SERVICING

ROUTINE MAINTENANCE

Routine maintenance is not necessary. An occasional check should be made on the tightness of electrical connections and security of the unit to the engine.

TEST PROCEDURES

In Position

Connect a voltmeter (0-20 range) between the battery terminals and then operate the starter switch. If the voltmeter reading falls appreciably but the starter motor does not turn the engine check that the battery is sufficiently well charged. If however, the voltmeter reading remains unaffected and the starter motor does not turn the engine, check that the terminal connections at the battery starter switch and starter motor and clean and secure.

On Bench

Measuring the Light Running Current

Secure the starter motor in a vice, check the light running current and armature speed using a 12 volt battery and a suitable ammeter. Typical performance characteristics obtained with a 12 volt, 120 amp./hr. (20 hour rate) battery in a well-charged condition are, 100 amperes at 5,500 –7,500 r.p.m. inclusive of the solenoid hold-on current. Connect one terminal of the battery, via the ammeter to either of the solenoid terminals that are linked with the copper strap and from this connection make a short link to the Lucar terminal. Connect the remaining battery terminal to the yoke of the motor, see Fig. 1.

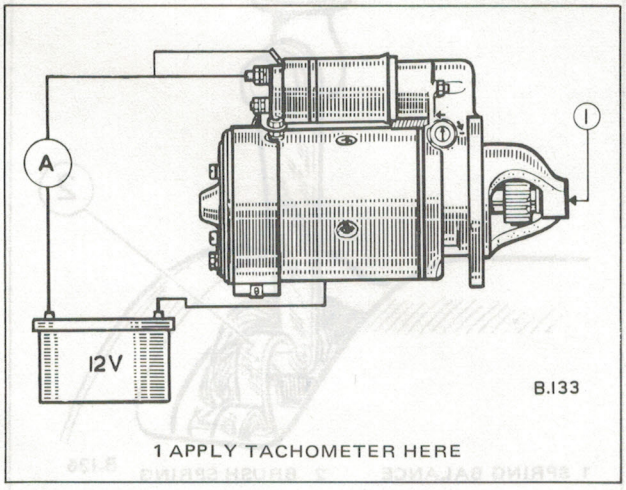


Fig. 1. *Measuring light running current and speed*

Measuring Lock Torque and Current

Keep the same electrical connections as indicated under 'Measuring the Light Running Current', carry out a lock torque test as shown in Fig. 2. Typical peformance figures are as quoted in 'Data'.

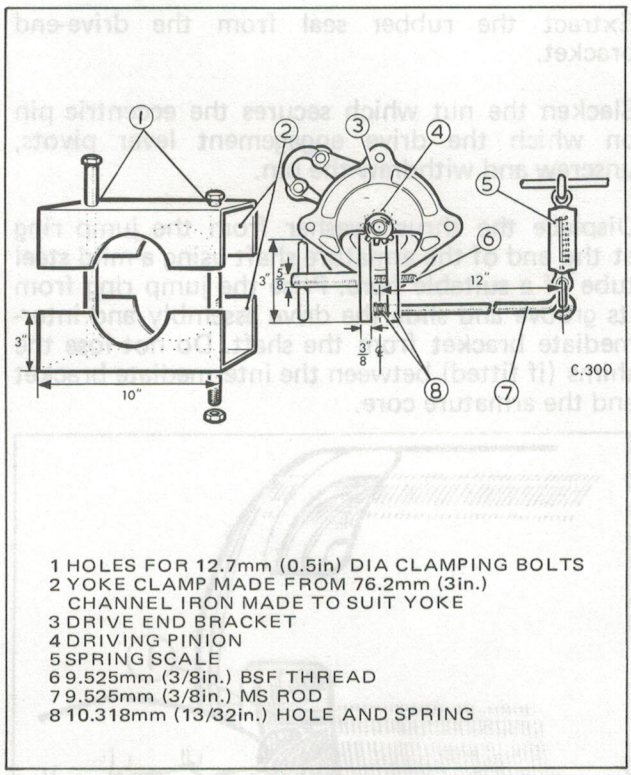


Fig. 2. *Measuring lock torque*

If a constant voltage supply is used, ensure that it is adjusted to 5 volts at the starter motor terminal when testing.

If the starter motor fails to perform satisfactorily in either or both of the foregoing tests it must be replaced with a new unit or dismantled for examination.

OVERHAUL

To Dismantle

Disconnect the copper link and eyeletted cable from solenoid terminals S1 and S2

Remove the two solenoid securing nuts. Withdraw the solenoid from the drive-end bracket casting, carefully disengage the solenoid plunger from the intermediate and drive-end brackets.

Unscrew and withdraw the two through-bolts from the commutator-end bracket. The commutator-end bracket and yoke can then be removed from the intermediate and drive-end brackets.

Extract the rubber seal from the drive-end bracket.

Slacken the nut which secures the eccentric pin on which the drive engagement lever pivots, unscrew and withdraw the pin.

Displace the thrust washer from the jump ring at the end of the armature shaft using a mild steel tube of a suitable bore. Prise the jump ring from its groove and slide the drive assembly and intermediate bracket from the shaft. Do not lose the shims (if fitted) between the intermediate bracket and the armature core.

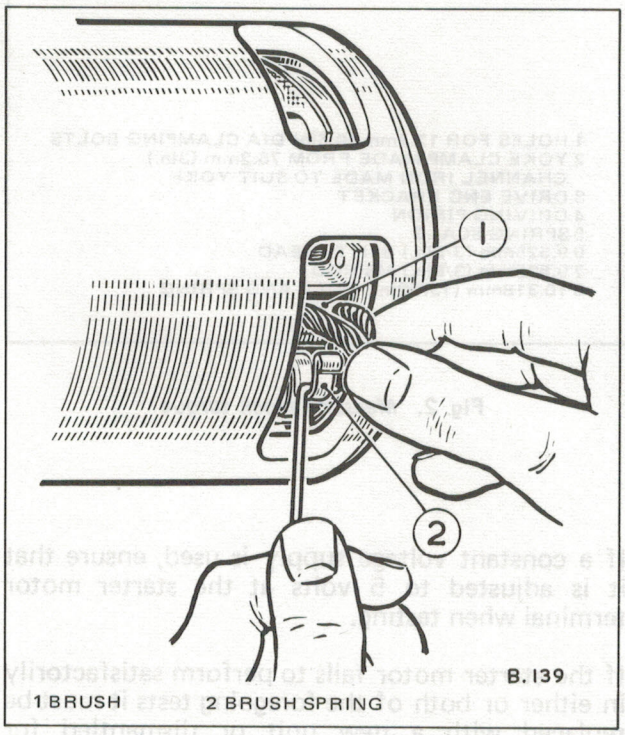


Fig. 3 *Checking brushgear*

Inspection and Overhaul

Brushes

Check that the brushes are free to move in their holders as shown in Fig. 3. If necessary, remove the brushes and clean with a non-fluffy petrol-moistened rag. Refit the brushes in their original positions. Renew the brushes, if worn, to 7.9mm (5/16 in.) in length, or approaching it.

The two earth brush flexible connectors are soldered to terminal plates secured by brush box rivets, and the two insulated brush flexible connectors are hot pressed to the free ends of the field coils.

To replace the insulated brushes:

(a) Cut off the brush flexibles about 3mm (1/8 in.) from the hot-pressed joint.

(b) Open out and tin the loop of the replacement brush.

(c) Place the tinned loop over the stub of the flexible, squeeze up and solder.

(d) Check that the new brushes move freely in their boxes.

Note. The brushes are pre-formed so that 'bedding in' to the commutator is unnecessary.

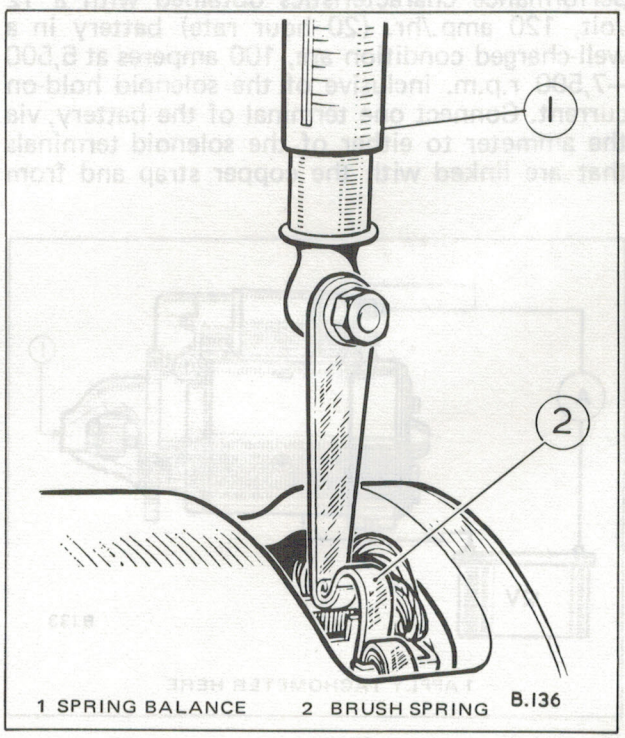


Fig. 4 *Checking brush spring pressure*

Test the brush spring tension using a spring balance in the manner shown in Fig. 4. Check with the spring tension quoted in 'DATA' and renew the spring if tension is low.

Commutator

A commutator in good condition will be burnished and free from pits and burn spots. Clean the commutator with a petrol-moistened cloth. If this is ineffective, spin the armature and carefully polish the commutator with a strip of fine glass paper (do not use emery cloth). Remove all abrasive dust with dry compressed air.

If the commutator is badly worn mount the armature between centres in a lathe, rotate at high speed and take a light cut with a very sharp tool. Do not move more metal than is necessary. The minimum diameter to which the commutator can be machined is 39mm (1.5in.) Polish with a very fine glass paper. Remove all dust using dry compressed air. *The insulators between the commutator segments must not be undercut under any circumstances.*

Armature

If the armature conductors are found to be lifted from the commutator/riser, overspeeding is indicated. This may be due to the starter motor having remained engaged while the engine is running, thus causing the armature to be rotated at excessive speed. Check that the clutch assembly is disengaging when the engine fires.

The armature must always be renewed if damaged, no attempt should be made to true a distorted shaft or to machine the armature core. An indication of a bent shaft or worn bearings is given by scored armature laminations.

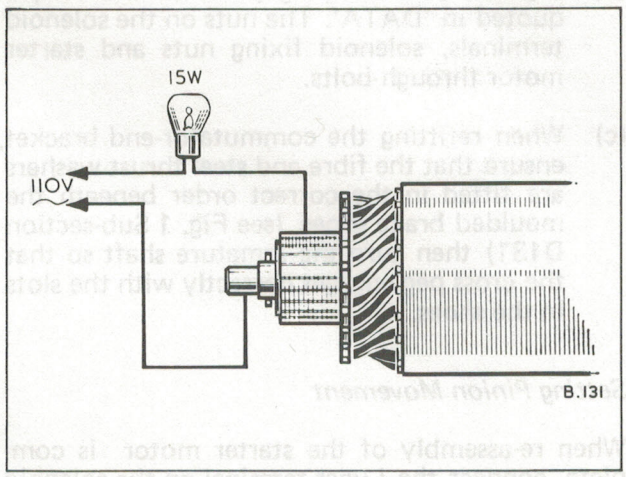


Fig. 5. *Armature winding insulation test*

To check the armature insulations, use a 110 volt A.C. 15 watt test lamp as shown in Fig. 5. Before testing remove all traces of brush dust. The test lamp must not light when connected between the commutator segment and the armature shaft, faulty insulation will be indicated if the test lamp lights.

If a short circuit in the windings is suspected, check the armature on a 'growler'. Overheating may cause blobs of solder to short circuit the commutator segments.

If the cause of the armature failure cannot be located and remedied a replacement armature must be fitted.

Field Coils

Test the field coils for continuity by connecting a 110 volt A.C. test lamp between the field coil eyelet and a clean part of the yoke, see Fig. 6. If the test lamp lights it indicates that the field coils are earthed to the yoke and must be renewed.

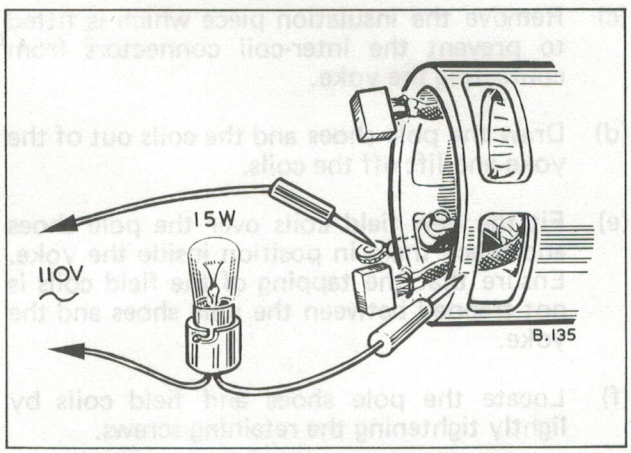


Fig. 6. *Field coil insulating test using low voltage mains*

Using the same equipment, check the insulated pair of brush boxes on the commutator-end bracket. Clean off all traces of brush deposit before testing. Connect the test lamp between each insulated brush box and the bracket, see Fig. 7. If the lamp lights, this indicates faulty insulation and the end bracket must be renewed.

To renew the field coils, carry out the following procedure.

(a) Mark the yoke and pole shoes in order that they can be refitted in the original position.

(b) Unscrew the four pole shoe retaining screws using a wheel operated screwdriver.

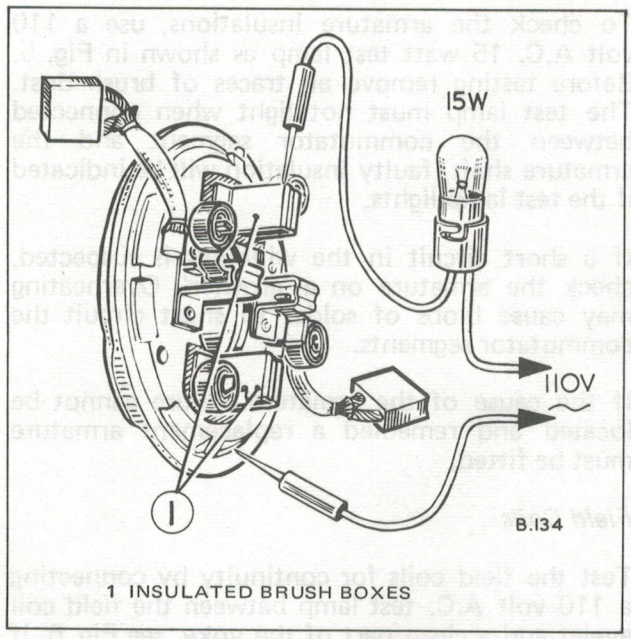


Fig. 7. *Brush-box insulation test using A.C. mains low voltage*

(c) Remove the insulation piece which is fitted to prevent the inter-coil connectors from contacting the yoke.

(d) Draw the pole shoes and the coils out of the yoke and lift off the coils.

(e) Fit the new field coils over the pole shoes and place them in position inside the yoke. Ensure that the tapping of the field coils is not trapped between the pole shoes and the yoke.

(f) Locate the pole shoes and field coils by lightly tightening the retaining screws.

(g) Refit the insulating piece between the field coil connections and the yoke.

(h) Finally tighten the screws by means of the wheel operated screwdriver.

Bearings

The commutator-end, drive-end and intermediate brackets are each fitted with a porous bronze bush. Bushes which are worn to the extent of allowing side movement of the armature shaft must be renewed. Maximum permissible measurements are:

Commutator-end bracket bush 12.827mm (0.505 in.) Intermediate bracket bush 28.625mm (1.127 in.)
Drive-end bracket bush 16.145mm (0.675 in.)

The bushes in the intermediate and drive-end brackets can be pressed out, whilst that in the commutator end bracket is best removed by inserting a 14.29 mm (9/16 in) tap squarely into the bush for a few turns to provide a purchase for extraction.

Press the new bushes into the shaft using a shouldered highly polished mandrel of the correct diameter, namely:

for Commutator-end bracket bush 12.7 mm (0.5 in.)
for Intermediate brack bush 28.4 mm (1.1 in.)
for Drive-end bracket bush 17.0 mm (0.67 in.)

Note: The new bushes should be completely immersed in clean engine oil for 24 hours prior to fitting.

Porous bronze bushes must not be reamed out after fitting or the porosity of the bush will be impaired.

To Re-Assemble

After cleaning all parts, the re-assembly procedure is the reversal of the dismantling procedure with particular attention given to the following.

(a) The thrust shims must be refitted between the intermediate bracket and the armature (see 'TO DISMANTLE'). The shims limit the end float to 0.127—0.508mm (0.005—0.020 in.). It is important to check the end float and, if necessary, adjust by shimming. Shims are available 0.254 and 0.457mm (0.010 and 0.018 in.) in thickness.

(b) Tighten the following parts to the torque quoted in 'DATA'. The nuts on the solenoid terminals, solenoid fixing nuts and starter motor through-bolts.

(c) When refitting the commutator-end bracket, ensure that the fibre and steel thrust washers are fitted in the correct order beneath the moulded brake shoes, (see Fig. 1 Sub-section D131) then turn the armature shaft so that the cross peg engages correctly with the slots in the shoes.

Setting Pinion Movement

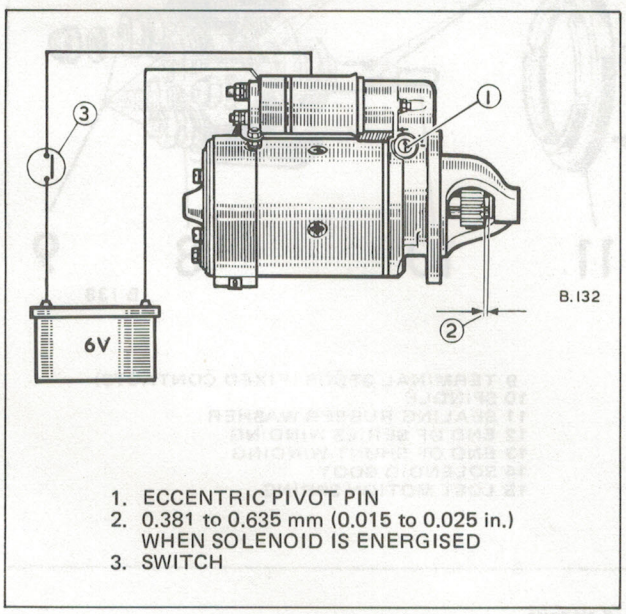
When re-assembly of the starter motor is complete, connect the Lucar terminal on the solenoid unit by way of a switch to a 6 volt supply.

Connect the other side of the supply to the starter motor yoke.

Close the switch, this throws the drive assembly forward into the engaged position. With the drive assembly in this position measure the distance between the front edge of the pinion and the thrust washer on the armature shaft extension.

Note: Make this measurement with the pinion pressed lightly towards the armature to take up any slack in the engagement linkage. For the setting to be correct this distance should be 0.381 to 0.625 mm (0.015 to 0.025 in).

Ensure that the eccentric pivot pin securing nut is slack, and turn the pin until the correct setting is obtained. It will be noted that the arc of adjustment is 180° and the head of the arrow marked on the pivot pin (see Fig. 8) should be set only between the arrow heads on the drive end bracket casting. After setting, tighten the securing nut to retain the pin in position and recheck the setting.



1. ECCENTRIC PIVOT PIN
2. 0.381 to 0.635 mm (0.015 to 0.025 in.) WHEN SOLENOID IS ENERGISED
3. SWITCH

Fig. 8. Setting pinion movement limit

ROLLER CLUTCH DRIVE

To Check

If the roller clutch drive assembly is in good condition it will:

(a) Provide instant take-up of the drive in the one direction.

(b) Rotate easily and smoothly in the other direction.

(c) Be free to move round or along the shaft splines without roughness or tendency to bind.

Should the assembly not meet any or all of these conditions, a replacement unit must be fitted.

All moving parts must be smeared liberally with Rocol 'Molydest' grease, starter motor grade, or an equivalent alternative.

SOLENOID

Current Checking of Solenoid Windings

The series and shunt windings of the operating coil can be checked individually by removing the solenoid external connections and carrying out low voltage direct current consumption tests. A 44/012 cable is needed with two moving coil ammeters, one calibrated 0—40 and the other 0—10, and a 4 volt constant voltage supply. The tests must be carried out with the windings cold. The solenoid internal connections are shown in Fig. 2 Sub-section D131.

(a) *Closing or Series Windings*

Using an 0—40 ammeter, connect the 4 volt supply between the main terminal 'S2' and the Lucar terminal, a current of 26 to 31 amperes should be indicated on the ammeter. If no current flows, the winding is open-circuited and a replacement unit must be fitted.

(b) *Hold-on or Shunt Winding*

Using an 0—10 ammeter, connect the 4 volt supply between the Lucar terminal and the solenoid body. A current of 5.5 to 6.5 amperes should be indicated. If no current flows, the winding is open-circuited and a replacement unit must be fitted.

Note: The resistance values of the two windings are 0.13 to 0.15 ohm (closing winding) and 0.63 to 0.73 ohm (hold-on winding).

Replacement of Terminal Base and Contacts Assembly

If a new solenoid unit is unobtainable, it is permissible to renew the terminal base and contacts assembly only, proceed as follows:

(a) Remove the two nuts which secure the moulded cover, together with the rubberised spring washers.

(b) Unsolder the ends of the winding from the soldered connections at the inner end of the Lucar terminal blade and at the terminal strip positioned 180° away. Pull the moulded cover gently away from the body of the solenoid during unsoldering.

(c) Withdraw the cover complete with contacts assembly once the unsoldering is completed.

(d) Re-assembly is a reversal of the removal procedure, resolder as necessary.

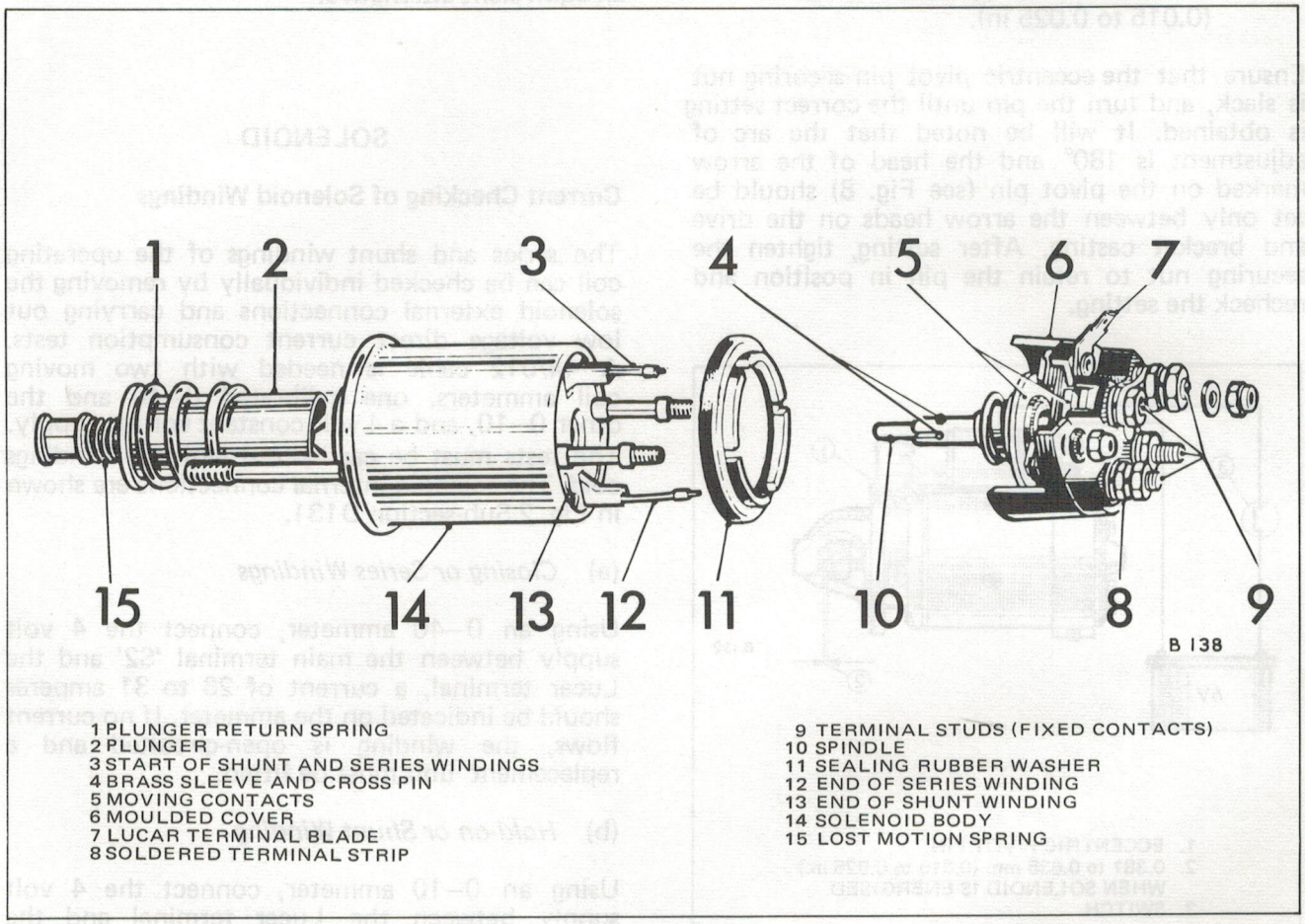


Fig. 9 *Solenoid details*