RELAYS
SENSITIVE TYPES
WESTERN ELECTRIC 260 AND 261 TYPES
KS TYPES
WESTON MODELS 30, 534, 546, 730, AND 1091
BETHLEHEM MODEL 1026
REQUIREMENTS AND ADJUSTING PROCEDURES

1. GENERAL

1.01 This section covers the requirements and adjusting procedures for sensitive-type relays such as Western Electric 260 and 261 types, KS types, Weston Models 30, 534, 546, 730, and 1091, and Bethlehem Model 1026.

1.02 This section is reissued to revise the procedure for adjusting the contact gaps on the Bethlehem Model 1026 relay.

1.03 Reference shall be made to Section 020-010-711 covering general requirements and definitions for additional information necessary for the proper application of the requirements listed herein.

1.04 The sensitive-type relays covered in this section are permanent magnet moving coil-type precision relays and should be treated as electrical indicating instruments. These relays are equipped with either one or two adjustable contacts. A change in current (or voltage) in the moving coil winding from a predetermined

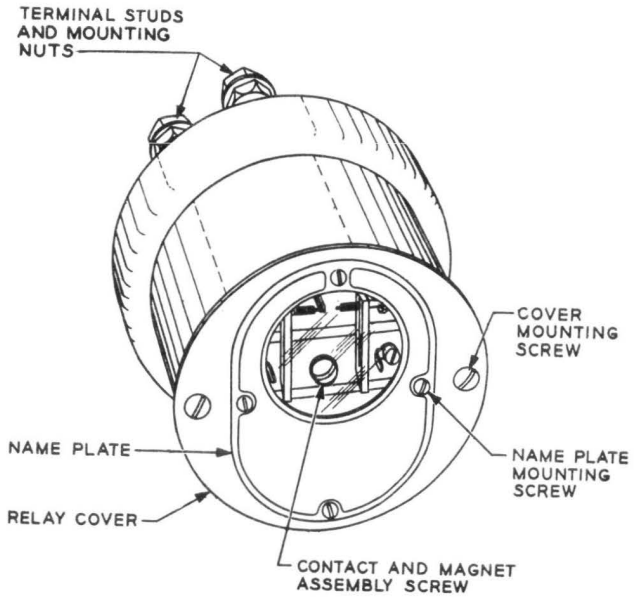


Fig. 1 – Western Electric 260 Type

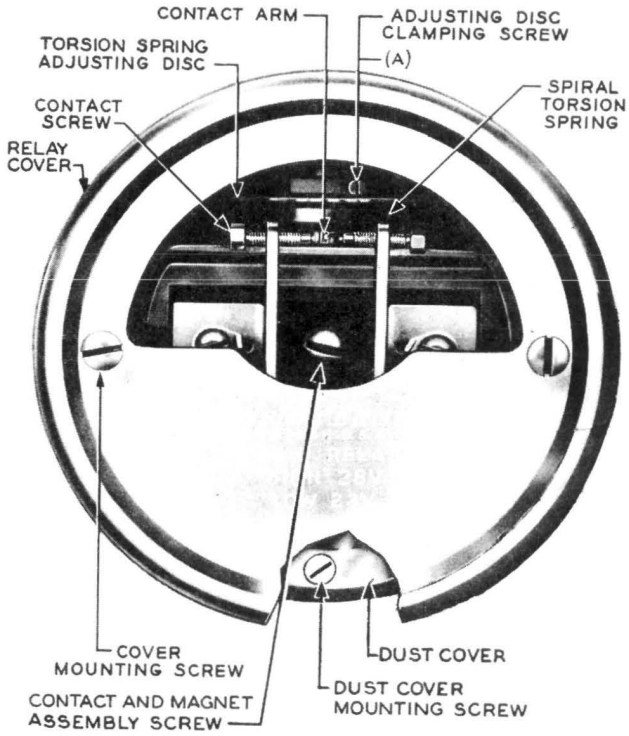


Fig. 2 – Western Electric 261 Type — Front View

value causes the contact arm to move against a contact but, when the current (or voltage) becomes normal again, the contact arm automatically returns to its normal position. Some relays are provided with scale plates and the contact arm is a pointer which indicates a change in current (or voltage) within the range of the relay.

1.05 A ***controlled*** circuit is a circuit which functions directly through the contacts of the relay.

1.06 ***Rated values*** are the values of voltage or current given on the nameplate of the relay and are the values to which the relay is adjusted by the manufacturer.

1.07 ***Nominal values*** are the values of voltage or current shown in the circuit requirement table or in other job information for the particular relay. In most cases, these values agree with the rated values. In cases where nominal values have been specified which differ from the rated values and the relay has been modified to agree with the nominal values, these values are usually stamped on the relay in red characters.

1.08 The ***tolerance*** is the permissible variation from the nominal or rated values at either the top or bottom of the range.

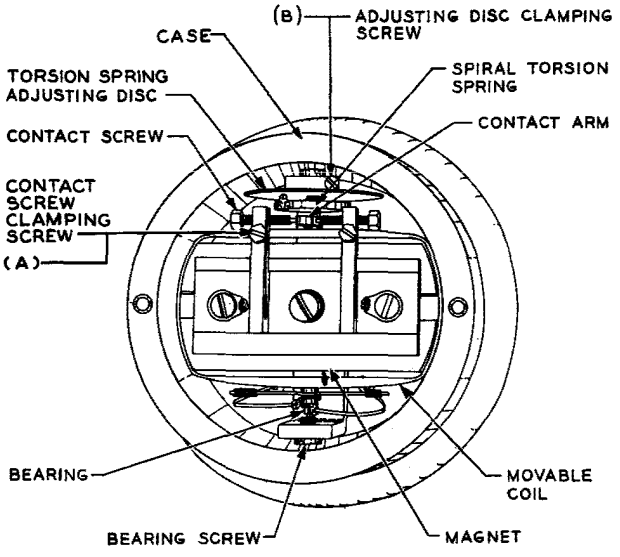


Fig. 3 – Western Electric 260 Type — Cover Removed (earlier relays having contact screw clamping screws)

1.09 The nominal values specified in the circuit requirement table or on other job information give the range within which the voltage or current is to be controlled. For checking or adjusting purposes, a tolerance is permitted which is applied to each end of the range to determine the limiting values. The tables in this section cover the minimum and maximum values together with the tolerances for each nominal and rated value for relays which are not covered in circuit requirement tables. Western Electric 260-type relays are covered in the tables in this section up to and including the 260AL relay. To obtain the tolerance for relays not covered in the tables, apply the tolerance specified for a similar relay listed which has high- and low-rated values most nearly the same as those specified for the relay being checked or adjusted.

1.10 The detailed procedures for checking the relays are based on using the KS-8039 volt-milliammeter, which has a rated accuracy of 1/4 of 1 per cent, although the general methods are applicable to other equivalent instruments.

1.11 When checking or adjusting a relay with the voltmeter, it is recommended that the scale on the meter be selected so that the voltage limit to be checked falls in the upper third of the scale range. This will give the most accurate adjustment of the relay.

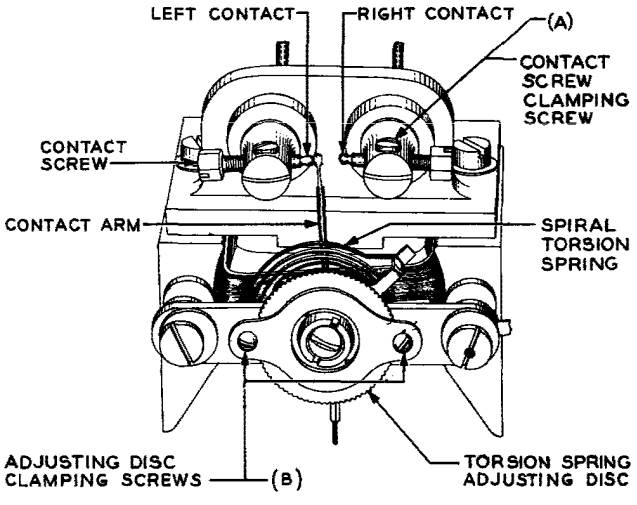


Fig. 4 – Contact Assembly — Weston Models (earlier relays having contact screw clamping screws)

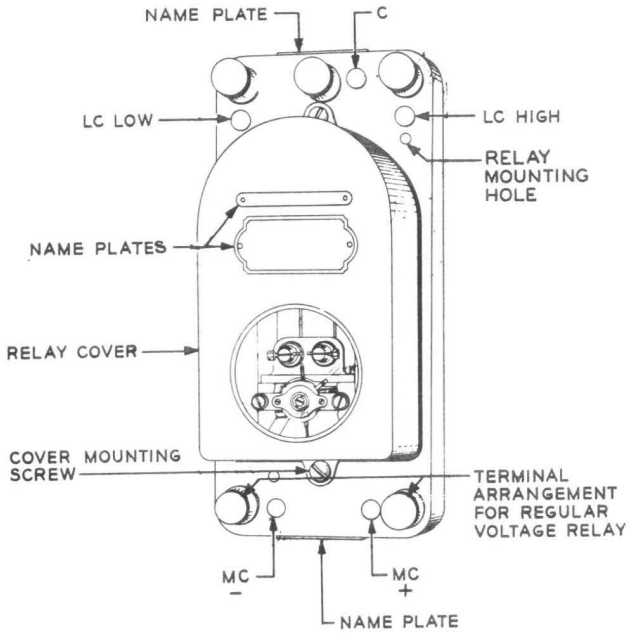


Fig. 5 – Weston Model 30

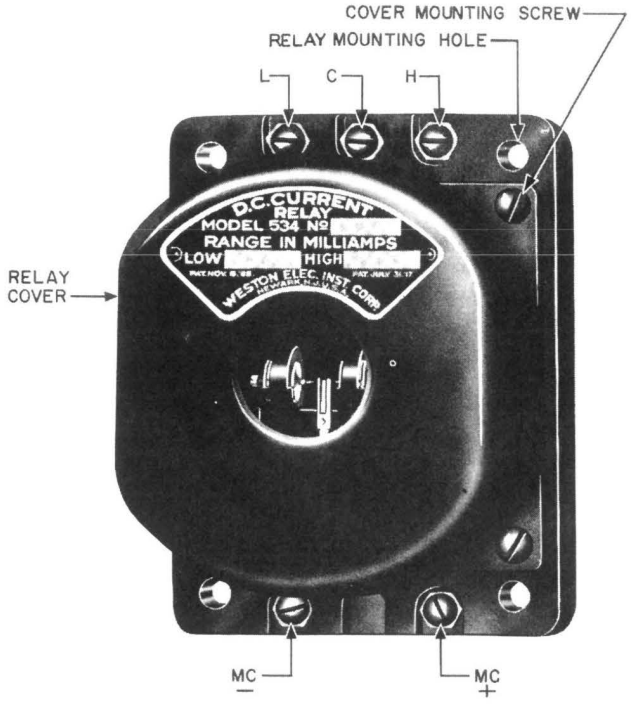


Fig. 6 – Weston Model 534 (surface case)

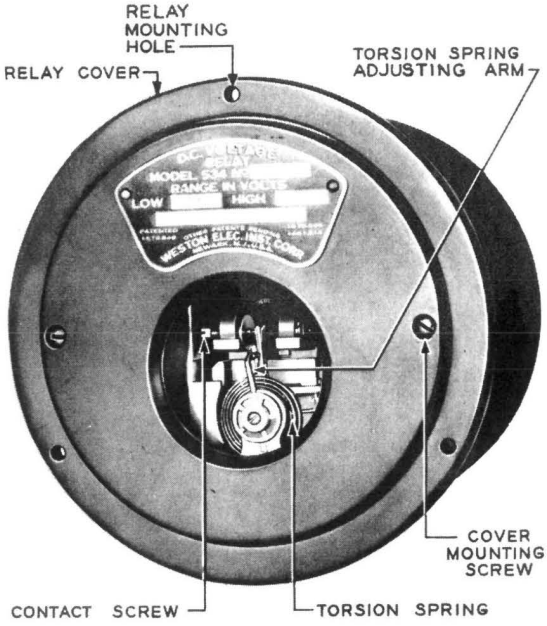


Fig. 7 – Weston Model 534 (flush mounting case)

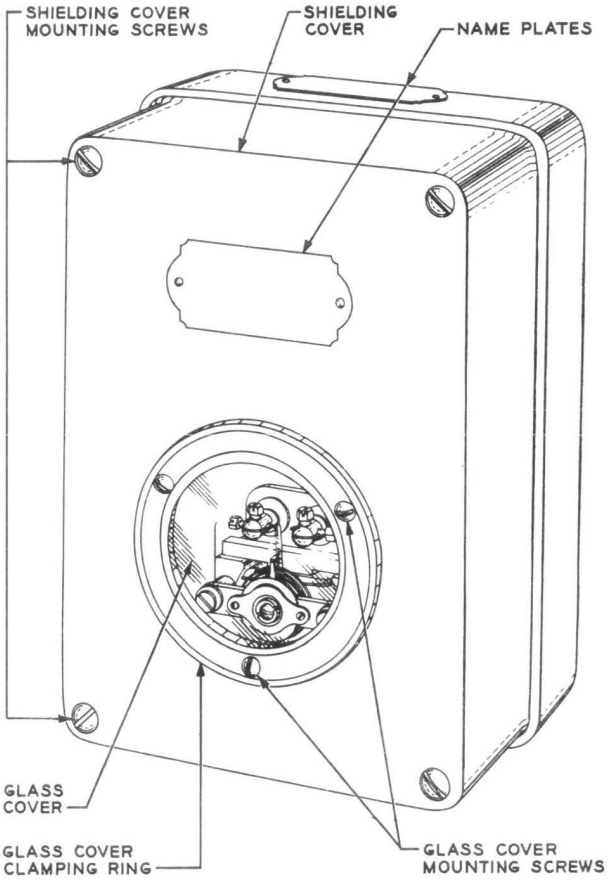
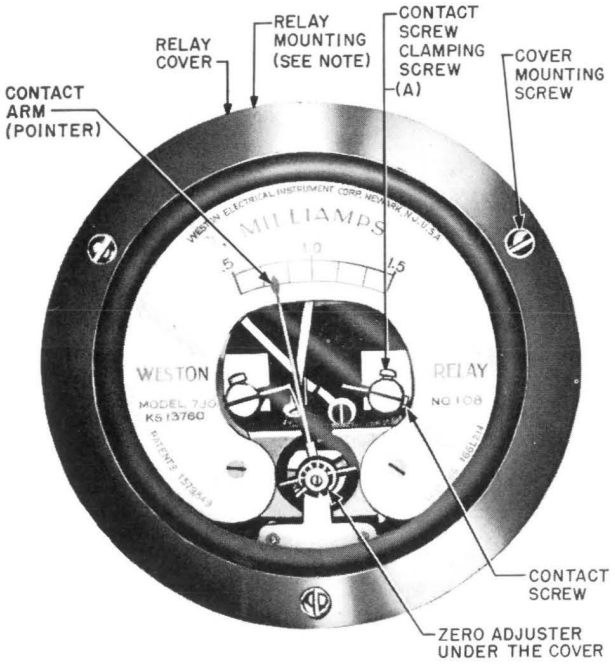


Fig. 8 – Weston Model 546



NOTE: THREE MOUNTING STUDS ARE PERMANENTLY ATTACHED TO THE BACK OF THE CASE FLANGE.

Fig. 9 – Model 730 (flush mounting case) — Front View

2. REQUIREMENTS

2.01 ***Mounting of Relay and Cover:*** The relay and the relay cover shall be held securely by their mounting screws.

Gauge by feel.

2.02 ***Tightness of Contact Screw Clamping Screws*** (Western Electric 260 type and Weston models): Fig. 3(A), Fig. 4(A), Fig. 9(A), and 10(A) — The contact screw clamping screws shall be sufficiently tight to hold the contact screws in their adjusted position.

Gauge by feel.

2.03 ***Tightness of Adjusting Disc Clamping Screws*** (Western Electric 260 and 261 types and Weston models): Fig. 2(A), 3(B), and 4(B) — The adjusting disc clamping screws shall be sufficiently tight to hold the torsion spring adjusting disc in its adjusted position.

Gauge by feel.

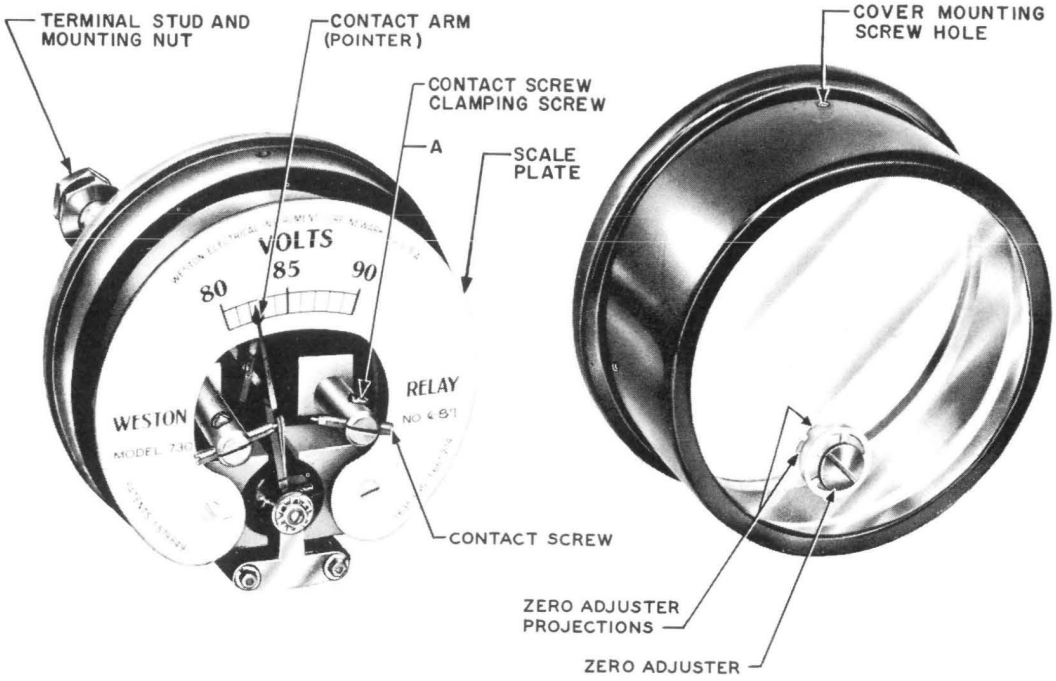
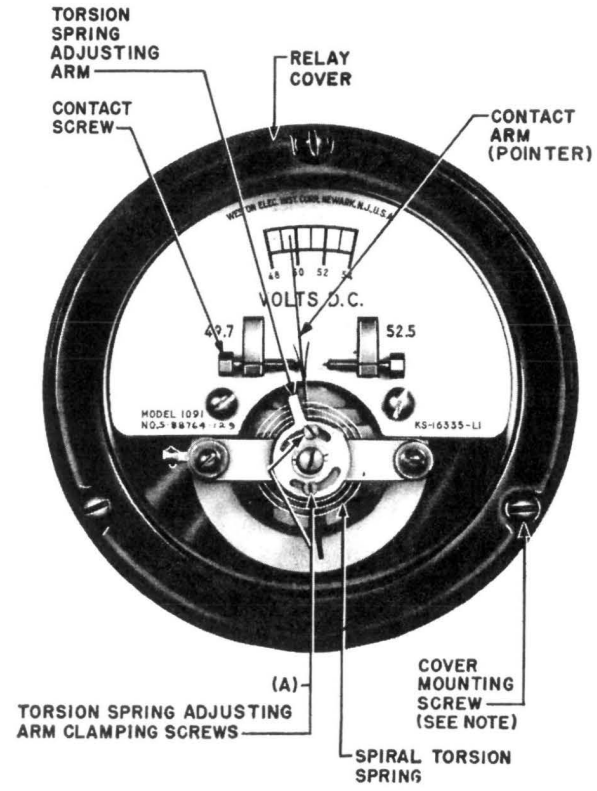


Fig. 10 – Model 730 (surface case) — Cover Removed — Used in Power Plants



NOTE: THE COVER MOUNTING SCREWS FASTEN THE COVER TO THE RELAY MOUNTING STUDS WHICH ARE PERMANENTLY ATTACHED TO THE RELAY CASE.

Fig. 11 – Weston Model 1091 (flush mounting case) — Front View

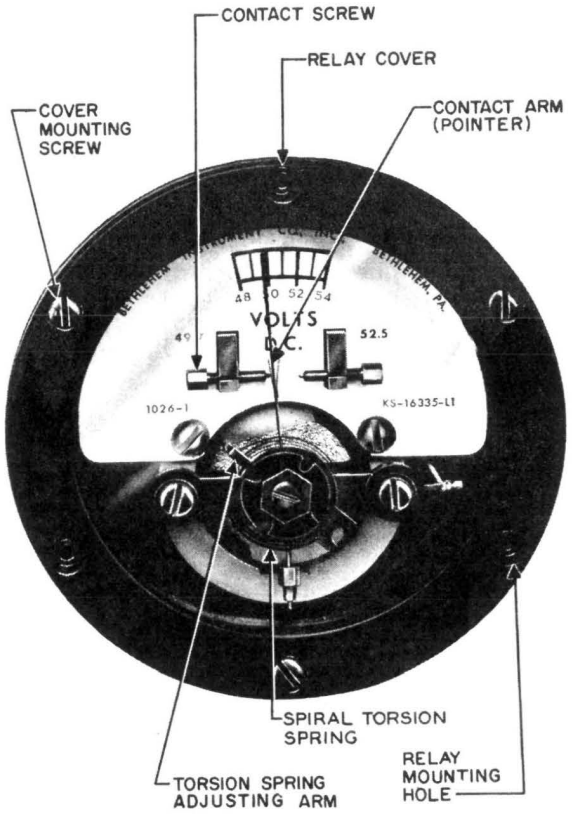


Fig. 12 – Bethlehem Model 1026 (flush mounting case) — Front View

2.04 ***Tightness of Torsion Spring Adjusting Arm Clamping Screws*** (Weston Model 1091): Fig. 11(A) — The torsion spring adjusting arm clamping screws shall be sufficiently tight to hold the torsion spring adjusting arm in its adjusted position.

Gauge by feel.

2.05 ***Freedom of Pointer Movement*** (relays having scale plates): When current through the instrument is gradually decreased or increased, the pointer shall follow this change smoothly.

Gauge by eye.

To check this requirement, it will be necessary to vary the voltage. This may be done in some cases by changing the load, in others by changing the float voltage of the charging unit, and in others by using the 35-type test set as covered in 3.05 through 3.07.

2.06 ***Pointer Setting*** (relays having zero adjusters): With a definite value of voltage or current applied to the relay and to the standard instrument, the pointer shall point to the same scale reading on the relay as indicated by the pointer on the standard instrument. For current relays, the pointer shall point to the same scale reading on the relay as indicated by the pointer on the milliammeter of the 35-type test set.

To check this requirement, unless otherwise specified in the circuit requirement table or in Table B, choose any convenient voltage or current value between the relay contacts as determined from the scale reading on the individual relay.

2.07 ***Electrical Requirements***

(a) ***General:*** Unless otherwise specified in the circuit requirement table or other job information, the relay shall meet the accuracy requirements within the limits specified in the tables in this section. (See 1.09.) Relays not listed in the tables shall meet the electrical requirements specified in the circuit requirement tables. The electrical requirements shall be met with the relay cover on.

(b) ***Regular Voltage Relays (Table A) and Current Relays (Table B)***

(1) ***Low Voltage or Current:*** The left contact shall not make contact on the maximum low limit, but shall make reliable contact on the minimum low limit.

(2) ***High Voltage or Current:*** The right contact shall not make contact on the minimum high limit, but shall make reliable contact on the maximum high limit.

(c) ***Differential Voltage Relays***

(1) The relay shall not make contact with either the left or the right contact on the minimum voltage difference limit between the two sources of supply, but shall make reliable contact with either the left or the right contact on the maximum voltage difference limit.

TABLE A — REGULAR VOLTAGE RELAYS

WESTERN ELECTRIC CODE	KS NUMBER		LOW-VOLTAGE LIMITS (volts)			HIGH-VOLTAGE LIMITS (volts)			TOLERANCE (volt)	SEE NOTE
	SHIELDED	NON-SHIELDED	MIN	RATED	MAX	MIN	RATED	MAX		
		1371	36.90	37.00	37.10	40.90	41.00	41.10	±0.10	
		1376	19.80	20.00	20.20	20.80	21.00	21.20	±0.20	
		1387	121.40	122.00	122.60	131.40	132.00	132.60	±0.60	
		1932								1
		1938	38.75	39.00	39.25	40.25	40.50	40.75	±0.25	
		1939	37.75	38.00	38.25	41.75	42.00	42.25	±0.25	
		2139	44.60	45.00	45.40	49.60	50.00	50.40	±0.40	
		2354	82.00	85.00	88.00					
		2454								1
		2765	109.20	110.00	110.80	119.20	120.00	120.80	±0.80	
260M	7023	2900	38.75	39.00	39.25	40.25	40.50	40.75	±0.25	
		2909	23.80	24.00	24.20	24.80	25.00	25.20	±0.20	2
260A	7001	2910	37.75	38.00	38.25	41.75	42.00	42.25	±0.25	
260B	7002	2911	47.75	48.00	48.25	50.00	50.25	50.50	±0.25	
		2912	45.70	46.00	46.30	50.45	50.75	51.05	±0.30	
		3015	22.80	23.00	23.20	23.80	24.00	24.20	±0.20	3
			23.80	24.00	24.20	24.80	25.00	25.20	±0.20	4
		3116	21.80	22.00	22.20	22.80	23.00	23.20	±0.20	
	7003	3117	22.30	22.50	22.70	23.30	23.50	23.70	±0.20	
		3118	23.30	23.50	23.70	24.30	24.50	24.70	±0.20	
260D	7004	3119	32.75	33.00	33.25	34.75	35.00	35.25	±0.25	
260E	7005	3120	65.70	66.00	66.30	69.70	70.00	70.30	±0.30	
	7006	3121	125.30	126.00	126.70	133.30	134.00	134.70	±0.70	
260G	7007	3122	126.30	127.00	127.70	134.30	135.00	135.70	±0.70	
		6036	19.80	20.00	20.20	20.80	21.00	21.20	±0.20	
		6084	45.60	46.00	46.40	51.60	52.00	52.40	±0.40	

TABLE A — REGULAR VOLTAGE RELAYS (cont)

WESTERN ELECTRIC CODE	KS NUMBER		LOW-VOLTAGE LIMITS (volts)			HIGH-VOLTAGE LIMITS (volts)			TOLERANCE (volt)	SEE NOTE
	SHIELDED	NON-SHIELDED	MIN	RATED	MAX	MIN	RATED	MAX		
		6100	23.80	24.00	24.20	25.05	25.25	25.45	±0.20	
	7010	6190	22.80	23.00	23.20	23.80	24.00	24.20	±0.20	3
			24.20	24.40	24.60	25.30	25.50	25.70	±0.20	4
		6191	26.50	26.70	26.90	27.60	27.80	28.00	±0.20	
		6192	59.50	60.00	60.50	65.50	66.00	66.50	±0.50	
		6199	37.75	38.00	38.25	41.75	42.00	42.25	±0.25	
		6200	38.75	39.00	39.25	40.25	40.50	40.75	±0.25	
		6211	85.40	86.00	86.60	93.40	94.00	94.60	±0.60	
		6227	50.30	50.50	50.70	52.30	52.50	52.70	±0.20	3
			53.30	53.50	53.70	55.40	55.60	55.80	±0.20	4
	7011	6342	43.50	44.00	44.50	49.75	50.25	50.75	±0.50	
	7012	6350	44.50	45.00	45.50	49.75	50.25	50.75	±0.50	
260AC	7013	6565	25.05	25.25	25.45	26.05	26.25	26.45	±0.20	
	7014	6613	11.40	11.50	11.60	12.40	12.50	12.60	±0.10	
		6615	45.00	45.30	45.60	50.45	50.75	51.05	±0.30	
		6616	23.50	23.75	24.00	26.50	26.75	27.00	±0.25	
	7015	6796	43.55	44.00	44.45	45.55	46.00	46.45	±0.45	
	7016	6797	31.17	31.50	31.83	33.17	33.50	33.83	±0.33	
	7017	6798	16.80	17.00	17.20	17.80	18.00	18.20	±0.20	
260K	7018	6826	23.25	23.50	23.75	26.50	26.75	27.00	±0.25	
	7019	6855	59.30	60.00	60.70	68.30	69.00	69.70	±0.70	
	7020	6856	64.50	65.00	65.50	67.50	68.00	68.50	±0.50	
260L	7021	6871	45.95	46.25	46.55	50.45	50.75	51.05	±0.30	
	7022	6872	130.00	131.00	132.00	134.00	135.00	136.00	±1.00	
		6969	20.78	21.00	21.22	22.78	23.00	23.22	±0.22	
260N	7024		22.50	22.75	23.00	24.75	25.00	25.25	±0.25	
	7025		85.40	86.00	86.60	93.40	94.00	94.60	±0.60	
	7027		46.75	47.00	47.25	48.75	49.00	49.25	±0.25	
260R	7028		23.05	23.25	23.45	24.05	24.25	24.45	±0.20	
260S	7030		21.55	21.75	21.95	24.55	24.75	24.95	±0.20	
260T	7031		24.50	24.75	25.00	26.50	26.75	27.00	±0.25	
260U	7032		47.50	47.75	48.00	50.00	50.25	50.50	±0.25	
260W	7033		124.10	125.00	125.90	134.10	135.00	135.90	±0.90	
260Y	7034		138.00	139.00	140.00	145.00	146.00	147.00	±1.00	3
			144.00	145.00	146.00	151.20	152.20	153.20	±1.00	4
260AA	7035		23.75	24.00	24.25	27.75	28.00	28.25	±0.25	
260AB	7036		39.75	40.00	40.25	41.25	41.50	41.75	±0.25	
	7437		7.50	8.00	8.50	12.00	12.50	13.00	±0.50	
260AD			47.00	47.25	47.50	54.00	54.25	54.50	±0.25	
260AE			47.50	47.75	48.00	50.50	50.75	51.00	±0.25	
260AF			47.45	47.75	48.05	52.20	52.50	52.80	±0.30	
260AG			22.80	23.00	23.20	25.80	26.00	26.20	±0.20	
260AH			45.50	45.75	46.00	50.75	51.00	51.25	±0.25	
260AJ			138.00	139.00	140.00	161.00	162.00	163.00	±1.00	
260AK			142.00	143.00	144.00	155.00	156.00	157.00	±1.00	3
			145.70	146.70	147.70	159.00	160.00	161.00	±1.00	4
260AL			140.00	141.00	142.00	156.00	157.00	158.00	±1.00	

TABLE B — CURRENT RELAYS

KS NUMBER NON-SHIELDED	LOW-CURRENT LIMITS (amp)			HIGH-CURRENT LIMITS (amp)			TOLERANCE (amp)	SEE NOTE
	MIN	NOMINAL	MAX	MIN	NOMINAL	MAX		
2254								5,6,8
2803	0.0094	0.0095	0.0096	0.0104	0.0105	0.0106	±0.0001	
6364								5,6
6459								5,6
7242								5,6
7719								5,6
7733								5,6
8007								5,6
13760	0.0003	0.0005	0.0007	—	—	—	±0.0002	7,9

Notes for Tables A and B

1. The left contact shall not make contact on the specified low-voltage value +0.1 volt, but shall make reliable contact on the specified low-voltage value. The right contact shall not make contact on the specified high voltage −0.1 volt, but shall make reliable contact on the specified high-voltage value.
2. The difference of potential required between the break of one contact and the make of the other contact shall be minimum 0.75 volt.
3. For low-voltage range, close the key associated with the relay.
4. For high-voltage range, open the key associated with the relay.
5. In cases where the electrical values for this relay cannot be measured with the voltage or current instruments available, or where the system in which the relay functions does not permit applying the electrical requirements specified in the circuit requirement table, the relay shall be considered defective if it does not function satisfactorily under circuit operating conditions, and it shall be replaced.
6. Weston Model 30 relay.
7. Weston Model 730 relay (flush-mounting case).
8. No field readjustment is recommended for the KS-2254 relay. If the relay fails to operate satisfactorily, it should be replaced.
9. The pointer shall be adjusted to indicate 1 on the scale plate when a current of 1000 microamperes is applied to the terminals of the operating coil of the relay.

TABLE C — DIFFERENTIAL VOLTAGE RELAYS

WESTERN ELECTRIC CODE	KS NUMBER		RANGE (volts)	VOLTAGE DIFFERENCE LIMITS (volts)			TOLERANCE (volt)
	SHIELDED	NON-SHIELDED		MIN	RATED	MAX	
		2507	(120 - 240)	4.50	5.00	5.50	±0.50
260H	7008	3123	(34 - 68)	1.50	1.70	1.90	±0.20
260J	7009	3124	(110/220 - 130/260)	4.50	5.00	5.50	±0.50
	7026		(45/90 - 52/104)	1.80	2.00	2.20	±0.20

3. ADJUSTING PROCEDURES

3.001 ***List of Tools and Test Apparatus***

CODE OR SPEC NO.	DESCRIPTION
TOOLS	
209	5/16-Inch Hex. Open Single-End Offset Wrench
417A	1/4- and 3/8-Inch Hex. Open Single-End Wrench
KS-6367	7/16- and 5/8-Inch Open Double-End Flat Wrench
KS-6854	3-1/2 Inch Screwdriver
R-1005	Jewelers Screwdriver
R-2262	5/32- and 7/32-Inch Open Double-End Flat Wrench
—	3-Inch C Screwdriver
—	4-Inch E Screwdriver
—	T-501 Voltmeter Relay Wrench, Bethlehem Instrument Co, Inc, Bethlehem, Pa
TEST APPARATUS	
35 Type	Test Set
KS-8039	Weston Model 622 Volt-Milliammeter and Associated Connecting Leads or Equivalent

3.002 Before making any adjustment on the relay, determine that the trouble is not with the connecting circuits. No adjustments, other than those covered in this section, should be made by the regular maintenance forces. It is assumed that all other adjustments will be made in a central instrument bureau, repair center, or by authorized instrument repair personnel.

3.003 When making adjustments, place the relay in the position corresponding to that which it occupies when in use in order to maintain the same relative position between the moving parts of the relay and the contact points. Relays intended for mounting on steel panels shall be adjusted either on their respective panels or on steel panels of similar thickness. Relays intended for mounting on nonmagnetic panels shall be adjusted in a place where they will not be affected by outside influence such as iron, steel, magnetic fields, and other relays. The relay under test should be kept at least 18 inches away from the current or voltage measuring instrument. When possible, adjust the Weston Model 30 relay in the location it occupies when in use because of the magnetic effect of adjacent apparatus and framework.

3.004 When making adjustments and the cover has been removed, do not place the relay where moving air currents may cause the pointer to deflect.

3.005 When adjusting the relay, do not leave the cover off longer than necessary because of the possibility of dust accumulating on the contacts and on the other parts of the relay mechanism.

3.006 When readjusting, the relay shall make contact as close as practicable to the specified voltage or current limits as indicated by the standard voltmeter or the milliammeter of the test set.

3.007 ***Removing Covers:*** To adjust the relay to meet its requirements, it will be necessary to remove the relay cover as follows.

(1) ***Western Electric 260 and 261 Types, and Weston Models 30 and 534:*** Fig. 1, 2, 5, 6, and 7 — Remove the cover mounting screws using the 4-inch E screwdriver and remove the cover. If the screws are sealed, break the seals. In the case of the 261-type relay, also remove the dust cover mounting screws with the KS-6854 screwdriver and remove the dust cover.

(2) ***Weston Model 546:*** Fig. 8 — Remove the glass cover mounting screws using the KS-6854 screwdriver.

(3) ***Weston Model 730*** (flush-mounting case): Fig. 9 — Remove the cover mounting screws using the 3-inch C screwdriver and remove the cover.

(4) ***Weston Model 730*** (surface case): Fig. 10 — Remove the cover mounting screws using the R-1005 screwdriver and remove the cover.

(5) ***Weston Model 1091:*** Fig. 11 — Remove the cover mounting screws using the KS-6854 screwdriver and remove the cover.

(6) ***Bethlehem Model 1026:*** Fig. 12 — Remove the cover mounting screws using the 3-inch C screwdriver and remove the cover.

3.008 ***Remounting Covers:*** After adjusting the relay, remount the relay cover as follows.

(1) ***Weston Model 730*** (surface case): When remounting the cover, be ***very*** careful to see that the two projections underneath the zero adjuster straddle the torsion spring adjusting arm. No force should be used in pressing home the cover, but the zero adjuster screw should be turned until the projections are in the proper location for assembly. Tighten the cover mounting screws securely using the R-1005 screwdriver.

(2) ***All Other Relays:*** Replace the cover in the reverse order of removal and tighten the screws securely using the proper screwdriver.

3.01 ***Mounting of Relay and Cover*** (Reqt 2.01)

(1) ***Weston Models 30 and 534:*** If the relay or the relay cover is not held securely by the mounting screws, tighten the screws using the 4-inch E screwdriver.

(2) ***Western Electric 260 and 261 Types and Weston Model 546:*** If the relay is not held securely to the mounting, tighten the mounting nuts using the KS-6367 wrench.

(3) ***Western Electric 260 and 261 Types:*** If the relay cover is not held securely by the mounting screws, tighten the screws using the 4-inch E screwdriver.

(4) ***Weston Model 546:*** If the relay shielding cover is not held securely by the mounting screws, tighten the screws using the 4-inch E screwdriver. Tighten the glass cover mounting screws using the KS-6854 screwdriver.

(5) ***Weston Model 730*** (flush-mounting case): If the relay is not held securely by the mounting studs, tighten the mounting nuts using the 417A wrench. If the relay cover is not held securely by the mounting screws, tighten the screws using the 3-inch C screwdriver.

(6) ***Weston Model 730*** (surface case): If the relay is not held securely to the mounting, tighten the mounting nuts using the 417A wrench. If the relay cover is not held securely by the mounting screws, tighten the screws using the R-1005 screwdriver.

(7) ***Weston Model 1091:*** If the relay cover is not held securely by the mounting screws, tighten the screws using the KS-6854 screwdriver. If the relay is not held securely to the mounting, tighten the mounting nuts using the 209 offset wrench.

(8) ***Bethlehem Model 1026:*** If the relay or the relay cover is not held securely by the mounting screws, tighten the screws using the 3-inch C screwdriver.

3.02 ***Tightness of Contact Screw Clamping Screws*** (Reqt 2.02)

(1) If the contact screw clamping screws are loose, tighten them as follows.

(a) ***Western Electric 260 Type:*** Use the KS-6854 screwdriver.

(b) ***Weston Models Having Contact Screw Clamping Screws*** (except model 546): Use the R-1005 screwdriver.

(c) ***Weston Model 546 Relay:*** Use the R-2262 wrench.

(d) ***All Relays:*** If the contact screws are mounted in slotted brackets and the screws are loose, the relay should be replaced.

3.03 ***Tightness of Adjusting Disc Clamping Screws*** (Reqt 2.03)

(1) Tighten the adjusting disc clamping screws using the KS-6854 screwdriver for Western Electric 260- and 261-type relays and the R-1005 screwdriver for Weston model relays which are provided with adjusting discs.

3.04 ***Tightness of Torsion Spring Adjusting Arm Clamping Screws*** (Reqt 2.04)

(1) Tighten the torsion spring adjusting arm clamping screws using the R-1005 screwdriver.

3.05 ***Freedom of Pointer Movement*** (Reqt 2.05)
3.06 ***Pointer Setting*** (Reqt 2.06)
3.07 ***Electrical Requirements*** (Reqt 2.07)

General

(1) Relays failing to meet the requirements should be replaced.

Regular Voltage Relays

(2) ***Preparation:*** To check whether the relay meets the requirements, use the 35-type test set and the KS-8039 volt-milliammeter.

(3) Open the circuit through the relay windings by removing the fuses or by opening the switches associated with the relay. Do not disturb the connections from the contacts of the relay to the controlled circuit.

(4) ***35-Type Test Set Application:*** Depending upon circuit conditions, connect the relay to the test set using either B/V or G/V application as covered in Section 100-101-101. In these applications, when using the 35D or 35F test set, the VM key should be normal with the external voltmeter connected across the winding terminals of the relay.

(5) Determine the voltage at which the relay is to be checked. Follow the information specified in Table A and, for relays not listed in the table, follow the information covered in the circuit requirement table.

(6) Turn the VOLTS switch on the standard instrument to the scale position so that the relay checking voltage is in the upper two thirds of the scale.

(7) ***Caution: If a potential greater than 60 volts is used, take care not to touch the metal portions of the rheostat while using the test set.***

(8) ***Freedom of Pointer Movement*** (relays having scale plates): Adjust the sliders of the test set, as required, until the standard instrument indicates a value slightly higher than the starting value as covered in (5). Gradually decrease and then increase the current through the relay using the sliders, as required, and check that the requirement is met.

(9) ***Pointer Adjustment*** (relays having zero adjusters): Adjust the sliders of the test set, as required, until the standard instrument indicates a voltage value between the relay contacts as determined from the scale of the relay under test, unless otherwise specified in the circuit requirement table. Then proceed as follows.

Caution: The zero adjuster screw should turn freely. Do not attempt to turn the screw after resistance is met, as the adjusting mechanism may be seriously damaged. In making this adjustment, observe that there is considerable slack motion in the zero adjuster screw. When the position of the pointer has been changed, back off the screw slightly before the final check.

(a) ***Weston Model 730*** (flush-mounting case): Remove the relay cover to gain access to the zero adjuster screw (3.007). Turn the screw using the R-1005 screwdriver until the requirement is met. Remount the cover (3.008).

(b) ***Weston Model 730*** (surface case): Turn the zero adjuster screw using the R-1005 screwdriver until the requirement is met.

(10) ***Accuracy:*** Adjust the sliders of the test set, as required, until the lower limit of the specified low voltage is indicated on the standard voltmeter. The left contacts should make as indicated by the functioning of the controlled circuit.

(11) Increase the applied voltage towards the upper limit of the specified low voltage by adjusting the sliders so as to decrease the resistance in the circuit. Observe whether or not the controlled circuit functions just before or just as the upper limit of the specified low voltage is reached.

(12) Then adjust the sliders of the test set until the lower limit of the specified high voltage is reached. The controlled circuit should not function until just after this limit is reached but it should function before or when the upper limit of the specified high voltage is reached.

(13) ***Example:*** Assume that the specified range of a voltage alarm relay is 22 to 23 volts with a tolerance of $\pm$ 0.2 volt for each of these values. The left contacts shall make, as indicated by the alarm, on a low voltage of minimum 21.8 volts or a voltage less than 22.2 volts. The right contacts shall make on a high voltage of maximum 23.2 volts or a voltage more than 22.8 volts. Neither of the alarms shall be given when the applied voltage is at or between 22.2 and 22.8 volts.

(14) If the relay does not function satisfactorily, make the following adjustments as required.

(a) ***All Relays:*** Adjust the contact gaps as covered in (15) and (17).

(b) ***All Relays Except Weston Model 730:*** Adjust the tension of the torsion spring as covered in (16).

(15) If the relay functions satisfactorily on one side and not on the other side, it is an indication that the contact gap on the latter side is not satisfactory. In this case, proceed as follows. Where the relay is equipped with contact screw clamping screws, loosen the contact screw clamping screw associated with the contact that failed. Use the KS-6854 screwdriver for Western Electric 260-type relays, the R-2262 wrench for Weston Model 546, and the R-1005 screwdriver for other Weston relays having contact screw clamping screws. Turn the contact screw in (clockwise) or out (counterclockwise) using the KS-6854 screwdriver or the R-2262 wrench, as required, until it just makes contact with the contact on the contact arm as indicated by the functioning of the controlled circuit when the voltage is within the specified limits. Then tighten the clamping screw. For Western Electric and Weston relays not equipped with contact screw clamping screws, use the KS-6854 screwdriver or the R-2262 wrench, as required, to turn the contact screw in or out. For the Bethlehem Model 1026 relay, use the T-501 wrench to turn the contact screw. Make all checks for operation with the screwdriver and the wrench removed because of the magnetic effect on the relay.

(16) If the controlled circuit functions for low voltage on a voltage less than the lower limit of the specified low voltage (makes too late) and for high voltage on a voltage less than the lower limit of the specified high voltage (makes too soon), it is an indication that the tension of the torsion spring is too weak. For the example in (13), voltages of 21.7 and 22.7 volts, respectively. To change the tension of the torsion spring, proceed as follows.

(a) ***Weston Models and Western Electric 260 and 261 Types Equipped With Torsion Spring Adjusting Discs:*** Loosen the adjusting disc clamping screw or screws, using the R-1005 screwdriver for Weston relays and the KS-6854 screwdriver for Western Electric 260- and 261-type relays, while holding the disc in position with the thumb and forefinger. Turn the disc to the left (counterclockwise) to increase the spring tension or to the right (clockwise) to decrease the spring tension. After the adjustments have been made and the controlled circuit functions for low voltage, make sure that the adjusting disc clamping screws are tight.

(b) ***Weston Models*** (except model 1091) ***and Bethlehem Model 1026 Equipped With Torsion Spring Adjusting Arms:*** With the thumb and forefinger, carefully shift the torsion spring adjusting arm to the left (counterclockwise) to increase the spring tension or to the right (clockwise) to decrease the spring tension.

(c) ***Weston Model 1091:*** Loosen the torsion spring adjusting arm clamping screws, using the R-1005 screwdriver, while holding the torsion spring adjusting arm in position with the thumb and forefinger. Proceed as covered in (b) to change the spring tension. After the adjustments have been made and the controlled circuit functions for low voltage, make sure that the clamping screws are tight.

(17) If the controlled circuit functions for low voltage on a voltage higher than the upper limit of the specified low voltage (makes too soon) and for high voltage on a voltage less than the lower limit of the specified high voltage (makes too soon), both contacts are out of adjustment. In this case, adjust the sliders of the test set, as required, until a voltage midway between the specified high and low voltage is indicated on the standard voltmeter. Back off the contact screws until there is approximately equal clearance between the contacts on the contact arm and both the right and the left contacts. Then proceed with the readjustments as covered in (15) and (16).

(18) After making the readjustments, check the relay with the cover on for proper functioning on the high and low voltage limits as covered in (10) through (12) and, if necessary, refine the adjustments as covered in (14) through (17).

(19) After completing the necessary adjustments, remove all test connections and connect all wires that were disconnected. Replace all fuses and close all switches associated with the relay.

Current Relays

(20) Proceed as covered in (2) and (3).

(21) ***35-Type Test Set Application:*** Depending upon circuit conditions, connect the relay to the test set using either BATT or GRD application as covered in Section 100-101-101.

(22) Determine the current at which the relay is to be checked. Follow the information specified in Table B. For relays not listed in the table, follow the information covered in the circuit requirement table.

(23) ***Freedom of Pointer Movement*** (relays having scale plates)

(a) Operate and hold the MIL-AMPS key of the test set to select the appropriate current range of the relay.

(b) Gradually decrease and then increase the current through the relay using the sliders of the test set as required. Observe the milliammeter of the test set to see that the requirement is met. Release the MIL-AMPS key.

(24) ***Pointer Adjustment*** (relays having zero adjusters): Proceed as covered in (23)(a). Adjust the sliders of the test set, as required, until the milliammeter of the test set indicates a current value between the relay contacts determined from the scale of the relay under test, unless otherwise specified in Table B or in the circuit requirement table. Then proceed as covered in (9)(a) or (9)(b). Release the MIL-AMPS key.

Caution: The zero adjuster screw should turn freely. Do not attempt to turn the screw after resistance is met, as the adjusting mechanism may be seriously damaged. In making this adjustment, observe that there is considerable slack motion in the zero adjuster screw. When the position of the pointer has been changed, back off the screw slightly before the final check.

(25) ***Accuracy:*** Operate and hold the MIL-AMPS key to select the appropriate current range of the relay while varying the current within the specified limits in a manner similar to that covered in (10) through (12). Observe the milliammeter of the test set to determine whether or not the controlled circuit functions within the specified current limits.

(26) If it is necessary to make any adjustments, proceed in a manner similar to that covered in (14) through (18).

(27) Proceed as covered in (19).

Differential Voltage Relays

(28) Proceed as covered in (2) through (4). Do not disturb the connection to the N terminal of the relay windings. Determine the voltage at which the relay is to be checked. Follow the information specified in Table C and, for relays not listed in the table, follow the information covered in the circuit requirement table. Then proceed as covered in (6) and (7).

Note: Voltage relays which are not self-contained use an external resistor to extend the voltage range. In such cases, connect the standard voltmeter to the relay through the resistor.

(29) Adjust the sliders of the test set, as required, to vary the voltage across one winding of the relay and observe whether the controlled circuit functions when the unbalance voltage is within the specified limits. In the same manner, check the other winding of the relay for proper functioning when the unbalance voltage is within the specified limits.

(30) If the relay does not operate satisfactorily, adjust the contact gaps as covered in (15) and (17) or the tension of the torsion spring as covered in (16).

(31) After making the adjustments, check the relay with the cover on for proper functioning as covered in (29) and, if necessary, refine the adjustments as covered in (30).

(32) Proceed as covered in (19).

Relays Used in Carrier Pilot Channel Alarm Circuit

(33) After checking the relay in accordance with the requirements specified in the circuit requirement table and it is found nec-

essary to make adjustments, proceed as follows.

(34) If necessary, adjust the contact gaps as covered in (15).

(35) ***Example:*** Assume that the specified range of the relay is 1.5 db on either side of the normal level with a tolerance of ±0.2 db for the low level point and ±0.2 db for the high level point. On the low level side, the contacts should make when the variation from normal level is between 1.3 db and 1.7 db low. On the high level side, the contacts should make when the variation from normal level is between 1.3 db and 1.7 db high. Neither contact should be made when the variation from normal level is between 1.3 db low and 1.3 db high.

(36) If the relay makes too late for the low level side or makes too soon for the high level side, adjust the tension of the torsion spring as covered in (16). For example in (35), a variation from normal level of more than 1.7 db low for the low side and a variation from normal level of less than 1.3 db high for the high side, respectively.

(37) If the pointer of the pilot indicator meter does not hold to a steady indication and accurate adjustment is hindered thereby, supply the pilot indicator with current at the pilot frequency from a local oscillator.

(38) In some cases where the relay used prior to the KS-6364 relay is being checked and readjusted and it is found that sufficient separation between the contacts cannot be obtained, it will be necessary to connect a resistance (about 1000 ohms should be satisfactory) across the moving coil of the relay.

(39) If the relay makes too soon for the low level side and makes too soon for the high level side, both contacts are out of adjustment. For example in (35), a variation from normal level of less than 1.3 db low for the low side and a variation from normal level of less than 1.3 db high for the high side, respectively. In this case, adjust the circuit until the normal level is indicated. Back off the contact screws in the manner covered in (17). Then proceed with the readjustments as covered in (15) and (16)(a).

(40) After making the readjustments, check the relay with the cover on for proper functioning on the high and low db limits as covered in (10) through (12) and, if necessary, refine the adjustments as covered in (34) and (36) through (39).

(41) Proceed as covered in (19).