TELETYPEWRITER— MOTOR GENERATOR SETS 110-VOLT D-C SUPPLY

1. GENERAL

1.01 This section describes motor-generator sets suitable for supplying 110-volt d-c to teletypewriter apparatus and gives information regarding their installation and maintenance. It includes information on some old machines suitable for use with printing telegraph apparatus. The sets included are listed in the table following.

1.02 In connection with maintenance of motor-generator sets in service, before proceeding with any work on the machine, obtain the necessary authority for its release unless the work is done out of hours. In case it is necessary to interrupt service during maintenance, authority should also be obtained for the release of the circuit.

Caution: Do not touch at the same time or otherwise short circuit or ground line terminals or parts which are at different potentials.

1.03 The following is a list of motor-generator sets.

KS	Teletype Cat. No. Machine	Generator Amps.	Generator Watts	Motor Frequency	Motor Volts	Motor Phase	
5118	71510M	.27	30	60	110	1	Mfr. Disc.
	71508M	.27	30	50	110	1	
	71522M	.27	30	25	110	1	
5380		.27	30	60	110	1	Mfr. Disc.
		.27	30	50	110	1	
		.27	30	25	110	1	
5380-01	71509M	.27	30	60	110	1	
	71507M	.27	30	50	110	1	
	71521M	.27	30	25	110	1	
*5190		3.0	330	60	230	2 or 3	Mfr. Disc.
		3.0	330	50	230	3	
		3.0	330	25	230	3	
		3.0	330	60	220/110	1	
		3.0	330	—	230	D-C	
*5190-01		3.0	330	60	230	2 or 3	Mfr. Disc.
		3.0	330	60	220/110	1	
		3.0	330	60	200	3	
		3.0	330	—	230	D-C	
*5190-02		3.0	330	60	230	2 or 3	
		‡3.0	330	60	220/110	1	
		3.0	330	60	200	3	
		3.0	330	60	230	D-C	
5469	78371M	1.14	125	60	110	1	Mfr. Disc.
	80960M	.99	100	50	110	1	
	80961M	.99	100	25	110	1	
†‡5469-01	87895M	1.14	125	60	110	1	
	87896M	.99	100	50	110	1	
	87897M	.99	100	25	110	1	

Notes: All generators rated 110 volts d-c.

*Machines marked with an asterisk (*) are sometimes known as Ft. Wayne Type.

†Machines marked with a dagger (†) are provided with radio interference filters.

‡Machines marked with a double dagger (‡) are capacitor type start.

2. TOOLS, GAUGES AND MATERIALS

(Equivalents may be substituted if desired)

2.01 No maintenance tools other than those included in the regular tool list as given in P30.301, or cleaning tools and materials as listed in P30.010 and lubricants as listed in P30.011 will usually be required.

2.02 Should it be found desirable to measure the power service or the output of the generator it will be necessary to secure additional meters. A Weston Model 528 a-c voltmeter, scale 0-150-300 volts for measuring the power service voltage or a Weston Model 280 triple range d-c volt-milliampere meter, scale 150-15-1.5 volts and 15-1.5-.15 amperes for measuring generator output are suggested.

3. DESCRIPTION

3.01 Motor-generator sets are two-unit, four bearing direct connected sets consisting of a motor driving a d-c generator. The motors are either alternating current or direct current depending upon the source of power at individual installation.

3.02 Alternating current motors may be single, 2 or 3 phase, 110, 200 or 230 volt, 60, 50 or 25 cycle motors depending upon the local power supply. All a-c motors are designed to start when connected directly across full line voltage. Some single phase motors are of the resistance split phase, induction type with a centrifugal switching device which opens the starting winding circuit when the rotor approaches full load speed. (KS-5380 motors are of this type.) Other single phase motors are of the capacitor split phase induction type with a similar centrifugal switch to open the starting winding circuit as the rotor approaches full load speed. (KS-5190-02 and KS-5469-01 motors are of this type.)

3.03 Direct current motors have a separate wall mounted starter.

3.04 KS-5190 type sets include a control panel, the motor and generator with fuses and fuse blocks (generally of the cartridge type although in some instances Fusetrons have been substituted), a voltmeter for reading the generator voltage, and a rheostat for controlling the voltage.

3.05 Motors and generators except KS-5190 are provided with a flexible cord and polarized plug on motor and connector body on generator for making connection to the power service or other teletypewriter apparatus.

4. CONNECTIONS

4.01 The motor and generator shall be connected to the source of supply and to the teletypewriter in accordance with standard practices.

4.02 Typical wiring diagrams of motors and generators are shown below.

5. CLEANING

5.01 The cleaning of the teletypewriter motor-generator set should be confined ordinarily to those parts where appearance is a factor.

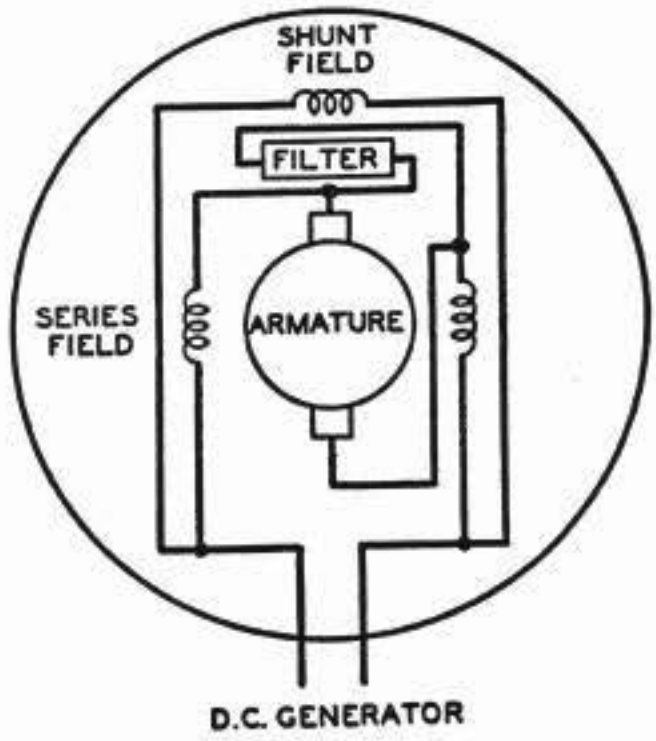

Fig. 1—Schematic Wiring—D-C Generator

Notes:

Filter is not provided in all cases.

Armature may be connected in middle or at end of series field.

5.02 The power should be disconnected during the cleaning process except as otherwise specified.

5.03 Care should be taken to protect the customer's furniture and rugs from oil or dirt resulting from the cleaning process. Any covers or other parts removed while cleaning should be set aside in some location where they are not likely to be damaged and where they will not inconvenience the customer's employees.

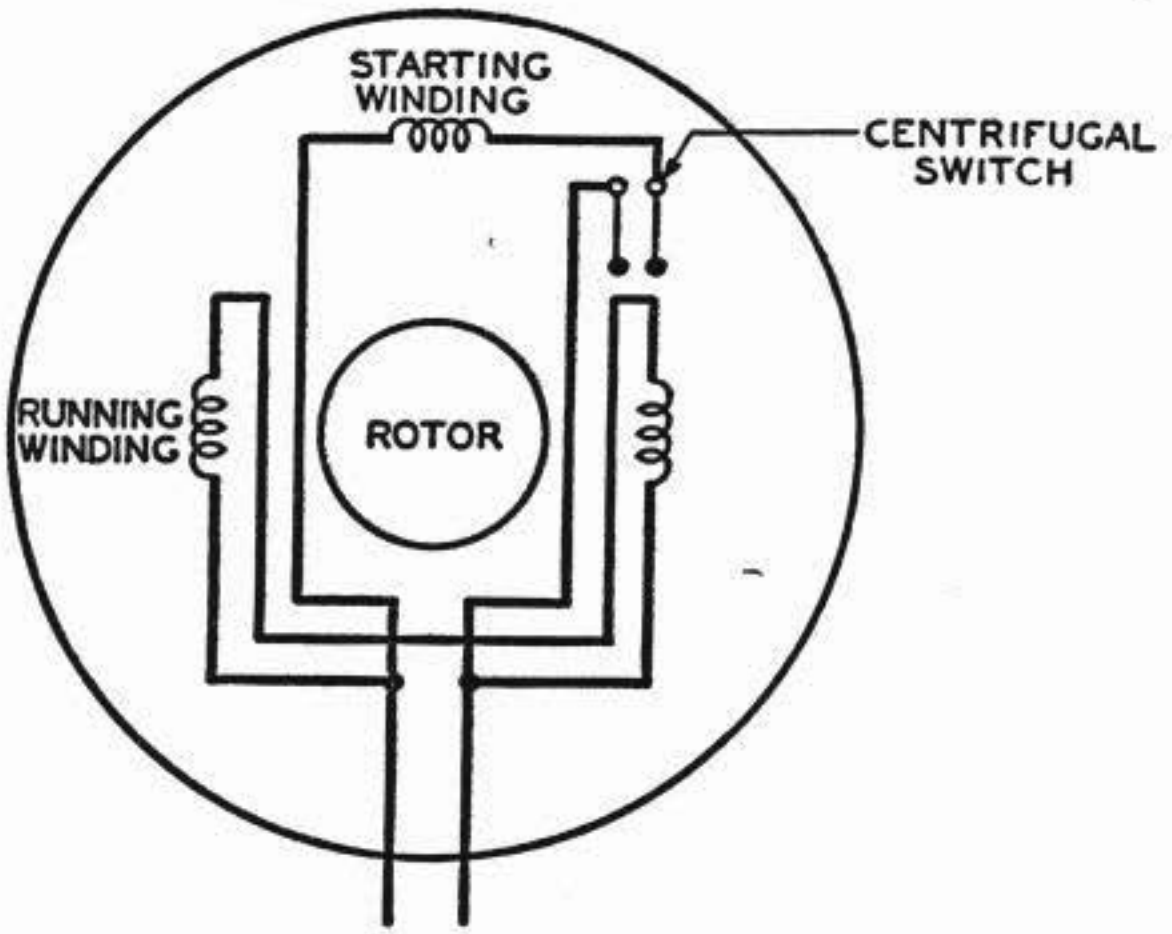

Fig. 2—Schematic Wiring—A-C Motor Resistance Type Starting

Notes:

Starting winding generally has either two or four coils in series.

Running winding generally has either two or four coils in series and in parallel with two or four other coils in series.

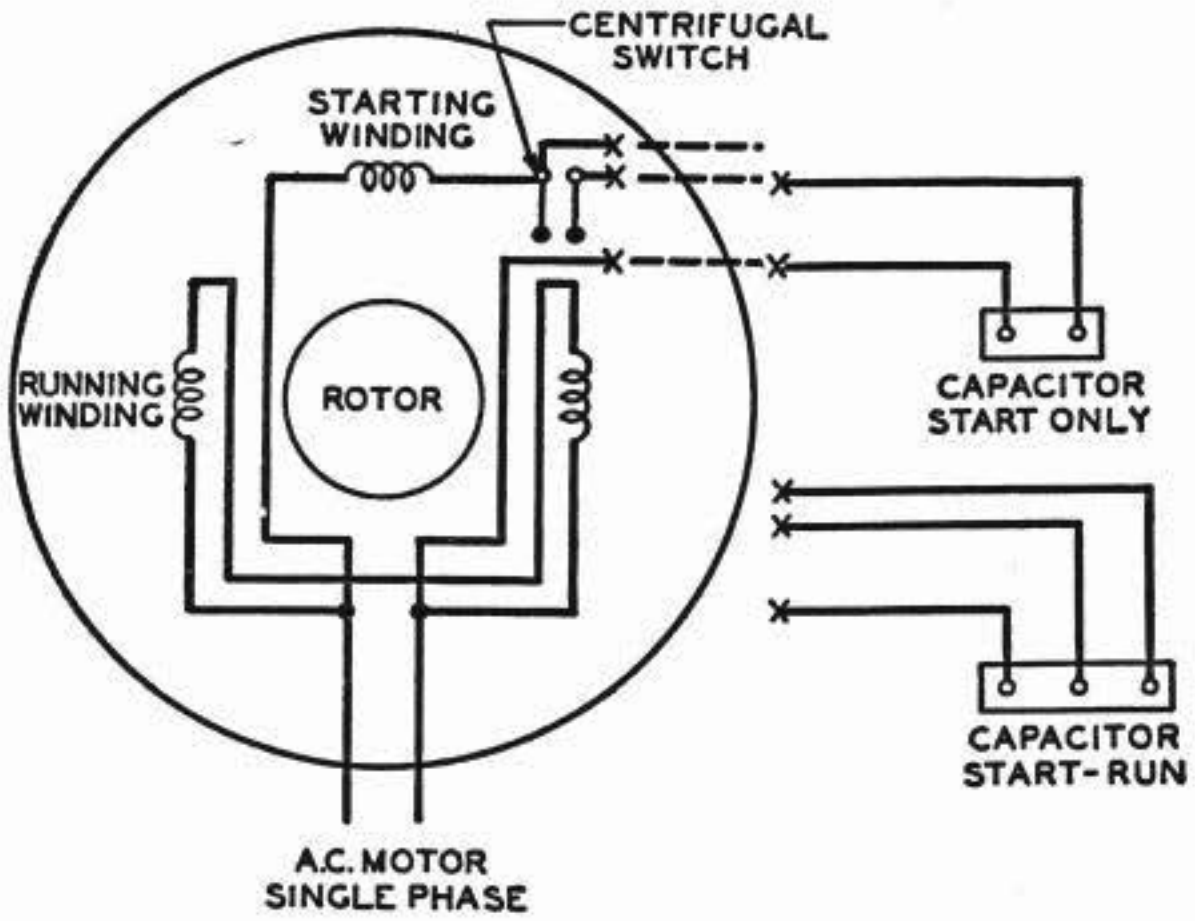

Fig. 3—Schematic Wiring—A-C Motor Capacitator Type Starting

Notes:

Starting winding generally has either two or four coils in series.

Running winding generally has either two or four coils in series and in parallel with two or four other coils in series.

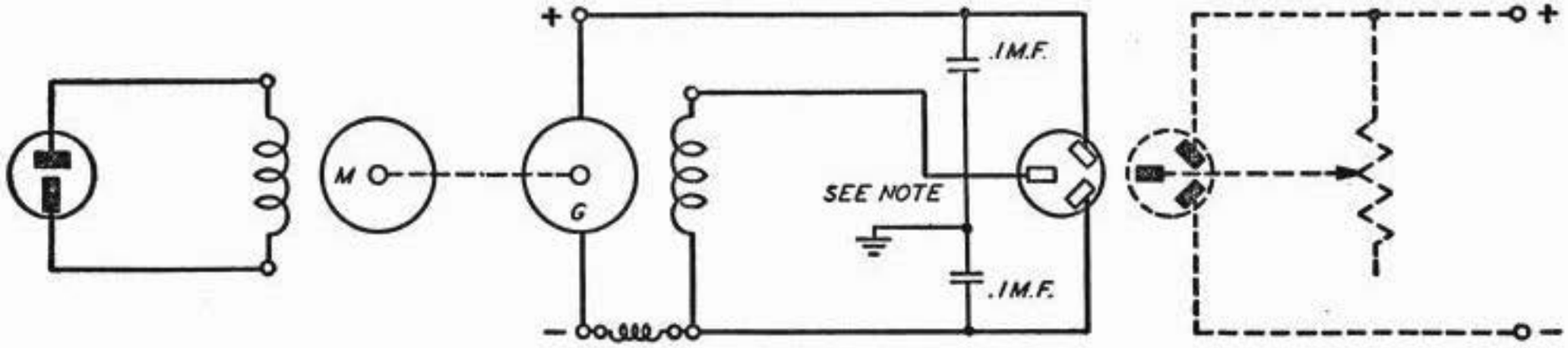

Fig. 4—Schematic Wiring—KS-5469 Machine

Notes:

Dotted equipment and wiring not furnished by the supplier.

Radio interference filter—two 0.1 mf condensers connected across generator output terminals and midpoint connected to generator frame.

5.04 Use a dry piece of KS-2423 cloth for cleaning except as otherwise specified. For parts not readily accessible the cloth may be wrapped around a screwdriver or a KS-6320 orange stick. Complete the cleaning of a unit of equipment before starting the lubrication.

5.05 Remove the bursh es and wipe them with a KS-2423 cloth slightly moistened with petroleum spirits or carbon tetrachloride. In removing the brushes note or mark the position so that the brush may be replaced in the same holder and in the same position in the holder. If the brush has a number stamped on the carbon, this may be used as a guide.

5.06 While the brush is removed clean out the brush holder with KS-2423 cloth moistened with petroleum spirits or with carbon tetrachloride and wrapped around a screwdriver blade or KS-6320 orange stick.

6. LUBRICATION

6.01 At each maintenance visit the motor-generator bearings shall be lubricated with 4 to 6 drops of oil as listed in the general section, P30.011, on Teletypewriter Apparatus, Lubrication—General Requirements. As the bearings of the motor-generator sets are of the waste packed type grease cannot be used as a lubricant, and the use of petroleum spirits or carbon tetrachloride in the bearing chamber or waste packing should be avoided.

6.02 Apply oil from a hand oiler through the hole in the top of the bearing chamber or through the oiler in each end shield.

6.03 Excessive oiling shall be avoided. Any surplus oil should be wiped from the outside of the bearing chamber where possible. Should the waste inside the bearing chamber become dry and glazed, it will be necessary to replace the waste.

7. REQUIREMENTS AND PROCEDURES

7.01 **Rotating element** shall turn freely.

(a) To check, turn rotor over by hand and observe that there is no binding in bearings and that the rotor does not touch the stator.

(b) To eliminate binding see that there is nothing in or on the set to prevent rotation. If the machine indicates tight spots or binding in the bearings due to misalignment, it will be necessary to realign the motor and generator on the base. Proper alignment will be obtained when the coupling shows freedom of movement and the machine operates quietly with a minimum of noise and vibration.

(c) If either armature touches the stator, return the defective unit for repair.

Note: Motors and generators of some sets are doweled to the base, hence their position is fixed. On other sets the position of the feet is usually marked on the subbase. Their position should be kept as near to these markings as possible.

7.02 **Brushes** shall be at least 5/16 inch long exclusive of spring, shall be free in their holders, and shall press against the commutator with sufficient force to give successful commutation.

Note: **Successful commutation** for the purposes of this section may be said to obtain if neither the brushes nor the commutator is injured in normal service to the extent that abnormal maintenance is required. The presence of some visible sparking is not necessarily evidence of unsuccessful commutation.

(a) To check, remove brush spring caps, observe that the brushes are free to move in the holders and the brush spring extends beyond the top of the brush holder with the cap removed.

(b) To adjust, remove the brush, sand any rough spots on the brush, wipe out the brush holder with a cleaning cloth moistened with petroleum spirits or carbon tetrachloride and if necessary replace any short brushes. Do not put oil on a brush or brush holder in order to obtain free movement since it may leak to the commutator and also is likely to dry and cause brush binding later.

(c) The supply of new brushes should previously have had their contacting surface shaped to conform to the curvature of the commutator so that it will not be necessary to do this on the job. The method of shaping the brush face to the proper curvature is as follows:

(1) Wrap a piece of 4/0 sandpaper around a sector of the armature under the brush holder.

(2) Place the brush in the holder with the numbered or marked side up, bearing against the sandpaper under the normal pressure of the brush spring.

(3) Turn the armature and sandpaper back and forth by hand until the brush surface has the proper curvature. The last turning of the armature should be in the normal direction of rotation.

(4) Remove the brush and bevel the edges slightly with sandpaper.

7.03 **Commutating surfaces** of the collector rings or commutator shall be free from scores, pits or other deformation of the surface or structure except that caused by normal wear.

(a) A smooth, even, chocolate brown coating of oxide on the commutator is a desirable condition and the commutator should not be disturbed unless there is excessive sparking at the brushes under load.

(b) If there is excessive sparking clean the commutator with KS-2423 cloth. If after this procedure there is still excessive sparking, remove the armature from the motor and clean the commutator lightly with 4/0 sandpaper. To do this wrap a piece of sandpaper around the commutator and rotate the armature, holding the sandpaper lightly by hand. Do not attempt to remove any grooves or pits as this can be done properly in the repair shop only. Blow out the dust and sand particles. Wipe the commutator with KS-2423 cloth dampened with petroleum spirits or carbon tetrachloride.

(c) Before dismantling the set mark the position of the feet as nearly as possible to aid in obtaining the correct alignment when reassembling. Note the position of any shims and see that they are put back in the same position.

(d) In dismantling be sure and mark the brushes so that they may be replaced in the same holders and in the same position in the holder.

(e) After cleaning the commutator or collector ring surfaces avoid touching them with the hand or fingers as the grease and perspiration may later on cause burned spots or poor contact.

7.04 **Brush holders** shall clear the commutator or slip rings by min. 1/32 inch—max. 5/64 inch.

Note: This requirement need be checked only when the operation of the set is unsatisfactory or there is reason to believe the requirement is not being met.

(a) To measure the brush holder clearance, remove the brush, insert a small stiff wire with a short right angle bend on the end through the brush holder against the commutator or collector ring. Mark the position of the outer end of the brush holder on the wire and measure this length. Pull the wire back out slightly until the projection of the right angle bend catches against the inner end of the brush holder. Again note the position of the outer end of the brush holder on the wire and measure this length. The difference in these two lengths, plus the thickness of the wire at the right angle bend projection

will be the distance of the brush holder from the commutator or collector ring.

(b) To adjust, loosen the set screw which secures the brush holder in the end shield and adjust the distance as necessary. After an adjustment tighten the set screw firmly.

(c) In some machines it will be necessary to loosen the cap screws which hold the brush housing to the motor end shield and remove the brush housing. Then with a wrench loosen the nuts which hold the brush holders, move the brush holders as required and again firmly tighten the holding nuts. Reassemble.

8. OPERATING TESTS

8.01 **Motor starting centrifugal switch** on a-c motors shall operate to open the starting contacts as the motor approaches full rated speed.

Note: Satisfactory operation of the switch will usually be indicated by a snapping sound as the motor comes up to speed.

(a) Should the motor fail to start or makes undue noise during starting, examine the starting switch for burned contacts or contacts not making.

(b) Should difficulty be experienced in meeting this requirement it is suggested that the motor be replaced by a new or repaired motor and the replaced motor returned for adjustment or repair.

8.02 **Motor Speed** shall be within the following limits under any conditions of load not exceeding full load, impressed voltage at rated value (110, 200 or 230 volts) ± 10% and frequency at normal value (25, 50 or 60 cycles) ± 2%, machine hot or cold.

		Maximum	Minimum
D-C	Motors	1800 rpm.	1650 rpm.
A-C 60 cycle	"	1800 rpm.	1650 rpm.
A-C 50 "	"	1500 rpm.	1350 rpm.
A-C 25 "	"	1500 rpm.	1350 rpm.

Use speed indicator.

Note: This requirement need not be checked unless there is reason to believe the motor speed is outside these limits or its operation indicates a check is desirable.

(a) To check the speed remove the dust cap in the center of the end shield, insert a speed indicator against the shaft and read the speed. Motors which do not meet the speed requirements should be examined for loose con-

nections and in the case of a-c motors for unsatisfactory operation of the starting switch.

8.03 **The generator voltage** shall remain within the limits of maximum 145 volts, minimum 105 volts.

Note: Under full load, hot conditions, the generator voltage will usually fall within the limits of maximum 125 volts, minimum 105 volts.

(a) Read the voltage on the associated voltmeter on the panel or with a portable voltmeter using the 471A tool.

(b) If voltage is not within limits check
1. Freedom of rotation.
2. Generator connections.
3. Field resistance (where provided).
4. Power supply.

(c) If the voltage fluctuates check
1. Generator connections.
2. Power supply.
3. Brushes binding.
4. Insufficient brush pressure.
5. Rough commutator.

(d) If the voltage fails to build up or is reversed check
1. Generator connections.
2. Field resistance (where provided).
3. Remove brushes and flash generator field momentarily with 45 volt B battery, placing + battery on + generator terminal and — battery on — generator terminal. Repeat if necessary.

(e) On some machines the value of field resistance is marked on the generator nameplate. Where the value is not given it may be determined in the following manner.

(f) With the motor operating from a normal source of power and the motor speed within specified limits, the resistance in series with the generator field should be adjusted to produce a no-load cold output voltage from the generator between maximum 135 volts and minimum 132 volts. Once the proper value of resistance is determined it should be used thereafter.

8.04 Motor and generator frame temperature shall not exceed 90C — 194F.

Note: This need not be checked if the fingers can be held on the motor frame and bearing housing when operated continuously on normal voltage and current.

(a) If machine temperature is too high, check for misalignment, see that the starting switch operates, that the commutating surfaces are clean and connections firm.