INSTRUCTIONS

PHASE SEQUENCE AND UNDERVOLTAGE RELAYS

TYPES

ICR11A ICR13A
ICR11B ICR13B
ICR12A ICR14A
ICR12B ICR15A
ICR16A

IN

DRAWOUT CASES

GENERAL ELECTRIC
SCHENECTADY, N.Y.

These instructions do not purport to cover all details or variations in equipment nor to provide every possible contingency to be met in connection with installation, operation or maintenance. ould further information be desired or should particular problems arise which are not covered sufently for the purchaser's purposes, the matter should be referred to the General Electric Company.

PHASE SEQUENCE AND UNDERVOLTAGE RELAY

ICR11A, ICR11B, ICR12A, ICR12B, ICR13A, ICR13B, ICR14A, ICR15A, ICR16A

The Type ICR induction-disk relays are designed to protect a-c machines against circuit undervoltage, phase undervoltage (or open phase), and reversed phase sequence. On polyphase circuits, however, they will not protect against phase undervoltage if voltage is maintained on all phases by the phase-balancing action of rotating machinery connected to the circuit.

The ICR11A relay has single-circuit contacts which open on undervoltage, or reversed phase sequence, and a time lever for adjusting the time delay with which the contacts close. It is designed for polyphase circuits. The relay has neither holding nor target action.

The ICR11B relay is similar to the ICR11A except that it is provided with a holding coil to maintain the contacts in the closed position until the contact circuit is opened elsewhere.

The ICR12A relay has single-circuit contacts which open on undervoltage or reversed phase sequence, but has no time lever. A slot in the disk provides a differential between the value of voltage at which the contacts open and the value at which they close. This relay is designed for polyphase circuits.

The ICR12B relay is similar to the ICR-12A except that it is designed for undervoltage protection on single-phase circuits.

The ICR13A relay has single-circuit contacts which close on undervoltage, or reversed phase sequence, but has no time lever. A slot in the disk provides a differential between the value of the voltage at which the contacts close and the value at which they open. The relay is designed for polyphase circuits.

The ICR13B relay has single-circuit contacts which close on undervoltage or reversed phase sequence, and a time lever for adjusting the time delay with which the contacts close. The relay is provided with both holding and target action. The relay is designed for polyphase circuits.

The ICR14A relay has double-throw, single-circuit closing contacts. The left-hand contacts open on undervoltage, or reversed phase sequence. There is no time lever and the action is instantaneous. The relay is like the ICR11B in that it is provided with holding action only. The relay is designed for polyphase circuits.

The ICR15A relay is similar to the ICR14A except that it is designed to provide a time delay between the instant of complete loss of voltage and the closure of the right-hand contacts.

The ICR16A relay is similar to the ICR-14A accept that it has two-circuit contacts in each direction and it is designed to provide a time delay between the instant of complete loss of voltage and the closure of the right-hand contacts.

DRAWOUT CASE

This instruction book is written to cover the above type relays mounted in the drawout case. The drawout cases are made in three major sizes each of which has studs for external connections at both ends or at the bottom only. These are respectively referred to as "double-end" and "single-end" cases. In either construction, the electrical connections between the relay units and the case are made through stationary molded inner and outer blocks between which nests a removable connecting plug which completes the circuits. The outer block attached to the case has the studs for external connections and the inner block has terminals for the internal connections.

The relay mechanism is mounted in the steel framework called the cradle and is a complete unit with all leads being terminated at the inner block. This cradle is held firmly in the case with a latch at both top and bottom and by two guide pins at the back of the case. The connecting plug, besides making the electrical connections between the respective blocks of the cradle and case, also locks the latch in place. The cover, which is drawn to the cradle by thumbscrews, holds the connecting plug in place.

To draw out the cradle, the cover must first be removed. Then, the plug can be drawn out. In so doing, the trip circuit is first opened, then the current transformer circuits are shorted and then disconnected from the relay elements, and finally the voltage circuits are opened. After the plug has been removed, the latch can be released and the cradle easily drawn out. To replace the cradle, the reverse order is followed.

NOTE: Care must be taken to insert the connecting plug slowly on relays that have contacts which are closed when de-energized but open under normal operating conditions.

A separate testing plug can be inserted in place of the connecting plug to test the relay in place on the panel either from its own source of current and voltage, or from other sources. Or the cradle can be drawn out and replaced by another which has been tested in the laboratory.

CONTACT RATING

The current-closing rating of the contacts is 30 amperes for voltages not exceeding

250 volts. The current-carrying ratings are limited by the two different ratingsof target and holding coils as indicated in the following table:-

	Amperes A-c or D-c	
	1 Amp (0.25 Ohm)	0.2 Amp (7 Ohm)
Function	Tar. & Hold. Coil	Tar. & Hold. Coil
Tripping Duty	30	5
Carry Continuously	4	0.8

The 0.2-ampere coil is for use with two trip coils that operate on currents ranging from 0.2 up to 1.0 ampere at the minimum control voltage. If this coil is used with trip coils that take 1.0 ampere or more, there is a possibility that the 7 ohms resistance will reduce the tripping current to so low a value that the breaker will not be tripped. This coil can safely carry tripping currents as high as 5 amperes.

The 1.0-ampere coil should be used with trip coils that take 1.0 ampere or more at the minimum control voltage, provided the tripping current does not exceed 30 amperes at the maximum control voltage. If the tripping current exceeds 30 amperes, an auxiliary relay must be used to control the trip-coil circuit, the connections being such that the tripping current does not pass through the contacts or the target holding coil of the protective relay.

When it is desirable to adopt one type of relay as standard to be used anywhere on a system, relays with the 1.0-ampere coil should be chosen. These relays should also be used when it is impossible to obtain trip-coil data, but attention is called to the fact that the target may not operate if used with trip coils taking less than 1.0 ampere.

INSTALLATION

Install the relay in a place that is clean and dry, free from dust and excessive vibration, and well lighted to facilitate inspection and testing.

The relay should be mounted on a vertical surface by its supporting studs or screws. The disk shaft should be vertical.

The panel drilling and outline dimensions of all Type ICR relays are shown in Fig. 1.

External resistors are used with certain ratings. These resistors should be connected as follows; If two resistors are furnished, the one with the higher ohmic value should be connected in series with the coil connected to terminals 5-6; the other resistor should be in series with the other coil circuit (studs 7-8). If the two resistors are identical, one should be connected in series with each coil circuit. If only one resistor is furnished, consider it as the higher of two and connect as outlined above.

The internal connection diagrams, Fig. 2, Fig. 3, and Fig. 8 indicate the proper terminals for the various connections. Typical wiring diagrams are shown in Fig. 4 and Fig. 5. Permanently ground one of the steel mounting studs or screws with a copper conductor of not less than No. 12 B & S gauge or its equivalent.

Before the relay is placed in service inspect the moving parts for any undue friction or other injury that may have occurred during shipment. Rotate the disk manually to close the contacts. When released, the disk should return freely to its normal position.

The lower jewel bearings have been oiled, and the top bearings filled with vaseline, at the factory. No further lubrication of any part of the relay should be attempted.

SETTINGS

The standard factory adjustment for the ICR11A and ICR11B relays is to open the contacts at 76.5 per cent of rated voltage; for the ICR12A and ICR12B relays, to open at 76.5 per cent of rated voltage and close again at 86 per cent; for the ICR13A relay to open at 86 per cent of rated voltage and close again at 76.5 per cent; for the ICR13B relay to close at 76.5 per cent of rated voltage; for the ICR14A, ICR15A and ICR16A relays (which have double-throw contacts), to close the left-hand contacts at 90 per cent of rated voltage and to close the right-hand contacts at 80 per cent.

These settings may be changed by shifting the adjustable support for the outer end of the control spring on the ICR11A, 11B and 13B relays; for the ICR12A, 12B and 13A relays, by the disk stop; for the ICR14A, ICR15A and ICR16A relays by the control spring and position of the right-hand movable contact on the gear sector.

Shifting the spring support varies both the contact-opening and contact-closing voltage. Adjusting the left-hand disk stop on the ICR12A and 12B varies the contact-opening voltage only and on the ICR13A the contact-closing voltage only. Screwing the stop in increases the spread between contact-opening and contact-closing voltage. On the ICR14A and ICR15A adjusting the right-hand movable contact varies the contact-opening voltage only.

ADJUSTMENTS AND CARE

The relays are adjusted at the factory and (except to make the settings described above) it is advisable not to disturb the adjustments. If, for any reason, they have been disturbed, the following points should be oberved in restoring them.

Bearings

When replacing the disk, the lower jewel

screw should be turned up until the disk is centered in the air gaps, after which it should be locked in position by the set screw provided for this purpose.

The upper bearing pin should be adjusted so that the disk shaft has about 1/64 inch of end play.

The lower jewel may be tested for cracks by exploring its surface with the point of a fine needle. If it is necessary to replace the jewel, a new pivot should be screwed into the bottom end of the shaft at the same time. A very small drop of General Electric meter-jewel oil, Cat. 66x728, or fine watch oil, should be placed on the new jewel before it is inserted.

Gear Mesh

The gear and pinion should be meshed as deeply as possible without binding in any position when the disk is rotated. This adjustment is correct when a slight backlash can be felt in all disk positions. The two screws holding the contact mechanism assembly to the relay frame should be tightened securely after this adjustment is made.

On relays which do not have a time lever, the relative position of the gear and pinion when meshed should be such as to allow about 1/4 inch disk edge movement away from the left-hand disk stop to just close the contacts.

Contacts

If the contacts become dirty or pitted slightly, they should be cleaned by scraping the surfaces lightly with a sharp knife or by using a fine, clean file. Under no circumstances should emery or crocus cloth be used on fine-silver relay contacts. Finish by wiping the contacts with a clean soft cloth and avoid touching them with the fingers. Contacts cleaned in this manner will remain in good condition for many months under ordinary service conditions.

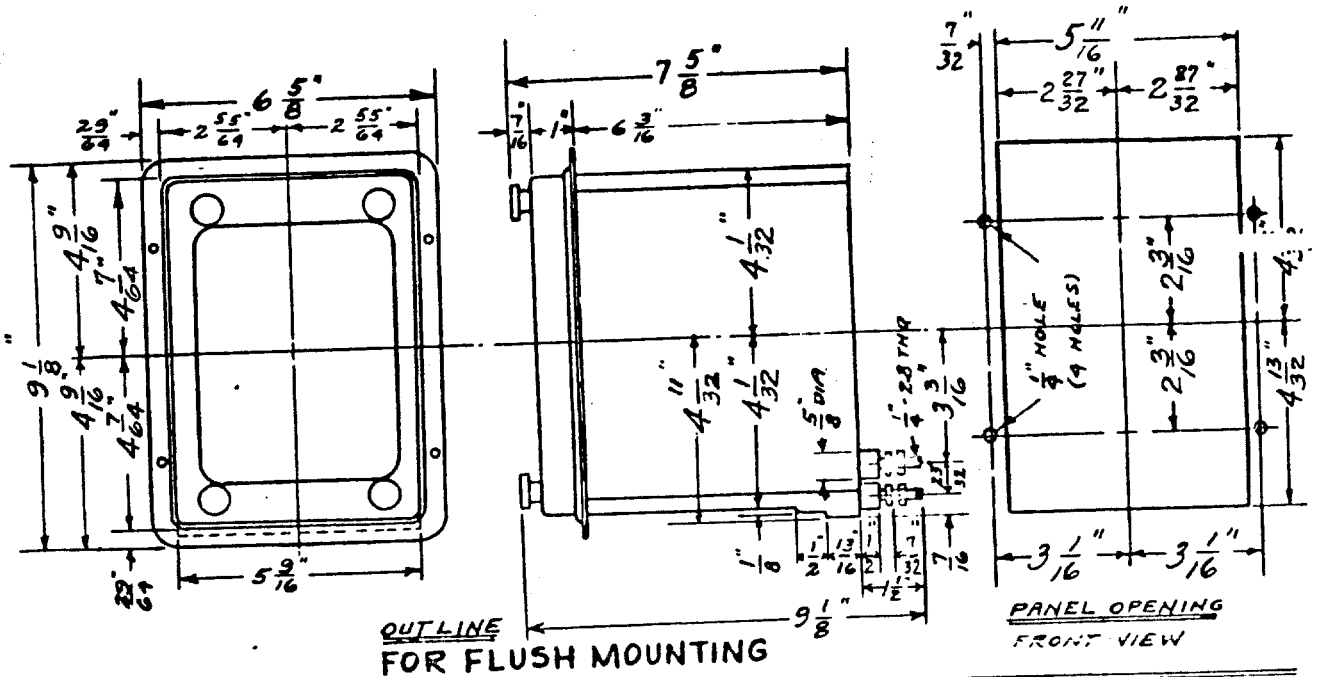
With the contacts just closed, there should be enough movement left to permit the fixed contact tips to be deflected about 1/32 inch when the stop is finally engaged. The tips should lie in the same vertical plane. These adjustments are readily obtained by moving each contact brush by means of the screw in the front of the brush block which pushes against it. On relays which do not have a time lever, the adjustment of the right-hand disk stop screw should be such that the above-mentioned brush adjustment is secured with the brushes in about the mid-position of their possible range of adjustment by means of the brush block screws.

PERIODIC TESTS

An operation test and inspection of the relay and its connections at least once every six months are recommended.

RENEWAL PARTS

When ordering renewal parts, refer to the nearest sales office of the General Electric Company and describe the required part in detail, giving the model number and rating of the relays as they appear on the nameplate.



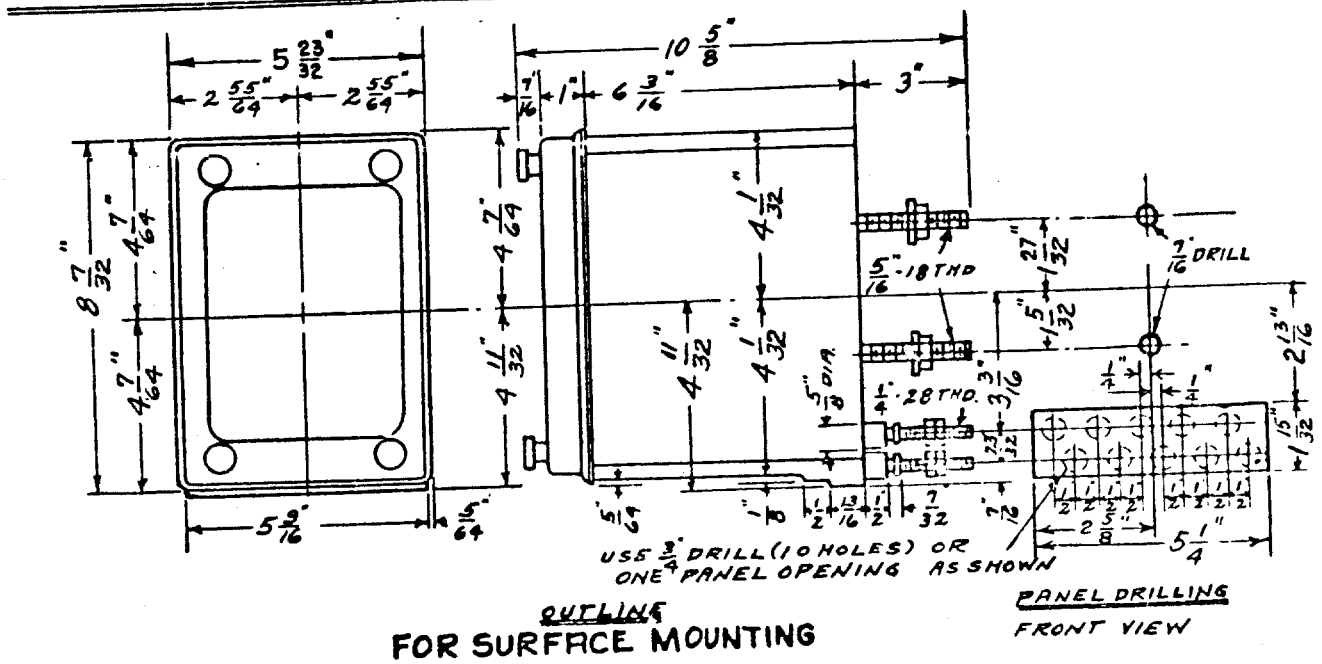


FIG. 1 - OUTLINE & PANEL DRILLING FOR DRAWOUT CASE. ONE-UNIT, SINGLE-END.
(K-6174671)

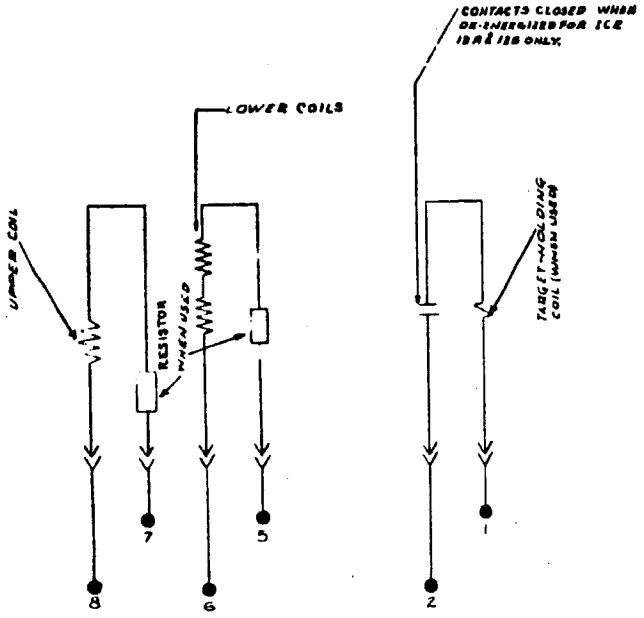


FIG. 2 - INTERNAL CONNECTIONS FOR TYPES ICR11A, ICR11B, ICR12A, ICR12B, ICR13A, ICR13B, RELAYS IN THE DRAWOUT CASE (BACK VIEW). (K-6174719)

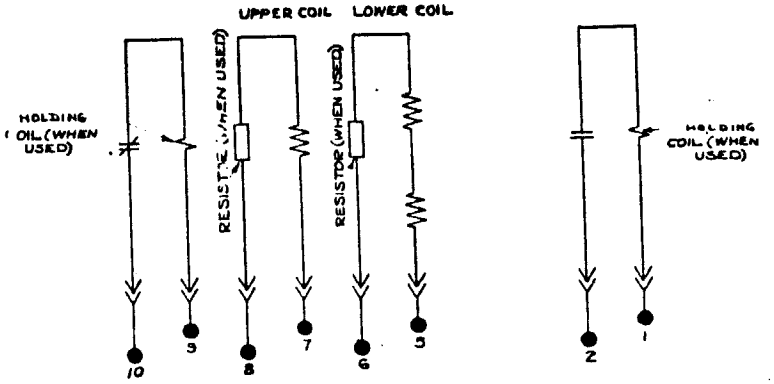


FIG. 3 - INTERNAL CONNECTIONS FOR TYPES ICR14A AND ICR15A RELAYS IN DRAWOUT CASES (BACK VIEW). (K-6174683)

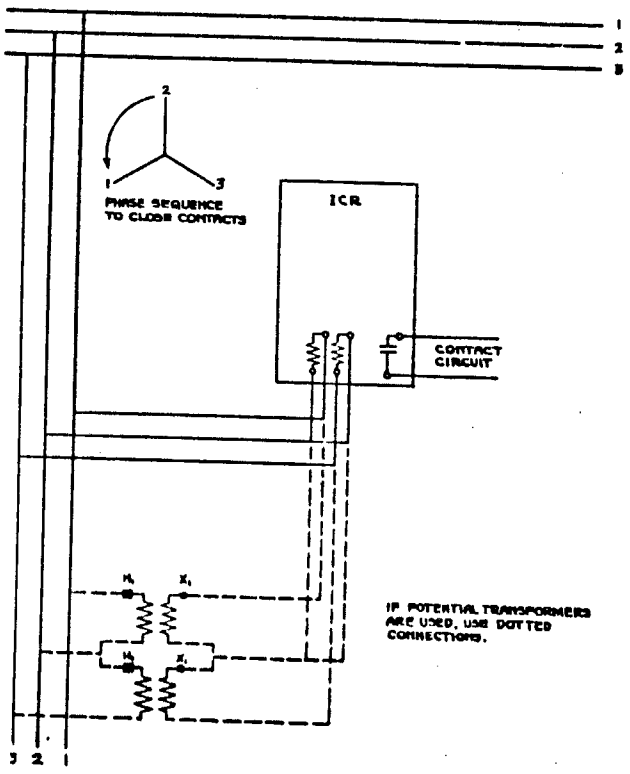


FIG. 4 - TYPICAL EXTERNAL CONNECTIONS FOR TYPE ICR RELAYS IN DRAWOUT CASES (BACK VIEW. (K-6154199)

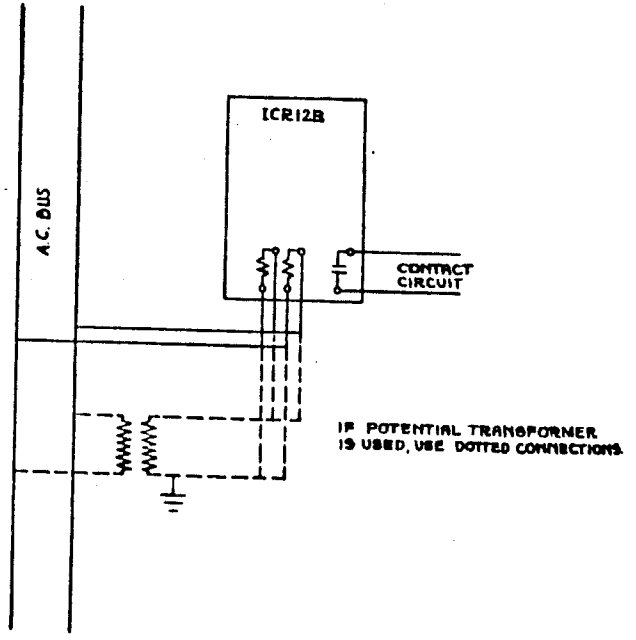


FIG. 5 - TYPICAL EXTERNAL CONNECTIONS FOR TYPE ICR12B RELAYS IN DRAWOUT CASE (BACK VIEW). (K-6154195)

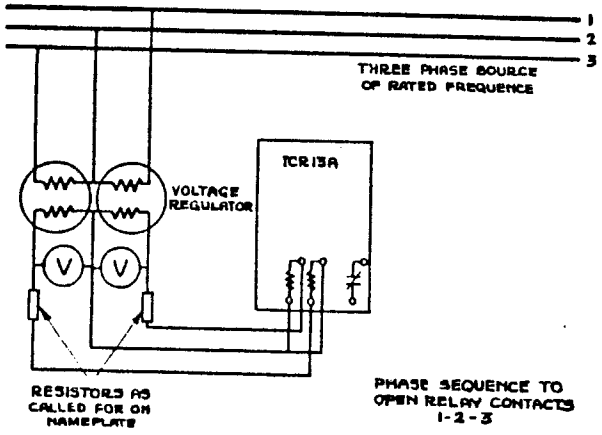


FIG. 6 - TESTING CONNECTIONS FOR TYPE ICR13A RELAYS IN DRAWOUT CASE (BACK VIEW). (K-6154198)

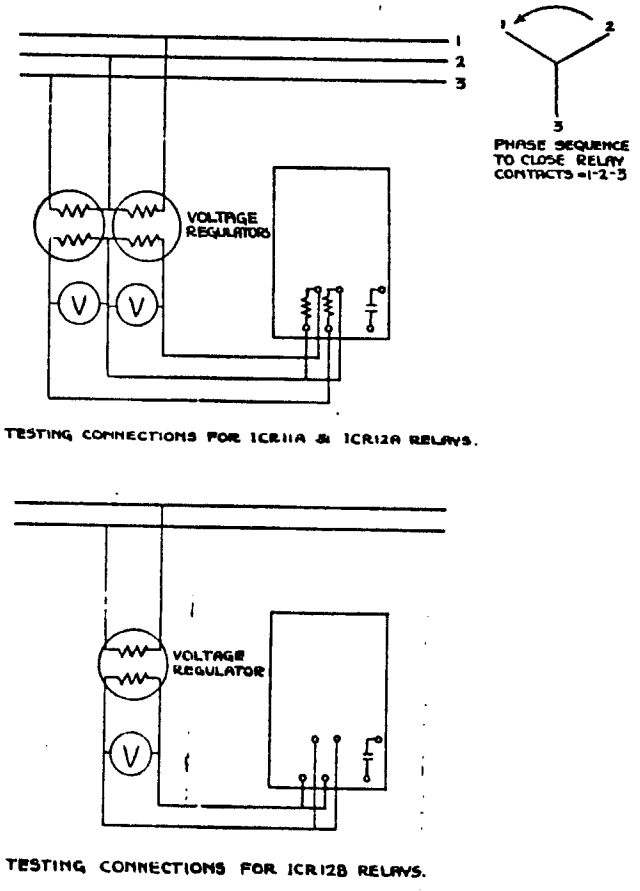


FIG. 7 - TESTING CONNECTIONS FOR TYPES ICR11A, ICR12A AND ICR12B RELAYS IN DRAWOUT CASE (BACK VIEW). (K-6154194)

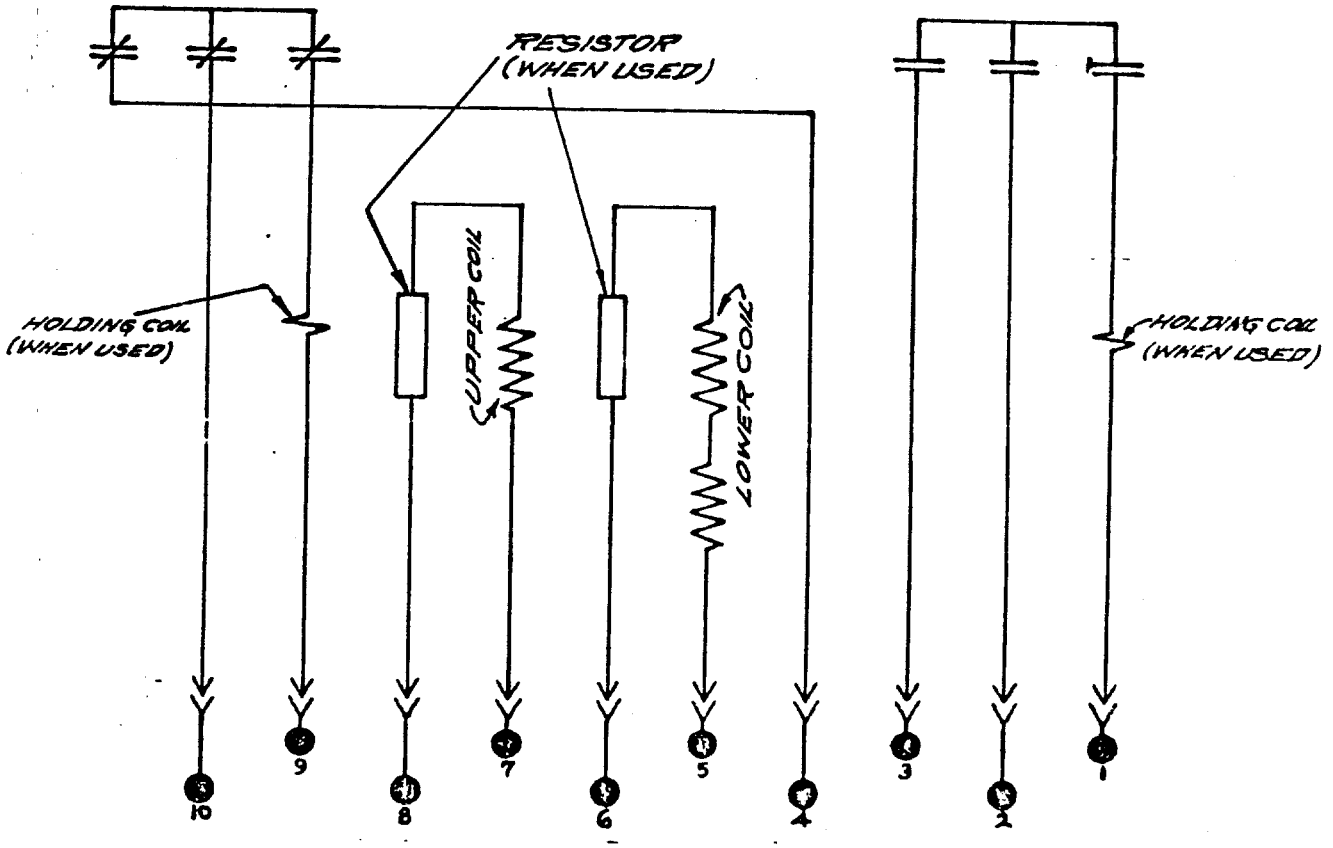


FIG. 8 INTERNAL CONNECTIONS FOR TYPE ICR1GA RELAY IN DRAWOUT CASE-BACK VIEW (K-6209581)

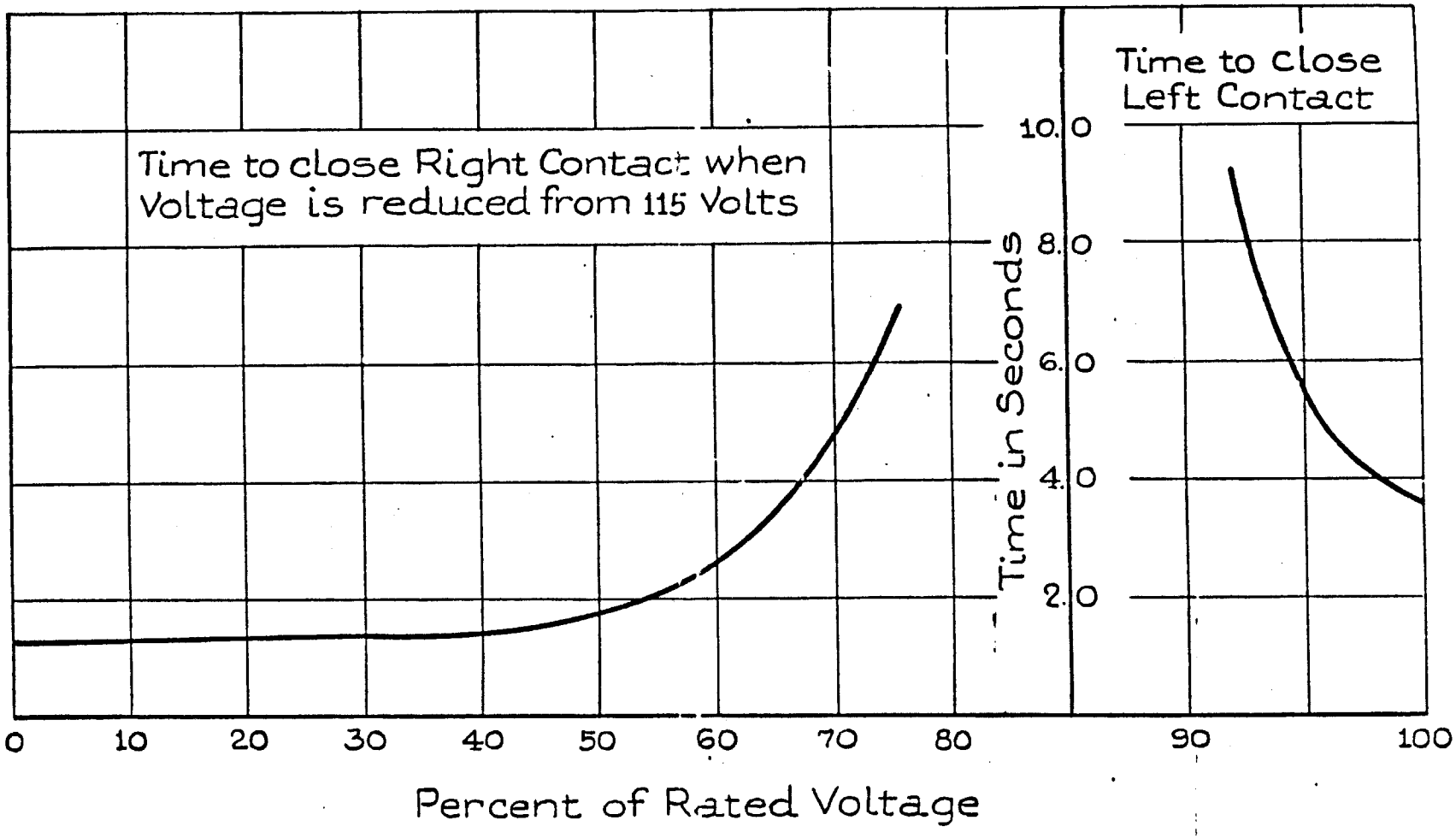


FIG. 9 12ICR15A1 AVERAGE TIME CHARACTERISTICS - VOLTS TO CLOSE LEFT CONTACT 103.5 VOLTS, VOLTS TO CLOSE RIGHT CONTACT 92.0 VOLTS 600 POINT DRAG MAGNET (K-6174629)

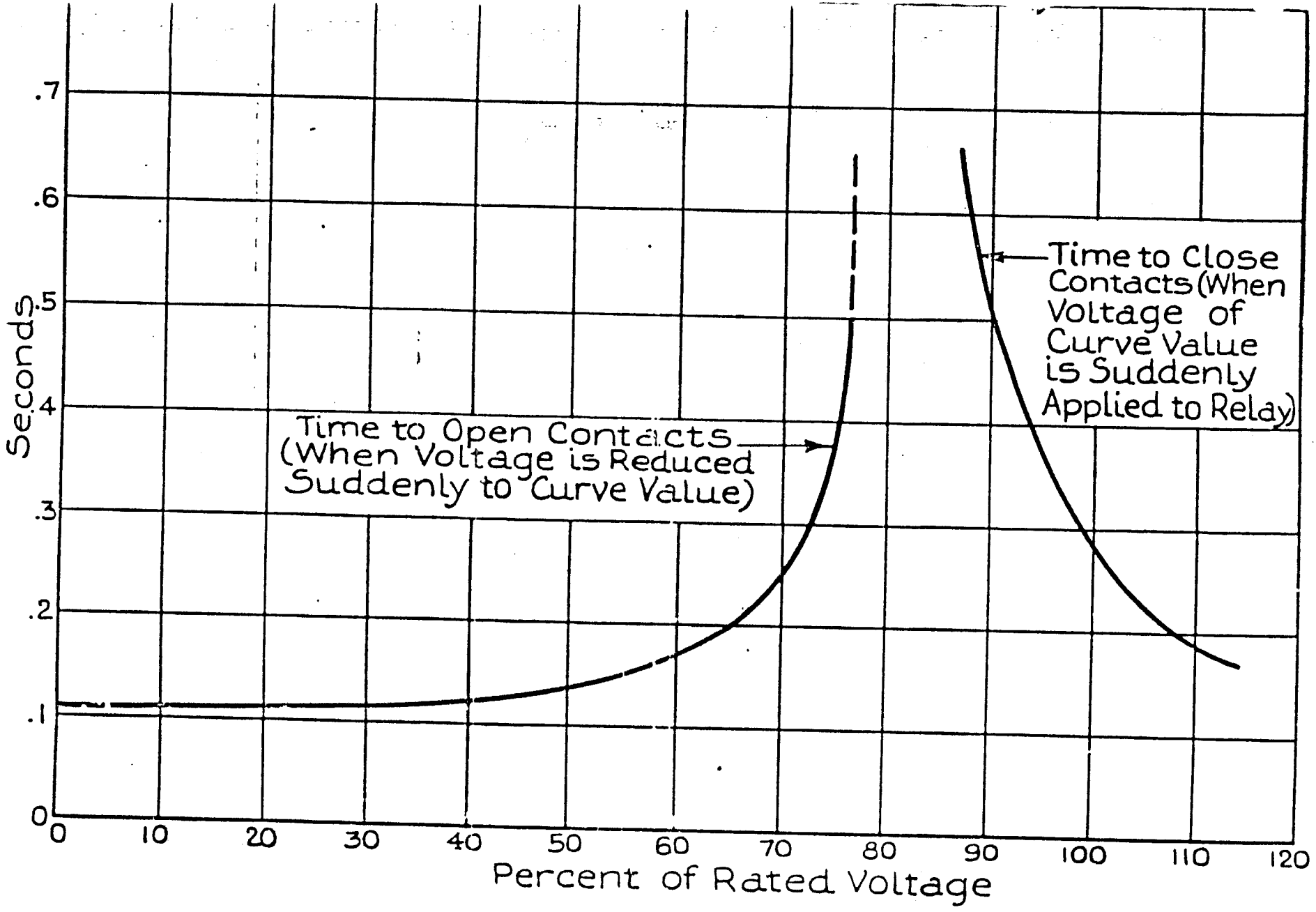


FIG. 10 ICR12A AND ICR12B RELAYS AVERAGE TIME CHARACTERISTICS FOR STANDARD ADJUSTMENTS: CLOSE 86% RATED VOLTS, OPEN 76.5% RATED VOLTS DISC TRAVEL - 1/4 INCH AT STOPS (H-6084895)

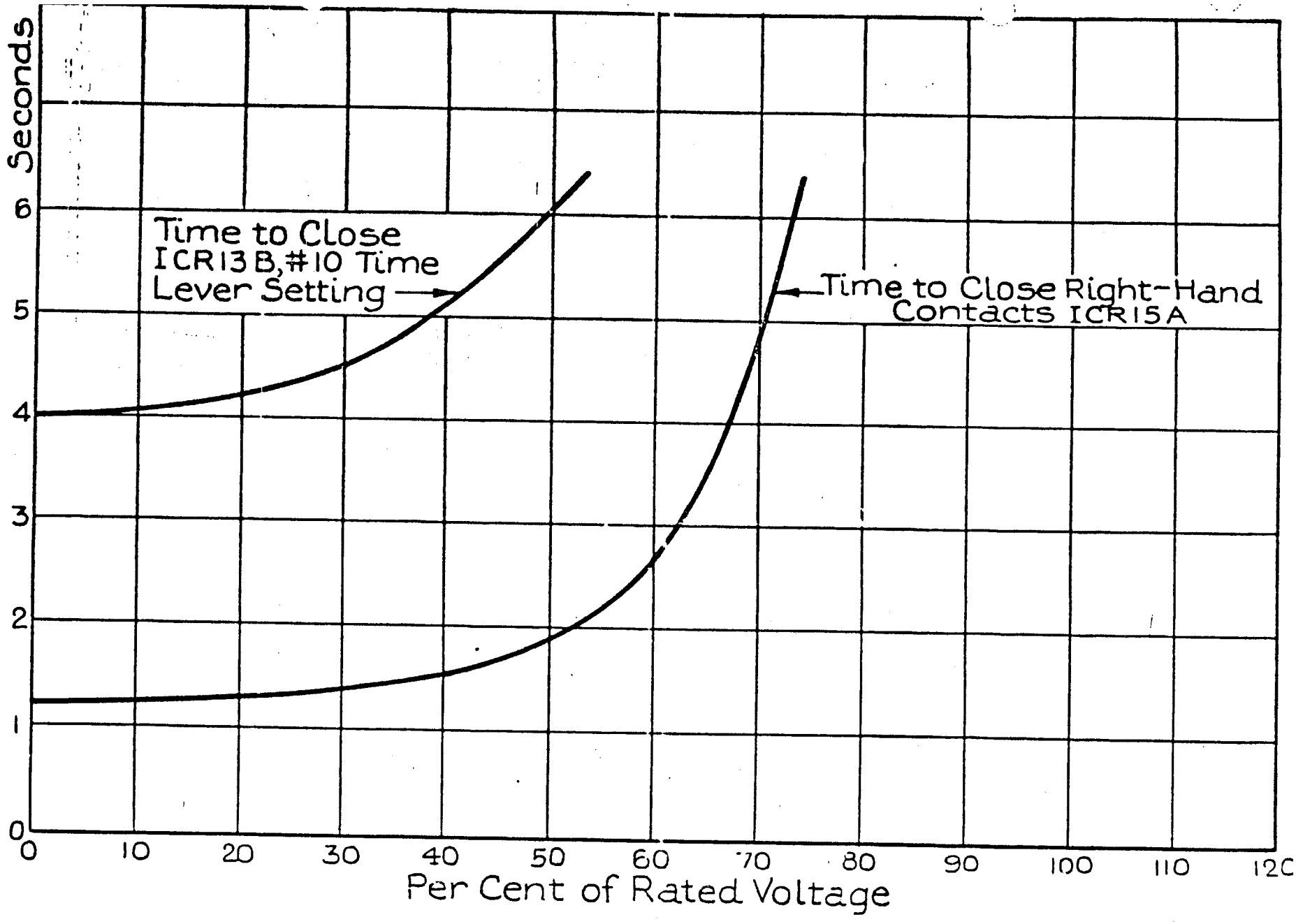


FIG. 11 ICR13B & ICR15A RELAYS. AVERAGE TIME CHARACTERISTCS WHEN VOLTAGE IS REDUCED SUDDENLY TO CURVE VALUE, USING STANDARD UNDER-VOLTAGE SETTINGS AS FOLLOWS: ICR13B — 76.5% RATED VOLTAGE. ICR15A — 80% RATED VOLTAGE. (H-6084896).

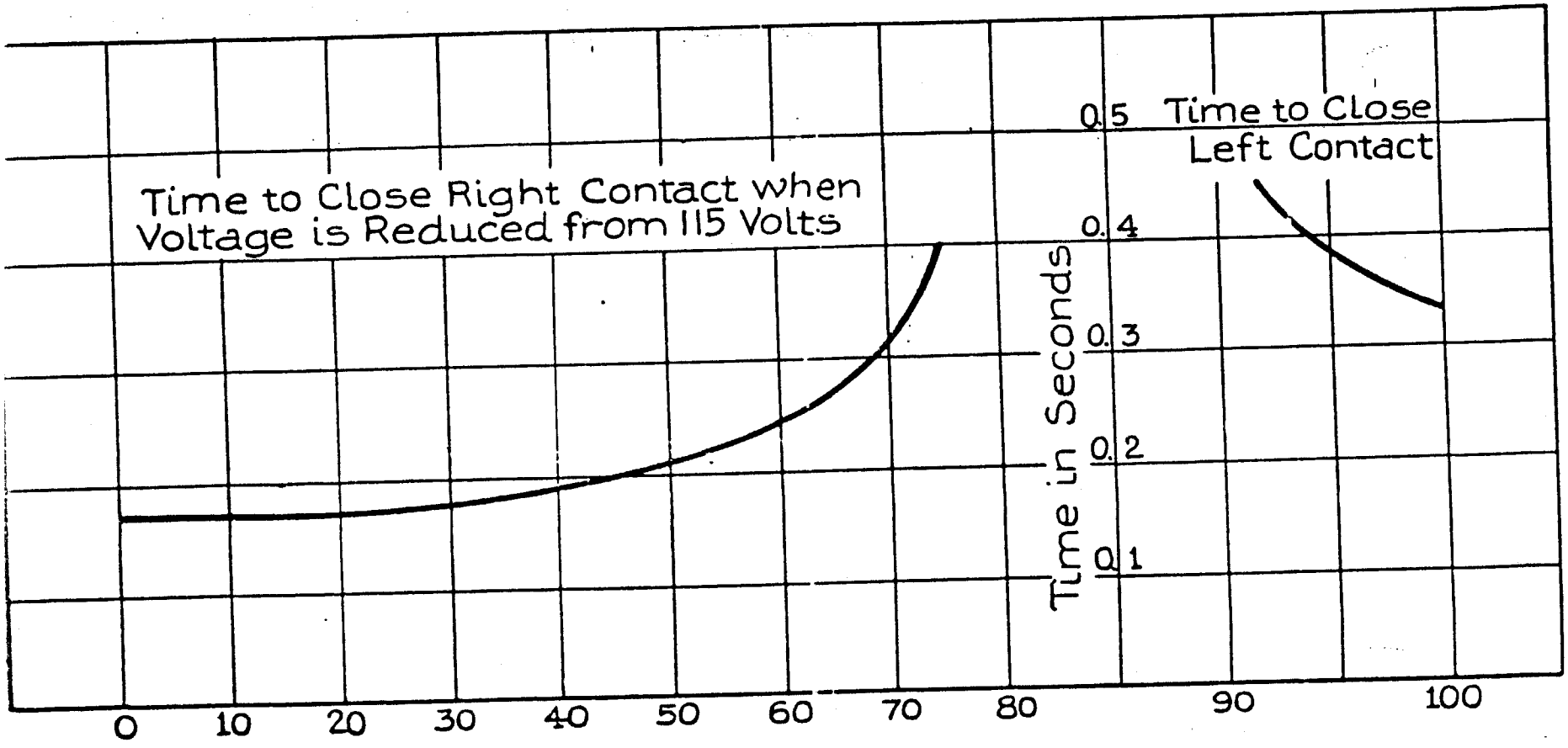


FIG. 12 121CR14A1 RELAY.
VOLTS TO CLOSE LEFT CONTACT = 103.5 VOLTS.
VOLTS TO CLOSE RIGHT CONTACT = 92.0 VOLTS.
250 POINT DRAG MAGNET. (K-6174628).