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SECTION 2A

SUSPENSION DIAGNOSIS

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SPECIFICATIONS

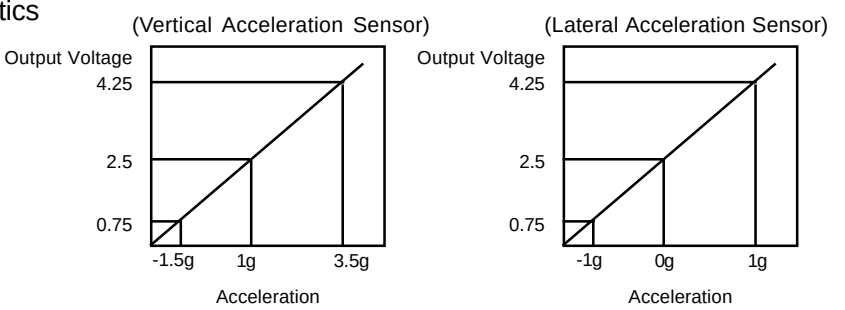
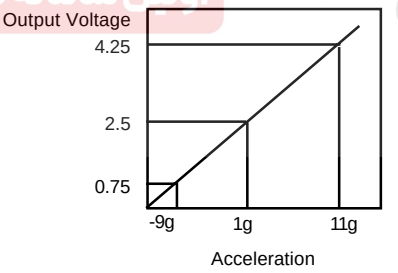
GENERAL SPECIFICATIONS

Application		Front	Rear
ECS Control Type		3-stage Variable Damping Force Control Type	
Shock Absorber	Max. Length (mm)	344 - 350	517 - 523
	Compressed Length (mm)	245 ± 3	331 ± 3
	Stroke (mm)	102	188

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GENERAL SPECIFICATIONS (Cont'd)

Application		Description
Body Vertical and Lateral Acceleration Sensor	Power Voltage (V)	4.75 - 5.25
	Consuming Current (mA)	Less than 10
	Output Current (mA)	Less than 2.0
	Operating Characteristics	
Damping Force Switching Actuator	Type	3-stage Rotary Step Motor Type
	Voltage Rating (V)	DC12
	Current Rating (A)	Less than 2.5
	Current Time (mS)	95 - 105
Axle Vertical Acceleration Sensor (Wheel G Sensor)	Power Voltage (V)	4.75 - 5.25
	Consuming Current (mA)	Less than 10
	Output Current (mA)	Less than 2.0
	Operating Characteristics	

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DIAGNOSIS

GENERAL DIAGNOSIS

Problems in the steering, the suspension, the tires, and the wheels involve several systems. Consider all systems when you diagnose a complaint. Some problems, such as abnormal or excessive tire wear and scuffed tires, may by the result of hard driving. Always road test the vehicle first. If possible, do this road test with the customer.

Proceed with the following preliminary checks. Correct any substandard conditions.

Vehicle Rolling

Checks	Action
Broken Stabilizer Bar	Replace
Faulty Shock Absorber	Replace

Abnormal Noises

Checks	Action
Loosened Mountings	Retightening
Damaged or Worn wheel Bearing	Replace
Damaged Shock Absorber	Replace
Damaged Tire	Replace

Poor Riding

Checks	Action
Over Inflated Tire	Pressure Adjustment
Faulty Shock Absorber	Replace
Loosened wheel Nut	Tighten as Specified
Bent or Broken Coil Spring	Replace
Damaged Tire	Replace
Worn Bushing	Replace

Vehicle Pulls to Right or Left

Checks	Action
Deformed Arm Assembly	Replace
Worn Bushing	Replace
Bent or Broken Coil Spring	Replace
Difference Between L/H & R/H Heights	Adjust

Hard Steering

Checks	Action
Incorrect Wheel Alignment	Repair
Excessive Resistance of Lower Arm Ball Joint	Replace
Insufficient Tire Pressure	Adjust
Faulty Power Steering	Repair or Replace

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Steering Instability

Checks	Action
Incorrect Front wheel Alignment	Replace
Worn or Loosened Lower Arm Bushing	Repair or Replace

Vehicle Bottoming

Checks	Action
Worn or Broken Coil Spring	Replace

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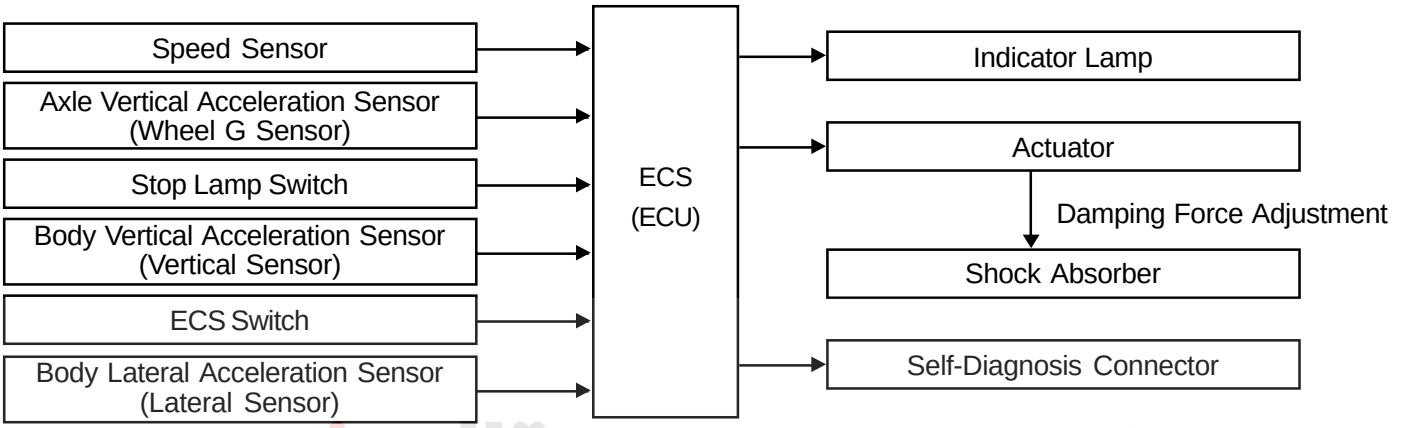
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INPUT & OUTPUT DEVICES AND DAMPING FORCE CONTROL LOGIC

INPUT & OUTPUT DEVICES

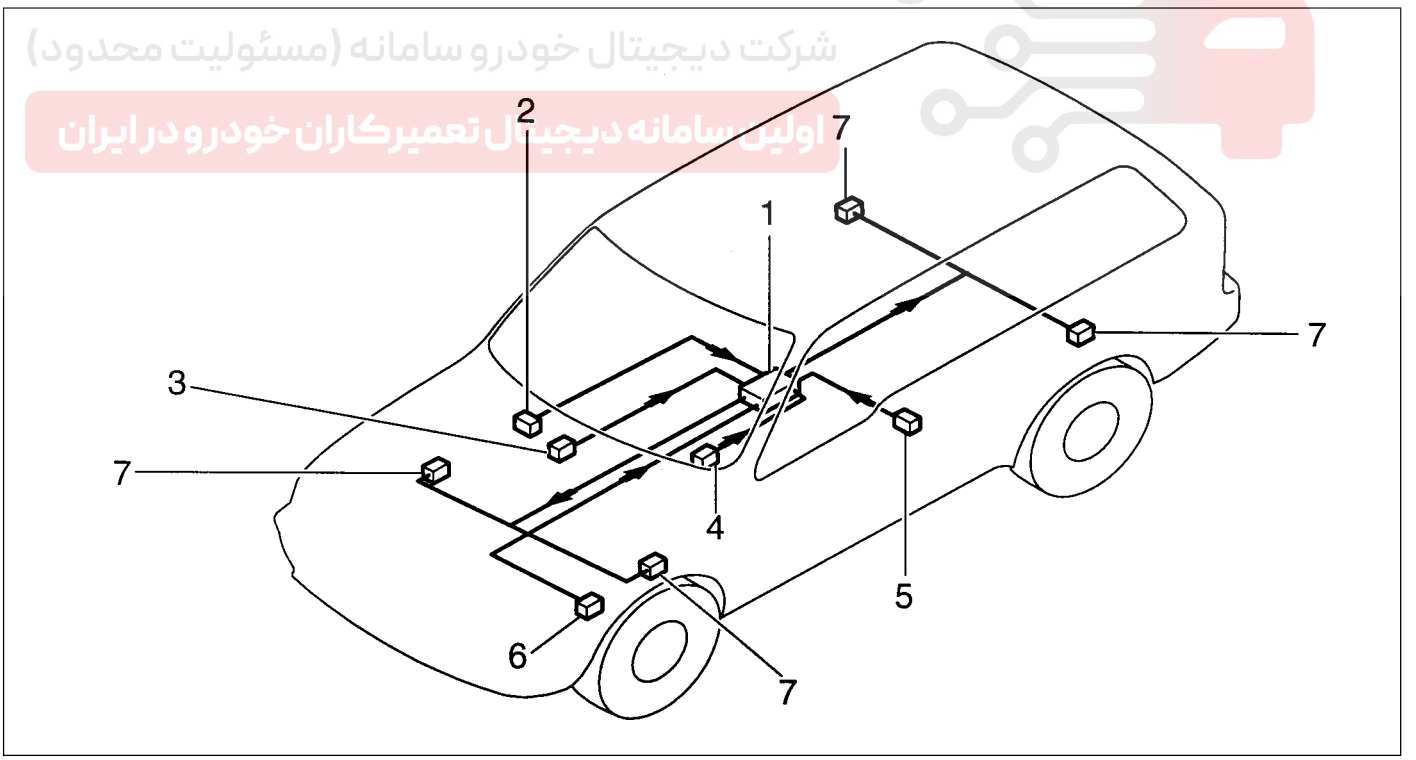
Damping force of shock absorber will rotate shock absorber control rod in 3 modes by driving actuator on the upper shock absorber when signaled from ECS.

Rotary valve in the shock absorber will control hydraulic flow according to rotation of control rod to adjust damping force of shock absorber in SOFT« MEDIUM« HARD.



SYSTEM LAYOUT

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1 ECS (ECU)
2 Body Vertical Acceleration Sensor (Vertical Sensor)
3 Body Lateral Acceleration Sensor (Lateral Sensor)
4 ECS Mode Switch
5 Stop Lamp Switch
6 Axle Vertical Acceleration Sensor (Wheel G Sensor)
7 Mode Actuator

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DAMPING FORCE CONTROL LOGIC

Control Logic that applies on damping force variable suspension is comprised of road sensing driving comfort control logic to increase driving comfort and vehicle speed sensing control logic, anti-roll control logic and anti-dive control logic to secure control safety.

Logic \ Sensor	Speed	Vertical Sensor (2.5g)	Lateral Sensor (1g)	Axle Acceleration Sensor (10g)	Brake
Road Sensing Driving Comfort Control Logic		●		●	
Anti-bounce Control Logic	●	●			
Anti-roll Control Logic	●		●		
Anti-dive Control Logic	●				●
Vehicle Speed Sensing Control Logic	●				

NORMAL CONTROL

Initial Stage

When ignition switch is "ON", system initialization will be performed for approx. 3 seconds. During this time, warning lamp will stay ON and damping force will be switched to Hard status. After 3 seconds, warning lamp will turn off and normal control status will be restored.

Normal Damping Force Control Establishment

Damping force will have Soft® Medium® Hard status in AUTO mode and Medium® Hard status in SPORT mode. When double control items are satisfied at the same time it will be Hard® Medium® Soft in order.

Normal Damping Force Control Release

Control mode release will be "Hard® Medium® Soft"or "Medium® Soft". In case that returned from Hard status to Medium status during control, it will be done after elapse of setting times. Returning from Medium status to Soft status will be done immediately without delay.

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SELF-DIAGNOSIS

ECS-ECU indicates ECS circuit defectives to the driver by flickering ECS indicator lamp in the meter cluster 0.5 second of interval if there are defectives.

Code	Defects	Judging Conditions	Set Time	Remedy	Release Conditions	Set Time
01	Body vertical acceleration sensor	When sensor output voltage is less than 0.5-4.5V, more than 4.5V.	0.9 - 1.1sec.	Stop anti-bounce ride control	Sensor Voltage ³ 2.0 ± 0.1V ³ 3.0 ± 0.1V	0.9 - 1.1sec.
02	Body lateral acceleration sensor	When sensor output voltage is less than 0.55±0.15V, more than 4.45±0.1V.	0.9 - 1.1sec.	Stop anti-roll control	Sensor Voltage ³ 2.0 ± 0.1V ³ 3.0 ± 0.1V	0.9 - 1.1sec.
03	Axle vertical acceleration sensor (wheel G sensor)	When sensor output voltage is less than 0.5-4.5V, more than 4.5V.	0.9 - 1.1sec.	Stop ride control	Sensor Voltage ³ 2.0 ± 0.1V ³ 3.0 ± 0.1V	0.9 - 1.1sec.
04	Front actuator	Check step motor power supply detecting circuit for open and short. check for relative connectors.	0.4 - 0.6sec.	Stop control after returning to the previ-ous mode	IGN+ SW. OFF® ON	
05	Rear actuator	When defective detect-ing circuit has detected defectives during output OFF.	0.4 - 0.6sec.	Stop control after returning to the previous mode	IGN+ SW. OFF® ON	
06	ECU	When ECU does not work normally.	0.4 - 0.6sec.	Stop control	Reset	

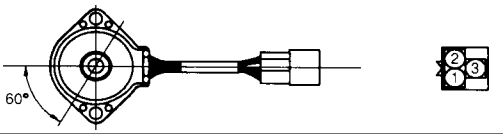
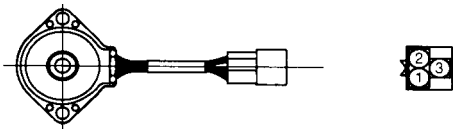
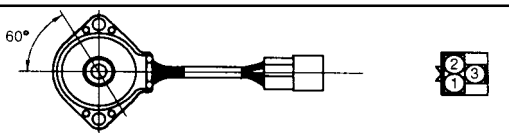
1. Turn the ignition switch ON and if ECS system is normal, ECS indicator lamp will turn on for 3 seconds and then go off. However if defective, ECS indicator lamp will flicker in the interval of 0.5 second continuously.
2. Identify fault code with Scanner.

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ACTUATOR INSPECTION

Output position of the actuator should be changed as below when battery voltage is applied between actuator connector terminals.

Connector terminal	Battery Voltage	Position of The Actuator Output	Remark
1 (White)	-		SOFT Mode
2 (Black)	OPEN		
3 (Red)	+		
1 (White)	+		MEDIUM Mode
2 (Black)	-		
3 (Red)	OPEN		
1 (White)	OPEN		HARD Mode
2 (Black)	+		
3 (Red)	-		

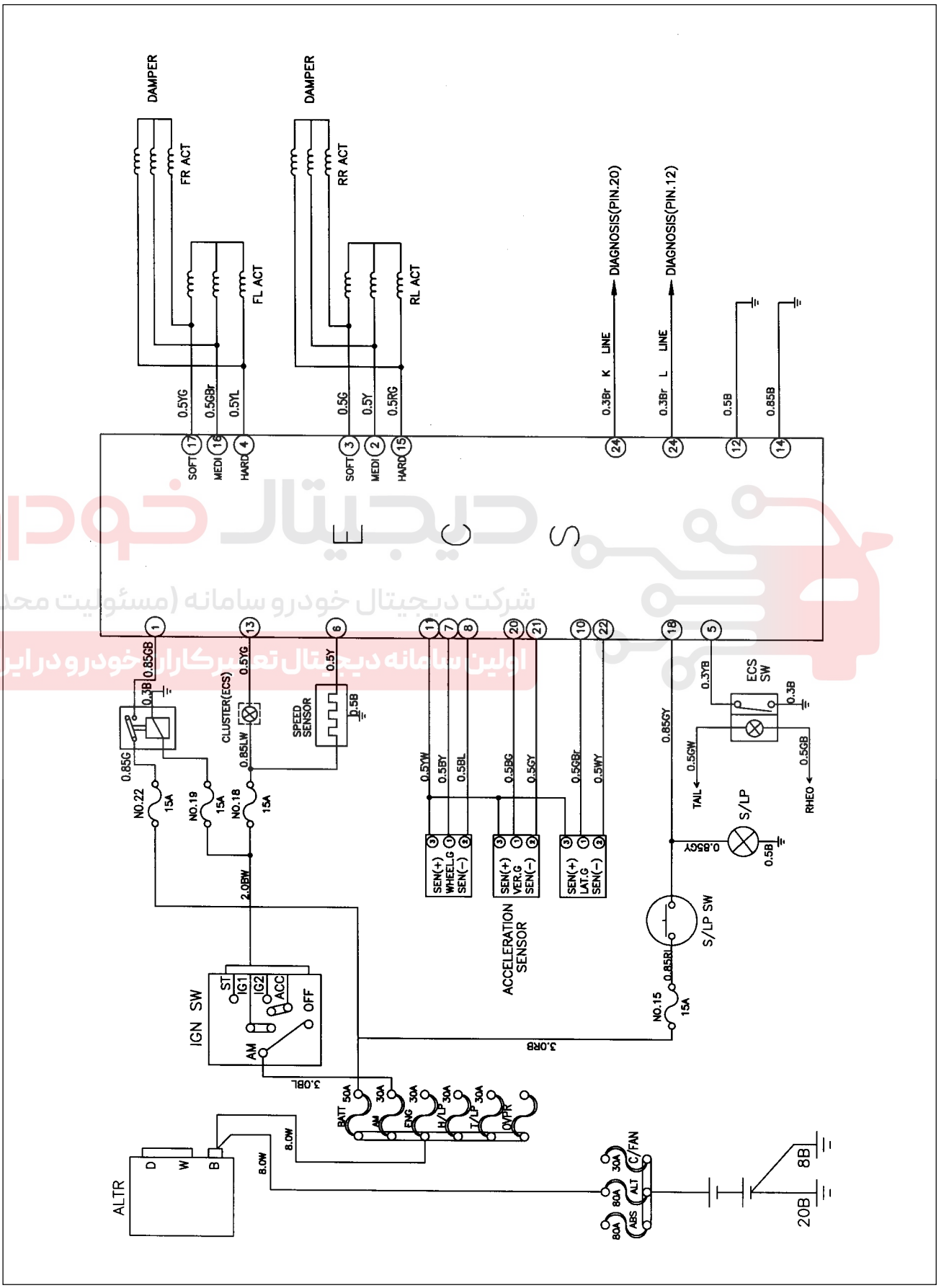
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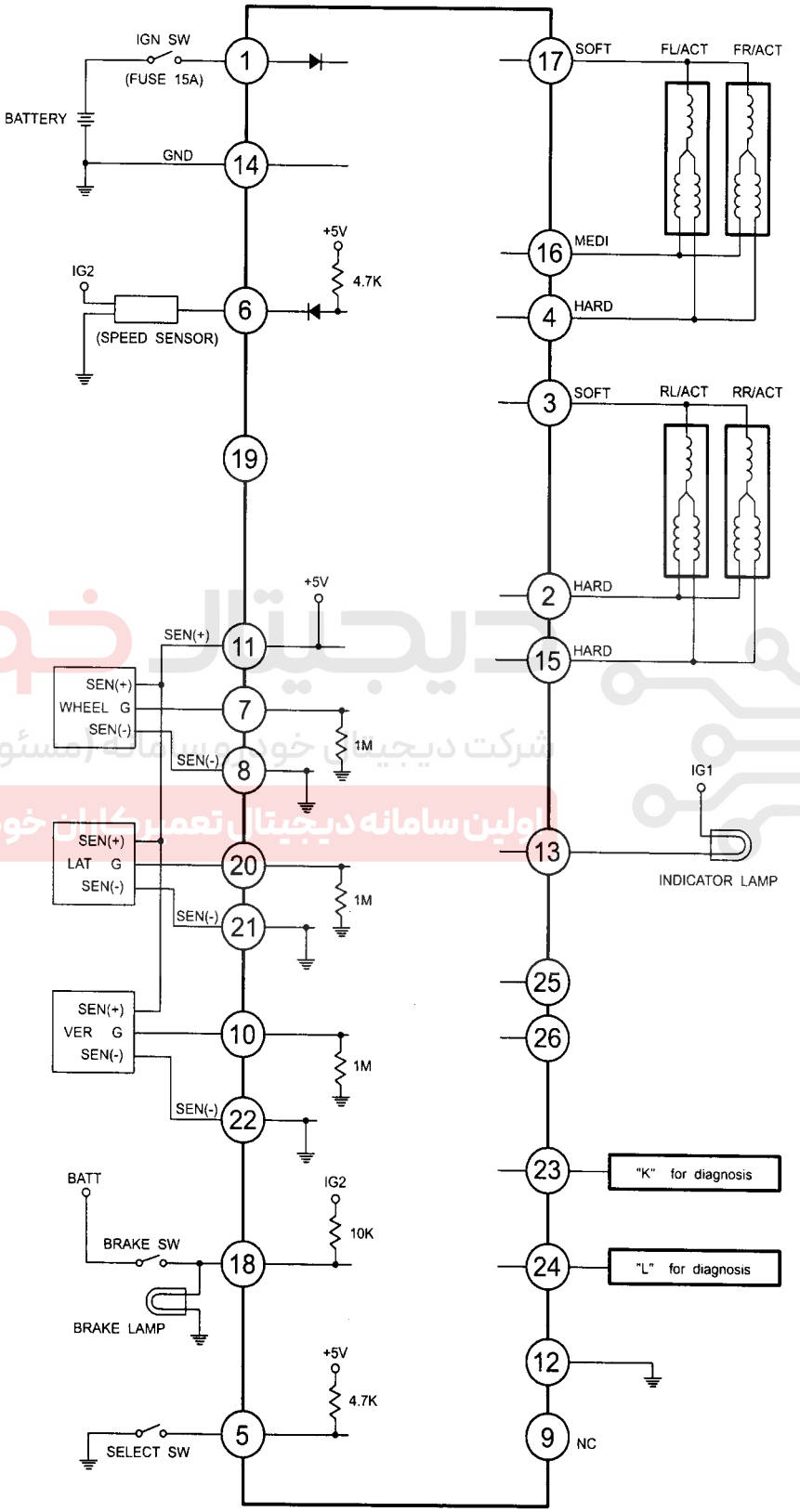
SCHEMATIC AND ROUTING DIAGRAMS

ECS CIRCUIT



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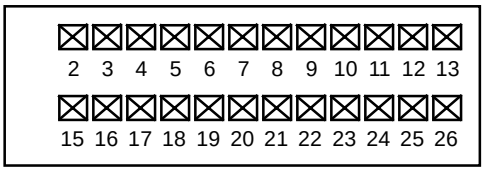


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Connector Pin Number and Circuits

NO.	Circuit	NO.	Circuit
1	Ignition	14	Chassis Ground
2	Actuator R-MEDIUM	15	Actuator R-HEAD
3	Actuator R-SOFT	16	Actuator F-MEDIUM
4	Actuator F-HEAD	17	Actuator F-SOFT
5	Select Switch	18	Brake Switch
6	Speed Sensor	19	-
7	Wheel G Sensor	20	Lateral G Sensor
8	Wheel G Sensor Ground	21	Lateral G Sensor Ground
9	-	22	Vertical G Sensor Ground
10	Vertical G Sensor	23	Diagnosis K Line
11	Sensor +5V	24	Diagnosis L Line
12	Chassis Ground	25	-
13	Indicator Lamp	26	-



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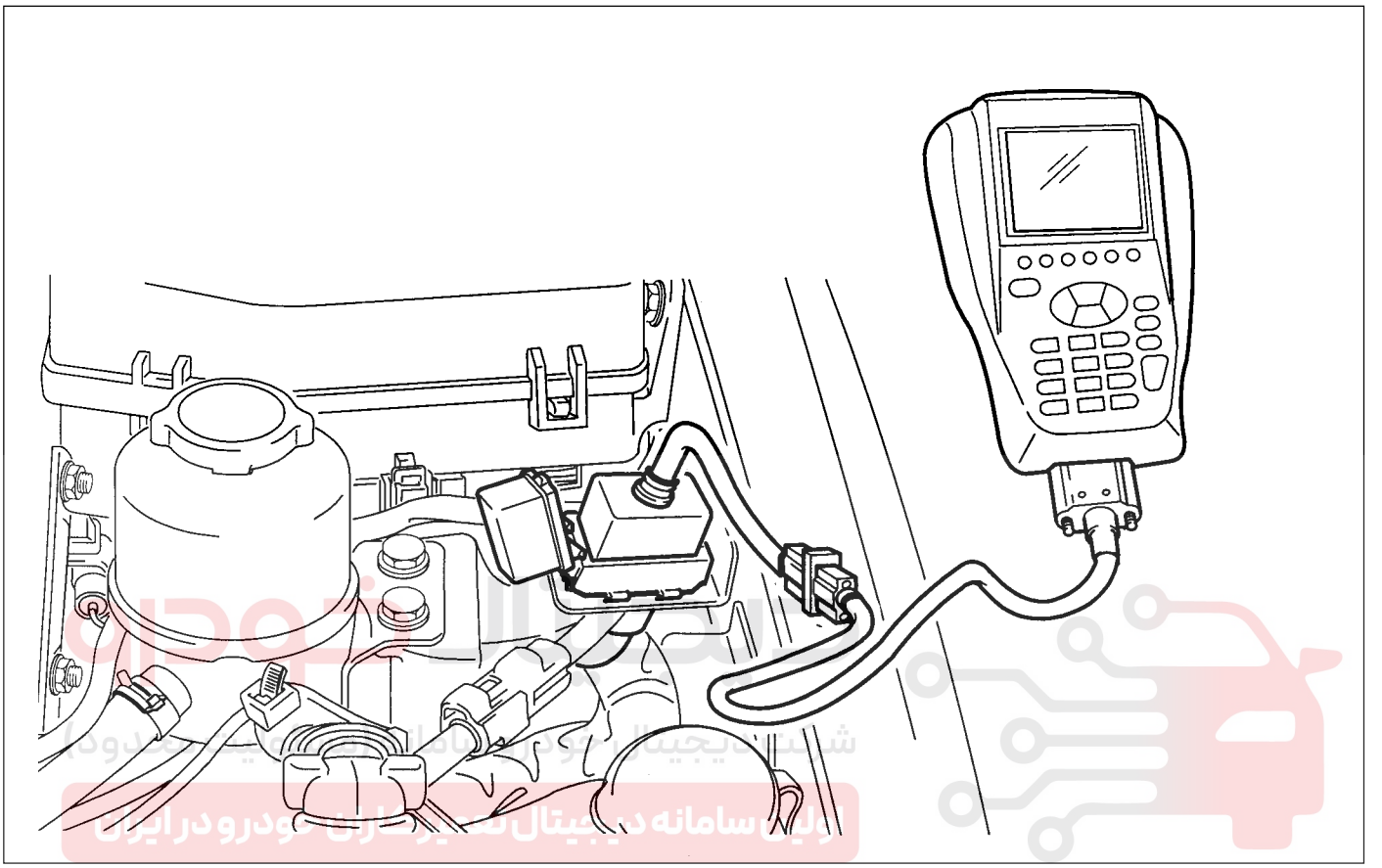
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SELF DIAGNOSIS TEST

DIAGNOSIS TEST

Special Tool Requirements : Scanner



1. Position the ignition switch to 'OFF'.
2. Connect Scanner harness connector to the engine compartment diagnosis socket.
3. Turn the ignition switch to 'ON' position.
4. Select "Electronic control vehicle diagnosis" from function selection display and press "Enter".
5. Select "Musso ('98 model year)" from vehicle model selection display and press 'Enter'.
6. Select "Electronic suspension system (ECS)" from control system selection display and press 'Enter'.
7. Select "Self-diagnosis" from diagnosis item selection display.

   Notice

   Check sensor value output display, if necessary.

8. Determine the fault code and check defective component.

   Notice

   Refer to self-diagnosis list.

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Self - Diagnosis List

Fault Code	Defects	Service Hint
01	Vertical Acceleration Sensor	1. Check sensor supply voltage ● Condition - IGN ON ● Standard value - voltage between pin 11 and 8 of ECU : 4.5 - 5.0V 2. Check sensor output voltage ● Condition - IGN ON ● Standard value - voltage between pin 20 and 11 of ECU : 0.5 - 4.5V 3. Check the sensor. 4. Check circuit for open. 5. Check connection of other connectors.
02	Lateral Acceleration Sensor	1. Check sensor supply voltage ● Condition - IGN ON ● Standard value - voltage between pin 11 and 8 of ECU : 4.5 - 5.0V 2. Check sensor output voltage ● Condition - IGN ON ● Standard value - voltage between pin 10 and 11 of ECU : 0.5 - 4.5V 3. Check the sensor. 4. Check circuit for open. 5. Check connection of other connectors.
03	Wheel Acceleration Sensor	1. Check sensor supply voltage ● Condition - IGN ON ● Standard value - voltage between pin 11, 8 and pin 7,11 of ECU : 4.5 - 5.0V 2. Check sensor output voltage 3. Check the sensor. 4. Check circuit for open. 5. Check connection of other connectors.
04	Front Step Motor	1. Check step motor supply voltage. 2. Check circuit for open. 3. Check connection of other connectors.
05	Rear Step Motor	1. Check step motor supply voltage. 2. Check circuit for open. 3. Check connection of other connectors.
06	ECU	1. Check connectors of ECU. 2. Replace the ECU.

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SECTION 2B

WHEEL ALIGNMENT

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SPECIFICATIONS

WHEEL ALIGNMENT SPECIFICATIONS

Application	Description
Camber	0° ± 30'
Caster	2°30' ± 30'
Toe-in	0 - 4 mm
King Pin Inclination	12°30'

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DIAGNOSIS

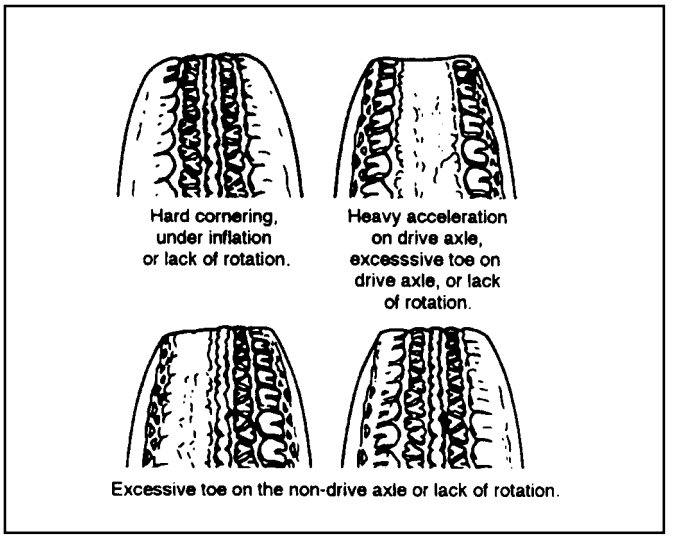
TIRE DIAGNOSIS

Irregular and Premature Wear

Irregular and premature tire wear has many causes. Some of them are incorrect inflation pressures, lack of regular rotation, poor driving habits, or improper wheel alignment.

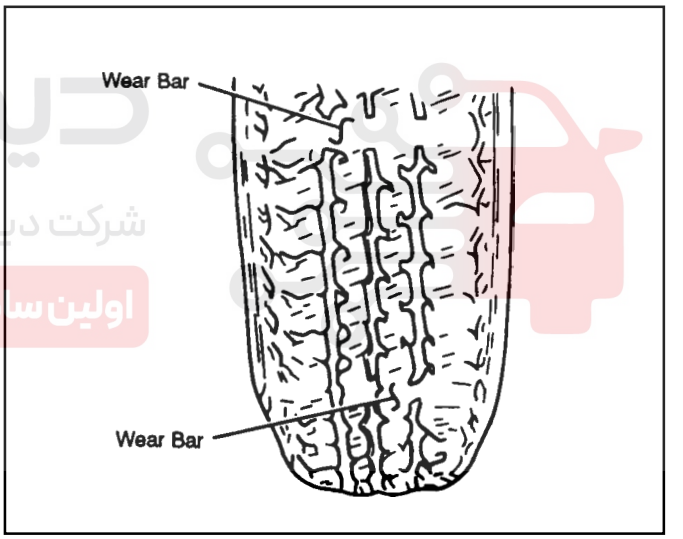
Rotate the tires if :

- The front tire wear is different from the rear.
- The left and right front tire wear is unequal.
- The left and right rear tire wear is unequal, Check wheel alignment if :
- The left and right front tire wear is unequal.
- The wear is uneven across the tread of either front tire.
- The front tire treads are scuffed with “feather” edges on the side of the tread ribs or blocks.



Tread Wear Indicators

The original equipment tires have built-in tread wear indicators to show when the tires need replacement. These indicators appear as bands when the tire tread depth becomes shallow. Tire replacement is recommended when the indicators appear in three or more grooves at six locations.



Radial Tire Waddle

Waddle is side-to-side movement at the front or rear of the vehicle. It is caused by the steel belt not being straight within the tire, or by excessive lateral runout of the tire or wheel.

The vehicle must be road tested to determine which end of the vehicle has the faulty tire. The rear end of the vehicle will shake from side to side or “waddle” if the waddle tire is on the rear of the vehicle. From the driver’s seat, it feels as though someone is pushing on the side of the vehicle. If the faulty tire is on the front of the vehicle, the waddle is more visual. The front sheet meld appears to be moving back and forth, and the drivers seat feels like the pivot point in the vehicle.

Waddle can be diagnosed using the method of substituting known good tire and wheel assemblies on the problem vehicle

1. Road test the vehicle to determine if the waddle is coming from the front or the rear of the vehicle.
2. Install good tires and wheels from a similar vehicle in place of those on the offending end of the problem vehicle. If the source of the waddle is not obvious, change the rear tires.

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3. Road test the vehicle. If there is improvement, install the original tires to find the offending tire. If there is no a straight improvement, install good tires in place of all four offending tires.
4. Install original tires one at a time to find the offending tire.

RADIAL TIRE LEAD/PULL

Lead/pull is the deviation of the vehicle from a straight path on a level road with no pressure on the steering wheel. Lead is usually caused by:

- Incorrect alignment.
- Uneven brake adjustment.
- Tire construction.

The way in which a tire is built can produce lead/pull in the vehicle.011-center belts on radial tires can cause the tire to develop a side force while the vehicle rolls straight down the road. If one side of the tire has even a little larger diameter than the diameter of the other side, the tire will tend to roll to one side. Unequal diameters will cause the tire to develop a side force which can produce vehicle lead/pull.

The radial lead/pull diagnosis chart should be used to determine whether the problem originates from an alignment problem or from the tires. Part of the lead diagnosis procedure calls for tire rotation that is different from the proper tire rotation pattern. If a medium- to high-mileage tire is moved to the other side of the vehicle, be sure to check for ride roughness. Rear tires will not cause lead/pull.

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Radial Tire Lead/Pull Diagnosis Chart

Step	Action	Values(s)	Yes	No
1	1. Perform wheel alignment preliminary inspection. 2. Check the brakes for dragging. 3. Road test the vehicle. Does the vehicle lead/pull?	-	Go to *Step 2*	System OK
2	1. Cross switch the front tire and wheel assemblies. 2. Road test the vehicle. Does the vehicle lead/pull?	-	Go to *Step 3*	System OK
3	1. Check the front wheel alignment. Is the alignment within specifications?	-	Go to *Step 4*	Adjust alignment
4	1. Compare the front camber and front caster to specifications. Are they within specifications?	-	Go to *Step 7*	Go to *Step 5*
5	1. Check the vehicle frame. Is the frame bent?	-	Go to *Step 6*	Go to *Step 1*
6	1. Straighten the frame. Is the repair complete?	-	Go to *Step 3*	-
7	1. The probable cause is the tires. 2. Switch the left front tire and wheel assembly with the left rear tire and wheel assembly. 3. Road test the vehicle. Does the vehicle still lead/pull?	-	Go to *Step 9*	Go to *Step 8*
8	1. Switch the left front tire and wheel assembly with the left rear tire and wheel assembly and replace the left front tire. Does the repair complete?	-	System OK	Go to *Step 1*
9	1. Switch the right front tire and wheel assembly with the right rear tire and wheel assembly. 2. Road test the vehicle. Does the vehicle still lead/pull?	-	Go to *Step 1*	Go to *Step 10*
10	1. Switch the right front tire and wheel assembly with the right rear tire and wheel assembly and replace the right front tire. Is the repair complete?	-	System OK	Go to *Step 1*

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VIBRATION DIAGNOSIS

Wheel imbalance causes most highway speed vibration problems. A vibration can remain after dynamic balancing because:

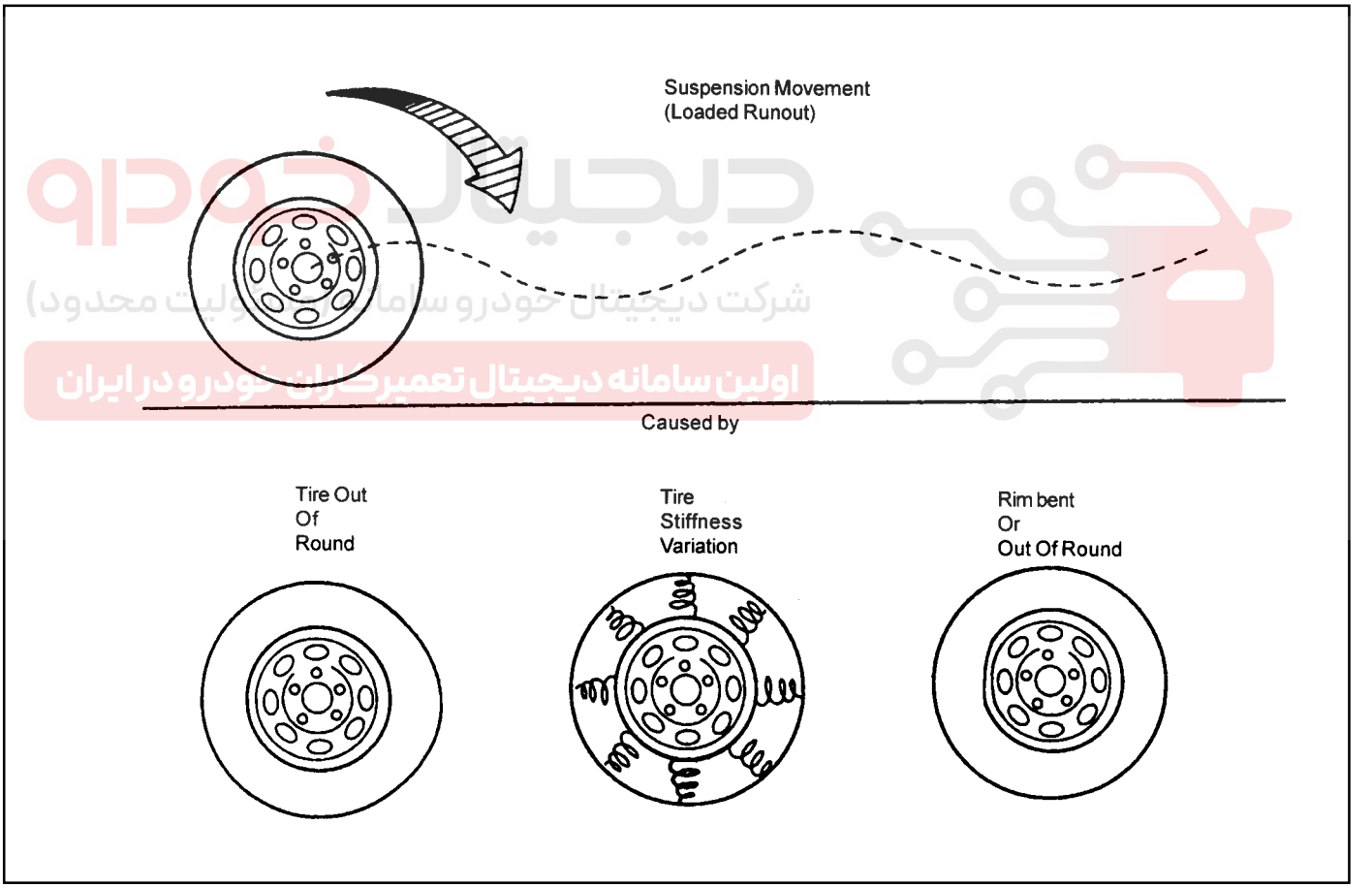
- A tire is out of round.
- A rim is out of round.
- A tire stiffness variation exists.

Measuring tire and wheel free runout will uncover only part of the problem, All three causes, known as loaded radial runout, must be checked using method of substituting known good tire and wheel assemblies on the problem vehicle.

Preliminary Checks

Prior to performing any work, always road test the car and perform a careful visual inspection for:

- Obvious tire and wheel runout.
- Obvious drive axle runout.
- Improper tire inflation.
- Incorrect trim height.
- Bent or damaged wheels.
- Debris build-up on the tire or the wheel.
- Irregular or excessive tire wear.
- Improper tire bead seating on the rim,
- Imperfections in the tires, including: tread deformations, separations, or bulges from impact damage. Slight sidewall indentations are normal and will not affect ride quality.



Tire Balancing

Balance is the easiest procedure to perform and should be done first if the vibration occurs at high speeds. Do an off-vehicle, two-plane dynamic balance first to correct any imbalance in the tire and wheel assembly.

An on-vehicle finish balance will correct any brake drum, rotor, or wheel cover imbalance, If balancing does not correct the high-speed vibration, or if the vibration occurs at low speeds, runout is the probable cause.

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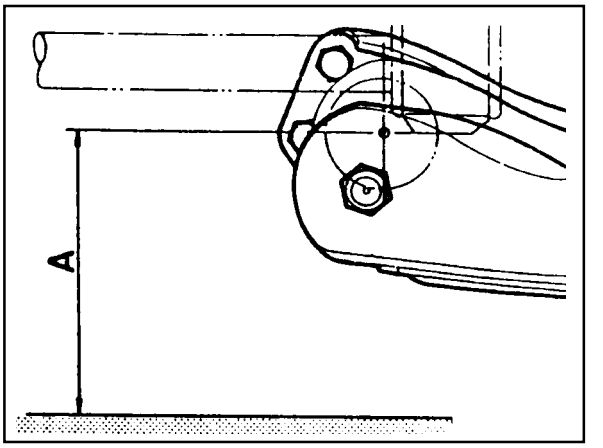
MAINTENANCE AND REPAIR

ON VEHICLE SERVICE

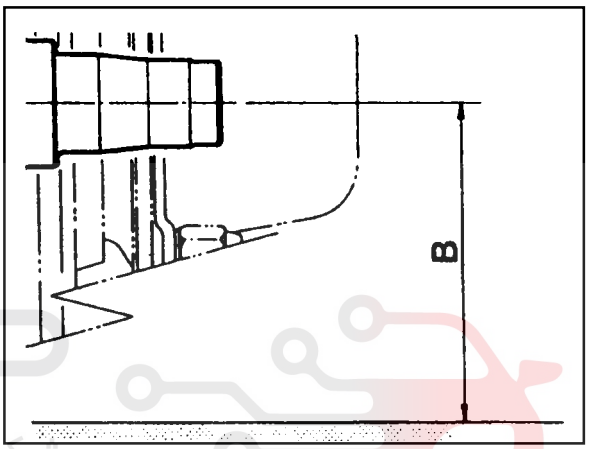
WHEEL ALIGNMENT

Vehicle Height

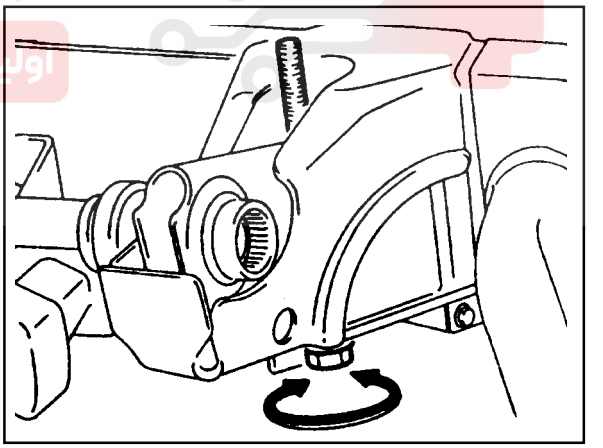
1. Check the tire for proper inflation.
2. Measure 'A' from the center of the lower arm rear mounting bolt end to the ground.



3. Measure 'B' from the center of the steering knuckle shaft to the ground.



4. If the difference between 'A' and 'B' is not within specification, adjust vehicle height using torsion bar height control bolt.



'B' - 'A'	31 - 36mm

Notice

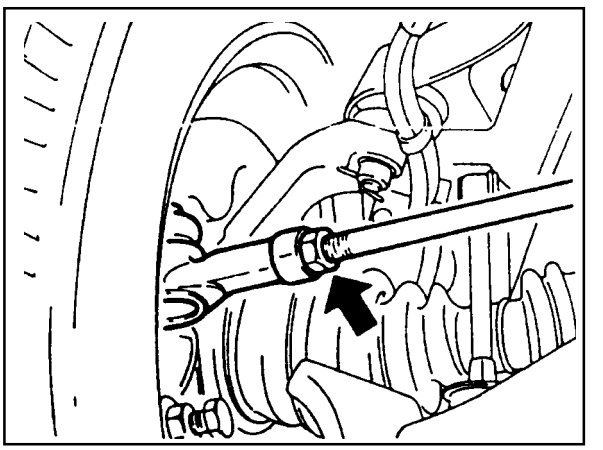
Before wheel alignment, adjust vehicle height first.

Toe-in

1. Measure toe-in.

Specification	0 - 4mm

2. If toe-in is not within specification, loosen the tie rod nuts and adjust it by turning the tie rod.



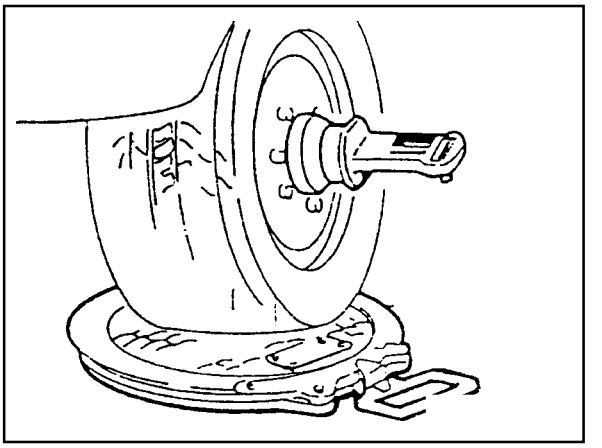
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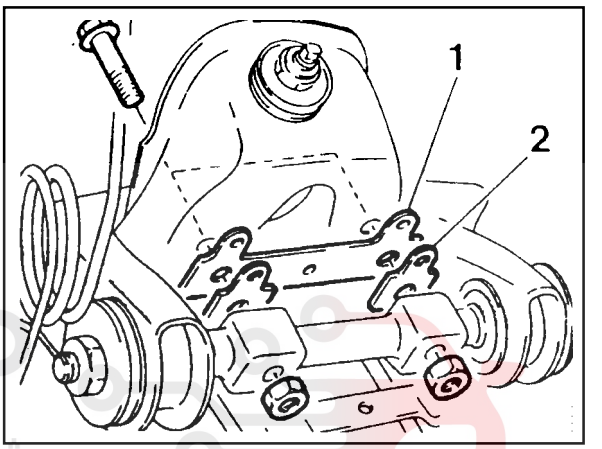
Camber

1. Remove the free wheel hub.
2. Measure camber with a wheel alignment equipment.

Specification	0°±30’



3. If camber measurements are not within specification, adjust it by increasing or decreasing the number of adjusting shims (1) inserted between the upper arm shaft and cross bracket.



Camber Change

Adjusting Shims	Increasing 1 ea	Decreasing 1 ea
1.6 large	+ 19’	- 19’
3.2 large	+ 38’	- 38’

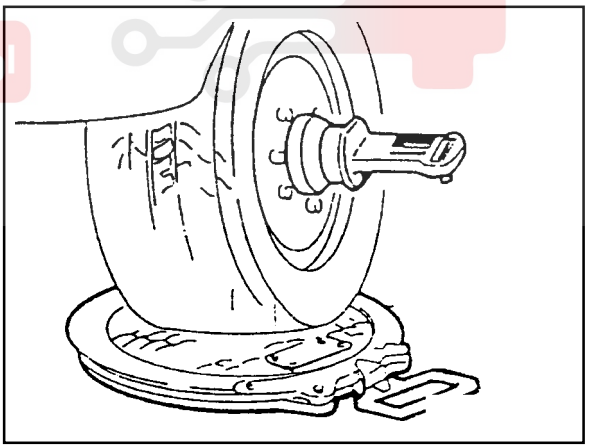
Notice

Difference between the left and right should be adjusted within 30’.

Caster

1. Remove the free wheel hub.
2. Measure caster with a wheel alignment equipment and a turning radius gauge.

Specification	2° 30’ ± 30’



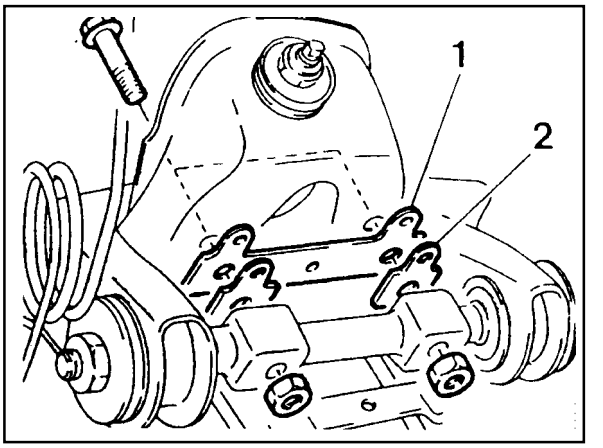
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3. If caster measurements are not within specification, adjust it by increasing 1ea (rear) or decreasing 1ea (front).

Caster Change

Adjusting Shims	FRONT	
	Increasing 1ea	Decreasing 1ea
0.4 small	- 11’	+ 11’
1.6 small	- 43’	+ 43’
Adjusting Shims	REAR	
	Increasing 1ea	Decreasing 1ea
0.4 small	+ 11’	- 11’
1.6 small	+ 43’	- 43’



Notice

Difference between the left and right should be adjusted within 30’.

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GENERAL DESCRIPTION AND SYSTEM OPERATION

FOUR WHEEL ALIGNMENT

The first responsibility of engineering is to design safe steering and suspension systems. Each component must be strong enough to withstand and absorb extreme punishment. Both the steering system and the front and the rear suspension must function geometrically with thebody mass.

The steering and the suspension systems require that the front wheels self-return and that the tire rolling effort and the road friction be held to a negligible force in order to allow the customer to direct the vehicle with the least effort and the most comfort.

A complete wheel alignment check should include measurements of the rear toe and camber.

Four-wheel alignment assures that all four wheels will be running in precisely the same direction.

When the vehicle is geometrically aligned, fuel economy and tire life are at their peak, and steering and performance are maximized.

TOE

Toe-in is the turning in of the tires, while toe-out is the turning out of the tires from the geometric centerline or thrust line. The toe ensures parallel rolling of the wheels.

The toe serves to offset the small deflections of the wheel support system which occur when the vehicle is rolling forward. The specified toe angle is the setting which achieves 0 degrees of toe when the vehicle is moving.

Incorrect toe-in or toe-out will cause tire wear and reduced fuel economy. As the individual steering and suspension components wear from vehicle mileage, additional toe will be needed to compensate for the wear.

Always correct the toe dimension last.

CASTER

Caster is the tilting 91 the uppermost point of the steering axis either forward or backward from the vertical when viewed from the side of the vehicle. A backward tilt is positive, and a forward tilt is negative. Caster influences directional control of the steering but does not affect tire wear. Weak springs or overloading a vehicle will affect caster. One wheel with more positive caster will pull toward the center of the car. This condition will cause the car to move or lean toward the side with the least amount of positive caster. Caster is measured in degrees.

CAMBER

Camber is the tilting of the top of the tire from the vertical when viewed from the front of the vehicle. When the tires tilt outward, the camber is positive. When the tires tilt inward, the camber is negative. The camber angle is measured in degrees from the vertical. Camber influences both directional control and tire wear.

If the vehicle has too much positive camber, the outside shoulder of the tire will wear. If the vehicle has too much negative camber, the inside shoulder of the tire will wear.

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SECTION 2C

FRONT SUSPENSION

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SPECIFICATIONS

GENERAL SPECIFICATIONS

Application		Description
Type		Double Wishbone
Spring Type		Torsion Bar Spring
Torsion Bar	Length	1,040 mm
	Outer Diameter(f)	24.5 mm
Shock Absorber		Cylindrical Reciprocation Type
Stabilizer Type		Torsion Bar Spring

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FASTENER TIGHTENING SPECIFICATIONS

Stabilizer Bar

Application	N•m
Stabilizer Bar Retaining Nut	30 - 45
Stabilizer Bar Link Nut	60 - 80
Lower Arm Nut	16 - 22

Torsion Bar

Application		N•m
Torque Arm Bolt	M10	40 - 60
	M12	60 - 80

Lower and Upper Arm

Application	N•m
Upper Arm Nut	120 - 140
Upper Arm End Castle Nut	80 - 150
Lower Arm Nut	150 - 180
Lower Arm End Castle Nut	120 - 180

Steering Knuckle and Drive Shaft

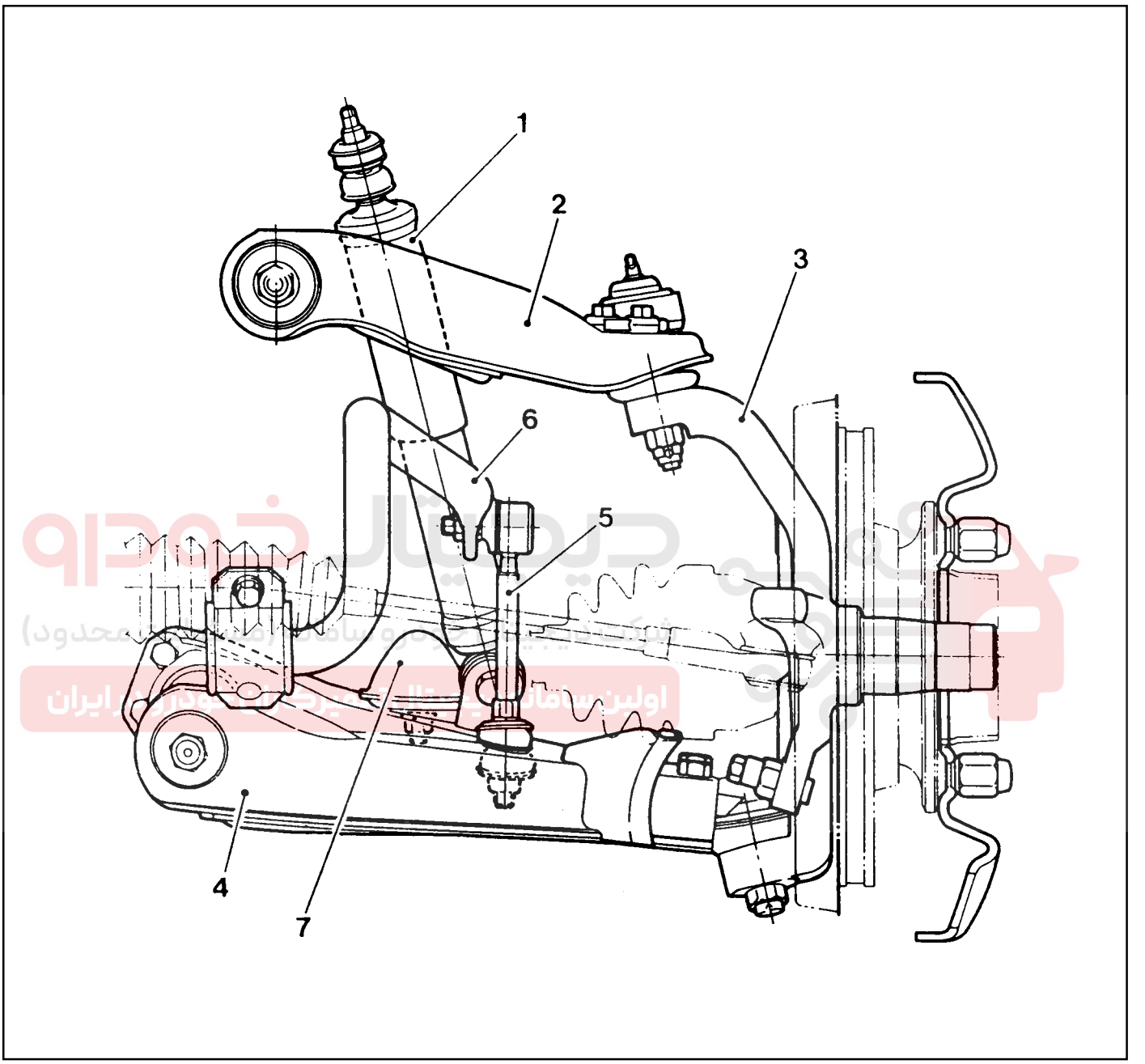
Application	N•m
Brake Caliper Hose Bolt	25 - 35
Brake Caliper Mounting Bolt	85 - 105
Tie Rod Retaining Nut	35 - 45
Upper Arm Retaining Nut	80 - 150
Lower Arm Retaining Nut	120 - 180

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COMPONENT LOCATOR

FRONT SUSPENSION



1 Shock Absorber
2 Upper Arm
3 Steering Knuckle
4 Lower Arm
5 Stabilizer Bar Link
6 Stabilizer Bar
7 Suspension Bumper

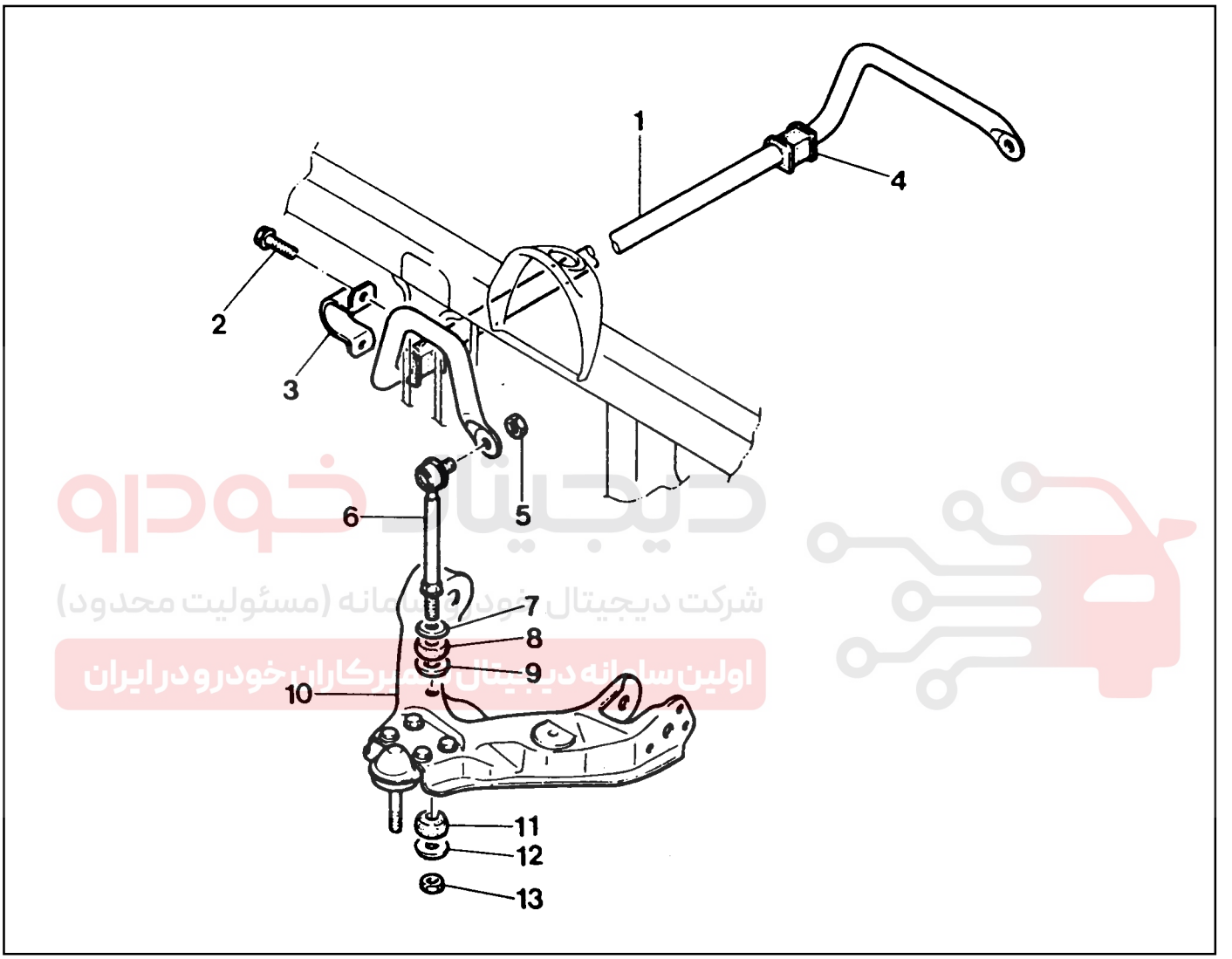
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MAINTENANCE AND REPAIR

ON-VEHICLE SERVICE

FRONT STABILIZER BAR



1 Front Stabilizer Bar
2 Bolt ..... 30-45 Nm
3 Fixing Cap
4 Bushing
5 Nut ..... 60-80 Nm
6 Stabilizer Bar Link Assembly
7 Outer Washer
8 Bushing
9 Center Washer
10 Lower Arm
11 Bushing
12 Outer Washer
13 Nut ..... 16-22 Nm

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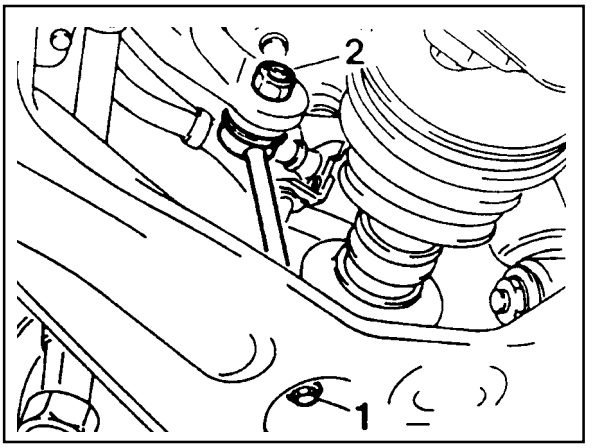
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Removal & Installation Procedure

1. Remove the connecting nuts (1) from stabilizer bar link.

Installation Notice

Tightening Torque	16 - 22 Nm



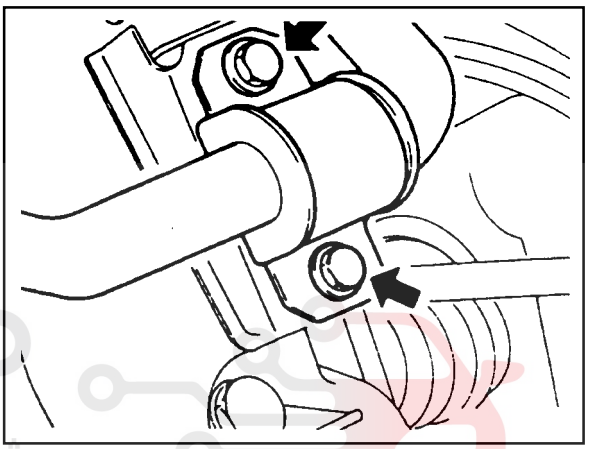
2. Remove the connecting nuts (2) of the stabilizer bar and link and then remove the link.

Installation Notice

Tightening Torque	60 - 80 Nm

3. Remove the stabilizer bar fixing cap bolts (arrow) and remove the stabilizer bar.

Tightening Torque	30 - 45 Nm

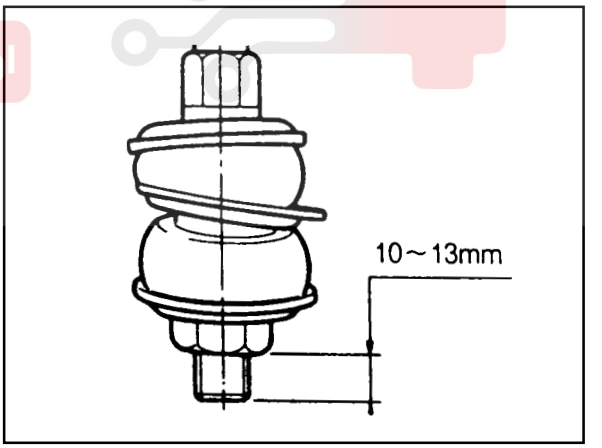


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4. Installation should follow the removal precedure in the reverse order.

Notice

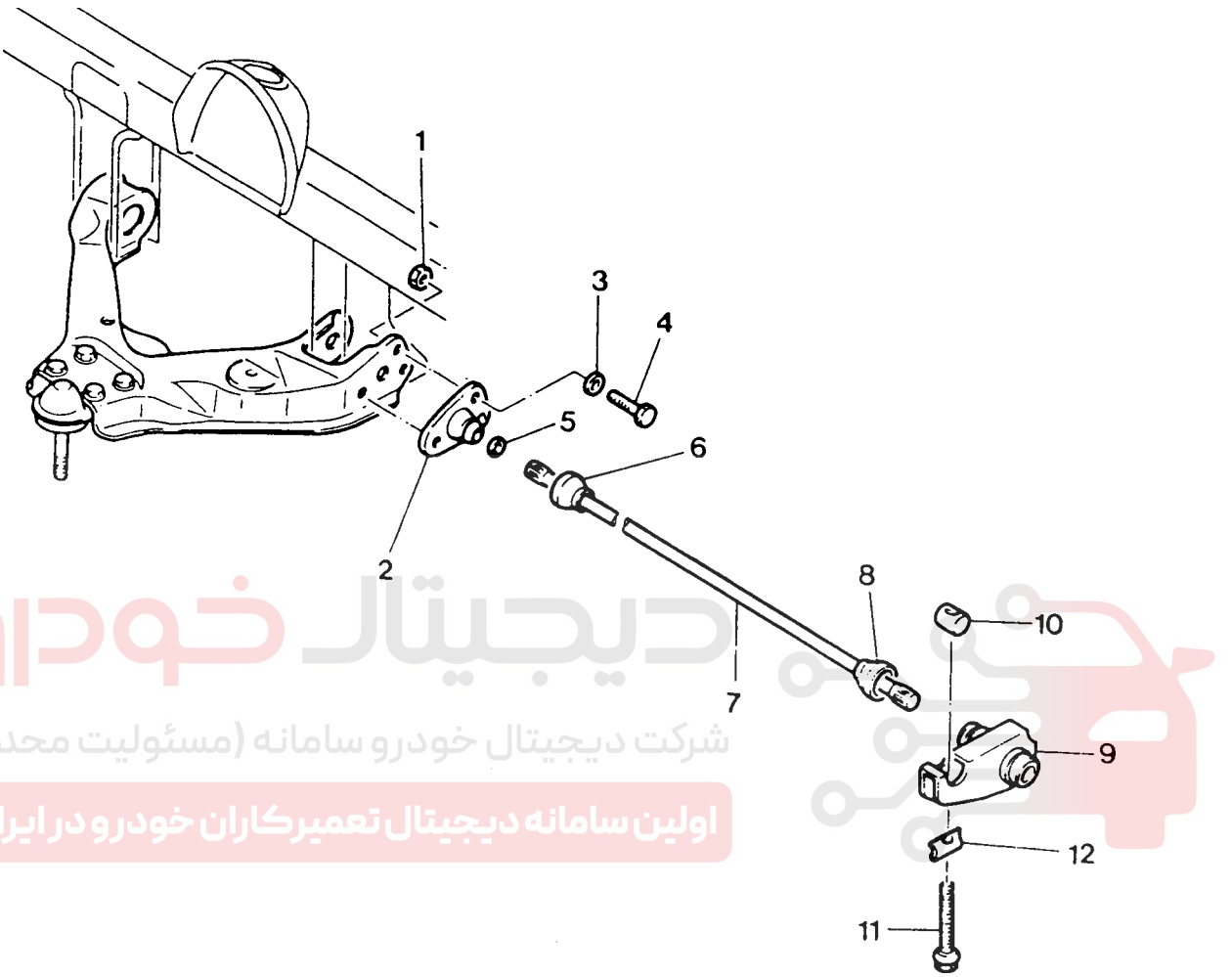
The distance between the end of the nut and the end of the link should be in 10-13 mm at the connection of the stabilizer bar link and lower arm.



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TORSION BAR



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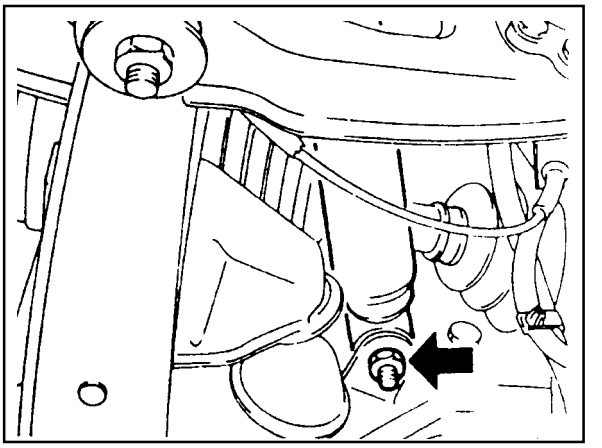
1 Nut
2 Torque Arm
3 Washer
4 Bolt ..... M10 : 40-60 Nm
M12 : 60-80 Nm
5 Torsion Bar End Seat
6 Dust Cover
7 Torsion Bar
8 Dust Cover
9 Height Control Arm Assembly
10 Height Control Bolt End Piece
11 Height Control Bolt
12 Height Control Seat

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Removal & Installation Procedure

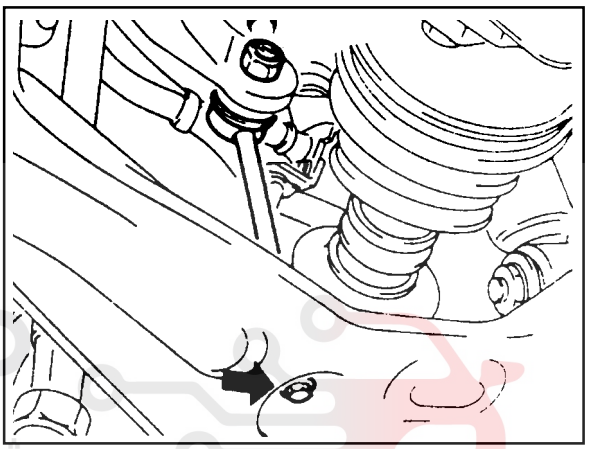
1. Remove the fixing nuts and bolts of the shock absorber and lower arm connection.



Installation Notice

Tightening Torque	60 - 80 Nm

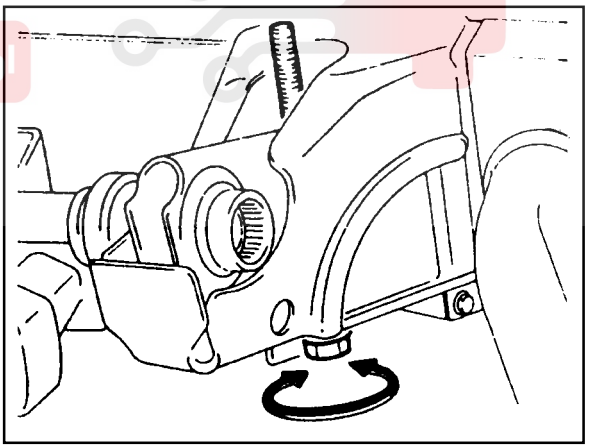
2. Remove the connecting nuts of the stabilizer bar link to the lower arm.



Installation Notice

Tightening Torque	16 - 22 Nm

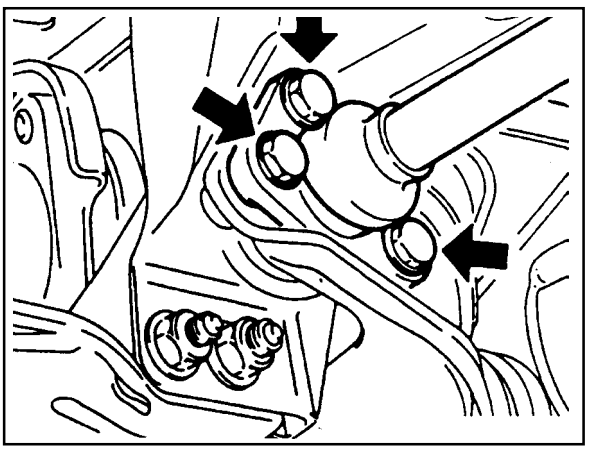
3. Turn the height control bolt until the distance between the end of the height control bolt end piece and the bolt end becomes 0-5 mm.



Installation Notice

Install the torsion bar spring and adjust the distance between the end of the height control bolt and piece end the bolt end to be 50-55 mm. Adjust the vehicle height.

4. Remove the torque arm fixing nuts and bolts and then withdraw the torsion bar spring.



Installation Notice

Tightening Torque	M10	40 - 60 Nm
	M12	60 - 80 Nm

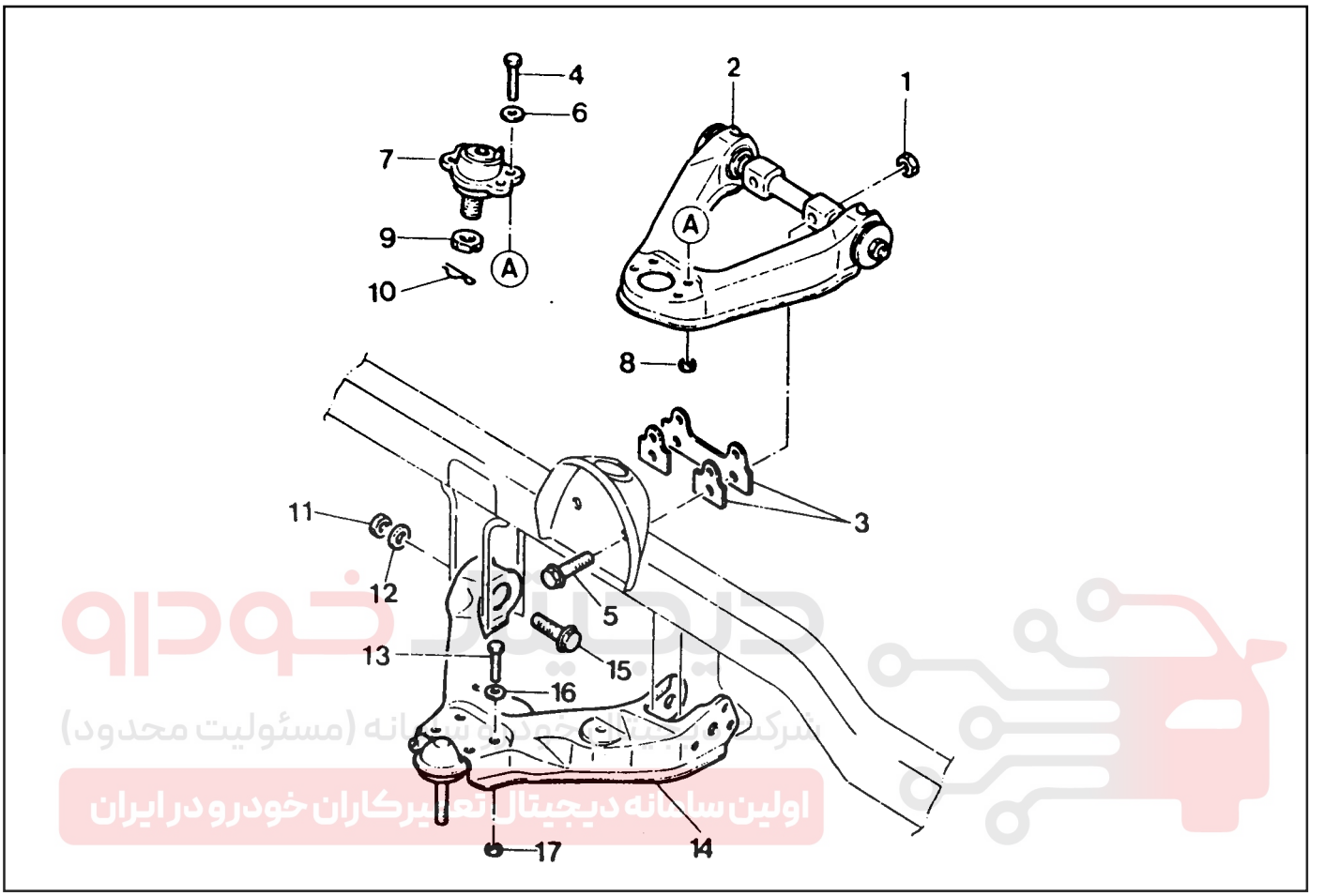
5. Installation should follow the removal precedure in the reverse order.
6. Check and adjust the wheel alignment.

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FRONT LOWER AND UPPER ARM

Preceding Work : Removal of the torsion bar spring
Removal of the steering knuckle and drive shaft



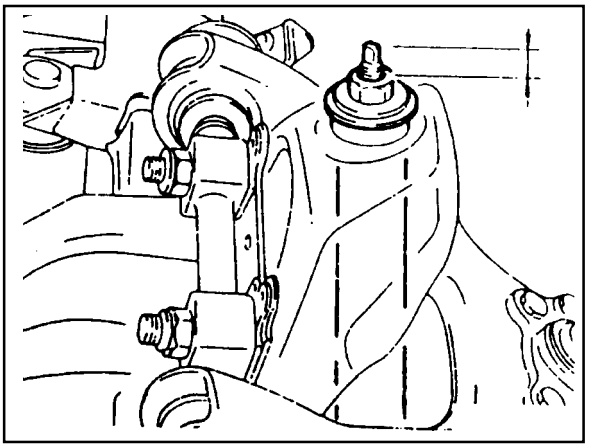
1 Nut ..... 120-140 Nm
2 Fulcrum Pin and Upper Arm Assembly
3 Camber/Caster Adjusting Shim
4 Bolt
5 Bolt
6 Washer
7 Upper Arm End
8 Nut ..... 16-22 Nm
9 Castle Nut ..... 80-150 Nm
10 Cotter Pin ..... Replace
11 Nut ..... 150-180 Nm
12 Washer
13 Bolt
14 Lower Arm Assembly and Lower Arm End
15 Bolt
16 Washer
17 Nut ..... 60-80 Nm

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Removal & Installation Procedure

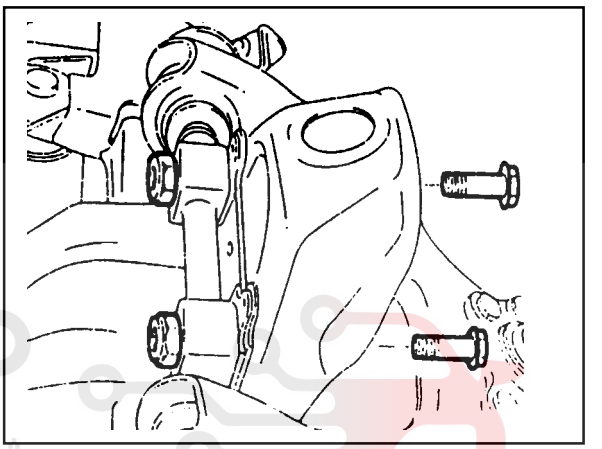
1. Remove the shock absorber.



Installation Notice

Upper	Distance between the nut end and the screw end	6 - 9 mm
Lower	Tightening Torque	60 - 80 Nm

2. Remove the fulcrum pin mounting bolts and nuts and remove the upper arm assembly.



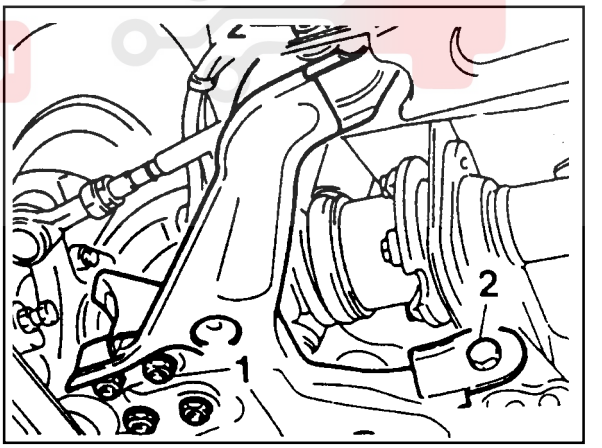
Notice

Be careful not to damage or lose the adjusting shims.

Installation Notice

Tightening Torque	120 - 140 Nm

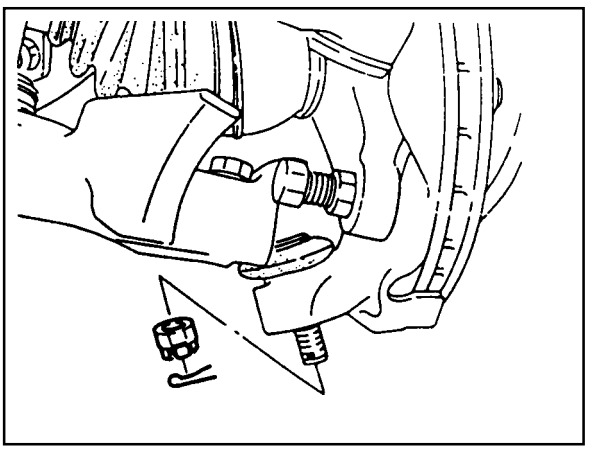
3. Remove the lower arm mounting bolts (2).



Installation Notice

Tightening Torque	150 - 180 Nm

4. Pull out the cotter pin from the lower arm ball end assembly and remove lower arm after loosening the slotted nut.



Installation Notice

Tightening Torque	120 - 180 Nm

Notice

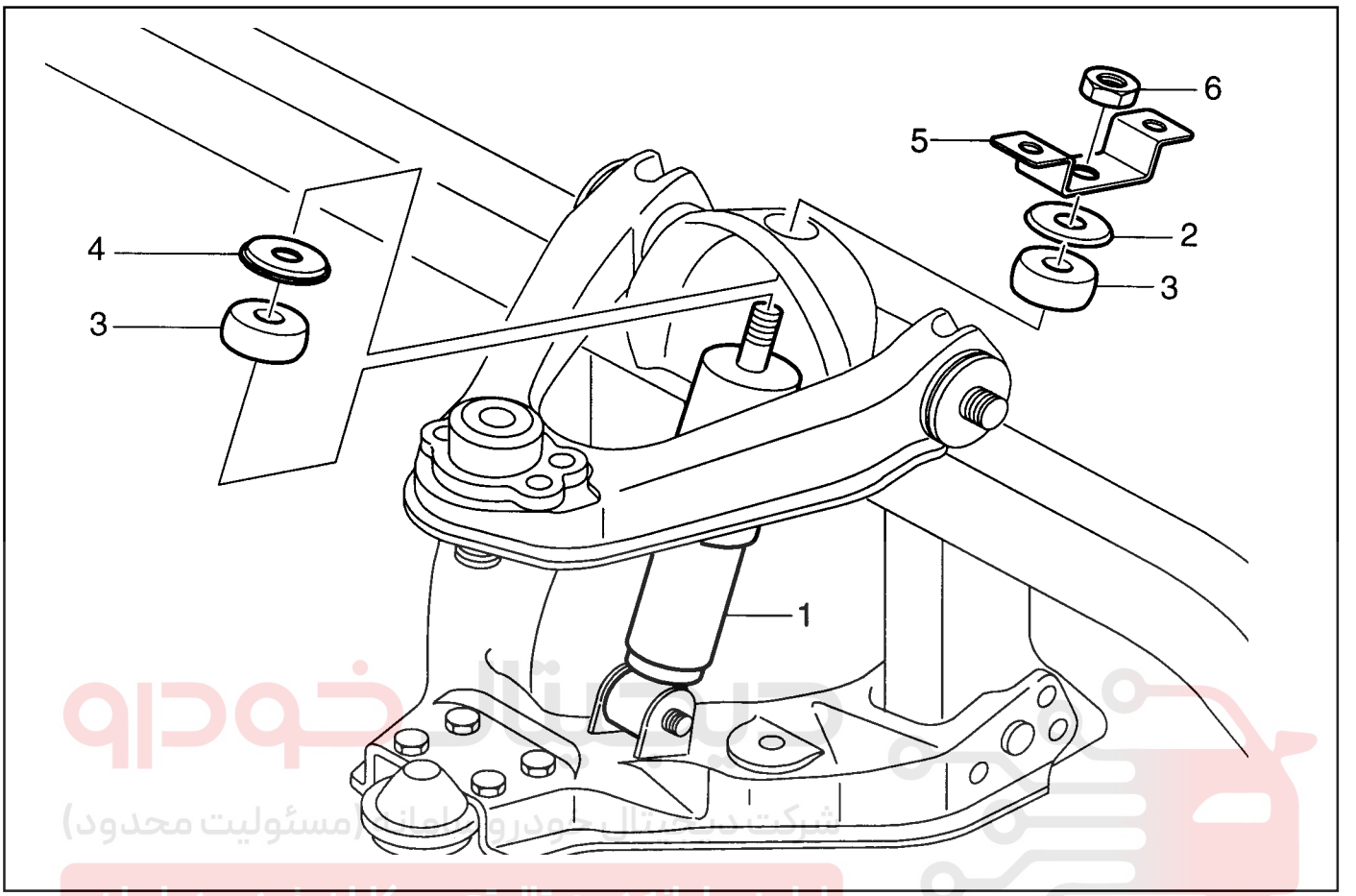
Replace the cotter pin with new one.

5. Installation should follow the removal precedure in the reverse order.

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FRONT SHOCK ABSORBER



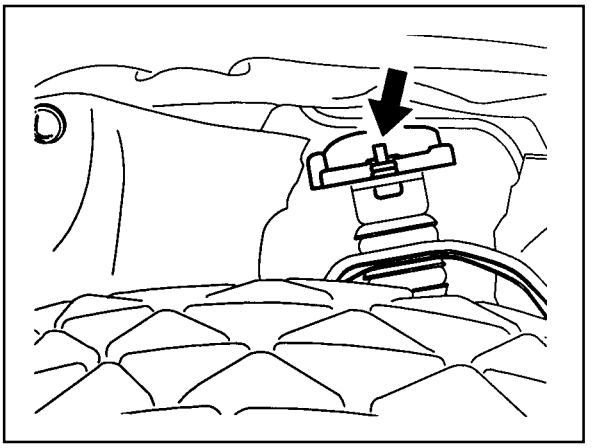
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1 Front Shock Absorber
2 Washer
3 Bush
4 Center Washer
5 Actuator Mounting Bracket
6 Nut 40-60Nm

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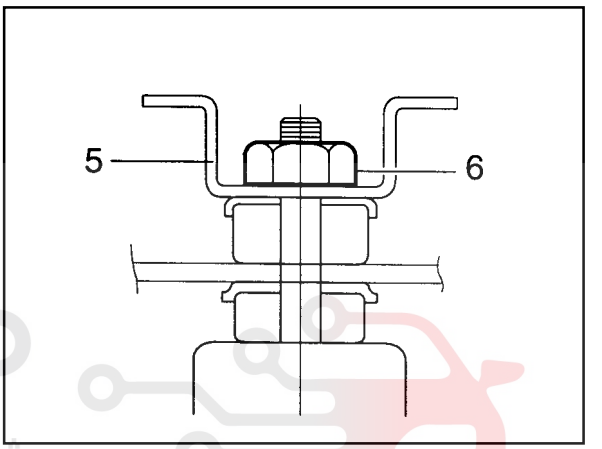
Removal & Installation Procedure



1. Disconnect actuator connector and unscrew bolt and remove actuator assembly.

   Notice

   When installing the actuator to the mounting bracket, the wiring should face the front of the frame.



2. Unscrew the upper nut (6).

   Notice

   When screwing the nut, actuator contacting surface of the mounting bracket and rod end should be 0.5 - 1.5mm.

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3. Remove the mounting bracket (5).

   Notice

   When installing the bracket, it should be vertical to the frame side member.

4. Remove the bush and check for damage and replace if necessary.

5. Unscrew shock absorber lower bolt and nut and remove the shock absorber.

   Notice

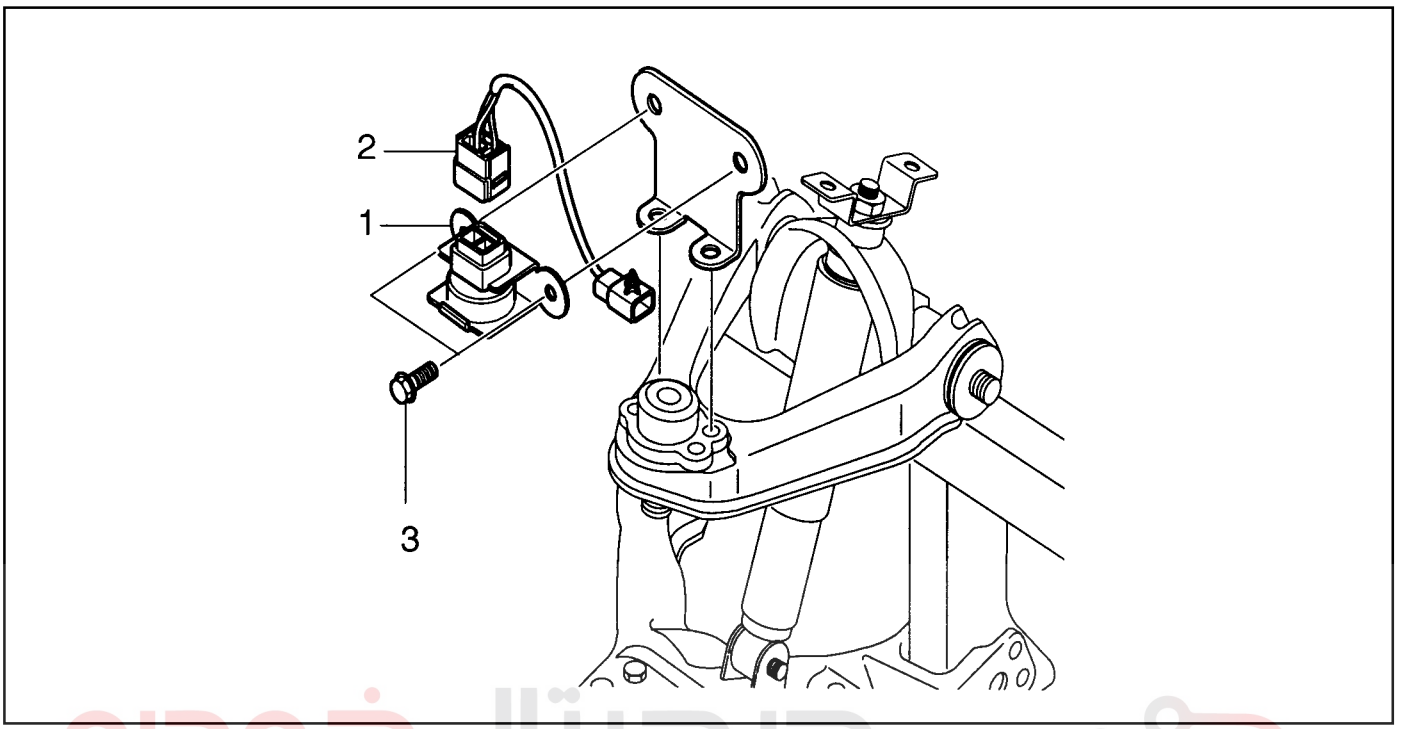
   Shock absorber is filled with gas, never attempt to cut or heat.

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

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AXLE VERTICAL ACCELERATION SENSOR (WHEEL G SENSOR)



1 Axle Vertical Acceleration Sensor (wheel G sensor)
2 Extension Wiring
3 Bolt (M6) ..... 20 - 30Nm

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Removal & Installation Procedure

1. Disconnect extension wiring connector (2) from the axle vertical acceleration sensor.

   Notice

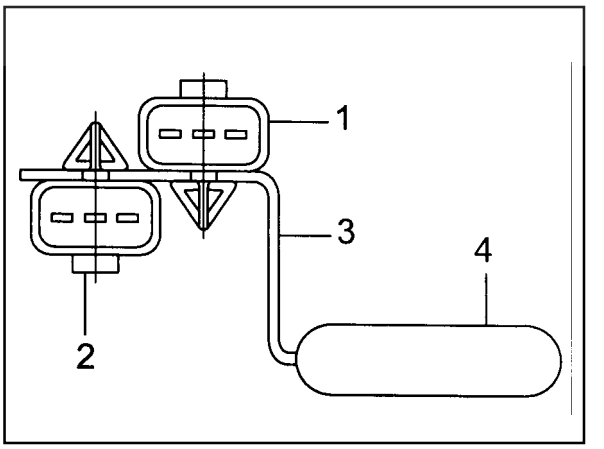
   Installation of wiring connector should be as shown in the right drawing.

2. Unscrew bolts (3) and remove the axle vertical acceleration sensor (1).

   Notice

   When installing the sensor to the bracket, the sensor wiring should be upward.

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



1 Actuator Connector
2 Axle Vertical Acceleration Sensor Connector
3 Front Hose Mounting Bracket
4 Frame Side Member

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VERTICAL AND LATERAL SENSOR

Removal & Installation Procedure

1. Disconnect vertical sensor and lateral sensor connectors.

   Notice

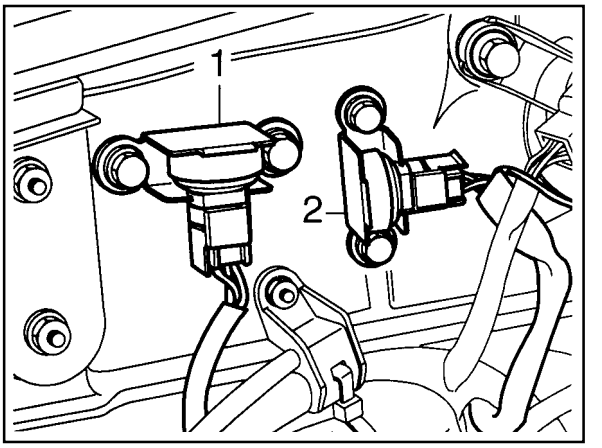
   When connecting the connectors, connector connection of the lateral sensor (2) should be in the right and connector connection of the vertical sensor (1) should face downward.

2. Unscrew bolts and remove vertical sensor and lateral sensor.

   Installation Notice

Tightening Torque	20 - 30 Nm

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



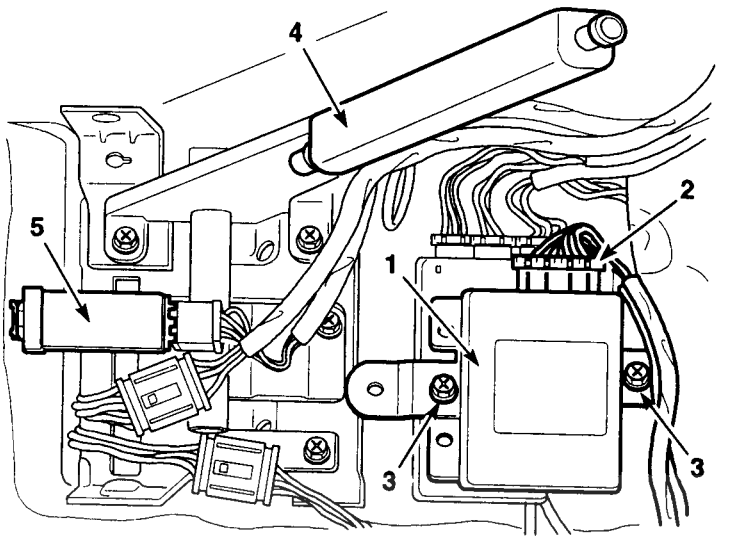
1 Body Vertical Acceleration Sensor(Vertical Sensor)
2 Body Lateral Acceleration Sensor (Lateral Sensor)

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ECS (ECU)

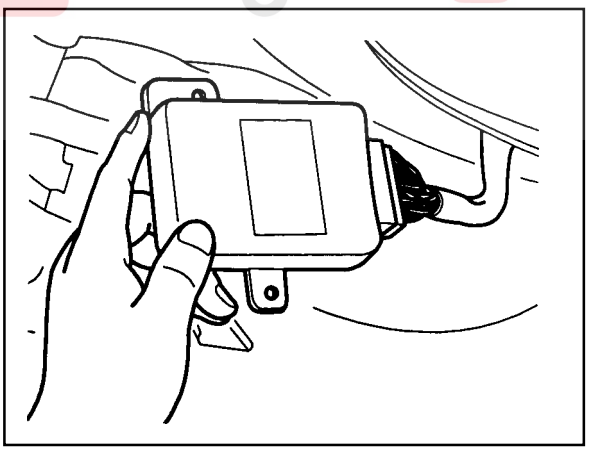


1 Electronically Controlled Suspension (ECU)
2 Connector
3 Bolts (2 pieces)
4 Parking Brake Lever
5 Over Voltage Protection Relay

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Removal & Installation Procedure

1. Disconnect each connectors from the console box and remove the console box.
2. Disconnect ECU connector.
3. Unscrew 10mm x 2 bolts and remove ECS (ECU).
4. Installation should follow the removal procedure in the reverse order.



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SECTION 2D

REAR SUSPENSION

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SPECIFICATIONS

GENERAL SPECIFICATIONS

Application		Description
Type		5-link
Spring Type		Coil Spring
Coil Spring	Wire Diameter (mm)	13.8 mm
	Diameter (mm)	126.8 mm
	Free Heigth (mm)	384.5 mm
	Outer Diameter (mm)	f139.6 mm
	Spring Constant (kg·m)	2.58 kg
Shock Absorber		Cylindrical Reciprocation Type
Stabilizer Type		Torsion Bar Type

FASTENER TIGHTENING SPECIFICATIONS

Application	N•m
Upper Nut	16 - 22
Stabilizer Bar Bolt	30 - 45
Lateral Rod Nut	150 - 180
Shock Absorber Mounting Nut Upper	50 - 65
Arm Fixing Nut	150 - 180

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DIAGNOSIS

NOISE (DURING STRAIGHT DRIVING)

Check	Action
Lack of Oil	Replenish
Low Viscosity of Oil	Replace
Insufficient Oil	Replace
Excessive Backlash of Ring Gear	Adjust
Worn or Damaged Tooth of Ring and Pinion Gear	Replace
Worn or Damaged Drive Pinion Bearing	Replace
Worn Spline of Side Bearing and Side Gear	Replace
Bent Axle Housing	Replace
Bent Differential Case	Replace
Worn Pinion Shaft	Replace
Incorrect Drive Pinion Preload	Adjust
Incorrect Contact of Ring Gear and Pinion	Retightening

OIL LEAKAGE

Check	Action
Excessive Oil	Adjust
Faulty Seal of Carrier Contact Surface	Repair
Axle Housing Crack	Replace
Worn or Damaged Oil Seal	Replace

NOISE (DURING TURNING)

Check	Action
Worn or Damaged Tooth of Pinion or Side Gear	Replace
Worn Pinion Shaft	Replace
Excessive Backlash of Pinion Gear and Side Gear	Replace
Excessive End-play of Rear Axle Shaft	Adjust
Incorrect Contact of Side Gear and Differential Case	Replace
Axle Housing Crack	Replace
Bent or Poor Installation of Drive Pinion Oil Seal	Replace
Damaged or Torn Drive Pinion Oil Seal	Replace
Loosened Bearing Collar	Replace
Worn or Damaged Universal Joint	Replace
Worn of Damaged Axle Shaft Bearing	Replace

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HEATING

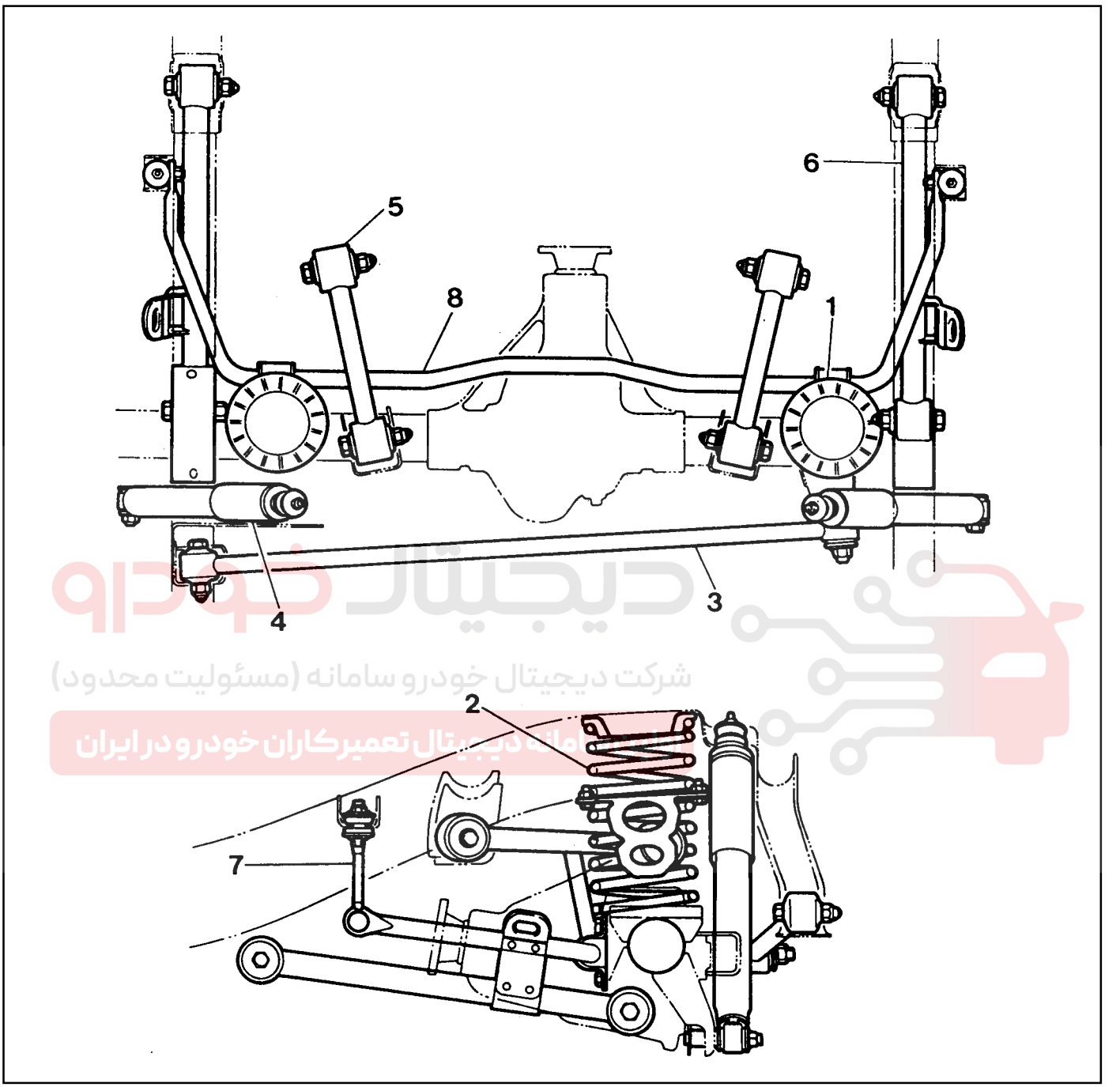
Check	Action
Lack of Oil	Replenish
Insufficient Backlash of Gears	Adjust
Excessive Preload of Bearing	Adjust

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COMPONENT LOCATOR



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1 Spring Seat
2 Coil Spring
3 Lateral Rod
4 Shock Absorber
5 Upper Arm
6 Lower Arm
7 Connecting Link
8 Stabilizer Bar

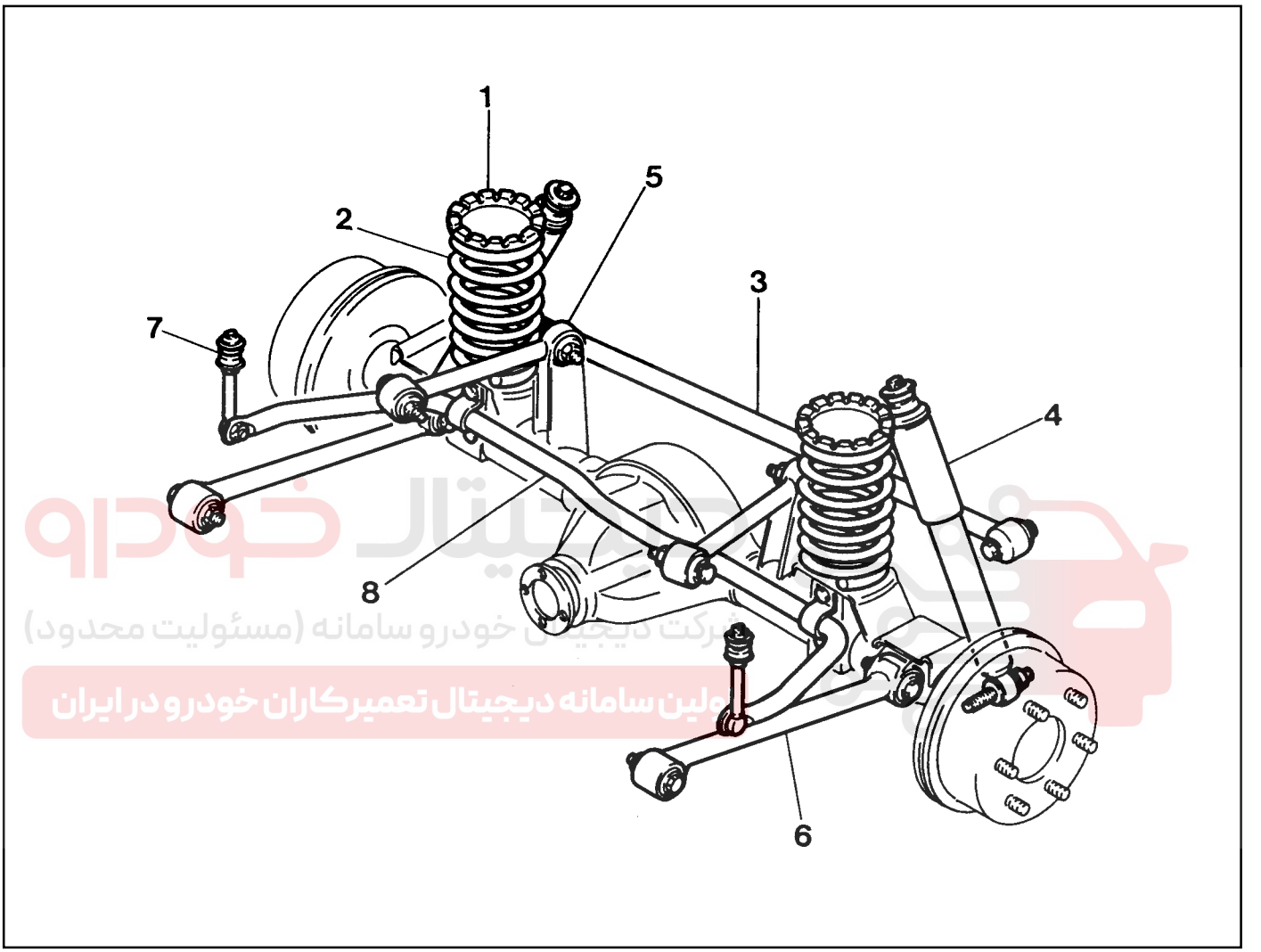
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MAINTENANCE AND REPAIR

ON-VEHICLE SERIVCE

REAR SUSPENSION (5 - LINK)



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1 Spring Seat
2 Coil Spring
3 Lateral Rod
4 Shock Absorber
5 Upper Arm
6 Lower Arm
7 Connecting Link
8 Stabilizer Bar

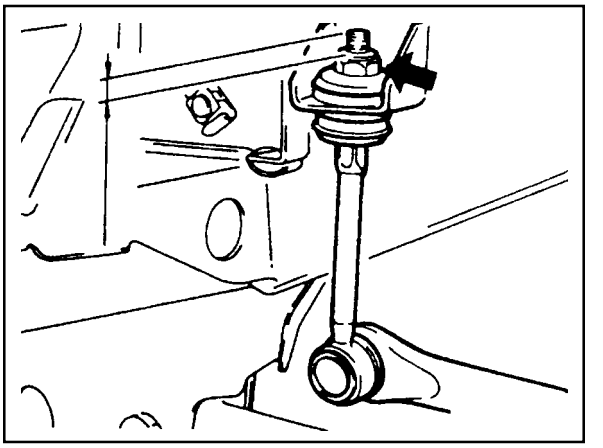
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Removal & Installation Procedure

- **Stabilizer bar**

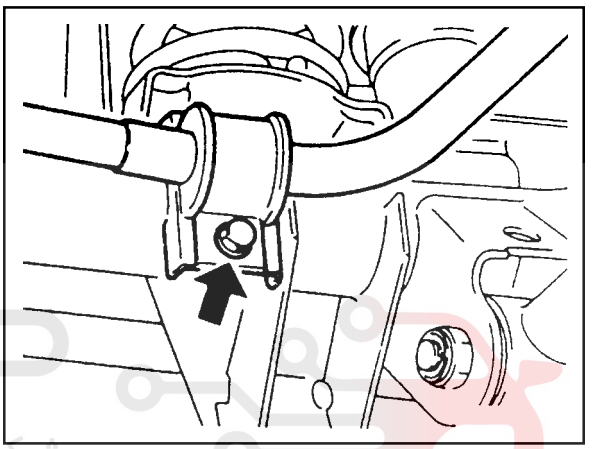
1. Remove the upper nut of the connecting link.



Installation Notice

Distance Between the Nut end and the Screw end	10 - 13 mm
Tightening Torque	16 - 22 Nm

2. Remove the stabilizer bar cap fixing bolts (arrow) and remove the stabilizer bar.

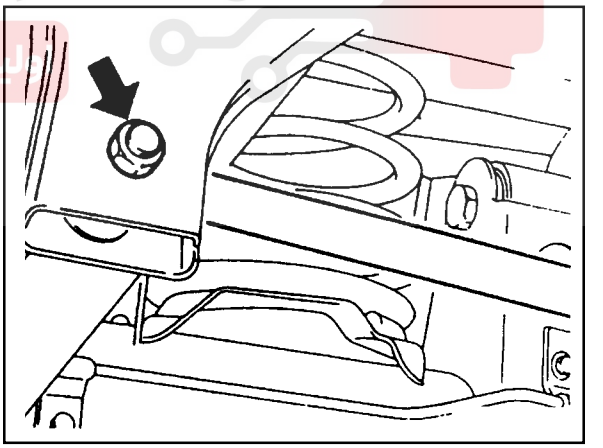


Installation Notice

Tightening Torque	30 - 45 Nm

- **Lateral Rod**

1. Remove the lateral rod fixing nut from the frame.



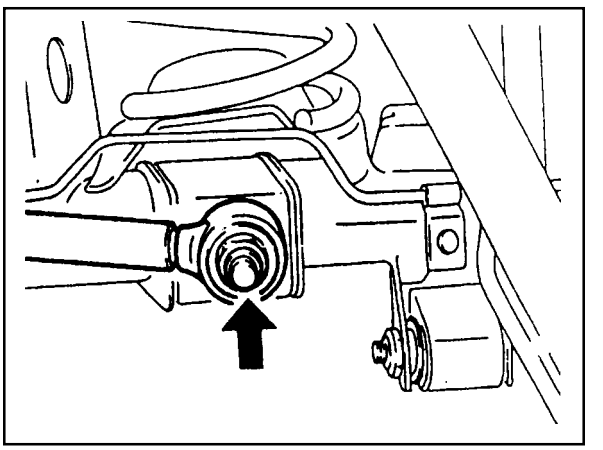
Notice

Completely press the coil springs.

Installation Notice

Tightening Torque	150 - 180 Nm

2. Remove the lateral rod fixing nut from the rear axle and remove the lateral rod.



Installation Notice

Tightening Torque	150 - 180 Nm

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- Shock Absorber.

1. Remove the lower mounting nut.

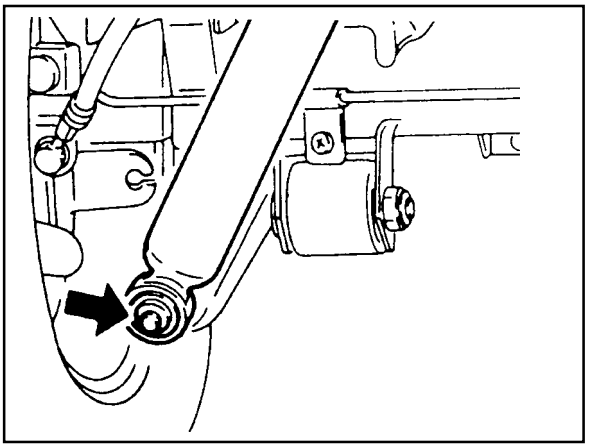
Installation Notice

Tightening Torque	50 - 65 Nm

2. Remove the upper mounting nut and remove the shock absorber.

Installation Notice

Distance between the nut end and the screw end	6 - 9 mm
Tightening Torque	30 - 45 Nm



- Upper Arm

1. Remove the upper arm fixing nut from the frame.

Installation Notice

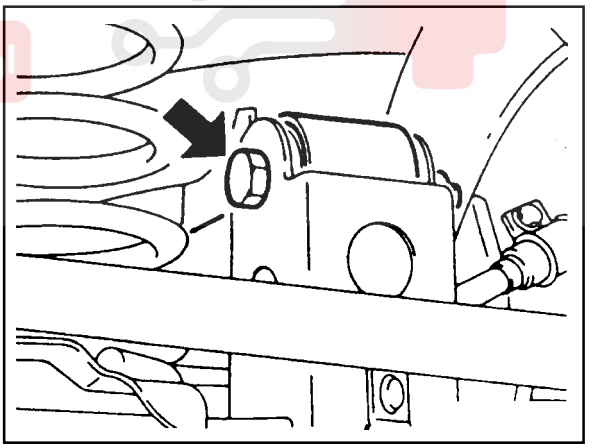
Tightening Torque	150 - 180 Nm

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2. Remove the upper arm fixing nut from the rear axle and remove the upper arm.

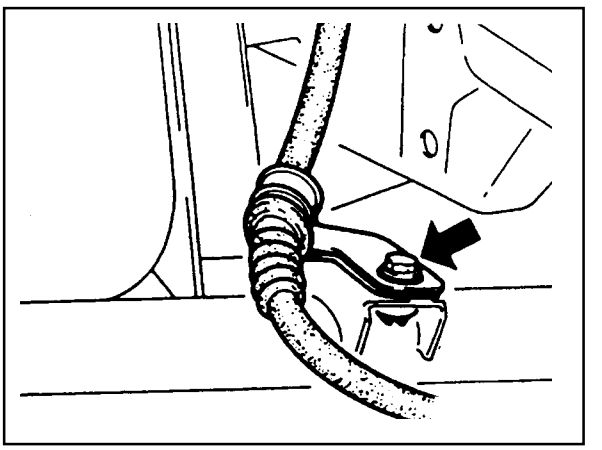
Installation Notice

Tightening Torque	150 - 180 Nm



- **Lower arm**

1. Remove the parking brake cable bracket.



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2. Remove the lower arm fixing nut from the frame.

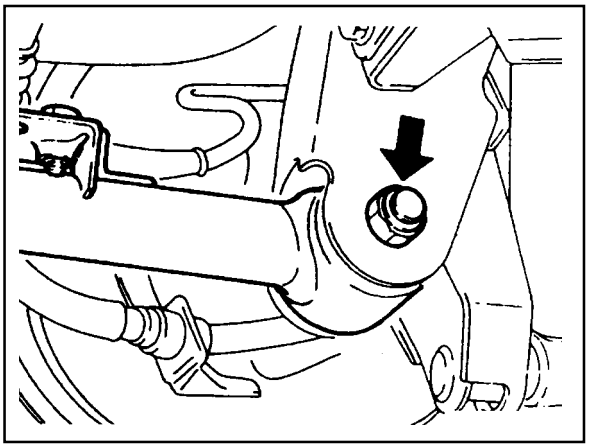
Installation Notice

Tightening Torque	150 - 180 Nm

3. Remove the lower arm fixing nut from the rear axle and remove the lower arm.

Installation Notice

Tightening Torque	150 - 180 Nm

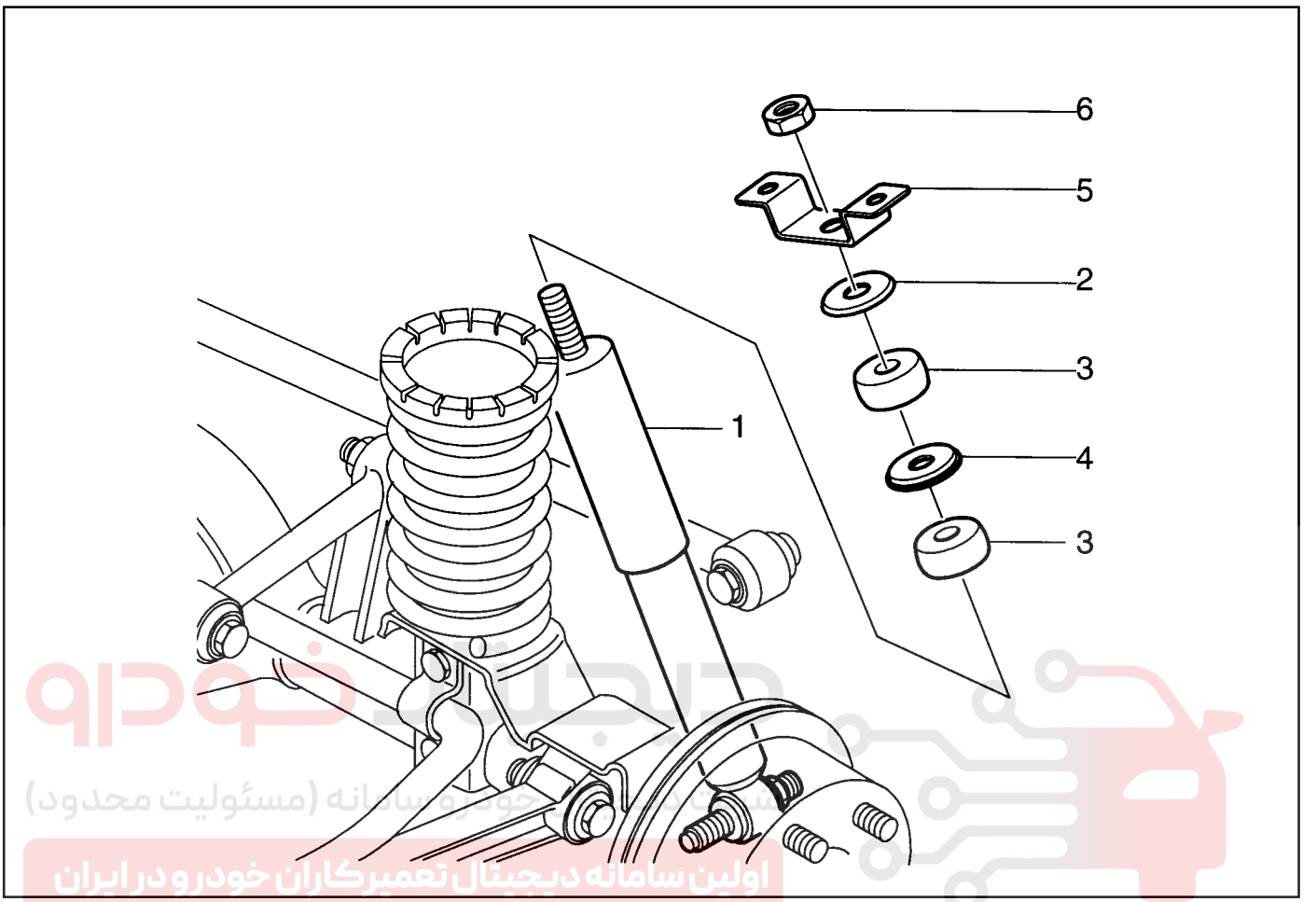


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REAR SHOCK ABSORBER



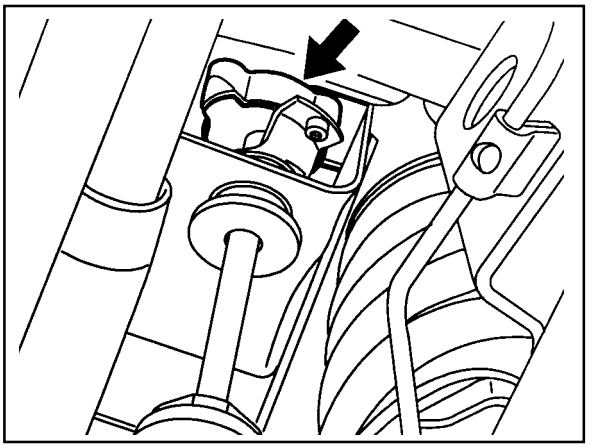
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1 Rear Shock Absorber
2 Washer
3 Bush
4 Center Washer
5 Actuator Mounting Bracket
6 Nut (M12 x 1.25) ..... 40 - 60Nm

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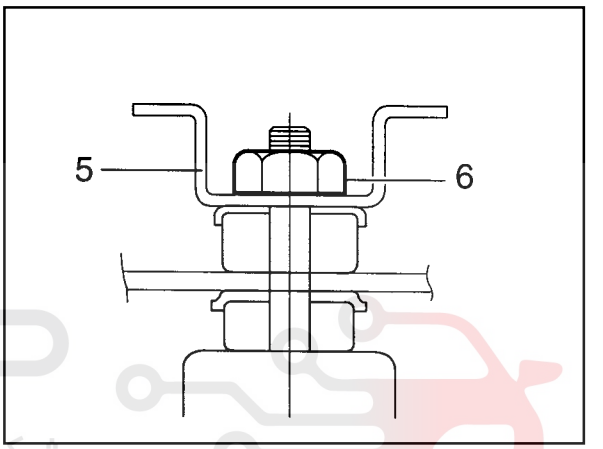
Removal & Installation Procedure



1. Disconnect actuator connector and unscrew bolt and remove actuator assembly.

   Notice

   - When installing the actuator to the mounting bracket, the wiring should face outward of the frame.
   - Actuator wiring should be fixed 40 - 50mm away from the wiring ends when fixing it with the frame open clip.



2. Unscrew the upper nut (6).

   Notice

   When screwing the nut, actuator contacting surface of the mounting bracket and rod end should be 0.5 - 1.5mm.

3. Remove the mounting bracket (5).

   Notice

   When installing the bracket, it should be parallel to the frame side member.

4. Remove the bush and check for damage and replace if necessary.
5. Unscrew shock absorber lower bolt and nut and remove the shock absorber.

   Notice

   Shock absorber is filled with gas, never attempt to cut or heat.

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

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SECTION 2E

TIRES AND WHEELS

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Maintenance and Repair **2E-5**
On-Vehicle Service 2E-5
Wheels and Tires 2E-5

SPECIFICATIONS

GENERAL SPECIFICATIONS

Application		Description
Wheel	Material	Alumimun
	Size	7JJ X 15
Tire	Type	Radial Tire
	Size and Tire Pressure	P215 / 75R 15 - 30psi
		P235 / 75R 15 - 30psi
		P255 / 70R 15 - 30psi

FASTENER TIGHTENING SPECIFICATIONS

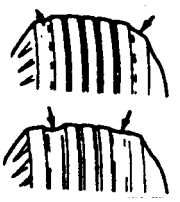
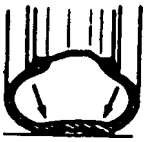
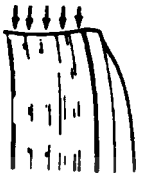
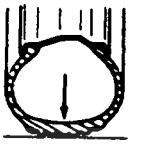
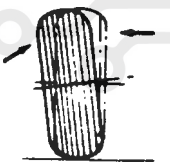
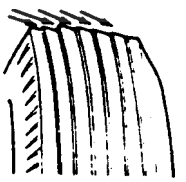
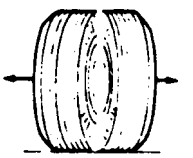
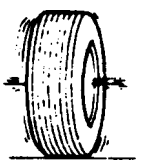
Application		N•m
Wheel Bolt	Steel	80 - 120
	Alumimum	110 - 130

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DIAGNOSIS

WEAR PATTERN DIAGNOSIS

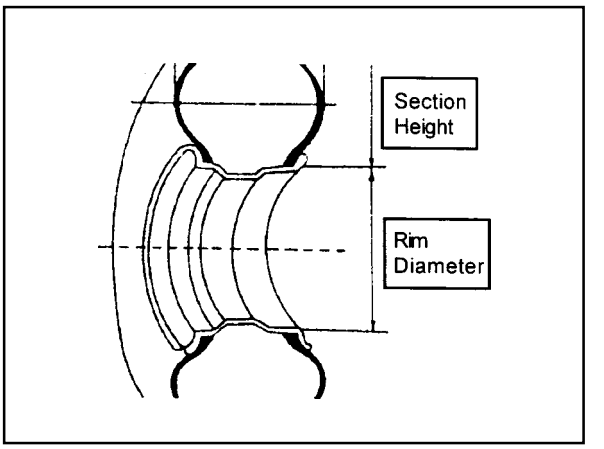
Wear Pattern	Possible Cause	Remedy
Wear on Both Tread Shoulders 	Under Inflation 	Adjust
Wear on Tread Center 	Over Inflation 	Adjust
Tread Torn Out 	Under Inflation	Adjust
One-sided Tread Wear 	Incorrect Camber or Toe-in 	Adjust
Feather Edging of Tread 	Incorrect Toe-in 	Adjust
Spotty Tread Wear 	Out of Wheel Balance 	Adjust
Spotty Wear-wear Localized on Shoulder Sections 	Out of Wheel Balance	Adjust
	Play in Hub Bearings	Check play Adjust preload
	Play in Ball Joint	Check
	Defective Shock Absorber	Check

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IDENTIFICATION

RADIAL TIRE



P 215/75 R 15 94 H M+S

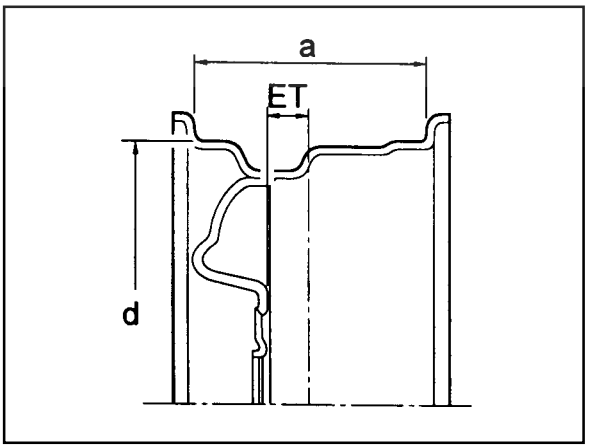
- M+S — Four Season Mud & Snow
- H — Speed Rating (max. 210km/h)
- 94 — Load Range (below 670kg)
- 15 — Rim Diameter (inch)
- R — Radial Tire
- 75 — Aspect Ratio = (Section Height ¸ Section Width) x 100
- 215 — Section Width (mm)
- P — Passenger Car

215/65 R 16 93 V

- V — Speed Rating (max. 240km/h)
- 93 — Load Range (below 650kg)
- 16 — Rim Diameter (inch)
- R — Radial Tire
- 65 — Aspect Ratio = (Section Height ¸ Section Width) x 100
- 215 — Section Width(mm)
- Summer Tire

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WHEEL DISC



7 J x 16 ET 39

- ET 39 — Wheel Offset (mm) (Distance from rim center to wheel nave contacting surface)
- 16 — Rim Diameter (inch)
- x — Identification for One-piece Well-base Rim
- J — Code Letter for Height and Profile of Rim Flange
- 7 — Rim Width (Inch)

ET : Distance from Rim Center to Wheel have Contacting Surface (mm)

a : Rim Width (Inch)

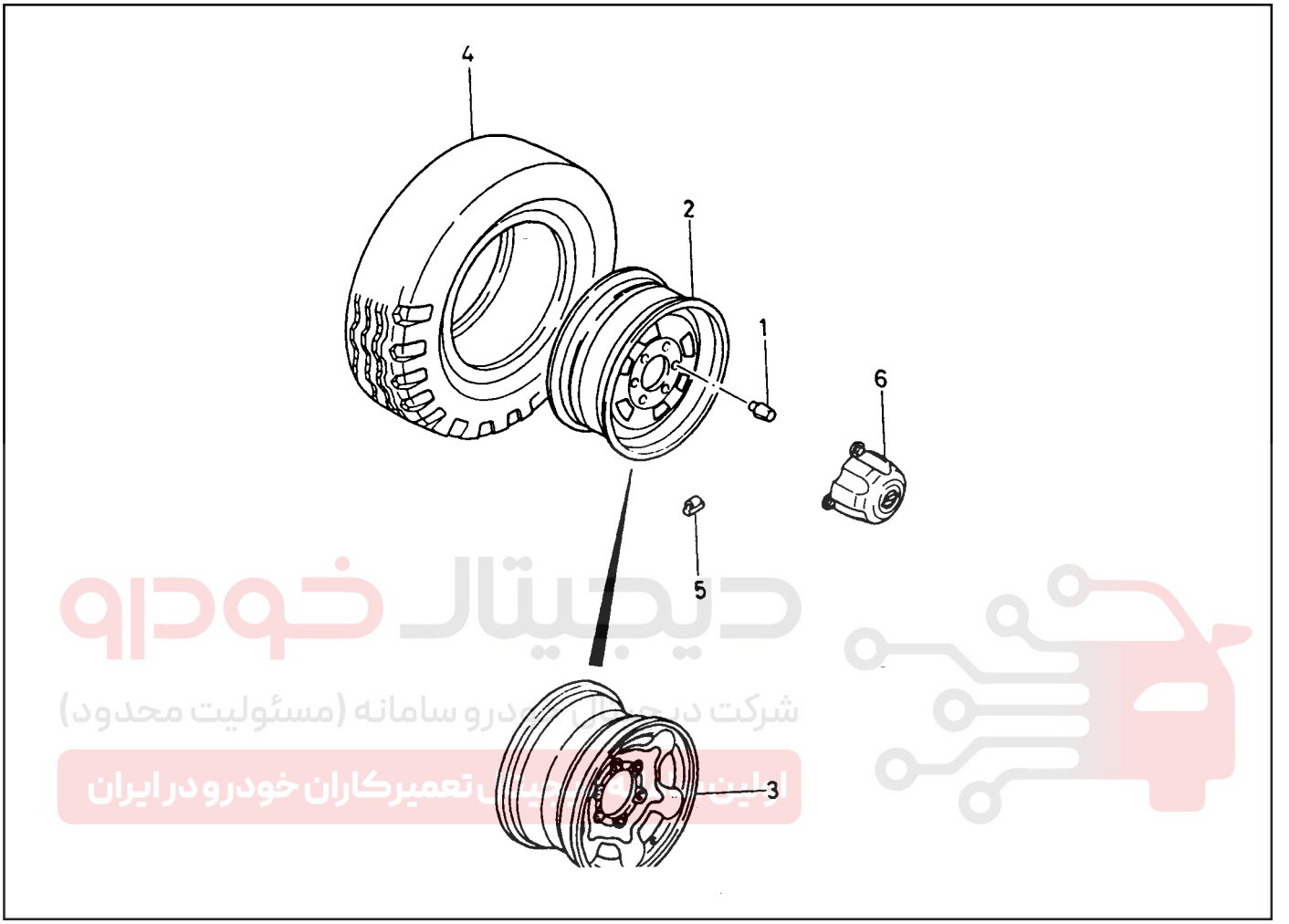
d : Rim Diameter (Inch)

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COMPONENT LOCATOR

WHEEL AND TIRE



1 Wheel Bolts ..... Steel Wheel : 80-120 Nm
..... Aluminium Wheel : 110-130 Nm
2 Steel Wheel
3 Aluminium Wheel
4 Tire
5 Steel Wheel Weight Balance
6 Hub Cap

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MAINTENANCE AND REPAIR

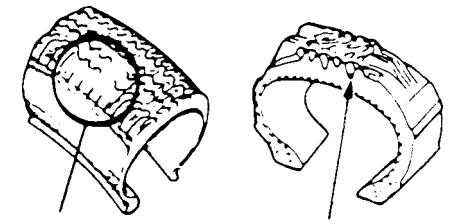
ON-VEHICLE SERVICE

WHEELS AND TIRES

Removal & Installation Procedure

1. Inspection of tire

   Check tread area for tread surface, crack, damage by nail in or stones. Replace or repair if necessary.



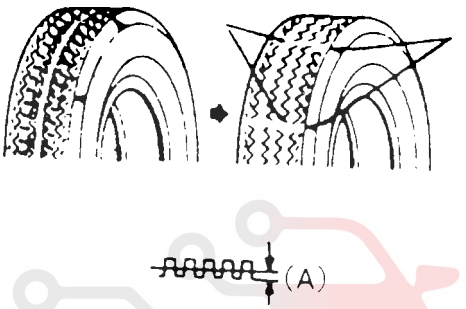
Tread - wear Indicator

Flat Hose

2. Wear limit.

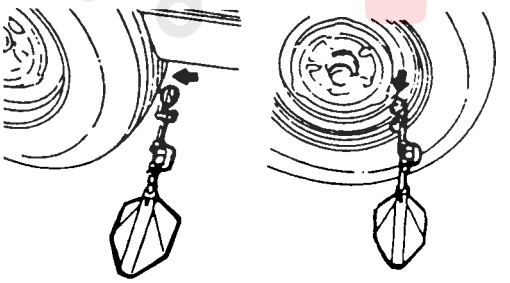
Limit	1.6mm

- Replace the tire if tread-wear indicator of the tread grooves appears where marked '▲'.
- The wear limit of snow tire is the same as normal tire (1.6mm) and indicator location is marked '⊢'.



3. Runout measurement.
   - Excessive runout of tires and wheels can cause the abnormal wear of tire. Using a dial indicator, measure wheel and tire runout.
   - Measure radial runout at the rim flange and center of the tire tread area.

Standard	2.66mm



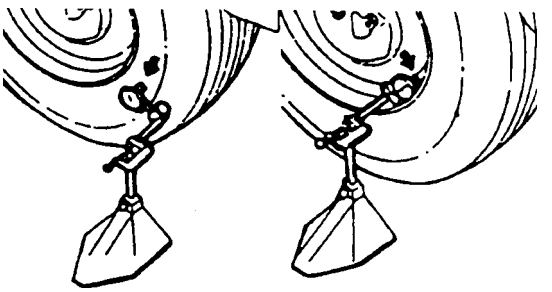
Radial runout measurement

- Measure lateral runout at the tire bead area of the wheel and tire sidewall.

Standard	2.03mm

Notice

If runout is excessive, replace the tire or wheel.



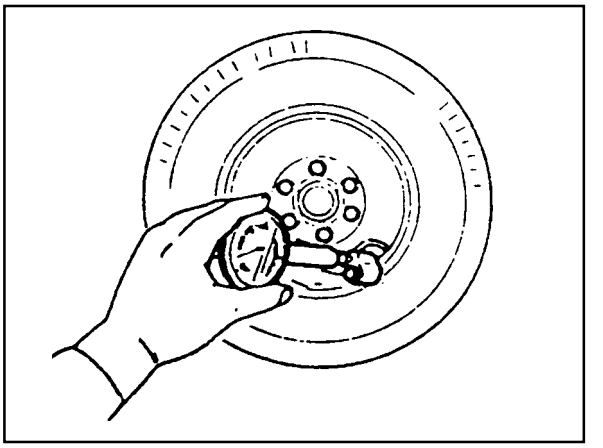
Lateral runout measurement

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4. Tire pressure inspection.
   - Tire pressure.

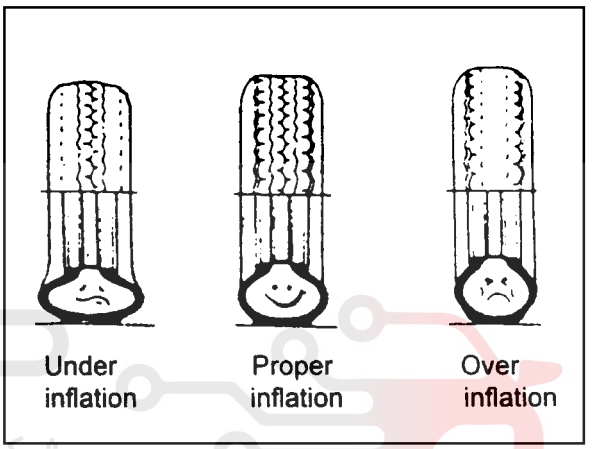
Front & Rear (P235/75R15)	2.1kg/cm^2(30PSI)



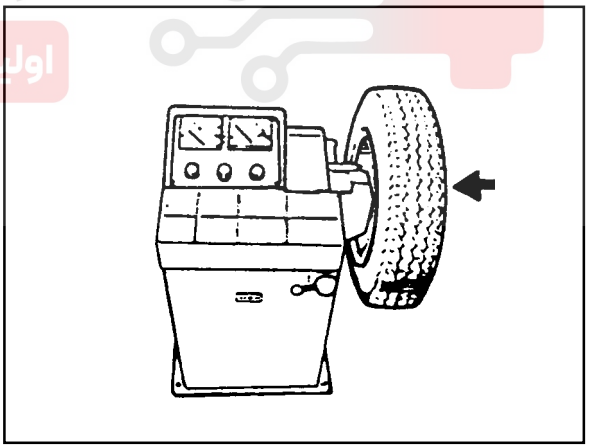
   - Check tread contact with road.

Notice

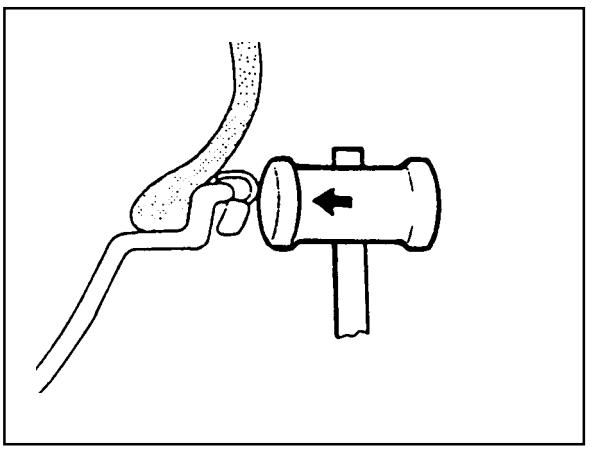
- If underinflated, tire may come away from the wheel during rapid steering.
- An overinflated tire will cause a hard riding and uneven wear.



5. Wheel balance.
   - Balance weights should be on each side. When the wheel is out of balance or a tire has been repaired, be sure to balance the wheel again.



   - If total weight is over 150g, readjust the balance by reinstalling the tire on the wheel.
   - Balance weight should not protrude from the wheel rim over 3mm.
   - For aluminum wheel, use aluminum wheel balance weight only.

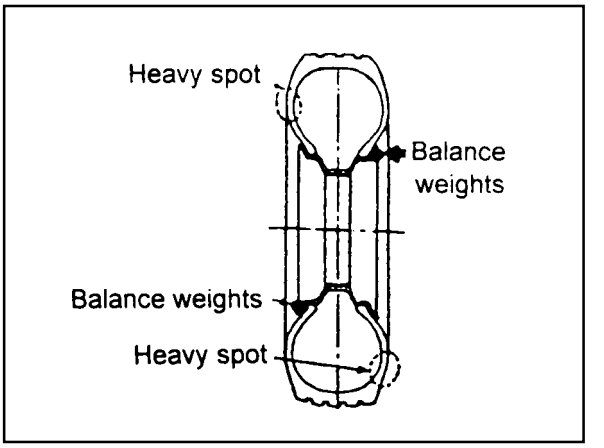


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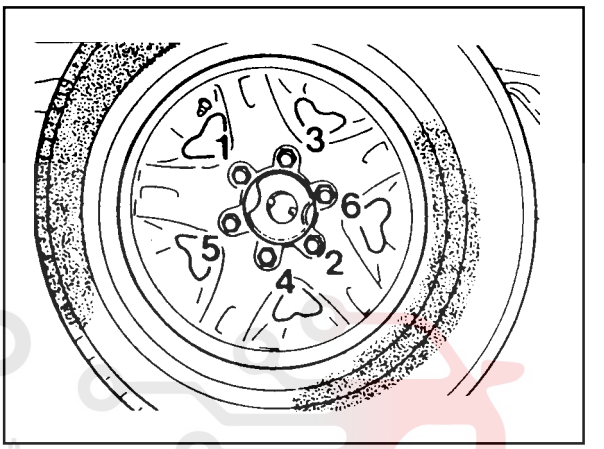
- To correct unbalance, install equal weights 180° opposite each other, one on the inside of the wheel and one on the outside, at the point of unbalance.
- Balance Weight

10g	20g	30g	40g	50g	60g
0.4oz	0.7oz	1.10oz	1.40oz	1.80oz	2.1oz



6. Cautions for installation and removal.
   - Clean the mounting surfaces of hub and wheel.
   - Do not apply grease or oil on the nuts and bolts (It will cause looseness and poor tightening).
   - Using a jack, lift up the tire about 3cm from the ground.
   - Tighten nuts in a criss-cross pattern 2-3 times.

Tighten Torque	Steel : 80 - 120Nm
	Aluminium : 110 - 130Nm



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