

## SECTION 3B1

## POWER RACK AND PINION

**CAUTION:** To help avoid personal injury when a car is on a hoist, provide additional support for the car at the end opposite from which components are being removed. This will reduce the possibility of the car falling off the hoist.

**NOTICE:** All steering fasteners are important attaching parts that could affect the performance of vital parts and systems, and/or could result in major repair expense. They must be replaced with one of the same part number (or with an equivalent part) if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of these parts.

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## GENERAL INFORMATION

## DESCRIPTION OF POWER RACK AND PINION

The power rack and pinion steering system has a rotary control valve which directs hydraulic fluid coming from the hydraulic pump to one side or the other side of the rack piston. The integral rack piston is attached to the rack. The rack piston converts hydraulic pressure to a linear force which moves the rack left or right. The force is then transmitted through the inner and outer tie rods to the steering knuckles, which turn the wheels.

If hydraulic assist is not available, manual control is maintained, however, under these conditions, more steering effort is required. The movement of the steering wheel is transferred to the pinion. The movement of the pinion is then transferred through the pinion teeth, which mesh with teeth on the rack, causing the rack to move.

A vane-type pump provides hydraulic pressure for the system.

## SEAL REPLACEMENT RECOMMENDATIONS

Lip seals, which seal rotating shafts, require special treatment. This type of seal is used on the steering gear at the pinion shaft. When a leak occurs in this area, always replace the seal after inspecting and thoroughly cleaning the sealing surface. Replace the shaft only if very severe pitting is found. If the corrosion in the lip seal contact zone is slight, clean the surface of the shaft with crocus cloth. Replace the shaft only if the leakage cannot be stopped by smoothing with crocus cloth first.

## CHECKING AND ADDING FLUID

Power steering fluid level is indicated either by marks on a see-through fluid reservoir or by marks on a fluid level indicator on the fluid reservoir cap.

**NOTICE:** When adding fluid or making a complete fluid change, always use GM Part No. 1050017 (or equivalent) power steering fluid. Failure to use the proper fluid will cause hose and seal damage and fluid leaks.

If the fluid is warmed up, about 66° C (150° F) – hot to the touch, the fluid level should be between the “HOT” and “COLD” marks.

If the fluid is cool, about 21° C (70° F), the fluid level should be between the “ADD” and “COLD” marks.

### ON-CAR SERVICE

#### BLEEDING POWER STEERING SYSTEM

If the power steering hydraulic system has been serviced, an accurate fluid level reading cannot be obtained unless air is bled from the system. Follow these steps to bleed air:

1. With the wheels turned all the way to the left, add power steering fluid to the “COLD” mark on the fluid level indicator.
2. Start the engine. With the engine running at fast idle, recheck the fluid level. If necessary, add fluid to bring the level to the “COLD” mark.
3. Bleed the system by turning the wheels from side to side without hitting stops. Keep the fluid level just above the internal pump casting, or at the “COLD” mark. Fluid with air in it has a light tan or red appearance. This air must be eliminated from the fluid before normal steering action can be obtained.
4. Return the wheels to the center position. Continue running the engine for two or three minutes.
5. Road test the car to be sure the steering functions normally and is free from noise.
6. Recheck the fluid level as described in Steps 1 and 2. Make sure the fluid level is at the “HOT” mark after the system has stabilized at its normal operating temperature.

**NOTICE:** When adding fluid or making a complete fluid change, always use GM Part No. 1050017 (or equivalent) power steering fluid. Failure to use the proper fluid will cause hose and seal damage and fluid leaks.

#### IDLE SPEED POWER STEERING PRESSURE SWITCH

##### Remove or Disconnect

1. Electrical connection
2. Switch

##### Install or Connect

1. Switch
2. Electrical connection

##### Inspect

- For leaks

## A CARLINE

### Rack and Pinion Assembly

See Figure 1

Tools Required:  
J 24319-01 Puller

#### Remove or Disconnect

- See the “CAUTION” on page 1.
1. Air cleaner
  2. Intermediate shaft lower pinch bolt
  3. Intermediate shaft from stub shaft

**CAUTION:** Failure to disconnect the intermediate shaft from the rack and pinion stub shaft can result in damage to the steering gear and/or intermediate shaft. This damage can cause loss of steering control which could result in personal injury.

4. Line retaining clips
5. Lines at gear from pump
6. Raise car with suspension contact hoist. See Section 0A.
7. Both front tire and wheel assemblies
8. Tie rod ends from knuckles with J 24319-01
9. Remaining brackets and clips on crossmember
10. Support body with stands to allow lowering of frame.
11. Rear frame mount bolts and lower rear of frame up to 128 mm (5"). See Section 2A.

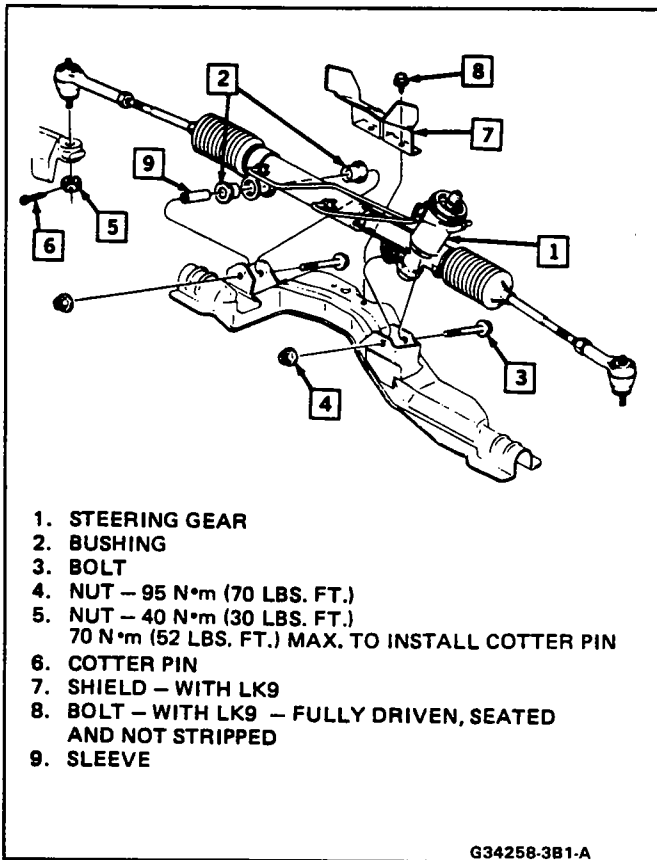
**NOTICE:** Do not lower rear of frame too far as damage to engine components nearest to the cowl may result.

12. Heat shield if equipped
13. Rack and pinion mounting bolts
14. Rack and pinion through left wheel opening

#### Install or Connect

1. Rack and pinion through left wheel opening
2. Rack and pinion mounting bolts and tighten to specifications
3. Heat shield if equipped
4. Raise frame and install rear frame bolts and tighten to specifications. See Section 2A.
5. Remove stands.
6. Brackets and clips on crossmember
7. Tie rod ends and tighten to specifications
8. Both tire and wheel assemblies and tighten to specifications. See Section 3E.
9. Lower car.
10. Lines at gear from pump and tighten to specifications
11. Line retaining clips
12. Intermediate shaft at stub shaft and tighten pinch bolt to specifications. See Section 3B4.
13. Air cleaner
14. Fill with fluid.
15. Bleed air from system.

-  **Inspect**
- For leaks



1. STEERING GEAR
2. BUSHING
3. BOLT
4. NUT - 95 N\*m (70 LBS. FT.)
5. NUT - 40 N\*m (30 LBS. FT.)  
70 N\*m (52 LBS. FT.) MAX. TO INSTALL COTTER PIN
6. COTTER PIN
7. SHIELD - WITH LK9
8. BOLT - WITH LK9 - FULLY DRIVEN, SEATED  
AND NOT STRIPPED
9. SLEEVE

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Figure 1 Rack and Pinion Mounting - A Carline

**Hose and Pipes**

See Figures 2 thru 4

 **Remove or Disconnect**

1. Clips or clamps
2. Lines at rack and pinion and pump
3. Hose or pipe


 **Install or Connect**

1. Hose or pipe
2. Lines at rack and pinion and pump and tighten to specifications
3. Clips or clamps
4. Fill with fluid.
5. Bleed air from system.

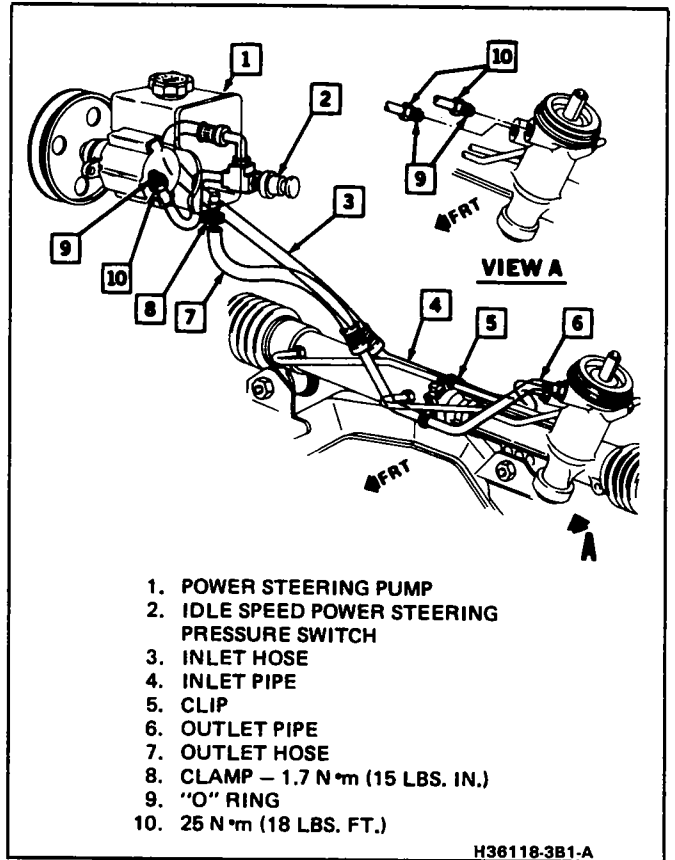
-  **Inspect**
- For leaks

**Cooling Pipe To Steering Gear Hose**

See Figure 6

 **Remove or Disconnect**

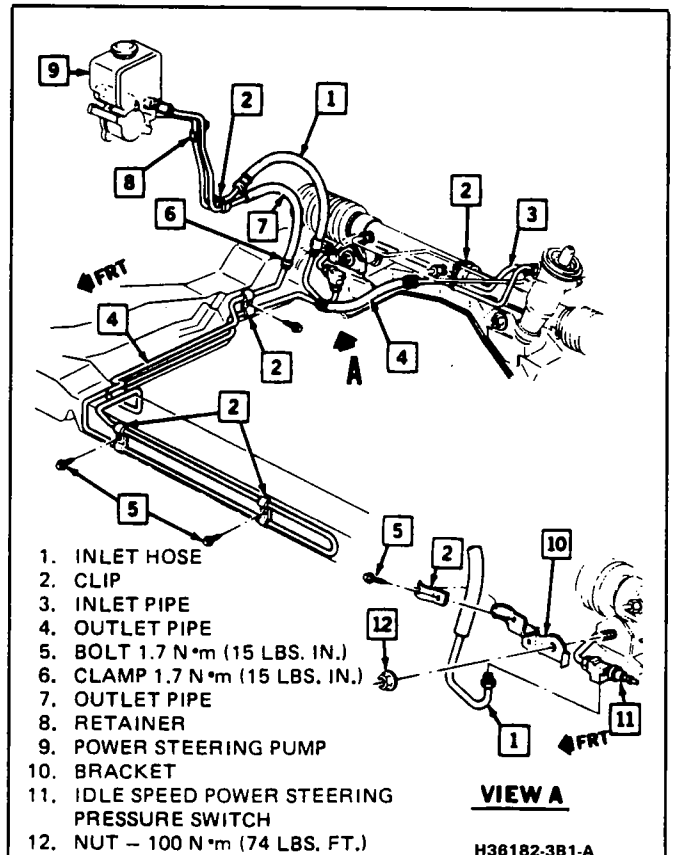
1. Raise car. See Section 0A.
2. Heat shield



1. POWER STEERING PUMP
2. IDLE SPEED POWER STEERING PRESSURE SWITCH
3. INLET HOSE
4. INLET PIPE
5. CLIP
6. OUTLET PIPE
7. OUTLET HOSE
8. CLAMP - 1.7 N\*m (15 LBS. IN.)
9. "O" RING
10. 25 N\*m (18 LBS. FT.)

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Figure 2 Power Steering Line Routing - A Carline, VIN R



1. INLET HOSE
2. CLIP
3. INLET PIPE
4. OUTLET PIPE
5. BOLT 1.7 N\*m (15 LBS. IN.)
6. CLAMP 1.7 N\*m (15 LBS. IN.)
7. OUTLET PIPE
8. RETAINER
9. POWER STEERING PUMP
10. BRACKET
11. IDLE SPEED POWER STEERING PRESSURE SWITCH
12. NUT - 100 N\*m (74 LBS. FT.)

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Figure 3 Power Steering Line Routing - A Carline, VIN W

## 3B1-4 POWER RACK AND PINION

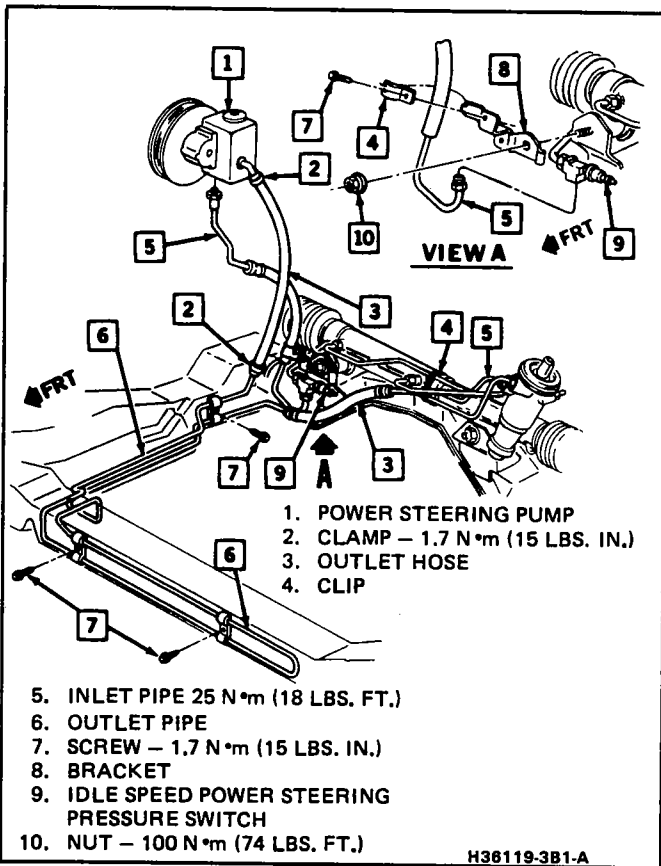


Figure 4 Power Steering Line Routing - A Carline, VIN 3

3. Return pipe to gear and drain fluid
4. Cut collar at cooling pipe
5. Return pipe and cut remaining collar

### ↔ Install or Connect

1. Hose to return pipe with screw type clamp
2. Return pipe to gear and tighten to specifications
3. Hose to cooling pipe with screw type clamp
4. Heat shield
5. Lower car.
6. Fill with fluid.
7. Bleed power steering system.



Inspect

- For leaks

### Cooling Pipe To Fluid Reservoir Hose

See Figure 6

### ↔ Remove or Disconnect

1. Drain fluid reservoir
2. Return hose from pump
3. Raise car. See Section 0A.
4. Cut collar at fluid reservoir hose to cooling pipe connection.
5. Hose

### ↔ Install or Connect

1. Hose to cooling pipe with screw type clamp

2. Lower car.
3. Return hose to pump
4. Fill with fluid.
5. Bleed power steering system.



Inspect

- For leaks

### Cooling Pipes

See Figure 6

### ↔ Remove or Disconnect

1. Drain fluid reservoir.
2. Return line at pump
3. Raise car. See Section 0A.
4. Pressure line at gear
5. Return line at gear
6. Cooling pipe retainers
7. Cooling pipe
8. Cut collars at hose to cooling pipe connections.
9. Form new cooling pipe from bulk pipe.

### ↔ Install or Connect

1. New cooling pipe to hoses
2. Clamp with screw type clamps
3. Cooling pipe to body with retainers
4. Return line at gear and tighten to specifications
5. Pressure line at gear and tighten to specifications
6. Lower car.
7. Return line at pump
8. Fill with fluid.
9. Bleed power steering system.



Inspect

- For leaks

## E CARLINE

### Rack and Pinion Assembly

See Figure 5

Tools Required:

J 24319-01 Puller

### ↔ Remove or Disconnect

- See the "CAUTION" on page 1.
  - 1. Raise car with suspension contact hoist. See Section 0A.
  - 2. Both front tire and wheel assemblies
  - 3. Intermediate shaft lower pinch bolt
- CAUTION: Failure to disconnect the intermediate shaft from the rack and pinion stub shaft can result in damage to the steering gear and/or intermediate shaft. This damage can cause loss of steering control which could result in personal injury.**
4. Tie rod ends from steering knuckles with J 24319-01

5. Line retainer
6. Outlet and pressure hose
7. Connection at idle speed power steering pressure switch
8. Rack and pinion mounting bolts
9. Rack and pinion through left wheel opening

**Install or Connect**

1. Rack and pinion through left wheel opening
2. Apply RTV sealer around inserts.
3. Rack and pinion mounting bolts and tighten to specifications
4. Connection at idle speed power steering pressure switch
5. Outlet and pressure hose
6. Line retainer
7. Tie rod ends to steering knuckles and tighten to specifications
8. Intermediate shaft lower pinch bolt and tighten to specifications. See Section 3B4.
9. Both tire and wheel assemblies and tighten to specifications
10. Lower car.
11. Fill with fluid.
12. Bleed air from system.

**Inspect**

- For leaks

**Inlet Hose**

See Figure 6

**Remove or Disconnect**

1. Raise car. See Section 0A.
2. Hose at gear
3. Pipe retainer
4. Hose at pump

**Install or Connect**

1. Hose at pump
2. Hose at gear and tighten to specifications
3. Pipe retainer
4. Lower car.
5. Fill with fluid.
6. Bleed power steering system.

**Inspect**

- For leaks

**Cooling Pipe To Steering Gear Pipe**

See Figures 6 and 7

Tools Required:  
J 36391 Separator

**Remove or Disconnect**

1. Raise car. See Section 0A.
2. Heat shield
3. Pipe from gear and drain fluid

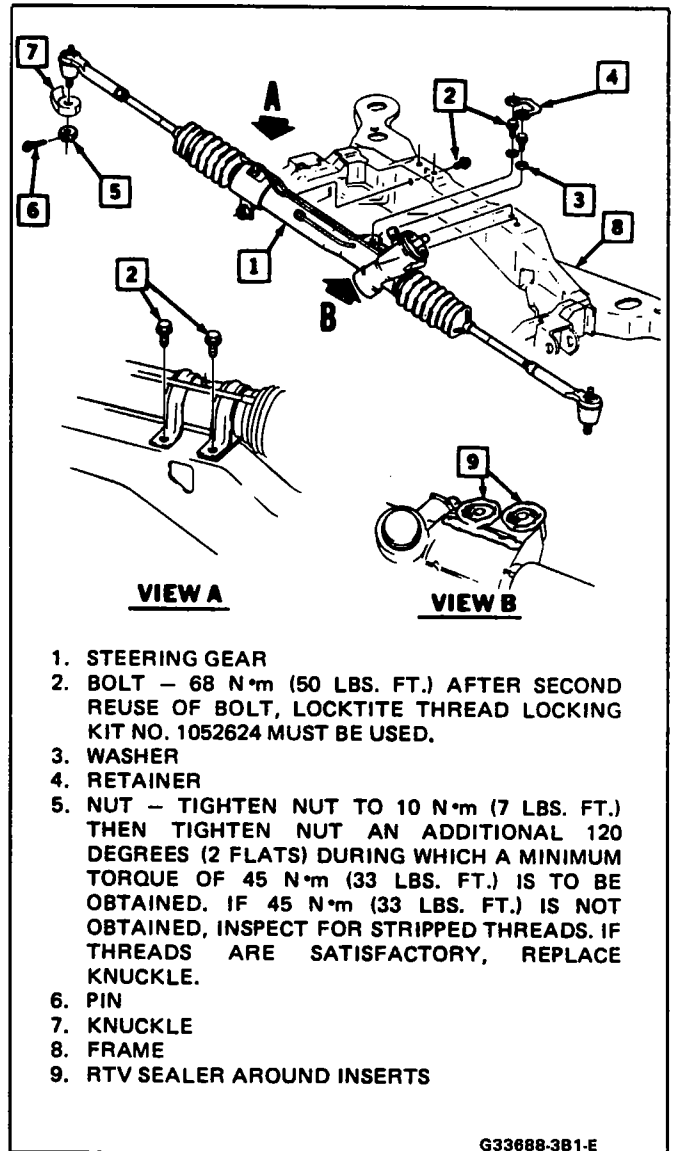


Figure 5 Rack and Pinion Mounting - E Carline

4. Pipe from clip on frame
5. Pipe from cooling pipe using J 36391

**Install or Connect**

1. Pipe to cooling pipe
2. Pipe to clip on frame
3. Pipe at gear and tighten to specifications
4. Heat shield
5. Lower car.
6. Fill with fluid.
7. Bleed power steering system.

**Inspect**

- For leaks

**Cooling Pipe To Fluid Reservoir Pipe**

See Figures 6 and 7

Tools Required:  
J 36391 Separator

## 3B1-6 POWER RACK AND PINION

### Remove or Disconnect

1. Drain fluid reservoir.
2. Raise car. See Section 0A.
3. Pipe from cooling pipe using J 36391
4. Lower car.
5. Bottom bolt from belt tensioner and move belt out of way
6. Return hose from reservoir
7. Drive belt tensioner
8. Pipe from clip on frame and generator bracket
9. Pipe

### Install or Connect

1. Pipe to clip on frame and generator bracket
2. Drive belt tensioner
3. Return hose to reservoir
4. Raise car.
5. Pipe to cooling pipe
6. Lower car.
7. Fill with fluid.
8. Bleed power steering system.

### Inspect

- For leaks

## Cooling Pipe

See Figures 6 and 7

Tools Required:  
J 36391 Separator

### Remove or Disconnect

1. Drain fluid reservoir.
2. Raise car. See Section 0A.
3. Pipes from both ends of cooling pipe using J 36391
4. Cooling pipe from clips
5. Cooling pipe

### Install or Connect

1. Cooling pipe to clips
2. Pipes to both ends of cooling pipe
3. Lower car.
4. Fill with fluid.
5. Bleed power steering system.

### Inspect

- For leaks

## Cooling Pipe "O" Ring Seals

See Figure 7

Tools Required:  
J 36391 Separator

### Remove or Disconnect

1. Pipe from cooling pipe using J 36391 or depress tabs on retainer
2. Retainer from pipe

3. Spacer and "O" ring seals from cooling pipe

### Install or Connect

1. Align retainer in seal kit with cooling pipe.
2. Insert seal kit until retainer locks in place.
3. Remove pin.
4. Pipe to cooling pipe
5. Fill with fluid.
6. Bleed power steering system.

### Inspect

- For leaks

## C & H CARLINE

### Rack and Pinion Assembly

See Figure 8

Tools Required:  
J 24319-01 Puller

### Remove or Disconnect

- See the "CAUTION" on page 1.
1. Raise car with suspension contact hoist. See Section 0A.
  2. Both front tire and wheel assemblies
  3. Intermediate shaft lower pinch bolt
- CAUTION: Failure to disconnect the intermediate shaft from the rack and pinion stub shaft can result in damage to the steering gear and/or intermediate shaft. This damage can cause loss of steering control which could result in personal injury.**
4. Tie rod ends from steering knuckles with J 24319-01
  5. Line retainer
  6. Pressure switch connection
  7. Outlet and pressure hose
  8. Rack and pinion mounting bolts
  9. Support body with stands to allow lowering of frame.
  10. Loosen front frame bolts.
  11. Rear frame bolts
  12. Lower rear of frame about 76 mm (3").

**NOTICE:** Do not lower rear of frame too far as damage to engine components nearest to the cowl may result.

13. Rack and pinion through left wheel opening

### Install or Connect

1. Rack and pinion through left wheel opening
2. Raise rear of frame.
3. Frame bolts and tighten to specifications. See Section 2A.
4. Remove stands.
5. Apply RTV sealer around inserts.
6. Rack and pinion mounting bolts and tighten to specifications

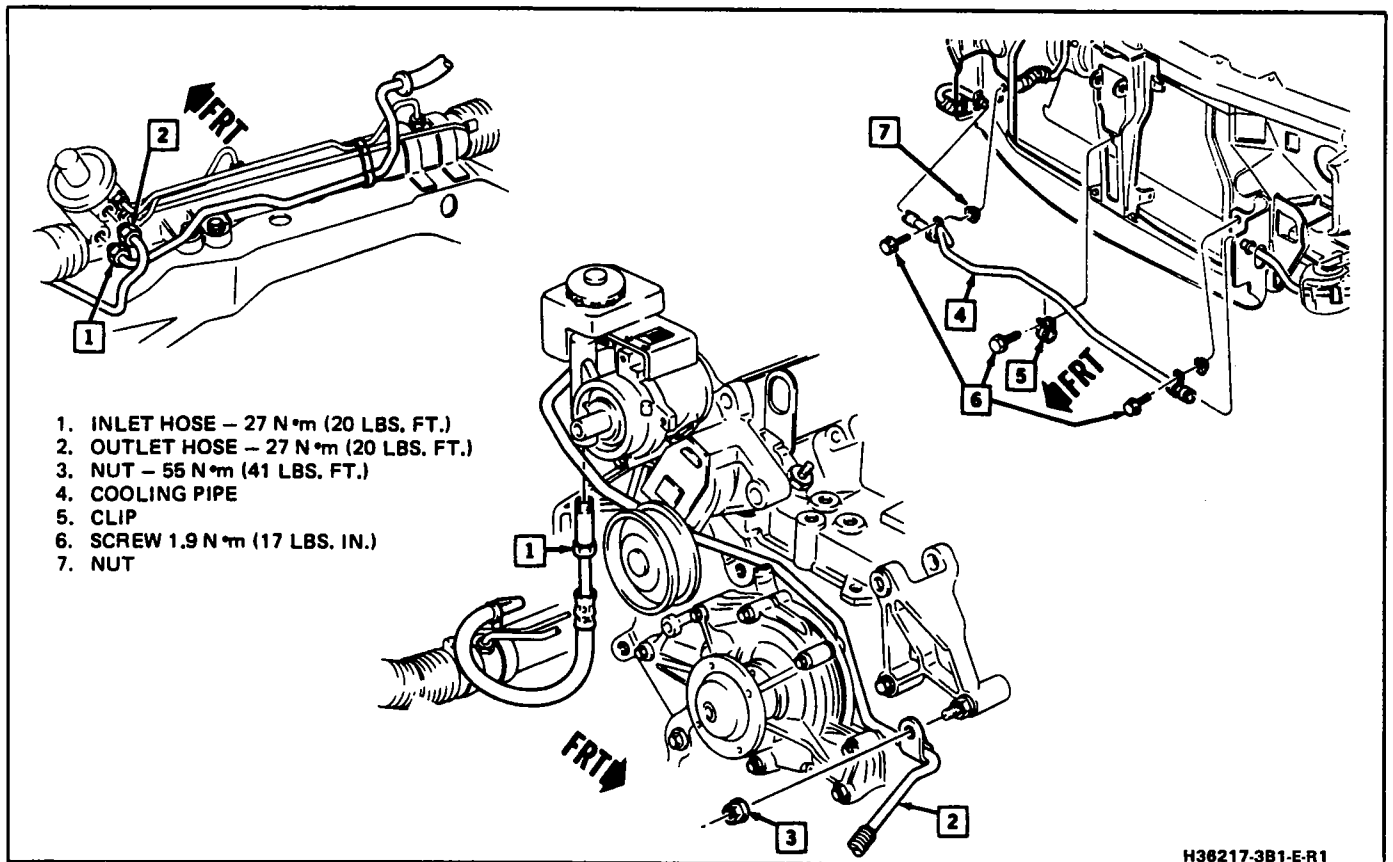


Figure 6 Hoses and Cooling Pipe

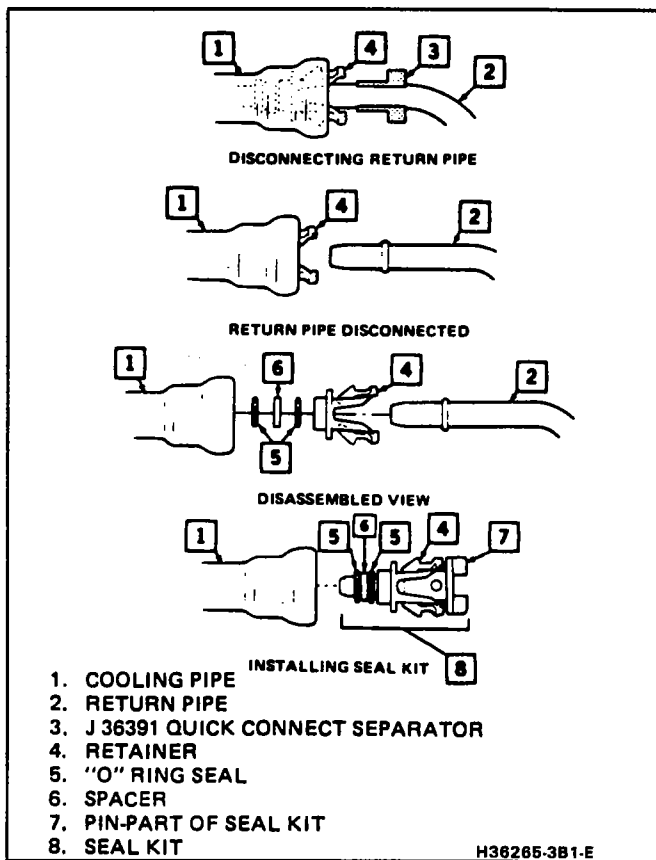


Figure 7 Quick Connect Service

7. Outlet and pressure hose
8. Pressure switch connection
9. Line retainer
10. Tie rod ends to steering knuckles and tighten to specifications
11. Intermediate shaft lower pinch bolt and tighten to specifications. See Section 3B4.
12. Both tire and wheel assemblies and tighten to specifications. See Section 3E.
13. Lower car.
14. Fill with fluid.
15. Bleed air from system.



Inspect

- For leaks

### Hoses and Pipes

See Figure 9



Remove or Disconnect

1. Retainer if replacing inlet hose
2. Screw if replacing outlet pipe
3. Hose clamps or connections at gear and pump
4. Hose or pipe



Install or Connect

1. Hose or pipe
2. Hose clamps or connections at gear and pump and tighten to specifications
3. Screw if replacing outlet pipe

## 3B1-8 POWER RACK AND PINION

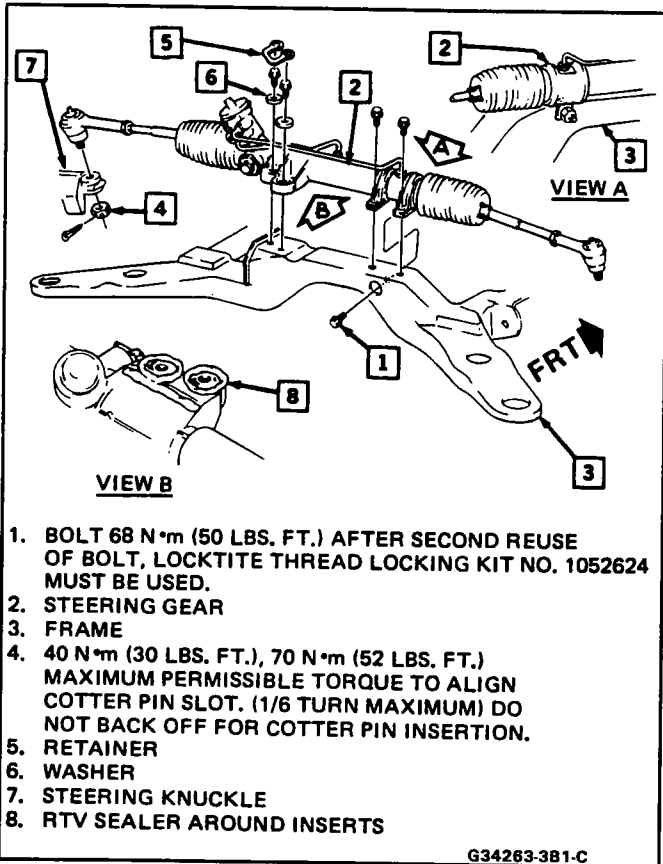


Figure 8 Rack and Pinion Mounting - C & H Carline

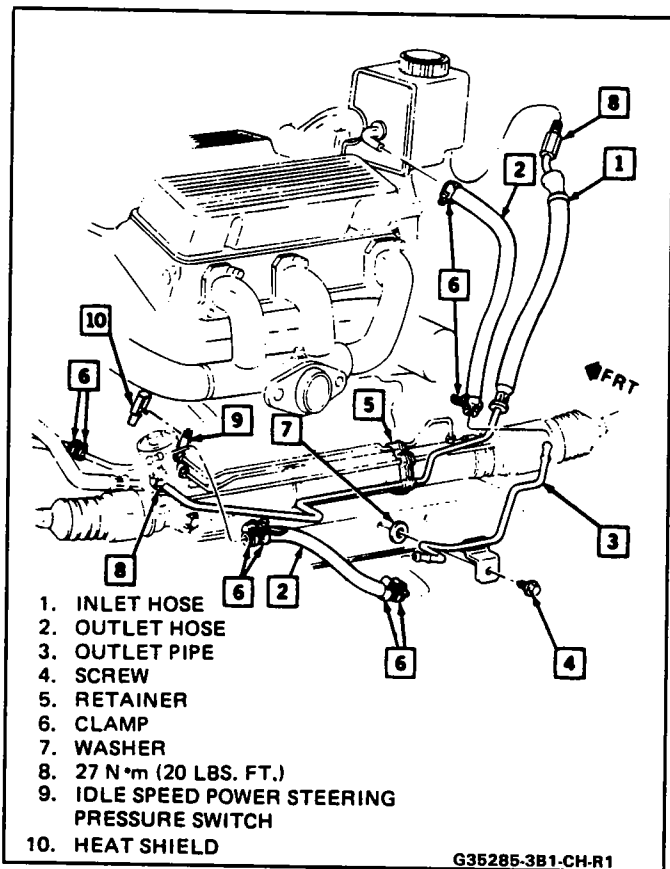


Figure 9 Power Steering Line Routing - C & H Carline

4. Retainer if replacing inlet hose
5. Fill with fluid.
6. Bleed power steering system.



Inspect

- For leaks

### Cooling Pipe

See Figure 10

#### ↔ Remove or Disconnect

1. Raise car. See Section 0A.
2. Hoses from cooling pipe
3. Clip on cooling pipe if removing lower pipe
4. Cooling pipe from retainers
5. Cooling pipe
6. Form new cooling pipe from bulk pipe.

#### → Install or Connect

1. Cooling pipe into retainers
2. Clip on cooling pipe if lower pipe was removed
3. Hoses on cooling pipe
4. Lower car.
5. Fill with fluid.
6. Bleed power steering system.



Inspect

- For leaks

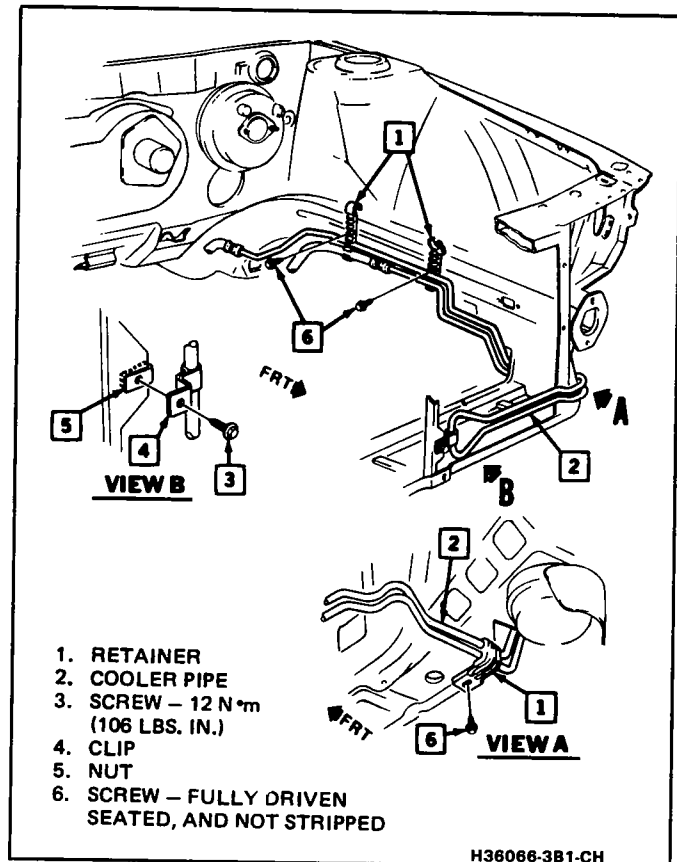


Figure 10 Cooling Pipes and Hose - C & H Carline



**J CARLINE****Rack and Pinion Assembly**

See Figure 11

Tools Required:

J 24319-01 Puller

**↔ Remove or Disconnect**

- See the "CAUTION" on page 1.
- 1. Left sound insulator
- 2. Upper pinch bolt on coupling assembly
- 3. Line retainer
- 4. Raise car. See Section 0A.
- 5. Both front tire and wheel assemblies
- 6. Tie rod ends from knuckles with J 24319-01
- 7. Lower car.
- 8. Left and right mounting clamps
- 9. Lines at gear from pump
- 10. Move gear forward and remove lower pinch bolt on coupling assembly.
- 11. Coupling from gear
- 12. Dash seal from gear
- 13. Rack and pinion through left wheel opening

**! Important**

- If studs were removed with mounting clamps, reinstall studs into cowl and tighten to specifications. After second reuse of stud, thread locking kit no. 1052624 or equivalent must be used.

**→ Install or Connect**

1. Rack and pinion through left wheel opening
2. Dash seal on gear
3. Move gear forward and install coupling on gear.
4. Lower pinch bolt and tighten to specifications. See Section 3B4.
5. Lines at gear from pump and tighten to specifications
6. Left and right mounting clamps and tighten to specifications
7. Raise car.
8. Tie rod ends and tighten to specifications
9. Both front tire and wheel assemblies and tighten to specifications. See Section 3E.
10. Line retainer
11. Lower car.
12. Upper pinch bolt on coupling assembly and tighten to specification. See Section 3B4.
13. Left sound insulator
14. Fill with fluid.
15. Bleed air from system.

**👁 Inspect**

- For leaks

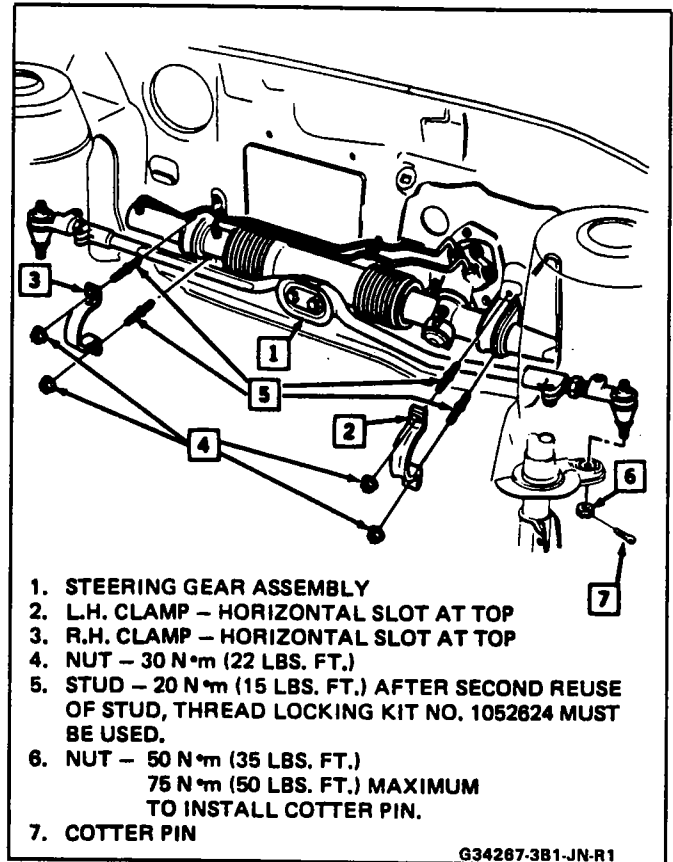


Figure 11 Rack and Pinion Mounting - J Carline

**Hose and Pipes**

See Figures 12 through 14

**↔ Remove or Disconnect**

1. Lines at rack and pinion and pump
2. Lines from retainer
3. Hose or pipe

**→ Install or Connect**

1. Hose or pipe
2. Lines in retainer
3. Lines at rack and pinion and pump and tighten to specifications
4. Fill with fluid.
5. Bleed air from system.

**👁 Inspect**

- For leaks

**Remote Fluid Reservoir Hose - VIN K**

See Figure 13

**↔ Remove or Disconnect**

1. Siphon fluid from fluid reservoir.
2. Hose clamps
3. Hose

**→ Install or Connect**

1. Hose

## 3B1-10 POWER RACK AND PINION

2. Hose clamps
3. Fill with fluid
4. Bleed power steering system.



Inspect

- For leaks

### Remote Fluid Reservoir – VIN K

See Figure 13



Remove or Disconnect

1. Siphon fluid from fluid reservoir.
2. Hose clamps
3. Both hoses
4. Fluid reservoir attaching screws
5. Fluid reservoir



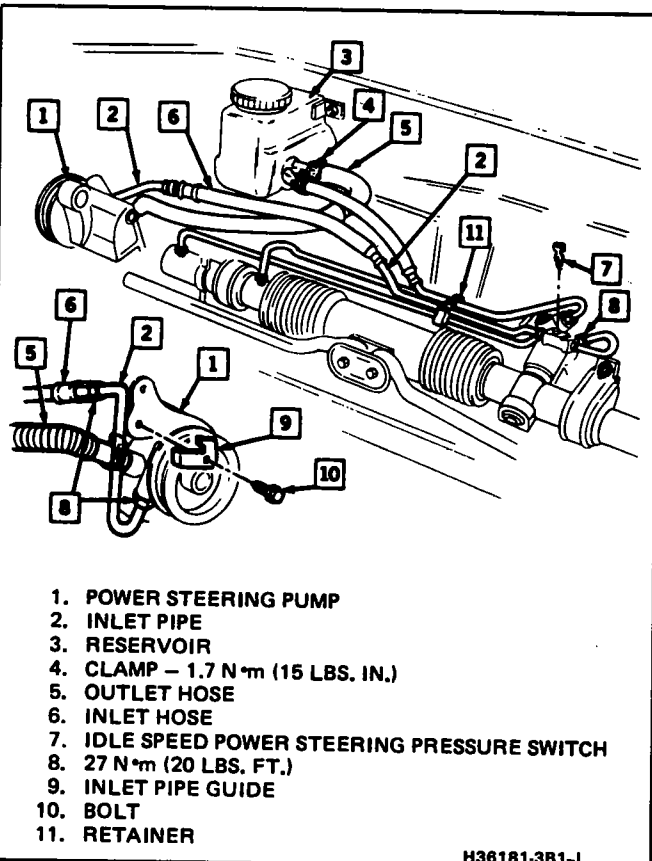
Install or Connect

1. Fluid reservoir to cowl with attaching screws
2. Both hoses
3. Hose clamps
4. Fill with fluid.



Inspect

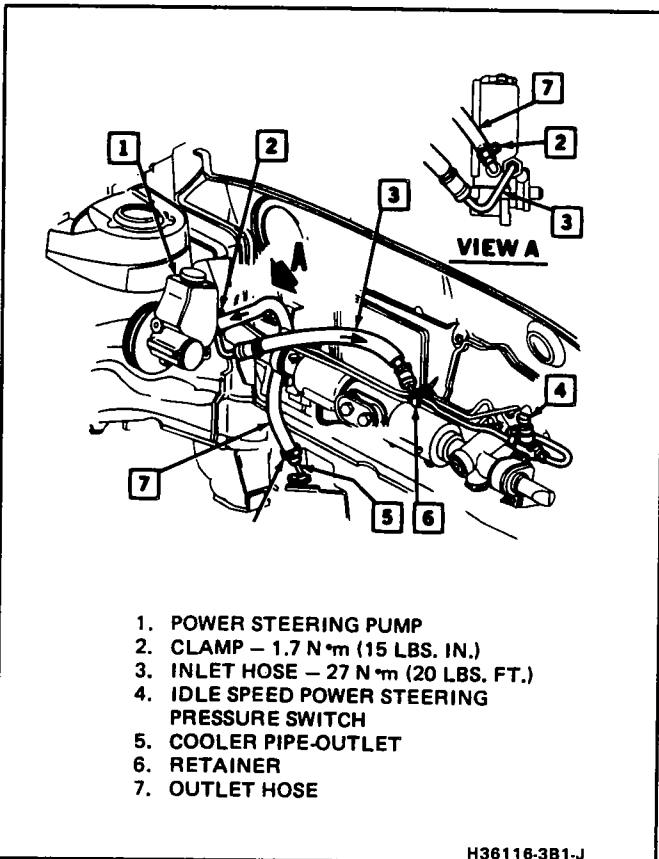
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1. POWER STEERING PUMP
2. INLET PIPE
3. RESERVOIR
4. CLAMP – 1.7 N<sup>m</sup> (15 LBS. IN.)
5. OUTLET HOSE
6. INLET HOSE
7. IDLE SPEED POWER STEERING PRESSURE SWITCH
8. 27 N<sup>m</sup> (20 LBS. FT.)
9. INLET PIPE GUIDE
10. BOLT
11. RETAINER

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Figure 13 Power Steering Line Routing – J Carline, VIN K



1. POWER STEERING PUMP
2. CLAMP – 1.7 N<sup>m</sup> (15 LBS. IN.)
3. INLET HOSE – 27 N<sup>m</sup> (20 LBS. FT.)
4. IDLE SPEED POWER STEERING PRESSURE SWITCH
5. COOLER PIPE-OUTLET
6. RETAINER
7. OUTLET HOSE

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Figure 12 Power Steering Line Routing – J Carline, VIN 1

### Cooling Pipe

See Figure 14



Remove or Disconnect

1. Raise car. See Section 0A.
2. Clamps on hoses
3. Hose from cooling pipe and plug hoses
4. Clips from body
5. Cooling pipe
6. Form new cooling pipe from bulk pipe.



Install or Connect

1. Cooling pipe
2. Clips to body
3. Hose to cooling pipe
4. Clamp on hoses
5. Lower car.
6. Fill with fluid.
7. Bleed power steering system.



Inspect

- For leaks

## N CARLINE

### Rack and Pinion Assembly

See Figure 15

Tools Required:

J 24319-01 Puller

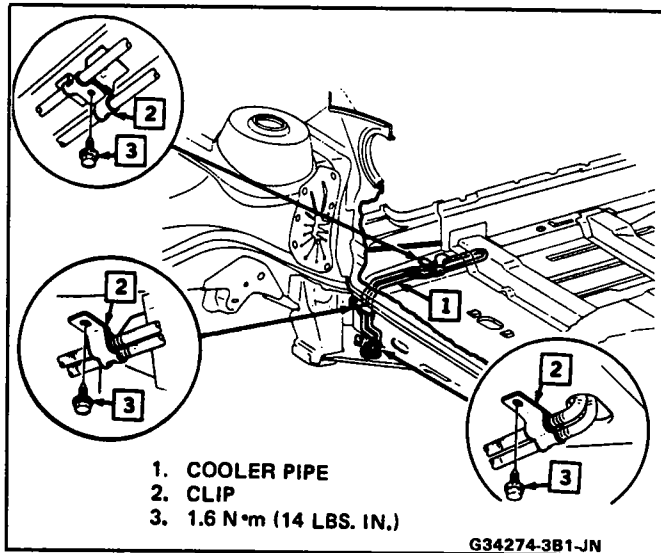


Figure 14 Cooling Pipe - J Carline, VIN 1

**↔ Remove or Disconnect**

- See the "CAUTION" on page 1.
- 1. Left sound insulator
- 2. Upper pinch bolt on coupling assembly
- 3. Line retainer
- 4. Raise car. See Section 0A.
- 5. Both front tire and wheel assemblies
- 6. Tie rod ends from knuckles with J 24319-01
- 7. Lower car.
- 8. Left and right mounting clamps
- 9. Lines at gear from pump
- 10. Move gear forward and remove lower pinch bolt on coupling assembly.
- 11. Coupling from gear
- 12. Dash seal from gear
- 13. Rack and pinion through left wheel opening

**! Important**

- If studs were removed with mounting clamps, reinstall studs into cowl and tighten to specifications. After second reuse of stud, thread locking kit no. 1052624 or equivalent must be used.

**→← Install or Connect**

1. Rack and pinion through left wheel opening
2. Dash seal on gear
3. Move gear forward and install coupling on gear.
4. Lower pinch bolt and tighten to specifications. See Section 3B4.
5. Lines at gear from pump and tighten to specifications
6. Left and right mounting clamps and tighten to specifications
7. Raise car.
8. Tie rod ends and tighten to specifications
9. Both front tire and wheel assemblies and tighten to specifications. See Section 3E.
10. Line retainer
11. Lower car.

12. Upper pinch bolt on coupling assembly and tighten to specification. See Section 3B4.
13. Left sound insulator
14. Fill with fluid.
15. Bleed air from system.

**🔍 Inspect**

- For leaks

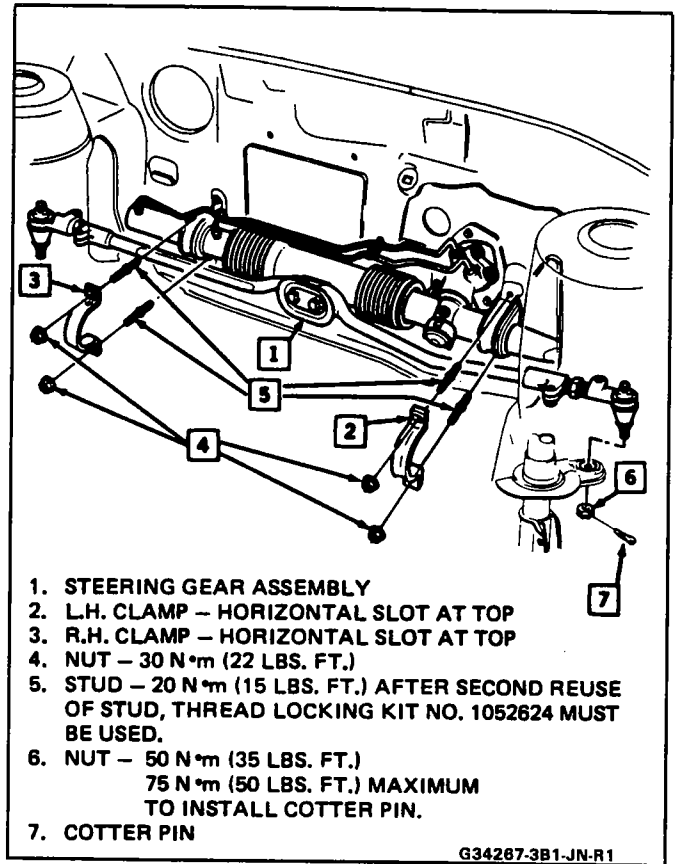


Figure 15 Rack and Pinion Mounting - N Carline

**Hoses and Pipes**

**↔ Remove or Disconnect**

1. Retainer or clip
2. Clamp and/or nuts at connections
3. Hose or pipe

**→← Install or Connect**

1. Hose or pipe
2. Clamp and/or nuts and tighten to specifications
3. Retainer or clip
4. Fill with fluid.
5. Bleed power steering system.

**🔍 Inspect**

- For leaks

## 3B1-12 POWER RACK AND PINION

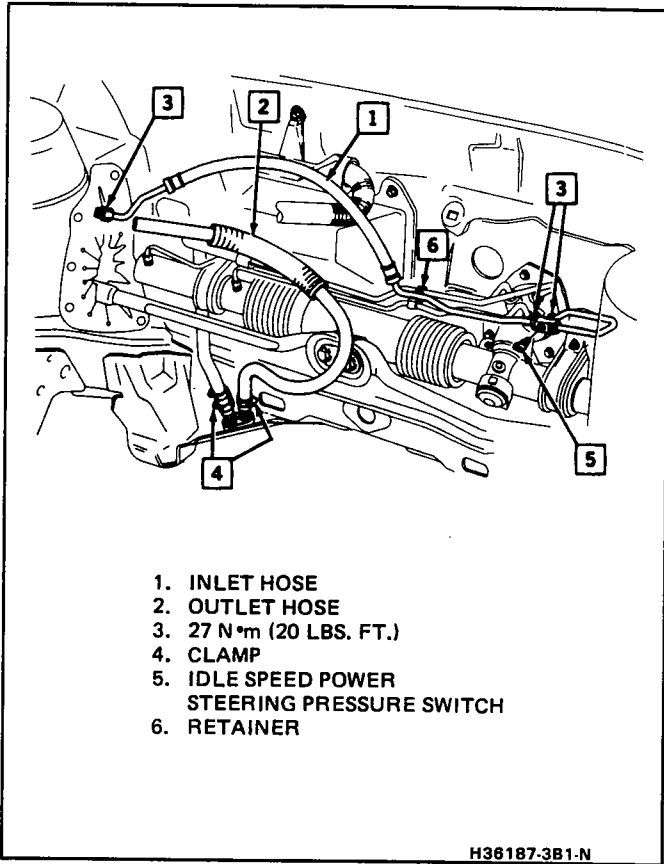


Figure 16 Power Steering Line Routing - N Carline, VIN U with Automatic Transaxle

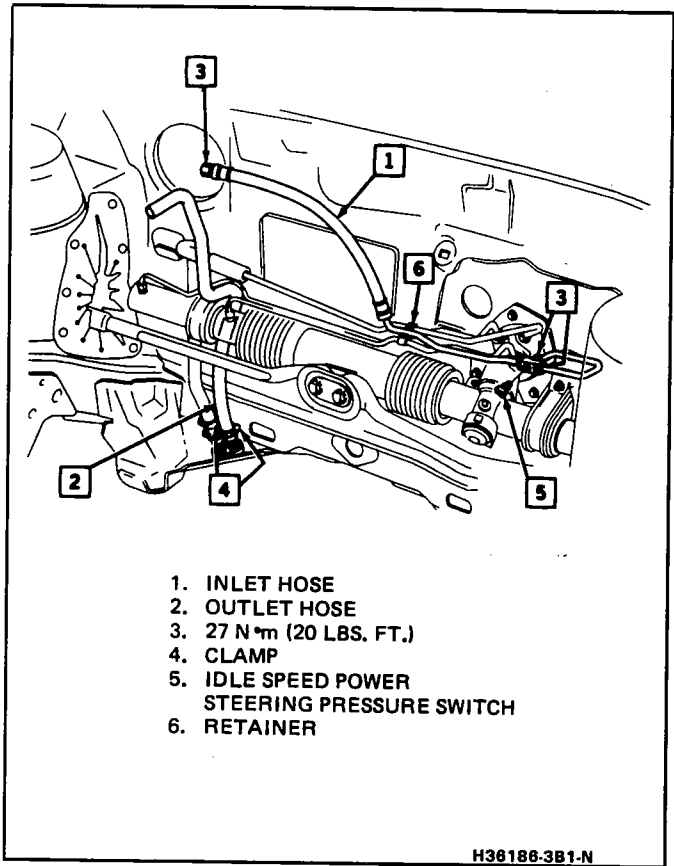


Figure 18 Power Steering Outlet Line Routing - N Carline, VIN L

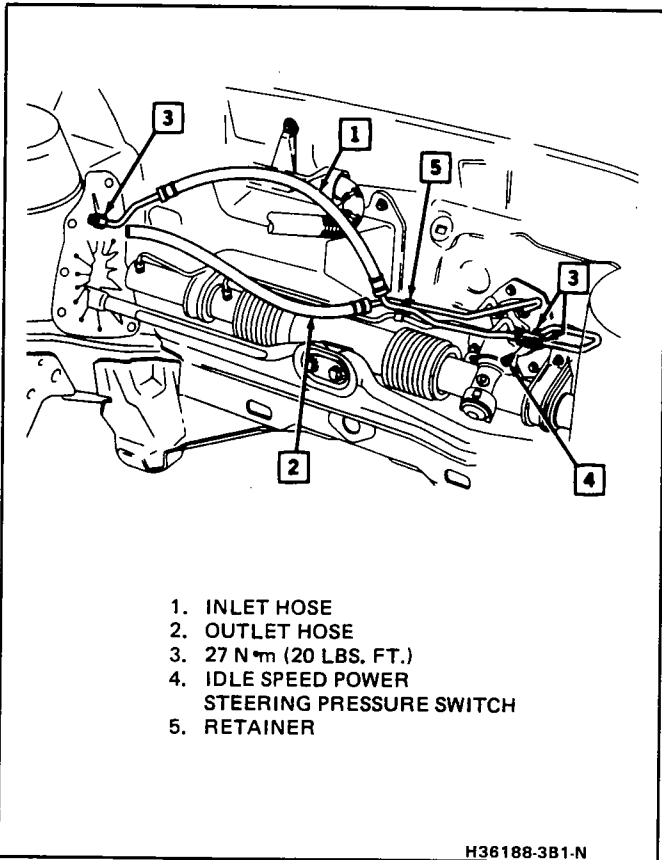


Figure 17 Power Steering Line Routing - N Carline, VIN U with Manual Transaxle

### Cooling Pipe

See Figure 19

#### ↔ Remove or Disconnect

1. Raise car. See Section 0A.
2. Clamps on hoses
3. Hose from cooling pipe and plug hoses
4. Clips from body
5. Cooling pipe
6. Form new cooling pipe from bulk pipe.

#### ↔ Install or Connect

1. Cooling pipe
2. Clips to body
3. Hose to cooling pipe
4. Clamp on hoses
5. Lower car.
6. Fill with fluid.
7. Bleed power steering system.

#### 🔍 Inspect

- For leaks

### UNIT REPAIR CENTER-TAKE-OFF

#### Outer Tie Rod

See Figure 25

Tools Required:

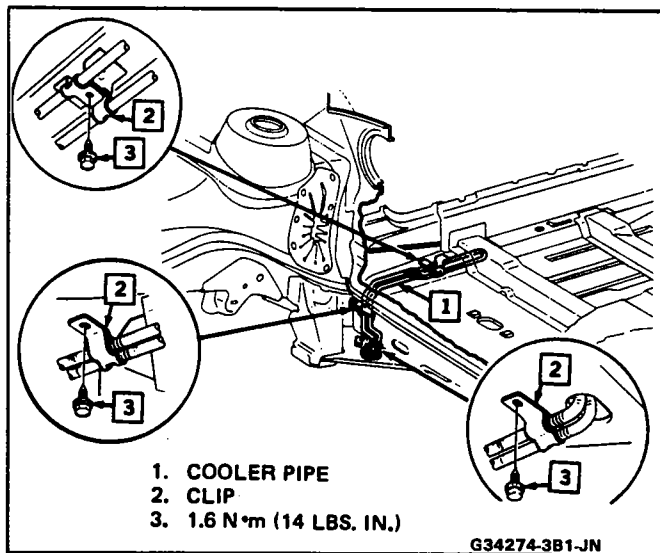


Figure 19 Cooling Pipe – N Carline, VIN U &amp; L

## J 24319-01 Steering Linkage Puller

## Remove or Disconnect

1. Cotter pin and hex slotted nut from outer tie rod ball stud
2. Loosen outer tie rod pinch bolts (33).
3. Separate outer tie rod (35) or (36) from steering knuckle using J 24319-01.
4. Outer tie rod (35) or (36) from tie rod adjuster (34)

## Install or Connect

1. Outer tie rod (35) or (36) to tie rod adjuster (34)
2. Outer tie rod ball stud to steering knuckle
3. Hex slotted nut (39) to tie rod ball stud

## Tighten

- Hex slotted nut (39) to 50 N·m (35 lbs. ft.) maximum of 75 N·m (50 lbs. ft.) to install cotter pin
4. Cotter pin (40) to hole in tie rod ball stud

## Adjust

- Toe by turning tie rod adjuster (34)

## Tighten

- Pinch bolts (33) to 55 N·m (41 lbs. ft.)

## Inner Tie Rod

See Figure 26

## Remove or Disconnect

1. Lock plate (32) from inner tie rod bolts (31) and dispose
2. Inner tie rod bolts (31) if both tie rods, bolt support plate (30) and inner tie rod assemblies (27) and (29). If only one inner tie rod is removed, slide inner tie rod assembly from between bolt support plate (30) and center housing cover washer (26). If both inner tie rods are to be

removed for replacement, after removing the first inner tie rod, reinstall inner tie rod bolt (31) to keep rack and pinion boot (53) and other parts inside the rack and pinion boot in proper alignment.

## Install or Connect

1. Center housing cover washer (26) fitted into rack and pinion boot (53)
2. Inner tie rod bolts (31) through holes in bolt support plate (30), inner tie rod bushing (28) which is part of the inner tie rod assembly (27) or (28), center housing cover washer (26) captured in recesses in rack and pinion boot (53), insert and rack guide assembly (25), which is hidden inside the rack and pinion boot (53) into threaded hole in rod and rack assembly (41)

## Tighten

- Inner tie rod bolts (31) to 90 N·m (65 lbs. ft.)
3. New lock plate (32) with notches in the proper position over flats of inner tie rod bolts (31)

## Inner Pivot Bushing

See Figures 27 and 28

Tools Required:

J 29809 Bushing Remover and Installer

## Remove or Disconnect

1. Inner tie rod, see "INNER TIE ROD."

## Disassemble

1. Inner pivot bushing (28) from inner tie rod (27) or (29) using J 29809

## Assemble

1. Coat inner pivot bushing (28) lightly with grease for ease of installation.
2. Inner pivot bushing (28) into inner tie rod (27) or (29) using J 29809

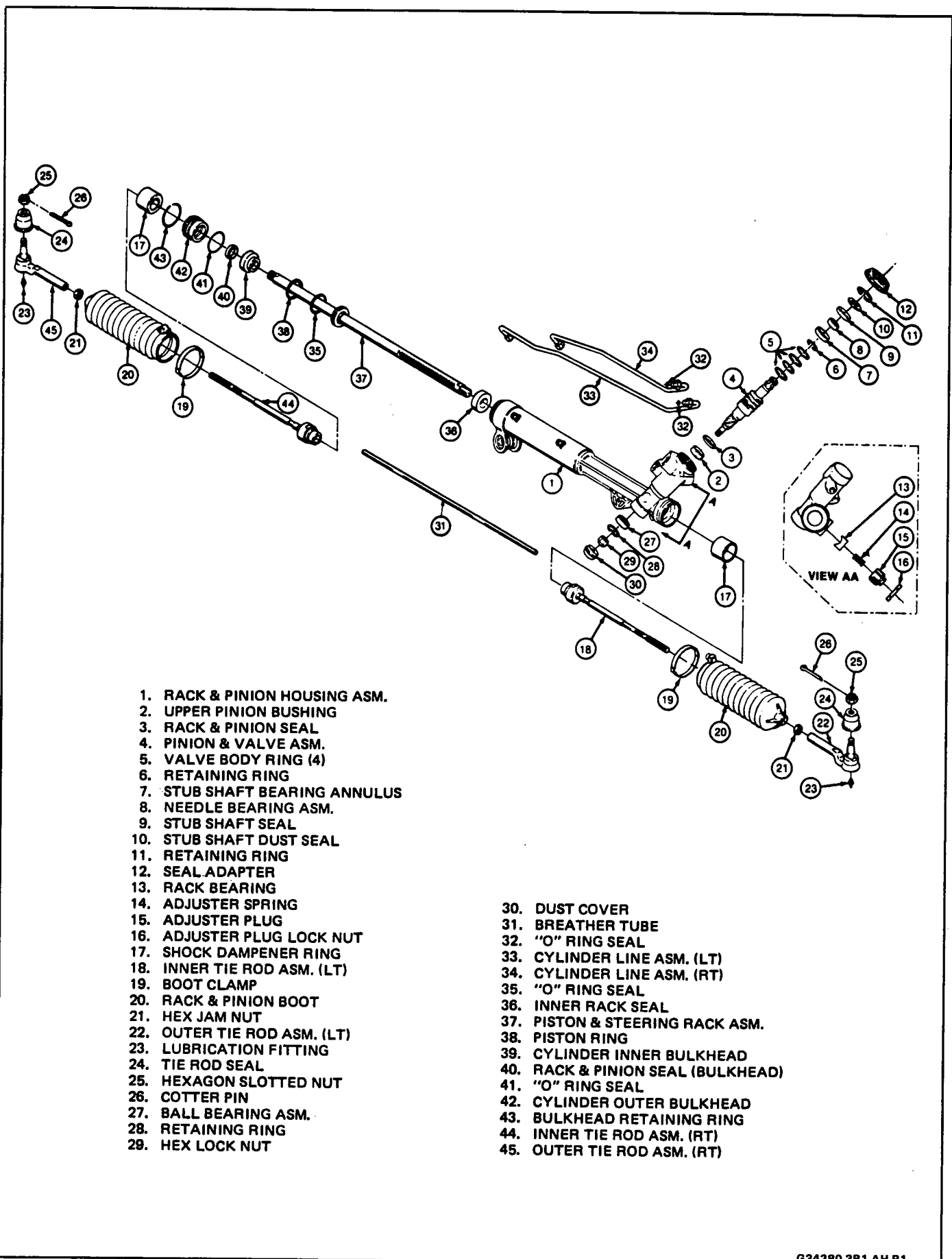
## Install or Connect

1. Center housing cover washer (26) fitted into rack and pinion boot (53)
2. Inner tie rod bolts (31) through holes in bolt support plate (30), inner tie rod bushing (28) which is part of the inner tie rod assembly (27) or (28), center housing cover washer (26) captured in recesses in rack and pinion boot (53), insert and rack guide assembly (25), which is hidden inside the rack and pinion boot (53) into threaded hole in rod and rack assembly (41)

## Tighten

- Inner tie rod bolts (31) to 90 N·m (65 lbs. ft.)
3. New lock plate (32) with notches in the proper position over flats of inner tie rod bolts (31)

# 3B1-14 POWER RACK AND PINION



- |                               |                                   |
|-------------------------------|-----------------------------------|
| 1. RACK & PINION HOUSING ASM. | 30. DUST COVER                    |
| 2. UPPER PINION BUSHING       | 31. BREATHER TUBE                 |
| 3. RACK & PINION SEAL         | 32. "O" RING SEAL                 |
| 4. PINION & VALVE ASM.        | 33. CYLINDER LINE ASM. (LT)       |
| 5. VALVE BODY RING (4)        | 34. CYLINDER LINE ASM. (RT)       |
| 6. RETAINING RING             | 35. "O" RING SEAL                 |
| 7. STUB SHAFT BEARING ANNULUS | 36. INNER RACK SEAL               |
| 8. NEEDLE BEARING ASM.        | 37. PISTON & STEERING RACK ASM.   |
| 9. STUB SHAFT SEAL            | 38. PISTON RING                   |
| 10. STUB SHAFT DUST SEAL      | 39. CYLINDER INNER BULKHEAD       |
| 11. RETAINING RING            | 40. RACK & PINION SEAL (BULKHEAD) |
| 12. SEAL ADAPTER              | 41. "O" RING SEAL                 |
| 13. RACK BEARING              | 42. CYLINDER OUTER BULKHEAD       |
| 14. ADJUSTER SPRING           | 43. BULKHEAD RETAINING RING       |
| 15. ADJUSTER PLUG             | 44. INNER TIE ROD ASM. (RT)       |
| 16. ADJUSTER PLUG LOCK NUT    | 45. OUTER TIE ROD ASM. (RT)       |
| 17. SHOCK DAMPENER RING       |                                   |
| 18. INNER TIE ROD ASM. (LT)   |                                   |
| 19. BOOT CLAMP                |                                   |
| 20. RACK & PINION BOOT        |                                   |
| 21. HEX JAM NUT               |                                   |
| 22. OUTER TIE ROD ASM. (LT)   |                                   |
| 23. LUBRICATION FITTING       |                                   |
| 24. TIE ROD SEAL              |                                   |
| 25. HEXAGON SLOTTED NUT       |                                   |
| 26. COTTER PIN                |                                   |
| 27. BALL BEARING ASM.         |                                   |
| 28. RETAINING RING            |                                   |
| 29. HEX LOCK NUT              |                                   |

Figure 20 Power Rack and Pinion Steering Assembly (End-Take-Off)

**1. REMOVE AND INSTALL OUTER TIE ROD**

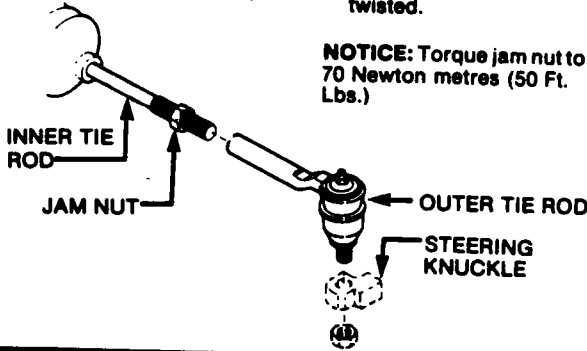
**REMOVE**

1. Loosen jam nut.
2. Remove tie rod from steering knuckle, using Tool J-24319-01 or BT 7101.
3. Remove outer tie rod.

**INSTALL**

1. Install parts as shown.
2. Do not tighten jam nut.
3. Make toe-in adjustment by turning inner tie rod.
4. Be sure boot is not twisted.

**NOTICE:** Torque jam nut to 70 Newton metres (50 Ft. Lbs.)



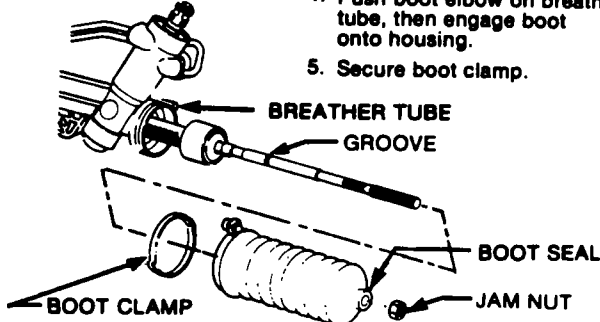
**2. REMOVE AND INSTALL BOOT SEAL AND BREATHER TUBE**

**REMOVE**

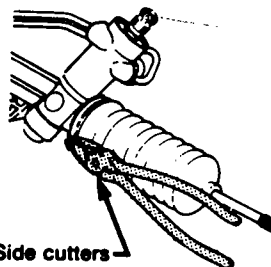
1. Remove jam nut.
2. Cut boot clamp and discard.
3. Mark breather tube location on housing, before removing tube.
4. See insert for proper boot seal removal.

**INSTALL**

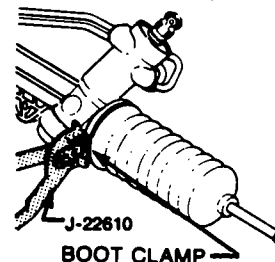
1. Line up mark and install breather tube.
2. Install new clamp on boot before installing boot.
3. See insert for proper installation of boot seal.
4. Push boot elbow on breather tube, then engage boot onto housing.
5. Secure boot clamp.



**A. Cut boot clamp**

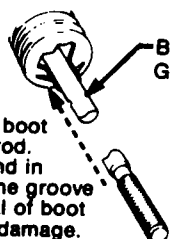


**B. Secure boot clamp**



**REMOVE**

To prevent boot damage, slide tie rod end of boot toward center of gear enough to expose boot groove on the tie rod. Place a rubber band in groove. This fills the groove and allows removal of boot from gear without damage.



**REPLACE**

1. Remove rubber band.
2. Slide boot on tie rod until boot snaps into groove.



**THE FOLLOWING STEPS MUST BE PERFORMED WITH RACK & PINION ASSEMBLY REMOVED FROM CAR**

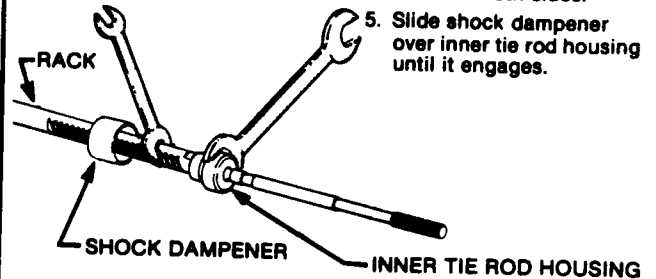
**3. REMOVE AND INSTALL INNER TIE ROD**

**REMOVE**

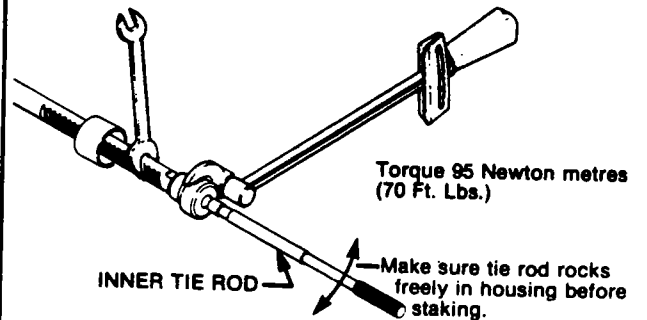
1. Remove shock dampener ring from inner tie rod housing and slide back on rack.
2. Put wrench on rack flat to prevent rack damage when removing tie rod.
3. Put wrench on tie rod pivot housing flats.
4. Turn housing counter-clockwise until tie rod assy separates from rack.

**INSTALL**

1. Bottom inner tie rod assy on rack.
2. Torque housing. (Use wrench on rack to avoid internal gear damage.)
3. Support rack and housing and stake tie rod housing to rack flat. (Stake both sides.)
4. Inspect stake, a .25 millimetres (.010 inch) feeler gage must not pass between rack and housing stake on both sides.
5. Slide shock dampener over inner tie rod housing until it engages.



**A. Torque inner tie rod.**



**B. Stake housing to rack (both sides).**

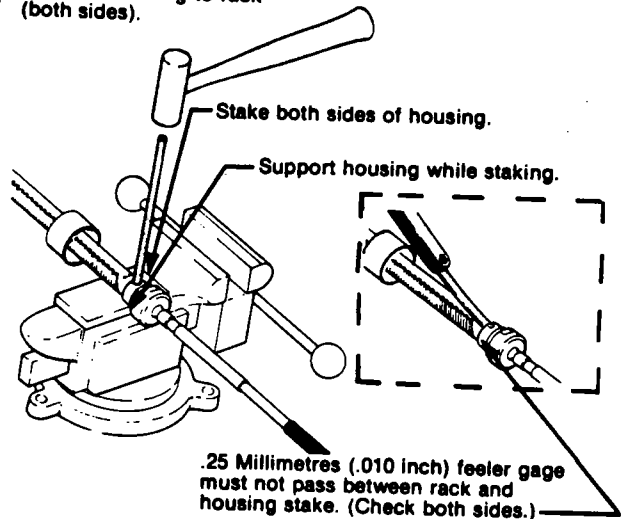


Figure 21 Servicing Rack and Pinion Assembly (1 of 3)

### 4. REMOVE AND INSTALL RACK BEARING ON CAR ADJUSTMENT

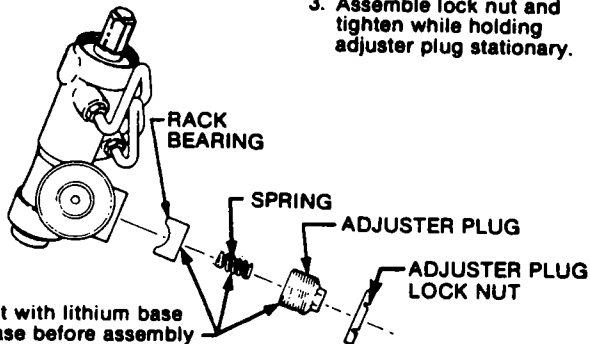
If only the rack bearing requires adjustment, refer to **INSTALL** Step 2 below. Make adjustment with front wheels raised and steering wheel centered. **WHEN ADJUSTING ON CAR**, checking pinion torque is not required. Be sure to check returnability of the steering wheel to center after adjustment.

#### REMOVE

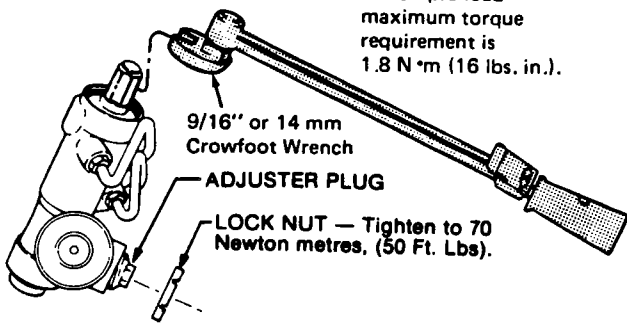
1. Loosen adjuster plug lock nut.
2. Turn adjuster plug counterclockwise until it separates from housing.
3. Remove parts as shown.

#### INSTALL

1. Install parts as shown.
2. With rack centered, turn adjuster plug clockwise until it bottoms, then back off 50° to 70°. Check torque on pinion.
3. Assemble lock nut and tighten while holding adjuster plug stationary.



Pinion pre-load maximum torque requirement is 1.8 N·m (16 lbs. in.).



### 5. REMOVE AND INSTALL STUB SHAFT SEALS

#### REMOVE

1. Remove retaining ring.
2. Remove dust cover.
3. While holding the stub shaft remove lock nut from pinion.

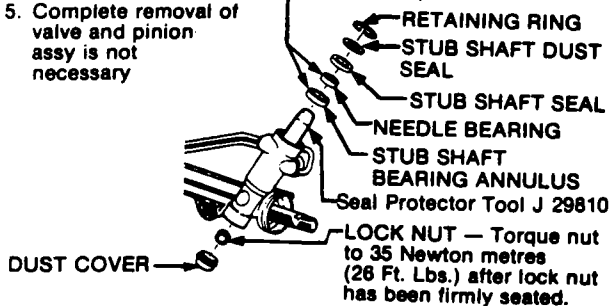
**NOTICE:** If stub shaft is not held, damage to the pinion teeth will occur.

4. **USING A PRESS**, press on threaded end of pinion until flush with ball bearing assy.
5. Complete removal of valve and pinion assy is not necessary

#### INSTALL

1. Install annulus assembly in gear.
2. Place seal protector Tool J 29810 on stub shaft and install stub shaft seals and snapping.
3. While holding stub shaft firmly seat the lock nut, torque to specifications.

Bearing and annulus are pressed together. Disassemble only if bearing replacement is required.



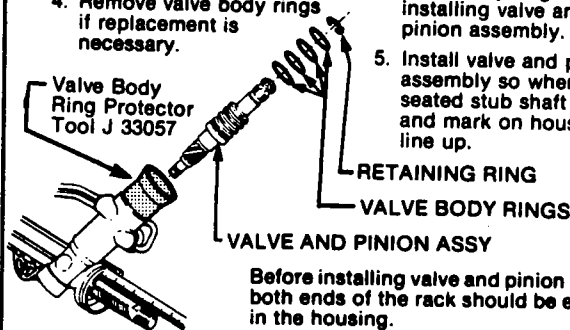
### 6. REMOVE AND INSTALL VALVE AND PINION ASSY

#### REMOVE

1. Turn stub shaft until rack is equal distance on both sides of housing, with pinion fully engaged.
2. Mark location of stub shaft flat on housing.
3. **USING A PRESS**, press on threaded end of pinion until it is possible to remove valve and pinion assy.
4. Remove valve body rings if replacement is necessary.

#### INSTALL

1. Install new valve body rings if required.
2. Care should be taken not to cut rings at installation.
3. Measure rack so that it's equal on both sides.
4. Use valve body ring protector, Tool J 33057 to prevent damaging valve body rings while installing valve and pinion assembly.
5. Install valve and pinion assembly so when fully seated stub shaft flat, and mark on housing line up.



### 7. REMOVE AND INSTALL BULKHEAD

#### REMOVE

1. Use punch in access hole to remove bulkhead retaining ring.
2. If only the bulkhead, bulkhead O-ring seal or rack seal (bulkhead) are to be replaced. Loosen (LT) fitting and remove cylinder line.
3. Plug (LT) cylinder line hole at cylinder using a finger or plastic cap with 7/16 x 20 internal threads over hole to prevent oil leaking from cylinder.
4. Using a 11/16 inch-12 point socket turn stub shaft. Move rack to the right forcing the bulkhead out of the housing. Use drain pan to catch hydraulic oil from assy.
5. If inner rack seal or piston ring are to be replaced, use rack to remove bulkhead instead of compressed oil method.

#### INSTALL

1. Using crocus cloth remove burrs or sharp edges from retaining ring groove in housing. This must be done to insure that the new O-ring is not damaged at assembly.
2. Install parts as shown.
3. Coat all seals with power steering fluid.
4. Slip bullet seal protector over end of rack and install bulkhead.
5. Make sure open end of retaining ring is approximately 13 millimeters (.50 inch) from access hole.
6. Retaining ring must be fully seated.

(Install Seal Using Seal Installer J 28527 or J 29706)

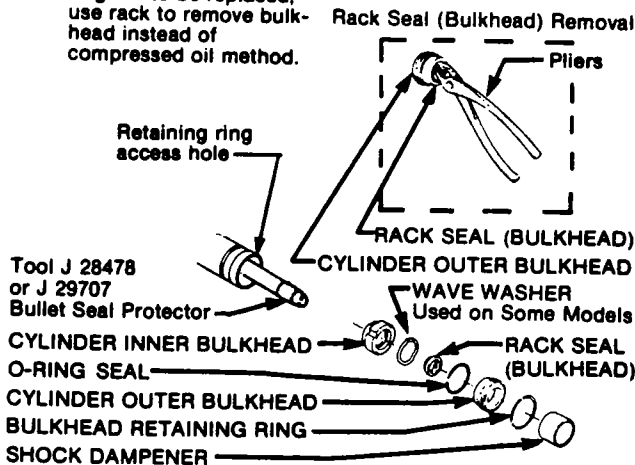


Figure 22 Servicing Rack and Pinion Assembly (2 of 3)



### 8. REMOVE AND INSTALL INNER RACK SEAL, RACK AND PISTON RING

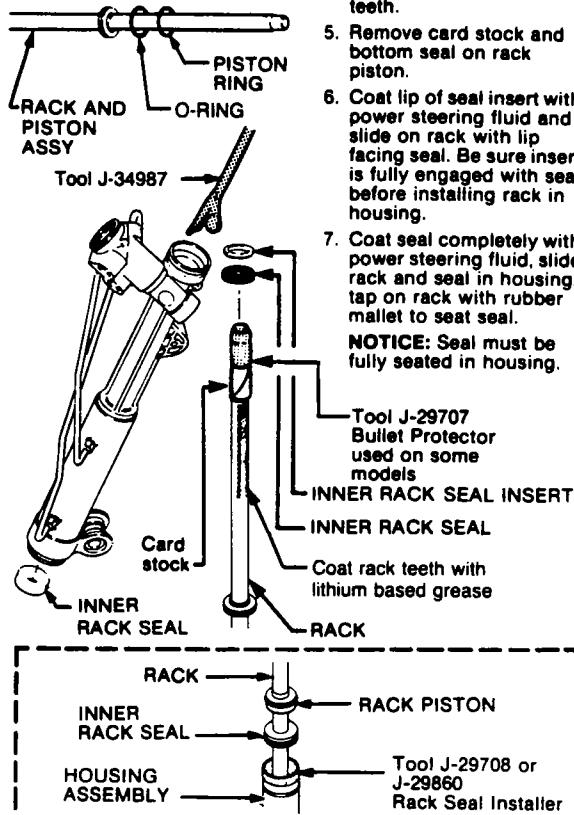
#### REMOVE

1. Remove rack from housing.
2. Remove piston ring & O-ring seal and dispose.
3. Fit tool J-34987 into housing. Gently tap on end of tool until seal is removed.
4. Dispose of old seal.

#### INSTALL

1. Install new O-ring seal and piston ring on rack.
2. Care should be taken not to cut ring at installation.
3. Wrap card stock around end of rack and rack teeth.
4. Coat seal lip with power steering fluid, slide seal with seal lip facing piston on to card stock, slide card and seal over rack teeth.
5. Remove card stock and bottom seal on rack piston.
6. Coat lip of seal insert with power steering fluid and slide on rack with lip facing seal. Be sure insert is fully engaged with seal before installing rack in housing.
7. Coat seal completely with power steering fluid, slide rack and seal in housing, tap on rack with rubber mallet to seat seal.

**NOTICE:** Seal must be fully seated in housing.



### 9. REMOVE AND INSTALL BALL BEARING ASSY

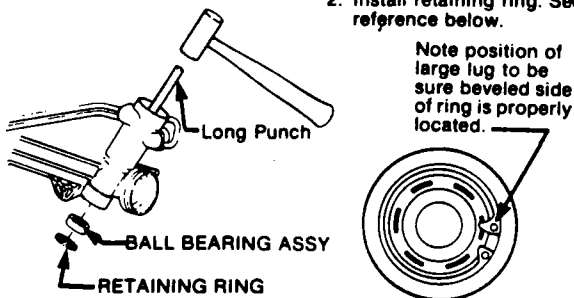
#### REMOVE

1. Remove bearing retaining ring.
2. Use drift or punch and gently tap on bearing until bearing is removed.

#### INSTALL

1. Install new ball bearing assy. Using a suitable socket, press on outer race. Be careful not to cock bearing in housing.
2. Install retaining ring. See reference below.

Note position of large lug to be sure beveled side of ring is properly located.



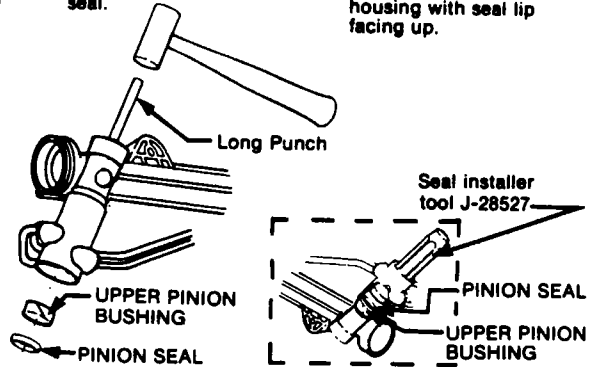
### 10. REMOVE AND INSTALL UPPER PINION BEARING & SEAL

#### REMOVE

1. Remove upper pinion bushing and seal with a punch.
2. Dispose of bushing and seal.

#### INSTALL

1. Install new bushing as shown.
2. Install new seal. Using installer, seat seal in housing with seal lip facing up.



### 11. REMOVE AND INSTALL CYLINDER LINE

#### REMOVE

1. Using flare wrench loosen fittings and remove cylinder line.
2. Be sure O-ring is also removed and disposed of.

#### INSTALL

1. Place new O-ring seal on cylinder line.
2. Assemble both ends to housing finger tight to assure proper alignment.
3. Tighten to specifications.

**NOTICE:** Care should be taken not to strip aluminum housing.

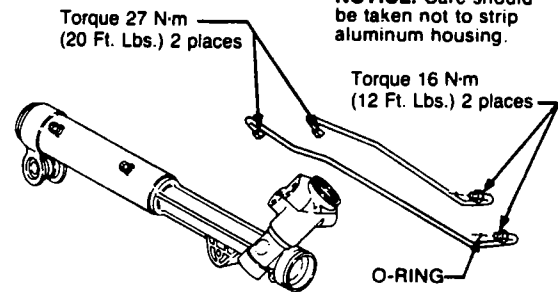
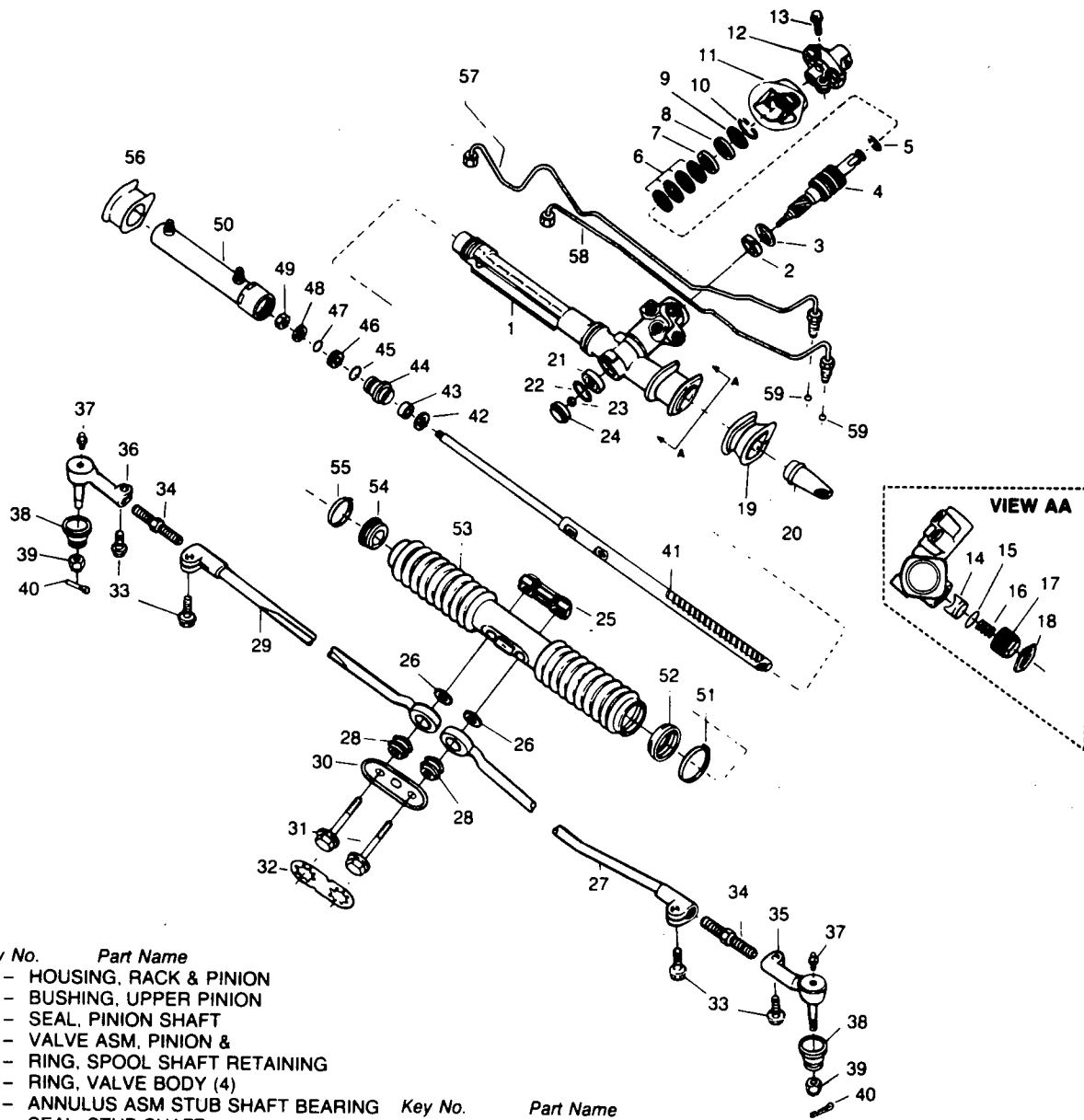


Figure 23 Servicing Rack and Pinion Assembly (3 of 3)

# 3B1-18 POWER RACK AND PINION



- | Key No. | Part Name                      |
|---------|--------------------------------|
| 1       | HOUSING, RACK & PINION         |
| 2       | BUSHING, UPPER PINION          |
| 3       | SEAL, PINION SHAFT             |
| 4       | VALVE ASM, PINION &            |
| 5       | RING, SPOOL SHAFT RETAINING    |
| 6       | RING, VALVE BODY (4)           |
| 7       | ANNULUS ASM STUB SHAFT BEARING |
| 8       | SEAL, STUB SHAFT               |
| 9       | SEAL, STUB SHAFT DUST          |
| 10      | RING, RETAINING                |
| 11      | SEAL, DASH                     |
| 12      | COUPLING ASM, FLANGE & STRG    |
| 13      | BOLT, PINCH                    |
| 14      | BEARING, RACK                  |
| 15      | SEAL, O-RING                   |
| 16      | SPRING, ADJUSTER               |
| 17      | PLUG, ADJUSTER                 |
| 18      | NUT, ADJUSTER PLUG LOCK        |
| 19      | GROMMET, MOUNTING (LH)         |
| 20      | COVER, HOUSING END             |
| 21      | BEARING ASM, PINION            |
| 22      | RING, RETAINING                |
| 23      | NUT, HEX LOCK                  |
| 24      | COVER, DUST                    |
| 25      | GUIDE ASM, INSERT & RACK       |
| 26      | WASHER, CENTER HSG COVER       |
| 27      | ROD, INNER TIE (LH)            |
| 28      | BUSHING, INNER PIVOT           |

- | Key No. | Part Name               |
|---------|-------------------------|
| 29      | ROD, INNER TIE (RH)     |
| 30      | PLATE, BOLT SUPPORT     |
| 31      | BOLT, INNER TIE ROD     |
| 32      | PLATE, LOCK             |
| 33      | BOLT, PINCH             |
| 34      | ADJUSTER, TIE ROD       |
| 35      | ROD ASM, OUTER TIE (LH) |
| 36      | ROD ASM, OUTER TIE (RH) |
| 37      | FITTING, LUBRICATION    |
| 38      | SEAL, TIE ROD           |
| 39      | NUT, HEX SLOTTED        |
| 40      | PIN, COTTER             |
| 41      | RACK ASM, ROD &         |
| 42      | WASHER, SEAL BACK-UP    |
| 43      | SEAL, PISTON ROD        |
| 44      | GUIDE, PISTON ROD       |
| 45      | SEAL, O-RING            |
| 46      | PISTON, RACK            |
| 47      | SEAL, O-RING            |
| 48      | RING, PISTON            |
| 49      | NUT, HEX                |

- | Key No. | Part Name               |
|---------|-------------------------|
| 50      | TUBE ASM, CYLINDER      |
| 51      | CLAMP, BOOT             |
| 52      | BUSHING, BOOT RETAINING |
| 53      | BOOT, RACK & PINION     |
| 54      | BUSHING, BOOT RETAINING |
| 55      | CLAMP, BOOT             |
| 56      | GROMMET, MOUNTING (RH)  |
| 57      | LINE ASM, CYLINDER (RT) |
| 58      | LINE ASM, CYLINDER (LT) |
| 59      | SEAL, O-RING            |

Figure 24 Power Rack and Pinion Steering Assembly (Center-Take-Off)

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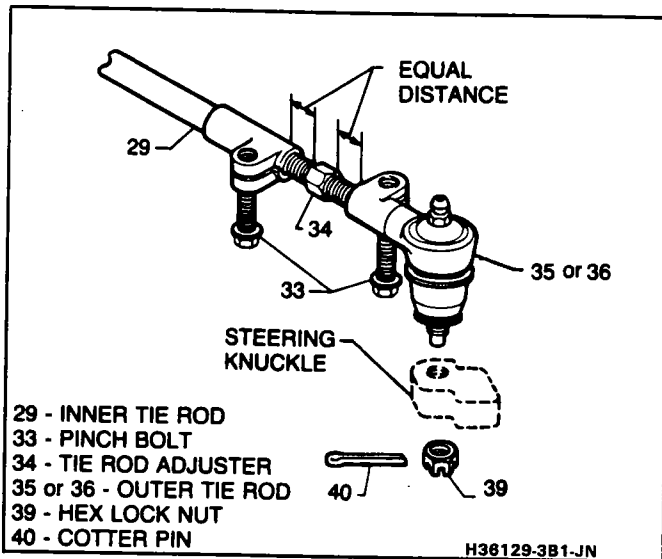


Figure 25 Outer Tie Rod

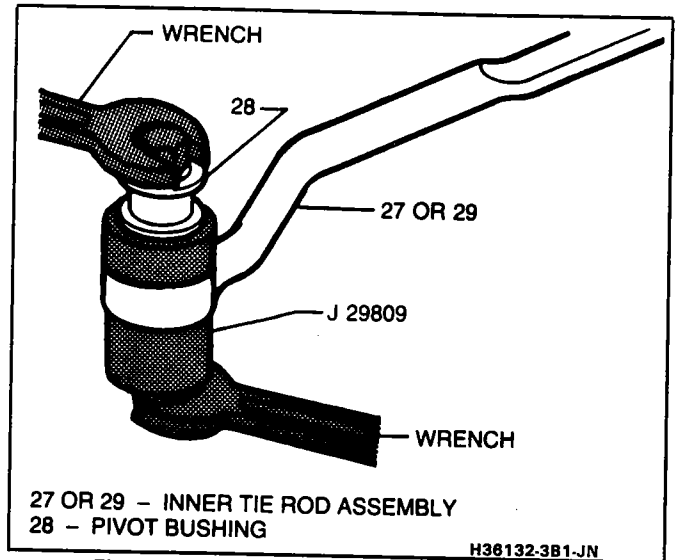


Figure 28 Inner Pivot Bushing Installation

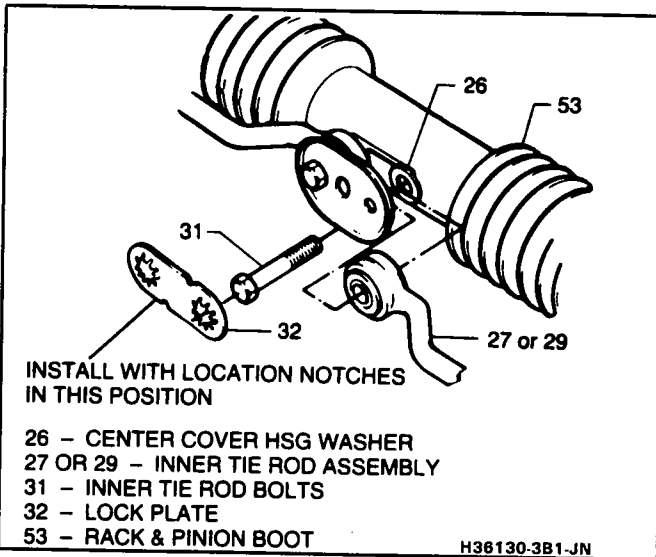


Figure 26 Inner Tie Rod

### Flange and Steering Coupling Assembly

See Figure 29

#### ↔ Remove or Disconnect

1. Rack and pinion steering assembly from car
2. Pinch bolt (13) from flange and steering coupling assembly (12)
3. Flange and steering coupling assembly (12) from stub shaft of pinion and valve assembly (4)

#### ↔ Install or Connect

1. Flange and steering coupling assembly (12) to stub shaft of pinion and valve assembly (4)

#### ⤵ Tighten

- Pinch bolt (13) to flange and steering coupling assembly (12) to 40 N·m (29 lbs. ft.)

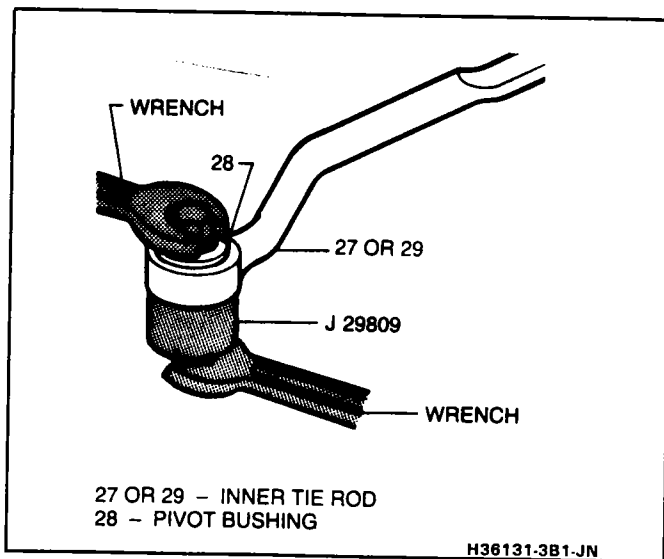


Figure 27 Inner Pivot Bushing Removal

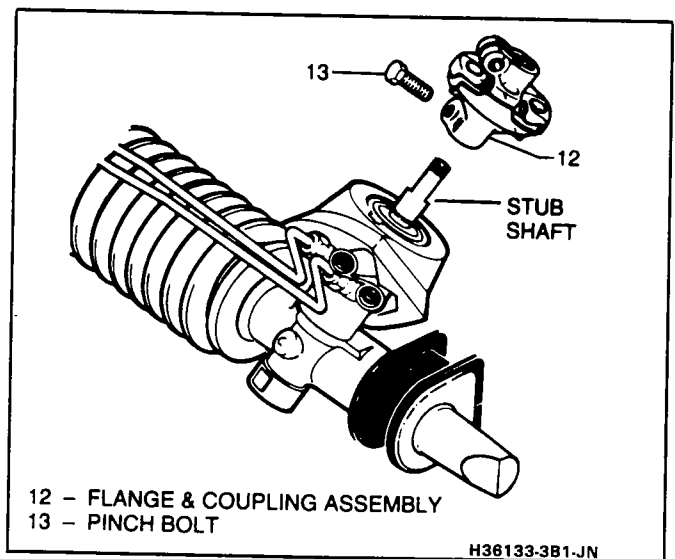


Figure 29 Flange and Steering Coupling Assembly

**Dash Seal**

See Figure 30

**↔ Remove or Disconnect**

1. Rack and pinion steering assembly from car
2. Flange and steering coupling assembly, see "FLANGE AND STEERING COUPLING ASSEMBLY"
3. Dash seal (11) from rack and pinion housing (1)

**↔ Install or Connect**

1. Line up notch in dash seal (11) and rack and pinion housing (1)
2. Dash seal (11) to housing (1); top of dash seal is flush or below top of housing (1)
3. Flange and steering coupling assembly (12) to stub shaft of pinion and valve assembly (4)

**⌚ Tighten**

- Pinch bolt (13) to flange and steering coupling assembly (12) to 40 N·m (29 lbs. ft.)

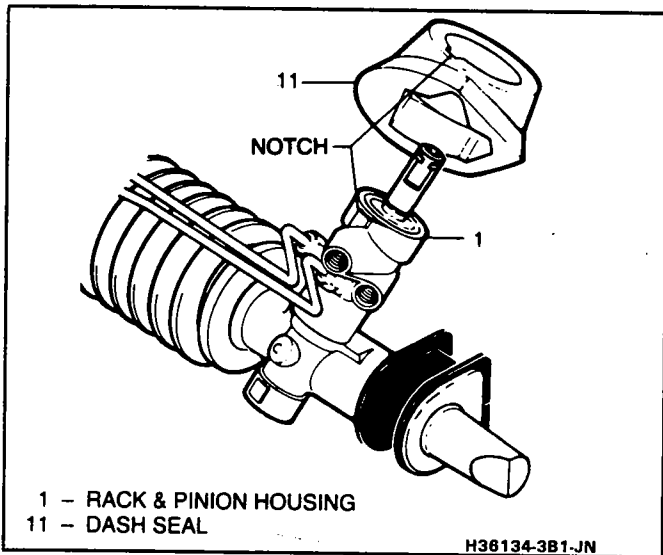


Figure 30 Dash Seal

**Hydraulic Cylinder Lines**

**↔ Remove or Disconnect**

1. Rack and pinion steering assembly from car
2. Cylinder lines (57) or (58) from rack and pinion housing (1)
3. "O"ring seals (59) from cylinder lines (57) and (58)

**↔ Install or Connect**

1. Lubricate "O"ring seals (59) with power steering fluid
2. "O"ring seals (59) to cylinder lines (57) or (58)
3. Cylinder lines (57) or (58) to rack and pinion housing (1) and tighten fittings at the valve end to 18 N·m (14 lbs. ft.) and fittings at the cylinder end to 28 N·m (20 lbs. ft.)

**Boot or Rack Guide**

See Figures 31 and 32

Tools Required:

J 22610 Boot Clamp Installer

**↔ Remove or Disconnect**

1. Rack and pinion steering assembly from car
2. Lock plate (32) from inner tie rod bolts (31) and dispose
3. Inner tie rod bolts (31), bolt support plate (30), inner tie rod assemblies (27) or (29)
4. Cylinder lines (57) and (58) with "O"ring seals (59) attached from rack and pinion steering assembly
5. Mounting grommet (56), boot clamps (51) and (55) by cutting
6. Slide boot retaining bushing (54) from rack and pinion boot (53)
7. Slide boot assembly consisting of rack and pinion boot (53), boot retaining bushing (52), and center housing cover washers (26), captured in the rack and pinion boot (53) from rack and pinion housing (1)
8. Insert and rack guide assembly (25) from rod and rack assembly (41) if necessary

**↔ Install or Connect**

1. Slide boot retaining bushing (52) from rack and pinion boot (53)
2. Slide new boot clamp (51) onto rack and pinion boot (53)
3. Insert boot retaining bushing (52) into rack and pinion boot (53)
4. Coat inner lip of boot retaining bushing (52) lightly with grease for ease of assembly. Slide assembly onto housing assembly (1)
5. Be sure center housing cover washers (26) are in place on rack and pinion boot (53)
6. For ease of assembly, inner tie rod bolt (31) through center housing cover washers (26), insert and rack guide (25). Lightly thread bolt into rod and rack assembly (41), this keeps the components in proper alignment
7. Boot retaining bushing (54) onto cylinder tube of rack and pinion assembly. Slide into end of rack and pinion boot (53)
8. Slide boot clamp (55) over cylinder end of housing and position on rack and pinion boot (53)
9. Slide rack and pinion boot (53) and boot retaining bushing (52) until seated in bushing groove in housing (1)
10. Position boot clamp (51) on rack and pinion boot and crimp clamp
11. Position bridge of boot clamp (55) over split in boot retaining bushing (54) and crimp clamp

**! Important**

- Bridge of boot clamp must be crimped over split in boot retaining bushing (52) to insure proper sealing

12. With "O"ring seals (59) on cylinder line assemblies (57) and (58) to rack and pinion housing assembly, tighten fittings at valve end of housing to 18 N·m (14 lbs. ft.) and fittings at cylinder end to 28 N·m (20 lbs. ft.)
13. Inner tie rod bolts (31) thru holes in bolt support plate (30), inner pivot bushing (28), which is part of inner tie rod assemblies (27) and (28), center housing cover washer (26), insert and rack guide assembly (25) into threaded hole in rod and rack assembly (41)

 **Tighten**

- Inner tie rod bolts (31) 90 N·m (65 lbs. ft.)

14. New lock plate (32) with notches in the proper position over flats of inner tie rod bolts (31)

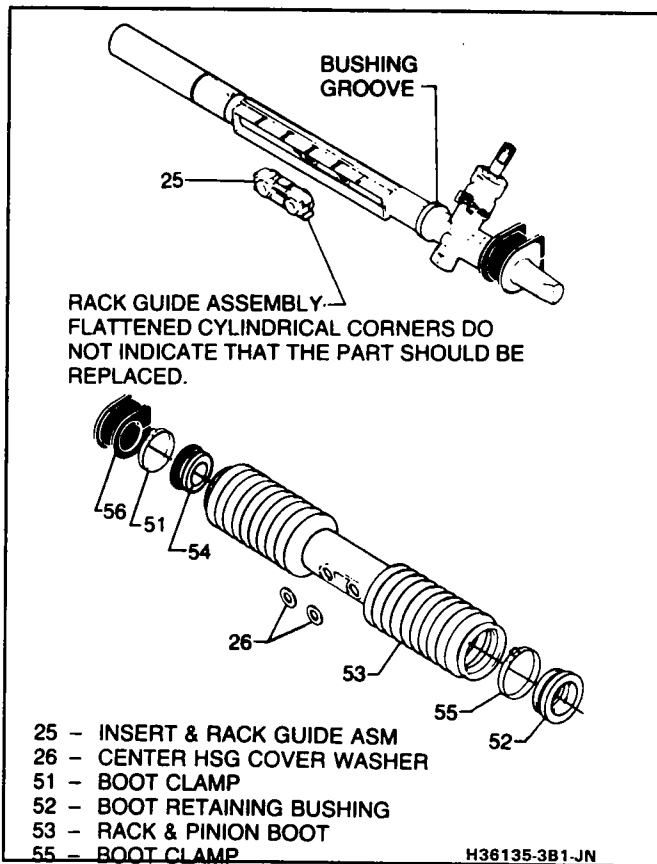


Figure 31 Boot or Rack Guide

**Rack Bearings**

See Figures 33 and 34

Tools Required:  
(14 mm) 9/16 Crowfoot  
Torque Wrench

 **Remove or Disconnect**

1. Rack and pinion assembly from car
2. Adjuster plug lock nut (18) from adjuster plug (17)
3. Adjuster plug (17) from housing (1)
4. Adjuster spring (16), rack bearing (14), with "O"ring seal (15) attached

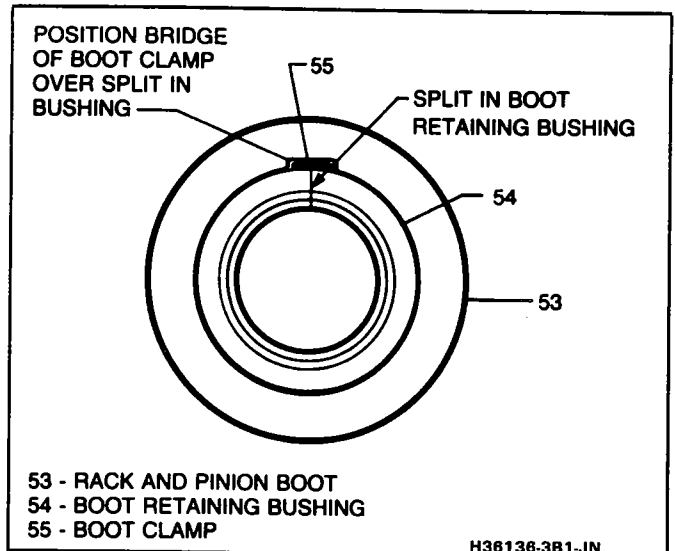


Figure 32 Boot Clamp Position

 **Install or Connect**


1. Coat rack bearing (14), "O"ring seal (15) attached to rack bearing, adjuster spring (16), adjuster plug (17), with lithium base grease
2. Rack bearing (14) with "O"ring seal (15), adjuster spring (16), adjuster plug (17) into housing (1)

 **Adjust**

- With rack centered in housing, turn adjuster plug (17) clockwise until it bottoms in housing, then back off 50° to 70° and check torque on pinion. Maximum pinion pre-load torque is 1.8 N·m (16 lbs. in.).
3. Lock nut (18) to adjuster plug (17). Tighten to 70 N·m (50 lbs. ft.) while holding adjuster plug (17) stationary

**Rack Bearing Preload  
On-Car Adjustment**

See Figure 34

 **Remove or Disconnect**

1. Loosen lock nut (18) and turn adjuster plug (17) clockwise until it bottoms in housing, then back off 50° to 70°
2. Make adjustment with front wheels raised and steering wheel centered. Be sure to check returnability of the steering wheel to center after adjustment
3. Lock nut (18) to adjuster plug (17). Tighten to 70 N·m (50 lbs. ft.) while holding adjuster plug (17) stationary

**Stub Shaft Seals and Upper Bearing**

See Figure 35

Tools Required:

J 29810 Stub Shaft Seal Protector

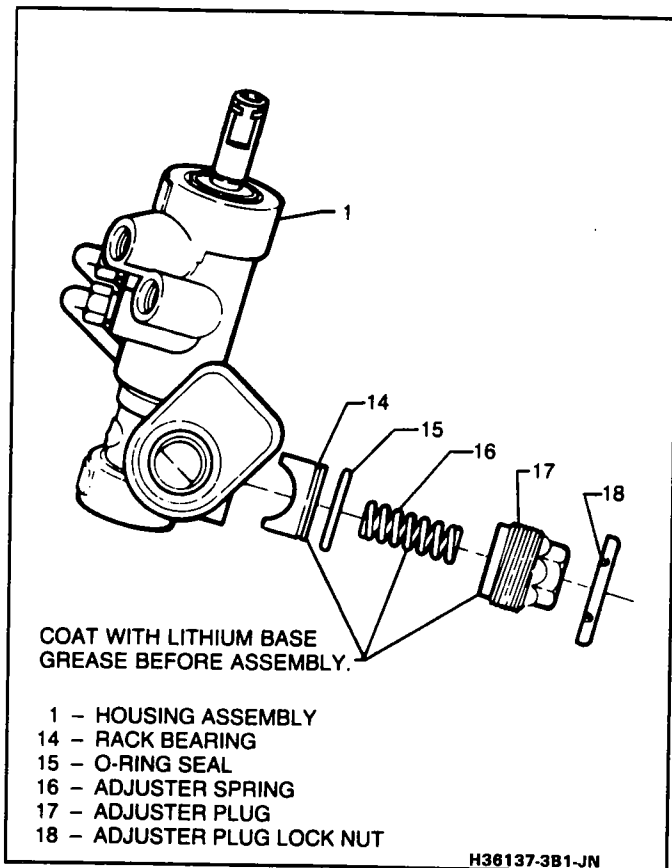


Figure 33 Rack Bearing

↔ Remove or Disconnect

1. Rack and pinion steering assembly from car
2. Adjuster plug lock nut (18) from adjuster plug (17)
3. Adjuster plug (17) from housing (1)
4. Adjuster spring (16), rack bearing (14), with "O"ring seal attached
5. Retaining ring (10) from bottom of housing (1)
6. Dust cover (24) from valve part of housing (1)
7. While holding stub shaft, lock nut (23) from pinion

! Important

- If stub is not held, damage to the pinion teeth will occur. Using a PRESS, press on the threaded end of pinion until flush with ball bearing assembly (21)
8. Complete removal of valve and pinion assembly (4) is not required
  9. Stub shaft dust seal (9), stub shaft seal (8), and stub shaft bearing annulus assembly (7) from valve end of housing (1)

↔ Install or Connect

1. Bottom valve assembly (4) into housing (1)
2. Lock nut (23) to threaded end of pinion

! Important

- While holding the stub shaft, tighten lock nut (23) to 35 N·m (26 lbs. ft.). If stub shaft is not held, damage to the pinion teeth will occur
3. Dust cover (24) to housing (1)
  4. Stub shaft bearing annulus (7) onto stub shaft. Slide into housing (1)
  5. Seal protector J 29810 onto stub shaft
  6. Stub shaft seal (8), stub shaft dust seal (9) over protector and into housing (1)
  7. Retaining ring (10) into groove in housing (1)
  8. Coat rack bearing (14), "O"ring seal (15) attached to rack bearing, adjuster spring (16), adjuster plug (17) with lithium base grease
  9. Rack bearing (14) with "O"ring seal (15), adjuster spring (16), adjuster plug (17) into housing (1)

🔑 Adjust

- With rack centered in housing, turn adjuster plug (17) clockwise until it bottoms in housing (1), then back off 50° to 70°. Check torque on the pinion. Maximum pinion pre-load torque in 1.8 N·m (16 lbs. in.).

10. Lock nut (18) to adjuster plug (17). Tighten to 70 N·m (50 lbs. ft.) while holding adjuster plug (17) stationary

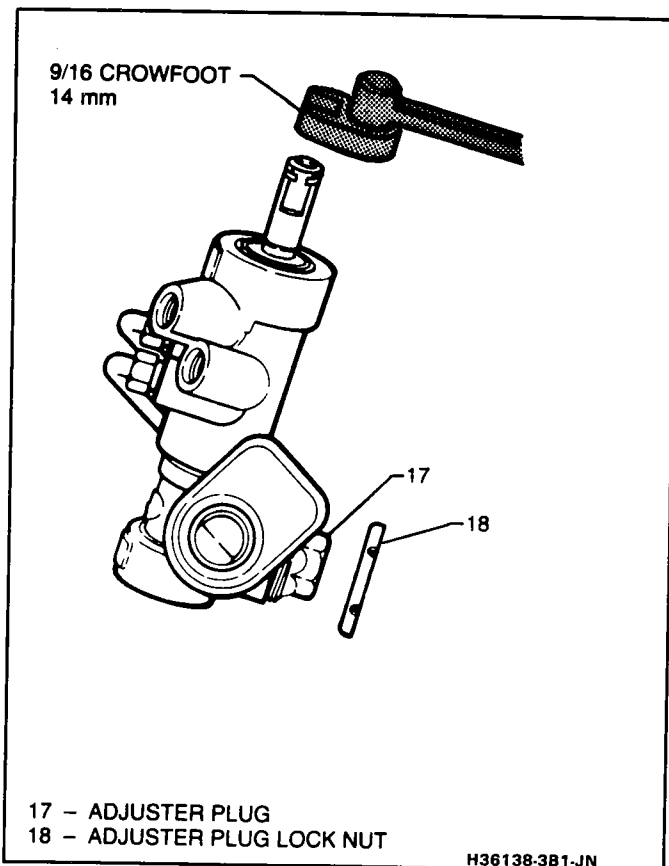


Figure 34 Rack Bearing Adjustment

Valve and Pinion Assembly

See Figure 36

Tools Required:

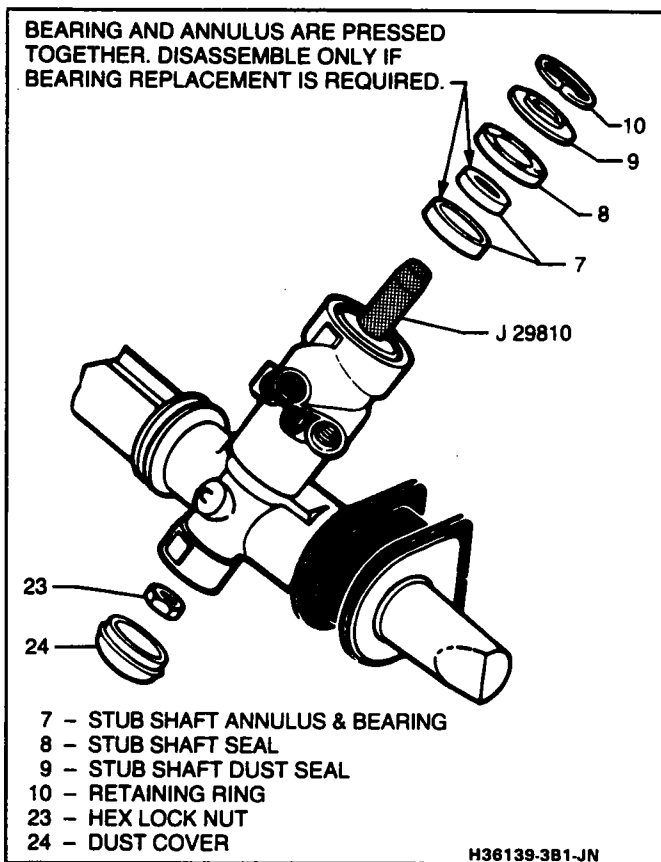


Figure 35 Stub Shaft Seals and Upper Bearing

J 29810 Stub Shaft Seal Protector

J 33057 Pinion and Valve Ring Protector

### ↔ Remove or Disconnect

1. Rack and pinion assembly from car
2. Pinch bolt (13) from flange and steering coupling assembly (12)
3. Flange and steering coupling assembly (12) from stub shaft of pinion and valve assembly (4)
4. Dash seal (11) from housing (1)
5. Adjuster plug lock nut (18) from adjuster plug (17)
6. Adjuster plug from housing (1)
7. Adjuster spring (16), rack bearing (14), with "O"ring seal (15) attached
8. Retaining ring (10) from housing (1)
9. Dust cover (24) from housing (1)
10. While holding the stub shaft, lock nut (23) from pinion

### ! Important

- If stub shaft is not held, damage to the pinion teeth will occur
11. With gear centered, mark location of stub shaft notch on housing; this will aid in proper assembly

### ! Important

- Using a PRESS, press on threaded end of pinion until it is possible to remove the valve and pinion assembly (4) from housing (1)

12. Stub shaft dust seal (9), stub shaft seal (8), stub shaft bearing annulus assembly (7), pinion and valve assembly (4), with spool shaft retaining ring (5) and valve body rings (6) attached
13. Valve body rings (6) from pinion and valve assembly (4) if replacement is necessary

### ↔ Install or Connect

1. New valve body rings (6) to pinion and valve assembly (4). If new valve body rings are required, care should be taken not to cut rings at installation
2. Rack centered in housing (1)
3. Pinion and valve assembly (4), with spool shaft retaining ring (5) and valve body rings (6) included into housing using J 33057 to prevent damaging valve body rings during installation of pinion and valve assembly (4)

### ! Important

- When pinion and valve assembly (4) is fully seated, notch in stub shaft and mark on housing (1) line up, and the rack is centered in the housing
4. While holding the stub shaft, tighten lock nut (23) to threaded pinion to 35 N·m (26 lbs. ft.)

### ! Important

- If stub is not held, damage to the pinion teeth will occur
5. Dust cover (24) to housing (1)
  6. Stub shaft bearing annulus (7) onto stub shaft. Slide into housing (1)
  7. Seal protector J 29810 onto stub shaft
  8. Stub shaft seal (8), stub shaft dust seal (9) over protector and into housing (1)
  9. Retaining ring (10) into groove in housing (1)
  10. Coat rack bearing (14) with "O"ring seal (15) attached, adjuster spring (16), adjuster plug (17) with lithium base grease
  11. Rack bearing (14), with "O"ring seal (15) attached, adjuster spring (16), adjuster plug (17) into housing (1)

### ⚙ Adjust

- With rack centered in the housing, turn adjuster plug (17) clockwise until it bottoms in the housing, then back off 50° to 70°. Check torque on pinion. Maximum pinion pre-load torque is 1.8 N·m (16 lbs. in.).
12. Lock nut (18) to adjuster plug (17). Tighten to 70 N·m (50 lbs. ft.) while holding adjuster plug stationary

## Rack and Pinion Steering Assembly

See Figures 24 through 38

Tools Required:

J 22610 Boot Clamp Installer

J 29810 Stub Shaft Seal Protector

**Rack and Pinion Steering Assembly**

See Figures 37 thru 43

**Tools Required:**

- J 22610 Boot Clamp Installer
- J 29810 Stub Shaft Seal Protector
- J 29822 Pinion Seal Installer
- J 33057 Pinion and Valve Assembly Ring Protector
- J 36343 Cylinder Tube Nut Wrench

**Remove or Disconnect**

1. Rack and pinion steering assembly from car
2. Pinch bolt (13) from flange and steering coupling assembly (12)
3. Flange and steering coupling assembly (12) from stub shaft of pinion and valve assembly (4)
4. Dash seal (11) from housing (1)
5. Lock plate (32) from inner tie rod bolts (31) and dispose
6. Inner tie rod bolts (31), bolt support plate (30), inner tie rod assemblies (27) and (29)
7. Cylinder lines (57) and (58) with "O"ring seals (59)
8. Mounting grommet (56), boot clamps (51) and (55) by cutting
9. Slide boot retaining bushing (54) from rack and pinion boot (53)
10. Slide boot assembly, consisting of rack and pinion boot (53), boot retaining bushing (52), and center housing cover washers (26), captured in rack and pinion boot (53) from housing
11. Insert and rack guide assembly (25)
12. Adjuster plug lock nut (18) from adjuster plug (17)
13. Adjuster plug (17) from housing (1)
14. Adjuster spring (16), rack bearing (14) with "O"ring seal (15) attached
15. Retaining ring (10) from housing (1)
16. Dust cover (24) from housing (1)
17. While holding the stub shaft, lock nut (23) from pinion

**Important**

- If stub shaft is not held, damage to the pinion teeth will occur
18. With gear centered, mark location of stub shaft notch on housing to aid in proper installation of the pinion and valve assembly

**Important**

- Using a PRESS, press on the threaded end of the pinion until it is possible to remove the pinion and valve assembly (4) from the housing (1)
19. Stub shaft dust seal (9), stub shaft seal (8), stub shaft bearing annulus assembly (7), pinion and valve assembly (4) with spool shaft retaining ring (5) and valve body rings (6) attached

20. Cylinder tube assembly (50) from housing (1) using J 36343. Mark location of fittings on housing before removal
21. Piston rod guide rack assembly from housing

**Disassemble**

1. Hex nut (49) from rod and rack assembly (41)
2. Rack piston (46), containing "O"ring seal (47), and piston ring (48), piston rod guide assembly, consisting of piston rod guide (44), "O"ring seal (45), piston rod seal (43), and seal back-up washer (42) for rod and rack assembly (41)
3. "O"ring seal (45), piston rod seal (43) from piston rod guide (44)
22. Retaining ring (22) from housing (1)
23. Pinion bearing assembly (21) from housing (1)
24. Pinion shaft seal (3), upper pinion bushing (2) from housing (1)

**Clean**

- Parts in power steering fluid. Be sure threaded portion on housing (1) is free of foreign material
- Dry parts

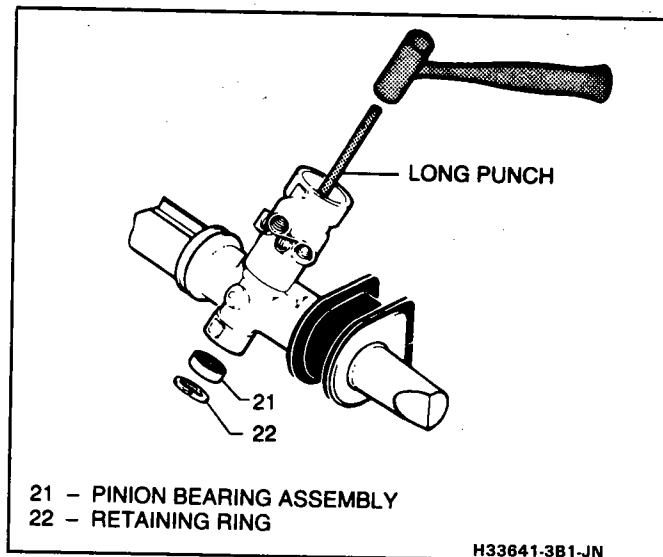


Figure 37 Pinion Bearing Assembly Removal

**Install or Connect**

1. Coat all seals with power steering fluid
2. Upper pinion bushing (2) into valve bore in housing (1)
3. Seat pinion shaft seal (3) into valve bore using J 29822
4. Pinion bearing assembly (21) into housing (1) using a PRESS
5. Retaining ring (22) in groove in housing (1)

**Important**

- Note proper position of retaining ring (22) before installation



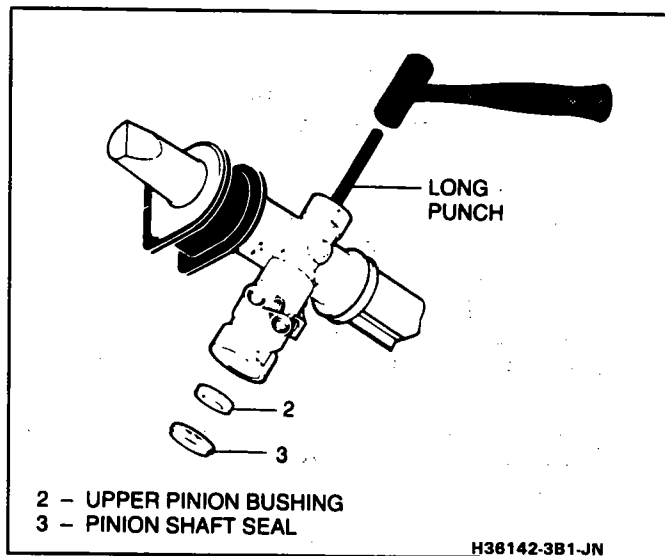


Figure 38 Pinion Shaft Seal and Bushing Removal

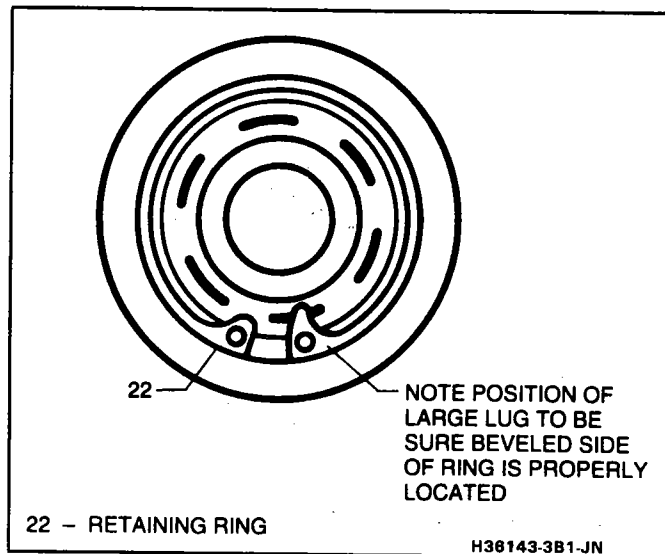


Figure 39 Retaining Ring Position

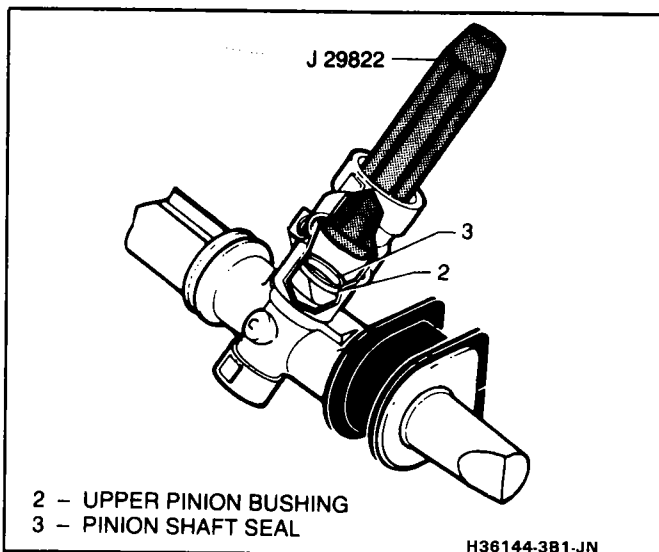


Figure 40 Pinion Shaft Seal and Bushing Installation

**✳ Assemble**

1. Piston rod seal (43), "O"ring seal (45) to piston rod guide (44)
2. "O"ring seal (47), piston ring (48) to rack piston (46)
3. Slide seal back-up washer (42), piston rod guide assembly, rack piston onto rod and rack assembly (41)
4. Hex nut (49) to rod and rack assembly (41). Tighten hex nut to 40 N·m (30 lbs. ft.)
6. Slide piston rod guide assembly into housing
7. One small drop of Loctite 242 or equivalent in three equally spaced locations around the threaded portion of the housing

**! Important**

- Be sure to use the Loctite 242 sparingly to ensure ease of removal of cylinder tube assembly (50) if future repairs are required
8. Cylinder tube assembly (50) over rack piston ring (48) to housing (1). Using J 36343 tighten to 112 N·m (82 lbs. ft.)

**! Important**

- Be sure to line up fittings on cylinder tube (50) with mark on housing (1) before tightening to ensure cylinder line installation
9. Insert and rack guide assembly (25) to rod and rack assembly (41) in housing (1)
  10. Center rack guide assembly in housing window opening
  11. Pinion and valve assembly (4), also containing new valve body rings (6), spool shaft retaining ring (5) into housing (1) using J 33057

**! Important**

- When pinion and valve assembly (4) is fully seated in the housing, the notch in the stub shaft and the mark on the housing line up and insert and rack guide assembly (25) is centered in the housing window
12. While holding the stub shaft, tighten lock nut (23) to threaded pinion 35 N·m (26 lbs. ft.)

**! Important**

- If the stub shaft is not held, damage to the pinion teeth will occur
13. Dust cover (24) to housing (1)
  14. Stub shaft bearing annulus assembly (7) onto stub shaft. Slide into housing (1)
  15. Seal protector J 29810 onto stub shaft
  16. Stub shaft seal (8), stub shaft seal (9), over protector and into housing (1)
  17. Retaining ring (10) into groove in housing (1)
  18. Coat rack bearing (14) with "O"ring seal (15) attached, adjuster spring (16), adjuster plug (17) with lithium base grease into housing (1)



**Adjust**

- With rack centered in the window in the housing (1), turn adjuster plug (17) clockwise until it bottoms in the housing, then back off 50° to 70°. Check pinion torque. Maximum pinion preload torque is 1.8 N·m (16 lbs. in.).

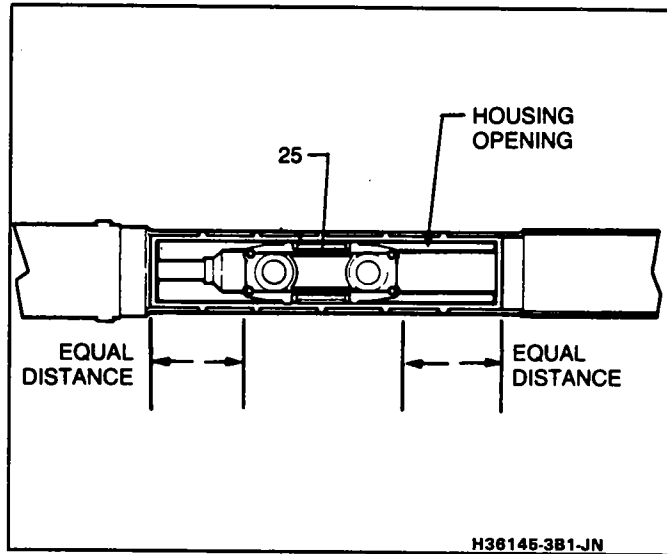


Figure 41 Center Insert and Rack Guide Assembly

19. Lock nut (18) to adjuster plug (17). Tighten to 70 N·m (50 lbs. ft.) while holding adjuster plug stationary
20. Slide boot retaining bushing (52) from rack and pinion boot (53)
21. Slide new boot clamp (51) onto rack and pinion boot (53)
22. Insert boot retaining bushing (52) into rack and pinion boot (53)

23. Coat inner lip of boot retaining bushing (52) lightly with grease for ease of assembly. Slide assembly onto housing assembly
24. Be sure centering cover washers (26) are in place on rack and pinion boot (53)
25. For ease of assembly, inner tie rod bolt (31) through center cover washers (26), insert and rack guide (25), lightly thread bolt into rod and rack assembly (41). This keeps the components in proper alignment
26. Boot retaining bushing (54) onto cylinder tube assembly (50). Slide into end of rack and pinion boot (53)
27. Slide rack and pinion boot (53) and boot retaining bushing (52) until seated in the bushing groove in the housing (1)
28. Position boot clamps (51) onto rack and pinion boot (53) and crimp clamp
29. Position bridge of boot clamp (55) over split in boot retaining bushing (54) and crimp clamp



**Important**

- It is important that bridge of clamp is positioned over split in boot retaining bushing to insure proper sealing
30. With "O"ring seals (59) on cylinder line assemblies (57) and (58) to rack and pinion housing assembly, tighten fittings at valve end of housing to 18 N·m (14 lbs. ft.) and the fittings at the cylinder end of the housing to 28 N·m (20 lbs. ft.)
  31. Inner tie rod bolts (31), through holes in bolt support plate (30), inner pivot bushings (28) which are part of inner tie rod assemblies (27) and (28), center housing cover washers (26), insert and rack guide assembly (25) into threaded holes in rod and rack assembly (41)



**Tighten**

- Inner tie rod bolts (31) to 90 N·m (65 lbs. ft.)
32. New lock plate (32), with notches in the proper position, over flats of inner tie rod bolts (31)

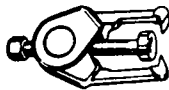
**GENERAL SPECIFICATIONS**

Lubricant .....	Power Steering Fluid No. 1050017 or Equivalent	
	LITERS	PINTS
Capacity .....	.50	1.0
Pump Only .....		
Complete System .....	.75	1-1/2

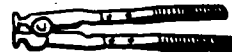
**RECOMMENDED TORQUE SPECIFICATIONS**

	N*m	LBS. FT.
Adjuster Plug Locknut .....	70	50
Inner Tie Rod Housing to Rack .....	95	70
Intermediate Shaft Pinch Bolts .....	48	35
Outer Tie Rod Jam Nut .....	40	30
Pinion Locknut .....	35	26
Pinion Pre-load .....	1.8	16*
Power Steering Line Fittings .....	27	20
Tie Rod Pinch Bolts .....	55	41

\* Lbs. In.



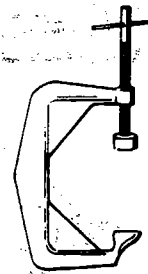
J-24319-01



J-22610



J-29860  
J-33057



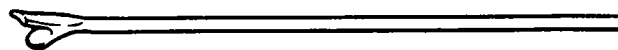
J-22269-01



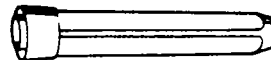
J-29810



J-28478



J-34987



J-28527

- J-22269-01 LOW SERVO COVER REMOVER & INSTALLER (TIE ROD END INSTALLER)
- J-22610 KEYSTONE CLAMP PLIERS
- J-24319-01 PULLER
- J-28478 BULKHEAD INNER SEAL PROTECTOR
- J-28527 PINION SEAL INSTALLER
- J-29810 STUB SHAFT SEAL PROTECTOR
- J-29860 RACK PISTON SEAL PROTECTOR
- J-33057 PINION & VALVE ASSEMBLY SEAL RING PROTECTOR
- J-34987 INNER RACK SEAL REMOVER

G34287-3B1-AH

Figure 42 Specifications, Torque Values and Tools (End-Take-Off)

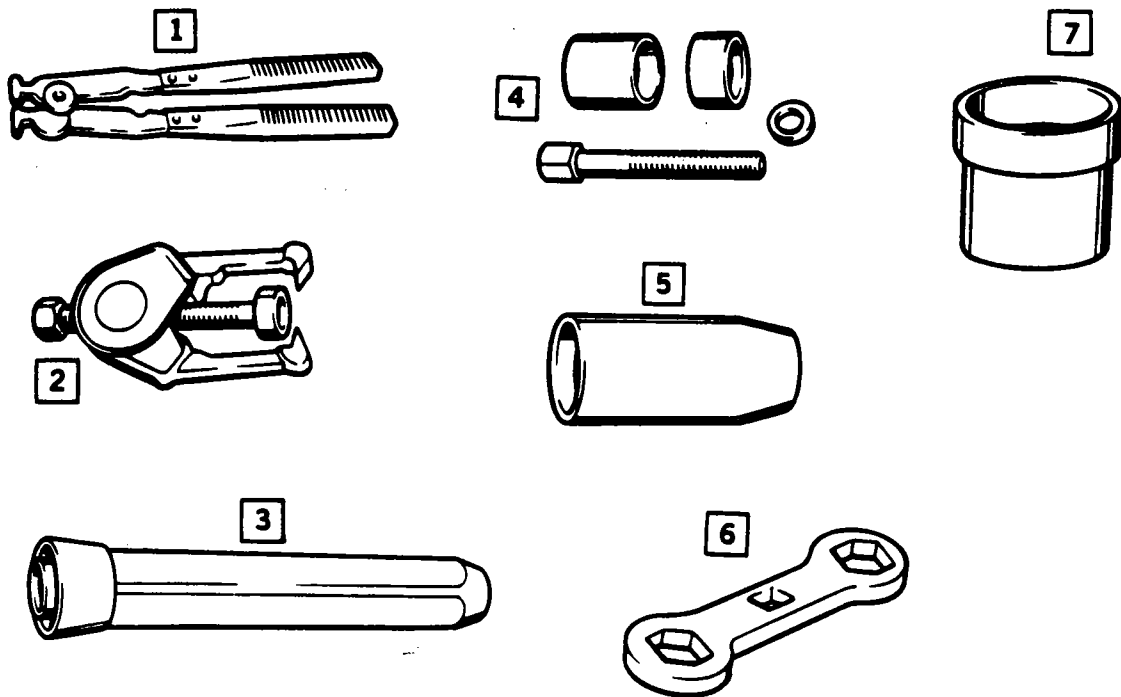
# 3B1-28 POWER RACK AND PINION

## GENERAL SPECIFICATIONS

Lubricant .....	Power Steering Fluid No. 1050017 or Equivalent		
Capacity		LITERS	PINTS
Pump Only .....		.50	1.0
Complete System .....		.75	1-1/2

## RECOMMENDED TORQUE SPECIFICATIONS

	N*m	LBS. FT.	LBS. IN.
Adjuster Plug Locknut .....	70	50	
Coupling to Stub Shaft .....	50	37	
Coupling to Steering Column .....	46	34	
Inner Tie Rod Bolts .....	90	65	
Pinion Locknut .....	35	26	
Pinion Preload .....	1.8		16
Power Steering Line Fittings .....	27	20	
Rack & Pinion Mounting Clamp Nuts .....	38	28	
Rod & Piston Assembly to Rack .....	90	65	
Tie Rod End to Steering Knuckle Nut .....	50	35	
Tie Rod Pinch Bolts .....	55	41	



- |               |   |
|---------------|---|
| 1. J 22610    | KEYSTONE CLAMP PLIERS                         |
| 2. J 24319-01 | PULLER  |
| 3. J 29822    | PINION SEAL INSTALLER                         |
| 4. J 29809    | INNER TIE ROD BUSHING REMOVER/INSTALLER       |
| 5. J 29810    | STUB SHAFT SEAL PROTECTOR                     |
| 6. J 36343    | CYLINDER TUBE WRENCH                          |
| 7. J 33057    | PINION & VALVE ASSEMBLY TEFLON RING PROTECTOR |

H36179-3B1-JN

Figure 43 Specifications, Torque Values and Tools (Center-Take-Off)

# SECTION 3B5

## STEERING WHEELS AND COLUMNS

### B-G CARLINES

**NOTICE:** All steering wheel and column fasteners are important attaching parts in that they could affect the performance of vital components and systems, and/or could result in major repair expense. They must be replaced with one of the same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of these parts. For prevailing torque nut(s) and bolt(s), refer to the "Reuse of Prevailing Torque Nut(s) and Bolt(s)" chart in Section 0A.

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## GENERAL INFORMATION

### STEERING COLUMN

The locking energy absorbing steering column includes three important features in addition to the steering function:

1. In a front-end collision, the energy absorbing column is designed to collapse in order to minimize the possibility of injury to the driver.
2. The ignition switch and lock are conveniently mounted on the column.
3. When locked, the column mounted lock acts as a theft deterrent by preventing the operation of both ignition and steering.

The multifunction turn signal lever controls the headlight dimmer, windshield wipers and cruise control.

The column may be easily disassembled and reassembled. To ensure the energy absorbing action, it is important to use only the specified screws, bolts and nuts and to tighten them to the specified torque. Apply a thin coat of lithium grease to all friction points when reassembling.

When the column assembly is removed from the car, special care must be taken in handling it. Use of a steering wheel puller other than the one recommended in this manual or a sharp blow on the end of the steering shaft or shift lever, leaning on the assembly or dropping the assembly could shear or loosen the plastic fasteners which maintain column rigidity.

### IGNITION LOCK SYSTEM

*See Figure 1*

All steering columns contain a mechanical neutral start system. This system relies on a mechanical block to prevent starting the engine in other than "P" (Park) or "N" (Neutral).

The mechanical block is achieved by a wedge shape finger added to the ignition switch actuator rod.

In either "P" or "N", this finger passes through the bowl plate slots, allowing the lock cylinder full rotational travel into the "Start" position.

### ON-CAR SERVICE

#### MULTIFUNCTION TURN SIGNAL LEVER

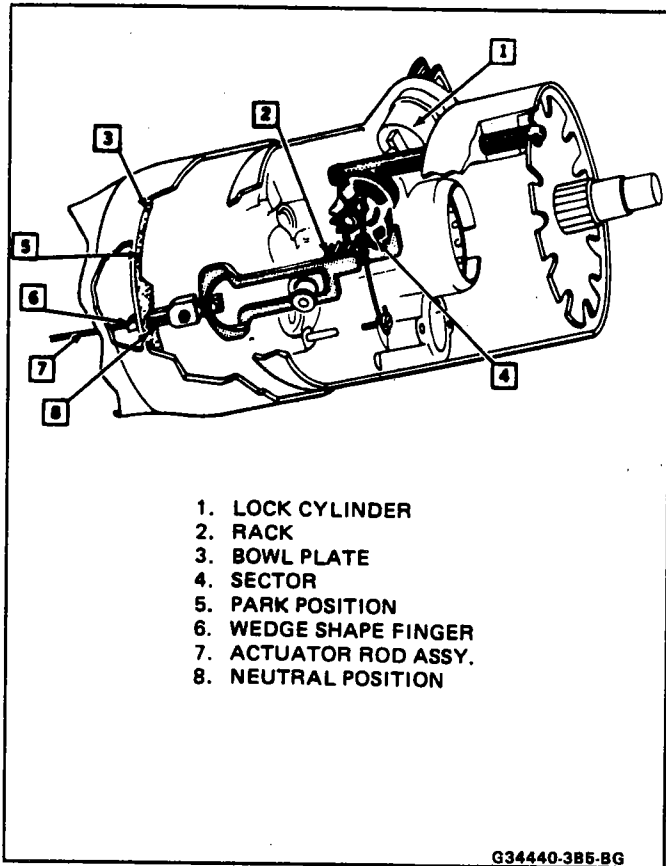
*See Figure 2*

##### Remove or Disconnect

1. Make sure lever is in center or "Off" position.
2. Pull lever straight out of turn signal switch.
3. If equipped with cruise control, attach mechanic's wire to connector and pull harness through column.

##### Install or Connect

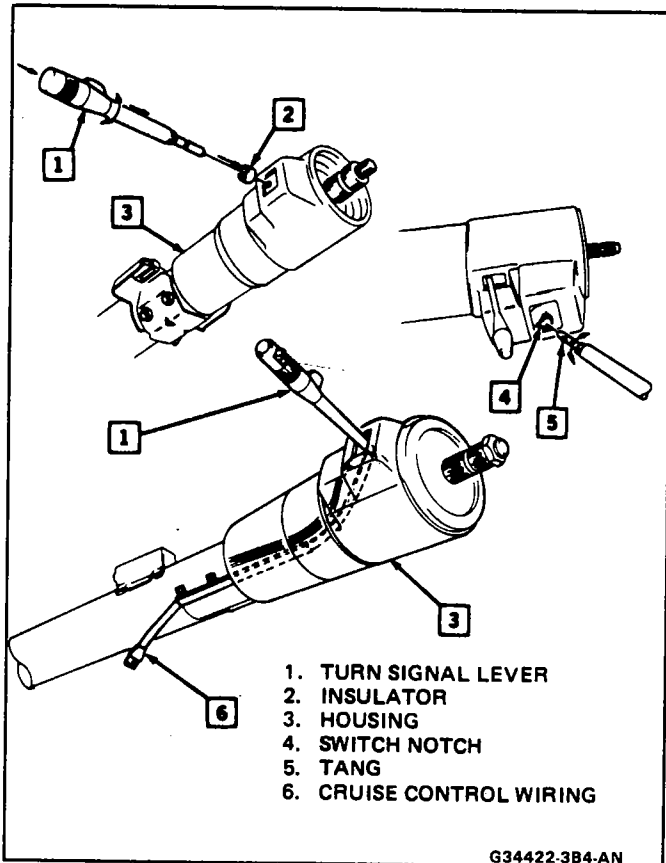
1. If equipped with cruise control, attach connector to mechanic's wire and pull harness through column.
2. Push lever into turn signal switch.



1. LOCK CYLINDER
2. RACK
3. BOWL PLATE
4. SECTOR
5. PARK POSITION
6. WEDGE SHAPE FINGER
7. ACTUATOR ROD ASSY.
8. NEUTRAL POSITION

G34440-3B5-BG

Figure 1 Mechanical Neutral Start



1. TURN SIGNAL LEVER
2. INSULATOR
3. HOUSING
4. SWITCH NOTCH
5. TANG
6. CRUISE CONTROL WIRING

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Figure 2 Multifunction Turn Signal Lever

### STEERING COLUMN SHIFT LEVER

See Figure 3

↔ Remove or Disconnect

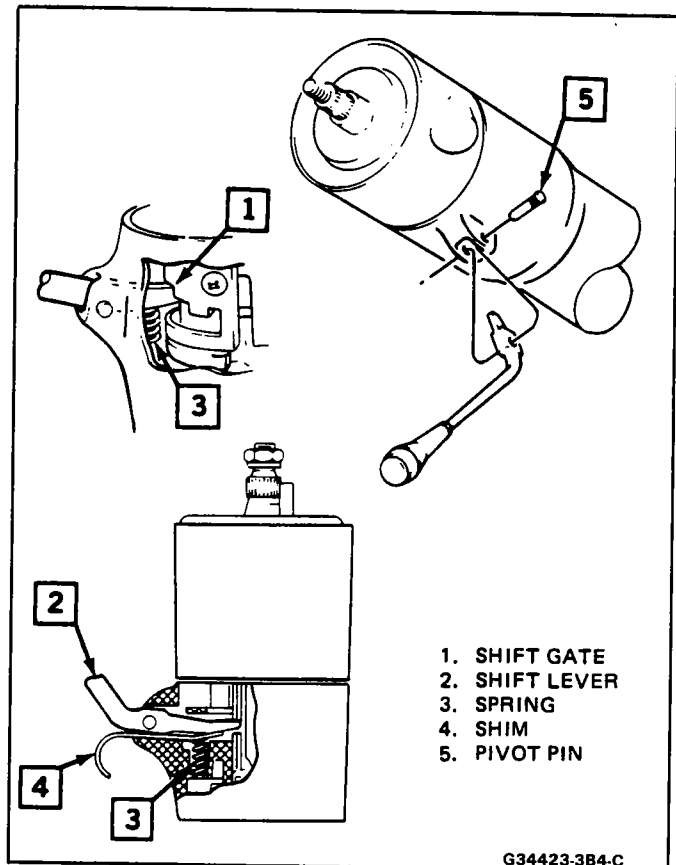
1. Pivot pin from the housing
2. Lever out of the housing being careful not to lose spring

→← Install or Connect

- If problems are experienced while installing the shift lever over spring, a shim may be used as shown.

  1. Spring
  2. Shim over top of spring
  3. Shift lever
  4. Pivot pin
  5. Remove shim.

- After shift lever installation into column, there must be positive shift gate feel in all positions.



1. SHIFT GATE
2. SHIFT LEVER
3. SPRING
4. SHIM
5. PIVOT PIN

G34423-3B4-C

Figure 3 Steering Column Shift Lever

### SHIFT INDICATOR ADJUSTMENT

See Figure 4

🔧 Adjust

- Steering column attachment should be complete

  1. Position shift lever in "N" (Neutral) gate notch
  2. Guide clip on edge of shift bowl to centrally position pointer on "N" (Neutral)
  3. Push clip onto bowl

Care must be taken to assure that cable rests on bowl, not on column jacket.

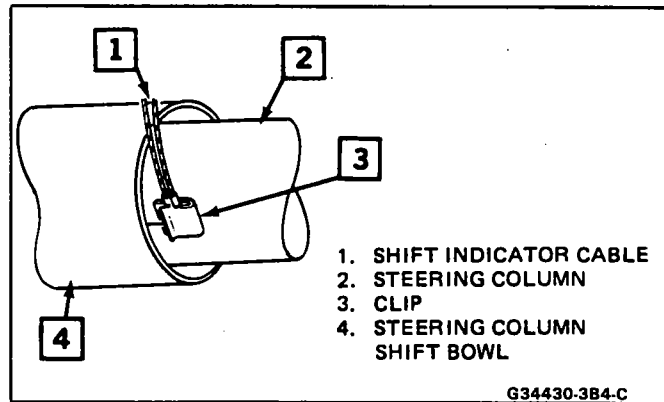


Figure 4 Shift Indicator Adjustment

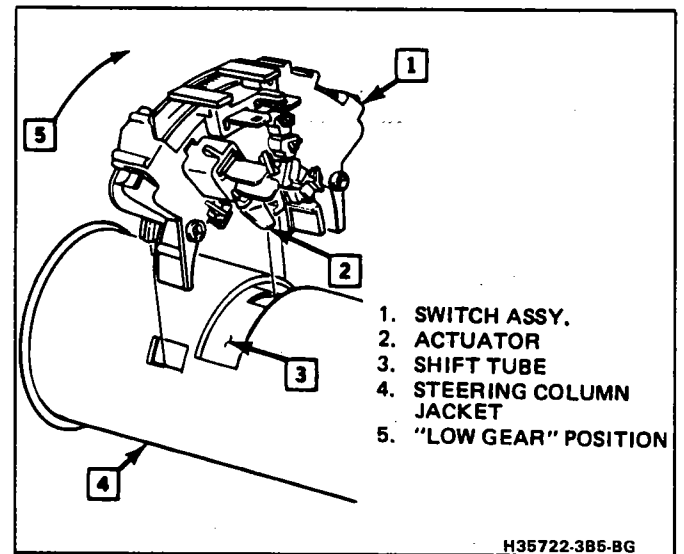


Figure 5 Park-Neutral-Backup Lamp Switch

## PARK-NEUTRAL-BACKUP LAMP SWITCH

See Figure 5

The Park-Neutral-Backup Lamp switch indicates to the ECM when the transmission is in "Park" or "Neutral" and turns on the backup lamps by completing the circuit when the transmission is in "Reverse".

### ↔ Remove or Disconnect

1. Battery
2. Left sound insulator (if equipped)
3. Wiring at switch
4. Switch

### Replacement - Using Old Switch

### ↔ Install or Connect

1. Place transmission in "Neutral".
2. Align actuator on switch with hole in shift tube.
3. Position connector side of switch to fit into cutout in steering column jacket.
4. Push down on switch and snap the 2 tangs on switch into place on steering column jacket.
5. Move switch housing to "Low" gear position.
6. Place transmission in "Park". Switch will ratchet as it adjusts itself.

### Replacement - Using New Switch

1. Place transmission in "Neutral".
2. Align actuator on switch with hole in shift tube.
3. Position connector side of switch to fit into cutout in steering column jacket.
4. Push down on switch and snap the 2 tangs on switch into place on steering column jacket.
5. Place transmission in "Park". Switch will ratchet as it adjusts itself.

## STEERING WHEEL (EXCEPT SPORT STYLES)

See Figure 6

Tools Required:

J 1859-03 Steering Wheel Puller  
BT-61-9 Steering Wheel Puller

### ↔ Remove or Disconnect

1. Negative battery cable
2. Pad assembly attaching screws and lift up on pad and disconnect horn wire by pushing in on insulator and turning counterclockwise
3. Steering wheel nut retainer and nut, and remove steering wheel using J 1859-03 or BT-61-9

### ↔ Install or Connect

1. With the alignment marks on the steering wheel hub and the steering shaft aligned, install the steering wheel and nut. Tighten nut to 41 N·m (30 lbs. ft.) and install nut retainer.
2. Horn wire in cam tower and push in and turn clockwise. Then align pad assembly into position and install screws.
3. Negative battery cable

## STEERING WHEEL (SPORT STYLES)

See Figure 6

Tools Required:

J 1859-03 Steering Wheel Puller  
BT-61-9 Steering Wheel Puller

### ↔ Remove or Disconnect

1. Negative battery cable
2. Pull up on cap assembly to remove.
3. Steering wheel nut retainer and nut, and remove steering wheel using J 1859-03 or BT-61-9

### ↔ Install or Connect

1. With the alignment marks on the steering wheel hub and the steering shaft aligned, install the steering wheel and nut. Tighten nut to 41 N·m (30 lbs. ft.) and install nut retainer.

2. Align cap assembly into position and push straight down into place.
3. Negative battery cable

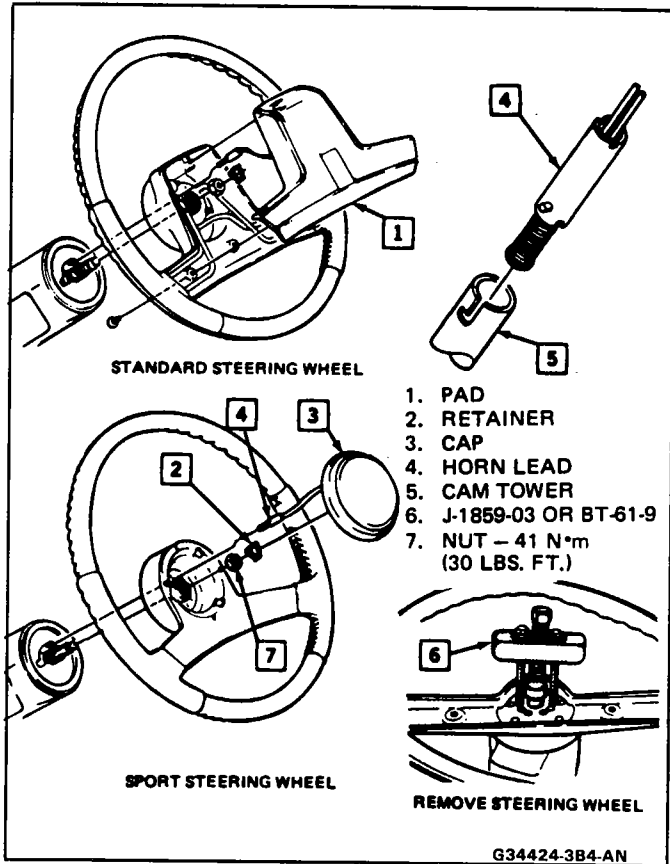


Figure 6 Steering Wheel Removal

7. Trim cap or lower trim panel from instrument panel
8. Cover and lower attaching bolts
9. If equipped with column shift, remove shift indicator cable clip from shift bowl.
10. Two nuts from upper support bracket while holding column in position
11. Lower column and disconnect wiring. If spacers were used, retain for use when installing steering column.
12. Carefully remove steering column from inside of car.
  - If there is a possibility that the steering column may be partially collapsed, see "Checking Column For Accident Damage".

↔ Install or Connect

1. Carefully position steering column through cowl.
2. Wiring before raising steering column
3. Raise steering column into position and loosely install nuts at upper support bracket. If spacers were removed, install equal thickness on each side.
4. Intermediate shaft onto steering column shaft. Install clamp bolt and nut and tighten nut to 70 N·m (50 lbs. ft.).
5. Lower attaching bolts and cover
6. Tighten nuts at upper support bracket to 27 N·m (20 lbs. ft.)
7. If equipped with column shift, install shift indicator cable clip to shift bowl and adjust.
8. Trim cap or lower trim panel on instrument panel
9. Left sound insulator
10. If steering wheel was removed, install steering wheel, see "Steering Wheel".
11. Negative battery cable

**STEERING COLUMN**

See Figure 7 or 8

Tools Required:

J 23074 Steering Column Holding Fixture

**NOTICE:** Once the steering column is removed from the car, the column is extremely susceptible to damage. Dropping the column assembly on its end could collapse the steering shaft or loosen the plastic injections which maintain column rigidity. Leaning on the column assembly could cause the jacket to bend or deform. Any of the above damage could impair the column's collapsible design. If it is necessary to remove the steering wheel, use only the specified steering wheel puller. Under no conditions should the end of the shaft be hammered upon as hammering could loosen plastic injections which maintain column rigidity.

↔ Remove or Disconnect

1. Negative battery cable
2. Bolt from intermediate shaft at lower end of column shaft
3. Shift linkage from shift tube lever at lower end of steering column
4. If column is to be replaced or repaired on the bench, remove steering wheel. Refer to "Steering Wheel".
5. Left sound insulator
6. Lower steering column cover

**STEERING COLUMN SERVICE ON BENCH**

↔ Remove or Disconnect

1. Steering column from car
  2. Column support bracket and wiring protector
  3. Install column holding fixture J 23074.
  4. Install column and tool into vise.
  5. Lock plate cover
  6. Lock plate and retainer
- Continue column service as necessary, see "Unit Repair".

**UNIT REPAIR**

**STEERING COLUMN**

See Figures 9 thru 15

**INTERMEDIATE SHAFT**

See Figure 16

**CHECKING COLUMN FOR ACCIDENT DAMAGE**

See Figure 17



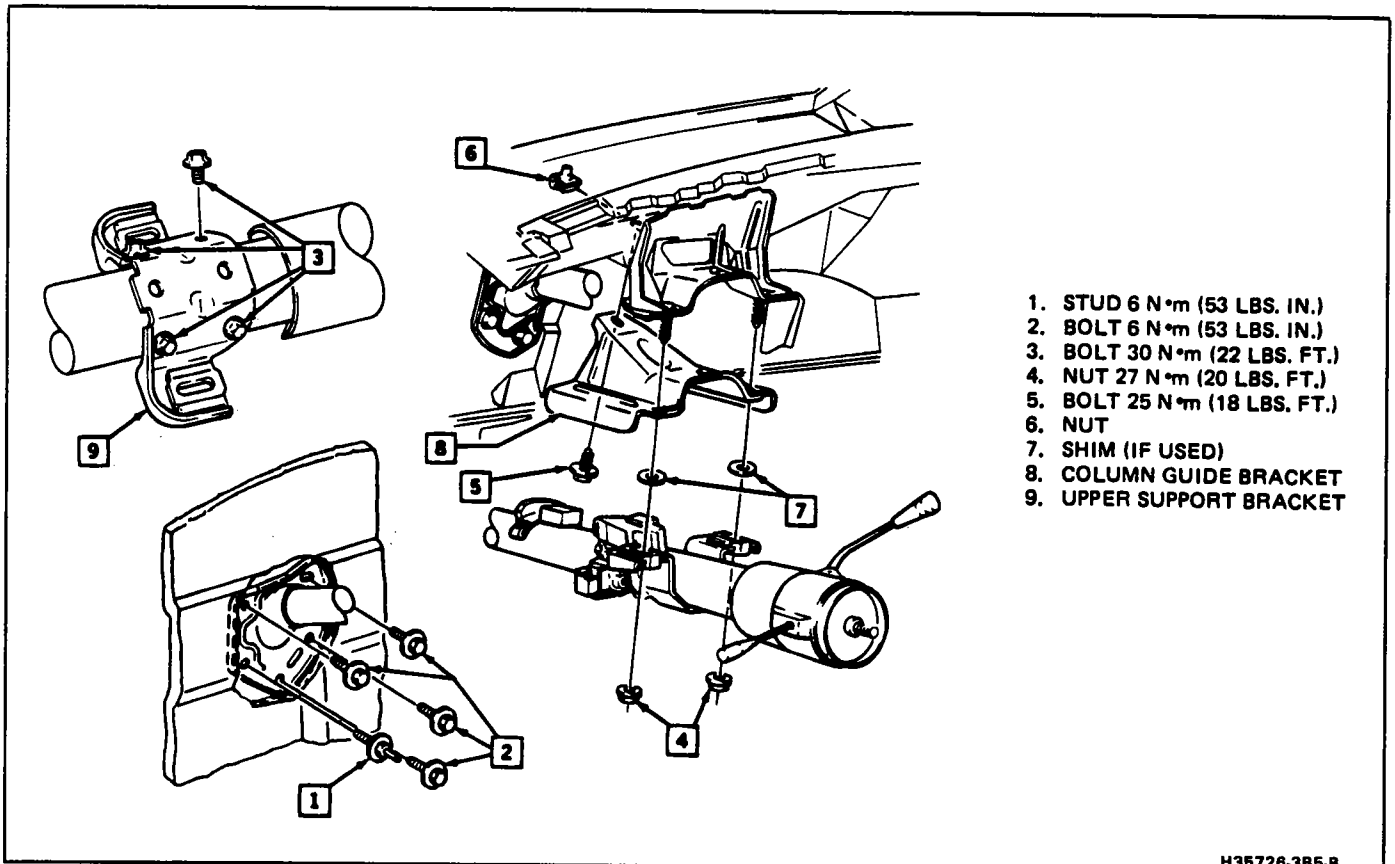


Figure 7 Steering Column Mounting - B Carline

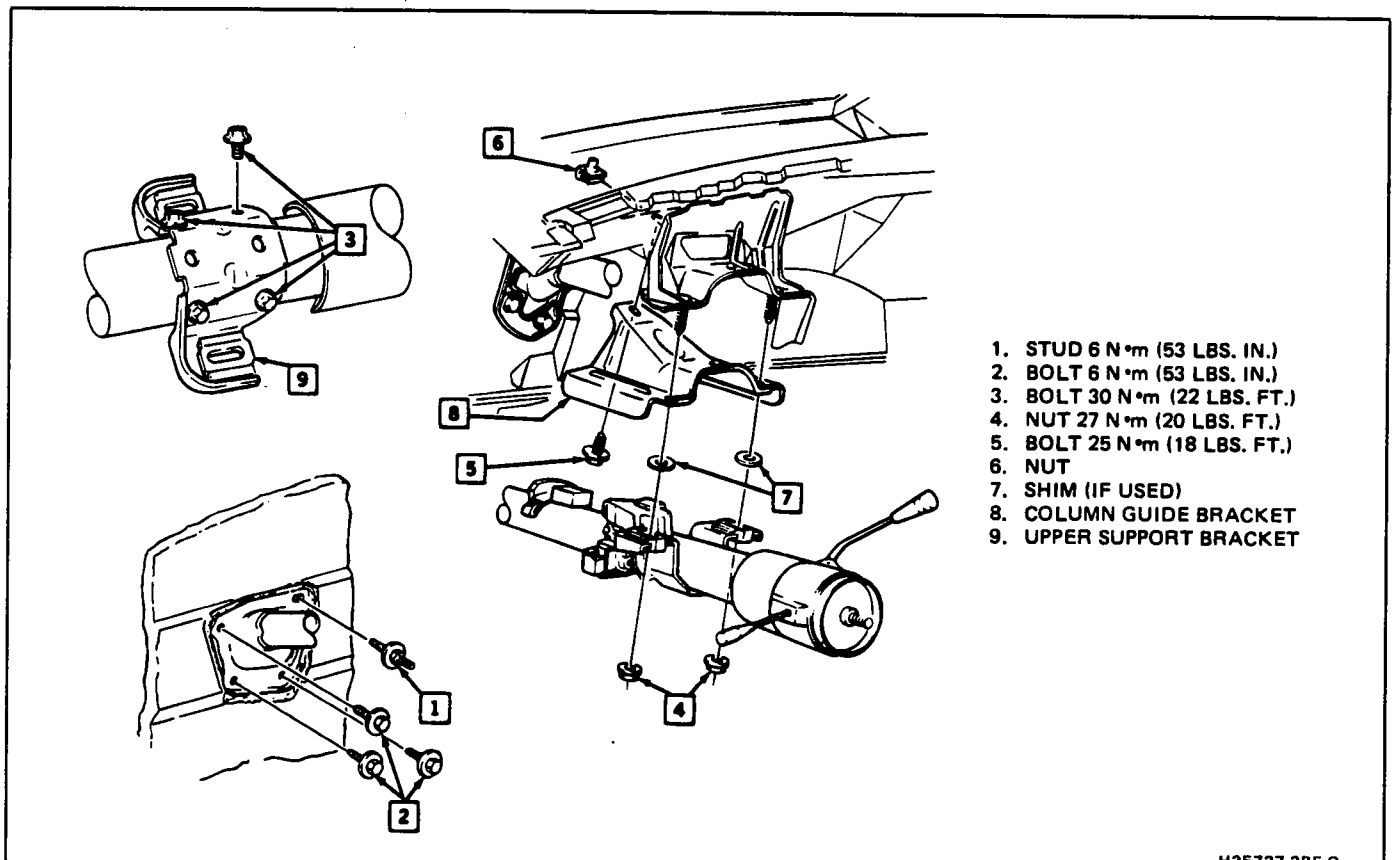
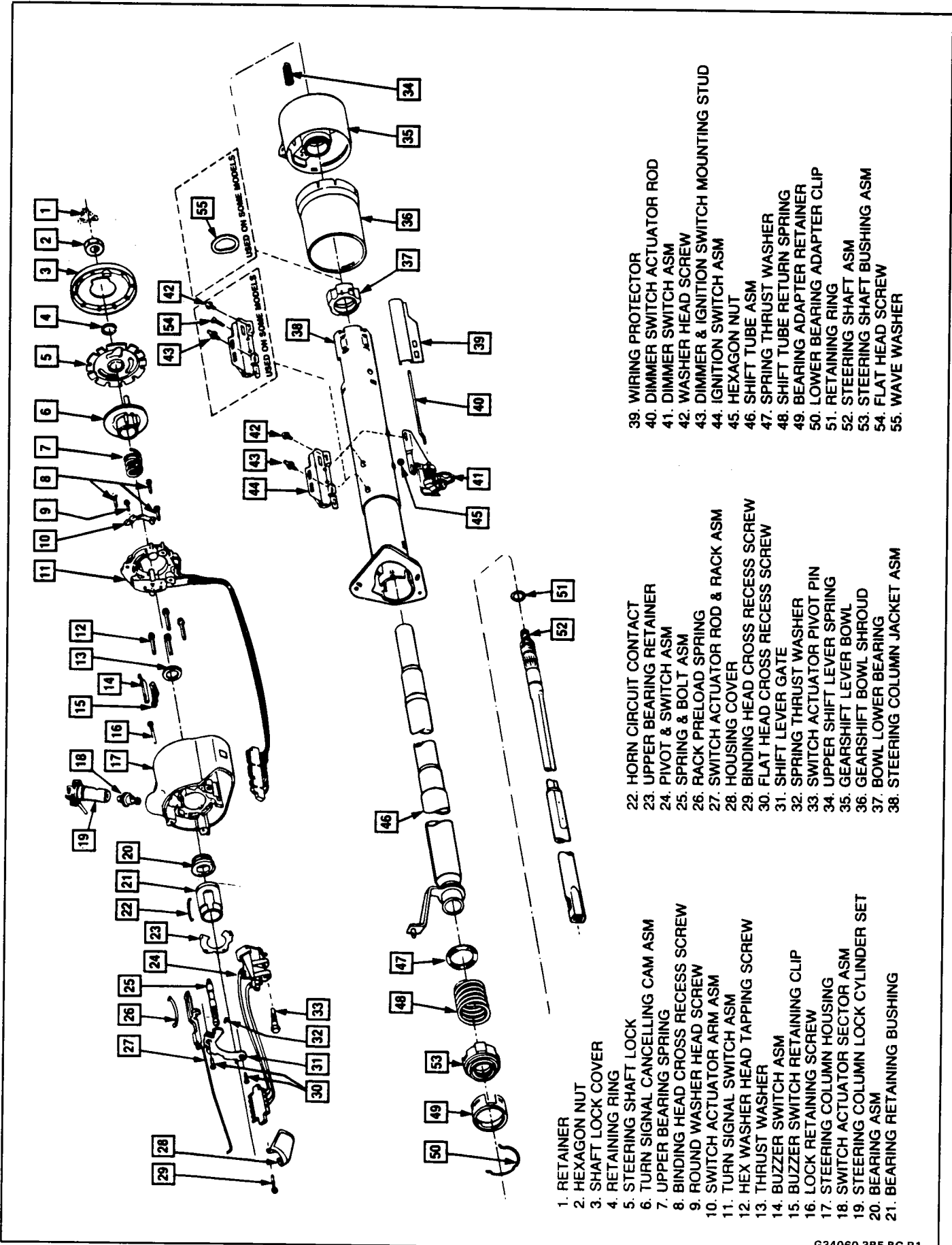


Figure 8 Steering Column Mounting - G Carline



- 1. RETAINER
- 2. HEXAGON NUT
- 3. SHAFT LOCK COVER
- 4. RETAINING RING
- 5. STEERING SHAFT LOCK
- 6. TURN SIGNAL CANCELLING CAM ASM
- 7. UPPER BEARING SPRING
- 8. BINDING HEAD CROSS RECESS SCREW
- 9. ROUND WASHER HEAD SCREW
- 10. SWITCH ACTUATOR ARM ASM
- 11. TURN SIGNAL SWITCH ASM
- 12. HEX WASHER HEAD TAPPING SCREW
- 13. THRUST WASHER
- 14. BUZZER SWITCH ASM
- 15. BUZZER SWITCH RETAINING CLIP
- 16. LOCK RETAINING SCREW
- 17. STEERING COLUMN HOUSING
- 18. SWITCH ACTUATOR SECTOR ASM
- 19. STEERING COLUMN LOCK CYLINDER SET
- 20. BEARING ASM
- 21. BEARING RETAINING BUSHING

- 22. HORN CIRCUIT CONTACT
- 23. UPPER BEARING RETAINER
- 24. PIVOT & SWITCH ASM
- 25. SPRING & BOLT ASM
- 26. RACK PRELOAD SPRING
- 27. SWITCH ACTUATOR ROD & RACK ASM
- 28. HOUSING COVER
- 29. BINDING HEAD CROSS RECESS SCREW
- 30. FLAT HEAD CROSS RECESS SCREW
- 31. SHIFT LEVER GATE
- 32. SPRING THRUST WASHER
- 33. SWITCH ACTUATOR PIVOT PIN
- 34. UPPER SHIFT LEVER SPRING
- 35. GEARSHIFT LEVER BOWL
- 36. GEARSHIFT BOWL SHROUD
- 37. BOWL LOWER BEARING
- 38. STEERING COLUMN JACKET ASM

- 39. WIRING PROTECTOR
- 40. DIMMER SWITCH ACTUATOR ROD
- 41. DIMMER SWITCH ASM
- 42. WASHER HEAD SCREW
- 43. DIMMER & IGNITION SWITCH MOUNTING STUD
- 44. IGNITION SWITCH ASM
- 45. HEXAGON NUT
- 46. SHIFT TUBE ASM
- 47. SPRING THRUST WASHER
- 48. SHIFT TUBE RETURN SPRING
- 49. BEARING ADAPTER RETAINER
- 50. LOWER BEARING ADAPTER CLIP
- 51. RETAINING RING
- 52. STEERING SHAFT ASM
- 53. STEERING SHAFT BUSHING ASM
- 54. FLAT HEAD SCREW
- 55. WAVE WASHER

Figure 9 Standard Steering Column

# ALL STANDARD STEERING COLUMNS

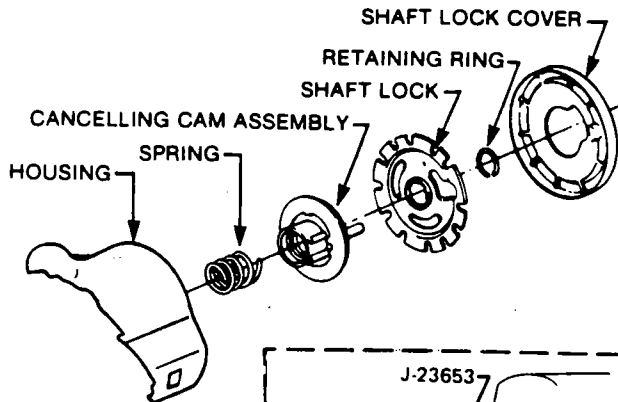
## 1. REMOVE AND INSTALL LOCK PLATE AND/OR CANCELLING CAM

### REMOVE

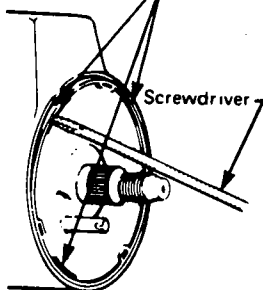
1. Remove parts as shown.

### INSTALL

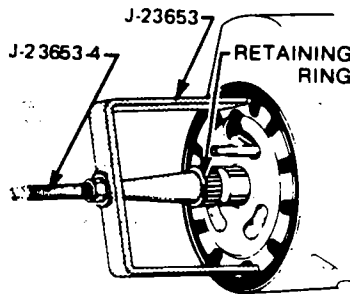
1. Install parts as shown.



Pry out at these locations to remove cover



REMOVE SHAFT LOCK COVER



Tighten nut until tool slightly depresses shaft lock.

REMOVE AND INSTALL RETAINING RING

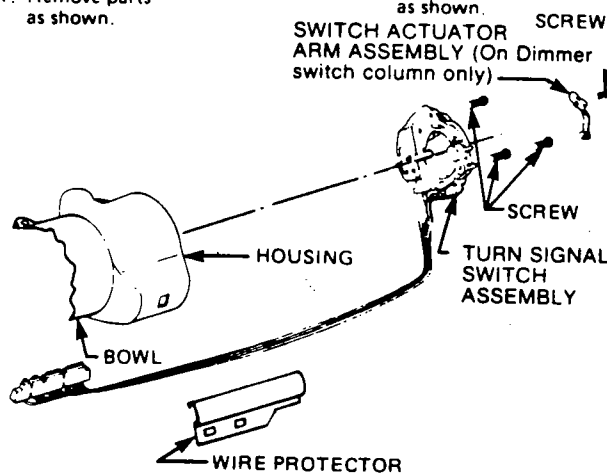
## 2. REMOVE AND INSTALL TURN SIGNAL SWITCH

### REMOVE

1. Remove parts as shown.

### INSTALL

1. Install parts as shown.

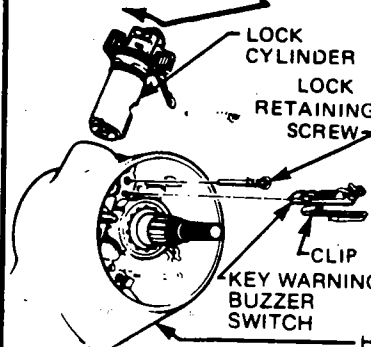


## 3. REMOVE AND INSTALL IGNITION LOCK AND KEY WARNING BUZZER

### REMOVE

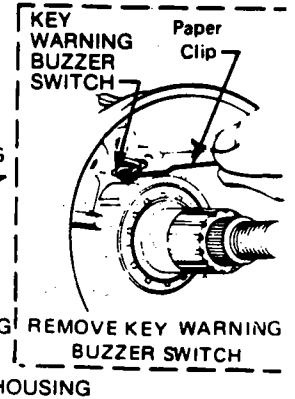
1. Turn lock to "RUN" position and remove key warning buzzer switch.
2. Remove parts as shown.

To assemble, rotate to stop while holding cylinder.



### INSTALL

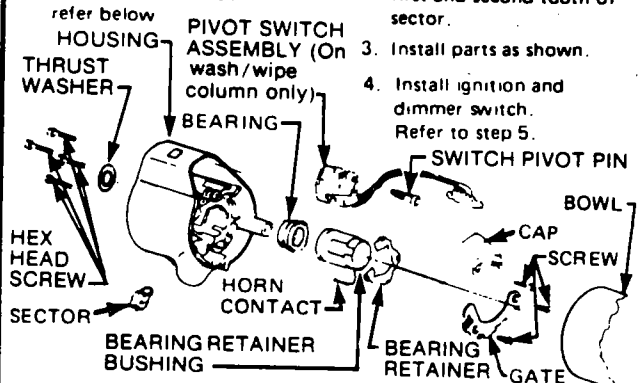
1. Install lock cylinder.
2. Turn lock to "RUN" position and install key warning buzzer switch.



## 4. REMOVE AND INSTALL HOUSING AND WIPER SWITCH

### REMOVE

1. Remove ignition and dimmer switch. Refer to step 5.
2. Remove parts as shown.
3. For KEY RELEASE refer below



### INSTALL

1. For KEY RELEASE refer below.
2. Assemble rack so that first rack tooth engages between first and second tooth of sector.
3. Install parts as shown.
4. Install ignition and dimmer switch. Refer to step 5.

NOTE: Housing without bearing retainer and bushing has spun in bearing. If repair is necessary, complete housing assembly replacement is necessary.

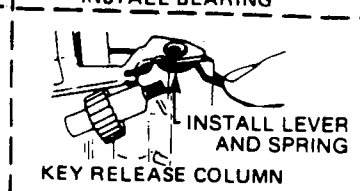
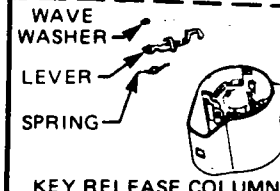
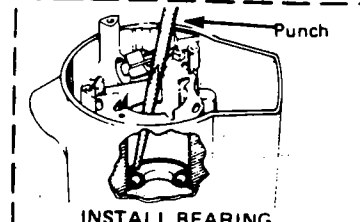
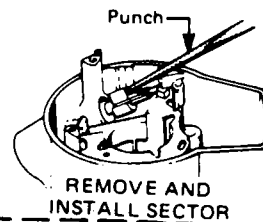
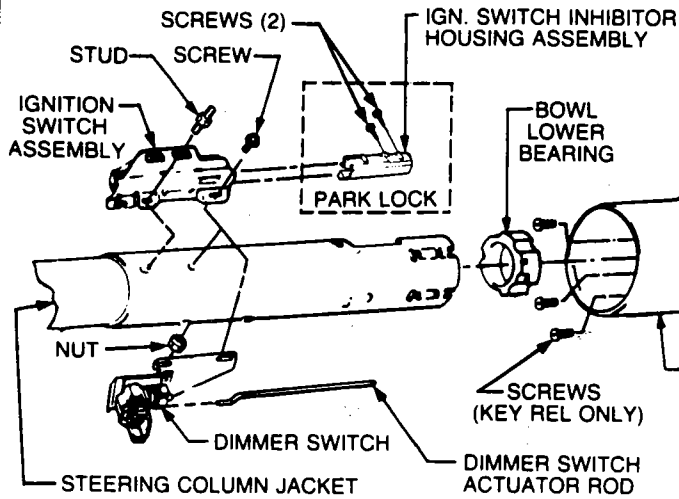


Figure 10 Standard Steering Column Unit Repair (1 of 2)

**5. REMOVE AND INSTALL IGNITION AND DIMMER SWITCH**

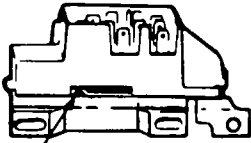
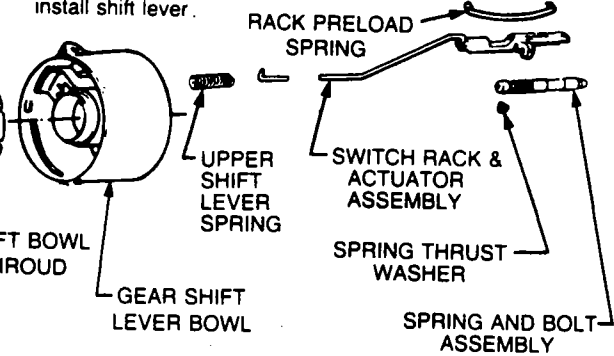
**REMOVE**

1. Remove parts as shown.



**INSTALL**

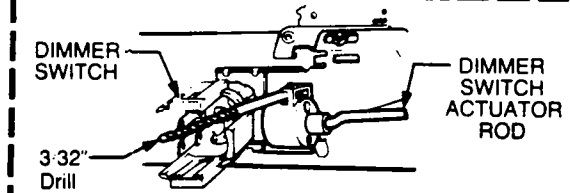
1. Install parts as shown
2. Position rod in slider hole and install ignition switch. Install lower stud and tighten to 4.0 N-m.
3. Install dimmer switch and depress switch slightly to insert 3/32" drill. Force switch up to remove lash, then tighten screw, and nut to 4.0 N-m.
4. Place shifter in neutral and install shift lever.



MOVE SWITCH SLIDER TO EXTREME LEFT POSITION

- KEY RELEASE  
Leave slider at extreme left
- PARK LOCK  
Move slider one detent to the right (off lock)
- ALL OTHER COLUMNS  
Move slider two detents to the right (off unlock)

INSTALL IGNITION SWITCH



ADJUST DIMMER SWITCH

**6. REMOVE AND INSTALL STEERING SHAFT AND SHIFT TUBE**

**REMOVE**

1. Remove parts as shown.

ADAPTER AND BEARING ASSEMBLY

BEARING RETAINER  
SCREWS

SHIFT TUBE RETURN SPRING

RETAINER CLIP

RETAINER

LOCKWASHER & SCREW ASM

LOWER BEARING ADAPTER

RETAINER BEARING ADAPTER

BEARING ASSEMBLY

LOWER BEARING ADAPTER CLIP

**INSTALL**

1. Install parts as shown.
2. Refer to inset for manual transmission lever adjustment.

OPTIONAL

SPRING THRUST WASHER

SHIFT TUBE RETURN SPRING

ADAPTER AND BEARING ASSEMBLY

MANUAL TRANSMISSION

SPACER LEVER SHIFT LEVER

LOWER SHIFT LEVER SUPPORT & ALIGNMENT PLATE

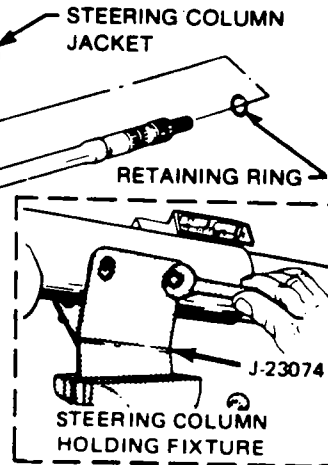
BACK-UP LIGHT SWITCH

STEERING COLUMN JACKET

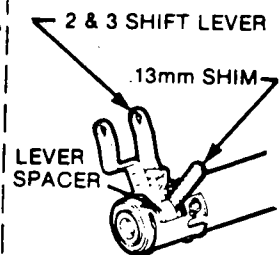
STEERING SHAFT ASSEMBLY

SHIFT TUBE ASSEMBLY (COLUMN SHIFT ONLY)

RETAINING RING



Install shim between second & third shift lever and lever spacer.



Rotate screw in direction of arrow until 2 & 3 shift lever is tight against shim. Tighten (3) screws to 10.2 N-m. Remove shim.

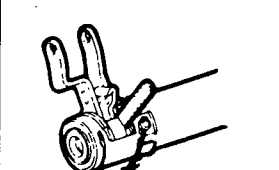


Figure 11 Standard Steering Column Unit Repair (2 of 2)

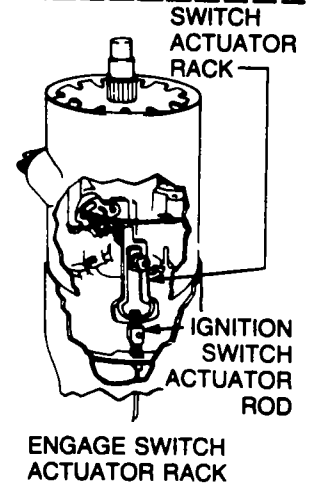
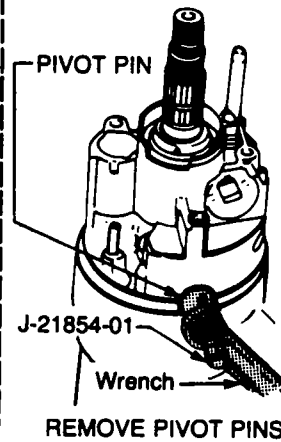
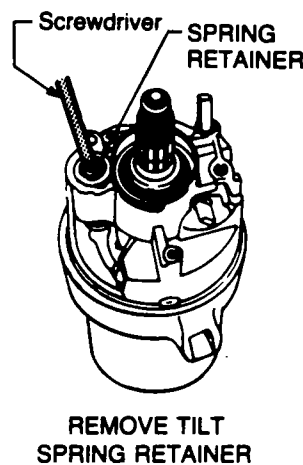
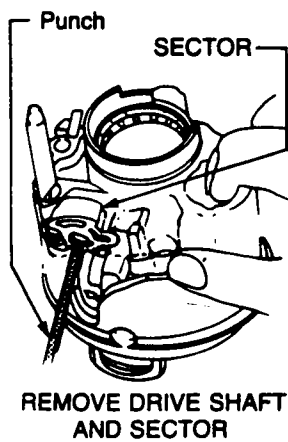
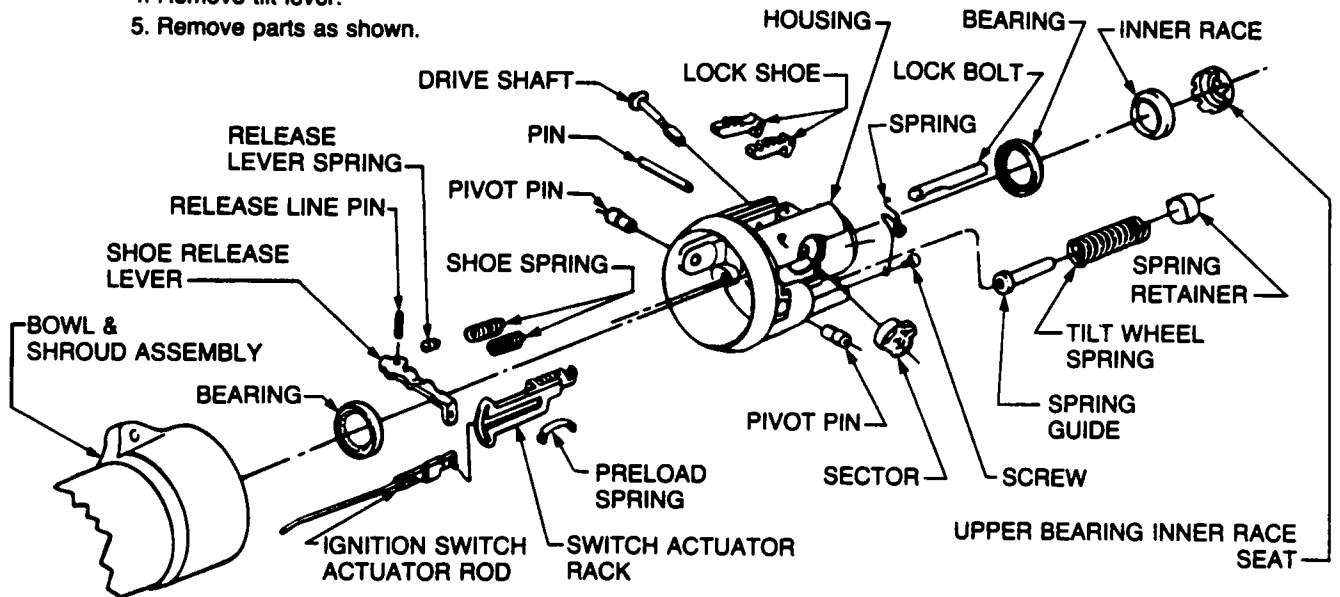
### 5. REMOVE AND INSTALL HOUSING

#### REMOVE

1. Reinstall tilt lever and place column in full "UP" position.
2. Remove tilt spring and pivot pins.
3. Remove housing by pulling upward on tilt lever and pull housing upward until it stops. Move housing to the right to disengage rack from actuator.
4. Remove tilt lever.
5. Remove parts as shown.

#### INSTALL

1. Install parts as shown.
2. While holding up on tilt lever to disengage lock shoes install over steering shaft. Move rack downward and hold. Tip housing to the left until rack engages pin on actuator rod. Push housing down until pivot pin holes are in alignment.



### 6. REMOVE AND INSTALL LOWER STEERING SHAFT ASSEMBLY

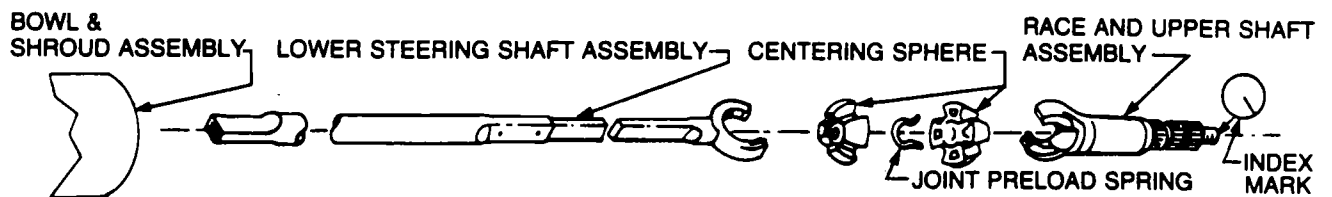
#### REMOVE

1. Remove parts as shown.

ON DISASSEMBLY, OBSERVE ALIGNMENT OF BOLT SLOT AND INDEX MARK. REASSEMBLE IN SAME MANNER.

#### INSTALL

1. Install parts as shown.



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Figure 14 Tilt Wheel Steering Column Repair (2 of 3)

**7. REMOVE AND INSTALL SHIFT TUBE, IGNITION AND DIMMER SWITCH ASSEMBLIES**

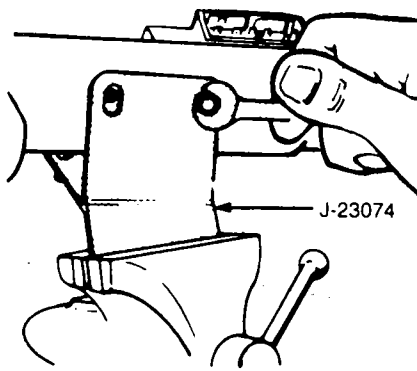
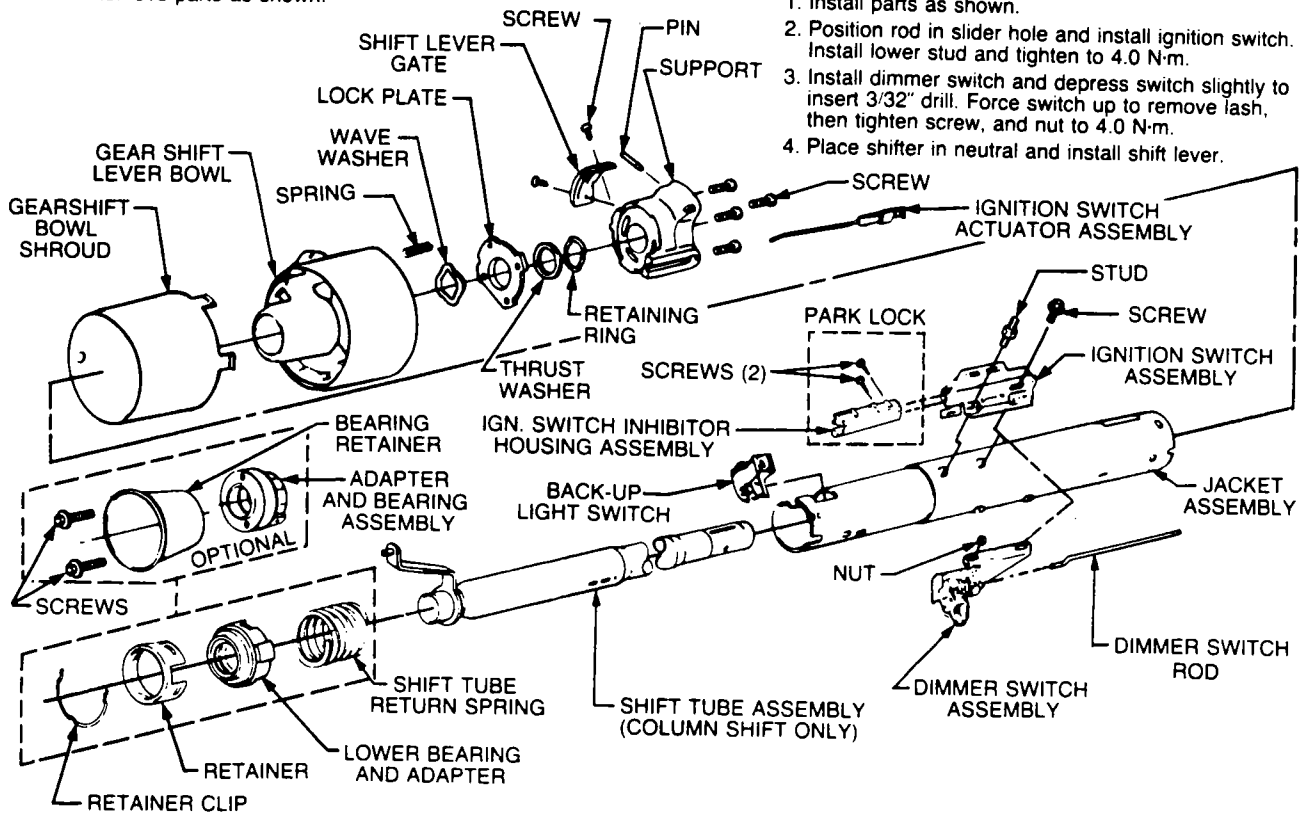
**REMOVE**

1. Remove parts as shown.

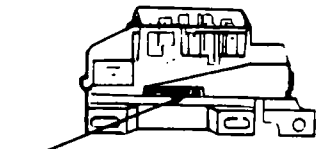
**INSTALL**

1. Install parts as shown.

2. Position rod in slider hole and install ignition switch. Install lower stud and tighten to 4.0 N-m.
3. Install dimmer switch and depress switch slightly to insert 3/32" drill. Force switch up to remove lash, then tighten screw, and nut to 4.0 N-m.
4. Place shifter in neutral and install shift lever.

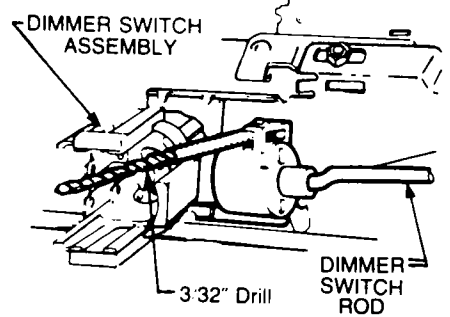


STEERING COLUMN HOLDING FIXTURE

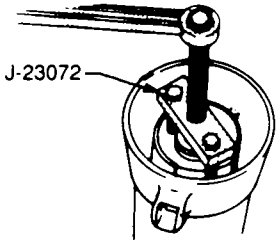


- MOVE SWITCH SLIDER TO EXTREME RIGHT POSITION

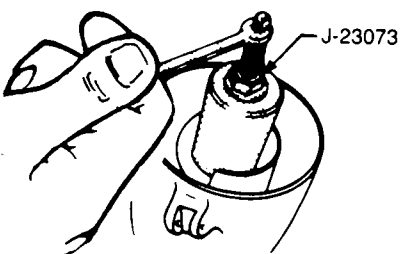
INSTALL IGNITION SWITCH ASSEMBLY



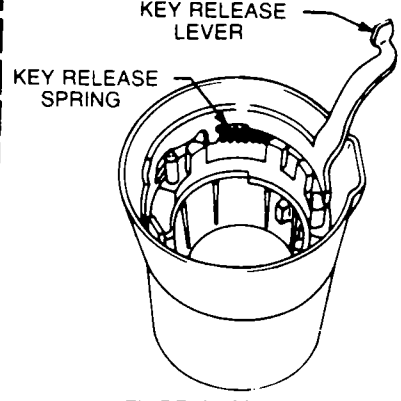
ADJUST DIMMER SWITCH ASSEMBLY



REMOVE SHIFT TUBE ASSEMBLY FROM BOWL



INSTALL SHIFT TUBE ASSEMBLY



KEY RELEASE LEVER

Figure 15 Tilt Wheel Steering Column Repair (3 of 3)

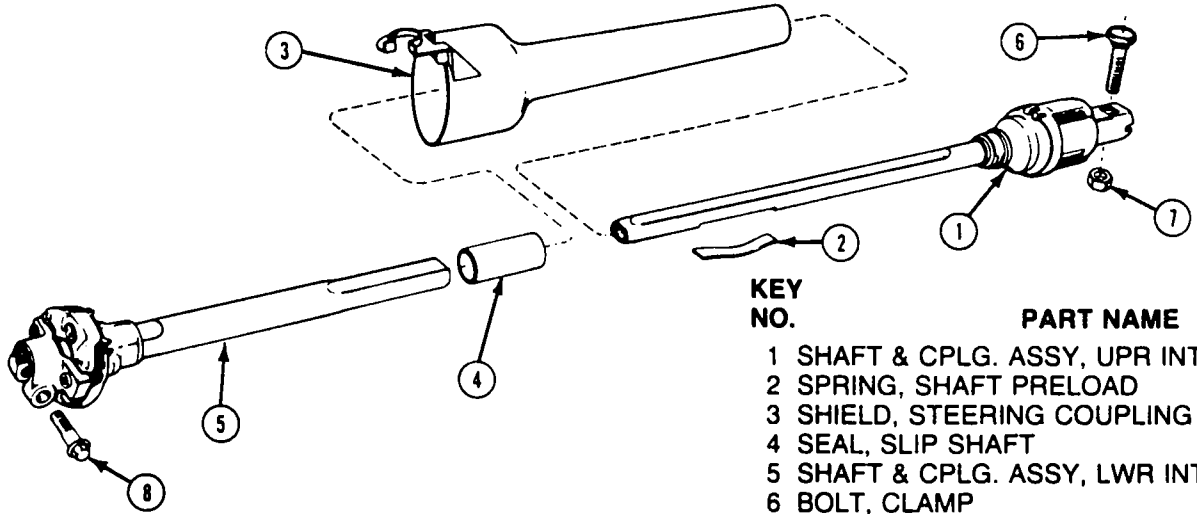
# INTERMEDIATE SHAFT ASSEMBLY

## REMOVE

1. DISENGAGE STONE SHIELD FROM BOSS ON STEERING GEAR HOUSING OR ADAPTER. REMOVE PINCH BOLT FROM FLEXIBLE COUPLING.
2. REMOVE COUPLING CLAMP TO STEERING SHAFT ATTACHING BOLT AND NUT.
3. PUSH UP ON INTERMEDIATE SHAFT TO REMOVE FROM STEERING GEAR STUB SHAFT THEN PULL DOWN UNTIL COUPLING IS REMOVED FROM STEERING SHAFT.

## INSTALL

1. INSTALL INTERMEDIATE SHAFT ON STEERING SHAFT AND INSTALL BOLT AND NUT AND TORQUE NUT TO 70 N·m (50 FT. LBS.)
2. PULL DOWN ON INTERMEDIATE SHAFT TO INSTALL ON STEERING GEAR STUB SHAFT. COUPLING MUST BE FULLY SEATED SO SPLINES ARE NOT VISIBLE BETWEEN COUPLING AND GEAR.
3. INSTALL STONE SHIELD ON STEERING GEAR RETURN HOSE NUT.



### KEY NO.

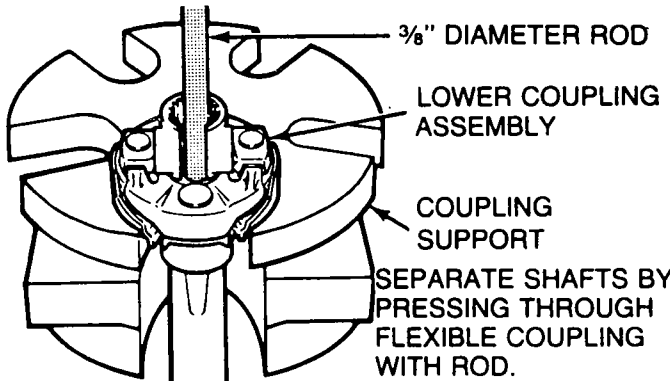
### PART NAME

- |   |                                |
|---|--------------------------------|
| 1 | SHAFT & CPLG. ASSY, UPR INTER. |
| 2 | SPRING, SHAFT PRELOAD          |
| 3 | SHIELD, STEERING COUPLING      |
| 4 | SEAL, SLIP SHAFT               |
| 5 | SHAFT & CPLG. ASSY, LWR INTER. |
| 6 | BOLT, CLAMP                    |
| 7 | NUT, HEX                       |
| 8 | BOLT, PINCH                    |

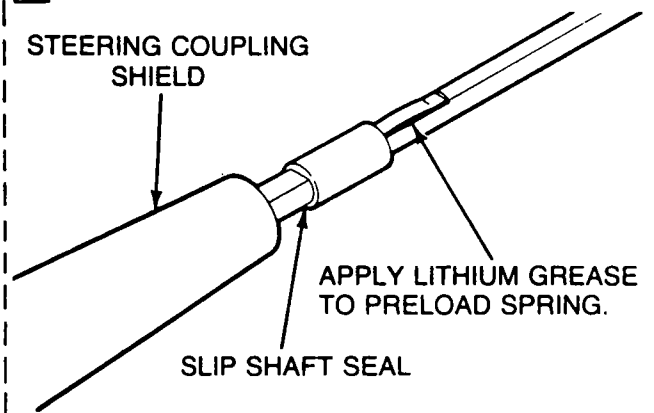
SHAFT ASSEMBLY, COUPLING & INTER. STEERING

## DISASSEMBLE & ASSEMBLE INTERMEDIATE SHAFT

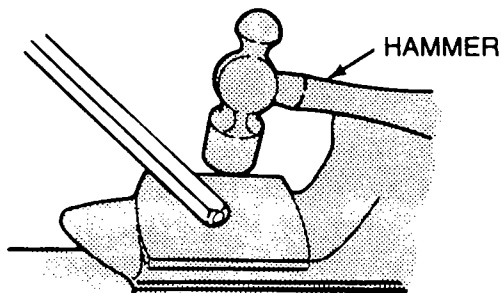
### 1. SEPARATE UPPER & LOWER INTERMEDIATE SHAFT



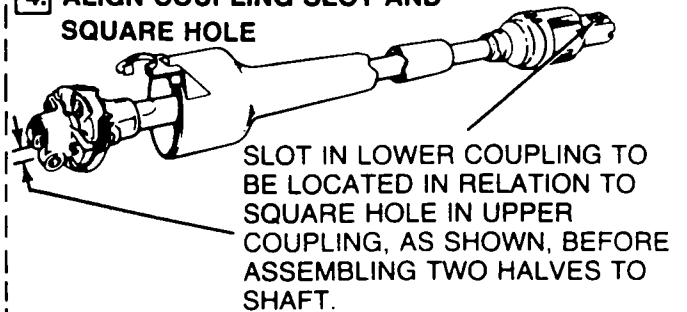
### 3. ASSEMBLE SLIP SHAFT



### 2. REMOVE STAKE MARKS



### 4. ALIGN COUPLING SLOT AND SQUARE HOLE



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Figure 16 Intermediate Shaft Assembly

# CHECKING STEERING COLUMN FOR ACCIDENT DAMAGE

Cars involved in accidents resulting in frame damage, major body or sheet metal damage, or where the steering column has been impacted may also have a damaged or misaligned steering column.

## CHECKING PROCEDURE

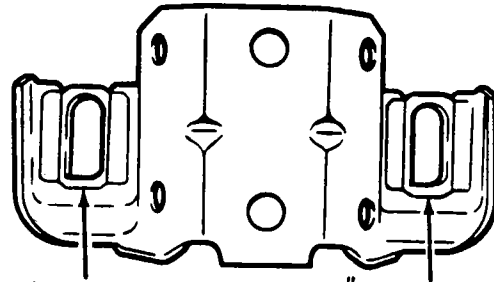
1. Check capsules on steering column bracket assembly; all should be within 1.59mm (1/16") from the bottom of the slots. (View A) If not, bracket should be replaced.

2. Check contact surface "A". (View B) The bolt head must not contact surface "A" or shear load would be increased. If contact is made, replace bracket.

3. On cars with column shift, check operation of the shift lever. If you are able to move lever to "Park" position without raising lever, it is an indication that the upper shift tube plastic bearing is broken.

4. Check for jacket collapse by measuring the distance from edge of the back-up switch window to the lower edge of upper jacket. (Refer to View C for dimensions.) If jacket dimensions are not within specifications a NEW jacket must be installed. Visually inspect for sheared injected plastic in the shift tube (View D), and the steering shaft (View E). If either one, or both are sheared replace with NEW parts.

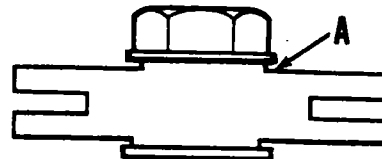
5. Any frame damage that could cause a bent steering shaft must have steering shaft runout checked in the following manner: Remove intermediate shaft. Hold ruler against lower end of steering shaft and have steering wheel rotated. Runout must not exceed 1.59mm (1/16"). Dial indicator may be used instead of a ruler.



Capsules must be within 1.59mm (1/16") from bottom of slots if not, replace bracket assembly.

View A

The bolt head must not contact surface "A". If contact is made, the capsule shear load will be increased—Replace bracket.



View B

Check for sheared injected plastic at these locations.



View D

Check for sheared injected plastic at these locations.



View E

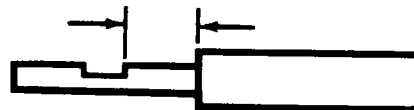
## METHOD TO DETERMINE COLUMN COLLAPSE MEASURE DISTANCE BETWEEN ARROWS OF ILLUSTRATION.

### STANDARD COLUMN

B Series . . . . . 89 mm to 91 mm (3 1/2" to 3 19/32")  
G Series . . . . . 40 mm to 42 mm (1 9/16" to 1 21/32")

### TILT COLUMN

B Series . . . . . 101 mm to 103 mm (3 31/32" to 4 1/16")  
G Series . . . . . 52 mm to 54 mm (2 1/16" to 2 5/32")



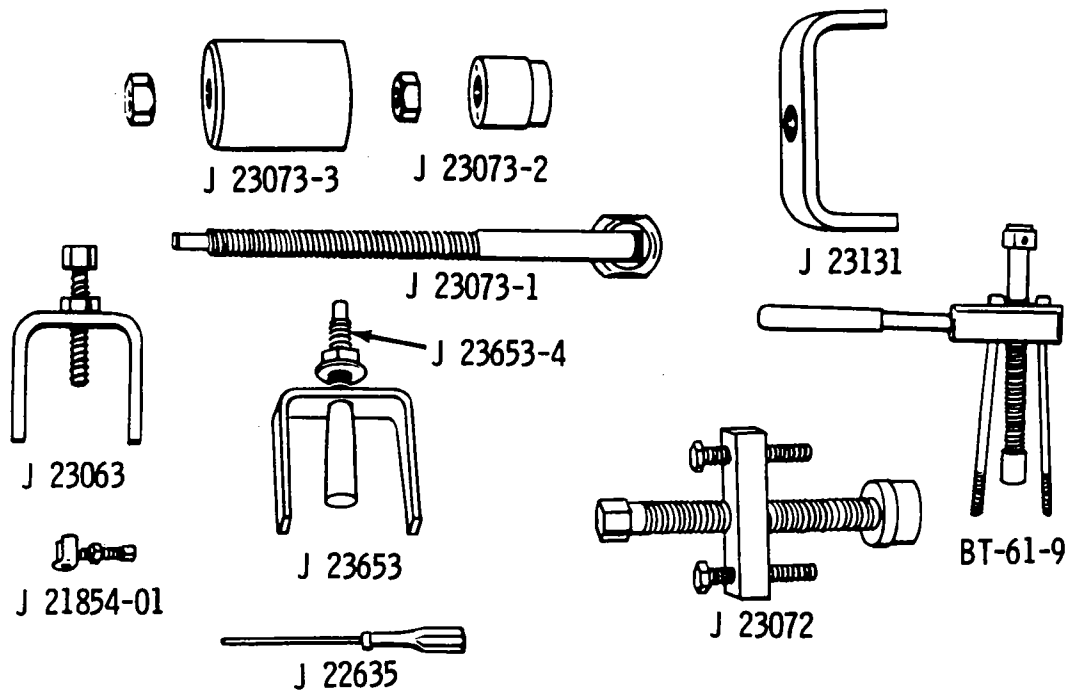
View C

Figure 17 Checking Column for Accident Damage



TORQUE SPECIFICATIONS

APPLICATION	TORQUE		
	N·m	LBS. IN.	LBS. FT.
Steering Wheel to Shaft Nut .....	41		30
Turn Signal Switch Attaching Screws .....	4	35	
Ignition Switch Attaching Screws .....	4	35	
Bracket to Steering Column Support Nuts .....	27		20
Bracket to Steering Column Bolts .....	30		22
Intermediate Shaft To Steering Column Nut.....	70		50



BT-61-9	STEERING WHEEL PULLER	J 23072	SHIFT TUBE REMOVER
J 21854-01	PIVOT PIN REMOVER	J 23073-1-2-3	SHIFT TUBE INSTALLER
J 22635	LOCK SHOE & RELEASE LEVER	J 23131	LOCK PLATE COMPRESSOR
	REMOVER & INSTALLER	J 23653 &	
J 23063	LOCK PLATE COMPRESSOR	J 23653-4	LOCK PLATE COMPRESSOR

Figure 18 Torque Specifications and Special Tools



# SECTION 3B6

## STEERING LINKAGE

### B-G CARLINE

**NOTICE:** All steering linkage fasteners are important attaching parts in that they could affect the performance of vital components and systems, and/or could result in major repair expense. They must be replaced with one of the same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of these parts. For prevailing torque nut(s) and bolt(s), refer to the "Reuse of Prevailing Torque Nut(s) and Bolt(s)" chart in Section 0A.

## CONTENTS

Diagnosis .....	Section 3
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Relay Rod .....	3B6-2

Tie Rod Adjuster .....	3B6-3
Idler Arm .....	3B6-4
Pitman Arm .....	3B6-4
Tie Rod Seal Replacement .....	3B6-5
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Special Tools .....	3B6-5

## GENERAL INFORMATION

### See Figure 1

A parallelogram type steering linkage connects both front wheels to the steering gear through the pitman arm. The outer tie rods are attached to steering knuckles and the inner tie rods are attached to the relay rod. The left end of the relay rod is supported by the pitman arm which is driven by the steering gear and the right end by an idler arm which pivots on a support attached to the frame. The pitman and idler arms are always parallel to each other and move through symmetrical arcs.

Lubricate steering linkage with EP Chassis Lube GM #1052356 or equivalent meeting GM-6031M specifications whenever work is done on the linkage, and at intervals specified in maintenance schedule.

Worn or damaged linkage seals should be replaced.

**NOTICE:** When disconnecting a linkage joint, no attempt should be made to disengage the joint by driving a wedge between the joint and the attached part because seal damage may result which will cause premature failure of joint.

## ON-CAR SERVICE

### CHECKING LINKAGE WEAR

#### See Figure 2



#### Inspect

1. Raise car on one side at frame directly behind the front wheel so that tire is approximately 25.4 mm (1 inch) off the floor, see Section 0A.
2. Position steering wheel in the straight ahead and locked position.

3. Position dial indicator.
4. Grasp front wheel and move wheel back and forth. Indicator reading should not exceed 2.74 mm (.108 inch).
5. If indicator reading is not within specifications, a check should be made of all suspension and linkage parts and wheel bearing adjustment.

## TIE RODS

### See Figures 3 thru 5

#### Tools Required:

- J 24319-01 Linkage Puller
- J 29193 Linkage Installer



#### Remove or Disconnect

1. Raise car and suitably support, see Section 0A.



#### Important

- Tie rod adjuster parts often become rusted in service. In such cases, it is recommended that if the torque required to remove the nut from the bolt after breakaway exceeds 9 N·m (80 lbs. in.), discard the nuts and bolts. Apply penetrating oil between the clamp and adjuster and rotate the clamps until they move freely. Install new bolts and nuts having the same part number to assure proper clamping at the specified nut torque.
2. If replacing outer tie rod, remove cotter pin and castellated nut from outer tie rod.
  3. Tie rod from steering knuckle by using J 24319-01
  4. If replacing inner tie rod, remove nut and disconnect inner ball joint from relay rod using J 24319-01.

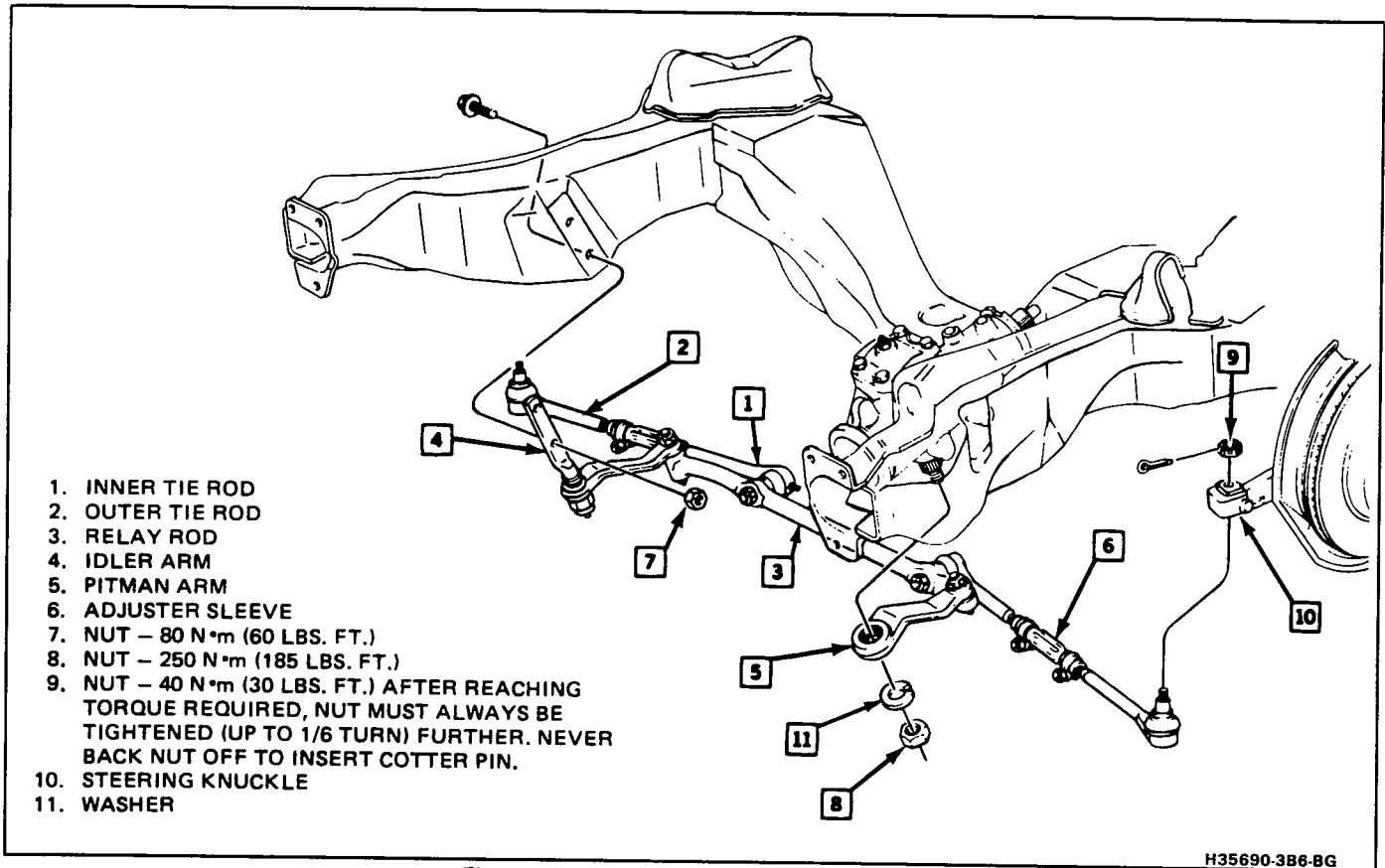


Figure 1 Steering Linkage (B-G Carline)

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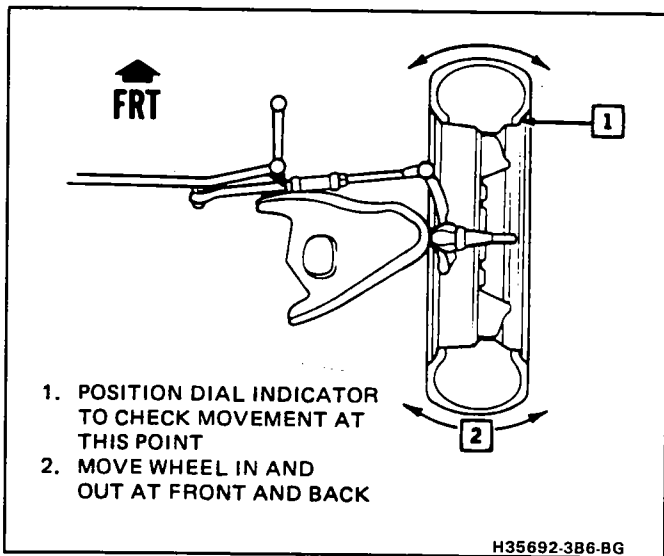


Figure 2 Checking Linkage Wear

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clean and smooth, ball studs may turn in tie rod when attempting to tighten nut. The ball stud must have no nicks on the taper. Inspect and replace damaged seals as necessary.

3. Tie rod in steering knuckle and/or relay rod
4. If replacing inner tie rod, install J 29193 and tighten to 20 N·m (15 lbs. ft.) to seat tie rod to relay rod. Remove tool and tighten nut 54 N·m (40 lbs. ft.).
5. Outer tie rod nuts and tighten to 40 N·m (30 lbs. ft.), then tighten nuts just enough to align slot in castellated nut with hole in stud and install cotter pins.

**! Important**

- Before tightening clamp bolts on the tie rod adjuster, make sure that the tie rods are in their center of travel on the ball studs and tighten adjuster clamps to 19 N·m (14 lbs. ft.). Make certain that adjuster and clamps are positioned properly.

6. Lower car.

**🔧 Adjust**

- Toe-in to specification, see Section 3A

**RELAY ROD**

See Figure 6

Tools Required:

- J 24319-01 Linkage Puller
- J 29193 Linkage Installer

5. Tie rod from adjuster by loosening clamp bolts and unscrewing tie rod from adjuster

**↔ Install or Connect**

**NOTICE:** See NOTICE on Page 3B6-1.

1. Lubricate the tie rod adjuster threads with EP Chassis Lube and thread ends of tie rod into the adjuster making sure both ends are threaded an equal distance into the adjuster.
2. Make sure that threads on ball stud and in ball stud nuts are clean and smooth. If threads are not

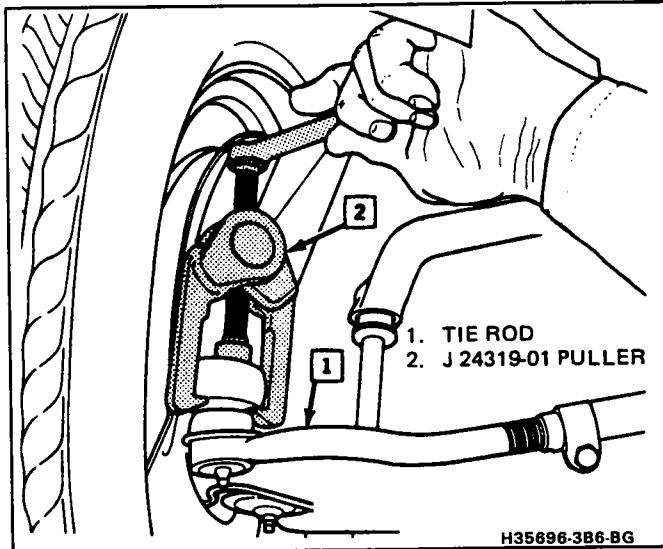


Figure 3 Separating Tie Rod at Knuckle

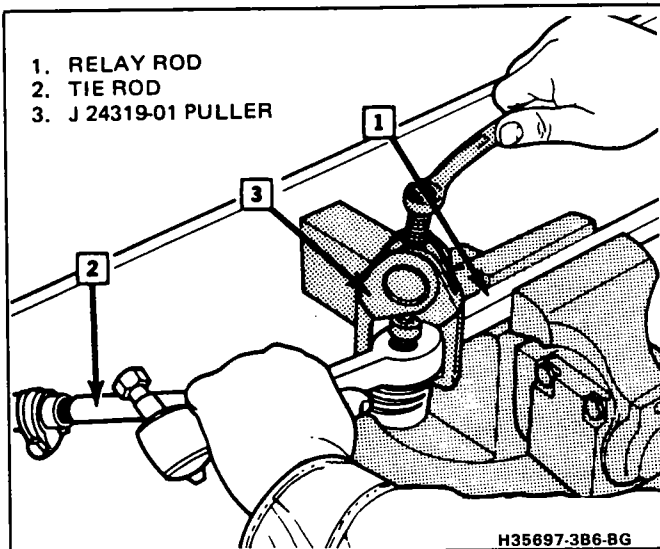


Figure 4 Separating Tie Rod at Relay Rod

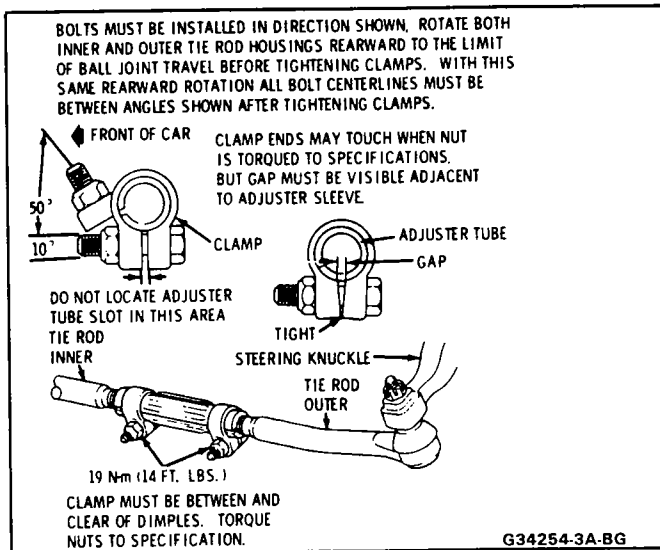


Figure 5 Positioning Adjuster Clamp

↔ Remove or Disconnect

1. Raise car and suitably support, see Section 0A.

2. Inner tie rods from relay rod, see "Tie Rods"
3. Nut from relay rod at pitman arm
4. Relay rod from pitman arm by using J 24319-01
5. Move steering linkage as required to free pitman arm from relay rod.
6. Nut from idler arm and remove relay rod from idler arm by using J 24319-01

↔ Install or Connect

**NOTICE:** See NOTICE on Page 3B6-1.

1. Inspect and replace damaged seals as necessary.
2. Relay rod to idler arm. Install J 29193 and tighten to 20 N·m (15 lbs. ft.) to seat relay rod to idler arm. Remove tool and tighten nut to 54 N·m (40 lbs. ft.).
3. Relay rod to pitman arm. Install J 29193 and tighten to 20 N·m (15 lbs. ft.) to seat relay rod to pitman arm. Remove tool and tighten nut to 60 N·m (45 lbs. ft.)
4. Tie rods to relay rod, see "Tie Rods"
5. Lower car.

🔧 Adjust

- Toe-in to specification, see Section 3A

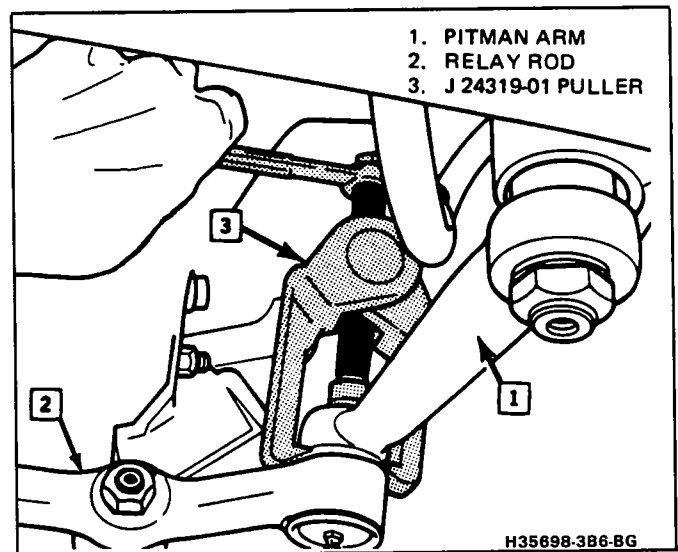


Figure 6 Separating Pitman Arm

**TIE ROD ADJUSTER**

See Figures 3 and 5

Tool Required:  
J 24319-01 Linkage Puller

↔ Remove or Disconnect

1. Raise car and suitably support, see Section 0A.
2. Clamp bolts on adjuster
3. Cotter pin and nut from outer tie rod
4. Tie rod from steering knuckle by using J 24319-01
5. Unthread outer tie rod from adjuster.
6. Unthread adjuster from inner tie rod.

**!** Important

- Tie rod adjuster parts often become rusted in service. In such cases, it is recommended that if the torque required to remove the nut from the bolt after breakaway exceeds 9 N·m (80 lbs. in.), discard the nuts and bolts. Apply penetrating oil between the clamp and tube and rotate the clamps until they move freely. Install new bolts and nuts having the same part number to assure proper clamping at the specified nut torque.

**↔** Install or Connect

**NOTICE:** See NOTICE on Page 3B6-1.

1. Lubricate the tie rod threads with EP Chassis Lube and thread ends of tie rod into the adjuster making sure both ends are threaded an equal distance into the adjuster.
2. Make sure that threads on ball stud and in ball stud nuts are clean and smooth. If threads are not clean and smooth, ball studs may turn in tie rod when attempting to tighten nut. The ball stud must have no nicks on the taper. Inspect and replace damaged seals as necessary.
3. Ball stud nut on outer tie rod and tighten to 40 N·m (30 lbs. ft.), then tighten nuts just enough to align slot in castellated nut with hole in stud and install cotter pins.

**!** Important

- Before tightening clamp bolts on the tie rod adjuster, make sure that the tie rods are in their center of travel on the ball studs and tighten adjuster clamps to 19 N·m (14 lbs. ft.). Make certain that adjuster and clamps are positioned properly.
4. Lower car.

**⚙** Adjust

- Toe-in to specification, see Section 3A

**IDLER ARM**

See Figures 7 and 8

The idler arm assembly should be replaced if vertical lash exceeds 3.2 mm (1/8 inch) when an up and down force of 110 Newtons (25 pounds) is applied at the relay rod end of the idler arm.

Tools Required:

- J 24319-01 Linkage Puller
- J 29193 Linkage Installer

**↔** Remove or Disconnect

1. Raise car and suitably support, see Section 0A.
2. Idler arm to frame nuts and bolts
3. Nut from idler arm to relay rod ball stud
4. Idler arm from relay rod by using J 24319-01
5. Idler arm

**↔** Install or Connect

**NOTICE:** See NOTICE on page 3B6-1.

The linkage requires proper location of the idler arm on its threaded support so that the idler arm ball socket will be level with the pitman arm ball socket. The support must be threaded into the idler arm bushing until the distance from the center of the lower mounting bolt hole to the top of the idler arm boss is as specified. The position of the idler arm must be adjusted before the idler arm assembly is installed in the car. After adjusting, the idler arm support must be free to rotate 90° in each direction.

1. Support to frame and tighten nuts to 80 N·m (60 lbs. ft.)
2. Relay rod to idler arm. Install J 29193 and tighten to 20 N·m (15 lbs. ft.) to seat relay rod to idler arm. Remove tool and tighten nut to 54 N·m (40 lbs. ft.).
3. Lower car.

**⚙** Adjust

- Toe-in to specification, see Section 3A

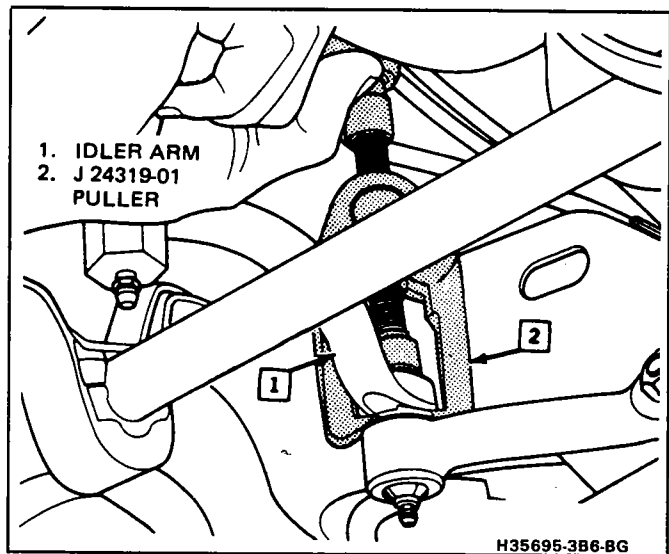


Figure 7 Separating Idler Arm From Relay Rod

**PITMAN ARM**

See Figure 6

Tools Required:

- J 24319-01 Linkage Puller
- J 29193 Linkage Installer
- J 9172 Pitman Arm Puller

**↔** Remove or Disconnect

1. Lock steering wheel in straight ahead position.
2. Raise car and suitably support, see Section 0A.
3. Nut from pitman arm ball stud
4. Relay rod from pitman arm using J 24319-01. Move steering linkage as required to free pitman arm from relay rod.
5. Pitman arm nut and lock washer from pitman shaft

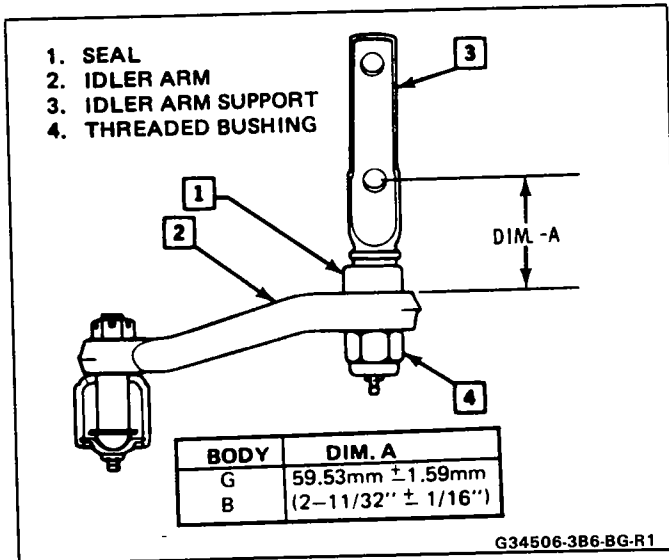


Figure 8 Idler Arm Adjustment

- Pitman arm with J 9172, DO NOT HAMMER ON PULLER

Install or Connect

NOTICE: See NOTICE on Page 3B6-1.

- With the wheels in the straight-ahead position, install pitman arm on pitman shaft.
- New pitman shaft nut and lock washer and tighten to 250 N·m (185 lbs. ft.)
- Relay rod to pitman arm. Install J 29193 and tighten to 20 N·m (15 lbs. ft.) to seat relay rod to pitman arm. Remove tool and tighten nut to 60 N·m (45 lbs. ft.)
- Lower car.

TIE ROD SEAL REPLACEMENT

See Figures 3 and 4

Tools Required:

- J 24319-01 Linkage Puller
- J 29193 Linkage Installer

Remove or Disconnect

- Raise car and suitably support, see Section 0A.
- If replacing outer tie rod seal, remove cotter pin and castellated nut from outer tie rod.
- Outer tie rod from steering knuckle using J 24319-01
- If replacing inner tie rod seal, remove nut from inner tie rod.
- Inner tie rod from relay rod using J 24319-01
- Pry old seal off tie rod.

Install or Connect

NOTICE: See NOTICE on Page 3B6-1.

- Wipe tie rod clean.
- Position new seal on tie rod stud. Move flange of seal over seat on housing with a firm, even push.
- Inner tie rod to relay rod if replacing inner tie rod seal. Install J 29193 and tighten to 20 N·m (15 lbs. ft.) to seat inner tie rod to relay rod. Remove tool and tighten nut to 54 N·m (40 lbs. ft.)
- Outer tie rod to steering knuckle if replacing outer tie rod seal and tighten nut to 40 N·m (30 lbs. ft.). Tighten nut just enough to align slot in castellated nut with hole in stud and install cotter pin.
- Lower car.

APPLICATION	N·m	LBS. FT.
Steering Arm To Tie Rod End Nut . . . . .	*40	30
Tie Rod Clamp Nuts . . . . .	19	14
Tie Rod to Relay Rod Nut . . . . .	54	40
Pitman Arm to Relay Rod Nut . . . . .	60	45
Pitman Arm to Steering Gear Nut . . . . .	250	185
Idler Arm to Relay Rod Nut . . . . .	54	40
Idler Arm to Frame Nut . . . . .	80	60

\* Do not back off to insert cotter pin - turn to next hole.

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Figure 9 Torque Specifications

SPECIAL TOOLS

- J 9172 . . . . . Pitman Arm Puller
- J 24319-01 . . . . . Linkage Puller
- J 29107 . . . . . Pitman Arm Puller
- J 29193 . . . . . Linkage Installer





## SECTION 3B7

## POWER STEERING GEAR AND PUMP

**NOTICE:** All steering gear and pump fasteners are important attaching parts in that they could affect the performance of vital components and systems, and/or could result in major repair expense. They must be replaced with one of the same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of these parts. For prevailing torque nut(s) and bolt(s), refer to the "Reuse of Prevailing Torque Nut(s) and Bolt(s)" chart in Section 0A.

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Flow Control Valve .....	3B7-3	Special Tools .....	3B7-19

## GENERAL DESCRIPTION

The steering gear is mounted on the left frame side rail and is secured by three mounting bolts. The gear is joined to the intermediate shaft by a flexible coupling that helps isolate noise and road shock from the car's interior.

A constant displacement vane type pump provides hydraulic pressure and flow for the steering system. The pump is located on the engine and is belt driven by the engine crankshaft pulley.

## POWER STEERING GEAR

The "800" series steering gear is used on all carlines. The major internal components of the steering gear are the rotary valve assembly, steering worm shaft, rack piston assembly, and the pitman shaft. The movement of these parts, while turning or parking, is aided by hydraulic pressure and flow supplied by the pump. Manual steering is always available at times when the engine is not running or in the event of pump or belt failure. Steering effort is increased under such conditions.

The steering stub shaft, rotary valve, worm shaft, and rack piston assembly are all "in line". All oil passages are internal within the gear housing except for the pressure and return hoses between the gear and the pump.

The hydraulic spool valve is concentric with the input shaft and is contained in the rear section of the gear housing. It contains a spool that is held in neutral position by means of a torsion bar. The spool is attached to one end of the torsion bar and the valve body to the other end. Twisting of the torsion bar

allows the spool to rotate relative to the valve body, thereby operating the valve.

## POWER STEERING PUMP

There are two series of power steering pumps used: P Series and TC Series. The P-Series pump is a submerged pump. The pump housing is surrounded by the fluid reservoir. The TC-Series pump uses a remote reservoir.

## SEAL REPLACEMENT

Lip seals, which seal rotating shafts, require special treatment. This type seal is used on the drive shaft of the pump and on the pitman shaft and stub shaft of the gear. When leakage occurs, always replace the seal after inspecting and thoroughly cleaning the sealing surfaces. Replace the shaft only if very severe pitting is found. If the corrosion in the lip seal contact zone is slight, clean the surface of the shaft with crocus cloth. Replace the shaft only if the leakage cannot be stopped by smoothing with crocus cloth first.

## ON-CAR SERVICE

## CHECKING AND ADDING FLUID

Power steering fluid level is indicated by marks on a fluid level indicator on the fluid reservoir cap.

**NOTICE:** When adding fluid or making a complete fluid change, always use GM Part No. 1050017 (or equivalent) power steering fluid. Failure to use the proper fluid will cause hose and seal damage and fluid leaks.

If the fluid is warmed up, about 66°C (150°F) - hot to the touch, the fluid level should be between the "HOT" and "COLD" marks.  
 If the fluid is cool, about 21°C (70°F), the fluid level should be between the "ADD" and "COLD" marks.

**PUMP BELT**

**Checking Belt Tension**

**VIN A & Y**

See Figure 1

**Tool Required:**  
 J 23600-B Belt Tension Gage or  
 BT-33-73F Belt Tension Gage

**Measure**

Position belt tension gage J 23600-B or BT-33-73F on belt. If belt tension is not within specification, adjust belt tension, see "Belt Tension Chart" in Section 0A.

**Adjusting Belt Tension**

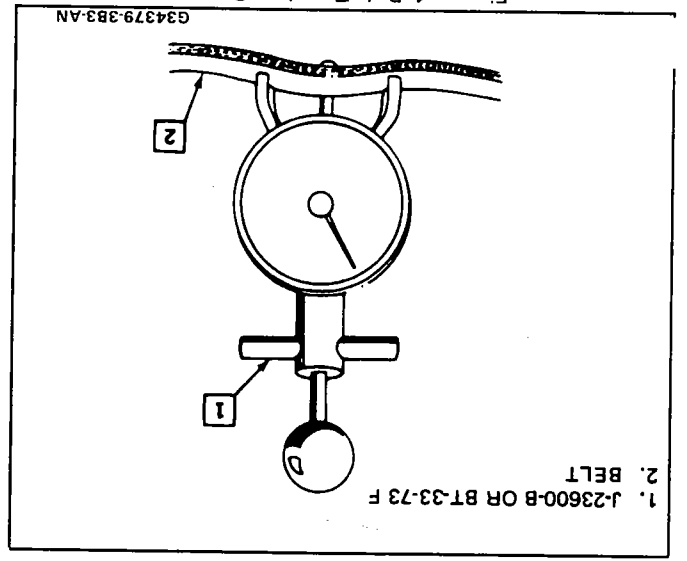
**VIN A & Y**

See Figures 1 & 2

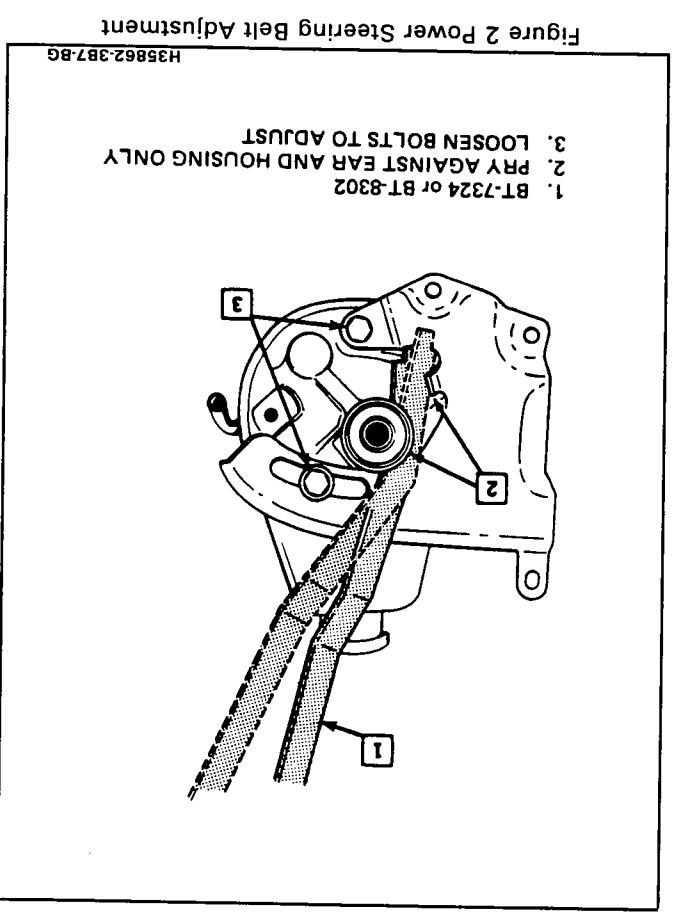
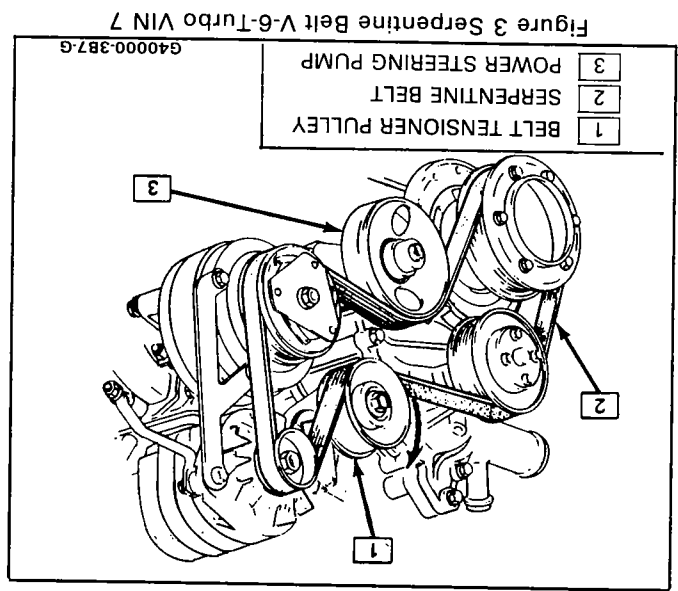
**Adjust**


When adjusting the power steering pump belt, do not pry against the pump reservoir. Only the pump bracket should be pryed against when adjusting belt tension.

1. Position belt tension gage BT-33-73F or J 23600-B on pump belt.
2. Loosen pump mounting bolts.
3. Adjust belt by prying pump away from engine, see "Belt Tension Chart" in Section 0A.
4. Tighten pump bolts to torque specification.



- Pump Belt Replacement**  
**VIN A & Y**
- Remove or Disconnect**
1. Drive belts required for power steering pump belt replacement
  2. Loosen power steering pump attaching bolts.
  3. Power steering belt



 Install or Connect

1. Power steering belt
2. Adjust belt. Refer to "Adjusting Belt Tension".

**SERPENTINE BELT VIN 7**

A single serpentine belt is used to drive all engine mounted accessories. All driven accessories are rigidly mounted to the engine. Drive belt tension is maintained by a spring loaded belt tensioner.


A belt squeak when the engine is started or stopped is normal and has no effect on belt durability.

The drive belt tensioner can control belt tension over a broad range of belt lengths; however, there are limits to the tensioner's ability to compensate. Using the tensioner outside its operating range can result in poor tension control and/or damage to the tensioner.

**SERPENTINE BELT REPLACEMENT**

See Figure 3


Using an 18 mm box end wrench rotate the belt tensioner pulley clockwise to relieve the tension on the belt. The belt may be removed or installed with the pulley in this position.

**FLOW CONTROL VALVE VIN A & Y** Remove or Disconnect


1. High pressure hose from pump fitting and drain oil
2. Fitting and withdraw flow control valve and spring with a magnet

 Inspect

- Flow control valve must slide freely in housing bore. If sticking occurs, check for dirt or burrs. If the flow control valve is suspected of being faulty, install new valve. This is serviced as a unit and is factory calibrated.

 Install or Connect

1. Valve and spring into pump
2. Fitting and "O" ring to pump and tighten to 50 N·m (37 lbs. ft.)
3. High pressure hose to fitting and tighten to 27 N·m (20 lbs. ft.)
4. Fill with fluid.
5. Bleed power steering system.

**FLOW CONTROL VALVE VIN 7** Remove or Disconnect

1. Raise car and suitably support, see Section 0A
2. Pump assembly. See procedure in this section.
3. Pressure hose fitting from pump
  - The flow control valve and spring are retained in their bore by the hose fitting.
4. Flow control valve and spring.

 Inspect

Flow control valve must slide freely in its housing bore. If sticking occurs, check for dirt or burrs. If the flow control valve is suspected of being faulty, install a new valve. This valve is serviced as an assembly and is factory calibrated.

 Install or Connect

1. Flow control valve and spring
2. Pressure hose fitting
3. Pump assembly. See procedure in this section.
4. Lower car
5. Fill and bleed the system. Refer to "Bleeding Power Steering System" in this section.

 Inspect

- For proper fluid level
- For leaks

**BLEEDING POWER STEERING SYSTEM**

If the power steering hydraulic system has been serviced, an accurate fluid level reading cannot be obtained unless air is bled from the system. Follow these steps to bleed air:

1. With the wheels turned all the way to the left, add power steering fluid to the "COLD" mark on the fluid level indicator.
2. Start the engine, run at fast idle momentarily, shut engine off and recheck fluid level. If necessary, add fluid to bring the level to the "COLD" mark.
3. Start engine and bleed the system by turning the wheels from side to side without hitting stops. Keep the fluid level just above the internal pump casting, or at the "COLD" mark. Fluid with air in it has a light tan or red appearance. This air must be eliminated from the fluid before normal steering action can be obtained.
4. Return the wheels to the center position. Continue running the engine for two or three minutes.
5. Road test the car to be sure the steering functions normally and is free from noise.
6. Recheck the fluid level as described in Steps 1 and 2. Make sure the fluid level is at the "HOT" mark after the system has stabilized at its normal operating temperature.

**NOTICE:** When adding fluid or making a complete fluid change, always use GM Part No. 1050017 (or equivalent) power steering fluid. Failure to use the proper fluid will cause hose and seal damage and fluid leaks.

**PUMP DRIVE PULLEY**

See Figure 4

Tools Required:

- BT-7185 or J 29785-A Remover
- BT-7005-A or J 25033-B Installer

## 3B7-4 POWER STEERING GEAR AND PUMP

### ↔ Remove or Disconnect

1. Belt from pulley
2. Pump from engine for tool clearance if necessary
3. Pulley with removal tool

### →← Install or Connect

1. Pulley with installer tool

#### ! Important

- Face of pulley hub must be flush with pump drive shaft.
  - Do not use arbor press to install pulley.
2. Pump on engine if previously removed
  3. Belt on pulley

#### 🔧 Adjust

- Belt tension
4. Bleed power steering system if pump was removed from engine.

### 👁 Inspect

- For leaks

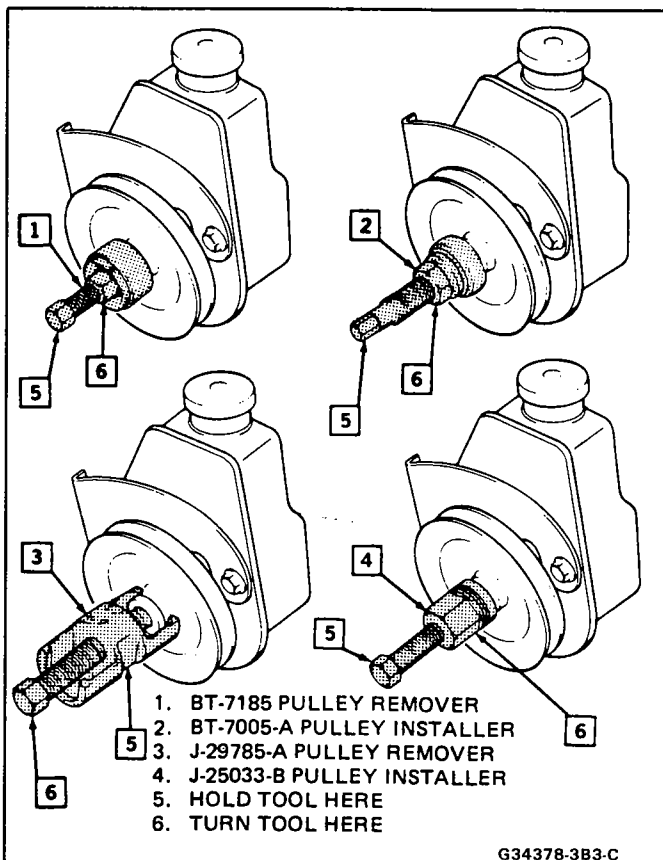


Figure 4 Remove and Install Power Steering Pump Pulley (Typical)

## POWER STEERING PUMP V-6 VIN A

See Figures 5 & 6

### ↔ Remove or Disconnect

1. Negative battery cable
2. Bolts and nut from adjuster bracket

3. Both lines at pump and cap lines
4. Power steering pump belt
5. Pump assembly
6. Pulley and bracket from pump. Refer to "Pump Pulley".

### →← Install or Connect

1. Bracket and pulley to pump. Front of pulley should be flush with front of pump shaft. Refer to "Pump Pulley".
2. Pump assembly to car
3. Power steering lines and tighten fittings to 27 N·m (20 lbs. ft.)
4. Bolts and nut to adjuster bracket
5. Fill with fluid.
6. Pump belt
7. Adjust belt. Refer to "Adjusting Belt Tension".
8. Bleed power steering system.

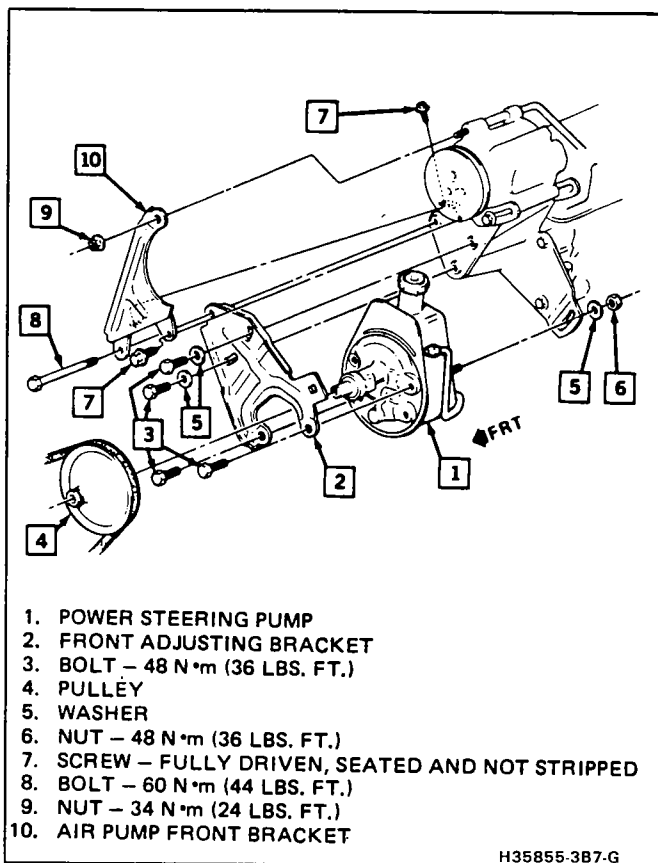


Figure 5 Power Steering Pump Mounting - G Carline V6, VIN A

## POWER STEERING PUMP - V-6 TURBO

### G Carline VIN 7

See Figure 10 & 14

### ↔ Remove or Disconnect

1. Negative battery cable
2. Turn steering wheel all the way to the left
3. Serpentine belt
4. Left intercooler bracket bolts and bracket
5. Raise car and suitably support, see Section 0A

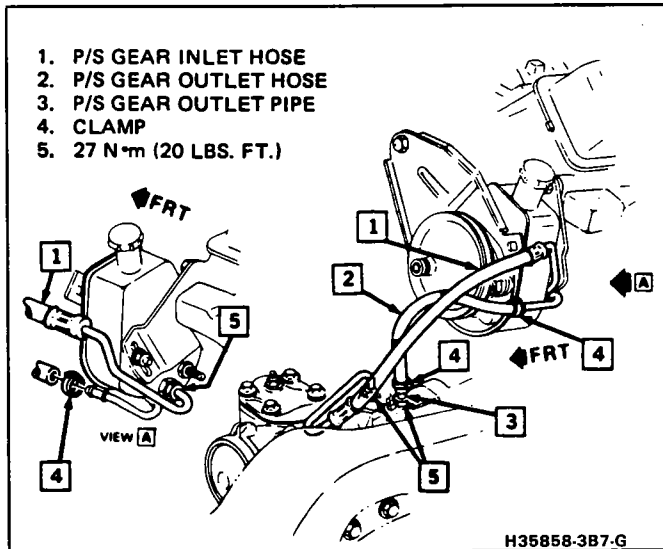


Figure 6 Power Steering Pump Hose Routing - G Carline V6, VIN A

6. Pressure hose from pump pipe and drain the system
7. Pump mounting bolts
8. Pump return hose

**↔ Install or Connect**

1. Pump to mounting bracket with mounting bolts
2. Tighten bolts to 27 N·m (20 lbs. ft.)
3. Return hose to pump
4. Pressure hose to pump
5. Lower car
6. Intercooler bracket and bolts
7. Serpentine belt
8. Negative battery cable
9. Fill and bleed the system. Refer to "Bleeding Power Steering System" in this section.

**🔍 Inspect**

- for proper fluid level
- for leaks

**POWER STEERING PUMP (V-8)**

See Figures 7 thru 9

1. Negative battery cable
2. Loosen belts.
3. Pump pulley. Refer to "Pump Pulley".
4. Pump bracket bolts
5. Both lines at pump and cap lines
6. Remove pump.

**↔ Install or Connect**

1. Position pump and reinstall lines. Tighten fittings to 27 N·m (20 lbs. ft.).
2. Pump brackets
3. Pump pulley. Front of pulley should be flush with front of pump shaft. Refer to "Pump Pulley".
4. Fill with fluid.
5. Pump belt
6. Adjust belt. Refer to "Adjusting Belt Tension".

7. Bleed power steering system.

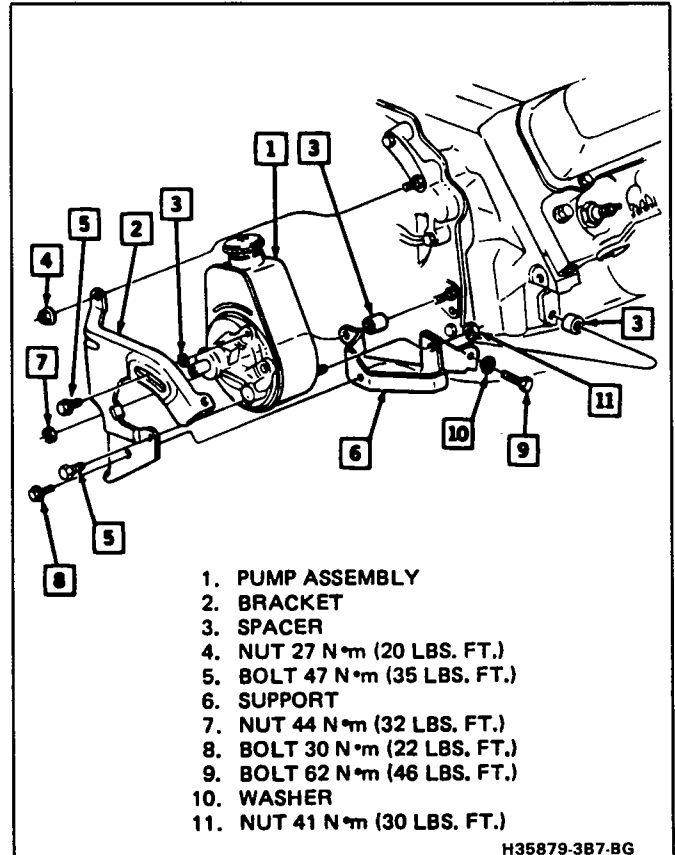


Figure 7 Power Steering Pump Mounting - B and G Carline and V8

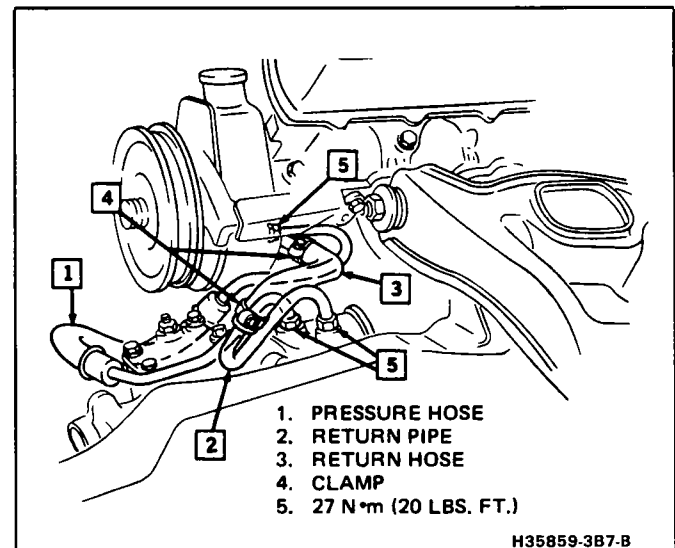


Figure 8 Power Steering Pump Hose Routing - B Carline and V8

**POWER STEERING GEAR**

See Figures 11 & 12

Tool Required:

J 29107 Pitman Arm Puller

**↔ Remove or Disconnect**

1. Position container under gear to catch dripping fluid.

## 3B7-6 POWER STEERING GEAR AND PUMP

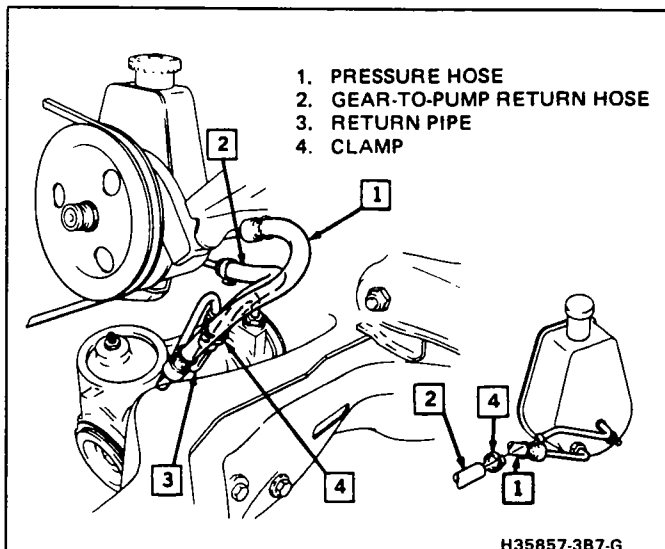


Figure 9 Power Steering Pump Hose Routing - G Carline and V8

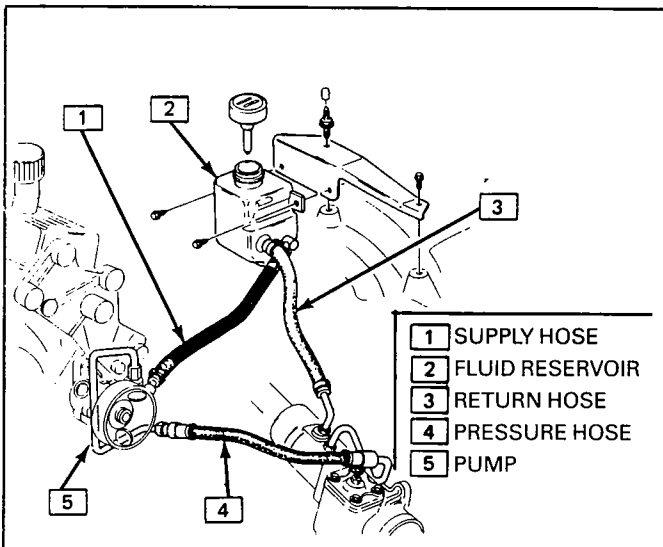


Figure 10 Power Steering Hose Routing G Carline-V6 Turbo

2. Pressure and return lines at steering gear. Plug all openings to prevent loss of fluid and entrance of dirt into system.
3. Pinch bolt and disconnect intermediate shaft from gear

**CAUTION:** Failure to disconnect the intermediate shaft from the steering gear stub shaft can result in damage to the steering gear and/or intermediate shaft. This damage can cause loss of steering control which could result in a vehicle crash and bodily injury.

4. Raise car and suitably support, see Section 0A.
5. Nut and lockwasher from pitman shaft and remove pitman arm from steering gear using J 29107, see Section 3B6
6. Three bolts and flat washers that hold gear to frame and lower gear assembly down and out of car

### Install or Connect

Before installing the steering gear, apply a sodium soap fine fiber grease to the gear mounting pads to prevent squeaks between the gear housing and the frame. Before positioning the gear, note that the flat on the gear lower shaft must index with the flat in the intermediate shaft. Make certain there is a minimum of 1.02mm (.040") clearance between intermediate shaft coupling and steering gear upper seal.

1. Position steering gear to frame so that gear aligns with intermediate shaft and three frame holes. Before tightening the steering gear to frame bolts, shift the steering gear as necessary to place it in the same plane as the steering shaft so that the intermediate shaft is not distorted. Secure gear to frame with three mounting bolts. Tighten to 110 N·m (80 lbs. ft.).

### Important

- If mounting threads are stripped, do not repair, replace housing.
2. Pitman arm on pitman shaft and install lockwasher and nut and tighten to 250 N·m (185 lbs. ft.)
  3. Lower car.
  4. Pressure and return lines to steering gear and tighten fittings to 27 N·m (20 lbs. ft.)
  5. Intermediate shaft on gear stub shaft, aligning the shaft. Install pinch bolt and tighten to 48 N·m (35 lbs. ft.)

## UNIT REPAIR

### POWER STEERING PUMP

See Figures 13 thru 22

#### Cleaning and Inspection

After disassembly, carefully clean all pump parts in cleaning solvent. Replace any damaged or worn parts.

#### Inspect

1. Flow control valve assembly for score marks, wear, burrs, or other damage
2. Castings for cracks or other visual evidence of damage. Check machined surfaces, especially mating surfaces on "O" ring seals, for scratches or burrs that might permit leaks. Examine the V-shaped notches at edges of discharge ports on pressure plate. These notches must be clean and undamaged if pump noise is to be avoided, as they cushion the hydraulic shock when each vane passes the port.
3. Cam ring inner diameter surfaces for score marks. The cam ring is specially treated and a dull gray-black finish and wavy grain appearance inside the cam ring is normal.
4. Pump shaft for score marks, excessive wear or damage, particularly at splines and at bearing and seal surfaces. Separate and inspect rotor and vanes for wear and general condition.

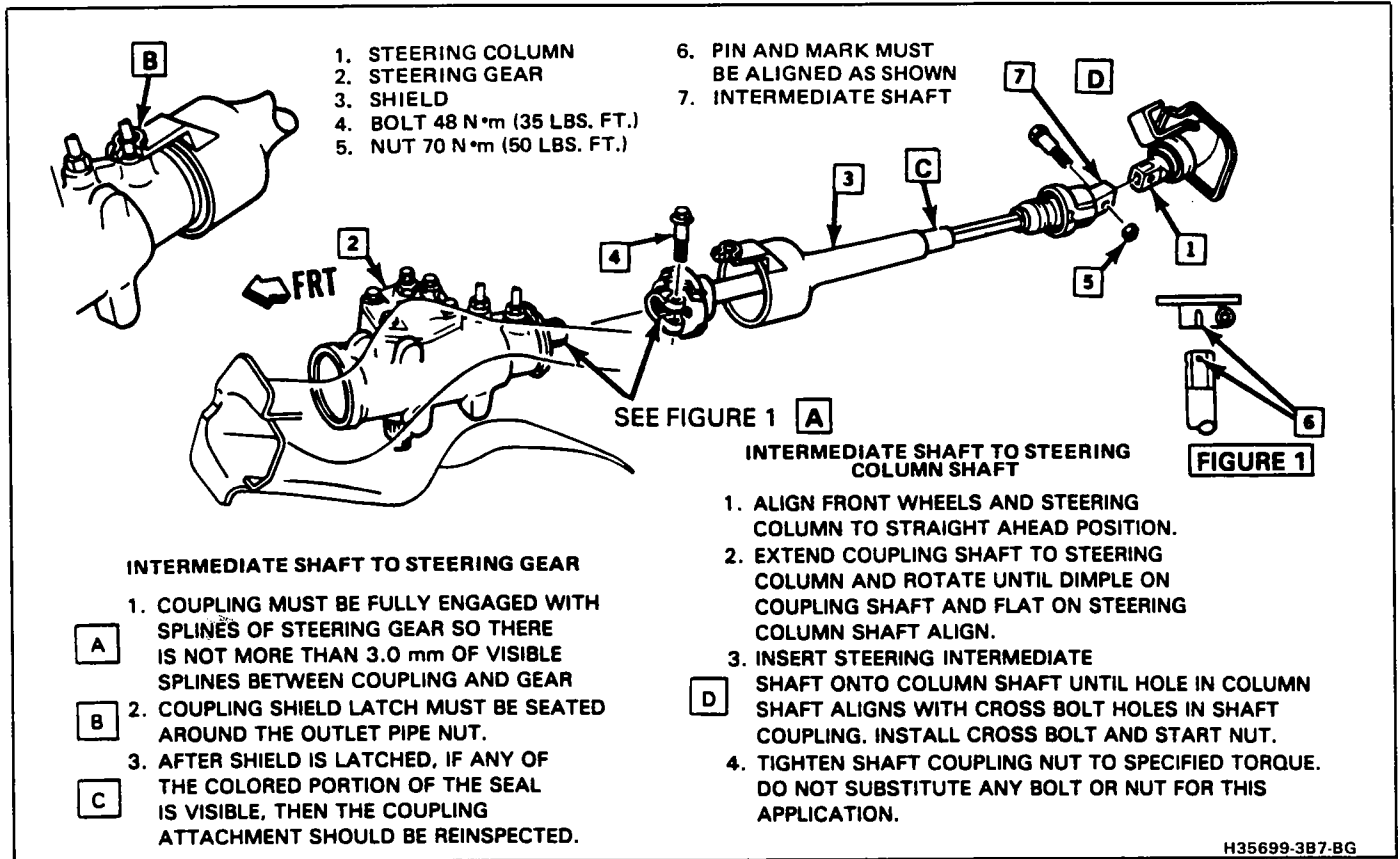


Figure 11 Intermediate Shaft Coupling

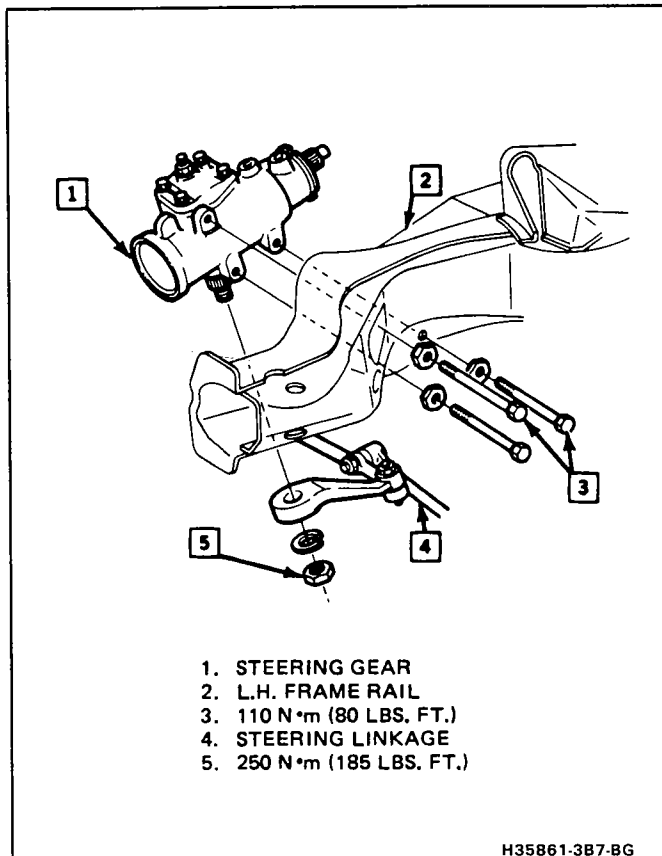


Figure 12 Power Steering Gear Mounting

5. Shaft bushing in pump housing, and replace pump housing if bushing is scored or excessively worn

If any internal parts are found to be worn or damaged, flush steering gear or disassemble gear and clean internal parts.

## POWER STEERING GEAR

See Figures 13 thru 17

### Cleaning and Inspection

After disassembly, carefully clean all parts in cleaning solvent. Replace any damaged or worn parts.

#### Inspect

1. Drive pin in the stub shaft or valve body for looseness, cracks, excessive wear or broken, replace the complete valve and shaft assembly if these conditions exist.
2. For evidence of leakage between the torsion bar and the stub shaft or scores, nicks, or burrs on the machined surface of the stub shaft. If these areas cannot be cleaned up with crocus cloth, the entire valve assembly must be replaced.
3. Outside diameter of the valve spool and the inside diameter of the valve body for nicks, burrs, or wear spots. If these areas cannot be cleaned up by the use of crocus cloth, the complete valve and shaft assembly will have to be replaced.

### 3B7-8 POWER STEERING GEAR AND PUMP

4. Small notch in the skirt of the valve body for excessive wear, the complete valve and shaft assembly will have to be replaced if the notch is worn.
5. Fit of the valve spool in the valve body (with the valve spool dampener "O" ring removed). If the valve spool does not rotate freely without binding, the complete valve and shaft assembly will have to be replaced.

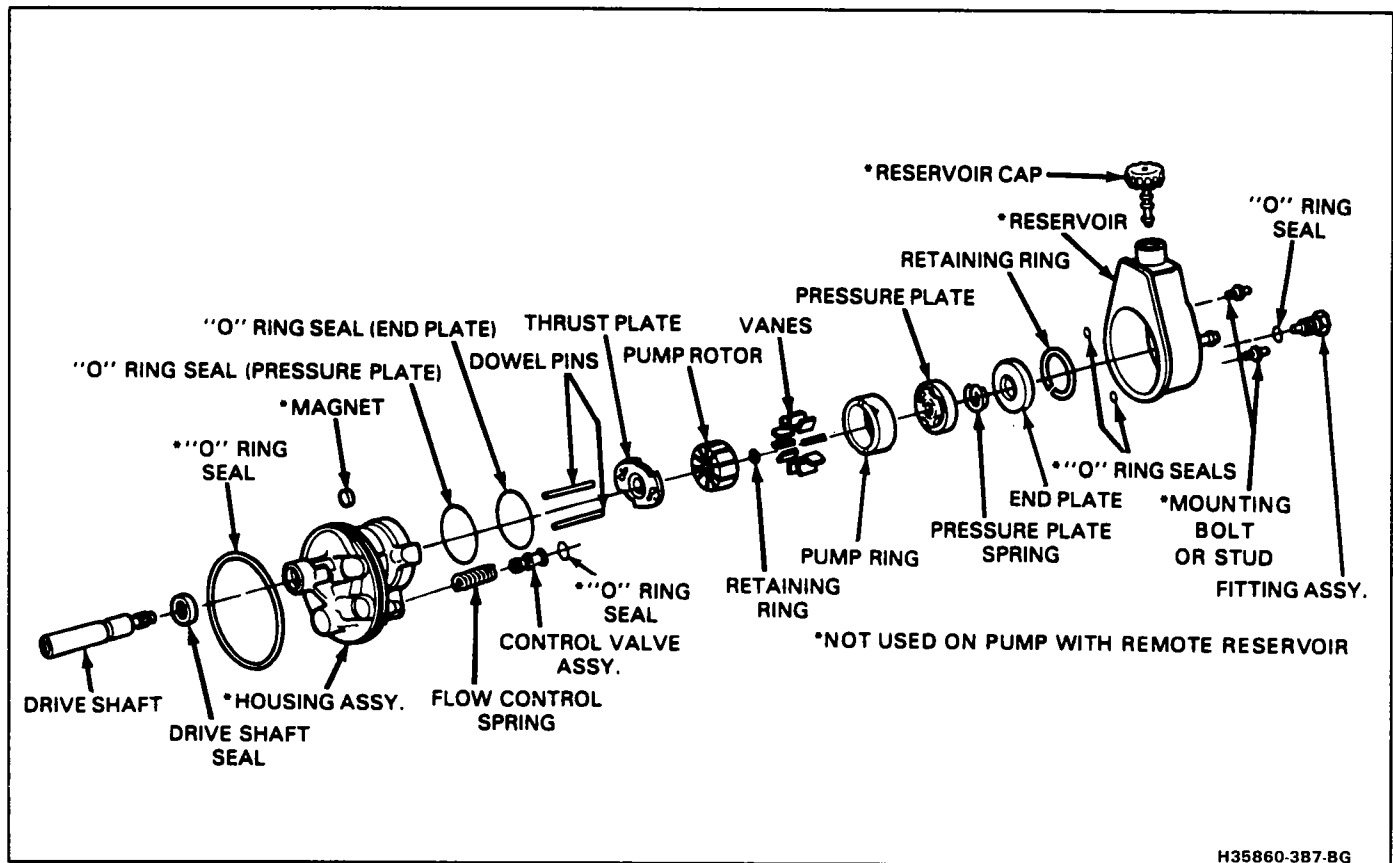


Figure 13 N and P Series Power Steering Pump

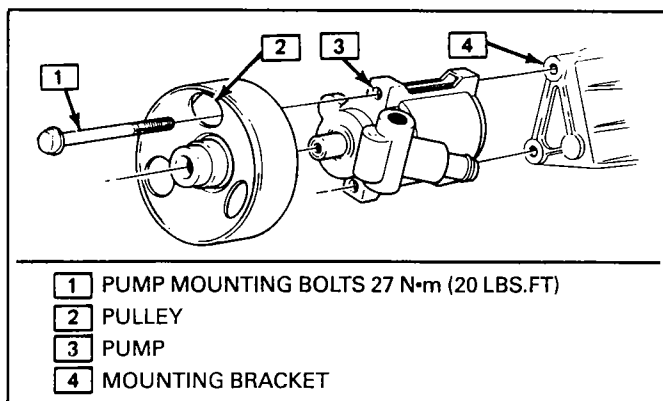
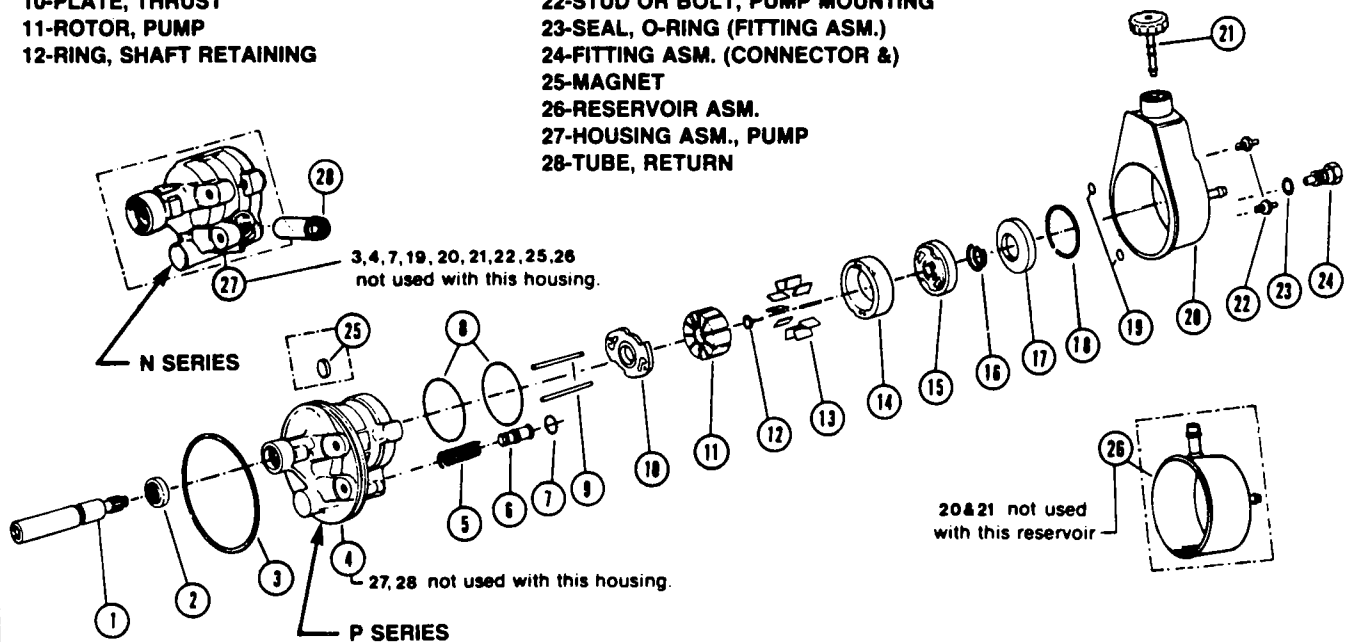


Figure 14 G Turbo Power Steering Pump VIN 7



## POWER STEERING PUMP ASSEMBLY (N SERIES-REMOTE RESERVOIR) (P SERIES-SUBMERGED)

- |   |   |
|---|---|
| <ul style="list-style-type: none"> <li>1-SHAFT, DRIVE</li> <li>2-SEAL, DRIVE SHAFT</li> <li>3-SEAL, O-RING (HOUSING)</li> <li>4-HOUSING ASM., PUMP</li> <li>5-SPRING, FLOW CONTROL</li> <li>6-VALVE ASM., CONTROL</li> <li>7-SEAL, O-RING (HOUSING)</li> <li>8-SEAL, O-RING (PRESSURE &amp; END PLATE)</li> <li>9-PIN, DOWEL</li> <li>10-PLATE, THRUST</li> <li>11-ROTOR, PUMP</li> <li>12-RING, SHAFT RETAINING</li> </ul> | <ul style="list-style-type: none"> <li>13-VANE, PUMP</li> <li>14-RING, PUMP</li> <li>15-PLATE, PRESSURE</li> <li>16-SPRING, PRESSURE PLATE</li> <li>17-PLATE, END</li> <li>18-RING, END PLATE RETAINING</li> <li>19-SEAL, O-RING (HOUSING TO STUD)</li> <li>20-RESERVOIR ASM.</li> <li>21-CAP ASM., RESERVOIR</li> <li>22-STUD OR BOLT, PUMP MOUNTING</li> <li>23-SEAL, O-RING (FITTING ASM.)</li> <li>24-FITTING ASM. (CONNECTOR &amp;)</li> <li>25-MAGNET</li> <li>26-RESERVOIR ASM.</li> <li>27-HOUSING ASM., PUMP</li> <li>28-TUBE, RETURN</li> </ul> |
|---|---|

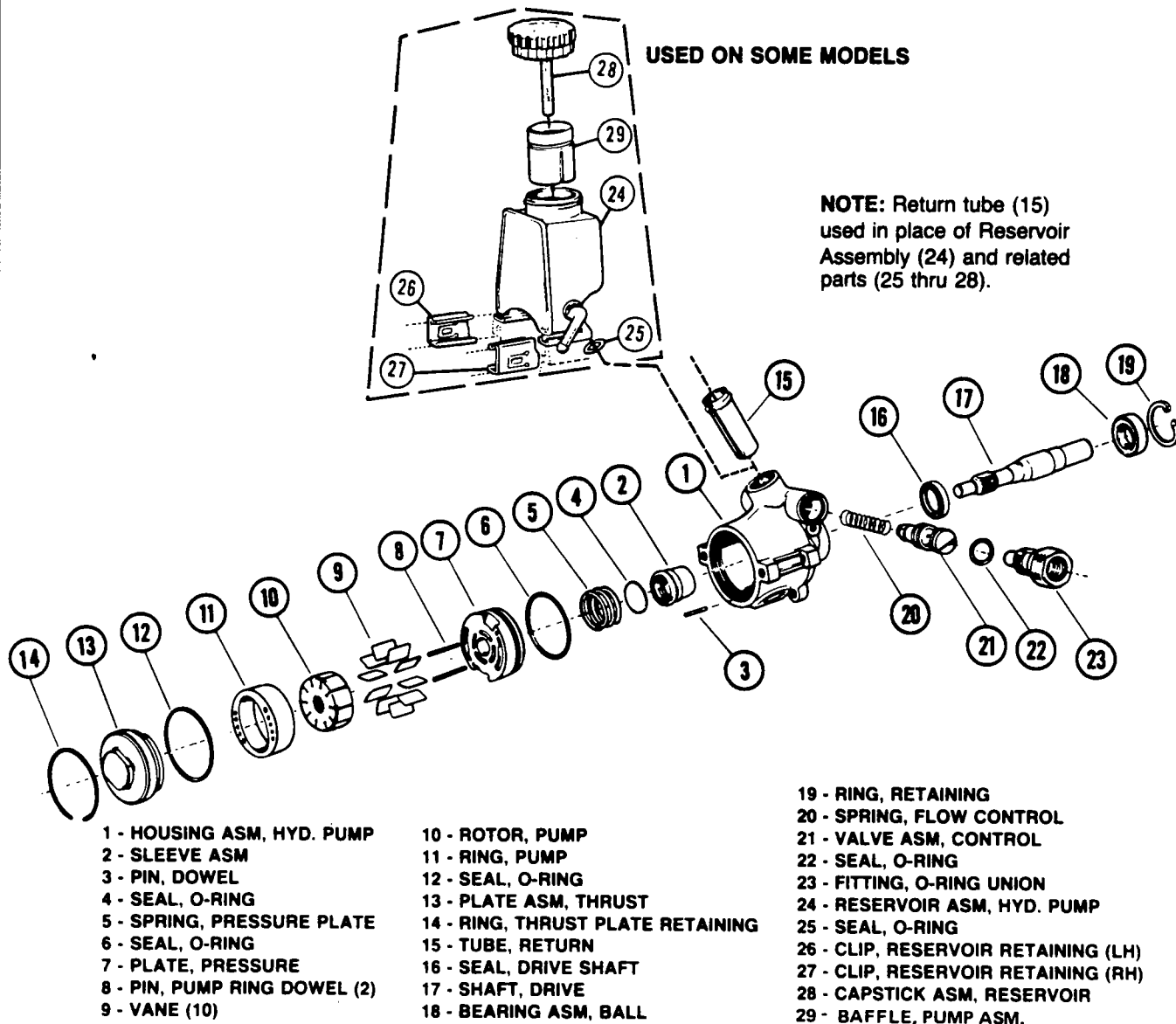


### BENCH REPAIR INDEX (N&P SERIES PUMP)

TO REMOVE	EXPLODED VIEW NO.	PERFORM STEPS
Drive Shaft Seal	2	1
Pump Reservoir	20 or 26	2
Control Valve Asm.	6	2-3
End Plate	17	3
Rotating Group	1-10-11-12-13-14-15	2-3-4
O-Ring Seals (Rotating Group) & Drive Shaft	2-8	2-3-4-5
Return Tube	28	6

Figure 15 N and P Series Power Steering Pump Overhaul

**POWER STEERING PUMP ASSEMBLY (TC SERIES)**



**BENCH REPAIR INDEX (TC SERIES)**

TO REMOVE	EXPLODED VIEW NO.	PERFORM STEPS
Return Tube	15	7
Control Valve Asm.	21	2
Drive Shaft	17	3
Ball Bearing (Drive Shaft)	18	3
Drive Shaft Seal	16	3-4
Rotating Group	7-9-10-11-12-13	3&5
Sleeve Asm.	2	3-5-6
Hydraulic Pump Reservoir Asm.	24	1

Figure 16 TC Series Power Steering Pump and Repair Index

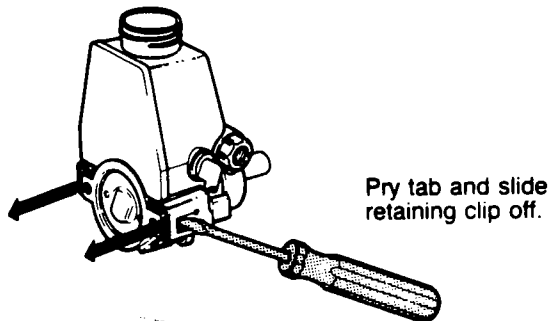
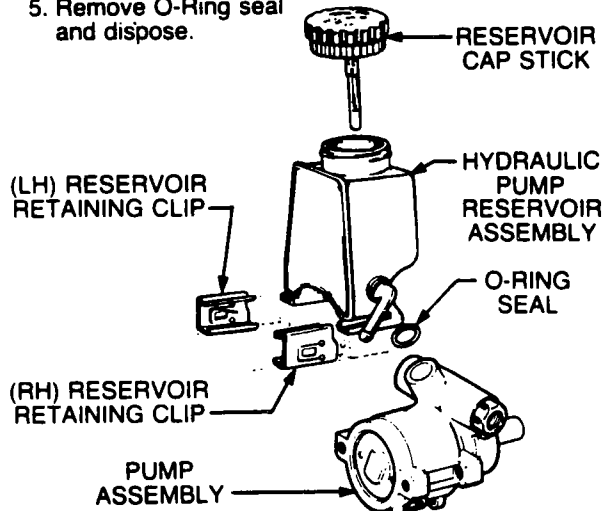
### 1. REMOVE AND INSTALL RESERVOIR ASSEMBLY

#### REMOVE

1. Remove reservoir cap stick, drain hydraulic oil from reservoir.
2. Pry tab on reservoir retaining clip.
3. Slide retaining clips off pump assembly.
4. Remove reservoir assembly.
5. Remove O-Ring seal and dispose.

#### INSTALL

1. Lubricate O-Ring seal and install as shown.
  2. Fit reservoir on pump assembly.
  3. Install both (RH) and (LH) reservoir retaining clips.
- NOTE:** Be sure tabs are engaged on pump fully.



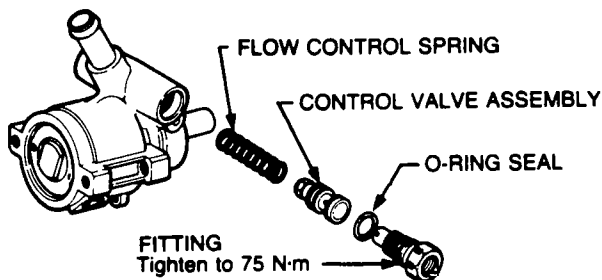
### 2. REMOVE AND INSTALL CONTROL VALVE ASSEMBLY

#### REMOVE

1. Remove parts as shown.

#### INSTALL

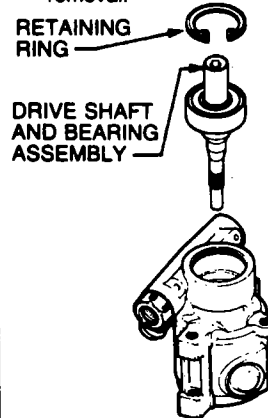
1. Install parts as shown.
2. Tighten to specifications.



### 3. REMOVE AND INSTALL DRIVE SHAFT AND OR BALL BEARING ASSEMBLY

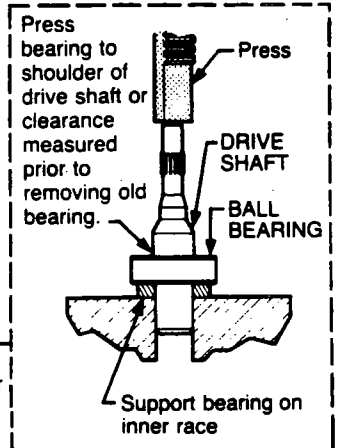
#### REMOVE

1. Remove retaining ring with suitable snap ring pliers.
2. Remove drive shaft and bearing assembly from housing.
3. Refer to inset for bearing removal.

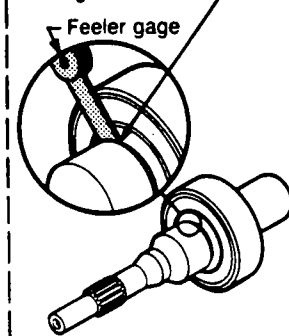


#### INSTALL

1. See inset for installation of bearing on drive shaft.
2. Slide assembly into housing while rotating drive shaft so shaft serrations engage with rotor.
3. Bottom bearing in housing.
4. Install retaining ring with beveled side outward.



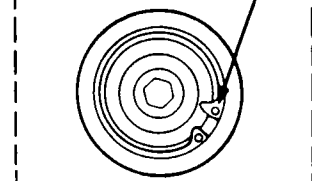
When clearance exists between drive shaft shoulder and bearing inner race, measure clearance before bearing removal.



Remove bearing

Install bearing

Note position of large lug to be sure beveled side of ring is properly located.

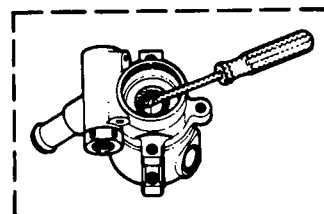


Install retaining ring

### 4. REMOVE AND INSTALL DRIVE SHAFT SEAL

#### REMOVE

1. Using a screwdriver, pry seal from housing.



Seal removal

#### INSTALL

1. Using suitable socket, press seal into housing until bottomed.

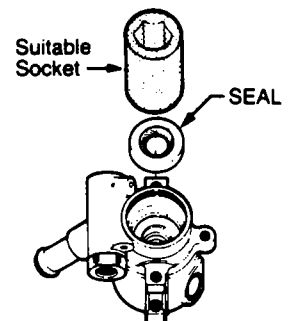


Figure 17 TC Series Power Steering Pump Repair (1 of 2)

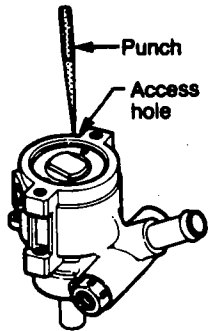
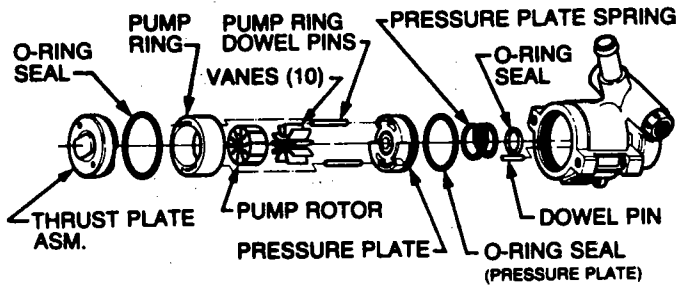
**5. REMOVE AND INSTALL ROTATING GROUP**

**REMOVE**

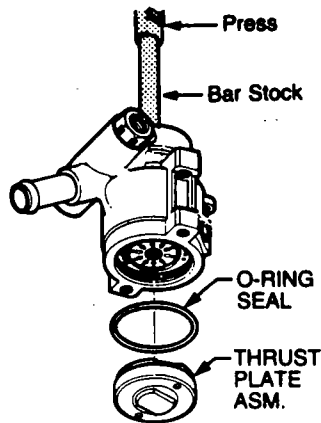
1. Using a small punch in the access hole, remove the retaining ring.
2. Using a 5/8" piece of bar stock or suitable brass drift, press on pressure plate hub from drive shaft side of housing until thrust plate can be removed.
3. The O-ring seal in housing must be removed next. It is now possible to remove the remaining parts of the rotating group from housing. It may still be necessary to use a press to remove the pressure plate.
4. Remove O-ring seal from the sleeve assembly and dispose.

**INSTALL**

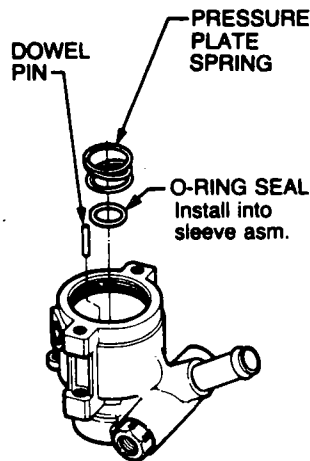
1. Lubricate new O-ring seal and install into sleeve assembly.
2. Insert dowel pin in housing.
3. Install spring over sleeve assembly in housing.
4. Lubricate O-ring seal and install on pressure plate.
5. Mark top of pressure plate directly over dowel pin hole in plate. This will help line up hole with dowel pin.
6. Install pressure plate in housing. Be sure dowel pin and hole in pressure plate engage properly.
7. Install two (2) pump ring dowel pins in holes in pressure plate. Slide pump ring over these two pins. Be sure identification marks on pump ring are facing upward.
8. Install rotor with counter bore side toward drive shaft end of housing. Add ten vanes.
9. Lubricate O-ring seal and install in housing.
10. Install thrust plate in housing, making sure that dimples in thrust plate line up with bolt holes in housing and that thrust plate engages pump ring dowel pins.
11. Using a press, press on thrust plate far enough to install retaining ring.
12. Install retaining ring with opening of ring centered with bolt hole in housing nearest to access hole.



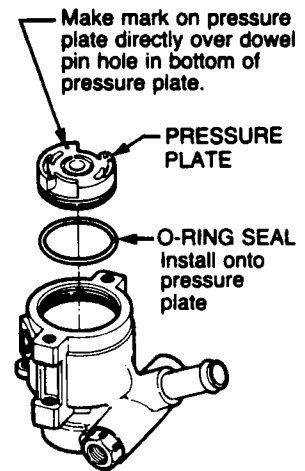
Retaining ring removal



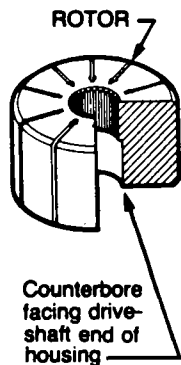
Thrust plate removal



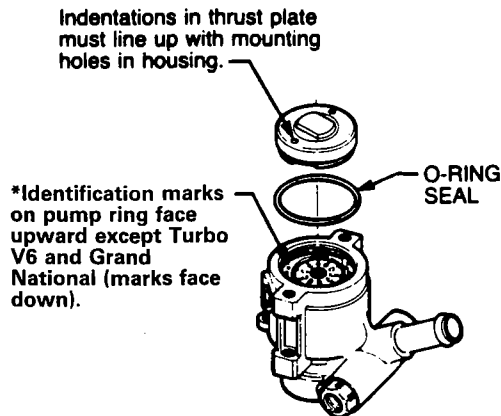
Install spring



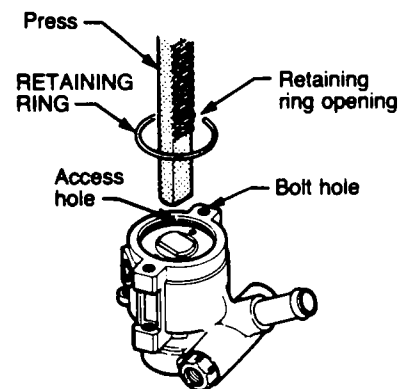
Install pressure plate



Install rotor



Install seal and thrust plate.



Install retaining ring

Figure 18 TC Series Power Steering Pump Repair (2 of 2)

# POWER STEERING GEAR (800 MODEL)

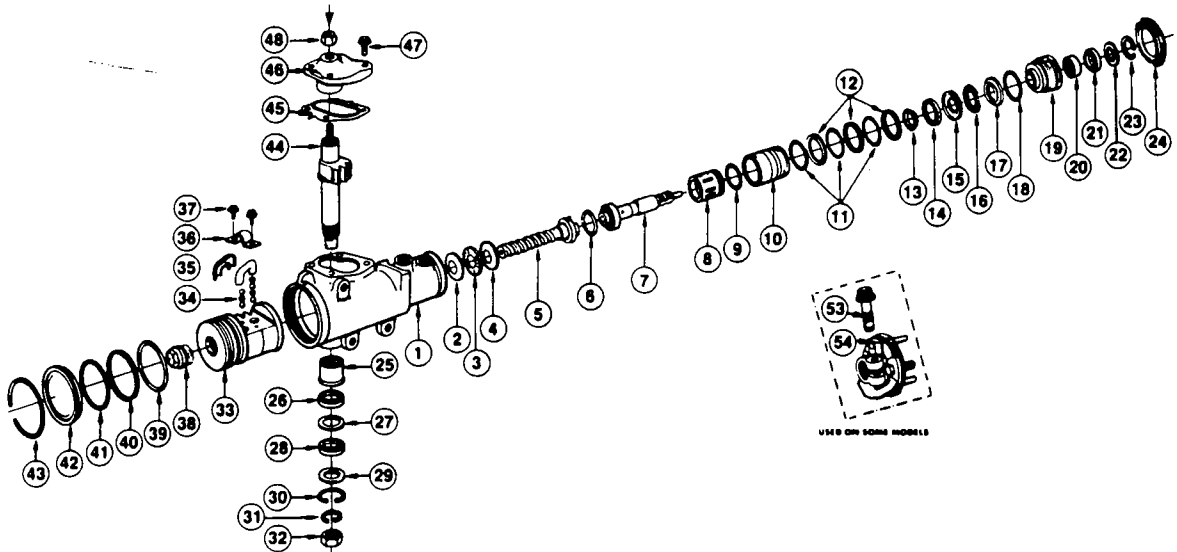
## GENERAL DESCRIPTION

These Integral Power Steering Gears have a control valve which directs oil to either side of the rack piston. The rack piston converts hydraulic power into mechanical force. This force is transmitted to the mating pitman shaft teeth, through the pitman shaft to the steering linkage.

The model 800 incorporates a recirculating ball system in which steel balls act as a rolling thread between a steering worm-shaft and the rack-piston.

Whenever a part which forms a sealing surface for an "O" ring is removed, the "O" ring seal should also be removed and replaced with a new seal. Whenever one of the Pitman shaft or stub shaft seals are removed all adjacent seals should be removed and replaced with new seals. Lubricate all new seals with power steering fluid to ease assembly.

Key No.	Part Name	Key No.	Part Name	Key No.	Part Name
1	HOUSING, STEERING GEAR	19	PLUG, ADJUSTER	37	SCREW ASSY., LOCKWASHER & (2)
2	RACE, THRUST BEARING (WORM)	20	BEARING, NEEDLE	38	PLUG, RACK PISTON
3	BEARING ASSY., ROLLER THRUST (WORM)	21	SEAL, STUB SHAFT	39	SEAL, "O" RING (RACK PISTON)
4	RACE, THRUST BEARING (WORM)	22	SEAL, STUB SHAFT DUST	40	RING, RACK PISTON
5	WORM, STEERING	23	RING, RETAINING	41	SEAL, "O" RING (HOUSING END PLUG)
6	SEAL "O" RING (STUB SHAFT)	24	NUT, ADJUSTER PLUG LOCK	42	PLUG, HOUSING END
7	SHAFT, STUB	25	BEARING ASSY., NEEDLE (PITMAN SHAFT)	43	RING, RETAINING (HOUSING END PLUG)
8	SPOOL, VALVE	26	SEAL, PITMAN SHAFT (SINGLE LIP)	44	GEAR ASSY., PITMAN SHAFT
9	SEAL, "O" RING (SPOOL)	27	WASHER, SEAL BACK-UP (PITMAN SHAFT)	45	SEAL ASSY., GASKET
10	BODY, VALVE	28	SEAL, PITMAN SHAFT (DOUBLE LIP)	46	COVER ASSY., HOUSING SIDE
11	RING, VALVE BODY (3)	29	WASHER, SEAL BACK-UP (PITMAN SHAFT)	47	BOLT, HEX. HEAD (SIDE COVER) (4)
12	SEAL, "O" RING (VALVE BODY) (3)	30	RING, RETAINING (PITMAN SHAFT SEAL)	48	NUT, LASH ADJUSTER
13	RETAINER, BEARING (ADJUSTER)	31	WASHER, PITMAN SHAFT LOCK	49	THIS NUMBER NOT USED
14	SPACER, THRUST BEARING	32	NUT, PITMAN SHAFT	50	THIS NUMBER NOT USED
15	RACE, UPPER THRUST BEARING (SMALL)	33	NUT, RACK PISTON	51	THIS NUMBER NOT USED
16	BEARING, UPPER THRUST	34	BALL	52	THIS NUMBER NOT USED
17	RACE, UPPER THRUST BEARING (LARGE)	35	GUIDE, BALL RETURN (2)	53	BOLT, COUPLING PINCH
18	SEAL, "O" RING (ADJUSTER)	36	CLAMP, BALL RETURN GUIDE	54	COUPLING, STEERING SHAFT



H35876-3B7-BG

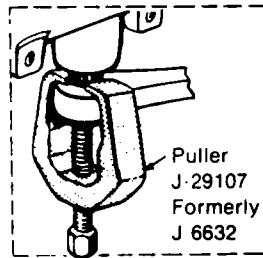
Figure 19 Power Steering Gear

**1. REMOVE AND INSTALL PITMAN SHAFT SEALS IN CAR**

**REMOVE**

1. Clean exposed end of pitman shaft and end of housing after removing pitman arm.
2. Remove retaining ring with snap ring pliers J 4245.
3. Start engine and turn wheels fully to the left to force seals and washer out.
4. Turn off engine.
5. Inspect housing and shaft.

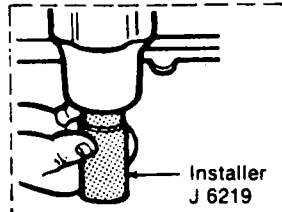
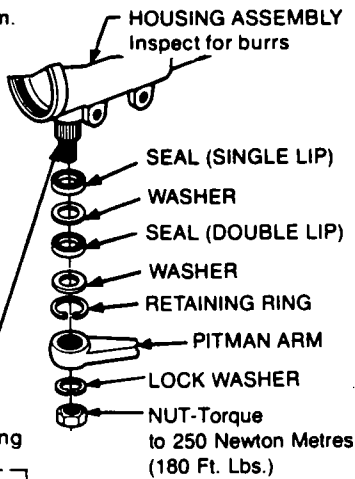
**PITMAN SHAFT**  
Inspect seal surface for roughness and pitting



Remove Pitman Arm

**INSTALL**

1. Install parts as shown.

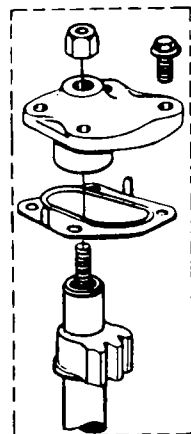


Install Seals

**2. REMOVE AND INSTALL PITMAN SHAFT AND SIDE COVER**

**REMOVE**

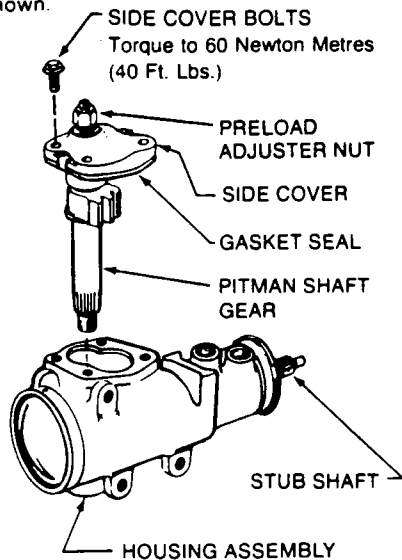
1. If pitman shaft and side cover are to be separated, remove preload adjuster nut.
2. Rotate stub shaft to center gear, then remove parts as shown.



Separate pitman shaft and gasket seal from side cover if required.

**INSTALL**

1. If removed, install gasket seal by bending tabs around cover edges.
2. Install parts as shown.



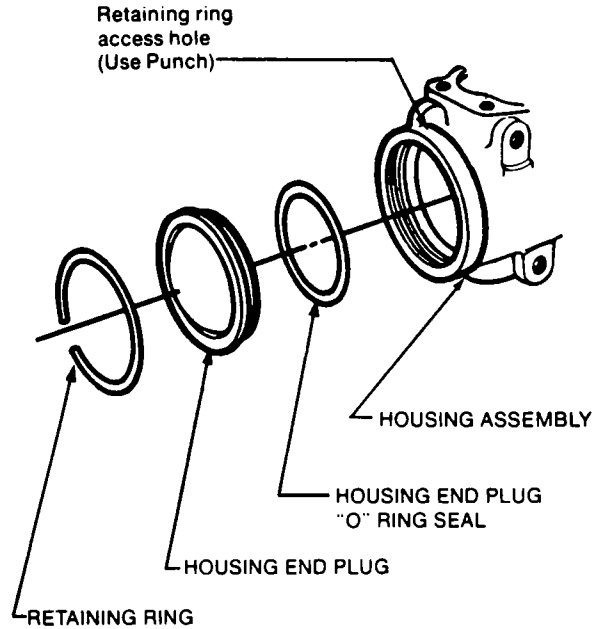
**3. REMOVE AND INSTALL HOUSING END PLUG**

**REMOVE**

1. Remove parts as shown.

**INSTALL**

1. Install parts as shown. Open end of retaining ring to be approx. 25 mm (1 inch) from access hole.



**4. REMOVE AND INSTALL RACK PISTON**

**REMOVE**

1. Remove parts as shown.

**INSTALL**

1. Install parts as shown.

When installing rack, care should be taken not to cut teflon seal, rack piston seal compressor J 7576 or J 8947 may be used to compress seal.

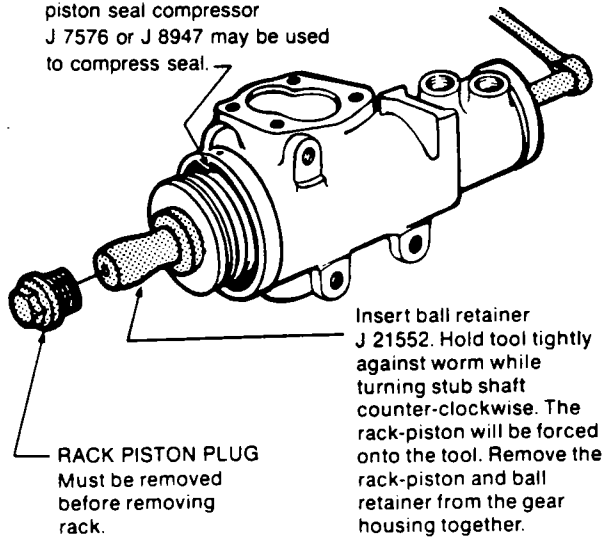
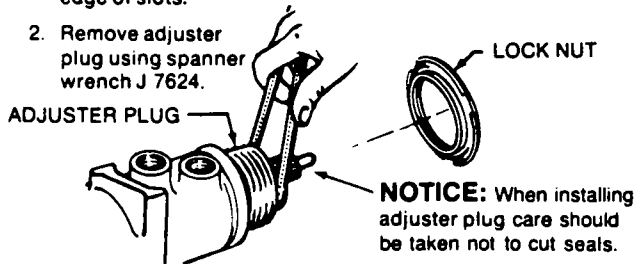


Figure 20 Power Steering Gear Overhaul (1 of 4)

**5. REMOVE AND INSTALL ADJUSTER PLUG ASSEMBLY**

- REMOVE**
1. Loosen lock nut. Use punch against edge of slots.
  2. Remove adjuster plug using spanner wrench J 7624.

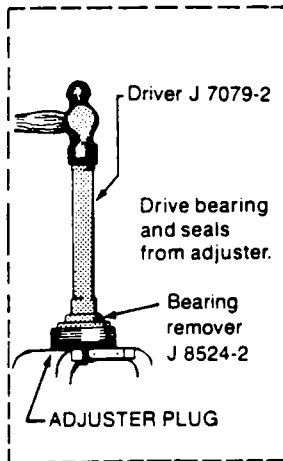
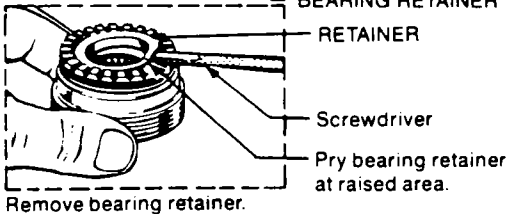
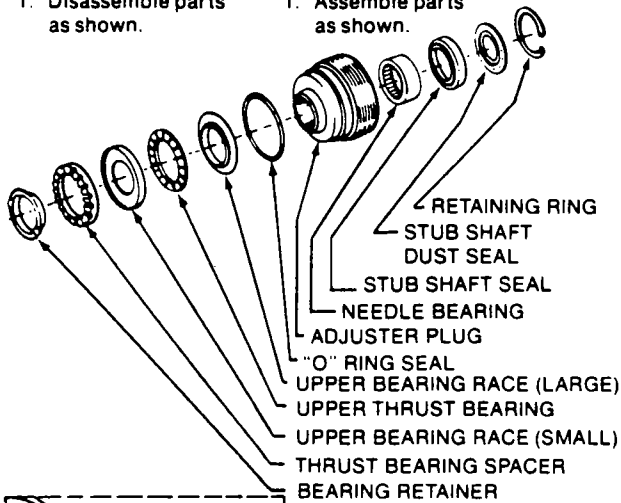
- INSTALL**
1. Install parts as shown.



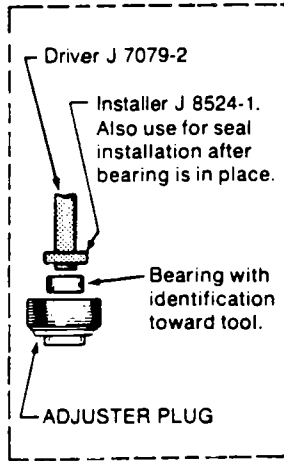
**6. DISASSEMBLE AND ASSEMBLE ADJUSTER PLUG ASSEMBLY**

- DISASSEMBLE**
1. Disassemble parts as shown.

- ASSEMBLE**
1. Assemble parts as shown.



Remove bearing and seals.

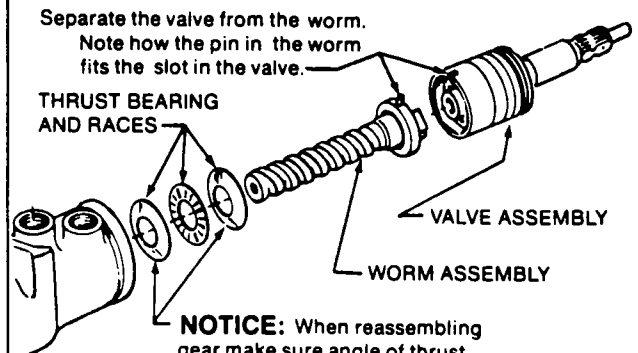


Install bearing and seals.

**7. REMOVE AND INSTALL BEARING, WORM, AND VALVE ASSEMBLY**

- REMOVE**
1. Grasp stub shaft and remove valve and worm assembly as a unit.

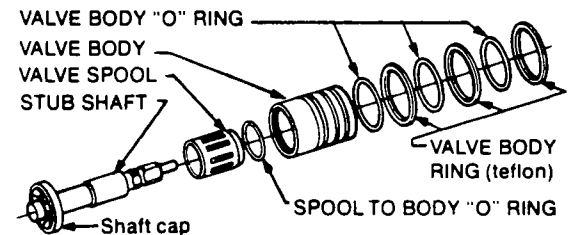
- INSTALL**
1. Install parts as shown.



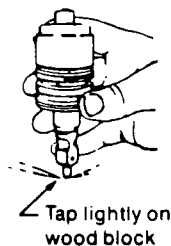
**8. DISASSEMBLE AND ASSEMBLE VALVE**

- DISASSEMBLE**
1. Disassemble parts as shown.

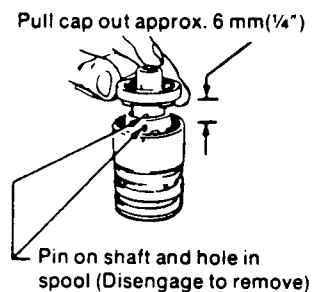
- ASSEMBLE**
1. Assemble parts as shown.



A. Loosen shaft cap



B. Remove and install stub shaft.



C. Remove and install spool

Rotate while removing or installing



D. Engage stub shaft

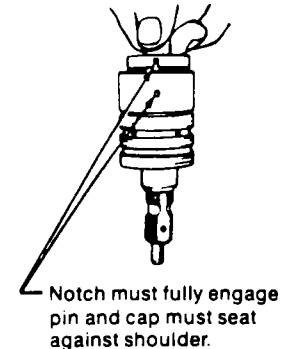


Figure 21 Power Steering Gear Overhaul (2 of 4)

**9. DISASSEMBLE AND ASSEMBLE RACK PISTON**

**DISASSEMBLE**

1. Disassemble parts as shown.
2. Clean and inspect all parts for excessive wear.

**ASSEMBLE**

1. Assemble parts as shown.

**NOTICE:** The black balls are smaller than the silver balls. The black and silver balls must be installed alternately into the rack-piston and return guide to maintain rack piston to worm gear preload.

**TEFLON SEAL AND "O" RING—**  
If replaced lubricate new seal and "O" ring with power steering fluid.

Turn worm until worm groove is aligned with the lower ball return guide hole.

**WORM—**Slide all the way into the rack-piston.

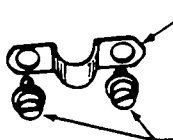
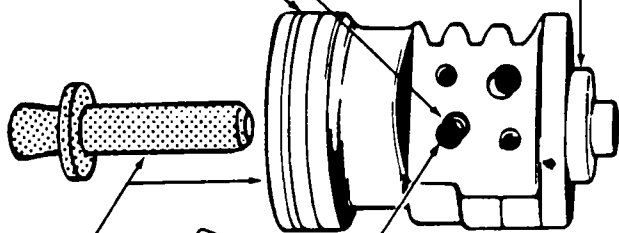
Lubricate balls with power steering fluid. Install balls, through ball return guide hole, while rotating worm counterclockwise.

Before assembling rack in housing, ball retainer J 21552 must be inserted into rack to allow removal of worm.

**GUIDE—**Alternately install remainder of balls and retain with grease at each end of guide.

**CLAMP**

**SCREW—**Tighten to 5 Newton Metres (4 Ft. Lbs.)



**10. REMOVE AND INSTALL PITMAN SHAFT SEALS AND BEARING**

**REMOVE**

1. Clean end of housing thoroughly to prevent dirt from entering and be extremely careful not to score the housing bore.
2. Remove retaining ring with snap ring pliers J 4245.
3. Using screw driver, pry seals and washers from bore.

**INSTALL**

1. Coat seal lip and washer face with anhydrous calcium grease.
2. Install parts as shown.

**HOUSING ASSEMBLY**  
Inspect for burrs.

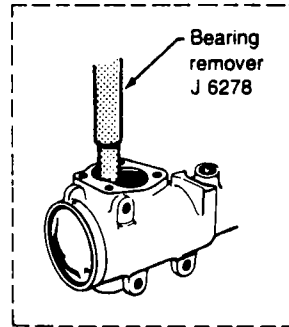
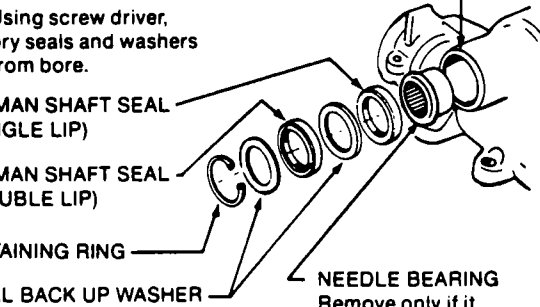
**PITMAN SHAFT SEAL (SINGLE LIP)**

**PITMAN SHAFT SEAL (DOUBLE LIP)**

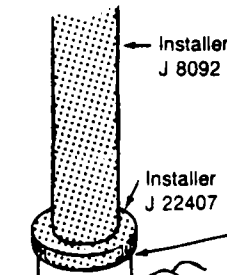
**RETAINING RING**

**SEAL BACK UP WASHER**

**NEEDLE BEARING**  
Remove only if it needs replacing.

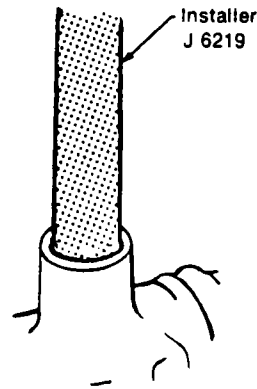


Removing bearing



When tool bottoms on housing bearing is fully installed.

Install Pitman shaft bearing.



Install Pitman shaft seals.

Figure 22 Power Steering Gear Overhaul (3 of 4)



**11. REMOVE AND INSTALL CHECK VALVE**

**REMOVE**

1. Remove parts as shown.



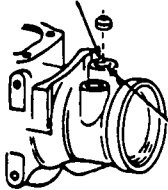
With small screwdriver, pry check valve from housing.

Care should be taken not to damage threads when prying on edge of housing.

Remove check valve.

**INSTALL**

1. Install parts as shown.



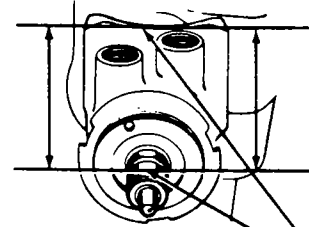
Install check valve.



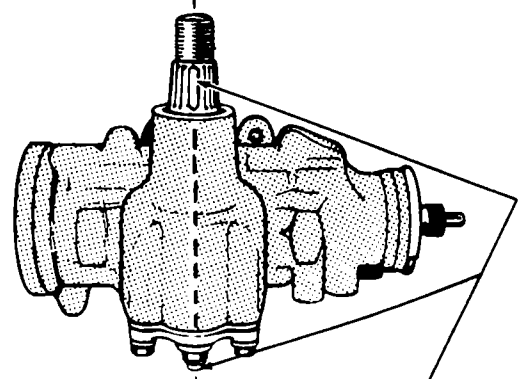
Using a piece of  $\frac{3}{8}$  tubing, 4 inches long, carefully drive the check valve into the housing.

**13. PITMAN SHAFT "OVER-CENTER" SECTOR ADJUSTMENT**

A.



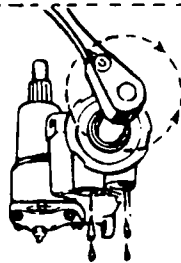
When gear is on center flat on stub shaft is normally on same side as, and parallel with, side cover.



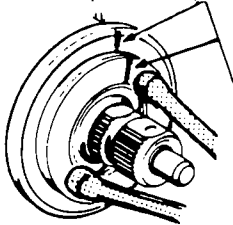
The block tooth on the Pitman shaft is in line with the over-center preload adjuster.

**12. ADJUST THRUST BEARING PRELOAD**

A. Before adjusting bearing preload, rotate the stub shaft back and forth to drain all oil from gear.

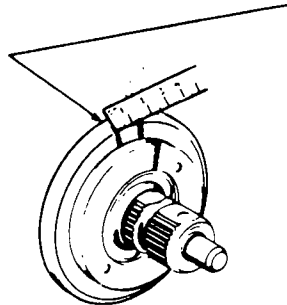


B. Using spanner wrench J 7624, tighten adjuster plug until thrust bearing is firmly bottomed, 27 Newton Metres (22 Ft. Lbs.).



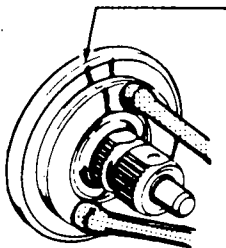
Mark housing and face of adjuster plug.

C.



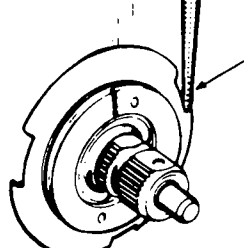
Measure back counterclockwise 13mm ( $\frac{1}{2}$ " ) and place a second mark on housing.

D.



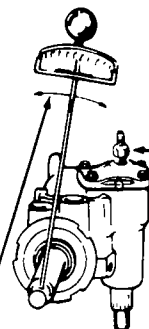
Turn adjuster counterclockwise until mark on face of adjuster lines up with second mark on housing.

E.



Using punch in notch tighten lock nut securely. Hold adjuster plug to maintain alignment of the marks.

B. Back off preload adjuster until it stops, then turn it in one full turn.



With gear at center of travel, check torque to turn stub shaft (reading #1).

C. Turn adjuster in until torque to turn stub shaft is 0.6 to 1.2 Newton Metres (6 to 10 in. Lbs.) more than reading #1.



Torque adjuster lock nut to 27 Newton Metres (20 Ft. Lbs.)

Prevent adjuster screw from turning while torqueing lock nut.

Figure 23 Power Steering Gear Overhaul (4 of 4)

**GENERAL SPECIFICATIONS**

FLUID ..... POWER STEERING FLUID NO. 1050017 OR EQUIVALENT

**ADJUSTMENTS**

VALVE ASSEMBLY AND SEAL DRAG..... 0.1 TO 0.4 N·m (1 TO 4 IN. LBS.)  
 THRUST BEARING PRE-LOAD ..... 0.3 TO 0.4 N·m (3 TO 4 IN. LBS.) IN EXCESS OF  
 VALVE ASSEMBLY AND SEAL DRAG.  
 OVERCENTER ADJUSTMENT ..... 0.6 TO 1.2 N·m (6 TO 10 IN. LBS.) (NEW GEAR)  
 0.4 TO 0.5 N·m (OR 4 TO 5 IN. LBS.) (USED GEAR)  
 IN EXCESS OF COMBINED THRUST BEARING PRE-LOAD.

ADJUSTMENT OF THE STEERING GEAR IN THE CAR IS NOT RECOMMENDED BECAUSE OF THE DIFFICULTY ENCOUNTERED IN ADJUSTING THE WORM THRUST BEARING PRELOAD AND THE CONFUSING EFFECTS OF THE HYDRAULIC FLUID IN THE GEAR. SINCE A GEAR ADJUSTMENT IS MADE ONLY AS A CORRECTION AND NOT AS A PERIODIC ADJUSTMENT, IT IS BETTER TO TAKE THE EXTRA TIME AND MAKE THE ADJUSTMENT CORRECTLY THE FIRST TIME.

SINCE A HANDLING STABILITY COMPLAINT CAN BE CAUSED BY IMPROPERLY ADJUSTED WORM THRUST BEARINGS AS WELL AS AN IMPROPER GEAR OVER-CENTER ADJUSTMENT, IT IS NECESSARY THAT THE STEERING GEAR ASSEMBLY BE REMOVED FROM THE CAR AND BOTH THRUST BEARING AND OVER-CENTER PRELOAD BE CHECKED AND CORRECTED AS NECESSARY. AN IN-CAR CHECK OF THE STEERING GEAR WILL NOT SHOW A THRUST BEARING ADJUSTMENT ERROR.

**TORQUE SPECIFICATIONS**

POWER STEERING PUMP	N·m	LBS. FT.
RESERVOIR BOLT.....	48	35
FLOW CONTROL FITTING.....	50	37
PRESSURE HOSE.....	27	20

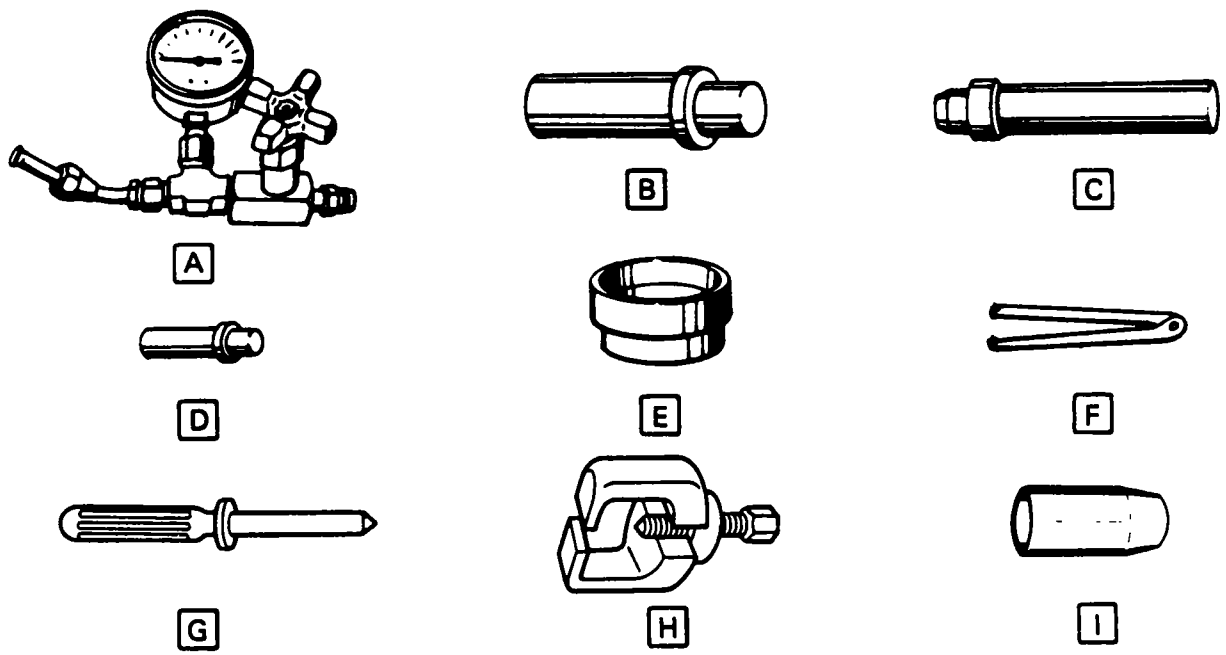
**SYSTEM CAPACITY**

COMPLETE SYSTEM.....	1-1/4 LITERS	1-1/4 QTS.
PUMP ONLY.....	1/2 LITER	1/2 QT.

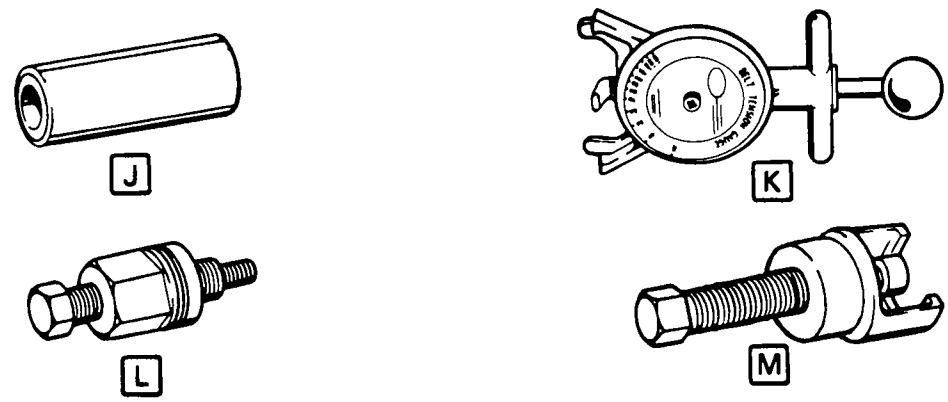
**STEERING GEAR  
 RECOMMENDED TORQUE SPECIFICATIONS**

	N·m	LBS. FT.
GEAR TO FRAME BOLTS.....	110	80
HIGH PRESSURE LINE FITTING (AT GEAR).....	27	20
OIL RETURN LINE FITTING (AT GEAR).....	27	20
ADJUSTING SCREW LOCKNUT.....	27	20
SIDE COVER BOLTS.....	60	45
ADJUSTER PLUG LOCKNUT.....	110	80
RETURN GUIDE CLAMP SCREWS.....	5	4
RACK-PISTON PLUG.....	100	75
PITMAN SHAFT NUT.....	250	185
COUPLING FLANGE BOLT.....	48	35

**POWER STEERING GEAR**



**POWER STEERING PUMP**



KEY	TOOL NO.	NAME	KEY	TOOL NO.	NAME
A	J 5176-D	PRESSURE TESTING MANIFOLD	E	J 8947	RACK-PISTON TEFLON RING COMPRESSOR
B	J 5188	END COVER SEAL AND NEEDLE BEARING INSTALLER	F	J 7824	SPANNER WRENCH
C	J 6221	BEARING INSTALLER	G	J 21552	RACK PISTON ARBOR
D	J 6278	PITMAN SHAFT BEARING REMOVER AND INSTALLER	H	J 24319-01	PITMAN ARM PULLER
D	J 6278-2	ADAPTER (USED WITH J-6278 FOR INSTALLING PITMAN SHAFT SEALS AND BEARING)	H	J 29107	PITMAN ARM PULLER
E	J 7578	RACK-PISTON TEFLON RING COMPRESSOR	I	J 29810	STUB SHAFT SEAL PROTECTOR
			J	J 7728	SEAL INSTALLER
			K	J 23600	BELT TENSION GAGE
			L	J 25033-B	POWER STEERING PUMP PULLEY INSTALLER
			M	J 25034-B	POWER STEERING PUMP PULLEY REMOVER

Figure 25 Special Tools

