

Test step 19

Testing electronic control unit (current to solenoid valve "pressure reduction stage").

Note

Not possible on electronic control unit 3rd version with green or blue type rating plate. Installed starting February 1984.

Actuation

Attention! Do not actuate brake pedal. Depress pushbutton VL (34), VR (35) and HA (36) one after the other. In addition, push yellow light button (32) at each pushbutton position. After releasing yellow light button, wait for zero readout, only then push yellow light button again. Following each pushbutton and light button actuation, read value on tester.

Readout

Good	Fault
Lamp 1 (green) Digital readout: between 4.5–5.7 A	Readout: < (lower) 4.5 A > (higher) 5.7 A

Electronic control unit defective.

Remedy

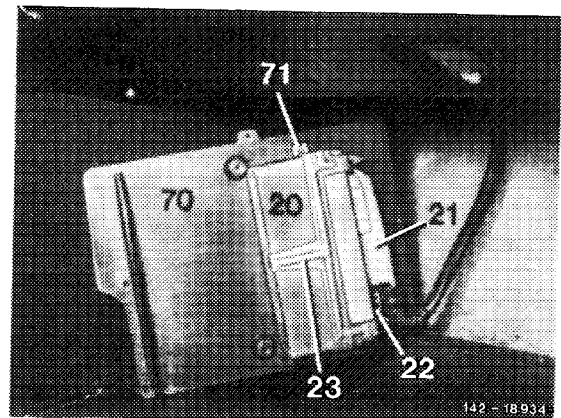
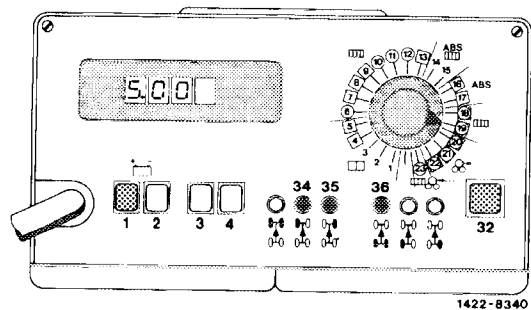
Replace electronic control unit (20).

Additional test steps require a brake test bench.

Note

Prior to test on drum dynamometer, perform test steps 1–19.

Test steps 20–23 require a perfectly functioning service brake. Drums of test bench and tires should be dry during test. When testing front axle, actuate parking brake.



Test step 20

Testing pressure reduction, testing for leaks and exchangeability.

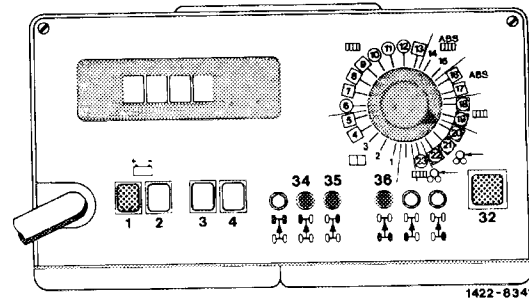
Actuation

For testing at front axle, switch on lefthand or righthand drum of dynamometer only. For testing at rear axle, switch on both drums.

Actuate brake pedal until 2000 N braking force are attained. Then hold brake pedal in this position until test procedure is completed. Depress pushbutton VL (34) or VR (35) and additionally yellow light button (32).

Attention! At end of test, release brake pedal and only then yellow light button.

With rear axle of vehicle on dynamometer, actuate pushbutton HA (36) and yellow light button. Each time after depressing pushbutton and light button, check pressure reduction on measuring instruments of dynamometer.



Readout (on dynamometer)

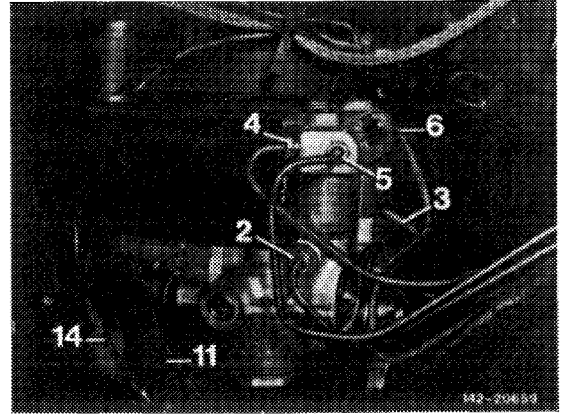
Good	Fault
<p>Lamp 1 (green) Pressure reduction Upon actuation of light button the braking force is reduced from 2000 N to approx. 800–1000 N. (500 N difference between VL and VR are permitted).</p>	<p>Pressure reduction Upon actuation of light button the braking force is reduced only slightly or not at all. If difference in brake force between VL and VR is more than 500 N, repeat test at pushbutton symbol VA and repeat operation of both rollers.</p>
<p>Leak test When pedal force is increased, the braking force should not increase above this value (approx. 800 N to 1000 N) (do not release brake pedal during this test).</p>	<p>Leak test When pedal force is increased, the braking force will quickly rise above lower value.</p>

Exchangeability

The braking force is reduced and indicated in accordance with pushed buttons carrying symbols VL, VR or HA.

Exchangeability

The indicated braking force increases above 2000 N after actuation of yellow light button.

**Pressure reduction**

1. Check speed sensor (perform test step 23).
2. Hydraulic unit defective.

Leak test

1. Brake lines leaking.
2. Hydraulic unit leaking.

Exchangeability

Brake lines wrongly connected.

Remedy**Pressure reduction**

Replace hydraulic unit.

Leak test

1. Check brake lines (visual checkup).
2. Replace hydraulic unit.

Exchangeability

Connect brake lines correctly.

Test step 21

Testing pressure build-up.

Actuation

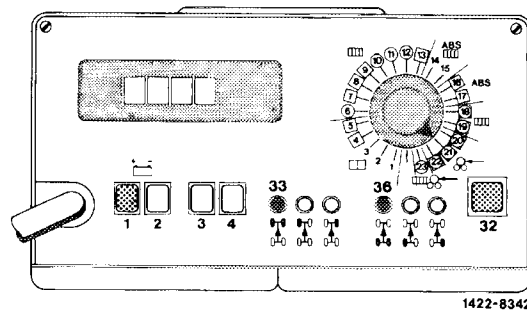
Engage both drums of brake test bench. Actuate brake pedal until 2000 N braking force are attained on front axle.

Keep brake pedal in this position constant until test is completed. Depress pushbutton VA (33) and additionally yellow light button (32).

Attention!

At end of test, release brake pedal first and only then yellow light button.

With rear axle of vehicle on brake test bench, repeat actuation while depressing pushbutton HA (36).

**Readout (on test bench)**

Good

Fault

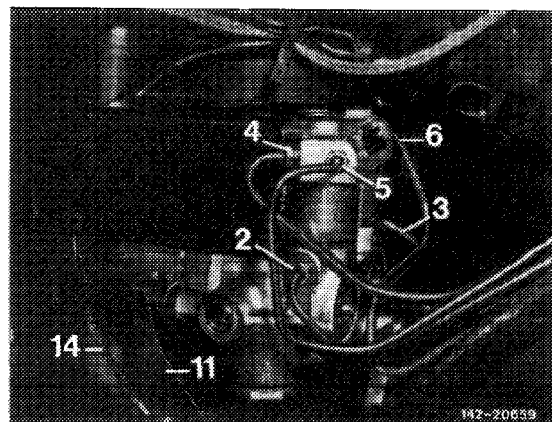
Lamp 1 (green)
Upon actuation of yellow light button, braking forces are reduced from 2000 N to approx. 500–800 N on front axle and approx. 300–600 N on rear axle, and are then increased to approx. 1300–1500 N on front axle and rear axle. (Difference of 500 N between VL and VR permitted).

Braking force is built-up only slightly or not at all upon actuation of yellow light button.

Hydraulik unit defective.

Remedy

Replace hydraulic unit.



Test step 22

Testing pump delivery.

Actuation

Engage both drums of brake test bench. Actuate brake pedal until 2000 N braking force are attained on front axle. Keep brake pedal in this position constant until test sequence is completed. Depress pushbutton VA (33) and additionally yellow light button (32).

Attention!

At end of test release brake pedal first and then only yellow light button.

With rear axle of vehicle on test bench, repeat actuation and depress pushbutton HA (36).

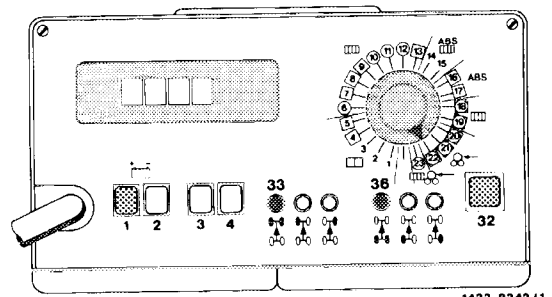
Note: If test step is repeated, wait for approx. 10 s.

Readout

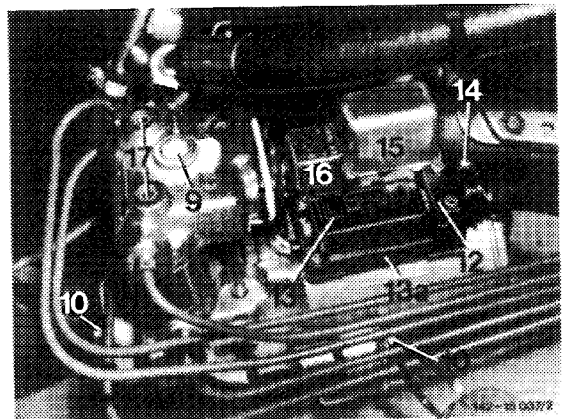
Good	Fault
<p>Lamp 1 (green) Upon actuation of yellow light button the braking force is reduced from 2000 N during first pressure reduction cycle to approx. 1000 N, and during second pressure reduction cycle to less than 500 N. The brake pedal will exert pressure against foot.</p>	<p>Upon actuation of yellow light button the braking force is only slightly reduced during second pressure reduction cycle to more than 500 N or not at all. (Repeat test step, if pedal force could not be held constant).</p>

Return pump not delivering.

Remedy
Replace hydraulic unit.



1422-8342/1



Test step 23

Testing rpm sensors for function.

Actuation

Engage lefthand drum of brake test bench.
Actuate pushbutton VL (34) and read digital readout. Disengage lefthand drum.

Engage righthand drum, actuate pushbutton VR (35) and read digital readout.

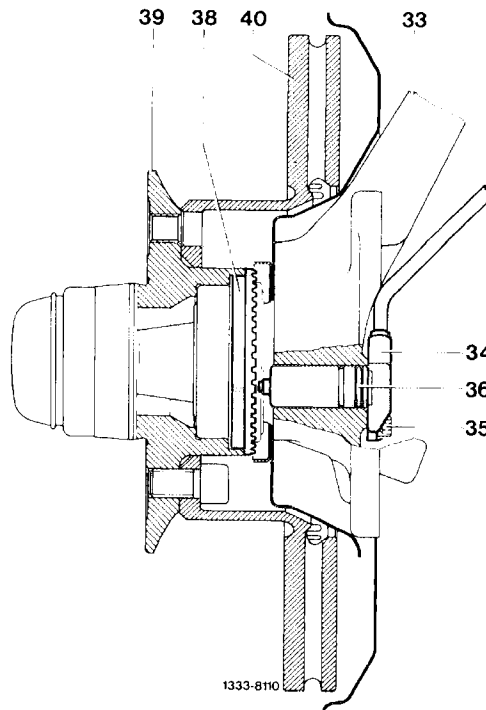
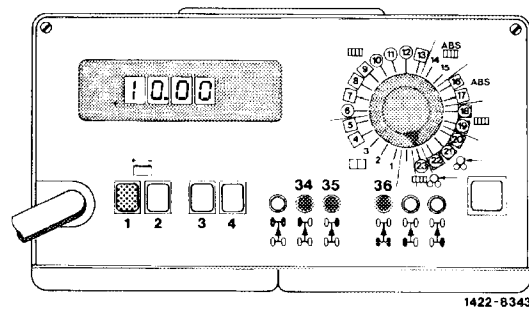
With rear axle of vehicle on brake test bench, engage both drums and actuate pushbutton HA (36).

Note

Readout around 10.00, if possible. If close to 1.00, search fault (probably wheel bearing play).

Readout

Good	Fault
Digital readout between 1.00 to 19.00	Readout: < (lower) 1.00 or close to 1.00



1. Rpm sensor loose.
2. Respective rpm sensor defective.
3. Air gap between rpm sensor (34) and gear wheel (38) (rotor) too large.
4. Foreign body on rpm sensor.

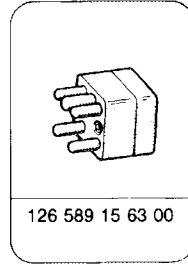
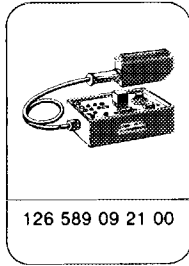
Remedy

1. Tighten rpm sensor.
2. Replace rpm sensor.
3. Check wheel bearing or wheel bearing play on front axle.
4. Check whether edge of rpm sensor carries a metallic foreign body.

End of test.

B. Testing with adapter

Special tool

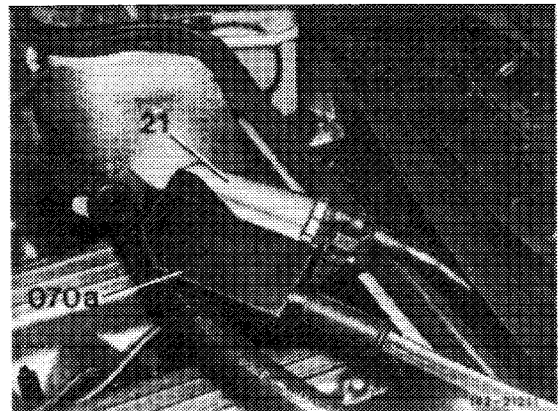


Conventional tool

Multimeter	e.g. SUN Type DMM 5 Digital multimeter with DC clip-on probe All SUN agencies	e.g. Thorn Emi, type Avometer 2003 Pocket multimeter without DC clip-on probe Thorn Emi Technologi Bodenseestraße 113 D-8000 München 60
------------	----------------------------------------------------------------------------------------	-----------------------------------------------------------------------------------------------------------------------------------------------------

Connecting tester

- 1 Remove electronic control unit with ignition switched off.
- 2 Connect multiple plug (35-polig) of cable set (21) for electronic control unit with plug (070a) of adapter (070).

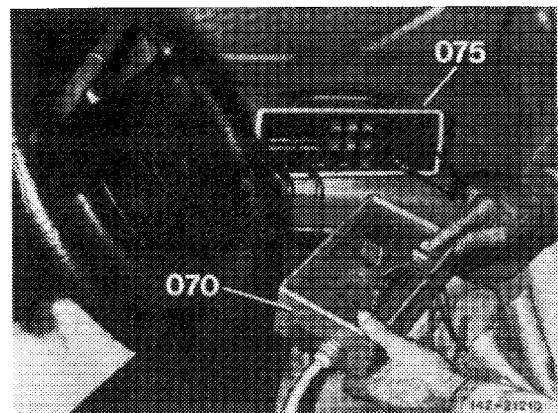


- 3 Connect multimeter.

Note: Do not drive vehicle with adapter connected.

Switch off all other current consumers during test.

This tester permits checking the entire ABS system with the exception of the electronic control unit.



Test step 1

Testing relay (51) for voltage supply of electronic control unit and valve relay (16) in rest position. Testing of overvoltage protection (51) and alternator.

Note

Relay (50) for voltage supply of electronic control unit and overvoltage protection (51) are one unit since September 1981.

The overvoltage protection has again been modified as of September 1985. It can be tested only together with protective adapter, part No. 126 589 15 63 00.

The overvoltage protection has 7 pins as of September 1986.





Actuation for testing relay (51) for voltage supply of electronic control unit and valve relay (16) in rest position

Rotary switch to position 1 – ignition Off.

Actuation for testing voltage supply

Rotary switch to position 1 – ignition On.

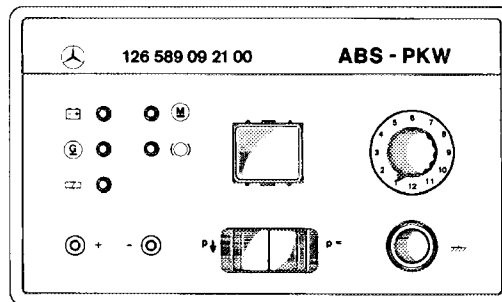
Note

LED  and  ON with ignition switched on, continuously. LED  OFF below 10.5 battery voltage. LED  OFF when starting engine.

Actuation for testing alternator

Rotary switch to position 1 – ignition On.

Run engine for a short moment.




1423-10272

Readout

Good

Fault

Relay (51) for voltage supply of electronic control unit rest position


All LED  OFF

Relay (51) for voltage supply of electronic control unit rest position

LED  ON

Voltage supply

U = 10.5 – 15 V

LED  ON


LED  ON

ABS indicator lamp

ON

Voltage supply

U = < (lower) 10.5

LED  OFF


LED  OFF

ABS indicator lamp

OFF

Alternator

Charge indicator lamp

and LED  OFF

Alternator

Charge indicator lamp

and LED  ON

Relay (50) for voltage supply of electronic control unit and valve relay (16) in rest position

1. Relay (50) defective.
2. Valve relay (16) defective.

Voltage supply

1. Charge condition of battery not in order.

Regulating voltage of alternator not in order.

2. Overvoltage protection (51) defective.
3. Relay (50) defective.
4. Connecting line interrupted.

Indicator lamp not in socket.

Indicator lamp defective.

5. Valve relay (16) defective.
6. Diode of hydraulic unit or in valve relay (16) defective.

Note

Modified hydraulic unit without diode in plug socket starting early 1986.

(Item 5 and 6 only if ABS indicator lamp is not lighting up).

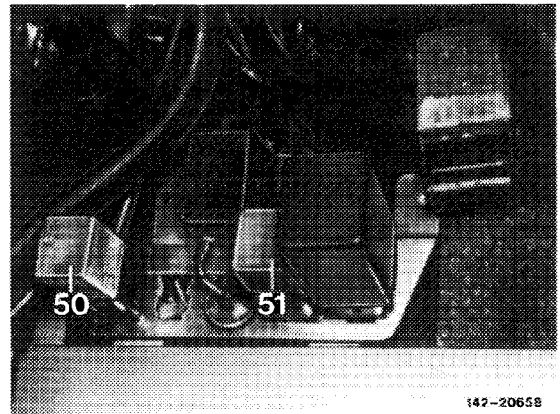
Remedy

Relay (51) in rest position.

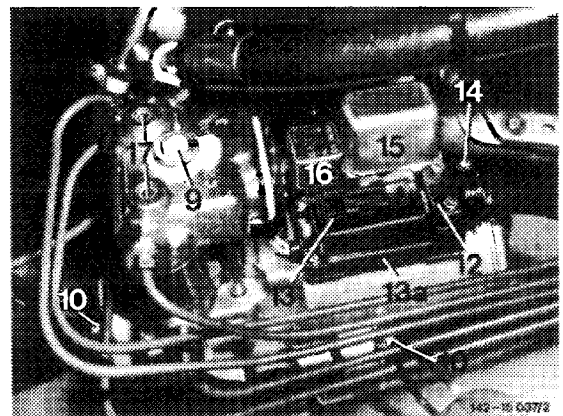
1. Renew relay (50).
2. Renew valve relay (16).

Voltage supply







1. Check battery and recharge, if required, or check regulating voltage of alternator.
2. Renew overvoltage protection (51).
3. Renew relay (50).
4. Check connecting line. Check indicator lamp and renew, if required.
5. Renew valve relay (16).
6. Replace hydraulic unit or valve relay (16).



142-20658



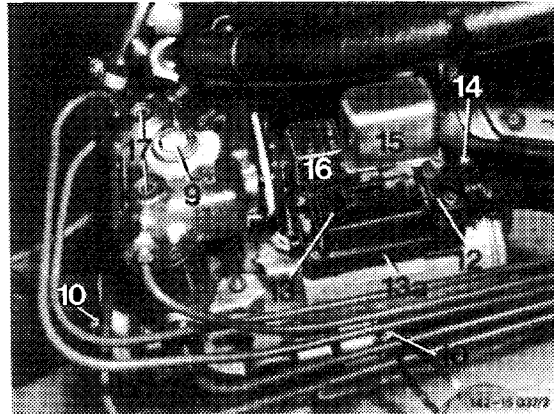
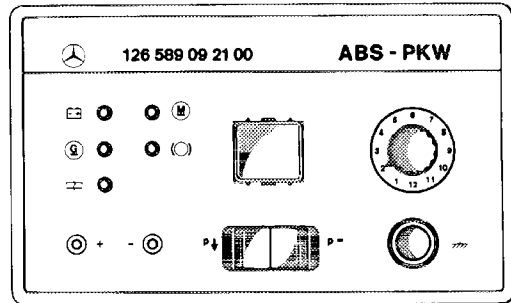
142-0103772





Test step 2 Testing valve relay (16).	
Actuation: Ignition on. Rotary switch in position 2.	
Readout	
Good	Fault
ABS indicator lamp off.	ABS indicator lamp on.
LED  ON	LED  OFF
LED  ON	LED  OFF
LED  ON	LED  OFF

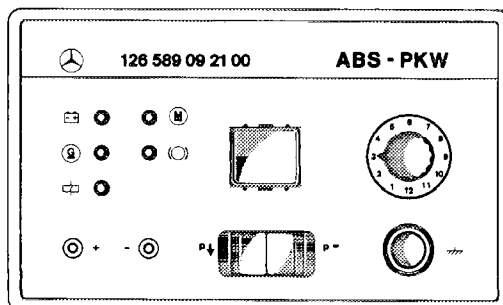
1. Valve relay (16) defective.
2. Connecting line interrupted.

Remedy

1. Renew valve relay (16).
2. Check connecting line.



Test step 3 Testing diode in hydraulic unit or in valve relay (volts).	
Note: Modified hydraulic unit without diode in plug socket since early 1986.	
Actuation: Ignition On. Rotary switch in position 3.	
Readout	
Good	Fault
ABS indicator lamp ON	ABS indicator lamp OFF
$U = 0.4 - 1.5 \text{ V}$	$U = < \text{(lower) } 0.4 \text{ V}$
LED  ON	LED  OFF
LED  ON	LED  OFF



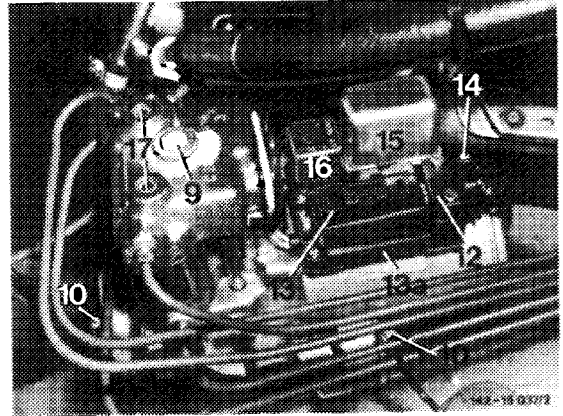
1. Valve relay (16) defective.
2. Diode of hydraulic unit or in valve relay (16) defective.
3. Connecting line interrupted or interchanged.

Remedy

1. Renew valve relay (16).
2. Replace hydraulic unit or valve relay (16).
3. Check connecting line.

Attention!

If the ABS indicator lamp goes out upon replacement of hydraulic unit with ignition switched on and the engine not running, also replace electronic control unit as a consecutive damage of the defective diode.



Test steps 4, 5 and 6

Test internal resistance, insulation resistance and exchangeability of rpm sensors VL (4), VR (5) and HA (6); (ohms and volts).

Actuation for testing internal resistance

Ignition on. Rotary switch consecutively to position 4 (VL), 5 (VR) and 6 (HA).

Actuation for testing insulation resistance

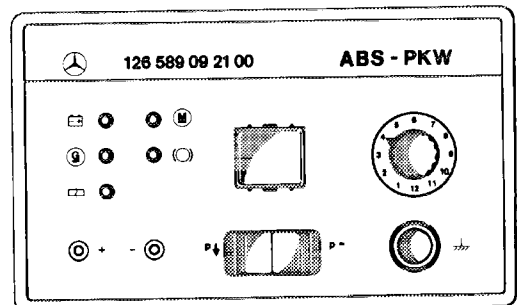
Ignition on. Rotary switch consecutively to position 4 (VL), 5 (VR) and 6 (HA). Push ground connection button.

Actuation for testing exchangeability





Ignition on. Rotary switch consecutively to position 4 (VL), 5 (VR) and 6 (HA). Turn respective wheel approx. 1 rev/sec.

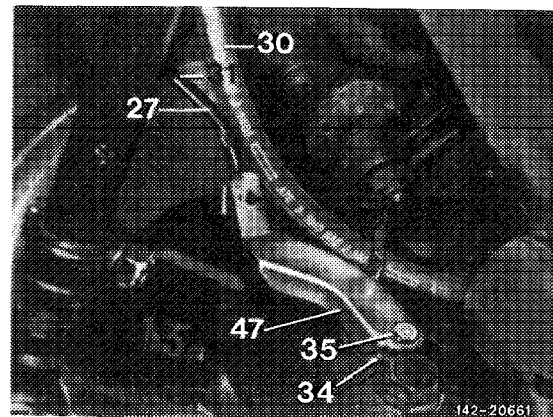
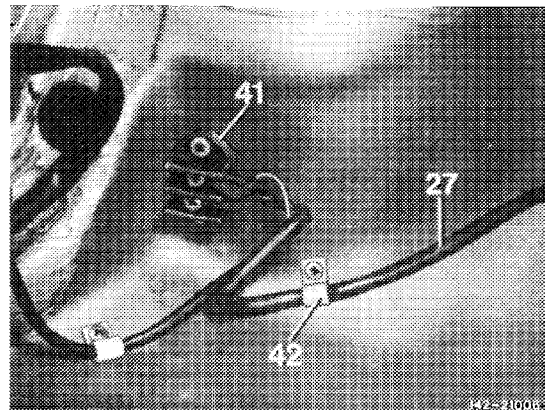
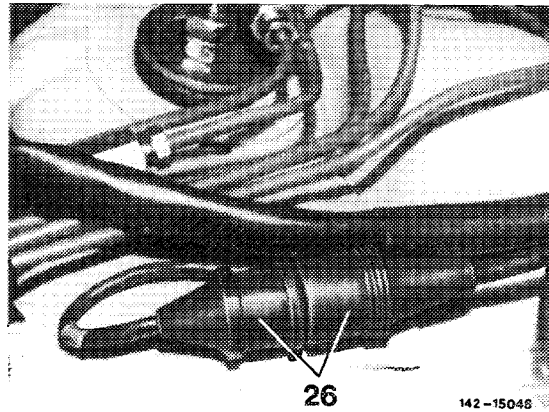
Note

1. When testing rpm sensor of rear axle, hold one wheel in place.
2. To simplify test sequence it will be of advantage to perform the test for pressure-holding or pressure reduction (test steps 8, 9 and 10) after testing for exchangeability.



1423-10275

Readout	
Good	Fault
LED  ON	LED  OFF
LED  ON	LED  OFF
ABS indicator lamp ON	ABS indicator lamp OFF
Internal resistance	Internal resistance
Front axle	Front axle
0.85 kΩ	< (lower) 0.85 kΩ
	> (higher) 2.3 kΩ
Rear axle	Rear axle
0.6 kΩ – 1.6 kΩ	< (lower) 0.6 kΩ
	> (higher) 1.6 kΩ
Insulation resistance	Insulation resistance
> (higher) 20 kΩ	< (lower) 20 kΩ
Exchangeability	Exchangeability
U ~ ≥ 0.1 V ~	0 V



Internal resistance test and exchangeability

1. Poor contact on coaxial plugs (26) or on cable connector (41).
2. Line to respective rpm sensor interrupted or interchanged.
3. Rpm sensor defective.
4. Wheel bearing play too high.

Insulation resistance test

1. Line to respective rpm sensor connected to ground.
2. Coaxial plug (26) or cable connector (41) connected to ground.
3. Rpm sensor connected to ground.

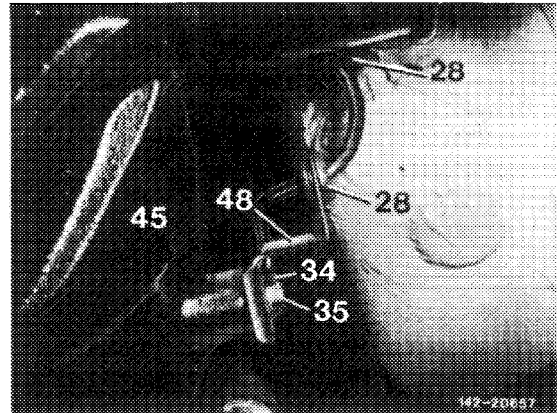
Remedy

Internal resistance test and exchangeability

1. Test coaxial plug or cable connector.
2. Check connecting lines.
3. Renew rpm sensor.
4. Adjust wheel bearing play.

Insulation resistance test

1. Test line toward rpm sensor.
2. Test coaxial plug or cable connector.
3. Renew rpm sensor.



Test steps 8, 9 and 10

Testing of internal resistance, of pressure holding and pressure reduction of solenoid valves, testing of return pump.

Actuation for testing internal resistance

Ignition off. Push grounding button. Rotary switch consecutively to position 8 (VL), 9 (VR) and 10 (HA).

Note

Pay attention to resistance of measuring line!

Actuation for testing pressure holding

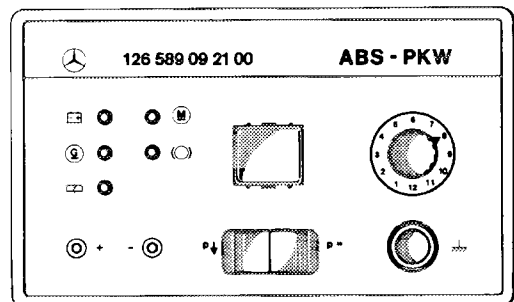
Ignition on. Rotary switch consecutively to position 8 (VL), 9 (VR) and 10 (HA). Turn respective wheel. Push P = – button. Operate brake pedal.

Actuation for testing pressure reduction















Ignition on. Rotary switch consecutively to position 8 (VL), 9 (VR) and 10 (HA). Operate brake pedal. Push P = – button. Turn respective wheel.

Note

After releasing P = – button, LED **M** should slowly go out.

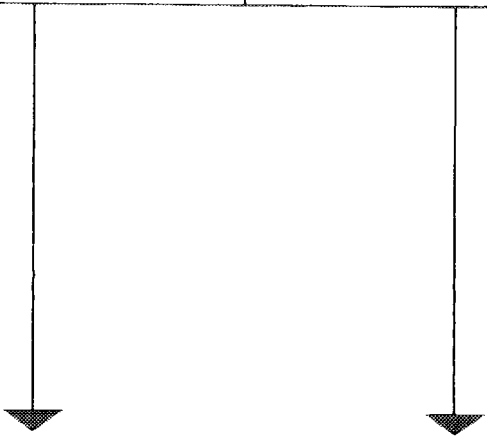


1423-10276

Readout	
Good	Fault
<p>Internal resistance 0.7 Ω – 1.7 Ω</p> <p>Pressure behavior LED  ON LED  ON LED  ON ABS indicator lamp OFF Wheel should permit turning.</p> <p>Pressure reduction LED  ON LED  ON LED  ON LED  ON ABS indicator lamp OFF Wheel should permit turning. Return pump running.</p>	<p>Internal resistance > (higher) 1.7 Ω < (lower) 0.7 Ω</p> <p>Pressure behavior LED  OFF LED  OFF LED  OFF ABS indicator lamp ON Wheel stops.</p> <p>Pressure reduction LED  OFF LED  OFF LED  OFF LED  OFF ABS indicator lamp ON Wheel cannot be turned. Return pump not running.</p>

Note: Test steps 8, 9 and 10 can also be performed on a drum dynamometer.
Observe the following:

Readout	
Good	Fault
<p>Pressure holding No brake force should build up.</p> <p>Pressure reduction The introduced braking force should be getting less. Return pump running.</p>	<p>Pressure holding Brake force building up.</p> <p>Pressure reduction The introduced braking force is not getting less. Return pump not running.</p>



Internal resistance test

1. Poor contact at plug connection on hydraulic unit.
2. Connecting lines interrupted.
3. Solenoid valve defective.

Pressure holding and pressure reduction

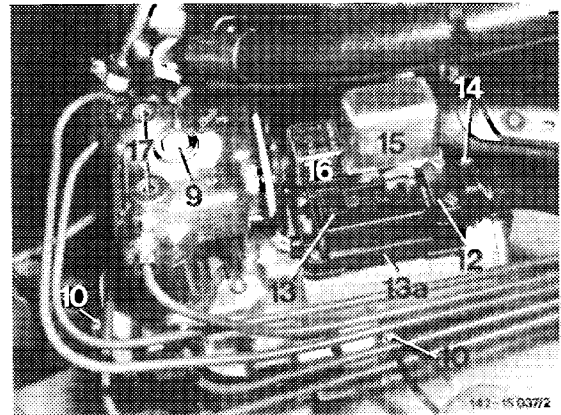
1. Motor relay (15) defective.
 2. Return pump defective.
 3. Solenoid valve defective.
-

Remedy**Internal resistance test**

1. Check plug connection.
2. Check connecting lines.
3. Renew hydraulic unit.

Pressure holding and pressure reduction

1. Renew motor relay (15).
 2. Renew hydraulic unit.
-

**Test step 12**

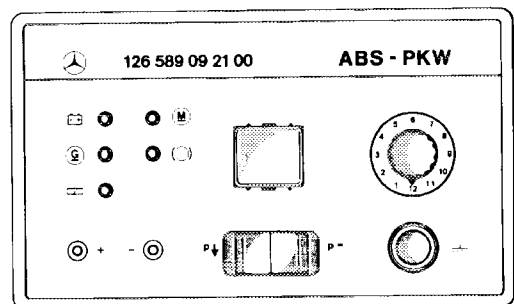
Testing overvoltage protection.

Attention!

An overvoltage protection with integrated relay for voltage supply of electronic control unit and an exchangeable fuse are installed since September 1981. During test the overvoltage protection version installed in vehicle must be plugged into test unit.

As of September 1985 the overvoltage protection has again been modified. It can be tested only together with protective adapter part No. 126 589 15 63 00.





As of September 1986 the overvoltage protection has 7 pins.



Actuation

Ignition On. Rotary switch in position 12.
Plug overvoltage protection of vehicle into
adapter and of adapter into vehicle.

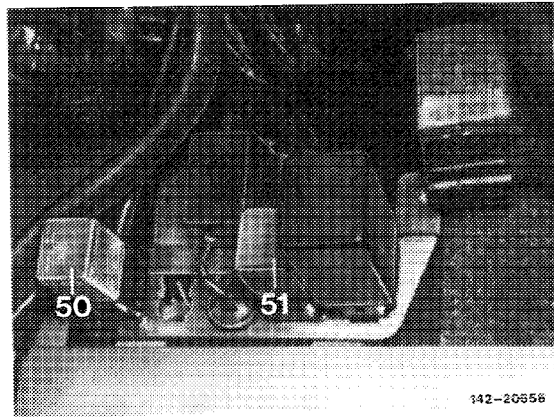
Readout

Good	Fault
LED  ON	LED  OFF
LED  ON	LED  OFF
ABS indicator lamp ON	ABS indicator lamp OFF
U = 0.4 – 1.5 V	U = < (lower) 0.4 V U = > (higher) 1.5 V

-
1. Overvoltage protection (51) defective.
-

Remedy

1. Renew overvoltage protection (51).



142-20556

Testing of stop lamp switch**Note**

Only possible with modified cable harness,
installed as of February 1984. The stop lamp
switch is connected to 35-pole plug on pin 25.

Actuation

Ignition On. Operate brake pedal.

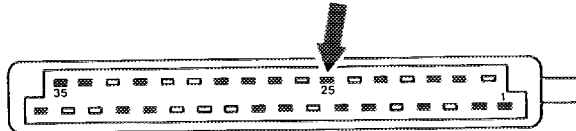
Readout

Good	Fault
LED (0) On	LED (0) Off

-
1. Stop lamp switch defective.
 2. Connecting line interrupted.
-

Remedy

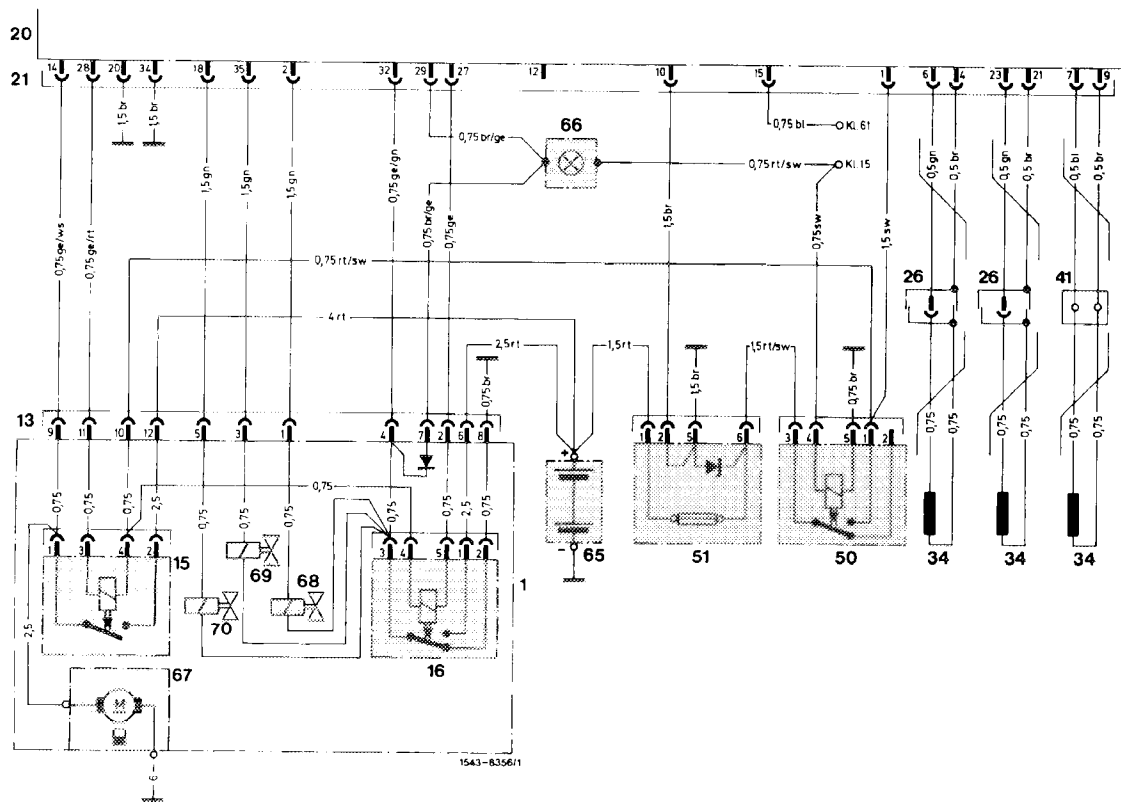
1. Renew stop lamp switch.
2. Check connecting line.



1424-12 247

End of test

Electric wiring diagram
 (Electronic control unit 1st version
 Indicator lamp goes out after 5 km/h).



- | | | | |
|----|-------------------------------------------|----|-----------------------------------------------------|
| 1 | Hydraulic unit | 50 | Relay for voltage supply of electronic control unit |
| 13 | Plug socket of hydraulic unit | 51 | Overvoltage protection |
| 15 | Relay for return pump motor | 65 | Battery |
| 16 | Relay for solenoid valve | 66 | ABS indicator lamp |
| 20 | Electronic control unit | 67 | Return pump motor |
| 21 | Multiple plug for electronic control unit | 68 | Solenoid valve for front axle left |
| 26 | Coaxial plug | 69 | Solenoid valve for front axle right |
| 34 | Rpm sensor | 70 | Solenoid valve for rear axle |
| 41 | Cable connector | | |

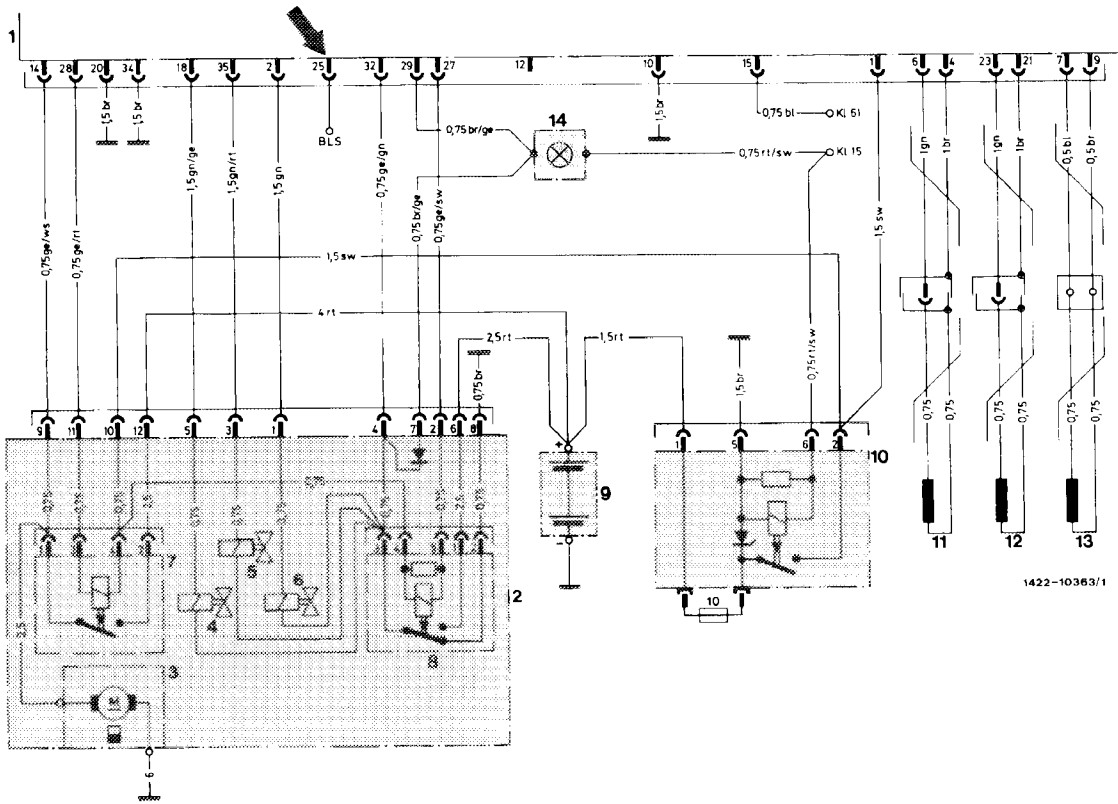
Electric wiring diagram

(Electronic control unit 2nd version

Indicator lamp goes out when engine is started).

(Electronic control unit 3rd version with green or blue Bosch type rating plate

Stop lamp switch included in ABS logics, pin 25, arrow)



1422-10363/1

- 1 Electronic control unit
- 2 Hydraulic unit
- 3 Return pump motor
- 4 Solenoid valve for rear axle
- 5 Solenoid valve for front axle right
- 6 Solenoid valve for front axle left
- 7 Relay for return pump motor
- 8 Relay for solenoid valves

- 9 Battery
- 10 Overtoltage protection and relay for voltage supply of electronic control unit
- 11 Rpm sensor front axle left
- 12 Rpm sensor front axle right
- 13 Rpm sensor rear axle
- 14 ABS indicator lamp