General

DESCRIPTION

BRAKE SYSTEM

The service brakes are internally expanding type hydraulic brakes acting on all wheels. The brakes for the front wheels are 2-leading type and those for the rear wheels are duo-servo or dual 2-leading type.

The brake booster gives faster hydraulic pressure buildup. Tandem type brake master cylinder also contributes to safety. The brake pedal, which is easy-to-operate pendant type, transmits depression force via operating rod, etc. to the BRAKE BOOSTER, which boosts it and drives the master cylinder.

The BRAKE BOOSTER vacuum line is equipped with a vacuum tank which minimizes negative pressure change even in the case of repeated and frequent braking operation.

Brake Booster

1. When not in Operation

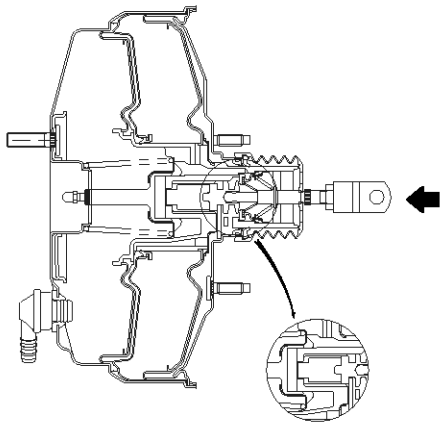
   When not in operation, no force acts on the operating rod and hence the valve plunger is seated on the poppet to open the negative pressure valve and to close the atmospheric valve.

   Negative pressure generated by the engine draws out air from the chamber on the left side of the diaphragm plate. And as the chamber on the right side of the diaphragm plate is also evacuated via the vacuum channel and the negative pressure valve that is opened. As a result, the diaphragm plate is pressed tightly onto the rear shell surface by the diaphragm plate return spring. Atmosphere goes through the air filter into space around the operating rod but does not flow further as the atmospheric valve of the valve plunger is closed.

2. When in Operation

   When the brake pedal depression force overcomes the valve return spring force, the operating rod, valve plunger and poppet now move to the left and the poppet is pressed tightly onto the valve plunger seat by the poppet spring, closing the negative pressure valve. When the brake pedal is further depressed following closure of this valve, the valve plunger clears the poppet to open the atmospheric valve and atmosphere now flows through the channel into the chamber on the right side of the diaphragm.

   This flow of atmosphere produces the pressure difference across the diaphragm and the force resulting from such pressure difference overcomes the piston return spring force. As a result, the diaphragm pushes the push rod as it moves from right to left. The push rod thus pushes the master cylinder piston, generating high fluid pressure from low pedal depression force.



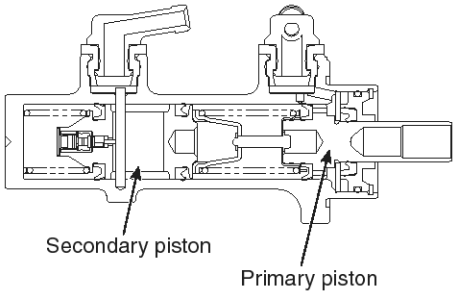
SUDBR9016L

Brake Master Cylinder

1. Normal Operation

   The tandem type brake master cylinder has independent hydraulic systems for front and rear brakes.

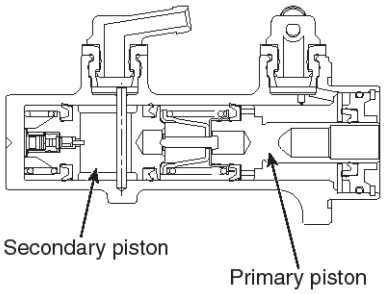
   Should one of the two hydraulic systems fail, braking by survived system (front or rear wheels) ensures safety. When the brake pedal is depressed, the primary piston is pushed to left, developing hydraulic pressure in the pressure chamber on the primary side. This pressure directly acts on the secondary piston to push the secondary piston to left, developing hydraulic pressure also in the pressure chamber on the secondary side. As a result, each piston pressurizes brake fluid to generate hydraulic pressure in both front and rear brake systems.



SUDBR9017L

2. When fluid leaks are caused in front brake system

   In this case, depression of the brake pedal to push the push rod does not develop hydraulic pressure as the brake fluid leaks from the front brake system. Therefore, the primary piston compresses the primary return spring and the retainer pushes the secondary piston, which then pressurizes brake fluid in space between the secondary piston and cylinder body, thus generating hydraulic pressure in the rear brake system only.



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3. When fluid leaks are caused in rear brake system

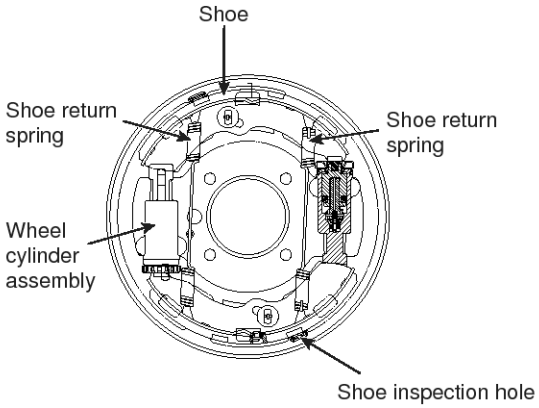
   In this case, when the brake pedal is depressed to push out the push rod, the secondary piston end comes into contact with the cylinder body since brake fluid in the rear brake system leaks. When the push rod is further pushed, the primary piston pressurizes brake fluid in the space between the primary and secondary pistons, generating hydraulic pressure in the front brake system only.

Front And Rear Wheel Brakes

Front wheel Brakes

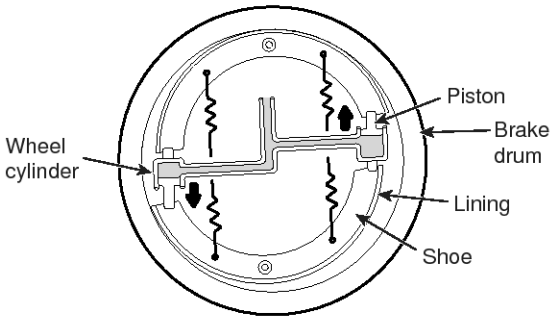
The wheel cylinder is so constructed that the piston extends in one direction only to push the shoes which are held down to the backing plate by the shoe hold down pin. The return springs mounted on the shoe fixed and moving sides cause contraction of the shoe and wheel cylinder piston when the brake is released.

When the vehicle is running forward, both shoes work as leading shoes.



EMTBR5004A

When the pedal is depressed, brake fluid supplied under pressure from the master cylinder enters the wheel cylinder, of which piston moves the shoe moving side so that the lining is pressed against the drum inside. Resultant friction between the lining and drum causes the shoe to try to turn with the drum, thus boosting the braking force.

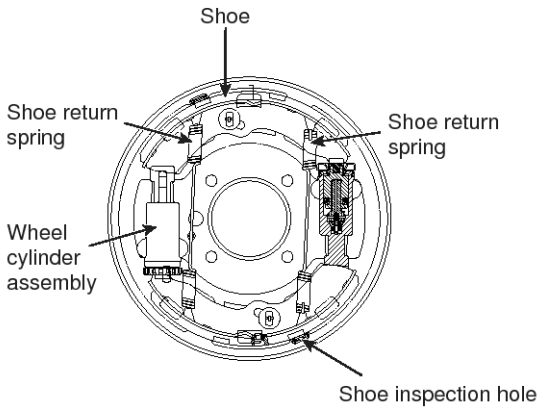


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Rear Wheel Brake

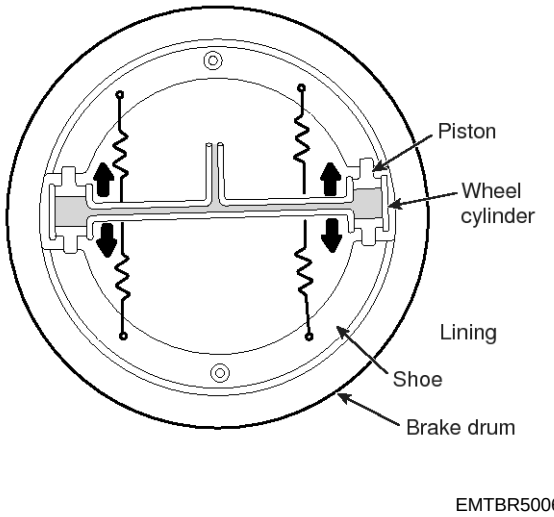
Dual 2-leading Brake

The wheel cylinders are installed at front and rear and the pistons extend in both upward and downward directions to push the shoes from both directions. The shoes are held down to the backing plate by shoe hold down pins and the return springs mounted on the shoes causing contraction of the shoe and wheel cylinder piston when the brake is released. During both forward and reverse operation of the vehicle, the shoes work as leading shoes.



EMTBR5004A

When the pedal is depressed, brake fluid supplied under pressure from the master cylinder enters the wheel cylinder, of which piston causes the shoe to expand in both directions to press the lining against the drum inside. Resultant friction between the lining and drum causes the shoe to try to turn with the drum, thus boosting the braking force.

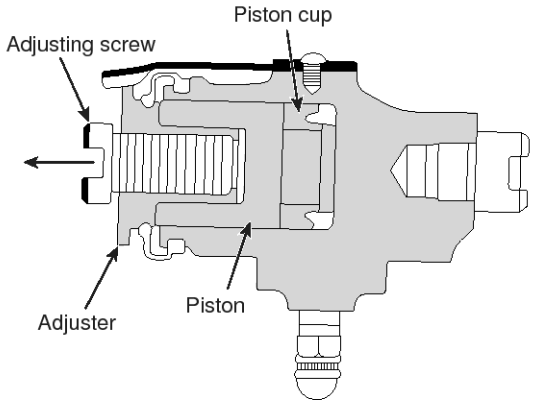


EMTBR5006A

Wheel Cylinder

The wheel cylinder driven by hydraulic pressure generated by the brake master cylinder presses the shoe (lining) against the brake drum.

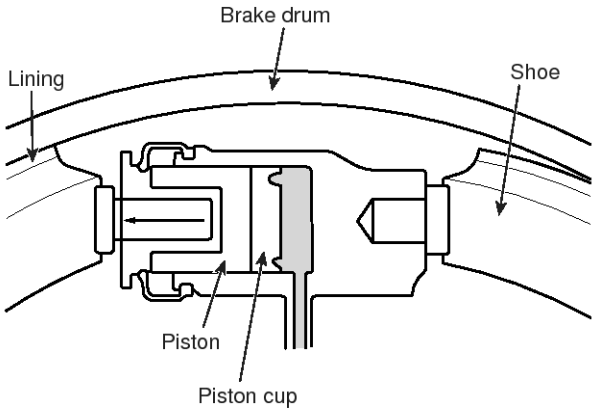
There are following two types of wheel cylinder according to the method of pushing the shoe.



EMTBR5007A

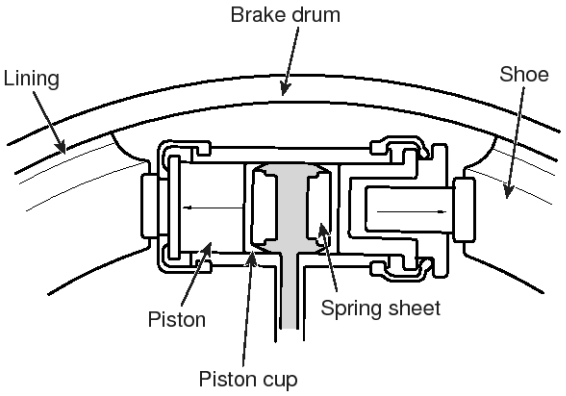
1. 2-leading type : Front brake

   In pedaling brake, oil pressure rising is master cylinder goes into wheel cylinder and pushes piston. Shoe contacting with the end of piston sticks to brake drum and generates frictional force.



EMTBR5008A

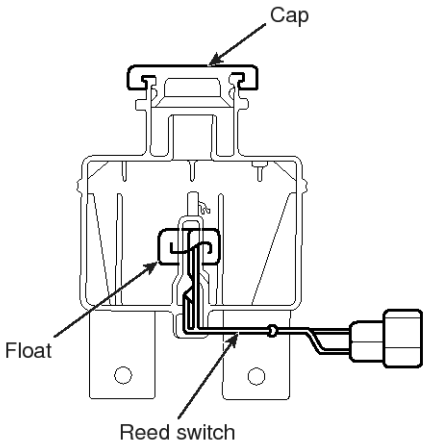
2. Dual 2-leading type : rear brake



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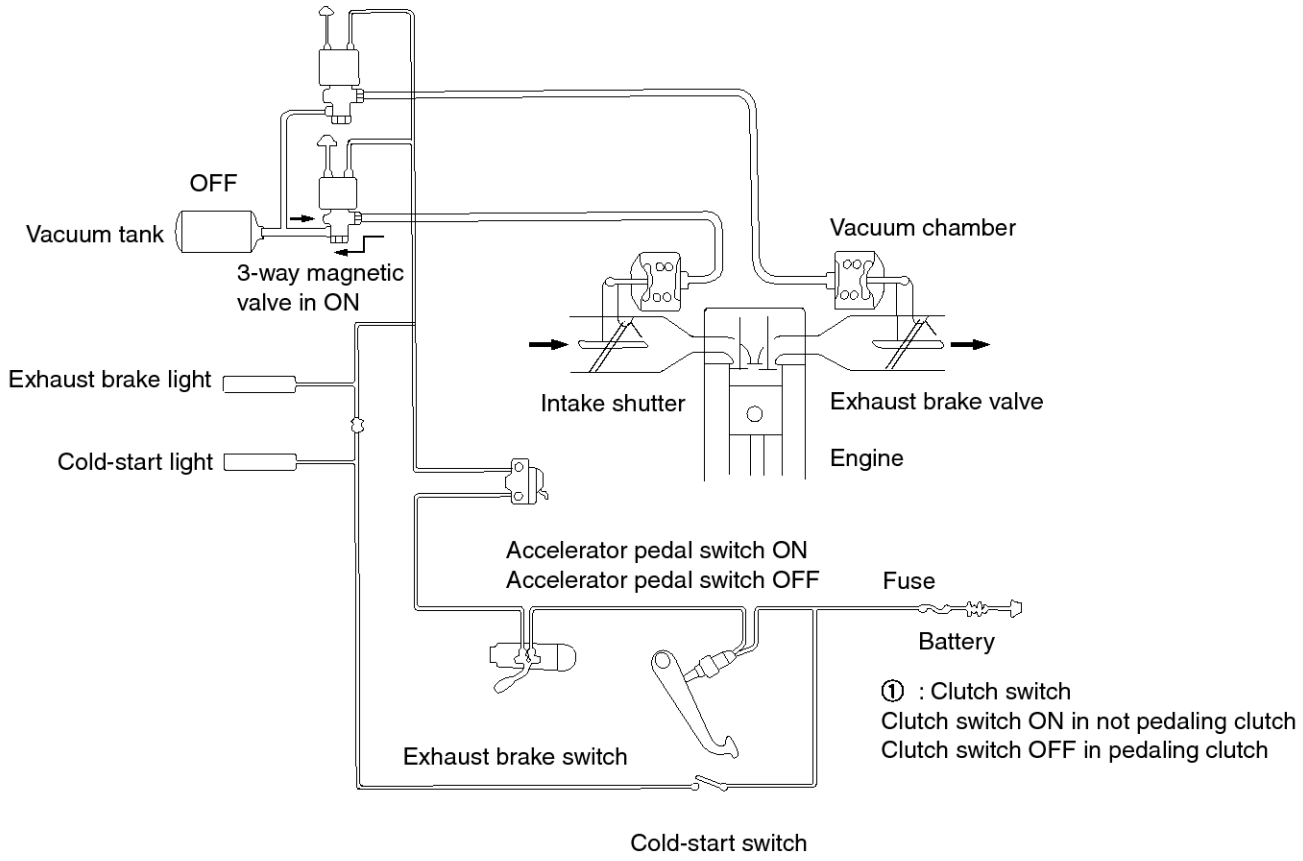
Brake Fluid Level Sensor

The brake fluid level sensor installed in the brake fluid tank senses the brake fluid level in the tank. When the fluid level drops to a preset level, the sensor operates to turn on the warning lamp in the cluster to warn low brake fluid level.



EMTBR5010A

Exhaust Brake



SUDBRA015L

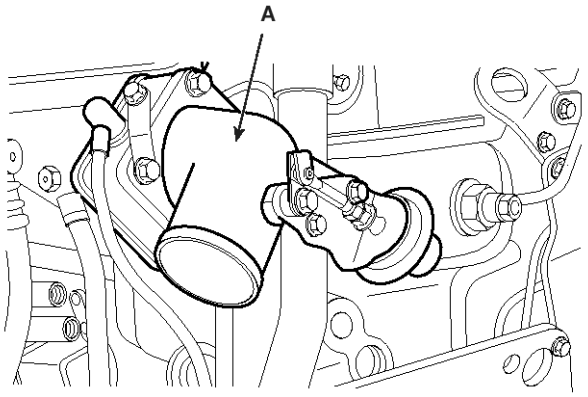
The exhaust brake system, as an assistant function of the service brake, comprises of the exhaust brake device installed at the middle portion of the exhaust pipe and the intake shutter installed at the intake manipulate to reduce the intake air noise.

When the exhaust brake device close the butterfly valve, the pressure inside of the pipe increases. This increased pressure influences to the piston to get the braking force. At that time, the intake shutter is also closed. When the clutch pedal, the accelerator pedal or the exhaust brake switch is released, the electric circuit is OFF and the exhaust brake is released.

The exhaust brake is the vacuum type assistant device which uses the negative pressure.

Intake Shutter

When the exhaust brake is operating, the intake shutter(A) reduces the amount of the intake air through the intake manipulate so as that the exhaust pressure is operated to the piston effectively. As a result, the noise will be reduced and the brake will be more effective.



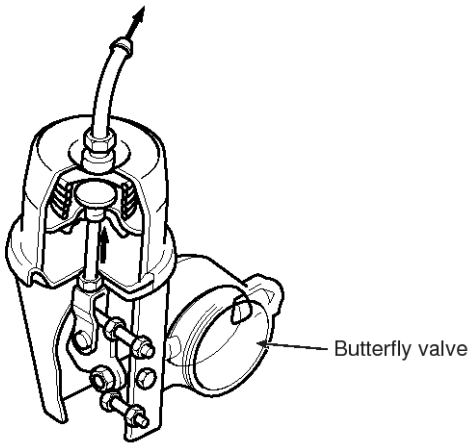
KMTBR5513A

Exhaust Brake Unit

1. At Working

   If the exhaust brake switch is ON, the three-way magnetic valve is opened. The vacuum pressure of the vacuum tank is applied to the exhaust brake unit so as to pull the piston.

   As a result, the butterfly valve linked to the push rod is closed so that the exhaust brake is working.

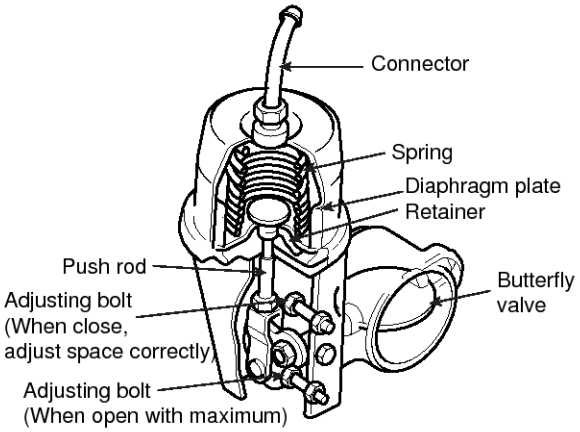


EMTBR5012A

2. At releasing

   If the exhaust brake switch, the clutch switch and the accelerator switch are OFF, the 3-way magnetic valve closes the circuit to the vacuum tank and opens the atmosphere circuit.

   Therefore, the atmospheric pressure is applied to the exhaust brake unit. Due to the spring tension, the butterfly valve is opened. The exhaust brake is released.

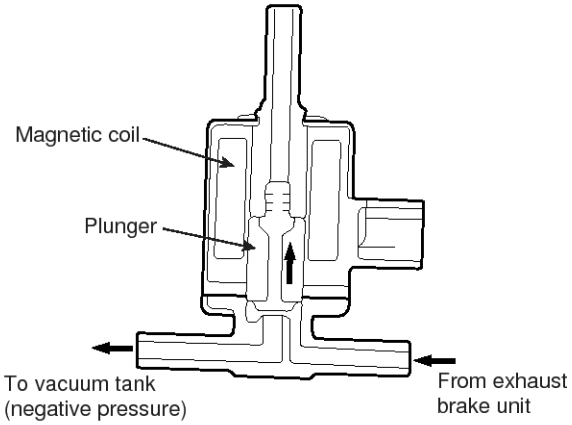


EMTBR5013A

The 3-way Magnetic Valve

1. At working

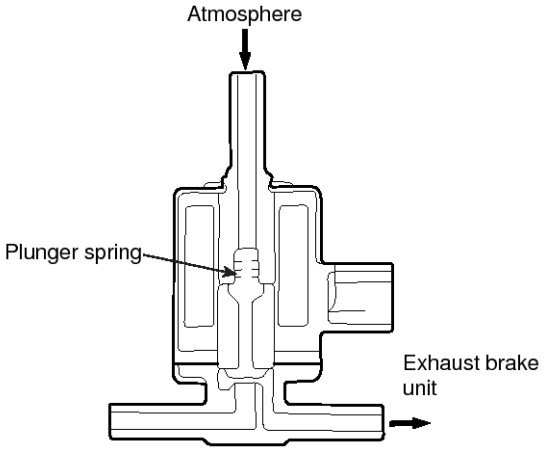
   If the exhaust brake switch is ON, an electric current will flow through the coil and then a magnetic field is formed. The magnetic force pulls the plunge to upward. At that time, the valve seat at the plunger closes the way to the atmosphere pressure while it opens the way linking the vacuum tank and the brake chamber.



EMTBR5014A

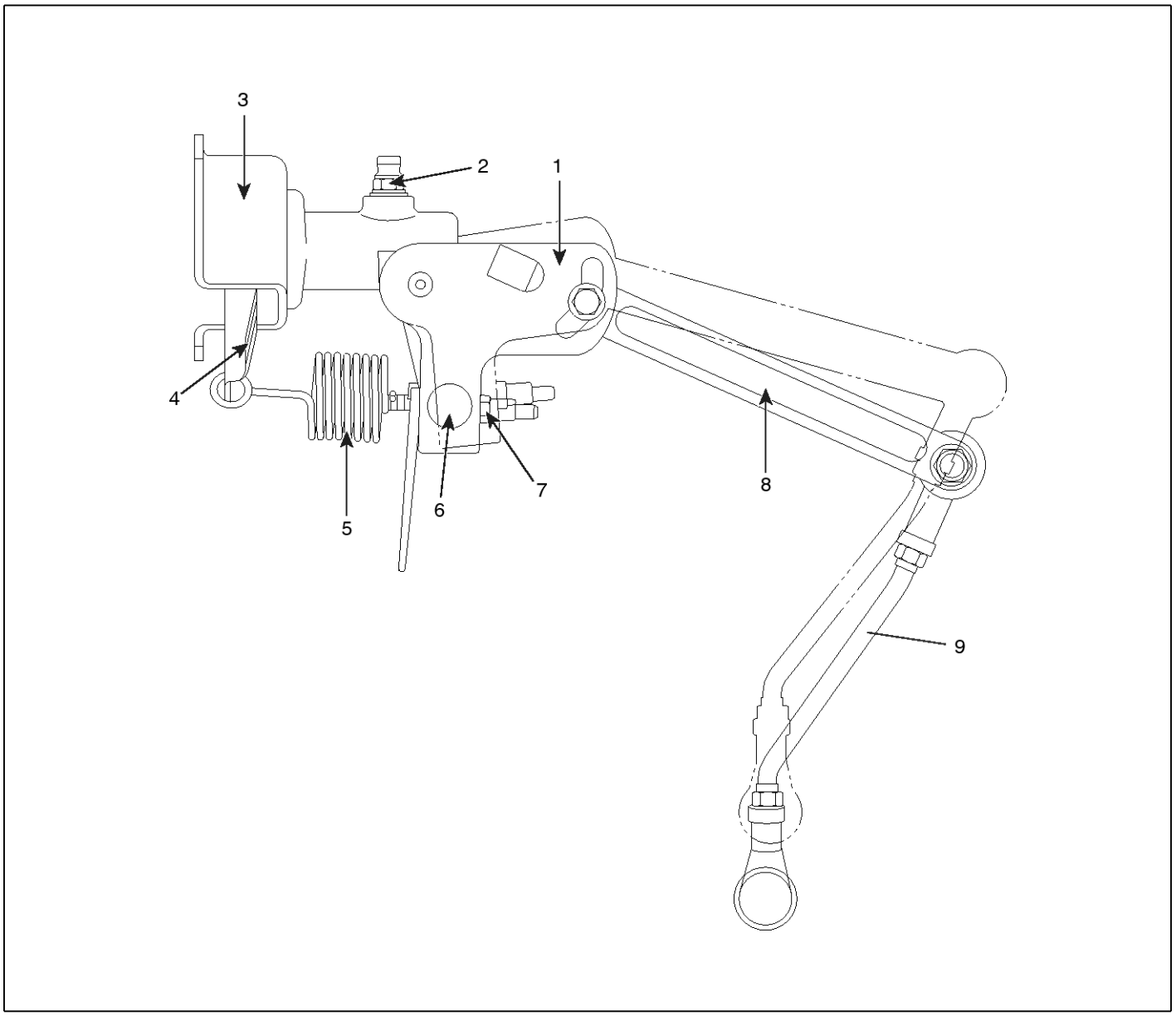
2. At releasing

   If the exhaust brake switch is OFF, the electric current flowing through the coil is shut down. Due to the spring tension, the plunger will be pushed so as to close the way to vacuum tank while the way to the atmosphere pressure and the brake chamber.



EMTBR5060A

LOAD SENSING PROPORTIONING VALVE



SUDBRA021L

1. LSPV assembly
2. Bleeder screw
3. Bracket
4. Lever assembly
5. Sensor spring
6. Spring guide
7. Adjusting nut
8. Operating lever
9. Connecting link assembly

Construction

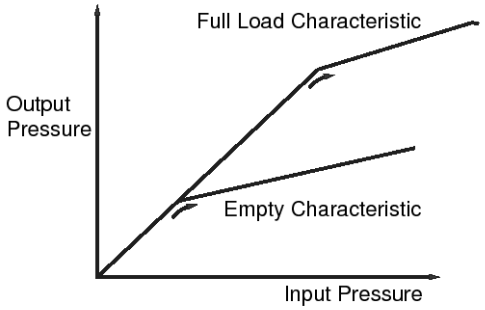
LSPV is consist of sensor part and pressure controller part.

1. Sensor part

   It consists of spring, operating lever, link. It senses the height of vehicle with varying according to the amount loads

2. Pressure controller part

   It consists of valve stem mechanism for proportioning control of sensor force.



EMTBR5016A

Operating Principle

LSPV body is mounted in the frame and the end of the link is mounted in the rear axle. With varying of amount of vehicle load changes the relative position of frame and rear axle, so sensor spring force varies to the valve stem. It controls the rear axle brake fluid pressure.

1. Unloaded status

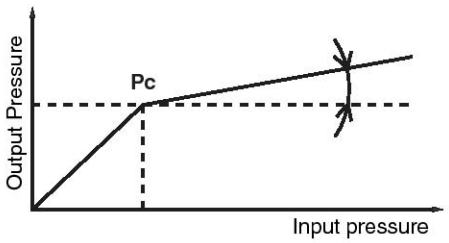
   The sensor spring presses the valve stem slightly, so the brake fluid pressure is set weakly.

2. Loaded status

   The sensor spring presses the valve stem strongly, so the brake fluid pressure is set highly.

NOTICE

Don't loose or don't retighten the adjusting nut crimping.



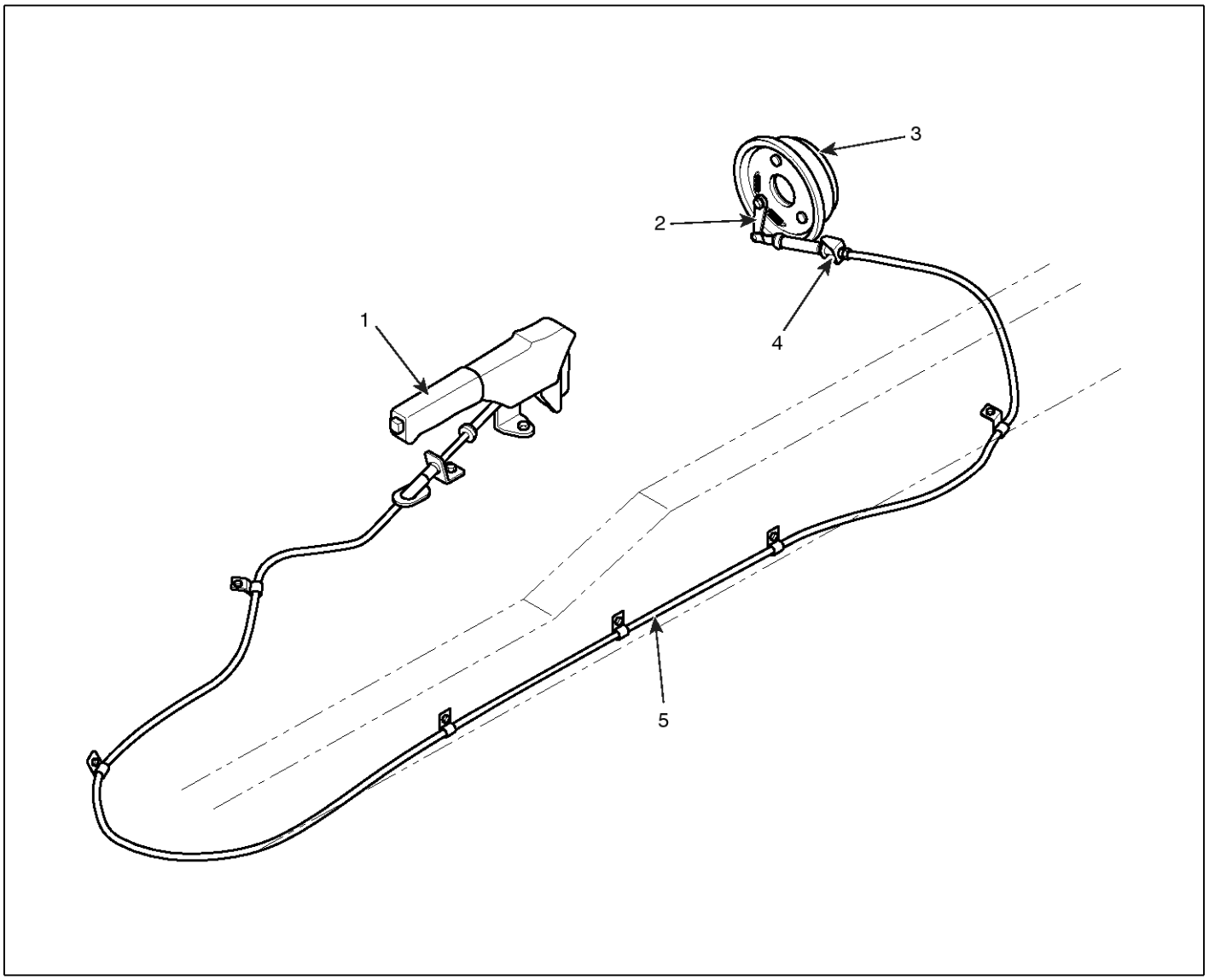
SUDBR9036L

Service and Inspection of the LSPV

Check the LSPV as below when replace the sensor spring, valve body assembly or reinstall the rear axle, rear spring.

Symptom	Probable Cause	Remedy
Braking force is insufficient.	Insufficient air bleeding	Air bleeding
	Maladjusted sensor spring	Readjust
	Sensor spring broken	Replace valve assembly
	Oil leakage in the brake fluid line or LSPV assembly	Tighten brake fluid line or replace LSPV assembly
Rear brake is lock too fast.	Maladjusted sensor spring	Readjust
	Inner fault the LSPV	Replace LSPV assembly

PARKING BRAKE GENERAL



SUDBRA022L

1. Parking brake lever assembly
2. Cam lever
3. Parking brake drum
4. Adjusting nut
5. Parking brake cable

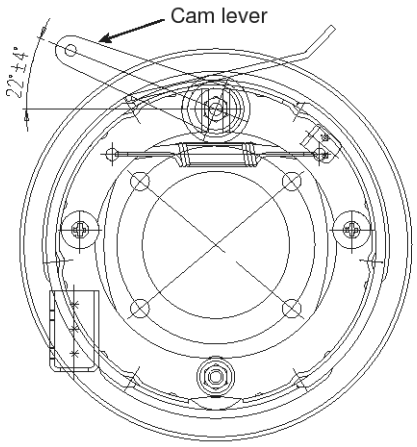
The parking brake installed behind the transmission is an internal expansion type acting on the propeller shaft.

It controls propeller shaft rotation to work as a parking brake.

The control is wire mechanical type; brake shoes are pressed via a wire to control the propeller shaft.

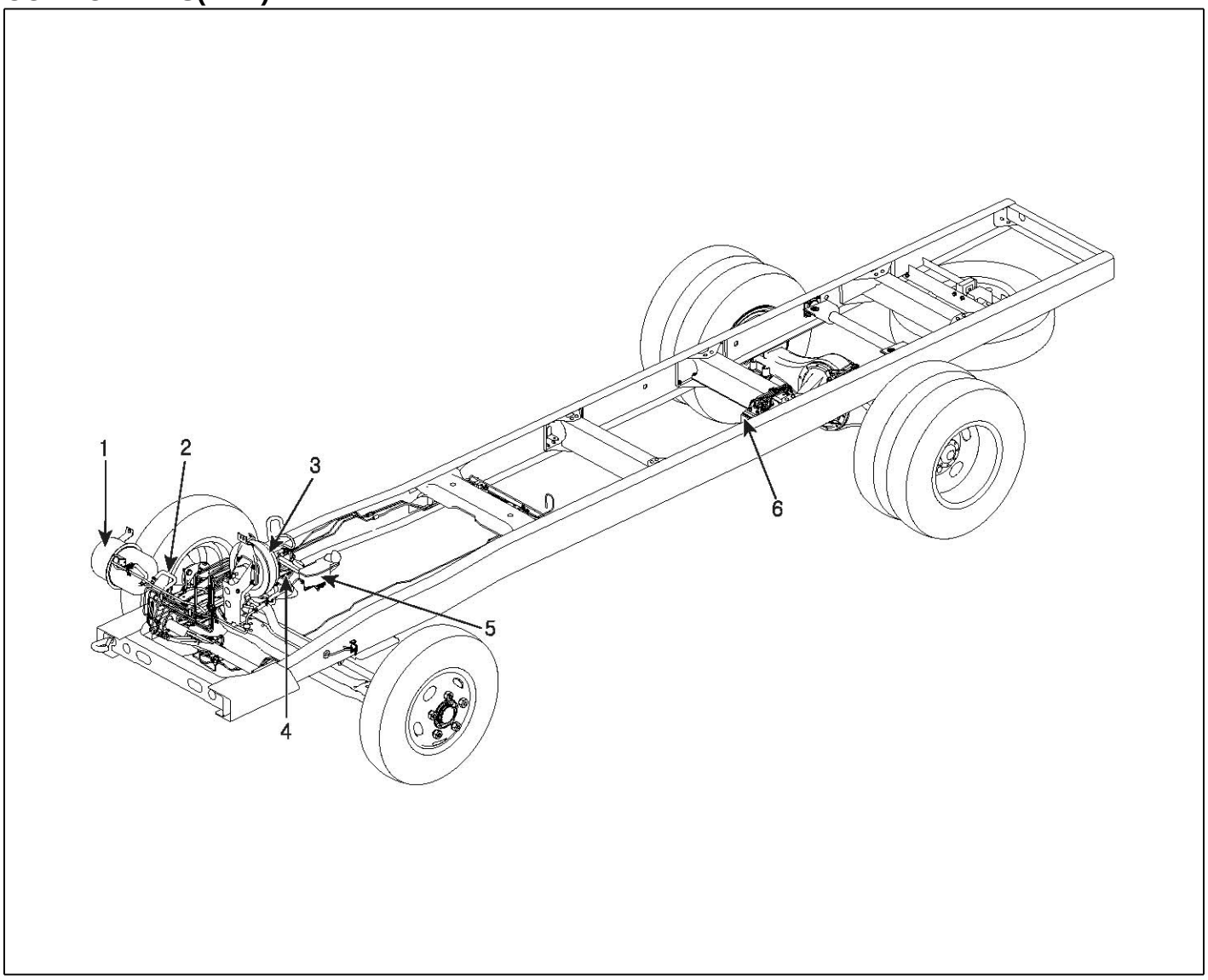
Parking Brake Proper

When the lever at the driver's seat is pulled, the cam lever is actuated via a wire cable and resultant cam rotation causes the brake shoes to expand and be forced against the brake drum. The braking force is thus obtained by friction between the shoes and drum. When the lever is released, the cam lever returns to the initial position and the braking force is released by the brake shoe return springs.



EMTBR5019A

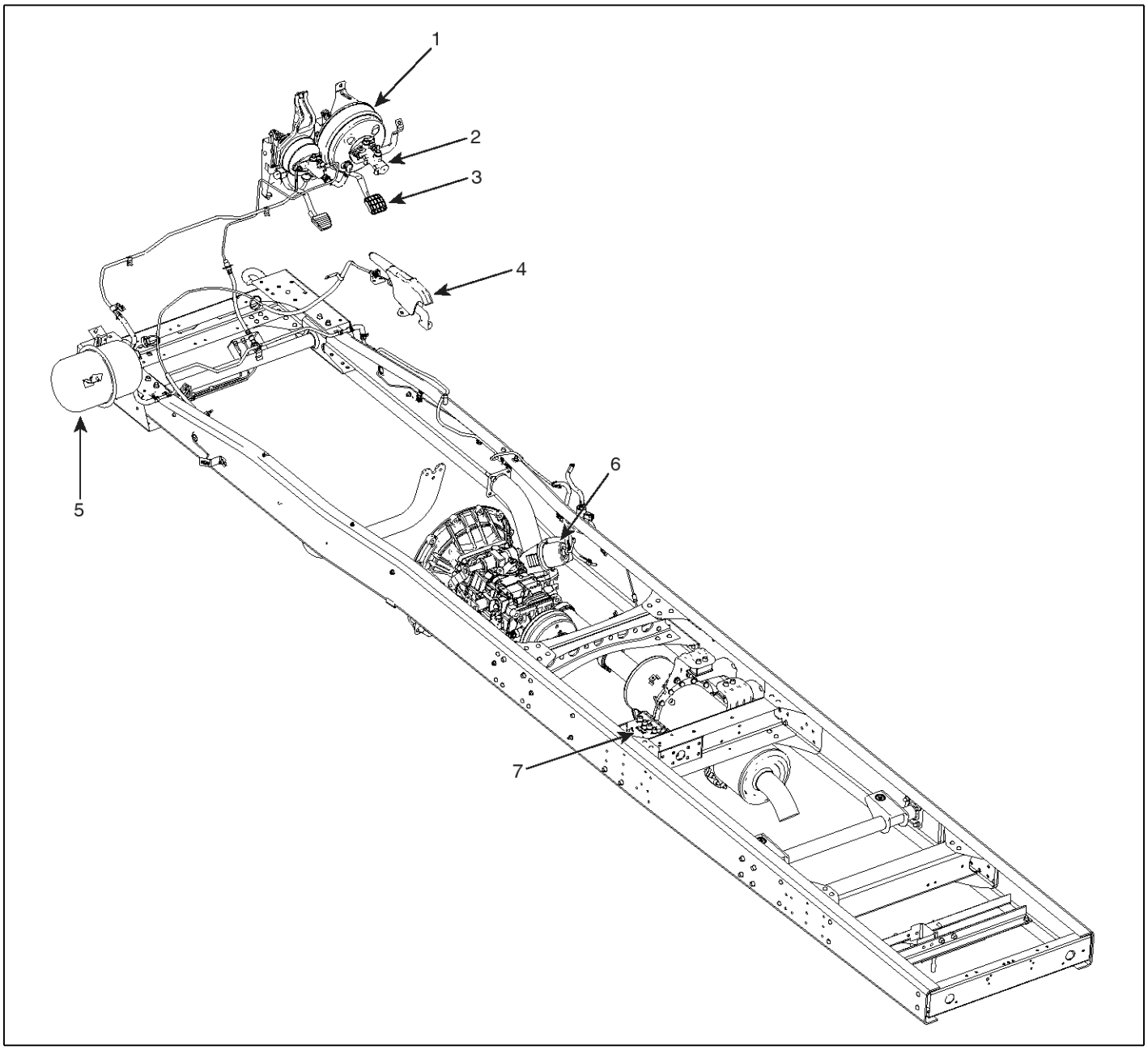
COMPONENTS(LHD)



SUDBRA001L

1. Vacuum tank
2. Vacuum hose
3. Brake booster
4. Master cylinder
5. Reservoir tank
6. A.B.S modulator

COMPONENTS(RHD)



SUDBRA002L

1. Brake booster
2. Master cylinder
3. Brake pedal
4. Parking brake lever
5. Vacuum tank
6. Exhaust brake
7. ABS HECU(Hydraulic Electrical Control Unit)

Diagnosis

Symptom	Causes	Remedy	Remark
Irregular Braking Force	The air pressures of tire are different.	Adjust the air pressure of tire.	
	The sizes of the right and left tires are different .	Replace the tire.	
	The adjustment of the wheel bearing is defective.	Adjust (Check the wheel bearing)	
	The sizes of the right and left wheel bases are different.	Check and adjust the loosening the U-bolt or damages on center bolt.	
	The wheel alignment is defective.	Adjust	
After releasing the brake pedal, the braking force is release too late.	The vertical surface of the back plate is rough.	Replace the back plate or check the lining.	
	The operation of the wheel cylinder is defective .	Check the contacting, the piston cup and wearing status. If needed, replace it. Check the lining.	
	The return spring is damaged.	Replace the spring.	
Unbalance at the right and left braking force	The surface of the lining is contaminated by the oil, grease or water.	If it is contaminated by oil or grease, then replace it. If it is contaminated by water , dry it.	
	The lining is defective or The material of lining is improper.	Replace or adjust.	
	The wear is irregular. The surface is rough.	Replace the lining. Check the inside of the drum, if needed, replace it.	
	The lining contact is defective.	Adjust the lining with being installed.	
	The brake drum is worn irregularly.	Adjust or replace it.	
Unstable braking force	The brake drum is deformed.	Replace	
	The back plate is deformed or loosened. The vertical surface of it is rough.	If it is loosened, tighten with specified torque. Otherwise, replace it.	
Improper Lock Point	The drum is worn.	Adjust or Replace	Drum limit STD : Dia+2mm
	The lining is worn irregularly.	Adjust	
	The lining contact is defective.	Adjust with being installed. (Temperature of lining should be less than 100°C)	

Symptom	Causes		Remedy	Remark
Low Braking Force	The clearance between the brake pedal and floor is 45mm or more. (at Pressure-600mmHg, Pressure 50kg)		Refer to the item for decreasing the clearance between the brake pedal and floor.	
	The lining contact is defective.		Adjust with being installed not being disassembled. (Temperature should be 100 °C or less)	
	The surface of the lining is contaminated by the oil, grease or water. The lining is deteriorated.		If it is contaminated by oil or grease, then replace it. If it is contaminated by water , dry it.	
	The vacuum force is too low.		Replace the lining.	
	The drum surface is rough.		Check the pipe or the vacuum pump. If needed, replace.	
	The brake booster is defective.		Adjust or Replace	
	The brake oil level is too low.		Adjust or Replace	
The clearance between the pedal and the floor is too narrow.	The air intrudes.		Refill	
	Vapor lock		Air Exhausting	
	The adjustment on pedal is defective. The clearance is too large.		Referring to the brake drawn item, adjust or replace. And then exhaust the air.	
	The shoe clearance is too large.		Adjust the pedal clearance. Check the total stroke.	
	The cup of the master cylinder is defective.		Adjust the shoe clearance. If the wear exceeds the limit, replace.	
	The brake shoe is deformed or damaged.		If the tightening does not satisfy the specifications, replace the kit.	
	The brake booster is defective.		Replace	
	When the wheel is rotating with being lifted by jack, there are some noises.		Replace	
During braking, the noise and shock are made abnormally.	During braking (at low speed), noise is made continually.	Foreign materials in drum	Check that the brake is damaged. Remove the foreign materials.	
		Return spring is damaged.	Check that the parts are damaged by broken parts. If needed, replace.	
		Hold down cup is damaged.	Check that the parts are damaged by broken parts. If needed, replace.	
	The grease is deficiency in sliding parts.	Improper adjustment on wheel bearing	Check the rotating surface. Adjust	
		The lining is worn.	Replace	
	The drum inside surface is rough.		Apply the grease.	
	The drum is cracked.		Modify the inner surface with sand paper . Replace	

Symptom	Causes		Remedy	Remark
The drum is overheated.	The outlet of the brake master cylinder is clogged.		If the booster operating rod is not properly adjusted, adjust the pedal clearance of the rod clevis to 10~15mm.	
	The brake does not return.		Check the burst of the return spring, the bearing lubricant, the stop lamp switch adjustment. If needed, adjust.	
	The booster is defective.		Replace	
	The vertical surface of the back plate is scratched.		If the surface is too rough, replace. If it is too dry, apply the grease.	
	The wheel cylinder piston cup is defective.		Replace	
	The oil return has problems due to the over tight of the brake pipe nut.		Check the connector hole diameter. If it is reduced, replace.	
	When the wheel is rotating with being lifted by jack, the wheel is hard to rotate.	The wheel bearing clearance is too large.	Replace bearing or adjust.	Specific wheel is overheated.
		Shoe clearance is improper.	Adjust	
		Return spring is defective.	Check the part damages due to the spring over working. If needed replace.	
		Brake shoe is worn.	Replace	
The pedal returning is defective.	The pedal linkage is rusted or deformed.		Disassemble. Adjust or replace. Oil the grease.	
	It is bursting due to the defectives on the pedal return spring.		Replace	
	The booster operating rod is pushed.		Adjust the pedal clearance with 10~15 mm.	
Brake is vibrating.	The drum is eccentrically centered.		Replace	
	The drum is deformed.		Replace	
	The king pin bushing is worn.		Replace the bushing	
	The hub bearing is worn.		Adjust (Check the rolling surface) or replace.	
Brake is drawn.	The pedal clearance is too narrow.		Adjust the booster working rod.	
	The shoe clearance is improper.		Adjust	
	The back plate vertical surface is rough.		Replace the back plate.	
	The shoe spring is burst.		Replace	
	The master cylinder or wheel cylinder piston cup is deteriorated and swelled.		Replace	

Symptom	Causes	Remedy	Remark
Brake makes noises.	Brake shoe contacting is defective.	Adjust the lining with being installed not being disassembled (Temperature should be 100°C or less)	
	Lining is deformed.	Replace the lining. Replace the drum if it has hardened surface.	
	Drum has hardened surface.	Replace.	
	Shoe is deformed.	Replace.	
	Back plate is deformed or installed improperly.	Replace or adjust	
	Front bearing is loosened.	Adjust (Check the rolling surface)	
	Powder from the wear of the lining is adhered.	Clear	
	Lining is worn.	Replace.	
Exhaust brake does not work.	Vacuum pressure is improper.	Check the vacuum pump or piping. If needed repair.	
	Electric circuit is defective.	Check the clutch switch, the micro switch and the exhaust brake circuit. If needed, repair.	
	Vacuum pipe is damaged.	Replace.	
	3-way magnetic valve does not work.	Replace.	
	Exhaust brake valve does not work.	Replace.	
	Exhaust brake valve shaft is adhered.	Replace.	
	Power chamber is defective.	Disassemble and check.	
Exhaust brake can not be released.	3-way magnetic valve does not work.	Replace.	
	Exhaust brake valve does not work.	Replace.	
	Exhaust brake valve shaft is adhered.	Replace.	
	Electric circuit is defective.	Check the clutch switch, the micro switch and the exhaust brake circuit. If needed, repair.	

Diagnosis (Parking brake)

Symptom	Causes		Remedy	Remark
Parking brake does not work.	Operating mechanism has a problem.	When pulling the parking brake with 30kg, there is no lever stroke clearance and shoe clearance.	Adjust the shoe clearance and cable.	
		The locking status between the lever lock latch and Ratchet pull is improper.	Adjust the Ratchet pull lock status. Replace it	
		Wire is broken or elongated.	Replace the cable.	
	Parking brake is defective.	Tolerance between the shoe clearance and the brake lever pulling is too large.	Adjust the shoe clearance.	
		Drum inner surface is deformed or twisted.	Repair the drum inner surface. Replace the lining.	
		Lining is irregularly worn. Drum inner surface is contacted irregularly .	Replace the lining.	
		The oil of drum and lining is contaminated.	Clear the inner surface of the drum. Replace the lining.	
Parking brake can not be released.	Operating mechanism has a problem.	Return spring is damaged. The tension of the return spring is inferior .	Replace the return spring.	
		The inner cable does not move smoothly.	Replace the cable.	
		After the parking brake is released , the brake is operating.	Adjust the pulling tolerance limit.	
	Parking brake is defective.	Return spring is damaged. The tension of the return spring is inferior .	Replace the return spring.	
		The shoe clearance is too narrow.	Adjust the shoe clearance.	

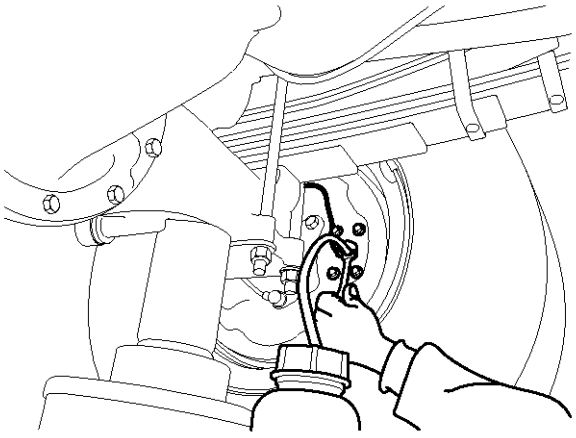
On-Vehicle Inspection and Adjustment

Air bleeding of the Brake

1. Fill up the brake oil tank with the brake oil at the maximum level. During the air bleeding, if the level is lowered, refill the brake oil.

   ⚠CAUTION
   Be careful that the brake oil does not drop on the painted surface. If the brake oil contacts the painted surface, immediately wash it by water.

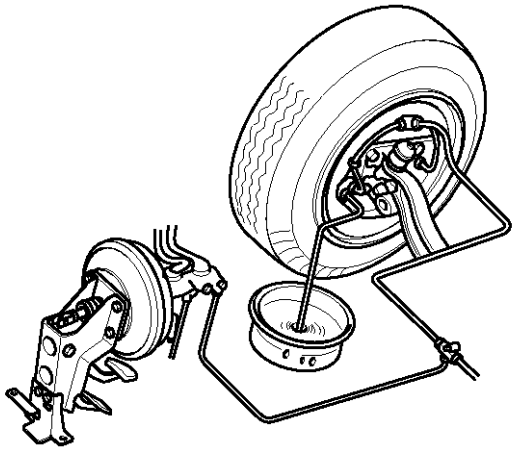
2. Connecting an end of transparent vinyl tubes at the air breather of the front wheel cylinder and the rear wheel cylinder, put the other end of the tubes into the transparent container having the brake oil.



KMTBR5518A

3. Step on the brake pedal several times. Pressing the brake pedal at half, loosen the air bleeder screw to evacuate the air with the brake oil.

   And then, pressing the pedal until it reaches to the floor, tighten the air bleeder screw. Release the pedal. There procedures should be repeated until any air bubble is not shown in the brake oil.



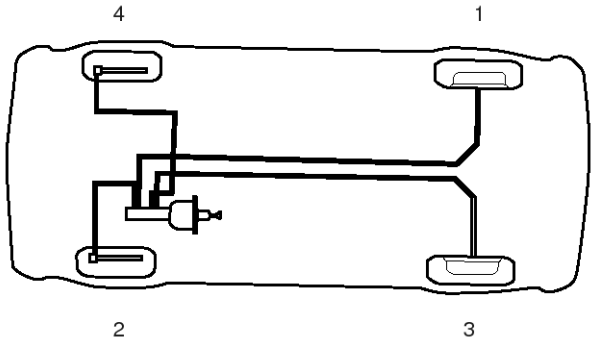
KMTBR5519A

4. Tighten the bleeder screw

Tightening Torque for the bleeder Screw
Front: 6.9~8.8Nm(0.7~0.9kgf.m, 5.1~6.5lb-ft)
Rear : 6.9~8.8Nm(0.7~0.9kgf.m, 5.1~6.5lb-ft)

5. Step on the brake pedal several times. Pressing the brake pedal at half, loosen the air breather screw to evacuate the air with the brake oil.

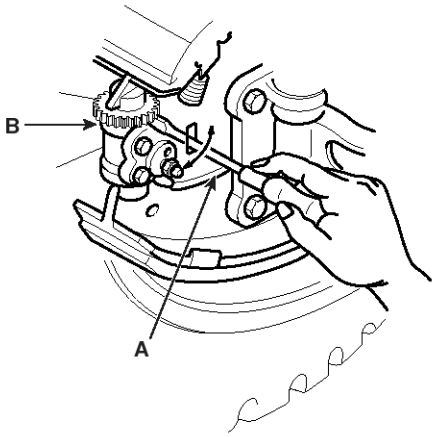
   And then, pressing the pedal until it reaches to the floor, tighten the air breather screw. Release the pedal. There procedures should be repeated until any air bubble is not shown in the brake oil.



KMTBR5520A

Adjustment of Brake Shoe Gap

1. Using the screw driver(A), turn the wheel cylinder adjuster(B) to the shoe expansion direction until the drum is not rotate anymore. Turn the adjuster reversely with the following notch number. (At that time, the drag torque between the lining and the drum should be less than 50kgf.m).



KMTBR5521A

The Notch Number for reverse rotation of the Adjuster.

Front Wheel Cylinder	Auto adjuster type	9~11
	Manual adjuster type	4~6
Rear Wheel Cylinder	Auto adjuster type	9~11
	Manual adjuster type	4~6

Specifications

Front Wheel Brake (Drum Type)

Item		Specifications
Brake type		2-leading Brake
Wheel cylinder	Inner diameter	31.75mm
Brake drum	Inner diameter	320mm
Brake lining	Width x Thickness (mm)	85 x 10(Standard), 110 x 11(Option in case of HD72,78)

Front wheel Brake (Disk Type)

Item	Specifications
Cylinder diameter	Ø 76 mm
Effective radius	118 mm
Disk outer diameter	Ø 304 mm
Disk inner diameter	Ø 164 mm
Pad thickness	12.5 mm
Pad effective thickness	10.5 mm

Rear Wheel Brake

Item		Specifications
Brake type		2-leading Brake
Wheel cylinder	Inner diameter	28.57mm
Brake drum	Inner diameter	320mm
Brake lining	Width x Thickness (mm)	85 x 10(Standard), 110 x 11(Option in case of HD72,78)

Brake system

Item			Specification
Brake Pedal	Total Stroke		140 mm
Booster	Total Stroke		31 mm
Master Cylinder	Inner Diameter		Ø 31.75 mm, Ø 30.15 mm
	Stroke	Piston	31±1 mm
		Primary	17 ± 0.5 mm
		Secondary	14 ± 0.5 mm

Exhaust Brake

Item			Specification
Control System			Combination of Electric and Vacuum Type
Exhaust Brake Valve Type			Butterfly Valve
Exhaust Brake Chamber	Diaphragm Effective Diameter		76.2mm
	With Installing N(kg)	Spring Tension	90~110 (9.18~11.22)
		Rod Tensile Force	142.1(14.5): Vacuum Pressure-400mmHg
		Spring Tension	125~153 (12.78~15.62)
		Rod Tensile Force	103(10.5) Vacuum Pressure-400mmHg

Parking brake

Item		Specification
Type		Internal expansion type acting on propeller shaft
Control		Mechanical cable
Parking lever	Normal stroke	8~9 clicks(20 kgf)
Parking brake size	Drum i.d. x Lining width x Lining thickness	180 x 35 x 5 (T/M : M2S5, M3S5) 190 x 45 x 4 (T/M : M035S5) 230 x 55 x 4 (T/M : T60S5, T60S6)

SERVICE STANDARDS

Description				Nominal value, mm (Basic diameter in [ ])		Limit (mm)	Correction and remarks
Brake pedal	Bushing to collar clearance			[16]0.02 to 0.26		0.5	Replace bushing
	Brake pedal play			3-8			Adjust
	Stop lamp switch installation clearance			0 to 1			Replace
Brake master cylinder	Primary and secondary piston to cylinder body clearance			0.038 ~ 0.145		0.2	Replace
	Primary retainer assembly	Free length		38.1			Replace
	Secondary spring deterioration	Free length		37.7			Replace
Front drum brake	Brake drum	I.D.		320		322	Replace
	Brake lining	Thickness		10		4	Replace
	Return spring			30±3/227		19/227	Replace
	Wheel cylinder body to piston clearance			[31.75]0.03 to 0.13		0.2	Replace
	Brake shoe clearance(No. of notches returned of wheel cylinder adjuster)			Auto	9~11		Adjust
				Manual	4~6		
Rear wheel brake	Brake drum	I.D.		320		322	Replace
	Brake lining	Thickness		10		4	Replace
	Return spring	Load N(kgf)/installed length		30±3/227		19/227	Replace
	Wheel cylinder	Body to piston clearance		0.02-0.11		0.2	Replace
	Brake drum	Out of roundness		0.05		-	Replace
	Brake shoe clearance (number of return notches of wheel cylinder adjuster)			Auto	9~11		Adjust
				Manual	4~6		

Description					Nominal value, mm (Basic diameter in [ ])	Limit (mm)	Correction and remarks
Exhaust brake	Power chamber air tightness [15 seconds after application of -67 kPa (-500 mmHg) negative pressure]				-63 kPa (-475 mmHg) or more		Replace
	Valve to body clearance when butterfly valve is fully closed [at power chamber vacuum -87 to -93 kPa(-650 to -700 mmHg)				0.1 to 0.4mm		Replace
	3-way magnet valve	Air tightness	When -100 kPa (-750 mmHg) negative pressure is applied from vacuum tank side to operate valve with exhaust brake unit side plugged tightly		No air to be sucked in from atmosphere side		Replace
			When 98 kPa (1 kgf/cm² air pressure is applied from atmosphere side to operate valve with exhaust brake unit side plugged tightly		No air to leak from vacuum tank side		Replace
		Minimum operating voltage	When -100 kPa(-750 mmHg) negative pressure is applied to vacuum tank side	24V type unit	22V or less		Replace
			When 98 kPa (1 kgf/cm² air pressure is applied from atmosphere side with exhaust brake unit side plugged tightly	24V type unit	22V or less		Replace

SERVICE STANDARDS (Parking brake)

Description			Nominal value, mm (Basic diameter in [ ])	Limit (mm)	Correction and remarks
Brake drum	I.D.		180	181	Correct to limit, replace when limit is reached.
			190	192	
			230	232	
	Squareness		0.05 or less		Correct or replace
	Concentricity		0.1 or less		
	Cylindricity		0.1 or less		
	Static rotation imbalance		0.49 N.cm(50 gf.cm) or less		
Brake lining thickness		Model with M2S5 T/M	10 ~ 11	4.0	Replace
Brake shoe clearance		Model with M2S5 T/M	0.25 to 0.35		Adjust
Brake shoe return spring	Free length	Model with M2S5 T/M	98	-	
	Load N (kgf)/installed length	Model with M2S5 T/M	67 to 86 (6.8 to 8.8)/104	104.364 (6.5)/104	Replace
Shoe hold down spring	Spring A(longer one of free length)	Free length	34.1		Replace
		Load N (kgf)/installed length	59 to 69 (6.0 to 7.0)/13.7	59 (6.0)/13.7	
	Spring B(shorter one of free length)	Free length	23.6		
		Load N (kgf)/installed length	59 to 69 (6.0 to 7.0)/10.5	59 (6.0)/10.5	

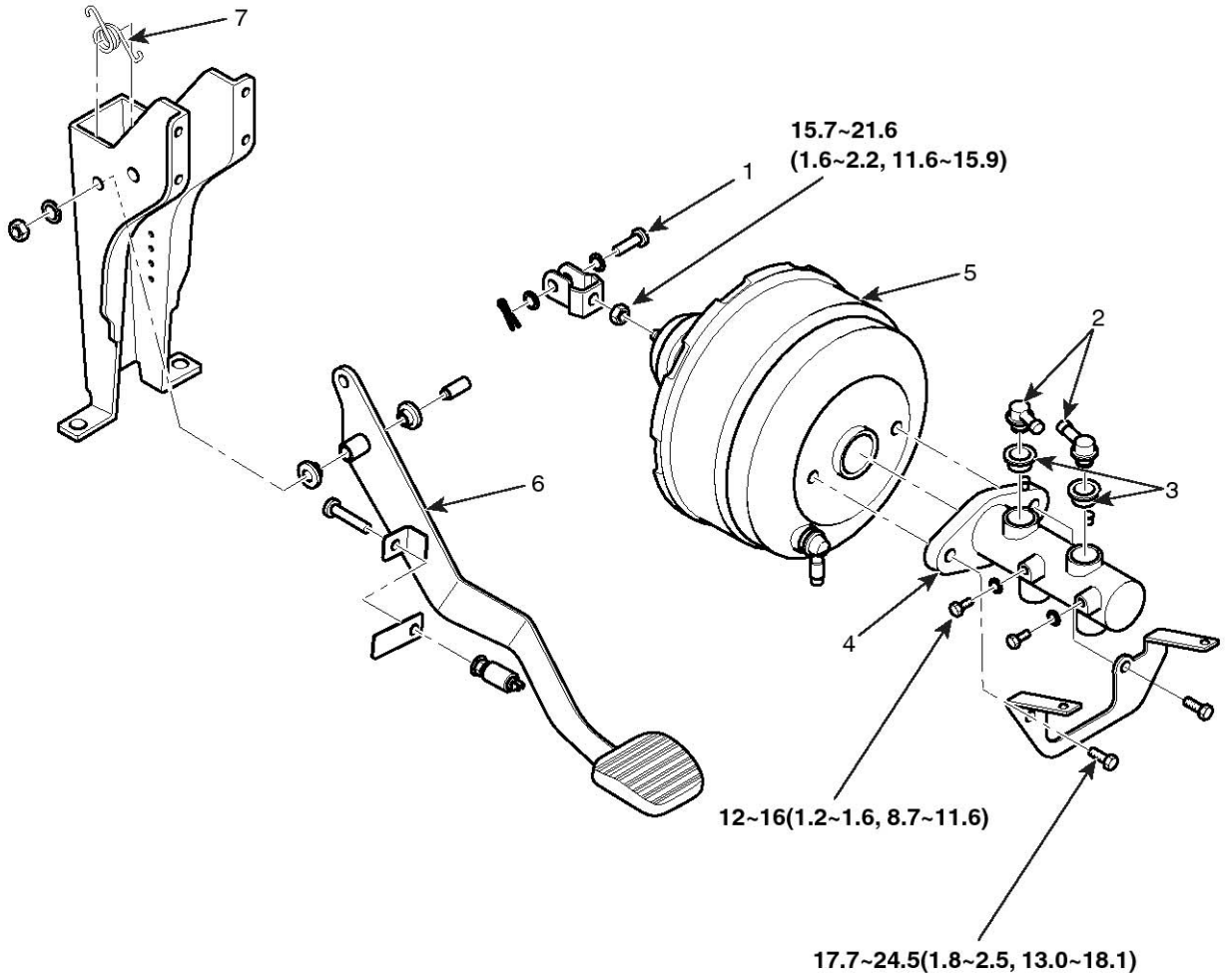
Tightening torque table

Description	Tightening torque		
	Nm	Kgf.m	Lb-ft
Mounting nut between the master cylinder and booster	17.7~24.5	1.8~2.5	13~18.1
Master cylinder set bolt	12~16	1.2~1.6	8.7~11.6
Brake booster mounting nut	12.7~15.7	1.3~1.6	9.4~11.8
Brake booster clevis lock nut	15.7~21.6	1.6~2.2	11.6~15.9
Master cylinder outlet port nut	12.7~16.8	1.3~1.7	9.4~12.3
LSPV connecting link mounting bolt	22~33	2.2~3.3	15.9~23.9
LSPV flange bolt mounting bolt	22~33	2.2~3.3	15.9~23.9
Front drum brake air bleeding port	6.9~12.7	0.7~1.3	5.1~9.4
Front spindle mounting bolt	98~137	10~14	72~101
Brake hose to union mounting bolt(Front drum brake)	24.5~29.4	2.5~3	18.1~21.7
Exhaust brake to exhaust pipe mounting bolt	44.1~58.8	4.5~6	32.5~43.4

Vacuum Assisted Hydraulic Brake

Brake Pedal

Component



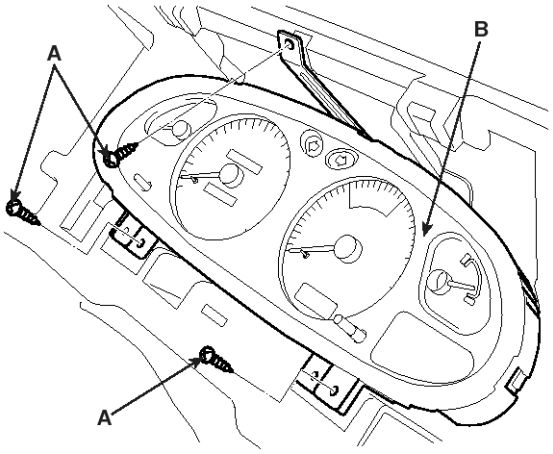
Tightening torque : Nm(kgf.m, lb-ft)

SUDBRA003L

1. Clevis pin
2. Hose connector
3. Grommet
4. Master cylinder
5. Booster
6. Pedal assembly
7. Return spring

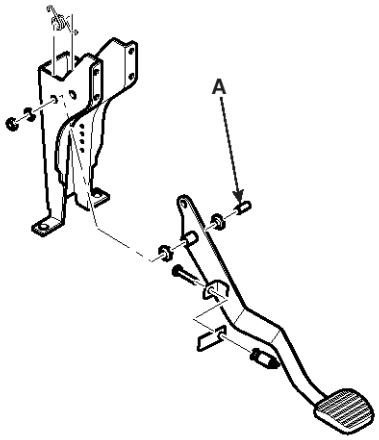
Removal

1. Loosen the steering column assembly mounting bolt. Pull down the steering column.
2. Loosen the bolt(A), Remove the instrument panel(B).



KMTBR5003A

3. Remove the master cylinder (Refer to the BR-"Master cylinder")
4. Remove the brake booster (Refer to the BR-"Booster")
5. Remove the brake light switch.
6. Remove the shaft bolt(A) connected to the bracket.

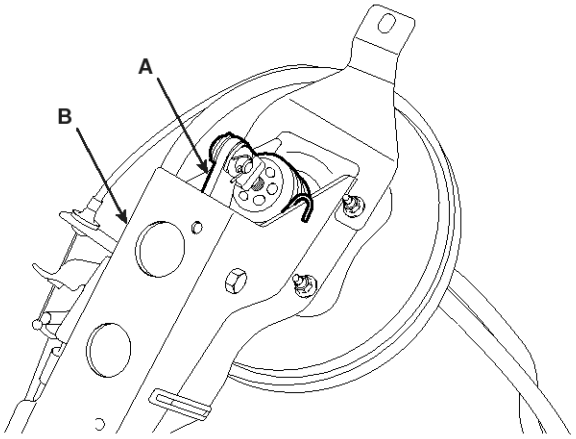


KMTBR5040A

Installation

1. Install the brake pedal assembly(A) to the bracket(B).

⚠CAUTION
Before the assembling, apply the grease inside of the brake pedal assembly pipe.



KMTBR5527A

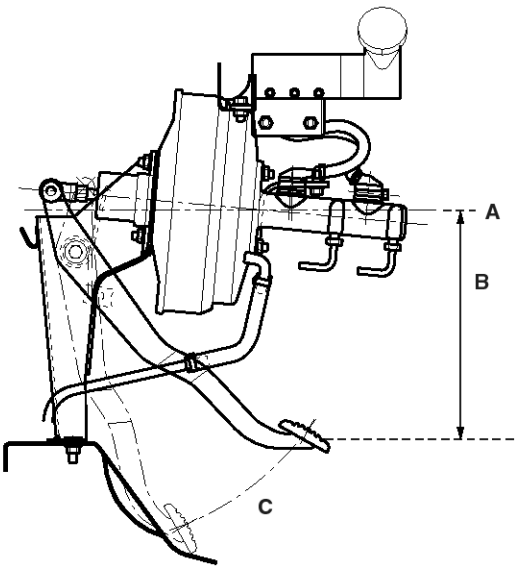
2. Install the brake light switch.
3. Install the booster and the master cylinder.

⚠CAUTION
Apply the grease on the clevis pin and the washer

Adjustment

Adjust the height of the brake pedal

1. Turn the booster operating rod so that the distance from the center of the brake pedal pad to the A point of the instrument panel lower portion is the 'B'. After adjusting, fix the clevis with the nut. Check that the maximum stroke of the pedal is more than 'C' (before filling the brake oil)



SUDBRA004L

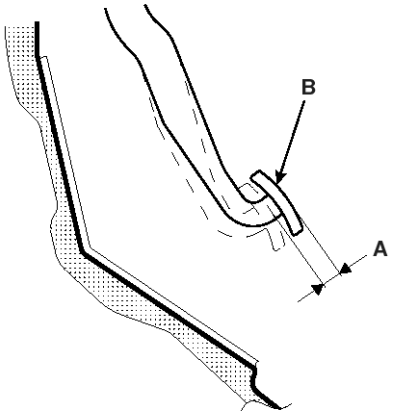
	Engine	B(mm)	C(mm)
Non A-BS	D4DD, D4GA	280±2	140±4
	The others	273±3	140±4
ABS	D4DD, D4GA	280±2	140±4
	The others	273±2	140±4

Free play clearance of the Brake pedal

1. Setting the brake pedal to the original position, check if the free play(B) clearance is 5mm at least by pressing the pedal(A).

   If the clearance excesses the reference, re-adjust the position of the brake pedal.

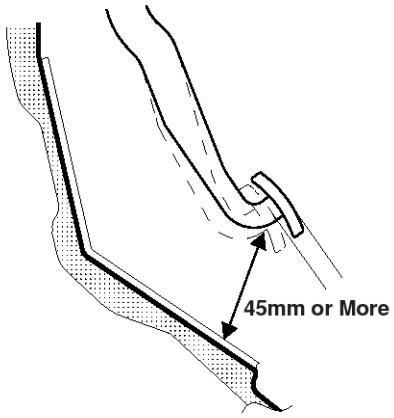
   ⚠CAUTION
   When checking the free play clearance of the brake pedal, the master back negative pressure should be 0.



KMTBR5005A

Gap between the brake pedal and the floor.

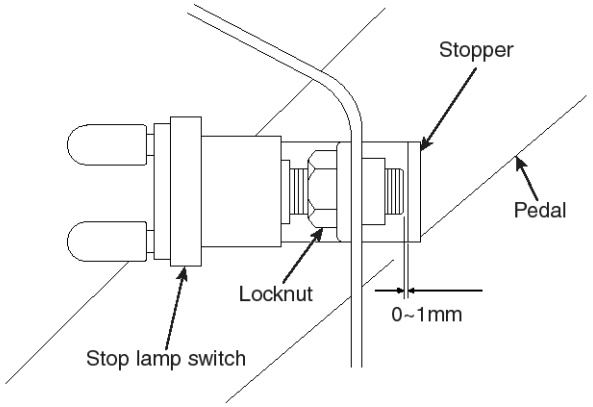
1. After cranking the engine, check if the gap between the floor and the pedal is more than 45mm by pressing the pedal with 50kg.



EMTBR5023A

Stop Lamp Switch

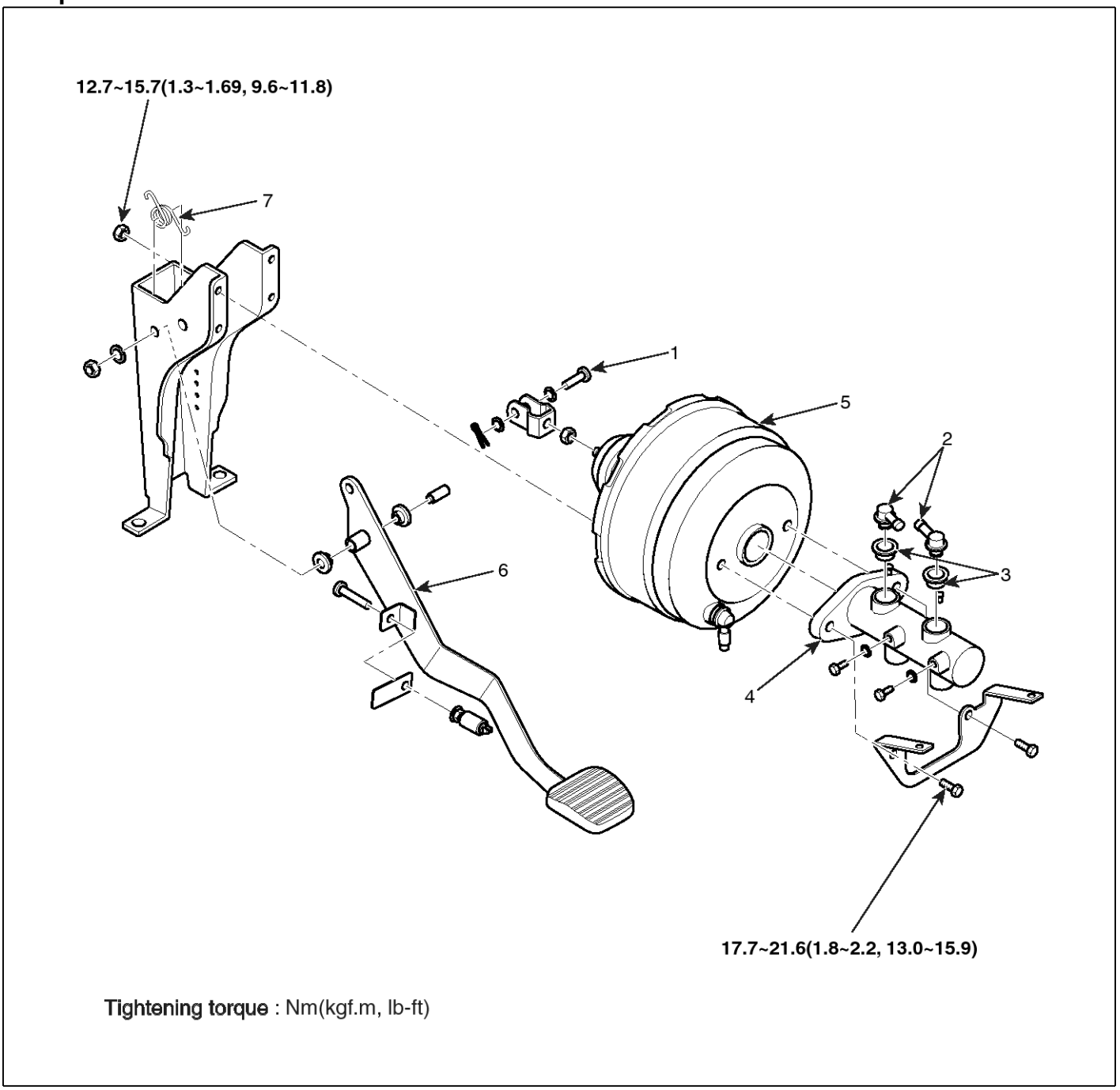
1. Adjusting the gap between the end of the brake. Stop lamp switch screw and the pedal stopper to 0~1mm, tighten the locknut.



SUDBR9014L

Brake Booster

Components

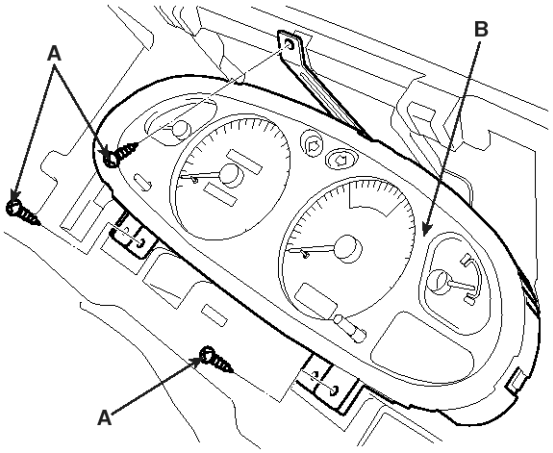


SUDBRA005L

1. Clevis pin
2. Hose connector
3. Grommet
4. Master cylinder
5. Booster
6. Pedal assembly
7. Return spring

Removal

1. Loosen the bolt for mounting of the steering column assembly. Put the steering column down.
2. Loosen the bolt(A), Remove the instrument panel(B).

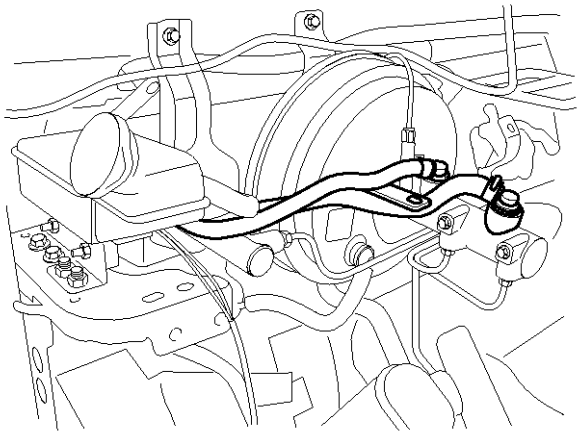


KMTBR5003A

3. Taking out the brake hose linking between the brake oil and the master cylinder, evacuate the brake oil. Also, taking out the clutch hose of the clutch master cylinder, evacuate the brake oil.

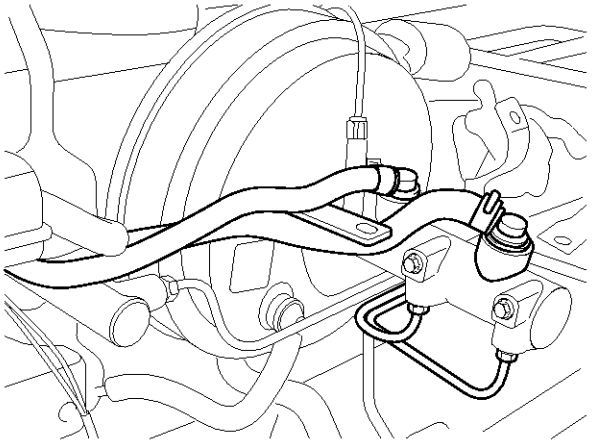
⚠CAUTION

As the brake oil could be harmful to the painted surface, if the body is contaminated by the brake oil, clean it out with water or soap water.



KMTBR5523A

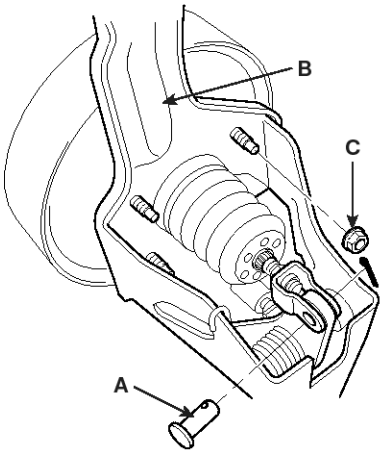
4. Loosen the 2 bolts for mounting the master cylinder. Disassemble the reservoir hose and the brake tube. Remove the master cylinder.



KMTBR5524A

5. Remove the brake booster and the master cylinder.
6. Remove the booster clevis pin (A) installed at the brake pedal assembly.

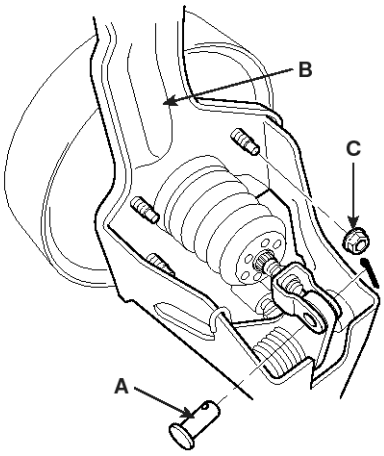
   Loosen the booster mounting nut (C) from the pedal support member (B). Remove the booster.



KMTBR5004A

Installation

1. Insert the clevis pin (A) into the brake pedal. Fix the split pin firmly.



KMTBR5004A

2. Tighten the booster mounting nut (C) to the pedal support member (B).
3. Connect the vacuum hose to the booster.
4. Assemble the master cylinder to the booster. Connect the reservoir hose and the brake tube.
5. Assemble the instrument panel. Install the steering column.

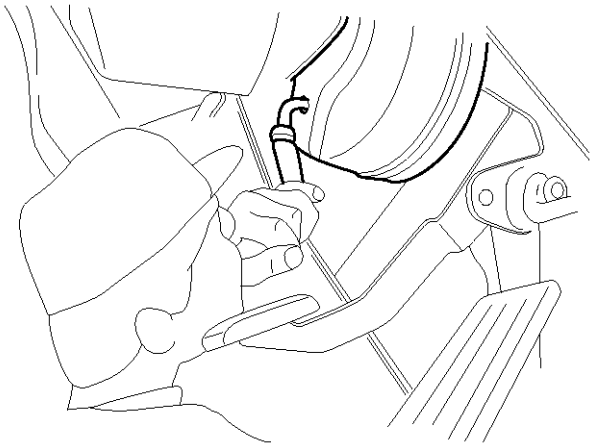
⚠CAUTION

- **After installing the brake booster, adjust the height of the brake pedal and the free play clearance.**
- **When installing, the snap pin and the clevis pin are should be replaced new ones.**
- **Apply the recommended grease on the clevis pin and the washer.**

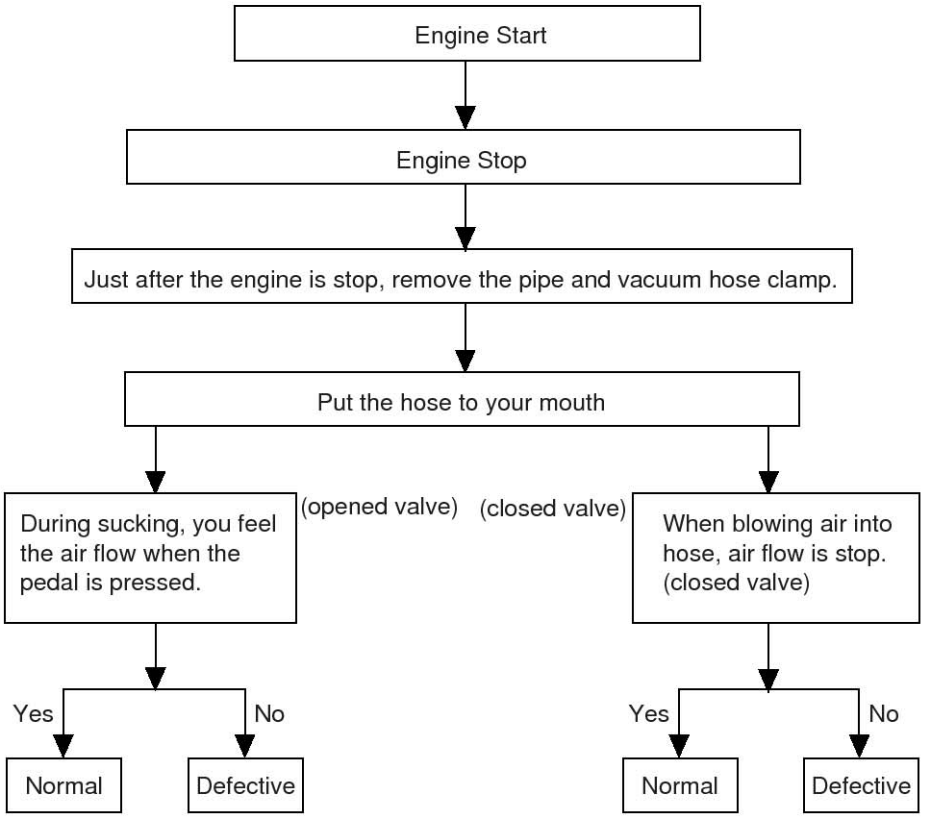
6. Fill the reservoir with the brake oil. Perform the brake air bleeding.
7. Check the brake oil leakage.

Inspection

There are two methods for inspecting the booster. The one is not to use the tester, the other is to use a simple tester for inspecting the characteristics. These two methods can be performed on vehicle. Before the inspection, check if the brake pipe and the hose are connected tightly or damaged.



KMTBR5525A



EMTBR5020A

⚠CAUTION

- **Be careful that a sharpen material does not intrude into the check valve.**
- **Check at the opened state and at the closed state of the valve.**
- **If it is replaced with kit, do not replace the check valve.**

Test for temporarily operating of Booster

The followings are for checking the general functions of the booster.

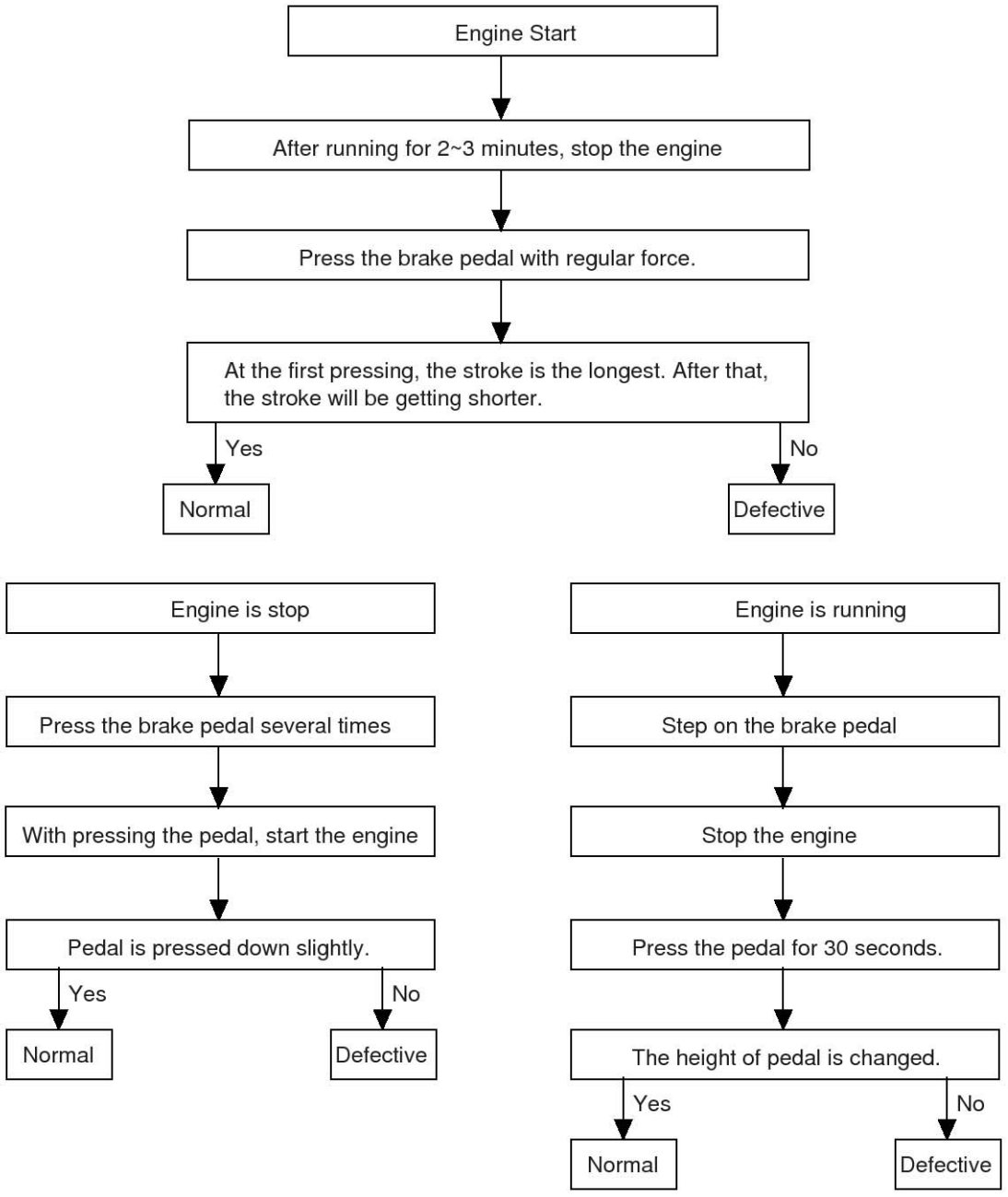
⚠CAUTION

- **If the booster has problem, it should be replaced in assembly because it can not be disassembled for repair.**

1. Method without tester

   After checking the following three-items, if they are all normal, then most functions of booster would be normal. If one of following items has a problem, the booster may have been damaged.

   - Check Valve
   - Vacuum Hose
   - Booster



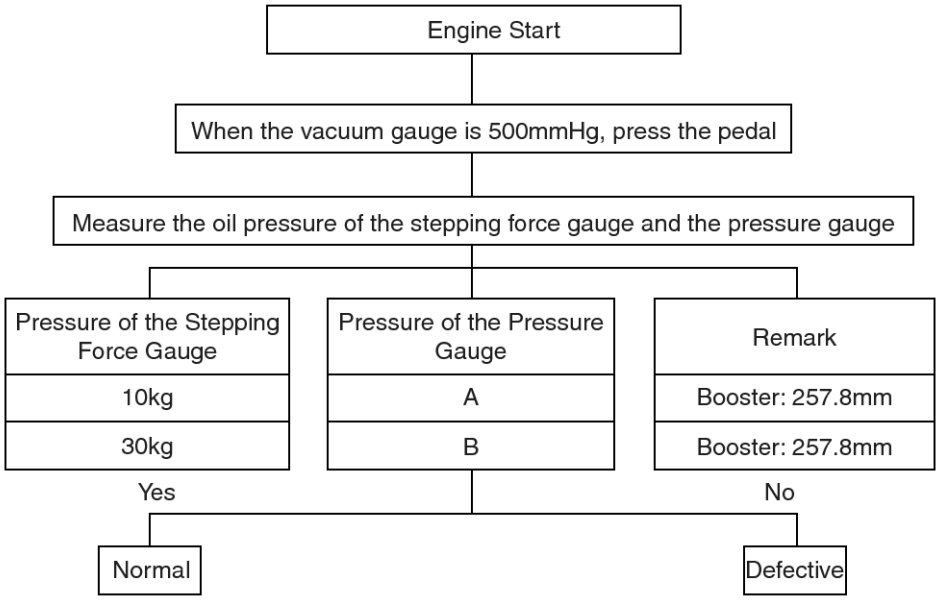
EMTBR5021A

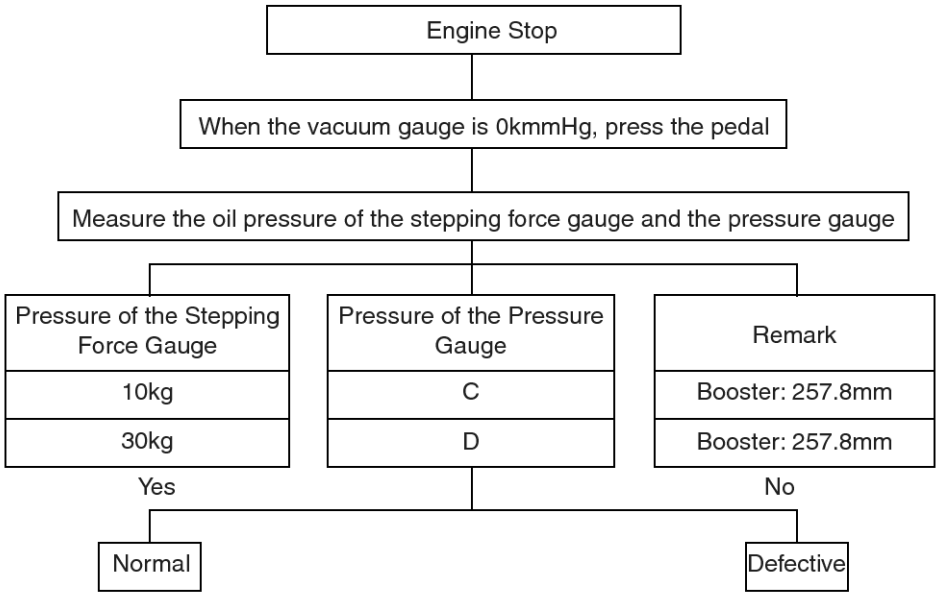
2. Method for test using a simple tester

   As shown in following figures, connect the vacuum gauge, the pressure gauge and the stepping (foot pressing) power gauge. Test in the following sequence.

If it lease one of two among the gauges shows abnormal valve, the following components may have a problem.

- Vacuum hose
- Booster
- Check Valve



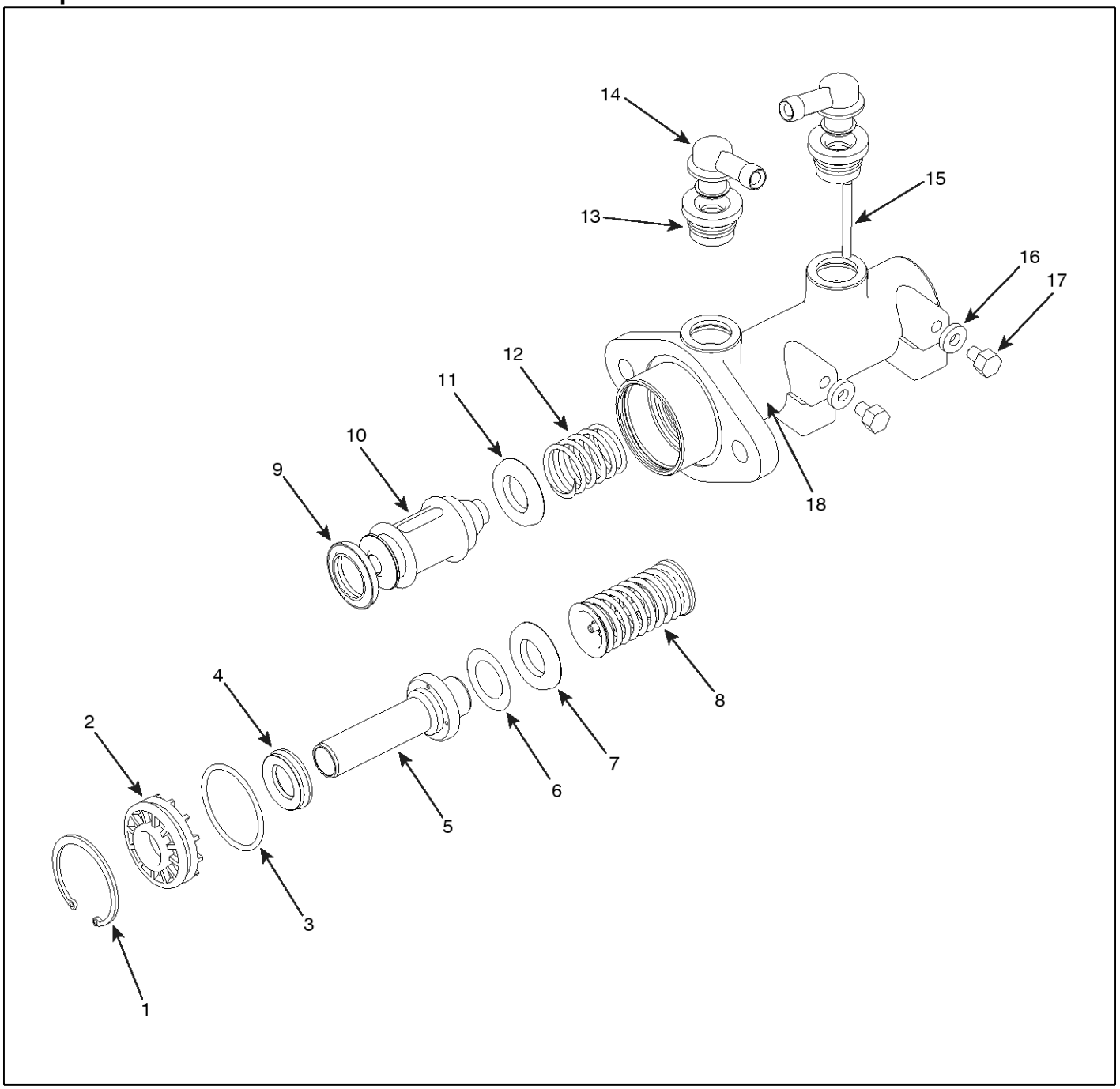


	Engine	A(kg/cm²)	B(kg/cm²)	C(kg/cm²)	D(kg/cm²)
Non ABS	D4DD, D4GA	37	81	2.5	12.5
	Except for D4DD, D4GA	41	87	2.5	13.5
ABS	D4DD, D4GA	48	78	2.5	13.3
	Except for D4DD, D4GA	48	78	2.5	13.3

SUDBRA014L

Brake Master Cylinder

Components

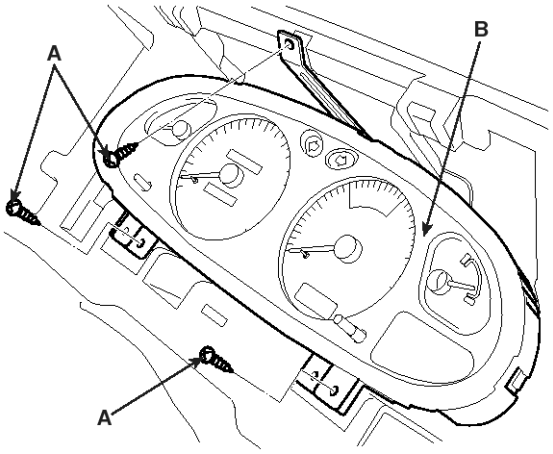


SUDBRA006L

1. Circlip
2. Guide bush
3. O-ring
4. Vacuum seal
5. Primary piston
6. Plunger Washer
7. Recup seal
8. Retainer ass'y
9. L-type seal
10. Secondary piston
11. Recup seal
12. Secondary Spring
13. Reservoir seal
14. Adaptor Pipe Fitting
15. Cylinder pin
16. Washer
17. Bolt
18. Body

Removal

1. Loosen the steering column assembly mounting bolt. Put down the steering column.
2. Loosen the bolt(A), Remove the instrument panel(B).

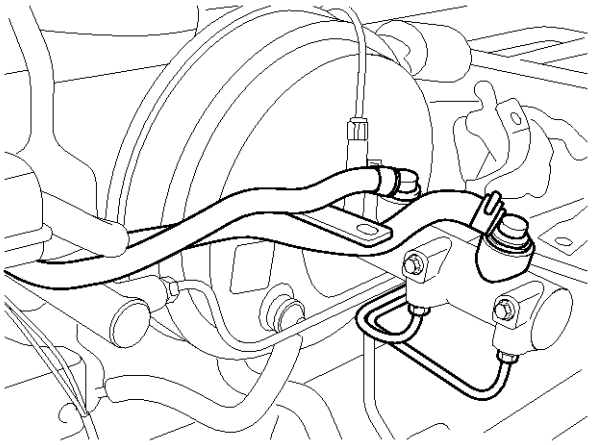


KMTBR5003A

3. Take out the brake hose installed between the brake oil tank and the master cylinder. Evacuate the brake oil. Take out the clutch hose of the clutch master cylinder. Evacuate the brake oil.

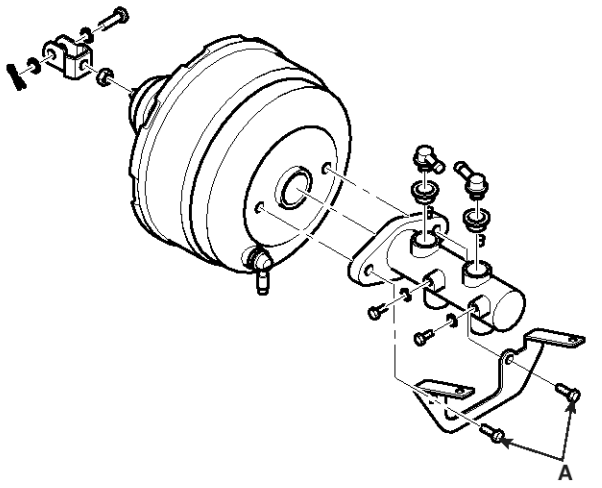
⚠CAUTION

If the painted surface is contaminated by the brake oil, the painted surface may be damaged. Clean out the brake oil from the body with water or soap water. Be careful that the brake oil does not contact you.



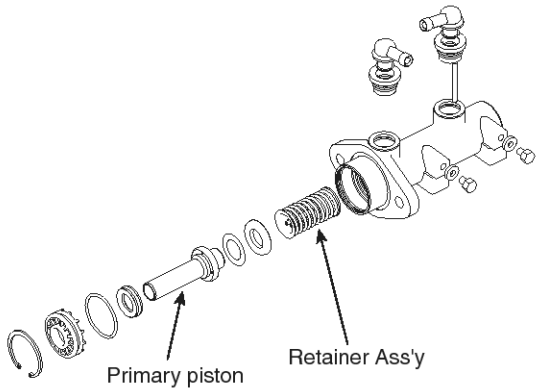
KMTBR5524A

4. Remove the tubes connecting to the front brake and the rear brake.
5. Remove the 2 of master cylinder bracket nuts connecting to the booster.



KMTBR5042A

6. Disassemble the primary piston assembly.



SUDBR9021L

7. Taking off the stopping, disassemble the secondary piston assembly.

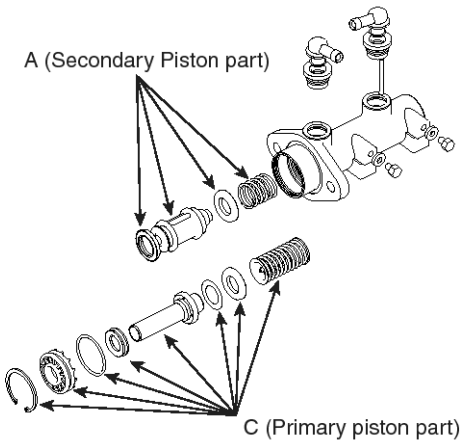
⚠CAUTION

Check if the master cylinder inner surface and the piston surface. If any one is damaged, replace it in assembly unit.

Installation

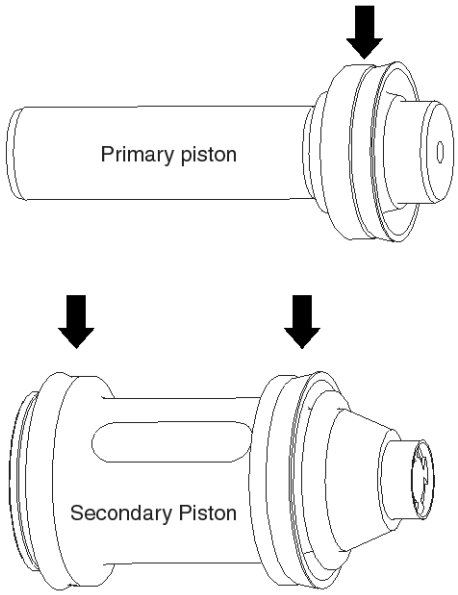
1. After assembling the secondary piston assembly(A), fix it with the cylinder pin.

   ⚠CAUTION
   Clear the inside of the cylinder or piston with the brake oil or alcohol. When assembling, apply the brake oil at piston and seal.



SUDBR9022L

2. Assemble the primary piston assembly(C). When assembling piston, assemble the retainer seal and recup seal align with the arrow direction to prevent the recup seal from being damaged. (Use only DOT3 for the brake oil.)

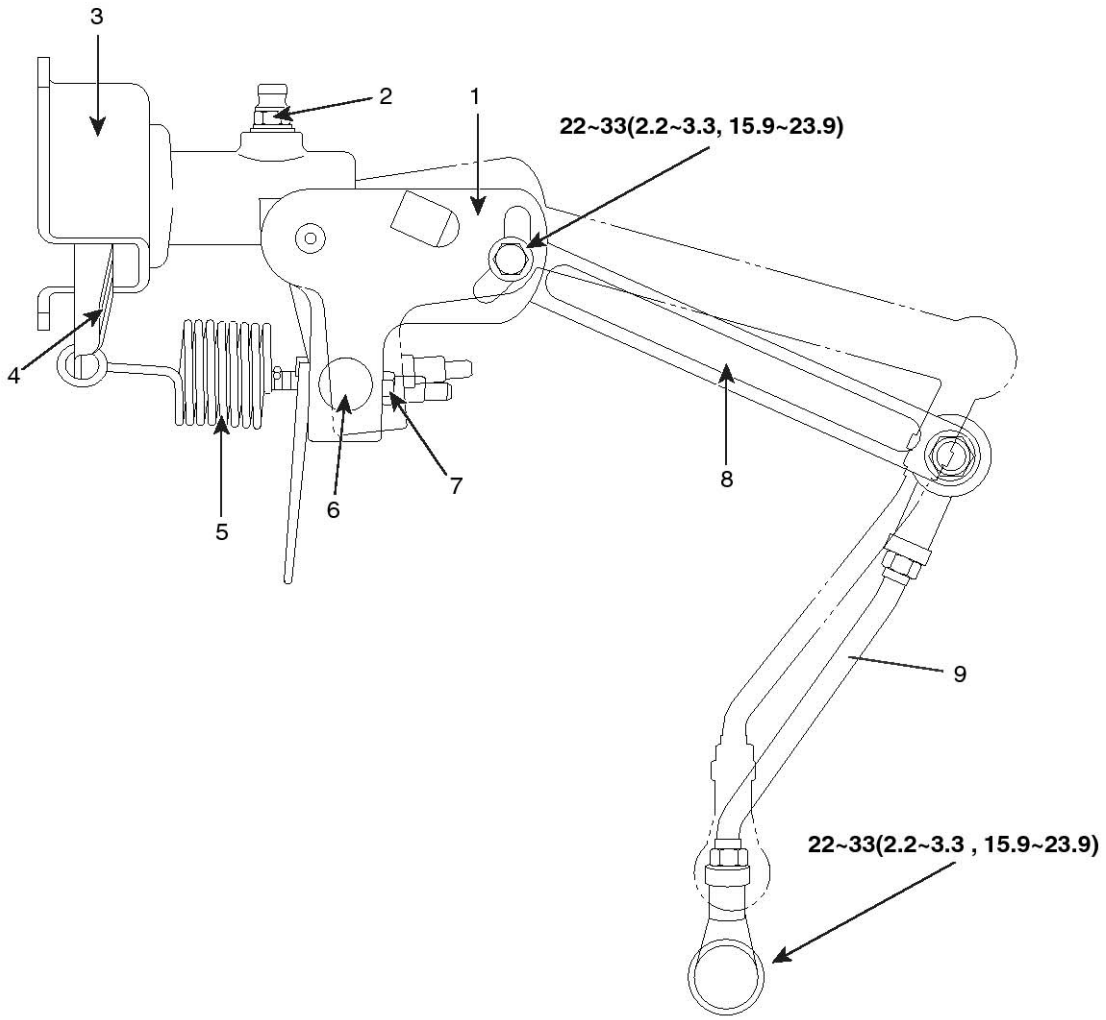


SUDBR9023L

3. Install the master cylinder at the booster.
4. Connect the two brake tubes. Connect the two brake tubes to the reservoir tank.
5. After installing the master cylinder, perform the air bleeding.

Load Sensing Proportioning Valve(L.S.P.V)

COMPONENTS



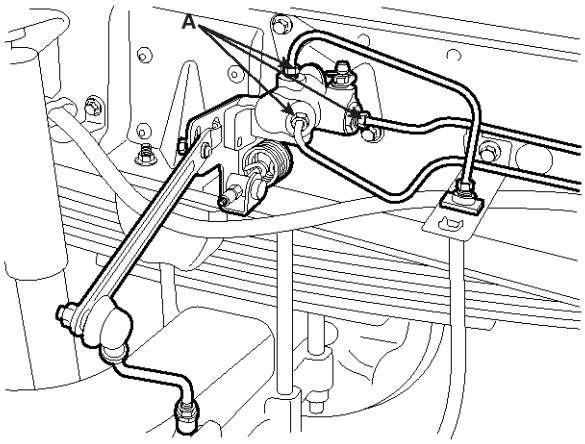
Tightening torque : **Nm(kgf.m , lb-ft)**

SUDBRA007L

1. LSPV assembly
2. Bleeder screw
3. Bracket
4. Lever assembly
5. Sensor spring
6. Spring guide
7. Adjusting nut
8. Operating lever
9. Connecting link assembly

Removal

1. Remove the brake tube(A) connecting to the LSP valve.



KMTBR5557A

2. Remove the LSP valve mounting bolt and nut.

Service and Inspection of the LSPV

1. Check the LSPV as below when replace the sensor spring, valve body assembly or reinstall the rear axle, rear spring.
   1) Braking force is insufficient

Probable Cause	Remedy
Insufficient air bleeding	Air bleeding
Maladjusted sensor spring	Readjust
Sensor spring broken	Replace valve assembly
Oil leakage in the brake fluid line or LSPV assembly	Tighten brake fluid line or replace LSPV assembly

   2) Rear brake is lock too fast

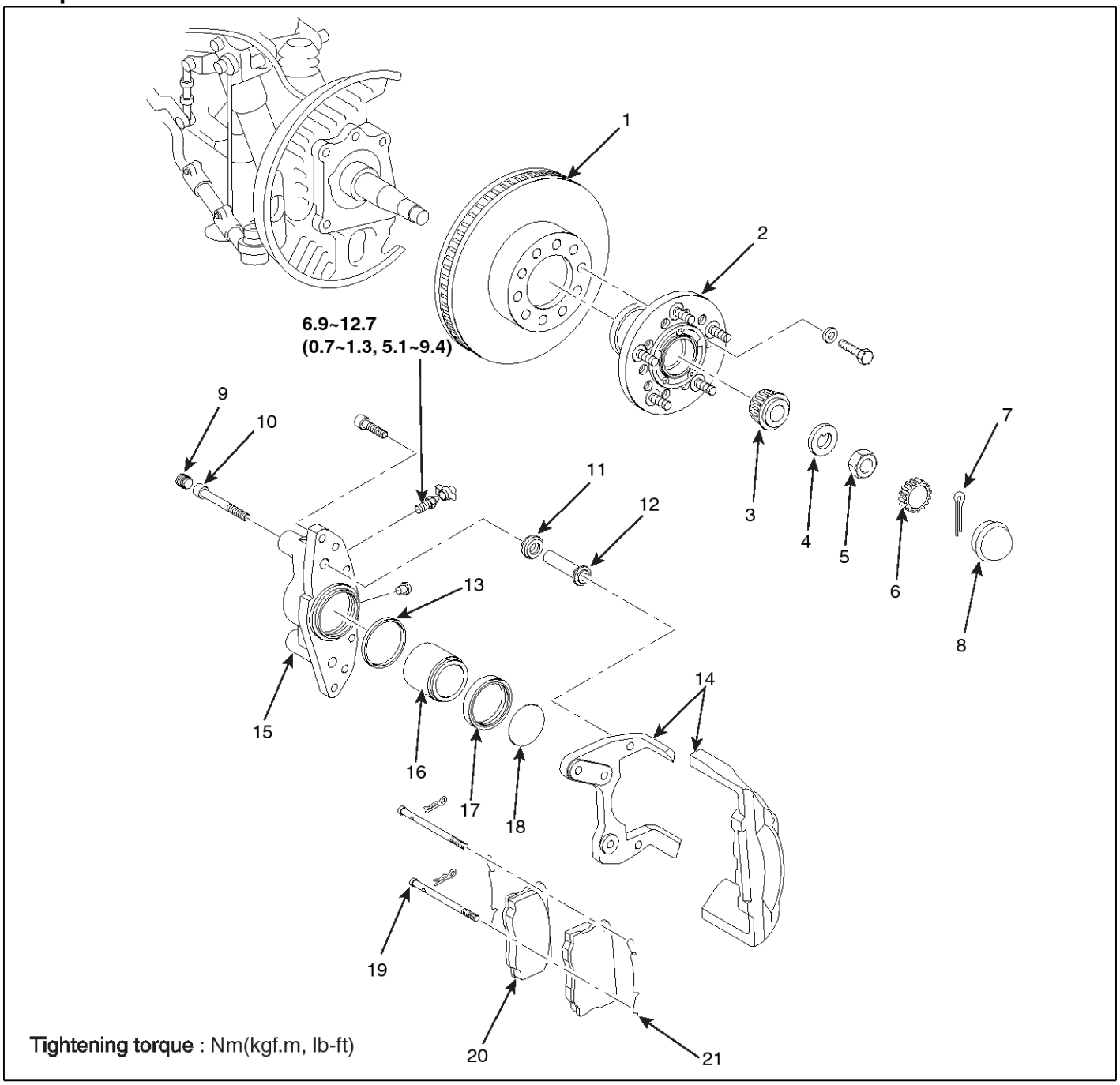
Probable Cause	Remedy
Maladjusted sensor spring	Readjust
Inner fault the LSPV	Replace LSPV assembly

Front Brake Assembly

Front Brake Assembly

Disc Brake

Components

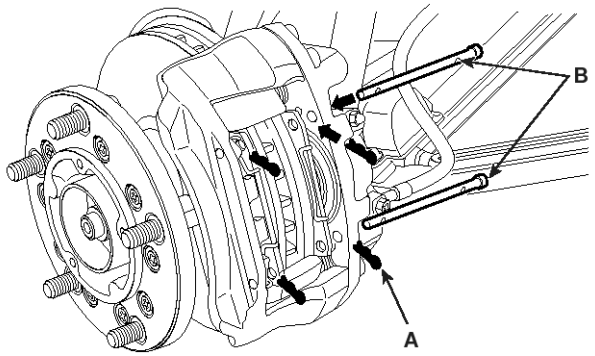


SUDBRA008L

1. Brake disc
2. Hub
3. Bearing
4. Clow washer
5. Nut
6. Nut cab
7. Cottor pin
8. Grease cap
9. Sleeve plug
10. Sleeve bolt
11. Sleeve boot
12. Sleeve
13. Piston seal
14. Caliper bridge
15. Caliper housing
16. Piston
17. Boot
18. Retaining ring
19. Retaining pin
20. Brake pad
21. Pad spring

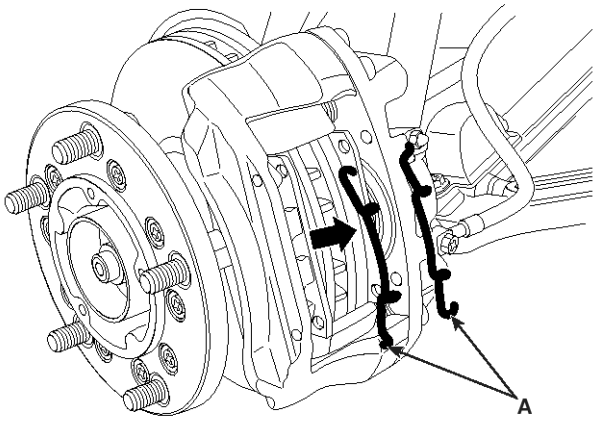
Removal

1. Parking the car, remove the front tire. (Refer to the PA-"Front Axle")
2. After taking off the clip(A), remove the retaining pin(B).



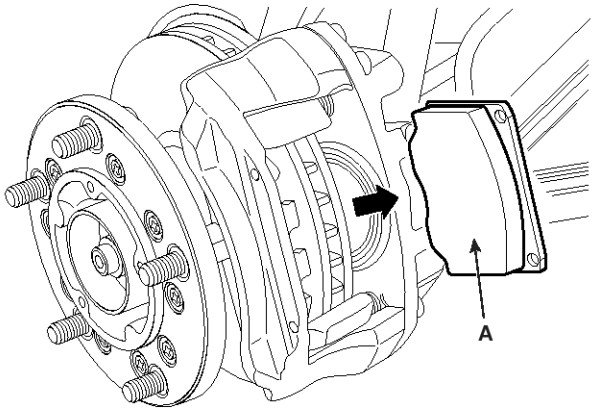
KMTBR5533A

3. Remove the pad spring(A).



KMTBR5534A

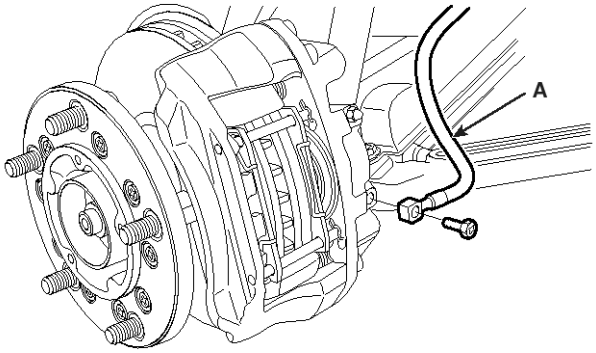
4. Remove the pad and the spacer(A) from the caliper housing.



KMTBR5535A

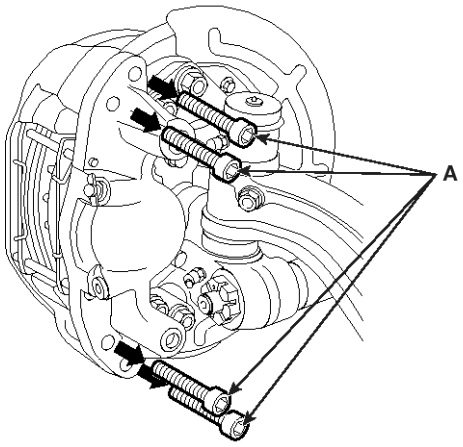
5. Loosen the bolt. Remove the flexible hose(A) from the caliper.

⚠CAUTION
Fix the hose to prevent the brake oil from flowing out.



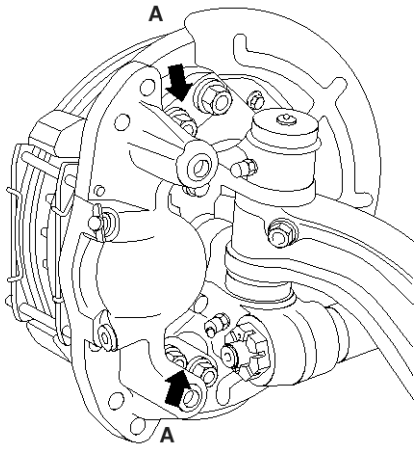
KMTBR5536A

6. After loosening the 4 bolts(A), remove the bridge from the caliper housing.



KMTBR5537A

7. Loosing the fixing bolt(A) of the caliper housing, remove the housing.



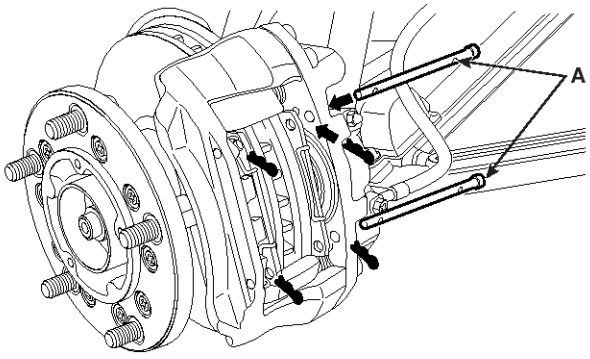
KMTBR5538A

Installation

1. Install the pad to the caliper housing with being the warning indicator to the lower portion.

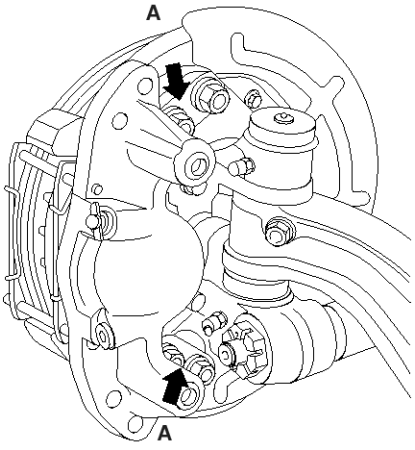
   ⚠CAUTION
   Do not contaminate the surfaces of the pad and disk with oil and dust.

2. Install a new pad spring and a new retaining pin(A).



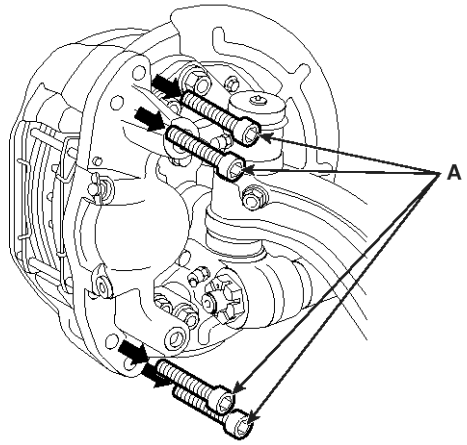
KMTBR5533B

3. After inserting the retaining ring, install the clip.
4. Install the caliper housing(A) to the knuckle.



KMTBR5538A

5. Install the bridge(A) to the caliper housing.

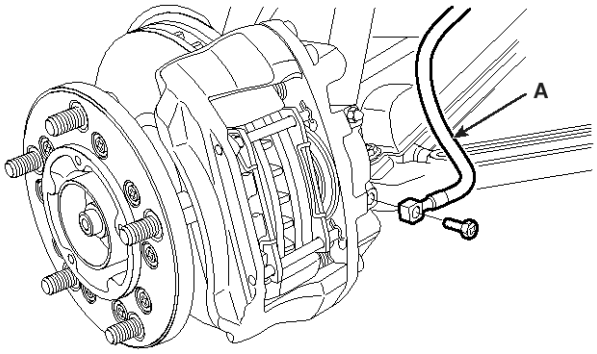


KMTBR5537A

6. Install the flexible hose(A).

⚠CAUTION

- **When installing, be careful that the hose is not twisted.**
- **If the brake oil is leaked, clear it perfectly.**

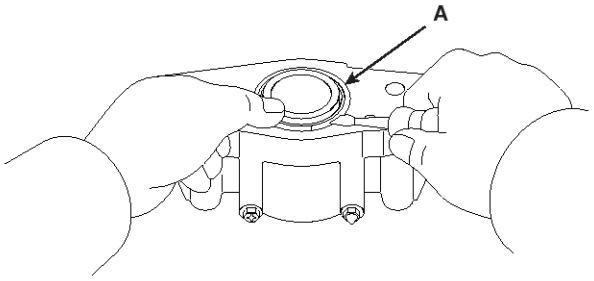


KMTBR5536A

7. Assemble the clip, the retaining pin, the pad spring and the pad.
8. Install the front wheel.

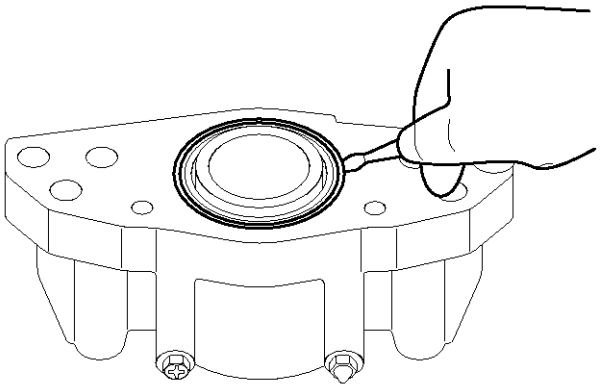
Disassembly

1. Using a driver, remove the retaining ring(A).



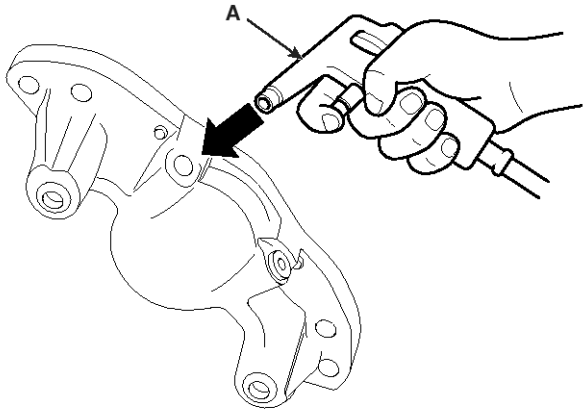
KMTBR5539A

2. Using a driver, remove the cylinder boot.



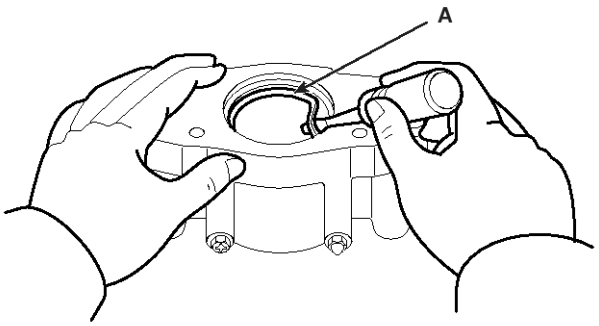
KMTBR5540A

3. Insert a cloth for preventing from damage between the piston and the cylinder. Using an air gun(A), remove the piston from the cylinder.



KMTBR5541A

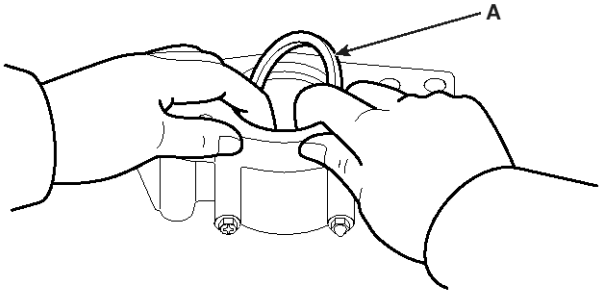
4. Remove the piston seal(A) using a driver.



KMTBR5542A

Reassembly

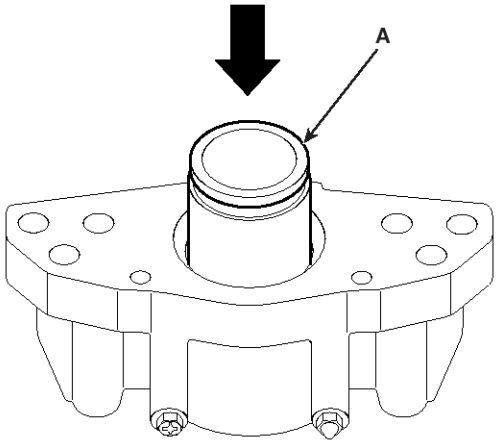
1. Clear the piston and the cylinder with the brake oil.
2. Insert a new piston seal(A) into the caliper cylinder groove.



KMTBR5543A

3. Assemble the piston to the cylinder boot careful that the piston(A) is not twisted.

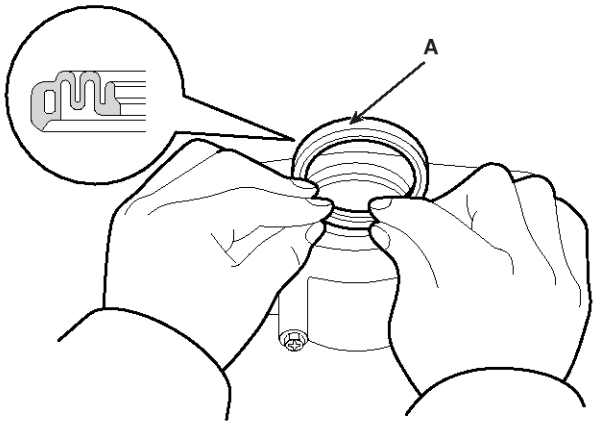
⚠CAUTION
When assembling the piston, be careful that the piston seal is not damaged.



KMTBR5544A

4. Assemble a new cylinder boot(A) to the caliper cylinder along to the direction as shown in figure.

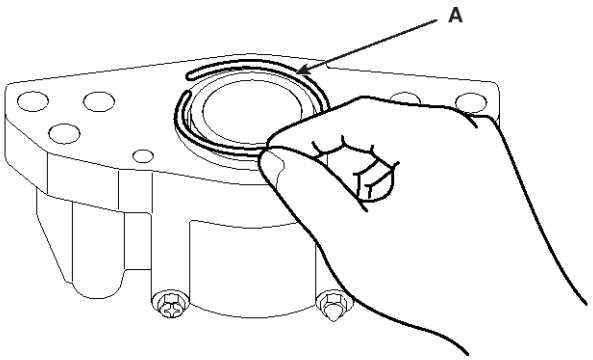
⚠CAUTION
Insert the boot correctly into the cylinder groove.



KMTBR5545A

5. Assemble a new retaining ring(A) to the cylinder boot.

⚠CAUTION
Be careful that the boot is not damaged.

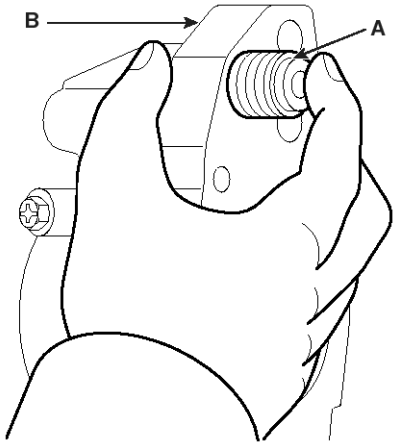


KMTBR5546A

6. Assemble a new dust boot(A) to the caliper housing(B).

Install a bushing at the dust boot.

Check if the bushing can slip slightly.



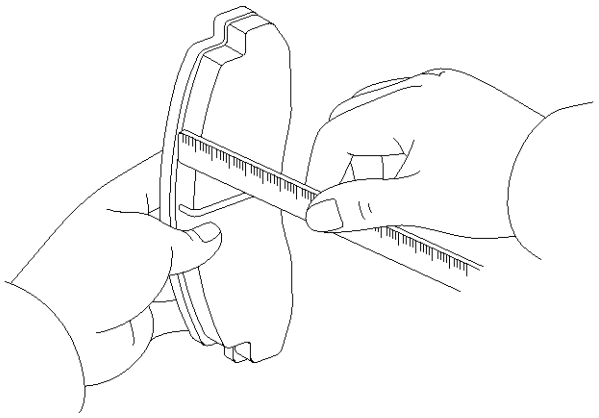
KMTBR5547A

Inspection

Check the Caliper Pad

1. Remove the front wheel
2. Check the pad thickness.

Reference Value	12.5mm
Limit Value	2.0mm

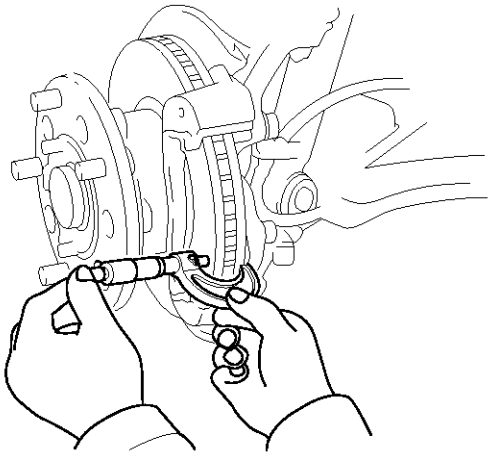


KMTBR5548A

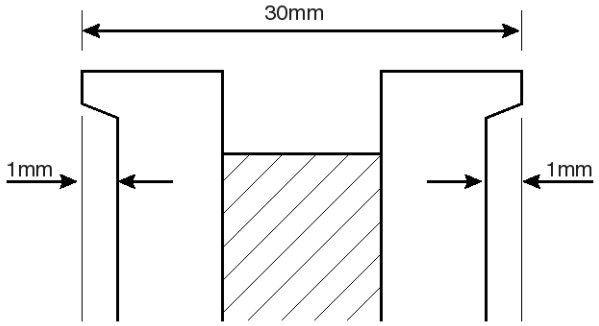
Check the Disk

1. Check the thickness of the disk

Reference Value	30mm
Limit Value	28mm (By each rotor face : 1mm)



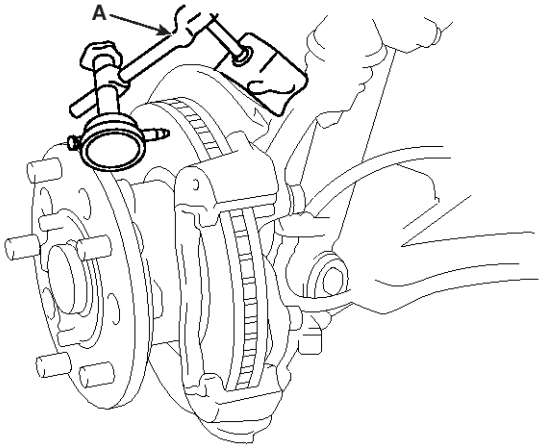
SUDBR7501D



SUDBR7502D

2. Check the disk vibration
   1) Before checking the disk vibration, firstly check the clearance of the wheel bearing.
   2) Using a dial gauge, check the disk vibration at the 10mm position from the disk to outside.

Limit Value	0.12mm



KMTBR5550A

   3) If the disk vibration exceeds the limit, check the vibration of the front axle.
   4) If the front axle vibration is less than limit, adjust the disk vibration within the limit.
   5) If the disk vibration exceeds the limit, replace the disk.

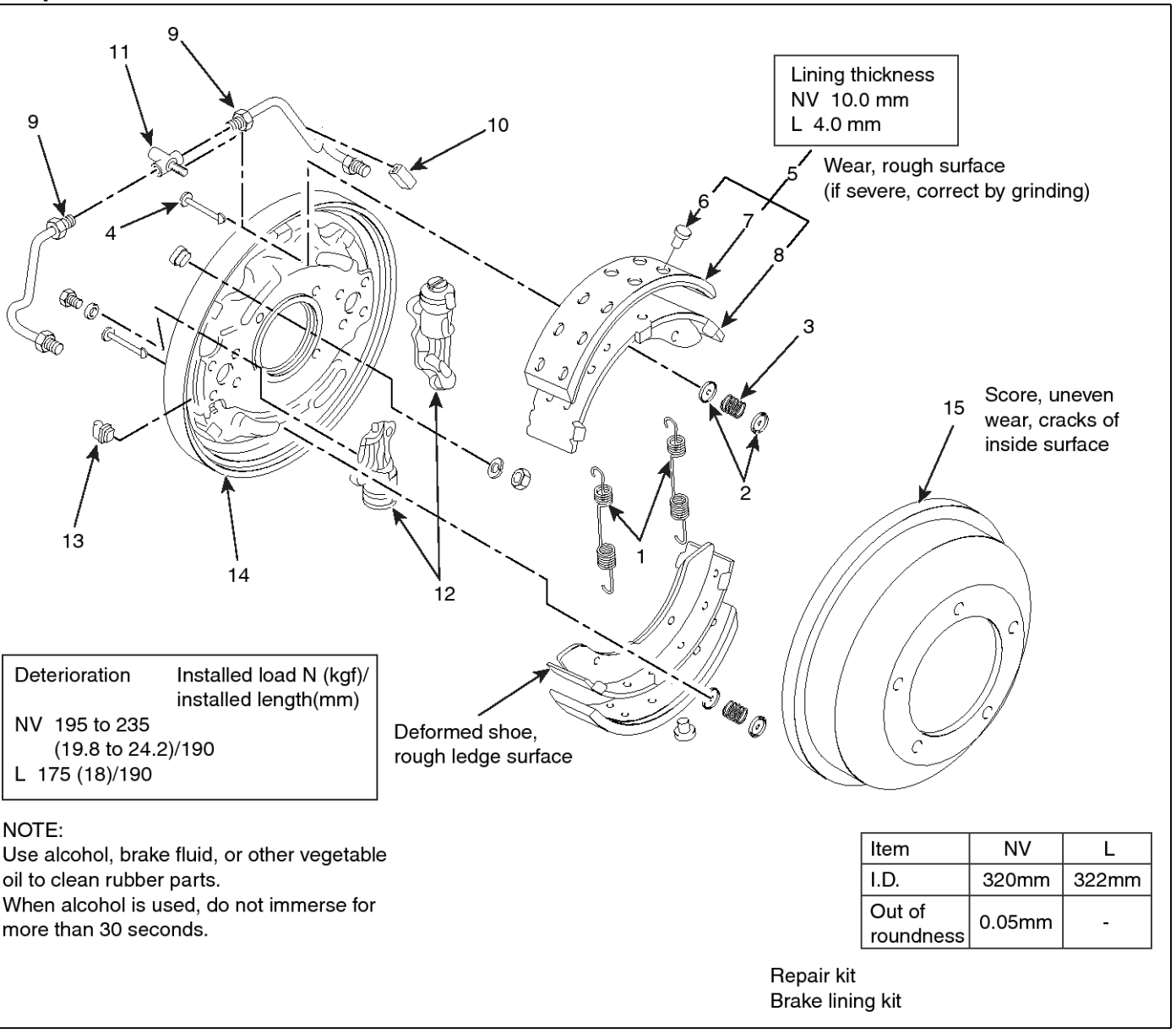
3. Replace the front disk
   1) Disassemble the disk from the axle hub.
   2) Loosening the 10 bolts, disassemble the axle lower part and the disk.
   3) Install a new disk to the axle hub.

      ⚠CAUTION
      When replacing the disk, clean the space between teeth of pulse-ring without damage of pulse-ring tooth. Be cautious not to come off the gilt.

   4) Install the axle hub to the steering knuckle.
   5) Adjust the free rod of the front wheel bearing.

Drum Brake

Components



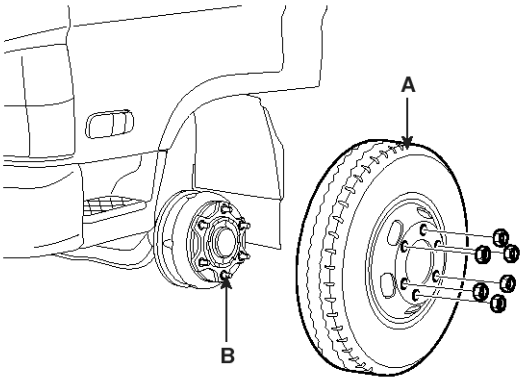
SUDBRA009L

1. Return spring
2. Shoe hold down cup
3. Shoe hold down spring
4. Shoe hold down pin
5. Shoe and lining assembly
6. Rivet
7. Lining
8. Shoe
9. Pipe
10. Rubber
11. Connector
12. Wheel cylinder assembly
13. Cover
14. Backing plate
15. Brake drum

Removal

1. Parking the car, remove the front tire. (Refer to the PA-"Front Axle").

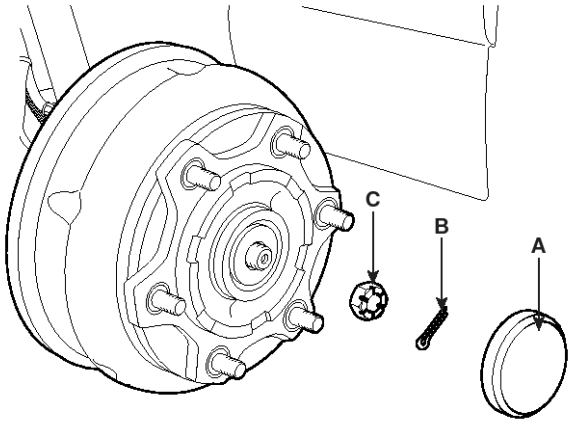
   ⚠CAUTION
   When removing the wheel and tire (A), be careful that the hub bolt (B) is not damaged.



KMTBR5006A

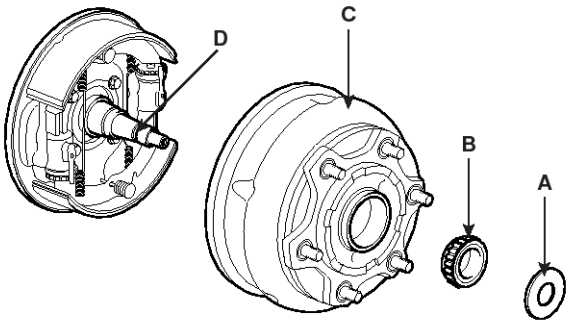
2. After removing the wheel cap (A), remove the split pin (B) and the lock nut (C).

   ⚠CAUTION
   When removing the lock nut (C), be careful that the washer and the outer bearing are not drop down to the ground.



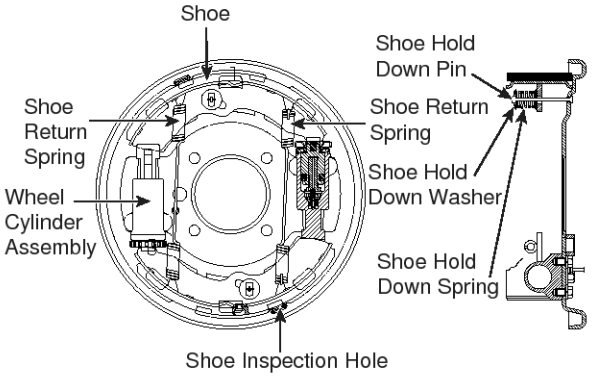
KMTBR5007A

3. Remove the washer (A), the outer bearing (B) and the hub knuckle (C) from the knuckle (D).



KMTBR5008A

4. Remove the shoe hold down spring and the shoe hold down pin. Removing the return spring, remove the shoe and lining assembly.



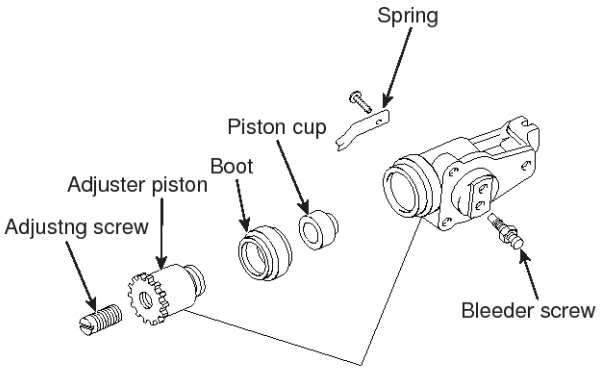
EMTBR5029A

Replacement

Wheel Cylinder

1. After running 64,000km, check if the inside of the adjuster piston and the wheel cylinder have rusts.

   Check that the dust boot is damaged. Check that the piston cup has been worn, cracked and swelled. After checking, if needed, replace the damaged parts.
2. Loosening the screw, disassemble the adjuster piston.

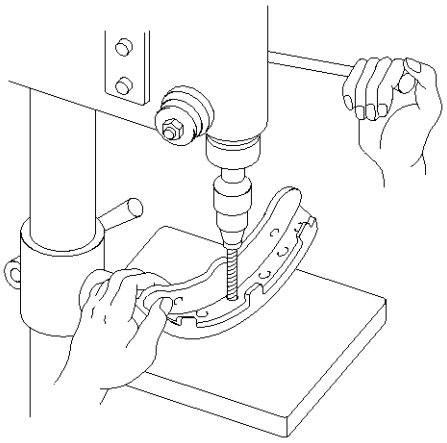


EMTBR5030A

Bleeder Screw Tightening Torque:
6.9~8.9Nm(0.7 ~ 0.9 kgf.m, 5.1~6.5lb-ft)

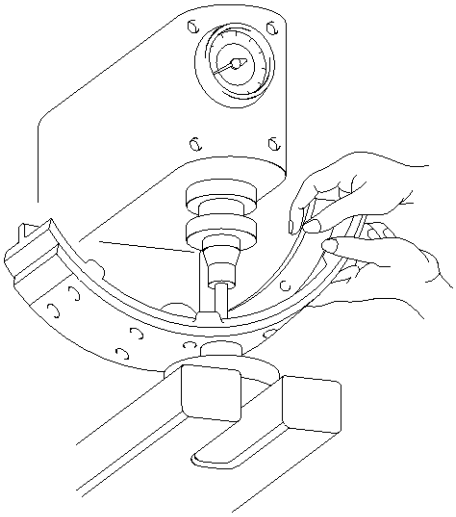
Lining

1. Using a drill machine, drill the jointing part of the shoe side rivet. Remove the lining.



KMTBR5553A

2. Assemble the lining
   1) Clear the lining mounting surface of the shoe with the specific oil.
   2) Perform the riveting with the pressure of 2100 ± 100kg.

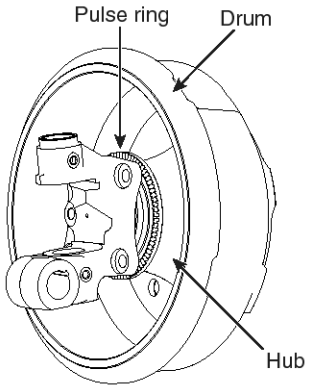


KMTBR5554A

   3) When performing the riveting, at the 0.4mm position of the side end surface, the shoe lining gap should be 0.3mm or less. At the around of the rivet, it should be 0.5mm or less.
   4) After checking that the brake drum and the lining are contacted, if there is any defective, modify it with the brake lining grinder.

⚠CAUTION

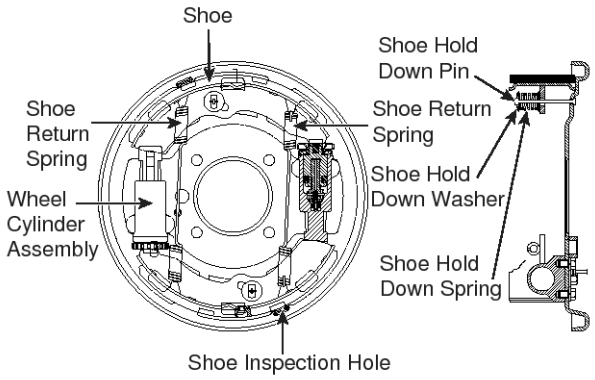
- **Lining should be replaced in a kit.**
- **Use the same size of the lining**
- **Do not contaminate the lining surface with oil or grease.**
- **When replacing the lining, clean the space between teeth of pulse-ring without damage of pulse-ring tooth. Be cautious not to come off the gilt.**



SUDBR9025L

Installation

1. After assembling the wheel cylinder assembly, install the shoe return spring.
2. Install the shoe hold down spring.

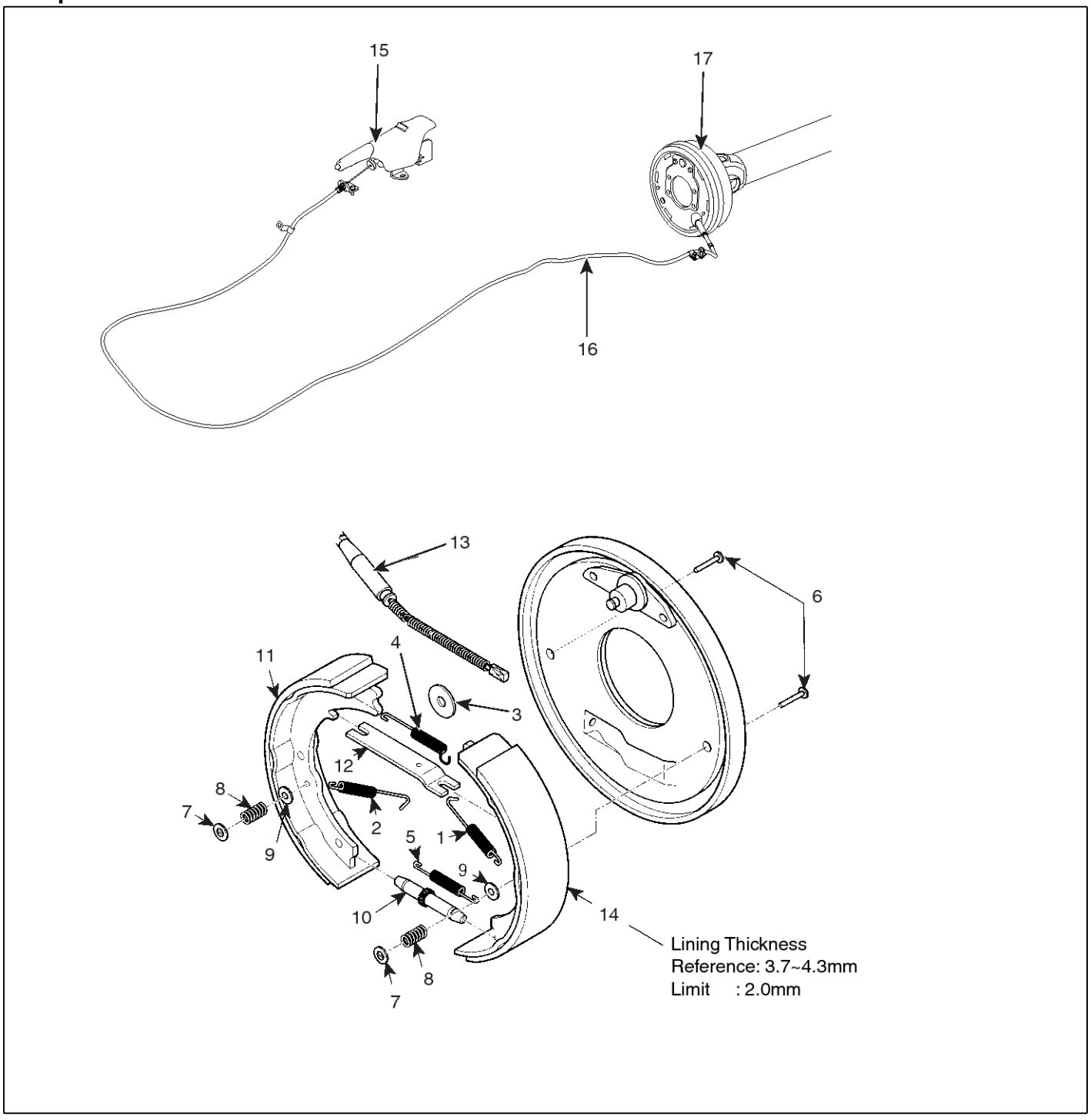


EMTBR5029A

3. Apply the grease at each part.
4. For installing the drum brake, refer to the PA-"Front Axle."

Parking Brake System

Components

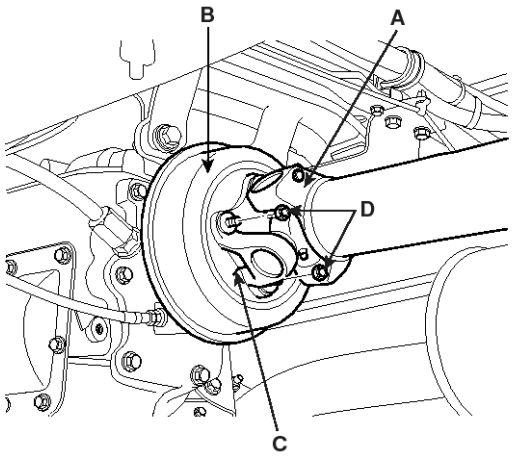


SUDBRA010L

1. Return Spring
2. Return Spring
3. Shoe Guide Plate
4. Strut Spring
5. Adjuster Spring
6. Shoe Hold Pin
7. Spring Seat
8. Hold Spring
9. Spring Seat
10. Adjuster
11. Shoe Assembly
12. Strut
13. Parking Brake Cable
14. Shoe Assembly
15. Parking Brake Lever
16. Cable
17. Parking Brake Assembly

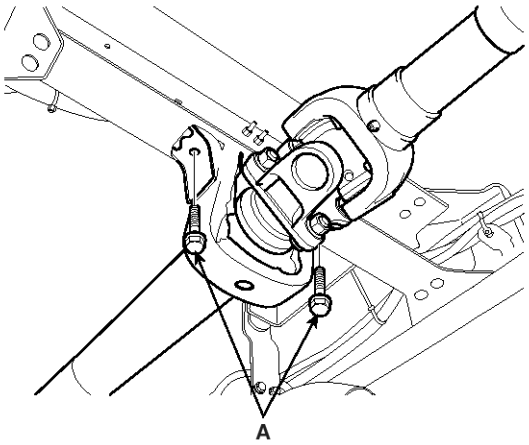
Removal

1. Make an alignment marking(C) to the flange yoke (A) of the front propeller shaft and the parking brake drum(B). Remove the tightening nut (D) of the propeller shaft.



KMTBR5021A

2. Remove the tightening bolt (A) of the center bearing bracket.

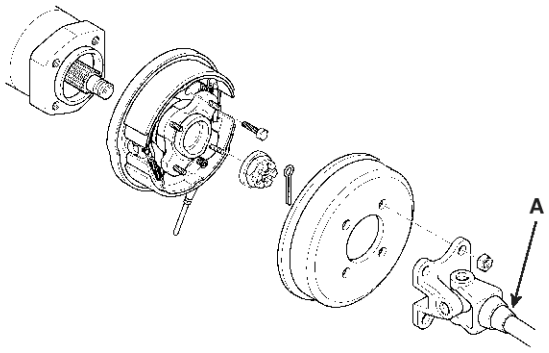


KMTBR5022A

NOTICE

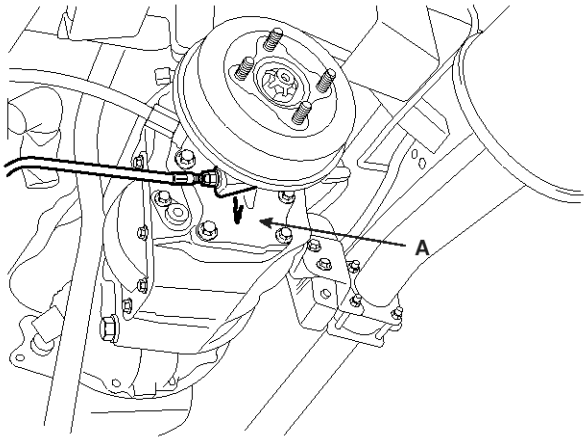
For short axis, the center bearing is one. For long-axis, the center bearing are two.

3. Remove the front propeller shaft(A).



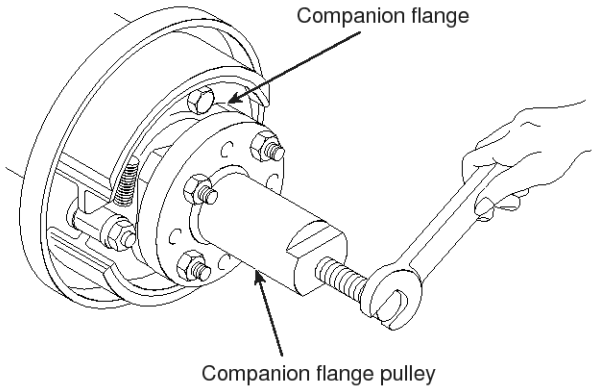
KMTBR5023A

4. Remove the parking brake cable clip (A).



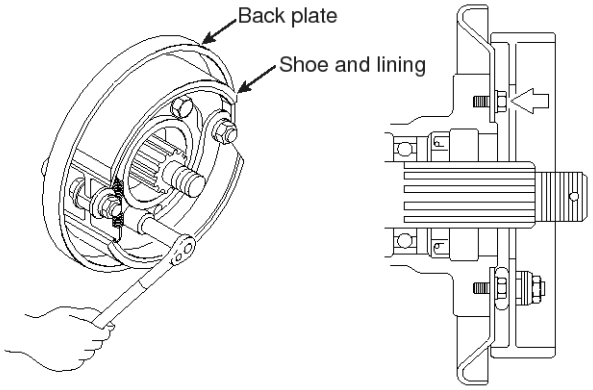
KMTBR5568A

5. Using a companion flange puller, remove the companion flange from the main shaft.



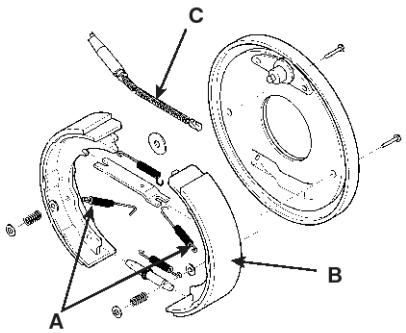
EMTBR5040A

6. Using a socket wrench, remove the flange bolt. Remove the shoe and lining assembly.



EMTBR5041A

7. Remove the shoe hold pin and spring.
8. Taking off the return spring(A), remove the shoe assembly(B).
9. Remove the parking brake cable(C).



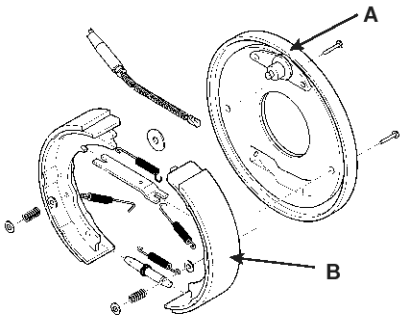
KMTBR5024A

Installation

1. Install the shoe and lining assembly(B) to the back plate(A).

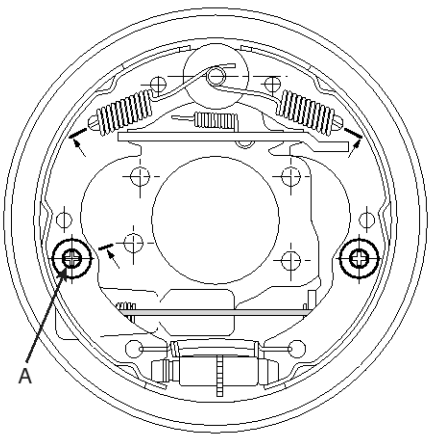
⚠CAUTION

- **Do not contaminate the lining surface with foreign materials.**
- **The outer diameter of the lining should be Ø180.**
- **Apply the grease at the following portions.**
  - **Contacting surface between the back plate and the shoe.**
  - **Contacting surface between the shoe and the anchor pin.**
  - **Contacting surface between the adjuster thread and the nut and sleeve.**



KMTBR5045A

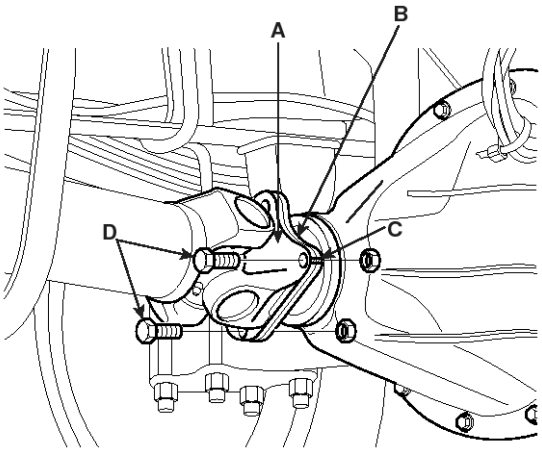
2. After installing the parking brake cable, install the shoe hold pin and spring.



KMTBR5046A

3. Aligning the align markings(C) of the rear axle companion flange (A) and the flange yoke (B) of the rear propeller shaft, install the tightening bolt (D) of the propeller shaft.

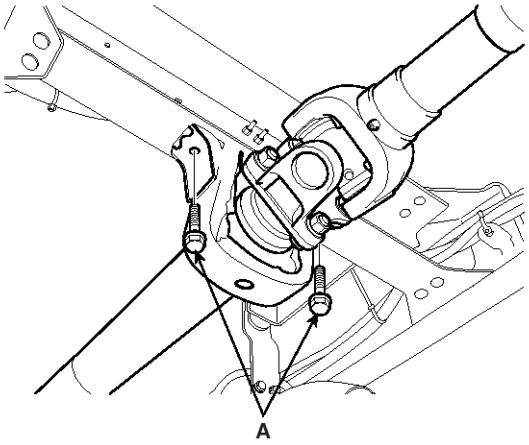
Tightening Torque :
98~117 Nm(10~12 kgf.m, 72.3~86.7 lb-ft) : P3
59~69 Nm(6~7 kgf.m, 43.3~50.6 lb-ft) : P2



KMTBR5025A

4. Install the tightening bolt (A) of the center bearing bracket.

Tightening Torque :
69~93 Nm(7.0~9.5 kgf.m, 50.6~68.7 lb-ft)



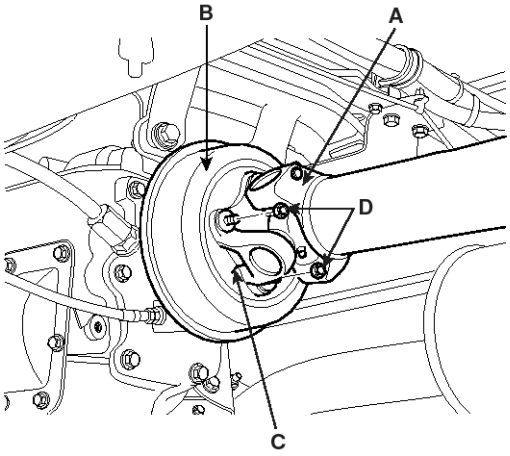
KMTBR5022A

NOTICE

For short-axis, the center bearing is none. For long-axis, the center bearing is one.

5. Aligning the align marking (C) of the flange yoke (A) of the front propeller shaft and that of the parking brake drum (B), install the tightening nut (D) of the propeller shaft.

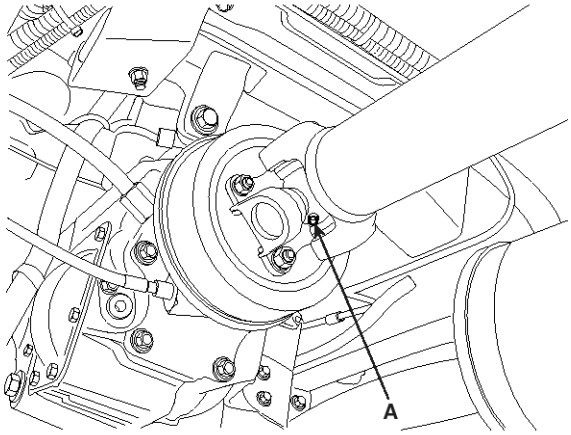
Tightening Torque :
98~117 Nm(10~12 kgf.m, 72.3~86.7 lb-ft)



KMTBR5021A

6. Inject the recommended grease to the grease nipple (A) until the grease is leaked out oil seal. Clear the leaked grease.

Recommended Grease: ALVANIA EP#2

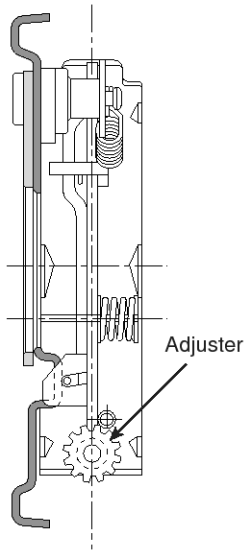


KMTBR5026A

Adjustment

Method for adjusting the Lining gap.

1. Turn the adjuster to the shoe expansion direction until the shoe contacts the drum.
2. Turn the adjust to the reverse direction of the shoe expansion direction with 8~10 notch.

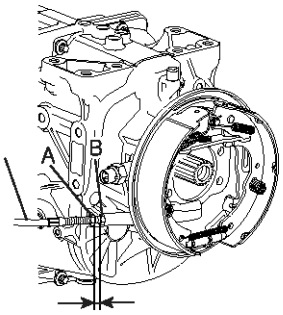


EMTBR5042A

3. After operating the parking brake lever several times, turn the drum with hand. At that time, the lining should not contact with the drum.

Adjusting the parking brake

1. Release the parking brake.
2. Pulling the out cable with the 6~10kgf force, locate the nut (A) at the position at which the gap is 3~7mm.



KMTBR5027A

3. Returning the out cable. Tighten the nut (B) near the nut (A) with the specified torque.

Tightening Torque:
38.2~50Nm(3.9~5.1kgf.m, 28.2~36.9lb-ft)

4. After the initial adjusting of the cable, check the following items.
   1) Check the click number of the parking brake and hand force.

Hand force	Number of lever click
20kg or more	8~9 notch

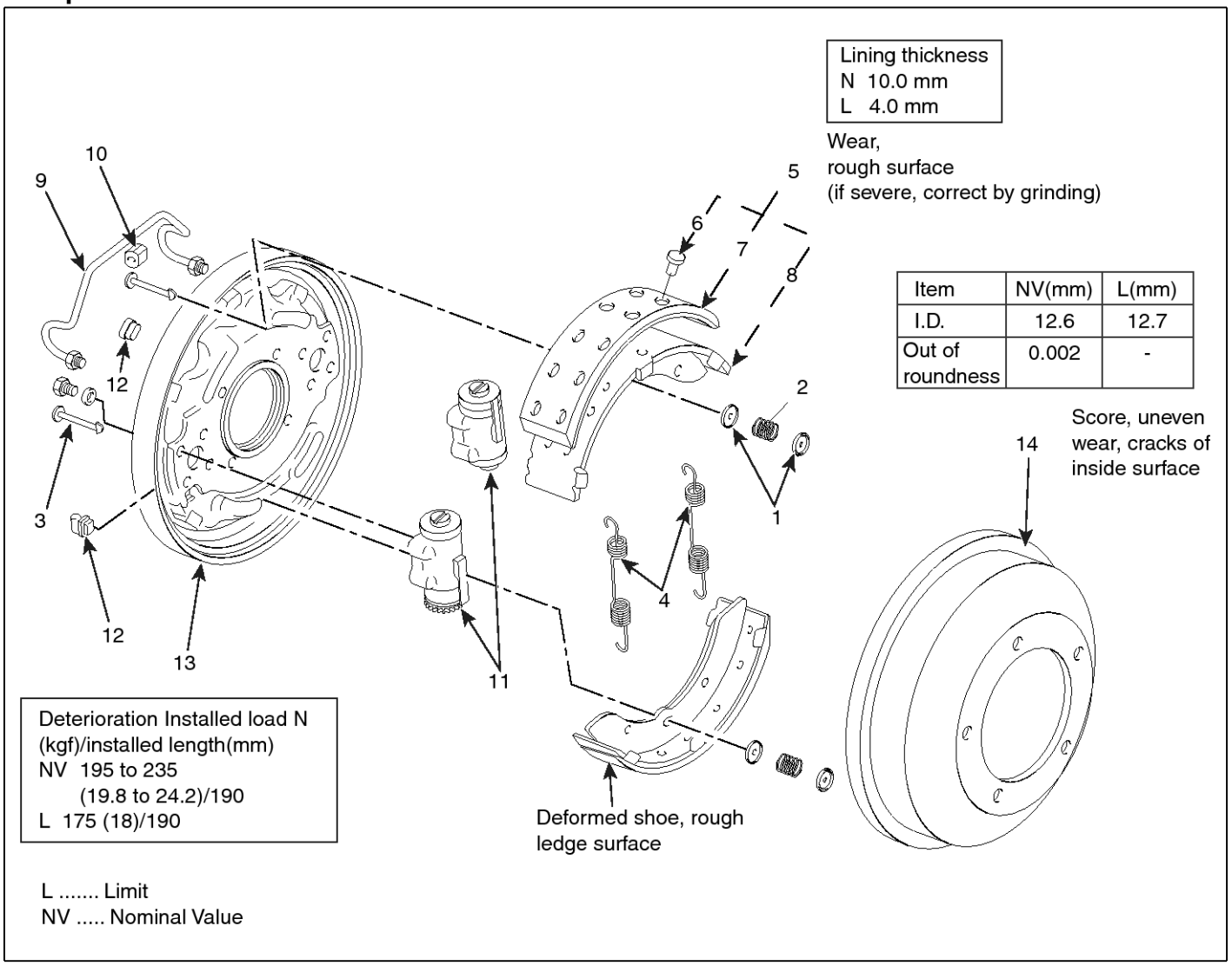
   2) Check that the parking brake warning Lamp is normally working.
   3) Tighten the parking brake bracket flange bolt with the specified torque.

Tightening Torque:
11.8~14.7Nm(1.2~1.5kgf.m, 8.7~10.9lb-ft)

Rear Brake Assembly

Drum Brake

Components



SUDBRA011L

1. Shoe hold down cup
2. Shoe hold down spring
3. Shoe hold down pin
4. Return spring
5. Shoe and lining assembly
6. Rivet
7. Lining
8. Shoe
9. Pipe
10. Rubber
11. Wheel cylinder assembly
12. Cover
13. Backing plate
14. Brake drum

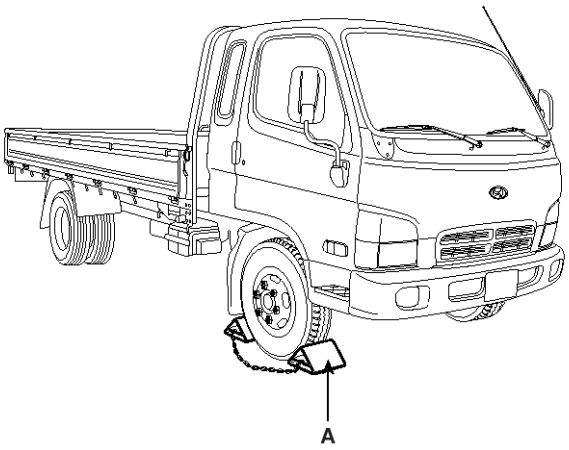
NOTICE

Use alcohol, brake fluid, or other vegetable oil to clean rubber parts.

When alcohol is used, do not immerse for more than 30 seconds.

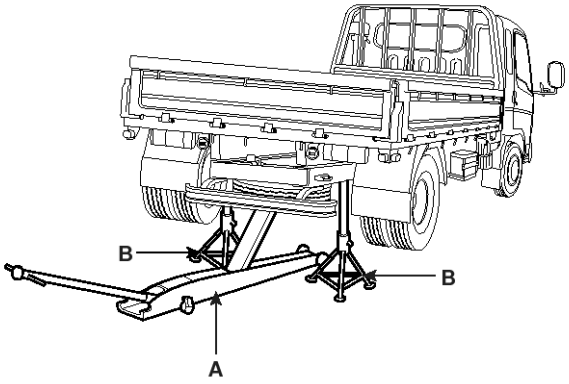
Removal

1. Place the wooden blocks (A) at the front and rear sides of the front wheel.



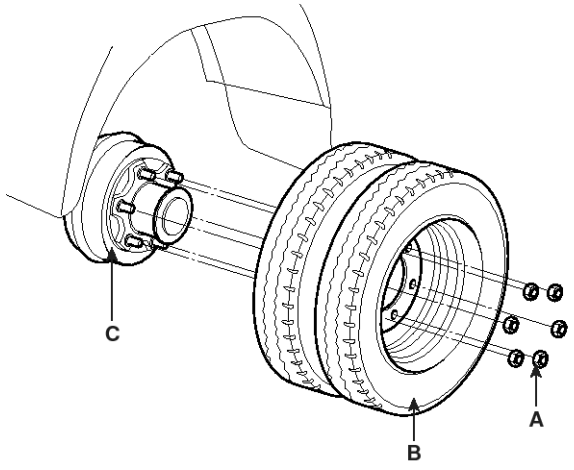
KMTBR5010A

2. Loosen the wheel nut. Lift up the axle with the garage jack (A) and support the frame stand (B).



KMTBR5011A

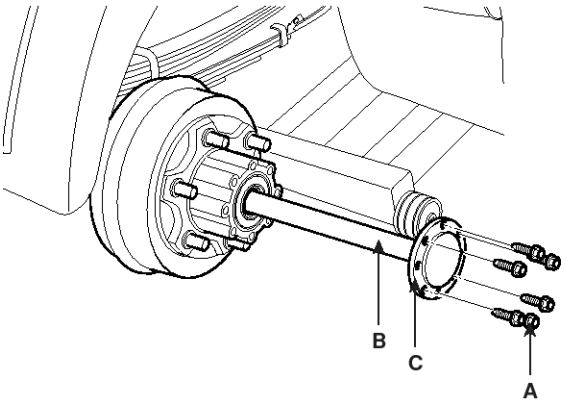
3. After taking off the wheel nut (A), remove the wheel and tire (B) from the hub (C).



EMTBR5064A

⚠CAUTION
When removing the wheel and tire (B), be careful that the hub bolt (B) is not damaged.

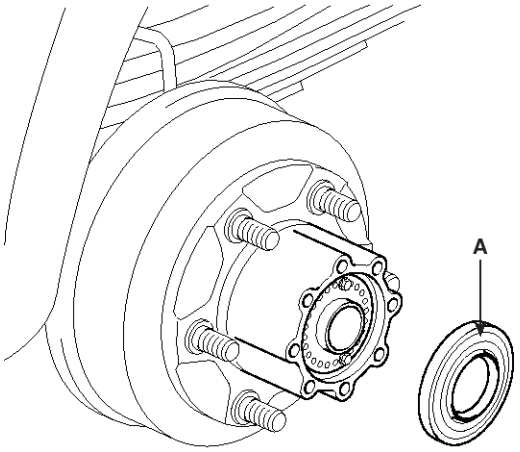
4. After taking off the hub bolt (A), remove the axle shaft (B).



KMTBR5013A

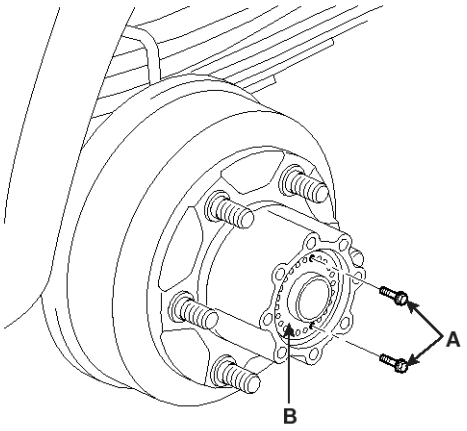
⚠CAUTION
If the axle shaft (B) is hard to remove, insert the hub bolt (A) into the removing screw hole (C) and then try to remove it.

5. Remove the oil seal (A)



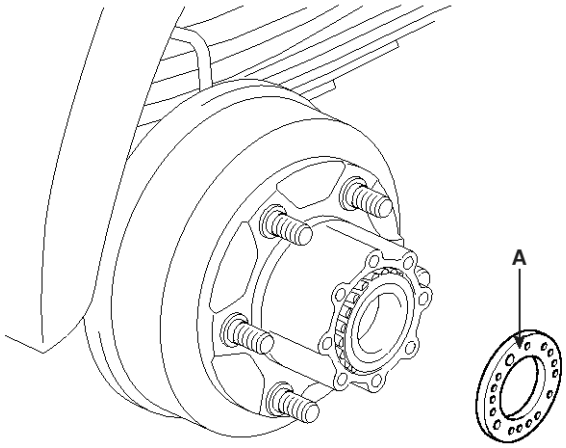
KMTBR5014A

6. Loosening the lock nut tightening bolt (A), remove the lock washer (B).



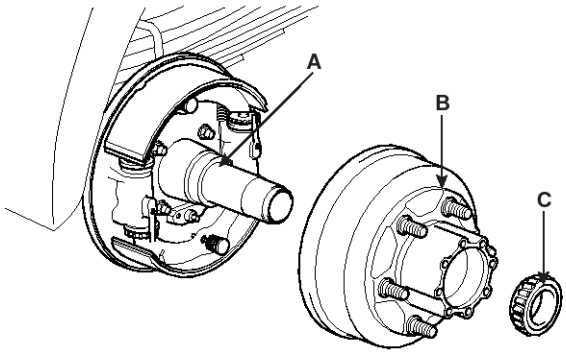
KMTBR5015A

7. Using the special tool (09527-47000), remove the lock nut (A).



KMTBR5016A

8. Remove the rear wheel hub (B) with the outer bearing (C) from the axle housing (A).

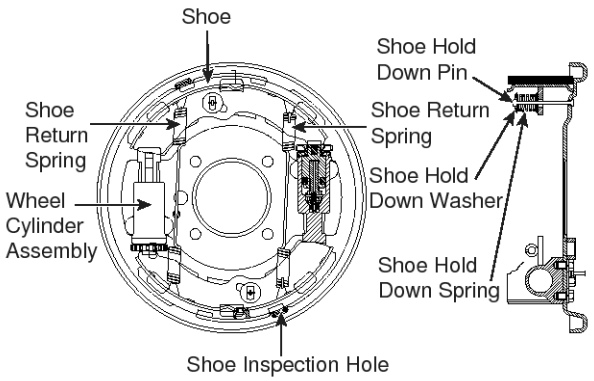


KMTBR5017A

⚠CAUTION

Be careful that the outer hub bearing(C) is not torn off.

9. Remove the shoe hold down spring and the shoe hold down pin. Remove the return spring. Remove the lining assembly.

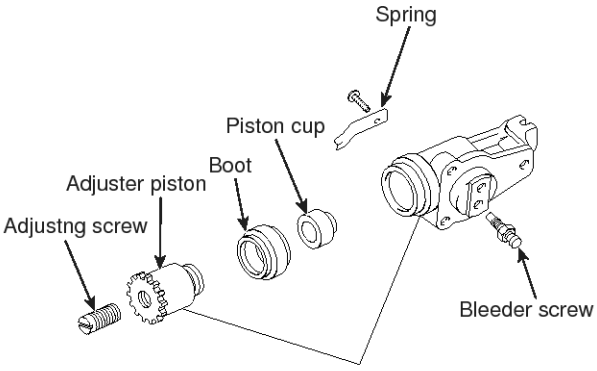


EMTBR5029A

Replacement

Wheel Cylinder

1. After running 64,000km, check if the inside of the adjuster piston and the wheel cylinder have rusts. Check that the dust boot is damaged. Check that the piston cup has been worn, cracked and swelled. After checking, if needed, replace the damaged parts.
2. Loosening the screw, remove the adjuster piston.

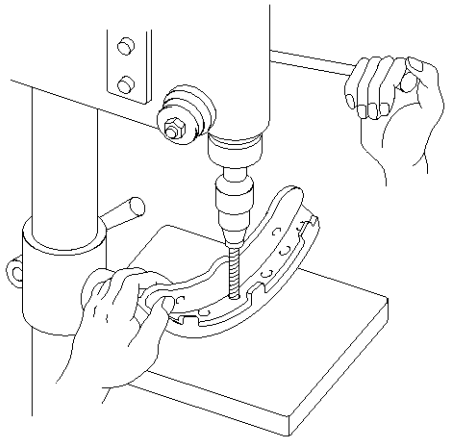


EMTBR5030A

Bleeder Screw Tightening Torque: 6.9~8.9Nm(0.7 ~ 0.9 kgf.m, 5.1~6.5lb-ft)

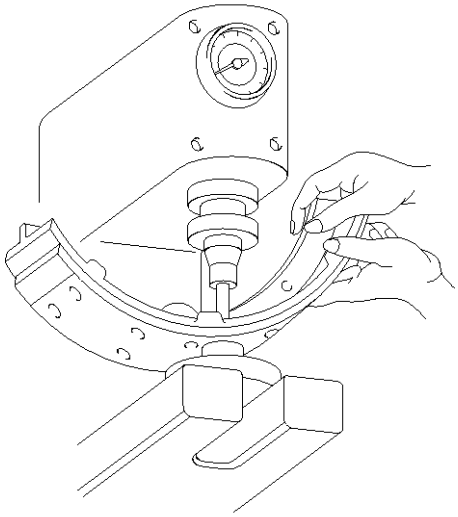
Lining

1. Using a drill machine, drill the joining part of the shoe side rivet. Remove the lining.



KMTBR5553A

2. Assemble the lining
   1) Clear the lining mounting surface of the shoe with the specific oil.
   2) Perform the riveting with the pressure of 2100 ± 100kg.

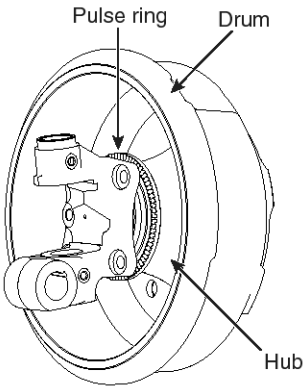


KMTBR5554A

   3) When performing the riveting, at the 0.4mm position of the side end surface, the shoe lining gap should be 0.3mm or less. At the around of the rivet, it should be 0.5mm or less.
   4) After checking that the brake drum and the lining are contacted, if there is any defective, modify it with the brake lining grinder.

⚠CAUTION

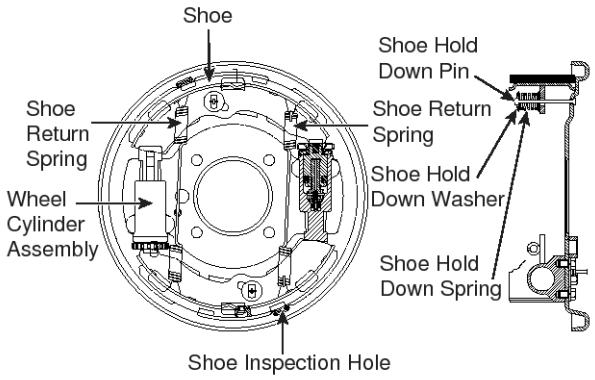
- **Lining should be replaced in a kit.**
- **Use the same size of the lining**
- **Do not contaminate the lining surface with oil or grease.**
- **When replacing the lining, clean the space between teeth of pulse-ring without damage of pulse-ring tooth. Be cautious not to come off the gilt.**



SUDBR9025L

Installation

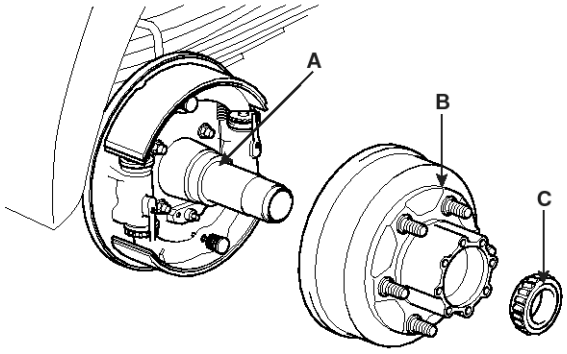
1. After assembling the wheel cylinder assembly, install the shoe return spring.
2. Install the shoe hold down spring.



EMTBR5029A

3. Apply the grease at each part.
4. Inject the recommended grease at the inside of the wheel hub (A).

Recommended Grease: RETINAX 0434 of Hankook Shell Oil Co., Ltd
RETINAX 0419 of Hankook Shell Oil Co., Ltd
KO-GW02 of CheonMa Mineral Oil Co., Ltd



KMTBR5017A

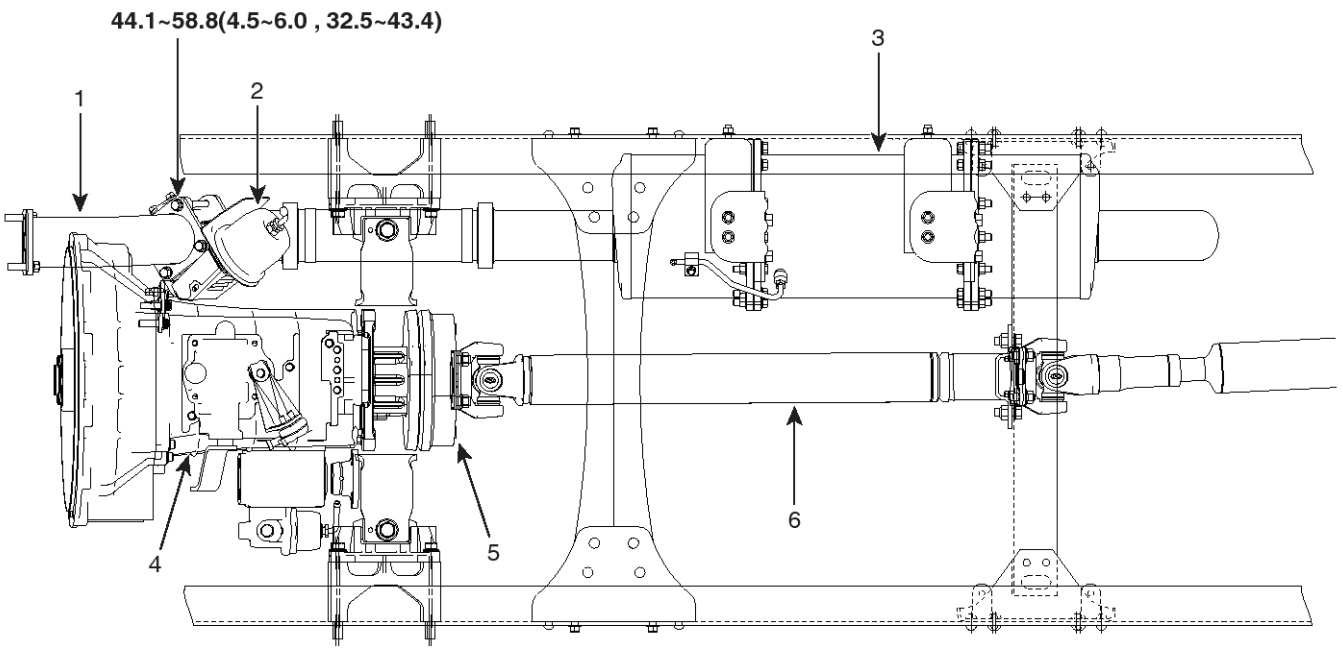
5. Install the rear wheel hub (B) and the outer bearing (C) at the axle housing (A).

   ⚠CAUTION
   Use only the set comprising the bearing and the bearing race.
6. For the next step of installation, refer to the PA-"Rear Axle."

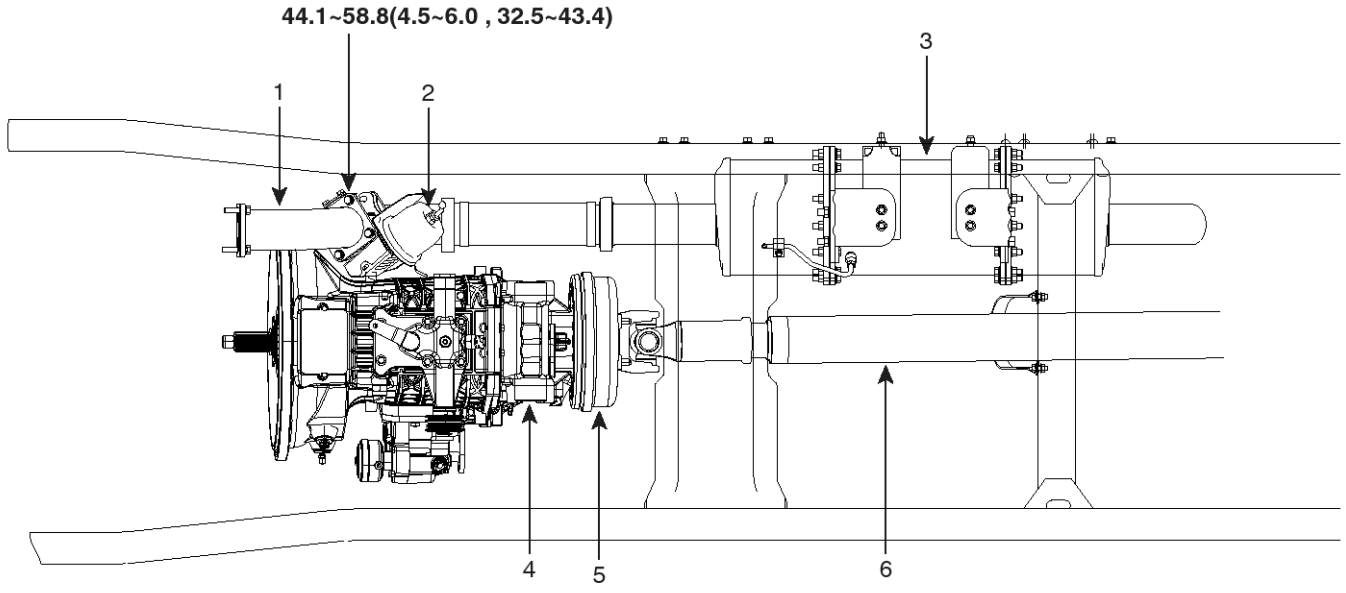
Exhaust Brake

Component location - D4GA engine

D4GA engine



D4GA-degrade engine

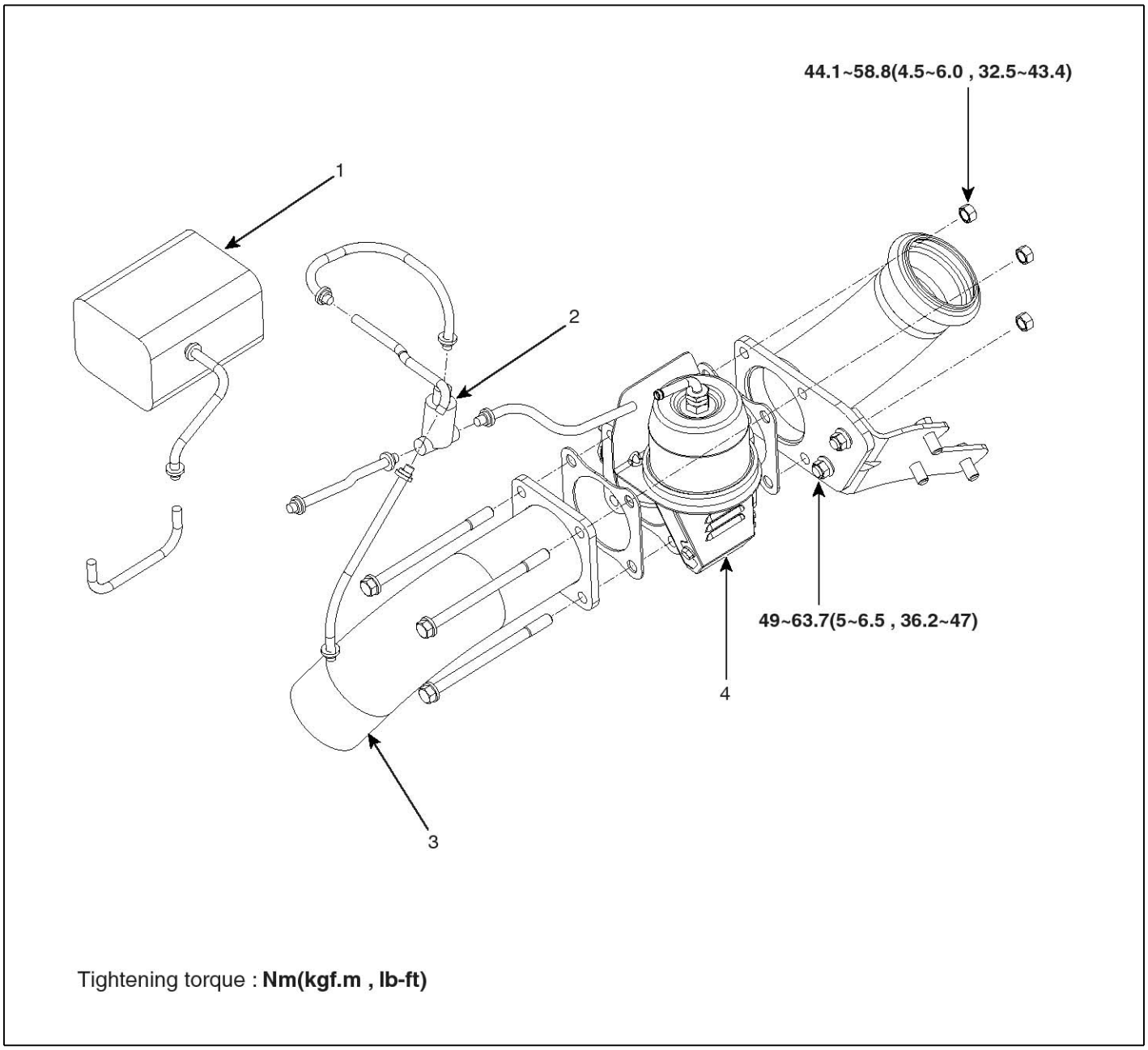


Tightening torque : **Nm(kgf.m , lb-ft)**

SUDBRA016L

1. Front exhaust pipe
2. Exhaust brake assembly
3. Muffler
4. Manual transmission
5. Parking brake-drum
6. Propeller shaft

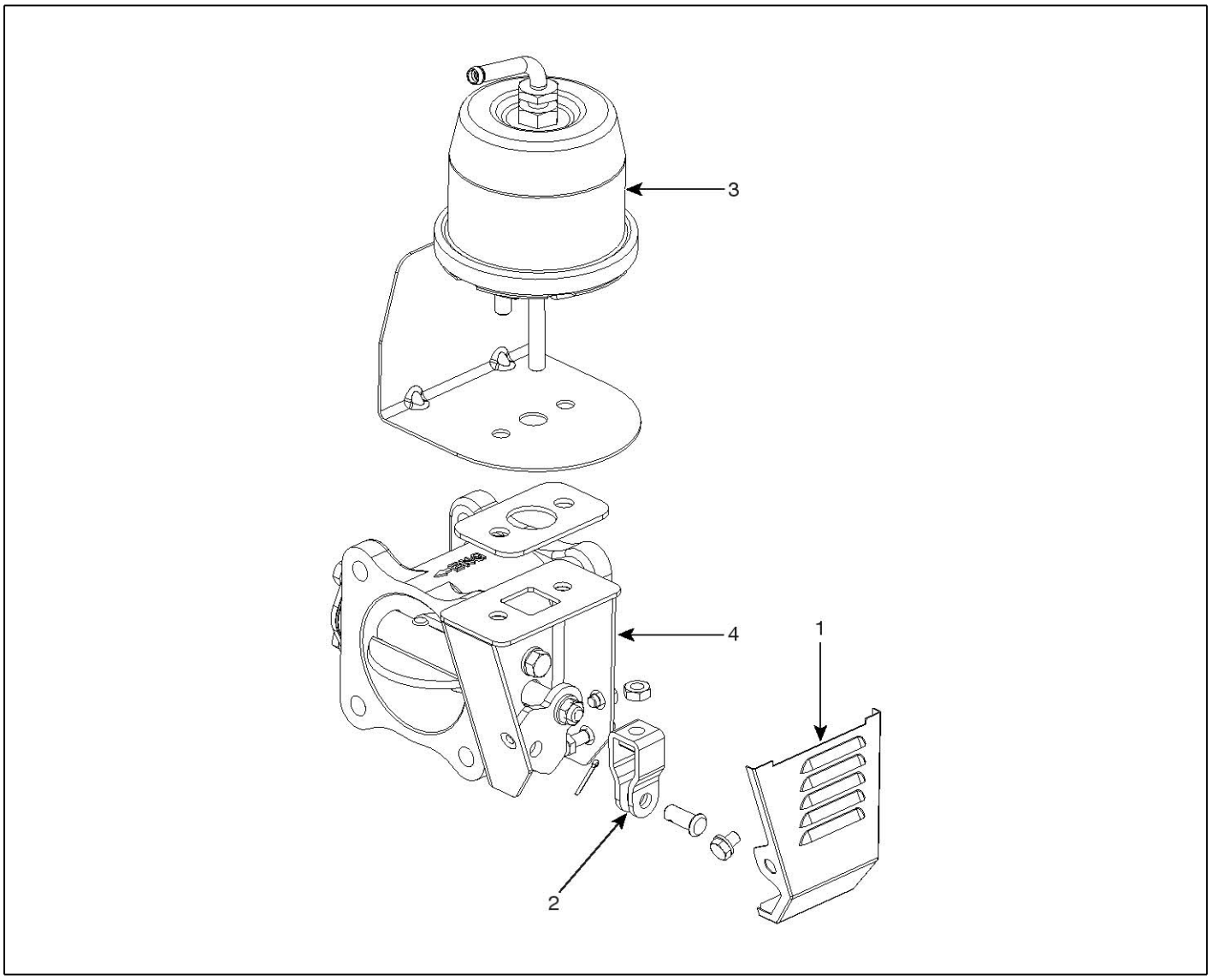
Component(1) - D4GA engine



SUDBRA017L

1. Vacuum tank
2. Magnetic valve
3. Exhaust brake unit
4. Exhaust pipe

Component(2) - D4GA engine

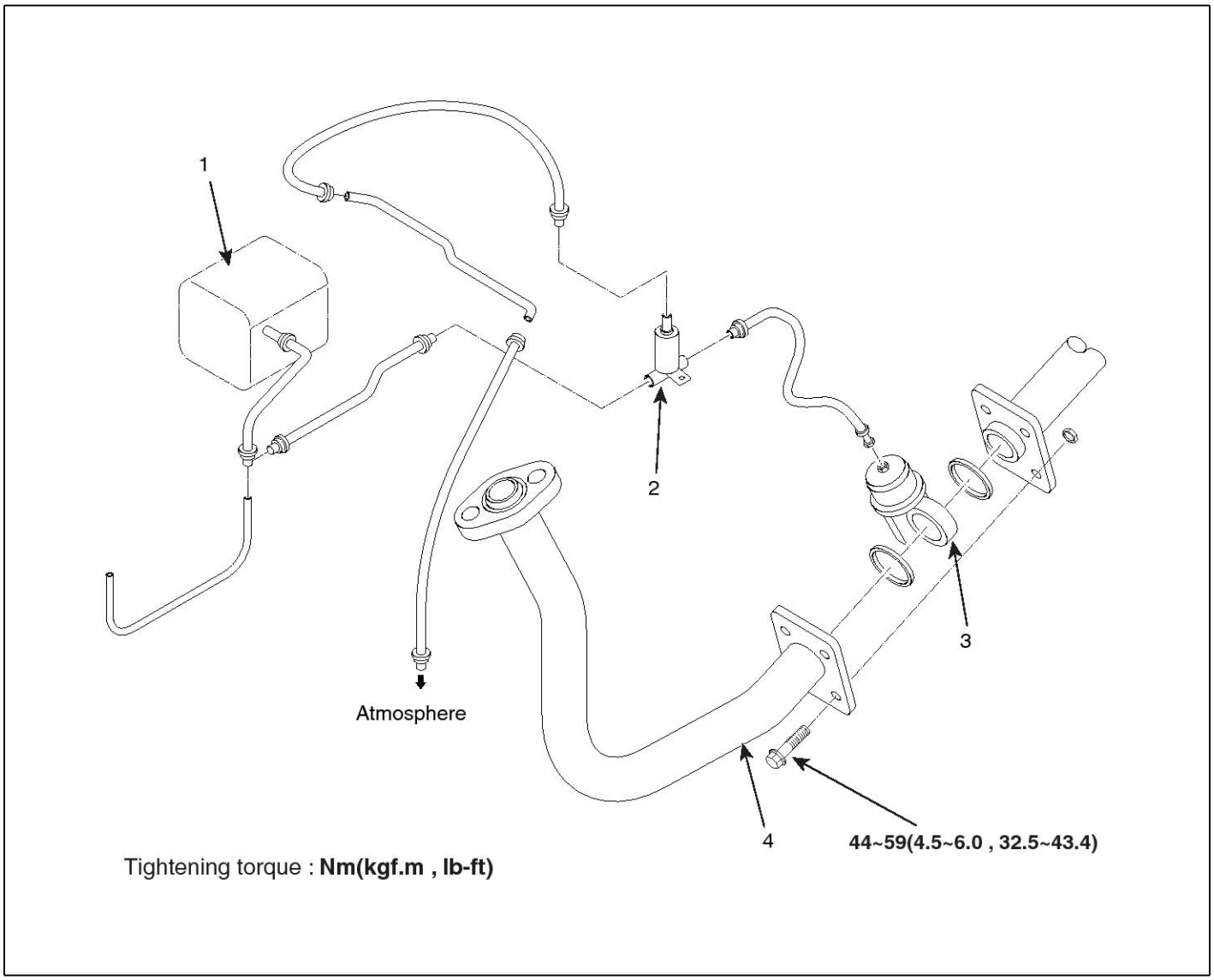


SUDBRA018L

1. Cover
2. Clevis
3. Power chamber
4. Exhaust brake valve

⚠CAUTION
Never do not disassemble the power chamber.

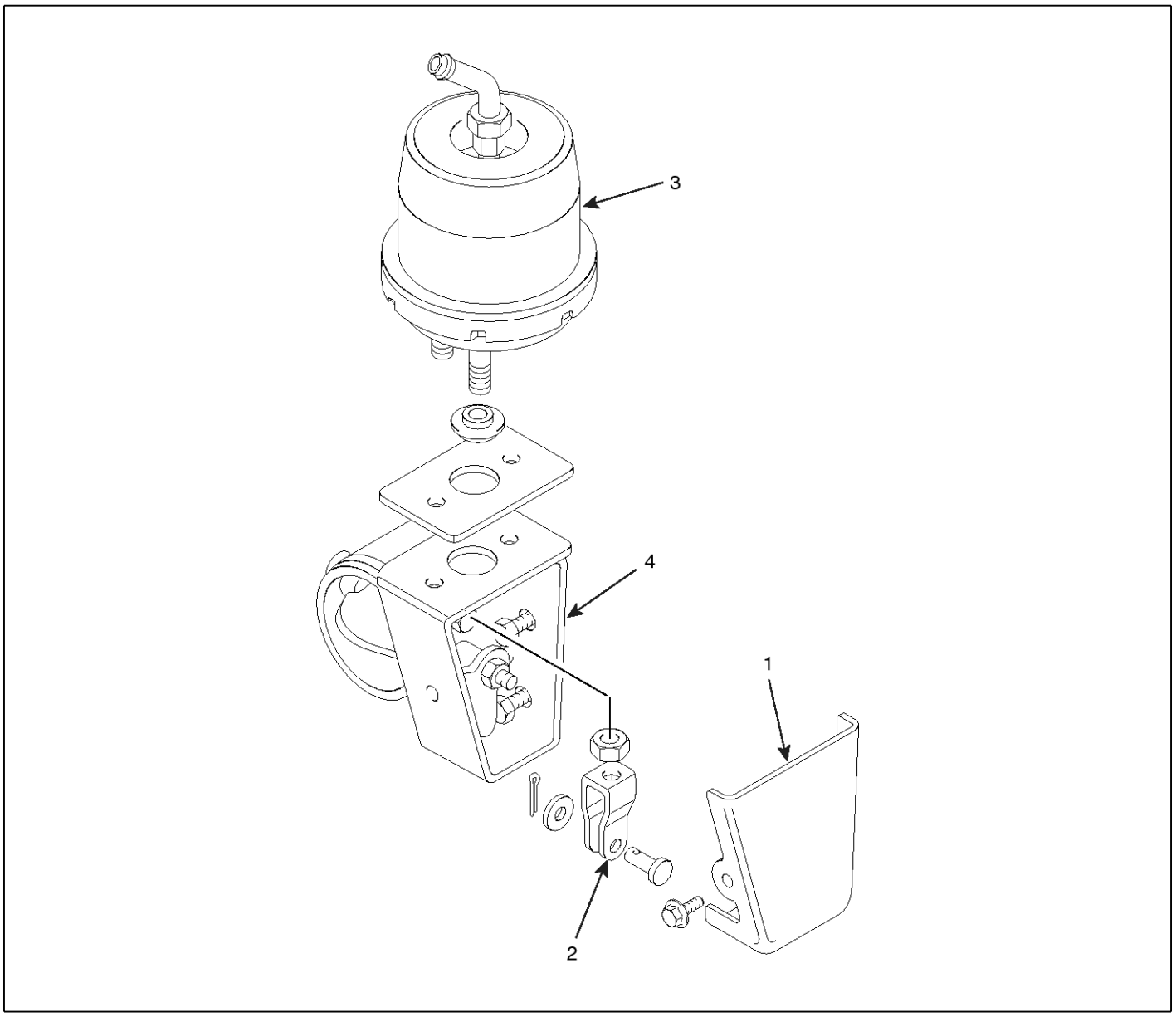
Component (1) - Except D4GA engine



SUDBRA012L

1. Vacuum tank
2. Magnetic valve
3. Exhaust brake unit
4. Exhaust pipe

Component (2) - Except D4GA engine
[Exhaust brake unit]



SUDBRA013L

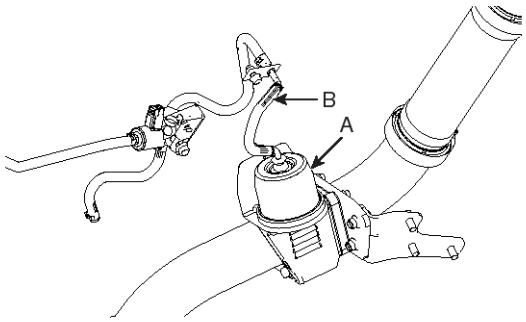
1. Cover
2. Clevis
3. Power chamber
4. Exhaust brake valve

⚠CAUTION
The power chamber is non-disassembly type.
Do not attempt to disassemble.

Replacement

[D4GA engine]

1. Remove the vacuum pipe(B) connected to the exhaust brake unit(A).



SUDBR8559D

2. Remove the mounting bolt connected to the front exhaust pipe. Remove the exhaust brake unit(A).
3. The installation is the reverse order of the removal.

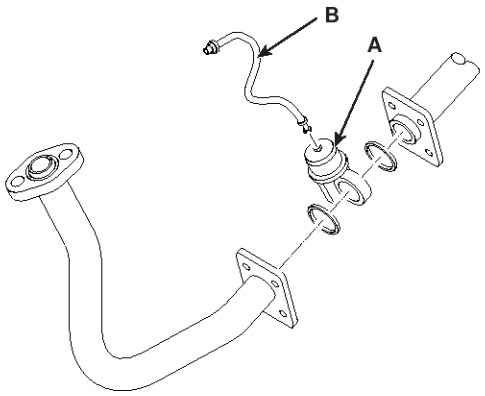
The mounting bolt(Front exhaust pipe - exhaust brake unit) : 44.1~58.8 Nm(4.5~6 kgf.m , 32.5~43.4 lb-ft)

⚠CAUTION

When connecting the exhaust brake to the exhaust pipe, tighten them accurately lest the gas should not be leaked.

[Except D4GA engine]

1. Remove the vacuum pipe(B) connected to the exhaust brake unit(A).

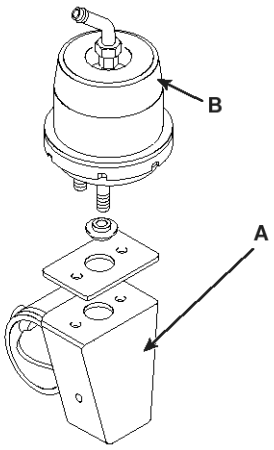


KMTBR5579A

2. Remove the exhaust brake mounting bolt connected to the exhaust pipe.
3. Remove the power chamber (B) from exhaust brake unit(A).

⚠CAUTION

Do not try to disassemble the power chamber because it can not be disassembled.

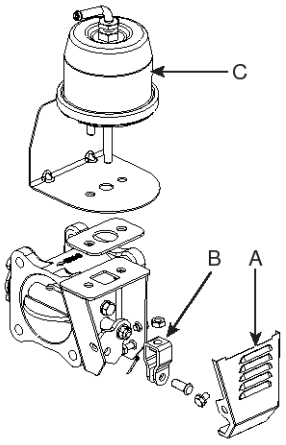


KMTBR5580A

Disassembly

[D4GA engine]

1. Remove the exhaust brake cover(A).
2. Remove the clevis(B).
3. Remove the power chamber(C).



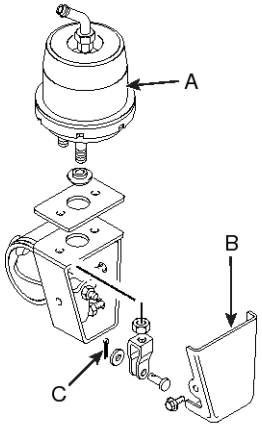
SUDBR8026D

⚠CAUTION
Never do not disassemble the power chamber.

[Except D4GA engine]

1. Remove the power chamber (A).

⚠CAUTION
Do not try to disassemble the power chamber because it can not be disassembled.



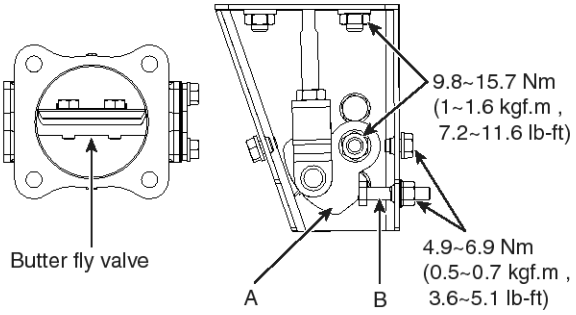
KMTBR5581A

2. Remove the exhaust brake cover (B).
3. Remove the clevis (C).

Reassembly

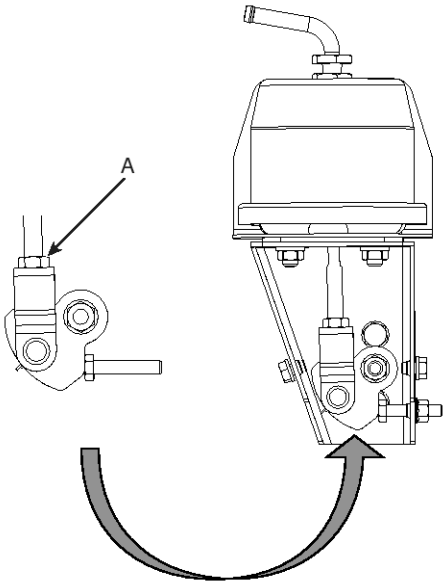
[D4GA engine]

1. Open the butter fly valve completely. Then adjust the adjusting bolt(B) and tighten the lock nut for fixing the lever(A).



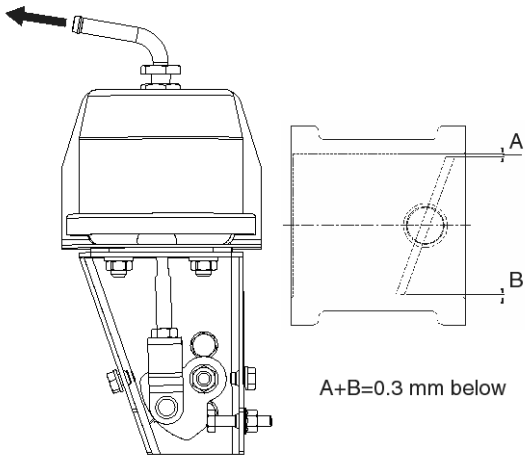
SUDBRA019L

2. Fixing the rod of the power chamber in the state of press-in with 2~4 mm, tighten the lock nut(A).



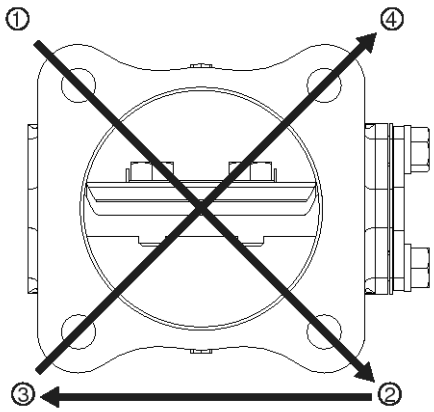
SUDBR8028D

3. Adjust the adjusting bolt so as that the gap(A+B) between the body is below 0.3 mm, when the butterfly valve is fully closed due to the -650~-750mmHg of the vacuum pressure applied to the power chamber.



SUDBRA020L

4. Tighten the mounting bolt like as below order when installing the exhaust brake.



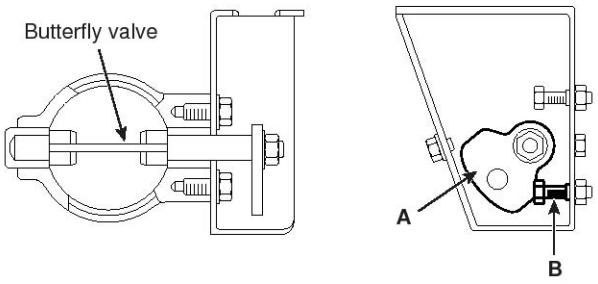
SUDBR8030D

NOTICE

Tighten the bolts like as picture. It doesn't matter wherever you start to tighten the bolt.

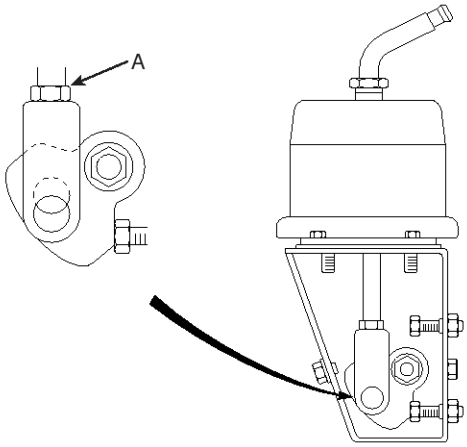
[Except D4GA engine]

1. With opening the butterfly valve, adjust the adjusting bolt(B) to fix the lever(A) and tighten the lock nut.



EMTBR5034A

2. Fixing the rod of the power chamber in the state of press-in with 2~4mm, tighten the lock nut(A).

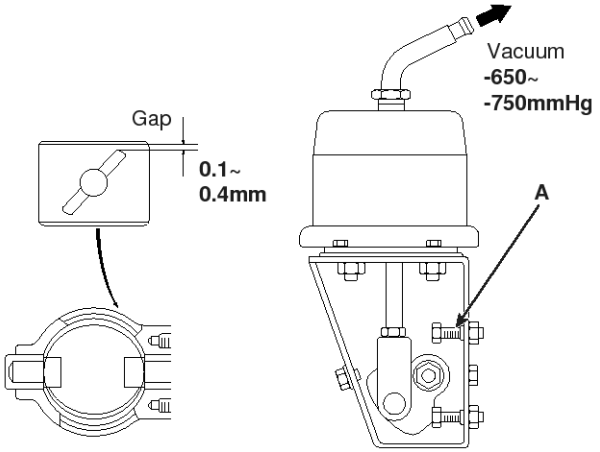


KMTBR5561A

3. Adjust the adjusting bolt(A) so as that the gap between the body is 0.1~0.4mm, when the butterfly valve is fully closed due to the -650~-750mmHg of the vacuum pressure applied to the power chamber.

   And then tighten the lock nut.

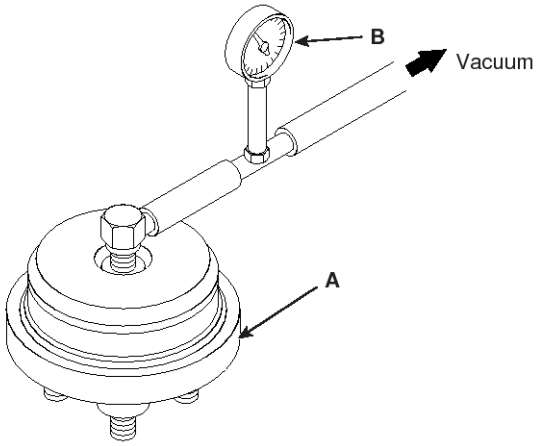
   Check that the opening and closing of the brake valve is smoothly working when the power chamber is applied the vacuum pressure of -400~-600mmHg or atmospheric pressure.



EMTBR5035A

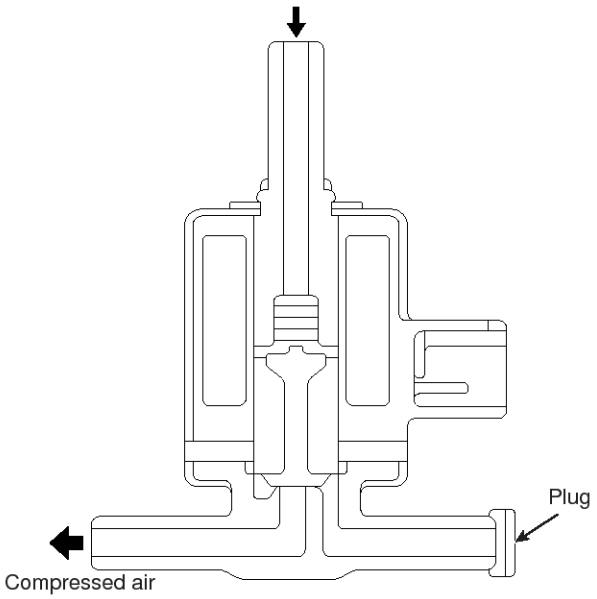
Inspection

1. Apply the vacuum pressure of 500mmHg or more to the power chamber(A) so as that the vacuum gauge(B) indicates the -500mmHg. After 15 seconds, check that the vacuum gauge indicates the specific valve.



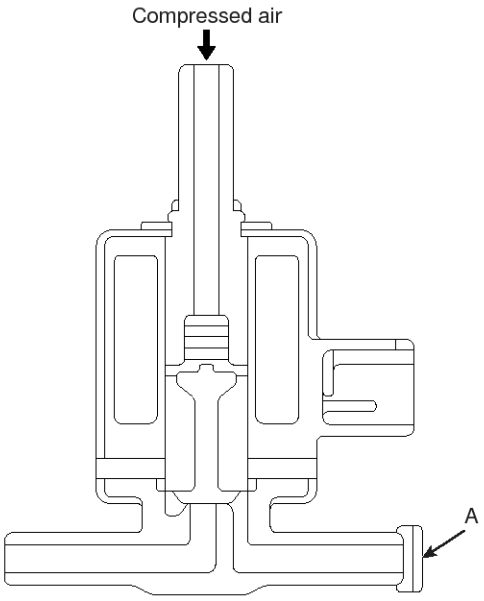
EMTBR5036A

2. 3-way Magnetic Valve
   1) Check for air tightness
      1. Closing the valve of the exhaust brake unit side with a plug and applying the vacuum pressure of -750mmHg to the vacuum tank side valve, there should be no air leakage to the atmosphere side valve.



EMTBR5037A

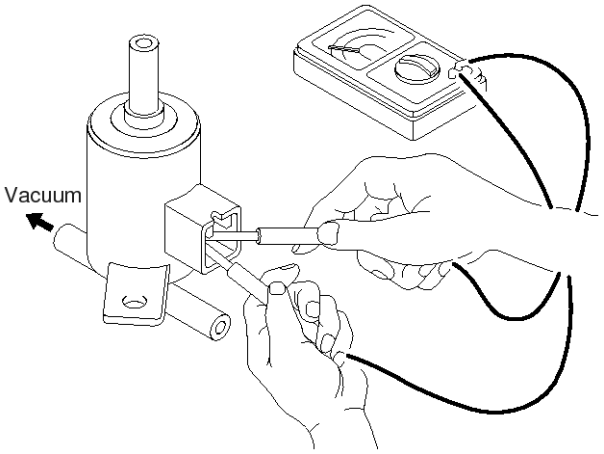
      2. Closing the valve to the exhaust brake unit side and applying the air pressure of 1kg/cm² to the valve of the atmosphere side, there should be no air leakage to the vacuum tank side valve.



EMTBR5061A

2) Operating Inspection

1. Applying the -750mmHg vacuum pressure to the vacuum tank side valve, check that the valve is working at the voltage of 22V or less.



EMTBR5038A

2. Closing the exhaust brake unit side valve with a plug and applying the 1kg/cm² air pressure to the atmosphere side valve, check that the valve is working at the voltage of 22V or less.

ABS

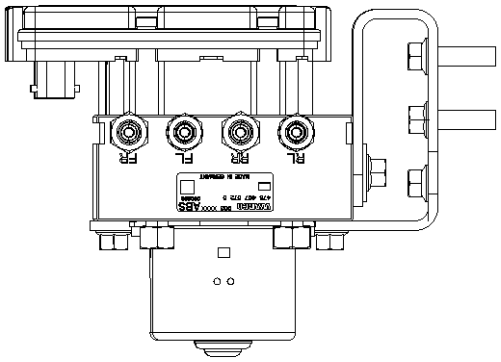
ABS specification

Item	24V
Modulator	
Operating voltage range	20~32 V
On-board voltage	24 V
Operating temperature range	-40°~ 85°C
Motor relay	
On-board voltage	DC24V
On-board current	17.5 A

DESCRIPTION

Overview

WABCO Hydraulic Anti-lock Braking System (HABS) is an electronic wheel speed monitoring and control system. E Version HABS consists of an electronic control unit (ECU) mounted directly on a modulator valve.



SUDBR9001L

How Hydraulic ABS Works

ABS wheel sensors detect wheel speeds. The sensors generate signals that are transmitted to an ECU. If the wheels start to lock, the ECU signals the modulator assembly to regulate the brake pressure of each locking wheel.

During an ABS stop, solenoid valves in the modulator assembly are rapidly pulsed; that is, it opens and closes several times per second to control the brake pressure. When this occurs, drivers may notice a pulsation of the brake pedal.

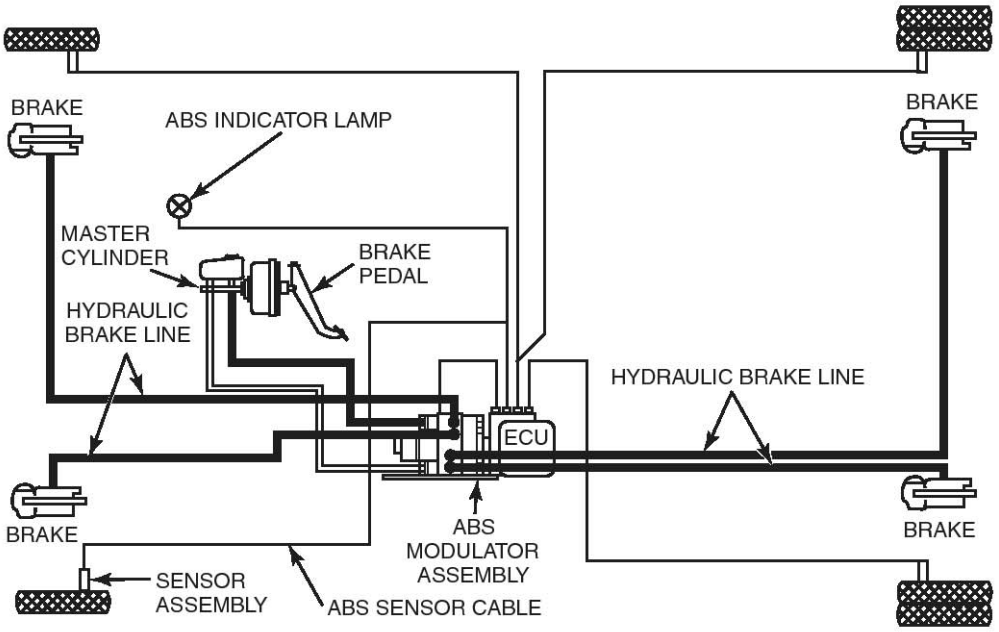
An ABS indicator lamp on the vehicle instrument panel alerts the driver to a possible system fault and provides blink code information to diagnose the system.

If the ABS indicator lamp comes on during normal vehicle operation, drivers may complete their trip, but are instructed to have their vehicle serviced as soon as possible.

In the unlikely event of an ABS system malfunction, the ABS in the affected wheel will be disabled and will return to normal braking.

The other sensed wheels will retain their ABS function.

SYSTEM LAYOUT



SUDBR9002L

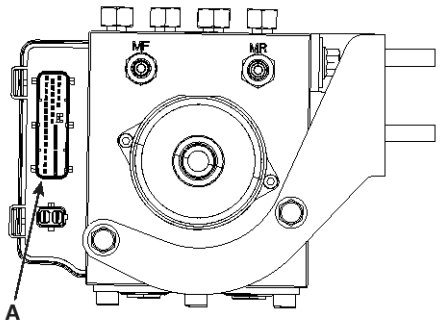
The ABS modulator assembly may be mounted in any orientation as long as the modulator is below the master cylinder and above the wheel cylinders.

SYSTEM COMPONENTS

The following components make up WABCO E Version HABS.

Electronic Control Unit (ECU)

The electronic control unit (ECU,A) processes sensor signals and generates solenoid valve commands to reduce, maintain or reapply brake pressure.



SUDBR9003L

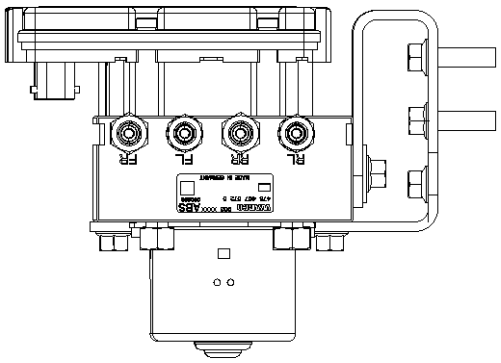
Modulator Assembly

The modulator assembly contains brake fluid. Handle the modulator assembly with appropriate care. Do not expose the modulator assembly to impact loads or excessive vibrations.

Do not blow compressed air into the hydraulic ports.

Mishandling the modulator assembly may lead to component damage and system failure.

The modulator assembly houses the HABS solenoid control valves, one inlet valve and one outlet valve per wheel, a pump motor driving a pump system and a low pressure accumulator per circuit.

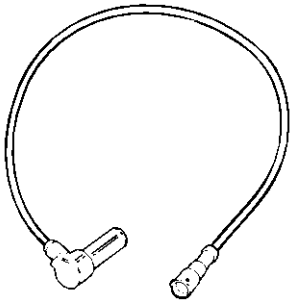


SUDBR9001L

Sensors

Sensor with Molded Socket

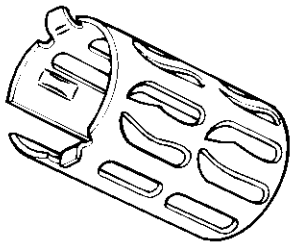
- It measures the speed of a tooth wheel rotating with the vehicle wheel.
- It produces an output voltage proportional to wheel speed.



SUDBR9004L

Sensor Spring Clip

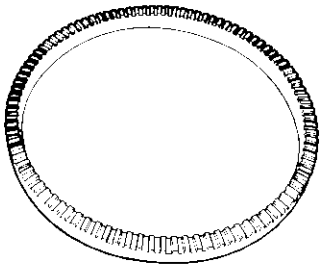
- It holds the wheel speed sensor in close proximity to the tooth wheel.



SUDBR9005L

Tooth Wheel

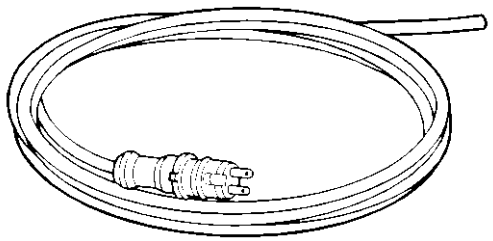
- A machined or stamped ring mounted to a machined surface on the hub of each ABS-monitored wheel.



SUDBR9006L

Sensor Extension Cables

- Two-wire cable with molded-on connector.
- It connects the wheel speed sensor to the ECU.



SUDBR9007L

ABS Indicator Lamp

- It is located on vehicle instrument panel.
- It alerts drivers to a possible system fault.
- It is used by service personnel to display blink codes.



SUDBR9008L

System Diagnostics

Use Hi-Scan diagnostic equipment or standard blink codes to diagnose hydraulic ABS faults.

Blink Code Diagnostics

ABS Indicator Lamp: This lamp, located on the vehicle instrument panel, serves two purposes:

1. It alerts drivers or service personnel to a possible fault in the hydraulic ABS, as follows:

   If the ABS indicator lamp comes on briefly then goes OFF when the ignition is turned ON there are no active faults in the hydraulic ABS.

   If the ABS indicator lamp comes on and stays on after the ignition is turned ON and the vehicle is driven in excess of four mph (6 km/h), there may be an active fault in the hydraulic ABS.

   If the ABS indicator lamp comes on and stays on and goes OFF after the vehicle is driven in excess of four mph (6 km/h) or illuminates intermittently during driving, there may be a stored fault in the hydraulic ABS.

2. It displays diagnostic blink codes for easy servicing.

   Blink Code: A series of blinks or flashes that describe a particular ABS system condition. Refer to Table A and Table B in this section for blink code identification.

   Blink Code Diagnostics: The ability of the WABCO ECU to sense faults in the ABS system and to define these faults via blink codes.

   Blink Code Mode: To ground the 12th pin of Data Link Connector activates blink code diagnostic capabilities.

   Clearing Fault Codes: The process of erasing faults from the ECU memory bank. Refer to table A in this section.

   Fault Code: An ABS condition (fault) detected and stored in memory by the WABCO ECU and displayed by blink code. System faults may be active or stored.

   Active Fault: A condition that currently exists in the ABS system; for example, a sensor circuit malfunction on the left front steering axle. An active fault must be repaired before you can display additional faults. Once an active fault has been repaired, it becomes a stored fault.

   Stored Fault: A condition that caused the system to register a fault, but is not currently active. For example, a loose wire that corrected itself. A stored fault can also be an active fault that has been corrected. Refer to active fault.

   Table A, in this section, describes the method of distinguishing between active and stored faults and explains how to clear them.

Using Blink Code Diagnostics

Follow the steps listed in table A to use blink code diagnostics.

Table A: Identifying E Version Hydraulic ABS Blink Codes

Troubleshooting with Blink Code Diagnostics

Mode	Procedure	System Response	Action
Diagnostics	Step I. Turn ignition on.	Possible responses:	
		1. ABS indicator lamp comes on momentarily then goes out, indicating System O.K.	No recognizable active faults in the ABS. No action required.
		2. ABS indicator lamp does not light, indicating possible wiring fault or burned-out bulb.	Inspect wiring. Inspect bulb. Make the necessary repairs.
		3. ABS indicator lamp stays on, indicating: * Fault, or faults, in the system * Sensor fault during last operation * Faults cleared from ECU, but vehicle not driven. * ECU disconnected.	 Continue with blink code diagnostics. Go to Step II. Continue with blink code diagnostics. Go to Step II. Drive vehicle — lamp will go out when vehicle reaches four mph (6 km/h). Connect ECU.
	Step II. Ground the 12th pin of Data Link Connector for one second, then release.	ABS indicator lamp begins flashing two-digit blink code(s).	Determine if fault is active or stored: Active Fault: Lamp will repeatedly display one code. Stored Fault: Lamp will display code for each stored fault then stop blinking. Faults will be displayed one time only.
	Step III. Count the flashes to determine the blink code.	First Digit: 1-14 flashes, Pause (0.5-3 seconds). Second Digit: 1-11 flashes, Pause (0.5-3 seconds).	Find definition for blink code on blink code chart.
	Step IV. Turn ignition OFF. Repair and Record faults.	Active Fault.	Make the necessary repairs.
		Stored Faults.	Record for future reference.

Clear	Step V. Turn ignition ON. Clear faults from memory: Ground the 12th pin of Data Link Connector for at least three seconds, then release.	ABS indicator lamp flashes eight times.	All stored faults successfully cleared. Turn ignition OFF. Turn ignition ON. The indicator lamp will stay on. This is because the ECU is looking for wheel speed. Drive the vehicle at a speed of four mph (6 km/h). Once the ECU senses wheel speed, the lamp will go off.
		Eight flashes not received.	Active faults still exist, repeat Step I through Step V.

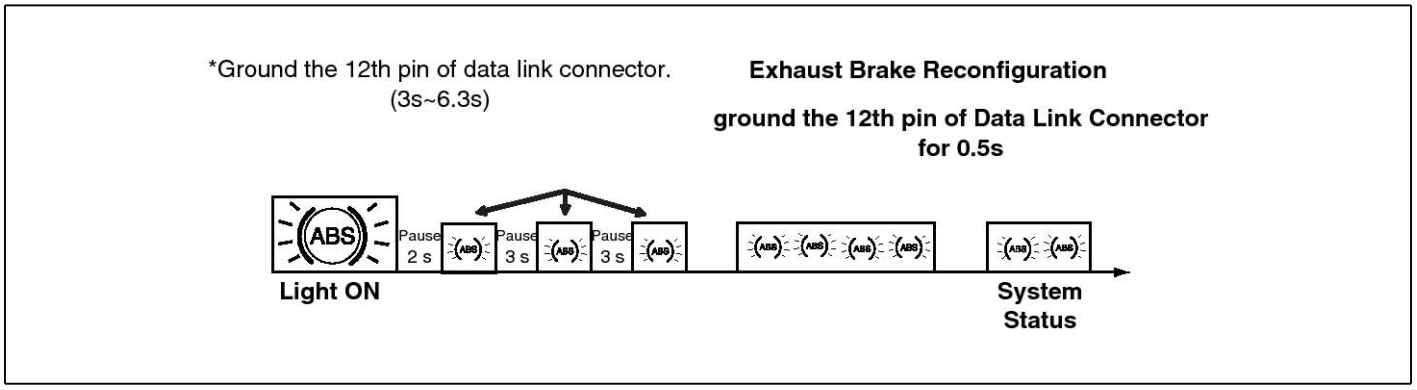
Exhaust Brake Reconfiguration

Within system mode (2 seconds after activation) the reconfiguration of the exhaust brake can be requested via grounding and releasing the 12th pin of Data Link Connector three times in a row.

Retarder reconfiguration is executed only if no active faults are being stored inside the ECU.

For confirmation the ABS warning lamp is blinked 4 times fast after the exhaust brake configuration has been reset.

Afterwards the system code is blinked out endlessly.



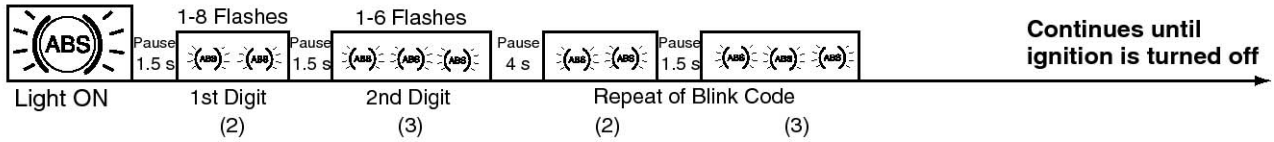
SUDBR9013L

Trouble shooting and testing

Blink code

*Ground the 12th pin of data link connector.
(0.5s~3s)

Active Fault

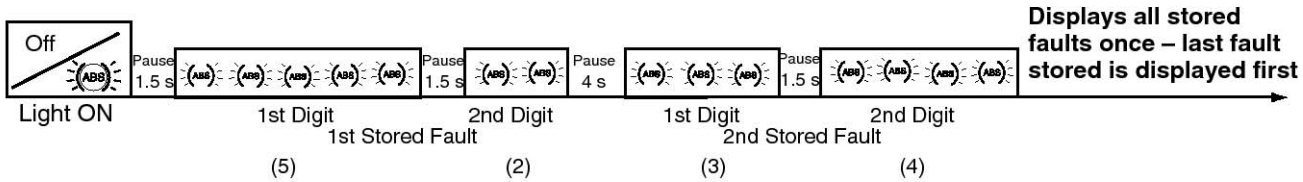


Blink Code 2-3 : Fault in ABS sensor air gap-Left Front

*Ground the 12th pin of data link connector.
(0.5s~3s)

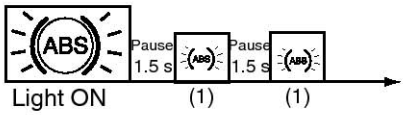
Blink Code 5-2 : Tyre combination -Left Rear
3-4 : Sensor impedance -Right Rear

Stored Faults



*Ground the 12th pin of data link connector.
(0.5s~3s)

System O.K.



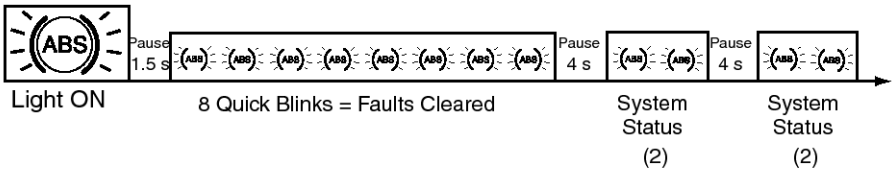
Blink Code 1-1 : System OK

SUDBR9009L

*Ground the 12th pin of data link connector.
(3s~6.3s)

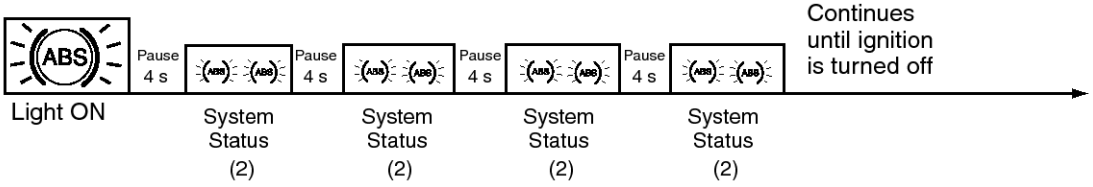
Note: After faults are cleared and vehicle is started, ABS lamp will stay on until vehicle is driven over 4km/h.

Faults Cleared



*Ground the 12th pin of data link connector.
(3s~6.3s)

Faults Not Cleared (Active Faults Still Exist)



SUDBR9010L

E Version Hydraulic(Add-on) ABS Blink Codes

Use the information in Table B to identify a fault and check for correct volt or ohm measurements and repair the fault.

List of fault codes

Table B : E Version Hydraulic(Add-on) ABS Blink Codes

1st digit : Component being faulty

2nd digit : Detailed location of the fault or detailed description of the fault.

Table B

fault code (1st digit)	fault code (2nd digit)	Fault number	Repair Instruction
1 No Failure	1 No Failure	-	-
2 Sensor: Airgap	1 RHF	1	2.1 / 2.4
2 Sensor: Airgap	2 LHR	2	2.1 / 2.4
2 Sensor: Airgap	3 LHF	3	2.1 / 2.4
2 Sensor: Airgap	4 RHR	4	2.1 / 2.4
3 Sensor: Impedance	1 RHF	23	2.5
3 Sensor: Impedance	2 LHR	24	2.5
3 Sensor: Impedance	3 LHF	25	2.5
3 Sensor: Impedance	4 RHR	26	2.5
4 Sensor: No trigger at all	1 RHF	73	2.1 / 2.3 / 2.4 / 2.5 / 2.6
4 Sensor: No trigger at all	2 LHR	74	2.1 / 2.3 / 2.4 / 2.5 / 2.6
4 Sensor: No trigger at all	3 LHF	75	2.1 / 2.3 / 2.4 / 2.5 / 2.6
4 Sensor: No trigger at all	4 RHR	76	2.1 / 2.3 / 2.4 / 2.5 / 2.6
5 Sensor: Tyre Combination	1 RHF	63	2.2
5 Sensor: Tyre Combination	2 LHR	64	2.2
5 Sensor: Tyre Combination	3 LHF	65	2.2
5 Sensor: Tyre Combination	4 RHR	66	2.2
6 Power Amplifier: Short to Ubat/Uvent	1 RHF IV	9	1.1
6 Power Amplifier: Short to Ubat/Uvent	2 RHF OV	10	1.1
6 Power Amplifier: Short to Ubat/Uvent	3 LHF IV	11	1.1
6 Power Amplifier: Short to Ubat/Uvent	4 LHF OV	12	1.1
6 Power Amplifier: Short to Ubat/Uvent	5 RHR IV	13	1.1
6 Power Amplifier: Short to Ubat/Uvent	6 RHR OV	14	1.1
6 Power Amplifier: Short to Ubat/Uvent	7 LHR IV	15	1.1
6 Power Amplifier: Short to Ubat/Uvent	8 LHR OV	16	1.1
6 Power Amplifier: Short to Ubat/Uvent	9 EBR	17	1.1
6 Power Amplifier: Short to Ubat/Uvent	10 BLR	18	1.1

fault code (1st digit)	fault code (2nd digit)	Fault number	Repair Instruction
7 Power Amplifier: Open circuit	1 RHF IV	27	1.1
7 Power Amplifier: Open circuit	2 RHF OV	28	1.1
7 Power Amplifier: Open circuit	3 LHF IV	29	1.1
7 Power Amplifier: Open circuit	4 LHF OV	30	1.1
7 Power Amplifier: Open circuit	5 RHR IV	31	1.1
7 Power Amplifier: Open circuit	6 RHR OV	32	1.1
7 Power Amplifier: Open circuit	7 LHR IV	33	1.1
7 Power Amplifier: Open circuit	8 LHR OV	34	1.1
7 Power Amplifier: Open circuit	9 EBR	35	1.1
7 Power Amplifier: Open circuit	10 BLR	36	1.1
8 Power Amplifier: Short to ground	1 RHF IV	41	1.1
8 Power Amplifier: Short to ground	2 RHF OV	42	1.1
8 Power Amplifier: Short to ground	3 LHF IV	43	1.1
8 Power Amplifier: Short to ground	4 LHF OV	44	1.1
8 Power Amplifier: Short to ground	5 RHR IV	45	1.1
8 Power Amplifier: Short to ground	6 RHR OV	46	1.1
8 Power Amplifier: Short to ground	7 LHR IV	47	1.1
8 Power Amplifier: Short to ground	8 LHR OV	48	1.1
8 Power Amplifier: Short to ground	9 EBR	49	1.1
8 Power Amplifier: Short to ground	10 BLR	50	1.1
9 Inlet Valve Actuation Time	1 RHF	80	2.1 / 2.4 / 2.5/ 1.1
9 Inlet Valve Actuation Time	2 LHR	81	2.1 / 2.4 / 2.5/ 1.1
9 Inlet Valve Actuation Time	3 LHF	82	2.1 / 2.4 / 2.5/ 1.1
9 Inlet Valve Actuation Time	4 RHR	83	2.1 / 2.4 / 2.5/ 1.1
10 Pump Motor	1 pm monitor voltage unexp. high	67	1.1
10 Pump Motor	2 pm monitor voltage unexp. low	68	6.1
10 Pump Motor	3 motor does not turn	69	6.3
10 Pump Motor	4 no pm supply voltage	70	6.2
10 Pump Motor	5 pm relay does not switch on	71	1.1
10 Pump Motor	6 pm relay does not switch off	72	1.1
11 J1939	1 Internal	77	1.1
11 J1939	2 bus failure	78	8.1
11 J1939	3 message failure	79	8.2
12 Pole Wheel	1 RHF	84	2.4
12 Pole Wheel	2 LHR	85	2.4

fault code (1st digit)	fault code (2nd digit)	Fault number	Repair Instruction
12 Pole Wheel	3 LHF	86	2.4
12 Pole Wheel	4 RHR	87	2.4
13 Brake Chatter	1 RHF	90	2.7
13 Brake Chatter	2 LHR	91	2.7
13 Brake Chatter	3 LHF	92	2.7
13 Brake Chatter	4 RHR	93	2.7
14 System	1 valve relay can't switch off	55	1.1
14 System	2 valve relay can't switch on	56	11.1
14 System	3 reference ground connection	57	11.2
14 System	5 ABS warning light bulb	59	12.1
14 System	6 brake warning light bulb	60	13.1
14 System	7 High Voltage	61	11.3
14 System	8 Low Voltage	62	11.4
14 System	9 Clamp	88	1.1
14 System	10 Pull Up Down	89	1.1
14 System	11 Internal Error	0	1.1

* Refer to 88 page about "Repair Instruction".

* An abbreviation

RHF : Right Hand Front

LHR : Left Hand Rear

LHF : Left Hand Front

RHR : Right Hand Rear

IV : Inlet Valve

OV : Outlet Valve

EBR : Endurance Brake Relay(Exhaust Brake Relay)

BLR : Brake Light Relay

PM : Pump Motor

DTC Troubleshooting

NOTICE

A:enabled

B:disabled

C:Selective switched off

D:temporary selective switched off

E:Selective switch off only during cycling

F:Control functions permanently disabled at this wheel end

** Refer to 88 page about "Repair Instruction".*

System reaction	SPN	SID	FMI	Repair	General actions	ABS	EBD	Brake	ABS
Main controller, safety controller	254	254	12	1.1	brake valve power supply switched off	B	B	ON	ON
Sensor front right									
Airgap	2	2	1	2.1 / 2.4		C	A	OFF	ON
Impedance	2	2	5	2.5		C	A	OFF	ON
Pole wheel	2	2	7	2.4		C	A	OFF	ON
No trigger at all	2	2	8	2.1 / 2.3 / 2.4 / 2.5 / 2.6		C	A	OFF	ON
Inlet valve actuation time not plausible (75 % switch on time within 5 minutes)	254	254	9	2.1 / 2.4 / 2.5 / 1.1		C	A	OFF	ON
Brake chatter	2	2	11	2.7		D	A	OFF	ON(Only during cycling)
Tire combination	2	2	13	2.2		C	A	OFF	ON
Sensor rear left									
Airgap	3	3	1	2.1 / 2.4	take over speed from other rear wheel	C	A	OFF	ON
Impedance	3	3	5	2.5		C	A	OFF	ON
Pole wheel	3	3	7	2.4		C	A	OFF	ON
No trigger at all	3	3	8	2.1 / 2.3 / 2.4 / 2.5 / 2.6		C	A	OFF	ON
Inlet valve actuation time not plausible (75 % switch on time within 5 minutes)	254	254	9	2.1 / 2.4 / 2.5 / 1.1		C	A	OFF	ON
Brake chatter	3	3	11	2.7		D	A	OFF	ON(Only during cycling)

System reaction	SPN	SID	FMI	Repair	General actions	ABS	EBD	Brake	ABS
Tire combination	3	3	13	2.2	take over speed from other rear wheel	C	A	OFF	ON
Sensor front left									
Airgap	1	1	1	2.1 / 2.4		C	A	OFF	ON
Impedance	1	1	5	2.5		C	A	OFF	ON
Pole wheel	1	1	7	2.4		C	A	OFF	ON
No trigger at all	1	1	8	2.1 / 2.3 / 2.4 / 2.5 / 2.6		C	A	OFF	ON
Inlet valve actuation time not plausible (75 % switch on time within 5 minutes)	254	254	9	2.1 / 2.4 / 2.5 / 1.1		C	A	OFF	ON
Brake chatter	1	1	11	2.7		D	A	OFF	ON(Only during cycling)
Tire combination	1	1	13	2.2		C	A	OFF	ON
Sensor rear right									
Airgap	4	4	1	2.1 / 2.4	take over speed from other rear wheel	C	A	OFF	ON
Impedance	4	4	5	2.5		C	A	OFF	ON
Pole wheel	4	4	7	2.4		C	A	OFF	ON
No trigger at all	4	4	8	2.1 / 2.3 / 2.4 / 2.5 / 2.6		C	A	OFF	ON
Inlet valve actuation time not plausible (75 % switch on time within 5 minutes)	254	254	9	2.1 / 2.4 / 2.5 / 1.1		C	A	OFF	ON
Brake chatter	4	4	11	2.7		D	A	OFF	ON(Only during cycling)
Tire combination	4	4	13	2.2	take over speed from other rear wheel	C	A	OFF	ON
Power amp. inlet valve front right									
Shorted to ubat	43	43	3	1.1	brake valve power supply switched off	B	B	OFF	ON
Open circuit	43	43	5			C	A	OFF	ON
Shorted to ground	43	43	6			C	A	OFF	ON
Power amp. outlet valve front right									

System reaction	SPN	SID	FMI	Repair	General actions	ABS	EBD	Brake	ABS
Shorted to ubat	49	49	3	1.1	brake valve power supply switched off	B	B	OFF	ON
Open circuit	49	49	5			C	A	OFF	ON
Shorted to ground	49	49	6			C	A	OFF	ON
Power amp. inlet valve front left									
Shorted to ubat	42	42	3	1.1	brake valve power supply switched off	B	B	OFF	ON
Open circuit	42	42	5			C	A	OFF	ON
Shorted to ground	42	42	6			C	A	OFF	ON
Power amp. outlet valve front left									
Shorted to ubat	48	48	3	1.1	brake valve power supply switched off	B	B	OFF	ON
Open circuit	48	48	5			C	A	OFF	ON
Shorted to ground	48	48	6			C	A	OFF	ON
Power amp. inlet valve rear left									
Shorted to ubat	44	44	3	1.1	brake valve power supply switched off	B	B	OFF	ON
Open circuit	44	44	5			C	B	OFF	ON
Shorted to ground	44	44	6			C	B	OFF	ON
Power amp. outlet valve rear left									
Shorted to ubat	50	50	3	1.1	brake valve power supply switched off	B	B	OFF	ON
Open circuit	50	50	5			C	B	OFF	ON
Shorted to ground	50	50	6			C	B	OFF	ON
Power amp. inlet valve rear right									
Shorted to ubat	45	45	3	1.1	brake valve power supply switched off	B	B	OFF	ON
Open circuit	45	45	5			C	B	OFF	ON
Shorted to ground	45	45	6			C	B	OFF	ON
Power amp. outlet valve rear right									

System reaction	SPN	SID	FMI	Repair	General actions	ABS	EBD	Brake	ABS
Shorted to ubat	51	51	3	1.1	brake valve power supply switched off	B	B	OFF	ON
Open circuit	51	51	5			C	B	OFF	ON
Shorted to ground	51	51	6			C	B	OFF	ON
Power amp. endurance brake relay									
Shorted to ubat	13	13	3	15.1		A	A	OFF	ON
Open circuit	13	13	5	15.2		A	A	OFF	ON
Shorted to ground	13	13	6	15.3		A	A	OFF	ON
Internal valve relay (provides supply voltage for ABS pressure control valves)									
Can’t switch off	30	30	3	1.1		B	B	ON	ON
Valve supply voltage missing or can’t switch on	30	30	4	11.1		B	B	ON	ON
ABS warning light relay (if available)	1438	23	5	12.1		A	A	ON	-
Brake warning light relay (if available)	1439	101	5	13.1		A	A	-	ON
ECU main ground or reference ground connection	98	98	2	11.2		B	B	ON	ON
High voltage (>17V for 12V-ECU, >32V for 24V ECU) if corresponding parameter is set.	251	251	3	11.3		A	A	ON	ON
Pump motor									
Pump motor does operate when not expected.	2581	54	3	6.4		B	A	OFF	ON
Pump motor does not switch on.	2581	54	4	6.4		B	A	OFF	ON
Supply voltage for pump motor missing	2581	54	5			B	A	OFF	ON
Pump motor does not turn.	2581	54	7	1.1		B	A	OFF	ON
Relay voltage missing	2581	54	12	1.1		B	A	OFF	ON
J1939 communication									
BUS error	231	231	5	8.1		A	A	OFF	ON
Internal error	231	231	12	1.1		A	A	OFF	ON
Message time out(J1939)									

System reaction	SPN	SID	FMI	Repair	General actions	ABS	EBD	Brake	ABS
Engine retarder if configured	231	231	9	8.2		A	A	OFF	ON
Driveline retarder if configured									OFF
Exhaust retarder if configured									-
Engine ECU, engine hours (E-H_R) if configured									-

Multiple failures

System reaction	SPN	SID	FMI	Repair	General actions	ABS	EBD	Brake Warning Lamp	ABS
Sensor failures at both rear axle wheel ends	According to DTC codes			Refer to repair instructions of DTC.		B	B	ON	ON
Sensor failures at both front axle wheel ends	According to DTC codes			Refer to repair instructions of DTC.		B	B	ON	ON
Power amp. failures on both rear axle wheel ends	According to DTC codes			Refer to repair instructions of DTC.		B	B	ON	ON
More than 100 sensor faults on the same wheel	According to DTC codes			Refer to repair instructions of DTC.		F	F	OFF	ON

Special system conditions

System reaction	General actions	ABS	EBD		ABS
Sensor failure detected during the last drive cycle		disabled, until all wheel speeds passed sensor test	enabled	OFF	ON, until all wheel speeds passed sensor test
Low voltage	See repair instruction 11.4	Stays enabled if ABS is currently cycling. Future ABS cycles will be disabled for the duration of the low voltage condition.	enabled	OFF	ON

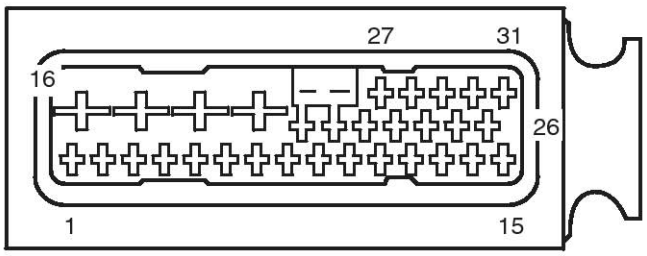
Repair Instruction

R.I. Number	R.I. Sub-Number	Instruction
1		ECU
	1	Replace ECU.
2		Sensor / Tone ring combination
	1	Check airgap (range 0.2 -1.7 mm). Check bearing play and tone ring run out. Eliminate root cause for airgap extension and push sensor back in afterwards. Check tone ring for damage (missing teeth, corrosion). Replace tone ring if necessary.
	2	Check tire size is within released range. Check number of teeth on tone ring.
	3	Check J1939 communication with engine controller.[1]
	4	Check tone ring for damage/missing teeth/corrosion. Replace tone ring if necessary.
	5	Check sensor impedance and sensor wiring and connectors for intermittent contact. Replace sensor and/or sensor wiring if necessary.
	6	Check sensor installation. Check airgap and push sensor back in afterwards.
	7	Check foundation brakes; condition may occur even without system failure
6		Pump Motor
	1	If pump motor runs permanently -> 1.1. If not, -> 6.3.
	2	Check wiring and connections of the pump motor supply voltage. Check pump motor fuse. Use break-out-box. Without ECU the pump motor supply voltage (pin 16/31) has to be measured. The voltage level shall be equivalent to battery voltage.
	3	Replace HCU.
8		J1939-Interface
	1	Check electrical system of J1939 bus (connections, wiring).
	2	Check J1939 devices (Retarder, engine ECU).
11		Supply Voltage, Ground connection
	1	Check valve supply voltage fuse and wiring. Check Pin 17/31. The voltage level shall be equivalent to battery voltage. If this fails -> 1.1
	2	Check wiring and connectors of the ECU ground connections. Check wiring and connectors of reference ground. Open ground connections and reassemble.
	3	Supply voltage too high. Check alternator and battery.
	4	Supply voltage too low. Check alternator and battery.
12		ABS-Warning Lamp relay

R.I. Number	R.I. Sub-Number	Instruction
	1	Check wiring and connections of the ABS warning lamp relay. Replace relay if necessary. Use break-out-box. Without ECU the voltage has to be measured. The voltage level shall be equivalent to battery v-oltage. Current-measurement with Pin 21/31 short to battery voltage.
13		Brake-Warning Lamp relay
	1	Check wiring and connections of the brake warning lamp relay. Replace relay if necessary. Use break-out-box. Without ECU the voltage has to be measured. The voltage level shall be equivalent to battery v-oltage. Current-measurement with Pin 20/31 short to Ubat.
15		Endurance Brake Relay (EBR)
	1	Shorted to Ubat. Check wiring and connections of the EBR. Replace EBR if necessary. If furthe-r failure occurs -> 1.1.
	2	Open circuit. Check wiring and connections of the EBR. Replace EBR if necessary. If further fa-ilure occurs -> 1.1.
	3	Shorted to Ground. Check wiring and connections of the EBR. Replace EBR if necessary. If fur-ther failure occurs -> 1.1.

[1] Valid for vehicles with J1939 interface only

CONNECTOR CONFIGURATIONS

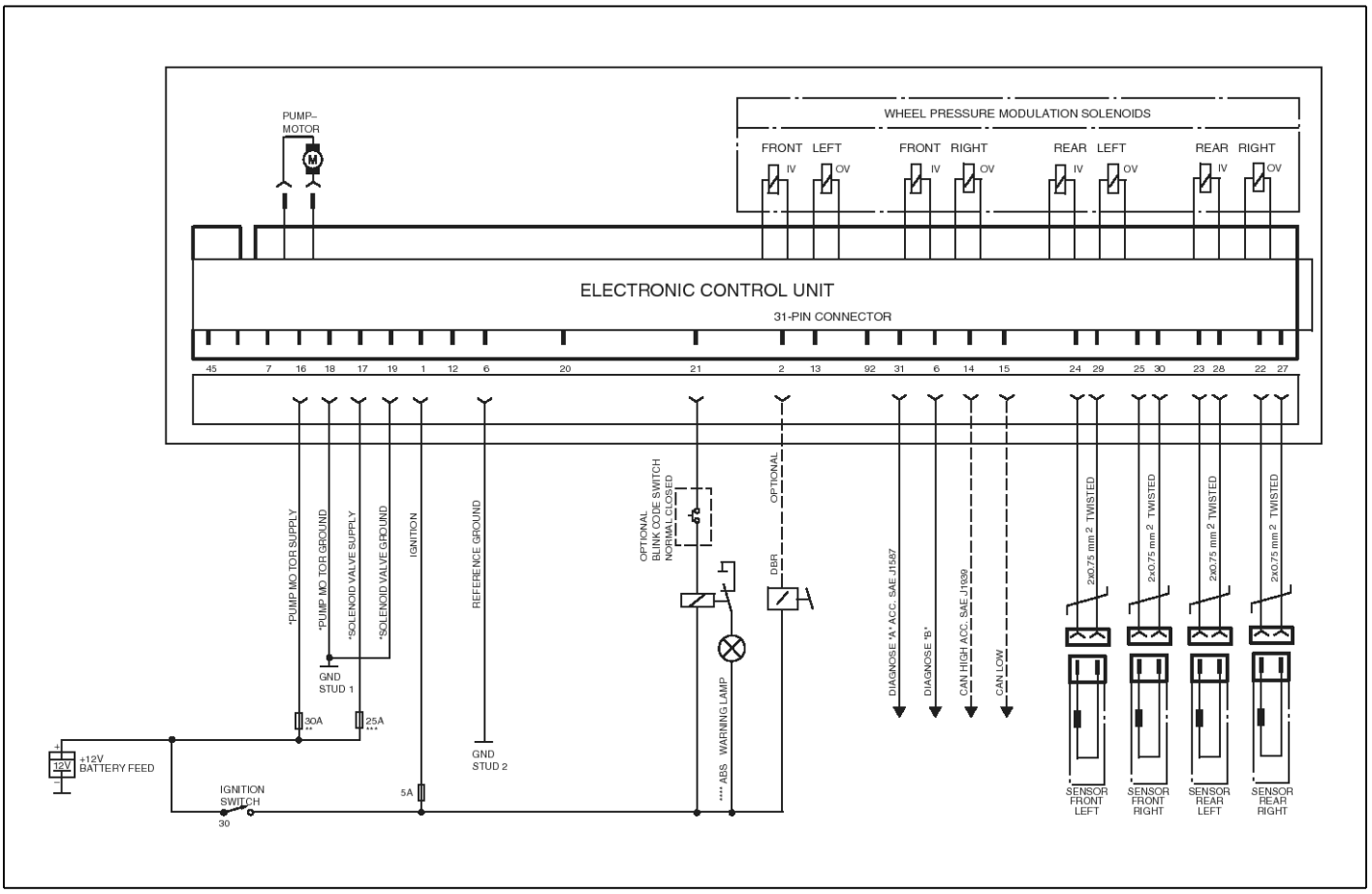


Count from the pin number at the end of each row, identify pin assembly to measure. Connector view shows the back of the connector.

PIN #	Circuit Label
1	Ignition 24V
2	DBR Relay (optional)
3	Not Used
4	Not Used
5	Not Used
6	Reference Ground
7	Not Used
8	Not Used
9	Not Used
10	Not Used
11	Not Used
12	Not Used
13	Not Used
14	J1939 + High - (optional)
15	J1939 - Low - (optional)

PIN #	Circuit Label
16	Pump Motor Supply 24v+
17	Solenoid Valve Supply 24v+
18	Pump Motor Ground -Gnd
19	Solenoid Valve Ground -Gnd
20	Brake Warning Lamp Relay
21	ABS Warning Lamp Relay
22	Rear Right Wheel Speed Sensor
23	Rear Left Wheel Speed Sensor
24	Front Left Wheel Speed Sensor
25	Front Right Wheel Speed Sensor
26	ISO14230 (KWP2000)
27	Rear Right Wheel Speed Sensor
28	Rear Left Wheel Speed Sensor
29	Front Left Wheel Speed Sensor
30	Front Right Wheel Speed Sensor
31	Not Used

FULL CIRCUIT DIAGRAM



SUDBR9012L

INSPECTION

Standard Testing

Test Equipment: Volt-Ohm Meter (VOM)

Use of a VOM with automatic polarity sensing is recommended. This eliminates the concern of the polarity of the meter leads during voltage measurements.

System Requirements and Component Tests

Tire Size Range

For correct hydraulic ABS operation, front and rear tire sizes must be within 16% of each other.

Calculate the tire size with the following equation:

% Difference = (RPM Steer/RPM Drive) − 1 x 100

* RPM = tire revolutions per mile

⚠CAUTION

When troubleshooting or testing the ABS system, do not damage the connector terminals. Damaged connector terminals may cause system malfunction.

Voltage Check

Voltage must be between 20 and 32 volts for the 24-volt hydraulic ABS to function correctly.

Check voltage as follows.

1. Turn ignition ON.
2. Check for the correct voltage.
   - Pins 16 to 18
   - Pins 17 to 19
   - Pins 1 to 6

Standard Component Testing

ABS Indicator Lamp

If the ABS indicator lamp does not come on after the ignition is turned on, or it comes on but does not go out after 2.5 seconds, check all ABS fuses or circuit breakers and replace if necessary.

Check the wiring to the ABS diagnostic switch and the indicator lamp and repair or replace the wiring as required. When checking the indicator lamp, follow these steps:

1. Check voltage potential at the lamp socket.
2. Check continuity of the wires to the socket.
3. Replace the bulb.

Sensor Adjustment

On steering axles, the sensor is typically accessible on the in-board side of the steering knuckle.

On drive axles, the sensor is typically accessible on the in-board side of the rear axle spindle.

To adjust the sensor, push the sensor in until it contacts the tooth wheel.

* Do not pry or push sensors with sharp objects.

* Sensors will self-adjust during wheel rotation.

NOTICE

No gap is allowable at installation. During normal operation, a gap not to exceed 0.04-inch(1mm) is allowable.

Sensor Output Voltage Test

Sensor output voltage must be at least 0.2 volt AC at 30 rpm. Test the sensor output voltage as follows:

1. Turn ignition OFF.
2. Disconnect the ECU to measure voltage at the pins on the ECU connector.

   WARNING

   Park the vehicle on a level surface. Block the wheels to prevent the vehicle from moving. Support the vehicle with safety stands. Do not work under a vehicle supported only by jacks. Jacks can slip and fall over. Serious personal injury and damage to components can result.
3. Place blocks under the front and rear tires to stop the vehicle from moving.
4. Raise the vehicle off the ground. Place safety stands under the axle.
5. Rotate the wheel by hand at 30 rpm (1/2 revolution per second).
6. Measure the voltage at the pins indicated in Table C. Voltage tolerance is ≥0.2 volts alternating current (VAC).

Table C: Sensor Check Pins

Sensor	HABS E Version ECU
	31 Pin Harness
Left front	Pin 24 and Pin 29
Right front	Pin 25 and Pin 30
Left rear	Pin 23 and Pin 28
Right rear	Pin 22 and Pin 27

Sensor Resistance

The sensor circuit resistance must be between 830 and 2,100 ohms. Measure resistance at the sensor connector, or at the pins on the ECU connector, as follows.

1. Turn ignition OFF.
2. To measure resistance at the pins on ECU connector, disconnect the ECU connector from the ECU.

   To measure resistance at the sensor connector, disconnect the sensor from the sensor extension cable.
3. Measure output at the pins indicated in Table C.

   If measurement is not between 830 and 2,100 ohms, replace the sensor.

ADJUSTMENT

Brake Bleeding Procedures

General

The following brake bleeding methods explain how to bleed the hydraulic ABS modulator assembly during installation, or in the event of air in the brake system. There are instructions for both pressure and manual bleeding procedures.

These instructions include the procedure for bleeding both the master cylinder and the brake system. In some cases, for example, if you are replacing only the modulator assembly, it may not be necessary to bleed the master cylinder.

NOTICE

The modulator assembly must be handled with appropriate care and should not be exposed to excessive impact or compressed air at the hydraulic ports prior to assembly.

WARNING

Failure to bleed the system whenever any hydraulic system fitting is loosened or disconnected will allow air to remain in the system. This will prevent the hydraulic pressure in the brake system from rising enough to apply the brakes correctly.

This will cause the stopping distance to increase and can result in serious personal injury.

Correctly discard hydraulic brake fluid that is removed from the brake system. Hydraulic brake fluid that is removed can be contaminated and can cause damage, loss of braking and serious personal injury.

Use only the type of hydraulic brake fluid specified by the equipment manufacturer. Do not use or mix different types of hydraulic brake fluid. The wrong hydraulic brake fluid will damage the rubber parts of the brake caliper and can cause damage, loss of braking and serious personal injury.

NOTICE

Use DOT 3 or DOT 4 hydraulic brake fluid. Refer to the vehicle specifications to determine which fluid to use.

CAUTION

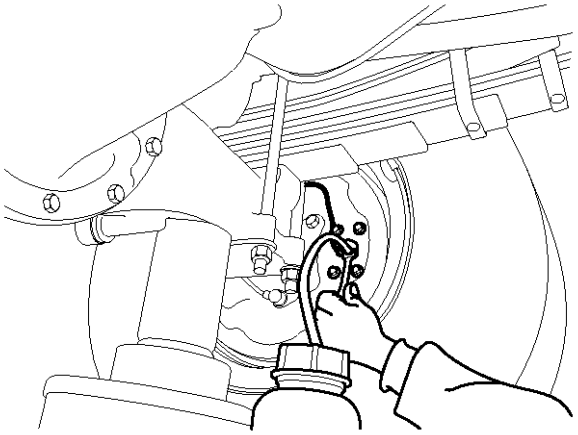
Hydraulic brake fluid is a caustic substance. Contact with hydraulic brake fluid can cause skin irritation. Do not let hydraulic brake fluid touch any painted surfaces, as it will remove the paint. Hydraulic brake fluid may also damage certain non-metal surfaces. Do not let fluid get on brake pads, shoes, rotors or discs.

1. Fill up the brake oil tank with the brake oil at the maximum level. During the air bleeding, if the level is lowered, refill the brake oil.

   CAUTION

   Be careful that the brake oil does not drop on the painted surface. If the brake oil contacts the painted surface, immediately wash it by water.

2. Connecting an end of transparent vinyl tubes at the air breather of the front wheel cylinder and the rear wheel cylinder, put the other end of the tubes into the transparent container having the brake oil.

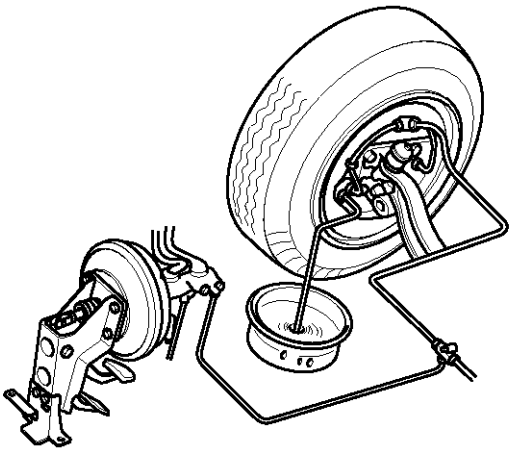


KMTBR5518A

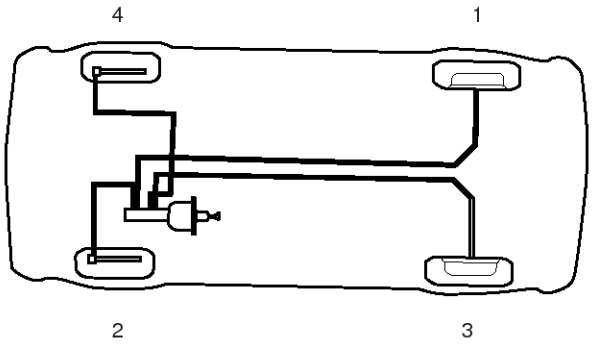
3. Step on the brake pedal several times. Pressing the brake pedal at half, loosen the air bleeder screw to evacuate the air with the brake oil.

   And then, pressing the pedal until it reaches to the floor, tighten the air bleeder screw. Release the pedal.

   There procedures should be repeated until any air bubble is not shown in the brake oil.



KMTBR5519A



KMTBR5520A

4. Tighten the bleeder screw.

Tightening Torque for the bleeder Screw
Front: 6.9~8.8Nm(0.7~0.9kgf.m, 5.1~6.5lb-ft)
Rear : 6.9~8.8Nm(0.7~0.9kgf.m, 5.1~6.5lb-ft)

ABS Modulator

REMOVAL

⚠CAUTION

The modulator assembly contains hydraulic brake fluid, a caustic substance. Remove the valve carefully so that fluid does not leak and cause skin irritation or damage to components.

NOTICE

If there is interference, the entire bracket and valve assembly can be removed.

1. Apply the parking brakes. Block the front and rear tires to prevent vehicle movement.
2. Place a container under the modulator assembly to catch leaking brake fluid.
3. Disconnect the electrical harness connector from the modulator assembly.
4. Mark the six brake lines for ease of installation. Disconnect the lines from the modulator assembly.
5. Remove the three mounting cap screws and washers that attach the modulator assembly to the bracket.

   NOTICE

   Whenever any hydraulic system fitting is loosened or disconnected, the entire system must be bled to remove any air that may have entered. Refer to "Brake Bleeding Procedures" in this section.
6. Remove the modulator assembly after disconnect the ECU.
7. Use a 4 mm Allen wrench to loosen and remove the four mounting screws that attach the ECU module to the modulator valve.
8. Carefully remove the ECU by lifting straight out. To avoid damage, do not twist the ECU during removal.

INSTALLATION

1. Position the old ECU onto the new modulator valve. Apply gentle pressure to seat the ECU. Motor connector must achieve full depth onto the housing. The gap between the modulator and the ECU must not exceed 0.08-inch (2 mm).
2. Use a 4 mm Allen wrench to tighten the four mounting screws that attach the ECU to the modulator. Tighten to 1.5 Nm(0.16 kgf.m , 1.17 lb-ft).

   Do not exceed this torque. The metal sleeves on the ECU housing must rest flat on the body of the modulator.
3. When the ECU is correctly installed with the metal sleeves flat on the modulator, tighten the bolts to 2.5~3.5 Nm(0.25~0.35 kgf.m , 1.8~2.6 lb-ft).
4. Position the modulator assembly in place on the vehicle.
5. Tighten the three mounting nuts to 22 Nm(2.2 kgf.m , 16.2 lb-ft).
6. Connect the electrical harnesses to the modulator assembly.
7. Connect and tighten the brake line connections.
8. Bleed the brake system, per the following instructions.

Wheel Speed Sensor

DESCRIPTION

Sensor Lube Specification

WABCO specifications call for a sensor lubricant with the following characteristics.

Lube must be mineral oil-based and contain molydisulfide. It should have excellent anti-corrosion and adhesion characteristics and be capable of continuous function in a temperature range of –40° to 300°F (–40° to 150°C).

REPLACEMENT

FRONT AXLE

Removal

WARNING

To prevent serious eye injury, always wear safe eye protection when you perform vehicle maintenance or service.

Park the vehicle on a level surface. Block the wheels to prevent the vehicle from moving. Support the vehicle with safety stands. Do not work under a vehicle supported only by jacks. Jacks can slip and fall over. Serious personal injury and damage to components can result.

CAUTION

To avoid damage to the electrical system or HABS components, when welding on a HABS-equipped vehicle disconnect the power connector from the ECU.

1. Park the vehicle on a level surface. Apply the parking brakes.

   Block the rear tires to prevent the vehicle from moving.

   If necessary, raise the front tires off the ground. Place safety stands under the axle.
2. Disconnect the fasteners that hold the sensor cable to other components.
3. Disconnect the sensor cable from the chassis harness.
4. Remove the sensor from the sensor holder. Twist and pull the sensor to remove it from the sensor bracket. Do not pull on the cable.

Installation

1. Connect the sensor cable to the chassis harness.
2. Install the fasteners used to hold the sensor cable in place.
3. Apply a WABCO-recommended lubricant to the sensor spring clip and sensor.
4. Install the sensor spring clip. Verify that the spring clip tabs are on the inboard side of the vehicle.
5. With the tabs on the inboard side, push the sensor spring clip into the bushing in the steering knuckle until the clip stops.
6. Push the sensor completely into the sensor spring clip until it contacts the tooth wheel.
7. Fasten the sensor cable every 12 inches(305mm). Correctly bundle and store any excess cable in the sub-frame.
8. Remove the blocks and safety stands.
9. Perform a voltage output check to ensure correct installation.

REAR AXLE

Removal

1. Apply the parking brake. Block the front tires to prevent vehicle movement.
2. Raise the rear tires off the ground. Place safety stands under the axle.
3. If the rear tire must be removed to gain access to the sensor, release the parking brake to release the brake shoe.

   Remove the wheel and tire assembly from the axle.
4. Remove the sensor from the mounting block. Use a twisting motion if necessary. Do not pull on the cable.
5. Disconnect the sensor cable from the chassis harness.
6. Remove the sensor cable from any cable clamps or clips.
7. Remove the sensor spring clip from the sensor bracket.

Installation

1. Connect the new sensor cable to the chassis harness.
2. Press the sensor spring clip into the sensor bracket, located on the rear axle, until it stops. Verify that the tabs are on the inboard side.
3. Apply a WABCO-recommended lubricant to the sensor.
4. Push the sensor completely into the spring clip until it contacts the tooth wheel.
5. Reattach the sensor cable to the cable clamps or clips.
6. Fasten the sensor cable every 12 inches(305mm). Correctly bundle and store excess cable in the sub-frame.
7. Replace the tire and remove the safety stands. Lower the vehicle and remove the blocks from the front tires.
8. Perform a voltage output check to ensure correct installation.

ABS Control Module(ABS ECU)

REMOVAL

WARNING

To prevent serious eye injury, always wear safe eye protection when you perform vehicle maintenance or service.

CAUTION

Hydraulic brake fluid is a caustic substance. Contact with the hydraulic brake fluid can cause skin irritation. Do not let hydraulic brake fluid touch any painted surfaces, as it will remove the paint. Hydraulic brake fluid may also damage certain non-metal surfaces. Do not let fluid contact brake pads, shoes, rotors or discs.

NOTICE

Do not open the ECU. Opening the ECU to gain access to the internal components will void the warranty.

NOTICE

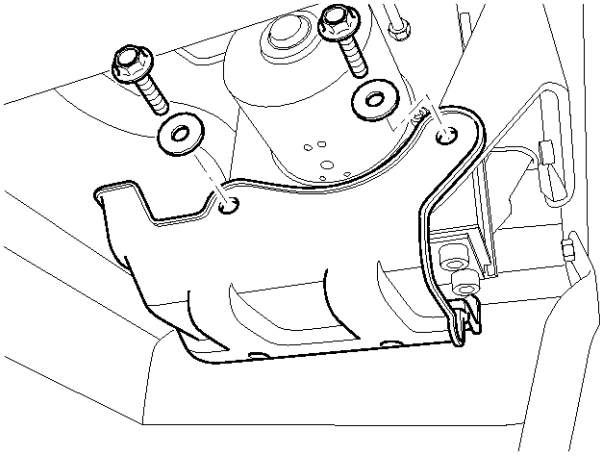
The following general guidelines are provided to facilitate the safe removal of the ECU module from the modulator assembly.

* It is not necessary to remove the entire modulator to replace the Electronic Control Unit (ECU).

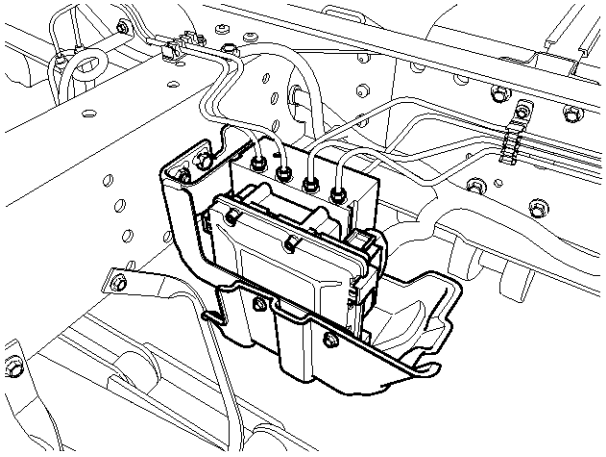
* When only the ECU is replaced, bleeding the system is not necessary.

1. Park the vehicle on a level surface. For vehicles with manual parking brakes, apply the parking brakes.
2. Block the front and rear tires to prevent vehicle movement.
3. Disconnect the battery.
4. Use a clean rag to carefully wipe the surface of the modulator and the surrounding area.
5. Open the latches on the 31-pin harness attached to the ECU.

   After the latch is released, remove the connector from the ECU.



SUDBRA501L



SUDBRA502L

6. Use a 4 mm allen wrench to loosen and remove the four mounting screws that attach the ECU module to the modulator valve.
7. Carefully remove the ECU by lifting straight out. To avoid damage, do not twist the ECU during removal. Determine the warranty status of the ECU. If the ECU is under warranty, return it to HMC. If it is not under warranty, discard the used ECU.
8. Use a clean rag to carefully clean the area around the valves formerly covered by the ECU.

INSTALLATION

⚠CAUTION

Excessive force in positioning the ECU onto the modulator will damage the ECU housing. Do not force the ECU into position.

Use a gentle, even pressure when positioning the ECU.

1. Position the ECU onto the modulator valve. Apply gentle pressure to seat the ECU. Motor connectors must achieve full depth into the housing. The gap between the modulator and ECU must not exceed 0.08-inch (2 mm).
2. Use a 4 mm Allen wrench to tighten the four mounting screws that attach the ECU to the modulator. Tighten to 1.5 Nm(0.16 kgf.m , 1.17 lb-ft).

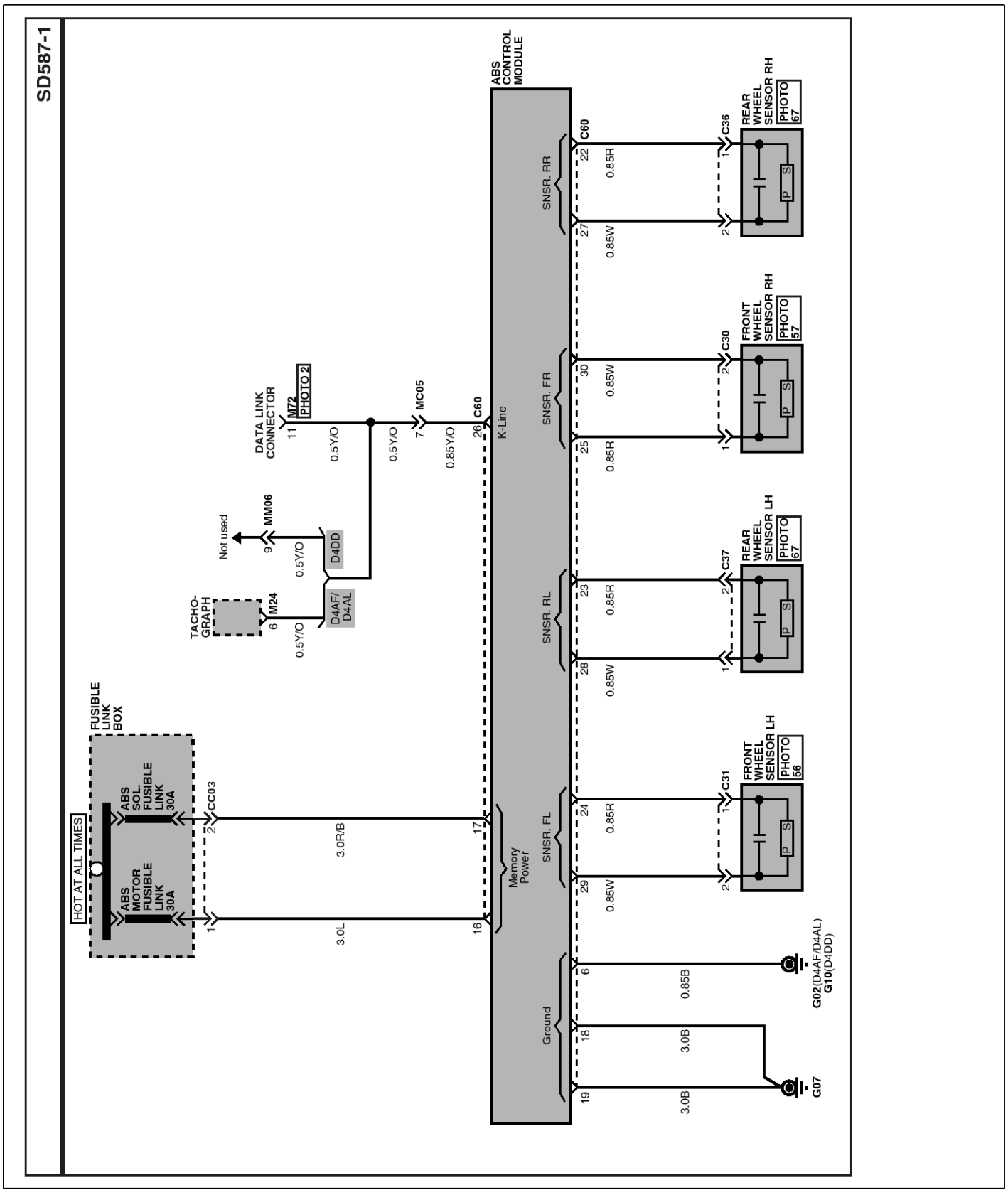
   Do not exceed this torque. The metal sleeves on the ECU housing must rest flat on the body of the modulator.
3. When the ECU is correctly installed with the metal sleeves flat on the modulator, tighten the bolts to 2.5~3.5 Nm(0.25~0.35 kgf.m , 1.8~2.6 lb-ft).

   WARNING

   Electrical connectors must be correctly installed with the latch pushed in to lock the connector. Failure to do so may allow the connectors to come loose or disconnect resulting in loss of ABS function.
4. Attach the 31-pin harness connector to the ECU.
5. Connect the battery.

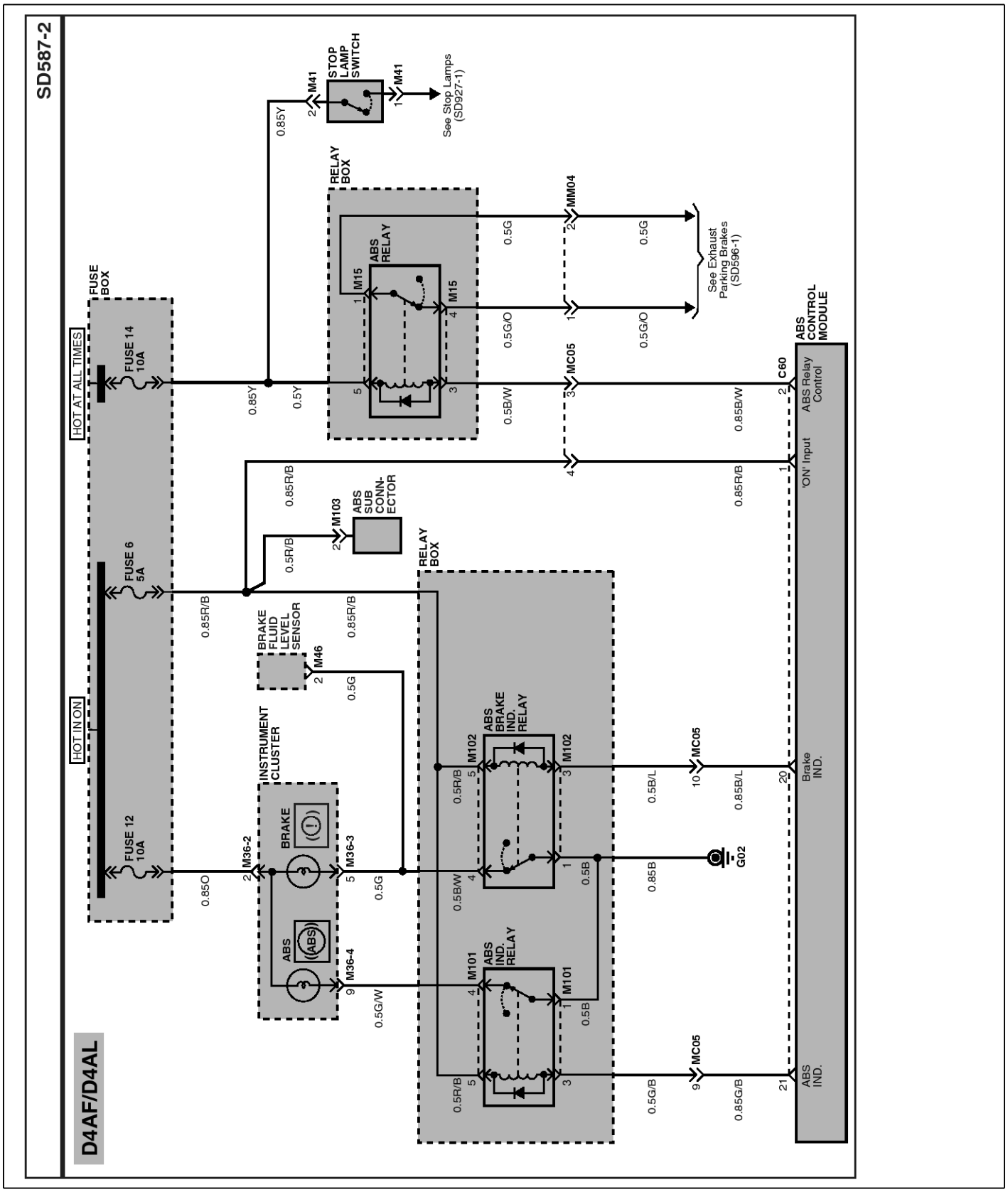
SCHEMATIC DIAGRAMS

ABS CONTROL SYSTEM (1) - HD65, 72, 78



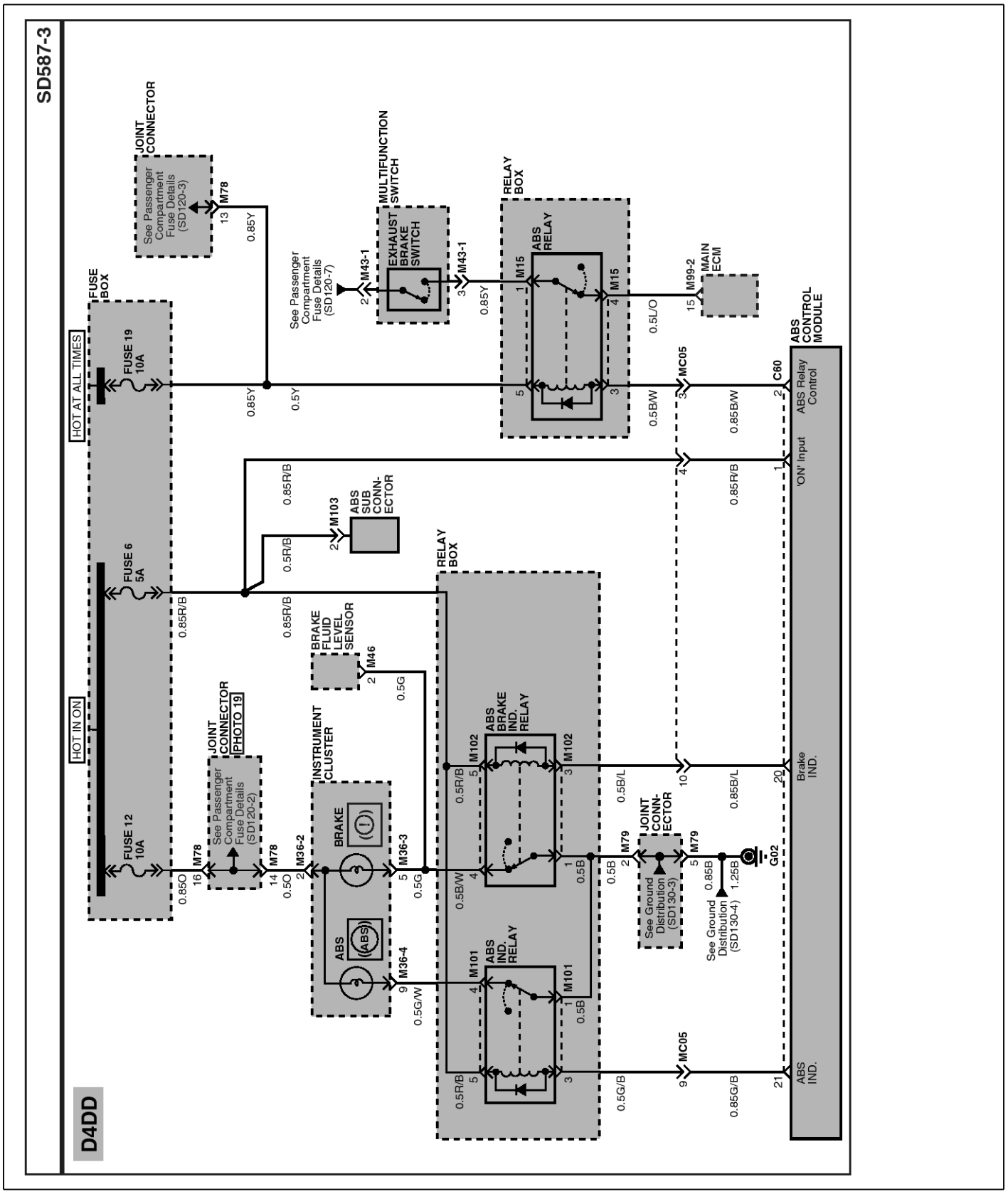
SUDBR9026L

ABS CONTROL SYSTEM (2) - HD65, 72, 78



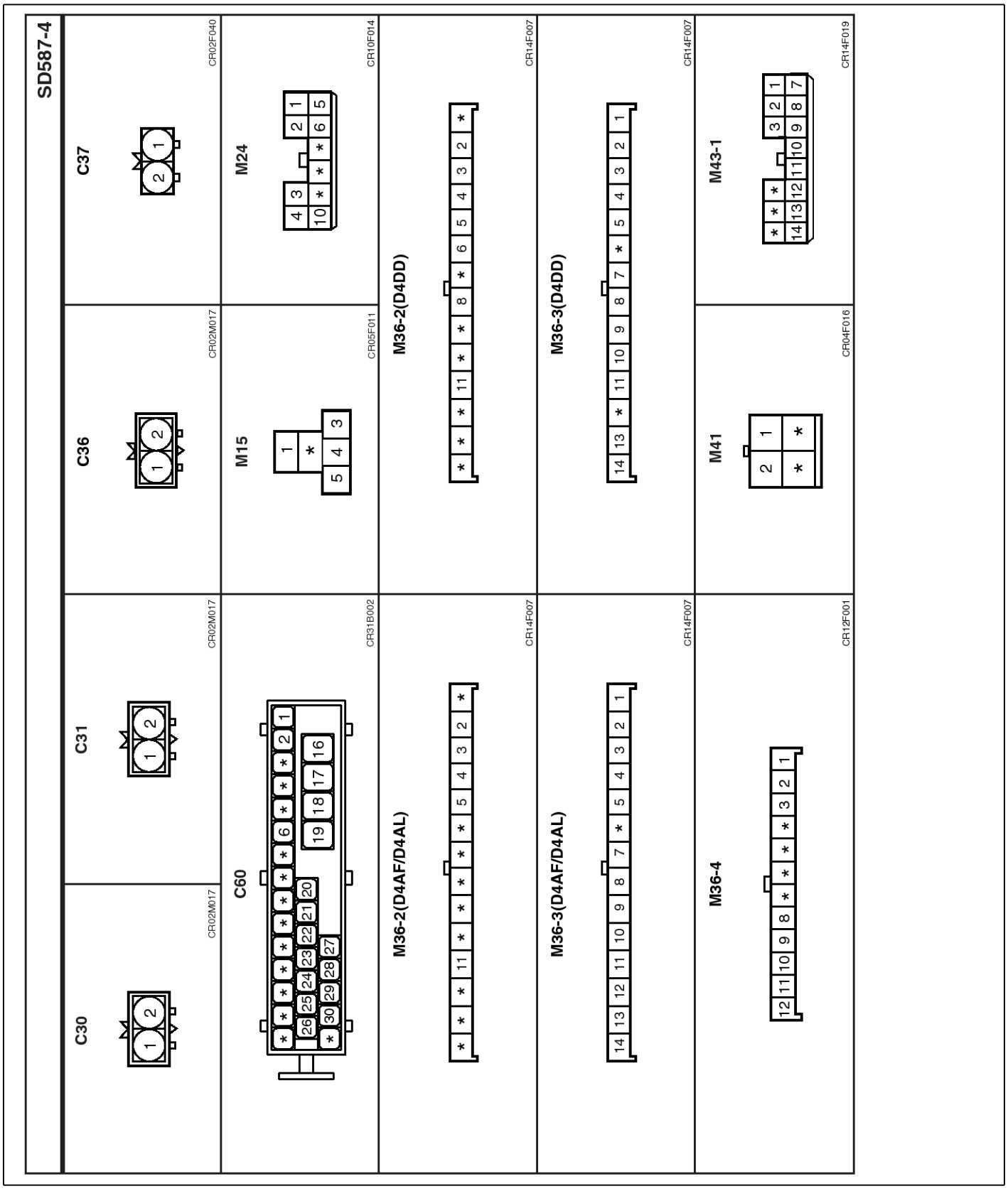
SUDBR9027L

ABS CONTROL SYSTEM (3) - HD65, 72, 78

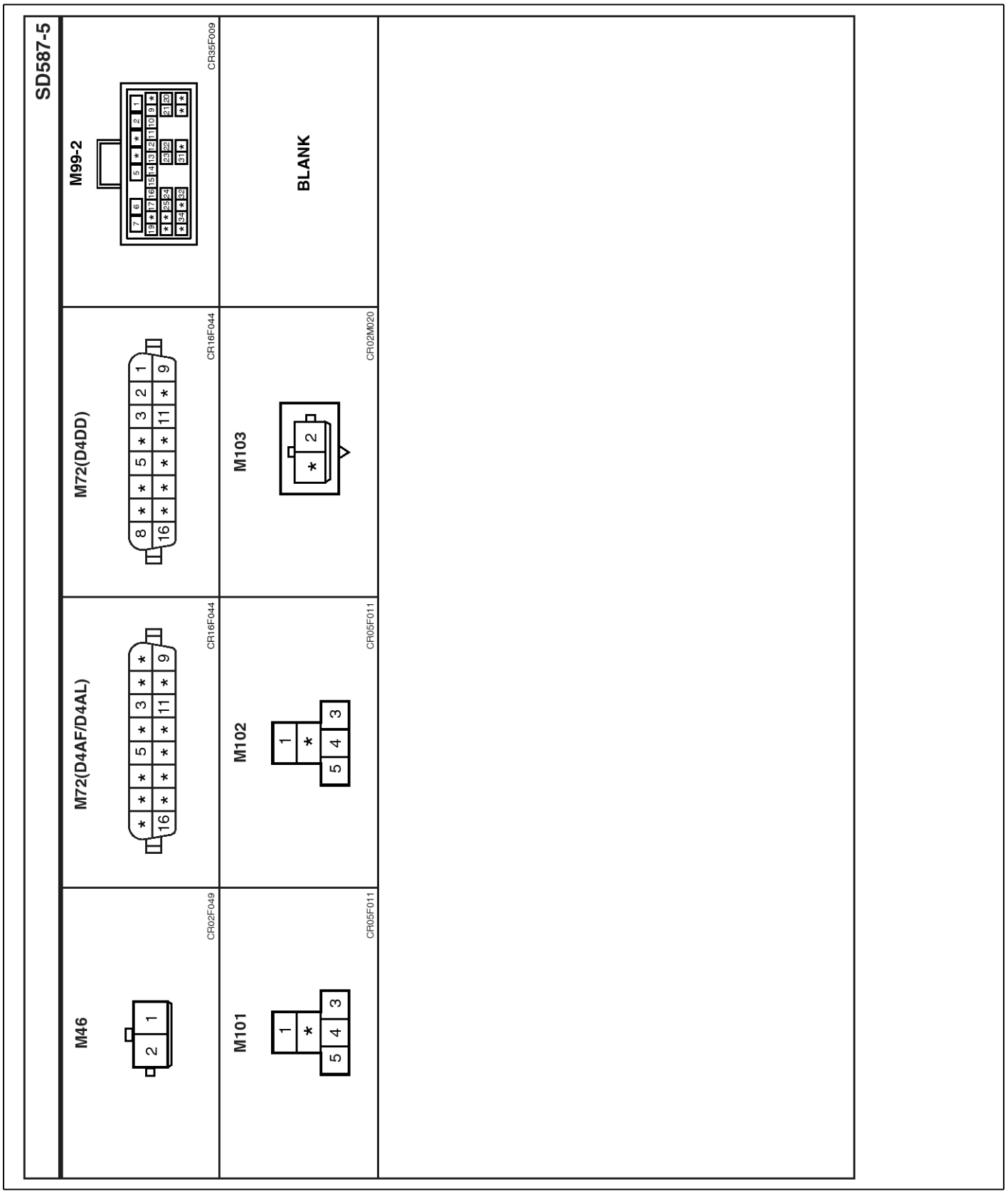


SUDBR9028L

ABS CONTROL SYSTEM (4) - HD65, 72, 78



ABS CONTROL SYSTEM (5) - HD65, 72, 78



SUDBR9030L

DTC Chart

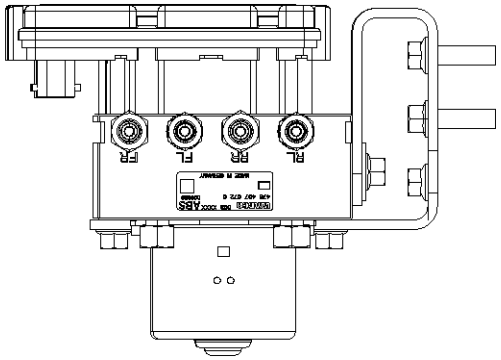
Number	DTC	Description
1	0000	Internal error
2	0001	Sensor Right Hand Front(Airgap)
3	0002	Sensor Left Hand Rear(Airgap)
4	0003	Sensor Left Hand Front(Airgap)
5	0004	Sensor Right Hand Rear(Airgap)
6	0009	Input Valve Right Hand Front(Short To Ubatt/Uvent)
7	000A	Output Valve Right Hand Front(Short To Ubatt/Uvent)
8	000B	Input Valve Left Hand Front(Short To Ubatt/Uvent)
9	000C	Output Valve Left Hand Front(Short To Ubatt/Uvent)
10	000D	Input Valve Right Hand Rear(Short To Ubatt/Uvent)
11	000E	Output Valve Right Hand Rear(Short To Ubatt/Uvent)
12	000F	Input Valve Left Hand Rear(Short To Ubatt/Uvent)
13	0010	Output Valve Left Hand Rear(Short To Ubatt/Uvent)
14	0011	Endurance Brake Relay(Short To Ubatt/Uvent)
15	0017	Sensor Right Hand Front(Impedance)
16	0018	Sensor Left Hand Rear(Impedance)
17	0019	Sensor Left Hand Front(Impedance)
18	001A	Sensor Right Hand Rear(Impedance)
19	001B	Input Valve Right Hand Front(Open Circuit)
20	001C	Output Valve Right Hand Front(Open Circuit)
21	001D	Input Valve Left Hand Front(Open Circuit)
22	001E	Output Valve Left Hand Front(Open Circuit)
23	001F	Input Valve Right Hand Rear(Open Circuit)
24	0020	Output Valve Right Hand Rear(Open Circuit)
25	0021	Input Valve Left Hand Rear(Open Circuit)
26	0022	Output Valve Left Hand Rear(Open Circuit)
27	0023	Endurance Brake Relay(Open Circuit)
28	0024	Brake Light Relay(Open Circuit)
29	0029	Input Valve Right Hand Front(Short To Ground)
30	002A	Output Valve Right Hand Front(Short To Ground)
31	002B	Input Valve Left Hand Front(Short To Ground)
32	002C	Output Valve Left Hand Front(Short To Ground)
33	002D	Input Valve Right Hand Rear(Short To Ground)
34	002E	Output Valve Right Hand Rear(Short To Ground)

Number	DTC	Description
35	002F	Input Valve Left Hand Rear(Short To Ground)
36	0030	Output Valve Left Hand Rear(Short To Ground)
37	0032	Endurance Brake Relay(Short To Ground)
38	0033	Brake Light Relay(Short To Ground)
39	0037	Valve Relay(Can't Switch Off)
40	0038	Valve Relay(Can't Switch On)
41	0039	Reference Ground Connection
42	003B	ABS Warning Light Bulb
43	003C	Brake Warning Light Bulb
44	003D	High Voltage
45	003F	Sensor Right Hand Front(Tire Combination)
46	0040	Sensor Left Hand Rear(Tire Combination)
47	0041	Sensor Left Hand Front(Tire Combination)
48	0042	Sensor Right Hand Rear(Tire Combination)
49	0043	Pump Motor Does Not Switch On
50	0044	Pump Motor Does Not Switch Off
51	0045	Pump Motor Does Not Turn
52	0046	Pump Motor Supply Voltage Missing
53	0047	Pump Motor Relay Voltage Missing
54	0049	Sensor Right Hand Front(No Trigger At All)
55	004A	Sensor Left Hand Rear(No Trigger At All)
56	004B	Sensor Left Hand Front(No Trigger At All)
57	004C	Sensor Right Hand Rear(No Trigger At All)
58	004D	J1939 Internal Error
59	004E	J1939 Bus
60	004F	J1939 Message
61	0050	Inlet Valve(Right Hand Front) Actuation Time Unplausible
62	0051	Inlet Valve(Left Hand Rear) Actuation Time Unplausible
63	0052	Inlet Valve(Left Hand Front) Actuation Time Unplausible
64	0053	Inlet Valve(Right Hand Rear) Actuation Time Unplausible
65	0054	Pole Wheel Right Hand Front(Cyclic Failure)
66	0055	Pole Wheel Left Hand Rear(Cyclic Failure)
67	0056	Pole Wheel Left Hand Front(Cyclic Failure)
68	0057	Pole Wheel Right Hand Rear(Cyclic Failure)
69	0058	Clamp Transistor Failure

Number	DTC	Description
70	0059	Pull Up Down Failure
71	005A	Sensor Right Hand Front(Signal Disturbed)
72	005B	Sensor Left Hand Rear(Signal Disturbed)
73	005C	Sensor Left Hand Front(Signal Disturbed)
74	005D	Sensor Right Hand Rear(Signal Disturbed)

0000 Internal error

COMPONENT LOCATION



SUDWAB9001L

GENERAL DESCRIPTION

The Antilock Brake System (ABS) prevents the skid phenomenon that may occurs during a sudden brake while the vehicle is driving or when there is snow or water on the road. By preventing the wheels from sticking or skidding on the road while the brake is applied, ABS maintains the directional stability of the vehicle, secures the steer ability, provides the maximum braking power so as to reduce the braking distance and to pursue the overall safety of the driver and passengers. As the main device to perform ABS' braking function, HECU consists of an input amplifier circuit that processes the input signal, an ABS control and SAFETY circuit that calculates the control and performs FAIL SAFE, an output circuit that drives the pressure control valve, a voltage adjustment circuit that regulates the voltage, and a failure memory circuit that memorizes any malfunctioning. In case of a system malfunctioning, the warning light is turned on, and at the same time, the power to the pressure control valve is cut off, and the operation of ABS is stopped.

DTC DESCRIPTION

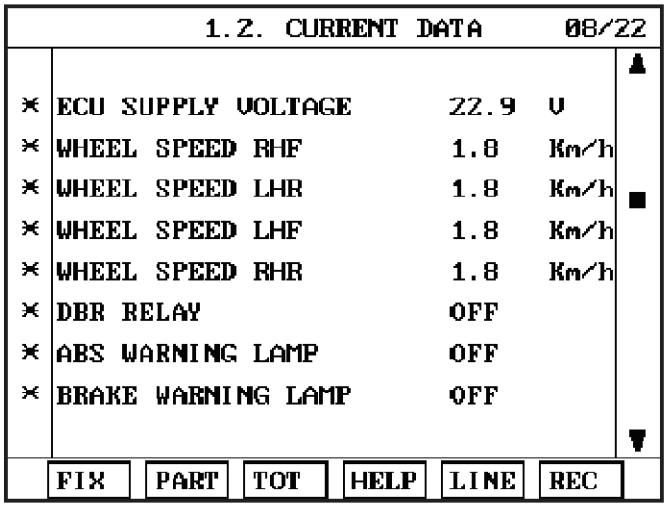
HECU continues to monitor the internal components, such as memory, input and output circuits. In case of an error during the operation of the control system, HECU determines whether it is a failure state and outputs a fail code.

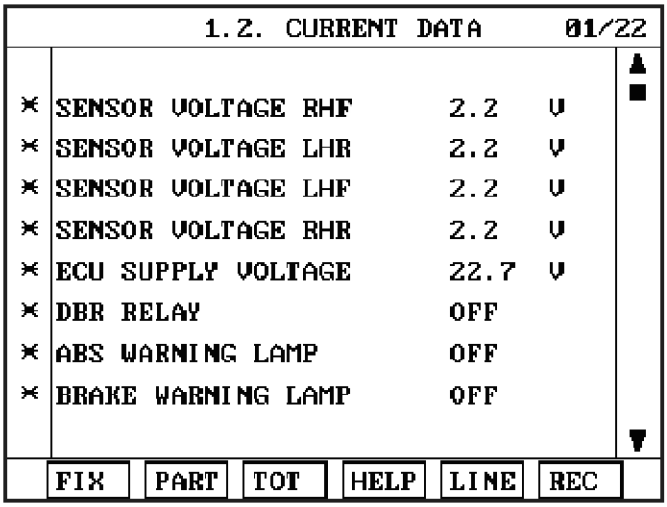
DTC DETECTING CONDITION

Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Replace ECU.
Enable Conditions	Ignition ON			
Threshold Value	When the HECU detects malfunction in the control system			
Diagnosis Time	Below 1,000 ms			
Fail Safe	Fuel Cut	No	• ABS disabled	
	Fuel Limit	Yes		
	MIL	Yes		

MONITOR SCAN TOOL DATA

1. Connect scan tool to the self-diagnosis connector.
2. Turn the ignition ON.
3. Monitor the service data on the scan tool.





SUDWAB9007L

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness, and terminals.

   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

   YES

   Repair as necessary and then go to “Verification of Vehicle Repair” procedure.

   NO

   Go to “Signal Circuit Inspection” procedure.

COMPONENT INSPECTION

1. Start the engine.
2. Drive the vehicle with approx. 15km/h or higher.
3. Turn the ignition ON. Leave the engine OFF.
4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
7. Are any diagnostic trouble codes (DTCs) detected?

YES

Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to “Verification of Vehicle Repair” procedure.

NO

There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. And go to "Verification of Vehicle Repair” procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

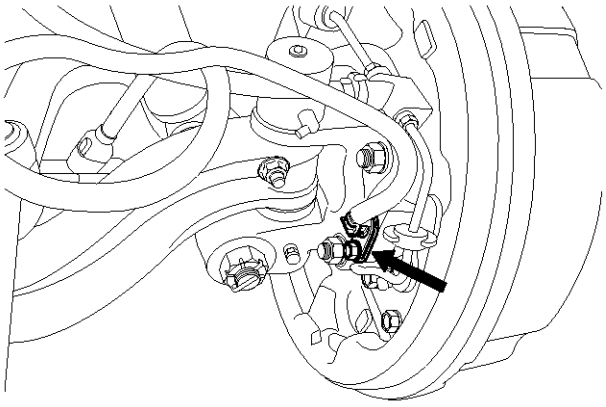
Go to the applicable DTC procedure.

NO

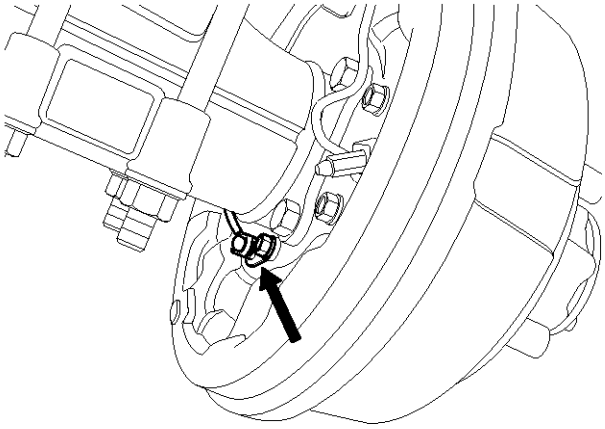
System OK

0001 Sensor Right Hand Front(Airgap)

COMPONENT LOCATION



Front wheel speed sensor



Rear wheel speed sensor

SUDWAB9002L

GENERAL DESCRIPTION

The wheel sensor is crucial for HECU to calculate the speed of the vehicle and determine whether the wheel is in 'Lock' mode or not. For example, in case of a front-wheel drive vehicle, the signal of the rear wheel speed is used as a reference value for the speed of the vehicle. If there occurs the difference in speed between the front and rear wheels, ABS control is performed. The wheel sensor creates a sine curve based on the magnetic field created by the permanent magnet inside the sensor when the tone wheel rotates. The frequency and the AC voltage change by a certain ratio depending on the wheel speed, and HECU determines the speed of the vehicle by calculating the frequency of the signal.

DTC DESCRIPTION

HECU continues to monitor the input signal from the wheel sensor. If the ABS control state changes abnormally when the sensor output voltage becomes low because the air gap in the front right wheel sensor is too big, HECU determines it as a failure state and outputs a fail code.

DTC DETECTING CONDITION

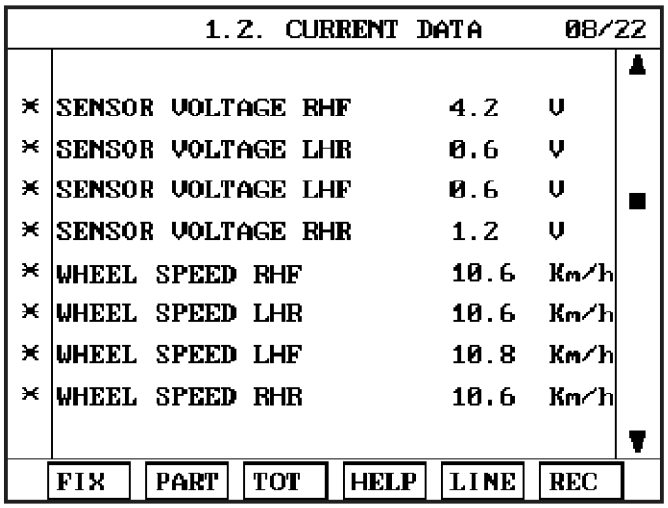
Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Check air gap. • Check bearing play and tone ring run out. • Check tone ring for damage.
Enable Conditions	Ignition ON			
Threshold Value	Vehicle speed > 5.0 kph. Air gap 0.2 ~ 1.7 mm			
Diagnosis Time	Below 1,000 ms			
Fail Safe	Fuel Cut	No	• ABS function disabled for concerned wheel	
	Fuel Limit	Yes		
	MIL	Yes		

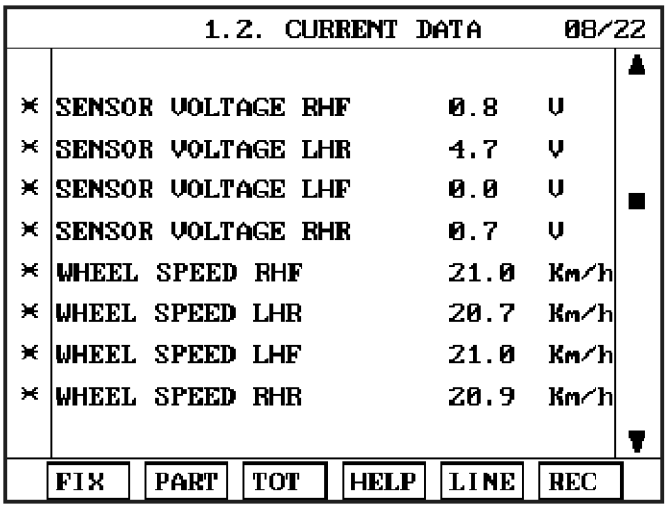
SPECIFICATION

Wheel sensor resistance	830 ~ 2,100 Ω (At 20)
Air gap	0.2 ~ 1.7 mm

MONITOR SCAN TOOL DATA

1. Start the engine.
2. Connect the scan tool to the self-diagnosis connector. Select the service data.
3. Drive the vehicle straight at a constant speed in the normal road surface.
4. Monitor the data "Wheel speed RHF" parameter on the scan tool.
   - Specification: Normal if its speed is nearly in accordance with the speed in the gauge.





SUDWAB9008L

5. Is the data measured within specification?

YES

There may be the poor contact of wheel sensor circuit or a past trouble which did not erase the memory of HECU after having repaired. Totally check the connector for looseness, poor contact, bent, corrosion, contamination, deformation, or damage.

Repair or replace it if necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to “Terminal & Connector Inspection” procedure.

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness, and terminals.

   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

Repair as necessary and then go to “Verification of Vehicle Repair” procedure.

NO

Go to “Signal Circuit Inspection” procedure.

COMPONENT INSPECTION

Sensor Air Gap Inspection

1. Turn the ignition OFF.
2. Check the air gap between right hand front tone wheel and wheel sensor with a thickness gauge.
   - Specification: 0.2~1.7 mm
3. Is the value measured within specification?

YES

Go to next procedure.

NO

Repair it after checking wheel sensor installation condition and go to "Verification of Vehicle Repair” procedure.

Repair or replace it after checking the condition of rotor and wheel bearing and go to "Verification of

Vehicle Repair" procedure.

Adjust it after checking the air gap between wheel sensor and rotor and go to "Verification of Vehicle Repair" procedure.

Right Hand Front Wheel Sensor Inspection

1. Turn the ignition OFF.
2. Disconnect the right hand front when sensor connector.
3. Measure the resistance between positive (+) and negative (-) of the right hand front wheel sensor (C30).
   - Specification: 830 ~ 2,100 Ω (At 20)
4. Is the resistance measured within specification?

YES

After checking the HECU for contamination or damage, install a known-good HECU and check it good or not.

Replace the HECU if the vehicle is normal condition and go to "Verification of Vehicle Repair" procedure.

NO

Replace the sensor if the vehicle is normal after temporarily installing a known-good sensor and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

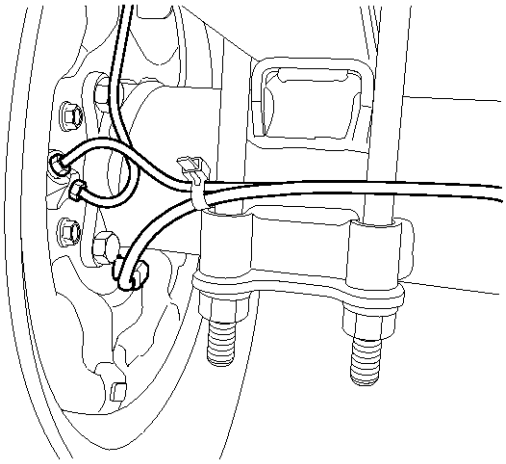
Go to the applicable DTC procedure.

NO

System OK

0002 Sensor Left Hand Rear(Airgap)

COMPONENT LOCATION



SUDWAB9048L

GENERAL DESCRIPTION

The wheel sensor is crucial for HECU to calculate the speed of the vehicle and determine whether the wheel is in 'Lock' mode or not. For example, in case of a front-wheel drive vehicle, the signal of the rear wheel speed is used as a reference value for the speed of the vehicle. If there occurs the difference in speed between the front and rear wheels, ABS control is performed. The wheel sensor creates a sine curve based on the magnetic field created by the permanent magnet inside the sensor when the tone wheel rotates. The frequency and the AC voltage change by a certain ratio depending on the wheel speed, and HECU determines the speed of the vehicle by calculating the frequency of the signal.

DTC DESCRIPTION

HECU continues to monitor the input signal from the wheel sensor. If the ABS control state changes abnormally when the sensor output voltage becomes low because the air gap in the rear left wheel sensor is too big, HECU determines it as a failure state and outputs a fail code.

DTC DETECTING CONDITION

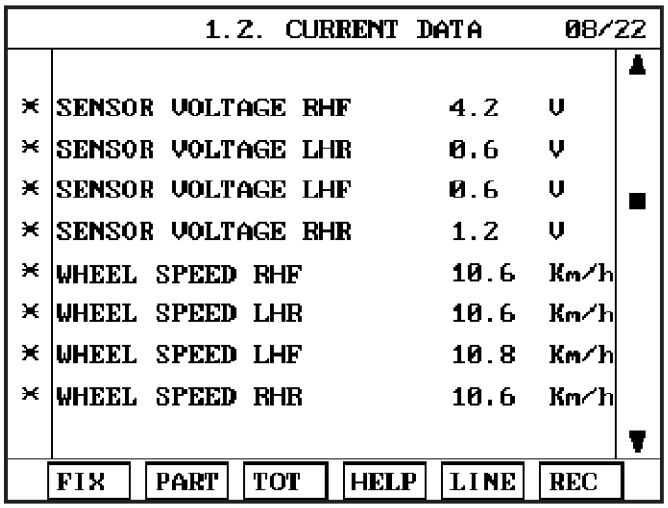
Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Check air gap. • Check bearing play and tone ring run out. • Check tone ring for damage.
Enable Conditions	Ignition ON			
Threshold Value	Vehicle speed > 5.0 kph. Air gap 0.2 ~ 1.7 mm			
Diagnosis Time	Below 1,000 ms			
Fail Safe	Fuel Cut	No	• ABS function disabled for concerned wheel.	
	Fuel Limit	Yes		
	MIL	Yes		

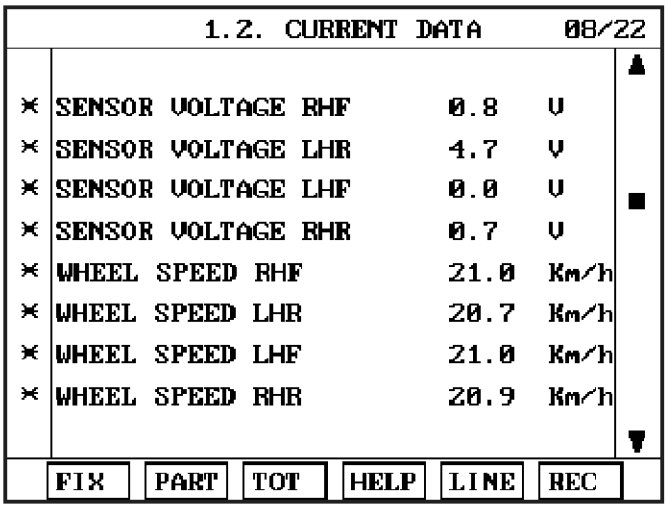
SPECIFICATION

Wheel sensor resistance	830 ~ 2,100 Ω (At 20)
Air gap	0.2 ~ 1.7 mm

MONITOR SCAN TOOL DATA

1. Start the engine.
2. Connect the scan tool to the self-diagnosis connector. Select the service data.
3. Drive the vehicle straight at a constant speed in the normal road surface.
4. Monitor the data "Wheel speed LHR" parameter on the scan tool.
   - Specification: Normal if its speed is nearly in accordance with the speed in the gauge.





SUDWAB9008L

5. Is the data measured within specification?

YES

There may be the poor contact of wheel sensor circuit or a past trouble which did not erase the memory of HECU after having repaired. Totally check the connector for looseness, poor contact, bent, corrosion, contamination, deformation, or damage.

Repair or replace it if necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to “Terminal & Connector Inspection” procedure.

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness, and terminals.

   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

Repair as necessary and then go to “Verification of Vehicle Repair” procedure.

NO

Go to “Signal Circuit Inspection” procedure.

COMPONENT INSPECTION

Sensor Air Gap Inspection

1. Turn the ignition OFF.
2. Check the air gap between left hand rear tone wheel and wheel sensor with a thickness gauge.
   - Specification: 0.2~1.7 mm
3. Is the value measured within specification?

YES

Go to next procedure.

NO

Repair it after checking wheel sensor installation condition and go to "Verification of Vehicle Repair” procedure.

Repair or replace it after checking the condition of rotor and wheel bearing and go to "Verification of Vehicle Repair” procedure.

Adjust it after checking the air gap between wheel sensor and rotor and go to "Verification of Vehicle

Repair" procedure.

Left Hand Rear Wheel Sensor Inspection

1. Turn the ignition OFF.
2. Disconnect the left hand rear connector (C37).
3. Measure the resistance between terminal positive (+) and terminal negative (-) of the left hand rear wheel sensor (C37).
   - Specification: 830 ~ 2100 Ω (At 20)
4. Is the resistance measured within specification?

YES

After checking the HECU for contamination or damage, install a known-good HECU and check it good or not.

Replace the HECU if the vehicle is normal condition and go to "Verification of Vehicle Repair" procedure.

NO

Replace the sensor if the vehicle is normal after temporarily installing a known-good sensor and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

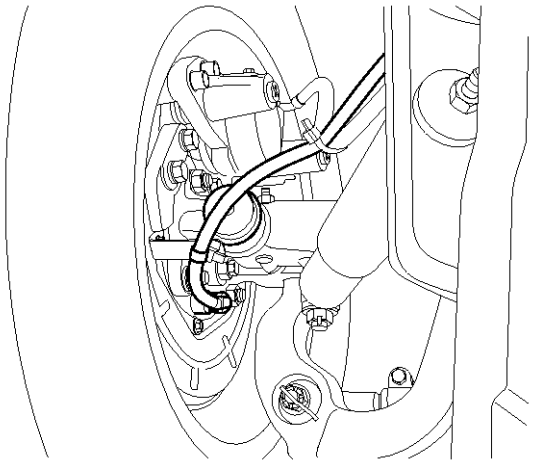
Go to the applicable DTC procedure.

NO

System OK

0003 Sensor Left Hand Front(Airgap)

COMPONENT LOCATION



SUDWAB9049L

GENERAL DESCRIPTION

The wheel sensor is crucial for HECU to calculate the speed of the vehicle and determine whether the wheel is in 'Lock' mode or not. For example, in case of a front-wheel drive vehicle, the signal of the rear wheel speed is used as a reference value for the speed of the vehicle. If there occurs the difference in speed between the front and rear wheels, ABS control is performed. The wheel sensor creates a sine curve based on the magnetic field created by the permanent magnet inside the sensor when the tone wheel rotates. The frequency and the AC voltage change by a certain ratio depending on the wheel speed, and HECU determines the speed of the vehicle by calculating the frequency of the signal.

DTC DESCRIPTION

HECU continues to monitor the input signal from the wheel sensor. If the ABS control state changes abnormally when the sensor output voltage becomes low because the air gap in the front left wheel sensor is too big, HECU determines it as a failure state and outputs a fail code.

DTC DETECTING CONDITION

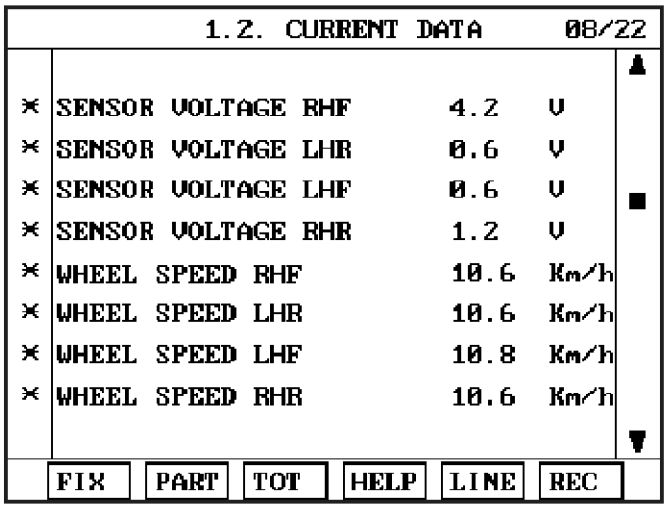
Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Check air gap. • Check bearing play and tone ring run out. • Check tone ring for damage.
Enable Conditions	Ignition ON			
Threshold Value	Vehicle speed > 5.0 kph. Air gap 0.2 ~ 1.7 mm			
Diagnosis Time	Below 1,000 ms			
Fail Safe	Fuel Cut	No	• ABS function disabled for concerned wheel.	
	Fuel Limit	Yes		
	MIL	Yes		

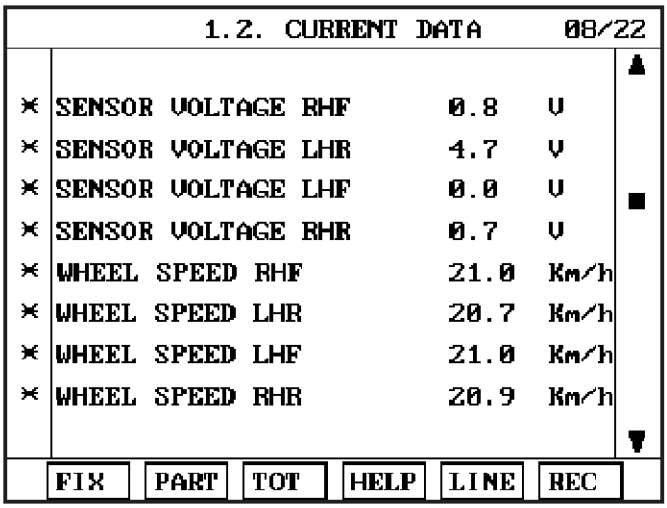
SPECIFICATION

Wheel sensor resistance	830 ~ 2,100 Ω (At 20)
Air gap	0.2 ~ 1.7 mm

MONITOR SCAN TOOL DATA

1. Start the engine.
2. Connect the scan tool to the self-diagnosis connector. Select the service data.
3. Drive the vehicle straight at a constant speed in the normal road surface.
4. Monitor the data "Wheel speed LHF" parameter on the scan tool.
   - Specification: Normal if its speed is nearly in accordance with the speed in the gauge.





SUDWAB9008L

5. Is the data measured within specification?

YES

There may be the poor contact of wheel sensor circuit or a past trouble which did not erase the memory of HECU after having repaired. Totally check the connector for looseness, poor contact, bent, corrosion, contamination, deformation, or damage.

Repair or replace it if necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to "Terminal & Connector Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness, and terminals.

   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

Go to "Signal Circuit Inspection" procedure.

COMPONENT INSPECTION

Left Hand Front Wheel Sensor Inspection

1. Turn the ignition OFF.
2. Disconnect the left hand front connector (C31).
3. Measure the resistance between terminal positive (+) and terminal negative (-) of the left hand front wheel sensor.
   - Specification: 830 ~ 2,100 Ω (At 20)
4. Is the resistance measured within specification?

YES

After checking the HECU for contamination or damage, install a known-good HECU and check it good or not.

Replace the HECU if the vehicle is normal condition and go to "Verification of Vehicle Repair" procedure.

NO

Replace the sensor if the vehicle is normal after temporarily installing a known-good sensor and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

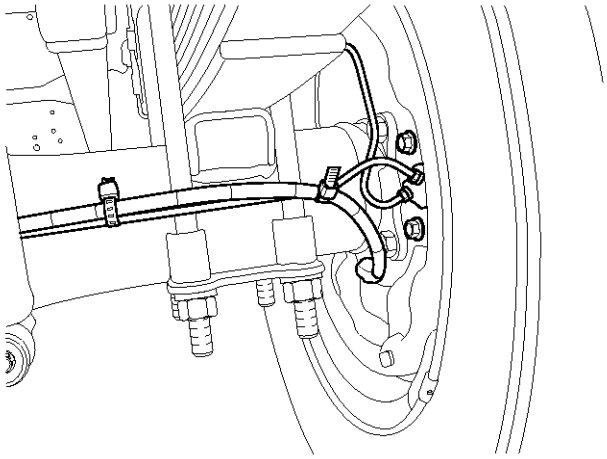
Go to the applicable DTC procedure.

NO

System OK

0004 Sensor Right Hand Rear(Airgap)

COMPONENT LOCATION



SUDWAB9050L

GENERAL DESCRIPTION

The wheel sensor is crucial for HECU to calculate the speed of the vehicle and determine whether the wheel is in 'Lock' mode or not. For example, in case of a front-wheel drive vehicle, the signal of the rear wheel speed is used as a reference value for the speed of the vehicle. If there occurs the difference in speed between the front and rear wheels, ABS control is performed. The wheel sensor creates a sine curve based on the magnetic field created by the permanent magnet inside the sensor when the tone wheel rotates. The frequency and the AC voltage change by a certain ratio depending on the wheel speed, and HECU determines the speed of the vehicle by calculating the frequency of the signal.

DTC DESCRIPTION

HECU continues to monitor the input signal from the wheel sensor. If the ABS control state changes abnormally when the sensor output voltage becomes low because the air gap in the Rear right wheel sensor is too big, HECU determines it as a failure state and outputs a fail code.

DTC DETECTING CONDITION

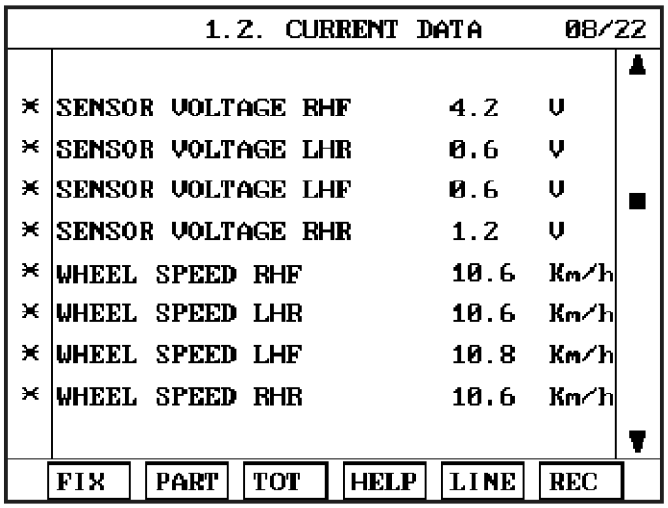
Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Check air gap. • Check bearing play and tone ring run out. • Check tone ring for damage.
Enable Conditions	Ignition ON			
Threshold Value	Vehicle speed > 5.0 kph. Air gap 0.2 ~ 1.7 mm			
Diagnosis Time	Below 1,000 ms			
Fail Safe	Fuel Cut	No	• ABS function disabled for concerned wheel	
	Fuel Limit	Yes		
	MIL	Yes		

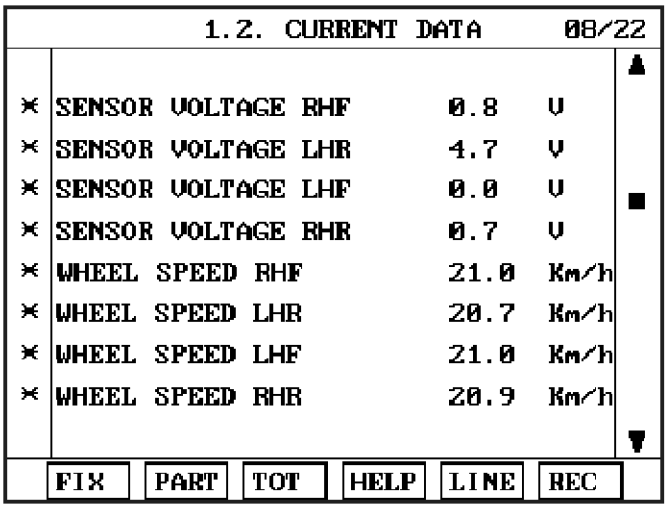
SPECIFICATION

Wheel sensor resistance	830 ~ 2,100 Ω (At 20)
Air gap	0.2 ~ 1.7 mm

MONITOR SCAN TOOL DATA

1. Start the engine.
2. Connect the scan tool to the self-diagnosis connector. Select the service data.
3. Drive the vehicle straight at a constant speed in the normal road surface.
4. Monitor the data "Wheel speed RHR" parameter on the scan tool.
   - Specification: Normal if its speed is nearly in accordance with the speed in the gauge.





SUDWAB9008L

5. Is the data measured within specification?

YES

There may be the poor contact of wheel sensor circuit or a past trouble which did not erase the memory of HECU after having repaired. Totally check the connector for looseness, poor contact, bent, corrosion, contamination, deformation, or damage.

Repair or replace it if necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to "Terminal & Connector Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness, and terminals.

   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

Go to "Signal Circuit Inspection" procedure.

COMPONENT INSPECTION

Right hand rear Wheel Sensor Inspection

1. Turn the ignition OFF.
2. Disconnect the right hand rear connector (C36).
3. Measure the resistance between terminal positive (+) and terminal negative (-) of the right hand rear wheel sensor (C36).
   - Specification: 830 ~ 2100 Ω (At 20)
4. Is the resistance measured within specification?

YES

After checking the HECU for contamination or damage, install a known-good HECU and check it good or not.

Replace the HECU if the vehicle is normal condition and go to "Verification of Vehicle Repair" procedure.

NO

Replace the sensor if the vehicle is normal after temporarily installing a known-good sensor and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

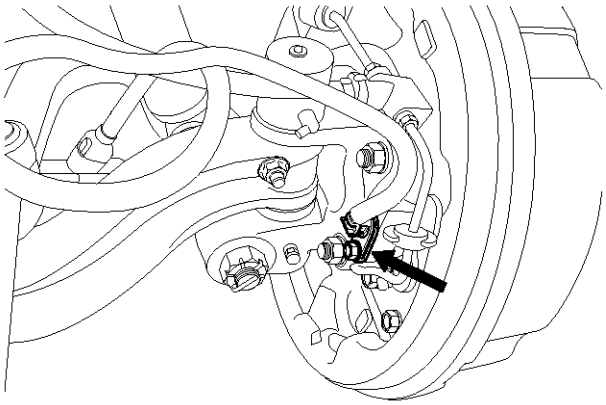
Go to the applicable DTC procedure.

NO

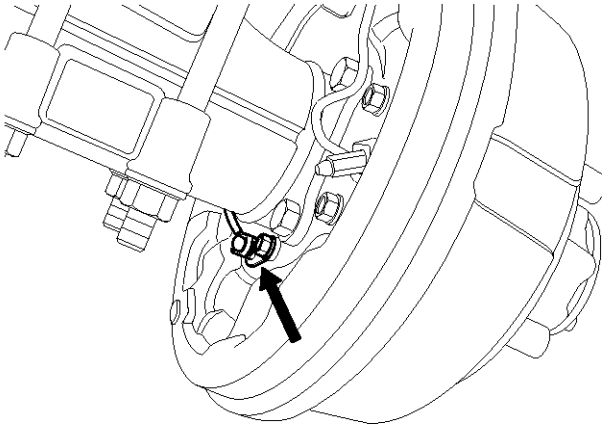
System OK

0009 Input Valve Right Hand Front(Short To Ubatt/Uvent)

COMPONENT LOCATION



Front wheel speed sensor



Rear wheel speed sensor

SUDWAB9002L

GENERAL DESCRIPTION

The Antilock Brake System (ABS) prevents the skid phenomenon that may occurs during a sudden brake while the vehicle is driving or when there is snow or water on the road. By preventing the wheels from sticking or skidding on the road while the brake is applied, ABS maintains the directional stability of the vehicle, secures the steer ability, provides the maximum braking power so as to reduce the braking distance and to pursue the overall safety of the driver and passengers. As the main device to perform ABS' braking function, HECU consists of an input amplifier circuit that processes the input signal, an ABS control and SAFETY circuit that calculates the control and performs FAIL SAFE, an output circuit that drives the pressure control valve, a voltage adjustment circuit that regulates the voltage, and a failure memory circuit that memorizes any malfunctioning. In case of a system malfunctioning, the warning light is turned on, and at the same time, the power to the pressure control valve is cut off, and the operation of ABS is stopped.

DTC DESCRIPTION

HECU continues to monitor the internal components, such as memory, input and output circuits. In case of an error during the operation of the control system, HECU determines whether it is a failure state and outputs a fail code.

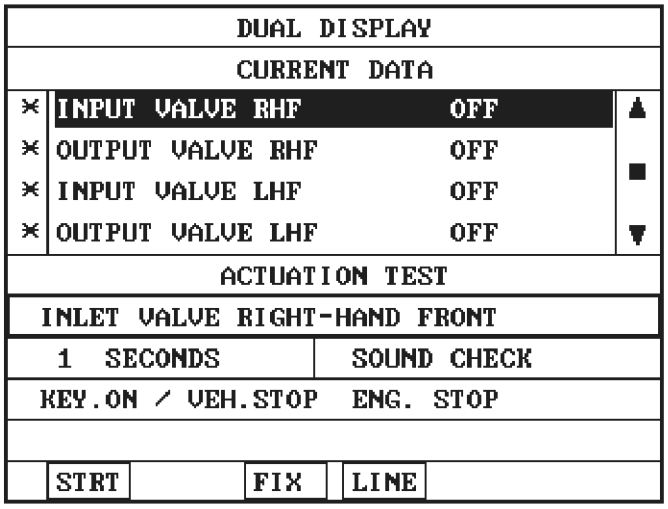
DTC DETECTING CONDITION

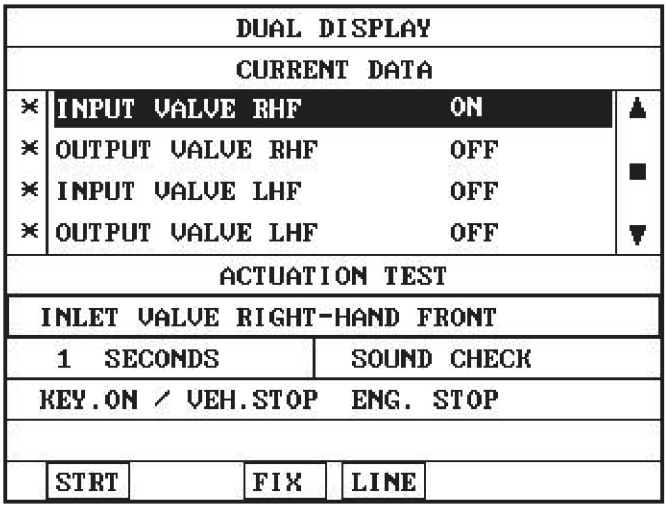
Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Replace ECU.
Enable Conditions	Ignition ON			
Threshold Value	When the HECU detects malfunction in the control system			
Diagnosis Time	Below 1,000 ms			
Fail Safe	Fuel Cut	No	• ABS disabled	
	Fuel Limit	Yes		
	MIL	Yes		

MONITOR SCAN TOOL DATA

1. Connect the scan tool to the self-diagnosis connector.
2. Turn the ignition ON.
3. Select the data "Actuation test"
4. Check the right hand front inlet valve for operation when activating the actuator.

   ■ Specification: Normal if the activating sound is heard.





SUDWAB9009L

Fig1) Right hand front inlet valve Actuation test at IG ON

5. Does the valve activate normally?

YES

There may be a transient trouble due to defective valve or a past trouble which did not erase the memory of HECU after having repair.

And go to "Verification of Vehicle Repair" procedure.

NO

Go to "Component Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness, and terminals.

   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

Repair as necessary and then go to “Verification of Vehicle Repair” procedure.

NO

Go to “Signal Circuit Inspection” procedure.

COMPONENT INSPECTION

1. Start the engine.
2. Drive the vehicle with approx. 15km/h or higher.
3. Turn the ignition ON. Leave the engine OFF.
4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
7. Are any diagnostic trouble codes (DTCs) detected?

YES

Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to “Verification of Vehicle Repair” procedure.

NO

There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. And go to "Verification of Vehicle Repair” procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

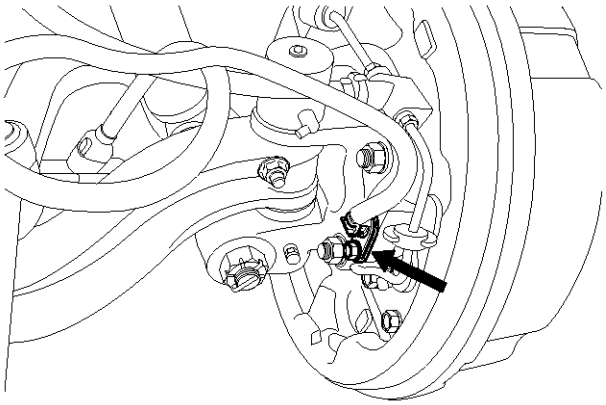
Go to the applicable DTC procedure.

NO

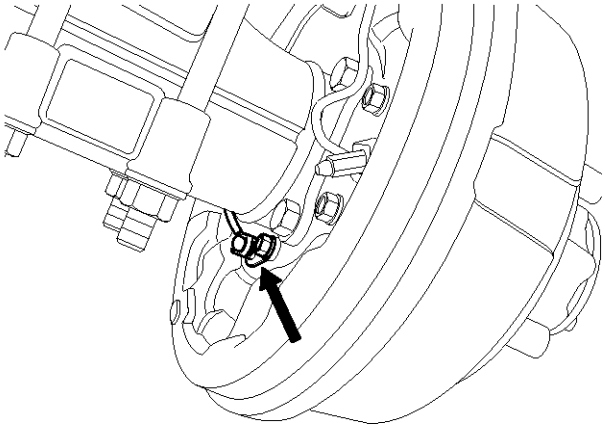
System OK

000A Output Valve Right Hand Front(Short To Ubatt/Uvent)

COMPONENT LOCATION



Front wheel speed sensor



Rear wheel speed sensor

SUDWAB9002L

GENERAL DESCRIPTION

The Antilock Brake System (ABS) prevents the skid phenomenon that may occurs during a sudden brake while the vehicle is driving or when there is snow or water on the road. By preventing the wheels from sticking or skidding on the road while the brake is applied, ABS maintains the directional stability of the vehicle, secures the steer ability, provides the maximum braking power so as to reduce the braking distance and to pursue the overall safety of the driver and passengers. As the main device to perform ABS' braking function, HECU consists of an input amplifier circuit that processes the input signal, an ABS control and SAFETY circuit that calculates the control and performs FAIL SAFE, an output circuit that drives the pressure control valve, a voltage adjustment circuit that regulates the voltage, and a failure memory circuit that memorizes any malfunctioning. In case of a system malfunctioning, the warning light is turned on, and at the same time, the power to the pressure control valve is cut off, and the operation of ABS is stopped.

DTC DESCRIPTION

HECU continues to monitor the internal components, such as memory, input and output circuits. In case of an error during the operation of the control system, HECU determines whether it is a failure state and outputs a fail code.

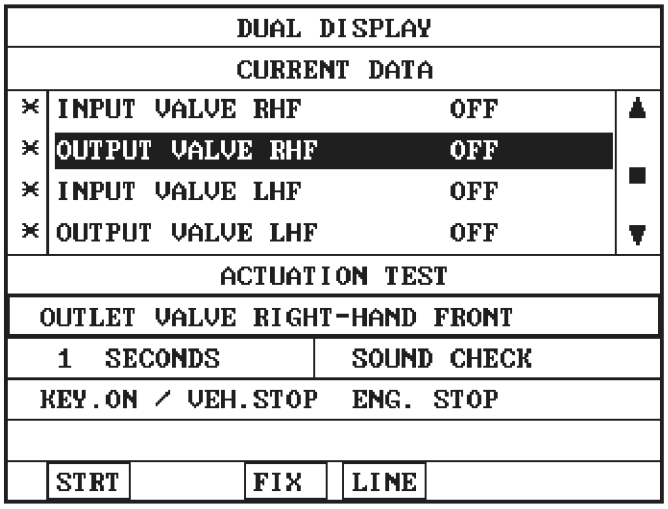
DTC DETECTING CONDITION

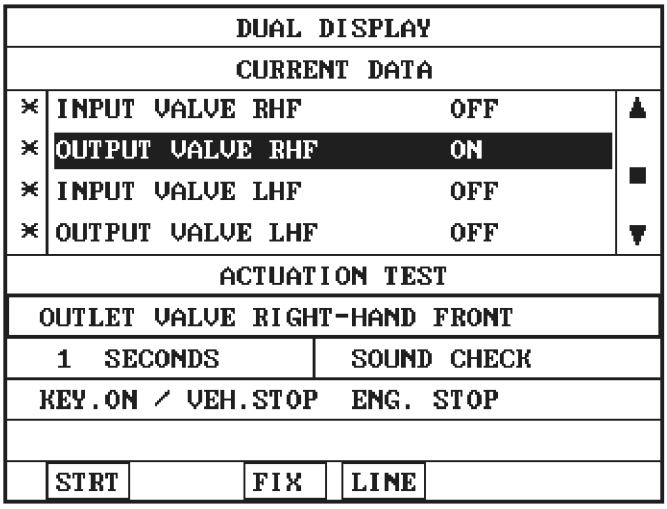
Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Replace ECU.
Enable Conditions	Ignition ON			
Threshold Value	When the HECU detects malfunction in the control system			
Diagnosis Time	Below 1,000 ms			
Fail Safe	Fuel Cut	No	• ABS disabled	
	Fuel Limit	Yes		
	MIL	Yes		

MONITOR SCAN TOOL DATA

1. Connect the scan tool to the self-diagnosis connector.
2. Turn the ignition ON.
3. Select the data "Actuation test"
4. Check the right hand front outlet valve for operation when activating the actuator.

   ■ Specification: Normal if the activating sound is heard.





SUDWAB9010L

Fig1) Right hand front outlet valve Actuation test at IG ON

5. Does the valve activate normally?

YES

There may be a transient trouble due to defective valve or a past trouble which did not erase the memory of HECU after having repair.

And go to "Verification of Vehicle Repair" procedure.

NO

Go to "Component Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness, and terminals.

   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

Repair as necessary and then go to “Verification of Vehicle Repair” procedure.

NO

Go to “Signal Circuit Inspection” procedure.

COMPONENT INSPECTION

1. Start the engine.
2. Drive the vehicle with approx. 15km/h or higher.
3. Turn the ignition ON. Leave the engine OFF.
4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
7. Are any diagnostic trouble codes (DTCs) detected?

YES

Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to “Verification of Vehicle Repair” procedure.

NO

There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. And go to "Verification of Vehicle Repair” procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

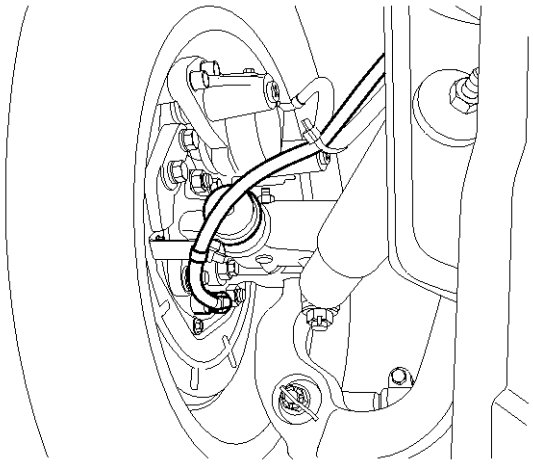
Go to the applicable DTC procedure.

NO

System OK

000B Input Valve Left Hand Front(Short To Ubatt/Uvent)

COMPONENT LOCATION



SUDWAB9049L

GENERAL DESCRIPTION

The Antilock Brake System (ABS) prevents the skid phenomenon that may occurs during a sudden brake while the vehicle is driving or when there is snow or water on the road. By preventing the wheels from sticking or skidding on the road while the brake is applied, ABS maintains the directional stability of the vehicle, secures the steer ability, provides the maximum braking power so as to reduce the braking distance and to pursue the overall safety of the driver and passengers. As the main device to perform ABS' braking function, HECU consists of an input amplifier circuit that processes the input signal, an ABS control and SAFETY circuit that calculates the control and performs FAIL SAFE, an output circuit that drives the pressure control valve, a voltage adjustment circuit that regulates the voltage, and a failure memory circuit that memorizes any malfunctioning. In case of a system malfunctioning, the warning light is turned on, and at the same time, the power to the pressure control valve is cut off, and the operation of ABS is stopped.

DTC DESCRIPTION

HECU continues to monitor the internal components, such as memory, input and output circuits. In case of an error during the operation of the control system, HECU determines whether it is a failure state and outputs a fail code.

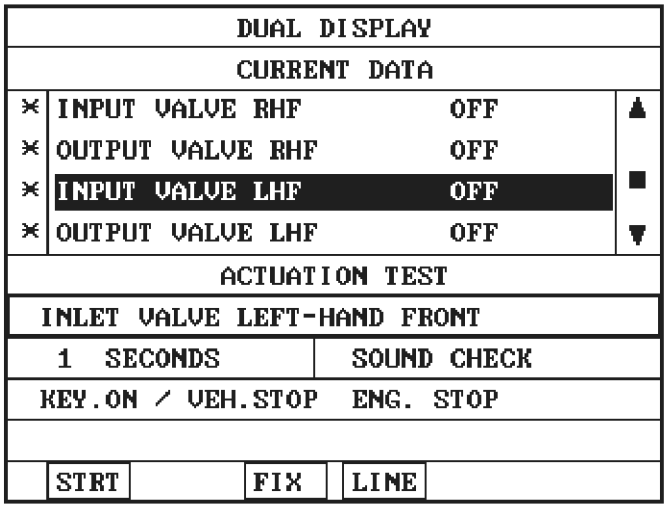
DTC DETECTING CONDITION

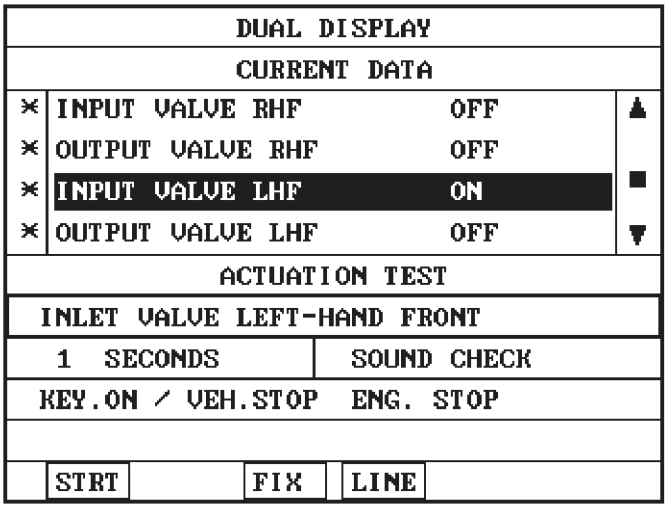
Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Replace ECU.
Enable Conditions	Ignition ON			
Threshold Value	When the HECU detects malfunction in the control system			
Diagnosis Time	Below 1,000 ms			
Fail Safe	Fuel Cut	No	• ABS disabled	
	Fuel Limit	Yes		
	MIL	Yes		

MONITOR SCAN TOOL DATA

1. Connect the scan tool to the self-diagnosis connector.
2. Turn the ignition ON.
3. Select the data "Actuation test"
4. Check the left hand front inlet valve for operation when activating the actuator.

   ■ Specification: Normal if the activating sound is heard.





SUDWAB9011L

Fig1) Left hand front inlet valve Actuation test at IG ON

5. Does the valve activate normally?

YES

There may be a transient trouble due to defective valve or a past trouble which did not erase the memory of HECU after having repair.

And go to "Verification of Vehicle Repair" procedure.

NO

Go to "Component Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness, and terminals.

   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

Repair as necessary and then go to “Verification of Vehicle Repair” procedure.

NO

Go to “Signal Circuit Inspection” procedure.

COMPONENT INSPECTION

1. Start the engine.
2. Drive the vehicle with approx. 15km/h or higher.
3. Turn the ignition ON. Leave the engine OFF.
4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
7. Are any diagnostic trouble codes (DTCs) detected?

YES

Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to “Verification of Vehicle Repair” procedure.

NO

There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. And go to "Verification of Vehicle Repair” procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

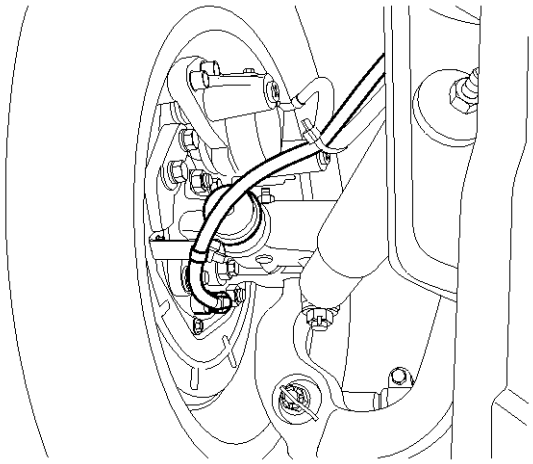
Go to the applicable DTC procedure.

NO

System OK

000C Output Valve Left Hand Front(Short To Ubatt/Uvent)

COMPONENT LOCATION



SUDWAB9049L

GENERAL DESCRIPTION

The Antilock Brake System (ABS) prevents the skid phenomenon that may occurs during a sudden brake while the vehicle is driving or when there is snow or water on the road. By preventing the wheels from sticking or skidding on the road while the brake is applied, ABS maintains the directional stability of the vehicle, secures the steer ability, provides the maximum braking power so as to reduce the braking distance and to pursue the overall safety of the driver and passengers. As the main device to perform ABS' braking function, HECU consists of an input amplifier circuit that processes the input signal, an ABS control and SAFETY circuit that calculates the control and performs FAIL SAFE, an output circuit that drives the pressure control valve, a voltage adjustment circuit that regulates the voltage, and a failure memory circuit that memorizes any malfunctioning. In case of a system malfunctioning, the warning light is turned on, and at the same time, the power to the pressure control valve is cut off, and the operation of ABS is stopped.

DTC DESCRIPTION

HECU continues to monitor the internal components, such as memory, input and output circuits. In case of an error during the operation of the control system, HECU determines whether it is a failure state and outputs a fail code.

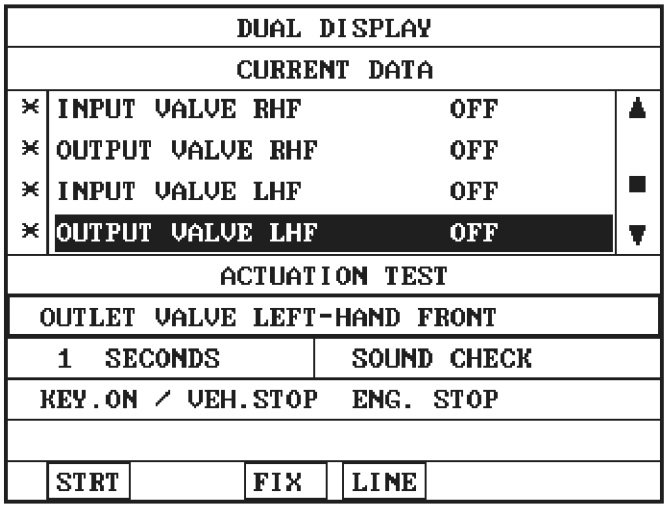
DTC DETECTING CONDITION

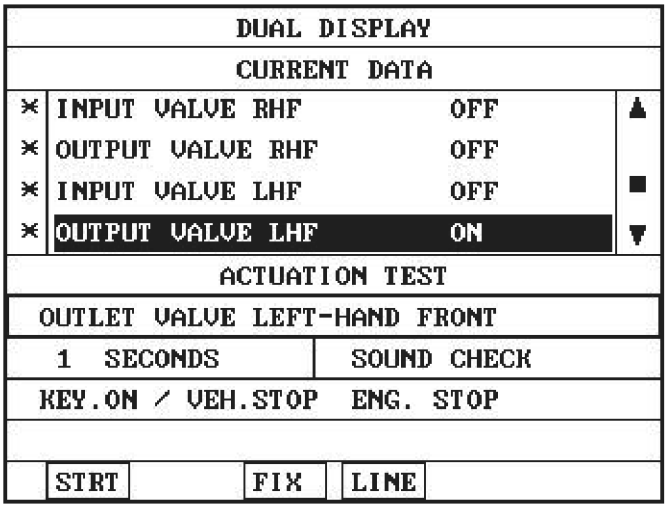
Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Replace ECU.
Enable Conditions	Ignition ON			
Threshold Value	When the HECU detects malfunction in the control system			
Diagnosis Time	Below 1,000 ms			
Fail Safe	Fuel Cut	No	• ABS disabled	
	Fuel Limit	Yes		
	MIL	Yes		

MONITOR SCAN TOOL DATA

1. Connect the scan tool to the self-diagnosis connector.
2. Turn the ignition ON.
3. Select the data "Actuation test"
4. Check the left hand front outlet valve for operation when activating the actuator.

   ■ Specification: Normal if the activating sound is heard.





SUDWAB9012L

Fig1) Left hand front outlet valve Actuation test at IG ON

5. Does the valve activate normally?

YES

There may be a transient trouble due to defective valve or a past trouble which did not erase the memory of HECU after having repair.

And go to "Verification of Vehicle Repair" procedure.

NO

Go to "Component Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness, and terminals.

   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

Repair as necessary and then go to “Verification of Vehicle Repair” procedure.

NO

Go to “Signal Circuit Inspection” procedure.

COMPONENT INSPECTION

1. Start the engine.
2. Drive the vehicle with approx. 15km/h or higher.
3. Turn the ignition ON. Leave the engine OFF.
4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
7. Are any diagnostic trouble codes (DTCs) detected?

YES

Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to “Verification of Vehicle Repair” procedure.

NO

There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. And go to "Verification of Vehicle Repair” procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

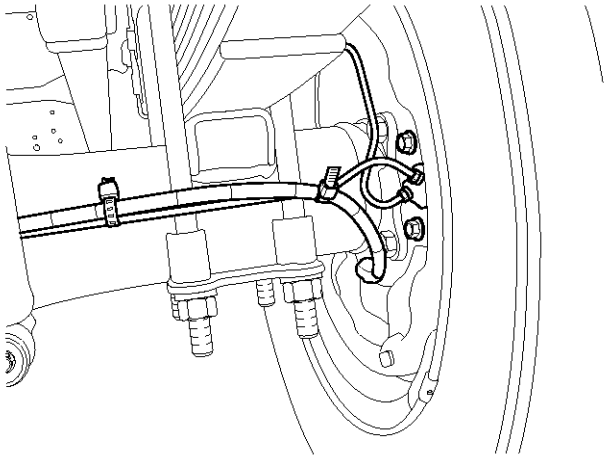
Go to the applicable DTC procedure.

NO

System OK

000D Input Valve Right Hand Rear(Short To Ubatt/Uvent)

COMPONENT LOCATION



SUDWAB9050L

GENERAL DESCRIPTION

The Antilock Brake System (ABS) prevents the skid phenomenon that may occurs during a sudden brake while the vehicle is driving or when there is snow or water on the road. By preventing the wheels from sticking or skidding on the road while the brake is applied, ABS maintains the directional stability of the vehicle, secures the steer ability, provides the maximum braking power so as to reduce the braking distance and to pursue the overall safety of the driver and passengers. As the main device to perform ABS' braking function, HECU consists of an input amplifier circuit that processes the input signal, an ABS control and SAFETY circuit that calculates the control and performs FAIL SAFE, an output circuit that drives the pressure control valve, a voltage adjustment circuit that regulates the voltage, and a failure memory circuit that memorizes any malfunctioning. In case of a system malfunctioning, the warning light is turned on, and at the same time, the power to the pressure control valve is cut off, and the operation of ABS is stopped.

DTC DESCRIPTION

HECU continues to monitor the internal components, such as memory, input and output circuits. In case of an error during the operation of the control system, HECU determines whether it is a failure state and outputs a fail code.

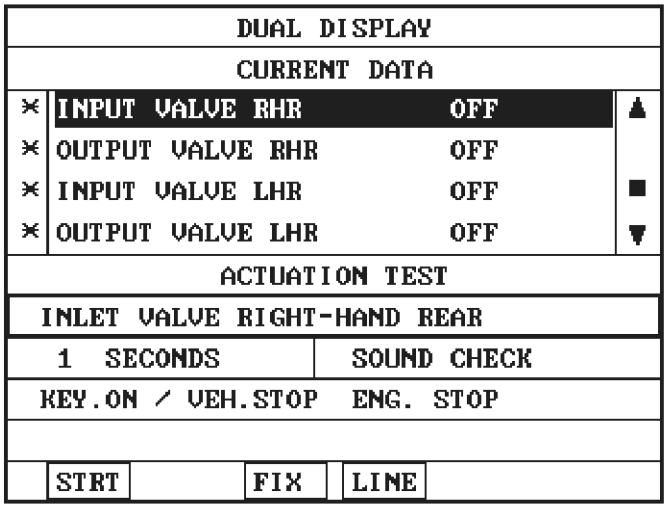
DTC DETECTING CONDITION

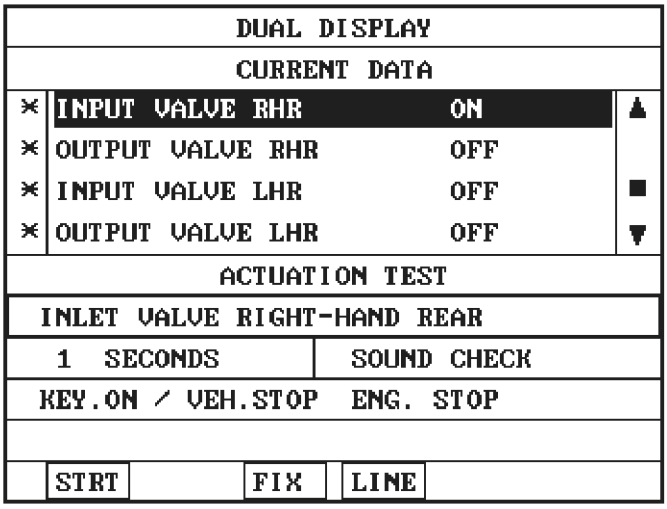
Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Replace ECU.
Enable Conditions	Ignition ON			
Threshold Value	When the HECU detects malfunction in the control system			
Diagnosis Time	Below 1,000 ms			
Fail Safe	Fuel Cut	No	• ABS disabled	
	Fuel Limit	Yes		
	MIL	Yes		

MONITOR SCAN TOOL DATA

1. Connect the scan tool to the self-diagnosis connector.
2. Turn the ignition ON.
3. Select the data "Actuation test"
4. Check the right hand rear inlet valve for operation when activating the actuator.

   ■ Specification: Normal if the activating sound is heard.





SUDWAB9013L

Fig1) Right hand rear inlet valve Actuation test at IG ON

5. Does the valve activate normally?

YES

There may be a transient trouble due to defective valve or a past trouble which did not erase the memory of HECU after having repair.

And go to "Verification of Vehicle Repair" procedure.

NO

Go to "Component Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness, and terminals.

   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

Repair as necessary and then go to “Verification of Vehicle Repair” procedure.

NO

Go to “Signal Circuit Inspection” procedure.

COMPONENT INSPECTION

1. Start the engine.
2. Drive the vehicle with approx. 15km/h or higher.
3. Turn the ignition ON. Leave the engine OFF.
4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
7. Are any diagnostic trouble codes (DTCs) detected?

YES

Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to “Verification of Vehicle Repair” procedure.

NO

There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. And go to "Verification of Vehicle Repair” procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

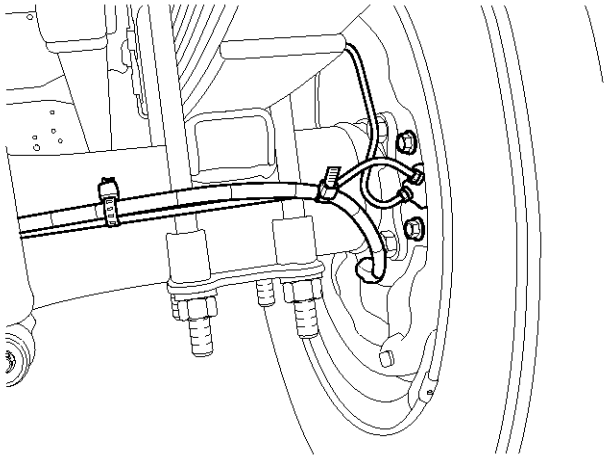
Go to the applicable DTC procedure.

NO

System OK

000E Output Valve Right Hand Rear(Short To Ubatt/Uvent)

COMPONENT LOCATION



SUDWAB9050L

GENERAL DESCRIPTION

The Antilock Brake System (ABS) prevents the skid phenomenon that may occurs during a sudden brake while the vehicle is driving or when there is snow or water on the road. By preventing the wheels from sticking or skidding on the road while the brake is applied, ABS maintains the directional stability of the vehicle, secures the steer ability, provides the maximum braking power so as to reduce the braking distance and to pursue the overall safety of the driver and passengers. As the main device to perform ABS' braking function, HECU consists of an input amplifier circuit that processes the input signal, an ABS control and SAFETY circuit that calculates the control and performs FAIL SAFE, an output circuit that drives the pressure control valve, a voltage adjustment circuit that regulates the voltage, and a failure memory circuit that memorizes any malfunctioning. In case of a system malfunctioning, the warning light is turned on, and at the same time, the power to the pressure control valve is cut off, and the operation of ABS is stopped.

DTC DESCRIPTION

HECU continues to monitor the internal components, such as memory, input and output circuits. In case of an error during the operation of the control system, HECU determines whether it is a failure state and outputs a fail code.

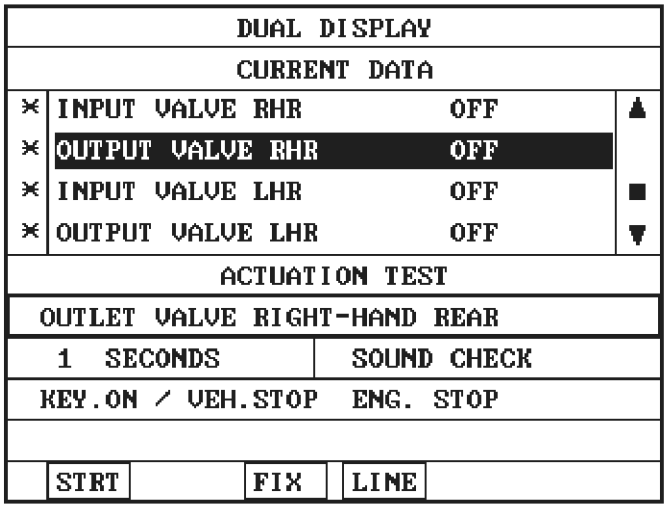
DTC DETECTING CONDITION

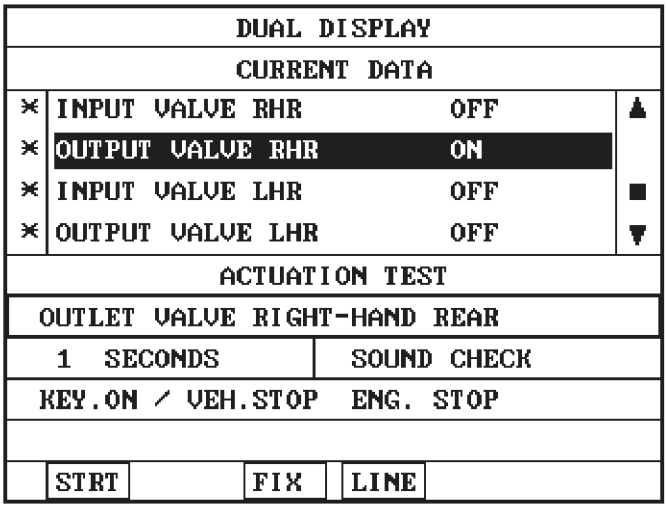
Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Replace ECU.
Enable Conditions	Ignition ON			
Threshold Value	When the HECU detects malfunction in the control system			
Diagnosis Time	Below 1,000 ms			
Fail Safe	Fuel Cut	No	• ABS disabled	
	Fuel Limit	Yes		
	MIL	Yes		

MONITOR SCAN TOOL DATA

1. Connect the scan tool to the self-diagnosis connector.
2. Turn the ignition ON.
3. Select the data "Actuation test"
4. Check the right hand rear outlet valve for operation when activating the actuator.

   ■ Specification: Normal if the activating sound is heard.





SUDWAB9014L

Fig1) Right hand rear outlet valve Actuation test at IG ON

5. Does the valve activate normally?

YES

There may be a transient trouble due to defective valve or a past trouble which did not erase the memory of HECU after having repair.

And go to "Verification of Vehicle Repair" procedure.

NO

Go to "Component Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness, and terminals.

   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

Repair as necessary and then go to “Verification of Vehicle Repair” procedure.

NO

Go to “Signal Circuit Inspection” procedure.

COMPONENT INSPECTION

1. Start the engine.
2. Drive the vehicle with approx. 15km/h or higher.
3. Turn the ignition ON. Leave the engine OFF.
4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
7. Are any diagnostic trouble codes (DTCs) detected?

YES

Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to “Verification of Vehicle Repair” procedure.

NO

There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. And go to "Verification of Vehicle Repair” procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

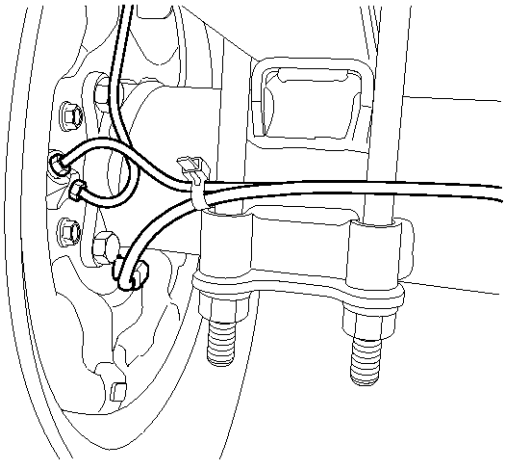
Go to the applicable DTC procedure.

NO

System OK

000F Input Valve Left Hand Rear(Short To Ubatt/Uvent)

COMPONENT LOCATION



SUDWAB9048L

GENERAL DESCRIPTION

The Antilock Brake System (ABS) prevents the skid phenomenon that may occurs during a sudden brake while the vehicle is driving or when there is snow or water on the road. By preventing the wheels from sticking or skidding on the road while the brake is applied, ABS maintains the directional stability of the vehicle, secures the steer ability, provides the maximum braking power so as to reduce the braking distance and to pursue the overall safety of the driver and passengers. As the main device to perform ABS' braking function, HECU consists of an input amplifier circuit that processes the input signal, an ABS control and SAFETY circuit that calculates the control and performs FAIL SAFE, an output circuit that drives the pressure control valve, a voltage adjustment circuit that regulates the voltage, and a failure memory circuit that memorizes any malfunctioning. In case of a system malfunctioning, the warning light is turned on, and at the same time, the power to the pressure control valve is cut off, and the operation of ABS is stopped.

DTC DESCRIPTION

HECU continues to monitor the internal components, such as memory, input and output circuits. In case of an error during the operation of the control system, HECU determines whether it is a failure state and outputs a fail code.

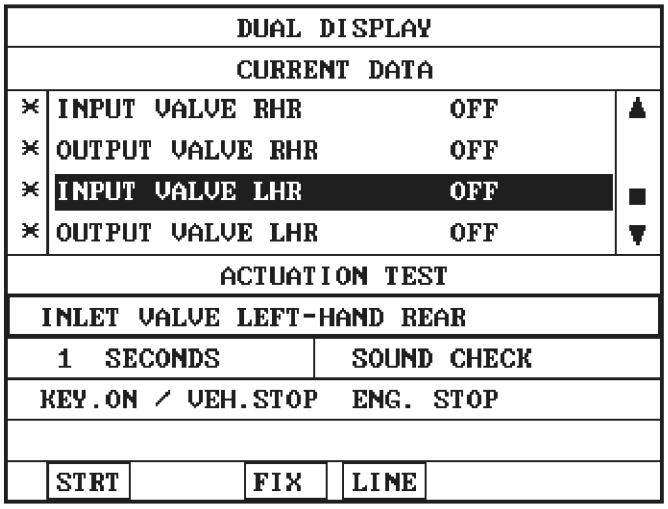
DTC DETECTING CONDITION

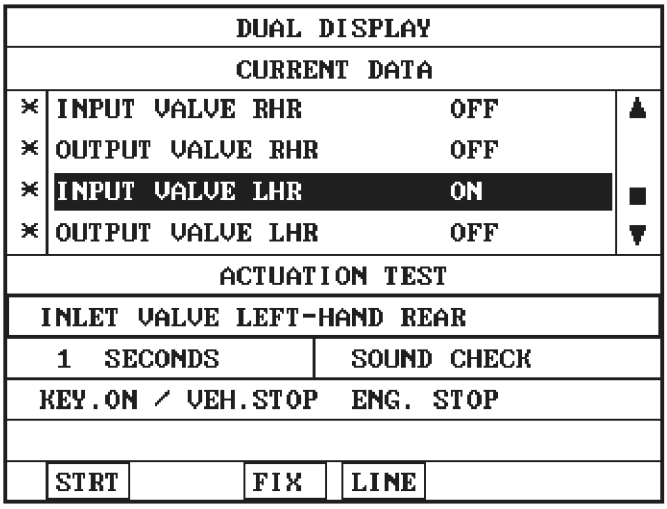
Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Replace ECU.
Enable Conditions	Ignition ON			
Threshold Value	When the HECU detects malfunction in the control system			
Diagnosis Time	Below 1,000 ms			
Fail Safe	Fuel Cut	No	• ABS disabled	
	Fuel Limit	Yes		
	MIL	Yes		

MONITOR SCAN TOOL DATA

1. Connect the scan tool to the self-diagnosis connector.
2. Turn the ignition ON.
3. Select the data "Actuation test"
4. Check the left hand rear inlet valve for operation when activating the actuator.

   ■ Specification: Normal if the activating sound is heard.





SUDWAB9015L

Fig1) Left hand rear inlet valve Actuation test at IG ON

5. Does the valve activate normally?

YES

There may be a transient trouble due to defective valve or a past trouble which did not erase the memory of HECU after having repair.

And go to "Verification of Vehicle Repair" procedure.

NO

Go to "Component Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness, and terminals.

   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

Repair as necessary and then go to “Verification of Vehicle Repair” procedure.

NO

Go to “Signal Circuit Inspection” procedure.

COMPONENT INSPECTION

1. Start the engine.
2. Drive the vehicle with approx. 15km/h or higher.
3. Turn the ignition ON. Leave the engine OFF.
4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
7. Are any diagnostic trouble codes (DTCs) detected?

YES

Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to “Verification of Vehicle Repair” procedure.

NO

There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. And go to "Verification of Vehicle Repair” procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

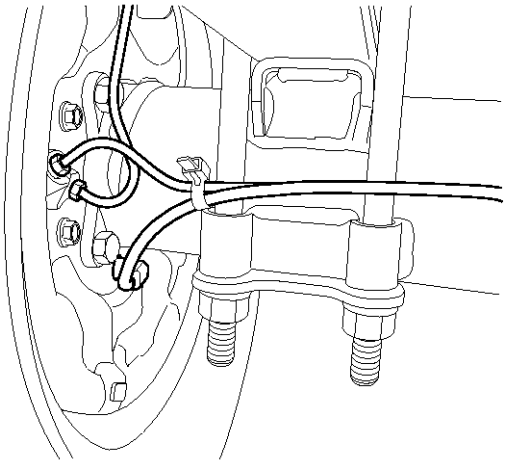
Go to the applicable DTC procedure.

NO

System OK

0010 Output Valve Left Hand Rear(Short To Ubatt/Uvent)

COMPONENT LOCATION



SUDWAB9048L

GENERAL DESCRIPTION

The Antilock Brake System (ABS) prevents the skid phenomenon that may occurs during a sudden brake while the vehicle is driving or when there is snow or water on the road. By preventing the wheels from sticking or skidding on the road while the brake is applied, ABS maintains the directional stability of the vehicle, secures the steer ability, provides the maximum braking power so as to reduce the braking distance and to pursue the overall safety of the driver and passengers. As the main device to perform ABS' braking function, HECU consists of an input amplifier circuit that processes the input signal, an ABS control and SAFETY circuit that calculates the control and performs FAIL SAFE, an output circuit that drives the pressure control valve, a voltage adjustment circuit that regulates the voltage, and a failure memory circuit that memorizes any malfunctioning. In case of a system malfunctioning, the warning light is turned on, and at the same time, the power to the pressure control valve is cut off, and the operation of ABS is stopped.

DTC DESCRIPTION

HECU continues to monitor the internal components, such as memory, input and output circuits. In case of an error during the operation of the control system, HECU determines whether it is a failure state and outputs a fail code.

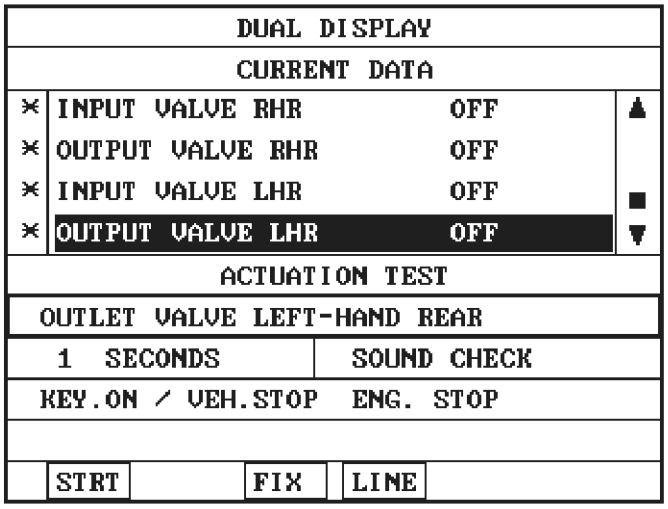
DTC DETECTING CONDITION

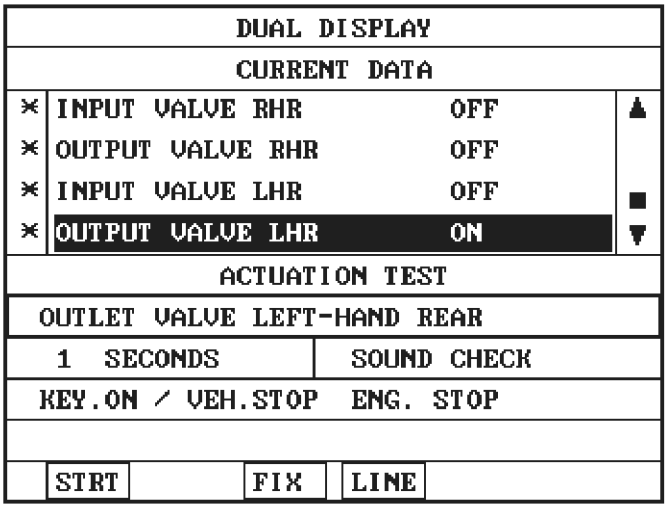
Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Replace ECU.
Enable Conditions	Ignition ON			
Threshold Value	When the HECU detects malfunction in the control system			
Diagnosis Time	Below 1,000 ms			
Fail Safe	Fuel Cut	No	• ABS disabled	
	Fuel Limit	Yes		
	MIL	Yes		

MONITOR SCAN TOOL DATA

1. Connect the scan tool to the self-diagnosis connector.
2. Turn the ignition ON.
3. Select the data "Actuation test".
4. Check the left hand rear outlet valve for operation when activating the actuator.

   ■ Specification: Normal if the activating sound is heard.





SUDWAB9016L

Fig1) Left hand rear outlet valve Actuation test at IG ON

5. Does the valve activate normally?

YES

There may be a transient trouble due to defective valve or a past trouble which did not erase the memory of HECU after having repair.

And go to "Verification of Vehicle Repair" procedure.

NO

Go to "Component Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness, and terminals.

   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

Repair as necessary and then go to “Verification of Vehicle Repair” procedure.

NO

Go to “Signal Circuit Inspection” procedure.

COMPONENT INSPECTION

1. Start the engine.
2. Drive the vehicle with approx. 15km/h or higher.
3. Turn the ignition ON. Leave the engine OFF.
4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
7. Are any diagnostic trouble codes (DTCs) detected?

YES

Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to “Verification of Vehicle Repair” procedure.

NO

There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. And go to "Verification of Vehicle Repair” procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

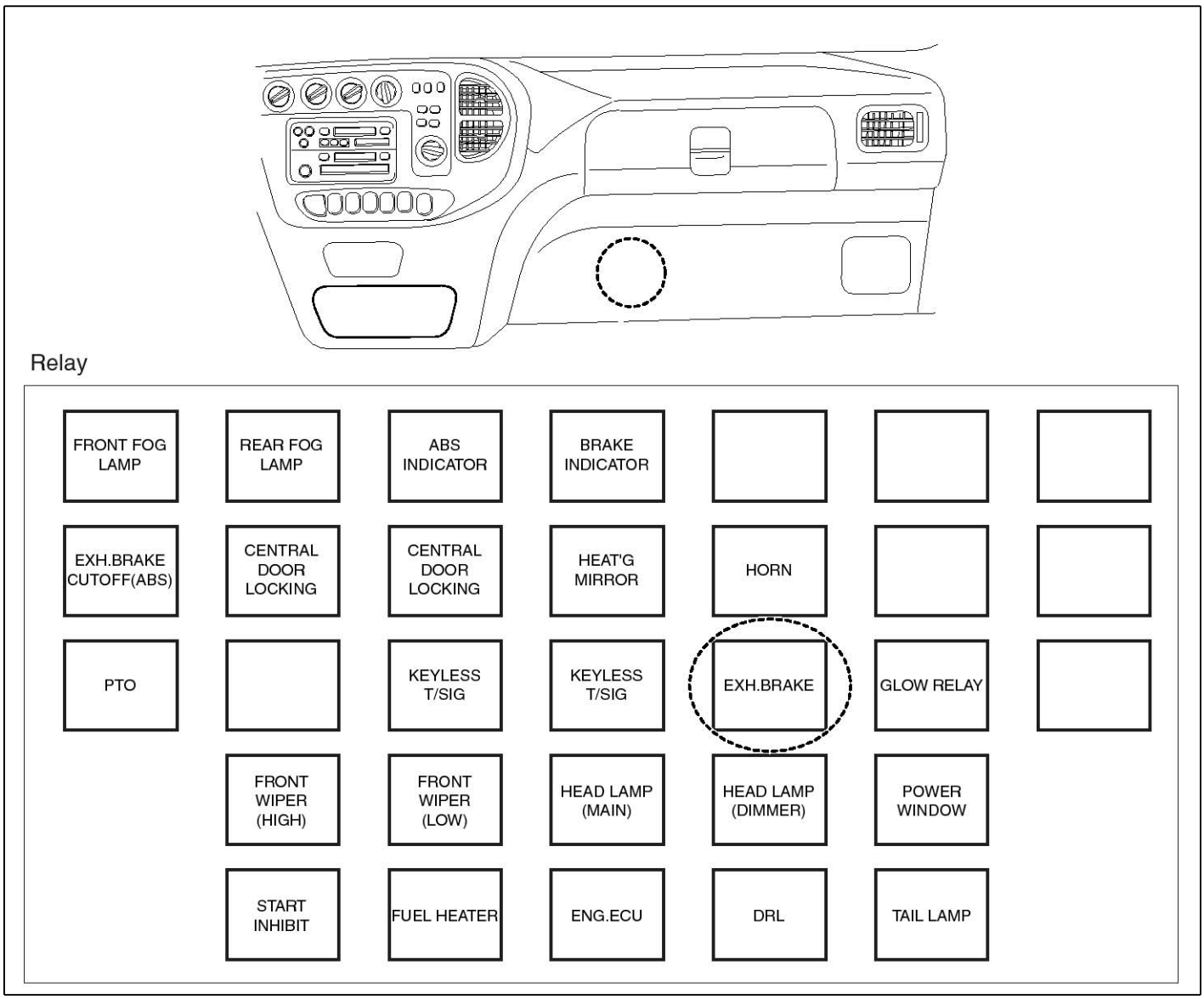
Go to the applicable DTC procedure.

NO

System OK

0011 Endurance Brake Relay(Short To Ubatt/Uvent)

COMPONENT LOCATION



SUDWAB9003L

GENERAL DESCRIPTION

The Endurance Brake Relay (DBR) is a device with which ABS ECU forcefully disengages any third brake applied by the driver, such as a supplementary brake like endurance brake, during the operation of ABS, and is installed in vehicles of 2.5t or larger where both the endurance brake and ABS are applied. In case when ABS is operational on a very slippery road and when a skid occurs on the rear wheels not by the main brake but by endurance brake, ABS ECU cannot control the rear wheel. Therefore, this function is applied for smooth ABS control.

DTC DESCRIPTION

HECU continues to monitor the DBR control signal. If a short-circuit in the power source is detected in the DBR control line, HECU determines it as a failure and outputs a fail code.

DTC DETECTING CONDITION

Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Poor connection of connector and wiring damage • Short to power of control circuit • Defective DBR relay
Enable Conditions	Ignition ON			
Threshold Value	When short to the control circuit of DBR relay is detected			
Diagnosis Time	Below 1,000 ms			
Fail Safe	Fuel Cut	No	• The ABS function works normally.	
	Fuel Limit	Yes		
	MIL	Yes		

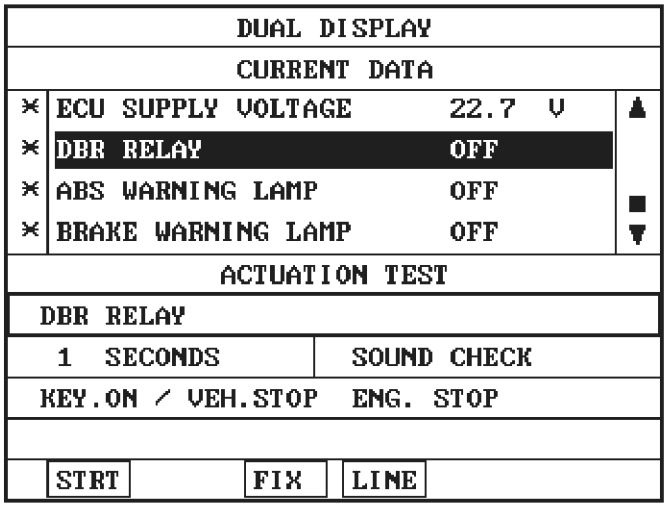
SPECIFICATION

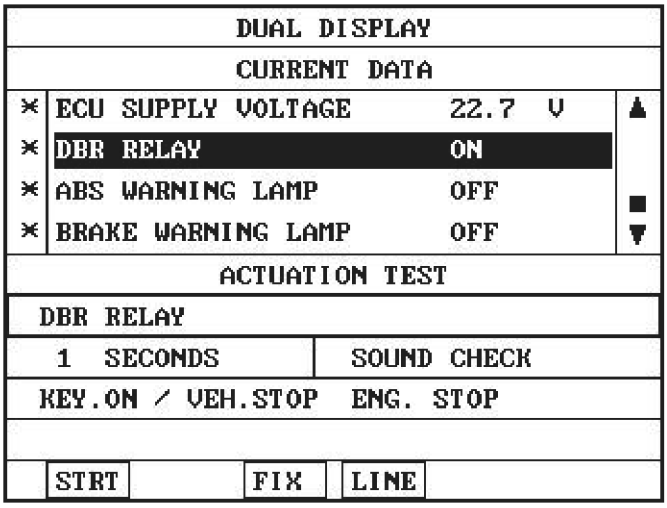
ABS relay coil resistance	200 ~ 450 Ω (At 20)

MONITOR SCAN TOOL DATA

1. Connect the scan tool to the self-diagnosis connector.
2. Turn the ignition ON. Leave the engine OFF.
3. Select the data "Actuation test" on the scan tool.
4. Select the data “DBR relay” and perform actuation test.

   ■ Specification: Normal if the activating sound is heard.





SUDWAB9017L

5. Can you hear the activating sound from the DBR relay?

YES

There may be the defective HECU or a transient trouble due to a past trouble which did not erase the memory of HECU after having repaired. Totally check the connector for looseness, poor contact, bent, corrosion, contamination, deformation, or damage.

Repair or replace it if necessary and go to "Verification of Vehicle Repair” procedure.

NO

Go to “Terminal & Connector Inspection” procedure.

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness, and terminals.

   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination,

deterioration, or damage.

3. Has a problem been found?

YES

Repair as necessary and then go to “Verification of Vehicle Repair” procedure.

NO

Go to “Signal Circuit Inspection” procedure.

CONTROL CIRCUIT INSPECTION

1. Turn the ignition OFF.
2. Disconnect the DBR relay connector (M15) and HECU connector (C60).
3. Measure the voltage between the terminal 3 of DBR relay (M15) and chassis ground.
   - Specification: Below 0~0.1 V
4. Is the voltage measured within specification?

YES

Go to “Component Inspection” procedure.

NO

Repair short to power between terminal of HECU and terminal of DBR relay control and go to “Verification of Vehicle Repair” procedure.

COMPONENT INSPECTION

1. Turn the ignition OFF.
2. Disconnect the DBR relay connector (M15).
3. Measure the resistance between terminals 3 and 5 of DBR relay component.
   - Specification: DBR relay coil resistance: 200 ~ 450 Ω (At 20)
4. Measure the resistance between terminals 1 and 4 of DBR relay while applying and cutting off B+ power to terminals 3 and 5 of DBR relay.
   - Specification

   Continuity (When applying power)

   Infinite (When cutting off power)
5. Is the resistance measured within specification?

YES

Go to "Verification of Vehicle Repair” procedure.

NO

Replace the relay and go to "Verification of Vehicle Repair” procedure.

Repeat "Component Inspection" procedure several times.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

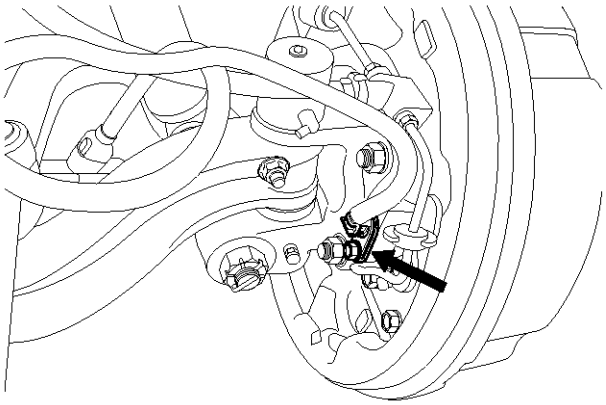
Go to the applicable DTC procedure.

NO

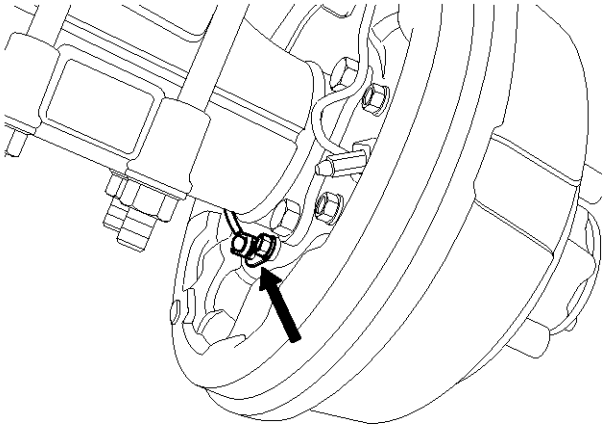
System OK

0017 Sensor Right Hand Front(Impedance)

COMPONENT LOCATION



Front wheel speed sensor



Rear wheel speed sensor

SUDWAB9002L

GENERAL DESCRIPTION

The wheel sensor is crucial for HECU to calculate the speed of the vehicle and determine whether the wheel is in 'Lock' mode or not. For example, in case of a front-wheel drive vehicle, the signal of the rear wheel speed is used as a reference value for the speed of the vehicle. If there occurs the difference in speed between the front and rear wheels, ABS control is performed. The wheel sensor creates a sine curve based on the magnetic field created by the permanent magnet inside the sensor when the tone wheel rotates. The frequency and the AC voltage change by a certain ratio depending on the wheel speed, and HECU determines the speed of the vehicle by calculating the frequency of the signal.

DTC DESCRIPTION

HECU continues to monitor the input signal from the wheel sensor. If the resistance value in the front right wheel sensor signal line is abnormal, HECU determines it as a failure state and outputs a fail code.

DTC DETECTING CONDITION

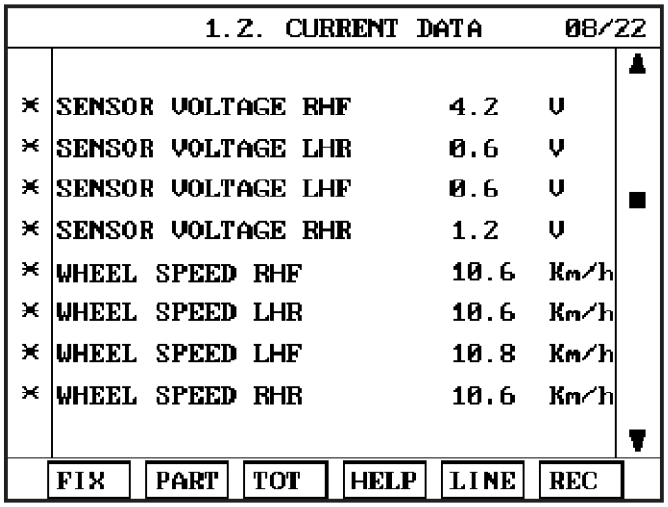
Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Defective sensor wiring. • Defective sensor.
Enable Conditions	Ignition ON			
Threshold Value	Sensor impedance 830 Ω, Sensor impedance>2,100 Ω			
Diagnosis Time	1,000 ms			
Fail Safe	Fuel Cut	No	• ABS function disabled for concerned wheel.	
	Fuel Limit	No		
	MIL	Yes		

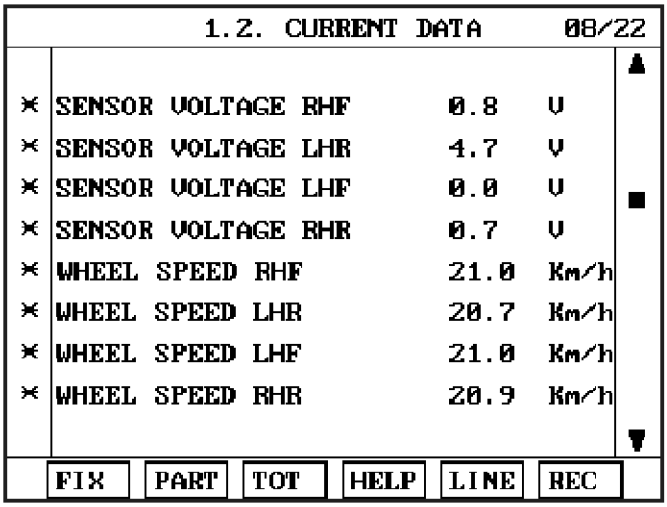
SPECIFICATION

Wheel sensor resistance	830 ~ 2,100 Ω (At 20)
Air gap	0.2 ~ 1.7 mm

MONITOR SCAN TOOL DATA

1. Start the engine.
2. Connect the scan tool to the self-diagnosis connector. Select the service data.
3. Drive the vehicle straight at a constant speed in the normal road surface.
4. Monitor the data "Wheel speed RHF" parameter on the scan tool.
   ■ Specification: Normal if its speed is nearly in accordance with the speed in the gauge.





SUDWAB9008L

5. Is the data measured within specification?

YES

There may be the poor contact of wheel sensor circuit or a past trouble which did not erase the memory of HECU after having repaired. Totally check the connector for looseness, poor contact, bent, corrosion, contamination, deformation, or damage.

Repair or replace it if necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to “Terminal & Connector Inspection” procedure.

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness, and terminals.

   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

Repair as necessary and then go to “Verification of Vehicle Repair” procedure.

NO

Go to “Signal Circuit Inspection” procedure.

SIGNAL CIRCUIT INSPECTION

Signal (+) Open Inspection

1. Disconnect the HECU connector and the wheel speed sensor connector.
2. Turn the ignition ON. Leave the engine OFF.
3. Measure the resistance between the terminal 25 of HECU harness connector (C60) and the terminal 1 of wheel speed sensor harness connector (C30).
   ■ Specification: Continuity
4. Is the resistance measured within specification?

YES

Go to next procedure.

NO

Repair open circuit and go to "Verification of Vehicle Repair" procedure.

NO

Go to “Signal Circuit Inspection” procedure.

COMPONENT INSPECTION

1. Start the engine.
2. Drive the vehicle with approx. 15km/h or higher.
3. Turn the ignition ON. Leave the engine OFF.
4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
7. Are any diagnostic trouble codes (DTCs) detected?

YES

Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to “Verification of Vehicle Repair” procedure.

NO

There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. And go to "Verification of Vehicle Repair” procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

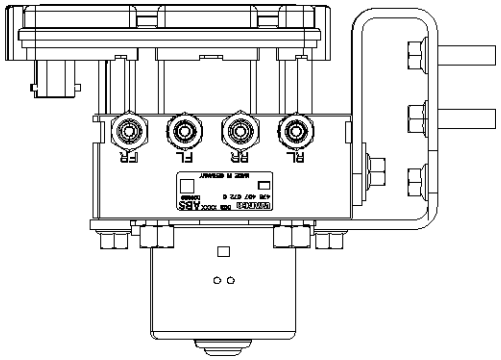
Go to the applicable DTC procedure.

NO

System OK

0044 Pump Motor Does Not Switch Off

COMPONENT LOCATION



SUDWAB9001L

GENERAL DESCRIPTION

The Antilock Brake System (ABS) prevents the skid phenomenon that may occurs during a sudden brake while the vehicle is driving or when there is snow or water on the road. By preventing the wheels from sticking or skidding on the road while the brake is applied, ABS maintains the directional stability of the vehicle, secures the steer ability, provides the maximum braking power so as to reduce the braking distance and to pursue the overall safety of the driver and passengers. As the main device to perform ABS' braking function, HECU consists of an input amplifier circuit that processes the input signal, an ABS control and SAFETY circuit that calculates the control and performs FAIL SAFE, an output circuit that drives the pressure control valve, a voltage adjustment circuit that regulates the voltage, and a failure memory circuit that memorizes any malfunctioning. In case of a system malfunctioning, the warning light is turned on, and at the same time, the power to the pressure control valve is cut off, and the operation of ABS is stopped.

DTC DESCRIPTION

HECU continues to monitor the internal components, such as memory, input and output circuits. In case of an error during the operation of the control system, HECU determines whether it is a failure state and outputs a fail code.

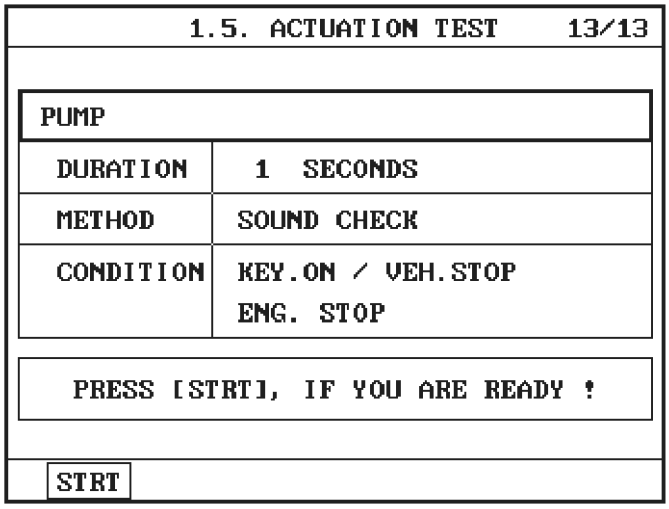
DTC DETECTING CONDITION

Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Replace ECU.
Enable Conditions	Ignition ON			
Threshold Value	When the pump motor in HECU will not stop			
Diagnosis Time	Below 1,000 ms			
Fail Safe	Fuel Cut	No	• ABS disabled	
	Fuel Limit	Yes		
	MIL	Yes		

MONITOR SCAN TOOL DATA

1. Connect the scan tool to the self-diagnosis connector.
2. Turn the ignition ON.
3. Select the data "Actuation test".
4. Check the pump motor for operation when activating the actuator.

   ■ Specification: Normal if the activating sound is heard.



SUDWAB9041L

5. Does the valve activate normally?

YES

There may be a transient trouble due to defective valve or a past trouble which did not erase the memory of HECU after having repair.

And go to "Verification of Vehicle Repair" procedure.

NO

Go to "Component Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness, and terminals.

   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

Repair as necessary and then go to “Verification of Vehicle Repair” procedure.

NO

Go to “Signal Circuit Inspection” procedure.

COMPONENT INSPECTION

1. Start the engine.
2. Drive the vehicle with approx. 15km/h or higher.
3. Turn the ignition ON. Leave the engine OFF.
4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
7. Are any diagnostic trouble codes (DTCs) detected?

YES

Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to “Verification of Vehicle Repair” procedure.

NO

There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. And go to "Verification of Vehicle Repair” procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

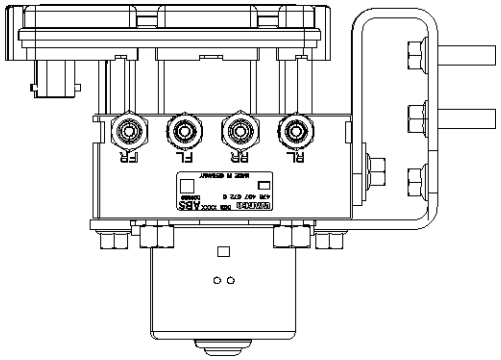
Go to the applicable DTC procedure.

NO

System OK

0045 Pump Motor Does Not Turn

COMPONENT LOCATION



SUDWAB9001L

GENERAL DESCRIPTION

The Antilock Brake System (ABS) prevents the skid phenomenon that may occurs during a sudden brake while the vehicle is driving or when there is snow or water on the road. By preventing the wheels from sticking or skidding on the road while the brake is applied, ABS maintains the directional stability of the vehicle, secures the steer ability, provides the maximum braking power so as to reduce the braking distance and to pursue the overall safety of the driver and passengers. As the main device to perform ABS' braking function, HECU consists of an input amplifier circuit that processes the input signal, an ABS control and SAFETY circuit that calculates the control and performs FAIL SAFE, an output circuit that drives the pressure control valve, a voltage adjustment circuit that regulates the voltage, and a failure memory circuit that memorizes any malfunctioning. In case of a system malfunctioning, the warning light is turned on, and at the same time, the power to the pressure control valve is cut off, and the operation of ABS is stopped.

DTC DESCRIPTION

HECU continues to monitor the internal components, such as memory, input and output circuits. In case of an error during the operation of the control system, HECU determines whether it is a failure state and outputs a fail code.

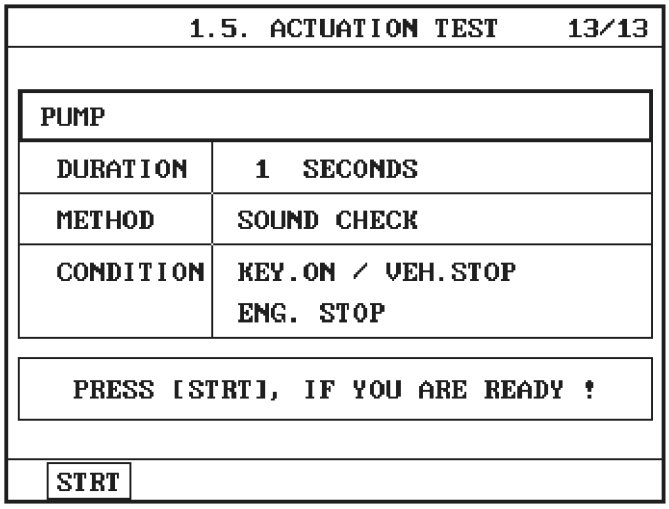
DTC DETECTING CONDITION

Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Replace ECU.
Enable Conditions	Ignition ON			
Threshold Value	When the pump motor in HECU does not work			
Diagnosis Time	1,000 ms			
Fail Safe	Fuel Cut	No	• ABS disabled	
	Fuel Limit	Yes		
	MIL	Yes		

MONITOR SCAN TOOL DATA

1. Connect the scan tool to the self-diagnosis connector.
2. Turn the ignition ON.
3. Select the data "Actuation test".
4. Check the pump motor for operation when activating the actuator.

   ■ Specification: Normal if the activating sound is heard.



SUDWAB9042L

5. Does the valve activate normally?

YES

There may be a transient trouble due to defective valve or a past trouble which did not erase the memory of HECU after having repair.

And go to "Verification of Vehicle Repair" procedure.

NO

Go to "Component Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness, and terminals.

   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

Repair as necessary and then go to “Verification of Vehicle Repair” procedure.

NO

Go to “Signal Circuit Inspection” procedure.

COMPONENT INSPECTION

1. Start the engine.
2. Drive the vehicle with approx. 15km/h or higher.
3. Turn the ignition ON. Leave the engine OFF.
4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
7. Are any diagnostic trouble codes (DTCs) detected?

YES

Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to “Verification of Vehicle Repair” procedure.

NO

There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. And go to "Verification of Vehicle Repair” procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

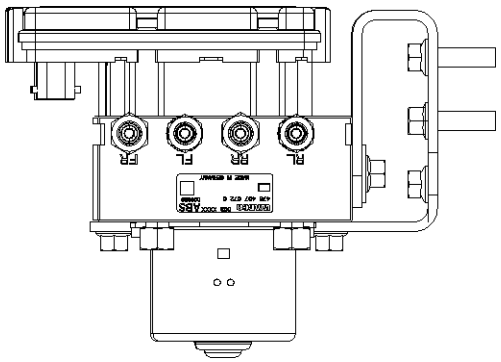
Go to the applicable DTC procedure.

NO

System OK

0046 Pump Motor Supply Voltage Missing

COMPONENT LOCATION



SUDWAB9001L

GENERAL DESCRIPTION

HECU supplies the battery voltage to all solenoid valves through the valve relay controlled by ECU. All solenoid valves and valve relay are installed in HECU.

DTC DESCRIPTION

HECU monitors the incoming system power, and if the pump motor does not function due to no power, it outputs a fail code.

DTC DETECTING CONDITION

Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Replace ECU. • Poor contact in connector or wiring damage.
Enable Conditions	Ignition ON			
Threshold Value	When there is no power in pump motor			
Diagnosis Time	Below 1,000 ms			
Fail Safe	Fuel Cut	No	• ABS disabled	
	Fuel Limit	Yes		
	MIL	Yes		

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness, and terminals.

   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

Repair as necessary and then go to “Verification of Vehicle Repair” procedure.

NO

Go to “Signal Circuit Inspection” procedure.

CONTROL CIRCUIT INSPECTION

Control Circuit inspection

1. Turn the ignition OFF.
2. Disconnect the HECU connector (C60).
3. Turn the ignition ON. Leave the engine OFF.
4. Measure the voltage between the terminal 16 of HECU connector (C60) and chassis ground.
   - Specification: Battery voltage
5. Is the voltage measured within specification?

YES

Go to "Ground Circuit Inspection" procedure.

NO

Check the fuse 30A. If it is burnt, replace it. When the fuse is normal, check open circuit between terminal (+) of battery and terminal 16 of HECU connector (C60) and short to ground. Repair if there is any problem and go to “Verification of Vehicle Repair” procedure.

GROUND CIRCUIT INSPECTION

1. Turn the ignition OFF.
2. Disconnect the HECU connector (C60).
3. Measure the resistance between the terminals 18, 19 of HECU harness connector (C60) and chassis ground.
   - Specification: Continuity
4. Is the resistance measured within specification?

YES

Go to “Component Inspection” procedure.

NO

Check open or poor contact between the solenoid valve ground of HECU harness connector and chassis ground. And go to "Verification of Vehicle Repair” procedure.

COMPONENT INSPECTION

1. Start the engine.
2. Drive the vehicle with approx. 15km/h or higher.
3. Turn the ignition ON. Leave the engine OFF.
4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
7. Are any diagnostic trouble codes (DTCs) detected?

YES

Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to “Verification of Vehicle Repair” procedure.

NO

There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. And go to "Verification of Vehicle Repair” procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

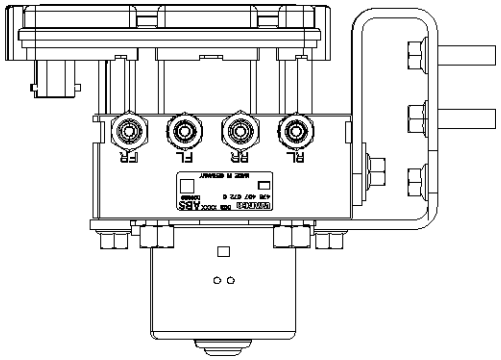
Go to the applicable DTC procedure.

NO

System OK

0047 Pump Motor Relay Voltage Missing

COMPONENT LOCATION



SUDWAB9001L

GENERAL DESCRIPTION

The Antilock Brake System (ABS) prevents the skid phenomenon that may occurs during a sudden brake while the vehicle is driving or when there is snow or water on the road. By preventing the wheels from sticking or skidding on the road while the brake is applied, ABS maintains the directional stability of the vehicle, secures the steer ability, provides the maximum braking power so as to reduce the braking distance and to pursue the overall safety of the driver and passengers. As the main device to perform ABS' braking function, HECU consists of an input amplifier circuit that processes the input signal, an ABS control and SAFETY circuit that calculates the control and performs FAIL SAFE, an output circuit that drives the pressure control valve, a voltage adjustment circuit that regulates the voltage, and a failure memory circuit that memorizes any malfunctioning. In case of a system malfunctioning, the warning light is turned on, and at the same time, the power to the pressure control valve is cut off, and the operation of ABS is stopped.

DTC DESCRIPTION

HECU continues to monitor the internal components, such as memory, input and output circuits. In case of an error during the operation of the control system, HECU determines whether it is a failure state and outputs a fail code.

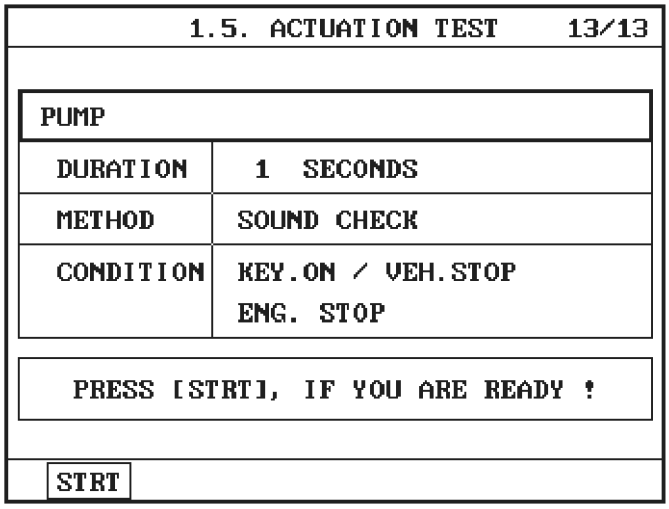
DTC DETECTING CONDITION

Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Replace ECU.
Enable Conditions	Ignition ON			
Threshold Value	When the pump motor in HECU does not work			
Diagnosis Time	Below 1,000 ms			
Fail Safe	Fuel Cut	No	• ABS disabled	
	Fuel Limit	Yes		
	MIL	Yes		

MONITOR SCAN TOOL DATA

1. Connect the scan tool to the self-diagnosis connector.
2. Turn the ignition ON.
3. Select the data "Actuation test".
4. Check the pump motor for operation when activating the actuator.

   ■ Specification: Normal if the activating sound is heard.



SUDWAB9043L

5. Does the valve activate normally?

YES

There may be a transient trouble due to defective valve or a past trouble which did not erase the memory of HECU after having repair.

And go to "Verification of Vehicle Repair" procedure.

NO

Go to "Component Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness, and terminals.

   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

Repair as necessary and then go to “Verification of Vehicle Repair” procedure.

NO

Go to “Signal Circuit Inspection” procedure.

COMPONENT INSPECTION

1. Start the engine.
2. Drive the vehicle with approx. 15km/h or higher.
3. Turn the ignition ON. Leave the engine OFF.
4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
7. Are any diagnostic trouble codes (DTCs) detected?

YES

Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to “Verification of Vehicle Repair” procedure.

NO

There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. And go to "Verification of Vehicle Repair” procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

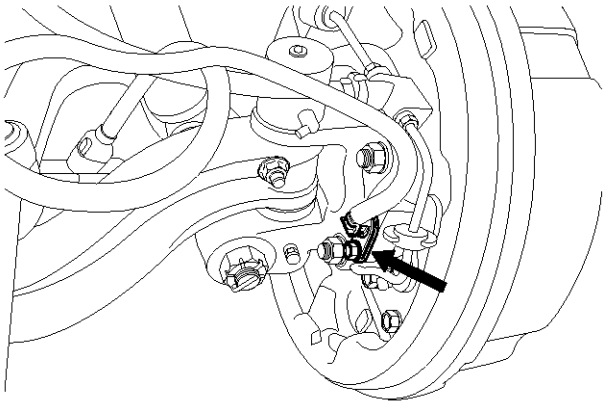
Go to the applicable DTC procedure.

NO

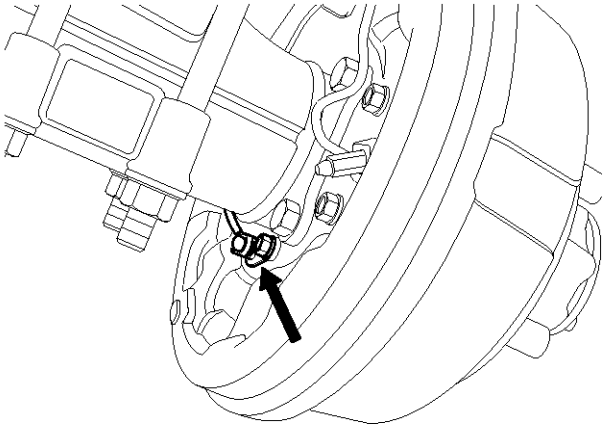
System OK

0049 Sensor Right Hand Front(No Trigger At All)

COMPONENT LOCATION



Front wheel speed sensor



Rear wheel speed sensor

SUDWAB9002L

GENERAL DESCRIPTION

The wheel sensor is crucial for HECU to calculate the speed of the vehicle and determine whether the wheel is in 'Lock' mode or not. For example, in case of a front-wheel drive vehicle, the signal of the rear wheel speed is used as a reference value for the speed of the vehicle. If there occurs the difference in speed between the front and rear wheels, ABS control is performed. The wheel sensor creates a sine curve based on the magnetic field created by the permanent magnet inside the sensor when the tone wheel rotates. The frequency and the AC voltage change by a certain ratio depending on the wheel speed, and HECU determines the speed of the vehicle by calculating the frequency of the signal.

DTC DESCRIPTION

HECU continues to monitor the input signal from the wheel sensor. If the ABS control state changes abnormally when the sensor output voltage becomes low because the air gap in the front right wheel sensor is too big, HECU determines it as a failure state and outputs a fail code.

DTC DETECTING CONDITION

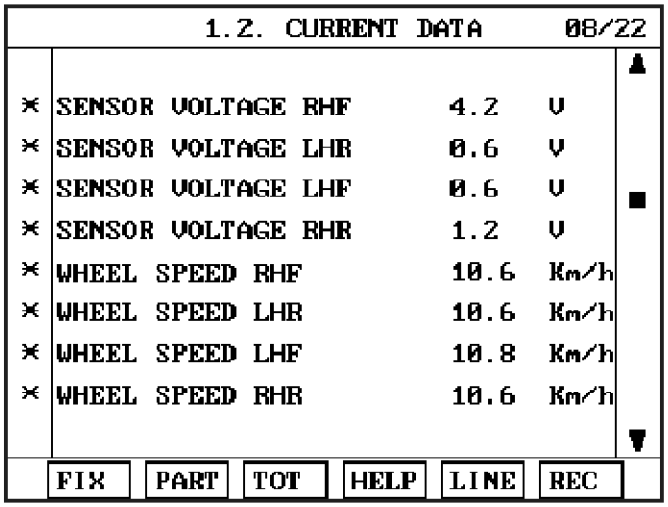
Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Check air gap. • Check bearing play and tone ring run out. • Check tone ring for damage.
Enable Conditions	Ignition ON			
Threshold Value	.Vehicle speed > 15.0kph.Air gap 0.2 ~ 1.7mm			
Diagnosis Time	1,000 ms			
Fail Safe	Fuel Cut	No	• ABS function disabled for concerned wheel	
	Fuel Limit	Yes		
	MIL	Yes		

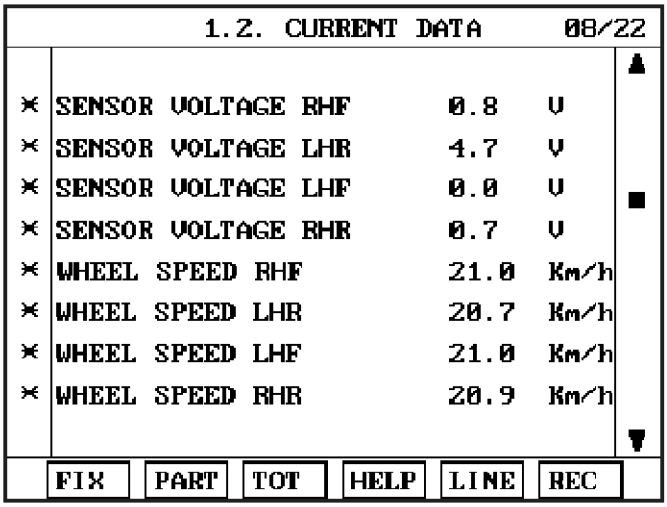
SPECIFICATION

Wheel sensor resistance	830 ~ 2,100 Ω (At 20)
Air gap	0.2 ~ 1.7 mm

MONITOR SCAN TOOL DATA

1. Start the engine.
2. Connect the scan tool to the self-diagnosis connector. Select the service data.
3. Drive the vehicle straight at a constant speed in the normal road surface.
4. Monitor the data "Wheel speed RHF" parameter on the scan tool.
   ■ Specification: Normal if its speed is nearly in accordance with the speed in the gauge.





SUDWAB9008L

5. Is the data measured within specification?

YES

There may be the poor contact of wheel sensor circuit or a past trouble which did not erase the memory of HECU after having repaired. Totally check the connector for looseness, poor contact, bent, corrosion, contamination, deformation, or damage.

Repair or replace it if necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to “Terminal & Connector Inspection” procedure.

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness, and terminals.

   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

Repair as necessary and then go to “Verification of Vehicle Repair” procedure.

NO

Go to “Signal Circuit Inspection” procedure.

COMPONENT INSPECTION

Sensor Air Gap Inspection

1. Turn the ignition OFF.
2. Check the air gap between right hand front tone wheel and wheel sensor with a thickness gauge.
   ■ Specification: 0.2~1.7 mm
3. Is the value measured within specification?

YES

Go to next procedure.

NO

Repair it after checking wheel sensor installation condition and go to "Verification of Vehicle Repair” procedure.

Repair or replace it after checking the condition of rotor and wheel bearing and go to "Verification of

Vehicle Repair" procedure.

Adjust it after checking the air gap between wheel sensor and rotor and go to "Verification of Vehicle Repair" procedure.

Right Hand Front Wheel Sensor Inspection

1. Turn the ignition OFF.
2. Disconnect the right hand front when sensor connector.
3. Measure the resistance between positive (+) and negative (-) of the right hand front wheel sensor (C30).
   - Specification: 830 ~ 2,100 Ω (At 20)
4. Is the resistance measured within specification?

YES

After checking the HECU for contamination or damage, install a known-good HECU and check it good or not.

Replace the HECU if the vehicle is normal condition and go to "Verification of Vehicle Repair" procedure.

NO

Replace the sensor if the vehicle is normal after temporarily installing a known-good sensor and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

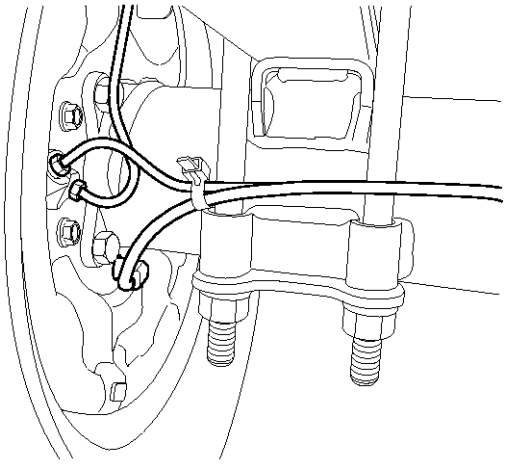
Go to the applicable DTC procedure.

NO

System OK

004A Sensor Left Hand Rear(No Trigger At All)

COMPONENT LOCATION



SUDWAB9048L

GENERAL DESCRIPTION

The wheel sensor is crucial for HECU to calculate the speed of the vehicle and determine whether the wheel is in 'Lock' mode or not. For example, in case of a front-wheel drive vehicle, the signal of the rear wheel speed is used as a reference value for the speed of the vehicle. If there occurs the difference in speed between the front and rear wheels, ABS control is performed. The wheel sensor creates a sine curve based on the magnetic field created by the permanent magnet inside the sensor when the tone wheel rotates. The frequency and the AC voltage change by a certain ratio depending on the wheel speed, and HECU determines the speed of the vehicle by calculating the frequency of the signal.

DTC DESCRIPTION

HECU continues to monitor the input signal from the wheel sensor. If the ABS control state changes abnormally when the sensor output voltage becomes low because the air gap in the rear left wheel sensor is too big, HECU determines it as a failure state and outputs a fail code.

DTC DETECTING CONDITION

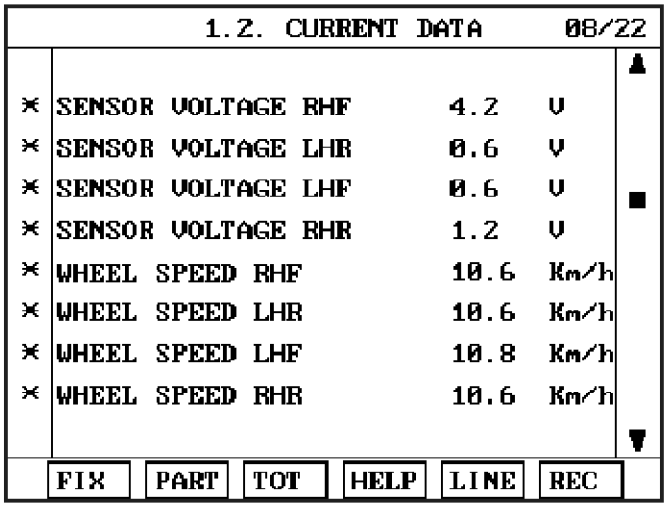
Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Check air gap. • Check bearing play and tone ring run out. • Check tone ring for damage.
Enable Conditions	Ignition ON			
Threshold Value	.Vehicle speed > 15.0 kph.Air gap 0.2 ~ 1.7 mm			
Diagnosis Time	Below 1,000 ms			
Fail Safe	Fuel Cut	No	• ABS function disabled for concerned wheel	
	Fuel Limit	Yes		
	MIL	Yes		

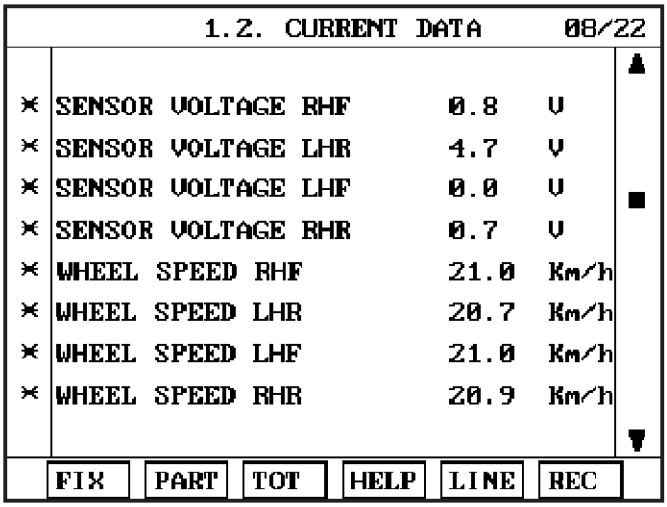
SPECIFICATION

Wheel sensor resistance	830 ~ 2,100 Ω (At 20)
Air gap	0.2 ~ 1.7 mm

MONITOR SCAN TOOL DATA

1. Start the engine.
2. Connect the scan tool to the self-diagnosis connector. Select the service data.
3. Drive the vehicle straight at a constant speed in the normal road surface.
4. Monitor the data "Wheel speed LHR" parameter on the scan tool.
   - Specification: Normal if its speed is nearly in accordance with the speed in the gauge.





SUDWAB9008L

5. Is the data measured within specification?

YES

There may be the poor contact of wheel sensor circuit or a past trouble which did not erase the memory of HECU after having repaired. Totally check the connector for looseness, poor contact, bent, corrosion, contamination, deformation, or damage.

Repair or replace it if necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to “Terminal & Connector Inspection” procedure.

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness, and terminals.

   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

Repair as necessary and then go to “Verification of Vehicle Repair” procedure.

NO

Go to “Signal Circuit Inspection” procedure.

COMPONENT INSPECTION

Sensor Air Gap Inspection

1. Turn the ignition OFF.
2. Check the air gap between left hand rear tone wheel and wheel sensor with a thickness gauge.
   - Specification: 0.2~1.7 mm
3. Is the value measured within specification?

YES

Go to next procedure.

NO

Repair it after checking wheel sensor installation condition and go to "Verification of Vehicle Repair” procedure.

Repair or replace it after checking the condition of rotor and wheel bearing and go to "Verification of Vehicle Repair” procedure.

Adjust it after checking the air gap between wheel sensor and rotor and go to "Verification of Vehicle

Repair" procedure.

Left Hand Rear Wheel Sensor Inspection

1. Turn the ignition OFF.
2. Disconnect the left hand rear connector (C37).
3. Measure the resistance between terminal positive (+) and terminal negative (-) of the left hand rear wheel sensor (C37).
   - Specification: 830 ~ 2100 Ω (At 20)
4. Is the resistance measured within specification?

YES

After checking the HECU for contamination or damage, install a known-good HECU and check it good or not.

Replace the HECU if the vehicle is normal condition and go to "Verification of Vehicle Repair" procedure.

NO

Replace the sensor if the vehicle is normal after temporarily installing a known-good sensor and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

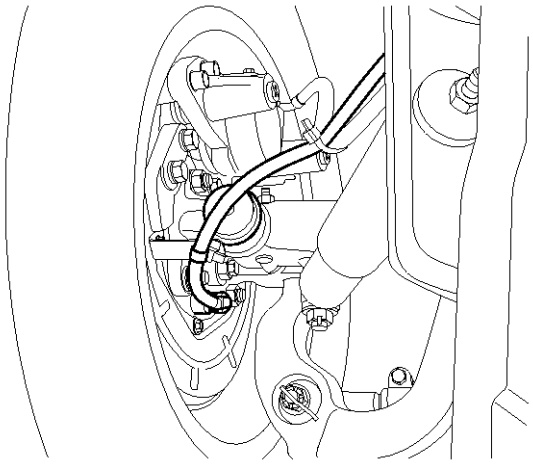
Go to the applicable DTC procedure.

NO

System OK

004B Sensor Left Hand Front(No Trigger At All)

COMPONENT LOCATION



SUDWAB9049L

GENERAL DESCRIPTION

The wheel sensor is crucial for HECU to calculate the speed of the vehicle and determine whether the wheel is in 'Lock' mode or not. For example, in case of a front-wheel drive vehicle, the signal of the rear wheel speed is used as a reference value for the speed of the vehicle. If there occurs the difference in speed between the front and rear wheels, ABS control is performed. The wheel sensor creates a sine curve based on the magnetic field created by the permanent magnet inside the sensor when the tone wheel rotates. The frequency and the AC voltage change by a certain ratio depending on the wheel speed, and HECU determines the speed of the vehicle by calculating the frequency of the signal.

DTC DESCRIPTION

HECU continues to monitor the input signal from the wheel sensor. If the ABS control state changes abnormally when the sensor output voltage becomes low because the air gap in the front left wheel sensor is too big, HECU determines it as a failure state and outputs a fail code.

DTC DETECTING CONDITION

Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Check air gap. • Check bearing play and tone ring run out. • Check tone ring for damage.
Enable Conditions	Ignition ON			
Threshold Value	.Vehicle speed > 15.0 kph. Air gap 0.2 ~ 1.7 mm			
Diagnosis Time	Below 1,000 ms			
Fail Safe	Fuel Cut	No	• ABS function disabled for concerned wheel	
	Fuel Limit	Yes		
	MIL	Yes		

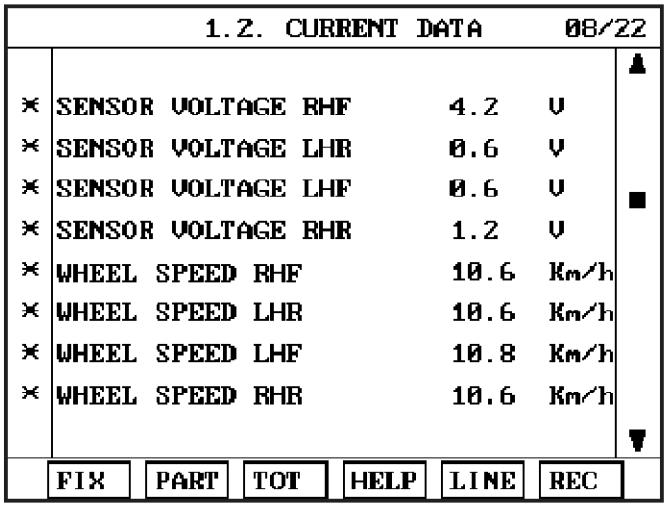
SPECIFICATION

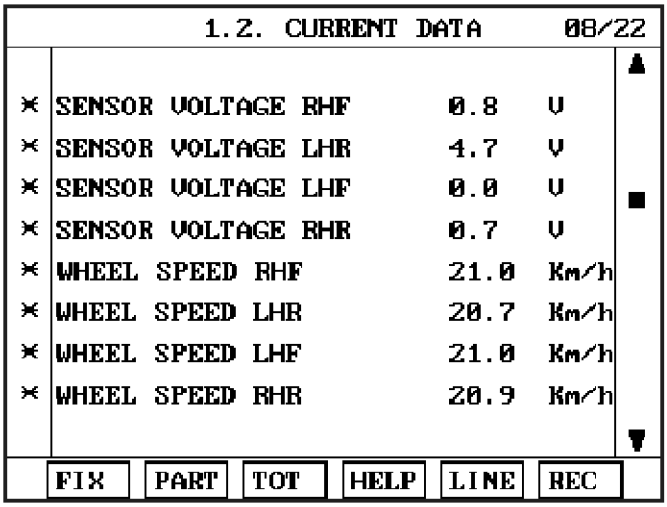
Wheel sensor resistance	830 ~ 2,100 Ω (At 20)
Air gap	0.2 ~ 1.7 mm

MONITOR SCAN TOOL DATA

1. Start the engine.
2. Connect the scan tool to the self-diagnosis connector. Select the service data.
3. Drive the vehicle straight at a constant speed in the normal road surface.
4. Monitor the data "Wheel speed LHF" parameter on the scan tool.

   ■ Specification: Normal if its speed is nearly in accordance with the speed in the gauge.





SUDWAB9008L

5. Is the data measured within specification?

YES

There may be the poor contact of wheel sensor circuit or a past trouble which did not erase the memory of HECU after having repaired. Totally check the connector for looseness, poor contact, bent, corrosion, contamination, deformation, or damage.

Repair or replace it if necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to “Terminal & Connector Inspection” procedure.

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness, and terminals.

   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

Repair as necessary and then go to “Verification of Vehicle Repair” procedure.

NO

Go to “Signal Circuit Inspection” procedure.

COMPONENT INSPECTION

Left Hand Front Wheel Sensor Inspection

1. Turn the ignition OFF.
2. Disconnect the left hand front connector (C31).
3. Measure the resistance between terminal positive (+) and terminal negative (-) of the left hand front wheel sensor.
   - Specification: 830 ~ 2,100 Ω (At 20)
4. Is the resistance measured within specification?

YES

After checking the HECU for contamination or damage, install a known-good HECU and check it good or not.

Replace the HECU if the vehicle is normal condition and go to "Verification of Vehicle Repair" procedure.

NO

Replace the sensor if the vehicle is normal after temporarily installing a known-good sensor and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

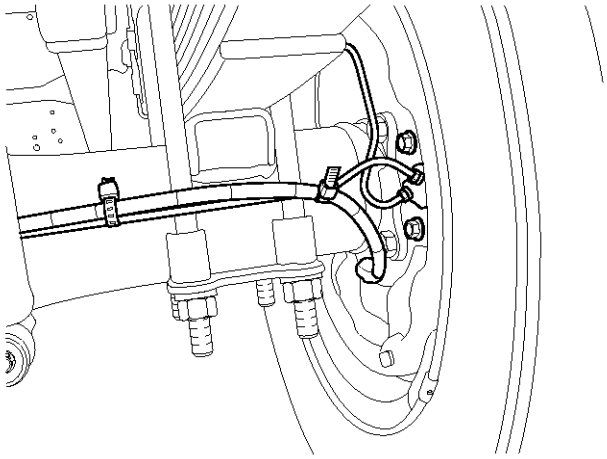
Go to the applicable DTC procedure.

NO

System OK

004C Sensor Right Hand Rear(No Trigger At All)

COMPONENT LOCATION



SUDWAB9050L

GENERAL DESCRIPTION

The wheel sensor is crucial for HECU to calculate the speed of the vehicle and determine whether the wheel is in 'Lock' mode or not. For example, in case of a front-wheel drive vehicle, the signal of the rear wheel speed is used as a reference value for the speed of the vehicle. If there occurs the difference in speed between the front and rear wheels, ABS control is performed. The wheel sensor creates a sine curve based on the magnetic field created by the permanent magnet inside the sensor when the tone wheel rotates. The frequency and the AC voltage change by a certain ratio depending on the wheel speed, and HECU determines the speed of the vehicle by calculating the frequency of the signal.

DTC DESCRIPTION

HECU continues to monitor the input signal from the wheel sensor. If the ABS control state changes abnormally when the sensor output voltage becomes low because the air gap in the Rear right wheel sensor is too big, HECU determines it as a failure state and outputs a fail code.

DTC DETECTING CONDITION

Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Check air gap. • Check bearing play and tone ring run out. • Check tone ring for damage.
Enable Conditions	Ignition ON			
Threshold Value	.Vehicle speed > 15.0 kph. Air gap 0.2 ~ 1.7 mm			
Diagnosis Time	Below 1,000 ms			
Fail Safe	Fuel Cut	No	• ABS function disabled for concerned wheel	
	Fuel Limit	Yes		
	MIL	Yes		

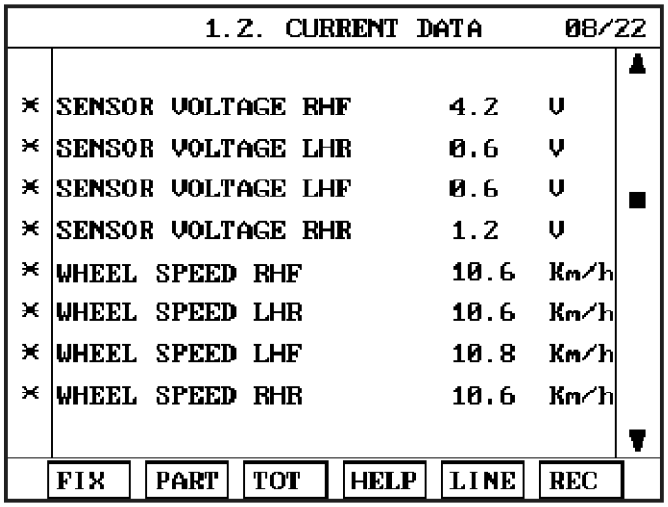
SPECIFICATION

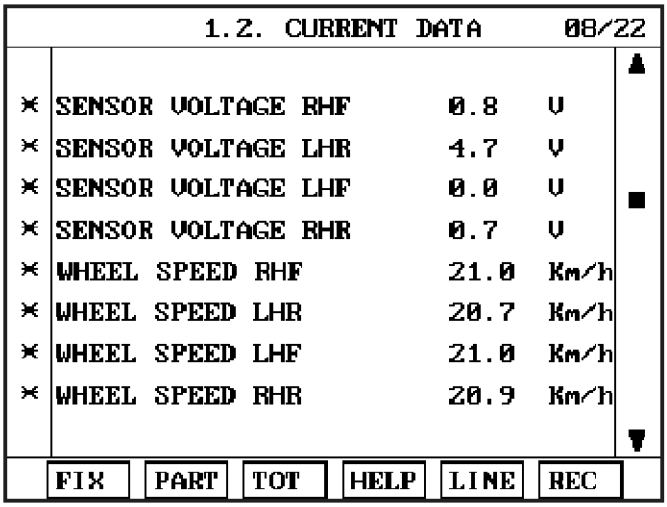
Wheel sensor resistance	830 ~ 2,100 Ω (At 20)
Air gap	0.2 ~ 1.7 mm

MONITOR SCAN TOOL DATA

1. Start the engine.
2. Connect the scan tool to the self-diagnosis connector. Select the service data.
3. Drive the vehicle straight at a constant speed in the normal road surface.
4. Monitor the data "Wheel speed RHR" parameter on the scan tool.

   ■ Specification: Normal if its speed is nearly in accordance with the speed in the gauge.





SUDWAB9008L

5. Is the data measured within specification?

YES

There may be the poor contact of wheel sensor circuit or a past trouble which did not erase the memory of HECU after having repaired. Totally check the connector for looseness, poor contact, bent, corrosion, contamination, deformation, or damage.

Repair or replace it if necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to “Terminal & Connector Inspection” procedure.

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness, and terminals.

   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

Repair as necessary and then go to “Verification of Vehicle Repair” procedure.

NO

Go to “Signal Circuit Inspection” procedure.

COMPONENT INSPECTION

Right hand rear Wheel Sensor Inspection

1. Turn the ignition OFF.
2. Disconnect the right hand rear connector (C36).
3. Measure the resistance between terminal positive (+) and terminal negative (-) of the right hand rear wheel sensor (C36).
   - Specification: 830 ~ 2100 Ω (At 20)
4. Is the resistance measured within specification?

YES

After checking the HECU for contamination or damage, install a known-good HECU and check it good or not.

Replace the HECU if the vehicle is normal condition and go to "Verification of Vehicle Repair" procedure.

NO

Replace the sensor if the vehicle is normal after temporarily installing a known-good sensor and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

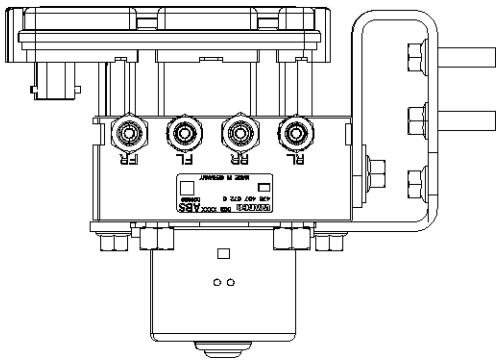
Go to the applicable DTC procedure.

NO

System OK

004D J1939 Internal Error

COMPONENT LOCATION



SUDWAB9001L

GENERAL DESCRIPTION

The Antilock Brake System (ABS) prevents the skid phenomenon that may occurs during a sudden brake while the vehicle is driving or when there is snow or water on the road. By preventing the wheels from sticking or skidding on the road while the brake is applied, ABS maintains the directional stability of the vehicle, secures the steer ability, provides the maximum braking power so as to reduce the braking distance and to pursue the overall safety of the driver and passengers. As the main device to perform ABS' braking function, HECU consists of an input amplifier circuit that processes the input signal, an ABS control and SAFETY circuit that calculates the control and performs FAIL SAFE, an output circuit that drives the pressure control valve, a voltage adjustment circuit that regulates the voltage, and a failure memory circuit that memorizes any malfunctioning. In case of a system malfunctioning, the warning light is turned on, and at the same time, the power to the pressure control valve is cut off, and the operation of ABS is stopped.

DTC DESCRIPTION

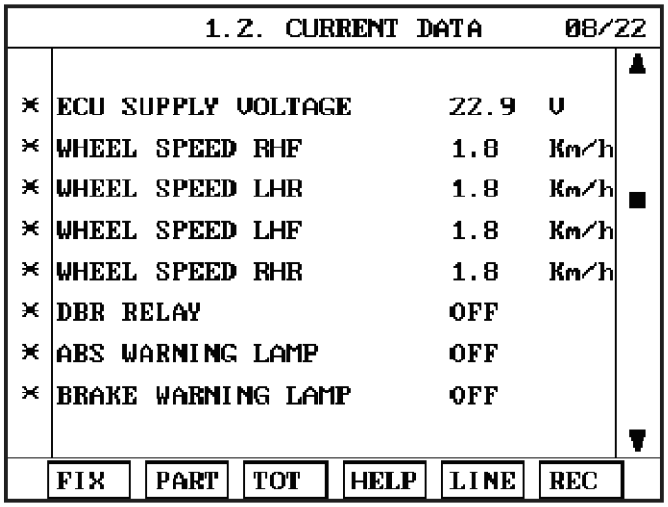
HECU continues to monitor the internal components, such as memory, input and output circuits. In case of an error during the operation of the control system, HECU determines whether it is a failure state and outputs a fail code.

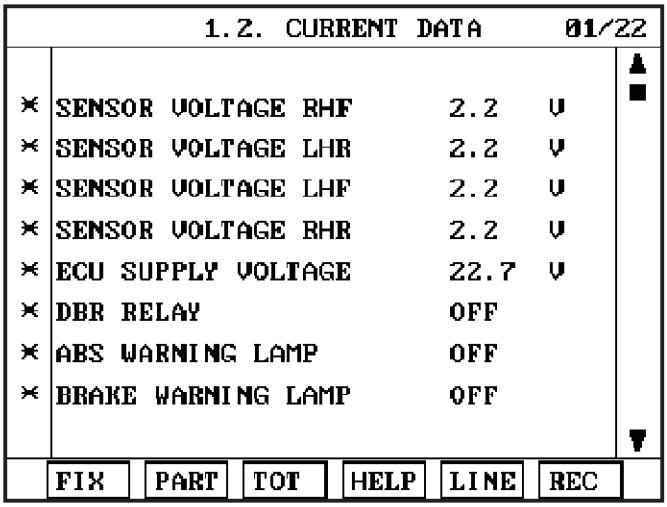
DTC DETECTING CONDITION

Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Replace ECU.
Enable Conditions	Ignition ON			
Threshold Value	When the HECU detects malfunction in the control system			
Diagnosis Time	Below 1,000 ms			
Fail Safe	Fuel Cut	No	• ABS disabled	
	Fuel Limit	Yes		
	MIL	Yes		

MONITOR SCAN TOOL DATA

1. Connect scan tool to the self-diagnosis connector.
2. Turn the ignition ON.
3. Monitor the service data on the scan tool.





SUDWAB9007L

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness, and terminals.

   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

   YES

   Repair as necessary and then go to “Verification of Vehicle Repair” procedure.

   NO

   Go to “Signal Circuit Inspection” procedure.

COMPONENT INSPECTION

1. Start the engine.
2. Drive the vehicle with approx. 15km/h or higher.
3. Turn the ignition ON. Leave the engine OFF.
4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
7. Are any diagnostic trouble codes (DTCs) detected?

YES

Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to “Verification of Vehicle Repair” procedure.

NO

There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. And go to "Verification of Vehicle Repair” procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

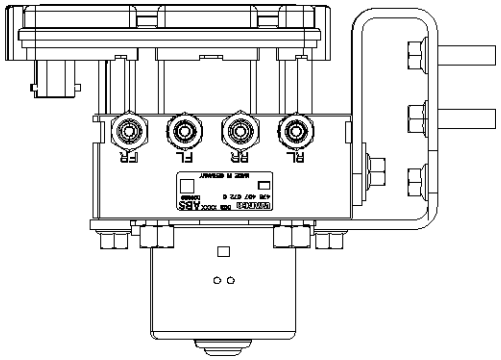
Go to the applicable DTC procedure.

NO

System OK

004E J1939 Bus

COMPONENT LOCATION



SUDWAB9001L

GENERAL DESCRIPTION

The Antilock Brake System (ABS) prevents the skid phenomenon that may occurs during a sudden brake while the vehicle is driving or when there is snow or water on the road. By preventing the wheels from sticking or skidding on the road while the brake is applied, ABS maintains the directional stability of the vehicle, secures the steer ability, provides the maximum braking power so as to reduce the braking distance and to pursue the overall safety of the driver and passengers. As the main device to perform ABS' braking function, HECU consists of an input amplifier circuit that processes the input signal, an ABS control and SAFETY circuit that calculates the control and performs FAIL SAFE, an output circuit that drives the pressure control valve, a voltage adjustment circuit that regulates the voltage, and a failure memory circuit that memorizes any malfunctioning. In case of a system malfunctioning, the warning light is turned on, and at the same time, the power to the pressure control valve is cut off, and the operation of ABS is stopped.

DTC DESCRIPTION

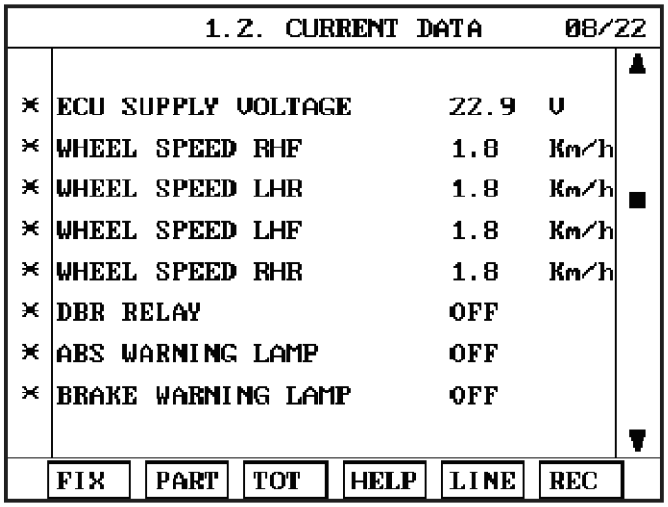
HECU continues to monitor the internal components, such as memory, input and output circuits. In case of an error during the operation of the control system, HECU determines whether it is a failure state and outputs a fail code.

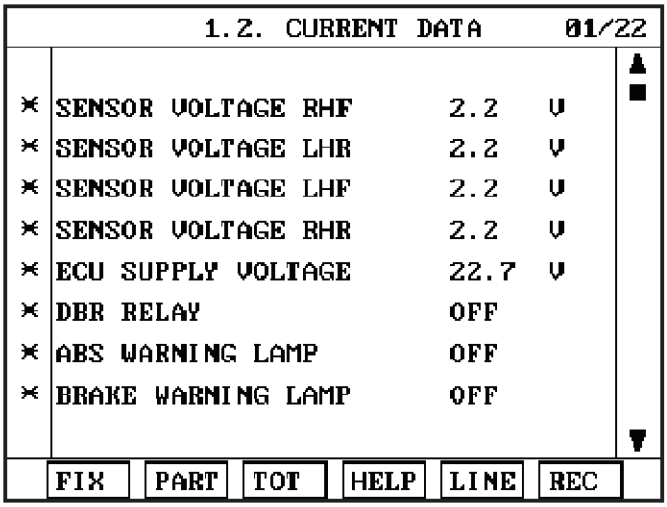
DTC DETECTING CONDITION

Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Replace ECU.
Enable Conditions	Ignition ON			
Threshold Value	When the HECU detects malfunction in the control system			
Diagnosis Time	Below 1,000 ms			
Fail Safe	Fuel Cut	No	• ABS disabled	
	Fuel Limit	Yes		
	MIL	Yes		

MONITOR SCAN TOOL DATA

1. Connect scan tool to the self-diagnosis connector.
2. Turn the ignition ON.
3. Monitor the service data on the scan tool.





SUDWAB9007L

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness, and terminals.

   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

   YES

   Repair as necessary and then go to “Verification of Vehicle Repair” procedure.

   NO

   Go to “Signal Circuit Inspection” procedure.

COMPONENT INSPECTION

1. Start the engine.
2. Drive the vehicle with approx. 15km/h or higher.
3. Turn the ignition ON. Leave the engine OFF.
4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
7. Are any diagnostic trouble codes (DTCs) detected?

YES

Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to “Verification of Vehicle Repair” procedure.

NO

There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. And go to "Verification of Vehicle Repair” procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

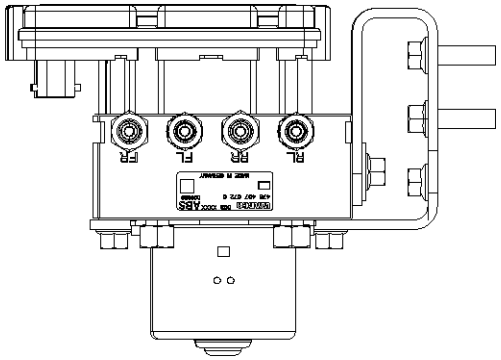
Go to the applicable DTC procedure.

NO

System OK

004F J1939 Message

COMPONENT LOCATION



SUDWAB9001L

GENERAL DESCRIPTION

The Antilock Brake System (ABS) prevents the skid phenomenon that may occurs during a sudden brake while the vehicle is driving or when there is snow or water on the road. By preventing the wheels from sticking or skidding on the road while the brake is applied, ABS maintains the directional stability of the vehicle, secures the steer ability, provides the maximum braking power so as to reduce the braking distance and to pursue the overall safety of the driver and passengers. As the main device to perform ABS' braking function, HECU consists of an input amplifier circuit that processes the input signal, an ABS control and SAFETY circuit that calculates the control and performs FAIL SAFE, an output circuit that drives the pressure control valve, a voltage adjustment circuit that regulates the voltage, and a failure memory circuit that memorizes any malfunctioning. In case of a system malfunctioning, the warning light is turned on, and at the same time, the power to the pressure control valve is cut off, and the operation of ABS is stopped.

DTC DESCRIPTION

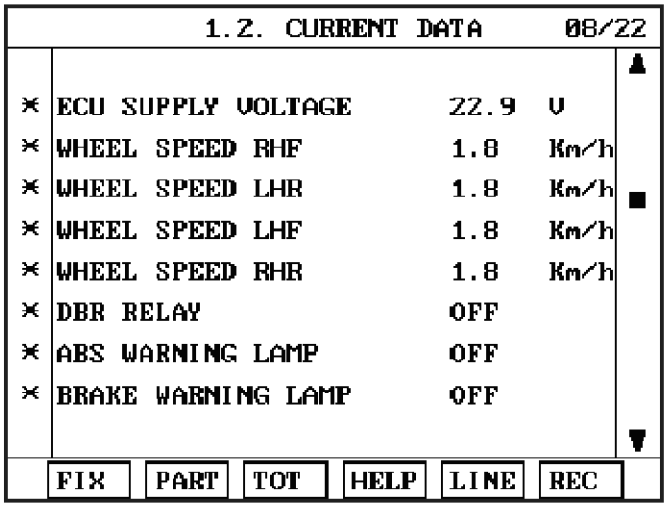
HECU continues to monitor the internal components, such as memory, input and output circuits. In case of an error during the operation of the control system, HECU determines whether it is a failure state and outputs a fail code.

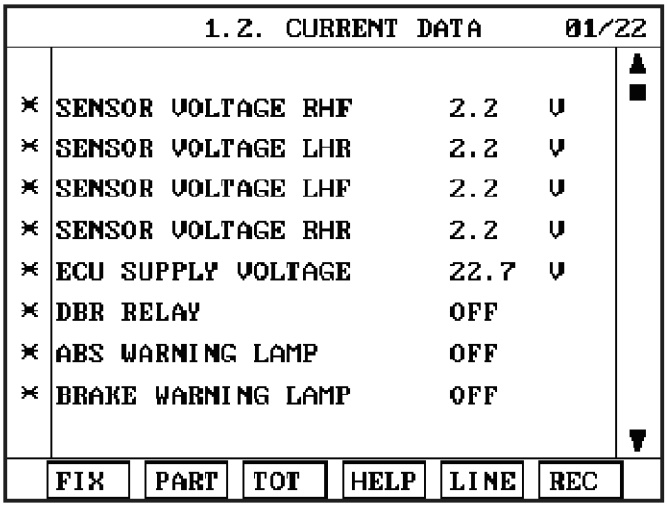
DTC DETECTING CONDITION

Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Replace ECU.
Enable Conditions	Ignition ON			
Threshold Value	When the HECU detects malfunction in the control system			
Diagnosis Time	Below 1,000 ms			
Fail Safe	Fuel Cut	No	• ABS disabled	
	Fuel Limit	Yes		
	MIL	Yes		

MONITOR SCAN TOOL DATA

1. Connect scan tool to the self-diagnosis connector.
2. Turn the ignition ON.
3. Monitor the service data on the scan tool.





SUDWAB9007L

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness, and terminals.

   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

   YES

   Repair as necessary and then go to “Verification of Vehicle Repair” procedure.

   NO

   Go to “Signal Circuit Inspection” procedure.

COMPONENT INSPECTION

1. Start the engine.
2. Drive the vehicle with approx. 15km/h or higher.
3. Turn the ignition ON. Leave the engine OFF.
4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
7. Are any diagnostic trouble codes (DTCs) detected?

YES

Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to “Verification of Vehicle Repair” procedure.

NO

There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. And go to "Verification of Vehicle Repair” procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

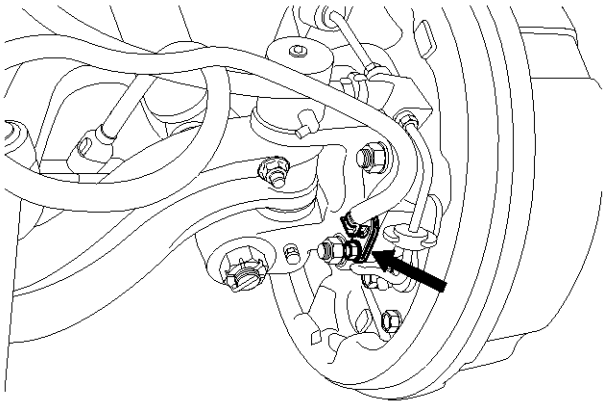
Go to the applicable DTC procedure.

NO

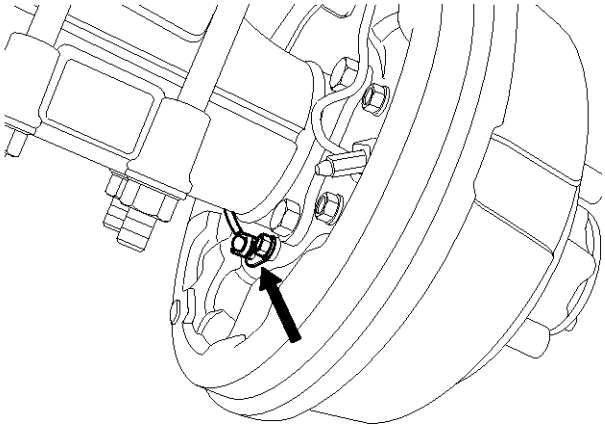
System OK

0050 Inlet Valve(Right Hand Front) Actuation Time Unplausible

COMPONENT LOCATION



Front wheel speed sensor



Rear wheel speed sensor

SUDWAB9002L

GENERAL DESCRIPTION

The Antilock Brake System (ABS) prevents the skid phenomenon that may occurs during a sudden brake while the vehicle is driving or when there is snow or water on the road. By preventing the wheels from sticking or skidding on the road while the brake is applied, ABS maintains the directional stability of the vehicle, secures the steer ability, provides the maximum braking power so as to reduce the braking distance and to pursue the overall safety of the driver and passengers. As the main device to perform ABS' braking function, HECU consists of an input amplifier circuit that processes the input signal, an ABS control and SAFETY circuit that calculates the control and performs FAIL SAFE, an output circuit that drives the pressure control valve, a voltage adjustment circuit that regulates the voltage, and a failure memory circuit that memorizes any malfunctioning. In case of a system malfunctioning, the warning light is turned on, and at the same time, the power to the pressure control valve is cut off, and the operation of ABS is stopped.

DTC DESCRIPTION

HECU continues to monitor the internal components, such as memory, input and output circuits. In case of an error during the operation of the control system, HECU determines whether it is a failure state and outputs a fail code.

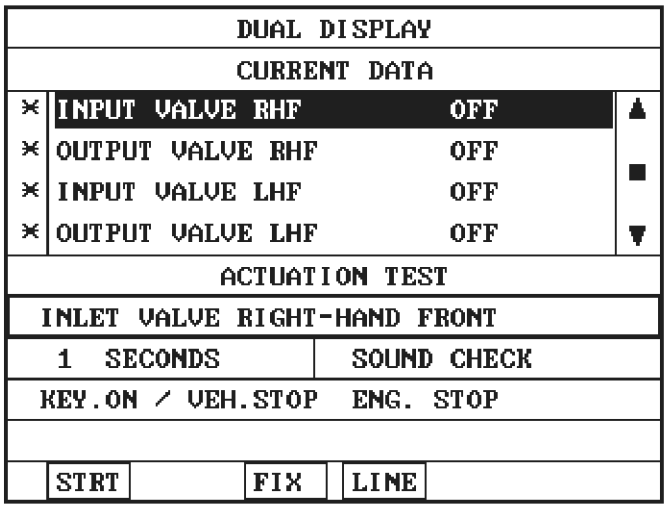
DTC DETECTING CONDITION

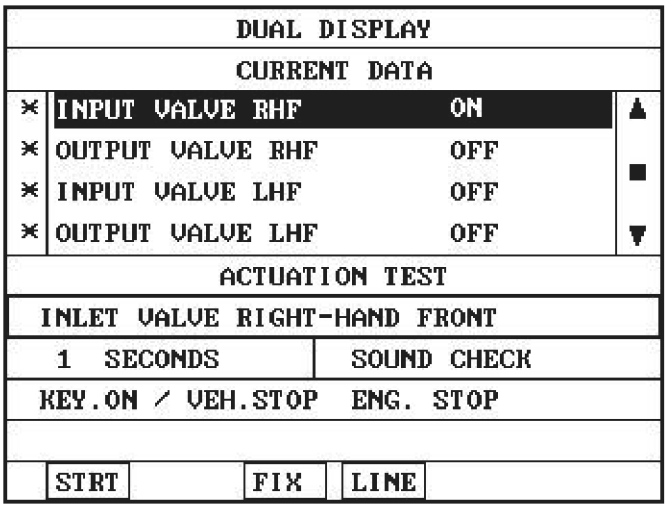
Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Replace ECU.
Enable Conditions	Ignition ON			
Threshold Value	.When the HECU detects malfunction in the control system.Air gap : 0.2~1.7 mm			
Diagnosis Time	Below 1,000 ms			
Fail Safe	Fuel Cut	No	• ABS disabled	
	Fuel Limit	Yes		
	MIL	Yes		

MONITOR SCAN TOOL DATA

1. Connect the scan tool to the self-diagnosis connector.
2. Turn the ignition ON.
3. Select the data "Actuation test".
4. Check the right hand front inlet valve for operation when activating the actuator.

   ■ Specification: Normal if the activating sound is heard.





SUDWAB9044L

Fig1) Right hand front inlet valve Actuation test at IG ON

5. Does the valve activate normally?

YES

There may be a transient trouble due to defective valve or a past trouble which did not erase the memory of HECU after having repair.

And go to "Verification of Vehicle Repair" procedure.

NO

Go to "Component Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness, and terminals.

   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

Repair as necessary and then go to “Verification of

Vehicle Repair" procedure.

NO

Go to "Signal Circuit Inspection" procedure.

COMPONENT INSPECTION

1. Start the engine.
2. Drive the vehicle with approx. 15km/h or higher.
3. Turn the ignition ON. Leave the engine OFF.
4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
7. Are any diagnostic trouble codes (DTCs) detected?

YES

Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to "Verification of Vehicle Repair" procedure.

NO

There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. And go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

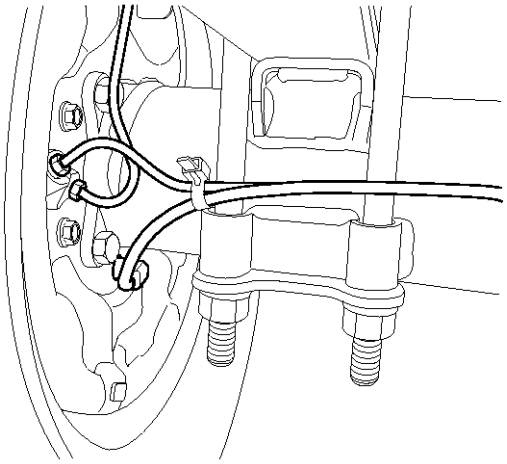
Go to the applicable DTC procedure.

NO

System OK

0051 Inlet Valve(Left Hand Rear) Actuation Time Unplausible

COMPONENT LOCATION



SUDWAB9048L

GENERAL DESCRIPTION

The Antilock Brake System (ABS) prevents the skid phenomenon that may occurs during a sudden brake while the vehicle is driving or when there is snow or water on the road. By preventing the wheels from sticking or skidding on the road while the brake is applied, ABS maintains the directional stability of the vehicle, secures the steer ability, provides the maximum braking power so as to reduce the braking distance and to pursue the overall safety of the driver and passengers. As the main device to perform ABS' braking function, HECU consists of an input amplifier circuit that processes the input signal, an ABS control and SAFETY circuit that calculates the control and performs FAIL SAFE, an output circuit that drives the pressure control valve, a voltage adjustment circuit that regulates the voltage, and a failure memory circuit that memorizes any malfunctioning. In case of a system malfunctioning, the warning light is turned on, and at the same time, the power to the pressure control valve is cut off, and the operation of ABS is stopped.

DTC DESCRIPTION

HECU continues to monitor the internal components, such as memory, input and output circuits. In case of an error during the operation of the control system, HECU determines whether it is a failure state and outputs a fail code.

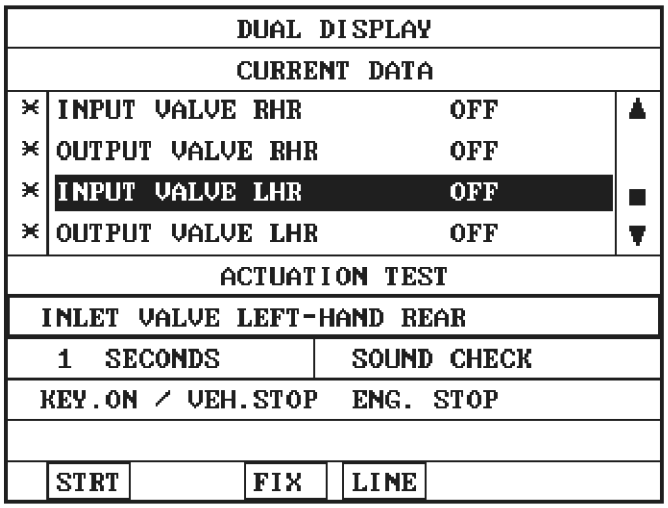
DTC DETECTING CONDITION

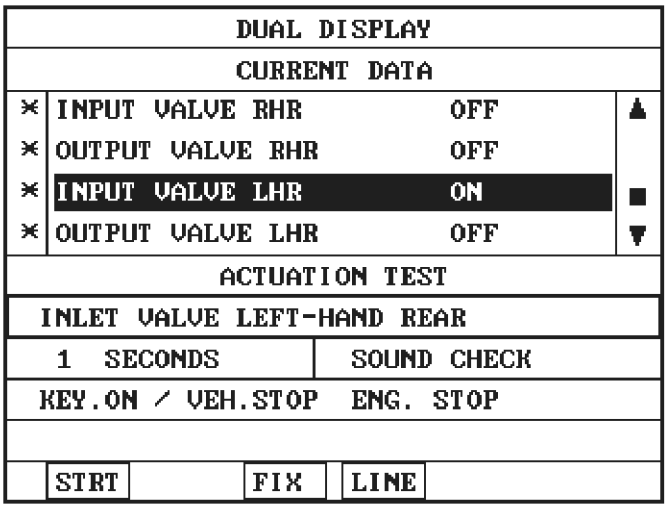
Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Replace ECU.
Enable Conditions	Ignition ON			
Threshold Value	When the HECU detects malfunction in the control system.Air gap : 0.2 ~1.7 mm			
Diagnosis Time	Below 1,000 ms			
Fail Safe	Fuel Cut	No	• ABS disabled	
	Fuel Limit	Yes		
	MIL	Yes		

MONITOR SCAN TOOL DATA

1. Connect the scan tool to the self-diagnosis connector.
2. Turn the ignition ON.
3. Select the data "Actuation test".
4. Check the left hand rear inlet valve for operation when activating the actuator.

   ■ Specification: Normal if the activating sound is heard.





SUDWAB9045L

Fig1) Left hand rear inlet valve Actuation test at IG ON

5. Does the valve activate normally?

YES

There may be a transient trouble due to defective valve or a past trouble which did not erase the memory of HECU after having repair.

And go to "Verification of Vehicle Repair" procedure.

NO

Go to "Component Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness, and terminals.

   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

Repair as necessary and then go to “Verification of

Vehicle Repair" procedure.

NO

Go to "Signal Circuit Inspection" procedure.

COMPONENT INSPECTION

1. Start the engine.
2. Drive the vehicle with approx. 15km/h or higher.
3. Turn the ignition ON. Leave the engine OFF.
4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
7. Are any diagnostic trouble codes (DTCs) detected?

YES

Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to "Verification of Vehicle Repair" procedure.

NO

There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. And go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

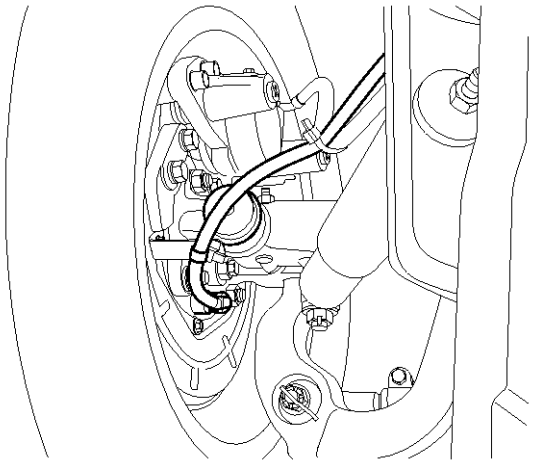
Go to the applicable DTC procedure.

NO

System OK

0052 Inlet Valve(Left Hand Front) Actuation Time Unplausible

COMPONENT LOCATION



SUDWAB9049L

GENERAL DESCRIPTION

The Antilock Brake System (ABS) prevents the skid phenomenon that may occurs during a sudden brake while the vehicle is driving or when there is snow or water on the road. By preventing the wheels from sticking or skidding on the road while the brake is applied, ABS maintains the directional stability of the vehicle, secures the steer ability, provides the maximum braking power so as to reduce the braking distance and to pursue the overall safety of the driver and passengers. As the main device to perform ABS' braking function, HECU consists of an input amplifier circuit that processes the input signal, an ABS control and SAFETY circuit that calculates the control and performs FAIL SAFE, an output circuit that drives the pressure control valve, a voltage adjustment circuit that regulates the voltage, and a failure memory circuit that memorizes any malfunctioning. In case of a system malfunctioning, the warning light is turned on, and at the same time, the power to the pressure control valve is cut off, and the operation of ABS is stopped.

DTC DESCRIPTION

HECU continues to monitor the internal components, such as memory, input and output circuits. In case of an error during the operation of the control system, HECU determines whether it is a failure state and outputs a fail code.

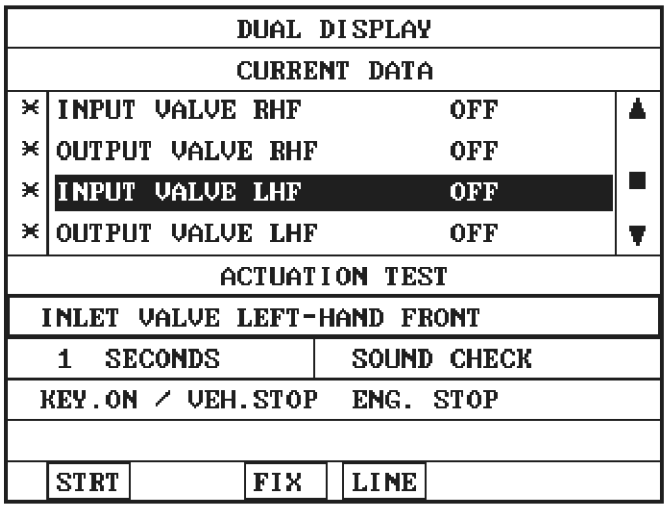
DTC DETECTING CONDITION

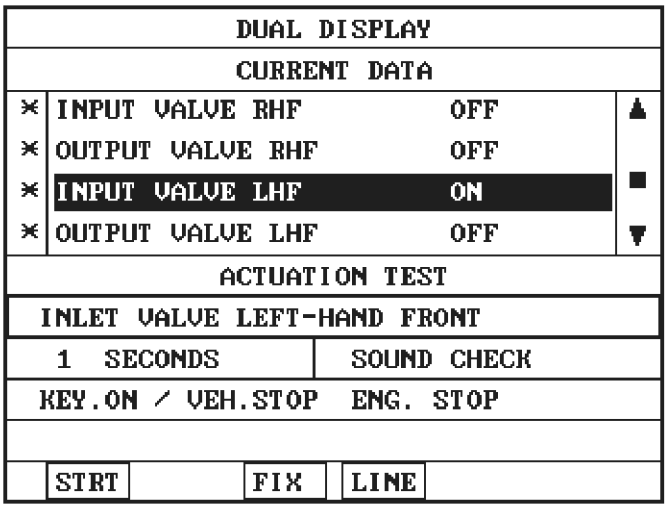
Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Replace ECU.
Enable Conditions	Ignition ON			
Threshold Value	When the HECU detects malfunction in the control system.Air gap : 0.2 ~1.7 mm			
Diagnosis Time	Below 1,000 ms			
Fail Safe	Fuel Cut	No	• ABS disabled	
	Fuel Limit	Yes		
	MIL	Yes		

MONITOR SCAN TOOL DATA

1. Connect the scan tool to the self-diagnosis connector.
2. Turn the ignition ON.
3. Select the data "Actuation test".
4. Check the left hand front inlet valve for operation when activating the actuator.

   ■ Specification: Normal if the activating sound is heard.





SUDWAB9046L

Fig1) Left hand front inlet valve Actuation test at IG ON

5. Does the valve activate normally?

YES

There may be a transient trouble due to defective valve or a past trouble which did not erase the memory of HECU after having repair.

And go to "Verification of Vehicle Repair" procedure.

NO

Go to "Component Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness, and terminals.

   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

Repair as necessary and then go to “Verification of

Vehicle Repair" procedure.

NO

Go to "Signal Circuit Inspection" procedure.

COMPONENT INSPECTION

1. Start the engine.
2. Drive the vehicle with approx. 15km/h or higher.
3. Turn the ignition ON. Leave the engine OFF.
4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
7. Are any diagnostic trouble codes (DTCs) detected?

YES

Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to "Verification of Vehicle Repair" procedure.

NO

There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. And go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

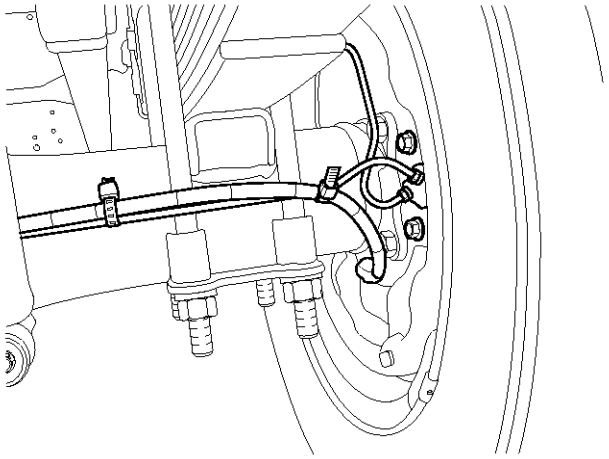
Go to the applicable DTC procedure.

NO

System OK

0053 Inlet Valve(Right Hand Rear) Actuation Time Unplausible

COMPONENT LOCATION



SUDWAB9050L

GENERAL DESCRIPTION

The Antilock Brake System (ABS) prevents the skid phenomenon that may occurs during a sudden brake while the vehicle is driving or when there is snow or water on the road. By preventing the wheels from sticking or skidding on the road while the brake is applied, ABS maintains the directional stability of the vehicle, secures the steer ability, provides the maximum braking power so as to reduce the braking distance and to pursue the overall safety of the driver and passengers. As the main device to perform ABS' braking function, HECU consists of an input amplifier circuit that processes the input signal, an ABS control and SAFETY circuit that calculates the control and performs FAIL SAFE, an output circuit that drives the pressure control valve, a voltage adjustment circuit that regulates the voltage, and a failure memory circuit that memorizes any malfunctioning. In case of a system malfunctioning, the warning light is turned on, and at the same time, the power to the pressure control valve is cut off, and the operation of ABS is stopped.

DTC DESCRIPTION

HECU continues to monitor the internal components, such as memory, input and output circuits. In case of an error during the operation of the control system, HECU determines whether it is a failure state and outputs a fail code.

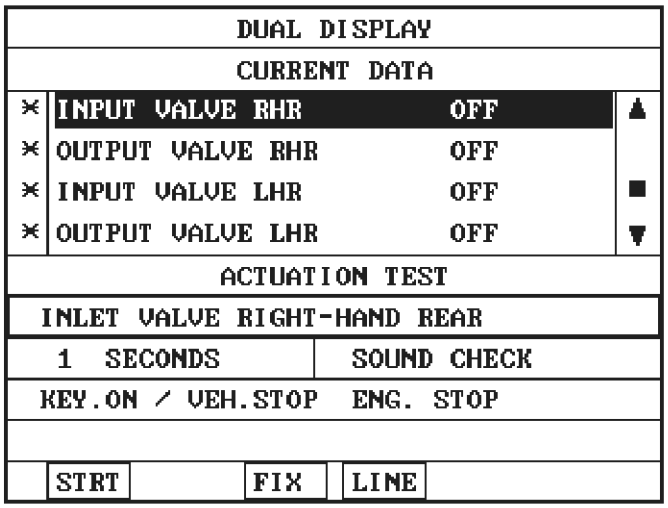
DTC DETECTING CONDITION

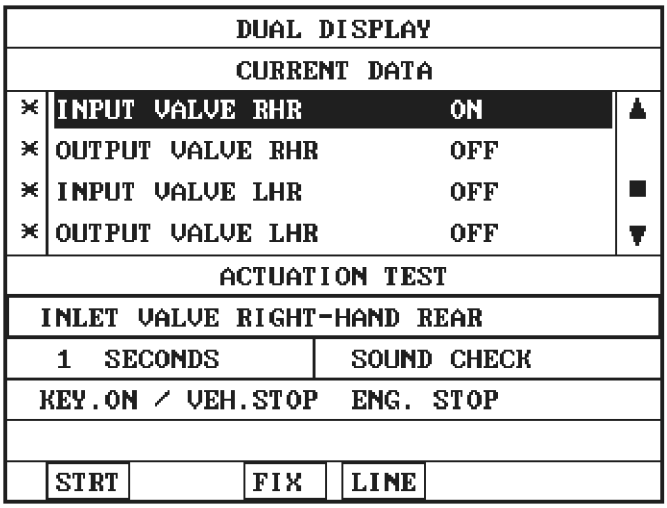
Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Replace ECU.
Enable Conditions	Ignition ON			
Threshold Value	When the HECU detects malfunction in the control system.Air gap : 0.2 ~1.7 mm			
Diagnosis Time	Below 1,000 ms			
Fail Safe	Fuel Cut	No	• ABS disabled	
	Fuel Limit	Yes		
	MIL	Yes		

MONITOR SCAN TOOL DATA

1. Connect the scan tool to the self-diagnosis connector.
2. Turn the ignition ON.
3. Select the data "Actuation test".
4. Check the right hand rear inlet valve for operation when activating the actuator.

   ■ Specification: Normal if the activating sound is heard.





SUDWAB9022L

Fig1) Right hand rear inlet valve Actuation test at IG ON

5. Does the valve activate normally?

YES

There may be a transient trouble due to defective valve or a past trouble which did not erase the memory of HECU after having repair.

And go to "Verification of Vehicle Repair" procedure.

NO

Go to "Component Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness, and terminals.

   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

Repair as necessary and then go to “Verification of

Vehicle Repair" procedure.

NO

Go to "Signal Circuit Inspection" procedure.

COMPONENT INSPECTION

1. Start the engine.
2. Drive the vehicle with approx. 15km/h or higher.
3. Turn the ignition ON. Leave the engine OFF.
4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
7. Are any diagnostic trouble codes (DTCs) detected?

YES

Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to "Verification of Vehicle Repair" procedure.

NO

There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. And go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

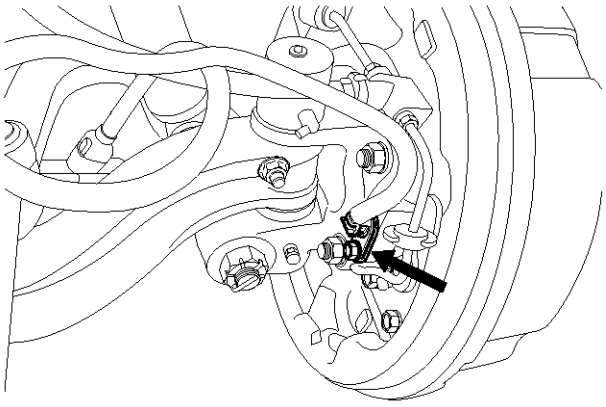
Go to the applicable DTC procedure.

NO

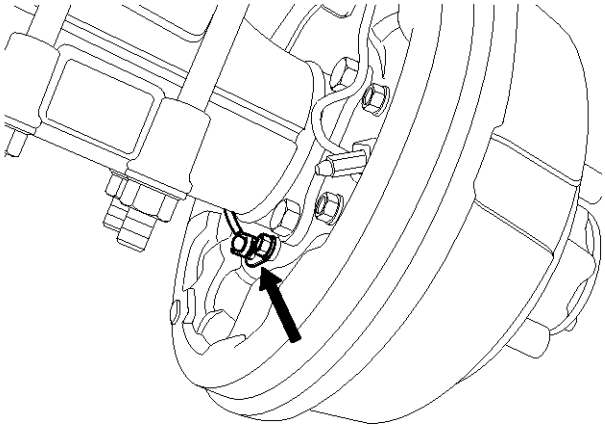
System OK

0054 Pole Wheel Right Hand Front(Cyclic Failure)

COMPONENT LOCATION



Front wheel speed sensor



Rear wheel speed sensor

SUDWAB9002L

GENERAL DESCRIPTION

The wheel sensor is crucial for HECU to calculate the speed of the vehicle and determine whether the wheel is in 'Lock' mode or not. For example, in case of a front-wheel drive vehicle, the signal of the rear wheel speed is used as a reference value for the speed of the vehicle. If there occurs the difference in speed between the front and rear wheels, ABS control is performed. The wheel sensor creates a sine curve based on the magnetic field created by the permanent magnet inside the sensor when the tone wheel rotates. The frequency and the AC voltage change by a certain ratio depending on the wheel speed, and HECU determines the speed of the vehicle by calculating the frequency of the signal.

DTC DESCRIPTION

HECU continues to monitor the input signal from the wheel sensor. If the ABS control state changes abnormally when the sensor output voltage becomes low because the air gap in the front right wheel sensor is too big, HECU determines it as a failure state and outputs a fail code.

DTC DETECTING CONDITION

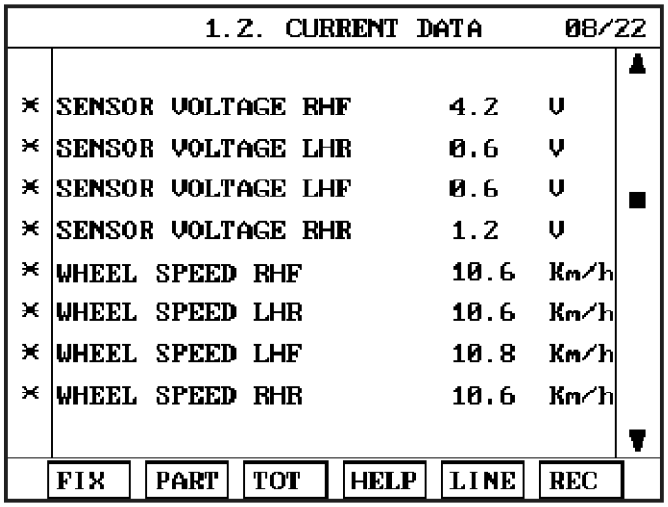
Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Check air gap. • Check bearing play and tone ring run out. • Check tone ring for damage.
Enable Conditions	Ignition ON			
Threshold Value	Vehicle speed > 5.0 kph. Air gap : 0.2~1.7 mm			
Diagnosis Time	Below 1,000 ms			
Fail Safe	Fuel Cut	No	• ABS function disabled for concerned wheel	
	Fuel Limit	Yes		
	MIL	Yes		

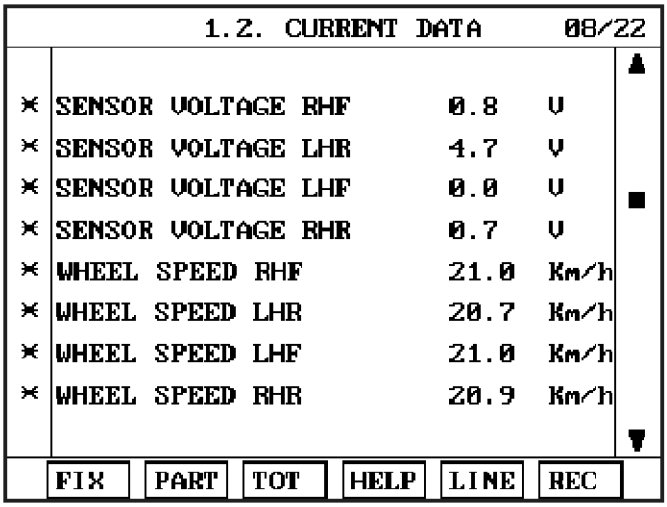
SPECIFICATION

Air gap	0.2 ~ 1.7 mm

MONITOR SCAN TOOL DATA

1. Start the engine.
2. Connect the scan tool to the self-diagnosis connector. Select the service data.
3. Drive the vehicle straight at a constant speed in the normal road surface.
4. Monitor the data "Wheel speed RHF" parameter on the scan tool.
   ■ Specification: Normal if its speed is nearly in accordance with the speed in the gauge.





SUDWAB9008L

5. Is the data measured within specification?

YES

There may be the poor contact of wheel sensor circuit or a past trouble which did not erase the memory of HECU after having repaired. Totally check the connector for looseness, poor contact, bent, corrosion, contamination, deformation, or damage.

Repair or replace it if necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to “Terminal & Connector Inspection” procedure.

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness, and terminals.

   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

Repair as necessary and then go to “Verification of Vehicle Repair” procedure.

NO

Go to “Signal Circuit Inspection” procedure.

COMPONENT INSPECTION

Sensor Air Gap Inspection

1. Turn the ignition OFF.
2. Check the air gap between right hand front tone wheel and wheel sensor with a thickness gauge.
   ■ Specification: 0.2~1.7 mm
3. Is the value measured within specification?

YES

Go to next procedure.

NO

Repair it after checking wheel sensor installation condition and go to "Verification of Vehicle Repair” procedure.

Repair or replace it after checking the condition of rotor and wheel bearing and go to "Verification of Vehicle Repair” procedure.

Adjust it after checking the air gap between wheel sensor and rotor and go to "Verification of Vehicle

Repair" procedure.

Check Number of Teeth on Tone Ring

1. Turn the ignition OFF.
2. Check the number of teeth on right hand front tone ring.
3. Is the number of teeth normal?

YES

Go to "Verification of Vehicle Repair" procedure.

NO

Repair it or replace with known-good one and check the condition of vehicle.

If normal, replace with new one. And go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

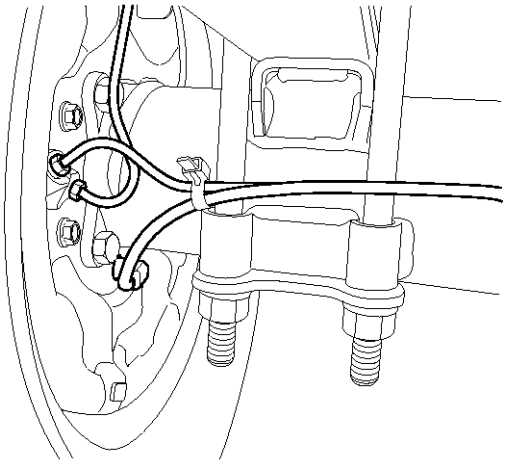
Go to the applicable DTC procedure.

NO

System OK

0055 Pole Wheel Left Hand Rear(Cyclic Failure)

COMPONENT LOCATION



SUDWAB9048L

GENERAL DESCRIPTION

The wheel sensor is crucial for HECU to calculate the speed of the vehicle and determine whether the wheel is in 'Lock' mode or not. For example, in case of a front-wheel drive vehicle, the signal of the rear wheel speed is used as a reference value for the speed of the vehicle. If there occurs the difference in speed between the front and rear wheels, ABS control is performed. The wheel sensor creates a sine curve based on the magnetic field created by the permanent magnet inside the sensor when the tone wheel rotates. The frequency and the AC voltage change by a certain ratio depending on the wheel speed, and HECU determines the speed of the vehicle by calculating the frequency of the signal.

DTC DESCRIPTION

HECU continues to monitor the input signal from the wheel sensor. If the ABS control state changes abnormally when the sensor output voltage becomes low because the air gap in the rear left wheel sensor is too big, HECU determines it as a failure state and outputs a fail code.

DTC DETECTING CONDITION

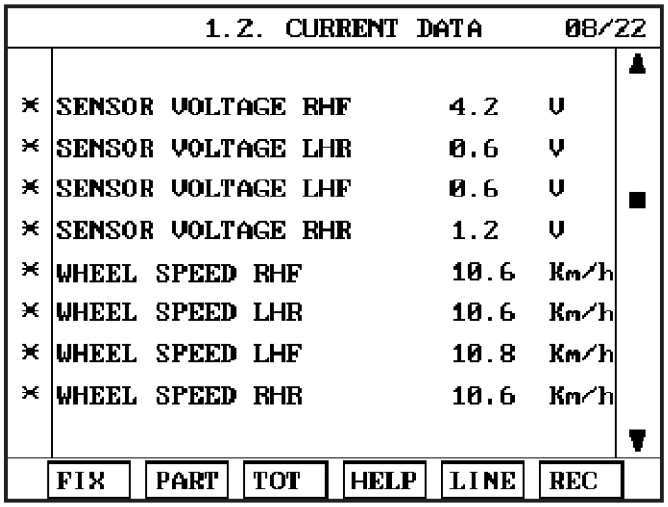
Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Check air gap. • Check bearing play and tone ring run out. • Check tone ring for damage.
Enable Conditions	Ignition ON			
Threshold Value	Vehicle speed > 5.0 kph. Air gap : 0.2~1.7 mm			
Diagnosis Time	Below 1,000 ms			
Fail Safe	Fuel Cut	No	• ABS function disabled for concerned wheel	
	Fuel Limit	Yes		
	MIL	Yes		

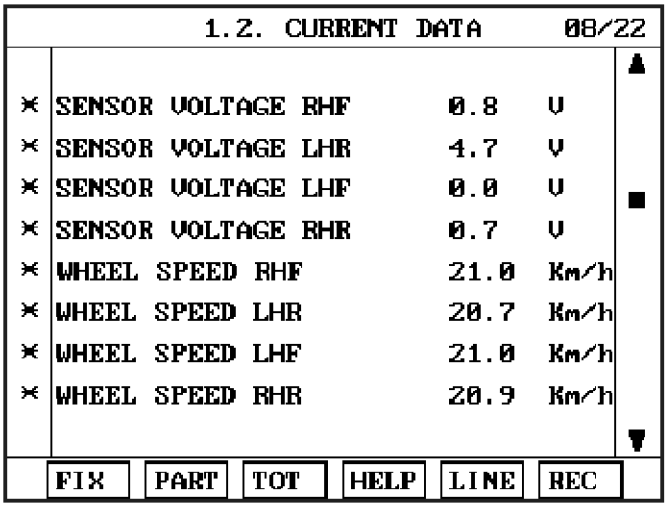
SPECIFICATION

Air gap	0.2 ~ 1.7 mm

MONITOR SCAN TOOL DATA

1. Start the engine.
2. Connect the scan tool to the self-diagnosis connector. Select the service data.
3. Drive the vehicle straight at a constant speed in the normal road surface.
4. Monitor the data "Wheel speed LHR" parameter on the scan tool.
   - Specification: Normal if its speed is nearly in accordance with the speed in the gauge.





SUDWAB9008L

5. Is the data measured within specification?

YES

There may be the poor contact of wheel sensor circuit or a past trouble which did not erase the memory of HECU after having repaired. Totally check the connector for looseness, poor contact, bent, corrosion, contamination, deformation, or damage.

Repair or replace it if necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to “Terminal & Connector Inspection” procedure.

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness, and terminals.

   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

Repair as necessary and then go to “Verification of Vehicle Repair” procedure.

NO

Go to “Signal Circuit Inspection” procedure.

COMPONENT INSPECTION

Sensor Air Gap Inspection

1. Turn the ignition OFF.
2. Check the air gap between left hand rear tone wheel and wheel sensor with a thickness gauge.
   - Specification: 0.2~1.7 mm
3. Is the value measured within specification?

YES

Go to next procedure.

NO

Repair it after checking wheel sensor installation condition and go to "Verification of Vehicle Repair” procedure.

Repair or replace it after checking the condition of rotor and wheel bearing and go to "Verification of Vehicle Repair” procedure.

Adjust it after checking the air gap between wheel sensor and rotor and go to "Verification of Vehicle

Repair" procedure.

Check Number of Teeth on Tone Ring

1. Turn the ignition OFF.
2. Check the number of teeth on left hand rear tone ring.
3. Is the number of teeth normal?

YES

Go to "Verification of Vehicle Repair" procedure.

NO

Repair it or replace with known-good one and check the condition of vehicle.

If normal, replace with new one. And go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

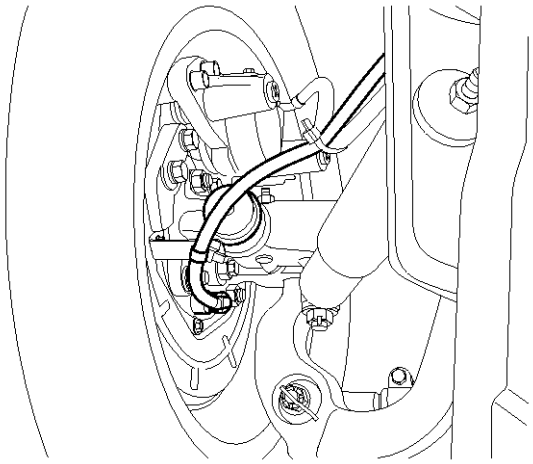
Go to the applicable DTC procedure.

NO

System OK

0056 Pole Wheel Left Hand Front(Cyclic Failure)

COMPONENT LOCATION



SUDWAB9049L

GENERAL DESCRIPTION

The wheel sensor is crucial for HECU to calculate the speed of the vehicle and determine whether the wheel is in 'Lock' mode or not. For example, in case of a front-wheel drive vehicle, the signal of the rear wheel speed is used as a reference value for the speed of the vehicle. If there occurs the difference in speed between the front and rear wheels, ABS control is performed. The wheel sensor creates a sine curve based on the magnetic field created by the permanent magnet inside the sensor when the tone wheel rotates. The frequency and the AC voltage change by a certain ratio depending on the wheel speed, and HECU determines the speed of the vehicle by calculating the frequency of the signal.

DTC DESCRIPTION

HECU continues to monitor the input signal from the wheel sensor. If the ABS control state changes abnormally when the sensor output voltage becomes low because the air gap in the front left wheel sensor is too big, HECU determines it as a failure state and outputs a fail code.

DTC DETECTING CONDITION

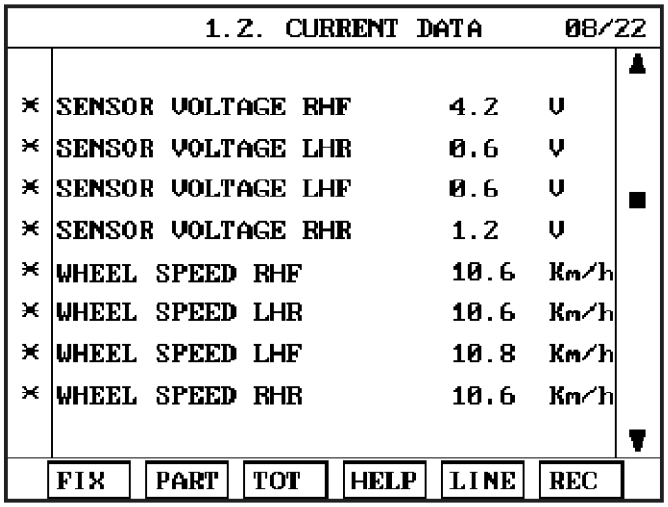
Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Check air gap. • Check bearing play and tone ring run out. • Check tone ring for damage.
Enable Conditions	Ignition ON			
Threshold Value	Vehicle speed > 5.0 kph. Air gap : 0.2~1.7 mm			
Diagnosis Time	Below 1,000 ms			
Fail Safe	Fuel Cut	No	• ABS function disabled for concerned wheel.	
	Fuel Limit	Yes		
	MIL	Yes		

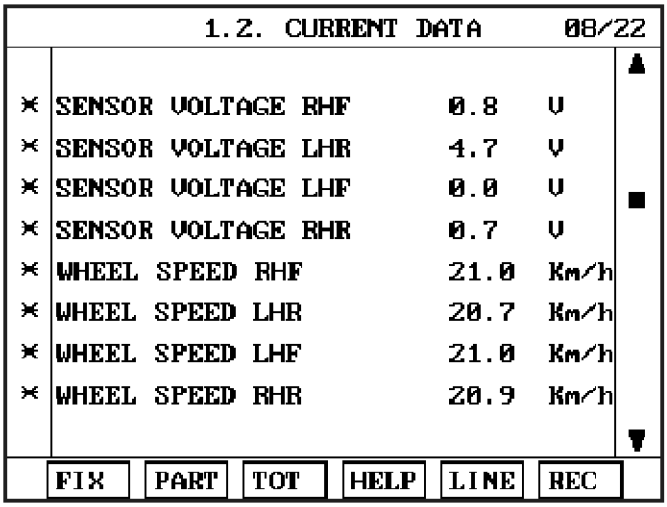
SPECIFICATION

Air gap	0.2 ~ 1.7 mm

MONITOR SCAN TOOL DATA

1. Start the engine.
2. Connect the scan tool to the self-diagnosis connector. Select the service data.
3. Drive the vehicle straight at a constant speed in the normal road surface.
4. Monitor the data "Wheel speed LHF" parameter on the scan tool.
   - Specification: Normal if its speed is nearly in accordance with the speed in the gauge.





SUDWAB9008L

5. Is the data measured within specification?

YES

There may be the poor contact of wheel sensor circuit or a past trouble which did not erase the memory of HECU after having repaired. Totally check the connector for looseness, poor contact, bent, corrosion, contamination, deformation, or damage.

Repair or replace it if necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to “Terminal & Connector Inspection” procedure.

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness, and terminals.

   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

Repair as necessary and then go to “Verification of Vehicle Repair” procedure.

NO

Go to “Signal Circuit Inspection” procedure.

COMPONENT INSPECTION

Sensor Air Gap Inspection

1. Turn the ignition OFF.
2. Check the air gap between left hand front tone wheel and wheel sensor with a thickness gauge.
   - Specification: 0.2~1.7mm
3. Is the value measured within specification?

YES

Go to next procedure.

NO

Repair it after checking wheel sensor installation condition and go to "Verification of Vehicle Repair” procedure.

Repair or replace it after checking the condition of rotor and wheel bearing and go to "Verification of Vehicle Repair” procedure.

Adjust it after checking the air gap between wheel sensor and rotor and go to "Verification of Vehicle

Repair" procedure.

Check Number of Teeth on Tone Ring

1. Turn the ignition OFF.
2. Check the number of teeth on left hand front tone ring.
3. Is the number of teeth normal?

YES

Go to "Verification of Vehicle Repair" procedure.

NO

Repair it or replace with known-good one and check the condition of vehicle.

If normal, replace with new one. And go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

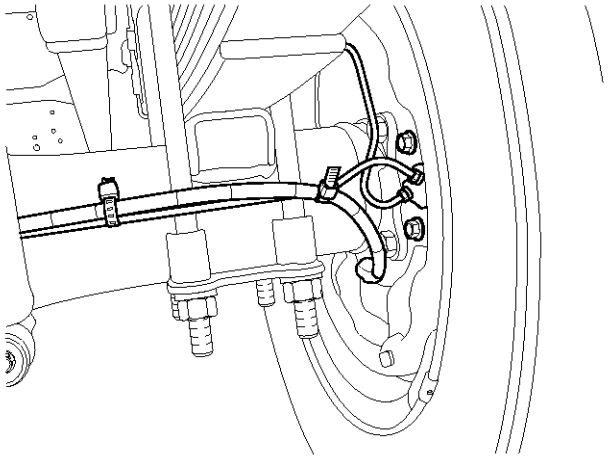
Go to the applicable DTC procedure.

NO

System OK

0057 Pole Wheel Right Hand Rear(Cyclic Failure)

COMPONENT LOCATION



SUDWAB9050L

GENERAL DESCRIPTION

The wheel sensor is crucial for HECU to calculate the speed of the vehicle and determine whether the wheel is in 'Lock' mode or not. For example, in case of a front-wheel drive vehicle, the signal of the rear wheel speed is used as a reference value for the speed of the vehicle. If there occurs the difference in speed between the front and rear wheels, ABS control is performed. The wheel sensor creates a sine curve based on the magnetic field created by the permanent magnet inside the sensor when the tone wheel rotates. The frequency and the AC voltage change by a certain ratio depending on the wheel speed, and HECU determines the speed of the vehicle by calculating the frequency of the signal.

DTC DESCRIPTION

HECU continues to monitor the input signal from the wheel sensor. If the ABS control state changes abnormally when the sensor output voltage becomes low because the air gap in the Rear right wheel sensor is too big, HECU determines it as a failure state and outputs a fail code.

DTC DETECTING CONDITION

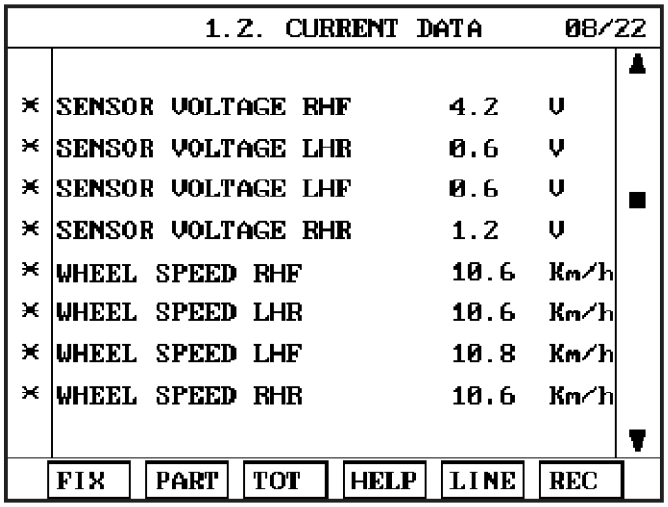
Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Check air gap. • Check bearing play and tone ring run out. • Check tone ring for damage.
Enable Conditions	Ignition ON			
Threshold Value	Vehicle speed > 5.0 kph. Air gap : 0.2~1.7 mm			
Diagnosis Time	Below 1,000 ms			
Fail Safe	Fuel Cut	No	• ABS function disabled for concerned wheel	
	Fuel Limit	Yes		
	MIL	Yes		

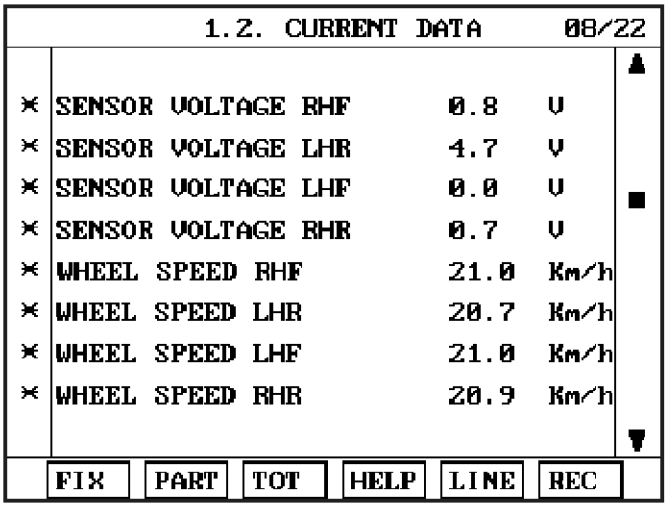
SPECIFICATION

Air gap	0.2 ~ 1.7 mm

MONITOR SCAN TOOL DATA

1. Start the engine.
2. Connect the scan tool to the self-diagnosis connector. Select the service data.
3. Drive the vehicle straight at a constant speed in the normal road surface.
4. Monitor the data "Wheel speed RHR" parameter on the scan tool.
   ■ Specification: Normal if its speed is nearly in accordance with the speed in the gauge.





SUDWAB9008L

5. Is the data measured within specification?

YES

There may be the poor contact of wheel sensor circuit or a past trouble which did not erase the memory of HECU after having repaired. Totally check the connector for looseness, poor contact, bent, corrosion, contamination, deformation, or damage.

Repair or replace it if necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to “Terminal & Connector Inspection” procedure.

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness, and terminals.

   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

Repair as necessary and then go to “Verification of Vehicle Repair” procedure.

NO

Go to “Signal Circuit Inspection” procedure.

COMPONENT INSPECTION

Sensor Air Gap Inspection

1. Turn the ignition OFF.
2. Check the air gap between right hand rear tone wheel and wheel sensor with a thickness gauge.
   ■ Specification: 0.2~1.7mm
3. Is the value measured within specification?

YES

Go to next procedure.

NO

Repair it after checking wheel sensor installation condition and go to "Verification of Vehicle Repair” procedure.

Repair or replace it after checking the condition of rotor and wheel bearing and go to "Verification of Vehicle Repair” procedure.

Adjust it after checking the air gap between wheel sensor and rotor and go to "Verification of Vehicle

Repair" procedure.

Check Number of Teeth on Tone Ring

1. Turn the ignition OFF.
2. Check the number of teeth on right hand rear tone ring.
3. Is the number of teeth normal?

YES

Go to "Verification of Vehicle Repair" procedure.

NO

Repair it or replace with known-good one and check the condition of vehicle.

If normal, replace with new one. And go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

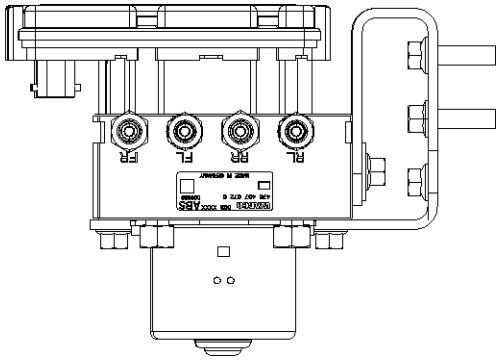
Go to the applicable DTC procedure.

NO

System OK

0058 Clamp Transistor Failure

COMPONENT LOCATION



SUDWAB9001L

GENERAL DESCRIPTION

The Antilock Brake System (ABS) prevents the skid phenomenon that may occurs during a sudden brake while the vehicle is driving or when there is snow or water on the road. By preventing the wheels from sticking or skidding on the road while the brake is applied, ABS maintains the directional stability of the vehicle, secures the steer ability, provides the maximum braking power so as to reduce the braking distance and to pursue the overall safety of the driver and passengers. As the main device to perform ABS' braking function, HECU consists of an input amplifier circuit that processes the input signal, an ABS control and SAFETY circuit that calculates the control and performs FAIL SAFE, an output circuit that drives the pressure control valve, a voltage adjustment circuit that regulates the voltage, and a failure memory circuit that memorizes any malfunctioning. In case of a system malfunctioning, the warning light is turned on, and at the same time, the power to the pressure control valve is cut off, and the operation of ABS is stopped.

DTC DESCRIPTION

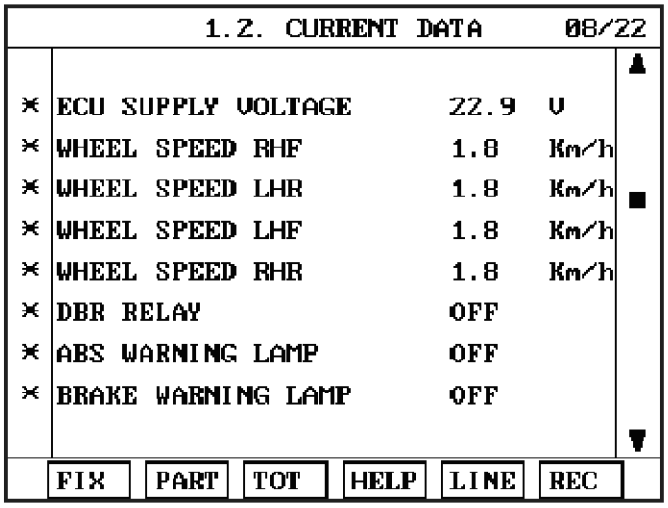
HECU continues to monitor the internal components, such as memory, input and output circuits. In case of an error during the operation of the control system, HECU determines whether it is a failure state and outputs a fail code.

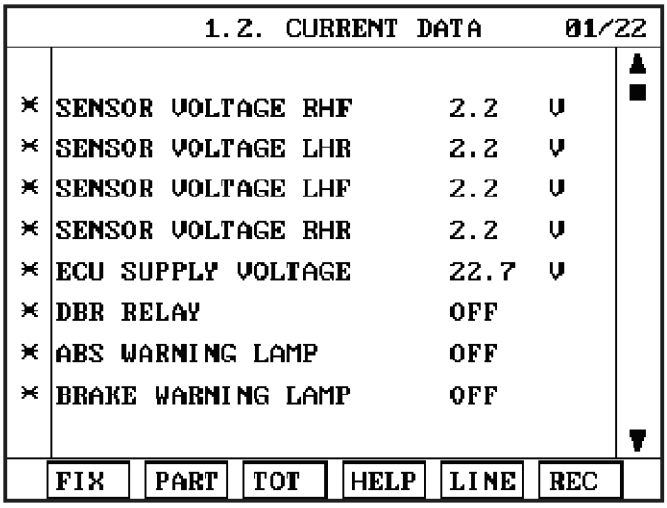
DTC DETECTING CONDITION

Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Replace ECU.
Enable Conditions	Ignition ON			
Threshold Value	When the HECU detects malfunction in the control system			
Diagnosis Time	Below 1,000 ms			
Fail Safe	Fuel Cut	No	• ABS disabled	
	Fuel Limit	Yes		
	MIL	Yes		

MONITOR SCAN TOOL DATA

1. Connect scan tool to the self-diagnosis connector.
2. Turn the ignition ON.
3. Monitor the service data on the scan tool.





SUDWAB9007L

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness, and terminals.

   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

   YES

   Repair as necessary and then go to “Verification of Vehicle Repair” procedure.

   NO

   Go to “Signal Circuit Inspection” procedure.

COMPONENT INSPECTION

1. Start the engine.
2. Drive the vehicle with approx. 15km/h or higher.
3. Turn the ignition ON. Leave the engine OFF.
4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
7. Are any diagnostic trouble codes (DTCs) detected?

YES

Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to “Verification of Vehicle Repair” procedure.

NO

There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. And go to "Verification of Vehicle Repair” procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

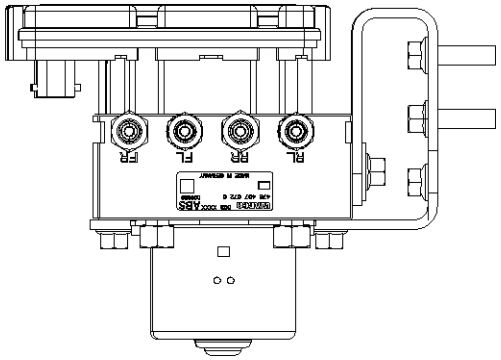
Go to the applicable DTC procedure.

NO

System OK

0059 Pull Up Down Failure

COMPONENT LOCATION



SUDWAB9001L

GENERAL DESCRIPTION

The Antilock Brake System (ABS) prevents the skid phenomenon that may occurs during a sudden brake while the vehicle is driving or when there is snow or water on the road. By preventing the wheels from sticking or skidding on the road while the brake is applied, ABS maintains the directional stability of the vehicle, secures the steer ability, provides the maximum braking power so as to reduce the braking distance and to pursue the overall safety of the driver and passengers. As the main device to perform ABS' braking function, HECU consists of an input amplifier circuit that processes the input signal, an ABS control and SAFETY circuit that calculates the control and performs FAIL SAFE, an output circuit that drives the pressure control valve, a voltage adjustment circuit that regulates the voltage, and a failure memory circuit that memorizes any malfunctioning. In case of a system malfunctioning, the warning light is turned on, and at the same time, the power to the pressure control valve is cut off, and the operation of ABS is stopped.

DTC DESCRIPTION

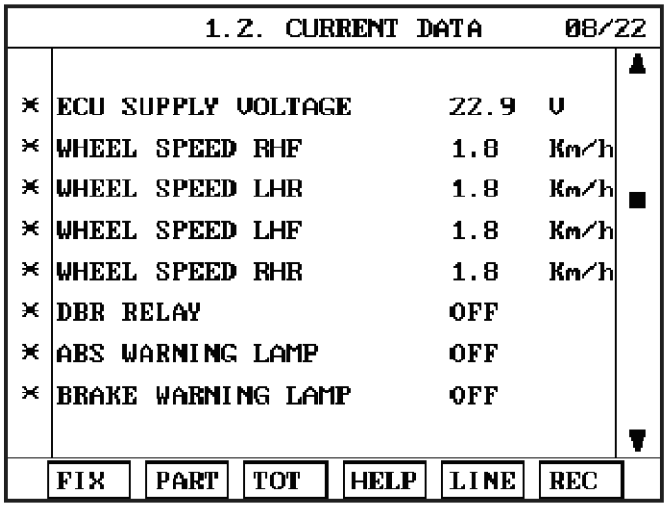
HECU continues to monitor the internal components, such as memory, input and output circuits. In case of an error during the operation of the control system, HECU determines whether it is a failure state and outputs a fail code.

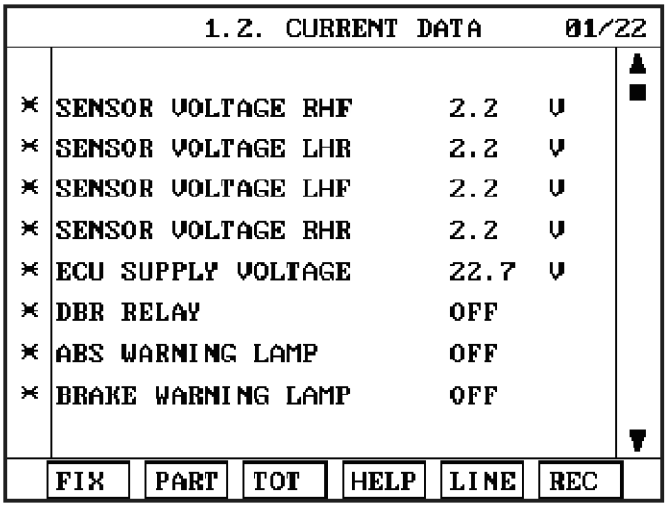
DTC DETECTING CONDITION

Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Replace ECU.
Enable Conditions	Ignition ON			
Threshold Value	When the HECU detects malfunction in the control system			
Diagnosis Time	Below 1,000 ms			
Fail Safe	Fuel Cut	No	• ABS disabled	
	Fuel Limit	Yes		
	MIL	Yes		

MONITOR SCAN TOOL DATA

1. Connect scan tool to the self-diagnosis connector.
2. Turn the ignition ON.
3. Monitor the service data on the scan tool.





SUDWAB9007L

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness, and terminals.

   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

   YES

   Repair as necessary and then go to “Verification of Vehicle Repair” procedure.

   NO

   Go to “Signal Circuit Inspection” procedure.

COMPONENT INSPECTION

1. Start the engine.
2. Drive the vehicle with approx. 15km/h or higher.
3. Turn the ignition ON. Leave the engine OFF.
4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
7. Are any diagnostic trouble codes (DTCs) detected?

YES

Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to “Verification of Vehicle Repair” procedure.

NO

There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. And go to "Verification of Vehicle Repair” procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

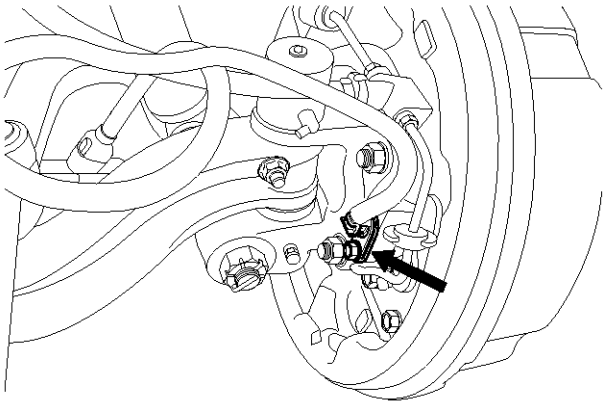
Go to the applicable DTC procedure.

NO

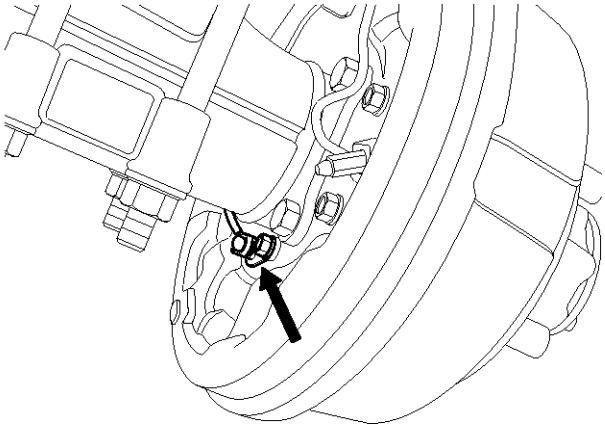
System OK

005A Sensor Right Hand Front(Signal Disturbed)

COMPONENT LOCATION



Front wheel speed sensor



Rear wheel speed sensor

SUDWAB9002L

GENERAL DESCRIPTION

The wheel sensor is crucial for HECU to calculate the speed of the vehicle and determine whether the wheel is in 'Lock' mode or not. For example, in case of a front-wheel drive vehicle, the signal of the rear wheel speed is used as a reference value for the speed of the vehicle. If there occurs the difference in speed between the front and rear wheels, ABS control is performed. The wheel sensor creates a sine curve based on the magnetic field created by the permanent magnet inside the sensor when the tone wheel rotates. The frequency and the AC voltage change by a certain ratio depending on the wheel speed, and HECU determines the speed of the vehicle by calculating the frequency of the signal.

DTC DESCRIPTION

If the sensor output voltage becomes too low because of larger air gap on the front right wheel sensor or the ABS control status changes abnormally due to too much vibration or noise in the brake, HECU determines it as a failure and outputs a fail code.

DTC DETECTING CONDITION

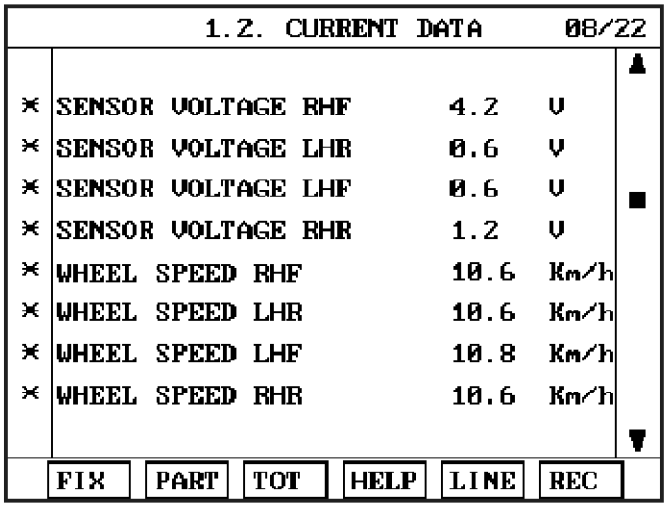
Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Check air gap. • Check bearing play and tone ring run out. • Check tone ring for damage. • Brake chatter.
Enable Conditions	Ignition ON			
Threshold Value	Vehicle speed > 5.0 kph			
Diagnosis Time	Below 1,000 ms			
Fail Safe	Fuel Cut	No	• ABS function temporarily disabled for concerned wheel.	
	Fuel Limit	Yes		
	MIL	Yes		

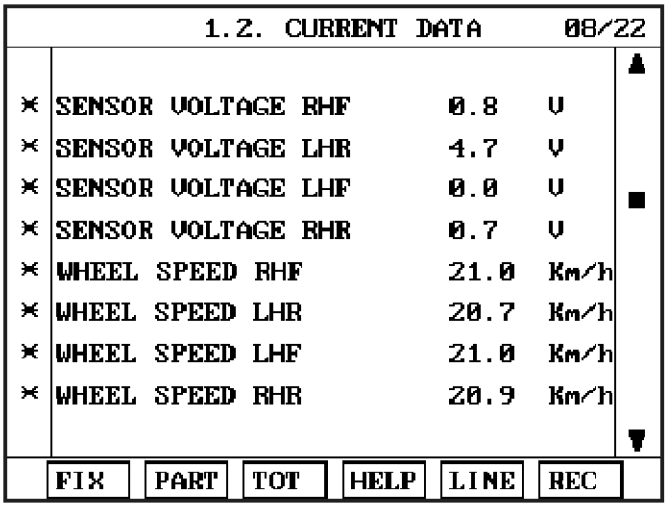
SPECIFICATION

Air gap	0.2 ~ 1.7 mm

MONITOR SCAN TOOL DATA

1. Start the engine.
2. Connect the scan tool to the self-diagnosis connector. Select the service data.
3. Drive the vehicle straight at a constant speed in the normal road surface.
4. Monitor the data "Wheel speed RHF" parameter on the scan tool.
   ■ Specification: Normal if its speed is nearly in accordance with the speed in the gauge.





SUDWAB9008L

5. Is the data measured within specification?

YES

There may be the poor contact of wheel sensor circuit or a past trouble which did not erase the memory of HECU after having repaired. Totally check the connector for looseness, poor contact, bent, corrosion, contamination, deformation, or damage.

Repair or replace it if necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to “Terminal & Connector Inspection” procedure.

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness, and terminals.

   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

Repair as necessary and then go to “Verification of Vehicle Repair” procedure.

NO

Go to “Signal Circuit Inspection” procedure.

COMPONENT INSPECTION

Sensor Air Gap Inspection

1. Turn the ignition OFF.
2. Check the air gap between right hand front tone wheel and wheel sensor with a thickness gauge.
   ■ Specification: 0.2~1.7 mm
3. Is the value measured within specification?

YES

Go to next procedure.

NO

Repair it after checking wheel sensor installation condition and go to "Verification of Vehicle Repair” procedure.

Repair or replace it after checking the condition of rotor and wheel bearing and go to "Verification of Vehicle Repair” procedure.

Adjust it after checking the air gap between wheel sensor and rotor and go to "Verification of Vehicle

Repair" procedure.

Check Number of Teeth on Tone Ring

1. Turn the ignition OFF.
2. Check the number of teeth on right hand front tone ring.
3. Is the number of teeth normal?

YES

Go to "Verification of Vehicle Repair" procedure.

NO

Repair it or replace with known-good one and check the condition of vehicle.

If normal, replace with new one. And go to "Verification of Vehicle Repair" procedure.

Check Brake Chatter

1. Turn the ignition OFF.
2. Check the pad and drum of the right hand front brake.
3. Is the condition of the brake normal?

YES

Go to "Verification of Vehicle Repair" procedure.

NO

Repair it or replace with known-good one and check the condition of the vehicle.

If normal, replace with new one. And go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

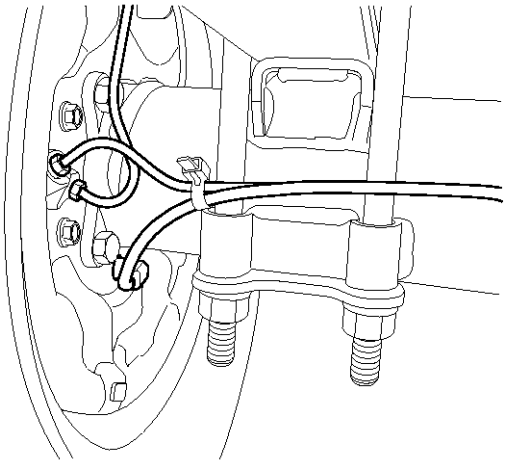
Go to the applicable DTC procedure.

NO

System OK

005B Sensor Left Hand Rear(Signal Disturbed)

COMPONENT LOCATION



SUDWAB9048L

GENERAL DESCRIPTION

The wheel sensor is crucial for HECU to calculate the speed of the vehicle and determine whether the wheel is in 'Lock' mode or not. For example, in case of a front-wheel drive vehicle, the signal of the rear wheel speed is used as a reference value for the speed of the vehicle. If there occurs the difference in speed between the front and rear wheels, ABS control is performed. The wheel sensor creates a sine curve based on the magnetic field created by the permanent magnet inside the sensor when the tone wheel rotates. The frequency and the AC voltage change by a certain ratio depending on the wheel speed, and HECU determines the speed of the vehicle by calculating the frequency of the signal.

DTC DESCRIPTION

If the sensor output voltage becomes too low because of larger air gap on the rear left wheel sensor or the ABS control status changes abnormally due to too much vibration or noise in the brake, HECU determines it as a failure and outputs a fail code.

DTC DETECTING CONDITION

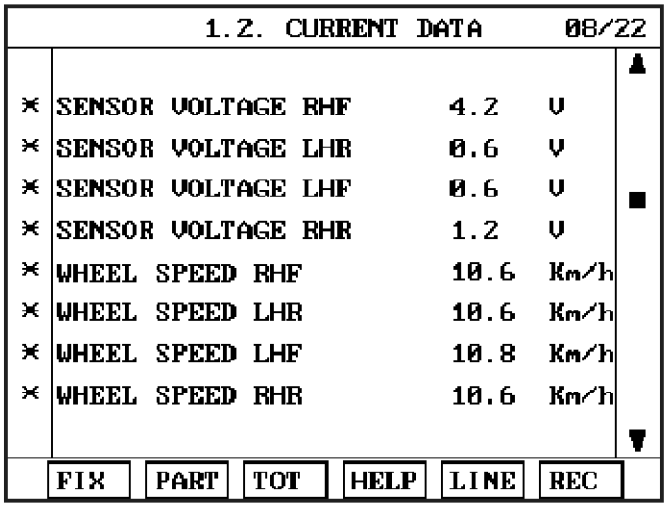
Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Check air gap. • Check bearing play and tone ring run out. • Check tone ring for damage. • Brake chatter.
Enable Conditions	Ignition ON			
Threshold Value	Vehicle speed > 5.0 kph			
Diagnosis Time	Below 1,000 ms			
Fail Safe	Fuel Cut	No	• ABS function temporarily disabled for concerned wheel.	
	Fuel Limit	Yes		
	MIL	Yes		

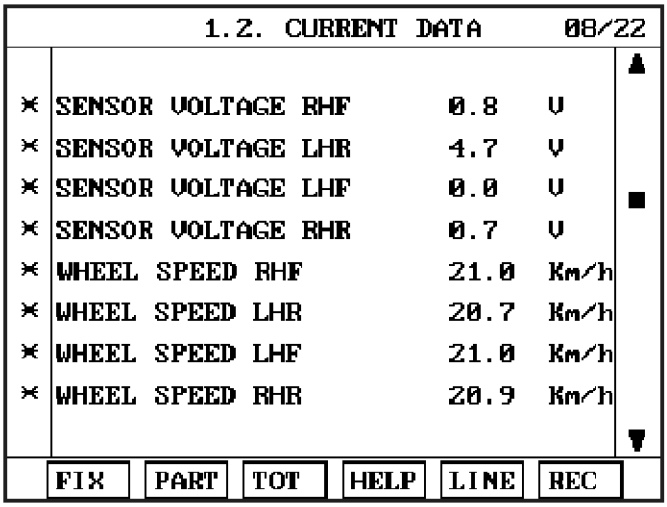
SPECIFICATION

Air gap	0.2 ~ 1.7 mm

MONITOR SCAN TOOL DATA

1. Start the engine.
2. Connect the scan tool to the self-diagnosis connector. Select the service data.
3. Drive the vehicle straight at a constant speed in the normal road surface.
4. Monitor the data "Wheel speed LHR" parameter on the scan tool.
   ■ Specification: Normal if its speed is nearly in accordance with the speed in the gauge.





SUDWAB9008L

5. Is the data measured within specification?

YES

There may be the poor contact of wheel sensor circuit or a past trouble which did not erase the memory of HECU after having repaired. Totally check the connector for looseness, poor contact, bent, corrosion, contamination, deformation, or damage.

Repair or replace it if necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to “Terminal & Connector Inspection” procedure.

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness, and terminals.

   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

Repair as necessary and then go to “Verification of Vehicle Repair” procedure.

NO

Go to “Signal Circuit Inspection” procedure.

COMPONENT INSPECTION

Sensor Air Gap Inspection

1. Turn the ignition OFF.
2. Check the air gap between left hand rear tone wheel and wheel sensor with a thickness gauge.
   ■ Specification: 0.2~1.7mm
3. Is the value measured within specification?

YES

Go to next procedure.

NO

Repair it after checking wheel sensor installation condition and go to "Verification of Vehicle Repair” procedure.

Repair or replace it after checking the condition of rotor and wheel bearing and go to "Verification of Vehicle Repair” procedure.

Adjust it after checking the air gap between wheel sensor and rotor and go to "Verification of Vehicle

Repair" procedure.

Check Number of Teeth on Tone Ring

1. Turn the ignition OFF.
2. Check the number of teeth on left hand rear tone ring.
3. Is the number of teeth normal?

YES

Go to "Verification of Vehicle Repair" procedure.

NO

Repair it or replace with known-good one and check the condition of vehicle.

If normal, replace with new one. And go to "Verification of Vehicle Repair" procedure.

Check Brake Chatter

1. Turn the ignition OFF.
2. Check the pad and drum of the left hand rear brake.
3. Is the condition of the brake normal?

YES

Go to "Verification of Vehicle Repair" procedure.

NO

Repair it or replace with known-good one and check the condition of the vehicle.

If normal, replace with new one. And go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

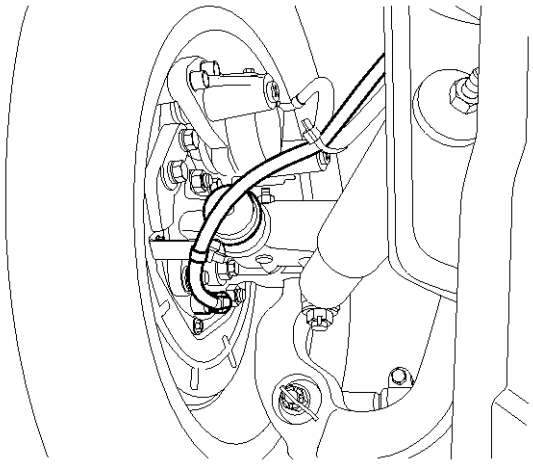
Go to the applicable DTC procedure.

NO

System OK

005C Sensor Left Hand Front(Signal Disturbed)

COMPONENT LOCATION



SUDWAB9049L

GENERAL DESCRIPTION

The wheel sensor is crucial for HECU to calculate the speed of the vehicle and determine whether the wheel is in 'Lock' mode or not. For example, in case of a front-wheel drive vehicle, the signal of the rear wheel speed is used as a reference value for the speed of the vehicle. If there occurs the difference in speed between the front and rear wheels, ABS control is performed. The wheel sensor creates a sine curve based on the magnetic field created by the permanent magnet inside the sensor when the tone wheel rotates. The frequency and the AC voltage change by a certain ratio depending on the wheel speed, and HECU determines the speed of the vehicle by calculating the frequency of the signal.

DTC DESCRIPTION

If the sensor output voltage becomes too low because of larger air gap on the front left wheel sensor or the ABS control status changes abnormally due to too much vibration or noise in the brake, HECU determines it as a failure and outputs a fail code.

DTC DETECTING CONDITION

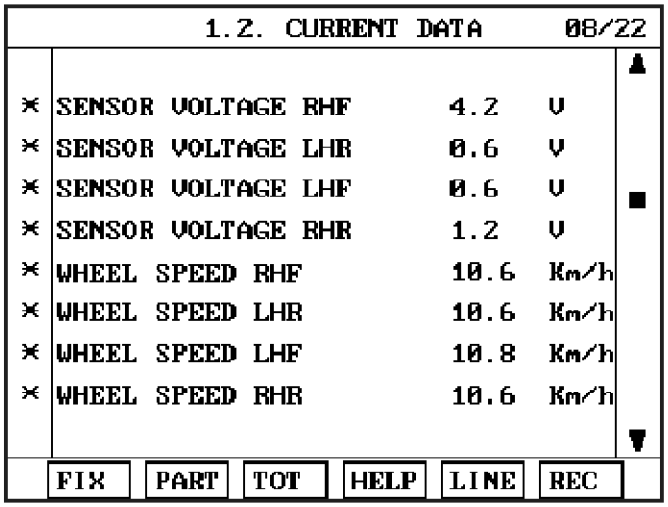
Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Check air gap. • Check bearing play and tone ring run out. • Check tone ring for damage. • Brake chatter.
Enable Conditions	Ignition ON			
Threshold Value	Vehicle speed > 5.0 kph			
Diagnosis Time	Below 1,000 ms			
Fail Safe	Fuel Cut	No	• ABS function temporarily disabled for concerned wheel	
	Fuel Limit	Yes		
	MIL	Yes		

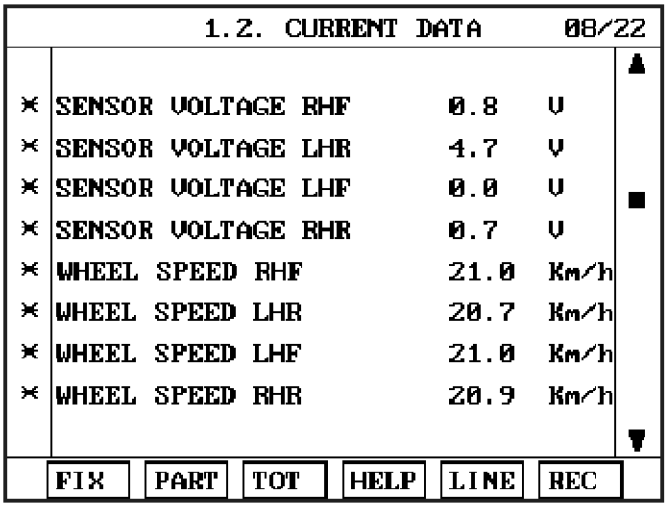
SPECIFICATION

Air gap	0.2 ~ 1.7 mm

MONITOR SCAN TOOL DATA

1. Start the engine.
2. Connect the scan tool to the self-diagnosis connector. Select the service data.
3. Drive the vehicle straight at a constant speed in the normal road surface.
4. Monitor the data "Wheel speed LHF" parameter on the scan tool.
   - Specification: Normal if its speed is nearly in accordance with the speed in the gauge.





SUDWAB9008L

5. Is the data measured within specification?

YES

There may be the poor contact of wheel sensor circuit or a past trouble which did not erase the memory of HECU after having repaired. Totally check the connector for looseness, poor contact, bent, corrosion, contamination, deformation, or damage.

Repair or replace it if necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to “Terminal & Connector Inspection” procedure.

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness, and terminals.

   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

Repair as necessary and then go to “Verification of Vehicle Repair” procedure.

NO

Go to “Signal Circuit Inspection” procedure.

COMPONENT INSPECTION

Sensor Air Gap Inspection

1. Turn the ignition OFF.
2. Check the air gap between left hand front tone wheel and wheel sensor with a thickness gauge.
   - Specification: 0.2~1.7 mm
3. Is the value measured within specification?

YES

Go to next procedure.

NO

Repair it after checking wheel sensor installation condition and go to "Verification of Vehicle Repair” procedure.

Repair or replace it after checking the condition of rotor and wheel bearing and go to "Verification of Vehicle Repair” procedure.

Adjust it after checking the air gap between wheel sensor and rotor and go to "Verification of Vehicle

Repair" procedure.

Check Number of Teeth on Tone Ring

1. Turn the ignition OFF.
2. Check the number of teeth on left hand front tone ring.
3. Is the number of teeth normal?

YES

Go to "Verification of Vehicle Repair" procedure.

NO

Repair it or replace with known-good one and check the condition of vehicle.

If normal, replace with new one. And go to "Verification of Vehicle Repair" procedure.

Check Brake Chatter

1. Turn the ignition OFF.
2. Check the pad and drum of the left hand front brake.
3. Is the condition of the brake normal?

YES

Go to "Verification of Vehicle Repair" procedure.

NO

Repair it or replace with known-good one and check the condition of the vehicle.

If normal, replace with new one. And go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

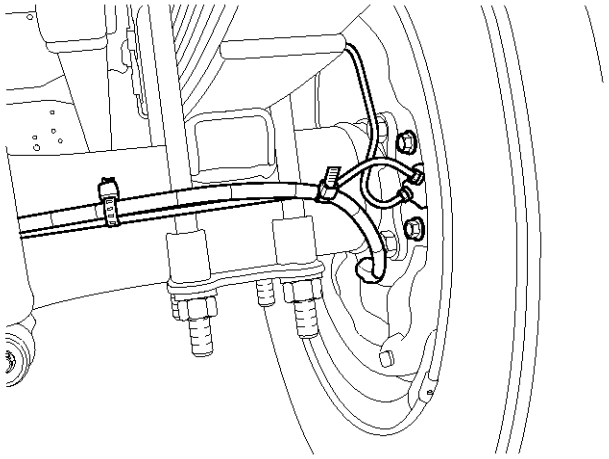
Go to the applicable DTC procedure.

NO

System OK

005D Sensor Right Hand Rear(Signal Disturbed)

COMPONENT LOCATION



SUDWAB9050L

GENERAL DESCRIPTION

The wheel sensor is crucial for HECU to calculate the speed of the vehicle and determine whether the wheel is in 'Lock' mode or not. For example, in case of a front-wheel drive vehicle, the signal of the rear wheel speed is used as a reference value for the speed of the vehicle. If there occurs the difference in speed between the front and rear wheels, ABS control is performed. The wheel sensor creates a sine curve based on the magnetic field created by the permanent magnet inside the sensor when the tone wheel rotates. The frequency and the AC voltage change by a certain ratio depending on the wheel speed, and HECU determines the speed of the vehicle by calculating the frequency of the signal.

DTC DESCRIPTION

If the sensor output voltage becomes too low because of larger air gap on the rear right wheel sensor or the ABS control status changes abnormally due to too much vibration or noise in the brake, HECU determines it as a failure and outputs a fail code.

DTC DETECTING CONDITION

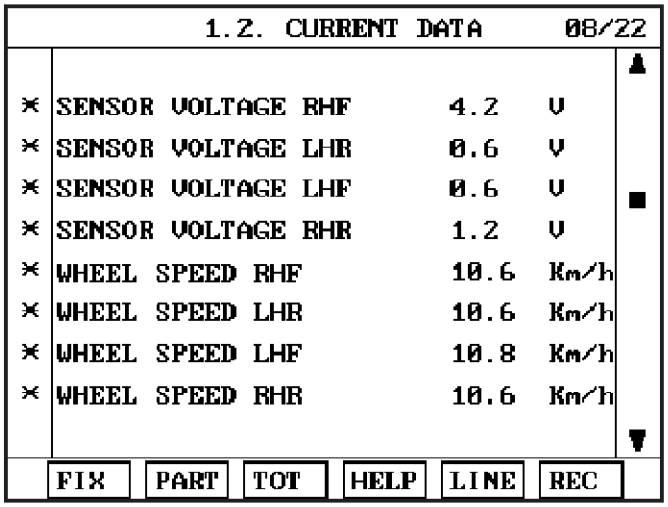
Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Check air gap. • Check bearing play and tone ring run out. • Check tone ring for damage. • Brake chatter.
Enable Conditions	Ignition ON			
Threshold Value	.Vehicle speed > 5.0 kph			
Diagnosis Time	Below 1,000 ms			
Fail Safe	Fuel Cut	No	• ABS function temporarily disabled for concerned wheel.	
	Fuel Limit	Yes		
	MIL	Yes		

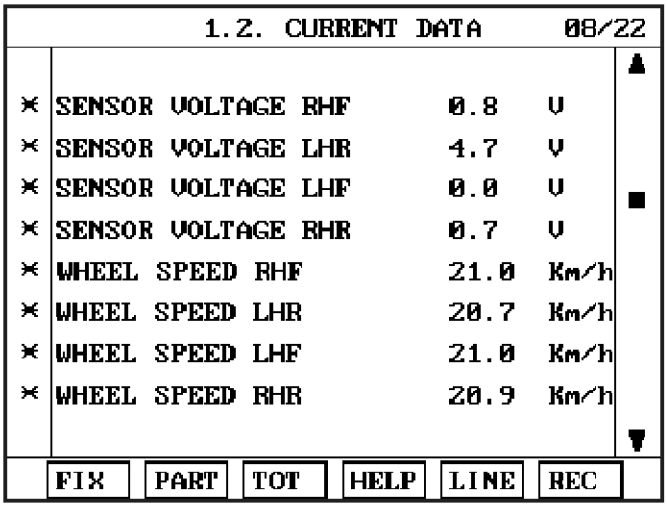
SPECIFICATION

Air gap	0.2 ~ 1.7 mm

MONITOR SCAN TOOL DATA

1. Start the engine.
2. Connect the scan tool to the self-diagnosis connector. Select the service data.
3. Drive the vehicle straight at a constant speed in the normal road surface.
4. Monitor the data "Wheel speed RHR" parameter on the scan tool.
   - Specification: Normal if its speed is nearly in accordance with the speed in the gauge.





SUDWAB9008L

5. Is the data measured within specification?

YES

There may be the poor contact of wheel sensor circuit or a past trouble which did not erase the memory of HECU after having repaired. Totally check the connector for looseness, poor contact, bent, corrosion, contamination, deformation, or damage.

Repair or replace it if necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to “Terminal & Connector Inspection” procedure.

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness, and terminals.

   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

Repair as necessary and then go to “Verification of Vehicle Repair” procedure.

NO

Go to “Signal Circuit Inspection” procedure.

COMPONENT INSPECTION

Sensor Air Gap Inspection

1. Turn the ignition OFF.
2. Check the air gap between right hand rear tone wheel and wheel sensor with a thickness gauge.
   - Specification: 0.2~1.7 mm
3. Is the value measured within specification?

YES

Go to next procedure.

NO

Repair it after checking wheel sensor installation condition and go to "Verification of Vehicle Repair” procedure.

Repair or replace it after checking the condition of rotor and wheel bearing and go to "Verification of Vehicle Repair” procedure.

Adjust it after checking the air gap between wheel sensor and rotor and go to "Verification of Vehicle

Repair" procedure.

Check Number of Teeth on Tone Ring

1. Turn the ignition OFF.
2. Check the number of teeth on right hand rear tone ring.
3. Is the number of teeth normal?

YES

Go to "Verification of Vehicle Repair" procedure.

NO

Repair it or replace with known-good one and check the condition of vehicle.

If normal, replace with new one. And go to "Verification of Vehicle Repair" procedure.

Check Brake Chatter

1. Turn the ignition OFF.
2. Check the pad and drum of the right hand rear brake.
3. Is the condition of the brake normal?

YES

Go to "Verification of Vehicle Repair" procedure.

NO

Repair it or replace with known-good one and check the condition of the vehicle.

If normal, replace with new one. And go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

Go to the applicable DTC procedure.

NO

System OK