

ASSEMBLING AND  
USING YOUR

*Heathkit*

TUBE CHECKER  
MODEL TC-1



THE HEATH COMPANY  
BENTON HARBOR, MICH.

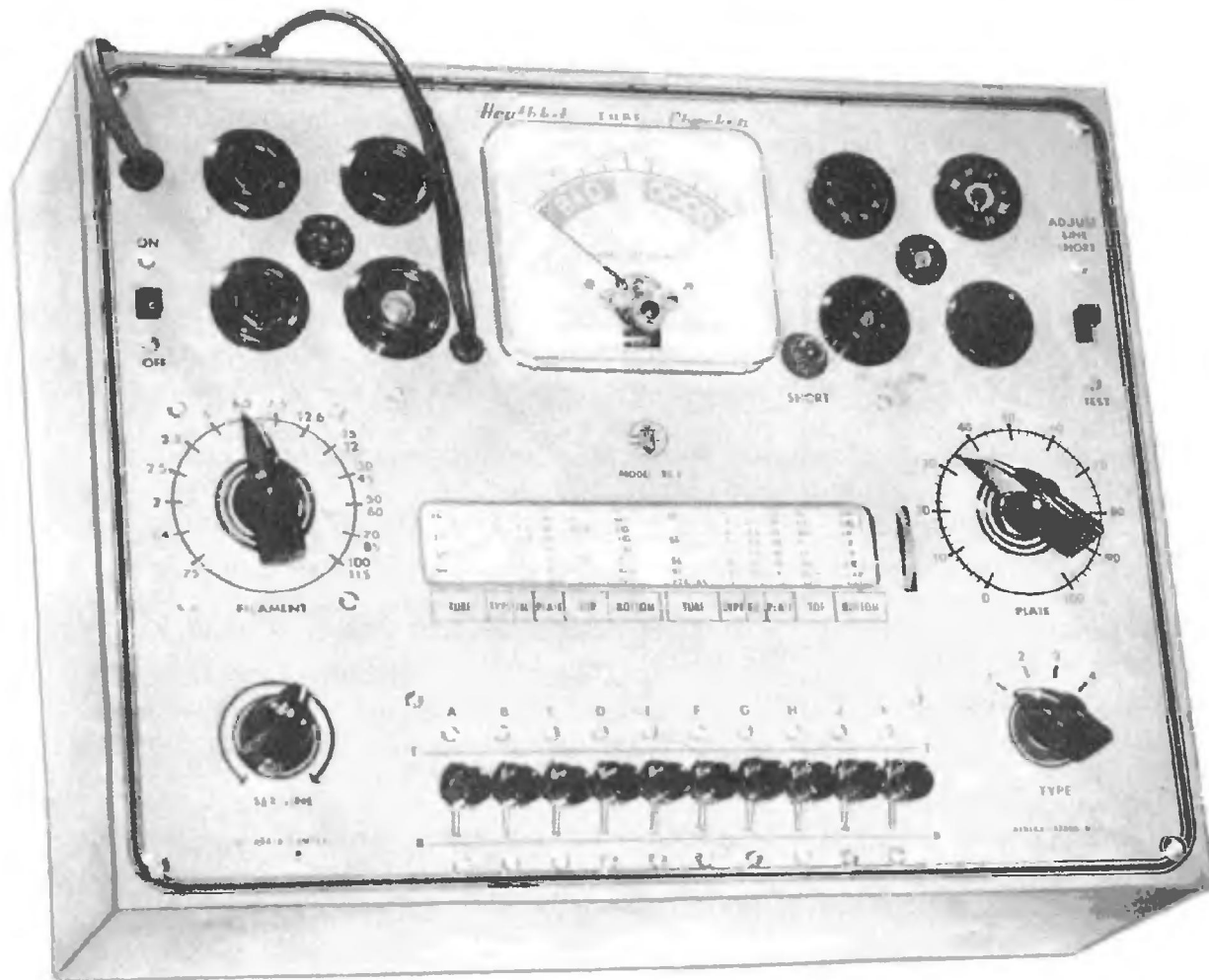
PRICE \$1.00

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# The TC-1 Heathkit Tube Checker



## HEATHKIT TUBE CHECKER FEATURES

Simplified, fast, lever switches allow insertion of individual tube elements making the instrument extremely flexible and truly obsolescence free.

Any combination of base connections possible.

Filament voltages from .75V to 117V available.

Has 1 ma 100 mv meter with easily read "good" "bad" scale.

Blank socket hole provided to facilitate modification for checking newly added types.

Correct settings for new tubes easily determined.

Checks 4, 5, 6 and 7 pin large, regular and miniature, octal, loctal, Hytron, 9 pin miniature series tubes and pilot lamps.

Checks for emission, shorted elements, open elements and filament continuity.

Tests oscillator section of converter tubes separately.

Highest quality switches, meter and sockets.

Fast acting gear driver roll chart.

Fine wood cabinet and attractive two color panel.

## ASSEMBLING THE HEATHKIT MODEL TC1 TUBE CHECKER

The Heathkit Tube Checker provides the most modern rapid method of checking receiver tubes available. Fast action lever switches control the position of each element allowing its insertion or removal thereby indicating that each tube element is functioning. Open elements are found easily. Shorted elements are indicated by neon glow bulb.

The best of parts are used in your Heathkit Tube Checker--Centralab lever switches and wire wound controls, Amphenol sockets, quality power transformer, Mallory rotary switches, clear plastic faced one MA meter using Alnico V magnet, brass gear driven roller chart.

The line voltage control is continuously variable allowing accurate adjustment. A complete range of filament voltages are provided. The Stackpole spring return test slide switch protects the meter while the checker is being set up, as the instrument should never be in test position except when set for the type of tube under test.

The Heath Company has provided the best of materials and design in this instrument and it deserves the best of construction. This instrument will be useful many years and care taken in assembly will eliminate trouble later.

Thoroughly familiarize yourself with the layout, schematic, pictorial and photo-prints. Read the instructions completely through once and if helpful mark the values of the parts on the schematic--even if not familiar with radio symbols follow the construction on the schematic identifying the symbols on the information chart--later more complicated sets are shown with schematic only and learning on this tube checker is good training.

Make a good mechanical joint of each connection--metal to metal as solder itself is not a good conductor and serves only to hold the connection rigid. Where a wire makes a connection, take the bare wire through the hole and bring it back to the outside wire making a solid connection that can be pulled without coming loose. Use only good quality ROSIN CORE RADIO TYPE SOLDER. Other types will corrode and ruin delicate radio parts.

Begin by checking the parts against the parts list. Identify each part. This will avoid throwing away any small parts in the packing. Use the charts to identify resistors and condensers.

From time to time, small changes in parts will be made by the Heath Company. All parts supplied will work just as well as the part for which it was substituted. 47,000 ohm resistors (which is the new radio manufacturers rating for 50,000 ohms) may be substituted for 50,000 ohms or a one watt resistor may be substituted for  $\frac{1}{2}$  watt, etc. All substitutions will be of equal or better quality than the original and will be made in order that a minimum delay will occur in filling your order.

The newer types of insulated resistors have a higher wattage rating. The  $\frac{1}{4}$  watt size is now rated at  $\frac{1}{2}$  watt and these are used in this kit. Bolts and nuts are counted mechanically and if a few are missing, please secure locally.

The sockets are held in place by the wavy metal rings which are forced over the sockets and into the grooves provided around the upper edge of the socket. The end of the ring can be held in the groove and the rest of the ring forced over and into the groove with a screw driver.

Begin the assembly with the sockets. Note that the keyway or indicating pin is toward the opposite or lever switch side of the panel. The miniature sockets are held in place by the cupped washers which have sharp points on the inside and should be installed first. These are forced over the socket tightly against the panel. The power slide switch mounts with the two terminals toward top panel (nearest line cord grommet.) The filament selector switch is mounted as shown and then the wiring to it, as shown in step one, is completed before mounting the transformer directly over it. Connect the resistor TC49 (75,000 ohm) to the last (100-115V) terminal of the selector

switch when this lead is attached--use spaghetti over the resistor lead and leave the lead length of the resistor as long as possible to reach the terminal strip which is installed later. Mount the line adjust control TC32 and connect the black leads from the power transformer as shown. Use one nut below the panel on this control as the locating pin on the control is not used and its thickness must be accounted for. Connect the black primary transformer lead marked zero (0) to the OFF-ON slide switch (O94).

The following additional parts are now assembled to the panel--the ten lever switches (TC33), the two pole four position rotary switch (TC13), the 200 ohm plate adjust control (TC11), the double pole double throw spring return slide switch with the slide normally in the "adjust line-short" position (TC14), the indicating meter TC25. While mounting the meter install the dual terminal strip under the meter holding nut nearest the power transformer and the three contact vertical terminal strip under the mounting nut nearest the plate control potentiometer. The instrument rectifier (TC10) is mounted against one of the roll chart brackets (TC37) on the side opposite the bracket feet. This bracket is then mounted beside the power transformer with the rectifier toward the selector switch. The other three contact vertical terminal strip is held in place by the roll chart bracket nut nearest the seven prong socket. The line cord, grid clip and neon indicator rubber grommets are installed. The large brass drive gear is held in place by a quarter inch rod which has a 6-32 stud on one end, a slight shoulder prevents the gear from coming off, the other two contact terminal strip mounts under the nut which holds this stud in place. The tubular condenser (O49) is connected between the two terminal strips below the meter. Resistor TC53, O12 and A11 are now mounted on these terminal strips as shown on step two wiring diagram. Resistors TC51, TC52, TC30 and TC31 are mounted on rotary switch TC13. The secondary red leads from the power transformer are connected as shown and resistor TC29 is mounted on the dual terminal strip near the plate control potentiometer. Bus wire is supplied for the connection of the three contacts on the ten lever switches--the contacts nearest the roller chart are the rotor contacts which later connect to the tube contacts. The balance of the wiring in step two can now be completed--(CAUTION: Use the leads as supplied with the instrument rectifier placing spaghetti over them--do not solder to the rectifier itself as heat will ruin it.) Observe the polarity of the rectifier--a small red dot on one contact denotes the positive terminal. The neon short indicator bulb is placed in its socket and pressed into the rubber grommet--use sufficient wire in connecting the socket to allow for its removal for bulb replacement. Install the line cord using a knot inside the grommet to prevent strain on the solder connections. The line cord should be separated into two leads, one going to the center contact of the adjust control, the other to the other contact of the slide switch. With the completion of step two wiring, the tester sockets are wired as shown in wiring step number three. All the connections from the lever switches should be carried around the end of the roll chart bracket to the sockets. In wiring the sockets, all number one pins are connected together, number two pins together, etc.--in case of question about any particular socket, consult any tube manual. The lever switches are connected in the same order, lever switch A to socket pin No. 1, lever switch B to pin No. 2, etc. Lever switch K (I is omitted as it looks like a one and might be confusing on the chart) connects to the grid clip at the dual terminal strip near the meter. The pilot light testing socket located in the center of the seven prong socket is connected directly to the filament contacts on the lever switches eliminating the need for setting any lever switch for checking them.

Upon completion of the wiring, a recheck should be made by tracing over each lead of the step wiring diagrams with a colored pencil as the wire is followed through in the instrument. If all wiring is correct, insert the power plug into 110-120 Volt 60 cycle AC outlet and slide power switch to on position, meter pointer should go to approximately one-half scale. If meter attempts to swing left, the instrument rectifier connections are reversed. In localities having a high line voltage, a minimum setting of the "Line Adjust" control should be used. The quality check will not be affected.

With the instrument operating satisfactorily, the roller chart should be installed, A roll of special adhesive tape is provided to cement the plastic window in place. This tape is adhesive on each side and a six and one half inch strip is placed parallel to each side of the roller chart window under the instrument. The plastic is then pressed against the tape and is firmly held in

place by the tape. See that the plastic completely covers the tapes or remove excess tape with knife to prevent chart from sticking to tape. The chart should not be unrolled to avoid the possibility of misalignment. Loosen the screws holding the roll chart bracket which has the gear drive sufficiently to allow the chart pins to be inserted into the bracket. Leave the chart slightly loose so that the chart rolls easily. Tighten the bracket screws and test by rolling the chart to each end using care as the end is approached to prevent tearing the chart from the rollers. If chart tightens at ends, loosen slightly more. The instrument is now installed in the cabinet using the four wood screws supplied.

### USE OF THE HEATHKIT TUBE CHECKER

The following steps should always be followed in setting up for any tube test.

1. With power cord connected, move roll chart to tube to be tested and turn set line control until meter pointer is at line test point.
2. Set type switch to type shown in chart.
3. Set filament selector switch to voltage shown.
4. Set plate control to setting shown in chart.
5. Set lever switches to top and bottom positions as shown in top and bottom column of chart.
6. Insert tube.
7. Check tube for short by moving levers shown in light type through the two positions, returning it to the position shown on chart. Flashing during switching indicates no defect.
8. Check Tube for quality by sliding test slide switch to test position (allowing sufficient time for tube to heat.) Pointer indication above full scale indicates tube is extremely good or more than 130%. To make element continuity check on these tubes, turn plate control so that pointer falls within end scale markings and proceed with continuity tests. Tubes having the same base connections and similar characteristics, and in some instances differing only in filament voltage, occasionally have slightly different roll chart settings to provide optimum conditions for testing.

To test for open elements, proceed as follows:

9. Holding slide switch in test position, move each lever in the T (top) position (only those shown in light type) to the B (bottom) and return. Satisfactory element (one properly connected to its pins) is indicated by a change in meter reading. The grid element usually shows a large change while a screen or plate shows only slight change.

To check filaments and a filament taps for continuity: Set filament selector to .75.

10. Move each lever shown in dark type in right column on the chart through its two positions--satisfactory filament and taps shown by bright glow of short test indicator (always move one lever at a time.)

Please make the following changes in your Tube Chart.

|           |   |      |    |      |            |
|-----------|---|------|----|------|------------|
| 6AK6      | 3 | 6.3  | 30 | ABEF | <b>CG</b>  |
| 6K8       | 1 | 6.3  | 20 | EF   | <b>GH</b>  |
|           | 1 | 6.3  | 22 | CDK  | <b>GH</b>  |
| 12AL5     | 1 | 12.6 | 25 | G    | <b>AD</b>  |
|           | 1 | 12.6 | 25 | B    | <b>DE</b>  |
| VR-75     | 4 | .75  | 30 | E    | <b>BCG</b> |
| VR-90-30  | 4 | .75  | 30 | E    | <b>BCG</b> |
| VR-105    | 4 | .75  | 30 | E    | <b>BCG</b> |
| VR-150-30 | 4 | .75  | 30 | E    | <b>BCG</b> |

### MULTIPLE TYPE TUBES

Tubes which contain several sets of elements are indicated on the chart by a bracketed set of listings, one for each test to be made on the tube. The tester is set up according to the tests in each line and checked through all the tests as outlined above.

## PILOT LIGHTS

Check pilot lights by setting the filament selector switch to the proper voltage and inserting bulb in socket in the center of the seven pin socket.

## NEW TUBES

New type tubes may easily be set up and checked if the data on the tube is available.

1. Determine the filament voltage and set filament selector accordingly.
2. Set type control as follows: Position one for diode types and low cathode current types below 4 ma), position two for tubes with current drains between 3 and 15 ma filament types, position three heater type tubes above 8 ma, position four gas control tubes, gaseous rectifiers and eye or target tubes.
3. Leave the first filament connection lever (lever A is pin No. 1, lever B is pin No. 2, etc.) in the center position.
4. Move the other filament lever to the B (bottom) position (if filament is tapped, move it to B position also.)
5. Move the cathode to B (bottom) position.
6. Move all other elements (screens, suppressors, grid, plate, etc.) to the T (top) position.
7. Hold test slide switch in test position and adjust plate load control to bring pointer to mid point of the good scale (check several tubes and select the average.)
8. Note the settings in this manual.

**Special Sockets:** The Heath Company will attempt to supply sockets for any type tube on request. An acorn socket can be supplied and the panel punched for it for a charge of \$2.00. In testing tubes with more than one top contact, a small grid clip lead can be made with a phone tip on the other end which can be inserted in contact of vacant socket and connected into tester with proper lever switch.

## IN CASE OF DIFFICULTY

1. Recheck entire wiring. Follow each lead on the schematic with colored pencil and trace it out on the instrument. Most cases of difficulty result from wrong or reversed connections (often having a friend check the wiring will divulge an error consistently being overlooked.)
2. Check the voltages as shown on the transformer wrapper at the connections of the transformer leads. This will show up misinterpretation of the markings.
3. Make continuity check between lever switch rotor contacts and various socket pins to make certain that all contact ones are connected to lever A, etc.
4. The set line control normally operates hot and effects a part of its cooling through the aluminum panel. Slight vibration of the meter needle is to be expected.
5. If unable to obtain results, write the Service Department of the Heath Company giving all possible information such as indications, voltages, etc. and we will attempt to help you.
6. If desired, your instrument may be returned to the factory for repair or service. The Heath Company will check your tube checker and put it in operating condition for a charge of \$3.00 plus charges for any parts or alterations required due to damaged or improper construction.

**NOTE:** Before returning your instrument to factory, be sure to install all panel and chassis mounting screws.

Tighten power transformer securely.

Attach a tag, giving name, address and trouble experienced, to your instrument.

Pack instrument in a rugged container, preferably wood using at least three inches of shredded newspaper or excelsior on all sides. Do not use folded newspaper. Do not ship in original carton only.

Ship by prepaid express if possible. Return shipment will be made by express collect.

Failure to follow the above instructions may result in damage in transit which might not be considered by the carrier as their responsibility.

Prices subject to change without notice. The Heath Company reserves the right to change the design or construction of its instruments without incurring liability for equipment or products previously supplied.

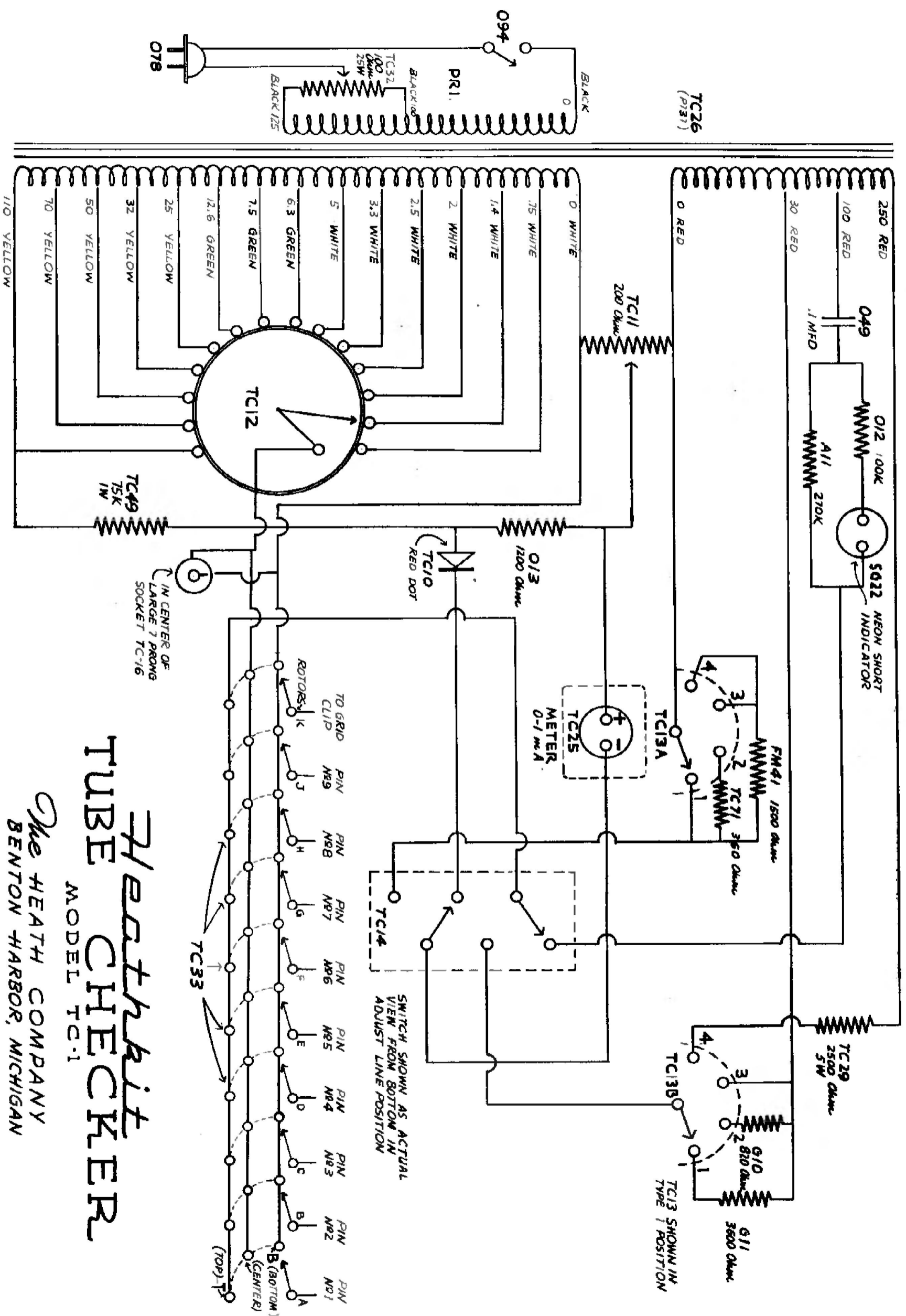
### WARRANTY

The Heath Company limits its warranty on any part supplied with any Heathkit (except tubes, meters, and rectifiers, where the original manufacturer's guarantee only applies) to the replacement within three (3) months of said part which, when returned with prior permission, postpaid, was, in the judgment of the Heath Company, defective at the time of sale.

The assembler is urged to follow the instructions exactly as provided. The Heath Company assumes no responsibility for the operation of the completed instrument, for liability for any damages or injuries sustained in the assembly or operation of the device.

### HEATH COMPANY Benton Harbor, Michigan TC1 TUBE CHECKER PARTS LIST

| PART NO.                                 | PARTS PER KIT | DESCRIPTION                      | PART NO.             | PARTS PER KIT | DESCRIPTION                       |
|--|---------------|----------------------------------|----------------------|---------------|-----------------------------------|
| <b>RESISTORS</b>                         |               |                                  | <b>MISCELLANEOUS</b> |               |                                   |
| TC49                                     | 1             | 75,000 Ohm 1 Watt 2% Prec. Res.  | TC55                 | 2             | Miniature Socket Rings            |
| TC71                                     | 1             | 360 Ohm Resistor                 | TC21                 | 1             | 9 Prong Miniature Socket (78-A9P) |
| G10                                      | 1             | 820 Ohm Resistor                 | TC20                 | 1             | Hytron 5 Prong Socket (78-6H)     |
| O13                                      | 1             | 1,200 Ohm Resistor               | TC27                 | 1             | Blank Socket (78-B)               |
| FM41                                     | 1             | 1,500 Ohm Resistor               | C25A                 | 1             | Pilot Light Socket                |
| G11                                      | 1             | 3,600 Ohm Resistor               | SG25                 | 2             | 3 Lug Terminal Strips             |
| O12                                      | 1             | 100,000 Ohm Resistor             | S32                  | 2             | 2 Lug Terminal Strips             |
| A11                                      | 1             | 270,000 Ohm Resistor             | SG22                 | 1             | NE51 Bulb                         |
| TC29                                     | 1             | 2500 Ohm 5 Watt w.w. Resistor    | TC10                 | 1             | Half Wave Instr. Rectifier        |
| <b>CONDENSERS</b>                        |               |                                  | TC23                 | 1             | Grid Clip                         |
| O49                                      | 1             | .1 MFD Condenser                 | TC40                 | 1             | Drive Gear Pin                    |
| <b>CONTROLS</b>                          |               |                                  | TC43                 | 1             | Large Gear (G-140)                |
| TC11                                     | 1             | 200 Ohm Control                  | TC66                 | 1             | 5/16" Grommet                     |
| TC32                                     | 1             | 100 Ohm 25 Watt Control          | O35                  | 1             | 3/8" Grommet                      |
| <b>SWITCHES</b>                          |               |                                  | C24                  | 1             | Pilot Light Grommet               |
| O94                                      | 1             | SPST Slide Switch                | TS72                 | 34            | #6 Lock Washers                   |
| TC33                                     | 10            | Single Pole 3 Pos. Lever Sw.     | TC39                 | 4             | Brass Washers #10 7/16" OD        |
| TC12                                     | 1             | Single Pole 14 Pos. Rotary Sw.   | O28                  | 4             | Control Washers                   |
| TC14                                     | 1             | DPDT Spring Return Slide Sw.     | O31                  | 32            | 6/32 x 3/8" Machine Screws        |
| TC13                                     | 1             | 2 Pole 4 Pos. Rotary Sw.         | O101                 | 4             | Lock Washers                      |
| <b>KNOBS - SOCKETS - TERMINAL STRIPS</b> |               |                                  | S22                  | 34            | 6/32 x 1/4" Nuts                  |
| TC34                                     | 10            | Knobs for Lever Switches         | O33                  | 4             | Control Nuts                      |
| O51                                      | 2             | Small Pointer Knobs              | TC46                 | 4             | #6-5/8" Type A Sheet Metal Screws |
| TC24                                     | 2             | Large Pointer Knobs              | TC65                 | 1             | Grid Clip Test Lead (1 Ft.)       |
| TC22                                     | 1             | 4 Prong Socket (78-S4)           | TC35                 | 1             | Roll Hook-up Wire (35 Ft.)        |
| TC19                                     | 1             | 5 Prong Socket (78-S5)           | IB43                 | 1             | Length #20 Bare Copperwire (18")  |
| TC18                                     | 1             | 6 Prong Socket (78-S6)           | P27                  | 1             | Length of Spaghetti (6 Inch)      |
| TC16                                     | 1             | 7 Prong Socket (78-7CD)          | O78                  | 1             | Line Cord                         |
| TC17                                     | 1             | Loctal Socket (78-8L)            | TC69                 | 1             | Chart Window                      |
| O54                                      | 1             | Octal Socket                     | TC70                 | 1             | Length Window Tape (15")          |
| O43                                      | 7             | Octal Socket Rings               | TC64                 | 1             | Chart Roller Assembly             |
| TC54                                     | 1             | Large Socket Ring                | TC37                 | 2             | Roll Chart Brackets Brackets      |
| TC15                                     | 1             | 7 Prong Miniature Socket (78-7P) | TC25                 | 1             | Tube Checker Meter (O-1 MA)       |
|  |               |                                  | TC26                 | 1             | Power Transformer (P131)          |
|  |               |                                  | TC28                 | 1             | Panel                             |
|  |               |                                  | TC36                 | 1             | Cabinet                           |
|  |               |                                  | TC1                  | 1             | Instruction Manual                |



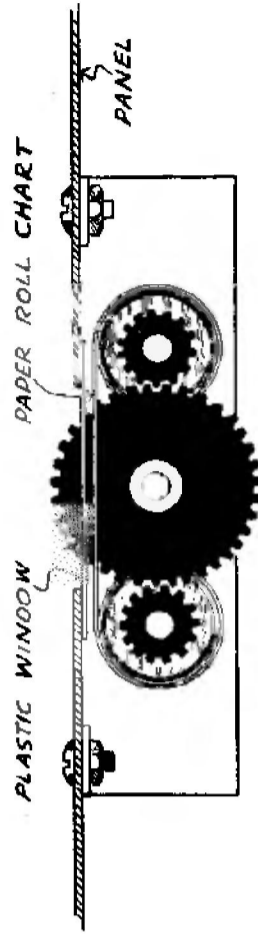
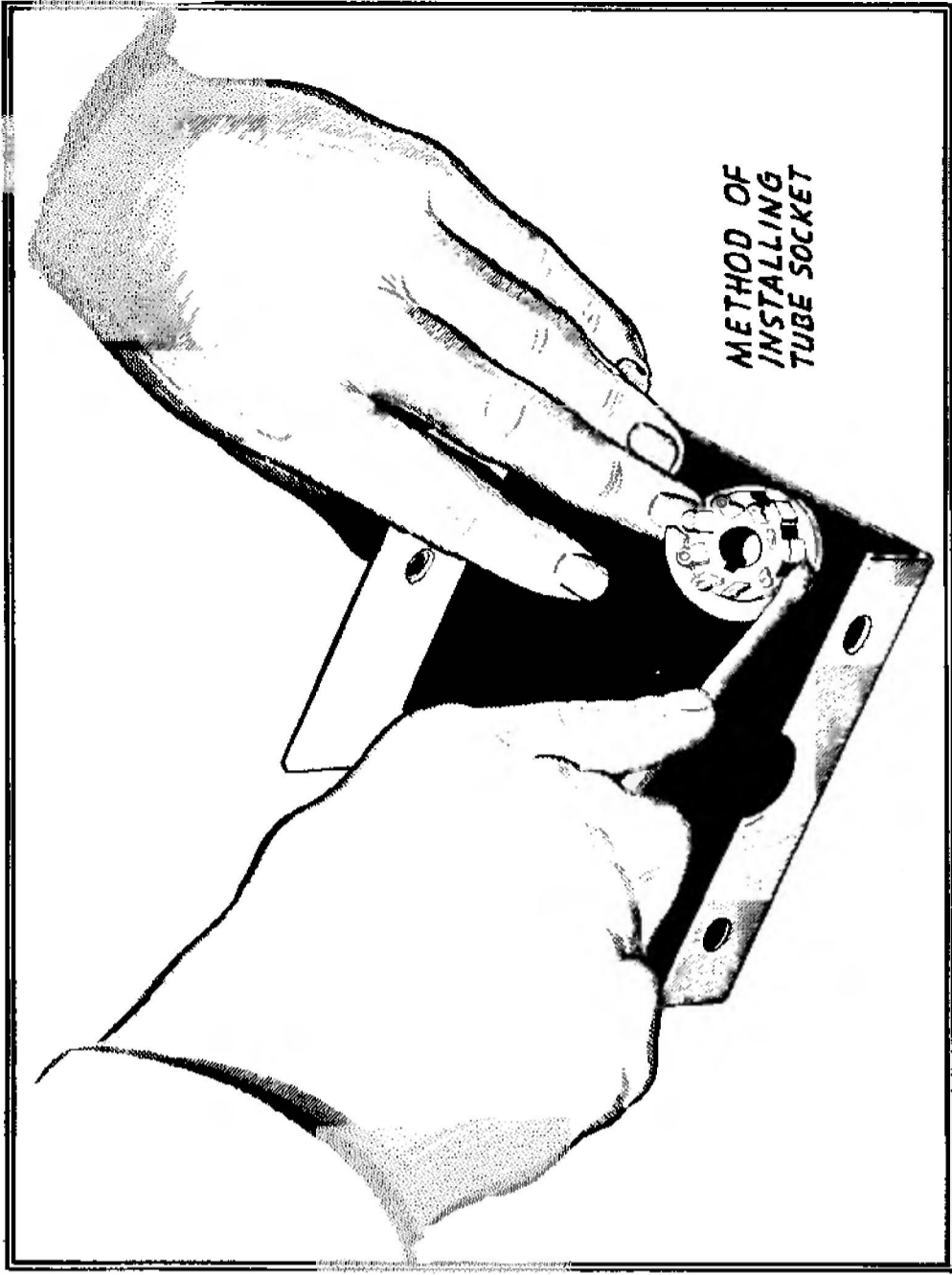
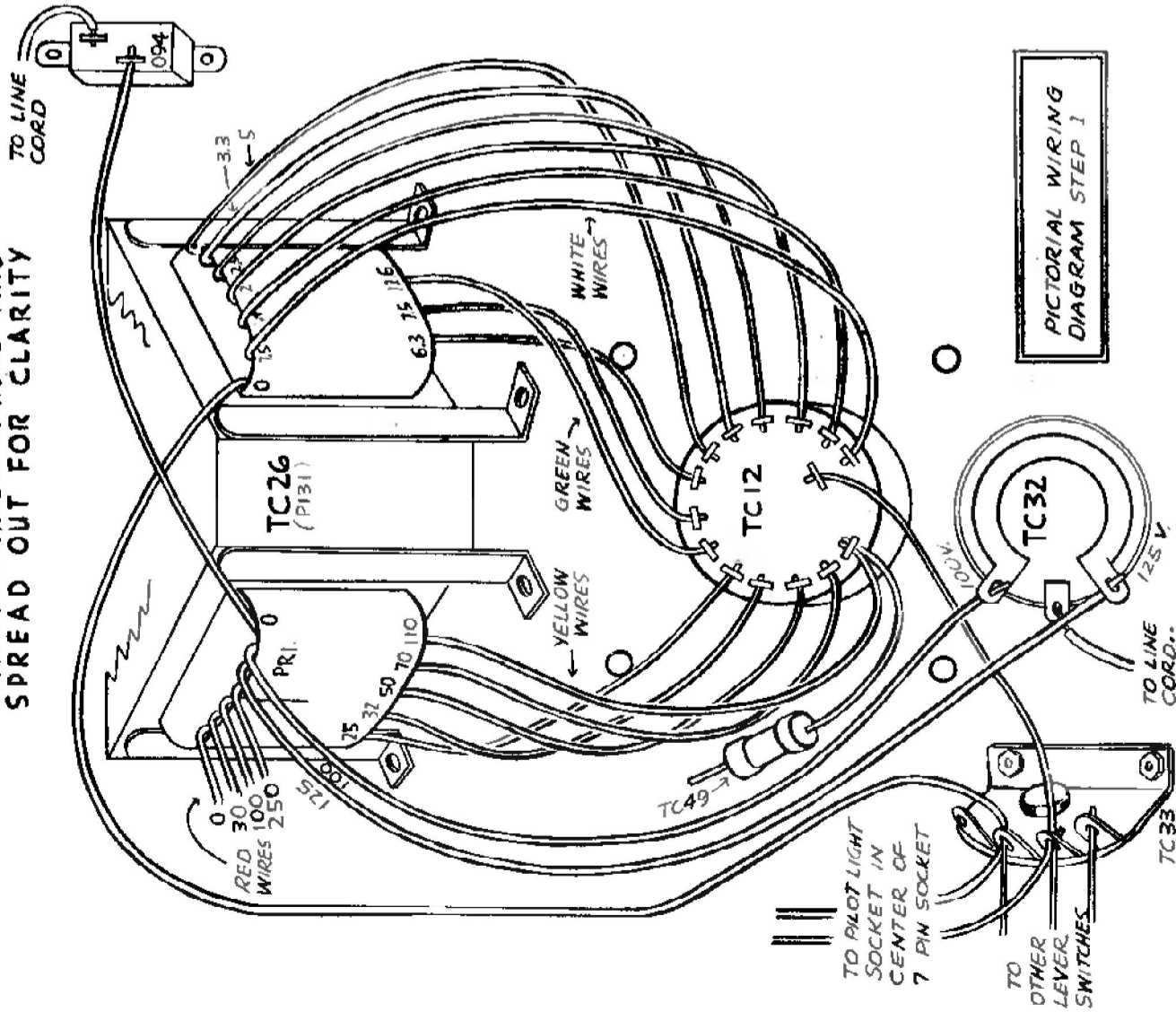
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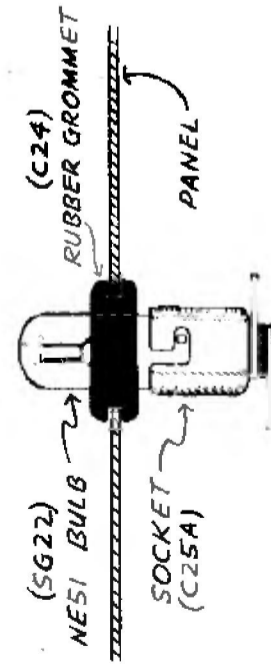
TRANSFORMER RAISED AND SPREAD OUT FOR CLARITY



# Heathkit TUBE CHECKER

MODEL TC-1

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3-17-49

TC59

| VT No. | RMA No.    | VT No.  | RMA No.           | VT No.  | RMA No.   |
|--------|------------|---------|-------------------|---------|-----------|
| VT-24  | 864        | VT-93A  | 6B8G              | VT-164  | 1619      |
| VT-25  | 10         | VT-94   | 6J5               | VT-165  | 1624      |
| VT-26  | 22         | VT-94A  | 6J5G              | VT-167  | 6K8       |
| VT-27  | 30         | VT-94B  | 6J5 Spec. Selec.  | VT-168A | 6Y6G      |
| VT-28  | 24,24A     | VT-94C  | 6J5G Spec. Selec. | VT-169  | 12C8      |
| VT-29  | 27         | VT-94D  | 6J5GT/G           | VT-170  | 1E5-GP    |
| VT-31  | 31         | VT-95   | 2A3               | VT-171  | 1R5       |
| VT-33  | 33         | VT-96   | 6N7               | VT-172  | 1S5       |
| VT-36  | 36         | VT-96B  | 6N7 Spec. Selec.  | VT-173  | 1T4       |
| VT-37  | 37         | VT-97   | 5W4               | VT-174  | 3S4       |
| VT-38  | 38         | VT-98   | 6U5/6G5           | VT-176  | 6AB7/1853 |
| VT-40  | 40         | VT-99   | 6F8G              | VT-177  | 1LH4      |
| VT-44  | 32         | VT-100  | 807               | VT-178  | 1LC6      |
| VT-45  | 45         | VT-101  | 837               | VT-179  | 1LN5      |
| VT-46A | 866A       | VT-103  | 6SQ7              | VT-181  | 7Z4       |
| VT-47  | 47         | VT-104  | 12SQ7             | VT-182  | 3B7/1291  |
| VT-48  | 41         | VT-105  | 6SC7              | VT-183  | 1R4/1294  |
| VT-49  | 39/44      | VT-107  | 6V6               | VT-184  | VR90-30   |
| VT-50  | 50         | VT-107A | 6V6GT             | VT-185  | 306/1299  |
| VT-51  | 841        | VT-107B | 6V6G              | VT-188  | 7E6       |
| VT-54  | 34         | VT-112  | 6AC7/1852         | VT-189  | 7F7       |
| VT-55  | 865        | VT-114  | 5T4               | VT-190  | 7H7       |
| VT-56  | 56         | VT-115  | 6L6               | VT-192  | 7A4       |
| VT-57  | 57         | VT-115A | 6L6G              | VT-193  | 7C7       |
| VT-58  | 58         | VT-116  | 6SJ7              | VT-194  | 7J7       |
| VT-62  | 801        | VT-116A | 6SJ7GT            | VT-196  | 6W5G      |
| VT-63  | 46         | VT-116B | 6SJ7Y             | VT-198A | 6G6G      |
| VT-64  | 800        | VT-117  | 6SK7              | VT-199  | 6SS7      |
| VT-65  | 6C5        | VT-117A | 6SK7GT            | VT-200  | VR105-30  |
| VT-65A | 6C5G       | VT-119  | 2X2/879           | VT-201  | 25L6      |
| VT-66  | 6F6        | VT-124  | 1A5GT             | VT-201C | 25L6GT    |
| VT-66A | 6F6G       | VT-125  | 1C5GT             | VT-202  | 9002      |
| VT-67  | 30 Special | VT-126  | 6X5               | VT-203  | 9003      |
| VT-68  | 6B7        | VT-126A | 6X5G              | VT-205  | 6ST7      |
| VT-69  | 6D6        | VT-126B | 6X5GT             | VT-206A | 5V4G      |
| VT-70  | 6F7        | VT-131  | 12SK7             | VT-207  | 12AH7GT   |
| VT-72  | 842        | VT-132  | 12K8              | VT-208  | 7B8       |
| VT-74  | 5Z4        | VT-133  | 12SR7             | VT-209  | 12SG7     |
| VT-75  | 75         | VT-134  | 12A6              | VT-210  | 1S4       |
| VT-76  | 76         | VT-135  | 12J5GT            | VT-211  | 6SG7      |
| VT-77  | 77         | VT-135A | 12J5              | VT-213A | 6L5G      |
| VT-78  | 78         | VT-136  | 1625              | VT-214  | 12H6      |
| VT-80  | 80         | VT-137  | 1626              | VT-215  | 6E5       |
| VT-83  | 83         | VT-138  | 1629              | VT-222  | 884       |
| VT-84  | 84/6Z4     | VT-139  | VR150-30          | VT-223  | 1H5GT     |
| VT-86  | 6K7        | VT-145  | 5Z3               | VT-224  | 2C34/RK34 |
| VT-86A | 6K7G       | VT-146  | 1N5GT             | VT-229  | 6SL7      |
| VT-86B | 6K7GT      | VT-147  | 1A7GT             | VT-231  | 6SN7GT    |
| VT-87  | 6L7        | VT-148  | 1D8GT             | VT-233  | 6SR7      |
| VT-87A | 6L7G       | VT-149  | 3A8GT             | VT-239  | 1LE3      |
| VT-88  | 6R7        | VT-150  | 6SA7              | VT-241  | 7E5/1201  |
| VT-88A | 6R7G       | VT-150A | 6SA7GT            | VT-243  | 7C4/1203A |
| VT-88B | 6R7GT      | VT-151  | 6A8G              | VT-244  | 5U4G      |
| VT-89  | 89         | VT-151B | 6A8GT             | VT-245  | 2050      |
| VT-90  | 6H6        | VT-152  | 6K6GT             | VT-247  | 6AG7      |
| VT-90A | 6H6GT      | VT-152A | 6K6G              | VT-260  | VR75-30   |
| VT-91  | 6J7        | VT-153  | 12C8              | VT-264  | 3Q4       |
| VT-91A | 6J7GT      | VT-161  | 12SA7             | VT-268  | 12SC7     |
| VT-92  | 6Q7        | VT-162  | 12SJ7             | VT-288  | 12SH7     |
| VT-93  | 6B8        | VT-163  | 6C8G              | VT-289  | 12SL7GT   |