MOTOR-GENERATORS
KS-5668-02 AND KS-15834
REQUIREMENTS AND ADJUSTING PROCEDURES

1. GENERAL

1.01 This section covers apparatus requirements and adjusting procedures for the KS-5668-02 and KS-15834 motor-generators.

1.02 This section is reissued to remove brush dimensions from Table A and to include information on conversion of brush holders.

1.03 Reference shall be made to Section 020-010-711 for additional information necessary for the proper application of the requirements listed herein. Refer to Section 171-110-701 for commutator and brush maintenance, Section 171-110-801 for commutator resurfacing, Section 171-110-802 for brush replacements, and Section 155-614-801 for replacement parts and procedures.

1.04 ***Phi*** ϕ: Requirements are marked with a phi when they are not required to be checked before turnover.

1.05 ***Asterisk*** (*): Requirements are marked with an asterisk when to check for them would necessitate the dismantling or dismounting of apparatus, or would affect the adjustment involved, or other adjustments. No check need be made for these requirements unless the apparatus or part is made accessible for other reasons, or its performance indicates that such a check is advisable.

1.06 ***Brush-holder yoke position marks*** designating the position of the yoke for best commutation are located on the yoke and on the frame of the generator. These marks are established by the manufacturer, and when the yoke is set with both marks in line, the brushes will usually be in the proper position for the best commutation.

1.07 Excessive brush pressure produces mechanical wear, and insufficient pressure results in damage to the equipment through pitting of the commutator and dusting of the brushes. The requirements, as specified herein, represent a practical balance between the two and should result in satisfactory commutation.

1.08 ***Normal operation*** may be defined as a condition in which the generator is carrying any load from no load to full load with the output voltage within the limits stamped on the nameplate.

1.09 ***Successful commutation,*** for the purpose of this section, may be said to have been obtained if neither the brushes nor the commutator is burned or injured to the extent that abnormal maintenance is required. The presence of some visible sparking is not necessarily evidence of unsuccessful commutation.

1.10 The machines with their protective guard, brush riggings, and brush holders are shown in Fig. 1 through 7.

2. REQUIREMENTS

2.01 ***Lubrication***

ϕ(a) Ball bearings shall be lubricated with 260-300P grease annually in service or after being dismantled.

(b) Normally, ball bearings shall not be lubricated when a machine is being put into service unless the machine has been in storage for 2 or more years before being installed, in which event they shall be lubricated.

2.02 ***Voltage:*** It shall be possible to adjust manually the voltage of the generator at any temperature, cold to hot; at any load, no load to the available office load not exceeding rated nameplate current (amperes) within the

limits given below for the particular rating of the machine.

63-volt generators — 44-63 volts
160-volt generators — 120-160 volts

Use switchboard voltmeter.

Note: When the generator is under control of a voltage regulator, the hand rheostat may not hold the voltage within specified limits under all conditions of no load to full load. If the regulated voltage under office load conditions is within specified limits, checks at other loads may be omitted.

2.03 ***Capacity:*** The generator shall be capable of continuously supplying the available office load, not in excess of the rated machine load, within the voltage limits given in 2.02.

ϕ2.04 ***Bearings:*** Bearings shall be free from excessive wear. If the motor-generator operates satisfactorily under available office load and the other requirements of this section are met, the bearings shall be considered to be in satisfactory condition.

Note: Ball bearings are characteristically noisier in operation than sleeve bearings. Certain noises, such as the rolling noise of the balls in the race and the squealing noise of the ball cage, while undesirable, must be expected. However, abnormal noises may be an indication of worn bearings, improper assembly, or damage from vibration and shock during transportation.

2.05 ***Freedom of Rotating Parts:*** The motor and generator rotors shall turn freely in their bearings.

2.06 ***Direction of Rotation:*** The direction of rotation of the motor-generators shall be counterclockwise when viewing the motor end.

2.07 ***Noise and Vibration***

(a) The noise and vibration of a motor-generator under operating conditions shall not be excessive at any load from no load to full load.

(b) When excessive vibration is suspected, the machine shall be tested under any condition of load from no load to rated load and the amplitude of vertical and horizontal vibration shall not exceed 0.002 inch when measured at the bearings.

2.08** ***Commutation: Without altering the position of the brush-holder yoke, the generator shall commutate successfully at any current between no load and the available office load, not exceeding rated nameplate current (amperes), within the limits specified in 2.02 and with the machine at any temperature within the limits specified in 2.17. (See Section 171-110-701.)

2.09** ***Commutator: Commutator diameters shall not be less than the minimum shown →in Table A.

2.10 ***Commutator Surface***

(a) The surface of the generator commutator shall be clean and free from scoring, pitting, or other deformation of the surface or structure, save that caused by normal wear.

Gauge by sight and feel.

(b) The commutator shall have no high, low, or loose segments or flat spots. The eccentricity of the commutator shall not be enough to cause poor commutation or poor operation of the generator.

ϕ(c) The mica between the commutator segments shall be undercut.

2.11** ***Brush Holders and Yokes

(a) The clearance between the commutator and the lower edge of the brush holder shall be

Min 1/32 inch
Max 1/8 inch

→ Use the R-8550 scale

(b) The angle between the brush-holder slide surface and a line tangent to the commutator surface at the midpoint of the brush arc shall be

Min 55 degrees
Max 58 degrees

Use template.

Table A — Minimum Commutator Diameter and Brush Pressure

MOTOR-GENERATOR KS-5668-02 LIST NO.	MINIMUM COMMUTATOR DIAMETER (In Inches)	BRUSH PRESSURE					
		MIN			MAX		
		LB	OZ	GRAMS	LB	OZ	GRAMS
9	4-1/8	1	3	535	1	10	750
10	7-1/8	1	14	855	2	10	1190
11	7-1/8	2	6	1065	3	5	1495
12	8-3/8	2	6	1065	3	5	1495
19	7-1/8	1	14	855	2	10	1190
20	7-1/8	2	6	1065	3	5	1495
21	8-3/8	2	6	1065	3	5	1495
KS-15834 LIST NO.							
3	6-1/4	1	6	635	2	0	905
4	7-1/8	1	14	855	2	10	1190
5	8-3/8	1	14	855	2	10	1190
6	6-1/4	1	6	635	2	0	905
7	7-1/8	1	14	855	2	10	1190
8	8-3/8	1	14	855	2	10	1190

(c) The brush-holder yoke shall be located so that the position marks on the yoke and on the stationary surface adjacent to it are in line.

(d) The brush-holder yoke shall be held securely in position.

(e) These machines are equipped with either the Baylis-type brush holders as shown in Fig. 2 and 7, or the constant pressure brush holders as shown in Fig. 4, 5, and 6.

ϕ**2.12** ***Brush Length:*** The length of the brushes, measured on the long face of the brushes, shall be a minimum of 1-1/8 inches long.

Use the R-8550 scale.

2.13** ***Brush Pressure

(a) When Baylis-type brush holders are employed, the brush-holder springs shall be adjusted so that the unit brush pressure will be between 2-1/2 and 3-1/2 pounds per square inch. The total brush pressure for this type, as specified in Table A, is obtained by multiplying brush width by thickness by unit pressure. (See Section 171-110-802 for brush information.)

Use spring balance or tension gauge as applicable.

Note: Where poor commutation has been experienced due to difficulty in maintaining proper brush pressure, a change to the constant pressure brush holder is recommended. Conversion shall be made in accordance with PEM 8323.

(b) The constant pressure brush holders have a coiled spring which exerts a constant pressure on the brush regardless of the extent of brush wear. They do not require adjustment for pressure, but should be checked each time that a brush is replaced to assure that the coil spring in the holder is bearing directly on the brush and is not entangled with the flexible copper leads.

2.14** ***Brush Alignment: See Section 171-110-701.

*2.15 ***Brush Spacing:*** The brushes shall be spaced evenly around the commutator so that the variation in the spacing between brushes on adjacent brush-holder studs shall be

Max 1/16 inch

→Use the R-8550 scale.

Note: If the generator commutates successfully, it will not be necessary to check this requirement. (See 1.09.)

*2.16 ***Brush Fit***

(a) Generator brushes shall not bind in their holders; neither shall they be loose enough to cause poor commutation. (See 1.09.)

(b) The contact faces of the brushes shall be fitted to the commutator so as to insure successful commutation. (See 1.09.)

(c) All brushes shall be seated so that they have 100 percent arc and at least 80 percent of their area in contact with the commutator.

*2.17 ***Temperature***

(a) When in continuous operation within normal voltage and current limits and carrying not more than full-rated loads, the temperature of any part of the motor-generator shall not be excessive.

(b) Electrical connectors shall not overheat.

(c) If the temperature is thought to be excessive, it should be measured by thermometer. The temperature rise of the various parts shall not exceed the following.

	MAXIMUM RISE ABOVE AMBIENT
Bearings (hottest exposed part)	40 C (104 F)
Windings and Frames	50 C (122 F)
Commutator	65 C (149 F)

To check the temperatures, hold the bulb of the thermometer against the hottest spot on the outside of the bearing bracket, frame, or part under consideration. Cover the part of the bulb which is not in contact with a piece of felt or the equivalent. Observe the highest temperature indicated.

Note: The temperature of moving parts shall be taken immediately after the machine has come to a full stop.

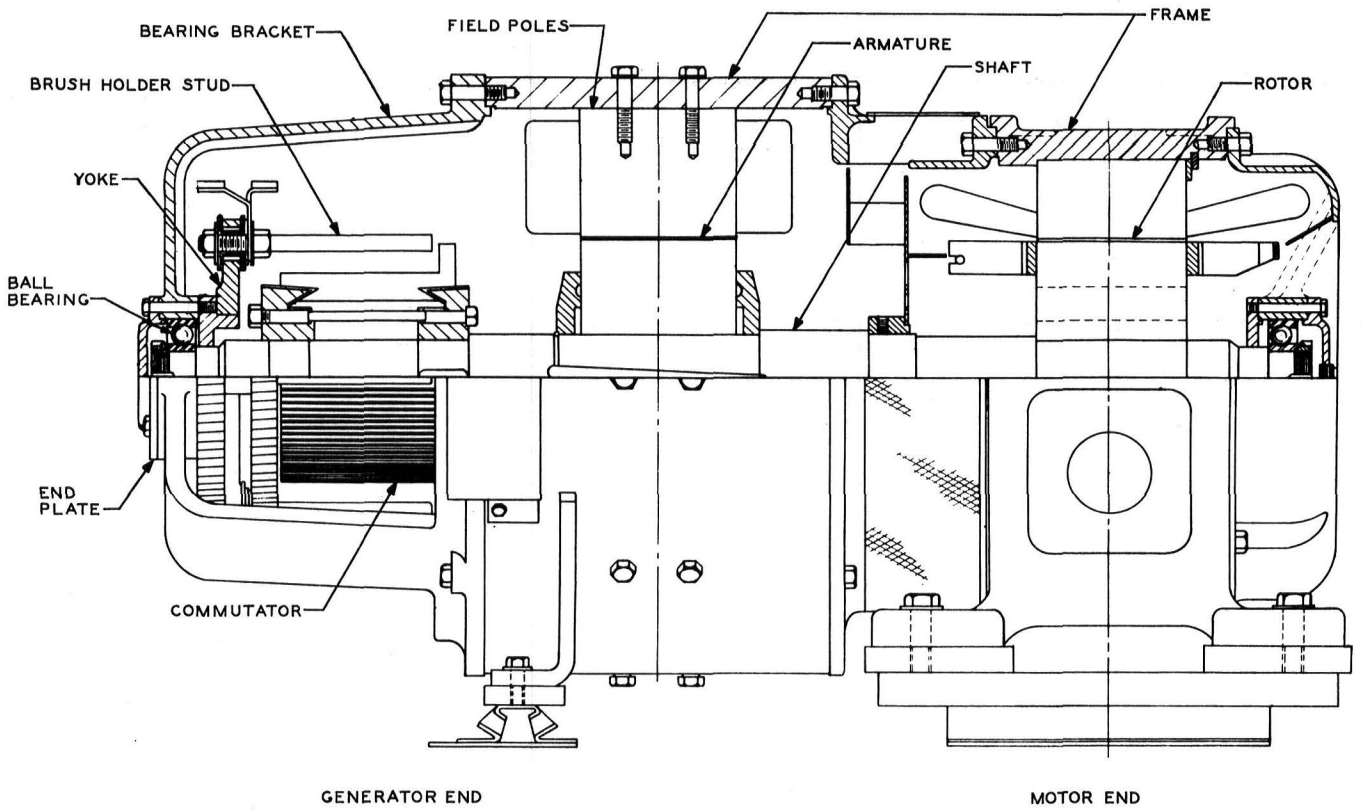

Fig. 1 – Motor-Generator — KS-5668-02 L11 Shown

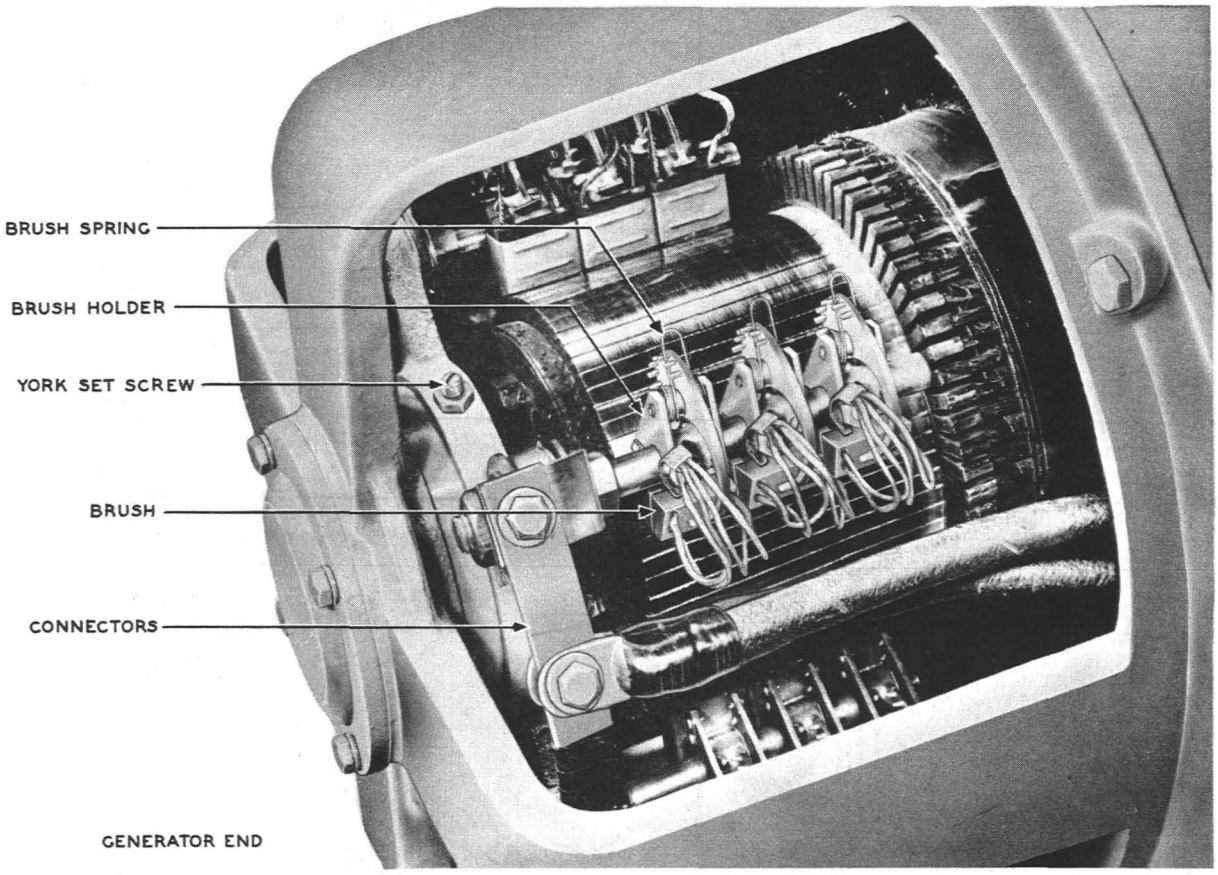

Fig. 2 – Generator End — Baylis-Type Brush Rigging

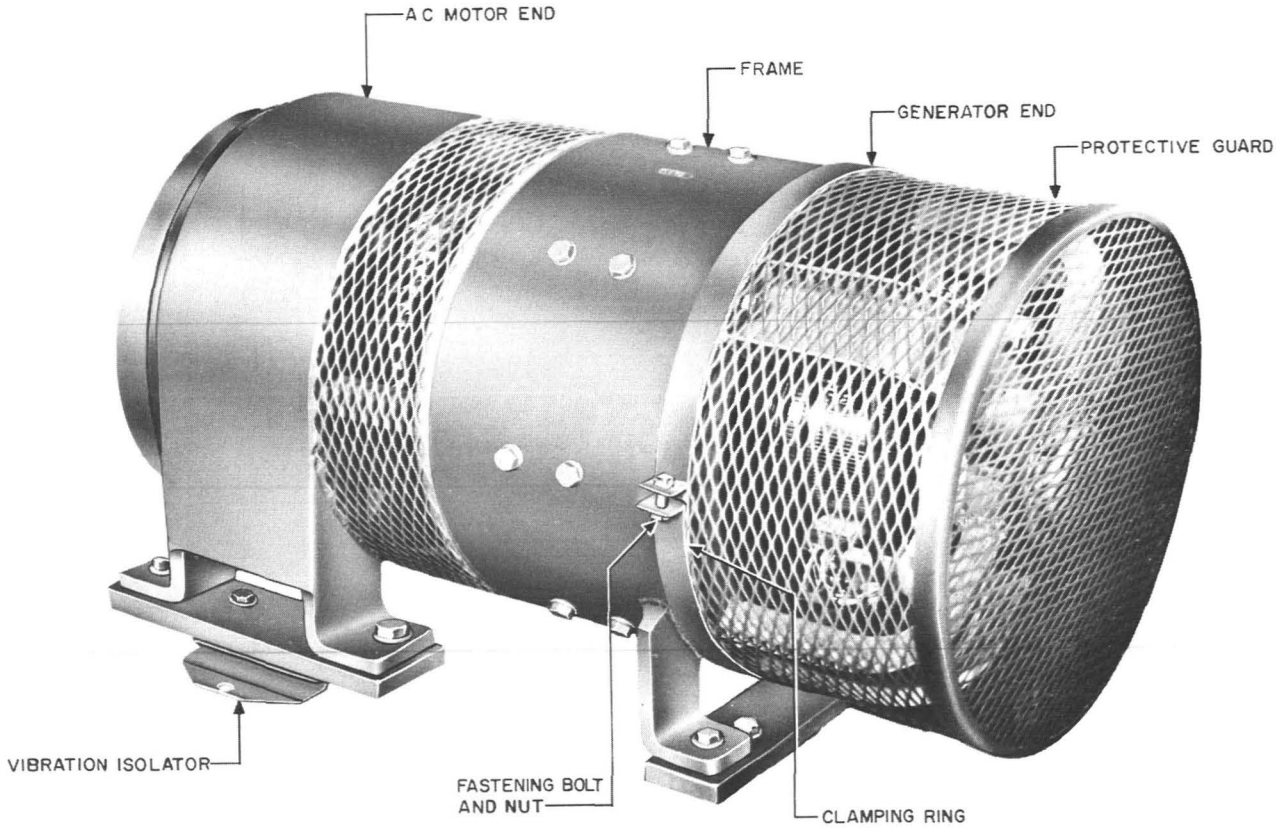

Fig. 3 – Motor-Generator — KS-15834 L8 Shown

be adjusted within the proper limits, examine the rheostat for possible damage, and repair or replace if necessary. Examine the generator windings for possible trouble or loose connections, and repair or replace if necessary. If the voltage is still outside the limits, check the driving agent for proper speed. If the voltage remains outside the limits after the above checks, it may be necessary to consult the supplier.

(2) If ***at installation*** or after the internal connections have been repaired, the generator fails to build up voltage or builds up in the wrong direction, the field may be reversed.

Caution: If the field is reversed and a minus voltage begins building, the machine should be stopped immediately to avoid damage to the machine and control equipment.

If the generator fails to build up voltage, the machine shall be stopped, the brushes shall be raised, paper shall be placed between the brushes and the commutator, and the rheostats shall be turned to the ALL RESISTANCE IN position. Block the circuit breaker in OPERATED condition and momentarily close the charging switch to flash the field. If this does not clear the trouble, verify circuit continuity through the rheostat resistance and contacts and examine the rheostats for possible injury. Compare the speed of the machine with the rated speed given on the nameplate.

3.03 ***Capacity*** (Reqt 2.03)

(1) To determine the capability of a generator to supply the office load, observe the current and voltage at a time when the office load is at a maximum.

3.04 ***Bearings*** (Reqt 2.04)

(1) Replace all worn bearings in accordance with Section 155-614-801.

3.05 ***Freedom of Rotating Parts*** (Reqt 2.05)

(1) Examine the motor-generator and remove any foreign objects which would interfere with rotation. Also check to see that all bolts are tightened securely, and tighten if necessary. Examine the generator for binding brushes and make adjustments or replacements if necessary.

3.06 ***Direction of Rotation*** (Reqt 2.06)

(1) If the motor-generator rotates in the wrong direction, interchange two of the three leads connecting the motor to the power service.

3.07 ***Noise and Vibration*** (Reqt 2.07)

(1) Where excessive noise and vibration are present, see that all vibration isolators are properly supported on the floor and that all bolts are tightened securely.

(2) If the noise and vibration continue to be excessive after the above adjustments have been made, the trouble may be caused by worn bearings. If this is found to be the case, the bearings should be replaced in accordance with Section 155-614-801.

3.08 ***Commutation*** (Reqt 2.08)

(1) If commutation is not satisfactory, see that requirements 2.09 through 2.17 are met. (See Section 171-110-701.)

3.09 ***Commutator*** (Reqt 2.09)

(1) See Section 171-110-701 for commutator care.

(2) When the commutator reaches the minimum diameter specified, the machine should be taken down and the rotating member returned to the shop for the installation of a new commutator, or a complete new rotating member should be installed.

3.10 ***Commutator Surface*** (Reqt 2.10)

(1) See Section 171-110-701 for commutator care and Section 171-110-801 for commutator resurfacing.

3.11 ***Brush Holders and Yokes*** (Reqt 2.11)

(1) To adjust the distance between a brush holder and commutator, loosen the hexagonal nuts holding the brush-holder stud in place on the brush-holder yoke. Slide the stud in the slotted holes of the yoke as found necessary. Inasmuch as the brush angle is very critical, any adjustment of distance of the

brush holder from the commutator should be made by sliding the brush stud up or down in the slots without turning the brush holders on the studs or the studs themselves. Check the angle after adjusting the clearance.

(2) To set a Baylis-type brush holder at the correct angle, cut a guide template as described below. Reproduce Fig. 8 on a piece of stiff cardboard, making the radius of the arc equal to the radius of the commutator. The radius is one-half of the diameter, which may be obtained by measurement. Draw a radius, and where it crosses the arc (point A), draw a line AC at a right angle to it. This will be tangent to the arc. From point A, measure 2 inches along this line and draw another line, BD, at a right angle. Measure along this line 3 inches. Draw the line AB. This line will be at an angle of 56-1/2 degrees to the tangent. Draw another line, EF, parallel to, and to the left of, the line AB, at a distance from it equal to one-half the thickness of the brush. Cut the template as shown, and after loosening the setscrew which holds the brush holder to its stud, place the template against the commutator surface and the slide surface of the brush holder, rotating the holder to obtain the required angle. Tighten the setscrew firmly.

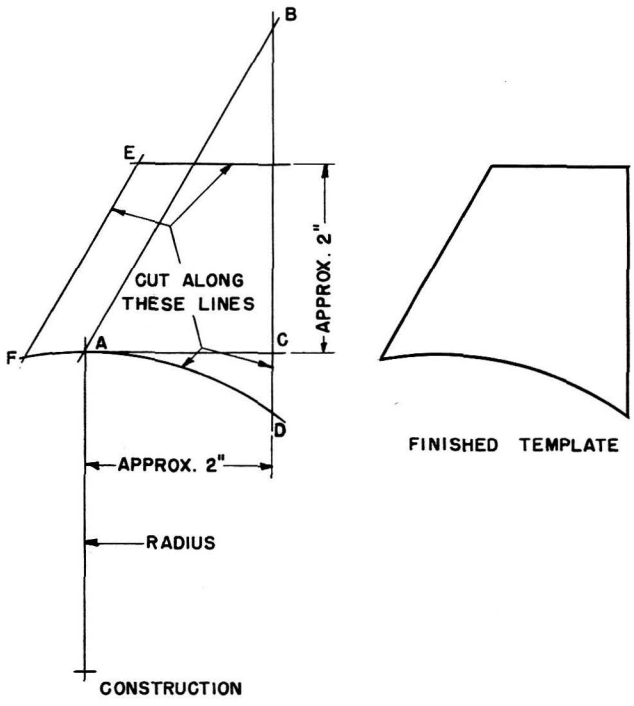

Fig. 8 – Template for Setting Baylis-Type Brush Holder

(3) In adjusting the clearance of any type of brush holder, it is desirable to work toward the minimum limit. If desired, a gauge instead of scale may be used to measure the clearance between the brush holder and commutator.

(4) If it is necessary to realign the brush-holder yoke, loosen the locknut or clamping screw, shift the yoke, and retighten.

3.12 ***Brush Length*** (Reqt 2.12)
3.13 ***Brush Pressure*** (Reqt 2.13)
3.14 ***Brush Alignment*** (Reqt 2.14)
3.15 ***Brush Spacing*** (Reqt 2.15)
3.16 ***Brush Fit*** (Reqt 2.16)

(1) See Section 171-110-701.

3.17 ***Temperature*** (Reqt 2.17)

(1) If the temperature exceeds the specified limits, see that other requirements are met. If these requirements are met and the temperature is still outside the specified limits, refer the matter to the supervisor as the motor-generator may have to be replaced. The supplier or his approved representative should be consulted.