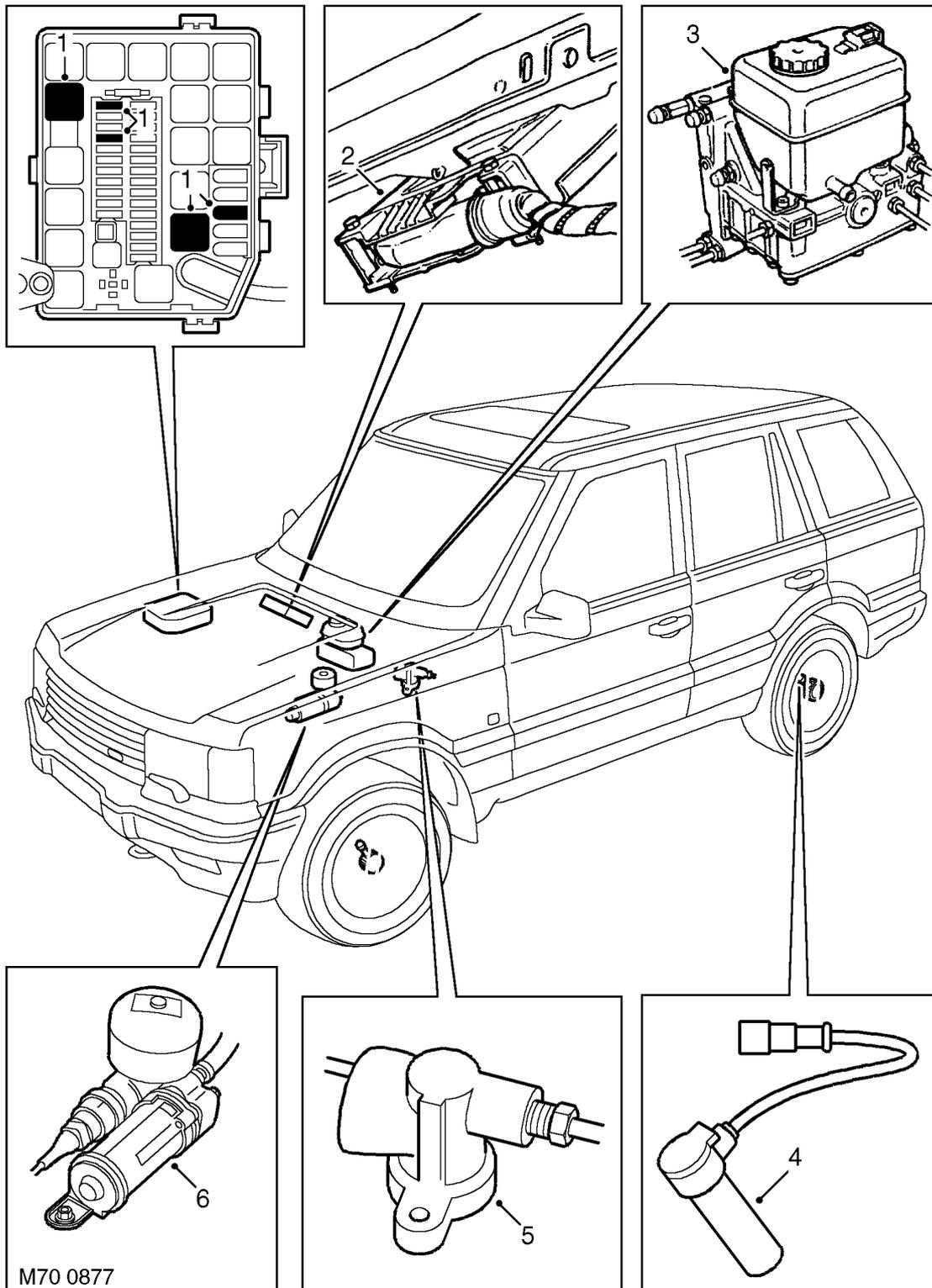




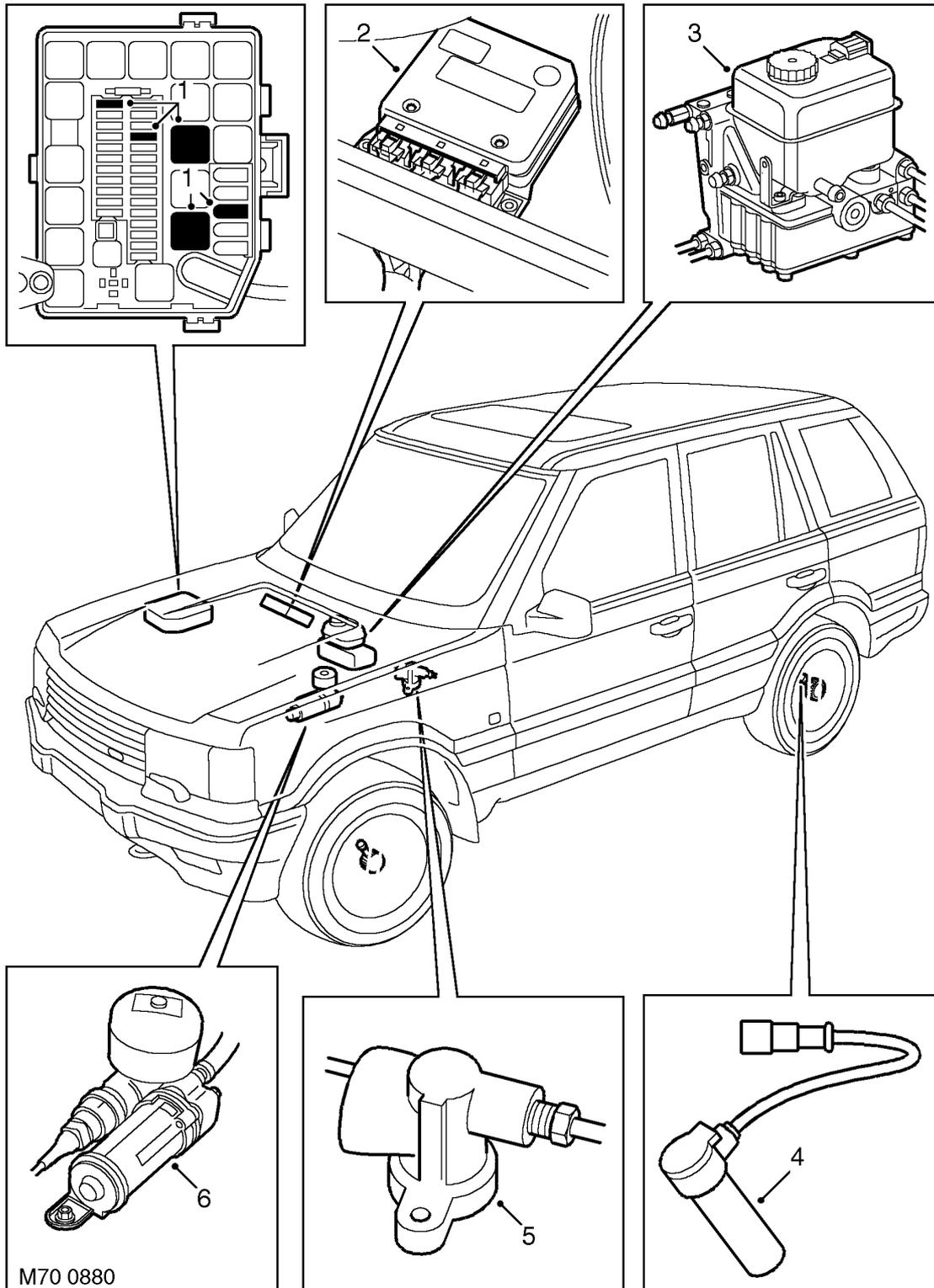
LOCATION OF COMPONENTS - ABS UP TO 99MY



1. Relays and fuses
2. ABS Electronic Control Unit (ECU)
3. Brake booster/ABS modulator unit

4. Front and rear sensors/exciter rings
5. Pressure Conscious Reducing Valve (PCR)
6. ABS power unit

LOCATION OF COMPONENTS - ABS FROM 99MY



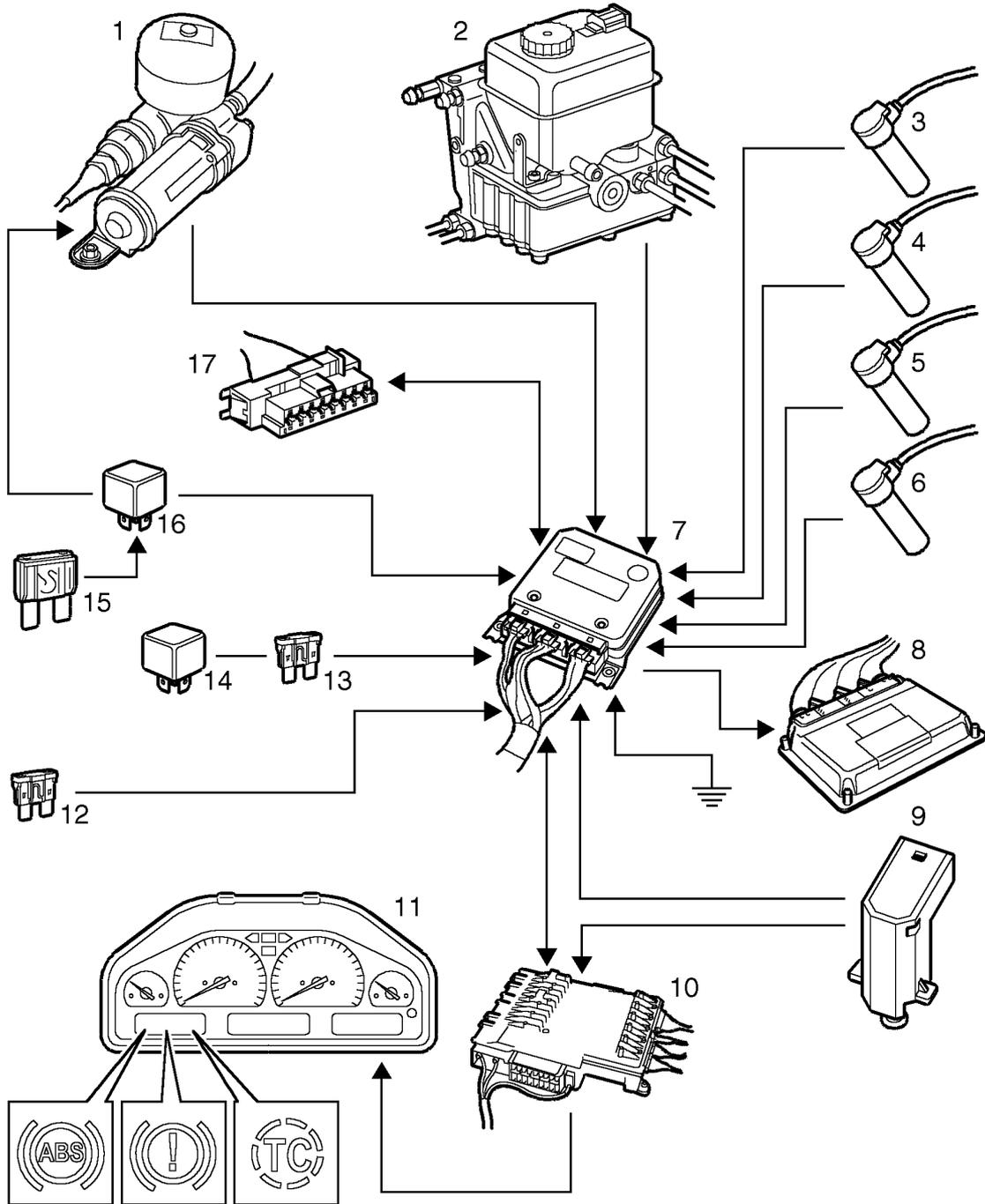
1. Relays and fuses
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ABS CONTROL SCHEMATIC



M70 0878



1. ABS power unit
2. Brake booster/ABS modulator unit
3. Front left speed sensor
4. Front right speed sensor
5. Rear left speed sensor
6. Rear right speed sensor
7. ABS ECU (From 99MY shown)
8. Engine Control Module (V8 only)
9. Brake pedal switch
10. Body electrical Control Module (BeCM)
11. Instrument pack
12. Fuse - Battery supply
13. Fuse - Ignition supply
14. Ignition relay
15. Maxi fuse - ABS power unit relay supply
16. ABS power unit relay
17. Diagnostic socket

ANTI-LOCK BRAKE SYSTEM - DESCRIPTION**Anti-lock Braking System (ABS)**

NOTE: On vehicles up to 99MY, the Anti-lock Brake System (ABS) is a standard feature, with Electronic Traction Control (ETC) optional. On vehicles from 99MY the ABS and ETC is standard on all models.

The brake system is hydraulically power assisted with an integrated, electronically controlled four channel ABS system.

The use of a power assisted brake system means that, during brake application, additional hydraulic energy is provided by the hydraulic power unit. This hydraulic power unit consists of an electrically driven pump and an accumulator which stores hydraulic energy in readiness for brake application. A pressure switch controls hydraulic pump operation to maintain fluid pressure in the accumulator.

Fluid pressure is distributed from the brake booster/ABS modulator unit to each of the four brake calipers. Foot pedal pressure is assisted by pressure created in the master cylinder and direct pressure from the power valve. The combination of the master cylinder and the power valve allows the driver to vary braking force by varying force applied to the brake pedal.

The hydraulic system comprises two completely independent circuits, with a vertical i.e. front/rear split. The combined POWER and HYDROSTATIC CIRCUIT supplies the front calipers. The POWER CIRCUIT supplies the rear calipers.

The purpose of ABS is to prevent the vehicle wheels locking during brake application, maintaining vehicle steerability and stability. This allows the vehicle to be steered while the brakes are applied, even under emergency conditions, and to avoid obstacles where there is sufficient space to redirect the vehicle.

The ABS system on vehicles up to 99MY uses a 'C' series ABS ECU which includes an optional two wheel electronic traction control feature. The ECU has a single connector and is located on the bulkhead behind the glovebox.

On vehicles from 99MY a 'D' series ABS ECU is used. The 'D' series ECU features four wheel electronic traction control which is a standard feature on all models. The ECU has three connectors and is located in the same position as the 'C' series ECU.

The ABS ECU receives wheel speed information from four wheel speed sensors. The ECU monitors the deceleration of each wheel during braking and, in the event of one or more wheels being outside the expected values, controls via the hydraulic system the braking force available to that wheel.

When the wheel speed has returned to within the expected limits, the ECU restores the hydraulic pressure to the wheel. The ABS system allows optimal stopping distances to be achieved and prevents the wheels from locking.

The system is active after the ignition is switched to position II and has completed a bulb check. ABS and ETC warning lamps in the instrument pack warn of system operation and failure. Normal (non-ABS) braking remains available in the event of an ABS system failure.

When the ABS system operates, the driver will experience an audible noise from the ABS modulator and vibration transmitted through the brake pedal.



WARNING: ABS IS AN AID TO RETAINING STEERING CONTROL AND STABILITY WHILE BRAKING.

- **ABS CANNOT DEFY THE NATURAL LAWS OF PHYSICS ACTING ON THE VEHICLE.**
- **ABS WILL NOT PREVENT ACCIDENTS RESULTING FROM EXCESSIVE CORNERING SPEEDS, FOLLOWING ANOTHER VEHICLE TOO CLOSELY OR AQUAPLANING, I.E. WHERE A LAYER OF WATER PREVENTS ADEQUATE CONTACT BETWEEN TYRE AND ROAD SURFACE.**
- **THE ADDITIONAL CONTROL PROVIDED BY ABS MUST NEVER BE EXPLOITED IN A DANGEROUS OR RECKLESS MANNER WHICH COULD JEOPARDISE THE SAFETY OF DRIVER OR OTHER ROAD USERS.**



Electronic Traction Control (ETC) - Up to 99MY

ETC is an option, available as an extension to ABS. The system operates on the rear axle only, to prevent loss of traction where one wheel has more grip than the other. The system works by applying the brake to a spinning rear wheel. This transfers torque to the wheel with grip. By applying the brake, ETC supplies the torque resistance which the wheel cannot.

An example of when the system would operate is where one side of the vehicle is on ice, with the other side on tarmac. ETC will control the spinning rear wheel.

If both wheels spin the system does not operate, as braking one wheel will not aid traction.

The system switches itself out at 50 km/h (30 mph). A vehicle travelling above this speed will not need ETC.

ETC system operation is smooth and continuous and will not affect the comfort of the vehicle.

ETC is inhibited when the brakes are applied. When the ETC feature is operating the 'TC' warning lamp in the instrument pack will illuminate for a minimum of two seconds, a single audible warning will sound and on earlier vehicles 'TRACTION' will be displayed in the message centre.

Electronic Traction Control (ETC) - From 99MY

ETC is standard on all models from 99MY onwards. ETC operates in conjunction with the ABS system to give improved traction for all wheels where one wheel has more grip than the other. The system operates by applying the brake to a spinning wheel. This transfers torque to the remaining wheels with grip. By applying the brake, ETC supplies the torque resistance which the wheel cannot.

An example of when the system would operate is where one side of the vehicle is on ice, with the other side on tarmac. The ABS ECU monitors the speed of the each wheel. If any wheels are rotating faster than the others, brake pressure is applied to that wheel, slowing it down to match the other wheel speeds.

If all wheels spin at the same speed the system does not operate, as braking one wheel will not aid traction.

The system switches itself out at 100 km/h (62.5 mph). A vehicle travelling above this speed will not need ETC.

ETC system operation is smooth and continuous and will not affect the comfort of the vehicle. No driver intervention is required.

ETC is inhibited when the brakes are applied. When the ETC feature is operating the 'TC' warning lamp in the instrument pack will illuminate for a minimum of two seconds and a single audible warning will sound.



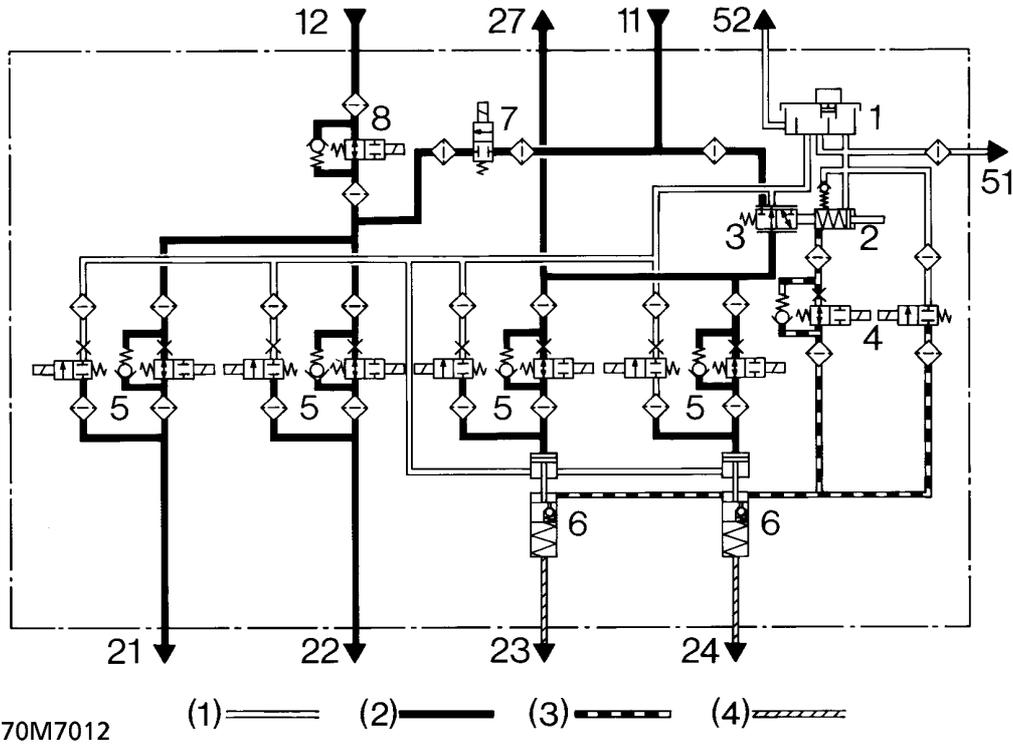
WARNING: Vehicles from 99MY are fitted with 4 wheel traction control, which must be disabled prior to testing on a single axle dynamometer.

4 Wheel Electronic Traction Control (ETC) Disable Procedure

1. Switch on ignition.
2. Press brake pedal 10 times within 5 seconds of switching the ignition on.
3. Check that the traction control light on the instrument panel has stayed on.
4. The message centre will display Traction Failure and give an audible signal.
5. The traction control will be switched on automatically when the vehicle reaches 7 km/h.

Hydraulic Circuit Diagram

Brake booster/ABS modulator unit - up to 99MY



- (1) Fluid feed/return
- (2) Power circuit
- (3) Hydrostatic (master cylinder) circuit
- (4) Combined hydrostatic/power circuit

Brake booster/ABS modulator unit components

- 1. Fluid reservoir
- 2. Master cylinder
- 3. Power valve
- 4. Isolating valve
- 5. ABS solenoid control valves
- 6. Servo cylinders

ETC option

- 7. ETC inlet solenoid valve - normally closed
- 8. ETC isolating solenoid valve - normally open

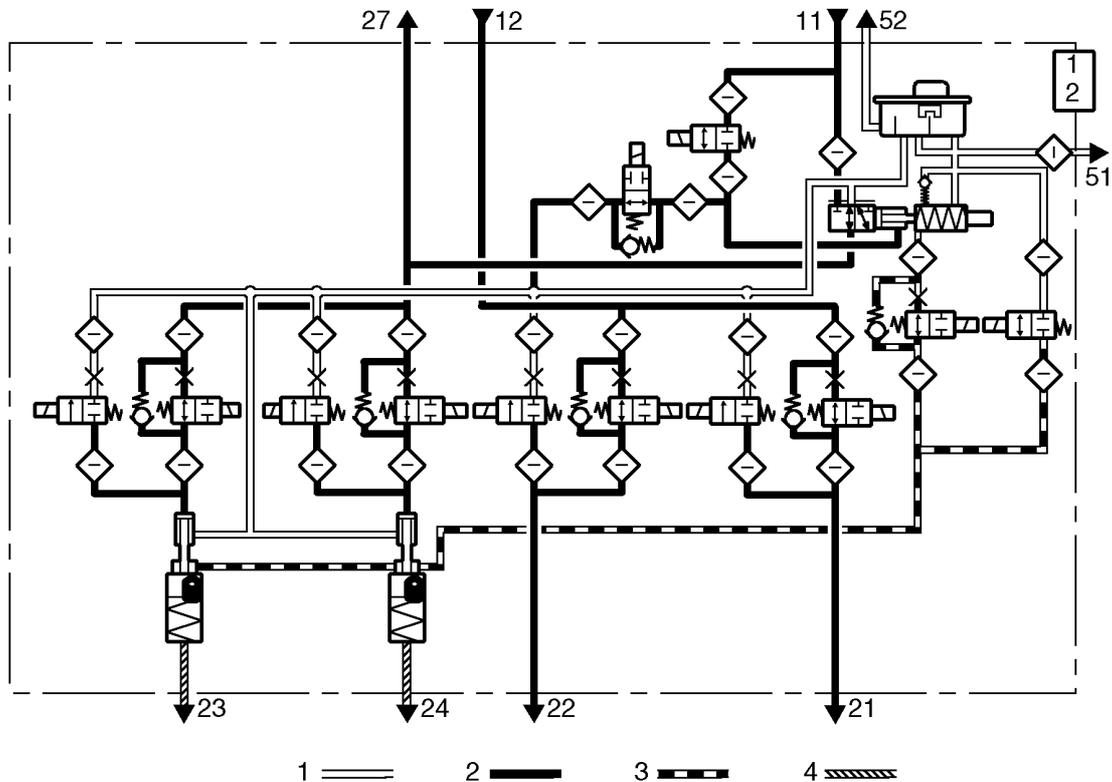
Brake booster/ABS modulator unit port identification

- 11. High pressure supply from hydraulic pump
- 12. Supply from PCRV
- 21. Supply to left hand rear caliper
- 22. Supply to right hand rear caliper
- 23. Supply to left hand front caliper
- 24. Supply to right hand front caliper
- 27. Supply to PCRV
- 51. Low pressure supply to hydraulic pump
- 52. Supply to clutch master cylinder (manual vehicles)



Hydraulic Circuit Diagram

Brake booster/ABS modulator unit - from 99MY



M70 0879

- (1) Fluid feed/return
- (2) Power circuit
- (3) Hydrostatic (master cylinder) circuit
- (4) Combined hydrostatic/power circuit

Brake booster/ABS modulator unit components

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Hydraulic components

Numbers refer to location of components illustrations

Brake booster/ABS modulator unit

Mounted in the same position as a conventional brake master cylinder/servo unit, the brake booster/ABS modulator contains the following components: fluid reservoir, power valve, master cylinder, isolating valve, ABS control valves and servo cylinders. It also contains the ETC solenoid control valves



NOTE: The brake booster/ABS modulator unit is not a serviceable item, if internal failure occurs a new unit must be fitted.

The fluid reservoir and its seals may be changed in the event of damage.



WARNING: Extreme care must be taken when changing reservoir seals to avoid ingress of debris.

Fluid reservoir - 1.

Mounted on top of the unit, the plastic reservoir is subdivided internally to provide separate capacity for brake fluid used in the hydrostatic and power circuits. A central tube incorporates a filter. A built in fluid level warning switch and a finer filter for the power circuit fluid are also incorporated. The fluid level warning switch is closed when there is sufficient fluid in reservoir.

On manual vehicles, the reservoir also supplies fluid to the clutch system.

Master cylinder - 2.

Operation of the master cylinder displaces a volume of brake fluid into the servo cylinders and increases fluid pressure. Piston movement inside the master cylinder will also activate the power valve.

Power valve - 3.

The power valve is an extension of the master cylinder, it controls fluid pressure in the power circuit in direct proportion to pressure in the master cylinder. The power valve is of spool valve design.

Isolating valve - 4.

The isolating valve consists of two solenoid valves controlling fluid inlet and outlet. Their function is to disconnect the master cylinder from the servo cylinders and to connect the servo cylinders to the reservoir return during ABS function.

ABS solenoid control valves, 8 off - 5.

Each pair, comprising inlet and outlet solenoid valves, control ABS braking to each wheel. In response to signals from the ECU, the valves decrease, hold or increase brake pressure according to the need to retain wheel rotation and obtain optimum braking. The solenoid valves are designed to respond rapidly to ECU signals.

Servo cylinders, 2 off - 6.

Servo cylinders have five functions:

1. To provide combined energy from both hydrostatic and power circuit to brake calipers.
2. To provide 'brake feel' at the brake pedal.
3. To provide hydrostatic (master cylinder) braking through the servo cylinders to calipers in the event of no power circuit pressure to servo cylinders.
4. To provide braking from the power circuit and from hydrostatic fluid remaining in servo cylinder, in event of no hydrostatic circuit pressure from master cylinder.
5. To provide ABS control to the front calipers in response to pressure modulations in the power circuit.



ETC control valves - up to 99MY - 7 & 8

The ETC control valves are optional on vehicles up to 99MY. The ETC inlet solenoid valve (7) is normally closed and the ETC isolating solenoid valve (8) is normally open when ETC operation is not required.

When ETC operation is required, the inlet solenoid valve opens allowing fluid from the power circuit to flow to the rear ABS solenoid control valves.

Simultaneously, the ETC isolating solenoid valve closes, isolating the connection to the PCRV. The ABS ECU energises the applicable ABS solenoid valve to pressurise the applicable rear wheel brake.

ETC control valves - from 99MY - 7 & 8

The ETC control valves are standard on vehicles from 99MY. The ETC inlet solenoid valve (7) is normally closed and the ETC isolating solenoid valve (8) is normally open when ETC operation is not required.

When ETC operation is required, the inlet solenoid valve opens allowing fluid from the power circuit to flow to the power valve. The power valve is actuated by the pressure and opens to allow fluid from the power circuit to flow directly to the front ABS solenoid control valves and to the rear solenoid control valves via the PCRV. The ETC isolating solenoid valve closes isolating the return flow from each ABS solenoid control valve. The ABS ECU energises the applicable ABS solenoid valve(s) to pressurise the applicable front and/or rear wheel brake.

ABS power unit

The ABS power unit consists of an electrically driven pump, a pressure switch and an accumulator.

The pressure switch incorporates three electro-mechanical switches: one for the pump, another, at a different pressure setting, to illuminate the pressure warning lamp. The latter switch plus a third switch inform the ECU of low pressure and that ABS function should cease while pressure remains low.

The pump also incorporates a non-return valve and a pressure relief valve to protect the system.



NOTE: The pump and pressure switch are not serviceable, if failure occurs a new unit must be fitted.

The diaphragm type accumulator is fitted to the power unit. The accumulator is precharged with nitrogen at up to 80 bar. Its function is to store hydraulic energy ready for the next brake application.



NOTE: Accumulator replacement is possible if failure occurs. Correct disposal of old accumulators is essential. See

Repair.

Pressure Conscious Reducing Valve (PCRV)

The PCRV is located adjacent to the brake booster/ABS modulator unit. It is connected between the power valve and ABS solenoid valves for the rear axle. Its function is to limit brake pressure to rear axle.



NOTE: The PCRV is not a serviceable item, if failure occurs a new unit must be fitted.

Brake calipers - front and rear



NOTE: To identify separate hydraulic circuits, they are referred to as HYDROSTATIC and POWER circuits.

Power circuit - Consists of rear calipers and servo cylinders, supplied by direct hydraulic power from the power valve.

Hydrostatic circuit - Consists of servo cylinders supplied by master cylinder pressure. The front calipers are supplied with direct hydraulic energy from the servo cylinders, comprising a combination of master cylinder pressure and direct hydraulic power.

ABS Electronic Control Unit - ECU

ABS/ETC operation is controlled by the ECU. The ECU is attached to a bracket which in turn is attached to the bulkhead. A closing plate beneath the passenger side fascia provides access to the ECU.

The ECU is connected to the ABS harness by a 35 pin connector on up to 99MY vehicles and by 9, 15 and 18 pin connectors on vehicles from 99MY.

When system faults are detected by the ECU, warning lamps in the instrument pack can be illuminated for ABS, ETC and braking system faults. Certain faults are also displayed in the instrument pack message centre. Refer to Operation - Warning lamps for lamp and message centre operation.

The ABS ECU generates a digital road speed signal from the average speed of the four wheels. The ABS ECU passes the road speed signal to the BeCM. The BeCM outputs the road speed signal to the following interfaces:

- Engine Control Module (ECM)
- Cruise control ECU (V8 only)
- Instrument pack
- Air Temperature Control (ATC) ECU
- In-Car Entertainment (ICE)
- Electronic Air Suspension (EAS) ECU
- Electronic Automatic Transmission (EAT) ECU.

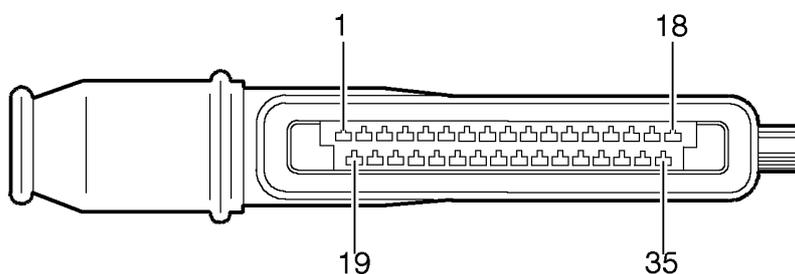
The ABS ECU also outputs a rough road signal to the ECM on V8 engine vehicles only. The digital rough road signal is generated from the difference in rotational speed of each wheel.

The ECU is a non-serviceable item, it must be replaced if failure occurs.



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ABS ECU connector pin details - up to 99MY



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ABS ECU connector face view

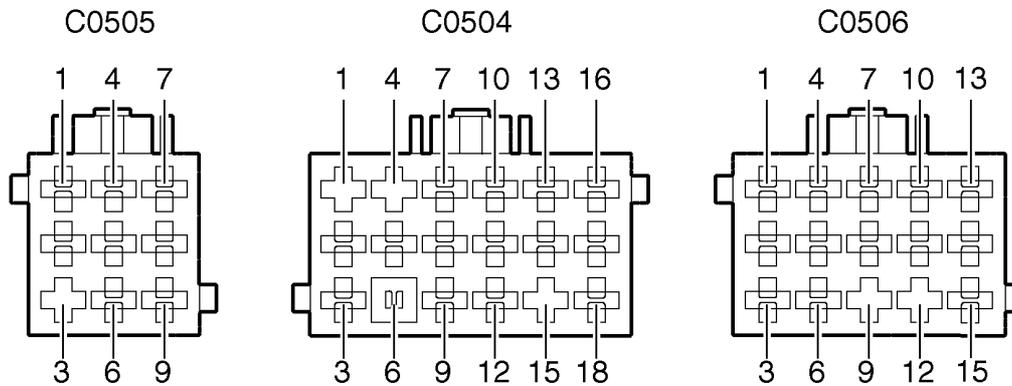
35 pin connector No.C116

Pin No.	Description	Input/Output
1	ABS valve relay (battery supply)	Input
2	Brake booster/ABS modulator - ETC normally open valve	Output
3	BeCM - ETC information lamp	Output
4	Brake booster/ABS modulator - Rear right inlet valve	Output
5	Brake booster/ABS modulator - Rear right outlet valve	Output
6	Brake booster/ABS modulator - Front right inlet valve	Output
7	Brake booster/ABS modulator - Front right outlet valve	Output
8	ABS valve relay coil	Output
9	Ignition supply	Input
10	Brake switch 2 (normally closed)	Input
11	Brake booster/ABS modulator - Isolating inlet valve	Output
12	Brake booster/ABS modulator - Isolating outlet valve	Output
13	Diagnostic socket - K line	Input
14	Diagnostic socket - L line	Input
15	Front left wheel speed sensor	Input
16	Rear right wheel speed sensor	Input


ABS ECU connector pin details - Up to 99MY (Continued)

Pin No.	Description	Input/Output
17	Front right wheel speed sensor	Input
18	Rear left wheel speed sensor	Input
19	Not used	-
20	Brake booster/ABS modulator - ETC normally closed valve	Output
21	Brake booster/ABS modulator - Rear left inlet valve	Output
22	Brake booster/ABS modulator - Rear left outlet valve	Output
23	Brake booster/ABS modulator - Front left inlet valve	Output
24	Brake booster/ABS modulator - Front left outlet valve	Output
25	Brake switch 1 (normally open)	Input
26	BeCM - ABS warning lamp	Output
27	Earth	Input
28	BeCM - Road speed signal	Output
29	ECM - Rough road signal	Output
30	ABS pump low pressure warning switch 1	Output
31	ABS pump low pressure warning switch 2	Input/Output
32	Front left wheel speed sensor	Input
33	Rear right wheel speed sensor	Input
34	Front right wheel speed sensor	Input
35	Rear left wheel speed sensor	Input

ABS ECU connector pin details - From 99MY



M70 0882

ABS ECU connector face view

18 pin connector No. C504

9 pin connector No. C505

15 pin connector No. C506

Pin No.	Description	Input/Output
C504		
1	Battery supply	Input
2	Ignition supply	Input
3	BeCM - Road speed signal	Input
4	ECM - Rough road signal (V8 only)	Output
5	Diagnostic socket - K line	Input
6	Not used	-
7	Brake pedal switch 1 (normally closed)	Input
8	ABS pump monitor	Input
9	ABS pump relay override	Input
10	ABS pump low pressure switch 2	Input
11	ABS pump low pressure switch 3	Input
12	ABS ECU earth	Input
C505		
1	Front left wheel speed sensor	Input
2	Front left wheel speed sensor	Input
3	Right rear wheel speed sensor	Input


ABS ECU connector pin details - From 99MY - (Continued)

Pin No.	Description	Input/Output
4	Front right wheel speed sensor	Input
5	Front right wheel speed sensor	Input
6	Right rear wheel speed sensor	Input
7	Rear left wheel speed sensor	Input
8	Rear left wheel speed sensor	Input
9	Not used	-
C506		
1	Front left ABS solenoid control valve	Output
2	Front left ABS solenoid control valve	Output
3	Reference earth	Input
4	Front right ABS solenoid control valve	Output
5	Front right ABS solenoid control valve	Output
6	Not used	-
7	Rear left ABS solenoid control valve	Output
8	Rear left ABS solenoid control valve	Output
9	Not used	-
10	Rear right ABS solenoid control valve	Output
11	Rear right ABS solenoid control valve	Output
12	ETC Normally open solenoid control valve	Output
13	Isolating valve	Output
14	Isolating valve	Output
15	ETC Normally closed solenoid control valve	Output
13	Not used	-
14	Brake pedal switch 2 (normally open)	Input
15	Not used	-
16	Not used	-
17	ETC warning lamp	Output
18	ABS warning lamp	Output

Relays and fuses - Up to 99MY

The ABS electrical system has two relays and three fuses, located in the engine compartment fusebox.

- Relay 2 (yellow) - ABS valve relay.
- Relay 15 (green) - Ignition relay - ABS power.
- Relay 17 (black) - ABS pump relay. Note that this relay is unique to the ABS system.
- Fuse Maxi 3 (40 Amp) - ABS pump relay.
- Fuse 24 (5 Amp) - ABS ECU - Ignition supply.
- Fuse 27 (30 Amp) - ABS ECU - Battery supply.

Relays and fuses - From 99MY

The ABS electrical system has two relays and three fuses, located in the engine compartment fusebox.

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- Fuse Maxi 3 (40 Amp) - ABS pump relay.
- Fuse 24 (5 Amp) - ABS ECU - Ignition supply.
- Fuse 38 (30 Amp) - ABS ECU - Battery supply.

Sensors, exciter rings - 4 off

A sensor is mounted at each wheel, sensing a 60 tooth exciter ring. When the vehicle is in motion the inductive sensors send signals to the ECU.

The front exciter ring is fitted adjacent to the constant velocity joint in each front hub. The rear exciter ring is inside the axle adjacent to the wheel bearing assembly.



NOTE: Road speed information from the ECU is transmitted to the Body electrical Control Module (BeCM) to drive the speedometer and all systems requiring speed information, except the transfer box ECU.

Brake calipers

Lucas Colette type calipers are used all round. The front disc brake calipers each house two pistons, hydraulic pressure is supplied by a combination of power and hydrostatic circuit. The rear disc brake calipers each house one piston, hydraulic pressure is supplied by the power circuit via a Pressure Conscious Reducing Valve (PCRVR).

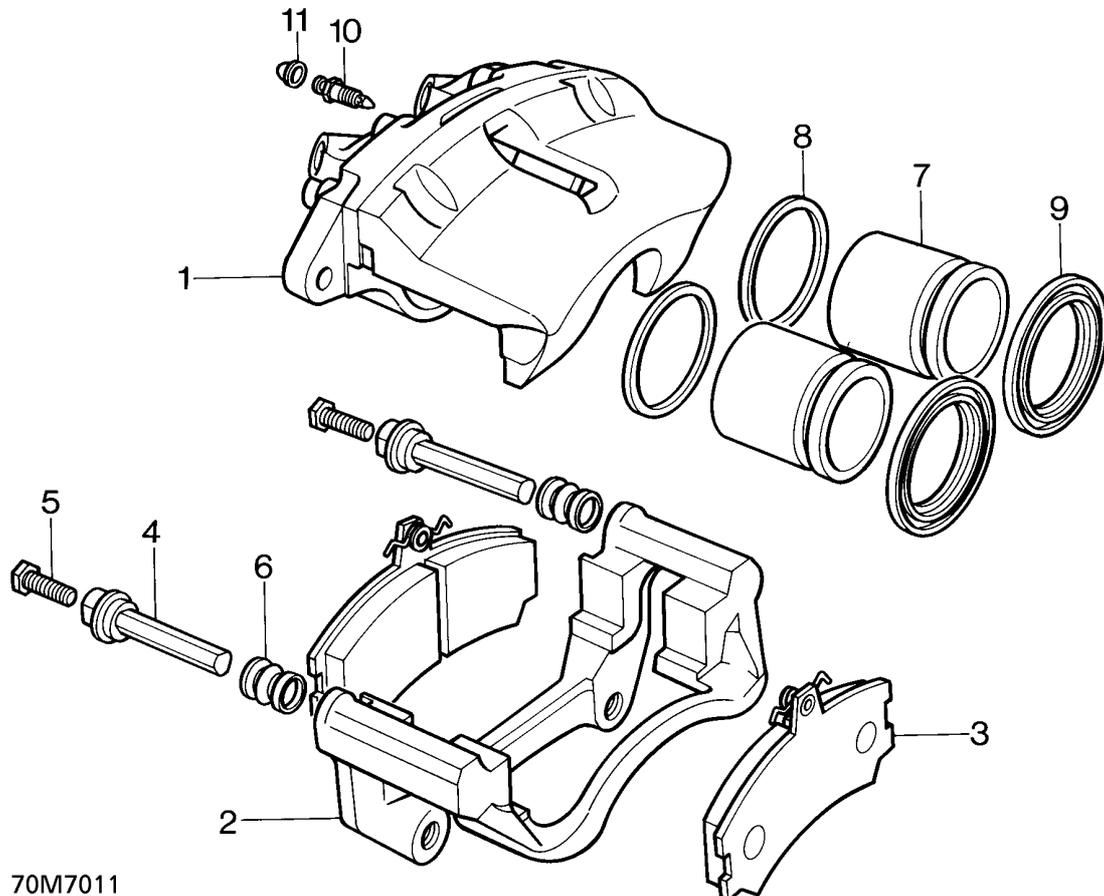
The operation of both front and rear calipers is in principle the same. The Colette type caliper consists of two main components, a carrier and a hydraulic body assembly. The carrier is bolted to the hub assembly. The hydraulic body slides on two greased guide pins housed in the carrier. The guide pins are sealed by the dust covers to avoid unequal sliding loads caused by dirt or corrosion.

When the footbrake is applied hydraulic pressure pushes the piston and, with it, the inboard pad on to the disc. The hydraulic body reacts and slides on the guide pins to bring the outboard pad into contact with the disc. The clamping force on both sides of the disc is then equal.

When hydraulic pressure is released, the piston seal retracts the piston a small amount. This allows the moving parts to relax sufficiently for the brake pads to remain in close proximity to the disc ready for the next brake application.



Brake caliper assembly



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1. Hydraulic body
2. Carrier
3. Brake pad
4. Guide pin
5. Guide pin bolt
6. Guide pin boot

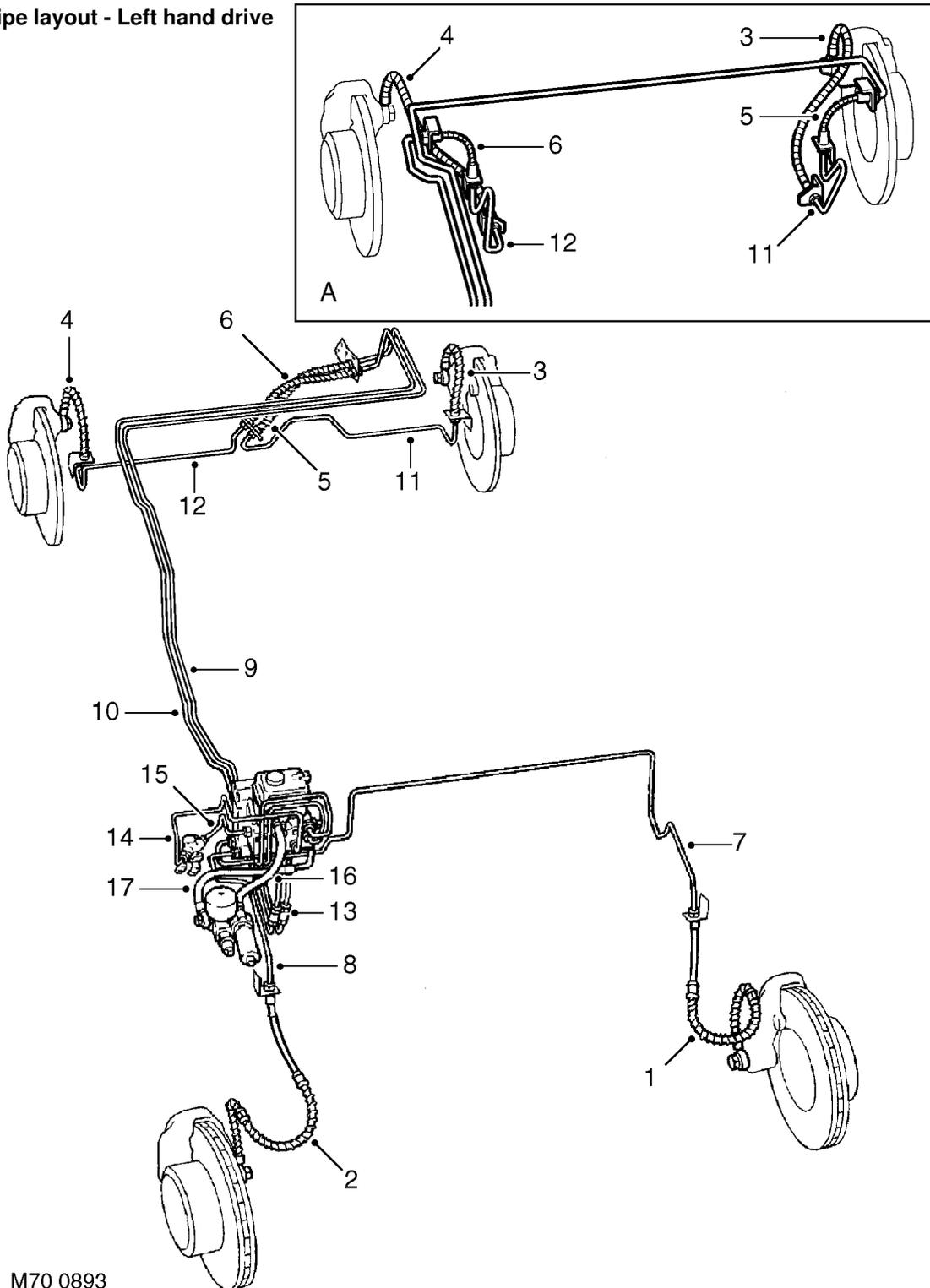
7. Piston
8. Fluid seal
9. Dust cover
10. Bleedscrew
11. Dustcap

The hand operated parking brake acts on a brake drum at the rear of the transfer gearbox and is completely independent of the hydraulic circuits.



NOTE: Illustration shows a front, two piston, caliper. Rear calipers are of similar construction with a single piston.

Brake pipe layout - Left hand drive



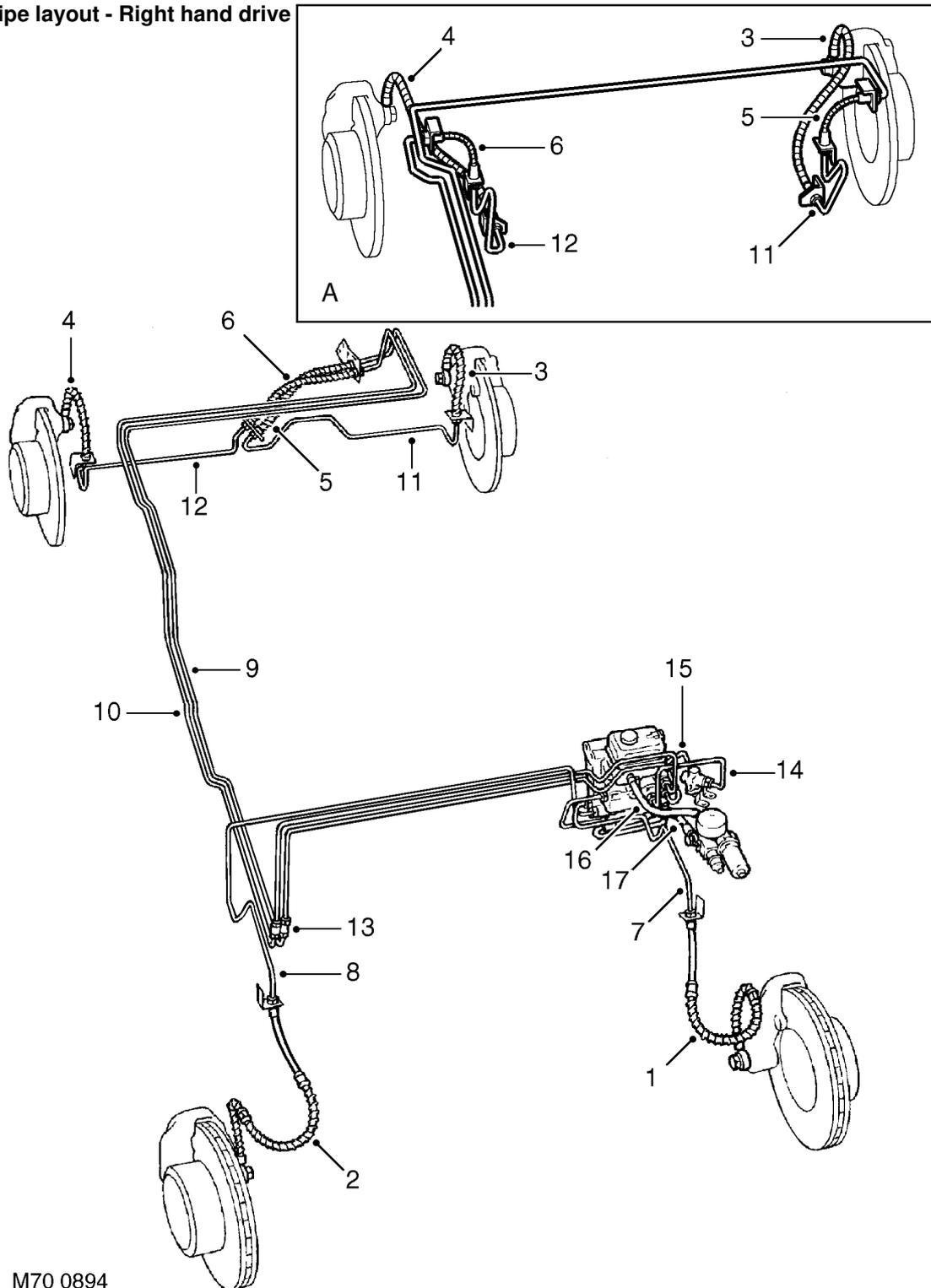
M70 0893
INSET A = VEHICLES FROM 97MY

FLEXIBLE HOSES

- | | |
|---------------------|---------------------------------|
| 1. Front left hand | 4. Rear right hand |
| 2. Front right hand | 5. Rear left hand intermediate |
| 3. Rear left hand | 6. Rear right hand intermediate |



Brake pipe layout - Right hand drive



M70 0894

PIPES

- 7. Feed to front left hand
- 8. Feed to front right hand
- 9. Feed to rear left hand intermediate hose
- 10. Feed to rear right hand intermediate hose
- 11. Feed to rear left hand flexible hose
- 12. Feed to rear right hand flexible hose

- 13. Two way connectors
- 14. From PCRV
- 15. To PCRV

Power unit hoses

- 16. Fluid feed to pump
- 17. Pressure fluid from pump

ANTI-LOCK BRAKE SYSTEM - OPERATION**Warning lights****Brake fluid pressure/level and parking brake warning lamp - (red)**

The warning lamp situated in instrument binnacle indicates insufficient pressure in system and/or low fluid level and/or park brake applied. The warning lamp will illuminate, for 3 seconds when ignition is switched ON as part of initial bulb check, and continuously when parking brake is applied. If the pressure in hydraulic system is lower than the cut-in pressure for the warning lamp, the lamp will illuminate. When the lamp is on hydraulic pump will be heard running.



NOTE: If the lamp remains illuminated after the bulb check AND releasing the park brake, DO NOT drive the vehicle until the lamp extinguishes.



WARNING: IF THE LAMP ILLUMINATES WHILE THE VEHICLE IS IN MOTION, INVESTIGATE FAULT IMMEDIATELY. BRAKING WILL BE AVAILABLE AFTER LOSS OF PRESSURE, BUT GREATER FORCE AND TRAVEL WILL BE REQUIRED AT THE PEDAL TO SLOW THE VEHICLE.

ABS warning lamp - (yellow)

WARNING: Power assisted braking is not available if ignition is switched off. An increase in effort at brake pedal will be required to apply brakes.

The ABS warning lamp situated in instrument binnacle indicates a failure in ABS system.

The warning lamp will illuminate for 1 second when ignition is switched ON, it will briefly extinguish and will illuminate again. This indicates that the system self monitoring check was successful, and system performs correctly.

If it does not extinguish and illuminate again a system fault has occurred.

The warning lamp will extinguish when vehicle speed exceeds 7 km/h (5 mph).

If lamp remains on or subsequently illuminates with ignition ON a fault in ABS system is indicated. The self monitoring procedure is repeated frequently while ignition is ON. If a fault is detected during self monitoring, the lamp will illuminate indicating that one or more wheels are not under ABS control.



WARNING: Reduced ABS control is possible with ABS warning lamp illuminated depending on severity and type of fault. If both ABS and brake failure warning lamps are illuminated, loss of system pressure or hydraulic pump failure is indicated. STOP VEHICLE AND IMMEDIATELY INVESTIGATE THE FAULT.

Traction control warning lamp - (amber)

The Traction Control warning lamp situated in instrument pack informs the driver that traction control is active. The warning lamp will illuminate when the ignition is switched ON, and the ABS and ETC systems have completed their self checks, the 'TC' lamp will illuminate for 3 seconds. This indicates that the ETC system is operative, and also performs the bulb check.

When traction control is active the lamp will illuminate for a minimum of 2 seconds, a single audible chime will sound and the message centre will display 'TRACTION'. The message and lamp will be extinguished when ETC has stopped working.

On later models, the 'TRACTION' message is not displayed in the message centre. The driver is informed of ETC operation by the 'TC' warning lamp and the single audible chime.

If a fault disables TC, the TC lamp will illuminate and the message 'TRACTION FAILURE' will be displayed. A single audible chime will sound on the first occurrence of the message.

If the system is over used and there is a risk of components overheating, the system will shut itself down. The TC lamp will flash for 10 seconds minimum, a single audible chime will sound and the message 'TRACTION OVERHEAT' will be displayed. Traction control will be available after components have cooled down.



NOTE: Traction control only operates below 50 km/h (30 mph) on models up to 99MY and below 100 km/h (62.5 mph) on models from 99MY.



Warning lamp functionality

System Condition	ABS Warning Lamp - Amber	ETC Lamp - Amber	Brake Warning Lamp - Red
Bulb check with no faults in ECU memory and system pressurised.	Lamp ON for 1 second, then goes OFF for 0.5 second, then ON until vehicle speed exceeds 4.3 mph (7 km/h).	Lamp OFF for 1 second, ON for 3 seconds, then goes OFF.	Lamp ON for 3 seconds, then goes OFF providing handbrake is off and fluid level is correct.
Ignition ON, system being pressurised.	Lamp ON until 110 bar (1595 lbf.in ²) pressure in system. Lamp will stay ON until vehicle speed exceeds 4.3 mph (7 km/h).	Lamp ON until 110 bar (1595 lbf.in ²) pressure in system.	Lamp ON until 110 bar (1595 lbf.in ²) pressure in system.
Bulb check with fault stored in ECU memory, but no current fault present.	Lamp ON until vehicle speed exceeds 4.3 mph (7 km/h).	Lamp OFF for 1 second, then ON for 3 seconds, then goes OFF.	ON for 3 seconds, then goes OFF providing handbrake is off and fluid level is correct.
Bulb check with fault present and stored in ECU memory.	Lamp stays ON until ignition is turned off.	Lamp ON for 3 seconds, then goes OFF.	Lamp ON for 3 seconds, then goes OFF providing handbrake is off and fluid level is correct.
ABS fault condition detected by ECU.	Lamp stays ON, 'ABS FAULT' displayed in instrument pack message centre.	Lamp stays OFF.	Lamp stays OFF.
ABS fault/ETC fault condition detected by ECU.	Lamp stays ON, 'ABS FAULT' displayed in instrument pack message centre.	Lamp stays ON, 'TRACTION FAILURE' displayed in instrument pack message centre.	Lamp ON, only if ABS pump/pressure switch fault is detected by ECU.
ABS system active.	Lamp stays OFF.	Lamp stays OFF.	Lamp stays OFF.
ETC system active.	Lamp stays OFF.	Lamp is ON for a minimum of 2 seconds.	Lamp stays OFF.
ETC system fault detected by ECU.	Lamp stays OFF.	Lamp stays ON.	Lamp stays OFF.
Diagnostic operation	Lamp stays ON.	Lamp stays ON.	Lamp stays ON.

Diagnostics

While the ignition is in position II, the ABS ECU monitors the system for faults. Diagnostic information and system function monitoring can be accessed by connecting TestBook to the vehicle diagnostic connector in the passenger footwell, near the centre console.

After detecting a fault, the ABS ECU will select a suitable default strategy which will retain, if possible, some operational ABS capability. If ABS is not active, conventional braking will remain available. Fault codes are stored in the ECU's memory for current and historic faults. The stored fault codes can be accessed, read and then cleared when the fault is rectified.

Driving the vehicle



WARNING: On surfaces which are soft and deep, for example deep powdery snow, sand or gravel, braking distance may be greater than with non ABS braking. In these conditions wheel lock and the build up of snow or gravel under wheels may be an aid to shorter stopping distance. However it is still an advantage to maintain the stability and manoeuvrability available with ABS control.

1. Switch on ignition, system will automatically carry out self test function. This will be felt as a slight movement in brake pedal and a short, rapid series of clicks indicating that solenoid valves have been checked.
2. Observe warning lights, check parking brake/fluid warning light extinguishes after initial bulb check or when parking brake is released, indicating that power assistance is available. Note time taken to pressurise system is up to 40 seconds.
3. Start vehicle and drive away, at 7 km/h (5 mph) the ABS warning light must be extinguished. **See this section.**
4. In road conditions where surface friction is sufficient to slow or stop the vehicle without wheel lock, ABS does not operate.
5. In an emergency braking situation, if one or more wheels begin to slow rapidly in relation to vehicle speed, ABS will detect wheel locking tendency and will regulate brake pressure to maintain wheel rotation.

6. ABS operation will be felt as a vibration through pedal, at same time solenoid cycling will be heard.



NOTE: Constant pressure on foot pedal whilst ABS is operating is more effective than cadence braking. Do not pump brake pedal, this may reduce ABS efficiency and increase stopping distance.

7. Downward travel of pedal will also feel hard at point at which ABS operates. Little further pedal travel is possible at this point, BUT, force on the pedal can be varied to influence braking force while ABS retains control.

Brake application with partial failure



WARNING: IF A FAULT DEVELOPS IN THE BRAKE SYSTEM IT IS ESSENTIAL THAT IT IS INVESTIGATED IMMEDIATELY.



NOTE: If, during braking, a drastically reduced resistance is detected at pedal and braking effectiveness is very much reduced, failure of the non-powered (master cylinder) portion of system is indicated. When this occurs DO NOT PUMP BRAKE PEDAL. Push the pedal through free movement to obtain braking effort from the power circuit. It is essential that brake pedal travel is not obstructed by items such as extra footwell mats.

8. When power assistance is not available, ABS braking is not operative. Both warning lights are illuminated. Braking effort is available from master cylinder only. This results in longer pedal travel and greater pedal effort required to decelerate vehicle.



WARNING: FOOT PRESSURE ON THE PEDAL, USING MASTER CYLINDER ONLY, WILL NOT ACHIEVE THE SAME DEGREE OF BRAKING AS IS AVAILABLE FROM POWER ASSISTANCE.



9. If master cylinder fails, i.e. there is insufficient fluid in master cylinder to create pressure, braking to all four wheels is retained and ABS remains operative. The red warning light will be illuminated if cause of the master cylinder failure is a fluid leak and level in fluid reservoir is low enough to actuate fluid level switch.



WARNING: LONGER PEDAL TRAVEL IS REQUIRED, BUT POWER ASSISTED BRAKING IS AVAILABLE AT REDUCED

EFFICIENCY.

10. If brake failure occurs due to a fractured brake pipe between a servo cylinder and a wheel, there may be no pressure in the master cylinder. The fluid warning light will illuminate when level in fluid reservoir is low enough to actuate fluid level switch. Master cylinder and power valve will operate as for master cylinder failure, BUT, fluid from power circuit will push all moving parts in servo cylinder associated with failure to limit of travel. No pressurised fluid passes to the front brake caliper served by the affected servo cylinder, but pistons in rear calipers will be supplied with direct pressure from power valve. The front caliper served by the other servo cylinder retain braking as fluid from master cylinder is retained in servo cylinder not associated with the leakage.



WARNING: BRAKE PEDAL TRAVEL WILL BE GREATER AND EXTRA PEDAL EFFORT WILL BE REQUIRED,

ACCOMPANIED BY THE VEHICLE PULLING TO ONE SIDE.



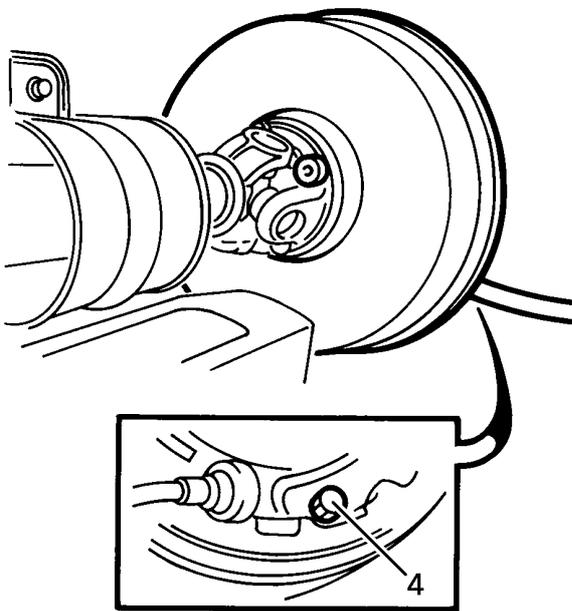
PARKING BRAKE - ADJUST

Service repair no - 70.45.09

Adjust

Shoes

1. Raise vehicle on four post lift.
2. Ensure brake lever is released. Raise lift.
3. Raise one rear wheel clear of lift.
4. Tighten brake shoe adjusting bolt to **25 Nm. (18 lbf.ft)**. Ensure brake drum is locked.



70M7015

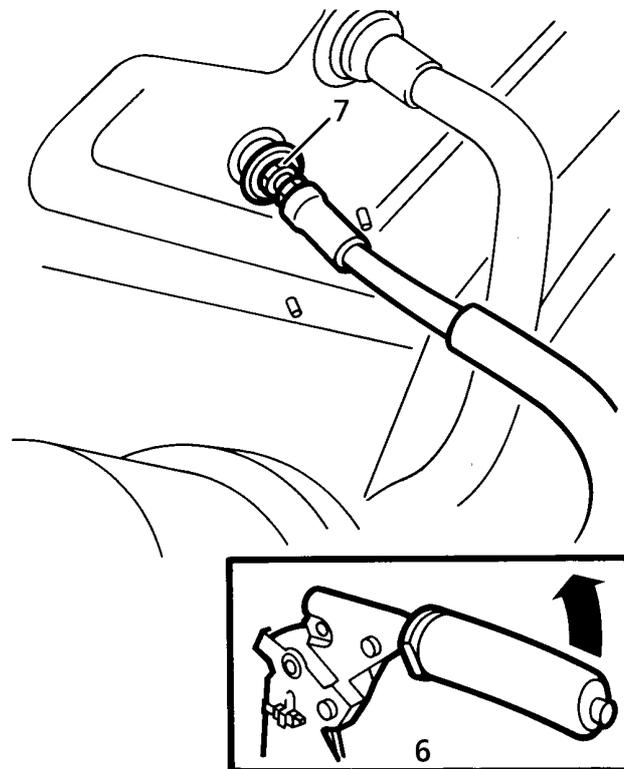
5. Back off adjusting bolt by 1.5 turns. Check brake drum is free to rotate.

Cable



NOTE: Ensure brake shoes are correctly adjusted before adjusting cable. Cable adjustment is for new cable or to compensate for cable stretch. Cable adjustment must not be used to take up brake shoe wear.

6. Parking brake should be fully operational on the third notch of ratchet with a pull of 15 kg. (30 lbs) on end of the brake lever.
7. To achieve this, release brake lever. From under vehicle, adjust length of outer cable.



70M7016

8. Lower vehicle.



GENERAL SERVICE INFORMATION



NOTE: ABS components ARE NOT serviceable. Replace components found to be faulty.

Brake fluid precautions



WARNING: Do not allow brake fluid to come into contact with eyes or skin.



CAUTION: Brake fluid can damage paintwork, if spilled wash off immediately with plenty of clean water.



WARNING: Use only correct brake fluid. If an assembly fluid is required use ONLY brake fluid. Do NOT use mineral oil, i.e. engine oil etc.



WARNING: THOROUGHLY CLEAN ALL BRAKE COMPONENTS, CALIPERS, PIPES AND FITTINGS BEFORE COMMENCING WORK ON BRAKE SYSTEM. FAILURE TO DO SO COULD CAUSE FOREIGN MATTER TO ENTER SYSTEM AND DAMAGE SEALS AND PISTONS, WHICH WILL SERIOUSLY IMPAIR BRAKE SYSTEM EFFICIENCY.



WARNING: ENSURE THAT ONLY NEW FLUID IS USED AND THAT IT IS TAKEN FROM A CLEAN SEALED CONTAINER.

DO NOT USE BRAKE FLUID PREVIOUSLY BLED FROM SYSTEM.

DO NOT USE OLD OR STORED BRAKE FLUID.

Brake system must be drained and flushed at recommended service intervals.

DO NOT flush brake system with any fluid other than recommended brake fluid.

DEPRESSURISE SYSTEM - Fluid pressure of 190 bar is produced by hydraulic pump. It is essential that the system is depressurised where instructed. See this section.

FLUID LEVEL CHECK/TOP UP

1. Park vehicle on level ground.
2. Turn ignition ON, to activate hydraulic pump. If pump does not operate depress brake pedal several times until pump operates.
3. When pump stops, check level is between 'MIN' and 'MAX' marks.



WARNING: Clean reservoir body and filler cap before removing cap. Use only fluid from a sealed container.

4. If level is below 'MIN' mark top up fluid level to 'MAX' mark on reservoir, using correct fluid. **See LUBRICANTS, FLUIDS AND CAPACITIES, Information.**

DO NOT OVER FILL RESERVOIR

DEPRESSURISE SYSTEM



WARNING: Before bleeding the system or working on any component in the brake system the following procedure MUST be carried out to depressurise the accumulator.

1. Switch off ignition.
2. Operate the brake pedal 30 times. Pedal travel will increase slightly and reduced resistance will be felt as pressure decreases.
3. Wait for 60 seconds, press the brake pedal four more times. This procedure will ensure that all pressure is evacuated from the system.

BRAKE SYSTEM BLEED

Service repair no - 70.25.02

Equipment: Bleed tube and a clean bottle containing a small amount of clean brake fluid.



CAUTION: Thoroughly clean all bleed screws, filler cap and connections using only clean brake fluid. **DO NOT USE MINERAL OIL I.E. ENGINE OIL ETC. MAINTAIN CLEANLINESS THROUGHOUT.**



NOTE: Do not allow reservoir fluid level to fall below 'MIN' level during bleeding. Regularly check level and keep topped up to 'MAX' level.



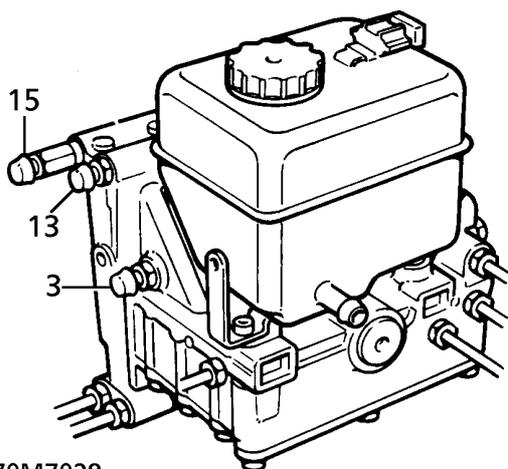
WARNING: Do not use previously used brake fluid. Ensure only new fluid is used, taken from a clean sealed container. Carefully dispose of unwanted fluid in a sealed container, marked **USED BRAKE FLUID**.

1. Depressurise system. *See this section.*



NOTE: Ensure ignition remains **OFF** until instruction 13.

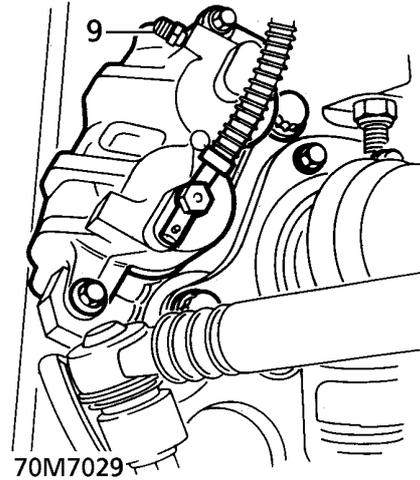
2. Fill fluid reservoir with specified fluid to 'MAX' level.
3. Bleed master cylinder as follows: Open bleed screw on booster, when fluid appears, close bleed screw.



70M7028

4. Fit tube to bleed screw.
5. Open bleed screw, depress pedal slowly and progressively.

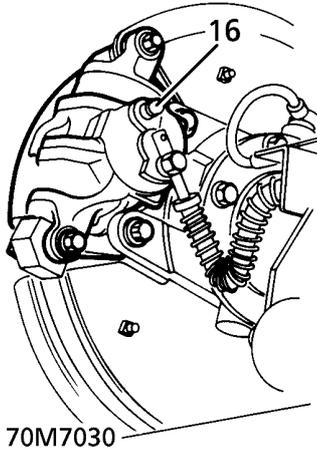
6. Close bleed screw. Release brake pedal.
7. Repeat instructions 5. and 6. until fluid is clear of air bubbles.
8. Open bleed screw, fully depress pedal, close bleed screw.
9. Bleed front calipers, driver's side caliper first, as follows: Open bleed screw, depress brake pedal slowly and progressively, Close bleed screw at bottom of each stroke, release pedal.



10. Repeat instruction 9. until fluid is clear of air bubbles.
11. Open bleed screw again. Fully depress brake pedal, close bleed screw.
12. Repeat instructions 9. to 11. for passenger side caliper.
13. Bleed two booster bleed screws, starting at the front bleed screw, as follows: Open bleed screw, depress brake pedal, switch ignition on.
14. Allow fluid to flow until clear of air bubbles. Switch ignition off, close bleed screw, release pedal.
15. Repeat instructions 13. and 14. for the rear booster bleed screw.



16. Bleed each rear caliper, driver's side caliper first, as follows: Open bleed screw, depress brake pedal slowly and progressively.



17. Switch on ignition for 4 seconds. Switch off ignition for 4 seconds. Repeat until fluid is clear of air bubbles.
18. Switch off ignition, close bleed screw, release pedal.
19. Switch on ignition, wait for ABS pump to stop running. Press brake pedal down firmly and fully release it five times.
20. With ignition on, repeat front caliper bleed instructions 9. to 12. Use only the lower two thirds of pedal travel when bleeding.
21. Repeat instruction 19.
22. Check/top up reservoir fluid level, *See this section.*



NOTE: If ABS pump makes a ticking noise when running during this procedure, repeat instructions 13. to 19. When the bleed procedure has been successfully completed, the ABS pump will not make any ticking noises.

ACCUMULATOR

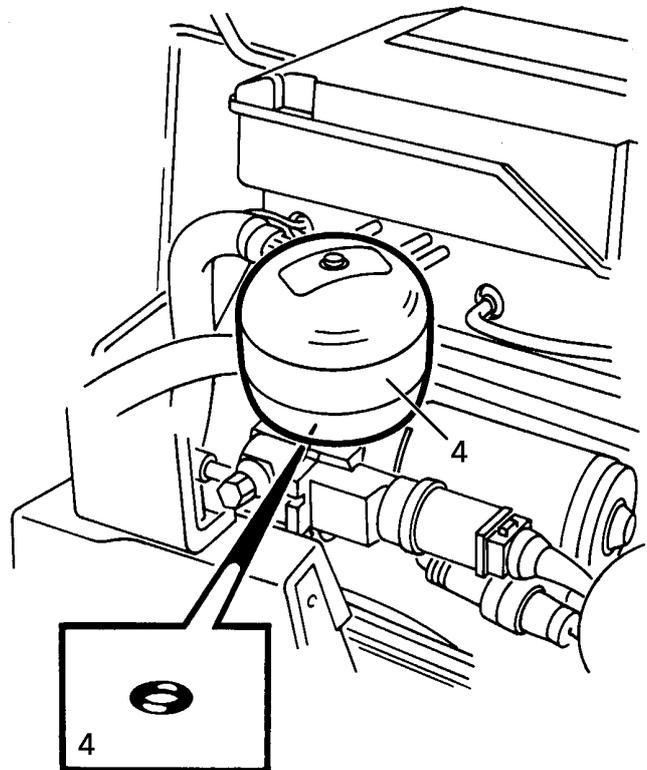
Service repair no - 70.65.21



WARNING: The accumulator is precharged with nitrogen at a pressure of up to 80 bar (1160 lbf/in²). Handle with extreme caution. **DO NOT** puncture or burn if disposal is necessary.

Remove

1. Disconnect battery negative lead.
2. Depressurise system. *See this section.*
3. Position cloth beneath accumulator to catch any fluid spillage.
4. Remove accumulator. Discard 'O' ring.



Disposal



WARNING: It is essential that safety goggles are worn when carrying out this procedure.

5. Secure accumulator firmly in a suitable vice.
6. Drill 5 mm hole in top of accumulator to depressurise nitrogen chamber.
7. Dispose of accumulator in an approved manner

Refit

8. Using a new 'O' ring, fit accumulator to pump.
9. Reconnect battery negative lead.
10. Bleed braking system. **See this section.**

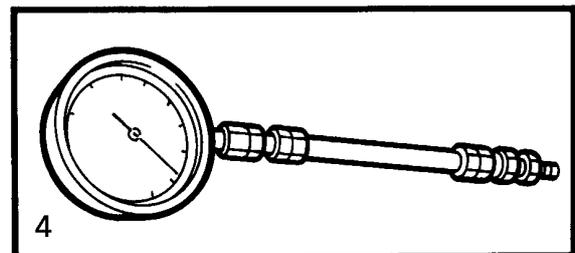
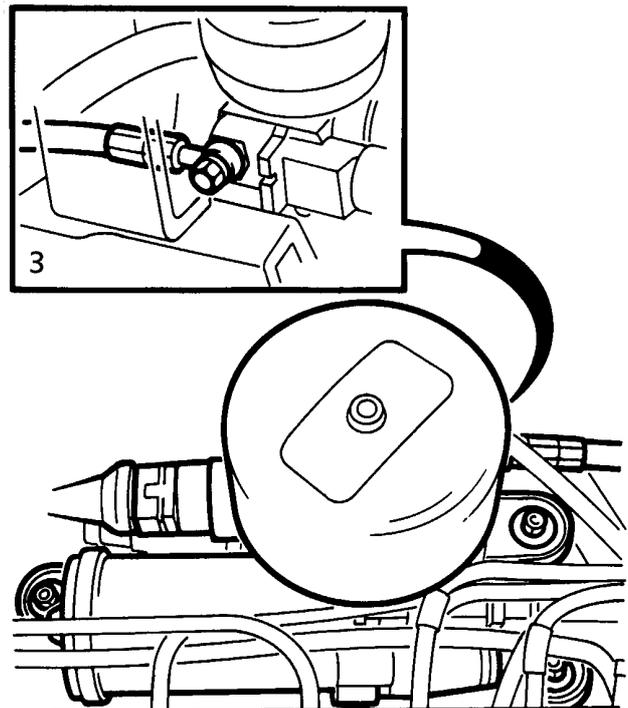
ACCUMULATOR PRECHARGE - CHECK

The diaphragm type accumulator is precharged with nitrogen at 80 bar (1160 lbf/in²), its function is to store hydraulic energy. Over a period of years, a normal loss of precharge will occur. This procedure will indicate the extent to which precharge pressure has fallen.



NOTE: A new accumulator at 20°C has a nominal pressure of 80 bar (1160 lbf/in²). Minimum acceptable pressure is 50 bar (725 lbf/in²).

1. Depressurise braking system. **See this section.**
2. Remove 3 nuts securing pump/motor assembly to valance. Raise assembly from mounting to allow clearance for pressure test adaptor.
3. Remove banjo bolt securing high pressure hose to pump. Collect sealing washers.



70M7033

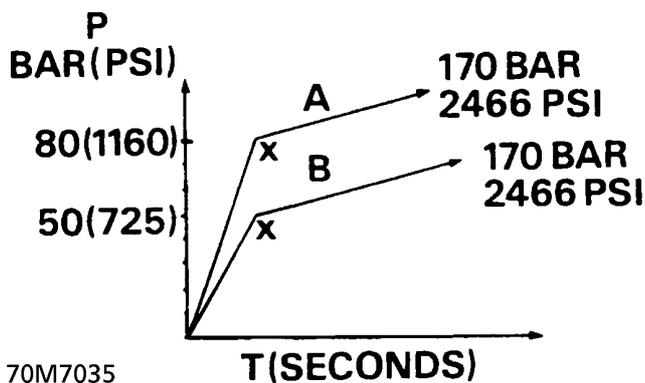


- Connect pressure gauge to pump using LRT-70-003 through high pressure hose union.



NOTE: Use original sealing washers.

- Switch ignition on. Observe pressure gauge.
- Pressure will rapidly rise to the accumulator precharge value, point X, at which point rate of increase will reduce as pressure rises to system pressure of approx. 170 bar - see graph 'A'.



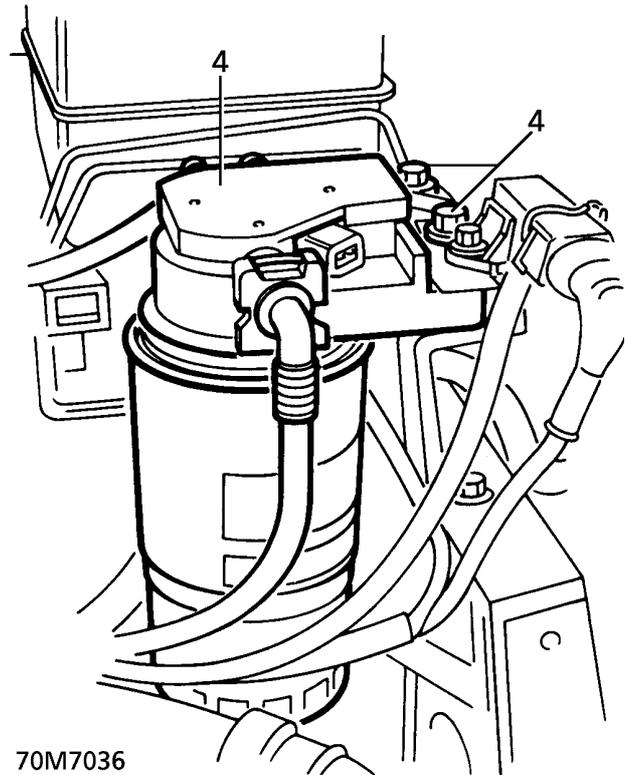
- With a new accumulator, point 'X' will occur at 80 bar.
- Renew accumulator if point 'X' occurs below 50 bar.
- Depressurise system. Remove test equipment.
- Using new sealing washers, position high pressure hose to pump. Secure with banjo bolt. Tighten to **24 Nm. (18 lbf.ft)**
- Align pump/motor assembly to mounting. Secure with nuts. Tighten to **8 Nm. (6 lbf.ft)**
- Bleed brake system. **See this section.**

HYDRAULIC BOOSTER UNIT

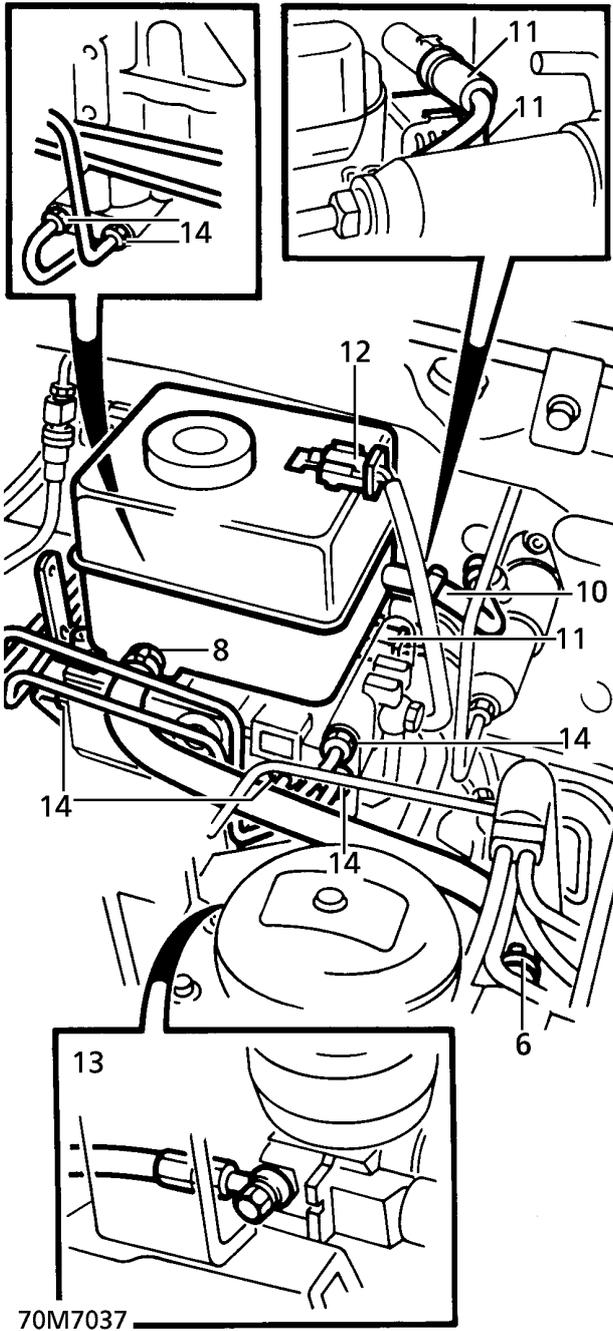
Service repair no - 70.65.20

Remove

- Disconnect battery negative lead.
- Depressurise braking system. **See this section.**
- RHD Vehicles Only:** Release coolant expansion tank from clips and bracket. Position tank aside for access to booster pipe connections.
- LHD Diesel Vehicles Only:** Remove 2 bolts securing fuel filter assembly to chassis turret. Move filter aside.



- Position cloth under booster to collect fluid spillage.
- Release clip from fluid reservoir hose at pump. Disconnect hose.
- Allow fluid to drain into suitable container. Discard fluid. Plug hose and pump.
- Disconnect hose from reservoir. Plug hose and reservoir.

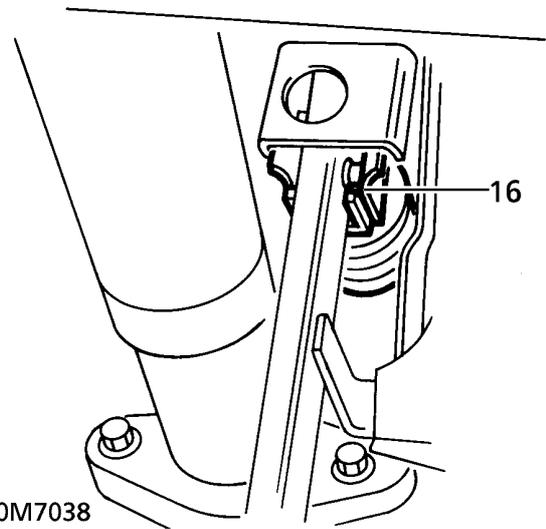


Manual Vehicles only.

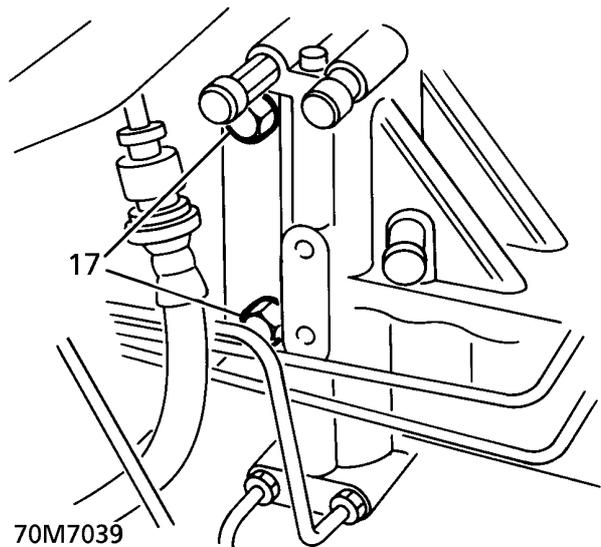
- 9. Reposition container beneath clutch master cylinder feed hose.
- 10. Disconnect clutch hose from reservoir. Allow fluid to drain. Plug hose and reservoir.

All Models.

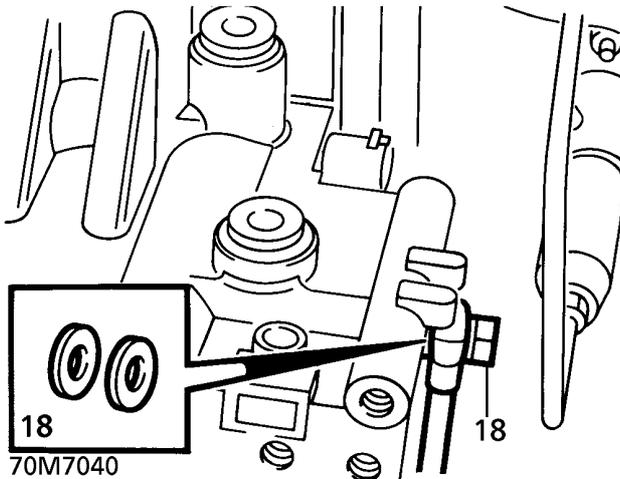
- 11. Disconnect 2 multiplugs from booster.
- 12. Disconnect fluid level switch multiplug.
- 13. Remove banjo bolt securing high pressure hose to pump. Discard sealing washers. Plug hose and pump.
- 14. Unscrew pipe unions from booster. Plug pipes and booster.
- 15. Remove closing panel. *See CHASSIS AND BODY, Repair.* Remove stop light switch. *See this section.*
- 16. Release booster push rod from brake pedal.



- 17. Remove 2 bolts securing booster assembly to pedal box. Remove booster.



- 18. Remove banjo bolt securing high pressure hose to booster. Discard sealing washers. Plug hose and booster.



Refit

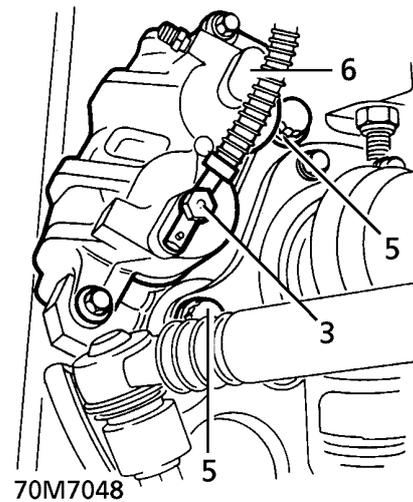
19. Remove plugs from high pressure hose and booster.
20. Position high pressure hose to booster. Secure with banjo bolt and new sealing washers. Tighten to **24 Nm. (18 lbf.ft)**
21. Position booster to pedal box. Ensure push rod engages with pedal. Secure booster with bolts. Tighten to **45 Nm. (33 lbf.ft)**
22. Remove plugs from brake pipes and booster. Align pipes to booster. Secure union nuts. Tighten to **14 Nm. (10 lbf.ft)**
23. Remove plugs from high pressure hose and pump.
24. Position high pressure hose to pump. Secure with banjo bolt and new sealing washers. Tighten to **24 Nm. (18 lbf.ft)**
25. Connect fluid level switch multiplug.
26. Connect 2 multiplugs to booster.
27. **Manual Vehicles only.** Remove plugs from clutch fluid hose and reservoir. Connect hose. Secure with clip.
28. Remove plugs from reservoir, brake fluid hose and pump.
29. Position hose to reservoir and pump. Secure with new clips.
30. Remove cloth from under booster.
31. **LHD Diesel Vehicles Only:** Align fuel filter to chassis turret. Secure with 2 bolts.
32. **RHD Vehicles Only:** Engage coolant expansion tank beneath bracket. Engage with clips.
33. Reconnect battery negative lead.
34. Bleed braking system. **See this section.**
35. Fit Fascia closing panel. **See CHASSIS AND BODY, Repair.**

FRONT CALIPER

Service repair no - 70.55.02

Remove

1. Remove brake pads. **See this section.**
2. Using an approved hose clamp, clamp flexible hose at caliper.
3. Remove banjo bolt securing flexible hose to caliper. Discard sealing washers.



4. Plug caliper and hose to prevent ingress of dirt.
5. Remove 2 bolts securing caliper.
6. Remove caliper.

Refit

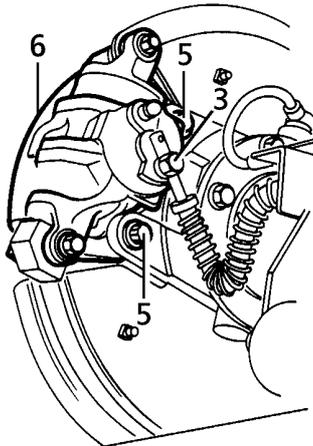
7. Clean exposed parts of caliper pistons with brake fluid.
8. Fit caliper to hub and secure with bolts. Tighten to **165 Nm. (122 lbf.ft)**
9. Remove plugs from caliper and hose.
10. Using new sealing washers, position hose to caliper. Secure with banjo bolt. Tighten to **32Nm. (24 lbf.ft)**
11. Remove hose clamp.
12. Refit brake pads. **See this section.**
13. Bleed both front brake calipers. **See this section.**
14. Remove safety stands. Lower vehicle.
15. Press brake pedal firmly several times to seat brake pads.

REAR CALIPER

Service repair no - 70.55.03

Remove

1. Remove brake pads. **See this section.**
2. Using an approved hose clamp, clamp flexible hose at caliper.
3. Remove banjo bolt securing flexible hose to caliper. Discard sealing washers.



70M7024

4. Plug caliper and hose to prevent ingress of dirt.
5. Remove 2 bolts securing caliper.
6. Remove caliper.

Refit

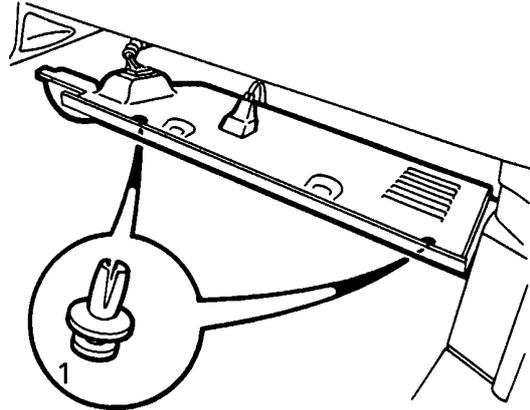
7. Clean exposed parts of caliper piston with brake fluid.
8. Fit caliper to hub and secure with bolts. Tighten to **100Nm. (74 lbf.ft)**
9. Remove plugs from caliper and hose.
10. Using new sealing washers, position hose to caliper and secure with banjo bolt. Tighten to **32Nm. (24 lbf.ft)**
11. Remove hose clamp.
12. Refit brake pads. **See this section.**
13. Bleed both rear brake calipers. **See this section.**
14. Remove safety stands. Lower vehicle.
15. Press brake pedal firmly several times to seat brake pads.

ELECTRONIC CONTROL UNIT (ECU)

Service repair no - 70.25.34

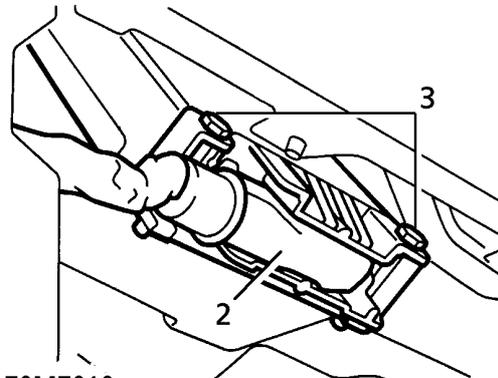
Remove

1. Remove 3 scrivet fasteners securing the passenger side fascia closing panel. Release closing panel for access to ABS ECU.



70M7047

2. Disconnect ECU multiplug.



70M7010

3. Remove 2 bolts securing ECU to bracket.
4. Remove ECU.

Refit

5. Locate ECU to bracket, fit securing bolts. Tighten to **6 Nm. (4 lbf.ft)**
6. Connect multiplug to ECU. Position closing panel, secure with scrivet fasteners.



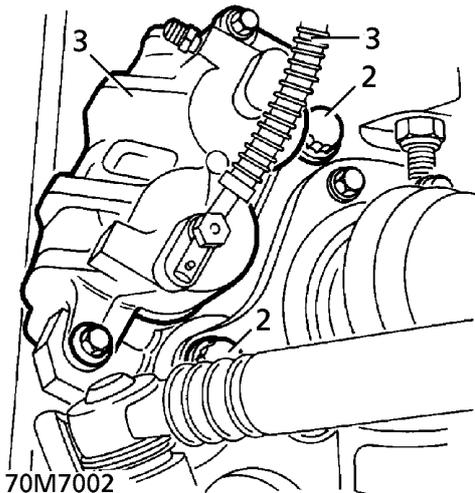
BRAKE DISC AND SHIELD - FRONT

Service repair no - 70.10.12 - Front disc

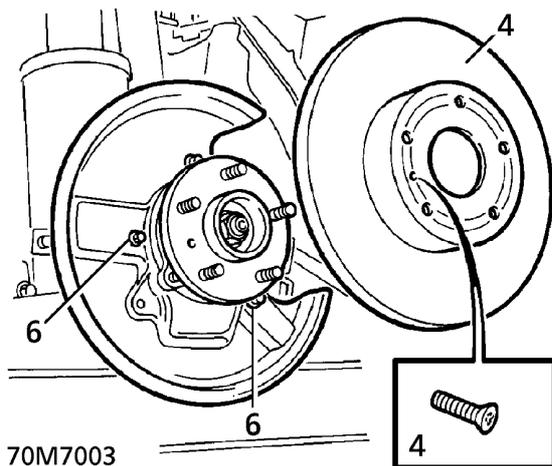
Service repair no - 70.10.18 - Disc shield

Remove

1. Remove front brake pads. *See this section.*
2. Remove 2 bolts securing caliper.



3. Tie caliper aside, ensuring brake hose is not stressed.
4. Remove screw securing disc, remove disc.



5. Using a wire brush, remove corrosion from mating faces. Clean with a suitable solvent.
6. Remove 3 bolts, remove disc shield.

Refit

7. Fit disc shield, secure with bolts. Tighten to **8 Nm. (6 lbf.ft)**
8. Fit brake disc, secure with screw. Tighten to **25 Nm. (18 lbf.ft)**
9. Untie brake caliper.
10. Fit brake caliper, secure with bolts. Tighten to **165 Nm. (122 lbf.ft)**
11. Fit front brake pads. *See this section.*

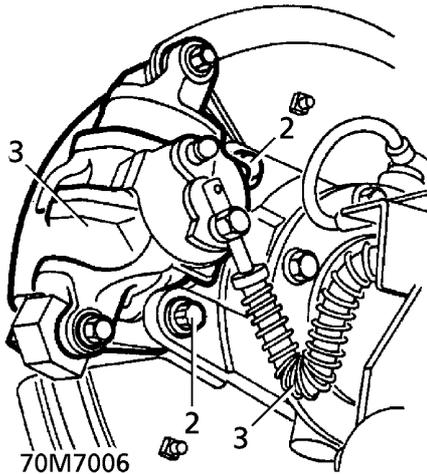
BRAKE DISC AND SHIELD - REAR

Service repair no - 70.10.34 - Rear disc

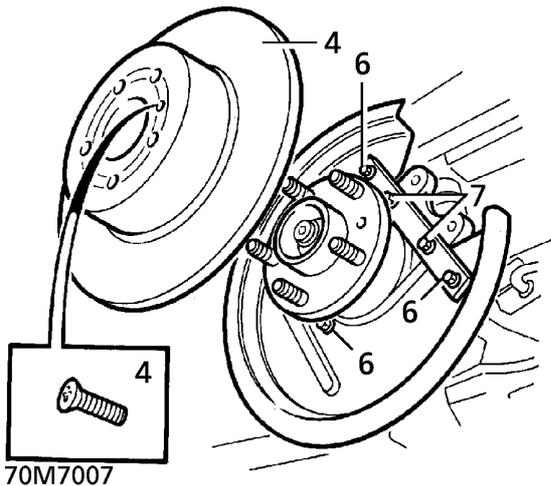
Service repair no - 70.10.19 - Disc shield

Remove

1. Remove rear brake pads. *See this section.*
2. Remove 2 bolts securing caliper.



3. Tie caliper aside, ensuring brake hose is not stressed.
4. Remove screw securing disc, remove disc.



5. Using a wire brush, remove corrosion from disc mating faces before cleaning with a suitable solvent.
6. Remove 3 bolts, remove disc shield.
7. Remove 2 bolts, remove shield strap.

Refit

8. Fit shield strap, secure with bolts. Tighten to **8 Nm. (6 lbf.ft)**
9. Fit disc shield, fit securing bolts. Tighten to **8 Nm. (6 lbf.ft)**
10. Fit brake disc, secure with screw. Tighten to **25 Nm. (18 lbf.ft)**
11. Untie brake caliper.
12. Fit brake caliper, fit bolts. Tighten to **100 Nm. (74 lbf.ft)**
13. Fit rear brake pads. *See this section.*



BRAKE PADS - FRONT

Service repair no - 70.40.02

Service tool:
LRT-70-500 - Piston clamp

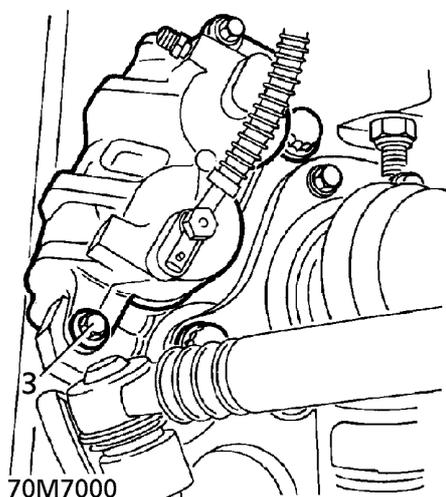
Remove

1. Raise the vehicle.



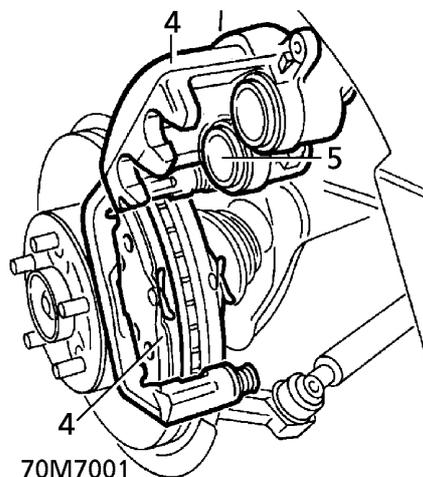
WARNING: Support on safety stands.

2. Remove front road wheels.
3. Remove bolt from lower guide pin of each caliper.



CAUTION: Guide pin uses a special, flange headed bolt. DO NOT use any other type of bolt.

4. Swivel caliper upwards, remove brake pads.



5. Using piston clamp, LRT-70-500, press caliper pistons fully into bores.



CAUTION: Ensure that displaced fluid does not overflow from reservoir.

6. Clean faces of pistons and pad locations in caliper.
7. Check condition of guide pin boots, replace if perished or split.

Refit

8. Fit brake pads with chamfer towards leading edge of disc (towards rear of vehicle). Swivel caliper downwards into position.
9. Fit new guide pin bolt. Tighten to **30 Nm (22 lbf.ft)**
10. Apply brake pedal several times to locate pads.
11. Check fluid reservoir level, top-up if necessary using correct grade of fluid. **See LUBRICANTS, FLUIDS AND CAPACITIES, Information.**
12. Fit road wheels. Tighten nuts to **108 Nm (80 lbf.ft)**.
13. Remove safety stands. Lower vehicle.

BRAKE PADS - REAR

Service repair no - 70.40.03

Service tool:
LRT-70-500 - Piston clamp

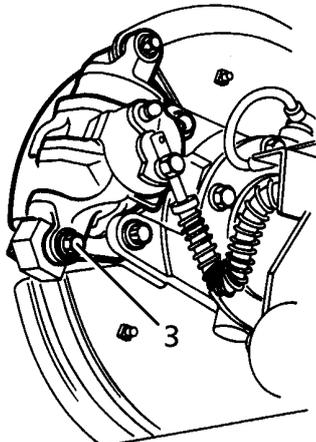
Remove

1. Raise the vehicle.



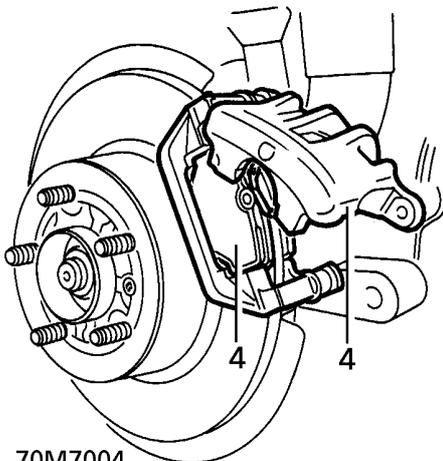
WARNING: Support on safety stands.

2. Remove rear road wheels.
3. Remove bolt from lower guide pin of each caliper.



70M7005

4. Swivel caliper upwards, remove brake pads.



70M7004

5. Using piston clamp, LRT-70-500, press caliper piston fully into bore.



CAUTION: Ensure that displaced fluid does not overflow from reservoir.

6. Clean faces of piston and pad locations in caliper.
7. Check condition of guide pin boots, replace if perished or split.

Refit

8. Fit brake pads with chamfer towards leading edge of disc (towards rear of vehicle). Swivel calipers downwards into position.
9. Fit new guide pin bolts, tighten to **30 Nm. (22 lbf.ft).**
10. Apply brake pedal several times to locate pads.
11. Check fluid reservoir level. Top-up if necessary using correct grade of fluid. **See LUBRICANTS, FLUIDS AND CAPACITIES, Information.**
12. Refit road wheels. Tighten nuts to **108 Nm. (80 lbf.ft).**
13. Remove safety stands. Lower vehicle.

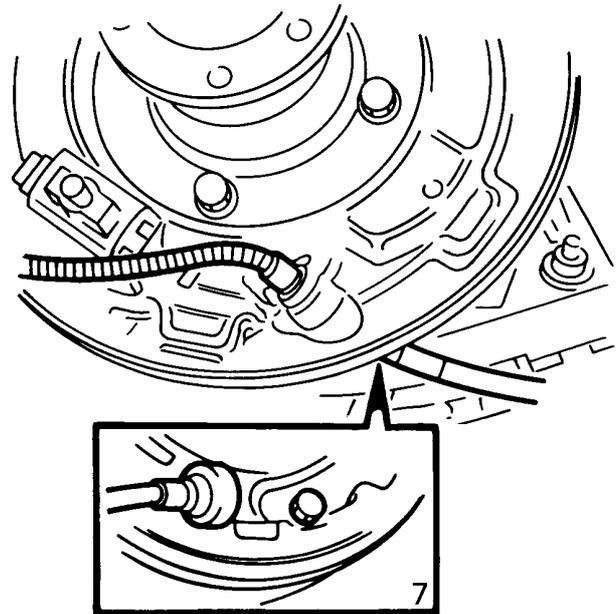
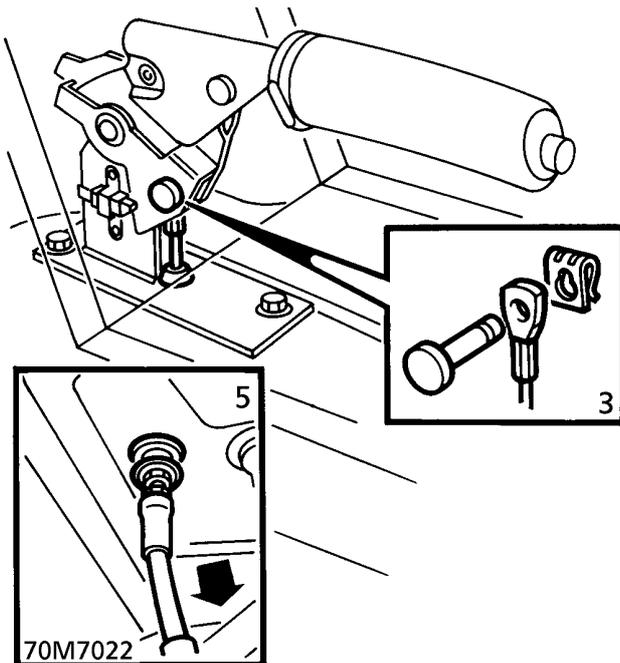


PARKING BRAKE CABLE

Service repair no - 70.35.25

Remove

1. Raise vehicle on four post lift.
2. Remove master switch pack from centre console. **See ELECTRICAL, Repair.**
3. Remove clevis pin securing brake cable to lever.



70M7023

Refit

4. Raise lift.
5. From under vehicle pull cable through grommet in floor. Refit grommet to floor.
6. Remove brake shoes. **See this section.**
7. Release cable from backplate.

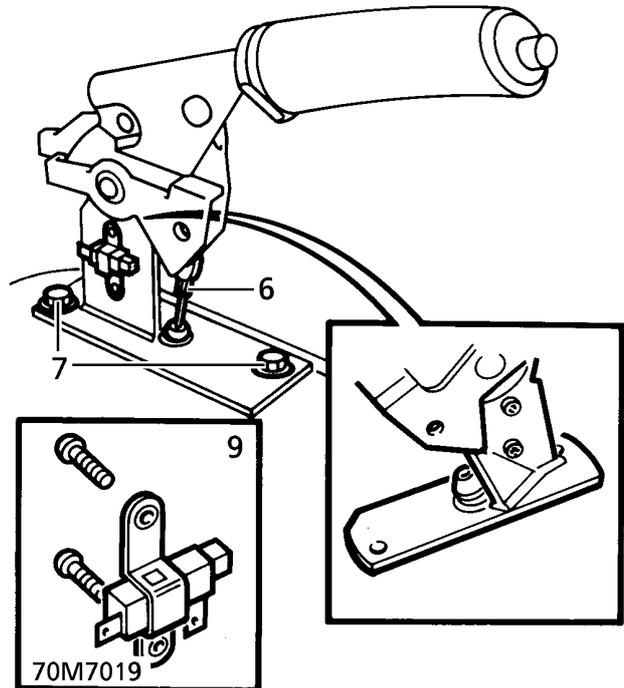
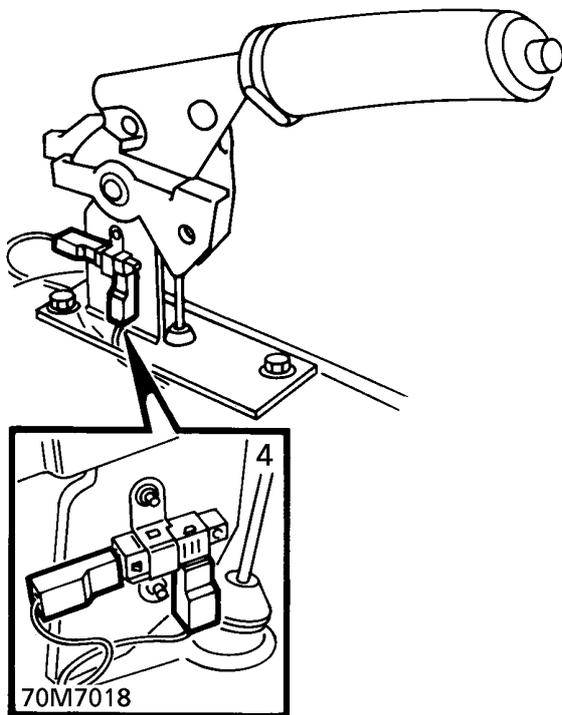
8. Fit cable to backplate.
9. Fit brake shoes and drum. **See this section.**
10. Feed brake cable through grommet into vehicle.
11. From inside vehicle, align cable to handbrake lever. Secure with clevis pin and clip.
12. Fit master switch pack. **See ELECTRICAL, Repair.**
13. Adjust parking brake. **See Adjustment.**

PARK BRAKE LEVER

Service repair no - 70.45.01

Remove

1. Raise vehicle on four post lift.
2. Disconnect battery negative lead.
3. Remove centre console. **See CHASSIS AND BODY, Repair.**
4. Disconnect 2 Lucars from parking brake warning switch.



5. Raise lift.
6. Pull brake cable through grommet in base of lever.
7. Remove 2 bolts securing lever. Remove lever.
8. Remove grommet from lever.
9. Remove 2 screws securing warning switch. Remove switch.

Refit

10. Reverse removal procedure.
11. Adjust parking brake. **See Adjustment.**



CALIPER GUIDE PIN BOOTS

Service repair no - 70.55.32

Remove

1. Remove brake pads. *See this section.*
2. Remove remaining bolts securing caliper body to carrier.
3. Release caliper body from carrier. Tie aside. Do not strain hydraulic hose.
4. Remove 2 guide pins. Collect boot from each guide pin.

Check

5. Clean guide pins, bores and boots.
6. Inspect guide pins and bores. Renew guide pins if scored or excessively corroded.
7. Inspect boots for splits. Replace as necessary.

Refit



NOTE: If new guide pin boots are to be fitted, lubricate with grease supplied. If existing boots are to be re-used, lubricate with Kluber Syntheso 'GLK 1' grease.

8. Fit guide pins and boots. Ensure boots locate correctly.
9. Untie caliper body, position to carrier. Fit upper guide pin bolt. Tighten to **30 Nm. (22 lbf.ft)**
10. Fit brake pads. *See this section.*

PARKING BRAKE DRUM AND SHOES

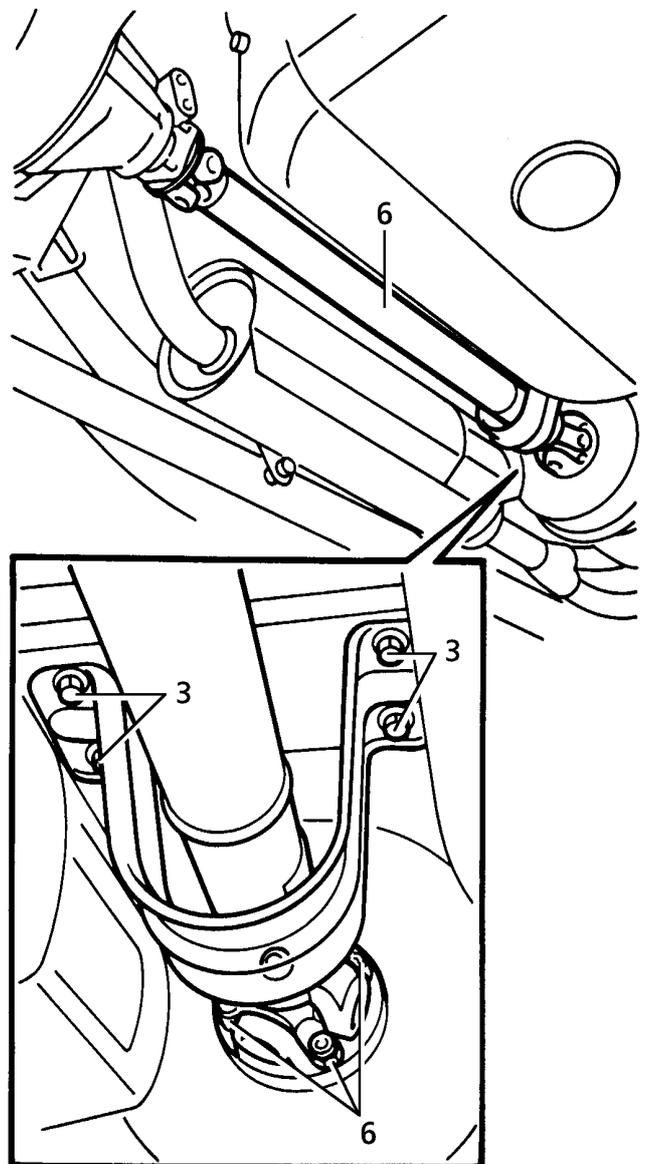
Service repair no - 70.45.17 - Brake Drum
Service repair no - 70.45.18 - Brake Shoes



WARNING: Do not use an air line to remove dust from brake assembly. Dust from brake linings can be a serious health risk if inhaled.

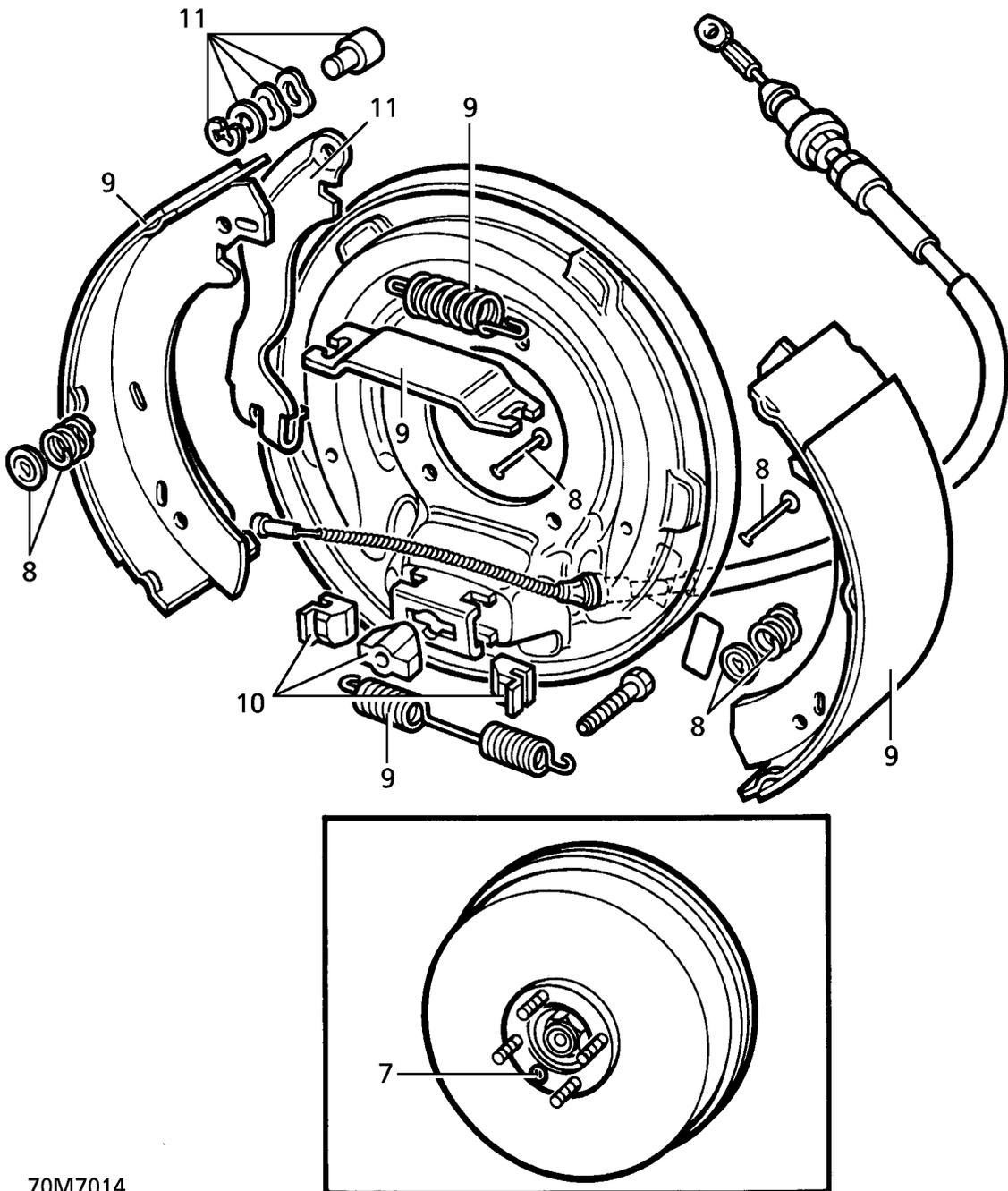
Remove

1. Raise vehicle on four post lift.
2. Release hand brake. Raise lift.
3. Remove 4 bolts securing rear propshaft guard. Remove guard.



70M7013

4. Mark propeller shaft flange and brake drum to aid re-assembly.
5. Raise one rear wheel to allow rotation of propeller shaft.
6. Remove 4 nuts securing shaft to drum. Release shaft. Tie aside.
7. Remove screw securing drum to drive flange. Remove drum.
8. Remove 2 washers, springs and pins retaining brake shoes to backplate.
9. Remove brake shoe. Collect pull off springs and abutment plate. Release remaining shoe from brake cable.
10. Remove adjuster plungers.
11. Remove 'C' clip securing cable lever to shoe. Remove flat washer, lever, 2 bellville washers and pivot pin.
12. Clean components with aerosol brake cleaner. Allow to dry. Examine components for wear. Replace as necessary.



70M7014



Refit

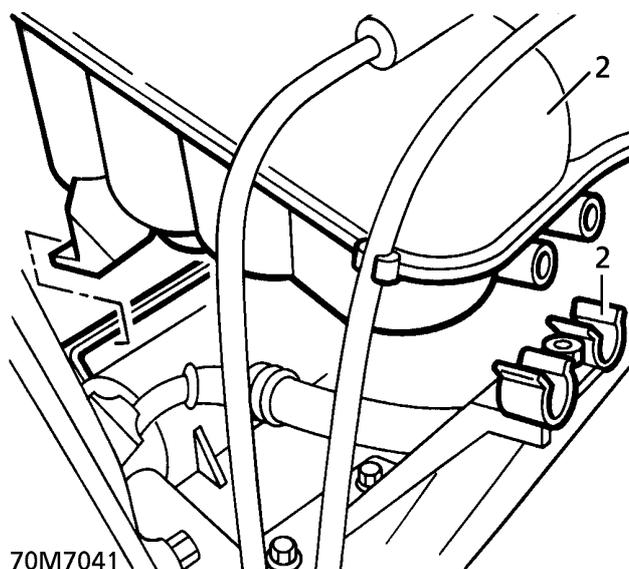
13. Fit adjuster plungers. Apply grease to cable lever pivot pin.
14. Fit pivot pin to shoe.
15. Fit 2 bellville washers, cable lever and flat washer. Secure with 'C' clip.
16. Fit shoe to brake cable, align to backplate and adjuster. Secure shoe to back plate with pin, spring and washer.
17. Fit abutment plate to shoe.
18. Fit pull off springs with remaining shoe. Secure shoe to backplate with pin, spring and washer.
19. Fit brake drum. Secure with screw.
20. Position propeller shaft to brake drum. Align marks. Secure with bolts. Tighten to **48 Nm (35 lbf.ft)**
21. Fit rear propeller shaft guard. Secure with bolts.
22. Adjust park brake. **See Adjustment.**
23. Remove support from under rear wheel. Lower lift.

PRESSURE CONSCIOUS REDUCING VALVE (PCRIV)

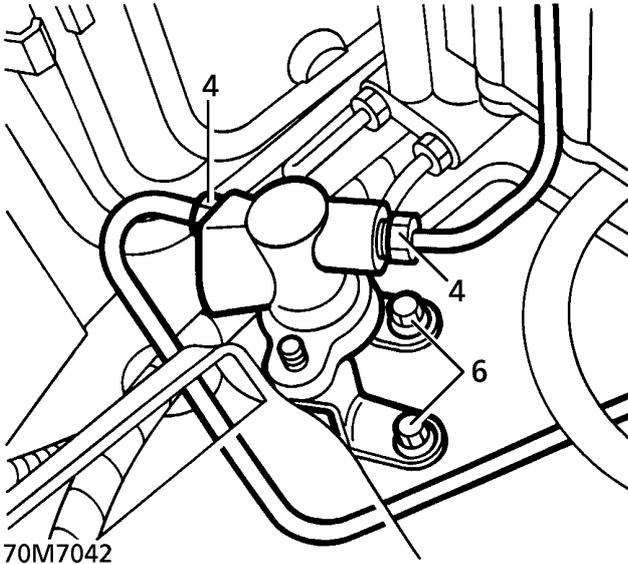
Service repair no - 70.25.21

Remove

1. Depressurise braking system. **See this section.**
2. **RHD Vehicles Only:** Release coolant reservoir from clips and bracket. Place reservoir aside for access to PCRIV.



3. Position cloth beneath PCRIV to catch fluid spillage.
4. Disconnect pipes from PCRIV.



5. Plug pipes and connections.
6. Remove 2 bolts securing PCRV to valance. Remove PCRV.

Refit

7. Position PCRV to valance. Secure with bolts. Tighten to **8 Nm. (6 lbf.ft)**
8. Remove plugs from PCRV and pipes.
9. Connect pipes to PCRV. Tighten unions to **14 Nm. (10lbf.ft)**
10. **RHD Vehicles Only:** Engage coolant reservoir beneath bracket. Secure to clips.
11. Bleed brake system. **See this section.**

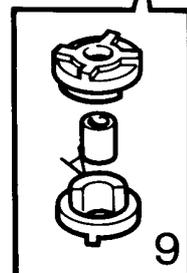
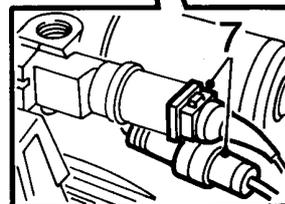
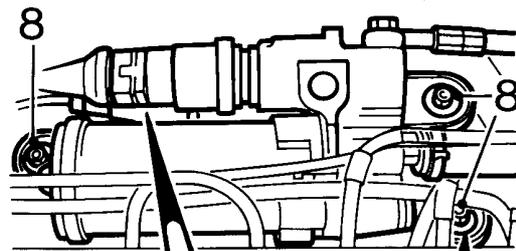
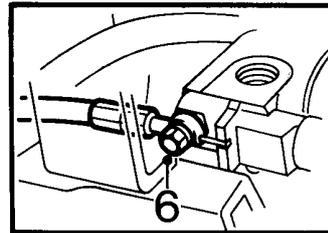
PUMP AND MOTOR

Service repair no - 70.65.02

Remove

CAUTION: Whenever pump/motor assembly is replaced, the ABS relay must also be replaced - See Description and Operation - Location Of Components - ABS Illustration.

1. Disconnect battery negative lead.
2. Remove accumulator. **See this section.**
3. Position cloth to catch fluid spillage.
4. Release clip securing reservoir hose to pump.
5. Disconnect reservoir hose. Plugs hose and connection.
6. Remove banjo bolt securing high pressure hose to pump. Collect sealing washers and discard. Plug hose and connection.



70M7034A



7. Disconnect multiplugs from motor and pressure switch.
8. Remove 3 nuts securing pump/motor assembly to valance. Remove assembly.
9. Collect rubber mountings and inserts from pump brackets.
10. Remove and discard ABS pump relay.

Refit

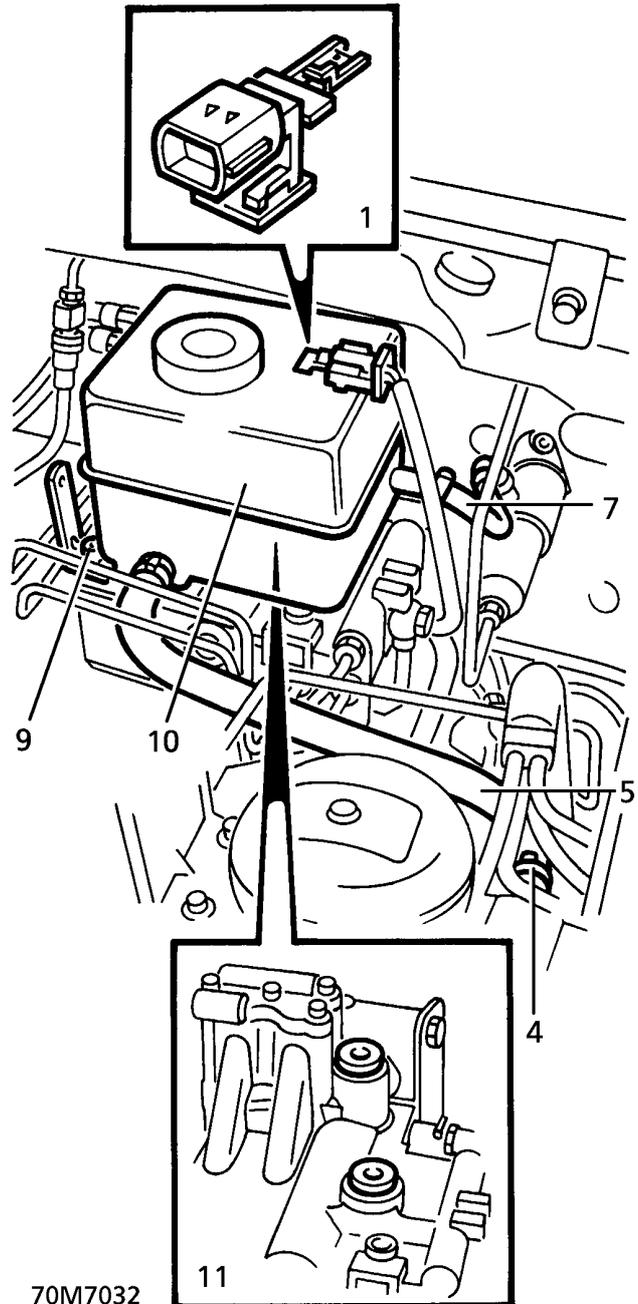
11. Fit rubbers and inserts to pump mountings.
12. Position pump/motor assembly to valance. Secure with nuts. Tighten to **8 Nm. (6 lbf.ft)**
13. Connect motor and pressure switch multiplugs.
14. Remove plugs from high pressure hose and pump.
15. Position high pressure hose to pump, ensuring correct location of the banjo timing peg into the slot. Secure with banjo bolt and new sealing washers. Tighten to **24 Nm. (18 lbf.ft)**
16. Remove plugs from reservoir hose and pump. Connect hose. Secure with clip.
17. Fit accumulator. **See this section.**
18. Fit replacement ABS pump relay.
19. Reconnect battery negative lead.

RESERVOIR AND SEALS

Service repair no - 70.65.22

Remove

1. Disconnect fluid level switch multiplug. Remove fluid filler cap.



70M7032

2. Position container to collect fluid.
3. Position cloth beneath pump to catch spillage.
4. Release clip securing reservoir hose to pump.
5. Release reservoir hose from pump. Drain reservoir into container.

Manual Vehicles only.

6. Reposition container beneath clutch reservoir hose.
7. Disconnect clutch master cylinder hose. Drain fluid into container.

All Vehicles.

8. Plug pipes and connections.
9. Remove bolt. Collect reservoir securing bracket.
10. Remove reservoir from 2 seals.
11. Remove reservoir seals from booster unit.



CAUTION: Do not allow seal debris to enter booster ports.

12. Plug reservoir and booster ports.
13. Release 2 clips securing fluid level switch to reservoir. Remove switch.

Refit

14. Fit fluid level switch to reservoir.
15. Remove plugs from booster ports and reservoir.
16. Lubricate new reservoir seals with clean brake fluid. Fit to booster ports.
17. Position reservoir. Engage fully into seals.
18. Position reservoir bracket. Secure with bolt. Tighten to **10 Nm. (7 lbf.ft)**

Manual Vehicles only.

19. Remove plug from clutch master cylinder hose. Connect hose to reservoir. Secure with clip.

All Vehicles.

20. Remove plug from reservoir hose and pump. Connect hose to pump. Secure with clip.
21. Connect fluid level switch multiplug.
22. Fill reservoir. **See LUBRICANTS, FLUIDS AND CAPACITIES, Information.**
23. Bleed brake system. **See this section.**

Manual Vehicles only.

24. Bleed clutch system. **See CLUTCH, Repair.**

ABS SENSORS - FRONT

Service repair no - 70.65.30



WARNING: If a sensor is removed for any reason, a NEW sensor bush must be fitted.

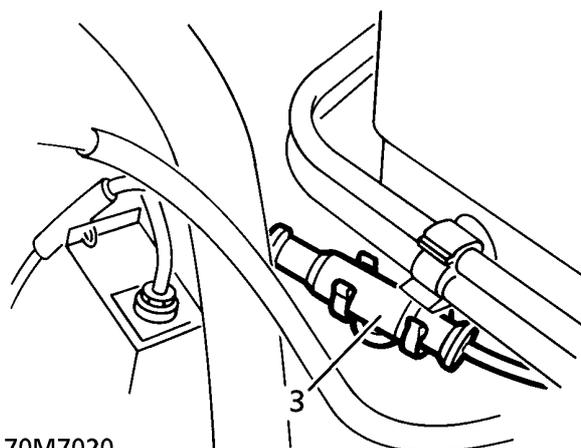
Remove

1. Raise the vehicle.



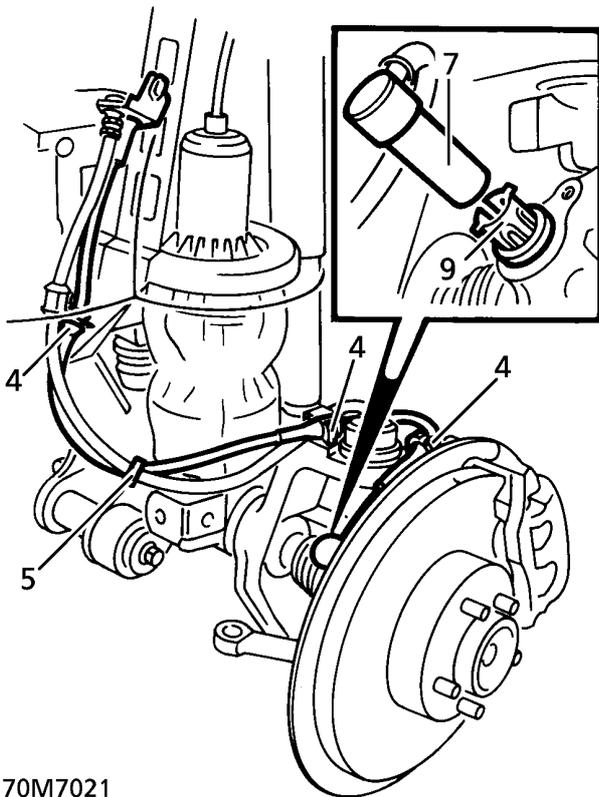
WARNING: Support on safety stands.

2. Remove road wheel.
3. Release sensor harness multiplug from clip. Disconnect multiplug.



70M7020

4. Release sensor harness from 3 brackets.



70M7021

5. Release sensor harness from brake hose clip.
6. Clean area around sensor to prevent ingress of dirt.
7. Using a suitable lever, prise sensor from bush.
8. Remove sensor/harness assembly.
9. Remove sensor bush.
10. Clean sensor location.

Refit

11. Lubricate new sensor bush with silicone grease.
See LUBRICANTS, FLUIDS AND CAPACITIES, Information.
12. Fit sensor bush.
13. Lubricate sensor with silicone grease.
14. Push sensor fully into bush until it contacts reluctor ring. Correct sensor position will be gained when vehicle is driven.
15. Engage sensor harness to brackets and brake hose clip.
16. Connect multiplug. Secure plug in clip.
17. Fit road wheel, tighten nuts to **108 Nm (80 lbf.ft)**.
18. Remove safety stands. Lower vehicle.
19. Clear ECU error code using **TestBook**.
20. Carry out short road test to ensure that ABS warning light remains extinguished.

ABS SENSORS - REAR

Service repair no - 70.65.33



WARNING: If a sensor is removed for any reason, a **NEW** sensor bush must be fitted.

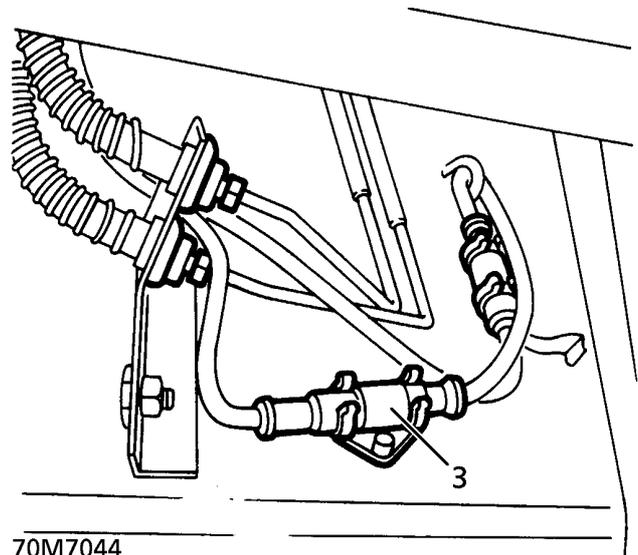
Remove

1. Raise the vehicle.



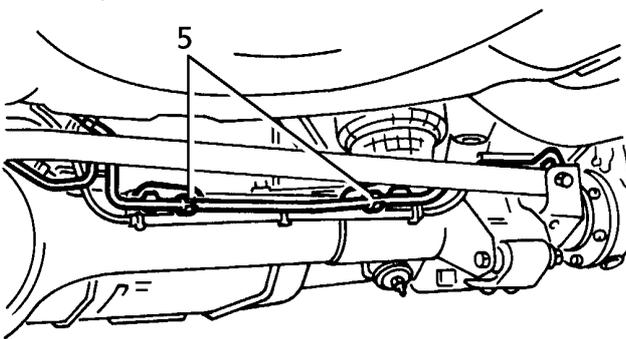
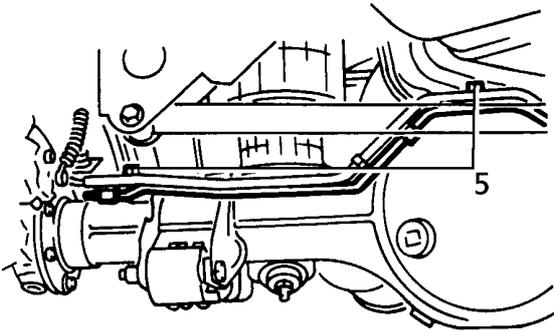
WARNING: Support on safety stands.

2. Remove road wheel.
3. Release sensor harness multiplug from clip. Disconnect multiplug.



70M7044

4. Release sensor harness grommets from bracket. Withdraw sensor harness.
5. Remove 2 bolts securing sensor harness guard to axle. Release 2 harness clips from brake pipe.

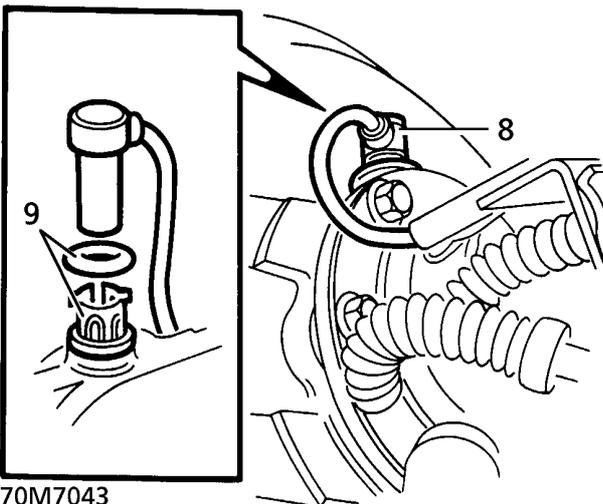


70M7045

Refit

11. Lubricate new sensor bush with silicone grease. **See LUBRICANTS, FLUIDS AND CAPACITIES, Information.**
12. Fit sensor bush and seal.
13. Lubricate sensor with silicone grease.
14. Push sensor fully into bush until it contacts reluctor ring. Correct sensor position will be gained when vehicle is driven.
15. Position sensor harness guard. Secure with bolts.
16. Engage sensor harness guard clips to brake pipe.
17. Thread sensor harness through grommets. Engage grommets in bracket.
18. Connect multiplug. Secure in clip.
19. Fit road wheel, tighten nuts to **108 Nm (80 lbf.ft)**.
20. Remove safety stands. Lower vehicle.
21. Clear ECU error code using **TestBook**.
22. Carry out short road test to ensure that ABS warning light remains extinguished.

6. Clean area around sensor to prevent ingress of dirt.
7. Using a suitable lever, prise sensor from bush.



70M7043

8. Remove sensor/harness assembly.
9. Remove seal and bush.
10. Clean sensor location.

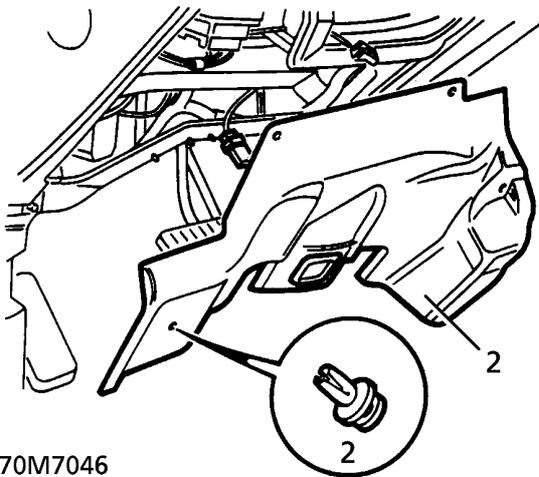


STOP LIGHT SWITCH - UP TO 99MY

Service repair no - 70.35.42

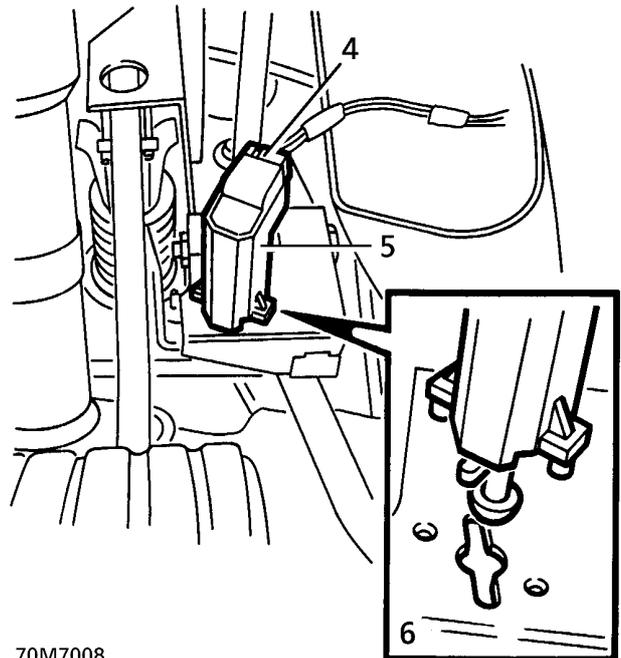
Remove

1. Remove driver side fascia closing panel. *See CHASSIS AND BODY, Repair.*
2. Remove 3 scrivet fasteners securing lower closing panel. Release panel for access to blower motor ducting.



70M7046

3. Release ducting from blower motor housing and heater. Remove blower motor ducting.
4. Release multiplug from stop light switch.



70M7008

5. Remove stop light switch from pedal bracket.

Refit

6. Engage switch fully into pedal bracket location.
7. Connect multiplug.



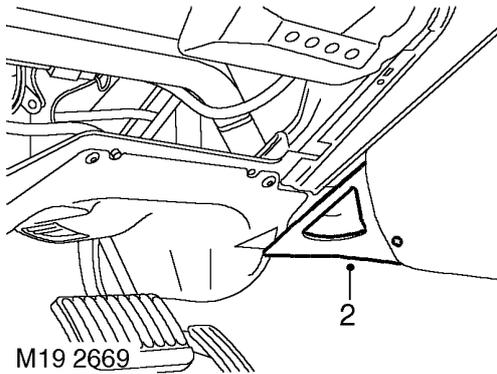
NOTE: The stop light switch is factory set and requires no adjustment in service.

8. Position blower ducting, fit to heater and blower motor housing locations.
9. Position lower closing panel and secure with scrivet fasteners.
10. Fit driver side fascia closing panel. *See CHASSIS AND BODY, Repair.*

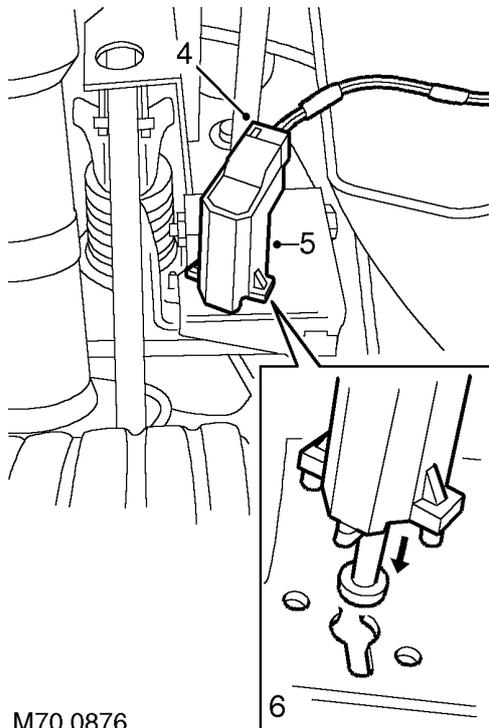
STOP LIGHT SWITCH - FROM 99MY

Service repair no - 70.35.42

1. Remove closing panel from fascia. **See CHASSIS AND BODY, Repair.**



2. Remove screw and remove heater outlet duct.
3. Remove 4 scrivenets and remove access panel from fascia.
4. Release and remove heater air duct for access to stop light switch.



5. Disconnect multiplug from stop light switch.
6. Remove stop light switch from pedal bracket.

Refit

7. Ensure new stop light switch plunger is fully extended for initial setting.
8. Fit stop light switch to pedal bracket and connect multiplug.
9. Fit heater air duct.
10. Fit access panel and secure with scrivenets.
11. Fit heater outlet duct and secure with screw.
12. Fit closing panel to fascia. **See CHASSIS AND BODY, Repair.**