Chapter Forty-seven

THE B.T.H. HIGH ENERGY IGNITION UNITS

Type C10TS/1 and C10TS/2

Contents

Illustrations

The information contained in this chapter has been supplied by The British Thomson-Houston Co., Ltd., and is a reproduction of B.T.H. Instruction Book No. 1709, Edition B, February, 1954.

Types C10TS/1 and C10TS/2 High Energy Ignition Units are generally similar, the principal design difference being that the /2 unit is fitted with an output terminal assembly having increased leakage distances, permitting an improved high-altitude performance. The information contained in this chapter applies principally to the /2 unit, but is also generally applicable to the /1 unit, any differences in information relating to the /1 unit being given in parenthesis. This chapter is applicable to all series and marks of Ghost engines.

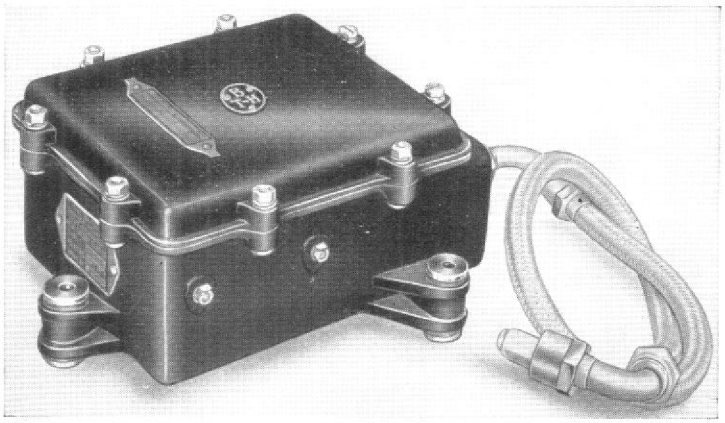


Fig. 1. C10TS/2 high energy ignition unit, with ignition cable.

DESCRIPTION

THE TYPE C10TS/2 HIGH ENERGY IGNITION UNIT shown in Fig. 1, is designed to provide ignition for gas-turbine engine combustion chambers where the use of the orthodox booster coil ignition is ineffective. The electrical discharges produced by the unit are delivered at a much slower repetition rate than those produced by a normal booster coil, but each discharge is of considerably higher energy. The duration of each discharge is of the order of 50 micro-seconds, and the peak discharge current is approximately 1500 amps. The unit is designed

for operation from the normal aircraft 24 volt D.C. supply. It is suitable for operation over an ambient temperature range of minus 50 deg. C. to plus 100 deg. C., and will function satisfactorily up to altitudes of the order of 60000 ft. (55000 ft. for the /1 unit). The components of the ignition unit are suitably treated to ensure satisfactory operation in all parts of the world, including tropical climates. A view of the interior of the ignition unit is shown in Fig. 2.

THE CASE is cast in magnesium-zirconium alloy and is fitted with a detachable top cover of the same material. The case is provided with three integral mounting lugs which are machined to accommodate resiliently-mounted bushes for the fixing bolts.

COIL AND TREMBLER MECHANISM. The coil primary and secondary windings are wound on a laminated core fitted with bonded fabric end cheeks. After winding, the coil is varnish-impregnated under vacuum to prevent the ingress of moisture into the windings. The trembler mechanism, which is of the conventional booster coil pattern, but with an improved design of armature suspension, is mounted on one of the coil end cheeks.

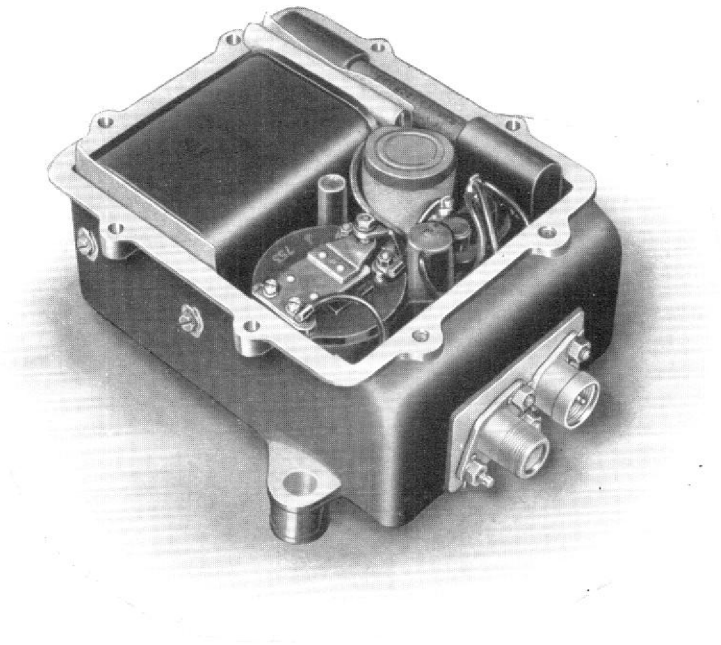


Fig. 2. Ignition unit with cover removed.

THE CAPACITORS are of the wound paper and aluminium foil type, and have been specially designed to operate satisfactorily over the wide ambient temperature range required.

THE SELENIUM TYPE RECTIFIERS are designed to give satisfactory service at high ambient tem-

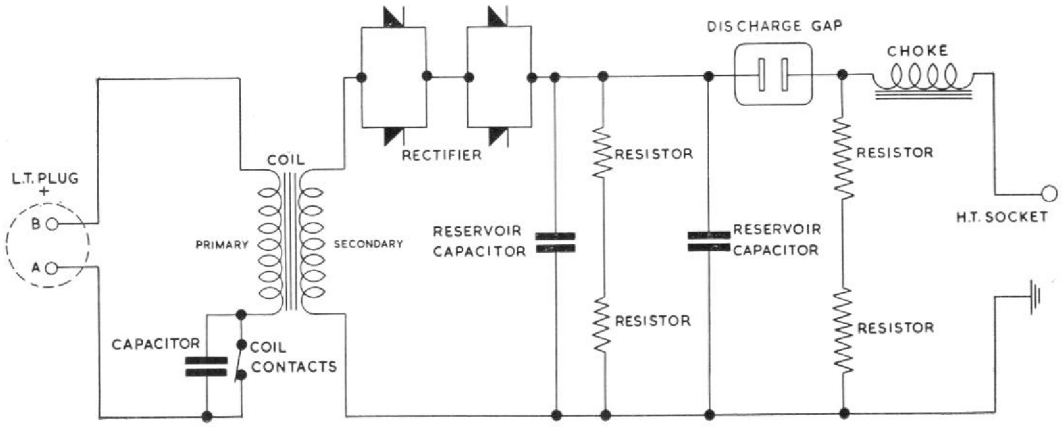


Fig. 3. Theoretical circuit diagram.

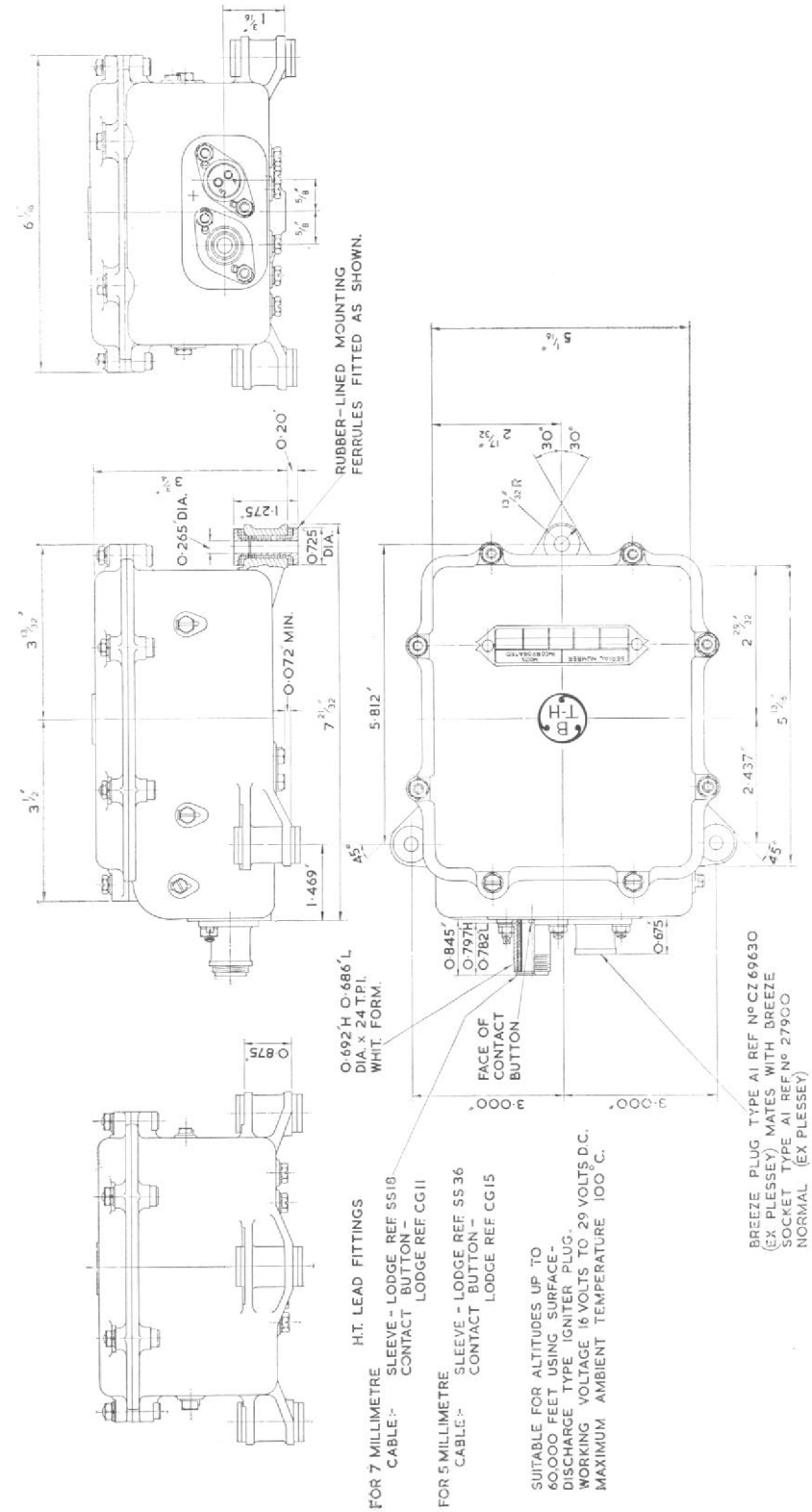


Fig. 4. Approximate dimensions and connection details, type C10TS/2 unit.

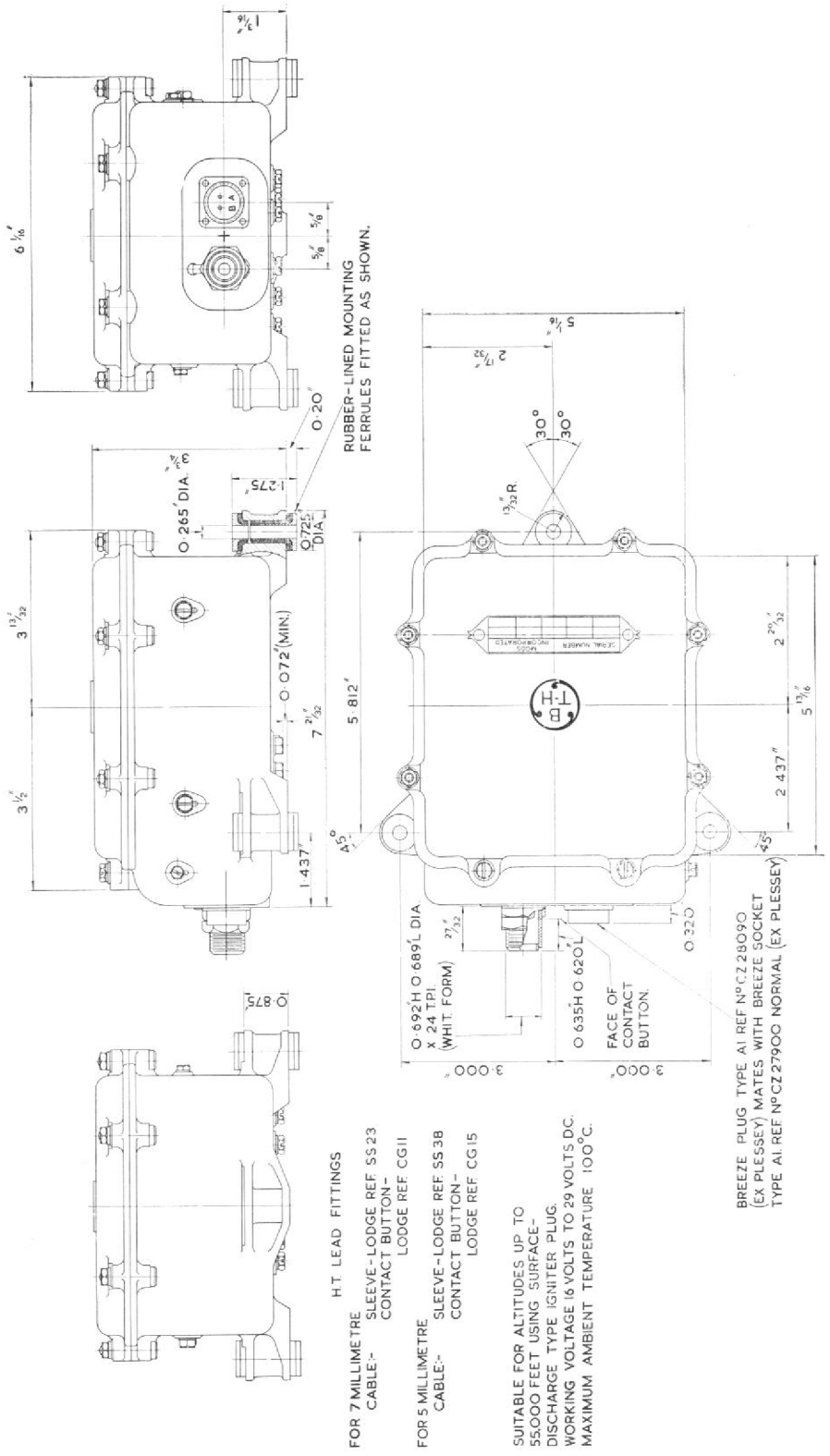


Fig. 5. Approximate dimensions and connection details, type C10TS/1 unit.

perature. They are mounted between special moulded end brackets which are designed to give adequate leakage distances under high altitude conditions.

SEALED DISCHARGE SPARK-GAP. The specially developed spark-gap, which is fitted with electrodes designed to withstand high current discharges, is enclosed in a hermetically-sealed glass envelope. Its break-down voltage is independent, therefore, of the prevailing altitude conditions. It is mounted in a special holder and adequate leakage distances are provided around its connections to ensure satisfactory operation at high altitude.

THE CHOKE COIL consists of a single layer winding wound on a moulded former having an iron dust core. The winding is shrouded to ensure satisfactory operation under high altitude conditions.

CONNECTIONS. The low-tension connection is made by means of a standard "Breeze" waterproof plug. The high-tension connection has a ceramic insulated sleeve and is arranged for the attachment of the standard sparking-plug type of connection used for the screened high-tension lead.

The theoretical circuit diagram of the ignition unit is shown in Fig. 3.

PRINCIPLE OF OPERATION

An induction coil, operated by a trembler mechanism from the 24 volt D.C. supply, repeatedly charges a reservoir capacitor through a high-voltage selenium rectifier until the capacitor voltage increases to a value at which the sealed discharge spark gap breaks down. The capacitor then discharges through the sealed spark gap, an inductance, and the engine surface discharge plug, which are all connected in series. The capacitor is then recharged and the process repeated at a frequency of not less than one discharge per second. Protective resistors are connected across the output circuit to limit the value to which the reservoir capacitor voltage rises in the event of an open-circuit occuring in the external high tension circuit. Discharge resistors are fitted to the reservoir capacitor to ensure the dissipation of stored energy should the capacitor be left in a charged condition when the unit is not in use. The minimum frequency of discharge is 60 per minute and the energy stored in the capacitor prior to discharge is approximately 12 joules.

TECHNICAL DATA

Input Voltage D.C.—16 to 29.
Maximum Input Current (amps)*—2·5.
Output Voltage (kilovolts)—2·0.
Stored Energy per Discharge (joules)—12.
Maximum Altitude (feet)—60000 (*55000 for the /1 unit*).
Ambient Temperature Range—minus 50 deg. C. to plus 100 deg. C.
Minimum Frequency of Discharge on 21 volts input—60 discharges per minute.
Weight—6 lb. 10 oz.
* Measured on a moving coil instrument.

INSTALLATION

The ignition unit is waterproof and climatically proofed, so that it is suitable for operation in all parts of the world. Surface discharge type of plugs must be fitted to the engine when high-energy ignition units are installed in an aircraft. The unit may be mounted in any position, by means of the resilient mountings provided. Approximate dimensions of the ignition unit and details of the high-tension and low-tension connections are shown in Fig. 4. Installation and removal on Ghost engines is covered in chapter 15.

The corresponding particulars of the /1 unit are shown in Fig. 5. Particulars of a typical ignition lead assembly are shown in Fig. 6. *The corresponding particulars of a typical ignition lead assembly for the /1 unit are shown in Fig. 7.*

MAINTENANCE

No attention is required in service other than the routine procedure of checking that the unit mountings are secure and all connections are tight. At the end of every 3000 flying hours (assuming approximately 1000 starting operations during this period), remove the unit from the aircraft..

PROCEDURE AFTER REMOVAL FROM AIRCRAFT

WARNING

(I) Do not operate the unit in a confined space where petrol is stored, batteries are charged, or inflammable vapour of any kind is likely to be present.

(II) Great care must be taken not to touch the end of the output lead, or the discharge plug, when the unit is in operation, otherwise a lethal shock will be received.

After removing an ignition unit from the aircraft, at the 'time expired' period, or because it is suspected of being faulty, test it in accordance with the following testing procedure.

Connect the ignition unit by a length of cable and conduit, as shown in Fig. 6, to a surface-discharge plug, which is known to be satisfactory. *Similar cable details for the /1 unit are shown in Fig. 7.* A standard screened engine-lead may be used for this purpose with a suitable adapter to house the discharge plug. Mount the surface-discharge plug on a suitable stand and connect it to the H.T. output socket of the unit. Connect a 24 volt D.C. supply from batteries to the input socket and note the rate of sparking.

Count the number of sparks produced in a period of one minute. The rate of sparking should be approximately one discharge per second. Should there be no sparking at the surface-discharge plug, the connections should be checked and it should be established that the discharge plug is in good condition. If necessary, **after first breaking the input circuit,** draw a pencil line across the plug electrodes to form a leakage path.

If the unit will not function satisfactorily, consult the Defect Diagnosis Table on page 16,

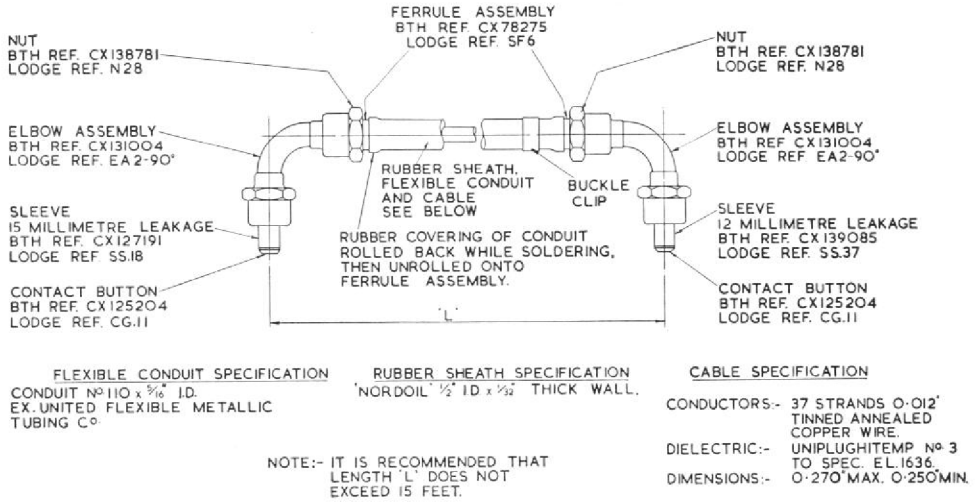


Fig. 6. Typical H.T. lead assembly for type C10TS/2 unit.

in order to diagnose the fault before proceeding to dismantle.

If the unit appears to be electrically satisfactory, proceed as follows. (The necessary dismantling and re-assembly operations associated with the following procedure are described on pages 7 and 9):—

(1) AT PERIODS OF EVERY 3000 FLYING HOURS

(a) Take off the cover, remove the armature assembly CX117465 and the adjustable contact CX125398, and fit new parts.

(b) If the two large (reservoir) capacitors fitted are marked with the reference number CX122433, remove them and fit new capacitors, reference number CX133827.

(2) AT PERIODS OF EVERY 6000 FLYING HOURS (in addition to carrying out the procedure called for in (1) (a) above)

(a) If the reservoir capacitors fitted are marked with the reference number CX133827, remove them and replace with new capacitors marked with the same reference number.

(b) Remove the discharge gap CX122545 and fit a new one.

It will be seen from the above that the replacement periods of the components mentioned are as follows:—

Description	*Drawing Reference*	*Replacement Period*
Armature assembly	CX117465	3000 flying hours
Adjustable contact	CX125398	
Capacitor	CX122433	
Capacitor	CX133827	6000 flying hours
Discharge gap	CX122545	

These figures are based on the assumption that 3000 flying hours operation represents approximately 1000 engine starting operations, and each of 45 seconds duration. It must be appreciated,

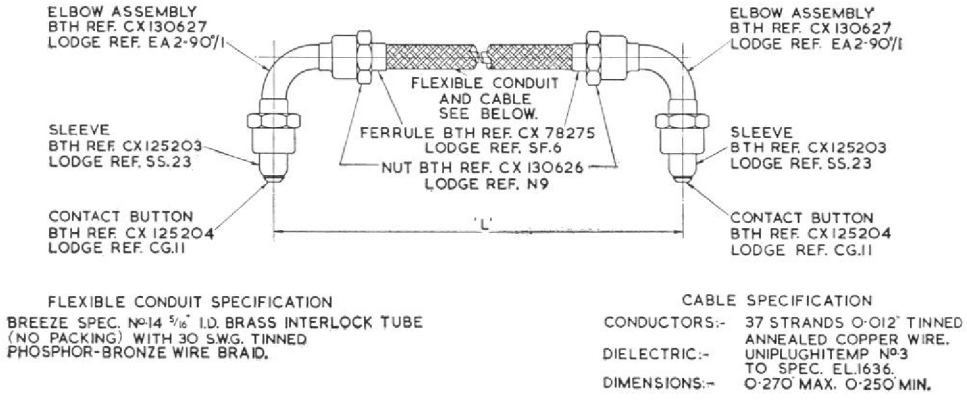


Fig. 7. Typical H.T. lead assembly for type C10TS/1 unit.

when assessing operating figures differing considerably from those quoted above, that the important factors are the number and duration of the starting operations actually carried out.

After carrying out the above procedure, check the interior of the unit for general condition. It must be perfectly clean, all connections must be sound and all wiring in good condition. When checking the connections to the reservoir capacitor terminals, take particular care to avoid exerting excessive pressure on the terminals. Maltreatment of the terminals may result in leakage of the capacitor impregnant. If there are any signs of leakage of impregnant from the capacitors, they must be removed and replaced by new capacitors, reference number CX133827.

The ignition unit must now be subjected to the full testing procedure as laid down on page 13. If the ignition unit fulfils all the testing requirements satisfactorily, it may be returned to service.

When replacements of the reservoir capacitors, discharge gap, armature assembly or adjustable contact are required at the periods stated on page 5, the unit should be dismantled only to the stages necessary to enable the required replacements to be made.

IMPORTANT

After operation, these units may hold a lethal charge. It is therefore important before commencing any dismantling operations, to discharge the reservoir capacitors. A convenient method of doing this is to short-circuit the terminal of the discharge gap to the case with a length of suitably-insulated wire.

The following paragraphs describe the dismantling operations for the Type C10TS/2 High Energy Unit. However, as the Type C10TS/1 unit is generally similar, the main differences being variations of H.T. socket and L.T. plug assemblies,

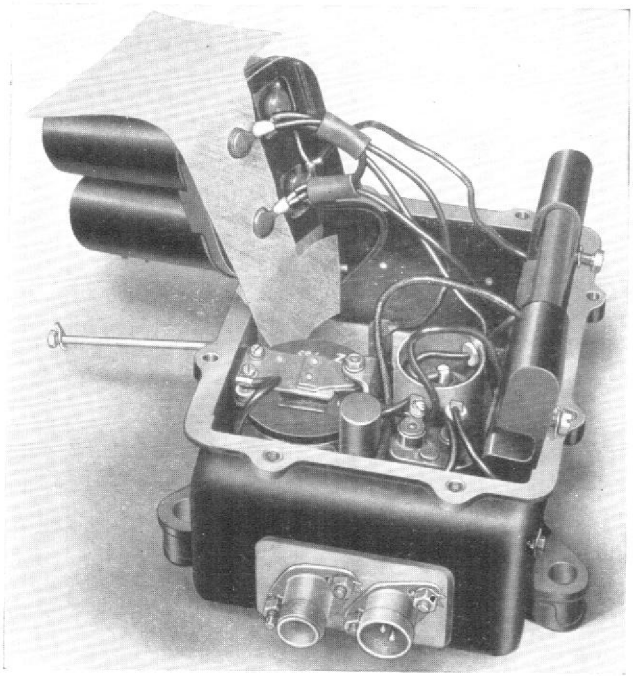


Fig. 8. Reservoir capacitors and rectifier assembly partly withdrawn.

If it does not fulfil all the requirements of the full testing procedure satisfactorily, consult the table on page 16, to assist in diagnosing the fault. After ascertaining the fault and making the necessary corrections and replacements, re-test the unit as outlined on page 13.

DISMANTLING

Provided that the interior of the ignition unit is clean, the components in good general condition, the wiring satisfactory and that the ignition unit will perform satisfactorily the requirements of the tests on page 13, it should be dismantled only when it is necessary to change components.

no difficulty should be experienced in dismantling this type of unit.

REMOVING THE COVER. Unscrew and remove the eight 2 B.A. hexagon-headed screws and nuts, together with the tab-washers. Remove the cover.

When removing the following components, unsolder the essential connections only at the appropriate stage:—

REMOVING THE RESERVOIR CAPACITORS. Remove the two 4 B.A. hexagon-headed screws projecting from the side of the case adjacent to the bases of the reservoir capacitors and then lift out

the capacitors complete with their insulation and packing components. If the reservoir capacitors do not require replacement, take particular care to avoid excessive pressure on their terminals as this may cause leakage of the impregnant. If it is essential to unsolder their connections, do not allow the iron to remain in contact with the terminals any longer than is absolutely necessary.

REMOVING THE RECTIFIER ASSEMBLY. Unscrew the two 2 B.A. hexagon-headed screws securing the assembly to the case and carefully withdraw the assembly. After withdrawal of the assembly, the end-mouldings may be slipped off easily to permit replacement of the rectifiers and resistor. Take care not to lose the rubber pads fitted in the end-mouldings.

Fig. 8 shows a view of an ignition unit with the reservoir capacitors and rectifier assembly partly removed.

REMOVING THE DISCHARGE GAP ASSEMBLY. Remove the two 2 B.A. hexagon-headed screws passing through the large machined pad on the under-side of the case of the unit. This releases the discharge gap assembly which can now be lifted out of the case complete with insulating tube. To remove the discharge gap, slacken off the 6 B.A. clamping screw at the base of the tube by inserting a narrow-bladed screwdriver through the clearance hole in the side of the insulation tube. The top connection is made by a 6 B.A. connection screw which may be unscrewed complete with its soldered lead, or in later units the leads may be removed by unscrewing the 6 B.A. screw in the head of the connection screw.

REMOVING THE PRIMARY CAPACITOR. Remove the two 2 B.A. hexagon-headed screws securing it to the bottom of the case and withdraw the capacitor.

REMOVING THE COIL ASSEMBLY. Remove the three 2 B.A. hexagon-headed screws securing it to the bottom face of the case.

The armature assembly may be removed after unscrewing its two 6 B.A. cheese-headed securing screws. The adjustable contact can be unscrewed after the removal of its locknut with a 4 B.A. spanner. In some instances it may be necessary to turn the adjustable contact in a clockwise direction, i.e. inwards, in order to remove it from its bracket.

To remove the coil from its case, unscrew the four 4 B.A. cheese-headed screws on the bottom of the coil case. The two resistor assemblies clamped by brackets to the side of the coil case can be withdrawn readily if required.

REMOVING THE CHOKE, H.T. SOCKET AND L.T. PLUG ASSEMBLIES. To remove the choke, unscrew the 4 B.A. hexagon-headed screw securing it to the side of the case. This will permit the choke to be lifted clear of the case but still attached to the H.T. socket assembly. Unscrew the 2 B.A. nuts holding the flange of the H.T. socket and withdraw it from the side of the case. The lead from the choke may now be fed through the socket and the contact button unsoldered, care being taken to retain any shims that may be fitted on the lead. The choke may now be removed from the case. The L.T. plug may be removed by unscrewing the two 2 B.A. nuts retaining its flange, releasing the spring clip at the back of the plug, and pressing the moulded portion into the case.

INSPECTION AND TESTING OF COMPONENTS

Before inspection is carried out, clean all the components by brushing them with a petrol-moistened soft brush and then dry them thoroughly with a jet of dry compressed air.

CASE AND COVER. Check that the castings are undamaged and are not cracked, examining particularly around the case mounting lugs. Check that the studs for the H.T. socket and L.T. plug assemblies are secure and that all tapped holes are undamaged. Check that the cover is a good fit on the case. If either part is faulty, fit a new one. If the ferrules in the case mounting lugs show signs of deterioration, fit new ones.

COIL ASSEMBLY. Examine the bonded-fabric end-flanges for cracks and signs of tracking, and check that all components mounted on the upper flange are fixed securely. If the flanges are faulty in any way, return the coil to The British Thomson-Houston Co. Ltd., Coventry, England, for possible rectification.

Check that the clips riveted to the coil case are secure and that the tapped holes in the mounting feet are undamaged. If the clips are loose or the tapped holes faulty, fit a new case.

Check the resistance of the coil windings. The resistance of the primary winding must be within the limits of 0·715 ohm and 0·585 ohm at 20 degrees C. and the resistance of the secondary winding within the limits of 1650 ohms and 1350 ohms at 20 degrees C. The resistance of the primary winding may be measured between pin B of the L.T. plug and the adjustable-contact bracket on the end-flange, with the contacts open, while the resistance of the secondary winding may be measured between the laminated core of the coil and the yellow varnished-silk insulated lead emerging through the rubber grommet in the side of the coil case.

There is no necessity to carry out a high-voltage test of the coil as its satisfactory performance when tested in the complete re-assembled unit will be an adequate indication that its insulation is satisfactory.

Check the resistance of the resistor assemblies fitted in the clips on the sides of the coil case. The resistance of the resistor fitted in the larger insulation tube should be within the limits of

150000 ohms ± 5% at 20 degrees C., while the resistance of the two resistors connected in series in the smaller insulation tube should be within the limits of 1,120,000 ohms ± 10% at 20 degrees C.

PRIMARY CAPACITOR. Check that there is no leakage of impregnant and that the terminals are secure, but do not strain them when checking. Check that the tapped holes in the mounting feet are satisfactory. If the impregnant is leaking, the terminals are loose, or the threads for the securing screws are defective, fit a new capacitor. Check the insulation resistance of the capacitor using a 500 volt Megger ; a reading of at least 100 megohms must be obtained. If one of the Megger leads be removed while the Megger is still delivering full voltage, a spark should be obtained when short-circuiting the capacitor terminals with a length of wire. If the insulation resistance value is low, fit a new capacitor.

RESERVOIR CAPACITORS. Before inspection, consult page 6 to ascertain the replacement life of the capacitors fitted. If the ignition unit has been removed from the aircraft because it is faulty, thereby probably not completing its full overhaul period, and is fitted with capacitors Ref. CX122433, note whether they are marked with the suffix numeral, /1 or /2. If they are marked CX122433/1, they should be changed even if they have not completed the period stated on page 6, but if they are marked CX122433/2 they may remain in service until the end of the period stated.

If the capacitors fitted are remaining in service, check that there is no leakage of impregnant and that the terminals are secure but take great care to avoid straining the terminals when checking them. If the impregnant is leaking, or the terminals are faulty, fit two new capacitors, Ref. CX133827.

H.T. SOCKET AND L.T. PLUG ASSEMBLIES. Check that the threads and insulation sleeve of the H.T. socket are undamaged and that the pins and insulated body of the plug are in good condition. If rectification of the threads is necessary, note that the thread dimensions for both socket and plug are 0·692 inch H, 0·686 inch L, 24 threads per inch, Whitworth form.

ARMATURE ASSEMBLY AND ADJUSTABLE CONTACT. Before inspection, consult page 6 to ascertain the replacement lives of these components. If the components are to remain in service, check that the armature spring is sound and secured firmly to the armature The contact must be secure and show no signs of movement.

Clean both contacts with a clean cloth, moistened with trichlorethylene ; if they are burnt or pitted clean them with a contact stone, and remove any high spots. It is not necessary to remove completely any deep crater that may have formed, as this is wasteful, as long as the majority of the contact face is flat, satisfactory operation will be obtained. It is most important that the stoning operation be carried out with extreme care as the contact faces must be parallel when the parts are re-assembled. If, after stoning, the thickness of the platinum tips of the contacts is less than *0,5 mm.* (0·020 inch) fit a new armature assembly and adjustable contact.

RECTIFIER ASSEMBLY. Check that the rectifier end-mouldings are in good condition, with no signs of cracking or of damaged threads for the securing screws. If faulty in any way, fit new mouldings. Check that the rectifiers are undamaged and that their soldered connections are in good condition. If faulty, renew or re-solder to make satisfactory. Check that the resistor tube assembly fitted between the centre sockets of the end-mouldings is in good condition. Check the resistance of this assembly which should be within the limits of 150000 ohms ± 5% at 20 degrees C. If the resistor assembly is faulty, fit a new one.

CHOKE ASSEMBLY. Check this assembly to ensure that it is undamaged and in good condition, and that the tapped hole in the base is satisfactory. If the assembly is faulty in any way, fit a new one.

DISCHARGE GAP ASSEMBLY. Before inspection, consult page 6 to ascertain the replacement life of the discharge gap. If it is to remain in service, check that it is not cracked or damaged and that its terminals are secure and in good condition. Check that the moulded base and insulation tube are undamaged and that the two holes in the base are satisfactory. If faulty in any way, fit a new part.

REASSEMBLY

New tab-washers, sealing wires, etc., must be fitted. When re-soldering connections, use only an approved solder and flux.

If the rubber compound has been removed from the ends of the tubes of the resistor assemblies, it must be renewed. The compound used is 'Bostikol' insulating compound Type B/23/01, obtainable from The B.B. Chemical Co. Ltd., Ulverscroft Road, Leicester, England. After refilling the tubes with this compound, bake them at a temperature of 80 to 100 degrees C. for approximately five hours.

An exploded view of the components of the Type C10TS/2 unit is shown in Fig. 9, and a diagram showing the connections between the various components is shown in Fig. 10. These illustrations should be consulted during the re-assembly operations.

Before replacing any components in the case, check that the two washers of 0·012 inch thick varnished-glass insulation are stuck in position on the inner wall of the case around the two holes for the rectifier assembly fixing screws. If the new washers are required, they must be stuck in posi-

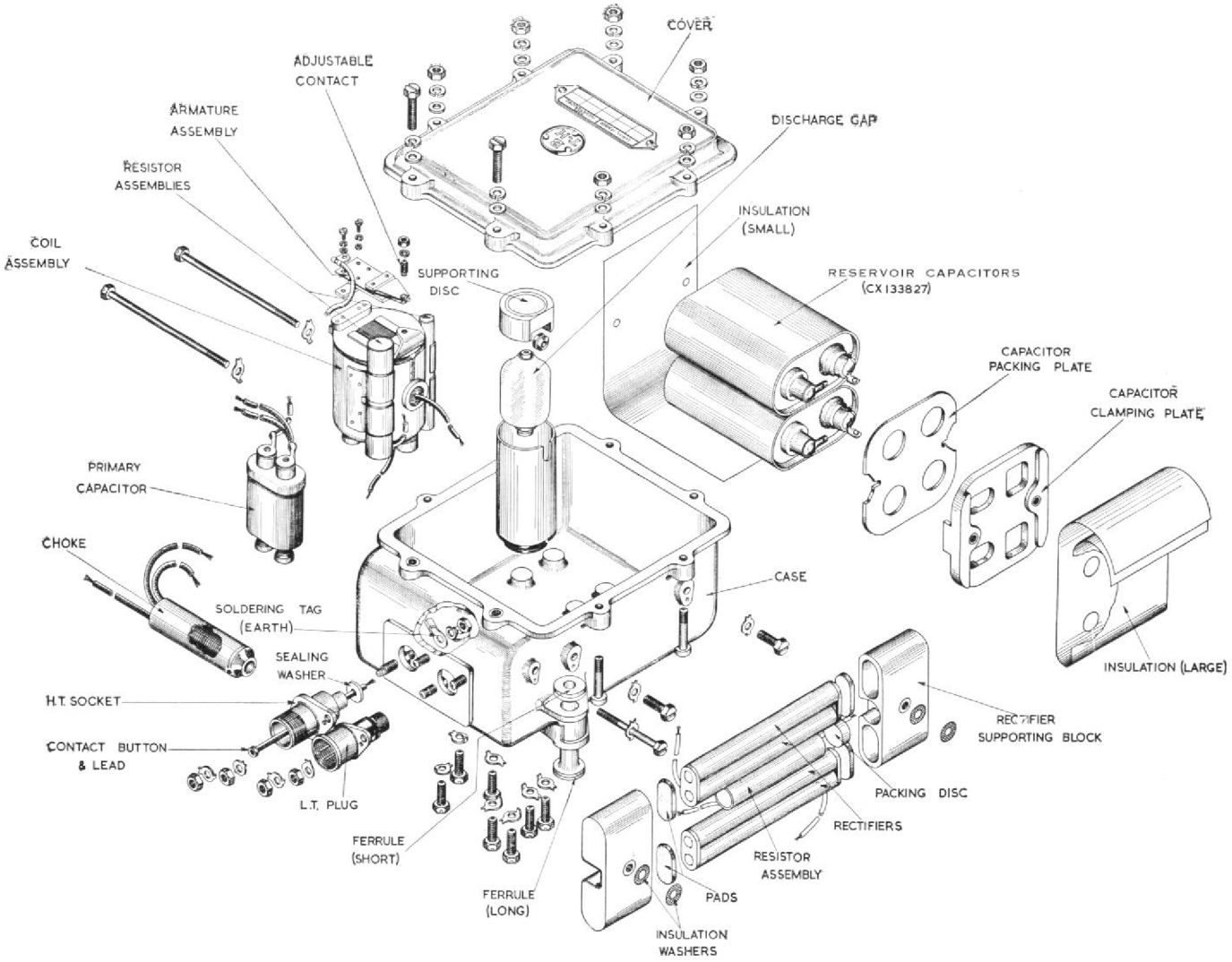
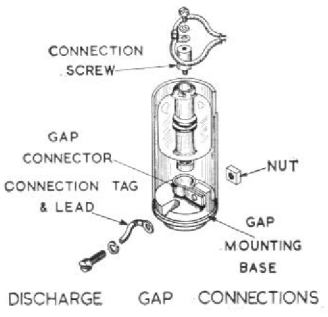


Fig. 9. Exploded view of Type C10TS/2 unit components; inset below shows details of discharge gap connections.

tion with 'Necol' cellulose cement, obtainable from Imperial Chemical Industries Ltd., Paints Division, Slough, Bucks, England.

H.T. SOCKET AND L.T. PLUG ASSEMBLIES. Attach the earth lead of the coil to the projecting portion of the longest stud securing the H.T. socket and secure with a nut locked with a tab-washer.

Pass the insulated body of the L.T. plug through its clearance hole in the end wall of the case, checking that the yellow varnished-silk insulated lead is connected to the positive pin B. Fit



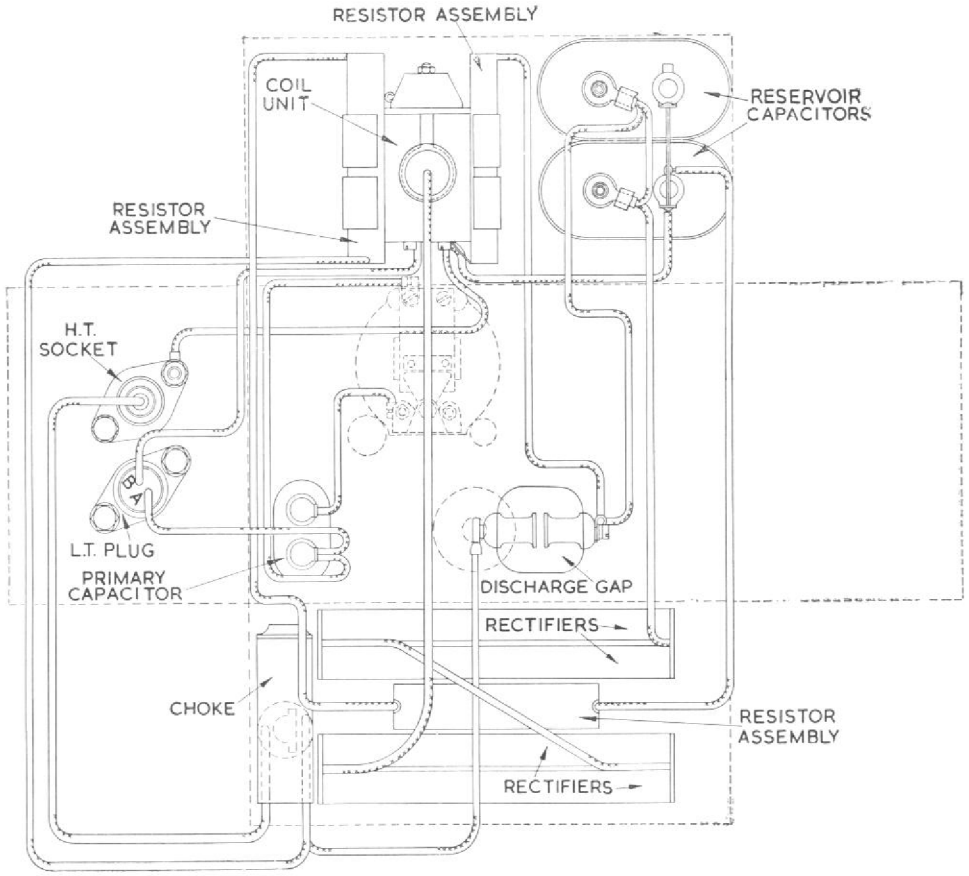


Fig. 10. Pictorial layout of components.

the insulated body back into the shell of the plug, positioning the rubber washer on the pins at the same time. Using a small screwdriver, prise back the circular clip until it slips into the groove machined in the plug shell and secures the insulated body. Now fit the plug shell on to its two locating studs using two 2 B.A. nuts and locking-tab washers. Tighten the nuts and bend up the tabs of the locking-tab washers.

DISCHARGE GAP AND CHOKE UNIT. There are three leads attached to the two terminals of the choke, the resistor and discharge gap leads being soldered to one terminal, while the H.T. terminal lead is soldered to the other. Pass the H.T. lead through the hole provided in the end of the case for the H.T. socket. Before assembling the choke to the side of the case, using a 4 B.A. screw and tab-washer, coat all joints, mating surfaces and threads of the choke, securing screw and tab-washer with BTH.3079 air-drying varnish. Hold the choke to prevent it turning when tightening the securing screw. Bend up the tab of the tab-washer.

Pass the H.T. lead through the rubber-sealing washer and then through the H.T. socket. Solder the H.T. contact button on to the lead and if necessary, file the contact face flat so that the distance between the outer rim of the socket and the front face of the contact button is between the limits of 0·797 inch and 0·782 inch. In some instances it may be necessary to use shims behind the contact button, as shown in Fig. 11, to obtain this dimen-

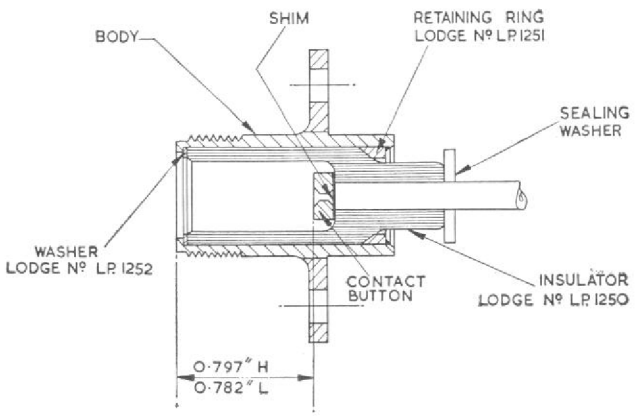


Fig. 11. Sectional view of H.T. socket.

sion. *The corresponding limits for the /1 unit are 0·635 inch and 0·620 inch.*

If the nut against the external locking-tab washer of the H.T. socket of a /1 unit has been removed, it must be re-tightened with a $\frac{7}{16}$ inch Whitworth indicating-type of torque spanner. The spanner must not slip at less than 250 in. lb. when exerting extra tightening force. Lock the new tab-washer securely against the tightened nut. Fit the locknut and tighten against the previously locked nut, using two $\frac{7}{16}$ inch Whitworth open-ended spanners, having jaws not exceeding $\frac{1}{8}$ inch thick.

COIL ASSEMBLY, PRIMARY CAPACITOR AND DISCHARGE GAP. Position the coil assembly on its three fixing holes, taking particular care to avoid trapping any leads. Varnish the spot-faced surfaces of the bottom wall of the case of the unit with BTH.3079 air-drying varnish, fit three tab-washers and varnish again before fitting the three 2 B.A. coil-retaining screws. Tighten the screws and lock with the tab-washers. If it has been removed, fit the resistor assembly (encased in the larger insulation tube) into its clip on the coil case.

Position the primary capacitor over its two fixing holes in the bottom corner of the case. Varnish the spot-faced underside of the case before and after fitting the securing screw tab-washers. Fit and tighten the screws and lock with the tab-washers.

At this stage, re-connect the leads between the primary capacitor and coil unit, arranging them in the space between the resistor and the inside of the case. When making connection to the primary capacitor do not allow the soldering iron to remain in contact with the capacitor terminals any longer than absolutely necessary to carry out the operation.

Fit the discharge gap assembly after ensuring that no leads are trapped by its moulded base. Varnish the securing screw tab-washers on both sides with air-drying varnish, fit and tighten the securing screws and bend up the tab-washers.

Fit the small rubber grommet on the lead which is fitted to the upper end of the discharge gap. The lead is either soldered into a horizontally-drilled hole in the older type of connection screw, or attached by means of a connection tag and 6 B.A. screw into a vertically-tapped hole in the later type of screw. The later type of connection screw will be required if reservoir capacitors, Ref. CX133827 have been fitted. Place the rubber grommet in the slot in the discharge gap insulation tube and arrange the surplus length of lead around the inside of the insulation tube.

RECTIFIER ASSEMBLY, RESERVOIR CAPACITORS, etc. Assemble the rectifier assembly, comprising end-mouldings, resistor and rectifiers, in accordance with the wiring diagram shown in Fig. 10. Connect the yellow varnished-silk insulated lead emerging through the rubber grommet in the side of the coil case to the top rectifier tube. Ensure that there is a rubber pad at the bottom of each rectifier locating socket in the end-mouldings and that a rubber packing piece is located in one of the resistor locating sockets..

When fitting two new reservoir capacitors, Ref. CX133827, assemble the associated components as shown in Fig. 9. *The associated components for the reservoir capacitors, Ref. CX122433 are shown in Fig. 12.*

When fitting two capacitors, CX133827, in place of capacitors CX122433, note that the wiring of the unit should be modified slightly so that it is in accordance with Fig. 10, and that the later type of discharge-gap connection screw (having a vertically-tapped hole) must be fitted.

The two stages of connection procedure for reservoir capacitors, Ref. CX133827, as shown in A and B of Fig. 13.

When making connections to the reservoir capacitors, take particular care to avoid exerting excessive pressure on the capacitor terminals as maltreatment may cause leakage of the impregnant. When making connections to the terminals, do not allow the soldering iron to remain in contact with the terminals any longer than is absolutely necessary to carry out the operation.

Position the smaller piece of varnished glass insulation over the bottom and side faces of the case so that the two holes punched in it coincide with the 4 B.A. holes in the case for the reservoir capacitor fixing screws. Lower the two capacitors and their associated components into the case, taking particular care to avoid straining their terminals and trapping any of the leads. Fit the two 4 B.A. fixing screws and tab-washers after coating both sides of the washers with air-drying varnish and ensuring that the glass insulation is positioned correctly.

The rectifier assembly may now be assembled into the case. Fit the securing screws after coating both sides of the associated tab-washers with air-drying varnish. Tighten the screws after checking that the rubber pads in the rectifier end-mouldings are positioned correctly and then bend up the tab-washers.

Fold and arrange the free ends of the larger piece of glass insulation (the piece over the capacitor terminals), into the space between the capacitor clamping plate and the rectifier assembly, as shown in C of Fig. 13 and Fig. 2 and 9.

Replace the rubber supporting disc on top of the discharge gap in its insulation tube. Check that the pressure required to compress this rubber disc when fitting the unit cover on to its fitting face, does not exceed 4 lb.

Before the unit cover is fitted finally together with its associated screws, nuts and tab-washers,

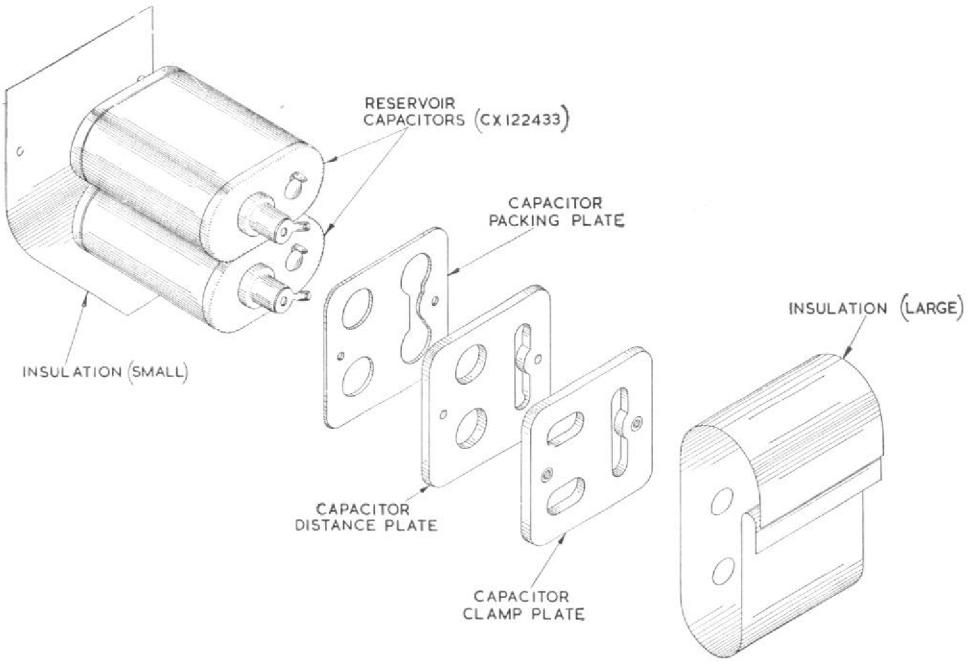


Fig. 12. Assembly of reservoir capacitor CX122433 components.

coat the mating surfaces of the cover and case with 'Wellseal' jointing compound, obtainable from The Wellworthy Piston Ring Ltd., Lymington, Hampshire, England. The unit must now be tested as described on this page.

If the enamelled surfaces of the unit have been damaged they should be 'touched up' where necessary with black enamel in accordance with Specification D.T.D.260. Care should be taken to ensure that the enamel seals all the joints.

TESTING

At the end of every 3000 flying hours period (assuming approximately 1000 engine-starting operations during this period), and at the completion of any major repairs or replacements, test the ignition unit as detailed below.

For all tests involving the operation of the ignition unit, connect the output socket to a surface-discharge plug by means of a length of cable and conduit, as shown in Fig. 6. *Particulars of the cable for the J1 unit are shown in Fig. 7.* A length of cable of approximately 5 feet is recommended, and a standard screened engine lead may be used for the purpose with a suitable adaptor to house the discharge plug.

Support the surface-discharge gap vertically with its sparking end uppermost and, during the

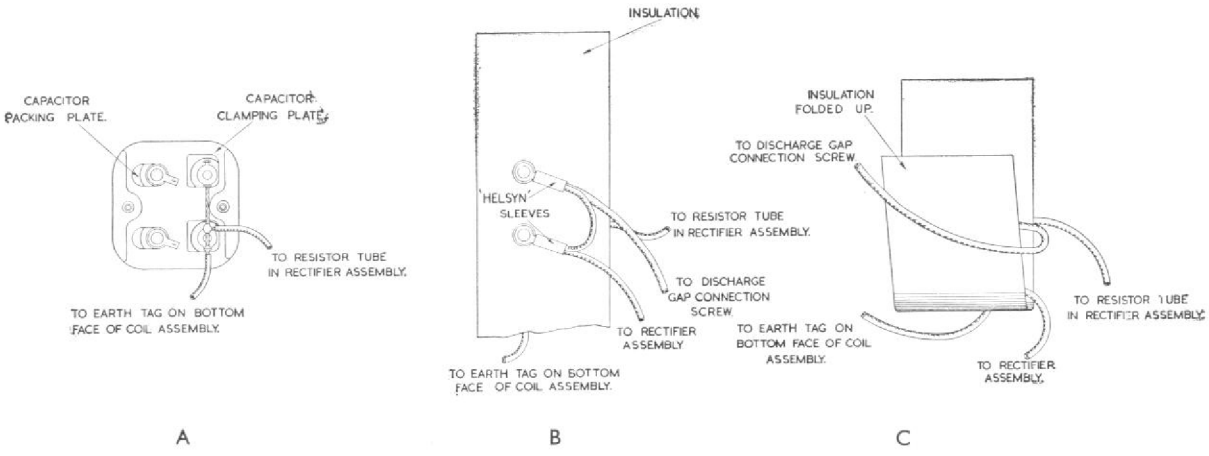


Fig. 13. Method of making connections to reservoir capacitors CX133827.

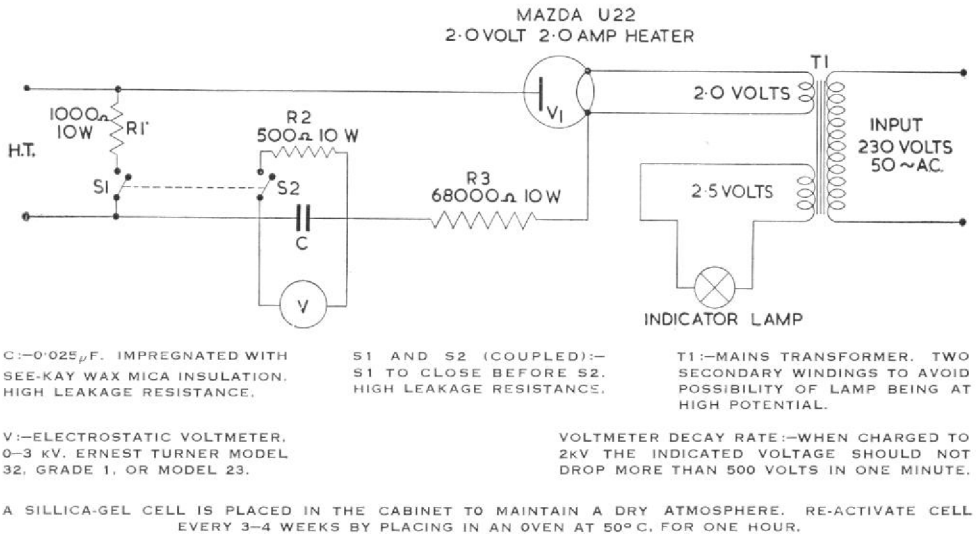


Fig. 14. Circuit diagram and details of peak voltmeter.

tests, maintain a carbon film on the sparking surface by dripping kerosene on to it from a pipette. Ten drops per minute is recommended and the kerosene should be filtered.

The input voltage must be maintained at the values specified in this chapter, within the limits of minus 0 + 1 volt, by tapping from batteries, without the use of resistors ; and the correct input polarity must be observed.

WARNING

(I) Do not operate the unit in a confined space where petrol is stored, batteries are charged, or inflammable vapour of any kind is likely to be present.

(II) Great care must be taken not to touch the end of the output lead, the discharge plug, or any part of the H.T. circuit when the unit is in operation, particularly when the cover is removed, otherwise a lethal shock will be received.

INPUT CURRENT. Measure the input current on 24 volts input with a moving-coil ammeter, and set the input current value to approximately 2·25 amperes by adjustment of the contact setting. In order to obtain this setting, it may be found necessary to increase the pressure of the armature spring by stroking gently between finger and thumb. After adjustment the input current must not exceed 2·5 amperes on 24 volts input.

MEASUREMENT OF PEAK CAPACITOR VOLTAGE. With the unit connected as described previously and with 29 volts applied to the input terminals, measure the peak voltage across the reservoir capacitors, using a peak-voltage voltmeter, the circuit of which is shown in Fig. 14. The voltage must be within the limits of 1·9 kV and 2·1 kV. Then disconnect the high-tension cable from the plug for a period of one minute and re-measure the peak voltage across the capacitors. This value must not exceed 2·5 kV.

PERFORMANCE TEST. With the unit connected as described previously, apply voltages of 16, 21, 24 and 28 volts to the input terminals for one, three, one, and one minute periods respectively, and count the number of sparks over a period of one minute at each voltage. The discharge rate on 24 volts input must not be less than sixty sparks per minute.

During the three minute test on 21 volts input, measure the time taken for ten sparks, six times, with a stop watch. In no case must this time exceed twelve seconds.

INSULATION TEST. Immediately after the performance test, measure the value of insulation resistance between the input terminals and the case, using a 500 volt Megger ; this value must not be less than 20 megohms.

ALTITUDE TEST. Enclose the ignition unit in an altitude box of approved design with the surface-discharge plug connected externally and supported vertically so that kerosene can be applied to its sparking surface as described previously.

Exhaust the altitude box to the equivalent of an altitude of 60000 feet, *55000 feet for the 11 unit,* and subject the unit to a one minute test with an input of 28 volts.

Check during the altitude test to ensure that no flash-over occurs other than at the discharge gap. In order to do this, it will be necessary to make a prior check without the cover fitted to the unit, and then fit the cover for a final test of one minute.

If the unit will not perform satisfactorily any of the requirements of this chapter, consult the

table on page 16 for assistance in diagnosing the fault.

STORAGE OF COMPLETE UNITS AND SPARE COMPONENTS

Ignition units and spare components must be stored in a dry atmosphere. They must not be stored where accumulators are present, otherwise the corrosive fumes emitted by the accumulators may cause damage. It is strongly recommended that all parts which cannot be stored in a dry atmosphere be pre-packed. Before placing a stored ignition unit into service, remove the cover and examine the interior for signs of corrosion. Should any corrosion be present, the ignition unit must be dismantled, overhauled, and tested.

SPECIAL TOOLS

No special tools are required during the overhaul of a Type C10TS/2 unit. *The only special tool required during the overhaul of a Type C10TS/1 unit is a $\frac{7}{16}$ inch Whitworth indicating-type torque spanner. This spanner must not slip at less than 250 in. lb. when tightening the nut on the H.T. socket of this type of unit.*

CONSUMABLE SPARES

The following is a list of spares which may be required for replacement purposes at each complete overhaul of an ignition unit.

Description	*Part No.*	*Qty.*
Armature assembly	CX117465	1
Adjustable contact	CX125398	1
3 BA locking washer for adjustable contact	CX95855-3	1
3 BA locknut for adjustable contact	CX136237	1
6 BA screw for armature assembly	CX112414-3	2
6 BA locking washer for armature securing screws	CX95855-1	2
6 BA connection tag, single-ended, for armature assembly connection lead	CX99373	1
2 BA locking washer for screws and nuts securing the cover to case	CX122547-4	8
2 BA locking-tab washer for H.T. socket and L.T. plug assemblies (/2 unit only)	CX112403-7	4
Locking-tab washer for H.T. socket assembly (/1 unit only)	CX134599	1
2 BA locking washer for H.T. socket assembly earth connection (/2 unit only)	CX112420-2	1
2 BA locking-tab washer for screws securing coil unit, discharge gap assembly, primary capacitor and rectifier assembly end-mouldings	CX53791	9
6 BA locking washer for screw securing discharge gap connector to mounting base	CX95855-1	1
Discharge gap	CX122545	1
'Helsyn' sleeve, Type DP, for leads to reservoir capacitor terminals	$\frac{9}{32}$″ I.D. × $\frac{3}{4}$″ long	2
4 BA locking-tab washer for screws securing reservoir capacitors and choke assembly	CX77922	3
Grommet for coil case	CX124919	1
Grommet for discharge gap insulation tube	CX126961	1
Pad for rectifier end-mouldings	CX122536	4
Packing disc for resistor socket of rectifier end-moulding	CX122842	1
Lead for internal connection purposes	40/0·0076″ tinned H.C.C. P.V.C. covered (black) insulation. Permanoid grade 'SX' × 0·128″ O.D.	As req'd.
Ferrule (long) for case mounting lugs	CX122533	3
Ferrule (short) for case mounting lugs	CX122534	3
'Wellseal' jointing compound	—	As req'd.
BTH 3079 air-drying varnish	—	As req'd.
DTD 260 black enamel	—	As req'd.
'Necol' cellulose cement	—	As req'd.
'Bostikol' insulating compound, Type B/23/01	—	As req'd.

The following additional spares will be required when reservoir capacitors Ref. CX133827 are being fitted in place of capacitors CX122433.

Description	*Part No.*	*Qty.*
Reservoir capacitor	CX133827	2
Packing plate for capacitors	CX136056	1
Clamping plate for capacitors	CX136015	1
Connection screw for discharge gap	CX133069	1
6 BA locking washer for screw securing connection tag and connection screw	CX95855-1	2
6 BA screw securing connection tag to connection screw	CX112434-35	1
6 BA connection tag for upper connection to discharge gap	CX99373	1
Insulation (small) for reservoir capacitors	CX124563	1
Insulation (large) for terminals of reservoir capacitors	CX125387	1

DEFECT DIAGNOSIS

Defect	*Possible cause*	*Remedy*
(1) Low input current (less than 1·75 amp. approx. on 24 volts input)	Incorrect armature contact adjustment	Examine contacts as described on page 9, and adjust as described on page 14.
(2) High input current (more than 2·5 amp. on 24 volts input)	(a) Contacts welded together (input current will be very high)	Examine contacts as described on page 9, and adjust as described on page 14.
	(b) Faulty primary circuit connections	Examine connections and check wiring.
	(c) Short-circuited or open-circuited primary capacitor or associated connections	Remove capacitor as described on page 7 and check as described on page 9.
	(d) Faulty coil primary winding	Remove coil assembly and check as described on page 8.
(3) No input current	(a) Faulty input external circuit	Check all external connections.
	(b) Open-circuited primary circuit in unit	Check all primary circuit connections and wiring in unit.
	(c) Open-circuited coil primary winding	Remove coil assembly and check as described on page 8.
(4) Excessive sparking at coil contacts	(a) Primary capacitor faulty	Remove capacitor as described on page 7 and check as described on page 9.
	(b) Contacts worn excessively	Check contacts as described on page 9 and then adjust as described on page 14.
(5) Low spark frequency of H.T. discharge	(a) Incorrect armature contact adjustment	Examine contacts as described on page 9, and adjust as described on page 14.
	(b) High discharge gap voltage	Remove discharge gap and fit a new one as described on pages 9 and 12.
	(c) Faulty coil assembly	Remove coil assembly and check as described on page 8.
	(d) Faulty rectifier assembly	Remove rectifier assembly and fit new rectifiers as described on pages 9 and 12.
	(e) Faulty resistor assembly (smaller diameter tube assembled in clip on side of coil assembly)	Remove coil assembly and check resistor assembly as described on page 8.
	(f) Faulty surface discharge plug	Carbonize or fit new plug.
(6) High spark frequency of H.T. discharge	(a) Low discharge gap voltage	Remove discharge gap and fit a new one as described on pages 9 and 12.
	(b) Faulty reservoir capacitors or open-circuited connections between reservoir capacitors	Remove reservoir capacitors and fit new ones as described on pages 9 and 12. Check all connections to capacitors.
(7) Continuous sparking at surface discharge plug	(a) Faulty reservoir capacitors or connections to reservoir capacitors	Remove reservoir capacitors and fit new ones as described on pages 9 and 12. Check all connections to capacitors.
	(b) Faulty discharge gap	Remove discharge gap and fit a new one as described on pages 9 and 12.
(8) Discharge gap fires but surface discharge plug does not fire	(a) Faulty surface discharge plug	Carbonize or fit new plug.
	(b) Faulty insulation in external H.T. circuit	Check H.T. lead and fittings.
	(c) Faulty insulation in H.T. socket or discharge section of unit	Examine all H.T. insulated components and renew as necessary.

Defect	*Possible cause*	*Remedy*
(9) Discharge at surface discharge plug cuts out at altitude	Faulty insulation in H.T. socket or discharge section of unit	Examine all H.T. insulated components and renew as necessary.
(10) No H.T. discharge either at discharge gap or surface discharge plug	(a) Incorrect armature contact adustment	Examine contacts as described on page 9, and adjust as described on page 14.
	(b) Armature assembly not 'trembling'	Check primary circuit, and if necessary, remove coil assembly and check as described on page 8.
	(c) Faulty coil secondary winding	Remove coil assembly and check as described on page 8.
	(d) Faulty rectifier assembly, or connections	Remove rectifier assembly and fit new rectifiers as described on pages 9 and 12. Check associated connections.
	(e) Faulty reservoir capacitors, or connections	Remove reservoir capacitors and fit new ones as described on pages 9 and 12. Check all connections to capacitors.
	(f) Faulty resistor assemblies	Remove resistor assemblies as described on page 8 and check as described on page 9.
	(g) Faulty discharge gap	Remove discharge gap and fit a new one as described on pages 9 and 12.