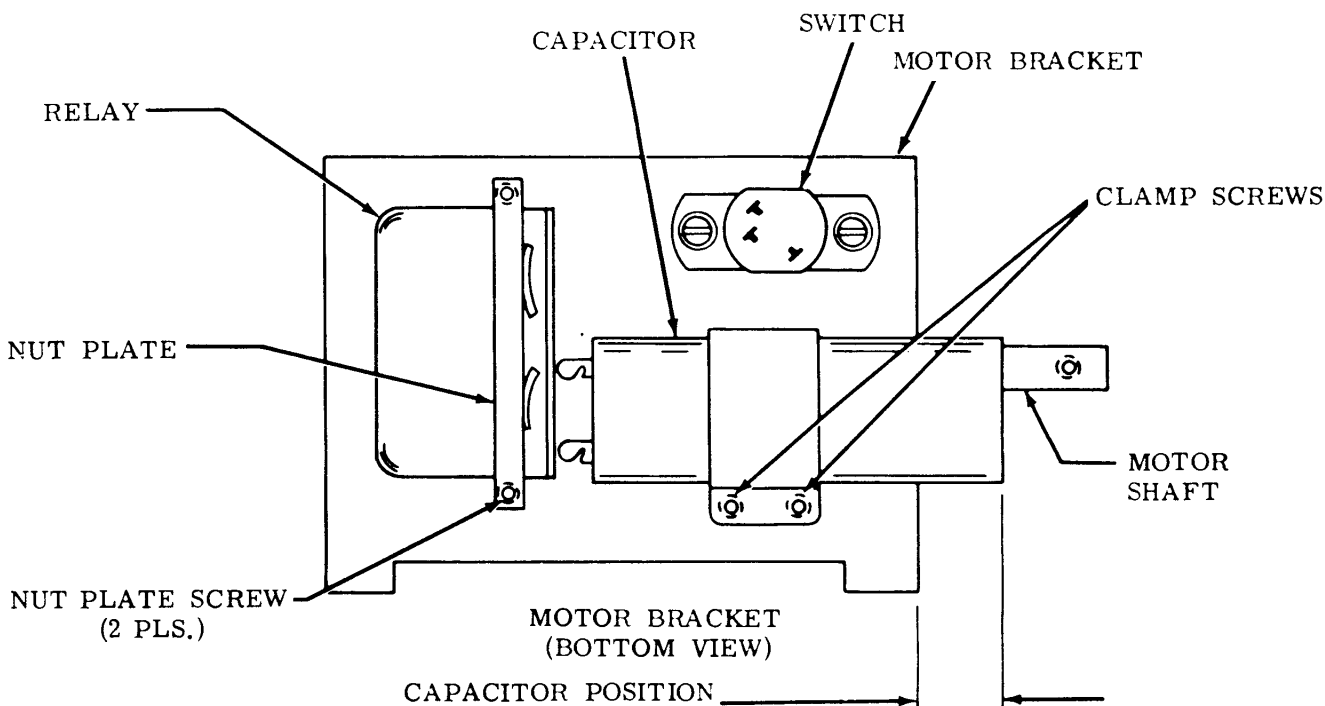
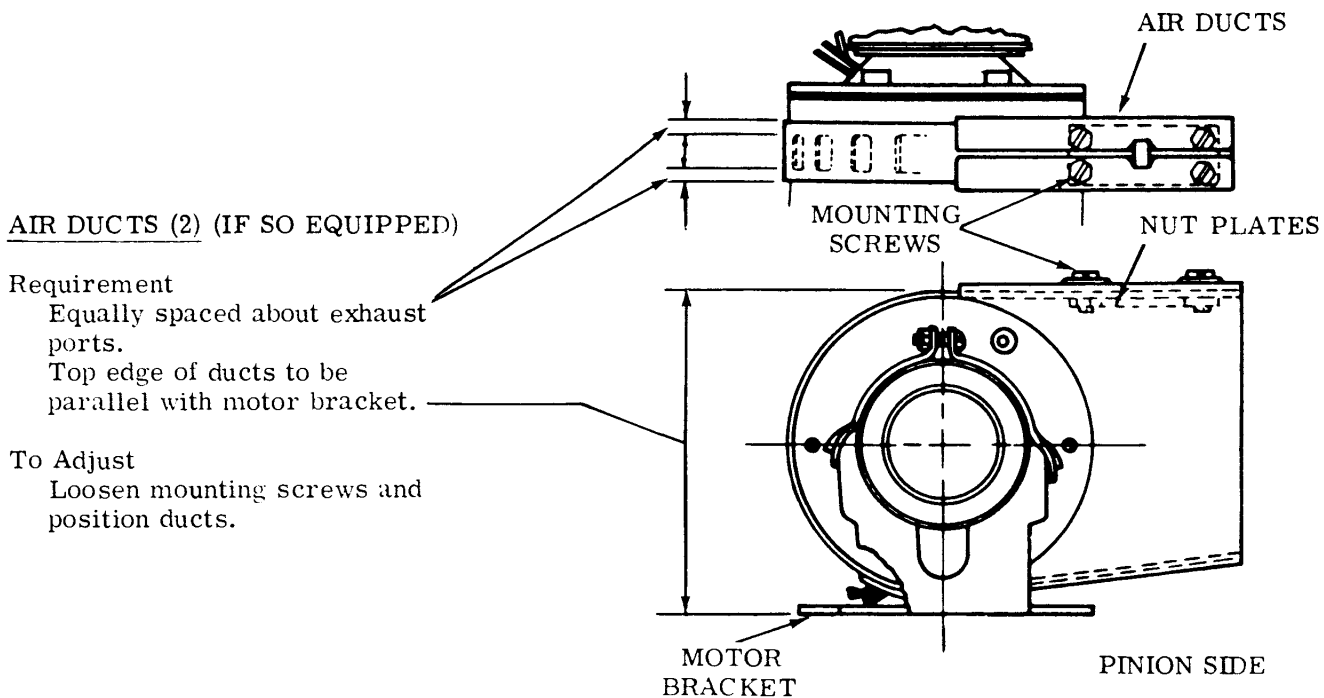
Position motor shield with its mount-
ing screws loosened.



(1) Requirement

Equal clearance between front and
rear ends of motor and motor shield.

2.03 Air Ducts and Capacitor Position

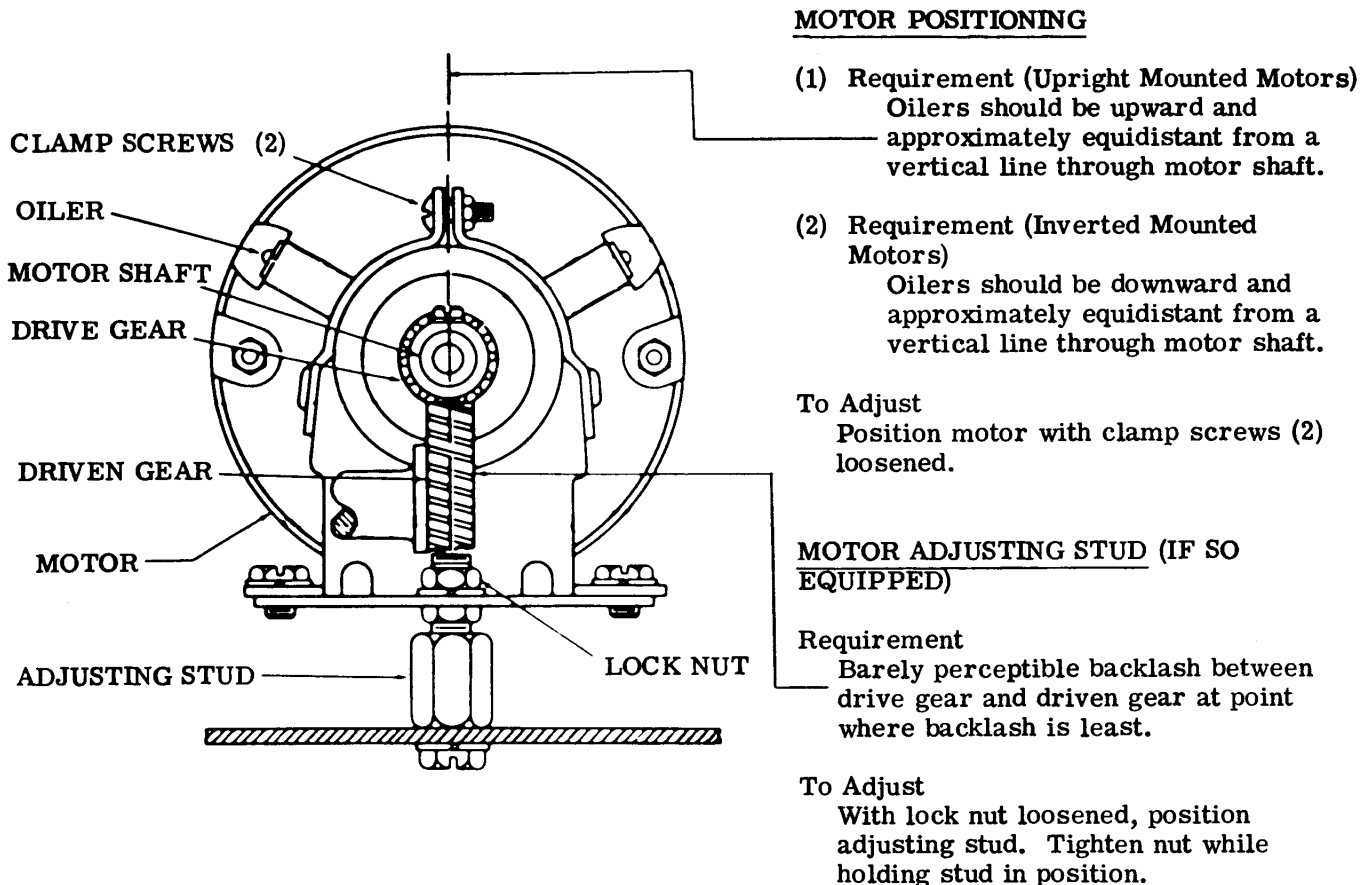


Requirement
Max 1 2 inch between motor bracket and end of capacitor.

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

3. STANDARD AND HEAVY DUTY SYNCHRONOUS MOTOR UNITS

3.01 Motor Positioning



CAUTION: IF MOTOR BECOMES BLOCKED FOR SEVERAL SECONDS, THERMOSTATIC CUTOUT 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.

4. SERIES GOVERNED MOTOR UNITS

4.01 Motor Positioning and Governor

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.

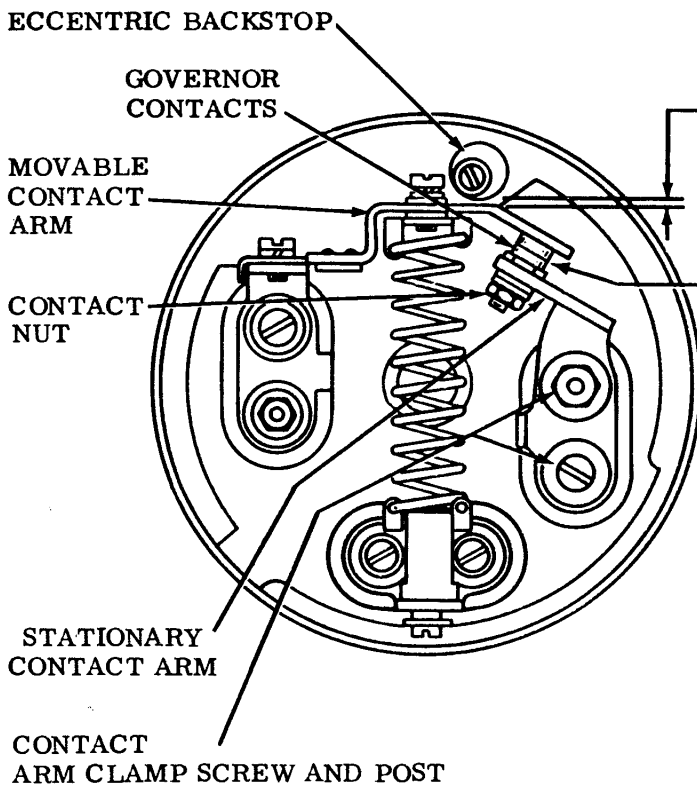
(B) GOVERNOR CONTACT

Requirement

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

To Adjust

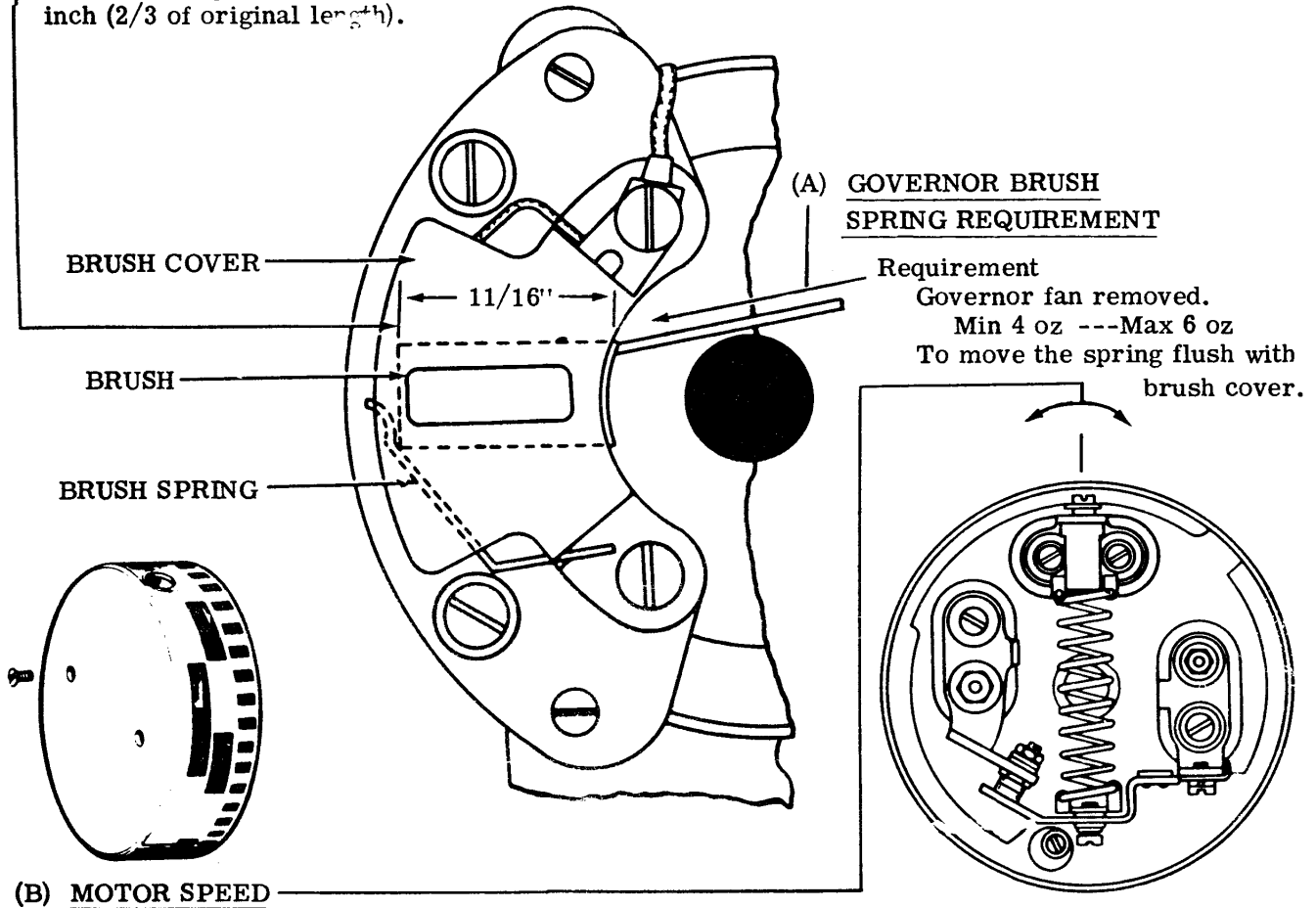
Position the stationary contact and contact arm with the clamp screw and post loosened.



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

4.02 Motor Governor

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



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

MOTOR UNITS

LUBRICATION

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1. GENERAL

1.01 This section has been revised to include additional information for lubricating miniature synchronous motors. Since this issue is a general revision, marginal arrows that indicate changes have been omitted.

1.02 For complete lubrication instructions refer also to the section covering teletypewriter apparatus general lubrication.

1.03 The motor should be lubricated initially, before being placed in service, as specified in the section covering the preparation of teletypewriter apparatus for installation. In the case of a new motor, the information supplied with it pertaining to the amount of lubricant should be used as a guide for further lubrication.

1.04 The suggested lubrication interval is indicated in the chart. However, because of varying conditions of application, the motor should be lubricated as often as specified by local instructions.

1.05 Before lubricating the motor, carefully and thoroughly clean the outer surfaces of the ball oilers with a clean cloth (KS2423)

dampened with petroleum spirits (KS7860). Avoid depressing the ball oilers so that grit, dirty grease, or contaminated petroleum spirits do not get into the motor bearings (Par. 2.01).

1.06 Whenever the motor is disassembled the bearings should be repacked with Beacon 325 grease or equivalent.

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

1.08 Use KS7470 oil where oil is specified.

1.09 The miniature synchronous motor does not contain ball oilers, as in the larger type motors, but has only a single oil hole in each end shield as shown in Par. 2.02.

CAUTION: DO NOT USE GREASE GUN ON 28, 32, 33 & 37 MOTOR UNITS.

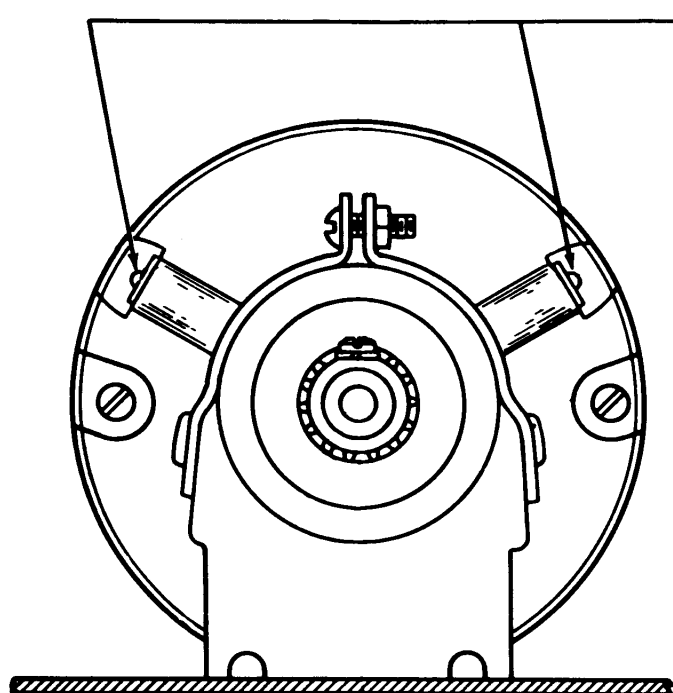
LUBRICATION INTERVAL

Motor Unit	Interval
Standard and heavy duty units	1500 consecutive operating hours or 6 months, whichever occurs first
Miniature units	750 consecutive operating hours or 3 months, whichever occurs first.

2. LUBRICATION

2.01 Motor Bearings - Standard Motors

Lubrication of motor bearings with ball type oilers.

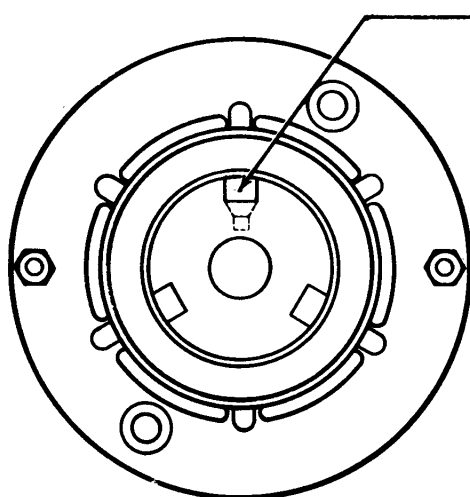


O6 Two Oilers
at Each End
(Depress Oiler
With Metal
Object)

Motor Bearings

Note: If motor is disassembled
at any time, do not replace
bearings until they have been re-
packed with (Teletype 195298)
(Beacon 325 or its equivalent)
grease.

2.02 Motor Bearings - Miniature Motors



O6 Oil Hole (2)

Oil Hole (One at
Each End of Motor)

MOTOR UNIT (MU, LMU AND YMU)

PARTS

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MOTOR UNIT APPLICATION CHART

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	37 Type
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														
①LMU10	Series, 1/20 HP, 115V/60 Hertz/3600 RPM, RF Sup.												X			
LMU11	AC Synchronous, 1/12 HP, 115V/60 Hertz/3600 RPM			X								X				
LMU12	AC Synchronous, 1/12 HP, 115V/60 Hertz/3600 RPM		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									
LMU20	AC Synchronous, 25 MHP, 115V/60 Hertz/3600 RPM							X								
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											
①LMU47	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								
YMU2	AC Synchronous, 1/20 HP, 115V/60 Hertz/3600 RPM															X

① Requires 173518 Mod. Kit for special variable speed application.

FIGURE 1. MOTOR UNIT APPLICATION CHART

SYNCHRONOUS MOTOR UNITS

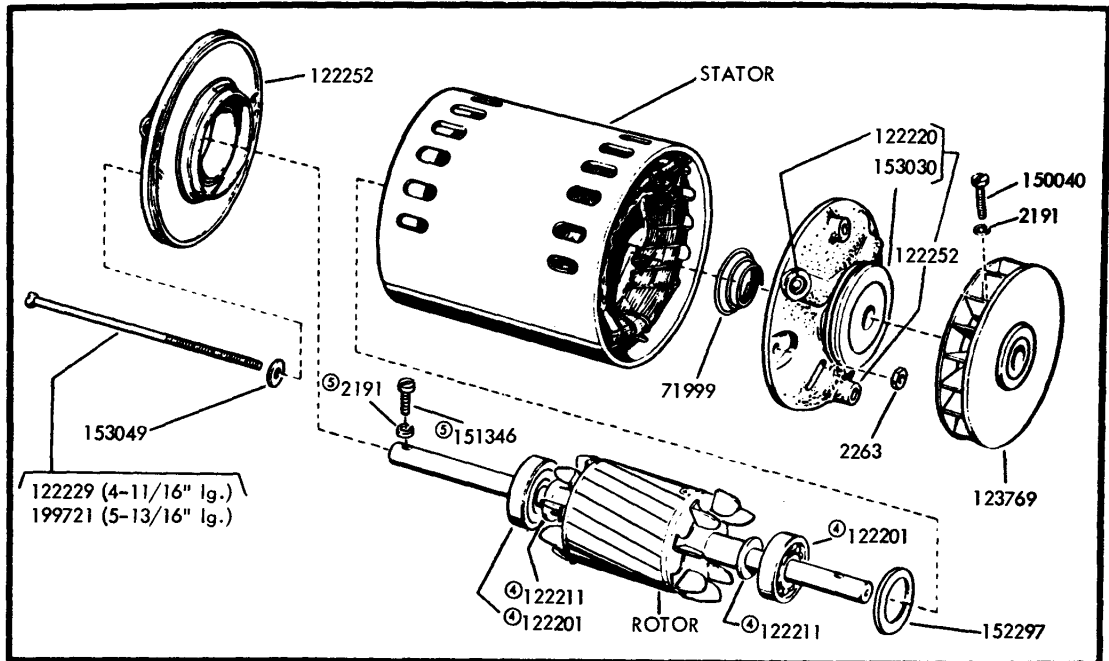
Teletype Code	Motor Assembly	Motor Bracket	Mounting Plate	Thermostatic Switch	Fixed Capacitor	Spring or Clamp	Relay	Relay Insulator	Spring or Clamp	Cable Assembly	Jumper
LMU3	151795	305661	305660	122249	122245	305658	151923	305659	305658	151927	96264R (5" lg. Red)
LMU11	155595	305661	305660	160304	160299	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/151626 Terminal) 96264R (5" lg. Red)
LMU26	161984	142589		174471	162072	151922	173425	162910	160302	162911	96264R (5" lg. Red)
LMU27		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	① 193781	122245	305658	151923	305659	305658	151927	96264R (5" lg. Red)
② LMU35	194924	171749		fused	① 195172	171702	① 195173	171704	171703	195178	
LMU36	178500	305661	305660	① 193781	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	① 193781	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/82474 Terminal) 312574 (6" lg. Black w/82474 Terminal)
LMU51	151795	194897		① 193781	122245	151922	151923	310341	151925	194899	96264R (5" lg. Red)
LMU52	151795	164612		① 193781	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	151795	312979		122249	122245	151922	151923	312977	151925	306320	96262R (4" 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

FIGURE 2. SYNCHRONOUS MOTOR CROSS — REFERENCE CHART



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	①160306	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	128874	AC Synchronous, 1/20 HP, 115V: 50/60 Hertz, 3000/3600 RPM	
Standard	178500	①122251	128874	AC Synchronous, 1/20 HP, 115V: 60 Hertz, 3600 RPM	
Standard	②196830	196831	128874	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	305063	320272	128874	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

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

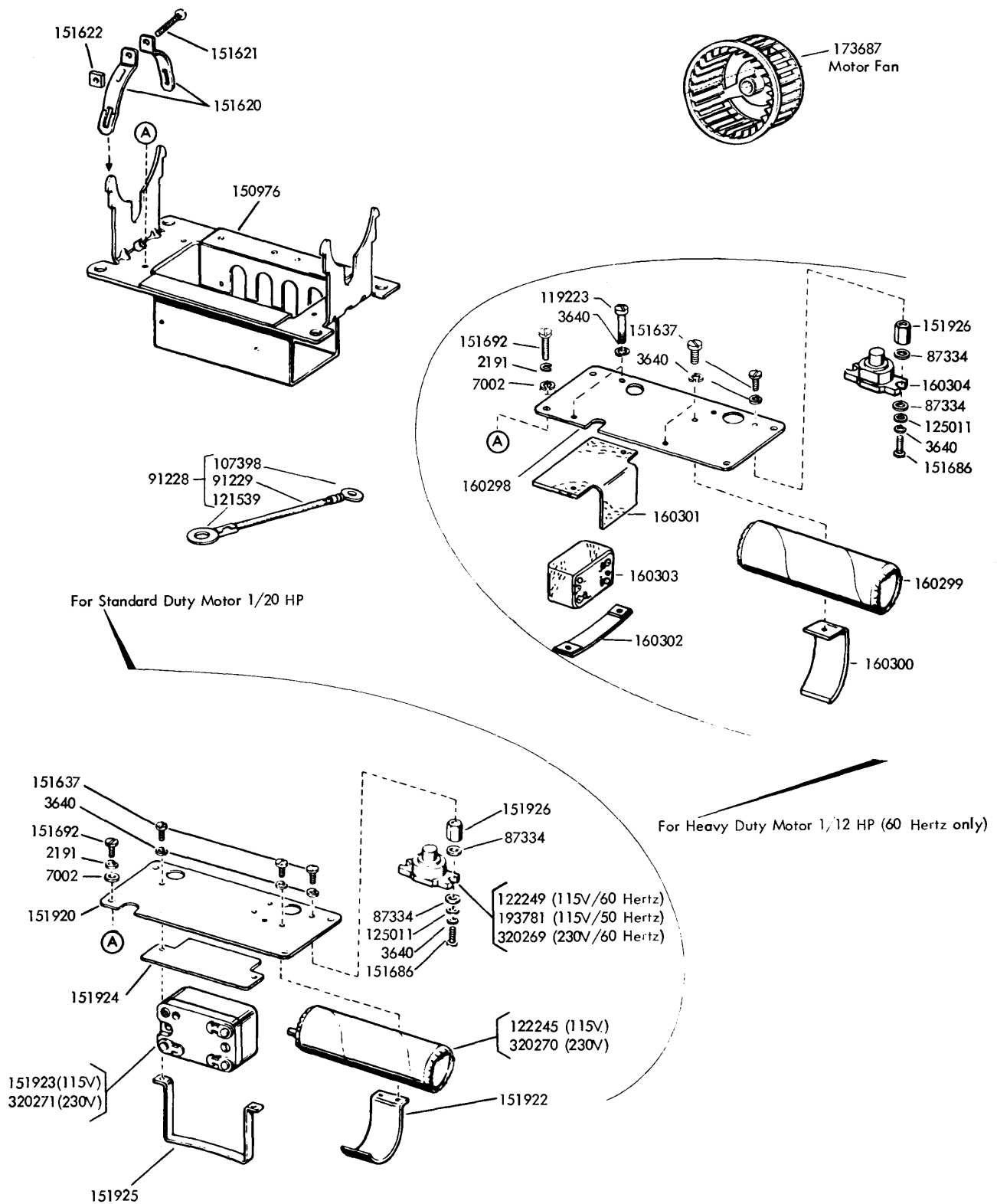


FIGURE 4. RELAY AND CAPACITOR MOUNTING (SYNCHRONOUS)

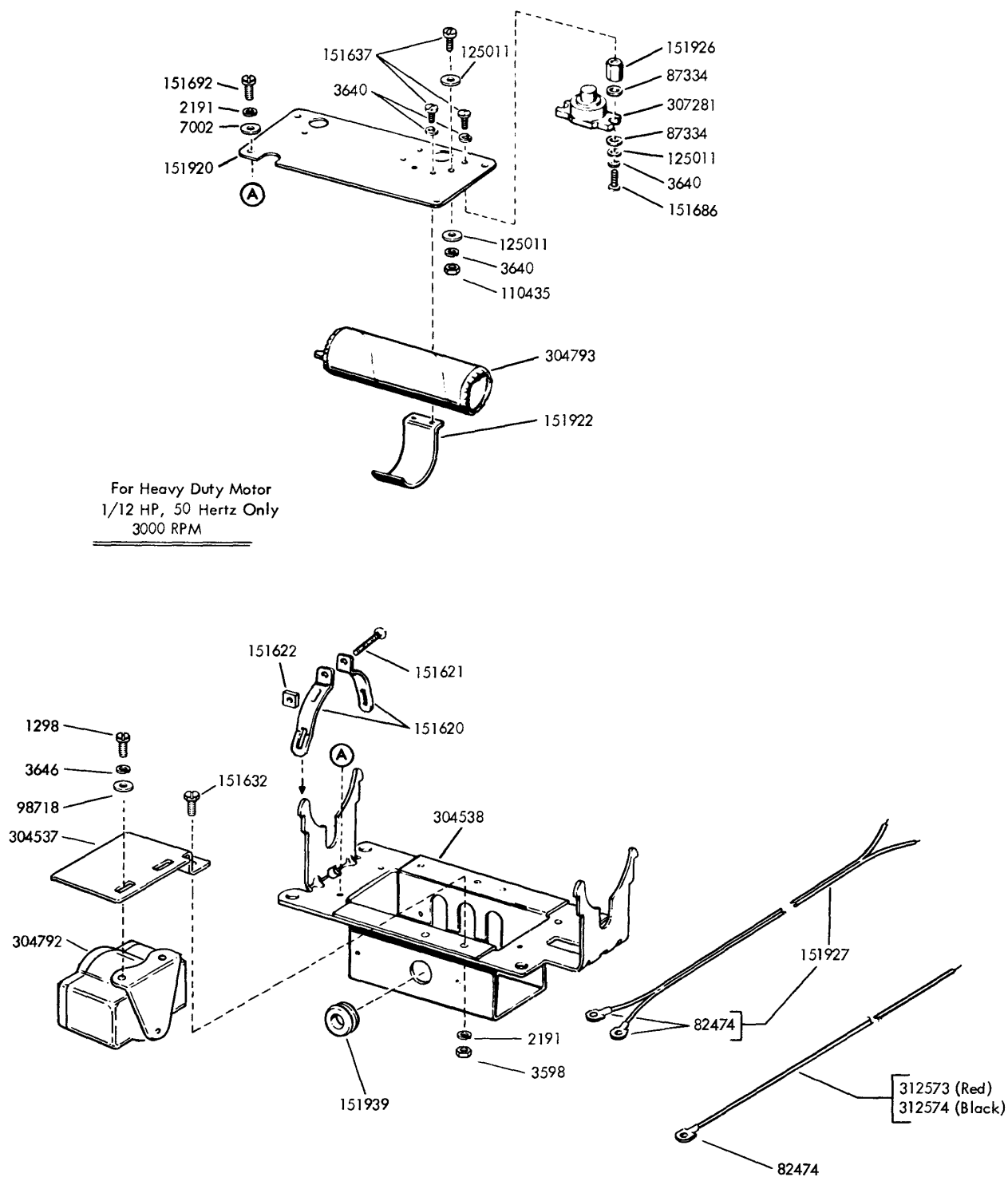


FIGURE 5. RELAY AND CAPACITOR MOUNTING (SYNCHRONOUS)

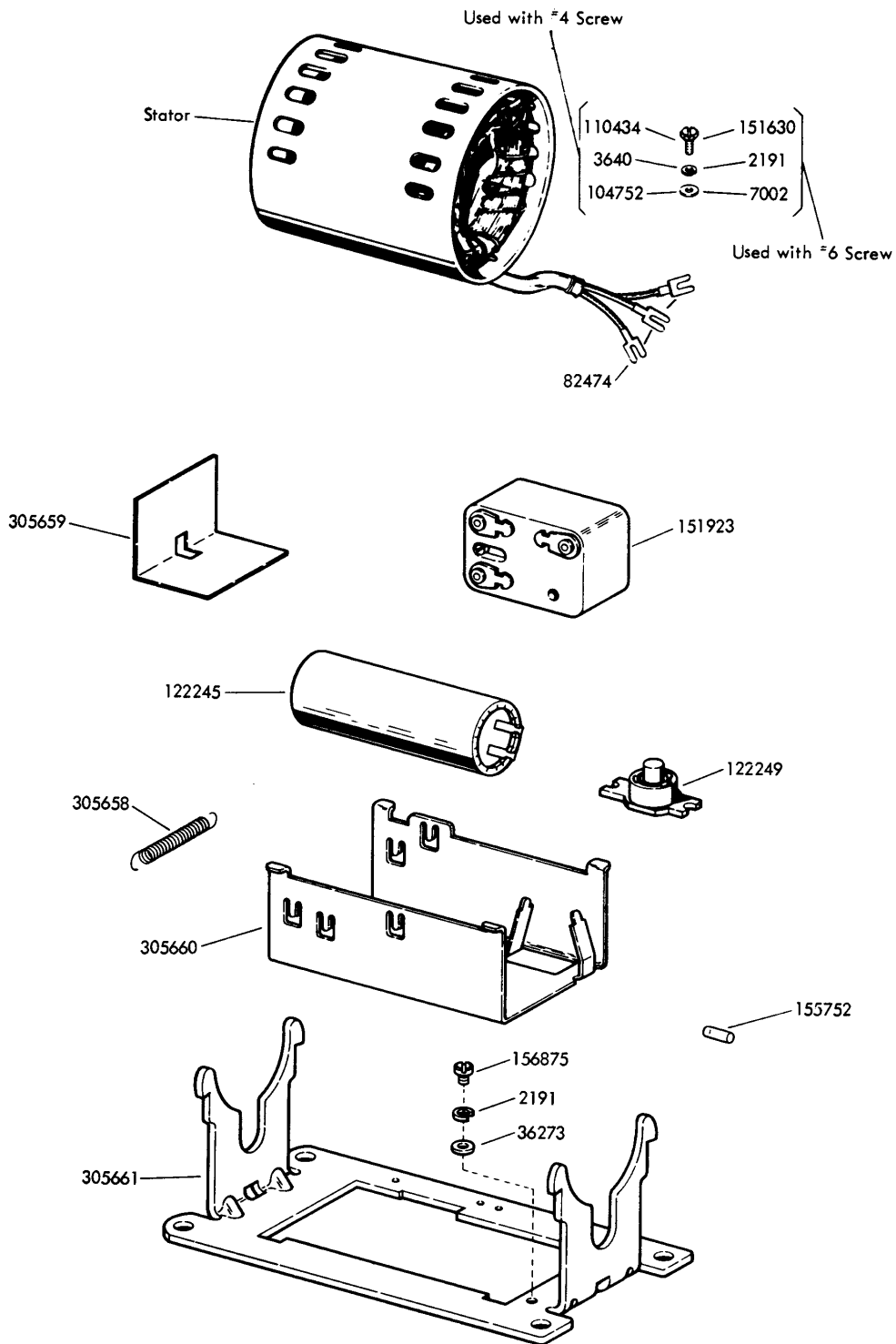


FIGURE 6. RELAY AND CAPACITOR MOUNTING

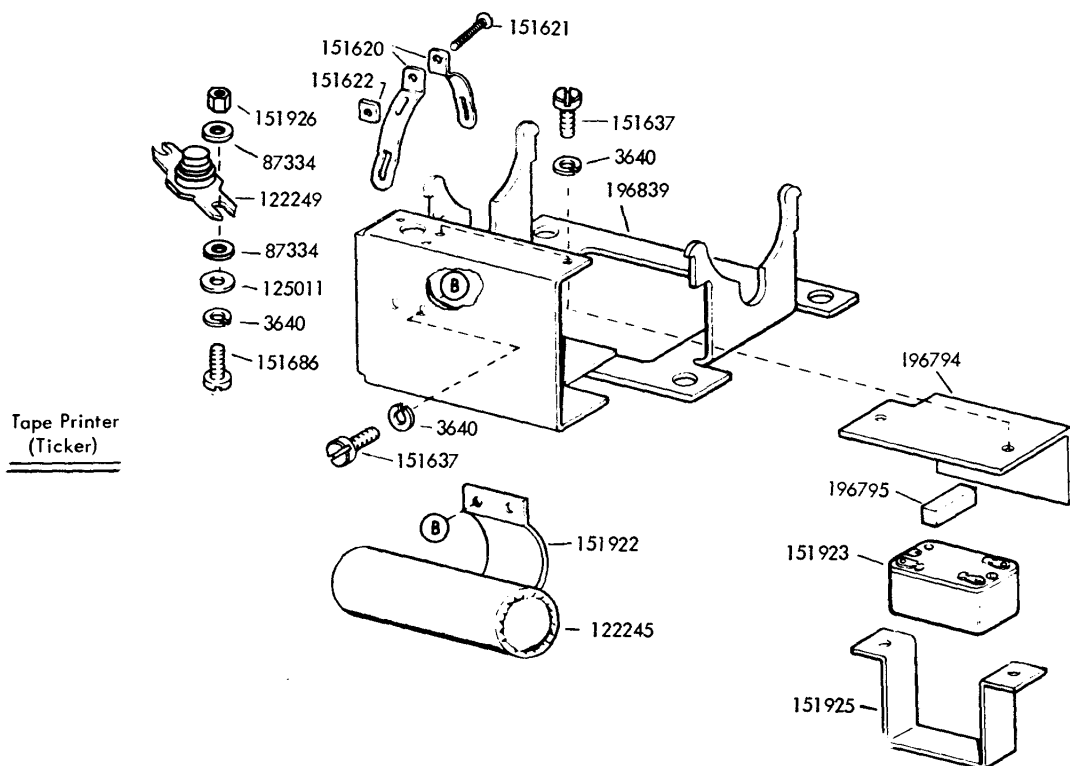
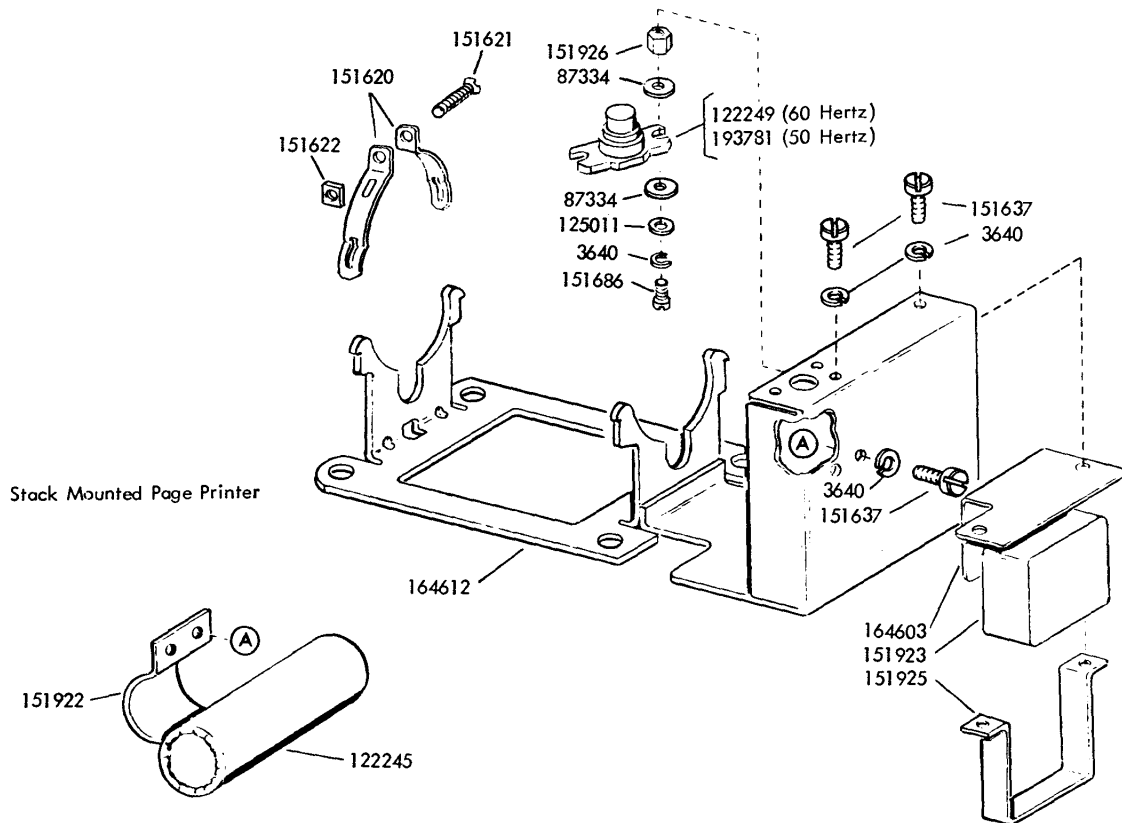


FIGURE 7. RELAY AND CAPACITOR MOUNTING (SYNCHRONOUS)

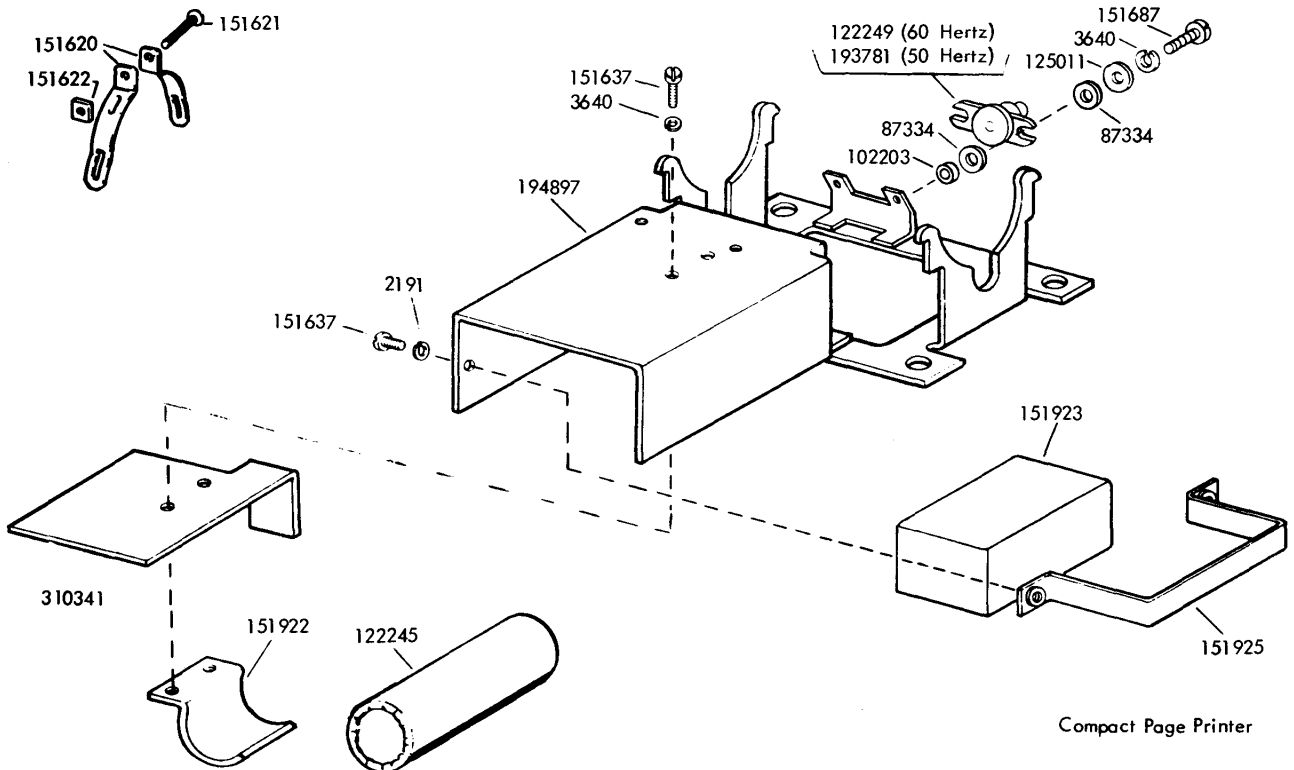
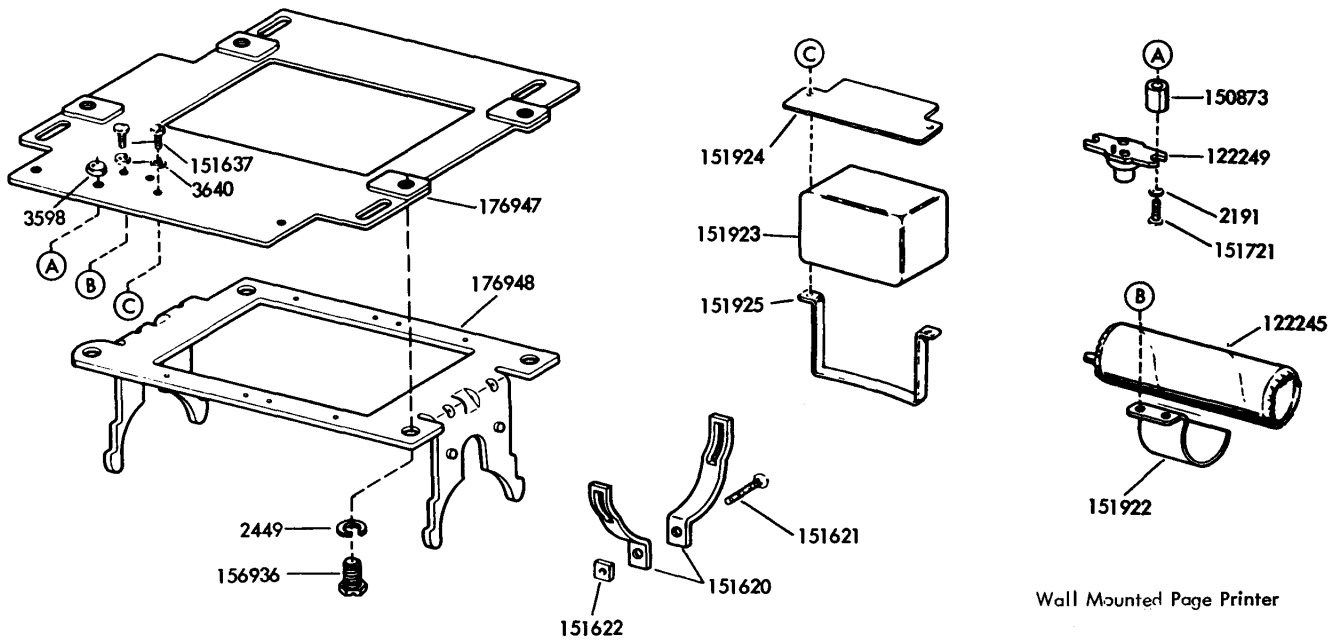
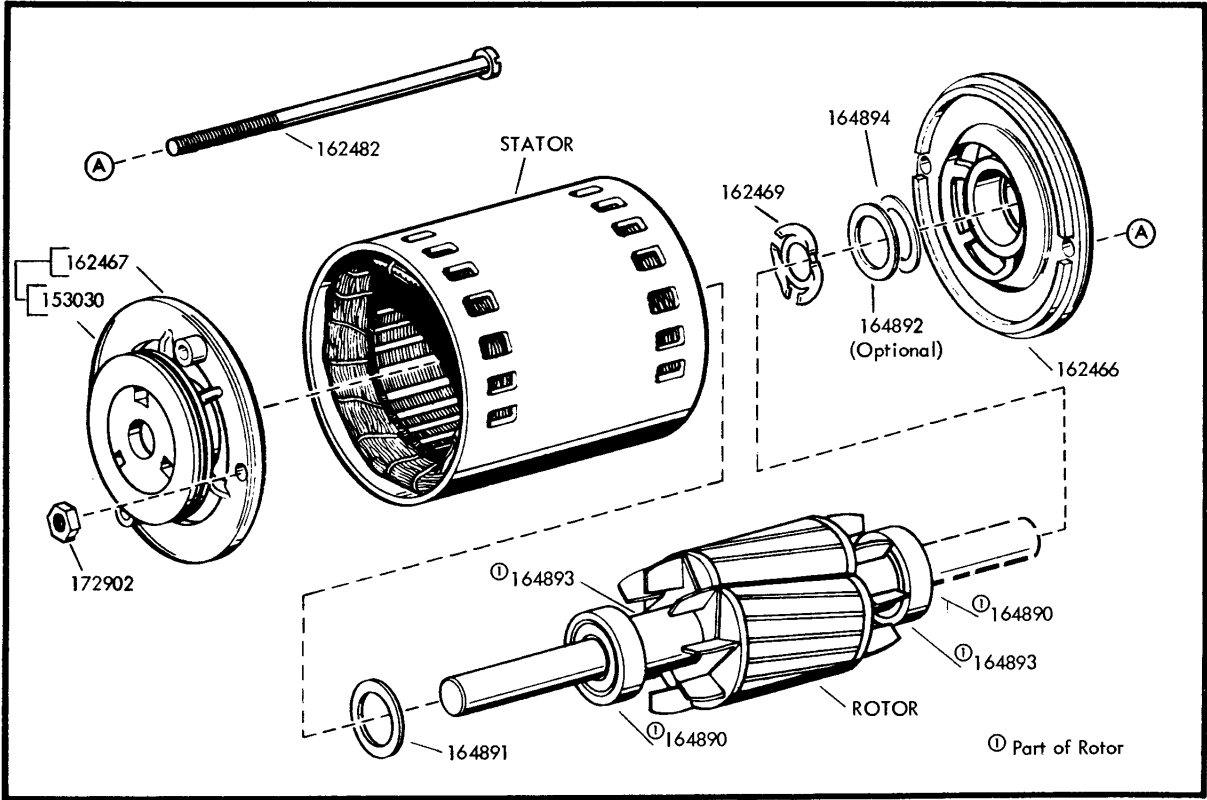


FIGURE 8. RELAY AND CAPACITOR MOUNTING (SYNCHRONOUS)



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)

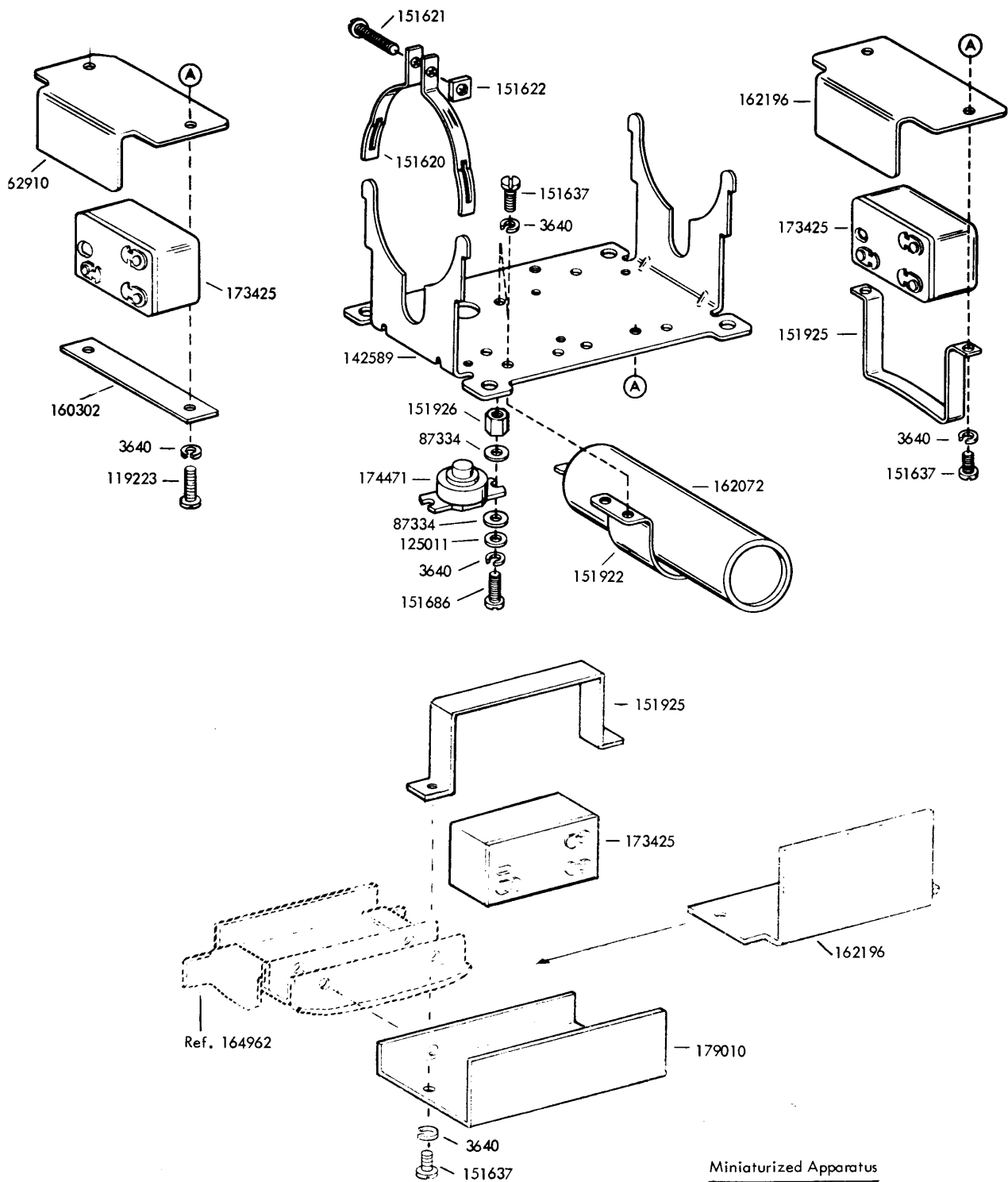


FIGURE 10. RELAY AND CAPACITOR MOUNTING (SYNCHRONOUS)

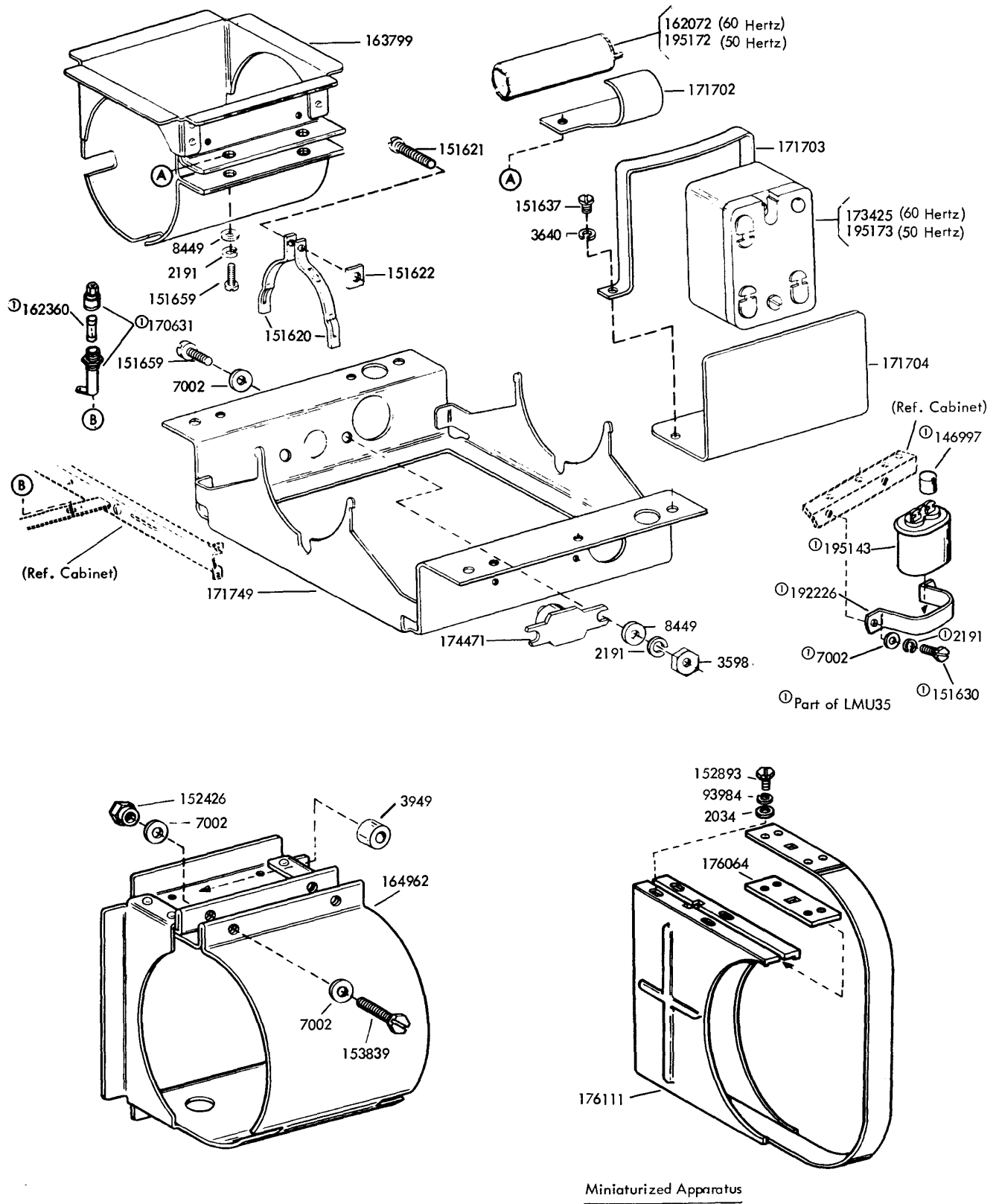


FIGURE 11. RELAY, CAPACITOR MOUNTING AND BRACKET (SYNCHRONOUS)

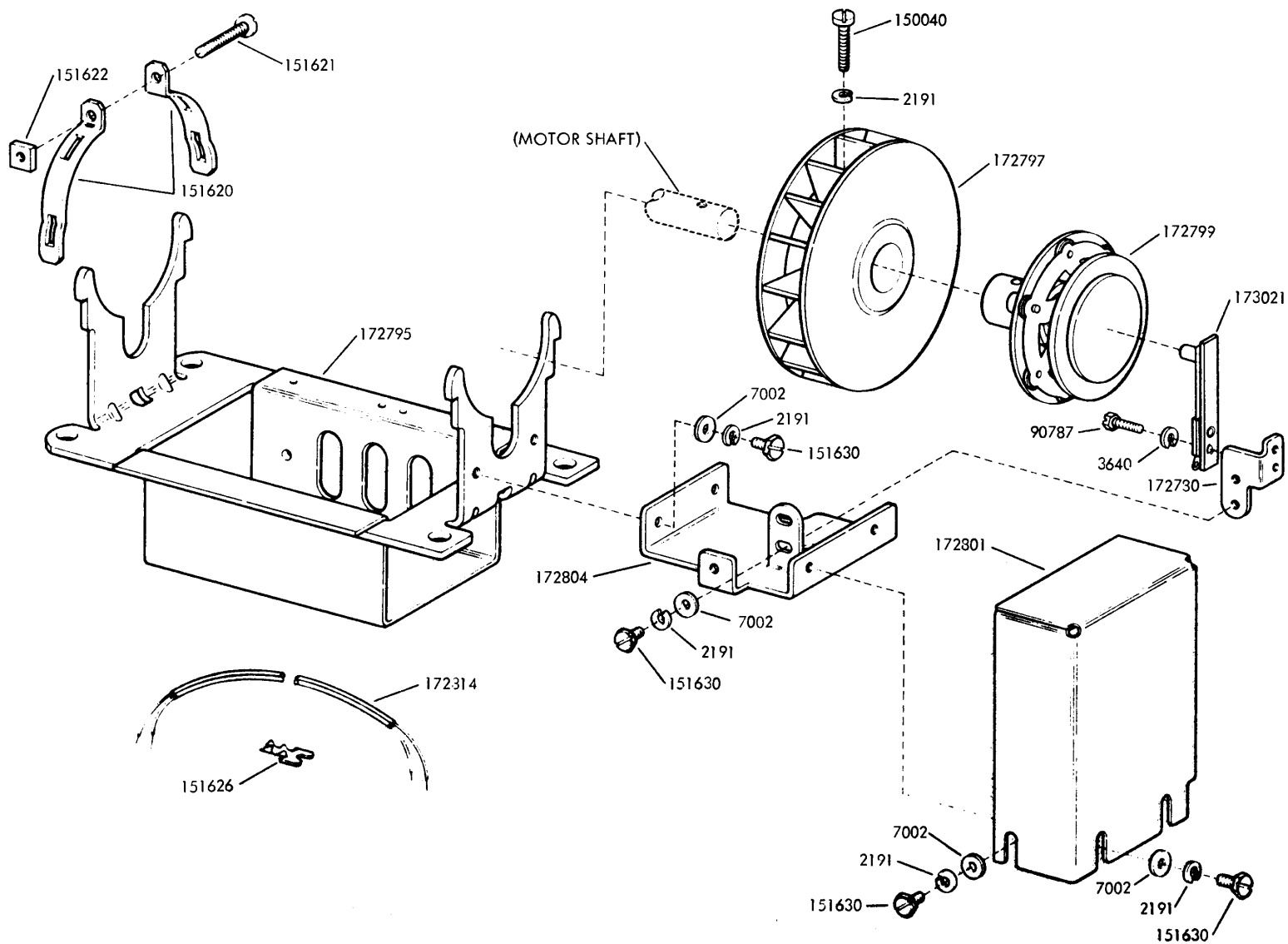


FIGURE 12. SYNCHRONOUS MOTOR MOUNTING WITH CENTRIFUGAL SWITCH ASSEMBLY

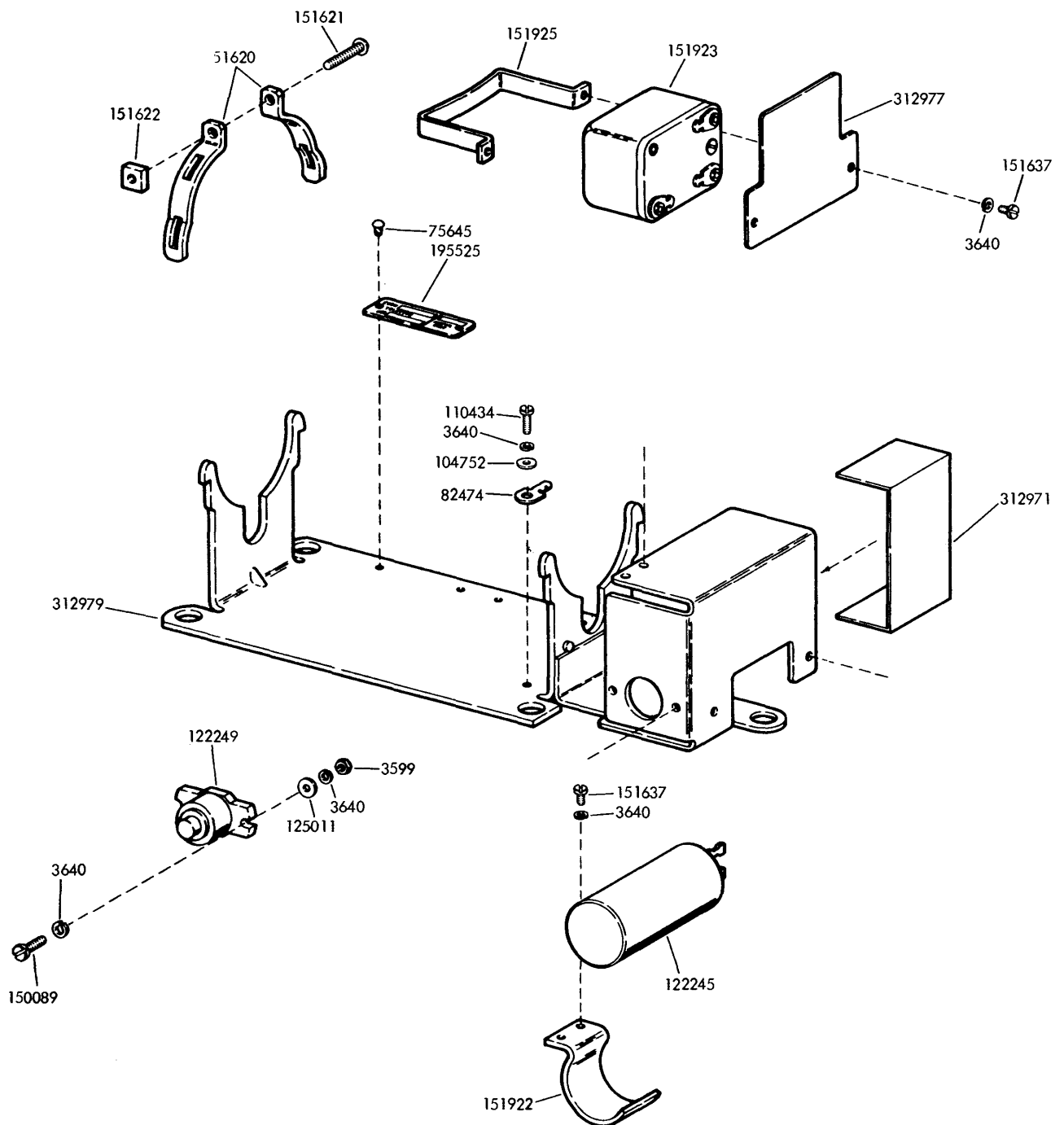
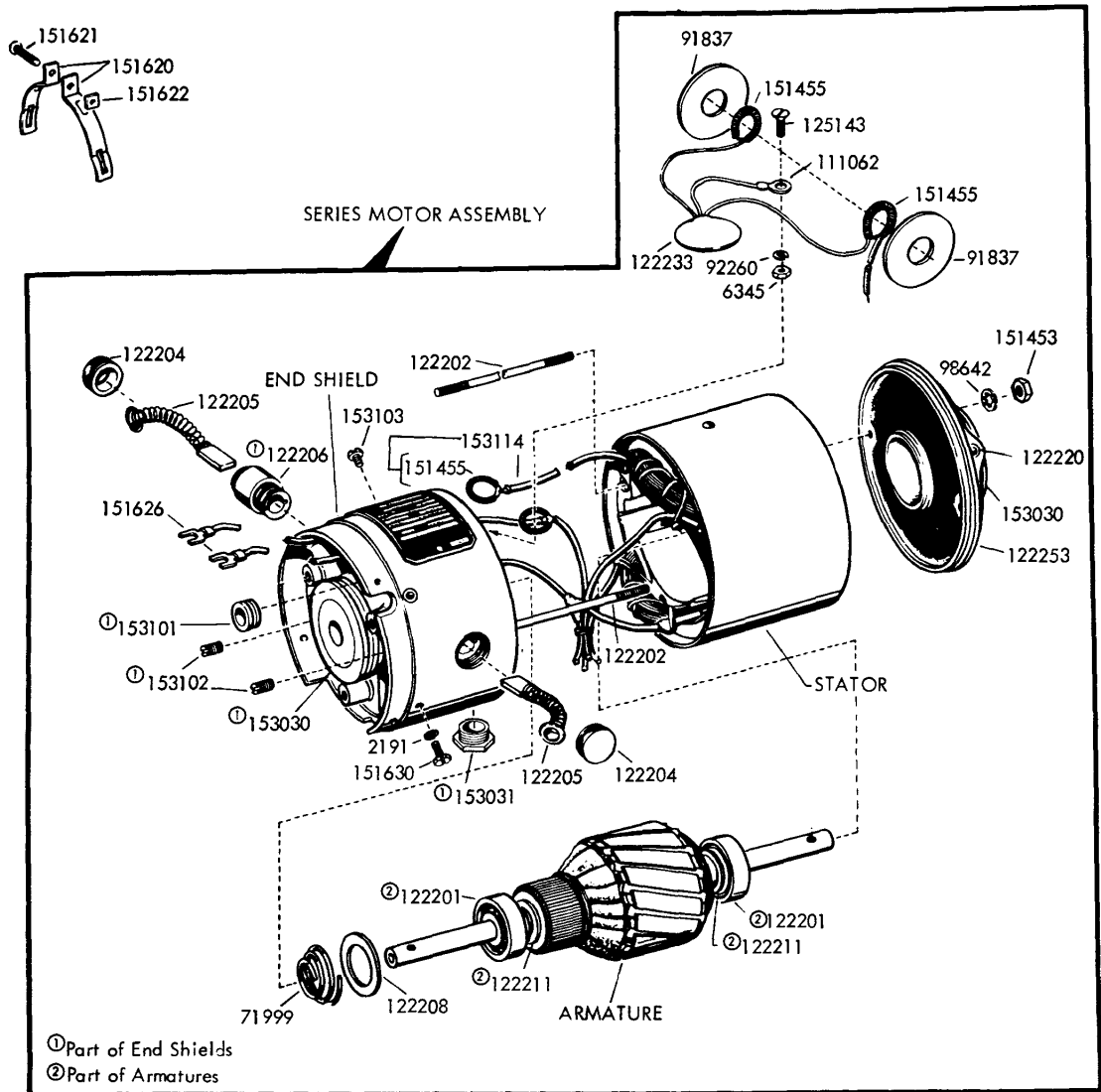


FIGURE 13. RELAY AND CAPACITOR MOUNTING (SYNCHRONOUS)

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/107398 and 121539 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/107398 and 121539 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/107398 and 121539 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/107398 and 121539 Terminals) 162684 (2-3/4" lg. w/164479 Terminal) 163268 (6-1/2" lg. White w/164479 Terminal) 163269 (2" lg. w/164479 Terminal)
LMU14	161577	152046	152039	152040	152067	161579	161580	161578	152059	91228 (2-1/2" lg. w/107398 and 121539 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/107398 and 121539 Terminals)
LMU28	179100	152046	179105	179106	179282	161579	179103	161578	179283	91228 (2-1/2" lg. w/107398 and 121539 Terminals)
LMU29	179190	152046	179420	179424	152067	179421	173004	179422	152059	91228 (2-1/2" lg. w/107398 and 121539 Terminals)
LMU32	194060	152046	194057	179424	194063	161579	179103	161578	152059	91228 (2-1/2" lg. w/107398 and 121539 Terminals)
LMU39	161577	152046	179420	179424	152067	161579	179103	161578	152059	91228 (2-1/2" lg. w/107398 and 121539 Terminals)
LMU41	150701	152046	179420	179424	152067	161579	179103	161578	152059	91228 (2-1/2" lg. w/107398 and 121539 Terminals)
LMU47	150701	152046	179420	179424	152067	161579	179103		152059	91228 (2-1/2" lg. w/107398 and 121539 Terminals)

FIGURE 14. SERIES MOTOR CROSS-REFERENCE CHART



SERIES MOTORS STANDARD OR HEAVY DUTY					MOTOR DATA
	MOTOR ASSEMBLY	STATOR	ARMATURE	END SHIELD	
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	③163272	161576	161575	163273	Series, 1/15 HP, 115V: 60 Hertz, 3600 RPM
Heavy	③164758	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

③ Arranged for Inverted Mounting

FIGURE 15. SERIES MOTOR ASSEMBLIES

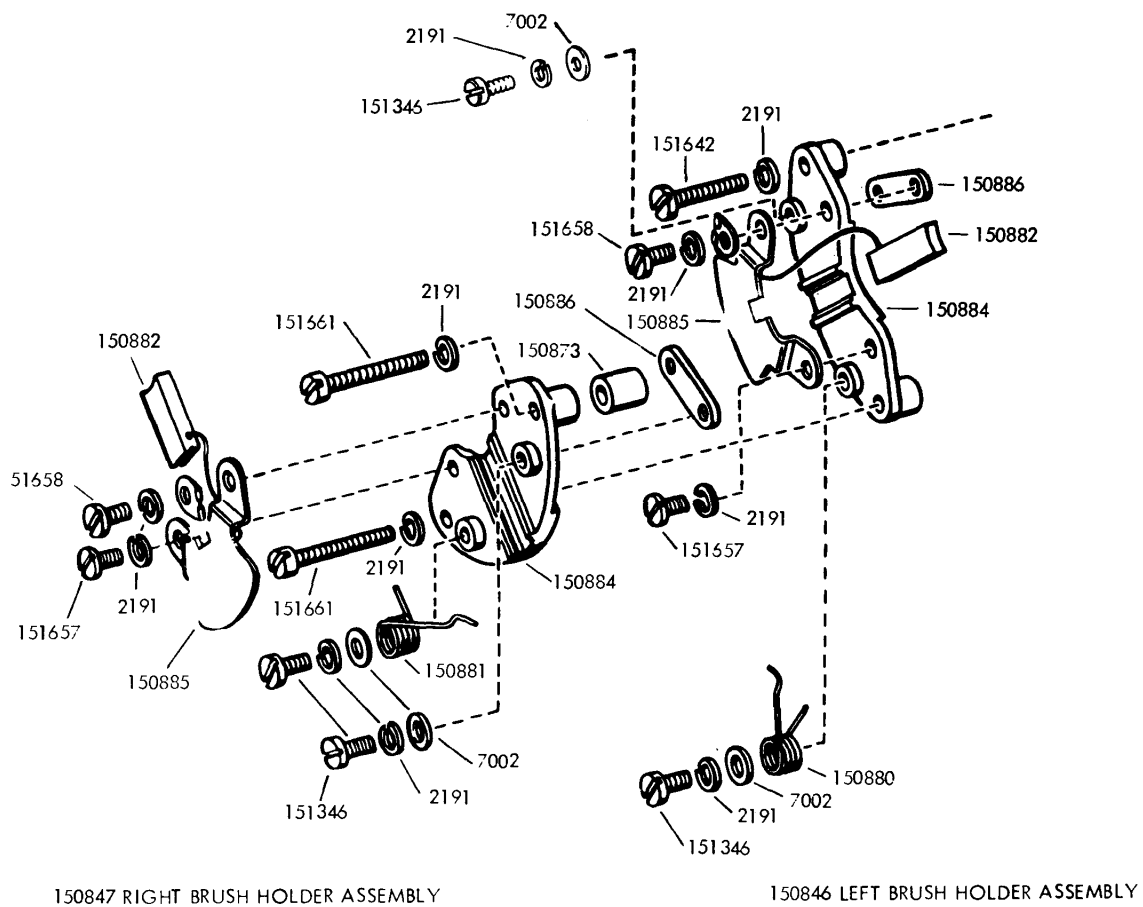


FIGURE 16. BRUSH ASSEMBLIES

FIGURE 17. 150845 GOVERNOR ASSEMBLY

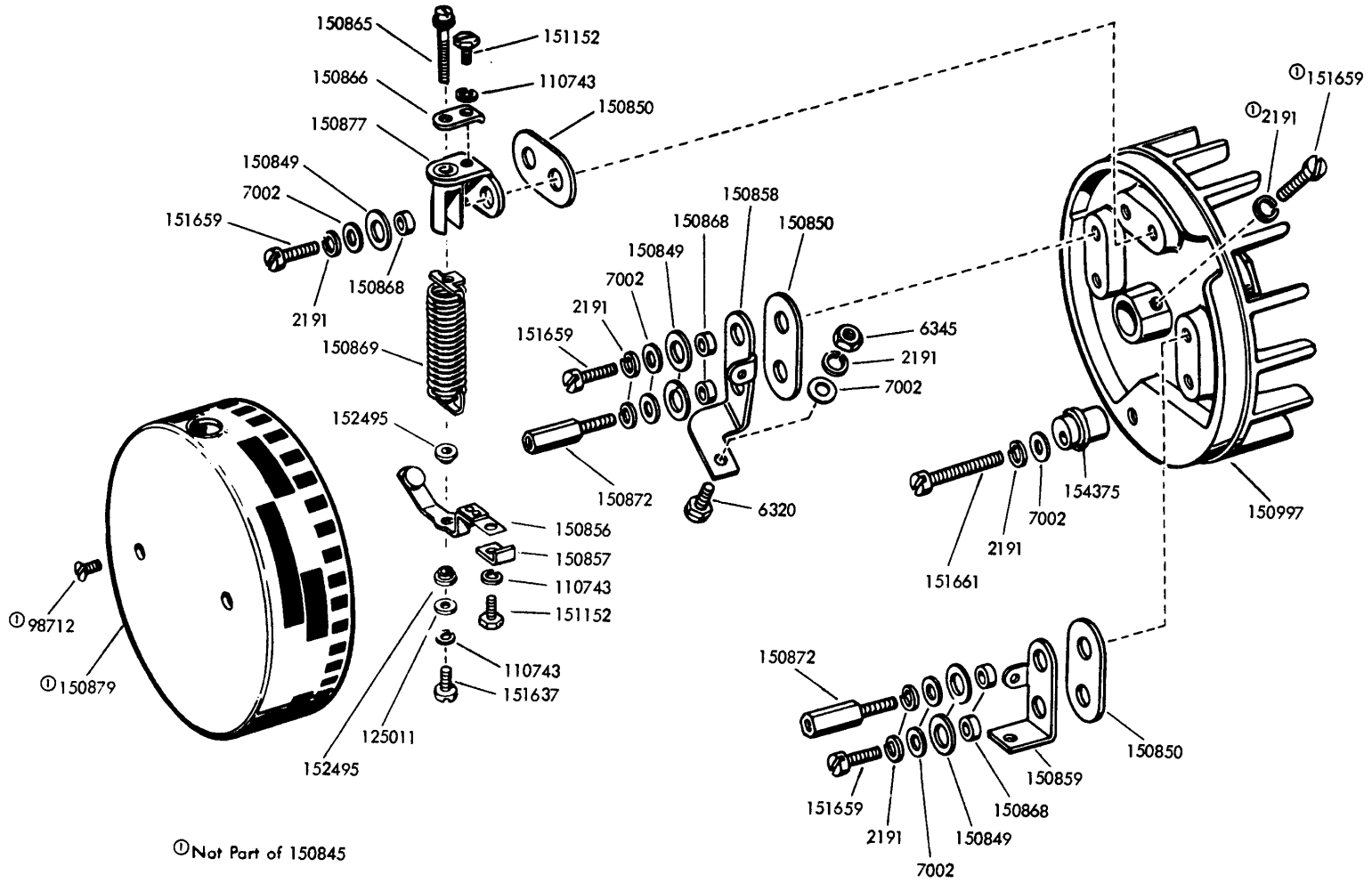
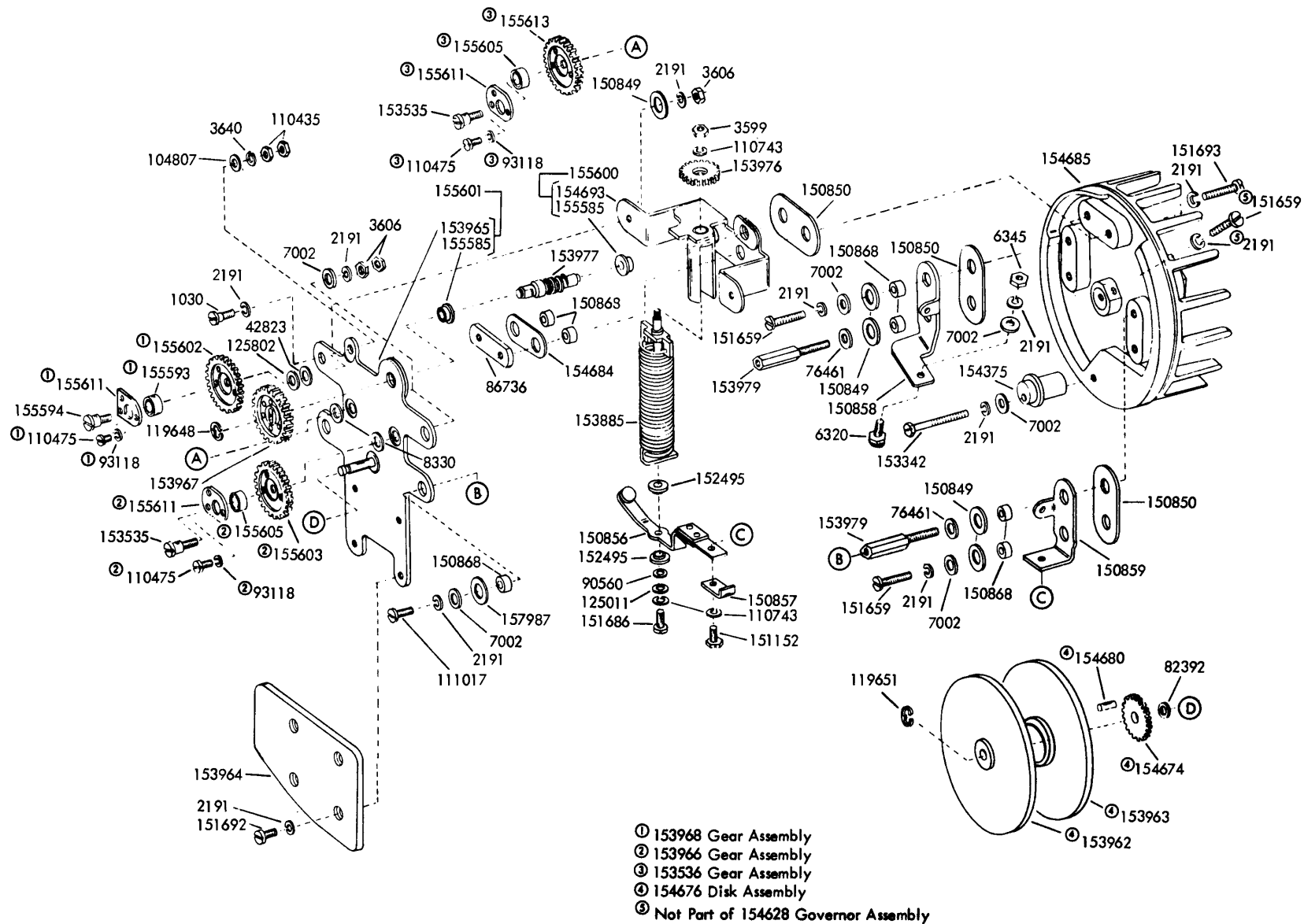


FIGURE 18. 154628 GOVERNOR ASSEMBLY



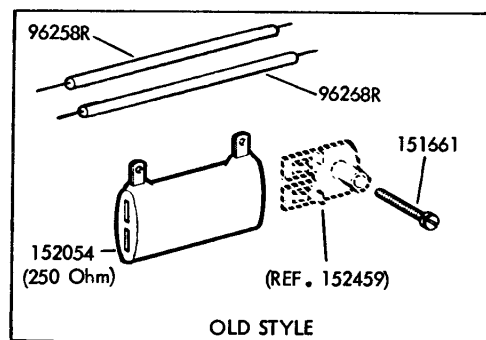
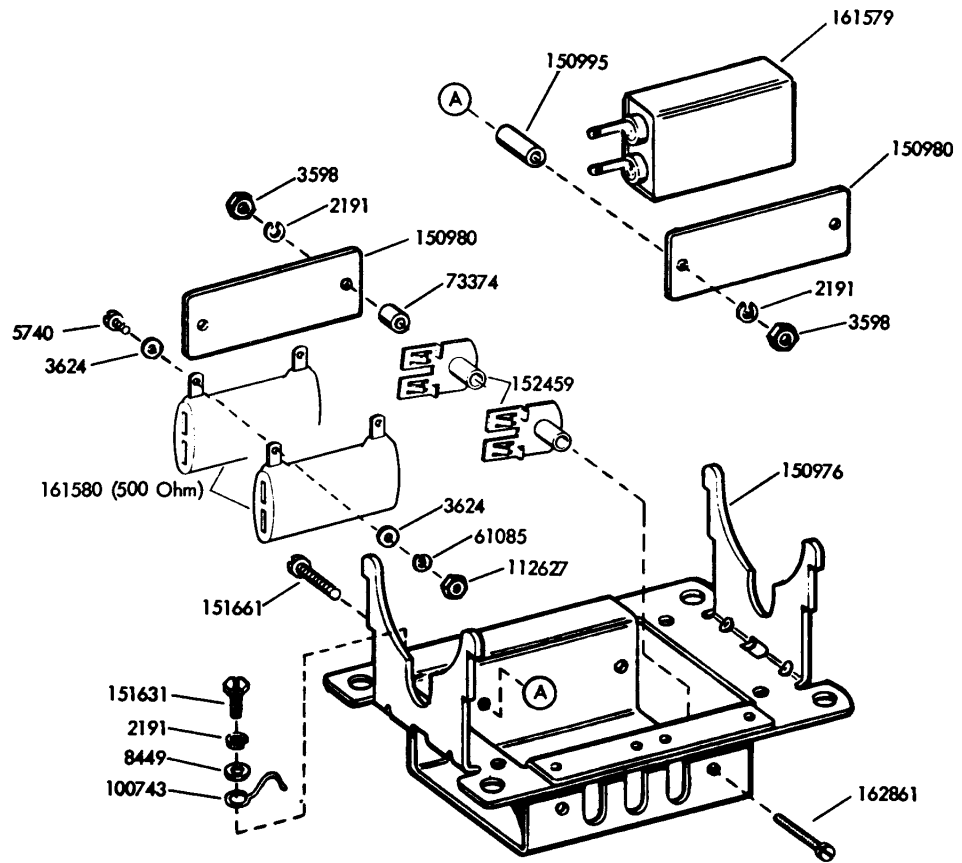
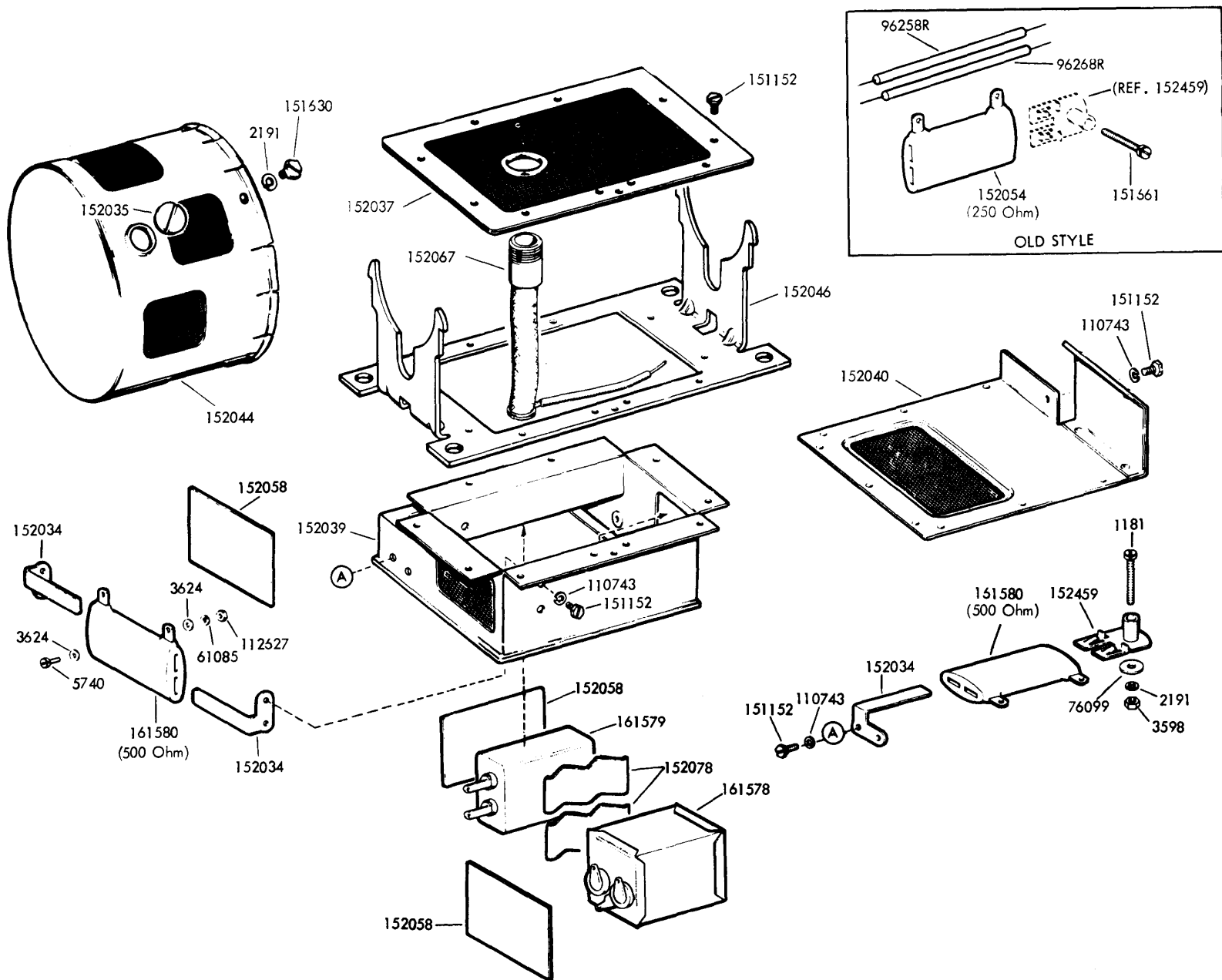


FIGURE 19. SERIES MOTOR MOUNTING PARTS

FIGURE 20. SERIES MOTOR MOUNTING PARTS WITH RF SUPPRESSION



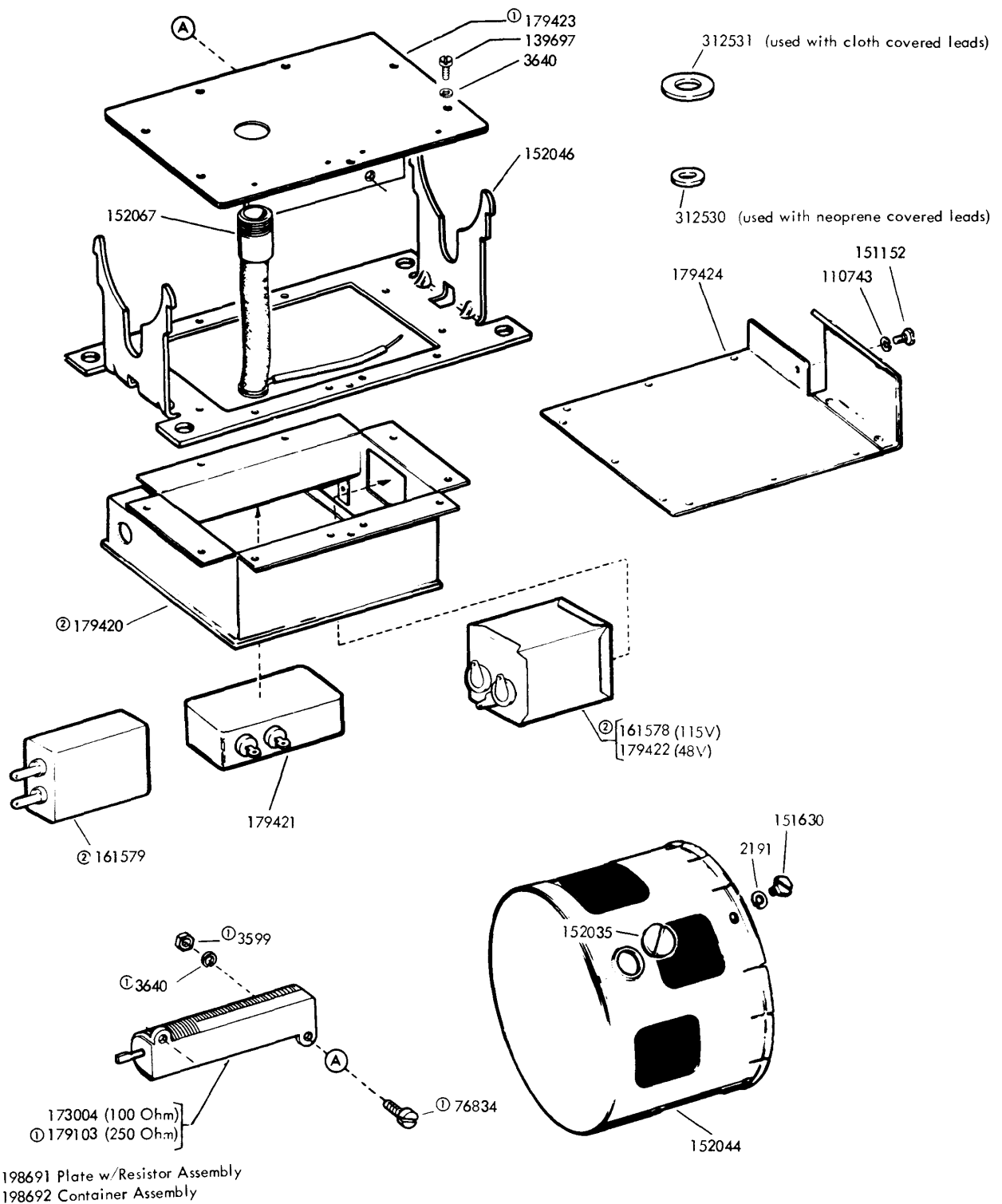


FIGURE 21. SERIES MOTOR MOUNTING PARTS WITH RF SUPPRESSION

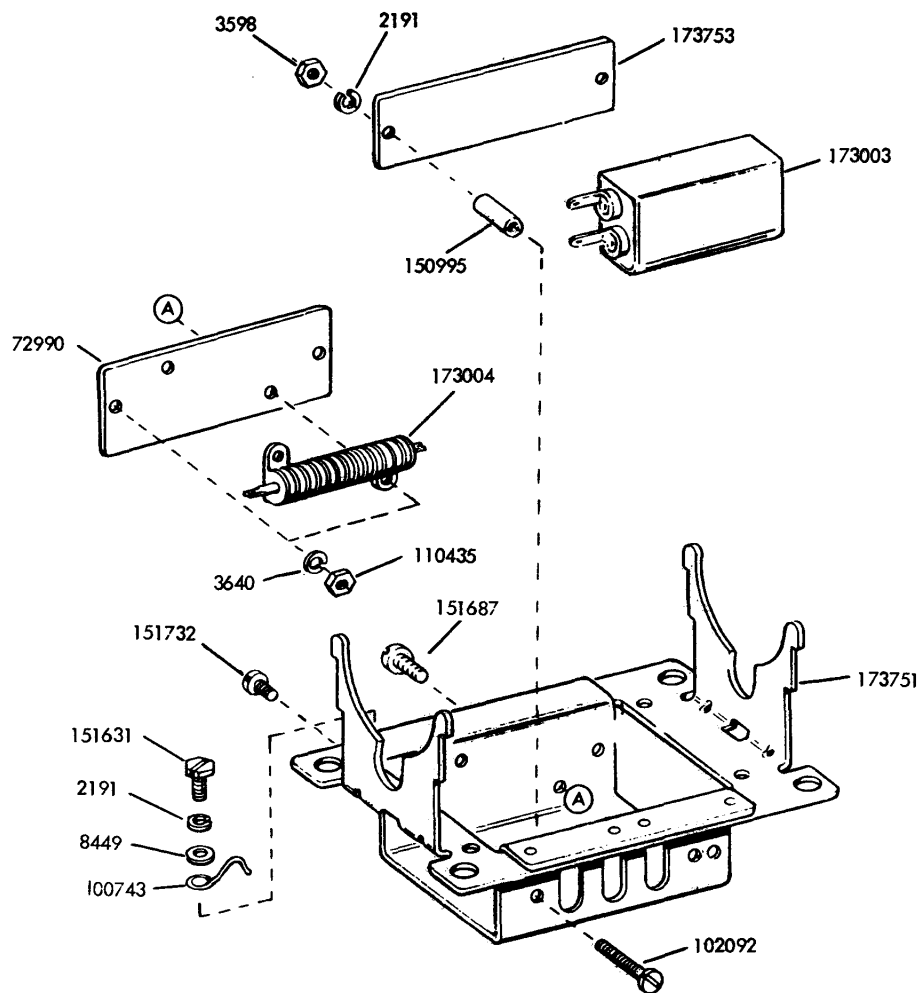


FIGURE 22. SERIES MOTOR MOUNTING PARTS

This exploded view diagram illustrates the assembly of a stack-mounted electronic unit. The components are labeled with the following part numbers:

- 179104: Top mounting bracket.
- 110435: Small circular fasteners.
- 3640: Small circular fasteners.
- 161578: Small rectangular component.
- 179106: Main rectangular housing.
- 110743: Small rectangular component.
- 151152: Small rectangular component.
- 179105: Main rectangular housing (alternative view).
- 110435: Small circular fasteners.
- 3640: Small circular fasteners.
- 151630: Small circular component.
- 2191: Small circular component.
- 152035: Small circular component.
- 152044: Main cylindrical component.
- 161579: Small rectangular component.
- 110435: Small circular fasteners.
- 3640: Small circular fasteners.
- 179103: Spring component.
- 179282: Curved bracket.
- 173974: Screw.
- 2669: Washer.
- 3438: Washer.
- 77140: Nut.
- 179102: Base plate.
- 76834: Screw.
- 152046: Mounting bracket.

The diagram shows the assembly sequence from the base plate (179102) up to the main housing (179105/179106) and the cylindrical component (152044). Dashed lines indicate the alignment and assembly path for each part. Labels A and B are used to denote specific assembly points or orientations.

Stack Mounted

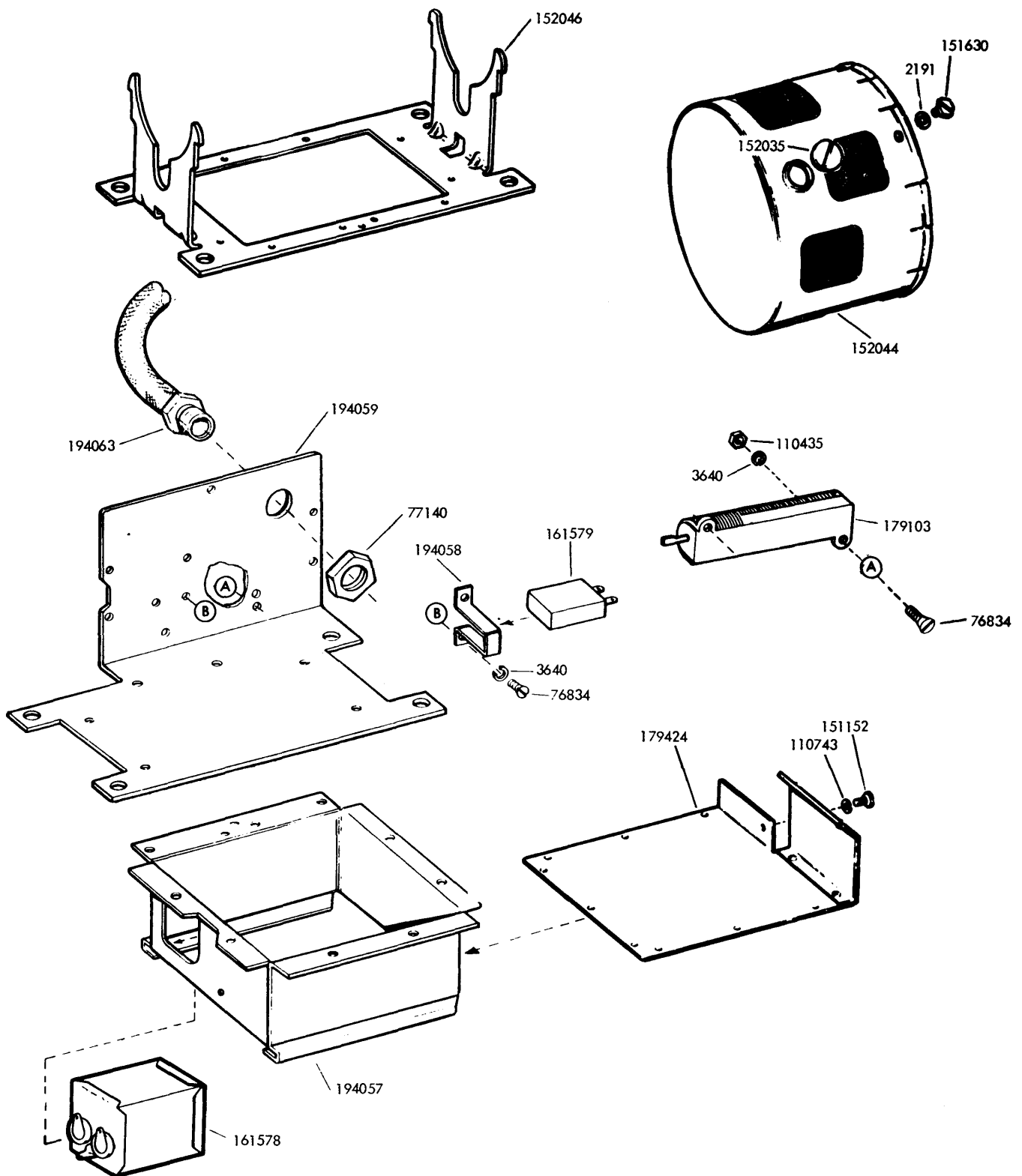


FIGURE 24. SERIES MOTOR MOUNTING PARTS WITH RF SUPPRESSION

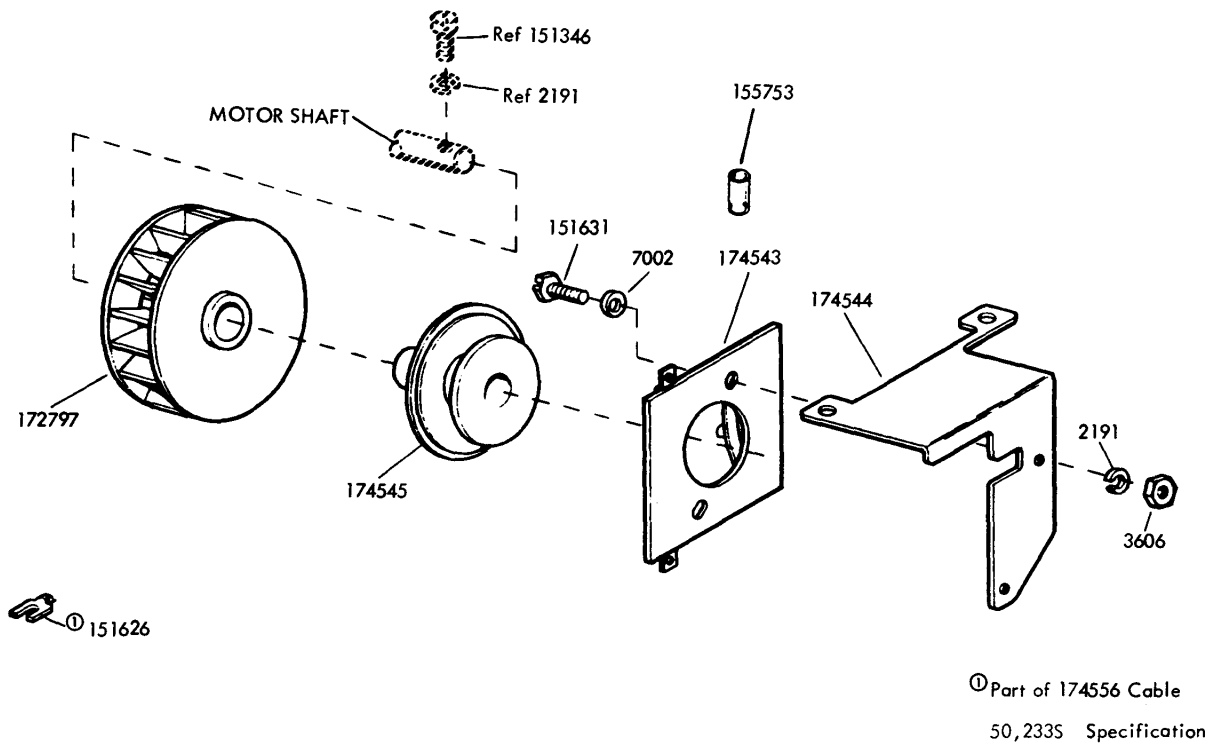


FIGURE 25. 174546 MODIFICATION KIT TO PROVIDE MOTOR RUNNING CONTACTS

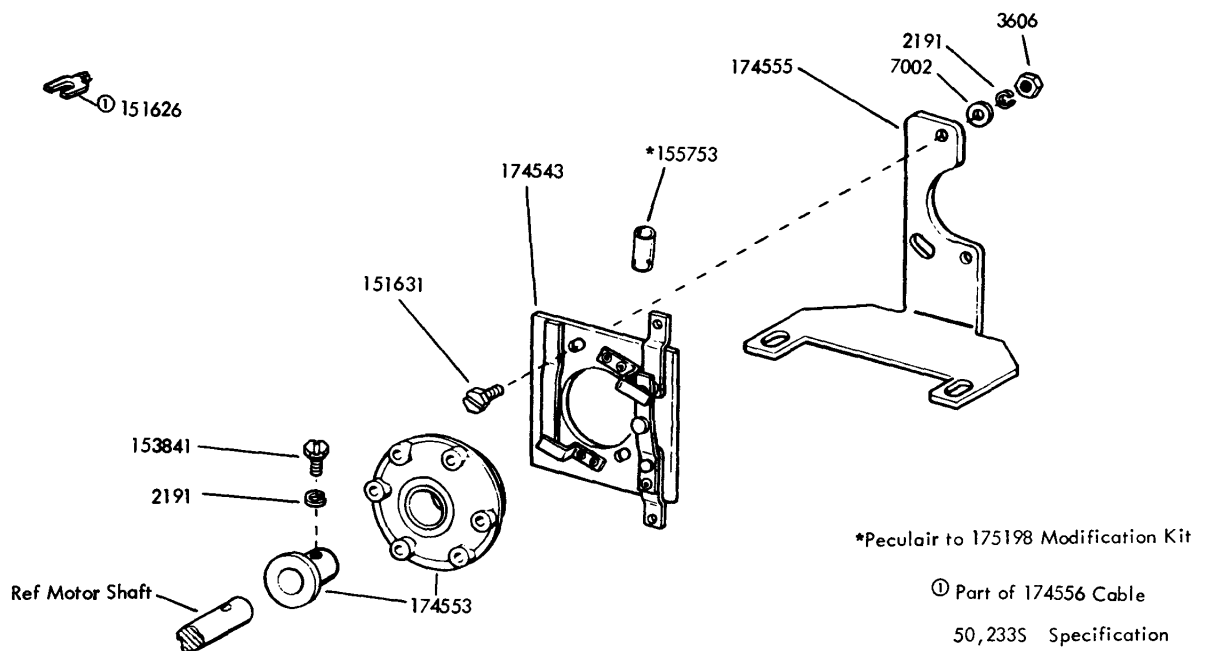


FIGURE 26. 174551 (LESS CABLE) 175198 (WITH CABLE) MODIFICATION KITS TO PROVIDE MOTOR RUNNING CONTACTS

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	Washer, Lock	7	19	
	75646	Screw, Drive	4		
	122233	Capacitor Assembly	1	13	
	139697	Screw, 4-40 x 9/32 Fil	7	19	
	151626	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	Washer, Lock	4	19	
	3640	Washer, Lock	8	19	
	75646	Screw, Drive	4		
	110743	Washer, Lock	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	
	151626	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	Washer, Lock	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	
	151626	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	Washer, Lock	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	
	151626	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	

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Part Number	Description and Page Number	Part Number	Description and Page Number	Part Number	Description and Page Number
1030	Screw, Shoulder 6-40 19	110435	Nut, 4-40 Hex 6, 19, 23, 24, 25	150980	Plate, Clamping 20
1181	Screw, 6-40 x 11/16 Fil 21	110475	Screw, 2-64 x 5/64 Rd 19	150995	Bushing 20, 23
1298	Screw, 8-32 x 1/4 Fil 6	110743	Washer, Lock 18, 19, 21, 22, 24, 25, 27	150997	Fan, Governor 18
2034	Washer, Flat 12			151152	Screw, 4-40 x 3/16 Hex 18, 19, 21, 22, 24, 25, 27
2191	Washer, Lack 4, 5, 6, 7, 9, 12, 13, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27	111017	Screw, 6-40 x 5/16 Fil 19	151346	Screw, 6-40 x 3/8 Fil 4, 17, 26
2263	Nut, 8-32 Hex 4	111062	Terminal 16	151453	Nut, 10-32 Hex 16
2449	Washer, Lock 9	112627	Nut, 2-56 Hex 20, 21	151455	Spring, Helical Clip 16
2669	Washer, Lock 24	119223	Screw, 4-40 x 1-15/32 Fil 5, 11	151620	Strap, Motor Mounting 5, 6, 8, 9, 11, 12, 13, 14, 16
3438	Washer, Flat 24	119648	Ring, Retaining 19		
3598	Nut, 6-40 Hex 6, 9, 12, 20, 21, 23	119651	Ring, Retaining 19	151621	Screw, 6-32 x 3/4 Rd 5, 6, 8, 9, 11, 12, 13, 14, 16
3599	Nut, 4-40 Hex 14, 19, 22	121539	Terminal 5, 15	151622	Nut, 6-32 Sq 5, 6, 8, 9, 11, 12, 13, 14, 16
3606	Nut, 6-40 Hex 19, 26	122200	Shield Assembly, End 16	151626	Terminal 3, 13, 16, 26, 27
3624	Washer, Flat 20, 21	122201	Rearing, Ball 4, 16	151630	Screw, 6-40 x 1/4 Hex 7, 12, 13, 16, 21, 22, 24, 25, 27
3640	Washer, Lack 5, 6, 7, 8, 9, 11, 12, 13, 14, 19, 22, 23, 24, 25, 27, 3646	122202	Stud 16	151631	Screw, 6-40 x 5/16 Hex 20, 23, 26
3646	Washer, Lock 6	122204	Cap, Brush 16	151632	Screw, 6-40 x 3/8 Hex 6
3949	Spacer, .160" Thk 12	122205	Brush w/Spring 16	151637	Screw, 4-40 x 1/4 Fil 5, 6, 8, 9, 11, 12, 14, 18
5740	Screw, 2-56 x 1/4 Fil 20, 21	122206	Holder, Brush 16	151642	Screw, 6-40 x 3/4 Fil 17
6320	Screw, 6-32 Contact 18, 19	122208	Washer, Flat 16	151657	Screw, 6-40 x 1/4 Fil 17
6345	Nut, 6-32 Hex 16, 18, 19	122210	Armature, Motor 16	151658	Screw, 6-40 x 5/16 Fil 17
7002	Washer, Flat 5, 6, 7, 12, 13, 17, 18, 19, 26	122211	Washer, Pull 4, 16	151659	Screw, 6-40 x 1/2 Fil 12, 18, 19
8330	Washer, Flat 19	122220	Oiler, Ball 4, 16	151661	Screw, 6-40 x 1" Fil 17, 18, 20, 21
8449	Spacer, .094" Thk 12, 20, 23	122221	Stator 16, 27	151686	Screw, 4-40 x 3/8 Fil 5, 6, 8, 11, 19
36273	Washer, Flat 7	122229	Bolt, 8-32 x 4-11/16 Fil 4	151687	Screw, 4-40 x 7/16 Fil 9, 23
42823	Washer, Flat 19	122233	Capacitor Assembly 16, 27	151692	Screw, 6-40 x 3/16 Fil 5, 6, 19
61085	Washer, Lock 20, 21	122245	Capacitor, 43 to 48 Mfd 3, 5, 7, 8, 9, 14	151693	Screw, 6-40 x 9/16 Fil 19
71999	Spring, Motor Thrust 4, 16	122249	Switch, Thermosiotic 3, 5, 7, 8, 9, 14	151721	Screw, 6-40 x 3/4 Hex 9
73374	Spacer, .250" 20	122251	Stator, Motor 4	151732	Screw, 4-40 x 11/32 Fil 23
75645	Screw, #0 x 1/8 Drive 14	122252	Shield Assembly, End 4	151795	Motor, Synchronous 3, 4
75646	Screw, #0 x 3/16 Drive 27	122253	Shield Assembly, End 16	151920	Plate, Mounting 3, 5, 6
76099	Washer, Flat 21	123769	Fan, Motor 4	151922	Clamp 3, 5, 6, 8, 9, 11, 14
76461	Washer, Flat 19	125011	Washer, Flat 5, 6, 8, 9, 11, 14, 18, 19	151923	Relay, Motor Starting 3, 5, 7, 8, 9, 14
76834	Screw, 4-40 x 3/8 Flat 22, 24, 25	125143	Screw, 6-32 x 3/8 Flat 16	151924	Insulator, .031" Thk 3, 5, 9
77140	Nut, Lock 9/16 - 32 Hex 24, 25	125082	Washer, Flat 19	151925	Clamp 3, 5, 8, 9, 11, 14
82392	Shim, .004" Thk 19	128874	Rotor, Motor 4	151926	Nut, 4-40 Spl 5, 6, 8, 11
82474	Terminal 3, 6, 7, 14	139697	Screw, 4-40 x 9/32 Fil 22, 27	151927	Cable w/Terminals 3, 6
86736	Plate, Clamping 19	142589	Bracket w/Cradle, Motor 3, 11	151939	Grommet, Rubber 6
87334	Washer, Insulating 5, 6, 8, 9, 11	146997	Cap, Bushing 12	152034	Bracket, Resistor 21
90560	Washer, Flat 19	150040	Screw, 6-40 x 5/8 Fil 4, 13	152035	Plug 21, 22, 24, 25, 27
90787	Screw, 4-40 x 3/8 Hex 13	150089	Screw, 4-40 x 1/2 Fil 14	152037	Cover 21
91228	Strap, 2-1/2" Braided 5, 15	150701	Motor, 115V AC Series 15, 16	152039	Container 15, 21
91229	Strap, 2" Braided 5	150845	Governor Assembly 1, 18	152040	Lid 15, 21
91837	Washer, Insulating 16	150846	Halder Assembly, Left Brush 17	152044	Cover 21, 22, 24, 25, 27
92260	Washer, Lock 16	150847	Halder Assembly, Right Brush 17	152046	Bracket w/Cradle, Motor 15, 21, 22, 24, 25, 27
93118	Washer, Lock 19	150849	Washer, Insulating 18, 19	152054	Resistor, 250 Ohm 20, 21
93984	Washer, Lock 12	150850	Insulator, .031" Thk 18, 19	152058	Separator 21
96258R	Jumper, 3" Red 20, 21	150856	Arm, Contact 18, 19	152059	Cable w/Terminals 15
96262R	Jumper, 4" Red 3	150857	Clamp 18, 19	152067	Nipple 15, 21, 22, 27
96264R	Jumper, 5" Red 3	150858	Bracket, Contact 18, 19	152078	Spring, Separator 21
96268R	Jumper, 7" Red 20, 21	150859	Bracket, Mounting 18, 19	152297	Washer, Bearing 4
96274R	Jumper, 10" Red 3	150865	Screw, 4-40 Clamping 18	152426	Nut, 6-40 Hex Self-Locking 12
98642	Washer, Lock 16	150866	Clamp 18	152459	Bracket, Mounting 20, 21
98712	Screw, 4-40 x 1/4 Flat 18	150868	Bushing, Insulating 18, 19	152495	Bushing 18, 19
98718	Washer, Flat 6	150869	Spring 18	152893	Screw, 4-40 x 1/4 Hex 12
100743	Clamp, Cable 20, 23	150872	Stud 18	153030	Mount, Vibration 4, 10, 16
102092	Screw, 6-40 x 1-17/32 Rd 23	150873	Collar 9, 17	153031	Bushing, Lead 16
102203	Bushing 9	150877	Bracket, Guide 18	153049	Washer, Insulating 4
104752	Washer, Flat 7, 14	150879	Cover, Governor 18	153101	Grommet, Rubber 16
104807	Washer, Flat 19	150880	Spring, Governor Brush 17		
107398	Terminal 5, 15	150881	Spring, Governor Brush 17		
110434	Screw, 4-40 x 3/16 Fil 7, 14	150882	Brush, Contact 17		
		150884	Mounting, Brush 17		
		150885	Plate, Brush 17		
		150886	Plate, Clamp 17		
		150976	Bracket w/Cradle, Motor 5, 15, 20		

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Part Number	Description and Page Number	Part Number	Description and Page Number	Part Number	Description and Page Number
153102	Screw, Set 8-32 16	162360	Fuse, SL-BL .8 Amp 12	176948	Bracket w/Cradle, Motor 3, 9
153103	Screw, 4-40 Self-Tapping 16	162464	Stator, Motor 10	178500	Motor, AC Synchronous 3, 4
153114	Jumper, 8-1/2" Black 16	162466	Shield, Rear End 10	179010	Bracket, Relay 11
153342	Screw, 6-40 x 15/16 Hex 19	162467	Shield, Front End 10	179016	Cable w/Terminal 3
153535	Screw, 6-40 Shoulder 19	162469	Washer, Spring 10	179100	Motor, 115V AC Series 15, 16
153536	Gear Assembly 19	162482	Bolt, 6-32 x 3-1/2 Fil 10	179101	Shield Assembly, End 16
153839	Screw, 6-40 x 5/8 Hex 12	162684	Jumper, 2-3/4" White 15	179102	Plate, Mounting 24
153841	Screw, 6-40 x 9/16 Hex 26	162685	Jumper, 4" White 15	179103	Resistor, 250 Ohm 15, 22, 24, 25
153885	Spring Assembly 19	162861	Screw, 6-40 x 1-7/16 Fil 20		
153962	Disk 19	162910	Insulator 3, 11	179104	Bracket, Clamp 24
153963	Disk 19	162911	Cable w/Terminals 3	179105	Container 15, 24
153964	Counterweight 19	163268	Jumper, 6-1/2" White 15	179106	Lid w/Insulator 15, 24
153965	Bracket 19	163269	Jumper, 2" White 15	179190	Motor, 48V DC Series 15, 16
153966	Gear Assembly 19	163272	Motor, 115V AC Series 15, 16	179282	Nipple 15, 24
153967	Gear, 28 T 19	163273	Shield Assembly, End 16	179283	Cable w/Terminals 15
153968	Gear Assembly 19	163799	Bracket 12	179420	Container 15, 22
153976	Gear, 32 T 19	164479	Terminal 15	179421	Capacitor, 1 MFD 15, 22
153977	Worm 19	164603	Insulator 3, 8	179422	Suppressor, Noise 15, 22
153979	Post 19	164612	Bracket w/Cradle, Motor 3, 8	179423	Plate w/Bracket 22
154375	Backstop 18, 19	164756	Stator, Motor 16	179424	Lid w/Insulator 15, 22, 25, 27
154628	Governor Assembly 1, 19	164757	Armature, Motor 16	192226	Bracket, Capacitor Mounting 12
154674	Gear, 20 T 19	164758	Motor, 48V DC Series 15, 16	193181	Cable w/Terminals 3
154676	Disk Assembly 19	164890	Bearing, Ball 10	193236	Cable w/Terminals 3
154680	Bearing, Roller 19	164891	Shim, .032" Thk 10	193781	Switch, Thermostatic 3, 5, 8, 9
154684	Insulator 19	164892	Shim, .018" Thk 10	194057	Container 15, 25
154685	Fan Assembly 19	164893	Collar, Thrust 10	194058	Clamp 25
154693	Bracket 19	164894	Shim, .018" Thk 10	194059	Bracket 25
155585	Bearing, Ball 19	164962	Bracket 11, 12	194060	Motor, 115V AC Series 15, 16
155593	Bearing, Ball 19	170631	Holder, Fuse 12	194062	Shield Assembly, End 16
155594	Screw, 4-40 Shoulder 19	170764	Motor, AC Synchronous 3, 4	194063	Nipple 15, 25
155595	Motor, Synchronous 3, 4	171702	Clamp 3, 12	194897	Bracket w/Cradle, Motor 3, 9
155600	Bracket 19	171703	Clamp 3, 12	194899	Cable w/Terminals 3
155601	Plate, Gear Train 19	171704	Insulator 3, 12	194924	Motor, 115V AC Synchronous 3, 10
155602	Gear, 28 T 19	171749	Bracket, w/Cradle, Motor 3, 12	195143	Capacitor, 7 MFD 12
155603	Gear, 28 T 19	171810	Cable w/Terminals 3	195172	Capacitor, Motor Start 64 to 77 MFD 3, 12
155605	Bearing, Ball 19	172780	Bracket, Contact Mounting 13	195173	Relay 3, 12
155611	Ring, Bearing 19	172795	Bracket w/Cradle, Motor 3, 13	195178	Cable w/Terminals 3
155613	Gear, 28 T 19	172797	Fan 13, 26	195214	Stator 10
155752	Sleeve, 5/64 ID x 1/2 Lg Insulating 7	172799	Switch, Centrifugal 13	195525	Plate, Identification 14
155753	Sleeve, 1/8 ID x 1/2" Lg Insulating 26	172801	Cover, Switch 13	196794	Insulator 3, 8
156875	Screw, 6-40 x 5/32 Fil 7	172804	Plate, Adapter 13	196795	Block, Mounting 8
156936	Screw, 1/4-32 x 5/16 Hex 9	172814	Cable w/Terminals 13	196830	Motor, Synchronous 3, 4
157987	Washer, Insulating 19	172902	Nut, 6-32 Hex 10	196831	Stator, Motor 4
159739	Motor, Synchronous 3, 4	172990	Plate 23	196839	Bracket w/Cradle, Motor 3, 8
160298	Plate, Mounting 5	173003	Capacitor, 1 MFD 15, 23	198691	Plate w/Resistor Assembly 22, 27, 28
160299	Capacitor, 226 MFD 3, 5	173004	Resistor, 100 Ohm 15, 22, 23	198692	Container Assembly 22, 27, 28
160300	Clamp 5	173021	Contact, Spring 13	198693	Modification Kit 27
160301	Plate, Insulating 5	173425	Relay, Motor Starting 3, 11, 12	199718	Motor, 115V AC 50 Hertz Synchronous 3, 4
160302	Plate, Nut 3, 5, 11	173518	Modification Kit 2	199719	Rotor, Motor 4
160303	Relay 3, 5	173687	Fan, Motor 5	199720	Stator, Motor 4
160304	Switch, Thermostatic 3, 5	173751	Bracket w/Cradle, Motor 15, 23	199721	Bolt, 8-32 x 5-13/16 Fil 4
160305	Rotor, Motor 4	173753	Plate 23	304537	Bracket 3, 6
160306	Stator, Motor 4	173974	Screw, 10-32 x 5/16 Hex 24	304538	Bracket 3, 6
161099	Cable w/Terminals 3	174471	Switch, Thermostatic 3, 11, 12	304739	Modification Kit 27
161575	Armature, Motor 16	174543	Switch 26	304792	Relay 3, 6
161576	Stator, Motor 16, 27	174544	Bracket 26	304793	Capacitor, 161 to 193 MFD 3, 6
161577	Motor, 115V AC Series 15, 16	174545	Rotor 26	305658	Spring 3, 7
161578	Suppressor, Noise 15, 21, 22, 24, 25	174546	Modification Kit 1, 26	305659	Insulator 3, 7
161579	Capacitor, .5 MFD 15, 20, 21, 22, 24, 25	174551	Modification Kit 1, 26	305660	Plate, Mounting 3, 7
161580	Resistor, 500 Ohm 15, 20, 21	174553	Rotor 26	305661	Bracket w/Cradle, Motor 3, 7
161984	Motor, AC Synchronous 3, 10	174555	Bracket, Switch 26	306063	Motor, 230V AC Synchronous 3, 4
162072	Capacitor, 88 to 108 MFD 3, 11, 12	174556	Cable w/Terminals 26	306320	Cable Assembly 3
162196	Insulator 3, 11	175198	Modification Kit 1, 26	306708	Modification Kit 27
		176064	Plate, Nut 12		
		176111	Duct 12		
		176137	Jumper, 9-1/4" Black 3		
		176947	Plate w/Pads 3, 9		

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Part Number	Description and Page Number	Part Number	Description and Page Number	Part Number	Description and Page Number
306709	Modification Kit 27	310341	Insulator 3, 9	312979	Bracket w/Cradle, Motor 3, 14
307281	Switch, Thermostatic 3, 6	312530	Washer, Textolite 22, 27, 28	320269	Switch, Thermostatic 3, 5
309431	Plate, Code 27	312531	Washer, Fiber 22, 27, 28	320270	Capacitor, 15 to 18 MFD 3, 5
309432	Plate, Code 27, 28	312573	Jumper, 6" Red 3, 6	320271	Relay, Motor Starting 3, 5
309433	Plate, Code 27	312574	Jumper, 6" Black 3, 6	320272	Stator 4
310295	Motor, Synchronous 3, 10	312971	Shield 14	330564	Rotor 10
		312977	Insulator 3, 14	330565	Rotor 10