Steering

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GROUP 23

STEERING

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STEERING

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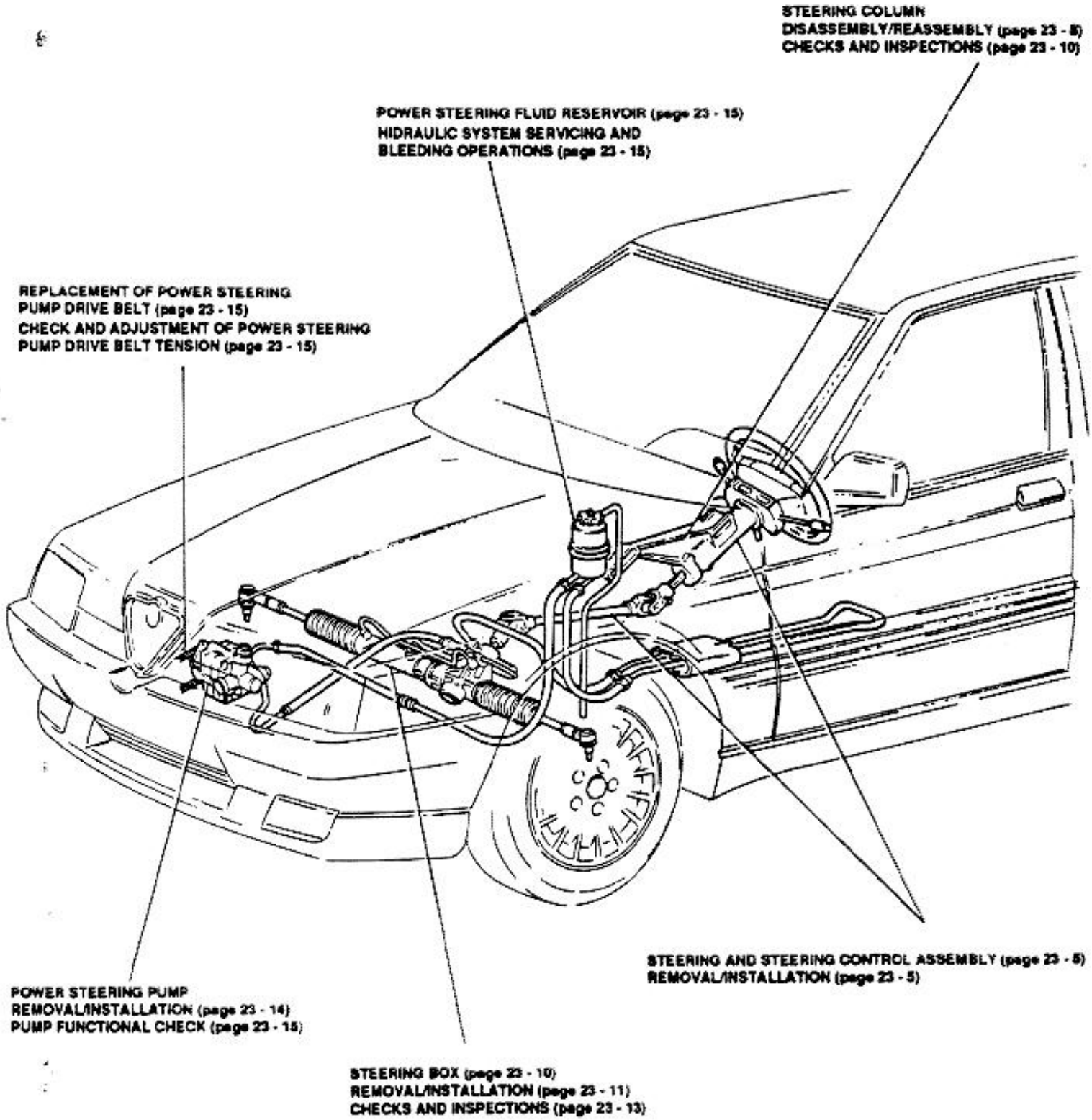
ILLUSTRATED INDEX

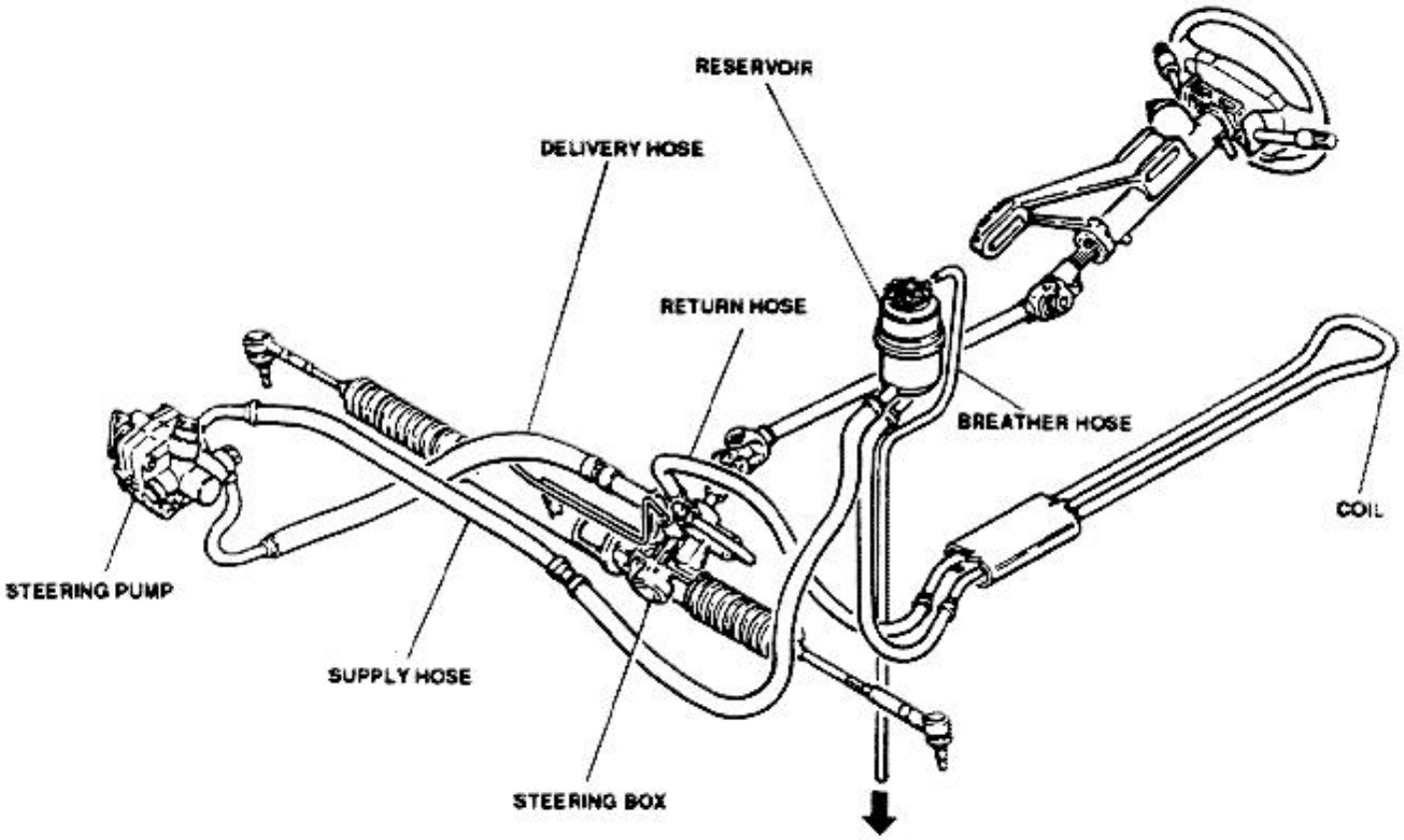


POWER STEERING SYSTEM

DESCRIPTION AND OPERATION

The steering system is provided with a rack type power steering which enhances the driving comfort and increases the driving safety.

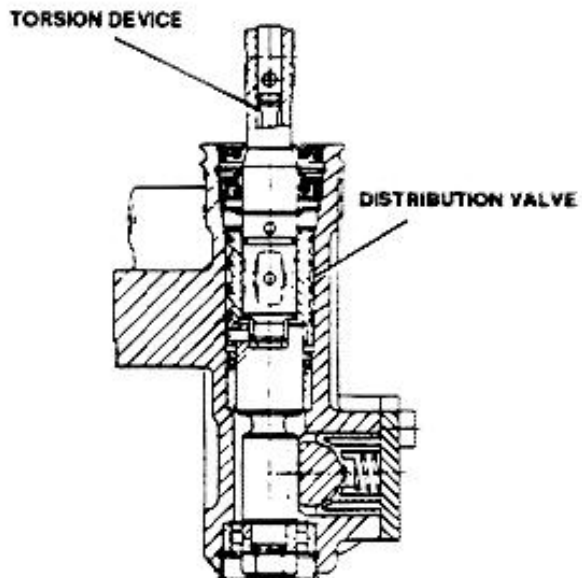
The system main components are: a vane pump provided with a flow rate and maximum pressure valve, a supply reservoir located in the engine compartment, a rack type steering box and a pipe coil used to cool off the fluid.



The steering pump is driven by the engine through a belt, and provides a supply pressure variable from 3.5 bar (50.75 psi) in "neutral" position to a maximum of 85 bar (1232.5 psi) in "full steering".

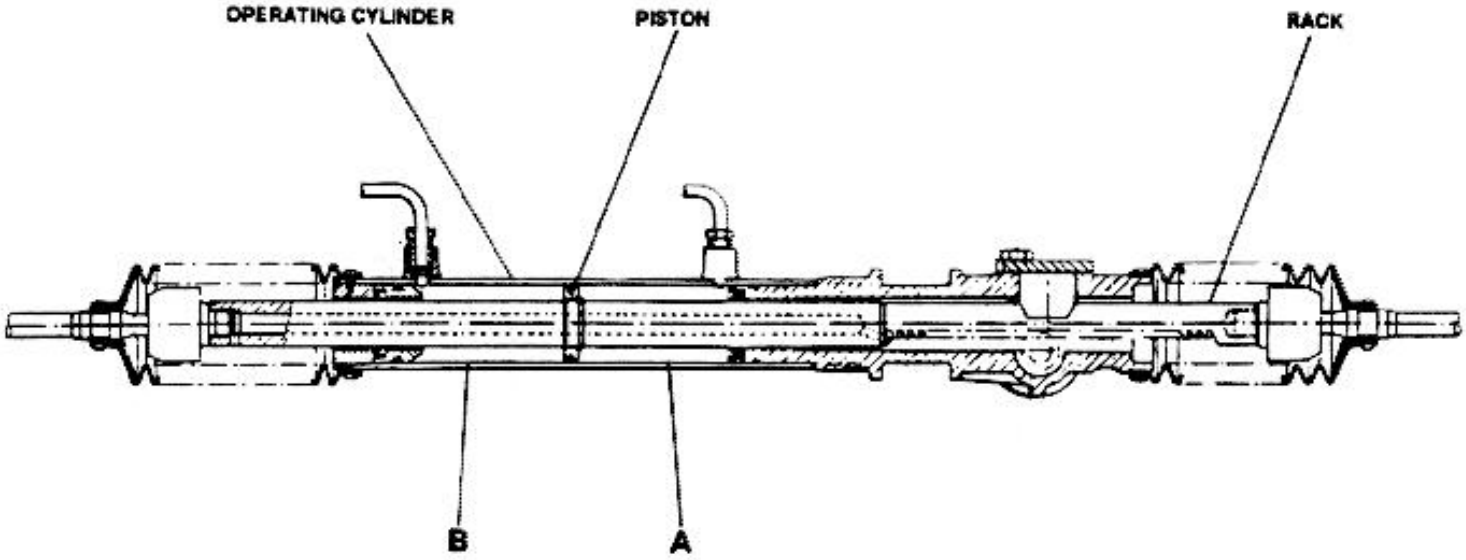
Inside the pump is located a quick minimum control valve which determines an increase in engine speed when the system works at pressure higher than 16 bar (232 PSI).

The power steering assembly is similar to a rack mechanical steering; the difference is that the power steering uses a box inside which there is a double effect piston, joint to the rack rod, that moves inside an actuating cylinder. Another difference is that in the worm screw seat, where is located a distribution valve with related ducts. The valve is controlled by a torsion device located on the worm



screw end.

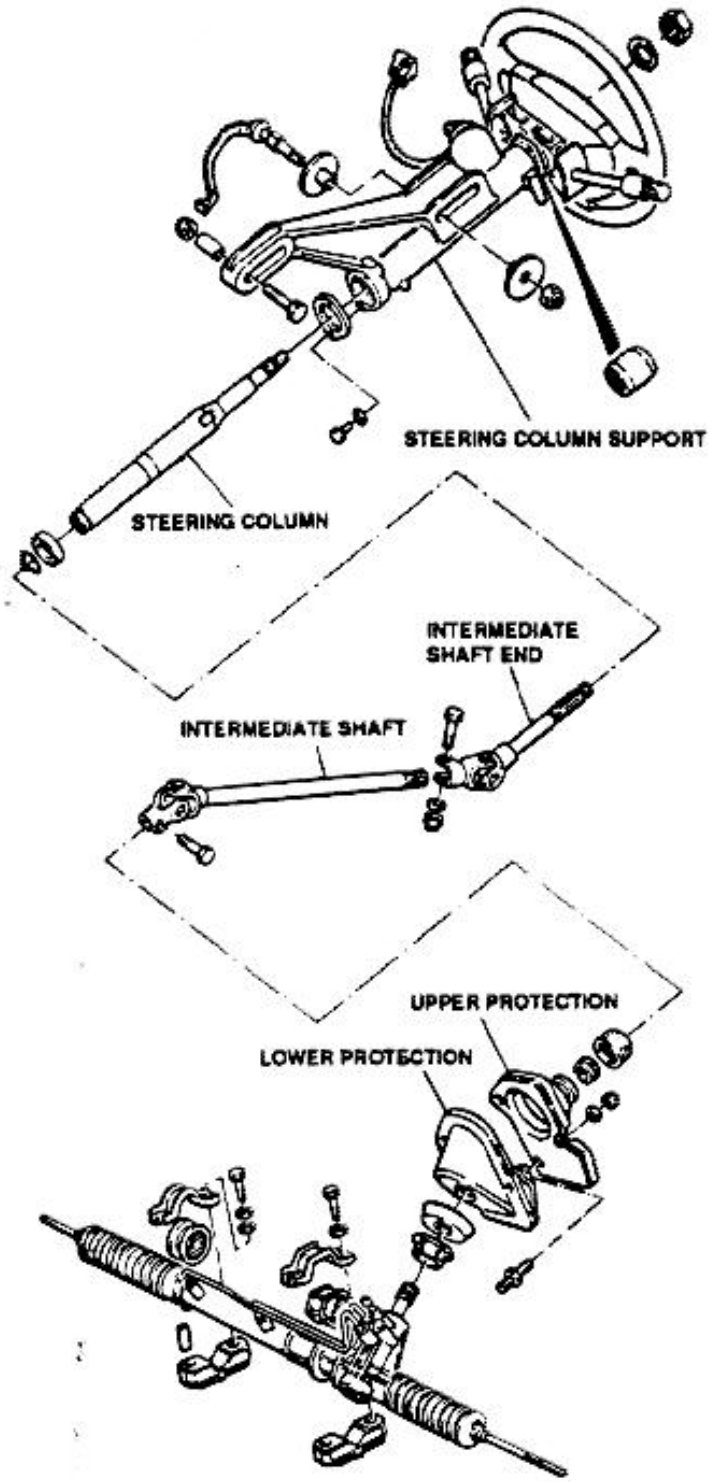
Depending on the torsion transmitted by the steering wheel to the device, fluid from pump is delivered to the reservoir or to one of the two chambers A and B in the actuating cylinder. Force generated by fluid pressure on the piston lateral surface determines its movement, the movement of the rack and hence of the wheels.



NOTE: SHOULD STEERING PUMP, actuating cylinder or distribution valve fail to operate, the power steering system works as a normal mechanical steering box; this malfunction is sensed by the steering wheel as an increase of force required to turn the steering wheel.

NOTE: The power steering system is self purging; purging is obtained by fully steering toward left or right with engine running and vehicle stopped.
This operation must be carried-out any time the connecting hoses are removed or installed.

STEERING AND STEERING CONTROL ASSEMBLY



The assembly includes the steering wheel and the steering column. The steering column is connected to the steering box by means of an intermediate shaft provided with two universal joints to make omokimetic the movement transmission. This solution gives the possibility to send a more even load to the steering wheel, distributing the seizings that arise on the steering column.
The steering column - intermediate shaft assembly is telescopic to permit axial adjustment of the steering wheel.

REMOVAL/INSTALLATION

WARNING:
Before carryng-out any opration on the air bag system, it is essential to prevent accidental actuation of the bag performing the following oprations:
- **Disconnect (+) and (-) leads from the battery.**
- **Insulate (-) lead.**

1. Remove two screws securing the module to the steering wheel using a suitable wrench (Torsen No.30).

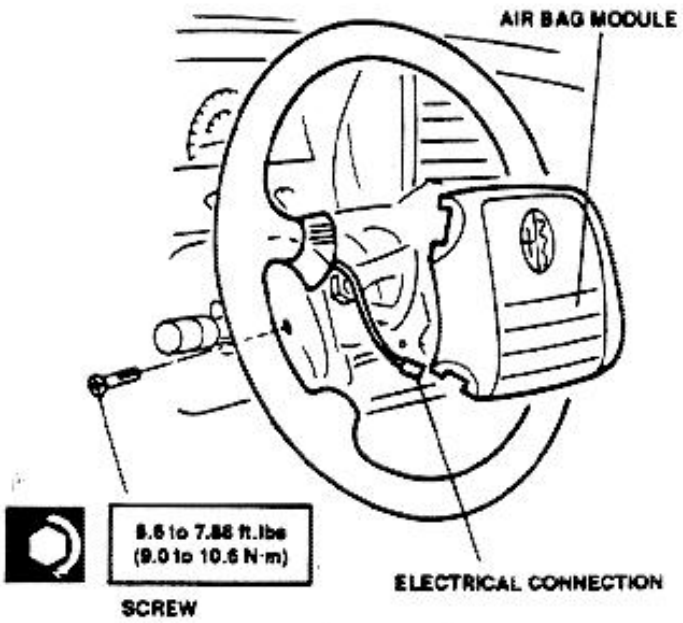
NOTE: Replace screws at any removal.

WARNING:
OPERATE WITH PRECAUTION! THE AIR BAG MODULE CONTAINS A BLASTING CHARGE THAT PRODUCES GAS (see Group 00: "SAFETY DEVICES").

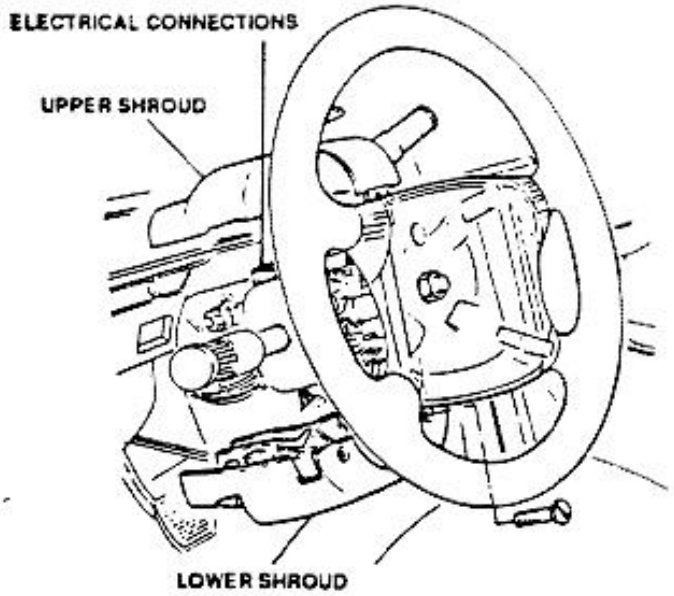
2. Partially extract air bag from steering wheel and disconnect electrical connector.
3. Remove air bag module.

NOTE: Stow the air bag module in the relevant safety container just after removal.

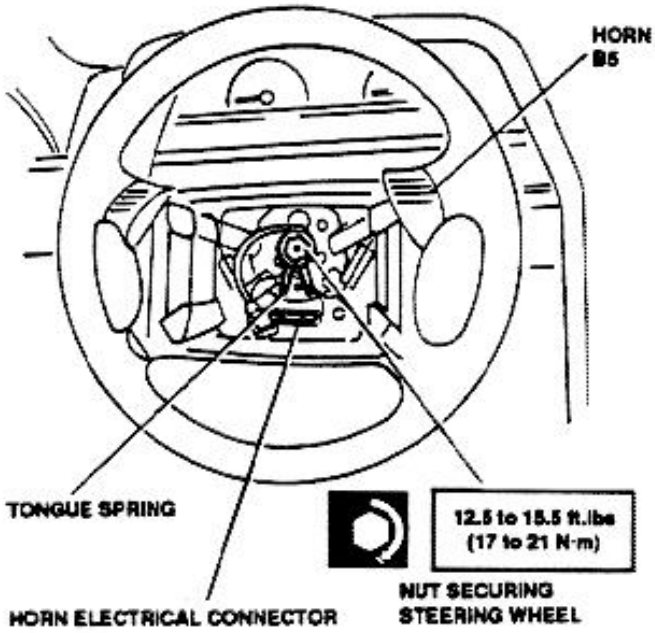
steering box by means of an intermediate shaft provided safety container just after removal.



4. Remove knees protection panel.
5. Rotate the steering wheel by 90° leftwards, and remove the left-side shrouds fixing screws, then rotate it by 180° rightwards and remove the right-side fixing screw.
6. Disconnect electrical connections and remove shrouds.

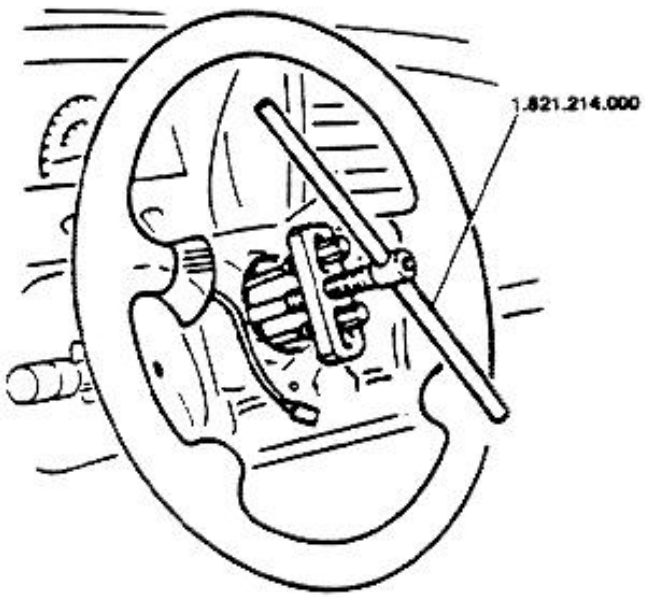


7. Disconnect horn electrical connector.
8. Loosen central nut securing steering wheel to steering column.
9. Remove tongue spring.



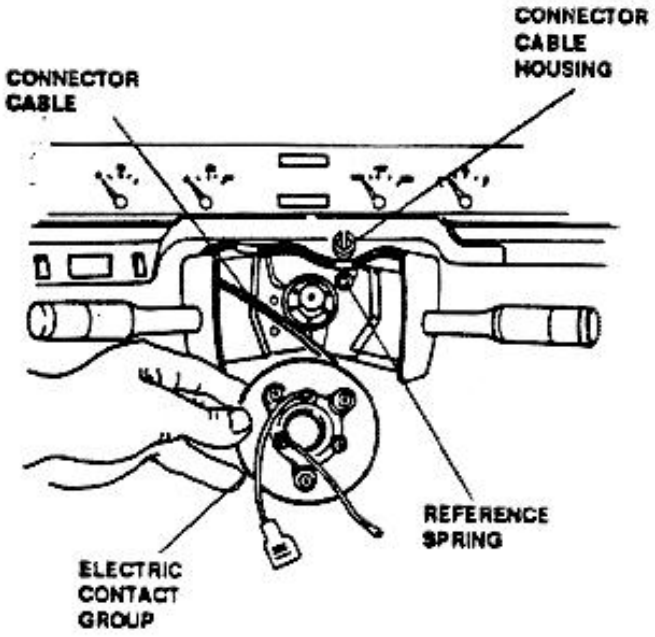
10. Remove steering wheel using tool **No. 1.821.214.000.**

CAUTION:
Do not rotate steering wheel whilst performing this operation to prevent breakage of steering wheel electric contact spiral spring.



11. Extract the electric contact group, paying attention not to damage the reference spring.

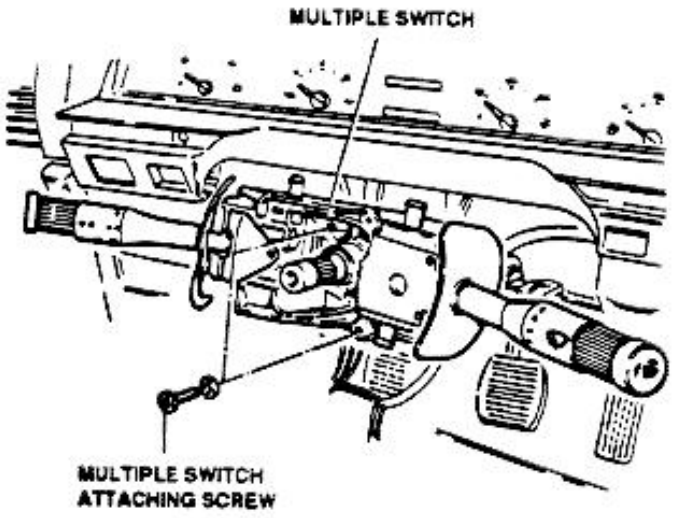
12. Disconnect the connector cable.



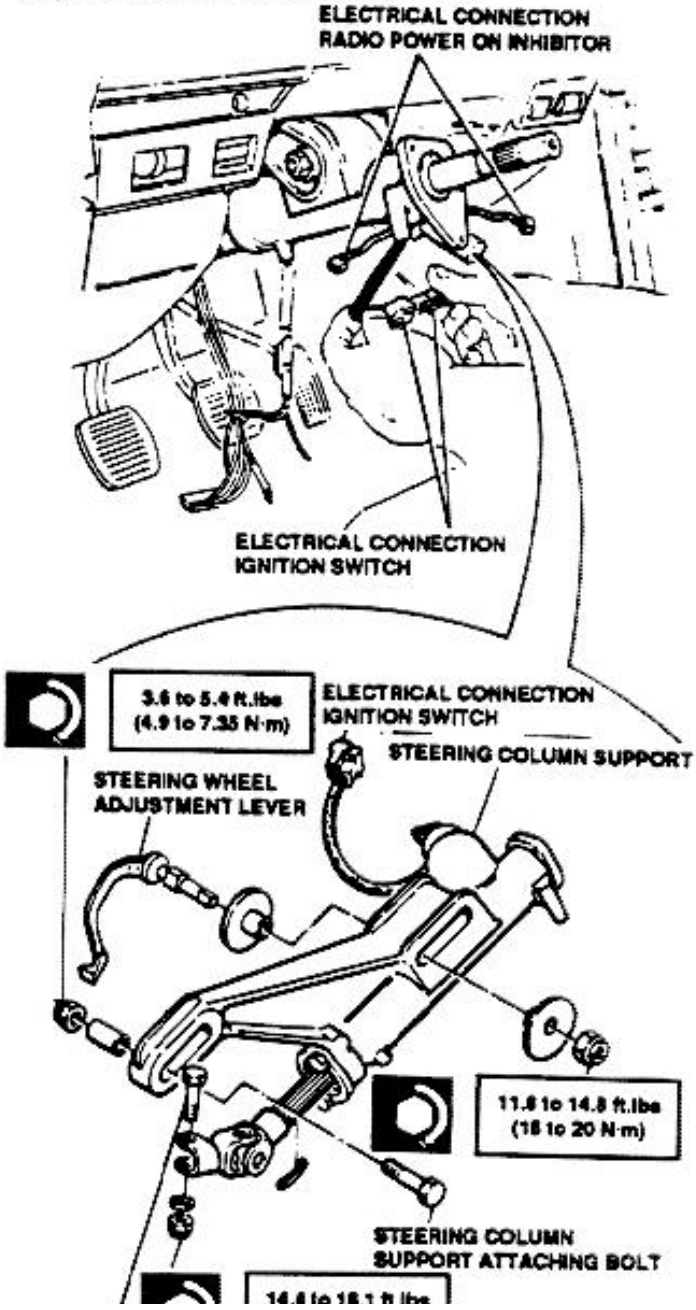
On reassembly, ensure the electric contact group reference spring is properly positioned, and the cable of electric connector is seated in its housing.

NOTE: Ensure the wheels are perfectly straight before carrying-out the following operations.

13. Remove screws and multiple switch, leaving it connected to wiring harness.



14. Remove relays support plate secured to steering column, leaving it connected to wiring harness.
15. Disconnect ground correction from rear side of steering column.
16. Withdraw and remove plastic protection located on clutch pump.
17. Disconnect electrical connections from ignition switch and radio inhibitor switch.
18. Remove steering column support securing bolt, related bushing and nut.
19. Loosen nut and remove steering wheel adjustment lever.
20. Remove steering column support assembly recovering key located on the splined part.

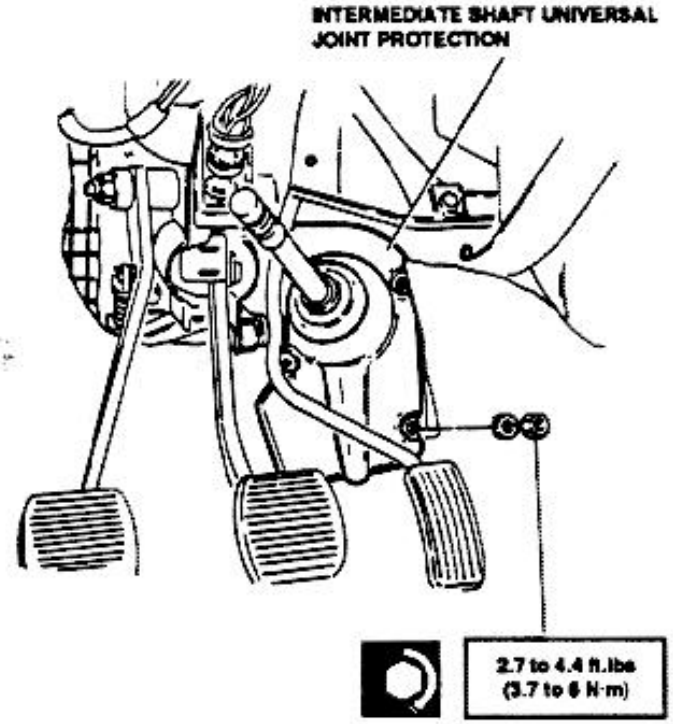


column, leaving it connected to wiring harness.

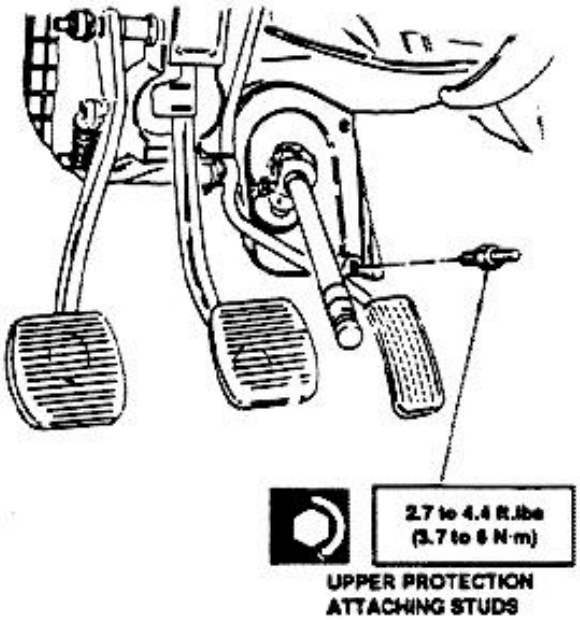
(19.5 to 24.5 N·m)

BOLT SECURING UNIVERSAL JOINT TO INTERMEDIATE SHAFT END

21. Remove upper cover of intermediate shaft universal joint.

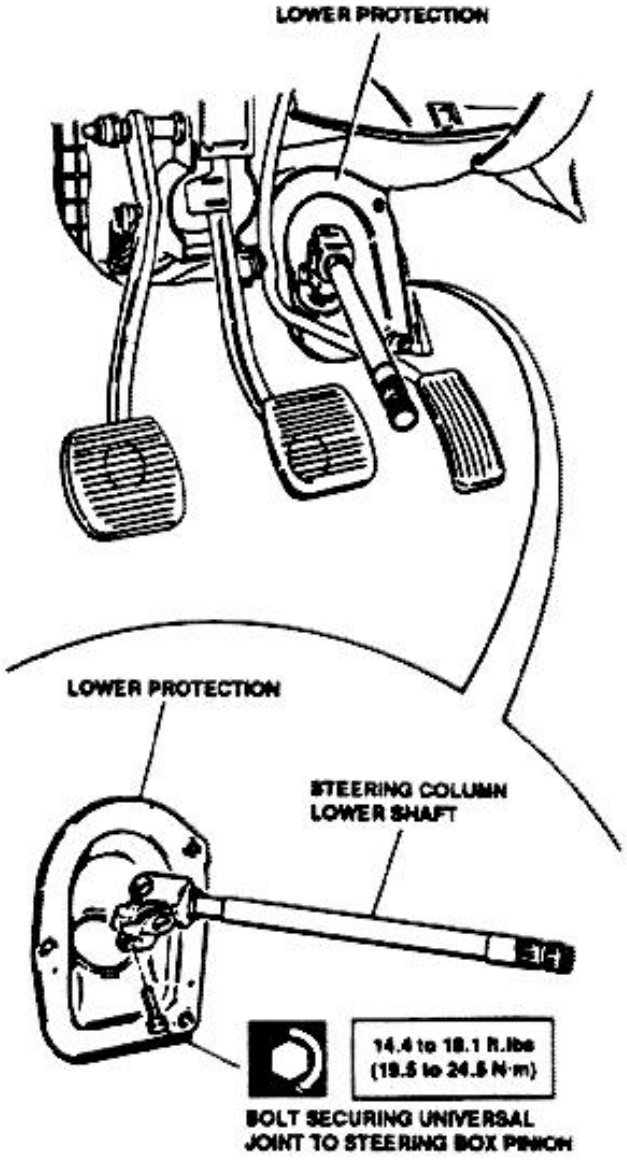


22. Remove lower cover studs.



23. Remove bolt securing intermediate shaft universal joint to steering box pinion.

25. Remove lower cover.



STEERING COLUMN

DISASSEMBLY/REASSEMBLY

1. Slide out intermediate shaft end from steering column support.
2. Remove steering column retaining flange.
3. Slide out complete steering column together with bearing and snap ring.

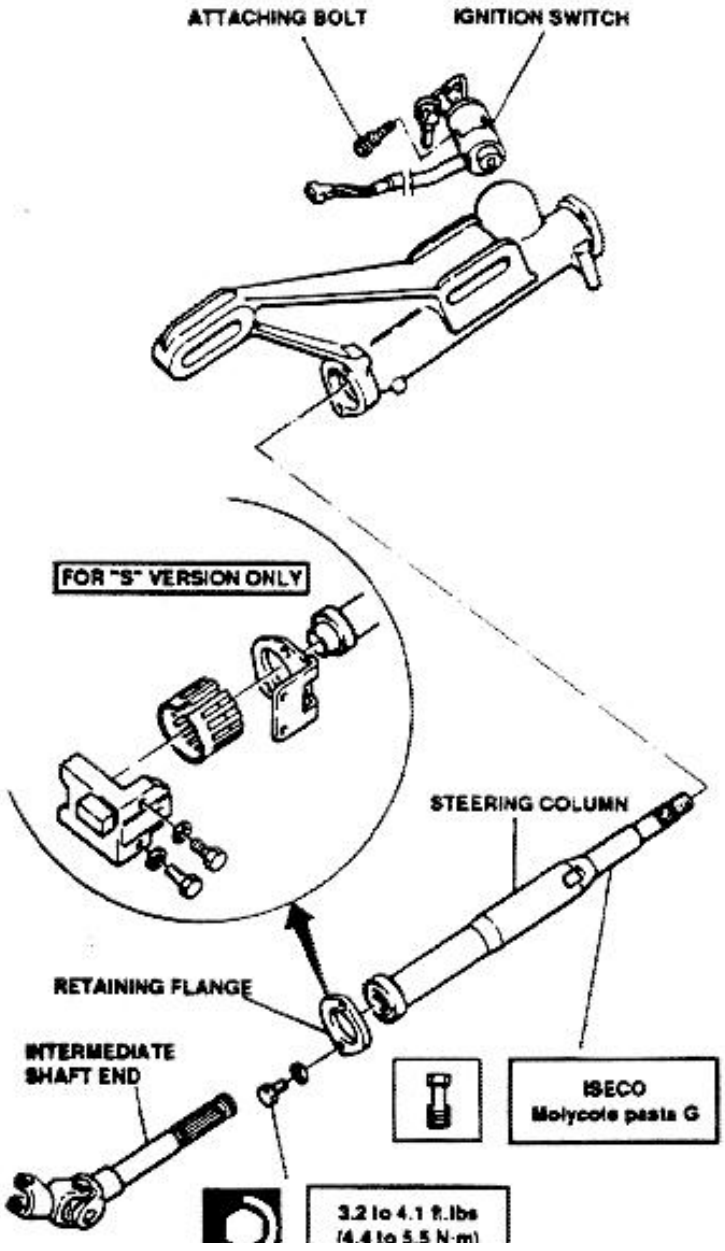
NOTE: Lubricate steering column before reassem-

24. Remove intermediate shaft. | bly.

4. Remove steering wheel rotation angle sensor (for "S" version only).
5. Remove phonic wheel from steering column (for "S" version only).

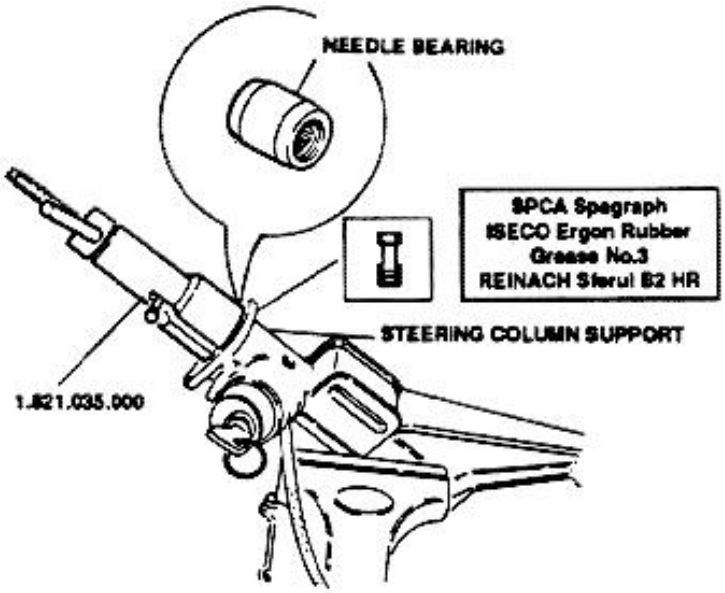
NOTE: When assembling carry-out phonic wheel adjustment (See Group 21: "CONTROLLED DAMPING SUSPENSIONS").

6. Using pin and hammer, loosen ignition block securing screw.
7. Remove ignition block sliding out electrical connection from column.



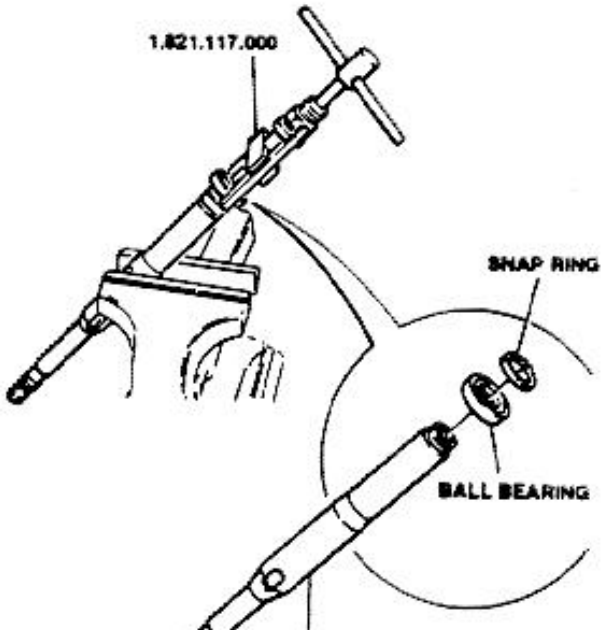
8. Using appropriate tool, extract needle bearing from column support.

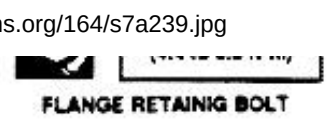
NOTE: When installing, lubricate column support seat and insert needle bearing using the appropriate tool.



9. Remove column bearing retaining ring.
10. Using appropriate tool, extract ball bearing from column.

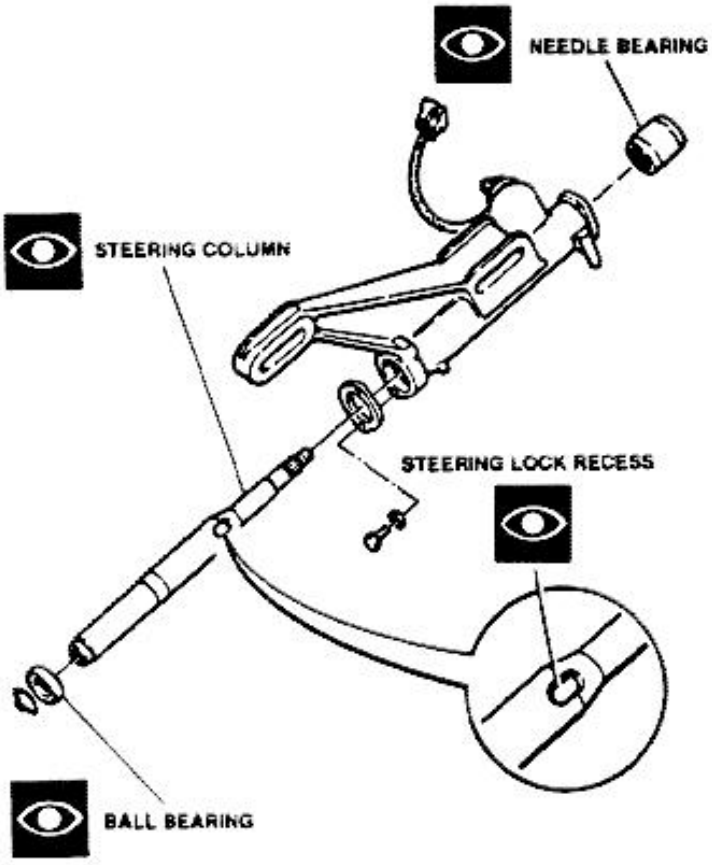
NOTE. Perform reassembly using the appropriate tool.



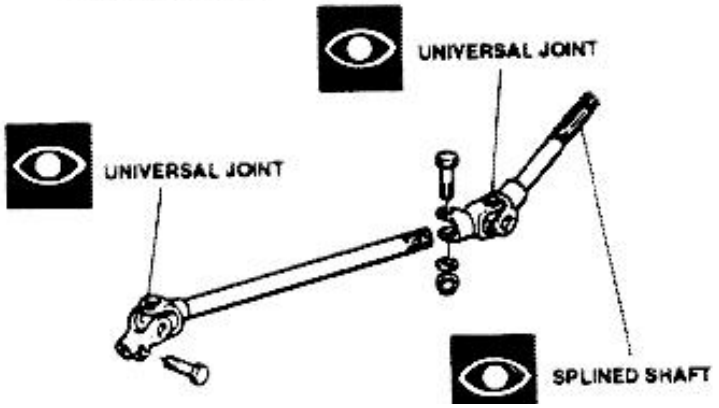


CHECKS AND INSPECTIONS

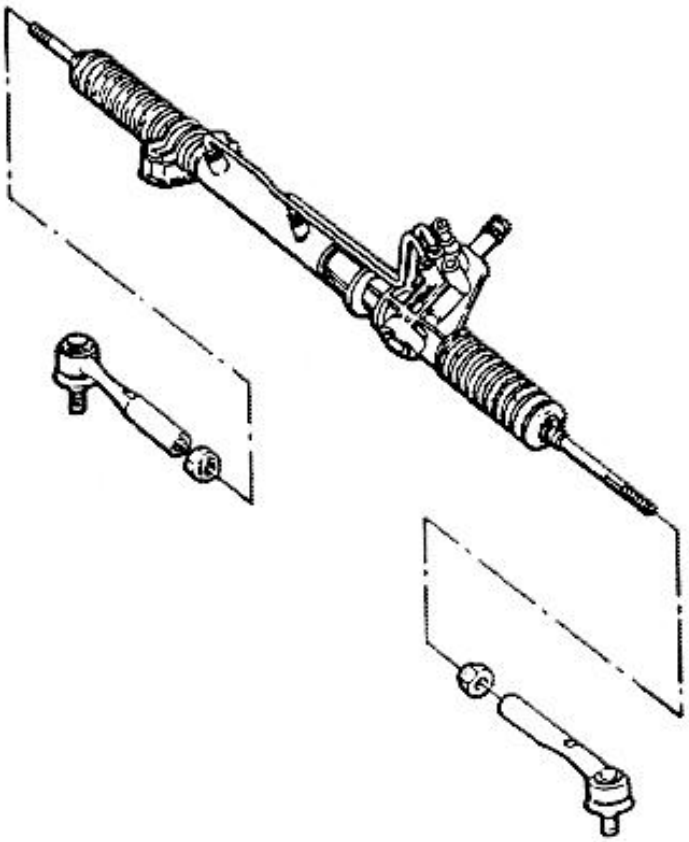
1. Inspect needle bearing and ball bearing for damage; inspect relevant seats in column support for scratches.
2. Inspect for absence of play between steering column and needle bearing; check that column is not off center.
3. Check for integrity of steering lock recess.



4. Check universal joint crosses for excessive play.
5. Inspect that splined shaft teeth are not damaged and excessively worn.

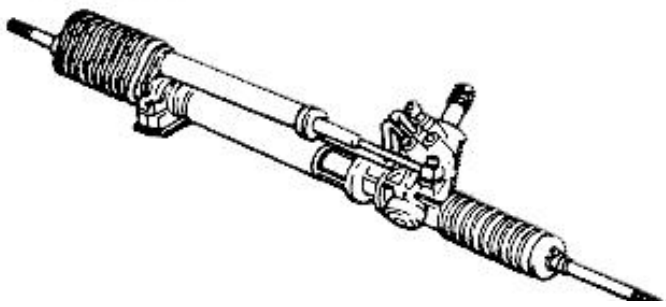


STEERING BOX



The steering box, similar to a mechanical one for the pinion-track coupling, is integrated by a hydraulic servo mechanism. This servo includes an actuating cylinder inside which there is a piston connected to the wheels by means of link rods, and a distribution valve that allows pressurized fluid passage from the pump to the actuating cylinder left and right chambers. The valve has an internal rigid connection, by means of bayonet type fitting, that guarantees the steering operation should a hydraulic system failure occur.

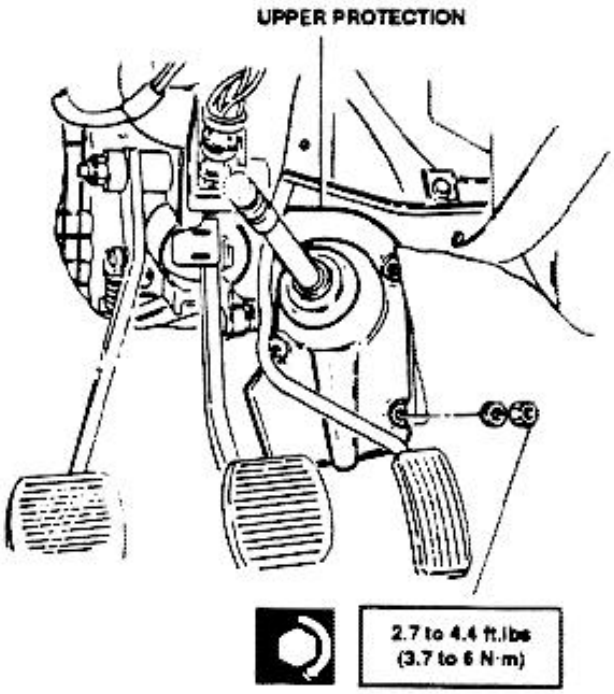
FOR "S" VERSION ONLY



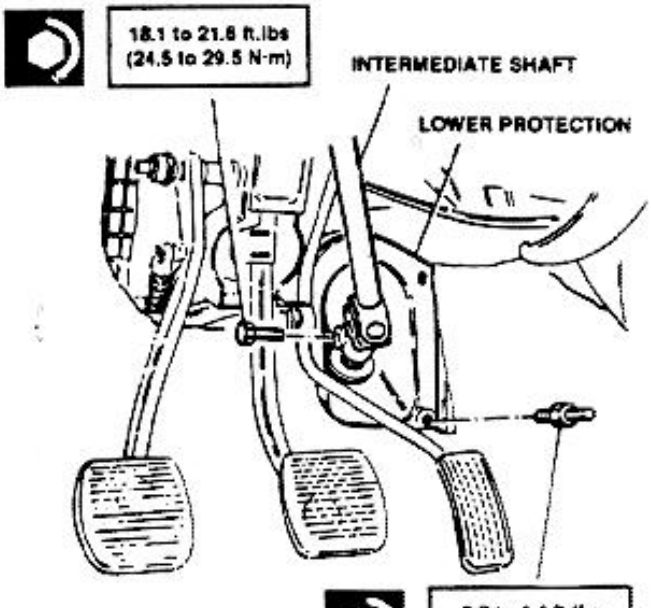
The powering steering of "S" version is provided with a recovery spring, located on the assembly upper part, to facilitate and optimize the steering wheel return (Hidro Racing System - HRS).

REMOVAL/INSTALLATION

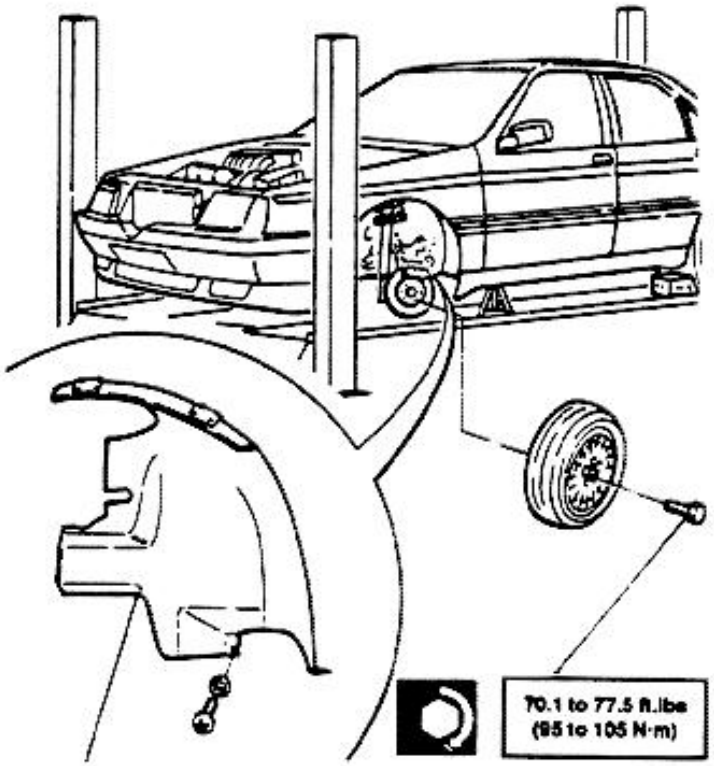
1. Remove upper cover on steering intermediate shaft universal joint.



2. Remove lower cover.
3. Disconnect steering intermediate shaft from steering box pinion.

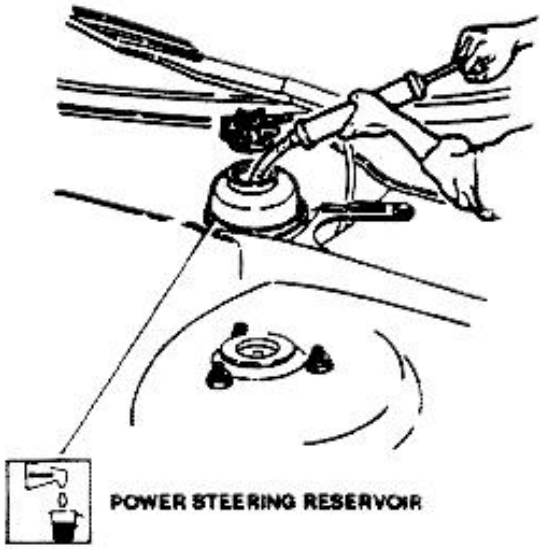


4. Remove front left wheel.
5. Remove wheelarch rear liner.



WHEELARCH REAR PROTECTION

6. Drain the power steering reservoir by sucking out the oil by means of a syringe.

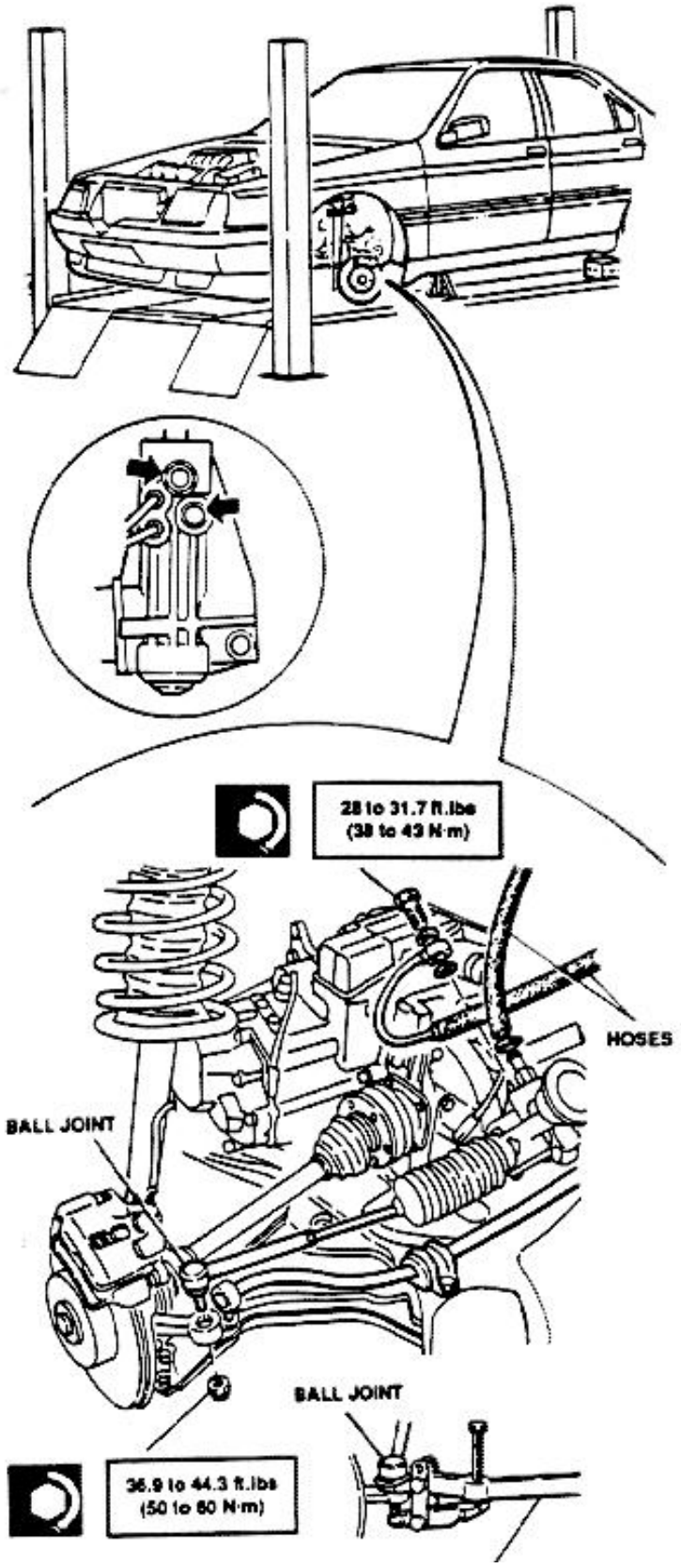


POWER STEERING RESERVOIR

7. Disconnect oil delivery and return hoses from the steering box.

2.7 to 4.4 ft.lbs
(3.7 to 6 N·m)

8. Using a suitable tool, extract the steering tie-rod ball joint (on both sides).

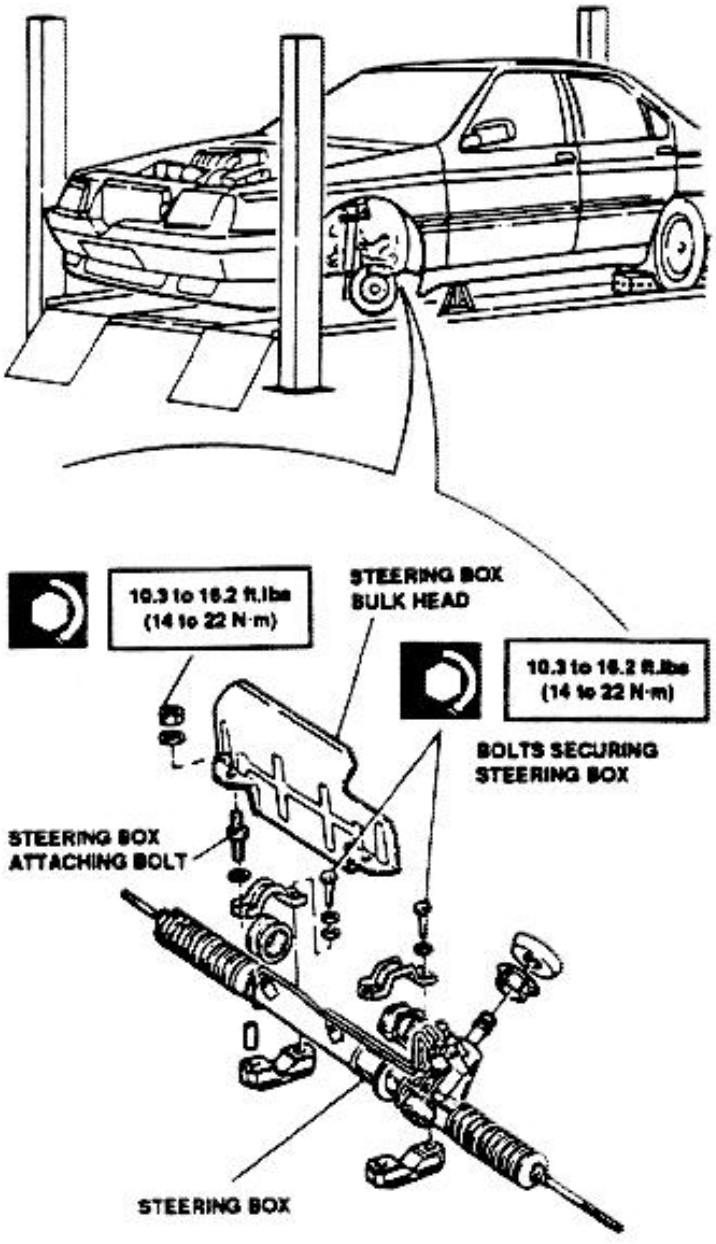


9. Remove steering box bulkhead.
10. Remove bolts securing steering box to frame.

At installation first tighten bolt on pinion side of steering box.

11. Slide out steering box from left wheelarch side.

NOTE: At installation, carry-out front wheels toe-in adjustment (see Group 21).



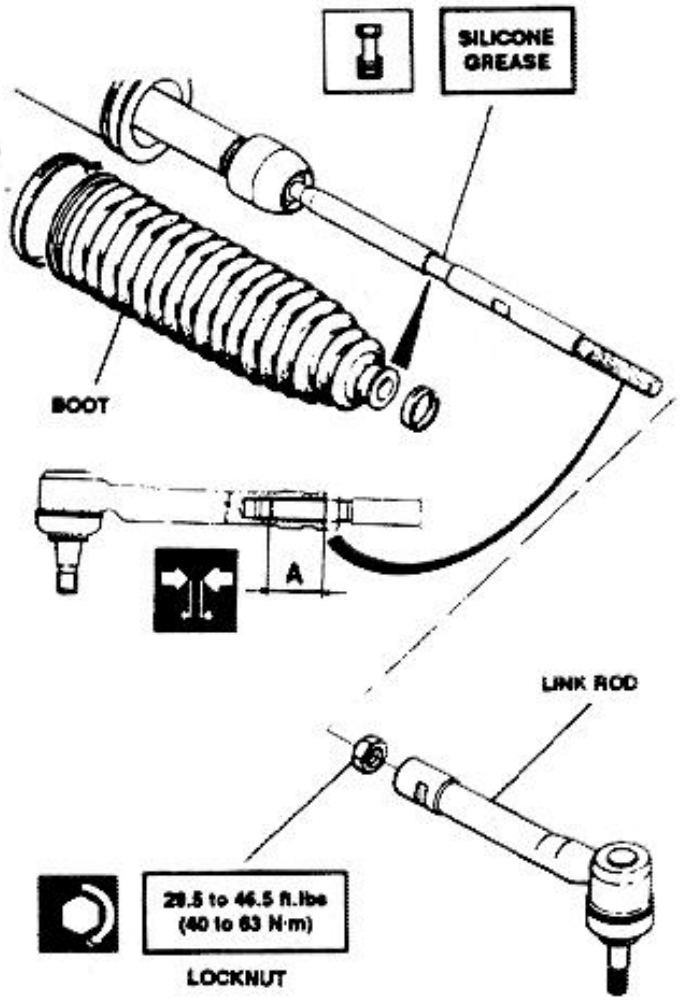
1,821,169,000

12. Loosen locknut.
13. Unscrew steering link rod and remove from arm.

NOTE: Measure distance "A" to be observed at installation.

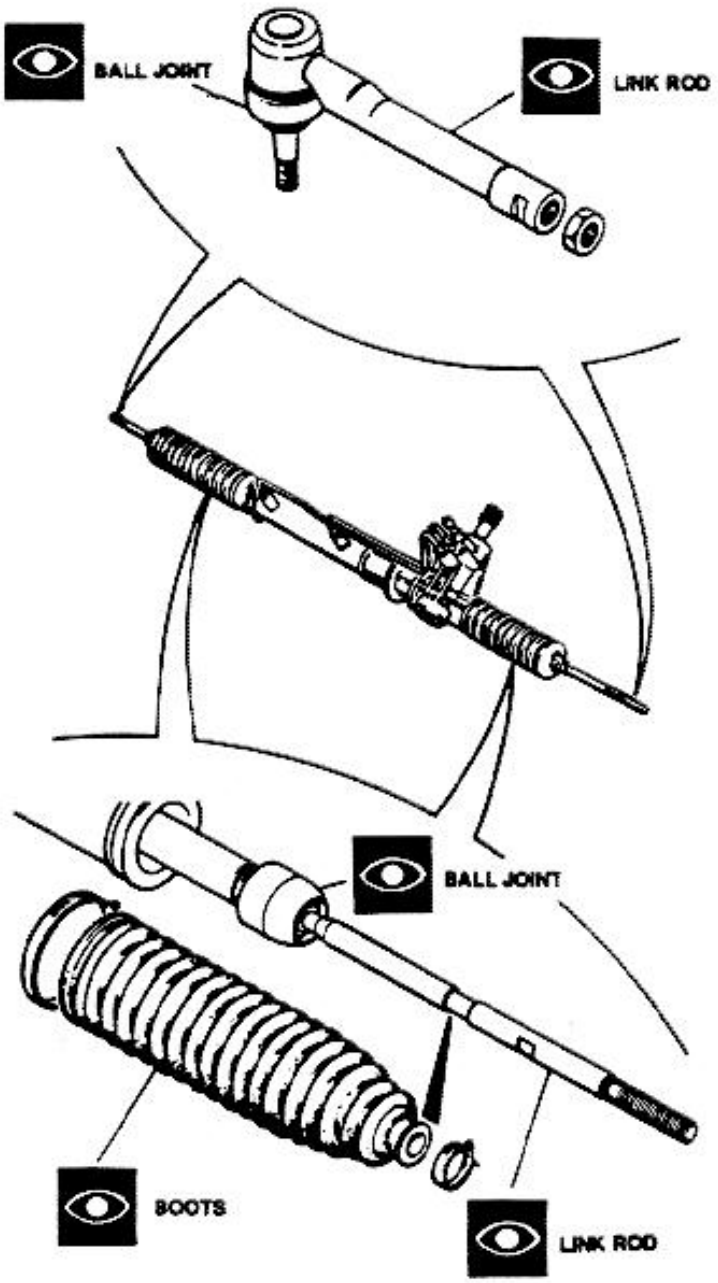
14. Remove boot.

At installation, lubricate contacting area between boot and steering rod with silicon grease in such a way that after clamp installation, closed at last but one or last but two tooth, the link rod could rotate freely inside boot.



CHECKS AND INSPECTIONS

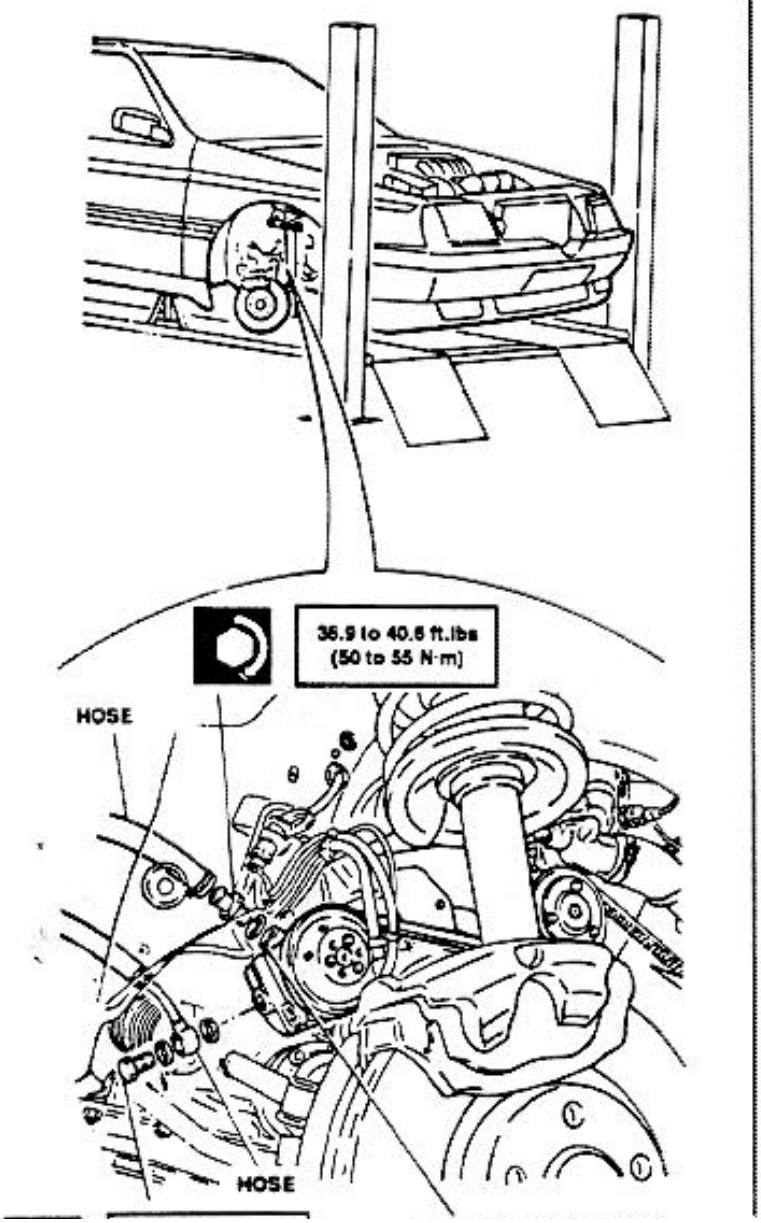
1. Check that the ball joints are not damaged or worn, and that they are free to rotate in their seats without sticking or excessive play.
2. Check that link rods are not damaged or distorted.
3. Check that rubber boots are in good condition.



POWER STEERING PUMP

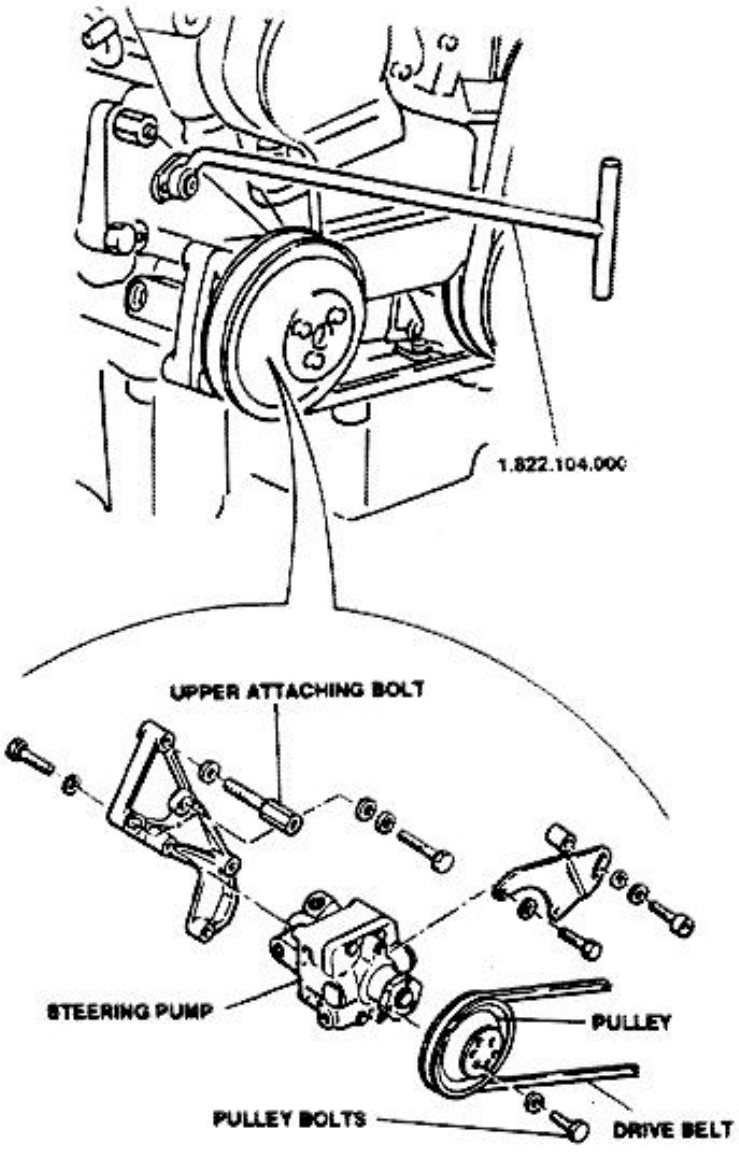
REMOVAL/INSTALLATION

1. Place vehicle on auto lift.
2. Place vehicle on an appropriate jack.
3. Remove right front wheel.
4. Working inside the right front fender, remove front protection and lift the rear protection portion that covers steering pump.
5. Remove plastic protection of steering pump drive belt.
6. Disconnect hoses from pump; collect hydraulic fluid.



Thoroughly clean hidraulic fittings using benzene.

7. Adequately plug pump holes from which hoses were disconnected.
8. Using tool **No. 1.822.104.000** loosen bolts located in the tension adjustment holes, and remove them.
9. Loosen and remove upper securing bolt and bolts securing pulley.
10. Remove pulley with related drive belt, and steering pump.



33.2 to 36.9 ft.lbs
(45 to 50 N·m)

PUMP FUNCTIONAL CHECK

Carry-out the pump functional check running the engine at a speed of 1000 to 4000 R.P.M., blocking the fluid delivery hose and checking that pressure rises to 85 bar (1232.5 psi); replace pump assembly if this condition is not met.

REPLACEMENT OF POWER STEERING PUMP DRIVE BELT

See Group 00.

CHECK AND ADJUSTMENT OF POWER STEERING PUMP DRIVE BELT TENSION.

See Group 00.

POWER STEERING FLUID RESERVOIR

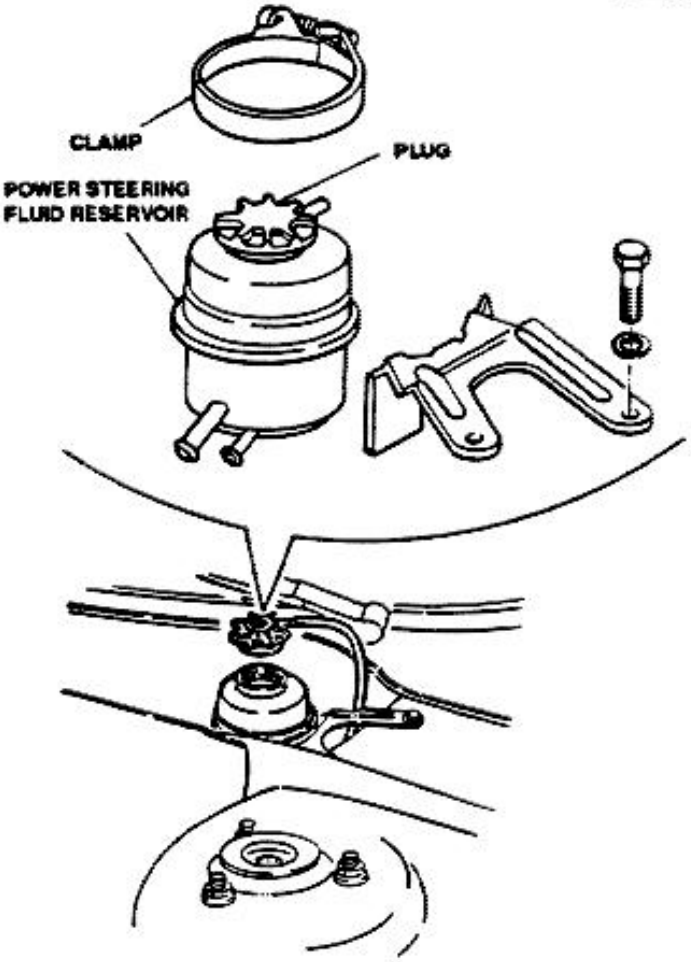
The reservoir is made of plastic material and is located in front of the firewall. To remove the reservoir, disconnect securing clamp and hoses underneath. The fluid level check shall be carried-out with engine running; top-up to normal level.

NOTE: Bleed the system any-time a component is removed.

CAUTION:
Use specified fluids only; to top-up the system always use fluid from sealed containers, opened just before use.

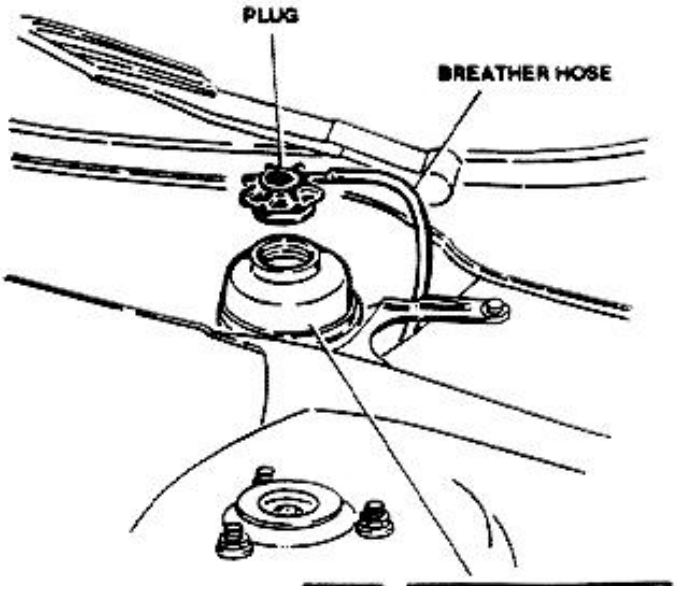
NOTE: The check of fluid level must be carried-out with vehicle standing on a flat surface.

NOTE: The servicing capacity of the system is 0.9 kg (2 lbs).

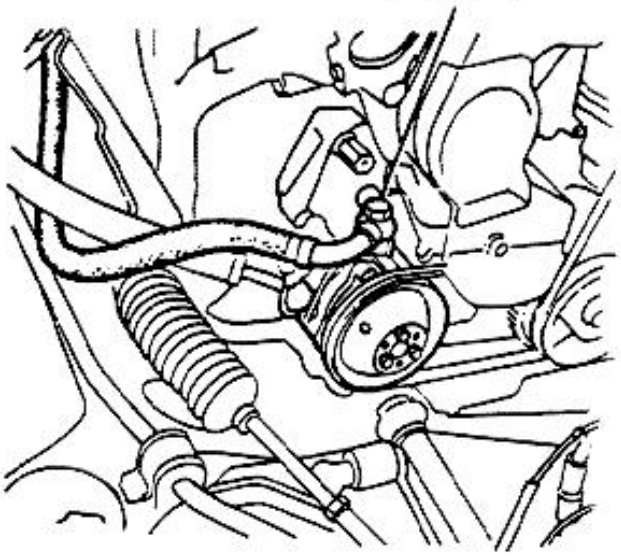


HYDRAULIC SYSTEM SERVICING AND BLEEDING OPERATIONS

1. Disconnect the reservoir breather hose.
2. Remove the plug and service the reservoir.



3. Slacken the intake union on the pump until oil comes out, then tighten to specified torque. With engine idling, and without leaving the reservoir run dry, turn the steering wheel completely several times; then top up the reservoir to the maximum level mark.



POWER STEERING FUNCTIONAL CHECK

Check the steering wheel rotation torque with engine running; the required torque shall be between 0.6 daN with engine at idle speed, and 0.75 daN with accelerator pedal fully down. If these values are not met, check system pressure as follows:
insert a pressure gauge, using a "Tee fitting, on the fluid delivery hose from the pump to the box and steer completely to the left or to the right. Applying a higher rotation force to the steering wheel, pressure read on the gauge should reach 85 bar (1232.5 psi). If this value is not met, the faulty component should be the pump or the distributor valve.

TECHNICAL CHARACTERISTICS AND SPECIFICATIONS

FLUIDS AND LUBRICANTS

Application	Type	Name
Needle bearing seat on steering column support	GREASE	SPCA Spagraph ISECO Ergon Rubber Grease No. 3 REINACH Sferul B2 AR
Steering column	GREASE	ISECO Molykote Pasta G
Power steering system oil servicing	OIL*	AGIP DEXRON II SHELL ATF DEXRON II

* 0.9 Kg (2 lbs)

TIGHTENING TORQUES

Nut securing steering wheel to steering column	12.5 to 15.5 ft.lbs	17 to 21 Nm
Screws securing air bag module to steering wheel	6.6 to 7.88 ft.lbs	9 to 10.6 Nm
Bolt securing universal joint to intermediate shaft end	14.4 to 18.1 ft.lbs	19.5 to 24.5 Nm
Bolt securing steering column support to body	3.6 to 5.4 ft.lbs	4.9 to 7.3 Nm
Nut securing steering wheel height adjustment device	11.8 to 14.8 ft.lbs	16 to 20 Nm
Nuts and studs securing upper and lower covers	2.7 to 4.4 ft.lbs	3.7 to 6 Nm
Bolt securing universal joint connecting intermediate shaft to steering box pinion	14.4 to 18.1 ft.lbs	19.5 to 24.5 Nm
Bolts securing flange retaining steering column to steering column support	3.2 to 4 ft.lbs	4.4 to 5.5 Nm
Nut securing steering link rod ball joint	36.9 to 44.3 ft.lbs	50 to 60 Nm
Locknut securing ball joint to steering link rod	29.5 to 46.5 ft.lbs	40 to 63 Nm
Nuts securing steering box bulkhead	10.3 to 16.2 ft.lbs	14 to 22 Nm
Bolts securing steering box to frame	10.3 to 16.2 ft.lbs	14 to 22 Nm
Fitting for oil delivery hose on steering box	28 to 31.7 ft.lbs	38 to 43 Nm
Fitting for supply line on power steering pump	36.9 to 40.6 ft.lbs	50 to 55 Nm
Fitting for delivery line to steering box	33.2 to 36.9 ft.lbs	45 to 50 Nm

SPECIAL TOOLS

Tool number	Description
1.821.035.000	Puller for steering column support needle bearing
1.821.214.000	Puller for steering wheel
1.821.117.000	Puller for steering column bearing
1.821.169.000	Puller for steering track rod ball joint
1.822.104.000	Special wrench for power steering securing bolts

TROUBLESHOOTING PROCEDURE

PRELIMINARY CHECKS

- Check tires pressure and wear.
- Check wheels attitude and characteristic angles.
- Position vehicle on a level and dry pavement, with engine at idle RPM.

TROUBLES AND SYMPTOMS	FAULT ISOLATION	TEST REFERENCE
LOW TANK FLUID LEVEL/ LEAKS	Visible leaks are generally present at the various components and pipes of the power steering system, with consequent decrease of level of fluid in the tank.	A
GRADUAL STIFFENING OF STEERING ACTION	Stiffening of steering action as the steering angle increases.	B
SUDDEN STIFFENING OF STEERING ACTION	Sudden stiffening of steering action during normal operation of steering.	C
NOISE/KNOCKS DURING STEERING OPERATION		D
CONTINUOUS NOISE		E
DAMAGED STEERING BOX BELLOWS		F
NOISY INTERMEDIATE STEERING SPINDLE		G
NOISY STEERING COLUMN		H

(Cont.d)

TROUBLESHOOTING PROCEDURE

TROUBLES AND SYMPTOMS	FAULT ISOLATION	TEST REFERENCE
DIFFICULT SLIDING OR MISSED LOCKING OF STEERING COLUMN		1

LOW TANK FLUID LEVEL/LEAKS	TEST A

TEST STEPS	RESULTS	REMEDY
A1 STEERING BOX SEALING RINGS CHECK		
- Check steering box sealing rings for wear or damage	OK ▶	Carry-out **step A2**
	~~OK~~ ▶	Replace **steering box**
A2 OIL LEAKS VISUAL CHECK		
- Check for leaks of steering box, pump or reservoir	OK ▶	Carry-out **step A3**
	~~OK~~ ▶	Tighten **fittings** to prescribed torque; replace fitting **seals**, if necessary
A3 PUMP SEALING RINGS CHECK		
- Check pump shaft sealing rings for wear or damage	~~OK~~ ▶	Replace **steering pump**

End of test A

GRADUAL STIFFENING OF STEERING ACTION	TEST B

TEST STEPS	RESULTS	REMEDY
B1 DISTRIBUTOR CHECK - Check distributor for integrity and efficiency of seals	OK ▶ ~~OK~~ ▶	Carry-out **step B2** Replace **steering box**
B2 OIL LEAKS CHECK - Check steering box for oil leakage	OK ▶ ~~OK~~ ▶	Carry-out **step B3** Replace **steering box**
B3 SYSTEM PRESSURE CHECK - Check that pump supply pressure does not decrease below **49.7 psi (3.5 bar)** with steering to neutral position	OK ▶ ~~OK~~ ▶	Carry-out **step B4** Replace **steering pump**
B4 PUMP BELT CHECK - Check pump drive belt is not loose, damaged or broken	~~OK~~ ▶	Restore proper tension of **belt**; replace **belt** if necessary

End of test B

SUDDEN STIFFENING OF STEERING ACTION	TEST C

TEST STEPS		RESULTS	REMEDY
C1	PIPES CHECK		
- Check pipes routing for breakage		OK ▶	Replace affected pipes

End of test C

NOISE/KNOCKS DURING STEERING OPERATION	TEST D

TEST STEPS	RESULTS	REMEDY
D1 OIL LEVEL CHECK		
- Check level of oil in the circuit	OK ▶	Carry-out **step D2**
	~~OK~~ ▶	Top-up **oil** to proper-level
D2 TRAPPED AIR CHECK		
- Check for presence of air in the system	OK ▶	Carry-out **step D3**
	~~OK~~ ▶	Bleed system by rotating the steering wheel several times to end of travel in both directions; if noise is still present, replace **steering box**
D3 TANK FILTER CHECK		
- Check tank filter for excessive dirt or obstruction	OK ▶	Carry-out **step D4**
	~~OK~~ ▶	Replace **tank**
D4 ATTACHMENTS CHECK		
- Check steering component attaching screws for looseness	OK ▶	Carry-out **step D5**
	~~OK~~ ▶	Tighten **screws** to prescribed torque

(Cont.d)

NOISE/KNOCKS DURING STEERING OPERATION	TEST D

TEST STEPS		RESULTS	REMEDY
D5	RODS AND JOINTS CHECK		
- Check steering rods and spherical joints for damage or wear		~~OK~~ ▶	Replace rods or joints

End of test D

CONTINUOUS NOISE	TEST E

TEST STEPS	RESULTS	REMEDY
E1 PUMP CHECK		
• Disconnect belt from steering pump and note if noise is still present	OK ▶	Replace pump

End of test E

DAMAGED STEERING BOX BELLOWS	TEST F

TEST STEPS		RESULTS	REMEDY
F1	BELLOWS CHECK		
- Check steering box bellows for damage or aging		OK ▶	Replace bellows

End of test F

NOISY INTERMEDIATE STEERING SPINDLE	TEST G

TEST STEPS	RESULTS	REMEDY
G1 UNIVERSAL JOINTS CHECK		
- Check intermediate steering spindle universal joint spider for excessive play	OK ▶	Carry-out **step G2**
	~~OK~~ ▶	Replace **intermediate steering spindle**
G2 SPLINED COUPLING CHECK		
- Check splined coupling of steering column and intermediate steering spindle for excessive play	~~OK~~ ▶	Replace defective items

End of test G

NOISY STEERING COLUMN	TEST H

TEST STEPS	RESULTS	REMEDY
H1 BEARINGS CHECK - Check steering column support bearings for wear or damage	OK ▶ ~~OK~~ ▶	Carry-out **step H2** Replace affected **bearings**
H2 STEERING COLUMN CHECK - Check steering column for interference with multiple switch shells	OK ▶ ~~OK~~ ▶	Carry-out **step H3** Install **multiple switch shells** properly
H3 JOINT ATTACHMENTS CHECK - Check universal joint attachment nuts at spindle ends for proper torque	~~OK~~ ▶	Torque **nuts** to prescribed value

End of test H

DIFFICULT SLIDING OR MISSED LOCKING OF STEERING COLUMN	TEST I

TEST STEPS		RESULTS	REMEDY
I1	STEERING COLUMN SUPPORT ATTACHMENT CHECK		
- Check for excessive torque of steering column to car body attachment screw		OK ▶	Carry-out **step I2**
		~~OK~~ ▶	Re-torque screw to proper value
I2	ADJUSTMENT LEVER ATTACHMENT CHECK		
- Check steering wheel axial adjustment lever attaching nut for excessive torque		OK ▶	Carry-out **step I3**
		~~OK~~ ▶	Re-torque nut to proper value
I3	SPLINED COUPLING LUBRICATION CHECK		
- Check for proper lubrication of splined coupling of steering column and intermediate steering spindle		~~OK~~ ▶	Lubricate **splined coupling** as required

End of test I