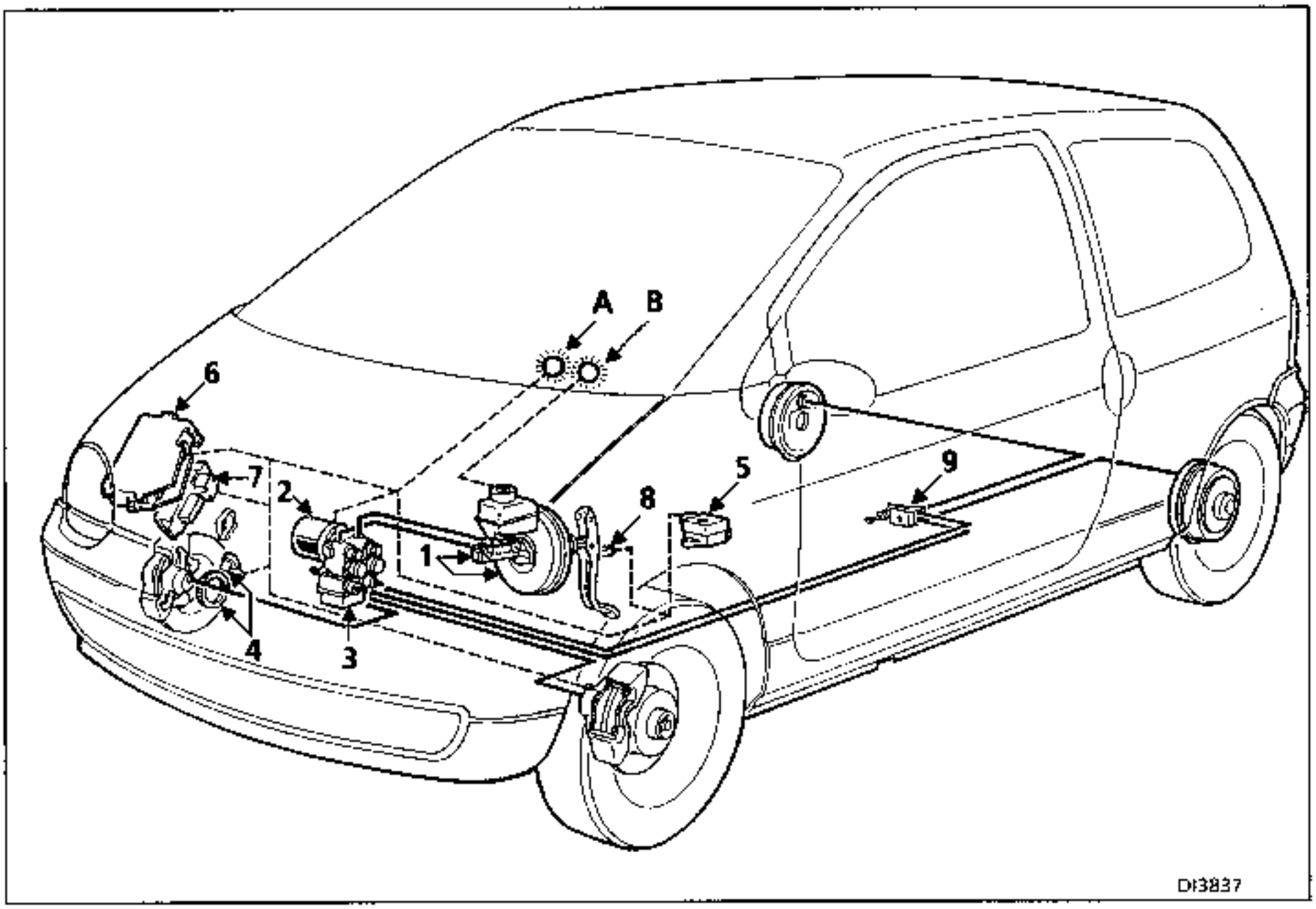
PRESENTATION OF THE MARK IV G TEVES ABS SYSTEM



Hydraulic connections
Electrical connections

1 Vacuum amplifier (master cylinder + brake servo).
2 Pump - motor.
3 Solenoid valve assembly.
4 Toothed target - Speed sensor
5 Acceleration sensor
6 Computer
7 Relay unit
8 Stop lights switch
9 Compensator

A ABS warning light
8 Nivocode warning light

RECOMMENDATIONS CONCERNING THE HANDLING OF THE VARIOUS TEVES ABS SYSTEM COMPONENTS

The vacuum amplifier (master cylinder + brake servo)

- Do not handle the part by the piston stem when transporting it.
- Do not handle the part by the vacuum take-off point.
- Remove protectors only when the part is to be fitted.
- Avoid impacts (do not drop the part).
- Store under dry conditions (avoid humidity and pollution).
- Observe the recommended packaging storage position for transport.
- Do not place parts one on top of another (individual packing).
- Observe the recommendations for use when draining or adding fluids.
- Never use mineral fluids.

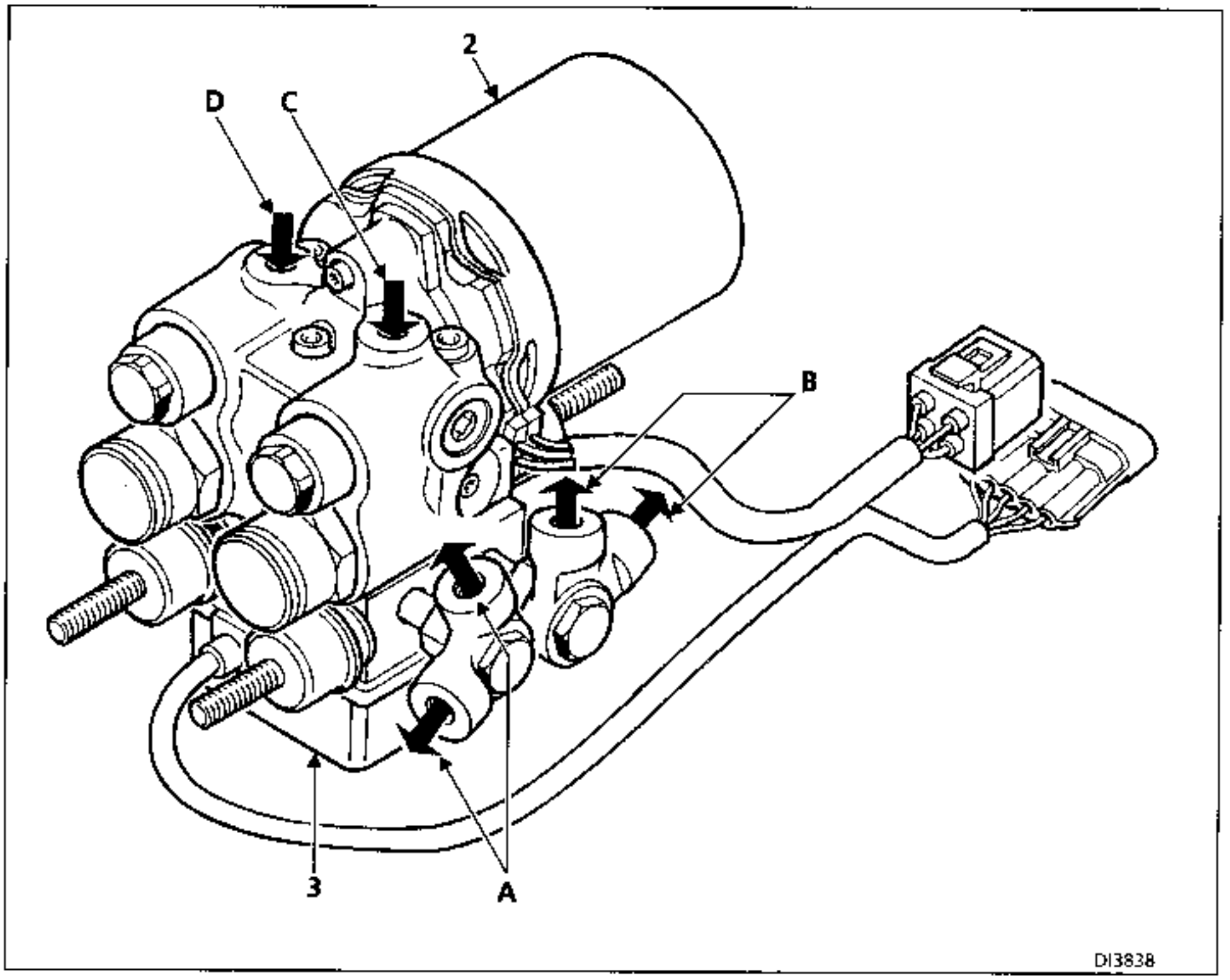
The hydraulic regulation assembly (pump - motor + solenoid valves)

- Observe the recommended packaging storage position for transport.
- Do not pull on the electrical wiring - do not carry the part by the wiring.
- Remove protectors only when the part is to be fitted.
- Avoid impacts (do not drop the part).
- Do not place parts one on top of another (individual packing).
- Store under dry conditions (avoid humidity and pollution).
- Observe the recommended storage time.
- Never operate the pump by external means if the brake pedal has been mechanically blocked.

The wheel sensors

- Do not twist the cable when fitting.
- Do not pull on the cable guides.
- Observe the recommended tightening torques.
- Use grease when fitting.

Presentation of the hydraulic regulation assembly.



2 Pump motor.

3 Regulating solenoid valves.

A Regulation assembly outlet pipe to front left hand and rear right hand wheels.

B Regulation assembly outlet pipe to front right hand and rear left hand wheels.

C Inlet pipe from master cylinder (primary circuit).

D Inlet pipe from master cylinder (secondary circuit).

ELECTRONICALLY CONTROLLED HYDRAULIC SYSTEMS
TEVES ABS

INTRODUCTION

DESCRIPTION

The "MARK IV G" ABS system comprises the following components :

- a vacuum amplifier with dual master cylinder and reservoir (1),
- a hydraulic regulation assembly comprising:
  - a dual circuit pump - motor assembly (2),
  - an inlet and outlet solenoid valve assembly (3).
- 2 target - sensor assemblies (on the front wheels) (4),
- an accelerometer sensor (5),
- a separate computer (6),

"MARK IV G" TEVES ABS is of the additional type.

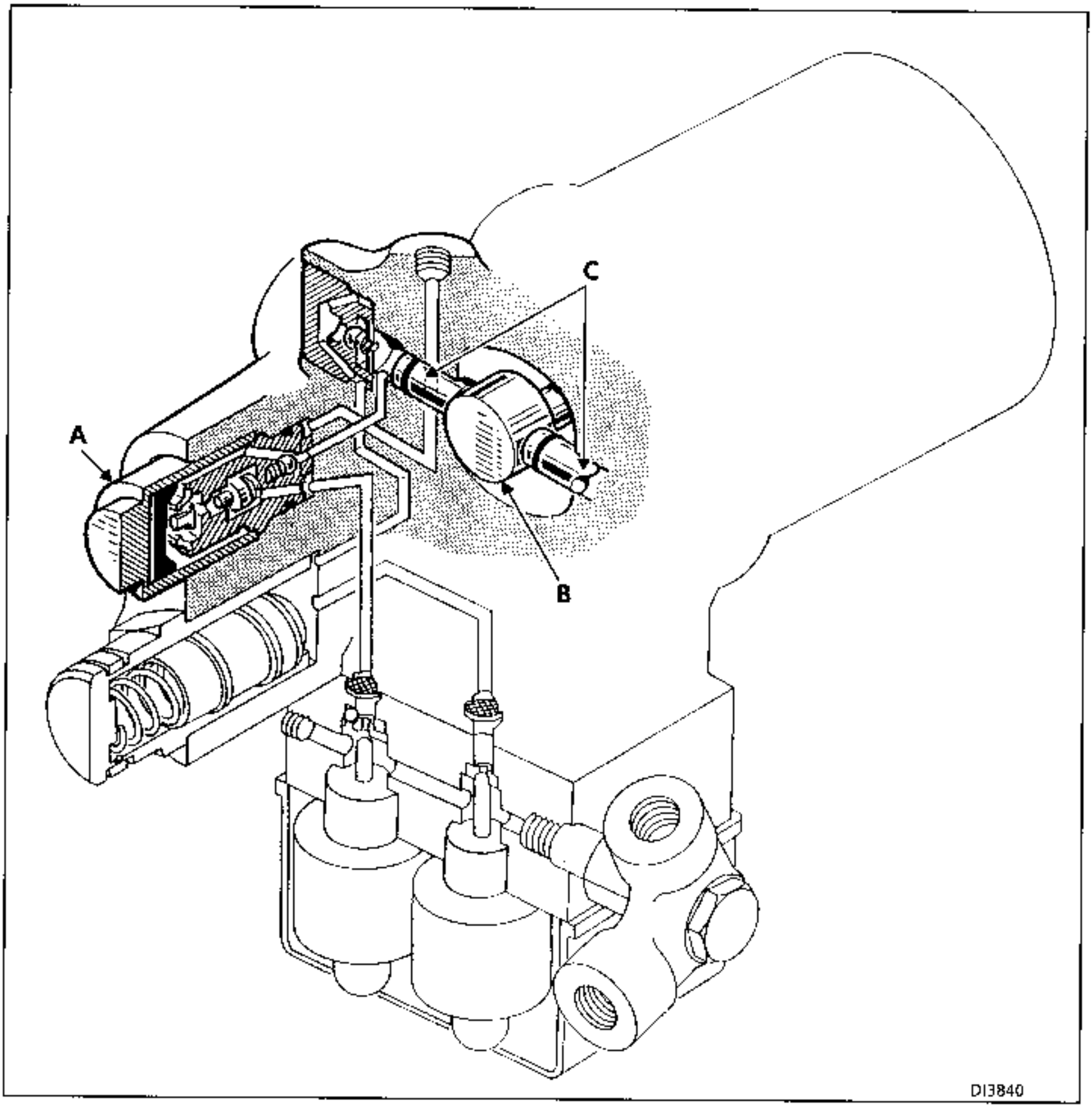
The system comprises a hydraulic assembly which is fitted in addition to the conventional braking system (master cylinder and brake - servo)

SPECIAL POINTS

The system has two speed sensors and an accelerometer sensor. Each hydraulic braking channel has a sensor at the front wheel and a regulation channel.In this way the front right hand wheel and the rear left hand wheel are regulated together, as are the front left hand wheel and the rear right hand wheel. The compensator retains its conventional function.

DESCRIPTION OF THE COMPONENTS

- the pump - motor assembly



A Damping chamber. This chamber reduces noise generated by oscillations in pressure at the pump outlet.

B Eccentric drive.

C Pistons.

The pump - motor assembly is an electric motor with a dual circuit hydraulic pump.

Role

During a regulation phase (drop in pressure), the pump returns fluid from the brakes to the master cylinder. This return of fluid can be noticed by movement of the brake pedal.

Location

The primary and secondary master cylinder circuits are each connected on the return side to a pump circuit.The assembly is electrically connected to the computer.

Operation

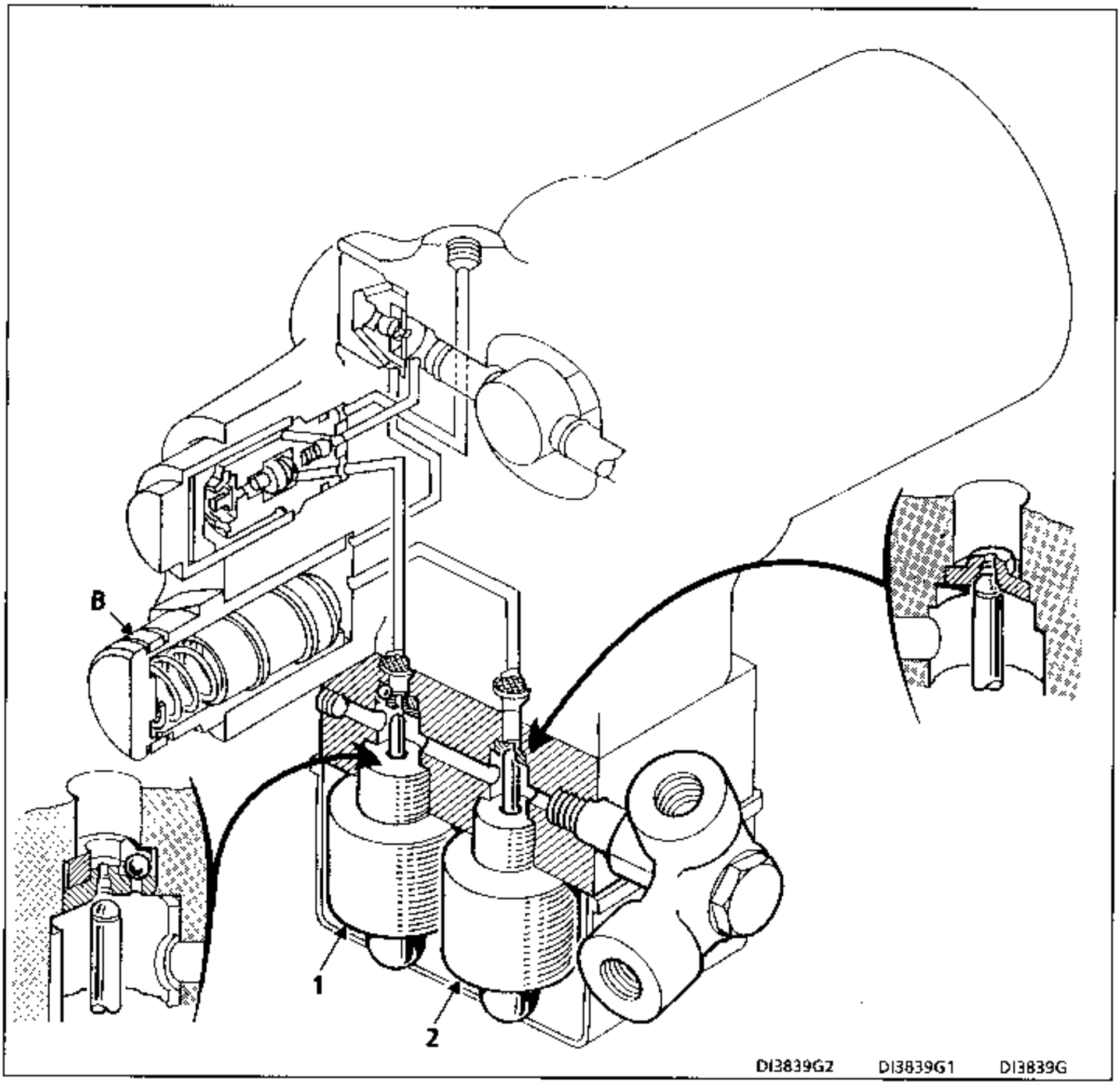
The electric motor shaft has an eccentric drive which converts the rotary movement into the alternate travel of the two pistons, positioned in opposition.
The computer monitors the motor using an integral inductive sensor. This sensor sends a sinusoidal signal via two separate lines (terminals 31-49 on the computer). If there is a fault with the electrical motor, the ABS function is immediately cancelled and the warning light on the instrument panel is illuminated.

Specifications

- Pressure : intake : ambient pressure
  return : dependent on the action at the brake pedal, corresponds closely to the pressure exerted at the pedal.
- Motor output : 250 Watts.
- Consumption : 32 amps at 200 bars.

DESCRIPTION OF THE COMPONENTS

- The solenoid valves



1 Inlet solenoid.

2 Outlet solenoid.

B Low pressure accumulator (see page 8).

DESCRIPTION OF THE COMPONENTS

- Low pressure accumulator (B):

This contains the brake fluid from the outlet solenoid when there is a large variation in adherence (change from high to low adherence).
The pressure level required to fill the low pressure accumulator must be sufficiently low to have no effect on the pressure drop during regulation, but must be sufficiently high to ensure the rating of the pump inlet non-return valve is exceeded in all circumstances.
The average flow from the pump is less than the maximum flow volume in a low pressure situation.
Each braking circuit has an inlet solenoid which is open when at rest and an outlet solenoid which is closed when at rest.
The separate or simultaneous action of the solenoids modulates the pressure in the braking circuits.

Location

The hydraulic connections are incorporated in the flange and pipes connect the solenoids to the wheels. The assembly is electrically connected to the computer.

Operation

The solenoid valves have one solenoid and a moving armature which opens and closes the valve. The rest position is assured by the joint action of an incorporated spring and hydraulic pressure. Filters protect the inlets.
In order to be able to reduce the pressure at the brakes at any moment, regardless of the electrical status of the valve, a non-return valve has been included in the inlet solenoid. This valve opens when the "master cylinder" pressure is less than the caliper pressure.

Example : brakes released during regulation.

Specifications

• Voltage		: 12 volts continuous
• Operating pressure		: 180 bar maximum.
• Switch time		: < 3 ms.
• Resistances :	inlet	: ≈ 6 Ω
	outlet	: ≈ 3 Ω
• Consumption:	inlet	: 2 A at 13 V
	outlet	: 3.9 A at 13 V

DESCRIPTION OF THE COMPONENTS

- **The computer**

Operational mode

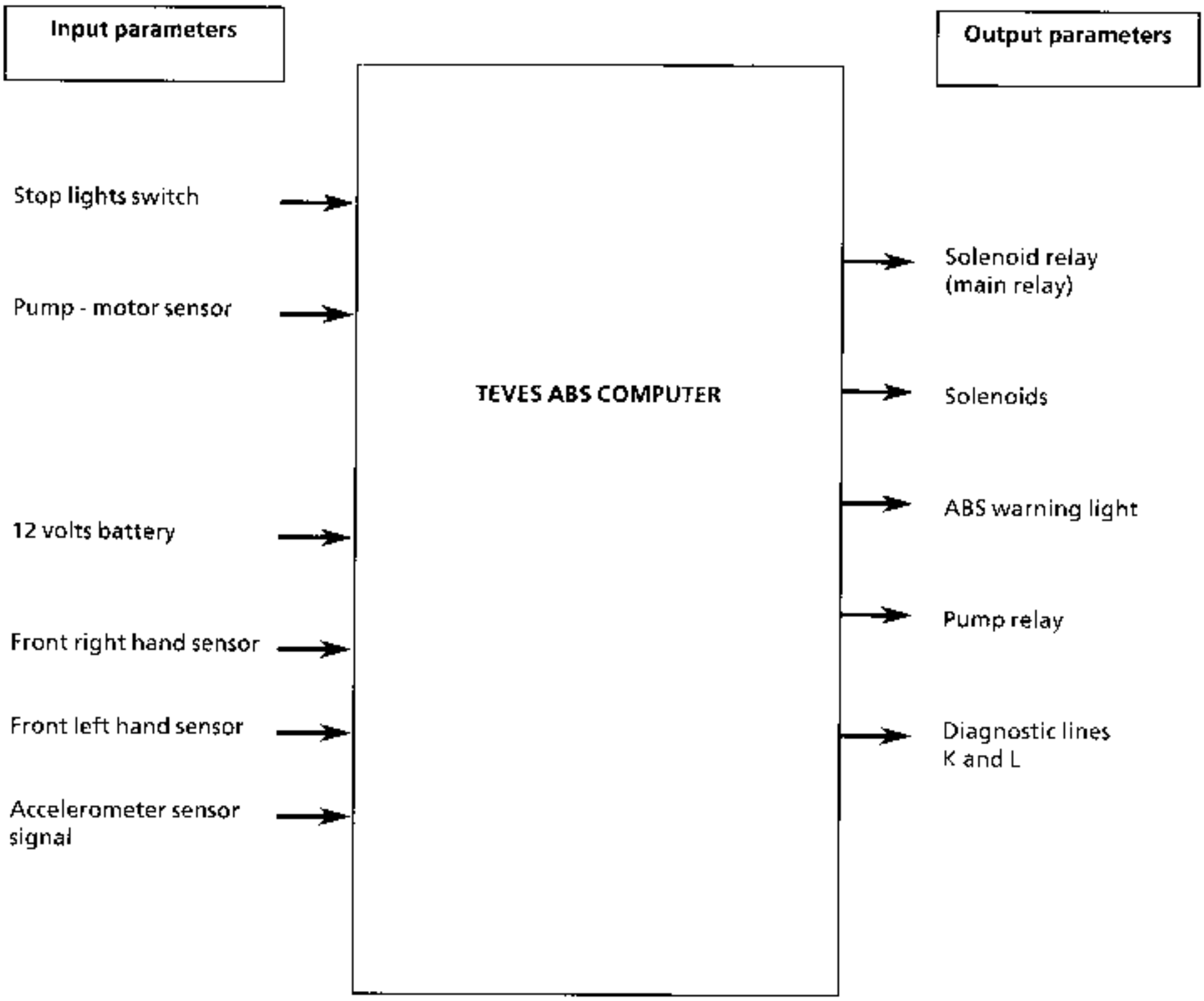
The information measured by the sensors is transformed electrically and processed in parallel by two microprocessors.
After amplification, the output signals are used to control the solenoids and the pump - motor.

Safety

The computer operates according to the principle of symmetrical redundancy: Verification of the conformity of internal signals (eg. : reference speed) and external signals (eg. : solenoid control) is carried out by using identical microprocessors.
If the signals do not conform, or if there is a breakdown or fault in the ABS system, the computer limits the operation of the systems according to an appropriate procedure. The fault is signalled by the warning light on the instrument panel and may be interpreted using the diagnostic test kit (XR25).

The complete system - sensors, electrical connections and solenoids - is under constant surveillance.

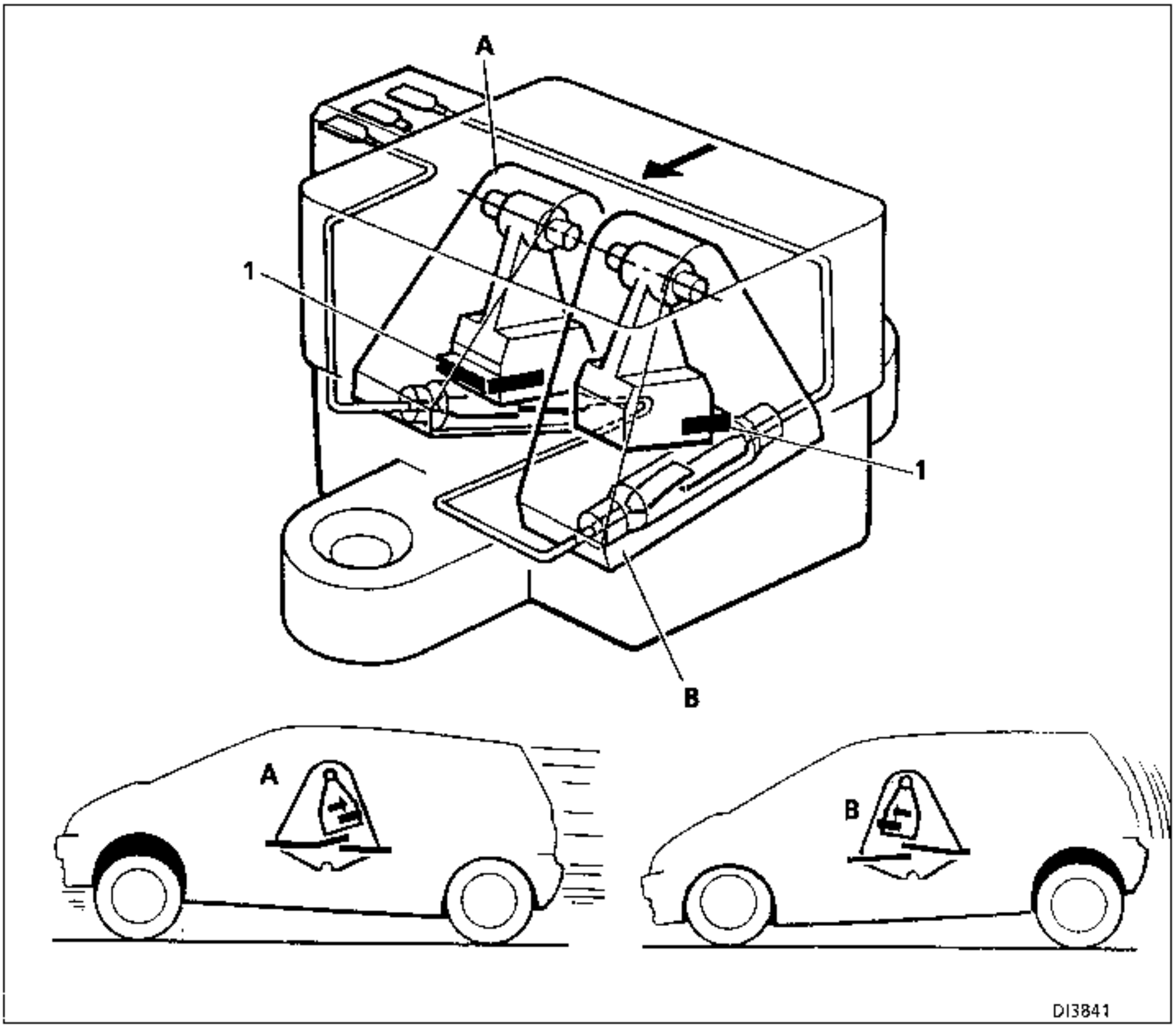
PARAMETERS MANAGED BY THE ABS COMPUTER



DESCRIPTION OF THE COMPONENTS

- **The accelerometer sensor**

This is located in the central console.



1 Magnet

A Acceleration sensor

B Deceleration sensor

Principle

The sensor supplies signals to the computer for two pre-determined thresholds (deceleration on braking in forwards and reverse gears).The sensor also reacts to corresponding acceleration of the vehicle in the direction opposite to the direction of vehicle travel.

The sensor has two pendular switches which, when correctly fitted, are closed in the rest position and during normal driving with slight acceleration or deceleration. When a threshold is reached, the switch opens. If the vehicle is on horizontal ground, both switches are closed (connections to terminals 25 -26 on the computer).

Technical specifications

- Sensor type : pendular switch.
- Resistance value : 0 Ω or infinity.

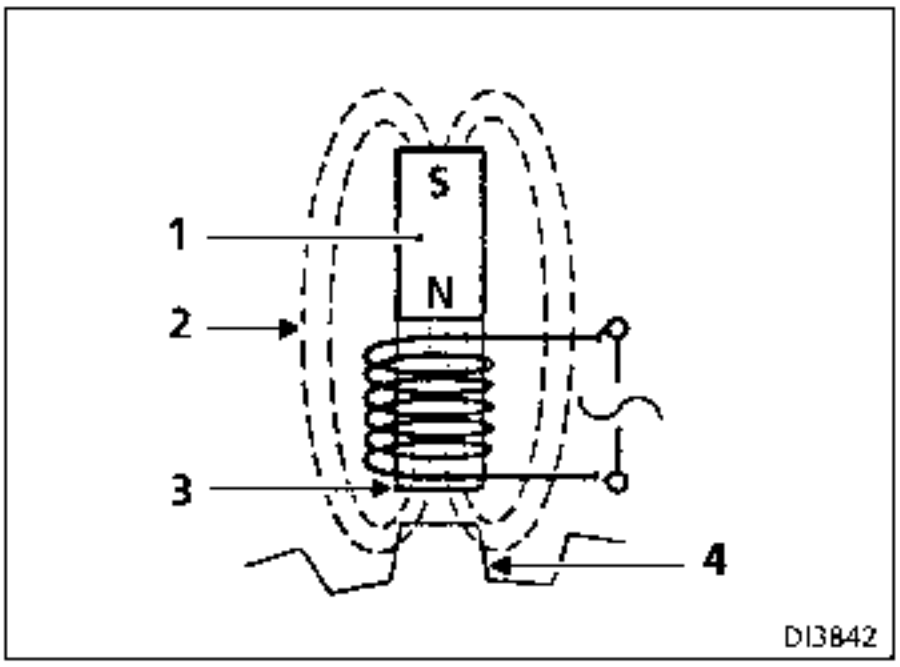
DESCRIPTION OF THE COMPONENTS

- **Speed sensors and target**

The wheel sensors measure the speed of each wheel at any given moment.

They operate according to the induction principle. There are two permanent magnets and a coil in the head of each sensor.

The magnetic flux is modified by the passing by of the target teeth. The variation in the magnetic field through the coil generates a quasi-sinusoidal alternating voltage whose frequency is proportional to the rotation speed of the wheel. The amplitude of the voltage depends on the air gap between the tooth and the sensor.

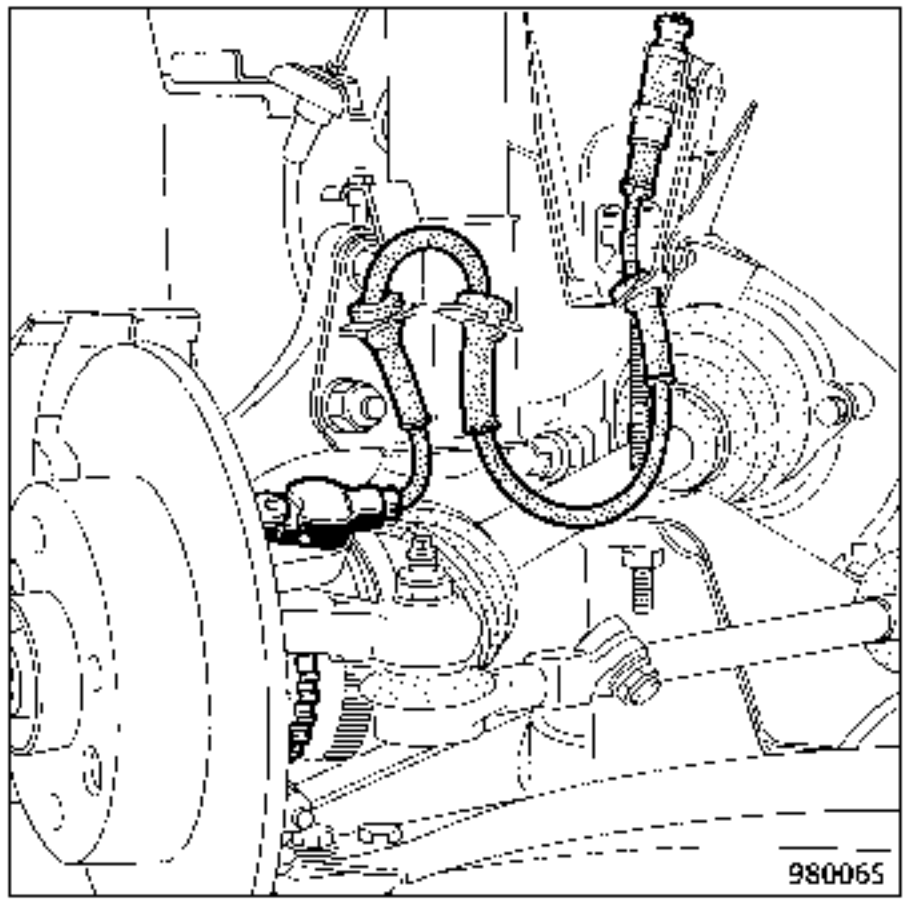


1 Magnet
2 Field lines
3 Polar mass
4 Target

The speed sensors are mounted on the stub axles and receive information from the toothed targets (38 teeth).

Front wheels

Targets embedded in driveshafts.
Axial sensors - non-adjustable.
Air gap: 1 mm ± 0.7.
Resistance : 1.1 kΩ ⊥ 200 Ω.



Electrical operation of the system

When the ignition is turned on, the computer is electrically fed with + after ignition feed (terminal n° 53).
Connections to vehicle earth are on terminals 1 and 19.

The computer earths terminal 34, activating the main relay. Battery voltage arrives via the fuse and the main relay terminals on computer terminals 3 and 33 . Terminals 14 and 15 on the relay board are also fed.

The computer then carries out its "setting up" cycle (2 second sensor test, solenoid test) and is then ready for operation.

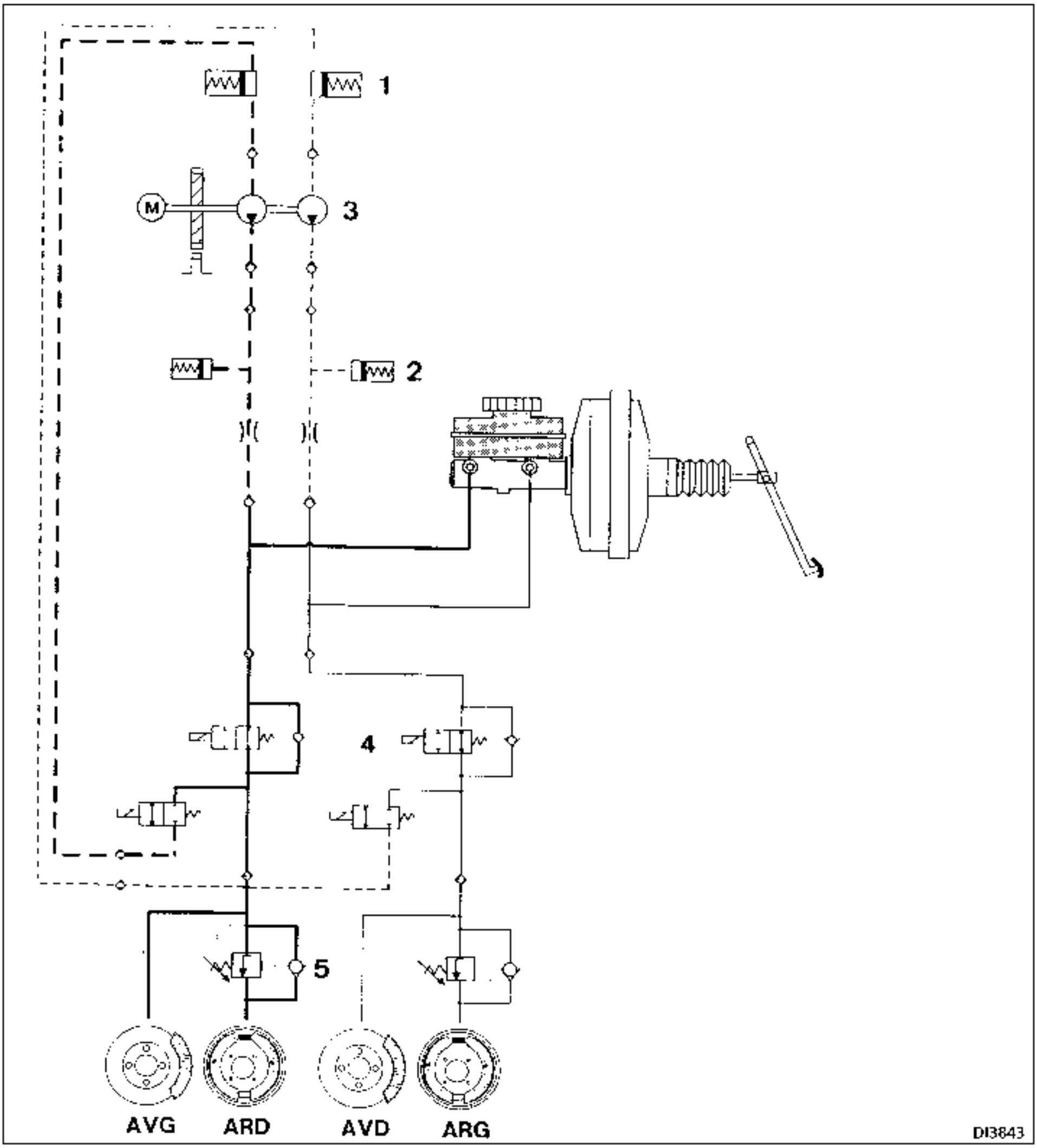
The wheel sensors

Measurement is effective from 1.25 mph (2 km/h).

The solenoids

When the ignition is turned on the solenoids are connected to battery voltage. They are then controlled by successive earthings.

HYDRAULIC OPERATION OF THE SYSTEM



KEY

1 Low pressure accumulator

2 Damping chamber

3 Pump - motor

4 Solenoids

5 Compensator

HYDRAULIC OPERATION OF THE SYSTEM (cont)

In the rest position, the central master cylinder valves are open so that the chambers upstream and downstream are connected. The inlet solenoid valves are open, the outlet solenoid valves are closed. The hydraulic pump is not operating.

Braking without regulation (braking moment < adherence moment)

After closing the central valves, hydraulic pressure is built up, determining a braking moment proportional to the action of the foot on the brake pedal. The solenoid valves and the pump remain at rest.

Braking with regulation (braking moment > adherence moment)

Remember that a change in state of a solenoid valve affects both one front wheel and one rear wheel at the same time.

There are three main states:

- maintenance of pressure,
- reduction in pressure,
- increase in pressure.

Maintenance of pressure

The inlet solenoid valve closes and isolates the master cylinder from the wheel caliper.
Braking pressure cannot be increased.

Reduction in pressure (reduction in the tendency to lock)

This phase is only used if the maintenance of pressure phase has not proved sufficient
The inlet solenoid valve remains closed.The outlet solenoid valve opens and the pump begins to operate at the same time.
The action of the pump allows the fluid stored in the accumulators to be returned to the master cylinder.

Increase in pressure (increase in braking)

The outlet solenoid valve closes and the inlet solenoid opens. The master cylinder is once more connected to the wheel caliper.
Hydraulic supply is assured by the master cylinder and also by the pump (if the accumulator has not been drained).
Since the volume of brake fluid transported is generally greater than the volume passing from the consumers to the low pressure accumulators, the accumulators only serve as intermediate accumulators for short periods of flow. The pump returns the brake fluid from the low pressure accumulators to the braking circuits.

Note : The braking pressure may be reduced at any moment, regardless of the electrical state of the solenoid valves, by releasing the brake pedal. The reduction in pressure is made by the non-return valve which is positioned in parallel to the inlet solenoid.

When the brake pedal is released the central valves allow the pressure between the reservoir and the master cylinder to be equalised.

Electrical state of the solenoid valves and the motor.

	Inlet	Outlet	Motor / Pump	
Increase	0	0	0	Without regulation
Maintain	1	0	1	Without regulation
Reduce	1	1	1	
Increase	0	0	1	

0 : not supplied with voltage

1 : supplied with voltage

Regulation principle

The two target and sensor assemblies for the wheels provide the computer with two signals corresponding to the speed of each front wheel at any given moment. A complementary signal is also used from the acceleration sensor.

Processing of sensor signals

After the wheel speed signals have been transformed (transformation of the sinusoidal signal to a square signal), both the signals from the sensors and the accelerometer signal are used to determine the **reference speed**.

Role of the signal from the accelerometer sensor

- The information from the accelerometer sensor is used to help determine the reference speed
- The absence of information from the rear wheels is compensated for in part by the information from this sensor
- The tendency to lock of both front wheels would, if no other information were available, lead to the determination of an incorrect reference speed (actual vehicle speed greater than reference speed).
- The sensor allows acceleration phases to be distinguished from deceleration phases.
- On deceleration, the opening and closing of the switches allows two types of adherence to be recognised; low adherence and medium / high adherence.

Given that for each type of adherence, a certain deceleration cannot physically be exceeded, the limits are defined.

The decrease in the reference speed can therefore be limited.

The reference speed is used to approximate the actual vehicle speed.

Slip
This is calculated by comparing the speed of each front wheel with the vehicle reference speed.

Acceleration
This is the variation in front wheel rotation speed by unit of time.

Programming for regulation and hydraulic intervention

The aim of this phase is to process and analyse the regulation parameters, together with the signal from the stop switch, in order to prepare the control signals for the solenoid valves and the pump.
When there is instability at one or both of the front wheels (when slip of the wheel or wheels concerned exceeds a pre-determined slip threshold) a process is launched to determine the driving conditions.
Depending on the driving conditions and the slip at each of the wheels, the regulation programming generates control signals for the solenoid valves and the pump.

Role of the stop switch

- The information from the stop switch allows the computer to adapt the slip threshold to a pre-determined value.
- If this information is not present, a regulation cycle cannot be started under optimum conditions, causing :
  - jerky regulation.
  - a high degree of wheel slip or a risk of losing steering control.

SELF DIAGNOSIS

- **Safety - monitoring**

A certain number of tests are performed when the ignition is turned on and when the vehicle is started under the following conditions:

1) Tests after turning the ignition on

During this phase, the following points are checked:

- internal microprocessor tests,
- connection tests (voltage feed (excess voltage), main relay, solenoid valve connections, speed sensor connections)
- fault memory control operation.

When this phase is complete the ABS warning light on the instrument panel is extinguished after 2 seconds, if all the tests are correct.

2) Tests after the vehicle has started moving for the first time

This test concerns the first wheel revolutions after the ignition has been turned on. The test is carried out as soon as the vehicle speed reaches 6.25 mph (10 km/h).

- Acceleration sensor (open circuit, short circuit, no regulation).
- Speed sensor coherence check.
- Test of the pump - motor*.

In this phase the pump - motor return information is checked after switching the motor on for a few milliseconds.

* This test is carried out at 18.75 mph (30 km/h).

IMPORTANT !
Any fault which occurs when the ABS is "not operational" is not taken into account.

TEVES ABS SYSTEM SELF DIAGNOSIS

Fault with ignition on, vehicle stationary

Component tested	Type of test	Test conditions	Customer complaint	Fault memorised
ABS warning light	Visual	Illuminated for 2 seconds after ignition turned on	Does not illuminate	No
Computer	Redundancy test	Test carried out when ignition turned on	No ABS + warning light illuminated	Yes
Battery feed	Feed check	a) U batt < 9.5 volts b) U batt > 16.5 volts	Wait mode + warning light illuminated No ABS + warning light illuminated	No Yes
Diagnostic connection	NOT TAKEN INTO ACCOUNT Diagnostic lines L and K are not tested when voltage is applied to the computer. If line L is earthed the diagnostic mode cannot be entered.			
Solenoid valves	CO , CC	Continuity test carried out continuously	No ABS + warning light illuminated	Yes
Stop lights switch	NOT TAKEN INTO ACCOUNT			
Main relay	CO , CC	Taken into account immediately	No ABS + warning light illuminated	Yes

TEVES ABS SYSTEM SELF DIAGNOSIS (cont)

Component tested	Type of test	Test conditions	Customer complaint	Fault memorised
Speed sensors	CO , CC	CO, CC for more than 250 ms.	No ABS + warning light illuminated	Yes
Pump relay	Not taken into account			
Pump sensor	Not taken into account			

TEVES ABS SYSTEM SELF DIAGNOSIS

Faults while driving (speed > 6.25 mph (10 km/h))

Component tested	Type of test	Test conditions	Customer complaint	Fault memorised
Computer	Continuous test	While driving	No ABS + warning light illuminated	Yes
Feed	Feed check	U batt < 9.5 volts	No ABS + warning light illuminated	No
		U batt > 16.5 volts	No ABS + warning light illuminated	Yes (main relay fault)
Diagnostic connections	Not taken into account Line K or L			

TEVES ABS SYSTEM SELF DIAGNOSIS (cont)

Component tested	Type of test	Test conditions	Customer complaint	Fault memorised
Speed sensors	Intermittent fault CC, CO	Speed < 12.5 mph (20 km/h) Time > 500 ms 12.5 mph (20 km/h) < Speed < 25 mph (40 km/h) Time > 500 ms	No ABS + warning light illuminated No ABS + warning light illuminated	Yes (sensor circuit fault)
		Speed > 25 mph (40 km/h) Time > 70 ms	No ABS + warning light illuminated	Yes (sensor circuit fault)
Speed sensors	Speed comparison between 2 wheels	a) Faster wheel speed > 12.5 mph(20 km/h) and slower wheel speed < 3.75 mph (6 km/h) after 2 minutes.	No ABS + warning light illuminated	Yes (sensor circuit fault)
		b) Faster wheel speed > 25 mph(40 km/h) and slower wheel speed < 60 % of faster wheel speed after 2 minutes.	No ABS + warning light illuminated	Yes (sensor circuit fault)
Speed sensors	Long term surveillance	Outlet solenoid energised for longer than 28 seconds	No ABS + warning light illuminated	Yes (sensor circuit fault)
Pump relay Pump - motor Pump sensor	CC, CO	The pump is tested if the following two conditions are met: 1) Wheel speed > 18.75 mph (30 km/h) 2) Stop switch not activated	No ABS + warning light illuminated	Yes
Stop lights switch	Not taken into account			

TEVES ABS SYSTEM SELF DIAGNOSIS (cont)

Component tested	Type of test	Test conditions	Customer complaint	Fault memorised
Acceleration sensor	CC –	Not in regulation phase and stop lights switch not activated	No ABS + warning light illuminated	Yes
	CC			
	CO	Wheel speed > 31.25 mph (50 km/h) and time > 2 minutes; not in regulation phase and stop lights switch not activated	No ABS + warning light illuminated	Yes

KEY

CO Electrical connection or component in open circuit.
CC Electrical connection or component in short circuit.
CC – Electrical connection or component in short circuit to earth or permanently controlled.

ABS COMPUTER PROGRAMMING

If there is a fault when the ignition is turned off, the fault is stored in the computer's memory.

This memory may be read at any time by the test kit **XR 25** using the appropriate cassette. Turning the ignition off and on again may however modify the interpretation of the bargraphs in certain cases. To avoid any confusion, a road test must be carried out (1) where the vehicle shows the fault (intermittent or permanent illumination of the ABS warning light) so that the diagnostic signal may be read **without having to turn the ignition off.**

(1) After erasing the memory (GO**). As a precaution note the bargraphs memorised so that fault finding may be carried out if the road test is not able to reproduce the fault.

Types of fault

a) ***Permanent fault***
A fault is "permanent" when it appears (ABS warning light illuminates) and is shown on the **XR 25** by fixed illumination of a bargraph other than 1 and 13 right hand side.

b) ***Intermittent fault***
A fault is "intermittent" after it has been memorised and has disappeared (shown on the **XR 25** by a flashing bargraph).

Important notes

If a fault appears in the computer diagnostic signals the ABS is put out of service by cutting the main relay coil earth. In this case the computer permanently illuminates the bargraphs corresponding to all the faults previously memorised (even if they were intermittent).

If several faults appeared at the same time, only one will be memorised. It is therefore important that when this fault has been repaired a new test is carried out after a road test.

Conditions for entering diagnostic mode:

- if no fault is present → Speed < 6.25 mph (10 km/h),
- if faults are present → diagnostic mode may be entered regardless of speed.

FAULT FINDING WITH THE XR 25

The **XR25** test kit must be used for all fault finding on the ABS system, regardless of the origin of the fault.

Communication between the computer and the **XR25** allows:

- the computer to be identified (31 X . 5),
- fault information stored to be read,
- system parameters to be read (wheel speed),
- the solenoids and pump motor to be controlled,
- the fault memory to be erased (erase the memory after each operation on the ABS).

Initialisation of dialogue

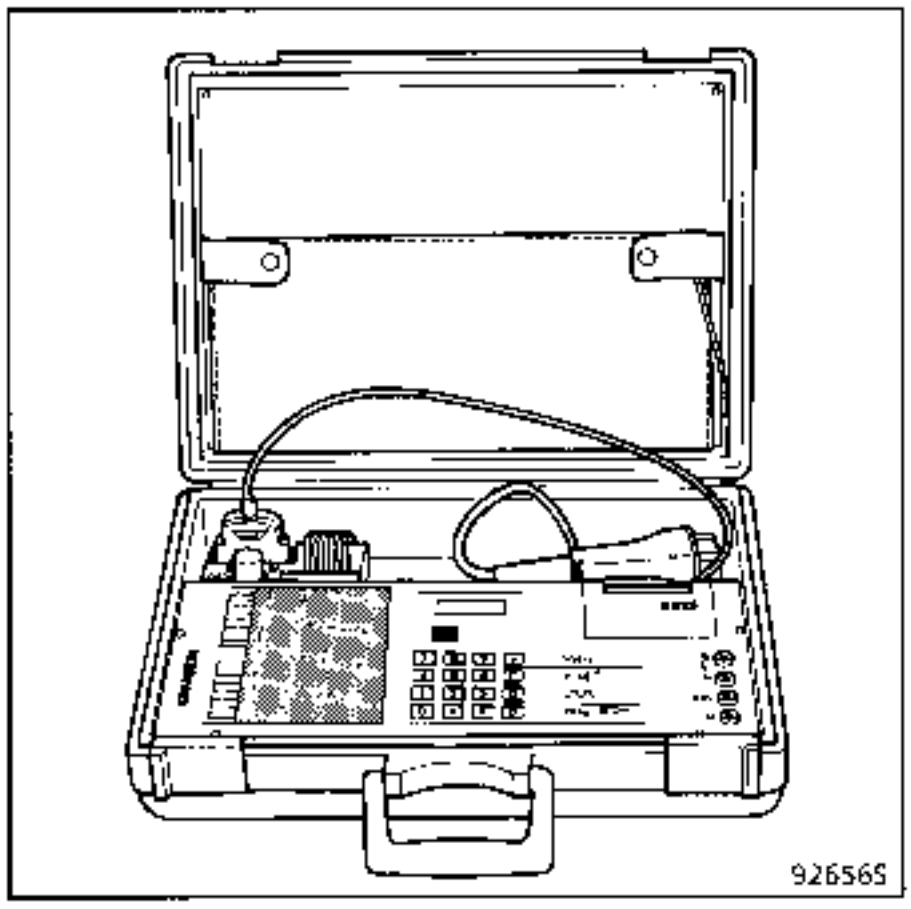
After connecting the XR25 at the end of a road test, without turning the ignition off on completion of the test :

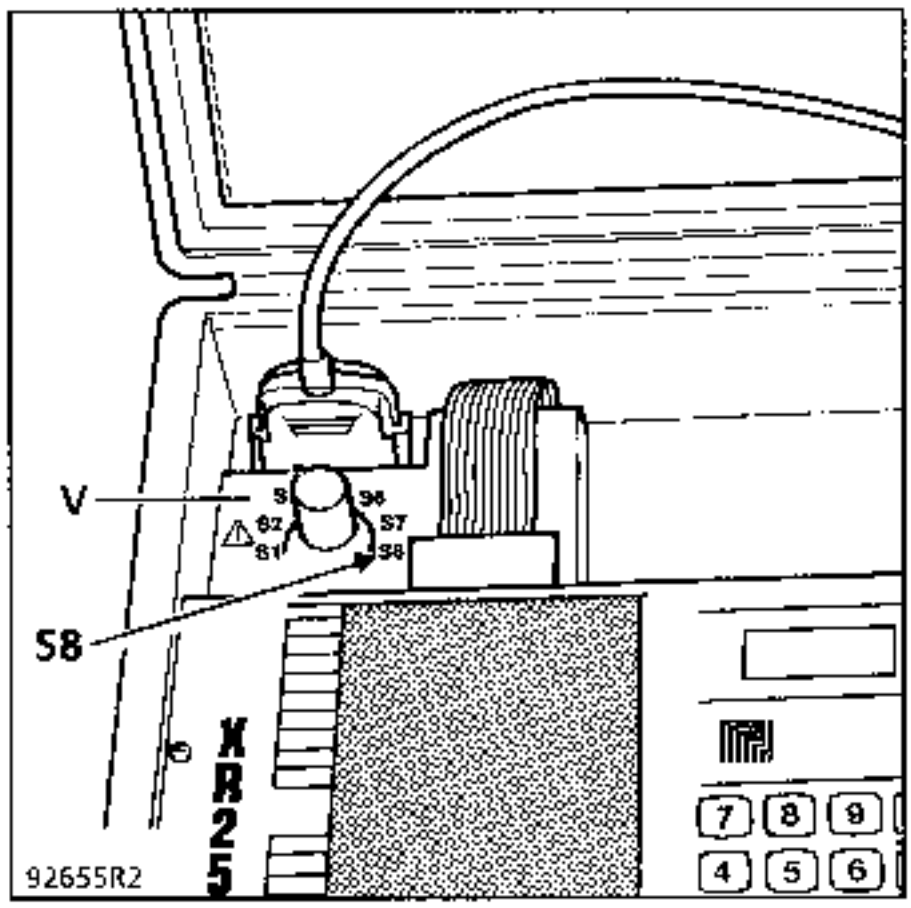
- Position the selector on **S8**.
- Connect to the computer by entering:

D **1** **1** sending a signal on both lines at the same time (K and L).

After dialogue using the **XR25** has ended (D11 - S8) :

- the ABS warning light flashes: no fault present,
- the ABS warning light is permanently illuminated: 1 fault present.





NOTE : The "V" warning light **must** be extinguished. If it illuminates, disconnect then reconnect the diagnostic socket. If it remains illuminated, check the **XR25** wiring and the battery voltage.

ELECTRONICALLY CONTROLLED HYDRAULIC SYSTEMS
TEVES ABS

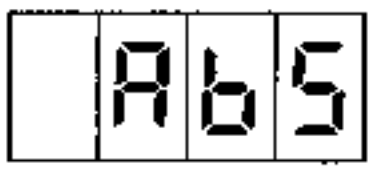
Analysis of the operation of the system using the **XR25** and the latest cassette following a road test where the ABS warning light illuminated.

At the end of the road test, without turning the ignition off, connect the **XR25.**

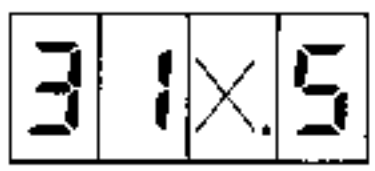
Enter code **D** **1** **1**

Position the ISO selector on S8.

The central display shows

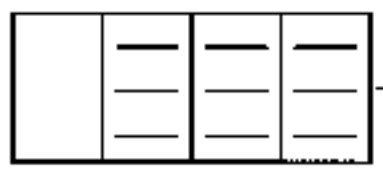


(1 second) then



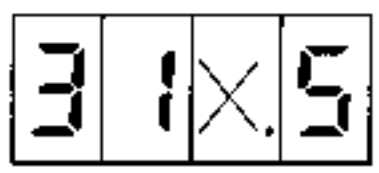
3 TEVES make
1X Computer number
5 Product tested is ABS

or



indicates dialogue has not been established

If initialisation has been carried out correctly: •



– The central display should show

- **ABS WITH NO FAULT**
  (2 bargraphs illuminated)

  Bargraph n° **1** right hand side: code present
  Bargraph n° **13** right hand side: stop circuit - foot off pedal

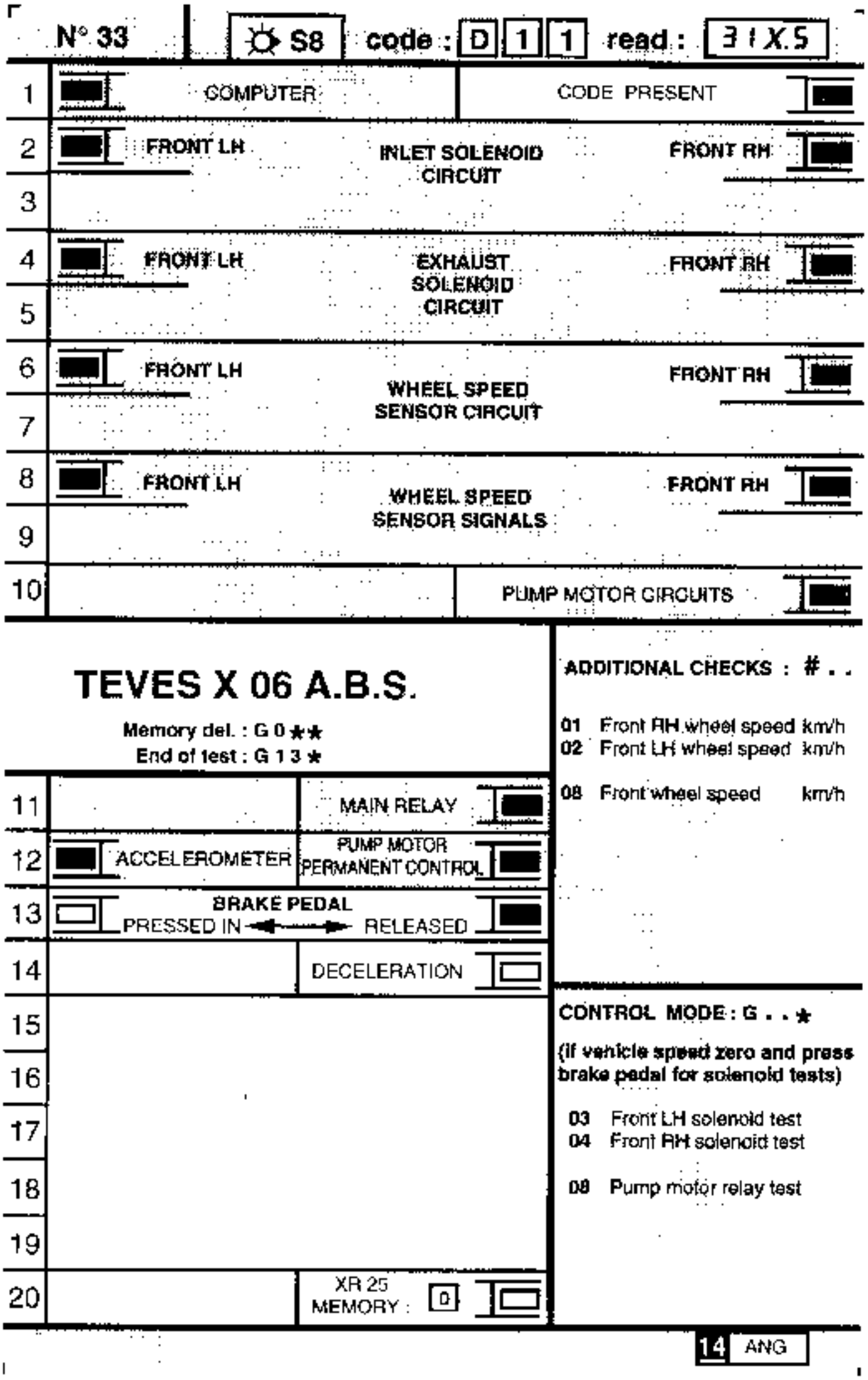
- **ABS WITH FAULT(S)**

  IMPORTANT DEFINITIONS :

  Intermittent fault : the fault appeared (illuminating the ABS warning light on the instrument panel) and disappeared by itself at a later moment (after turning the ignition off and on again). This type of fault is shown by a flashing bargraph.

  Permanent fault: a fault which is present when fault finding is carried out using the **XR25.** This type of fault is shown by a permanently illuminated bargraph.

IMPORTANT : if **D** **1** **1** is entered when the computer is in the test sequence, fault finding may take up to 40 seconds to begin. To reduce this delay enter: **G13*** (beep), then **D** **1** **1**



FI21433

Bargraphs on a **coloured** background are **fault** bargraphs.
Bargraphs on a **white** background are **status** bargraphs.

The following fault finding information must only be used following a road test where the ABS warning light was illuminated.
The **XR25** should only be connected at the end of the road test, without turning the ignition off.

CODE PRESENT ; ILLUMINATED : CORRECT (extinguishes if using key **G**).

If extinguished after entering **D11**, check:
- that the ISO selector is in the correct position : **S8**,
- that the correct version of the cassette for the **XR25** is being used with the correct code.

After these checks, does bargraph 1 remain extinguished?
- **NO** – : Correct.
- YES – : Check
  - The ABS NF electronic earth on the front face of the engine block.
  - That battery voltage > 9.5 volts and < 16.5 volts.
  - That the 10A ABS fuse in the passenger compartment connection unit has not blown.
  - That the 12 track connection **R183** (ABS/Passenger compartment) on the bulkhead under the windscreen wiper is correctly connected (black connection).

1

After these checks, does bargraph 1 remain extinguished?
- NO – : Correct.
- YES – : Test the communication with the injection computer (S8 and code D11).
  If dialogue cannot be established check :
  - That track **2** of the diagnostic socket is earthed ; track **6** + battery (+ before ignition fuse protected).
  - The continuity / insulation of the lines of the diagnostic socket / injection computer connection:
    Between track **10** on the diagnostic socket and **track 10** on the computer connector
    Between track **11** on the diagnostic socket and track **15** on the computer connector

If dialogue can be established check:
- Continuity of the diagnostic lines between the injection and ABS computers:
  Between track **10** on the injection computer connector and **track 23** on the ABS computer connector
  Intermediate connections: **R212G** (engine / passenger compartment) and **R183** track **B4**.
  Between **track 15** on the injection computer connector and **track 42** on the ABS computer connector
  Intermediate connections : **R212G** (engine / passenger compartment) and **R183** track **C1.**
- That the ABS computer is correctly fed: Earth on tracks **1** and **19** of the **55** track connector, + after ignition on track **53** of this connector (+ check condition of connections).

If the fault persists after these checks, replace the computer.
Erase the computer memory (G0**), leave the diagnostic mode(G13*) and carry out a road test.
Test again with the XR25 without turning the ignition off if the ABS warning light illuminates again during the test.

1 **COMPUTER FAULT**

Check the routing of the ABS wiring and its mounting (risk of electromagnetic interference).
Erase the computer memory (G0**), then leave the diagnostic mode (G13*).
If the computer fault re-appears, replace the computer.
End by erasing the computer memory (G0**).

2 **FRONT LEFT HAND INLET SOLENOID CIRCUIT FAULT**

2 **FRONT RIGHT HAND INLET SOLENOID CIRCUIT FAULT**

4 **FRONT LEFT HAND OUTLET SOLENOID CIRCUIT FAULT**

4 **FRONT RIGHT HAND OUTLET SOLENOID CIRCUIT FAULT**

- Disconnect the hydraulic assembly connector and measure the resistance of the solenoid coils at fault :
  - Inlet solenoid : 5 to 8 ohms between tracks C and A, C and D.
  - Outlet solenoid : 3 to 5 ohms between tracks C and B, C and E.

  If incorrect, replace the hydraulic assembly then erase the computer memory.
  If correct check the connections on the hydraulic assembly and on the computer and check / ensure the continuity of the following lines:
  Between track A on the hydraulic assembly 5 track connector and track 54 on the computer connector
  Between track B on the hydraulic assembly 5 track connector and track 36 on the computer connector
  Between track C on the hydraulic assembly 5 track connector and tracks 3 and 33 on the computer connector
  Between track D on the hydraulic assembly 5 track connector and track 55 on the computer connector
  Between track E on the hydraulic assembly 5 track connector and track 18 on the computer connector
- Check and ensure insulation between the various solenoid lines (tracks A B C D E on the 5 track connector). If all the checks are correct and the fault persists after erasing the computer memory (G0**), leave the diagnostic mode (G13*) turn the ignition off then on again, replace the computer and erase the new computer's memory.

6 **FRONT LEFT HAND WHEEL SENSOR CIRCUIT FAULT**

6 **FRONT RIGHT HAND WHEEL SENSOR CIRCUIT FAULT**

Open circuit or short circuit on the sensor circuit or speed sensor fault.

- Check the connector for the faulty sensor.
  If the connector is correct, check the resistance of the sensor at 20° C.
  - If the value is other than 1.1 Kohms ± 200 ohms, replace the sensor.
  - If the sensor resistance is correct, check the continuities of the lines between the faulty sensor connector and the computer connector:
    FLH sensor: track **1** on sensor/ track **48** on computer .
    track **2** on sensor/ track **30** on computer .
    FRH sensor: track **2** on sensor/ track **29** on computer .
    track **1** on sensor/ track **47**on computer .
- Check the insulation of the 2 sensor lines.
- Check the connections on the **55** track connector.

If all the tests are corrects, replace the sensor then erase the computer memory.
Leave the diagnostic mode (G13*) then carry out a road test.
If the fault re-appears, replace the computer and erase the new computer's memory.

8 **FRONT LEFT HAND WHEEL SENSOR SIGNAL FAULT**

8 **FRONT RIGHT HAND WHEEL SENSOR SIGNAL FAULT**

If bargraph **6** (right or left hand side) is also illuminated, deal with that fault first.

Wheel speed information coherence fault.

- Check the sensor mounting (position and torque tightening).
- Check the sensor / target air gap over one turn of the faulty wheel:
  0.3 mm < air gap < 1.7 mm.
- Check the conformity of the target (condition, number of teeth= 38).
- Check the resistance of the sensor and the condition of its connections on the connector.
  If the value is other than 1.1 Kohms ± 200 ohms, replace the sensor.
- Check the connections on the **55** track connector.
- Check the wiring routing and its mounting.

If all the tests are corrects, replace the sensor then erase the computer memory.
Leave the diagnostic mode (G13*) then carry out a road test.
If the fault re-appears, it may be caused by a solenoid fault . The solenoids must be hydraulically tested (functions G03* and G04* on the XR25).
If the 10 locking / releasing cycles are not performed correctly for one of the front wheels, replace the hydraulic assembly.

10 **PUMP MOTOR CIRCUIT FAULT** (noted during a test at 18.75 mph (30 km/h))

- Check the pump motor 30A fuse.
- Measure the resistance of the relay coil between tracks **13** and **10** on the relay unit.
  Replace the relay unit if the coil resistance is not approximately 80 ohms.
- Check the **MA ABS** earth behind the right hand headlight unit.
- Turn the ignition off, disconnect the relay unit and measure the voltage between terminals **14** or **15** and **1** or **2** on the relay unit connector ; if no voltage is present, ensure the following continuities:
  - Between the ABS earth and tracks **1** and **2** on the relay unit connector.
  - Between the 30A pump motor fuse and tracks **14** and **15** on the relay unit connector.
    Intermediate connection: R183 (passenger compartment/ABS) on tracks A3 and A4.
- Disconnect the **4** track pump - motor and motor sensor connector and measure the following resistances on the pump · motor side : (replace the hydraulic assembly if the values are not correct).
- Pump - motor : R = 1 ohm ± 0.5 between tracks **1** and **3.**
- Motor sensor : R = approximately 16 ohms between tracks **2** and **4.**
  Check the connections on the **4** track connector.
- Check the connections on the computer and the relay unit.
- Check / ensure the continuity of the following lines:
  Between track **49** of the **55** track connector and track **8** on the relay unit connector.
  Between track **31** of the **55** track connector and track **7** on the relay unit connector.
  Between track **15** of the **55** track connector and track **13** on the relay unit connector.
  Between tracks **33** and **3** of the **55** track connector and tracks **9** and **10** on the relay unit connector.

If all the tests are correct and the fault re-appears during a road test at more than 18.75 mph (30 Km/h) after erasing the computer memory, leave the diagnostic mode (G13*), turn the ignition off then on again and replace the relay unit.

If the fault re-appears,it may be caused by a pressure fault connected to a mechanical problem with the pump. Carry out a hydraulic test to check the operation of the pump (functions G03* and G04* on the XR25). If the 10 locking / releasing cycles are not performed correctly for one of the front wheels, replace the hydraulic assembly.

Erase the memory after another road test to complete the operation.

11 MAIN RELAY CIRCUIT (solenoid relay)

- Check that the 5 track solenoid connector is correctly connected.
- Check there is no connection fault on the relay unit or the computer.
- Check the ABS MA earth behind the right hand headlight unit.
- Check the battery voltage (faulty if U > 16.5 volts) and the tightness of the terminals on the battery.
- Measure the resistance of the relay coil between tracks 3 and 12 of the unit.
  Replace the unit if the coil resistance is not approximately 80 ohms.
- Check / ensure continuity between track **34** on the computer connector and track **12** on the relay unit connector (**15 track**).
- Check / ensure continuity between track **3** of the **15** track connector and the 10A ABS fuse on the passenger compartment connection unit via the **12** track connection R183 (ABS/passenger compartment) track A1 located on the bulkhead under the windscreen wiper (or check for + after ignition on track 3 of the relay unit connector).
- Check the continuity between tracks **4** and **5** of the **15** track connector and the 30A ABS fuse on the engine connection unit and check the condition of the fuse.
- Check the continuity between tracks **9** and **10** of the **15** track connector and between tracks **3** and **33** of the **55** track connector.

If all the tests are correct and the fault re-appears after erasing the computer memory, leave the diagnostic mode (G13*) turn the ignition off then on again, then replace the relay unit.
If the fault re-appears again, erase the memory and replace the computer .
Complete the operation in this case by erasing the new computer's memory.

12 PERMANENT CONTROL

This bargraph shows that the hydraulic assembly is operating when it should not be:
* Pump operation only in regulation phase.
* ABS operation inhibited in diagnostic mode so regulation is impossible.

- Check / ensure insulation from earth of the line between track **13** on the relay unit connector and track **15** on the computer connector.

If the insulation is correct, replace the relay unit.

12 ACCELEROMETER CIRCUIT FAULT

- Place the vehicle on horizontal ground.
- Disconnect the computer connector and check the electrical continuity of the sensor between tracks **25** and **26** on the connector.
  Is continuity assured?

NO – Check / ensure the continuity of the following lines:
* Between track **25** of the computer connector and track **B3** of connection R183 (Passenger compartment/ABS).
* Between track **26** of the computer connector and track **B2** of connection R183 (Passenger compartment/ABS).

– Check the connections of connection R183.
– Check the mounting position of the acceleration sensor (arrow towards front of vehicle).
Note : the longitudinal acceleration sensor is located in front of the gear lever.

– Check / ensure the continuity of the following lines:
* Between track **B3** of connection R183 (Passenger compartment/ABS) and track **3** of the sensor connector.
* Between track **B2** of connection R183 (Passenger compartment/ABS) and track **1** of the sensor connector.

– Check the connections on the computer and on the acceleration sensor.
If all the tests are correct and the fault re-appears after erasing the computer memory, leave the diagnostic mode (G13*), turn the ignition off then carry out a road test (speed > 31.25 mph (50 km/h) for more than 2 minutes), then replace the acceleration sensor.
Repeat the erasure procedure and road test again before replacing the computer if the fault re-appears.
In this case, complete the operation by erasing the new computer's memory.

YES – Check the computer connections.
– Disconnect the acceleration sensor connector and the computer connector and check the insulation between the two lines of the sensors (tracks **25** and **26** on the computer connector).
Note : the acceleration sensor is located in front of the gear lever.

– Check / ensure insulation from earth of the 2 sensor lines.
If all the tests are correct and the fault re-appears after erasing the computer memory, leave the diagnostic mode (G13*), turn the ignition off then carry out a road test , then replace the acceleration sensor.
Repeat the erasure procedure and road test again before replacing the computer if the fault re-appears.
In this case, complete the operation by erasing the new computer's memory.

13 STOP CIRCUIT

ILLUMINATED ON LEFT HAND SIDE : CORRECT IF PEDAL IS DEPRESSED
ILLUMINATED ON RIGHT HAND SIDE : CORRECT IF PEDAL IS RAISED

- **When the pedal is pressed and released, does bargraph 13 illuminate on the right and left hand sides alternately?**
- **YES –** : Normal circuit operation.
- **NO –** : **What fault is noted in the illumination of bargraph 13 ?**

- **BG 13 permanently illuminated on left** : the stop lights are permanently illuminated.
  Adjust the stop switch or replace it if necessary.
  Look for a possible short circuit to + 12 volts on the line between the stop switch and the lights or the line to the computer (track **32**).

- **BG 13 extinguished on left when pedal depressed:**
  Do the stop lights illuminate when the pedal is depressed?
  - **NO –** : Check the condition and adjustment of the stop switch and the 10A stop lights fuse (in passenger compartment connection unit). Replace if necessary.
    Ignition on, is there + after ignition on track 1 of the stop switch?
    NO : Check for + after ignition at the fuse and ensure continuity between the stop lights fuse and track **1** of the stop switch.
    YES : Brake pedal depressed, is there + after ignition on track **3** of the stop switch ?
    NO : Replace the stop switch.
    YES : Check the connections on the stop switch.
    Ensure continuity between track **3** of the stop switch and the stop lights and with track **32** of the computer connector.
  - **YES –** : Is there a break between track **32** on the **55** track computer connector and track **3** on the stop switch? Ensure the continuity of this connection.
    Intermediate connection: **R183** (ABS/Passenger compartment) on the bulkhead under the windscreen wiper on track **C2**.

14 DECELERATION

This bargraph should only be illuminated if the vehicle is accelerating or decelerating.
If it is illuminated when the vehicle is stationary on horizontal ground, either the sensor is incorrectly fitted or its circuit is in open circuit (this would cause bargraph 12 LH side to illuminate on a road test).

If bargraph 14 RH side flashes or illuminates intermittently when the vehicle is on horizontal ground and is not accelerating or decelerating, carry out the following tests:
Check the connections on the sensor, on the computer and on connection R183.
Check the mounting position of the acceleration sensor.
Note : the acceleration sensor is located in front of the gear lever.
Check / ensure the insulation from earth of the 2 sensor lines.

AFTER ALL OPERATIONS ON THE ABS SYSTEM

Erase the computer memory (G0**).
Validate the end of fault finding (G13*).
Carry out a road test then check using the XR25.

AFTER REPLACING THE HYDRAULIC C ASSEMBLY

Check the system using the "G" functions on the **XR25** :

- G03* front left hand solenoid (10 cycles of locking / releasing the wheel).
- G04* front right hand solenoid (10 cycles of locking / releasing the wheel).

- G08* operation of the pump - motor.

XR25 FUNCTIONS

Important notes

To use the additional tests (#) and the command mode G, the ABS system must be operational (no faults detected by self diagnosis).

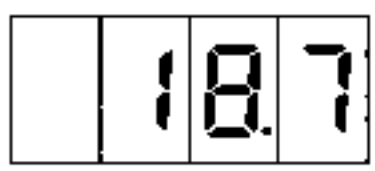
Additional tests (#)

After initialising the system, enter:

[#] [0] [0] → Computer version number

[#] [0] [1] → Front right hand wheel speed (km/h)

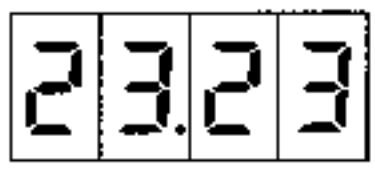
Example :



[#] [0] [2] → Front left hand wheel speed (km/h)

[#] [0] [8] → Front left hand and front right hand wheel speeds (km/h)

Example :



These tests allow

1 - the computer to be identified
2 - the wheel speed to be displayed and the allocation of the sensors to be checked (checking of target / sensor pairing).

ATTENTION : when communication between the computer and the **XR25** has been established, the warning light flashes and the ABS function is no longer assured (no fault present).

COMMAND MODE (G)

- **Hydraulic test** : key G (command mode allowing the operation of the solenoid valves to be checked (inlet and outlet)).

Lift the vehicle so that the wheels may be turned and check they turn freely.

↓

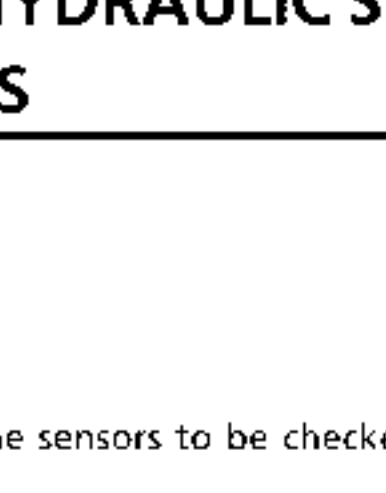
Depress the brake pedal to prevent the wheel from turning when rotated by hand (do not press the brake too hard to ensure that you are at the release limit).

Enter **D** **1** **1**

Then **G** **3** *****

→ The front left hand wheel should be released temporarily (10 times).

The central display shows:



The same for:

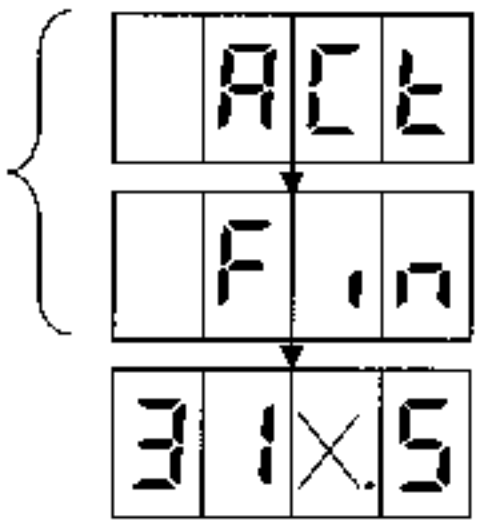
G **4** ***** Front right hand wheel solenoids

NOTE : these control modes (G) are only operational when the brake pedal is depressed.

– **Checking the operation of the relay and pump - motor**

The central display shows:

Enter [G] [8] [*] → The motor should operate for 2 seconds

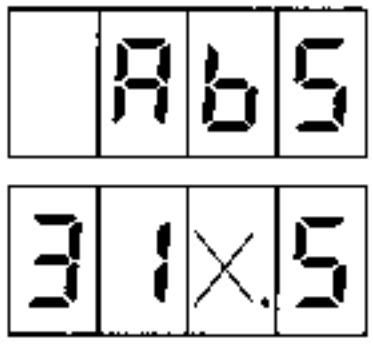


– **Erasing the memory**

Turn the ignition on but do not start the engine.

Enter code : [D] [1] [1]

The central display shows:



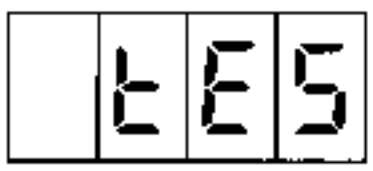
then

Enter code : [G] [0] [*]

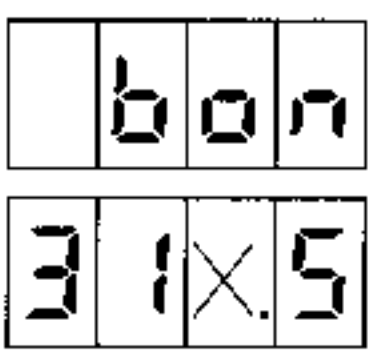
The central display shows:

Validate the request with [*]

The central display then shows:



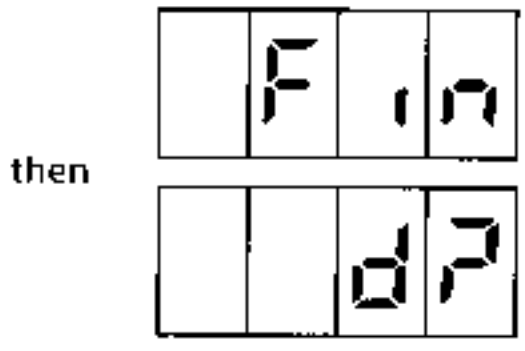
then



- **Validation of the end of the test**

Enter:

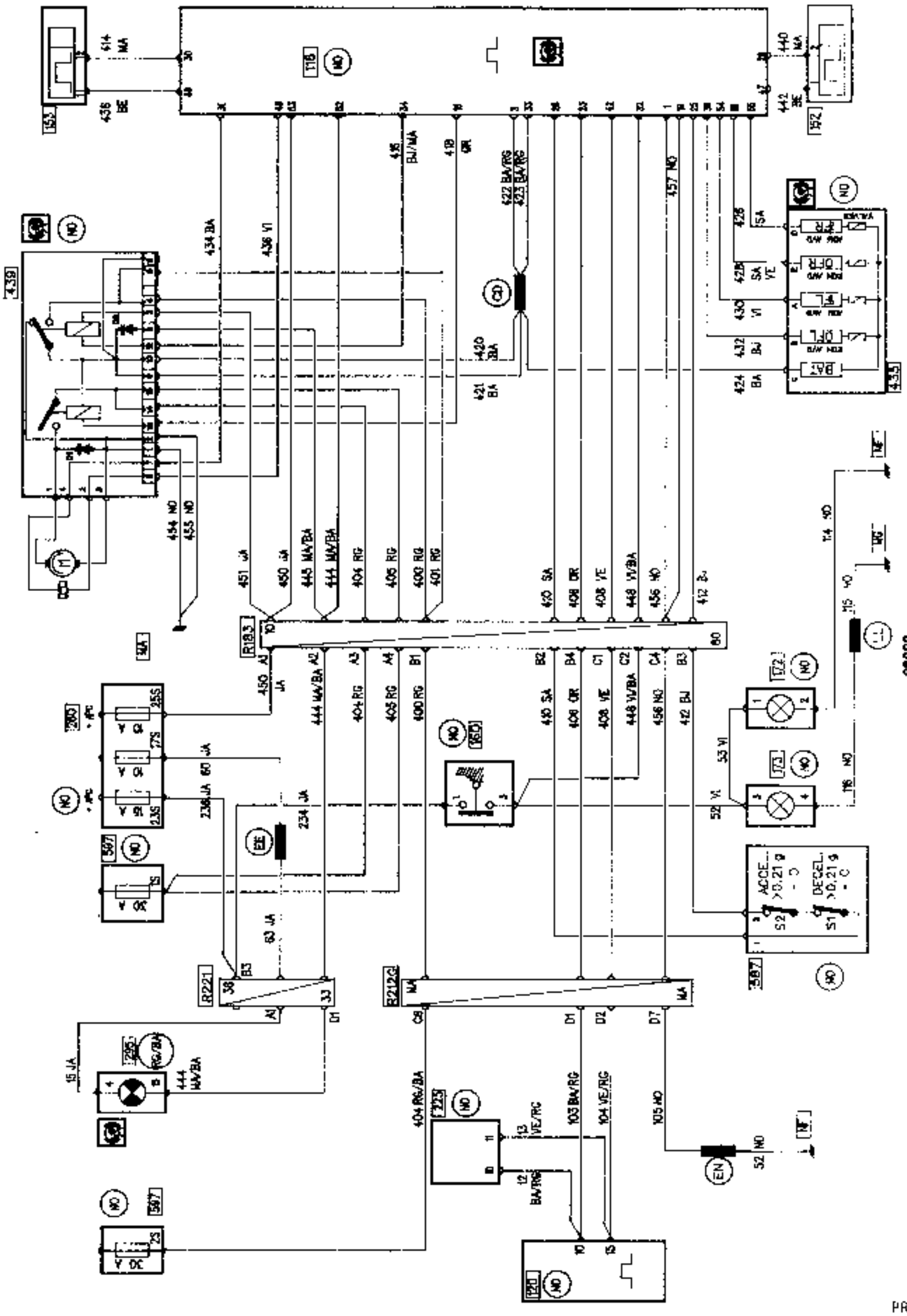
The central display shows:



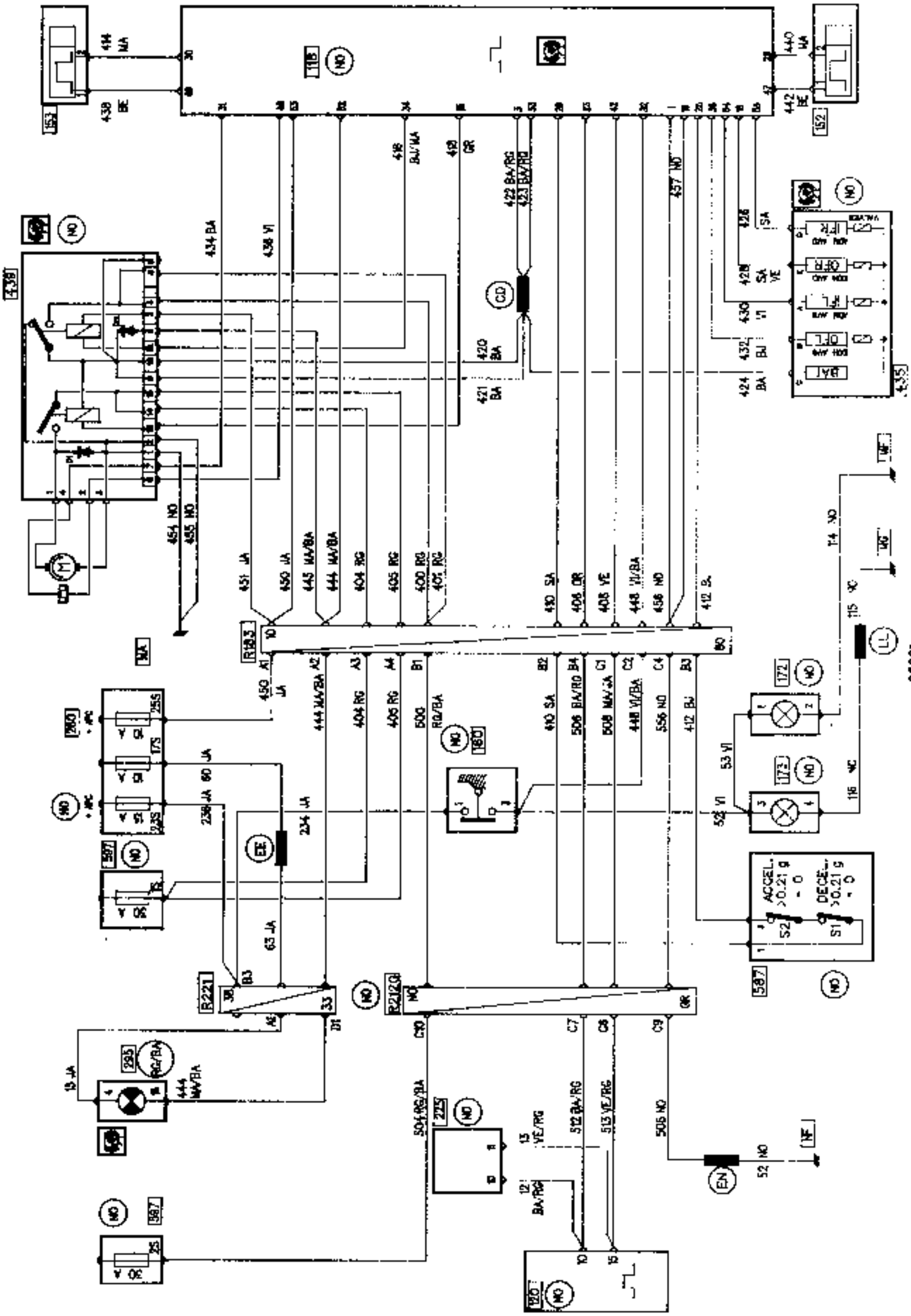
A moment later the ABS warning light should extinguish (if no fault is present):

- turn the ignition off,
- disconnect the XR25,
- replace the diagnostic socket cover.

Without air conditioning



With air conditioning



PRM3804

WIRING DIAGRAM KEY

Components:

118 ABS computer

120 Injection computer

152 Front right hand wheel sensor

153 Front left hand wheel sensor

160 Stop switch

172 Rear right hand stop light

173 Rear left hand stop light

225 Diagnostic socket

247 Instrument panel warning light

260 Fuse box

435 ABS solenoid valve unit

439 ABS board

587 ABS accelerator

597 Engine fuse box

Connections:

R183 Passenger compartment/ABS

R212 Engine/Passenger compartment

R221 Dashboard/Passenger compartment

Earth:

MA Front right hand electric earth

MF Rear right hand electric earth

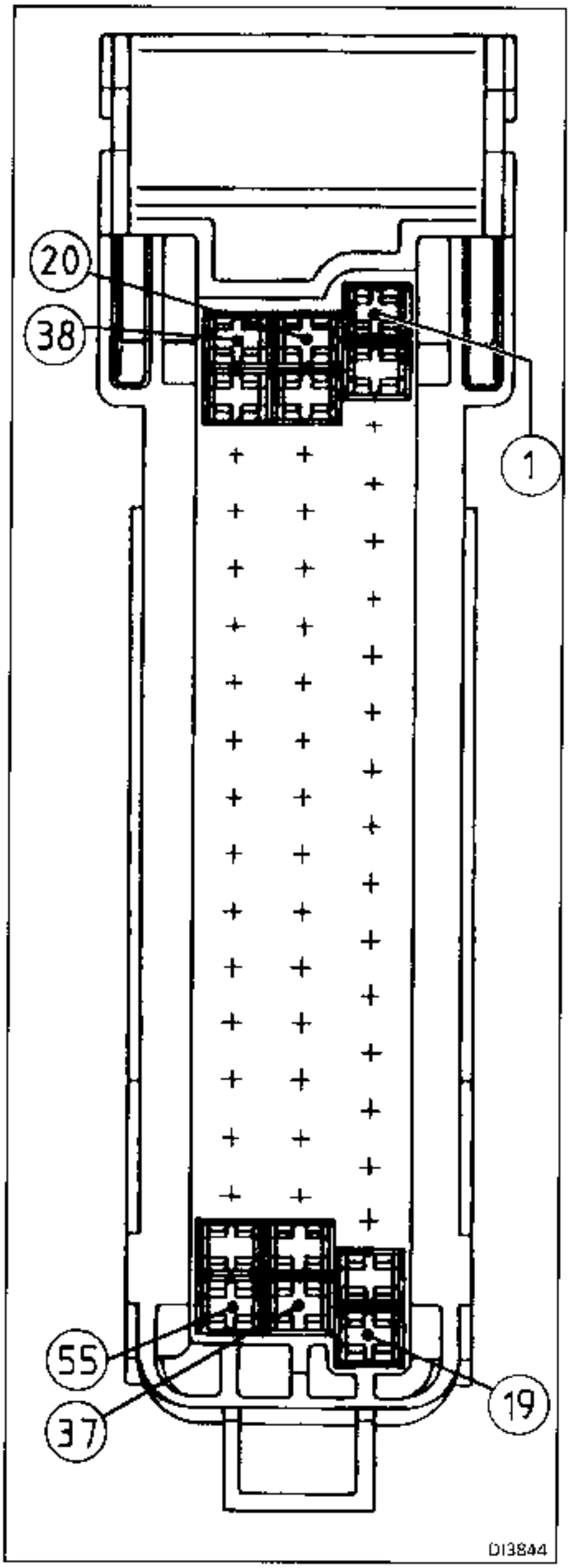
MG Rear left hand electric earth

NF Engine electronic earth

NOTE: Never disconnect the computer when the circuit is under voltage.
Testing of earths and resistances should only be carried out with the battery disconnected.

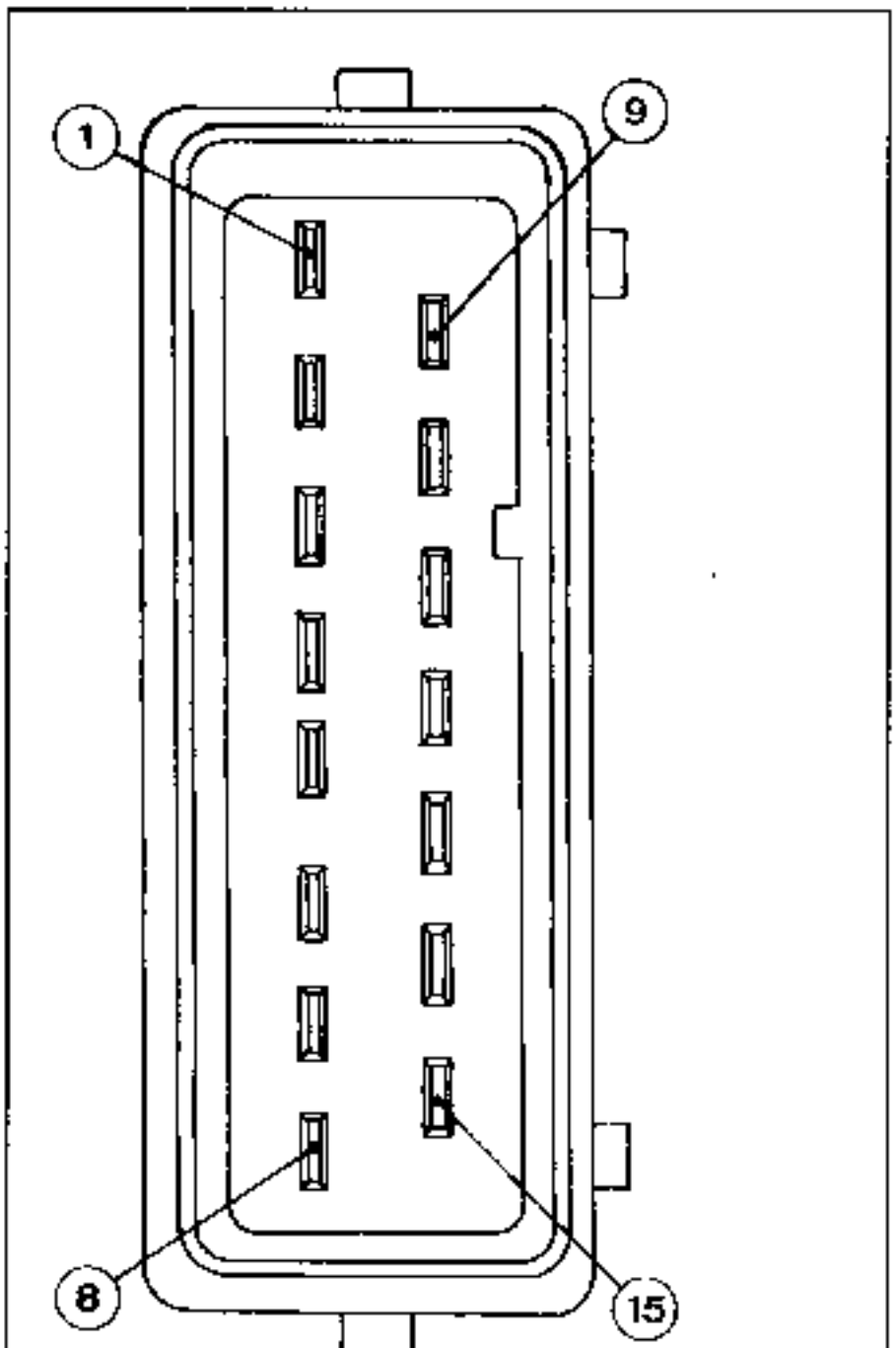
Allocation of computer connector pins (118)

Track	Allocation
1	Computer electronic earth
2	Not connected
3	Computer feed
4 to 14	Not connected
15	Main relay control
16	Not connected
17	Not connected
18	FRH outlet solenoid information
19	Computer electronic earth
20 to 22	Not connected
23	Diagnostic line L information
24	Not connected
25	Deceleration sensor information
26	Deceleration sensor common
27 and 28	Not connected
29	FRH sensor earth
30	FLH sensor earth
31	Pump - motor sensor information
32	Stop lights information
33	Sensor feed
34	Pump - motor relay control
35	Not connected
36	FLH outlet solenoid information
37 to 41	Not connected
42	Diagnostic line K information
43 to 46	Not connected
47	FRH sensor signal
48	FLH sensor signal
49	Pump - motor sensor information
50 and 51	Not connected
52	ABS warning light
53	+ after ignition
54	FLH inlet solenoid information
55	FRH inlet solenoid information



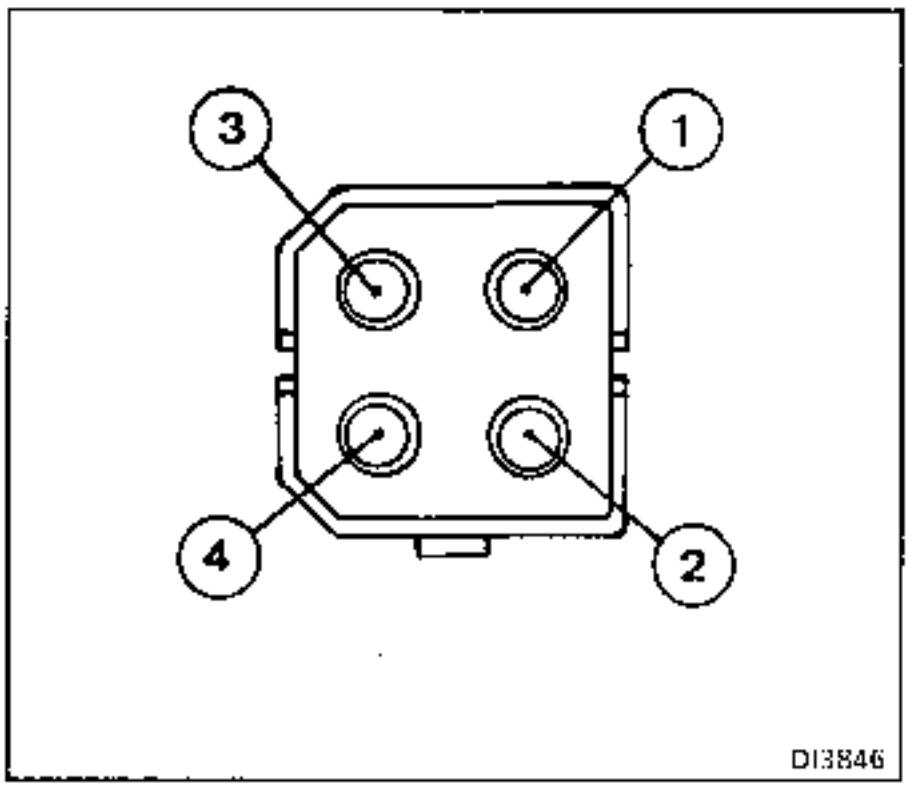
Relay board connector (439)

Track	Allocation
1	Pump - motor earth
2	Pump - motor earth
3	+ after ignition
4	+Battery
5	+Battery
6	ABS warning light
7	Pump - motor sensor information
8	Pump - motor sensor information
9	+Battery
10	+Battery
11	Not connected
12	Pump - motor relay control
13	Main relay control
14	Pump - motor feed
15	Pump - motor feed



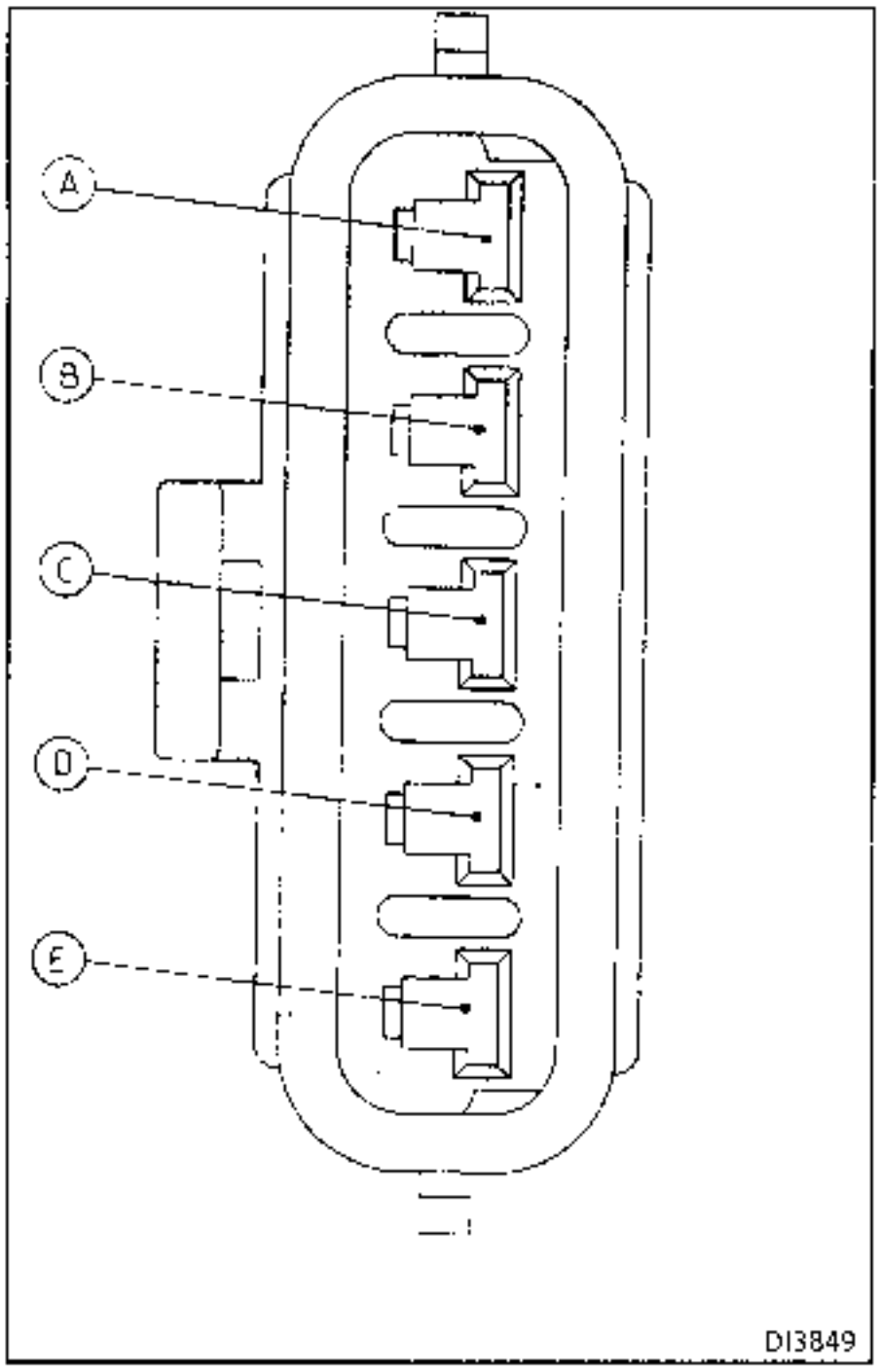
Pump - motor connector

Track	Allocation
1	+Pump - motor
2	Pump - motor sensor information
3	– Pump - motor
4	Pump - motor sensor information



Solenoid connector (435)

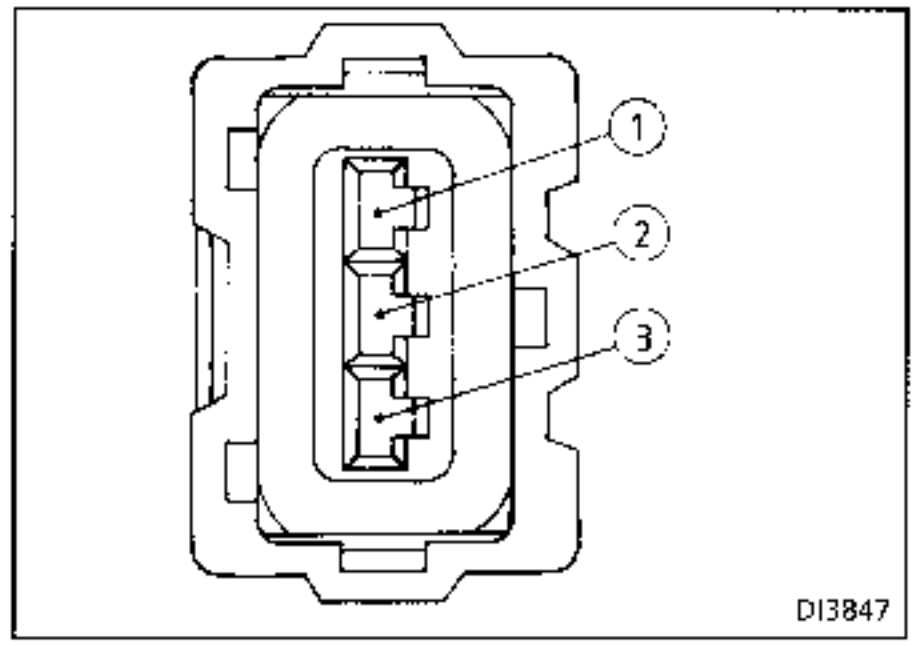
Track	Allocation
A	FLH inlet solenoid information
B	FLH outlet solenoid information
C	Solenoid feed
D	FRH inlet solenoid information
E	FRH outlet solenoid information



DI3849

Deceleration sensor connector (587)

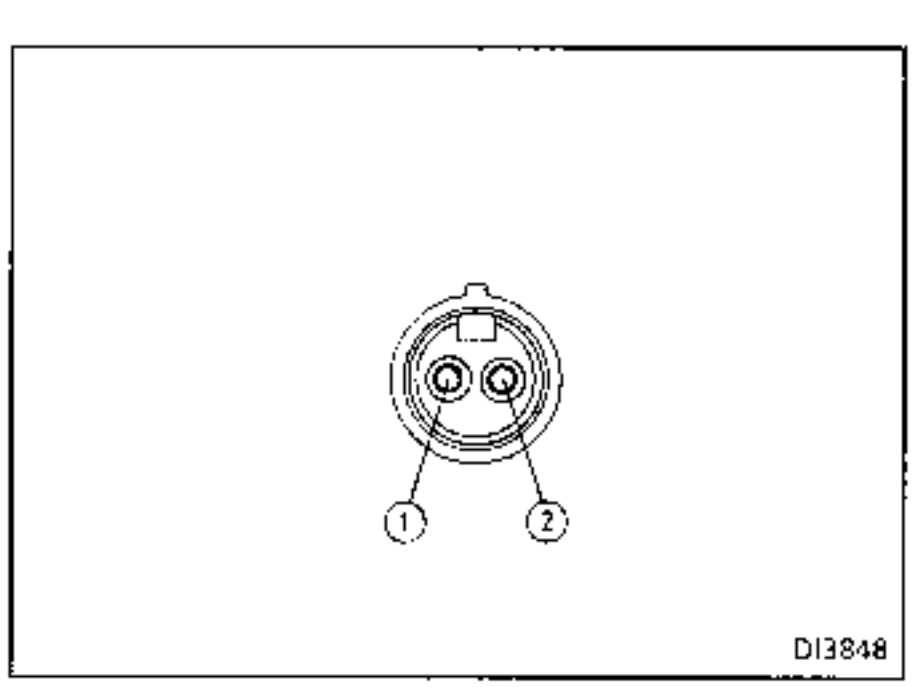
Track	Allocation
1	Deceleration sensor common
2	Not connected
3	Deceleration sensor information



DI3847

Speed sensor connector (152, 153)

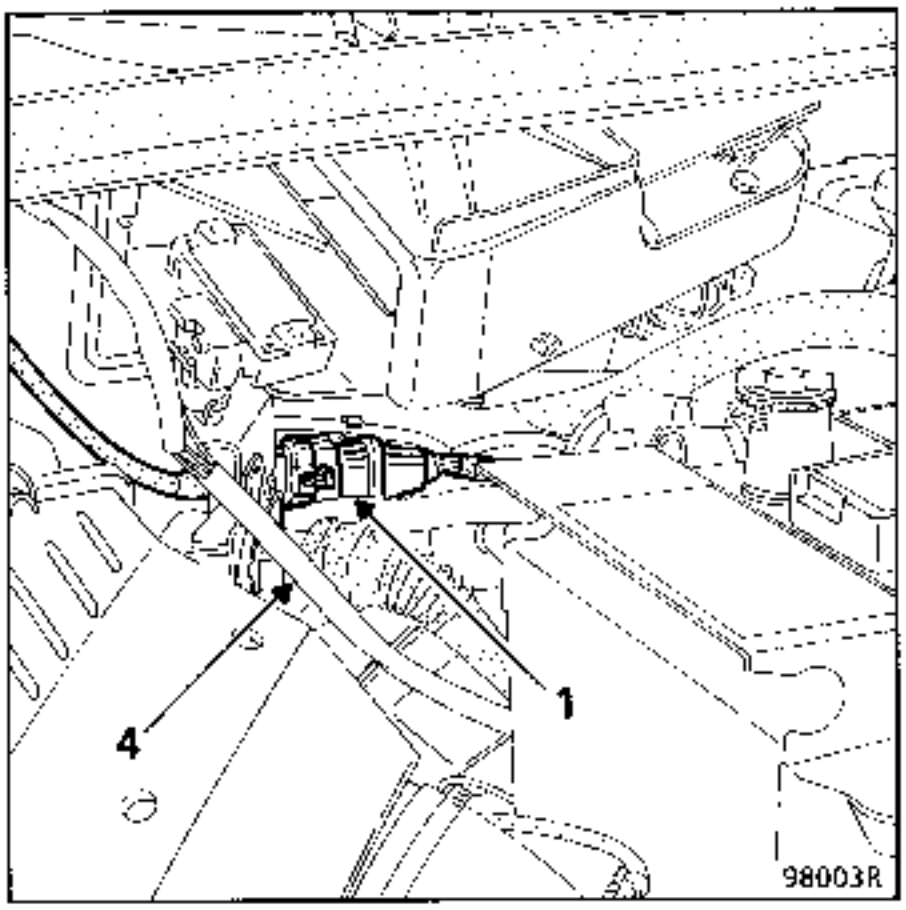
Track	Allocation
1	Sensor signal
2	Sensor earth

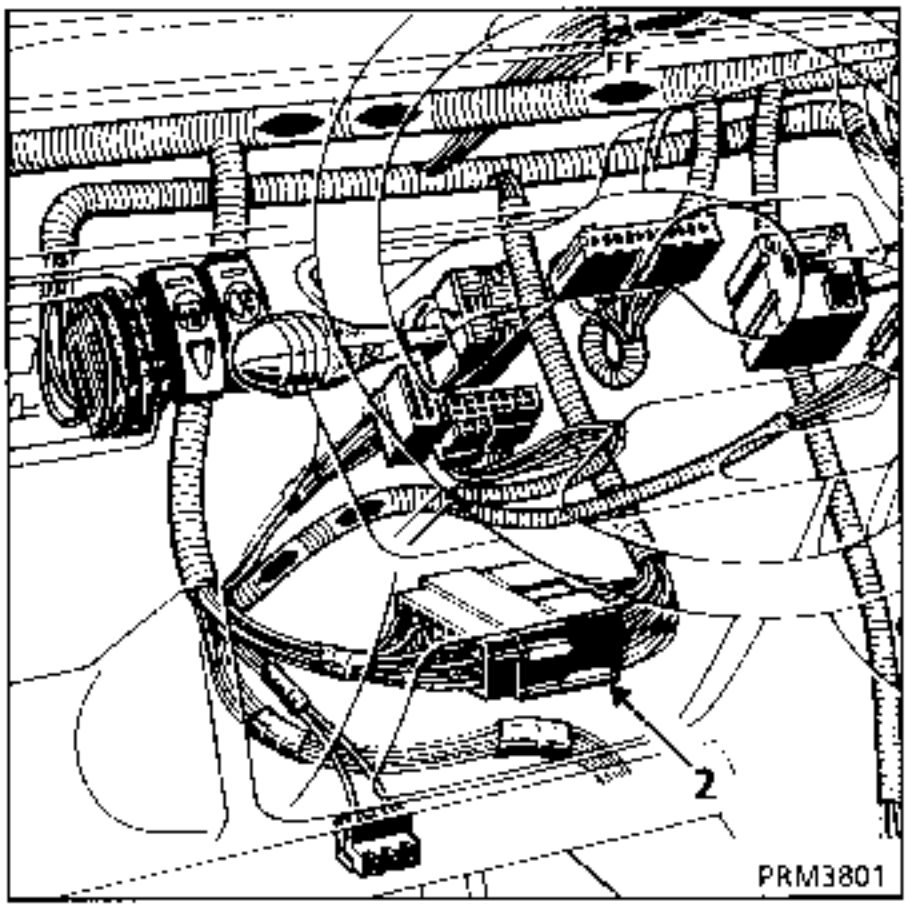


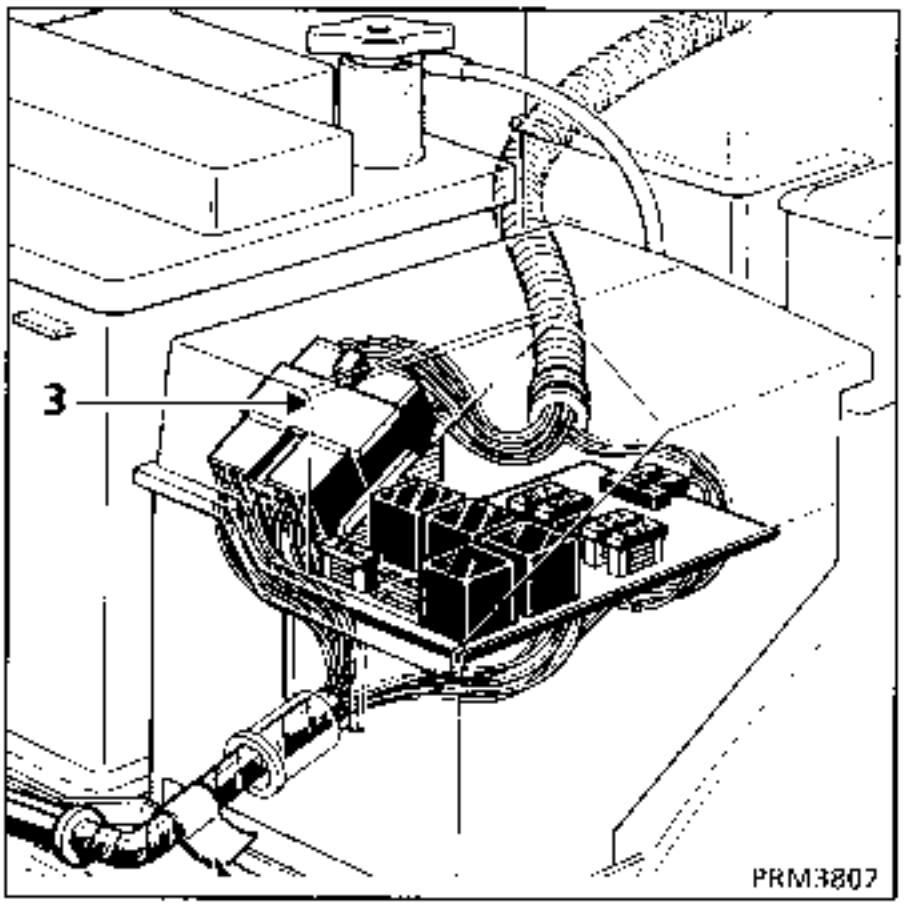
DI3848

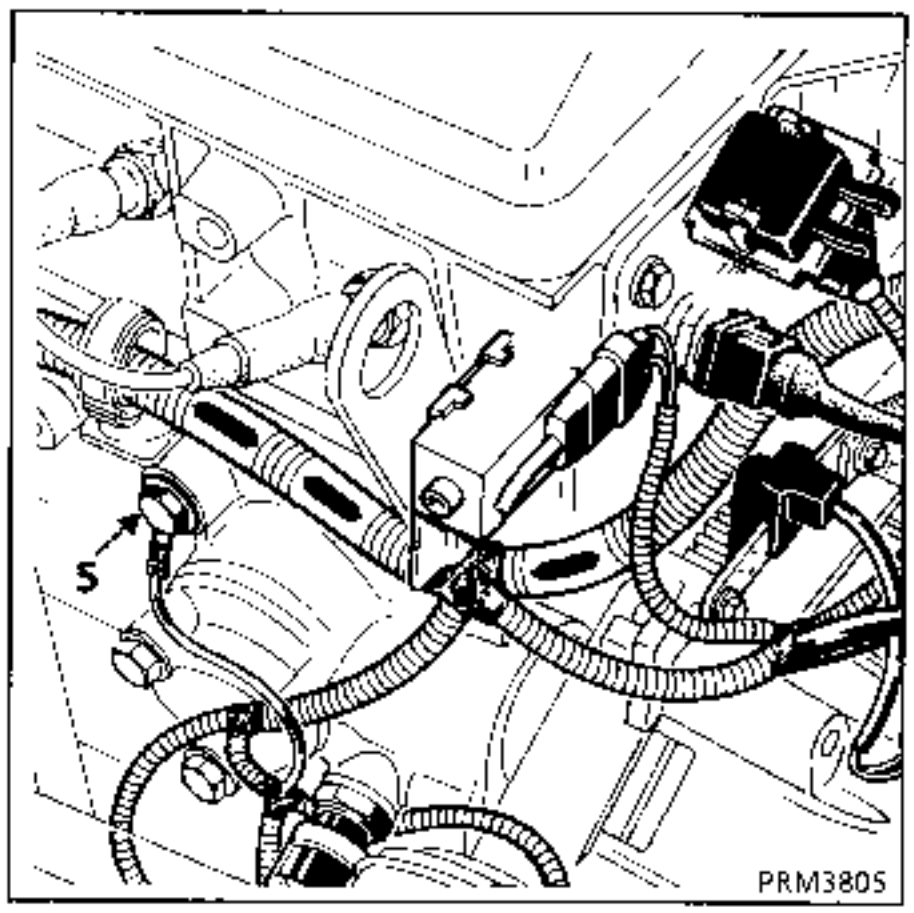
Allocation of connections and earths

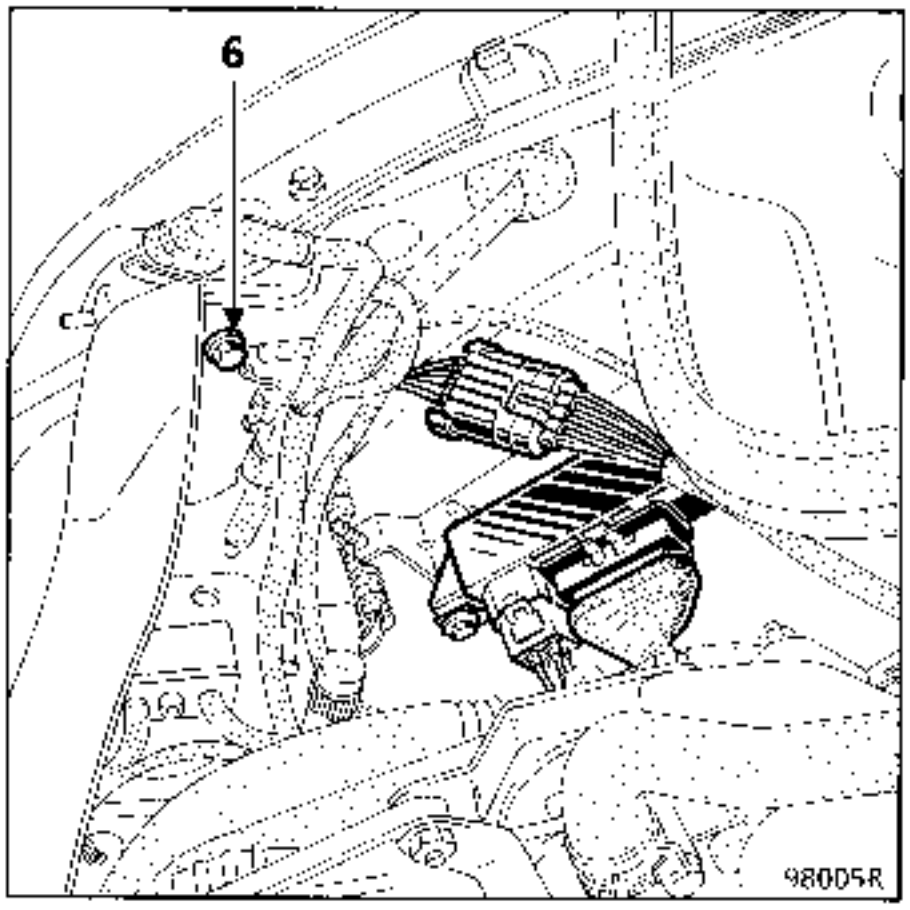
Connections, earths	Colour	Description	Location on vehicle
R183 (1)	black	Passenger compartment/ABS	Under windscreen wiper motor
R221 (2)	black	Dashboard/Passenger compartment	Behind steering column cover
R212 (3) without AC (4) with AC		Engine/Passenger compartment	– In engine connection unit (3) – Under windscreen wiper motor (4)
NF (5)	Black wire	Engine electronic earth	On engine block, near dipstick
MA (6)	Black wires	Earth	Behind FRH headlight unit






3
PRM3807


5
PRM3805


6
98005R

TEVES ABS FAULT CHART

(A) FAULTS NOTED BY THE OPERATION OF THE ABS WARNING LIGHT

- 1 - When the ignition is turned on
  - 1.1 - Warning light does not illuminate
  - 1.2 - Warning light illuminates permanently
  - 1.3 - Warning light illuminates dimly
- 2 - When the engine is started
  - 2.1 - Warning light remains illuminated
  - 2.2 - Warning light illuminates again
- 3 - During braking with ABS regulation
  - 3.1 - Warning light illuminates at the end of ABS regulation
  - 3.2 - Warning light illuminates during ABS regulation
- 4 - While driving
  - 4.1 - Warning light illuminates (permanent illumination)
  - 4.2 - Warning light illuminates intermittently

TEVES ABS FAULT CHART

(B) FAULTS NOTED IN OPERATION DURING BRAKING WITH ABS REGULATION, WITHOUT ILLUMINATION OF THE WARNING LIGHT

- 1 - One or more wheels lock
  - 1.1 - One or both front wheels lock
  - 1.2 One or both rear wheels lock
- 2 - Direction is affected
  - 2.1 - Pulling
  - 2.2 - Wandering
- 3 - "Unexpected" ABS operation
  - 3.1 - At low speed / pedal only slightly depressed
  - 3.2 - On poor road surfaces
  - 3.3 - When using special equipment (radio telephone, CB ...)
- 4 - Reactions noted at the brake pedal
  - 4.1 - Brake pedal travel lengthens after ABS regulation (pedal goes sloppy when regulation begins).
  - 4.2 - Long pedal travel
  - 4.3 - Vibrations / jerks at the pedal
- 5 - Noise from pump, assembly or pipes.

(C) OTHER CASES

- 1 - Vibrations/jerks felt at the pedal when slightly depressed, on turning the ignition on.

(A) Faults noted by the operation of the ABS warning light

1 - When the ignition is turned on

1.1 - Warning light does not illuminate

Connect the **XR25** to the vehicle's diagnostic socket, place the ISO switch on position S8 and use the latest version of the cassette for the **XR25**.
Enter code D11 .
Does the warning light illuminate after the initialisation period?

yes → Is the ABS warning light fixed or flashing?

flashing → Ensure continuity between track **6** on the relay unit connector and track **A2** on connection **R183** (ABS/passenger compartment) on the bulkhead under the windscreen wiper.
Check the condition of the connections.
Replace the relay unit if the fault persists.

fixed → Disconnect the relay unit.
Is there continuity between tracks **1** and **2** wiring side and earth?

yes → Deal with the fault finding associated with the illumination of the bargraph on the **XR25** and start fault finding again if the warning light does not operate correctly.

no → Ensure this continuity.
Does the fault persist?

yes → Deal with the fault finding associated with the illumination of the bargraph on the **XR25** and start fault finding again if the warning light does not operate correctly.

no → Correct

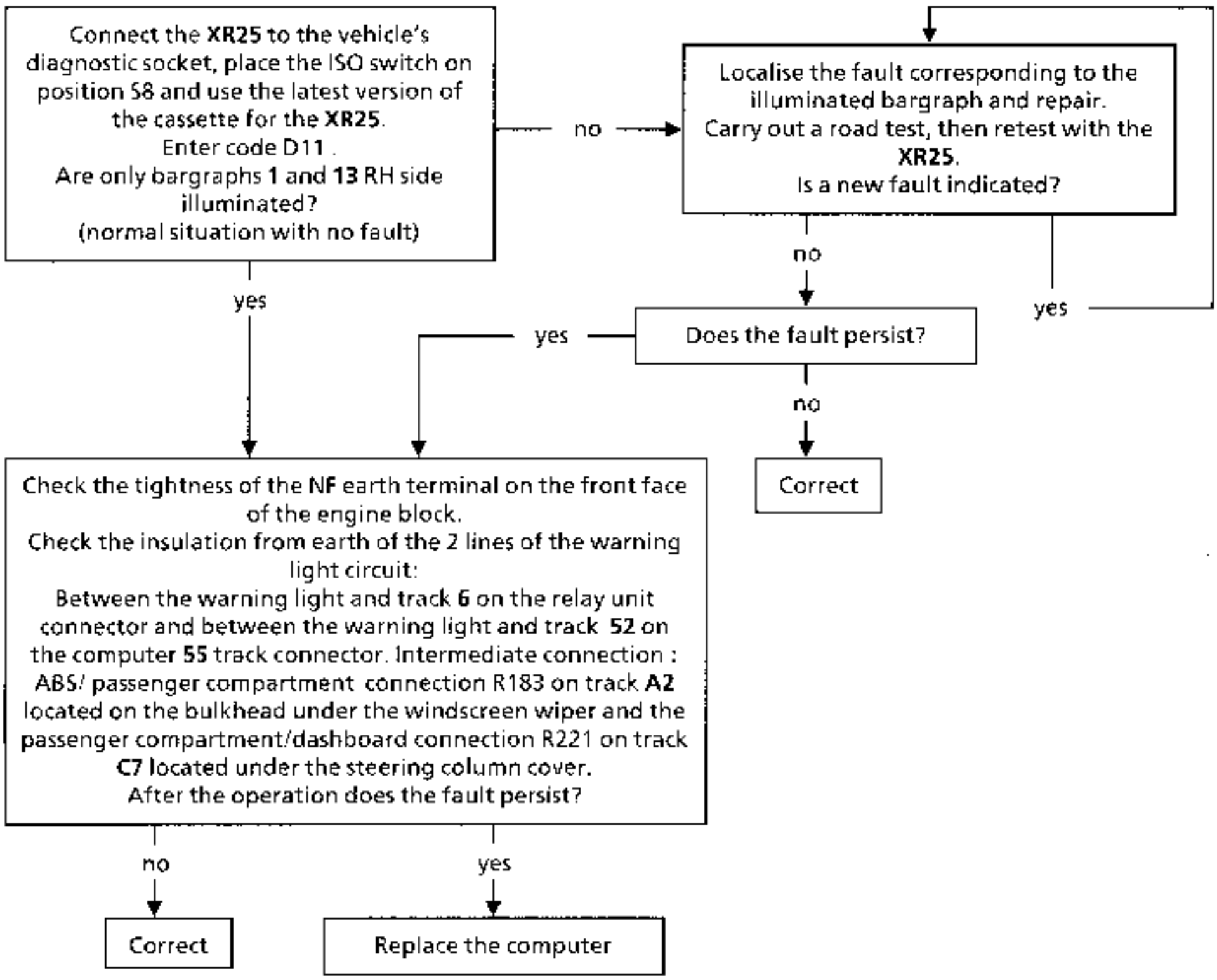
no → Check the condition of the fuse and the fuse holder for the warning light.
Check the ABS warning light bulb. After testing, does the fault persist ?

yes → Check / ensure
+ after ignition on the ABS warning light.
Check the condition of the connections on the connection R183 (ABS/passenger compartment) on the bulkhead under the windscreen wiper.
Check / ensure continuity between the warning light and track **A2** of connection R183.
Intermediate connection: R221 passenger compartment/dashboard on track **C7**.

(A) Faults noted by the operation of the ABS warning light

1 - When the ignition is turned on

1.2 - Warning light illuminates permanently



(A) **Faults noted by the operation of the ABS warning light**

1 - When the ignition is turned on

1.3 - Warning light illuminates dimly

When the ignition is turned on, does the warning light extinguish after 2 seconds?

yes

Check the condition of the ABS warning light bulb. (oxidation, poor contact ...)
Check the ABS earth and the connections on the warning light line (connection R183 passenger compartment/ABS on the bulkhead under the windscreen wiper and connection R221 passenger compartment /dashboard under the steering column cover)
Does the fault persist?

no → Correct

yes → Recheck your diagnosis

no

Connect the **XR25** to the vehicle's diagnostic socket, place the ISO switch on position 58 and use the latest version of the cassette for the **XR25**.
Turn the ignition on and enter code D11 .
Are only bargraphs **1** and **13** RH side illuminated?

yes

no

Localise the fault corresponding to the illuminated bargraph and repair.
Carry out a road test, then retest with the **XR25**.
Is a new fault indicated?

yes → (back to Localise the fault)

no

Does the fault persist?

yes

no → Correct

Check the insulation from earth of the 2 lines of the warning light circuit:
Between the warning light and track **6** on the relay unit connector and between the warning light and track **52** on the computer **55** track connector.
Intermediate connection : ABS/ passenger compartment connection **R183** on track **A2** located on the bulkhead under the windscreen wiper and the passenger compartment/dashboard connection R221 on track **C7** located under the steering column cover.
Also check the condition of the ABS earth and the connections of the **55** and **15** track connectors.
After the operation does the fault persist?

no → Correct

yes → Recheck your diagnosis

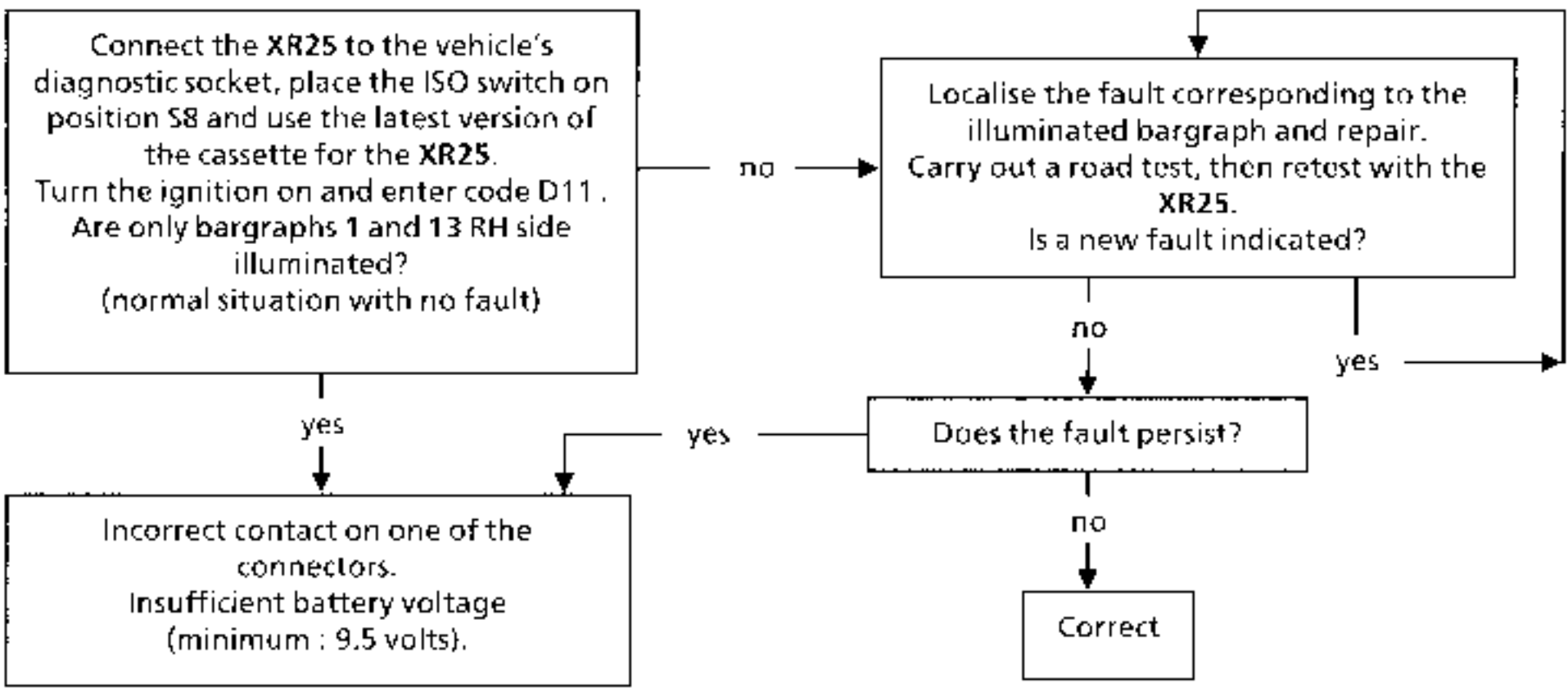
(A) **Faults noted by the operation of the ABS warning light**

2 - When the engine is started

2.1 - Warning light remains illuminated

Same fault finding as case 1.2.

2.2 - Warning light illuminates again



(A) **Faults noted by the operation of the ABS warning light**

3 - During braking with ABS regulation

3.1 - Warning light illuminates at the end of ABS regulation

XR25

Test for a possible sensor fault.

If the fault persists, check the battery voltage (minimum : 9.5 volts) and the wiring.

3.2 - Warning light illuminates during ABS regulation

XR25

If the fault persists, check the wiring (intermittent cut outs).

4 - While driving

4.1 - Warning light illuminates

XR25

4.2 - Warning light illuminates intermittently

Check the battery voltage (minimum : 9.5 volts).
Check the ABS NF earth on the front face of the engine block.

If these are correct, the computer has detected a fault when comparing wheel speed information, but the fault was too short lived to justify memorisation.
Ignore the illumination of the warning light in this case.

(B) Faults noted in operation during braking with ABS regulation, without illumination of warning light

1 - Wheels lock

1.1 - One or both front wheels lock

Reminder: locking of the wheels on a vehicle fitted with ABS, or tyre squeal which the driver takes to be a wheel locking, may be due to a normal reaction of the system and should not necessarily be taken as a fault :
- locking permitted below 3.75 mph (6 km/h).
- braking with ABS regulation on a very poor road surface (high degree of tyre squeal).

If the wheels are locking however, lift the vehicle so that the wheels may be turned and check:
- for possible incorrect connection of the speed sensor connectors. Use the functions #01 #02 while turning the appropriate wheel and check the coherence of the results obtained,
- if the value measured is zero, turn the other wheels to confirm the sensors have been incorrectly connected and repair the wiring,
- a possible incorrect connection of the pipes on the hydraulic assembly. Use the functions G03* G04* while pressing the brake pedal and check for the 10 cycles of locking and releasing at the wheel concerned.

If the 10 cycles are not performed on the wheel tested (wheel remains locked), check to see if they are performed at another wheel. (this confirms incorrect connection : repair).
If the 10 cycles are not performed at any wheel and the connections are correct, replace the hydraulic assembly.
Check the condition of the ABS targets and their conformity.
Also check the sensor / target air gap over one turn of each of the two front wheels
: 0.3 mm ≤ air gap over one revolution ≤ 1.7 mm
If the fault persists after these checks, replace the hydraulic assembly.

1.2 - One or both rear wheels lock

TWINGO ABS vehicles have a braking compensator which is load sensitive.
When adherence is identical at all four wheels, the compensator ensures that for each front circuit pressure, the rear circuit pressure is less, but is proportional according to a pre-determined ratio (stepped piston). The rear wheels should not therefore be able to lock.
When adherence conditions are not uniform (2 wheels on the same side with low adherence, 2 wheels on the other side with high adherence) it is probable that the rear wheel on the side with low adherence will tend to lock, without this being an operating fault.

If the rear wheels are actually locking and adherence is uniform for all four wheels, check that the brake linings fitted are those specified for a vehicle with ABS and check the adjustment of the braking compensator.
(Refer to this Technical Note for the method and adjustment values.)

(B) Faults noted in operation during braking with ABS regulation, without illumination of warning light

2 - Course is affected

2.1 -Pulling

Remove the 10A ABS fuse from the passenger compartment connection unit and carry out a road test with the ABS non-operational. Does the fault persist under these conditions?

yes → Check the conformity of the rear brake linings (special ABS linings).
Check the tyre pressures, the front axle assembly and for possible leaks in the circuit.

no ↓

Lift the vehicle so the wheels may be turned and check for:
- possible incorrect connection of the speed sensors,
- possible incorrect connection of the hydraulic pipes on the hydraulic assembly.

For both these tests, use the methods given in section 1.1
Check the condition of the ABS targets and their conformity.
Also check the sensor / target air gap over one turn of each wheel
If the fault persists , replace the hydraulic assembly.

2.2 -Wandering

Remove the 10A ABS fuse from the passenger compartment connection unit and carry out a road test with the ABS non-operational. Does the fault persist under these conditions?

yes → Road holding fault not connected to the ABS system.
Test the braking components conventionally.

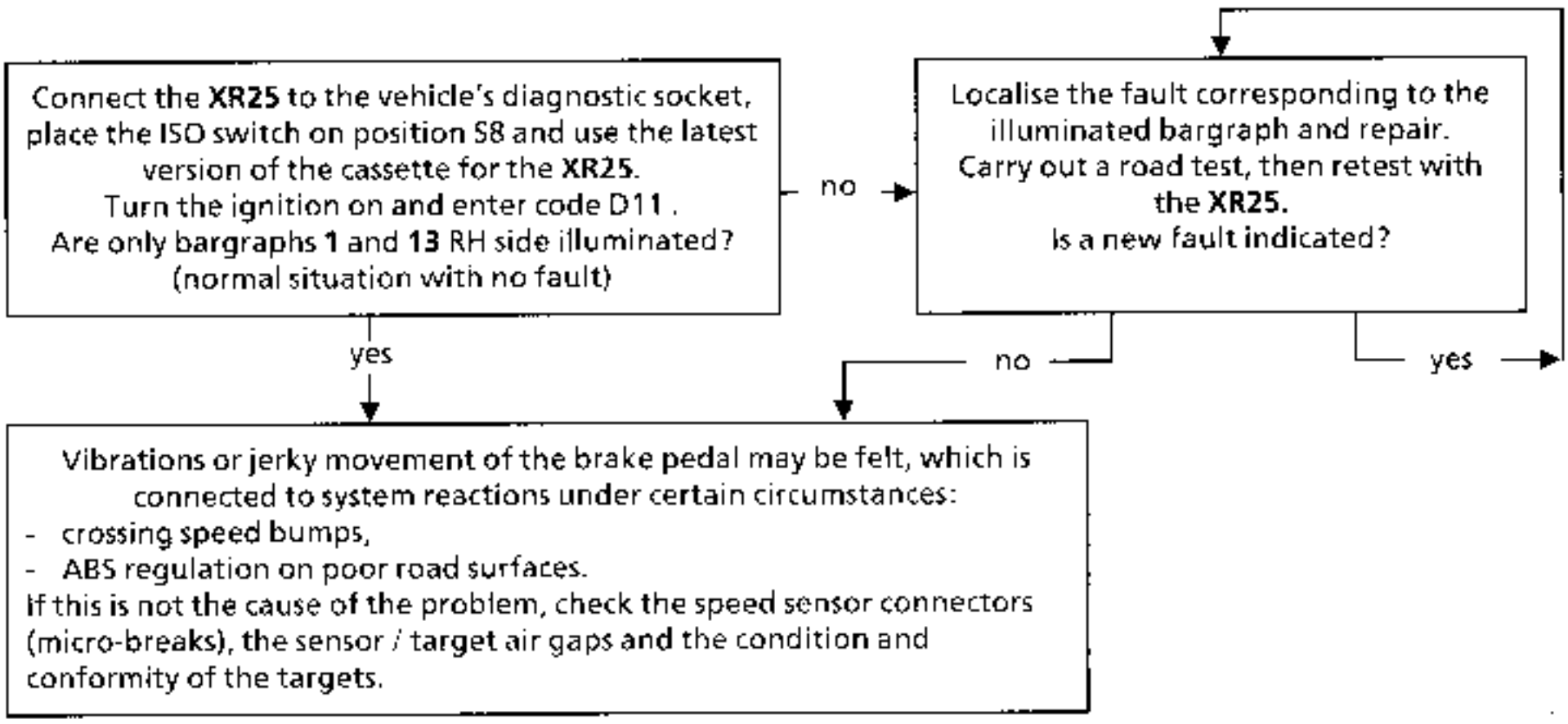
no ↓

Normal behaviour connected to the operation of the system in a regulation phase mainly in the case of non-uniform adherence or poor road surfaces.

(B) **Faults noted in operation during braking with ABS regulation, without illumination of warning light**

3 - "Unexpected" ABS operation

3.1 - At low speed / pedal only slightly depressed



3.2 - On poor road surfaces

On poor road surfaces it is normal to notice vibration or jerky pedal action as well as a higher degree of tyre squeal than on good road surfaces.

3.3 When using special equipment (radio telephone, CB ...)

Check that the equipment has been correctly installed, with no modification to the original wiring, particularly that for the ABS system.
Ensure that none of the ABS earths have been used for supplying feed to an accessory.

(B) **Faults noted in operation during braking with ABS regulation, without illumination of warning light**

4 - Reactions noted at the brake pedal

4.1 - Brake pedal travel lengthens after ABS regulation (pedal goes sloppy when regulation begins).

Air is entering the pipes and the hydraulic assembly is regulating to the braking circuits :
Bleed the circuits following the recommended procedure then use commands G03* and G04* on the **XR25.**
After the operation carry out a road test with ABS regulation.
Does the fault persist?

no → Correct

yes ↓

Repeat the above operation once or twice again.
After the operation, does the fault persist?

no → Correct

yes ↓

Replace the hydraulic assembly

4.2 - Long pedal travel

There is air in the braking circuits.
Bleed the system following the recommendations.
Repeat the operation if necessary.

4.3 - Vibrations / jerks at the pedal

Normal brake pedal reaction during an ABS regulation phase.

(B) **Faults noted in operation during braking with ABS regulation, without illumination of warning light**

5 - Noise from pump, assembly or pipes

- Vibration of the assembly: check the rubber insulation pads for mounting the assembly are present and are in good condition
- Vibration of the pipes: check that all the pipes are correctly clipped into their mounting clips and there is no contact between pipes, or between pipes and other components.

To determine where the noise is coming from, use functions G03* and G04* on the **XR25**.

(2) **Other cases**

1 - Vibrations/ jerks felt at the pedal when slightly depressed, on turning the ignition on.

When the ignition is turned on and the system carries out initialisation,the various components are self-tested including the simultaneous operation of the 4 solenoids of the hydraulic assembly.
If the brake pedal is depressed at this moment, it is normal to notice that it moves and that the solenoids are heard to operate. The greater the pressure at the brake pedal, the more noticeable the phenomenon will be.

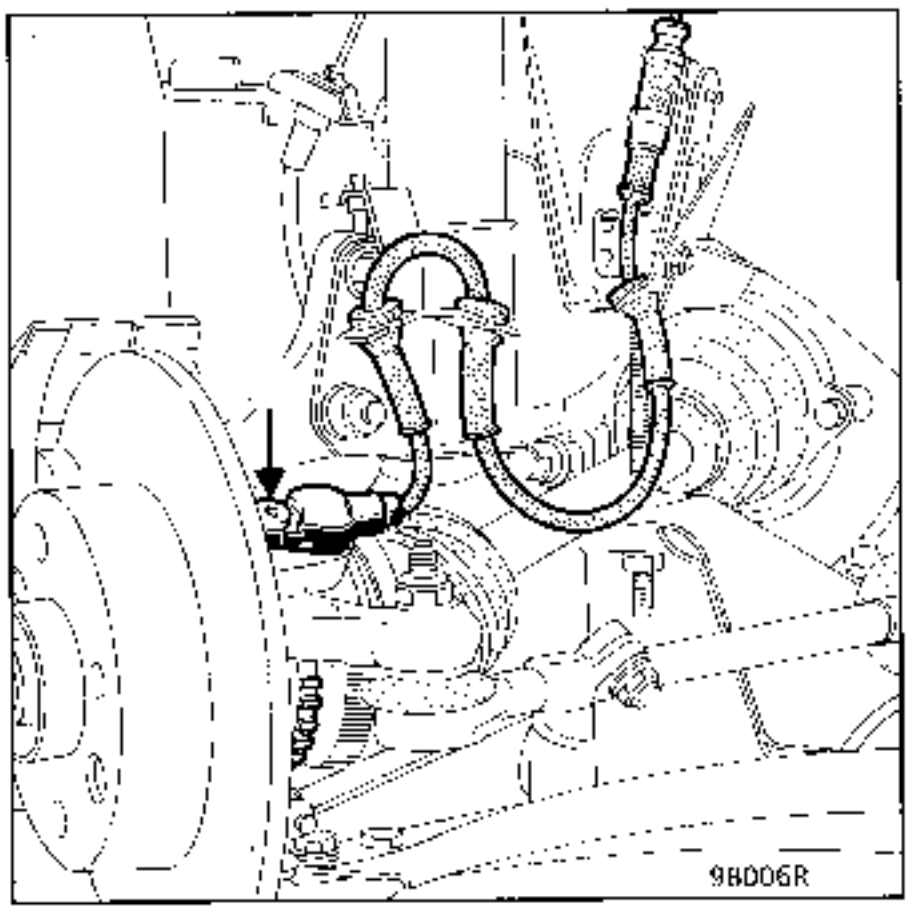
REMOVAL - REFITTING OF COMPONENT PARTS

1 - FRONT WHEEL SENSOR

TIGHTENING TORQUES (in daN.m)	▽
Wheel bolt	9
Sensor mounting bolt	0.8 to 1

REMOVAL

Remove:
- the wheel,
- the sensor mounting bolt (Torx T30).



Release the wire from its mountings and its connector.

REFITTING

Coat the sensor in **Multifonctions** grease Part Number 77 01 422 308, then put the sensor into position and clip the wire into its mountings. Reconnect the wire.

Check the recommended air gap over one turn of the wheel with a set of shims (non-adjustable).

Air gap: 1mm ˙ 0.7

NOTE : to eliminate risks of faults it is vital to ensure that the connector is connected correctly.

The sensor must be fitted by hand. Do not tap it when fitting it into position.

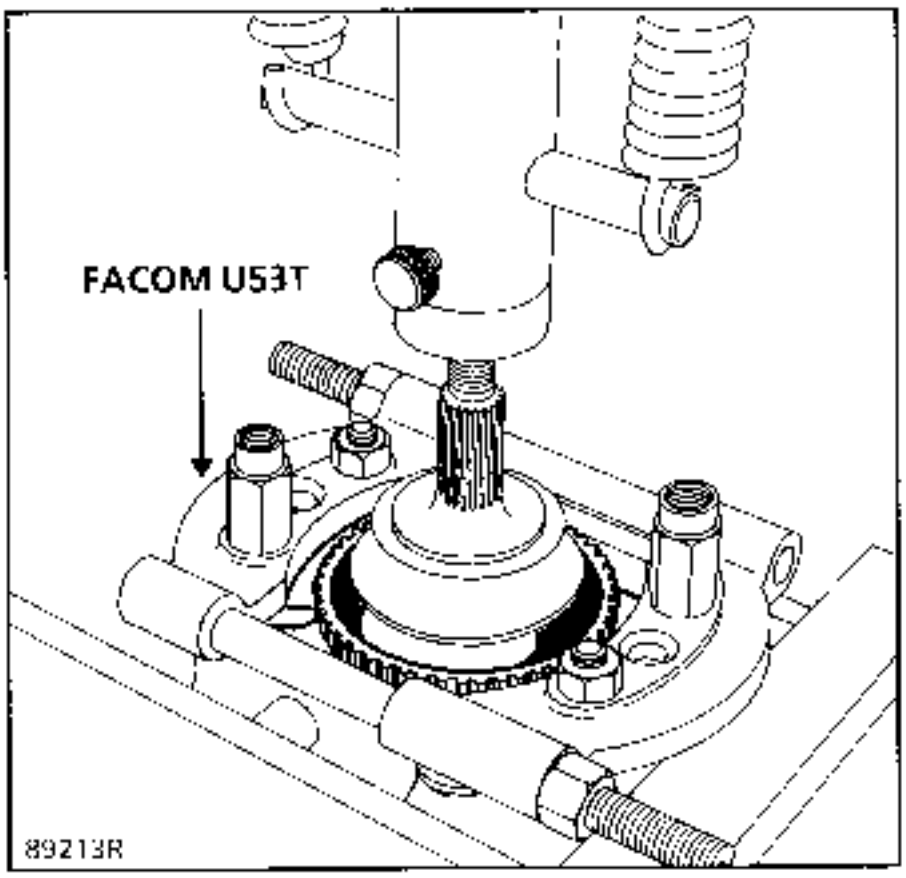
Do not push or pull on the wiring.

2 - FRONT WHEEL TARGET

SPECIAL TOOLING REQUIRED	
T.Av. 1084	Mandrel for fitting ABS target

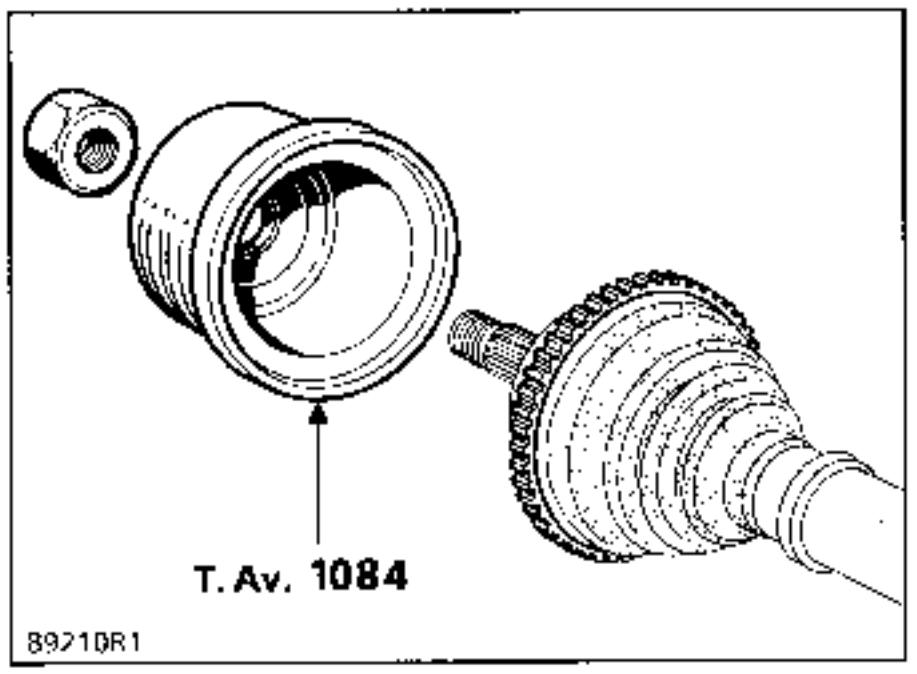
REMOVAL

Extract the target ring using a **FACOM U53T** type extractor.



REFITTING

Coat the target with **Loctite SCELBLOC** and refit it using tool **T.Av. 1084** . Re-use the old driveshaft nut.



NOTE : the Parts Department supplies machined driveshafts without an ABS target. The old target must be retained to be fitted to the new driveshaft. Single targets are however available from the Parts Department.

3 -COMPUTER

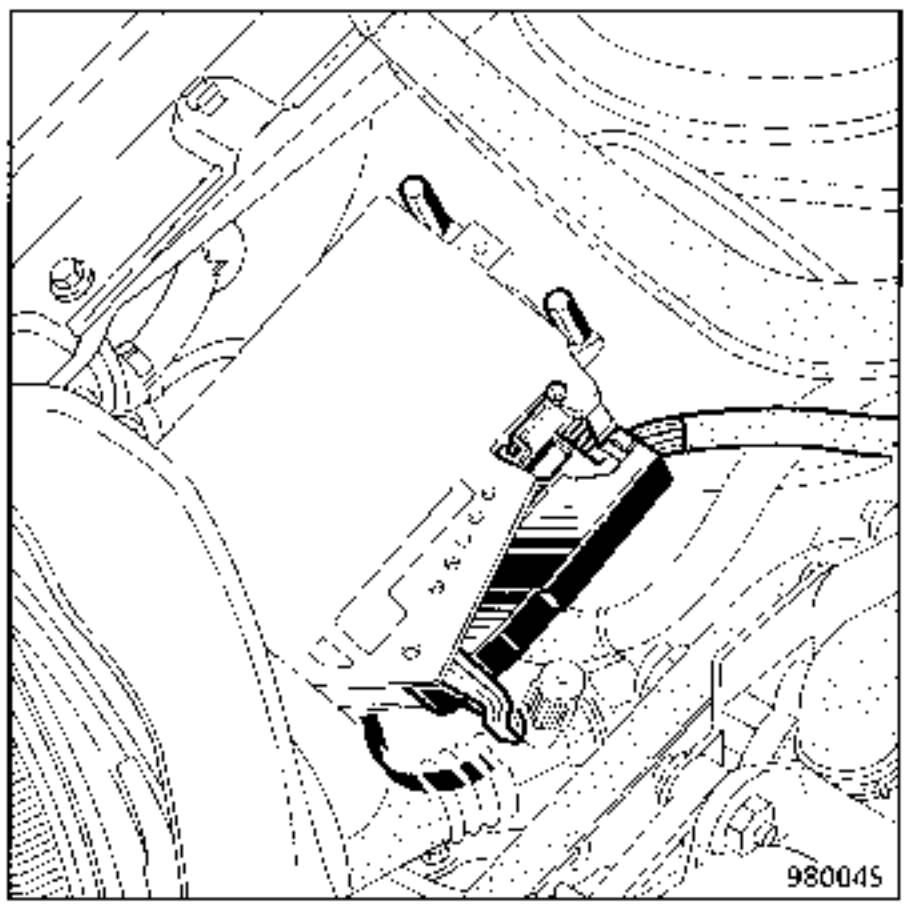
TIGHTENING TORQUES (in daN.m)	
Computer mounting bolt	0.4

REMOVAL

Disconnect the battery.

Remove the 3 mounting bolts.

Disconnect the **55** track connector (arrow).



Remove the computer

REFITTING - Special Notes

Reconnect the battery.

Test the system using the G functions on the **XR25**.

After a road test (with ABS regulation) check the ABS function on the **XR25**.

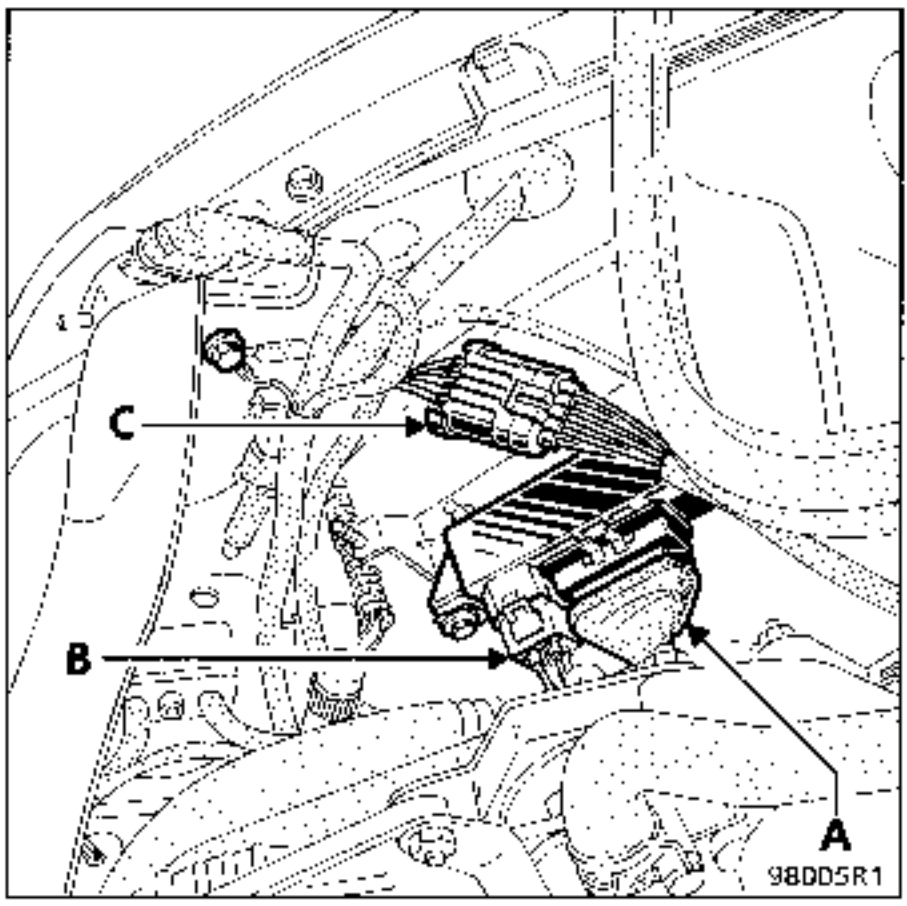
Validate the end of the test : G13*.

3 - RELAY BOARD

REMOVAL

This is located under the computer. The computer must be removed to reach the relay board.

There are no special notes for removal.



A Relay board connector **(15 track)**

B Pump - motor connector **(4 track)**

C Solenoid connector **(5 track)**

REFITTING

Reconnect the battery.

Test the system using the G functions on the **XR25**.

After a road test (with ABS regulation) check the ABS function on the **XR25.**

Validate the end of the test : G13*.

5 - HYDRAULIC ASSEMBLY
(pump - motor + solenoid)

SPECIAL TOOLING REQUIRED	
T. Av. 476	Ball joint extractor
T. Av. 1233-01	Assembly for working on the axle assembly mounting

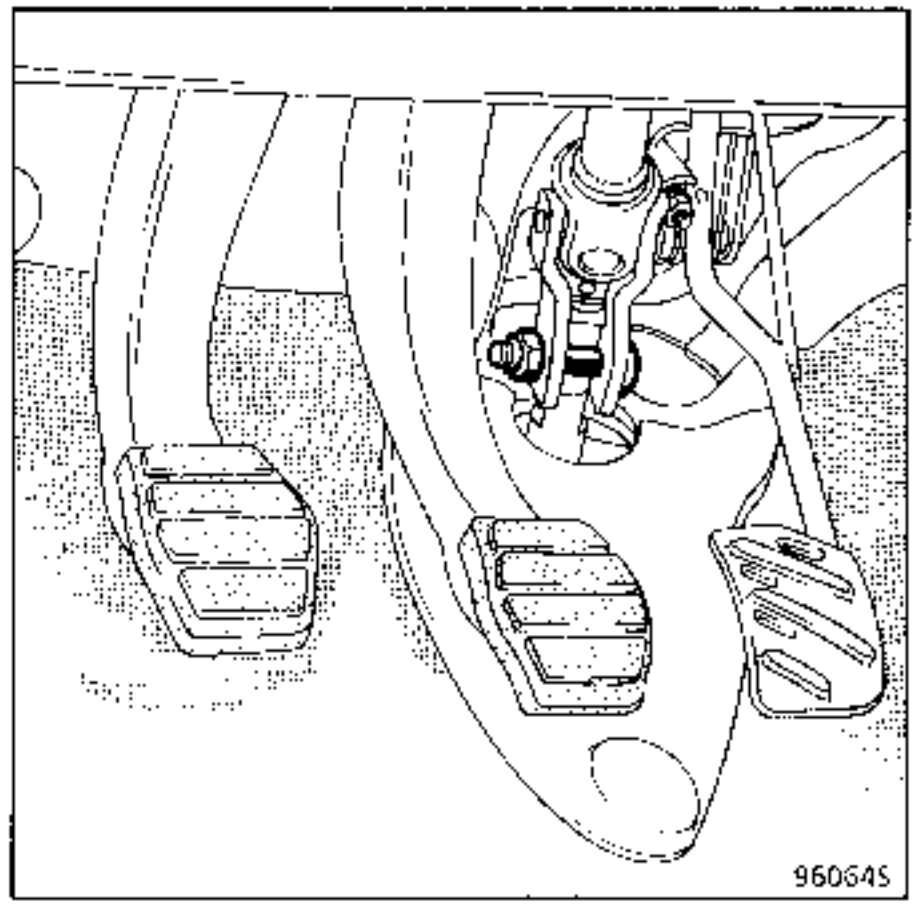
TIGHTENING TORQUES (in daN.m)		
Steering column universal joint nut		2.5
Mounting bolt for axle assembly mounting		6.5
Track rod end nut		3.5
Gear box rear mounting bolt		9.5
Wheel bolt		9
Pipe union	M10 × 100	1.2
	M12 × 100	1.5

The size of the hydraulic assembly means that the axle assembly mounting must be separated from the body and the two 10 mm diameter threaded rods of tool **T.Av. 1233-01** (2 sets) (4 x 10 mm diameter rods) must be used.

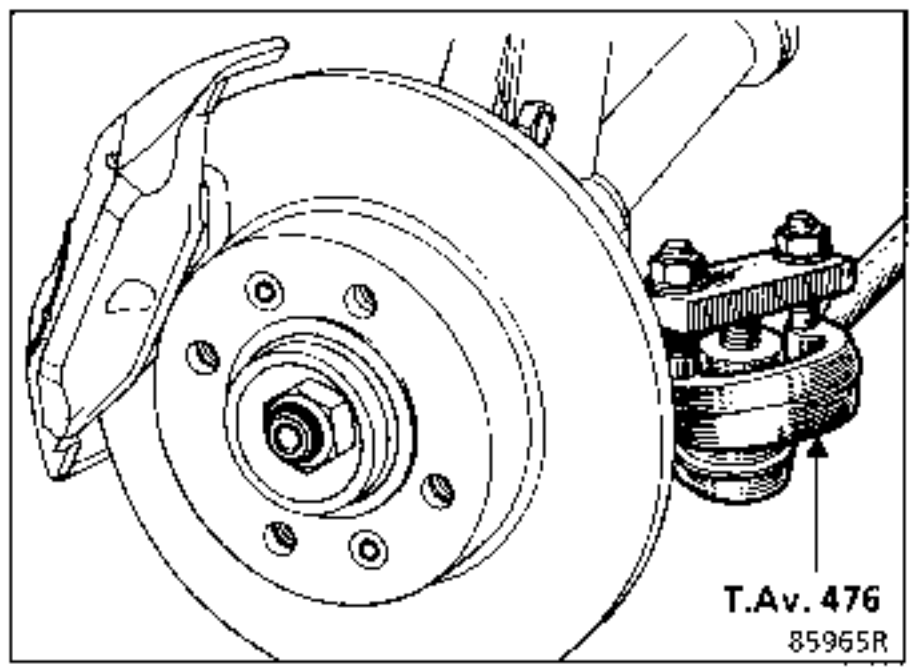
REMOVAL

Vehicle on a lift, battery disconnected,
remove:
- the nut and cam bolt mounting the steering column universal joint.

Fit a pedal press (to limit the amount of hydraulic fluid lost).

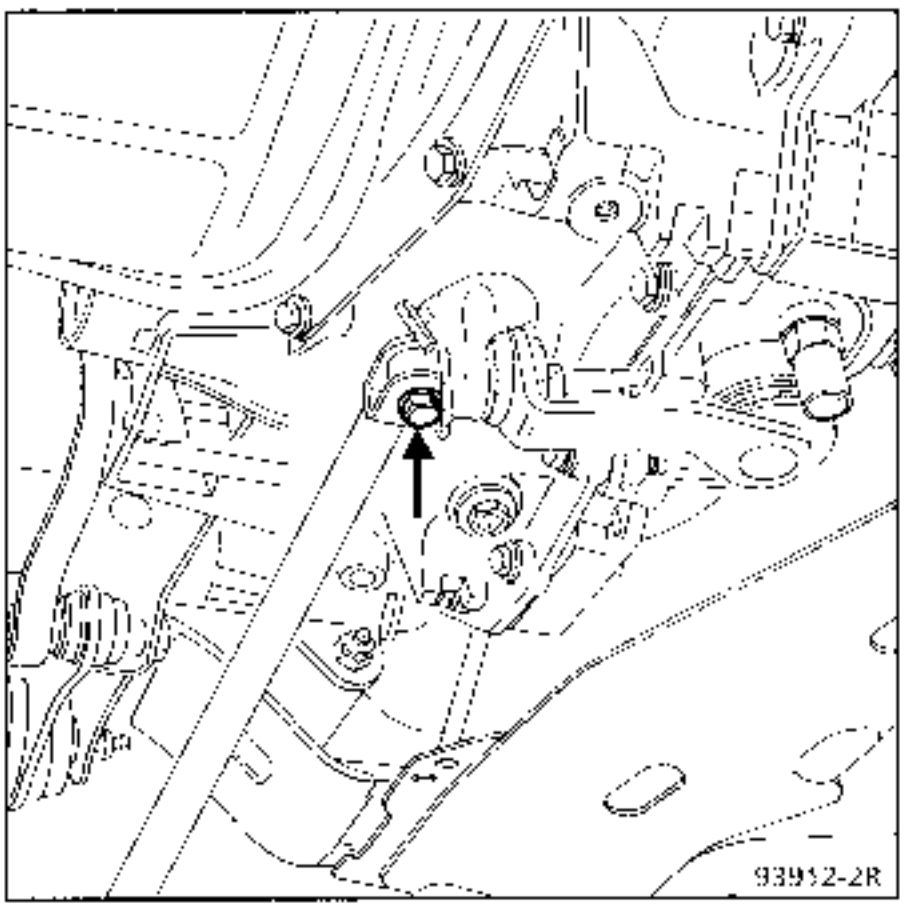


Remove:
- the front wheels,
- the track rod ends using tool **T.Av. 476**.



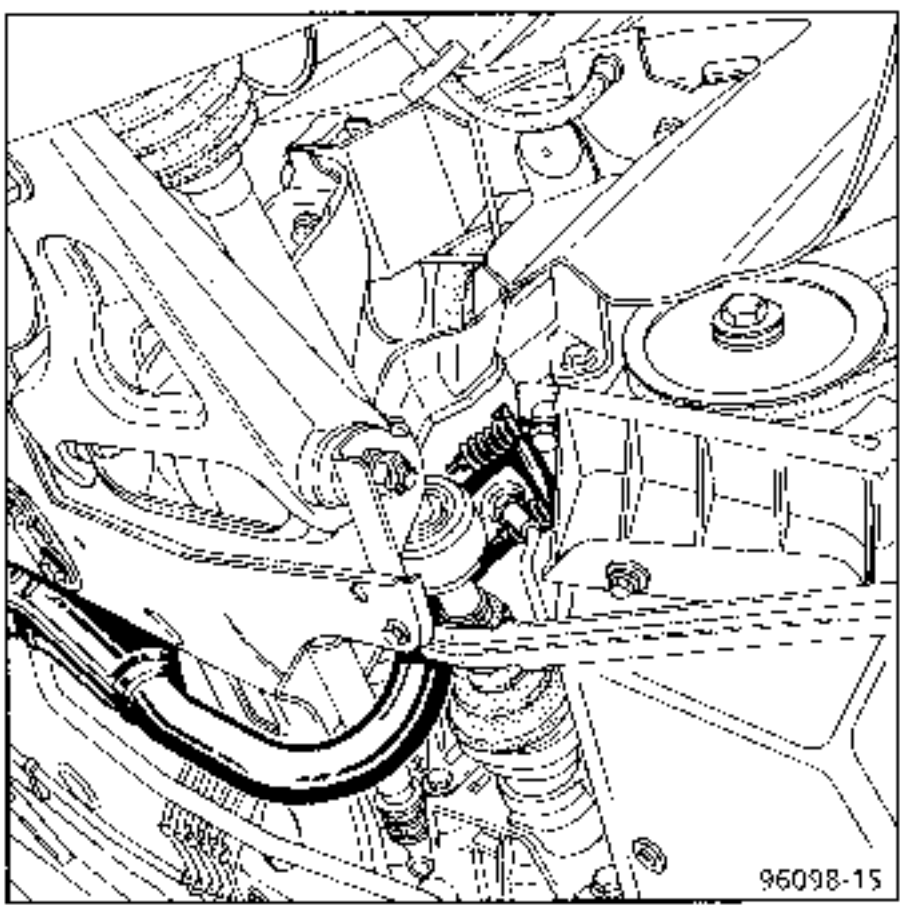
– the plastic engine undertray.

Release the gear control from the gear box output lever after removing the protective gaiter.

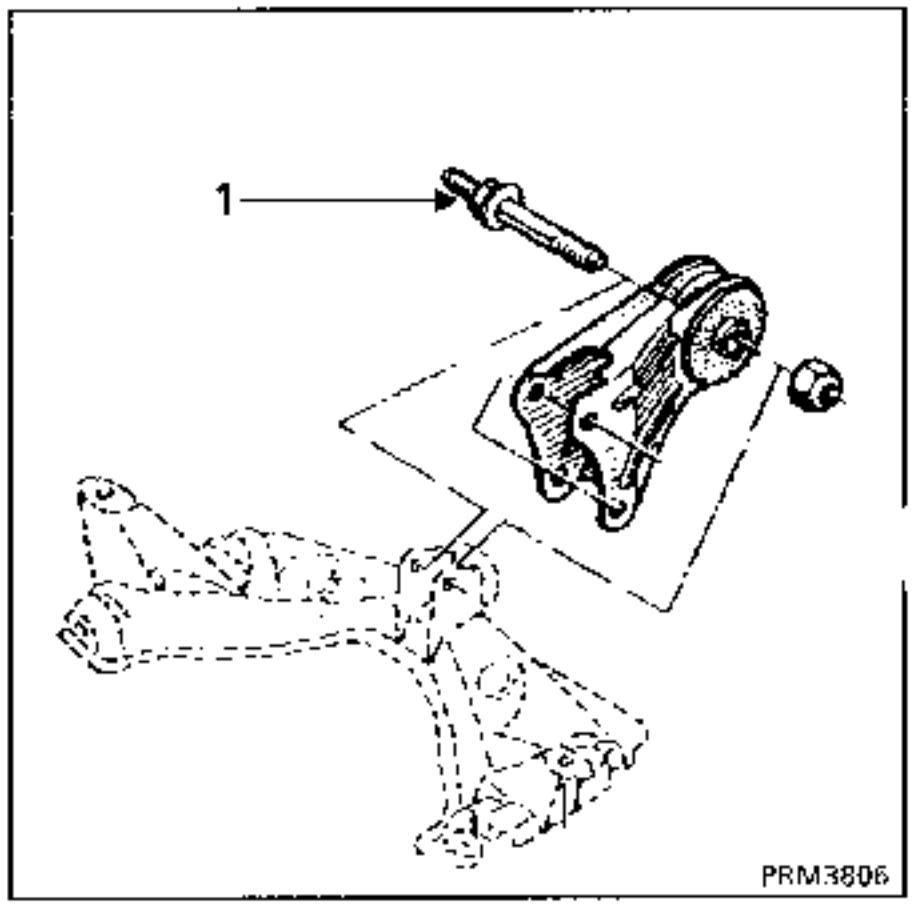


Attach the control rod to the exhaust pipe.

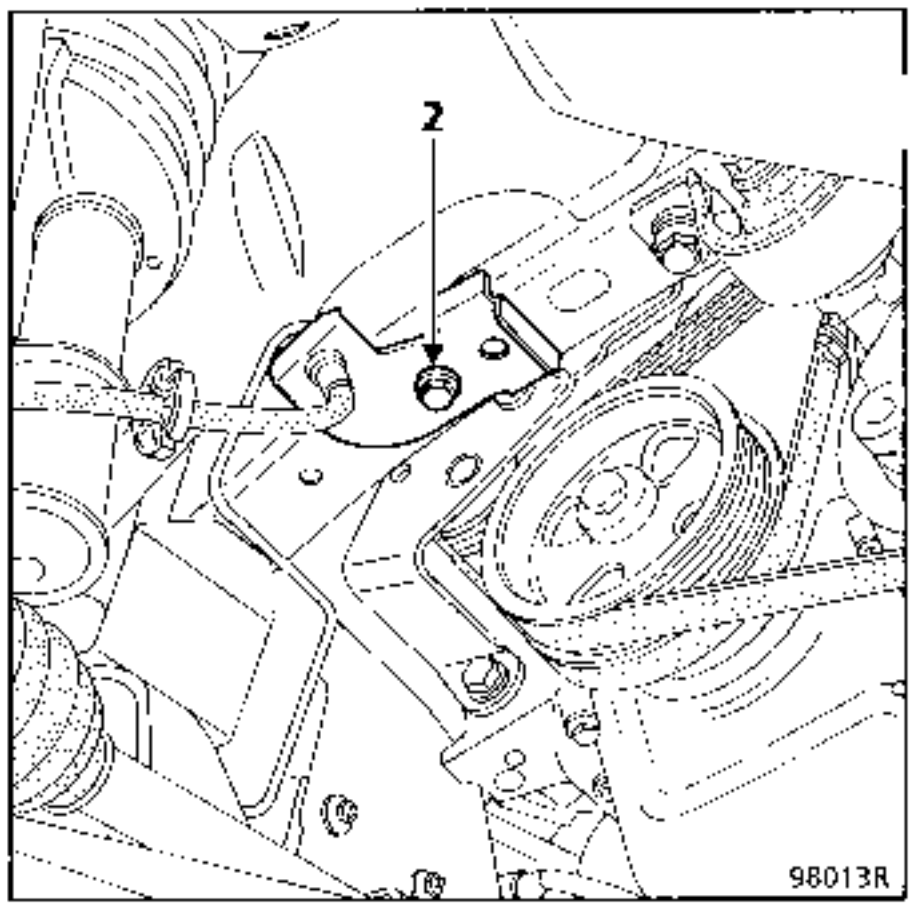
Remove:
– the catalytic converter,



– the heat shield,
– the rear gear box mounting bolt (1).



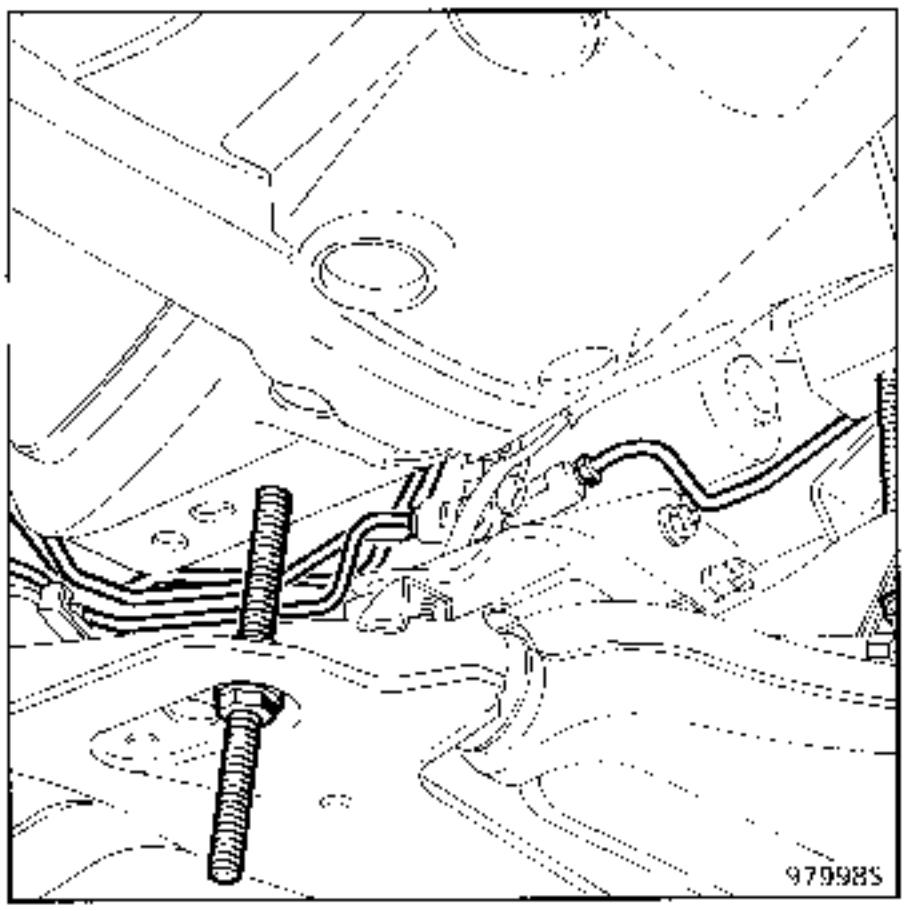
Remove:
– the brake pipe bracket mounting bolt(2) on the front right hand side member



Fit a jack under the axle assembly mounting.

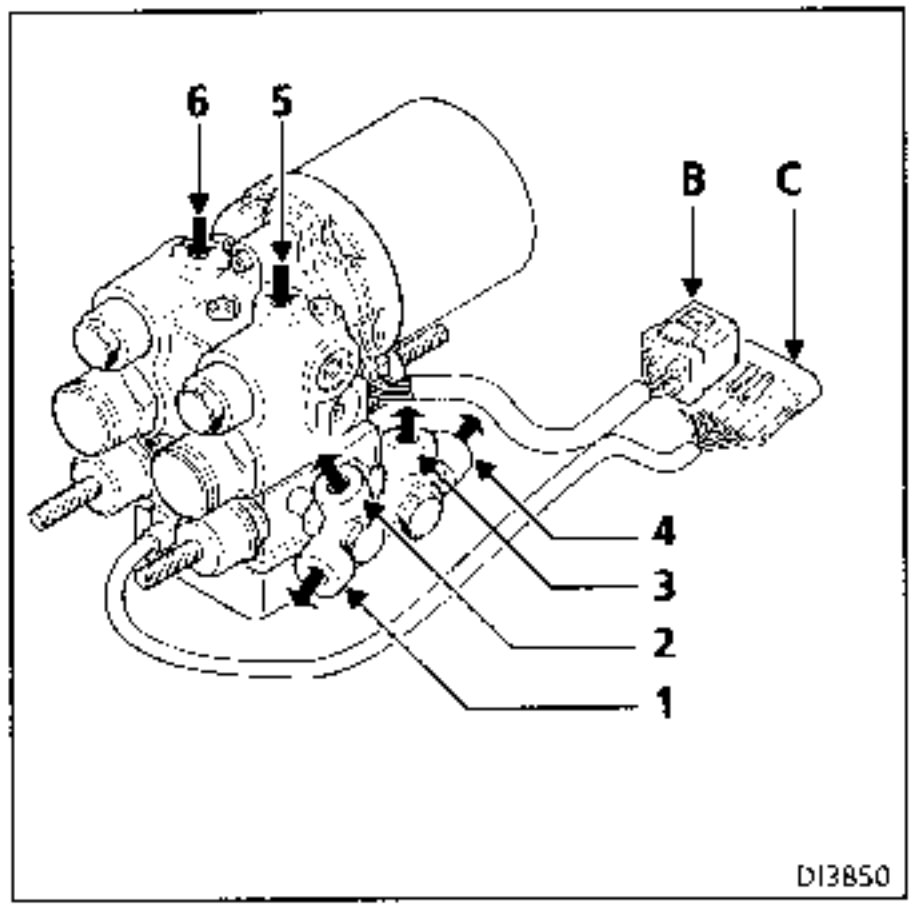
Replace the mounting bolts one by one with the 10 mm diameter threaded rods. Two rods should be used for the front mountings and two other rods for the rear mountings.

Lower the assembly so that the hydraulic assembly unions may be reached.

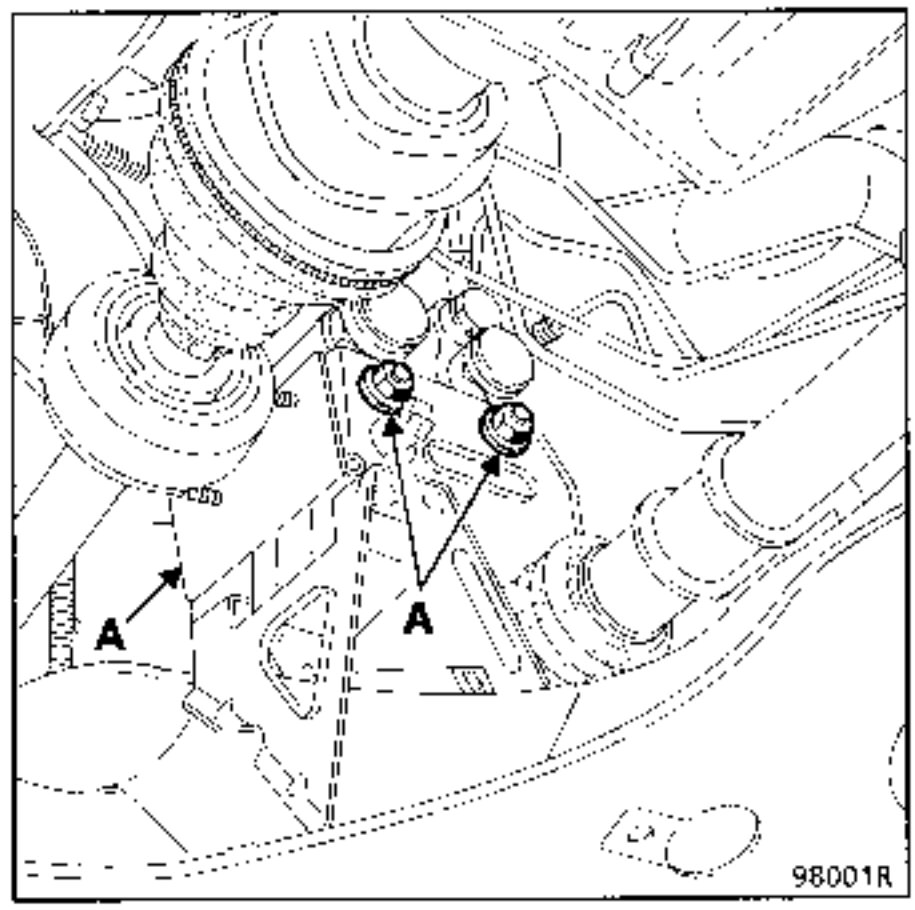


Attention : when lowering the assembly, release the rigid brake pipes.

Remove:
- the hydraulic assembly protective shields,
- the 6 hydraulic unions.



- the 3 nuts (A).



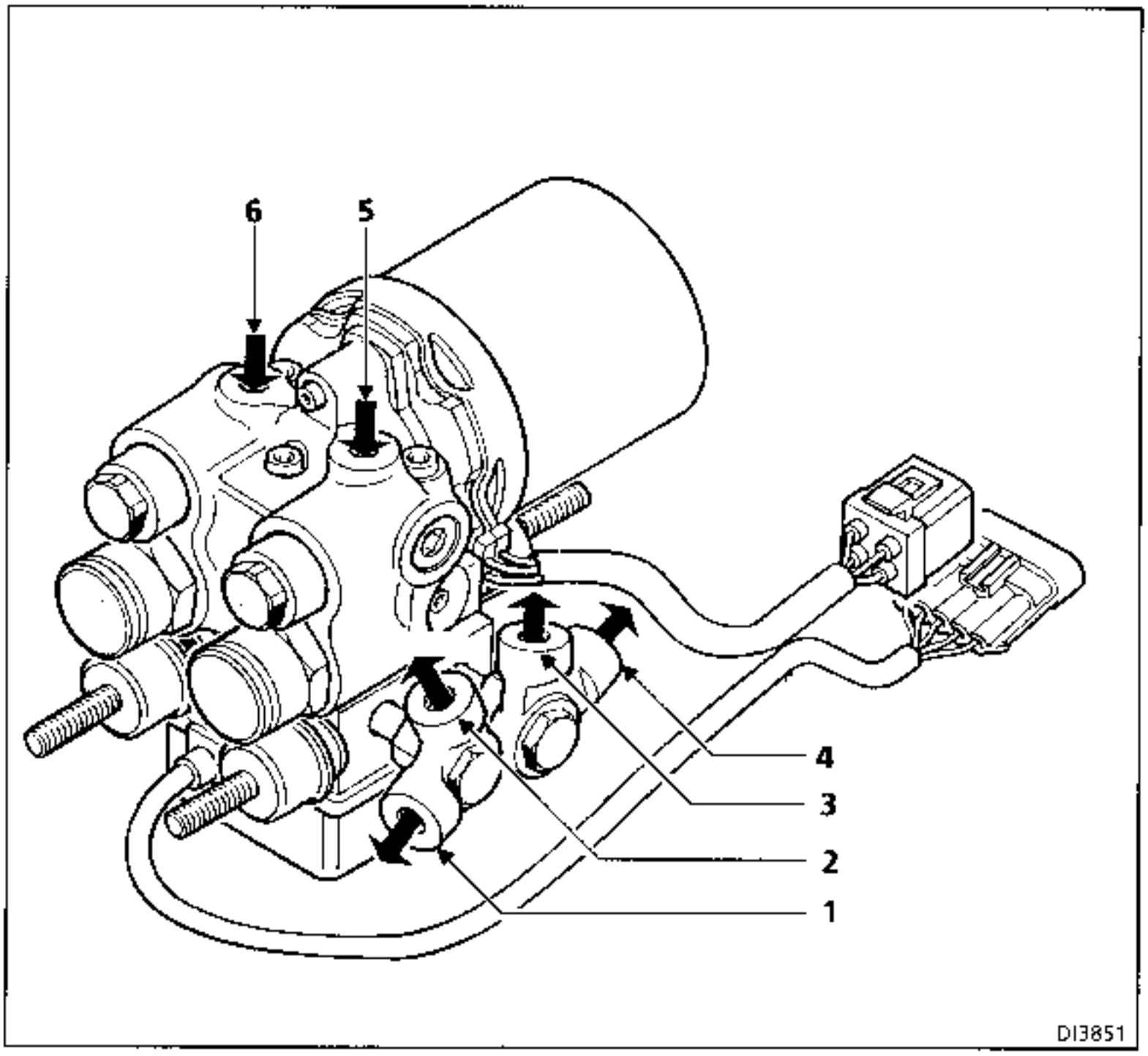
Fit plugs to the unions (to limit fluid loss).

Remove the hydraulic assembly forwards having disconnected the pump - motor connector (B) and the solenoid connector (C).
(see removal of relay board).

REFITTING

Refitting is the reverse of removal.

Fit the ABS assembly taking care to observe the position of the pipes.



1 rear right hand wheel

2 front left hand wheel

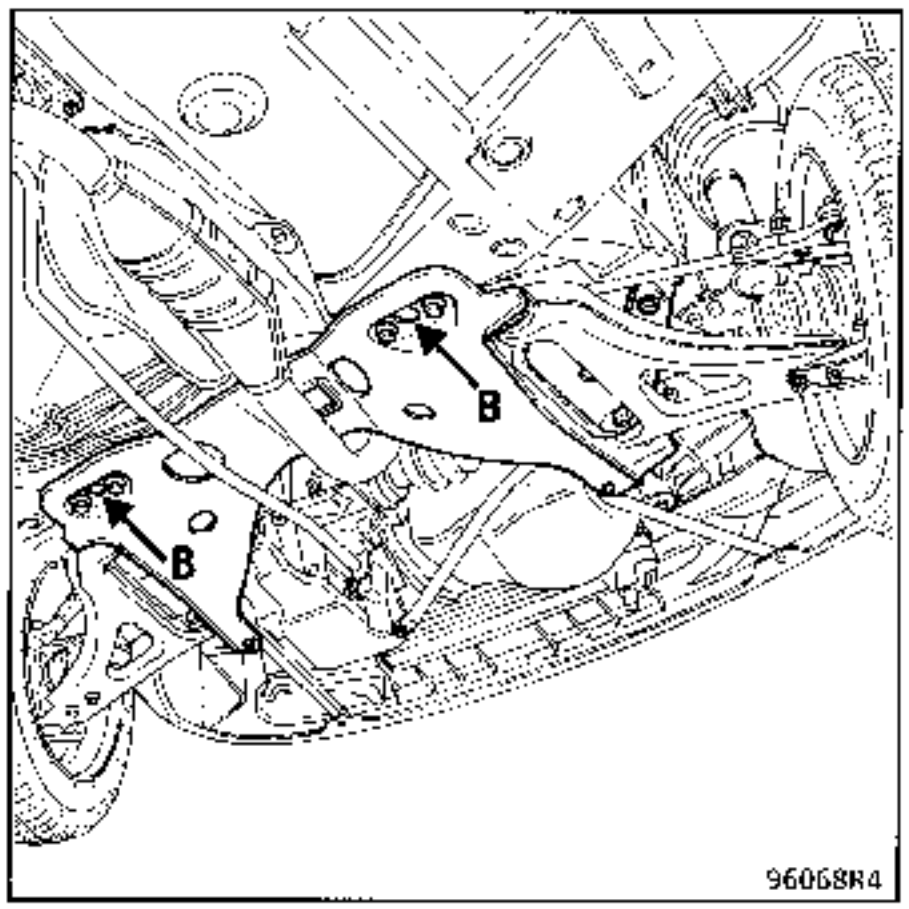
3 front right hand wheel

4 rear left hand wheel

5 master cylinder primary circuit

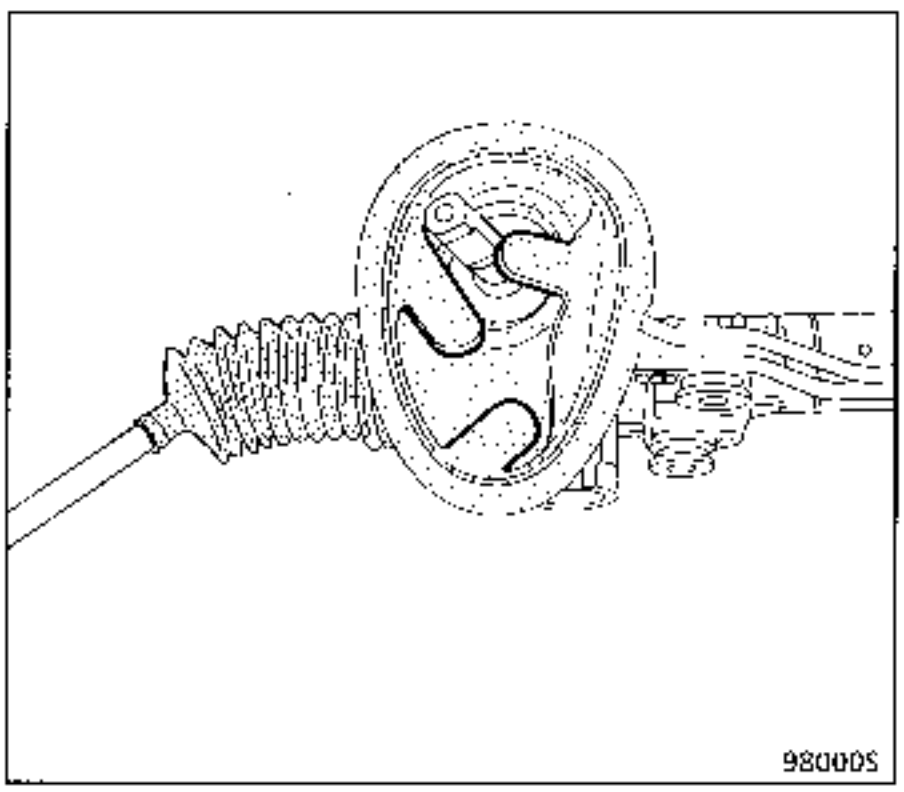
6 master cylinder secondary circuit

REFITTING (cont)
To ensure the assembly is correctly fitted, two 12 mm pins (for example a drill bit) MUST be fitted into index holes (B) in the axle assembly mounting, before the mounting bolts are finally tightened.



IMPORTANT

To make fitting the steering unit protective gaiter easier, fold the 3 tabs in before refitting the axle assembly mounting.



Bleed the system **following the recommendations for bleeding** (see following pages).

Test the system using the G functions on the **XR25**.

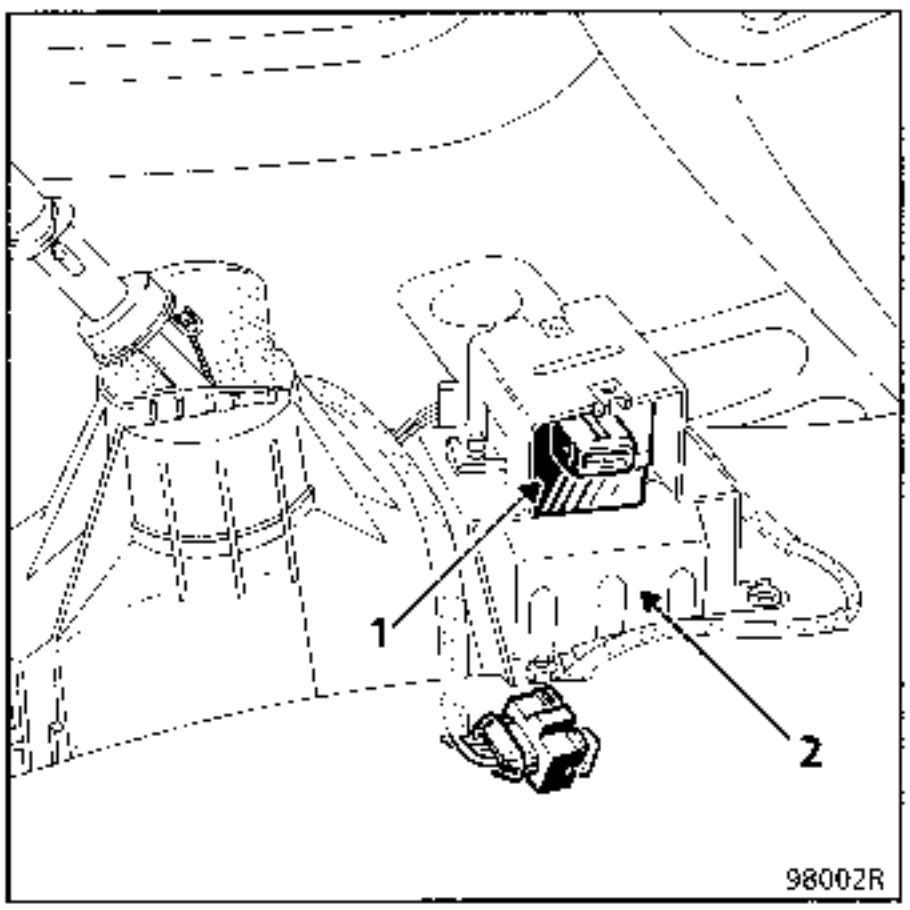
After a road test (with ABS regulation) check the ABS function on the **XR25**.

Validate the end of the test : G13*.

6 - ACCELERATION SENSOR

REMOVAL

This is located in the centre console.
To reach the sensor, remove the console (2 bolts).



1 – ABS acceleration sensor.

2 – Seat belt pre-tensioner computer.

REFITTING

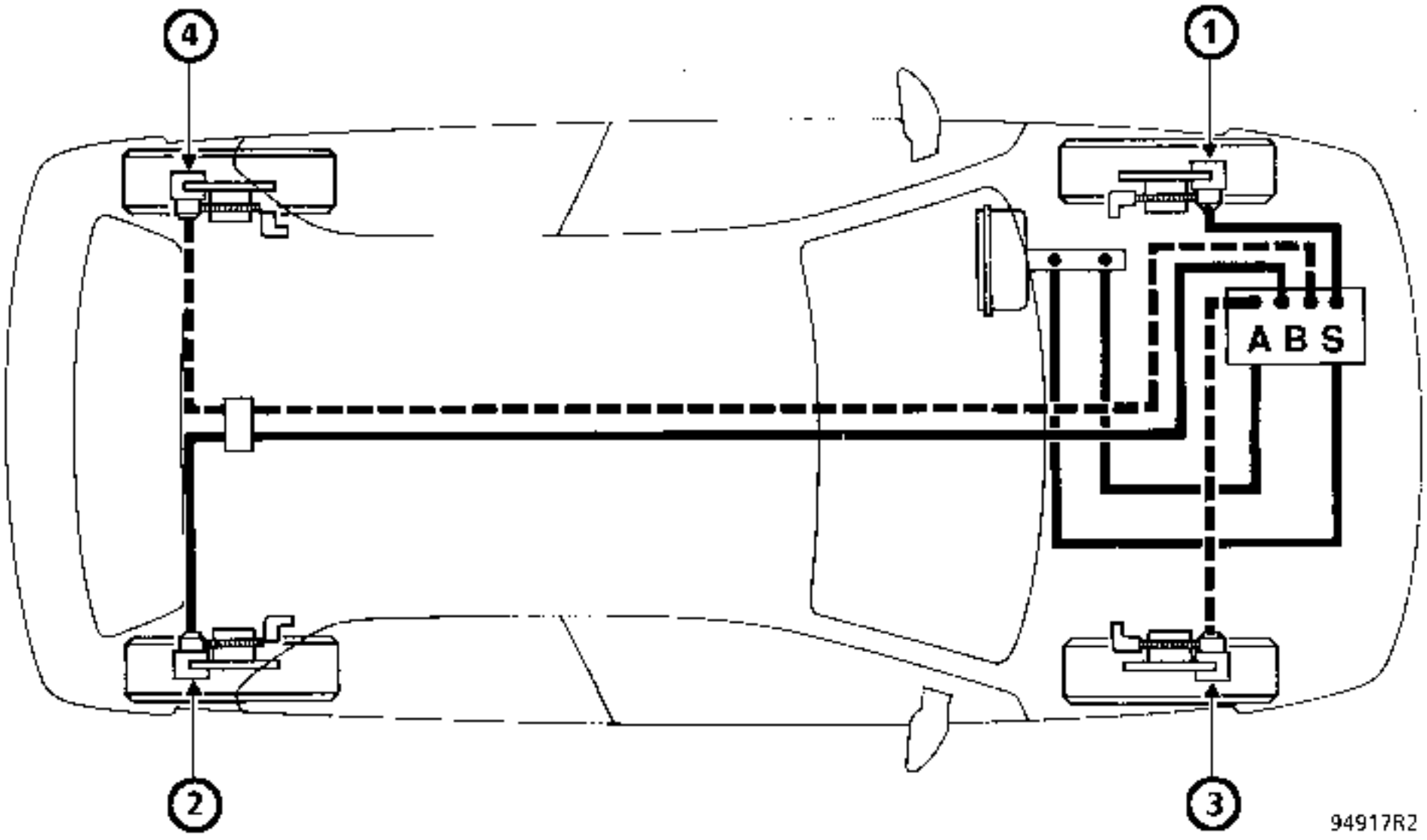
Ensure the sensor is correctly fitted:
arrow towards front of the vehicle.

BLEEDING

ATTENTION

The following order of bleed operations MUST be observed when bleeding the ABS hydraulic circuit

1. Front left hand wheel caliper
4. Rear right hand wheel caliper
2. Front right hand wheel caliper
3. Rear left hand wheel caliper



The ABS system should not be operated under any circumstances if the system has not been bled. If the pump takes in air, it is extremely difficult if not impossible to bleed it.

Because of this, the hydraulic assembly supplied by the Parts Department is already filled with brake fluid.

BLEEDING WITH BLEEDING EQUIPMENT

Connect the bleeding equipment to the brake fluid reservoir.

1. Fit the pipe to the bleed screw of the corresponding wheel cylinder.

   Open the bleed screw of the corresponding wheel cylinder and wait until the fluid runs out without any bubbles (duration: approximately 30 s).

   Close the bleed screw.

The order for bleeding operations must be observed:

a) master cylinder to front left hand side,

b) master cylinder to rear right hand side,

c) master cylinder to front right hand side,

d) master cylinder to rear left hand side.

2. Follow the bleeding procedure using the pedal, ensuring that the level of brake fluid in the reservoir is always between the minimum and maximum marks during the operation.

The order of operations specified in section 1 above must be strictly observed.

- Connect the pipe to the bleed screw of the corresponding wheel.
- Open the bleed screw concerned.
- Depress the pedal approximately 20 times.
- Check and top up the brake fluid level if necessary.

BLEEDING WITHOUT BLEEDING EQUIPMENT

The order of operations is the same as specified in section 1 above and must be strictly observed.

- Connect the pipe to the bleed screw of the corresponding wheel.
- Open the bleed screw concerned.
- Depress the pedal several times, until no more bubbles are seen.
- During the bleeding procedure, the level of brake fluid in the reservoir should always be between the minimum and maximum marks.

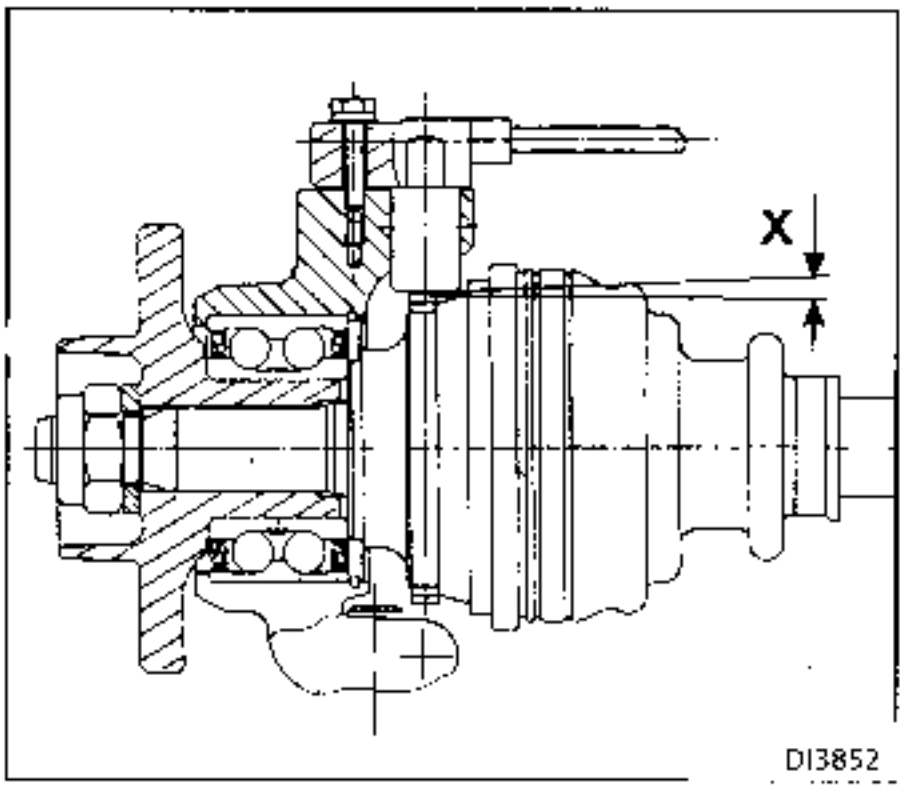
ADDITIONAL TESTS

1 - TARGET / SENSOR AIR GAP

Position the target so that the top of one of the teeth is parallel with the sensor.

Front sensor:

$$X = 1\,mm \pm 0.7$$

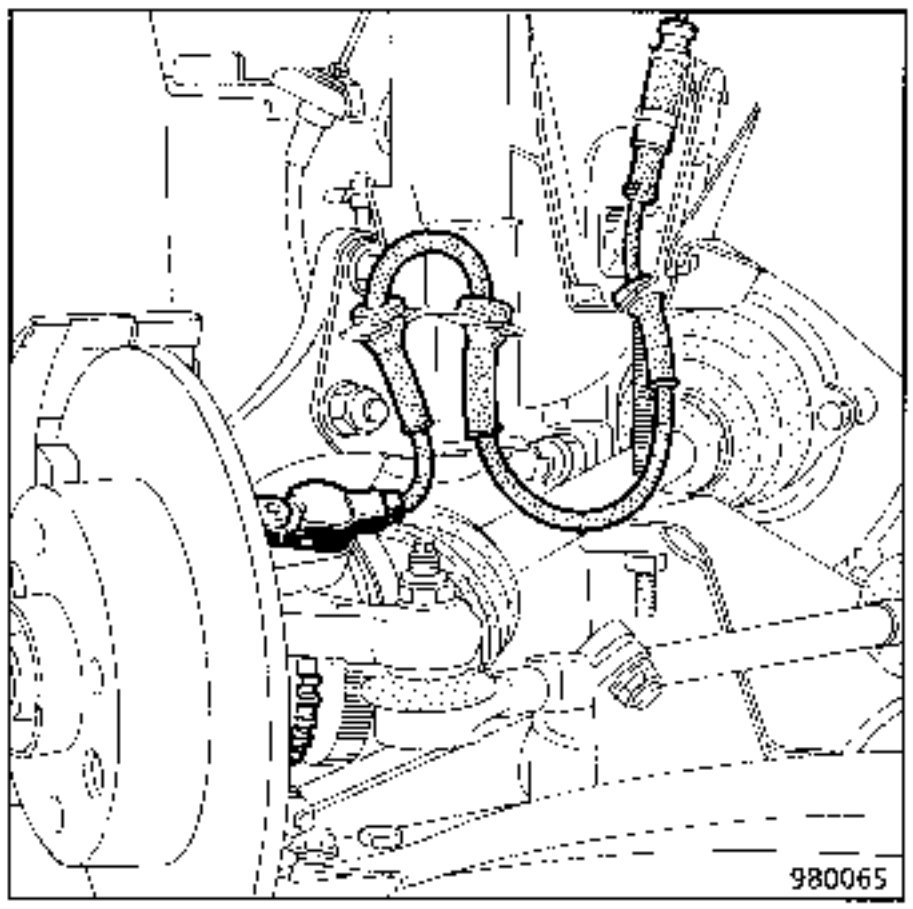


2 - SENSOR RESISTANCE

$$R = 1.1\,k\Omega \pm 200\,\Omega$$

3 - CHECKING THE WHEEL SENSOR CONNECTORS

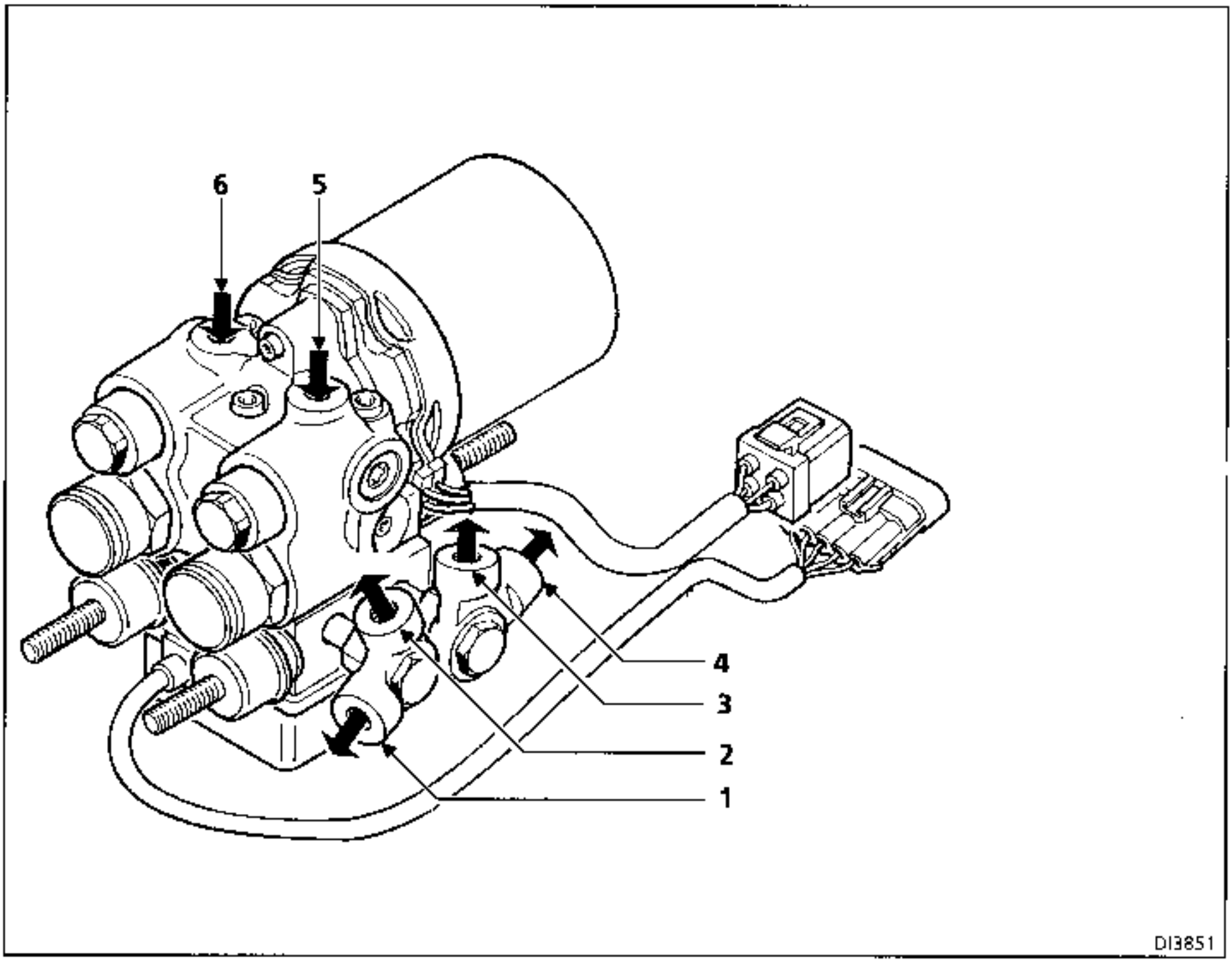
If the ABS warning light illuminates intermittently, check the wheel sensor connectors and clean them using NETELEC Part Number **77 01 403 517**.



Note

- When disconnecting the connectors, avoid using a sharp tool which could damage the retaining lugs on the 2 sections of the connector.
- Take care to observe the routing for the wiring and the connections (the reliability of the ABS system depends on correct routing).

Hydraulic assembly pipe markings



1 rear right hand wheel
2 front left hand wheel
3 front right hand wheel
4 rear left hand wheel
5 master cylinder primary circuit
6 master cylinder secondary circuit

COMPENSATOR

PRINCIPLE FOR CHECKING

These vehicles are fitted with a load sensitive compensator.

The pressure is read in an **X,** by comparison of the pressure at the rear wheels with a given pressure at the front wheels.

These dual compensators have two totally separate bodies which act in an X arrangement on one front wheel and one rear wheel.

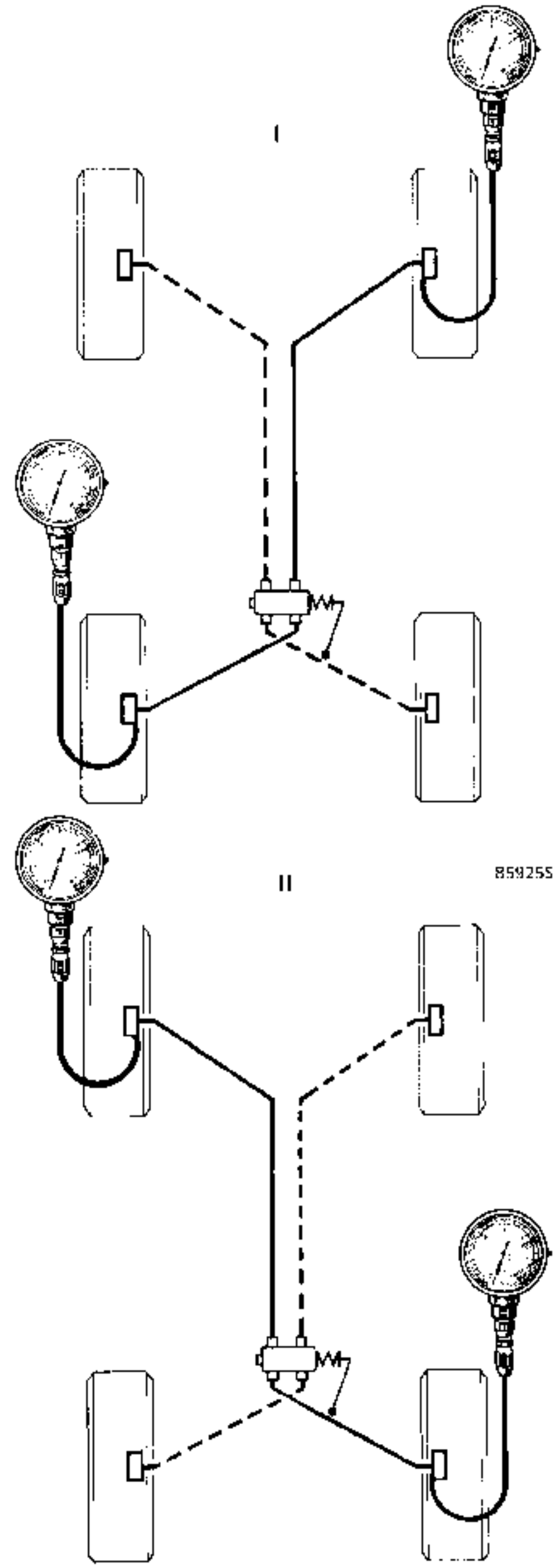
Both circuits must be checked.

I : front right / rear left
II : front left / rear right

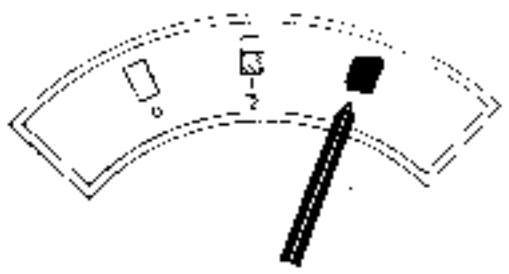
Load sensitive compensator.

On load sensitive compensators the adjustment allows the rear pressure to be regulated according to the front pressure.

Regulation acts simultaneously on both bodies of the compensator. If there is an incorrect pressure for only one of the bodies, replace the compensator.



These vehicles are fitted with a load sensitive compensator.
They should be tested with the vehicle unladen, the fuel tank full and the driver on board.

Vehicle type	Fuel tank	Test pressure (bar)	
		Front	Rear
C06 ABS	 Full 909665	100 →	21 $^{+0}_{-8}$

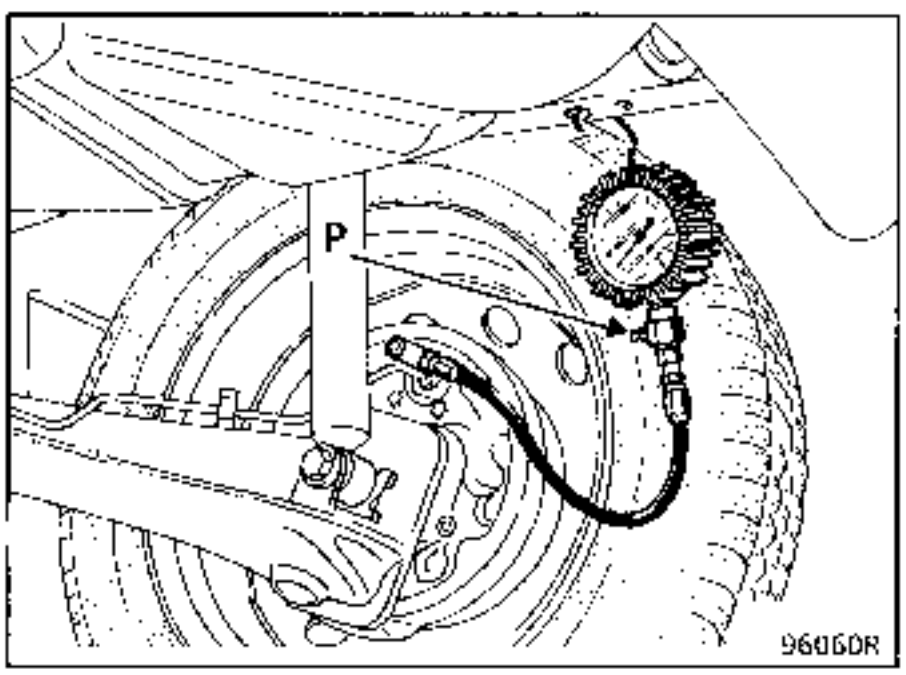
The compensator should be checked and adjusted with the vehicle on the ground and one person on board.

SPECIAL TOOLING REQUIRED	
Fre. 244-03 + 284-06 or Fre. 1085	Pressure gauge for testing brake compensator setting

CHECKING

Connect 2 pressure gauges **Fre. 244-03** or **Fre. 1085** :
- one at the front right hand side,
- one at the rear left hand side.

Bleed the pressure gauges: screw (P).



Depress the brake pedal progressively until the adjustment pressure is obtained at the front wheels (see table of values). Read the corresponding pressure at the rear wheels; correct it if necessary.

Carry out the same operation for the other circuit:
- one pressure gauge at the front left hand side,
- one pressure gauge at the rear right hand side.

If there is a large difference (values exceed tolerances), replace the compensator as no repair is permitted.

ADJUSTMENT

To adjust the compensator, slacken bolt (A) and move the rod (B) within sleeve (C).