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SERVICE MANUAL 4547

SERVICE SPECIFICATIONS

RD RELAYS

The Style RD designation includes a group of direct current, two position, polar-type relays. The fundamental design, physical dimensions, and general appearances of this entire group are identical, but various coil resistances and calibration values are furnished to suit specific applications. This service specification gives calibration tables and service instructions for Style RD relays. Because of the special fixtures required in the assembly of these relays, it is recommended that they be returned to the factory when major repairs involving replacement of parts are required. However, where facilities are available to handle major repairs, reference should be made to Service Specification SU-4547-A.

I. COMMON FEATURES

RD relays are individually housed with all operating parts fully enclosed and sealed. All contacts are visible through the front cover.

RD relays have two separate coil circuits which may be used independently, or in combination, to suit requirements as shown in Figure 1.

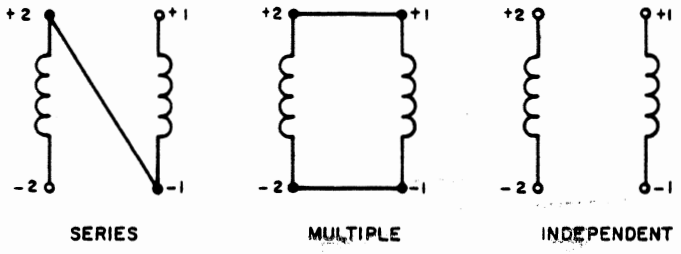

Figure 1 - RD Relay Coil Connections

RD relays are plug connected for quick and easy replacement. Coded key slots are provided in the relay case to mesh with pins in the mounting base, thereby preventing insertion of a given relay into an incorrect mounting base. The pin plate on each mounting base contains five pins in various combinations. Each separate type of RD relay has an individual combination assignment. Slots are milled in the base of each relay to match this assignment. The numbers which remain on the base of the relay after the slots have been cut identify the code combination for that relay.

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II. OPERATION

Two different types of relay operation are provided; namely, "magnetic stick" or "biased".

The stick type relay (red name plate) requires a polarity reversal to actuate the armature to operate the relay. The relay armature will remain in its last operated position until a d-c. voltage of polarity opposite to that which was last applied is used to energize the relay.

The armature of a biased type relay picks-up (moves clockwise) only when a d-c. voltage of a given polarity is applied. When a biased relay is either de-energized or energized by a voltage opposite the given polarity, the armature will remain in the counter-clockwise (de-energized) position or return to this position if picked up.

III. CLEANING

All foreign matter should be removed from the interior of the relay, paying particular attention to the contacts and armature stop pins. For general cleaning, a small, dry, fine-bristled (camel's hair) brush may be used. Contacts and stop pin surfaces may be cleaned by brushing lightly with a clean fine-bristled brush moistened with clean denatured ethyl alcohol and then drying immediately with a strip of clean lintless cloth tape.

IV. PERMANENT MAGNET

Magnet Charger UO340001 may be used to charge or age (reduce the strength of) the permanent magnets. Fixture UN327763 together with Gauss Meter, General Electric Cat. #416X29, can be used to measure the magnet strength. The initial permanent magnet strength should be approximately 90 gausses for biased relays and 80 gausses for stick relays.

It is permissible to increase or decrease the magnet strength if necessary to obtain proper calibration values.

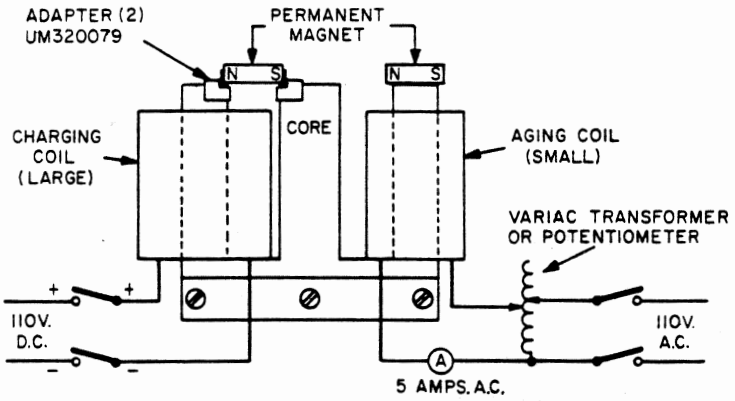

Figure 2 - Use of Magnet Charger

A. Charging

1. Place magnet on charger as shown in Figure 2 with end marked "N" on

charging coil.

2. Close 110 V. D.C. switch for 2 or 3 seconds, then open. Repeat, leave switch open.
3. Check magnet strength by applying magnet to the gauss meter fixture as shown in Figure 3. The reading should be no less than 100 gausses. Actual magnet strength is much higher since the fixture is arranged to measure only a part of the total flux.
4. The end marked "N" of a properly charged magnet should attract the end of a compass needle which points to geographic South.

B. Aging (Reducing Strength)

1. Place the magnet on the aging coil as shown in Figure 2. To increase the aging effect per unit ampere in aging coil, hold the magnet closer to the center core.
2. Adjust the variac for zero voltage.
3. Close the A.C. Switch.
4. Increase the a-c. current to 5 amps. then decrease slowly to zero. Open Switch.
5. Check magnet on gauss meter.
6. If gauss meter reading indicates too strong a magnet, age magnet again using a higher value of a-c. current.
   If gauss meter reading indicates too weak a magnet, fully charge magnet again and then age using a lower value of a-c. current.

C. Application of Magnets to Relay

Apply magnet to the relay with the side marked "N" to the left (when facing the magnet and with the magnetic structure extending upward).

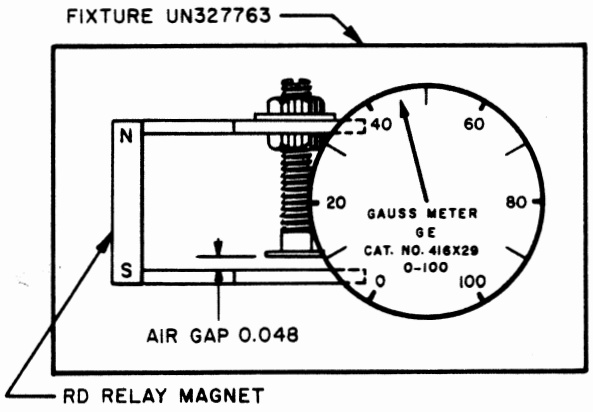

Figure 3 - Use of Gauss Meter Fixture

V. BIASED RELAY CONTACT ADJUSTMENT

A. Heel Contact Spring Adjustment

All spring pressures should be measured with a gram gage (Imtra Corpor-

ation), UJ620304, 10-80 grams, or equivalent. The gage should be applied to the contact spring next to the contact button on the side toward the weld. With gage at right angles to the contact spring, the force necessary to lift the spring away from the nylon rotor should be measured. This force should not be less than 20 grams nor more than 24 grams.

To check the pressure of the flexible Y heel springs, insert gages, UM372029, at each end of the armature with the side of the gage marked "bias" on the same side as the higher stop pin. These gages hold the armature in mid-position while the pressures of the Y springs are checked. All contacts should be open during this check. If necessary, the semi-rigid contact fingers should be bent to just open the contacts.

If a Y spring is found to have too little pressure, the pressure can be increased by opening the vertex of the Y spring with a metal rod (1/16" diameter). Pressures can be reduced by closing the vertex with a pair of tweezers. Care should be exercised to avoid permanently distorting the Y springs. If there is a marked unbalance between the pressures on the two sides of an individual spring, bend the Y spring at a point adjacent to the supporting stem in a direction which will equalize the pressures.

The single flexible springs are checked with the gages removed and the armature in the released or counter-clockwise position, (viewed from the front of the relay). Pressures on the single flexible heel spring can be adjusted by bending them slightly at the support. All bending should be done with a contact spring bender.

B. Back Contact Adjustment

Back contacts (those which are made when the armature is in the counter-clockwise position) should be adjusted using gages, UM372032. With the relay face down and turned so that the permanent magnet side of the relay is the near side, place the gages between the armature and the pole faces. Insert the gages on either end of the armature so the side marked "Bias-B" of the right gage is on the far side and the side marked "Bias-B" of the left gage is on the near side.

Plug the relay into fixture UN322799 which is essentially an RD relay mounting base equipped with contact indicating lamps. Using a spring bender, UR375786, applied near the welded end of the semi-rigid back contact member, bend the member so that both of its contact buttons just make with both of the corresponding Y heel spring contact buttons. If both of the contacts do not make simultaneously, use the narrow slotted end of tool, UM375775, to bend the post to which the contacts are welded just enough to align the contacts vertically. If necessary to raise or lower the Y spring contacts use the wide slotted end of the tool to bend the post. A lamp will indicate when the Y heel spring is made with either a front or back contact. The contact is properly adjusted when a light touch on the semi-rigid member extinguishes the lamp.

C. Front Contact Adjustment

After the four back contacts have been adjusted, remove the relay from the fixture and remove the gages from the relay. Now insert gages, UM372031, with the side marked "Bias-F" opposite to the position given above for the side marked "Bias-B" of the back contact gages. Plug the relay into the fixture and

adjust the eight semi-rigid front contact members in the same manner as described for the back contacts.

Care must be exercised when bending the semi-rigid front contact members adjacent to the bakelite cross members which support the front pivot. Pressure exerted by the bending tool against the bakelite might cause breakage.

D. Contact Openings

After the contacts have been adjusted, remove the relay from the test fixture and insert the same gages, UM372029, that were used for adjusting the flexible Y heel springs (Section V-A). All contacts should be open by approximately 0.002 inch.

VI. STICK RELAY CONTACT ADJUSTMENT

A. Heel Contact Springs should be adjusted the same as outlined in Section V-A except that gages, UM372028, should be used to position the armature.

B. Reverse Contacts should be adjusted the same as outlined in Section V-B (back contacts of biased relay) using gages, UM372030 (marked "Stick").

C. Normal Contacts should be adjusted the same as outlined in Section V-C (front contacts of biased relay) except using gages, UM372030 (marked "Stick").

D. Contact Openings should be checked the same as outlined in Section V-D except using gages, UM372028.

VII. CALIBRATION

A. Biased Relays

Test fixture UN334998 which is wired to connect the relay coils in series is used to check relay calibration values. Voltage d-c. is applied to the test fixture from a potentiometer and the current is measured with a milliammeter in the positive (+) coil lead to the fixture.

Set the potentiometer for a low output voltage. Throw the two top switches on the fixture up, and the bottom switch to the right. Positive polarity should now appear on the top right hand receptacle of the fixture and negative polarity should appear on the lower left hand receptacle.

Plug the biased relay into the fixture.

Increase the voltage until the current reaches the value given under "Charge" in Table #1. The relay armature should now be in the clockwise or picked up position. Decrease the voltage until the relay armature drops away to the counterclockwise position. The current at which the armature moves from the clockwise position to the counterclockwise position is the drop-away value. Momentarily open the circuit by throwing the bottom switch to the left and returning it to the right. Gradually increase the voltage until the relay armature moves once again to the clockwise position. The current at which the armature moves from the counterclockwise position to the clockwise position is the pick-up value. These current values must agree with the values given in Table #1 for proper relay calibration.

If the relay calibration does not conform with the values given in Table #1 check the contact adjustments once again before making the adjustments described below:

If the relay does not meet with the required calibration values or if the armature hangs in the mid position, adjustments must be made to the biasing springs and/or the permanent magnet. A relay armature is "hanging" when it fails to move without hesitation from one pole face to the opposite pole face at the required pick-up or drop-away current value given for calibration.

Hanging on drop-away may be caused by a weak permanent magnet, insufficient pressure in the biasing springs, or a combination of the two. Hanging on pick-up is caused by excessive pressure on the biasing springs. When adjusting the biasing springs an effort should be made to maintain nearly equal pressure in each of the two springs.

In some cases the spring pressure in the Y heel springs and in the single heel springs must be reduced in order to overcome hanging or to obtain proper calibration. The pressure in these springs should never be reduced below the 20 grams minimum value when measured as described in Section V. The pressure in the Y heel springs and in the single heel springs should be changed to obtain proper calibration only if it is found that allowable adjustment of the biasing springs and of the magnet strength, as described in the following, is inadequate to obtain proper calibration.

An increase of magnet strength raises the pickup value and decreases the drop-away current value. A decrease in magnet strength has the opposite effect on relay operation. An increase in the biasing spring pressure raises both the pick-up and the drop-away current values. A decrease in biasing spring pressure has the opposite effect on relay operation.

B. Magnetic Stick Relays

The same test fixture, UN334998, is used for calibrating both biased and magnetic stick type relays. Set the potentiometer for low output voltage and throw the two top switches down and the bottom switch to the left. Positive polarity should appear on the lower left hand receptacle of the fixture and negative polarity should appear on the upper right hand receptacle. Throw the bottom switch to the right and the polarity should reverse. Leave the switches in this position.

Plug the stick relay into the test fixture.

Increase the current to the value given under "Charge" in Table #1 and then gradually reduce the current to zero. Throw the bottom switch to the left and gradually increase the current until the relay picks up in the counterclockwise direction. The current at which the relay armature moves without hesitation from the clockwise position to the counterclockwise position is the reverse pick-up value.

Continue to increase the current until the value given under "Charge" is reached and then gradually reduce the current to zero. Throw the bottom switch to the right and gradually increase the current until the relay picks up in the clockwise direction. The current at which the relay armature moves without hesitation from the counterclockwise position to the clockwise position is the normal pick-up value.

If the stick relay calibration does not conform with the values given in Table #1, check the contact adjustments in accordance with Section VI before making the adjustments as follows:

Since there are no biasing springs on a stick type relay, the adjustment of the strength of the permanent magnet is the chief means used to obtain proper calibration. A reduction of permanent magnet strength decreases the required pick-up current (normal and reverse) and an increase of magnet strength raises the required pick-up current.

If the relay cannot be properly calibrated by permanent magnet adjustment alone and the relay armature hangs, reduce the pressure in the Y heel springs keeping within the specified limits set forth in Section VI.

VIII. CONTACT RESISTANCE

After cleaning the contacts as outlined in Section III, individual contact resistances should be no more than 0.03 ohm with the armature in the picked up or released position.

IX. SERVICE CALIBRATIONS

It is recommended that RD relays be removed from service when the calibration values are beyond the limits suggested in the calibration tables under the heading of Field Limits.

X. CONTACT AND BIAS SPRING REPLACEMENT

In the event any contact member or bias spring becomes unserviceable it should be removed. To remove the semi-rigid members a force perpendicular and away from the face of the relay should be applied to the member. A nail with half its head removed is a convenient tool to use for this purpose. To remove the flexible members roll them free of the insert. A new member can then be fastened to the relay body inserts by soldering as follows:

1. File off all the remnants of the old member until a smooth clean surface results on the insert to which the member was welded and apply a thin film of non-corrosive soldering flux.

2. With the armature held in mid-position, clamp the new member in place making sure that the contacts are aligned and that the contact end of the spring has clearance with respect to the nylon rotor.

3. Using an electric soldering iron heat the insert and apply solder, depending upon capillary action to carry the solder between the insert and the member. The solder should not build up excessively on the member beyond the limits of the insert.

4. Clean the excess flux from the joint. If a knife is used be careful not to score the flexible springs as this can eventually lead to breakage.

The references for the replacement members are as follows:

Flexible "Y" Spring	UN307995
Flexible Single Spring	UN307873
Bias Spring	UN317482
Semi-Rigid Contact Member	UN307993

XI. CONTACT BOUNCE TEST

As a final check of the continuity characteristics of the relay contacts a contact bounce test is recommended. This test is performed by operating the

relay at approximately 25 cycles/sec. and then observing the trace of contact make and break on an oscilloscope (Dumont Type 340 P1 screen or equivalent). The relay can be operated either directly from a 25 cycle A. C. source or driven at approximately 25 cycles by a 30 ohms-30 ohms RD stick type relay calibrated to pick-up at 0.053 ampere with the coils in series. The wiring and other details for the latter arrangement are found in Fig. 4.

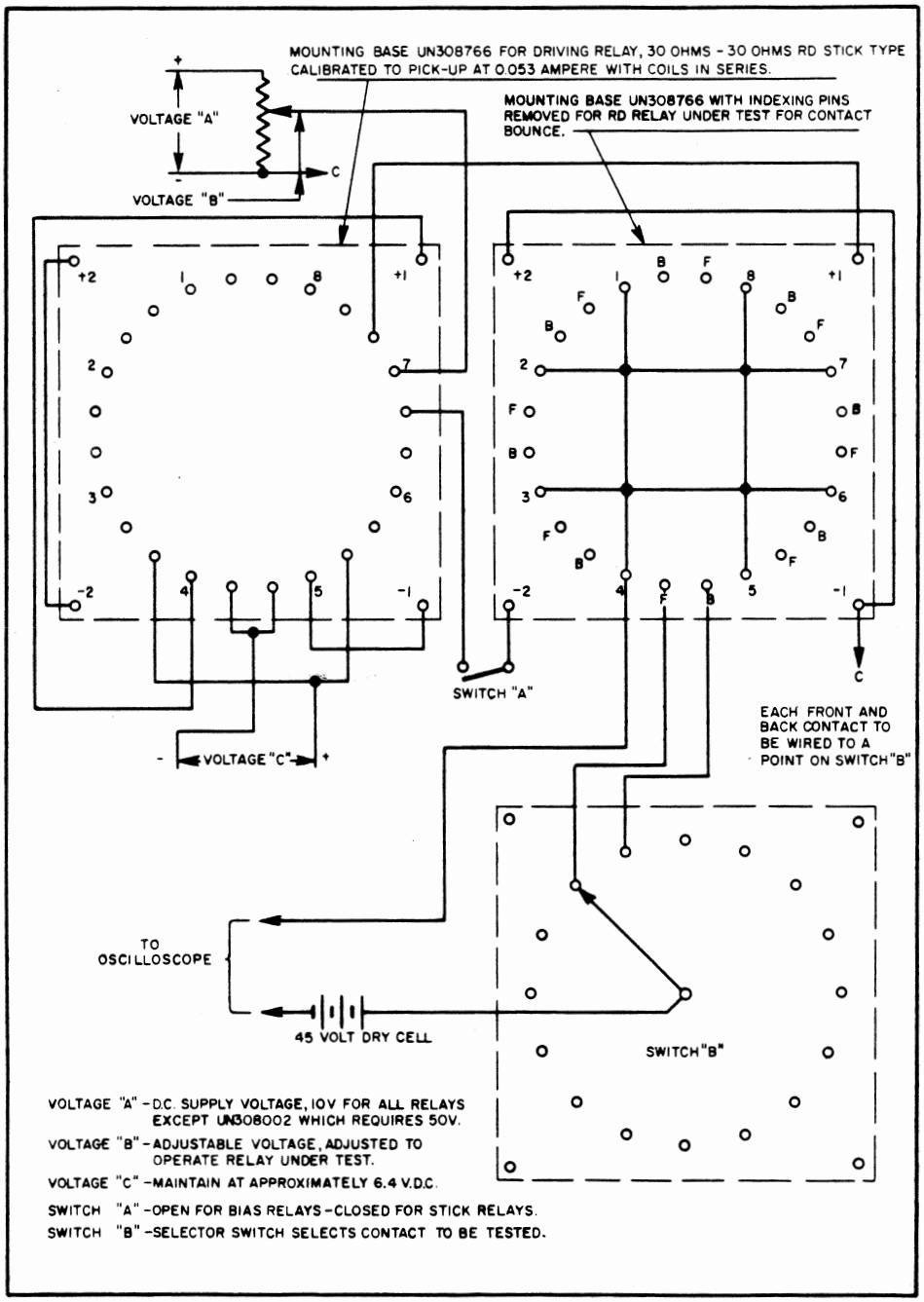

Figure 4

In this test some bounce will be observed in all contacts; the degree at which this bounce becomes objectionable is illustrated in Fig. 5. Contacts which show excessive bounce should be cleaned and checked for spring pressure per Sections V-A and VI-A. Low spring pressure is the primary cause of excessive contact bounce.

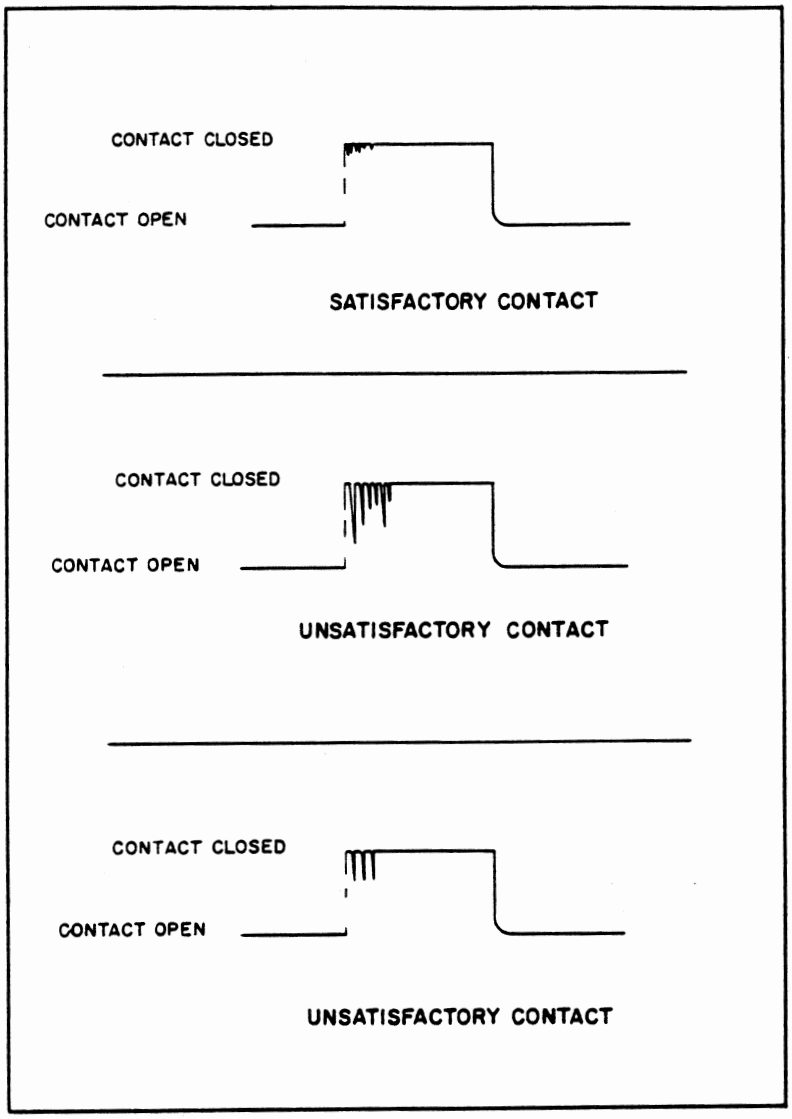

Figure 5

TABLE NO. 1

Calibration Data For Style "RD" Relays With Coils Connected In Series

(See Table No. 2 for coils connected in multiple)

BIASED RELAYS

RELAY PIECE NUMBER	RELAY RES. (IN OHMS ± 10%)	CHARGE		SHOP ADJUSTMENTS LIMITS			FIELD LIMITS		
		MILLIAMPS.	VOLTS	DROP-AWAY MILLIAMPS. (MIN.)	PICK-UP MILLIAMPS. (MIN.)	(MAX.)	DROP-AWAY MILLIAMPS. (MIN.)	PICK-UP MILLIAMPS. (MIN.)	(MAX.)
UN308001	100	120	12	15.0	55	60.0	10.0	51	65.0
UN308002	3460	32	110	1.5	8.5	9.3	1.3	7.8	10.2
UN315538	200	84	17	3.0	37	42.0	2.0	34	46.0
UN318614	60	140	9	7.5	63	70.0	5.0	57	77.0
UN386450	2.50			49.0	—	425			

STICK RELAYS

RELAY PIECE NUMBER	RELAY RES. (IN OHMS ± 10%)	CHARGE		SHOP ADJUSTMENTS LIMITS			FIELD LIMITS		
		MILLIAMPS.	VOLTS	DROP-AWAY MILLIAMPS. (MIN.)	PICK-UP MILLIAMPS. (MIN.)	(MAX.)	MINIMUM SERVICE ENERGIZATION	PICK-UP MILLIAMPS. (MIN.)	(MAX.)
UN308000	60	66	5		29	33	66	22.0	36.0
UN308003	572	28	18		13	14	22	11.5	15.5

TABLE NO. 2

Calibration Data For Style "RD" Relays With Coils Connected in Multiple

(See Table No. 1 for coils connected in series)

BIASED RELAYS

RELAY PIECE NUMBER	RELAY RES. (IN OHMS ± 10%)	CHARGE		SHOP ADJUSTMENTS LIMITS			FIELD LIMITS		
		MILLIAMPS.	VOLTS	DROP-AWAY MILLIAMPS. (MIN.)	PICK-UP MILLIAMPS. (MIN.)	(MAX.)	DROP-AWAY MILLIAMPS. (MIN.)	PICK-UP MILLIAMPS. (MIN.)	(MAX.)
UN308001	25	240	6	30	110	120	20	102	130
UN308002	865	64	55	3	17	18.6	2.6	15.6	20.4
UN315538	50	168	8.5	6	74	84	4	68	92
UN318614	15	280	4.5	15	126	140	10	114	154

STICK RELAYS

RELAY PIECE NUMBER	RELAY RES. (IN OHMS ± 10%)	CHARGE		SHOP ADJUSTMENTS LIMITS			FIELD LIMITS		
		MILLIAMPS.	VOLTS	DROP-AWAY MILLIAMPS. (MIN.)	PICK-UP MILLIAMPS. (MIN.)	(MAX.)	MINIMUM SERVICE ENERGIZATION	PICK-UP MILLIAMPS. (MIN.)	(MAX.)
UN308000	15	132	2.5	-	58	66	132	44	72
UN308003	143	56	9	-	26	28	44	23	31