

MOTOR-GENERATORS

KS-15839 AND KS-15842

REQUIREMENTS AND ADJUSTING PROCEDURES

1. GENERAL

1.01 This section covers apparatus requirements and adjusting procedures for the KS-15839 and KS-15842 motor-generators.

1.02 This section is reissued to specify the use of KS-19578 L1 trichloroethane instead of KS-8372 trichloroethylene. The same precautions that apply for KS-8372 trichloroethylene shall apply to KS-19578 L1 trichloroethane.

1.03 Reference shall be made to Section 020-010-711, covering general requirements and definitions 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 171-110-802 for brush replacements, Section 155-625-801 for generator replacement parts, and Section 171-110-801 for commutator resurfacing.

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 Ordinarily, excessive brush pressure produces mechanical wear; insufficient pressure results in damage to the equipment through pitting of the commutator and dusting of the brushes. The pressure on the brushes in these machines is constant and does not vary, neither can it be controlled by external manipulation.

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 are 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 These sets have separate motors and generators joined by either a Zurn flexible coupling or Falk flexible coupling type F. Machines, couplings, and brush rigging are shown in Fig. 1 to 5, inclusive.

2. REQUIREMENTS

2.01 Lubrication

Ball Bearings

ϕ (a) 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, but if it has been in storage for 2 or more years before being installed, they shall be lubricated.

Flexible Couplings

(c) Flexible couplings shall be examined after 30 days of initial running to determine if bolts should be tightened, and that lubrication seals are tight and not leaking lubricant.

φ(d) The Falk flexible coupling type F shall be cleaned and lubricated with 260-300P grease every 2 years.

Caution: *The Falk flexible coupling type F that is equipped with a grease pressure fitting shall never be lubricated with a pressure gun. When the coupling is dismantled for the first time and cleaned in order to relubricate, the pressure fitting hole shall be sealed from the inside to prevent grease leakage.*

φ(e) The Zurn type coupling shall be lubricated with 130-170 S 210 oil once every 3 years or at any time that the coupling is disassembled for other reasons.

***2.02 Voltages:** It shall be possible to manually adjust 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.

GENERATORS	VOLTAGE
33V	22 — 33
63V	44 — 63
160V	120 — 160

Use switchboard voltmeter.

Note: Where the generator is under control of a voltage regulator, the hand rheostat will not hold the voltage within the specified limits under all conditions. In such a case, if the regulated voltage under office load conditions is within specified limits, as shown above, checks at other loads may be omitted.

2.03 Capacity

(a) The motor shall be capable of starting its associated generator under no load and of driving it under all normal operating conditions.

(b) The generator shall be capable of supplying continuously the required office load, not exceeding rated machine load, with the voltage within the limits given in 2.02.

Use switchboard instruments.

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

Note: Ball bearings are characteristically more noisy 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 due to vibration or shock during transportation.

2.05 Freedom of Rotating Parts: The motor rotor and coupled generator armature shall rotate freely in their bearings.

Gauge by feel.

2.06 The *direction of rotation* shall be clockwise when viewed from the generator end.

2.07 Noise and Vibration

(a) The noise and vibration of a motor-generator set under any normal operating condition shall not be excessive at any load from no load to the office load not exceeding rated nameplate current (amperes).

Gauge by sound and feel.

2.08 Commutation: The generator shall commute successfully at any current between no load and the office load, not exceeding rated nameplate current (amperes), at any voltage within the limits specified in 2.02, and with the machine parts at any temperature within the limits specified in 2.16. (See 1.09.)

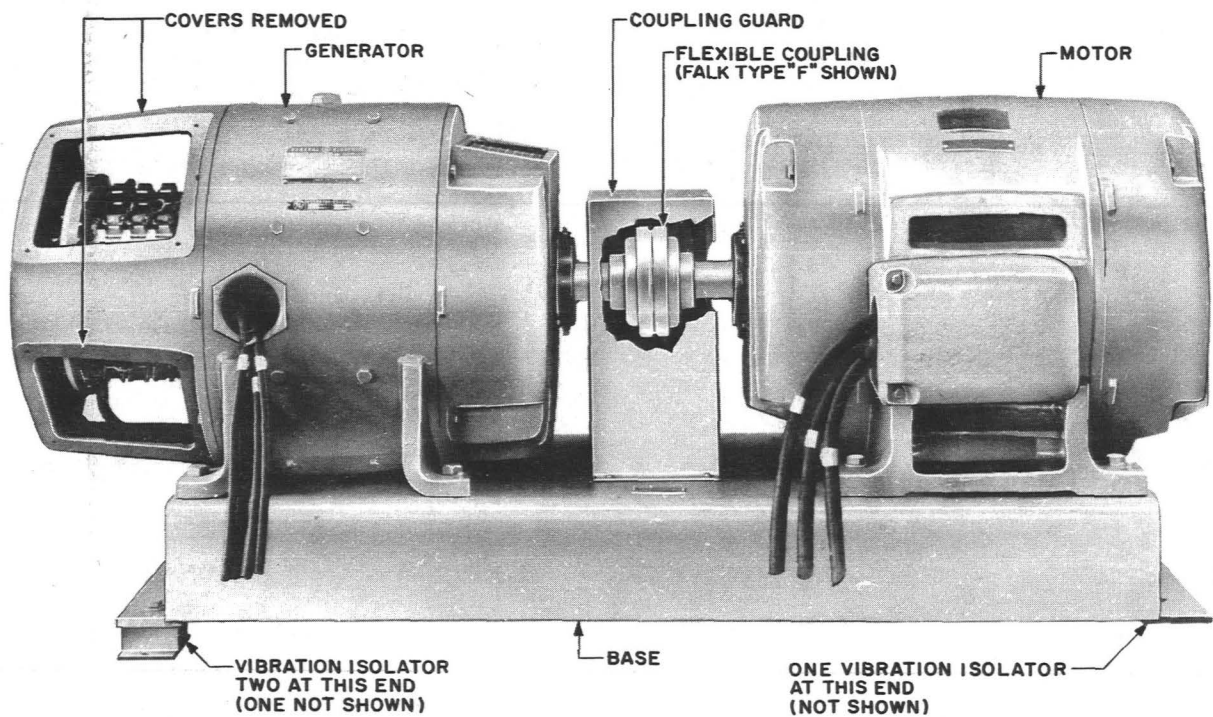


Fig. 1 - Motor-Generator — KS-15839, L5 Shown

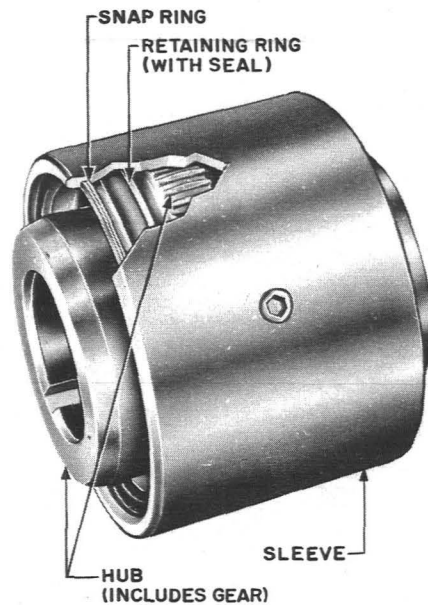
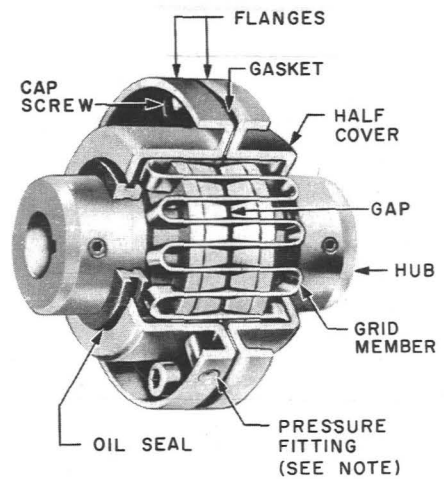


Fig. 2 - Zurn Type Flexible Coupling



NOTE: PRESSURE FITTINGS WERE FURNISHED ON SOME EARLY VINTAGE TYPE "F" COUPLINGS. THESE FITTINGS SHOULD NOT BE USED FOR LUBRICATION.

Fig. 3 - Falk Flexible Coupling Type F

***2.09 Commutator**

- (a) The commutator diameter shall not be less than the minimum shown below:

KS-15839 LIST NO.	KS-15842 LIST NO.	MINIMUM COMMUTATOR DIAMETER IN INCHES
3	3	5-1/8
4	4	5-3/4
5	—	7-1/4
6	—	7-1/4
9	—	5-1/8
10	—	5-3/4
11	5	6-1/2
12	—	7-1/4
14	6	5-1/8
15	7	5-3/4
16	—	7-1/4
17	—	7-1/4
19	—	5-3/4
20	8	6-1/2
21	—	7-1/4

φ2.10 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, except 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. (See 1.09.)

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

Gauge by sight and feel.

***2.11 Brush Holders and Yokes**

- (a) The clearance between the commutator and the lower edge of the brush holder shall be 1/32 inch minimum and 1/8 inch maximum.

Note: The periodic check of this clearance is necessary because of the gradual wear in the commutator surface and the resulting increase in the distance between commutator and brush holder.

- (b) The brush holders used in these machines 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.

- (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) Electrical connections shall not overheat.

- (f) The brush holders shall be so located that the brushes will not overlap the end of the commutator or ride upon that part of the commutator used for connection to the armature conductors, under any condition of normal operation.

- (g) When possible, the brush holders shall be staggered on the brush-holder studs so that the brushes on two adjacent studs shall cover the same portion of the commutator and the brushes on the other two studs shall cover the spaces between the brushes on the first two studs.

φ2.12 Brush Length: The minimum length of the brushes, measured on the long face of the brushes, shall be as follows.

GENERATOR	BRUSH LENGTH IN INCHES (minimum)
KS-15839	
L3, L9, L10, L14, & L19	1-1/4
L4, L5, L6, L11, L12, L15, L16, L17, L20, & L21	1-1/2
KS-15842	
L3 to L8	1

Use the R-8550 scale.

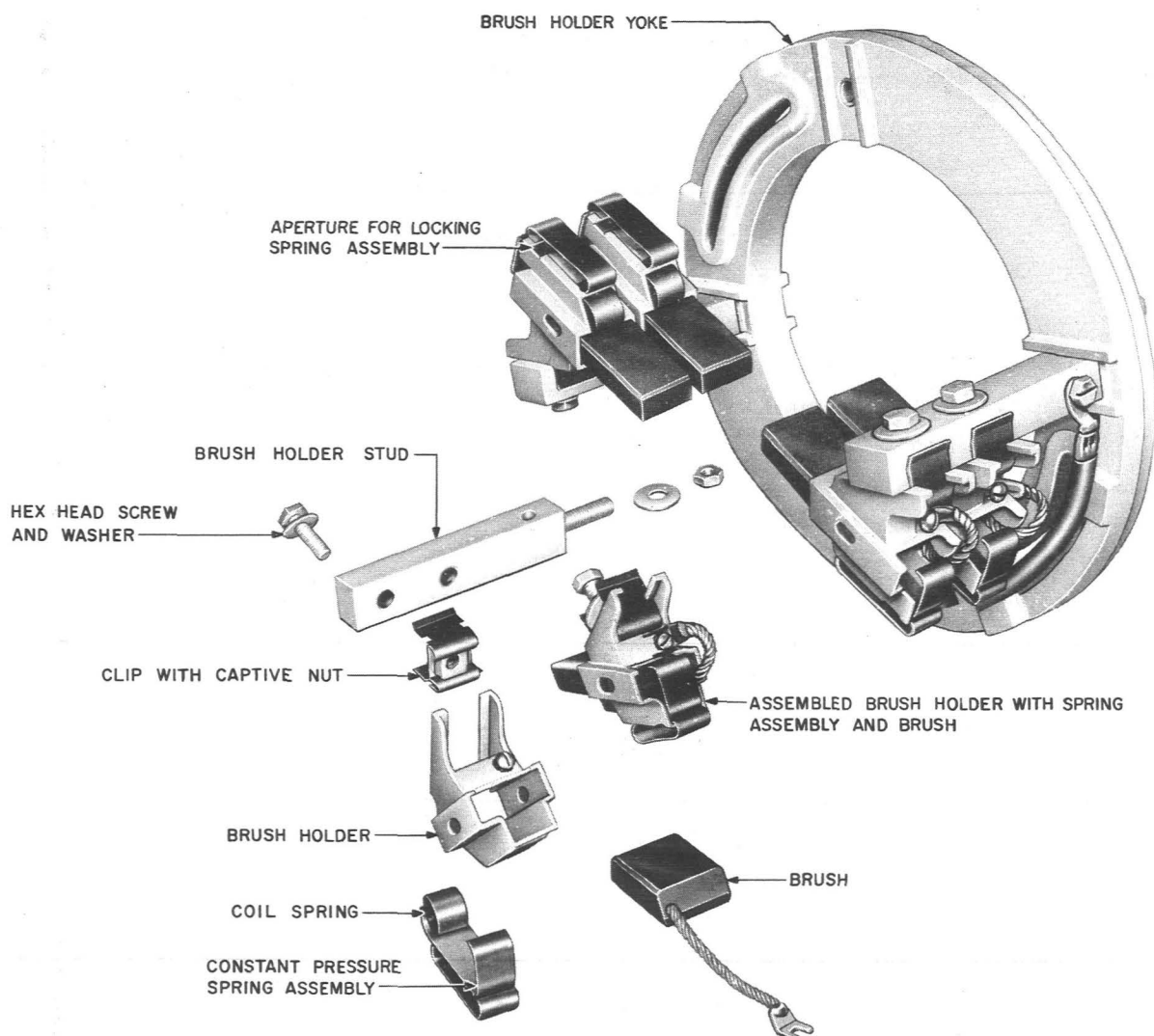


Fig. 4 - Yoke, Stud, and Brush Holder Assembly

φ2.13 Brush Alignment
φ2.14 Brush Spacing

- (a) 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 1/16 inch maximum.

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

- φ2.15 Brush Fit:** All brushes shall be seated so that they have 100 per cent arc and at least 80 per cent of their area in contact with the commutator.

***2.16 Temperature**

- (a) With normal voltage and frequency applied to the driving motor, and with the generator delivering its rated current continuously at any voltage within the limits specified, the temperature rises of the motor and gener-

ator windings and machine parts, above existing room temperature within the limits of 10 C and 40 C, shall not exceed the following values.

PART		MAXIMUM RISE ABOVE AMBIENT
Motor windings		50 C (122 F)
Generator windings		70 C (158 F)
Frames, cores, and other parts in contact with insulation	Motor	50 C (122 F)
	Generator	70 C (158 F)
Commutators, brushes and brush holders		85 C (185 F)
Bearings		40 C (104 F)

(b) If the temperature is thought to be excessive, it should be measured by thermometer. To check the temperature, proceed as follows. 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: To check temperature of rotating parts, the generator set shall be shut off and the temperature shall be taken as soon as the rotating part comes to a full stop. Use thermometer and felt pad.

3. ADJUSTING PROCEDURES

3.001 List of Tools, Gauges, and Materials

CODE OR SPEC NO.	DESCRIPTION
TOOLS	
KS-6320	Orange Sticks
R-2512	8-inch Adjustable Wrench
—	5-inch E Screwdriver
—	1-pound Ball Peen Hammer
—	Gun Nozzle, Alemite Z-737

CODE OR
SPEC NO.

DESCRIPTION

TOOLS

—	Gun, Grease, Lincoln Engineering Co, No. 5958
—	Wrench, Setscrew, Allen, Furnished With Falk Coupling

GAUGES

R-8550	6-inch Steel Scale
R-1032, Detail 1	Thermometer, -5 to 150 C

MATERIALS

KS-7860	Petroleum Spirits
→KS-19578 L1	Trichloroethane
KS-14666	Cleaning Cloth
—	Oil, 130-170 S 210
—	Grease, 260-300P
—	Felt
—	EPOXI-PATCH KIT 6C, Hysol Corp, Olean, N. Y., or METALSET KIT, A4, Smooth-On Mfg Co, Jersey City, N. J.

3.002 When using petroleum spirits for cleaning purposes in the power room, provide as much ventilation as practicable. After using the petroleum spirits, the commutators of all dc machines in the power room should be burnished in accordance with approved procedures for the machines involved, since the fumes from the petroleum spirits may soften commutator film and thus adversely affect commutation.

3.01 Lubrication (Reqt 2.01)

Ball Bearings

(1) Where the ball bearing housing is equipped with both a pressure fitting and a drain plug, proceed as follows with the machine stopped.

(a) Wipe off the pressure fitting with a clean cloth to avoid forcing dirt into the bearing chamber and place a pan under the drain hole to catch excess grease.

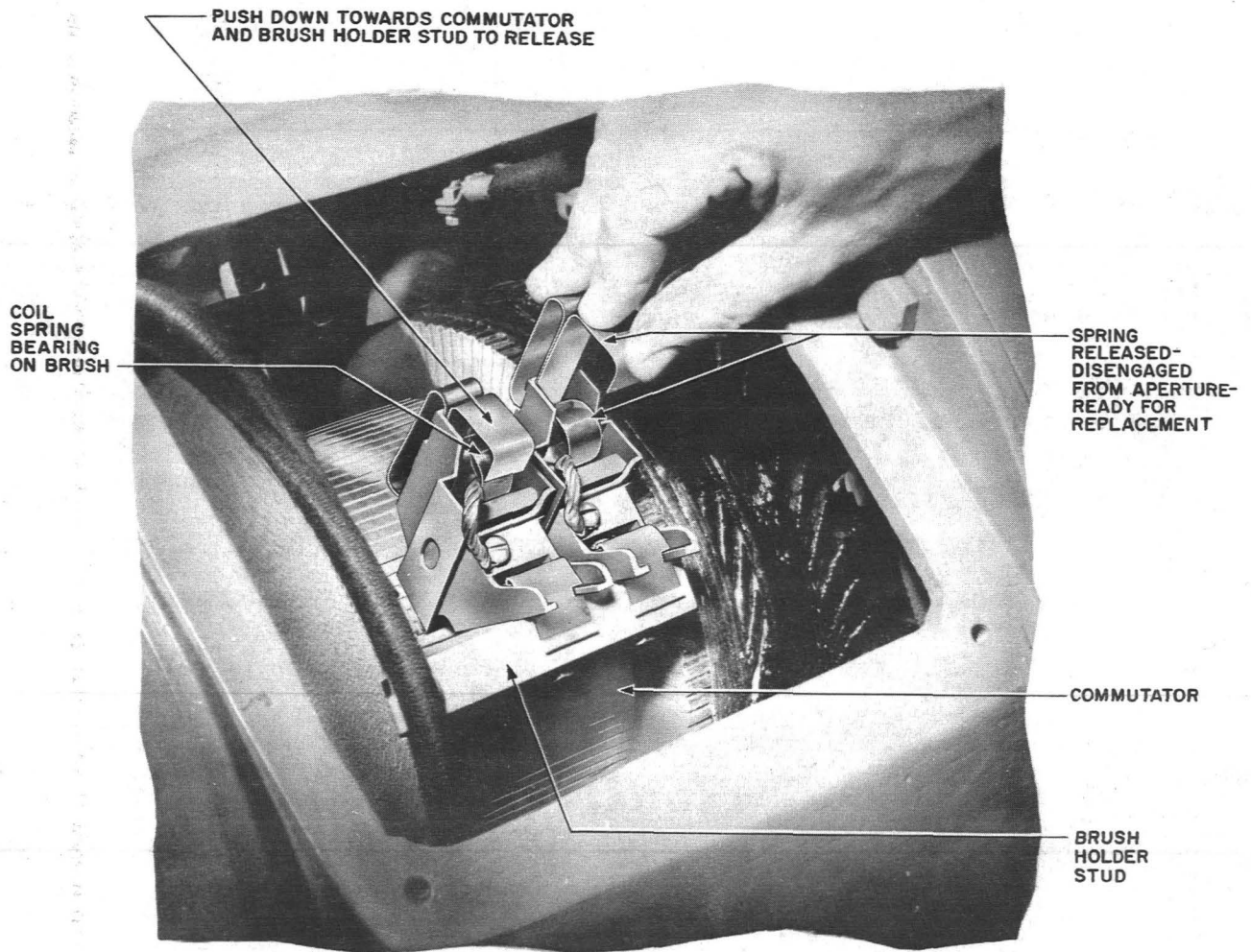


Fig. 5 – Constant Pressure Brush Holders

(b) Remove the drain plug and scoop out as much of the old grease from the drain hole as is possible to reach with an orange stick. This should remove old coagulated grease and provide pressure relief as the new grease is forced in.

(c) While pumping new grease into the pressure fitting, watch the drain hole and the shaft adjacent to the bearing housing carefully. Stop greasing when grease appears at the drain hole or if grease oozes out along the shaft before it appears at the drain hole. If grease does ooze along the shaft before it comes out of the drain hole, remove the pressure fitting to relieve the grease pressure. With a clean cloth wipe off any grease that may have oozed along the shaft.

Note: In any case, do not pump more than one full gun (approximately 5 ounces of grease) into the bearing chamber even if grease does not appear at the drain hole or shaft.

(d) Start and run the machine until hot. (This may take several hours.) This will expand the grease and force the excess grease out of the drain hole (or pressure fitting hole if this fitting was removed). After the grease has expanded fully and stopped coming out, stop the machine and scoop out as much grease from the drain hole (or pressure fitting hole) as is possible to reach with an orange stick. Replace the drain plug (and pressure fitting if removed).

Flexible Couplings

(2) To lubricate either type of couplings, remove protective guard by removing the hexagonal head bolts that fasten the guard to the base.

(3) To lubricate a Zurn type flexible coupling, remove the two lube plugs from the coupling sleeve and fill the coupling to overflowing with new lubricant using a standard grease gun with an Alemite nozzle. Replace lube plugs and wipe excess lubricant from surface of sleeve with a clean cloth.

Note: The lube holes do not have special threads or fittings that require special nozzles.

(4) To lubricate a Falk flexible coupling type F (see Fig. 3), remove the cap screws that fasten the two half covers and slide the covers back over the hubs to expose the hub teeth and gridmember.

(5) Locate the open end of the gridmember, pry it loose with a screwdriver, and remove it completely. Clean out all old lubricant from the gridmember, from the teeth on the hubs, from between the hub end faces, and from the half covers, by scrubbing with a typewriter brush dipped in petroleum spirits. Inspect the paper gasket, and if it is damaged, replace it with a new one ordered from the manufacturer or made locally from 1/32-inch Vellumoid packing (Vellumoid Co), or similar oilproof paper gasket material.

(6) Fill all the slots between the teeth with lubricant; also, force as much lubricant as possible down into the gap between the coupling hub end faces. This is essential since if only the slots are filled, a portion of the lubricant is squeezed out when the gridmember is inserted. Later, when centrifugal force caused by rotation of the coupling takes effect, most of the little amount of lubricant remaining in contact with the teeth after inserting the gridmember is thrown into the cover, leaving the teeth practically dry. If the gap is filled, however, not only will the space above the teeth be completely filled, but also the spaces around the teeth and gridmember because of the action of centrifugal force which throws the lubricant outward from the gap.

(7) Examine the gridmember and if it is not badly worn, re-use it; if it is worn to a sharp edge, replace it with a new one. Insert the gridmember in the slots by hand. Pack the spaces between and around the gridmember loops with as much lubricant as possible, filling the coupling to the limit. This is essential for proper functioning. Scrape off excess lubricant flush with the top of the gridmember convolutions. Draw the half covers up flush. Some excess lubricant will be pushed into the space between the half covers. Back the covers off enough to allow the insertion of a small steel scale, or similar implement so that when the covers are finally adjusted, there will be no layer of lubricant to keep them from seating properly. Draw the covers up again and fasten in place with the cap screws. Wipe off excess lubricant.

(8) Examine the coupling after the first few hours of running to see whether the lubricant is leaking out. If there is no leakage or if it stops soon, lubrication of the coupling should be satisfactory. If lubricant is leaking from between the flanges, the cap screws may have to be tightened or the gasket replaced. Some of the surplus lubricant may work out along the shaft past the inner edge of the covers during the first few times the machine is run and after it is stopped. If this continues until an amount believed to be more than the surplus applied has escaped, pull back the covers and examine the lubricant as to quantity and consistency, that is, whether oil has separated out; repack if necessary.

(9) On the earlier vintage coupling, the half covers have a grease pressure fitting in the flanges. This fitting should not be used for lubricating the coupling. If the coupling should begin to leak before the regular inspection and lubrication period, the following procedure shall be followed to seal off the pressure fitting. It shall also be followed the first time the coupling is dismantled for inspection and relubrication.

(a) Clean out the pressure fitting holes from the inside, using trichloroethane and a clean cloth. The holes should be cleaned as thoroughly as possible. The holes should then be filled flush to the inner surface of the half covers with epoxy resin

compound. The outer end of the pressure fitting shall also be sealed off by filling the fitting hole with compound flush to the outer surface of the flange. The compound shall be permitted 24 hours to set and cure before the half covers are reassembled and the machine put back into operation.

(b) The epoxy resin compound is mixed on the job, following the instructions contained in either the EPOXI-PATCH KIT 6C or the METALSET KIT A4. In separate tubes similar to toothpaste tubes, these kits furnish resin and hardener that can be mixed on a flat surface of discardable nature by squeezing out equal lengths from each tube and mixing with a spatula furnished in the kit.

Caution: *Do not allow skin contact with unset and uncured compound. If contact should occur, wash immediately with hot water and soap.*

3.02 Voltages (Reqt 2.02)

(1) Vary the voltage of the generator by manually operating the hand wheel of the associated rheostat. If the voltage cannot be adjusted within the proper limits, examine the rheostat for possible damage and replace or repair if necessary. Examine the generator windings for possible trouble and repair or replace loose connections. If the voltage is still outside the limits, check the driving agent for the 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 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.*

(3) If the generator fails to build up voltage, the machine shall be stopped, the brushes raised, and paper placed between the brushes and the commutator and the rheostats shall be turned to the ALL RESISTANCE IN position. Block the circuit breaker in OPER-

ATED 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 rheostat for possible injury. Compare the speed of the machine with the rated speed given on the nameplate.

3.03 Capacity (Reqt 2.03)

- (1) If the motor gives evidence of difficulty in starting or driving its normal load, check for freedom of rotation of the set.
- (2) To determine the output of a generator, 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 155-625-801.

3.05 Freedom of Rotating Parts (Reqt 2.05)

- (1) Examine the motor and the generator and remove any foreign objects which could prevent rotation. Also, check to see that all bolts are tightened securely and tighten if necessary. Examine for worn bearings and replace them if necessary.
- (2) Examine the generator for binding or worn brushes and adjust or replace them 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 155-625-801.

3.08 Commutation (Reqt 2.08)

- (1) If commutation is not satisfactory, see that requirements 2.09 to 2.16 are met. (See Section 171-110-701.)

3.09 Commutator (Reqt 2.09)

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

Note: The operation of machines at light loads for prolonged periods of time will result in loss of commutation film and excessive deterioration of commutator and brushes. When machines are being operated at light average loads, the commutator should be frequently checked for loss of film. If it is suspected that there is loss of commutator film, some of the brushes should be removed in accordance with Section 171-110-701.

- (2) When the commutator reaches the minimum diameter specified, the machine should be taken down and the rotating member returned to the shop for 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 the commutator, loosen the hexagonal head cap screw on the brush holder stud that engages the captive hexagonal nut in the clip of the brush holder. Move the brush

holder to meet the desired dimensions and retighten cap screw.

Note: It should not be necessary to adjust for the angle of the brush holder since the brush holders, brush-holder studs, and holder yoke are positioned mechanically and require no adjustment.

- (2) In adjusting the clearance of the brush holder, it is desirable to work towards the minimum limit. If desired, a gauge may be used instead of a scale to measure the distance between the brush holder and the commutator.
- (3) If it becomes necessary to realign the brush-holder yoke, loosen the locknut or clamping screw, shift the yoke and retighten.
- (4) If it is suspected that poor commutation is the result of unequal or insufficient pressure on the brushes, it may be necessary to replace the constant brush holders, and the supplier or his approved representative should be consulted.

3.12 Brush Length (Reqt 2.12)

3.13 Brush Alignment (Reqt 2.13)

3.14 Brush Spacing (Reqt 2.14)

3.15 Brush Fit (Reqt 2.15)

- (1) See Section 171-110-701.

3.16 Temperature (Reqt 2.16)

- (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.