

CHAPTER 5

BONDING TESTER

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Introduction

1. The bonding tester is a portable instrument provided for testing the bonding and screening connections of aircraft. There are several types in service; each consists essentially of an ohmmeter, the actual function and essential details of which are similar though parts and attachments are not interchangeable. The bonding between any two parts of an aircraft is tested by measuring the resistance between them.

2. An accumulator is contained within the instrument case to supply the test current, and two exploring spikes, connected to the ohmmeter by flexible leads, are provided for making contact to the two components of the aircraft between which the bonding is to be tested. The resistance between these two points is indicated on the scale of the instrument.

Types available

3. The following types of bonding tester are available for use:—

<i>Item</i>	<i>Stores Ref.</i>	<i>Type</i>	<i>Specifi- cation</i>	<i>Weight</i>	<i>Remarks</i>
Tester bonding	5G/1618	A	E & I. 417	3 lb. 9 oz.	Stores Ref. includes leads but not accumulator
Lead, double contact spike	5G/1619	A	E & I. 417	3 lb. 3 oz.	
Lead, single contact spike ...	5G/1620	B	E & I. 417		
Tester, bonding	5G/2126	B	E & I. 417	3 lb. 4 oz.	Stores Ref. includes leads but not accumulator
Lead, double contact spike ...	5G/2127	A	E & I. 417	3 lb. 15 oz.	
Lead, single contact spike ...	5G/2128	B	E & I. 417		
Accumulator, alkaline ...	5J/1623	N	E & I. 417	1 lb. 12 oz.	One required for either type of tester

ELECTRICAL EQUIPMENT MANUAL—
METERS AND TESTING APPARATUS

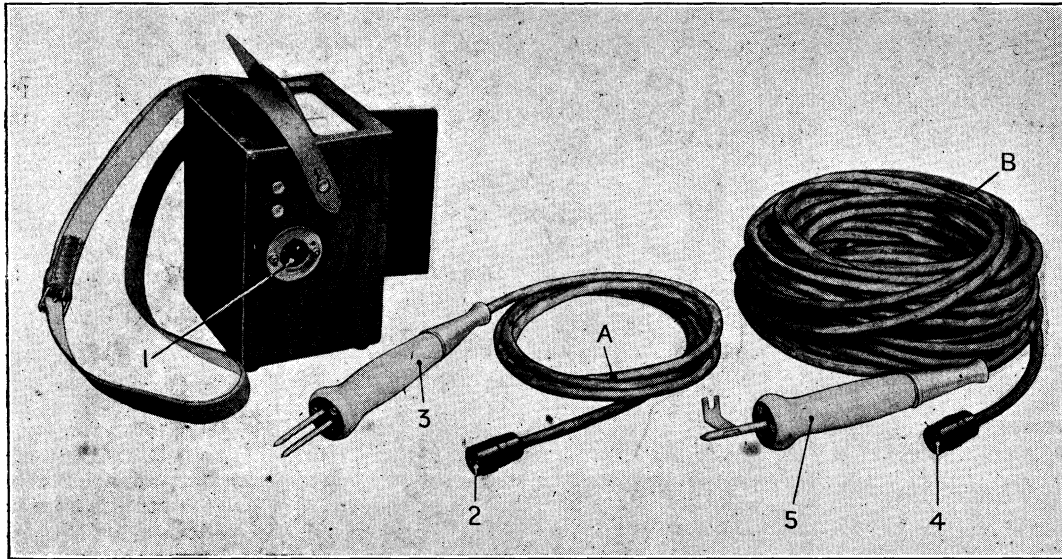
This is A.L. No. 12 to A.P.1095H, Vol. I and concerns Sect. 2.
Delete "(To be issued later)" after title of Chap. 5 in the List of Chapters,
write "A.L.12" in the outer margin of the list, insert this chapter, and
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DESCRIPTION

4. The ohmmeter and accumulator are enclosed in separate compartments in a teak case, fitted with a carrying strap or straps, as shown in fig. 1 and 2. The dial is situated at the top of the case and, in some instruments, is protected by a flap. Access to the accumulator is obtained through a door situated at the back or front of the case. Fixed metallic connectors pass through to this compartment from the ohmmeter, and are connected to the accumulator terminals by slotted lugs and thumb screws. The accumulator consists of a single type N alkaline cell having a capacity of 10 ampere-hours. One two-pole locking socket (1) is mounted in each side of the box for connecting the test leads.



1. Socket

2. Plug

3. Handle

4. Plug

5. Handle

Fig. 1.—Bonding tester, using two-pin plugs

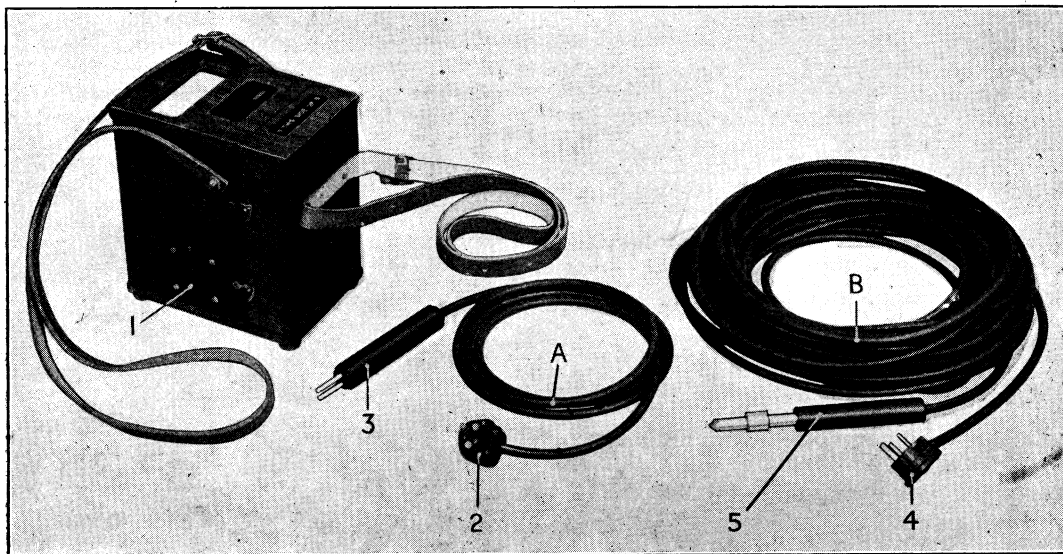
5. The instrument movement is that employed for the usual true ohmmeter. It consists of two coils mounted at an angle to one another on a common spindle and placed between the poles of a permanent magnet. One of these coils carries a fixed proportion of the current passed through the bond which is under test. The second coil is shunted across the bond under test, and is of high resistance compared with it; it thus carries a current proportional to the voltage drop across the bond. There is no spring or other mechanical control of the movement and the pointer may take up any position when no current is passing. The torque produced by the current in the first coil is in opposition to that of the second, so that a position of equilibrium will be taken up by the movement dependent on the ratio between the two currents. This ratio is directly proportional to the value of the bond under test, and will therefore be indicated by the position of the pointer.

6. By using the current coil to provide the controlling torque, instead of the usual spring control as for a voltmeter, the effect of variations of the accumulator voltage is eliminated, for since the currents in the coils are both directly proportional to this voltage their ratio will be independent of it. Fig. 3 indicates theoretically the circuit of the bonding tester and its operation in testing the electrical continuity of a bond.

7. The scale of the instrument is calibrated to read directly the resistance of the circuit under test. It reads from 0 to 0.1 ohm and is marked with divisions of 0.002 ohm, the multiples of 0.02 ohm being figured.

8. Two separate leads are provided. The A lead is 6 ft. long and consists of rubber-covered twin cable. A locking plug (2) is fitted at one end for making a two-pole connection to the ohmmeter. This plug may be a 2-pin or 3-pin type, as shown in fig. 1 and 2 respectively. At the other end is fitted a suitable handle (3) provided with two closely spaced exploring spikes, both of which must make contact with the part under test. The points are sharp and robust so as to penetrate any finish or corrosion on the surface of the metal. Each point is connected through one conductor of the cable to one of the plug connections.

9. The B lead is 60 ft. long and is made of the same type of twin cable with a similar 2- or 3-pin locking plug (4) at one end for connection to the ohmmeter. At the other end is a handle (5) with a single exploring spike attached to it. A slotted lug suitable for making a semi-permanent connection by means of a bolt or screw is attached to the spike so that it need not be held continuously in position by hand. Both the conductors of the cable are connected to the single spike, and at the other end each is connected to one connection of the plug.



1. Socket 2. Plug 3. Handle 4. Plug 5. Handle

Fig. 2.—Bonding tester, using three-pin plugs

10. The instrument is required to measure the resistance of the bond under test between the points of contact with the spikes only and, to avoid including the resistance of the leads in the measured value, the spikes are connected to the voltage coil through separate conductors. One conductor in each lead is thus used to carry the main current and the other to connect the voltage coil, through separate conductors, to the points between which the resistance is being measured. In lead B the voltage circuit is permanently connected to the current circuit since both conductors are connected to the one spike. In the A lead the conductors are connected to separate spikes and the voltage circuit is not completed until the two spikes are connected by contact with the metal of the bond under test. If these two spikes are connected together, and the A lead left unconnected the full voltage of the accumulator will be applied to the voltage coil and the indicator will show infinite resistance.

11. These instruments are suitable for use in tropical climates and are proof against inaccuracy from vibration or effects of reasonable handling in service. The average weight of the instrument without leads is 5 lb., and the average overall dimensions are approximately 5 in. by 6 in. by 7 in. high.

OPERATION

12. The bonding tester is carried slung by its straps so that the dial can be read easily. Where two straps are provided, one is used to steady the tester by passing the strap round the body of the person making the test. The instrument is used for testing the electrical continuity or efficiency of the electrical bonding of metal parts of an aircraft. This is done by measuring the resistance between a specified reference point and all other specified points, either of a complete aircraft or of a component such as a wing or fuselage. The reference point in the case of a complete aircraft will usually be an earth terminal, and in the case of a component the terminal used to connect its bonding to that of the adjacent component. Various other measurements may also be specified. The maximum value of resistance permissible will be stated. It is usually 0.025 ohm.

13. To measure the resistance between any two points the leads should be connected to the ohmmeter by inserting the plugs into the sockets in the sides of the instrument. The circuit is such that either lead may be connected to either socket. The operation of the set may then be checked by pressing the two spikes on the A lead against the single spike of the B lead. A reading of zero should be obtained.

14. The single contact spike should be connected to the reference point, either by pressing the contact point into the surface of the metal by hand, or by using the lug to make semi-permanent connection. This connection should always be made first. The instrument may then be carried to the second point and contact made there with both contact points of the double spike. The ohmmeter will then indicate the value of the resistance between the two points.

15. The contact points of the spikes are pointed to enable the protective covering on the metal to be pierced, so that good contact can be obtained with the least possible damage to the finish. Care must be exercised in making contact with metal of light gauge to avoid damaging the structure itself in any way. If a high resistance value is obtained the contact itself should first be suspected and the measurements repeated with the contact points pressed on a different part of the component. As parts of the electrical testing system, the exploring leads should be handled carefully to avoid kinking, crushing, or other damage with resultant injury to the electrical conductors.

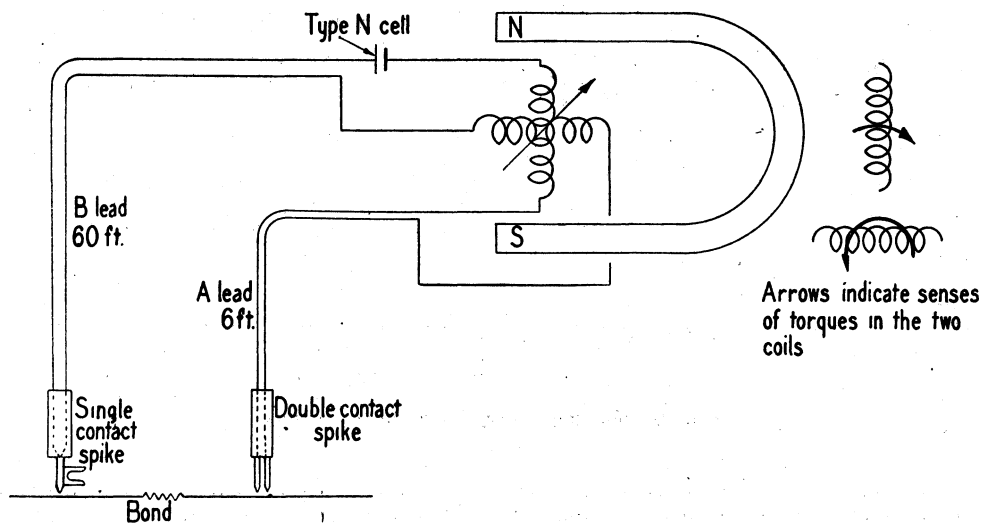


Fig. 3.—Diagram showing electrical circuit

SERVICING

16. The accumulator must be kept in good condition and periodically removed from the case and recharged. Instructions for charging and maintenance are given on or near the cell and must be rigidly observed. When replacing the accumulator in the case care should be taken to ensure the correct polarity for the connections. Further information regarding the care and maintenance of alkaline accumulators will be found in A.P.1095C, Vol. I, Sect. 1.

17. The ohmmeter itself is sealed in the case by the manufacturers, and no attempt must be made to open it. In the event of a fault developing the tester must be returned for repair.

18. The leads must be kept in good condition and the connections to the plugs and spikes must be sound. The reading of the instrument is affected by the resistance of the leads, which must not, therefore, be shortened or repaired. The plugs and sockets must be kept clean and the plugs should be a good push fit in the sockets. The contact points of the spikes should be sharpened if they have become blunt, care being taken to remove as little metal from the pencil points as possible.

19. The accuracy of the instrument should be checked from time to time by measuring resistances of known value, using the leads and spikes. Resistances of 0.02, 0.06, and 0.1 ohm should be measured, and the reading for these should be within 10 per cent. of the true value. The zero should also be checked by pressing the two spikes on the A lead against the single spike on the B lead.