SERVICING

MAINTENANCE

To ensure maximum life and trouble-free starting the following maintenance procedures should be undertaken at regular intervals dependent on operating conditions.

The starter should be examined to ensure the mounting bolts are securely fastened, and that all cable connections are clean and tight. High tensile steel bolts and heavy gauge spring washers must be used for securing the starter. The cables should also be inspected for fractures particularly at the point entering the terminal lug. The cable insulation should be free from chafing or deterioration.

Lubrication

The drive end bearing is lubricated by a wick contained in the drive endshield oil reservoir. The reservoir requires no attention during routine maintenance but should be refilled when the starter is dismantled at major overhaul periods, see INSPECTION AND OVERHAUL. In cases where the starter is not subjected to regular overhauls, the reservoir must be replenished at intervals of not more than two years. This should be done by removing the starter and adding a supply of oil through the oil filter hole in the drive end shield. The filler hole lies beneath a core plug which must be removed to gain access to the filler hole. New Plugs must be fitted using Tool No. 5693-300, and care must be taken to ensure a positive fit in the filler hole otherwise they will fall out in service.

An oil impregnated bearing is fitted at the commutator end of the machine and requires no attention.

Any attempt to grease the bearing may adversely affect its self-lubricating properties.

Difficulty in smooth pinion engagement may be caused by dirt on the armature shaft helix preventing the pinion moving freely along the shaft. If this occurs the starter should be removed and the helix and pinion sleeve cleaned with paraffin, and then lightly smeared with Aero Shell 6B grease.

TEST PROCEDURES

In Position

Ensure that the battery is fully charged. A defective starter switch or relay will prevent the starter from operating. To check the switch, temporarily bridge the terminals with a length of cable. If the starter now operates, the switch is defective. The ST relay may be checked by substitution. This particular relay fitted to the starting system has been chosen to operate satisfactorily with the starter and generator as fitted to the engine. The relay is NOT adjustable and cannot be serviced. If the relay is defective in any way it MUST BE REPLACED BY A NEW ONE OF IDENTICAL TYPE SYMBOL. THIS IS VITAL TO THE PROPER FUNCTIONING OF THE STARTER MOTOR. Test procedures for the 414 relay are given under "Bench Tests".

To ensure effective starter operation it is recommended that the total voltage drop in the cables, starter switch, relay, or any other switch in the 12 volt starter circuit does not exceed ½ volt at 38 amp for the starter solenoid circuit and ¼ volt at 5,3 amp for the relay switch circuit.

On the Bench

Solenoid Engagement Mechanism

WARNING:

WHEN TESTING SOLENOID ENGAGEMENT MECHANISM UNDER NO CIRCUMSTANCES SHOULD BOTH MAIN TERMINALS BE CONNECTED TO THE SUPPLY. OTHERWISE THE PINION WILL ROTATE AT HIGH SPEED WHEN PULLED FORWARD, CAUSING SERIOUS INJURY TO THE OPERATOR.

With the machine disconnected, pull the pinion forward by hand approximately 1,6 mm (0,0625 in) and release. The pinion should return to its original position.

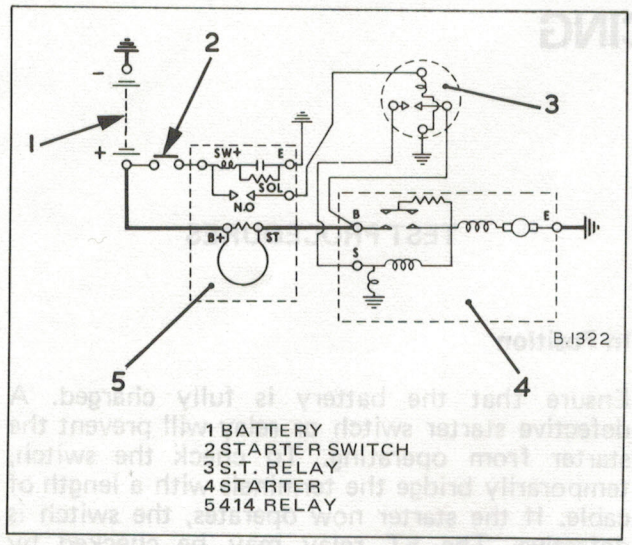


Fig. 1 *Typical 12 volt earth return circuit*

Energise the solenoid when cold by applying a battery voltage of 12 volt. For ALL tests the battery should be well charged, in good condition and of minimum capacity as indicated in Data.

It should be connected between the solenoid terminal 'S' and earth terminal for machines designed for earth return systems, and between the solenoid terminal 'S' and solenoid 'R' terminal for insulated return machines.

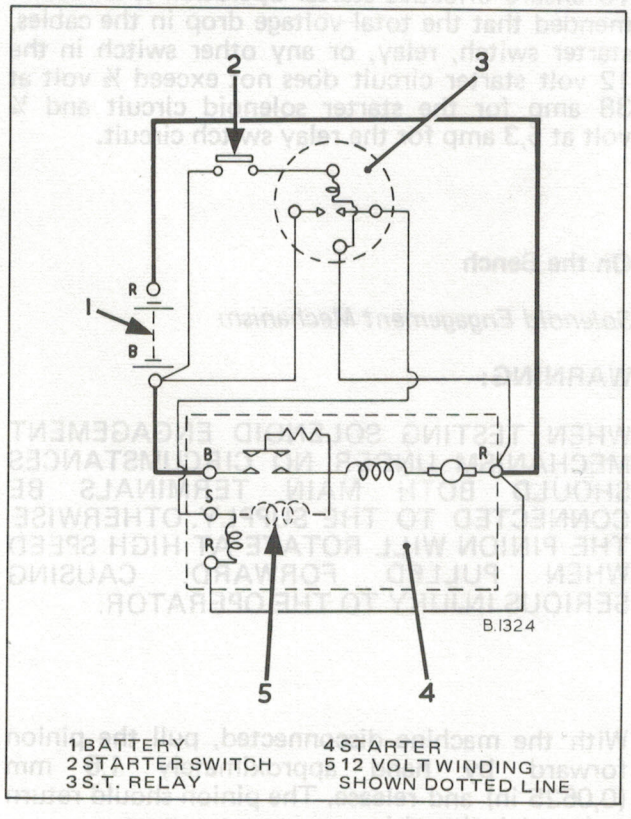


Fig. 2 *Insulated earth return circuit*

When the solenoid has been energised, the pinion should move forward for a distance of 6,3 mm (0,25 in) minimum.

With the solenoid still energised, draw the pinion forward by rotating it in the direction opposite to normal rotation. The locking mechanism should now come into operation, locking the pinion in the forward position.

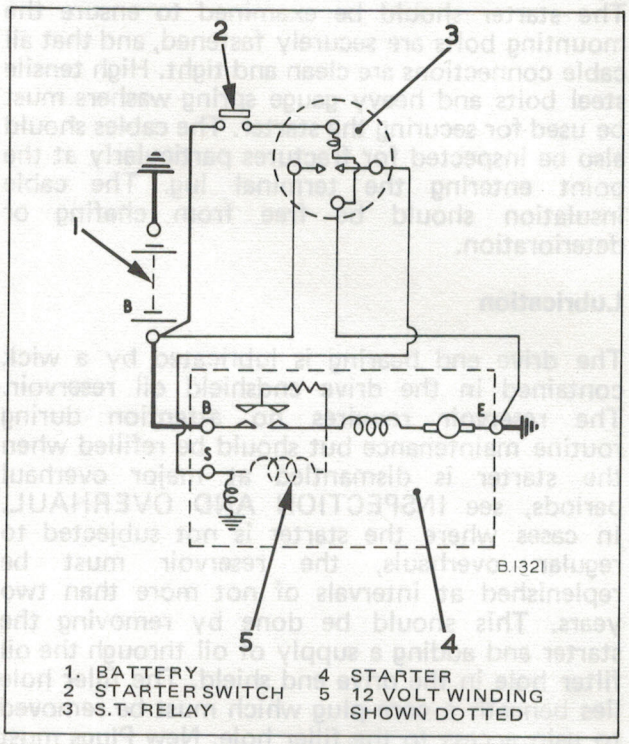


Fig. 3 *Earth return circuit*

Disconnect the supply to the solenoid. The pinion must return to its disengaged position in one sharp movement.

Check the recoil spring action by applying a compression spring balance to the driving end of the armature shaft. The force required before backward movement of the shaft occurs should be 13,6 to 17,2 kg (30 to 38 lb).

Starter Performance Tests

For these tests the brushes must bed for at least 80% of their contact area.

CAUTION:

If the starter is allowed to run without engaging a suitable flywheel, the pinion will not be restrained from rotating in the initial stages, and thus will not complete the forward movement necessary to trip the second stage contacts. Under these conditions, the resistor will remain in circuit and may be damaged by overheating. Moreover, prolonged running on first stage contacts may cause grooving of the solenoid trip mechanism. For these reasons the starter should always be run in conjunction with a flywheel, but if this is not possible, the running period must not exceed five seconds.

Mount the starter on the starter test bench, with a 3,18 mm (0,125 in) clearance between the face of the pinion and the face of the test bench flywheel.

Connect starter terminals as shown in Test Circuits Figs. 2 and 3 to a fully charged battery of suitable voltage and capacity not less than that shown in the Test Data.

Complete ten engagements into a partly locked flywheel to ensure that the engaging mechanism is operating satisfactorily. Non-engagement may be caused by a tight drive end bearing, or by the pinion binding on the armature shaft.

Disconnect the seperate supply to the solenoid, and connect the machine for normal operation. Then check the lock torque, the running torque, and the light running of the starter according to the Data table.

Note: It is important that the battery is adequately charged, in good condition and of minimum capacity specified. A partly charged battery or one in poor condition will not provide current sufficient to reach the specified torque figures.

Relay Test

Check continuity between B+ and ST terminals and the insulation to frame of all terminals, see Fig. 1. Check relay contact gaps which should be 1,14 to 1,27 mm (0,045 to 0,050 inches). When closed the core gap should be 0,38 to 0,51 mm (0,015 to 0,020 inches).

Connect a 1000 ohm, 5 watt variable resistance and milliammeter in series with a 12 volt battery and the relay winding, B + to 5W + terminal, B — to junction of capacitor positive and the black relay winding start lead. Increase the variable resistance and set the relay by adjusting the armature spring tension so that the contacts open at between 60 and 62 milliamps.

Connect a voltage source not exceeding 8 volt to terminals SW+ and E and observe that the relay momentarily closes. Failure to do this indicates a faulty capacitor, loose or broken connections, or an excessive core gap setting.

Connect a 12 volt lamp and battery in series with the relay contacts, SW+ and SOL terminals. Press aramature to coil, to close contacts and observe if lamp lights. Failure to light indicates dirty contacts, loose or broken connections.

DESCRIPTION AND MODIFICATIONS

This may seem a little out of place but I have heard about problems with people stealing work and selling it - for example on eBay.

If you're reading this and you bought this manual anywhere then you have been ripped off.

Please contact me via my email mikejamson@hotmail.com Otherwise I can be found on the dodge50 facebook page, if not then get in contact with Greg and he can pass the message on to me.

I have note done this pdf manual for my own personal gain and wish to see the community of 50 series owners benefit from the information here, and I do not want to see the community get taken advantage of and somebody else gain from it unfairly.

The information in pdf format will hopefully allow more of these wonderful trucks to stay on the road by providing information to everybody.

This has been quite a long and involved process to scan the manual and to convert it into a pdf format. I do aplogise as I have used several different scanners and several different computers to do it, so there are no doubt some errors hidden throughout, as well as some editing errors.

I have aimed to balance quality and file size and hope that this balance meets to everybody's approval.

If you see an error please let me know and I will fix it as soon as I can.

OVERHAUL

To Dismantle

Before overhaul it is advisable to obtain the following special tools. These will reduce the time spent on overhaul and enable a closer approach to factory standards to be achieved.

Tool Number	Description
5693-222	Setting Gauge for machines with a pinion face to mounting flange dimension of 47,63 mm (1,875 in).
5693-222A	Setting Gauge for machines with a pinion face to mounting flange dimension of 20,64 mm (0,8125 in).
5693-222B	Setting Gauge for machines with a pinion face to mounting flange dimension of 25,4 mm (1,000 in).
5693-240	Extraction and Replacement Tool for commutator end bearing.
5693-267	Plug Gauge for drive end bearing.
5693-266	Extractor, drive end bearing.
5693-275	Plug Gauge for commutator end bearing.
5693-298	Fitting Tool for inspection hole core plugs.
5693-299	Fitting Tool for dust scraper ring on drive end shield.
5693-300	Fitting Tool for lubricator core plug.
6244-4	End Float Gauge.
6244-3	Check Gauge for circlip on trip collar.
6244-6	Split Collar for dust seal protection.

In addition a compression spring balance scaled 0 to 10 lb in 1 lb units is required. A torque spanner with ½ in square drive and a 7/16 in BSF socket with the chamfered lead ground away is required to tighten the pinion nut to the required torque value.

The figures in brackets refer to Figs. 4 and 5 except where otherwise stated.

Remove the two core plugs (29) from the drive end shield (15) with sharp pointed instrument.

Unscrew the two field terminal screws (30) exposed when the core plugs are removed. Remove commutator cover (37).

Unscrew the brush lead screws, raise brush springs and remove the brushes from the holders. Removal of the brush lead screws also frees the field coil connections.

Remove end cap (32). Early models have a bayonet type fixing arrangement and should be removed by pushing inwards and twisting in the opposite direction of starter rotation. When removing the cap, take care not to lose steel ball (18) which is under pressure from spring (34). Later models are fitted with an internally screwed hexagon end cap and thrust pad.

Withdraw spring (34). Remove circlip (17) and withdraw thrust washer (33) or thrust pad and shim washers (16).

Unscrew and remove two through-bolts (35).

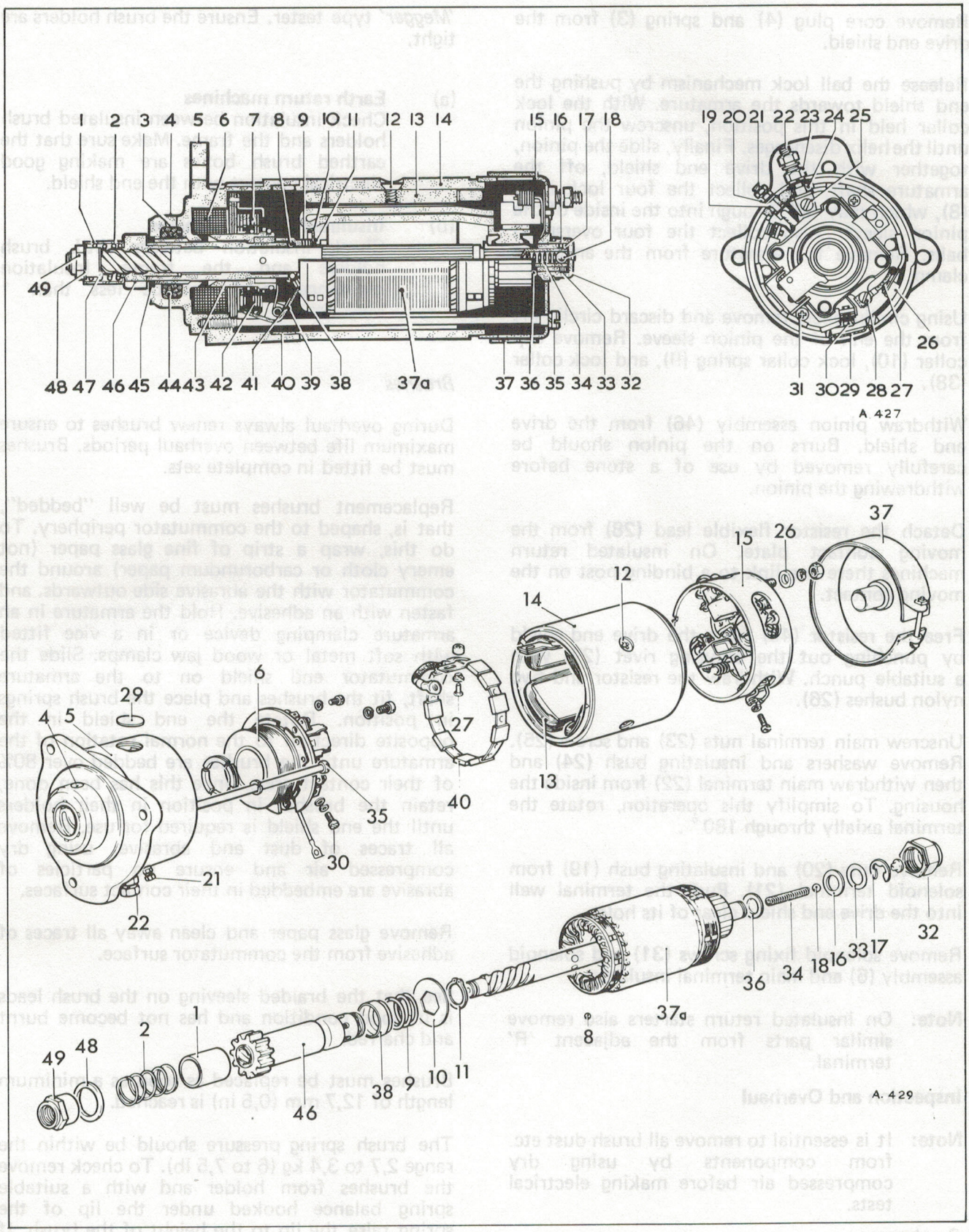
Carefully remove commutator end shield (15) and shims (36) from the end of the armature shaft. Keep the shims. When the armature is reassembled end float adjustment is simplified by fitting the original shims.

Tap drive end shield (5) away from yoke (14) with a hide or wooden mallet, and withdraw end shield complete with armature.

Secure the armature in an armature clamp and using a 7/16 in BSF box spanner or socket with the chamfered lead ground away, unscrew the pinion stop nut (49) in the direction of starter rotation. Remove the thrust washer (48), shim washer (47) return spring (2) and helix dust cover (1) when fitted.

KEY TO FIGS 4 & 5

1 HELIX COVER	26 SPACER
2 PINION SPRING	27 RESISTOR RIVET
3 SPRING	28 RESISTOR FLEXIBLE LEAD
4 LUBRICATOR CORE PLUG	29 CORE PLUG
5 DRIVE END SHIELD	30 FIELD TERMINAL SCREW
6 SOLENOID ASSY.	31 SELF TAPPING SCREWS
7 1ST CONTACT	32 END CAP
8 LOCKING BALLS	33 THRUST WASHER
9 LOCK COLLAR SPRING	34 RECOIL SPRING
10 TRIP COLLAR	35 THROUGH BOLTS
11 CIRCLIP	36 SHIMS
12 POLE SCREW	37 COMMUTATOR COVER
13 POLE SHOES	37a ARMATURE
14 YOKE	38 LOCK COLLAR
15 COMMUTATOR END SHIELD	
16 SHIM WASHERS	39 TRIGGER
17 CIRCLIP	40 RESISTOR
18 STEEL BALL	41 TRIGGER SPRING
19 INSULATING BUSH	42 2ND CONTACT
20 TERMINAL NUT	43 SOLENOID PLUNGER
21 SOLENOID TERMINAL	44 LUBRICATOR WICK
22 MAIN TERMINAL	45 DUST SCRAPER RING
23 TERMINAL NUT	46 PINION ASSY.
24 INSULATING BUSH	47 SHIM WASHER
25 SCREW	48 THRUST WASHER
	49 PINION STOP NUT



Figs 4 and 5 CAV Starter details

Remove core plug (4) and spring (3) from the drive end shield.

Release the ball lock mechanism by pushing the end shield towards the armature. With the lock collar held in this position, unscrew the pinion until the helix disengages. Finally, slide the pinion, together with the drive end shield, off the armature shaft, and collect the four lock balls (8), which may fall through into the inside of the pinion sleeve. Also collect the four overspeed balls. Remove the armature from the armature clamp.

Using circlip pliers remove and discard circlip (1) from the end of the pinion sleeve. Remove trip collar (10), lock collar spring (9), and lock collar (38).

Withdraw pinion assembly (46) from the drive end shield. Burrs on the pinion should be carefully removed by use of a stone before withdrawing the pinion.

Detach the resistor flexible lead (28) from the moving contact plate. On insulated return machines there is a link to a binding post on the moving contact.

Free the resistor (40) from the drive end shield by punching out the securing rivet (27) with a suitable punch. Withdraw the resistor and two nylon bushes (26).

Unscrew main terminal nuts (23) and screw (25). Remove washers and insulating bush (24) and then withdraw main terminal (22) from inside the housing. To simplify this operation, rotate the terminal axially through 180°.

Remove nuts (20) and insulating bush (19) from solenoid terminal (21). Push the terminal well into the drive end shield clear of its hole.

Remove solenoid fixing screws (31) and solenoid assembly (6) and main terminal insulator.

Note: On insulated return starters also remove similar parts from the adjacent 'R' terminal.

Inspection and Overhaul

Note: It is essential to remove all brush dust etc. from components by using dry compressed air before making electrical tests.

Brushgear

Check the brushgear insulation using a 100 volt *'Megger'* type tester. Ensure the brush holders are tight.

(a) **Earth return machines**
Check insulation between insulated brush holders and the frame. Make sure that the earthed brush boxes are making good electrical contact with the end shield.

(b) **Insulated return machines**
Check insulation between ALL brush holders and the frame. Insulation resistance must not be less than 1 Megohm.

Brushes

During overhaul always renew brushes to ensure maximum life between overhaul periods. Brushes must be fitted in complete sets.

Replacement brushes must be well "bedded", that is, shaped to the commutator periphery. To do this, wrap a strip of fine glass paper (not emery cloth or carborundum paper) around the commutator with the abrasive side outwards. and fasten with an adhesive. Hold the armature in an armature clamping device or in a vice fitted with soft metal or wood jaw clamps. Slide the commutator end shield on to the armature shaft, fit the brushes and place the brush springs in position. Rotate the end shield in the opposite direction to the normal rotation of the armature until the brushes are bedded over 80% of their contact area. Once this has been done, retain the brushes in position in their holders until the end shield is required for use. Remove all traces of dust and abrasive, using dry compressed air and ensure no particles of abrasive are embedded in their contact surfaces.

Remove glass paper and clean away all traces of adhesive from the commutator surface.

See that the braided sleeving on the brush leads is in good condition and has not become burnt and charred.

Brushes must be replaced as soon as a minimum length of 12,7 mm (0,5 in) is reached.

The brush spring pressure should be within the range 2,7 to 3,4 kg (6 to 7,5 lb). To check remove the brushes from holder and with a suitable spring balance hooked under the lip of the spring raise the lip to the height of the brush. If the spring pressure is outside the limits, fit new brush springs.

Commutator

If the commutator surface is dirty or discoloured, it can be cleaned with a very fine grade of glass paper, do not use emery cloth or carborundum paper. In cases where the surface is badly pitted or grooved, set the armature up in a lathe and skim commutator. With a rough cut remove just sufficient copper to clear traces of grooving or pitting, after which a light cut should be taken, using a diamond or tungsten carbide tipped tool to obtain the desired high quality finish. Finally, remove all traces of swarf using dry compressed air.

The recess in the commutator is required only for manufacture, and can be eliminated when skimming is undertaken. Minimum diameter to which the commutator can be reduced is 39.2 mm (1,56 in) and the radius at the junction of the risers and commutator must not exceed 1,0 mm (0,040 in). Do NOT skim the risers.

The commutator must not be undercut otherwise brush dust tracking may occur.

Armature Assembly

If the armature windings are suspect, they can be tested for continuity and short circuits by means of a "growler" armature tester; if such a machine is not available, the armature may be tested by substitution.

Check for insulation to earth by means of a 100 volt "Megger" type Tester between any commutator segment and the armature shaft. Resistance should be at least 1 Megohm.

Examine the recesses in the armature shaft for burrs caused by the steel balls and carefully stone these off.

Inspect the shaft helices for signs of damage or excessive wear. Finally, clean the helices with paraffin and smear them with a small quantity of grease. See RECOMMENDED LUBRICANTS.

No attempt should be made to machine the armature core.

Pinion

If the pinion teeth are badly worn or damaged change the pinion. See that the new pinion has the same number of teeth, and is a free sliding fit on the armature shaft. If necessary lightly lap the pinion and shaft using a fine lapping paste. Remove all traces of lapping paste,using a bottle brush to ensure absolute cleanliness of the pinion helix. When the pinion is fitted with an oil seal inside, all burrs or sharp edges on the armature shaft and helix must be removed with an abrasive stone otherwise these will tear the oil seal. Fit a new seal with the 'U' channel facing towards the pinion teeth end. See Fig. 6.

Springs

See that the springs are not damaged and have not lost tension. When compressed the tension should be:

Spring	Compressed length	Tension
Lock spring	9,53 mm (0,375 in)	0,765 to 0,878 kg (1,69 to 1,94 lb)
Recoil spring	33,35 mm (1,313 in)	12,0 to 13,39 kg (26,5 to 29,5 lb)
Pinion spring	31,75 mm (1,250 in)	3,5 to 3,85 kg (7,75 to 8,5 lb)
Pinion spring (oil sealed starter)	37,3 mm (1,469 in)	4,4 to 4,6 kg (9,81 to 10,19 lb)

Field Windings

Before making electrical tests remove all traces of brush dust etc. by blowing with dry compressed air.

The windings can be tested for earth to the yoke and poles using a 100 volt 'Megger' type tester. Insulation resistance to earth must be not less than 1 Megohm.

There is no easy way of checking for initial shorts in the coils as their resistance is very low. New coils should be tried if the existing ones are suspect. Unserviceable coils should be replaced as follows.

Unscrew pole screws (12) Fig. 4 and remove the poleshoes (13) and windings, noting the position of the windings and poleshoes in order to facilitate re-assembly.

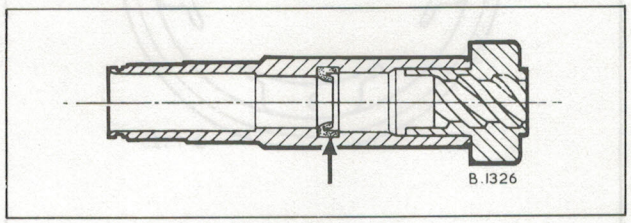


Fig. 6 *Pinion oil seal arrowed*

Fit the new windings into the yoke and replace the poleshoes in their original positions otherwise they may foul the armature. As an aid to correct assembly, the poleshoes are numbered, and must be replaced in the positions shown in Fig. 7.

Insert and tighten pole fixing screws (12) to 3,5 to 4,2 kg m (25 to 30 lb ft) using a commercial

poleshoe screwdriver. Care must be taken that the poleshoes are correctly aligned in the yoke and no space exists between the mating surfaces otherwise they will not bed down fully and may foul the armature.

Bearings

Commutator End

Ensure that the commutator end bearing is tight in its housing. Check the side play between armature shaft and bearing. If this is excessive, fit a new bearing following the removal of the end shield as follows:

Press the old bearing out of the end shield using Tool No. 5693-240.

With the same tool, press the new bearing with a smear of light oil into the end shield. No machining should be attempted. Check the bore with Plug Gauge 5693-275.

Drive End

Check the internal diameter of the drive end bearing with Plug Gauge 5693-267. If the bearing is worn a new drive end shield assembly should be fitted.

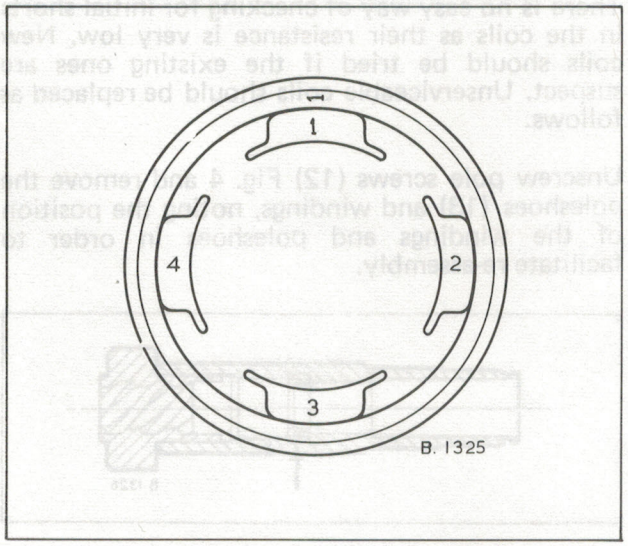


Fig. 7. *Yoke poleshoes*

IMPORTANT. On new drive end shields a leatheroid retaining pad is fitted in the oilway. This must be removed to prevent the bearing being oil starved. Check that the felt pad is free to move under the influence of the spring.

SOLENOID

To Test

The coils can be checked for short or open circuits by measuring current consumption at nominal voltage. 12 VOLT STARTER SOLENOIDS are dual wound and consist of a pull-in and a hold-on winding therefore before testing these, a link should be made between the base of the contact assembly (3) and the terminal lug (8) Fig. 8 on EARTH RETURN versions, or between the green lead and terminal lug (8) on INSULATED RETURN versions.

Examine the contacts and if necessary clean them with white spirit or very fine carborundum paper. The first stage gap should be 2,1 mm (0,083 in) with a bottom limit of 1,93 mm (0,076 in) and a maximum of 2,5 mm (0,098 in). Press down the plunger and check that the second stage contacts make only after the trigger is tripped.

If the contacts are badly burnt, gap excessive, or coils appear to have overheated, the solenoid can be replaced as a complete unit.

To replace defective parts follow this procedure:

To Dismantle

Refer to Fig. 8

Remove the burred over ends of the rivet (1) also that rivets securing the trigger assembly (6) using a 4,75 mm (0,187 in) diameter drill.

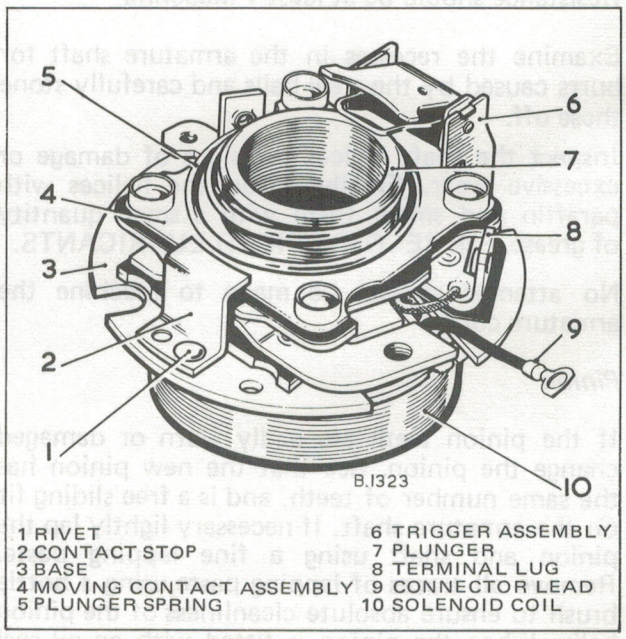


Fig. 8 *Solenoid switch assembly*

Carefully punch out the rivets and remove contact stop (2) and trigger assembly. Examine trigger assembly for wear on the pivot points, if excessive, fit new trigger assembly.

Withdraw plunger (7) plunger spring (5) moving contact assembly (4) and inner spring as one assembly.

Unsolder the red solenoid lead connected to the fixed contact lug (8) on 12 volt machines also the bare solenoid lead connected to the fixed contact baseplate on all earth return machines.

Remove fixed contact assembly (3).

To Assemble

Locate fixed contact assembly (3) on solenoid coil (10). Ensure the contact plate rivet holes line up with those in the solenoid coil plate.

Replace the assembly consisting of the plunger, moving contact and springs. The rectangular shaped extension on one side of the moving contact assembly must face the two rivet holes for the trigger.

Push the solenoid plunger fully home. With the plunger held in this position replace contact stop (2) and trigger assembly (6) and rivet in position.

Solder the red solenoid lead to the fixed contact lug (8). On all earth return machines solder the other bare solenoid lead to the fixed contact baseplate localising the area of solder. Test security of joint with sharp tug on the lead.

Check the first stage contact gap is within the limits set down in section headed 'Testing solenoid coils and contacts'. Slight adjustment can be made by bending the brass contact stop (2).

STARTER MOTOR

To Assemble

Overspeed Segments

(a) It is vital to check that there are no burrs or sharp edges on the segments which would prevent efficient operation of the overspeed protection device. Place the garter spring on a clean flat surface and position the four segments inside the spring so that they lie end to end in a circle. The garter spring will fit in the outer groove of the segments and hold them together.

(b) Place the solenoid switch on the bench, coil end upwards and with the fingers gently push in the garter spring and segment assembly into the bore of the solenoid plunger so that it fits into the recess provided. It will be easier if one segment is located in the recess first and the other three edged into position.

Overspeed Balls

The overspeed balls as well as the locking balls can be inserted into the pinion sleeve holes from inside the bore.

The figures in brackets refer to Fig. 4 unless otherwise stated.

Fit the split protection collar, using Tool No. 6244-6 to protect the dust scraper ring (45) in the drive end shield and insert the pinion assembly.

Detach the split protection collar.

Take the assembled solenoid switch and place main terminal insulator under the main terminal lug (56) Fig. 5, the end with the hole upright.

Insert the solenoid assembly into the drive end shield and fasten it in position with screws (31) and spring washers.

Drop the anodized metal strip on the inside face of the main terminal insulator.

Place the shaped insulator bush (19) over the solenoid terminal screw (21) add the solenoid terminal tag ((9) Fig. 8) black lead over the terminal screw and push it through its hole in the end shield. Fit round insulating bush, spring washer and nut (20).

Note: On insulated return models there is a further solenoid lead, coloured green or yellow, which must be attached to its terminal screw exactly as above. This is the 'R' terminal.

Insert main terminal (22) into position from inside the housing through the anodized metal strip and insulator into the hole in the end shield. Replace insulating bush (4) rubber ring, insulating washers, plain washers, spring washers and nut (23) fingertight. Pressing down the plunger gives room to insert the main terminal.

Insert spring washer and screw (25) and secure. Now tighten nut (23) to a torque of 0,7 kg m (5 lb ft).

Fit the lock collar (38) to the pinion sleeve making sure that the 45° chamfer inside the collar is facing towards the solenoid assembly.

Replace the spring (9) trip collar (10) and secure in position with a new circlip (11) dished side downwards. Make sure that the circlip locates in the locking collar groove. Check with gauge 6244-3 so that it seats squarely.

Insert resistor (40) into its recess in the drive end shield and secure it in position by means of bush and spacer (26) and rivet (27).

Connect the resistor flexible lead to the lug on the solenoid assembly moving contact by means of washer and screw (28).

Note: On insulated return models there is a link bar between the lug and a corner of the moving contact. The link is secured to the lug by a washer and screw and the other end is attached to a post together with the resistor flexible lead by means of a washer and nut.

Insert the four lock balls (8) and the four overspeed balls into the pinion sleeve holes from inside the bore. Use a small screw driver blade with a spot of grease to feed in the balls and a smear of grease to hold them in position.

Assemble the pinion and end shield assembly to the armature as follows:

(a) Pull the pinion out of the drive end shield until lock collar (39) is pressed back against its spring by the end of solenoid plunger (43). Keep it in this position until otherwise stated.

(b) Press lock balls (8) fully into their holes to allow free entry of the armature shaft.

(c) Slide the pinion and end shield assembly on the armature shaft, taking care not to displace the lock balls.

(d) Engage the pinion with the shaft helix, and then release the pull on the pinion. Screw the pinion on to the shaft and check that the pinion locking mechanism engages.

(e) Finally, support the weight of the drive end shield, and rotate the pinion first in one direction and then in the other to ensure that the pinion is free on the shaft and that the locking mechanism functions correctly. The locking mechanism can be released by pulling lock collar (38) back against its spring.

Mount the armature in an armature clamp. Assemble the helix dust cover (1) pinion return spring (2) shim washer (47), and thrust washer (48) on to the pinion shaft. Screw a NEW pinion stop nut (49) on to the shaft in the opposite direction of starter rotation. Using a 7/16 in BSF socket with the chamfered lead ground away, tighten the pinion stop nut to a torque of 5,6 to 6,9 kg m (40 to 50 lbf. ft). On oil sealed starters only use Loctite grade 'D' on the nut thread.

Assemble the armature and drive end shield assembly to yoke (14), ensuring that the dowel in the end of the yoke locates in the end shield slot.

Note: Seal the joint between yoke and each end shield with Wellseal Compound.

Check that shims (36) have all been removed from the armature shaft, and assemble commutator end shield (15). Fit through bolts (35) and tighten securely to a torque of 0,95 to 1,0 kg m (7 to 7.5 lb ft).

Replace thrust washer (33) and circlips (17), but do not fit shims (16).

To Set End Float

The armature end float, and the distance between the pinion and mounting flange, must now be adjusted as follows, using appropriate Gauge 5693-222, 5693-222A or 5693-222B.

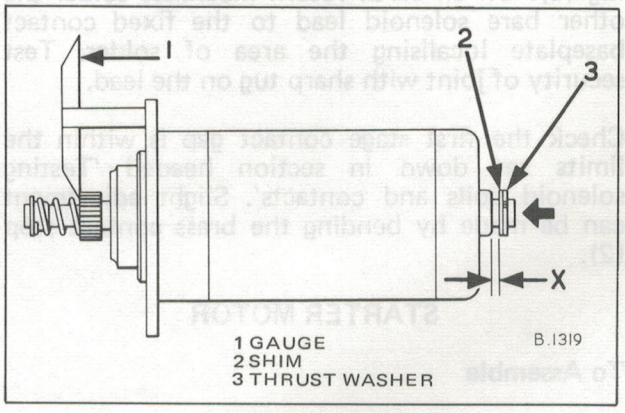


Fig. 9 *End float adjustment*

(a) Bolt the gauge on to the mounting flange with the arm marked "CHECK" towards the pinion Fig. 9, then push the armature towards the drive end of the machine until the pinion face just touches the gauge. With the armature held in this position, measure gap 'X' between thrust washers (3) and the commutator end shield, using feeler gauges.

Shim washers, having a total thickness equivalent to the measurement taken by the feeler gauges should then be fitted between the thrust washer and circlip. The shim washers must be well greased before use and are available in two thicknesses 0,20 and 0,10 mm (0,008 and 0,004 in). A combination of these sizes giving the closest approximation to the required dimension should be used.

(b) When this has been done, push the armature towards the commutator end of the machine as shown in Fig. 10 and again measure gap 'X' which should now be within the limits 2,03 + 0,50 − 0,0 mm (0,079 + 0,020 − 0,0 in). A GO NO-GO gauge is available, Tool No. 6244-4.

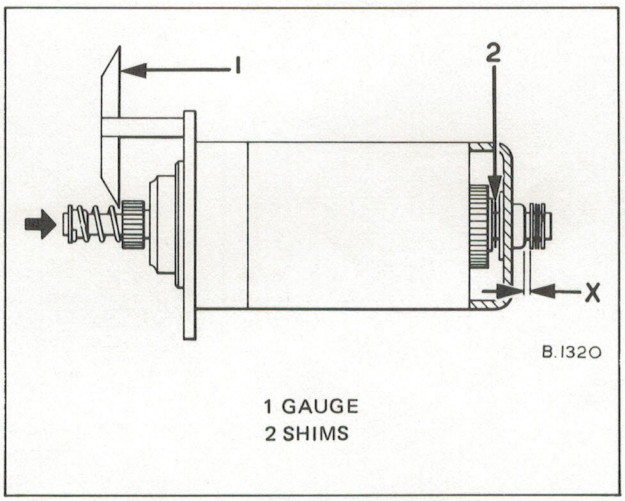


Fig. 10. End float adjustment

If the gap is outside this limit, remove the commutator end shield, and fit shim washers (2) on the armature shaft to the value of the excess. For example, if the gap is 3,04 mm (0,120 in) shim washers having a total thickness 0,51 to 1,01 mm (0,020 to 0,040 in) should be fitted i.e. four shims, each 0,20 mm (0,008 in) thick. These shims must be smeared with grease before use.

Replace commutator end shield, thrust washers, shim washers as determined in paragraph (a), and the circlip.

(c) Smear steel ball (18) and spring (34) with grease and insert them in the bore in the armature shaft. Replace end cap (32), twisting it in the direction of starter rotation to lock it in place.

Note. If a screwed end cap is originally fitted in place of a bayonet type the starter must be held vertically commutator end uppermost and the thrust pad attached to the cap with grease. The cap must be tightened to a torque of 0,1 to 1,4 kg m (7 to 10 lb ft) and the two thin corners of the hexagon caulked to slots in the bearing collar with a punch.

(d) Check that any variation in the relationship of pinion position to check gauge is within the limits of + 0,076 - 0,051 mm (+ 0,003 - 0,002 in).

Rectify if necessary by varying the shims as in (b).

Fill the reservoir in the drive end shield with oil, and insert spring (3). Replace core plug (4) using Tool No. 5693-300.

Connect the field windings and the free end of the resistor to the solenoid switch lugs by means of screws and washers (30).

Fit the brushes and place brush springs in position. Connect the brush leads and the field winding leads to the brush gear. Check that the brush leads allow free movement of the brushes in their holders.