

## SECTION 6D

# MANUAL STEERING GEAR

**CAUTION:** Disconnect the negative battery cable before removing or installing any electrical unit or when a tool or equipment could easily come in contact with exposed electrical terminals. Disconnecting this cable will help prevent personal injury and damage to the vehicle. The ignition must also be in LOCK unless otherwise noted.

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## SPECIFICATIONS

### GENERAL SPECIFICATIONS

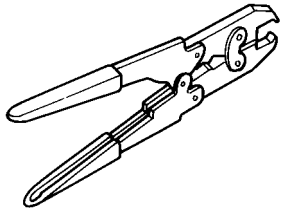
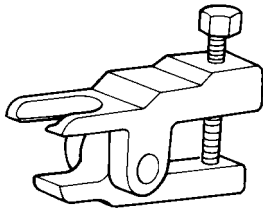
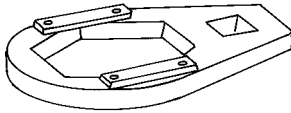
Application	Description
Lubricant	Lithium-Base Grease No. 1051344 or Equivalent

### FASTENER TIGHTENING SPECIFICATIONS

Application	N•m	Lb-Ft	Lb-In
Adjuster Plug Locknut	70	52	-
Coolant Surge Tank Attaching Nuts	4	-	35
Coupling Flange Pinch Bolt	22	16	-
Inner Tie Rod Bolts	90	66	-
Inner Tie Rod Pinch Bolts	22	16	-
Outer Tie Rod Hex Nut	60	44	-
Outer Tie Rod Pinch Bolts	22	16	-
Pinion Preload	0.7 to 1.5	-	6 to 13
Steering Gear Retaining Bracket Nuts or Bolts	38	28	-
Steering Gear Retaining Bracket Studs	20	15	-

## SPECIAL TOOLS

### SPECIAL TOOLS TABLE

 <p>A104A008</p>	<p><b>KM-J-26610 Installer</b></p>	 <p>A106C034</p>	<p><b>KM-507-B Ball Joint Remover</b></p>
 <p>A105C025</p>	<p><b>KM-472 Wrench</b></p>		

## DIAGNOSIS

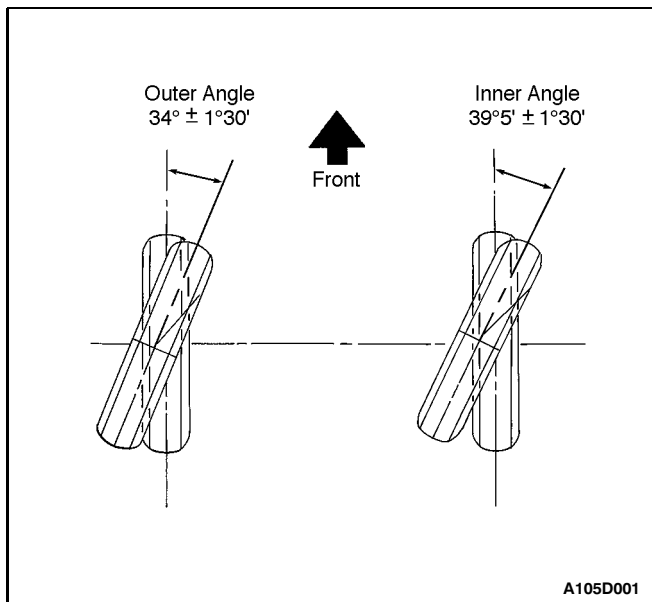
### MANUAL RACK AND PINION STEERING GEAR

#### Excessive Play or Looseness in the Steering System

Checks	Action
Check the steering gear adjustment.	Perform straight-ahead check.
Check the wheel bearing for wear or damage.	Replace the wheel bearing.
Check the outer tie rods for improper installation.	Tighten the tie rods.

#### Rattling Noise in the Steering Gear

Checks	Action
Check the steering gear for improper and insufficient lubrication.	Lubricate the rack assembly. Lubricate the pinion assembly.
Check the steering gear mounting for improper installation.	Tighten the steering gear mounting bolts and the nuts.
Check the outer tie rods for improper installation.	Tighten the tie rods.



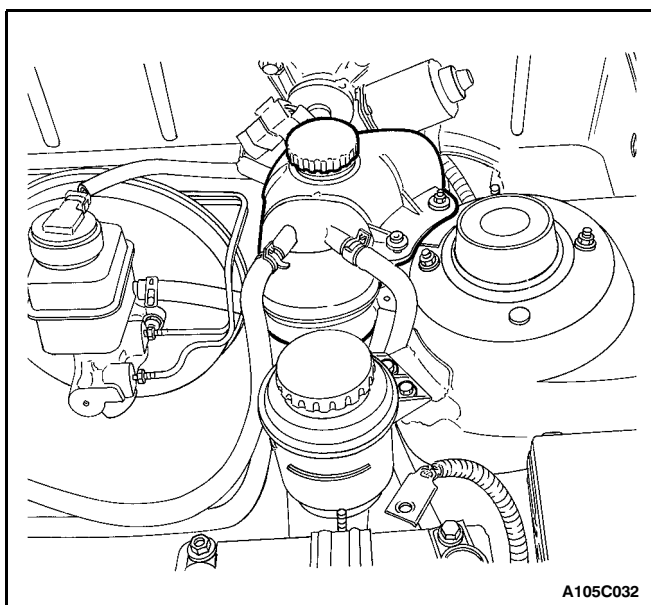
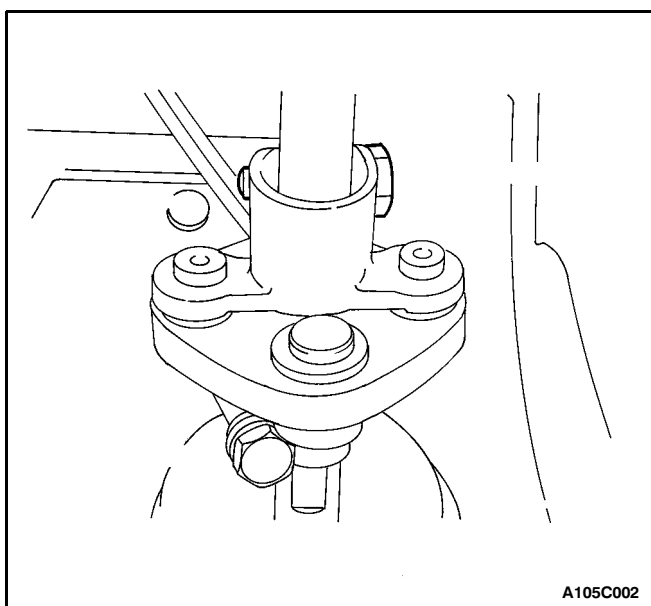
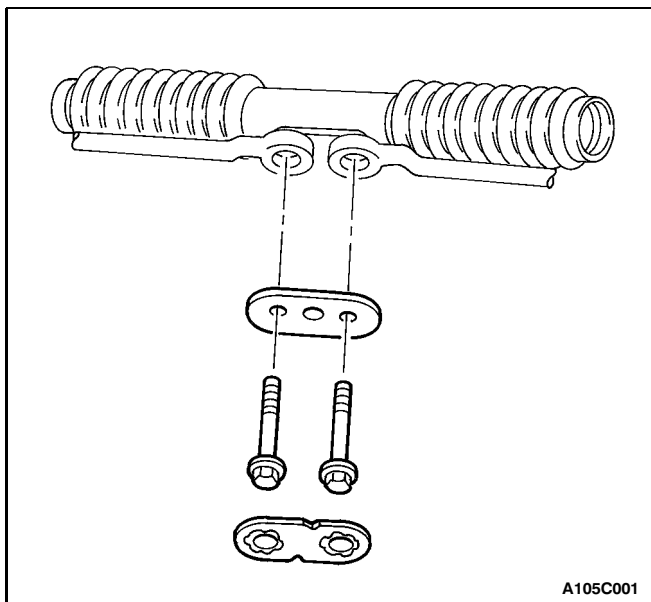
## STRAIGHT-AHEAD CHECK

After all the necessary operations on the steering gear are completed, check the exact straight-ahead position of the steering in each case.

With the vehicle on the floor, place the steering wheel in the straight-ahead position. Mark the centerline of both tires on the floor. Turn the steering wheel all the way to the right and mark the new centerline of both tires on the floor.

**Straight Ahead Check Table**

Step	Action	Value(s)	Yes	No
1	Place the steering wheel in the straight-ahead position. Is the wheel in the correct position?	-	Go to Step 2	-
2	Is the steering coupling flange pinch bolt lying horizontally?	-	Go to Step 3	Go to Step 4
3	Is the steering wheel off center by more than 5 degrees?	-	Go to Step 5	Go to Step 6
4	The pinion is displaced on the rack. The steering pinion position must be corrected. Is the repair complete?	-	Go to Step 2	-
5	Remove steering wheel and center on the spindle splines. Is the repair complete?	-	Go to Step 3	-
6	Turn the steering wheel all the way to the right. Measure the inner and the outer angles of the tire centerline compared to the straight-ahead centerline. Do the angles match the value specified?	Inner angle: 39°5'4 1°30' Outer angle: 34°4 1°30'	System OK	Go to Step 7
7	The rack assembly was not assembled correctly. Repair as needed. Is the repair complete?	-	Go to Step 6	-



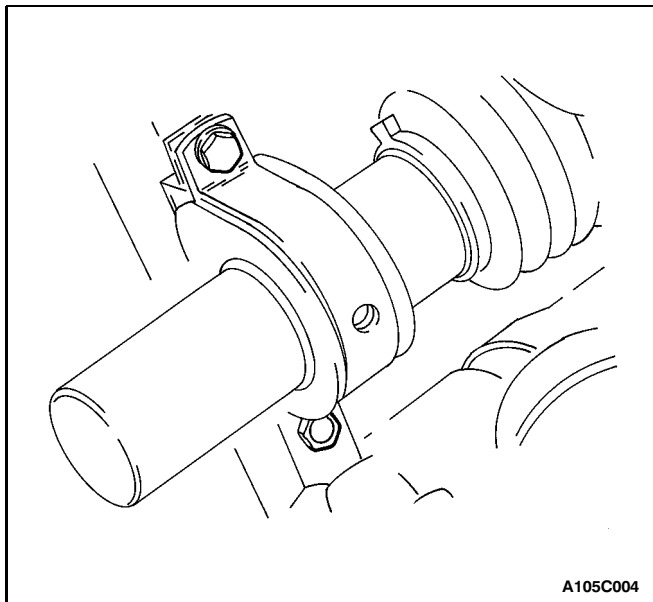
## MAINTENANCE AND REPAIR

### ON-VEHICLE SERVICE

#### RACK AND PINION ASSEMBLY

##### Removal Procedure

1. Disconnect the negative battery cable.
2. Disconnect the inner tie rods from the rack and pinion assembly by removing the lock plate, the inner tie rod bolts, and the inner tie rod plate. Do not reuse the lock plate.
3. Position the steering gear straight ahead by turning the steering wheel until the spokes are centered diagonally and pointing downward.
4. Loosen the top pinch bolt on the coupling flange.
5. For left-hand drive vehicles, disconnect the coolant surge tank from the vehicle by removing the attaching nuts. Without disconnecting the hoses, move the tank out of the repair area.

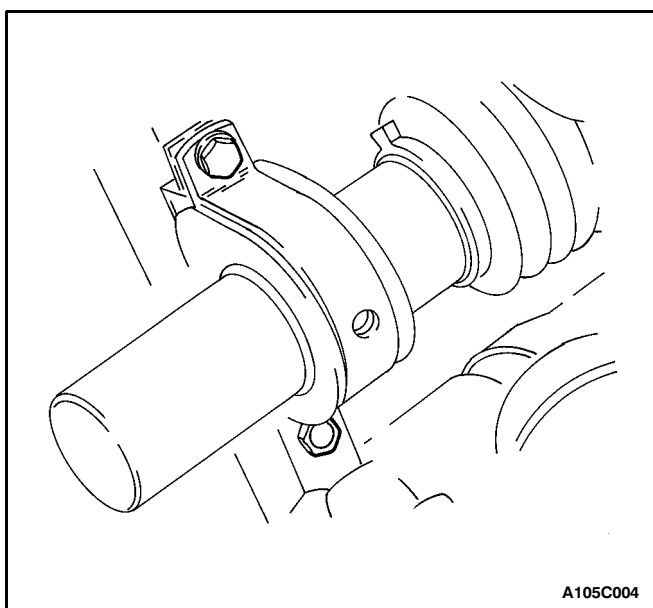


A105C004

6. Disconnect the steering gear retaining bracket nuts from the bottom of each steering gear retaining bracket. Disconnect the steering gear retaining bracket nuts and bolts from the top of each steering gear retaining bracket.
7. Remove the left inner and outer tie rod from the vehicle. Refer to "Outer Tie Rod" and "Inner Tie Rod" in this section.
8. Remove the rack and pinion assembly through the front wheel opening.
9. If the studs were removed with the mounting clamps, reinstall the studs into the cowl.

### Tighten

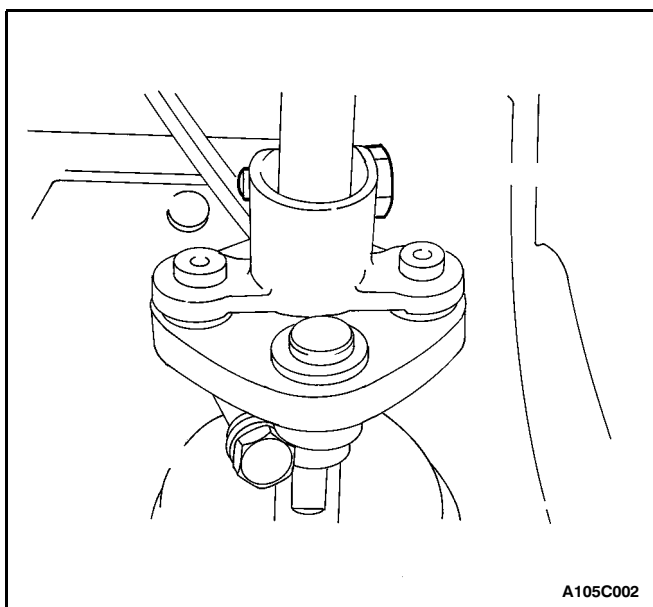
Tighten the steering gear retaining bracket studs to 20 N•m (15 lb-ft).



A105C004

### Installation Procedure

1. Install the rack and pinion steering gear assembly through the front wheel opening. The steering gear must be in a straight-ahead position. The steering wheel spokes must be centered diagonally and point downwards.
2. Connect the steering gear assembly to the body with two mounting brackets. Loosely attach all the steering gear retaining bracket nuts and bolts.



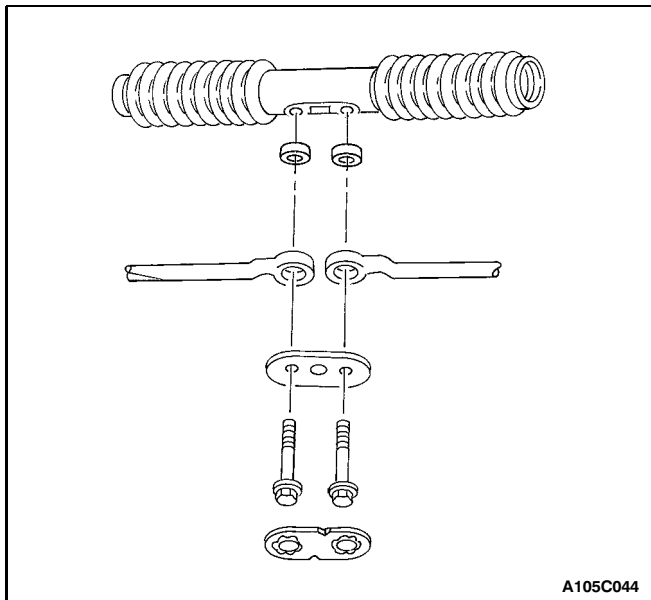
A105C002

**Important:** Be sure the center housing cover washers are located between the tie rods and the steering gear. Always use a new lock plate.

3. Connect both tie rods to the steering gear by threading the inner tie rod bolts through the inner tie rod plate, the tie rods, and the center housing cover washers into the rack guide. Install a new lock plate.

### Tighten

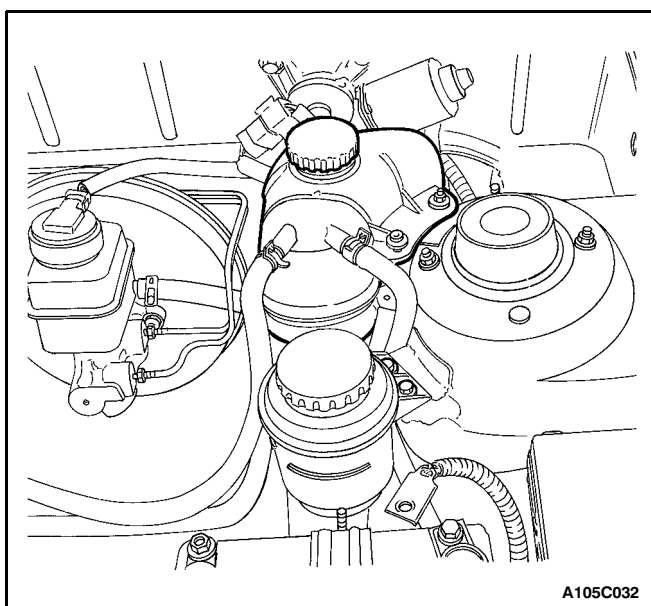
Tighten the inner tie rod bolts to 90 N•m (66 lb-ft).



4. Seat the dash seal and attach the coupling flange to the steering gear. Secure the coupling flange assembly with the top pinch bolt on the coupling flange assembly.

### Tighten

Tighten the coupling flange pinch bolt to 22 N•m (16 lb-ft).



5. Tighten all the steering gear retaining bracket nuts and bolts.

### Tighten

Tighten the steering gear retaining bracket nuts and bolts to 38 N•m (28 lb-ft).

6. Check that the steering gear has remained in the straight-ahead position.
7. Connect negative battery cable.
8. For left-hand drive vehicles, reconnect the coolant surge tank with the attaching nuts.

### Tighten

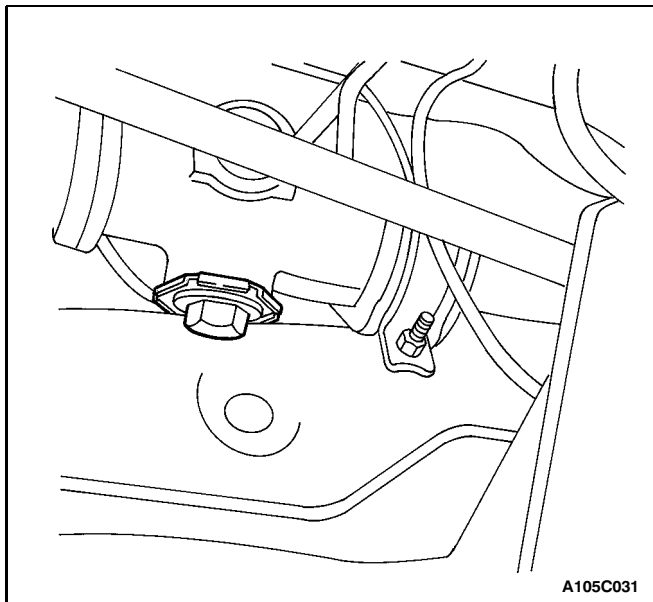
Tighten the coolant surge tank attaching nuts to 4 N•m (35 lb-in).

## OUTER TIE ROD

Refer to Section 6C, Power Steering Gear.

## INNER TIE ROD

Refer to Section 6C, Power Steering Gear.



## RACK BEARING PRELOAD ON-VEHICLE ADJUSTMENT

### Adjustment Procedure

Make the rack bearing adjustment with the front wheel raised and the steering wheel centered. Be sure to check the returnability of the steering wheel to center after the adjustment.

1. Loosen the locknut and turn the adjuster plug clockwise until it bottoms in the housing.
2. Loosen the adjuster plug 30 to 40 degrees.
3. Tighten the adjuster plug locknut while holding the adjuster plug stationary.

### Tighten

Tighten the adjuster plug locknut to 70 N•m (52 lb-ft).

## UNIT REPAIR

### RACK AND PINION

(Left-Hand Drive Shown, Right Hand Drive Similar)

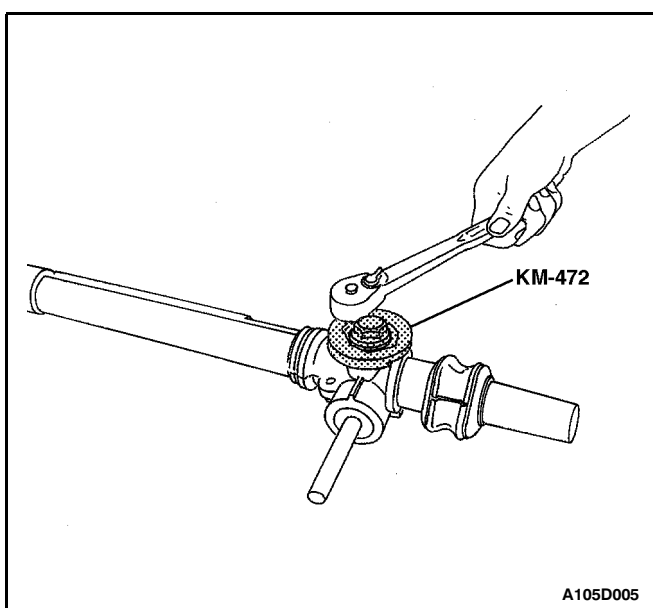
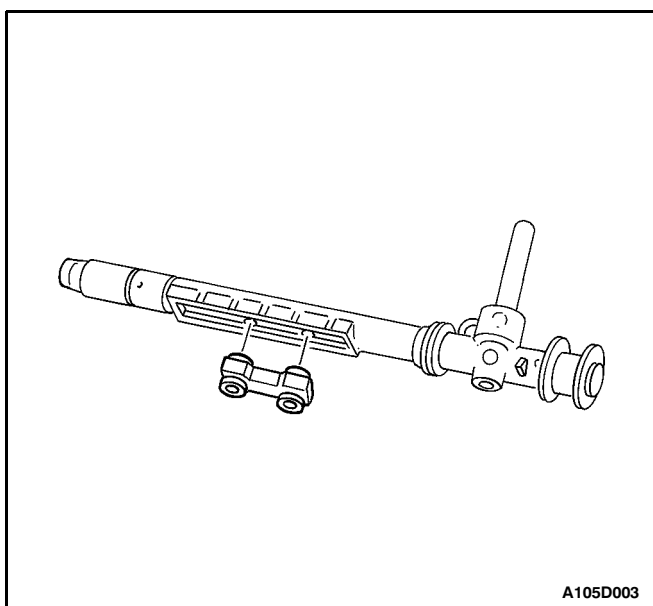
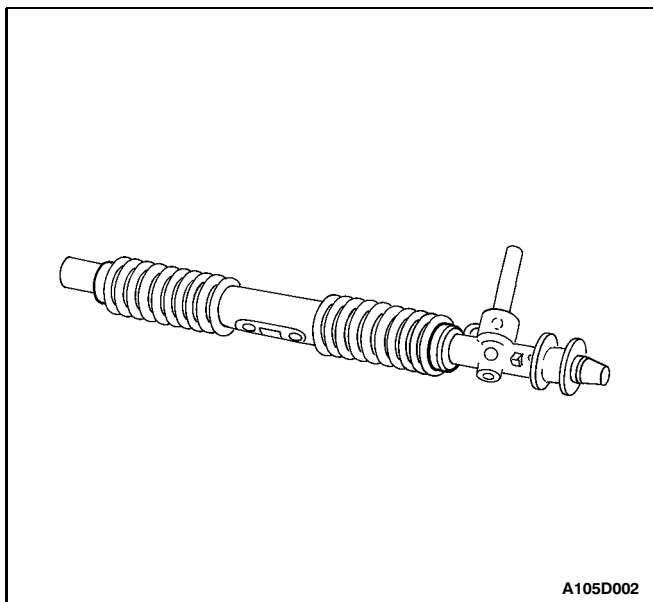
Tools Required

KM-J-26610 Installer

KM-472 Wrench

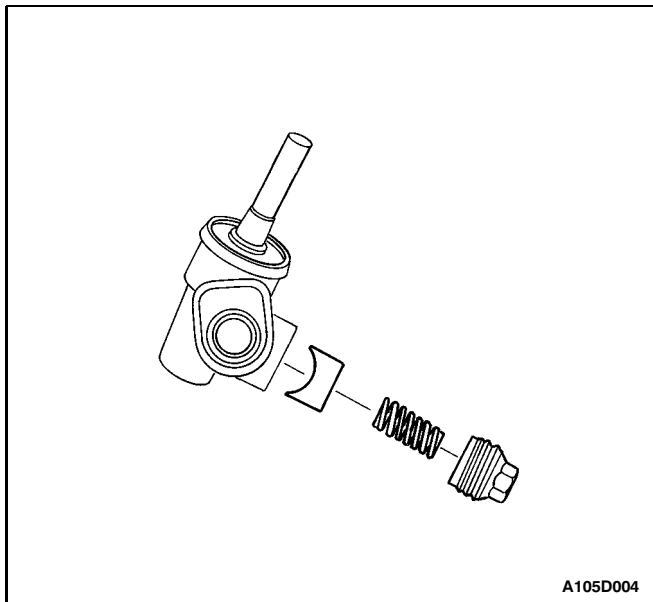
#### Disassembly Procedure

1. Remove the rack and pinion steering assembly from the vehicle. Refer to "Rack and Pinion Assembly" in this section.
2. Cut off the rack and pinion boot clamps and remove the rack and pinion boot.
3. Remove the rack guide assembly.



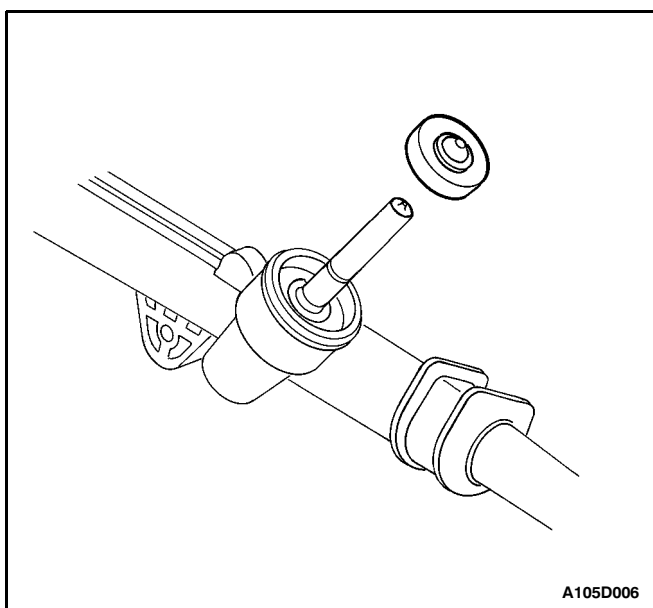
4. Remove the adjuster plug locknut from the adjuster plug using the wrench KM-472.





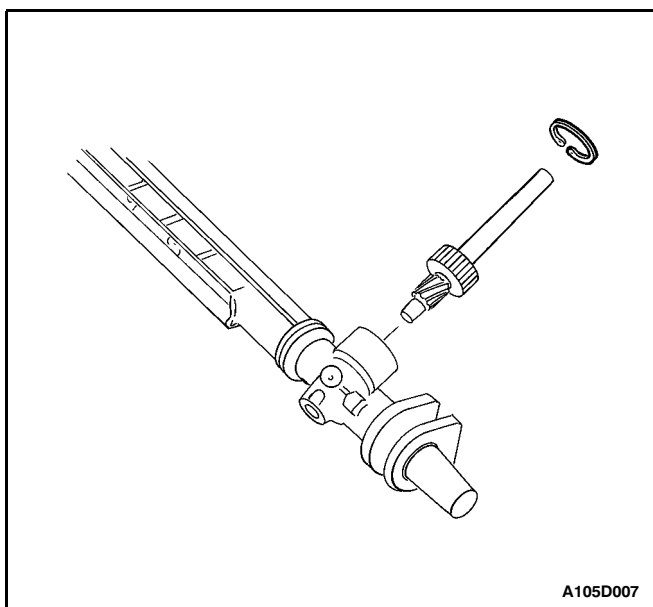
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5. Remove the adjuster plug, the adjuster spring and the rack bearing with the O-ring seal attached.



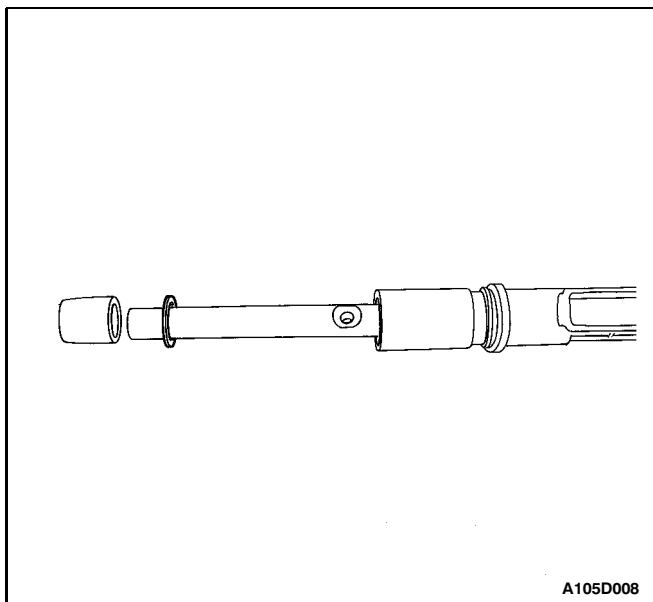
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6. With the rack gear centered, mark the location of the stub shaft notch on the housing to aid in the proper installation of the pinion and valve assembly.
7. Remove the pinion shaft seal by pressing down on one side of the seal and pulling up on the other side of the seal.

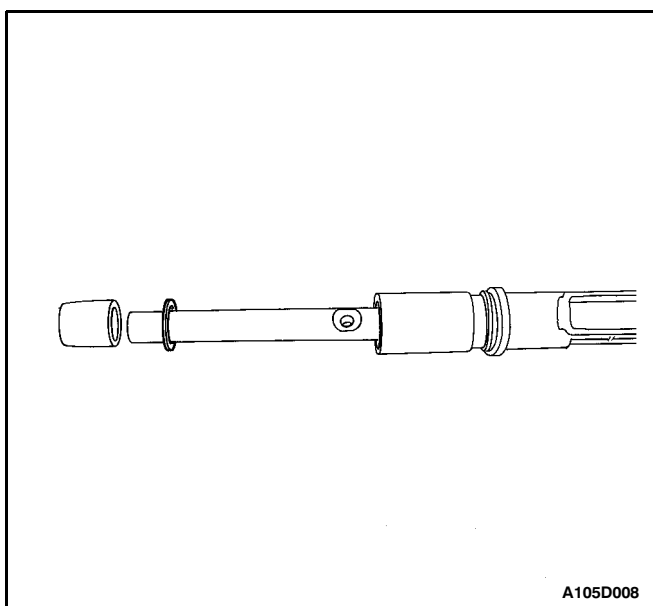


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8. Remove the retaining ring and pull the pinion and valve assembly out of the rack and pinion housing.



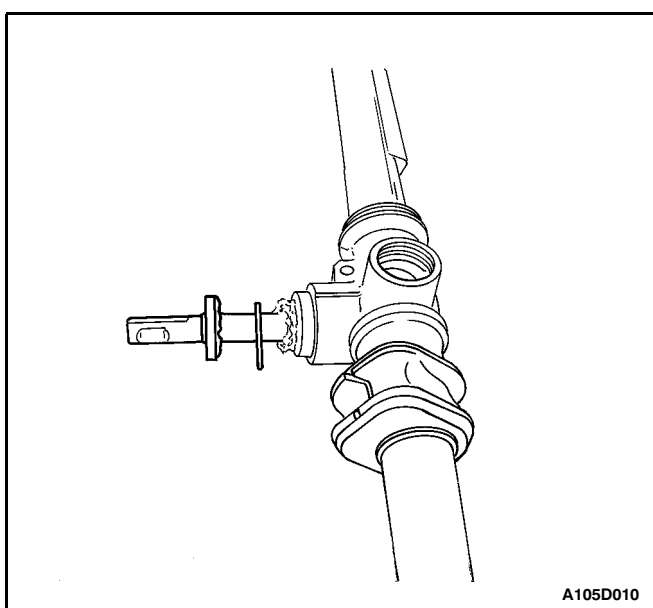
9. Remove the housing end cover.
10. Remove the rack housing retaining ring.
11. Remove the rack shaft from the rack and pinion housing.



### Assembly Procedure

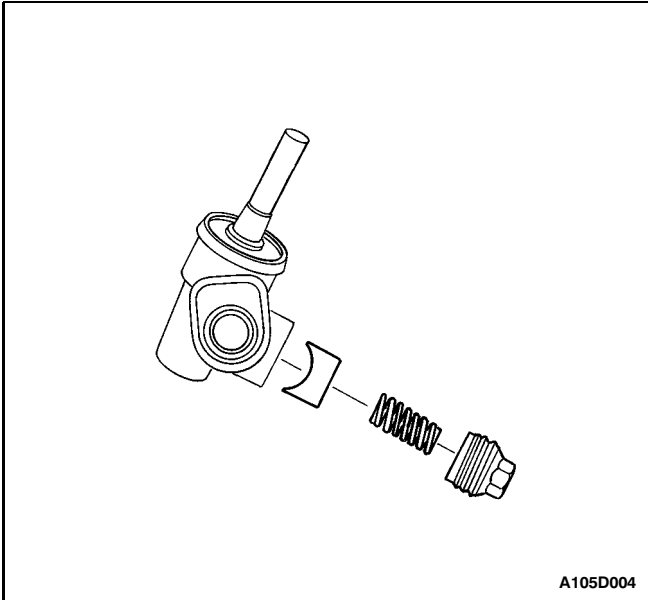
**Important:** All interlocking metal parts must be lubricated with lithium-base grease as they are assembled.

1. Install the rack shaft into the rack and pinion housing. Install the retaining ring.
2. Install the housing end cover.



**Important:** When the pinion and valve assembly is fully seated in the housing, be sure the notch in the stub shaft and the mark on the housing line up. Be sure the rack guide assembly is centered in the housing window.

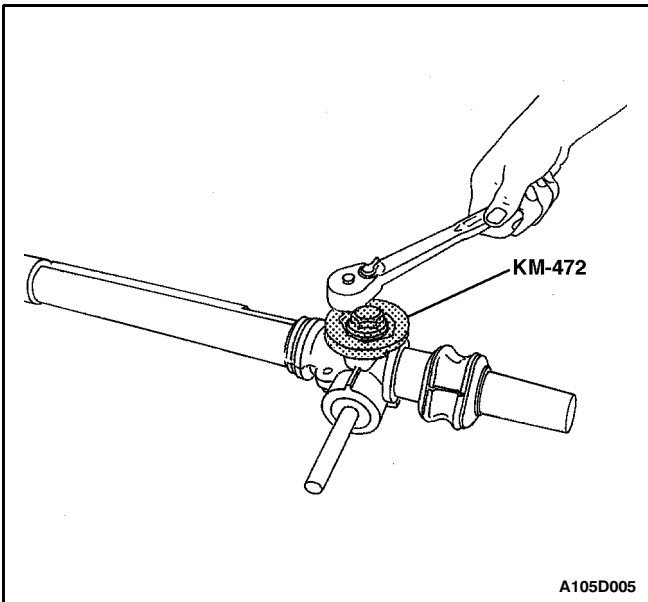
3. Center the rack guide assembly in the housing window opening.
4. Line up the stub shaft notch with the mark on the housing. Seat the pinion and valve assembly into the rack and pinion housing.
5. Install the retaining ring and seat the pinion seal. The top of the seal should be flush with the top of the housing.



6. Coat the rack bearing (with the O-ring seal attached), the adjuster spring, and the adjuster plug with lithium-base grease. Install them into the housing.

### Tighten

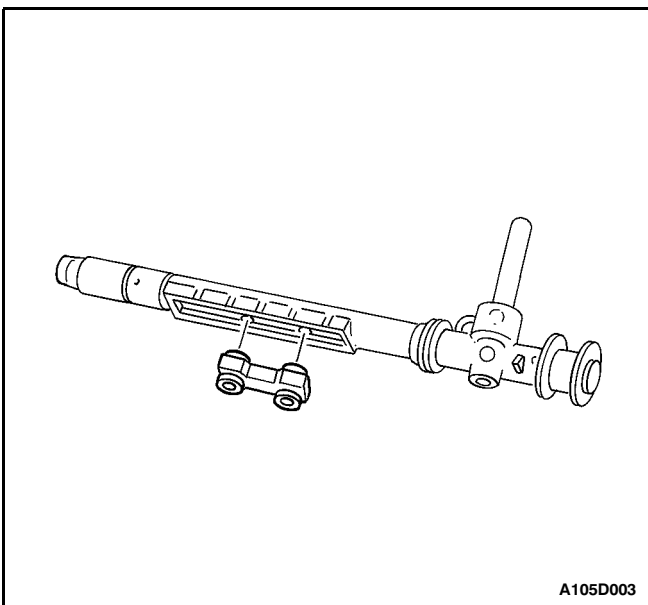
With the rack centered in the window in the housing, turn the adjuster plug clockwise until a torque of 5 N•m (44 lb-in) is obtained. Then back the adjuster plug off by 20 to 30 degrees. Check the pinion pre-loaded torque is within the range 0.7 to 1.5 N•m (6 to 13 lb-in).



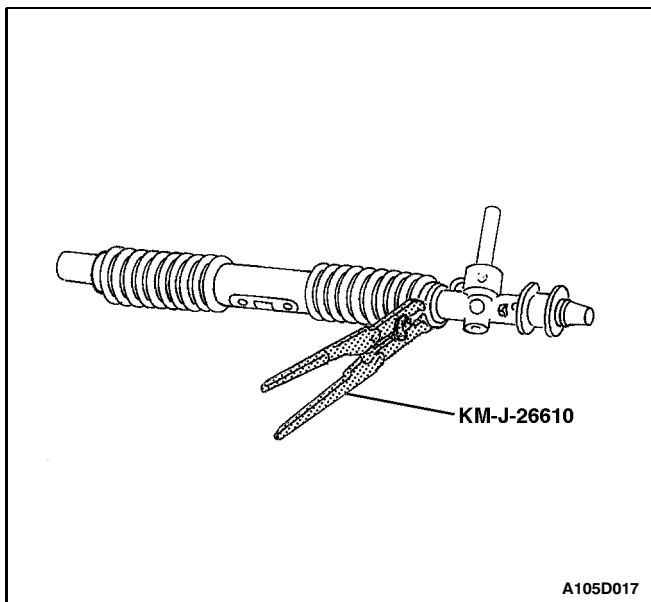
7. Thread the adjuster plug locknut onto the adjuster plug.

### Tighten

Tighten the adjuster plug locknut to 70 N•m (52 lb-ft) using the wrench KM-472. Hold the adjuster plug stationary.



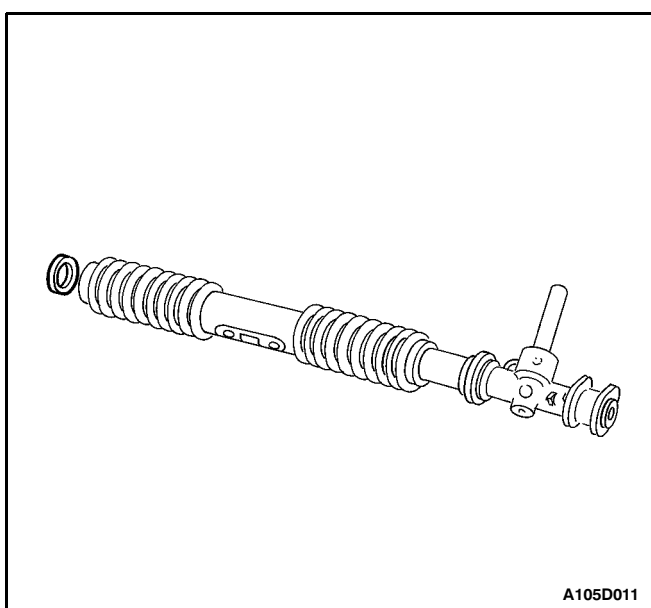
8. Place the rack guide assembly into the rod and rack assembly. Center the rack guide assembly in the housing window opening.



9. Slide a new boot clamp onto the rack and pinion boot.

**Notice:** Be sure centering cover washers are in place on rack and pinion boot. For ease of assembly, install the inner tie rod bolts through the center cover washers and rack guide, then lightly thread the bolt into the rod and rack assembly. This will help keep the components in proper alignment.

10. Position the boot clamps onto the rack and pinion boot. Crimp the clamp using the installer KM-J-26610. Be sure the boot retaining bushing is in place.
11. Install the rack and pinion assembly into the vehicle. Refer to "Rack and Pinion Assembly" in this section.



### RACK AND PINION BOOT

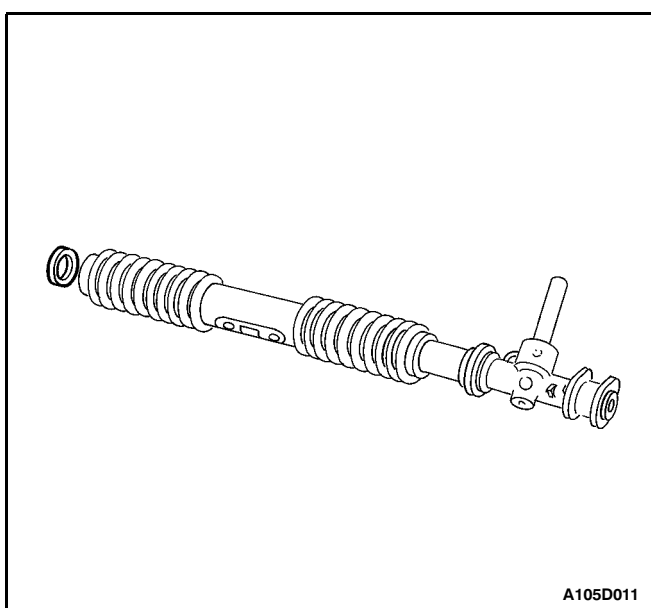
(Left-Hand Drive Shown, Right Hand Drive Similar)

**Tools Required**

KM-J-26610 Installer

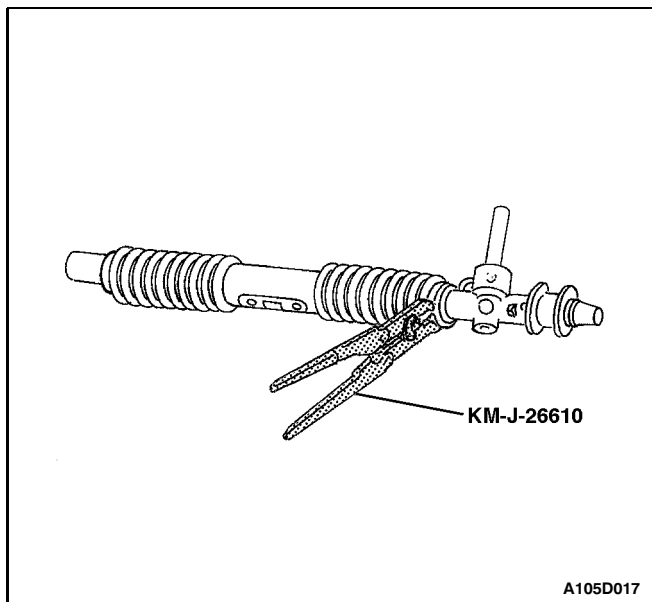
#### Disassembly Procedure

1. Remove the rack and pinion steering assembly from the vehicle. Refer to "Rack and Pinion Assembly" in this section.
2. Remove the mounting bracket bushing.
3. Cut off the rack and pinion boot clamps. Remove the rack and pinion boot.
4. Replace the boot retaining bushing if it is damaged.
5. Replace the housing end cover only if it is damaged.

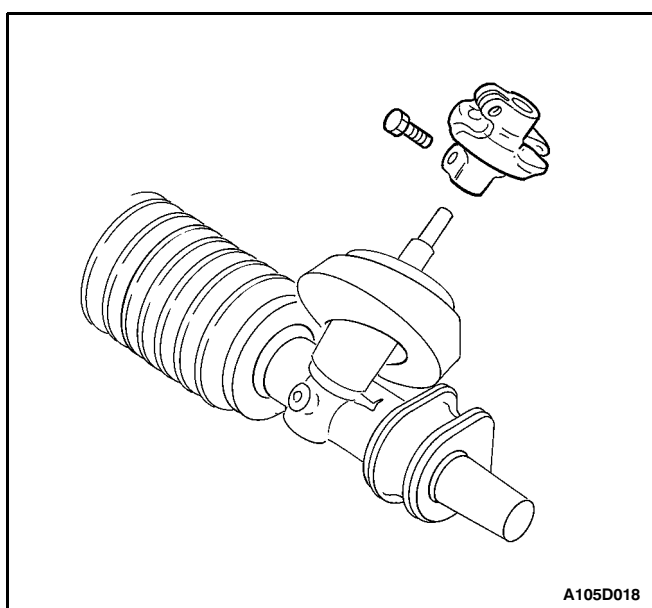


#### Assembly Procedure

1. Slide the new boot clamp onto the boot. Slide the boot onto the housing.
2. Install the boot retaining bushing into the boot. Lightly coat the inner lip of the boot retaining bushing with multipurpose grease for ease of assembly.



3. Slide the boot and the boot retaining bushing until they are seated in the bushing groove at the pinion end of housing.
4. Crimp the new boot clamps using the installer KM-J-26610.
5. Install the mounting bracket bushing.
6. Install the rack and pinion steering assembly into the vehicle. Refer to "Rack and Pinion Assembly" in this section.

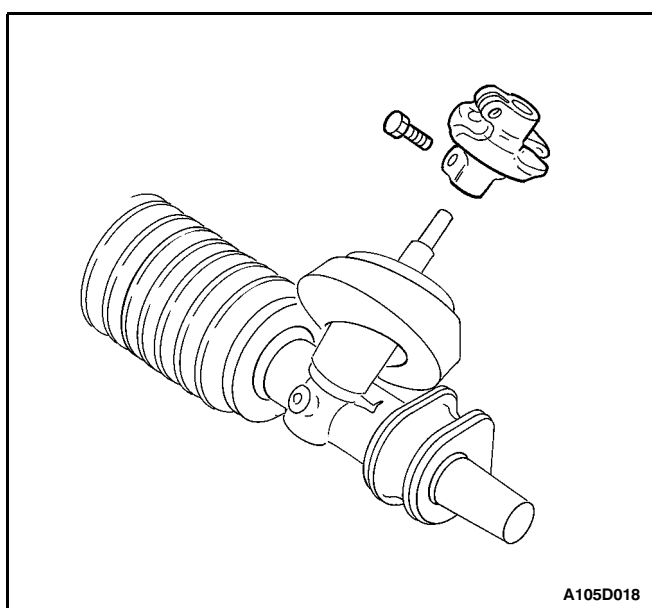


## COUPLING ASSEMBLY

(Left-Hand Drive Shown, Right Hand Drive Similar)

### Disassembly Procedure

1. Remove the rack and pinion steering assembly from the vehicle. Refer to "Rack and Pinion Assembly" in this section.
2. Remove the pinch bolt from the coupling flange assembly.
3. Remove the coupling flange assembly from the stub shaft of the pinion and valve assembly.



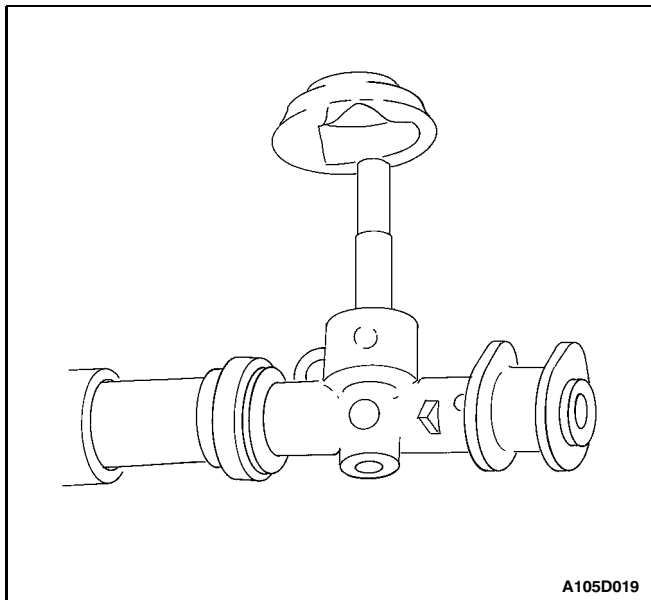
### Assembly Procedure

1. Connect the flange and steering assembly to the stub shaft of the pinion and valve assembly.
2. Insert the pinch bolt into the flange and steering coupling assembly.

### Tighten

Tighten the coupling flange pinch bolt to 22 N•m (16 lb-ft).

3. Install the rack and pinion steering assembly into the vehicle. Refer to "Rack and Pinion Assembly" in this section.

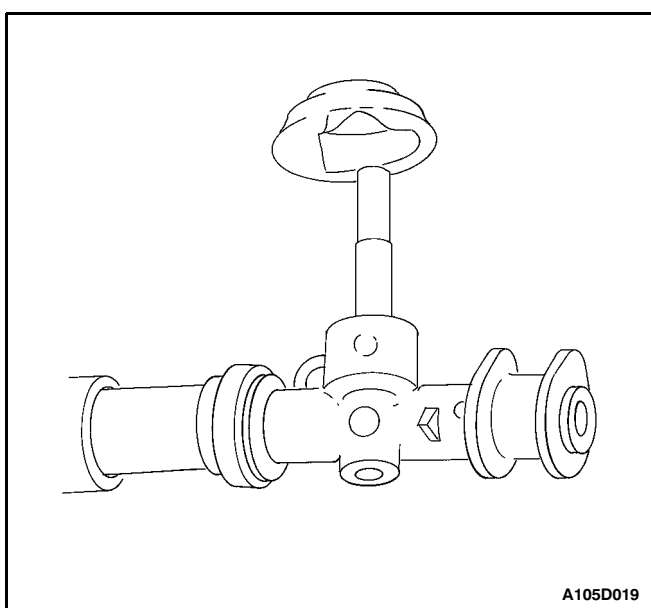


## DASH SEAL

(Left-Hand Drive Shown, Right Hand Drive Similar)

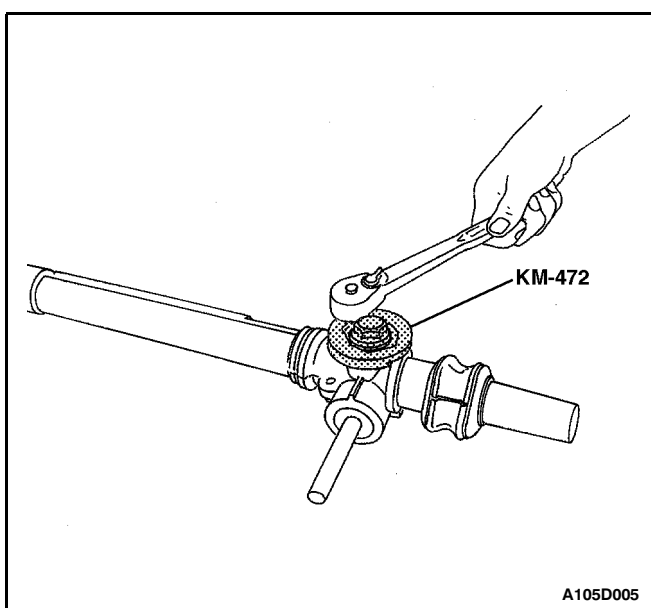
### Disassembly Procedure

1. Remove the rack and pinion steering assembly from the vehicle. Refer to "Rack and Pinion Assembly" in this section.
2. Remove the flange and steering coupling assembly. Refer to "Coupling Assembly" in this section.
3. Remove the dash seal from the rack and pinion housing.



### Assembly Procedure

1. Line up the notch in the dash seal and the rack and pinion housing.
2. Connect the dash seal to the housing.
3. Connect the flange and steering coupling assembly. Refer to "Coupling Assembly" in this section.
4. Install the rack and pinion steering assembly into the vehicle. Refer to "Rack and Pinion Assembly" in this section.



## RACK BEARING

(Left-Hand Drive Shown, Right Hand Drive Similar)

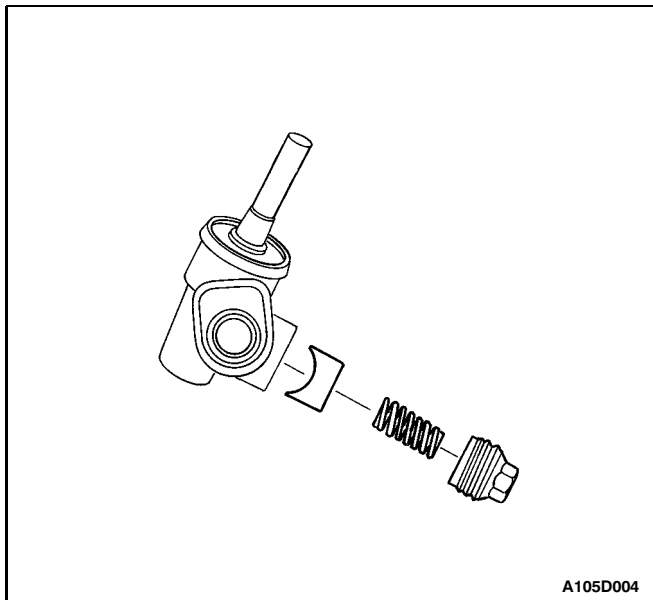
Tools Required

KM-472 Wrench

### Disassembly Procedure

1. Remove the rack and pinion steering assembly from the vehicle. Refer to "Rack and Pinion Assembly" in this section.
2. Remove the adjuster plug locknut from the adjuster plug using the wrench KM-472.

3. Remove the adjuster plug, the adjuster spring and the rack bearing with the O-ring seal attached.



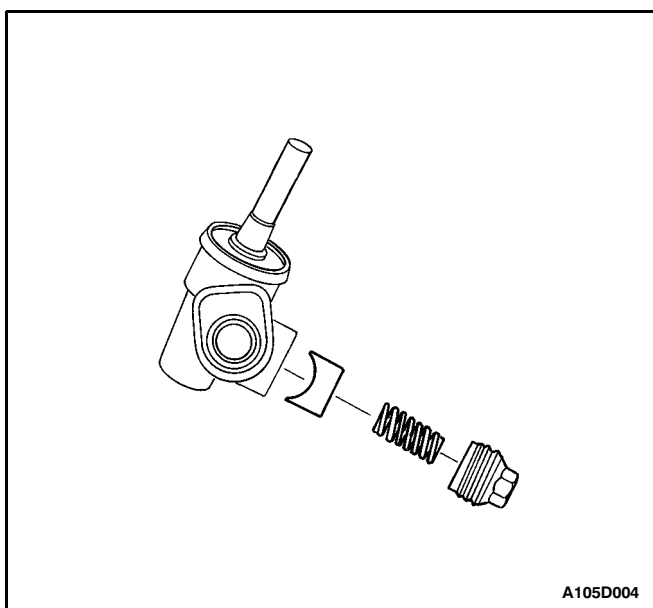
### Assembly Procedure

**Important:** All interlocking metal parts must be lubricated with lithium-base grease 1051344 or equivalent as they are assembled.

1. Coat the rack bearing (with the O-ring seal attached), the adjuster spring, and the adjuster plug with lithium-base grease. Install them into the housing.

#### Tighten

With the rack centered in the window in the housing, turn the adjuster plug clockwise until a torque of 5 N•m (44 lb-in) is obtained. Then back the adjuster plug off by 20 to 30 degrees. Check the pinion pre-loaded torque is within the range 0.7 to 1.5 N•m (6 to 13 lb-in).

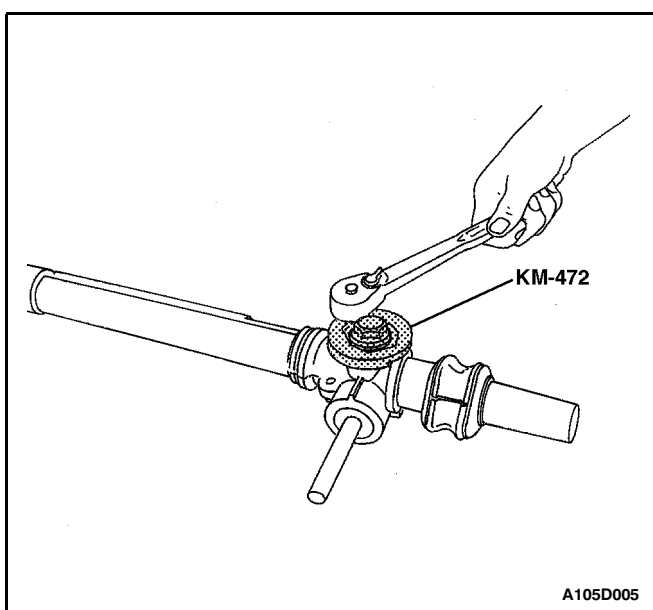


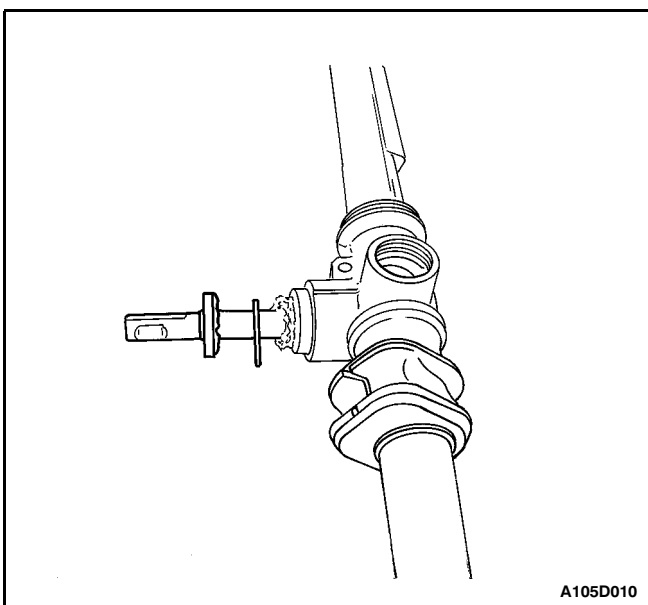
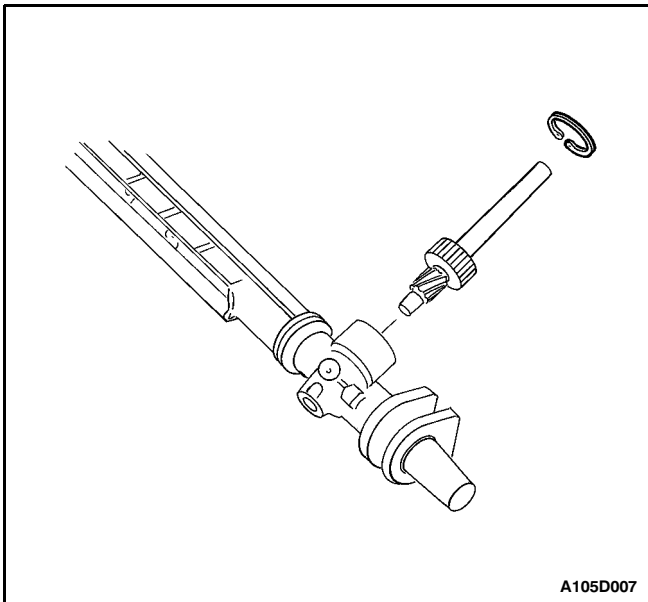
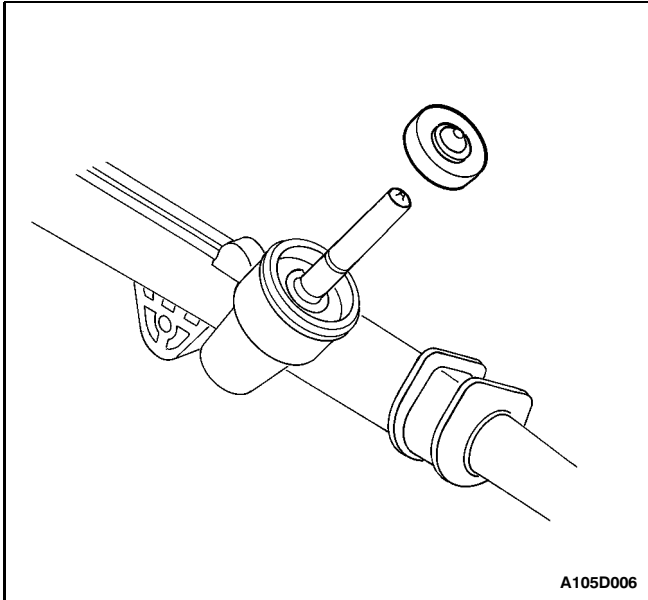
2. Thread the locknut onto the adjuster plug.

#### Tighten

Tighten the locknut to 70 N•m (52 lb-ft) using the wrench KM-472. Hold the adjuster plug stationary.

3. Install the rack and pinion assembly into the vehicle. Refer to "Rack and Pinion Assembly" in this section.





## PINION SHAFT

(Left-Hand Drive Shown, Right Hand Drive Similar)

### Disassembly Procedure

1. Remove the rack and pinion steering assembly from the vehicle. Refer to "Rack and Pinion Assembly" in this section.
2. With the rack gear centered, mark the location of the stub shaft notch on the housing to aid in the proper installation of the pinion and valve assembly.
3. Remove the pinion shaft seal by pressing down on one side of the seal and pulling up on the other side of the seal.
4. Remove the retaining ring and pull the pinion and valve assembly out of the rack and pinion housing.

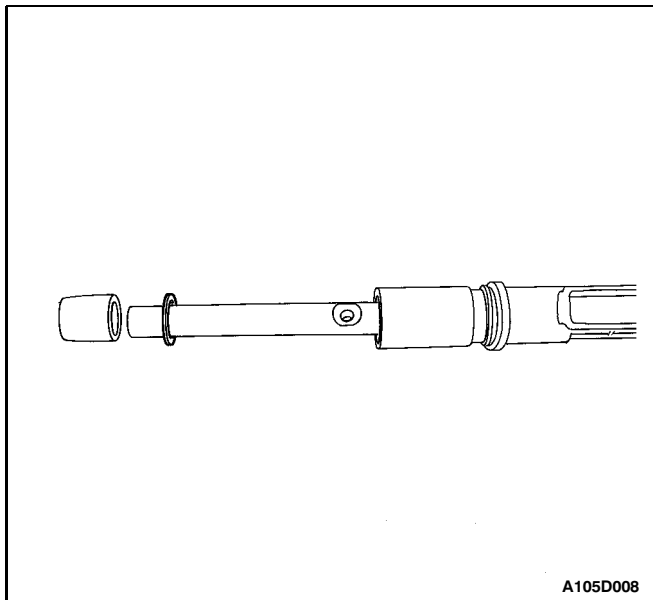
### Assembly Procedure

**Important:** All the interlocking metal parts must be lubricated with lithium-base grease 1051344 or equivalent as they are assembled.

**Important:** When the pinion and valve assembly is fully seated in the housing, be sure the notch in the stub shaft and the mark on the housing line up. Be sure the rack guide assembly is centered in the housing window.

1. Center the rack guide assembly in the housing window opening.
2. Line up the stub shaft notch with the mark on the housing. Seat the pinion and valve assembly into the rack and pinion housing.
3. Install the retaining ring and seat the pinion seal. The top of the seal should be flush with the top of the housing.

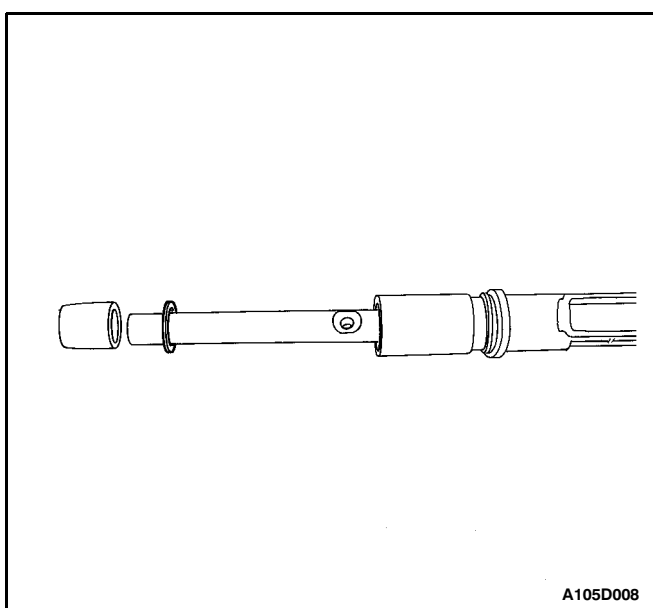




## RACK

### Disassembly Procedure

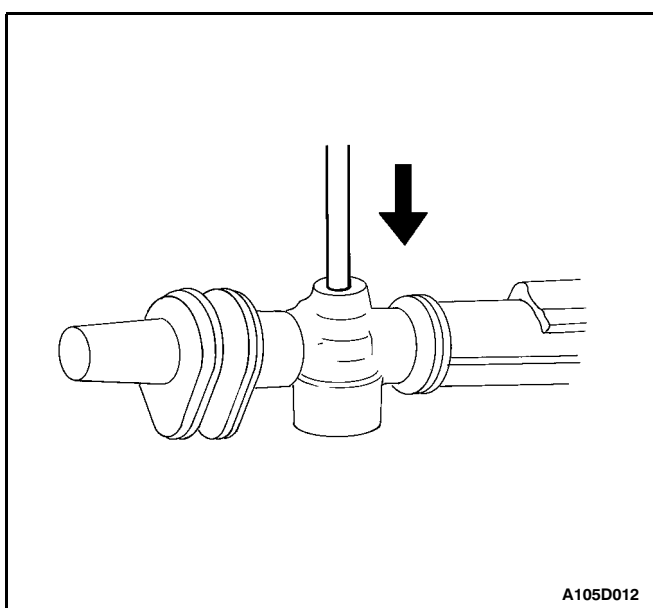
1. Remove the rack and pinion steering assembly from the vehicle. Refer to "Rack and Pinion Assembly" in this section.
2. Remove the rack bearing assembly. Refer to "Rack Bearing" in this section.
3. Remove the pinion shaft assembly. Refer to "Pinion Shaft" in this section.
4. Remove the housing end cover.
5. Remove the rack shaft from the rack and pinion housing.



### Assembly Procedure

**Important:** All interlocking metal parts must be lubricated with lithium-base grease 1051344 or equivalent as they are assembled.

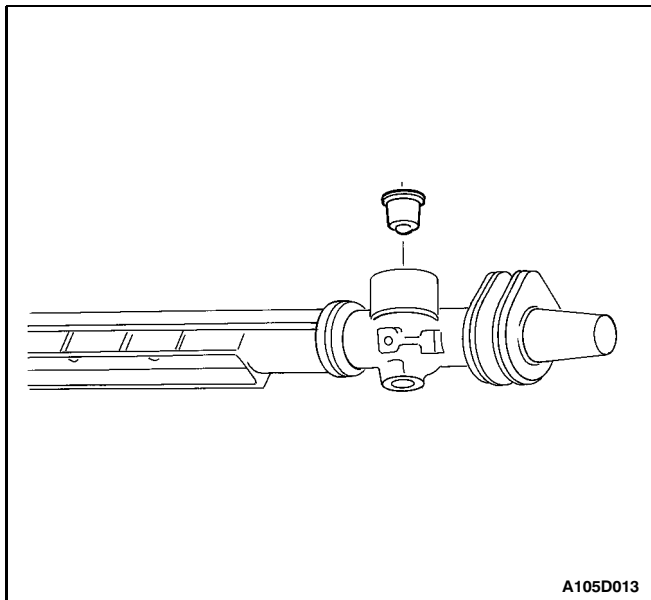
1. Install the rack shaft into the rack and pinion housing. Install the retaining ring.
2. Install the housing end cover.
3. Install the pinion shaft assembly. Refer to "Pinion Shaft" in this section.
4. Install the rack bearing assembly. Refer to "Rack Bearing" in this section.
5. Install the rack and pinion steering assembly into the vehicle. Refer to "Rack and Pinion Assembly" in this section.



## ROLLER BEARING

### Disassembly Procedure

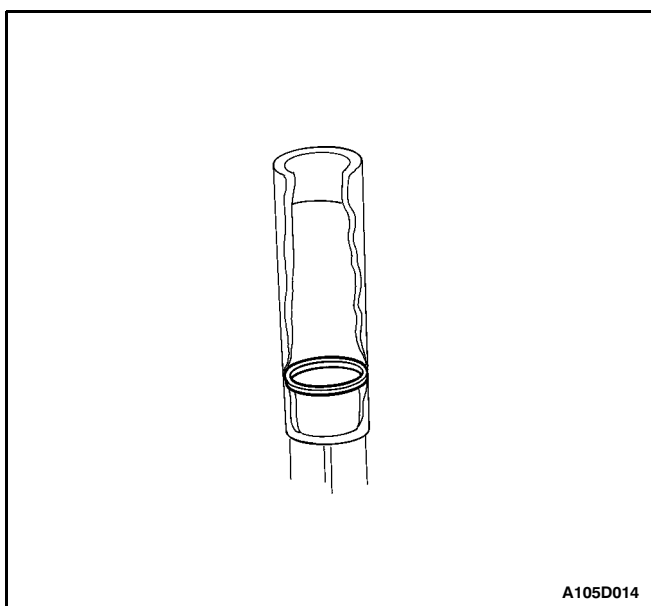
1. Remove the rack and pinion steering assembly from the vehicle. Refer to "Rack and Pinion Assembly" in this section.
2. Remove the rack bearing assembly. Refer to "Rack Bearing" in this section.
3. Remove the pinion shaft assembly. Refer to "Pinion Shaft" in this section.
4. Remove the roller bearing using a press and a suitable drift.



### Assembly Procedure

**Important:** Make sure the bearing is fully bottomed in the housing.

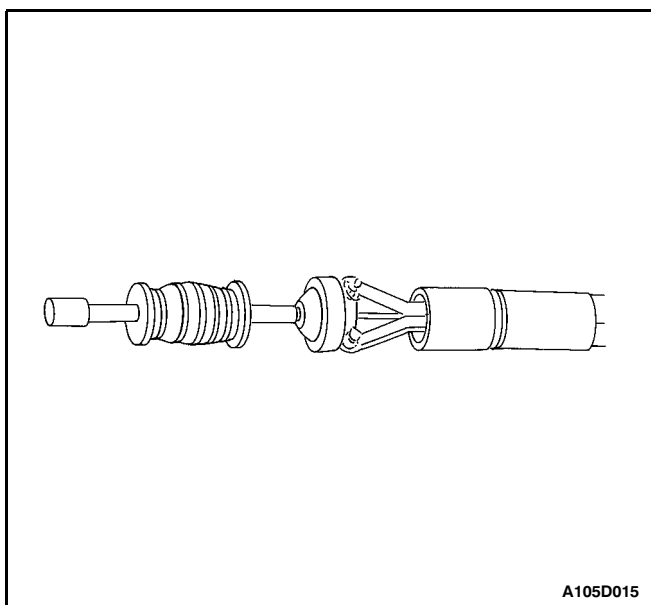
1. Install the roller bearing using a press and a suitable drift.
2. Install the pinion shaft assembly. Refer to "Pinion Shaft" in this section.
3. Install the rack bearing assembly. Refer to "Rack Bearing" in this section.
4. Install the rack and pinion steering assembly from the vehicle. Refer to "Rack and Pinion Assembly" in this section.

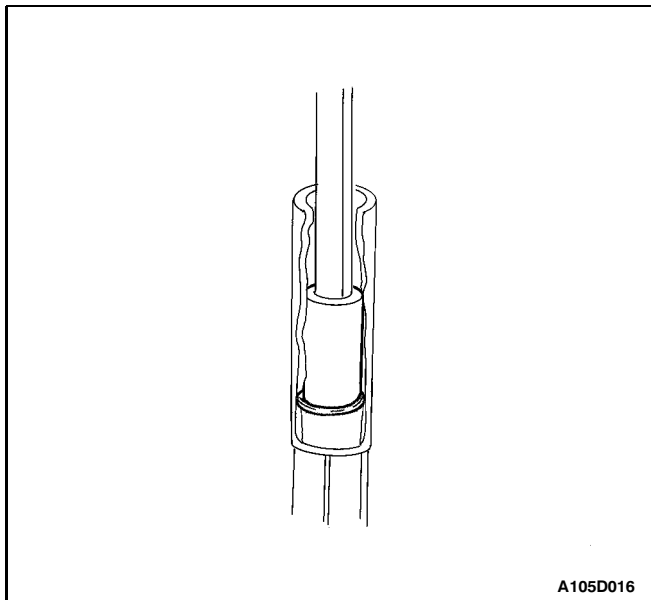


### RACK BUSHING

#### Disassembly Procedure

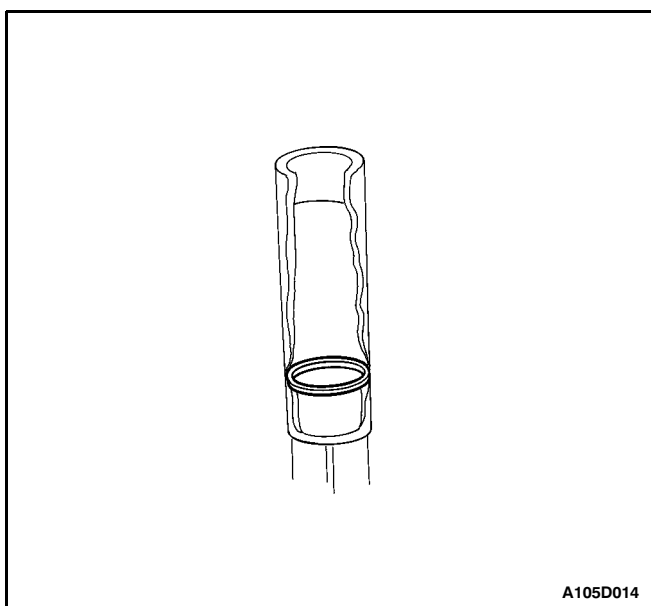
1. Remove the rack and pinion steering assembly from the vehicle. Refer to "Rack and Pinion Assembly" in this section.
2. Remove the rack bearing assembly. Refer to "Rack Bearing" in this section.
3. Remove the pinion shaft assembly. Refer to "Pinion Shaft" in this section.
4. Remove the rack shaft. Refer to "Rack" in this section.
5. Remove the rack housing retaining ring with extended snap ring pliers.
6. Remove the rack bushing using a slide hammer and a suitable attachment.





### Assembly Procedure

1. Install the new rack bushing using a drift and an appropriate socket. Press the bushing into the housing by placing the socket on top of it and applying pressure with a drift and a press.



2. Install the rack housing retaining ring.
3. Install the rack shaft. Refer to "Rack" in this section.
4. Install the pinion shaft assembly. Refer to "Pinion Shaft" in this section.
5. Install the rack bearing assembly. Refer to "Rack Bearing" in this section.
6. Install the rack and pinion steering assembly into the vehicle. Refer to "Rack and Pinion Assembly" in this section.

## **GENERAL DESCRIPTION AND SYSTEM OPERATION**

### **MANUAL RACK AND PINION**

The manual rack and pinion steering system consists of two main components: the rack and the pinion. The motion of the pinion is transferred through the pinion teeth that mesh with the teeth on the rack, which moves the rack. The force is then transmitted through the arms on the struts, which turn the wheels.