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**COMMON SYSTEMS
35F TEST SET CIRCUIT
FOR ADJUSTING RELAYS AND
OTHER ELECTRO-MAGNETIC APPARATUS**

SECTION I - GENERAL DESCRIPTION

1. PURPOSE OF CIRCUIT

This circuit is used for testing relays and other electromagnetic apparatus on a voltage or current flow basis.

The test set is arranged so that current to an external circuit can be measured and regulated for making electrical checks upon relays, clutches, and other apparatus for which current flow requirements are specified.

SECTION II - DETAILED DESCRIPTION

1. TESTING RELAYS OR OTHER APPARATUS NOT CONNECTED TO BATTERY OR GROUND (B/G TEST SET PREPARATION)

1.1 Preliminary Operation

Battery and ground may be supplied to the test set by patching from a battery supply jack with (a) a cord in Fig. 3, (b) a cord in Fig. 4, in offices where battery is connected to the tip and ground to the sleeve of battery supply jacks, (c) a cord in Fig. 8 equipped with the proper connecting tools, (d) by inserting a regular working common battery switchboard cord directly in the test (BAT and GRD) jack, (e) by connecting ground and battery to the binding posts designated GRD and BAT respectively, or (f) by a cord in Fig. 11 to a KS-14523 connector providing battery and ground.

If the relay or apparatus to be tested is bridged by a jack, this jack may be patched with a cord in Fig. 3; if it is a relay in the tip or ring of a cord circuit, this cord may be inserted directly in the T and R jack. If connection is to be made to relay winding terminals or terminals of other apparatus, a cord in Fig. 8 equipped with the proper connecting tools may be used.

Before setting up any readings, all short-circuiting switches of the telegraph keys should be open and all rheostat slides should be in their extreme right position. If currents less than 1 ma at 24 volts or less than 2 ma at 48 volts are to be read, the circuits through keys 3 and 4 should be used to cut in additional resistors as required. These resistors are designated from A to M. Under this condition all knife switches designated 3 and 4, controlling

these resistors, should be open. The maximum resistance of the rheostat should be in the circuit before operating the knife switches to guard as much as possible against the injury to the meter. It is desirable to set up readings for "hold" and "release" values before "operate" in order to obtain more accurate readings for the "operate". With the MIL AMPS keys normal the 750 scale of the meter is in circuit so that the 3MA, 15/3, or 75 scale keys should not be operated until the readings of the milliammeter indicates that the current is less than the full scale reading of the range to which the transfer is to be made. The circuit is so arranged that the 3MA and 15/3 keys must be operated (in opposite directions) before the 3MA winding is connected into circuit.

1.2 Testing

With the REV and BAT and GRD CO keys normal and the G knife switch open, ground is connected through these keys and the S jacks to the ring of the T and R jacks. Battery is connected through the BAT and GRD CO key, the A fuse, VM and scale change keys to the meter, through the VM key, black rheostat, one of the telegraph keys, red rheostat, the B fuse, REV key and contacts of the S jacks to the tip of the T and R jack. The relay or apparatus under test may then be checked for the requirements specified. Current through the relay or apparatus under test may be reversed by operating the REV key. This is necessary when testing polarized relays.

2. TESTING RELAYS OR APPARATUS HAVING GROUND CONNECTED TO ONE SIDE OF THE WINDING (BAT TEST SET PREPARATION)

The conditions for this test are the same as described in 1.1 and 1.2 except battery is connected to the ring of the test (BAT and GRD) jacks and no ground is required. If the tip clip of the patching test cord is connected to the relay or apparatus under test, the REV and BAT and GRD CO keys should be normal and the G switch open. If the ring conductor is used the REV key should be operated. The relay or apparatus under test may then be checked for the requirements specified.

3. TESTING RELAYS OR APPARATUS HAVING BATTERY CONNECTED TO ONE SIDE OF THE WINDING (GRD TEST SET PREPARATION)

The conditions for this test are the same as described in 1.1 and 1.2 except

ground is connected to the tip of the test BAT and GRD jack and no battery is required. If the ring clip of the patching test cord is connected to the relay or apparatus under test, the REV key should be normal and the BAT and GRD CO keys and the G switch operated. The relay or apparatus under test may then be checked for the requirements specified.

4. TESTING RELAYS OR APPARATUS HAVING BATTERY AND GROUND ON THE WINDING (METALLIC TEST SET PREPARATION)

The conditions for this test are the same as described for this test under 1.1 and 1.2 except no battery or ground supply are required. However if the cord supplying battery and ground is connected to the test BAT and GRD jack this battery and ground will be disconnected by operating the BAT and GRD CO key and opening the G switch. If ground is connected to the tip clip and battery to the ring clip of the patching test cord the REV key should be normal, but if this condition is reversed the REV key should be operated. The relay or apparatus under test may then be checked for the requirements specified.

5. SLEEVE AND LAMP TESTS

The 10-ohm and 500-ohm resistances associated with the L switch are provided to approximate the sleeve condition of various cord circuits. When setting up a test for supervisory relays or checking contact closure, it is necessary to ground the sleeve through 500 ohms or 34 ohms. The ground which is usually supplied through the tip of another A cord and the X resistor is approximately 34 ohms. With the L switch operated to the 500 and LAMP position, the lamp is connected across the tip and ring of the signal BAT and GRD jack in local circuit and may be used to check contact closure using a cord in Fig. 8. Binding posts L1 and L2 may also be connected to check contact closure in the same manner as when using the signal battery and ground supply jacks. Connecting ground to the L1 binding post with the L switch normal, places a 500-ohm ground on the sleeve of the T and R jacks and with the L switch operated to the 10 position places approximately 10-ohm ground on the sleeve of the T and R jacks. The lamp may also be connected in series with 500 ohms or approximately 10 ohms by supplying battery or ground to the L1 or L2 binding post and operating the L switch to the 500 and LAMP or 10 position as required, if it is desired to operate any apparatus over the sleeve of the T and R jack while making current flow adjustments over the tip and ring of this same jack.

6. THE MILLIAMMETER IS WIRED AND CONNECTED IN THE CIRCUIT FOR USE IN OFFICES HAVING THE POSITIVE SIDE OF THE BATTERY GROUNDED

When the VM key is operated the voltmeter is connected through appropriate resistances also the REV key to the tip and ring of the T and R jack. The voltmeter may be used to check the voltage of external circuits or that of the battery supply jack by shorting all resistances.

With the voltmeter connected across the T and R leads to the apparatus under test and the battery or ground or both connected through the test set, the voltage applied to the relay may be varied by adjustment of the set resistance. When battery or ground is connected to the apparatus under test, use of a short circuit plug in the BAT and GRD jack together with the operation of the BAT and GRD CO and GRD switches will connect the voltmeter in multiple with the variable resistance and by closing the battery or ground circuit externally any desired voltage may be obtained by resistance variations.

If a particular set resistance is desired, rather than a definite current flow the voltage of the battery supply may be determined by operating the VM key and closing a telegraph key with all resistance cut out. Restoring the VM key and using the milliammeter the desired resistance may be provided by $I = \frac{E}{R}$. E being the previously determined voltage, R the desired resistance and I the reading for the milliammeter.

SECTION III - REFERENCE DATA

1. WORKING LIMITS

None.

2. FUNCTIONAL DESIGNATIONS

None.

3. FUNCTIONS

3.01 This test set is provided with a volt milliammeter and variable resistances for checking current flow requirements of relays and other electrical apparatus for which current values are specified.

3.02 The set is equipped with four telegraph keys and a black and red rheostat which permits setting up four different and independent current flow values at one time. The rheostat is constructed in two

sections with four sliders on each and the sections are referred to as black and red. The resistance of the red rheostat is approximately 28,000 ohms and is divided in steps of 1000 ohms each, while the resistance of the black rheostat is approximately 1150 ohms and is used for obtaining finer readings.

3.03 The meter is provided with four current ranges which give full scale readings of 3MA, 15MA, 75MA, and 750MA under control of non-locking keys designated 3MA, 15-3, 75, and 750. On the milliammeter side with all keys normal the 750 mil scale is connected to the test circuit.

3.04 On the volts side the designations of this key are 15,300, 75 with the 300 normal scale. The four telegraph keys are each equipped with a short circuiting switch, so that a steady current will be maintained while adjusting the slides for the proper readings.

3.05 The telegraph keys 1 and 2 are connected directly to the red and black rheostats, while keys 3 and 4 each close a circuit through approximately 500,000 ohms and the inner contacts of a cutoff jack, through which the test circuit may be connected to a remote control key or some other external circuit, such as an interrupter. Part or all of the high resistance can be cut out by means of the single pole double throw switches, three of which are associated with the 3 key and three with the 4 key. With all switches operated to the zero position all resistors from A to S are short circuited.

3.06 The set is arranged to connect to the apparatus under test by means of jacks and/or binding posts. With the exception of the two jacks 4W and 3R the test and signal jacks are wired in duplicate to permit the use of cords with 109 or 110 plugs.

3.07 The set is arranged to make tests over the tip, ring, and sleeve separately or over the tip and ring together.

3.08 A reverse key, REV is used to reverse the leads to the apparatus under test by reversing the tip and ring leads to the T and R jacks.

3.09 When the VM key is operated the 3 mil scale is connected in series with appropriate resistance to give full scale readings of 300 volts with 15 - 75 key at normal or full scale at 15 volts and 75 volts with respectively designated keys operated.

NONE OF THE NON-LOCKING KEYS SHOULD BE HELD IN AN OPERATED POSITION WHILE OPERATING OR RESTORING ANY OF THE LOCKING KEYS.

3.10 A switch G is used for connecting ground to one side of the milliammeter but it is effective only when the BAT and GRD CO key is operated. If the G switch is operated to the position marked GRD, ground is connected to one side of the milliammeter. If the G switch is open and the BAT and GRD CO key operated a metallic circuit is closed through the milliammeter.

3.11 A switch L is provided to control the sleeve condition of the T and R jacks and is used principally in testing supervisory relays. With this switch normal, a 500-ohm resistance is in the sleeve circuit. When this switch is operated in the direction marked -10, a 10-ohm resistance is placed in parallel with the 500 ohms and when operated to the 500 and LAMP position a local circuit is closed through the signal lamp. A 12-volt, 24-volt, or 48-volt lamp may be used as required to suit the test condition.

3.12 With battery and ground supplied to the test BAT and GRD jack and the BAT and GRD CO key normal, tests may be made through the T and R jacks on apparatus connected to ground on the tip or ring, or on apparatus bridged across the tip and ring of the T and R jacks. With the BAT and GRD CO key operated, tests may be made on apparatus connected to battery on the tip or ring or on apparatus connected to battery on the ring and ground on the tip (metallic test). For any of the above conditions if the connections give a reversed reading, the REV key should be operated.

3.13 The connections to various apparatus and relays are made with the test set by the different patching cords shown, or by connecting leads to the binding posts, multiplied to the jacks.

3.14 Associated Cords

3.141 The cord in Fig. 3 may be used as a battery supply cord when the jack supplying battery has ground on the tip and battery on the ring. It may also be used as a patching cord for extending the T and R or S jacks.

3.142 The cord in Fig. 4 is required for battery supply wherever the standard battery supply jack is provided.

3.143 The cord in Fig. 5 is required in place of the cord in Fig. 3 only when a jack requiring a 110 plug is patched to the 3R or 4W jacks.

3.144 The 32C test set Fig. 2 provides remote control for the No. 3 and 4 key circuits and may also be required for use with an associated relay timing test set. In either instance it provides manual remote control.

3.145 The cord in Fig. 6 is required only for step-by-step offices and provides for a direct connection to a test jack.

3.146 The cord in Fig. 8 is required whenever any standard tool is used for connecting to apparatus under test or for battery supply when no battery supply jacks are available.

3.147 The cord in Fig. 9 may be substituted for the cord in Fig. 8 when the sleeve is to be extended by means of connecting tools.

3.148 The above cords are supplemented by the use of the single jumper cord in Fig. 7 for use with tools also by the use of the 361, 364, 365, and 357 tools and by the 257A test plug (No. 10 office) also the 113A plug gauge.

3.149 The above cords are supplemented by the use of the single jumper cord in Fig. 7 for use with tools also by the use of the 361, 364, 365, and 357 tools and by the 257A test plug (No. 10 office) also the 113A plug gauge.

3.150 The cord in Fig. 11 is required for supplying battery power to the test set, in No. 1 ESS offices, from equipment frames.

4. CONNECTING CIRCUITS

(a) Battery and Ground Supply Circuits.

(b) Relay Timing Test Set Circuits.

SECTION IV - REASONS FOR REISSUE

A. CHANGED AND ADDED FUNCTIONS

A.1 A cord is added to permit the use of the 35F test set at a No. 1 ESS central office. Fig. 11 specifies a cord to be used at a No. 1 electronic switching office to supply power to the 35F test set from the No. 1 ESS equipment frames.

B. CHANGES IN APPARATUS

B.1 Added

Fig. 11 - W3AW Cord

D. DESCRIPTION OF CHANGES

D.1 Fig. 11 consisting of a W3AW cord is added.

D.2 In Circuit Note 102 and Option Used Table, Fig. 11 is listed.

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