BRAKE SYSTEM

4115-01/4803-01/4810-01/4810-08/4830-01/4830-02/ 4841-01/4841-02/4841-15/4850-01/4850-02/4850-09/ 4910-01/

GENERAL INFORMATION

OVERVIEW AND OPERATING PROCESS

CONFIGURATION AND FUNCTION

REMOVAL AND INSTALLATION

BRAKE SYSTEM 4850-01

GENERAL INFORMATION

1. SPECIFICATION

Unit	Description	Specification
Front brake	Type	Ventilated disc
	Outer diameter of disc	Ø294 mm
	Inner diameter of caliper cylinder	Ø43.0 x 2 mm
	Thickness of disc	28 mm (wear limit: 25.4 mm)
	Area of brake pad	Above 60 cm2
	Pad wear indicator	Mechanical type
Rear brake	Type	Solid disc
	Outer diameter of disc	Ø299 m
	Thickness of disc	10.4 mm (wear limit: 8.5 mm)
	Area of brake pad	Above 28.8 cm2
	Pad wear indicator	Mechanical type
Brake booster	Type	Vacuum assist type
	Size	8” + 9” (Tandem)
Master cylinder	Type	Tandem type(integrated level sensor)
	Inner diameter of cylinder	Ø26.99 mm
Brake pedal	Maximum operating stroke	150 mm
	Pedal ratio	4 : 1
	Free play	3 to 10 mm
Parking brake	Type	Mechanically expanded rear lining
	Operating type	Hand operated type
	Inner diameter of drum	Ø190 mm
Brake oil	Specification	DOT 4
	Capacity	0.7 to 0.8 liters

NOTE

Service Interval: Change the brake oil at every 2 years

DOT?

It is the quality grade of brake fluid established by US Department of Transportation.

2. SYSTEM OVERVIEW

1) Terms and Definition

- CBS: Conventional Brake System
- ABS: Anti-Lock Brake System
- EBD: Electronic brake-Force Distribution
- ESP: Electronic Stability Program
- ABD: Automatic Braking Differential
- ASR: Acceleration Slip Regulation
- AYC: Active Yaw Control (Understeer and Oversteer Control)
- HBA: Hydraulic Brake Assistant
- ARP: Active Rollover Protection
- HSA: Hill Start Assistant
- Brake pad: Brake pad is a component of disk brakes used in automotive and other applications. Brake pad is steel backing plates with friction material bound to the surface that faces the brake disc.
- Brake disc: The brake disc is a device for slowing or stopping the rotation of a wheel while it is in motion.
- Brake caliper: To stop the wheel, friction material in the form of brake pads (mounted on a device called a brake caliper) is forced hydraulically against both sides of the disc. Friction causes the disc and attached wheel to slow or stop.
- Brake master cylinder: The brake master cylinder is a control device that converts non-hydraulic pressure (commonly from a driver's foot) into hydraulic pressure, in order to move other device(s) which are located at the other end of the hydraulic system, such as one or more slave cylinders. As piston(s) move along the bore of the master cylinder, this movement is transferred through the hydraulic fluid, to result in a movement of the slave cylinder(s). The hydraulic pressure created by moving a piston (inside the bore of the master cylinder) toward the slave cylinder(s) compresses the fluid evenly, but by varying the comparative surface-area of the master cylinder and/or each slave cylinder, one will vary the amount of force and displacement applied to each slave cylinder (relative to the amount of force and displacement that was applied to the master cylinder).

2) Functions

Function	Vehicle with CBS	Vehicle with ABS/EBD	Vehicle with ESP
ABS	Not applied	Applied	Applied
EBD		Applied	
ABD		Not applied	
ASR			
AYC			
HBA			
ARP			

Modification basis	
Application basis	
Affected VIN	

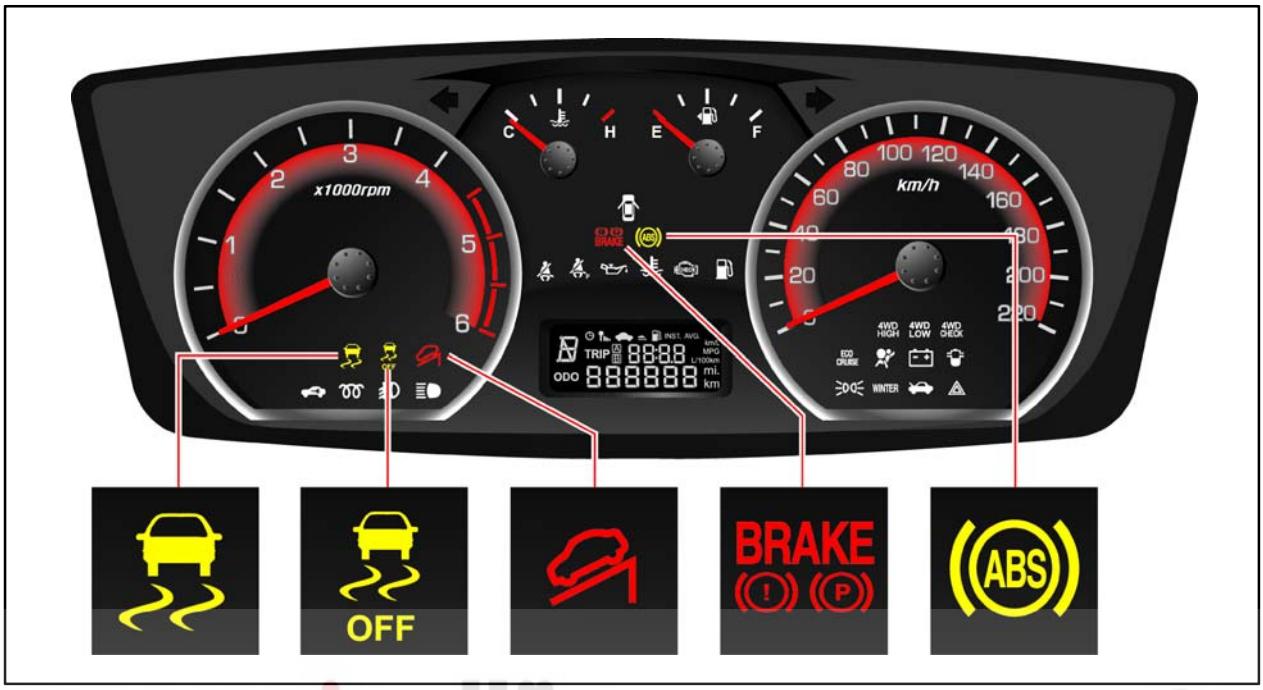
3) Parts Arrangement

Part name	Vehicle with CBS	Vehicle with ABS/EBD	Vehicle with ESP
HECU	Not applied	Applied	Applied
Front wheel speed sensor			
Rear wheel speed sensor			
ABS warning lamp			
EBD indicator			
Longitudinal G sensor		2WD: N/A, 4WD: Applied	Not applied
Sensor cluster (Yaw rate sensor, lateral/longitudinal G sensor)		Not applied	Applied
ESP indicator			
ESP OFF switch and warning lamp			
Steering wheel angle sensor			

4) Components

	ABS		ESP+ARP	
	2WD	4WD	2WD	4WD
Whhel speed sensor	4	4	4	4
Sensor cluster	N/A	N/A	Applied	Applied
G-sensor	N/A	Applied	N/A	N/A
2H G-sensor	-	Operating	-	-
4H G-sensor	-	Operating	-	-
4L G-sensor	-	Operating	-	-
2H sensor cluster	-	-	Operating	Operating
4H sensor cluster	-	-	Operating	Operating
4L sensor cluster	-	-	Operating	Operating

5) Indicators and Warning Lamps for ABS/ESP



Lamp	Indicator/Warning Lamp	Description
EBD warning lamp		ON when EBD function is failed
ABS warning lamp		ON when ABS function is failed
ESP indicator		Blinking when ESP function is operating
ESP OFF indicator		ON when the ESP OFF switch is pressed
ESP warning lamp		ON when ESP function is failed
ESP buzzer		Sound when ESP function is operating
HDC indicator		Red: HDC operating Green: HDC switched ON

Modification basis	
Application basis	
Affected VIN	

3. TROUBLESHOOTING

Problem	Possible Cause	Action
Noise or vehicle vibration when applied	Incorrectly mounted back plate or caliper	Repair
	Loosened bolt of back plate or caliper	Retighten
	Uneven wear of brake disc	Replace
	Brake pad contamination	Clean or replace
	Sticking brake pad on contact surface	Replace
	Wear or hardening of brake pad	Replace
	Excessive clearance between caliper and pad	Repair
	Uneven contact of pad	Repair
	Lack of lubrication in sliding parts	Lubricate
	Improper operation of caliper	Replace
	Dust cover missing	Repair
	Loosened suspension mounting bolt	Retighten
Pulls to one side when braking	Unbalanced tire pressure between left and right	Adjust
	Poor contact of brake pad	Repair
	Oil or grease on brake pad	Replace
	Scratch, uneven wear, distortion of brake disc	Replace
	Improperly installed brake caliper	Repair
	Improper operation of auto adjuster	Repair
	Crack or distortion of brake pad	Replace
Poor braking	Oil leak or contamination	Repair or replace
	Air in brake line	Bleed air
	Improper operation of brake booster	Repair
	Poor contact of brake pad	Repair
	Oil or grease on brake pad	Replace
	Improper operation of auto adjuster	Repair
	Clogged brake line	Repair
	Improper operation of proportioning valve	Repair

Problem	Possible Cause	Action
Increased pedal stroke	Air in brake line	Bleed air
	Oil leak	Repair
	Worn brake pad	Replace
	Excessive clearance between push rod and master cylinder	Adjust
	Worn or damaged piston seal	Replace
Brake dragging	Parking brake is not fully released	Release
	Incorrect adjustment of parking brake	Adjust
	Incorrectly adjusted clearance of parking brake shoe	Adjust
	Faulty brake pedal return spring	Replace
	Incorrectly adjusted free play of brake pedal	Adjust
	Faulty master cylinder	Replace
	Lack of lubrication in sliding parts	Lubricate
	Faulty brake booster (vacuum leak)	Repair
Poor parking brake	Wear, hardening or poor contact of brake pad	Replace
	Oil or water on lining	Repair or replace
	Fixed or broken parking brake cable	Replace
	Excessive stroke of brake lever	Adjust notch
	Faulty auto clearance adjuster	Repair
Increased stroke of parking brake lever	Loosened parking brake cable	Adjust or replace
	Incorrectly adjusted parking brake cable	Adjus
	Defective automatic lining clearance adjuster	Repair or replace
	Worn brake lining	Replace

Modification basis	
Application basis	
Affected VIN	

Problem	Cause	Action
Burning smell around tire	Too frequent braking in high driving speed	Reduce the use of foot brake/use engine brake properly
	Used only foot brake during downhill driving	
	Driving with foot on brake pedal	Get off the foot from pedal
	Foreign materials such as dirt or sand in brake system	Replace: caliper, wheel cylinder, master cylinder, return spring
	Broken return spring in shoe assembly	Replace
	Incorrectly adjusted parking brake cable	Adjust
	Incorrect wheel or wheel cover (generating the heat)	Replace

▶ BRAKE OPERATION AND NOISE

This section describes the noise phenomena occurred possibly in the brake system operation. Distinguish between the information given below and the actual problems and then, inspect the vehicle and take appropriate measures.

- **Noise symptoms and Causes**

Symptom 1. If depressing the brake pedal when the engine is cold, "screeching" sound always occurs and, after driving for a while, the sound disappears..

This usually occurs in the morning. When the temperature goes down, the dew condensation phenomenon sets moisture on the brake disc as the window frost forms. Due to this moisture, the iron within the brake disc and pad oxidizes, forming undetectable micro-rusts on the disc surface. When starting the engine under this condition, noise may sound due to the friction of micro-rusts. When operating the brake several times, the disc temperature goes up and the micro-rusts come off and the noise goes away. Depending on the driving conditions, noise gets louder when slightly depressing the brake pedal and oppositely, noise is smaller when deeply depressing the brake pedal. This is simply a physical phenomenon, called "morning effect" in professional terms, and does not imply any problems with the brake system.

Symptom 2. Slip or screech after the brake pad replacement.

This usually occurs when the bed-in is not made between the disc and the pad's friction material. The bed-in is a state that the brake system normally works and gives no noise out, when, after about 300 km city driving, the contact area of the pad friction material is enlarged and the disk is in complete contact with the pad's friction material. Therefore, for some time after the brake disk/pad replacement, the brake system poorly operates or noise (abnormal sound) occurs due to the partial contact.

Symptom 3. "Groaning" sound occurs in the automatic transmission vehicle when slightly taking the foot off the brake pedal to slowly start after waiting for the signal, or slightly depressing the brake pedal.

This is the noise "Creep groan" that occurs when, in both the automatic and manual transmission, slightly releasing the brake pedal in the neutral gear at downhill roads.
It frequently occurs at the low braking power and low speed, through the following process. When operating the brake system at low speed and low pressure, adhesion and slip repeatedly take place between the brake disk and the friction material, and this makes the braking power inconstant, instantly increasing or decreasing, and gives out the brake noise.
It is also a physical phenomenon and has no relation with the brake performance.

Modification basis	
Application basis	
Affected VIN	

4. AIR BLEEDING

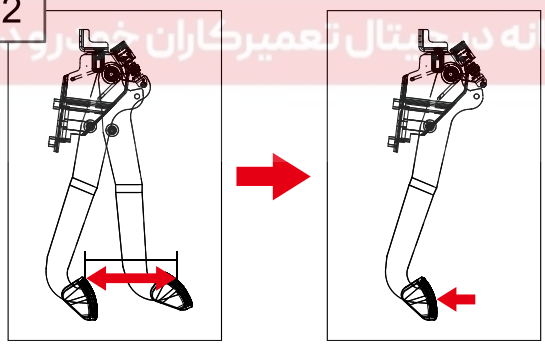
CAUTION

- Never reuse the used brake fluid.
- Use only specifies brake fluid (DOT 4). Add brake fluid between MAX and MIN lines on the reservoir (0.7 to 0.8 liters).
- Be careful not to splash the brake fluid on painted area or body.
- Make sure that any foreign material does not get into brake line.
- Always work with another staff.

1

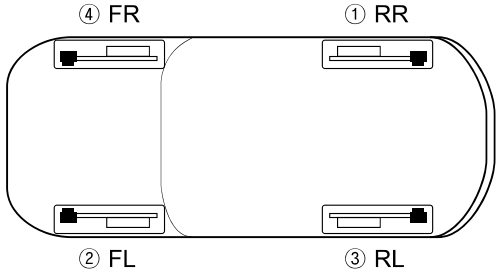
1. Fill up the brake fluid up to "MAX" line on the reservoir.

2



2. Fill the reservoir with brake fluid and pump the brake pedal several times. Then keep it depressed.

3

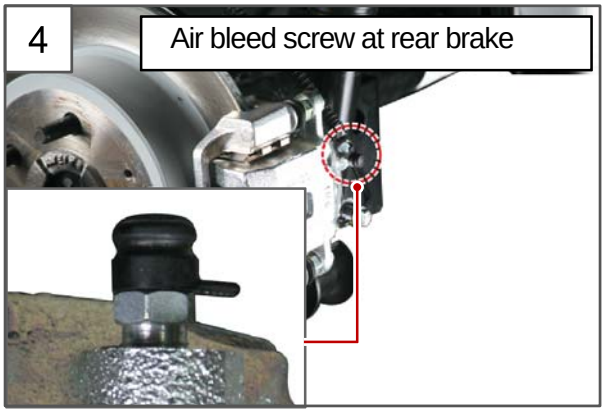


3. Loosen the bleed screw and collect the bleeding brake fluid from the brake line with the order in the figure.

CAUTION

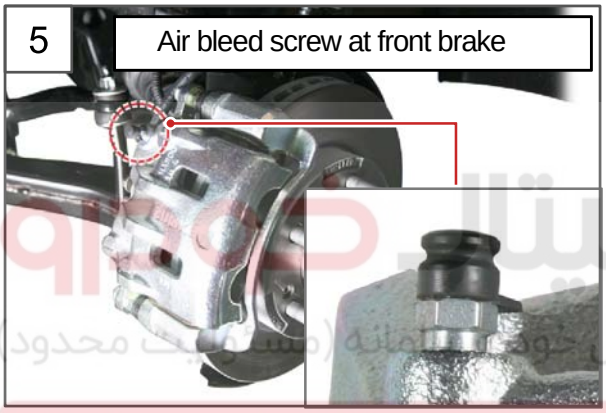
Fill the reservoir with the brake fluid as much as it bleeded, and continue to bleeding operation.

Modification basis	
Application basis	
Affected VIN	



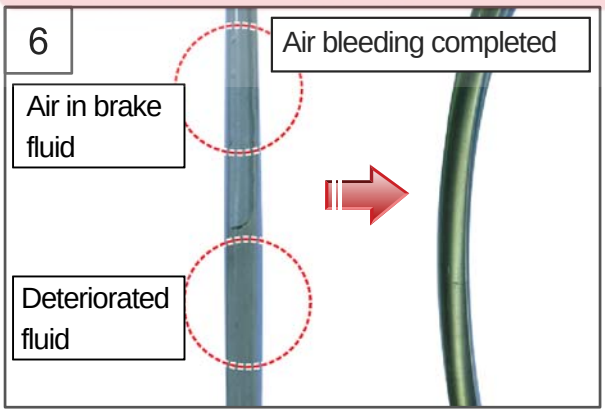
4. Air bleed screw at rear brake

Tightening torque 9.8 ~ 11.2Nm



5. Air bleed screw at front brake

Tightening torque 9.8 ~ 11.2Nm



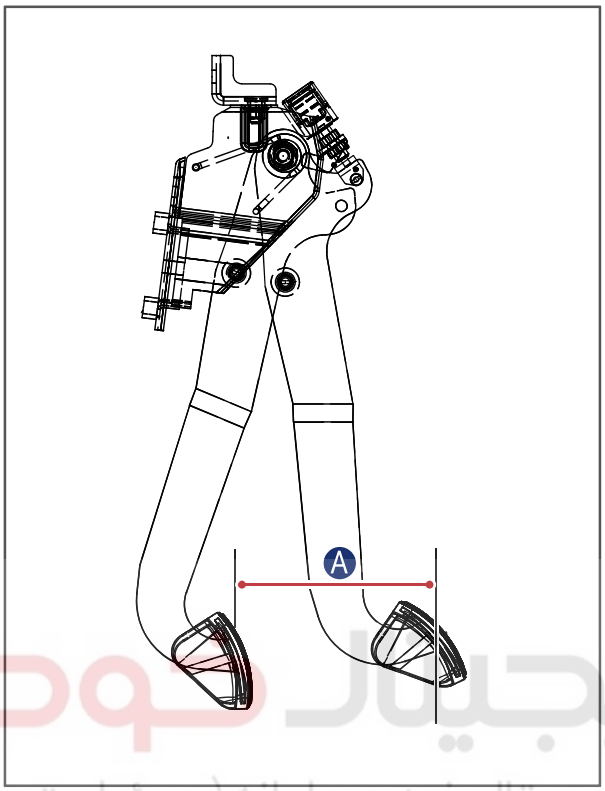
6. Repeat the air bleeding procedures until clear brake fluid comes out of air bleed screw.

7. Check for oil leaks from the brake lines.

Modification basis	
Application basis	
Affected VIN	

5. BRAKE SYSTEM CHECK

▶ Maximum Stroke of Brake Pedal



- Check the brake pedal with below procedures:

1. Start the engine.
2. Pump the brake pedal around 3 times.
3. Depress the brake pedal with approx. 30 kg and measure the distance (A) between the upper surface of pedal pad and the lower dash panel.
4. If the measured value is out of the specified value, adjust the length.

Specified value (A)	150mm

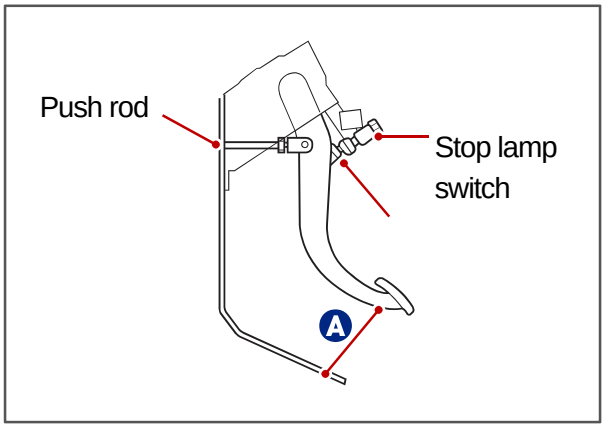
Over the specified value

Cause	Action
Worn brake pad	Replace
Worn brake shoe	Replace
Improper stroke of hand brake	Adjust
Air in brake line	Air bleeding
Oil leak	Repair or replace
Brake booster push rod	Replace or adjust
Improperly adjusted stopper bolt	Adjust

Below the specified value

Cause	Action
Brake booster push rod	Replace or adjust
Air in brake fluid	Replace
Improperly adjusted stopper bolt	Adjust

▶ Pedal Height



- Check the pedal height with below procedures:

1. Start the engine and measure the length (A) between floor mat and pedal.
2. If the measured value is out of the specified value, adjust the length.

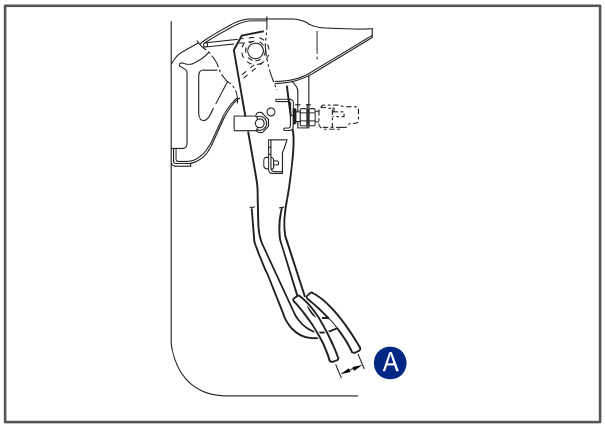
Specified value (B)	155mm

- Adjust the pedal height with below procedures:

1. Disconnect the stop lamp switch connector.
   Unscrew the lock nut and remove the stop
2. lamp switch assembly.
   Loosen the lock nut on the pedal push rod.
3. Turn the pedal push rod to adjust the pedal
4. height.
   Tighten the lock nut.
5. Install the stop lamp switch assembly.
6. Connect the stop lamp switch connector.
7. Check if the stop lamps come on when
8. pressing the brake pedal around 5 mm.
   If the stop lamp dpes not come on, adjust the
9. stop lamp switch assembly again.
   If the stop lamps come on, tighten the lock nut
10. and measure the pedal height again.

Modification basis	
Application basis	
Affected VIN	

▶ Pedal Free Play



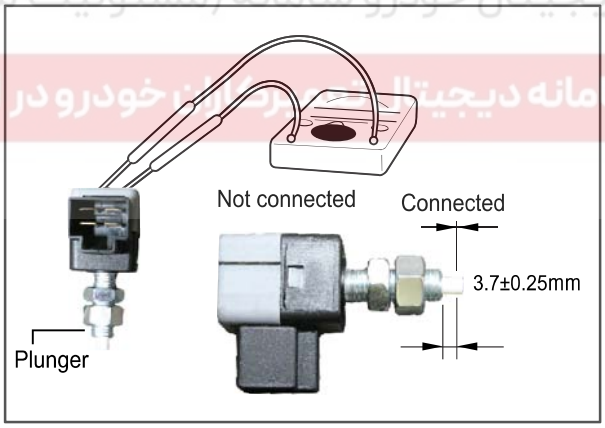
- Check the pedal free play with below procedures:

1. Stop the engine.
2. Depress the brake pedal several times to discharge the vacuum pressure of the brake booster.
3. Depress the brake pedal until you feel the resistance, and measure the movement (A).

Specified value (A)	3 ~ 10mm

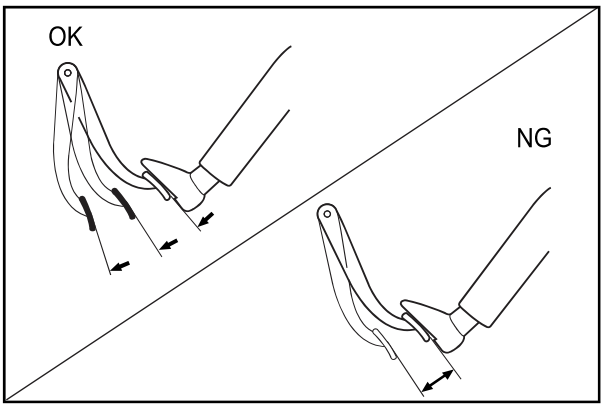
- Below the specified value: Check if the distance between the outer case of stop lamp switch and the brake pedal.
- Over the specified value: It may be caused by bigger clearance between the clevis pin and the brake pedal arm. Replace the components if necessary.

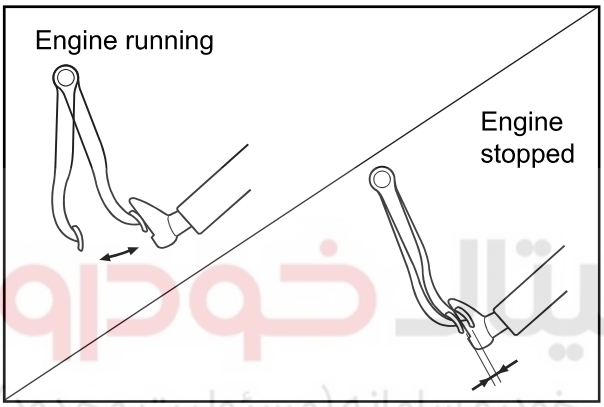
▶ Stop Lamp Switch



- Connect the multimeter to stop lamp switch connector and check if the continuity exists when pushing in the plunger. If the continuity doesn't exist, the stop lamp switch is normal.

▶ Brake Booster





1. Let the engine run for 1 to 2 minutes and stop it. If the brake pedal stroke is shortened as pumping the brake pedal, the system is normal. If not, the system is defective.
2. Depress the brake pedal several times with engine off. If the brake goes down when starting engine with pedal depressed, the system is normal. If not, the system is defective.
3. Depress the brake pedal when the engine is running. If the pedal height is not changed for 30 seconds after stopping the engine, the system is normal. If not, the system is defective.

If the above three checks are OK, the system is normal. If any condition is not met, check the valve, vacuum hose and brake booster.

Modification basis	
Application basis	
Affected VIN	

▶ Brake Fluid

1. Color

   - Ligh gold (New oil) → Brown → Black

2. Service Interval/Type

   - Change: every 2 years, Type: DOT4
     The water in the brake fluid has an adverse effect to the brake system. If the fluid contains around 3% of water, the boiling point of the brake fluid goes down by 25%. It will cause the vapor lock frequently.
     Water content in fluid: around 3% after 18 months, around 7~10% after few years
     The water ib fluid makes the corrosion in the brake lines, deforms and deteriorates the rubber components, brake calipers and pistons.

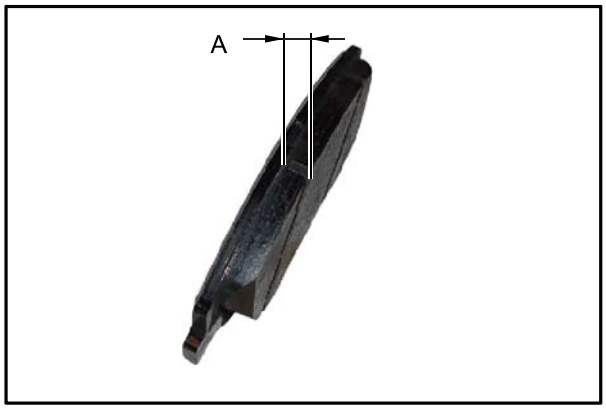
▶ Brake Fluid Type

DOT4: Brake fluid for premium vehicle. Lower water absorbing rate AND higher boiling point than DOT3

▶ Brake Fluid Level Check

The brake fluid level should be between "MAX" and "MIN" on the reservoir. If it is below "MIN" mark, check for oil leaks and refill the reservoir with the specified fluid.

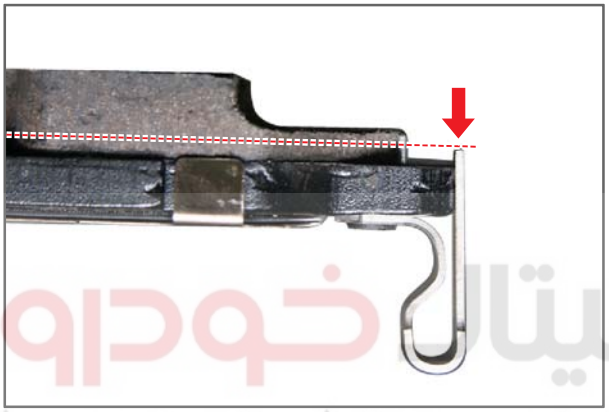
▶ Front Brake



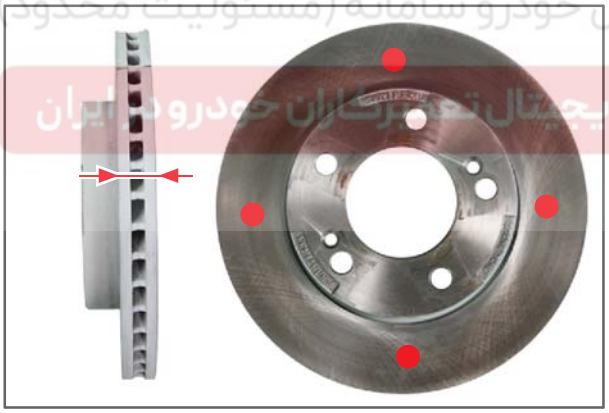
1. Pad Thickness

- Measure the pad thickness and replace it if it is below the wear limit.

New pad	Wear limit
10.5 mm	2 mm



- Wera limit point



2. Disc Thickness

- Measure the disc thickness at over four points.
- If any of measured points is below the wear limit, replace the brake disc with new one.

New disc	Wear limit
28 mm	25.4 mm

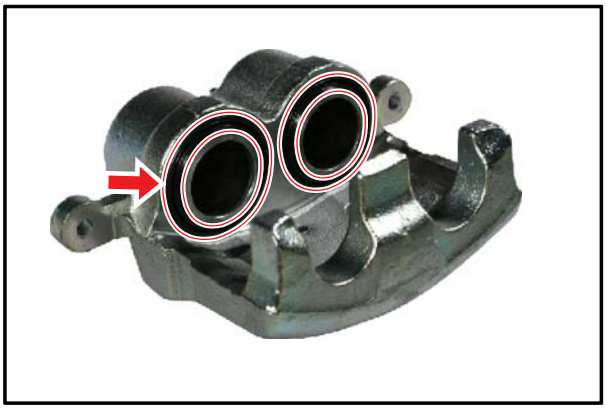
3. Disc Run-Out

- Install the dial gauge on the side of brake disc and measure the run-out while rotating the brake disc.
- If the measured value exceeds the limit, replace the brake disc with new one. Otherwise, it may cause the pedal vibration and shimmy when braking.

Limit	0.03 mm (before installation)
	0.07 mm (when installed)

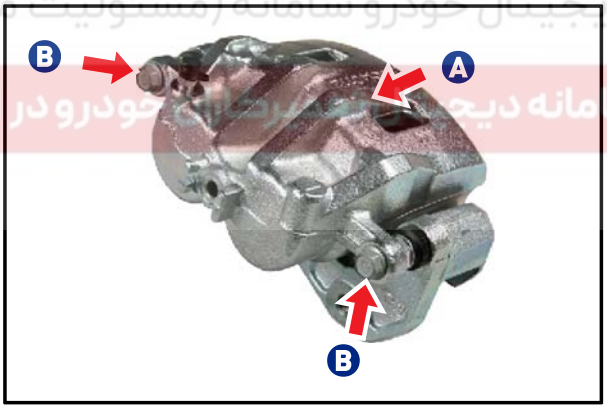
Modification basis	
Application basis	
Affected VIN	

Clean the dissembled components and visually check the followings:



4. Damage and tear on boot

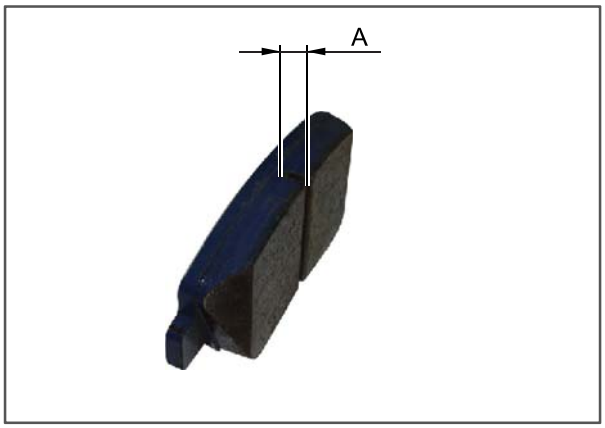
5. Uneven wear and oil contamination



6. Damage, crack and wear on cylinder body (A) and guide pin (B)

7. Wear, rust and damage on the cylinder and piston
8. Scratch and bending on disc plate

▶ Rear Brake



Pad Thickness

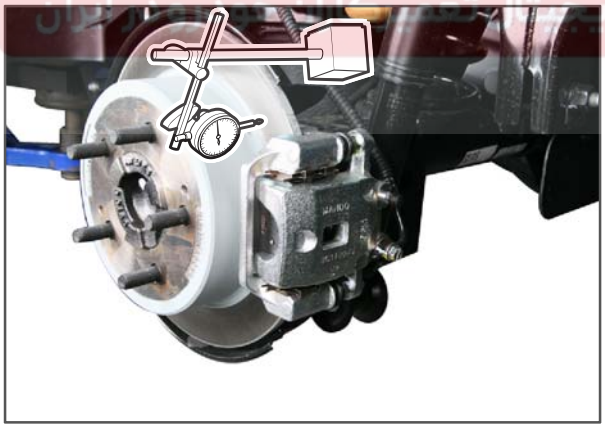
1. Remove the front tire.
2. 2. Measure the pad thickness and replace it if it is below the wear limit.

New pad	Wear limit
10 mm	2mm

Disc thickness

1. Measure the disc thickness at over four points.
2. If any of measured points is below the wear limit, replace the brake disc with new one.

New disc	Wear limit
10.4mm	8.5mm



Disc Run-Out

1. Install the dial gauge on the side of brake disc and measure the run-out while rotating the brake disc.
2. If the measured value exceeds the limit, replace the brake disc with new one. Otherwise, it may cause the pedal vibration and shimmy when braking.

Limit	0.03 mm (before installation)
	0.07 mm (when installed)

Modification basis	
Application basis	
Affected VIN	

▶ Parking Brake

Check the brake force with below procedures:

1. Count the number of the clicks (notches) when pulling up the parking brake with 19 kg of force.

Specified notches	5

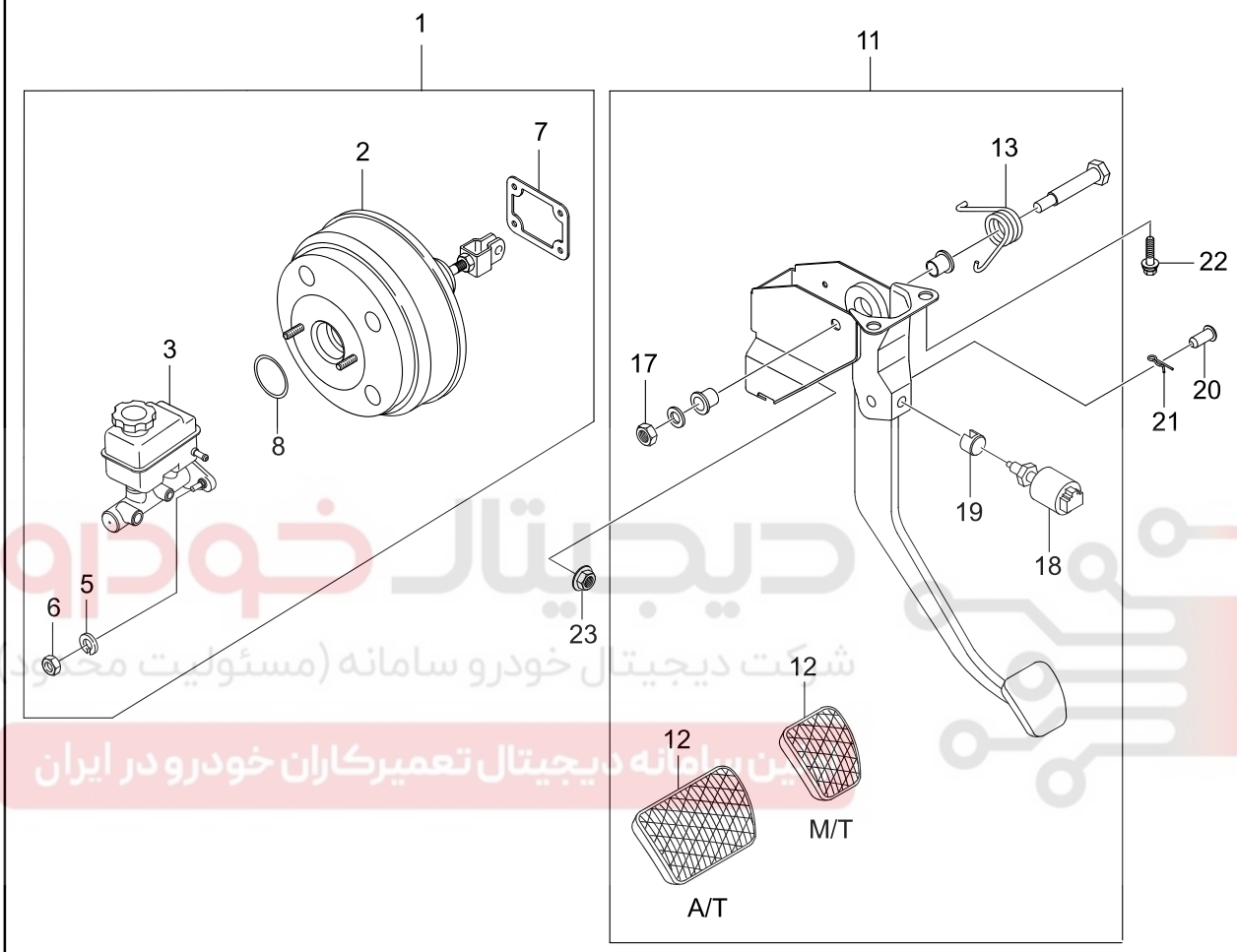
2. If the clicks are over or below the specified value, adjust the clicks to the specified value with the parking brake adjusting nut.
3. Check the parking brake force after adjustment.
4. If the parking brake force is not enough, check the parking brake lever and cable. Replace the components if needed.

CAUTION

Never park the vehicle only with the parking brake on the stiff hill. It may cause roll down of the vehicle due to release of the parking brake. Place the wheel chocks under the wheels.

6. COMPONENTS

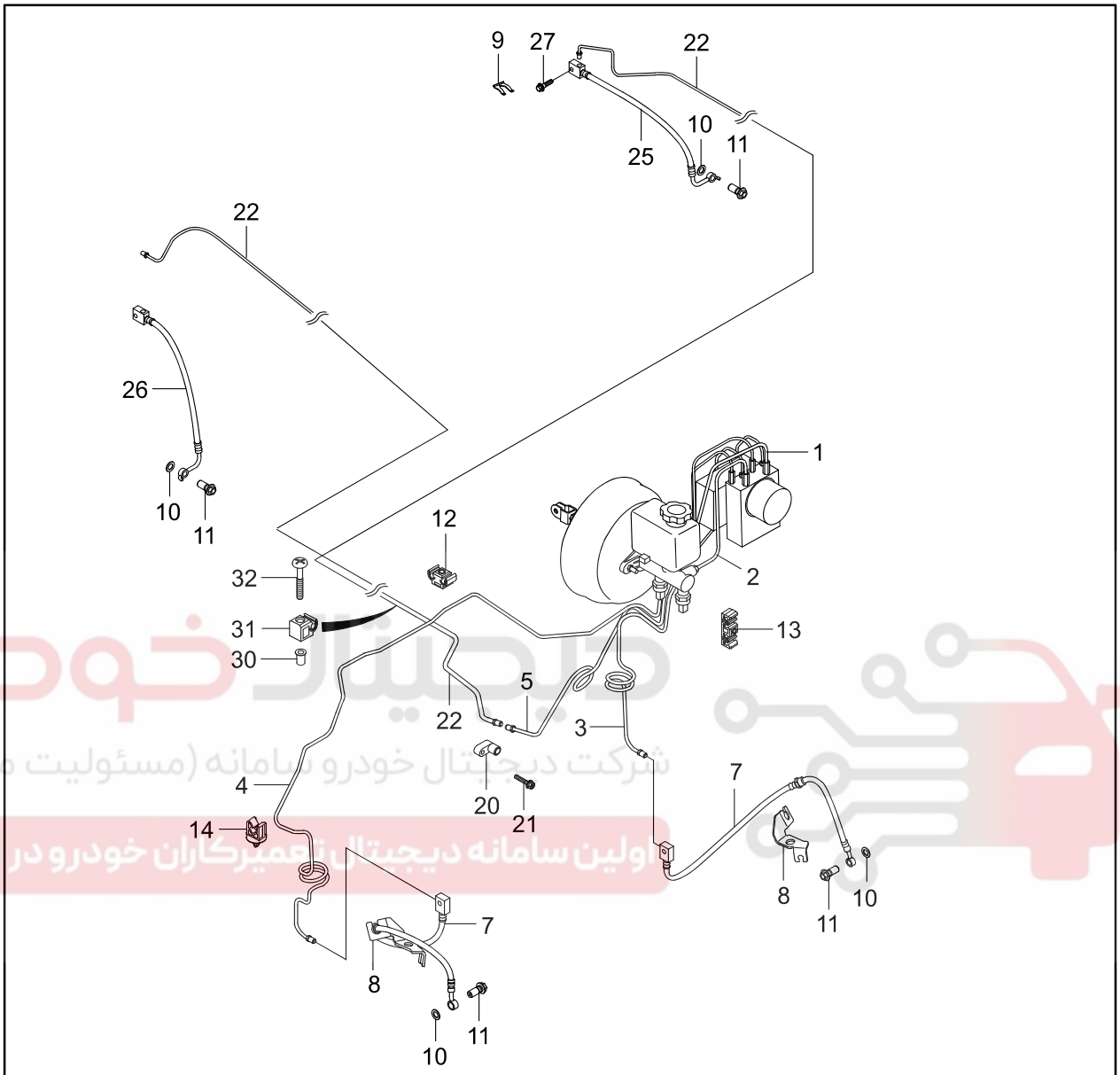
▶ **Brake Pedal, Master Cylinder and Booster**



1. Brake master cylinder assembly
2. Brake booster assembly
3. Brake master cylinder
6. Nut (12.8~16.7 Nm)
7. Booster mounting seal
8. O-ring
11. Brake pedal assembly
12. Brake pedal
13. Brake pedal return spring
17. Nut - Brake pedal
18. Stop lamp switch
19. Stopper
20. Clevis pin
21. Snap pin
22. Bolt - Brake pedal assembly (17.6~21.6 Nm)
23. Nut - Brake booster (17.6~21.6 Nm)

Modification basis	
Application basis	
Affected VIN	

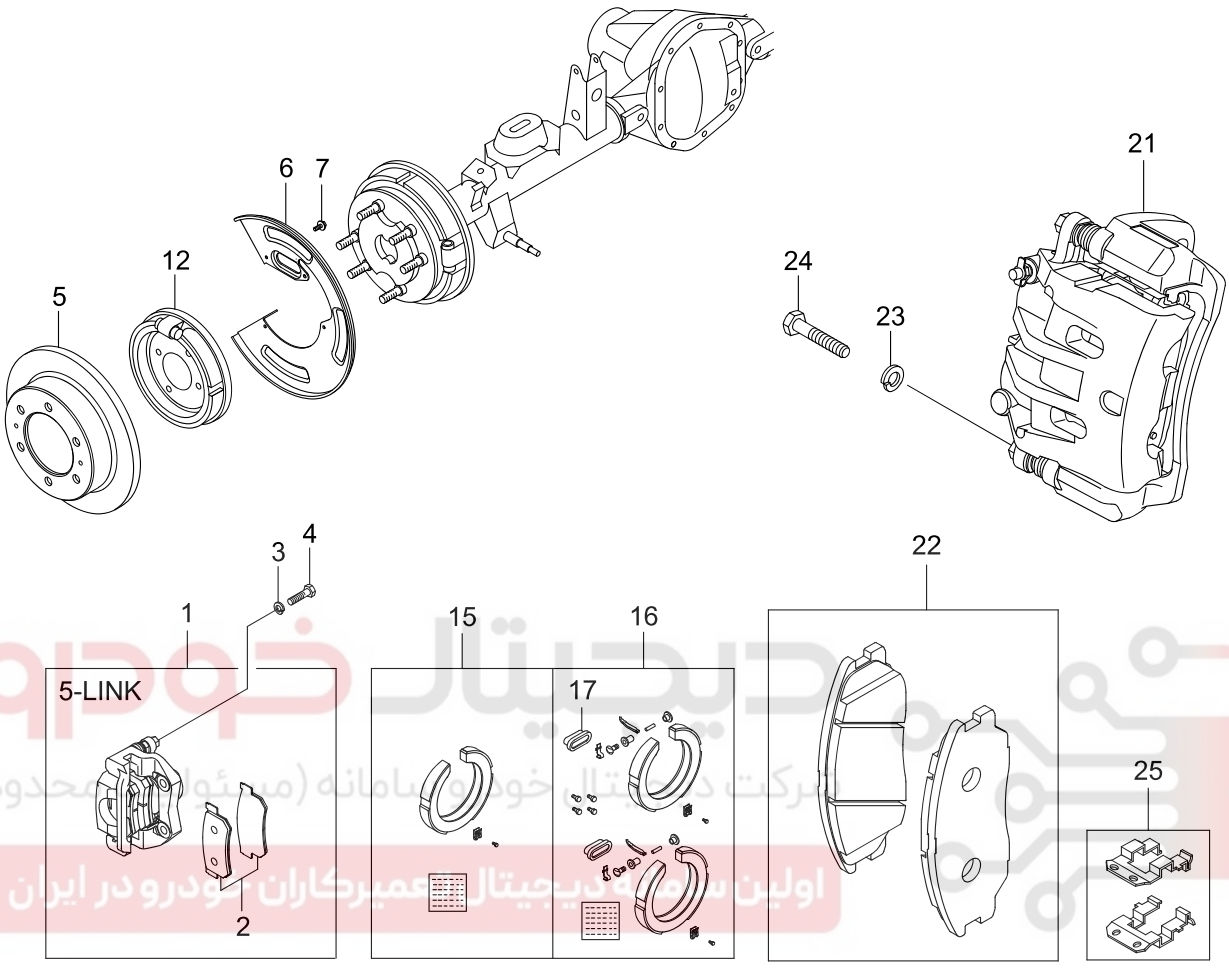
▶ Brake Pipe



1. Master cylinder primary tube assembly
2. Master cylinder secondary tube assembly
3. Front tube assembly
4. Front tube assembly
5. 2-way connector tube assembly
7. Front brake hose assembly
8. Front brake hose mounting holder
9. Flexible hose clip
11. Caliper eye bolt (19.6~29.4 Nm)
12. Brake tube mounting clip
13. Brake tube mounting clip
14. Brake tube mounting holder
20. Brake tube 2-way connector
21. Screw
22. Rear hose 2-way connector
24. 3-way connector hose tube assembly
25. Rear brake hose assembly
26. Rear brake hose assembly
27. Bolt (9.8~11.8 Nm)

Modification basis	
Application basis	
Effected VIN	

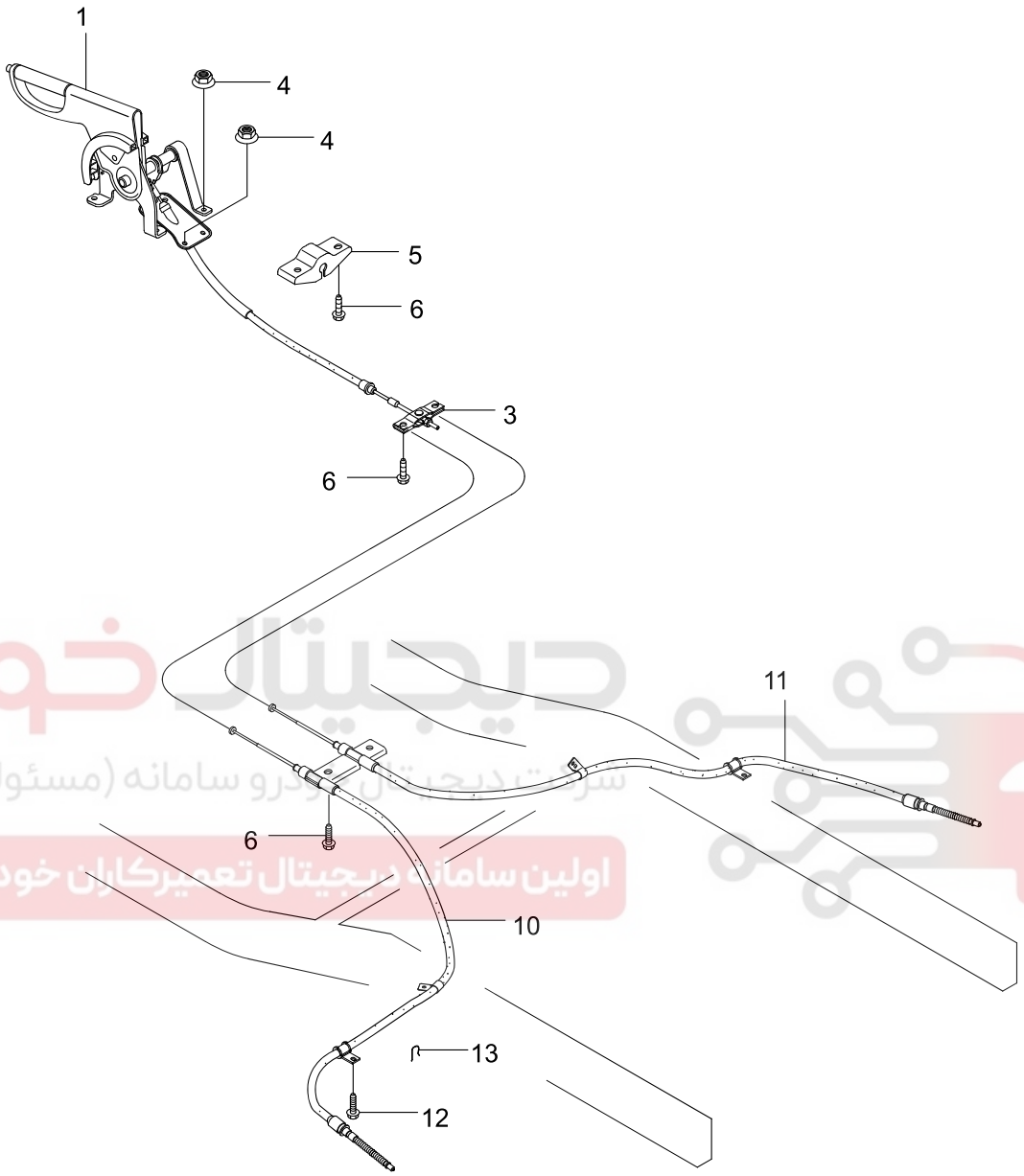
▶ Front/Rear Brake Assembly



1. Rear brake caliper assembly
2. Rear brake pad
3. Washer
4. Bolt (52.9~63.7 Nm)
5. Rear brake disc
6. Rear disc brake dust shield
7. Bolt
12. Rear drum brake assembly
15. Parking brake shoe
16. Parking brake repair kit
17. Rear axle shaft grommet
21. Front brake caliper assembly
22. Front brake pad
23. Washer
24. Front caliper mounting bolt (25.5~30.4 Nm)
25. Caliper clip set

Modification basis	
Application basis	
Affected VIN	

▶ Parking Brake



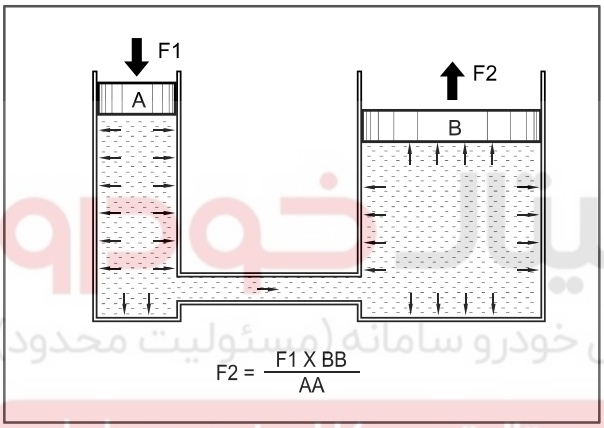
1. Parking brake lever assembly
3. Equalizer
4. Nut (9.8~12.7 Nm)
5. Front brake mounting bracket
6. Bolt
10. Parking brake rear cable assembly
11. Parking brake rear cable assembly
12. Bolt (9.8~12.7 Nm)
13. Parking brake cable retaining ring

OVERVIEW AND OPERATING PROCESS

1. OVERVIEW

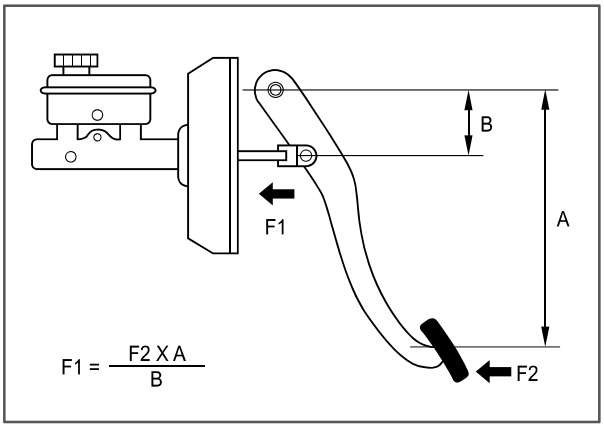
Even though a driver cuts off the power, while driving, the vehicle continues to move due to the law of inertia. Therefore, a braking device is needed to stop the vehicle. The brake system normally uses the frictional discs that converts the kinetic energy to the thermal energy by frictional operation. The brake system consists of the brake disc (front wheel), brake disc or drum (rear wheel), parking brake (mechanical type), master cylinder, booster, pedal and supply lines (pipes and hoses).

▶ Hydraulic Brake



This system uses the leverage effect and Pascal's principle. When depressing the brake pedal, the pedal pressure is increased by booster and is delivered to master cylinder to generate hydraulic pressure. The hydraulic pressure generated by the master cylinder is delivered to the brake caliper through the brake pipes or hoses. This hydraulic pressure pushes the brake calipers, accordingly the caliper pads are contacted to brake disc to generate the braking force.

▶ Brake Pedal



Brake pedal uses the leverage effect to apply bigger force to the brake master cylinder.

Modification basis	
Application basis	
Affected VIN	

▶ Braking distance & stopping distance

Stopping distance = free running distance + braking distance

What is stopping distance?

A certain distance (free running distance + braking distance) is needed from the moment an obstacle appears ahead until you bring your vehicle to a complete stop. This is called as stopping distance.
What is braking distance?
Tire slip occurs until the vehicle stops completely when the the brake is applied.
This slip is what we call a braking distance.

What is free running distance?

The free running distance is the time from the driver sees the obstacles and begins to prepare for depressing the brake pedal until the moment the brake pedal is depressed.

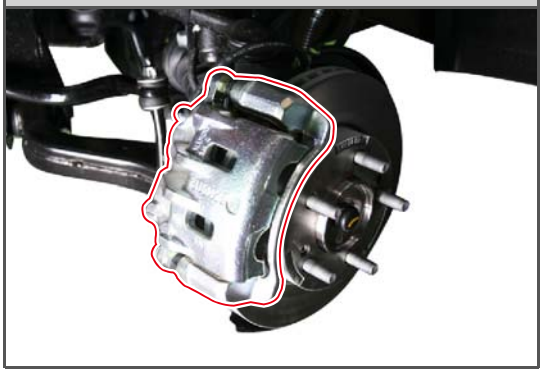
2. SYSTEM LAYOUT

Master Cylinder and Booster

HECU

Brake Pedal

Front Brake Assembly



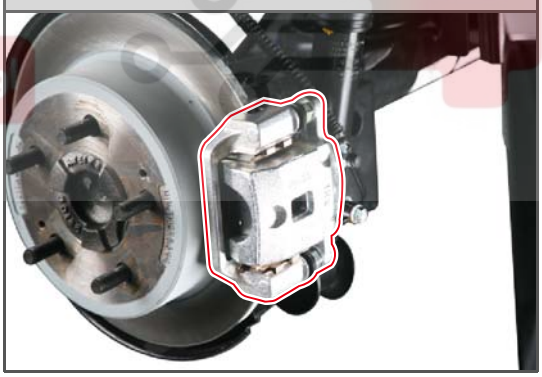
Front Wheel Speed Sensor (4WD)

Modification basis	
Application basis	
Affected VIN	

ABS/EBD Indicators

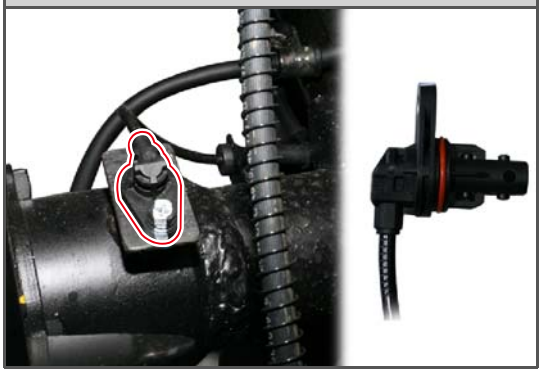
Parking Brake Lever

Rear Brake Assembly



Parking Brake

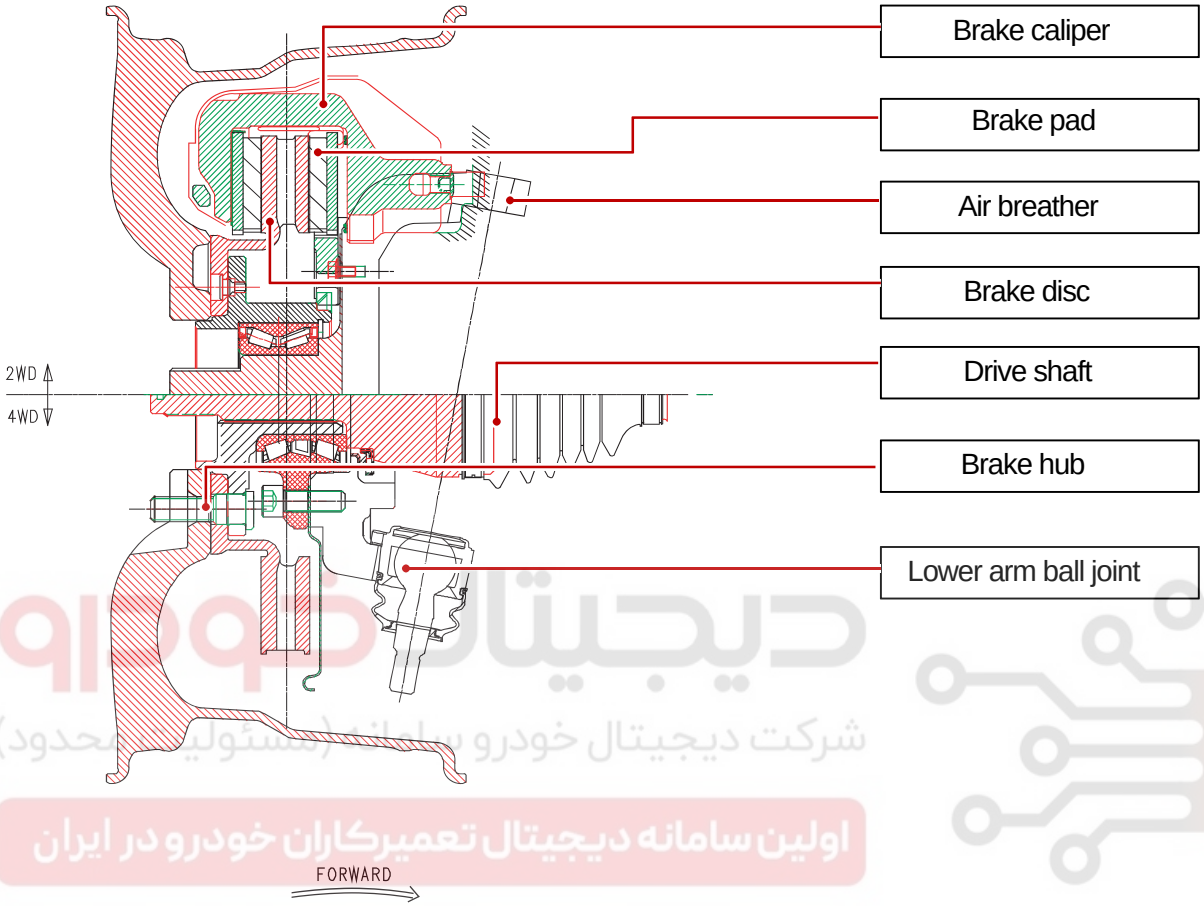
Rear Wheel Speed Sensor (4WD)

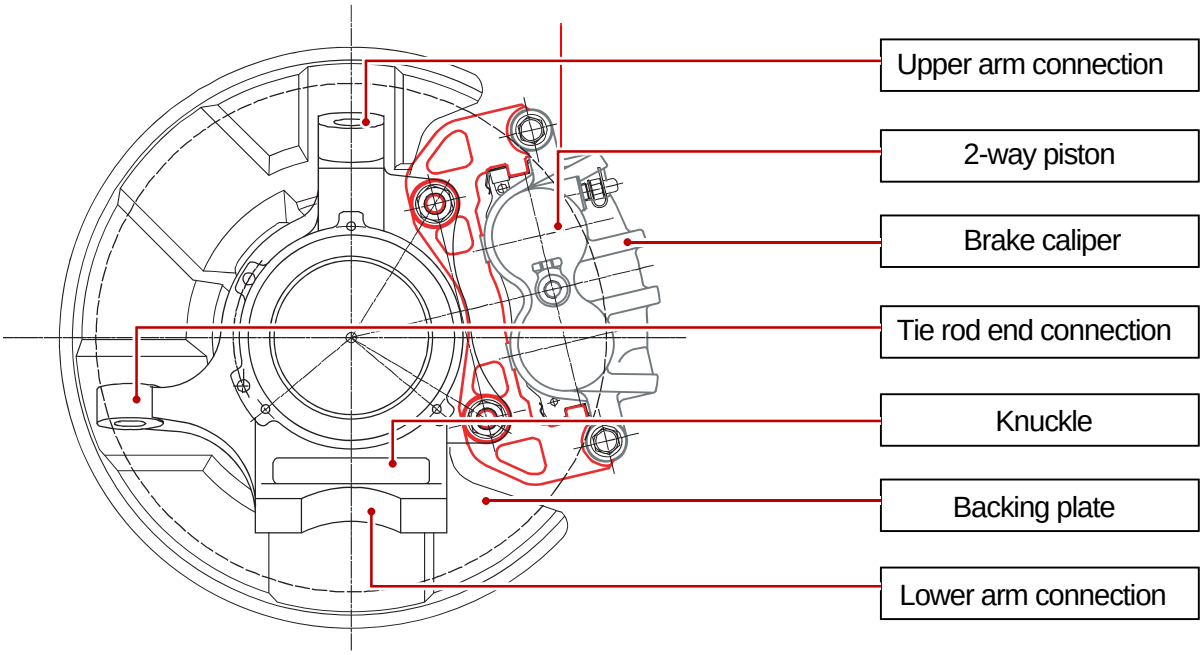


Modification basis	
Application basis	
Effected VIN	

3. PARKING BRAKE

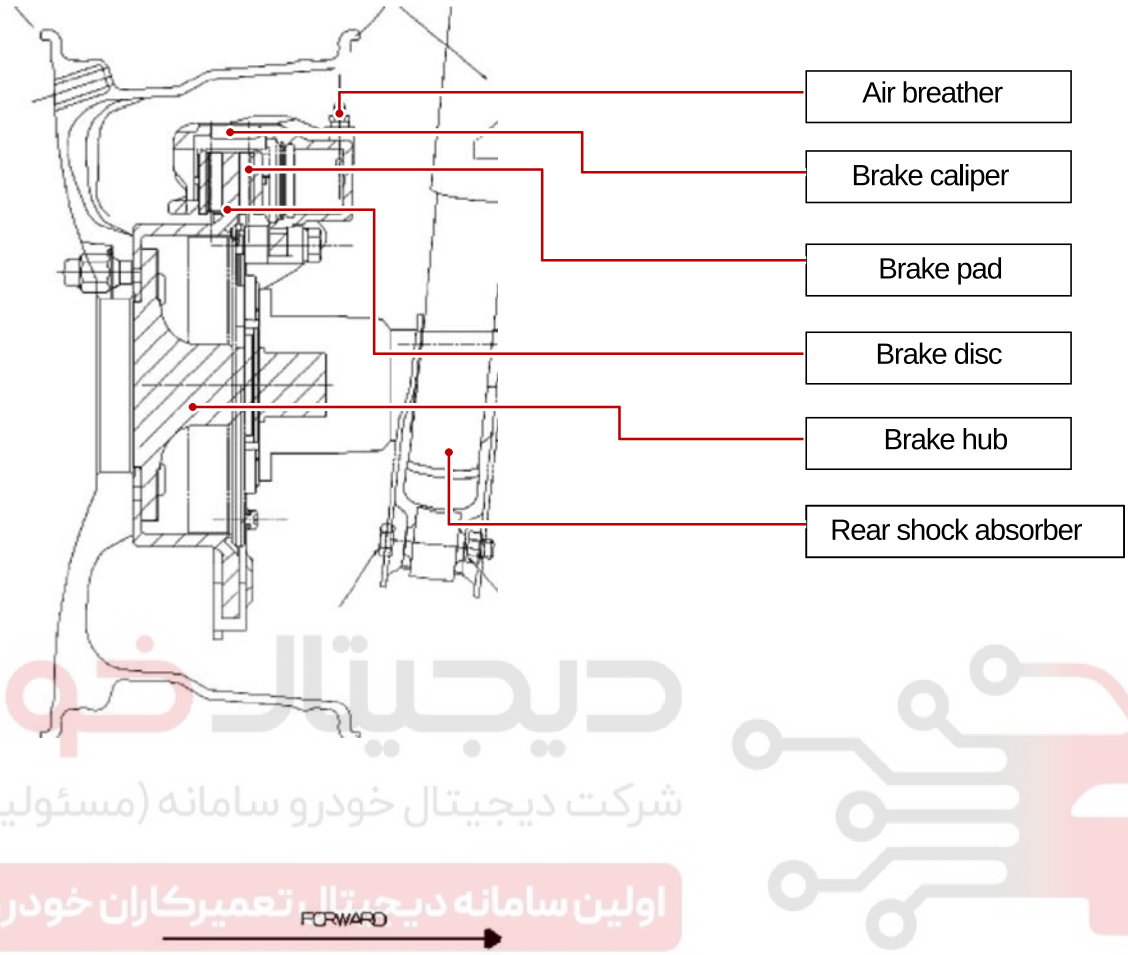
▶ Front Disc Brake

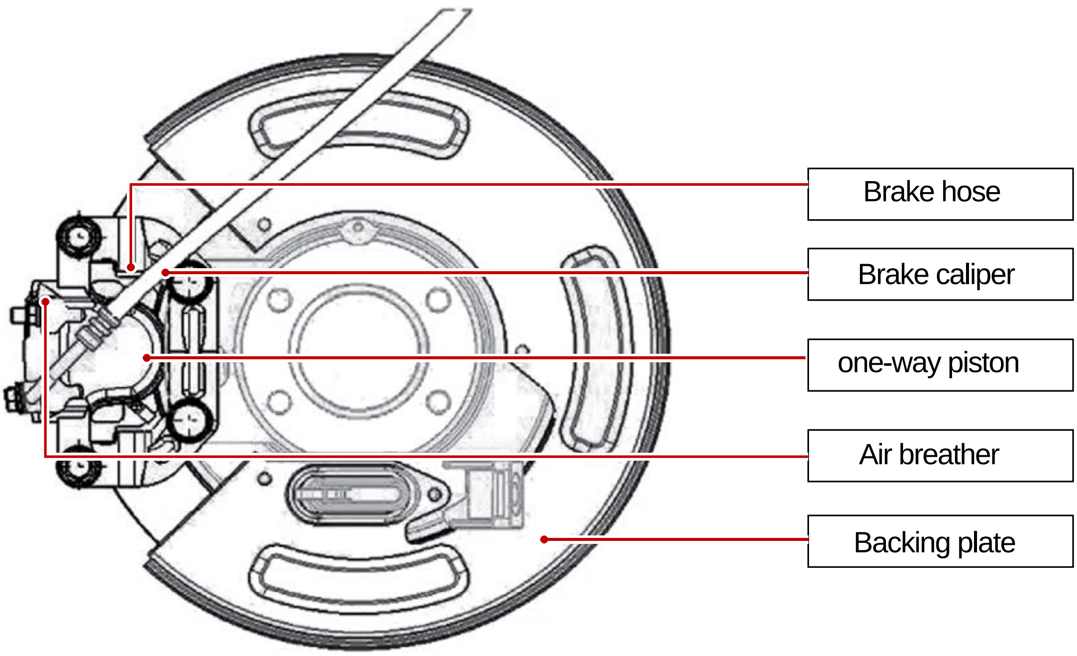




Modification basis	
Application basis	
Affected VIN	

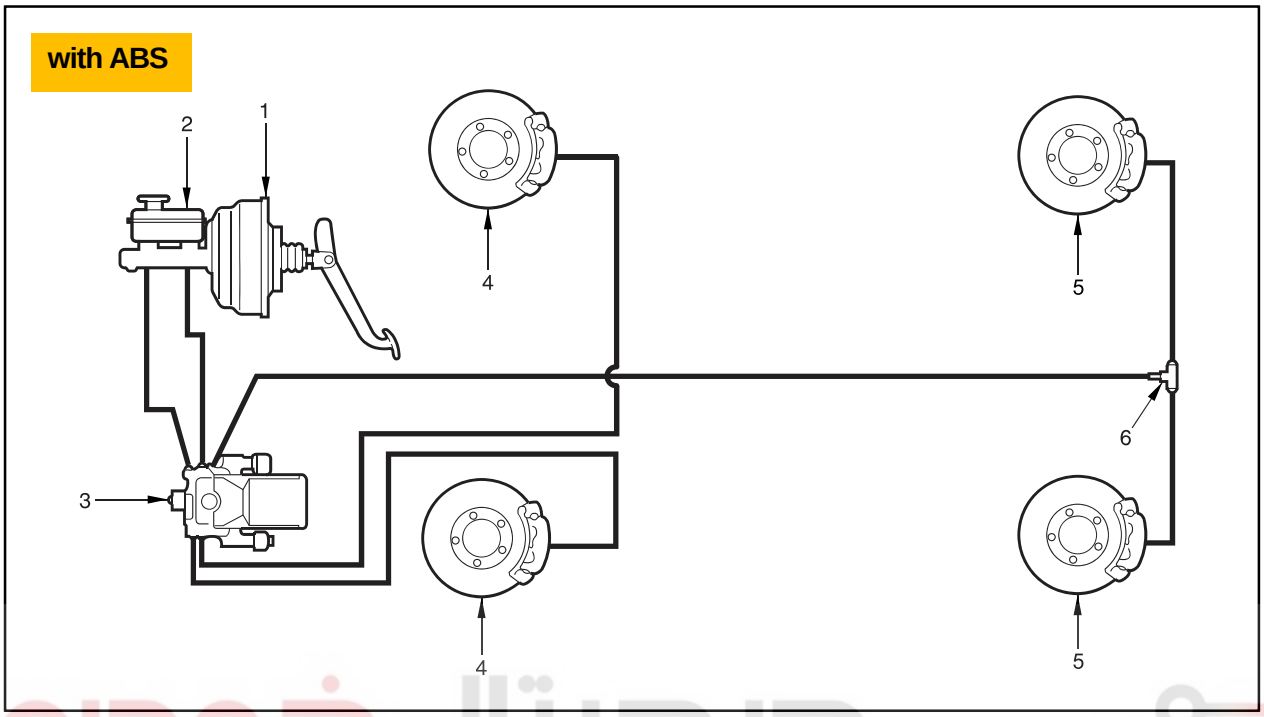
▶ **Rear Disc Brake**





Modification basis	
Application basis	
Affected VIN	

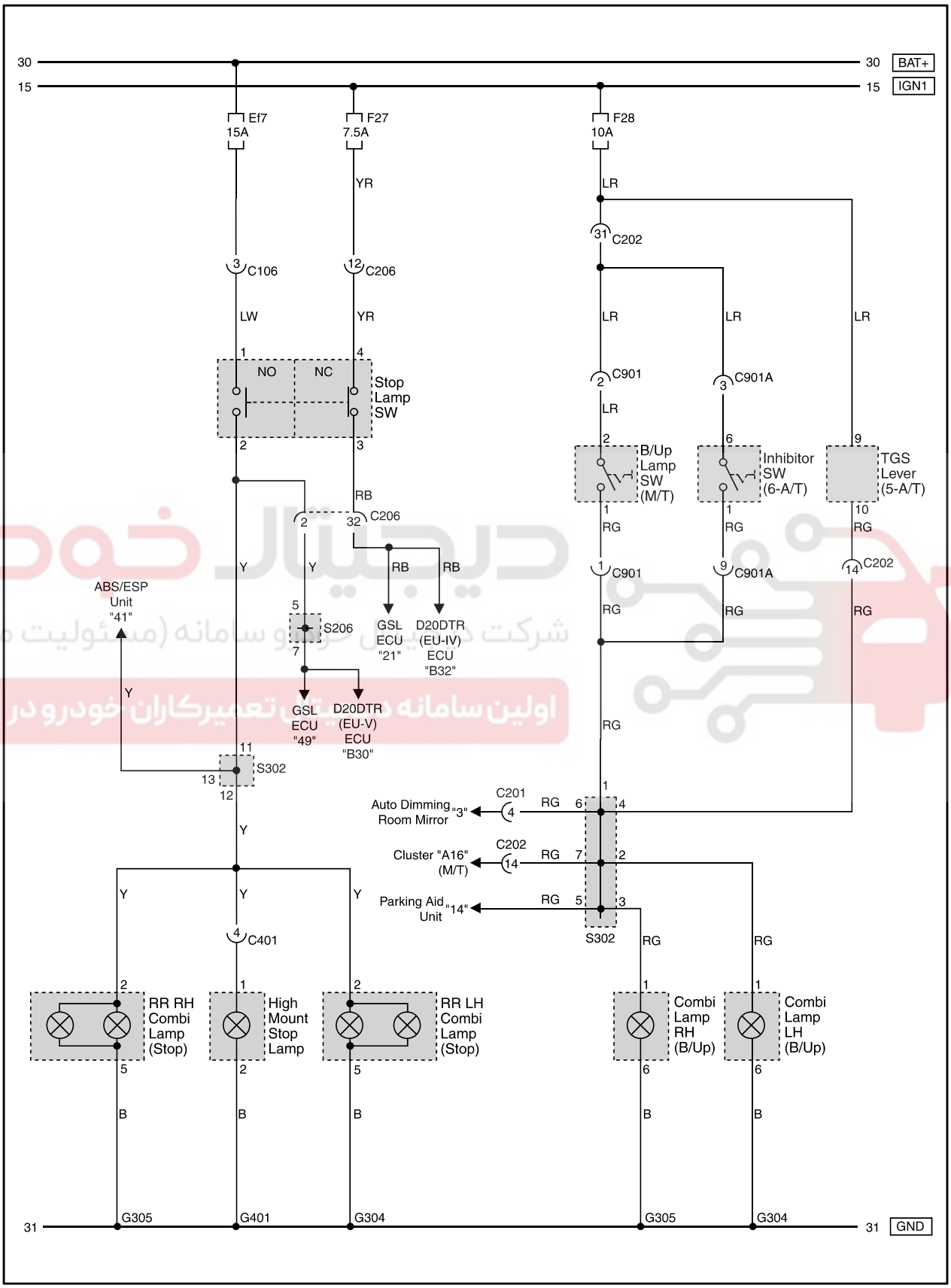
4. HYDRAULIC CIRCUIT



1. Brake booster
2. Brake fluid reservoir and master cylinder
3. HECU (Hydraulic & Electric Control Unit)
4. Front disc brake and caliper
5. Rear disc brake and caliper
6. 3-way connector (ESP ONLY)

Modification basis	
Application basis	
Affected VIN	

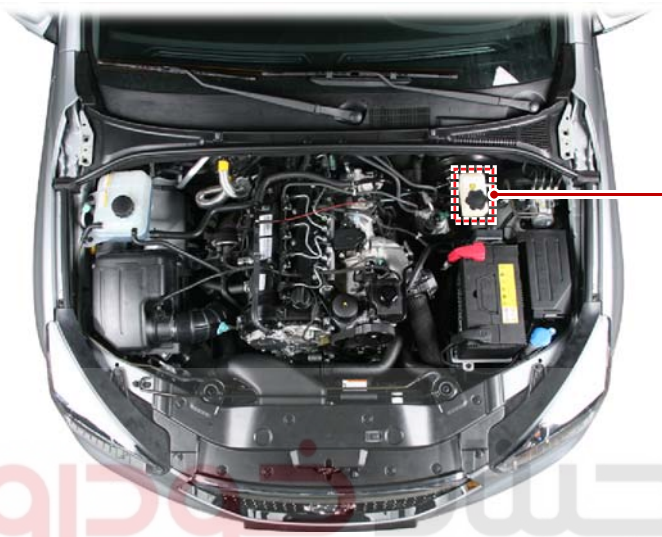
5. CIRCUIT DIAGRAM OF STOP LAMP



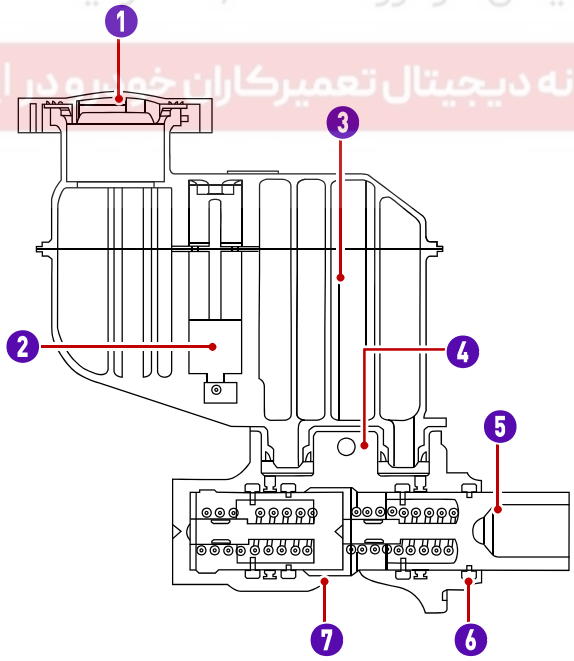
CONFIGURATION AND FUNCTION

S.G.N. 4850-01 BRAKE MASTER CYLINDER ASSEMBLY

Brake master cylinder is located at the brake booster in engine comopartment. It generates the hydraulic pressure to stop the vehicle when thr driver depress the brake pedal.



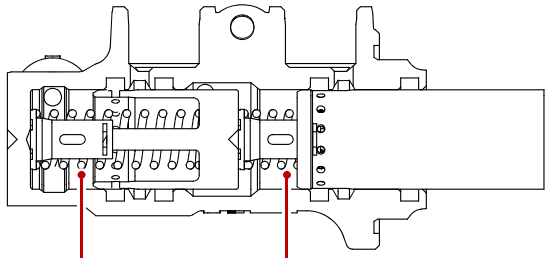
Brake Master Cylinder



1. Reservoir cap
2. Brake fluid float
3. Reservoir
4. Grommet
5. Primary piston
6. L-type sealing
7. Secondary piston

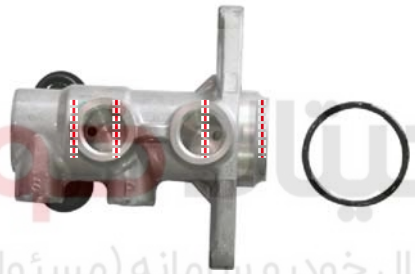
Modification basis	
Application basis	
Affected VIN	

▶ Master Cylinder

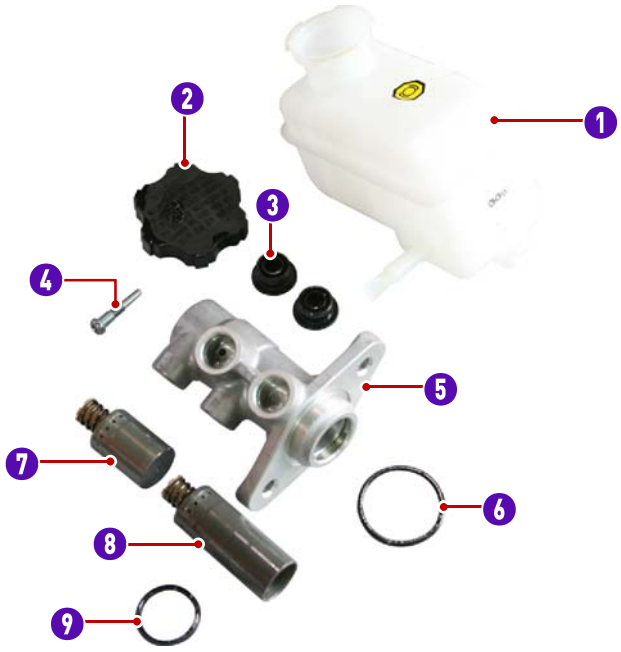


The brake master cylinder is designed to convert the force from the brake master cylinder to the high hydraulic pressure. The brake system uses the tandem type master cylinder with in-line 2 pistons. The in-line 2 pistons generate the hydraulic pressure. The piston cup on the piston keeps the sealing conditions in cylinder and prevents the oil leaks. The hydraulic pressure generated by the primary piston is delivered to the front wheels, and the hydraulic pressure generated by the secondary piston is delivered to the rear wheels.

L-type Sealing



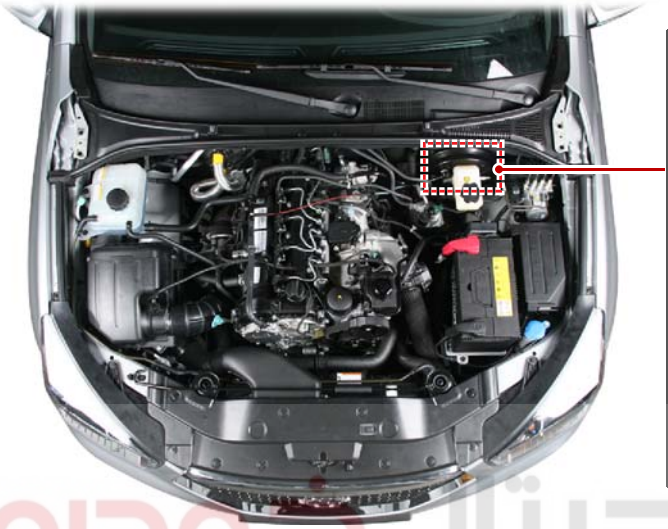
Master Cylinder Assembly



1. Brake fluid reservoir
2. Reservoir cap
3. Grommet
4. Screw
5. Master cylinder assembly
6. O-ring
7. Secondary piston
8. Primary piston
9. L-type sealing

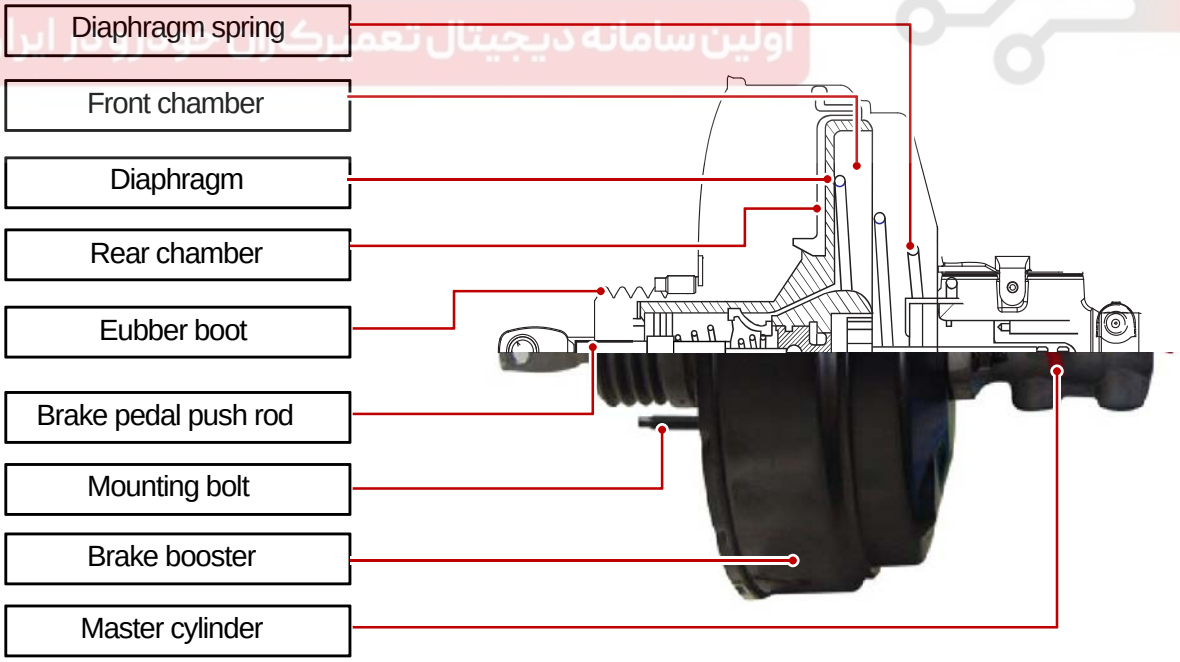
S.G.N. 4850-02 BRAKE BOOSTER ASSEMBLY

The brake booster is located in the engine compartment. The brake booster is a power assist device for brake system. It relieves the pedal depressing force by using the pressure difference between the vacuum pressure generated by vacuum pump in intake manifold and the atmospheric pressure.

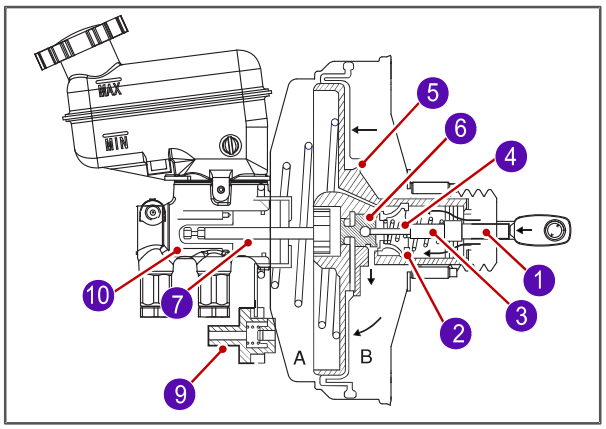


Brake Booster

Components

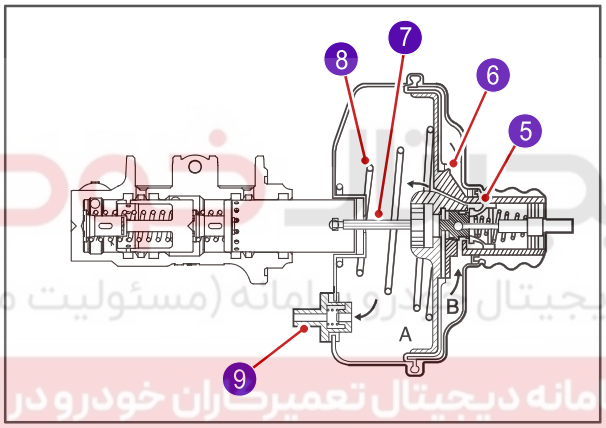


Modification basis	
Application basis	
Affected VIN	



1. **Pressure distribution at working**

When depressing the brake pedal, the push rod (1) in booster pushes the poppet (2) and valve plunger (3). The poppet (2) pushes the power piston seat (5) resulting in closing the vacuum valve (9). The chamber (A) and (B) in power cylinder are isolated and the valve plunger (3) is separated from the poppet (2). And then the air valve (6) opens and air flows into the chamber (B) through filter. Then, the power piston (5) pushes the master cylinder push rod (7) to assist the brake operation.



2. **Pressure distribution after working**

When releasing the brake pedal, the valve plunger (3) returns back to the original position by return spring (4) and the air valve (6) closes. At this time, the vacuum valve (9) opens and the pressure difference between chamber (A) and (B) in power cylinder is eliminated. Accordingly, the power piston (5) returns back to original position by the reaction of master cylinder (10) and the diaphragm return spring (8).

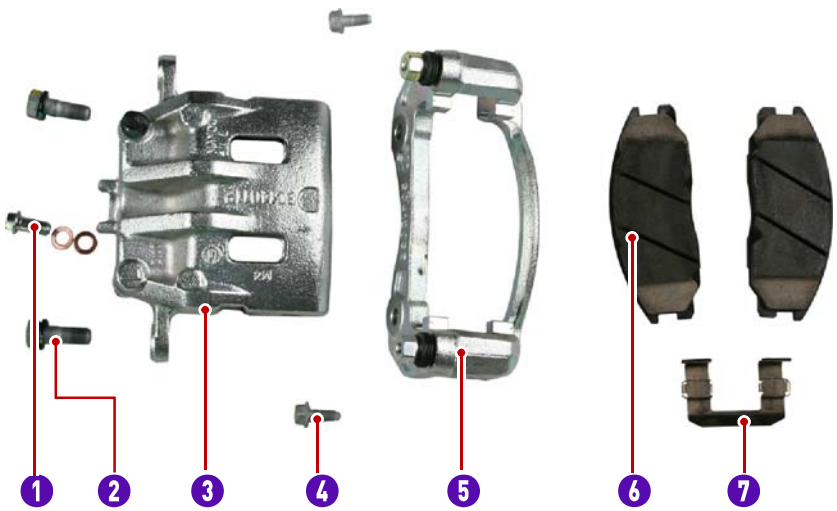
S.G.N. 4803-01

FRONT BRAKE CALIPER ASSEMBLY

The disc brake is normally used for front wheels. The floating caliper type disc brake installed in this vehicle has two brake cylinders at one side of caliper. The hydraulic pressure generated by master cylinder pushes the piston to contact the pad against the disc. The caliper is moved to contact to the opposite pad.

Front Brake Caliper Assembly

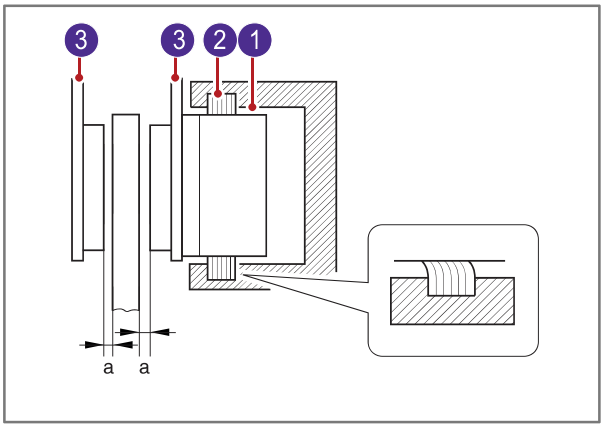
2-Port Brake Caliper Assembly



1. Eye bolt
2. Bolt
3. Caliper (2-port piston)
4. Bolt
5. Carrier
6. Brake pad
7. Clip

Modification basis	
Application basis	
Affected VIN	

▶ Adjustment of Clearance

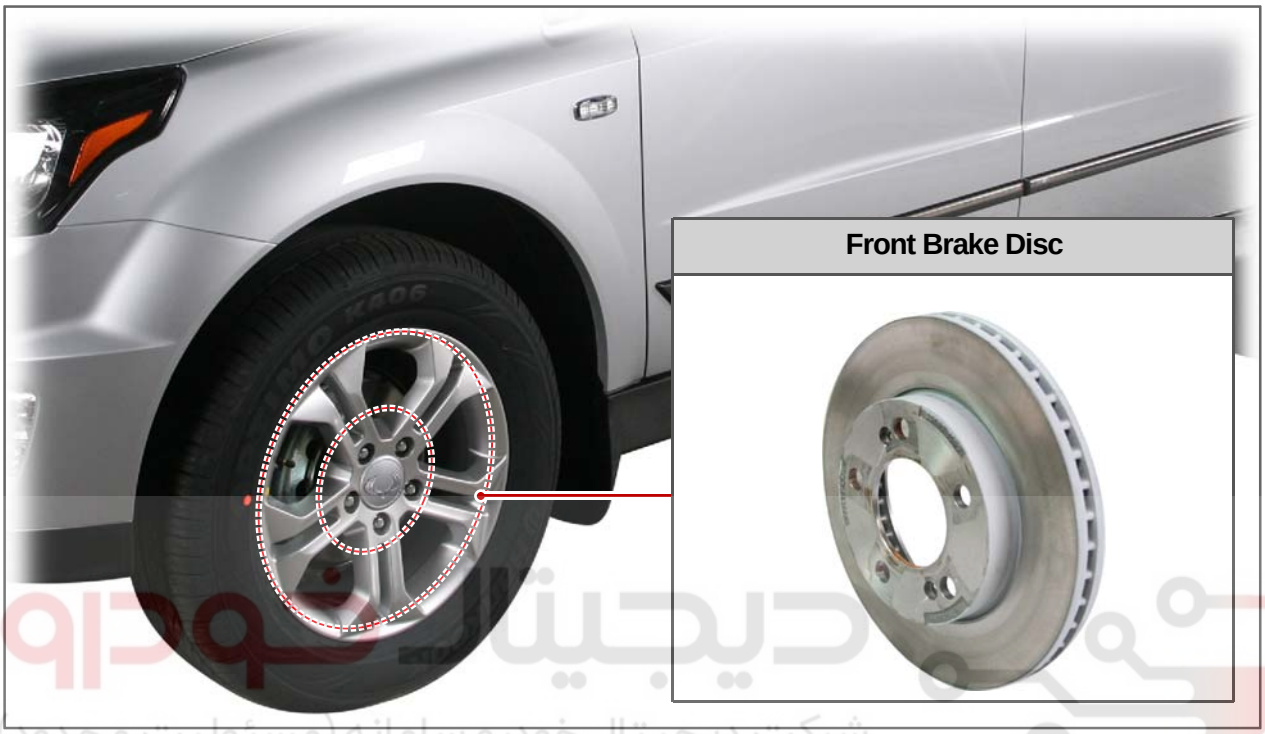


1. Piston
2. Piston seal
3. Pad
a. Clearance

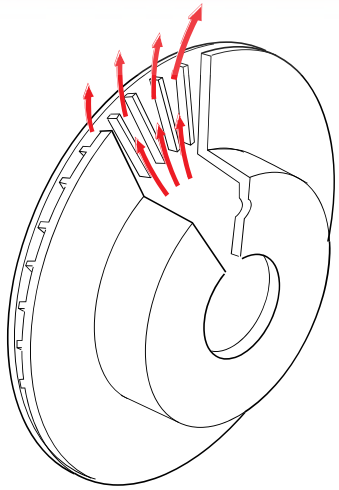
When the hydraulic pressure is applied to the piston, the piston moves to push the pad. The piston seal, which extent considerable pressure against the piston, moves with cylinder. However, the piston seal shape is deformed since the piston seal is fixed at the cylinder groove as shown in below figure. When the pressure is released from the piston, the piston comes back to its original position by a restoring and elastic force of the seal. When the pad wear is excessive, the piston seal cannot reach to the desired point because the seal's deformation is limited. Accordingly, the piston always comes back by the deformed distance of piston seal, it keeps the initial clearance.

S.G.N.
4115-01 FRONT BRAKE DISC

To stop the wheel, friction material in the form of brake pads (mounted on a device called a brake caliper) is forced hydraulically against the disc.



Ventilated Disc



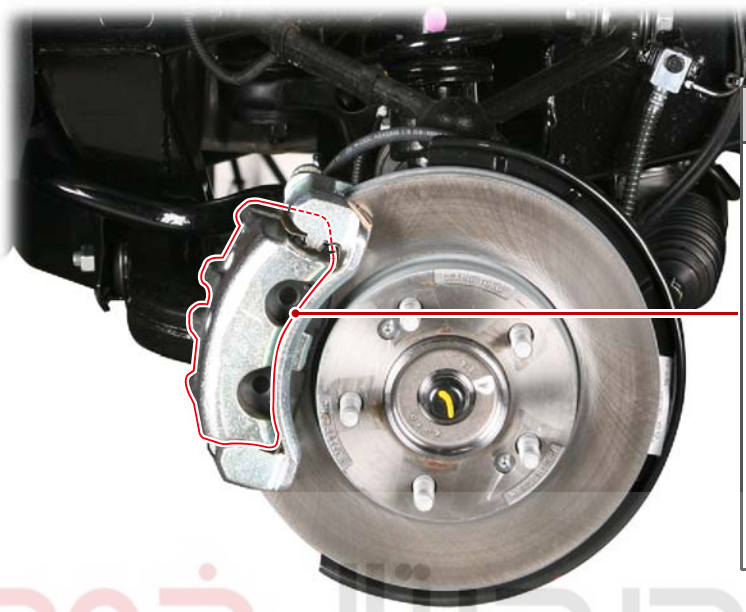
The ventilated disc design helps to dissipate the generated heat and is commonly used on the more-heavily-loaded front discs.

Modification basis	
Application basis	
Affected VIN	

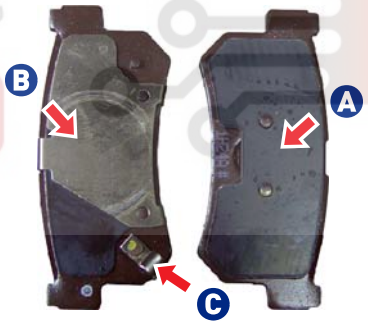
S.G.N. 4830-02

BRAKE PAD

Brake pad is a component of disk brake used in automotive. Brake pad is steel backing plates with friction material bound to the surface that faces the disk brake rotor.



Brake Pad

2-port Front Brake Pad	1-port Front Brake Pad
	

A. Anti-noise shim
- Prevents the development of noise when braking
- Clip type
- Double layer type with rubber and steel plates

B. Cover shim
- Prevents the piston oil seal from damaging due to friction heat
- Stainless

C. Pad wear sensor
- Informs the pad change timing
- Contacts against the brake disc to generate the noise

Modification basis	
Application basis	
Affected VIN	

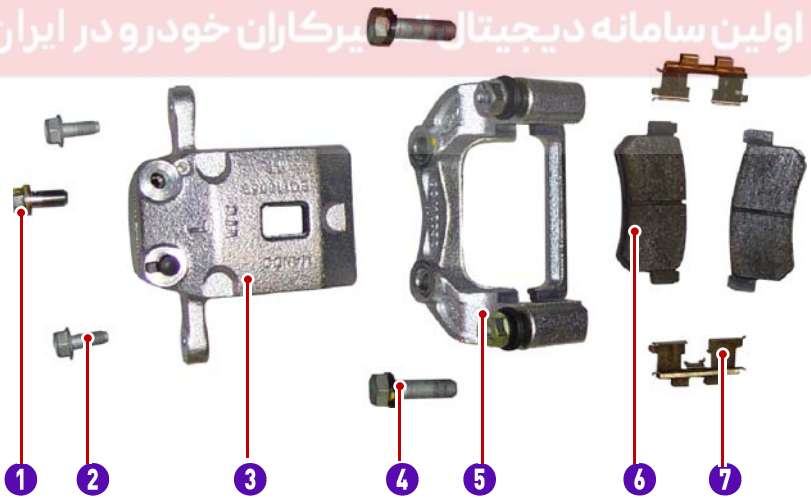
S.G.N. 4841-01

REAR BRAKE CALIPER ASSEMBLY

The disc brake is normally used for front wheels, however, it is also used for rear wheels in the vehicle with ABS or ESP system. The floating caliper type disc brake installed in this vehicle has only one brake cylinder at one side of caliper. The hydraulic pressure generated by master cylinder pushes the piston to contact the pad against the disc. The caliper is moved to contact to the opposite pad.

Raer Brake Caliper

1-Port Rear Brake Caliper Assembly

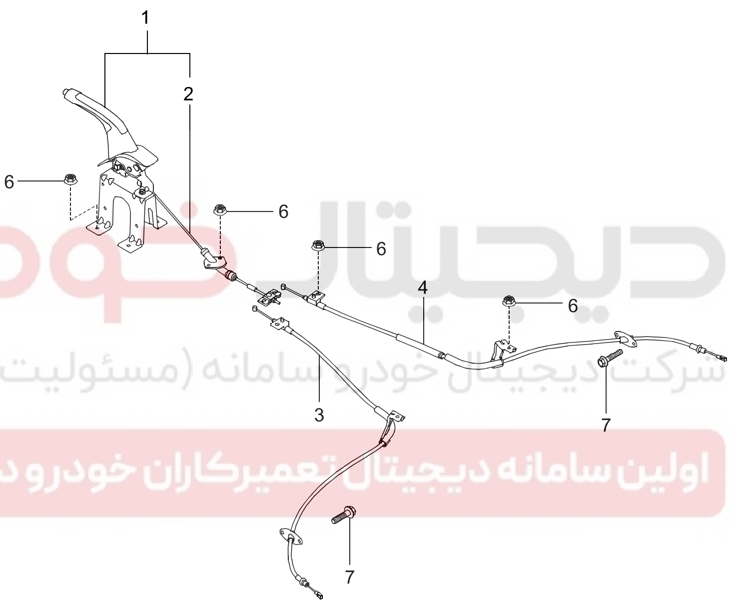


1. Eye bolt
2. Bolt
3. Caliper (1-port piston)
4. Bolt
5. Carrier
6. Brake pad
7. Pad spring

Modification basis	
Application basis	
Affected VIN	

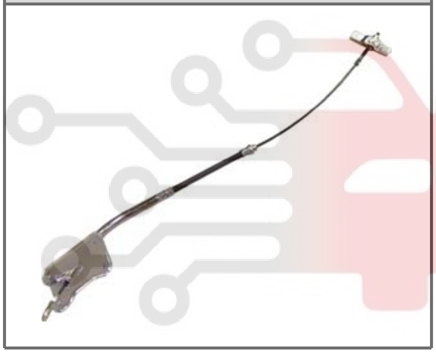
S.G.N. 4910-01 PARKING BRAKE

The parking brake is the mechanical device to hold the vehicle. When pulling up the lever, the parking brake cable between the lever and the rear drum brake trailing shoe pulls the parking brake lining to contact to drum.



Parking Brake Lever

Center Cable

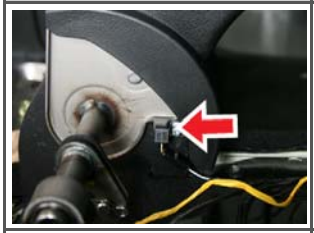
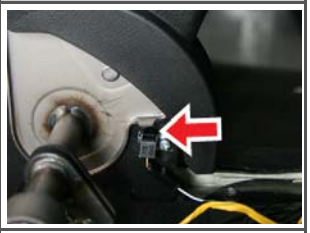


Rear Cable

Modification basis	
Application basis	
Affected VIN	

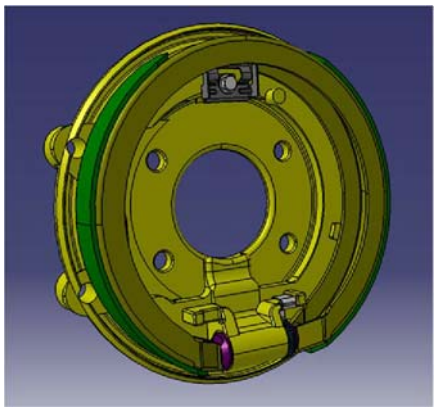
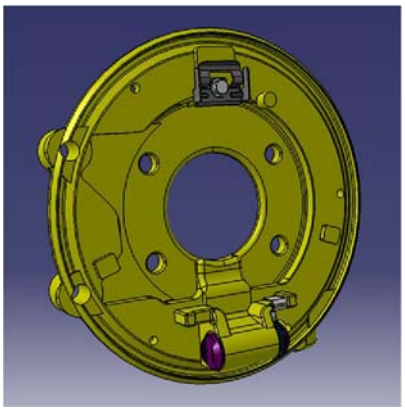
▶ Parking Brake Switch and Warning Lamp

When pulling up the parking brake lever with the ignition ON, the parking brake indicator comes on.

Released	Applied
	
	

Warning Lamp


▶ Inside View

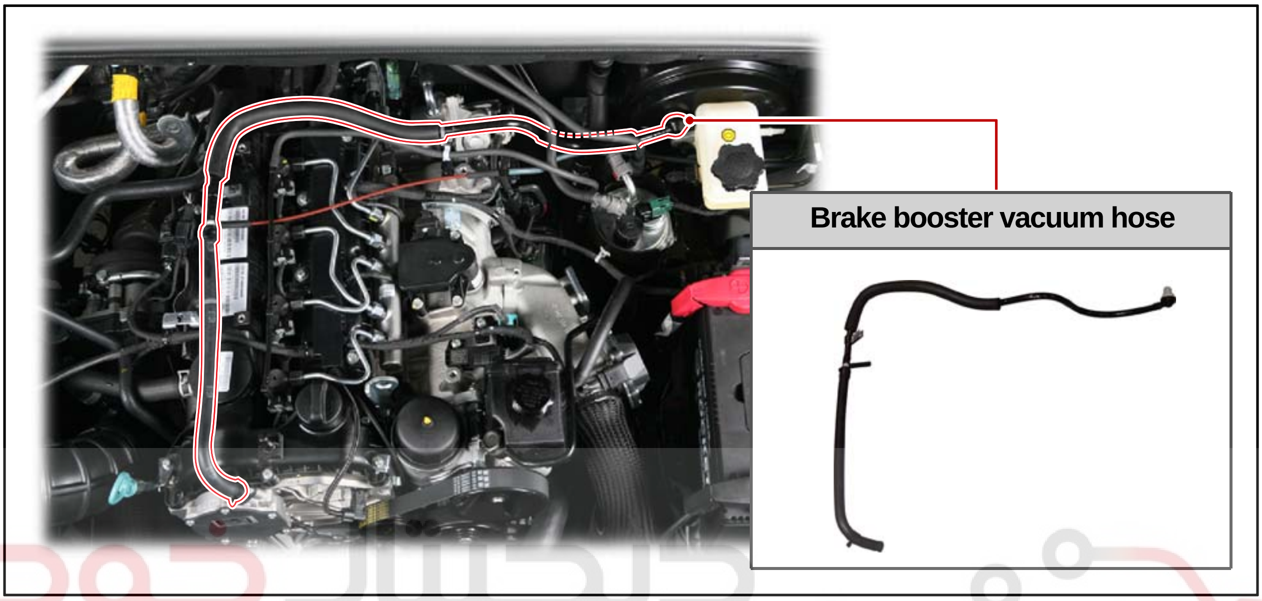
with Parking Brake	without Parking Brake
	

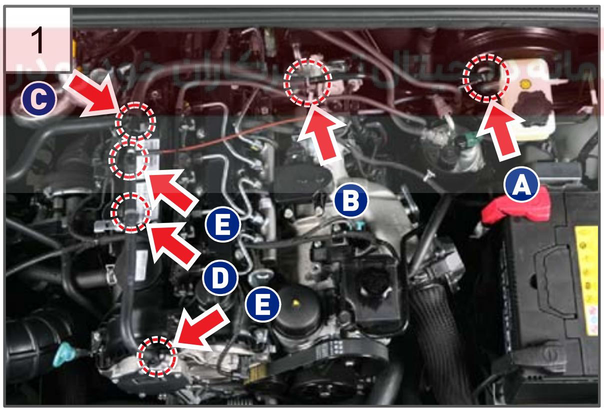
Modification basis	
Application basis	
Affected VIN	

REMOVAL AND INSTALLATION

S.G.N. 4850-09 BRAKE BOOSTER VACUUM HOSE

Preceding work - Remove the acoustic cover in engine compartment.

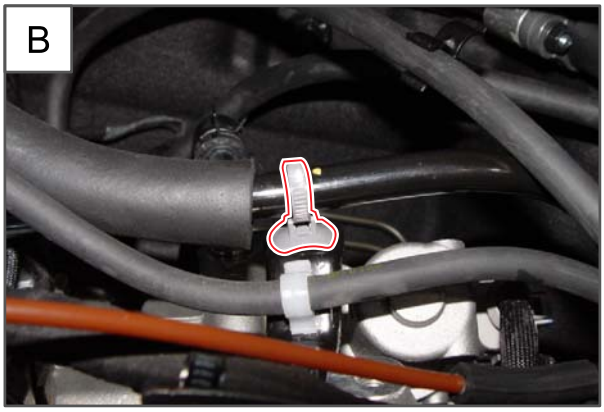




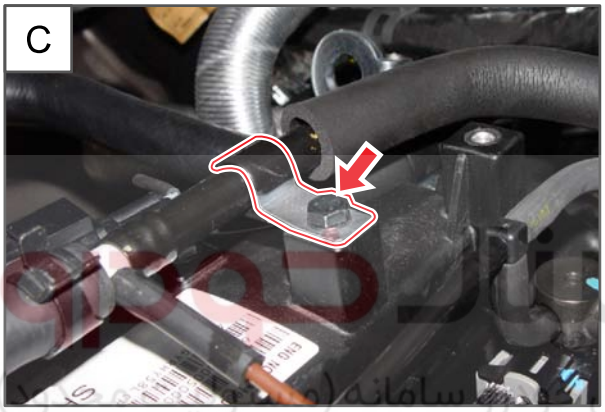
1. Disconnect the vacuum hode.

A Disconnect the vacuum hose from the brake booster.

Modification basis	
Application basis	
Affected VIN	



B. Disconnect the hose from the clamp (booster side).

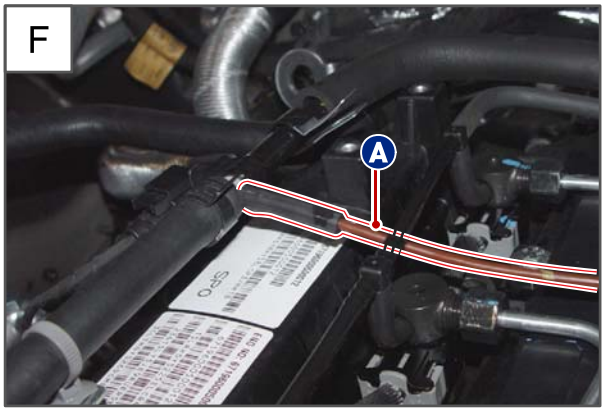


C. Remove the center clamp.

D. Disconnect the hose from the clamp (vacuum pump side)

E. Disconnect the vacuum hose from the vacuum pump.

Modification basis	
Application basis	
Affected VIN	



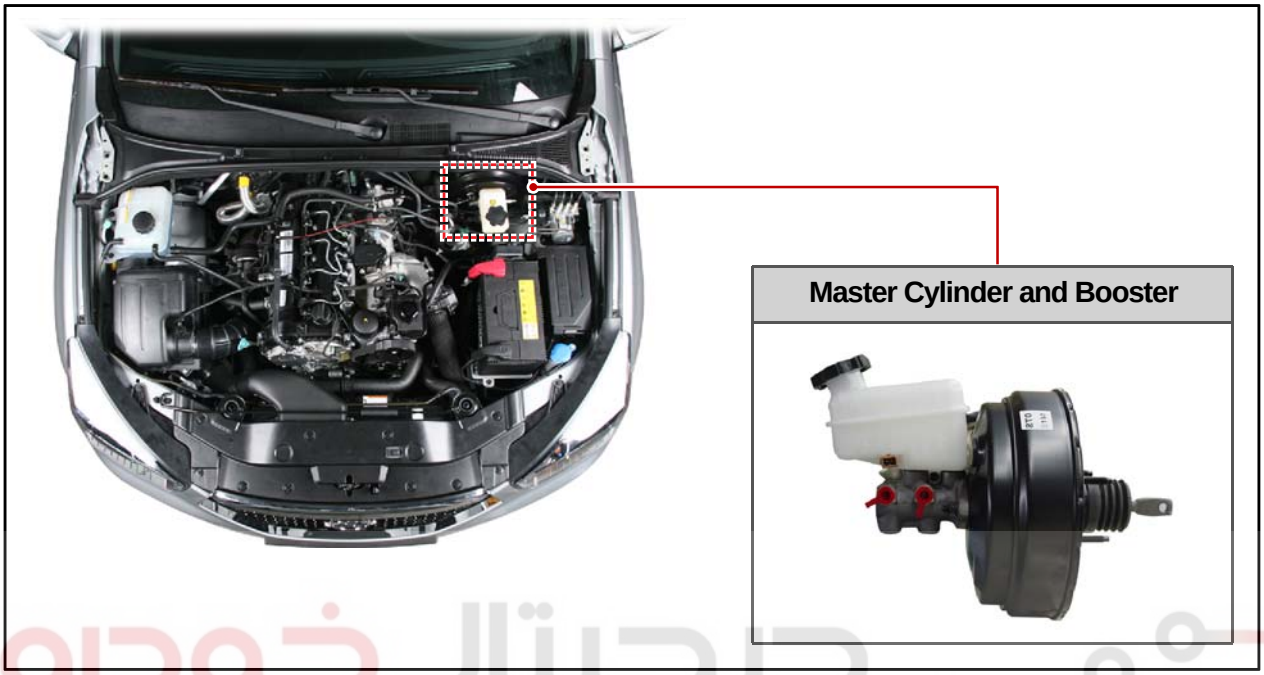
F. Disconnect the vacuum hose (A) to solenoid at center area and remove the vacuum hose.

2. Install the vacuum hose in the reverse order of removal.

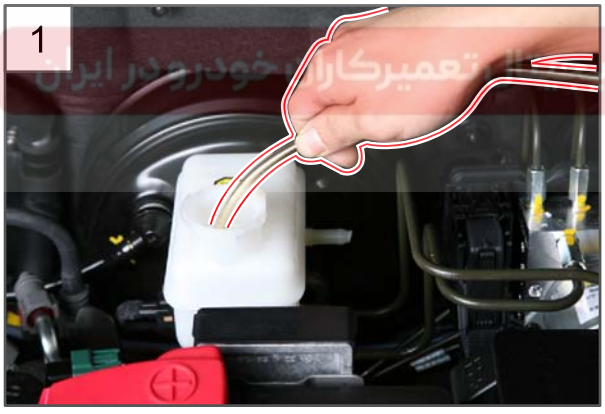
S.G.N. 4850-01

MASTER CYLINDER AND BOOSTER

Preceding work - Disconnect the negative cable from the battery.



1

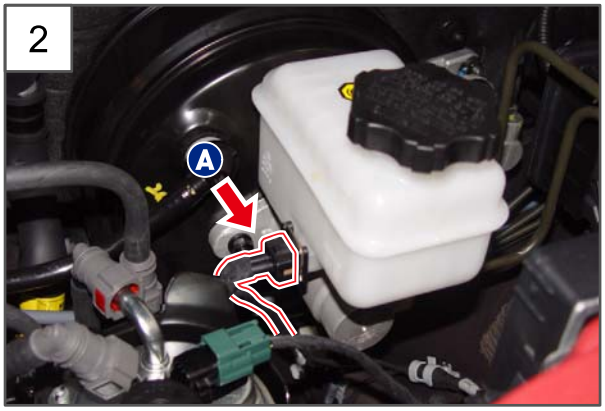


1. Open the brake fluid reservoir cap and drain the brake fluid in the fluid reservoir using the suction device.

CAUTION

Make sure that the brake fluid does not get on other parts when draining it.

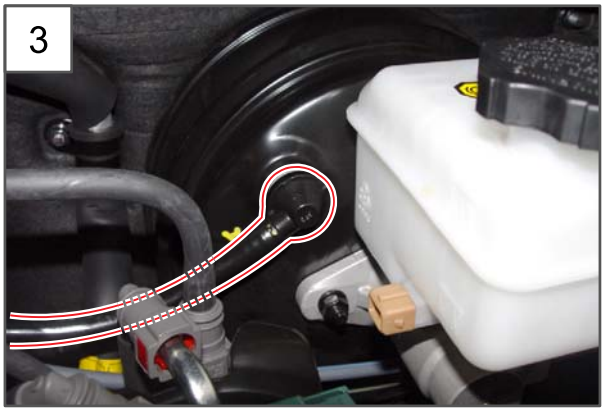
2



2. Disconnect the level switch connector (A) from the brake fluid reservoir.

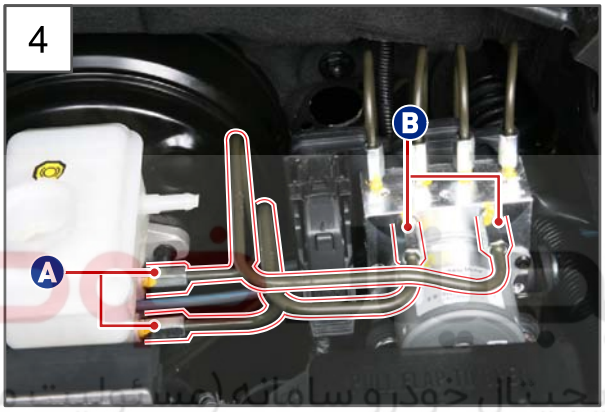
Modification basis	
Application basis	
Affected VIN	

3



3. Disconnect the vacuum hose from the brake booster.

4

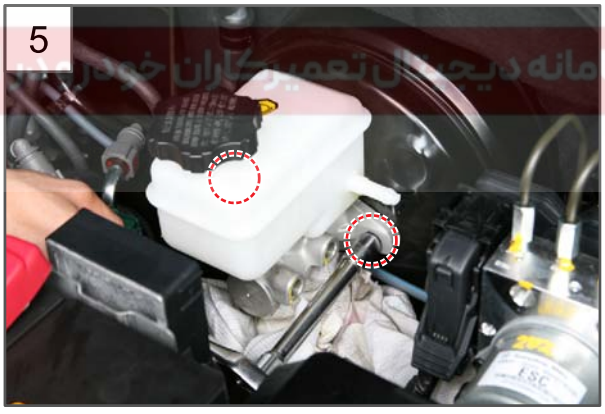


4. Unscrew two pipe nuts (A, 12 mm) to master cylinder and two pipe nuts (B, ESP: 12 mm-2EA, ABS: 10mm-2EA) to HECU, and remove the pipes.

Tightening torque (A) 19 ~ 23Nm

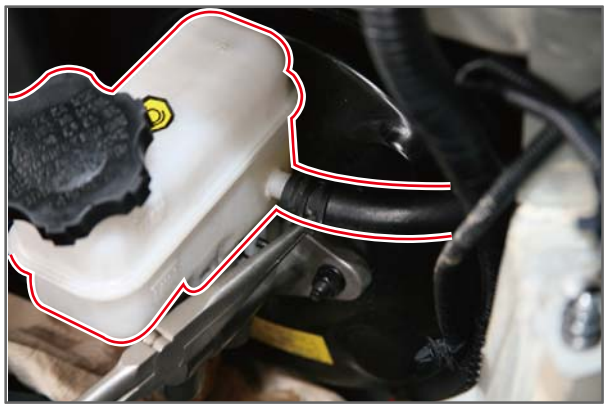
Tightening torque (B) 19 ~ 23Nm(ESP)
12 ~ 16Nm(ABS)

5



5. Unscrew two nuts (12 mm) and remove the brake master cylinder.

Tightening torque 12.8 ~ 16.7Nm



For manual transmission equipped vehicle, disengage the clamp for the hose connected to the clutch master cylinder from the brake fluid reservoir and disconnect the hose from the reservoir.

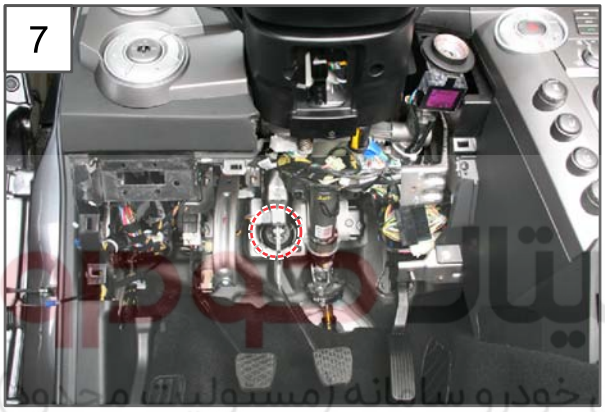
CAUTION

Place a piece of cloth or shop rag under the hose in order to prevent the brake fluid from getting on other parts as the fluid remaining in the hose may flow out. The opening of the removed hose should be covered with plastic bag, etc.

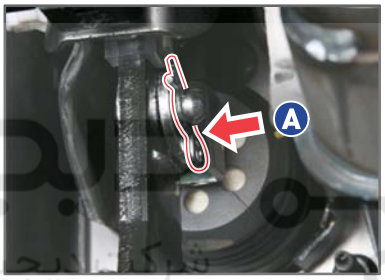
6

6. Separate the brake master cylinder from the brake booster.

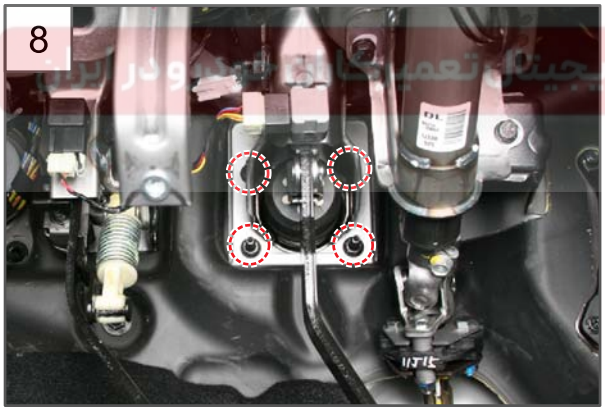
7



7. Pull out the clevis pin (A) from the push rod and pedal.



8



8. Unscrew four nuts (12 mm) from the brake booster.

Tightening torque 17.6 ~ 21.6Nm

9

9. Remove the brake booster from the engine compartment.

10. Install the brake booster and msater cylinder in the reverse order of removal.

Modification basis	
Application basis	
Affected VIN	

Brake Booster Assembly

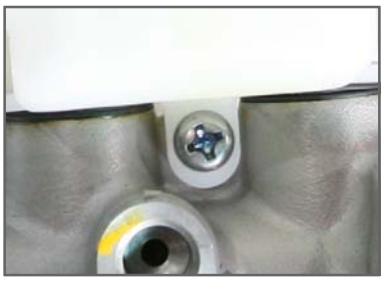
Master Cylinder Assembly

Modification basis	
Application basis	
Affected VIN	

▶ Disassembly of Brake Fluid Reservoir

1

1. Remove the screw from the removed master cylinder.



2

2. Separate the master cylinder and the reservoir.

3

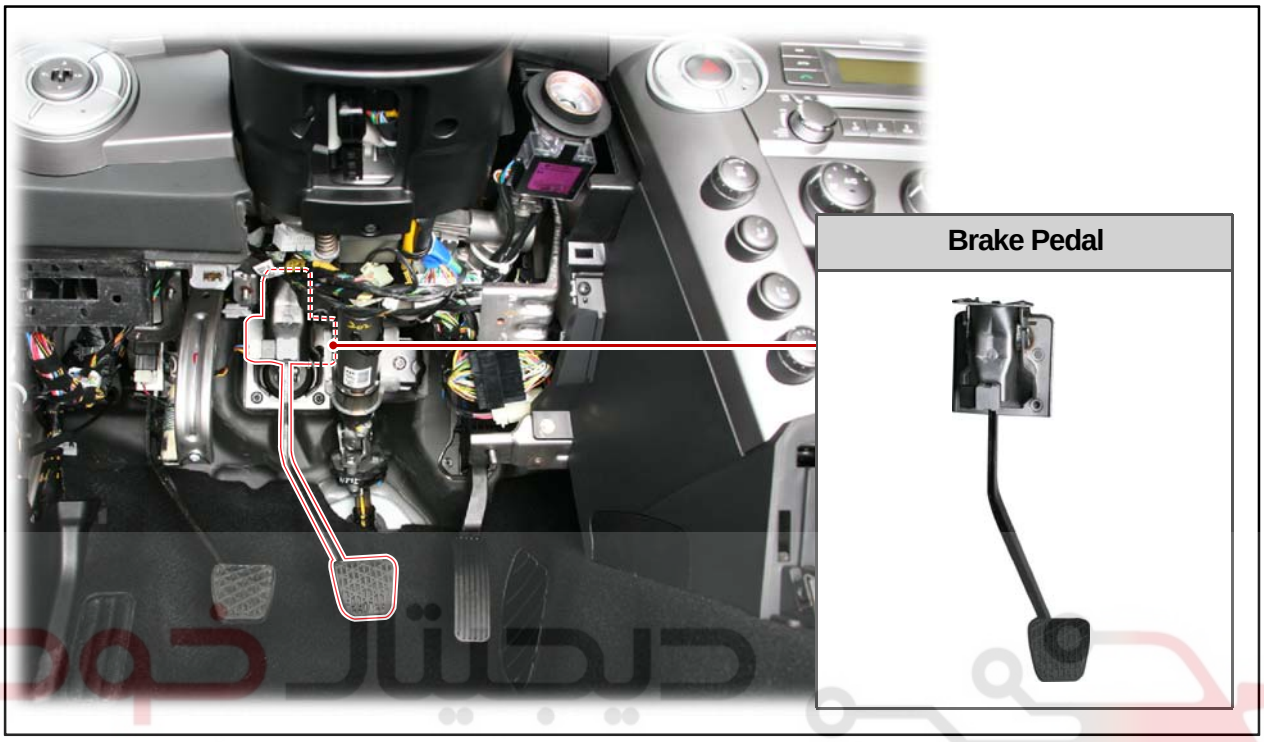
3. Reassemble the brake fluid reservoir in the reverse order of diassembly.

Modification basis	
Application basis	
Affected VIN	

S.G.N. 4810-01

BRAKE PEDAL

Preceding work - Disconnect the negative cable from the battery.



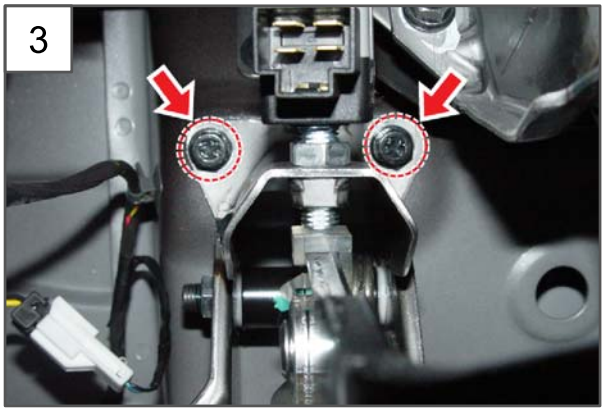
1

1. Disconnect the stop lamp switch connector (A).

2

2. Pull out the clevis pin (A) from the brake pedal and push rod.

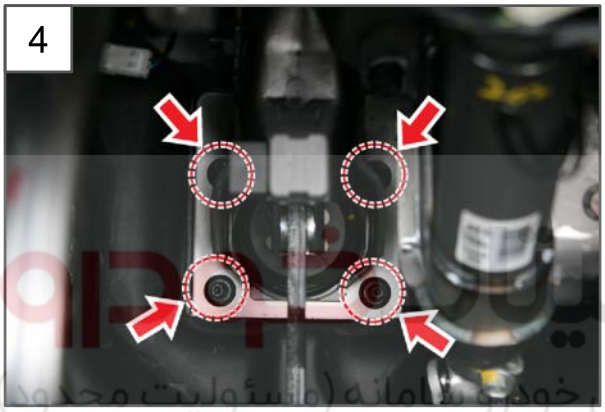
3



3. Remove two upper bolts (12 mm)b from the brake pedal bracket.

Tightening torque 17.6 ~ 21.6Nm

4



4. Unscrew four nuts (12 mm) from the bracket and remove the brake pedal assembly.

Tightening torque 17.6 ~ 21.6Nm

5

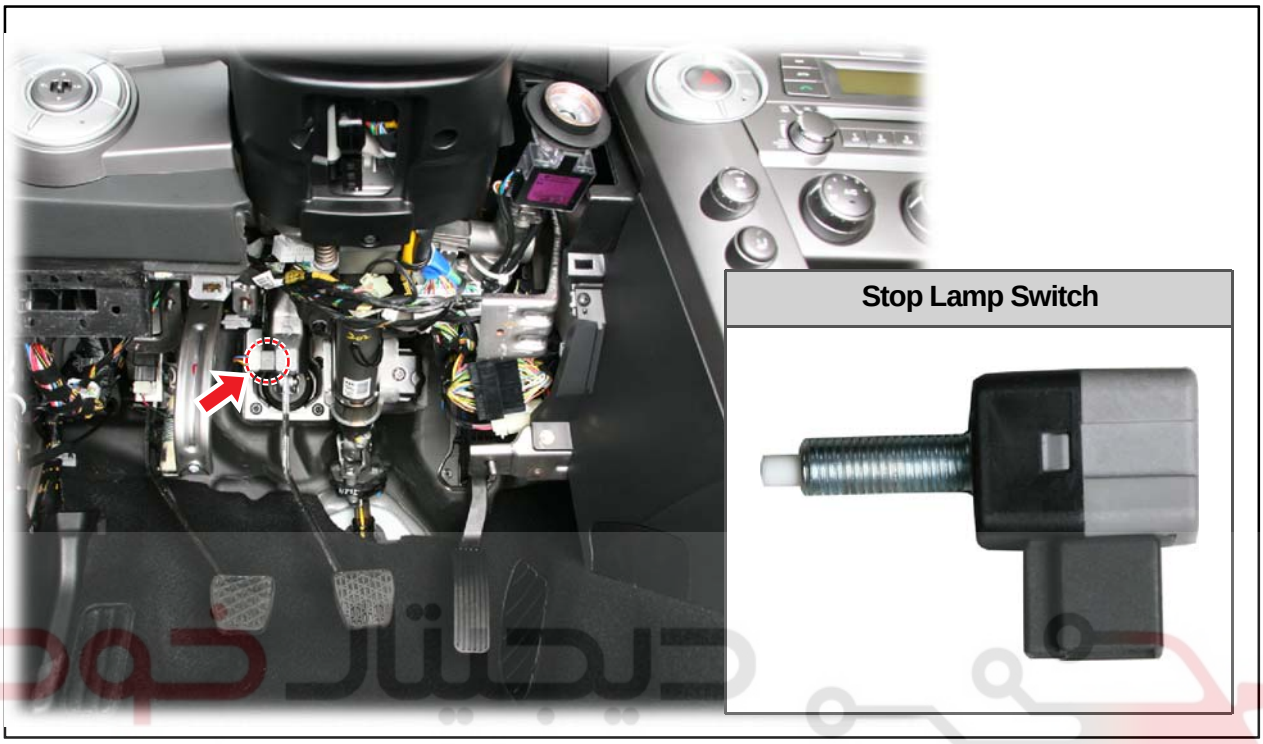
5. Install the brake pedal in the reverse order of removal.

Modification basis	
Application basis	
Affected VIN	

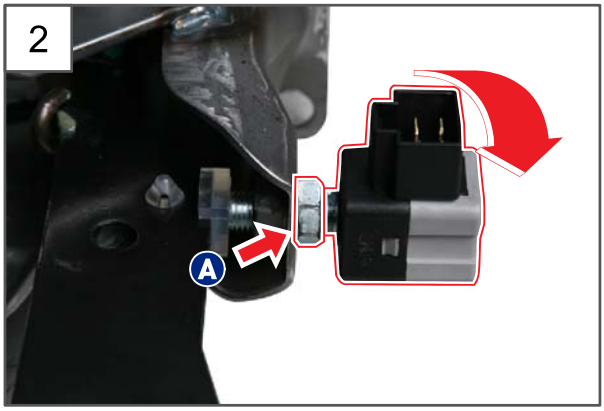
S.G.N. 4810-08

STOP LAMP SWITCH

Preceding work - Disconnect the negative cable from the battery.



1. Disconnect the stop lamp switch connector (A).



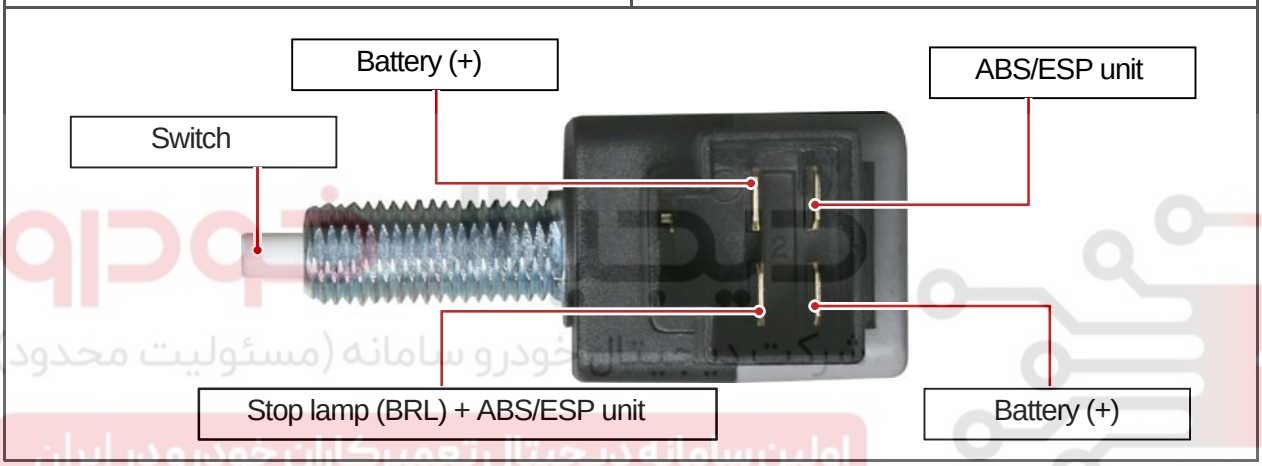
2. Unscrew the nut (A) and turn the stop lamp switch counterclockwise to remove it.

Tightening torque 9 ~ 10Nm

3. Install the stop lamp switch in the reverse order of removal.

Modification basis	
Application basis	
Affected VIN	

Stop Lamp Switch



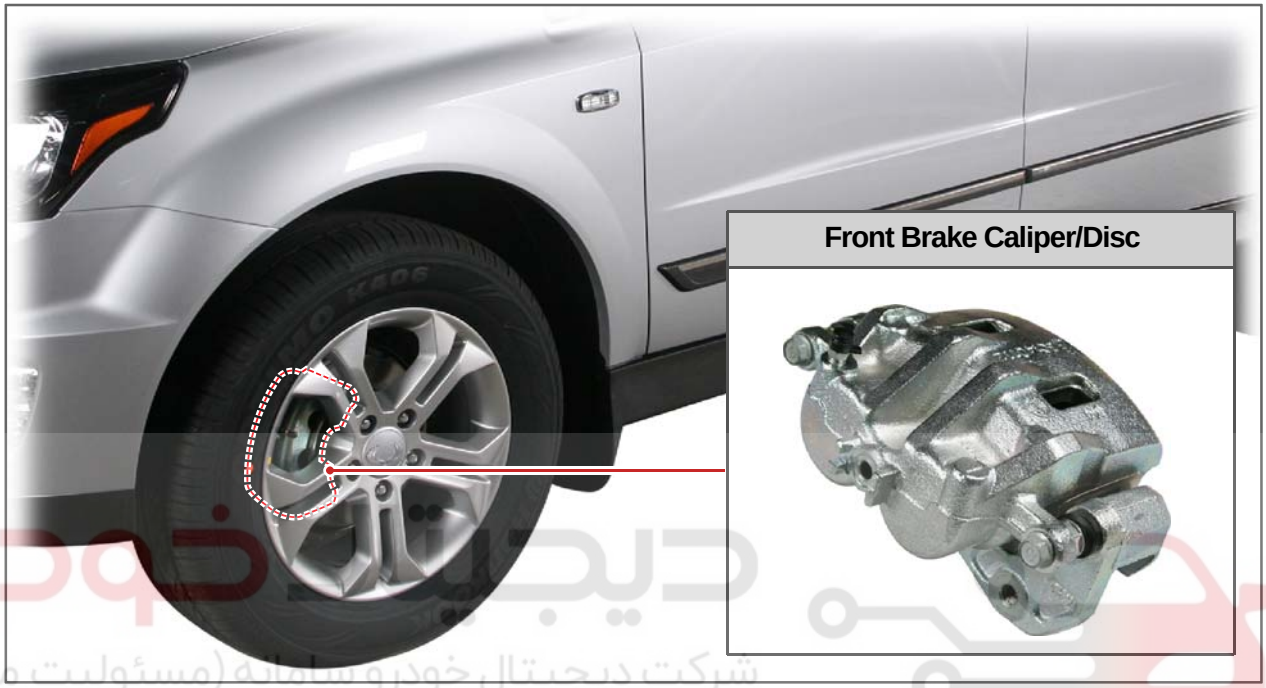
Modification basis	
Application basis	
Affected VIN	

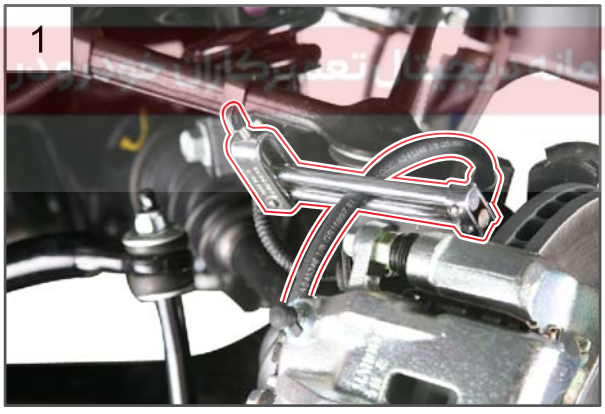
S.G.N. 4830-01

FRONT BRAKE CALIPER/DISC

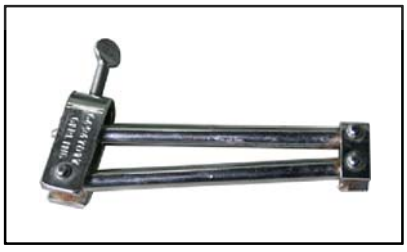
Preceding work
- Disconnect the negative cable from the battery.
- Remove the front tires.

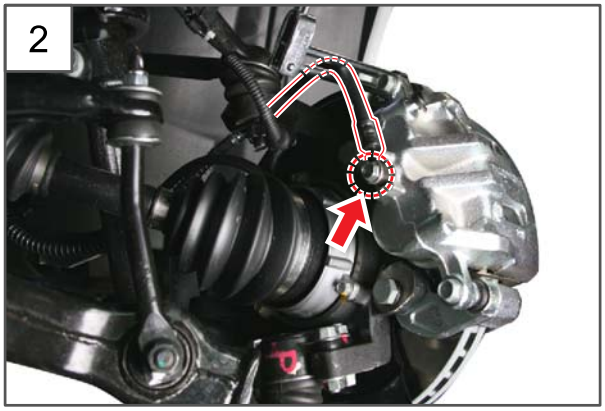
▶ Brake Caliper





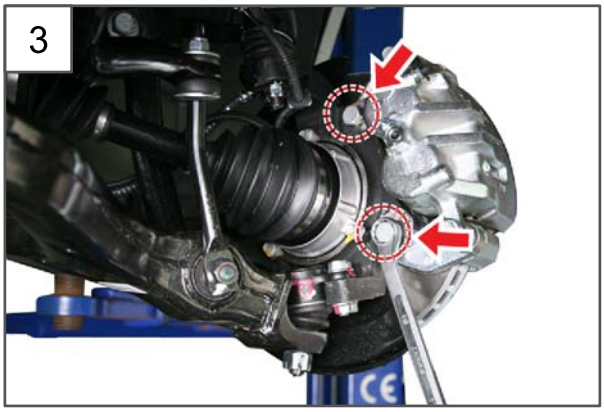
1. Clamp the brake hose with a special service tool to prevent the oil from leaking.





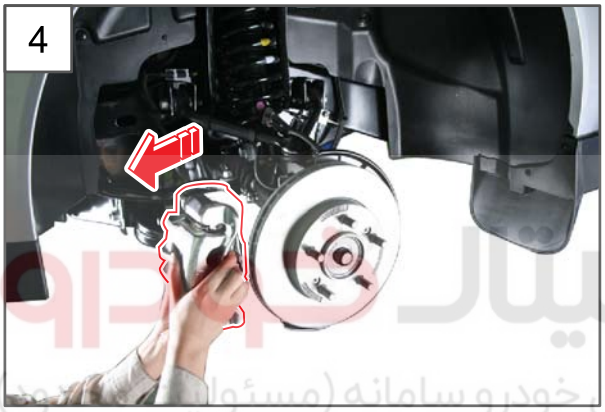
2. Unscrew the eye bolt (12 mm) and remove the front brake hose from the caliper.

Tightening torque 19.6 ~ 29.4Nm



3. Unscrew two bolts (19 mm) from the brake caliper.

Tightening torque 83.3 ~ 102.9Nm



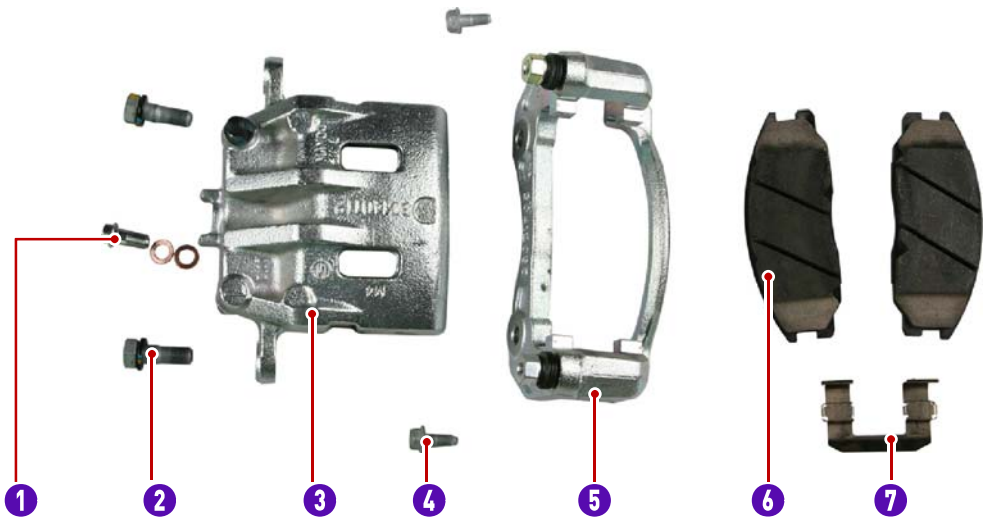
4. Remove the front brake caliper assembly.

CAUTION

Always perform the air bleeding after installing the brake caliper.

5. Install the front brake caliper assembly in the reverse order of removal.

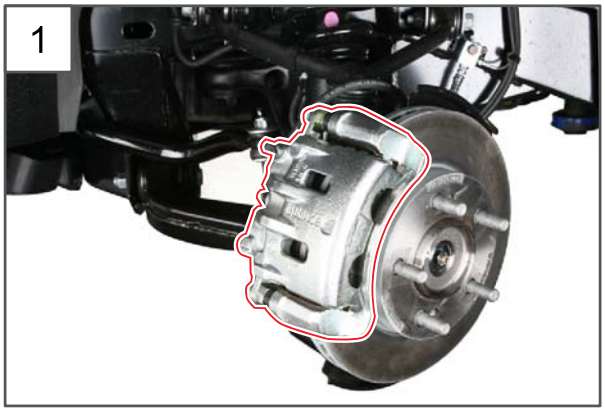
Front Brake Caliper Assembly



1. Eye bolt
2. Bolt
3. Caliper
4. Bolt
5. Carrier
6. Brake pad
7. Pad spring

Modification basis	
Application basis	
Affected VIN	

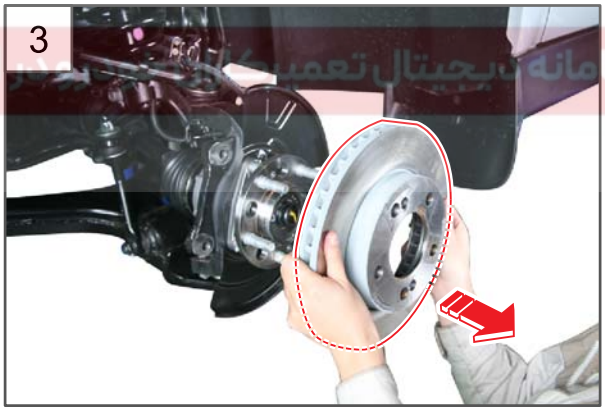
▶ Brake Disc



1. Remove the front brake caliper.

2. Remove two screws from the brake disc.

Tightening torque 8 ~ 10Nm

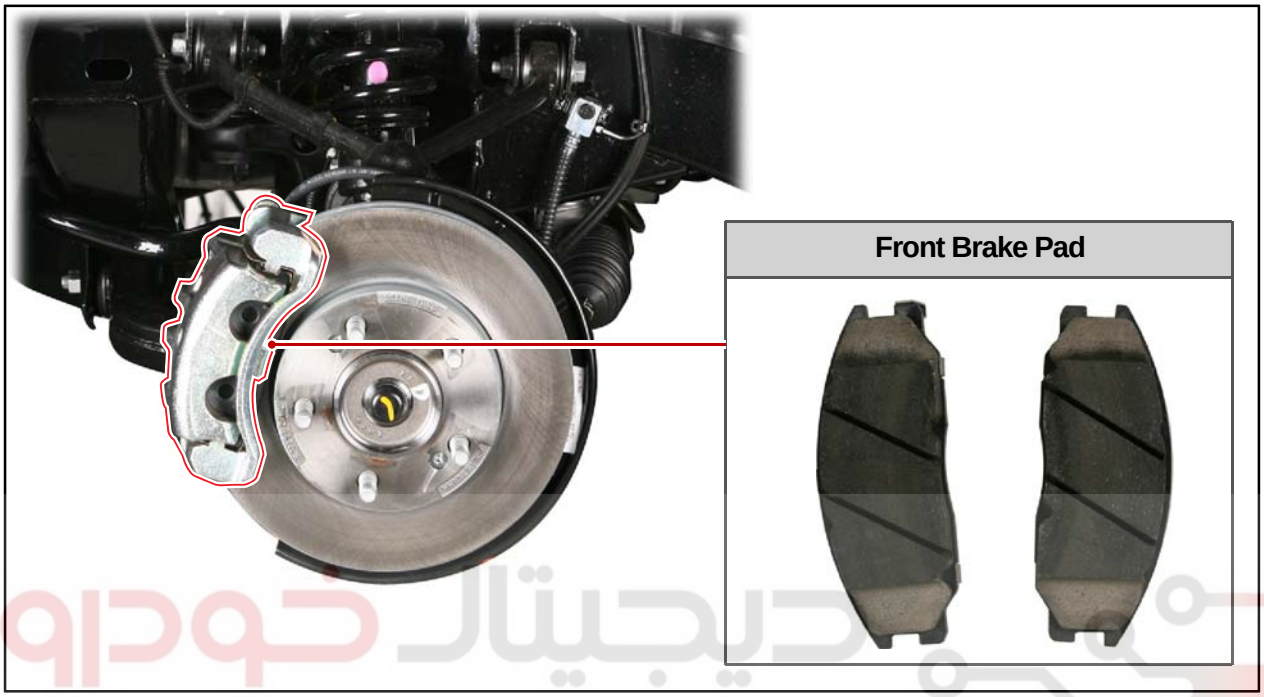


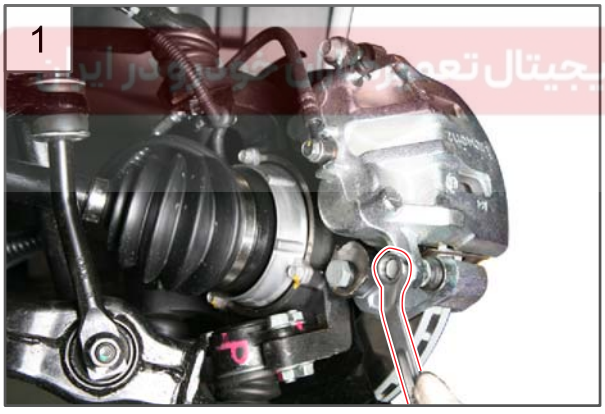
3. Remove the brake disc from the knuckle.

4. Install the brake disc in the reverse order of removal.

S.G.N.
4830-02 FRONT BRAKE PAD

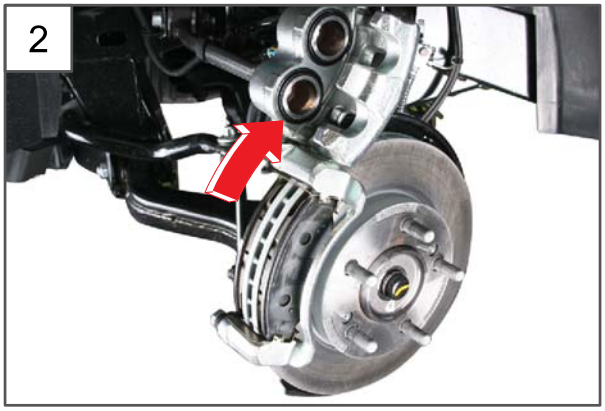
Preceding work
- Disconnect the negative cable from the battery.
- Remove the front tires.





1. Unscrew the lower bolt (14 mm) from the brake caliper.

Tightening torque 25.5 ~ 30.4Nm



2. Raise the brake caliper cylinder to arrow direction.

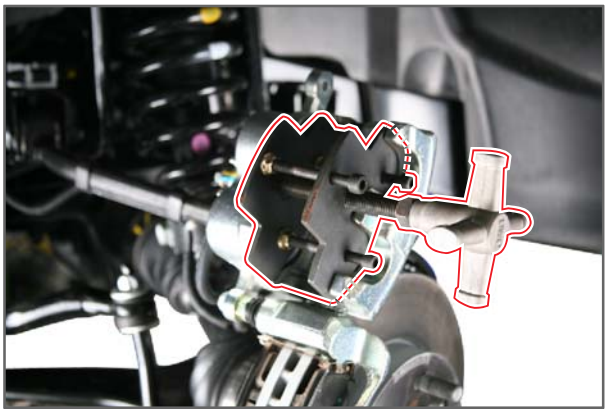
Modification basis	
Application basis	
Affected VIN	

3. Remove the brake pad and replace it with new one.

4. Install the front brake pad in the reverse order of removal.

Front Brake Pad

Cautions When Installing

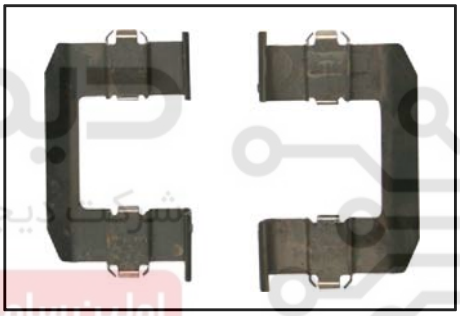


Push the pistons in the caliper cylinder with a special service tool.

CAUTION

Be careful not to damage the rubber boot sround piston.

Install the caliper clips before installing the brake pad.



To check the operation of brake pedal, pump the brake pedal several times after installing the brake caliper assembly.

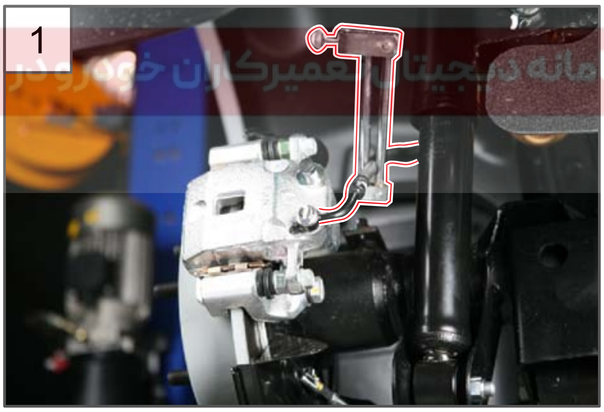
Modification basis	
Application basis	
Affected VIN	

4841-01 REAR BRAKE CALIPER/DISC

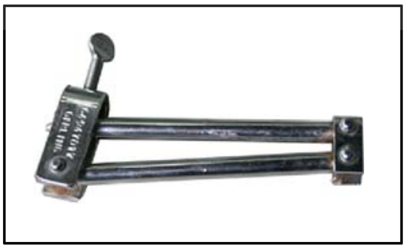
S.G.N.

Preceding work
- Disconnect the negative cable from the battery.
- Remove the rear tires.

▶ Rear Brake Caliper



1. Clamp the brake hose with a special service tool to prevent the oil from leaking.

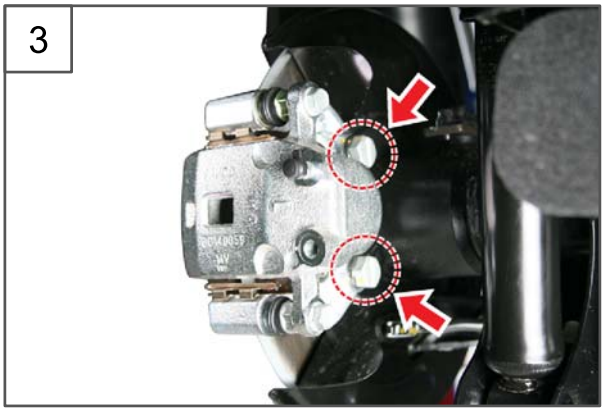


2. Unscrew the eye bolt (12 mm) and remove the rear brake hose from the caliper.

Tightening torque 19.6 ~ 29.4Nm

Modification basis	
Application basis	
Affected VIN	

3



3. Unscrew two bolts (19 mm) from the rear brake caliper.

Tightening torque 52.9 ~ 63.7Nm

4

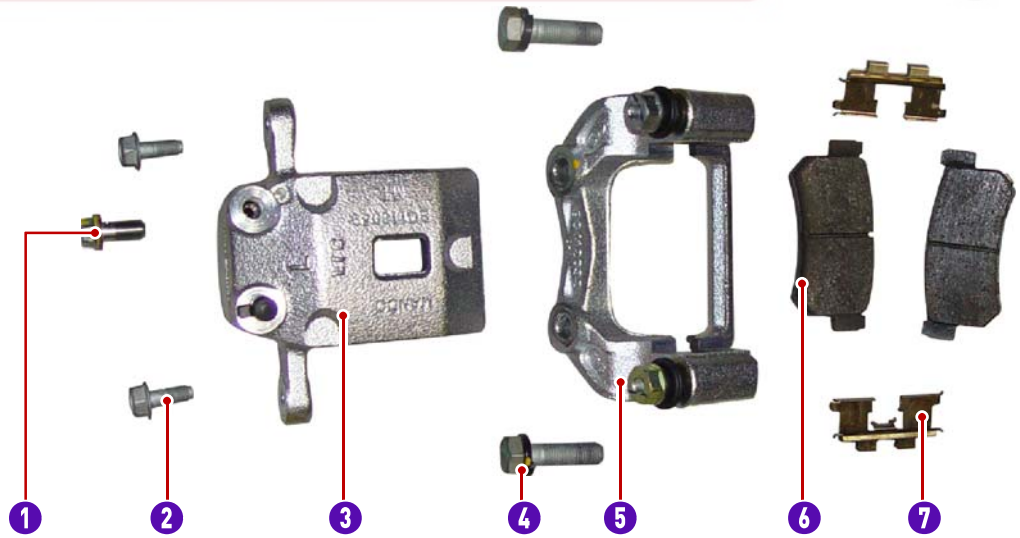
4. Remove the rear brake caliper assembly from the brake disc.

CAUTION

Always perform the air bleeding after installing the brake caliper.

5. Install the rear brake caliper assembly in the reverse order of removal.

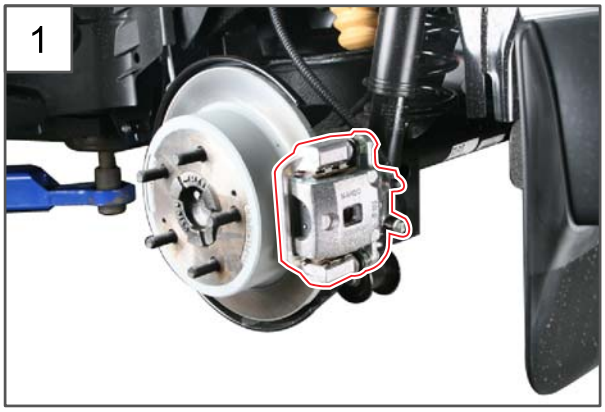
Rear Brake Caliper Assembly



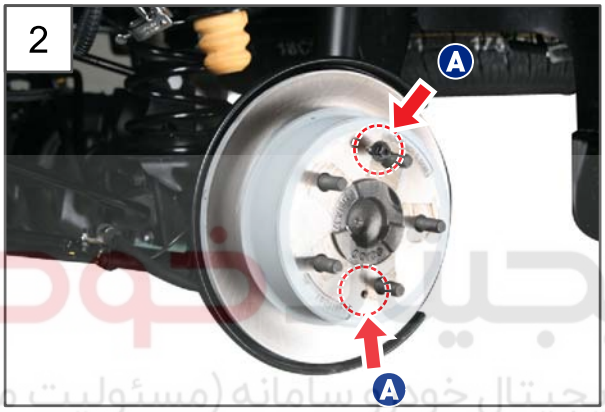
1. Eye bolt
2. Bolt
3. Caliper
4. Bolt
5. Carrier
6. Brake pad
7. Pad spring

Modification basis	
Application basis	
Affected VIN	

▶ Rear Brake Disc



1. Remove the front brake caliper.



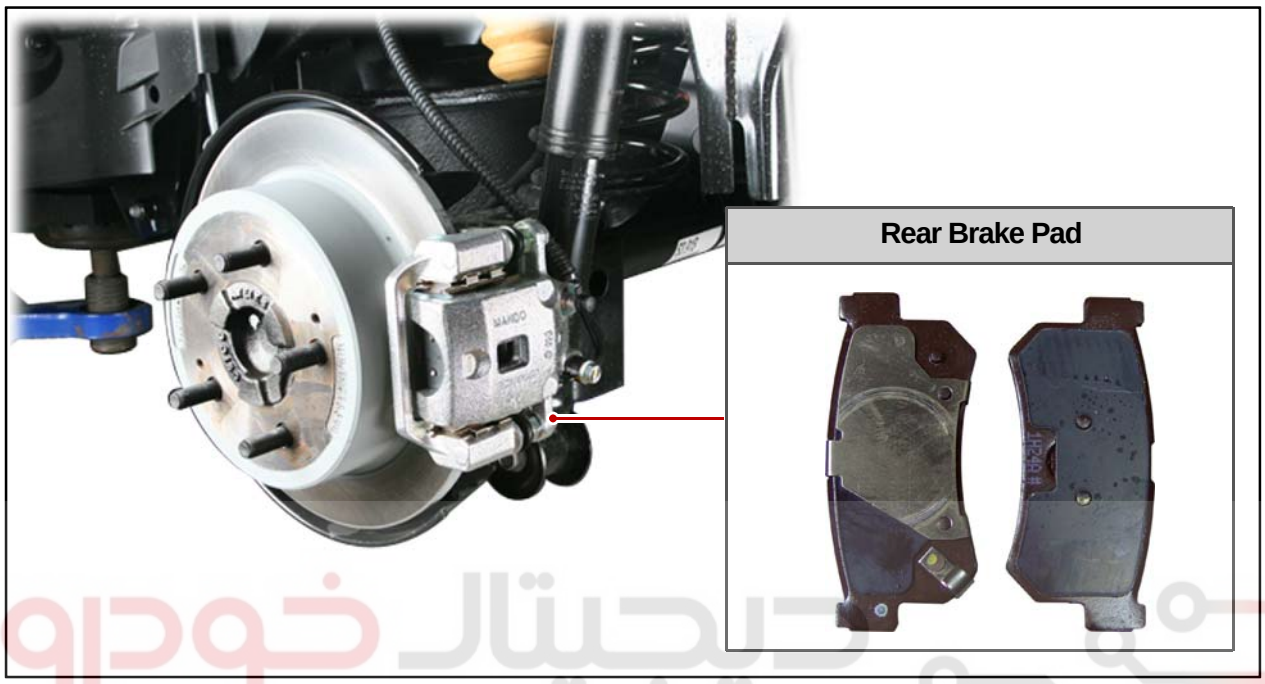
2. Tighten two M8x1.0 bolts evenly to separate the brake disc and rear axle shaft flange.

3. Remove the rear brake disc.

4. Install the brake disc in the reverse order of removal.

S.G.N.
4841-02 REAR BRAKE PAD

Preceding work
- Disconnect the negative cable from the battery.
- Remove the rear tires.



1. Unscrew the lower bolt (14 mm) from the brake caliper.

Tightening torque 25.5 ~ 30.4Nm

2. Raise the brake caliper cylinder to arrow direction.

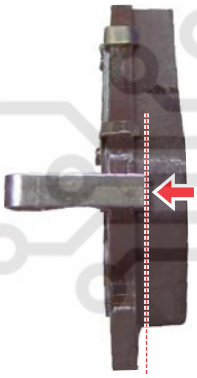
Modification basis	
Application basis	
Affected VIN	

3. Remove the brake pad and replace it with new one.

4. Install the rear brake pad in the reverse order of removal.

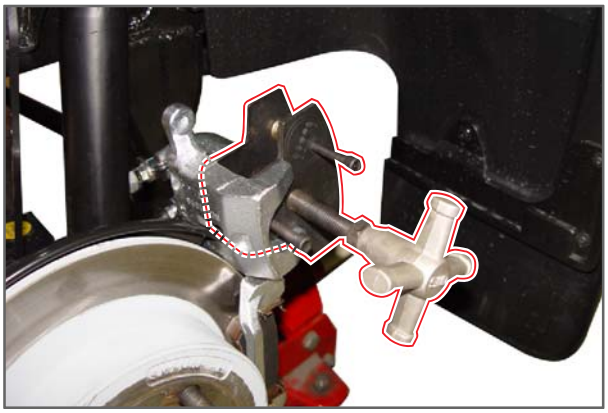
Rear Brake Pad

Wear Limit



Modification basis	
Application basis	
Affected VIN	

Cautions When Installing

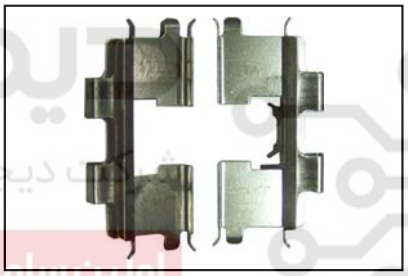


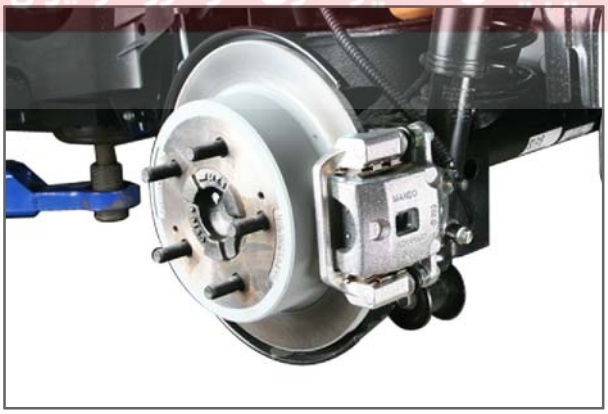
Push the pistons in the caliper cylinder with a special service tool.

CAUTION

Be careful not to damage the rubber boot sround piston.

Install the caliper clips before installing the brake pad.





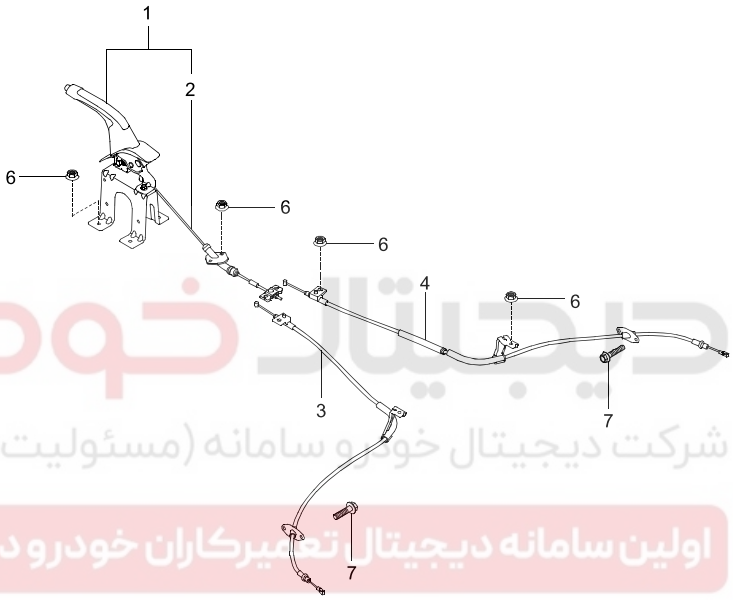
To check the operation of brake pedal, pump the brake pedal several times after installing the brake caliper assembly.

Modification basis	
Application basis	
Affected VIN	

S.G.N. 4910-01

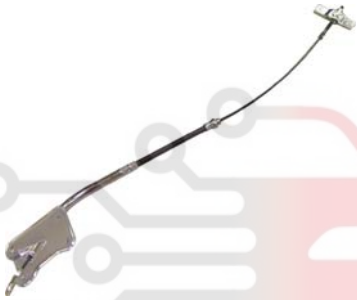
PARKING BRAKE ASSEMBLY

Preceding work - Disconnect the negative cable from the battery.



Parking Brake Lever

Center Cable

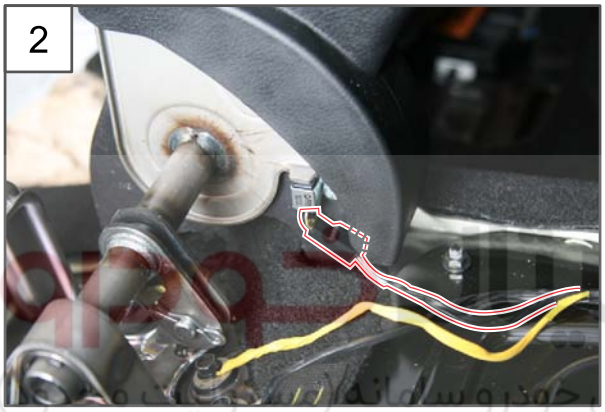


Rear Cable

Modification basis	
Application basis	
Affected VIN	

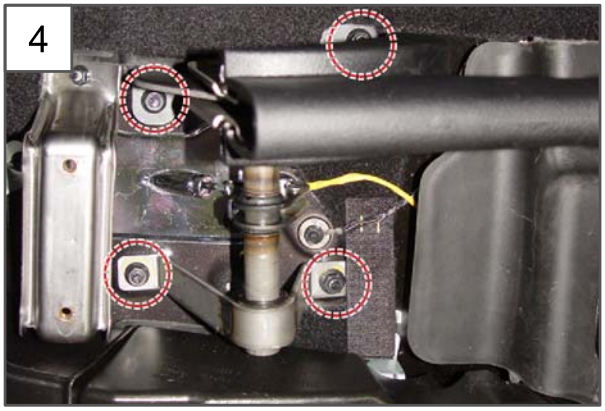
▶ Parking Brake Lever Assembly

1. Remove the center console.



2. Remove the stop lamp switch connector.

3. Pull out the clevis pin from the parking brake lever and remove the parking brake cable.



4. Unscrew four nuts (10 mm) and remove the parking brake lever.

Tightening torque 9.8 ~ 12.7Nm

5. Install the parking brake lever in the reverse order of removal.

Modification basis	
Application basis	
Affected VIN	

Parking Brake Lever Assembly	Parking Brake Lamp Switch
	ON  OFF 

▶ Center Cable

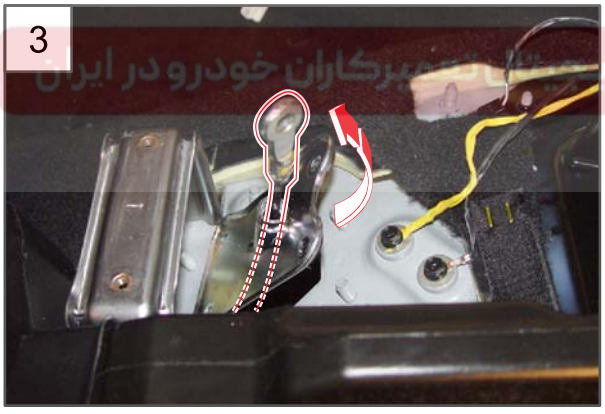
1

1. Loosen the tension of the parking brake cable by rotating the equalizer nut counterclockwise, and separate the center cable from the rear cable.

2

2. Unscrew four nuts from the floor bracket for parking brake cable in vehicle.

3



3. Pull out the parking brake cable to arrow direction.

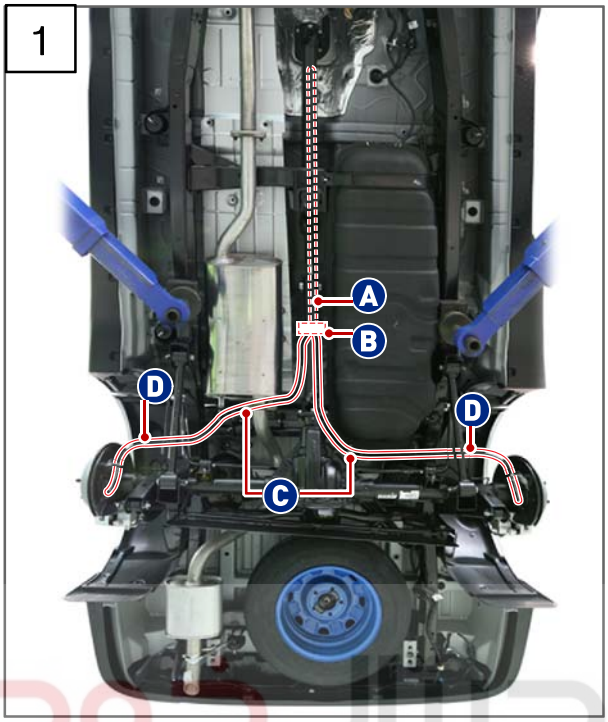
4

4. Install the center cable in the reverse order of removal.

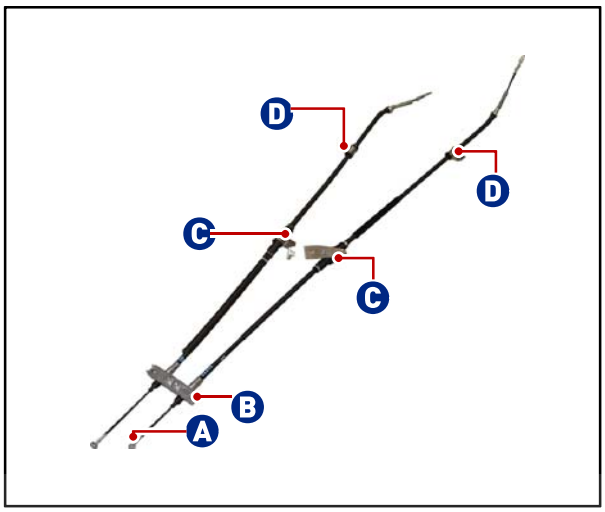
Modification basis	
Application basis	
Affected VIN	

▶ Rear Cable

1



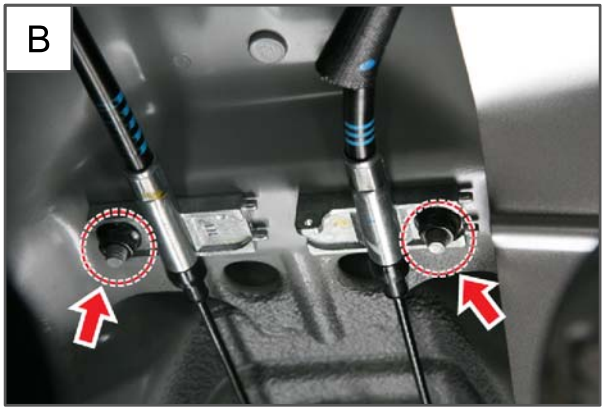
1. Remove the parking cable mounting brackets in alphabetical order in the figure.



A

A. Loosen the tension of the parking brake cable by rotating the equalizer nut counterclockwise, and separate the center cable from the rear cable.

B

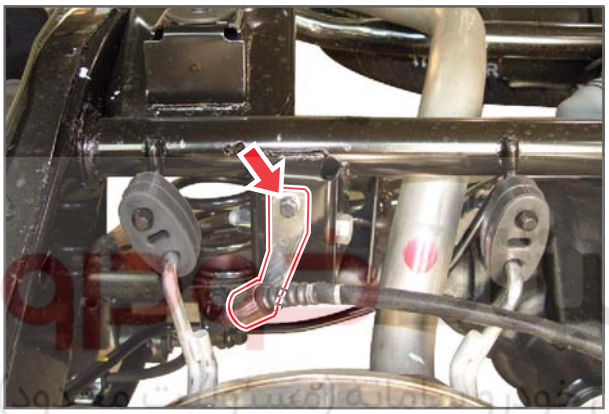


B. Unscrew the nuts (12 mm) from the rear parking brake mounting bracket.

Tightening torque 9.8 ~ 12.7Nm

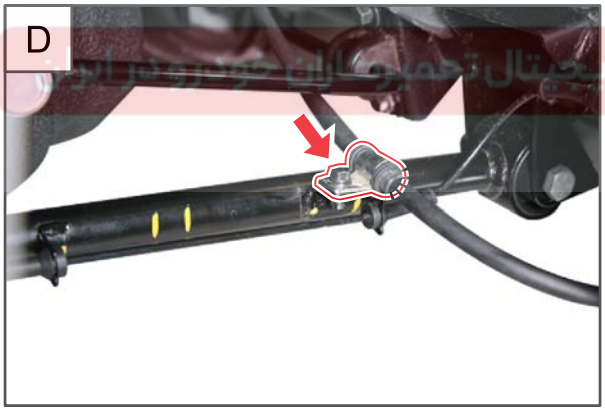
C. Unscrew the bolt (12 mm) from the upper left bracket on rear axle.

Tightening torque 9.8 ~ 12.7Nm



Unscrew the bolt (12 mm) from the upper right bracket on rear axle.

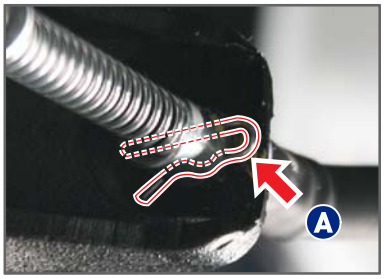
Tightening torque 9.8 ~ 12.7Nm



D. Unscrew the bolts (12 mm) from the upper brackets on rear left and right lower arms.

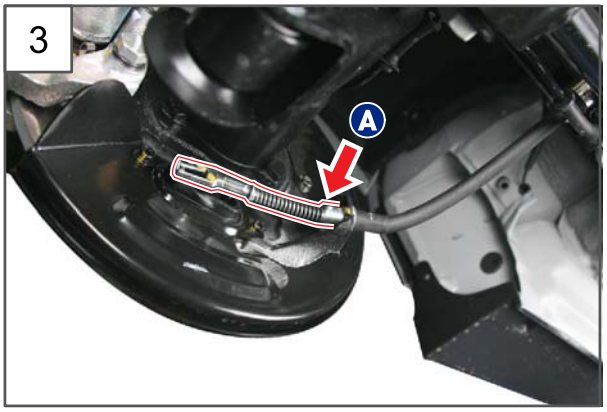
Tightening torque 9.8 ~ 12.7Nm

2. Remove the clevis pin 9A) from the rear parking brake cable.

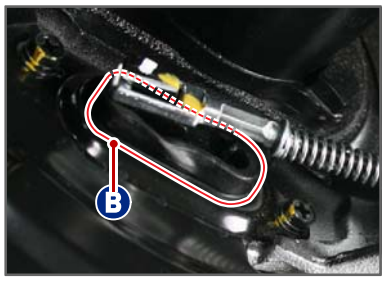


Modification basis	
Application basis	
Affected VIN	

3



3. Remove the rear parking brake cable (A) from the operating lever (B).

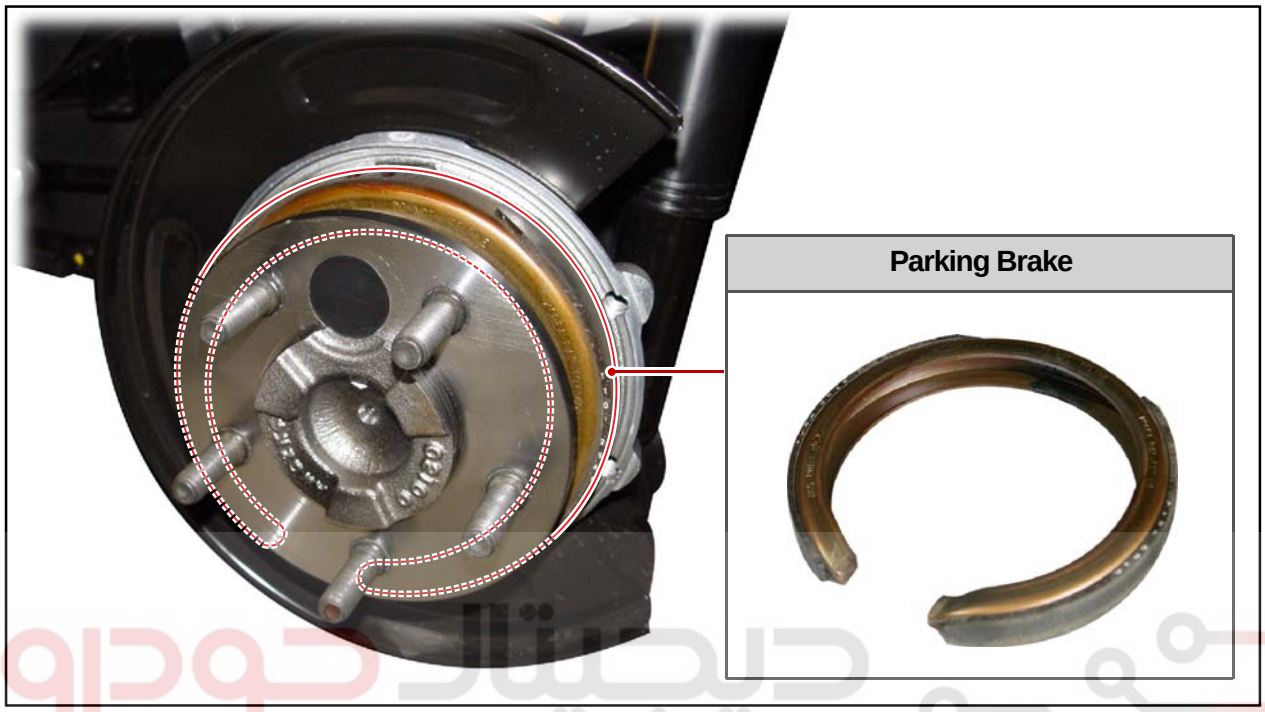


4

4. Install the rear parking brake cable in the reverse order of removal.

S.G.N. 4841-15 PARKING BRAKE LINING (SHOE)

Preceding work - Disconnect the negative cable from the battery.



1. Remove the rear brake caliper from the brake disc.

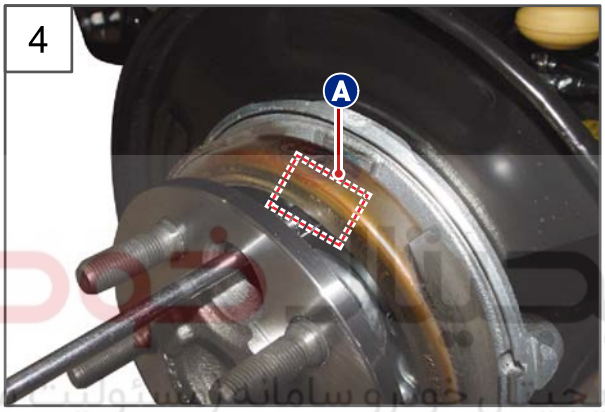
2. Remove the rear brake disc.

Modification basis	
Application basis	
Affected VIN	

3

3. Remove the rubber cover from the axle shaft.

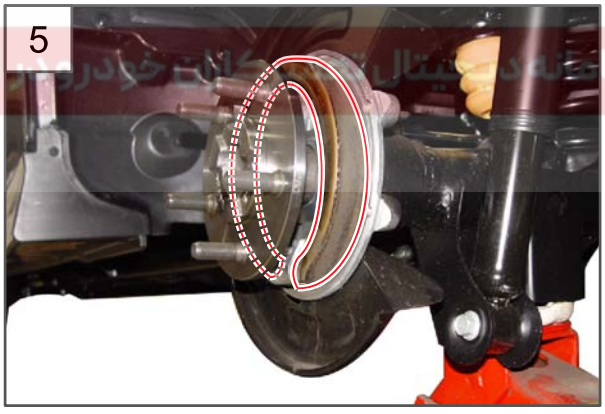
4



4. Turn the axle shaft and remove the lock plate (A) on the brake lining (shoe).

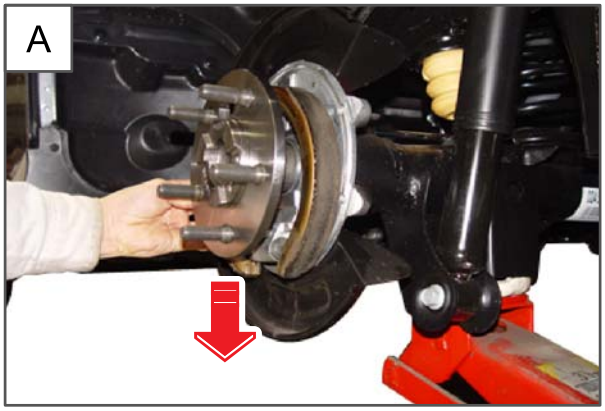
Lock plate

5

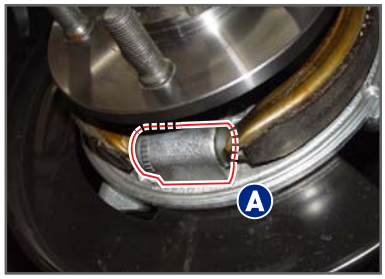


5. Remove the parking brake lining (shoe).

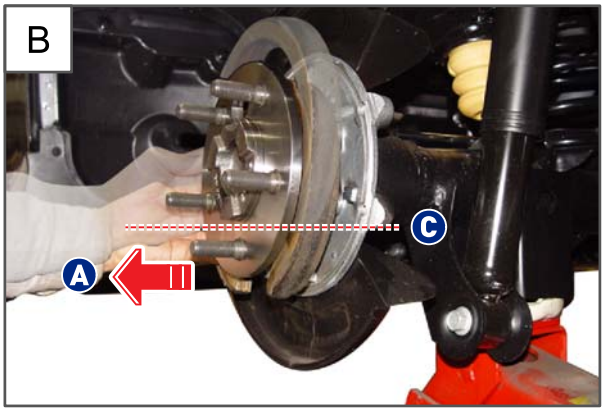
A



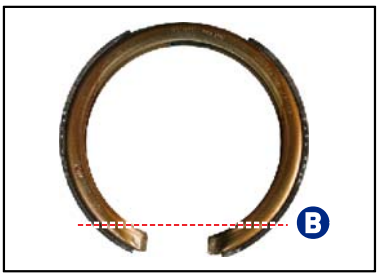
A. Separate the brake lining (shoe) from the rear brake operating cylinder (A).



B



B. Pull the lining (shoe) to arrow direction (A) until the end (B) of lining (shoe) gets to the position (C).



C

C. Widen the lining (shoe) and remove it.

6

6. Install the parking brake lining in the reverse order of removal.

Modification basis	
Application basis	
Affected VIN	