

TM 11-6625-539-15

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

OPERATOR, ORGANIZATIONAL, FIELD AND DEPOT MAINTENANCE MANUAL

TRANSISTOR TEST SET TS-1836/U

Headquarters, Department of the Army, Washington 25, D.C.  
5 February 1963

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CHANGE }  
NO. 3 }

HEADQUARTERS  
DEPARTMENT OF THE ARMY

Washington, DC, 12 December 1983

# OPERATOR, ORGANIZATIONAL, FIELD AND DEPOT MAINTENANCE MANUAL TRANSISTOR TEST SET TS-1836/U (NSN 6625-00-168-0954)

TM 11-6625-539-15, 5 February 1963, is changed as follows:

*Cover.* The title is superseded as shown above.

*Page 2.* Delete paragraphs 1.1, 1.2 and 1.3 and substitute:

## 1.1. Consolidated Index of Army Publications and Blank Forms

Refer to the latest issue of DA Pam 310-1 to determine whether there are new editions, changes or additional publications pertaining to the equipment.

## 1.2. Maintenance Forms, Records, and Reports

*a. Reports of Maintenance and Unsatisfactory Equipment.* Department of the Army forms and procedures used for equipment maintenance will be those prescribed by TM 38-750, The Army Maintenance Management System.

*b. Report of Packaging and Handling Deficiencies.* Fill out and forward SF 364 (Report of Discrepancy (ROD)) as prescribed in AR 735-11-2/DLAR 4140.55 /NAVMATINST 4355.73A/ AFR 400-54/MCO 4430.3F.

*c. Discrepancy in Shipment Report (DISREP) (SF 361).* Fill out and forward Discrepancy in Shipment Report (DISREP) SF 361 as prescribed in AR 55-38 /NAVSUPINST 4610.33B/ AFR 75-18/MCO P4610.19D/DLAR 4500.15.

## 1.3. Reporting Errors and Recommending Improvements

You can help improve this manual. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Mail your letter or DA Form 2028 (Recommended Changes to Publications and Blank Forms) direct to: Commander, US Army Communications-Electronics Command and Fort Monmouth, ATTN: DRSEL-ME-MP, Fort Monmouth, New Jersey 07703. In either case a reply will be furnished direct to you.

Paragraphs 1.4, 1.5, 1.6 and 1.7 are added after paragraph 1.3.

## 1.4. Reporting Equipment Improvement Recommendations (EIR)

If your transistor test set needs improvement, let us know. Send us an EIR. You, the user, are the only one who can tell us what you don't like about your equipment. Let us know why you don't like the design. Put it on an SF 368 (Quality Deficiency Report). Mail it to Commander, US Army Communications-Electronics Command and Fort Monmouth, ATTN: DRSEL-ME-MP, Fort Monmouth, New Jersey 07703. We'll send you a reply.

## 1.5. Administrative Storage

Administrative Storage of equipment issued to and used by Army activities will have preventive maintenance performed in accordance with the PMCS charts before storing. When removing the equipment from administrative storage the PMCS should be performed to assure operational readiness. Disassembly and repacking of equipment for shipment or limited storage are covered in TM 740-90-1.

## 1.6. Destruction of Army Electronics Materiel

Destruction of Army electronics materiel to prevent enemy use shall be in accordance with TM 750-2442.

## 1.7. Items Comprising an Operable Transistor Test Set TS-1836/U

The Test Set, Transistor TS-1836/U is illustrated in figure 1-1.

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\*This change supersedes Cl, 6 Dec 63 and C2, 12 Feb 74.

NSN

QTY

Nomenclature, part No., and mfr. code

6625-00-893-2628

Test Set, Transistor TS-183G/U which includes:

**NOTE**

The part number is followed by the applicable 5-digit Federal supply code for manufacturers (FSCM) identified in SB 708-42 and used to identify manufacturer, distributor, or Government agency, etc.

**NOTE**

Dry batteries shown are used with the equipment but are not considered part of the equipment. They will be preshipped automatically but are to be requisitioned in quantities necessary for the particular organization in accordance with SB 11-6.

|                  |   |   |
|------------------|---|---|
| 6135-00-473-6278 | 1 | Battery Dry: Mercury type (special) SB-12459-2, 11419                 |
| 6135-00-473-6279 | 1 | Battery Dry: Mercury type (special) SB-12450-2, 11419                 |
| 5995-00-857-2830 | 1 | Cable Assembly, Special Purpose, Electrical: SP-13741-3-1, 11419      |
| 5995-00-857-2831 | 1 | Cable Assembly, Special Purpose, Electrical: SP-13741-3-2, 11419      |
| 6625-00-329-2595 | 1 | Data Hook: test tables and transistor test outlines: 950100003, 11419 |

Page 6. Add paragraphs 4.1 through 4.9 after paragraph 4.

**4.1. Scope of Maintenance**

The maintenance duties assigned to the operator and organizational repair personnel of the equipment are listed below together with a reference to the paragraphs covering the specific maintenance functions. The tools and test equipment required are listed in appendix B.

- a. Operator/crew preventive maintenance checks and services (para 4.4).
- b. Organizational preventive maintenance checks and services (para 4.5).
- c. Cleaning (para 4.8).
- d. Touchup painting (para 4.9).

**4.2. General****NOTE**

Refer to TM 750-244-2 for proper procedures for destruction of this equipment to prevent enemy use.

a. Operator/crew preventive maintenance is the systematic care, servicing and inspection of equipment to prevent the occurrence of trouble, to reduce downtime, and to maintain equipment in serviceable condition. To be sure that your transistor test set is always ready for your mission, you must do scheduled preventive maintenance checks and services (PMCS).

(1) BEFORE OPERATION, perform your B PMCS to be sure that your equipment is ready to go.

(2) When an item of equipment is reinstalled

after removal, for any reason, perform the necessary B PMCS to be sure the item meets the readiness reporting criteria.

(3) Use the ITEM NO. column in the PMCS table to get the number to be used in the TM ITEM NO. column on DA Form 2404 (Equipment Inspection and Maintenance Worksheet) when you fill out the form.

b. Organizational preventive maintenance procedures are designed to help maintain equipment in serviceable condition. They include items to be checked and how to check them. These checks and services, described in paragraph 4.5, outline inspections that are to be made at specific monthly (M) intervals.

c. Routine checks like CLEANING, DUSTING, WASHING, CHECKING FOR FRAYED CABLES, STOWING ITEMS NOT IN USE, COVERING UNUSED RECEPTACLES, CHECKING FOR LOOSE NUTS AND BOLTS AND CHECKING FOR COMPLETENESS are not listed as PMCS checks. They are things that you should do any time you see they must be done. If you find a routine check like one of those listed in your PMCS, it is because other operators reported problems with this item.

**NOTE**

When you are doing any PMCS or routine checks, keep in mind the warnings and cautions.

**WARNINGS**

- Adequate ventilation should be provided while using TRICHLOROTRIFLUOROETHANE. Prolonged breathing of vapor should be avoided. The solvent should not be used near heat or open flame; the products of decomposition are toxic and irritating. Since TRICHLOROTRIFLUOROETHANE dissolves natural oils, prolonged contact with skin should be avoided. When necessary, use gloves which the solvent cannot penetrate. If the solvent is taken internally, consult a physician immediately.
- Compressed air is dangerous and can cause serious bodily harm if protective means or methods are not observed to prevent a chip or particle (of whatever size) from being blown into the eyes or unbroken skin of the operator or other personnel. Goggles must be worn at all times while cleaning with compressed air. Compressed air shall not be used for cleaning purposes except where reduced to less than 29 pounds per square inch gage (psig) and then only with effective chip guarding and personnel protective equipment. Do not use compressed air to dry parts when trichlorotrifluoroethane has been used.

**NOTES**

The PROCEDURES column in your PMCS charts instruct how to perform the required checks and services. Carefully follow these instructions and, if tools are needed or the chart so instructs, get organizational maintenance to do the necessary work.

If your equipment must be in operation all the time, check those items that can be checked and serviced without disturbing operation. Make the complete checks and services when the equipment can be shut down.

d. Deficiencies that cannot be corrected must be reported to higher category maintenance personnel. Records and reports of preventive maintenance must be made in accordance with procedures given in TM 38-750.

#### **4.3. Operator/Crew Preventive Maintenance Checks and Services**

Perform before operation PMCS if you are operating the item for the first time.

**NOTE**

The checks in the interval column are to be performed in the order listed.

#### **4.4. Operator/Crew Preventive Maintenance Checks and Services Chart**

B — Before

| Item No. | Interval | Item to be Inspected        | Procedures - Check for and have repaired or adjusted as necessary                         | Equipment is not Ready/Available If:                               |
|----------|----------|-----------------------------|---|--|
|          | B        |                             |   |  |
| 1        | •        | Mission essential equipment | Check for completeness and satisfactory condition of the equipment. Report missing items. | Available equipment is insufficient to support the combat mission. |

#### 4.5. Organizational Preventive Maintenance Checks and Services Chart

M - Monthly

| Item No. | Interval | Item to be Inspected                                    | Procedures   |
|----------|----------|---|--|
|          | M        |   |  |
| 1        | •        | Mercury Batteries BT1 and BT2 or Zinc-Carbon batteries. | Check batteries as described in paragraph 4b. Replace batteries as required. |

Paragraph 4-6 and 4-7 deleted.

#### 4.8. Cleaning

Inspect the exterior of the equipment. The exterior surfaces should be free of dust, dirt, grease, and fungus.

a. Remove dust and loose dirt with a clean, soft cloth.

#### WARNING

Adequate ventilation should be provided while using TRICHLOROTRIFLUOROETHANE. Prolonged breathing of vapor should be avoided. The solvent should not be used near heat or open flame; the products of decomposition are toxic and irritating. Since TRICHLOROTRIFLUOROETHANE dissolves natural oils, prolonged contact with skin should be avoided. When necessary, use gloves which the solvent cannot penetrate. If the solvent is taken internally, consult a physician immediately.

b. Remove grease, fungus, and ground-in dirt from the case; use a cloth dampened (not wet) with Cleaning compound (NSN 6850-00-105-3084).

c. Remove dust or dirt from plugs and jacks with a brush.

#### CAUTION

Do not press on the meter face (glass) when cleaning; the meter may become damaged.

d. Clean the front panel, meter, and control knobs; use a soft, clean cloth. If necessary, dampen the cloth with water; mild soap may be used for more effective cleaning.

#### 4.9. Touch Painting Instructions

Remove rust and corrosion from metal surfaces by lightly sanding them with fine sandpaper. Brush two thin coats of paint on the bare metal to protect it from further corrosion. Refer to the applicable cleaning and refinishing practices specified in TM 43-0139.

Page 13. Add appendix A as follows:

#### APPENDIX A

#### REFERENCES

DA Pam 310-1  
TM 11-6625-203-12

TM 11-6625-539-20P

TM 38-750  
TM 43-0139  
TM 740-90-1  
TM 750-244-2

Consolidated Index of Army Publications and Blank Forms. Operator's and Organizational Maintenance Manual: Multimeter, AN/URM-105 and AN/URM-105C (Including Multimeter, ME-77/U and ME-77 C/U).

Organizational Maintenance Repair Parts and Special Tools Lists for Test Set, Transistor, TS-1836/U (FSN 6625-893-2628).

The Army Maintenance Management System (TAMMS).

Painting Instructions for Field Use.

Administrative Storage of Equipment.

Procedures for Destruction of Electronics Materiel to Prevent Enemy Use.

Change APPENDIX I to APPENDIX B.

Page 17, Appendix II deleted.

By Order of the Secretary of the Army:

Official:

JOHN A. WICKHAM JR.  
*General, United States Army*  
*Chief of Staff*

ROBERT M. JOYCE  
*Major General, United States Army*  
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## SECTION I

### USE AND MAINTENANCE

#### 1. DESCRIPTION.

The Sierra Model 219B Transistor Tester, figure 1-1, (Patent No. 2, 922, 544) is a self-contained, portable instrument that measures the beta parameter of a transistor without removing the transistor from the circuit. Also, leakage current ( $I_{c_o}$ ) and beta can be measured with the transistor removed from the circuit. Because of the low current levels employed to measure beta and  $I_{c_o}$ , the tester is particularly useful for measuring low-signal type transistors.

b. The capability of this instrument to make in-circuit beta measurements arises from its ability to discriminate between a special test signal generated by the test transistor and spurious signals flowing in the surrounding circuit. In addition, low-impedance techniques are employed to offset readout errors that might occur with low resistances in the external circuit.

c. The tester measures beta in the circuit with a maximum error of  $\pm 20$  percent, provided that the circuit impedance across the emitter-base and emitter-collector transistor terminals

exceeds 500 ohms. (External d-c resistances below 500 ohms will cause a warning light to glow.) However, because most conventional transistor circuits have terminal resistances much higher than 500 ohms, the probable accuracy is considerably better than  $\pm 20$  percent; also, though the d-c resistance may be less than 500 ohms, the reactance could be much greater, resulting in an accuracy equal to or better than  $\pm 20$  percent.

d. The tester is housed in a strong plastic case which has a handle for convenient transporting. Two three-prod test cables and a booklet that contains transistor test data are stored within the front cover. The transistor tester is shipped from the factory with mercury batteries. Zinc-carbon type batteries are available upon order. When the tester cover is closed, the battery supplies are automatically deenergized.

#### 2. SPECIFICATIONS.

a. Table 1-1 lists the Model 219B specifications.

TABLE 1-1. TABLE OF SPECIFICATIONS<

|   |   |
|---|---|
| Test Ranges:                              | Beta: 1 to 4, 3 to 12, 10 to 40, 30 to 120, approximation to 300  |
|   | $I_{c_o}$ : 0 to 50 microampere and 0 to 500 microampere  |
| Beta Accuracy:                            | In-circuit tests: maximum $\pm 20\%$ error for external resistive loads of 500 ohms across emitter-collector and emitter -base terminals. Typical circuit tests are in error about $\pm 5\%$ .  |
|   | Out-of-circuit tests: $\pm 10\%$ maximum error  |
| Transistor and Semi-Conductor Complement: | 4 each, type 2N404 transistors<br>3 each, type 2N527 transistors<br>1 each, type 1N191 diode  |
| Operating Temperature:                    | 32° F to 149± F (0° C to 65° C)   |
| Power Requirements:                       | The transistor tester contains two separate, 12-volt battery supplies. One provides the power for the internal test circuits, and the other furnishes the collector voltage for the transistor under test. Either mercury or zinc-carbon type batteries may be used. Six-hundred operating hours of life may be expected under normal conditions. |



TABLE 1-1 (Continued)

Input-Connections:

In-circuit transistors are tested by either of two, three-prod test cables. The prods of one cable are small, insulated spade clips and the prods of the other cable are miniature alligator clips. The leads of both test cables are color coded and alphabetically identified, C-collector, E-emitter, and B for base. Out-of-circuit transistors may be tested by using either a test cable or the transistor socket on the front panel.

Over-All Dimensions:

10 inches by 7-5/8 inches by 6-1/2 inches

Weight:

Shipping: 13 pounds  
Operating: 10-1/4 pounds including batteries.

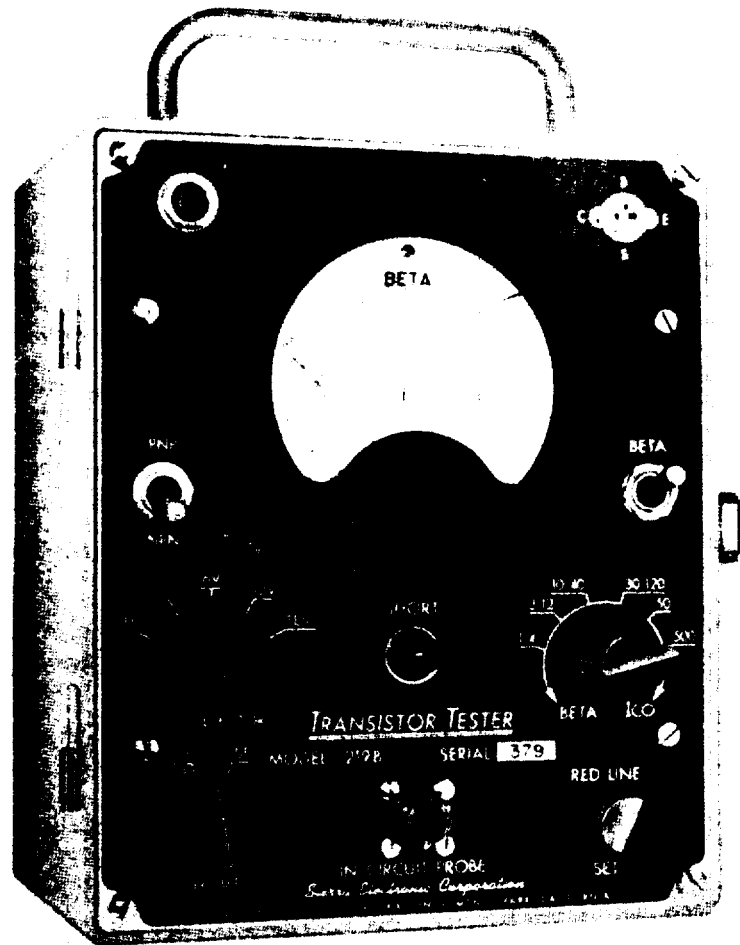


Figure 1-1. Sierra Model 219B Transistor Tester

### 3. PREPARATION FOR USE.

a. INITIAL INSPECTION. The tester should be inspected for in-transit damage.

b. INSTALLING MERCURY BATTERIES. The tester is delivered from the factory in a corrugated container. Packed separately within the container are seven mercury batteries. To install these batteries, first remove the unit from the case by loosening the four front-panel retaining screws. Note that the battery board has mounting clips for both mercury and zinc-carbon type batteries. The location, polarity and voltage for each mercury battery is marked on the board. Carefully observe polarity and voltage markings on the batteries before inserting them. Be sure the bias battery makes contact with the side tap contacts. Replace the unit in the case.

c. INSTALLING ZINC-CARBON BATTERIES. Remove the unit from the case by loosening the four front-panel retaining screws. Note that there are two sets of clips marked ZINC CARBON BATTERIES and a row of seven tip jacks along the top of the battery board. Each tip jack is identified by letters corresponding to the colors of the leads from the zinc-carbon batteries. Insert the tipped leads into their corresponding tip jacks on the battery board. Replace the unit in the case.

#### CAUTION

Always remove zinc -carbon batteries before storing the transistor tester; also, never ship the transistor tester without first removing all carbon or mercury-type batteries.

### 4. OPERATION.

a. GENERAL. The following paragraphs describe the proper methods for making transistor beta and leakage-current measurements; in addition, table 1-2 lists all operating controls and indicators by panel marking, description, and function.

#### b. BATTERY CHECKOUT.

(1) Turn BIAS SELECTOR switch to TEST position.

(2) Observe readout meter. If needle is within green band, main power batteries are satisfactory. If needle is below green band, replace batteries BT2, 3, 4, 5, 6 and 7 before continuing tests.

(3) Connect alligator-clip three-prod test cable to transistor tester.

(4) Connect a d-c voltmeter with a range of 0-15 volts to test cable: positive terminal of meter goes to emitter prod (GREEN), negative terminal of meter goes to collector prod (RED).

(5) Set PNP-NPN switch to PNP.

(6) Turn BIAS SELECTOR switch to 3V, 6V, and 12V positions. At each position observe voltmeter. The voltmeter should read 2.3 to 3 volts, 5 to 6 volts, and 10 to 12 volts, respectively. If any reading is less than the specified minimum, replace battery BT1 before continuing tests.

c. IN-CIRCUIT TRANSISTOR BETA TESTS. Before testing transistor, refer to test data booklet mounted within front cover of tester. Table II of the booklet illustrates the base connections of common transistors. Table I of the booklet lists the test parameters for each transistor. Select the entry corresponding to the transistor to be tested and proceed as follows:

(1) Completely reenergize the circuit containing the transistor to be tested.

(2) Set the beta- $I_{co}$  switch to the appropriate beta range.

(3) Set PNP-NPN switch to transistor type.

(4) Connect test cable to receptacle on panel. Connect the three prods of the test cable to the proper terminals of the transistor.

(5) Turn BIAS SELECTOR switch to 3V position. If SHORT indicator glows there may be external circuit loads across either the base-collector terminals or the collector-emitter terminals. (Proceed with the test, remembering that beta may be in error by more than 20 percent.

(6) Turn SHORT switch to BE position. If SHORT indicator glows there may be an external circuit load across the base-emitter terminals. (Proceed with the tests, remembering that beta may be in error by more than 20 percent. )

(7) Turn BIAS SELECTOR switch to proper collector voltage for test transistor.

TABLE 1-2. OPERATING CONTROLS AND INDICATORS

| PANEL MARKING  | DESCRIPTION                             | FUNCTION  |
|--|---|---|
| SHORT  | Amber indicator light                   | Indicates shorted transistor. When in-circuit transistors are tested, this light also indicates that the surrounding circuit presents a resistive load of less than 500 ohms between E-B or E-C.  |
| E-B-C-B  | Miniature socket                        | Receptacle for out-of-circuit test transistors.   |
| PNP-NPN  | Two-position toggle switch              | Selects polarity of collector and emitter bias for the type of transistor under test.   |
| BETA   | Two-position toggle switch              | In the down position (momentary) it permits readout of beta.  |
| Readout Meter  | Circular, 0 to 50 d-c microampere meter | <p>(1) BETA scales indicate magnitude of transistor beta.</p> <p>(2) <math>I_{co}</math> scales indicate magnitude of leakage current .</p> <p>(3) Green band used when testing batteries BT2, 3, 4, 5, 6 and 7.</p> <p>(4) Red line used when adjusting output of reference signal source.</p> |
| SHORT:<br>BE, CB-CE                                  | Two-position rotary switch              | <p>(1) CB-CE position tests for short circuit or low resistance across collector -base or collector- emitter.</p> <p>(2) BE position (momentary) tests for short circuit or low resistance across base-emitter.</p>   |
| BIAS<br>SELECTOR:<br>OFF, 3V ,<br>6V , 12V ,<br>TEST | Five-position rotary switch             | <p>(1) OFF position removes all voltage from collector of transistor under test and tester transistors.</p> <p>(2) 3V, 6V and 12V positions apply corresponding voltage to collector of test transistor.</p> <p>(3) TEST position checks batteries BT2, 3, 4, 5, 6 and 7.</p>                   |
| BETA-ICO   | Six-position rotary switch              | Beta and $I_{co}$ range switch.   |
| RED LINE<br>SET                                      | Potentiometer                           | Permits adjustment of internal test signal.   |
| IN CIRCUIT<br>PROBE                                  | Three-prong female connector            | Receptacle for three-prod test cable.   |

(8) Adjust RED LINE SET until needle coincides with red line. If needle cannot be adjusted to red line and the SHORT indicator did not glow, the transistor is probably faulty. If the needle cannot be adjusted to red line, but the SHORT indicator did glow, either the transistor is shorted or there may be very low resistances in the external circuit.

(9) Depress BETA switch and observe value on readout meter. If beta does not read on scale, select a more appropriate scale such that the reading is in the calibrated section of the scale. If possible, try not to use the extreme left-hand portion of the scale. Compare this with minimum value given in table I of test data booklet. If reading is below that indicated in the table, the transistor is defective.

### NOTE

If beta is less than the lowest acceptable limit and the test transistor has another transistor or diode in its base circuit, it is best to remove and isolate the base lead and recheck beta.

(10) Turn BIAS SELECTOR switch to OFF position.

d. OUT -OF - CIRCUIT TRANSISTOR BETA TEST. Before testing transistor, refer to test data booklet mounted within front cover of tester. Table 11 of the booklet illustrates the base connections of common transistors. Table I of the booklet lists the test parameters for each transistor. Select the entry corresponding to the transistor to be tested and proceed as follows:

(1) Set the BETA- $I_{co}$  switch to the appropriate beta range.

(2) Set PNP - NPN switch to transistor type.

(3) Insert transistor leads into proper prongs of EBCB socket. Alternately, if the three - prod test cable is connected, clip each prod to the proper transistor lead.

### NOTE

Do not try to test two transistors simultaneously by leaving one in the EBCB socket and connecting the other to the test prods.

(4) Turn BIAS SELECTOR switch to 3V position. If SHORT indicator glows, the transistor is shorted and no further tests are necessary.

(5) Turn SHORT switch to BE position. If SHORT indicator glows, the transistor is shorted and no further tests are necessary.

(6) Turn BIAS SELECTOR switch to proper collector bias for test transistor

(7) Adjust RED LINE SET control until needle coincides with red line. If the needle cannot be adjusted to the red line, the transistor is faulty and no further tests are necessary.

(8) Press BETA switch and read beta value on the readout meter. If possible, try not to use the extreme left-hand portion of the scale. Compare this with minimum value given in table I of test data booklet. If reading is below that given in the table, the transistor is defective.

(9) Turn BIAS SELECTOR switch to OFF position.

e. Transistor LEAKAGE TEST. Since the leakage current ( $I_{co}$ ) of the transistor is measured on a direct-current basis, any alternate current paths through the external circuit would create measurement errors. In view of this, the manufacturer does not recommend in-circuit leakage tests.

### CAUTION

Do not let the test prods touch each other during the leakage test.

To measure leakage current, refer to paragraph 4d and perform steps (2) to (6). Then turn the BETA  $I_{co}$  switch to the 50-microampere range and read  $I_{co}$  on the readout meter. If  $I_{co}$  exceeds 50 micro-amperes, switch to the 500-& microampere range. If  $I_{co}$  exceeds the value given in table I of the test data booklet, the transistor is defective. Restore controls to their OFF positions.

## 5. MAINTENANCE.

### a. THEORY OF OPERATION

(1) Figure 1-2 illustrates a functional block diagram of the tester when measuring beta. The transistor beta parameter is defined as the current gain of a common - emitter transistor configuration, and is expressed by the equation

$$\beta = \frac{\Delta I_c}{\Delta I_b}$$

where

$B$  = beta  
 $\Delta I_c$  = change in collector current  
caused by a change in base  
current  
 $\Delta I_b$  = change in base current

(2) When measuring beta of a transistor removed from the circuit, conventional a-c or d-c current measurements suffice to obtain an indication of transistor beta. However, when measuring beta of a transistor connected in the circuit, these methods are inadequate. This is due to currents flowing in the collector or base, or both, that are not attributable to transistor conduction. These currents result from resistances and reactance that are an integral part of the circuit, shunting the emitter-base and emitter - collector junction. The Sierra transistor tester employs a method that eliminates erroneous readings caused by these sneak paths: when an a-c signal is applied to the base of a common-emitter circuit operating class B, conduction of the transistor results in high second-harmonic

content in the base and collector currents; the magnitudes of these second - harmonic currents are directly related to transistor conduction (and thus beta) and has no relation to any sneak currents (which would have a frequency equal to the fundamental). By measuring the relative values of the second-harmonic base and collector currents, and applying the beta equation, an accurate determination of beta can be made.

#### NOTE

If the external base circuit contains another diode or transistor, this can introduce an erroneous second-harmonic current and consequently cause an excessive error in beta. (See operating portion of this manual.)

(3) From the basic beta equation, if  $I_c$  is equal to one unit, beta would equal

$$B = \frac{1}{\Delta I_b}$$

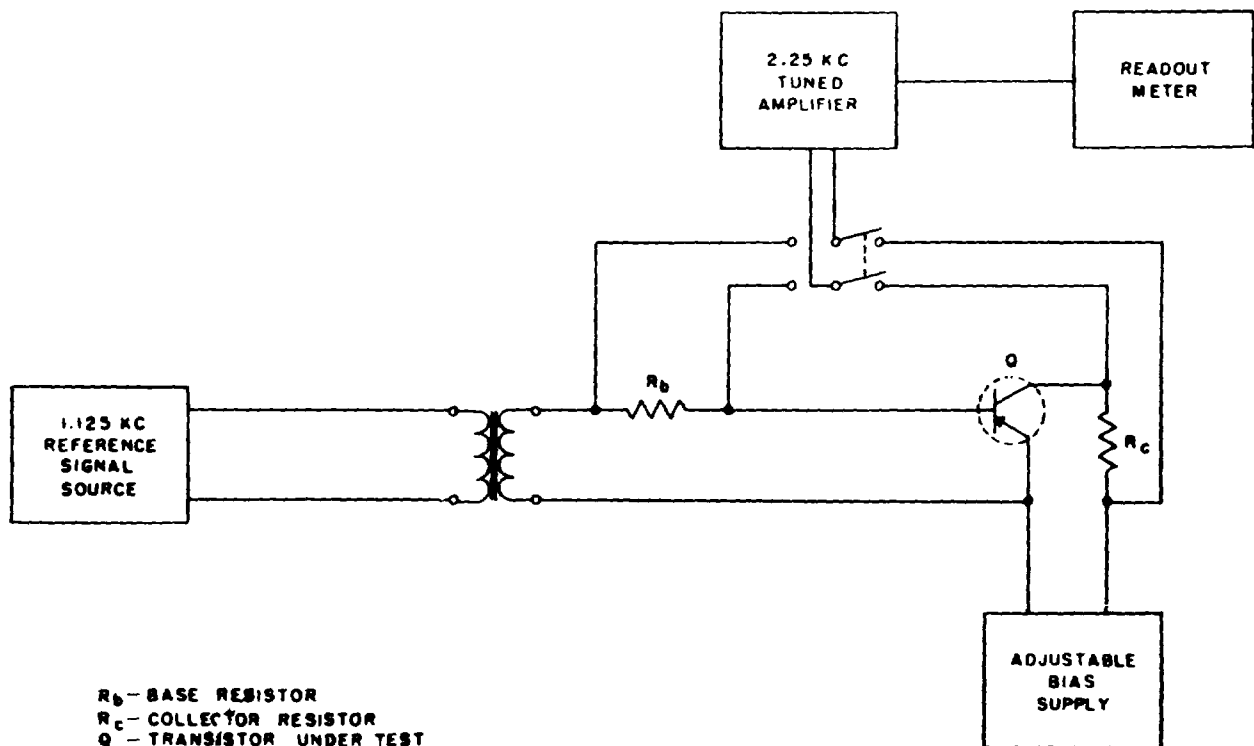


Figure 1-2. Transistor Tester, Functional Block Diagram

or  $\beta$  would be inversely proportional to  $\Delta I_b$ . In the tester, the collector current of the transistor under test is set to an average collector current of 1 milliamper, and then the base current is measured. The readout meter is calibrated in terms of  $\beta$  as an inverse function of the current through the meter.

(4) As shown in figure 1-2, a 1, 125-kc reference signal is applied to the base-emitter junction of the test transistor. The 2.25-kc (second harmonic) tuned amplifier is switched across collector load resistor  $R_c$ , and the reference signal is adjusted for 1-milliamper (red line on readout meter) average d-c collector current. The tuned amplifier is then switched across the series base resistor ( $R_b$ ) and the readout meter indicates the value of  $\beta$ .

(5) For the transistor tester to retain its specified accuracy, the impedance loading across the emitter-base and emitter-collector junctions of the test transistor must be 500 ohms or greater. In the event this d-c resistance requirement is not met, a front - panel warning light indicates this low-resistance shunt path; but if an impedance of 500 ohms or more is present the specified accuracy is retained regardless of the lighted lamp. This same warning light also indicates a shorted transistor.

(6) The readout meter (minus its associated amplifier ) measures transistor leakage current ( $I_{co}$ ) when the transistor is disconnected from the circuit. This facility provides an additional check on transistor degradation.

#### NOTE

Due to d-c shunt paths, do not measure  $I_{co}$  when the test transistor is in the circuit.

In operation, an appropriate d-c voltage in series with the readout meter is applied to the collector-base junction, and the emitter circuit is opened. Collector-to-base leakage current is then read on the readout meter. To prevent possible damage to the readout meter, a series resistor is included in the circuit; consequently, this resistor is in series with the collector-base junction resistance and causes a small error in  $I_{co}$ , the extent of the error depending on the relative resistance values. As  $I_{co}$  becomes greater (less base-collector junction resistance) the error becomes greater, but for most cases the error is less than 5 percent.

#### b. CIRCUIT ANALYSIS (See figure 1-3. )

(1) 1.125 -KC REFERENCE SIGNAL SOURCE. Transistor **Q1** and associated components comprise a Hartley oscillator. The frequency of oscillation is controlled by capacitor **C3** and the inductance of the primary of transformer **T1**. Positive feedback is taken from pin 1 of **T1** and applied through resistor **R5** and capacitor **C1** to the base of **Q1**. The base of **Q1** is forward biased by the voltage taken from the voltage-divider network **R1** and **R2**. Resistor **R3** and capacitor **C2** provide a small amount of stabilizing reverse bias. The oscillator output is taken from the secondary of transformer **T1** and applied to potentiometer **R27**.

(2) That portion of the 1.125 -kc signal between ground and the wiper of potentiometer **R27** is applied through capacitor **C4** to the base of emitter follower **Q2**. Voltage-divider network **R6** and **R7** provide forward bias for **Q2**. The output is taken from emitter resistor **R8**, and applied through capacitor **C5** to the base of transistor **Q3**, another emitter follower. The output of **Q3** is applied through capacitor **C6** to the primary of transformer **T2**. The secondary of **T2** then applies the 1.125 kc to terminals 14 and 15 of the printed circuit board. Terminal 14 applies one side of the 1. 125-kc signal through contacts 1, 2, 3, or 4 of switch-section **S1A** to the emitter of the transistor under test, while terminal 15 applies the other side (through resistor **R29, R30, R31, or R32**; contacts 1, 2, 3, 4 of switch-section **S1C**; and contacts 10 and 11 of switch **S2**) to the base of the transistor under test.

(3) 2.25-KC TUNED AMPLIFIER. Depending on the position (figure 1-3) of switch **S4**, a 2. 25-kc signal (second harmonic of 1.125 kc) is taken from across resistor **R29, R30, R31, or R32** ( $R_b$ ) or across resistor **R28** ( $R_c$ ), and this signal is applied through the 2. 25-kc series-resonant circuit readily passes 2.25 kc but rejects the 1.125 kc. The voltage divider (**R12, R13**) connected from collector to ground provides negative feedback for stabilization purposes. The output of **Q4** is taken from the wiper of potentiometer **R14** (which serves as the collector load resistor) and applied through capacitor **C8** to the base of common - emitter voltage amplifier **Q5**. The 2. 25-kc parallel-resonant circuit (composed of **C10** and **L2** ) provides a high-impedance base circuit for 2.25 kc but short-circuits other frequencies to ground. Capacitor **C11** is a d-c blocking capacitor. The output of **Q5** is taken from the collector and applied to the base of transistor **Q6**. Voltage amplifier **Q6** is identical to **Q5** except for component values.

(4) The output of **Q6** is taken from the collector and applied through capacitor **C16** to diode **CR1**. This diode conducts on the negative

cycles of the signal, and the resulting current is applied through contacts 7-9 or 7-10 of **switch-section 55A** to the 1, 2, 3, or 4 contacts of **switch-section SIB**. These contacts in turn apply the d-c current through meter M1 to the 7, 8, 9, or 10 contacts of switch-section SIB and then to ground.

(5) **ELECTRONIC SWITCH.** Transistor Q? (figure 1-3) and associated components serves to **detect** a low-resistance path through or around (external circuit) the transistor under test. The circuit operates in the following manner: the collector of Q? receives the negative common of battery **BT1** through resistor R33 or R34, depending on the setting of switch-section 55A. The emitter of Q? receives a positive 3 or 6 volts through the 7-9 or 7-10 contacts (respectively) of switch-section **S5C**. (When **S5C** is in the 12-volt position, the emitter is open, and consequently the electronic switch is disabled.) The positive 3 or 6 volts from battery **BT1** is also applied through resistors **R37** or R38, contacts 1-3 or 1-4 of switch-section **S5C**, resistor **R26**, and various contacts of the other switches to one of the electrodes of the transistor under test. Depending upon the resistance seen by this voltage, a d-c current flows through this path. This current flowing through resistor **R37** or **R38** drops a voltage of such polarity that the **base of Q?** becomes more negative than its emitter, and thus forward biases Q?. Transistor Q? is normally near cutoff, but when the forward bias across resistor **R37** or **R38** reaches a preset critical point (indicating 500 ohms or less shunting a transistor electrode, or a shorted transistor), Q? goes into conduction and lights **SHORT** indicator DS1.

(6) **LEAKAGE - CURRENT TEST CIRCUIT.** When measuring I<sub>e</sub> the emitter (figure 1-3) of the test transistor, operated by contact 5 or 6 of switch-section 51A, the collector (if the transistor is a **PNP** type) is brought through switches S2 and S3 to the negative side of battery **BT1**, and the emitter is applied to meter M1 through switch S2 and various contacts of switch **S1**. Depending on whether the 50- or 500-microampere range is being used, the meter is then returned through meter-protection resistors **R35** or R39, and then applied to the positive side of **BT1** through resistors **R26**, and **R37** or **R38** (depending on the position of switch S5, the **BIAS SELECTOR**). The meter records the leakage current. If the voltage developed across resistor **R37** or **R38** is large enough the electronic switch operates and a short is indicated. When in the 500- microampere position, switch S1 connects meter shunt **R36** across meter M1, which changes the meter scale from a basic 50 microampere to 500 microampere.

c. **CALIBRATION.** In the event of parts replacement or normal aging of the tester transistors, it may be necessary to calibrate the tester. This involves adjusting the gain of the tuned amplifier to a point where 1 milliamperes of transistor - under - test collector current results in the readout meter being deflected to its red line indication. To perform this calibration, proceed as follows:

(1) Set the readout meter to zero with the screwdriver zero adjust control.

(2) Perform steps (1) through (6) in paragraph 4d (out -of - circuit transistor beta test) using a good, low-power transistor.

(3) Using clip leads, insert a d-c milliammeter in series with the test transistor collector.

(4) Adjust **RED LINE SET** control for a reading of 1 milliamperes on the d-c milliammeter.

(5) Adjust potentiometer R14 until readout meter is deflected to the red line indication.

#### d. TROUBLE SHOOTING.

Reliability profiles made on instruments of its type predict that the likely sequence of part failures, in order of time, should be weak and dead batteries, mechanical failure of test leads and frequently adjusted controls, burnout of incandescent lights, transistor beta fall-off accompanied by increased leakage current, leaky or shorted capacitors, and defective composition resistors. This sequence ignores the possibility of one failure causing multiple failures; that is, a shorted transistor causes excess current flow through a composition resistor which results in the eventual disintegration of that resistor by heat. Since this instrument is of simple design, no elaborate trouble-shooting methods are necessary. Should a malfunction be suspected, localize the trouble to one of the following functional groups of component parts: main power batteries, collector battery, **SHORT** indicating circuit, 1. 125-kc reference signal source, and 2. 25-kc tuned amplifier and readout meter. Note that this is the sequence of functional groups employed whenever the beta of a transistor is tested according to the steps given in the operating instructions. If, at some step in the procedure, an abnormal indication should occur that is not assignable to the transistor under test, note the functional group(s) used by that step. After servicing either the 1. 125-kc reference signal source or the 2.25- kc tuned amplifier, calibrate amplifier gain as described in paragraph 5c. For the overall schematic diagram of the transistor tester, refer to figure 1-3

## SECTION II

### PARTS BREAKDOWN

2-1. This section contains a complete list of **re-** part number.  
placeable parts for the Model 219B Transistor  
Tester. Table 2-1 lists each part with its refer-  
ence designation, description and manufacturer's

TABLE 2-1. REPLACEABLE PARTS

| PART<br>DESIG. | DESCRIPTION   | PART NO.           | MANUFACTURER         |
|----------------|---|--------------------|----------------------|
| <b>BT1</b>     | Battery; mercury type; 2.7, 5.4, and 12.1 volt tops; 1000 milliampere hours | 918500001          | Sierra               |
| <b>BT2</b>     | Battery; mercury type; 4.05 volts; 3600 milliampere hours                   | 918500002          | Sierra               |
| <b>BT3</b>     | Same as <b>BT2</b>  |                    |                      |
| <b>BT4</b>     | Same as <b>BT2</b>  |                    |                      |
| <b>BT5</b>     | Same as <b>BT2</b>  |                    |                      |
| <b>BT6</b>     | Same as <b>BT2</b>  |                    |                      |
| <b>BT7</b>     | Same as <b>BT2</b>  |                    |                      |
| <b>C1</b>      | Capacitor, tantalum, 22 $\mu\text{fd} \pm 20\%$ , 15 vdc                    | <b>SCM226BP01</b>  | Texas Instruments    |
| <b>C2</b>      | Same as C1  |                    |                      |
| <b>C3</b>      | Capacitor, Mylar, 1 $\mu\text{fd} \pm 2\%$ , 50 vdc                         | MC105H5AT          | Southern Electronics |
| <b>C4</b>      | Capacitor, tantalum, 10 $\mu\text{fd} \pm 20\%$ , 15 vdc                    | SCM108BP01         | Texas Instruments    |
| <b>C5</b>      | Same as C4  |                    |                      |
| <b>C6</b>      | Same as C4  |                    |                      |
| <b>C7</b>      | Capacitor, paper, 0.022 $\mu\text{fd} \pm 5\%$ , 100 vdc                    | <b>196P2235152</b> | Sprague              |
| <b>C8</b>      | Capacitor, Mylar, 0.15 $\mu\text{fd} \pm 20\%$ , 100 vdc                    | <b>G1F27AB164</b>  | General Electric     |
| <b>C9</b>      | Same as C4  |                    |                      |
| <b>C10</b>     | Same as C3  |                    |                      |
| <b>C11</b>     | Same as C4  |                    |                      |
| <b>C12</b>     | Same as C4  |                    |                      |
| <b>C13</b>     | Same as <b>C8</b>   |                    |                      |
| <b>C14</b>     | Same as C3  |                    |                      |
| <b>C15</b>     | Same as C4  |                    |                      |
| <b>C16</b>     | Same as <b>C8</b>   |                    |                      |
| <b>C17</b>     | Same as C4  |                    |                      |
| <b>C18</b>     | Same as C1  |                    |                      |
| <b>C19</b>     | Capacitor, disc ceramic, 0.005 $\mu\text{fd} \pm 20\%$ , 500 vdc            | ED .005            | Erie                 |
| <b>CR1</b>     | Diode, germanium  | <b>1N191</b>       | Sylvania             |



TABLE 2-1. (Continued)

| PART<br>DESIG | DESCRIPTION   | PART NO.           | MANUFACTURER     |
|---------------|---|--------------------|------------------|
| <b>DS1</b>    | Lamp, incandescent, <b>1.3 volt</b> ,<br>0.06 ampere, midget flanged type | 331                | General Electric |
| <b>J1</b>     | Receptacle, connector, female   | <b>PT02-A-8-35</b> | Bendix           |
| <b>L1</b>     | Inductor, <b>toroidal</b> , 225 <b>mh</b> <b>±10%</b>                     | 909000090          | Sierra           |
| L2            | Inductor, <b>toroidal</b> , 5 <b>mh</b> <b>±1%</b>                        | 909000091          | Sierra           |
| L3            | Same as L2  |                    |                  |
| M1            | Meter, ruggedized, 50 microampere<br><b>±1%</b> , 3000 ohm *20%           | 911800030          | Sierra           |
| Q1            | Transistor, germanium, <b>PNP</b> , <b>2N404</b>                          | <b>2N404</b>       | RCA              |
| Q2            | Transistor, germanium, <b>PNP</b> , <b>2N527</b>                          | <b>2N527</b>       | Genera, Electric |
| Q3            | Same as Q2  |                    |                  |
| <b>Q4</b>     | Same as <b>Q1</b>   |                    |                  |
| Q5            | Same as <b>Q1</b>   |                    |                  |
| Q6            | Same as <b>Q1</b>   |                    |                  |
| Q7            | Same as Q2  |                    |                  |
| <b>R1</b>     | Resistor, fixed, 3.3K *1 O%, 1/2 w  | EB                 | Allen Bradley    |
| R2            | Resistor, fixed, 4.7K <b>±10%</b> , 1/2 w                                 | EB                 | Allen Bradley    |
| R3            | Resistor, fixed, <b>1K</b> <b>±10%</b> , 1/2 w                            | EB                 | Allen Bradley    |
| R4            | Resistor, fixed, 100 ohm <b>±10%</b> , 1/2 w                              | EB                 | Allen Bradley    |
| R5            | Resistor, fixed, <b>3.3K</b> <b>±5%</b> , 1/2 w                           | EB                 | Allen Bradley    |
| R6            | Resistor, fixed, 12K <b>±10%</b> , 1/2 w                                  | EB                 | Allen Bradley    |
| R7            | Same as R6  |                    |                  |
| R8            | Resistor, fixed, 1.5K <b>±10%</b> , 1/2 w                                 | EB                 | Allen Bradley    |
| R9            | Same as R6  |                    |                  |
| <b>R10</b>    | Same as R6  |                    |                  |
| <b>R11</b>    | Same as <b>R8</b>   |                    |                  |
| <b>R12</b>    | Resistor, fixed, 47K <b>±10%</b> , 1/2 w                                  | EB                 | Allen Bradley    |
| <b>R13</b>    | Resistor, fixed, 5.6K <b>±10%</b> , 1/2 w                                 | EB                 | Allen Bradley    |
| <b>R14</b>    | Resistor, variable, 5K *1 O%, 2 w   | <b>CLU5021</b>     | Ohmite           |
| <b>R15</b>    | Resistor, fixed, 680 ohms <b>±10%</b> , 1/2 w                             | EB                 | Allen Bradley    |
| <b>R16</b>    | Same as <b>R12</b>  |                    |                  |
| <b>R17</b>    | Same as <b>R13</b>  |                    |                  |
| <b>R18</b>    | Same as <b>R13</b>  |                    |                  |
| <b>R19</b>    | Same as <b>R15</b>  |                    |                  |
| <b>R20</b>    | Same as <b>R1</b>   |                    |                  |
| <b>R21</b>    | Same as R2  |                    |                  |
| <b>R22</b>    | Resistor, fixed, 8.2K <b>±10%</b> , 1/2 w                                 | EB                 | Allen Bradley    |

TABLE 2-1. (Continued)

| PART<br>DESIG. | DESCRIPTION   | PART NO.     | MANUFACTURER  |
|----------------|---|--------------|---------------|
| R23            | Resistor, fixed, 560 ohms *1 O%, 1/2 w                                      | EB           | Allen Bradley |
| R24            | Resistor , fixed, 10K *1 O%, 1/2 w  | EB           | Allen Bradley |
| R25            | Resistor, fixed, 270K *1 O%, 1/2 w  | EB           | Allen Bradley |
| R26            | Resistor, fixed, 680 ohms $\pm 10\%$ , 1/2 w                                | EB           | Allen Bradley |
| R27            | Resistor, variable, <b>2. 5K</b> $\pm 10\%$ , 2 w                           | 907900017    | Sierra        |
| R28            | Resistor, fixed, wirewound, 0.5 ohm $\pm 3\%$ , 3 w                         | RS-2         | Dalohm        |
| R29            | Resistor, fixed, wirewound, 15 ohm *1%, 3 w                                 | RS-2         | Dalohm        |
| R30            | Resistor, fixed, wirewound, 5 ohms $\pm 1\%$ , 3 w                          | RS-2         | Dalohm        |
| R31            | Resistor, fixed, wirewound, 1.5 ohms $\pm 1\%$ , 3 w                        | RS-2         | Dalohm        |
| R32            | Same as R28   |              |               |
| R33            | Resistor, fixed, 39 ohms $\pm 10\%$ , 1/2 w                                 | EB           | Allen Bradley |
| R34            | Resistor, fixed, 10 ohms $\pm 10\%$ , 1/2 w                                 | EB           | Allen Bradley |
| R35            | Same as R12   |              |               |
| R36            | Resistor, fixed, 330 ohms *1 O%, 1/2 w                                      | EB           | Allen Bradley |
| R37            | Resistor, fixed, 82 ohms $\pm 10\%$ , 1/2 w                                 | EB           | Allen Bradley |
| R38            | Resistor, fixed, 47 ohms $\pm 10\%$ , 1/2 w                                 | EB           | Allen Bradley |
| S1             | Switch, rotary, 6 pole, 6 position, 3 sections                              | 911200048    | Sierra        |
| S2             | Switch, rotary, 3 pole, 2 position, 1 section                               | 911200049    | Sierra        |
| S3             | Switch, toggle, <b>DPDT</b>   | <b>ST52N</b> | JAN Type      |
| S4             | Switch, toggle, <b>DPDT</b> , one position momentary                        | <b>ST52R</b> | JAN Type      |
| S5             | Switch, rotary, 6 pole, 5 position, 3 section                               | 911200050    | Sierra        |
| S6             | Switch, pushbutton, 2 pole, 2 position, 3 amperes, 120 vac                  | NF4005       | Switchcraft   |
| T1             | Transformer, toroidal, 20 mh $\pm 10\%$ , primary inductance                | 909300002    | Sierra        |
| T2             | Transformer, 500-ohm center-tapped primary, 500-ohm center-tapped secondary | AR- 162      | Argonne       |
| xQ1            | Socket, transistor, with flat saddle  | 3301         | Elco          |

APPENDIX B  
MAINTENANCE ALLOCATION  
TEST SET TRANSISTOR TS-1836/U

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Section 1. INTRODUCTION

**1. General**

*a.* This section assigns maintenance functions to be performed on components, assemblies, and sub-assemblies by the lowest appropriate maintenance echelon.

*b.* Columns in the maintenance allocation chart are as follows:

- (1) *Component.* This column shows only the nomenclature or standard item name. Additional descriptive data is included only where clarification is necessary to identify the component. Components, assemblies, and subassemblies are listed in top-down order. That is, the assemblies which are part of a component are listed immediately below that component, and the subassemblies which are part of an assembly are listed immediately below that assembly. Each generation breakdown (components, assemblies, or sub-assemblies) are listed in disassembly order or alphabetical order.
- (2) *Maintenance function.* This column indicates the various maintenance functions allocated to the echelons.
  - (a) *Service.* To clean, to preserve, and to replenish lubricants.
  - (b) *Adjust.* To regulate periodically to prevent malfunction.
  - (c) *Inspect.* To verify serviceability and to detect incipient electrical or mechanical failure by scrutiny.
  - (d) *Test.* To verify serviceability and to detect incipient electrical or mechanical failure by use of special equipment such as gages, meters, etc.
  - (e) *Replace.* To substitute serviceable components, assemblies, or sub-assemblies, for unserviceable components, assemblies, or subassemblies.

- (f) *Repair.* To restore an item to serviceable condition through correction of a specific failure or unserviceable condition. This function includes but is not limited to welding, grinding, riveting, straightening, and replacement of parts other than the trial and error replacement of running spare type items such as fuses, lamps, or electron tubes.
- (g) *Align.* To adjust two or more components of an electrical system so that their functions are properly synchronized.
- (h) *Calibrate.* To determine, check, or rectify the graduation of an instrument, weapon, or weapons system, or components of a weapons system.
- (i) *Overhaul.* To restore an item to *completely serviceable* condition as prescribed by serviceability standards developed and published by heads of technical services. This is accomplished through employment of the technique of "Inspect and Repair Only as Necessary" (IROAN). Maximum utilization of diagnostic and test equipment is combined with minimum disassembly of the item during the overhaul process.
- (j) *Rebuild.* To restore an item to a standard as near as possible to original or new condition in appearance, performance, and life expectancy. This is accomplished through the maintenance technique of complete disassembly of the item, inspection of all parts or components, repair or replacement of worn or unserviceable elements using original manufacturing tolerances and/or

specifications and subsequent reassembly of the item.

- (3) *1st, 2d, 3d, 4th, and 5th echelons.* The symbol X placed in columns 3 through 7 indicates the echelon responsible for performing that particular maintenance operation, but does not necessarily indicate that repair parts will be stocked at that level. Echelons higher than the echelon marked by X are authorized to perform the indicated operation.
- (4) *Tools required.* This column indicates codes assigned to each individual tool equipment, test equipment, and maintenance equipment referenced. The grouping of codes in this column of the maintenance allocation chart indicates the tool, test, and maintenance equipment required to perform the maintenance function.
- (5) *Remarks.* Entries in this column will be utilized when necessary to clarify any

of the data cited in the preceding columns.

c. Columns in the allocation of tools for maintenance functions are as follows:

- (1) *Tools required for maintenance functions.* This column lists tools, test, and maintenance equipment required to perform the maintenance functions.
- (2) *1st, 2d, 3d, 4th, and 6th echelon.* The dagger (†) symbol in these columns indicates the echelons normally allocated the facility.
- (3) *Tool code.* This column lists the tool code assigned.

## 2. Maintenance by Using Organizations

When this equipment is used by signal services organizations organic to theater headquarters or communication zones to provide theater communications, those maintenance functions allocated up to and including fourth echelon are authorized to the organization operating this equipment.

## SECTION II MAJ. FINANCE ALLOCATION CHART

[illegible]

| (1)   | (2)     | (3)     | (4)     | (5)     | (6)     | (7)       | (8)     |
|---|---------|---------|---------|---------|---------|-----------|---------|
| TOOLS REQUIRED FOR MAINTENANCE FUNCTIONS    | 1ST ECH | 2ND ECH | 3RD ECH | 4TH ECH | 5TH ECH | TOOL CODE | REMARKS |
| TS-1836/U (continued)                       |         | †       |         |         |         | 1         |         |
| MULTIMETER AN/URM-105                       |         |         |         | †       |         | 2         |         |
| MULTIMETER TS-352/U                         |         | †       |         |         |         | 3         |         |
| TOOL KIT, RADAR AND RADIC REPAIRMAN TK-87/U |         |         |         | †       |         | 4         |         |
| TOOL KIT, RADAR AND RADIO REPAIRMAN TK-88/U |         |         |         |         |         |           |         |

## APPENDIX II

### BASIC ISSUE ITEMS LIST FOR TEST SET, TRANSISTOR TS-1836/U

---

#### Section I. INTRODUCTION

##### 1. General

a. This appendix lists items supplied for initial operation and for running spares. The list includes tools, parts, and material issued as part of the major end item. The list includes all items authorized for basic operator maintenance of the equipment. End items of equipment are issued on the basis of allowances prescribed in equipment authorization tables and other documents that are a basis for requisitioning.

b. Columns are as follows:

- (1) *Source, maintenance, and recoverability code.* Not used.
- (2) *Federal stock number.* This column lists the li-digit Federal stock number.
- (3) *Designation by model.* Not used.
- (4) *Description.* Nomenclature or the stand. ard item name and brief identifying data for each item are listed in this column. When requisitioning, enter the nomenclature and description,
- (5) *Unit of issue.* The unit of issue is each unless otherwise indicated and is the supply term by which the individual item is counted for procurement, storage,

requisitioning, allowances, and issue purposes.

- (6) *Expendability.* Nonexpendable items are indicated by NX. Expendable items are not annotated.
- (7) *Quantity authorized.* Under "Items Comprising an Operable Equipment", the column lists the quantit,of items supplied for the initial operation of the equipment. Under "Running Spare Items" the quantities listed are those issued initially with the equipment as spare parts. The quantities are authorized to be kept on hand by the operator for maintenance of the equipment.
- (8) *Illustrations.* The Item No. column lists the reference symbols used for identification of the items in the illustration or text of the manual.

##### 2. Batteries

Dry batteries shown are used with the equipment but are not considered part of the equipment. They will not be preshipped automatically but are to be requisitioned in quantities necessary for the particular organization, in accordance with SB 11-6.

## SECTION II FUNCTIONAL PARTS LIST

| (1)  | (2)                     | (3)                        | (4)  | (5)              | (6)           | (7)                    | (8)           | (9)        | (10) | (11) | (12) |
|--|-------------------------|----------------------------|--|------------------|---------------|------------------------|---------------|------------|------|------|------|
| SOURCE<br>MAINTENANCE<br>AND<br>RECOVERABILITY<br>CODE | FEDERAL<br>STOCK NUMBER | DESIGNATION<br>BY<br>MODEL | DESCRIPTION  | UNIT OF<br>ISSUE | EXPENDABILITY | QUANTITY<br>AUTHORIZED | ILLUSTRATIONS |            |      |      |      |
|  |                         |                            |  |                  |               |                        | FIGURE<br>NO  | ITEM<br>NO |      |      |      |
|  | 6625-893-2628           |                            | TEST SET, TRANSISTOR TS-1836/U: measures beta parameter and leakage current, operating data: beta test range 1 to 300; leakage current test range Ico to 500 va; operating power reqmts: 12v internal battery source |                  |               |                        |               |            |      |      |      |
|  |                         |                            | ITEMS COMPRISING AN OPERABLE EQUIPMENT   |                  |               |                        |               |            |      |      |      |
|  |                         |                            | TEST SET, TRANS STOR TS-1836/U: (BASIC COMPONENT)  |                  | NX            | 1                      |               |            |      |      |      |
| Ord thru AGC   |                         |                            | TECHNICAL MANUAL TM 11-6625-539-15   |                  |               | 2                      |               |            |      |      |      |
| 6135-857-3319  |                         |                            | BATTERY DRY: Mercury type (special) Sierra Electronics Corp No. SB-12459-2   |                  |               | 1                      |               |            |      | BT-1 |      |
| 6135-857-3320  |                         |                            | BATTERY DRY: Mercury type (special) Sierra Electronics Corp part No. SB-12460-2  |                  |               | 1                      |               |            |      | BT-2 |      |
| 5995-857-2830  |                         |                            | CABLE ASSEMBLY, SPECIAL PURPOSE, ELECTRICAL: Sierra Electronics Corp part No. SP-13741-3-1   |                  |               | 1                      |               |            |      | W1   |      |
| 5995-857-2831  |                         |                            | CABLE ASSEMBLY, SPECIAL PURPOSE, ELECTRICAL: Sierra Electronics Corp part SP13741-3-2  |                  |               | 1                      |               |            |      | W2   |      |
| 6625-329-2595  |                         |                            | DATA BOOK: test tables and transistor test outlines; Sierra Electronics Corp part No. 950100003  |                  |               | 1                      |               |            |      |      |      |
|  |                         |                            | RUNNING SPARE ITEMS  |                  |               |                        |               |            |      |      |      |
| 6240-228-7130  |                         |                            | LAMP, INCANDESCENT: 1.3v, 0.06 amp; GE part No. 331  |                  |               | 1                      |               |            |      | DS1  |      |





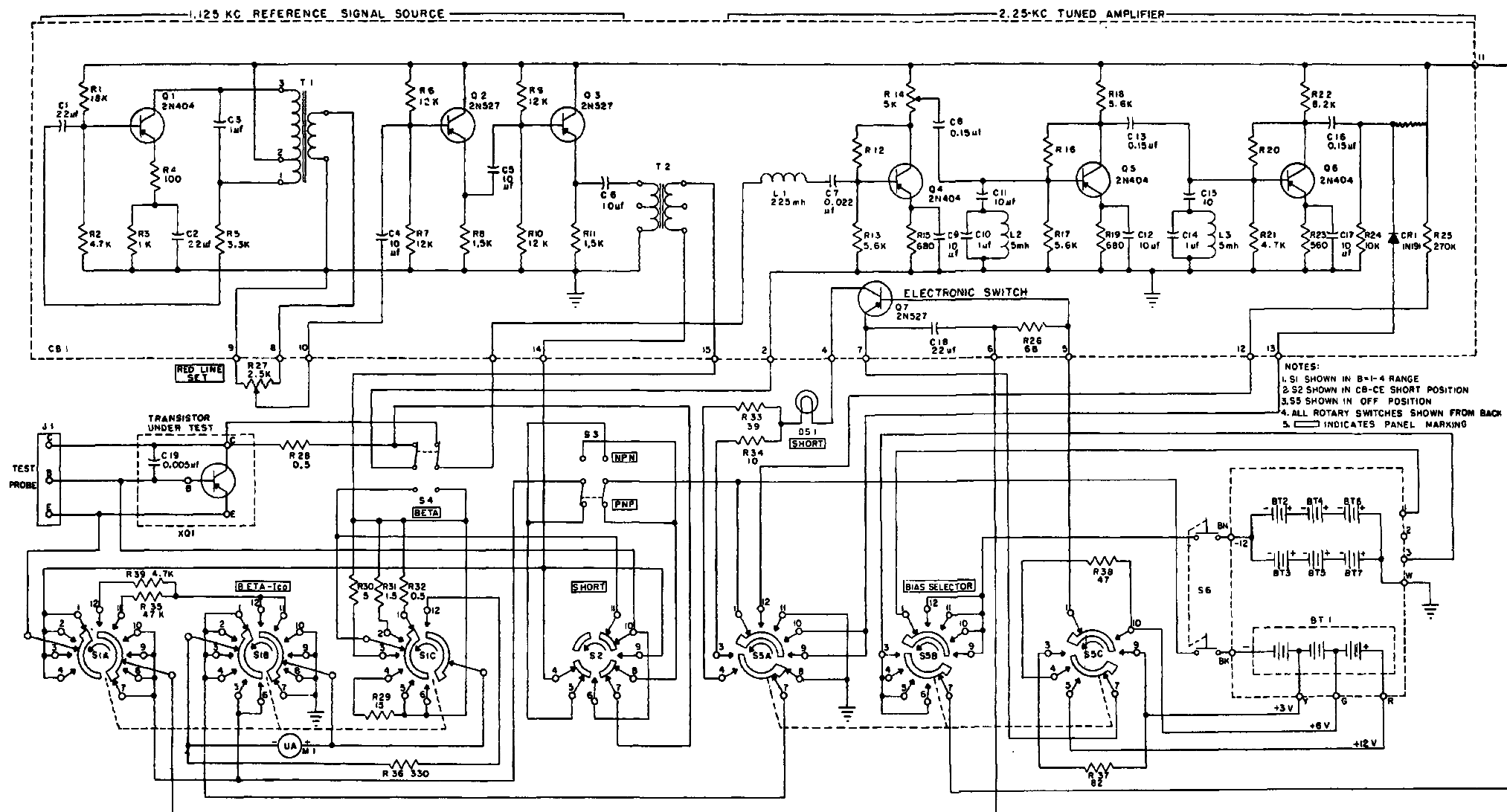


Figure 1-3. Transistor Tester,  
Overall Schematic Diagram

By Order of the Secretary of the Army:

EARLE G. WHEELER,  
*General, United States Army,*  
*Chief of Staff.*

Official:

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NG: State AG (3).

USAR: None.

For explanation of abbreviations used, see AR 32&50.

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## THE METRIC SYSTEM AND EQUIVALENTS

### LENGTH MEASURE

1 Centimeter = 10 Millimeters = 0.01 Meters = 0.3937 Inches  
 1 Meter = 100 Centimeters = 1000 Millimeters = 39.37 Inches  
 1 Kilometer = 1000 Meters = 0.621 Miles

### WEIGHTS

1 Gram = 0.001 Kilograms = 1000 Milligrams = 0.035 Ounces  
 1 Kilogram = 1000 Grams = 2.2 lb.  
 1 Metric Ton = 1000 Kilograms = 1 Megagram = 1.1 Short Tons

### LIQUID MEASURE

1 Milliliter = 0.001 Liters = 0.0338 Fluid Ounces  
 1 Liter = 1000 Milliliters = 33.82 Fluid Ounces

### SQUARE MEASURE

1 Sq. Centimeter = 100 Sq. Millimeters = 0.155 Sq. Inches  
 1 Sq. Meter = 10,000 Sq. Centimeters = 10.76 Sq. Feet  
 1 Sq. Kilometer = 1,000,000 Sq. Meters = 0.386 Sq. Miles

### CUBIC MEASURE

1 Cu. Centimeter = 1000 Cu. Millimeters = 0.06 Cu. Inches  
 1 Cu. Meter = 1,000,000 Cu. Centimeters = 35.31 Cu. Feet

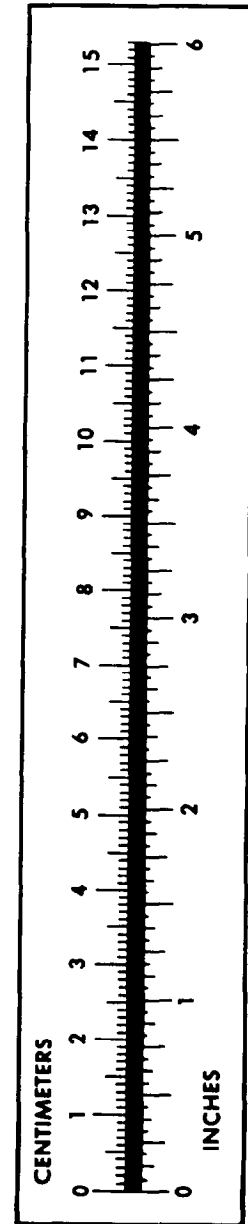
### TEMPERATURE

$5/9(^{\circ}\text{F} - 32) = ^{\circ}\text{C}$   
 212° Fahrenheit is equivalent to 100° Celsius  
 90° Fahrenheit is equivalent to 32.2° Celsius  
 32° Fahrenheit is equivalent to 0° Celsius  
 $9/5^{\circ}\text{C} + 32 = ^{\circ}\text{F}$

### APPROXIMATE CONVERSION FACTORS

| TO CHANGE              | TO                   | MULTIPLY BY |
|------------------------|----------------------|-------------|
| Inches                 | Centimeters          | 2.540       |
| Feet                   | Meters               | 0.305       |
| Yards                  | Meters               | 0.914       |
| Miles                  | Kilometers           | 1.609       |
| Square Inches          | Square Centimeters   | 6.451       |
| Square Feet            | Square Meters        | 0.093       |
| Square Yards           | Square Meters        | 0.836       |
| Square Miles           | Square Kilometers    | 2.590       |
| Acres                  | Square Hectometers   | 0.405       |
| Cubic Feet             | Cubic Meters         | 0.028       |
| Cubic Yards            | Cubic Meters         | 0.765       |
| Fluid Ounces           | Milliliters          | 29.573      |
| Quarts                 | Liters               | 0.473       |
| Gallons                | Liters               | 0.946       |
| Ounces                 | Liters               | 3.785       |
| Pounds                 | Grams                | 28.349      |
| Short Tons             | Kilograms            | 0.454       |
| Pound-Feet             | Metric Tons          | 0.907       |
| Pounds per Square Inch | Newton-Meters        | 1.356       |
| Miles per Gallon       | Kilopascals          | 6.895       |
| Miles per Hour         | Kilometers per Liter | 0.425       |
|                        | Kilometers per Hour  | 1.609       |

| TO CHANGE            | TO                     | MULTIPLY BY |
|----------------------|------------------------|-------------|
| Centimeters          | Inches                 | 0.394       |
| Meters               | Feet                   | 3.280       |
| Meters               | Yards                  | 1.094       |
| Kilometers           | Miles                  | 0.621       |
| Square Centimeters   | Square Inches          | 0.155       |
| Square Meters        | Square Feet            | 10.764      |
| Square Meters        | Square Yards           | 1.196       |
| Square Kilometers    | Square Miles           | 0.386       |
| Square Hectometers   | Acres                  | 2.471       |
| Cubic Meters         | Cubic Feet             | 35.315      |
| Cubic Meters         | Cubic Yards            | 1.308       |
| Milliliters          | Fluid Ounces           | 0.034       |
| Liters               | Pints                  | 2.113       |
| Liters               | Quarts                 | 1.057       |
| Liters               | Gallons                | 0.264       |
| Grams                | Ounces                 | 0.035       |
| Grams                | Pounds                 | 2.205       |
| Metric Tons          | Short Tons             | 1.102       |
| Newton-Meters        | Pounds-Feet            | 0.738       |
| Kilopascals          | Pounds per Square Inch | 0.145       |
| Kilometers per Liter | Miles per Gallon       | 2.354       |
| Kilometers per Hour  | Miles per Hour         | 0.621       |





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