

G.E.

## TYPE 17LV23 REGULATING RELAY

### 1. DESCRIPTION

The regulating relay consists of a frame mounting a shunt coil and series coil wound on the same spool, and an armature carrying a movable contact which operates between two fixed contacts. The contacts are connected to resistor tubes and arranged to vary the current flowing in the generator shunt field to maintain constant voltage.

### 2. OPERATION

The series coil is connected in the battery circuit so that it carries the charging current to the battery from the generator. The shunt coil is connected in series with a 20-ohm control resistor directly across the generator terminals and so varies in strength as generator voltage.

There are three possible circuit combinations depending on the position of the relay armature which in turn depends on the relation between the pull of the armature calibrating spring and the combination of the shunt and series coils. With low trolley voltage resulting in lower M-G speed, or heavy generator load, the generated voltage will drop, allowing the moving contact on RR to contact point 2. This produces maximum generator field to raise the voltage since there will be only 10.5 ohms resistance in the circuit from GA through the generator field. For intermediate load and speed the moving contacts on RR may float between points 2 and 3 inserting an additional 13 ohms in the field circuit. For light loads and higher speeds the moving contact may contact point 3 reducing the generator field still further by shunting the generator field with 5.65 ohms resistance. In actual operation, since the relay armature is very light weight and moves only a small amount, a minute voltage change will move the armature, so it vibrates very rapidly to produce a steady voltage regardless of load or speed conditions.

The series coil on the regulating relay carries only the charging current to the battery and normally has very little effect on the relay armature since this charging current is very small with a fully charged battery. If, however, the battery becomes discharged, the charging current would try to go very high since the shunt coil on the relay tries to hold full voltage. To protect the battery and generator from damage, the charging current through the series coil produces a pull which limits the charging current by reducing the generator voltage in the same manner as an increase in voltage previously described.

### 3. ADJUSTMENTS

Ordinarily all necessary adjustments can be made on the regulating relay by changing the tension of the calibrating spring. Increase spring tension to raise setting. The relay should be set to hold 35.5 volts if the equipment is cold, and 36.5 volts if the equipment has been running long enough to heat up to normal operating temperature.

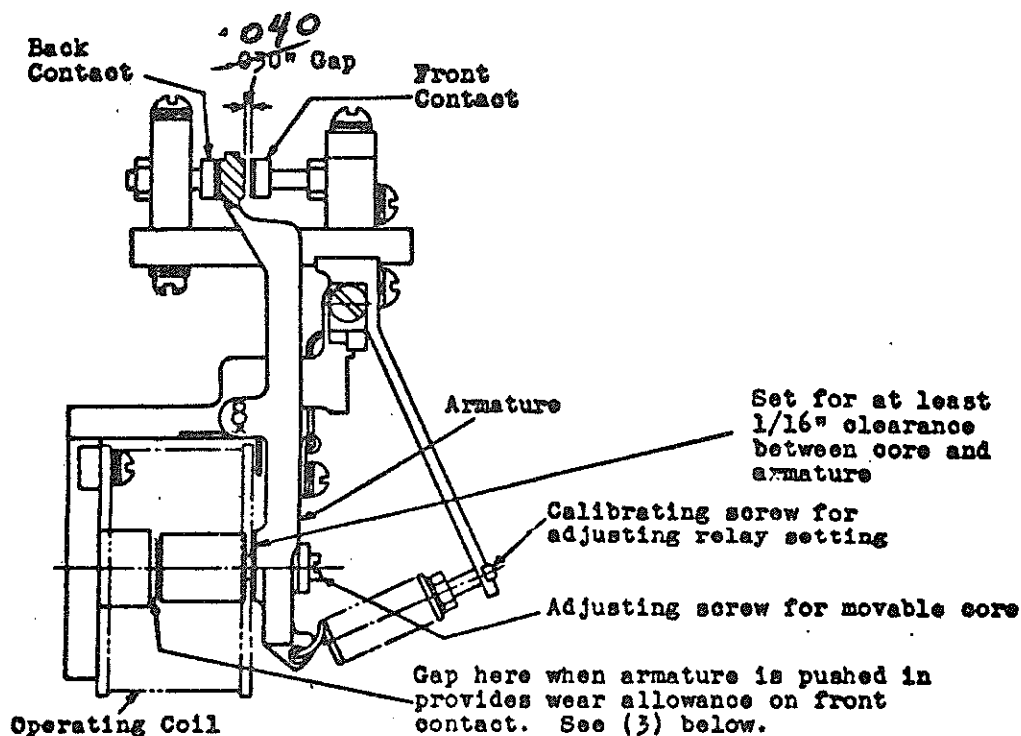
If any parts of the regulating relay are disassembled, or replaced, or if any new resistor tubes are installed, the contact adjustment should be checked as indicated on drawing and setting of relay rechecked.

## General Notes

The battery floats on the motor-generator set, the latter supplying all load requirements. The battery is considered more or less as a standby and supplies low-voltage power under emergency conditions, such as loss of line voltage or trouble with the motor-generator set.

The figure of 36.5 volts mentioned in the foregoing applies to a 16-cell lead battery. If a 24-cell Edison battery is used, the generator voltage should be adjusted at 41.0 volts.

### 4. INSPECTION AND DATA - See INSPECTION SECTION.

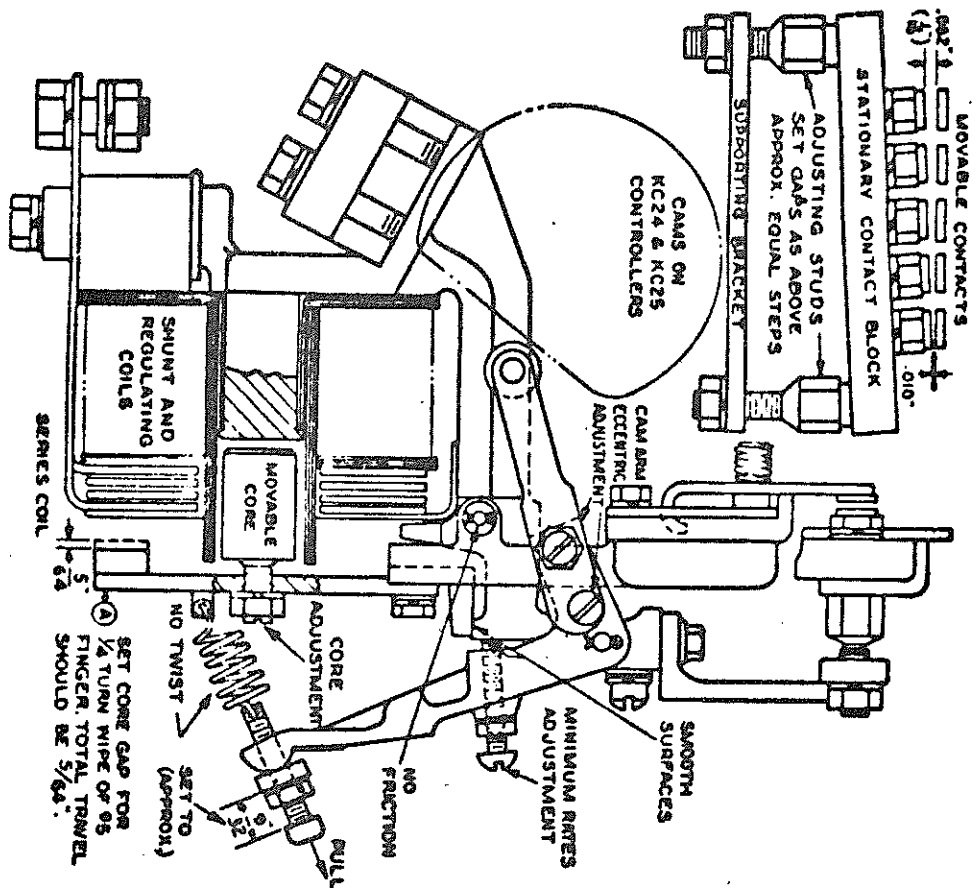


#### Contact Adjustment - 17LV23 Relay

1. Set movable core so there is at least 1/16" clearance between core and armature. This adjustment required so overhanging edge of armature will not strike flange on operating coil.
2. With stationary contacts free, push armature in until core bottoms and hold there while screwing up front contact until it touches movable contact.
3. Screw front contact one more turn toward center to provide about .030" wear allowance before core can bottom.
4. Screw out back contact until there is no gap between front and back contacts, then back off one turn and lock. This will provide total gap of .030" between front and back contacts.

#### Voltage Adjustment

Set voltage by calibrating screw. If regulated voltage differs more than  $\frac{1}{2}$  volt between front and back contacts, change core position slightly to correct.



FIELD ADJUSTMENTS OF ACCELERATING AND BRAKING RELAYS

FOR PCC CARS

TYPES 171C20A4 AND 171C20D4

1. SET CORRECT CAR PEDAL TRAVEL - APPROX 1/8 CLEARANCE MEASURED AT CONTROLLER STOPS IN MAXIMUM POSITIONS.
2. MAKE MECHANICAL ADJUSTMENTS AS PER SKETCHES. MEASUREMENTS MAY BE MADE AT POINT (A) WITH DIAL INDICATOR.
3. SET MAXIMUM RATES BY CAM ARM ECCENTRIC WITH BRAKE OR POWER PEDAL FULL ON BY WEIGHING ARMATURE SPRING OR CHECKING SHUNT COIL DROP OUT AMPS PER TABLE BELOW.
4. BOTH CONTROLLERS OFF, SET COASTING AND MINIMUM RATES WITH STOP SCREW ADJUSTMENT.
5. SET C2 PICK-UP RATE WITH ADJUSTABLE KC24 CAM

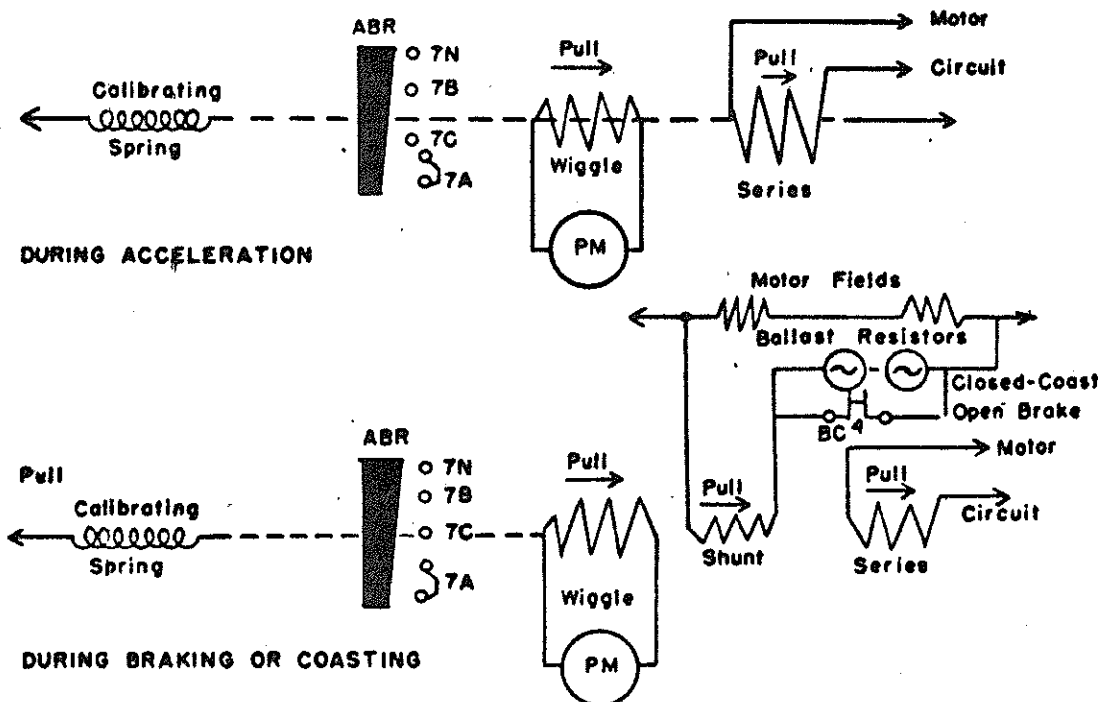
	BRAKE FULL ON	POWER FULL ON	MINIMUM POWER	COAST	C2 PICK-UP
A. FOR 4 3/4 MI./HR./SEC. ACCELERATION AND 4 MI./HR./SEC. BRAKING					
SPRING TENSION	40 OZ.	42 OZ.	8 1/2 OZ.	8 1/2 OZ.	10 1/2 OZ.
SHUNT COIL D.O.A.M.P.S.	7.5	7.8	3.8	3.8	4.8
SINGLE MOTOR AMPS	180	250	112	20	135
B. FOR 4 1/2 MI./HR./SEC. ACCELERATION AND 3 1/2 MI./HR./SEC. BRAKING					
SPRING TENSION	35 OZ.	40 OZ.	8 1/2 OZ.	8 1/2 OZ.	10 1/2 OZ.
SHUNT COIL D.O.A.M.P.S.	6.8	7.4	3.8	3.8	4.8
SINGLE MOTOR AMPS	160	234	112	20	135

\* SET MINIMUM POWER ACCURATELY WITH AMMETER DURING TEST RUN. RATE VARIES SLIGHTLY WITH VOLTAGE CONDITIONS. ALL VALUES GIVEN ABOVE ARE APPROXIMATE DUE TO MANY FACTORS AFFECTING RATES. VALUES ARE FOR 3900'S CAR WITH 25" WHEEL DIAMETER. FOR WORN WHEELS (23" DIA. AVG) REDUCE MAXIMUM VALUES 5% FOR SAME RATES.



In coasting and for minimum rates, the tension of the calibrating spring is determined by the stop-screw adjustment, as the cam on the master controller (power or brake) is not striking the roller on the relay arm to stretch the spring. When higher rates of speed are desired by operator, depressing pedal turns controller on and causes rate cam to stretch relay calibrating spring and increase rate in proportion to pedal movement up to maximum rates.

When relay is operating to hold some current value, a state of approximate balance is obtained between the tension of the calibrating spring and the combined pull of the series, shunt and wiggle coils.



OPERATION OF ACCELERATING AND BRAKING RELAY

PLATE  
A-118717

During braking the pull of the shunt coil is added to that of the wiggle and series coils, KC25-10 being open and ballast resistors in series with shunt coil. In coasting the KC25-10 finger closes to increase current in shunt coil to allow relay to regulate for low motor-current values. Current through motor fields produces a voltage across fields proportional to current across fields, this voltage being applied to shunt coil.

By connecting the wiggle coil across the pilot-motor armature, both "wiggle action" and "anticipation" are obtained. Wiggle action results from the fact that as relay starts to pick up and close contacts 7A, 7C, 7B and 7N, closing of these contacts results in a reduction of voltage on wiggle coil, tending to allow armature to drop out. In opening of relay contacts a similar opposing action takes place. The result of this wiggle action is a vibrating of the relay armature producing an average motor voltage to give the motor speed required to hold the current the car operator is requesting.

MOTOR GENERATOR 25 AMPS. 600 VOLTS	NO. 2 TRUCK BRAKE ACTUATORS 15 AMPS. 600 VOLTS	NO. 1 TRUCK BRAKE ACTUATORS 15 AMPS. 600 VOLTS	AUXILIARY 50 AMPS. 600 VOLTS	GENERATOR 60 AMPS. 32 VOLTS	NO. 2 TRUCK DRUM BRAKES 32 V.	NO. 1 TRUCK DRUM BRAKES 32 V.	NO. 2 TRUCK TRACK BRAKES	NO. 1 TRUCK TRACK BRAKES
25 A M P S	15 A M P S	15 A M P S	50 A M P S	60 A M P S	30 A M P S	30 A M P S	30 A M P S	30 A M P S

ST. LOUIS / G.E. P.C.C. (STEPWELL)

MOTOR GENERATOR 25 AMPS. 600 VOLTS	NO. 2 TRUCK BRAKE ACTUATORS 15 AMPS. 600 VOLTS	NO. 1 TRUCK BRAKE ACTUATORS 15 AMPS. 600 VOLTS	AUXILIARY 50 AMPS. 600 VOLTS	GENERATOR 60 AMPS. 32 VOLTS	NO. 2 TRUCK DRUM BRAKES 32 V.	NO. 1 TRUCK DRUM BRAKES 32 V.	NO. 2 TRUCK TRACK BRAKES	NO. 1 TRUCK TRACK BRAKES
25 A M P S .	15 A M P S .	15 A M P S .	50 A M P S .	60 A M P S .	30 A M P S .	30 A M P S .	30 A M P S .	30 A M P S .

ST. LOUIS / G.E. P.C.C. (STEPWELL)

**MASTER CONTROLLER CONTACTS**

**POWER 1100**

**O O M S O O O O M**

**BRAKE OFF**

**O O M O M M S O O M**

**LOCKED**

**M M O M O M S O O O**