1/60 HORSEPOWER DRIVE MOTOR

KS-5196

REQUIREMENTS AND ADJUSTING PROCEDURES

PARAGRAPH SUBJECT

SECTION 1

SECTION 2

SECTION 3

SECTION 1

1. GENERAL

1.1 This specification covers the installation and maintenance requirements for the 1/60 horse power direct current, shunt wound, drive motor, first developed for use with the #155 type and similar interrupters and distributors and equipped with a center contact speed regulator.

1.2 Section 2 of this specification gives the requirements for both operating tests and the inspection of mechanical adjustments which shall be used to determine whether the motor is in proper condition for service and delivery to the customer. These are called "Installation Test Requirements".

1.3 Section 3 of this specification is intended for maintenance purposes. It covers the operating and mechanical requirements which must be met in readjusting a 1/60 H.P. motor, which fails to meet the test requirements. These are called "Maintenance Requirements". In addition to the maintenance requirements, section 3 also gives the approved methods of meeting these requirements.

1.4 The following drawings are attached to and form a part of this specification:

Fig. 1 Outline Dimensions of Motor.
Fig. 2 Schematic Diagram of Connections of Motor.
Fig. 3 Parts of 1/60 HP D.C. Motor.

1.5 The 1/60 horse power motor consists of a shunt wound D.C. motor the speed of which is governed by a centrifugal speed regulator. The general construction of the motor is shown in Fig. 1. One end of the shaft is extended for a coupling and the opposite end is equipped with a center contact speed regulator for controlling the speed of the motor as hereinafter described. Fig. 2 shows the motor connections. The motor speed regulator is of the center contact type which has superseded the ring type.

1.51 The Center Contact Regulator Consists of Two Elements as Follows:

1.511 A single platinum-iridium contact mounted on the inner end of an adjustable screw which is concentrically mounted on an insulating cover at the commutator end of the motor housing. The screw has an adjusting knob on its outside end, see fig. 1. No lock nut is required with the construction used. The adjusting screw has movement in an axial direction only, rotation of the screw being prevented by a small pin sliding in a key way, and is controlled by the adjusting knob. A coil spring is assembled under the head of the adjusting screw on the inside of the cover plate, which serves to push the adjusting screw and the contact thereon in the direction of the rotating contact as far as the position of the adjusting knob at the setting used will permit.

1.512 A single platinum-iridium contact centrally mounted on a spring which is assembled with weights on a retaining ring which in turn is assembled in a collector ring mounted on the motor shaft extension inside the regulator housing of the motor. The retaining ring is secured to the collector ring by means of two round headed machine screws.

1.513 In normal operation, the contact between the fixed contact and rotating contact is rapidly made and broken maintaining the speed very closely. As the speed becomes high, the contacts close, short-circuiting the regulator resistance in series with the motor field, thus strengthening the field and slowing the motor down. When the speed becomes low, the contacts open and the regulator resistance is again inserted in the circuit, thus weakening the motor field and speeding the motor up.

1.52 The Bearings are of the ball bearing type and consist of three parts as follows:

1. The inner ring or ball race on the shaft.

2. The ball cage containing balls.

3. The outer ring or ball race which in both ends of the motor has a sliding fit in the bearing housing. In the commutator end the outer ring bears against a felt washer retaining ring which in turn bears against a shoulder turned in the bearing chamber, and in the coupling end bears against a keeper and a coil spring in the bearing chamber which serves to take up any end play. A steel plate with a copper and a felt washer is drawn up against each bearing housing by means of 4 screws through holes in the end shields, to make the housing tight and to prevent the lubricant escaping from the bearings to the inside of the machine.

1.53 Do not unpack the motor until ready to install. When unpacking, see that the motor is not damaged by the tools used for unpacking. See that none of the parts are missing or broken. Blow out any dust or packing material which may have sifted through the motor end shield openings.

SECTION 2

2. INSTALLATION TEST REQUIREMENTS

2.1 General

2.11 The following installation adjustments should always be made in the sequence presented in this specification to prevent interference of one adjustment with another.

2.12 Keep a record of the dates on which the machine is lubricated (see paragraph 3.22) and turn this record over to the Telephone Company when the machine is turned over to them.

2.2 Starting Motor

2.21 See that the power service corresponds with that designated on the motor nameplate when motors are installed for the first time, when motors are received from the factory or repair shop, and when

replacing 1/60 H.P. motors in offices where these motors are used on different power services. Before starting the motor for the first time or after assembling after cleaning, see that the motor serial number and the number painted on the motor speed regulating rheostat or resistance if furnished by the machine manufacturer are the same, or if not furnished by the machine manufacturer check to see that the resistance connected across the leads R-1 and R-2 agrees with the value marked on the motor nameplate. The rheostat arm should be set on the white mark or if a resistance furnished by the machine manufacturer is used the two flexible leads which are not cut off should be connected to R-1 and R-2.

2.22 Turn the armature by hand and see that it rotates freely, and that no loose bolts, nuts or other objects have been left inside the frame.

2.23 Disconnect the regulator resistance leads marked R1 and R2, from the motor regulator resistance, and remove one of the motor commutator brushes. See that the motor line switch is open. Connect a battery and buzzer across the ends of the leads R1 and R2. If the regulator contacts are closed, the buzzer will sound. Turn the regulator adjusting knob until the regulator contacts just touch or just separate as indicated by the buzzer. Then turn the adjusting knob 3-1/2 revolutions in a clockwise direction. The setting is then approximately correct. The regulator resistance leads should then be connected to the regulator resistance and the motor brush replaced. A telephone receiver and battery may be used in place of the battery and buzzer mentioned above.

2.24 Start the motor by closing the motor line switch.

2.25 If the operation is satisfactory and the direction of rotation is counter clockwise facing the coupling end of the motor the speed should be checked and should be adjusted as outlined in paragraph 3.43 to 1760 r.p.m. or 1785 r.p.m. depending on the nameplate rating, for the average voltage of the voltage range given on the motor nameplate. On some motor applications the actual motor speed may be read from a direct connected shaft. On other applications it

will be necessary to read the speed from shafts operating through reduction gears, applying the known ratio of speed reduction in order to obtain the actual motor speed.

2.3 Stopping Motor

2.31 The motor is stopped by opening the line switch.

2.4 Operating Requirements

2.41 The insulation resistance between the motor windings and the frame shall be equal to or greater than one Megohm.

2.42 The motor speed regulator should hold the speed within the limits of 1800 r.p.m. ± 2%, or 1775 r.p.m. ± 2% depending on its speed rating, without change of adjustments or change in the amount of the regulator resistance from the factory setting described in paragraph 2.21, for any conditions of voltage (within the limits specified on the motor nameplate) and temperature (hot or cold) when coupled to its associated drive.

SECTION 3

3. MAINTENANCE REQUIREMENTS

3.1 General

3.11 Routine maintenance adjustments should always be made in the sequence presented in this specification to prevent interference of one adjustment with another.

3.2 Cleaning and Lubrication

3.21 Cleaning

3.211 Every Week

Blow the dust from the windings of the motor. This should be done when the machine is not running and should be done more often if local conditions require it.

Wipe the exterior of motor with cheese cloth. Waste must not be used for wiping.

3.212 **Every Month**

Remove the cover plate from the speed regulator housing and force air into the housing to remove the dust. Do not change the setting of the speed regulator adjusting knob while the cover is removed and be sure when replacing the cover that the contact strip on the inside of the cover plate makes contact with the stud in the housing. Clean the motor commutator by removing the brushes and directing air through one of the brush holders, at the same time turning the armature slowly by hand. Clean brushes carefully by wiping with a cotton cloth moistened with petroleum spirits. Be careful to replace brushes in original brush holders and with same side up as before to maintain correct brush fit. Inspect the commutator and speed regulator brushes for wear. Inspect the speed regulator contacts for wear. The regulator contacts are self cleaning and require no attention. Do not sandpaper or file the contacts at any time even if they become rough or pitted.

3.213 **Every 18 Months**

Disassemble the motor and thoroughly clean as covered in paragraph 3.224. Replace the felt bearing washers. If the commutator needs refacing it should be done at this time thru the established routines. If the commutator does not require refacing but needs cleaning, this should be done with a cotton cloth moistened with petroleum spirits.

3.22 Lubrication

3.221 Remove the grease plugs with a screw driver and insert a KS-5000 grease gun in the grease plug hole in the top of each bearing housing. The lubricant used should be "Oneida" grease. Give the handle of the grease gun

one third of a turn, forcing the lubricant into the grease plug hole. The correct flow of grease from the gun can be assured only if the grease is packed in the gun without air pockets. The bearings are packed with grease when shipped and should be lubricated every six months after having been put into service.

3.222 See that no dirt gets into the bearings and that the screw plugs are replaced in the holes after lubricating the bearings.

3.223 Do not place any lubricant on the motor commutator or speed regulator collector ring surfaces.

3.224 Each motor should be taken from service periodically by regular routine, disassembled in accordance with paragraph 3.51, and the end shields, bearings and bearing housings thoroughly cleaned with petroleum spirits and repacked with fresh lubricant, as specified in paragraph 3.221. This cleaning routine should be arranged so that all of the motors in the office will be gone over once in every 18 months and should include cleaning the accumulated dirt from the windings and the inside of the frame.

3.3 Brushes

3.31 The brushes provided for the motor are carefully fitted before the motor is shipped and should give service for a considerable period without special attention. If, however, trouble is experienced from sparking at the commutator remove the caps holding the brushes in place and make sure that the brushes do not bind in the brush holders. If the brushes are found to be worn down to a minimum overall length of 1/2" replace them with new brushes. Keep an extra set of speed regulator and motor commutator brushes on hand for replacement purposes. Brushes should be ordered with faces curved to fit the curve of the commutator or collector ring. It is advisable to wear the new brushes in for several days with the motor running at no load in order to get a good fit.

3.4 Motor Speed Regulator Adjustment

3.41 With the center contact speed regulator, it is necessary, for most satisfactory operation, that the direction of the current through the contacts be such as to keep the fixed contact positive with respect to the rotating contact. The fixed contact will have the proper polarity if the motor lead tagged "M+" is connected to the positive side of the line, and the lead tagged "M-" is connected to the negative side of the line.

3.42 When it becomes necessary to change the speed adjustment, turn the adjusting knob in a counter-clockwise direction to lower the speed or in a clockwise direction to increase the speed. It should be noted that the directions in which the adjusting knob is turned are just opposite from those used for adjusting the old style ring type speed regulator formerly supplied on small DC motors. In making adjustments the knob should be turned only 10 or 15 degrees at a time and the speed checked before proceeding further.

3.43 The normal wear of the contacts causes a gradual increase in the speed of the motor. When the speed reaches 1836 r.p.m. at the maximum voltage obtained during the day within the specified voltage range, minimum load, hot, in the case of the 1800 r.p.m. motor, or reaches 1811 r.p.m. under these conditions in the case of the 1775 r.p.m. motor, the speed regulator should be adjusted under these conditions to 1785 r.p.m. or 1760 r.p.m. respectively.

3.44 The speed regulator contact points will eventually wear down. When either contact is worn down to approximately 1/32" in height a new contact should be ordered for eventual replacement, giving the motor model number, part letter, and complete rating of the machine as given on the motor nameplate, see Fig. 3 for complete instructions. Replacements for the fixed contact are furnished mounted on a small screw which screws into the adjusting screw on the cover plate (see part AM. Fig. 3). When installing a fixed contact set the screw up tight but not tight enough to strip the threads or twist off the hexagon screw head.

Replacements for the rotating contact consist of a contact and two weights riveted to a spring which is secured to a retaining ring (see part AN, Fig.3). A complete cover plate assembly, part AK, Fig. 3, or a complete rotating element, part AL, Fig. 3, may be ordered, if required, but should not ordinarily be necessary. After new contacts are installed adjust the regulator in accordance with paragraphs 2.23 and 2.25.

3.5 Disassembling and Assembling Motor

3.51 In disassembling the motor, use socket wrench W.E. Code #45 and a screw driver. Before removing the motor end shield and disassembling the motor, it is necessary to remove the two acorn nuts on the coupling end, the speed regulator, the motor and regulator brushes, and the four screws at each end which hold the steel and copper bearing washers in place. In removing the speed regulator, do not change the adjustment. Remove the three regulator cover screws, take off the insulating cover, remove the screw plug on the side of the regulator housing, loosen the set screw in the collector ring hub four or five turns and slide the collector ring off the shaft. Note the position of the collector ring on the shaft before removing, so as to replace in the same position against the shoulder on the shaft extension and with the hole in the shaft, if provided, registering with the screw hole in the collector ring hub.

3.52 The motor bearing construction in order from the commutator end shield in to the commutator consists of a felt washer, felt washer retaining ring, outer ball race, balls in their cage mounted on the inner ball race, copper washer, felt washer and steel washer. The bearing construction in order from the coupling end shield in to the motor rotor consists of a felt washer, felt washer retaining ring, coil spring, spring keeper outer ball race, balls in their cage mounted on the inner ball race, copper washer, felt washer and steel washer.

3.53 In assembling the motor, to facilitate lining up the four tapped holes in the steel washer and the four holes in the copper washer, with the four holes in

the end shield at each end, for the purpose of replacing the four clamping screws, use should be made of the W.E. Code #309 tool which has been provided for the purpose. This tool is a threaded stud which is introduced through one of the holes in the copper washer and screwed into one of the holes in the steel washer. By introducing this stud into one of the holes of the end shield, the four holes in each of the three associated parts are brought into line. Two of the screws on opposite sides are then put in place and set nearly tight, after which the stud is removed, and the remaining screws replaced. All screws should then be securely tightened. In replacing the end shield on the coupling end, be sure that the grease plug is toward the top. In assembling the motor be sure to replace the spring and keeper arrangement in the bearing housing at the coupling end to take up the end play.

3.6 General Troubles

3.61 If trouble is experienced in operation, look over all nuts and bolts to see that they are tight and make sure that the rotating element is free to turn in its bearings; that is, that the bearings themselves are in good condition and there is no mechanical obstruction to prevent rotation.

3.62 Hot bearings may be due to worn out or dirty grease, not enough grease or damaged bearings. Remove the end shield and inspect the balls and inner and outer race surfaces. Roughness may be due to grit in the lubricant.

3.63 Electrical Trouble should be checked for the following:

3.631 That the voltage stamped on the motor nameplate is actually available at the motor switch and at the motor terminals.

3.632 That the fuses are intact.

3.633 That all connections and contacts are properly made in the different circuits. Checking these points first will frequently locate the cause outside the motor when otherwise much time might be spent searching for it inside the motor.

3.64 Hunting may be encountered unless the following conditions are maintained:

3.641 At least 3/4 of the bearing surface of the motor commutator brushes worn in.

3.642 Commutator and collector rings clean. A dark chestnut brown color for a motor commutator indicates that it is in an ideal working condition.

3.643 The speed regulator housing and the moving parts of the regulator free from dust and dirt.

3.644 The rheostat arm in the proper positions as marked by a white line or the correct resistance value used if a rheostat is not furnished.

3.645 All connections tight.

3.646 Field yoke in proper position. If the field yoke is removed from the motor frame for any reason, a scribe mark should be made on the yoke and motor frame before removal to ensure replacing the yoke in exactly the same position. Be sure to tighten set screw after yoke is replaced.

3.65 If any parts of the motor are found to be defective so that the faults cannot be remedied by any of the means recommended in this specification, a report should be sent thru the regular channels for reporting complaints, giving in detail the nature of the trouble and complete nameplate data including serial and model numbers of the motor affected.

3.7 Spare Parts

3.71 It is not expected that any spare parts will be required for this set with the exception of the felt washers, the motor brushes and the speed regulator elements mentioned in paragraphs 1.52, 3.31 and 3.44 respectively. When ordering parts, be sure to give the model number and complete rating of the machine as given on the motor nameplate, reference number and name of part (see Fig.3) ordering direct from the nearest office of the Western Electric Company, Inc.

ATTACHED:

Fig. 1, 2, and 3

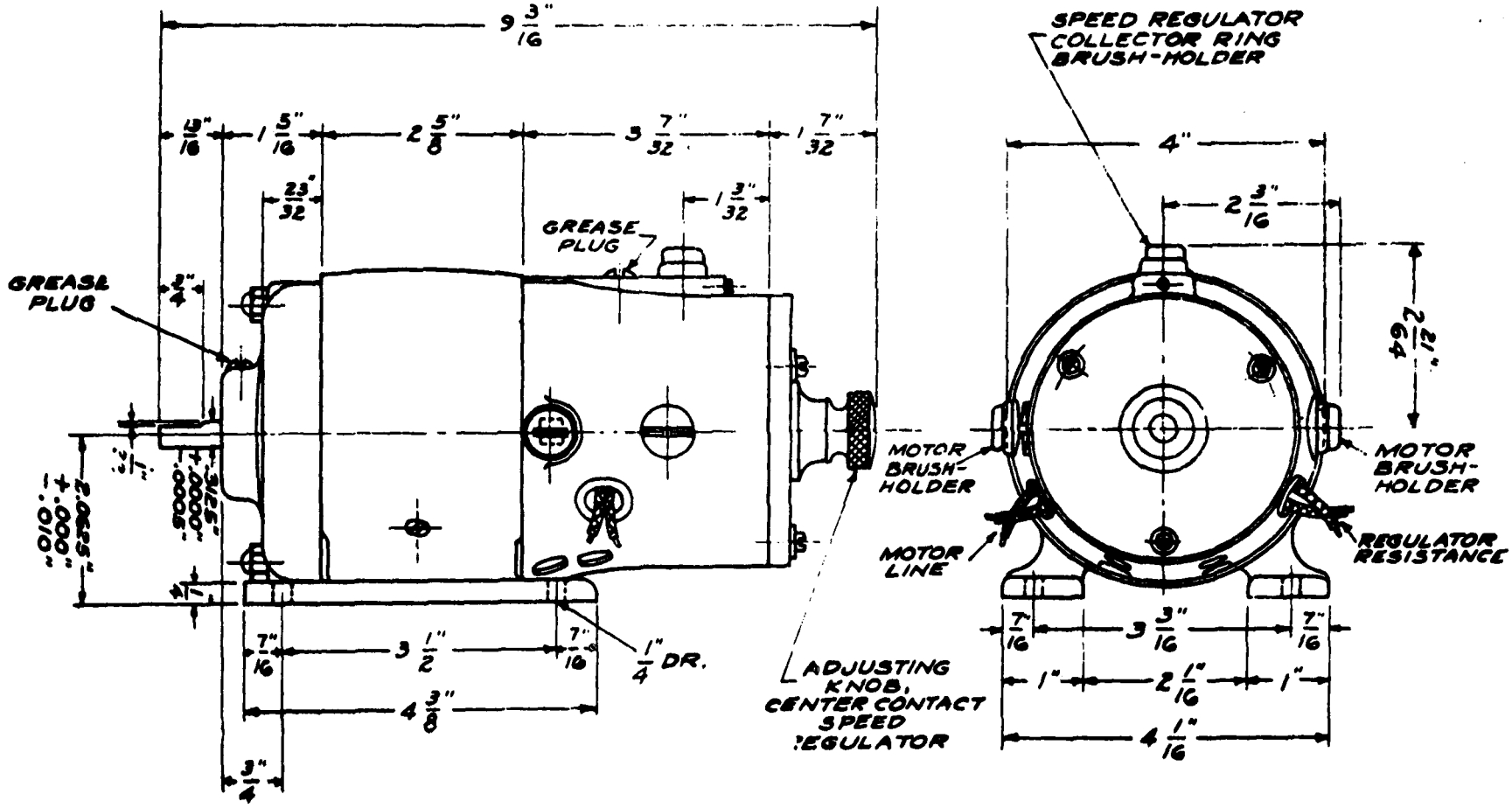
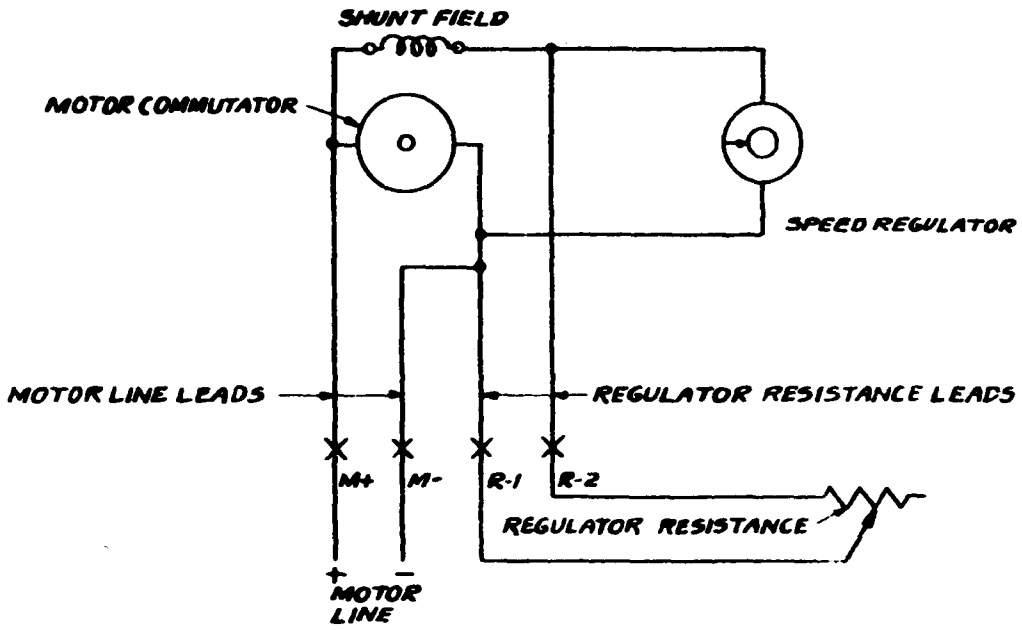


FIG. 1

OUTLINE DIMENSIONS OF
1/60 H.P. D.C. SHUNT MOTOR

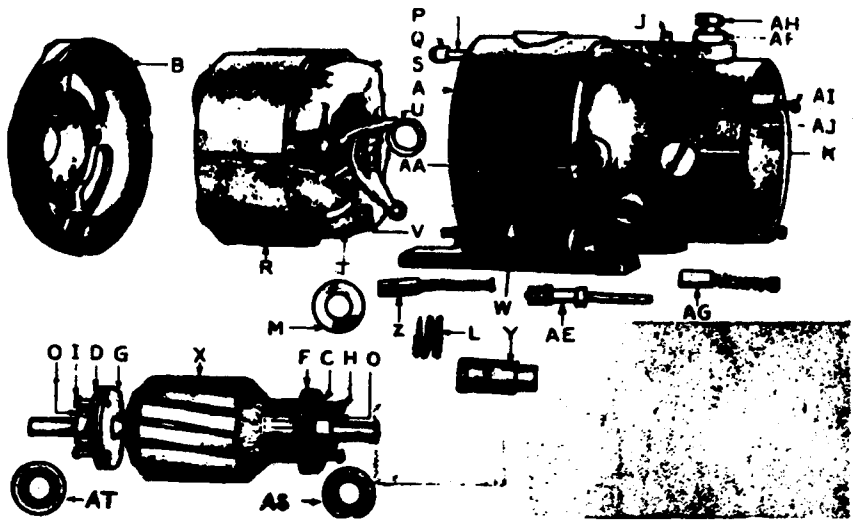


NOTES:

1. X DESIGNATES LEADS WHICH ARE BROUGHT OUT OF THE MOTOR.
2. DESIGNATIONS "M+" "M-" R-1 AND R-2 CORRESPOND TO TAG MARKINGS ON THE MOTOR LEADS.

SCHEMATIC DIAGRAM OF CONNECTIONS FOR 1/60 HORSEPOWER D.C MOTOR

FIG. 2



REFERENCE LETTER	NAME OF PART	REFERENCE LETTER	NAME OF PART
A	MOTOR FRAME	AE	SPEED REGULATOR CONTACT POST WITH CONTACT PIN, INSULATING WASHER AND BUSHINGS AND HEXAGON NUTS
B	END SHIELD COUPLING END	AF	INSULATED SPEED REGULATOR BRUSH HOLDER
C	COPPER WASHER FOR "F"	AG	SPEED REGULATOR BRUSH WITH SPRING, PIGTAIL & TERMINAL
D	COPPER WASHER FOR "G"	AH	SPEED REGULATOR BRUSH HOLDER CAP
E	*FELT WASHER FOR "F" AND "G"	AI	SCREW FOR HOLDING SPEED REGULATOR COVER PLATE
F	BEARING RETAINING RING COMMUTATOR END	AJ	WASHER FOR "AI"
G	BEARING RETAINING RING COUPLING END	AK	*COVER PLATE ASSEMBLY FOR CENTER CONTACT SPEED REGULATOR COMPLETE WITH FIXED CONTACT, SPRING, SCREW AND ADJUSTING KNOB
H	SCREW FOR HOLDING "F" TO "A"	AL	*ROTATING ELEMENT FOR CENTER CONTACT SPEED REGULATOR COMPLETE WITH COLLECTOR RING, WEIGHTS AND CONTACT
I	SCREW FOR HOLDING "G" TO "B"	AM	*FIXED CONTACT FOR CENTER CONTACT SPEED REGULATOR
J	GREASE PLUG	AN	*ROTATING CONTACT FOR CENTER CONTACT SPEED REGULATOR WITH SPRING, WEIGHTS AND MOUNTING RING
K	SCREW CAP FOR "A"	AO	*FIELD RHEOSTAT
L	THRUST SPRING FOR BALL BEARING	AP	*FIELD RESISTANCE TUBE
M	SPRING KEEPER FOR "L"	AR	*FELT WASHER FOR "AS" AND "AT"
O	BALL BEARING	AS	FELT WASHER RETAINING RING, COMMUTATOR END
P	TIE ROD	AT	FELT WASHER RETAINING RING, COUPLING END
Q	ACORN NUT FOR "P"		
R	FIELD CORE		
S	FIELD COIL, UPPER, WITH LEAD AND TERMINAL		
T	FIELD COIL, LOWER, WITH LEAD AND TERMINAL		
U	TERMINAL FOR MOTOR BRUSH HOLDER LEAD		
V	SET OF INSULATION FOR ONE FIELD COIL		
W	SET SCREW FOR "R"		
X	ARMATURE WITH SHAFT, WINDING AND COMMUTATOR		
Y	INSULATED MOTOR BRUSH HOLDER		
Z	MOTOR BRUSH WITH SPRING, PIGTAIL AND TERMINAL		
AA	MOTOR BRUSH HOLDER CAP		

*NOT SHOWN IN ILLUSTRATION

IN ORDERING GIVE REFERENCE LETTER AND NAME OF PART, NAME, RATING AND MODEL NUMBER OR MOTOR. IN ORDERING A FIELD RHEOSTAT PART "AO" OR FIELD RESISTANCE TUBE PART "AP", GIVE THE SERIAL NUMBER OF THE MOTOR IN ADDITION TO THE ABOVE INFORMATION

PARTS OF 1/60 HP DC MOTOR FIG. 3