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TP 35373/2
Supersedes previous edition TP 35373/1

Introduction

Specifications

Battery	**480/440**
System voltage V	12
Battery capacity, standard ..... Ah	55
Relative density (sg) of electrolyte	
— with a fully charged battery	1.28
— when recharging is necessary	1.21
Recommended charging current ..... A	5.5

Alternator	**480**	**440**	**440**
Type	Paris-Rhône A13 N133/N178	Paris-Rhône A13 N169	Bosch K1.14V28/70A
Maximum current rating ..... A	72	63	70
Maximum output ..... W	1050	800	980
Maximum running speed ..... r/min	15000	15000	12000
Reduction ratio engine-alternator	1:2	1:2	1:2
Minimum diameter of slip ring ..... mm	27.8	28.8	27
Minimum length of brushes ..... mm	8	8	7
Tightening torques			
— attachment bolts ..... Nm	40	40	40
— pulley nut ..... Nm	50	50	45
Resistance			
— rotor winding ..... ohms	2.4*	3.2	2.8
— stator ..... ohms/phase	0.095	0.159	0.09
Current rating at 13.5 V			
— 33 r/s (2000 r/min) ..... A	43	38	47
— 50 r/s (3000 r/min) ..... A	61	53	59
— 67 r/s (4000 r/min) ..... A	66	57	64
Voltage regulator			
Type (incorporated in alternator)	Paris-Rhône electronic YH 2925	Paris-Rhône electronic YV 1925	Bosch electronic 1197 311 008

* A Paris-Rhône alternator with a rotor winding of 3.2 ohms must always be fitted with a **YV 1925** voltage regulator.

Measurement data	**480/440**
Conditions	
— fully charged battery	
— alternator V-belt tensioned	
— warm alternator and voltage regulator	
(run the engine for 3 minutes at 33.3 r/s (2000 r/min)	
Measurement values (measured on the battery)	
Control voltage, unloaded, at 13.3 r/s (800 r/min) and higher V	13.5-15
Control voltage, loaded with 30 A, at 41.6 r/s (2500 r/min) and higher V	14-15

Starter motor

	Paris-Rhône	Bosch
Type	D9E771	208.517
Output ..... kW	1	0.85
Number of brushes	4	4
Minimum brush length ..... mm	6	9
Brush spring tension ..... Nm	15	15
Armature end float ..... mm	0.8	0.3
Commutator minimum thickness (axial)/diameter . mm	2	33.5
Relay cut-in voltage V	7.5	8

Test values — Paris-Rhône

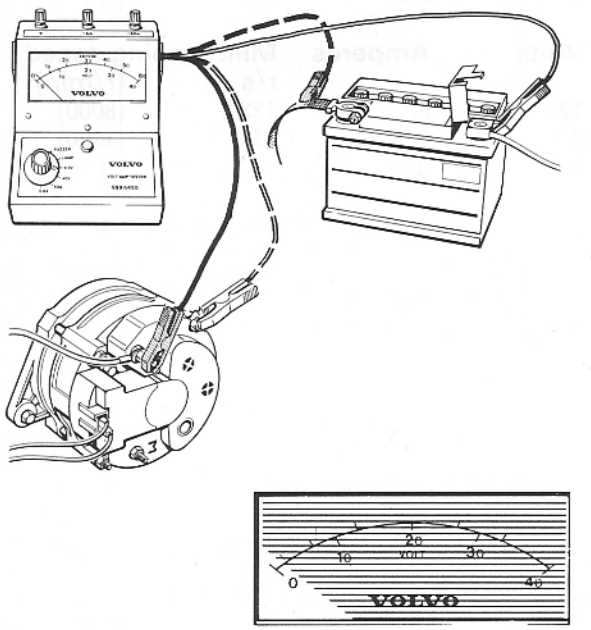
	Volts	Amperes	Min. running speed r/s	(r/min)
— Unloaded starter motor	12	60	99	(6000)
— Loaded starter motor	9	200	39.7	(2400)
— Blocked starter motor	6	480	—	(-)

Test values — Bosch

	Volts	Amperes	Min. running speed r/s	(r/min)
— Unloaded starter motor	12	60	133.3	(8000)
— Loaded starter motor	9	265	22.5	(1350)
— Blocked starter motor	6	390	—	(-)

Group 31. Battery

A. Battery and battery leads, testing and charging



10 259

A1

Check the battery leads

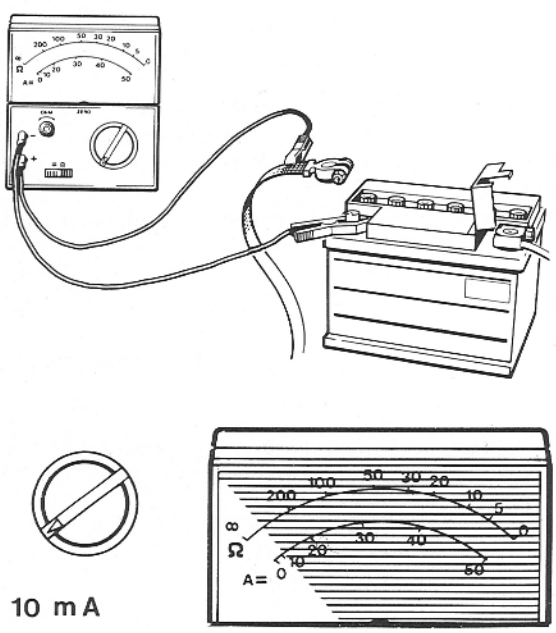
If the lead terminals on the battery, alternator, vehicle body or engine are loose or oxidized, this can result in a voltage drop; clean and tighten as necessary.

Test method
Connect up the voltmeter (range 4 V) between the B+ connection on the alternator and the battery plus pole. Run the engine at 33.3 r/s (2000 r/min).

The measured voltage drop should not be more than 0.2 V.

Perform the same test with the voltmeter connected between the alternator yoke and the battery negative pole.

If the voltage drop in the first or second test is higher than 0.2 V, the terminals of the plus lead or negative lead must in that case be cleaned and/or tightened.



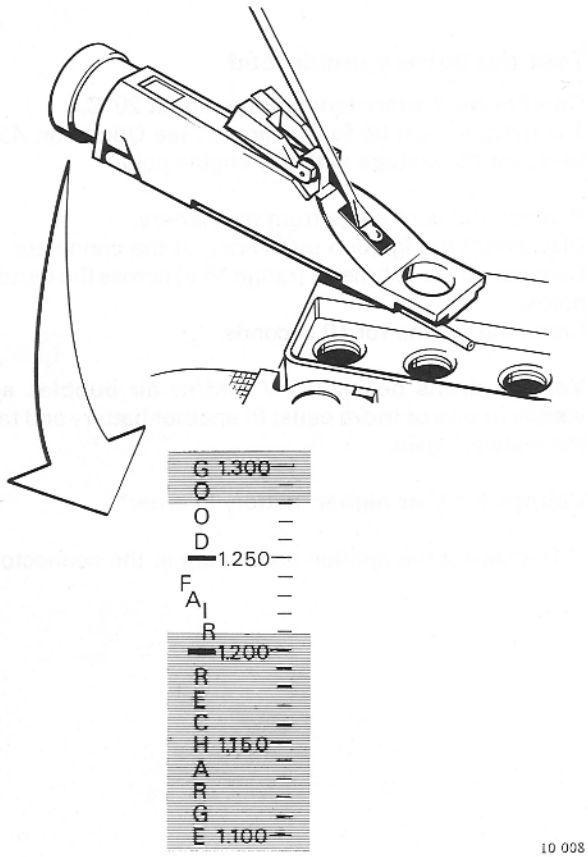
10 260

A2

Test for loss of current

With the ignition switched off, the maximum permissible current loss is 10 mA.

Test method
Disconnect the earth lead from the battery.
Connect up an ammeter between the battery pole and the earth lead.
If the current loss is greater than the above-mentioned values, this is caused by a switched-on consumer or short-circuiting in the electrical system.



10 008

A3

Check the relative density of the battery electrolyte

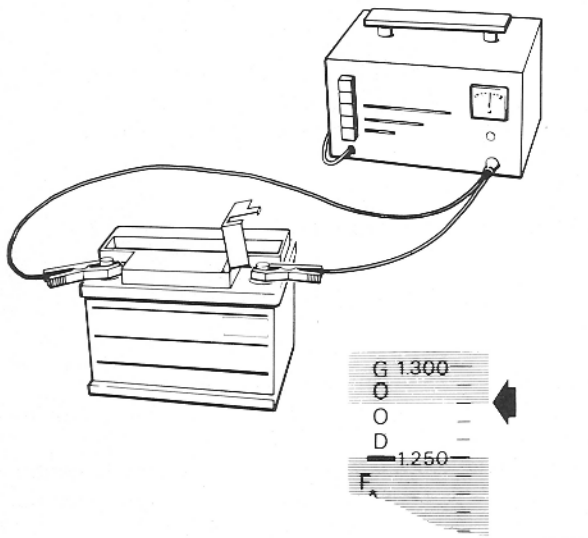
Note: the relative density (specific gravity) **cannot** be measured immediately after topping-up with distilled water.
In that case the battery must first be charged for a few hours.
Measure the relative density of the electrolyte in all the battery cells.

State of charge	Relative density at about 20°C
Fully charged	1.28
Half charged	1.21
Fully discharged	1.13

One or more cells have a relative density lower than 1.28: see Operation *A5*.

The relative density in all cells is lower than 1.28: charge the battery; see Operation *A4*.

The relative density in all cells is higher than 1.28: see Operation *A5*.



10 011

A4

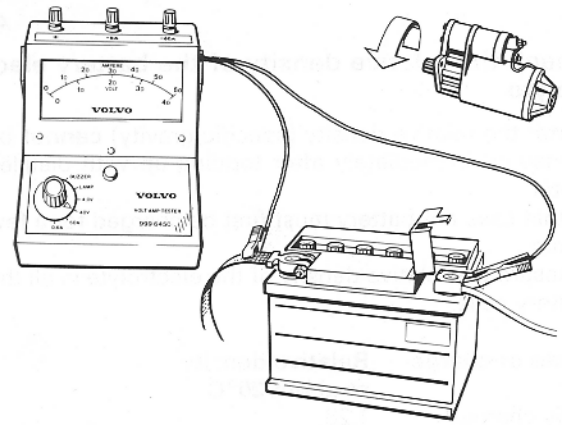
Charge the battery

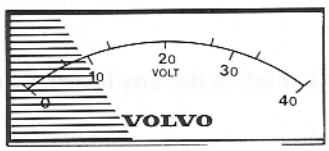
Remove the vent plugs from the battery.
Check the electrolyte level and top-up as necessary with distilled water.
Charge the battery for about 10 hours at the recommended charging current.
The recommended charging current is 0.1 x the battery capacity.
Example: battery capacity is 55 Ah; the recommended charging current in this case is 0.1 x 55 = 5.5 Ah.
Measure the relative density of the electrolyte in all the battery cells.
The relative density of the electrolyte in a fully charged battery should be 1.28 at about 20°C.
The maximum permissible difference between the highest and lowest values measured in the cells is **0.03**.

Difference between highest and lowest value is more than 0.03: fit a new battery.

Relative density in the cells is the same but the battery is not yet fully charged: charge the battery for another 10 hours*.

* If the battery is still not fully charged after this, a new battery will have to be fitted.





10 010

A5

Test the battery under load

Conditions: battery temperature about 20°C.
The battery must be fully charged; see Operation *A3*.
Measure the voltage with the engine cold.

Remove the vent plugs from the battery.
Disconnect the ignition unit wiring at the connector.
Connect up the voltmeter (range 15 V) across the battery poles.
Crank the engine for 10 seconds.

Voltage drops below 9.5 V and/or air bubbles are visible in one or more cells: fit another battery and test the voltage again.

Voltage 9.5 V or higher: battery in order**.

** Reconnect the ignition unit wiring at the connector.

Group 32. Charging system

B. Symptoms and causes

B1

Overview of malfunctions and possible causes

Battery discharges after some time
Battery in poor condition.
Loss of current caused by a consumer remaining switched on, or because of a short-circuit in the electrical system.
Voltage drop due to poor contact of cable terminals.
Fault in the charging current circuit.

Warning lamp glows faintly at times with the engine running
Grease deposits on brushes and slip rings.
Brushes worn down to minimum length.
Slip rings worn down too far.
Poor contact of positive terminal on the voltage regulator.

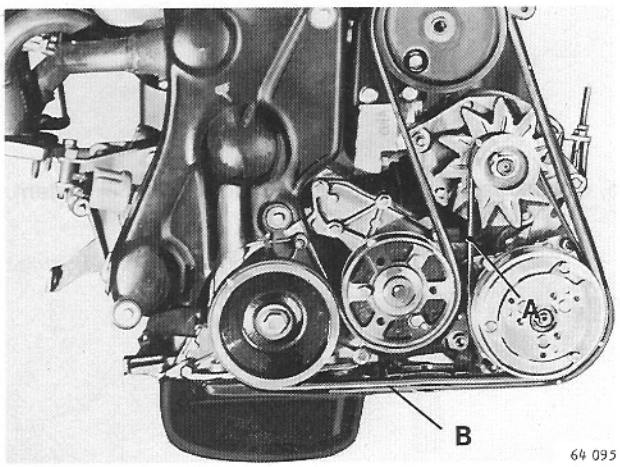
Electrolyte in the battery cells 'boils' with the engine running
Voltage regulator not working correctly, adjusts voltage at a too high level.

Warning lamp does not light up with the ignition switched on
Fuse or warning lamp defective.
Power supply interrupted.
Voltage regulator defective.

Warning lamp remains on with the engine running
Fault in warning lamp circuit.
Fault in charging current circuit.
Greasy, broken or damaged V-belt, or V-belt tension incorrect.

C. Fault tracing, malfunctions in the charging circuit

Conditions: the test must be conducted with a 'warm' alternator and voltage regulator (run the engine for about 3 minutes at 33.3 r/s (2000 r/min)).
Checks *A1* to *A5* must have been carried out and any faults remedied as necessary.



64 095

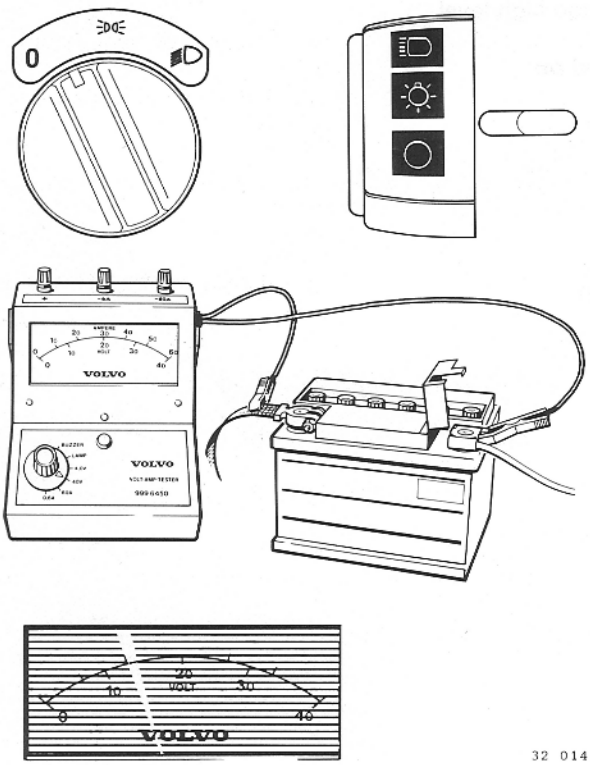
C1

Check the V-belt tension

Check the belt tension:
A 3-groove belt
B 6-groove belt

Value when adjusting	**3-groove**	**6-groove**
New belt N	350	700
Used belt N	225	500

Adjust as necessary.
Note: a damaged or greasy Poly-V-belt must be renewed.



32 014

C2

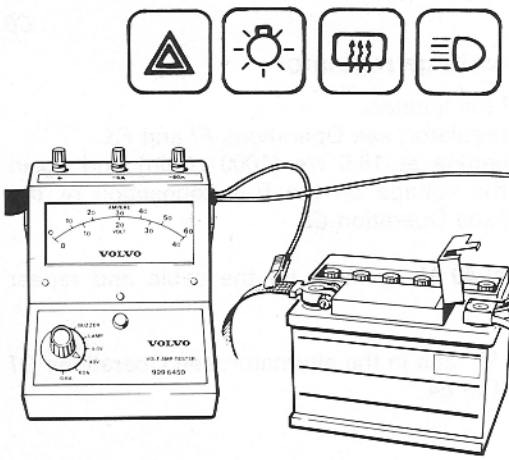
Measure the unloaded charging voltage

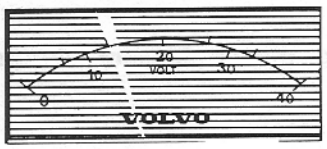
There must be no consumers switched on.
On the Swedish version: turn the lighting switch so it is set between the O and P positions (this switches off the day running lights).
Connect up the voltmeter across the battery poles (range 40 V).
Run the engine for 10 seconds at 25 r/s (1500 r/min).

Voltage higher than 15 V: renew the voltage regulator; see Operations *F1* and *F3*. Repeat Operation *C2*.

Voltage lower than 14 V: see Operation *C4*.

Voltage between 14-15 V: see Operation *C3*.





32 015

C3

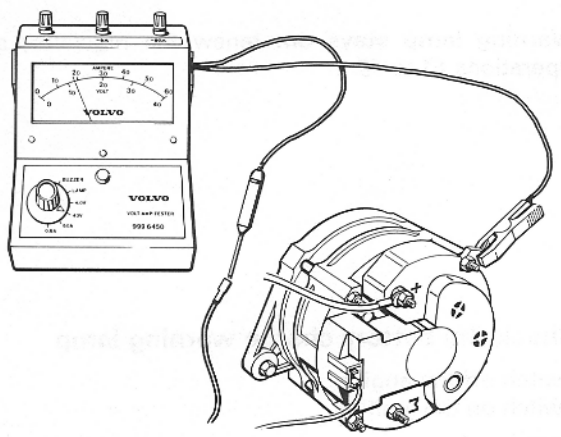
Measure the charging voltage under load

Run the engine for 10 seconds at 25 r/s (1500 r/min).
Switch on the following consumers:
headlight main beams, rear window heating, heater blower motor and hazard warning lights (a total of approx. 30 A).

Voltage lower than 14 V: fault in the alternator; see Operations *D1* to *D4* or *E1* to *E4*.

Voltage between 14-15 V: charging circuit in good working order*.

* If the charging circuit is in order, there may still be a malfunction in the battery charge warning lamp circuit; see Operations *C7* to *C9*.



10 265

C4

Check the current supply to the voltage regulator, if present

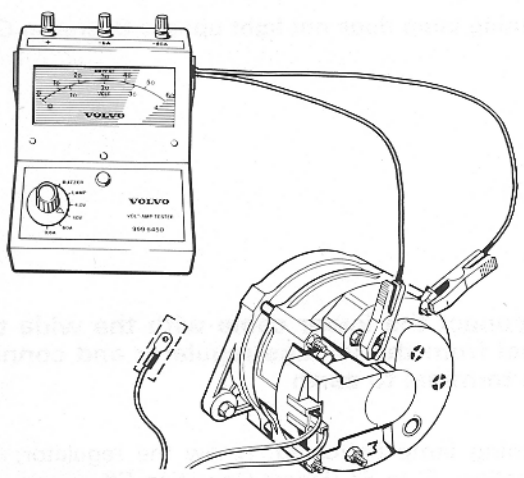
Switch off the engine.
Switch on the ignition.
Disconnect the cable from the voltage regulator.
Measure the voltage on the cable.

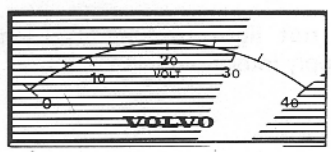
Voltage 12 V and higher: see Operation *C5**.

Voltage lower than 12 V: check the warning lamp.

No voltage: cable interrupted. Renew the cable. Repeat Operation *C2*.

* Reconnect the cable to the voltage regulator.





10 266

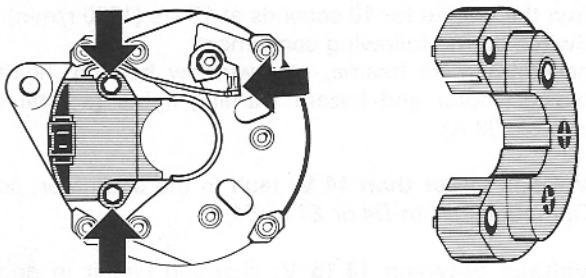
C5

Measure the charging voltage at the alternator

Disconnect the red cable from the B + connection on the alternator.
(Watch out for short-circuiting: insulate the cable eye)
Connect up the voltmeter (range 40 V) between the B + connection and earth.
Run the engine at 16.6 r/s (1000 r/min).

Voltage 30-40 V: renew the voltage regulator; see Operations *F1* to *F3*; repeat Operation *C2*.

Voltage 0 V: see Operation *C6*.



42 403

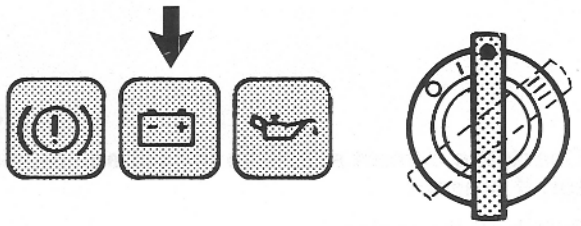
C6

Test the voltage regulator

Switch off the ignition.
Fit a new regulator; see Operations *F1* and *F3*.
Run the engine at 16.6 r/s (1000 r/min) and again measure the voltage on the B+ connection of the alternator; see Operation *C5*.

Voltage 30-40 V: connect up the cable and repeat Operation *C2*.

Voltage 0 V: fault in the alternator; see Operations *D1* to *D4* or *E1* to *E4*.



32 016

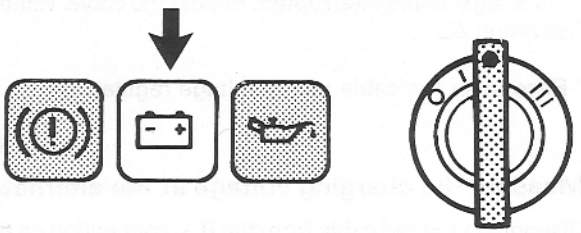
C7

Test the functioning of the battery charge warning lamp

Run the engine at idling speed.

Warning lamp does not light up: see Operation *C8*.

Warning lamp stays on: renew the regulator; see Operations *F1* to *F3*.



32 017

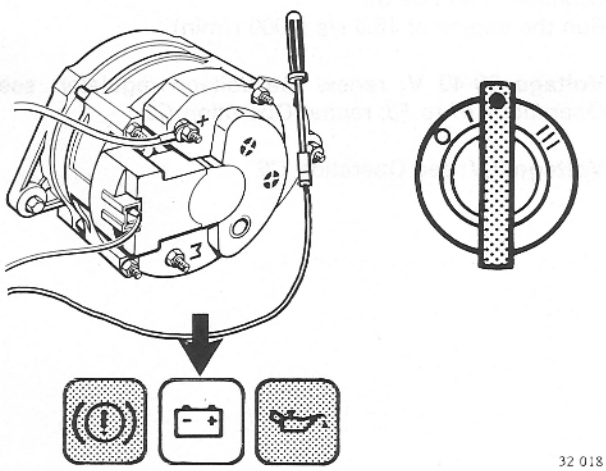
C8

Check the battery charge warning lamp

Switch off the engine.
Switch on the ignition.

Warning lamp lights up: circuit in order.

Warning lamp does not light up: see Operation *C9*.



32 018

C9

Disconect the lower cable with the wide terminal from the voltage regulator and connect this terminal to earth

Warning lamp lights up: renew the regulator; see Operations *F1* to *F3*. Repeat Operation *C8*.

Warning lamp does not light up: warning lamp defective or current supply interrupted.

D. Fault tracing, malfunctions in the Paris-Rhône alternator (removed from the car)

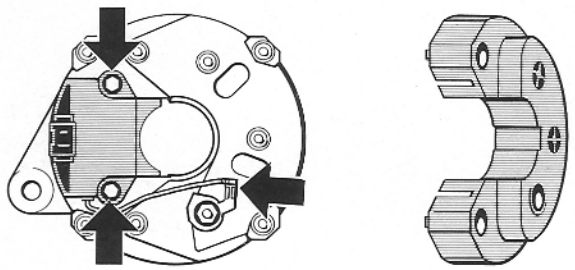
For the removal and installation of the alternator, see Operations *G1* and *K2*.

D1

Remove the voltage regulator

Remove the guard cap.
Disconnect the blue cable from the diode carrier.
Remove the attachment bolts.
Lift the voltage regulator out of the alternator at an angle.

Fitting is in reverse order to removal.



42 403

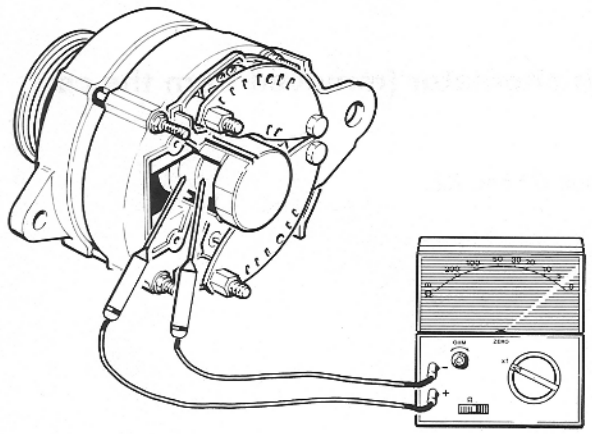
D2

Check the rotor for fractures

Note: the slip rings must not be greasy, damaged or worn down too far.
Measure the resistance across the slip rings.

Resistance infinite: rotor fractured; renew the rotor.

Resistance 2.4 or 3.2 ohms: see Operation *D3*.



10 278

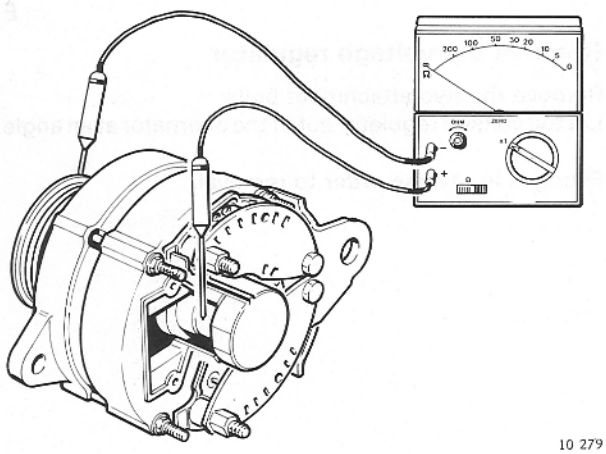
D3

Test the rotor for short-circuiting

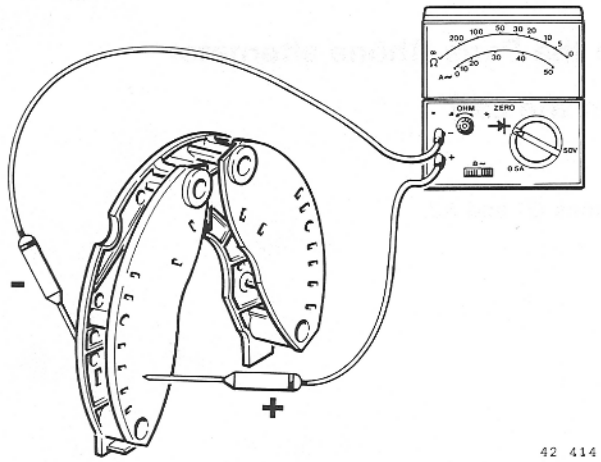
Measure the resistance between one of the slip rings and the rotor shaft (for example, on the pulley nut).

Resistance 0 ohms: short-circuit in the rotor; renew the rotor.

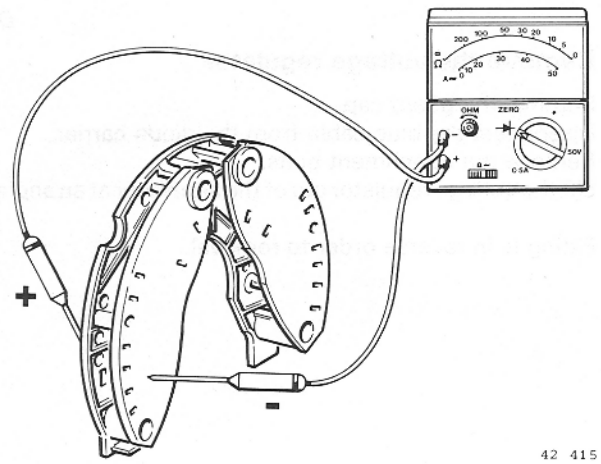
Resistance infinite: see Operation *D4*.



10 279



42 414



42 415

D4

Test the diodes (9x)

Remove the nuts and washers.
Unsolder the connections.
Remove the diode carrier from the alternator.

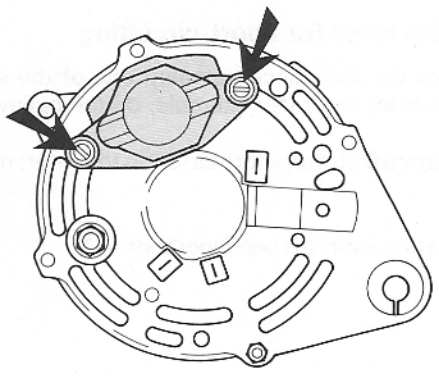
Test each diode for continuity (meter in diode position).
Test once with the plus-probe on one side of the diode and once with the plus-probe on the other side.
In one of the tests the pointer should show the correct reading and in the other test the pointer should not deflect at all.

Test value correct: renew the stator.

Different test value in one or more diodes: renew the diode carrier.

E. Fault tracing, malfunctions in the Bosch alternator (removed from the car)

For the removal and installation of the alternator, see Operations *G1* and *K2*.



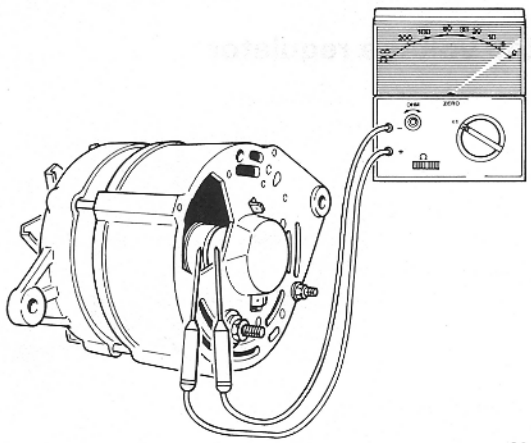
32 020

E1

Remove the voltage regulator

Remove the two attachment bolts.
Lift the voltage regulator out of the alternator at an angle.

Fitting is in reverse order to removal.



32 018

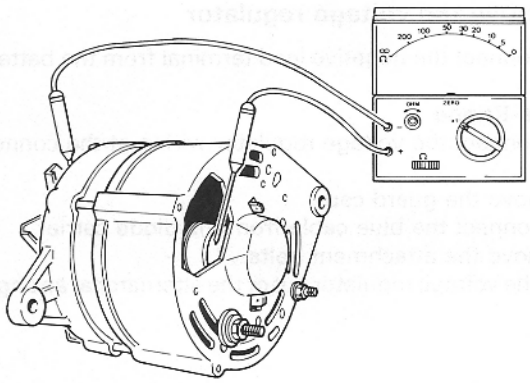
E2

Check the rotor for fractures

Note: the slip rings must not be greasy, damaged or worn down too far.
Measure the resistance across the slip rings.

Resistance infinite: rotor fractured; renew the rotor.

Resistance 2.8 ohms: see Operation *E3*.



32 019

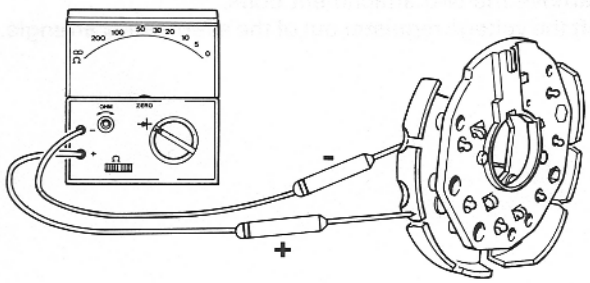
E3

Test the rotor for short-circuiting

Measure the resistance between one of the slip rings and the rotor shaft (for example, on the pulley nut).

Resistance 0 ohms: short-circuit in the rotor; renew the rotor.

Resistance infinite: see Operation *E4*.



32 027

E4

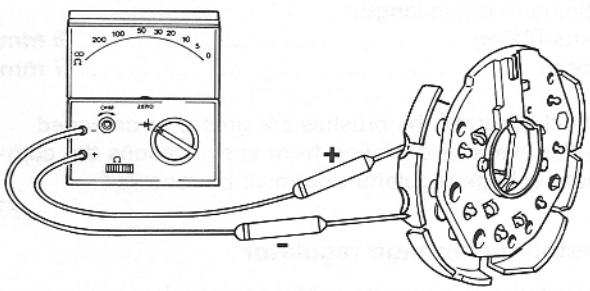
Test the diodes (9x)

Remove the nuts and washers.
Unsolder the connections.
Remove the diode carrier from the alternator.

Test each diode for continuity (meter in diode position).
Test once with the plus-probe on one side of the diode and once with the plus-probe on the other side.
In one of the tests the pointer should show the correct reading and in the other test the pointer should not deflect at all.

Test value correct: renew the stator.

Different test value in one or more diodes: renew the diode carrier.



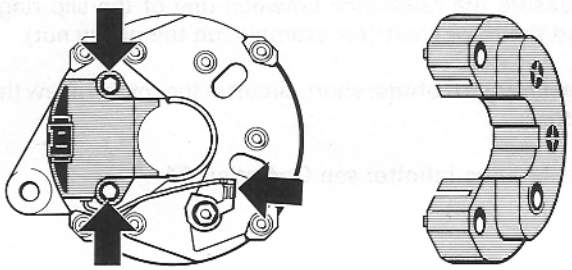
32 028

F. Checking and/or renewing the voltage regulator

F1

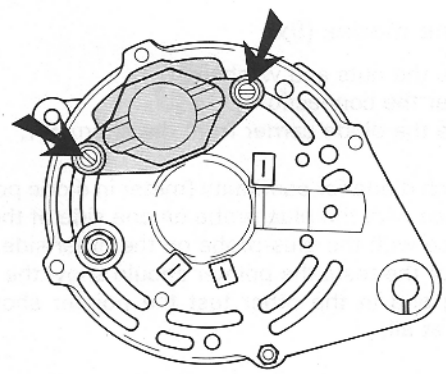
Remove the voltage regulator

Disconnect the negative lead terminal from the battery.



42 403

Paris-Rhône
Disconnect the voltage regulator wiring at the connector.
Remove the guard cap.
Disconnect the blue cable from the diode carrier.
Remove the attachment bolts.
Lift the voltage regulator out of the alternator at an angle.



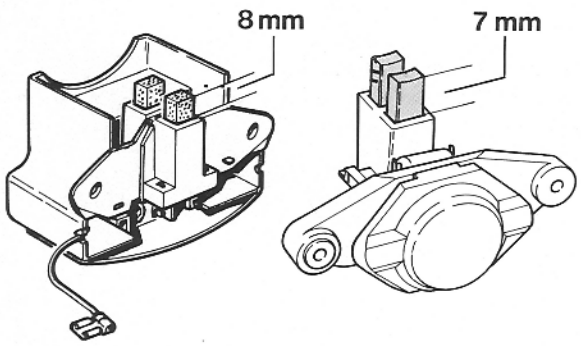
32 020

Bosch

Disconnect the wiring at the connector.
Remove the two attachment bolts.
Lift the voltage regulator out of the alternator at an angle.

F2

Check the brushes



32 035

Minimum brush length:
Paris-Rhône ..... **8 mm**
Bosch ..... **7 mm**

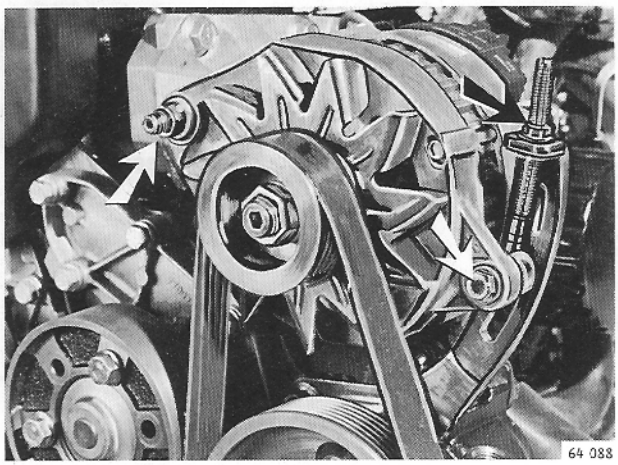
Check whether the brushes are greasy or damaged.
In the event of deviation from specifications the complete voltage regulator unit must be renewed.

F3

Install the voltage regulator

Installation is in reverse order to removal; see Operation *F1*.

G. Removing the alternator


64 088

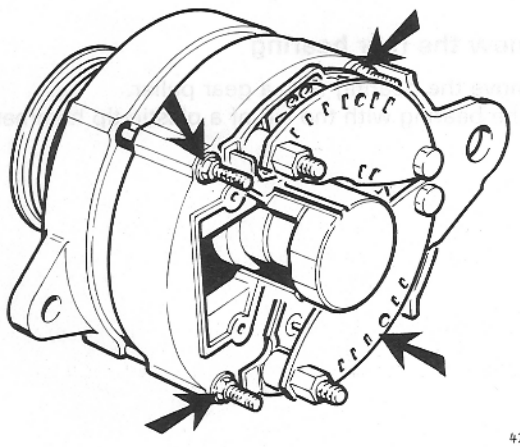
G1

Remove the alternator

Disconnect the negative lead terminal from the battery.
Disconnect the wiring.
Slacken the adjusting but (1) and the two attachment bolts (2).
Remove the Poly-V-belt.
Remove the attachment bolts.
Lift out the alternator.

H. Overhauling the Paris-Rhône alternator

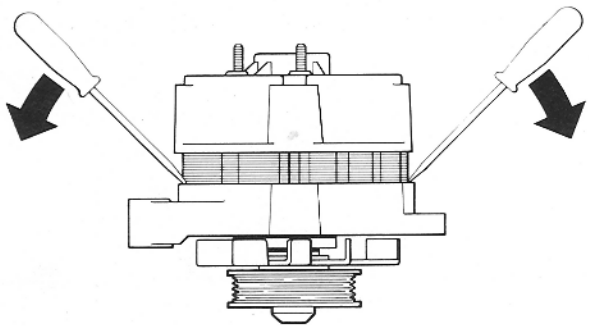
Remove the voltage regulator; see Operation *F1*.


42 406

H1

Remove the front end shield complete with rotor

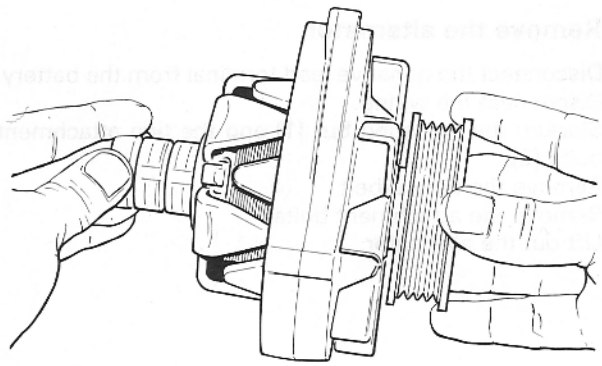
Clamp the alternator in a bench vice.
Mark the two end shields and the stator in relation to each other.
Remove the four nuts.



42 407

Remove the front end shield and rotor with the aid of two screwdrivers.
Caution: to prevent damage to the stator windings the screwdrivers must never be inserted deeper than **2 mm** in the alternator.

H2

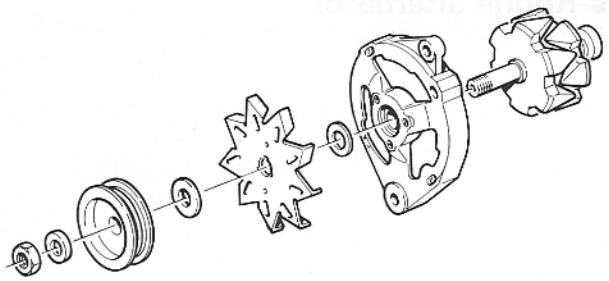


42 408

Inspect the bearings

Rotate the bearings and check for abnormal noise and excessive play.
Also check the plastic locating bush in the rear end shield for damage.

H3

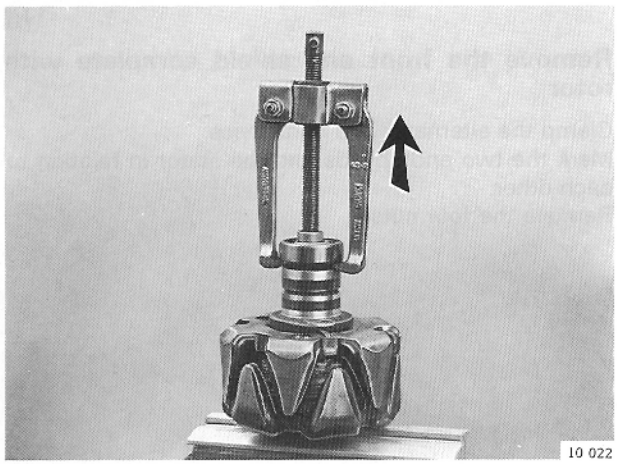


42 409

Remove the rotor from the front end shield

Clamp the rotor in a bench vice with soft jaws.
Remove the pulley and fan (use a socket-head wrench to stop the rotor shaft from turning).
Tap the rotor out of the bearing housing.

H4

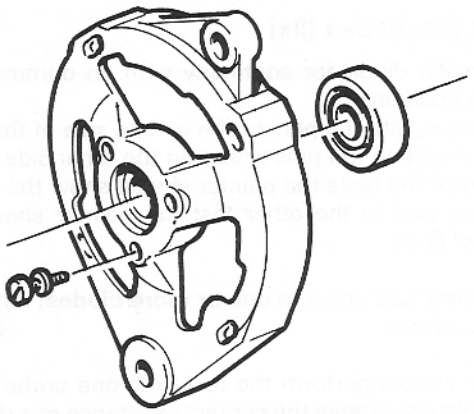


10 022

Renew the rear bearing

Remove the bearing with a gear puller.
Fit the bearing with the aid of a plastic-tip hammer.

H5

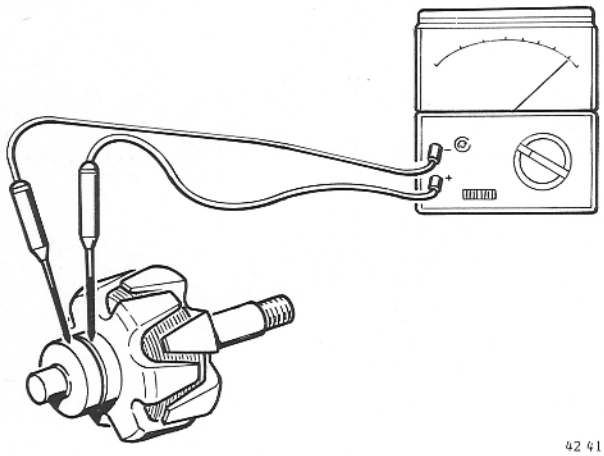


42 410

Renew the front bearing

Remove and fit the bearing with the aid of a plastic-tip hammer.

H6



42 411

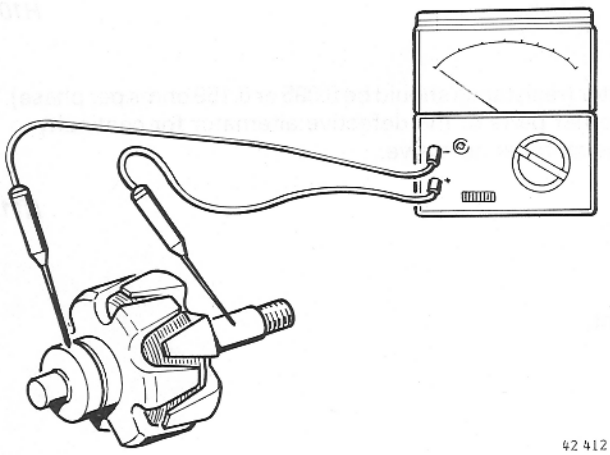
Check the rotor for fractures

Note: the slip rings must not be greasy, damaged or worn down too far.
Measure the resistance across the slip rings.

Resistance infinite: renew the rotor.

Resistance 2.4 or 3.2 ohms: move on to Operation *H7*.

H7



42 412

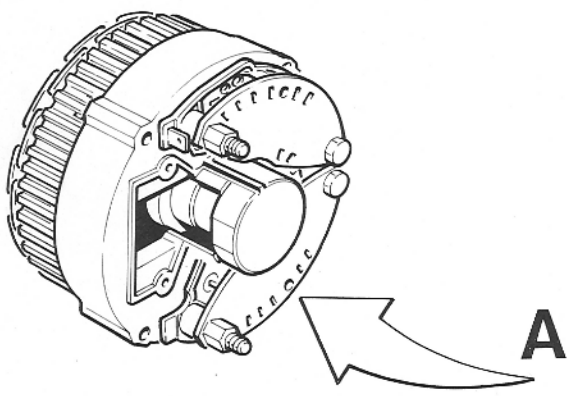
Test the rotor for short-circuiting

Measure the resistance between one of the slip rings and the rotor shaft.

Resistance 0 ohms or higher: renew the rotor.

Resistance infinite: rotor in order.

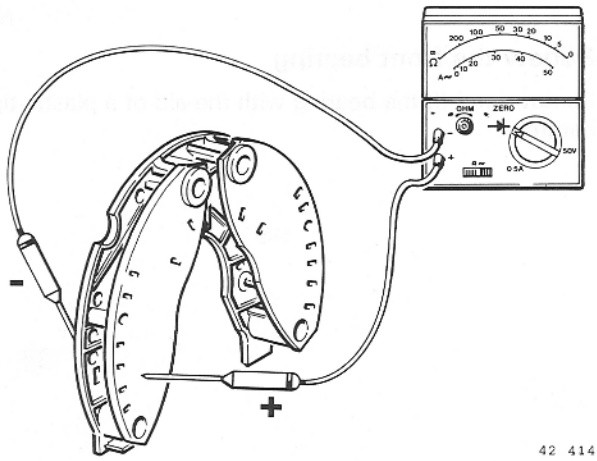
H8



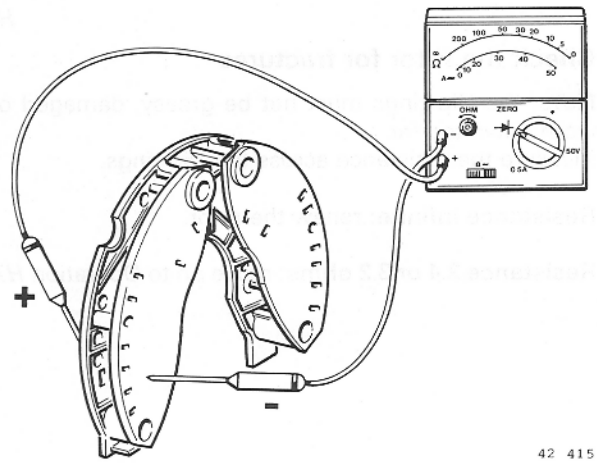
42 413

Remove the diode carrier and stator

Remove the bolts and the two nuts.
Unsolder the three cable connections (A) from the diode carrier.
Remove the stator from the rear end shield.



42 414



42 415

H9

Test the diodes (9x)

Test each diode for continuity with an ohmmeter (in diode position).
Test once with the plus-probe on one side of the diode and once with the plus-probe on the other side.
In one of the tests the pointer should show the correct reading and in the other test the pointer should not deflect at all.

Different test value in one or more diodes: renew the diode carrier.

Note: always perform the test with one probe on the baseplate to enable the contact resistance of a diode to be measured as well.

H10

Test the stator

Note: testing the stator for continuity requires a special ohmmeter (resistance should be 0.095 or 0.159 ohms per phase).
If no special ohmmeter is available, it is easier to test all the other parts of the defective alternator for continuity.
If the test values are correct, it can then be concluded that the stator is defective.

H11

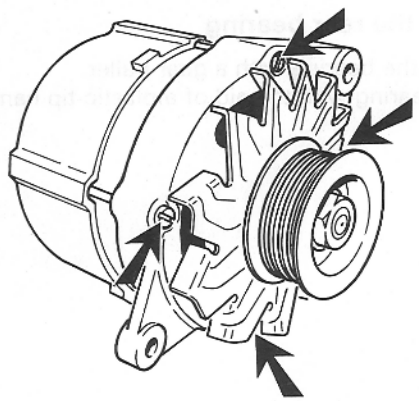
Assemble the alternator

Assembly is in reverse order to disassembly.
Note: lock the four nuts on the long bolts with a locking agent.
Tighten the pulley to **50 Nm**.
Fit the voltage regulator and guard cap; see Operation *F3*.

J. Overhauling the Bosch alternator

Remove the voltage regulator; see Operation *F1*.

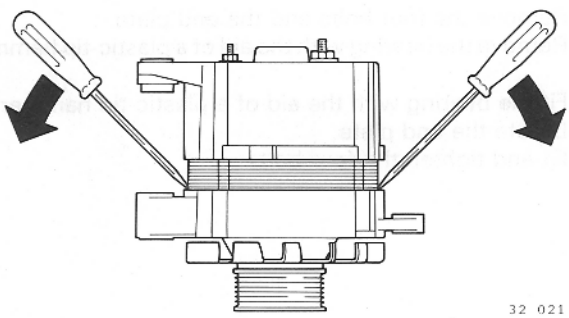
J1



32 025

Remove the front end shield complete with rotor

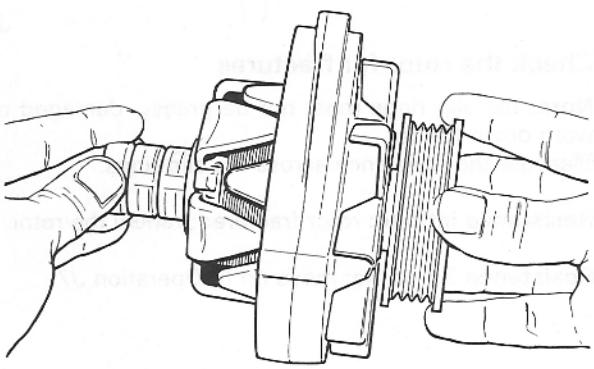
Clamp the alternator in a bench vice.
Mark the two end shields and the stator in relation to each other.
Remove the bracket.
Remove the four long bolts.



32 021

Remove the front end shield and rotor with the aid of two screwdrivers.
Caution: to prevent damage to the stator windings the screwdrivers must never be inserted deeper than **2 mm** in the alternator.

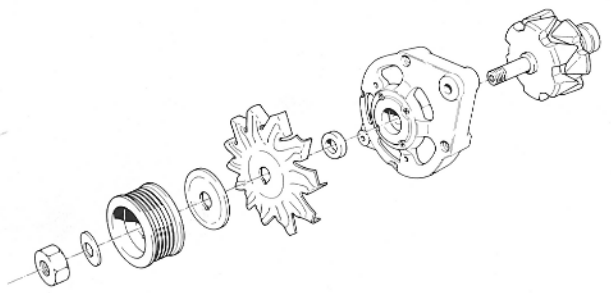
J2



42 408

Inspect the bearings

Rotate the bearings and check for abnormal noise and excessive play.

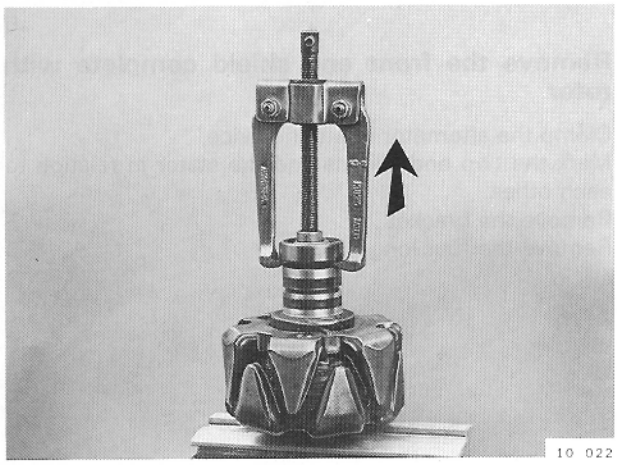


32 022

J3

Remove the rotor from the front end shield

Clamp the rotor in a bench vice with soft jaws.
Remove the pulley and fan (use a socket-head wrench to stop the rotor shaft from turning).
Tap the rotor out of the bearing housing.

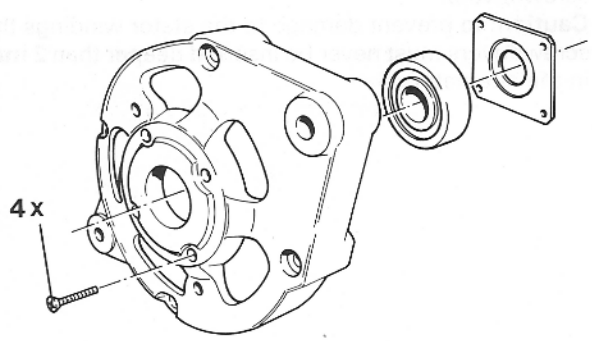


10 022

J4

Renew the rear bearing

Remove the bearing with a gear puller.
Fit the bearing with the aid of a plastic-tip hammer.



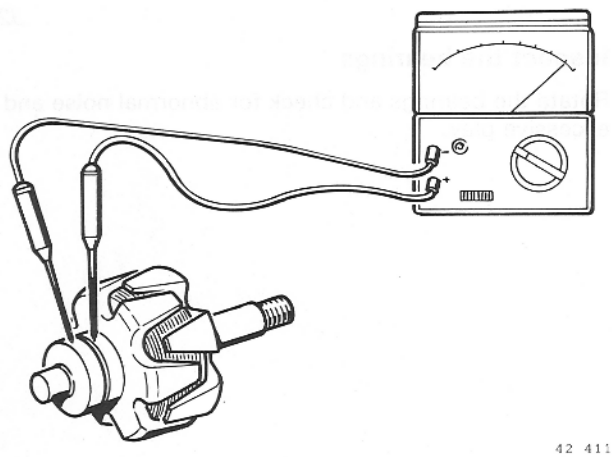
32 023

J5

Renew the front bearing

Remove the four bolts and the end plate.
Remove the bearing with the aid of a plastic-tip hammer.

Fit the bearing with the aid of a plastic-tip hammer.
Locate the end plate.
Fit and tighten the four bolts.



42 411

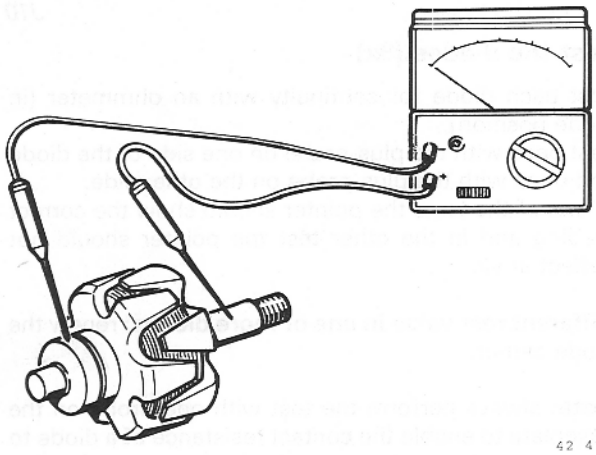
J6

Check the rotor for fractures

Note: the slip rings must not be greasy, damaged or worn down too far.
Measure the resistance across the slip rings.

Resistance infinite: rotor fractured; renew the rotor.

Resistance 2.8 ohms: move on to Operation *J7*.



42 412

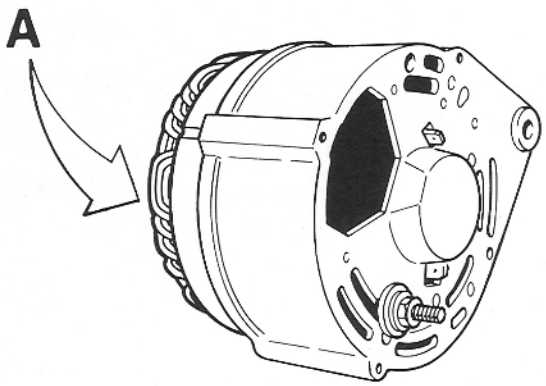
J7

Test the rotor for short-circuiting

Measure the resistance between one of the slip rings and the rotor shaft.

Resistance 0 ohms: renew the rotor.

Resistance infinite: rotor in order.

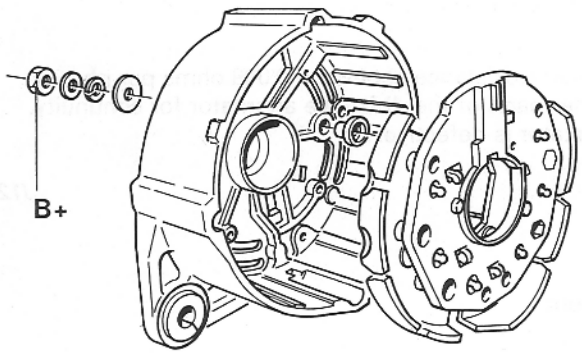


32 024

J8

Remove the stator

Unsolder the three cable connections (A) from the diode carrier.
Remove the stator from the rear end shield.



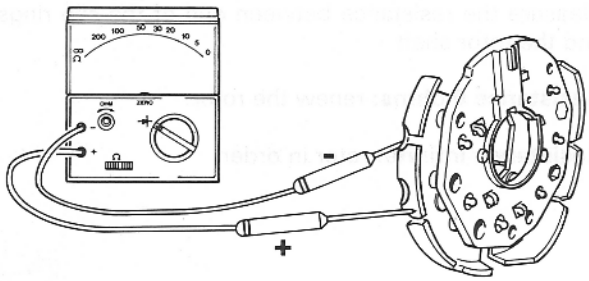
32 026

J9

Remove the diode carrier

Remove the nut (B+) on the outside of the rear end shield.
Remove the three bolts from the diode carrier.
Take out the diode carrier.

J10



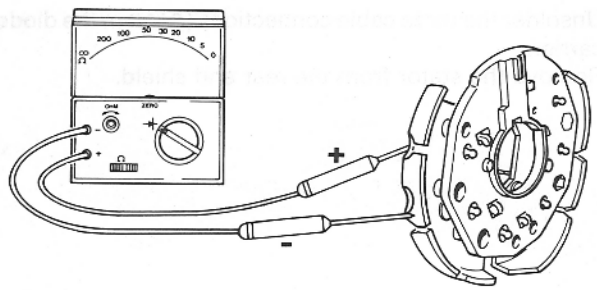
32 027

Test the diodes (9x)

Test each diode for continuity with an ohmmeter (in diode position).
Test once with the plus-probe on one side of the diode and once with the plus-probe on the other side.
In one of the tests the pointer should show the correct reading and in the other test the pointer should not deflect at all.

Different test value in one or more diodes: renew the diode carrier.

Note: always perform the test with one probe on the baseplate to enable the contact resistance of a diode to be measured as well.



32 028

J11

Test the stator

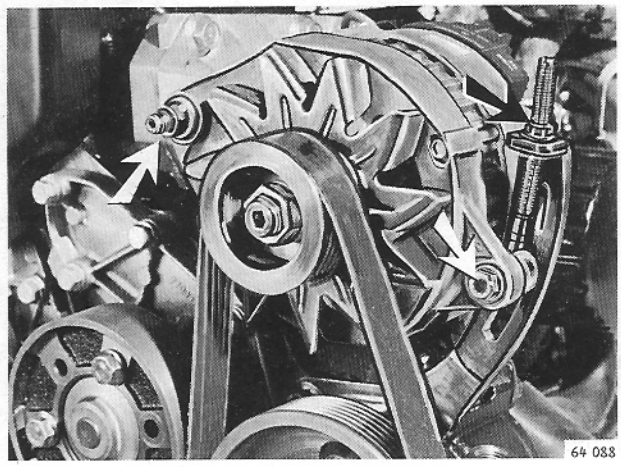
Note: testing the stator for continuity requires a special ohmmeter (resistance should be 0.009 ohms per phase).
If no special ohmmeter is available, it is easier to test all the other parts of the defective alternator for continuity.
If the test values are correct, it can then be concluded that the stator is defective.

J12

Assemble the alternator

Assembly is in reverse order to disassembly.
Note: lock the screw thread on the long bolts with a locking agent.
Tighten the pulley to **45 Nm**.
Fit the voltage regulator; see Operation *F3*.

K. Installing and testing the alternator



K1

Install and test the alternator

Alternator installation is in reverse order to removal; see Operation *G1*.
Adjust the tension of the Poly-V-belt.
A 3-groove belt
B 6-groove belt

Value when adjusting	3-groove	6-groove
New belt N	350	700
Used belt N	225	500

Note: a damaged or greasy Poly-V-belt must be renewed.

K2

Test the alternator

See Operations *C2* to *C5*.
Note: the alternator can also be tested on a special test bench. In this case follow the instructions given by the manufacturer of the test bench.

Group 33. Starter motor.

L. Symptoms and causes

L1

Overview of malfunctions and possible causes

Slow cranking speed and low amperage
Battery in poor condition.
High resistance due to dirty commutator.
Worn brushes or too low brush spring tension.
Bearing play.

Slow cranking speed and high amperage
Short-circuit in the field coils.
The armature is fouling the field coils as a result of worn bearings or a bent armature shaft.

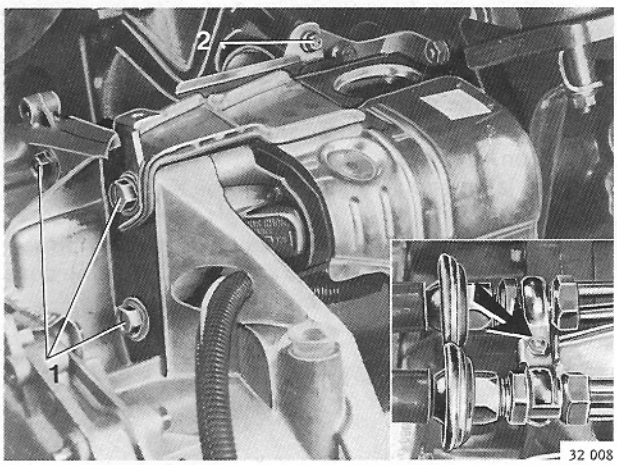
Excessive sparking discharge, slow cranking speed
Low spring tension due to worn brushes or too low tension of the brush springs.
Short-circuit or partial interruption of the armature winding.

The starter motor solenoid engages but the starter motor does not work
Defective starter motor solenoid.
Poor contact at the brushes.
Fracture in the field coils.
Rotor is fouling the bearing.

Slow running-on of the starter motor when the ignition key is released
Worn brushes.
Low brush spring tension.

Starter motor solenoid does not engage and disengage
Defective starter motor solenoid.
Defect in the wire between connection 50 of the starter motor and the ignition switch.
Defective ignition switch.

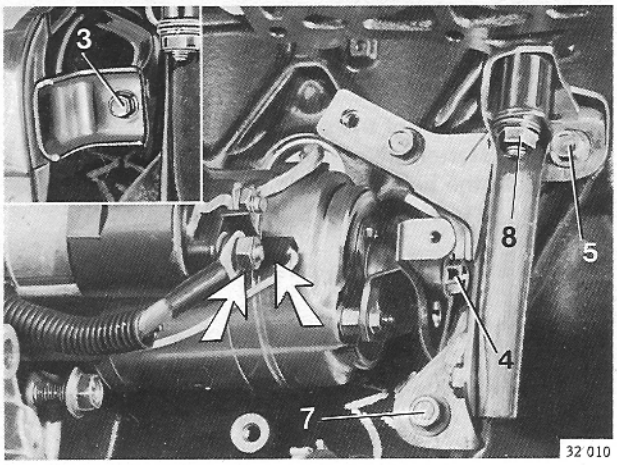
M. Removing the starter motor



M1

Remove the starter motor: operations from above the engine compartment

Disconnect the negative terminal from the battery pole.
On B18 KP engines: remove the air filter.
Remove the bolt from the clamping bracket for the Pulsair lines (if fitted).
Remove the three attachment bolts (1).
Remove the bolt (2) from the heat shield.

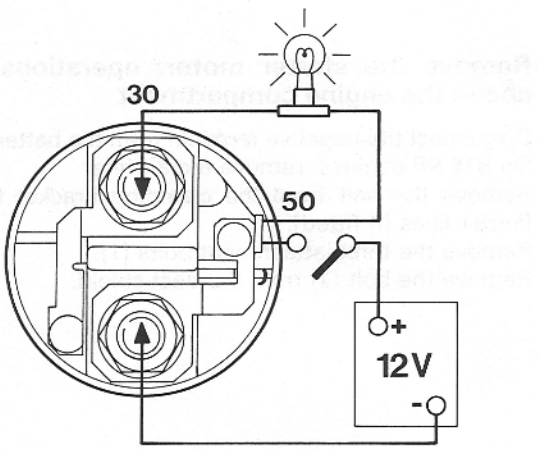


M2

Operations under the engine compartment

440/480
Remove the engine splash guard.
Note: on engines equipped with a Pulsair system, release the exhaust downpipe from the exhaust manifold.
Remove the bolt (3) from the heat shield and take off the heat shield.
Disconnect the wiring.
Remove the attachment bolt (4) from the starter motor.
480
Remove bolt (5) and slacken bolt (6) on the bracket.
Push the bracket clockwise and remove the starter motor.
440
Remove the bolts (5, 6 and 7) and nut (8).
Remove the bracket.
Remove the starter motor.

N. Testing and/or renewing the starter motor solenoid

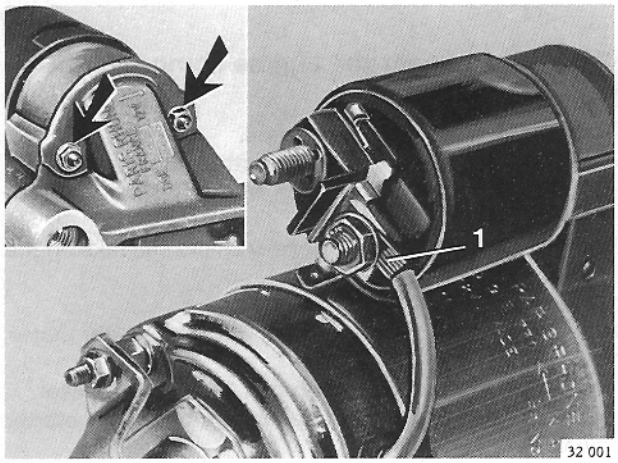


42 394

N1

Test the starter motor solenoid

Disconnect the cable from the field coils.
Connect up the solenoid as shown in the diagram.
Switch on.
The test lamp should light up and the armature should pull in.
Switch on and off a few times in quick succession.
If the armature does not pull in and/or the test lamp does not light up then the solenoid must be renewed.



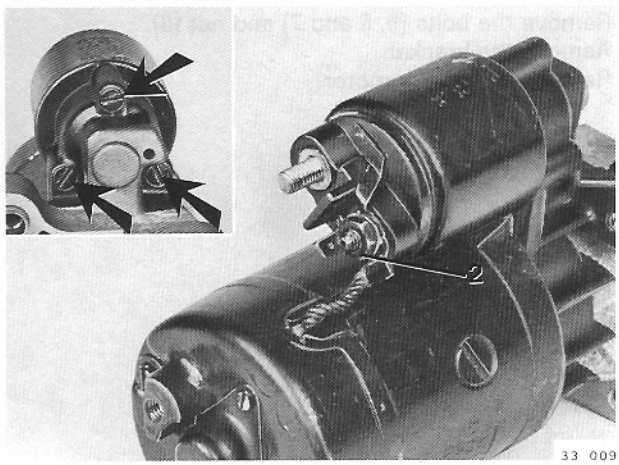
32 001

N2

Remove/fit the starter motor solenoid

Paris-Rhône
Clean the exterior of the starter motor.
Clamp the starter motor in a bench vice.
Disconnect the field coil cable (1) from the solenoid.
Remove the two nuts and lift off the solenoid.

Fitting is in reverse order to removal.



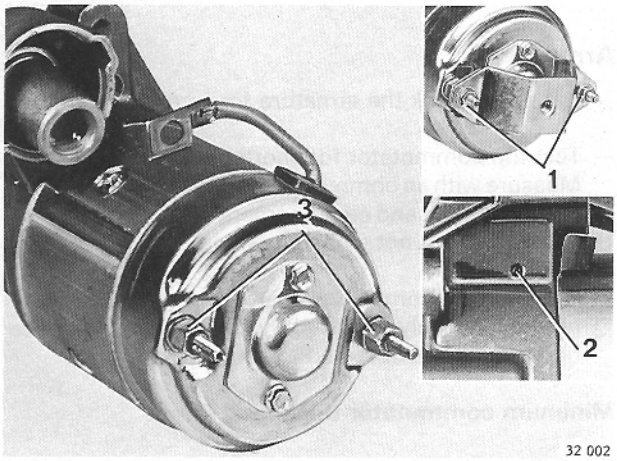
33 009

Bosch
Clean the exterior of the starter motor.
Clamp the starter motor in a bench vice.
Disconnect the field coil cable (2) from the solenoid.
Remove the three screws and lift off the solenoid.

Fitting is in reverse order to removal.

O. Disassembling the Paris-Rhône starter motor

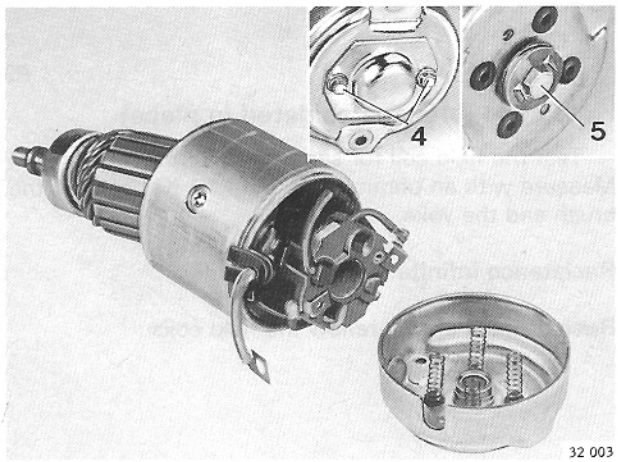
Remove the starter motor solenoid; see Operation *N2*.



O1

Remove the front end shield and fork from the yoke

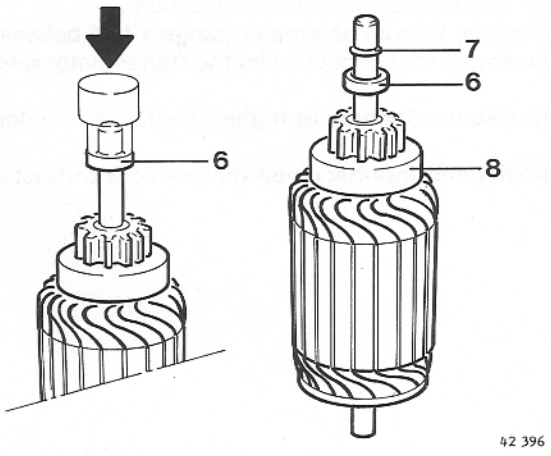
Remove the nuts (1) and take off the bracket.
Remove the pivot pin.
Remove the two nuts (3) and take off the front end shield.



O2

Remove the brush holder

Remove the two bolts (4) and take off the dust excluder.
Stop the shaft from turning and remove the bolt (5) together with the shims.
Remove the rear end shield from the yoke.
Take the brushes out of their guides.
Remove the brush holder.
Withdraw the armature and pinion gear assembly from the yoke.



O3

Remove the pinion gear

Tap the stop collar (6) back a short distance.
Remove the thrust washer (7), the stop collar (6) and the pinion gear (8).

O4

Clean all parts

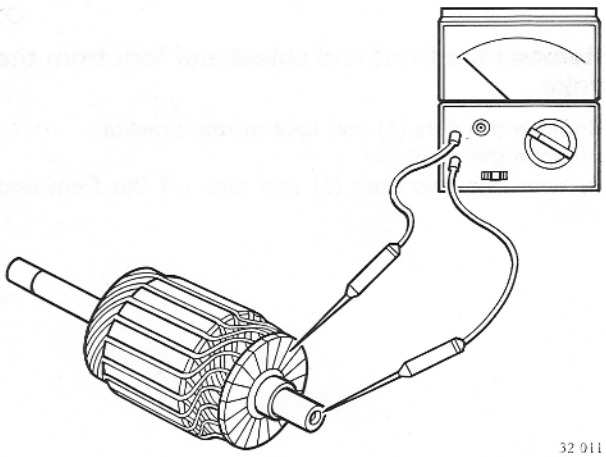
Note: the armature and yoke must not be cleaned by immersion in a liquid.

O5

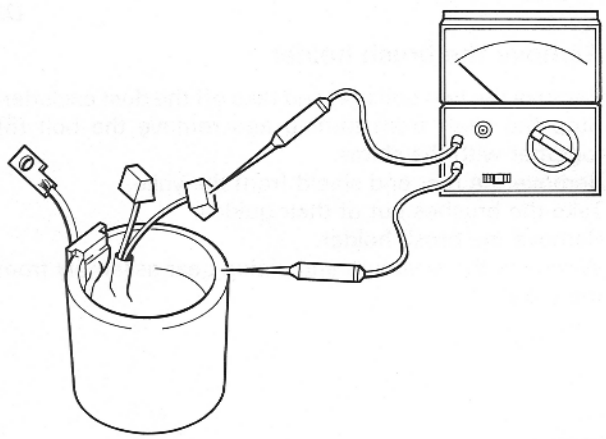
Check the pinion gear

Check that the freewheel gear locks in the direction of drive and freewheels in the opposite direction.

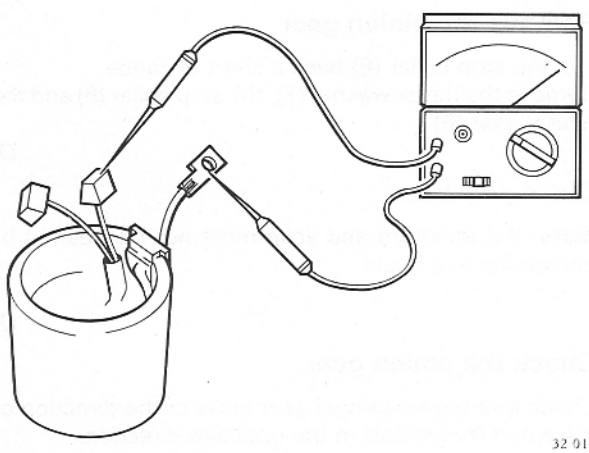
P. Testing and overhauling the Paris-Rhone starter motor



32 011



32 012



32 013

P1

Armature

— Carefully check the armature for wear and damage.

— Test the commutator for shorting to earth.
Measure with an ohmmeter (range x 1 K) between the armature shaft and each segment of the commutator.
The meter should not show a reading.

— A burnt or worn commutator must be machine-turned, but only skim lightly until an even surface finish has been obtained all round.

Minimum commutator thickness: 2 mm

Carefully polish the commutator to obtain a smooth finish.

P2

Field coils (brushes soldered in place)

— Test the field coil for shorting to earth.
Measure with an ohmmeter (range x 1 K) between the brush and the yoke.

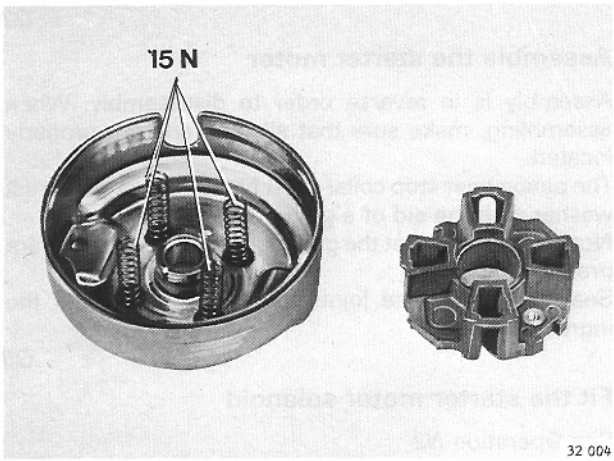
Resistance infinite: field coils in order.

Resistance 0 ohms: renew the field coils.

— Test the field coils for interruption.
Measure with an ohmmeter (range x 1 K) between the brush and the connection for the starter motor solenoid.

Resistance 0 ohms or higher: field coils in order.

Resistance infinite: renew the field coils and test again.



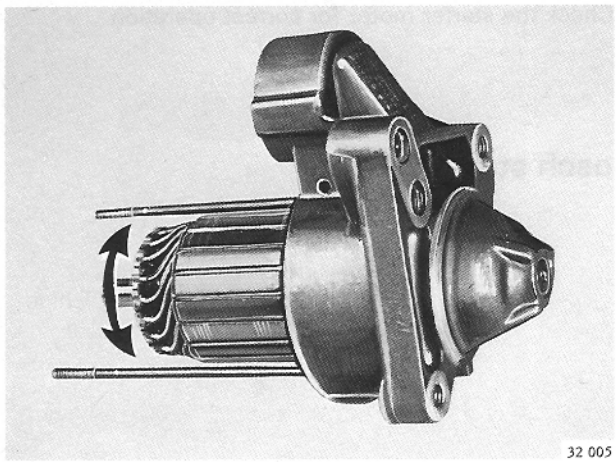
32 004

P3

Check the brush holder and brush springs

Inspect the brush holder for cracks.

Check the tension of the brush springs (15 N).

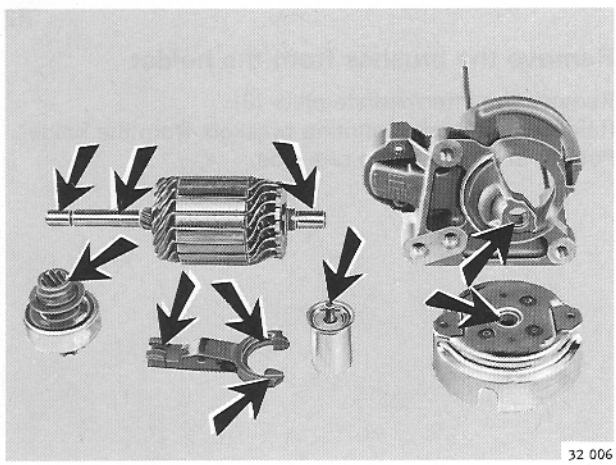

32 005

P4

Bearing bushes

Check the bearing bushes for damage and radial play. Renew the bushes if there is noticeable play between the armature shaft and the bushes.

Q. Assembling the Paris-Rhône starter motor


32 006

Q1

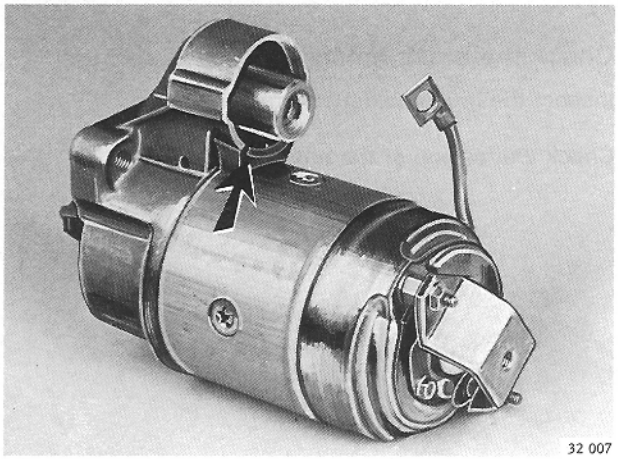
Lubricate the starter motor

Lubricate the various starter motor parts before assembly according to the schedule given below.

1 Squirt oil into the bearing bushes until they are full and squeeze the oil between thumb and index finger until the oil exits through the pores of the bush wall.

2 Lubricate the armature shaft and pinion gear with Volvo grease (Part No. 1161029).

3 Grease the pull rod and fork.


32 007

Q2

Assemble the starter motor

Assembly is in reverse order to disassembly. When assembling, make sure that all the parts are properly located.
The pinion gear stop collar must be fitted over the thrust washer with the aid of a gear puller.
Note: make sure that the guard plate and rubber seal are properly located.
Seal the seams and joints with paint to prevent the ingress of water.

Q3

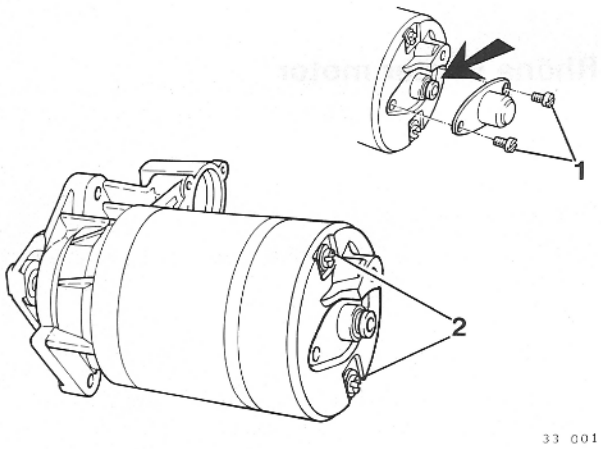
Fit the starter motor solenoid

See Operation *N2*.

Check the starter motor for correct operation.

R. Disassembling the Bosch starter motor

Remove the starter motor solenoid; see Operation *N2*.

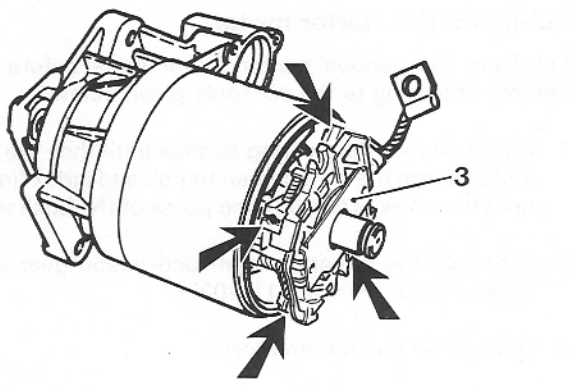


33 001

R1

Remove the rear end shield

Remove the two bolts (1) and take off the dust excluder.
Remove the lock washers and shims.
Remove the two long bolts (2) and take off the rear end shield.



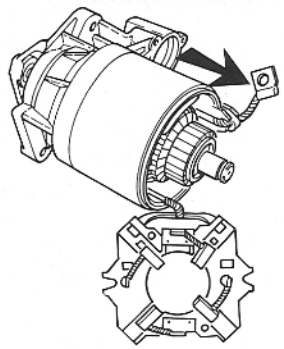
32 029

R2

Remove the brushes from the holder

Remove the intermediate plate (3).
Release the brush mounting brackets from the holder.
Put the brush holder to one side.

R3

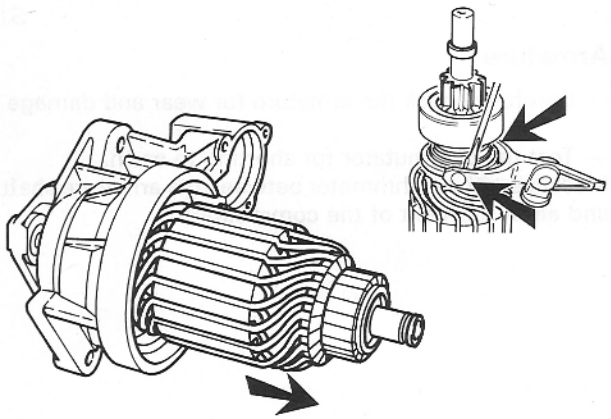


32 030

Separate the yoke from the armature and front end shield

Remove the yoke from the armature and the front end shield.

R4



32 031

Separate the armature from the front end shield

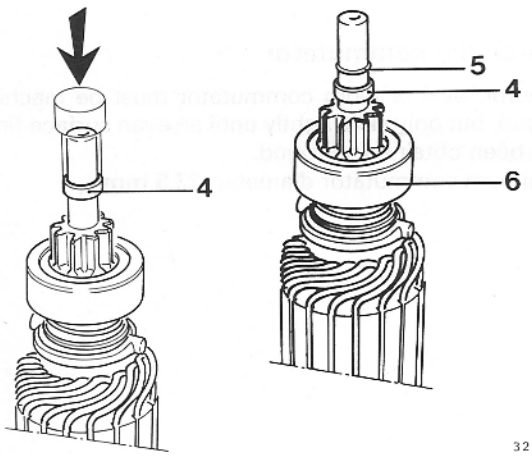
Remove the rubber joint and the fork pivot pad.
Remove the armature and fork assembly.

R5

Separate the fork from the pinion gear

Force apart the fork with a screwdriver and remove it from the pinion gear.

R6



32 032

Remove the pinion gear

Tap the stop collar (4) back a short distance.
Remove the thrust washer (5), the stop collar (4) and the pinion gear (6).

R7

Clean all parts

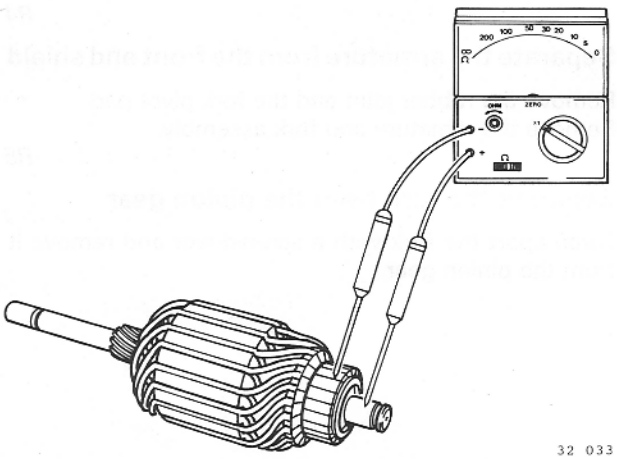
Note: the armature and yoke must not be cleaned by immersion in a liquid.

R8

Check the pinion gear

Check that the freewheel gear locks in the direction of drive and freewheels in the opposite direction.

S. Testing and overhauling the Bosch starter motor



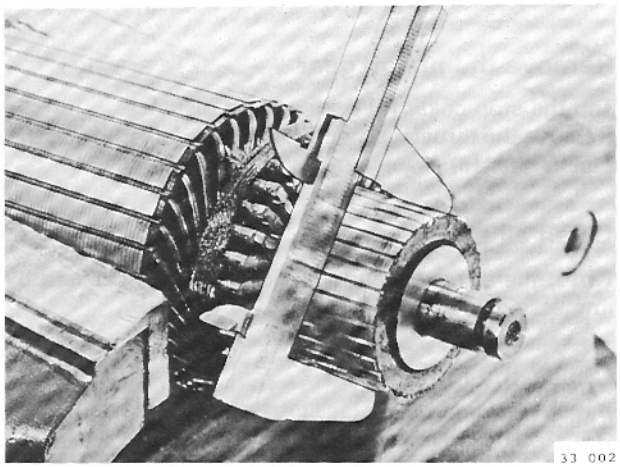
32 033

S1

Armature

— Carefully check the armature for wear and damage.

— Test the commutator for shorting to earth.
Measure with an ohmmeter between the armature shaft and **each** segment of the commutator.

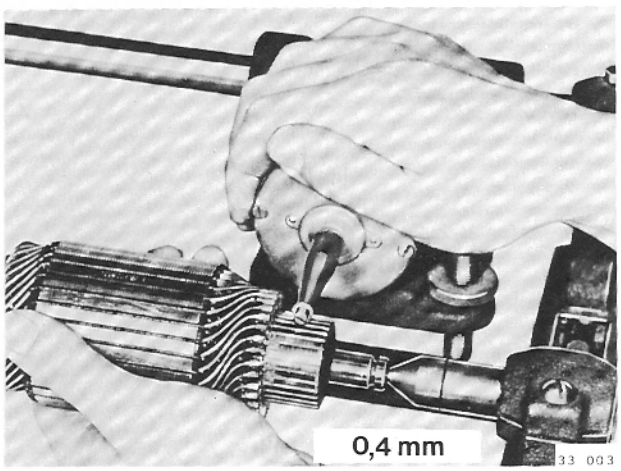


33 002

S2

Check the commutator

A burnt, oval or worn commutator must be machine-turned, but only skim lightly until an even surface finish has been obtained all round.
Minimum commutator diameter: **33.5 mm**



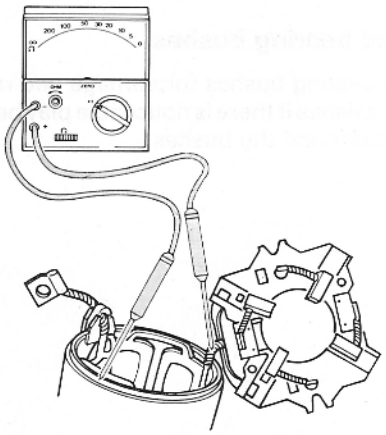
33 003

S3

Undercut the commutator insulation

Undercut the insulation between the commutator segments to a depth of **0.4 mm**.
Carefully polish the commutator with polishing paper to obtain a smooth finish.

S4



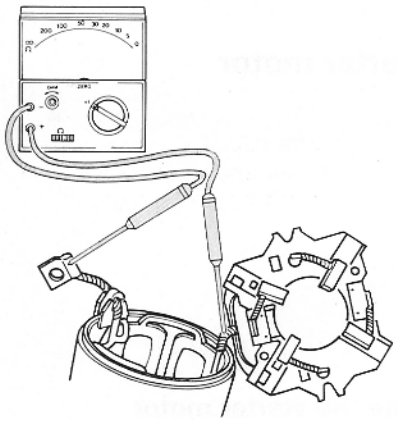
33 004

Field coils

— Test the field coils for shorting to earth.
Measure with an ohmmeter (range x 1 K) between the brush and the yoke.

Resistance infinite: field coils in order.

Resistance 0 ohms: renew the field coils.



33 005

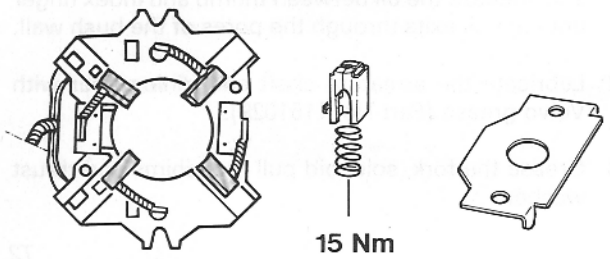
— Test the field coils for interruption.
Measure with an ohmmeter (range x 1 K) between the positive brushes and the connection for the starter motor solenoid.

Resistance 0 ohms or higher: field coils in order.

Resistance infinite: renew the field coils and test again.

S5

Check the brush holder and brush springs



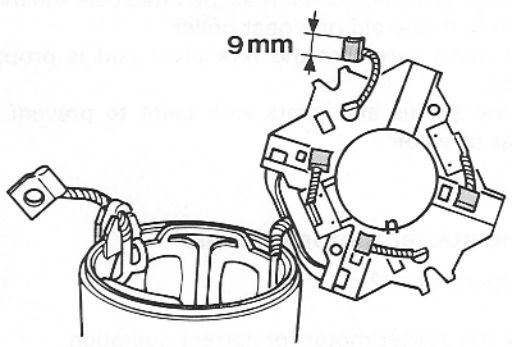
33 006

Inspect the brush holder for cracks.
Check the intermediate plate and the brush mounting brackets.

Check the tension of the brush springs (15 N).

S6

Check the brushes



33 007

Check the length of the brushes.

Minimum permissible length: **9 mm.**

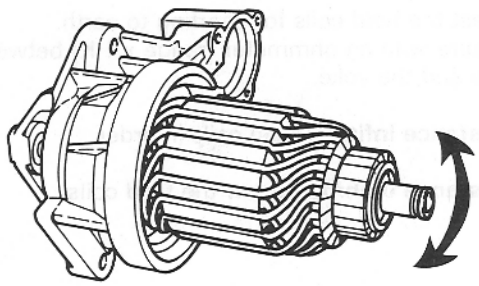
Renew the brushes as necessary.
This must be done by soldering.

Note: when soldering, make sure that the cables are not excessively covered with tin.

S7

Check the bearing bushes

Check the bearing bushes for damage and radial play. Renew the bushes if there is noticeable play between the armature shaft and the bushes.



32 034

T. Assembling the Bosch starter motor

T1

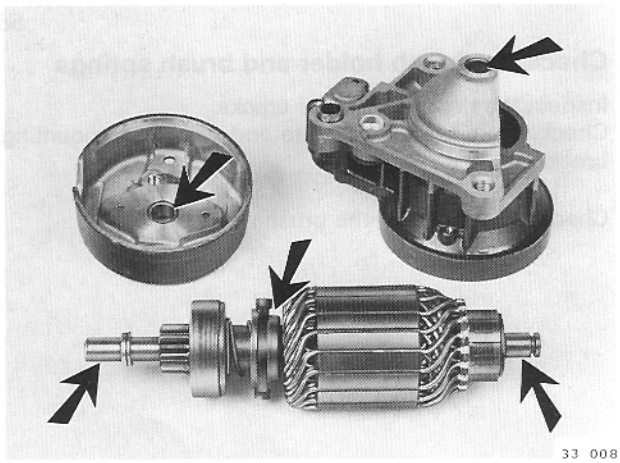
Lubricate the starter motor

Lubricate the various starter motor parts before assembly according to the schedule given below.

1 Squirt oil into the bearing bushes until they are full and squeeze the oil between thumb and index finger until the oil exits through the pores of the bush wall.

2 Lubricate the armature shaft and pinion gear with Volvo grease (Part No. 1161029).

3 Grease the fork, solenoid pull rod, shims and thrust washer.

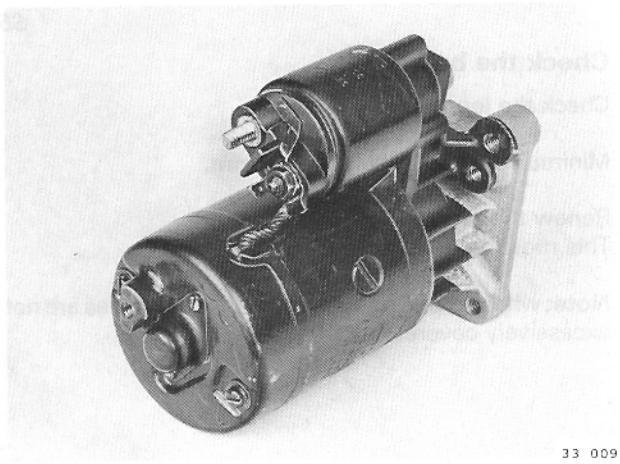


33 008

T2

Assemble the starter motor

Assembly is in reverse order to disassembly. When assembling, make sure that all the parts are properly located.
The pinion gear stop collar must be fitted over the thrust washer with the aid of a gear puller.
Note: make sure that the fork pivot pad is properly located.
Seal the seams and joints with paint to prevent the ingress of water.



33 009

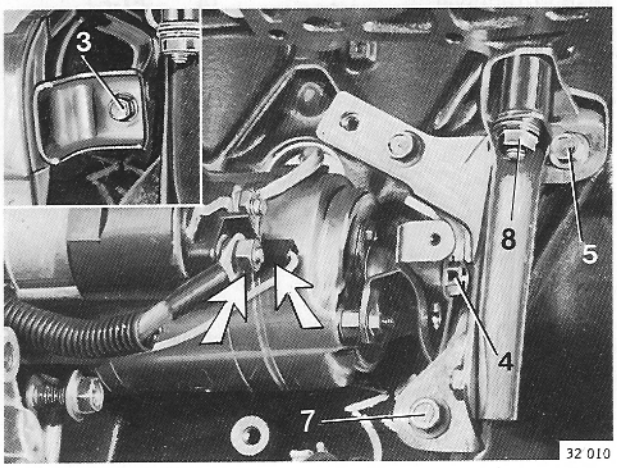
T3

Fit the starter motor solenoid

See Operation *N2*.

Check the starter motor for correct operation.

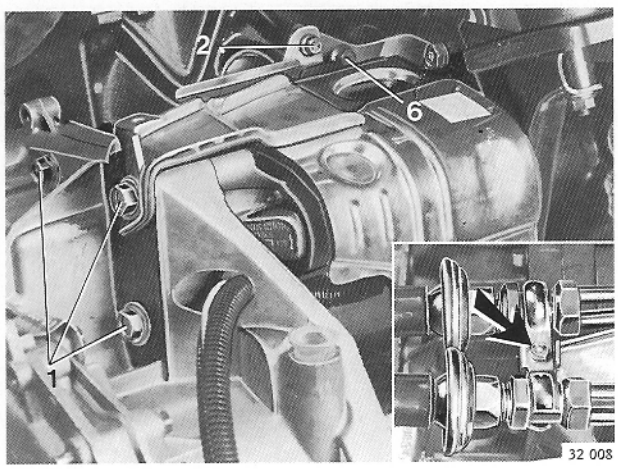
U. Installing the starter motor



U1

Install the starter motor: operations under the engine compartment

Locate the starter motor.
440
Fit the bracket.
Fit and tighten the starter motor attachment bolt (4) with hand pressure only.
Fit and tighten nut (8) and the bolts (7, 6 and 5).
Tighten attachment bolt (4).
480
Fit and tighten the starter motor attachment bolt (4).
Fit and tighten the bracket bolt (5).
Tighten bracket attachment bolt (6).
440/480
Connect up the wiring.
Locate the heat shield and fit and tighten the bolt (3).
Note: on engines equipped with a Pulsair system, secure the exhaust downpipe to the exhaust manifold.
Fit the engine splash guard.



U2

Operations from above the engine compartment

Fit and tighten the three attachment bolts (1).
Fit and tighten the heat shield bolt (2).
If a Pulsair system is installed, fit and tighten the bolt for the Pulsair lines clamping bracket.
On B18 KP engines: fit the air filter.
Reconnect the negative terminal to the battery pole.

Alphabetical index

Field report form

To:

Autodivisie Volvo Car B.V.
Afd. Service Technical Support
P.O. Box 1015
5700 MC Helmond
The Netherlands

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Concerns publication: .....

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Section: ..... Page ..... TP no. .....

Suggestions/reasoning:

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If so, make a copy of this page and send them to us at the above address.**

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