GROUP 16 — PROPELLER SHAFT

SECTION 0 — INDEX

SERVICE BULLETIN REFERENCE

DATE	NUMBER	SUBJECT	CHANGES

SECTION 1 — SERVICE DIAGNOSIS

Condition	Possible Cause	Correction
PROPELLER SHAFT VIBRATION	(a) Undercoating on propeller shaft.	(a) Clean shaft.
	(b) Worn universal joint bearings or needle rollers missing.	(b) Replace universal joint.
	(c) Worn universal joint housing.	(c) Replace faulty components.
	(d) Bent or out of balance propeller shaft.	(d) Replace or rebalance shaft.
	(e) Loose flange bolts.	(e) Tighten bolts to specification.
	(f) Bent drive yoke.	(f) Replace yoke.
	(g) Broken or weak rear spring.	(g) Replace faulty spring.
	(h) Rear spring incorrectly matched.	(h) Match rear springs.
	(i) Centre bearing bracket loose.	(i) Tighten attaching bolts to specified torque.
	(j) Centre bearing worn.	(j) Replace centre bearing.
	(k) Check condition and runout of spigot at rear flanges.	(k) Rotate companion flange 180° and recheck runout of female spigot.
UNIVERSAL JOINT NOISE	(a) Lack of lubrication.	(a) Remove and lubricate joint.
	(b) Worn universal joint.	(b) Replace joint.
	(c) Propeller shaft flange bolts loose.	(c) Tighten bolts to specifications.

SECTION 2 — PROPELLER SHAFT

SPECIFICATIONS

Type ..... Tubular
Max. Propeller Shaft Bend — One and Two Piece Shaft ..... 0,51 mm (0.020")

PROPELLER SHAFT

Sedan — Wagon

Refer Page 0 - 2 - 7 for Model Code.

Model Code	Trans. Type	Rear Axle Type	Length ℄ to ℄	Tube Dia. O.D.	No. Splines Front Yoke	Pink	White	Yellow	Lt. Green	Grey	Lt. Brown
3, 5, 7	Man-MMC	MMC 4 Hole Flange	1254,5 mm (49.39")	76,2 mm (3")	21	1				1	1
8	Auto-BW35	MMC 4 Hole Flange	1324,0 mm (52.13")	82,5 mm (3.25")	26	1		2			1
3, 5, 7	Man-MMC	BW 4 Hole Flange	1254,5 mm (49.39")	76,2 mm (3")	21	1	1			1	1
8	Auto-BW35 (Short Ext. Hsg)	BW 4 Hole Flange	1324,0 mm (52.13")	82,5 mm (3.25")	26	1	1	1			1
3, 5, 7	Man-MMC	BW 6 Hole Flange	1274,0 mm (50.16")	76,2 mm (3")	21	1	2				1
2, 8	Auto-BW35 (Short Ext. Hsg)	BW 6 Hole Flange	1324,0 mm (52.13")	82,5 mm (3.25")	26	1			1		1
7	Man-BW	BW 6 Hole Flange	1269,0 mm (49.96")	76,2 mm (3")	24	1		1			1
2, 8	Auto-BW35 (Long Ext. Hsg)	BW 6 Hole Flange	1181,0 mm (46.5")	76,2 mm (3")	26	1					1

Two Door Coupe

Model		Shaft Type	Length ℄ to ℄	Tube Diam. O.D.	Angularity
'78 Spec.	Man. Trans.	One Piece	1272,0 mm (50.08")	75,0 mm (2.95")	—
	Auto. Trans.	Two Piece	Front — 560,0 mm (22.05")	63,5 mm (2.5")	—
			Rear — 612,0 mm (24.1")	63,5 mm (2.5")	0° 8' — 1° 8'
'79 Spec.	Man. Trans.	One Piece	1272,0 mm (50.08")	75,0 mm (2.95")	—
	Auto. Trans.	Two Piece	Front — 560,0 mm (22.05")	65,0 mm (2.56")	—
			Rear — 612,0 mm (24.1")	65,0 mm (2.56")	0° 8' — 1° 8'

UNIVERSAL JOINTS

Front ..... Cross and Roller (Sliding Spline)
Centre ..... Cross and Roller
Rear ..... Cross and Roller
Rear Yoke Flange Spigot to Rear Axle Companion Flange Spigot Clearance ..... 0.76 mm (0.030")
Companion Flange Female Spigot Runout ..... 0.10 mm (0.004")

TORQUE SPECIFICATIONS

Flange Bolts — 8T bolts	24 to 30 Nm	18 to 22 lbs. ft.
— 10T bolts	30 to 35 Nm	22 to 26 lbs. ft.
Centre Bearing Bracket Bolts	30 to 40 Nm	22 to 29 lbs. ft.
Centre Bearing Yoke Nut	160 to 220 Nm	120 to 160 lbs. ft.

GENERAL INFORMATION

The propeller shaft is fitted with a cross and roller type universal joint with a sliding spline at its forward end.

The rear universal joint is the cross and roller type with a flange mounting fitted.

The cross and roller, sliding spline type front universal joint moves back and forth on the transmission output shaft splines.

The Automatic Coupe is fitted with a two piece propeller shaft. The shafts are supported by a rubber mounted centre bearing located in a centre bearing bracket attached to the floor pan tunnel.

PROPELLER SHAFT VIBRATION

Propeller shaft vibration frequency is much higher than wheel, tyre or brake drum/disc vibrations and is apparent at a particular road speed range and does not follow engine r.p.m. Vibration caused by an unbalanced propeller shaft or other chassis parts can usually be detected by driving at a speed slightly above the speed where the condition is most noticeable and shifting the transmission into neutral and letting the car slow down.

PROPELLER SHAFT — ONE PIECE

Removal

(1) Raise the rear of the vehicle and support on safety jacks, this will prevent loss of transmission lubricant.

(2) Mark the rear universal joint yoke and rear axle flange.

(3) Remove the bolts securing the propeller shaft to the rear axle flange.

(4) Slide the propeller shaft and front yoke from the transmission output shaft. Be careful not to damage the output shaft or yoke splines. Examine the sliding yoke seal for evidence of leakage. If no leakage is evident, do not disturb the seal.

NOTE: Prior to removal of the propeller shaft, the rear universal joint yoke and rear axle flange should be marked with a punch to ensure correct matching alignment of the propeller shaft with the rear axle flange during installation. Failure to carry out this operation may result in propeller shaft vibration.

Inspection

(1) Inspect the propeller shaft for bend and other defects. Move the shaft in V blocks placed approximately 100 mm (4.0") from the shaft ends. Position a dial indicator pointer at the centre of the shaft, and check the shaft for bend. If the shaft indicates bend in excess of the specified dimension or the shaft indicates cracks over the tubing or on the yoke weld seams replace the propeller shaft.

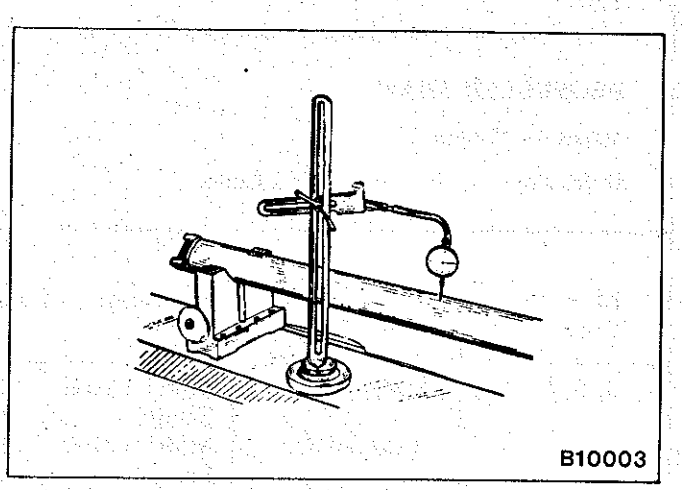


Fig. 1—Checking propeller shaft bend

(2) Check the sleeve yoke and the transmission mainshaft splines for wear and damage. Replace any faulty components.

Installation

(1) Clean the old Lubricant from the front yoke splines. Engage the yoke splines on the end of the output shaft, being careful not to burr the splines.

(2) Align the mating marks of the rear flanges, install the rear universal joint flange bolts and nuts and tighten to the specified torque.

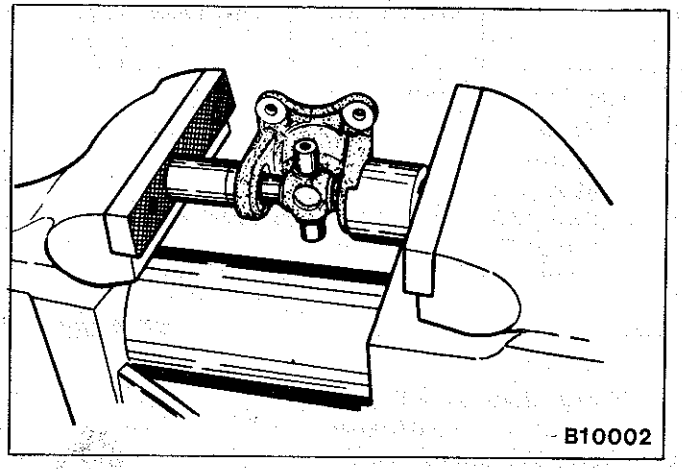


Fig. 2—Removing roller and bearing cup

CROSS AND ROLLER UNIVERSAL JOINT

Disassembly

(1) Mark all mating components prior to dismantling the propeller shaft.

(2) Remove retainer and press one bearing cup assembly out of the yoke by pressing the opposite bearing cup. Refer Fig. 2.

(3) Press the remaining bearing cup assembly out by pressing on the end of the cross assembly.

(4) Remove cross from yoke. The cross and seal retainers are serviced as an assembly. Do not remove seal retainers from the cross. Care should be taken to prevent damage to the components if they are to be re-used.

Cleaning and Inspection

(1) Clean the parts in a suitable solvent and dry with compressed air.

(2) Examine the bearing surfaces of the cross. The surfaces should be smooth, free of pits and ripples. If dust seal retainers are damaged, replace cross assembly.

(3) Examine roller bearings and cups. Bearings that have operated on a worn cross should be replaced. Bearings should have a uniform appearance and should roll freely inside the cups.

NOTE: As a running change, later universal joints were fitted with a 0,9 to 1,0 mm thick thrust pad in each bearing cup.

Assembly

(1) Force universal joint grease between the rollers in all four bearing cups. Fill the reservoirs in ends of cross.

NOTE: Do not overfill the bearing cups with grease as bearing cup damage may result upon installation.

(2) Place cross in propeller shaft yoke and insert bearing cup assemblies in yoke.

(3) Press bearing cup assemblies into yoke whilst guiding the cross into both cups.

(4) Press until both cup retainers can be installed in grooves.

(5) Position the remaining two cups on the cross and install retainers.

Re-install propeller shaft as previously described.

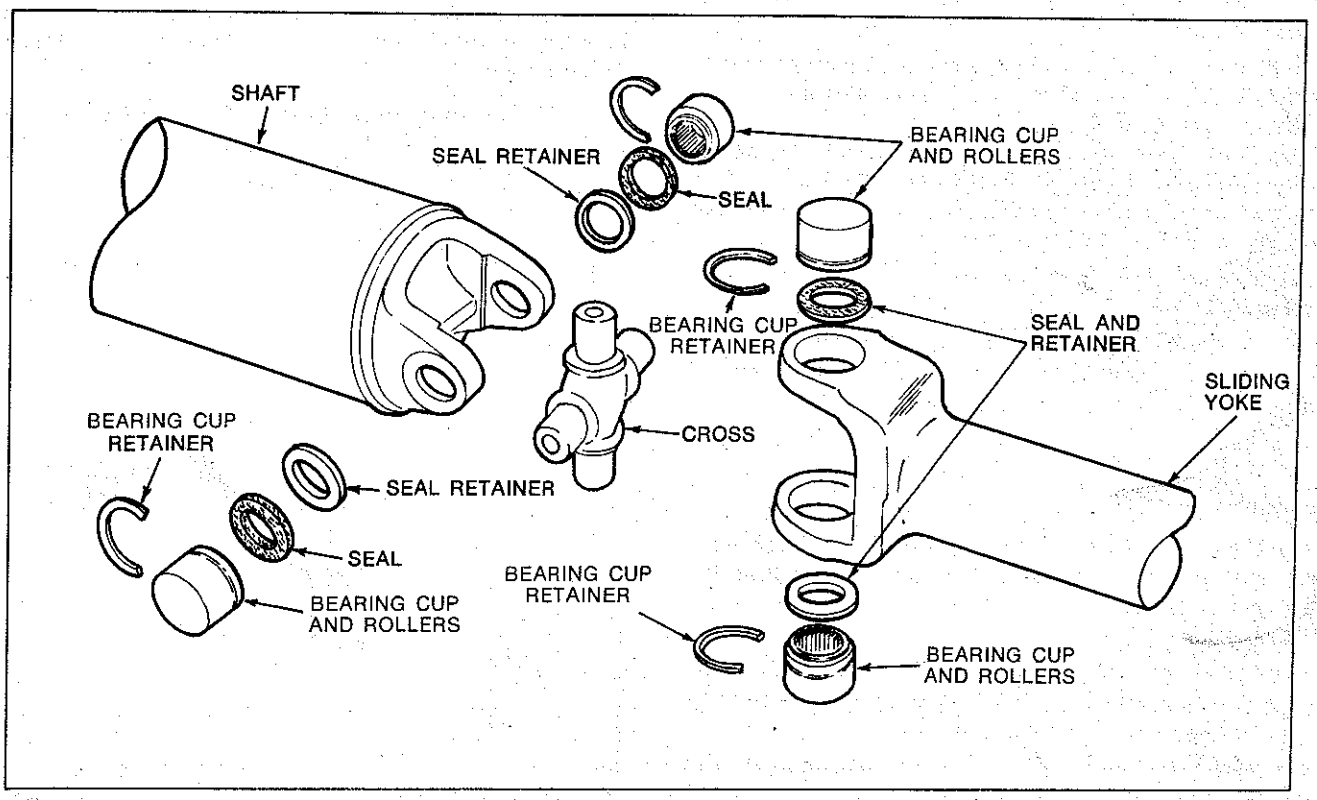


Fig. 3—Cross and roller universal joint — front (typical view)

PROPELLER SHAFT — TWO PIECE

Removal

(1) Raise the rear of the vehicle and support on safety jacks, this will prevent loss of the transmission lubricant.

(2) Mark the rear universal joint yoke and rear axle flange.

(3) Remove the bolts securing the propeller shaft to the rear axle flange.

(4) Remove the centre bearing attaching nuts and shims.

(5) Slide the propeller shaft and front yoke from the transmission output shaft. Be careful not to damage the output shaft or yoke splines. Examine the sliding yoke seal for evidence of leakage. If no leakage is evident do not disturb the seal.

NOTE: Prior to removal of the propeller shaft, the rear universal joint yoke and rear axle flange should be marked with a punch to ensure correct matching alignment of the propeller shaft with the rear axle flange during installation. Failure to carry out this operation may result in propeller shaft vibration.

Inspection

(1) Check the centre bearing bracket and rubber bearing support for deterioration and damage.

(2) Check the centre bearing for noise, looseness and smooth rotation.

(3) Mount the shaft in vee blocks placed approximately 50 mm (1.97 in.) from the shaft ends. Position a dial indicator pointer at the centre of the shaft and check the shaft for bend. If the shaft indicates bend in excess of the specified dimension or the shaft indicates cracks over the tubing or on the yoke weld seams, replace the propeller shaft assembly (refer Fig. 1).

(4) The universal joints can be inspected in the same manner as the one piece propeller shaft.

(5) Check the sleeve yoke and transmission mainshaft splines for wear and damage. Replace any faulty components.

Installation

(1) Clean the outside surface and splines of the front yoke and apply gear oil prior to installation. Engage the yoke splines on the end of the output shaft, being careful not to burr the splines.

(2) Install the centre bearing bracket and spacers leaving the attaching nuts loose to allow fore and aft movement of the bearing assembly (refer Fig. 8).

(3) Align the mating marks of the rear flanges and install the rear flange bolts and nuts.

(4) Tension the centre bearing and rear flange nuts to the specified torque.

Disassembly

(1) Mark all mating components prior to dismantling the propeller shaft (refer Fig. 4).

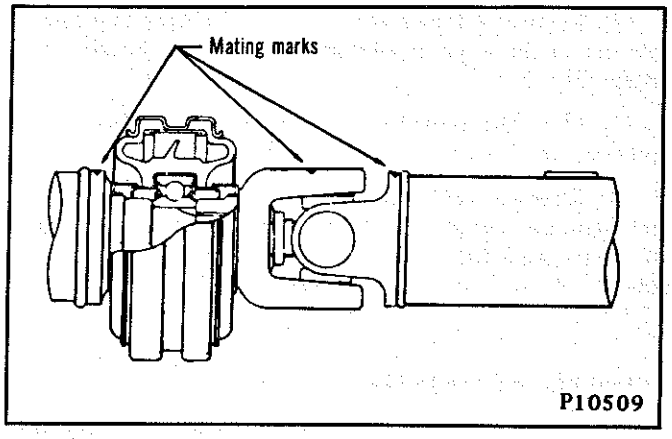


Fig. 4—Mating marks of yoke and shaft

(2) Dismantle the centre universal joint.

(a) Remove the retainers and press one bearing cup out of the yoke by pressing on the opposite bearing cup (refer Fig. 2).

(b) Press the remaining bearing cup out by pressing on the end of the cross assembly.

(c) Remove the cross from the yoke. The cross seals and retainers are serviced as an assembly. — Care should be taken to prevent damage to the components if they are to be re-used.

(3) Remove the centre bearing retaining nut and mark the yoke and splined shaft for ease of fitment.

(4) Remove the centre bearing bracket from the bearing.

(5) Using a puller remove the bearing from the shaft. (Refer Fig. 5).

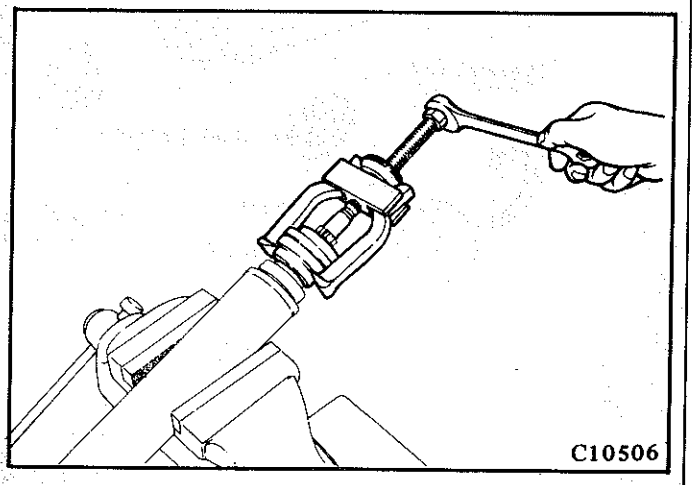


Fig. 5—Removing the centre bearing

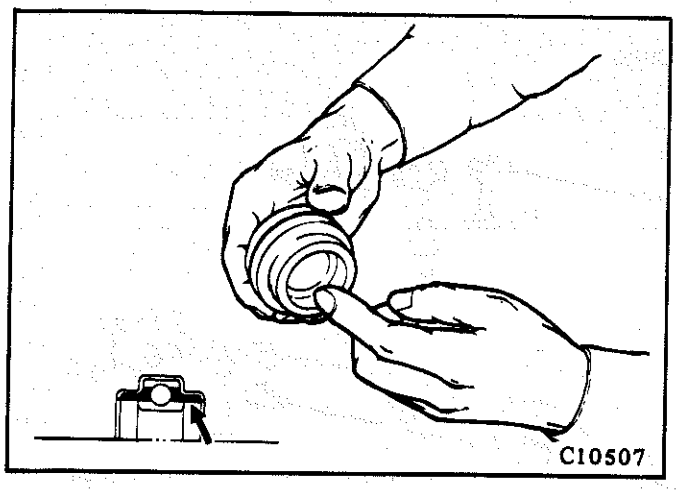


Fig. 6—Greasing point

NOTE: (1) The centre bearing bracket and rubber bearing support are spot welded on the circumference and therefore cannot be dismantled.
(2) Do not damage the propeller shaft tube when gripping in a vice.

Assembly

Centre Bearing

(1) Repack the bearing with multi-purpose grease (refer Fig. 6).

(2) Press the centre bearing onto the front shaft. Install the centre bearing bracket, ensuring that the rubber bearing support groove is correctly fitted to the bearing.

(3) Align the mating marks of the yoke and splines on the front shaft and fit the yoke (refer Fig. 4). Tension the yoke retaining nut to the specified torque.

(4) Align the mating marks of the yoke and rear shaft and assemble the universal joint.

Universal Joint

(1) Force universal joint grease between the rollers in all four universal joint bearing cups. Fill the reservoirs in the ends of the cross.

NOTE: Do not overfill the bearing cups with grease as bearing cup damage may result upon installation.

(2) Place the cross in the propeller shaft yoke and insert the bearing cup assemblies in the yoke.

(3) Press the bearing cup assemblies into the yoke whilst guiding the cross into both bearing cups.

(4) Press until both bearing cup retainers can be installed in the grooves.

TWO PIECE PROPELLER SHAFT ANGULARITY

(Automatic Only)

The front to rear shaft angular difference may be obtained by using a spirit level protractor. The angle of the front and rear shaft must be determined separately (refer Fig. 7) and then resolved to give the angular difference, see Specifications.

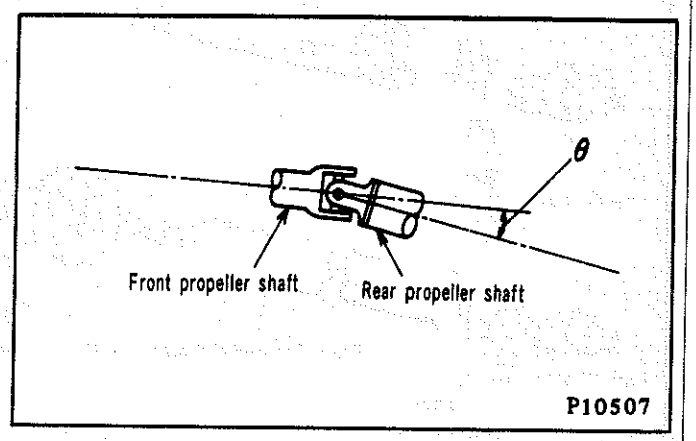


Fig. 7—Propeller shaft inclination

The propeller shaft angularity can be adjusted to the specified angle by means of shims inserted between the floor pan and centre bearing bracket (refer Fig. 8).

Shim Thickness
*1,2 mm (0.047 in.)
2,3 mm (0.091 in.)
3,2 mm (0.126 in.)
4,5 mm (0.180 in.)
6,0 mm (0.236 in.)

*Standard value

NOTE: Insertion of 1,2 mm (0.047 in.) thick spacer will decrease inclination by approximately 0°15'.

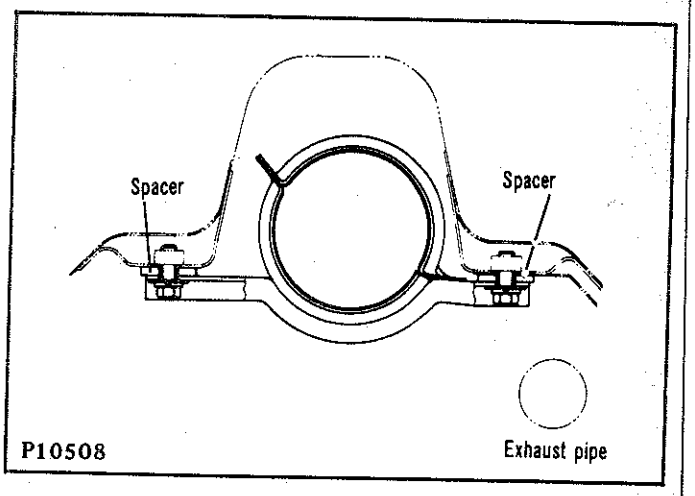


Fig. 8—Installing the centre bearing assembly

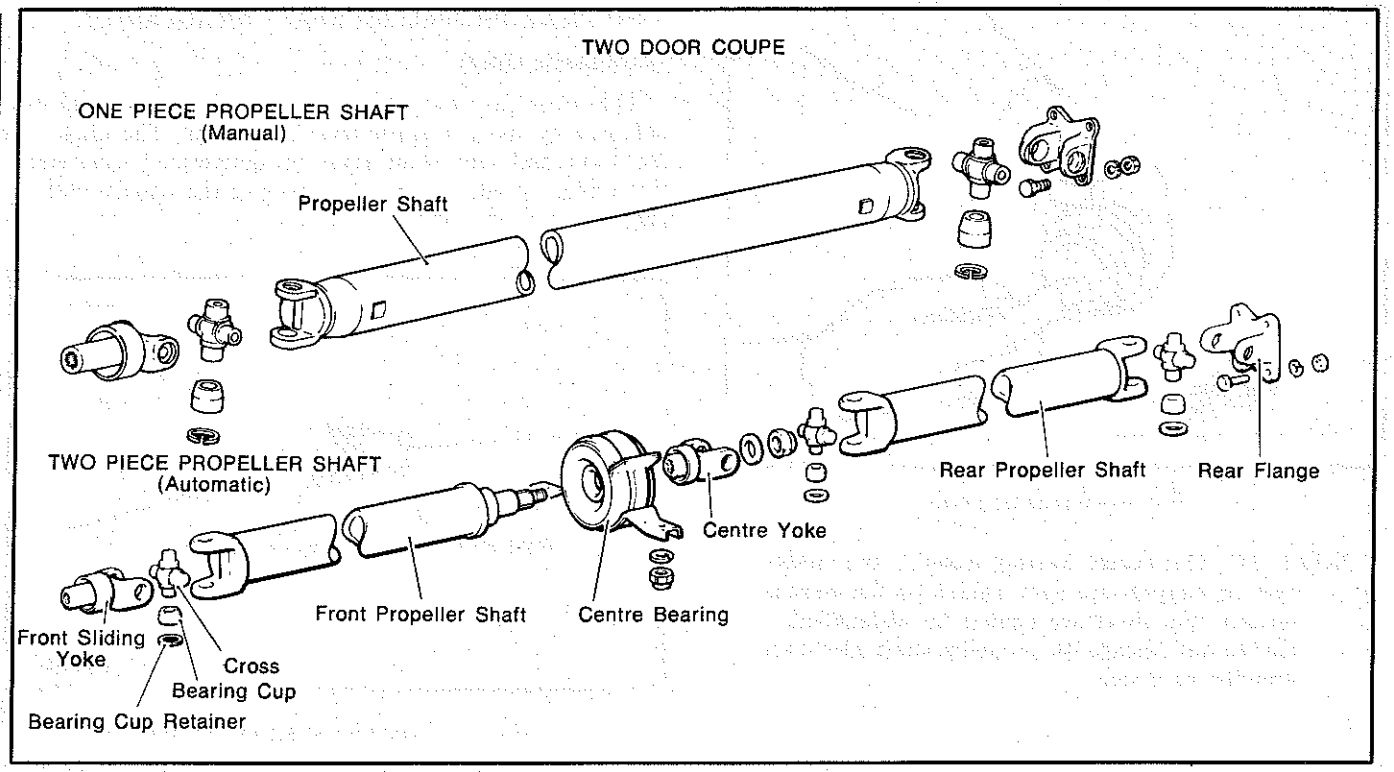


Fig. 9—Propeller shaft components

GROUP 17—REAR SUSPENSION AND SHOCK ABSORBERS.

SECTION 0—INDEX

SERVICE BULLETIN REFERENCE

DATE	NUMBER	SUBJECT	CHANGES

SECTION 1—SERVICE DIAGNOSIS.

Condition	Possible Cause	Correction
POOR RIDE	(a) Weak or broken spring.	(a) Replace spring.
	(b) Faulty shock absorber.	(b) Replace.
	(c) Incorrect tyre pressure.	(c) Adjust to specification.
NOISY OPERATION	(a) Suspension components loose.	(a) Tighten loose components.
	(b) Bushing pin worn.	(b) Replace faulty components.
	(c) Faulty shock absorber.	(c) Replace.
BODY ROLL	(a) Weak or broken spring.	(a) Replace spring.
	(b) Faulty suspension arms or bushings.	(b) Replace faulty components.

SECTION 2 — REAR SUSPENSION AND SHOCK ABSORBERS

Type	4 Link type coil spring suspension					
Coil Springs	Sedan (early except 2,6 ℓ)	Sedan (Late except 2,6 ℓ)	Sedan (2,6 ℓ only)	Station Wagon (except 2,6 ℓ)	Station Wagon (2,6 ℓ only)	Two Door
Wire Diameter	13,5 mm (0.53")	<———	<———	Upper 10,7 mm (0.42") Lower 14,7 mm (0.58")	<——— 14,5 mm (0.57")	12,8 mm (0.50")
O.D.	133,0 mm (5.24")	<———	<———	135,0 mm (5.31")	<———	132,8 mm (5.23")
Free Length	287,0 mm (11.30")	280,0 mm (11.03")	273,0 mm (10.76")	222,5 mm (8.94")	210,5 mm (8.46")	275,0 mm (10.83")
Load Rating	34,7 kNm (198 lb./m.)	<———	<———	35,9 kNm (205 lb./m.)	<———	34,5 kNm (197 lb./m.)
Colour Codes						
— Low Load	Purple	Green/White	Purple/White	Pink	Pink/White	(Low) Red
— High Load	Orange	Yellow/Blue	Orange/White	Brown	Brown/White	(Med.) Yellow (High) White

NOTE: Early models are identified by the symbol (GR) (low tolerance) or GR (high tolerance) on a yellow tag attached to the spring.

Shock Absorbers

	Sedans (except 2,6 ℓ)			Sedan 2,6 ℓ	Station Wagon		Two Door
V.I.C.*	(up to FJ29)	(From FJ29 to CJ29)	(From CJ29)		(Up to LK14)	(From LK14)	
Type	Double acting telescopic	<———	<———	<———	<———	<———	<———
Maximum Length (between bushing centre)	609,0 mm (23.48")	<———	<———	<———	495.0 mm (19.49")	<———	609,0 mm (23.48")
Minimum Length	379,0 mm (14.92")	<———	<———	<———	311,0 mm (12.24")	<———	379,0 mm (14.92")
Stroke	230,0 mm (9.06")	<———	<———	<———	184,0 mm (7.24")	<———	230,0 mm (9.06")
Bore	25,4 mm (1.00")	<———	<———	<———	<———	<———	<———
Colour Code	Black	Navy Blue	Black	Light Green	Black	Red Brown	Black

*For details see Group O.

Difference in Bushing End Projected Height	Sedan/Wagon	Two Door
Lower Control Arm	± 1,5 mm (0.060") or less	<———
Upper Control Arm	± 1,0 mm (0.040") or less	<———
Assist Link	± 1,5 mm (0.060") or less	± 2,00 mm (0.080") or less

TORQUE SPECIFICATIONS

	Nm	lb. ft.
Assist Link	49-58	36-43
Lower Control Arm	127-167	94-123
Shock Absorber — Lower	16-19	12-14
— Upper	64-79	47-58
Upper Control Arm	127-167	94-123

GENERAL INFORMATION

The rigid axle housing is retained by upper and lower control arms and assist links. Each lower arm assembly provides a seat for the coil spring.

Lateral location of the rear axle is achieved by the angle mounting of the upper control arms.

NOTE: It is important to support the rear axle when disconnecting the shock absorbers.

COIL SPRING AND CONTROL ARM

Removal.

(1) Loosen road wheels, raise rear of the vehicle and support on safety jacks placed under the body.

(2) Place a jack under the axle and raise the axle slightly.

(3) Disconnect the parking brake cable from the extension lever.

(4) Disconnect shock absorber lower links and lower the jack. The coil springs can now be removed.

(5) Raise the jack slightly and remove the bolts securing the lower control arm, assist link and upper arm, the arms and links can now be removed.

Inspection.

Check the coil springs for bends, cracks and deterioration and the spring pad for breakage.

Check the shock absorbers for fluid leaks, damage and the rod for bend. To test the shock absorber manually move the rod between both ends of its travel. The rod must stroke smoothly with uniform resistance.

Check the upper and lower control arms and assist link for bends and damage and check each bushing for deterioration, cracks and spalling.

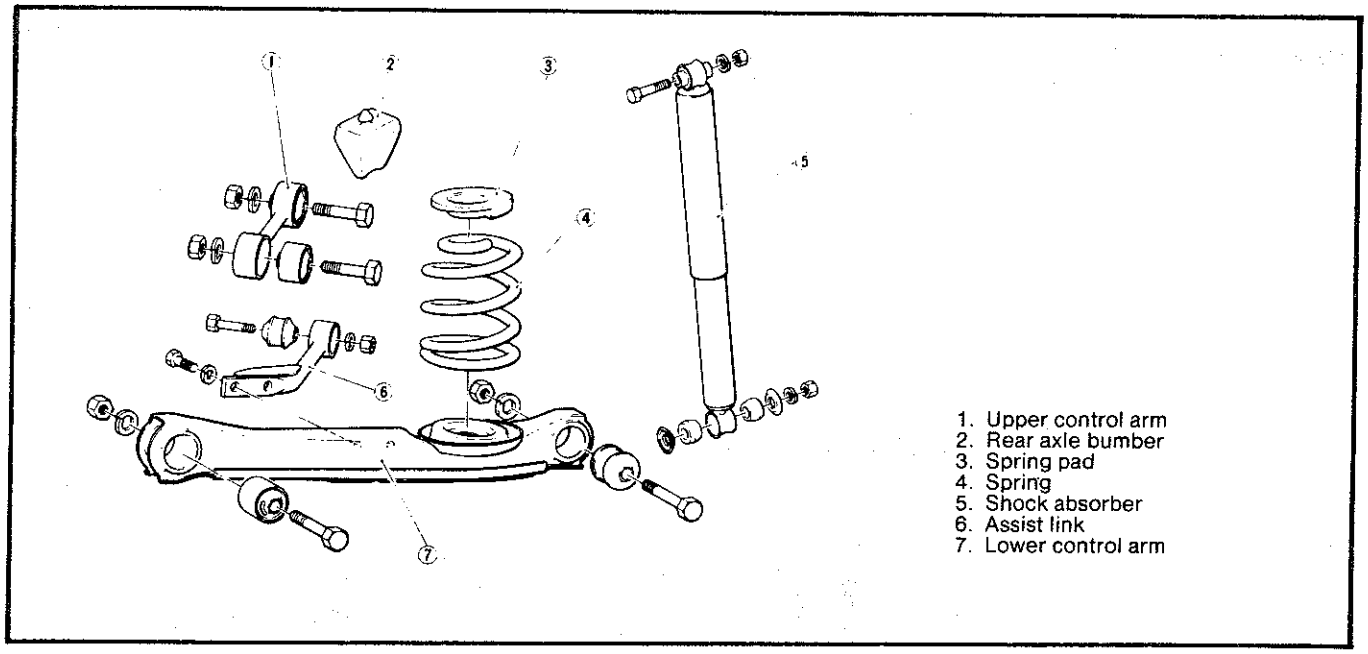


Fig. 1—Exploded view of rear suspension.

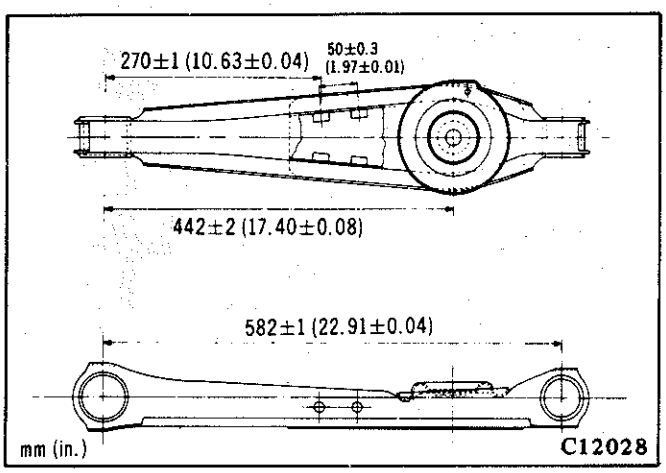


Fig. 2—Lower control arm alignment

Upper and lower control arm and assist link bushes should not be removed except when bushing replacement is necessary. When bushing replacement is necessary new bushes must be installed.

Installation

(1) With the rear axle slightly jacked up, temporarily install the lower and upper control arms and the assist link.

(2) Lower the rear axle and install the spring pad to the upper end of the spring and then insert the lower end of the spring in the spring groove provided in the spring seat of the lower control arm.

(3) Each spring has an identification mark for load classification, to maintain the correct vehicle attitude the springs should be fitted with matching identification marks on both sides of the vehicle.

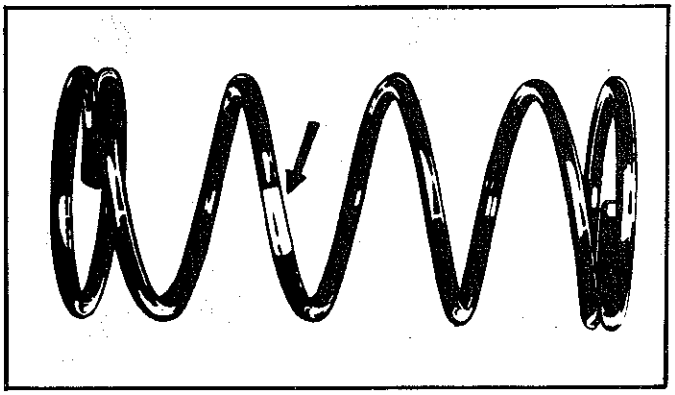


Fig. 3—Spring identification mark

NOTE: Intermixing of springs is permissable if problems are experienced in attaining the correct vehicle attitude.

(4) Raise the axle slightly and install the shock absorber lower links.

(5) Install the parking brake cable and adjust as specified in Group 5 — Brakes.

(6) Install the wheels and lower the vehicle to the floor.

(7) With the vehicle in an unladen condition tighten all control arm and assist link nuts and bolts to the specified torque.

NOTE: Failure to tighten the control arms as stated above may result in drive line shudder on initial vehicle movement.

BUSHING REPLACEMENT

Lower Arm Control

(1) With the lower control arm removed, remove the bushing with the aid of a press and suitable removal tool.

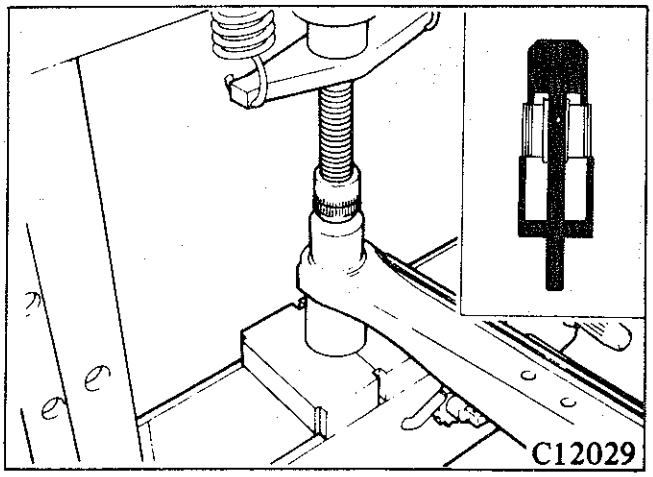


Fig. 4—Removing lower control arm front bushing

(2) Install the front bushing using a press and suitable installation tool. Install the bushing into the chamfered end of the bushing hole of the control arm (Fig. 6) and in the position as shown in Fig. 6, (large cut out facing rear of vehicle).

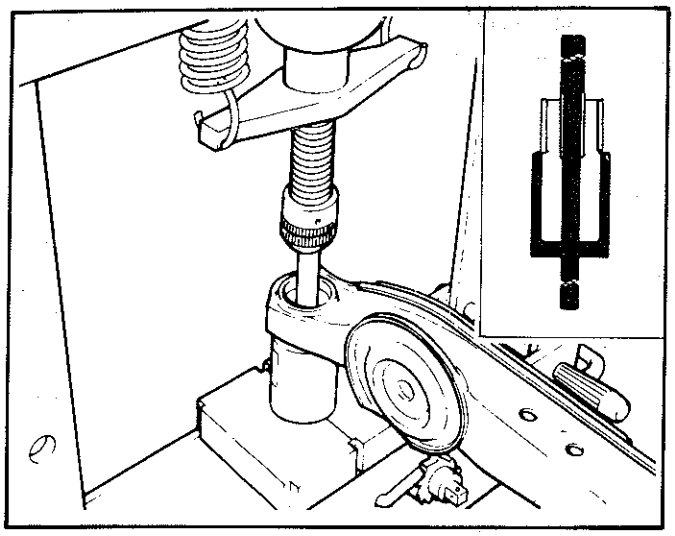


Fig. 5—Removing the lower control arm bushing

(3) Install the lower control arm rear bushing using a press and suitable installation tool. Lubricate the bushing and the bushing hole with a soap solution prior to installation. When installed, ensure the bushing projection past either side of the arm is within the specified limits.

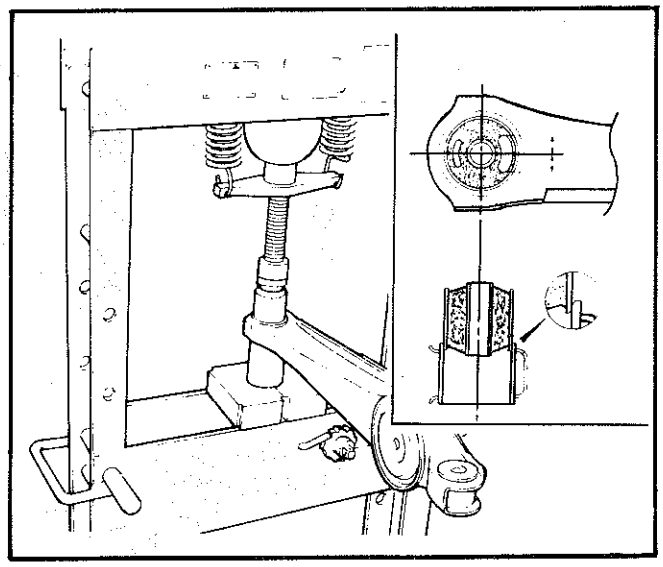


Fig. 6—Installing the lower control arm front bushing

Upper Control Arm

(1) With the upper control arm removed, remove the bushings with the aid of a press and suitable removal tool.

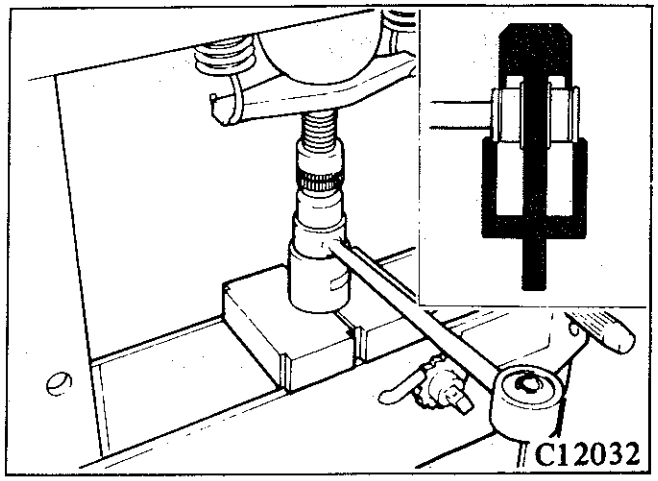


Fig. 7—Removing upper control arm rear bushing

(2) Install the bushing using a press and suitable installation tool. When installed, ensure the bushing projection past either side of the arm is within specified limits.

Assist Link

(1) With the assist link removed, remove the bushing with the aid of a press and suitable removal tool.

(2) Install the bushing using a press and suitable installation tool. Lubricate the bushing and bushing hole with a soap solution prior to installation. When installed ensure the bushing projection past either side of the arm is within the specified limits.

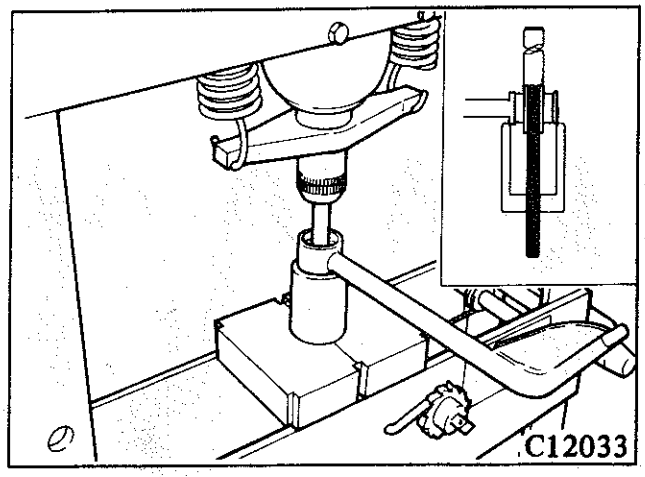


Fig. 8—Removing the assist link bushing

GROUP 19 — STEERING

SECTION 0 — INDEX

SERVICE BULLETIN REFERENCE

DATE	NUMBER	SUBJECT	CHANGES

SECTION 1 — SERVICE DIAGNOSIS

Condition	Possible Cause	Correction
HARD STEERING	(a) Low or uneven tyre pressure	(a) Inflate tyres to correct pressure
	(b) Faulty front wheel alignment	(b) Adjust wheel alignment
	(c) Insufficient steering gear lubricant	(c) Add the required amount of the specified lubricant
	(d) Seized or damaged ball joints	(d) Lubricate or replace ball joints
	(e) Incorrectly adjusted steering gear	(e) Adjust steering gear
	(f) Damaged lower arm or strut	(f) Repair or replace
	(g) Incorrectly adjusted or worn front wheel bearings	(g) Adjust or replace
EXCESSIVE STEERING WHEEL PLAY	(a) Low or uneven tyre pressure	(a) Inflate tyres to correct pressure
	(b) Steering linkage worn or loose	(b) Repair or replace faulty components
	(c) Incorrectly adjusted or worn front wheel bearings	(c) Adjust or replace
	(d) Steering arm loose on steering gear shaft	(d) Inspect for damage to shaft or arm, replace any faulty components
	(e) Steering gear housing attaching bolts loose	(e) Tighten bolts and check for damage
PULL TO ONE SIDE	(a) Incorrect tyre pressure	(a) Inflate tyres to correct pressure
	(b) Incorrectly adjusted front wheel bearings	(b) Adjust bearings as described in Group 22
	(c) Dragging brakes	(c) Check brake adjustment
	(d) Incorrect wheel alignment	(d) Adjust wheel alignment
	(e) Front and rear wheels out of alignment	(e) Repair or replace faulty components
	(f) Broken or sagging spring	(f) Replace spring
	(g) Damaged suspension components	(g) Replace faulty components
WHEEL TRAMP	(a) Incorrect tyre pressure	(a) Inflate tyres to correct pressure
	(b) Incorrectly balanced wheel assembly	(b) Balance wheel assemblies
	(c) Loose tie rod ends	(c) Tighten or replace tie rod ends
	(d) Worn or inoperative shock absorbers	(d) Repair or replace shock absorbers
ROAD WANDER	(a) Incorrect tyre pressure	(a) Inflate tyres to correct pressure
	(b) Faulty steering gear adjustment	(b) Adjust steering gear
	(c) Faulty front wheel bearings	(c) Replace bearings
	(d) Worn tie rod ends	(d) Replace tie rod ends

SECTION 2 —STEERING GEAR

SPECIFICATIONS

Steering gear type	Ball nut (variable ratio)
Ratio	18,5 to 22,5
Steering effort — measured at circumference of steering wheel with front wheels off ground	4,9 Nm (3.6 ft. lbs.) or less
Pitman arm end play	0,5 mm (0.020")
Mainshaft preload	0,34 to 0,54 Nm (3,0 to 4,8 in. lbs.)
Adjusting bolt to T groove axial clearance	0 to 0,05 mm (0 to 0,002")
Cross shaft to mainshaft backlash — measured with ball nut at centre of mainshaft	0 to 0,05 mm (0 to 0,002")
Mainshaft starting torque — gear assembled	0,64 to 0,84 Nm (5.7 to 7.4 in. lbs.)

Lubricant

Type	Hypoid gear oil SAE 90, API GL-4 (or higher)
Quantity	0,26 litres (0.46 pints)

SPECIAL TOOLS

E19M25	Socket preload setting (mainshaft)
E19M35	Pitman arm remover
E2237	Tie rod end, idler arm and relay rod ball joint remover

SPECIFICATIONS

	Nm	lbs./ft.
End cover bolts	15-19	11-14
Upper cover bolts	15-19	11-14
Housing bolts to frame	34-39	25-29
Pitman arm lock nut	127-146	94-108
Tie rod to relay rod lock nut	35-45	26-32

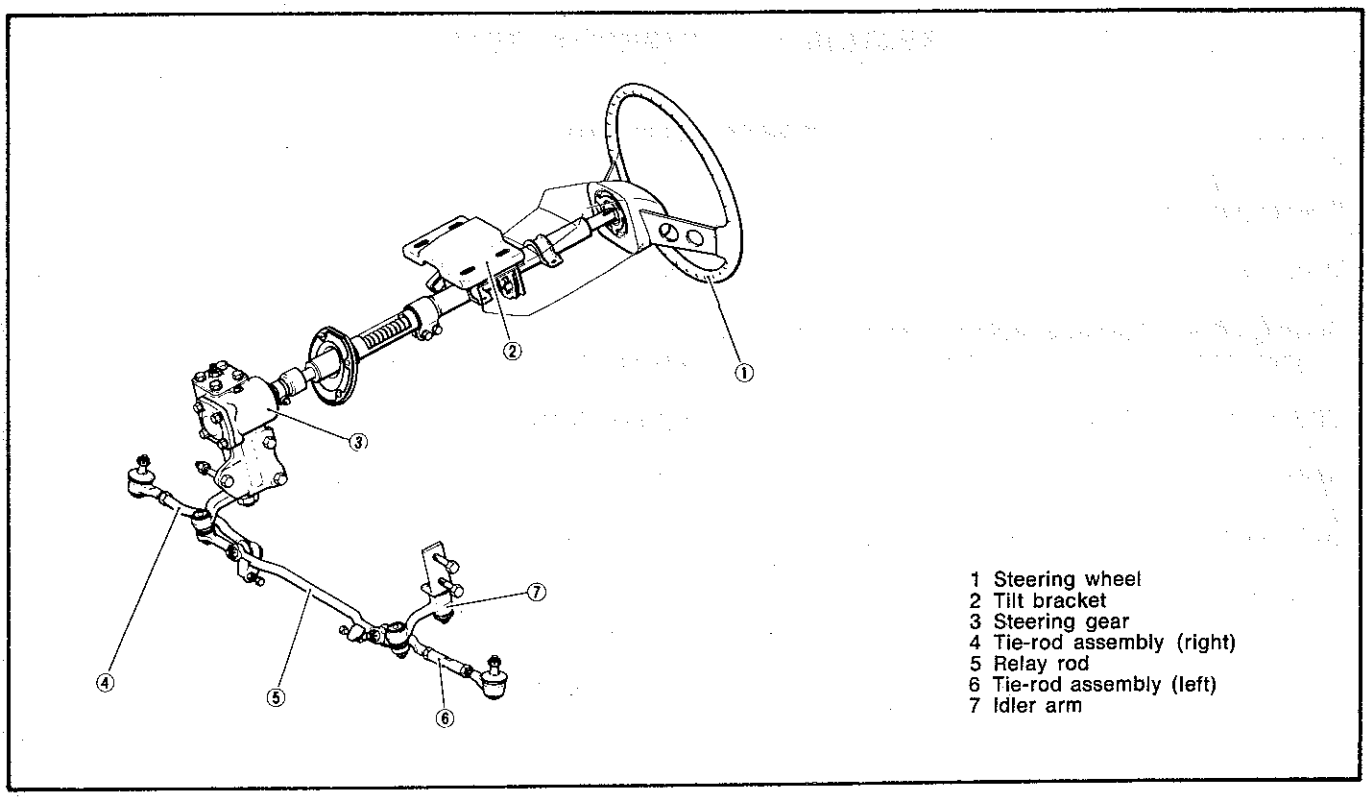


Fig. 1—Details of steering system

GENERAL INFORMATION

The steering gear is a variable ratio recirculating ball assembly with shim adjustment of mainshaft pre-load and screw adjustment of cross shaft to mainshaft backlash. The mainshaft assembly is mounted at each end in roller bearings. The cross shaft is mounted in bushes in the housing with splines on the lower end of the shaft for location of the pitman arm.

INSPECTION AND ADJUSTMENT

Checking Steering Wheel Play

Jack up the front wheels. Place the steering wheel in the straight-ahead position. If the steering wheel play exceeds 25 mm (1 in.), adjust it by means of the steering gear housing adjusting bolt.

The steering effort, measured at the circumference of the steering wheel with the front wheels off the ground should be as specified.

Pitman arm end play should not exceed specification.

NOTE:

- **Since the steering gear is a variable ratio type, it is necessary to place the steering wheel in the 'straight-ahead' position when adjustments are made. Adjustment off the straight-ahead position will result in damage to the gear.**
- **Overtightening the adjustment bolt will increase steering effort and have an adverse effect on steering wheel 'recovery' after cornering.**

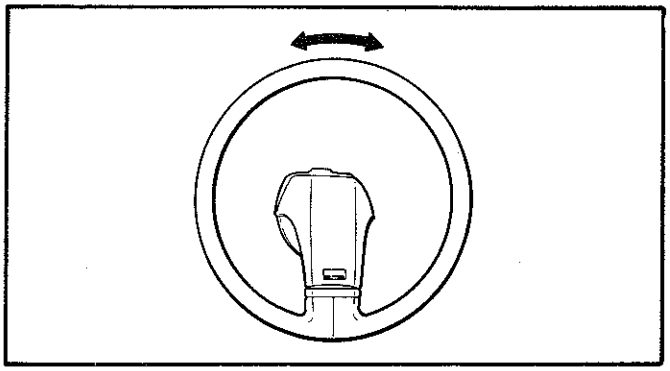


Fig. 2—Steering wheel free play

Checking Steering Gear Oil

Remove the bolt from the right lower corner of the upper cover and insert a special gauge (or a screw driver) up to the looped section of the gauge. The fluid level should be maintained at level A (see fig. 3) which is 22 mm (0.866") from the bottom of the looped section of the gauge. For lubricant type — see Specifications.

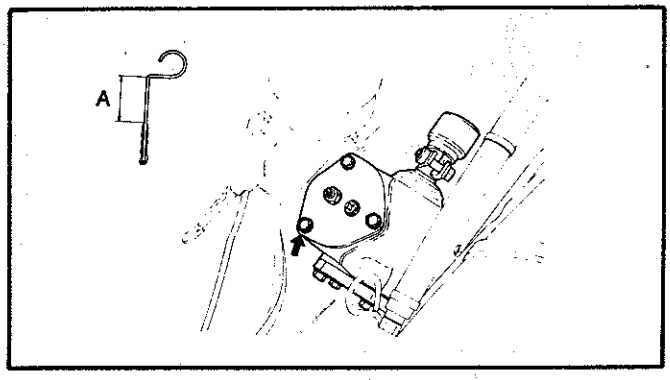


Fig. 3—Checking the steering gear oil level

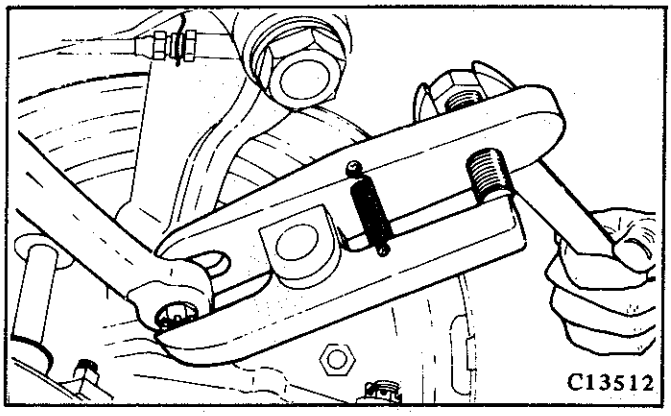


Fig. 5—Removing pitman arm and relay rod

STEERING GEAR

Removal

(1) Disconnect the steering shaft from the steering gear mainshaft.

(2) Disconnect the tie rod from the relay rod and disconnect the pitman arm from the relay rod, using tool number E2237.

(3) Disconnect the steering box to side rail attaching bolts and remove the steering gear through the engine compartment.

(4) Remove the pitman arm from the cross shaft, using tool number E19M35.

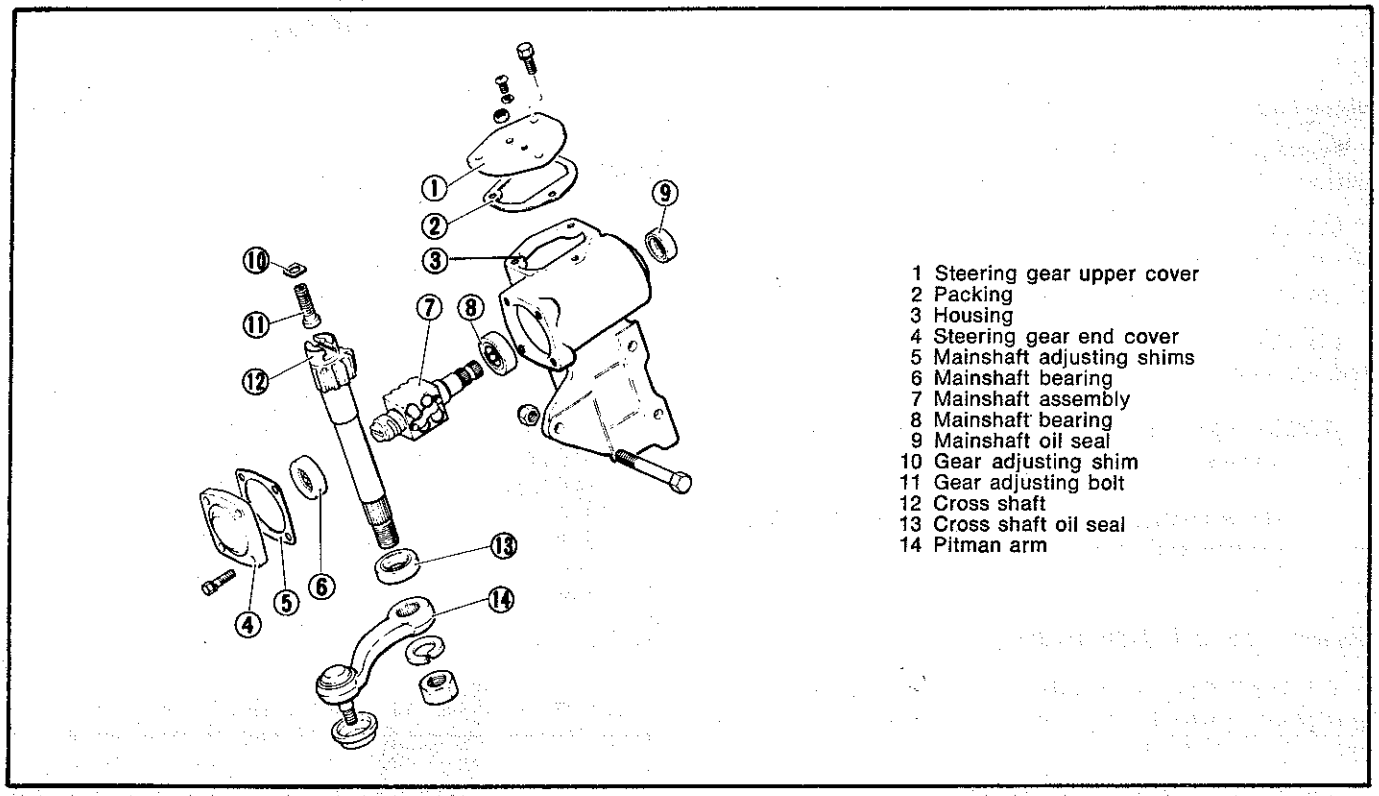
Disassembly

Prior to disassembly, record the starting torque of the mainshaft (as a guide for reassembly).

(1) Remove the lock nut from the steering gear adjusting bolt and turn the bolt slightly counterclockwise. Remove the upper cover bolts.

(2) Slide the upper cover up a little and remove it from the cross shaft. Then draw out the adjusting bolt from the upper cover.

(3) Rotate the mainshaft to place the cross shaft in neutral (straight-ahead) position and then pull the cross shaft out of the gear housing.



1 Steering gear upper cover
2 Packing
3 Housing
4 Steering gear end cover
5 Mainshaft adjusting shims
6 Mainshaft bearing
7 Mainshaft assembly
8 Mainshaft bearing
9 Mainshaft oil seal
10 Gear adjusting shim
11 Gear adjusting bolt
12 Cross shaft
13 Cross shaft oil seal
14 Pitman arm

Fig. 4—Exploded view of steering gear

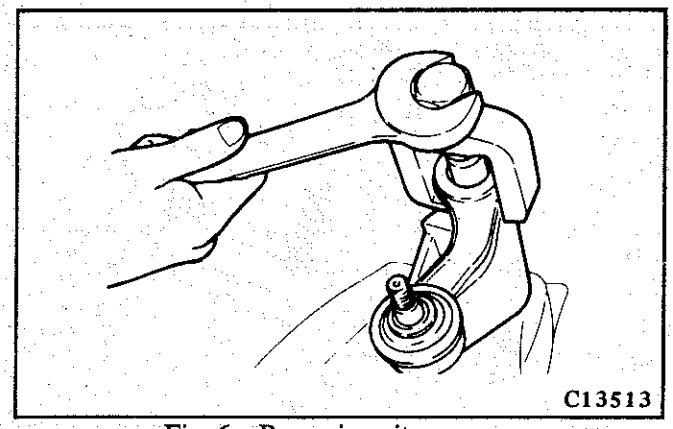


Fig. 6—Removing pitman arm

NOTE: Use care to avoid damage to the cross shaft splines and oil seal.

(4) Measure the mainshaft starting torque with the cross shaft removed.

(5) Remove the end cover and shim by loosening end cover attaching bolts.

NOTE: Keep the mainshaft adjusting shim for convenience of reassembly.

(6) Gently pull out the mainshaft and ball nut assembly and bearings.

NOTE: Do not disassemble the mainshaft and ball nut assembly.

Inspection

Perform the following checks, and correct or replace defective parts.

(1) Check the clearance between the cross shaft and the bushing.

(2) Check the mainshaft bearing for damage and wear.

(3) Check the ball nut for rotation on the mainshaft and axial play.

NOTE: When the mainshaft is positioned vertically, the gear should descend by gravity.

Do not attempt to move the ball nut to either extreme end of the mainshaft.

Reassembly and Adjustment

(1) Hold the gear housing in a vice and insert the mainshaft assembly into the gear housing. Hold the mainshaft horizontally.

Install the oil seal after applying a small amount of chassis grease to its lip.

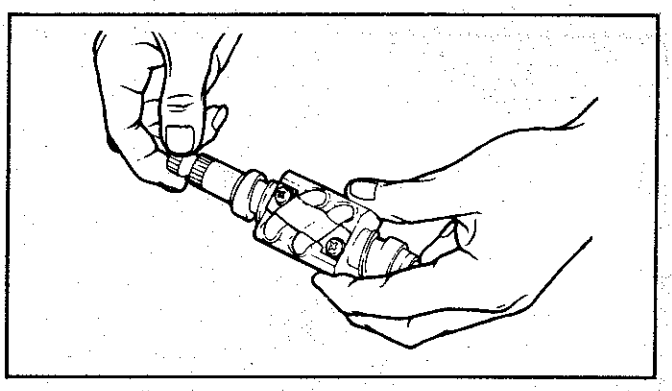


Fig. 7—Checking ball nut

Subsequently install the shim, and then the end cover to the housing. Tighten the end cover bolts to the specified torque. When installing the end cover, apply an appropriate amount of liquid sealer to both sides of the gasket and the bolts.

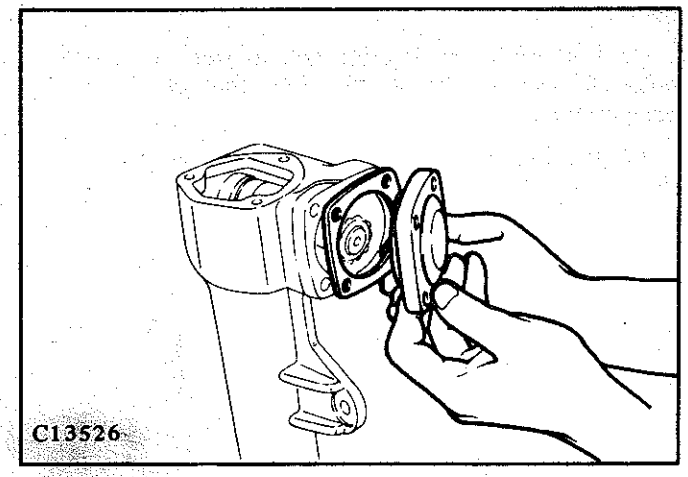


Fig. 8—Installing end cover

Mainshaft Adjusting Shims

Part No.	Thickness
MB005890	0,05 mm (0.0020 in.)
MB005891	0,06 mm (0.0024 in.)
MB005892	0,07 mm (0.0030 in.)
MB005893	0,10 mm (0.0040 in.)
MB005894	0,20 mm (0.0080 in.)
MB005895	0,30 mm (0.0120 in.)
MB005896	0,50 mm (0.0200 in.)

(2) Measure the mainshaft preload using the special tools Preload Socket E19M25 and Torque Wrench. If the measured preload is beyond the specified torque range adjust it by reducing or increasing the assembled thickness of the shim(s).

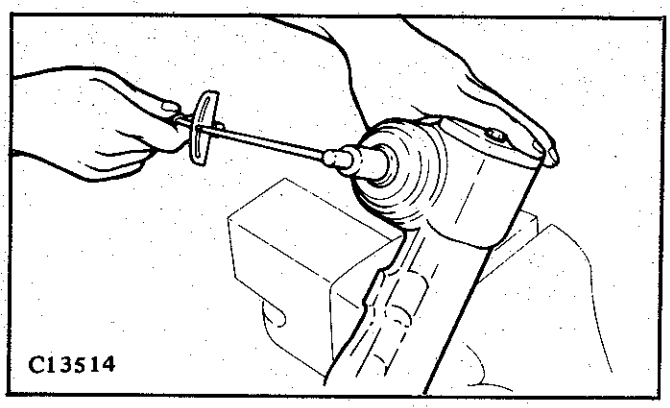


Fig. 9—Checking mainshaft preload adjustment

(3) Install the adjusting bolt and shim in the T groove provided in the cross shaft upper end and adjust the axial play by selecting the shims to meet the specified value.

Cross Shaft Adjusting Shims

Part No.	Thickness
MA180202	1,95 mm (0.077 in.)
MA180203	2,00 mm (0.079 in.)
MA180204	2,05 mm (0.081 in.)
MA180205	2,10 mm (0.083 in.)

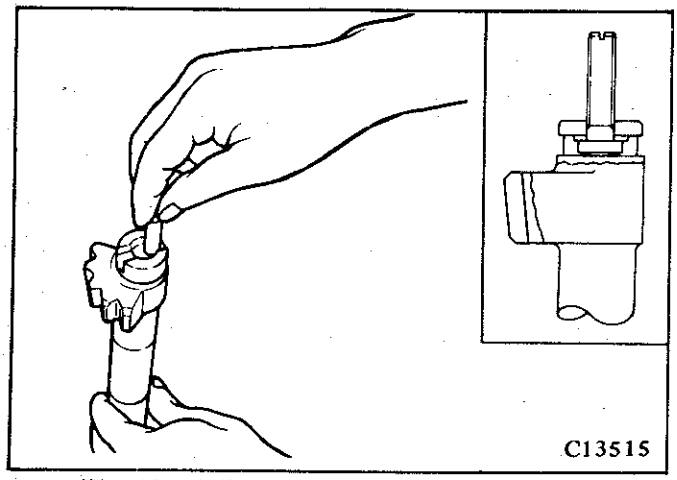


Fig. 10—Adjusting the cross shaft T groove

(4) Insert the cross shaft into the gear housing and tighten the upper cover to the specified torque.

- When meshing the cross shaft gear with the ball nut rack, be careful not to damage the bushing and oil seal.
- Apply a small amount of oil to the ball nut and cross shaft gear and shaft and apply grease to the oil seal lip when installing the cross shaft.
- Apply sealer to upper cover attaching bolts and adjusting bolt before installing the upper cover.

(5) Turn the cross shaft through its travel three to five times (**within** the maximum operating range) making sure that the mating surfaces of the cross shaft and mainshaft mesh smoothly.

(6) Adjust the cross shaft to mainshaft mesh (at the centre position of the mainshaft) to obtain the specified backlash — preferably zero.

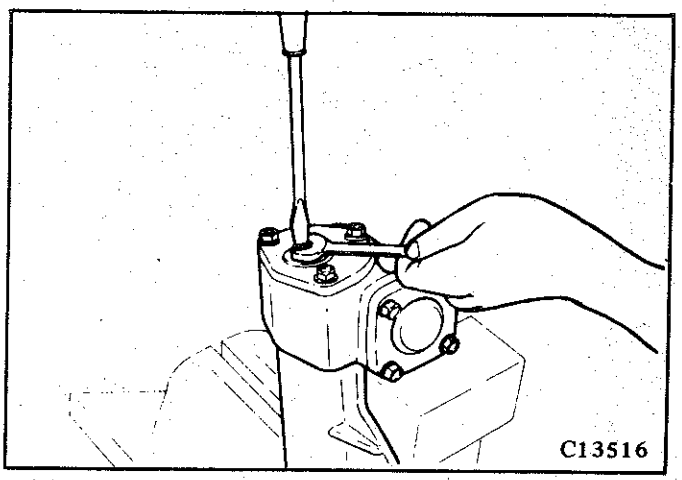


Fig. 11—Adjusting cross shaft to mainshaft backlash

(7) After completion of reassembly, measure the mainshaft starting torque, if it exceeds the specified dimension check the following:

- Check to ensure that the mainshaft turns smoothly throughout its length.
- Cross shaft eccentricity caused by faulty upper cover installation.
- Damaged cross shaft bushing.
- Faulty end cover installation.

(8) Fill the steering gear through the filler plug opening with the specified type and quantity of oil.

Installation

(1) Install the steering gear by reversing the removal procedure and tightening the housing retaining bolts, pitman arm lock nut and tie-rod to relay rod nuts to the specified torque.

(2) The cross shaft pitman arm should be coupled by aligning the cross shaft end slit with the alignment marks on pitman arm and tightening to the specified torque.

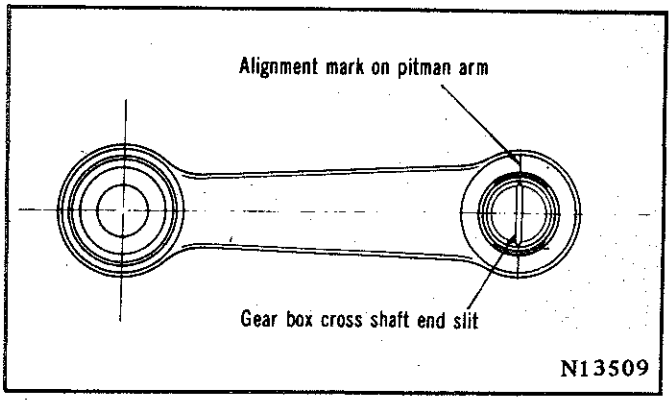


Fig. 12—Coupling pitman arm and cross shaft

SECTION 3 — STEERING COLUMN

SPECIFICATIONS

Steering wheel — four door	Two spoke
— two door	Single spoke
Diameter — four door std.	390 mm (15.35")
— four door sports	380 mm (14.96")
— two door	384 mm (15.12")
Column type	Collapsible bellows type
Tilt stroke — four door	42 mm (1.650")
— two door	40 mm (1.570")
Clearance joint pin A to bearing	0,016 to 0,056 mm (0.0006" to 0.0022")
Clearance joint pin A to socket	0,016 to 0,056 mm (0.0006" to 0.0022")
Fit joint pin B to steering shaft	0,003 mm (0.0001") loose to 0,034 mm (0.0013") interference
Clearance joint pin B to bearing	0,016 to 0,056 mm (0.0006" to 0.0022")
Length of inner steering shaft	823,4 ± 0,7 mm (34.42" ± 0.030")
Maximum runout of inner shaft	0,5 mm (0.020")
Clearance between upper and lower bearing and steering shaft — four door	0,100 to 0,212 mm (0.0039" to 0.0083")
— two door	0,003 to 0,115 mm (0.0001" to 0.0045")
Steering joint assembly free play	0,1 mm (0.004")
Inner shaft protrusion from column tube	92,0 ± 0,5 mm (3.62" ± 0.020")
Total movement of steering shaft measured at circumference of wheel	1 mm (0.040")

SPECIAL TOOLS

E19M10A	Steering wheel puller

TORQUE SPECIFICATIONS

	Nm	lbs./ft.
Column tube clamp bolts	5-8	3.6-5.8
Steering shaft clamp bolt	19-24	14.5-18
Steering wheel lock nut	34-45	25-33

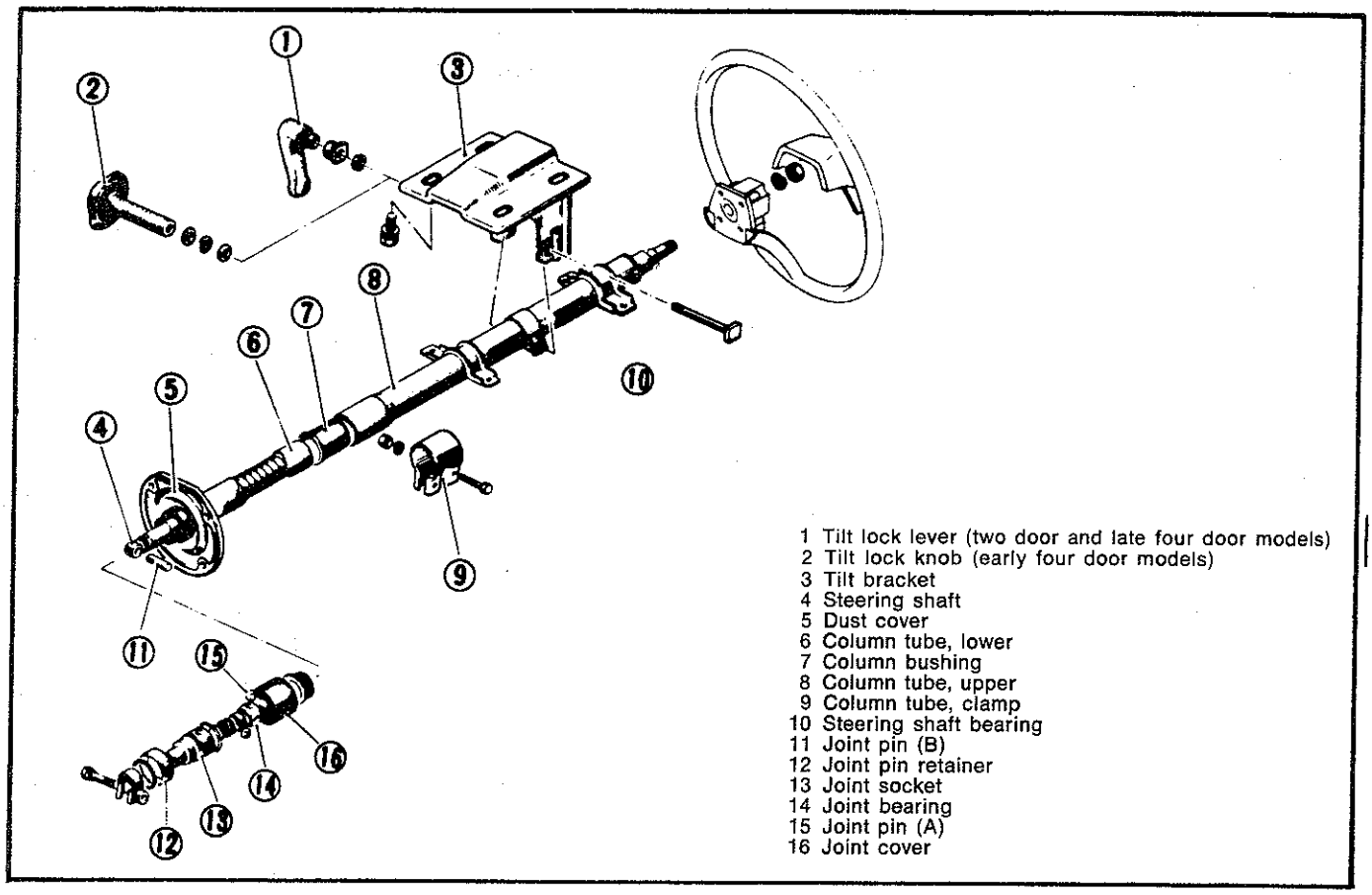


Fig. 1—Exploded view of steering shaft

GENERAL INFORMATION

The steering column is a collapsible type with a sleeve in the lower end of the column partially collapsing on primary impact (the vehicle against another object). On secondary impact (the driver against the steering wheel) further collapsing of the sleeve occurs.

The steering column also incorporates a steering/ignition lock and a facility for raising or lowering the steering wheel for optimum driver comfort.

STEERING COLUMN

Removal

(1) Remove the clamp bolt from the coupling between the steering shaft and the steering gear mainshaft (see fig. 2).

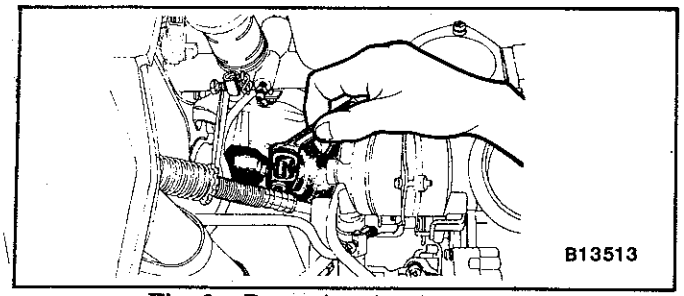


Fig. 2—Removing the clamp bolt

(2) Remove the horn pad by pulling up on the pad (see fig. 3) on two door models and four door models with Sports Pack option. Remove screws on underside of steering wheel spokes on other models and remove horn pad. Remove the steering wheel retaining nut and remove the steering wheel using Special Tool No. E19M10A.

NOTE: Do not apply impact force to the steering wheel during removal or replacement.

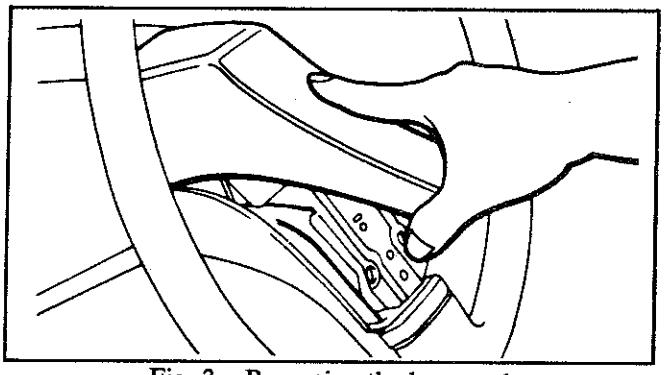


Fig. 3—Removing the horn pad

(3) Loosen the tilt lever or knob and bring the steering shaft to the lowest tilt adjusting position.

(4) Remove the column cover and disconnect the wiring loom connector.

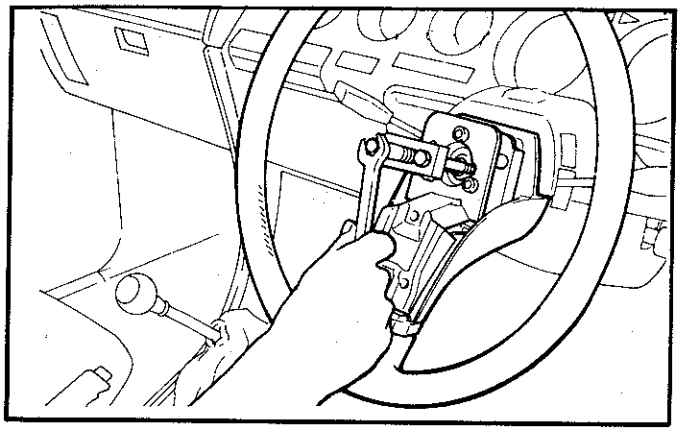


Fig. 4—Removing the steering wheel

(5) Remove the lower dust cover retaining bolts.

(6) Remove the tilt bracket bolts and remove the steering column and tilt bracket assembly from the vehicle.

(7) On two door and late four door models, remove the rubber stopper, the tilt lever and the tilt lock screw. Turn the lever in the direction of the arrow in Fig. 5. On early four door models, remove the knob by turning it counter clockwise.

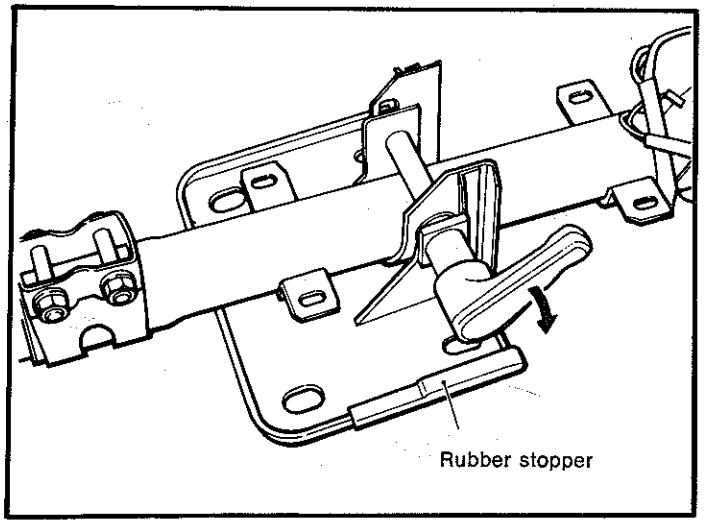


Fig. 5—Removing the tilt lever

Disassembly

(1) Pull the steering shaft lower bearing from the column tube and remove the steering shaft.

(2) Remove the joint socket cover by moving toward the steering shaft. Remove the wire circlip and move the joint pin retaining sleeve toward the socket.

(3) Set the steering shaft in an upright position and while holding the shaft downward, against spring tension, pull out pin A using a magnet. Remove the socket.

NOTE: Never attempt to use a hammer to remove joint pin A. Remove joint B (with a press), only when necessary.

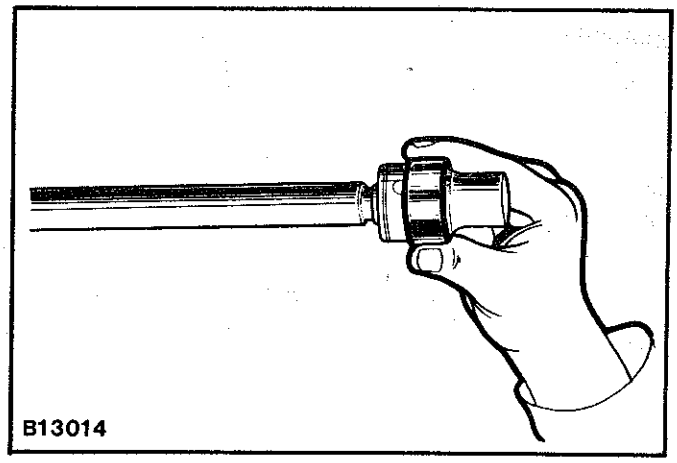


Fig. 6—Removing the joint retainer

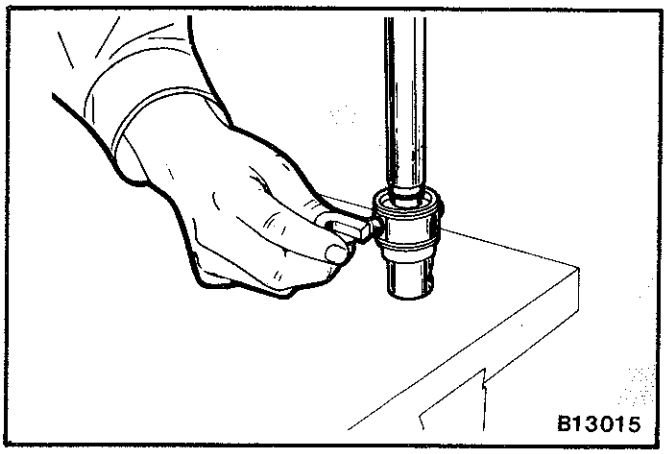


Fig. 7—Removing joint pin (A)

(4) Loosen the column tube clamp and remove the column tube lower by pulling downward. Remove the column bushing.

(5) The retaining screws for the steering column lock bracket are a 'tamper proof' style and will need to have a hacksaw cut made in the screw head to assist in removal. Insert a hacksaw cut and remove the steering wheel lock (fig. 8).

NOTE: Always fit new screws when reassembling the column.

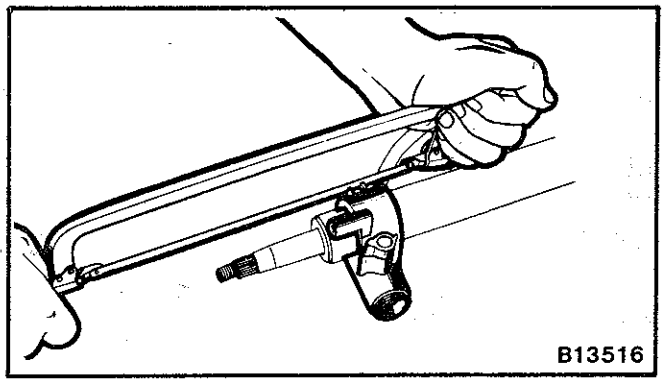


Fig. 8—Removing the steering wheel lock bracket

Inspection

Perform the following checks correcting or replacing any defective parts.

(1) Check the joint pin A, bearing and socket for fit, damage and wear. Clearance between the joint pin A and bearing and the joint pin A and the socket should be as detailed in Specifications.

(2) Check the press fit interference between joint pin B and the steering shaft and make certain that joint pin B rotates smoothly in the bearing without excessive play (see Specifications).

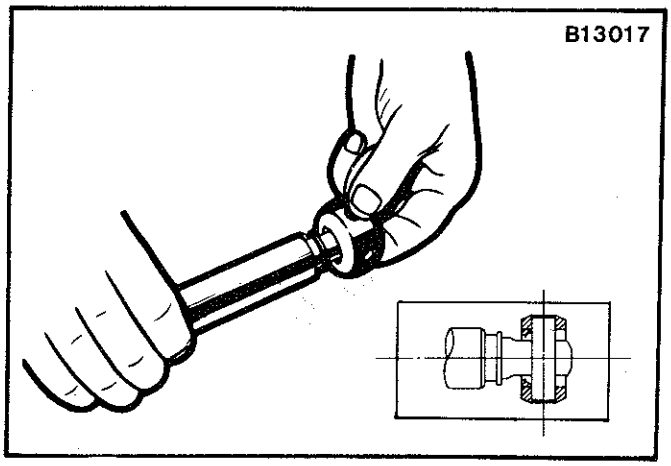


Fig. 9—Checking joint pin (B)

(3) Check the joint cover for cracks or damage.

(4) Check the steering shaft for length and run-out (see Specifications).

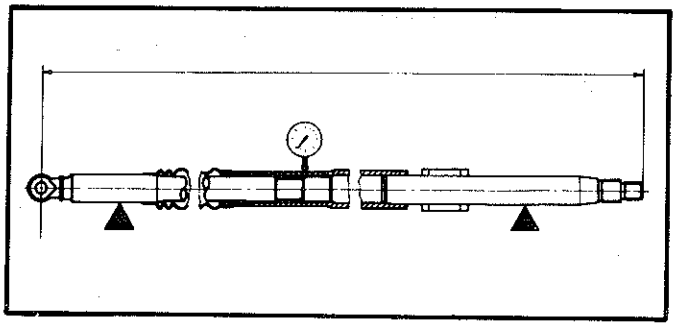


Fig. 10—Checking the steering shaft

(5) While holding down on the lower end of the steering shaft, check for fit between the upper and lower shafts, serration play and damage to the collapsible member.

(6) Check the column bushing stopper for damage.

(7) Check the upper and lower column bearings for damage and wear. Ensure that the clearance between the shaft and column bearings is within the specified limits.

(8) Check the tilt bracket and lock bolts for deformation and cracks.

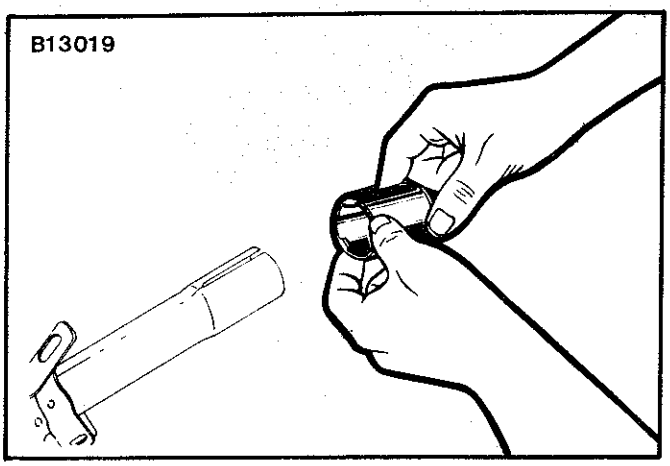


Fig. 11—Checking column bushing

NOTE: The notches shown in fig. 12 are broken by the tilt lock bolt upon secondary impact (the driver's impact on the steering wheel). Pay special attention when checking this area for cracks.

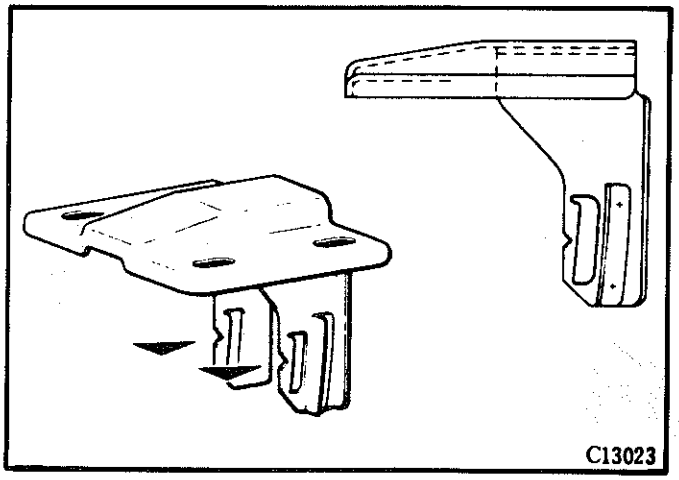


Fig. 12—Inspecting the tilt bracket

Assembly

(1) Install the bearing on the steering shaft lower end with the flanged surface facing upwards. Rotate the bearing 90° and insert the pin B. Make certain that the pin does not project above the bearing surface. Check for correct rotation of the bearing.

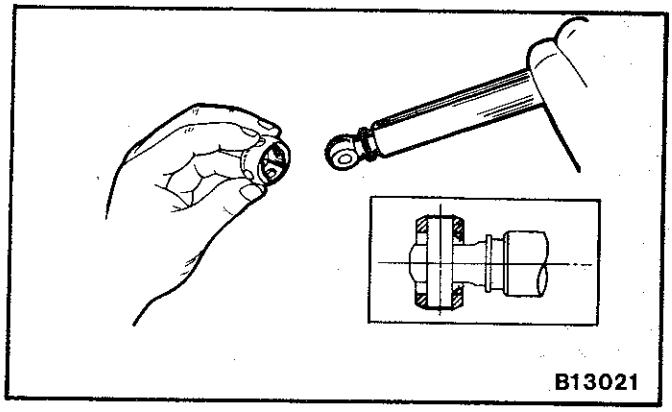


Fig. 13—Installing the joint bearing

(2) To install joint pin A, insert the spring in the socket, hold the steering shaft upright and while applying a downward pressure on the shaft, insert the pin A by hand.

Smear the socket, dust cover and ball seat with multi purpose grease NLGI no. 2 before installing the joint pin.

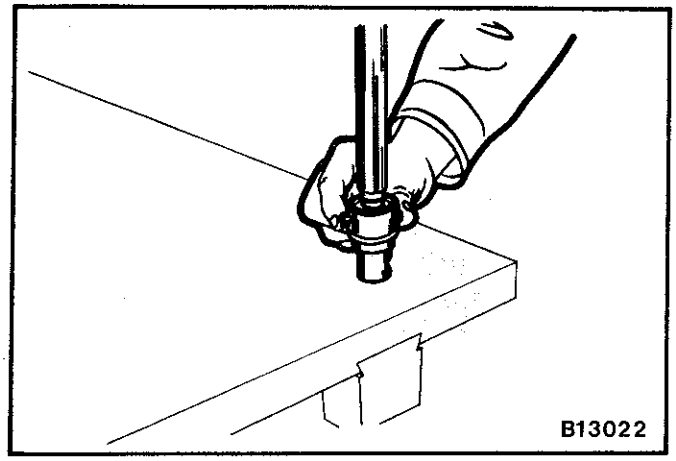


Fig. 14—Installing the joint pin (A)

After installation of joint pin A, make sure the socket and shaft rotates properly and free play is maintained within the specified limits. If free play is excessive, replace the joint pin.

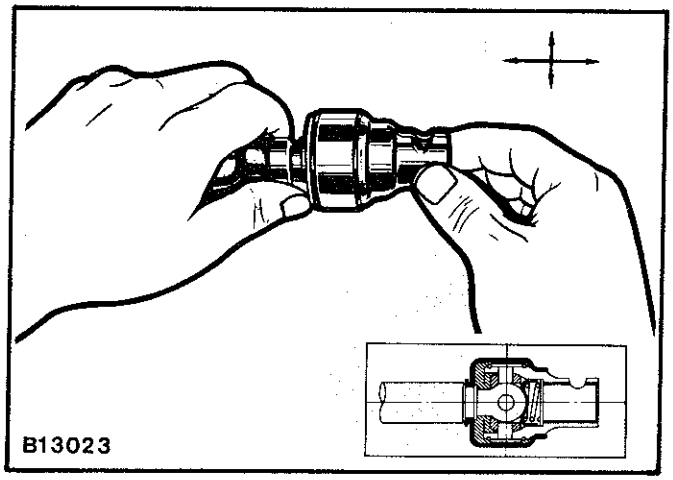


Fig. 15—Checking the joint pin

(3) Pack a sufficient amount of multi purpose grease, NLGI no. 2, in the upper and lower bearing, install a spacer onto the shaft and insert the steering shaft in the column tube. When installing the lower bearing in the column tube, wipe all oil and grease from the outside diameter of the bearing retainer (rubber) and the inside diameter of the steering column. Insert the bearing and apply a slight amount of adhesive to the end of the column, do not smear the bearing inside diameter with adhesive.

(4) Install the tilt bracket as follows:

Two Door and Late Four Door Models

• Place the column tube on the tilt bracket and insert the bolts. Screw the left hand thread tilt screw fully onto the tilt lever as shown in fig. 16. Back the screw off a half turn.

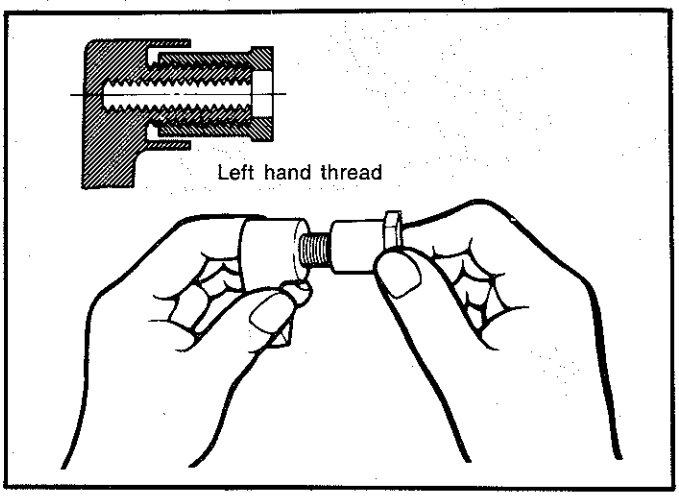


Fig. 16—Setting the tilt screw

Install the tilt lock lever and screw assembly onto the bolt and turn it until it contacts the end of the stopper. Note the left hand thread.

With the square face of the screw placed on the stopper surface, rotate the lever in the direction of the arrow (on the lever). Tighten the lever to check its position.

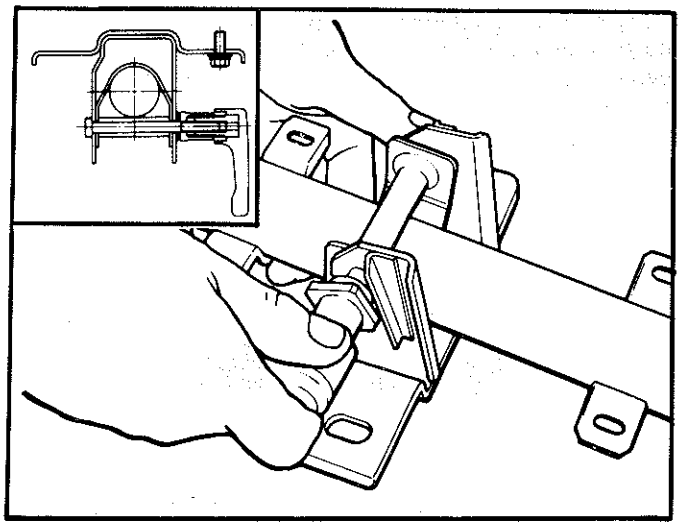


Fig. 17—Tightening the tilt lever

If the lever does not lock in the position illustrated in fig. 18, loosen the lever and adjust its position by rotating the square section, tilt screw or the bolt.

Four Door Models (Early)

Install the tilt bracket on the column tube and insert the bolts. Fit a plain spring and plain washer and the tilt knob in that order.

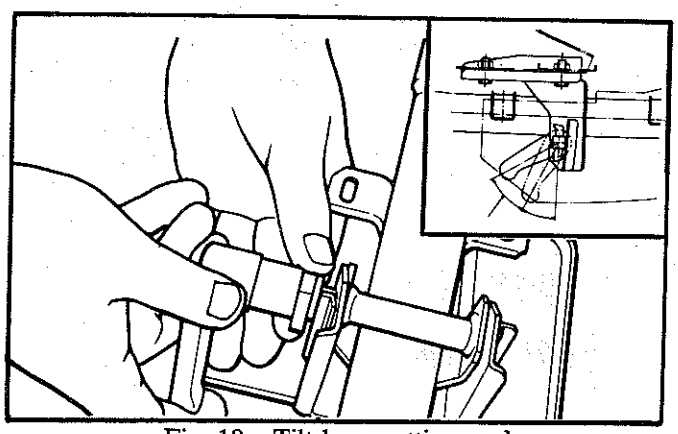


Fig. 18—Tilt lever setting angle

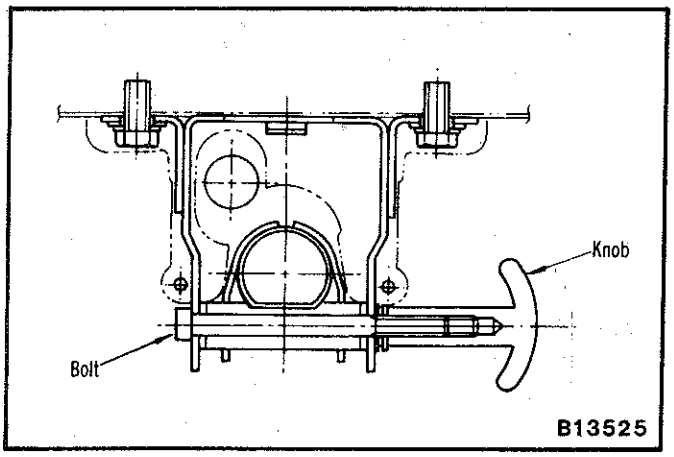


Fig. 19—Installing the tilt knob

(5) Install the column tube bushes into the upper and lower column tubes until the bushing stopper touches the column tube end. Position the column tube clamp with the bolts facing downwards, tighten the clamp bolts to the specified torque.

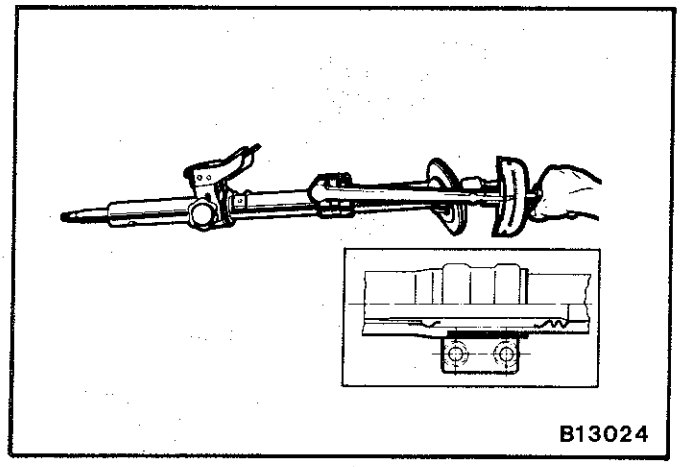


Fig. 20—Tightening column clamp bolts

(6) Temporarily install the steering column lock by aligning the column tube hole with the guide dowel on the steering column lock. Insert the ignition key and ensure that the lock functions correctly.

NOTE: Final tightening of the steering column lock should not be conducted until the steering column is installed in the vehicle.

Installation

(1) Align the socket bolt hole and the clamp — see fig. 21.

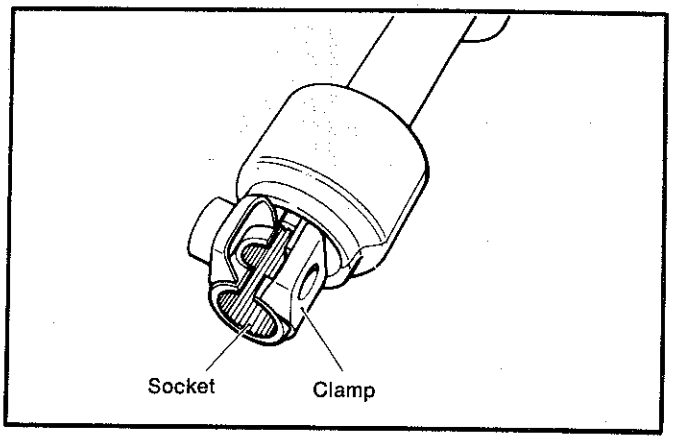


Fig. 21—Positioning the socket and clamp

(2) Install the steering column assembly in the vehicle. Connect the steering shaft clamp so that the bolt hole of the socket faces down when the steering box mainshaft is in the straight ahead position.

(3) Temporarily attach the tilt bracket to the instrument panel. Tighten the lower steering clamp to the specified torque.

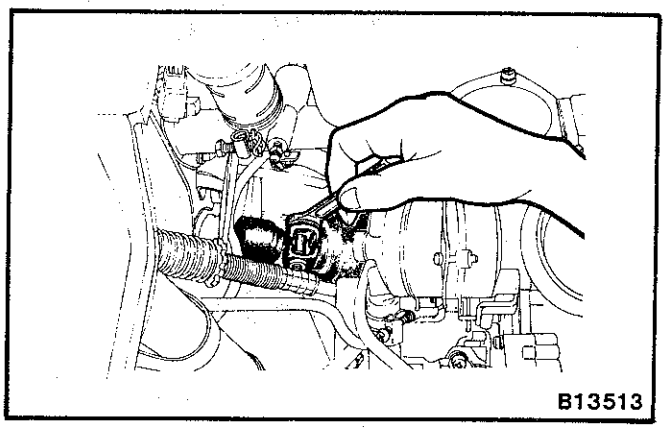


Fig. 22—Tightening steering shaft clamp bolt

(4) Position the tilt bracket to maintain the specified distance between the steering shaft top end and the upper end of the column tube, fig. 23. Tighten the tilt bracket mounting bolts.

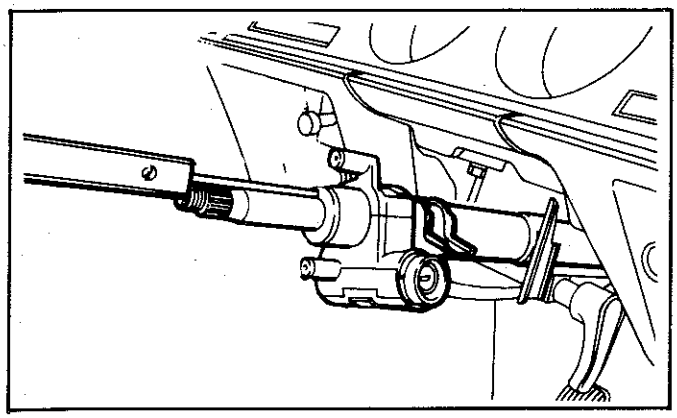


Fig. 23—Installing the steering shaft

(5) Ensure that the steering column lock is correctly located and tighten the retaining screws.

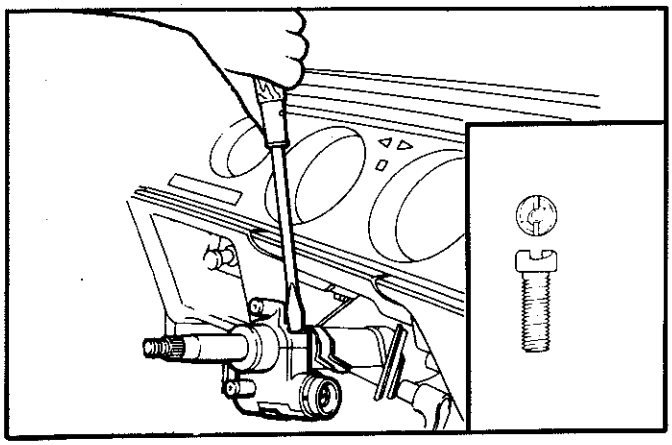


Fig. 24—Tightening the steering column lock

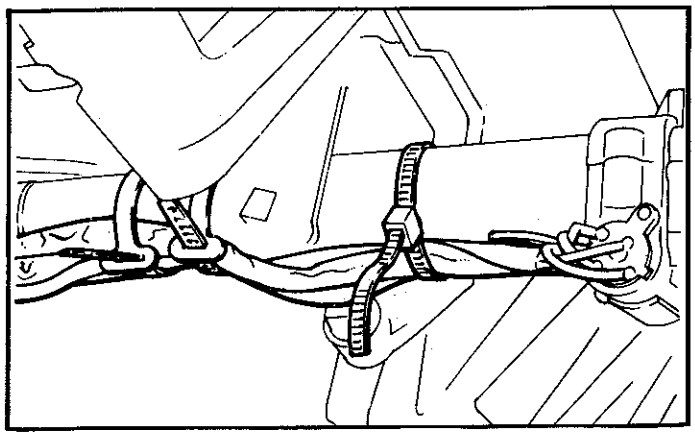


Fig. 25—Installing the column switch harness

(6) Attach the lower dust cover to the body applying sealer to the attaching bolts.

(7) Install the column switch (if removed), lay wiring harness along the centre of the column tube allowing clearance to all adjacent parts and secure with retaining clips.

(8) Connect the steering column wiring harness to the main wiring loom.

(9) Install the column cover.

(10) Set the front wheels in the straight ahead position, insert the steering wheel onto the shaft, fit the three cancel pins of the column switch into the holes in the steering wheel. If it is necessary to align the cancel pins and the steering wheel holes insert a screwdriver through the steering wheel and position the cancel pins, fig. 26.

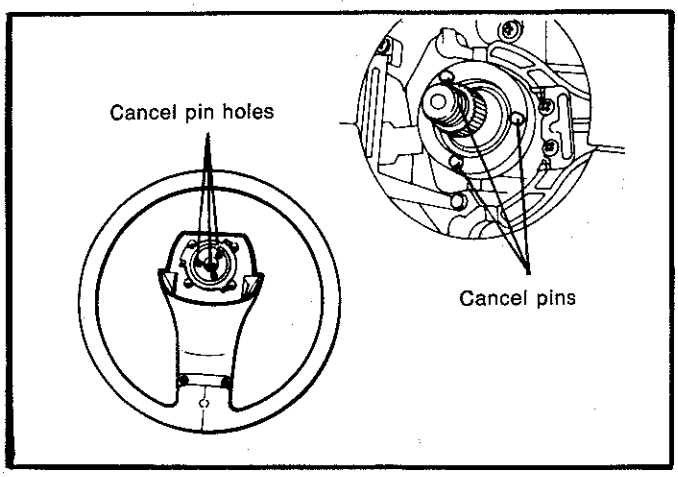


Fig. 26—Installing the steering wheel

(11) Tighten the steering wheel lock nut to the specified torque.

(12) Check that the total vertical and horizontal movement of the steering shaft (measured at the circumference of the steering wheel) is within the specified limits.

(13) Install the horn pad.

SECTION 4 — STEERING LINKAGE

SPECIFICATIONS

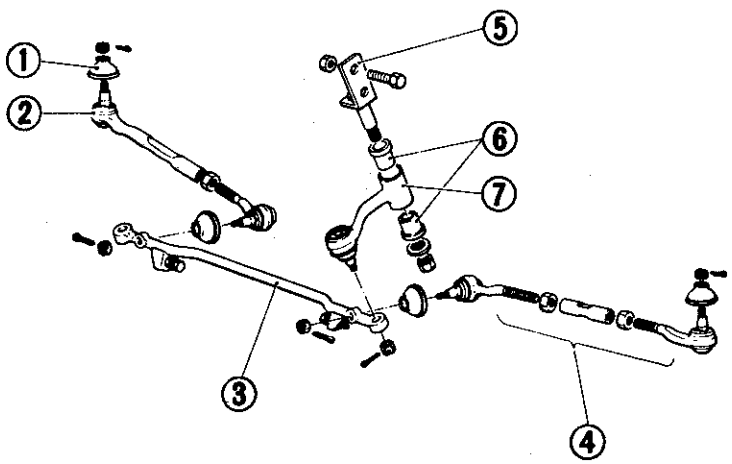
Distance between tie rod end studs	313 to 315 mm (12.32" to 12.40")
Relay rod to pitman arm/idler arm clearance	3,7 to 4,3 mm (0.150" to 0.170")
Idler arm starting torque	1,4 to 5 Nm (13 to 40 lbs. in.)
Lubricant — type	Multi purpose grease NLGI no. 2
— quantity per joint	5 ml (0.3 $in.^3$)

SPECIAL TOOLS

Tie rod end, idler arm, relay rod ball joint remover	E2237

TORQUE SPECIFICATIONS

	Nm	lbs./ft.
Tie rod end nut	35-45	26-32
Relay rod to pitman arm lock nut	35-45	26-32
Relay rod to idler arm lock nut	35-45	26-32
Idler arm to support	39-58	29-43



1 Dust boot
2 Tie rod end outer
3 Relay rod assembly
4 Tie rod assembly, LH
5 Idler arm bracket
6 Idler arm bushing
7 Idler arm

Fig. 1—Exploded view of steering linkage

TIE ROD ASSEMBLY

Removal

(1) Disconnect the tie rod ends using Tool No. E2237.

(2) Remove the tie rod ends from the tie rods.

NOTE:

- **The tie rod end (outer) is a left-hand thread and the tie rod end (inner) is a right-hand thread.**
- **The tie rod end socket plug is swaged into place and cannot be replaced.**

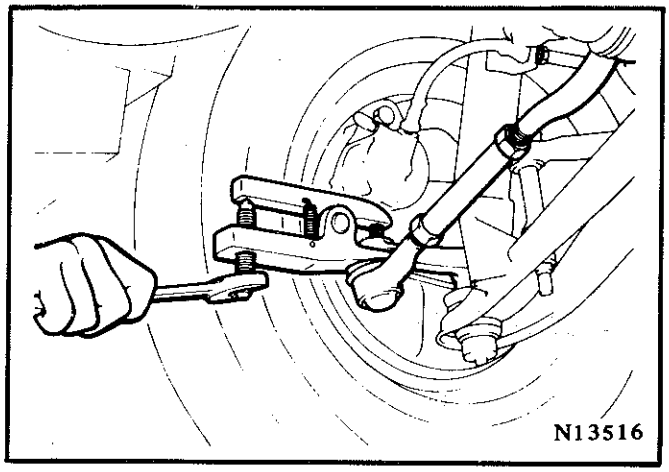


Fig. 2—Removing tie rod end

Inspection

Perform the following checks, and repair or replace any defective components.

(1) Check the tie rod end for damage and deformation.

(2) Check the tie rod end socket and stud for axial play.

(3) Check the dust boot for damage and cracks.

Installation

Install by reversing removal procedure noting the following:

(1) Coat the boot lip with grease and fill the inside of the dust boot with the specified type and quantity of grease before installing a new dust boot. Apply a liquid sealer to the tie rod mounting surface.

(2) Temporarily tighten the nuts so that the specified distance is maintained between the stud bolts at both ends of each tie rod assembly (Refer Fig. 4).

NOTE:

- **Tie rod ends should be turned in evenly so that dimensions 'A' (Fig. 4) are similar.**
- **Lubricate the tie rod threaded ends with multi-purpose grease.**

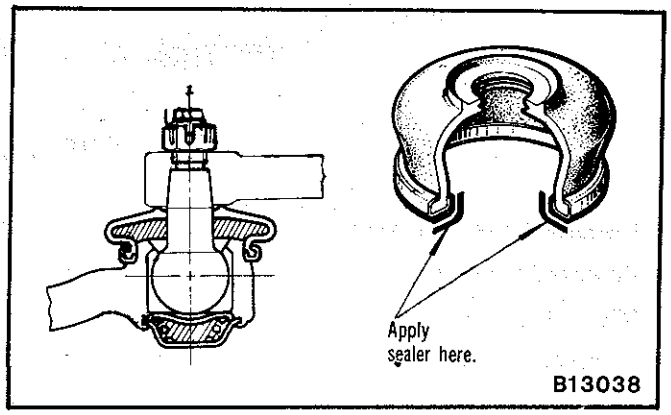


Fig. 3—Dust boot sealer application points

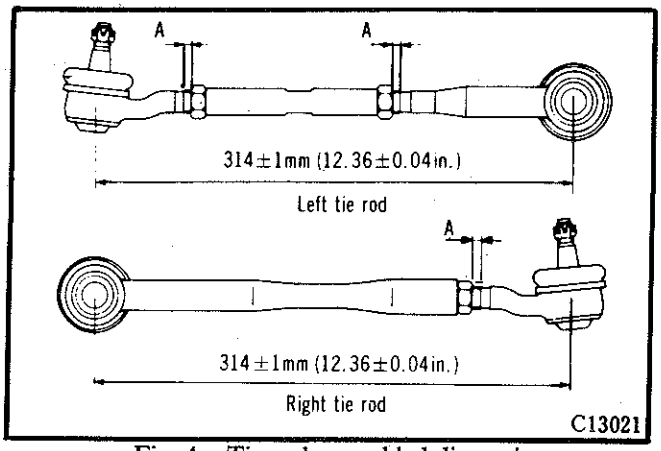


Fig. 4—Tie rod assembled dimensions

(3) When connecting the tie rod assembly to the knuckle arm, tighten the nuts to the specified torque, install a split pin as shown in Fig. 5. Subsequently adjust the toe-in and tighten the lock nut to the specified torque. (Refer to Group 2.)

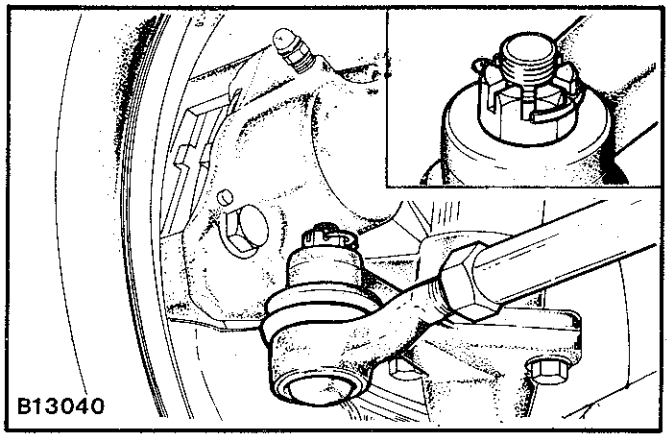


Fig. 5—Installing the tie rod assembly

RELAY ROD

Removal

(1) Remove the tie rods end joint, disconnect the pitman arm from the idler arm, using Tool No. E2237, remove the relay rod.

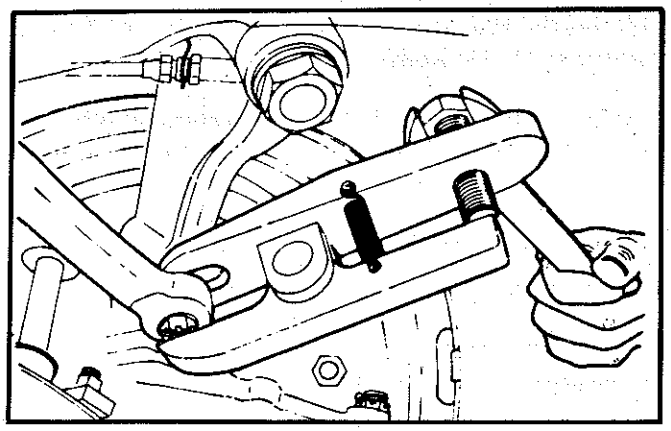


Fig. 6—Removing relay rod

Inspection

Perform the following check and repair or replace any defective components.

(1) Check the relay rod for damage and deformation.

Installation

Install by reversing removal procedure noting the following:

(1) Tighten the relay rod to pitman arm lock nut and the relay rod to idler arm lock nut to the specified torque.

(2) After the relay rod has been installed to the pitman arm and idler arm, check to ensure that clearance A, shown in Fig. 7, falls within the specified dimension.

(3) Install and seal the dust boot as previously described (refer Tie Rods).

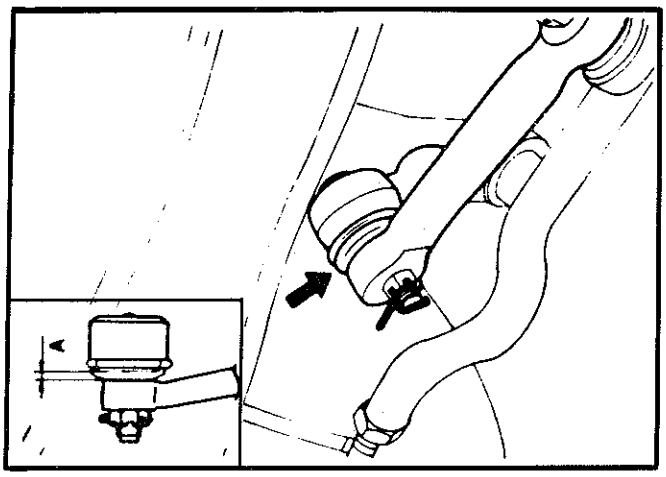


Fig. 7—Checking relay rod-to-pitman arm clearance and relay rod-to-idler arm clearance

IDLER ARM

Removal

(1) Disconnect the tie rod ends and disconnect the idler arm from the relay rod using Tool No. E2237.

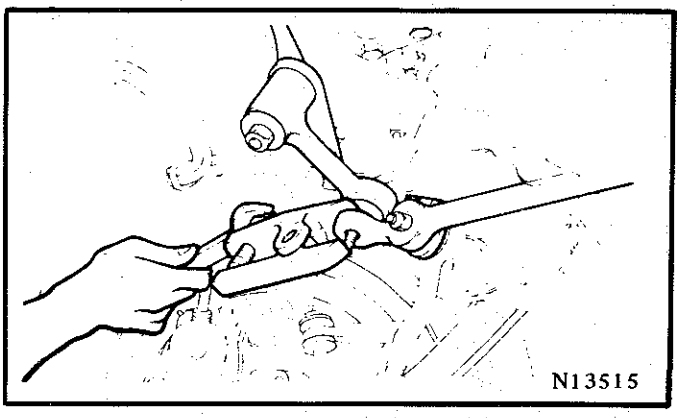


Fig. 8—Removing idler arm

(2) Detach the arm support from the body frame and remove the idler arm.

NOTE: Do not disassemble the idler arm and support unless absolutely necessary.

Inspection

Perform the following checks and repair or replace any defective components.

(1) Check the idler arm for damage or deformation and check the stud for looseness.

(2) Check the idler arm bearing for looseness.

Installation

Install by reversing removal procedure noting the following:

(1) Apply neutral detergent to the inside surface of the idler arm and outside surface of the bushing, and insert the bushing up to the stepped portion. If it is hard to insert, force it with a vice. After the bushing has been inserted, thoroughly wipe away the neutral detergent.

(2) Apply a thin coat of lithium base chassis grease to the shaft portion of the arm support and the inside surface of the bushing and insert the arm.

(3) Next, position the arm as illustrated in Fig. 9 and tighten to the specified torque.

Install the washer with the knurled surface directed toward the bushing.

NOTE:

- **The retaining nut is a self-locking type which should be renewed whenever it is removed.**
- **Only apply grease to the specified area, refer Fig. 9.**

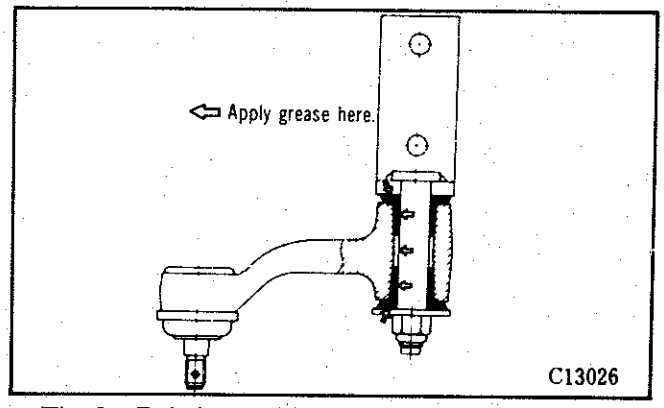


Fig. 9—Relative position of idler arm and support

(4) Install and seal the dust boot as previously described (refer Tie Rods).

(5) After the idler arm has been assembled, ensure the turning torque of the arm does not exceed the specified value.

(6) Tighten the idler arm to body frame bolts to the specified torque.

(7) After assembly of the idler arm to relay rod, check that the clearance between the bottom surface of the idler arm and the relay rod is within specification.