

CONDENSER TIMED RELAY INTERRUPTERS TESTS

1. GENERAL

- 1.01 This section covers the procedure for testing condenser timed relay interrupters except the relay timing test set and pulsing test set.
- 1.02 This section is reissued to include the use of pulse checking test set SD-96362-01 (J94723) and to include a pulsing arrangement similar to the PG and OPA relays of the Automatic Ticketing Sender.
- 1.05 The circuit requirement tables on all circuits issued or reissued after June 1, 1935 and employing condenser timed relay interrupters specify "pulse speed" and per cent break" or make and break time interval requirements for these interrupters, except where the interrupters form a complete circuit in themselves.

2. APPARATUS

When Using KS-7361 Per Cent Break Meter as in Fig. 1

- 2.01 35 Type Test Set.
- 2.02 KS-7361 Per Cent Break Meter.
- 2.03 KS-3008 Stop Watch (or watch with second hand).
- 2.04 KS-7608 Impulse Counter (or No. F789 Cenco Impulse Counter).
- 2.05 Four No. 364 Tools (Spade Terminals).
- 2.06 No. 365 Tools (Suspender Clips) as required.

2.07 Two No. 893 cords, each 6 feet long, equipped with No. 360 type tools on each end (1W13B cord) (Not required where W3M cord will span distance from interrupter to the 35 type test set. (See 3.05).

2.08 One P2P cord, 10 feet long, equipped with 1 No. 309 plug and 1 No. 310 plug (2P10A cord). (See 3.02).

2.09 W2W cord, 6 feet long, equipped with 1 No. 310 plug, 1 No. 360B tool and 1 No. 360C tool (2W17A cord) (3 required where battery and ground supply jacks are not available, otherwise 2 required. (See 3.02, 3.03 and 3.04).

2.10 One P3F cord 6 feet long, equipped with 1 No. 309 plug and 1 No. 310 plug (3P12G cord) (Not required unless interrupter leads terminate at a jack. See 3.05).

2.11 One W3M cord, 6 feet long, equipped 1 No. 310 plug and 3 No. 360 type tools (3W4A cords) (Required only when interrupter leads do not terminate at a jack. See 3.05).

2.12 One P3K cord, 6 feet long, equipped with two No. 310 plugs (3P15A cord). (See 3.05).

When Using Pulsing Checking Test Set J-94723

2.13 Pulse Checking Test Set J94723 (SD-96362-01)

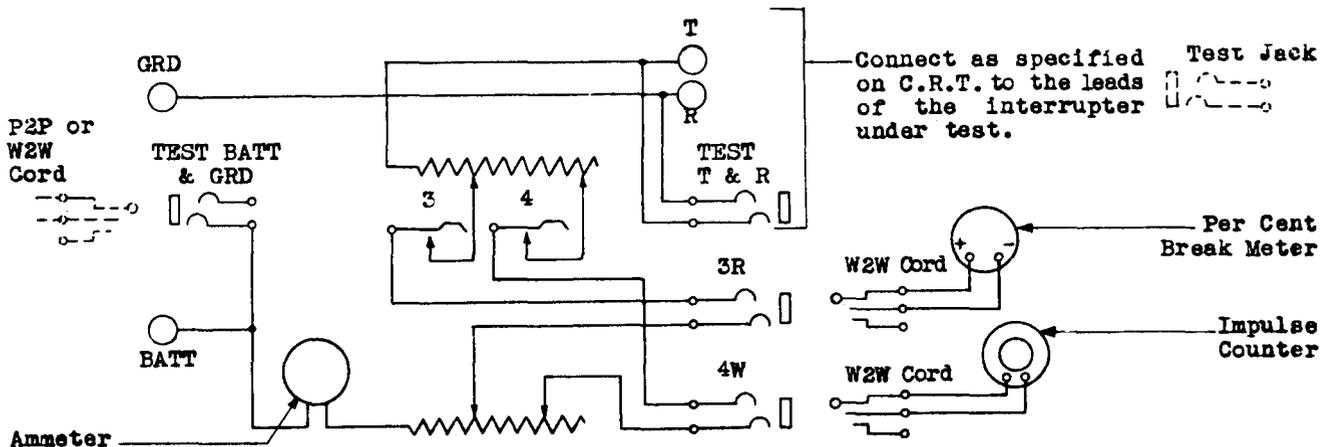


Fig. 1 - Schematic of Connection When Using
35 Type Test Set

- 2.14 Two P3K cords 6 feet long, each equipped with 2 No. 310 plugs (3P15A cord). (Required only when a battery and ground supply jack is available and when the interrupter leads terminate at a jack).
- 2.15 One W2W cord 6 feet long, equipped with 1 No. 360C tool (2W17A cord) and 2 No. 364 tools or 2 No. 365 tools, as required. (Required only when the interrupter leads do not terminate at a jack).
- 2.16 One W3M cord 6 feet long, equipped with 1 No. 310 plug, 1 No. 360A tool, 1 No. 360B tool and 1 No. 360C tool (3W4A cord) and 2 No. 364 tools or 2 No. 365 tools, as required. (Required when the battery and ground supply does not terminate at a jack).
- 2.17 One 3" cabinet screwdriver.

- notes on the circuit requirements table. If the interrupter leads terminate at the tip and ring of a jack, use a P3F cord, or a P3K cord. If the interrupter leads terminate at the tip and sleeve or ring and sleeve of a jack, use a W3M cord with the plug in the interrupter jack. If the interrupter leads do not terminate at a jack, use a W3M cord with the plug in the TEST T & R jack of the test set. (See Fig. 1). Where the distance between the T & R leads of the interrupter cannot be spanned by the two free ends of the W3M cord, use No. 893 cords in addition.
- 3.06 If the circuit through the interrupter contacts is not normally closed, block or insulate the necessary apparatus as specified on the circuit requirement tables and then set up the proper current flow values for the per cent break meter and the impulse counter as follows:

3. PREPARATION

When Using KS-7361 Per Cent Break Meter As in Fig. 1

- 3.01 See that the 35 type test set switches and keys are normal and that the resistance sliders are at the extreme right.
- 3.02 Connect the test set for application as specified under Test Set Prep. Where B/G application is specified connect the TEST BATT & GRD jack of the test set to the battery supply. If a battery supply jack is available, use the P2P cord with the plug connected to the test set. If battery supply terminals are provided, use a W2W cord connecting the white (tip) conductor to ground and the black (ring) conductor to battery.

Note: To avoid possible grounding of the battery supply leads, connect the cords to the test set first and when disconnecting remove the cords from the test set last.

- 3.03 Connect the per cent break meter to the 3R jack of the 35 type test set, using a W2W cord equipped with No. 364 tools. Connect the white (tip) conductor to the + terminal and the black (ring) conductor to the - terminal of the meter.

Note: To insure proper accuracy of the per cent break meter, it should be located approximately level and should not be closer than 12 inches to magnetic material.

- 3.04 Connect the impulse counter to the 4W jack of the test set, using a W2W cord equipped with No. 364 tools. Connect the white (tip) conductor to the left terminal of the counter and the black (ring) conductor to the right terminal.

- 3.05 Connect the test set to the circuit under test as specified in the test

- 3.07 See that key 4 of the 35 type test set is open. Close key 3 on the test set and set the sliders associated with key 3 so that the current through the per cent break meter causes the needle of the per cent break meter to deflect to the left and coincide with the 0 line on the meter scale. The value of this current will be approximately .012 ampere. Open key 3.

Caution: Exercise extreme care to see that the current is not allowed to exceed this value while adjusting the resistance sliders.

- 3.08 With key 3 of the 35 type test set open, operate the key on the counter and close key 4 on the test set. Set the sliders associated with key 4 so that the current through the impulse counter is as follows:

<u>Impulse Counter</u>	<u>Current in Amp.</u>
KS-7608	.150
Cenco No. 789 with Serial Numbers from 1 to 400 inclusive	.500
Cenco No. 789 with Serial Numbers 401 and above	.150

When Using Pulse Checking Test Set J-94723

- 3.09 Place the test set so that it is approximately level. As the meter is magnetically shielded it is unnecessary to avoid placing it adjacent to magnetic material. Restore the SCALE key, if operated to the normal or 40 position.

- 3.10 Turn the CAL potentiometer in a counterclockwise direction, to the limit of its travel.

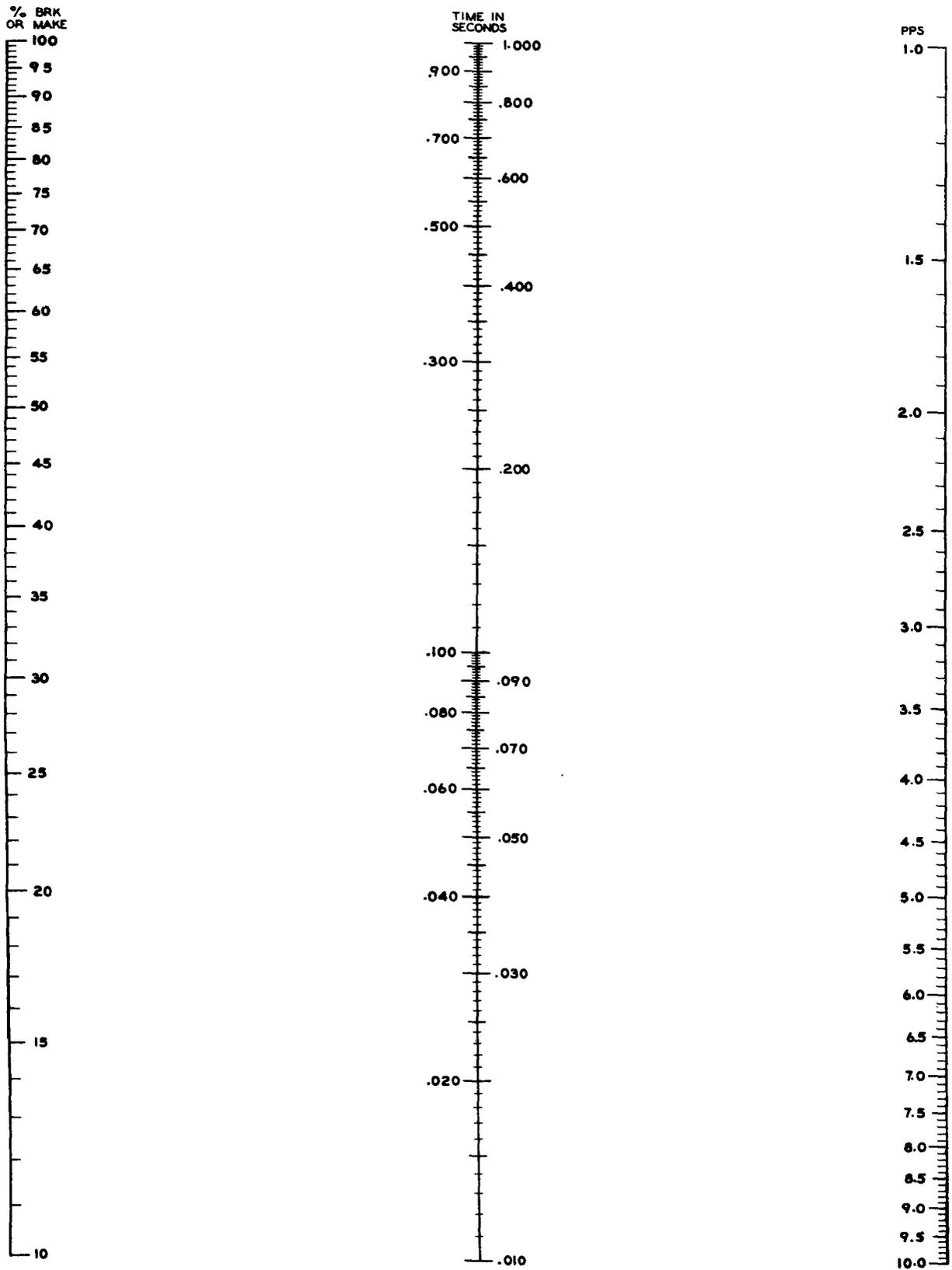


Fig. 2 - Pulse Conversion Chart

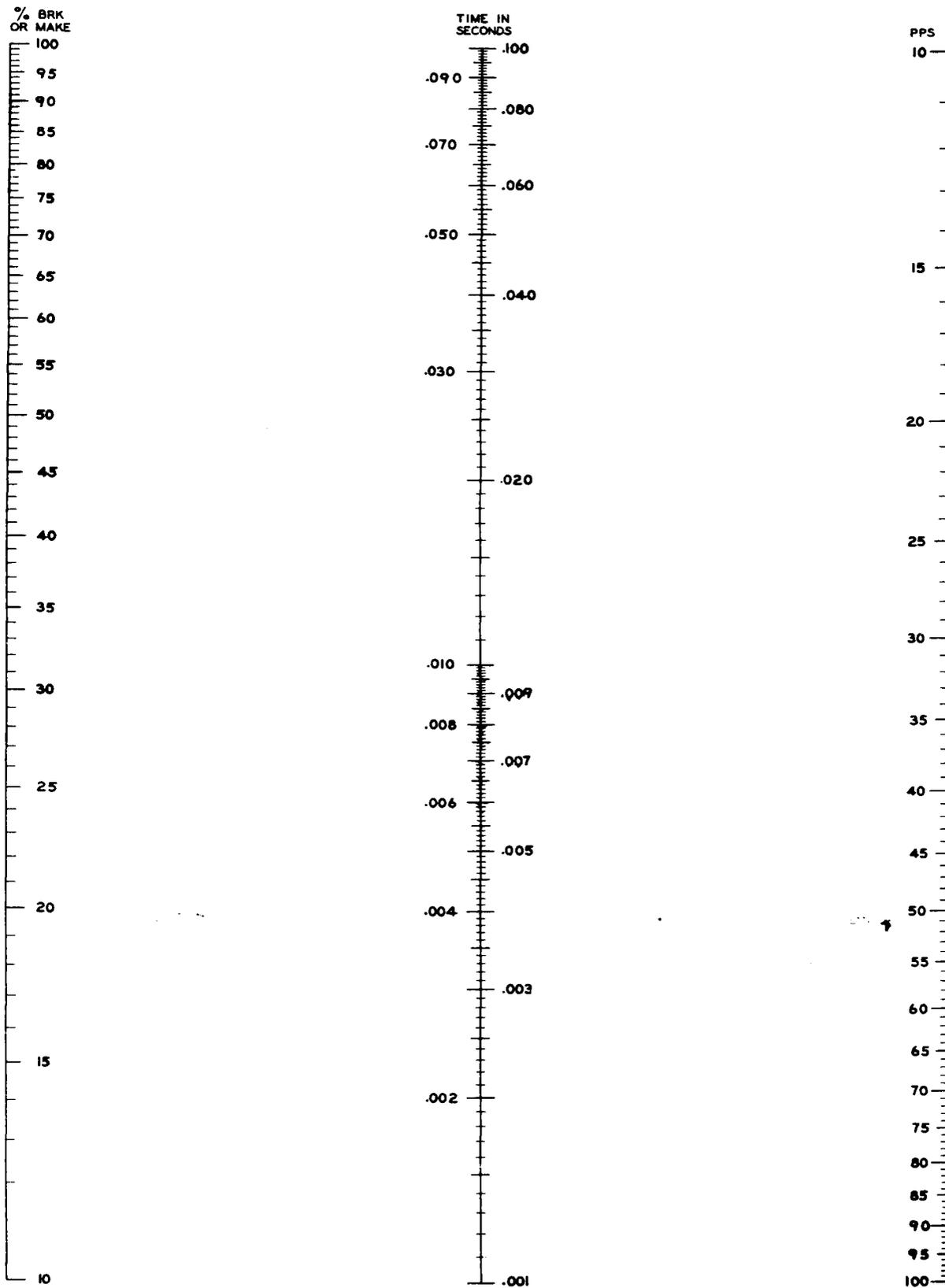


Fig. 3 - Pulse Conversion Chart

3.11 Observe that the pointer of the KS-8589 meter, which is part of test set J94723, is on the 100 per cent scale division. If not, turn the adjusting screw on top of the meter with the 3" cabinet screwdriver until it is.

3.12 Use a P3K or a W3M cord and connect battery and ground to the BAT-G jack.

Note: To avoid possible grounding of the battery supply leads, connect the cords to the test set first and when disconnecting remove the cords from the test set last.

3.13 Connect the circuit under test to the P jack of the test set by means of a P3K or a W2W cord, as specified in test notes on the circuit requirement table.

3.14 Set the CAL potentiometer so that the meter reads 0 per cent break.

4. METHOD

When Using KS-7361 Per Cent Break Meter as in Fig. 1

4.01 Starting Interrupter: Remove any blocking or insulating tool that may have been placed while setting up the current flow values. (See 3.06). If the interrupter does not start to function, consult the circuit requirement tables for the procedure necessary to start it.

Caution: In making the following tests, keys 3 and 4 of the 35 type test set must not both be closed at the same time in order to insure proper functioning of the per cent break meter and the impulse counter.

4.02 Checking Per Cent Break: Close key 3 of the 35 type test set. As the current through the per cent break meter is interrupted by the pulses of the interrupter, the needle on the meter assumes a position determined by the average amount of current for the pulse cycle. Note the reading on the meter which indicates the per cent break. Open key 3.

4.03 Checking Pulse Speed: Close key 4 of the 35 type test set. Determine the number of pulse cycles per minute as measured with the impulse counter and a watch. Start timing simultaneously with the starting of the impulse counter. At the end of one minute stop the impulse counter and observe the number of pulses recorded. Proceed as outlined in 4.07 to 4.16 inclusive.

When Using Pulse Checking Test Set J-94723

4.04 Starting Interrupter: Start the interrupter circuit under test, as

specified on the circuit requirement table.

4.05 Checking Per Cent Break: Operate the PCB (per cent break) key. When the needle of the meter has taken its final setting read the per cent break. If the needle oscillates slightly take the average between the extreme deflections.

4.06 Checking Pulse Speed: Operate the FPS (pulses per second) key and read the pulses per second from the meter as indicated on the 40 to 0 scale. If the reading is less than 20 pulses per second, operate the SCALE key to position 20 and read the pulses per second from the meter, as indicated on the 20 to 0 scale.

4.07 The method of using the per cent break and pulses per second measured in 4.02 and 4.03 or 4.05 and 4.06 is dependent upon the manner in which the requirements for condenser timed relay interrupters are shown on the circuit requirement tables. These requirements are shown on the circuit requirement table in one of the three following ways: (a) Pulse speed in pulses per second and per cent break expressed numerically. (b) Pulse speed in pulses per second and per cent break expressed in graphical (chart) form. (c) Make and break intervals of the pulse expressed in seconds.

Pulse Speed and Per Cent Break Requirements Expressed Numerically

4.08 The pulse speed in pulses per second and per cent break measured as covered in 4.03 and 4.02, or 4.06 and 4.05, respectively, should be within the limits specified on the circuit requirement tables. If the requirements are not met readjust as outlined in 4.10.

Pulse Speed and Per Cent Break Requirements Expressed in Graphical Form

4.09 Where pulse speed and per cent break requirements are expressed in graphical form as illustrated in Fig. 4, the point having the per cent break value measured in 4.02 or 4.05 and the pulses per second value measured in 4.03 or 4.06, when located on the graph, should lie within the area bounded by solid lines. If the point is outside the area bounded by the solid line, the requirements are not met.

4.10 If the requirements are not met, it usually indicates that the relays in the interrupter circuit require readjustment. First check and if necessary adjust the condenser timed relay or relays. If the requirements are still not met, check and if necessary adjust the pulse delivery relay or relays. In some circuits, adjustable capacities or biasing resistances are provided for adjusting to meet the inter-

rupter pulse requirements. In these circuits, if the relays are within requirements and if the interrupter pulse requirements are not met, it may indicate that the circuit network should be regulated. If the pulsing requirements cannot be met by adjusting the relays or by varying the amount of capacity or resistance of the network it is an indication of defective apparatus.

4.11 In Fig. 4 the solid lines are extended in both directions as dashed lines and the notations in the areas bounded by the dashed lines indicate by + and - signs, respectively, that the designated adjustable resistance or resistances should be increased or decreased to meet the requirements. For example, if the per cent break of the PLS relay (Fig. 4) is 50% and the speed 28 pulses per second, the location of the point is in the area bounded by dashed lines marked RES K+, RES L+. This indicates that the requirement is not met. If the PLS relay is within its mechanical and electrical requirements, the resistances L and K need to be increased to meet the pulse speed and per cent break requirements.

4.12 Fig 5 illustrates an arrangement in which there are two pulsing relays PLS and CTG where the adjustment for both relays is controlled by the same set of resistances. Unless otherwise specified, first check the relay for which the requirements are expressed by the area bounded by the inside solid lines designated PLS as covered in 4.09, 4.10 and 4.11. If this relay meets its requirements, the relay having requirements expressed by the outside solid lines should automatically meet its requirements.

4.13 Fig. 6 illustrates an arrangement for a pulsing relay where there is no adjustable resistance or capacity. In this case first check the relay for the requirements expressed by the area bounded by the solid lines as covered in 4.09. In the requirements are not met, it indicates that the relays in the interrupter circuit require adjustment.

4.14 Fig. 7 illustrates a pulsing arrangement using two or more relays but where provision is made for checking the pulsing output of only the OPA relay. Pulsing limits are not specified for the PG relay, which is the pulse generator relay and controls the operation of the pulse delivery, OPA relay. Therefore the solid lines representing the pulsing limits for the PG relay are not shown on the drawing. Check the output of the OPA relay as outlined in 4.09, 4.10 and 4.11. If the OPA relay meets its requirements the requirements for the other relays used in the pulsing arrangement are satisfactory.

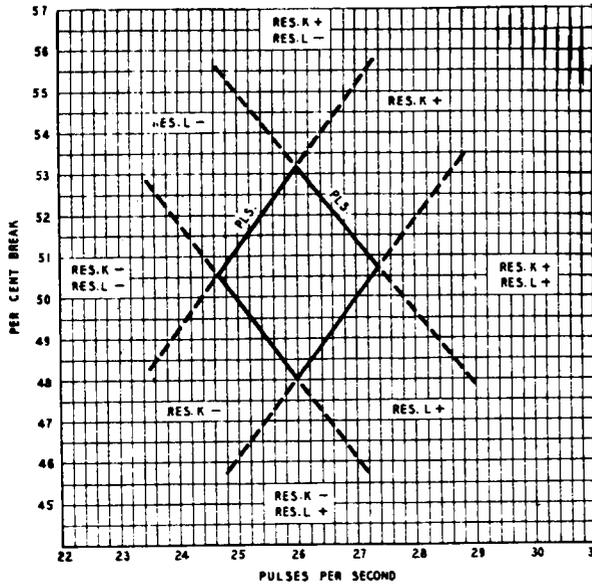


Fig. 4 - Chart Illustrating Pulse Speed and Per Cent Break Requirements - Variable Resistances Provided for Readjustment

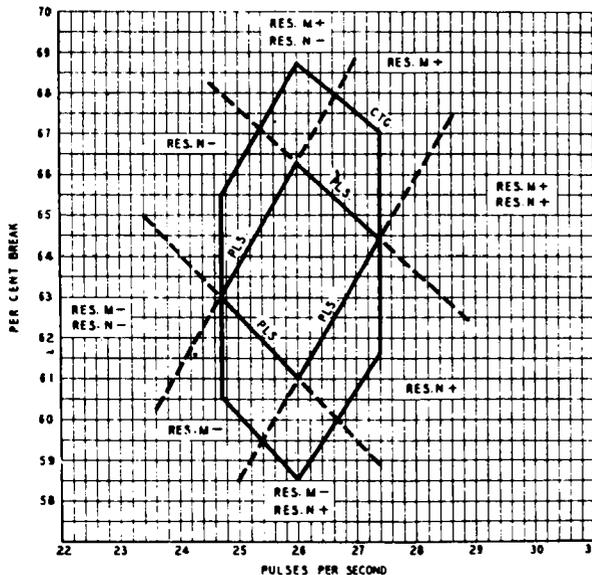


Fig. 5 - Chart Illustrating Pulse Speed and Per Cent Break Requirements - Variable Resistances Provided for Readjustment of Output of Two Relays

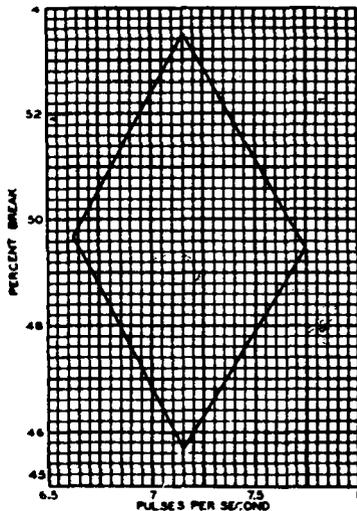


Fig. 6 - Chart Illustrating Pulse Speed and Per Cent Break Requirements - No Variable Resistances or Capacity Provided for Readjustment

Make and Break Intervals Expressed in Seconds

4.15 Using the per cent break and pulse speed in pulses per second measured as covered in 4.02 and 4.03, or 4.05 and 4.06 respectively, determine the make and break interval by using the pulse conversion charts (Figs. 2 and 3) as covered in 4.16, or compute the make interval and break interval in seconds as covered in 4.17. The values thus determined should be within the limits specified on the circuit requirement tables. If the requirements are not met readjust as outlined in 4.10.

4.16 Using a ruler or other straightedge, connect the points on the "PPS" and "per cent break of make" scales and read the time on the "time in seconds" scale. For example, assume the interrupter supplies 7.4 pulses per second at 66 per cent break. With the straightedge set on the 66 per cent in the "per cent break or make" scale and 7.4 in the "PPS" scale, the straightedge crosses the "time in seconds" column at .090. To determine the make interval, use 34 per cent make (100% - 66%) with 7.4 pulses per second in a similar manner.

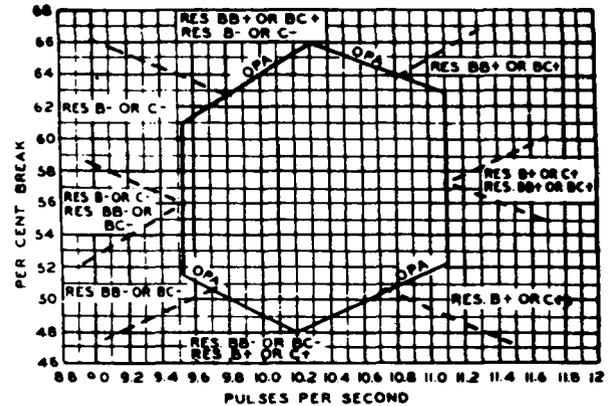


Fig. 7 - Chart Illustrating Pulse Speed and Per Cent Break Requirements - Variable Resistances Provided for Headadjustment of Relays but Where Facilities are Only Provided for Checking Output of Pulse Delivery Relay

4.17 Compute the length of the break and make intervals in accordance with the following formulae:

$$\text{Break Interval} = \frac{\text{Per Cent Break} \times .01}{\text{Pulses per second}}$$

$$\text{Make Interval} = \frac{(100 - \text{Per Cent Break}) \times .01}{\text{Pulses per second}}$$

For example, if the interrupter supplies pulses of 52 per cent break at 7.4 pulses per second, the break interval = $\frac{52 \times .01}{7.4} = .0703$ second and the make interval = $\frac{(100 - 52) \times .01}{7.4} = .0649$ second.

5. REPORTS

5.01 The required record of these tests should be entered on the proper form.