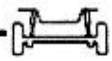
Page
Return
Page 1
Page 2
Page 3
Page 4
Page 5
Page 6
Page 7
Page 8
Page 9
Page 10
Page 11
Page 12
Page 13
Page 14
Page 15
Page 16
Page 17
Page 18
Page 19
Page 20
Page 21
Page 22
Page 23
Page 24
Page 25
Page 26
Page 27
Page 28
Page 29
Page 30
Page 31
Page 32
Page 33
Page 34
Page 35
Page 36
Page 37
Page 38
Page 39
Page 40
Page 41
Page 42
Page 43
Page 44
Page 45
Page 46
Page 47
Page 48
Page 49
Page 50
Page 51
Page 52



GROUP 21

SUSPENSIONS

TABLE OF CONTENTS

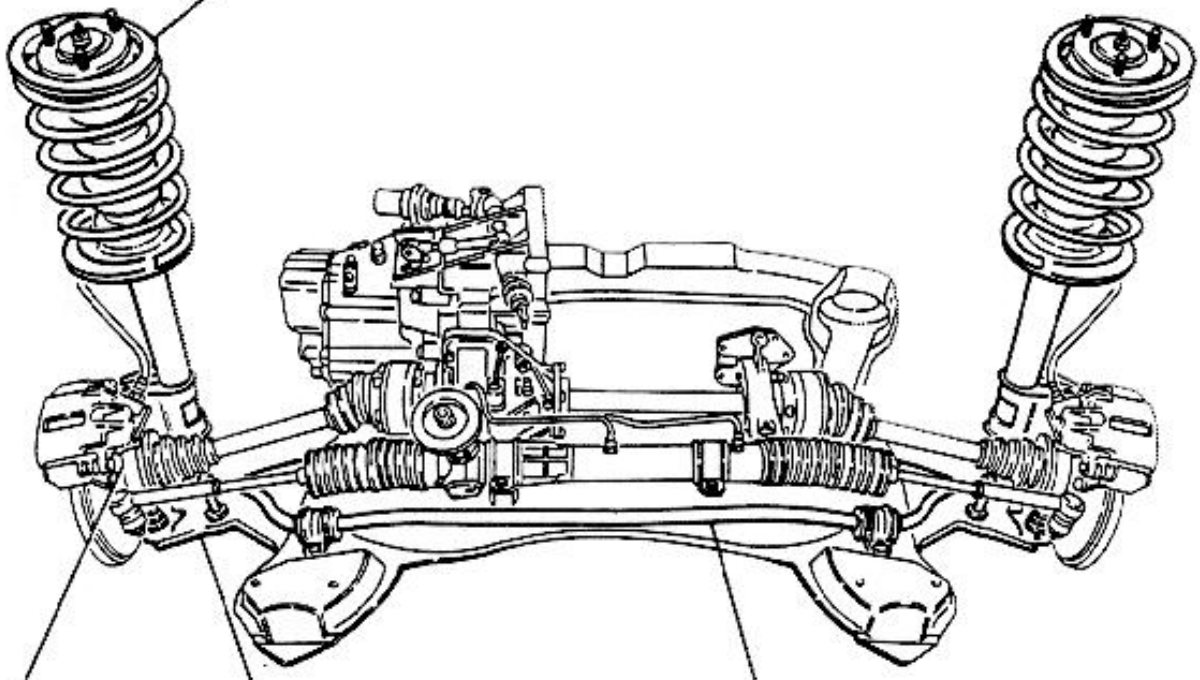
Page 53
Page 54

GROUP 21

SUSPENSIONS

TABLE OF CONTENTS

FRONT SUSPENSION
ILLUSTRATED INDEX



FRONT SUSPENSION

DESCRIPTION

The suspension system is of the independent wheels type using Mc Pherson struts, coil springs and stabilizer bars.

The coil springs are installed off center to reduce cross loads and increase the capacity of absorbing road pavement asperities.

The suspension system includes steel sturdy triangular control arms, with large base, connected by variable rigidity bushings to the auxiliary frame bolted to forward body supporting the engine-transmission assembly.

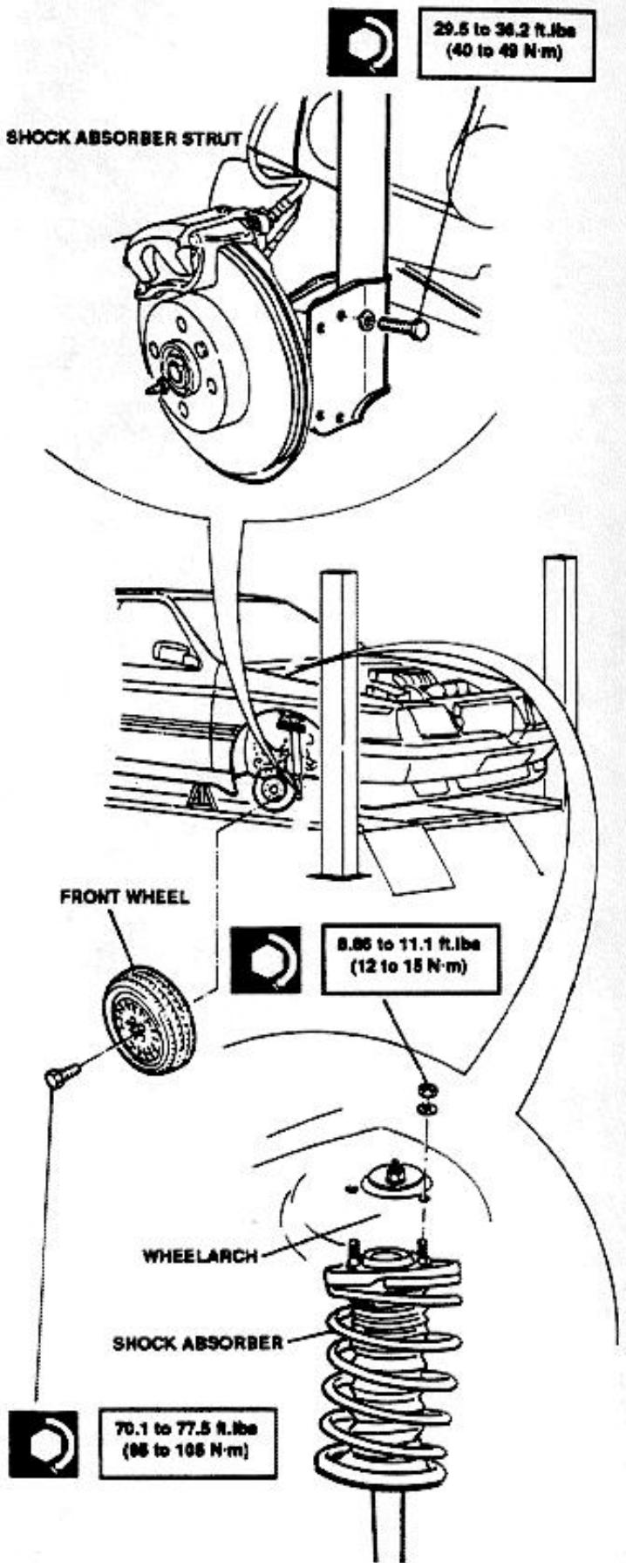
The steering box and radiators are installed on this frame, besides the engine and suspensions, completing vehicle front structure and increasing its rigidity: in this way a system, including engine-suspensions-steering, is made up in order to assure limber geometry and to facilitate checks and repairs.

The shock absorber struts are installed off center, compared to wheel center, to lower the upper attaching point and the forward hood line, increasing the vehicle aerodynamic features.

COIL SPRING AND SHOCK ABSORBER

REMOVAL/INSTALLATION

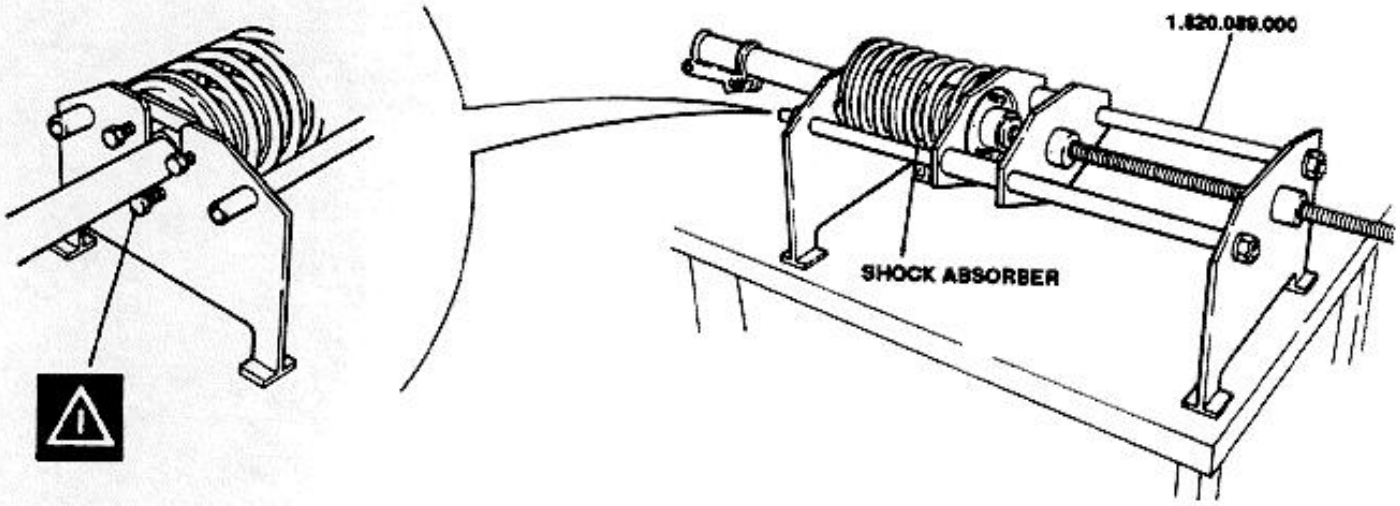
1. Remove front wheel.
2. Disconnect strut from hub carrier.
3. Disconnect shock absorber from wheelarch and remove it.



DISASSEMBLY/REASSEMBLY

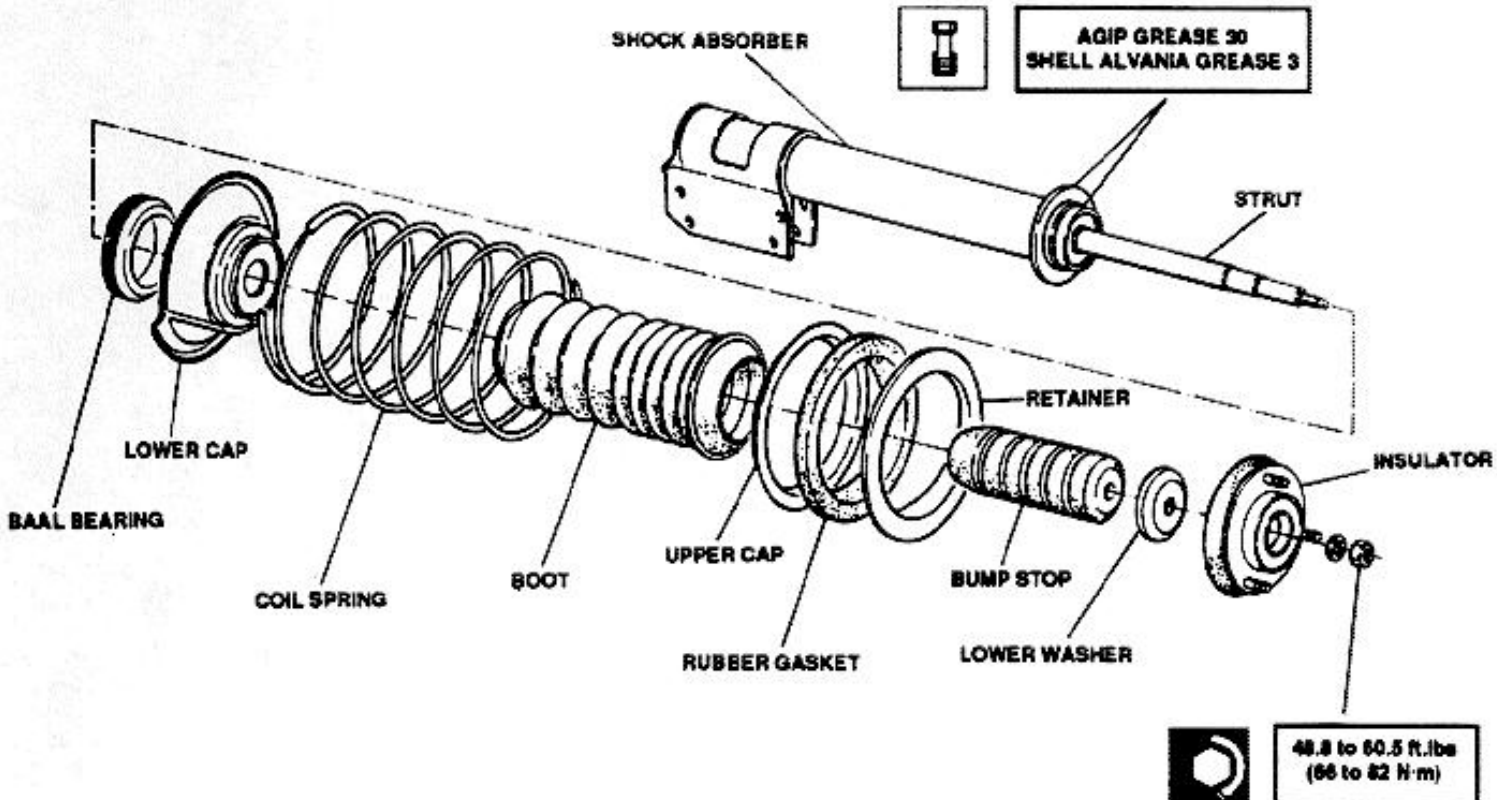
1. Position shock absorber assembly on the appropriate disassembly tool.
2. Loosen securing nut without removing it.

Before compressing the spring, make sure that the shock absorber strut is perpendicular to the support plate. If necessary, adjust using the relevant adjusting screws.



Compress spring and disassemble shock absorber.

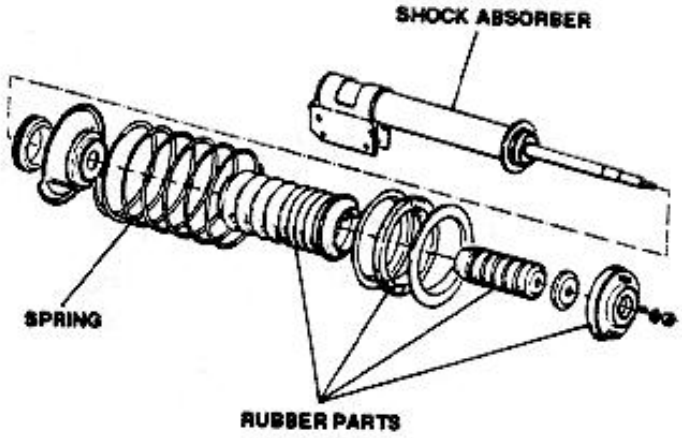
When installing grease the indicated surfaces.



SHOCKABSORBER NUT

CHECKS AND INSPECTIONS

1. Replace shock absorber if defective or in presence of oil leaks.
2. Visually check that springs show no signs of cracking or distortion.
3. Replace rubber components, if distorted, damaged or aged.
4. Check that spring height under a load of 417 to 443 Kg (920.5 to 977.8 lbs.) is 183 mm (7.20 in).



HUB CARRIER

REMOVAL/INSTALLATION

1. Remove front wheel.
2. Remove brake caliper.
3. Remove caulking and remove spindle lock nut.

When installing, replace nut and caulk it.

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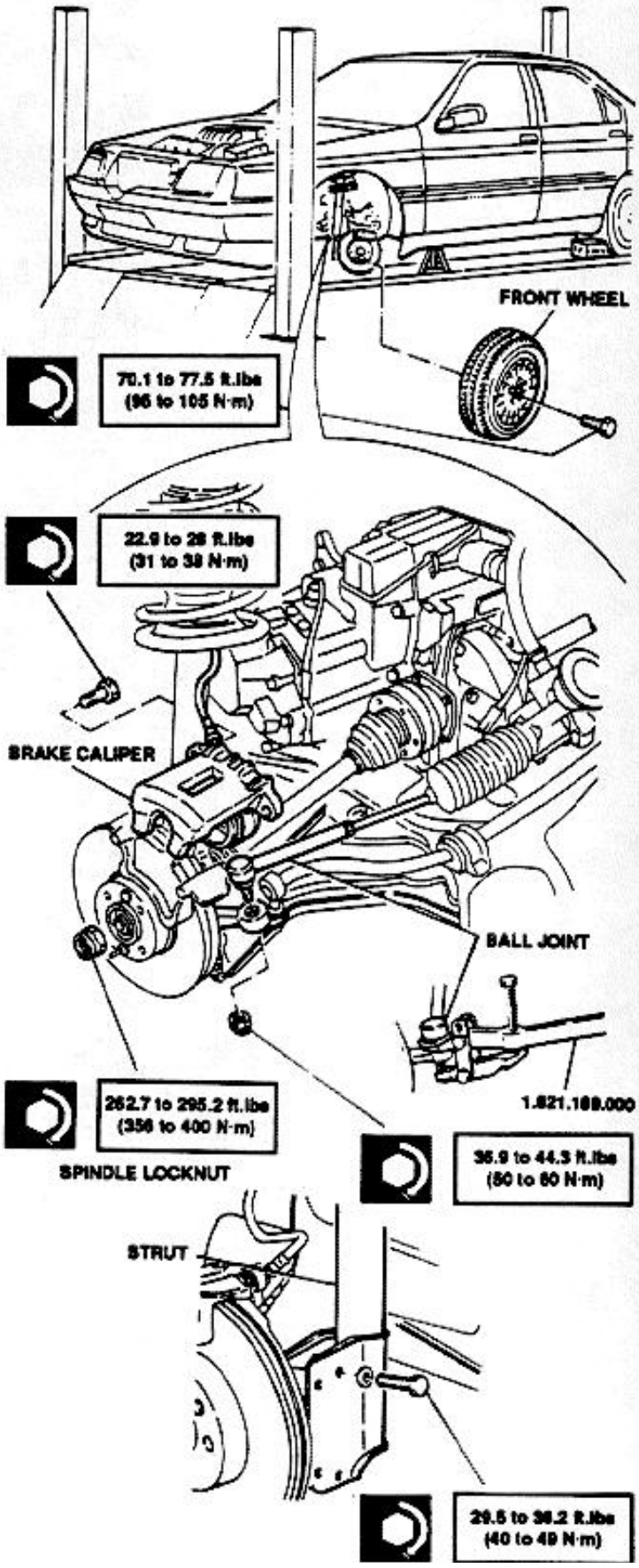
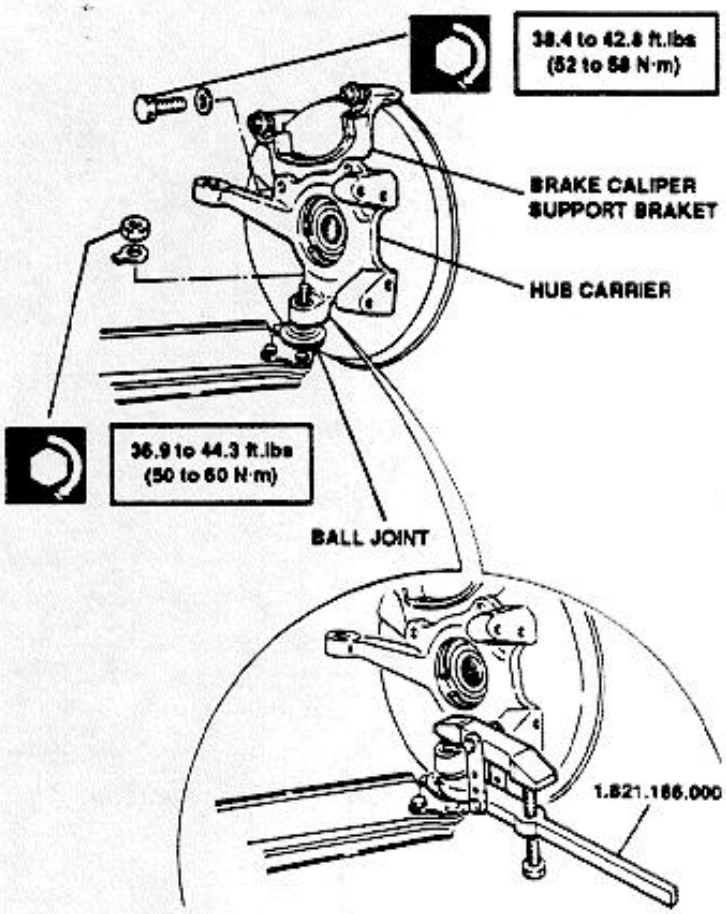
4. Disconnect shock absorber strut from hub carrier.
5. Using the appropriate tool pull out ball joint from

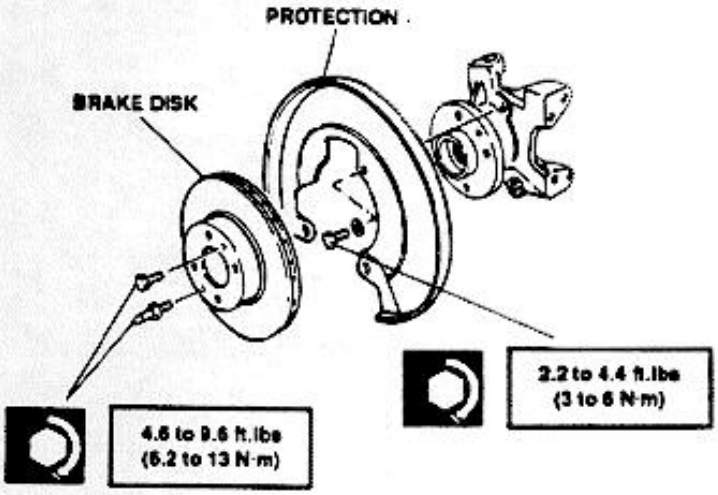


steering link rod.

6. Using the appropriate tool, extract the suspension control arm ball joint from the hub carrier.
7. Remove hub-carrier assembly together with brake disk.
8. Remove bracket supporting brake caliper.

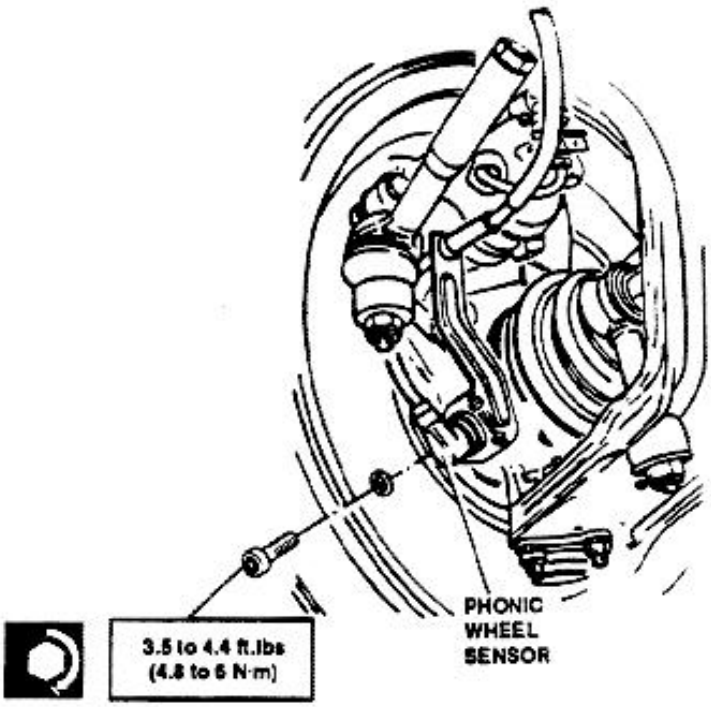


9. Remove brake disk from hub.
10. Remove brake disk protection.



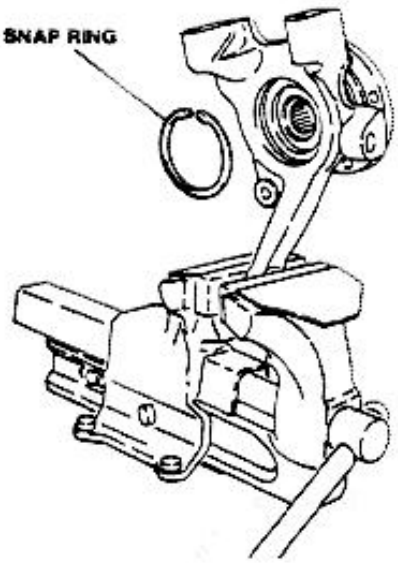
Variant for vehicles equipped with ABS system:

11. Remove phonic wheel sensor.

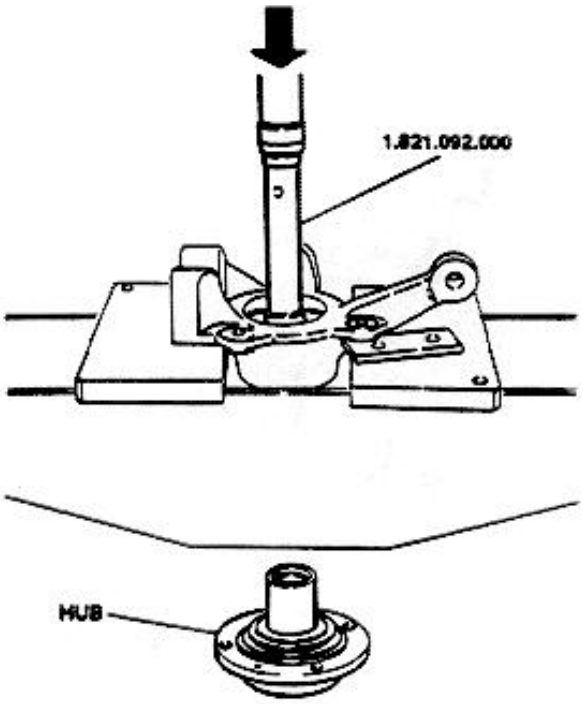


DISASSEMBLY

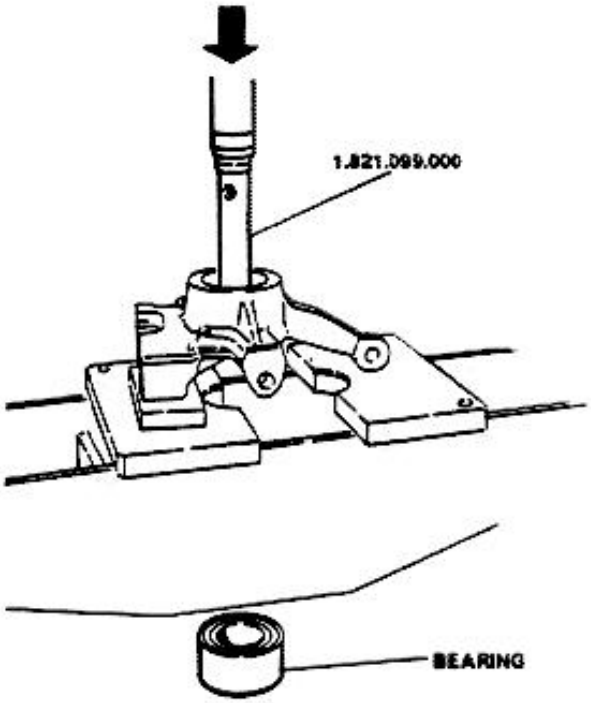
1. Remove snap ring.



2. Using the appropriate tool and a press pull out hub.

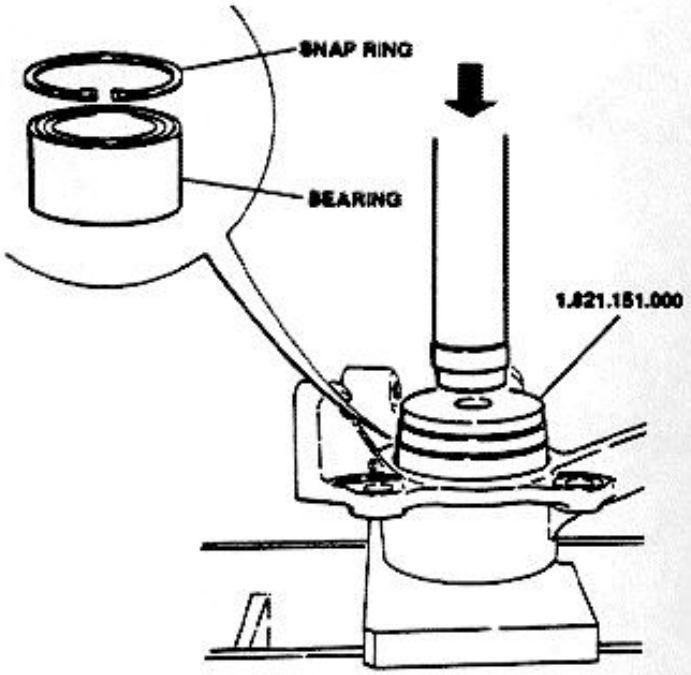


3. Using the appropriate tool and a press, pull out bearing.

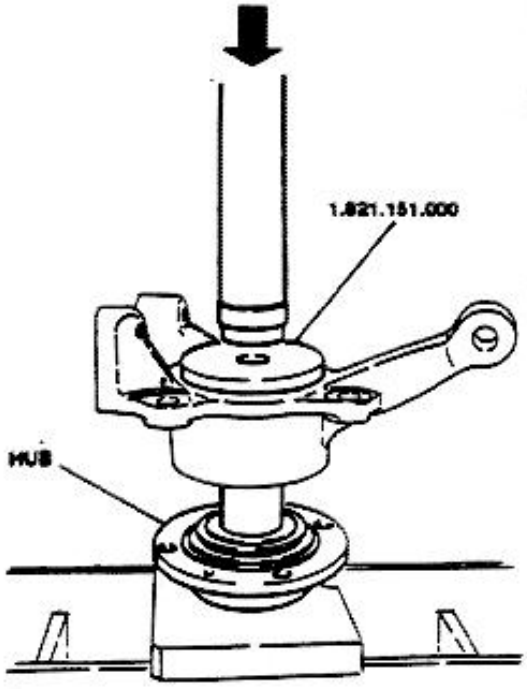


REASSEMBLY

1. Install bearing using a press and the appropriate tool.
2. Install retaining snap ring.



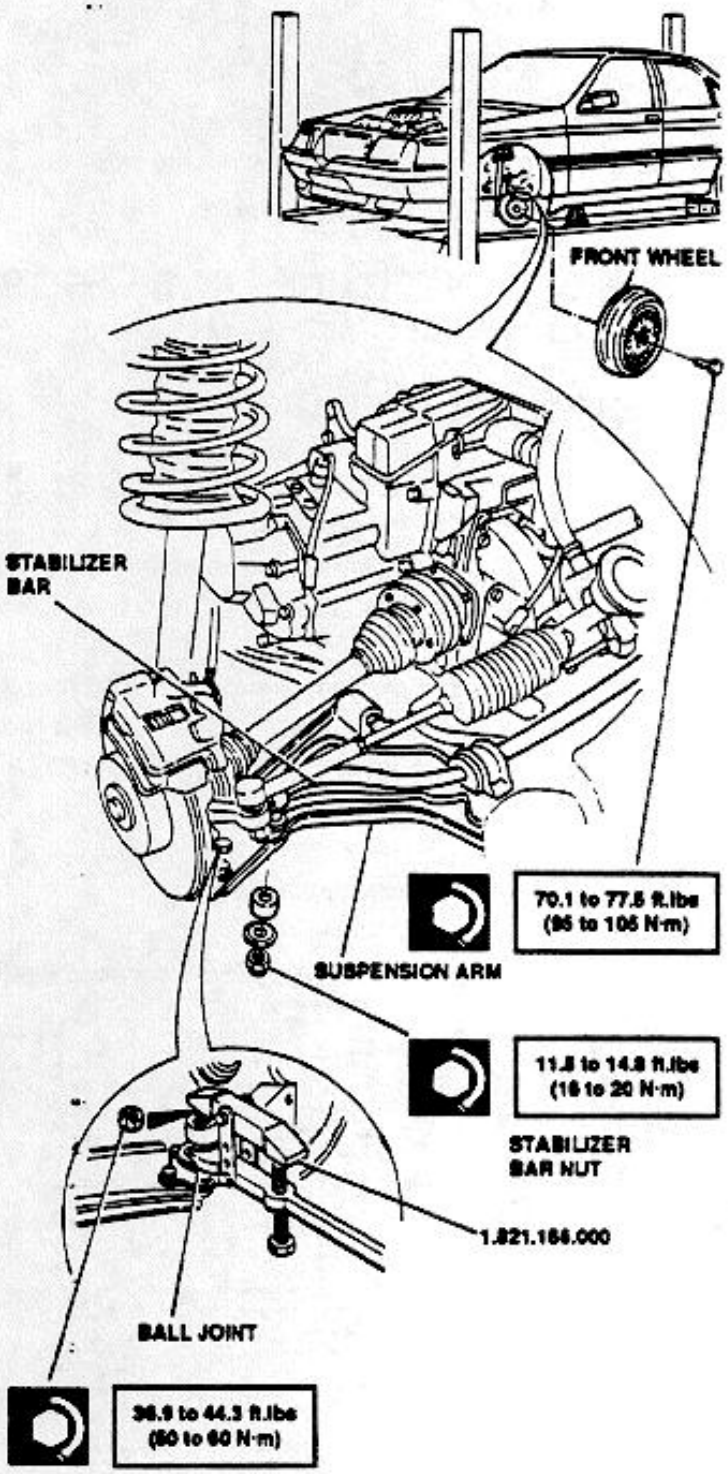
3. Install hub using a press and the appropriate tool.



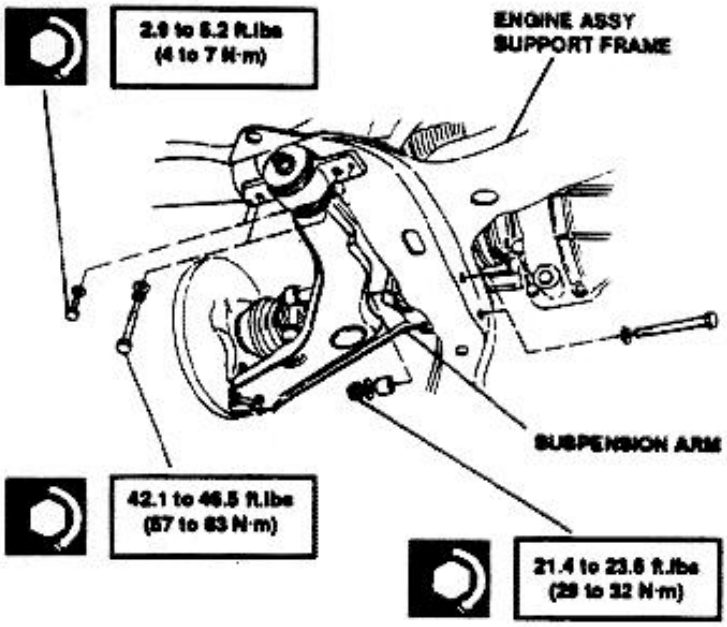
SUSPENSION ARM

REMOVAL/INSTALLATION

1. Remove front wheel.
2. Remove stabilizer bar from suspension arm.
3. Using the appropriate tool, pull out ball joint from hub carrier.



4. Remove suspension arm from engine support frame.

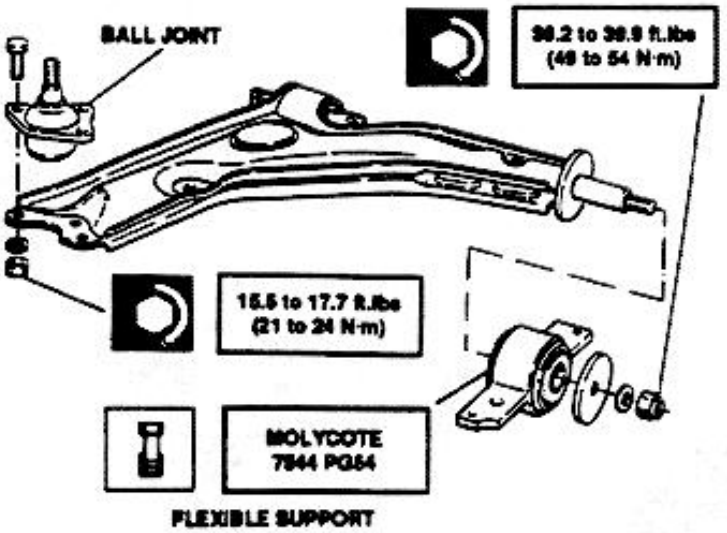


DISASSEMBLY/REASSEMBLY

1. Disassemble ball joint.

NOTE: When assembling, take extreme care not to damage the ball joint boot when installing the three securing screws.

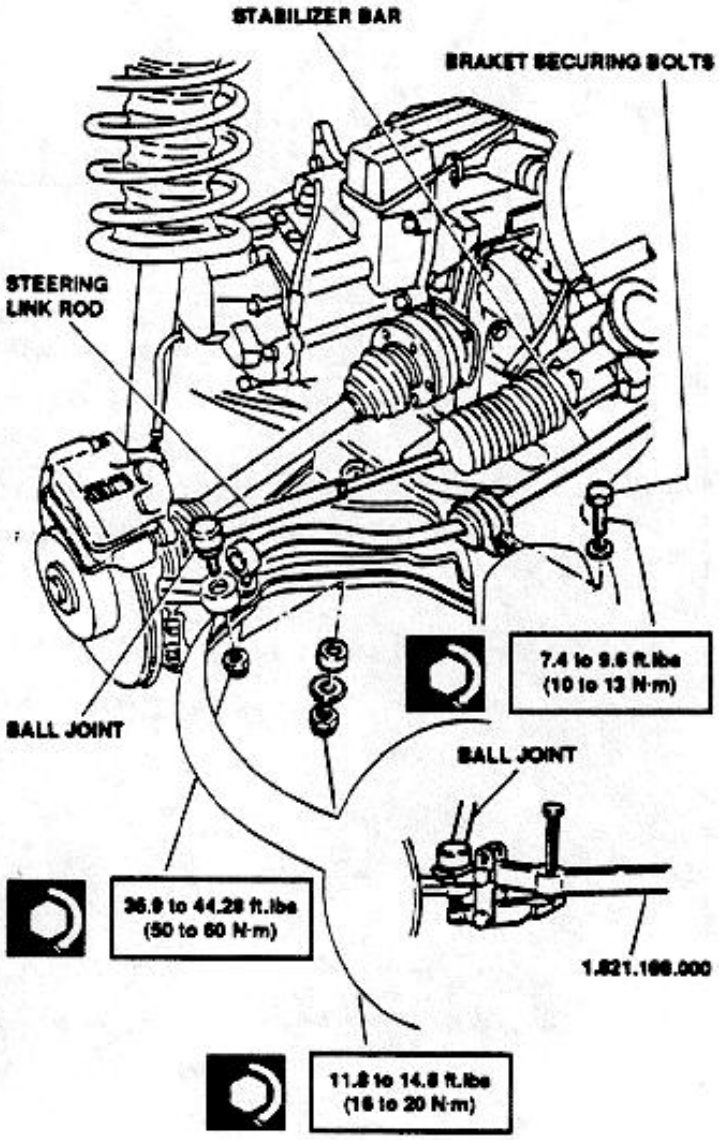
2. Disassemble flexible support.



STABILIZER BAR

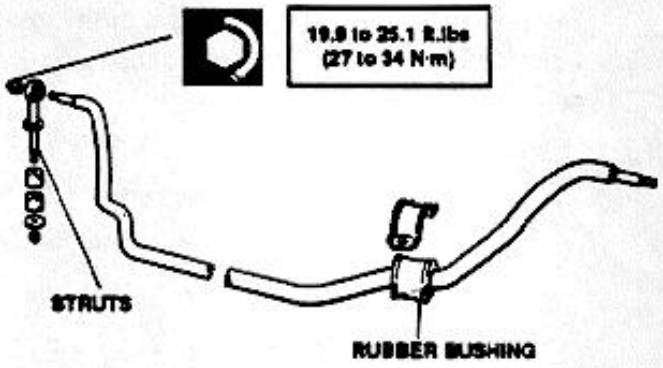
REMOVAL/INSTALLATION

1. Remove front wheel.
2. Remove wheelarch rear protection.
3. Disconnect bar from suspension arms.
4. Remove screws securing brackets.
5. Using the appropriate tool pull out ball joint from steering link rod (from one side of the vehicle only).
6. Pull out stabilizer bar from side of vehicle where link rod was disconnected.



DISASSEMBLY/REASSEMBLY

1. Disassemble struts.
2. Pull out rubber bushings.



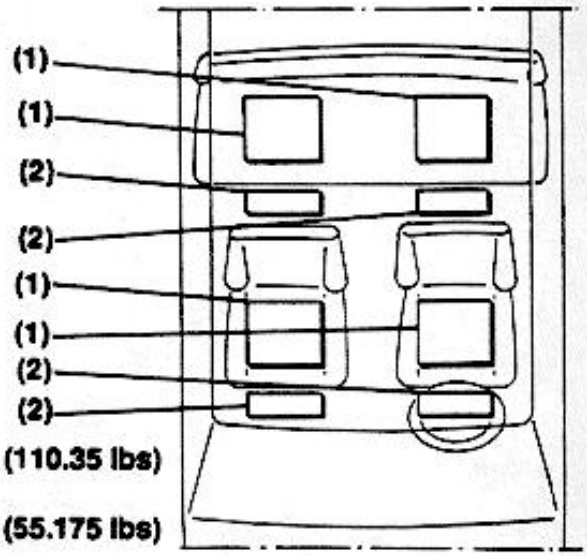
VEHICLE ATTITUDE AND FRONT WHEELS ALIGNMENT CHECK

PRELIMINARY OPERATIONS

1. Place vehicle on auto lift.
2. Check tires inflating pressure.
3. Prepare vehicle at static load (fuel tank fully serviced and weights as illustrated).

NOTE: As an alternative, it is possible to prepare vehicle without loads and in running order (Vehicle resting on wheels plus 5 to 30 liters (1.35 to 8.1 gals) of fuel).

4. Rock vehicle to settle suspensions.

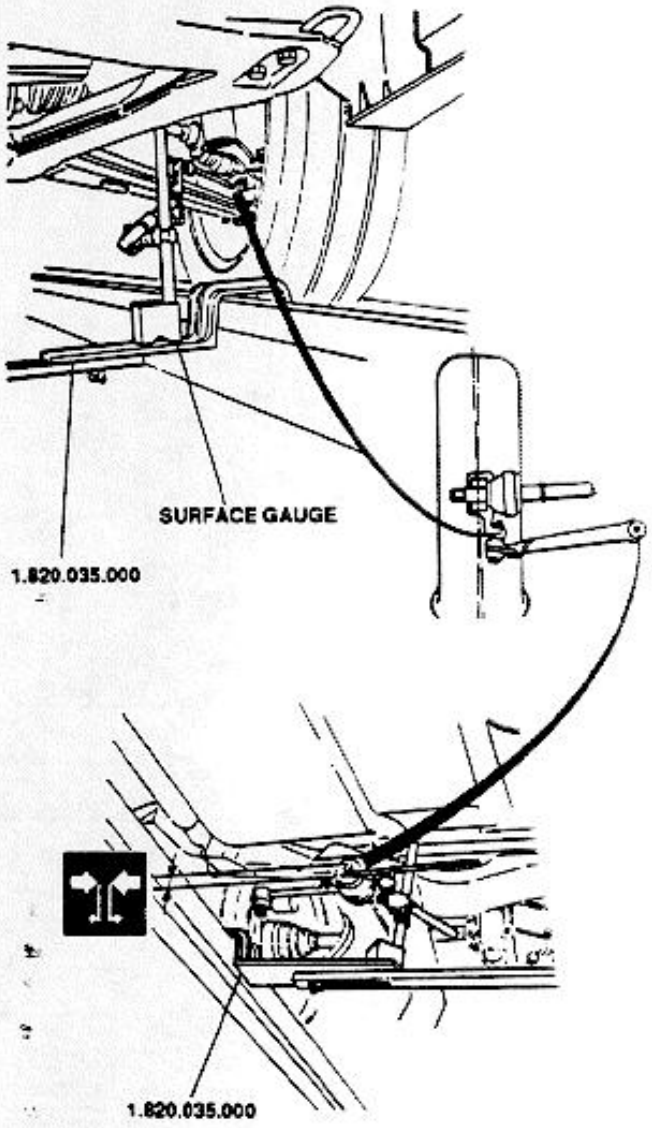


(1) 50 kg (110.35 lbs)

(2) 25 kg (55.175 lbs)

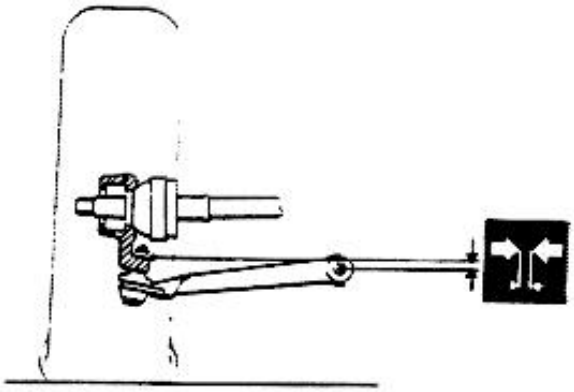
FRONT ATTITUDE CHECK

1. Position a ruler on the surface supporting the vehicle.
2. Set a surface gauge with its pointer aligned with the upper surface of the hub carrier where the suspension control arm ball joint is attached to the hub carrier.
3. Move the surface gauge and, using a millimeter ruler, measure the distance between the axis of the bolt securing the suspension control arm to the body and the surface gauge pointer.



Check the distance measured against specified values.

NOTE: If the attitude values are not within specified values, replace both suspension



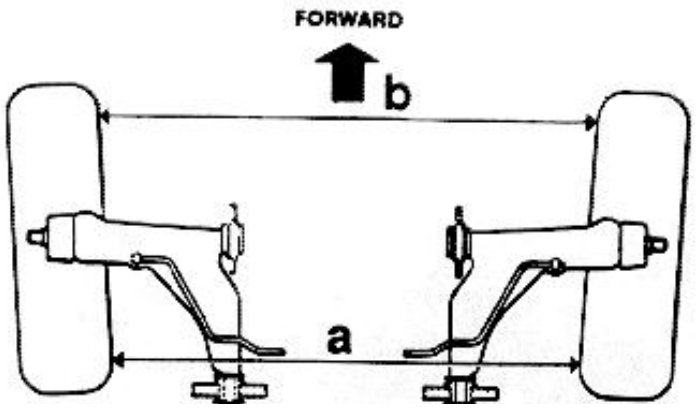
Values refer to static load vehicle	Values refer to empty vehicle in running order
-23 ± 7 mm (-0.905 ± 0.276 in)	+9 ± 7 mm (+0.354 ± 0.276 in)

FOR VEHICLES EQUIPPED WITH SPACERS BETWEEN ENGINE SUPPORT FRAME AND BODYWORK.	
Values refer to static load vehicle	Values refer to empty vehicle in running order
-36 ± 7 mm (-1.417 ± 0.276 in)	-10.5 ± 7 mm (-0.413 ± 0.276 in)

FRONT WHEELS TOE-IN CHECK

- Carry-out preliminary operations previously indicated.

1. Measure toe-in value using the appropriate tool.



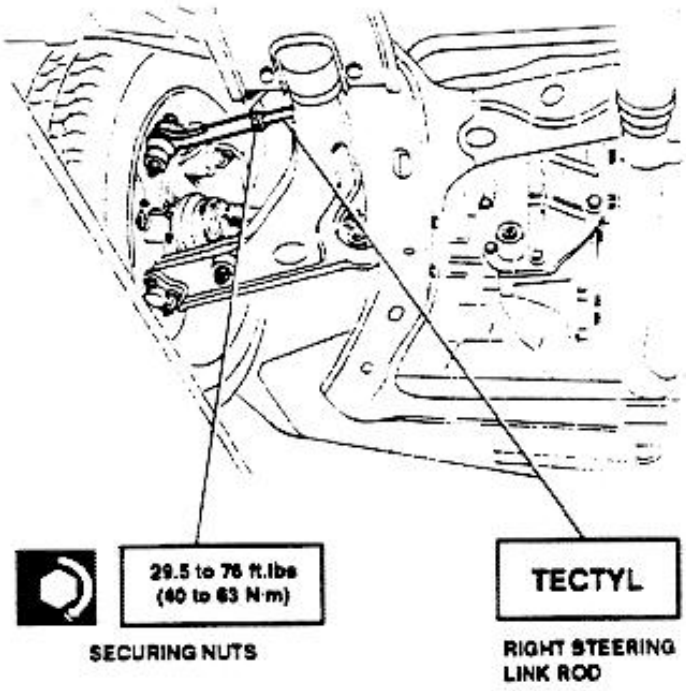
springs.

a - b =	
Values refer to static load vehicle	Values refer to empty vehicle in running order
0 ± 1 mm (0 ± 0.039 in)	-1 ± 1 mm (-0.039 ± 0.039 in)

- If different values from the indicated values are met, proceed as follows:
2. Loosen nuts securing the steering link rod.
3. Rotate link rod till specified value is obtained without changing the steering wheel races position.

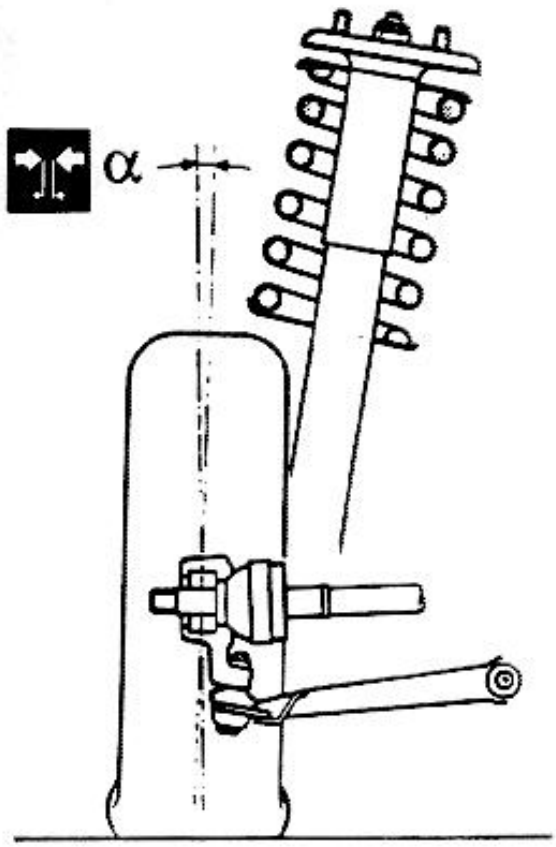
NOTE: Adjustment shall be carried-out on both link rods.

4. Tighten nuts securing rods and coat with corrosion preventive compound.



FRONT WHEELS ALIGNMENT CHECK:

CAMBER ANGLE

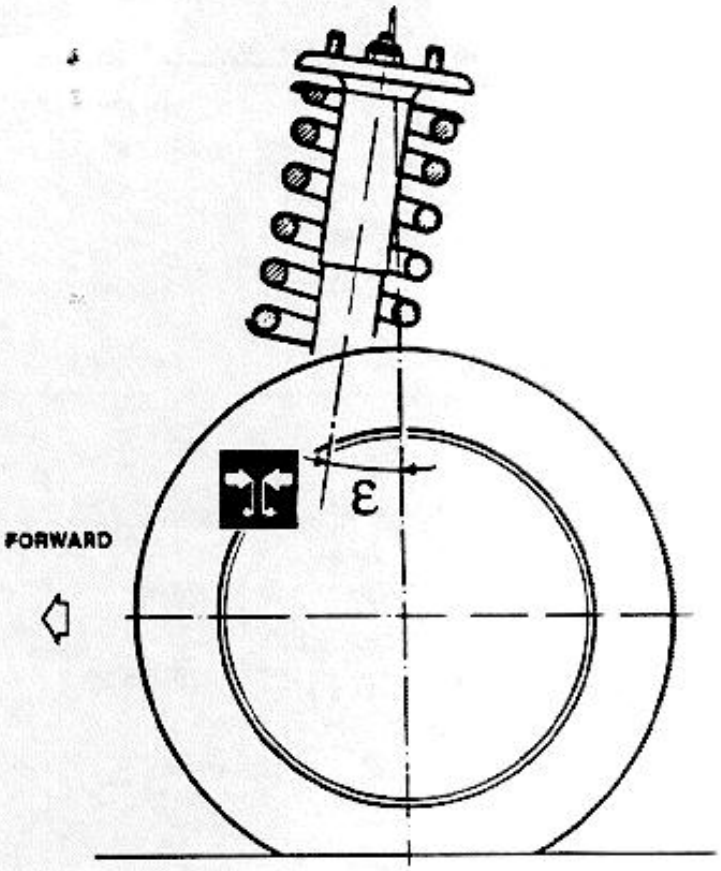


α =	
Values refer to static load vehicle	Values refer to empty vehicle in running order
-1°45' ± 20'	-1° ± 20'
-2° ± 20' *	-1°37' ± 20' *

* For vehicles equipped with spacers between engine support frame and bodywork.

NOTE: The camber angle cannot be adjusted.

PITCH ANGLE



ε =	
Values refer to static load vehicle	Values refer to empty vehicle in running order
2°30' ± 20'	2°20' ± 20'
2°25' ± 20' *	2°17' ± 20' *

* For vehicles equipped with spacers between engine support frame and bodywork.

NOTE: The pitch angle cannot be adjusted

TECHNICAL CHARACTERISTICS AND SPECIFICATIONS

COIL SPRINGS (version with MANUAL TRANSMISSION)

Wire diameter	13.5 ± 0.05 mm (0.531 ± 0.00197 in)
Outer spring diameter	174 ± 1.7 mm (6.850 ± 0.06693 in)
Inner spring diameter	147 ± 1.5 mm (5.787 ± 0.05905 in)
Total usable turns	4.75
Total unusable turns	1.25
Total spring turns	6
Coil sense	Right

COIL SPRINGS (version with AUTOMATIC TRANSMISSION and "S" version, from chassis No.....)

Wire diameter	13.7 ± 0.05 mm (0.539 ± 0.00197 in)
Outer spring diameter	173.7 ± 1.7 mm (6.839 ± 0.06693 in)
Inner spring diameter	146.3 ± 1.5 mm (5.760 ± 0.05905 in)
Total usable turns	4.7
Total unusable turns	1.3
Total spring turns	6
Coil sense	Right

SHOCK ABSORBERS

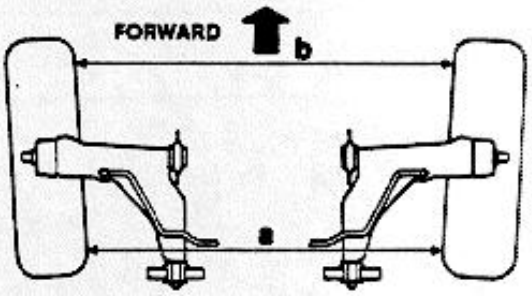
Shock absorber type	Hydraulic
Strut diameter	22 - 0.2 mm (0.866 - 0.0079 in)
Stroke	167 mm (6.574 in)

CHECKS AND ADJUSTMENTS

SPRING HEIGHT UNDER LOAD OF

Version with manual transmission	417 to 443 kg (920.32 to 977.7 lbs)
	183 mm (7.20 in)
Version with automatic transmission	436.5 to 463.5 kg (963.35 to 1022.9 lbs)
	183.5 mm (7.22 in)

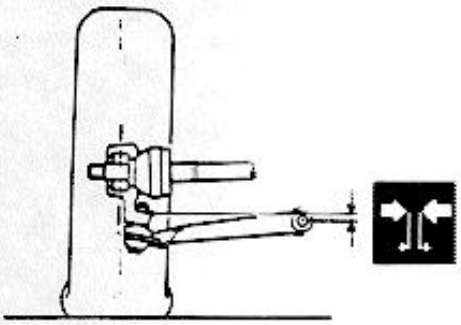
FRONT WHEELS TOE-IN CHECK



a - b =	0 ± 1 mm (0 ± 0.039 in)	(1)
	-1 ± 1 mm (-0.039 ± 0.039 in)	(2)

1) Values refer to static load vehicle
2) Values refer to empty vehicle in running order

FRONT ATTITUDE CHECK



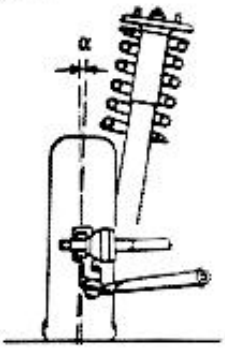
	-23 ± 7 mm (-0.905 ± 0.276 in)	(1)
	+9 ± 7 mm (+0.354 ± 0.276 in)	(2)

ONLY FOR VEHICLES EQUIPPED WITH SPACERS BETWEEN ENGINE SUPPORT FRAME AND BODYWORK		
	-36 ± 7 mm (-1.417 ± 0.276 in)	(1)
	-10.5 ± 7 mm (-0.413 ± 0.276 in)	(2)

1) Values refer to static load vehicle
2) Values refer to empty vehicle in running order

FRONT WHEELS ALIGNMENT

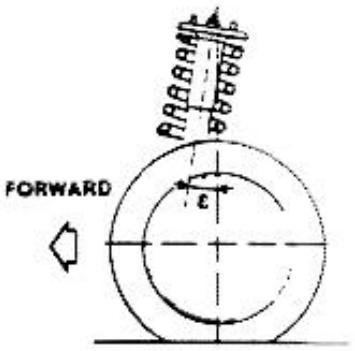
CAMBER ANGLE



α =	-1°45' ± 20'	(1)
	-2° ± 20' *	
	-1° ± 20'	(2)
	-1°37' ± 20' *	

1) Values refer to static load vehicle
2) Values refer to empty vehicle in running order
* For vehicles equipped with spacers between engine support frame and bodywork.

PITCH ANGLE



ε =	2°30' ± 20'	(1)
	2°25' ± 20' *	
	2°20' ± 20'	(2)
	2°17' ± 20' *	

1) Values refer to static load vehicle
2) Values refer to empty vehicle in running order
* For vehicles equipped with spacers between engine support frame and bodywork

FLUIDS AND LUBRICANTS

Application	Type	Name
Coil spring lower plate support bearing	GREASE	AGIP GREASE 30 SHELL ALVANIA GREASE 3
Steering link rod	WAX COMPOUND	TECTYL
Rubber supports	GREASE	MOLYCOTE 7544 PG54

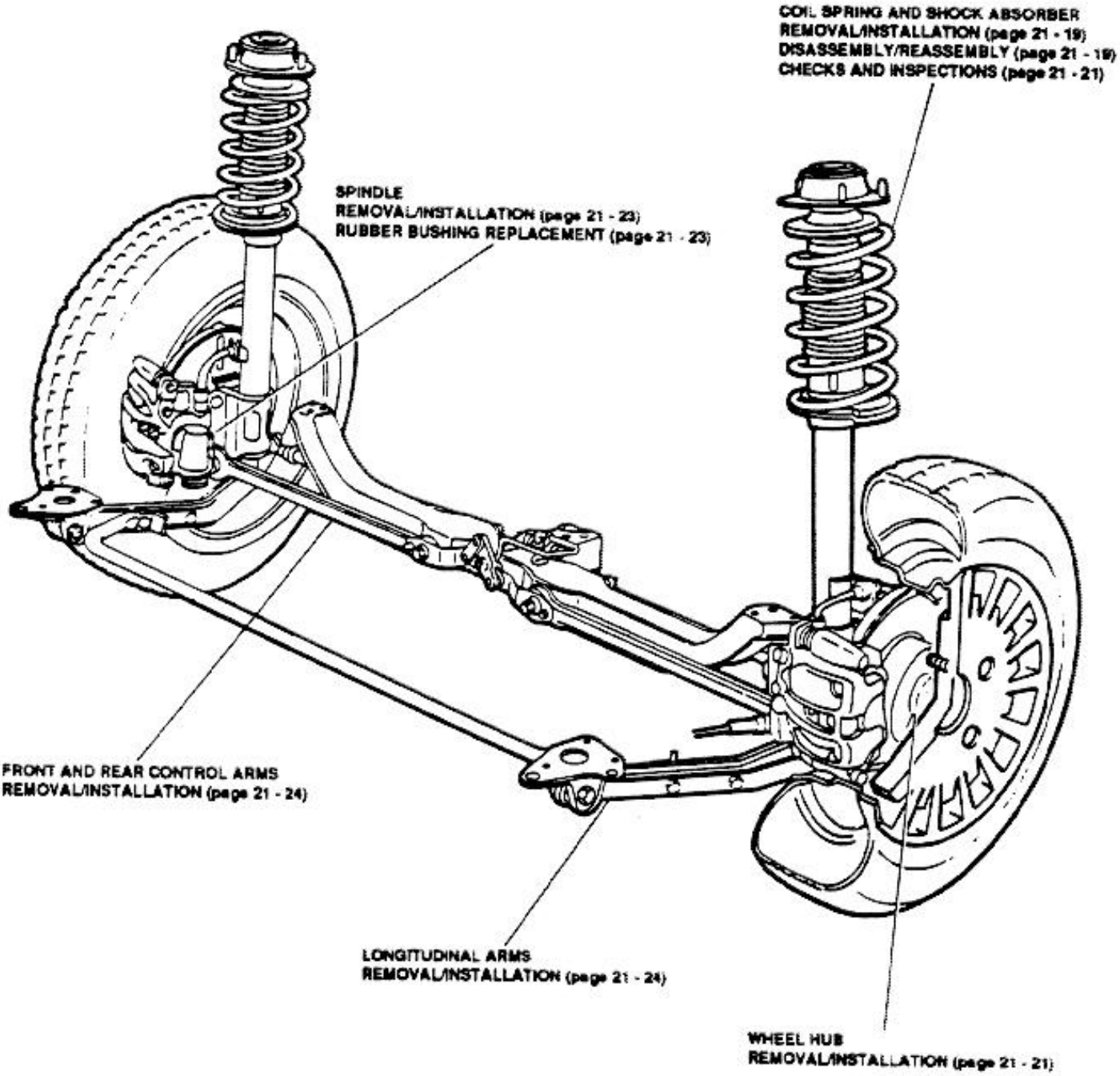
TIGHTENING TORQUES

Nut securing universal joint to front wheel hub	262.6 to 295.0 ft.lbs	356 to 400 Nm
Columns securing front wheel	70.1 to 77.5 ft.lbs	95 to 105 Nm
Screw securing shock absorber to suspension arm	29.5 to 36.2 ft.lbs	40 to 49 Nm
Nut securing shock absorber to wheelarch	8.8 to 11.1 ft.lbs	12 to 15 Nm
Nut securing shock absorber strut	48.7 to 60.5 ft.lbs	66 to 82 Nm
Screw securing brake caliper to bracket	22.9 to 28.0 ft.lbs	31 to 38 Nm
Nut securing steering cross rod ball joint	36.9 to 44.3 ft.lbs	50 to 60 Nm
Screw securing brake caliper bracket	38.4 to 42.8 ft.lbs	52 to 58 Nm
Nut securing suspension arm ball head	36.9 to 44.3 ft.lbs	50 to 60 Nm
Screw securing brake disk to hub	4.6 to 9.6 ft.lbs	6.2 to 13 Nm
Screw securing brake disk cover	2.2 to 4.4 ft.lbs	3 to 6 Nm
Screw securing sensor (Vehicles equipped with ABS)	3.5 to 4.4 ft.lbs	4.8 to 6 Nm
Nut securing stabilizer bar link to suspension arm	11.8 to 14.8 ft.lbs	16 to 20 Nm
Screw securing rubber support of suspension arm to engine support frame	2.9 to 5.2 ft.lbs	4 to 7 Nm
Screw securing rubber support of suspension arm to engine support frame	42 to 46.5 ft.lbs	57 to 63 Nm
Screw securing suspension arm to engine frame (rear section)	15.5 to 17.7 ft.lbs	21 to 24 Nm
Nut securing ball joint to suspension arm	15.5 to 17.7 ft.lbs	21 to 24 Nm
Nut securing strut to stabilzer bar	19.9 to 25.1 ft.lbs	27 to 34 Nm
Screw securing rubber support bracket of stabilizer bar	7.4 to 9.6 ft.lbs	10 to 13 Nm
Nut securing lateral steering rod	29.5 to 46.5 ft.lbs	40 to 63 Nm
Nut securing rubber support of steering link rod	36.2 to 39.85 ft.lbs	49 to 54 Nm

SPECIAL TOOLS

Tool number	Description
1.820.089.000	Shock absorber spring compression tool
1.821.092.000	Wheel hub puller
1.821.099.000	Front wheel hub bearing puller
1.821.151.000	Hub and wheel bearing inserting tool
1.821.166.000	Ball joint from stanchion puller
1.821.169.000	Steering link rod ball joint puller
1.820.035.000	Ruler, vehicle attitude check

REAR SUSPENSIONS
ILLUSTRATED INDEX



REAR SUSPENSIONS

DESCRIPTION

The ALFA 164 rear suspensions maintain same features of the front ones.

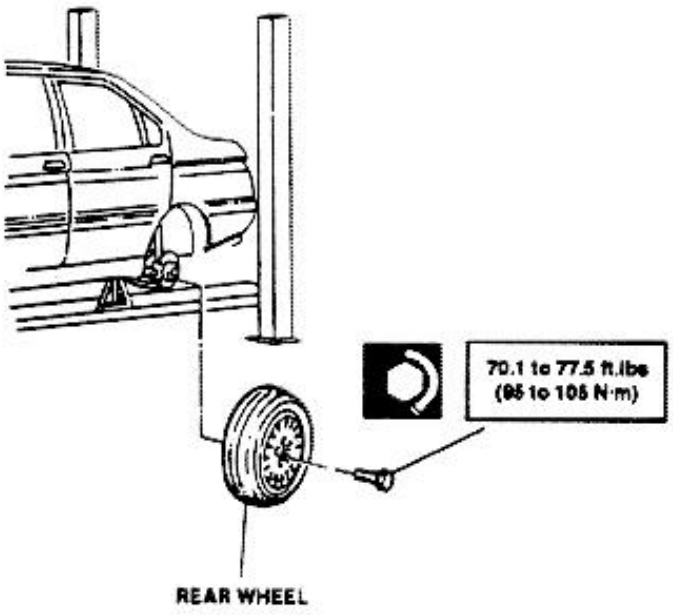
They are pre-installed off center with same advantages of the front suspensions to assure best adjustment and installation.

They are provided with connection control and longitudinal arms with stabilizer bar. The lower arms are very long, parallel and keep rear wheels always parallel to vehicle longitudinal axis to provide a high adhesion to road surface and an ideal driving condition. The advantages of such suspension system are: Weight reduction of not suspended masses, roll axis very low, decreased vehicle inclination while turning by means of the stabilizer bar.

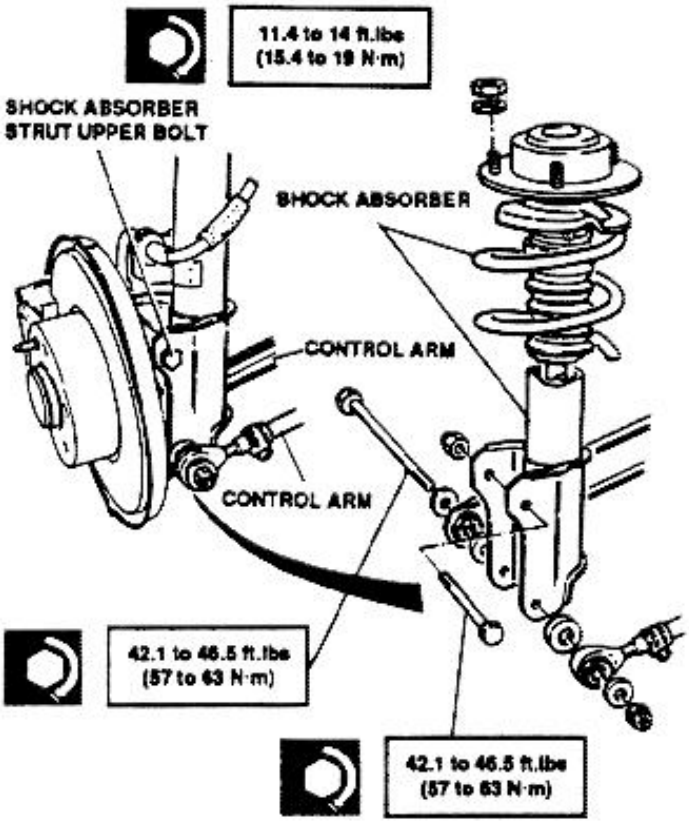
COIL SPRING AND SHOCK ABSORBER

REMOVAL/INSTALLATION

1 Remove rear wheel.



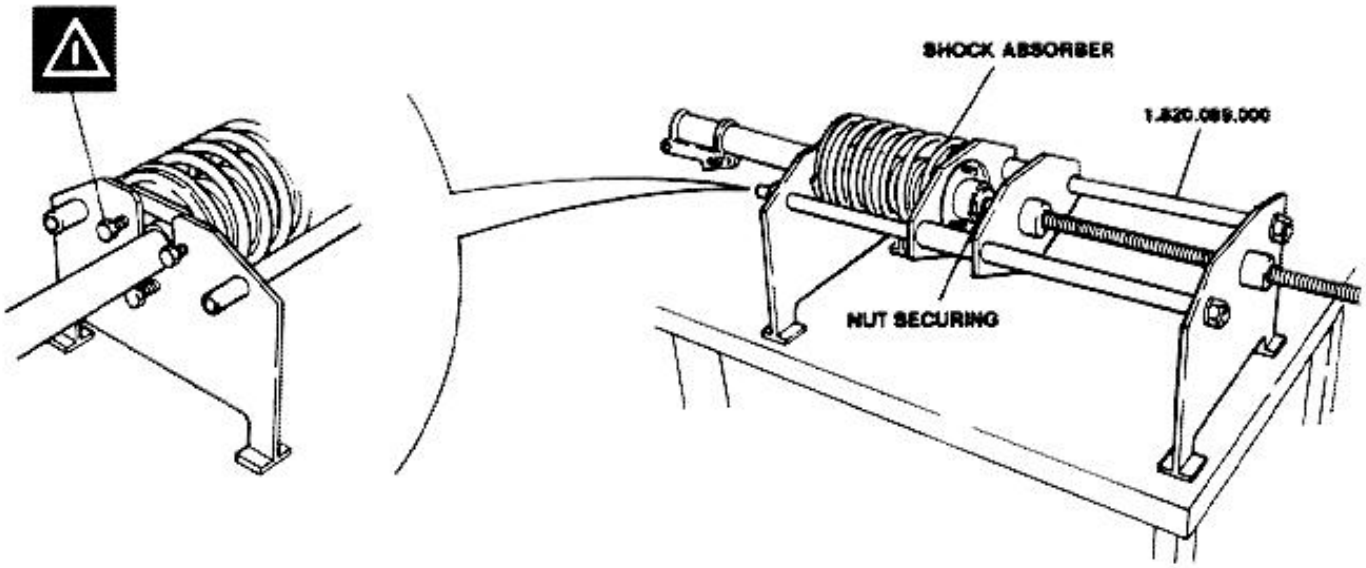
2. Disconnect shock absorber strut from spindle by removing upper securing bolt.
3. Disconnect front and rear control arms from spindle by removing lower securing bolt.
4. Disconnect the shock absorber from wheelarch in the trunk and remove it.



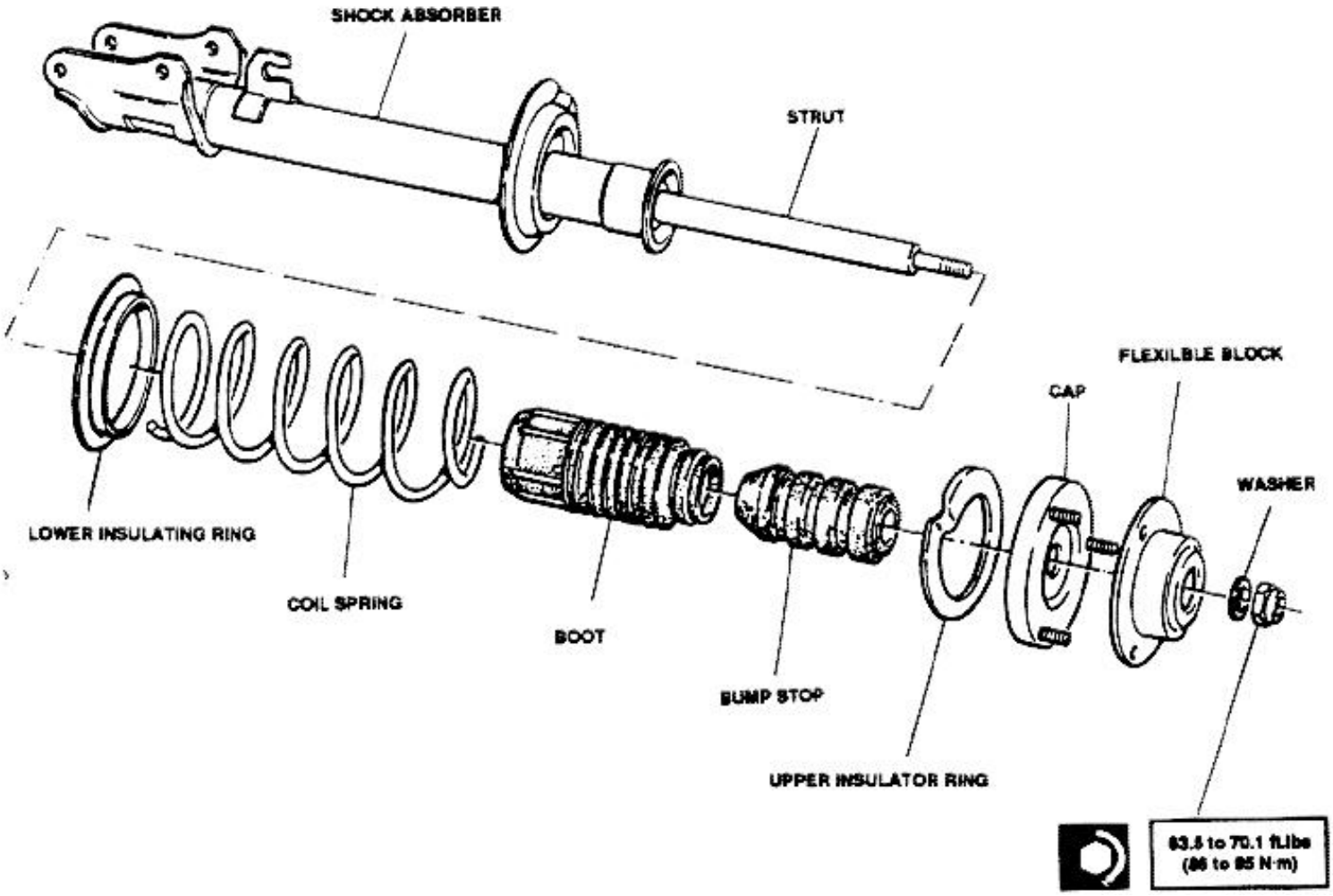
DISASSEMBLY/REASSEMBLY

1. Position shock absorber assembly on the appropriate disassembly tool.
2. Loosen the securing nut without removing it.

CAUTION:
Before compressing the spring, ensure that the shock absorber strut is perpendicular to the support plate. If necessary work on the adjusting screws.



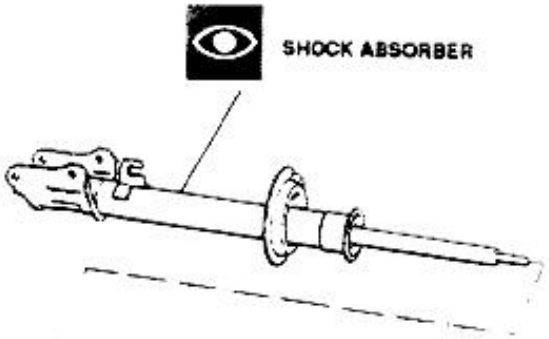
Compress spring and remove shock absorber assembly.

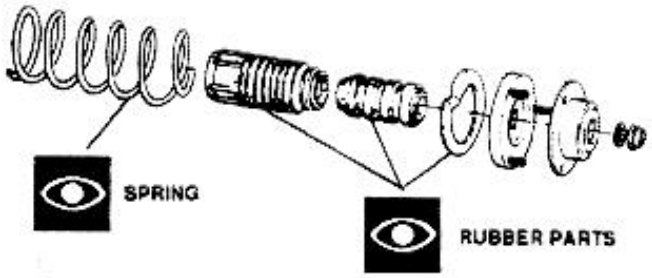


NUT SECURING
SHOCK ABSORBER

CHECKS AND INSPECTIONS

1. Replace shock absorber in case of incorrect operation or oil leakages.
2. Visually check that the spring is not cracked or deformed.
3. Replace any deformed, damaged or worn rubber item.
4. Check that spring height under a load of 339.5 to 360.5 Kg (748.94 to 795.26 lbs) is 192 mm (7.4 in).



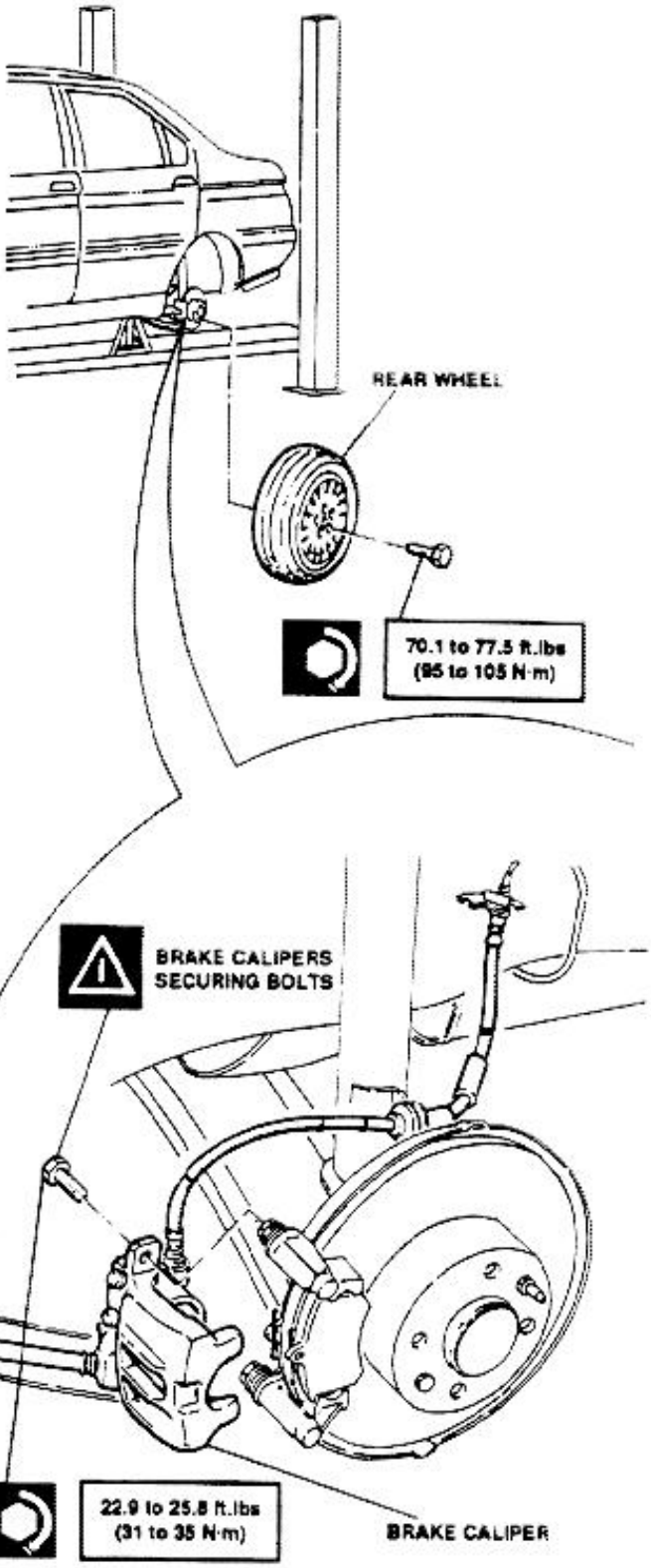


WHEEL HUB

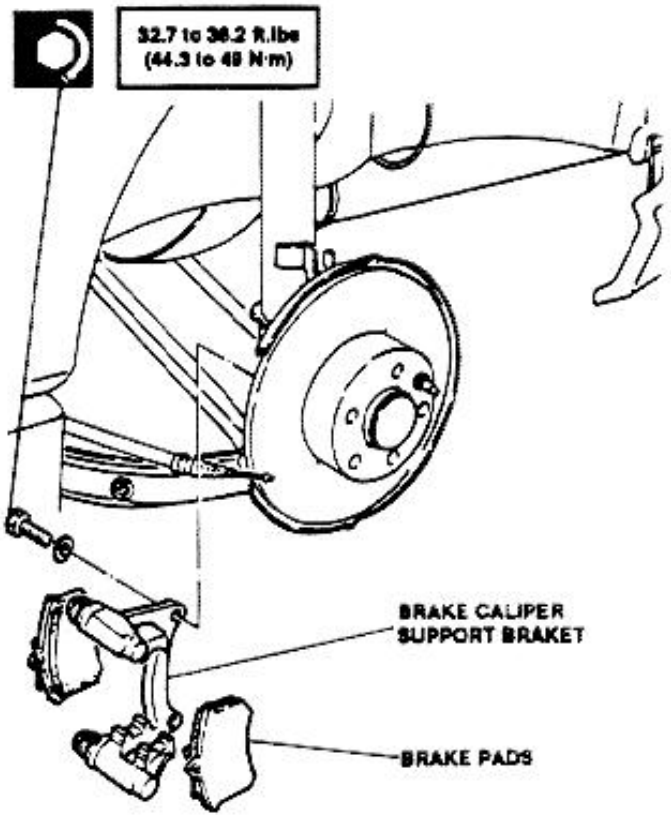
REMOVAL/INSTALLATION

1. Remove rear wheel.
2. Remove securing bolts and remove brake caliper.

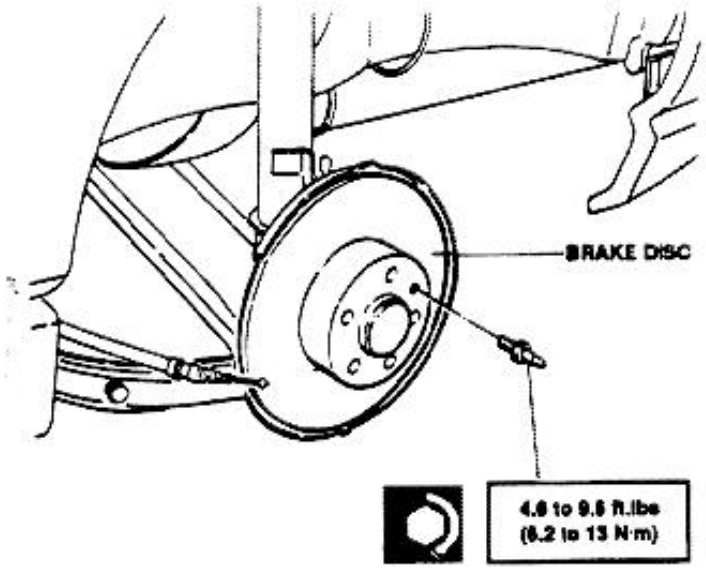
CAUTION:
When installing, replace brake caliper securing bolts.



3. Remove brake pads.
4. Remove brake caliper securing bracket.

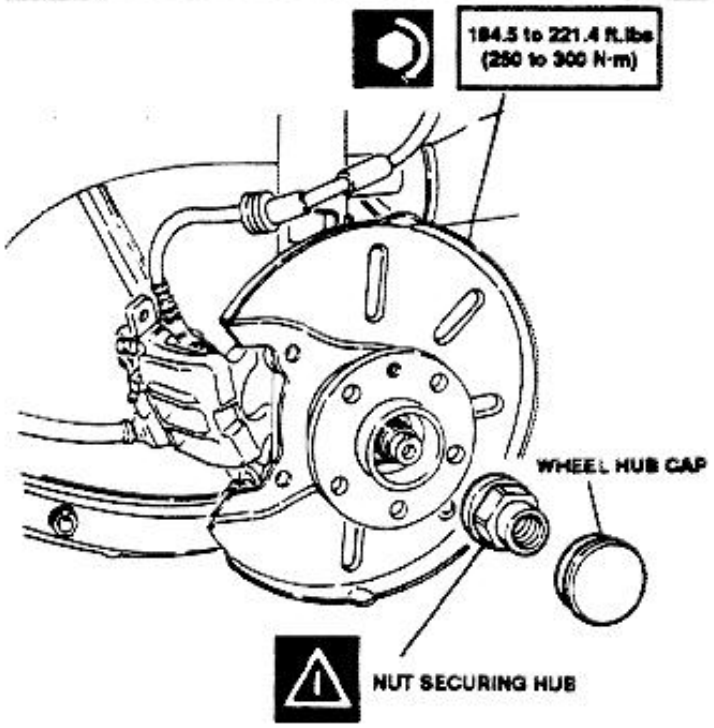


5. Remove brake disk.

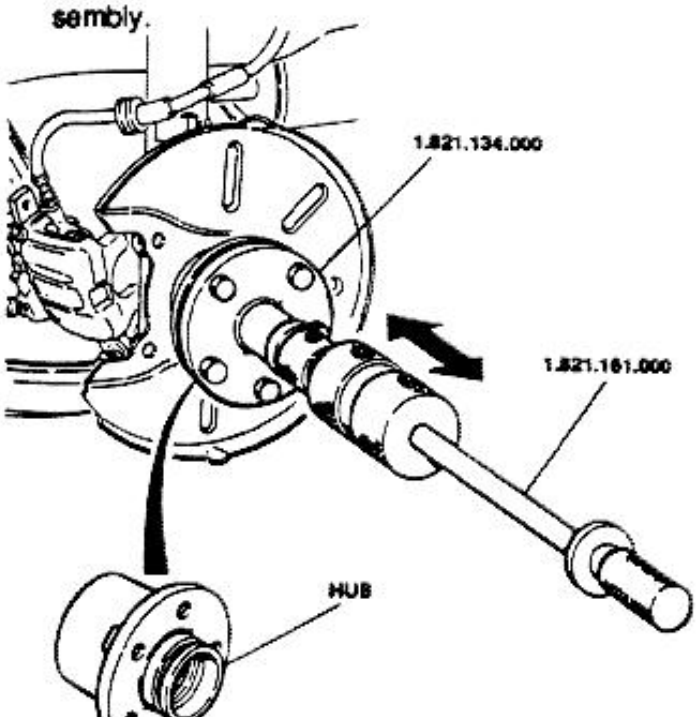


6. Remove wheel hub cap.
7. Remove caulking and the hub securing nut.

When reassembling, replace nut and then caulk it.



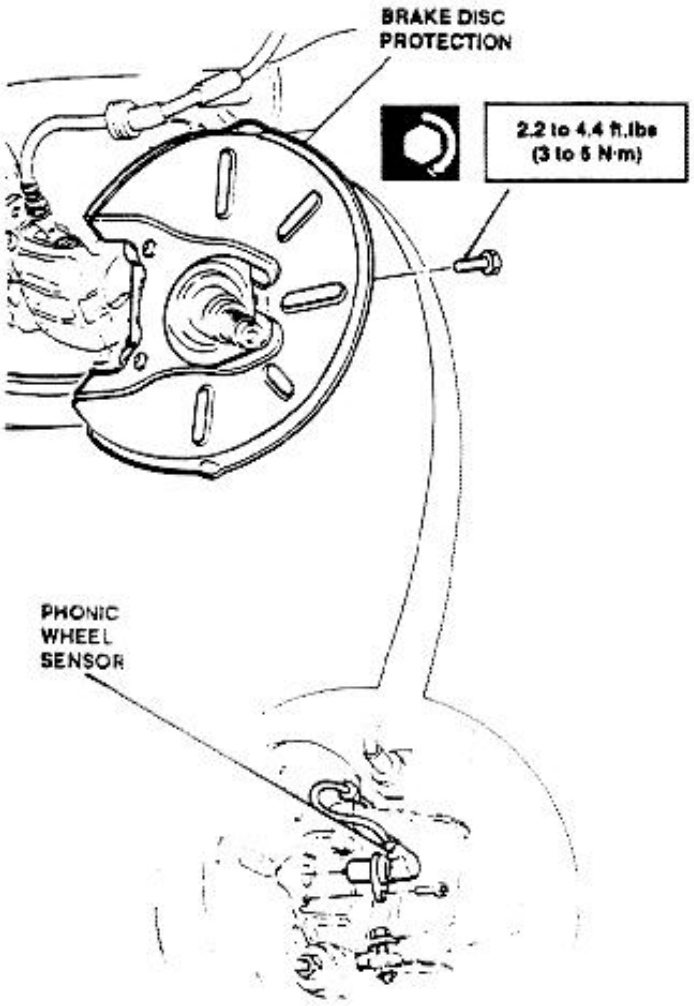
8. Apply special tool and extract the complete hub assembly.



SPINDLE

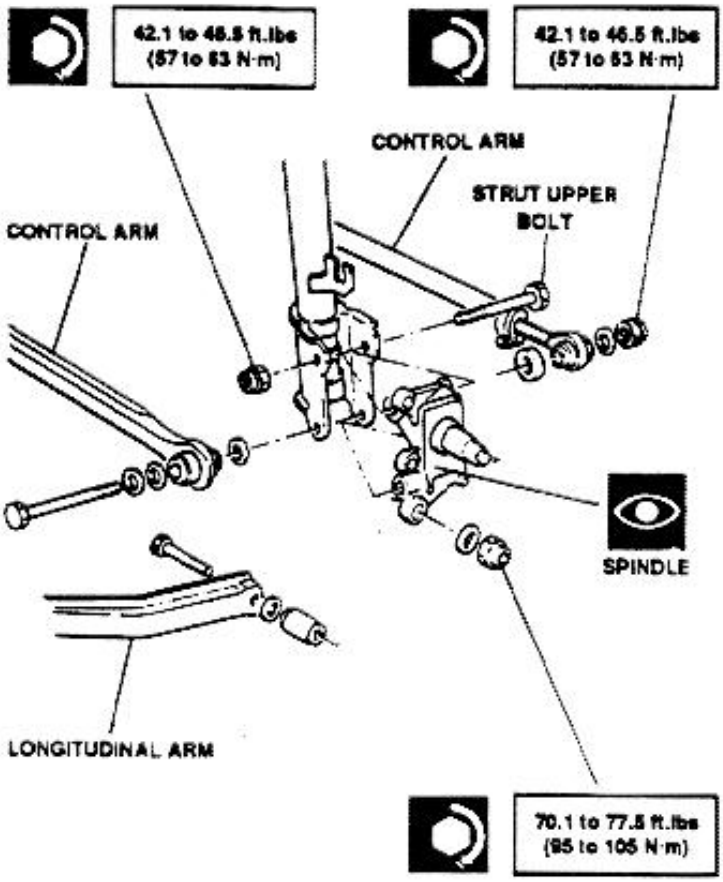
REMOVAL/INSTALLATION

1. Remove the wheel hub.
2. Remove the disk brake protection.
3. **For vehicles equipped with ABS system:** remove phonic wheel sensor.



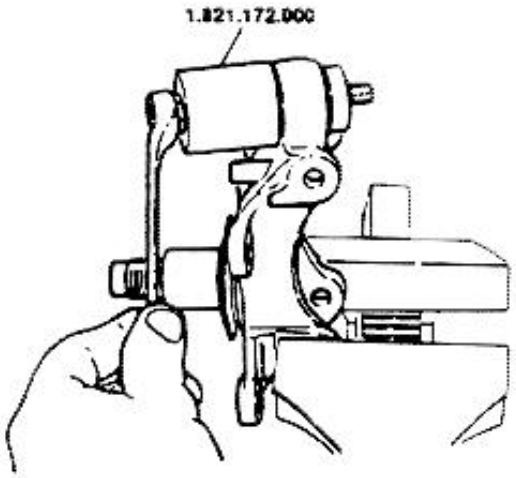
4. Disconnect shock absorber strut from the spindle by removing the upper screw.
5. Disconnect front and rear control arms from the spindle by removing the lower bolt.
6. Disconnect the longitudinal arm from the spindle.
7. Remove spindle.

The spindle must not show signs of cracks, deformations or wear, otherwise replace it.

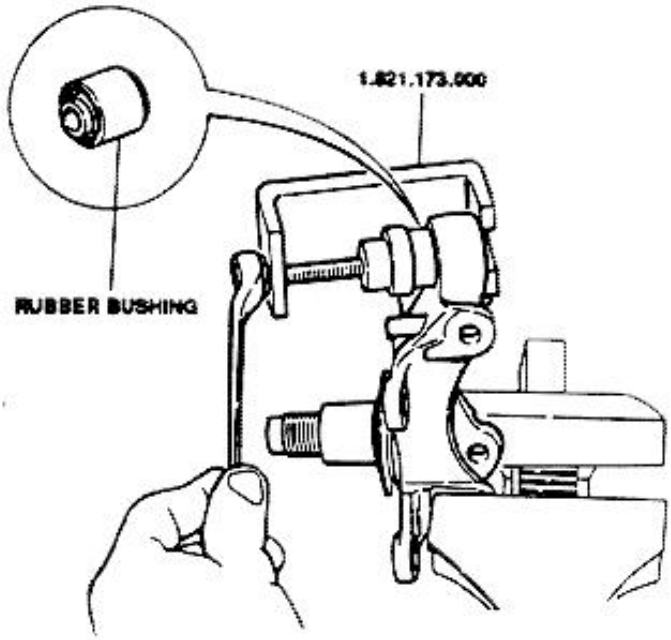


RUBBER BUSHING REPLACEMENT

1. Extraction of rubber bushing from spindle.



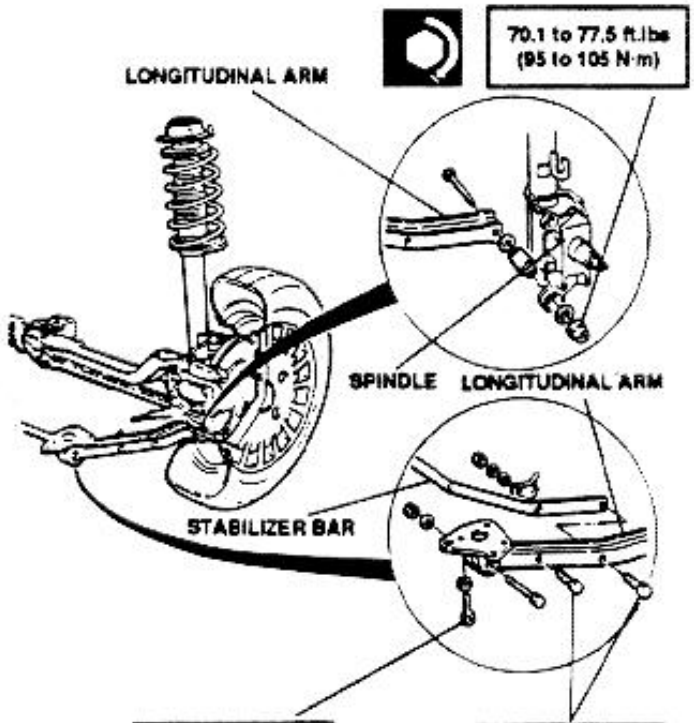
2. Insertion of rubber bushing into spindle.



LONGITUDINAL ARMS

REMOVAL/INSTALLATION

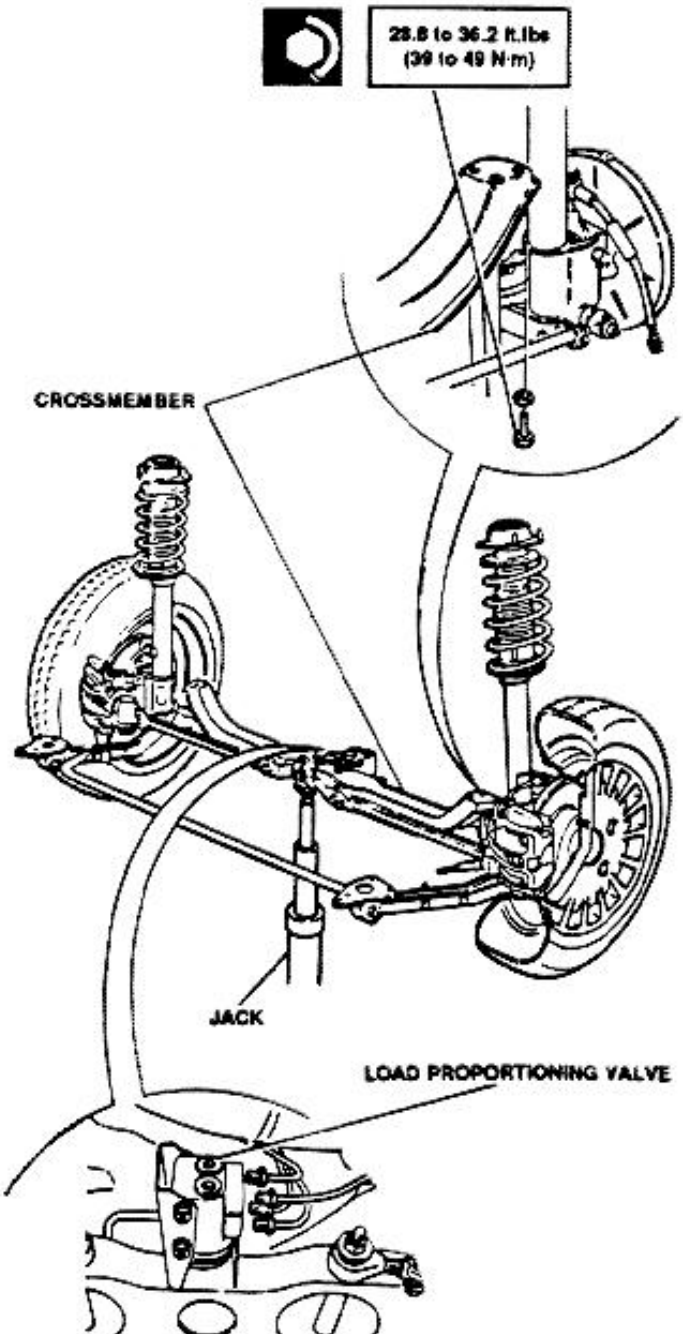
1. Remove rear wheel.
2. Disconnect arm from spindle.
3. Disconnect arm from stabilizer bar and from car body.



FRONT AND REAR CONTROL ARMS

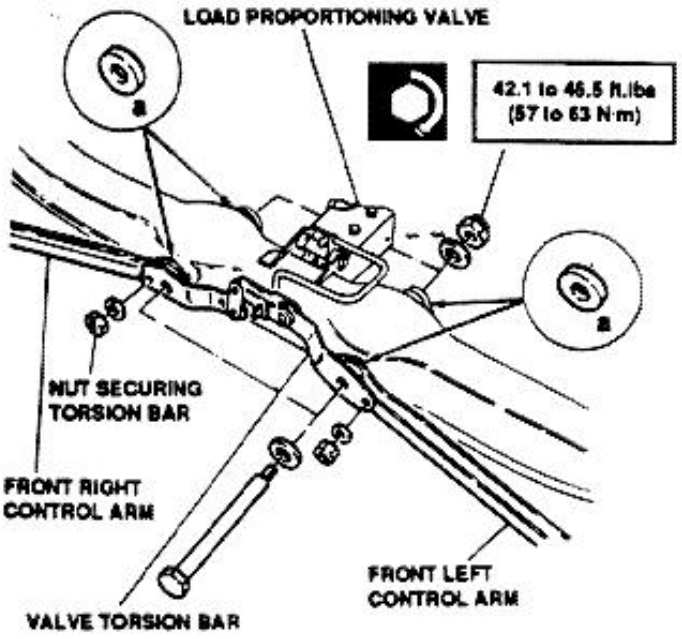
REMOVAL/INSTALLATION

1. Place a column-type jack under the crossmember to support rear suspension.
2. Remove load proportioning valve from crossmember (see **Group 22**).
3. Remove crossmember from car body.



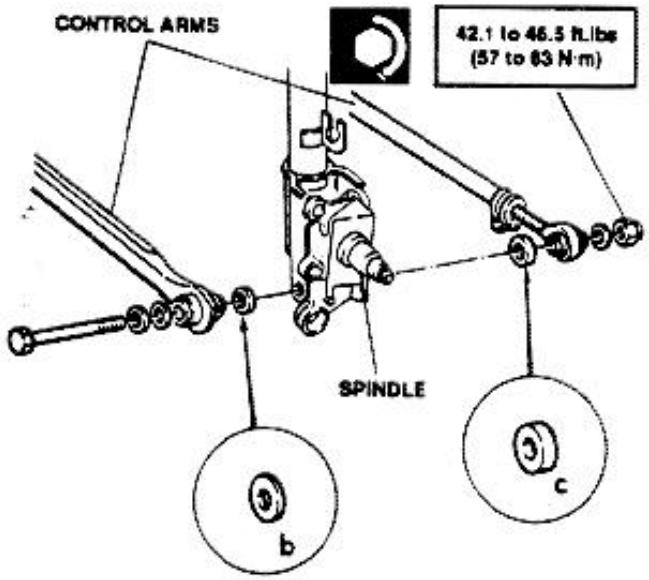
4. Remove nuts securing valve torsion bar to front control arms.

NOTE: When installing adjust load proportioning valve (see Group 22).



5. Disconnect arms from crossmember and from wheel spindle.

NOTE: When installing, spacers (a), (b) and (c) shall be installed in the original position.



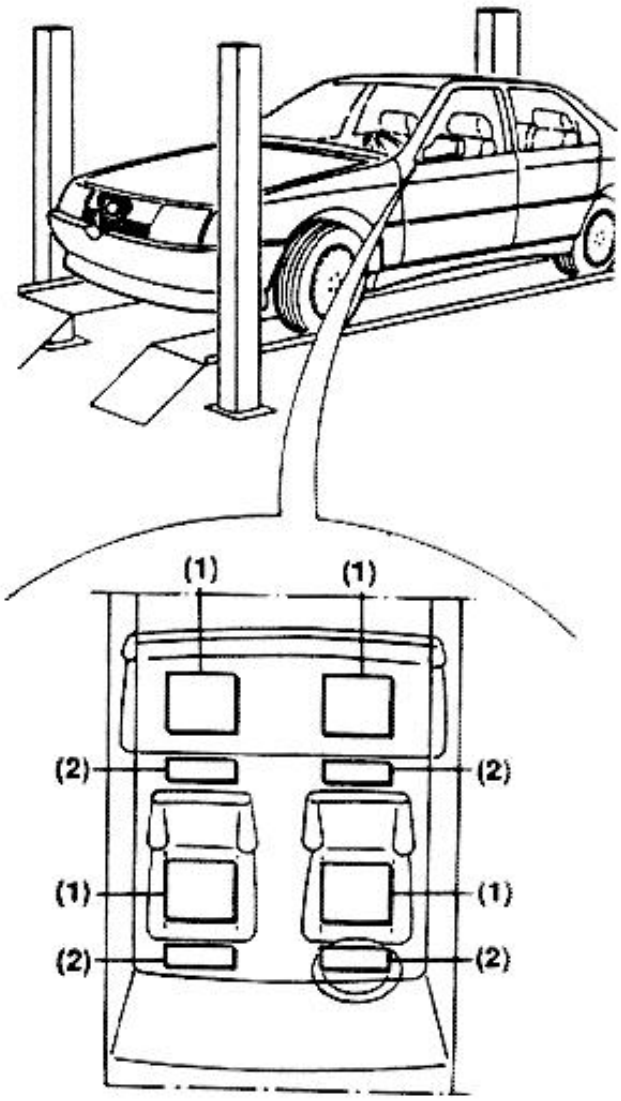
REAR WHEELS ATTITUDE AND ALIGNMENT CHECK

PRELIMINARY OPERATIONS

1. Place vehicle on auto lift.
2. Check tire pressure.
3. Prepare vehicle with static load (full tank + weights distributed as illustrated).

NOTE: Alternatively, the vehicle can be left empty in running order (vehicle resting on its wheels + 5 to 30 liters (1.35 to 8.1 gals) of fuel.

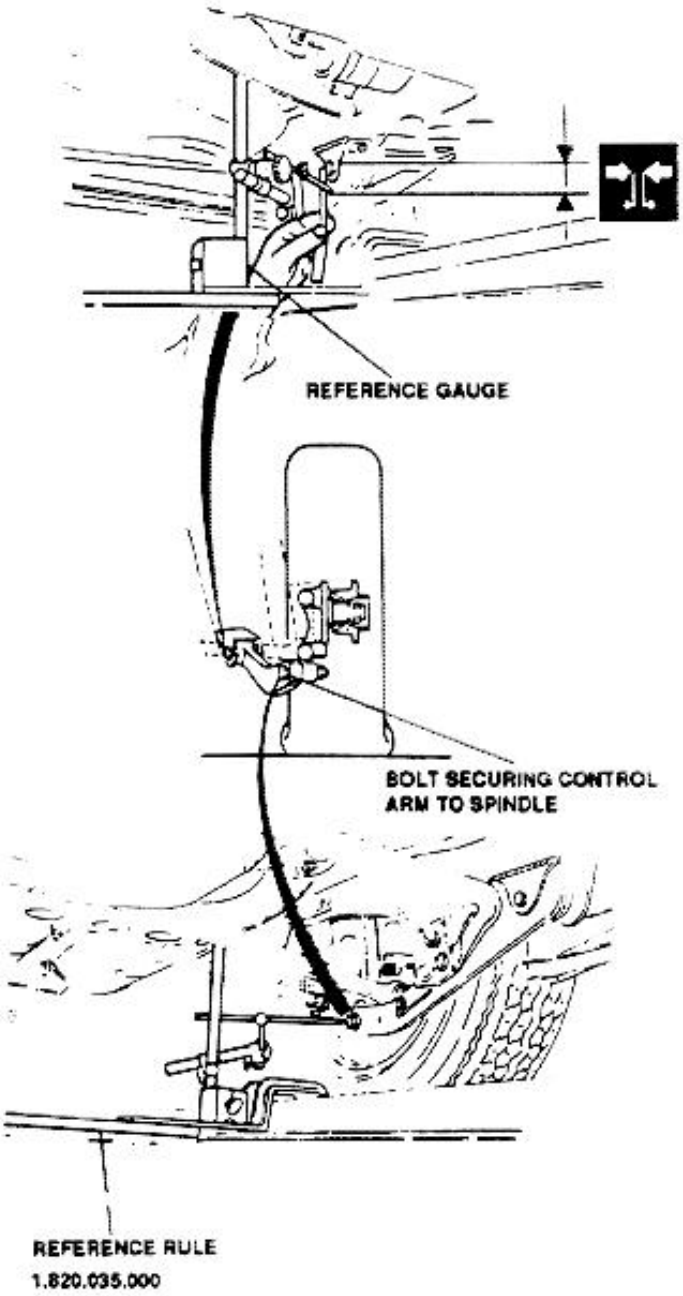
4. Rock vehicle several times to settle the suspension.



1) 50 kg (110.35 lbs)
2) 25 kg (55.175 lbs)

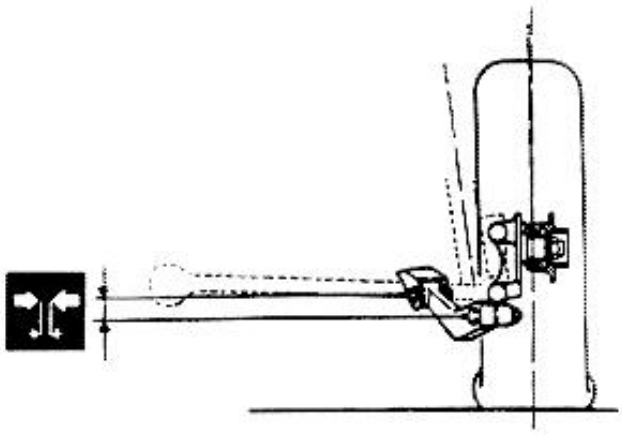
REAR ATTITUDE CHECK

1. Place reference rule on the surface on which the vehicle is resting.
2. Set a surface gauge so that its pointer is aligned with the centre of the bolt securing the longitudinal arm the spindle.
3. Move the surface gauge as indicated and use a millimetre rule to measure the distance between the axis of the bolt securing the longitudinal arm to the body and the surface gauge pointer.



Check the distance measured against specified values.

NOTE: If the attitude values are not within specified values, replace both suspension springs.

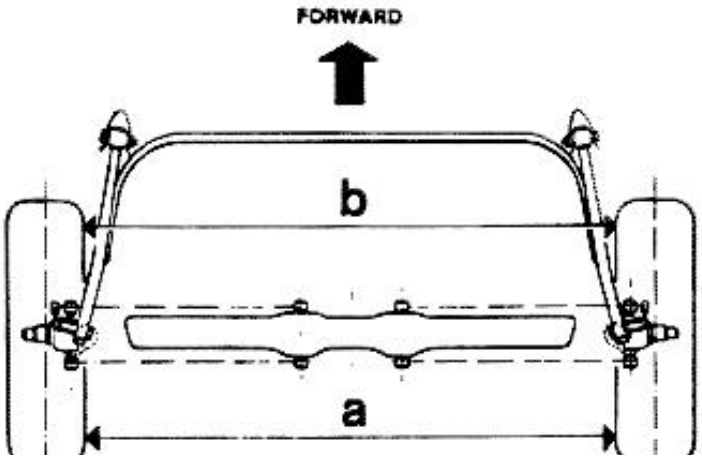


Values refer to static load vehicle	24 ± 7 mm (0.945 ± 0.276 in)
Values refer to empty vehicle in running order	56.5 ± 7 mm (2.224 ± 0.276 in)
	69.5 mm * (2.710 in)

* For vehicles equipped with spacers between engine support frame and bodywork.

REAR WHEELS TOE-IN CHECK

- Carry-out preliminary operations previously indicated.

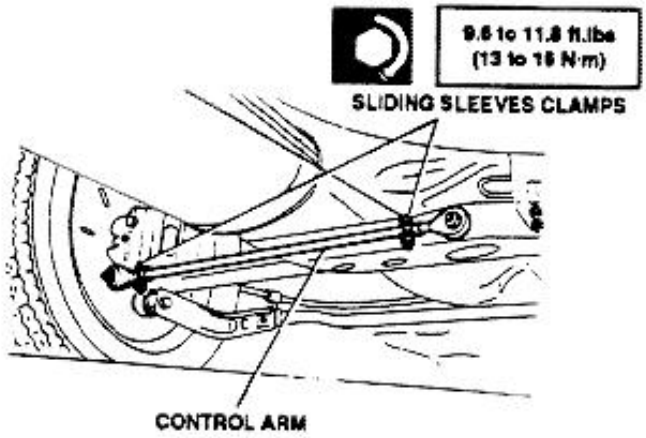


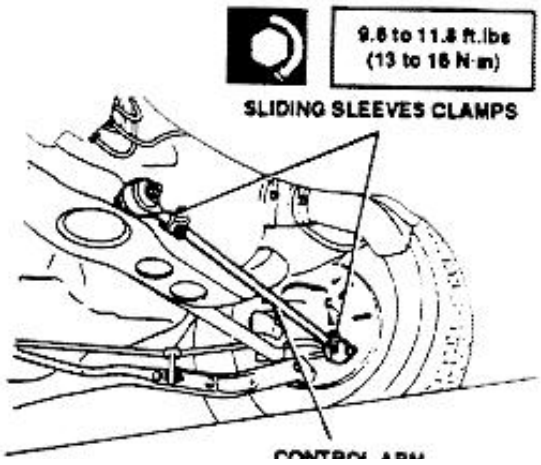
a - b =	
Values refer to static load vehicle	Values refer to empty vehicle in running order
3 ± 1 mm (0.118 ± 0.039 in)	5 ± 1 mm (0.197 ± 0.039 in)

- If values differ from the indicated ones, proceed as follows:
2. Loosen nuts of sliding sleeves clamps.
3. Rotate control arm till the correct values are obtained.

NOTE: Adjustment shall be carried out on both control arms.

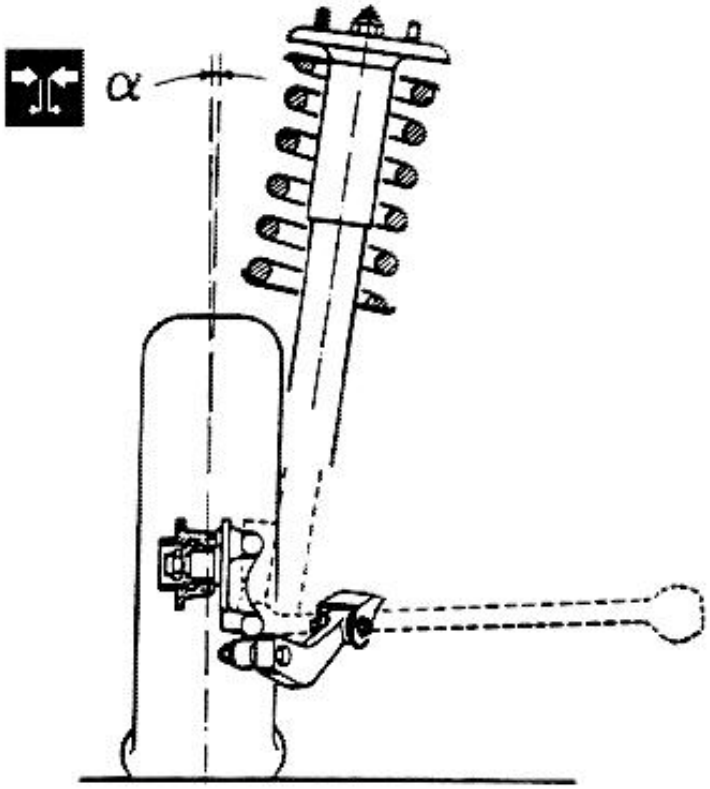
- Tighten clamps nuts.





REAR WHEELS ALIGNMENT CHECK:

CAMBER ANGLE



α =	
Values refer to static load vehicle	Values refer to empty vehicle in running order
-1° ± 20'	-15' ± 20'

NOTE: The camber angle cannot be adjusted

CONTROL ARM

NOTE: The camber angle cannot be adjusted.

TECHNICAL CHARACTERISTICS AND SPECIFICATIONS

COIL SPRINGS

Wire diameter	12.6 mm (0.496 in)
Outer spring diameter	139.1 ± 1.4 mm (5.476 ± 0.055 in)
Inner spring diameter	113.9 ± 1.1 mm (4.484 ± 0.043 in)
Total usable turns	5
Total unusable turns	~ 1.5
Total spring turns	~ 6.5
Coil sense	Right

SHOCK ABSORBERS

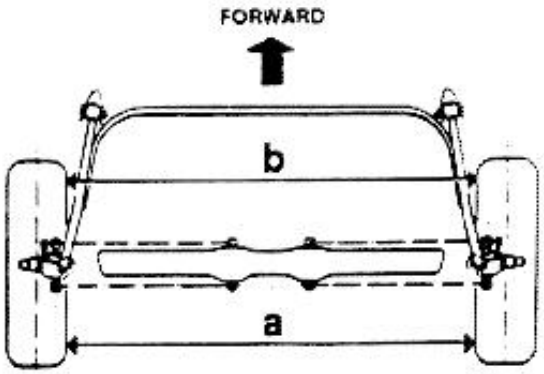
Shock absorber type	Hydraulic
Strut diameter	22 mm (0.866 in)
Stroke	214 mm (8.425 in)

CHECKS AND ADJUSTMENTS

SPRING HEIGHT UNDER LOAD OF

339.5 to 360.5 kg (748.94 to 795.26 lbs)	192 mm (7.56 in)

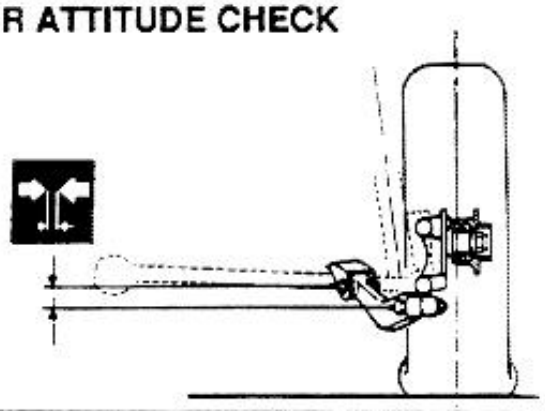
REAR WHEELS TOE-IN CHECK



a - b =	3 ± 1 mm (0.118 ± 0.039 in)	(1)
	5 ± 1 mm (0.197 ± 0.039 in)	(2)

1) Values refer to static load vehicle.

REAR ATTITUDE CHECK



	24 ± 7 mm (0.945 ± 0.276 in)	(1)
	56.5 ± 7 mm (2.224 ± 0.276 in)	(2)
	69.5 mm * (2.710 in)	(2)

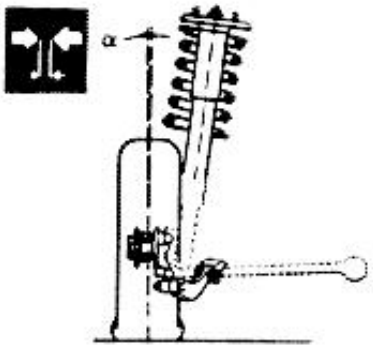
* For vehicles equipped with spacers between engine support frame and bodywork.

1) Values refer to static load vehicle.

1) Values refer to static load vehicle
2) Values refer to empty vehicle in running order

1) Values refer to static load vehicle
2) Values refer to empty vehicle in running order

CAMBER ANGLE:



α =	-1° ± 20'	(1)
	-15' ± 20'	(2)

1) Values refer to static load vehicle
2) Values refer to empty vehicle in running order

TIGHTENING TORQUES

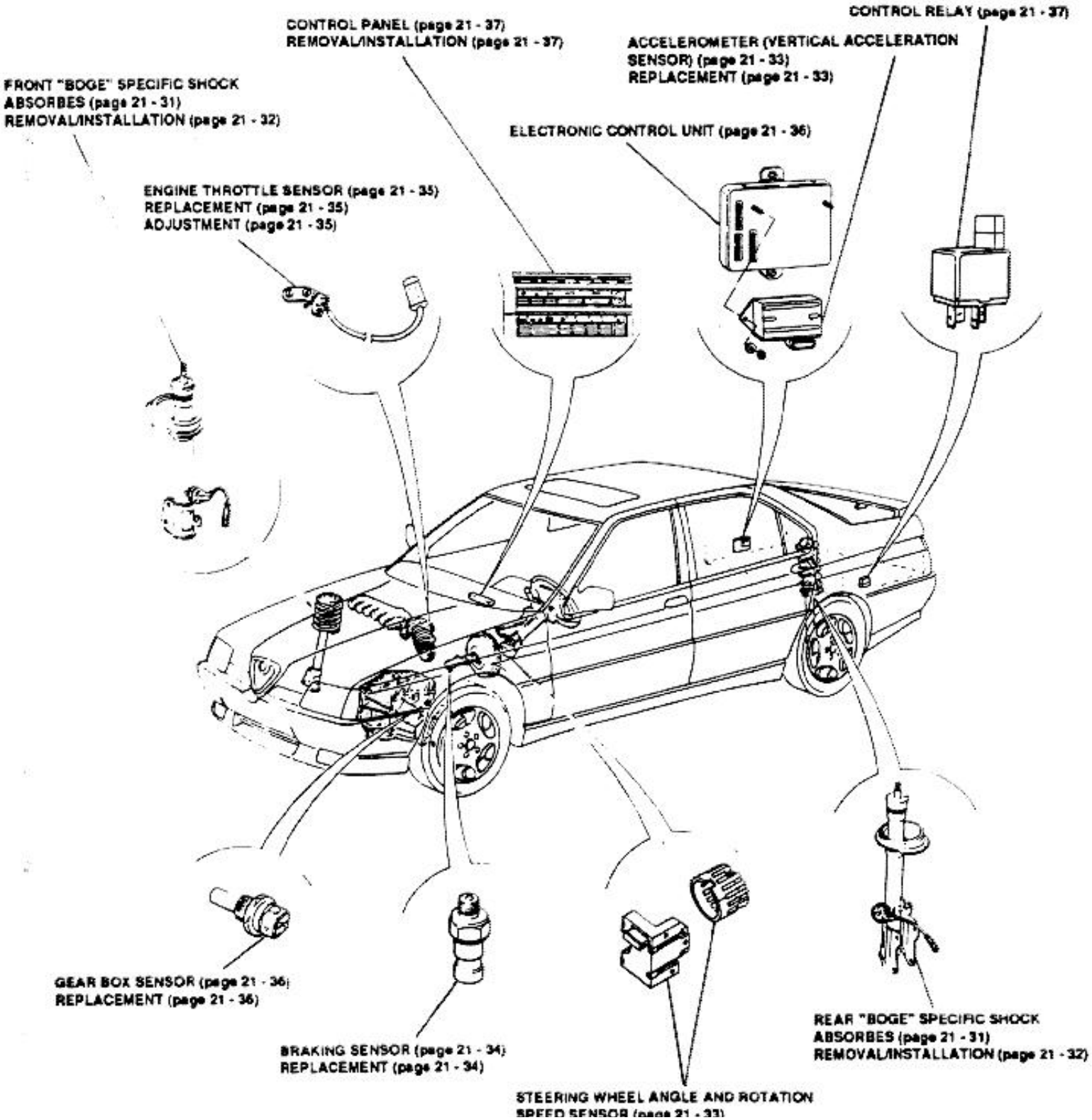
Columns securing rear wheels to hub	70.1 to 77.5 ft.lbs	95 to 105 Nm
Nut securing shock absorber to body	11.4 to 14 ft.lbs	15.4 to 19 Nm
Bolt securing shock absorber to spindle	42.1 to 46.5 ft.lbs	57 to 63 Nm
Bolt securing control arms and shock absorber to spindle	42.1 to 46.5 ft.lbs	57 to 63 Nm
Nut securing shock absorber strut	63.5 to 70.1 ft.lbs	86 to 95 Nm
Screw securing brake disk to hub	4.6 to 9.6 ft.lbs	6.2 to 13 Nm
Nut securing hub to spindle	184.5 to 220.4 ft.lbs	250 to 300 Nm
Bolt securing longitudinal arm to spindle	70.1 to 77.5 ft.lbs	95 to 105 Nm
Bolt securing longitudinal arm support to body	28.8 to 36.2 ft.lbs	39 to 49 Nm
Bolt securing stabilizer bar to control arm	42.1 to 46.5 ft.lbs	57 to 63 Nm
Bolt securing crossmember to body	22.6 to 36.2 ft.lbs	39 to 49 Nm
Bolt securing control arms to crossmember	42.1 to 46.5 ft.lbs	57 to 63 Nm
Bolt fixing front control arm adjustment sleeve	9.6 to 11.8 ft.lbs	13 to 16 ft.lbs

SPECIAL TOOLS

Tool number	Description
1.820.089.000	Shock absorber spring compression tool
1.821.134.000	Rear wheel hub puller - disassemble and use with 1.821.161.000
1.821.161.000	Ram
1.821.172.000	Rear wheel spindle bushing puller
1.821.173.000	Rear wheel spindle bushing pusher
1.820.035.000	Ruler, vehicle attitude check

CONTROLLED DAMPING SUSPENSIONS

ILLUSTRATED INDEX



DESCRIPTION

The controlled damping suspensions system is capable to change the shock absorbers damping at any moment, in real time, on all the four wheels. This system, electronically monitored, modifies the shock absorbers damping characteristics according to the driving and road pavement conditions. This feature provides, at any instant, maximum comfort, roadholding power and safety.
The controlled damping suspensions are capable to operate in two different logics: **"AUTO" or "SPORT"**, selected by two pushbuttons located on the center console switchboard. These two logics operate in accordance with two shock absorber conditions: they may operate with soft or rigid adjustments.
If the **"AUTO"** function is selected, the electronic system adjusts, the shock absorbers in real time, changing from soft to rigid or viceversa automatically, according to information received by several sensors which read, at any moment, the different driving conditions.
If the **"SPORT"** function is selected, the shock absorbers adjustment is alwaysset for a sport driving condition, with an increase in roadholding power against comfort.

SYSTEM OPERATION - "AUTOMATIC" MODE.

The monitored parameter is the vertical acceleration that is determined by road oscillations, steering angle and rate at which these variations occur, by the exceeding of a fixed value in the brakes hydraulic system pressure and by throttle opening when 1st and 2nd gear are selected.
The AUTO logic foresees two operation fields depending on vehicle speed.
1) Till the speed of 4 Km/h (2.5 MPH) the shock absorbers adjustment is rigid to allow monoeuvres without excessive springing on rough roads.
2) The system changes automatically the adjustment from soft to rigid when one of the following conditions is met:

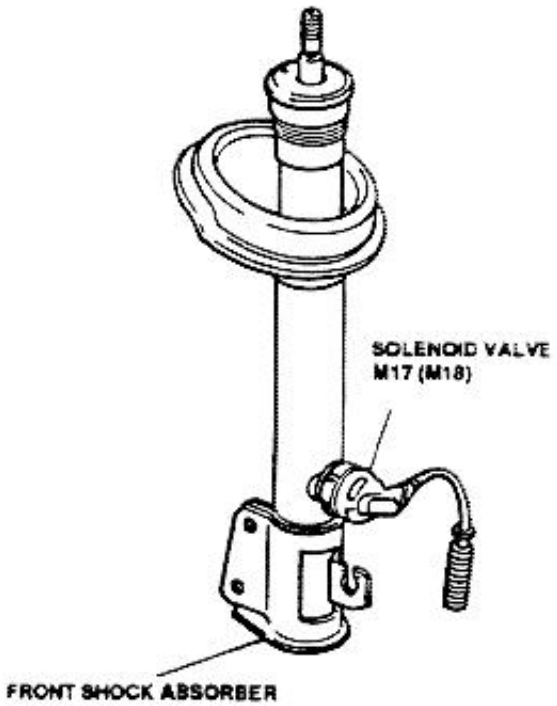
- sudden changes of direction due to obstacles on the road or very sharp turns; these conditions are sensed by the "Steering wheel angle and steering wheel rate of rotation" sensor;
- Bumps and road asperities generating oscillations of the body; these conditions are sensed by the "accelerometer" sensor;
- Vehicle braking with brake system pressure higher than 20 bar (290 psi); this condition is sensed by "braking pressure" sensor;
- Sudden speed-up using 1st and 2nd gear; this condition is sensed by the "engine throttle" sensor and by the "gearbox" sensor for speeds lower than 50 Km/h (31 MPH).

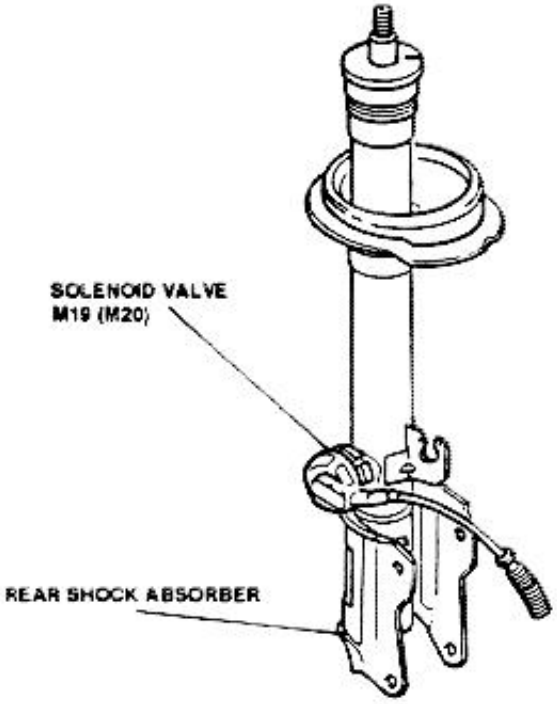
The system includes the following components:

A) "BOGE" specific shock absorbers
B) Sensors
C) Electronic control unit
D) Control relay
E) Control panel

A) "BOGE" SPECIFIC SHOCK ABSORBERS

The shock absorbers are of pressurized oleodynamic type, provided with a solenoid valve used to control oil flow, located on the shock observer outer tube.
The valve, upon input from the control unit, controls oil passage between two shock absorber chambers, proportionally modifying the damping action.
The actuating time, in other words the valve opening and closing time, is extremely short (about 5 milliseconds).

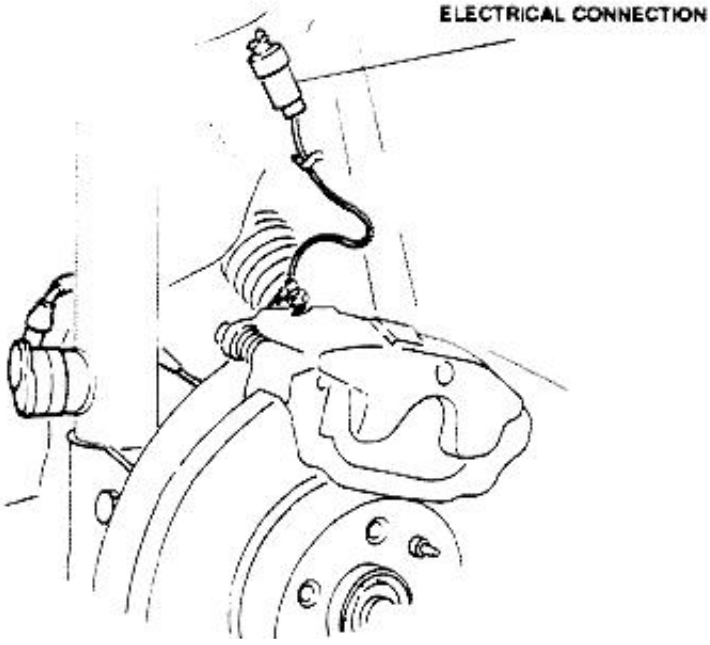




NOTE: In case of shock absorber or solenoid valve fault it is not foreseen any overhaul.

REMOVAL/INSTALLATION

1. Disconnect battery negative lead.
2. Remove protections of electrical connectors located on fenders.

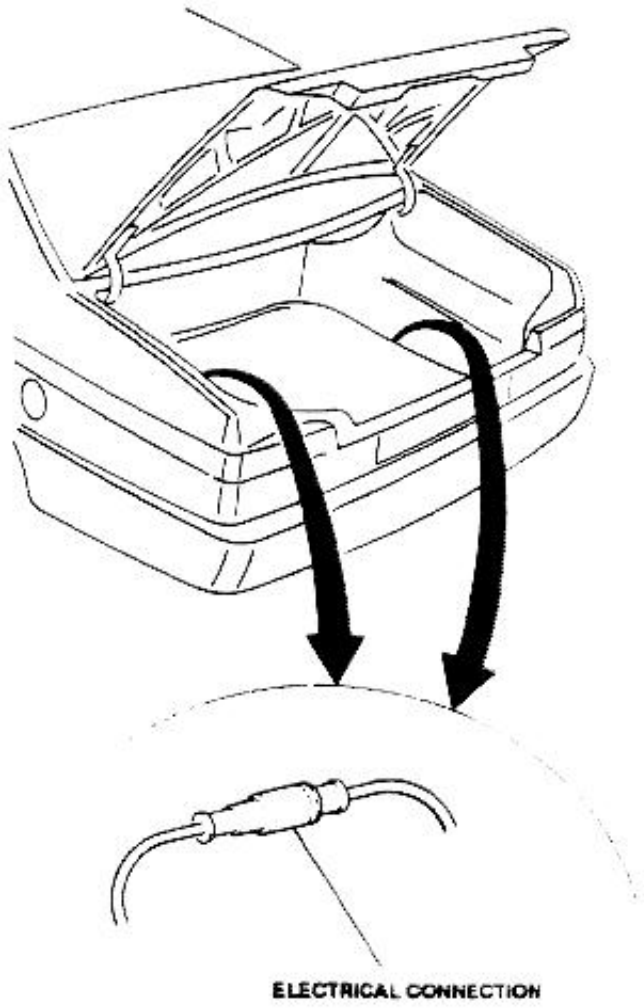


3. Disconnect front suspensions electrical connections.

WARNING:
NEVER DISASSEMBLE SHOCK ABSORBER: IT CONTAINS COMPRESSED GAS.

NOTE: Remove solenoid valve protection only when shock absorber has been completely assembled.

4. Disconnect rear suspensions electrical connections.



5. Refer to removal and installation procedures: "FRONT AND REAR SUSPENSIONS".

B) SENSORS

Six sensors provide the electronic control unit with specific data sensed at any moment. They are:

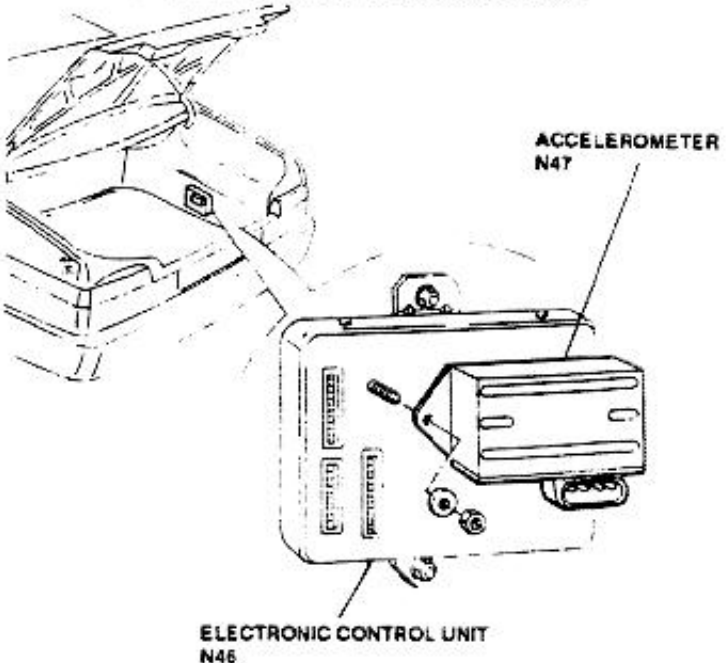
- **Accelerometer (vertical acceleration sensor)**
- **Steering wheel angle and rotation speed sensor**
- **Braking sensor**
- **Speedometer sensor**
- **Engine throttle sensor**
- **Gearbox sensor**

- ACCELEROMETER (VERTICAL ACCELERATION SENSOR)

It is fixed to the control unit located in the trunk. It senses vertical accelerations of the car body. These accelerations cause, inside the sensors, changing of values in a resistance. In the "AUTO" mode, the control unit, by monitoring signals according to their intensity and comparing then with vehicle speed, selects the shock absorber soft or rigid condition.

REPLACEMENT

1. Disconnect battery negative lead.
2. Loosen both accelerometer securing nuts and remove them.
3. Disconnect electrical connection.
4. Remove accelerometer from control unit.



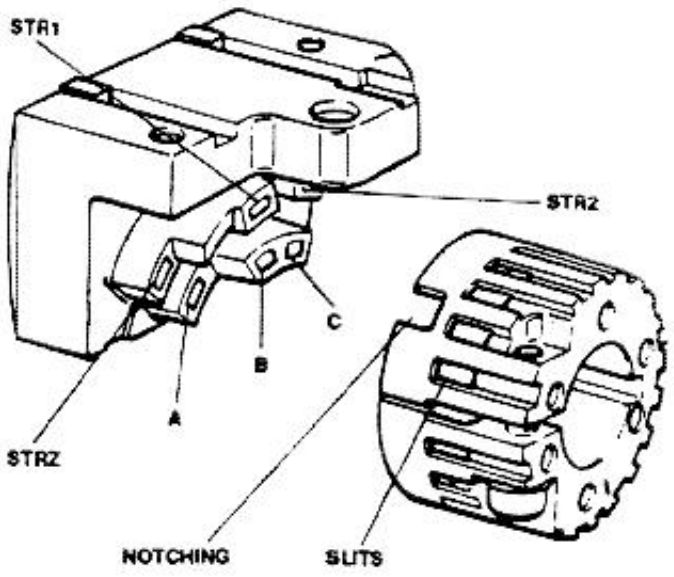
- STEERING WHEEL ANGLE AND ROTATION SPEED SENSOR.

The sensor is fixed to the steering column near the universal joint connecting the upper an lower sections. The sensor detects the curve radius from the steering wheel position and the speed at which the steering wheel has reached that angular position, compared to a fast or moderate driving condition.

Furthermore, this sensor detects any emergency manoevres to avoid sudden obstacles, such as a quick swerving.

The sensor includes three LED's A, B, C, interfaced to three photodiodes STRZ, STR1 and STR2. Between the LED's and the diodes is inserted a phonic wheel fixed to the steering column. The wheel has 20 equidistant slots along the circumference and a notching in relation with LED A and diode STRZ corresponding to a straight driving condition.

If illuminated by the LED's, the diodes sent to the control unit a succession of signals corresponding to the number of light intermittence caused by the slots passage between LED's and photodiodes. Since the phonic wheel slots are 20, to each signal corresponds a rotation angle of 18 degrees.



When set to "AUTO" the control unit adjusts shock absorbers to soft or rigid condition according to needs, by measuring the steering wheel rotation speed. This is received by the control unit as a frequence of signals coming from the sensor, being obvious that to a lower or

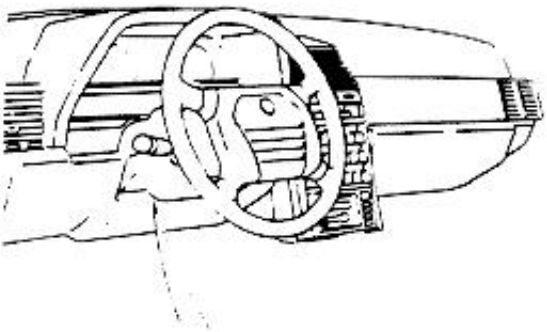
higher steering rate corresponds to an equal sequence of light openings from the phonic wheel slots.

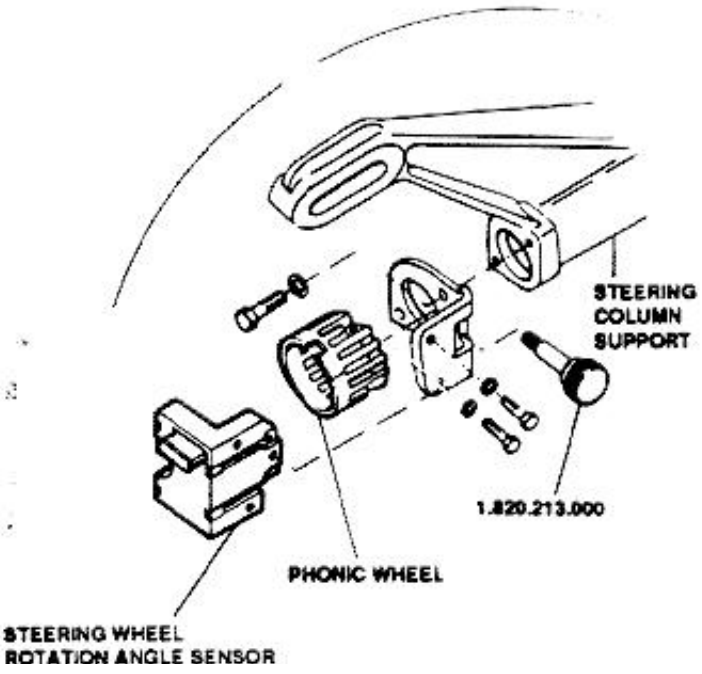
REMOVAL/INSTALLATION

Refer to **Group 23** for removal and installation having previously disconnected battery negative lead.

PHONIC WHEEL ADJUSTMENT

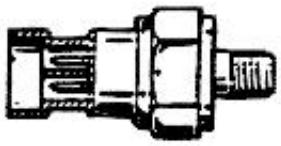
1. Loosen phonic wheel securing bolt.
2. Rotate steering wheel for a straight drive.
3. Insert tool **N.1.820.213.000** in the appropriate hole on the steering wheel rotation angle sensor; rotate phonic wheel till the threaded hole corresponds to the tool and screw it into the phonic wheel.
4. Tighten phonic wheel securing bolt.
5. Loosen and remove tool **N.1.820.213.000** from sensor.





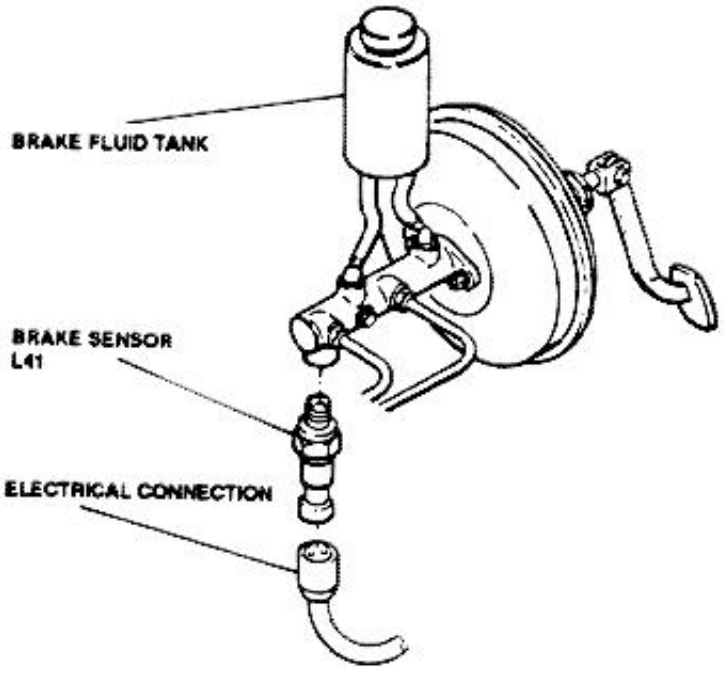
- BRAKING SENSOR

The braking sensor is installed on the brake pump front side. This sensor is adjusted for a pressure of 20 bar (290 psi) in the brakes hydraulic system. If this value is exceeded the control unit sets the shock absorbers to rigid condition. The sensor operates by a switch with normally open contacts; when they close, their reopening is obtained only when the brake pedal is released, and the system pressure drops to a value of 18.5 bar (268.2 psi). Information received by the control unit from the braking sensor are of the on/off type.



REPLACEMENT

1. Disconnect battery negative lead.
2. Empty brake fluid tank sucking the fluid with a syringe.
3. Disconnect electrical connection from the braking sensor.
4. Loosen sensor taking extreme care to recover hydraulic fluid from the pump, avoiding it from coming in contact with painted surfaces.
5. Plug port on pump left free by the sensor.

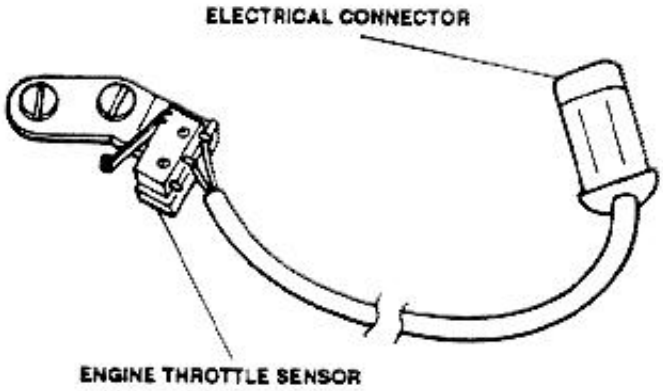


- SPEEDOMETER SENSOR

This sensor reads vehicle instaneous speed; it is located on the gear box and sends information to the control unit by an electronic module located inside the instrument panel.
Detection of actual speed is determinant for the behaviour of the control unit in comparison with information received from other sensors (see **WIRING DIAGRAMS AND ELECTRICAL DIAGNOSIS** book).

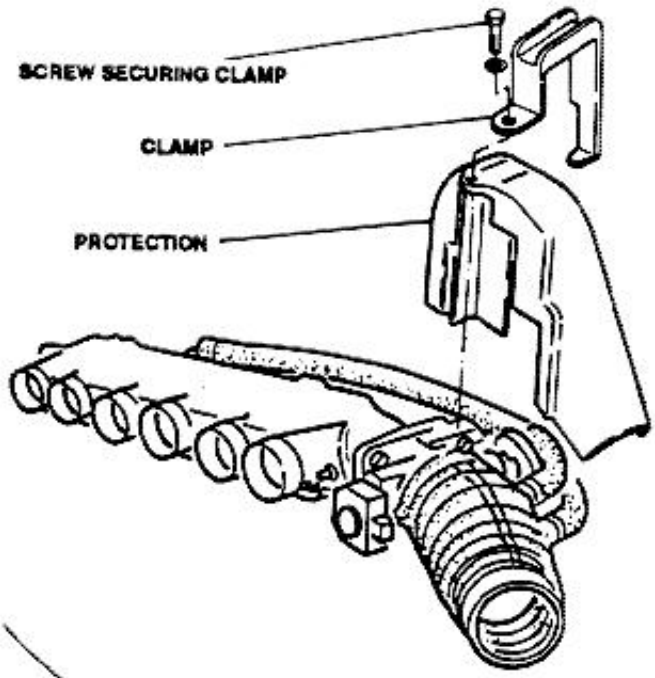
- ENGINE THROTTLE SENSOR

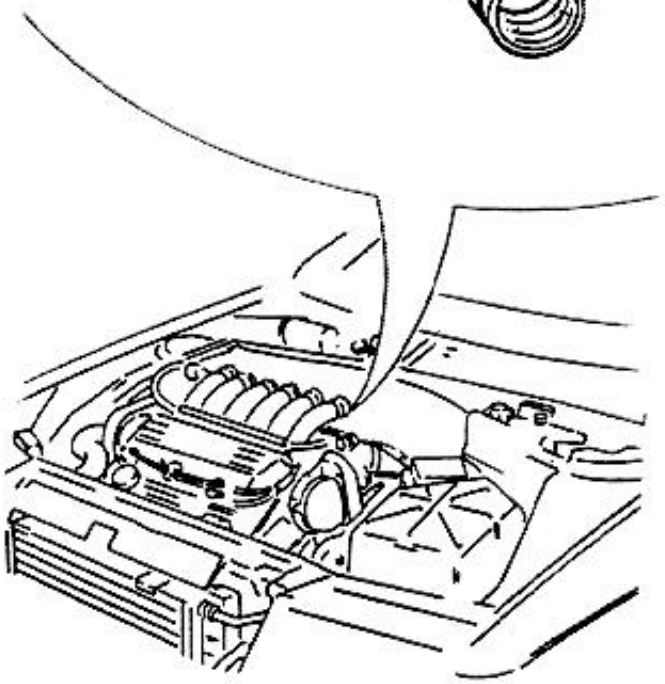
This sensor consists of a microswitch located on the throttle body.
It detects throttle position by closing a contact when its opening exceeds 20 degrees.
The microswitch closing is detected by the control unit when 1st or 2nd gear are selected.



REPLACEMENT

1. Disconnect battery negative lead.
2. Loosen screw securing clamp supporting hoses.
3. Remove clamp and plastic protection underneath.
4. Disconnect electrical connection from the throttle sensor.
5. Loosen nuts end remove sensor from support bracket.
6. At installation, reverse procedure carrying-out the following adjustment procedure.



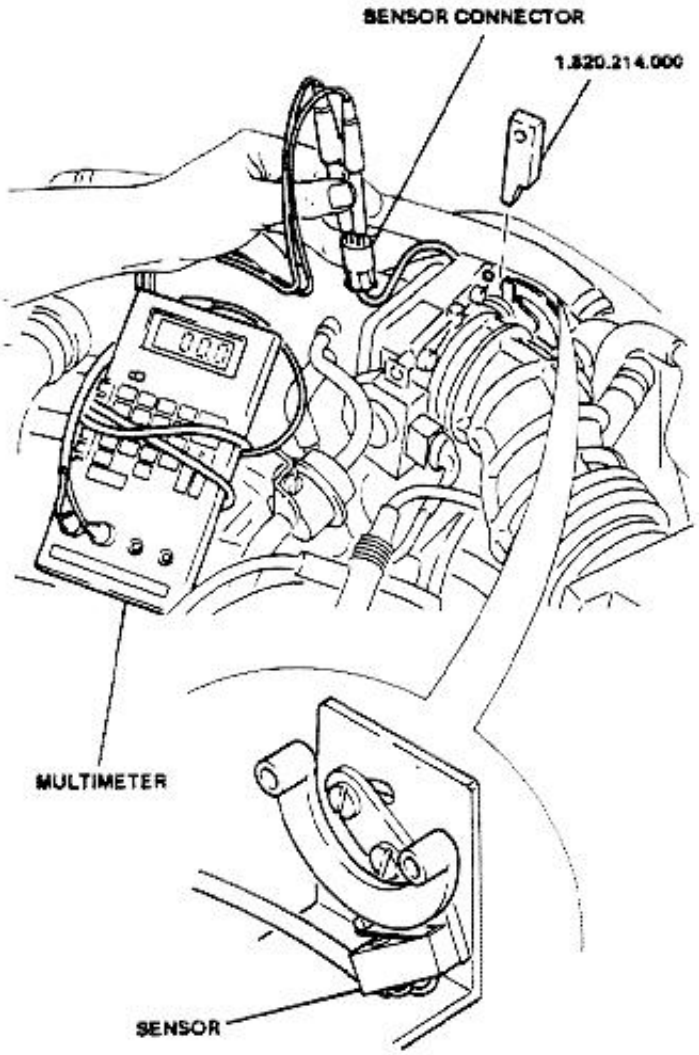


ADJUSTMENT

1. Install sensor and screw nuts without tightening them.
2. Connect multimeter (set to OHM) to sensor.
3. Insert tool **N.1.820.214.000** between throttle control and related stop.
4. Manually rotate switch until multimeter reads 0.00 Ω

following adjustment procedure. approx.

5. Tighten sensor nuts, remove tool **N.1.820.214.000** and disconnect multimeter.



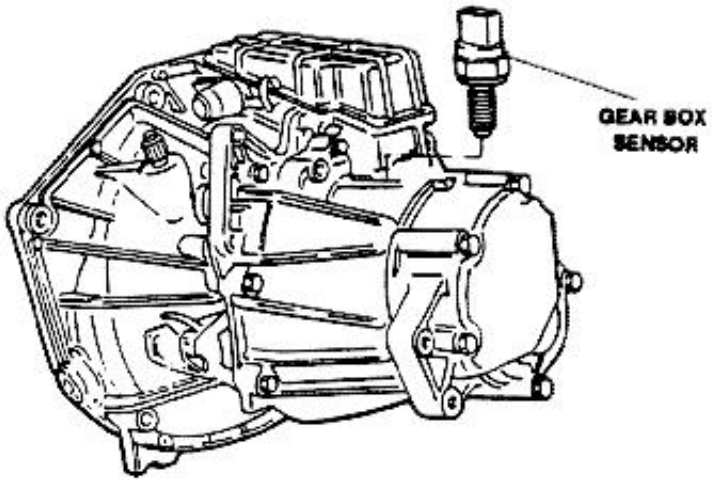
- GEAR BOX SENSOR

This device signals the control unit that 1st or 2nd gear has been selected. It consists of a microswitch installed on the gear box.

Data are sent to control unit together with those coming from throttle sensor.

REPLACEMENT

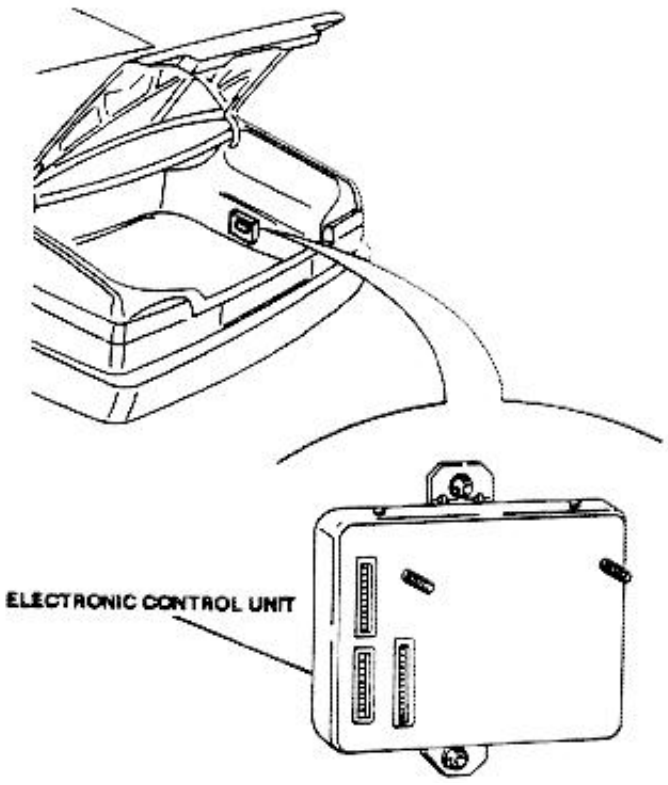
1. Disconnect battery negative lead.
2. Disconnect electrical connection from sensor.
3. Loosen and remove sensor from gear box.



C) ELECTRONIC CONTROL UNIT

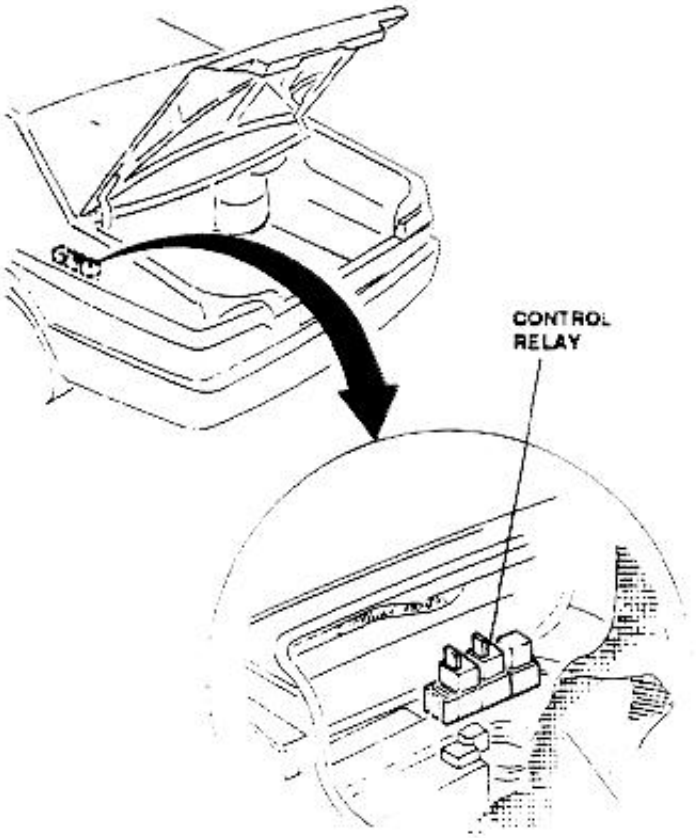
The control unit is a microcomputer which receives and computes, in accordance with a prefixed logic, information coming from all the sensors.

After this computation the control unit sends commands to the shock absorbers solenoid valves. The control unit is located in the trunk, secured to car body by means of a bracket and may be connected to the ALFA TESTER, by a flying connector, to easily identify any malfunction; on the control unit is located the accelerometer (see **WIRING DIAGRAMS AND ELECTRICAL DIAGNOSIS** Book).



D) CONTROL RELAY

The solenoid valves are energized by a relay located in the trunk left side. The energization time varies depending on the sensor that determined the energization.



E) CONTROL PANEL

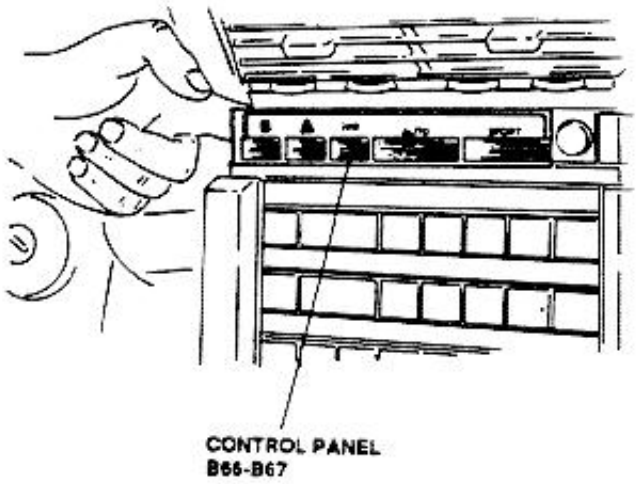
The operational logic for the two different driving conditions can be selected by the driver only by pressing either of the two buttons located above the air conditioning controls.

The "AUTO" button selects the logic for automatic driving condition; the "SPORT" button and related amber light selectlogic for a sport driving condition.

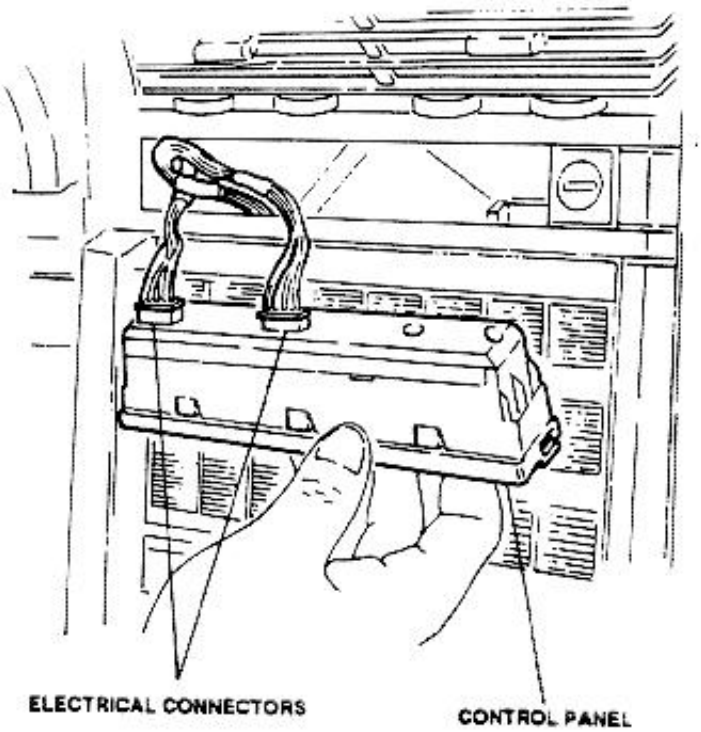
At each start a red light, located above the two buttons, illuminates and stays on for 2 to 4 seconds in order to check integrity of system warning indicator: the system then automatically operates on last condition, AUTO or SPORT, selected before vehicle stop.

REMOVAL/INSTALLATION

1. Disconnect battery negative lead.
2. Remove instrument panel (see Group 43).
3. Push, from rear, control panel and remove it from center console.



4. Disconnect both electrical connections from control panel.



SELF DIAGNOSIS AND SYSTEM MALFUNCTIONS

The self diagnosis of all system components is carried-out by the control unit when the engine is running, with vehicle standing or in motion. In both cases illumination of the red warning lamp indicates a malfunction: the system then automatically switches to bring shock absorbers to rigid condition. This conditions lasts until the malfunction is corrected. For the system malfunctions, detected by ALFA TESTER, refer to **WIRING DIAGRAMS AND ELECTRICAL DIAGNOSIS** Book.

TECHNICAL CHARACTERISTICS AND SPECIFICATIONS

FRONT SUSPENSION COIL SPRINGS

Wire diameter	13.5 ± 0.05 mm (0.531 ± 0.00197 in)
Outer spring diameter	174 ± 1.7 mm (6.850 ± 0.06693 in)
Inner spring diameter	147 ± 1.5 mm (5.787 ± 0.05905 in)
Total usable turns	4.75
Total unusable turns	1.25
Total spring turns	6
Coil sense	Right

REAR SUSPENSION COIL SPRINGS

Wire diameter	12.6 mm (0.496 in)
Outer spring diameter	139.1 ± 1.4 mm (5.476 ± 0.055 in)
Inner spring diameter	113.9 ± 1.1 mm (4.484 ± 0.043 in)
Total usable turns	5
Total unusable turns	~ 1.5
Total spring turns	~ 6.5
Coil sense	Right

FRONT SHOCK ABSORBERS *

Shock absorber type	Electrohydraulic with variable damping
Strut diameter	22 mm (0.866 in)
Stroke	167 ± 2.5 mm (6.6 ± 0.1 in)
Coil resistance	3 Ω ± 10% at 20°C (68°F)
Winding wire diameter	0.4 mm (0.016 in)
Number of turns	300 ± 3
Pulse current	min. 2A (>-40°C and <120°C)(>-40°F and <248°F)
Pulse width	10^{+10} mS
Duty cycle current	$1^{+0.2}$ A (>-40°C and <120°C)(>-40°F and <248°F)
Duty cycle	Continuous

* **Technical data and specifications for solenoid valve coil power supply with current of 2/1 A**

REAR SHOCK ABSORBERS *

Shock absorber type	Electrohydraulic with variable damping
Strut diameter	22 mm (0.866 in)
Stroke	212.5 ± 3 mm (8.366 ± 0.118 in)
Coil resistance	3 Ω ± 10% at 20°C (68°F)
Winding wire diameter	0.4 mm (0.016 in)
Number of turns	300 ± 3
Pulse current	min. 2A (>-40°C and <120°C)(>-40°F and <248°F)
Pulse width	10^{+10} mS
Duty cycle current	$1^{+0.2}$ A (>-40°C and <120°C)(>-40°F and <248°F)
Duty cycle	Continuous

* **Technical data and specifications for solenoid valve coil power supply with current of 2/1 A**

Prior to performing **Check** and **Adjustment** procedures of the **Wheel alignment** refer to **"PRELIMINARY OPERATIONS"** of Front and Rear Suspensions.

CHECKS AND ADJUSTMENTS

FRONT SPRING HEIGHT UNDER LOAD OF

417 to 443 kg (920.32 to 977.7 lbs)	183 mm (7.20 in)

REAR SPRING HEIGHT UNDER LOAD OF

339.5 to 360.5 kg (748.94 to 795.26 lbs)	192 mm (7.56 in)

For **Tightening torques**, **Toe-in**, **Attitude** and **Characteristics Angles values**, refer to related data listed in preceeding paragraph **"FRONT AND REAR SUSPENSIONS"**.

SPECIAL TOOLS

Tool number	Description
1.820.213.000	Reference pin for phonic wheel installation
1.820.214.000	Reference gauge for engine throttle angle position

TROUBLESHOOTING PROCEDURE: FRONT SUSPENSIONS

TROUBLES AND SYMPTOMS	FAULT ISOLATION	TEST REFERENCE
STEERING WHEEL KNOCKS, VIBRATIONS OR SHIMMY	- Knocking on the forecarriage while driving on rough roads (holes, hollows, asphalt rises, etc.). - Steeering wheel shimmy while driving at high speed on straight roads.	A
CONSTANT NOISE	- Constant noise from the forecarriage while driving on a straight and even road; the noise increases as speed of vehicle increases.	B
ABNORMAL (OR UNEVEN) TIRE WEAR	Refer to **Group 28: WHEELS & TIRES.**	C

TROUBLESHOOTING PROCEDURE: REAR SUSPENSIONS

TROUBLES AND SYMPTOMS	FAULT ISOLATION	TEST REFERENCE
KNOCKS	- Knocks on the rearcarriage while driving on rough roads (holes, hollows, asphalt rises, etc).	D
CONSTANT NOISE	- Constant noise from the rearcarriage while driving on a straight and even road; the noise increases as speed of vehicle increases.	E
VIBRATIONS	- Vibrations increase as vehicle speed increases.	F

TROUBLESHOOTING PROCEDURE: CONTROLLED DAMPING SUSPENSIONS

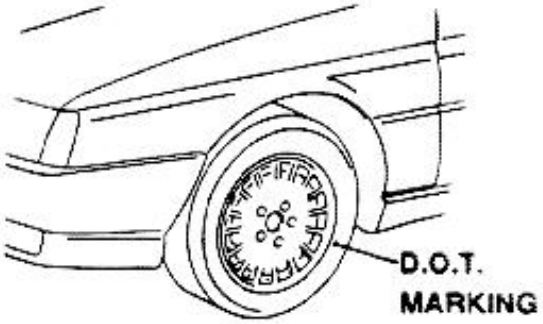
TROUBLES AND SYMPTOMS	FAULT ISOLATION	TEST REFERENCE
Refer to: **WIRING DIAGRAMS AND ELECTRICAL DIAGNOSIS**		

TROUBLESHOOTING PROCEDURE: DRIFT DURING THE RUN

PRELIMINARY CHECKS

TIRE CHECK

- Check that tires are in proper condition and wear is equalized; check that tires are evenly worn across the tread.
- Check that tire pressure is correct (**see Group 28**).

TROUBLES AND SYMPTOMS	FAULT ISOLATION	TEST REFERENCE
VEHICLE DRIFT DURING RUN - During straightaway driving, the vehicle tends to steer to the right and/or to the left. **NOTE**: Drift effect could be **constant** it, in all driving conditions, the vehicle tends to steer always to the right or to the left. Drift effect could be **differential** if the vehicle tends to steer in one direction during acceleration, and in the opposite direction during deceleration.	CHECK TIRES FOR PROPER INSTALLATION: - Ensure D.O.T. marking on tire sidewall is facing outwards (inflation valve side).  VEHICLE TESTING PROCEDURE Perform testing with vehicle unloaded, fuel tank serviced to about half capacity, absence of wind, on a straight and level road and at high speed. **WARNING:** **Pay-attention to the current road law requirements.** - Accelerate gradually but with continuity; then release the accelerator pedal. - Maintain a constant speed, then pull your hands off the steering wheel for a strech of road, paying the due attention.	**G** **NOTE**: If vehicle drifts only when brake is applied refer to **TROUBLESHOOTING PROCEDURE, Group 22.**

STEERING WHEEL KNOCKS, VIBRATIONS OR SHIMMY	TEST A

TEST STEPS	RESULTS	REMEDY
A1 TIRES CHECK - Check tires for correct pressure	OK ▶ ~~OK~~ ▶	Carry-out **step A2** Service **tires** to correct pressure
A2 WHEELS CHECK - Check: • wheels for proper balancing • rims for dents or distortions	OK ▶ ~~OK~~ ▶	Carry-out **step A3** Balance **wheels** or replace **rims**
A3 POWER STEERING ATTACHMENTS CHECK - Check power steering to frame attachments for looseness	OK ▶ ~~OK~~ ▶	Carry-out **step A4** Tighten **screws** to proper torque
A4 SPHERICAL PINS CHECK - Check spherical pins located at ends of side track rods for wear	OK ▶ ~~OK~~ ▶	Carry-out **step A5** Replace **spherical pins**

(Cont.d)

STEERING WHEEL KNOCKS, VIBRATIONS OR SHIMMY	TEST A

TEST STEPS	RESULTS	REMEDY
A5 WISHBONES CHECK - Check wishbone rubber mounts for wear or damage	OK ▶ ~~OK~~ ▶	Carry-out **step A6** Replace **rubber mounts**
A6 STABILIZER CHECK - Check stabilizer bar rubber pads for wear or damage	OK ▶ ~~OK~~ ▶	Carry-out **step A7** Replace **rubber pads**
A7 DAMPERS CHECK - Check: • damper attachments for proper torque • dampers efficiency	OK ▶ ~~OK~~ ▶	Carry-out **step A8** Tighten **attachments** or replace the affected damper, as requi-red
A8 WHEEL HUB CHECK - Check bearing housing inside the wheel hub for distor-tion	~~OK~~ ▶	Replace **wheel hub** and **bearing**, as re-quired

End of test A

CONSTANT NOISE	TEST B

TEST STEPS	RESULTS	REMEDY
B1 TIRES CHECK - Check tires for correct pressure	OK ▶	Carry-out **step B2**
	~~OK~~ ▶	Service **tires** to correct pressure
B2 WHEEL BEARINGS CHECK - Check wheel hub inner bearing for wear or damage bearing	~~OK~~ ▶	Replace **wheel hub bearing**

End of test B

ABNORMAL (OR UNEVEN) TIRE WEAR	TEST C

TEST STEPS		RESULTS	REMEDY
C1	TIRE WEAR CHECK		
- Refer to: **Group 28: WHEELS & TIRES**			

End of test C

KNOCKS	TEST D

TEST STEPS	RESULTS	REMEDY
D1 DAMPERS CHECK - Check: • damper attachments for proper torque • dampers efficiency	OK ▶ ~~OK~~ ▶	Carry-out **step D2** Tighten **attachments** or replace affected **damper**, as required
D2 RUBBER BUSHINGS CHECK - Check longitudinal and cross beam rubber bushings for wear	OK ▶ ~~OK~~ ▶	Carry-out **step D3** Replace **rubber bushings**
D3 WHEEL BEARING CHECK - Check wheel hub inner bearing for wear or damage	~~OK~~ ▶	Replace **wheel hub bearing**

End of test D

CONSTANT NOISE	TEST E

TEST STEPS	RESULTS	REMEDY
E1 TIRES CHECK - Check tires for correct pressure	OK ▶	Carry-out **step E2**
	~~OK~~ ▶	Service tires to correct pressure
E2 WHEEL BEARING CHECK - Check wheel hub inner bearing for wear and damage	~~OK~~ ▶	Replace **wheel hub bearing**

End of test E

VIBRATIONS	TEST F

TEST STEPS	RESULTS	REMEDY
F1 WHEELS BALANCING CHECK		
- Check wheels for proper balancing	OK ▶	Carry-out **step F2**
	~~OK~~ ▶	Balance **wheels**
F2 WHEEL RIMS CHECK		
- Check rims for dents or distortion	~~OK~~ ▶	Replace **affected rims**

End of test F

THE VEHICLE DRIFTS	TEST G

TEST STEPS	RESULTS	REMEDY
G1 UNDERBODY CHECK - Visually check vehicle underbody for absence of traces of accidental shocks, dents or distorted suspension arms	OK ▶ ~~OK~~ ▶	Carry-out **step G2** Repair or replace defective items
G2 WHEELS CHECK - Check that wheels rotate regularly, and that rotation is not rought due to malfunction of brake calipers or pads	OK ▶ ~~OK~~ ▶	Carry-out **step G3** Repair or replace defective or worn items (refer to **Group 22**)
G3 ATTITUDE CHECKS - Check: • front attitude • rear attitude	OK ▶ ~~OK~~ ▶	Carry-out **step G4** Replace both **suspension springs** on the same axle
G4 RUBBER BUSHES AND PADS CHECK - Check integrity of: • spherical pins and rubber supports of front suspension control arm • rubber bushes of rear suspension longitudinal and cross rods	OK ▶ ~~OK~~ ▶	Carry-out **step G5** Replace defective items

THE VEHICLE DRIFTS	TEST G

TEST STEPS	RESULTS	REMEDY
G5 WHEELS ALIGNMENT CHECK		
- Check: • front wheels alignment • rear wheels alignment	OK ▶ ~~OK~~ ▶	Carry-out **step G6** Adjust wheels alignment to correct values
G6 WHEELS CHARACTERISTIC ANGLES CHECK		
- Check: • front wheels camber and caster angles • rear wheels camber angle		

End of test G