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SECTION 4A

HYDRAULIC BRAKES

Caution: Disconnect the negative battery cable before removing or installing any electrical unit or when a tool or equipment could easily come in contact with exposed electrical terminals. Disconnecting this cable will help prevent personal injury and damage to the vehicle. The ignition must also be in LOCK unless otherwise noted.

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SPECIFICATIONS

GENERAL SPECIFICATIONS

Application		MANDO Brake	PBR Brake
Brake Pedal	Type	Suspended	
	Pedal Ratio	4.3 : 1	4.3 : 1
	Pedal Stroke	138 mm	132 mm
	Pedal Freeplay	1 - 4 mm	
Master Cylinder	Type	Tandem Type with Lever Sensor	
	Inner Diameter	f25.4 mm	f23.81 mm
Brake Booster	Type	Vacuum Booster Type	
	Ratio	5.6 : 1	5.0 : 1
Front Brake	Type	Ventilated Disc	
	I.D. of Caliper Cylinder	f60 mm	f60.4 mm
	Thickness of Brake Pad	10 mm	
	Thickness of Disc Plate	24 mm	
Rear Brake	Type	Solid Disc	¬
	I.D. of Caliper Cylinder	f38.2 mm	f40.5 mm
	Thickness of Brake Pad	10.0 mm	9.5 mm
	Thickness of Disc Plate	10.4 mm	¬
Parking Brake	Type	Rear Wheel Internal Expansion Type	
	Operation	Mechanical	
Brake Fluid	Specification	SAE J1703, DOT3	

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DIGNOSIS

NOISE OR VEHICLE VIBRATION WHEN APPLIED BRAKE

Check	Action
Incorrectly Mounted Back Plate or Caliper	Repair
Loosened Bolt of Back Plate or Caliper	Retighten
Crack or Uneven Wear of Brake Drum or Disc	Replace
Pad or Lining Sticking to Contact Surface	Replace
Excessive Clearance Between Caliper and Pad	Repair
Uneven Contact of Pad	Repair
Lack of Lubrication	Lubricate
Loosened Suspension	Retighten

PULLS TO ONE SIDE WHEN BRAKING

Check	Action
Incorrect Tire Pressure Between Left and Right	Adjust
Poor Contact of Pad or Lining	Repair
Oil or Grease is Applied to Pad or Lining	Replace
Bent or Uneven Wear of Drum	Replace
Incorrectly Mounted Wheel Cylinder	Repair
Faulty Auto Adjuster	Replace

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POOR BRAKING

Check	Action
Dirty or Lack of Fluid	Replenish or Replace(Check eventual leakage)
Air in Brake System	Bleeding
Faulty Brake Booster	Replace
Poor Contact of Pad or Lining	Repair
Oil or Grease on Pad	Replace
Faulty Auto Adjuster	Replace
Over Heated Rotor Due to Dragging Pad or Lining	Repair
Clogging Brake Line	Repair
Faulty Proportioning Valve	Repair (If low cut-in : Adjust) (If Leakage : Replace)

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INCREASING PEDAL STROKE (PEDAL GOES TO FLOOR) OR BRAKE DRAGGING

Check	Action
Air in Brake system	Bleeding
Fluid Leaking	Repair
Excessive Clearance Between Push Rod and M/cylinder	Adjust
Parking Brake is not Fully Released	Repair
Incorrect Adjustment of Parking Brake	Adjust
Weak Return Spring of Brake Pedal	Replace
Incorrect Pedal Freeplay	Repair
Broken Rear Drum Brake Shoe Return Spring	Replace
Lack of Lubrication	lubricate
Damaged Master Cylinder Check Valve or Piston Return Spring	Replace

POOR BRAKING OF PARKING BRAKE

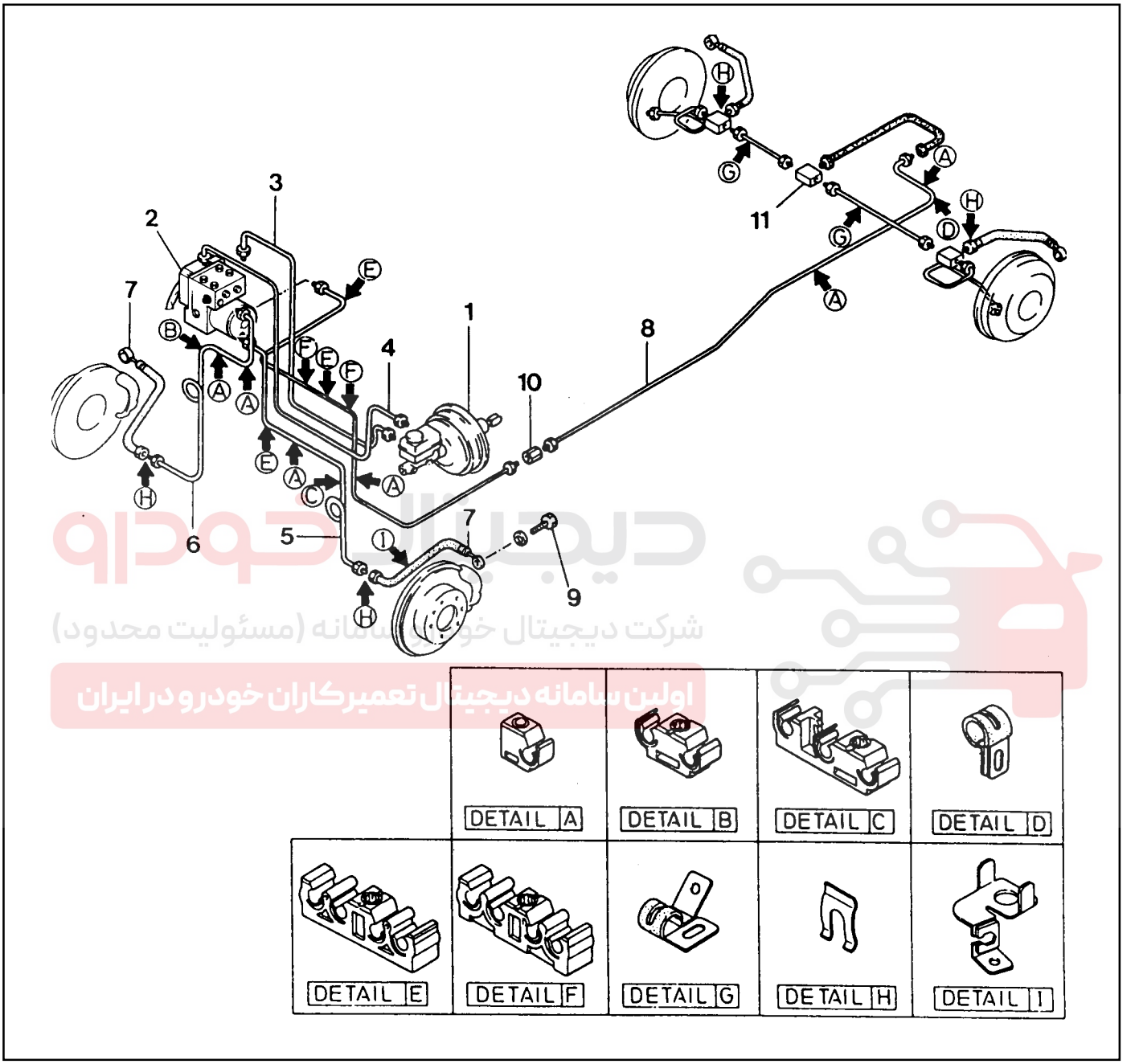
Check	Action
Insufficient Clearance Between Push Rod and Master Cylinder	Adjust
Worn Brake Lining	Replace
Oil or Grease on Lining	Replace
Binding Parking Brake Cable	Replace
Faulty Auto Adjuster	Replace
Excessive Lever Stroke	Adjust or Check Cable

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COMPONENT LOCATOR

ABS

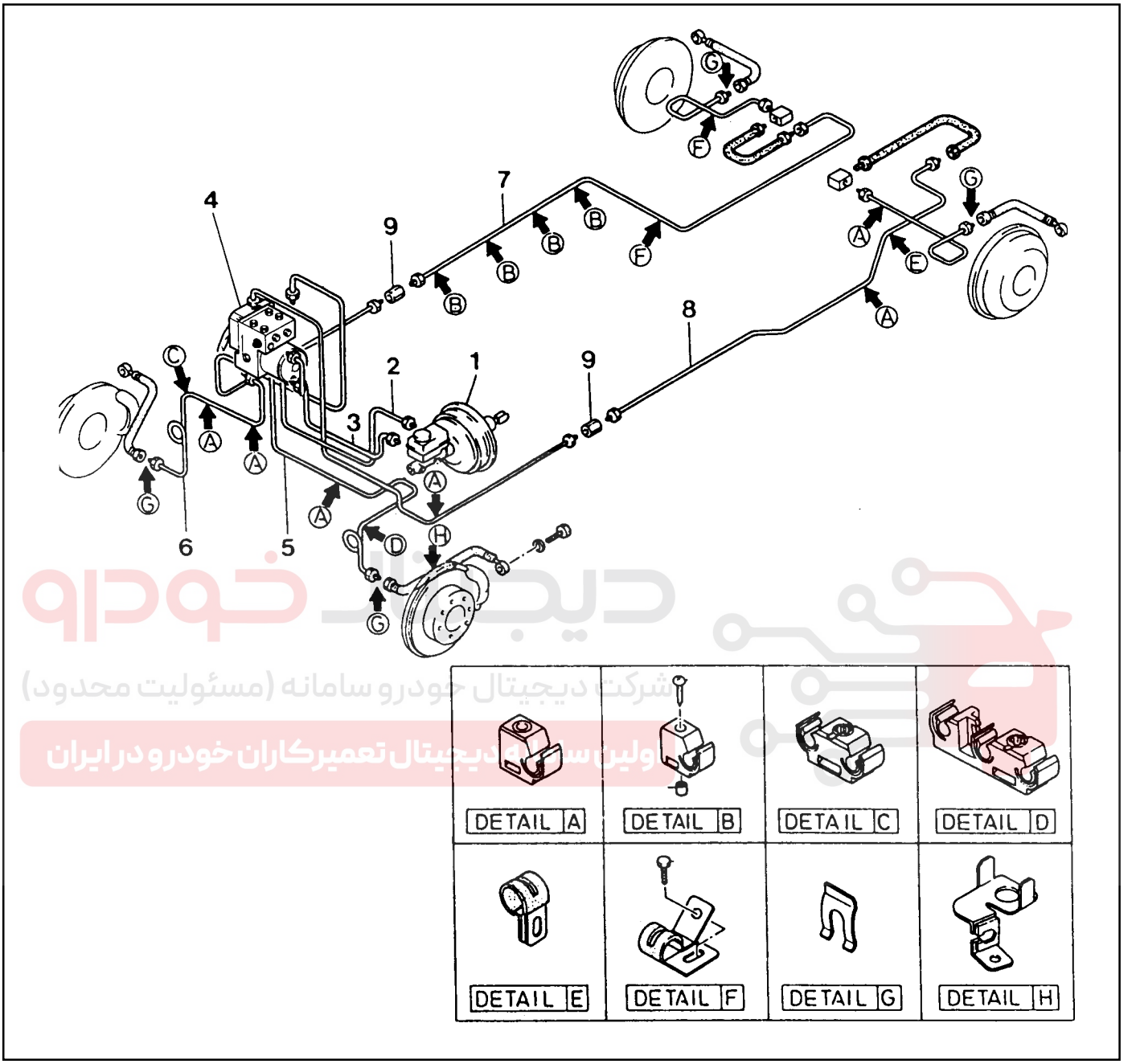


1 Actuation Assembly (Booster+TMC)
2 ABS Control Unit
3 Master Cylinder 2nd Tube (Secondary)
4 Master Cylinder 1st Tube (Primary)
5 Front Tube (LH)
6 Front Tube (RH)
7 Brake Hose
8 Rear Tube
9 Bolt ..... 25-35 Nm
10 2-way Connector
11 3-way Connector

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ABS / ABD

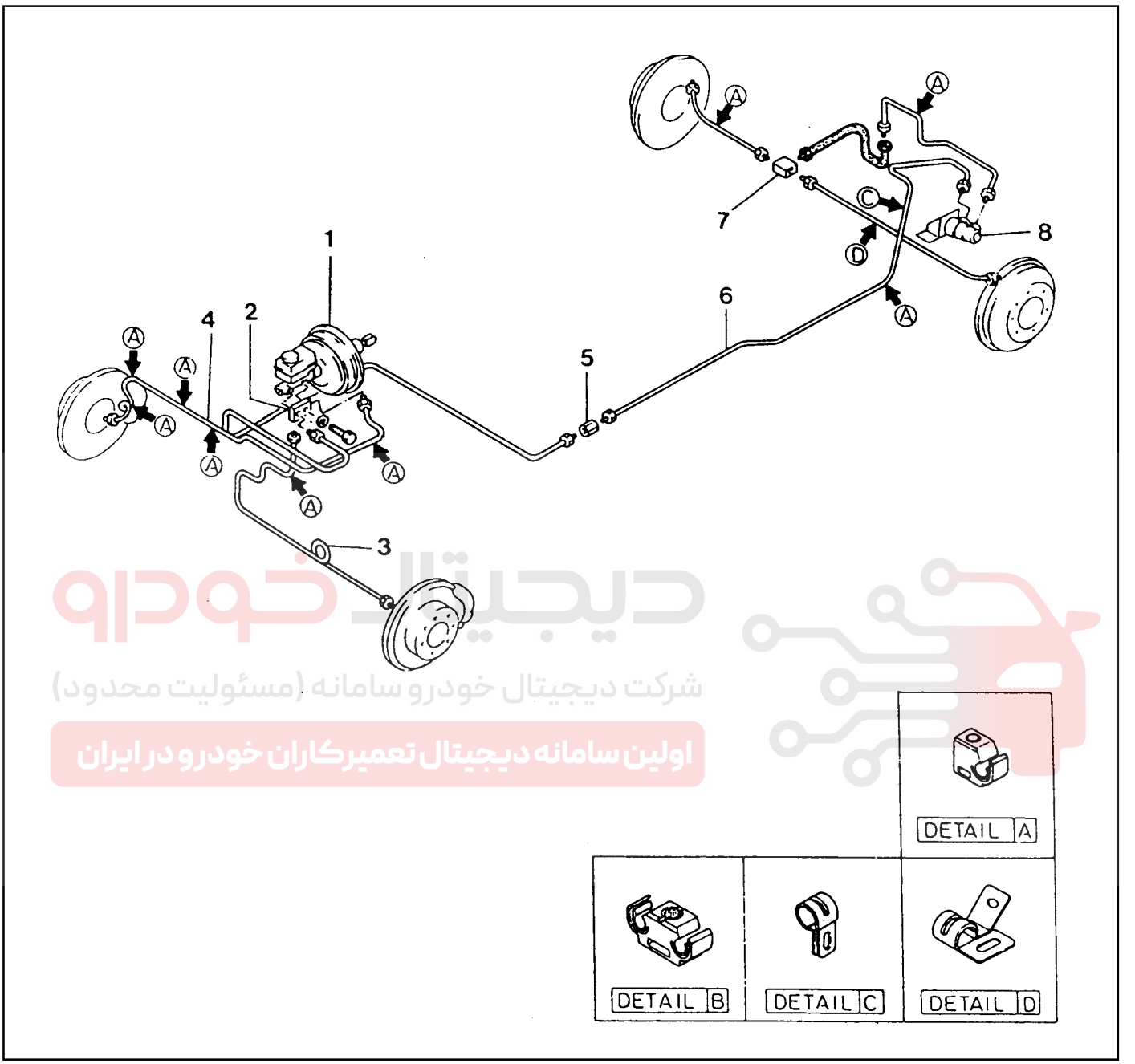


1 Actuation Assembly (Booster+TMC)
2 Master Cylinder 1st Tube (Primary)
3 Master Cylinder 2nd Tube (Secondary)
4 Hydraulic Modulator
5 Front Tube (LH)
6 Front Tube (RH)
7 Rear Tube (RH)
8 Rear Tube (LH)
9 2-way Connector

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NON-ABS/ABD



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1 Actuation Assembly (Booster+TMC)
2 3-way Connector
3 Front Tube (LH)
4 Front Tube (RH)
5 2-way Connector
6 Rear Tube
7 3-way Connector
8 LCRV

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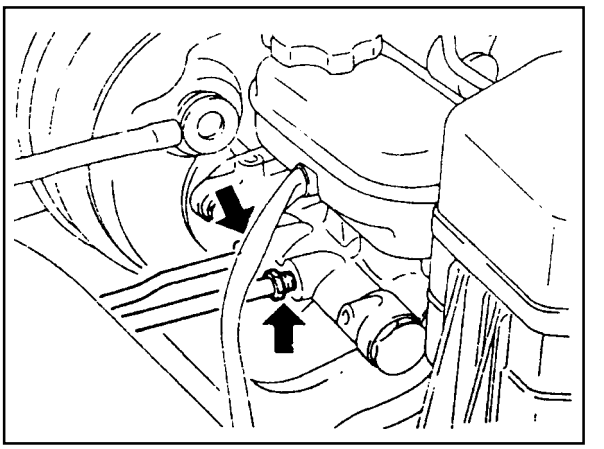
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MAINTENANCE AND REPAIR

ON-VEHICLE SERVICE

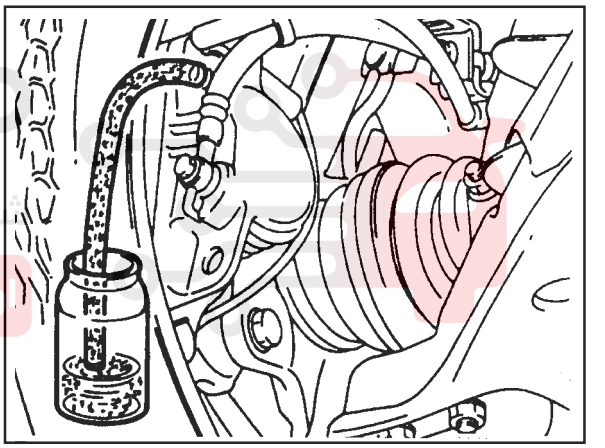
BLEEDING THE BRAKES

For Master Cylinder Replacement



1. Add oil after master cylinder replacement.
2. Run the engine and depress the brake pedal several times to build pressure and then keep the pedal fully depressed.
3. Loosen the screws of primary and secondary pipe at the master cylinder outlets to bleed air.
4. Repeat above step No.3 several times until there are no more air bubbles.
5. Bleed air in the system at the hydraulic unit outlet pipe and wheel if pressure building is not enough by depressing the pedal only after above air bleeding.

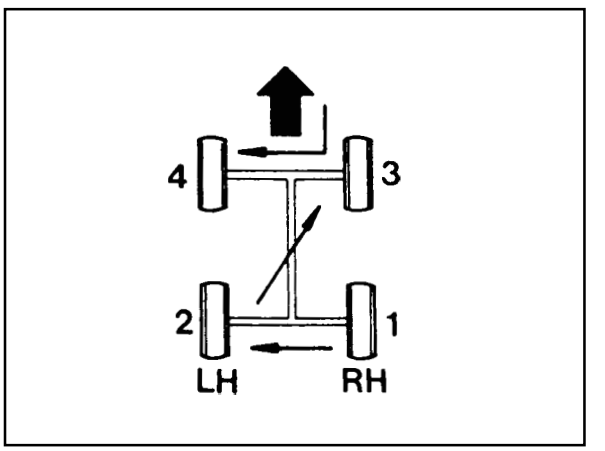
For Caliper and Brake Hose Replacement



1. Check the oil level from the oil reservoir and refill if necessary.
2. Run the engine and depress the pedal several times to build pressure and then keep the pedal fully depressed.
3. Connect a vinyl tube to the caliper breather and prepare a container to coentain brake oil.
4. Loosen the breather screw until there are no more bubbles.

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5. Bleed air in the system at four (4) wheels in order as shown in right figure if pressure building is not enough by depressing the pedal after above air bleeding.



Item	Tightening Torque
Front Bleeder Screw	9 - 14 Nm
Rear Bleeder Screw	

Notice

- Do not reuse the bled brake fluid.
- Always bleed the air after replacing brake fluid or master cylinder, caliper, brake hose and pipe.
- Always operate in normal order.

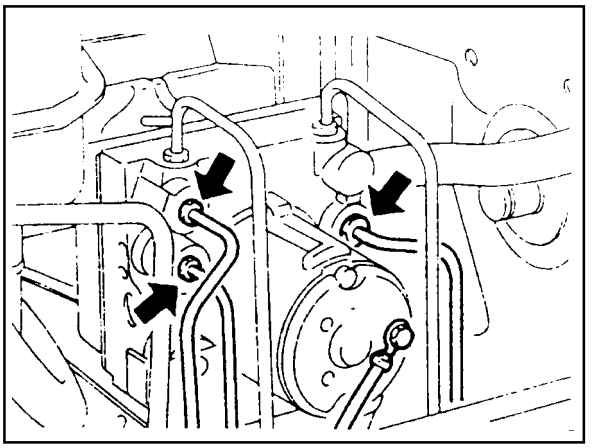
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For Hydraulic Unit Replacement

1. Add oil after hydraulic unit replacement.

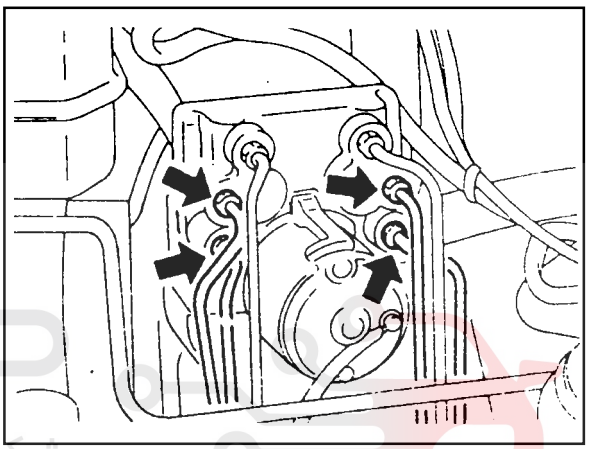
2. Run the engine and depress the pedal several times to build pressure and then keep the pedal fully depressed.



3. Loosen hydraulic pipe screws at the hydraulic unit outlets to bleed air.

4. Repeat above step No.3 several times until there are no more air bubbles.

5. Bleed air in the system from the wheels if pressure building is not enough by pressing the pedal only after above air bleeding.

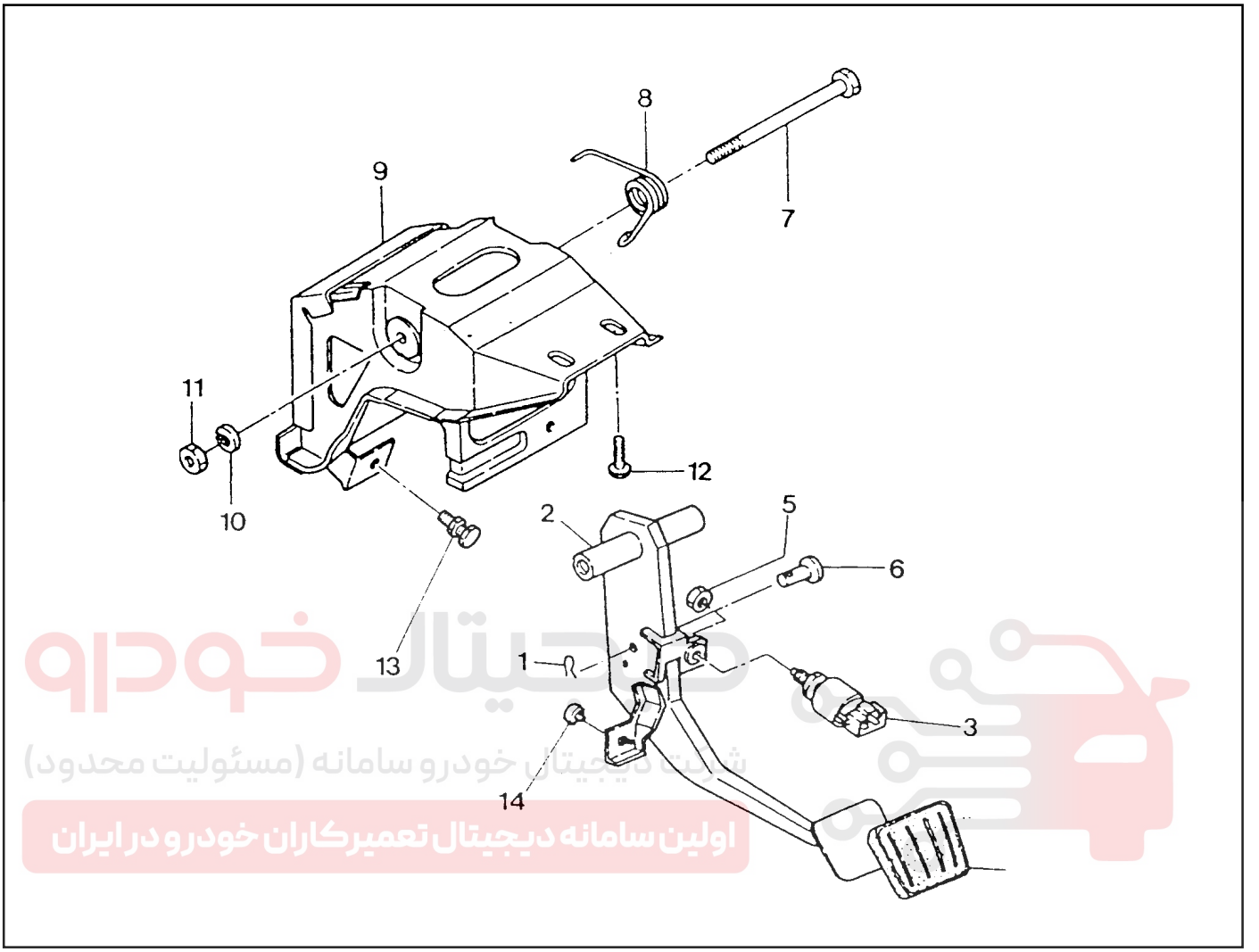


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BRAKE PEDAL



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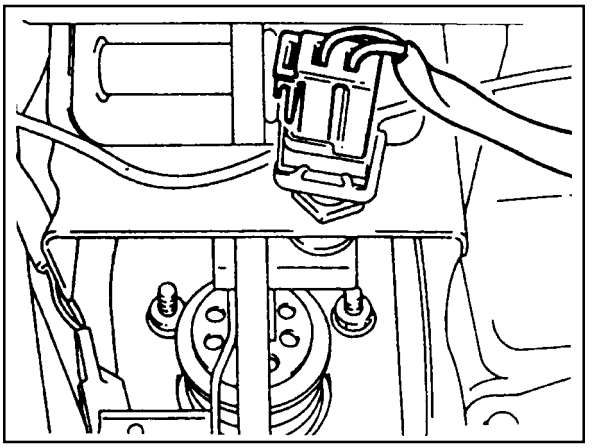
1 Clevis Pin
2 Brake Pedal
3 Stop Lamp Switch
4 Pad
5 Nut ..... 21-35 Nm
6 Yoke Pin
7 Fulcrum Pin
8 Return Spring
9 Pedal Mounting Bracket
10 Washer
11 Nut ..... 16-32 Nm
12 Bolt ..... 8-18 Nm
13 Stopper Bolt ..... Adjust
14 Rubber Pad ..... Replace

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Removal & Installation Procedure

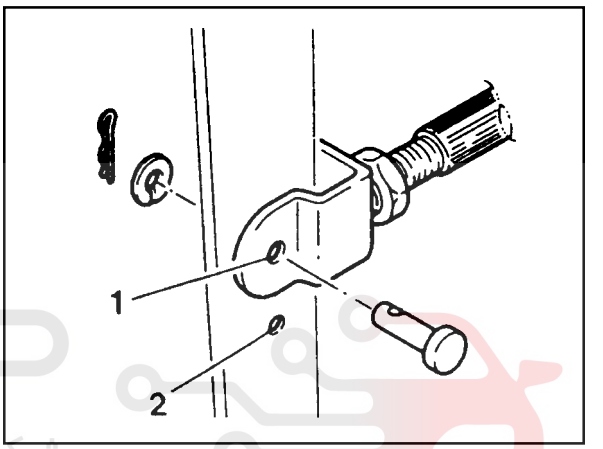
1. Remove the stop lamp switch connector.



2. Remove the clevis pin and disconnect the brake booster push rod.

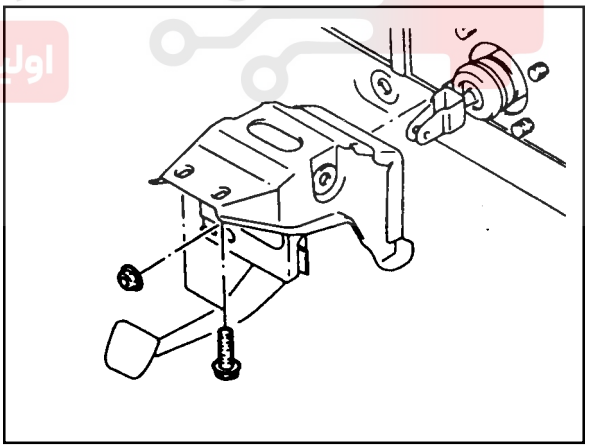
   Notice

   - Install in the upper hole (1), in case of Mando brake and in the below hole (2), incase of PBR brake.
   - Install the snap pin fully in the hole of clevis pin.
   - Apply the grease around the hole of clevis pin.



3. Loosen the nut (4EA) and bolt (2EA) and remove the brake pedal.
4. Installation should follow the removal procedure in reverse order.

Tightening Torque	8 - 18 Nm

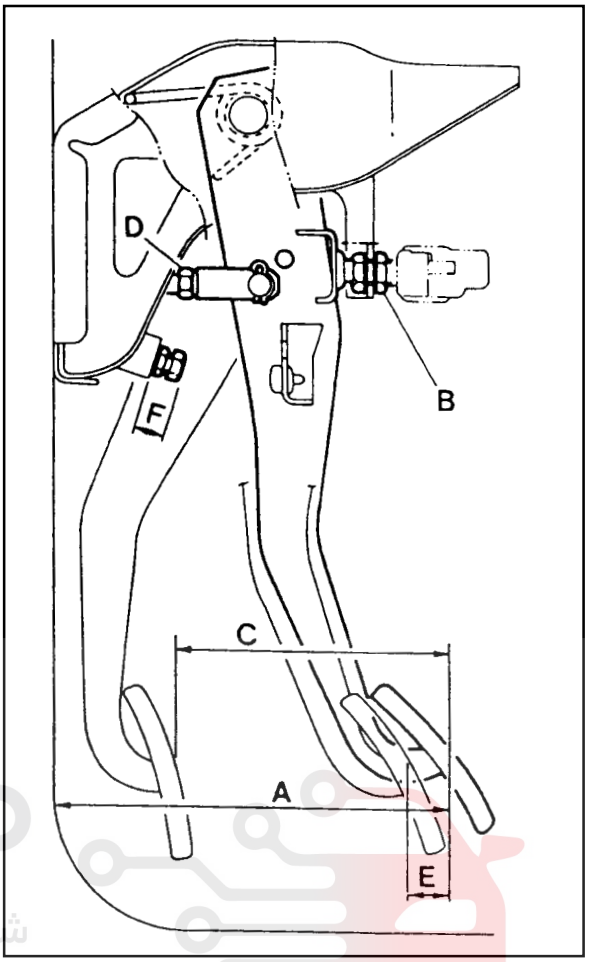


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Adjustment Procedure



1. Pedal Height

Height (A)	150 mm (From the carpet)

Notice

If pedal height is not in specified value, loosen the stop lamp nut (B) and adjust the pedal height.

2. Pedal Stroke

Stroke (C)	Mando : 138 mm
	PBR : 132mm

Notice

If pedal stroke is not in specified value, loosen the stop bolt and lock nut (F) and adjust the pedal stroke.

3. Free Play

Free Play (E)	1 - 4 mm

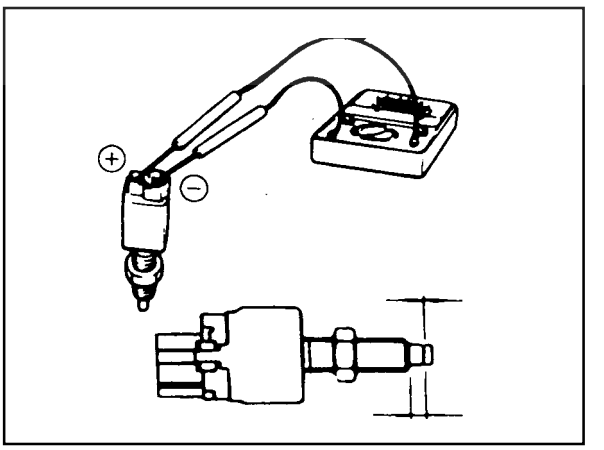
Notice

To adjust, depress the brake pedal several times until there is no more vacuum left in the vacuum line.

To adjust, loosen the lock nut (D) of the push rod and turn the rod.

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Inspection Procedure

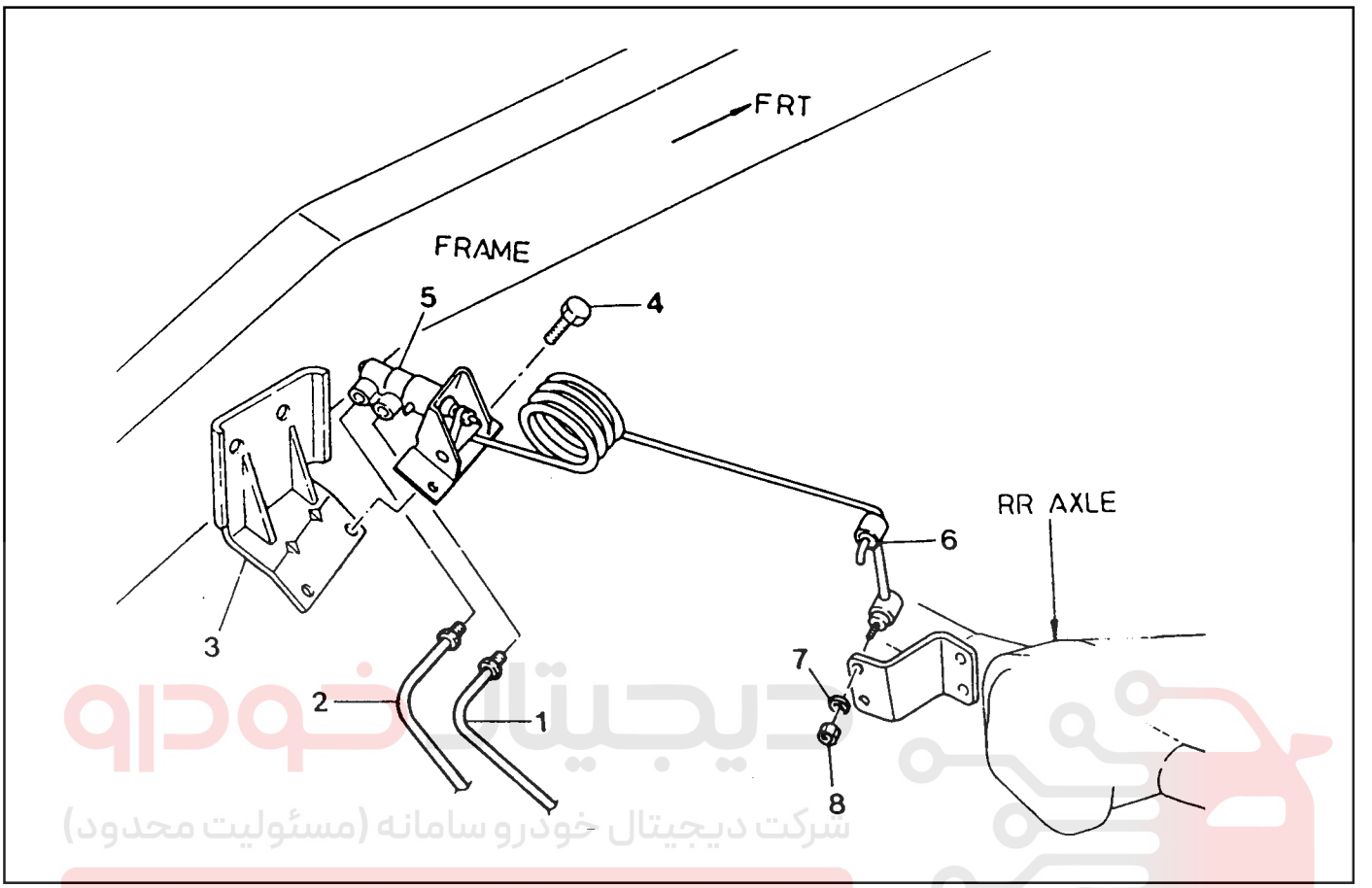


1. Inspect the wear of bushing.
2. Inspect the warp and bend of brake pedal.
3. Inspect the return spring of brake pedal.
4. Inspect the conductivity when connecting the tester to the stop lamp switch connector.

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LCRV (LOAD CONSCIOUS REDUCING VALVE)



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1 Brake Tube (from the master cylinder)
2 Brake Tube (from the rear brake)
3 LCRV Bracket
4 Bolt ..... 12 Nm
5 LCRV Assembly
6 Connecting Link
7 Spring Washer
8 Nut ..... 14-18 Nm

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Construction

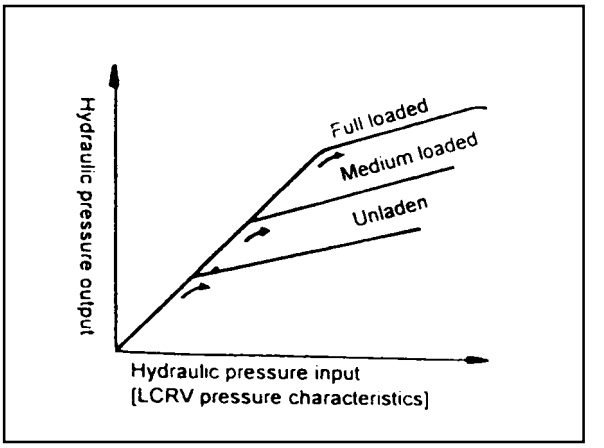
LCRV consists of sensing part and hydraulic control part.

1. Sensing Part

   It detects the changes of vehicle height caused by vehicle load. It consists of load sensing spring and control lever which change according to vehicle load.

2. Hydraulic Control Part

   It consists of valve stem devices which controls hydraulic pressure according to load detected by sensing part.



Trouble Shooting

Poor Braking

Possible Cause	Remedy
Air in Brake System	Bleeding
Poor Adjustment of Sensor Spring	Adjust
Damaged Sensor Spring	Replace
Fluid Leaking from LCRV	Replace

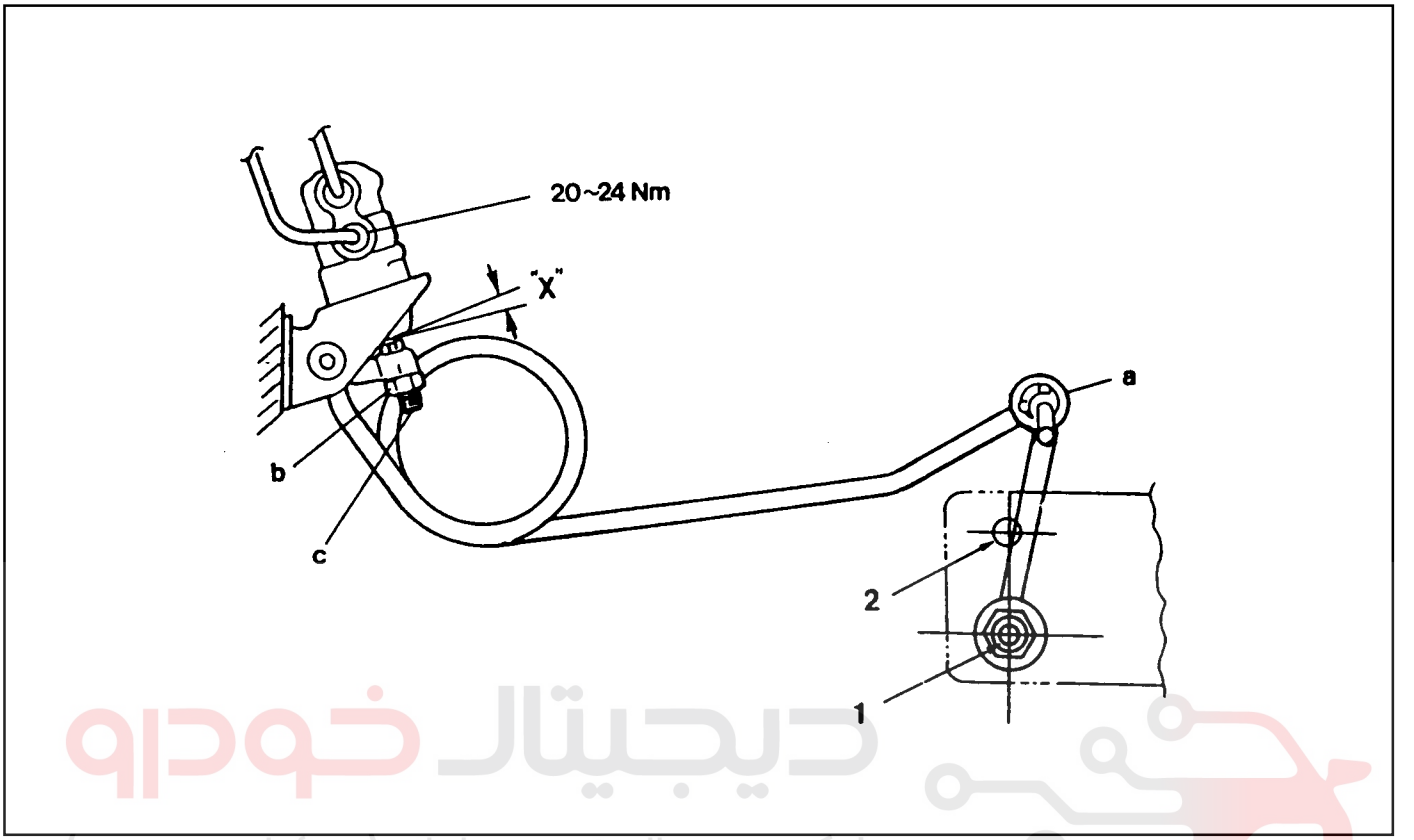
Abnormal Locking

Possible Cause	Remedy
Poor Adjustment of Sensor Spring	Adjust
Internal Fluid Leaking of LCRV	Replace

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LCRV SETTING METHOD



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1. LCRV setting should be performed with unladen vehicle condition.
2. Install the connecting rod (a) to the No.1 hole.

Tightening Torque	14 - 18 Nm

3. Adjust the clearance “X” to be 0 mm and tighten the bolt (c) using the lock nut (b).

Tightening Torque	14 - 18 Nm

4. Remove the connecting rod (a) from the No.1 hole and reinstall it to the No. 2 hole.
5. Place alignment marks between the lock nut (b) and adjusting screw (c) after the valve setting.

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SECTION 4B

MASTER CYLINDER

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Fastener Tightening Specifications 4B-1
Maintenance and Repair **4B-2**
On-Vehicle Service 4B-2
Booster & Brake Master Cylinder 4B-2

SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Application	N·m
Master Cylinder Nut	14 - 22
Booster Nut	8 - 18

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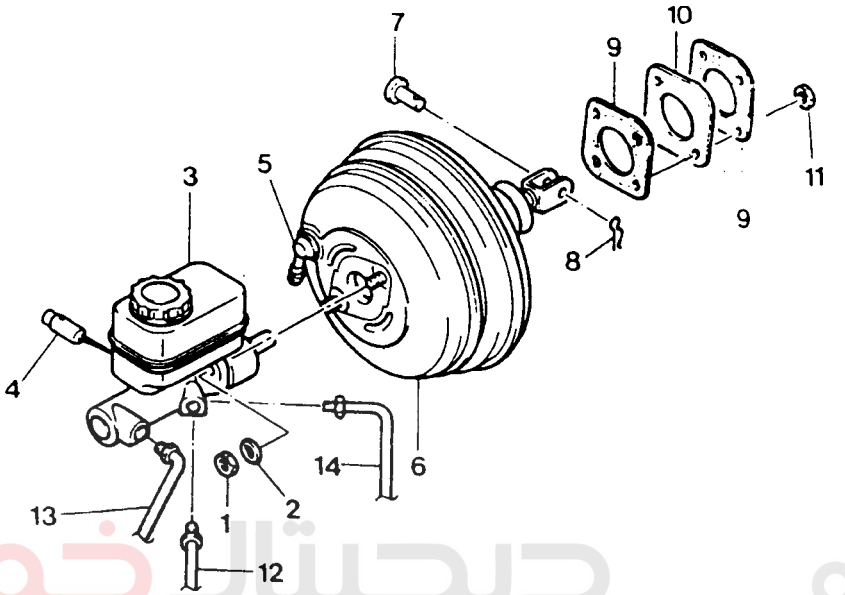
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MAINTENANCE AND REPAIR

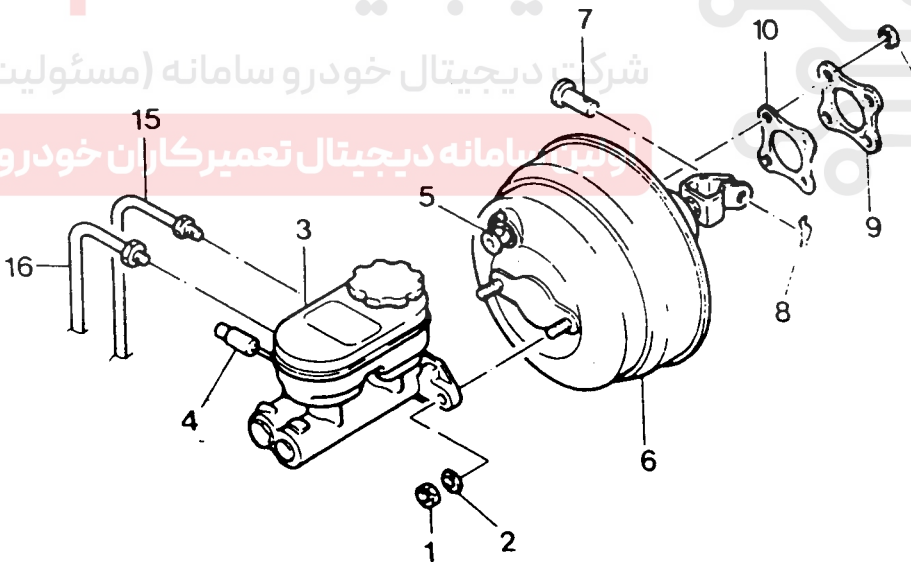
ON-VEHICLE SERVICE

BOOSTER AND BRAKE MASTER CYLINDER

MANDO



PBR



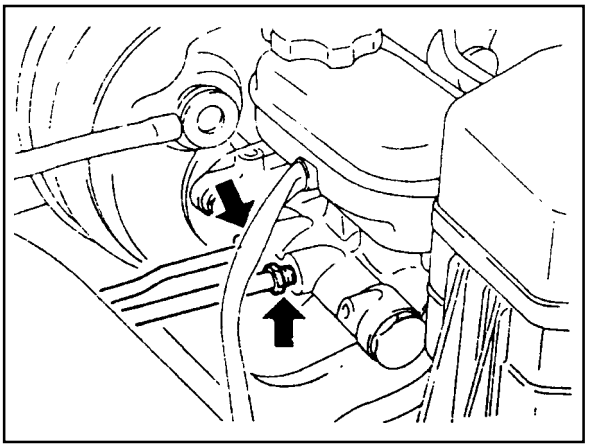
1 Nut ..... 14-22 Nm
2 Washer
3 Master Cylinder Assembly
4 Oil Level Sensor
5 Check Valve
6 Booster
7 Clevis Pin
8 Snap Pin
9 Seal
10 Spacer
11 Nut ..... 8-18 Nm
12 Front Tube (LH)
13 Front Tube (RH)
14 Rear Tube
15 1st Tube (Primary)
16 2nd Tube (Secondary)

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Removal & Installation Procedure

1. Remove the oil level sensor connector.
2. Remove the tube from the master cylinder.



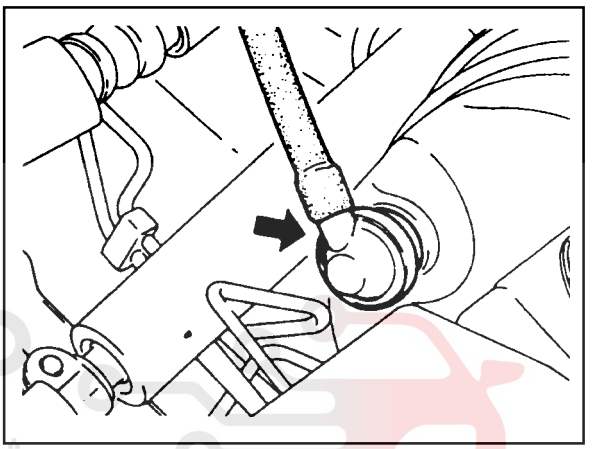
Installation Notice

Tightening Torque	15 - 19 Nm

Notice

- Be careful not to drop the oil when removing the tube.
- If the oil is dropped, promptly sweep up.

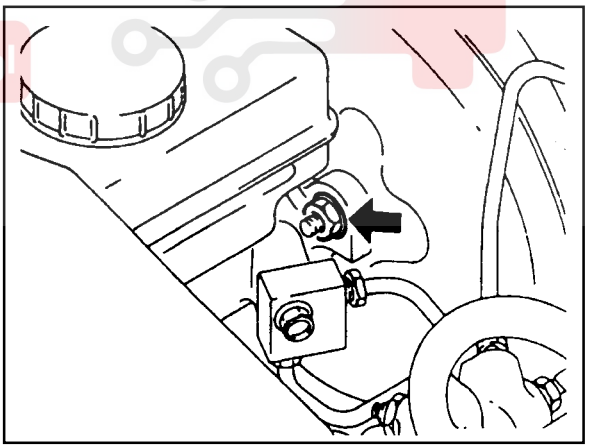
3. Remove the booster vacuum hose.



Notice

- Connect fully to the end of vacuum hose when installing.

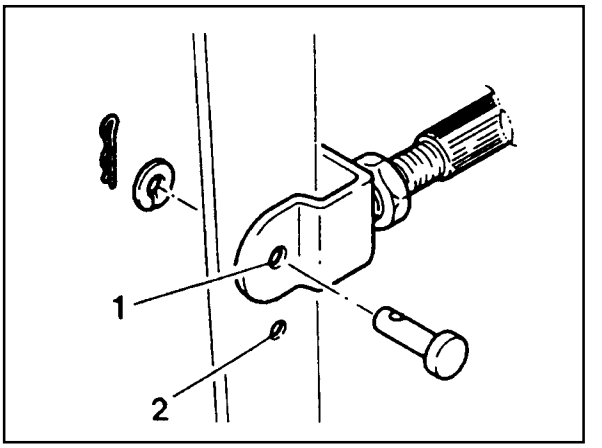
4. Loosen the nut of master cylinder.



Installation Notice

Tightening Torque	14 - 22 Nm

5. Remove the clevis pin and disconnect the pedal and brake booster push rod.



Notice

- Install in the upper hole when PBR brake.
- Connect the snap pin in the hole of clevis pin fully.
- Apply the grease around the hole of clevis pin.

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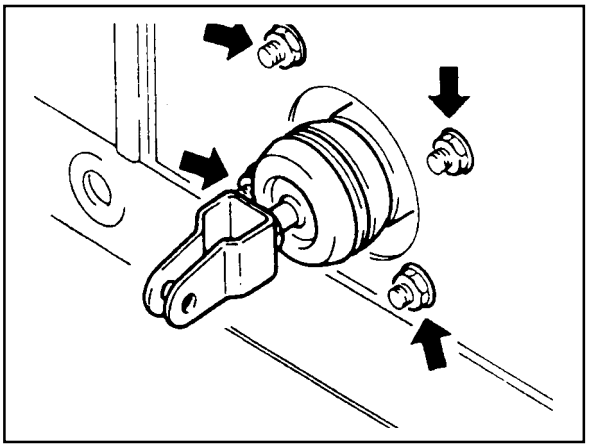
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6. Loosen the nut of booster and remove the booster from the dash panel.

Installation Notice

Tightening Torque	8 - 18 Nm

7. Installation should follow the removal procedure in the reverse order.
8. Add the fluid and bleed.
9. If necessary, adjust the pedal height, pedal stroke and free play.



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SECTION 4C

POWER BOOSTER

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SPECIFICATIONS

GENERAL SPECIFICATIONS

Application	N·m
Type	Vacuum Assisted
Ratio	5.6 : 1

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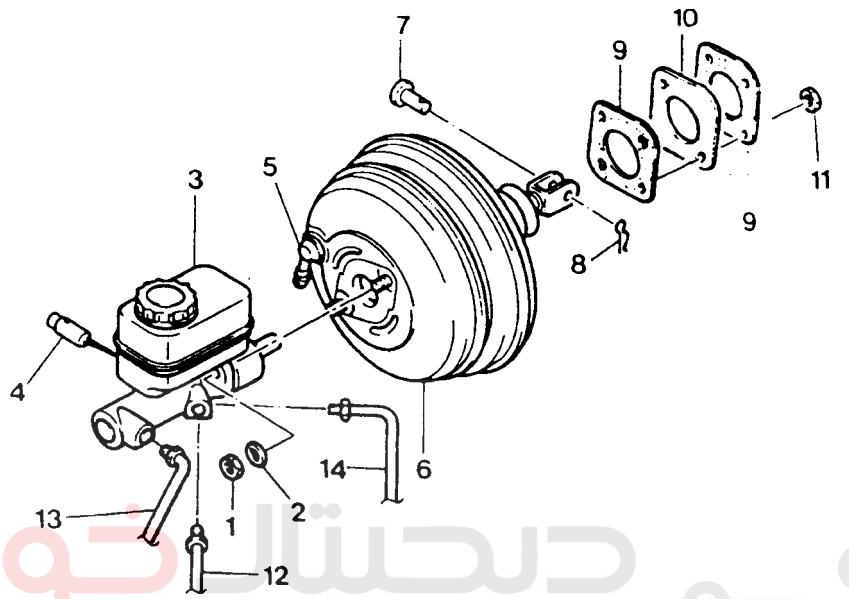
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MAINTENANCE AND REPAIR

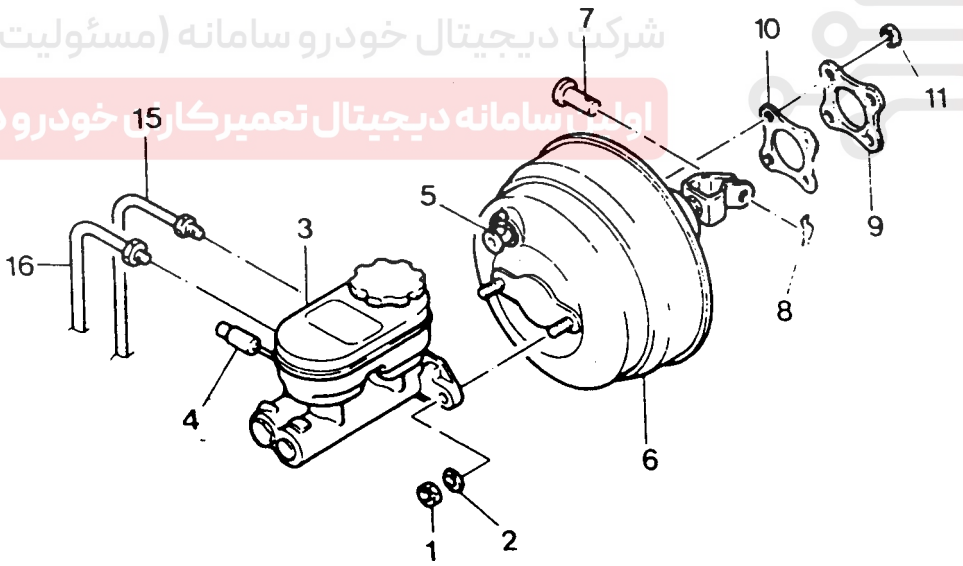
ON-VEHICLE SERVICE

BOOSTER AND BRAKE MASTER CYLINDER

MANDO



PBR



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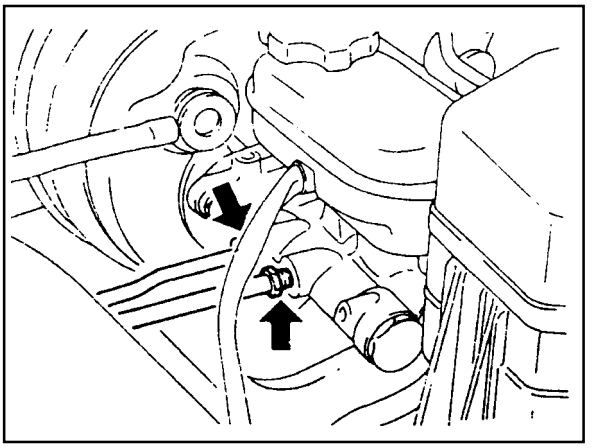
1	Nut	14-22 Nm
2	Washer	
3	Master Cylinder Assembly	
4	Oil Level Sensor	
5	Check Valve	
6	Booster	
7	Clevis Pin	
8	Snap Pin	
9	Seal	
10	Spacer	
11	Nut	8-18 Nm
12	Front Tube (LH)	
13	Front Tube (RH)	
14	Rear Tube	
15	1st Tube (Primary)	
16	2nd Tube (Secondary)	

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Removal & Installation Procedure

1. Remove the oil level sensor connector.
2. Remove the tube from the master cylinder.



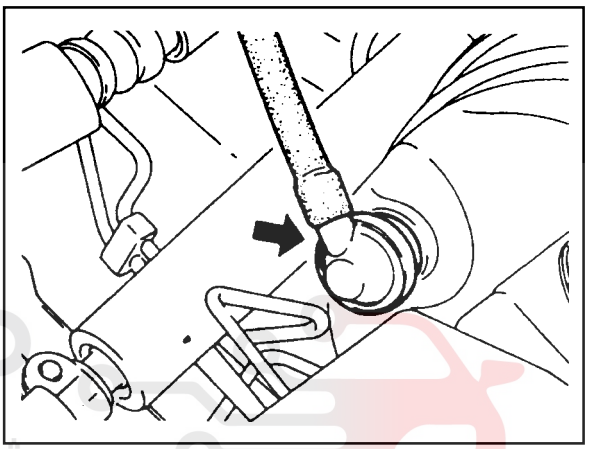
Installation Notice

Tightening Torque	15 - 19 Nm

Notice

- Be careful not to drop the oil when removing the tube.
- If the oil is dropped, promptly sweep up.

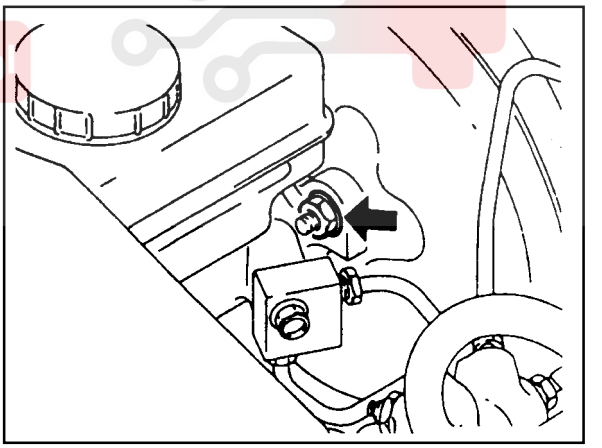
3. Remove the booster vacuum hose.



Notice

- Connect fully to the end of vacuum hose when installing.

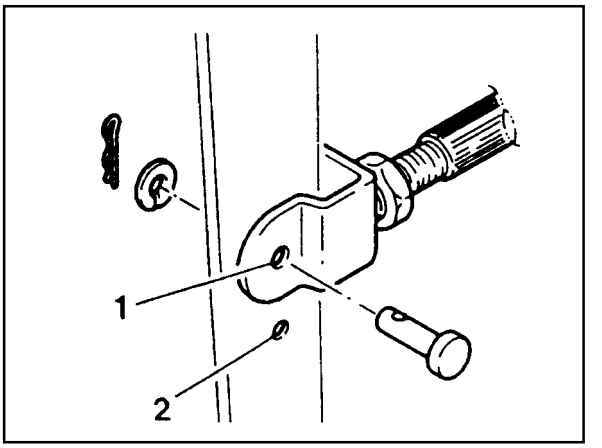
4. Loosen the nut of master cylinder.



Installation Notice

Tightening Torque	14 - 22 Nm

5. Remove the clevis pin and disconnect the pedal and brake booster push rod.



Notice

- Install in the upper hole when PBR brake.
- Connect the snap pin in the hole of clevis pin fully.
- Apply the grease around the hole of clevis pin.

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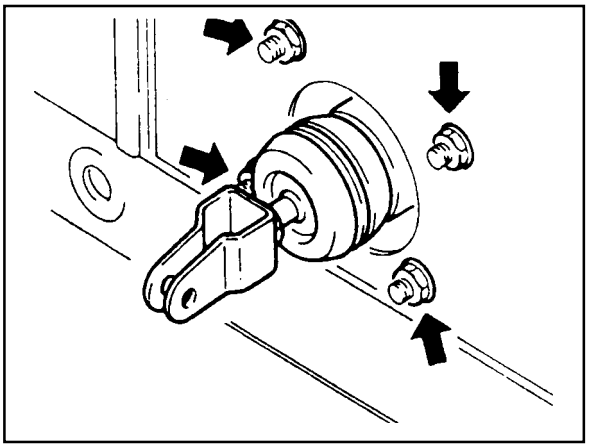
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6. Loosen the nut of booster and remove the booster from the dash panel.

Installation Notice

Tightening Torque	8 - 18 Nm

7. Installation should follow the removal procedure in the reverse order.
8. Add the fluid and bleed.
9. If necessary, adjust the pedal height, pedal stroke and free play.



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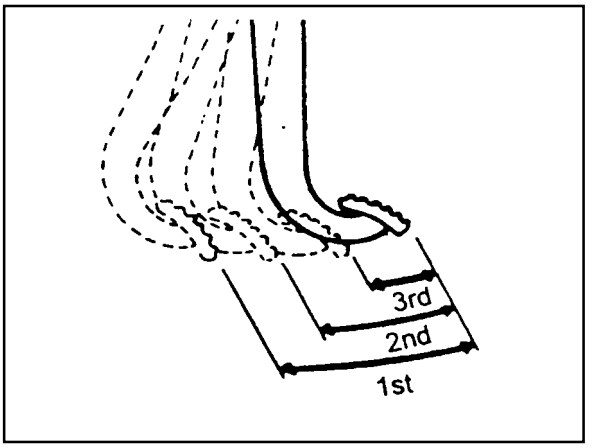
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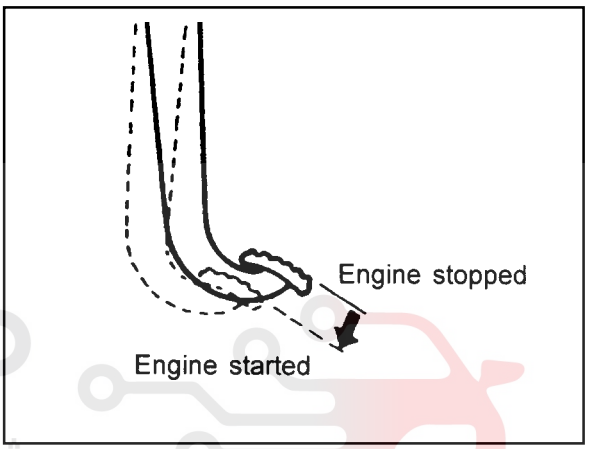
PEDAL STROKE INSPECTION

1. Start the engine and stop it after one or two minutes. Depress the brake pedal several times.

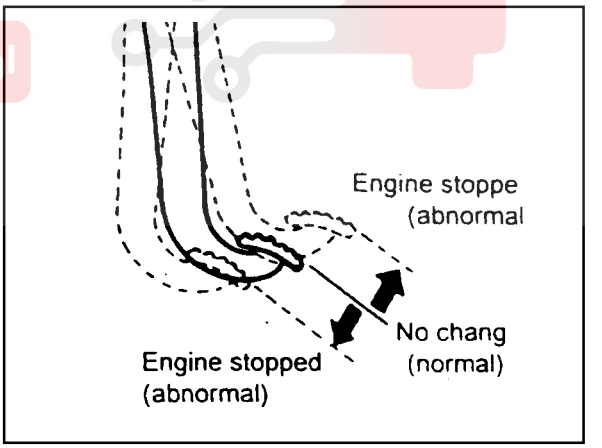
   If the pedal goes down furthest the first time, but gradually rises after the second or third time, brake booster is normal. If there is no change in pedal stroke, the brake booster is abnormal.



2. Depress the brake pedal several times with engine stopped, and depress the brake pedal and start the engine. If the pedal goes down slightly, the booster is normal.



3. Depress the brake pedal with engine running, and stop it with the pedal depressed. If there is no change in pedal height during 30 sec., the booster is normal.



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SECTION 4D

FRONT DISC BRAKES

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Fastener Tightening Specifications 4D-1
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On-Vehicle Service 4D-2
Front Disc Brake 4D-2
Unit Repair **4D-5**
Front Disc Brake 4D-5

SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Application	N·m
Caliper Mounting Bolt	85 - 105
Brake Hose Bolt & Nut	25 - 35
Caliper Bolt	22 - 34

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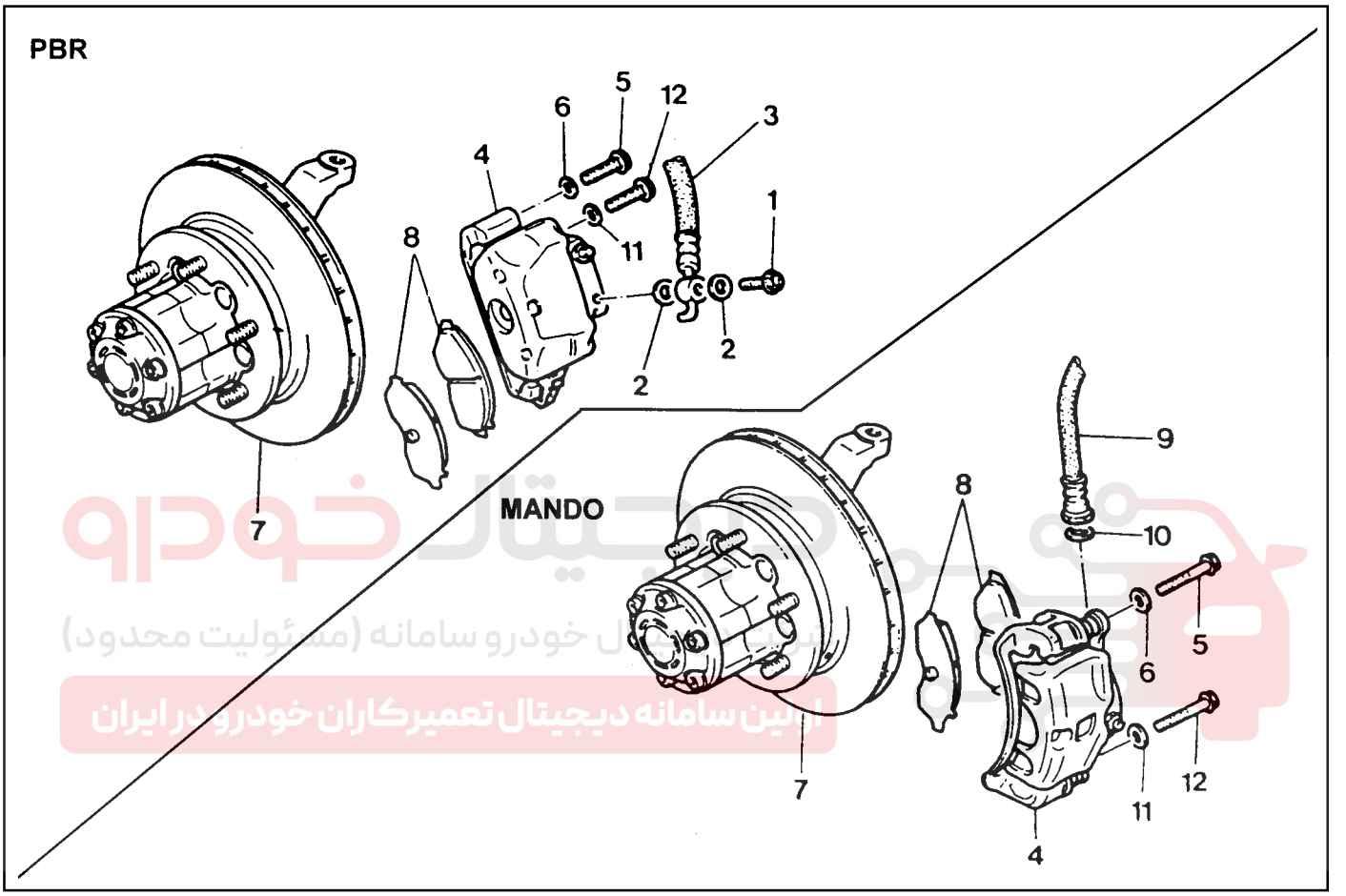
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MAINTENANCE AND REPAIR

ON-VEHICLE SERVICE

FRONT DISC BRAKE

Preceding Work : Removal of wheels and tires



1	Eye-Hose Bolt ..... 25-35 Nm	7	Front Disc Assembly
2	Gasket ..... Replace	8	Brake Pad
3	Brake Hose	9	Brake Hose and Nut ..... 25-35 Nm
4	Brake Caliper	10	Gasket ..... Replace
5	Bolt ..... 20 Nm	11	Washer
6	Washer	12	Bolt ..... 85-105 Nm

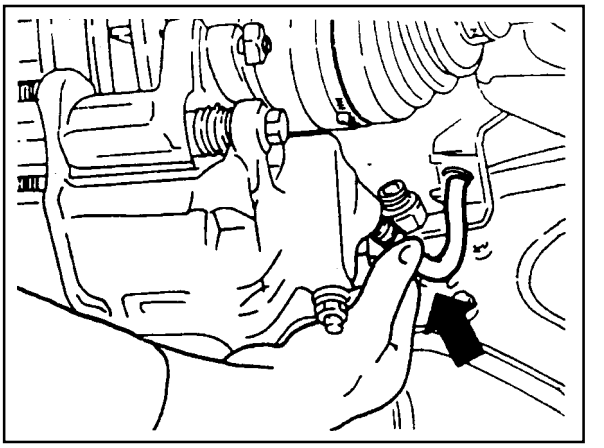
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Removal & Installation Procedure

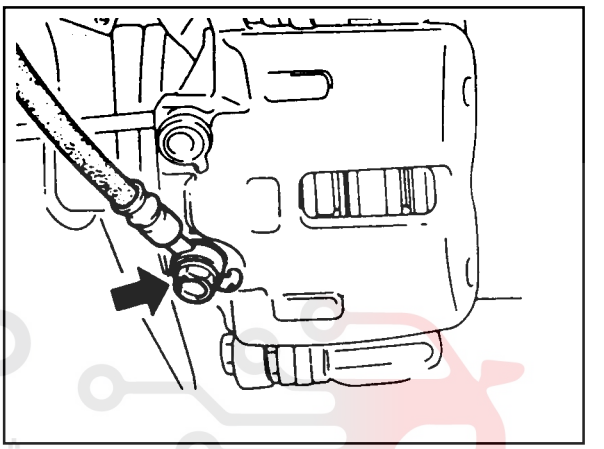
1. **MANDO Brake**
   Remove the hose mounting nut and disconnect the hose.
   Installation Notice

Tightening Torque	25 - 35 Nm



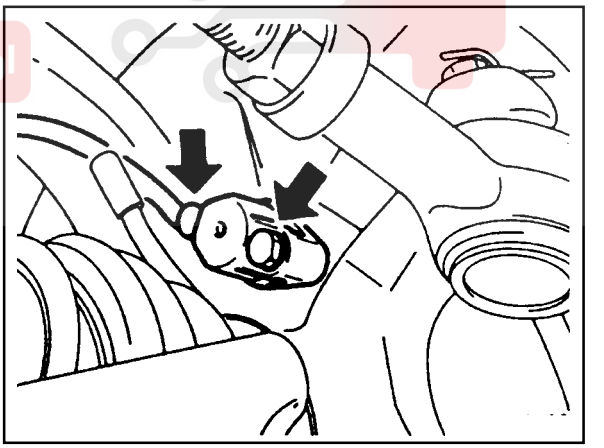
2. **PBR Brake**
   Remove the eye-hose bolt and disconnect the hose.
   Installation Notice

Tightening Torque	15 - 18 Nm



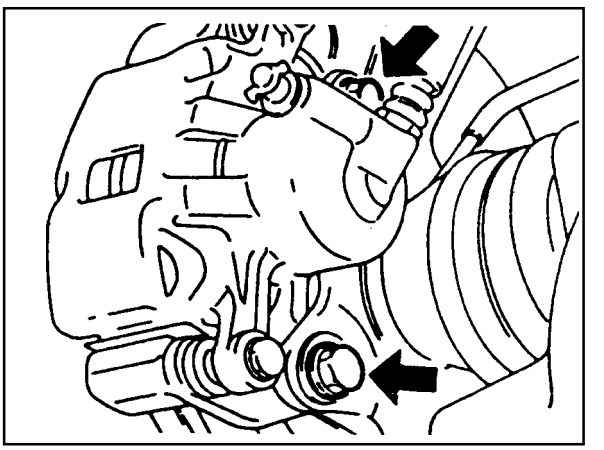
3. Remove the wheel speed sensor (for ABS vehicies).
   Installation Notice

Tightening Torque	6 - 8 Nm



4. Remove the mounting bolts and then caliper assembly.
   Installation Notice

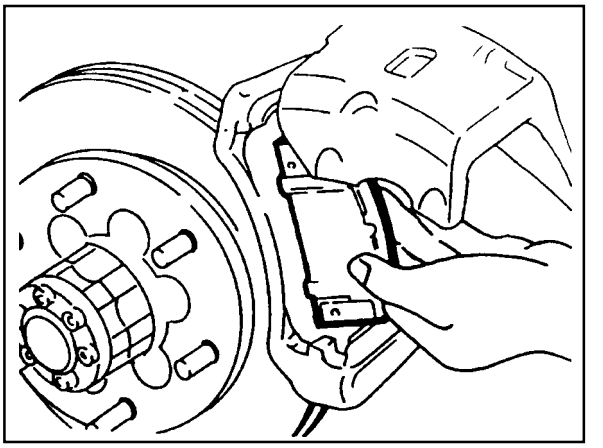
Tightening Torque	85 - 105 Nm



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5. Pull out the brake pads. Replace pads if necessary.
   Notice
   Always change the all pads on one wheel at a time.



6. Installation should follow the removal procedure in the reverse order.
7. Bleed the air from the system.

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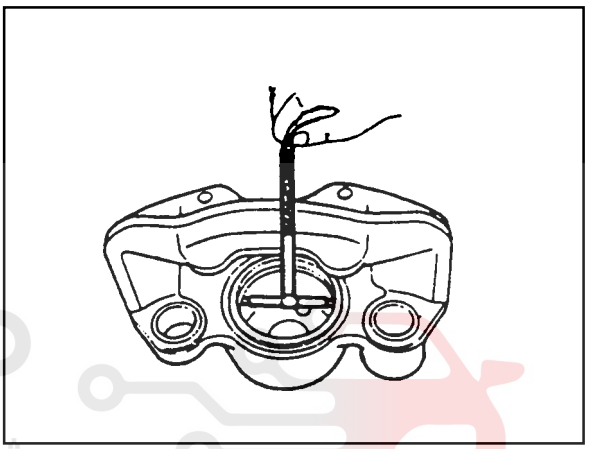
UNIT REPAIR

FRONT DISC BRAKE

Inspection Procedure

1. Clean all components and visually check the followings.
   - Check the cylinder and piston for wear, rust or damage.
   - Check the caliper body and guide pin for wear, damage or crank.
   - Check the pads for uneven wear or oiliness.
   - Check the boots for damage or tear.
2. Measure caliper housing inner diameter.

Item	Standard	Wear Limit
With PBR	f60.4 mm	f61.4 mm
With MANDO	f60.0 mm	f61.0 mm

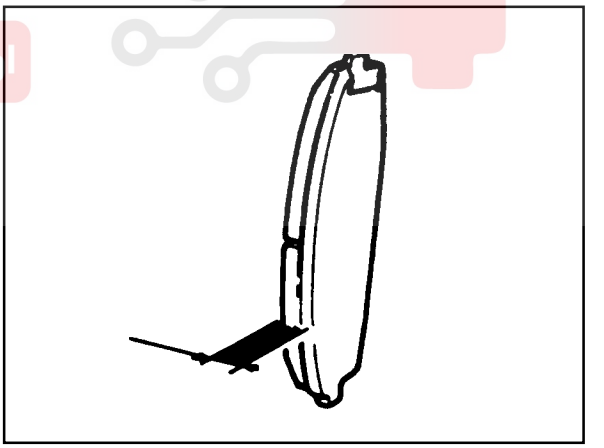


3. Measure pad thickness.

Standard	Wear Limit
10 mm	2.0 mm

Notice

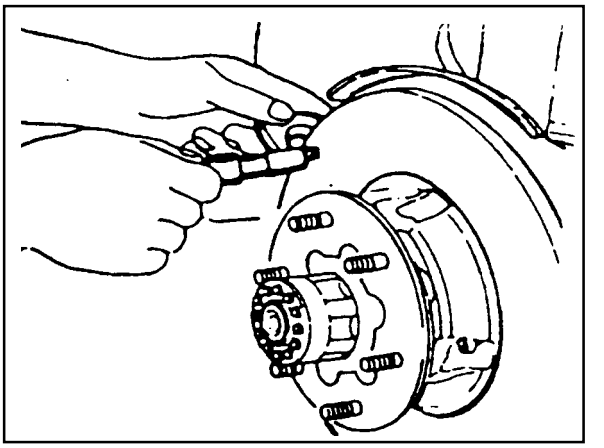
Always change the all pads on one wheel at a time.



4. Measure rotor disc thickness.

Standard	Wear Limit
24 mm	22 mm

5. Check the rotor disc for score or runout.



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SECTION 4E

REAR DISC BRAKES

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Rear Disc Brake 4E-4

SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Application	N·m
Caliper Mounting Bolt	85 - 105
Brake Hose	15 - 18
Caliper Bolt	20

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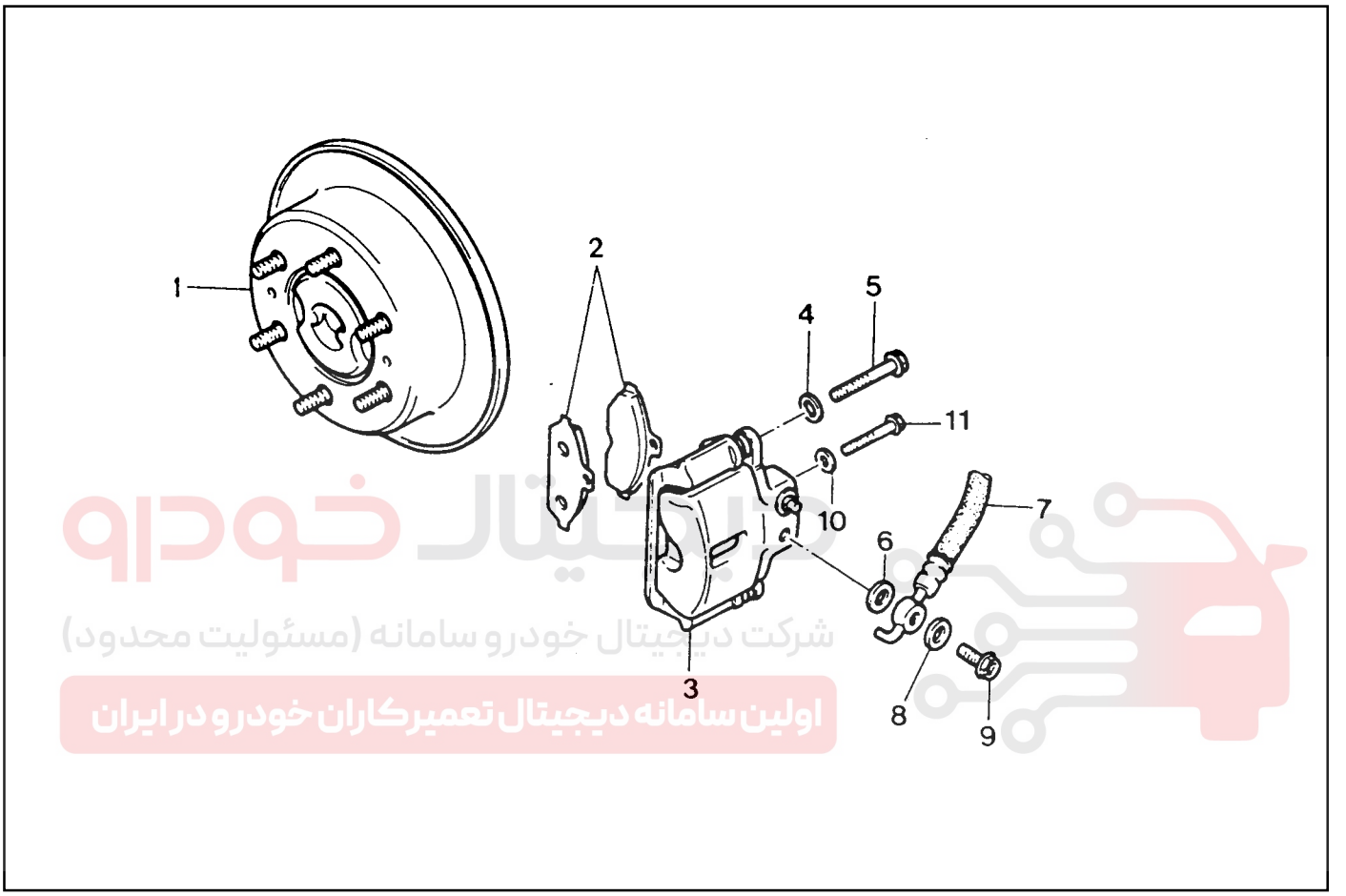
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MAINTENANCE AND REPAIR

ON-VEHICLE SERVICE

REAR DISC BRAKE

Preceding Work : Removal of wheels and tires



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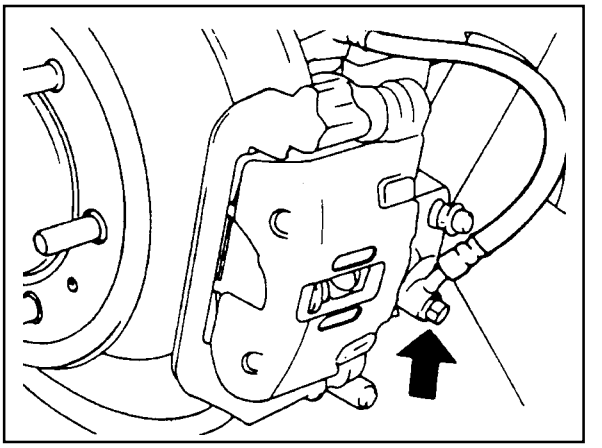
1 Rear Brake Disc Assembly
2 Brake Pad
3 Brake Caliper
4 Gasket ..... Replace
5 Bolt ..... 20 Nm
6 Gasket ..... Replace
7 Brake Hose
8 Gasket ..... Replace
9 Eye-hose Bolt ..... 15-18 Nm
10 Washer
11 Bolt ..... 85-105 Nm

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Removal & Installation Procedure

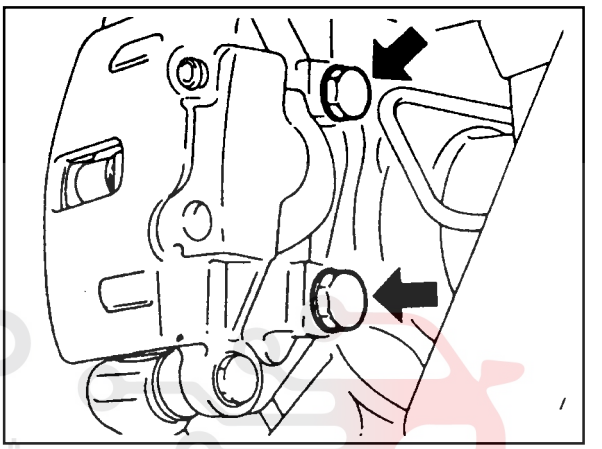
1. Remove the eye-hose bolt and disconnect the hose.



Installation Notice

Tightening Torque	15 - 18 Nm

2. Unscrew the mounting bolts and remove the brake caliper assembly.



Installation Notice

Tightening Torque	85 - 105 Nm

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3. Pull out the brake pads. Replace pads if necessary.

Notice

Always change the all pads on one wheel at a time.

4. Installation should follow the removal precedure in the reverse order.
5. Bleed the air from the system.

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UNIT REPAIR

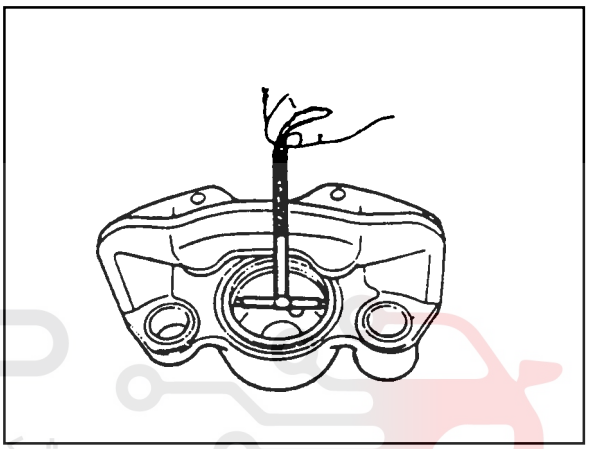
REAR DISC BRAKE

Inspection Procedure

1. Clean all components and visually check the followings.
   - Check the cylinder and piston for wear, rust or damage.
   - Check the caliper body and guide pin for wear, damage or crank.
   - Check the pads for uneven wear or oiliness.
   - Check the boots for damage or tear.

2. Measure caliper housing inner diameter.

Item	Standard	Wear Limit
With PBR	f40.5 mm	f41.5 mm
With MANDO	f38.2 mm	f39.2 mm

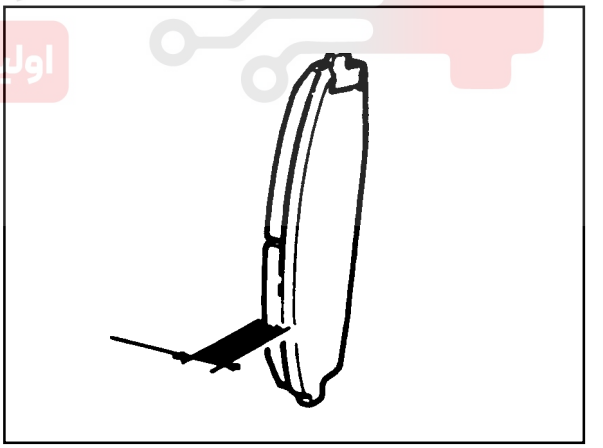


3. Measure pad thickness.

Standard	Wear Limit
9.5 mm	2.0 mm

Notice

Always change the all pads on one wheel at a time.



4. Measure rotor disc thickness.

Standard	Wear Limit
10.4 mm	9.3 mm

5. Check the rotor disc for score or runout.

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SECTION 4F

ANTILOCK BRAKE SYSTEM

Caution: Disconnect the negative battery cable before removing or installing any electrical unit or when a tool or equipment could easily come in contact with exposed electrical terminals. Disconnecting this cable will help prevent personal injury and damage to the vehicle. The ignition must also be in LOCK unless otherwise noted.

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SPECIFICATIONS

GENERAL SPECIFICATIONS

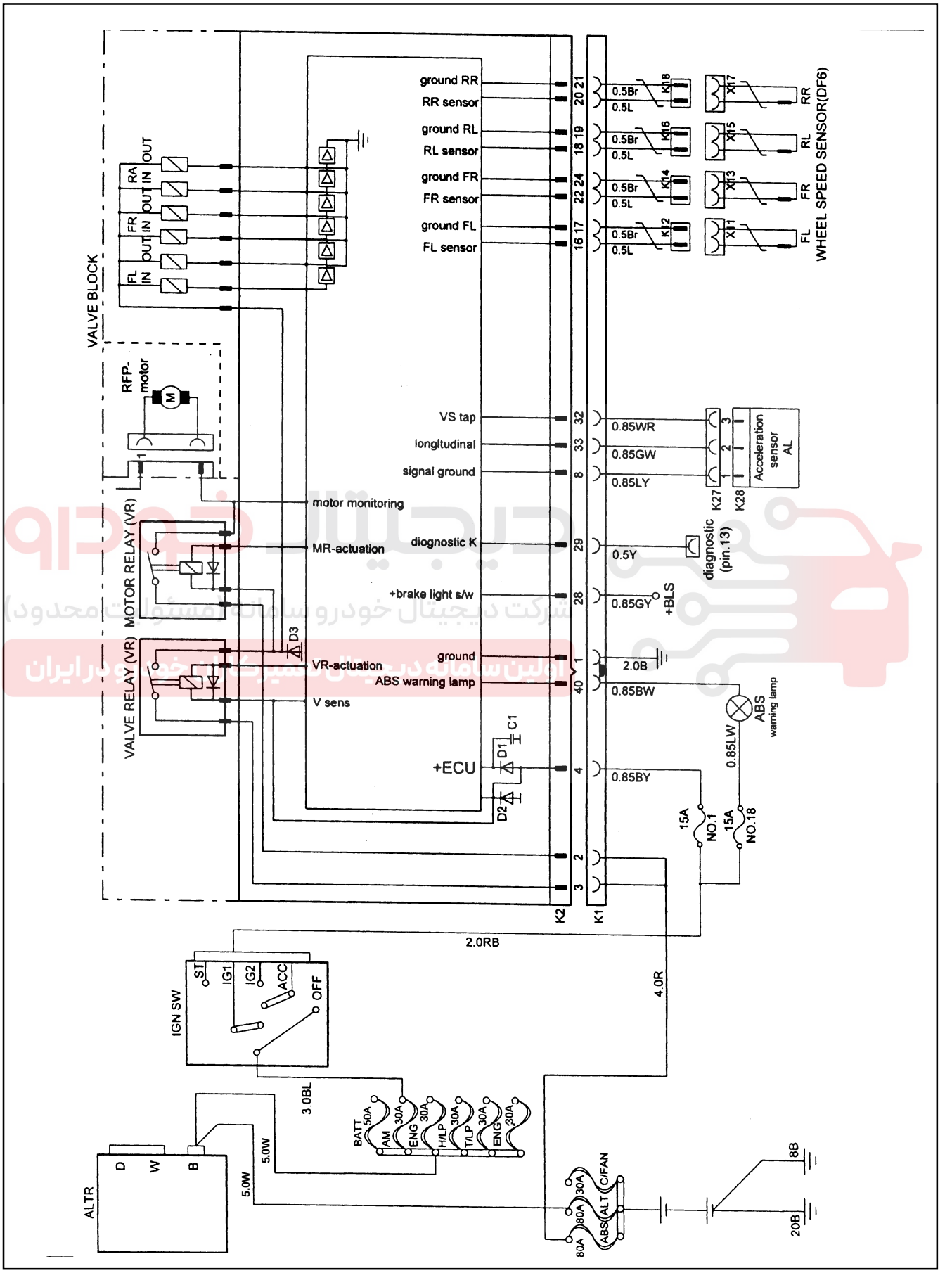
Application			Description	
Model			ABS 5.3	ABS/ABD 5.3
ECU	Number of Pins		31	83
	Operating Temperature		-40 ~ +120℃	-40 ~ +85℃
Hydraulic System	Motor Operating Current		Below MAX 40A	Below MAX 45A
	Solenoid Coil Resistance			8.04 - 9.04W except AV, HSV 4.04 - 4.54W
Wheel Speed Sensor	External Resistance		1.28KW - 1.92KW	1.28KW - 1.92KW
Impulse Ring	Air Gap	Front	0.35 - 1.60 mm	0.35 - 1.60 mm
		Rear	0.15 - 1.20 mm	0.15 - 1.20 mm
	Number of teeth	Front	52	52
		Rear	52	52

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SCHEMATIC AND ROUTING DIAGRAMS

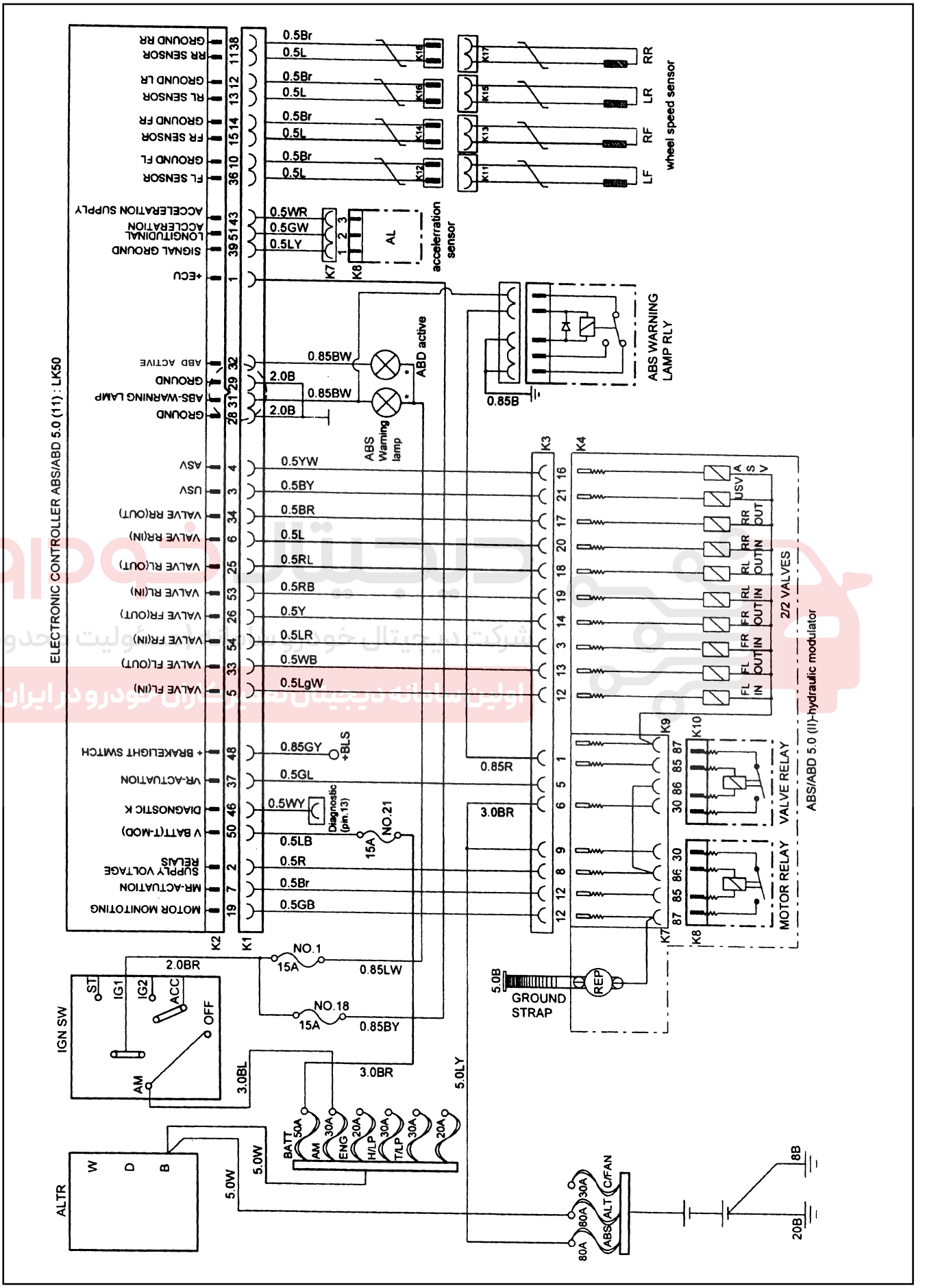
ABS 5.0



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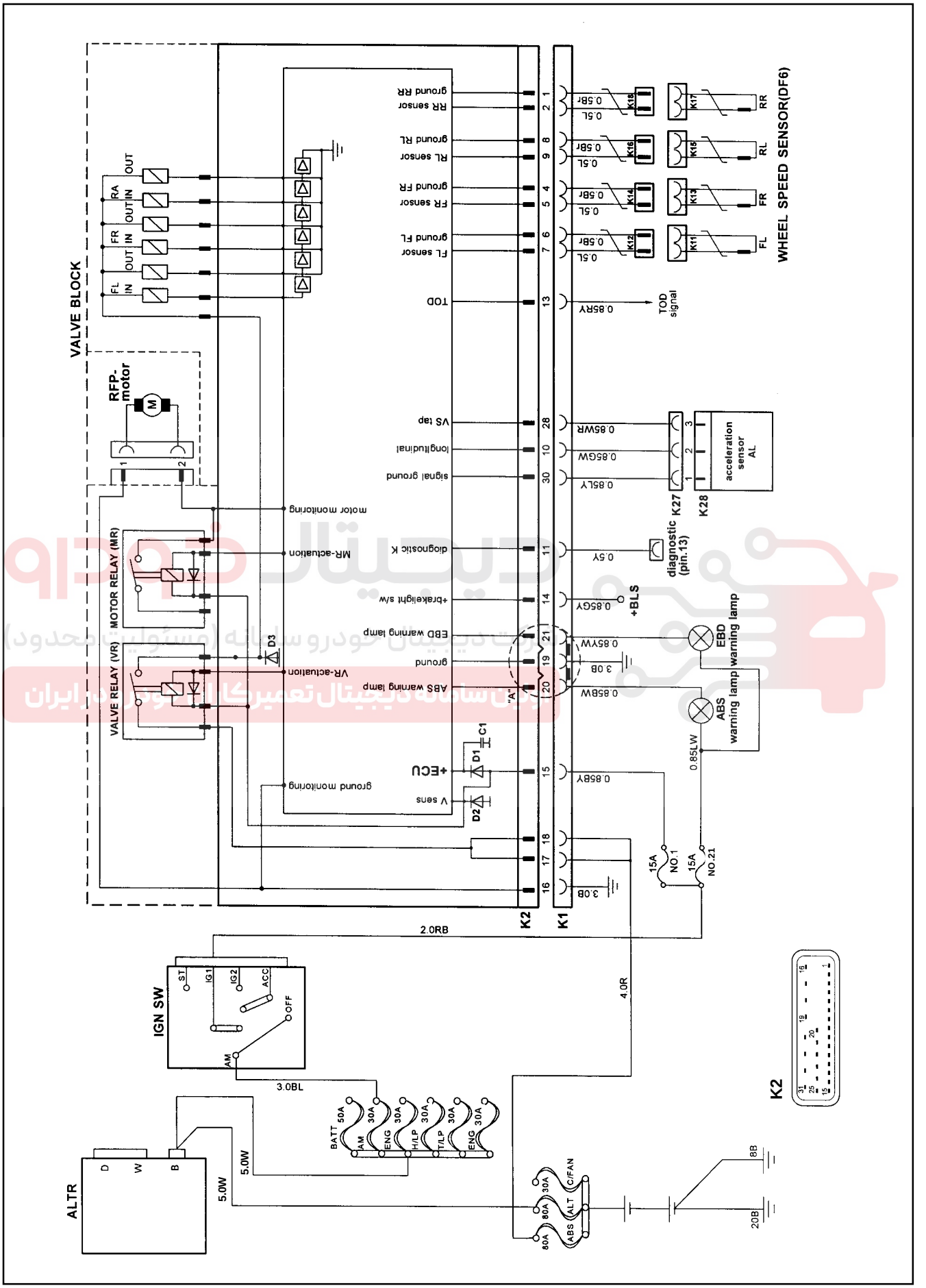
ABS/ABD 5.0



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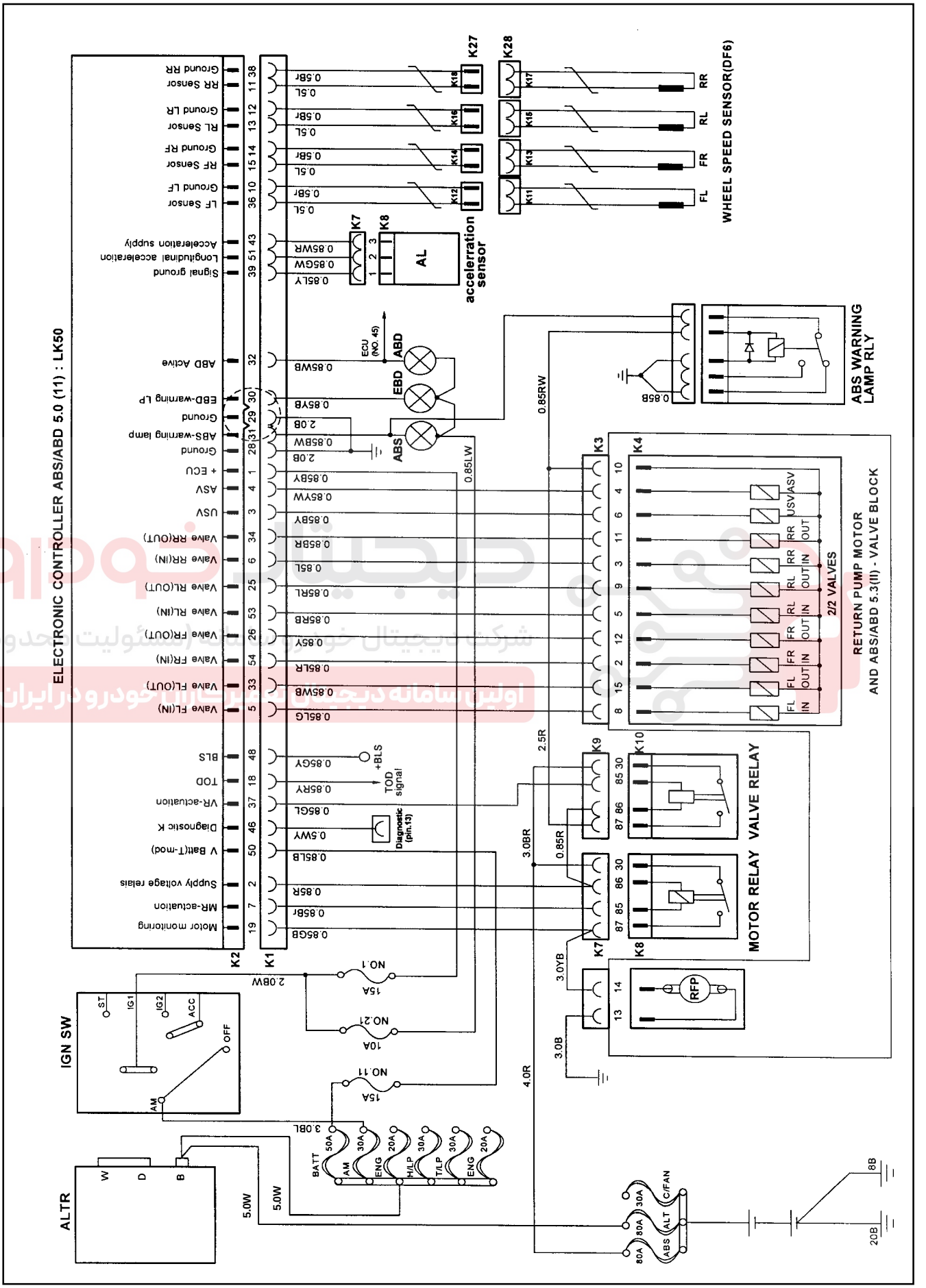
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ABS 5.3



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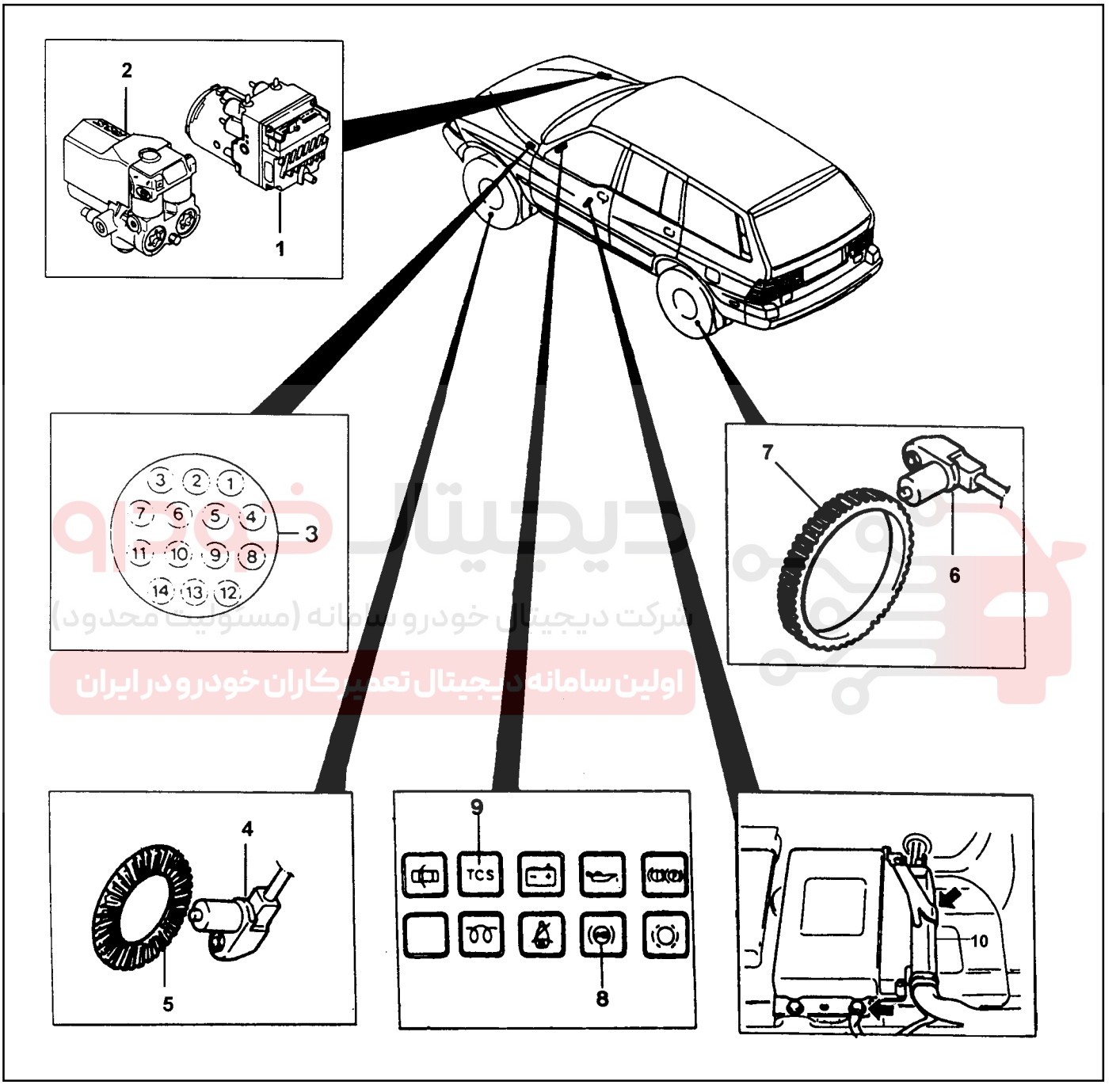


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COMPONENT LOCATOR

ABS,ABS/ABD



1 ABS Hydraulic Unit
2 ABS/ABD Hydraulic Unit
3 Diagnosis Socket
4 Front Wheel Speed Sensor
5 Front Impulse Ring
6 Rear Wheel Speed Sensor
7 Rear Impulse Ring
8 ABS Warning Indicator Light
9 TCS Indicator Light
10 ABS/ABD ECU

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ABD SYSTEM DESCRIPTION

General:

The Automatic Brake Differential Lock (ABD) is a traction system by means of brake intervention only, available in a low speed range (< 60kph).

It workes on m-split roads with sidewise different friction coefficients.

The spinning driven wheel is braked and the drive torque can be transferred to the wheel on the high- m side. During ABD active, the ABD information lamp is blinking.

The temperature of the brakes is calculated by a mathematical model and ABD is switched passive if the calculated temperature is greater than a threshold value(500℃).

ABD is permitted again, when the calculated temperature is less than 350℃.

Control Algorithm:

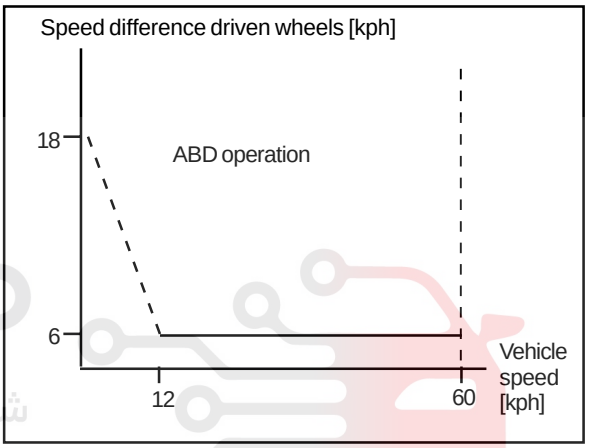
The input signals for the control algorithm are the filtered wheel speed signals from the ABS speed processing.

With the speed difference of the driven wheels, the control deviation is calculated.

If the control deviation exceeds a certain threshold value, the wheel with the greater slip is braked actively.

The threshold value depends on the vehicle speed:

It is reduced with increasing vehicle speed down to a constant value.



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Pressure Modulation:

Depending on the control deviation and the wheel acceleration of the spinning wheel, pressure increase, hold and decrease are made.

The pressure modulation is done with the conventional control with the valves. ASV, USV, EV and AV according the the following table:

	Increase	Hold	Decrease
ASV	Open	Open	Open
USV	Closed	Closed	Closed
EV	Open	Closed	Closed
AV	Closed	Closed	Open

Speed Range:

ABD is available in the speed range £ 60 kph.

Above 60 kph vehicle speed, ABD is passive.

It is possible to initiate ABD operation up to a vehicle speed of 55kph.

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Temperature Model:

ABD operation is a high thermal load for the brakes.

To avoid any damages at the brakes, the disk temperature is calculated with a mathematical model for each driven wheel separately. After ignition on, the calculation starts with 30℃ and then three different phases are evaluated separately and added:

ABD operation, braking and coling phase.

If the temperature is highter than 500℃, ABD is disabled for this wheel.

It is permitted again, if the model has calculated down the 350℃.

Lamp Concepts:

The system is equipped with an ABD information lamp, which is blinking during ABD operation.

The activation of the EBD, ABS warning lamp and the ABD info lampo is summarized in the following table:

	Ignition ON	ABS Operation	ABD Operation	System failure (EBD,ABS or ABD are not distinguished)	ABD passive due to temperature model
ABS warning lamp	2s on for lamp check	OFF	OFF	ON	OFF
ABD info lamp	2s on for lamp check	OFF	Dlinking (Flashing)	OFF	OFF
EBD warning lamp	2s on for lamp check	EBD operation / OFF	OFF	ON	OFF

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SELF DIAGNOSIS

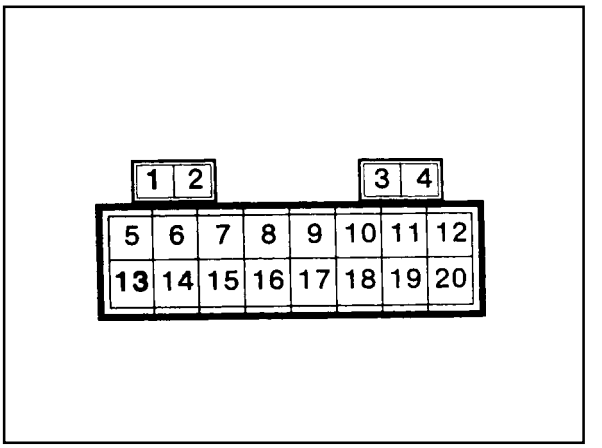
ABS, ABS/ABD 5.3

Initialization

1. Turn the ignition switch to "ON" position.
2. Using a service connector, ground the No.13 terminal of diagnosis socket and No.1 ground terminal for 3 - 4 seconds.

   Notice

   If it is over 5 seconds, initialization will not be performed.



3. After completing the initialization, ABS warning lamp will be turned on until the ignition switch is turned to "OFF" position.

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Output of Fault Code

1. Normal : 1 pulse (normal code 01)
2. Abnormal : 1 pulse (fault code)

   Notice

   - If appeared initial fault code and above 2 differnt fault code, perform again initialization.
   - Fault code will be output the numbers of fault code with a interval of 1 second.(turn on : 0.75 sec., turn off : 0.25 sec.)

Fault Code Elimination

After repairing the defect parts, eliminate the fault from ECU.

1. Ground the diagnosis No.13 terminal to No.1 ground terminal for over 5 seconds.
2. Turn the igniotion switch to "OFF" position.

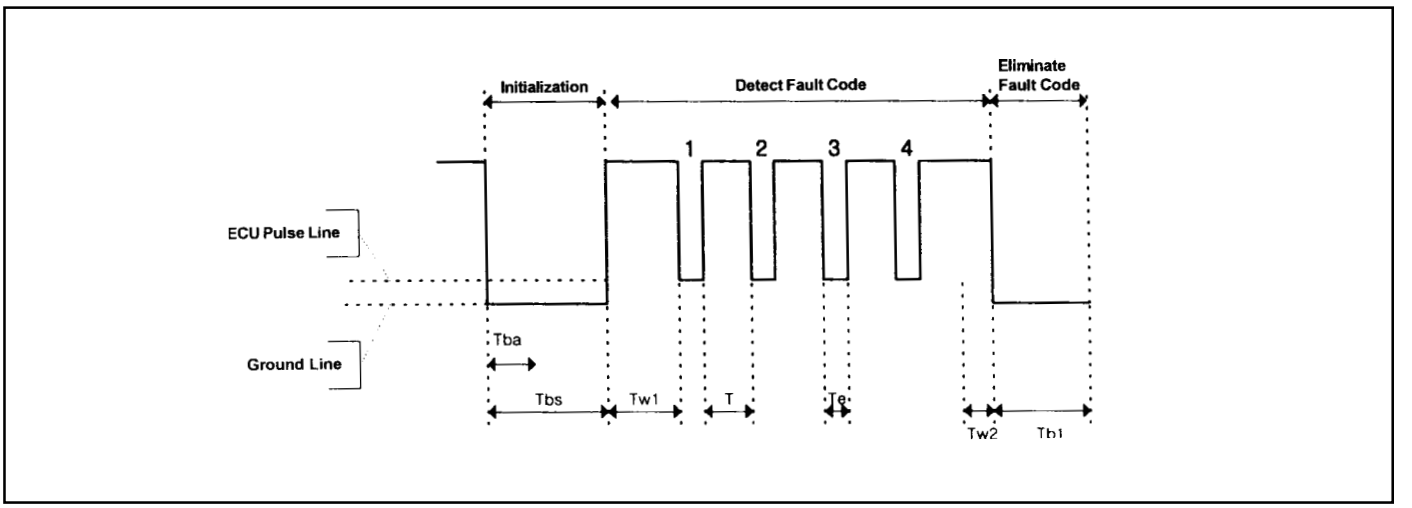
   Notice

   - If not eliminate the fault code, the code will be maintained.
   - Check and find the other defect parts with performing the imitialization again, if the fault code will be output, repair the defect parts completely.

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Diagnosis the Flash Code



[Ex]

- Time Differences of Normal Code 01 : TW1<T<Te<TW2
- Time Differences of Fault Code 15 : TW1<T<Te<TW2

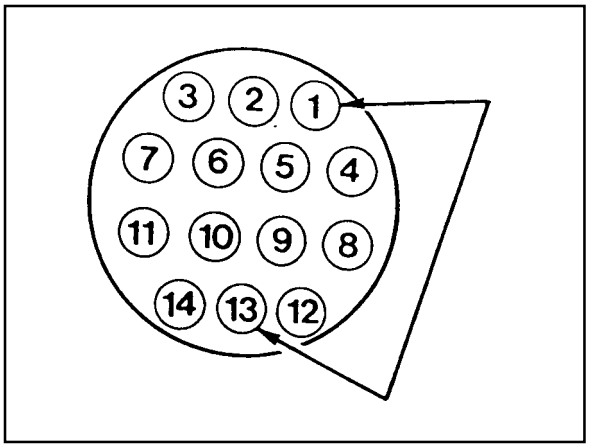
Time Characteristics

1. Initialization
   Tba < 5.0 sec.
   Tba 1.8 - 2.2 sec.
2. Output of Fault Code
   TW1 = 1.8 - 2.2 sec.
   TW2 = 1.8 - 2.2 sec.
   T = 0.75 sec., Te ³ 0.25 sec.
3. Elimination of Fault Code
   Tb1 = 5.0 sec.

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ABS, ABS/ABD 5.0



Initializing

1. Set the ignition switch n “ON” position.
2. Connect the No.1 terminal (Ground) and the No.13 (ABS) from diagnosis socket located in E/G room by use of service connector for 3 - 4 seconds and initialize the flash code.

   Notice

   Be careful not to connect over 5 seconds.
3. ABS indicator warning light continuously comes on until the ignition switch is “OFF”.

Dignosis Table

1. When the system is normal
   - One pulse (normal code 01) indicates.
2. When the system is abnormal
   - One pulse (defect code) indicates.

   Notice

   Repeat the initializing procedure when checking the defect code Defect code is indicated once for 1 sec (light on : 0.75 sec, light off : 0.25 sec).

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Removal the Defect Code

1. Repair the defect code and remove the memorized defect code in the ECU.
2. Connect the No. 13 terminal (ABS) from diagnosis socket and No. 1 terminal (ground) for over 5 seconds.
3. Set the ignition switch in the “OFF” position.

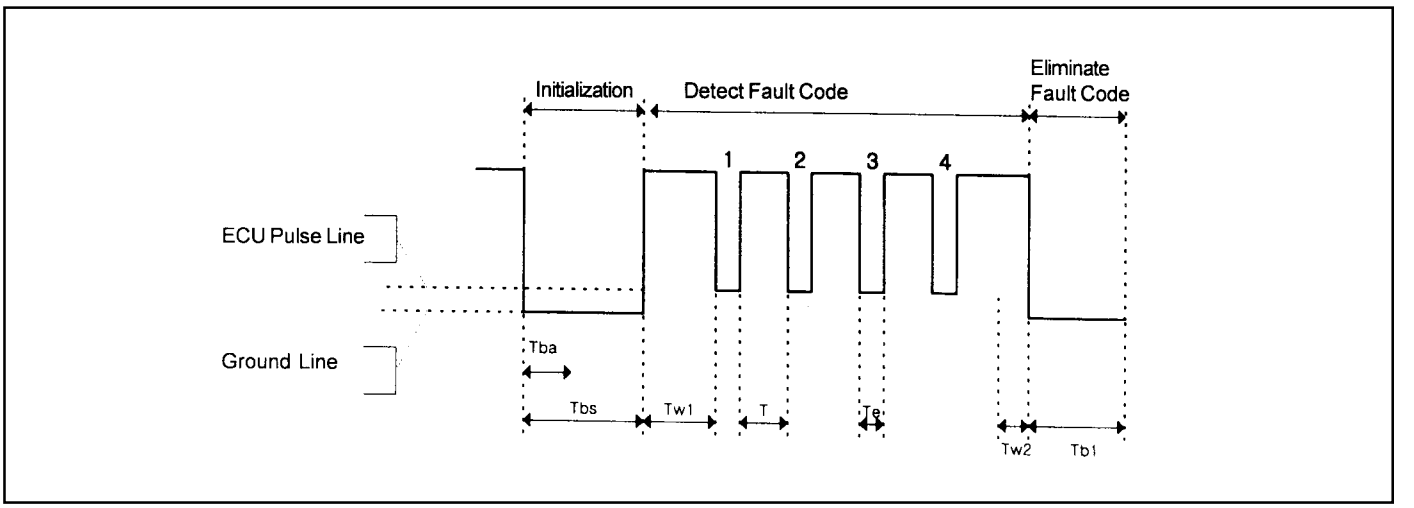
   Notice

   - Defect code will be memorized in ECU unless the defect code is not removed.
   - Repeat the initializing procedure and check the other defects.

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Diagnosis the Flash Code



[ex]

- Time differences of nromal code 01 : TW1<T<Te<TW2
- Time differences of fault code 15 : TW1<T<Te<TW2

Time Characteristics

1. Initialization
   Tba < 5.0 sec.
   Tba 1.8 - 2.2 sec.
2. Output of fault code
   TW1 = 1.8 - 2.2 sec.
   TW2 = 1.8 - 2.2 sec.
   T = 0.75 sec., Te ³ 0.25 sec.
3. Elimination of fault code
   Tb1 = 5.0 sec.

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DEFECT CODES

Defect Code	Application	Description
01	Normal	-
02	Defective ECU	Replace the ECU
03	Front/left Wheel Speed Sensor (Wire)	● Check resistance of the wheel speed sensor : 1.280KW - 1.920KW ● Check wire for ground and open. ● Replace the sensor.
04	Front/right Wheel Speed Sensor (Wire)	● Check resistance of the wheel speed sensor : 1.280KW - 1.920KW ● Check wire for ground and open. ● Replace the sensor.
05	Rear/left Wheel Speed Sensor (Wire)	● Check resistance of the wheel speed sensor : 1.280KW - 1.920KW ● Check wire for ground and open. ● Replace the sensor.
06	Rear/right Wheel Speed Sensor (Wire)	● Check resistance of the wheel speed sensor : 1.280KW - 1.920KW ● Check wire for ground and open. ● Replace the sensor.
07	Front/left Wheel Speed Sensor (Signal)	● Check wire for ground and open. ● Check connection of the wheel speed sensor connector and ECU side connector. ● Measure air gap between wheel teeth and wheel speed sensor and check installation of wheel tooth. (Standard air gap : 0.35 - 1.60 mm) ● Check output voltage of the sensor by rotating the wheel 1/2 - 1 revolution per second and shaking sensor wire. - When measured by multi - meter (AC) : output voltage > 70 mV - When measured in oscilloscope : output voltage ³ 120 mV/P-P ● Replace the sensor.
08	Front/right Wheel Speed Sensor (Signal)	● Check wire for ground and open. ● Check connection of the wheel speed sensor. connector and ECU side connector. ● Measure the air gap between wheel teeth and wheel speed sensor and check installation of wheel tooth. (Standard air gap : 0.35 - 1.60 mm) ● Check output voltage of the sensor by rotating the wheel 1/2 - 1 revolution per second and shaking sensor wire.

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Defect Code	Application	Description
		- When measured by multi - meter (AC) : output voltage > 70 mV - When measured in oscilloscope : output voltage ³ 120 mV/P-P ● Replace the sensor.
09	Rear/left Wheel Speed Sensor (Signal)	● Check wire for ground and open. ● Check connection of the wheel speed sensor connector and ECU side connector. (Standard air gap : 0.15 - 1.20 mm) ● Check output voltage of the sensor by rotating the wheel 1/2 - 1 revolution per second and shaking sensor wire. - When measured by multi - meter (AC) : output voltage > 70 mV - When measured in oscilloscope : output voltage ³ 120 mV/P-P ● Replace the sensor.
10	Rear/right Wheel Speed Sensor (Signal)	● Check wire for ground and open. ● Check connection of the wheel speed sensor connector and ECU side connector. ● Measure air gap between wheel teeth and wheel speed sensor and check installation of wheel tooth. (Standard air gap : 0.15 - 1.20 mm) ● Check output voltage of the sensor by rotating the wheel 1/2 - 1 revolution per second and shaking sensor wire. - When measured by multi - meter (AC) : output voltage > 70 mV - When measured in oscilloscope : output voltage ³ 120 mV/P-P ● Replace the sensor.
11	Wheel Rotor	● Check number of teeth on the wheel rotor and its condition. - Number of teeth : 52
12	Valve Relay	● Check valve relay voltage. ● Check connection of connector and terminals in the ECU and hydraulic modulator. ● Check ground. ● Check terminals for open or short. (When connector is removed) ● Replace the hydraulic modulator.

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Defect Code	Application	Description
13	Front / left INLET Valve	● Check each valve by using SCANNER's solenoid valve overriding function. ● Check connection of connector and terminals in the ECU hydraulic modulator.
14	Front / left OUTLET Valve	● Check each valve by using SCANNER's solenoid valve overriding function. ● Check connection of connector and terminals in the ECU hydraulic modulator. ● Check terminals for open or short. (When connector is removed) ● Replace the hydraulic modulator.
15	Front / right INLET Valve	● Check each valve by using SCANNER's solenoid valve overriding function. ● Check connection of connector and terminals in the ECU hydraulic modulator. ● Check terminals for open or short. (When connector is removed) ● Replace the hydraulic modulator.
16	Front / right OUTLET Valve	● Check each valve by using SCANNER's solenoid valve overriding function. ● Check connection of connector and terminals in the ECU hydraulic modulator. ● Check terminals for open or short. (When connector is removed) ● Replace the hydraulic modulator.
17	Rear / left INLET Valve (ABD)	● Check each valve by using SCANNER's solenoid valve overriding function. ● Check connection of connector and terminals in the ECU hydraulic modulator. ● Check terminals for open or short. (When connector is removed) ● Replace the hydraulic modulator.
18	Rear / left OUTLET Valve	● Check each valve by using SCANNER's solenoid valve overriding function. ● Check connection of connector and terminals in the ECU hydraulic modulator. ● Check terminals for open or short. (When connector is removed) ● Replace the hydraulic modulator.
19	Rear / Right INLET Valve	● Check each valve by using SCANNER's solenoid valve overriding function. ● Check connection of connector and terminals in the ECU hydraulic modulator. ● Check terminals for open or short.

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Defect Code	Application	Description
		● Check terminals for open or short. (When connector is removed) ● Replace the hydraulic modulator.
20	Rear / Right OUTLET Valve	● Check each valve by using SCANNER's solenoid valve overriding function. ● Check connection of connector and terminals in the ECU hydraulic modulator. ● Check terminals for open or short. (When connector is removed) ● Replace the hydraulic modulator
21	Function and Response of The Valve	● Check solenoid internal resistance of the prime(ASV) valve and pilot valve(USV) : 8.04 - 9.04 W ● Check each valve by using SCANNER's solenoid valve overriding function. ● Check connection of connector and terminals in the ECU and hydraulic modulator. ● Check terminals for open or short. (When connector is removed) ● Replace the hydraulic modulator
22	Function and Response of The Valve	● Check solenoid internal resistance of the prime(ASV) valve and pilot valve(USV) : 8.04 - 9.04 W ● Check each valve by using SCANNER's solenoid valve overriding function. ● Check connection of connector and terminals in the ECU and hydraulic modulator. ● Check terminals for open or short. (When connector is removed) ● Replace the hydraulic modulator
24	Motor Relay / Circulation Pump	● Check each valve by using SCANNER's pump motor overriding function. ● Check resistance between pump motor ground terminal and battery negative terminal : total resistance should be less than 15 mW ● Check body ground location. ● Check relay supply voltage : IGN on : 11 - 14 V ● Relay coil internal resistance : 70 - 80 W ● Replace the hydraulic modulator
27	Stop Lamp Switch	● Check by using SCANNER's stop lamp switch diagnosing function from sensor value output function. ● Check connection of ECU connector side stop lamp switch terminal. ● Check resistance of the stop lamp, switch. - Each end resistance value of the switch

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Defect Code	Application	Description
		when switch knob (planger) is pressed by 3mm : ¥ - Each ends resistance value of the switch when switch knob(plunger) is not pressed : less than 200 mW ● When brake is applied : ECU (ABS:No.14, ABD:No.48) terminal 11 - 14 V or VBattery. When brake is released : ECU (ABS:No.14, ABD:No.48) terminal 0 V
28	Power Voltage	● Check battery voltage. ● Resistance between ECU (ABD:No.28 & 29, ABS:No.19) pins and battery negative terminal : less than 20 mW ● Resistance between ECU No.1 (ABS:NO.15) pin and ignition terminal : less than 60 mW ● Check that normal voltage is applied to ECU (ABD:No.1, ABS:No.15) pin when ignition switch is turned to "ON" or "OFF". ● Check ABS fuses of 15A and 80A. ● Replace the ECU.
29	Residual Temperature Measurement (ABD only)	● Check wire (ECU No.50) for open or loose contact.
42	Acceleration Sensor Signal (wire)	● Check connection between connectors. ● Check relevant wires for open or short. (When connector is removed) ● Check voltage between ECU side ground (ABD:No.1, ABS:No.15 pin) and acceleration sensor side ground (ABD:No.1, ABS:No.15 pin / ECU side ABD:No.39, ABS:No.30 pin) (When connector is installed and power is applied) - Voltage : less than 0.25 V ● Check voltage among related terminals. (When connector is installed and power is applied) - Voltage between ECU (ABD:No.43, ABS:No.28 pin and ABD:No.39, ABS:No.30 pin) : 4.75 - 5.25 V - Signal voltage between ECU (ABD:No.51, ABS:No.10) pin and (ABD:No.39, ABS:No.30) pin : 1.95 V - 3.45 V (Measure it by laying acceleration sensor horizontally and without external force)

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Defect Code	Application	Description
43	Acceleration Sensor Signal (Signal)	● Check connection between connectors. ● Check relevant wires for open or short. (When connector is removed) ● Check and replace the acceleration sensor. ● Replace the ECU. ● Check voltage between ECU side ground (ABD:No.1, ABS:No.15 pin) and acceleration sensor side ground (ABD:No.1, ABS:No.15 pin / ECU side ABD:No.39, ABS:No.30 pin) (When connector is installed and power is applied) - Voltage : less than 0.25 V ● Check voltage among related terminals. (When connector is installed and power is applied) - Voltage between ECU (ABD:No.51, ABS:No.10 pin and ABD:No39, ABS:No.30) pin : 4.75 - 5.25 V - Signal voltage between ECU (ABD:No.51, ABS:No.10 pin and ABD:No39, ABS:No.30) pin : 1.95 V - 3.45 V (Measure it by laying acceleration sensor horizon tally and without external force)

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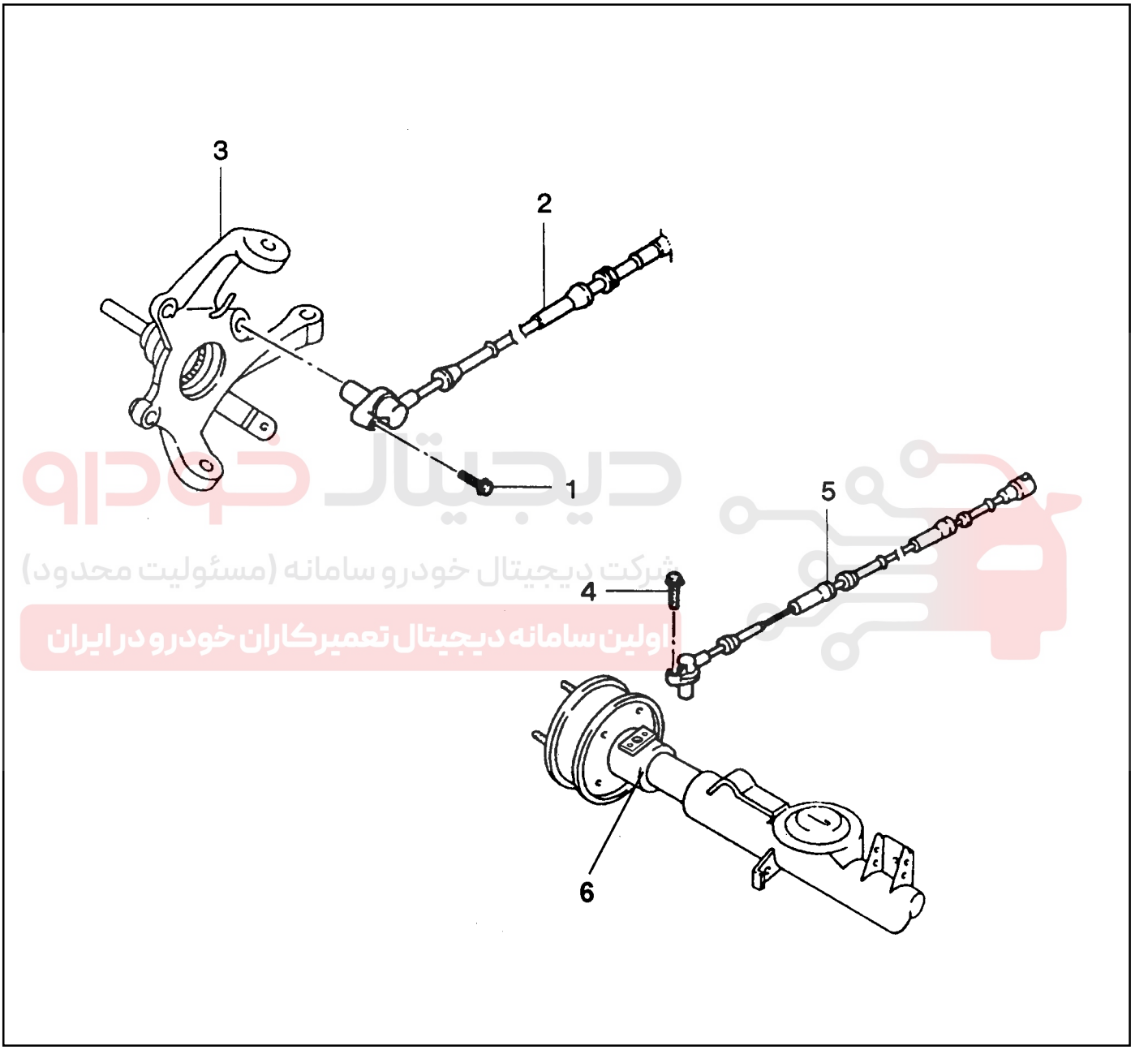
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MAINTENANCE AND REPAIR

ON-VEHICLE SERVICE

WHEEL SPEED SENSOR



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1 Bolt
2 Front Wheel Speed Sensor
3 Knuckle
4 Bolt
5 Rear Wheel Speed Sensor
6 Rear Axle

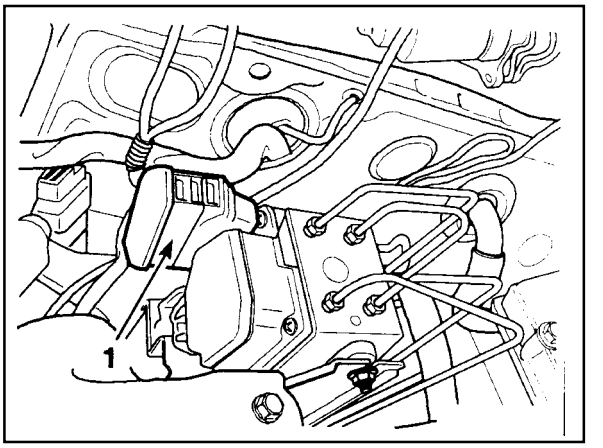
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Removal & Installation Procedure

ABS Hydraulic Unit

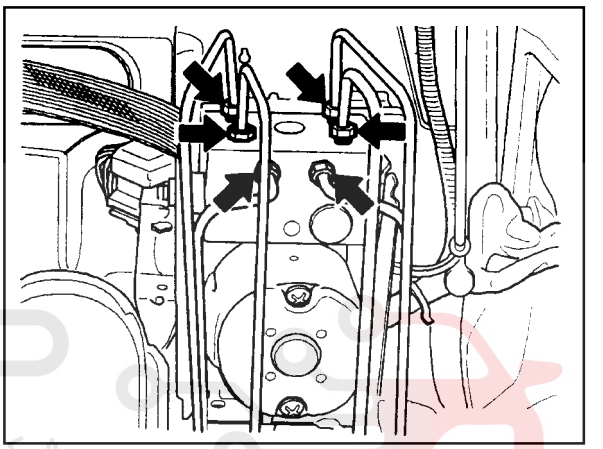
1. Release the ABS wiring connector locking lever in arrow direction and remove the connector.



Notice

- Do not force the connector when releasing in arrow direction.
- For installation of the connetor, align and firmly seat the connector of the hydraulic unit and wiring connector while keeping the locking lever upward and then push it down.

2. Remove the hydraulic lines of the hydraulic unit.



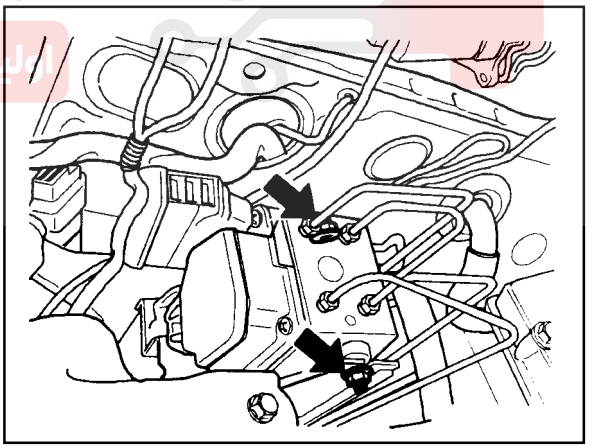
During removal, be careful not to drip brake fuid on the body.

Installation Notice

Tightening Torque	12 - 16 Nm

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3. Unscrew hydraulic unit mounting nuts (2EA) and remove the unit from the bracket.



Installation Notice

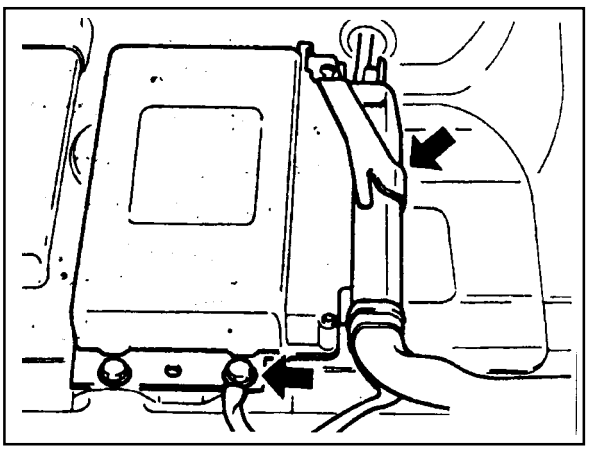
Tightening Torque	9 - 12 Nm

Notice

When carrying a new unit, never recline it over 30°.

Removal of the ABS / ABD Unit

Location : Under the front passenger's seat.



1. Remove the wiring connector of the ABS/ABD(or ABS:attached type) ECU.
2. Remove the ground wire.
3. Unscrew the mounting bolts and remove the ECU.
4. Installation should follow the removal precedure in reverse order.

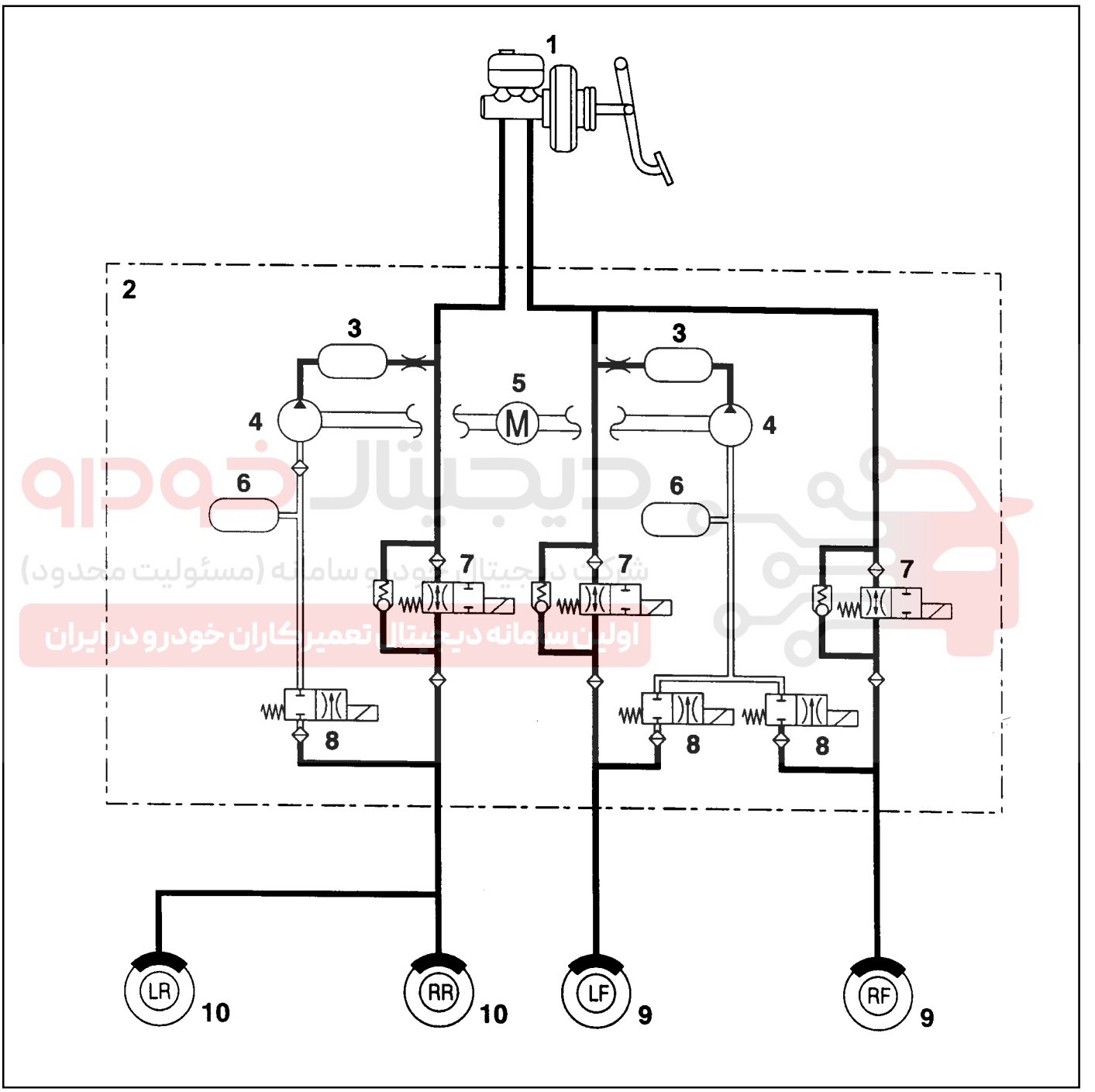
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HYDRAULIC CIRCUIT

ABS 5.3

Pressure Increased

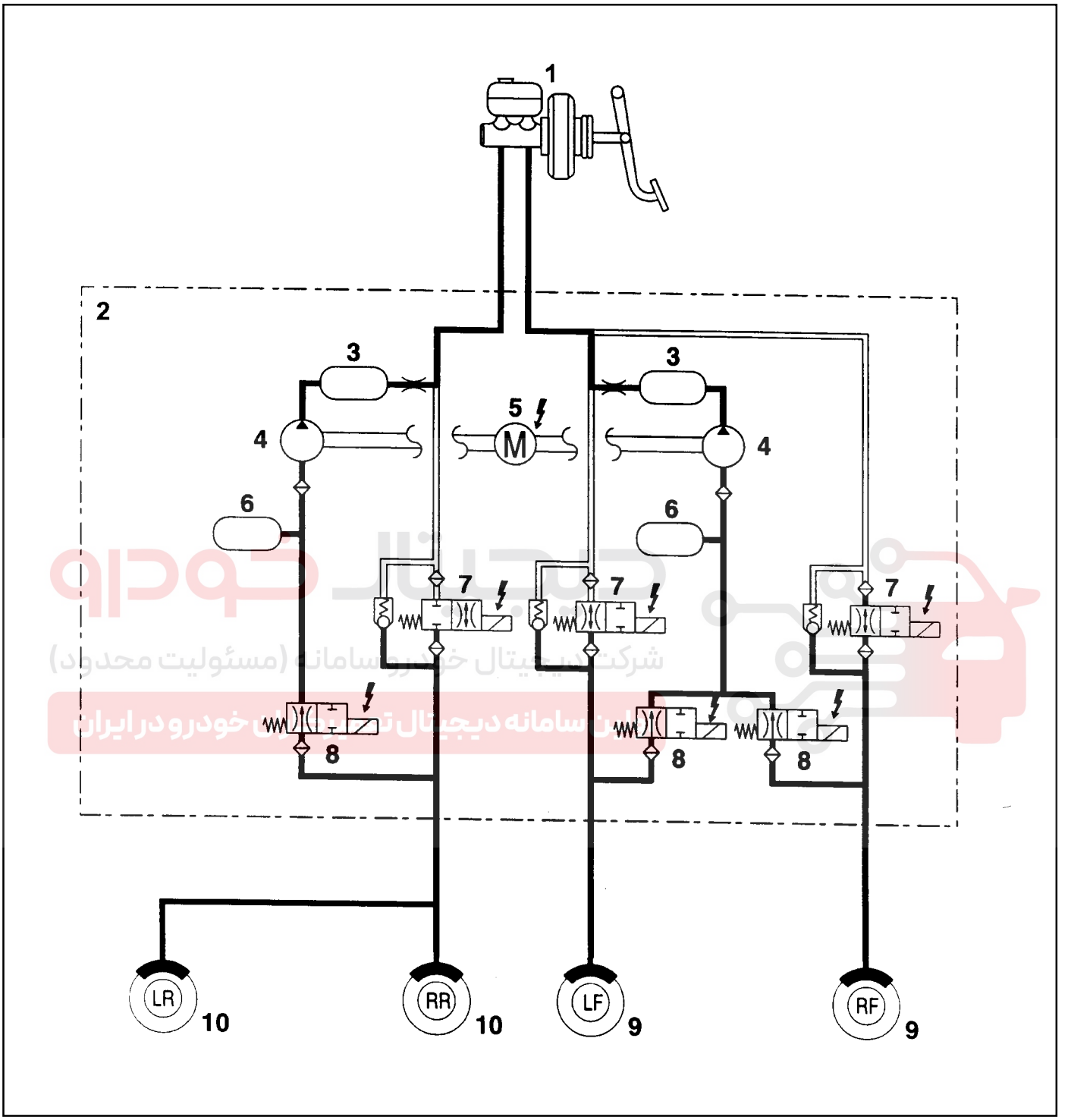


1 Master Cylinder
2 Hydraulic Unit
3 Damping Chamber
4 Return Pump
5 Return Pump Motor
6 Accumulator Chamber
7 Inlet Valve for Each Wheel
8 Outlet Valve for Each Wheel
9 Front Wheel
10 Rear Wheel

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Pressure Decreased

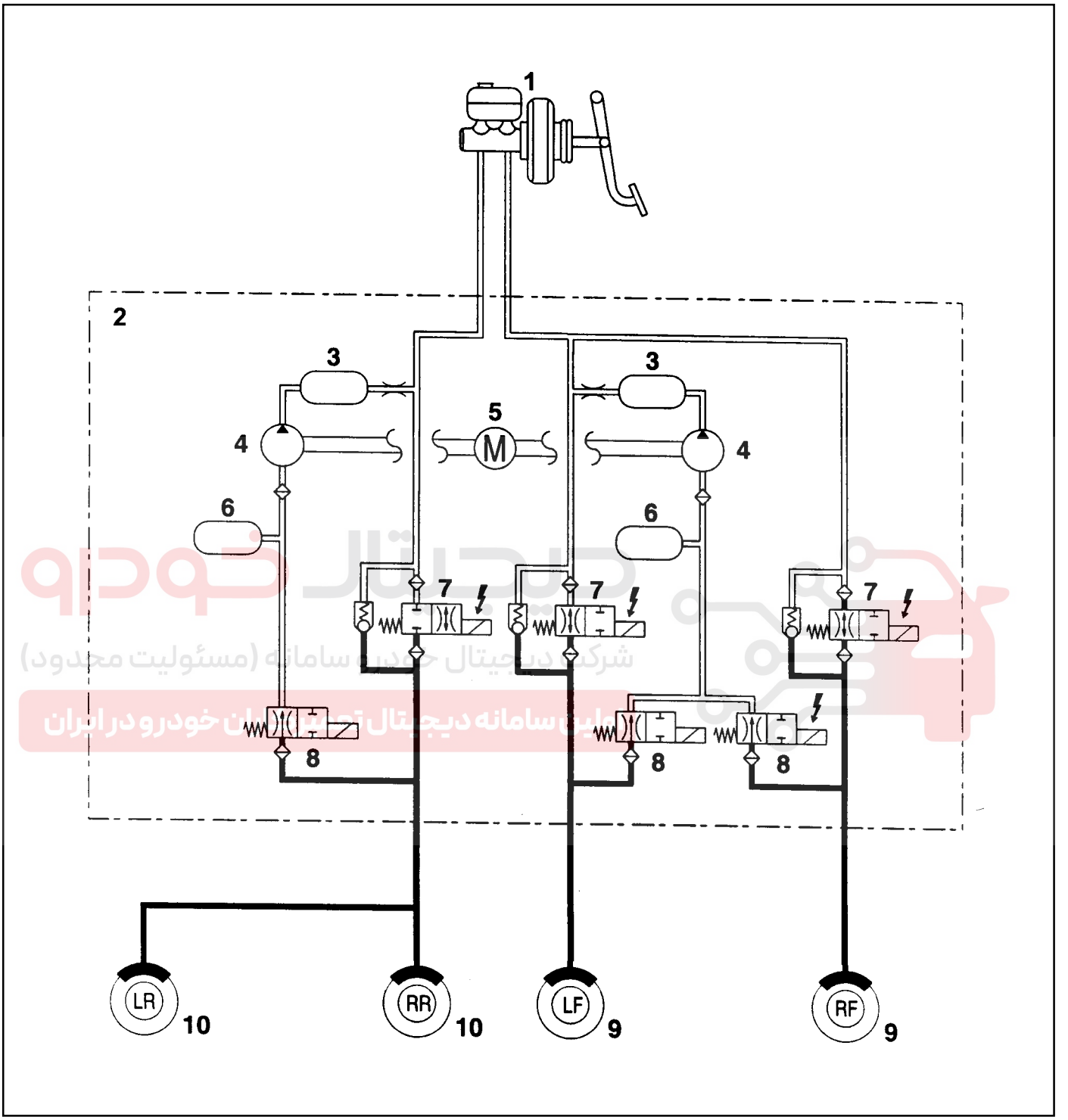


1 Master Cylinder
2 Hydraulic Unit
3 Damping Chamber
4 Return Pump
5 Return Pump Motor
6 Accumulator Chamber
7 Inlet Valve for Each Wheel
8 Outlet Valve for Each Wheel
9 Front Wheel
10 Rear Wheel

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Pressure Maintained



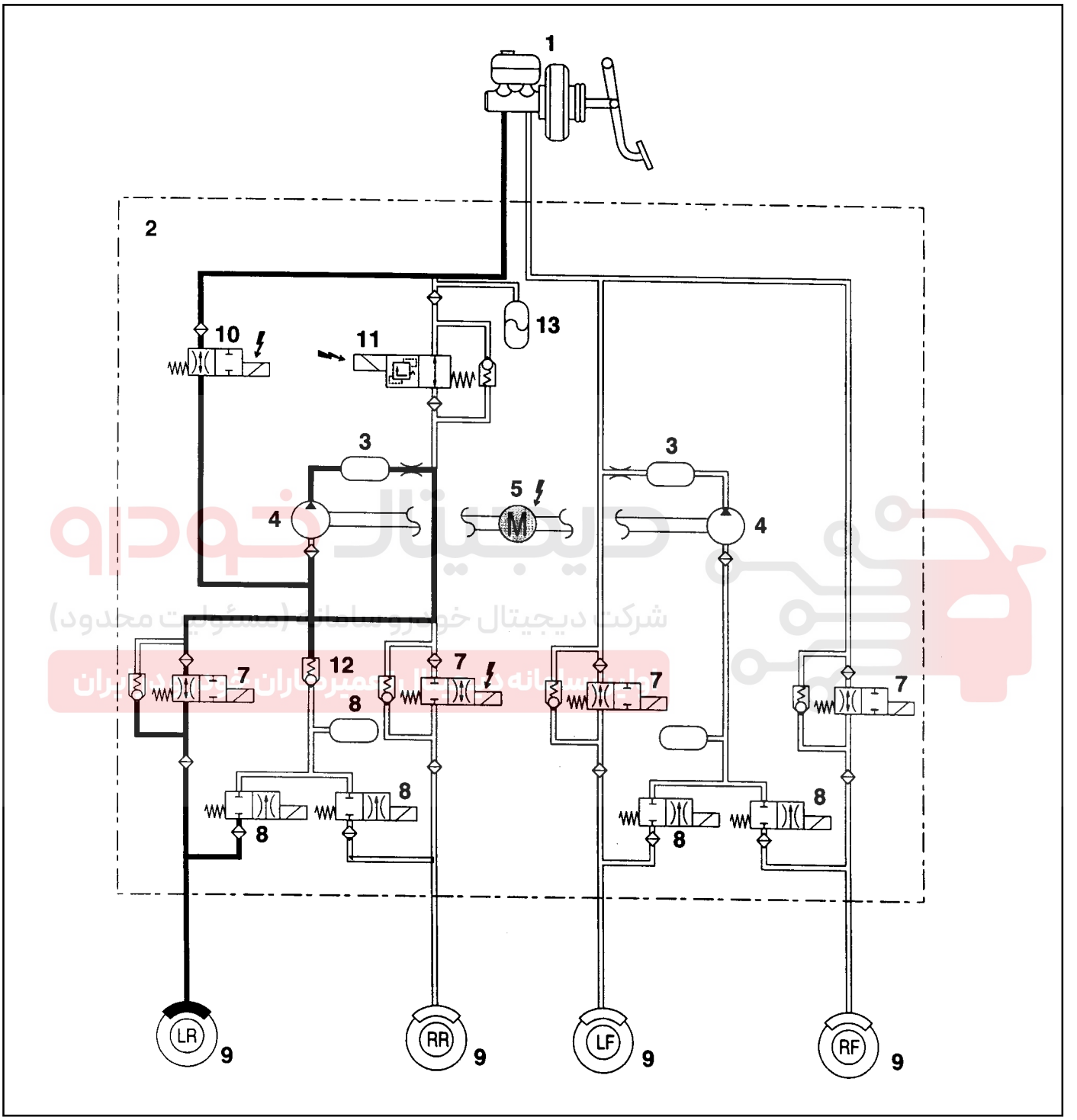
1 Master Cylinder
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6 Accumulator Chamber
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8 Outlet Valve for Each Wheel
9 Front Wheel
10 Rear Wheel

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ABS/ABD 5.3

Pressure Increased

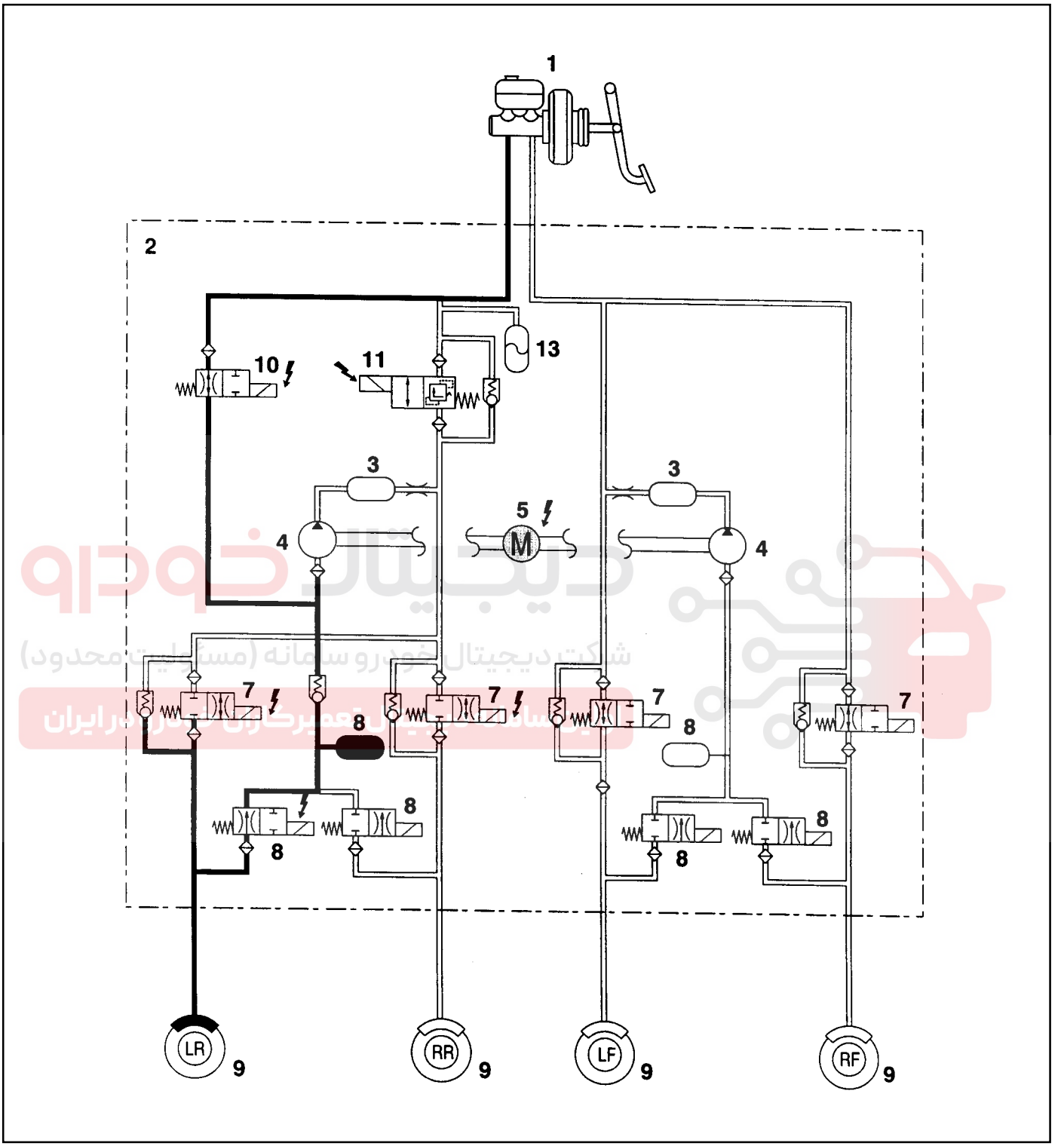


1 Master Cylinder
2 Hydraulic Unit
3 Damping Chamber
4 Return Pump
5 Return Pump Motor
6 Accumulator Chamber
7 Inlet Valve for Each Wheel
8 Outlet Valve for Each Wheel
9 Wheel
10 Prime Valve (ASV)
11 Pilot Valve (USV)
12 Check Valve
13 ISD (Integrated Suction Damper)

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Pressure Decreased

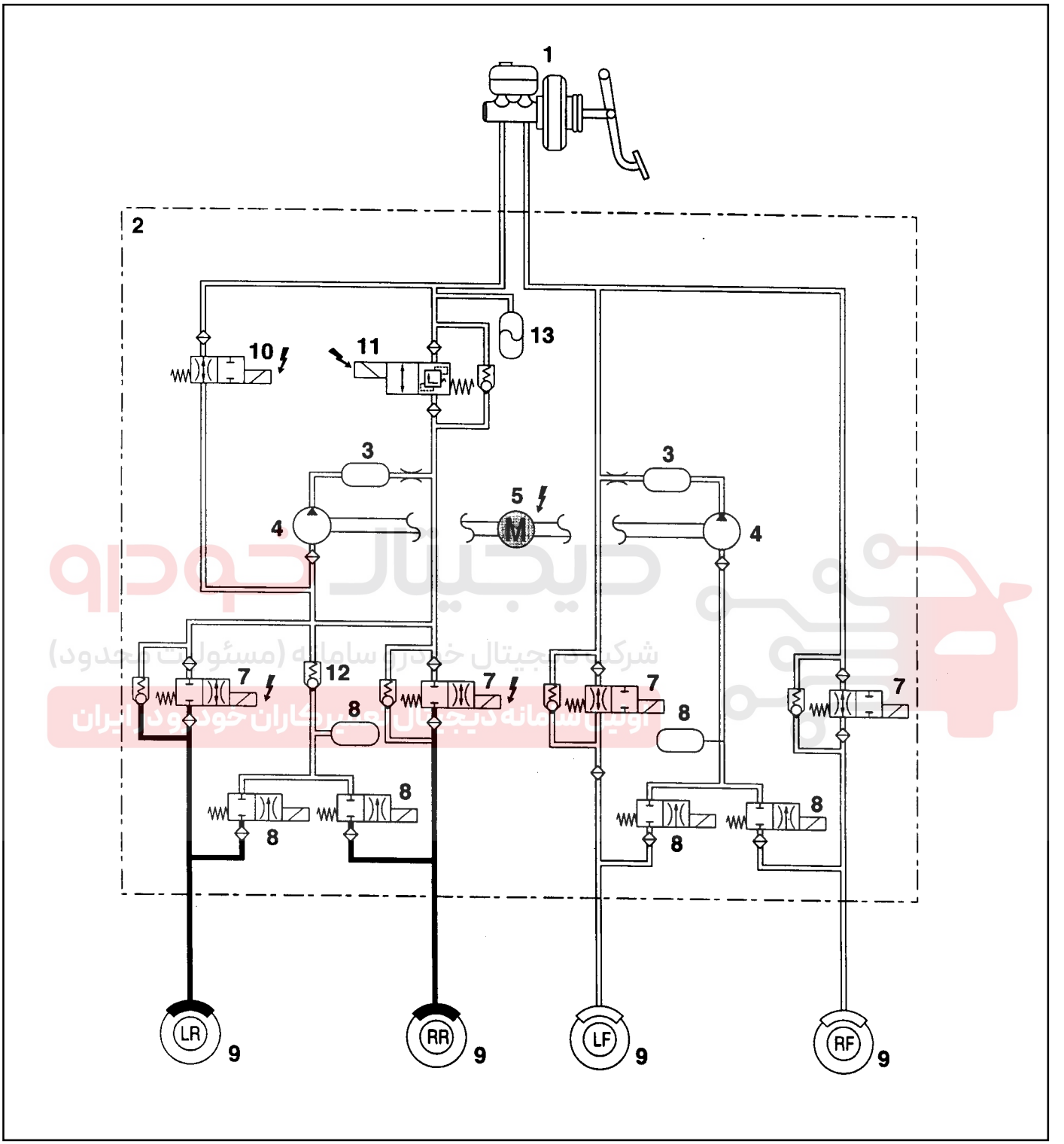


1 Master Cylinder
2 Hydraulic Unit
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5 Return Pump Motor
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12 Check Valve
13 ISD (Integrated Suction Damper)

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Pressure Maintained (Hold)



1 Master Cylinder
2 Hydraulic Unit
3 Damping Chamber
4 Return Pump
5 Return Pump Motor
6 Accumulator Chamber
7 Inlet Valve for Each Wheel
8 Outlet Valve for Each Wheel
9 Wheel
10 Prime Valve (ASV)
11 Pilot Valve (USV)
12 Check Valve
13 ISD (Integrated Suction Damper)

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SECTION 4G

PARKING BRAKE

Caution: Disconnect the negative battery cable before removing or installing any electrical unit or when a tool or equipment could easily come in contact with exposed electrical terminals. Disconnecting this cable will help prevent personal injury and damage to the vehicle. The ignition must also be in LOCK unless otherwise noted.

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سامانه (مسئولیت محدود)
کارگاران خودرو در ایران

SPECIFICATIONS

GENERAL SPECIFICATIONS

Application	Description
Type	Mechanically Operated Rear Wheel Expansion
Operating Type	Manual

FASTENER TIGHTENING SPECIFICATIONS

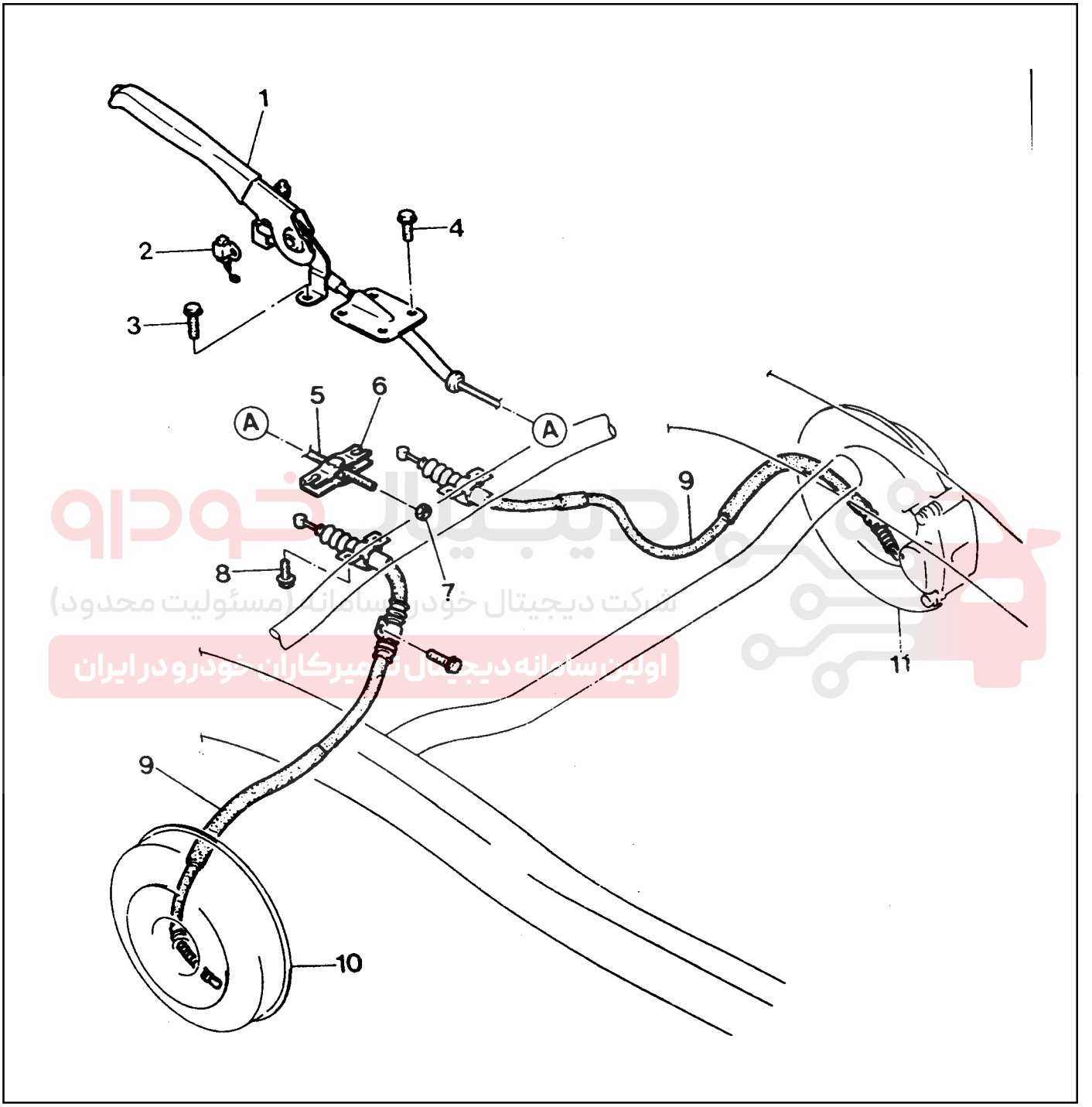
Application	N·m
Parking Brake Lever Bolt	8 - 18
Cable Mounting Bracket Bolt	8 - 18

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COMPONENT LOCATOR

PARKING BRAKE



1 Parking Brake Lever
2 Praking Brake Lamp Switch
3 Bolt
4 Bolt ..... 8-18 Nm
5 Front Parking Brake Cable
6 Equalizer
7 Nut
8 Bolt ..... 8-18 Nm
9 Rear Parking Brake Cable
10 Brake Drum (if Equipped with Rear Drum Brake)
11 Brake Disc (if Equipped with Rear Disc Brake)

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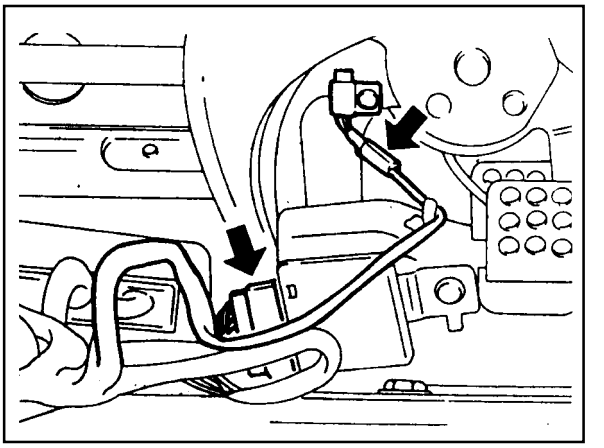
MAINTENANCE AND REPAIR

ON-VEHICLE SERVICE

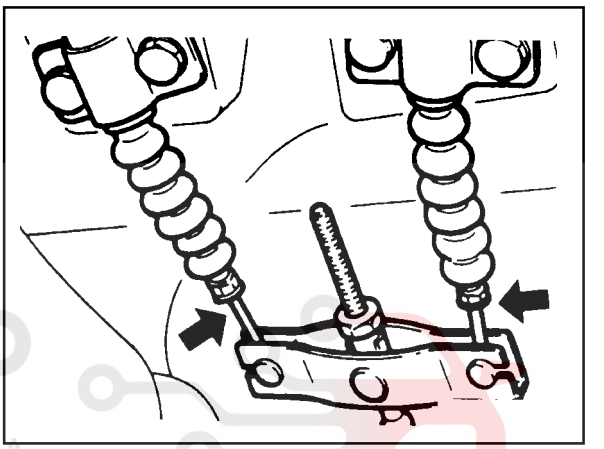
PARKING BRAKE

Removal & Installation Procedure

1. Disconnect the parking brake indicator switch connector.



2. Disconnect the right and left cable from equalizer while parking brake lever is released.



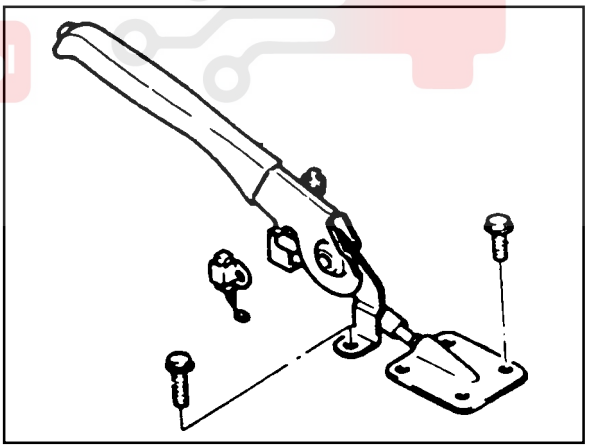
3. Unscrew 8 bolts and remove the parking brake lever assembly.

Installation Notice

Tightening Torque	8 - 18 Nm

Notice

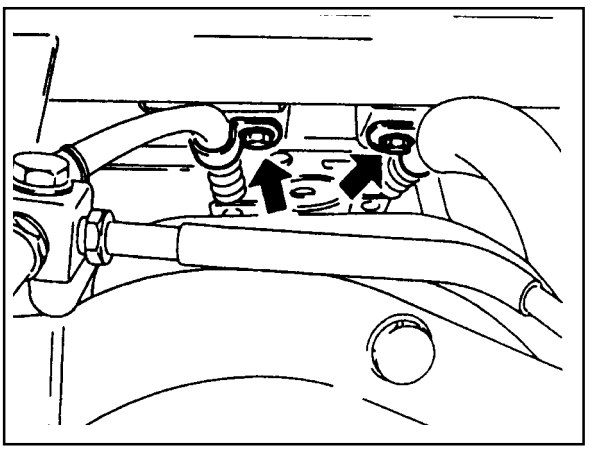
Tighten the bolts with sequence number while the lever is pulled up 4 to 6 notches.



4. Unscrew the frame and lower arm side cable mounting bracket bolts.

Installation Notice

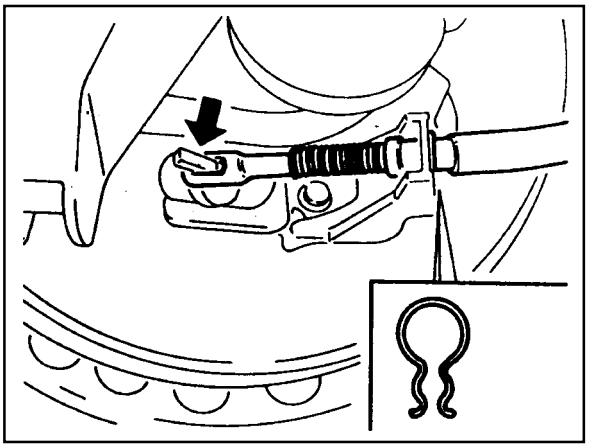
Tightening Torque	8 - 18 Nm



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5. Remove the retainer with a screwdriver and disconnect the brake cable.



6. Installation should follow the removal procedure in the reverse order.

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