

INTERRUPTERS—KS-15634 AND KS-15757 TYPE REQUIREMENTS AND ADJUSTING PROCEDURES

1. GENERAL

1.01 This section covers the KS-15634 L1 through L6, and L8 and KS-15757 L1 ac motor-driven interrupters used in ringing power plants. The KS-15634 and KS-15757 motor-driven interrupters have a single-phase synchronous capacitor-type 115-volt, 60-Hz, 1800-rpm motor (when manufactured by Holtzer-Cabot or Indiana General Inc., formerly the Borg Co.) or a 300-rpm motor (when manufactured by the North American Philips Corp. (formerly the A.W. Haydon Co.)) which drives an interrupter camshaft through a gear train enclosed in a gear box. The interrupter shaft of the KS-15634 L1, 2, 4, 5, 6, and 8 interrupters is driven at 10 rpm and provides a 6-second ringing cycle. The shaft of the KS-15634 L3 and KS-15757 L1 is driven at 7.5 rpm and provides an 8-second ringing cycle. Figures 1 and 2 show the KS-15634 L1 interrupters and Figures 3, 4 and 5 show the KS-15757 L1 interrupter. There is a redesigned version available of the KS-15634 and KS-15757 type interrupters manufactured by the North American Philips Corp. The list numbers are L1 through 6 and L8 for the KS-15634 and L1 for the KS-15757 type interrupters. The specifications for the new interrupters are the same as the old type with the exception that the new model has a permanently

lubricated gear train formed cam followers, and nylon, (10 percent Teflon* filled) outboard bearings, and drive motor operates at 300 rpm.

*Registered Trademark of the Dupont Co.

1.02 This section is reissued to:

- (a) Rearrange and renumber existing figures except for Fig. 1, which has been revised. Figures 2, 4, and 6 through 15 are new figures which include added North American Philips Corp. manufactured equipment.
- (b) Revise 1.03 to include North American Philips Corp. manufactured units.
- (c) Add note 2 in 2.02 (a) to the effect that the gear box on North American Philips Corp. units are permanently lubricated.
- (f) Revise 3.02(a)
- (g) Add 3.02(b)(15) and 3.02(c) to revise gear box and interrupter shaft bearing lubrication procedures.

The Equipment Test List is affected.

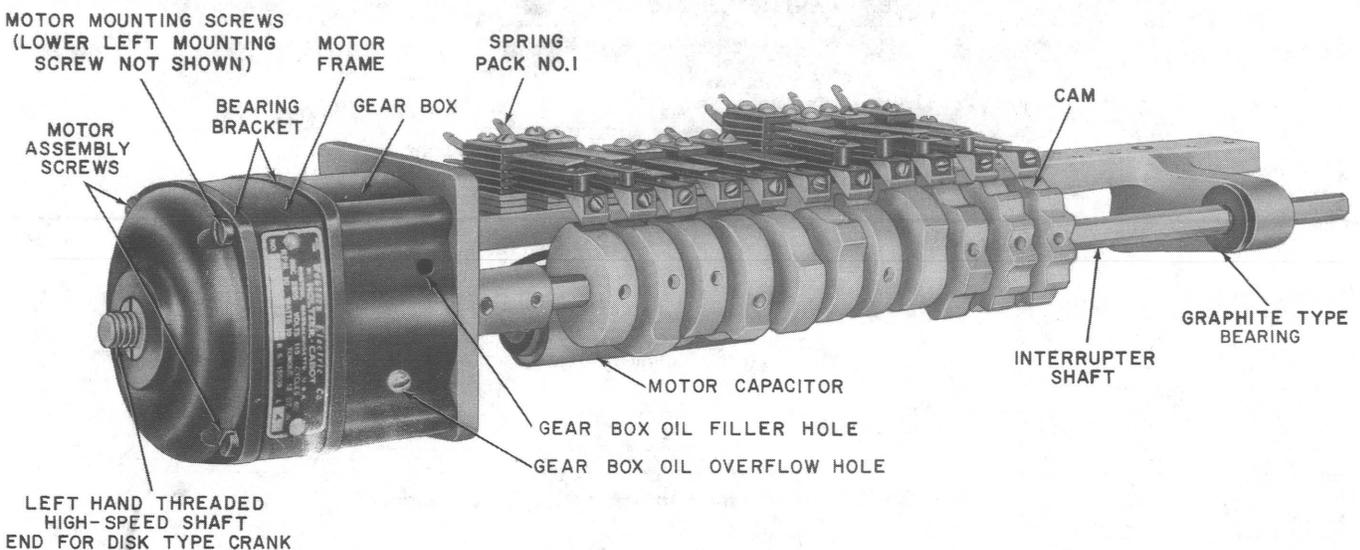


Fig. 1—KS-15634, List 1 Interrupter (Holtzer-Cabot)

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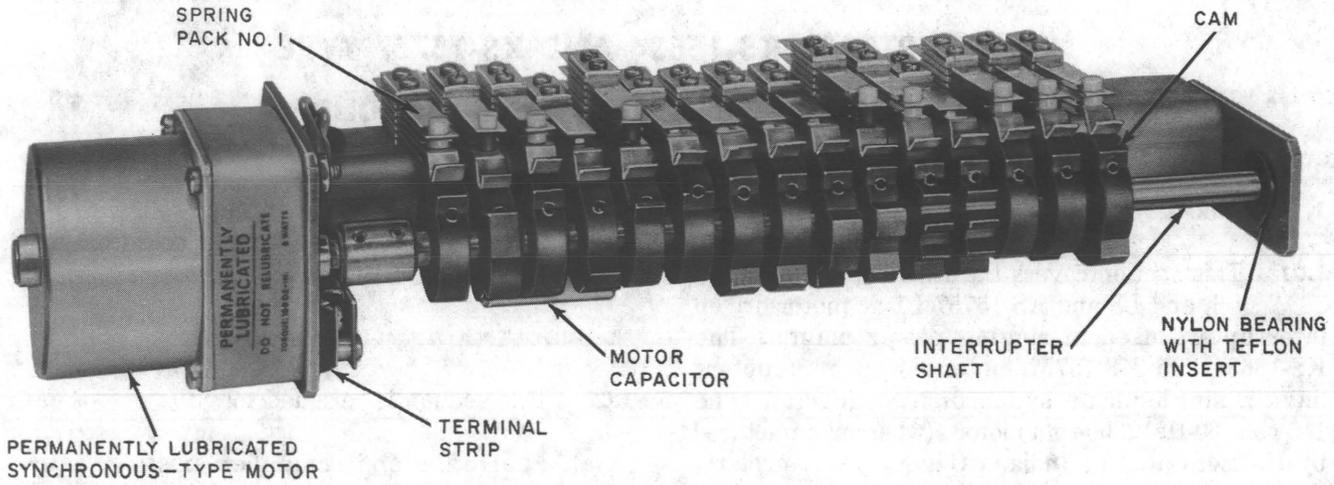


Fig. 2—KS-15634, List 4 Interrupter (North American Philips Corp)

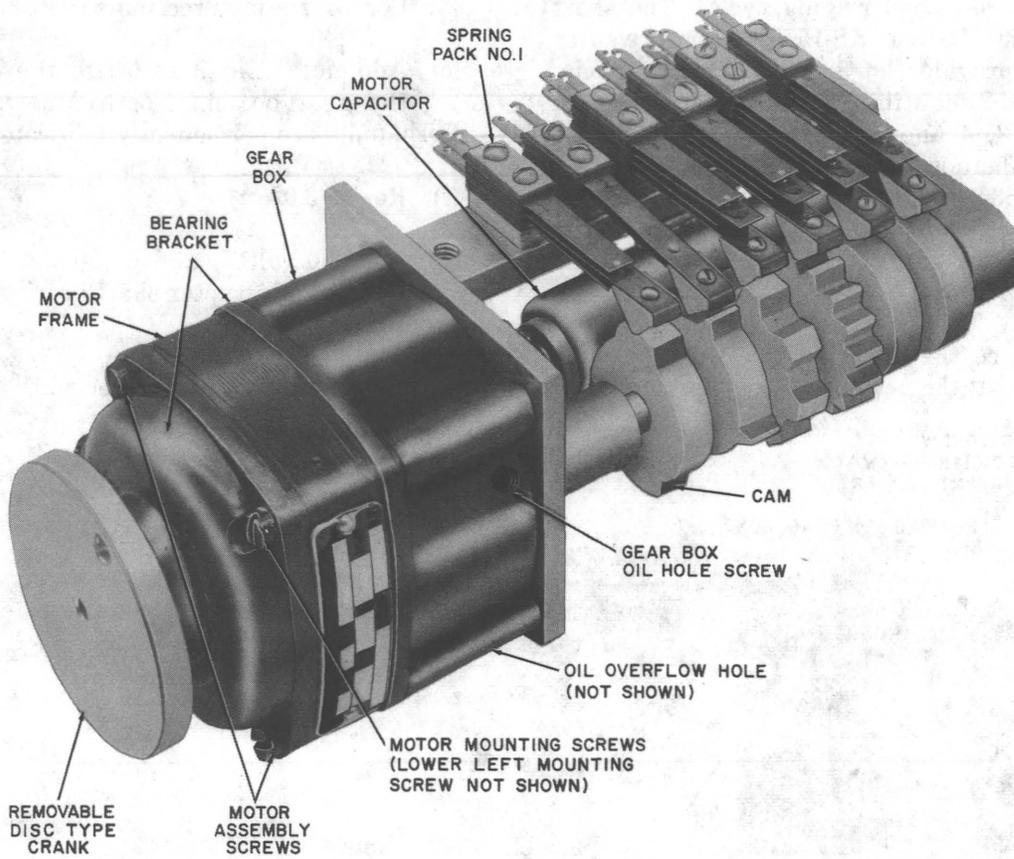


Fig. 3—KS-15757, List 1 Interrupter (Holtzer-Cabot)

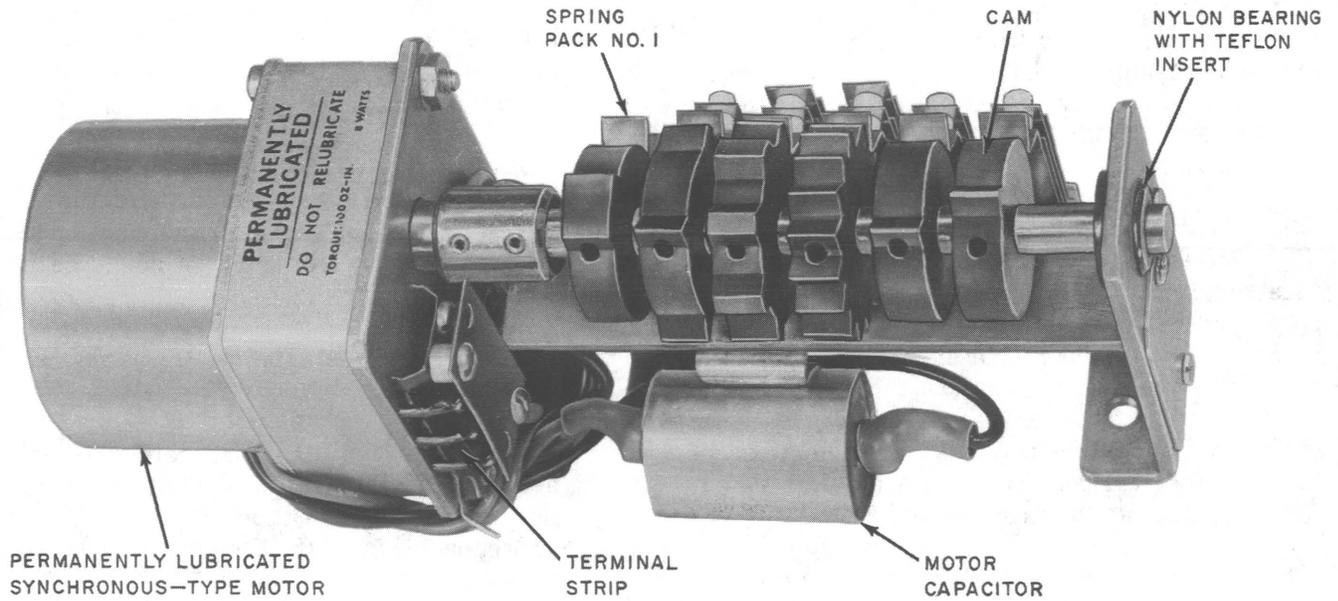


Fig. 4—KS-15757, List 1 Interrupter (North American Philips Corp)

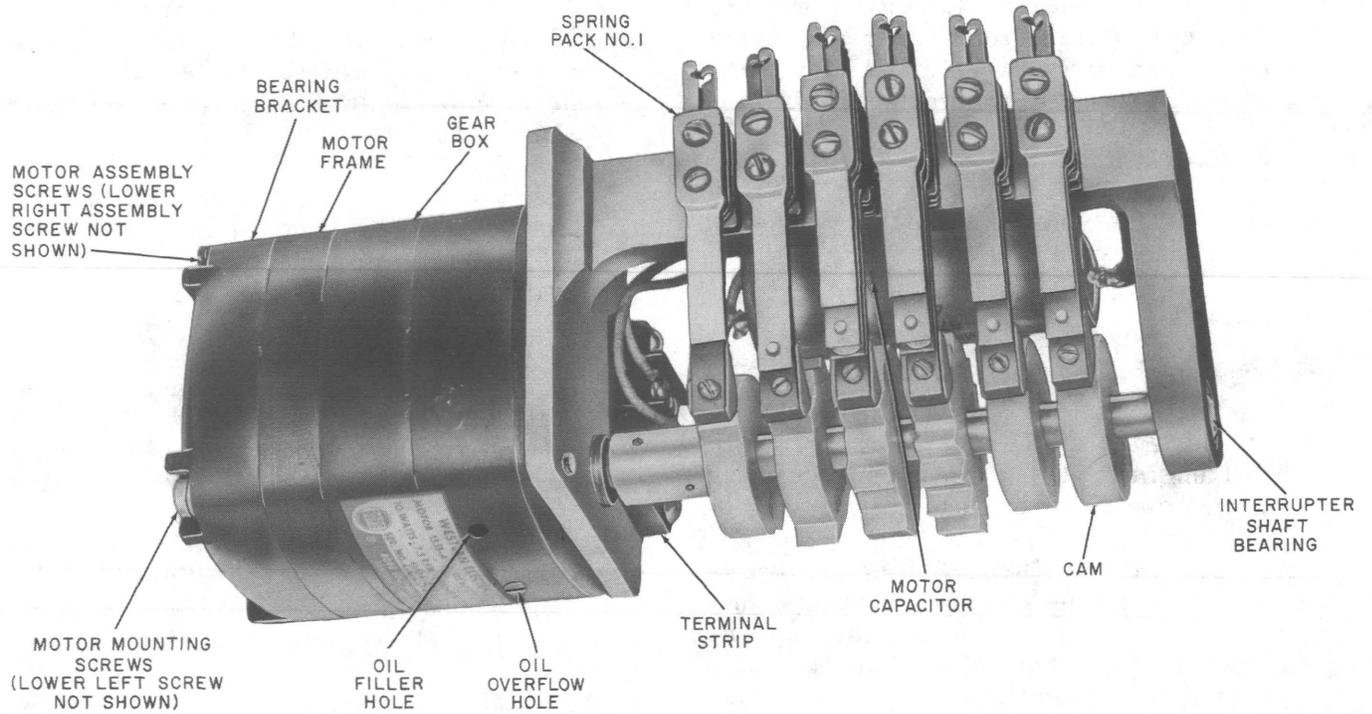


Fig. 5—KS-15757, List 1 Interrupter (Indiana General Inc)

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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 163-220-801 for replacement part information.

1.04 Asterisk (*): Requirements are marked with an asterisk when to check for them would necessitate the dismantling or dismounting of the apparatus or would affect the adjustment involved or other adjustments. No check need be made for these requirements unless the apparatus is made accessible for other reasons or its performance indicates that such a check is advisable, except that the interval requirement in the Equipment Test List must not be exceeded.

1.05 Before starting work on the interrupter, disconnect the power supply in any convenient manner to avoid unexpected starting.

Caution: Oil lubricated interrupters which are manufactured by the Holtzer-Cabot Corp. or the Indiana General Corp. are shipped with no oil in the gear box. Upon installation make sure that the gear box is lubricated in accordance with 2.02(a).

2. REQUIREMENTS

2.01 Cleaning: Contacts and other parts shall be cleaned when necessary.

Gauge by eye.

2.02 Lubrication:

- (a) **Gear Box:** If the interrupter gear box is oil lubricated and has been in storage or out of service for more than one year, it shall be cleaned with KS-7860 petroleum spirits and lubricated with KS-16326 L1 oil at the time of installation. If the interrupter is new it may have a grease lubricated gear box and no lubrication is required. If the unit has an oil lubricated gear box and has been out of service less than one year, it shall be lubricated, without cleaning, at the time of installation. The oil lubricated interrupter gear box shall be lubricated annually. When lubrication is required, oil shall be added so that it will just flow out of the overflow hole.

Note 1: The gear box on the KS-15634 and KS-15757 type interrupters manufactured by the North American Philips Corp. is permanently lubricated so no lubrication schedule is required.

Note 2: The KS-15634 and KS-15757 (all list numbers) Interrupter units manufactured by the Holtzer-Cabot Co. after January 1, 1972 are permanently lubricated so no lubrication schedule is required.

- (b) **Motor Bearings:** The motor bearings shall not be lubricated.

Note: Noisy or otherwise defective motor bearings of the Holtzer-Cabot or Indiana General Inc. units shall be replaced as covered in Section 163-220-801.

- (c) **Interrupter Shaft Bearing:**

Caution: Never lubricate the graphite-type interrupter shaft bearing on the KS-15634 (all list numbers) interrupters (by the Holtzer-Cabot Co.), or allow any lubricant on the shaft near the bearing. If the bearing is lubricated, the graphite will break down and swell, causing the interrupter shaft to bind.

Lubricate the porous bronze interrupter shaft bearing of the KS-15757 L1 Interrupter with KS-16326 L1 oil, using the KS-14796 oiler (both the Holtzer-Cabot and Indiana General Inc. types) annually.

Note: The interrupter shaft outboard bearing on the KS-15634 and KS-15757 type interrupters manufactured by the North American Philips Corp. is made of nylon (10 percent Teflon filled) so no lubrication is required.

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

Gauge by sound and feel.

- 2.04 Motor Frame Temperature:** The temperature of the motor frame shall not exceed 65°C (149°F).

Use R-1032 thermometer.

***2.05 Interrupter and Spring Pack Mounting:**

- (a) The interrupter shall be securely fastened to its mounting.
- (b) The spring packs shall be securely mounted.

Gauge by feel.

***2.06 Contact Follow:** There shall be visible follow of all contact springs after closure of the contacts.

Gauge by eye.

***2.07 Timing Requirements (Holtzer-Cabot and Indiana General Inc. types):**

- (a) **KS-15634 L1 through L6, and L8 Interrupters:** The timing of the normally open and normally closed contacts adjacent to the cam shall be in accordance with the applicable charts in Fig. 6 through 12, and 14 and the tolerances covered in (c) unless otherwise specified on the circuit drawing.

Gauge by eye.

Check as covered in (g).

- (b) **KS-15757 L1 Interrupter:** The timing of the normally open and normally closed contacts adjacent to the cam shall be in accordance with the applicable chart in Fig. 13 and 15 and the tolerances covered in (c) unless otherwise specified on the circuit drawing.

Gauge by eye.

Check as covered in (g).

(c) Tolerances for Requirements (a) and (b):

- (1) Taking the closure of the normally open contacts in No. 1 switch spring pack as occurring at 0 revolutions, the closure or opening of the contacts adjacent to the cam in other spring packs shall occur within $\pm 1-1/2$ revolutions or 0.05 seconds from their point of closure or opening as shown in the applicable charts in Fig. 6 through 15.
- (2) Contacts shall remain closed or open for not less than the smaller or more than

the greater number of revolutions shown in the adjustment limit column of the applicable chart in Fig. 6 through 15.

(d) Transfer Period KS-15634 L1 through L6:

The interval between the opening of one pair of contacts and the closure of the associated pair of contacts in each transfer spring combination shall be:

Min—1 revolution of the high-speed shaft

Max—2-1/4 revolutions of the high-speed shaft.

Gauge by eye.

Check as covered in (g).

- (e) **Transfer Period KS-15634 L8:** The contacts of the wiper spring for cams 1, 2, and 3 shall not make with the upper nor the lower spring contacts for at least 1-1/4 revolutions or .042 seconds of the high speed shaft, but one contact shall close within 2-1/4 revolutions or .075 seconds after the opening of the others.

Gauge by eye.

Check as covered in (g).

(f) Sequence of Closure of Make Contacts (spring packs having two or more make combinations):

- (1) The make contacts adjacent to the cam shall close first.
- (2) The make contacts adjacent to those covered in (1) shall close within 1/2 revolution or .016 seconds of the high-speed shaft after closure of the contacts covered in (1).
- (3) The make contacts adjacent to those covered in (2) shall close within 1 revolution or .033 seconds of the high-speed shaft after closure of the contacts covered in (1).

Gauge by eye.

Check as covered in (g).

- (g) To check the timing, proceed as follows.

(1) Make sure the power is disconnected from the interrupter before turning the shaft with the crank or wrench as covered in (2).

(2) Initially, the older type interrupters were provided with a crank consisting of a disc having a threaded hub and a finger insertion hole for turning the disc. On these interrupters, the end of the motor shaft may have either a left- or right-hand thread for mounting the crank. The end of the shaft on later interrupters has a hexagonal hole into which is inserted a proper size Allen wrench to serve as a crank.

(3) When manually cranking the shaft, check the timing by using the 81A test set or an indicating lamp connected across the contacts to indicate opening or closure of contacts. Check the intervals by counting the number of revolutions of the high-speed shaft while turning it by hand with the crank or Allen wrench. The timing of each spring pack should be checked for a complete revolution of the associated cam.

Note: The timing of the spring contacts is expressed on the chart in revolutions of the high-speed shaft. It is convenient to base the timing on this shaft since it gives a close adjustment due to the gear reduction to the interrupter camshaft.

(4) If interrupters are used with ESS equipment, the timing may be checked also by using built-in test equipment provided in the ESS equipment. (When using this method, use a KS-3008 stopwatch and consult the cam switch closure time (sec.) in applicable figures).

***2.08 Timing Requirements (North American Philips Types):**

(a) KS-15634 L1 through L6 and L8 Interrupters:

The time that the contacts shall remain closed or open shall be within the limits tabulated in the applicable revolutions adjustment limit column (or applicable closure time tolerance range column if using plant timing test equipment) of the timing charts. See Fig. 6 through 12 and 14.

Gauge by eye, or if used with ESS equipment, use built-in test equipment provided in the ESS.

(b) KS-15757 L1 Interrupter: The time that the contacts shall remain closed or open shall be within the limits tabulated in the applicable revolutions adjustment limit column (or the applicable closure time tolerance range column if using plant timing test equipment) of the timing chart. See Fig. 13 and 15.

Gauge by eye, or if used with ESS equipment, use built-in test equipment provided in the ESS.

(c) Tolerances for Requirements (a) and (b):

Taking the closure of spring No. 1 as occurring at 0 seconds, the closures or openings of the other springs shall occur within .050 seconds or 1-1/2 revolutions from the time from 0 shown for them on the timing chart for the machine being tested.

Note: Contacts shall remain closed or open within the limits tabulated in the adjustment limit column of the timing charts.

(d) Transfer Period KS-15634 L1 through L6 and L8: The transfer interval is as follows:

(1) The spring combination adjacent to the cam shall make first.

(2) The spring combination second from the cam shall make after, but not more than .016 seconds or 1/2 revolution after (1).

(3) In pile-ups having three makes, the spring combination farthest from the cam shall make after, but not more than .033 seconds or 1 revolution after (1).

Note: In pile-ups having transfers, during the transfer period, the contacts on the wiper spring shall touch neither the upper nor the lower spring contacts for at least .033 seconds, or 1 revolution but one contact shall close within .075 seconds or 2-1/4 revolutions after the opening of the other.

(c) To check the timing, proceed as follows:

Caution: Ensure that the power to the interrupter is disconnected.

(1) On the motor end of the shaft, remove the metal plug; there is a hexagonal hole

into which the proper size Allen wrench is inserted to serve as a crank.

(2) If turning the shaft with a Allen wrench, check the timing by using the 81A test set. If the interrupter is used in ESS equipment, use the built-in test equipment in the ESS plant and a KS-3008 stop watch. When using the latter method, consult the cam switch closure time (sec.) in applicable figures.⚡

3. ADJUSTMENT PROCEDURES

3.001 *List of Tools, Gauges, Materials, and Test Apparatus:*

CODE OR SPEC NO.	DESCRIPTION
TOOLS	
373D	Contact Burnisher Holder
R-1442	Brush
374A	Burnisher
374B	Burnisher
534B	Spring Adjuster
R-1005	Jewelers Screwdriver
R-1619	2-Inch "C" Clamp
R-2958	5/64-Inch Allen Wrench
R-2959	1/16-Inch Allen Wrench
—	P Long-Nose Pliers
—	3-Inch C Screwdriver
KS-14796	Oiler
—	4-Inch E Screwdriver
—	1/16-Inch Drive-Pin Punch, L.S. Starrett Co. No. 565 (or equivalent)
—	4-Ounce Riveting Hammer
—	Paper, Analytical Filter, Lint Free, No. 576 Carl Schlecher and Schuell Co. (or equivalent)
—	No. 4 Parker-Kalon, Type C, Self-Tapping Screw (on Indiana General Inc. Interrupter) or equivalent

CODE OR SPEC NO.

DESCRIPTION

—

No. 6 Parker-Kalon, Type C, Self-Tapping Screw (on Holtzer-Cabot Interrupter) or equivalent

GAUGES

R-1032,
Detail 1

Thermometer (−5° to 150° C)

MATERIALS

KS-6824

Sealing Compound

KS-16326 L1

Oil

KS-19578 L1

Trichloroethane

KS-7860

Petroleum Spirits

KS-14666

Cleaning Cloth

—

Asbestos Pad

—

Cellophane Tape

TEST APPARATUS

81A

Test Set

KS-3008

Stopwatch

3.002 Care should be exercised when using petroleum spirits in power rooms where there are dc machines, since commutation may be adversely affected by softening of commutator film by the fumes. To avoid the need for burnishing the commutators of dc machines, after doing any cleaning called for in this section, provide adequate ventilation, use the absolute minimum amount of petroleum spirits required for the cleaning operation, and keep the container closed when not in use.

3.01 *Cleaning* (Reqt 2.01)

(a) *KS-15634 L8:*

(1) Manually remove the power from the side of the plant associated with the interrupter to be cleaned. If interrupter is not removed from the frame, take the necessary precautions to protect the equipment mounted below the interrupter. Rotate the high-speed shaft with the crank or proper size Allen wrench until the contacts to be cleaned are open. Clean the contacts using only lint-free paper moistened with KS-19578 L1 trichloroethane. Visually

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inspect the contacts for foreign particles before restoring power.

- (2) Check requirements 2.06 and 2.07 after cleaning the contacts.
 - (3) Clean other parts of the interrupter using a dry KS-14666 cloth.
- (b) **All interrupters except KS-15634 L8:**

- (1) Clean the contacts (without gold overlay) as follows. Manually remove the power from the side of the plant associated with the interrupter to be cleaned. If the interrupter is not removed from the frame, take the necessary precautions to protect the equipment mounted below the interrupter. Burnish the contacts using the 373D contact burnisher holder with the 374A or 374B contact burnisher blade, depending on which can be conveniently inserted between the contacts. Using the crank or the proper size Allen wrench, rotate the high-speed shaft until the contacts to be cleaned are closed. Insert the burnisher blade between the contacts and move it back and forth three or four times.

- (2) Check requirements 2.06 and 2.07 after burnishing the contacts.
- (3) Clean other parts of the interrupter using a dry KS-14666 cloth.

3.02 **Lubrication** (Reqt 2.02):

- (a) **Lubrication of an Oil Lubricated Gear Box Without Cleaning:** If gear box cleaning is not required, lubricate the gear box as follows. The gear box must be in a level position when lubricating. Permanently remove screw, if provided, from the oil filler (upper) hole. Remove the screw (if provided) from the oil overflow hold near the bottom of the gear box, using the 3-inch C screwdriver.

Note: If the oil overflow hole was provided with a screw, it may be reused; if it was not, cut a thread with the specified self-tapping screw. See 3.001, and then remove the self tapping screw.

Add KS-16326 L1 oil, using the KS-14796 oiler in the oil filler hole until the lubricant flows

from the oil overflow hole. If the oil filler hole is not accessible, add oil through the oil overflow hole until the lubricant flows from this hole. Wait one minute after filling, install and tighten the oil overflow hole screw. Do not install a screw in the oil filler hole.

Caution: Do not install a screw in the oil filler hole. If a screw is installed, motor heat will cause the air in the gear box to expand and force oil through the oil seal into the motor unit.

(b) **Lubrication of an Oil Lubricated Gear Box With Cleaning:**

- (1) If gear box cleaning is required, remove the motor and gear box from the interrupter as covered in (2) and (3); drain the oil from the gear box as covered in (4), then remove the gear box from the motor, open the gear box, clean, and lubricate the gear train as covered in (5) through (9) for the Indiana General Inc. Interrupter or (10) through (14) for the Holtzer-Cabot Interrupter.

- (2) Clamp the interrupter shaft as follows in order to hold the shaft in position when the motor is removed. Loosen the setscrew of the cam nearest the interrupter shaft bearing, using the R-1005 jewelers screwdriver or the proper size Allen wrench as required. Slide this cam against the bearing and securely tighten the cam setscrew. Clamp the cam to the bearing bracket, using the R-1619 "C" clamp. Insert a thin piece of wood between the outer end of the bearing and the clamp to obtain a better clamping surface and to prevent damage to the bearing.

- (3) Remove the motor as follows. Tag and remove the motor and capacitor leads from the terminal strip, using the 3-inch C screwdriver. Remove the capacitor mounting screw from the interrupter frame, using the 4-inch E screwdriver and support the capacitor by its leads. If the motor coupling is provided with setscrews, loosen the two setscrews holding the coupling to the motor shaft using the proper size Allen wrench. If the coupling is secured to the motor shaft with a rollpin, remove the pin as follows. Place the 1/16-inch drive-pin punch on the pin and gently tap the punch with the 4-ounce riveting hammer

until the pin extends approximately 3/8-inch beyond the coupling. Remove the pin using the P long-nose pliers. Remove the upper right and lower left motor mounting screws (as viewed from the motor end of the interrupter), using the 4-inch E screwdriver and remove the motor and capacitor.

(4) Drain the oil from the gear box as follows:
Remove the screw from the oil overflow hole, using the 3-inch C screwdriver, and drain the oil into a receptacle by tilting the motor and gear box. Replace the oil overflow hole screw.

(5) **Indiana General Inc. Interrupter:**
Remove the motor assembly screws, using the 4-inch E screwdriver. Place the motor and gear box on a bench or table with the motor end down. Remove the gear box end plate, taking care not to lose the gasket. Remove the gear train assembly mounting screws, using the 3-inch C screwdriver, and remove the assembly.

(6) Clean the gears by rotating the shaft with the gear train assembly immersed in KS-7860 petroleum spirits in a suitable receptacle. Remove the assembly from the petroleum spirits. Examine the gear train and repeat the cleaning operation if necessary. When the gears are clean, wipe the assembly with a clean KS-14666 cloth.

(7) Wipe the inside of the gear box with a KS-14666 cloth moistened with KS-7860 petroleum spirits, then wipe again with a clean, dry cloth. Any time the seal is broken between the bearing bracket and the gear box or motor frame, clean and free the rim surfaces of any old sealing compound and oil before applying the new seal. Stir the KS-6824 sealing compound with a flat piece of hard smooth wood just before using. Apply a liberal coat of KS-6824 sealing compound, using an R-1442 brush, to both surfaces of the rims of the bearing brackets and the gear box or motor frame. Assemble the seal immediately and remove surplus sealing compound from the outside surfaces.

(8) Remount the gear train in the gear box, mount the gear box on the motor, and remount the motor on the interrupter in reverse order of removal.

(9) Lubricate the gear box as covered in (a).

(10) **Holtzer-Cabot Interrupter:** Mark the position of the gear box and the adjacent bearing bracket with respect to the motor frame to ensure proper alignment when remounting the parts. Remove the motor assembly screws, using the 4-inch E screwdriver, and carefully pry the bearing bracket and gear box from the motor frame using the blade of the screwdriver.

(11) Carefully pry the bearing bracket from the gear box, using the blade of the screwdriver. Place the gear box on a block of wood, with the shaft overhanging the edge of the block. Remove the gear train cover plate mounting screws in the gear box, using the 3-inch C screwdriver, and carefully remove the plate. Examine the felt pad on the inner surface of the cover plate for one or two spacing collars which may have remained in the pad during removal of the plate. These collars should be placed on the two bearing shafts which extend approximately 1/4-inch above their gears.

(12) Clean the gears as follows: Remount the bearing bracket on the gear box without the gear train cover plate. Cover the oil filler hole with a piece of cellophane tape. (The screw is still installed in the oil overflow hole). Fill the gear box with KS-7860 petroleum spirits through the opening in the bearing housing. Hold the gear box over a suitable receptacle and clean the gears by rotating the shaft. Turn the gear box over and drain the petroleum spirits into the receptacle. Remove the bearing bracket from the gear box and examine the gears. Repeat the cleaning operation if necessary. When the gears are clean, remove the tape from the gear box hole and wipe the gears and the gear box with a clean, dry KS-14666 cloth.

(13) Remount the gear train cover plate, making sure that the two collars are in place on the shafts of their associated gears. Anytime the seal is broken between the bearing bracket and the gear box or motor frame, clean and free the rim surface of any old sealing compound and oil before applying the new seal. Stir the KS-6824 sealing compound with a flat piece of hard smooth wood just before using. Apply a liberal coat of KS-6824

sealing compound, using an R-1442 brush, to both surfaces of the rims of the bearing brackets and the gear box or motor frame. Assemble the seal immediately and remove surplus sealing compound from the outside surfaces. Mount the bearing bracket and gear box on the motor frame and then mount the motor on the interrupter in reverse order of removal.

(14) Lubricate the gear box as covered in (a).

(15) *North American Philips Corp. Interrupters:* ♦See Note 1 in 2.02(a).♦

(c) ♦*Interrupter Shaft Bearing:*

Caution: Never lubricate the graphite-type interrupter shaft bearing on the KS-15634 L1 Interrupter (by the Holtzer-Cabot Co.).

(1) Lubricate the interrupter shaft bearing of the KS-15757 L1 Interrupter (both the Holtzer-Cabot and Indiana General Inc. types) annually by adding two drops of KS-16326 L1 oil using the KS-14796 oiler to the interrupter shaft at the interrupter shaft bearing. Wipe off any excess oil thoroughly using a KS-14666 cleaning cloth.

(2) See Note after 2.02(c) concerning the North American Philips Corp. manufactured interrupter shaft bearings.♦

3.03 *Operating Noise and Vibration* (Reqt 2.03):

If the requirement is not met, check for tightness of all screws and bolts and tighten them if necessary. If this does not correct the trouble, refer the matter to the supervisor as the motor or the interrupter may have to be replaced.

3.04 *Motor Frame Temperature* (Reqt 2.04):

To check this requirement, hold the bulb of the thermometer against the motor frame. Cover the portion of the bulb not in contact with the motor frame with the asbestos pad. Observe the

maximum temperature reading. If the temperature is above the specified limits and the nameplate voltage is not exceeded, refer the matter to the supervisor as the motor may have to be replaced.

3.05 *Interrupter and Spring Pack Mounting* (Reqt 2.05):

(1) If requirement (a) is not met, securely tighten the interrupter mounting screws using the 4-inch E screwdriver.

(2) If requirement (b) is not met, securely tighten the spring pack mounting screws using the 3-inch C screwdriver. Check requirements 2.06 and 2.07 after tightening the screws.

3.06 *Contact Follow* (Reqt 2.06)

3.07 *Timing Requirements* (Reqt 2.07):

(1) If these requirements are not met, adjust the contact springs using the 534B spring adjuster as covered in (2).

(2) Place the slotted portion of the spring adjuster at an angle against the edge of the spring. Roll the adjuster over the spring so that the spring engages the bottom of the slot. Then slide the adjuster to the base of the spring. Bend the spring as required, taking care not to disturb adjacent springs.

3.08 ♦*Timing Requirements (North American Philips Corp. Type)* (Reqt. 2.08):

(1) If these requirements are not met, adjust the contact springs using the 534B spring adjuster as covered in (2).

(2) Place the slotted portion of the spring adjuster against the edge of the spring. Roll the adjuster over the spring so that the spring engages the bottom of the slot. Then slide the adjuster to the base of the spring. Bend the spring as required, taking care not to disturb adjacent springs.♦

CAM SW. NO.	(SEE NOTE)	SPG. PK. TYPE	CAM SWITCH CLOSURE TIME (SEC)				HIGH SPEED SHAFT REV. PER CAM SWITCH CLOSURE				CAM SWITCH CLOSURE DURING REVOLUTIONS OF HIGH SPEED SHAFT							
			NOMINAL		TOLERANCE RANGE		NOMINAL		ADJUST LIMITS TOLERANCE									
			LONG	SHORT	LONG	SHORT	LONG	SHORT	LONG	SHORT	LONG	SHORT	0	30	60	90	120	150
1	I	F	1.35		1.30-1.40			40.5		39-42								
2	I	F	1.35		1.30-1.40			40.5		39-42								
3	I	A	1.35	0.45	1.30-1.40	0.40-0.50		40.5	13.5	39-42	12-15							
4	I	A	1.35	0.45	1.30-1.40	0.40-0.50		40.5	13.5	39-42	12-15							
5	I	A	1.35	0.45	1.30-1.40	0.40-0.50		40.5	13.5	39-42	12-15							
6	I	A		0.45		0.40-0.50			13.5		12-15							
7	I	H		0.25		0.20-0.30			7.5		6-9							
8	I	G	1.35		1.30-1.40			40.5		39-42								
9	I	H		0.50		0.45-0.55			15.0		13.5-16.5							
10	I	F		0.27		0.25-0.30			8.25		7.5-9.0							
11	I	C		0.27		0.25-0.30			8.25		7.5-9.0							

CAM SW. NO.	(SEE NOTE)	SPG. PK. TYPE	CAM SWITCH CLOSURE TIME (SEC)				HIGH SPEED SHAFT REV. PER CAM SWITCH CLOSURE				CAM SWITCH CLOSURE DURING REVOLUTIONS OF HIGH SPEED SHAFT							
			NOMINAL		TOLERANCE RANGE		NOMINAL		ADJUST LIMITS TOLERANCE									
			LONG	SHORT	LONG	SHORT	LONG	SHORT	LONG	SHORT	LONG	SHORT	0	5	10	15	20	25
1	I	F	1.35		1.30-1.40			6.75		6.5-7.0								
2	I	F	1.35		1.30-1.40			6.75		6.5-7.0								
3	I	A	1.35	0.45	1.30-1.40	0.40-0.50		6.75	2.25	6.5-7.0	2.0-2.5							
4	I	A	1.35	0.45	1.30-1.40	0.40-0.50		6.75	2.25	6.5-7.0	2.0-2.5							
5	I	A	1.35	0.45	1.30-1.40	0.40-0.50		6.75	2.25	6.5-7.0	2.0-2.5							
6	I	A		0.45		0.40-0.50			2.25		2.0-2.5							
7	I	H		0.25		0.20-0.30			1.25		1.0-1.5							
8	I	G	1.35		1.30-1.40			6.75		6.5-7.0								
9	I	H		0.50		0.45-0.55			2.50		2.25-2.75							
10	I	F		0.27		0.25-0.30			1.37		1.25-1.50							
11	I	C		0.27		0.25-0.30			1.37		1.25-1.50							

Fig. 6—KS-15634, List 1 (Holtzer-Cabot and North American Philips Corp) Timing Charts

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CAM SW. NO.	(SEE NOTE)	SPG. PK. TYPE	CAM SWITCH CLOSURE TIME (SEC)				HIGH SPEED SHAFT REV. PER CAM SWITCH CLOSURE				CAM SWITCH CLOSURE DURING REVOLUTIONS OF HIGH SPEED SHAFT						
			NOMINAL		TOLERANCE RANGE		NOMINAL		ADJUST LIMITS TOLERANCE		0	30	60	90	120	150	180
			LONG	SHORT	LONG	SHORT	LONG	SHORT	LONG	SHORT							
1	I	F	1.35		1.30-1.40		40.5		39-42								
2	I	G	1.35		1.30-1.40		40.5		39-42								
3	I	F	1.35		1.30-1.40		40.5		39-42								
4	I	A		0.45		0.40-0.50		13.5									
5	I	H		0.25		0.20-0.30		7.5									
6	I	C	3.00		2.95-3.05		90.0		88.5-91.5								
7	I	A	1.35		1.30-1.40		40.5		39-42								
8	I	A	1.35	.90	1.30-1.40	0.85-0.95	40.5	27.0	39-42	25.5-28.5							
9	I	A		.90		0.85-0.95		27.0		25.5-28.5							
10	I	H		.50		0.45-0.55		15.0		13.5-16.5							
11	I	F		0.27		0.25-0.30		8.25		7.5-9.0							
12	I	C		0.27		0.25-0.30		8.25		7.5-9.0							
13	I	F	1.35	0.45	1.30-1.40	0.40-0.50	40.5	13.5	39-42	12.0-15.0							
14	I	F	1.35	0.45	1.30-1.40	0.40-0.50	40.5	13.5	39-42	12.0-15.0							
15	I	F	1.35	0.45	1.30-1.40	0.40-0.50	40.5	13.5	39-42	12.0-15.0							

CAM SW. NO.	(SEE NOTE)	SPG. PK. TYPE	CAM SWITCH CLOSURE TIME (SEC)				HIGH SPEED SHAFT REV. PER CAM SWITCH CLOSURE				CAM SWITCH CLOSURE DURING REVOLUTIONS OF HIGH SPEED SHAFT						
			NOMINAL		TOLERANCE RANGE		NOMINAL		ADJUST LIMITS TOLERANCE		0	5	10	15	20	25	30
			LONG	SHORT	LONG	SHORT	LONG	SHORT	LONG	SHORT							
1	I	F	1.35		1.30-1.40		6.75		6.5-7.0								
2	I	G	1.35		1.30-1.40		6.75		6.5-7.0								
3	I	F	1.35		1.30-1.40		6.75		6.5-7.0								
4	I	A		0.45		0.40-0.50		2.25		2.0-2.5							
5	I	H		0.25		0.20-0.30		1.25		1.0-1.50							
6	I	C	3.00		2.95-3.05		15.00		14.7-15.3								
7	I	A	1.35		1.30-1.40		6.75		6.5-7.0								
8	I	A	1.35	0.90	1.30-1.40	0.85-0.95	6.75	4.50	6.5-7.0	4.25-4.75							
9	I	A		0.90		0.85-0.95		4.50		4.25-4.75							
10	I	H		0.50		0.45-0.55		2.50		2.25-2.75							
11	I	F		0.27		0.25-0.30		1.37		1.25-1.50							
12	I	C		0.27		0.25-0.30		1.37		1.25-1.50							
13	I	F	1.35	0.45	1.30-1.40	0.40-0.50	6.75	2.25	6.5-7.0	2.0-2.50							
14	I	F	1.35	0.45	1.30-1.40	0.40-0.50	6.75	2.25	6.5-7.0	2.0-2.50							
15	I	F	1.35	0.45	1.30-1.40	0.40-0.50	6.75	2.25	6.5-7.0	2.0-2.50							

Fig. 9—KS-15634 List 4 (Holtzer-Cabot and North American Philips Corp) Timing Charts

CAM SW. NO.	(SEE NOTE)	SPG. PK. TYPE	CAM SWITCH CLOSURE TIME (SEC)				HIGH SPEED SHAFT REV. PER CAM SWITCH CLOSURE				CAM SWITCH CLOSURE DURING REVOLUTIONS OF HIGH SPEED SHAFT						
			NOMINAL		TOLERANCE RANGE		NOMINAL		ADJUST LIMITS TOLERANCE								
			LONG	SHORT	LONG	SHORT	LONG	SHORT	LONG	SHORT	0	30	60	90	120	150	180
1	I	F	1.82		1.77-1.87		54.5		53-56								
2	I	C	1.82		1.77-1.87		54.5		53-56								
3	I	G	1.82		1.77-1.87		54.5		53-56								
4	I	H		0.90		0.85-0.95		27.0		25.5-28.5							
5	I	A		0.90		0.85-0.95		27.0		25.5-28.5							
6	I	F		0.25		0.20-0.30		7.5		6.0-9.0							
7	I	A	3.01		2.96-3.06		90.3		89-92								
8	I	A	1.82		1.77-1.87		54.5		53-56								
9	I	A		0.90		0.85-0.95		27.0		25.5-28.5							
10	I	J		0.50		0.45-0.55		15.0		13.5-16.5							
11	I	J		0.27		0.25-0.30		8.25		7.5-9.0							
12	I	C		0.27		0.25-0.30		8.25		7.5-9.0							
13	2	B		0.27		0.25-0.30		8.25		7.5-9.0							
14	I	A		0.45		0.40-0.50		13.5		12.0-15.0							

CAM SW. NO.	(SEE NOTE)	SPG. PK. TYPE	CAM SWITCH CLOSURE TIME (SEC)				HIGH SPEED SHAFT REV. PER CAM SWITCH CLOSURE				CAM SWITCH CLOSURE DURING REVOLUTIONS OF HIGH SPEED SHAFT						
			NOMINAL		TOLERANCE RANGE		NOMINAL		ADJUST LIMITS TOLERANCE								
			LONG	SHORT	LONG	SHORT	LONG	SHORT	LONG	SHORT	0	5	10	15	20	25	30
1	I	F	1.82		1.77-1.87		9.01		8.8-9.3								
2	I	C	1.82		1.77-1.87		9.01		8.8-9.3								
3	I	G	1.82		1.77-1.87		9.01		8.8-9.3								
4	I	H	0.87		0.85-0.95		4.50		4.25-4.75								
5	I	A	0.87		0.85-0.95		4.50		4.25-4.75								
6	I	F		0.25		0.20-0.30		1.25		1.0-1.50							
7	I	A	3.01		2.96-3.06		15.05		14.8-15.3								
8	I	A	1.82		1.77-1.87		9.01		8.8-9.3								
9	I	A	0.87		0.85-0.95		4.50		4.25-4.75								
10	I	J		0.50		0.45-0.55		2.50		2.25-2.75							
11	I	J		0.27		0.25-0.30		1.37		1.25-1.50							
12	I	C		0.27		0.25-0.30		1.37		1.25-1.50							
13	2	B		0.27		0.25-0.30		1.37		1.25-1.50							
14	I	A		0.45		0.40-0.50		2.25		2.0-2.50							

Fig. 10—KS-15634, List 5 (Holtzer-Cabot and North American Philips Corp) Timing Charts

SECTION 163-220-701

CAM SW. NO.	(SEE NOTE)	SPG. PK. TYPE	CAM SWITCH CLOSURE TIME (SEC)				HIGH SPEED SHAFT REV. PER CAM SWITCH CLOSURE				CAM SWITCH CLOSURE DURING REVOLUTIONS OF HIGH SPEED SHAFT						
			NOMINAL		TOLERANCE RANGE		NOMINAL		ADJUST LIMITS TOLERANCE								
			LONG	SHORT	LONG	SHORT	LONG	SHORT	LONG	SHORT	LONG	SHORT	0	30	60	90	120
1	I	F	1.82		1.77-1.87		54.5		53-56								
2	I	C	1.82		1.77-1.87		54.5		53-56								
3	I	G	1.82		1.77-1.87		54.5		53-56								
4	I	C		0.90		0.85-0.95		27.0		25.5-28.5							
5	I	A		0.90		0.85-0.95		27.0		25.5-28.5							
6	I	F		0.25		0.20-0.30		7.5		6.0-9.0							
7	I	C	1.35	0.45	1.30-1.40	0.40-0.50	40.5	13.5	39-42	12.0-15.0							
8	I	C	1.35	0.45	1.30-1.40	0.40-0.50	40.5	13.5	39-42	12.0-15.0							
9	I	C	1.35	0.45	1.30-1.40	0.40-0.50	40.5	13.5	39-42	12.0-15.0							
10	I	J		0.50		0.45-0.55		15.0		13.5-16.5							
11	I	J		0.27		0.25-0.30		8.25		7.5-9.0							
12	I	C		0.27		0.25-0.30		8.25		7.5-9.0							
13	2	B		0.27		0.25-0.30		8.25		7.5-9.0							
14	I	A		0.45		0.40-0.50		13.5		12.0-15.0							

CAM SW. NO.	(SEE NOTE)	SPG. PK. TYPE	CAM SWITCH CLOSURE TIME (SEC)				HIGH SPEED SHAFT REV. PER CAM SWITCH CLOSURE				CAM SWITCH CLOSURE DURING REVOLUTIONS OF HIGH SPEED SHAFT						
			NOMINAL		TOLERANCE RANGE		NOMINAL		ADJUST LIMITS TOLERANCE								
			LONG	SHORT	LONG	SHORT	LONG	SHORT	LONG	SHORT	LONG	SHORT	0	5	10	15	20
1	I	F	1.82		1.77-1.87		9.01		8.8-9.3								
2	I	C	1.82		1.77-1.87		9.01		8.8-9.3								
3	I	G	1.82		1.77-1.87		9.01		8.8-9.3								
4	I	C	0.90		0.85-0.95		4.50		4.25-4.75								
5	I	A	0.90		0.85-0.95		4.50		4.25-4.75								
6	I	F		0.25		0.20-0.30		1.25		1.0-1.50							
7	I	C	1.35	0.45	1.30-1.40	0.40-0.50	6.75	2.25	6.5-7.0	2.0-2.50							
8	I	C	1.35	0.45	1.30-1.40	0.40-0.50	6.75	2.25	6.5-7.0	2.0-2.50							
9	I	C	1.35	0.45	1.30-1.40	0.40-0.50	6.75	2.25	6.5-7.0	2.0-2.50							
10	I	J		0.50		0.45-0.55		2.50		2.25-2.75							
11	I	J		0.27		0.25-0.30		1.37		1.25-1.50							
12	I	C		0.27		0.25-0.30		1.37		1.25-1.50							
13	2	B		0.27		0.25-0.30		1.37		1.25-1.50							
14	I	A		0.45		0.40-0.50		2.25		2.0-2.50							

Fig. 11—KS-15634, List 6 (Holtzer-Cabot and North American Philips Corp) Timing Charts

CAM SW. NO.	(SEE NOTE)	SPG. PK. TYPE	CAM SWITCH CLOSURE TIME (SEC)				HIGH SPEED SHAFT REV. PER CAM SWITCH CLOSURE				CAM SWITCH CLOSURE DURING REVOLUTIONS OF HIGH SPEED SHAFT						
			NOMINAL		TOLERANCE RANGE		NOMINAL		ADJUST LIMITS TOLERANCE								
			LONG	SHORT	LONG	SHORT	LONG	SHORT	LONG	SHORT	LONG	SHORT	0	30	60	90	120
1	I	H	1.82		1.77-1.87		54.5		53-56								
2	I	H	1.82		1.77-1.87		54.5		53-56								
3	I	H	1.82		1.77-1.87		54.5		53-56								
4	I	H	1.82		1.77-1.87		54.5		53-56								
5	I	H	1.82		1.77-1.87		54.5		53-56								
6	I	H	1.82		1.77-1.87		54.5		53-56								
7	I	H		0.27		0.25-0.30		8.25		7.5-9.0							
8	I	H		0.50		0.45-0.55		15.0		13.5-16.5							
9	I	H		0.50		0.45-0.55		15.0		13.5-16.5							
10	2	H		0.27		0.25-0.30		8.25		7.5-9.0							
11	I	H		0.27		0.25-0.30		8.25		7.5-9.0							

CAM SW. NO.	(SEE NOTE)	SPG. PK. TYPE	CAM SWITCH CLOSURE TIME (SEC)				HIGH SPEED SHAFT REV. PER CAM SWITCH CLOSURE				CAM SWITCH CLOSURE DURING REVOLUTIONS OF HIGH SPEED SHAFT						
			NOMINAL		TOLERANCE RANGE		NOMINAL		ADJUST LIMITS TOLERANCE								
			LONG	SHORT	LONG	SHORT	LONG	SHORT	LONG	SHORT	LONG	SHORT	0	5	10	15	20
1	I	H	1.82		1.77-1.87		9.01		8.8-9.3								
2	I	H	1.82		1.77-1.87		9.01		8.8-9.3								
3	I	H	1.82		1.77-1.87		9.01		8.8-9.3								
4	I	H	1.82		1.77-1.87		9.01		8.8-9.3								
5	I	H	1.82		1.77-1.87		9.01		8.8-9.3								
6	I	H	1.82		1.77-1.87		9.01		8.8-9.3								
7	2	H		0.27		0.25-0.30		1.37		1.25-1.50							
8	I	H		0.50		0.45-0.55		2.50		2.25-2.75							
9	I	H		0.50		0.45-0.55		2.50		2.25-2.75							
10	I	H		0.27		0.25-0.30		1.37		1.25-1.50							
11	I	H		0.27		0.25-0.30		1.37		1.25-1.50							

Fig. 12—KS-15634, List 8 (Holtzer-Cabot and North American Philips Corp) Timing Charts

NOTES:

1. THE TIMING INTERVAL SHOWN (IN FIGURES DEPICTING KS-15634 INTERRUPTERS) IS THE PERIOD DURING WHICH THE NORMALLY OPEN CONTACTS ADJACENT TO THE CAM ARE CLOSED.
2. THE TIMING INTERVAL SHOWN IS THE PERIOD DURING WHICH THE NORMALLY CLOSED CONTACTS ADJACENT TO THE CAM ARE OPEN.
3. SPRING PACK TYPES:

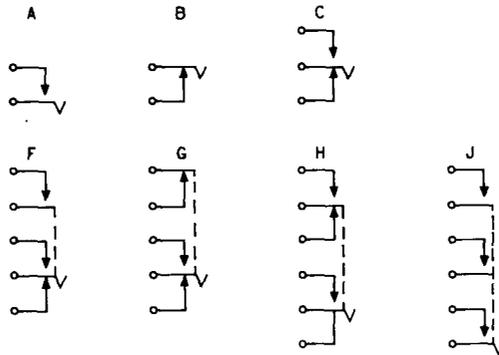


Fig. 14—KS-15634, Notes and Spring Pack Types

NOTES:

1. THE TIMING INTERVAL SHOWN (IN FIGURES DEPICTING KS-15757 INTERRUPTERS) IS THE PERIOD DURING WHICH THE NORMALLY OPEN CONTACTS ADJACENT TO THE CAM ARE CLOSED.
2. THE TIMING INTERVAL SHOWN IS THE PERIOD DURING WHICH THE NORMALLY CLOSED CONTACTS ADJACENT TO THE CAM ARE OPEN.
3. SPRING PACK TYPES:

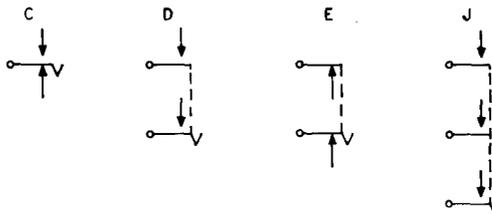


Fig. 15—KS-15757, Notes and Spring Pack Types