Service Manual for the AB207R Family of Alternators

Troubleshooting, Diagnostics and Repair

Prestolite electric

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AB207R
ALTERNATOR

1 INTRODUCTION

2 DISMANTLING

3 COMPONENT INSPECTION, TEST, AND RENEWAL

1.1 THE ALTERNATOR

The AB207R alternator has been developed to meet greatly increased demands for electrical power on Public Service Vehicles. The machine is continuously rated at 265 A at nominal 24 V and vehicle electrical system safety is enhanced by the provision of built-in protection devices.

The alternator is of the "brushless " design i.e. there are no rotating fields with their associated slip rings and brushes, thus enabling the machine to meet increasingly stringent interference suppression requirements, together with an ability to run for longer periods between overhauls.

A feature of the AB207R is that it is in effect, two machines within one casing.

Two regulators, one for each half of the machine, are fitted within the end cover, together with two sets of diode rectifiers. The outputs of the two halves of the alternator are connected in parallel to positive and negative terminals mounted on an extension of the rectifier end shield. In addition, there is provision for the supply of an alternating current signal for speed-sensing devices such as a tachometer ("AC" outlet) and a circuit to control loads which must be switched off when the alternator is not generating ("AO" or "alternator only" loads), to reduce battery drain.

Additional diodes are fitted in the regulator circuits to ensure that no interaction between the regulators occurs.

The machine is force-ventilated, with a centrifugal fan fitted to the drive shaft adjacent to the pulley and an axial fan fitted at the opposite end, within a shroud. The shroud is so designed that air input may be either via an axial connection, or a 90° elbow which may be fitted in one of four positions, to allow the connection of ducting to lead air from a cool, clean, dry intake position on the vehicle.

The alternator mountings may be of either swung- or cradle-type.

1.2 WORKING PRINCIPLES

In this design of heavy duty alternator, excitation of the system is provided by means of a stationary "tubular" field coil interposed between the core and the "imbricated" poles or "claws" of each rotor. Surrounding the rotor are wound stators, into which is induced alternating current as the rotors are turned. The stators are each wound with three sets of delta-connected coils to provide three-phase generation.

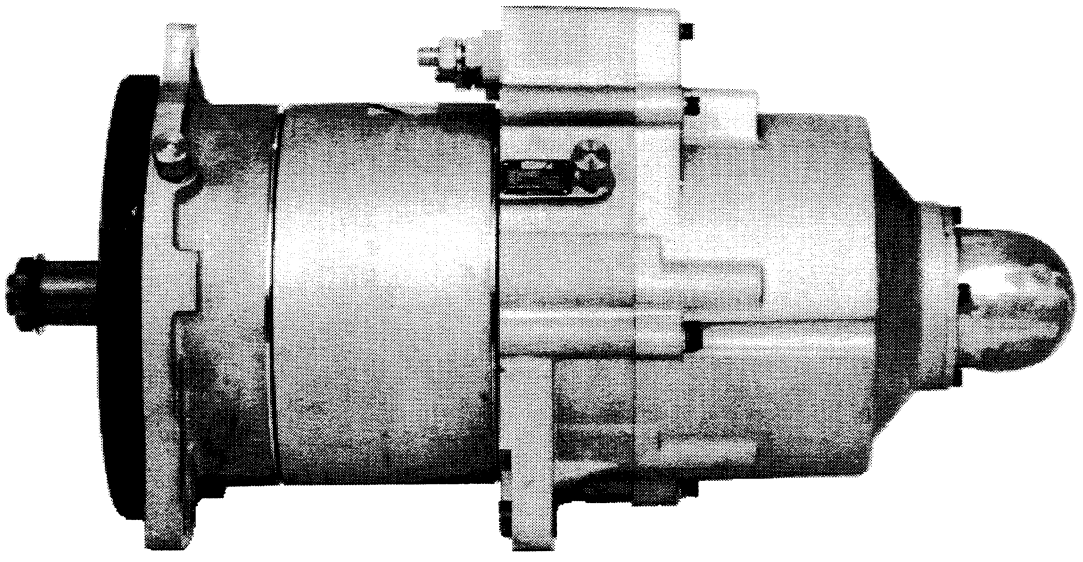
The two rotors within the AB207R are mounted back-to-back on a common drive shaft and their field coil "tubes" are fitted to each end shield. The current for each field is supplied, via an independent regulator, by three "auxiliary" diodes providing half-wave rectification. One auxiliary diode is connected to each phase and mounted on the phase heat sink. The diodes for each half of the machine are connected in parallel.

Each rotor induces current into a separate stator. Twelve pairs of heavy-current diodes mounted on six heat-sinks provide full-wave rectification of the output.

The design of the alternator is such that the maximum current and voltage which it can generate are automatically limited.

In the version described in this Manual, system voltage is sensed at the output terminals of the alternator. Should any of the wires between the terminals and the regulator fail, the system voltage will not rise above a pre-determined level. Should any other connection to either of the regulators fail, generation in the half of the machine controlled by that regulator will cease, but the alternator will continue to generate, at reduced power, from the other half.

If the system voltage should rise beyond a pre-determined level during normal running, for example, in the event of sudden load "dumping", the surge protection devices will protect the system by switching the alternator off for one to two seconds. If a prolonged over-voltage condition persists (i.e. for more than four seconds), the protection circuits will shut the charging system down. The alternator must then be stopped and the battery master switched turned off and then on again to reset the devices.



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1.3 INSTALLATION, FITTING, AND REMOVAL

The alternator is splash-proof, but to ensure satisfactory operation and long life, the air supplied for internal cooling must be ducted from a clean, dry area. The elbow attached to the end cover may be fitted in one of four radial positions, to facilitate connection to the ducting.

A battery master switch must be fitted in the main circuit; separate field isolation is not permitted. The surge protection device will prevent damage if the load is suddenly removed when the alternator is running.

The alternator warning light must have a rating of 2.8 to 3.2 W. No other load may be connected to the warning light circuit. Any external control circuits must be connected either to the"AC" output or the "AO" output in the auxiliary socket, depending upon the version and the current drawn (maximum 5 A).

If water should enter the alternator, for example during steam-cleaning, provision has been made for self-draining.

Refer to the engine or vehicle manufacturer's operating manual for fitting and removal instructions, especially for drive belt tension. See Section 6.9 for belt tension gauge.

Caution: Due to the weight of the machine, it must not be lifted by the terminals or the drive shaft; it must be lifted with a sling around the stator housing.

1.4 MAINTENANCE

Every 3 000 hours, six months, or 50 000 km, the two Stauffer grease lubricators must be refilled with the specified grease and fully screwed-in. Two capfuls must be applied to the drive end lubricator and one capful to the rectifier end lubricator. Do not over-lubricate either bearing.

Drive belt condition and tension must be checked each time the engine is serviced. Belt tension will be specified in the engine, vehicle, or plant manufacturer's operating manual. Several suitable belt-tension gauges are available; details are noted at the end of the Manual. If the drive to the alternator is by multiple belts and one of the belts requires replacement, all of the belts must be replaced and they must be in a matched set.

Some installations may incorporate an air inlet filter. This will require cleaning or replacement at intervals which will be specified in the engine, vehicle, or plant manufacturer's Operating Manual.

1.5 REPAIR

Note: If a charging system fault is noted, and the alternator is still installed on the engine, do not remove it until the integrity of all switches, wires, cables and connections between the alternator and the battery has been checked.

If an alternator has been returned, especially under warranty, with a claimed fault in performance, an external examination for damage and a full performance test must be carried out (if possible) before dismantling.

1.6 THIS MANUAL

This Manual is based on one version of the AB207R alternator, therefore the position of all components and cable connections should be noted during dismantling, to ensure correct reassembly.

The illustrations and text in this Manual are based on the swung-mounted version of the alternator. If a cradle-mounted version is required to be serviced, the main differences will be:

(a) No mounting and tensioning lugs on the two end shields.

(b) A spring dowel pin will be fitted to the stator housing, to locate the alternator axially for pulley alignment and to ensure the correct position of the electrical connections relative to the engine or vehicle wiring harness.

2.1 PREPARATION

2.1.1 Cleaning

Thoroughly clean the alternator externally before dismantling it, using a proprietary cleaning agent.

2.1.2 Alignment of housings

Mark the drive end shield, stator housing, rectifier end housing, and the elbow with a scriber or an indelible pen as an aid to correct alignment during reassembly.

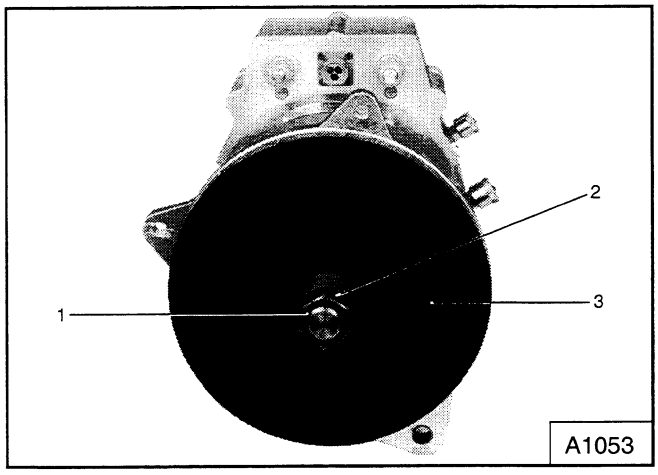
2.1.3 General advice

As the colouring of wires fitted to the terminal block may be concealed by paint, each should be identified as it is removed from its connection point.

For removal of the components mounted on the rectifier end shield, the alternator may be rested horizontally on a bench. For removal of the rectifier end shield and all subsequent components the machine must be supported on the drive end shield, with its axis vertical. Use suitable blocks, or a piece of large-bore tube, long enough to prevent the drive shaft from resting on the bench.

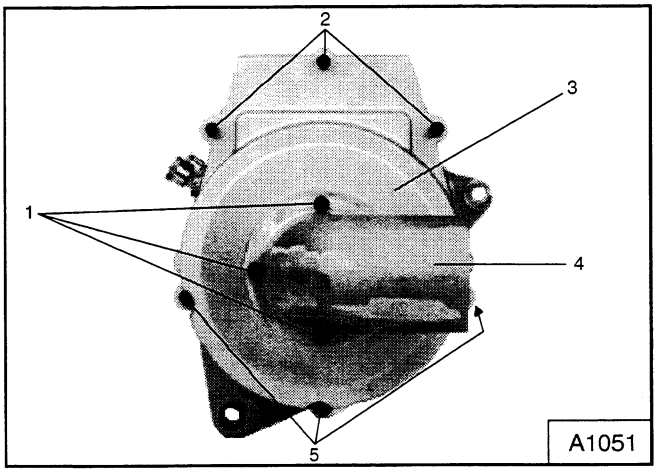
2.2 REMOVING THE PULLEY

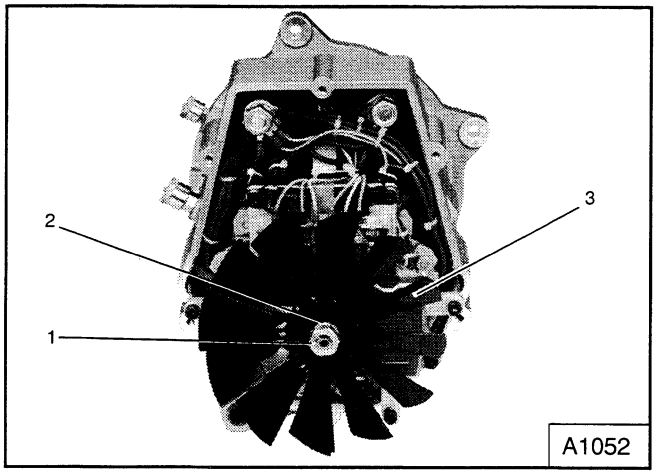
If fitted, restrain the drive pulley; slacken and remove the nut (1) and "Belleville" washer (2). If necessary, use a suitable extractor to carefully remove the pulley (not shown) from the shaft. Remove the Woodruff key and the outer fan (3). Store the fan carefully to avoid distortion or damage.



2.3 REMOVING THE AIR INLET CONNECTION, SHROUD, RECTIFIER END SHIELD, AND INNER FAN

Unscrew and remove the three Allen screws (1) and spring washers and remove the air inlet elbow (4) (or straight connector, which will have four screws and spring washers); there is no seal between the cowl and the elbow (or connector). Unscrew and remove the six Allen screws (2) and (5) and spring washers and remove the shroud (3).





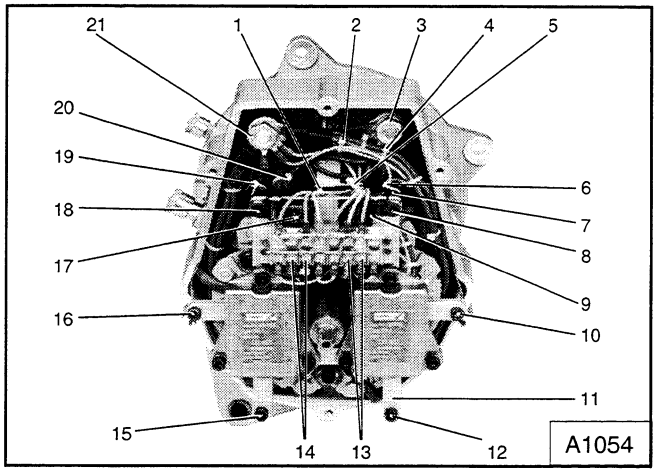
If the drive pulley is fitted to the rotor shaft, carefully restrain the pulley; slacken and remove the inner fan nut (1), together with the spring washer (2), inner fan (3), and flat washer (not visible behind the fan).

If no pulley is fitted, temporarily fit a Woodruff key to the shaft, together with a suitable pulley, securing the pulley lightly with the nut. Hold the pulley, slacken and release the nut, washers and fan.

Caution: take care to exert no strain on the fan blades; under no circumstances may the fan be used to provide a purchase for removal of its securing nut.

Store the fan carefully to avoid distortion or damage.

2.4 REGULATORS AND SUPPORT FRAME



2.4.1 Removing the regulator support frame assembly

Note: There may be some variation in the precise positions of cable ties from those shown in the illustrations.

Cut the cable ties (2) and (4) securing the red (positive) and those securing the black (negative) regulator wires to the "grouped" main output wires.

Cut the two cable ties (1) and (5) securing the blue and yellow wires to the large cable tie (7). Cut the large cable tie.

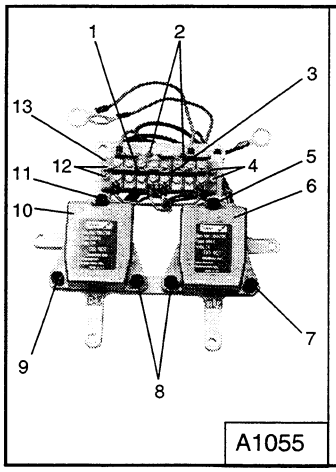
Cut the two cable ties (6) and (19) securing the suppressor capacitor wires to the upper spacers.

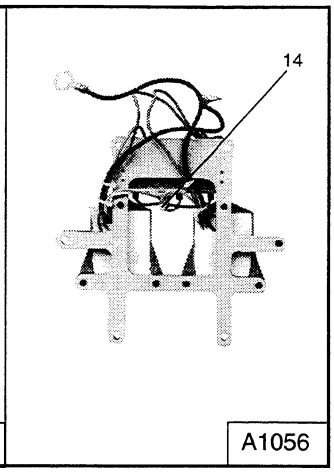
Cut the cable tie (20) securing the regulator wires to the upper left output wire.

Remove the two pairs of field coil wires (13) and (14) from the lower row of the terminal block; they are fitted to the second and third, and sixth and seventh terminals from the left-hand end.

Restrain the outer terminal locking nuts (not visible in the illustration); slacken and remove the inner nuts (3) and (21), spring washers and flat washers. Remove the wires from the suppressors (9) and (17), and the red and black regulator wires from the terminals.

Slacken and remove the six Allen screws (8), (10), (12), (15), (16), and (18) and spring washers; remove the regulator support frame assembly (11), with the two regulators, and the two suppressors.





2.4.2 Dismantling the support frame

Note (1): It is only necessary to remove the terminal block from the support frame if it has been damaged either mechanically, or by overheating. If any of the diodes (1), (2) and (3) are found to be faulty, they may be replaced with the terminal block in situ.

Note (2): The connecting links on the terminal block are only retained by the wire tag fixing screws; care must be taken that they do not become displaced when the wire tags are removed. The links between the terminals on the upper and lower groups on the terminal block are different; note which way up the terminal block is fitted.

Cut the cable tie (14) linking the pairs of yellow and green wires from the two regulators (6) and (10).

Note the positions of the remaining regulator wires on the terminal block (13) and then remove them. Slacken and remove the four screws (4) and (12), flat washers and spring washers, and remove the terminal block.

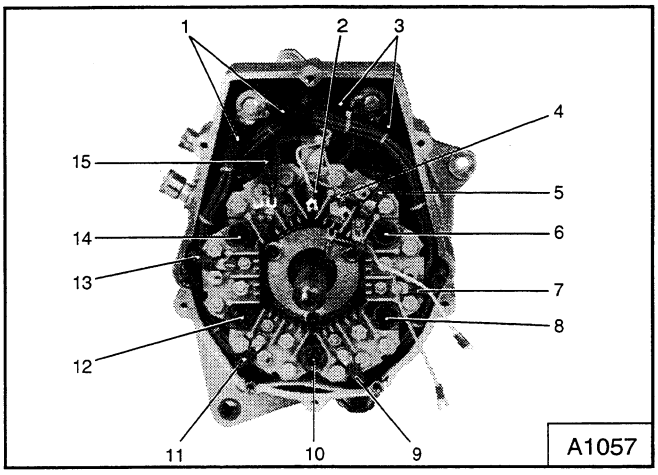
Slacken and remove the six Allen screws (5), (7), (8), (9) and (11) and remove the regulators.

2.5 REMOVING THE RECTIFIER PACK

Remove the two sets of grouped output wires (1) and (3) from each main terminal. It should not be necessary to cut any cable ties binding the grouped wires unless the rectifier assembly is to be completely dismantled. Note the exact positions of the ties and which wires are grouped together (an illustration showing cable tie positions is also included in Section 4 Reassembly).

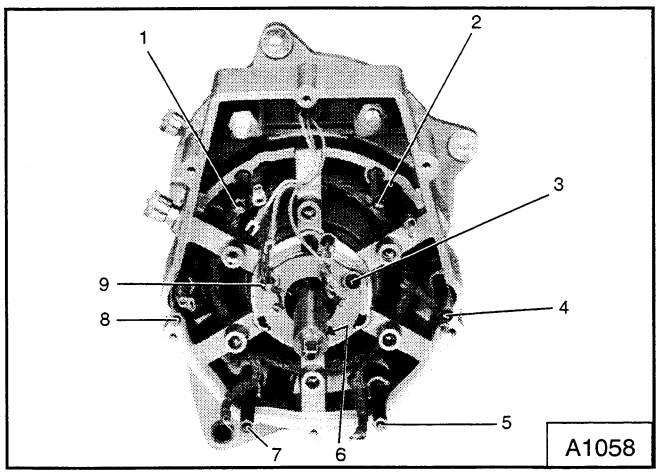
Disconnect and straighten the "phase" leads (5), (7), (9), (11), (13) and (15) from the front and rear stators, noting exactly how they are routed to the heat sinks (five will be led outside the "grouped" wires and one will be led between the two groups of positive wires and the rectifier pack. Disconnect the "AC signal" wire (4) (if specified), noting to which heat sink it is connected and how the wire is retained between a heat sink fin and the adjacent diode nut.

Slacken and remove the six Allen screws at positions (2), (6), (8), (10), (12) and (14) with their spring washers and flat washers, and carefully lift out the rectifier pack.

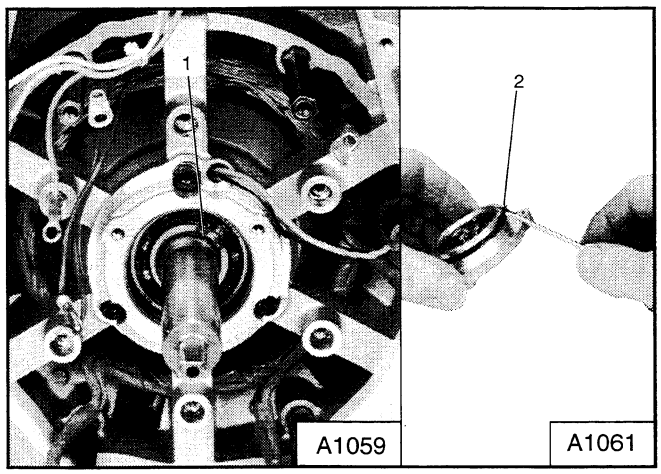


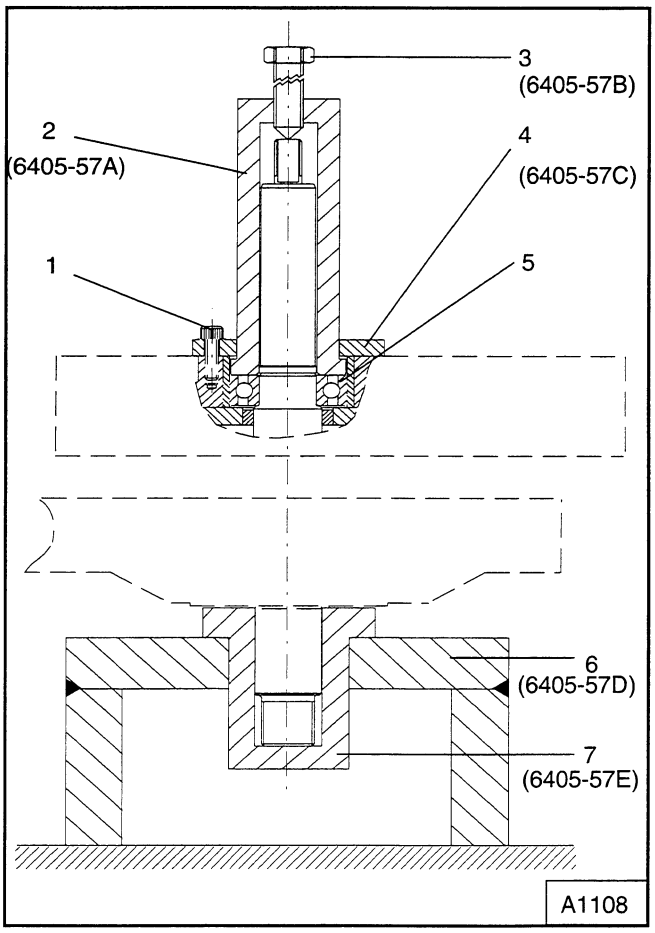
2.6 REMOVING THE SPACING PILLARS, REAR BEARING CAP, AND CIRCLIP

Slacken and remove the six spacers (1), (2), (4), (5), (7), and (8) and their spring washers. Slacken and remove the three rear bearing cover Allen screws (3), (6), and (9) and spring washers and remove the cover by the use of a pair of screwdrivers or similar tools.



Remove the shaft circlip (1). Remove and discard the O-ring (2).





2.7 REMOVING THE RECTIFIER END SHIELD (see Section 6.1.1 for Special Tools)

The bearing inner race is a press-fit onto the shaft and the outer race is a sliding-fit into the end shield liner.

Fit the cap (7) to the drive end of the rotor; with assistance, place the alternator vertically, drive end down, and insert the cap and shaft into the support (6).

Warning:

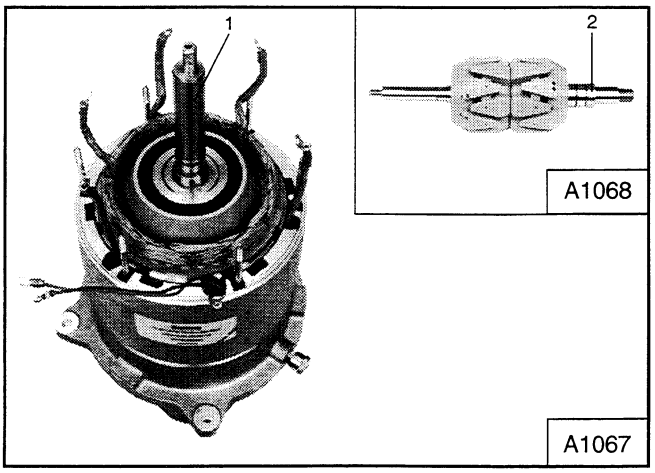
Support the alternator at all times whilst it is in this position and until the shaft is removed.

Fit the protection cap (2) to the rectifier end of the shaft and into the space above the RES bearing (5). Retain the cap with the ring (4), secured by the three RES bearing cap screws (1), tightened lightly.

Fit the extraction screw (3) to the upper cap and rotate it until it contacts the rotor; continue rotation until the bearing inner race is released from the rotor and the RES can be lifted off the stator housing

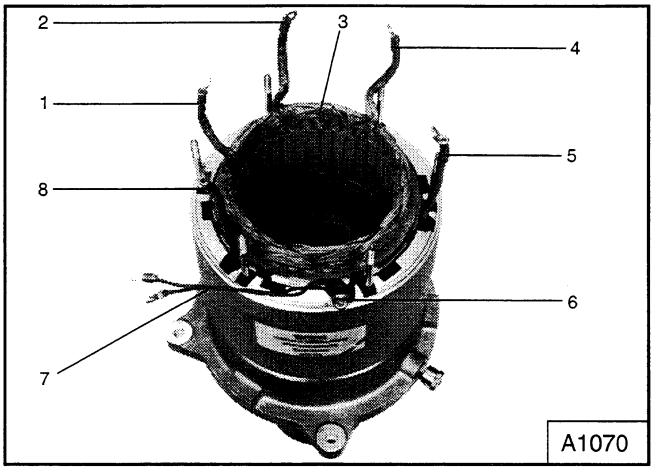
Remove the RES and lift out the bearing.

Discard the large O-ring (if fitted) between the RES and the stator housing.



2.8 REMOVING THE ROTOR

Carefully lift out the rotor (1). Note that the drive end outer spacer (2) may slide off as the rotor is lifted. If it does not, remove it.



2.9 REMOVING THE RECTIFIER END STATOR

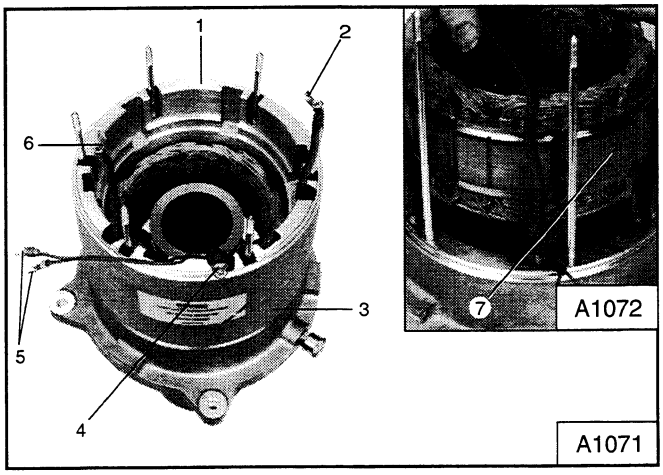
Lift out the stator (3), noting the positions of the three phase leads (1), (2), and (4) relative to the stator housing and to the drive end stator phase leads (5), (6), and (8). Note the "routes" followed by of the drive end field wires (7).

2.10 REMOVING THE STATOR HOUSING AND STATOR

Lift the stator housing (1) off the drive end shield. Before the phase lead tags (2), (4) and (6) enter their respective holes in the housing, carefully pull the drive end field coil wires (5), one at a time through the hole which they share with the centre phase lead (4) then continue with removal of the housing. Discard the large O-ring between the housing and the drive end shield (if fitted).

Note: Care must be taken to avoid damage to the insulation of the wires when they are fed through their holes in the stator housing.

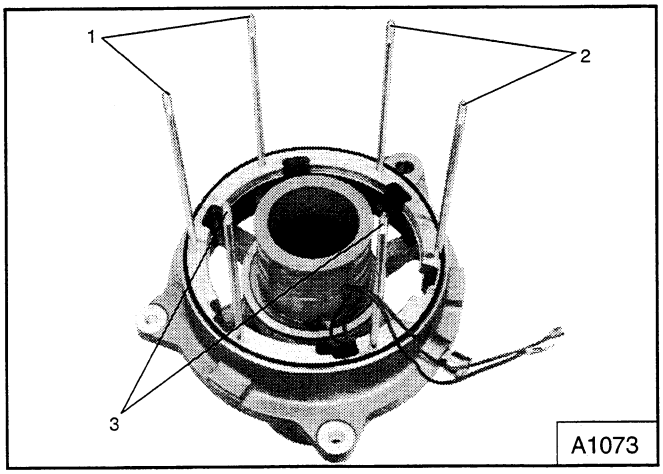
Cut any cable tie(s) joining the centre phase lead and the drive end field coil wires (visible when viewed from the drive end). Lift out the stator (7).



2.11 DISMANTLING THE DRIVE END SHIELD

2.11.1 Removing the long studs

Remove the six long studs (1), (2) and (3) by locking a pair of M6 x 1 nuts onto each in turn.

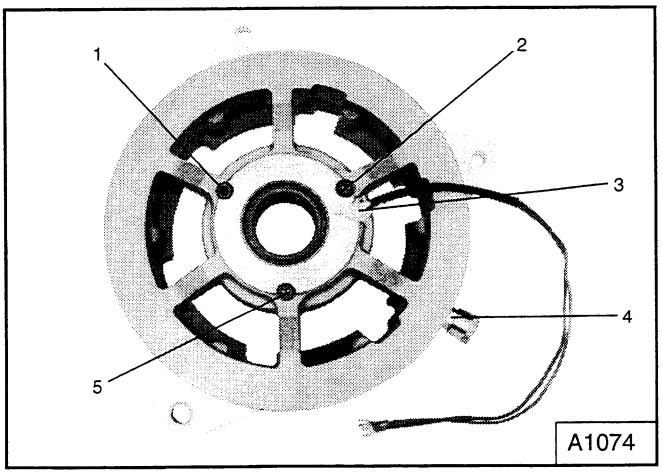


2.11.2 Removing the field coil

Carefully place the end shield on the bench (to avoid any damage to the coil-retaining flange) with the field coil facing downwards. Slacken and remove the three screws (1), (2) and (5) and spring washers. Carefully release the wires from any silicone rubber sealant ("Silcoset") at the point where they enter the end shield hole (3) (avoid damage to the insulation of the wires). Separate the end shield and the coil, passing the wires through the hole.

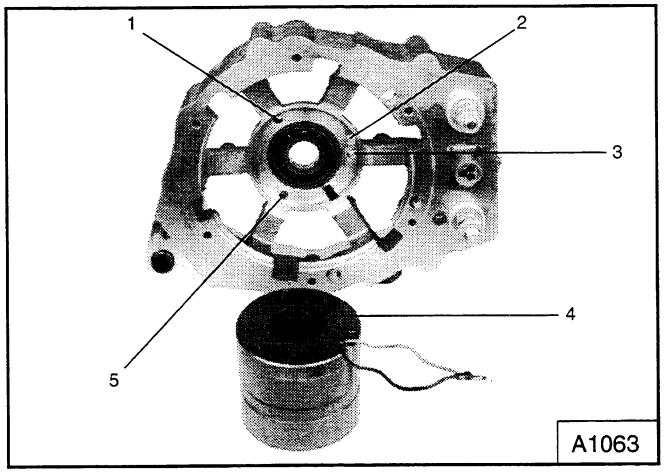
2.11.3 Removing the lubricator

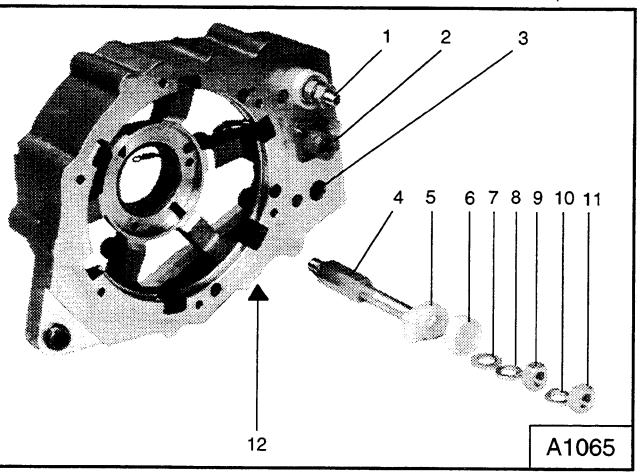
Use a suitable spanner to unscrew and remove the Stauffer lubricator body (4).



2.12 DISMANTLING THE RECTIFIER END SHIELD

Slacken and remove the three rectifier end field coil screws and spring washers at positions (1), (3), and (5). Remove the field coil (4), feeding the coil wires through the hole (2) in the end shield.





Restrain each output terminal (1) and (4) in turn; slacken and remove the nut (11) and spring washer (10), nut (9), spring washer (8), flat washer (7) and outer insulator (6). Remove the terminal and insulator (5) from the inner face of the end shield.

Note that the positive terminal (which is fitted in position (3)) has the longer hexagonal section and that the external threads of the two terminals are of different diameter (the positive thread is 12 mm and the negative is 10 mm).

If the auxiliary socket (2) is to be removed, slacken and remove the four screws, spring washers and flat washers; lift off the socket, complete with wires.

Slacken and remove the Stauffer lubricator (12) (not visible in the illustration).

3.1 PREPARATION

All components must be cleaned thoroughly before inspection or testing. To avoid damaging any electrical components during the cleaning process, a fluid suitable for cleaning electrical equipment (i.e. not water-based) must be used. Non-electrical parts may be cleaned with a proprieteary fluid similar to "white spirit". Remove any remaining thread locking compound from screws.

It is important that all components are then thoroughly dried, especially those which are insulated. The use of a drying oven is the most satisfactory way to dry the components, but compressed air may be used, with great care.

Note (1): Any local Health and Safety or Fire Regulations concerning the use of cleaning fluids and compressed air must be observed.

Note (2): Once a bearing has been removed from the rotor, it must be renewed.

All seals and gaskets must be renewed. Check all internal and external threads for damage.

Examine all components for signs of cracking, corrosion, local discolouration or any other signs of damage or excessive wear.

In addition to the normal workshop facilities, some mandrels and supports, which may be locally-made, and some test equipment will be required (see Section 6 Tools and Technical Information).

3.2 FIELD COILS

Note: The drive end field coil is shown, but the rectifier end coil is very similar, with the same relevant features.

3.2.1 Checking the coils

Check that the mating faces (1) and (2) of each field coil and its associated end shield are clean and free from any damage. It is very important that the coils fit to the end shields accurately, to avoid interference with the rotors when the alternator is assembled.

Check that there are no signs of overheating of the coils.

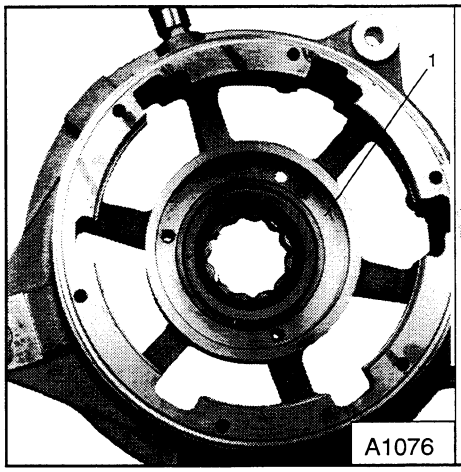
Check that the wires leading to the coils have not been overheated and that the insulation is in good condition, especially at the point (3) where the wires emerge from the coils.

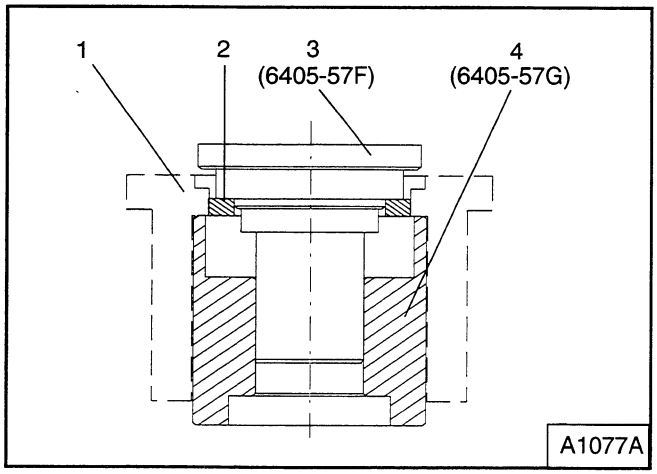
Check the resistance of each field coil. See Section 6 .7 (Technical Data) for the correct value.

Check insulation resistance with the 100 V Megohm tester. Resistance must be not less than 10 MΩ.

If the field coils are to be used again, thoroughly clean out any old grease from the groove (4).

Note: The two coils are different in that the front coil has longer wires and the positions of the wires relative to the grease grooves are different, when viewed from the "outer" ends of the coils.





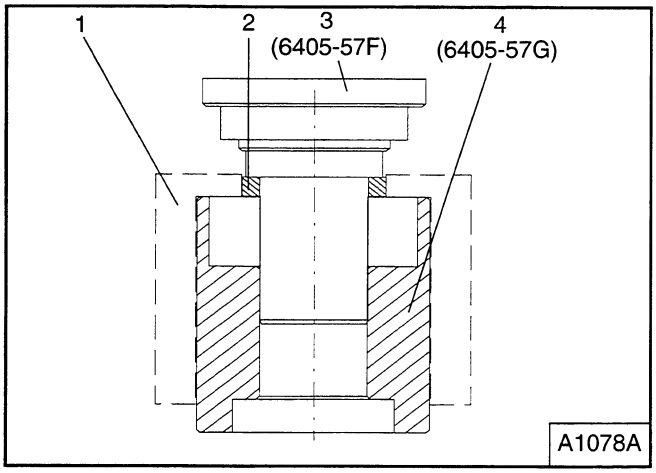
3.2.2 Removing the seals (see Section 6.1.2. for tools)

Caution: Do not apply any pressure to the ends of the coils - always use the specified support to support the mounting end of the coil on the inside as shown whilst the old seal is removed, or whilst a new one is pressed into position.

Note: Although the seals for the coils are of different diameters, the same mandrel, with stepped shoulders, is used for both seals.

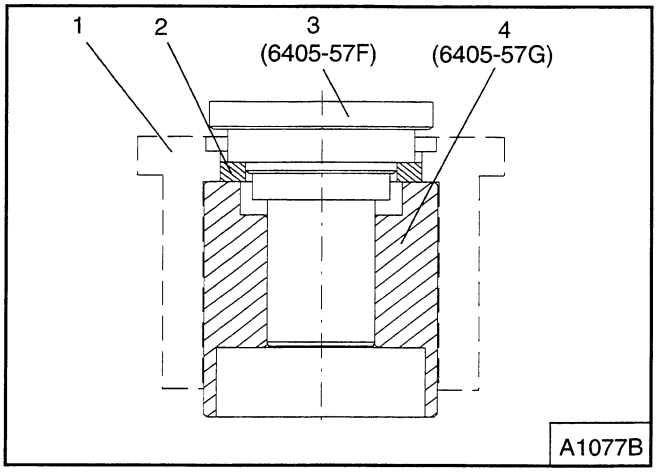
(a) Drive end field

Place the field coil (1) on the support (4) (with the larger diameter recess in the support uppermost). Use the mandrel (3) to press the seal (2) downwards into the recess.



(b) Rectifier end field

Place the field coil (1) on the support (4) (with the larger diameter recess in the support uppermost). Use the mandrel (3) to press the seal (2) downwards into the recess.

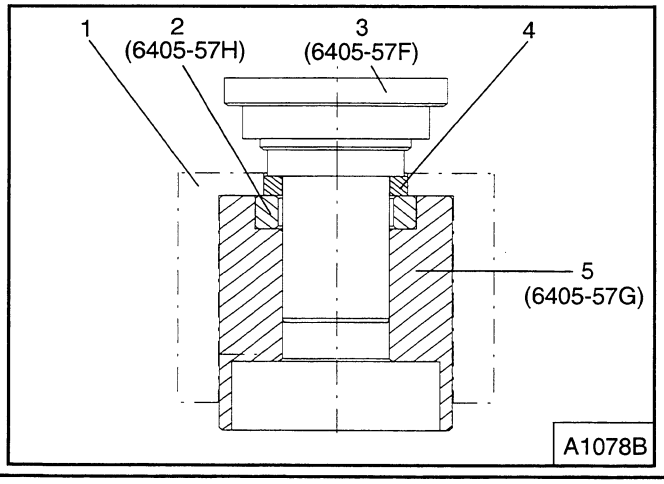


3.2.3 Fitting new seals (see Section 6.1.2. for tools)

(a) Drive end field

Place the field coil (1) onto the support (4) (with the smaller diameter recess uppermost). Fit a new seal (2) to the mandrel (3), with the flat face of the seal towards the mandrel shoulder.

Lightly grease the outer rim of the seal and fit it into the field bore, taking care to ensure that the seal is "square" to the bore. Press the seal in until it contacts the end face of the support. Do not use excessive force.



(b) Rectifier end field

Fit the ring (2) into the smaller recess in the support (5).

Place the field coil (1) onto the support (with the smaller diameter recess uppermost). Fit a new seal (4) to the mandrel (3), with the flat face of the seal towards the mandrel shoulder.

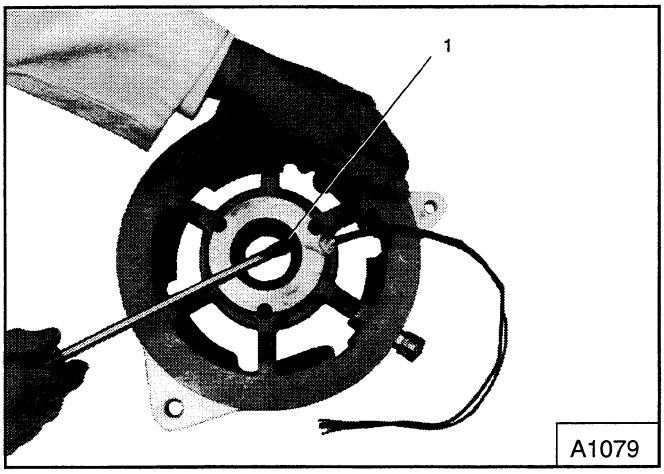
Lightly grease the outer rim of the seal and fit it into the field bore, taking care to ensure that the seal is "square" to the bore. Press the seal in until it contacts the end face of the ring. Do not use excessive force.

3.3 DRIVE END SHIELD

Examine the end shield for cracks or other damage. Check the mounting lugs and the bushes for wear or ovality. Clean all old grease from the passageways.

3.3.1 Removing the seal

As it is not possible to use a mandrel to press the seal (1) out, remove the seal by levering it out with a screwdriver or other suitable lever. Ensure that no damage is caused to the end shield face or bore.



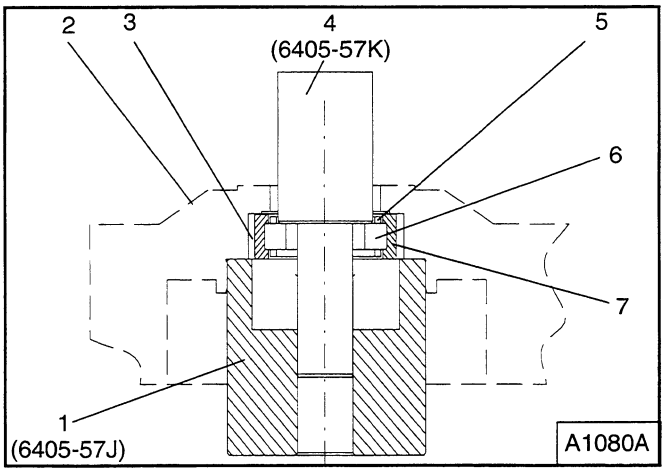
3.3.2 Removing the bearing (see Section 6.1.3. for tools)

Place the support (1) onto the bed of a suitable press and place the end shield (2) onto the support, located in the field coil mounting recess. The support must be used as shown, to avoid the risk of displacement of the liner (3) and the pressing load must not be taken by the frame of the end shield.

Place the mandrel (4) past the race cage (5) and into the bearing to rest on the rollers (6). Apply just sufficient force to press the bearing outer race (7) down from the liner.

Remove all traces of old locking compound from the inner surface of the liner.

Check that the liner is secure in the end shield.

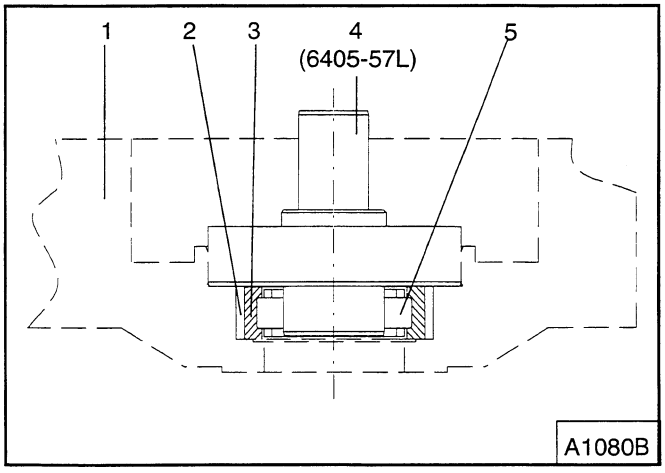


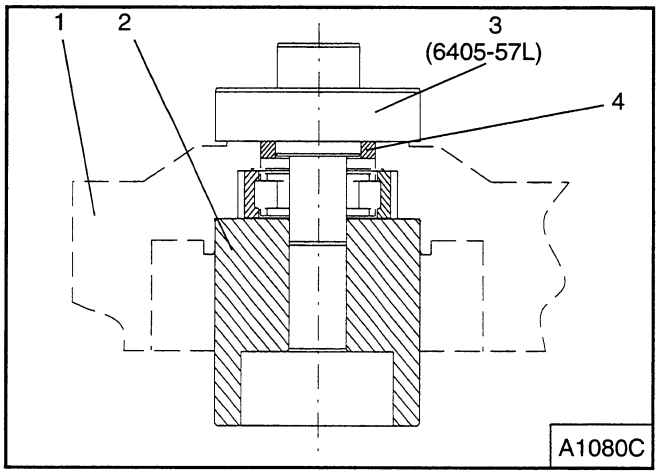
3.3.3 Fitting the bearing (see Section 6.1.3. for tools)

Place the end shield (1), with its outer face downwards, onto the bed of a suitable press.

Ensure that the rim of the outer race (3) of the bearing and the inner face of the liner (2) are grease-free.

Sparingly apply Loctite grade 601 to the rim of the outer race (ensuring that none can enter the caged rollers) and the outer race into the liner. Place the shorter end of the mandrel (4) into the roller cage (5) and enter the large diameter into the field coil recess. Press the outer race in until the mandrel abuts the field coil mounting face. **Do not use excessive force.**





3.3.4 Fitting the seal (see Section 6.1.3 for tools)

Place the end shield (1) onto the support (2), with the support located in the field coil recess. Fit the seal (4) to the mandrel (3), with its open end facing the mandrel shoulder. Lightly grease the outer rim of the seal. Enter the mandrel into the support and carefully press the seal into the end shield bore until the mandrel contacts the end shield outer face. **Do not use excessive force.**

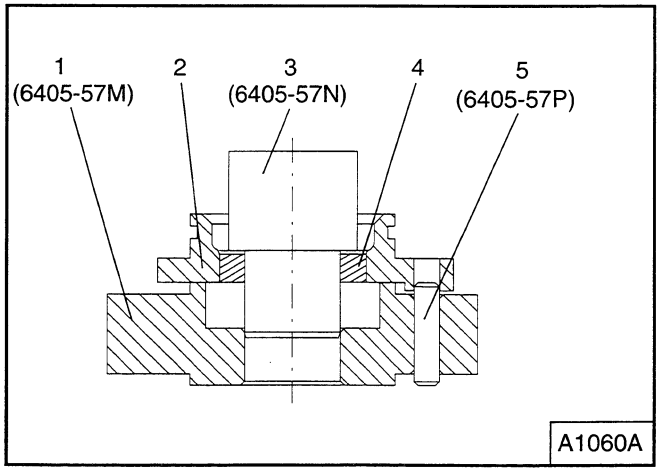
3.4 RECTIFIER END SHIELD

Examine the end shield for cracks or other damage. If necessary, remove any sharp edge to the holes through which the front stator phase leads and the front and rear field coil wires pass. Examine the mounting bolt sliding bush for tightness in the end shield bore. If the hole in the end shield is worn, replace the end shield; the bush must be a tight, but adjustable, fit.

Check that the bearing liner is secure in the end shield.

Clean all old grease from the passageways in the end shield.

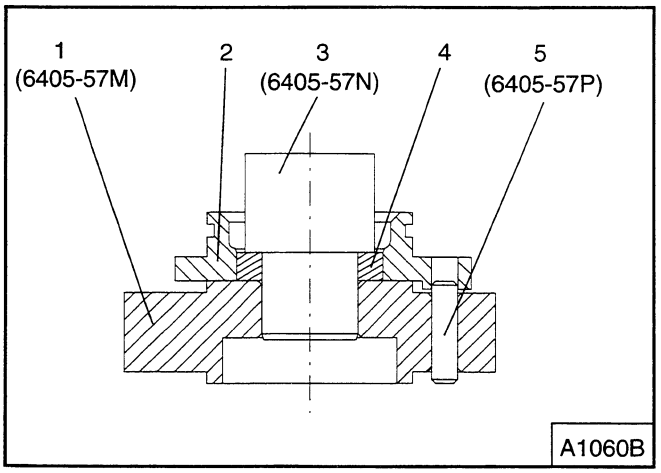
3.5 RECTIFIER END BEARING CAP



3.5.1 Removing the seal (see Section 6.1.4 for tools)

Ensure that the cap is undamaged and that there are no cracks. If it is damaged, it must be discarded.

Place the support (1) onto the press bed with the larger recess facing upwards. Place the cap (2), with its outer (rough) face downwards, onto the support. Align the three fixing screw holes with the spring dowel pins (5). Use the mandrel (3) to press the seal (4) down and into the recess.



3.5.2 Fitting the seal (see Section 6.1.4 for tools)

Turn the support (1) over to place the larger recess facing downwards and place the cap (2) onto the support, with the outer face downwards. Align the three fixing screw holes with the spring dowel pins (5).

Fit the new seal (4) to the mandrel (3), with its flat face towards the mandrel shoulder. Lightly grease the outer rim of the seal and press the seal into the cap until the seal just contacts the upper face of the support. Do not use excessive force.

3.6 STATORS

3.6.1 Visual checks

Check the windings and lead wires for signs of overheating or mechanical damage to the coils and insulation. Either stator may be replaced as necessary; they are not matched and are electrically different.

Check that the insulation of wires and the sleeves over the connecting tags are in good condition. Ensure that all windings are held securely in place and that all bindings are tight and in good condition.

3.6.2 Insulation check (see Section 6.7 Technical Data)

Clean the paint off a small area of each stator and check the insulation between the frame and one of the three stator "phase" leads using a 100 V DC tester. A minimum resistance of 10 MΩ should be indicated. If the resistance is below this figure, ensure that the stator is thoroughly dry and repeat the test. If the low resistance persists, the stator must be replaced.

3.6.3 Stator volt-drop check

Check each stator for continuity and correct resistance by wiring the 24 V battery in series with the adjustable load and the ammeter; complete the circuit across one pair of stator leads. Adjust the load to give a current of 40 A, then measure the voltage across the same two stator leads with the voltmeter.

Repeat this test on the remaining two pairs of leads. The indicated voltage should be the same for each test, within the limits given in Section 6.

Note: The two stators have different resistances, so that volt-drop across the phase windings will also be different.

Caution: Keep the time involved in this test to a minimum to avoid overheating the windings.

3.7 FANS

Check both fans for damage. Place the fan on a flat surface to check for distortion. If there are any signs of cracking of the blades or the structure of either fan, it must be replaced. Do not attempt to straighten blades; if either fan is faulty or damaged, it must be replaced.

3.8 REGULATORS

Note (1): The following tests are to be conducted with the regulators out of the alternator.

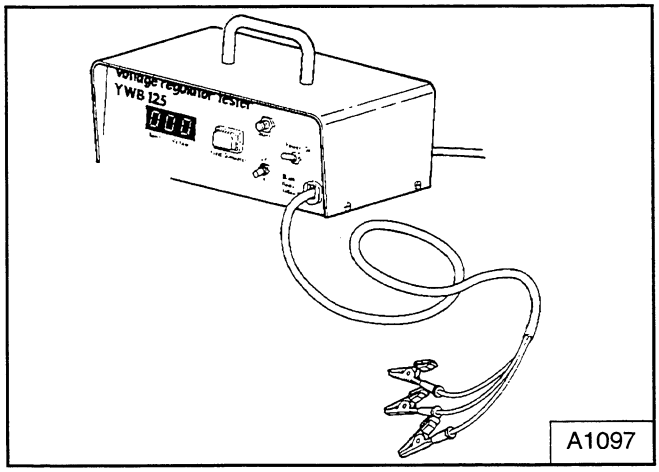
Note (2): Do not insulation-test the regulators.

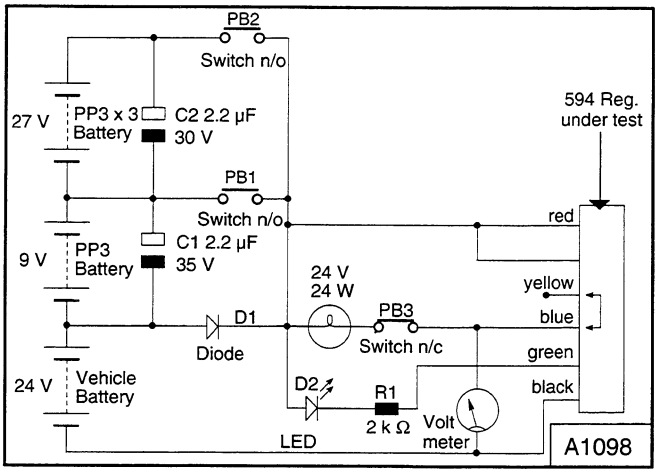
3.8.1 Testing the "regulated" voltage

Carry out the following test sequence for each regulator in turn, using the YWB 125 tester:

(i) Temporarily link together the red, blue and yellow wires from the regulator. Connect the red tester clip to the wires.

(ii) Connect the green wire from the regulator to the yellow tester clip.





"BOVSPU" Tester circuit

(iii) Connect the black regulator wire to the black tester clip.

(iv) Plug the tester into a suitable mains supply and switch on the mains.

(v) Switch on the tester - the display should be illuminated.

(vi) Press and release the "Start" button. The Field Simulator lamp should glow and a voltage value will be displayed.

If the correct voltage (27.8 V - 28.2 V) is shown, and the Field Simulator lamp glows, the regulator is fit for further service.

If an incorrect voltage is indicated and the Field Simulator lamp glows very brightly or does not glow at all, carry out the following checks:

(a) Check that the test leads are not shorting together.

(b) Repeat the test with the polarity switch (F+, F-) set to the opposite field system.

If an incorrect voltage is still shown, the regulator is faulty and must be replaced.

(vii) Switch off the tester and remove the test clips.

Repeat the test with the other regulator.

3.8.2 Testing the battery over-voltage and surge protection units ("BOVSPUs")

(i) Connect the regulator and tester circuit as shown. When all connections are complete, the LED D2 should be ON.

If the lamp is ON, the "BOVSPU" functions have failed open-circuit. If the LED does not light, the regulator function has failed open-circuit.

(ii) Press PB1; the LED should be switched OFF. If it is not, the regulator function has failed short-circuit.

Note: The state of the LED is not important in the remaining tests.

(iii) Press PB1 and hold it in for 5 seconds. The lamp should light. If it does not, check that, with PB1 held in, there is a voltage of at least 33 V between the black and yellow wires. If the voltage is correct and the lamp does not light, the BOVSPU battery over-voltage trip within the regulator is faulty.

(iv) Release PB1; the lamp should remain lit.

(v) Press PB3; the lamp will be switched off.

(vi) Release PB3; the lamp should be switched on again. If it is not, the BOVSPU latch function is faulty and the regulator must be replaced.

(vii) Switch the 24 V supply OFF and ON again, to reset the latch function.

(viii) Press and release PB2. The lamp should be lit and go off almost immediately. If it does not light, check that, with PB2 held in, there is a voltage of at least 55 V between the black and yellow regulator wires.

If the voltage is correct and the lamp does not light, the BOVSPU surge protection trip function is faulty. If the lamp lights and stays lit, the BOVSPU reset function is faulty. In both cases, the regulator must be replaced.

3.9 TESTING THE TERMINAL BLOCK DIODES

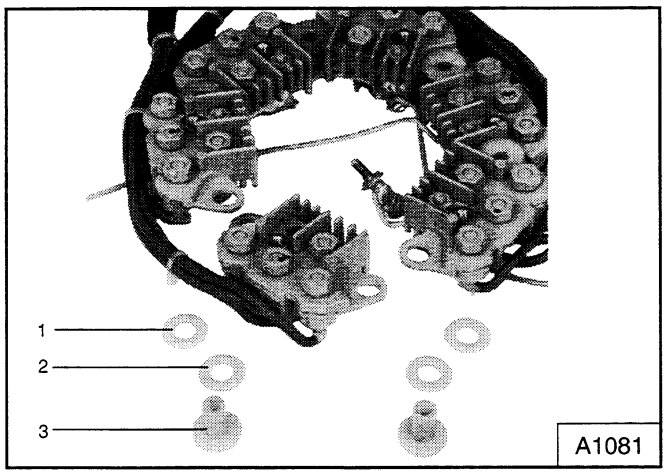
Note: Do not insulation-test these diodes.

With all connections to the terminal block removed, check each of the four diodes in turn with a suitable diode tester. If the diode terminations are painted, remove just enough of the paint to ensure good contact. All four diodes should show the same reading when tested in the "forward" direction. Before reassembly to the machine, repaint the diode terminations.

3.10 SEPARATING THE HEAT SINKS

It is not necessary to separate the heat sinks unless they are damaged or broken, or there are signs that any of the insulators have failed.

Adjacent heat sinks are joined by means of a tubular insulator (3) (shown inverted) and separated by a flat insulating disc (2), with another disc (1) to retain the assembly. The outer ends of the tubular insulators are slightly larger than the bores of the discs; the discs may be carefully levered off the tubes by means of a suitable screwdriver.



Warning

The discs may be ejected at speed unless they are covered during removal.

3.11 TESTING THE DIODES

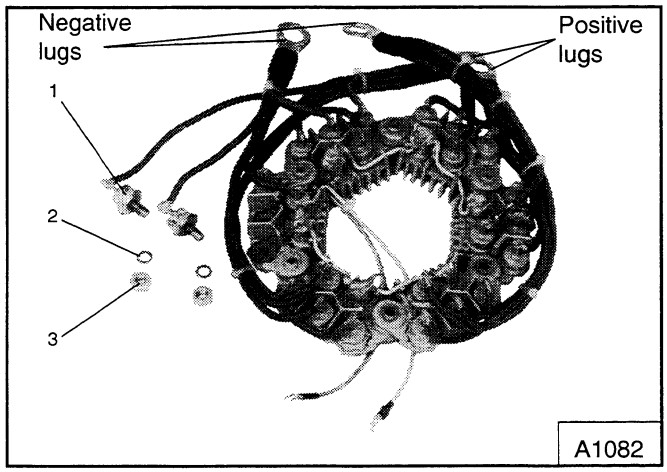
3.11.1 Testing the main diodes (Use a 100 V DC tester)

Refer to the table below for the correct responses of the diodes.

Test No.	Positive (#) (red) lead connected to:	Negative (#) (black) lead connected to:	Diodes under test	Result should be:
1	Each heat sink (*) in turn.	Positive lug	Positive	Zero
2	Positive lug	Each heat sink (*) in turn.	Positive	> 10 MΩ
3	Negative lug	Each heat sink (*) in turn.	Negative	Zero
4	Each heat sink (*) in turn.	Negative lug	Negative	> 10 MΩ

Note (1): (#) = "Positive" and "negative" leads refer to those from the Tester.

Note (2): (*) = "or diode body".



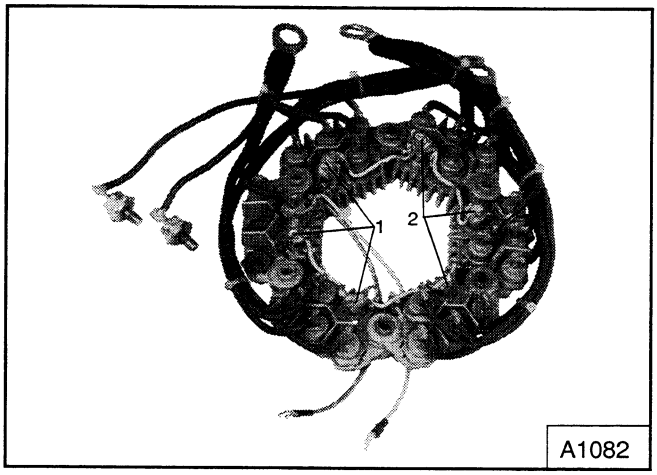
If a test result does not conform to the table above, the faulty diode pair must be separated. Unscrew and remove the nut (3) and spring washer (2) from one diode (1) in the faulty pair. Remove the diode from the heat sink and ensure that the diode stud does not touch the heat sink.

Repeat the tests to identify the faulty diode.

If the resistance is high when it should be low, either the diode under test is faulty or the lead connecting the diode to its main tag is broken or has a high-resistance connection, at either the diode or the tag.

If a diode fault is confirmed, i.e. the resistance is the opposite to that required and the connections are not broken, the diode must be replaced.

Confirm that the securing nuts on all the other diodes are tight and that all soldered connections are firm.



A1082

3.11.2 Testing the auxiliary diodes

The auxiliary diodes are at positions (1) and (2).

Test No.	Positive (red) lead connected to:	Negative (black) lead connected to:	Diode under test	Result should be:
5	Each heat sink in turn.	Relevant "A" wire	Auxiliary	Zero
6	Relevant "A" wire.	Each heat sink in turn.	Auxiliary	> 10 MΩ

If a diode fault is confirmed, i.e. the resistance is the opposite to that required and the connections are not broken, the diode must be replaced.

Confirm that the securing nuts on all the other diodes are tight and that all soldered connections are firm.

3.12 REPLACING A FAULTY DIODE

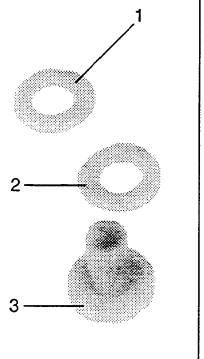
Un-solder the lead from the diode. Replace the diode with a new one, checking that its polarity is the same as the displaced diode. Refer to Section 6.8 for the solder to be used.

Carry out the appropriate tests on any new diodes when they have been connected to the main wires, as described in Section 3.11 above.

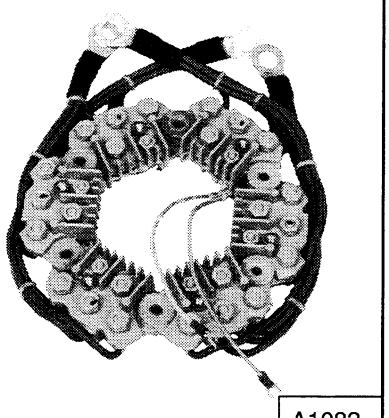
If an auxiliary diode is to be replaced, and the rectifier pack has been completely dismantled, connect the new diode after the heat sinks have been joined.

When all diode tests have been completed and any faulty diodes replaced, clean any old material from the "loose" diodes and the heat sinks, to ensure good thermal and electrical contact. Smear a small quantity of "Biccon XI" on to the seating faces. Fit the diode to their heat sinks; hold the diode body hexagon and fit the spring washers and nuts, tightened to their specified torque.

3.13 HEAT SINKS



A1081


A1083

3.13.1 Reassembling the rectifier assembly

The individual heat sink assemblies are identical, but the lengths of the leads from the diodes to the main tags are different and will dictate the positions of the heat sinks in the rectifier pack. If the rectifier pack has been completely dismantled, assemble the heat sinks in a circle with their ends alternately above and below each other and with the holes at each end aligned.

Fit an insulating bush (3) down through the each end of the three upper heat sinks, with the head of the bush on the same side as the diode securing nuts.

Fit one insulating washer (2) to the other end of each bush, to separate the heat sinks. Note that the ends of the bushes are slightly enlarged to retain the insulating washers, but the washers should easily be pressed onto the bushes.

If any difficulty is experienced, invert the rectifier assembly, rest the head of the tubular insulator on a small block and use a small piece of suitable tube to press the insulating disc into position. Fit the remaining three (lower) heat sinks to the bushes, with the diode connections facing the same way as the first set.

Secure the lower heat sinks to each bush with the remaining insulating washer (1).

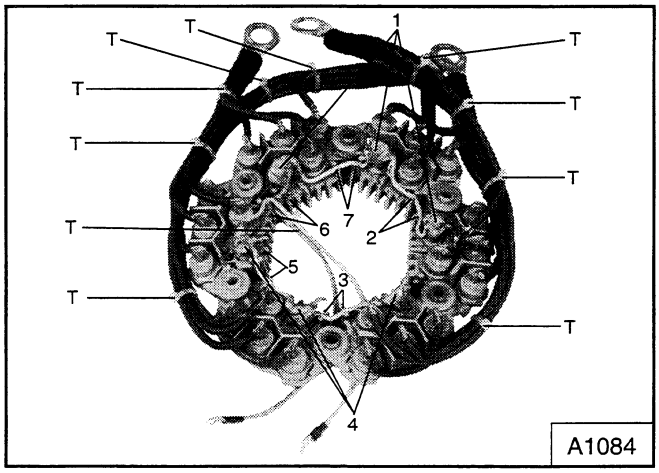
3.13.2 Connecting the auxiliary diodes and securing the wires

Connect the auxiliary diodes together in two groups of three (1) and (4), using the solder specified in Section 6.8. Ensure that the exposed ends of the diodes are clean and dry and cover them with silicone rubber sealant ("Silcoset") to make a watertight seal.

Press the wires together down between the small pillars on the heat sinks at the positions shown (2), (3), (5), (6), and (7).

Fit tie-wraps to the main and auxiliary wires in the positions marked "T" shown in the illustration.

When the rectifier assembly is complete, spray it with blue epoxy paint E192, ensuring that the main output terminal tags are not painted and that overspray does not cover the phase lead connection points on the heat sinks.



3.14 ROTOR

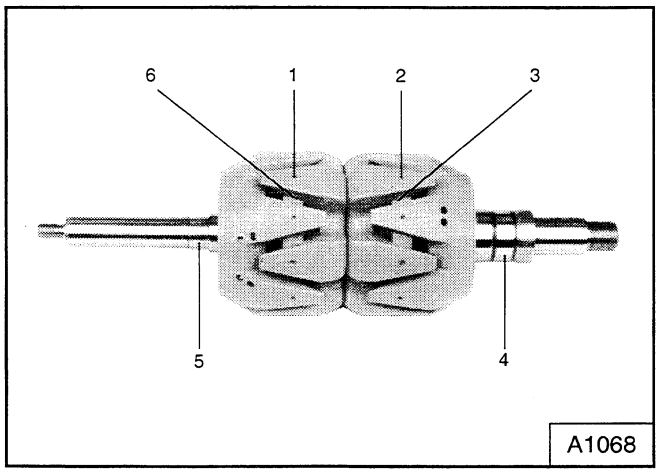
3.14.1 Checking the assembly

If there are significant signs of interference between adjacent components during service i.e. between the rotors and the field coils or the stators, the complete rotor/shaft assembly must be replaced, together with any other damaged component.

Check the security of the pairs of rotor "claws", the tightness of the locking spring dowel pins (two are shown at (1) and (2), and the non-magnetic rings (3) and (6).

Check that the muffs are secure on the shaft.

Mount the rotor assembly between centres and check the shaft for "runout" at each of the bearing journals (4) and (5) (note that, in the illustration, the bearing inner race is still fitted). If runout exceeds ± 0,1 mm measured at the bearing journals, the rotor assembly must be replaced; do not attempt to straighten the shaft.

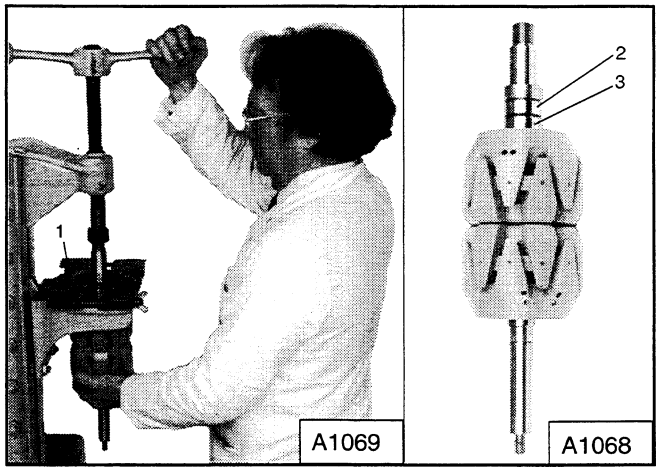


3.14.2 Removing the drive end bearing inner race and spacer

Clamp the two halves of the race support plate (1) carefully into the groove formed between the bearing inner race (2) and the shaft inner spacer (3) and apply pressure to the end of the shaft to withdraw the race. Ensure that the thread on the drive end of the shaft is protected by using a suitable spacer. As the race is separated from the inner spacer, readjust the support plate into the gap thus formed.

Warning

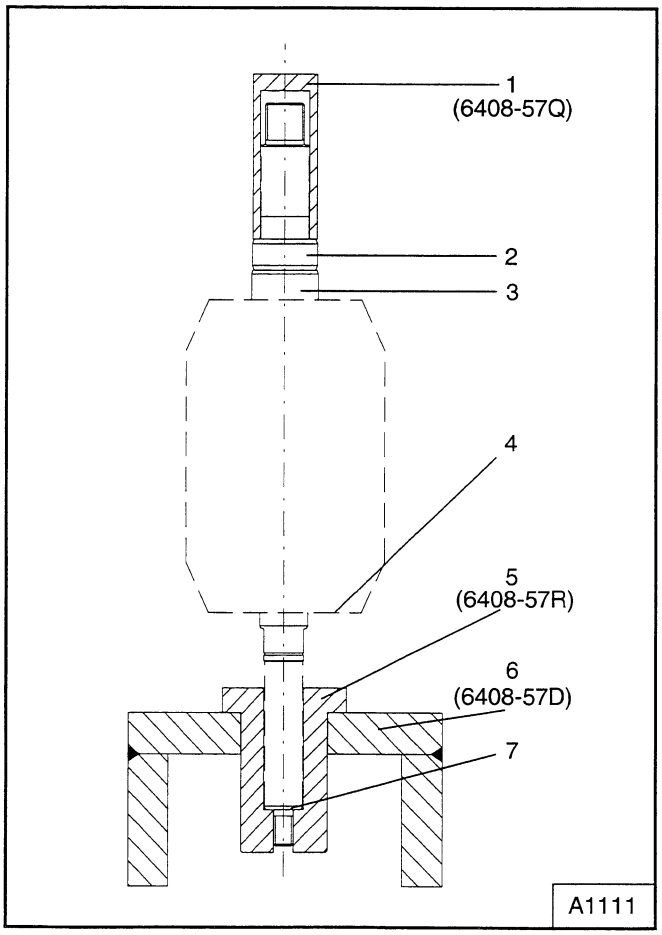
The weight of the shaft and rotor assembly is approximately 12 kg and care must be taken to support it as the shaft is pushed through the bearing race.



Note: Early examples of the alternator will be fitted with a chamfered inner spacer, with the chamfer adjacent to the bearing inner race; later versions may have a step formed into the outer end of the spacer to facilitate easier fitment of the race support plate.

Remove the inner spacer.

Note: Do not attempt to remove the rotor "claws" or muffs from the shaft; their accurate assembly is critical to correct operation of the alternator and the rotor is only supplied as a complete, factory, assembly.



3.14.3 Fitting a new drive end bearing inner race (see Sections 6.1.1 and 6.1.5 for Special Tools)

Note: The specified protection caps must be used. Do not apply any load onto the end of the rectifier end rotor "claw" assembly (4) or the muff.

Place the support (6) on the bed of a suitable press.

Fit the lower cap (5) to the rectifier end of the rotor and place the rotor and cap into the support, so that its weight is taken on the rear fan support shoulder (7).

Fit the inner spacer (3) (which is 2.0 mm longer than the outer spacer) to the drive (keyway) end of the rotor, with its chamfered (or stepped) end facing outwards. Fit the roller bearing inner race (2) to the rotor and press it into position, using the protection cap (1).

Note: Do not apply excessive force, which could be transmitted to the muffs or "claws", but just enough force to ensure that the spacer is clamped by the bearing inner race.

3.15 STATOR HOUSING

Examine the housing for any cracks or damage. If the holes through which the stator phase leads and the front field wires pass have any sharp edges, carefully remove them.

If the alternator is of the cradle-mounted type, examine the locating pin for damage; replace it if necessary.

3.16 LUBRICATORS

Remove the Stauffer grease caps from their bodies and clean out all the original grease. Refill the passageways with the specified grease. Carefully purge any air bubbles within the grease passageways. Refill the grease caps.

Note: The grease passageway in the rectifier end shield is pierced by one of the rectifier pack securing screw holes; temporarily place a screw in the hole (but do not block the passageway) to ensure that grease passes into the cavity in the inner face of the bearing housing. Remove and discard the first few millimetres of grease which emerge.

3.17 PULLEY

Examine the pulley sheaves for cracks or damage. Examine the Belleville washer for cracks. Replace it if it is "flattened".

3.18 INSULATORS

Check all insulators and insulating washers for breakage or signs of tracking.

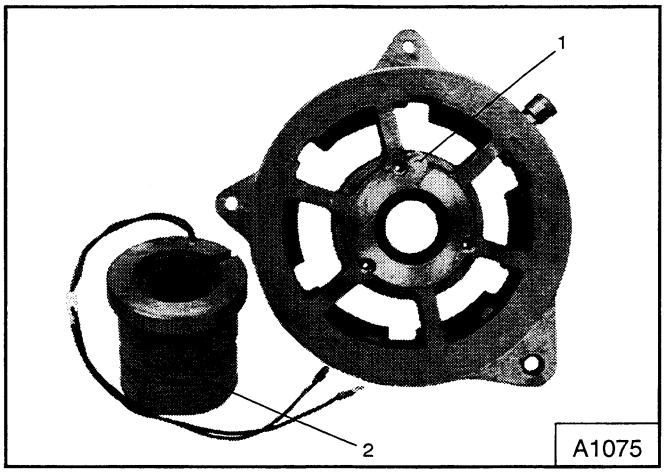
Note : See Section 6.1 and 6.2 for the relevant assembly tools, adhesives and sealants.

4.1 FITTING THE FIELD COIL, LUBRICATOR AND LONG STUDS TO THE DRIVE END SHIELD

4.1.1 Field coil

Ensure that the mating faces of the end shield and the field are burr-free and that the tape (2) securing the windings will not foul the rotor. Fit the field coil to the end shield and feed the field leads through the hole (1) in the drive end shield, one at a time. Ensure that the three Allen screws are clean and dry. Fit spring washers to the screws, lightly smear the threads with the specified grade of Loctite and tighten the screws to the specified torque.

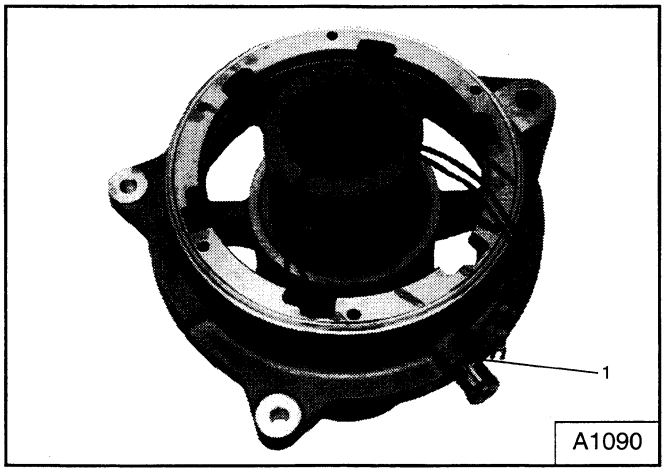
Bend the field wires back into the drive end shield.



4.1.2 Lubricator

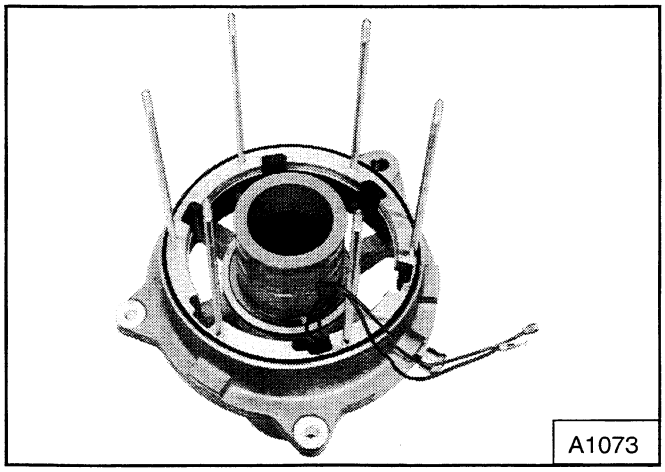
Fit the lubricator body (1) to the end shield and tighten it to the specified torque.

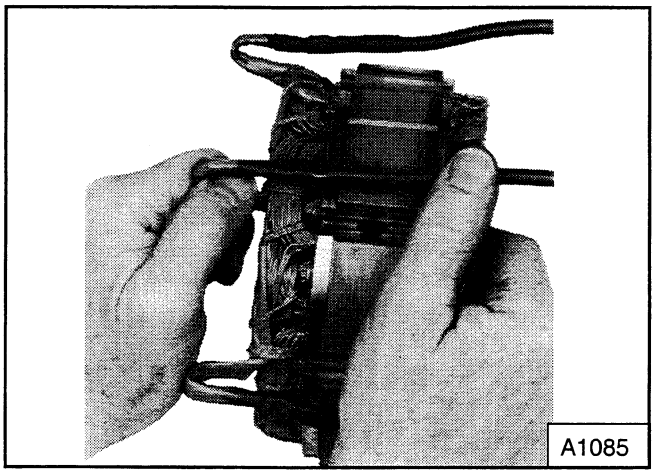
Use a grease gun, filled with the specified grease, to fill the lubricator body and the passageways in the end shield and the field coil until grease can be seen at the inner end. Place grease all around the caged rollers. Fill the lubricator cap, fit it to the body and leave it just engaged with the threads (it will be screwed fully onto the lubricator body after fitment of the shaft and inner race to the alternator).



4.1.3 Studs

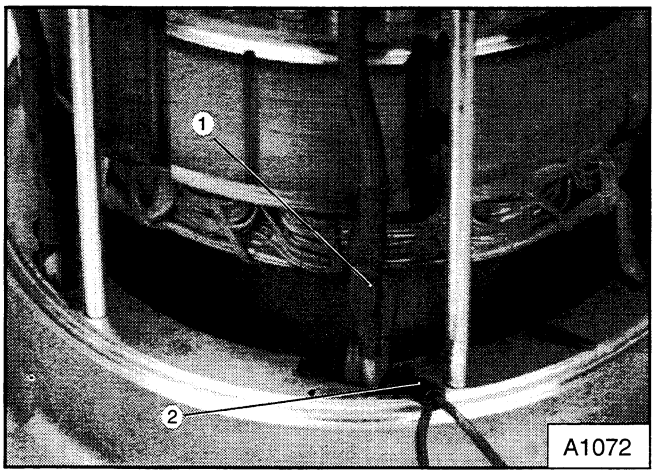
Fit the six long studs, using a pair of suitable nuts locked together. Tighten them to the specified torque.





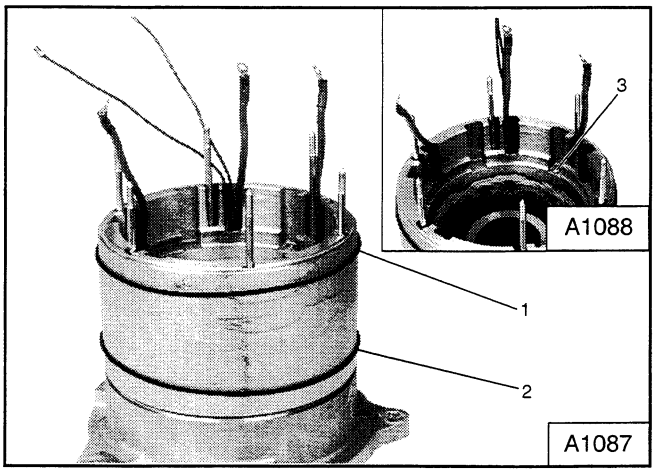
4.2 FITTING THE DRIVE END STATOR

If a new drive end stator is to be fitted, carefully bend the "phase" leads outwards and back on themselves as shown (10 mm minimum radius) and at approximately 25 mm from the coils.



Fit the stator to the drive end shield with the phase leads facing towards the rectifier end and with the middle lead (1) adjacent to the drive end field wires (2). Settle the stator onto the register in the drive end shield.

Ensure that the stator centre phase lead and the front field wires can be secured together with a cable tie when the alternator is fully-assembled.

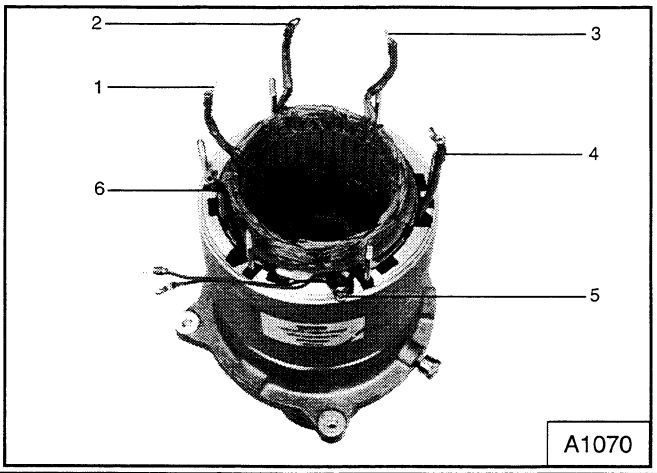


4.3 FITTING THE STATOR HOUSING

If specified, fit two new O-ring seals (1) and (2) over the stator housing. Fit the stator housing over the six long studs, with the (R) identification (3) facing upwards (i.e. towards the rectifier end). Note that there are only three phase lead holes, thus the position of the stator housing is fixed.

Carefully feed the field wires through the hole which they will share with the centre phase lead, then feed the three phase leads through their respective holes, ensuring that the insulation around the connecting tags is not destroyed.

Confirm that the stator laminations are properly seated on the register on the stator housing.



4.4 FITTING THE RECTIFIER END STATOR

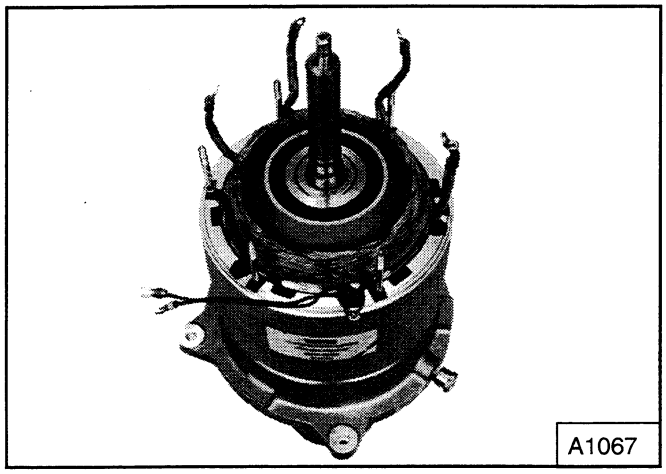
Fit the stator, with its "phase" leads (1), (2), and (3) facing upwards and equally spaced from the front stator phase leads (4), (5) and (6), to the stator housing, ensuring that the laminations are properly seated on the housing register.

Align the winding slots in the two stators so that they are "staggered" i.e. approximately half-way offset relative to each other.

4.5 FITTING THE ROTOR

Place the partly assembled alternator onto two blocks approximately 90 mm high, or onto a large diameter tube of suitable height to allow the shaft to be fitted.

Very carefully insert the rotor assembly through the drive end field coil and the stator and enter the bearing inner race into the drive end bearing. Do not turn the rotor shaft as it is fitted, to avoid the risk of damage to the seal, the field coils or the stators; ensure that the bearing inner race has fully entered the roller cage.



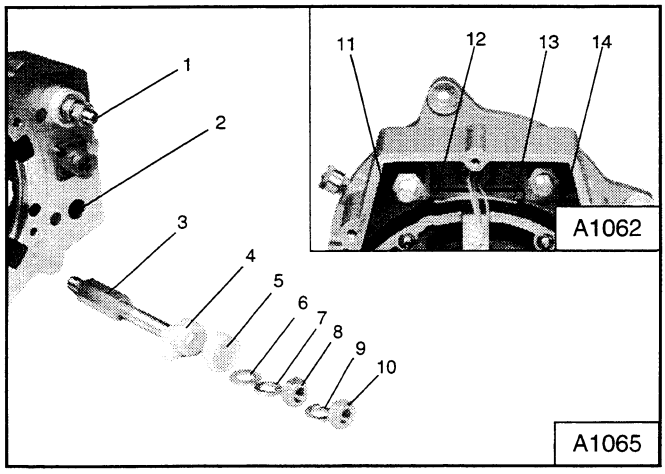
4.6 ASSEMBLING THE RECTIFIER END SHIELD

(i) Fitting the output terminals

The positive terminal (3) is the longer of the two and has M12x1,75 threads at each end. Fit the inner insulator (4) to the longer-threaded end, seating the body of the terminal into the hexagon socket in the insulator. Fit the terminal inside the rectifier end shield through the hole (2) adjacent to the positive indicator.

The rectangular part of the insulator must fit between the lugs (11), and (12) in the end shield. Fit the outer insulator (5) with its smaller diameter in the end shield hole, flat washer (6), the thicker of the two 12 mm bore spring washers (7), and nut (8). Restrain the terminal and tighten the nut to the specified torque. Fit the outer spring washer (9) and nut (10), leaving them finger-tight.

Repeat the operation for the shorter, negative, terminal (1), which has an M10x1,5 outer thread. Align the inner insulator between the lugs (13) and (14).



(ii) Fitting the auxiliary plug

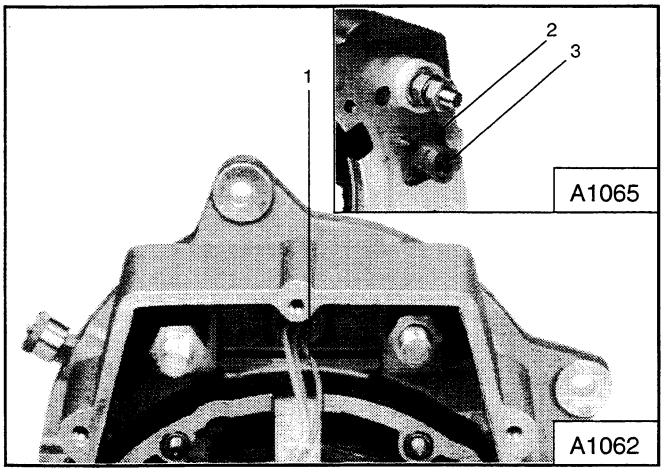
Pass the plug wires (1) through the hole in the end shield; position the plug (3) with the red "AC" wire in the upper left position (when viewed from the front of the alternator), securing the plug with the four screws (2), each with a shakeproof washer under its head, followed by a flat washer, tightened to the specified torque.

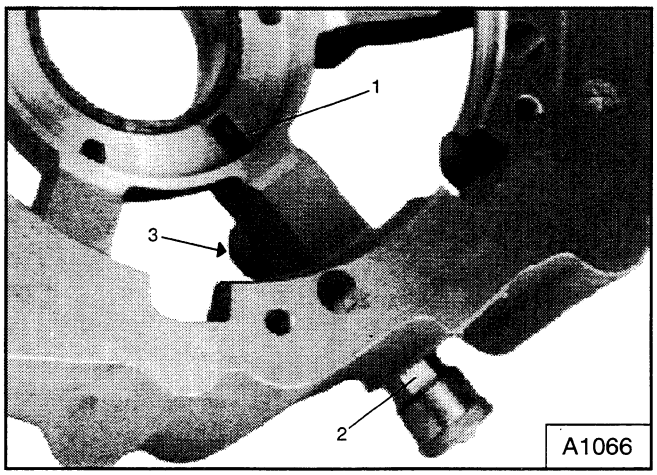
Using the 100 V DC Megohm Tester, check the insulation resistance to the end shield of the following (before connection to the internal components):

(a) Main positive and negative output terminals.

(b) All three wires from the auxiliary plug.

A resistance of at least 10 MΩ must be recorded. If it is not, the cause must be investigated before proceeding to the next assembly stage.



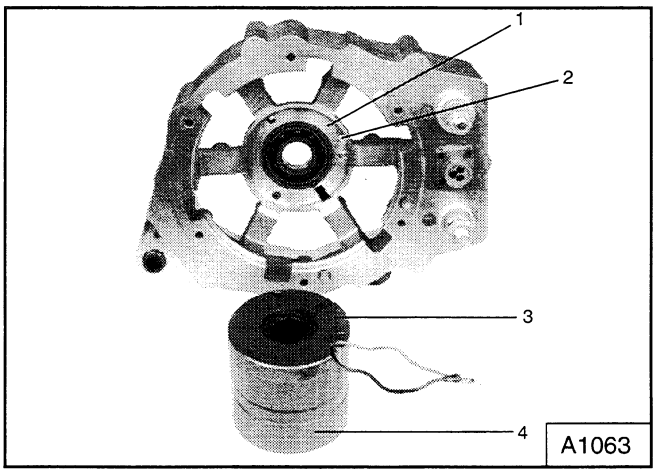


(iii) Fitting the lubricator

Fit the lubricator body (2) to the end shield, tightened to the specified torque. Temporarily fit one of the rectifier assembly retaining screws into the threaded hole (3) which breaks into the grease passageway leading to the bearing to prevent loss of grease whilst charging the system.

Use a grease gun, filled with the specified grease, to fill the lubricator and the passageway until grease can be seen emerging from the slot (1) in the end face of the field coil. Remove the first few millimetres of grease in case any contamination has been picked up, and purge any air bubbles.

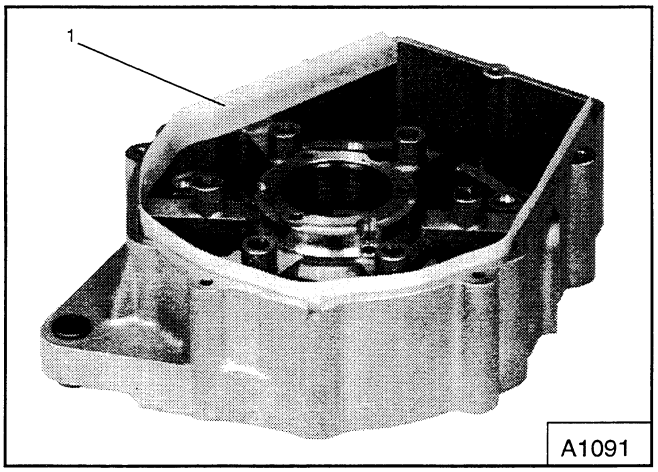
Fill the lubricator cap and fit it to the body, leaving it just on the thread.



(iv) Fitting the rear field coil to the rectifier end shield

Ensure that the mating faces (1) and (3) of the end shield and the field are burr-free and that the tape (4) securing the windings will not foul the rotor. Lay the field coil face down on a clean, smooth surface. Place the end shield over the coil and feed the field wires through the hole (2) in the end shield, one at a time.

Ensure that the three Allen screws are clean and dry; fit spring washers to the screws and smear the threads with the specified grade of Loctite. Fit the screws through the end shield and into the field coil. Tighten the screws to the specified torque.

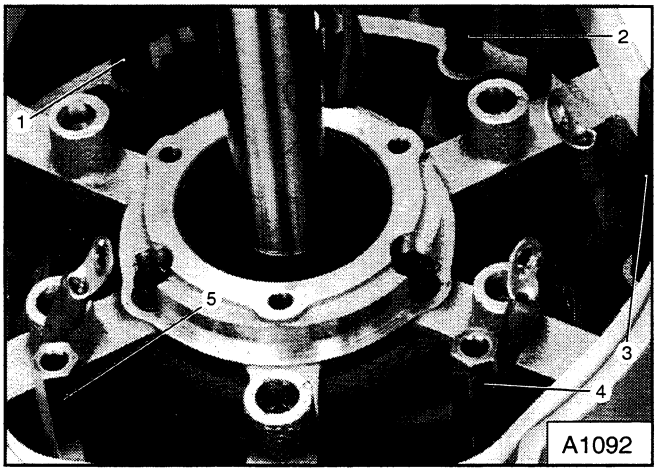


(v) Fitting the insulation strip

If the insulating strip (1), which is fitted to provide additional protection to the internal wires, has become displaced or damaged, remove any remaining material, degrease the inner face of the end shield and smear a band of "Bostik" All-purpose Adhesive around the face down as far as the level of the support webs.

Apply a similar band of adhesive to a new insulating strip. Allow the recommended drying time and fix the insulating strip to the end shield.

Remove the screw which has been acting as a temporary plug.

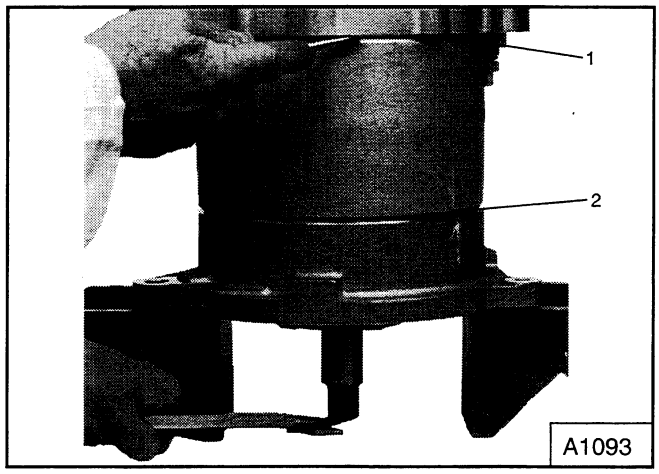


4.7 FITTING THE RECTIFIER END SHIELD

Grease the seal in the field coil and and fit the end shield over the rotor shaft and the long studs, aligning the mounting lugs (those with the steel sleeves) and lubricators on the two end shields. Place spring washers on to the long studs and fit the spacing pillars (five are shown at (1), (2), (3), (4) and (5)). Leave a gap of approximately 2 mm between the inner ends of the pillars and the end shield.

Use a lever and a pivot to carefully lift the rotor shaft (which will also lift the rectifier end shield) just enough to allow the two O-rings to be placed onto the shallow inner shoulders (1) and (2) at each end of the stator housing. Do not use an implement which could cut the O-rings.

Tighten the six spacers to their specified torque.



4.8 FITTING THE REAR BEARING (see Section 6.1.1 for Special Tools)

The bearing inner race (5) must be pressed onto the shaft; the outer race is a sliding fit in the liner (2) in the rectifier end shield (1).

Warning

Due to the weight of the alternator, either mechanical aid or two people must be used to place the machine onto the press. The machine must not be lifted by the shaft and must be supported at all times whilst it is on the press.

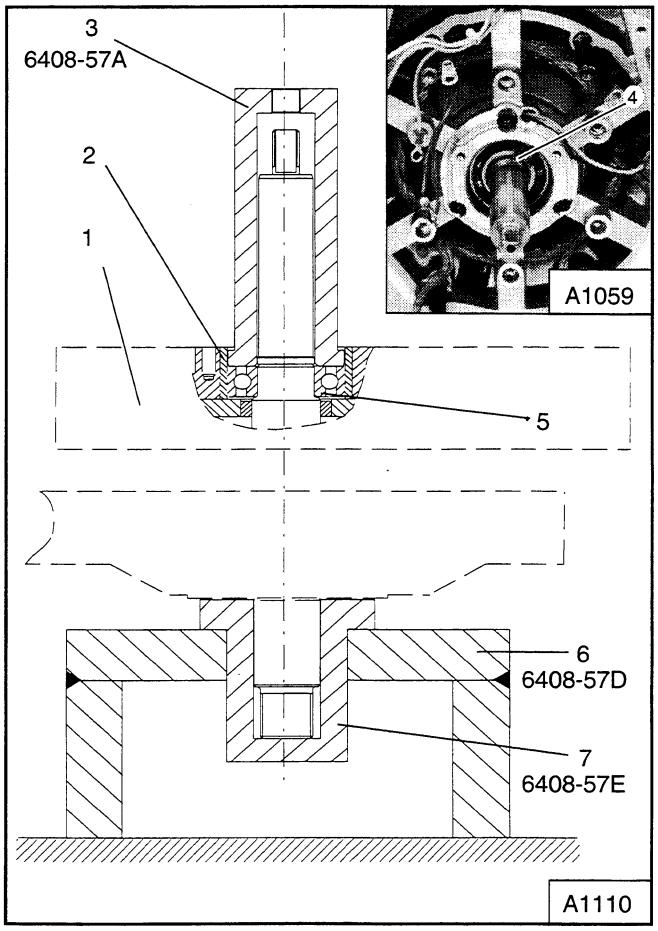
The weight of the alternator, and the load imposed when pressing the bearing onto the shaft, must be taken on the end of the shaft; under no circumstances may the loads be imposed upn the drive end shield.

Fit the cap (7) (without the extraction screw) into the support (6) and place the support on the bed of the press. Lift the alternator and place the drive end of the rotor into the sleeve. Great care must be taken to avoid damage to the shaft and the thread. The support will provide stability when the alternator is resting on the press bed.

Grease both sides of the bearing with the specified lubricant.

Fit the bearing to the rotor. Fit the cap (3) (without the extraction screw) over the shaft and press the bearing up to the shoulder on the shaft. Do not use excessive force.

Remove the upper cap, remove the alternator from the support (again using a lifting aid) and place it, with its axis horiztontal, on the bench. Fit the circlip (4).



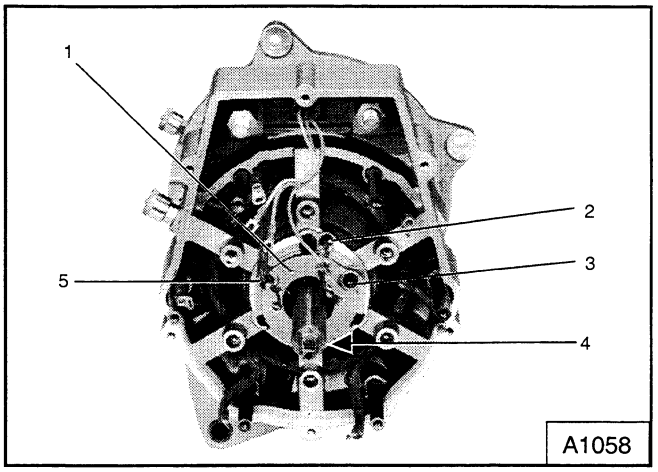
4.9 FITTING THE BEARING CAP

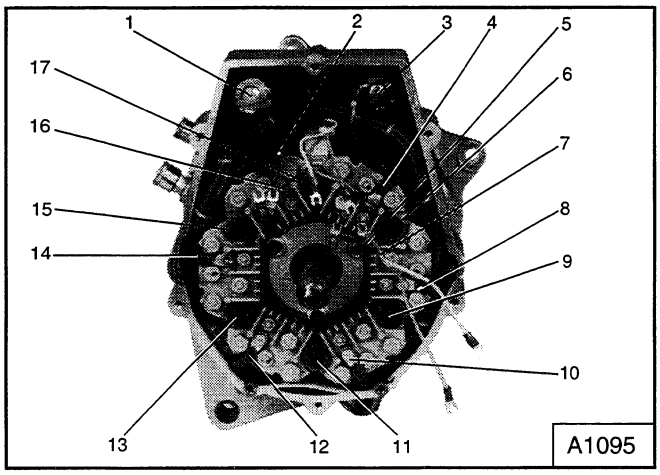
Ensure that the bearing is well-filled with grease.

Lightly grease a new O-ring and fit it to the bearing cap groove; fill the cap (1) with the specified grease, fit it to the rectifier end shield and secure it with the three Allen screws (3), (4) and (5) and spring washers, tightened to the specified torque.

Check the rotor for free rotation.

Ensure that the area around the field coil wires where they emerge from the hole in the end shield (2) is clean and dry and inject Silcoset into the hole and around the wires.





4.10 FITTING THE RECTIFIER ASSEMBLY

Fit the rectifier assembly with the diode stud nuts facing outwards, and with the grouped output leads over the positive and negative output terminals.

Note: Place the negative tag from the left-hand rectifier group over the negative terminal (3) first, followed by the negative tag from the right-hand rectifier; place the positive tag from the left-hand rectifier group over the positive terminal (1), followed by the positive tag from the right-hand rectifier group. This is to create the maximum space between the output wire groups and avoid strain on the tags.

Place the stator "phase" leads on the outside of the assembly, with the exception of the two top leads; the left-hand lead (16), which must pass between the two grouped positive leads (on the left in the illustration) and the heat sink nearest to the positive terminal. The upper right phase lead (4) must pass between the two grouped negative leads (on the right in the illustration) and the adjacent heat sink.

The wires (2) from the drive end field must pass over the rectifier assembly and downwards and the wires (7) from the rectifier end field must pass through the centre of the rectifier assembly and adjacent to the "A" wires (5). The wires from the drive end field must be placed on the left of the wires from the rectifier end field.

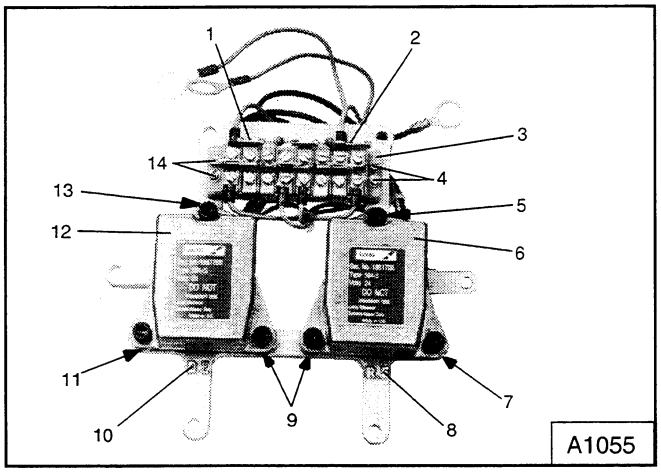
Ensure that the tubular insulators have all just entered the counterbores in the bearing assembly support bars.

Fit spring washers, followed by plain washers, to five of the six rectifier assembly Allen screws. Ensure that the threads are grease-free and carefully smear them with the specified Loctite; fit the screws (6), (9), (11), (13) and (17), leaving them loose.

Smear the screw (15) with the specified grade of Loctite under the head only. Fit a plain washer and a spring washer to the screw and fit the screw through the rectifier assembly to the end shield.

Fit the stator phase leads (8), (10), (12), (14) and (16) to the rectifier pack, secured with the slotted-head screws and spring washers, leaving the screws loose. The red (AC) wire from the socket must be fitted above the tag of phase lead (4).

Tighten all six rectifier assembly securing screws to the specified torque, and then tighten the phase lead screws to their specified torque.

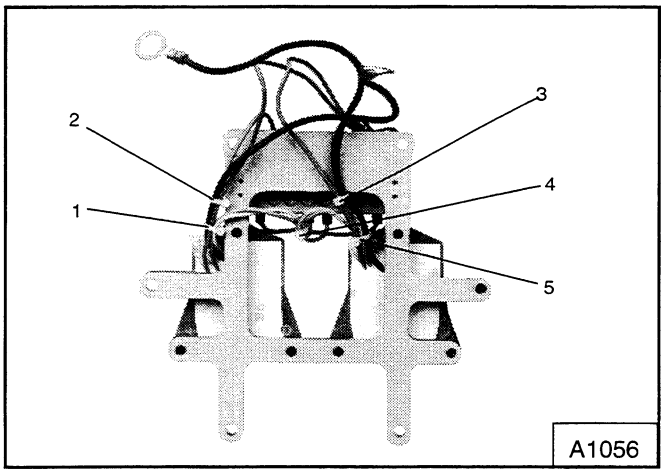


4.11 FITTING THE REGULATORS AND TERMINAL BLOCK TO THE SUPPORT FRAME

If it has been removed, fit the terminal block (3) to the frame, with the two triple linking bars (1) and (2) uppermost. Secure the terminal block with the four slotted-head screws (4) and (14), with spring washers under their heads, followed by flat washers. Tighten the screws to the specified torque.

Fit the two regulators (6) and (12) to the frame, with spacers at postions (5), (7), (9), (11) and (13) between the regulator housings and the frame, and secure the regulators each with three Allen screws and spring washers, tightened to the specified torque. The letters "DE" (10) (drive end) and "RE" (8) (rectifier end), denote which regulator controls which field. The regulators are identical, so it does not matter which is fitted to which side.

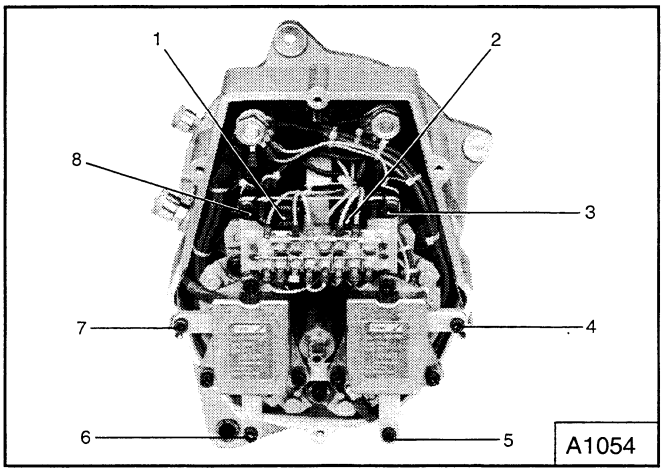
Turn the support frame assembly over and secure the wires with tie wraps at points (1), (2), (3), and (5). Note that the two pairs joined at point (4) are the green and yellow from each regulator; the other two groups are the red, black and blue wires.



4.12 FITTING THE REGULATOR SUPPORT FRAME ASSEMBLY AND CONNECTING THE WIRES

(i) Fitting the frame assembly

Fit the support frame assembly and fit the four Allen screws (4), (5), (6), and (7) and spring washers, leaving them only just engaged with the threads in the end shield. Fit a spring washer to each of the remaining two screws (3) and (8), followed by a suppressor. Loosely fit the two screws through the support frame to the end shield and position the suppressors (1) and (2) as shown. Leave the frame loose, to allow sufficient space behind through which to pass the regulator wires.



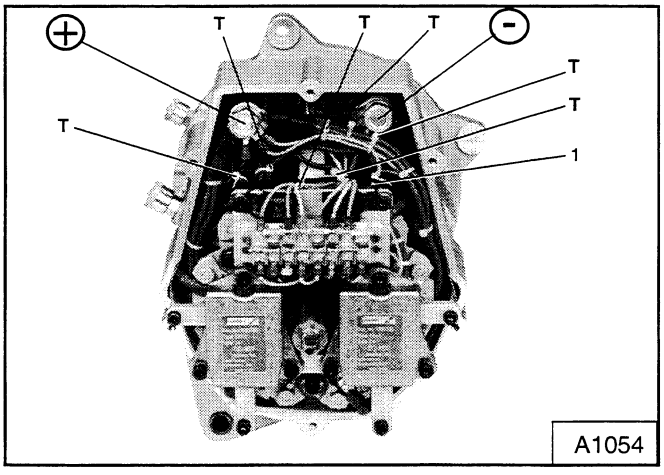
(ii) Connecting the wires to the main terminals

Fit the red leads from the two regulators to the positive terminal and the black leads to the negative terminal. Next, fit the lead from each suppressor to the adjacent output terminal. Fit a spring washer to each terminal. Restrain the external terminal nut adjacent to the insulator to prevent the imposition of strain on the insulator as the inner nut is tightened to the specified torque.

Use a 100 V DC "Megohm" tester to check insulation resistance between the frame of the alternator and the following terminals/pins:

B+ (both, if specified), B-, AC, AO and WL

The resistance, after 5 seconds, should be greater tham 10 MΩ. After this test, all connections must be discharged through a 15 kΩ resistor.



(iii) Connecting the wires to the terminal block.

Fit the blue, yellow and green wires from each regulator to the terminal block in the positions shown below.

Terminal Block

Blue (D.E. reg.)						Blue (R.E. reg.)	
Green (D.E. reg.)			Yellow (D.E. reg.)	Yellow (R.E. reg.)			Green (R.E. reg.)

Pass the two pairs of field wires under the terminal block and secure them to their respective terminals as shown below, together with the auxiliary diode wires and the wires from the auxiliary socket.

Terminal Block

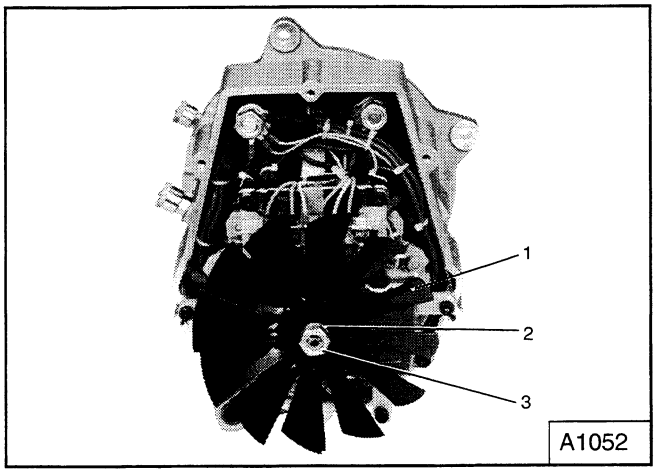
Blue (D.E. reg.)		Blue (aux. diodes)	Yellow (to plug (WL))	Blue (to plug (AO))	Yellow (aux. diodes)	Blue (R.E. reg.)	
Green (D.E. reg.)	Br'n/gr'n (D.E. field)	Blue (D.E. field)	Yellow (D.E. reg.)	Yellow (R.E. reg.)	Yellow (R.E. field)	Black (R.E. field)	Green (R.E. reg.)

Tighten the six regulator frame screws to the specified torque.

Fix a large tie-wrap (1) tightly between the two upper regulator frame spacers, to provide an anchor for the wires connected to the upper part of the terminal block. Secure the wires in position with cable ties at the points marked (T), taking care to avoid strain on the terminations.

Paint all exposed internal connections with blue Epoxy paint E192.

Caution: <u>Do Not</u> carry out any insulation tests once the regulator field circuits (blue and yellow wires) have been connected to the terminal block.



4.13 FITTING THE REAR FAN

Place the specified washer (not visible in the illustration) onto the shaft, followed by the rear fan (1) (with the six blind holes facing outwards) and the spring washer (2). Ensure that the rotor thread is grease free; apply Loctite 243 to the thread. Fit the nut (3) and tighten it to the specified torque.

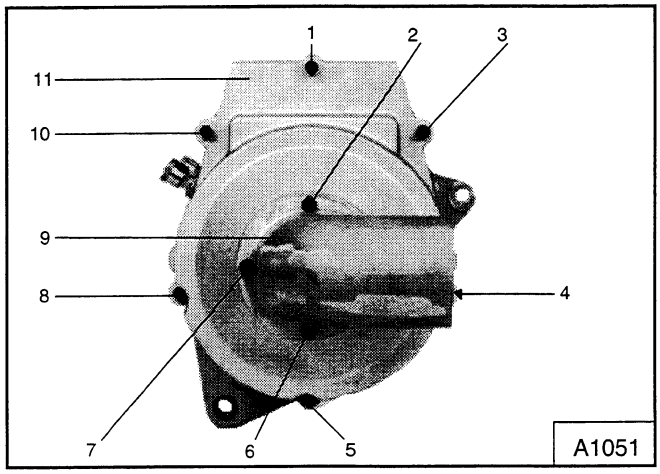
Caution: The fan must be treated with great care and <u>must not</u> be used as a restraint when its securing nut is tightened.

Fit a temporary pulley to the drive end of the shaft (if the alternator was not originally returned with one). Restrain the pulley and tighten the rear fan nut to the specified torque.

4.14 FITTING THE FAN SHROUD

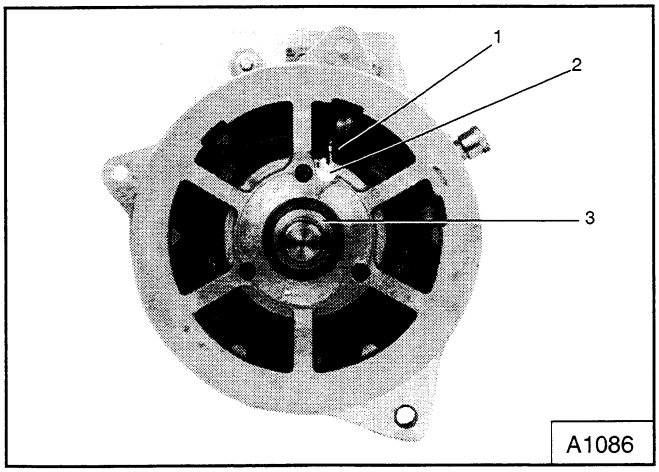
Fit the shroud (11) to the rectifier end shield and over the plastic insulating strip, securing it with the six screws and spring washers at (1), (3), (4), (5), (8) and (10).

If the air inlet connection (9) has been removed, fit it, secured with four screws and spring washers if it is of the straight-in, axial, type, or three screws (2), (6) and (7) and spring washers if it is an elbow. If it is of the latter type, fit it so that the input is pointing in the direction noted during dismantling. Tighten the screws to their specified torque.



4.15 SECURING THE FIELD WIRES

Seal the drive end field wires in position with Silcoset at position (2) where they emerge from the end shield. Secure the wires to the centre phase lead with a tie-wrap (1).

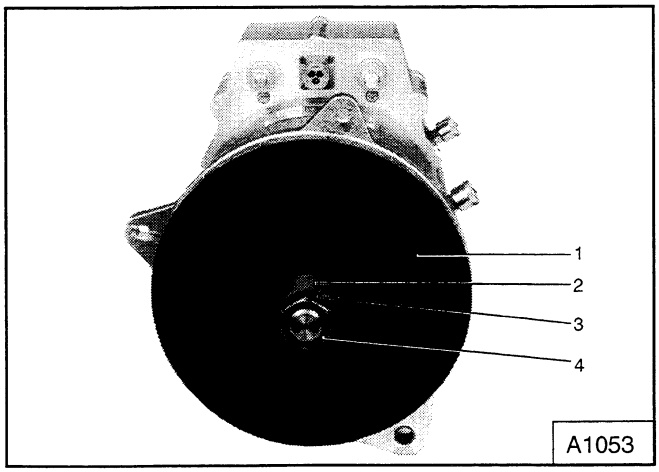


4.16 FITTING THE FAN AND PULLEY

Fit the drive end bearing outer spacer (3) (in Illust. No. A1086 above) to the drive shaft (with the chamfer facing inwards), followed by the front fan (1) with its flat face facing outwards.

Fit a new Woodruff key to the shaft and fit the drive pulley, followed by the "Belleville" washer, fitted with its concave face towards the pulley. Grip the pulley with a suitable tool and tighten the nut to the specified torque. Do not resist the tightening torque by restraining the fan.

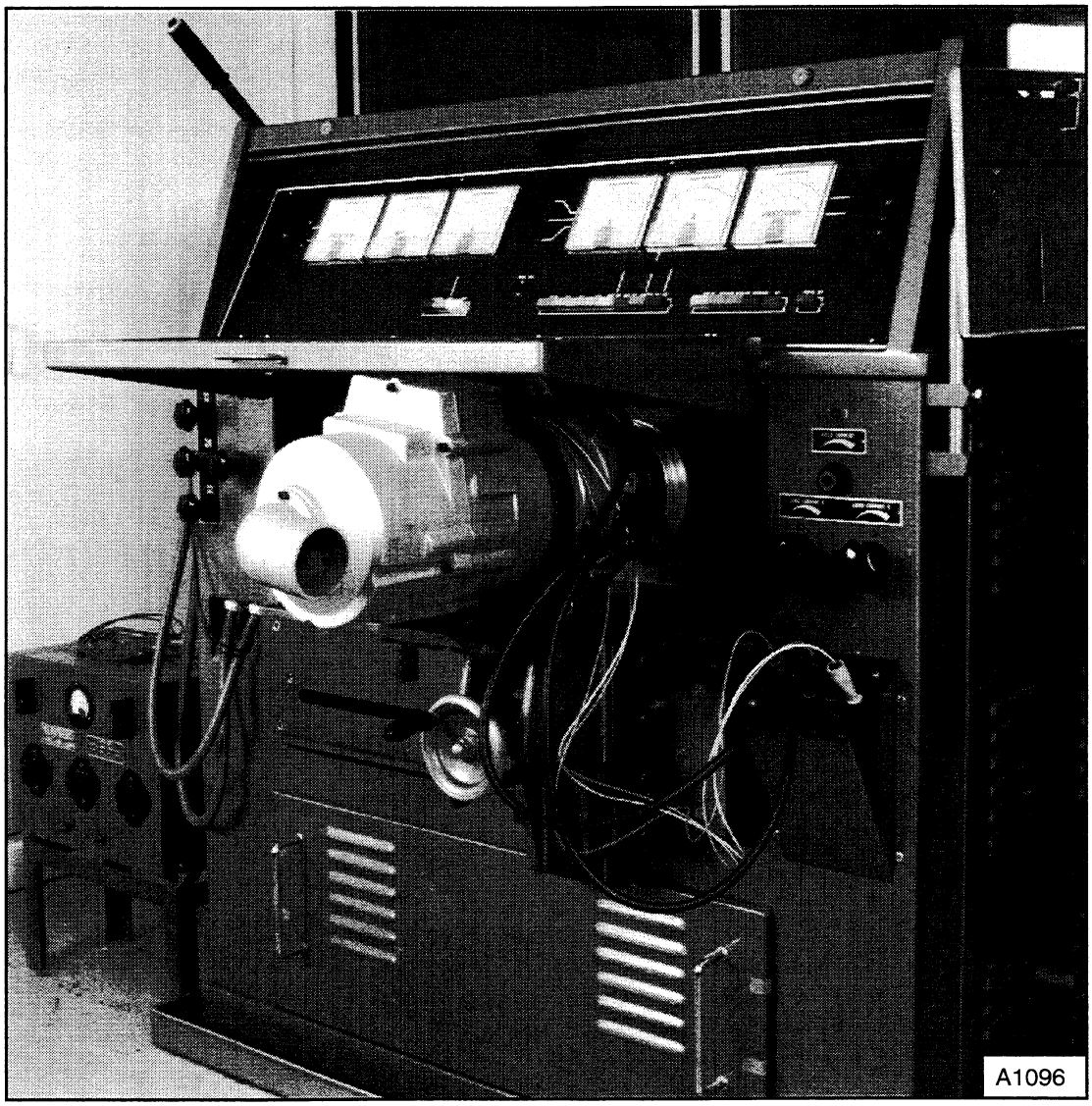
If the alternator was not fitted with its pulley when returned for servicing, a temporary spacer (2) must be fitted between the fan and the Belleville washer (3), to minimise the risk of damage to the fan in transit. In this case, the nut (4) must only be tightened enough to ensure that the fan is held firmly.



4.17 STORAGE

Place suitable plastic plugs or caps over or into the air inlet hole and over the auxiliary plug. Store the alternator in a clean dry place until it is required. Particular care must be taken to ensure that no weight bears upon the front fan during storage.

If the alternator is not issued for use within six months of build and test, the shaft must be rotated two or three times by hand. To ensure that the consituents of the lubricants are well mixed and that the bearings are fully coated; repeat this process every six months.



5.1 PREPARATION

Mount the alternator on the test machine and connect the drive.

Warning

Ensure that the cooling air inlet elbow (if specified) is fitted with its inlet either horizontal as shown, or facing downwards, to avoid the accidental ingress of foreign objects. In addition, take great care, when the machine is running, to ensure that no clothing can be sucked into the inlet.

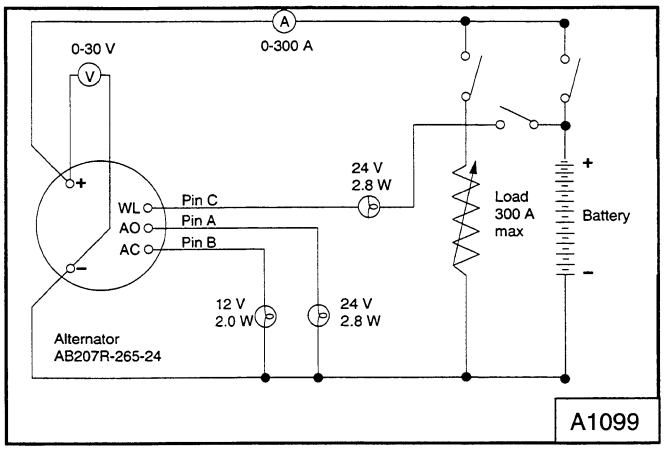
Do not run the alternator without the cover fitted.

Ensure that the alternator is correctly aligned and securely clamped and that the drive to the alternator is appropriate for the torque and speed involved. Ensure that the drive arrangement is covered by suitable safety guards and that any bare electrical connections are protected from accidental short-circuiting.

If it becomes necessary to check internal components or connections whilst the alternator is still on the test machine, the electrical supply to the machine must be isolated before the rectifier end cover is removed. Care must be taken to avoid damage to the inner fan whilst the cover is off.

5.2 PERFORMANCE TESTING

Make all electrical connections as shown in the circuit diagram below. The switches controlling the battery and the load circuits must be capable of carrying and switching the maximum currents which can be expected. With the battery switched ON and the warning light (WL) switched ON, the WL should be illuminated. (The load should be switched OFF until the alternator is charging.)



5.2.1 Checking cutting-in speed

(i) Start the drive and increase speed to 1200 rev/min. The WL should be extinguished and the alternator should start charging. The "AO" and "AC" lights should be illuminated.

If the WL is not extinguished, check all external connections. If no fault is found, switch off the electrical supply to the test machine, remove the alternator rear cover and check the auxiliary diode circuit.

(ii) Reduce speed until the warning light just comes on. This speed should be less than 1000 rev/min (corresponding to the "cold cutting-in" speed).

5.2.2 Checking the regulators

Increase speed to 4000 rev/min and set the load to 10 A. Voltage should be 27.95 V ± 0.25 V.

5.2.3 Checking the full-load curve

(i) Reduce speed to 2000 rev/min. Increase the load to 160 A. The voltage at the alternator terminals should not fall below 27 V.

(ii) Increase speed to 6000 rev/min. Increase the load until voltage drops to 26 V. The load current should be not less than 265 A.

5.2.4 Checking the surge protection units

(i) Reduce speed to 4000 rev/min and adjust the load to 150 A. Leave the battery ON and switch the load OFF rapidly. The surge protection devices should not trip and the alternator should continue to charge the battery. Reconnect the load.

(ii) With the alternator still running at 4000 rev/min and the load still at 150 A, switch the battery OFF and then switch the load OFF. The surge protection devices should trip, reducing the output voltage to zero and the WL should be switched on. After two seconds the alternator should re-excite itself and turn the WL off.

Switch both the load and the batteries ON. Output should be restored.

Repeat this test; the trip should operate correctly again.

Note: The battery over-voltage protection units (BOVSPUs) should have been checked during "Component Inspection and Renewal" (see Section 3.8.2)

5.2.5 Checking output stability

(i) Increase speed to 6000 rev/min. Adjust the load to achieve a current of not less than 200 A. Run the machine for 5 minutes, during which time voltage and current should remain steady.

If the machine has not satisfied any one or more of the test conditions, remove it from the test machine, rectify the fault (s) and repeat the complete test sequence.

If the machine has satisfied all of the test conditions, remove it from the test machine and fit protection caps to the air inlet and the auxiliaries plug. Refill the drive end shield bearing lubricator cap twice with the specified grease and screw it fully on to the lubricator body. Refill the rectifier end shield bearing lubricator cap once with the specified grease and screw it fully on to the lubricator body

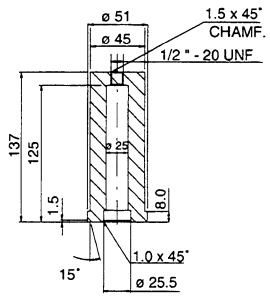
Store the alternator in a clean, dry place.

Note: If, after three months, the alternator has not been placed into service and driven, rotate the drive shaft by hand for at least two turns to ensure that the constituents of the lubricant are mixed and remain in contact with the bearing surfaces. Repeat this procedure every three months until the machine enters service.

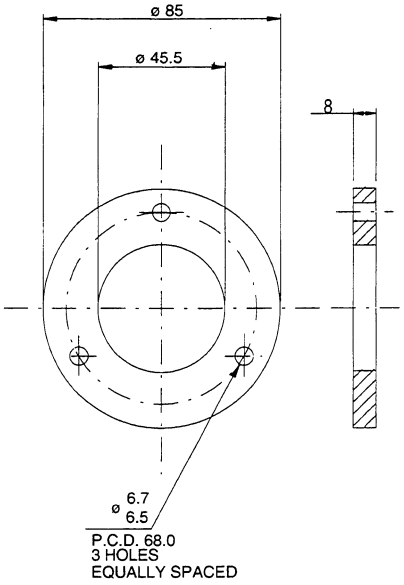
6.1 SPECIAL TOOLS (locally-made)

The following tools are essential for servicing the alternator and may be manufactured locally. The material should be mild steel. Unless otherwise indicated the tolerance on all dimensions is ± 0.2 mm.

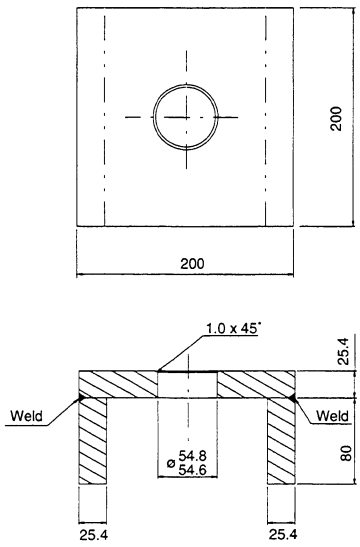
6.1.1 Tools for removal of the RES bearing



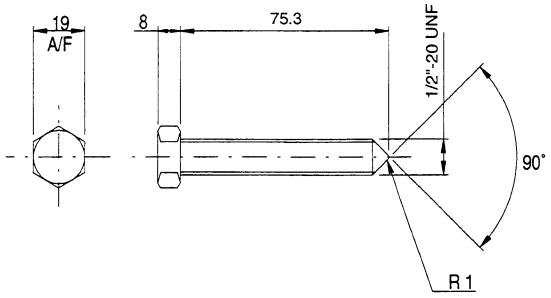
RES bearing removal / fitment cap
6408-57A



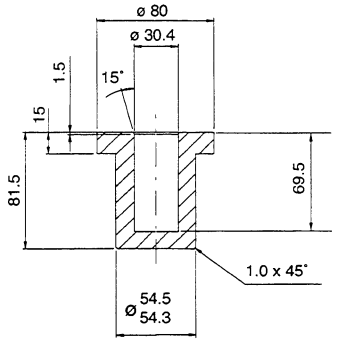
Cap retaining ring
6408-57C



Support
6408-57D



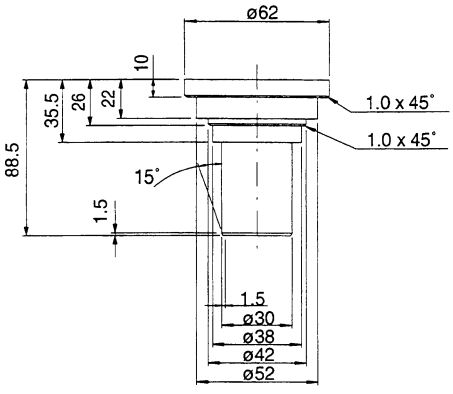
Extraction screw
6408-57B



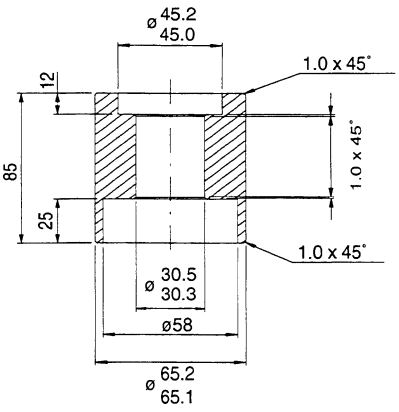
Drive end cap
6408-57E

A1100

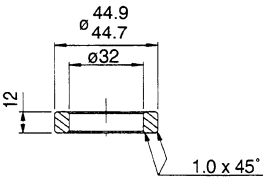
6.1.2 Tools for removal and fitment of the field coil seals



Mandrel
6408-57F



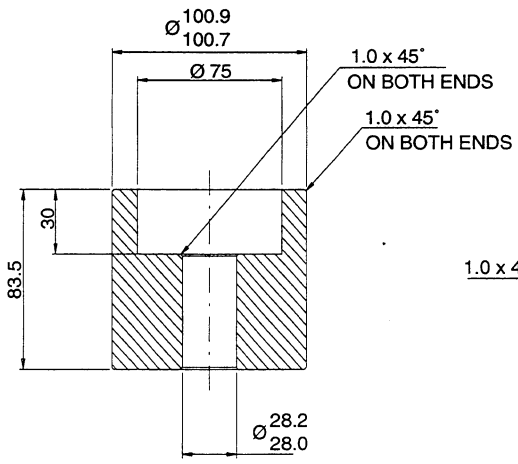
Support
6408-57G



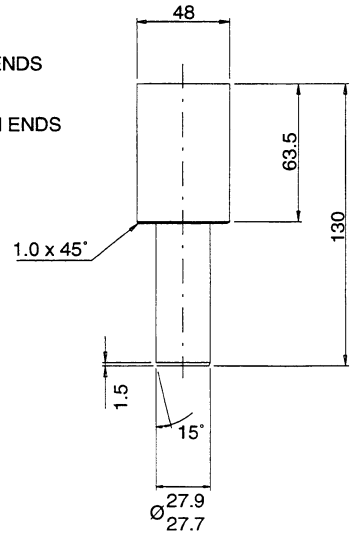
Spacer
6408-57H

A1101

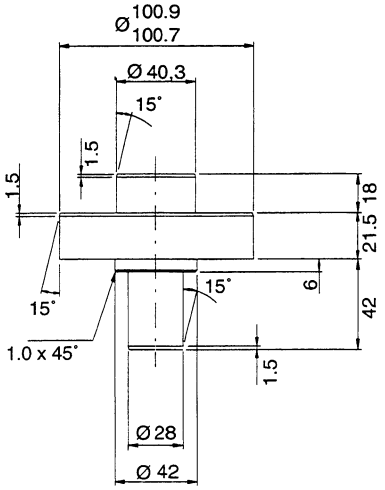
6.1.3 Tools for removal of the DES bearing and fitment of the DES bearing outer race and cage and seal



Support
6408-57J



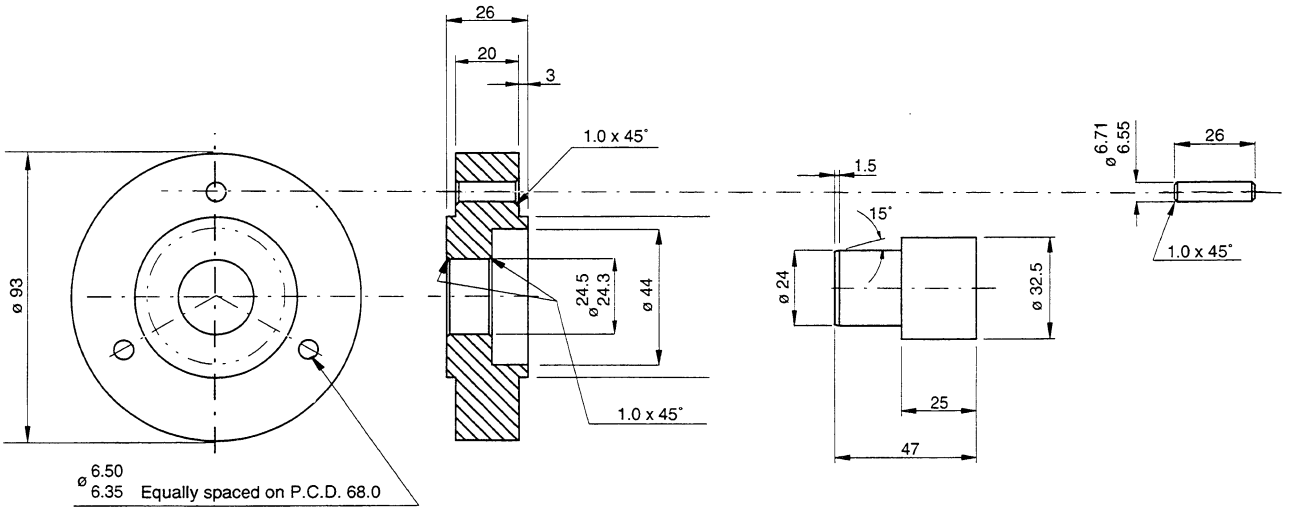
Bearing removal mandrel
6408-57K



Seal and bearing fitting mandrel
6408-57L

A1102

6.1.4 Tools for removal and fitment of the RES bearing cap seal



Cap
6408-51M

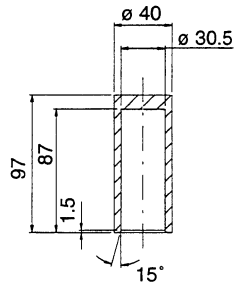
Mandrel
6408-57N

Spring dowel pin (3 off)
6408-57P

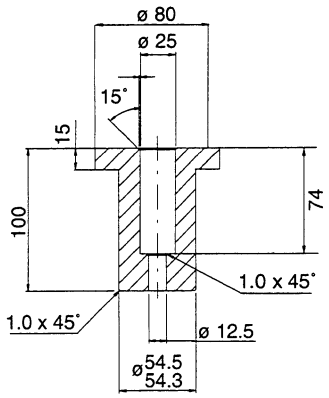
Note: Place the dowel pins into the holes to leave an equal amount exposed at each end.

A1103

6.1.5 Tools for fitment of the DES bearing inner race to the rotor (to be used in conjunction with support 6408-57D)



DES bearing inner race fitting cap
6408-57Q



Rectifier end shaft cap
6408-57R

A1104

6.2 SEALANTS AND LUBRICANT

Use	Type
Retention of rectifier end shield insulating strip:	Bostik all-purpose adhesive.
Front and rear bearings, oil seal lips, and spacer:	Shell Retinax LX grease.
Retention of front bearing outer race in liner:	Loctite 601
Rectifier assembly and field coil securing screws:	Loctite 243 with activator T
Silicone compound for bedding diodes onto heat sinks:	Biccon XI
Paint for diode insulation:	Blue Epoxy E192
Silicone compound for insulating auxiliary diodes:	Silcoset

6.3 MATERIAL SUPPLIERS

Bostik adhesives:

Bostik Limited
Ulverscroft Road
Leicester LE4 6BW
England
Tel: 0533 510 015

Loctite sealants:

Loctite UK
Watchmead
Welwyn Garden City
Hertfordshire AL7 1JB
England
Tel: 0707 331 277

Diode seating compound:

Bicc Plc
P.O. Box 4
Hall Lane
Prestcott
Merseyside L34 5UR
England
Tel: 051 430 7555

Retinax grease:

Shell UK Oil
No. 7 Oxford Road
Manchester
M60 7HH
England
Tel: 061 277 2000

Cleaning fluids

I.C.I. Limited
Po Box 13
The Heath
Runcorn
Cheshire WA7 4QF
England
Tel: 0928 514 444

Resistors:

Claude Lyons Limited
Ware Road
Hoddesdon
Hertfordshire EN11 9DX
England
Tel: 0992 467 161

Paint:

Trimite Ltd
Arundel Road
Uxbridge
Middlesex
UB8 2SD
Tel: 0895 251 234

Silcoset:

Ambersil Ltd
Wylds Road
Castlefield Industrial Estate
Bridgewater
Somerset
TA6 4DD
Tel: 0278 424 200

6.4 TORQUE VALUES

	Nm	Lbf ft	Tool size
Stauffer greaser bodies	8	5.9	9/16 in A/F
Field retaining screws	10	7.4	5 mm Allen key
Rear cover retaining screws	10	7.4	5 mm Allen key
Air inlet connector retaining screws	10	7.4	5 mm Allen key
Rectifier assembly retaining screws	8	5.9	5 mm Allen key
Main terminal nuts	10	7.4	Pos. - 19 mm A/F Neg. - 17 mm A/F
Rear fan securing nut	20	14.7	19 mm A/F
Auxiliary plug securing screws	0.5	0.4	Screwdriver
Regulator support frame mounting pillars	10	7.4	10 mm A/F
Regulator securing screws	10	7.4	5 mm Allen key
Rear bearing cap securing screws	8	5.9	5 mm Allen key
Drive shaft pulley nut	90-100	66-74	36 mm A/F
Terminal block screws	0.5	0.4	Screwdriver
Terminal screws	1.4	1.0	Screwdriver

6.5 TEST EQUIPMENT

A test machine with variable speed drive, capable of driving the alternator under full load at speeds up to 8000 rev/min.

A 24 V 100 AH battery.

A wire wound, resistor capable of absorbing a current of 300 A at 30 V without overheating.

Note: both the battery and load must be connected into the test circuit with fast-acting knife switches.

A wire-wound or carbon-pile variable resistor, capable of controlling the current through one "phase"winding of a stator to 40 A, for establishing the volt-drop balance between the three windings. (If the supply voltage is to be 24 V, a resistor of between 0.8 and 1.0 Ω will be required.)

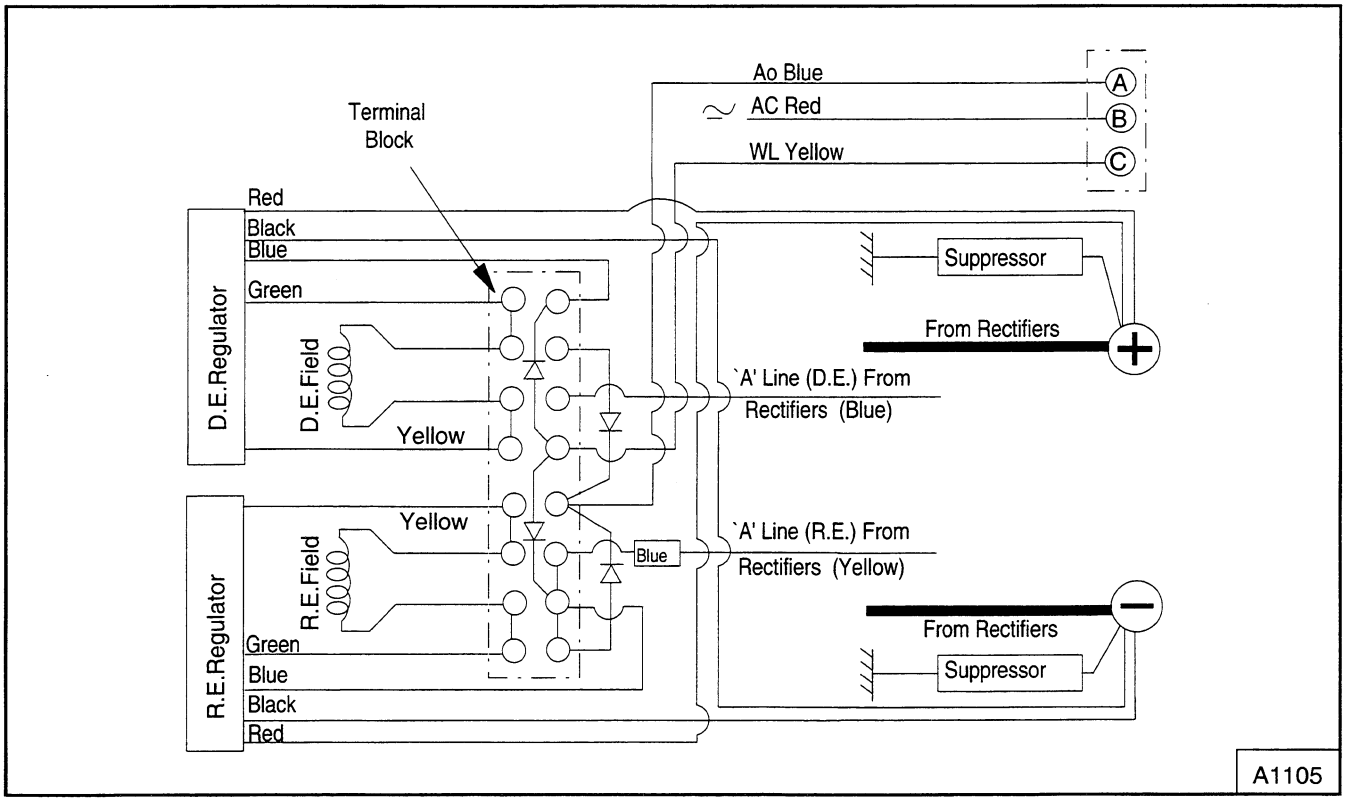
A 100 V DC "Megohm" tester.

A DC ammeter with a range of 0-300 A (moving-coil or digital).

An Avometer, or a similar multimeter (moving-coil or digital) with a DC voltage range of 0 to 30 V and a resistance range of 0 to 10 Ω.

Two 24 V, 2.8 W warning lamps.

6.6 INTERNAL CIRCUIT DIAGRAM



6.7 TECHNICAL DATA

Maximum ambient operating temperature	80°C
Rotation	Clockwise only
Maximum permissible speed	8000 rev/min
Mounting	Swing or cradle
Drive	V - (or poly -V) belt or shaft
Weight (approx.), excluding pulley	40 kg
Stator winding connections	Delta
Cutting-in speed	1000 rev/min
Maximum output current (at 28 V)	265 A
Maximum output	7420 W
Power absorbed	15 kW at 6000 rev/min
Stator volt-drop (per phase winding) (windings at 20°C and carrying 40 A):	
Drive end (6332-A1462)	1.5 ± 0.05 V
Rectifier end (6332-A1463)	3.0 ± 0.1 V
Field coil resistance (cold)	4.8 ± 0.2 Ω
Regulated voltage	28 V or 28.5 V, depending on type.

6.8 SOLDER

The solder to be used to connect the diodes to their wires is to be to BS 219, Grade K. This is a low-antimonal solder with a melting-point of 183-188°C (361-370°F).

6.9 BELT TENSION

A suitable belt tension gauge in the "Borroughs" range (BT-33-37F/86J) may be obtained from:

Snap-on Tools Ltd
Palmer House
15-154 Cross Street
Sale
Cheshire M33 1AQ
England

Tel: 061 969 0126