

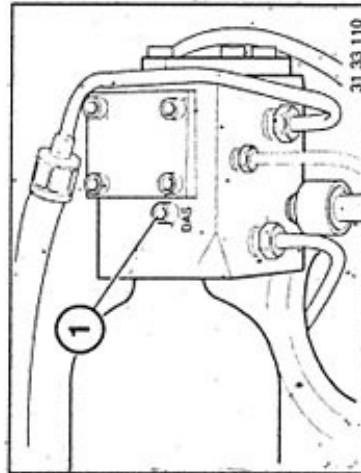
12 Engine electrical system

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For additional work, refer to "Repair Instructions for 7 Series E38"

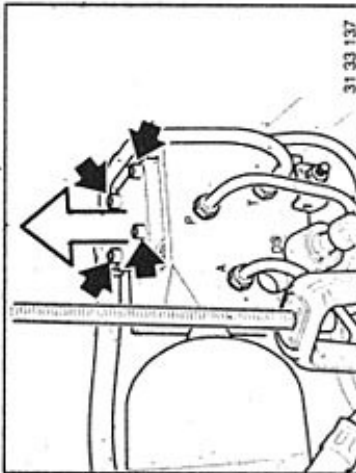
33 34 545 Replacing filter in spring accumulator unit

Switch off ignition.
Remove spare wheel.
Remove cover of spring accumulator unit.



Loosen pressure relief screw (1) half a turn to relieve spring accumulator pressure.

Installation:
Tightening torque 33 34 1AZ*

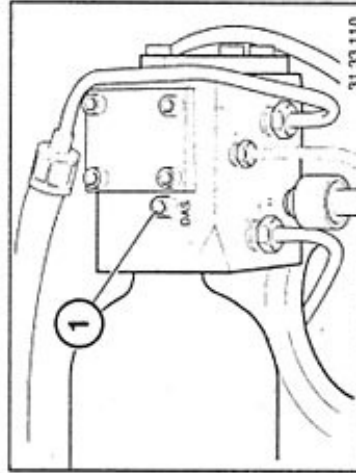


Unfasten screws and remove the filter cover.
Lift out filter element with special tool 11 3 251.

Installation:
Tightening torque 33 34 4AZ*

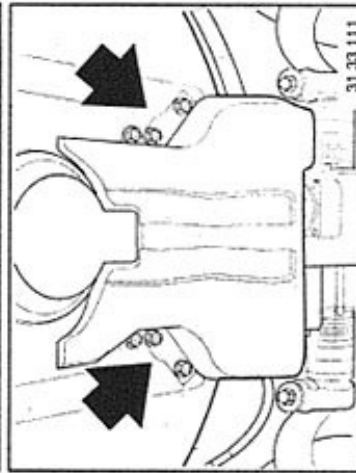
33 34 547 Replacing filter in actuator unit

Switch off ignition.
Remove spare wheel.
Remove cover from spring accumulator unit.

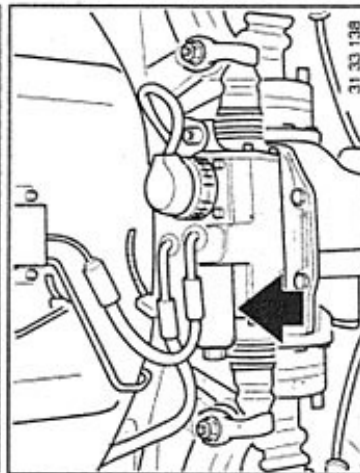


Loosen pressure relief screw (1) half a turn to relieve spring accumulator pressure.

Installation:
Tightening torque 33 34 1AZ*



Unfasten nuts and remove protective plate.



Unfasten filter bell housing and remove filter element.

Installation:
Tightening torque 33 34 7AZ*

INSTRUCTIONS FOR WORKING ON IGNITION SYSTEM, DME (DIGITAL MOTOR ELECTRONICS) AND ENGINE ELECTRICAL EQUIPMENT

Caution!

Always switch off ignition before working on ignition system – dangerous high tension!

- Always remove DME master relay for the compression test to avoid activation of ignition coils by ignition final stages of the DME control unit. Dangerous high tension!
- Always switch off ignition before connecting / disconnecting Service Tester, other testers and adapters or replacing components!
- Secondary (high tension) side of ignition system must be loaded with at least 4 k-ohms.
- Never start engine after removing distributor cap or disconnecting wire (terminal 4) on ignition coil (terminal 4).
- Never connect a shielded capacitor or test lamp on ignition coil terminal 1.
- Never connect ignition coil terminal 1 wire to ground or B+.
- Consequently terminal 1 wire may not be used to interlock starting when service installing a burglar alarm system.

Direct Ignition System (Without Distributor):

- Engine must never be started after disconnection of the secondary circuit, i.e. disconnection of connectors on spark plugs and ground connection (terminal 4a).
- There is dangerous high tension in or on
 - Ignition leads,
 - spark plug connectors,
 - spark plugs,
 - Ignition coil terminal 4
 (Caution! approx. 40 kV high tension) and
 - terminal 1 wire from ignition coil to DME control unit
 (Caution! approx. 350 V high tension at terminal 1).
- Battery as well as wires on alternator and starter may not be disconnected on a running engine.

INSTRUCTIONS FOR REMOVING AND INSTALLING ELECTRONIC CONTROL UNITS

Caution!

Disconnecting the car's battery will cancel the fault memories of control units.
Consequently prior to disconnection of the car's battery fault memories should be interrogated and faults printed by the printer of a BMW Service Tester. Investigate stored faults.
Ignition must always be switched off before disconnecting or connecting control unit plugs.
Removal and installation of components, relays, fuses, etc. could cause the storage of faults in fault memories of control units capable of self-diagnosis. Consequently fault memories must always be interrogated after working on the electrical system. Stored faults must be investigated and cancelled.

Note When Replacing DME (Digital Motor Electronics) Control Unit:

Each control unit is programmed with certain basic values, which serve as mean values.
The control unit receives different input values, depending on engine condition, which are compared with the stored values.
The adaptive system compares the input values with the stored map values. Appropriate correction commands are sent to the concerned drive elements. If, for example, the DME control unit would be without current for a long time (more than an hour), its adaptive system would lose the stored values. After re-operation of a cancelled or installation of a new control unit the input values of a pertinent engine must be read in and stored for the adaptive system. This procedure could lead to erratic idling and disturbed overrunning of the engine after starting. Depending on the engine it could require some time before all values are adapted to the engine condition.

Consequently there must be conformance with the following procedures before replacing a DME control unit or operating a control unit which had been disconnected.

- Run engine to operating temperature.
- Install control unit and drive car.

CHECKING COMPONENTS

Note:

Refer to Construction Group Repair Manual.

Always conform with safety precautions and accident prevention regulations whenever carrying out tests or work on engine electric and electronic components.

Always disconnect plugs of control units or components before checking electric wires.

Testing Aids:

Concerned wiring diagrams and current flow diagrams can be found in the binders for "Car Electric/Electronic Test Plan - 8 Series E 31".

Only use appropriate test leads, adapter leads (refer to concerned repairing instructions), terminals and test clips.

Test values for checking components are contained in the Car Electric / Electronic Test Plan.

Also refer to the Technical Data microfiche for other specifications.

OUTSIDE STARTING AIR AND CAR TELEPHONE

Siemens C 2:

When starting the engine with help of the battery in a different vehicle ensure that the Siemens C 2 telephone is not damaged through overvoltage. Disconnect the sender and receiver from the electrical system prior to starting the engine with outside help.

Siemens C 3 and Motorola C 451:

Senders and receivers of Siemens C 3 and Motorola C 451 car telephones have overvoltage protection, but calls may not be made while starting the engine with outside help.

Always refer to the pertinent operating instructions of other type and other make car telephones. If in doubt, disconnect the sender/receiver from the electrical system.

SYNCHRONIZATION OF BANKS OF M 70 ENGINE CYLINDERS

The following information is important when replacing one or both DME control units.

Each electronic control unit is programmed with certain basic values, which are only mean values.

A control unit, however, receives variable input values depending on the vehicle operating conditions, which are permanently compared with the stored values. The adaptive system first compares them, then determines corrective values required for a pertinent operating condition and finally forwards the latter values to the concerned components such as air volume meters, throttle valve assemblies, Motronic control units and so on.

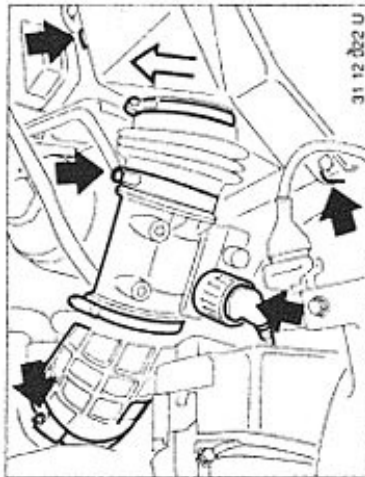
If, for example, the Motronic control unit were without current for a long period of time (more than 1 hour), its adaptive system would lose the stored values.

The adaptive system would have to find a balanced level between the programmed values and engine-orientated operating condition values after restoring operation of an erased control unit or installing a new control unit.

Consequently there must be conformance with the following procedures before an EML or DME control unit is replaced or after restoring operation of a disconnected control unit.

- Run engine to operating temperature.
- Install new control unit and drive car, whereby the car must coast three times from speeds above 5,000 rpm to the idling range in transmission range 1 (approx. 10 seconds).
- Have engine run at idling speed in transmission range P or N at least 5 minutes.

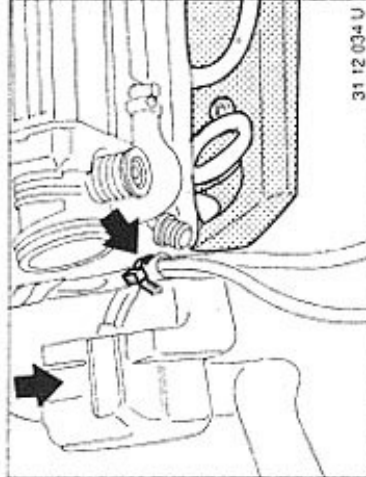
These procedures serve immediate and precise synchronization of both banks of cylinders in all operating conditions.



31 12 222 U

12 11 094 REPLACING BOTH DISTRIBUTOR CAPS

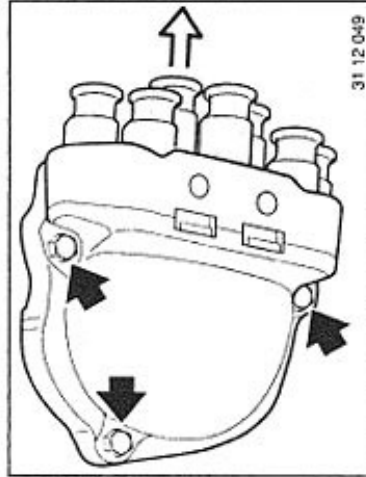
Remove upper air cleaner section complete with air mass sensor.



31 12 034 U

Loosen wire strap.
Take off cover.

Installation:
Engage cover in holder.



31 12 049

Pull off shielded connector.

Installation:
Numbers on leads and cap (for example 5) must be the same.

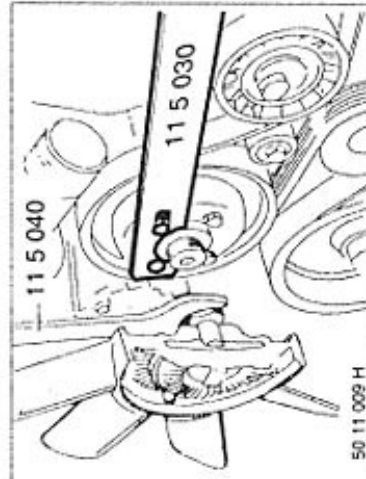
ZS = Ignition coil

Note:

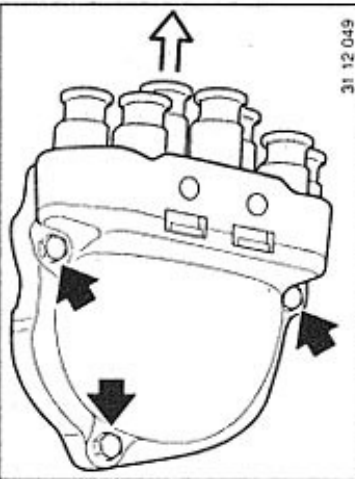
Firing order of M 70 engine is 1-7-5-11-3-9-6-12-2-8-4-10.

Numbers of ignition leads for bank of cylinders 7 ... 12 is equal to bank of cylinders 1 ... 6, i.e.
cylinder 7 = ignition lead 1,
cylinder 8 = ignition lead 2
and so on.

Unscrew fan – left-hand threads!
Use Special Tools 11 5 030 / 040.



50 11 009 H



31 12 049

Unscrew screws and take off distributor cap.

Caution!
Danger of cutting hands on radiator fins.

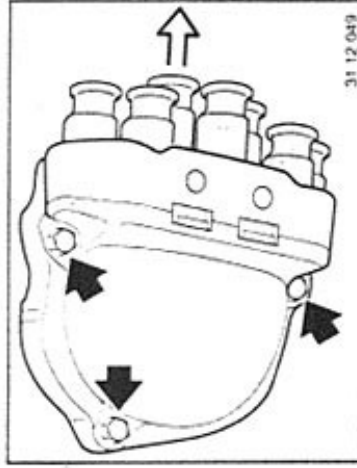
Installation:
Check seal, replacing if necessary.

12 11 096 Replacing left distributor cap
(M73)

Refer to
Repair Instructions for 7 Series E38.

12 11 098 Replacing right distributor
cap (M73)

Refer to
Repair Instructions for 7 Series E38.

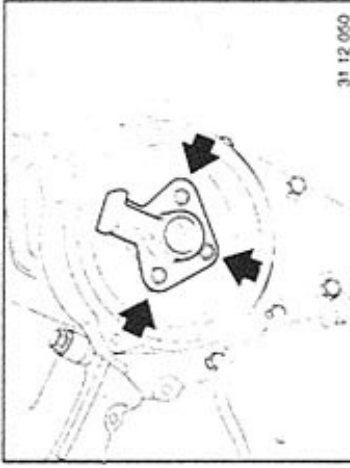


31 12 049

12 11 114 Replacing both distributor rotors

Remove distributor cap – refer to 12 11 096 or 12 11 098.
Repair Instructions for 7 Series E38.

If necessary, remove screenwash container.
Caution!
Risk of injury on radiator fins.

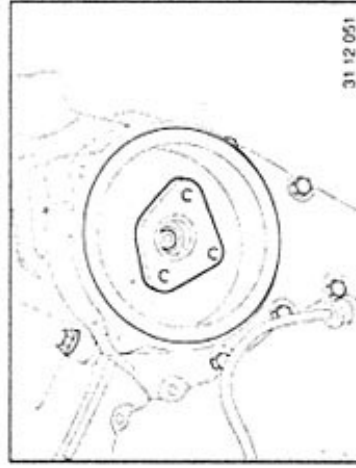


31 12 050

Unfasten screws with socket head cap wrench.

Installation:

Tightening torque,
refer to Technical Data 12 11 2AZ .



31 12 051

Note:

Measure resistance* and check surface and casting compound for hairline cracks and burn marks.

If unit is affected by these faults, always search for the cause of the fault and replace the relevant component.

12 11 206 Checking distributor cap, ignition leads and ignition line connector on left side

Refer to
Repair Instructions for 7 Series E38.

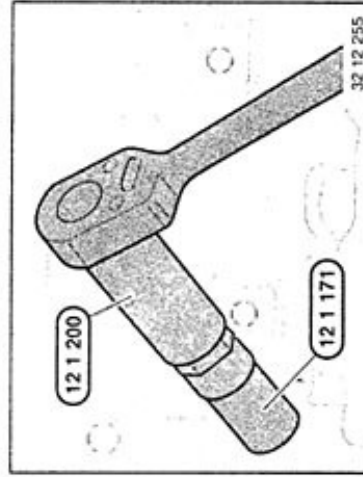
12 11 208 Checking distributor cap, ignition leads and ignition line connector on right side

Refer to
Repair Instructions for 7 Series E38.

12 12 011 Replacing spark plugs (M 70, S 70)

M 70

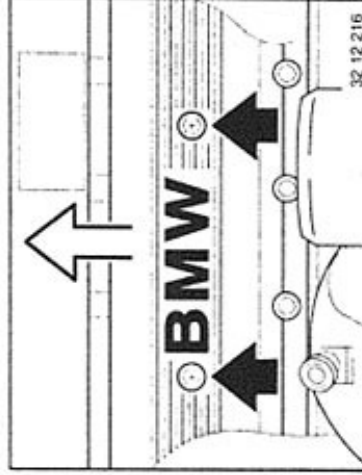
Remove windshield wash container.
Remove spark plug connector.
Unscrew and remove spark plug with special tool 12 1 170



Installation:

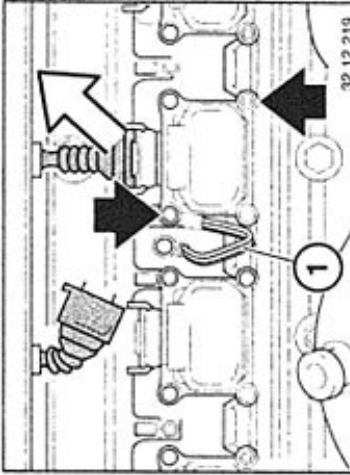
Tighten with special tool 12 1 171 and torque limiter 12 1 200.
Complete tool 12 1 170.
Without tool 12 1 200, note tightening torque.
Tightening torque 12 12 1AZ.

• Refer to Technical Data

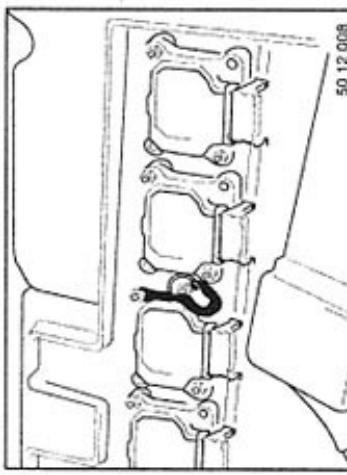


12 12 011 Replacing spark plugs (M 60)

Unclip cover over screws.
Unfasten screws.
Remove cover.

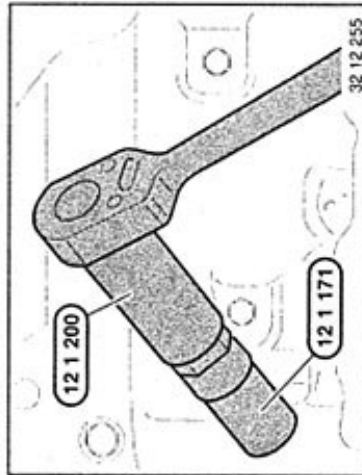


Unfasten screws.
Remove ignition coil.



Installation:

With the ignition coils on cylinders 3 and 6, the ground tapes on the cylinder head cover must be secured to the ignition coils.



Unscrew and remove spark plugs with special tool 12 1 171.

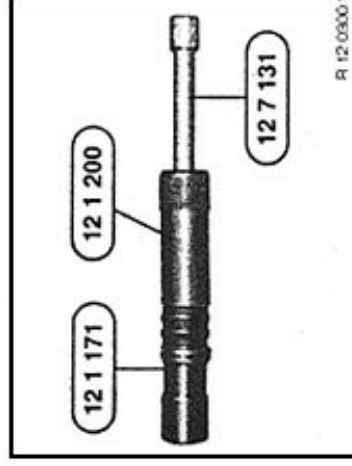
Installation:

Tighten using special tool 12 1 171 and torque limiter 12 1 200.
Complete tool 12 1 170.
Without tool 12 1 200, note tightening torque.
Tightening torque 12 12 1AZ.

• Refer to Technical Data

12 12 011 Replacing all spark plugs (M73)

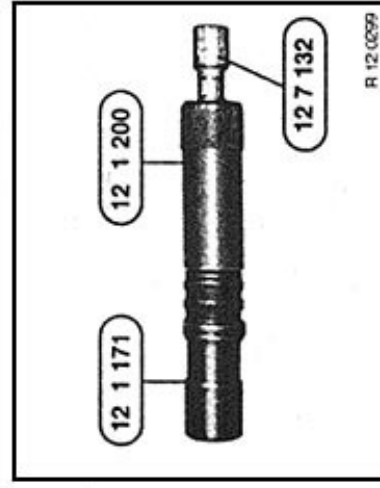
Switch off ignition.
Disconnect spark plug connector.



Cylinders 1-8:
Use special tools 12 7 131 and 12 1 171.

Installation:
Tighten down spark plug with special tool 12 1 171 and special tool 12 7 131 (extension) and special tool 12 1 200 (torque limiter). If not using special tool 12 1 200, note tightening torque.

Tightening torque,
refer to Technical Data 12 12 1AZ



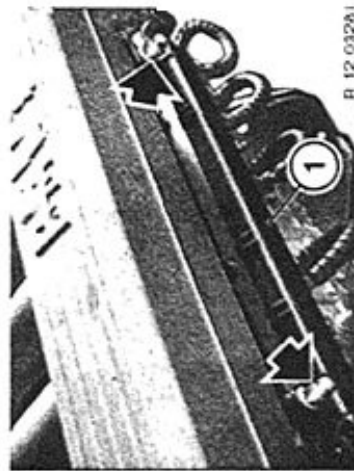
Cylinder 9-12:
Use special tools 12 7 132 and 12 1 171.

Installation:
Tighten down spark plug with special tool 12 1 171 and special tool 12 7 132 (extension) and special tool 12 1 200 (torque limiter). If not using special tool 12 1 200, note tightening torque.

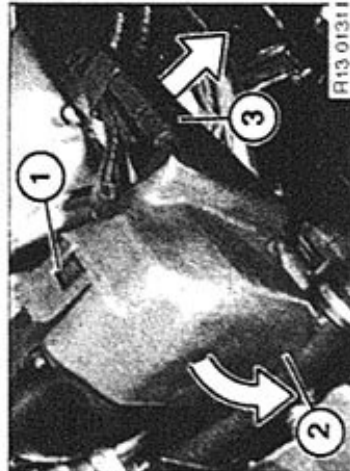
Tightening torque,
refer to Technical Data 12 12 1AZ

12 12 036 Replacing all ignition leads on left side (M73)

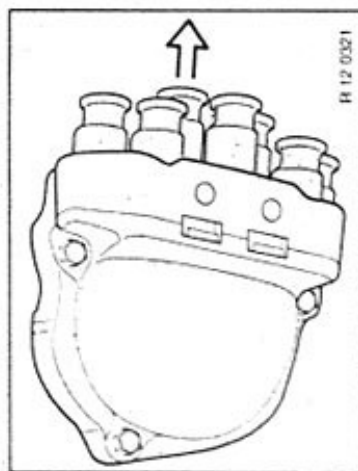
Switch off ignition.



R 12 03281



R 13 01311



R 12 0321

12 12 038 Replacing all ignition leads on right side (M73)

This operation is described in section 12 12 036.

Unfasten screw connection of ignition wiring harness on manifold.

Disconnect spark plug connector.

Unfasten cable tie on protective cap on distributor cap.

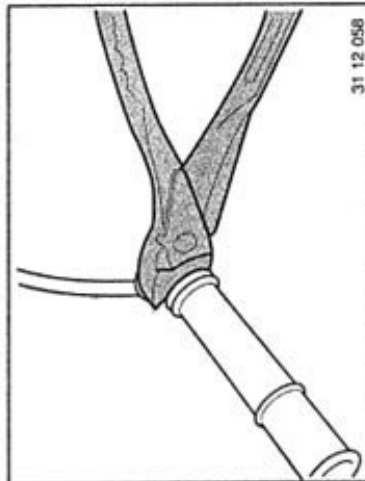
Unfasten clips (1-3) and remove protective cap.

Note sequence of ignition leads on distributor cap and remove ignition leads from distributor cap.

Installation:

Note firing order when fitting the ignition leads.

Firing order, refer to Technical Data

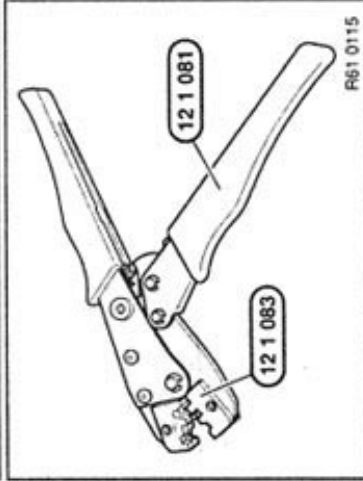


12 12 072 Replacing one spark plug connector

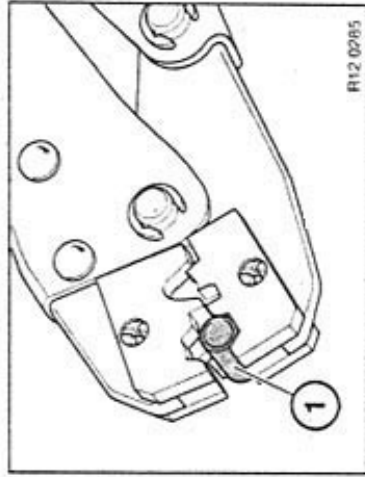
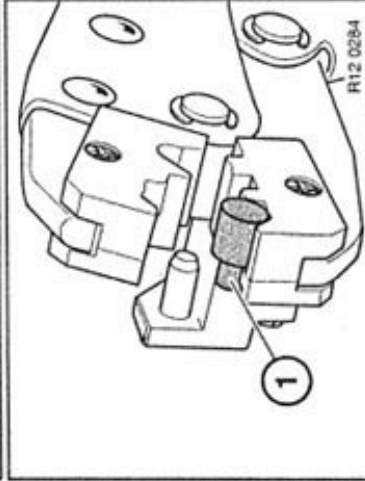
Switch off ignition.
Disconnect ignition lead directly behind the connector.



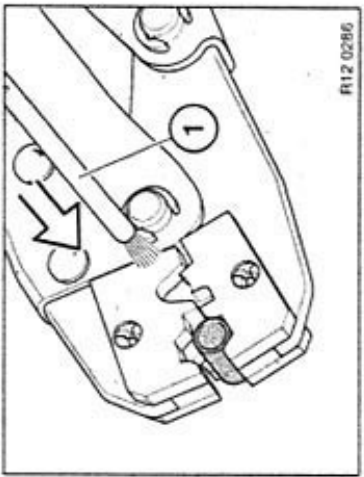
Strip insulation off a 6 mm length (A) of the ignition lead with insulation stripping pliers: wire cross section of 1.5 mm²



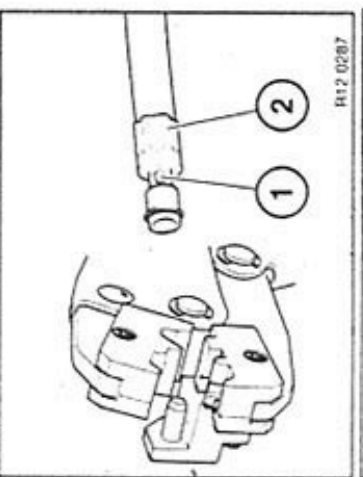
Fit special tool 12 1 083 in special tool 12 1 081.



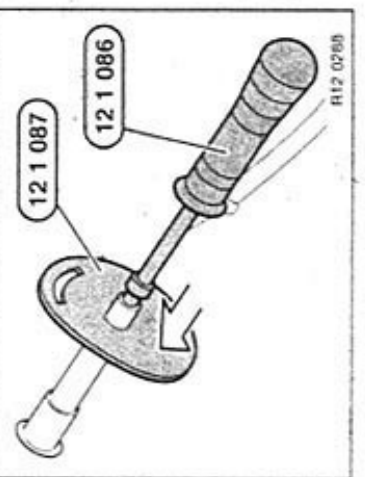
Tighten pliers by pressing handles together. This grips the adapter (1) in the matrix.



Insert stripped wires (1) firmly home in adapter. Press handles on pliers firmly together. Pliers open.



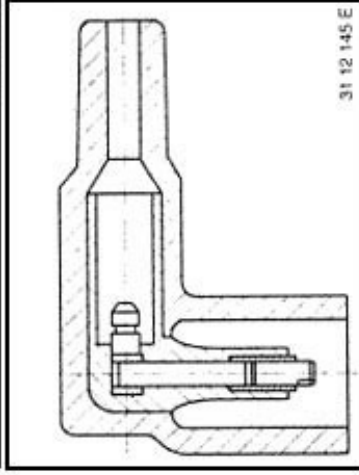
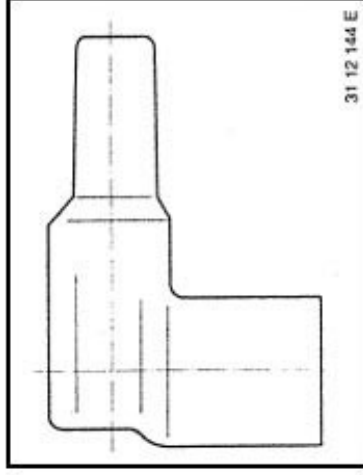
Remove crimped adapter with ignition lead. Wires (1) and insulation (2) (tension relief) must be crimped uniformly around entire circumference of adapter.

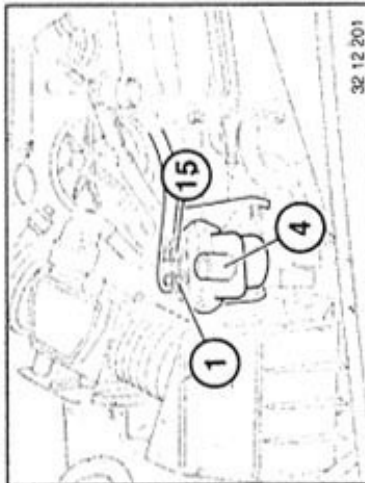


Slide special tool 12 1 087 onto spark plug connector. Spray ignition lead with special tool 12 1 088 (anti-friction agent). Insert ignition lead in special tool 12 1 086. Insert ignition lead in spark plug connector: adapter must locate audibly in spark plug connector.

12 12 151 Replacing one suppressor plug

Assembly, refer to 12 12 072.





32 12 201

12 13 009 Checking ignition coil (M 70, S 70)

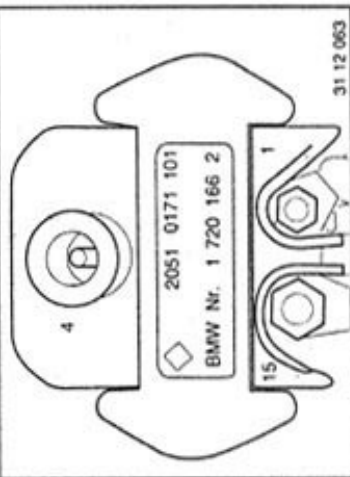
Multimeter check (M 06):

Measure resistance of primary coil

Term. 1/15 $\approx 0.5 \text{ k}\Omega \pm 10\%$

and secondary coil

Term. 15/4 $\approx 6 \text{ k}\Omega \pm 10\%$



31 12 063

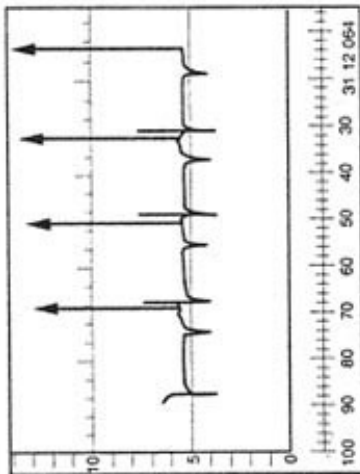
Check cast compound of primary coil carrier for hairline cracks. If gray material has emerged around the edges of the coil carrier, this indicates the presence of a defective ignition output stage in the DME control unit.

M 70:

Measurement of the right cylinder bank 1...6

Use adapter cable 61 2 010 and diagnosis cable. At this point, the oscilloscope receives a trigger signal from DME 1.

Perform measurement of left cylinder bank 7...12 with adapter cable 61 2 010 and universal diagnosis cable. Disconnect diagnosis cable from diagnosis connector to prevent oscilloscope from receiving a trigger signal from the wrong cylinder bank.



Connect BMW SERVICE TESTER to the diagnosis connector.

Perform an engine test, Test Step 09.

Note oscillogram - Ignition voltage:

6 ... 14 kV

Max. permitted deviation in ignition voltage:

3 kV

Connection: near cable connector distributor - high voltage pliers to line 4 for ignition coil. Connect trigger pliers (red) to ignition line 1 or 7.

Note: Numbering on ignition cables for cylinder bank 7...12 is the same as for cylinder bank 1...6. Cylinder 7 = ignition cable 1, etc

For cylinder bank 7...12:

Connect the universal diagnosis cable of the

Tester to the ignition coil:

Black clip on terminal 1, brown clip to vehicle ground

Note:

Very high ignition voltage deviations, indicated in Test Step 09, may be caused by incorrect connection of the Tester (connection to the wrong cylinder bank).

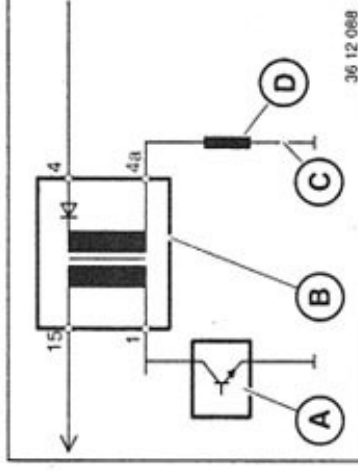
Note:

Cylinder recognition sensor on left side, on ignition line for cylinder 12.

Right side on ignition line to cylinder 6.

12 13 009 Checking Ignition coil (M73)

Refer to
Repair Instructions for 7 Series E38.



12 13 009 Checking ignition coil (M 60)

Circuit diagram for ignition coil in breakerless ignition distribution.

- (A) Piloting of primary coil in ignition coil of DME
- (B) Ignition coil
- (C) Ground connection of secondary coil
- (D) Measuring resistance which is installed in ground wire shared by ignition coils.

The measuring resistance is required for fault recognition in the secondary circuit of the ignition coils.
The fault is stored in the fault memory of the DME control unit.

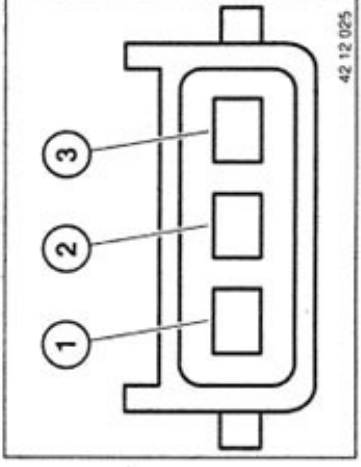
Resistance check:

Primary coil: Nom. value 0.4 - 0.8 Ω

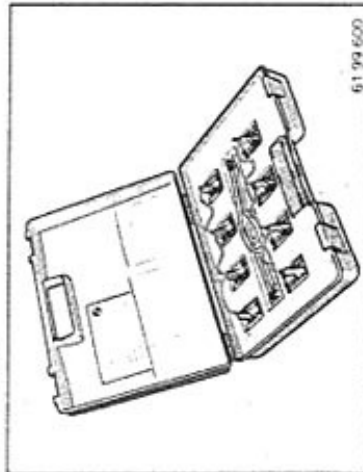
Secondary coil not registering on measuring instrument.

Pin allocation on ignition coil connector

- (1) Terminal 15
- (2) Terminal 4a
- (3) Terminal 1



Visual inspection of the ignition coil:
Check cast compound of primary coil carrier for hairline cracks. If gray material has emerged around the edges of the coil carrier, this indicates the presence of a defective ignition output stage in the DME control unit.



12 13 ... Check secondary voltage with the help of test adapter kit 12 7 040

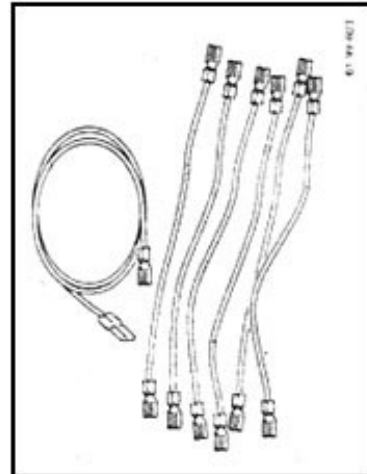
Use the adapter kit to perform the following checks:

- Secondary voltage check
- Comparison of ignition coils from different manufacturers
- Fault in ignition coil
- Fault in spark plug
- Fault in injection system

61 99 600

Caution!

Note safety instructions on page 12-0!

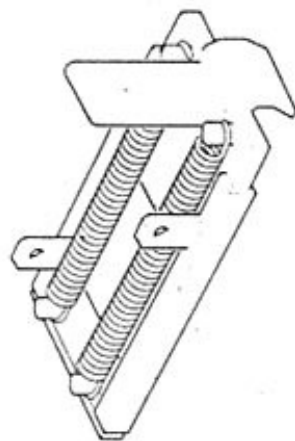


61 99 601

Attach connecting cable 12 7 043 to the single adapters 12 7 041 and attach connecting cable 12 7 042 for BMW Service Tester.

Connecting cable 12 7 043

Single adapter 12 7 041 for fitting to the ignition coil.



61 99 602

Connecting cable for BMW Service Tester 12 7 042. For connection to the Service Tester, the high voltage pliers must be unscrewed from the Service Tester line.

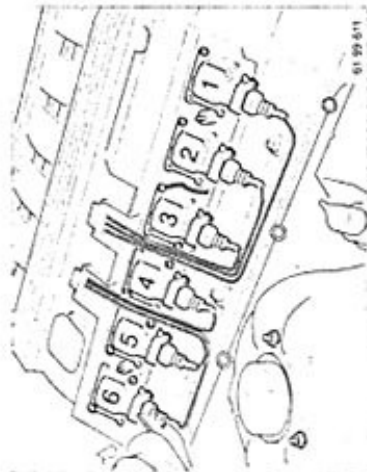


61 99 602

If no BMW Service Tester is available, a standard workshop oscilloscope with these measuring cables can be used. Connecting cable 12 7 042 is replaced by the measuring cable on the oscilloscope. The unit is then triggered externally by the induction pliers, attached to the primary voltage source on cylinder one.

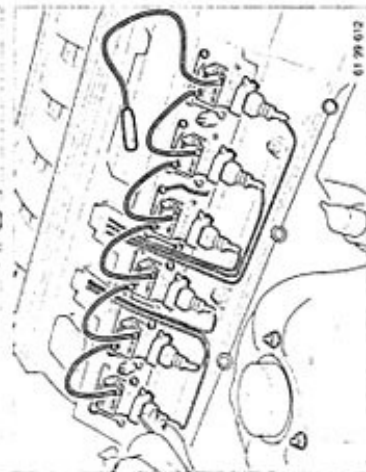
M 50:

Observe all safety instructions!
Switch off ignition.
Remove ignition coil cover.
Firing sequence 1-5-3-6-2-4

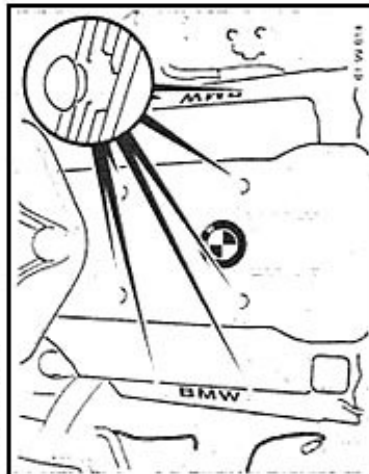


61 99 611

Fit single adapter 12 7 041 to the ignition coils and attach to the connecting cable kit 12 7 043.

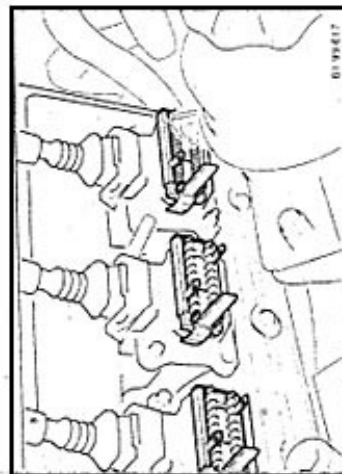


61 99 612

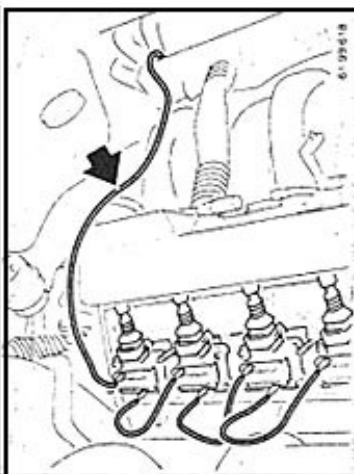


M 60:

Observe safety instructions!
Switch off ignition.
Remove ignition coil cover.
Firing sequence 1-5-4-8-6-3-7-2

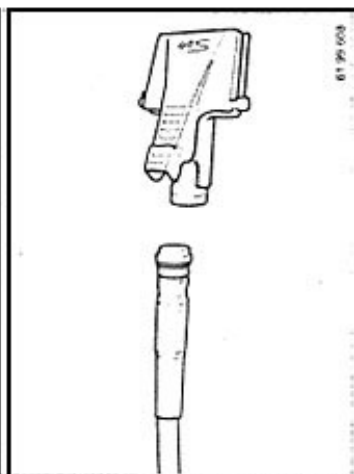


Fit single adapter 12 7 041 to the ignition coils and attach to connecting cable kit 12 7 043.



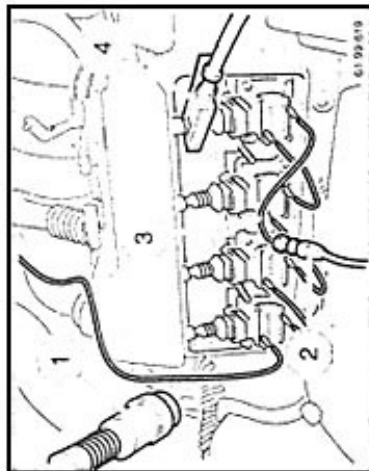
Note:

Use long connecting cable from connecting cable kit 12 7 043 for connecting the adapters of cylinder banks 1-4 and 5-8.

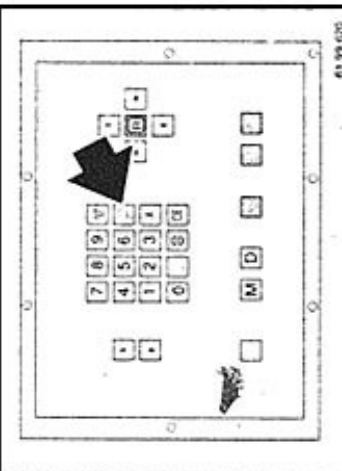


Connect BMW Service Tester:

Unscrew high voltage pliers from connecting cable of BMW Service Tester.
Attach connecting cable 12 7 042 to the high voltage adapter line of the BMW Service Tester.



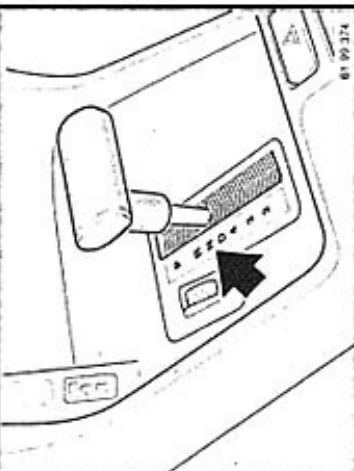
Connect BMW Service Tester to the diagnosis receptacle (1) on the vehicle.
Attach connecting cable 12 7 042 (2) to the high voltage connecting line (3) of the BMW Service Tester.
Connect trigger pliers (4) of the BMW Service Tester to the lead serving the ignition coil on cylinder one.



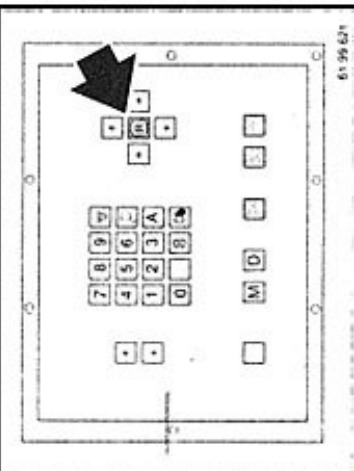
BMW Service Tester

Select test step 01 (engine). Next, select the following test step 10 (fuel mixture, exhaust).

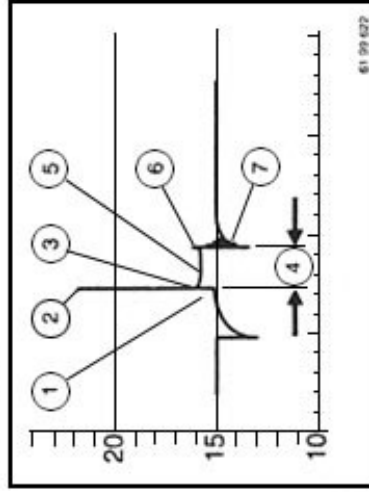
Enter the number of cylinders.



Apply handbrake and move shift lever into neutral setting. With automatic transmission, move selector lever into setting "P".



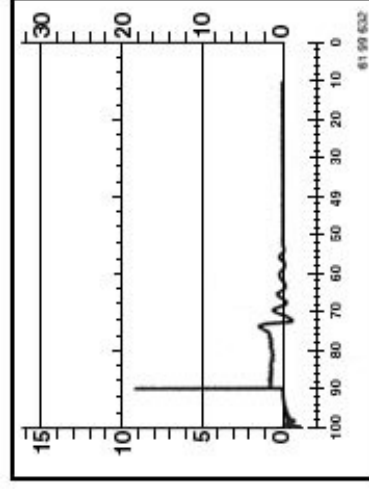
Select display modes for secondary voltage patterns on the oscilloscope by pressing the "R" button. Presentation of images (side-by-side, descending order, ascending order).



Normal oscillogram

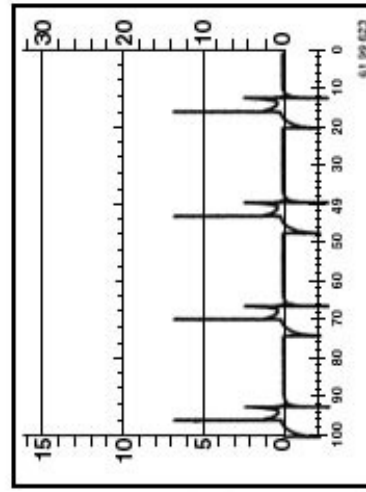
- 1 Start of ignition voltage spike
- 2 Tip of ignition voltage spike
- 3 Tip of combustion voltage spike
- 4 Combustion period
- 5 Combustion voltage curve
- 6 Start of attenuation procedure
- 7 Decay current

Display side-by-side
Evaluation of combustion voltage line and attenuation procedures.
Idle speed

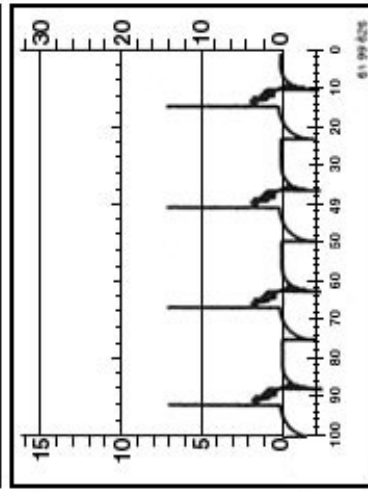


Consecutive displays Idle speed

Large deviations in the ignition voltage patterns can be identified.
The allocation of fault detected to relevant cylinder must be performed using consecutive or side-by-side display modes.



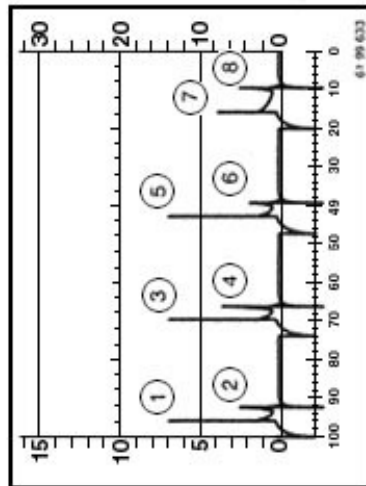
The display of ignition voltage peaks is approx. 20-25% lower than the real value.
More important than the tip of the ignition voltage spike is the uniformity of all cylinders. Deviations of 3000-4000 V are permitted.
If deviations exceed these values, refer to the following pages of "Fault Patterns".



Display at increased speed of approx. 2000 min⁻¹.
Evaluation of ignition voltage spikes.

Oscillogram readings of ignition coils from different manufacturers

Evaluation of ignition voltage spikes and the attenuation process at idle speed



Manufacturer: Breml

- 1 Normal ignition voltage spike (6000 - 9000 V)
- 2 Usual

Manufacturer: Beru

- 3 Normal ignition voltage spike
- 4 High start of attenuation processes

Manufacturer: May & Christe

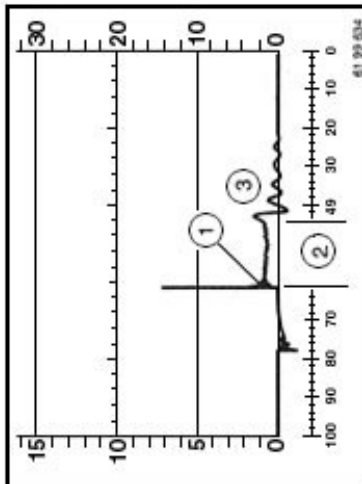
- 5 Normal ignition voltage spike
- 6 Low start of attenuation processes

Manufacturer: Bosch

- 7 Low ignition voltage spike
- 8 Normal start of attenuation processes

Note:

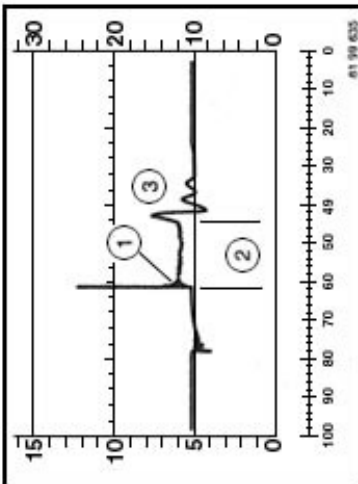
At high engine speeds, the ignition voltage spike becomes shorter - significantly shorter than units from other ignition coil manufacturers.



Evaluation of combustion voltage spike at raised engine speed of approx. 2500 min⁻¹.

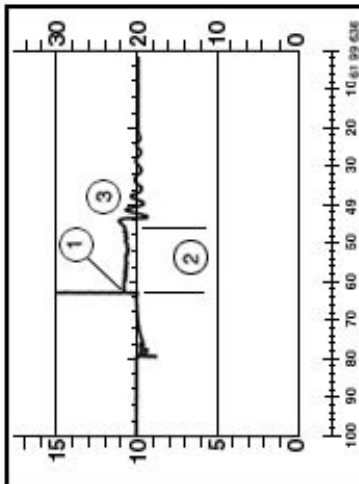
Manufacturer: Breml

- 1 Normal response of combustion voltage curve
- 2 Normal combustion period
- 3 3 to 4 attenuations



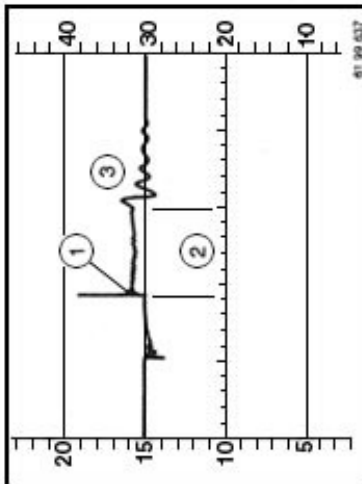
Manufacturer: Beru

- 1 Normal response of combustion voltage curve
- 2 Normal combustion period
- 3 At least 3 attenuations



Manufacturer: May & Christe

- 1 No response from the combustion voltage curve
- 2 Normal combustion period
- 3 At least 5 attenuations

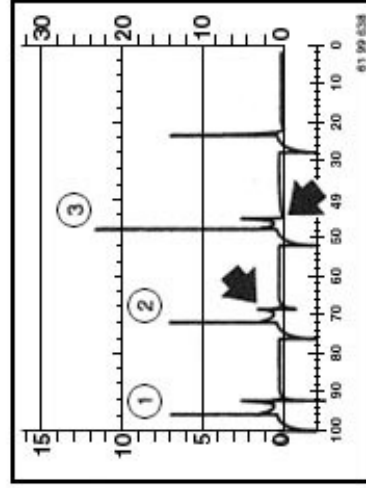


Manufacturer: Bosch

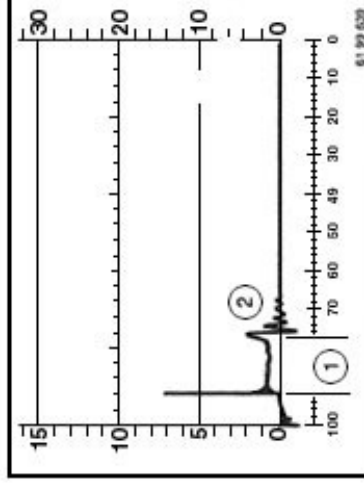
- 1 Normal response for combustion voltage curve
- 2 Long combustion period
- 3 At least 3 attenuations

Ignition coil fault

Evaluation of ignition voltage spikes and the attenuation process at idle speed.

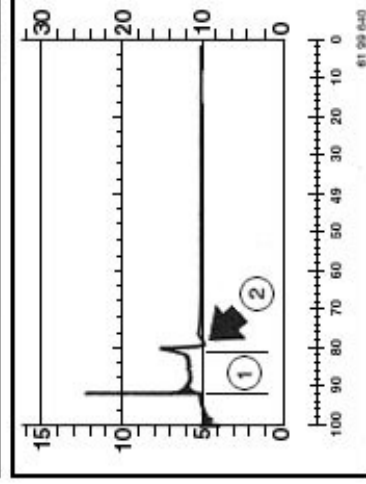


- 1 Start of attenuation processes - normal size upwards and downwards
- 2 Start of attenuation processes severely abbreviated
Ignition coil defective!
- 3 Start of downwards attenuation processes missing
Ignition coil defective!
Note:
Increased ignition voltage peak no longer present.

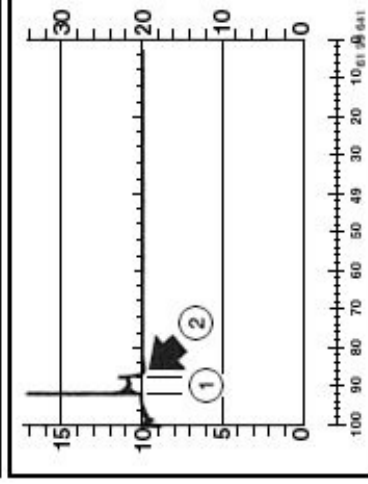


Evaluation of combustion voltage curve at idle speed

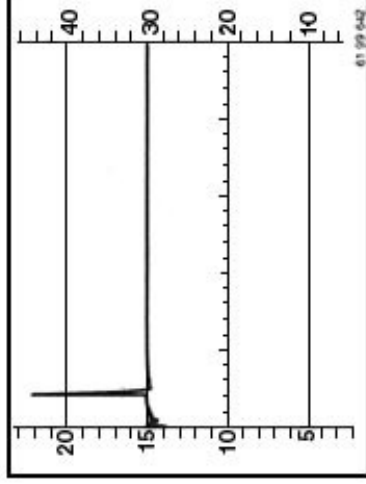
- 1 Normal combustion period
- 2 Normal attenuations after combustion voltage curve.
Ignition coil OK



- 1 Shortened combustion period
- 2 Only slight attenuations present after combustion voltage curve.
Ignition coil defective!



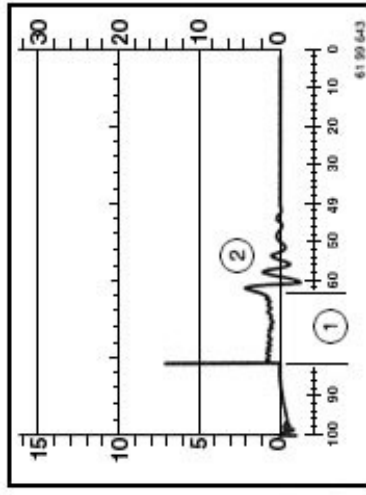
Severely abbreviated combustion period
Attenuations after combustion voltage curve absent
Ignition coil defective!



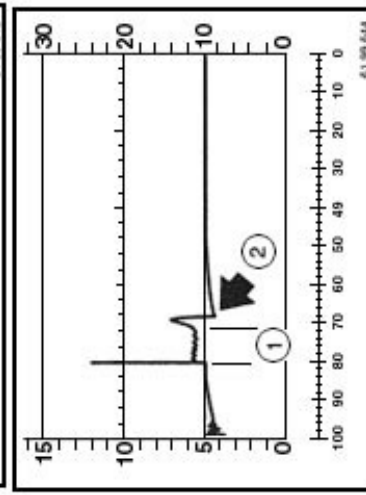
No combustion voltage curve.
Ignition coil defective!

Evaluation of combustion voltage curve at raised engine speed of approx. 1500 min⁻¹

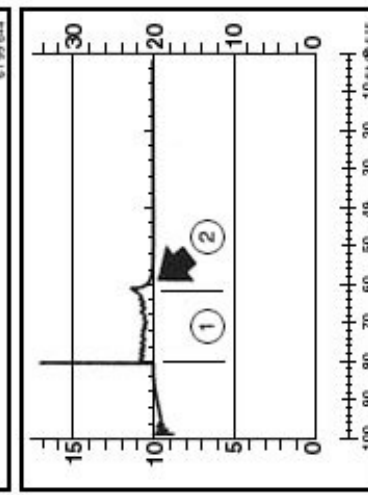
- 1 Normal combustion period
- 2 Normal attenuations after combustion voltage curve.
Ignition coil OK



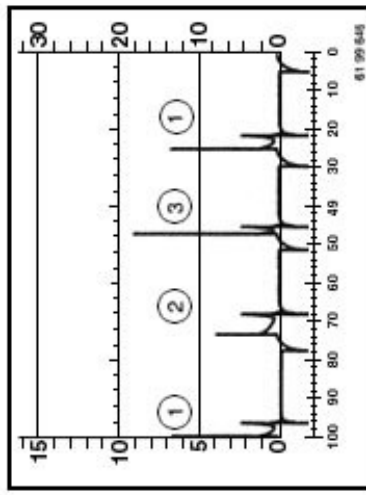
- 1 Shortened combustion period
- 2 Only slight attenuations present after combustion voltage curve
Ignition coil defective!



- 1 Normal combustion period
- 2 Attenuations after combustion voltage curve absent
Ignition coil defective!

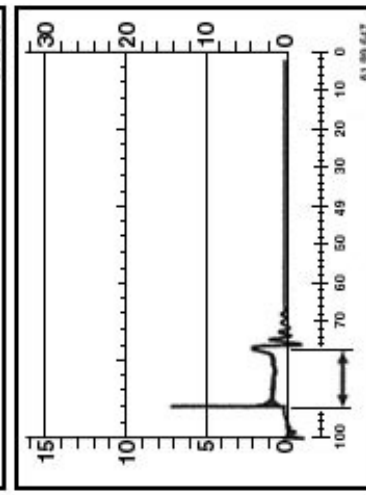


- Spark plug defects**
- 1 Normal ignition voltage spike:
spark plug OK
 - 2 Low ignition voltage spike
Small electrode gap
 - 3 High ignition voltage spike
Large electrode gap

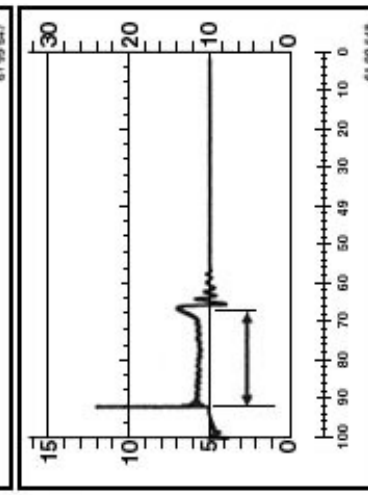


Evaluation of combustion period at idle speed

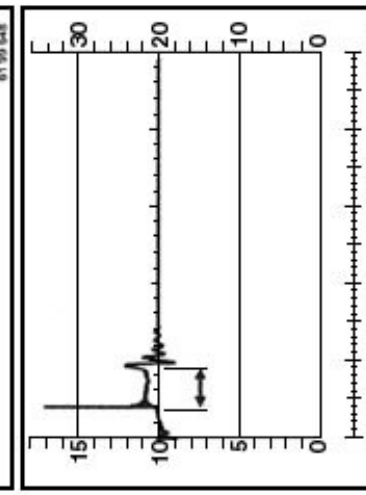
Normal combustion period
Spark plug OK

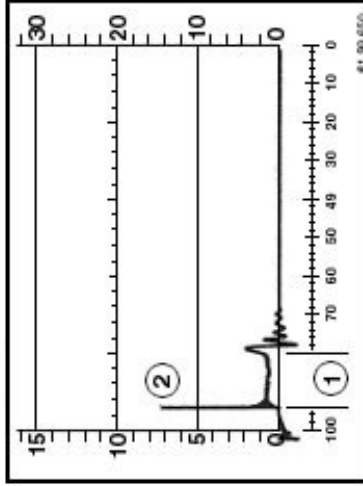


Long combustion period
Small electrode gap



Short combustion period
Large electrode gap

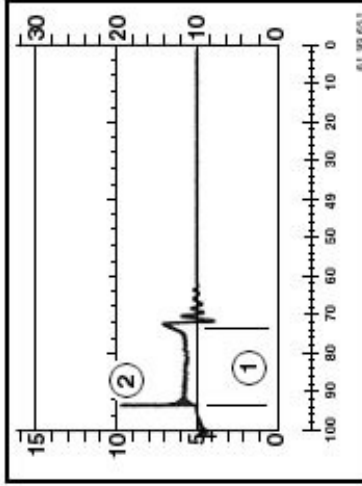




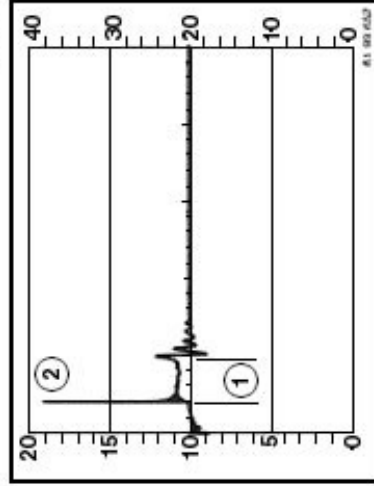
Additional fault patterns with evaluation

Evaluation of combustion period of ignition voltage spikes at idle speed

- 1 Normal combustion period
 - 2 Normal ignition voltage spike
- Ignition system OK



Long combustion period (1) with low ignition voltage spike (2).
Suggestive of low compression.
Fluctuating combustion period:
Suggestive of impurities in spark plug (shunt)



Short combustion period (1) with high ignition voltage spike.
Constant but brief combustion period:
Suggestive of defective ignition cable.

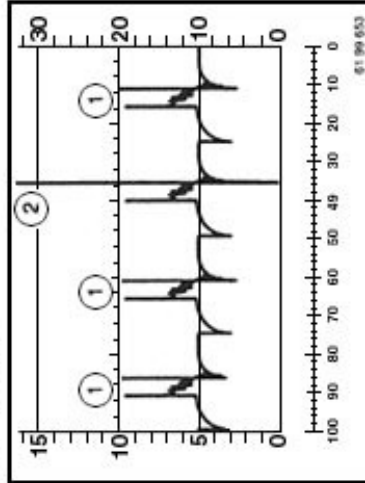
Note:
The combustion voltage curve may be entirely absent and the ignition voltage spike may be very high.

Excessive ignition voltage:

Electrode gap large
Compression high
Fuel mixture lean
Electrode temperature low
Electrode gap burned out
Ignition cable interrupted

Excessively low ignition voltage:

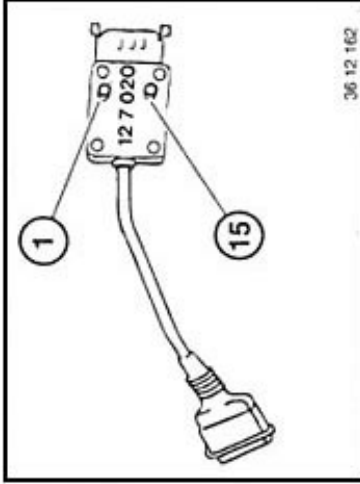
Electrode gap small
Compression low
Fuel mixture correct
Electrode temperature high
Electrode condition new



Fault in the injection system

Evaluation of ignition voltage spike when accelerator applied suddenly

- 1 Start of attenuation process is not significantly higher than the ignition voltage spike.
Injection system OK.
- 2 Start of attenuation process is significantly higher than the ignition voltage spike.
Fault in the injection system:
a) Lean fuel mixture
b) Defective injection valve
c) Low compression



Additional fault instructions on troubleshooting

For troubleshooting on the primary side of a single ignition coil, use adapter for primary voltage measurement and special tool 12 7 020.

If terminal 1 signal is absent on pin 1 in the diagnosis receptacle, with the help of special tool 12 7 020, the trigger signal for the Service Tester can be prepared externally.

Connect up BMW Service Tester.
Select Engine Test Step 05.

Select four-cylinder unit.

Connect universal adapter cable to tester.
Connect brown terminal to vehicle ground.
Black terminal to terminal 1 of special tool 12 7 020.

If there is no trigger signal in the diagnosis receptacle for a 6-cylinder engine, preselect two-cylinder unit on Service Tester.

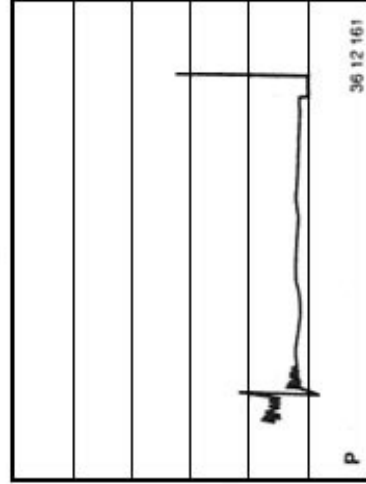
Do not use red inductive pliers because only one cylinder is being measured. For this reason, an engine speed display of factor 4 is too low.

Connect special tool 12 7 020 to the ignition coil to be measured, and to the vehicle wiring harness.

Generate standing signal on oscilloscope by pressing button R on the Service Tester.

Note:

The combustion voltage curve on the oscilloscope is very unsteady because, on a 4-valve engine, the combustion mixture swirl effect is more pronounced than in a 2-valve engine.



Checking secondary signal for
breakerless ignition distribu-
tion
(special tool 12 7 030)

Engine test step 10

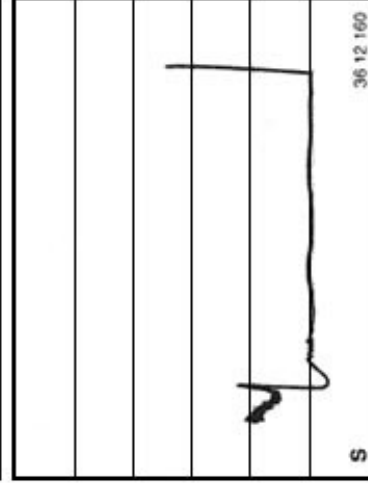
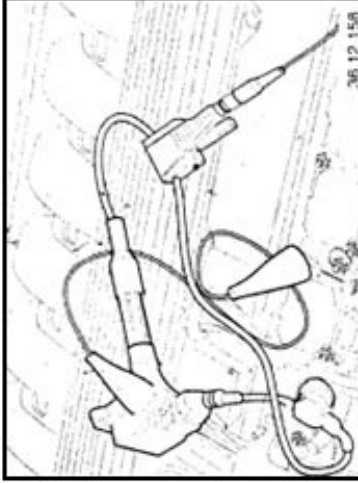
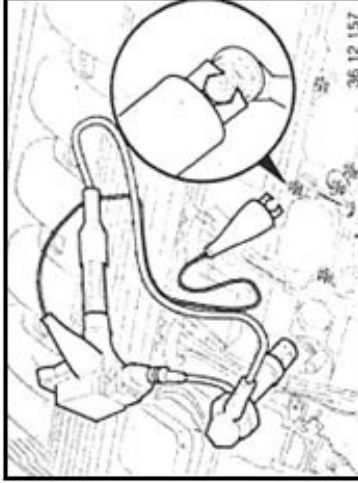
Remove ignition coil. Attach special tool
12 7 030 to the ignition coil to be measured. At-
tach high-voltage pliers to the ignition lead.

Connect ground lead of adapter to vehicle
ground and the ignition coil. Connect up diag-
nosis connector.
In the absence of a trigger signal (terminal 1),
connect black terminal of universal adapter ca-
ble to Pin 1 of the primary adapter cable.

Generate standing signal on the oscilloscope
by pressing button R on the Service Tester.

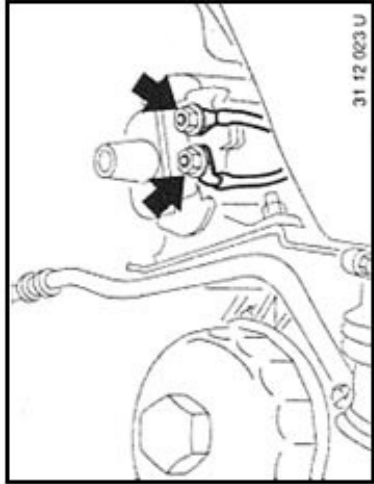
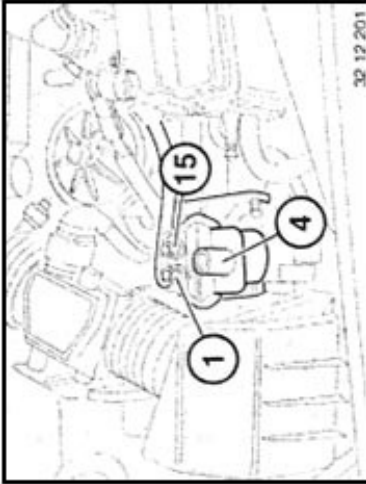
Note:
Neighboring ignition leads can give rise to in-
terference in the oscilloscope screen display.

For additional troubleshooting steps, see fault
memory in the engine control units.
Interrogate the fault memory and obtain fault
messages - see Electrical Troubleshooting
Manual.



12 13 011 Replacing ignition coil (M 70, S 70)

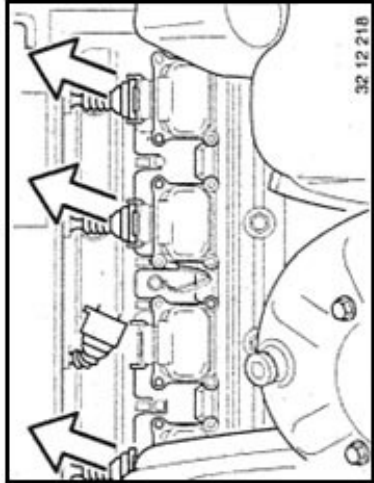
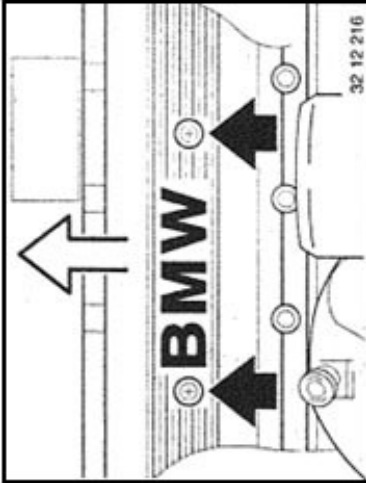
Caution!
Only work on the ignition system with the ignition switched off - high voltage - danger of death.
Note instructions for working on ignition system - see Page 12 - 0.



Remove protective cap and ignition lead (terminal 4).
Unfasten connections (term. 1 and term. 15).
Disconnect bracket and remove ignition coil.

12 13 011 Replacing ignition coils (M 60)

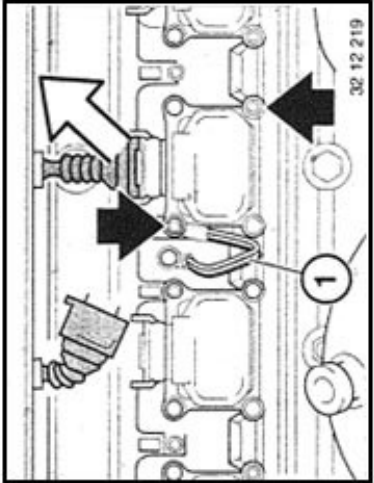
Unclip cover over screws in cylinder head cover.
Unfasten screws.
Remove cover from cylinder head cover.



Unfasten plug connections for ignition coils.

Unfasten screws of ignition coils.

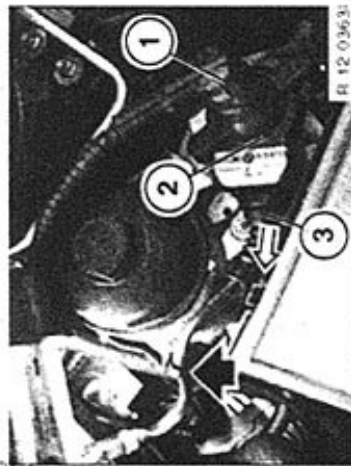
Installation:
On the ignition coils for cylinders 2 and 6, the ground tapes (1) from the cylinder head cover must be secured to the ignition coil screw connections.



12 13 511 Replacing ignition coil (M73)

Switch off ignition.

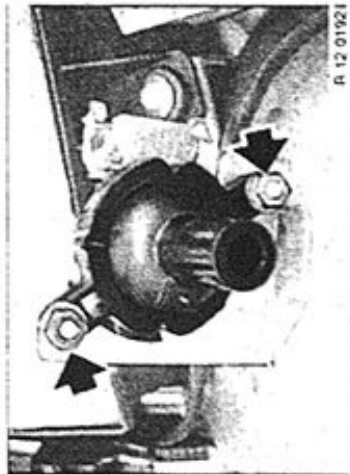
Removal illustrated here with example of ignition coil on left side. Cylinder bank 7-12.



Disconnect plug connection (1). Remove cap (2). Disconnect plug connection (3).

Installation:

Note routing of line in cable clip.



Unscrew nuts.
Ignition coil remove.

Installation:

Inverrogate fault memory of control unit for Digital Motor Electronics (DME), check faults in memory, rectify them, then cancel the fault memory.

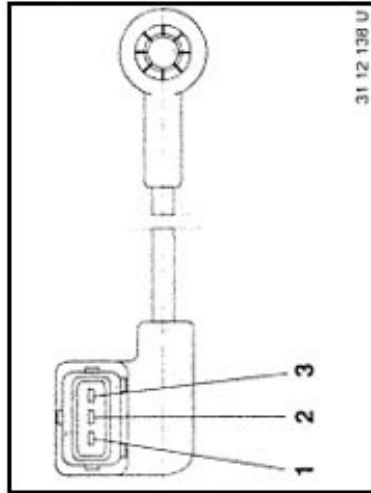
12 14 . . . Checking sender for cylinder identification (M 70, S 70)

Measure resistance in coil between pin 1 and pin 2.

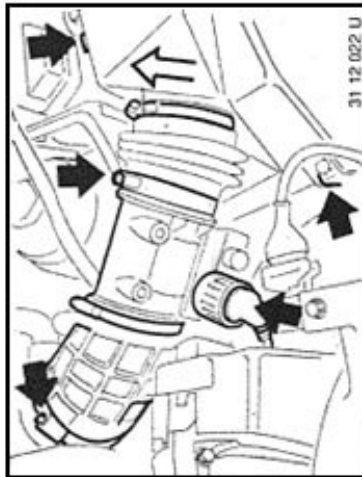
Nominal value: $\sim 1 \Omega$

Insulation resistance between pin 2 and pin 3.

Nominal value: $\sim 10 \text{ M}\Omega$

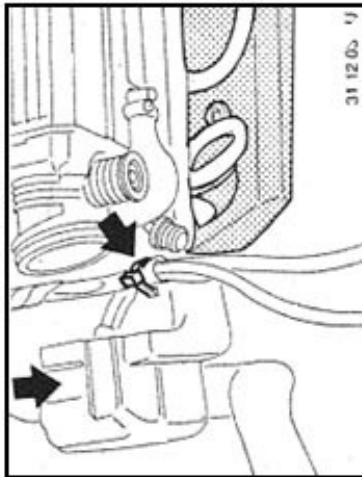


31 12 138 U

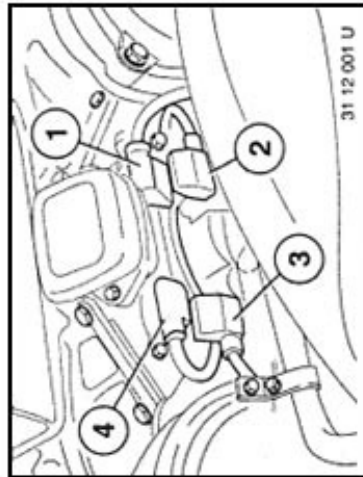


12 14 150 Replacing sender for cylinder identification (M 70, S 70)

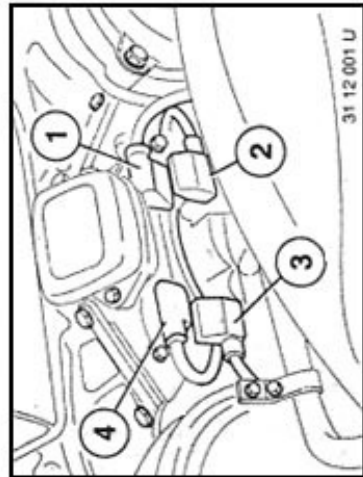
M 70:
Remove complete upper section of suction filter housing with mass air flow sensor.



Unfasten cable connector.
Remove cover from distributor cap.

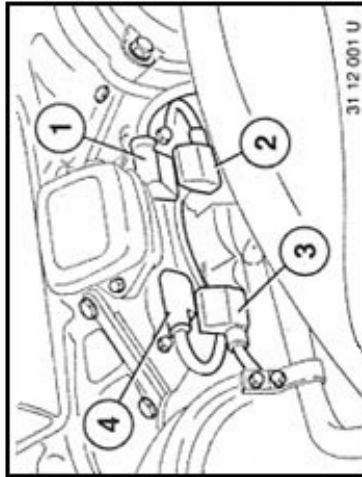


Senders are fitted to the ignition lead of cylinder numbers 6 / 12.
Disconnect suppression plug from ignition lead.
Remove sender from ignition lead.



Cylinder bank 1...6: (right cylinder bank)
Disconnect plug connection - remove cable.
Fit new sender.

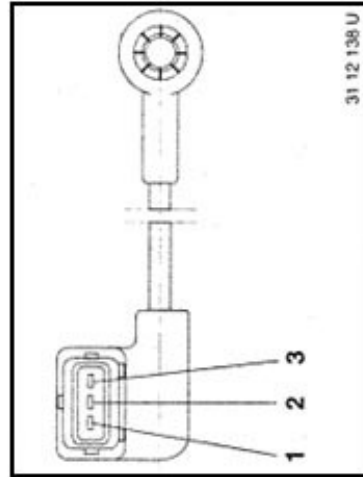
4 = inductive impulse sensor
3 = cylinder identification sender



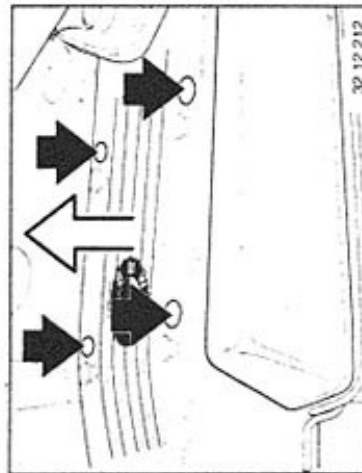
Cylinder bank 7...12: (left cylinder bank)
Disconnect plug connection - remove cable.
Fit new sender.

1 = cylinder identification sender
2 = inductive impulse sensor

Installation:
Fit suppression plug.
See Constr. Group Item 12 12 072

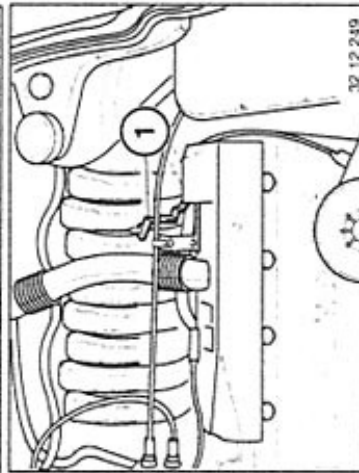


Check sender:
Measure resistance* of coil between line 1 and 2.

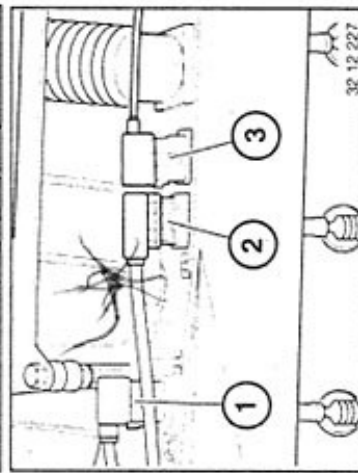


12 14 150 Replacing sender for cylinder recognition (camshaft sender) (M 60)

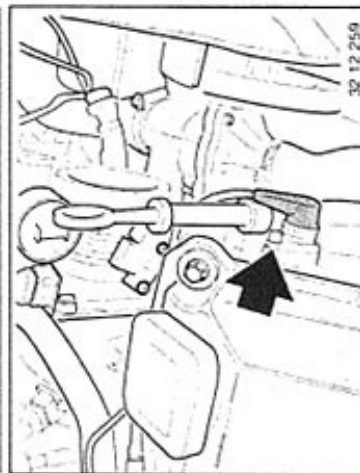
Interrogate fault memory
Switch off ignition.
Remove cover from screws on valve cover.
Unfasten screws.
Remove cover.



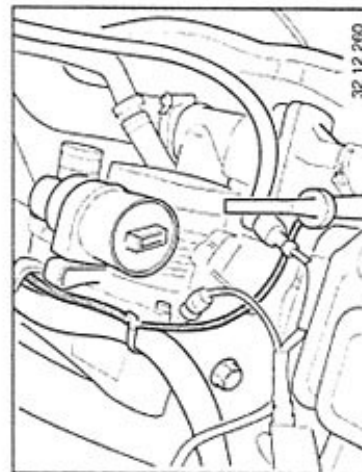
Disconnect plug connection (1).



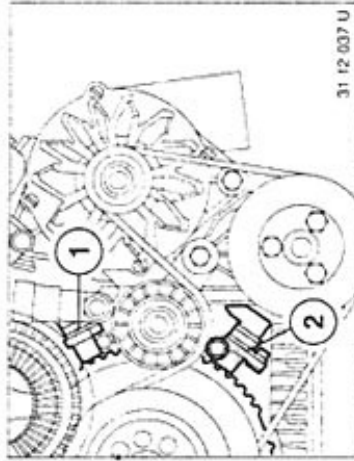
Disconnect plug connection (1).



Unfasten screw.



Installation:
Note wiring layout on injection pipe.

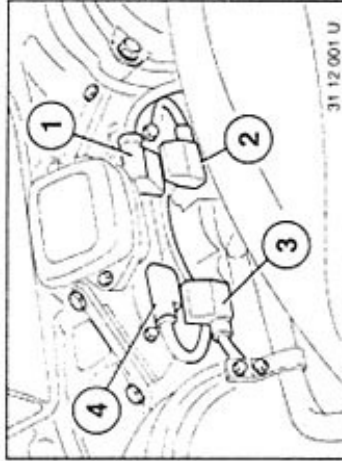


12 14 ... Checking impulse sensor

M 70:

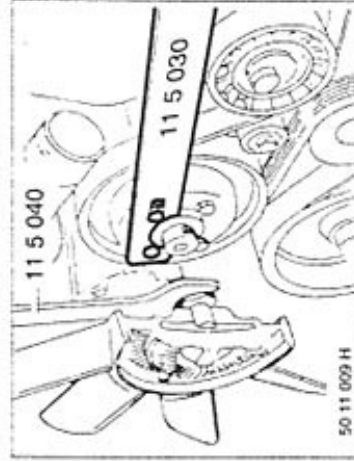
At top of timing case cover. Check that impulse sensor (1) for DME 1 is securely seated and free of damage.

At bottom of timing case cover.
Check impulse sensor (2) for DME 2 is securely seated and free of damage.



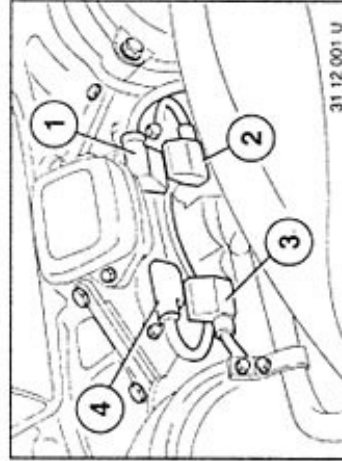
Unfasten connector (4), impulse sensor 1, right cylinder bank.

Unfasten connector (2), impulse sensor 2, left cylinder bank.

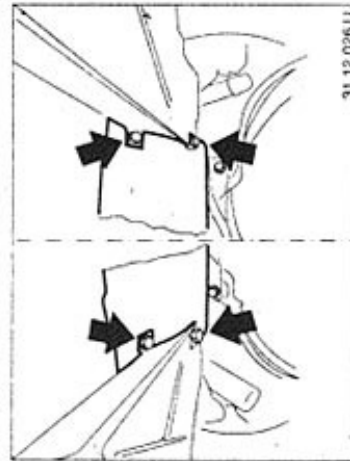


12 14 152 Replacing impulse sensor in left cylinder bank (M 70, S 70)

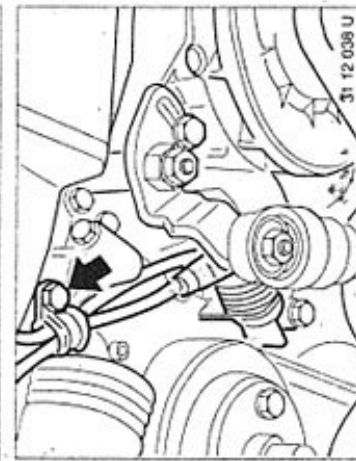
Remove fan.



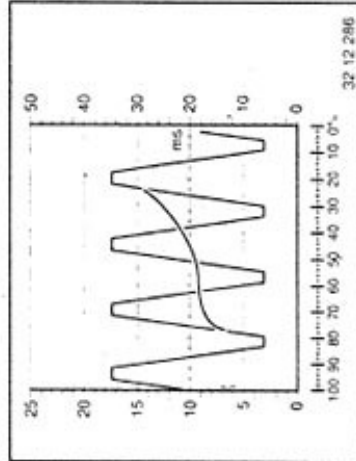
Unfasten plug connection (2) in bracket in top of timing case cover.



Remove underbody protection from assemblies.



Unfasten retaining strap from top of timing case cover.



Connect oscilloscope to connections 1 and 2 of impulse sensor (M22/23).
Turn crankshaft with starter motor.
This signal should appear on the screen.

M 70, M 60:

Select multimeter test on BMW Service Tester (M 06):

Plug connection disconnected.

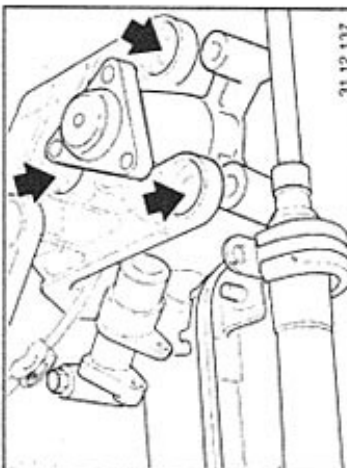
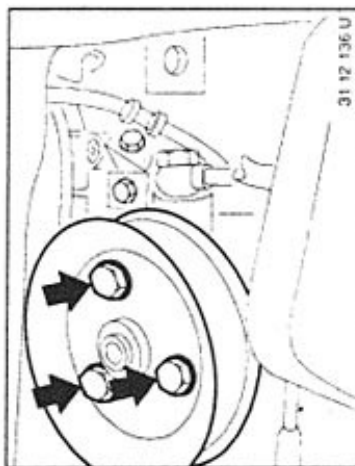
Resistance measurement between pins 1 and 2:

Nominal value: $520 \Omega \pm 5\%$

Check the shielding:

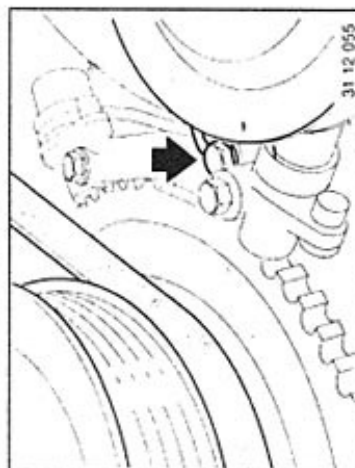
between pins 1 and 3: $> 100 \text{ k}\Omega$
between pins 2 and 3: $> 100 \text{ k}\Omega$

Unscrew pulley on power steering pump.



Loosen front power steering pump console bolts.

Unscrew cool air guide for alternator.

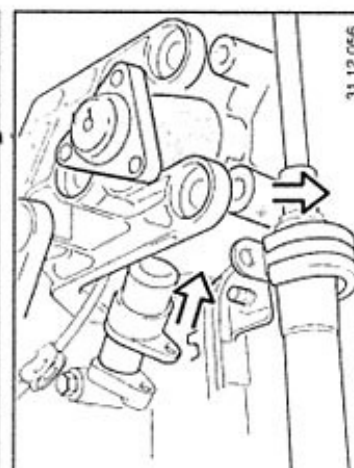


Unscrew pipe holder on lower timing case cover.
Turn increment wheel until bolt head is accessible through a tooth gap.

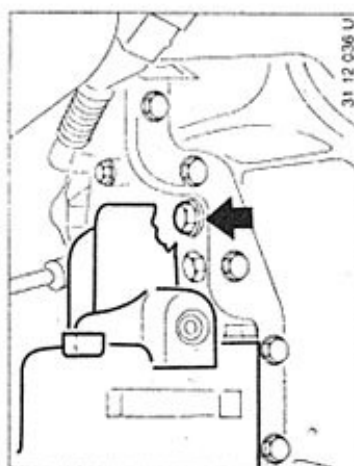
Unscrew both holders for hydraulic fluid pipes.



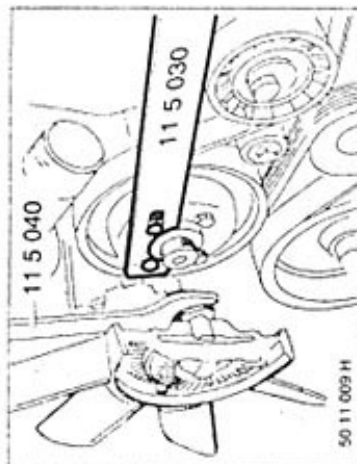
Unscrew pulse sender.
Press hydraulic fluid pump aside and remove the pulse sender.



Unscrew holder for hydraulic fluid pump on engine block.

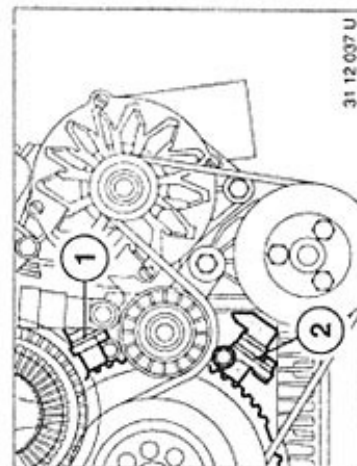


Checking Increment Wheel:
TDC mark must be at middle of a tooth.
Beginning at the TDC mark and continuing in the engine's direction of rotation there must be a gap after 30 teeth.

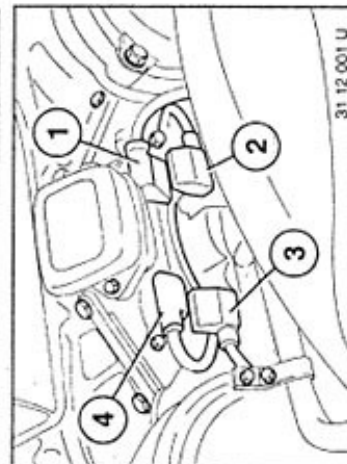


12 14 153 Replacing impulse sensor on right cylinder bank (M 70, S 70)

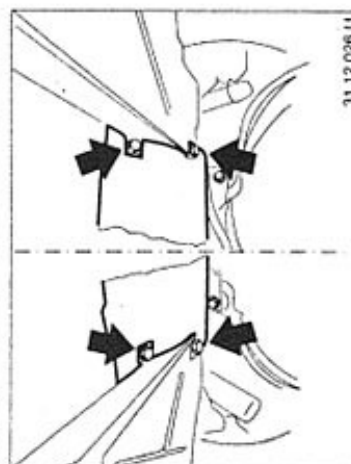
Remove fan.
Remove complete clamping fixture for toothed Vee belt.



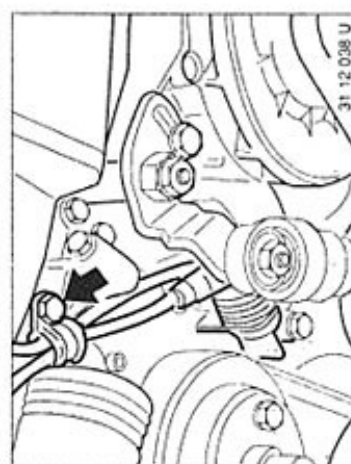
Unfasten impulse sensor (1) and remove.



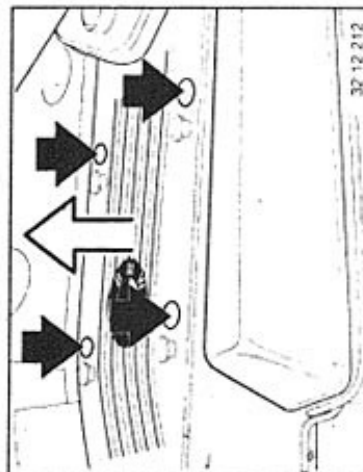
Unfasten top of plug connection (4) in bracket for timing case cover.



Remove underbody protection from assemblies.



Unfasten line bracket from top of timing case cover.



12 14 155 Replacing impulse sensor (M 60)

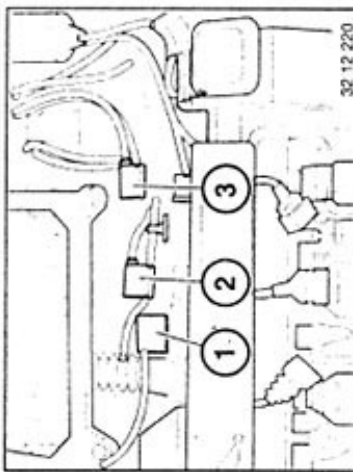
Interrogate fault memory.

Switch off ignition.

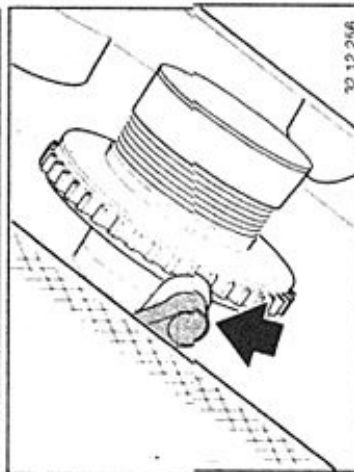
Unfasten cover from screws in valve cover.

Unfasten screws.

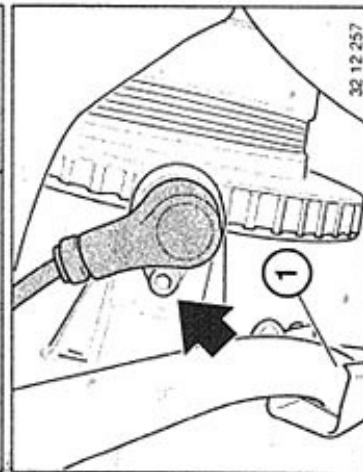
Remove cover.



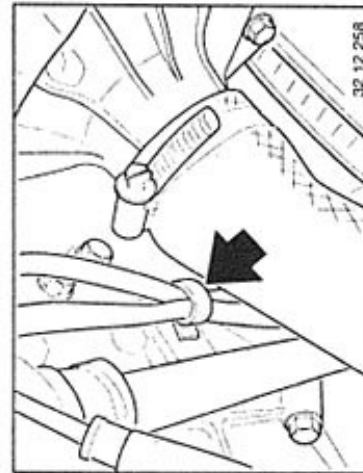
Disconnect plug connection (3).



The impulse sensor is located beside the incremental gear.



Unfasten screw (1).



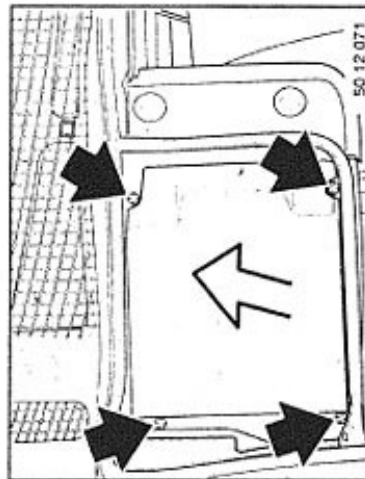
Note:
Observe pipe layout on the water pump.

12 14 500 Removing and installing / replacing both control units (Digital Motor Electronics) (M73)

Caution!

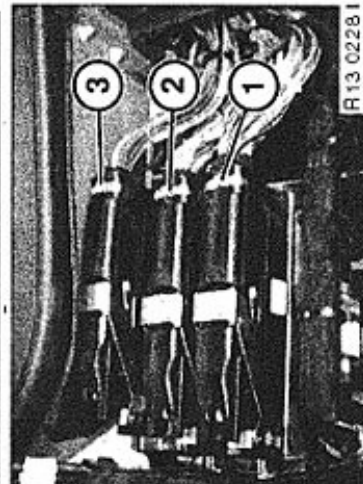
Note instructions for removal and installation of electronic control unit!
refer to General Data MG 12.

Switch off ignition.



Unfasten screws.

Remove cover from control unit box.



Control unit (1) for DME 1
(cylinder bank 1-6)

Control unit (2) for DME 2
(cylinder bank 7-12)

Control unit (3) for EPC (electronic engine
power control)

12 14 518 Replacing impulse sensor (cylinder bank 7-12) (M73)

Refer to

Repair Instructions for 7 Series E38.

12 14 519 Replacing impulse sensor (cylinder bank 1-6) (M73)

Refer to

Repair Instructions for 7 Series E38.

12 14 525 Replacing sensor for cylinder recognition (camshaft sensor) (M73)

Refer to
Repair Instructions for 7 Series E38.

12 14 610 Replacing right knock sensor (cylinder bank 1-4) (M60)

Refer to
Repair Instructions for 5 Series E34.

12 14 611 Replacing left knock sensor (cylinder bank 5-8) (M60)

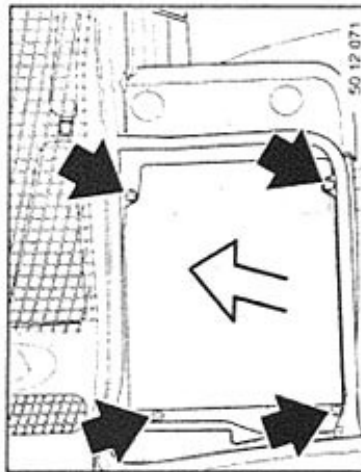
Refer to
Repair Instructions for 5 Series E34.

12 14 610 Replacing right knock sensor (cylinder bank 1-6) (M73)

Refer to
Repair Instructions for 7 Series E38.

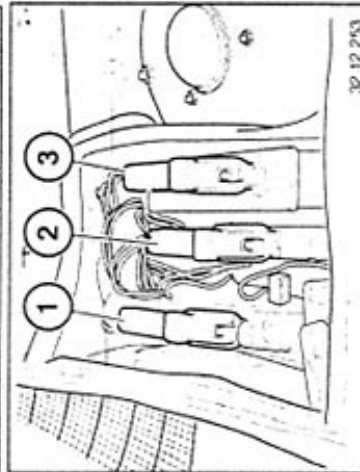
12 14 611 Replacing left knock sensor (cylinder bank 7-12) (M73)

Refer to
Repair Instructions for 7 Series E38.



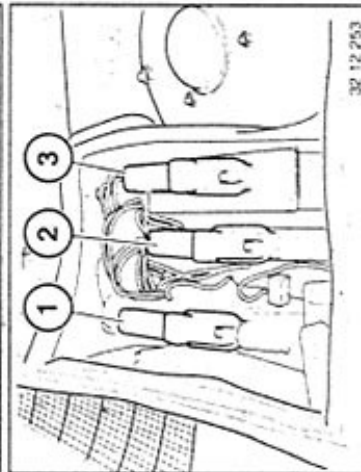
Relay / control units –
allocation of engine wiring
harness

Unfasten screws.
Remove cover.



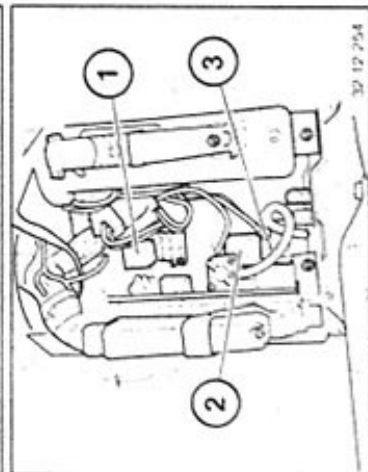
M 70, S 70:

- 1 Control unit for Digital Engine Control
- 2 Control unit for Digital Engine Control
- 3 Control unit for Electronic Power Control



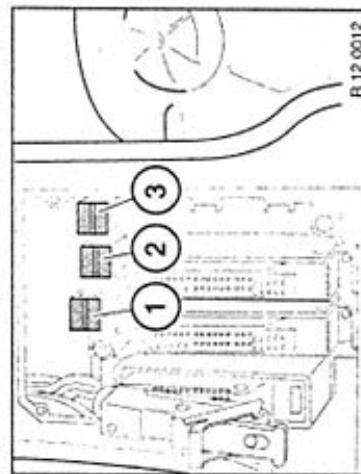
M 60:

- 1 Control unit for ABS
- 2 Control unit for Digital Engine Control
- 3 Control unit for automatic transmission



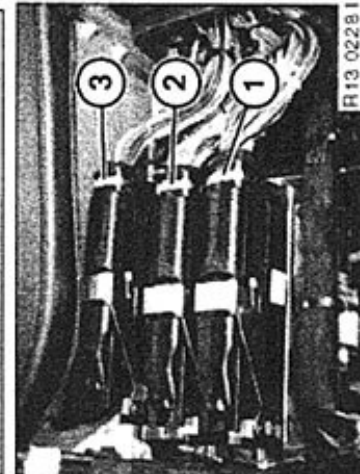
M 70, S 70:

- 1 Main relay for engine control unit
- 2 Relay for electric fuel pump
- 3 Relay for Lambda oxygen sensor heating



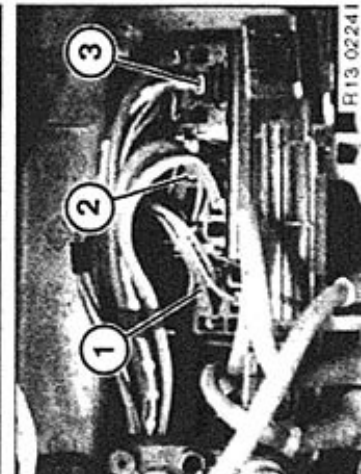
M 60:

- 1 Main relay for Digital Engine Control
- 2 Relay for electric fuel pump
- 3 Relay for Lambda oxygen sensor



M 73:

- 1 Control unit for DME 1
(cylinder bank 1-6)
- 2 Control unit for DME 2
(cylinder bank 7-12)
- 3 Control unit for EPC (electronic engine
power control)



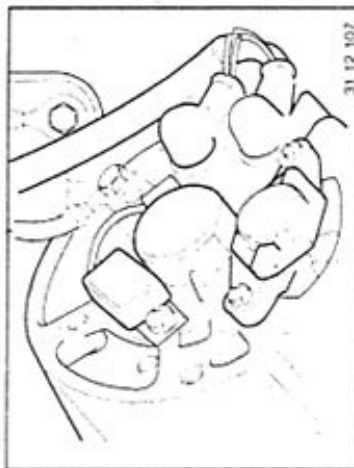
M 73:

- 1 Relay for electric fuel pump
- 2 Main relay for DME 1
- 3 Main relay for DME 2

Caution!

Depending on the construction status of the vehicle, the installation location of relays and control units may vary. In the event of any doubts, test by pulling the relevant relay whether the corresponding function is interrupted.

For additional instructions on troubleshooting, refer to Electrical Troubleshooting Manual for 8 Series.

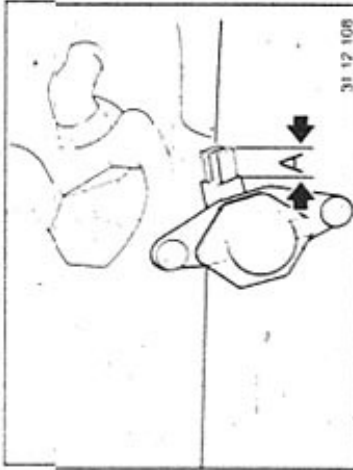


31 12 107

12 31 009 Checking 3-phase alternator and voltage regulator

Prerequisite for this inspection:

- Correct connections on the charged battery
- Correct connections on alternator and starter motor
- Good ground connection between engine and body
- Tensioned Vee belt

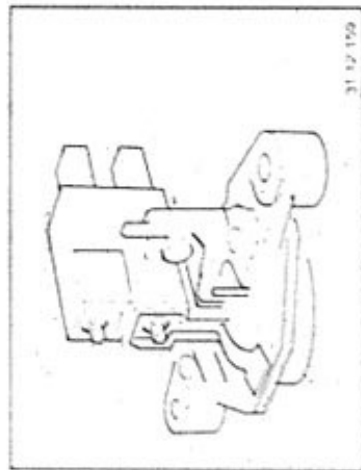


31 12 108

If the charge indicator lamp is lit continuously:
Remove voltage regulator and check carbon brushes, replacing if necessary 12 31 200.
Minimum length "A" 5 mm.

Caution!

There are alternators with normal regulators and alternators with constant voltage regulators.
These regulators are encoded mechanically and must not be confused with one another!



31 12 109

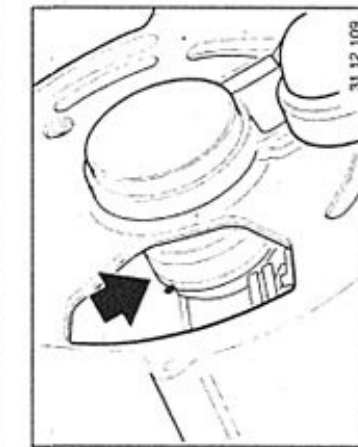
Normal regulator



31 12 160

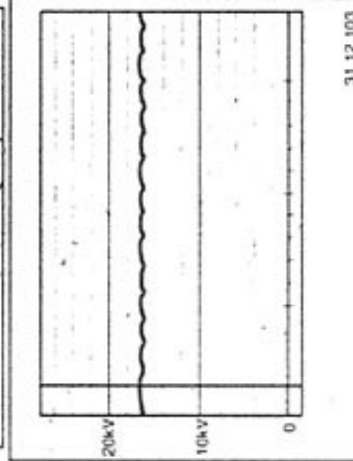
Constant voltage regulator.
Can be identified by the mechanical encoding.

The constant voltage regulator must never be installed in vehicles whose battery is in the engine compartment. This would result in damage to the battery.



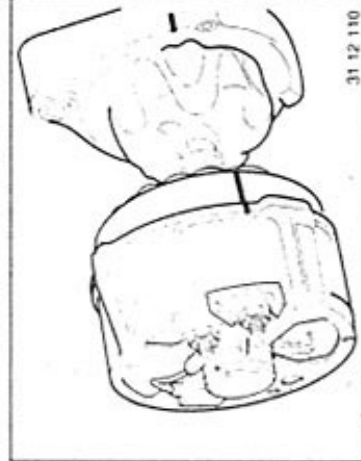
31 12 109

Installation:
Check slip rings for signs of wear. (line and if necessary and polish.
Connect up BMW SERVICE TESTER.
Switch on engine and compare measuring values with nominal values.



31 12 103

If the charge indicator light goes out while the engine is running and the control voltage* is not reached and the oscillogram is OK (as per illustration), the voltage regulator must be replaced 12 32 000.
For additional oscillograms, refer to Electrical Troubleshooting Manual for the 7 Series.



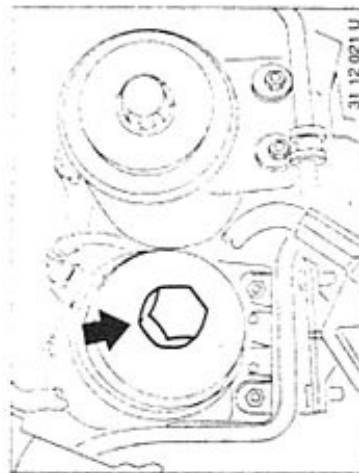
31 12 110

If the specified charge current is not achieved, remove the alternator, dismantle it and inspect the components.
For additional troubleshooting and notes on dismantling the alternator, refer to Construction Group Repair Instructions, Group 12.

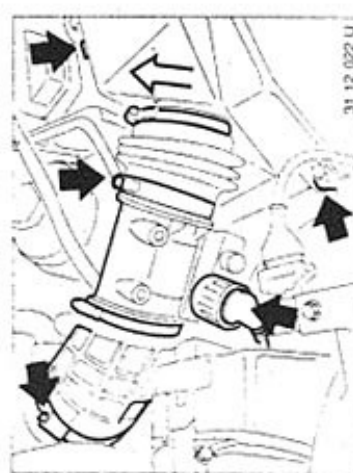
* Refer to Technical Data

12 31 020 Removing and installing or replacing 3-phase alternator (M 70, S 70)

Disconnect ground leads from the batteries.



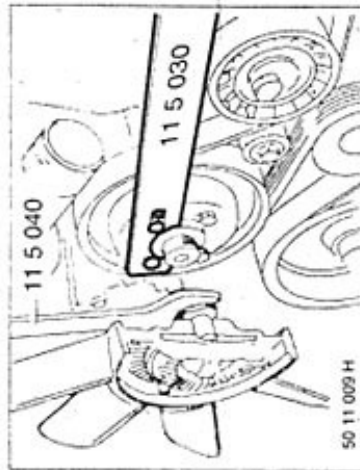
Unfasten cover from oil filter to enable engine oil to flow back into the oil pan.



Remove complete upper section of suction filter housing together with mass air flow sensor. Unfasten clips. Unfasten hose clip.

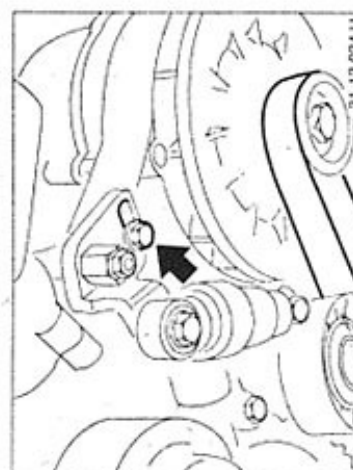


Remove cover from ignition coil. Unscrew nuts and remove leads.

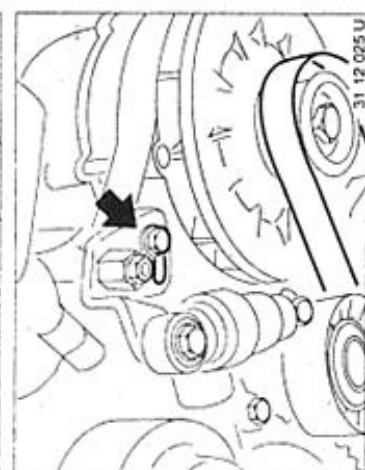


Remove viscous fan.

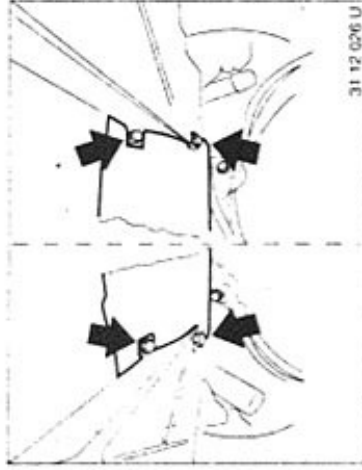
Unfasten hose clip from cooling air hose on alternator.



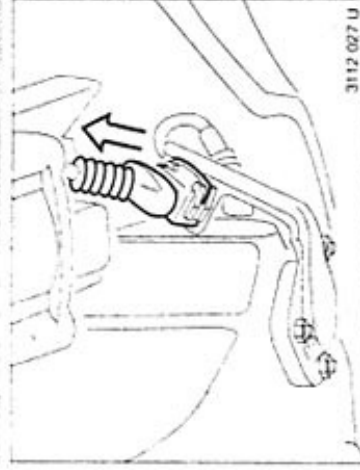
Unfasten clamping fixture for toothed Vee belts. Remove nut from clamping fixture. Unfasten screw.



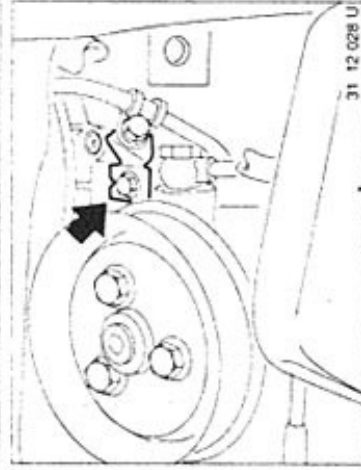
Unfasten top screw on alternator mount. Remove toothed Vee belt.



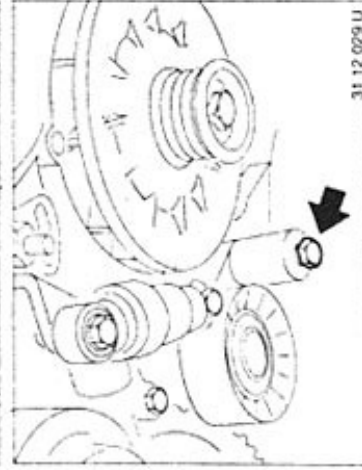
Unscrew splash guard.



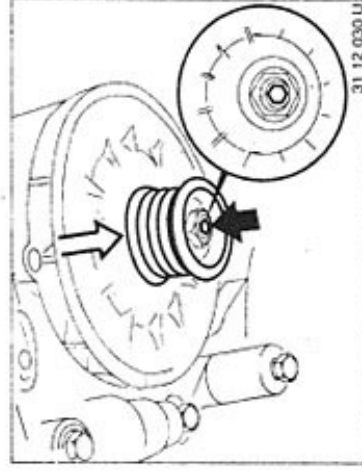
Pull off plug on oil level sender.



Unscrew hydraulic pipe holder on alternator.

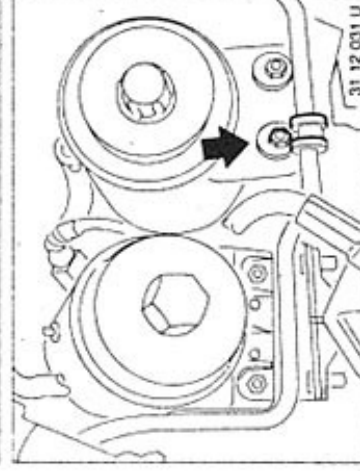


Loosen bottom tensioner bolt from underside of car.
Remove tensioner downward.
Unscrew cooling air hose on alternator.

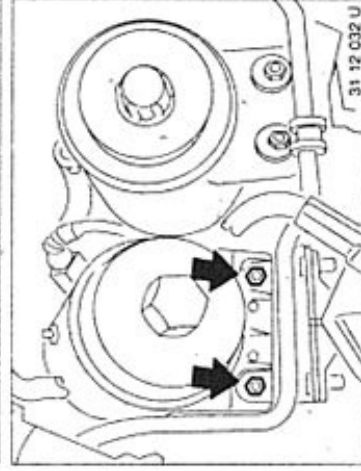


Unscrew pulley and fan from underside of car.
Unscrew both bottom bolts of alternator.

Installation:
Tightening torque*.

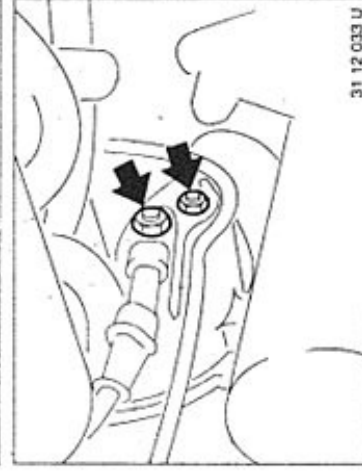


Unscrew upper hydraulic pipe holder.



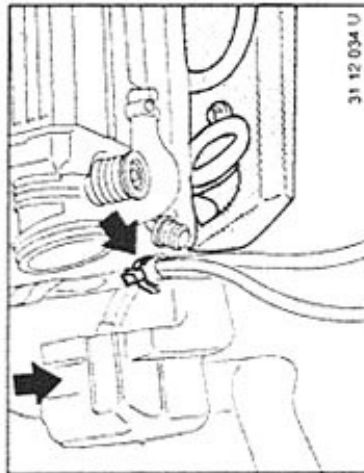
Remove complete full flow oil filter.

Installation:
Molded hoses on the oil filter impair removal and installation.
Install molded hoses straight.
Replace gaskets.
Check for correct seating of O-rings.



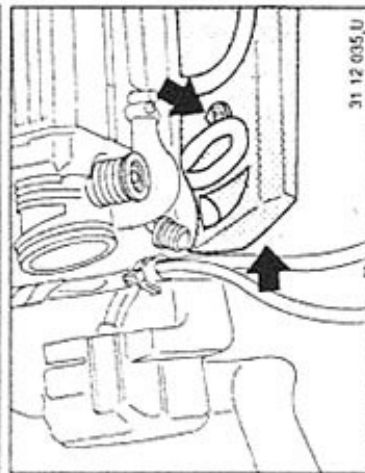
Unscrew pipes of alternator.

* See Specifications



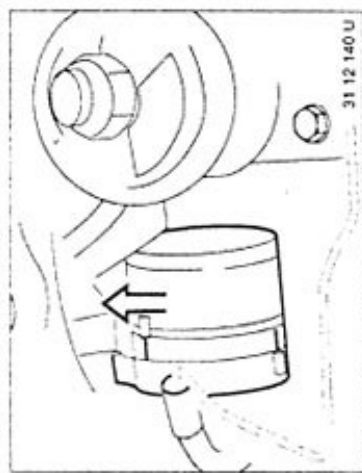
31 12 034 U

Remove cover of distributor and loosen the wire strap.



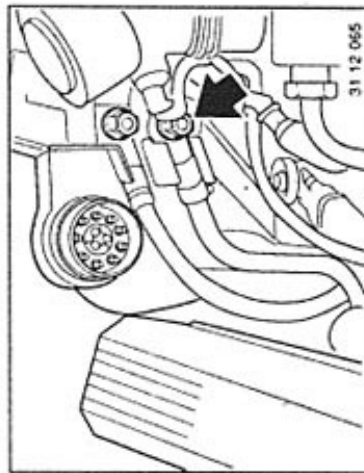
31 12 035 U

Unscrew screws.
Remove heat shield.



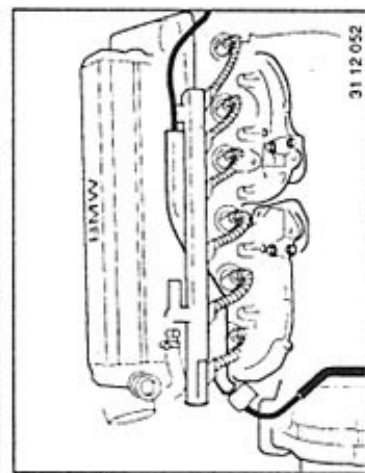
31 12 140 U

Remove alternator upwards approximately in installed position.
Press hydraulic pipe aside.



31 12 065

Routing of Alternator Wires:
Firewall connection at driver's side.



31 12 052

Routing of wires on engine.

Installation:

Install alternator without pulley approximately in installed position from above, connect wires on alternator, install upper bolt, mount the pulley and then continue from the underside of the vehicle.

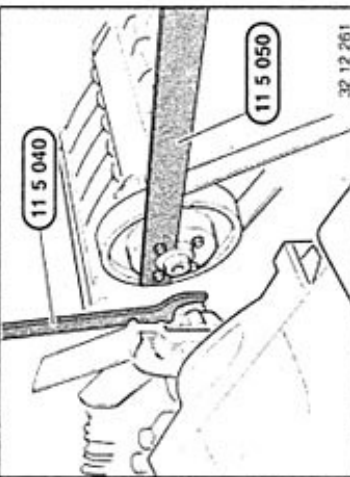
Check engine oil level and add engine oil if necessary.

12 31 020 Removing and installing or replacing 3-phase alternator (M 60)

Interrogate fault memories of control units since the fault memories of certain control units are cancelled when the battery is disconnected.

Note General Instructions on Page 12-0!

Disconnect ground lead from battery.

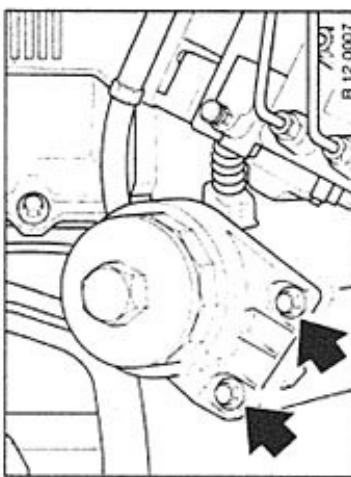


Remove fan wheel.

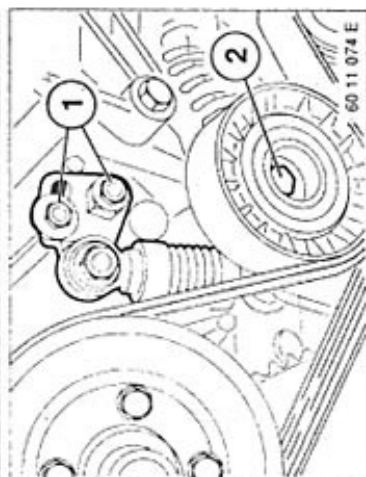
Unfasten fan connection with special tool 11 5 040 and counter support 11 5 050 for pulley wheel.

Tightening torque 11 52 1A2*

Caution!
Counterclockwise thread!

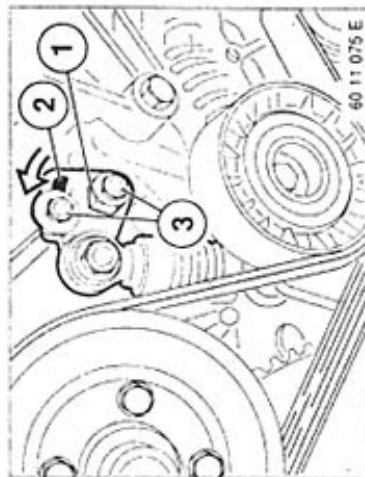


Unfasten screws and remove from bracket.



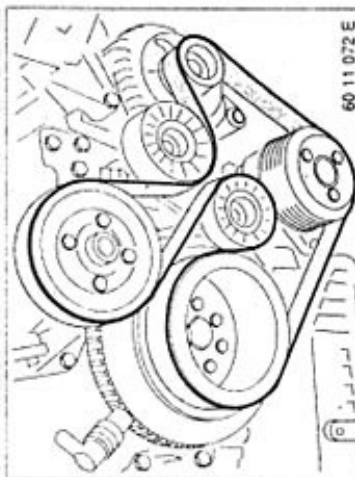
Unfasten nuts (1) and (2) and remove Vee belt tensioning fixture.

* Refer to Technical Data



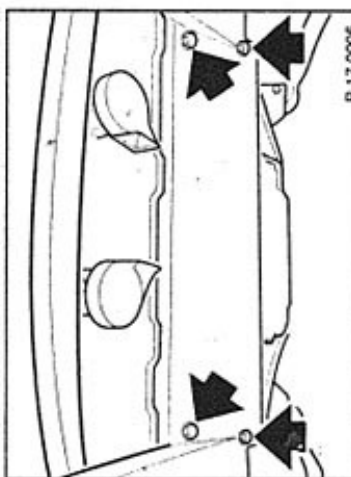
Installation:

Use hex head (1) to preload adjusting plate up to end of long bore (2), then tighten nuts (3).



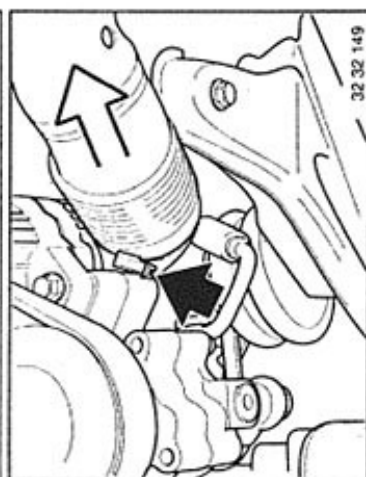
Installation:

Check toothed Vee belts for coolant and oil residue and replace if contaminated.
Fit toothed Vee belt and ensure that Vee belt and pulley wheel are located correctly.

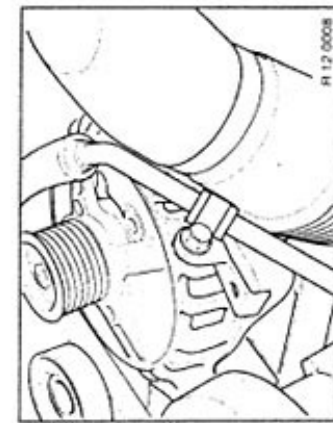


Unfasten screws.

Remove underbody protection from engine

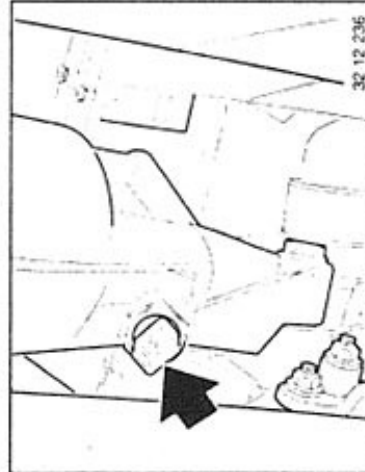


Remove alternator ventilation hose from alternator.

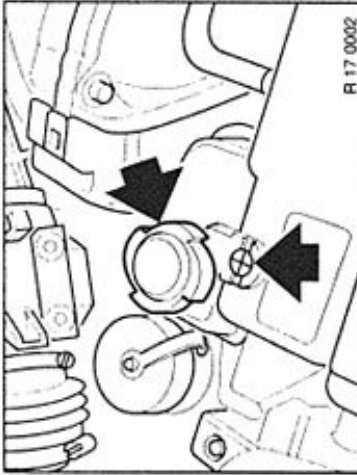


Unfasten retaining screw in alternator hydraulic line.

Remove upper section of suction filter with mass air flow sensor.

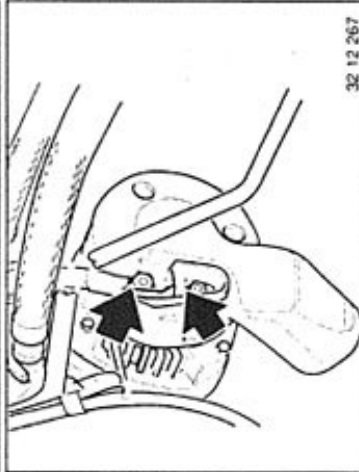


Disconnect plug connection from oil pressure switch.
Unfasten cable connector.

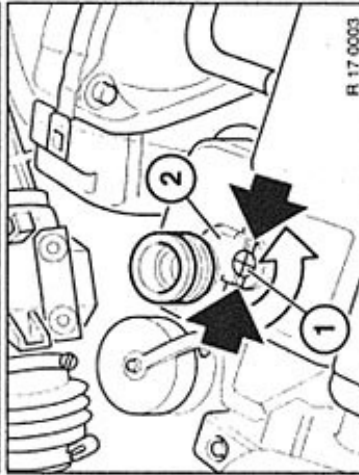


Caution!
Only unscrew sealing cover once engine has cooled down.

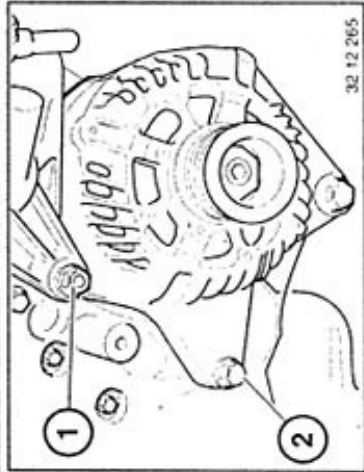
Installation:
Top up with specified coolant and bleed the cooling system, see 17 00 039.



Unfasten lines on alternator.
Tightening torque 12 31 1A2*



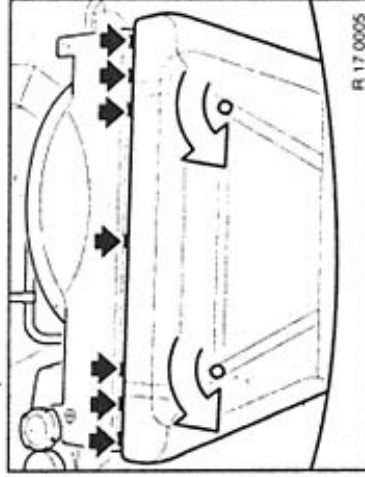
Unscrew complete vent screw (1), unfasten tainer (2) and remove.



Unfasten retaining screws (1) and (2) on the alternator.

Remove expansion tank by lifting upwards

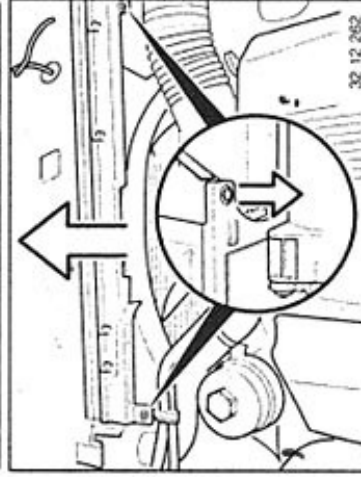
Installation:
Expansion tank must engage in radiator shroud.



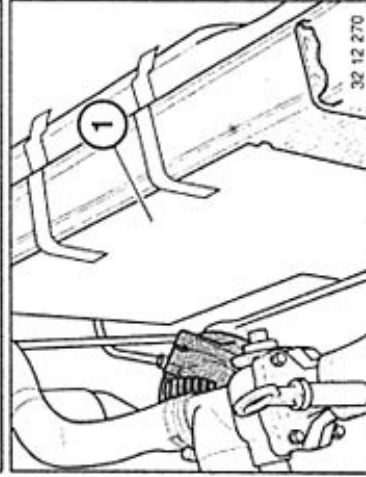
Unfasten upper section of air duct and unclip with screwdriver at specified points (arrows).



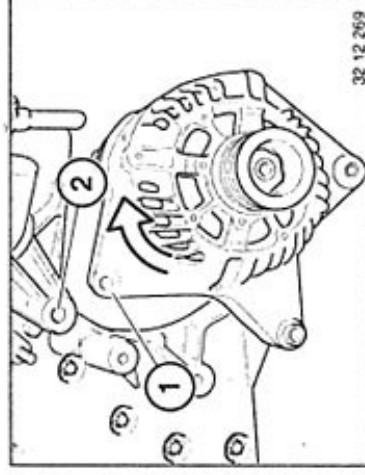
Unfasten overflow line from expansion tank.



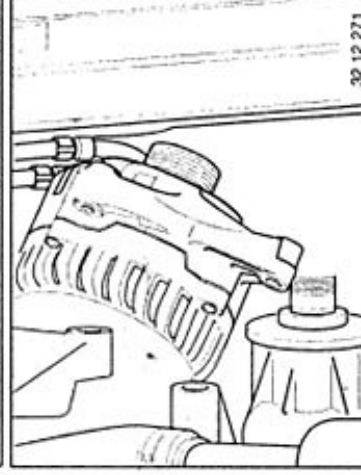
Remove clips on left and right sides.
Remove overflow line from fan shroud.
Remove fan shroud by lifting upwards.



Protect radiator and sheet metal plate (1) from damage.

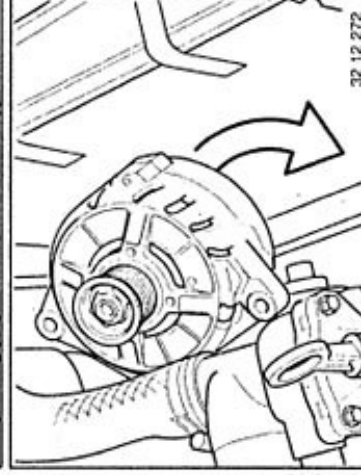


Pull alternator forwards.



Remove alternator by lifting upwards.

Caution!
Do not damage cable for actuating throttle valve for ASC+T!



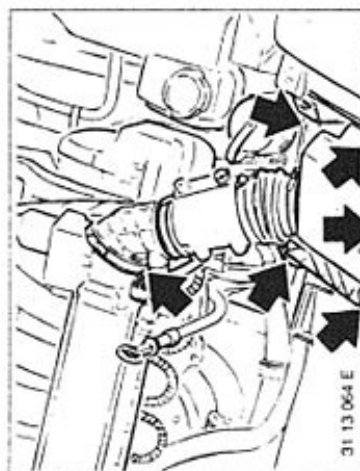
12 31 020 Removing and installing or replacing alternator (M73)

Observe notes on disconnecting and connecting battery, refer to General Data MG 12.

Switch off ignition.

Disconnect battery ground wires.

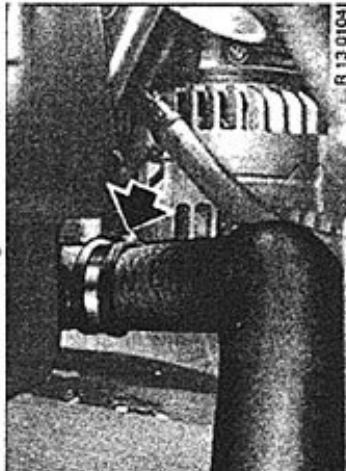
Remove alternator drive belt, refer to 11 28 010.



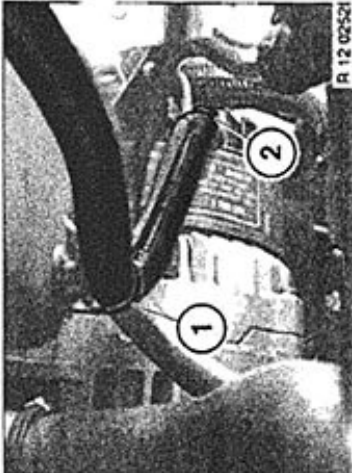
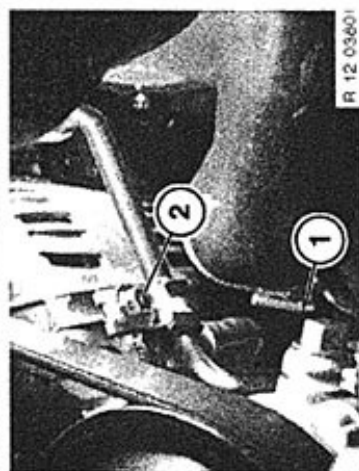
Remove upper section of intake filter housing with mass air flow sensor.



Remove bracket for coolant hose.



Unfasten hose clip (1) and remove cooling air hose. Unfasten screw in retaining clip (2) on hydraulic line and remove retaining clip.



Unfasten cable ties (1 and 2) on cover of distributor cap.

Unfasten connections on alternator.

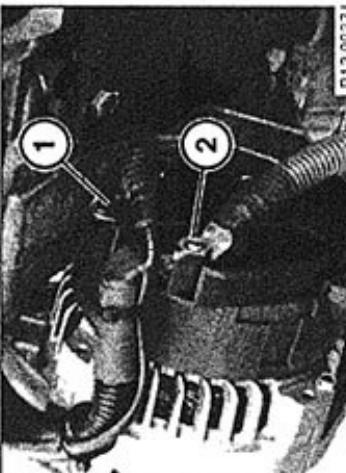
Connections illustrated here on removed alternator.

Disconnect plug connection (1).

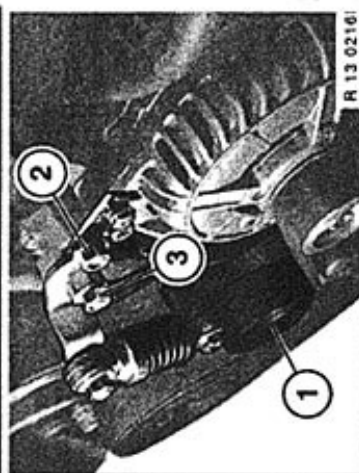
Unfasten nut (2).

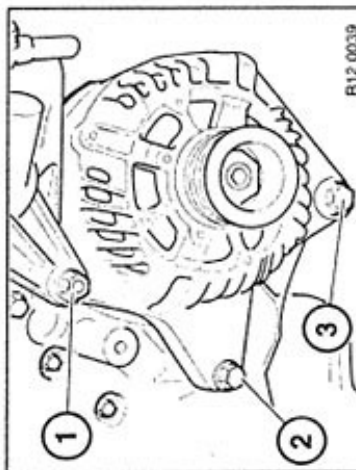
Installation:

Tightening torque, refer to Technical Data 12 31 1AZ.

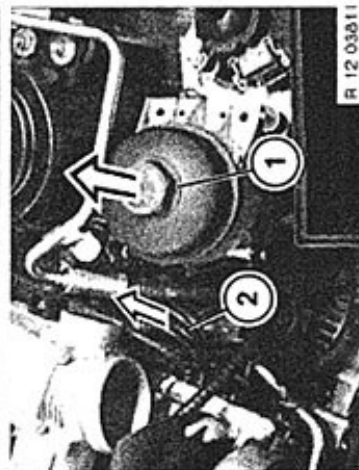


Unfasten screws (1 to 3). Remove tensioning roller for ribbed vee belt.

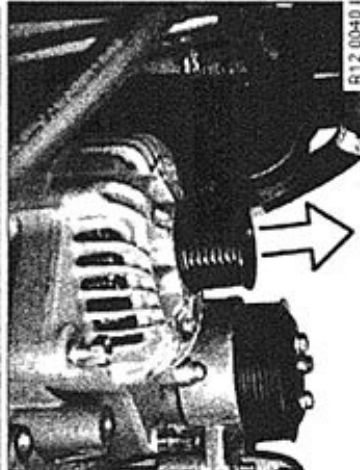




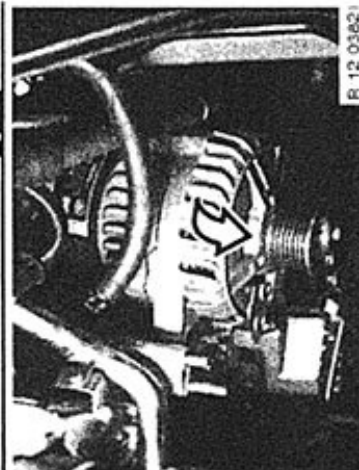
Unfasten screws (1 to 3).



Unfasten oil filter screw connection on bracket and place oil filter to one side.
Mark sequence of ignition leads on the distributor cap and remove ignition leads from the distributor cap.
Place ignition leads (2) to one side.
Remove distributor cap, refer to 12 11 096.



Pull out alternator.



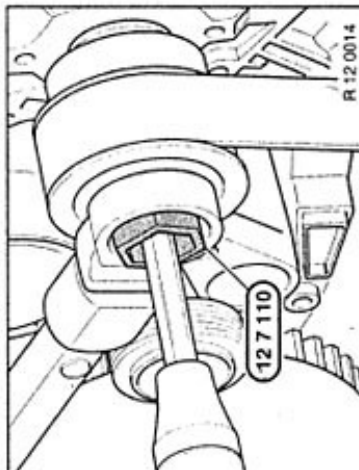
Screw alternator into radiator shroud. Remove alternator by lifting upwards.

Caution!
Avoid damage to radiator fins!



Installation:
First insert alternator in radiator shroud with pulley wheel.

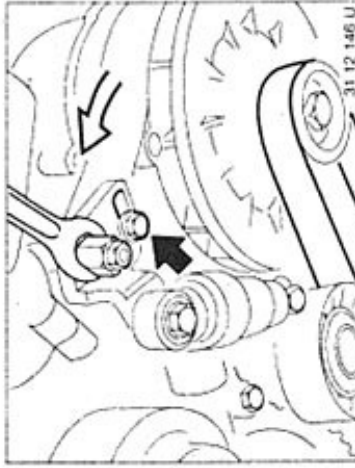
Caution!
Do not damage radiator fins!



Replace alternator pulley:

Unfasten nut with special tool 12 7 110, bracing alternator shaft with internal hex wrench or internally-spined wrench.

Installation:
Tightening torque, refer to Technical Data 12 31 3AZ.

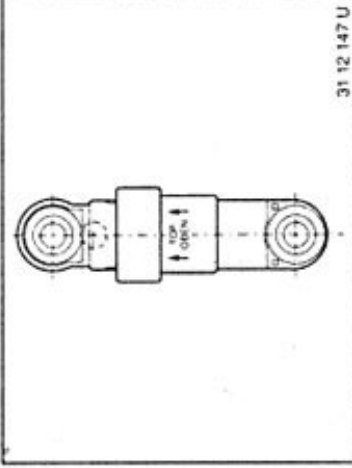


12 31... Tension vee-belt

Tension clamping fixture using open-end wrench until screw in long slot is firmly abutted.

Tighten screw.

At this point, hydraulic belt tensioner is O.K.



Note:

The hydraulic belt tensioner is filled with oil; always store removed elements horizontally. Incorrectly mounted elements can usually be bled by compressing several times in succession.

12 31 030 Removing and installing or replacing auxiliary alternator

Note General Data Gr. 61 00.

Unfasten battery ground wire.

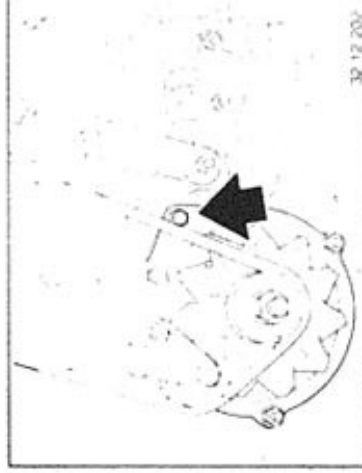
Installation:

Below the air conditioning compressor.

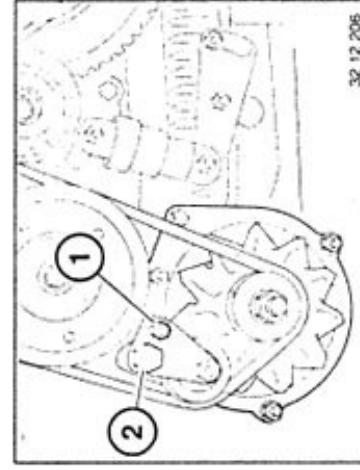
Unfasten ground strap from engine support.

Remove splash guard from below engine.

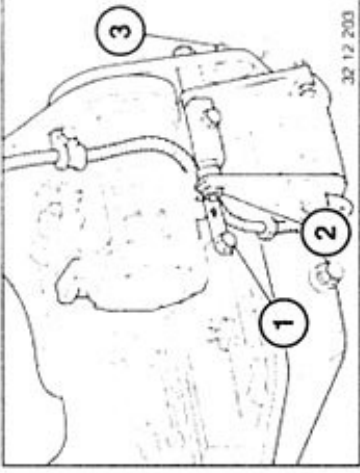
Unfasten retaining screws.



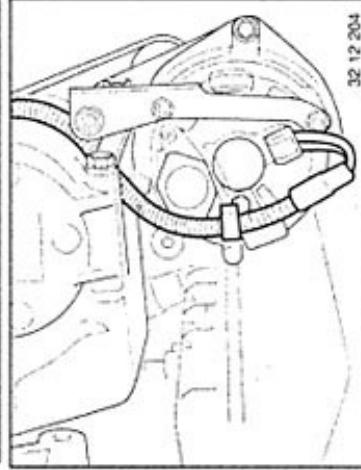
Loosen tensioning roller.
Remove Vee belt.



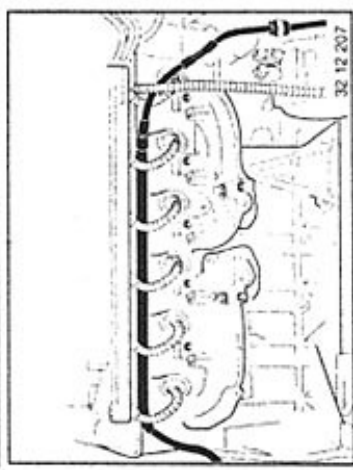
Unfasten retaining screws.
Pull complete alternator downwards to remove.

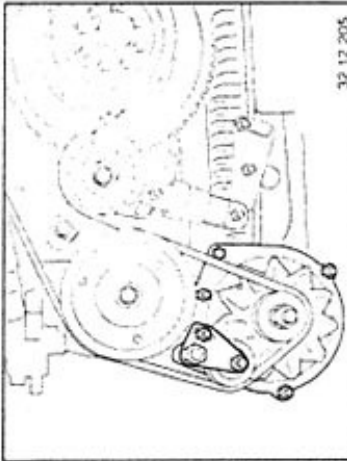


Unfasten retaining screws on lines.
Remove connector.
Remove lines.

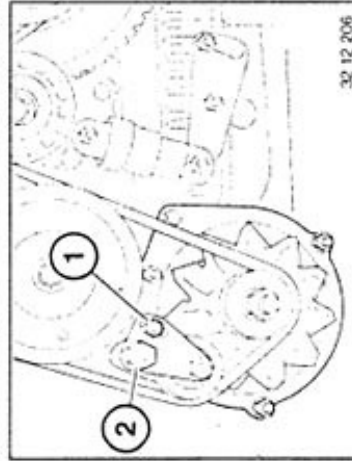


Line routing below ignition leads on cylinders
1...6.





32 12 205



32 12 206

12 31 ... Tension vee-belt for auxiliary alternator

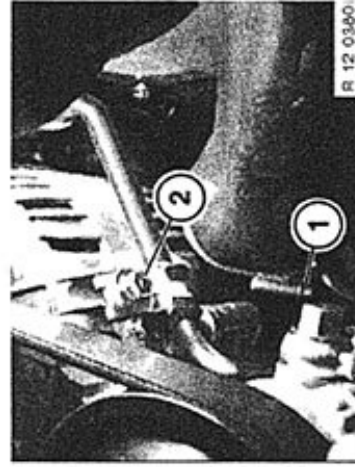
Unfasten screws (1) and (2).
Twist outside hex head (2) on bracket of tensioning roller to 10 Nm and secure with screws (1) and (2). Vee belt is then at correct tension (preload).

12 31 230 Removing and installing / replacing bearing block on alternator (M73)

Refer to,
Repair Instructions for 7 Series E38.

12 31 400 Replacing cooling air guide on alternator (M73)

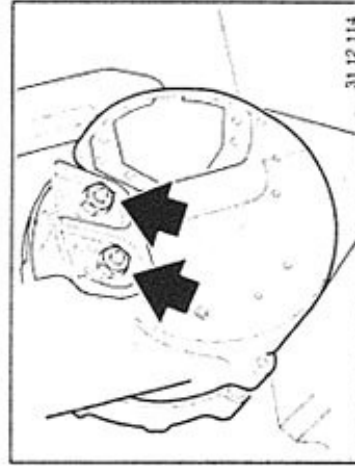
Unfasten hose clip (1) and remove cooling air guide from alternator. Unclip cooling air guide from brake air duct and remove.



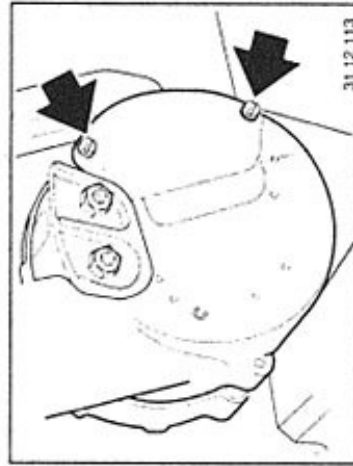
R 12 0360

12 32 000 Removing and installing or replacing regulator switch

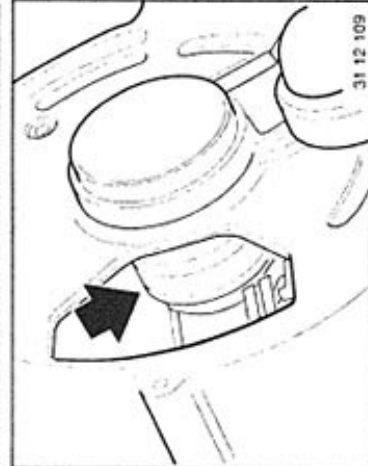
Disconnect ground wires from battery.



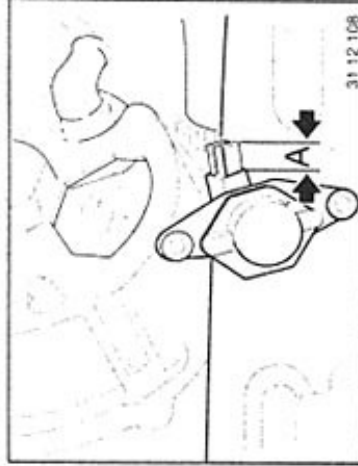
Remove 3-phase alternator, refer to 12 31 020.
Remove cover.



Unfasten screws.
Remove voltage regulator.



Check slip ring for wear and rework if necessary, refer to Construction Group Repair Manual 12 31 200.



Installation:
Clean contact faces and check preload on contact springs, bending again if necessary.

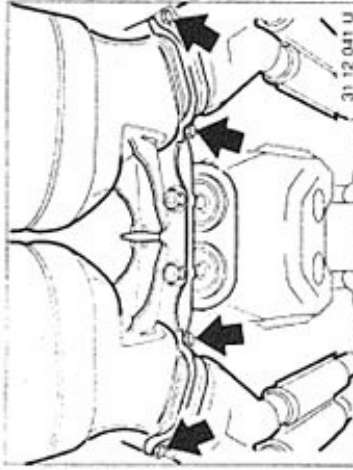
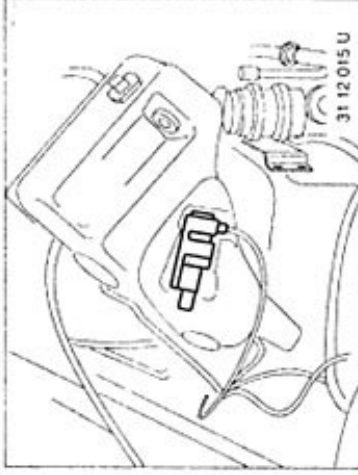
12 32 501 Replacing regulator switch for alternator (M73)

Refer to
Repair Instructions for 7 Series E38.

12 41 020 Removing and installing or replacing starter motor (M 70, S 70)

Interrogate fault memory.
Remove battery ground leads
Unless otherwise stated, the same operations apply to both automatic and manual transmissions.

Place container to one side.

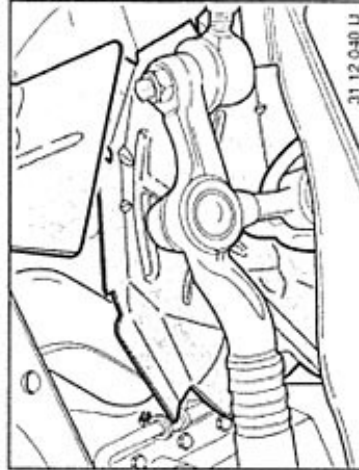


Unfasten exhaust system from transmission bracket, loosen intermediate rubber mount and remove complete exhaust system.



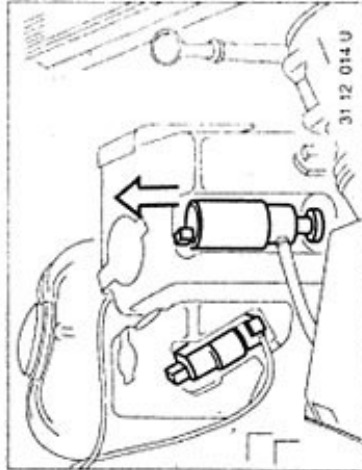
Remove heat shield from intake manifold.
Remove leads from starter support point.
Tightening torque 12 41 4A2.

Remove heat shield from pivot lever.



Remove hoses from manifold
First remove the front tube, then the rear tube by lifting upwards.
Observe assembly instructions for Group 18.

Empty water container for SRA, remove pump and place to one side.

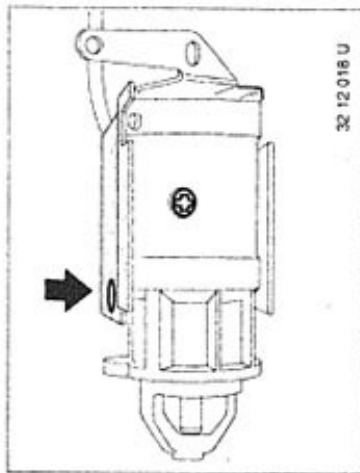


Automatic transmission:
Extend the tool.

• Refer to Technical Data

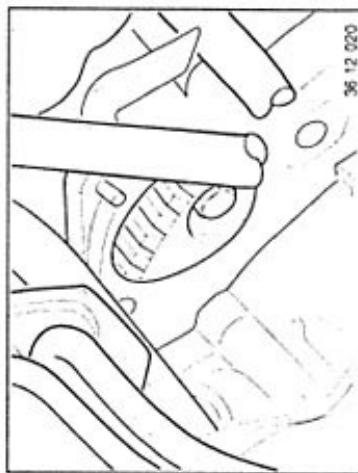
Automatic transmission:

Unfasten the upper starter retaining screw.
Install tool between firewall and wiring harness of E box from above.



Remove starter motor by pulling downwards.
Remove heat shield.
Remove bracket.

Unfasten upper starter screw.
Remove screws from above (direction of manifold).



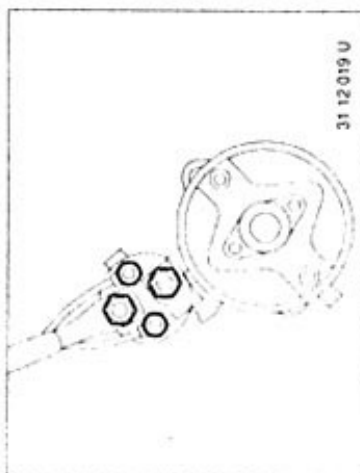
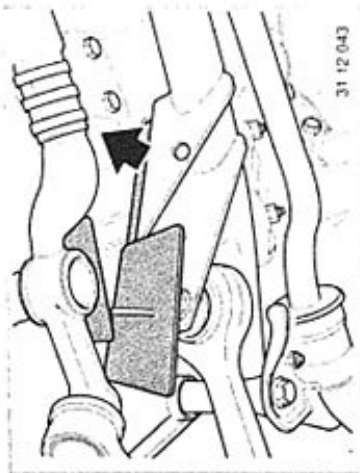
Check pinion of starter motor and starter gear ring on flywheel for signs of damage.

Note:

For additional troubleshooting notes and instructions on dismantling the starter motor, see Construction Group Repair Instructions for Group 12.

Manual transmission:

Unfasten upper starter screw from underside of vehicle.



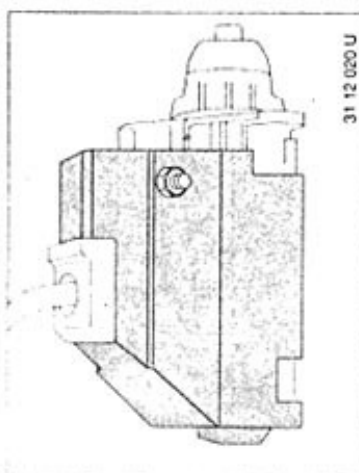
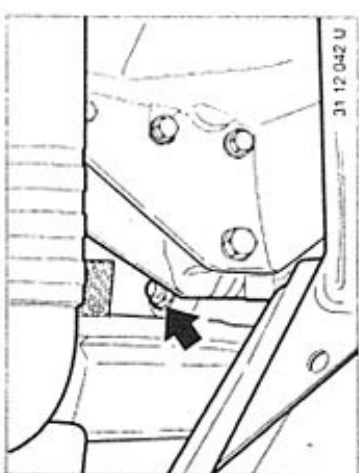
Installation:

Note correct position when installing the starter lead, otherwise it is not possible to install the heat shield.

First insert front tube from below.

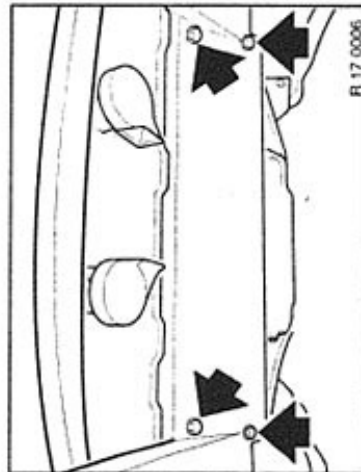
Note installation location of screws and springs. For subsequent procedure, see Group 18.

Unfasten bracket from engine mount.
Unfasten screw from underside of starter motor.

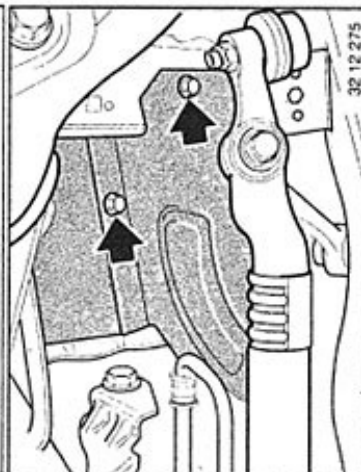


12 41 020 Removing and installing or replacing starter motor (M 60)

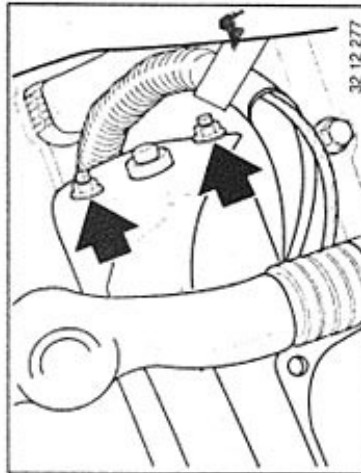
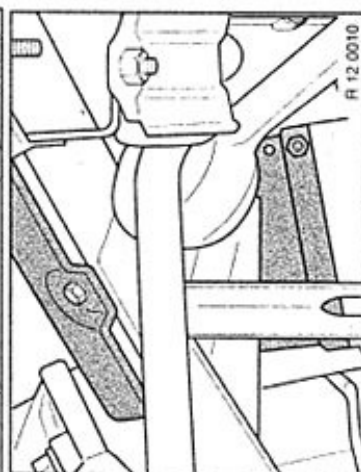
Note General Information for Group 12-0.
Disconnect battery ground lead.



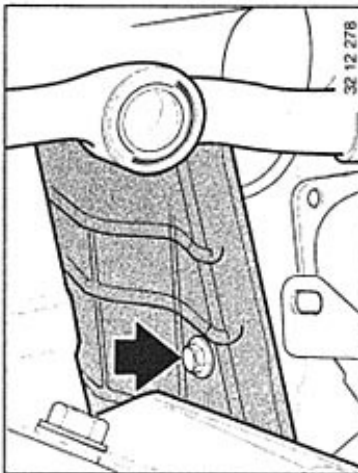
Remove underbody protection for assemblies.



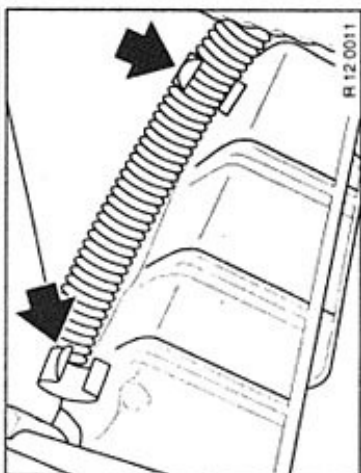
Remove right heat shield.
Unfasten screws.



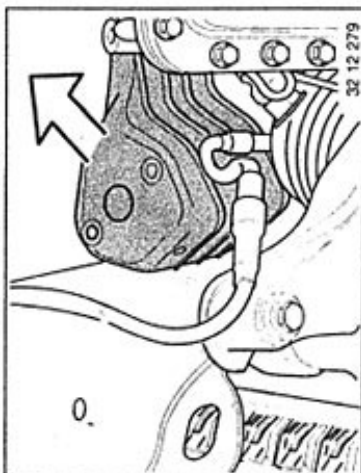
Unfasten screws.



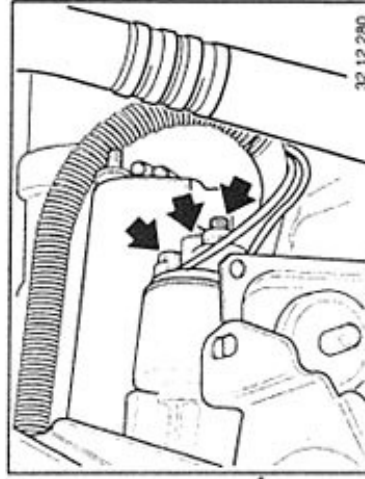
Unfasten screw.
Remove heat shield from starter motor.



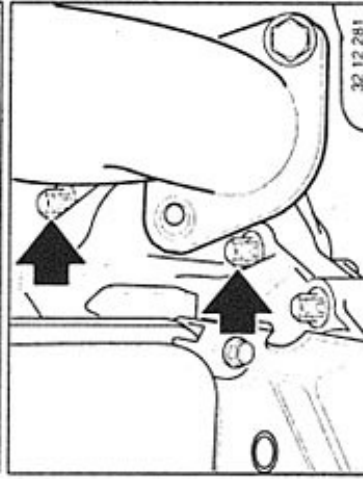
Unclip starter lead from heat shield.



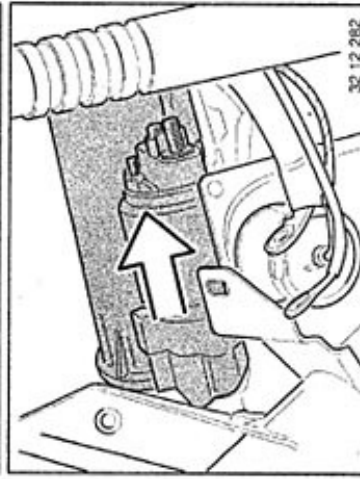
Remove heat shield from below between front axle carrier and reinforcement cross.



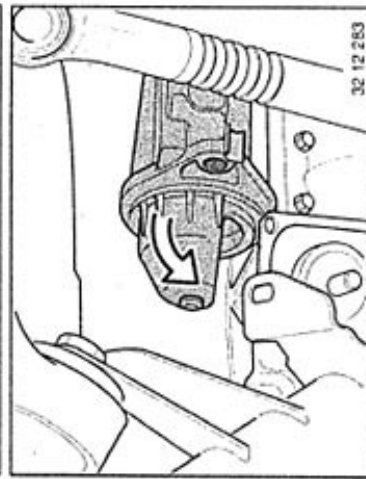
Unfasten screw connection for starter motor lead.
Tightening torque 12 41 4AZ*



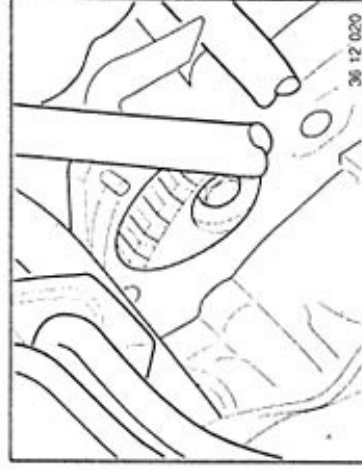
Unfasten screws.
Tightening torque 12 41 1AZ*



Remove starter motor from gear ring.



Remove starter motor from below between front axle carrier and reinforcement cross.



Check starter motor pinion and starter gear ring on flywheel for signs of damage.

Note:

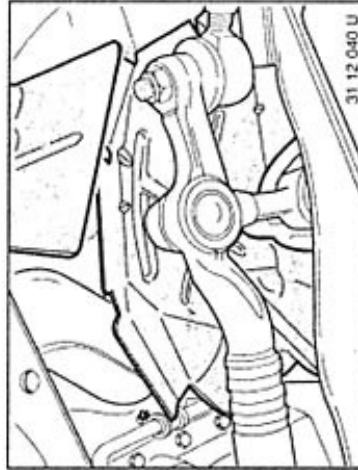
For additional troubleshooting notes and instructions on dismantling the starter motor, see Construction Group Repair Instructions, Group 12.

12 41 020 Removing and installing or replacing starter motor (M73)

Follow instructions on disconnecting and connecting battery, refer to General Data MG 12.

Switch off ignition.

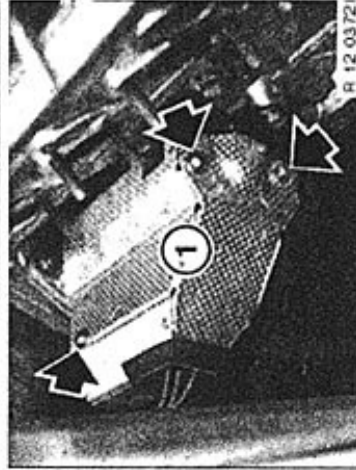
Disconnect battery ground leads.



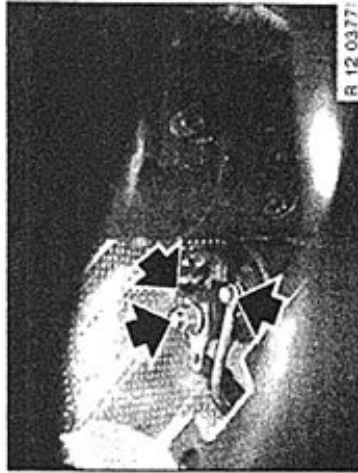
Remove heat baffle plate.

Remove right exhaust pipes.

Unfasten top screw and back screw from heat baffle plate on starter motor (illustrated here from above).



Unfasten lower screw in heat baffle plate and swivel heat baffle plate to one side.



Unfasten connections on starter motor.

Installation:
Tightening torque, refer to Technical Data 12 41 4AZ



Unfasten top and lower nuts on starter motor.

Installation:
Tightening torque, refer to Technical Data 12 41 1AZ



Support bracket on crankcase: unfasten screw. Remove support bracket. Remove starter motor from transmission mount.

Installation:

Check starter pinion for damage. Check starter crown wheel on flywheel for signs of damage.

Note:

A troubleshooting operation on starter motor and its peripherals is described in Construction Group Repair Instructions MG 12.

12 41 041 Replacing engagement magnet switch

Refer to
Repair Instructions for 3 Series E36.

12 41 551 Replacing carbon brushes on starter motor

Refer to
Repair Instructions for 3 Series E36.

12 41 103 Dismantling and assembling starter motor

Refer to
Repair Instructions for 3 Series E36.

**12 70 000 Function check of Electronic
Engine Power Control (EML)
(M73)**

Connect up DIS and interrogate fault memory.

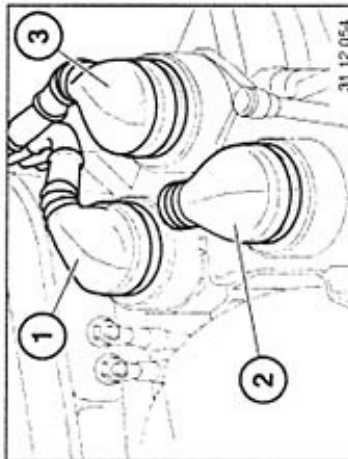
Note:

After each time the accelerator sensor is disconnected, perform a basic adaptation check of accelerator sensor. Procedure in accordance with DIS instruction.

12 70 500 Checking safety path of Electronic Engine Power Control (EML) (M70)

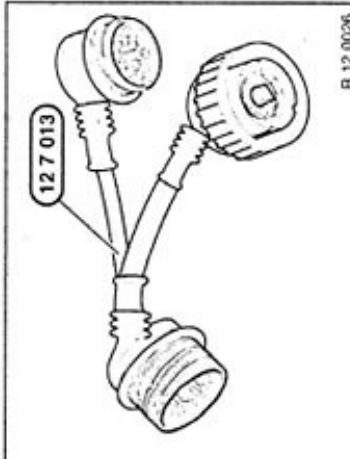
Note:

Before fitting test adapter to EML – interrogate fault memory.

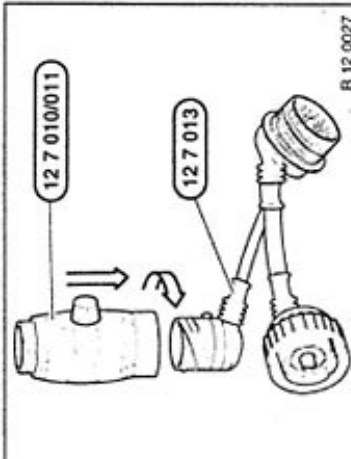


- 1 = Plug connection DME 1
- 2 = Plug connection DME 2
- 3 = EML plug connection

Switch off ignition. Unfasten EML plug connection.
Fit test adapter 12 7 013.



Connect test adapter 12 7 013 to test adapter 12 7 010/011.
Connect BMW Service Tester (to measure engine speed).



Test sequence:

Regulate test adapter 12 7 010/011 in center position "...".

Disconnect gear (idle setting).

Start engine.

Govern idle speed to approx. 2000 rpm with the knurled knob on the test adapter.

Then depress footbrake immediately.

The engine speed must fall to idle speed "immediately".

If this happens, the safety path is OK.

On vehicles with a manual transmission, repeat the test with the clutch pedal.

For notes on troubleshooting, see Electrical Troubleshooting Manual.

Switch off ignition.
Remove adapter.
Reinstall connector.

Note:

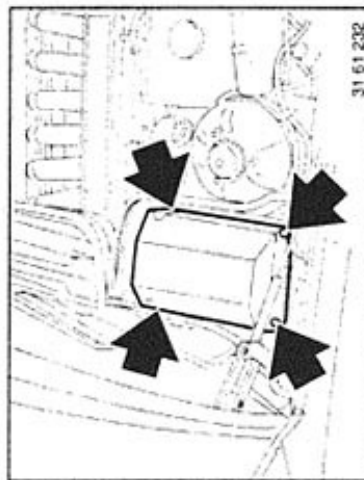
Interrogate fault memory.

Check faults in memory and rectify them.

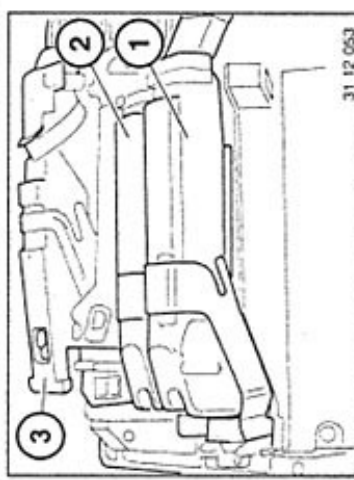
Cancel fault memory.

12 71 530 Replacing control unit for Electronic Engine Power Control (EML)(M70)

Note instructions on removal and installation of electronic control units, refer to General Data MG 12.



Unfasten screws in cover of electronics box.
Remove cover.



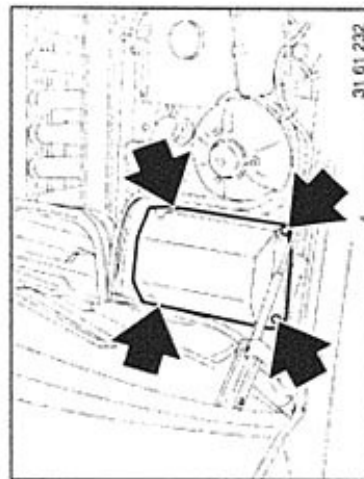
1 = DME control unit 1
2 = DME control unit 2
3 = EML control unit

Caution!

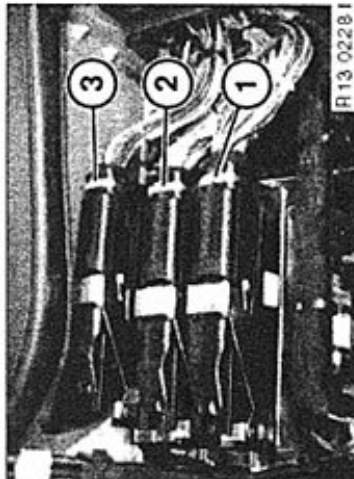
After replacement of the EML control unit, always perform the following test:
Check safety path of the Electronic Engine Power Control. Procedure described in Repair Instructions 12 70 500.

12 71 530 Replacing control unit for Electronic Engine Power Control (M73)

Note instructions on removal and installation of electronic control units, refer to General Data MG 12.



Unfasten screws in cover of electronics box.
Remove cover.



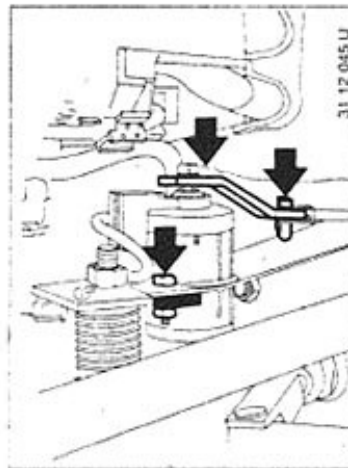
1 = DME control unit 1
2 = DME control unit 2
3 = EML control unit

Caution!

After replacement of EML control unit, always note:
Connect up DIS and follow procedure for replacing control unit.

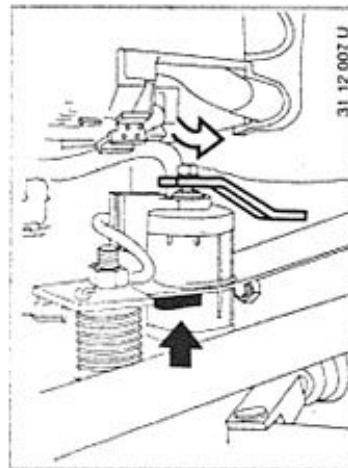
12 72 520 Removing and installing or replacing accelerator sensor (M70, S70)

Switch off ignition.
Remove trim from bottom left side of instrument panel.

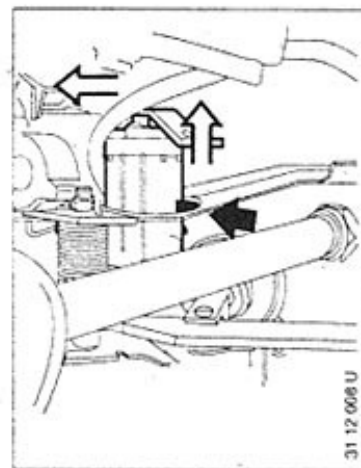


Remove accelerator sensor:
Disconnect lever from accelerator pedal.
Unfasten lever on accelerator sensor and pry off carefully.
Unfasten both screws.
Disconnect plug connection.

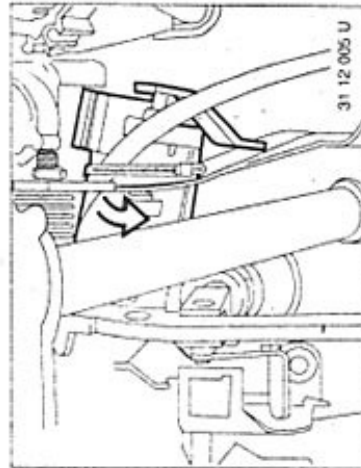
Caution!
Accelerator sensor must not be subjected to load in axial direction: this can cause premature damage to accelerator sensor.



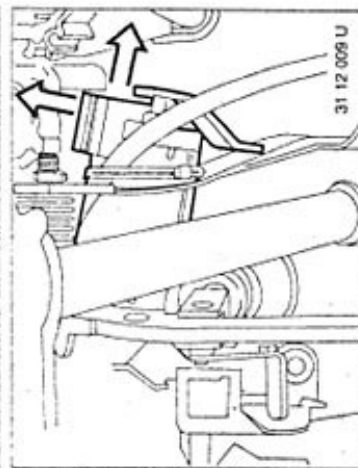
Rotate accelerator sensor approx. 45° counter-clockwise to enable the front retaining lug to be withdrawn from the oval aperture in the pedal block.



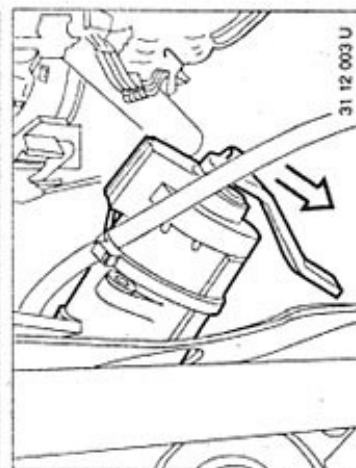
Withdraw retaining lug. Press accelerator sensor slightly towards acoustic insulation and pull out.



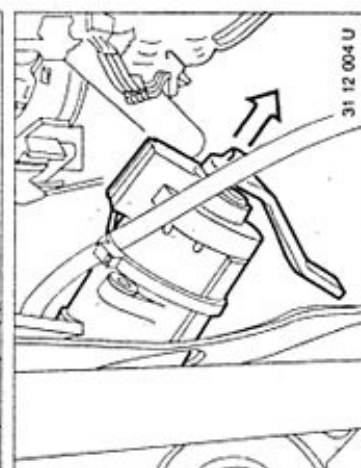
Rotate accelerator sensor clockwise until retaining lug can be withdrawn through aperture.



Press accelerator sensor upwards into acoustic insulation, to enable the 2nd retaining lug to be withdrawn from the pedal block.

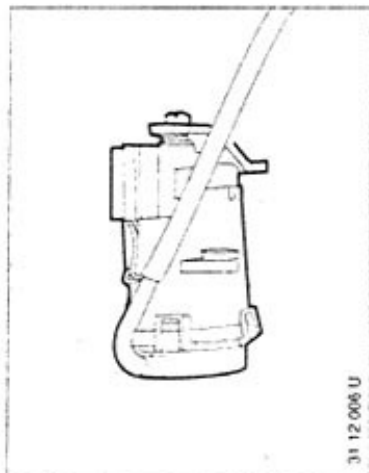


Rotate accelerator sensor approx. 60° counter-clockwise, tilt obliquely downwards towards heating pipes and pull down to remove.



Rotate accelerator sensor in such a way that lugs are realigned over hole pattern in bracket.

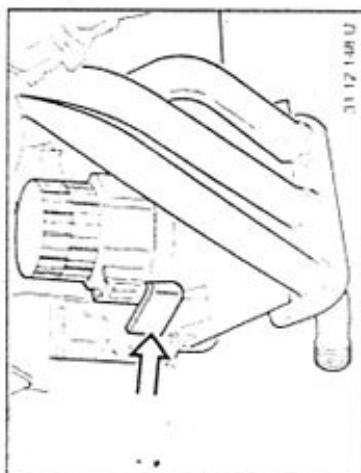
Installing Pedal Value Sender:
Installation will be easier with the lead
of the pedal value sender positioned
as shown.



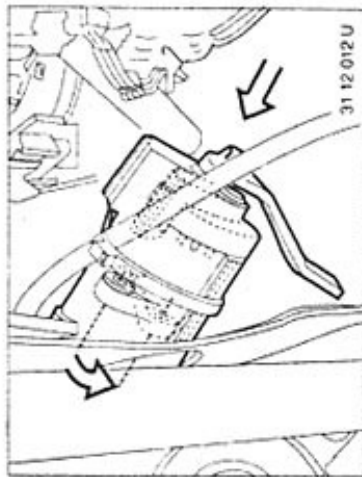
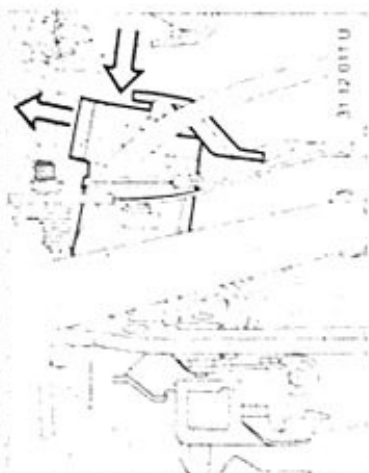
Work in pedal value sender that the
electric lead outlet is inclined past the
heater pipes.



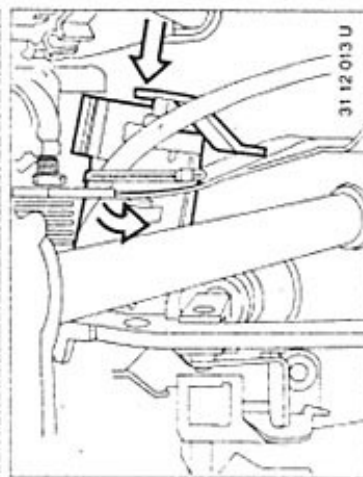
Bend clip of heater mounting screw
away.



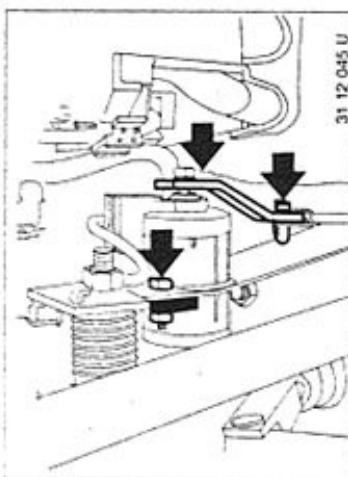
Press pedal value sender forward at an
angle in direction of the firewall.
Work rear end of the pedal value
sender into the pedal console.



Turn pedal value sender clockwise un-
til the front mounting eye is on the
oval opening.
Press pedal value sender up into the
noise insulating sheet.
Work in eye.



Turn pedal value sender until the sec-
ond mounting eye is above the oval
opening.
Work in eye.



Install bolts.
Mount arm.
Secure lead with wire strap.
Tightening torque*.

Important!

Pedal value sender must not be loaded
in axial direction, as pedal value send-
er could be damaged in advance.

Mount plug.
Adjusting and Checking Function of
Pedal Value Sender:
See Adjusting Accelerator Pedal in
12 72
Check safety path – see 12 70 500.

See Specifications

12 72 520 Removing and installing or replacing accelerator sensor (M73)

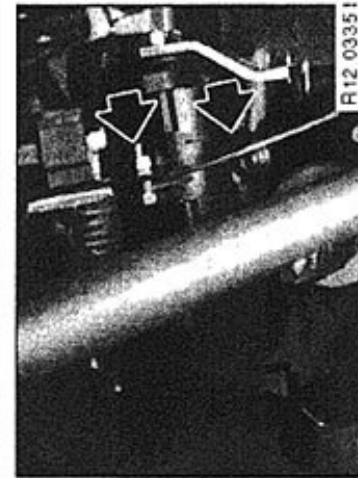
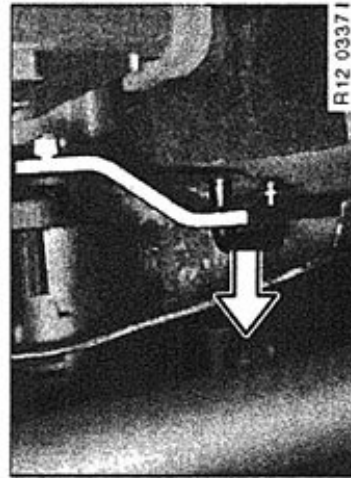
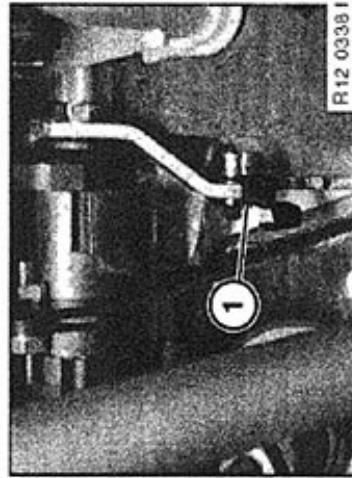
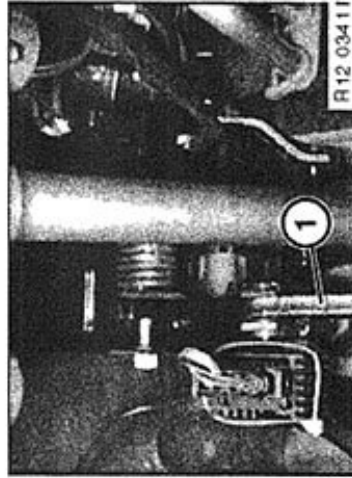
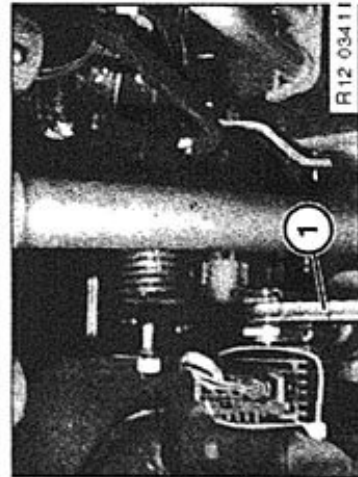
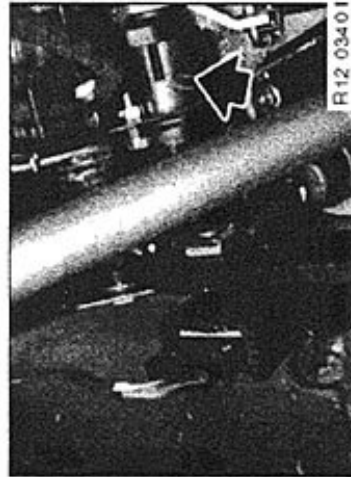
Switch off ignition.

Remove trim from bottom left side of instrument panel.

Note:
Whenever the accelerator sensor (PWG) is disconnected, basic adaptation of the accelerator sensor is required.
Procedure: Connect up DIS and select diagnosis option on EML IIS control unit then proceed in accordance with DIS instructions.

Installation: The accelerator sensor is mounted on the pedal block below the steering column.

Unfasten cable tie (1) and remove brake light switch (2), refer to 61 31 310.

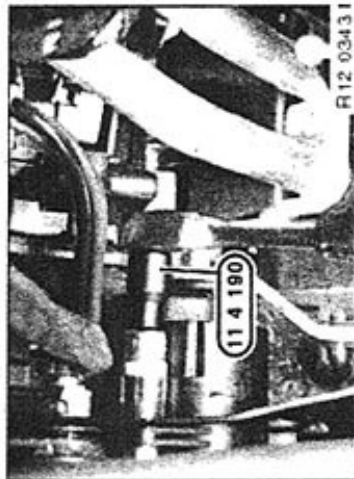


Remove brake pedal (1) from push rod, unfasten lock nut on push rod and remove push rod.
Removing and adjusting push rod, refer to 35 21 000.

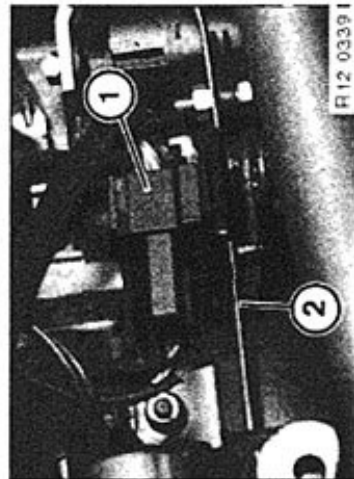
Unfasten retainer (1) from accelerator pedal linkage.

Disconnect linkage.

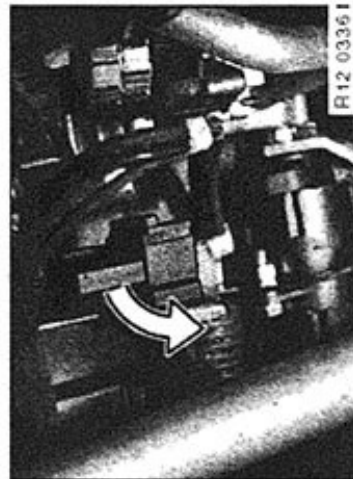
Unfasten screws on accelerator sensor with special tool 11 4 190.



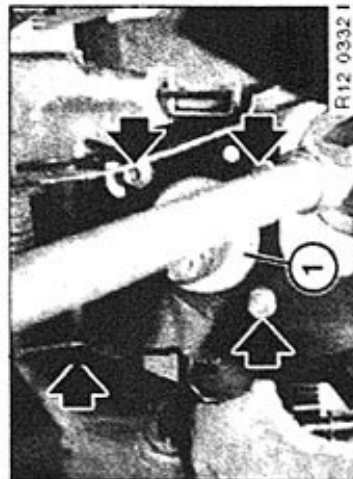
Unfasten screws on accelerator sensor with special tool 11 4 190.



Disconnect plug connection (1).

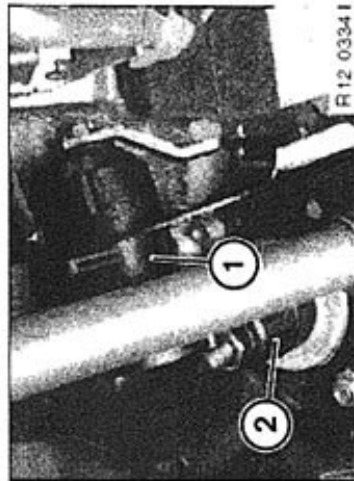


Unscrew plug connection to remove from bracket in pedal block.

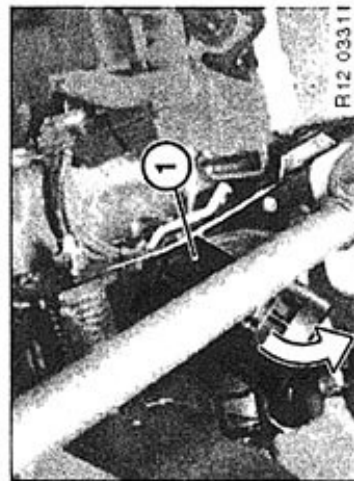


Loosen nut on pedal block to enable the brake unit (1) to be pressed approx. 5mm back into engine compartment.

Installation:
Replace self-locking nut.
Tightening torque, refer to Technical Data MG 35.

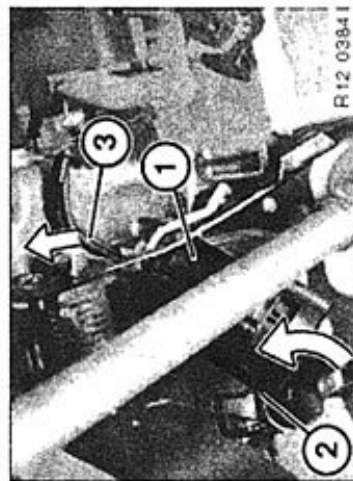


Press brake unit (2) approx. 5mm back into engine compartment and remove accelerator sensor (1).

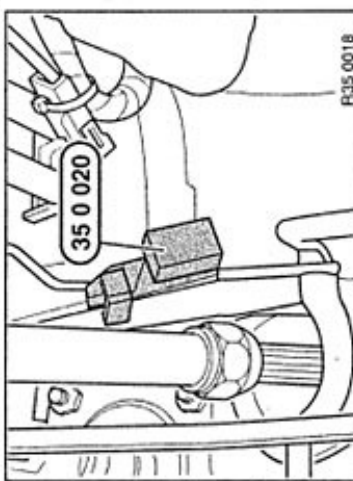


Remove accelerator sensor (1).

Caution!
Lever on accelerator sensor is preset by the factory and must not be unfastened! If the lever on the accelerator sensor has been unfastened, the complete accelerator sensor must be replaced!



Installation:
First insert wiring harness (3) and ensure, when assembling the accelerator sensor (1), that the wiring harness is in the upper section of the aperture.
Insert accelerator sensor (1) between steering column and bracket for brake light switch, pressing pedal block approx. 5mm backwards when doing so.



Checking adjustment of switch, refer to 35 41 480.

Installation:
After assembly of accelerator sensor, a basic adaptation procedure for the accelerator sensor must be run.
Procedure: Connect up DIS and select diagnosis mode for EML-ILIS control unit then follow subsequent procedure in accordance with DIS instruction.

12.72 550 Checking and adjusting accelerator sensor kinematics (M70)

1. Idle speed setting

Loosen hex nut (1) on accelerator sensor. Provide a gap of $A = 3$ mm between accelerator pedal and idle detent (2) (insert feeler gauge or similar item between them).

Tighten hex nut (1) on accelerator sensor (tightening torque*). Support accelerator sensor when tightening lever.

2. Full throttle setting

a) Manual transmission:

move accelerator pedal to kick-down pressure point in accelerator sensor. In this setting, move knurled screw (3) firmly up against accelerator pedal and secure with lock nut.

b) Automatic transmission:

Actuate accelerator pedal to kick-down pressure point in accelerator sensor. In this setting, adjust knurled screw (3) with gap of 6 mm between knurled screw and accelerator pedal. Lock off knurled screw.

Caution!

After adjustment, check accelerator sensor with diagnosis tester. Connect up tester, switch on ignition and move accelerator pedal to full throttle setting. Compare actual voltage value displayed by tester with nominal value and, if necessary, correct the setting.

Nominal value:

- a) manual transmission: 3.15 ... 3.3 V
- b) automatic transmission: 3.7 ... 3.8 V

Nominal value: Idle speed = min 353 mV
Idle speed = max 451 mV

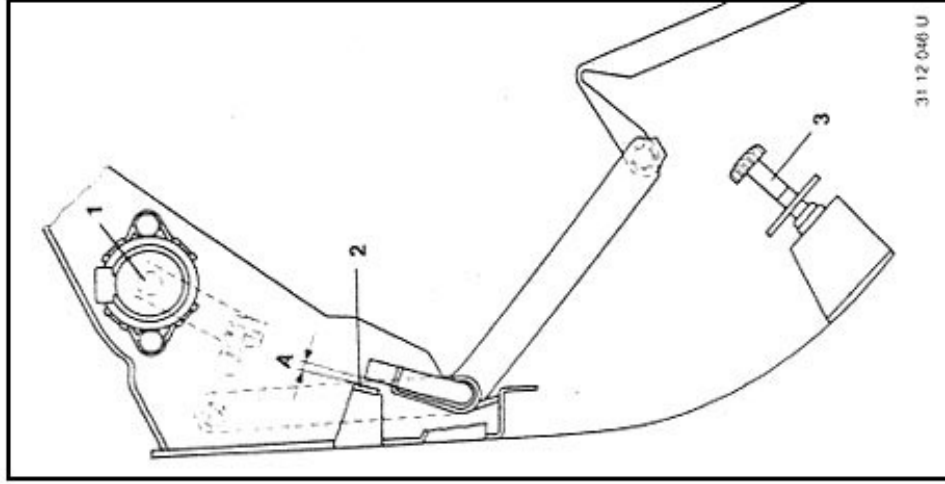
Check safety path, refer to Gr. 12

Pos. 12 70 500

Note:

Before fitting test adapter – interrogate EML fault memory.

*Refer to Technical Data



On-board Diagnosis

The DME control unit recognizes exhaust relevant faults and displays them by lighting up the "Check Engine" control lamp continuously. Check Engine control lamp - see Group 62. The fault lamp comes on after turning on the ignition and goes out when the engine runs. It is on continuously while the engine is running, if there is a fault.

Flashing codes help in locating faults precisely and eliminating them.

Fault Output:

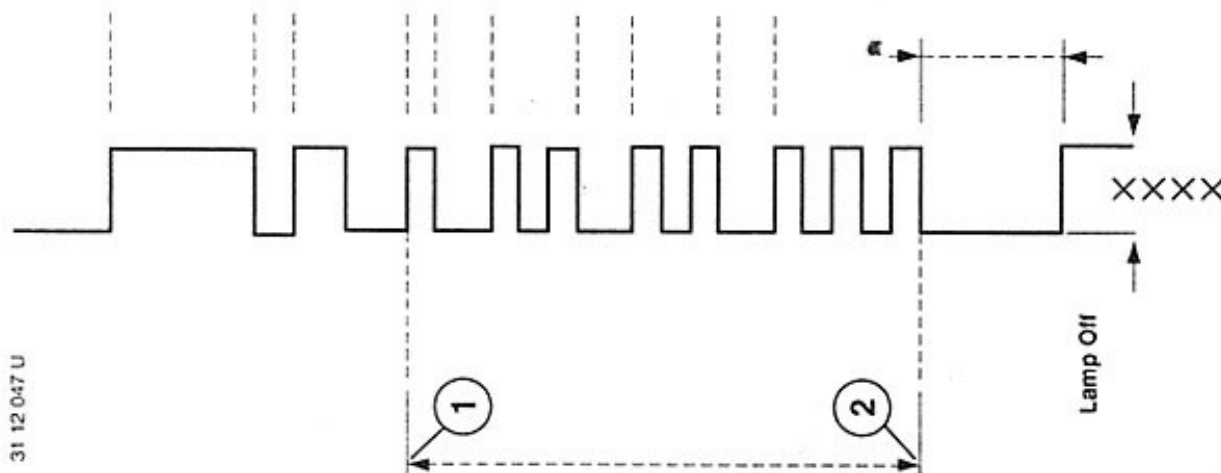
Activate flashing code output: Ignition ON, operate full load contact 5 times within 5 seconds.

Fault output begins.

See sample fault: faulty NTC coolant - code 1223.

Sample Fault Code: NTC Coolant Code 1223

31 12 047 U



5 times full load
stop within 5 sec.
with Ignition ON
5 s Lamp ON

0.5 s Lamp OFF
2.5 s Lamp ON

2.5 s Lamp OFF

Flash 1 - 2 times*

2.5 s Lamp OFF

Flash 1 - 8 times
Note number

2.5 s Lamp OFF

Flash 1 - 8 times
Note number

2.5 s Lamp OFF

Flash 1 - 8 times
Note number

2.5 s Lamp OFF

Lamp ON

1 = Start of fault code

2 = End of fault code

Note:

Each additional call must be activated again.
Code X444 - fault no longer stored.
Code X000 (long dark phase) - after fault output = end of output.

Two times for M 70
Left cylinder bank

TABLE OF FAULT CODES FOR DME 1.7

Code	Fault Branch
x111	Ignition
x211	Control unit (self test)
x215	Air mass sensor
x221	Oxygen sensor
x222	Oxygen control
x223	NTC coolant (see fault example)
x224	NTC Intake air
x231	Monitor of bat. voltage supply to contr. unit
x251	Injector final stage 1 (cylinders 2,4,6)
x252	Injector final stage (cylinders 7,9,11)
x261	Elec. fuel pump relay final stage
x263	Tank venting final stage
x264	Relay 3 final stage (oxygen sensor heating)
x268	Idle speed, CO potentiometer
x278	Ignition timing correction
x512	AC compressor shutoff
x513	Final stage pin 18
x515	Converter lockup clutch
x516	Speed signal
x517	MSR signal
x518	ASC signal
x818	Final stage

Remarks:

FL = Fault lamp

VL = Full load

Table 1: CARB Flashing Code Scope

Remarks:

x = 2 for M 70 control unit of left engine side
(cyl. 7 ... 12)x = 1 for M 70 control unit of right engine side
(cyl. 1 ... 6) and all other engines

Fault memory empty: code x444

Fault memory cancellation: versions.

1. Disconnect DME control unit on power supply by, for example, unplugging the control unit.
2. Put out cancel fault memory command with a BMW SERVICE TESTER (see car electric/electronic test plan).
3. Reactivate with Ignition "ON" while flashing code x000 is being put out; close (make) the full load switch 10 seconds.

13 Fuel System

Fuel System	
Fuel System M60	