

**MOTOR-DRIVEN INTERRUPTERS AND TONE MACHINES**  
**KS-5131, KS-5132, KS-5187, KS-5188, KS-5313,**  
**KS-5458, KS-5545, KS-15547**  
**REQUIREMENTS AND ADJUSTING PROCEDURES**

**1. GENERAL**

**1.01** This section covers requirements and adjusting procedures for KS-5131, KS-5132, KS-5187, KS-5188, KS-5313, KS-5458, KS-5545, and KS-15547 machines.

**1.02** This section is reissued to revise the requirements covering lubrication and timing and also to revise the List of Tools, Gauges, and Materials. Since this reissue covers a general revision, the arrows ordinarily used to indicate changes have been omitted.

**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.

**1.04** *Phi* ( $\phi$ ): 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 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** The KS-5131 and KS-5187 type dc motor-driven interrupter and tone machines consist of four spring-type interrupters to provide signals and a drum-type interrupter to provide high and low tones. The motors of the KS-5131 L24 and KS-5187 L24 interrupters operate on 24 to 29 volts dc. The motors of the KS-5131 L37 and KS-5187 L37 interrupters operate on 31 to 43 volts dc.

**1.07** The KS-5132 and KS-5188 type dc motor-driven howler interrupter is a drum-type interrupter providing high and low tones. The motor of the interrupter operates on either 20 to 28 or 31 to 43 volts dc.

**1.08** The KS-5313 type dc motor-driven howler interrupter is a drum-type interrupter providing a high tone. The motor of the KS-5313 L1 interrupter operates on 20 to 28 volts dc and that of the KS-5313 L2 interrupter on 40 to 56 volts dc.

**1.09** The KS-5458 type dc motor-driven interrupters are spring-type interrupters providing various rates of interruption. The motors of the KS-5458 L1 through L5 interrupters operate on 45 to 50 volts dc.

**1.10** The KS-5545 L1 ac motor-driven interrupter consists of a 75-volt, 20-cycle ac synchronous motor and a spring-type interrupter. The KS-5545 L2 machine is similar except that it has a 230-volt, 60-cycle ac synchronous motor. The KS-5545 L3 and L4 are similar to the L2 machine except that they have a 115-volt, 60-cycle ac synchronous motor. The spring-type interrupters provide various rates of interruption.

**1.11** The KS-15547 L1 ac motor-driven interrupter consists of a 115-volt, 60-cycle, single-phase, split-phase ac motor and a tone commutator to furnish 480 interruptions per minute. The KS-15547 L2 machine is similar except that the motor operates on 230 volts.

**1.12** *Successful Commutation*: Successful commutation is 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.

**1.13 Normal Operation:** Normal operation is the condition in which the motor is driving its interrupter assembly with the voltage at its terminals within the limits given on the nameplate.

**1.14** If a machine is arranged for automatic transfer, its supply fuse should be removed before starting work to avoid unexpected starting. When the fuse is removed, it should be remounted as promptly as feasible so that the machine may be available to take over the load.

## 2. REQUIREMENTS

### 2.01 Lubrication

**(a) Motor Shaft Bearings — All Interrupters Except KS-5458, KS-5545, and KS-15547:**

The motor shaft bearings shall be cleaned and lubricated with 260-300P grease when the machine is being put into service after 18 or more months in storage [see note of (f) (2)], after 2 to 4 years of service, or if the motor is dismantled for other reasons.

**(b) Motor Shaft Bearings — KS-5458 Interrupter:** The motor shaft bearings shall be lubricated in accordance with the following. The manufacturer's designations, as given on the motor nameplate, are used for identification.

**(1) Motor Type AD-20:** The motor shaft bearings shall be lubricated in accordance with requirement (a).

**(2) Motor Type CWD-2215:** The motor shaft shall be lubricated with ten drops of 220-260 S 100 oil at the time of installation and with 3 to 6 drops after every 4 to 6 weeks of service. Observe the hole in the bottom of the bearing housing during the interval between lubrications. If more than a trace of oil appears at the hole, decrease the amount of oil at the next lubrication. If there is no trace of oil, increase the amount of oil at the next lubrication.

**(3) Motor Type CBD-2215:** The motor shaft bearings cannot be lubricated. After 4 to 5 years of storage [see note

of (f) (2)] or when the bearings become defective in service, they shall be replaced.

**(c) Motor Shaft Bearings and Gear Case — KS-5545 Interrupter:** The motor shaft bearings and gear case shall be lubricated at the time of installation of the interrupter and annually thereafter with KS-6232 light mineral oil. Oil shall be added to the gear case and motor bearings until the oil appears at the overflow holes.

**(d) Motor Shaft Bearings — KS-15547 Interrupter:** The motor shaft bearings cannot be lubricated. After 4 to 5 years of storage or when the bearings become defective, they shall be replaced.

**(e) Worm and Worm Gear:** The worm and worm gear shall be lubricated with 930AA Lubriplate grease. Care shall be exercised to prevent grease from getting on interrupter contact springs, bumper pin rollers, or cams. The worm and worm gear shall be lubricated at the time of installation of the interrupter and every 4 to 6 weeks thereafter as required.

**(f) Low-Speed Interrupter Shaft Bearings**

**(1) KS-5131 Interrupter:** The low-speed interrupter shaft bearings shall be lubricated with one drop of 220-260 S 100 oil every 2 weeks or more as required.

**(2) KS-5458 Interrupter:** The low-speed interrupter shaft of the KS-5458 interrupter is equipped with graphite bearings which require no lubrication.

**Note:** The Western Electric Company inspection date stamp may be referred to in determining the storage period preceding installation.

**2.02 Operating Noise and Vibration:** The noise and vibration of the machine while operating under normal conditions shall not be excessive.

Gauge by sound and feel.

### 2.03 Freedom of Rotating Parts

**(a)** The high-speed shaft and the interrupter shaft shall rotate without bind.

Gauge by eye and feel.

**Note:** Due to its construction, the KS-5545 interrupter cannot be checked manually for freedom of rotating parts.

(b) Bumper pin rollers shall turn freely on their pins when they move in contact with the interrupter springs.

Gauge by eye.

**\* $\phi$ 2.04 Motor Speed**

(a) **All Interrupters Except KS-5458, KS-5545, and KS-15547 Interrupters:** The motor speed, under all conditions of supply voltage as specified on the nameplate and with the brushes properly positioned, shall be

Min 1000 rpm

Max 1500 rpm

(b) **KS-5458 Interrupter:** The motor speed shall be

Min 1130 rpm

Max 1280 rpm

(c) **KS-5545 Interrupter:** The synchronous speed of the list 1 machine is 1200 rpm. The synchronous speed of the list 2, 3, and 4 machines is 1800 rpm.

(d) **KS-15547 Interrupter:** The motor speed shall be

Min 1725 rpm

Max 1800 rpm

Use the Boulin Instrument Corp, Type A, Tachometer.

**$\phi$ 2.05 Motor Commutator and Interrupter Drum**

(a) The commutator and interrupter drum shall meet the applicable requirements covered in Section 171-110-701.

(b) The interrupter drum shall be on the motor shaft so that its segments are located centrally with respect to the brushes.

Gauge by eye.

**$\phi$ 2.06 Commutation:** The motor shall commute successfully under all conditions of normal operation.

Gauge by eye.

**\* $\phi$ 2.07 Motor-Brush-Holder Yoke:** The motor-brush-holder yoke shall be set so as to give successful commutation and correct motor speed.

**\* $\phi$ 2.08 Brush Holders**

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

Min 1/32 inch

Max 3/32 inch

(b) The brush holders of tone interrupters shall be mounted radially with respect to the shaft. The center line of the holder, if extended, shall pass through the axis of the shaft.

Gauge by eye.

**$\phi$ 2.09 Condition of Brushes:** The brushes shall meet the applicable requirements covered in Section 171-110-701.

**$\phi$ 2.10 Brush Length:** The length of the brushes, measured to the shoulder, shall be

Min 3/8 inch

Use the R-8550 scale.

**$\phi$ 2.11 Brush Pressure:** Brush pressure shall be adequate to give successful commutation.

**Note:** Brush pressure will usually be adequate if, with the brush holder screw cap removed and the end of the brush resting against the commutator or interrupter drum, the spring projects beyond the brush holder as follows

Commutator brush Min 1/2 inch

Interrupter brush Min 3/16 inch

**2.12 Low-Speed Interrupter Contact Springs**

(a) **Cleaning:** The interrupter contact surfaces shall be clean and free from build-ups which might interfere with reliable contact.

(b) **Contact Alignment:** The point of contact shall fall wholly within the circumference of the opposing contact disc.

(c) **Spring Stud Clearance:** Studs on any cam spring or contact spring shall not rub on the springs through which they pass when the interrupter assembly is operated.

Gauge by eye.

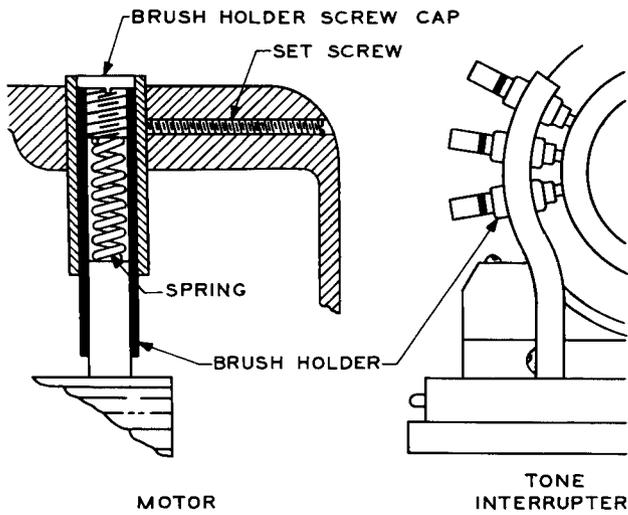


Fig. 1 - KS-5131 and KS-5132 Brush Holders

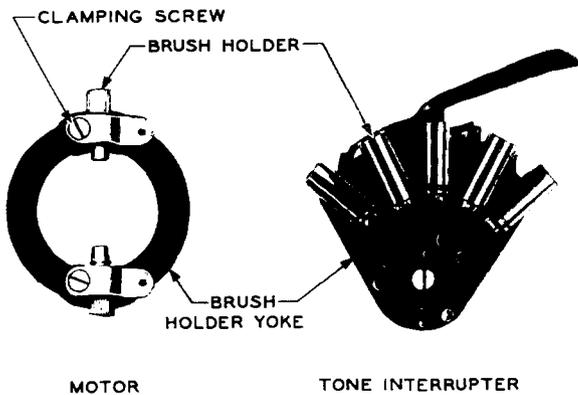


Fig. 2 - KS-5187, KS-5188, and KS-5313 Brush Holders

2.13 Timing Requirements

(a) *KS-5131 L24 and L37, KS-5187 L24 and L37, and KS-5458 L1 Through L5 Interrupters:* The timing shall be in accordance with Fig. 5 through Fig. 12.

Use 81A test set.

To check the timing, remove the cover. Connect the 81A test set across the contacts to be checked to indicate opening or closure of contacts. Check the intervals by counting the number of revolutions of the high-speed shaft while rotating the motor by hand.

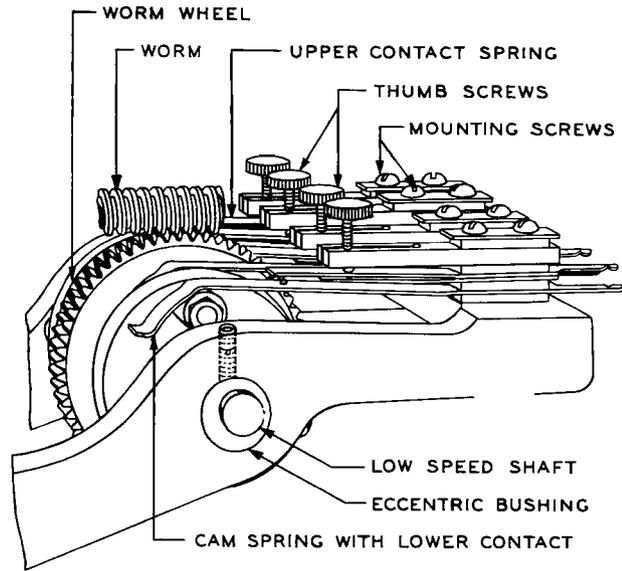


Fig. 3 - KS-5131 Low-Speed Interrupter

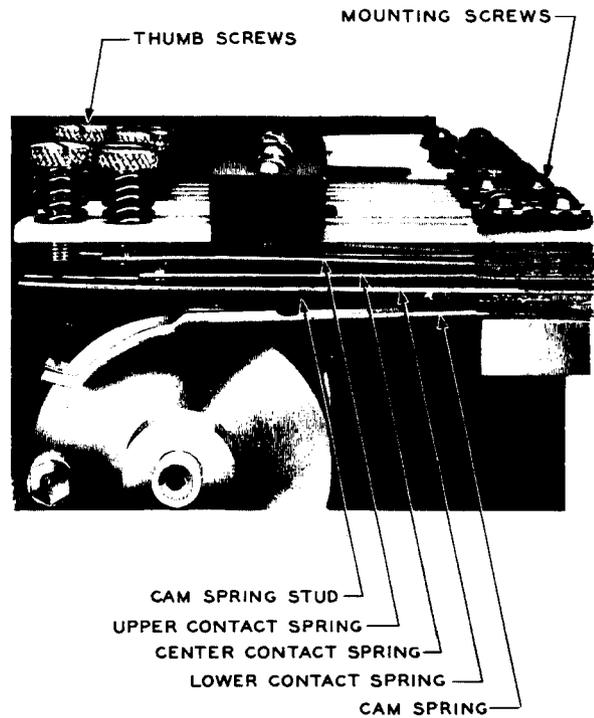


Fig. 4 - KS-5187 Interrupter

(b) *KS-5545 L1 Interrupter:* The open and closed periods of all timing pulses shall be approximately equal.

Gauge by ear.

To check this requirement, connect the 81A test set across the contacts to be checked and, with the motor operated electrically, compare

the intervals in which the buzzer sounds and is silent.

(c) **KS-5545 L2 Interrupter:** The duration of the pulse closure shall be approximately 0.5 second.

Gauge by eye and ear.

To check this requirement, connect the 81A test set across the contacts. Operate the motor electrically. Using chalk, apply a mark to the cam disc near its outer edge during the closed period of a pulse as indicated by the 81A test set. Stop the motor. A length of 3/16 to 1/4 inch on the cam indicates a time interval of approximately 0.5 second.

(d) **KS-5545 L3 Interrupter**

(1) **60-PPM Timing Pulses:** The open and closed periods of the timing pulses shall be approximately equal.

Gauge by ear.

To check this requirement, connect the 81A test set across the contacts to be checked and, with the motor operated electrically, compare the intervals in which the buzzer sounds and is silent.

(2) **10-PPM Timing Pulses:** The period of closure of springs 1 and 2 shall be approximately 2 seconds and that of springs 2 and 3 approximately 4 seconds. There shall be an interval between the break of springs 1 and 2 and the make of springs 2 and 3.

Gauge by ear.

To check this requirement, connect the 81A test set across terminals 1 and 2 and connect terminal 1 to terminal 3. The buzzer will sound during the closure of either pair of springs and should be interrupted during the transfer interval. An interval of 2 seconds may be judged satisfactorily by saying, "one hundred and fifty five," pronouncing each syllable fully and distinctly.

(e) **KS-5545 L4 Interrupter**

(1) **60- and 120-PPM Timing Pulses:** The open and closed periods of the timing pulses shall be approximately equal.

Gauge by ear.

To check this requirement, connect the 81A test set across the contacts to be checked and, with the motor operated electrically,

compare the intervals in which the buzzer sounds and is silent.

(2) **10-PPM Timing Pulses:** The period of closure of springs 1 and 2 shall be approximately 2 seconds and that of springs 2 and 3 approximately 4 seconds. There shall be an interval between the break of springs 1 and 2, and the make of springs 2 and 3.

Gauge by ear.

To check this requirement, connect the 81A test set across terminals 1 and 2 and connect terminal 1 to terminal 3. The buzzer will sound during the closure of either pair of springs and should be interrupted during the transfer interval. An interval of 2 seconds may be judged satisfactorily by saying, "one hundred and fifty five," pronouncing each syllable fully and distinctly.

φ2.14 **Operation of Centrifugal Starting Switch**

— **KS-15547 Interrupter:** The centrifugal starting switch shall disconnect the starting winding after the motor starts and reconnect the starting winding when the motor stops. To check this requirement, start and stop the motor. Listen for the click caused by the operation of the switch.

**Note:** The starting switch of the KS-15547 interrupter is located on the armature shaft on the end opposite to the tone commutator. Failure of the motor to start, accompanied by a humming sound, indicates that the contacts are not closed. Rapid overheating of the motor after starting indicates failure of the contacts to open.

\*φ2.15 **Temperature**

(1) **All Interrupters Except KS-5545 Interrupter:** The temperature of the following parts shall not exceed the values shown.

Bearings	80 C (176 F)
Motor Frame	90 C (194 F)

(2) **KS-5545 Interrupter:** The temperature of the motor frame shall not exceed 90 C (194 F).

Use the R-1032, Detail 1 thermometer.

To check the requirement, hold the bulb of the thermometer against the bearing housing or motor frame. Cover the portion of the bulb not in contact with the bearing housing or motor frame with an asbestos pad. Observe the maximum temperature reading.

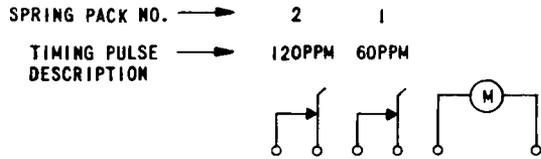


FIG. 5A - INTERRUPTER SCHEMATIC

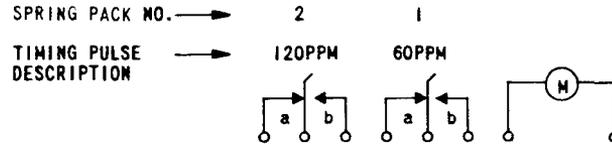
TIMING PULSE NO.	TIMING SEQUENCE						ALLOWABLE VARIATIONS FROM VALUES INDICATED ON CHART		PULSES PER MINUTE
	REVOLUTIONS OF HIGH SPEED SHAFT						START OF PULSE	DURATION OF PULSE	
	0	10	20	30	40	50	(REV OF HIGH SPEED SHAFT)	(REV OF HIGH SPEED SHAFT)	
	ELAPSED TIME IN SECONDS						MIN	MAX	
1	[Timing sequence for pulse 1: pulses occur between 0-10, 10-20, 20-30, 30-40, 40-50, 50-60 revolutions]						REFERENCE	9   10	60
2	[Timing sequence for pulse 2: pulses occur between 0-0.5, 0.5-1.0, 1.0-1.5, 1.5-2.0, 2.0-2.5, 2.5-3.0 seconds]						SEE NOTE 1	4   5	120

NOTES:

1. NO REQUIREMENT ON RELATION OF TIMING PULSE 2 TO ZERO REFERENCE.

FIG. 5B - TIMING CHART

Fig. 5 - KS-5131 P24 and L37 Interrupters



ALL CONTACTS SHOWN AT ZERO REFERENCE POSITION  
 FIG. 6A - INTERRUPTER SCHEMATIC

TIMING PULSE NO.	TIMING SEQUENCE							ALLOWABLE VARIATIONS FROM VALUES INDICATED ON CHART			PULSES PER MINUTE		
	REVOLUTIONS OF HIGH SPEED SHAFT							START OF PULSE (REV OF HIGH SPEED SHAFT)	DURATION OF PULSE (REV OF HIGH SPEED SHAFT)				
	0	10	20	30	40	50	60		MIN	MAX			
1a	[Pulse from 0 to 10 rev]							REFERENCE	9	10	60		
1b	[Pulse from 10 to 20 rev]							SEE NOTE 1	9	10			
2a	[Pulse from 0 to 10 rev]							SEE NOTES 1, 2	4	5	120		
2b	[Pulse from 10 to 20 rev]								4	5			
ELAPSED TIME IN SECONDS							0	0.5	1.0	1.5	2.0	2.5	3.0

NOTES:

1. TRANSFER INTERVAL: BREAK BEFORE MAKE. THE TRANSFER INTERVAL SHALL NOT EXCEED 2 REVOLUTIONS OF THE HIGH SPEED SHAFT.
2. NO REQUIREMENT ON RELATION OF TIMING PULSE 2 TO ZERO REFERENCE.

FIG. 6B - TIMING CHART

Fig. 6 - KS-5187 L24 and L37 Interrupters

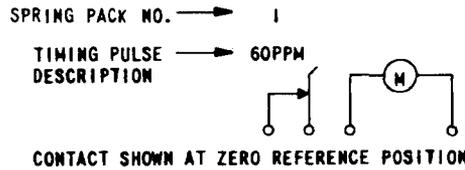


FIG. 7A - INTERRUPTER SCHEMATIC

TIMING PULSE NO.	TIMING SEQUENCE					ALLOWABLE VARIATIONS FROM VALUES INDICATED ON CHART			PULSES PER MINUTE
	REVOLUTIONS OF HIGH SPEED SHAFT					START OF PULSE (REV OF HIGH SPEED SHAFT)	DURATION OF PULSE (REV OF HIGH SPEED SHAFT)		
	0	10	20	30	40		MIN	MAX	
1	[Pulse from 0 to 10 rev]					REFERENCE	9	10	60
ELAPSED TIME IN SECONDS					0	0.5	1.0	1.5	2.0

FIG. 7B - TIMING CHART

Fig. 7 - KS-5458 L1 Interrupter

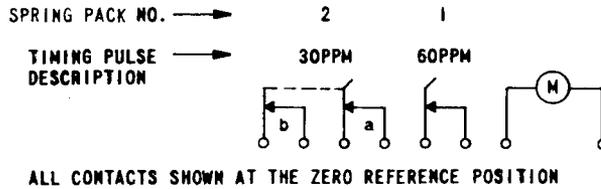


FIG. 8A - INTERRUPTER SCHEMATIC

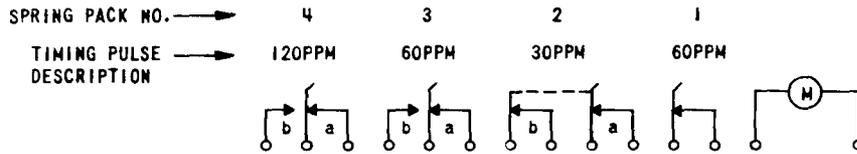
TIMING PULSE NO.	TIMING SEQUENCE					ALLOWABLE VARIATIONS FROM VALUES INDICATED ON CHART			PULSES PER MINUTE
						START OF PULSE (REV OF HIGH SPEED SHAFT)	DURATION OF PULSE (REV OF HIGH SPEED SHAFT)		
	REVOLUTIONS OF HIGH SPEED SHAFT							MIN	
1	0	10	20	30	40	SEE NOTE 1	(c) 5	6	60
							(d) 22	26	
2a	REFERENCE						30	34	30
2b	SEE NOTE 1						30	34	
ELAPSED TIME IN SECONDS									

NOTES:

1. NO REQUIREMENT ON RELATION OF TIMING PULSES 1 AND 2b TO ZERO REFERENCE.

FIG. 8B - TIMING CHART

Fig. 8 - KS-5458 L2 Interrupter



ALL CONTACTS SHOWN AT THE ZERO REFERENCE POSITION

FIG. 9A - INTERRUPTER SCHEMATIC

TIMING PULSE NO.	TIMING SEQUENCE					ALLOWABLE VARIATIONS FROM VALUES INDICATED ON CHART		PULSES PER MINUTE	
						START OF PULSE (REV OF HIGH SPEED SHAFT)	DURATION OF PULSE (REV OF HIGH SPEED SHAFT)		
	0	10	20	30	40	MIN	MAX		
1						SEE NOTE 2	(c) 5 (d) 22	60	
2a						REFERENCE	30 34	30	
2b						SEE NOTE 2	30 34		
3a						SEE NOTES 1, 2	9 10	60	
3b							9 10		
4a						SEE NOTES 1, 2	4 5	120	
4b							4 5		
		0 0.5 1.0 1.5 2.0 ELAPSED TIME IN SECONDS ← ONE REVOLUTION OF CAM →							

NOTES:

1. TRANSFER INTERVAL: BREAK BEFORE MAKE AT EACH TRANSFER. THE TRANSFER INTERVAL SHALL NOT EXCEED 2 REVOLUTIONS OF THE HIGH SPEED SHAFT.
2. NO REQUIREMENT ON RELATION OF TIMING PULSES 1, 2b, 3, AND 4 TO ZERO REFERENCE.

FIG. 9B - TIMING CHART

Fig. 9 - KS-5458 L3 Interrupter

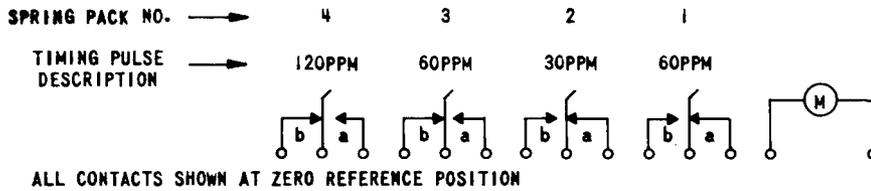
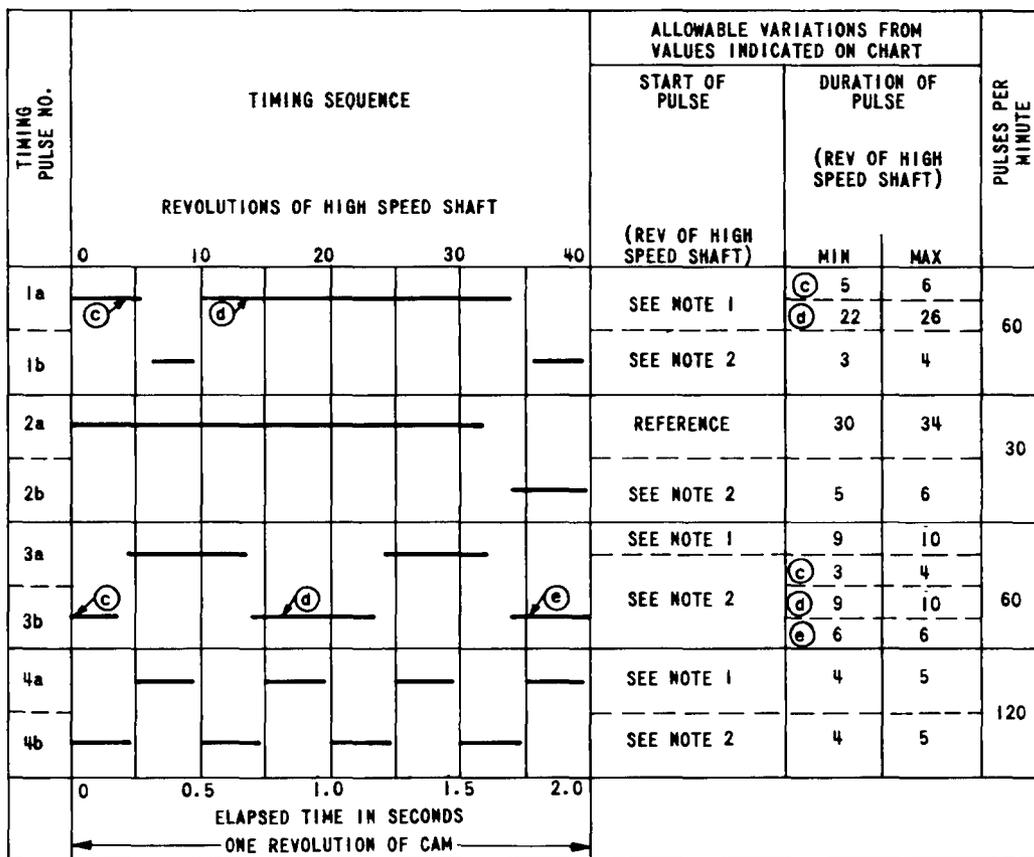


FIG. 10A - INTERRUPTER SCHEMATIC



NOTES:

1. NO REQUIREMENT ON RELATION OF TIMING PULSES 1,3 AND 4 TO ZERO REFERENCE.
2. TRANSFER INTERVAL: BREAK BEFORE MAKE AT EACH TRANSFER. THE TRANSFER INTERVAL SHALL NOT EXCEED 2 REVOLUTIONS OF THE HIGH SPEED SHAFT.

FIG. 10B - TIMING CHART

Fig. 10 - KS-5458 L4 Interrupter (when equipped with bumper pins)

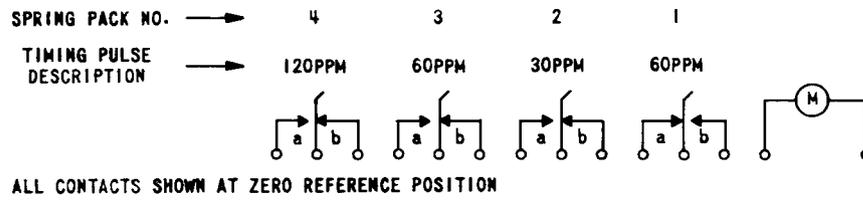
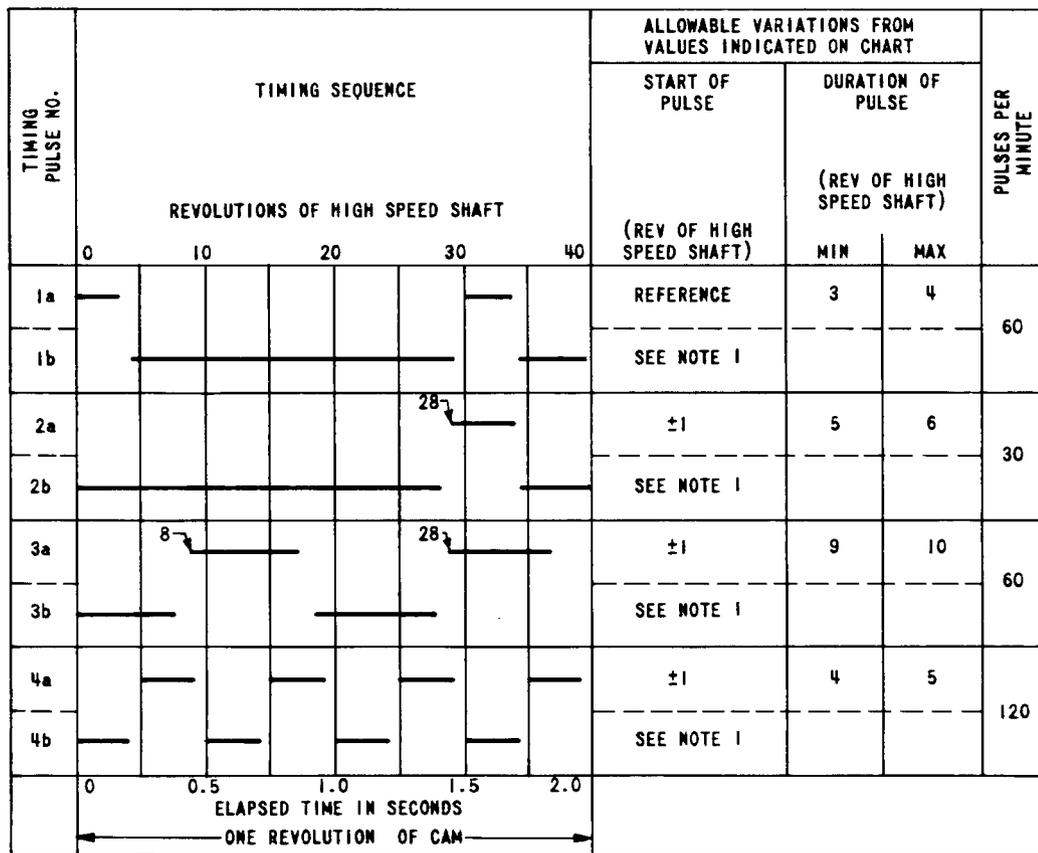


FIG. 11A - INTERRUPTER SCHEMATIC



NOTES:

1. TRANSFER INTERVAL: BREAK BEFORE MAKE. THE TRANSFER INTERVAL SHALL NOT EXCEED 1 REVOLUTION OF THE HIGH SPEED SHAFT.

FIG. 11B - TIMING CHART

Fig. 11 - KS-5458 L4 Interrupter (when equipped with cam)

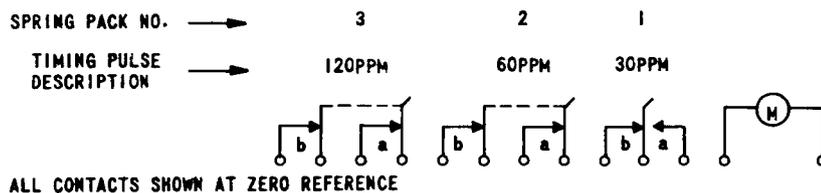


FIG. 12A - INTERRUPTER SCHEMATIC

TIMING PULSE NO.	TIMING SEQUENCE					ALLOWABLE VARIATIONS FROM VALUES INDICATED ON CHART			PULSES PER MINUTE
						START OF PULSE (REV OF HIGH SPEED SHAFT)	DURATION OF PULSE (REV OF HIGH SPEED SHAFT)		
	0	10	20	30	40		MIN	MAX	
1a						SEE NOTE 1			30
1b						REFERENCE	34	35	
2a						±1	9	10	60
2b						SEE NOTE 2			
3a						±1	4	5	120
3b						SEE NOTE 2			
	0	0.5	1.0	1.5	2.0	ELAPSED TIME IN SECONDS			
	← ONE REVOLUTION OF CAM →								

NOTES:

1. TRANSFER INTERVAL: BREAK BEFORE MAKE. THE TRANSFER INTERVAL SHALL NOT EXCEED 1/2 REVOLUTION OF THE HIGH SPEED SHAFT.
2. THE "a" SPRING SHALL MAKE FIRST. THE b SPRING SHALL MAKE WITHIN 1/2 REVOLUTION OF THE HIGH SPEED SHAFT AFTER MAKE OF "a" SPRING.

FIG. 12B - TIMING CHART

Fig. 12 - KS-5458 L5 Interrupter

**3. ADJUSTING PROCEDURES**

**3.001 List of Tools, Gauges, and Materials**  
(equivalents may be substituted)

CODE OR SPEC NO.	DESCRIPTION
<b>TOOLS</b>	
81A	Test Set
265C	Contact Burnisher
417A	1/4- and 3/8-Inch Double-End Wrench
KS-6015	Duckbill Pliers
KS-6320	Orange Stick
KS-6854	3-1/2 Inch Screwdriver
R-2670	3/32-Inch Allen Wrench
R-2969	Typewriter-Type Brush
—	10-Inch Hand Bellows
—	One-Pound Ball Peen Hammer
—	Oiler, 1604 Gem
—	Puller, 1000-1/2L Owantonna Tool Co
—	4-Inch E Screwdriver (or the replaced 4-inch regular screwdriver)
<b>GAUGES</b>	
R-1032, Detail 1	Thermometer
R-8550	6-Inch Steel Scale
—	Tachometer, Type A, Boulin Instrument Corp
<b>MATERIALS</b>	
KS-6232	Light Mineral Oil
KS-7860	Petroleum Spirits
KS-14666	Cloth, Cleaning
—	Abrasive Paper — Flint, Extra Fine
—	Asbestos Pad
—	Grease, 260-300P
—	Grease, Fiske Lubriplate 930AA, Fiske Bros Refining Co
—	Oil, 220-260 S 100
—	Wooden Toothpick

**3.01 Lubrication** (Req't 2.01)

- (1) Remove the interrupter from service before lubricating any parts.
- (2) **KS-5131 and KS-5132 Interrupters — Separable-Type Motor Bearings**
  - (a) Remove all brushes. Mark each brush to insure remounting in the same position and holder.
  - (b) Remove the interrupter drums.
  - (c) Remove the setscrew under the bearing housing on the end opposite the commutator. Loosen the locking screw on the face of the bearing plate on the commutator end, if provided, or else remove the screw under the bearing housing. Remove the bearing plate at each end by inserting a small screwdriver in the holes in the bearing plate and forcing the bearing plate in a counterclockwise direction. In removing the bearing plate on the commutator end, take care to remove the thrust spring and spring retaining washer from the machines so equipped. Remove the end shield opposite the commutator end.
  - (d) Remove the armature from the end opposite the commutator.
  - (e) Remove the outer ball races.
  - (f) Clean the grease from the bearings using a cloth, petroleum spirits, and a typewriter brush. Wipe the parts dry. Also clean the grease cups. Fill the bearings 1/3 full of grease.
  - (g) Screw the bearing plate on the end opposite the commutator so that it is flush with the end of the bearing housing. Insert the setscrew into the bottom of the bearing housing and back off the bearing plate just sufficiently to permit the setscrew to register in the first available hole in the periphery of the bearing plate. Tighten the setscrew firmly.
  - (h) On machines provided with a thrust spring, mount the thrust spring and spring retaining washer on the commutator end. Screw in the bearing plate on the commutator end until the spring is compressed and there is about 1/16-inch endplay of the

shaft as determined by pressing against the opposite end of the shaft. Make certain that the spring returns the shaft to its original position when the pressure is released. Tighten the locking screw on the face of the bearing plate.

(i) On machines not provided with a thrust spring, screw in the bearing plate on the commutator end until there is just perceptible endplay. Insert the setscrew to register in the first available hole in the periphery of the plate. Tighten the setscrews firmly.

(j) In remounting the interrupter drum, make sure that the setscrew or screws engage the flat on the shaft.

(k) Remount all brushes in their proper positions in their respective brush holders.

### (3) *KS-5131 Interrupter — Low-Speed Interrupter Shaft Bearings*

(a) Apply oil to the bearings with the oiler or with a clean toothpick.

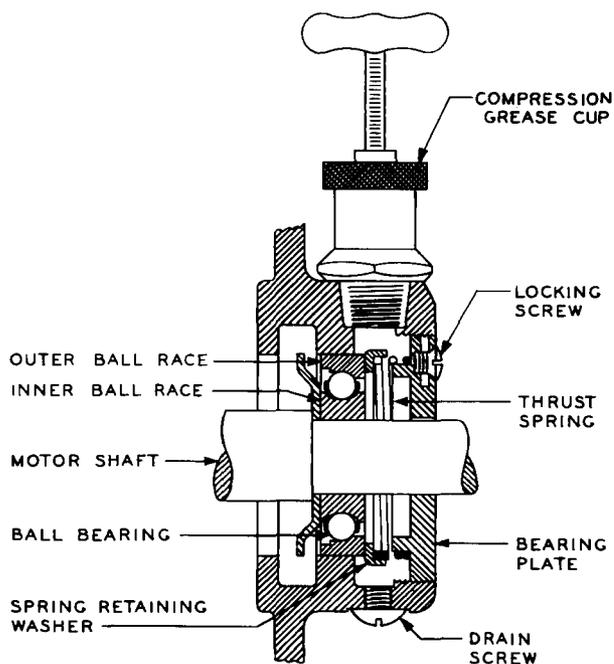


Fig. 13 — *KS-5131 and KS-5132 Bearing Assembly—Commutator End*

### (4) *KS-5187, KS-5188, and KS-5313 Interrupters — Separable-Type Motor Bearings*

(a) Remove the motor from its base.

(b) Remove all brushes and wipe them clean. Mark each brush to insure remounting in the same position and holder.

(c) Remove the tone interrupter drum, its brush holder yoke, and the bearing plate on the commutator end. Remove the thrust spring and retaining washer.

(d) Remove the motor brush holders with the support. This allows the end shield on the commutator end to slip by the inside bearing plate when the shield is removed.

(e) Remove the bearing plate on the end opposite the commutator.

(f) Remove the end shield on the commutator end and withdraw the armature.

(g) Remove the outer ball races.

(h) Clean the grease from the bearings using a cloth, petroleum spirits, and a typewriter brush. Wipe the parts dry. Fill the bearings 1/3 full of grease.

(i) Reassemble the motor in reverse order. When remounting the tone-interrupter drum, take care that the setscrew or screws engage the flats on the shaft.

### (5) *KS-5187, KS-5188, KS-5313 Interrupters and KS-5458 Interrupter-Type AD-20 Motor — Inseparable-Type Motor Bearings*

(a) Remove the motor from its base if necessary.

(b) Remove the brushes and slip off the leads from the motor brush holders. Mark each brush to insure remounting in the same position and holder.

(c) Remove the end shield on the commutator end and then remove the armature. There may be a thrust spring with washers on one end.

(d) Remove grease from the accessible side of the bearings with a clean cloth. Remove all hardened grease with an orange stick. Apply fresh grease around the balls, filling the space between the inner and outer ball races not more than 1/3 full.

(e) Reassemble the motor in reverse order. Remount all brushes in their respective brush holders.

**(6) *KS-5458 Interrupter-Type CWD-2215 Motor — Wool Packed Motor Bearings***

(a) Add oil through the fitting at the top of the bearing. A trace of oil should appear at the drain hole in the bottom of the bearing housing. This will probably occur within a day or two after oiling but may be delayed until some time before the next oiling. The oil should be wiped away when observed.

**(7) *KS-5458 Interrupter-Type CBD-2215 Motor and KS-15547 Interrupter — Double-Sealed Motor Bearings***

(a) These double-sealed ball bearings cannot be relubricated. If necessary, replace the bearings in accordance with Section 163-675-811.

**(8) *KS-5545 Interrupter — Motor Bearing and Gear Case***

(a) The hole for oiling one motor bearing is on the end opposite the interrupter.

(b) The hole for oiling the other bearing and the gears is located on top of the gear case. Remove the screw from the oil hole before oiling. Remount the screw after oiling.

(c) Oil may continue to appear around the oil overflow hole for a few days after oiling. All excess oil should be wiped off.

**Note:** The overflow hole in the bottom or near the bottom of the gear case is plugged initially to prevent leakage of oil during shipment. This plug or screw should be removed and discarded when the motor is installed.

**(9) *Worm and Worm Gear***

(a) Clean the worm and worm gear when first applying Lubriplate or whenever the old Lubriplate grease appears gummy or excessively dirty. Use petroleum spirits and a typewriter brush to remove the old grease from the gear teeth. A cloth may be used both in applying the petroleum spirits and in removing the excess in order to speed up drying.

(b) Before applying Lubriplate, make sure that the gear teeth are thoroughly dry. Apply the Lubriplate sparingly to the teeth of the worm gear over its entire circumference. The grease may be applied with the fingers but the shaft should be advanced manually to obtain access to all of the teeth on the worm gear. The spaces between the teeth of the worm gear need not be completely covered with grease since contact with the worm after the machine is started will distribute the grease over the entire tooth surface. It is not necessary to apply grease to the teeth of the worm.

(c) After lubricating the worm gear, run the machine a few minutes to squeeze the excess grease out of the gear teeth.

(d) Wipe excess grease off the sides of the worm gear with a clean cloth wrapped tightly around an orange stick.

**3.02 *Operating Noise and Vibration* (Reqt 2.02)**

(1) If the requirement is not met, check for tightness of all bolts and screws. Tighten bolts and screws if necessary.

(2) If this does not correct the trouble, the bearings may require replacing. Replace worn motor bearings on all, except KS-5458 interrupter equipped with type CWD-2215 motor, in accordance with Section 163-675-811. The bearings of the CWD-2215 type motor on the KS-5458 interrupter are not replaceable in the field. If replacement is required, the entire unit should be removed and sent to a shop equipped to replace the bearings.

**3.03 *Freedom of Rotating Parts* (Reqt 2.03)**

(1) Failure of shafts to rotate freely may be due to foreign objects which interfere with rotation, binding between the worm and worm gear, or worn bearings.

(2) Remove any foreign objects which might interfere with rotation.

(3) To eliminate binding between the worm and worm gear, loosen the setscrew on the worm gear and move the worm gear along the shaft as required. Securely tighten the setscrew. To reposition the worm gear of the KS-5131 interrupter, loosen the interrupter bearing setscrews and rotate the eccentric bushings until the worm and worm gear are

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fully meshed but the teeth of the worm gear do not rub the bottom of the thread on the worm. The eccentric bushing at each end of the interrupter shaft should have the same relative position in the interrupter frame.

(4) Replace worn bearings as covered in Section 163-675-811, except bearings of the CWD-2215 type motor on the KS-5458 interrupter. These bearings are not replaceable in the field. See 3.02(2).

(5) Replace bumper pin rollers with flat spots. Lubrication of metal bumper pin rollers with a slight amount of KS-6232 light mineral oil from time to time may relieve binding of these rollers. Apply the oil with a toothpick or wire as necessary. Since non-metallic bumper pin rollers may be damaged by prolonged contact with oil or grease, they should never be lubricated. If the rollers fail to turn freely, remove them and clean the roller and pin, using petroleum spirits and a cloth. Wipe thoroughly and be sure the pin is dry before remounting the roller.

### 3.04 *Motor Speed* (Reqt 2.04)

(1) **KS-5131, KS-5132, KS-5545, and KS-15547 Interrupters:** The speed of the KS-5131, KS-5132, KS-5545, and KS-15547 interrupters is not adjustable. If the requirement is not met, refer the matter to the supervisor.

(2) **KS-5187, KS-5188, KS-5313, and KS-5458 Interrupters:** The speed of the KS-5187, KS-5188, KS-5313, and KS-5458 machines may be adjusted by shifting the motor-brush-holder yoke as covered in 3.07.

### 3.05 *Motor Commutator and Interrupter Drum* (Reqt 2.05)

(1) Refer to Section 171-110-701 for procedures for maintaining the commutator and interrupter drum.

(2) To reposition an interrupter drum, loosen the setscrews which hold it on the shaft and slide it on the shaft as required. Tighten the setscrews against the flat spots on the shaft.

### 3.06 *Commutation* (Reqt 2.06)

(1) If the commutation is not successful, see that requirements 2.05 and 2.07 through 2.11 are met. If a commutator which was not

undercut originally fails to commutate successfully, it is permissible to undercut it. See Section 171-110-801.

### 3.07 *Motor-Brush-Holder Yoke* (Reqt 2.07)

(1) To adjust a motor-brush-holder yoke, loosen the clamping screws, shift the yoke, and tighten the screws. The best results will usually be obtained when the brush holder yoke position marks are in line.

### 3.08 *Brush Holders* (Reqt 2.08)

(1) To adjust the clearance of a commutator brush holder, loosen the clamping screw or setscrew, slide the holder to the required position, and retighten the screw.

(2) If a tone interrupter brush holder is only slightly off alignment, it will usually not interfere with commutation. Readjustment would not be justified, since any change in the position of the holder necessitates refitting the brush. If the holder is realigned, tighten the securing nuts firmly and reset the brush.

### 3.09 *Condition of Brushes* (Reqt 2.09)

(1) Refer to Section 171-110-701 for procedures for maintaining the brushes.

### 3.10 *Brush Length* (Reqt 2.10)

(1) Replace all brushes which do not meet the requirement.

### 3.11 *Brush Pressure* (Reqt 2.11)

(1) If the requirement is not met and the spring is short, stretch the spring. If the spring cannot be adjusted to meet the requirement, replace the brush.

### 3.12 *Low-Speed Interrupter Contact Springs* (Reqt 2.12)

(1) The contacts should be disconnected from the power supply during the cleaning operation. The purpose of cleaning contacts is to remove any gummy or dirty substance that would interfere with reliable contact. It is not necessary or desirable to keep contacts polished or shining. Clean contacts with a cloth moistened with petroleum spirits followed by a dry cloth.

(2) There should be as little smoothing of contacts as is consistent with satisfactory operation. Contacts should be smoothed while being held closed manually. With the contacts disconnected from the power supply, insert a burnishing tool between the contacts to be cleaned and draw it back and forth until the buildups are removed entirely or are reduced sufficiently to insure reliable contact. Clean the contacts as covered in (1).

(3) Replace springs which have badly worn contacts. Replace springs which have become bent.

(4) Where studs are found rubbing on the springs through which they pass, loosen the mounting screws and adjust the springs to provide the necessary clearance. Retighten the screws. Check requirement 2.13.

### 3.13 *Timing* (Reqt 2.13)

(1) The timing of the pulses is adjusted by turning the thumbscrew associated with the spring as required or, where thumbscrews are not provided, by shaping the contact springs with duckbill pliers.

(2) After making any adjustment of the transfer interval, recheck the timing of the pulse.

### 3.14 *Operation of the Centrifugal Starting Switch* (Reqt 2.14)

(1) If the motor fails to start when connected to the power supply, disassemble the motor as follows.

(a) Remove the brush-holder support by removing the two mounting screws. Remove the tone commutator after loosening the two setscrews, using the bearing puller if necessary. Loosen the through bolts and

remove the two screws from the end bell at the opposite end from the tone commutator. Carefully remove the end bells, noting that the end bell on the tone commutator end has a thrust spring in it. Remove the bearing with the puller.

(2) Inspect the centrifugal switch for freedom of operation and broken parts. If any part of the switch is broken or excessively worn, replace it in accordance with Section 163-675-811.

(3) Inspect the switch contacts and clean or smooth them as required. Clean the switch contacts and switch assembly by blowing out any metallic particles that may have collected. If the switch contacts are oily, clean them with a cloth moistened with petroleum spirits. When the oil has been removed, remove all moisture with a dry cloth.

(4) Before reassembling the motor, clean the bearing housing and the shaft with a cloth and petroleum spirits and give them a light coating of grease. When placing the bearing on the shaft, avoid putting any pressure on the outer ball race. Use a clean pipe or tube having an internal diameter slightly greater than the diameter of the shaft. Slip the tube over the shaft with the end in contact with the inner ball race, and tap it gently with the hammer as required, to seat the bearing. Reassemble the motor by a reverse procedure, making sure that the segmented part of the tone commutator is placed under the tone pickup brushes.

### 3.15 *Temperature* (Reqt 2.15)

(1) If the temperature exceeds the specified limits, check requirements 2.02 through 2.11. If these requirements are met, refer the matter to the supervisor.