

New!

LIONEL NO. 5F UNIVERSAL TEST SET

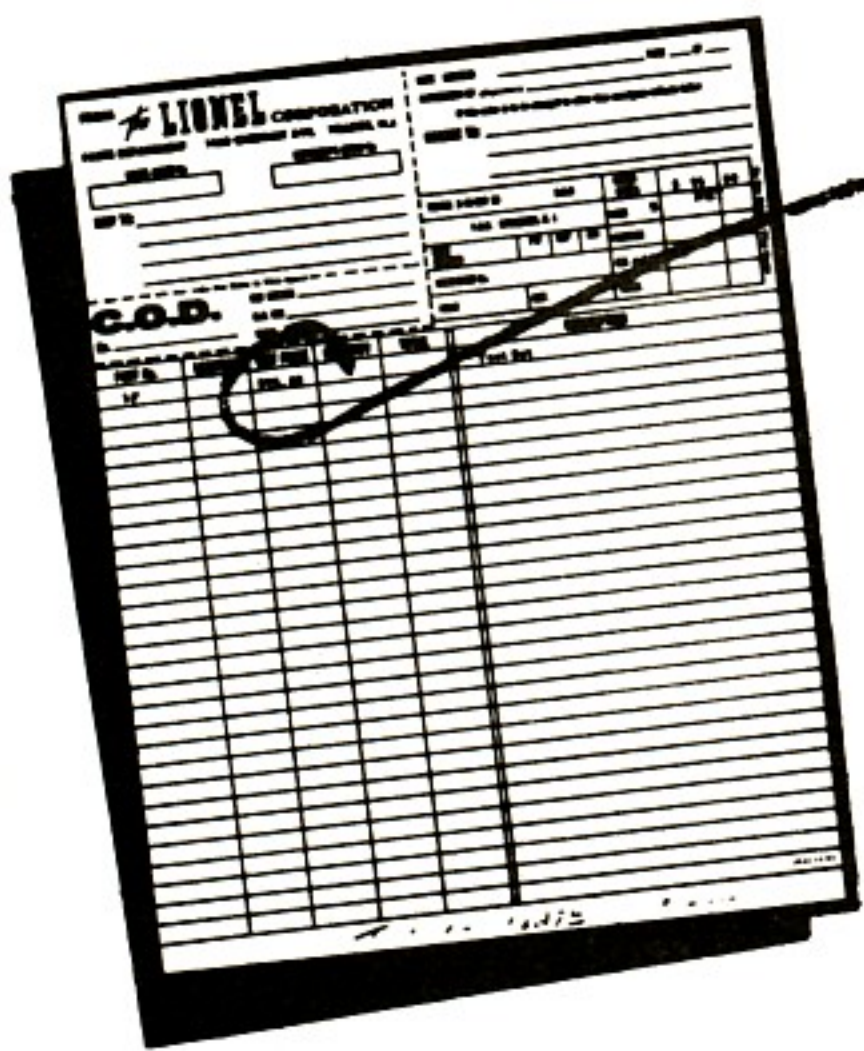
New!

FOR ALL LIONEL MODEL RAILROAD EQUIPMENT

We've been waiting for this one a long time along with you, and it's now ready for delivery. Shipments commence after January 1, 1962.

THIS TEST SET FEATURES:

1. Built-in 90-watt continuously variable AC and DC power supply.
Voltage for checking any piece of Lionel equipment -- either regular or HO -- can be precisely set and measured at any desired point.
2. Two high quality easy-to-read meters.
D. C. meter has 0-3 and 0-15 voltage ranges for accurate testing of HO equipment, whistle controllers, rectifiers and whistle relays, and 0-7.5, -15 and -30 ampere ranges for checking circuit breakers.
A. C. meter has 0-30 volt range for checking variable voltage supply, internal or external, and 0-14, -30 and -60 amperes ranges for checking circuit breakers.
3. Built-in 110-volt line fuse and a manual-resetting output circuit-breaker for complete overload protection.
4. Built-in 110-volt convenience outlet on tester panel for plugging in transformers under test.
5. Two test tracks: HO track with an uncoupler-re-railer section and Super-O track with No. 36 Operating Blades and No. 37 Uncoupling Unit.
6. Two sets of plug-in test clips.
7. Heavy gauge gray crinkle-finish steel cabinet with silk-screened aluminum panel. The cabinet measures 33" long, 7 1/2" deep and 9 1/2" high.
8. Complete operating instructions.



The price is \$95.00 Net. Please use the enclosed order form. We prefer you place your orders again even though you may have had it on order in the past.

For those of you with the 5D Tester who would like the new one, we will accept your used 5D's as trade-ins. We will pay a flat \$25.00 for all used 5D's provided they are intact -- no missing parts, etc. Here's how it works: Order your 5F at \$95.00 net -- when you get it, ship your 5D in and we will issue a credit for \$25.00 to your account.

The LIONEL CORPORATION
 SERVICE DEPARTMENT: Hoffman Place, Hillside, N.J.

INSTRUCTION MANUAL
for
No. 5F TEST SET



THE LIONEL CORPORATION
Hoffman Place, Hillside, New Jersey

LIONEL NO. 5F UNIVERSAL TEST SET

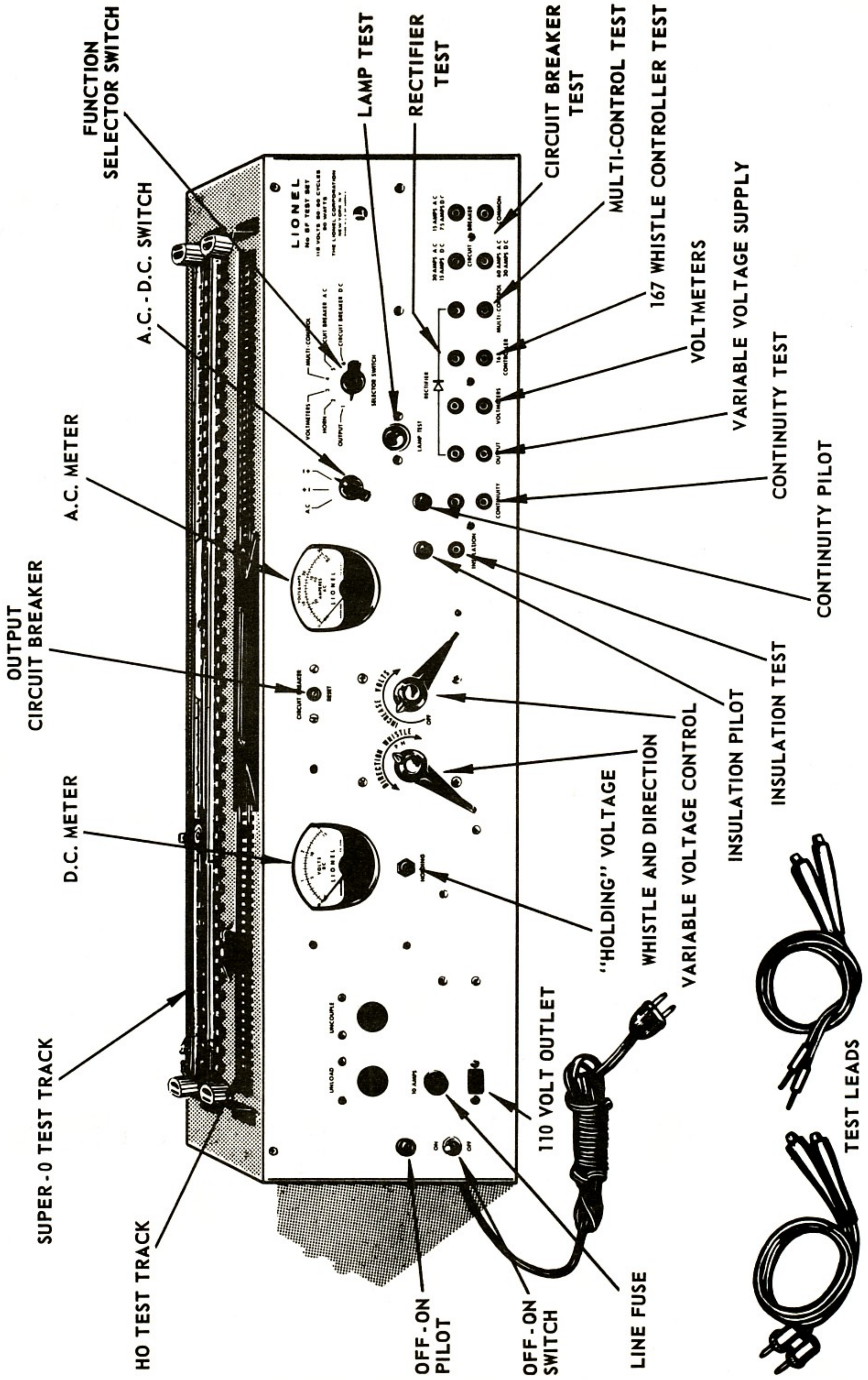


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GENERAL DESCRIPTION

Lionel 5F tester is an all-purpose tester for all Lionel transformers, power packs, locomotives, whistle tenders and all rolling stock and accessory equipment. It is designed to operate on 115 volts, 60 cycles A.C. line.

The wattage rating specified on the tester panel refers to the wattage of the built-in transformer which applies A.C. or D.C. voltages to the test tracks and the various test jacks on the lower part of the panel. This rating does not refer to the power you can draw from the outlet on the left of the panel. This outlet is connected to the A.C. line and the current which can be drawn from it is limited only by the rating of the 10-ampere tester fuse. This outlet is used for plugging in the line cord of transformers under test. The output of the built-in transformer is limited to approximately 5 amperes A.C. or 2.5 amperes D.C. by the circuit breaker mounted above the transformer. The circuit breaker is of the manual resetting type requiring a lapse of several seconds before it can be reset by pushing the red RESET button.

INSTALLATION:

Connect the 5F tester by plugging its line cord into any convenient 110V outlet. Switch power to "ON" position. Pilot light indicates that power is flowing into the tester and that the internal transformer is in good condition (not shorted).

TEST TRACKS:

Top of the 5F tester carries two test tracks: Super-O and HO. Voltage can be supplied to the track either by the built-in transformer with the selector switch in the OUTPUT or HORN position, or by an external transformer plugged into the VOLTMETERS or MULTICONTROL jacks with the selector switch set in the corresponding position. The actual voltage on the tracks is read on the A.C. and D.C. meters (A.C. meter will read only if polarity switch is in position A.C.).

If a short circuit exist on the tracks the track voltage will drop to practically zero. To avoid short circuits, move the power switch to OFF position before placing a car, locomotive or tender on the track. Snap the switch to ON position after making sure that all the wheels are properly placed on the rails.

VOLTMETERS:

The connections of the voltmeters are controlled by the selector switch which has six positions and the polarity switch which has three positions, as indicated on the panel. The A.C. voltmeter will not show any reading unless the polarity switch is in position A.C.

1. OUTPUT – In this position the A.C. and D.C. voltmeters and the tracks are connected together

with OUTPUT jacks which are fed by the built-in transformer.

2. HORN – In this position the A.C. and D.C. voltmeters and tracks are connected across an 8.3 ohms resistor and the output jacks are fed by the built-in transformer. This position is intended to test diesel horns and simulates the load of an average train outfit.

3. VOLTMETERS – In this position the meters and test tracks are connected to the VOLTMETERS jacks to read the voltage supplied by an external transformer or other power source.

4. MULTICONTROL – In this position the meters are connected to the MULTICONTROL jacks to check the pick-up and holding voltages provided by the whistle control circuits of Lionel Multicontrol transformers.

5. CIRCUIT BREAKERS – In these positions the meters are connected across the current-limiting resistor used to check the circuit breakers in Lionel transformers and is used to measure the current passing through the circuit breaker. The meters are calibrated to read both voltage and current on the same scales. The ranges are changed automatically as you plug the leads into the appropriate jacks. In other words, if the test leads are inserted into the COMMON and 30 AMP. A.C. jacks, and the polarity switch set to A.C., the value of the current can be read in amperes on the 0-30 scale of the A.C. meter.

PANEL JACKS:

1. INSULATION – When the test power switch is ON, this jack supplies line potential (115 volts) for checking transformer insulation, etc. The current is limited by means of a neon light and a resistor. The connection to this jack is made by means of a single banana plug lead supplied with the tester. This jack can also be used for checking the continuity of high resistance coils and other high impedance circuits elements, as described in the section on Insulation Test.

2. CONTINUITY – This set of jacks supplies 6 volts in series with a pilot light and is independent of the voltage setting of the built-in transformer. When the circuit is completed the indicator light will glow. This type of continuity test is used for tracing wiring, checking solder connections and low impedance circuits and circuit elements.

3. OUTPUT – These jacks are connected directly to the variable voltage winding of the built-in transformer and can supply voltages ranging from 5 to 16 volts adjustable by the voltage control handle.

4. VOLTMETERS – These jacks are connected directly to the D.C. voltmeter, test tracks and by means of the polarity switch to the A.C. voltmeter when the selector switch is set in VOLTMETER position. They can be used for checking any external A.C. and D.C. voltages within the ranges of the voltmeters.

5. 167 CONTROLLER – These jacks are used to

insert an external 167 whistle controller in series with the built-in transformer and test track. For this test selector switch should be set to MULTICONTROL position and polarity switch at A.C.

6. MULTICONTROL – These are used to make connections with the output voltage terminals of any multicontrol transformer. With the selector switch set at MULTICONTROL position and polarity switch set at A.C., the output voltage, whistle control and reversing control of the external transformer can be checked at these jacks.

7. CIRCUIT BREAKER – One common and three current ranges jacks control the test current required for checking circuit breakers in Lionel transformers. With the selector switch in position C.B.A.C. and polarity switch in position A.C. the A.C. voltmeter indicates the current through the circuit breaker in transformers with non-rectified output. For transformers with rectified output, selector switch should be on C.B.D.C. and the D.C. voltmeter indicates the current through the circuit breaker. The flickering of the voltmeter needle indicates operation of the circuit breaker.

TESTING PROCEDURE

TRANSFORMERS:

When checking a transformer brought in for service, first find out what type of power supply the customer has. The voltage rating designated on the transformer name plate must agree with the rating of his power line. There are some sections of the country where direct current power lines are still in use. A transformer cannot be used with direct current lines. If it is plugged into a D.C. outlet it will burn out almost instantaneously or else blow the line fuse.

Estimate the wattage requirements of the customer's layout, and compare it to the wattage rating of his transformer. If the transformer is overloaded it will tend to overheat, its output voltage will drop below normal level and it will give unsatisfactory service. Remember that a steady load on a transformer should not exceed 75% of its rated wattage.

1. Output Voltage Test

- a. Plug transformer line cord into tester outlet and snap power switch ON.
- b. Plug test leads into voltmeter jacks.
- c. Set selector switch to "VOLTMETERS" (pos. 3).
- d. Set polarity switch to A.C.
- e. Using the clips check the output terminals voltages. (See chart for terminals and voltages). When testing output voltage of a power pack or any D.C. power supply switch polarity from A.C. to either of the other two positions. This removes A.C. voltmeter from the circuit.

If your line voltage is 115 volts, the indicated voltages should correspond with the voltages specified on the terminal panel to within 10%. This variation is due to manufacturing tolerances plus the normal line variations. An output voltage much lower than specified indicates a possible shorted turn in the secondary winding (or incorrect wiring). Zero reading on all terminals indicates a totally shorted secondary winding or an open primary. Zero reading on one pair of terminals indicates an open or broken connection between the coil and one of the terminals.

- f. Check the variable voltages by turning the voltage control knobs through the full range. Variable voltages should vary smoothly and evenly through the entire range from minimum to maximum and should drop to zero after the minimum point. Uneven or irregular voltage variation with points within the range dropping to zero, indicates that there is varnish or other foreign matter on the contact surface of the secondary winding.

2. Circuit Breaker Test:

The circuit breakers which are contained within Lionel transformers are adjusted to open whenever the current drawn from a transformer exceeds a safe limit that would damage the transformer windings.

- a. Plug transformer line cord into outlet.
- b. Set selector switch to CIRCUIT BREAKER, either A.C. or D.C. as required.
- c. Set polarity switch to A.C. or D.C. as required.
- d. Connect the test leads to the proper transformer terminals. (See chart) Insert one plug into the COMMON jack and the other plug into the jack labeled with the desired test current range.
- e. Snap the power switch ON. The current passing through the circuit breaker will be indicated on one of the meters, and can be adjusted to the desired test value by moving the variable voltage control. NOTE: In all D.C. power packs voltage setting should be at maximum.

In the transformer under test is equipped with an overload indicator, the lamp should operate as specified in the transformer operating instructions.

As the circuit breaker opens the current reading on the meter will drop to zero.

3. Lamp Test:

If lamps do not operate properly, remove and test in lamp test socket of tester. The voltage available at the test socket is controlled by the built-in transformer which can be set at a minimum of 5 volts. Do not use it to test lamps with a lower voltage rating.

TRANSFORMER	VOLTAGE POSTS	OUTPUT (VOLTS)	MULTI-CONTROL TEST			CIRCUIT BREAKER TEST			
			POSTS TO BE USED	MINIMUM PICK-UP	MINIMUM HOLDING	POSTS TO USE	TEST JACK	TEST CURRENT (AMPERES)	TIME (SECONDS)
A & Q	A-U A-B B-C	14.5-24 8 6.5				(A) B-U (Q) A-U	15 AMP. A.C. 15 AMP. A.C.	14 14	4-15 3-14
R	A-F B-F A-C B-C D-E	14-24 6-16 14-24 6-16 10				A-E B-E	30 AMP. A.C. 30 AMP. A.C.	18 16	3-18 3-18
RX	A-U C-D B-D	12-18 10 14							
S	A-U B-C A-B	9-18.5 14 5	A-U (MAX)	5.5	0.8	A-U	15 AMP. A.C.	14	4-15
V & Z	A-U B-U C-U D-U	6.5-24 6.5-24 6.5-24 6.5-24				(V) A-U (Z) A-U	30 AMP. A.C. 60 AMP. A.C.	16 30	7-22 4-17
1010		7-14					15 AMP. A.C.	5	3-10
1011		8.5-13							
1011M 1211		8.5-12.5							
1014		7-13.5							
1015		7.5-15							
1016		7-14							
1025		8-15					15 AMP. A.C.	5	8-18
1026		7-15							
1032 1033 1044	A-U B-C A-B	5-15.5 10.5 5	A-U (MAX)	1.4	0.85	A-U	30 AMP. A.C.	20	7-15
1032M 1232	A-U B-C A-B	5.5-15.5 10 5.5	A-U (MAX)	5.5	0.8	A-U	30 AMP. A.C.	15	9-35
1034	A-U B-C A-B	9.5-18 13.5 5.5				A-U	30 AMP. A.C.	15	9-25
1037	A-U A-B	11.5-17 4							
1041	A-U B-U	7.5-13 5.5-11	A-U (MAX)	5.5	0.8	B-U	15 AMP. A.C.	12	3-15
1042	A-U B-U	8.5-15 6.5-13	A-U (MAX)	5.5	0.8	B-U	15 AMP. A.C.	12	3-15
1043		8-16					15 AMP. A.C.	10	10-35
1053		8-16	MAX	5.5	0.8		15 AMP. A.C.	10	10-35
1063		9-18		1.4	0.85		15 AMP. A.C.	15	5-15
1073		8-18					15 AMP. A.C.	15	3-15
1144	A-U B-U A-B B-C A-C	10-18 6-14 6 13 18				A-U	15 AMP. A.C.	15	4-12

TRANS-FORMER	VOLTAGE POSTS	OUTPUT (VOLTS)	MULTI-CONTROL TEST			CIRCUIT BREAKER TEST			
			POSTS TO BE USED	MINIMUM PICK-UP	MINIMUM HOLDING	POSTS TO USE	TEST JACK	TEST CURRENT (AMPERES)	TIME (SECONDS)
KW	A-U B-U C-D	6.7-19 6.7-19 12	A-U (MAX) B-U (MAX)	5.5 5.5	0.85 0.85	A-U	30 AMP. A.C.	20	15-45
LW	A-U A-C B-C A-B	7.5-18.5 14 5 18.5	A-U (MAX)	5.5	0.8	A-U	15 AMP. A.C.	15	9-22
RW	A-U A-B A-C B-D	9-18.5 3 9 15.5	A-U (MAX)	5.5	0.8	A-U	30 AMP. A.C.	15	5-25
RWM RW 250	A-U A-B A-C B-D	7.5-15.5 1.7 7.5 14	A-U (MAX)	5.5	0.8	A-U	30 AMP. A.C.	15	5-25
SW	A-U D-U B-U C-U	8-19V 8-19V 19V 14V	A-U D-U	5.5 5.5	0.8	B-U	30 AMP. A.C.	19-20	4-12
TW	A-U A-C A-D E-F	7-18 18 14 13.5	A-U (MAX)	5.5	0.8	A-U E-F	15 AMP. A.C. 15 AMP. A.C.	13	7-25 7-25
VW ZW	A-U B-U C-U D-U	6.5-20 6.5-20 6.5-20 6.5-20	A-U (MAX) D-U (MAX)	5.5 5.5	0.85 0.85	(VW) A-U (ZW) A-U	30 AMP. A.C. 60 AMP. A.C.	17 30	3-30 11-40

HO POWER EQUIPMENT

(Before checking HO Power Supplies, read instructions on page 10)

0100	D.C. A.C.	2-15V 16V				A.C. only	30 AMP. A.C.	15	5-10
0101	D.C. A.C.	7-14V 16V							
0102	D.C. A.C.	14V 12V & 16V				D.C. A.C.	15 AMP. D.C. 30 AMP. AC	12 12	3-5 3-5
0103	D.C.	7-13.5							
0104	Train #1 Train #2 A.C.	6-12 6-12 15				Train #1 Train #2 A.C.	15 AMP. D.C. 15 AMP. D.C. 30 AMP. A.C.	7 7 15	3-5 3-5 3-5

4. Multi-Control Test:

Multi-control transformers which have a built-in whistle control and a reversing switch requires two additional tests.

- a. Plug transformer line cord into outlet and snap power switch "ON".
- b. Turn selector switch to MULTI-CONTROL (pos. 4).
- c. Turn polarity switch to A.C. position.
- d. Connect the leads to the proper transformer terminals (see chart) and insert the plugs into the MULTI-CONTROL test jacks.
- e. Adjust the transformer voltage to the value given in the chart.
- f. Push the transformer whistle control to its "Pick-Up" position (part way). The "pick-up" voltage, as shown on the 0-15 volt scale of the D.C. voltmeter should be above the minimum pick-up value shown on the chart. (If the D.C. voltmeter moves off scale to the left, reverse the test leads).
- g. Push the transformer whistle control to its "holding" position (all the way down). The D.C. voltage indicated on the D.C. meter will drop. To read it accurately change the scale of the D.C. meter to 0-3 volts by pushing "Holding" switch located below the meter. The "holding" voltage should be above the minimum value shown in the chart. Release "Holding" switch on tester before releasing transformer whistle control.
- h. Operate the transformer whistle control slowly noting the A.C. voltmeter. The A.C. voltmeter should flicker but at no time should drop to zero. If the voltage drops to zero, there is an "open" spot in the whistle control switching sequence which would cause the locomotive reversing unit to trip to its next position.
- i. Push "reverse" button. The A.C. voltmeter should drop to zero.

5. Insulation Test:

This test checks the insulation between the primary and the secondary windings of a transformer and also between the primary winding and the transformer case.

This test is normally performed at the factory using a potential of 1200 volts. The tester furnishes 115 volts, but since the current used is limited to a very small value by a series resistor, there is no danger of shock to the operator. This test should be performed after every transformer repair job and whenever you suspect that the transformer has been overheated by a short circuit.

- a. Plug transformer line cord into outlet and snap power switch "ON".
- b. Plug lead into INSULATION TEST jack and holding the clip by the insulator touch the metal base or name plate, then the output

terminals. Make sure to check the "U" post in both "OFF and ON" position. Reverse transformer line plug and repeat test. In no case should the insulation test pilot light glow. If it does glow the insulation between the primary and secondary coil or between the primary and the case is damaged and the transformer is not safe to use because of danger of 110-volt shock.

To check the insulation lamp, plug the lead into the insulation jack and insert the other end of the lead into the left side of the outlet on the tester. The lamp should glow.

WHISTLES:

1. WHISTLE OPERATION – The whistle tender is checked by means of a standard built-in whistle control circuit under standard voltage and load conditions.

- a. Snap power switch ON.
Set selector switch to "HORN" (position 2).
Set polarity switch to "A.C."
Adjust A.C. voltage to 12 volts, using the built-in transformer. Hold whistle lever in "H" (holding) position, press "HOLDING" switch located below D.C. meter and vary the A.C. voltage until the D.C. meter reads 0.8 volts (0-3 volts range).
Release – HOLDING switch before releasing WHISTLE switch.
- b. Set selector switch to "OUTPUT" (position 1) place the whistle tender on the test track and turn the whistle control handle to "H" (holding) position. The whistle should blow.

HORNS:

The horn is checked by means of a standard built-in whistle switch under standard voltage and load conditions. Many horns will not operate if the locomotive motor is not running as not enough D.C. holding voltage is present to close the relay. To simulate the load of a standard motor an 8.3 ohms resistor is built into the test circuit.

- a. Snap power switch ON – Set selector switch to "HORN" (position 2) Polarity switch on A.C. Adjust the A.C. voltage to 12 volts using the built-in transformer. Place the whistle lever in the "H" (holding) position. Press holding switch located below the D.C. meter and adjust the A.C. voltage until the D.C. meter reads 0.8 volts (0-3 volts range). Release the holding switch before releasing whistle switch.
- b. Place the locomotive on the track – Push the WHISTLE control to the "H" (holding) position and the horn should blow. A fresh battery should be used when making this test. If the locomotive is equipped with a 3-position unit, it should be indexed to neutral position.

COUPLERS:

1. ELECTRO-MAGNET COUPLERS – Electro-magnet couplers are those which have individual coils and which are energized by means of sliding contact shoes.

- a. Place the unit under test so that the sliding shoe is on one of the control rails.
- b. Set polarity switch on A.C.
- c. Set the selector switch to “OUTPUT” and adjust the built-in transformer to provide 8 volts to the track.
- d. Press “UNCOUPLE” button used with the section of the track. The coupler knuckle should snap open when the “UNCOUPLE” button is pressed and should latch in closed position when pressed in manually.

2. MAGNETIC COUPLERS – Magnetic couplers are those operated by means of a trigger or armature plate which is attracted by the electromagnet of No. 37 Uncoupling Unit.

- a. Place the unit under test so that the coupler being tested is a few inches away from electromagnet.
- b. Set polarity switch on A.C.
- c. Set selector switch on “OUTPUT” (pos. 1) and adjust the built-in transformer to provide 9.5 volts to the test track.
- d. Press the “UNCOUPLE” button. The coupler should snap open as the coupler trigger or armature passes over the electromagnet and should latch in closed position when pressed in manually.

LOCOMOTIVES:

1. RUNNING CHARACTERISTICS – Lack of power and sluggish operation of the locomotive motor is generally due to a dirty commutator, worn out or oil soaked brushes, defective brush springs or lack of lubrication.

To check locomotive performance:

- a. Set locomotive on test track and snap power switch “ON”.
- b. Set polarity switch on A.C.
- c. Set selector switch to “OUTPUT” (pos. 1) and adjust track voltage between 8 and 12 volts depending on the size of the locomotive.
- d. The locomotive lamp should light and the locomotive should operate. Move the locomotive “E” UNIT lever to ON position and check the operation of the “E” UNIT by means of the DIRECTION control. If the voltmeter indicates zero and the lamp fails to light, there is a short either on the track or in the locomotive wiring.

2. SMOKE UNIT – Modern Lionel smoke locomotives are equipped with heater-type smoke generator of two different types. One uses SP smoke pellets made of a wax-like substance which melts

and vaporizes at a temperature of 350-450 degrees, omitting the characteristic white “smoke”. Upon cooling the vapor re-condenses into tiny white crystals which may be deposited around the smoke stack or on the surface of the locomotive body. Another type uses a smoke-producing liquid No. 960. This oil-base material should not be used in generators designed for pellets because of likelihood of spillage.

- a. For checking heater-type generators, set track voltage to 12 volts, and place an SP pellet or a few drops of smoke liquid into smoke stack. Smoke should be generated in a few seconds. To see whether the element is in good condition, check its continuity according to the wiring diagram of the locomotive.
- b. To check puffing, lift end of locomotive slightly to allow driving wheels to turn easily.

NOTE

First Lionel smoke locomotives made in 1946 were equipped with a lamp type generator using smoke pellets of a different type. Lionel-type generators have been obsoleted and should be replaced with heater-type generator as described in SEC LOC-SU.

WHISTLE CONTROLLERS:

Whistle controllers are checked by operating under a standard voltage and into a standard load.

- a. Snap power switch ON. Set polarity switch on A.C. Set selector switch to OUTPUT (pos. 1). Adjust the A.C. voltage to 15 volts using the built-in transformer.
- b. Connect the two terminals of the whistle controller to the 167 controller jack.
- c. Set selector switch to MULTICONTROL (pos. 4) and A.C. voltmeter should read above 11 volts.
- d. Press “Reverse” button on controller. The voltmeter should go down to zero and come back to original reading as button is released.
- e. Press the “whistle” control button on the controller slowly. As the button is pressed slowly the pick-up voltage indicated on the D.C. meter (0-15 volts) should read above 5.5 volts. As the button is pushed down further, the D.C. voltage should drop. Hold button down and press HOLDING switch located below the D.C. voltmeter. This will change the scale to the 0-3 volt range. On this range the D.C. voltmeter should read a minimum of 0.85 volts. Release HOLDING switch before releasing the “WHISTLE” button on the controller. Neglect the fluctuations of the A.C. voltmeter. (If the D.C. voltmeter goes off scale to the left, reverse the 167 whistle controller test leads). To prevent overheating of the controller coil,

No. 167 whistle controllers are equipped with a built-in circuit breaker. To check the operation of this circuit breaker, proceed as follows:

- a. Remove bottom of whistle controller case.
- b. Connect the 15 AMP jack of the circuit breaker test section to one side of the 167 whistle controller circuit breaker (clip on terminal above "REVERSE" button) and connect the other side of the 167 whistler controller circuit breaker (clip on solder lug at the end of the thermal strip) to post U of a KW or ZW transformer. Connect the "COMMON" jack to post A of the outside transformer used.
- c. Set the voltage control arm of the transformer at 12 volts and plug the line cord into the test outlet.
- d. Snap on power switch and using the voltage control arm of the transformer adjust the current through meter at 15 Amperes. The needle should flicker between 4 and 13 seconds indicating the circuit breaker operation.

OPERATING CARS:

1. CARS WITH BUILT-IN ELECTRIC MECHANISM AND SLIDING CONTACT SHOES — Lionel cars usually operate on slightly higher voltage than that used to run the train.

- a. Set the car on the remote control track section with the sliding shoes on control rails.
- b. Snap on power switch, set polarity switch on A.C., selector switch on "OUTPUT" (pos. 1) and adjust the track voltage to 12 volts A.C.
- c. Push the "UNLOAD" button on the tester panel. (For some operating cars which draw a heavy current you may have to readjust the track voltage).

NOTE: If the car uses electro-magnetic couplers one of them will open when the "UNLOAD" button is pressed. This is normal because one of the couplers sliding shoes will be on a "high" control rail.

2. CARS OPERATED WITH AUXILIARY RAIL CLIPS — Several Lionel cars are operated with auxiliary OTC contactors, power and ground clips built into various accessories, etc. To check these cars, connect a straight section of track equipped with the recommended auxiliary contact device to the OUTPUT jacks through a No. 90 controller.

- a. Set the car on the auxiliary rail device according to instructions for the particular car.
 - b. Snap on power switch. Set the polarity switch on A.C., selector switch to "OUTPUT" (position 1) and adjust the transformer voltage to read 12 volts on the A.C. voltmeter.
 - c. Push the No. 90 controller button to operate the car.
3. OPERATING CARS TRIGGERED BY TRACK

ELECTRO-MAGNET — Several Lionel cars are loaded or "cocked" manually but are set into operation or fired by means of the electromagnet built into the remote control track section. To check,

- a. "Load" the car and set it over the track electromagnet.
- b. Snap on power switch. Set the polarity switch to A.C., selector switch to "OUTPUT" (position 1) and adjust the transformer voltage to read 12 volts on the A.C. voltmeter.
- c. Push the "UNCOUPLE" button on tester panel to operate the car.

REMOTE CONTROL TRACKS UCS & NO. 6019

Trouble in the operation of a remote control track set may be caused either by faulty wiring or by improper functioning of the controller push buttons.

1. REMOTE CONTROL TRACK:

- a. Using the continuity jacks, check for continuity between the rails of the tracks. Use the circuit diagram which appears in the R.C.S. sections of the Service Manual.

2. CONTROLLER OPERATION — Pushing the "UNCOUPLE" button of the controller applies track voltage to the central electro-magnet of the remote control track sections and also to the auxiliary control rails.

- a. Set polarity switch on A.C., set selector switch on "OUTPUT" and adjust the voltage to 8 volts A.C.
- b. Connect the bottom output jack to the outside rail and the top output jack to the center rail.
- c. Set selector switch to "VOLTMETERS" (position 3) and connect the bottom voltmeter jack to the outside rail and the top of the auxiliary control rails in turn. Track voltage should appear at each of the auxiliary rails each time the "UNCOUPLE" button is pressed. Hold a steel screw driver above the center electro-magnet. Each time it is energized, the screw driver should be attracted to the coil. Pushing the "UNLOAD" button of the controller applies track voltage to the auxiliary rail or rails on one end of the remote control track and grounds the auxiliary control rails on the other end of the remote control track.
- d. Connect the bottom "VOLTMETERS" jack to a control rail connected to terminal No. 2 of UCS track and the top "VOLTMETERS" jack to a control rail connected to terminal No. 4 of UCS track and press "UNLOAD" button.
- e. Repeat test with all control rails.

TRACK:

In all ordinary three-rail track, the center or power rail is insulated from the rest of the circuit by fibre strips between the rail and the track ties. The outside rails are joined together electrically through the metal track ties and serve as "GROUND" for

the train circuit.

- a. Snap power switch on.
- b. Inserting the test leads into the "CONTINUITY" jacks, touch the outside rails. The continuity pilot light should glow. Touch the center rail and one of the outside rails. The continuity pilot light should not glow.

TRACK SWITCHES:

1. **MANUAL SWITCHES** — Manually operated switches should be tested for shorts in the same way as any ordinary track section. In addition No. 1022 and No. 142 manual switches should be tested for the operation of their non-derailing device.

2. REMOTE CONTROL SWITCHES:

- a. Set polarity switch on A.C. and selector switch on "OUTPUT" and adjust voltage for a reading of 10 volts A.C.
- b. Connect the center rail and one of the outside rails (except control rails) to the output jacks.
- c. Connect the controller to the switch and operate switch by moving the proper controller lever.
- d. To check the operation of the switch alone, remove the controller and using pliers handles short the common ground post on the switch box to each of the control post in turn. The swivel rail of the switch should snap over to the opposite direction as you change connection from one outside post to the other.
- e. To check the operation of the switches equipped with non-derailing device, short the insulated control rails, one at a time, to the outside rail on the same switch branch using a handle of a pair of pliers. The switch should snap to clear the way for a train running on that branch of the switch.
- f. If the switch has a provision for fixed voltage connection install the fixed voltage plug or screw into the switch. This should cut off power from the switch. Transfer the lead from the center rail to the fixed voltage plug or screw. This should restore switch power.
- g. To check the controller alone, use the continuity jack. Connect one of the jacks to common ground wire of the controller cable and the other to each of the remaining wires in turn. Moving the lever in the proper direction should complete the electrical circuit between the two wires and light the continuity pilot.

NOTE: In some "027" switches the controller lamp will go out in one of the positions of the switch lever. This is normal and is due to the design of the controller. See circuit diagram in appropriate section of the Service Manual.

TRACK SIGNAL ACCESSORIES:

- a. Set selector switch to "OUTPUT" and adjust

voltage to 10 volts A.C., with polarity switch set on A.C.

- b. Connect the common terminal of the accessory to one of the output jacks.
- c. With the other lead, touch each of the remaining terminals in turn.

OPERATING ACCESSORIES:

The normal operating voltage of all Lionel accessories is from 10 to 14 volts. To test any of these accessories, first check for normal operation at the proper voltage. If the accessory does not operate properly, test the circuit, checking for faulty wiring, shorts, etc. using the continuity jacks of the tester. Test the continuity of the coil and the operation of the motors separately.

AUTOMATIC STOP STATIONS AND SIGNALS:

Automatic stop station and signals No. 115 and Block Signal No. 253 contain a thermal delay switch which is closed a short time after the train comes to a stop in front of the station.

To test:

- a. Set polarity switch on A.C.
- b. Set selector switch on "OUTPUT" and adjust the voltage to 12 volts A.C.
- c. Connect terminals 1 and 2 to the output jacks. The station lights should go on.
- d. Connect terminals 1 and 3 to the "OUTPUT" jacks. This connection sends current through the terminal delay switch which should close after several seconds, shorting out the tester. The duration of the delay is set by means of a lever on the thermal delay switch.

CONTACTORS AND CONTROLLERS:

Lionel manufactures several types of track connectors or contactors which should be checked by means of the continuity jacks.

Contacts Nos. 154C and 1045C are similar in construction and are clamped onto rail sections so that the metal plate covering one of the outside rails is insulated from that rail by an insulating plate lining.

To test these contactors, clamp them onto an "0" or "027" track section and check for continuity between the contactor plate and the outside track rails. Contactor No. 153C is a double throw switch where No. 3 can make contact either with terminal No. 1 or terminal No. 2 depending on pressure on the contactor plate. This action can be tested by means of the continuity jacks.

Various Lionel controllers are arranged to make and break contacts in a pre-determined sequence. To check these, refer to the diagram of the controller and check the operation of the contacts by means of the continuity leads.

LAMPS:

All Lionel lamps can be checked in the lamp test socket located on the right side of the panel. The voltage available at the test socket corresponds to the setting of the built-in transformer.

Do not check lamps at voltages which are higher than the rated voltage of the lamp or it will burn out.

BATTERIES:

All Lionel diesel horns operate with a 1.5 volt battery. To check a battery:

- a. Set selector switch at VOLTMETERS (pos. 3) polarity switch at \pm , connect upper voltmeter jack to the minus (-) of the battery and the lower jack to the positive (+) of the battery.
- b. Press holding switch located below the D.C. voltmeter. The reading should be above 1.4 volts D.C. (0-3 volt range).

RECTIFIER PLATES:

To check rectifier discs, plates or plates in rectifier assemblies use the two jacks indicated on the panel.

- a. Snap power switch ON. Set polarity switch on A.C. Set selector switch on OUTPUT and adjust the voltage lever to read 14 volts on the A.C. meter.
- b. Set selector switch on MULTI-CONTROL and touch the leads to the two sides of the rectifier plate. The D.C. meter should indicate at least 5 volts. If the meter attempts to indicate backward reverse the leads.

In some cases the surface of the rectifier may be scratched or discolored. This does not necessarily mean that the rectifier is defective. All that is necessary is to make good contact with the sound portion of the rectifier surface.

NOTE: Most rectifiers can be checked while still in assembly on the transformer or power pack removing the case and making the necessary connections by means of probes.

"BRIDGE" RECTIFIERS:

Four-plate or full-wave bridge-type rectifiers may be checked as a complete assembly by applying an external A.C. voltage to the input terminals of the rectifier and measuring the D.C. output.

- a. Using a separate transformer, connect the A.C. terminals of the rectifier to 14-16 volts.
- b. Connect the D.C. or output terminals of the rectifier to MULTI-CONTROL jacks.
- c. Switch selector to MULTI-CONTROL.

The D.C. output as shown on the D.C. meter should be a volt or two lower than the A.C. input.

TESTING HO EQUIPMENT

All HO locomotives and other HO motorized equipment operates on Direct Current usually supplied by a "Power Pack". A power pack usually

consists of a step-down transformer to reduce the available A.C. household voltage, a rectifier to convert the low A.C. voltage to D.C., a variable resistor to control the D.C. output voltage, and a reversing switch to reverse the output polarity. Many power packs also contain protective circuit breakers and A.C. taps for accessory equipment.

HO accessory equipment such as electric switches and other solenoid-powered items can be operated on either D.C. or A.C. but certain vibrator-powered devices can be operated only on A.C.

To test the various items of HO equipment No. 5F Tester is equipped with an HO test track, a D.C. power supply which is applied to the test track and OUTPUT jacks, and a D.C. meter.

HO LOCOMOTIVES:

Switch the set ON. Set the polarity switch to D.C. and the selector switch to OUTPUT. If the voltmeter shows a reverse reading move polarity switch to alternate D.C. position. Adjust track voltage between 8 and 12 volts on the D.C. voltmeter. Place the locomotive on the HO test track. The locomotive should operate.

To reverse the locomotive reverse polarity by moving the switch to alternate position. NOTE: Under these circumstances the D.C. meter will attempt to read backward but this should cause no concern since no damage to the meter can result.

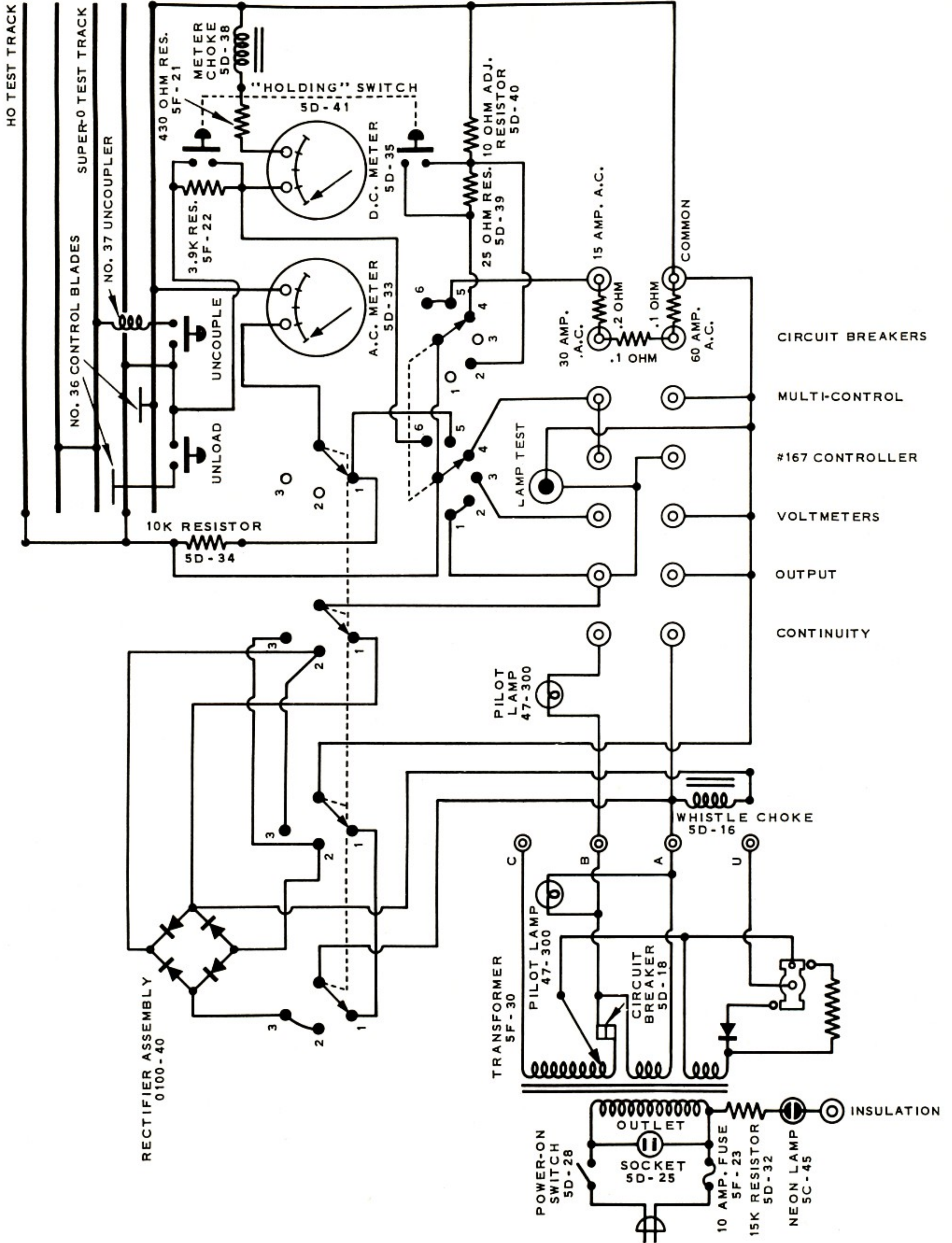
HO POWER PACKS:

HO Power Packs should be checked under load. To do this use the MULTI-CONTROL jacks.

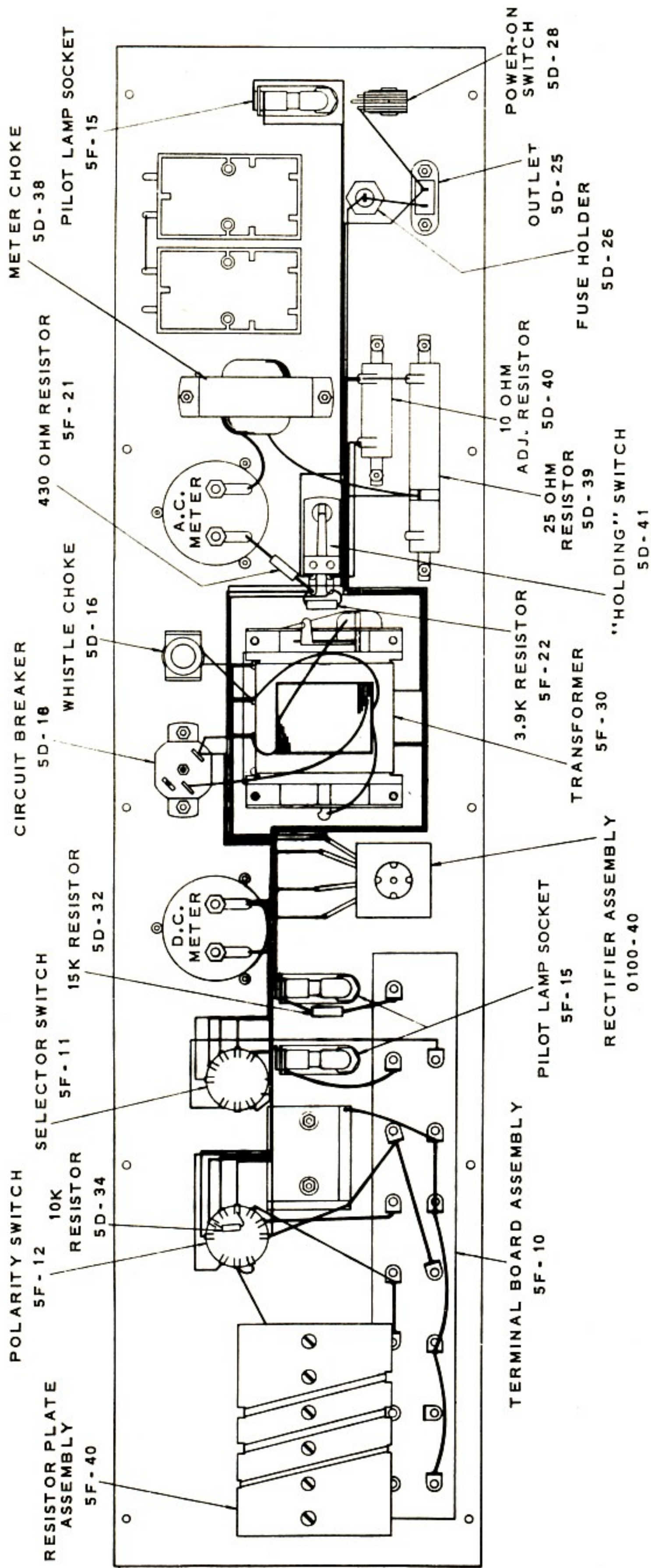
- a. Snap power switch ON. Set polarity switch on A.C. Set selector switch on MULTI-CONTROL.
- b. Connect test leads to the D.C. output terminals on the power pack under test and plug them into the MULTI-CONTROL jacks.
- c. Move the voltage control lever of the power pack from minimum to maximum position. The voltage should vary smoothly from about 6 volts to 12 volts D.C. To check the opposite polarity reverse the leads in the MULTI-CONTROL jacks and repeat.

NOTE: In No. 0100 Power Packs the voltage will vary from 0 to maximum.

SCHEMATIC DIAGRAM OF NO. 5F TESTER



REAR VIEW OF TESTER PANEL



REPLACEMENT PARTS FOR 5F UNIVERSAL TESTER

Part No.	Part Name	(Net) Price
5C-45	Neon Lamp	.15
5D-16	Whistle Choke	.75
5D-18	Circuit Breaker	2.00
5D-25	Outlet Socket	.40
5D-26	Fuse Holder	.50
5D-28	Power-On Switch	1.00
5D-32	15K Resistor	.35
5D-33	A. C. Meter	12.00
5D-34	10K Resistor	.75
5D-35	D. C. Meter	12.00
5D-38	Meter Choke	3.60
5D-39	25-Ohm Resistor	.65
5D-40	10-Ohm Adj. Resistor	1.55
5D-41	Holding Switch	1.55
5F-10	Terminal Bd. Assem	2.00
5F-11	Selector Switch	1.50

Part No.	Part Name	(Net) Price
5F-12	Polarity Switch	1.50
5F-15	Pilot Lamp Brkt.	.50
5F-21	430-Ohm Resistor	.70
5F-22	3.9 K Resistor	.70
5F-23	10 Amp Fuse (Box of 5)	.50
5F-24	Switch Knob	.25
5F-30	Transformer Assem.	6.00
5F-40	Resistor Plate Assem	2.00
5F-41	Banana Plug Leads pr	1.25
5F-42	Spade Leads pr	.75
0100-40	Rectifier Assem.	2.25
47-300	Pilot Lamp	.15
90-1	Controller	.75
B-292	Cord & Plug	.50