



SR11

Steering, Rack-And-Pinion

**Uniform
Procedures For
Collision Repair
UPCR**

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v.4.0



1. Description

This procedure describes diagnosis, replacement, and inspection of a rack-and-pinion steering system. Requirements for both manual and power steering are included.



2. Purpose

The purpose of this procedure is to provide industry-accepted requirements for performing high-quality repair of rack-and-pinion steering systems. This procedure is intended for use by professionals who are qualified through training and experience.



3. Referenced Documents

The following documents are considered part of this procedure by reference.

3.1 Procedures

- HM01 Hazardous Materials
- PS01 Personnel Safety
- RE21 Airbag Systems
- SR21 Steering Column
- SR41 Knuckle And Spindle
- SR51 Power Steering
- SU01 Independent, Strut
- SU11 Independent, SLA
- WA01 Wheel Alignment, Front
- WH01S Wheel

3.2 Other Information

- Equipment-specific information
- Vehicle-specific repair information
- Vehicle-specific dimension specifications



4. Equipment And Material Requirements

4.1 Equipment

The use of this equipment is included in this procedure:

- tie-rod end puller
- vehicle-specific inner tie-rod tool
- tie-rod sleeve-adjusting tools
- line wrenches
- steering wheel puller set



5. Damage Analysis

5.1 General Damage

Inspect the vehicle and steering system for these conditions:

- visible damage to, or misalignment of, the rails, crossmembers, engine cradle, or related steering-system support parts
- visible damage to the rack-and-pinion assembly or linkage parts
- worn or damaged rack-and-pinion assembly mounting locations and bushings
- pinion shaft end play
- damaged or contaminated tie-rod end seals
- visible damage to the steering wheel or column
- loose steering-shaft flexible coupling or U-joint
- visible damage to the steering knuckles or spindles
- visible damage to boots, seals, or dust covers
- improper power steering fluid level or condition, or damaged power steering parts, if applicable
- wheels not pointing straight ahead with the steering wheel centered
- steering wheel free-play exceeding 6 mm ($\frac{1}{4}$ ")
- corrosion on sealing or wear surfaces
- fluid leaks
- obvious wheel misalignment
- improper previous repairs
- visible damage to the front wheels or tires
- modifications to the steering or suspension system

5.2 Rack-And-Pinion Checks

Check the rack-and-pinion assembly for these indications of wear or damage:

- noise or binding when the pinion shaft is rotated with the tie-rod ends and steering-shaft coupling disconnected
- fluid leakage at gasket, seal, or boot areas
- cracked housing
- damaged mounting locations or bushings

5.3 Boot And Tie-Rod End Checks

Check the boots and tie-rod ends for these indications of excessive wear or damage:

- damaged, inflexible, or worn rubber boots
- damaged, worn, or loose boot clamps
- outer tie-rod end vertical free-play
- inner tie-rod ball and socket end vertical free-play
- noise or binding of the strut bearing or the upper or lower ball joints when a front wheel is moved with the tie rod disconnected

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5. Damage Analysis (cont'd)

Damaged parts must be replaced. Replacement of worn parts will be necessary to restore proper steering system performance. Follow the vehicle maker's recommendations and procedures for the replacement of steering parts, which may include the following:

- rack-and-pinion assembly
- dust covers and boots
- tie rods, adjusting sleeves, and clamps
- upper strut bearing
- upper and lower ball joints

Further checks may be required to determine the location and extent of damage. Follow the vehicle maker's recommendations. If there are no visible indications of damage, road-test the vehicle to confirm the diagnosis or verify proper operation of the steering system. See **11.2**.



6. Personnel Safety

6.1 General Safety

General safety information is in **PS01**.

6.2 Safety With Steering Systems

To prevent injury when working with steering systems:

- Properly lift and support the vehicle.
- Check fluid levels and add fluid only when the engine is not running.
- Use the proper equipment and procedures for compressing struts or springs.
- Use the proper tools, and follow the equipment and vehicle makers' recommendations.
- Do not disconnect the upper or lower ball joints without properly supporting and compressing the coil spring or torsion bar. See **SU01** or **SU11**.



7. Environmental Safety

7.1 Power Steering Fluid

Collect and properly dispose of power steering fluid.

Hazardous material safety information is in **HM01**.



8. Vehicle Protection

8.1 Electronic Parts

- Follow the vehicle maker's recommendations for recording and resetting electronic memories.
- Disconnect and isolate the negative battery cable, and disarm the passive restraint system. Follow the vehicle maker's recommendations.
- Carefully remove computer modules when welding or heating within 300 mm (12"), or a greater distance when recommended by the vehicle maker.
- Protect computer modules, connectors, and wiring from dirt, heat, static electricity, and moisture.
- Loosen or remove any wiring harnesses or electrical parts that could be damaged during the repair process.

8.2 Steering System

To prevent damage to steering system parts:

- Make sure the vehicle is properly supported during service.
- Do not weld or apply heat to any steering part.
- Use the proper tools, and follow the equipment maker's recommendations.
- Torque fasteners to the vehicle maker's recommendations.
- Replace any worn parts and one-time fasteners, as required.
- Make sure cotter pins are the proper size and properly locked. Do not reuse cotter pins.
- Use only the recommended power steering fluid.
- Do not weld or apply heat to any suspension part unless recommended by the vehicle maker.
- Do not apply pulling force to any suspension part.



9. Repair Procedure

9.1 Rack-And-Pinion Assembly Replacement

To replace a rack-and-pinion assembly:

1. Ensure that the vehicle structure is aligned to the vehicle maker's dimension specifications, and all steering- and suspension-system mounting points are properly located.
2. Follow the vehicle maker's recommendations for disabling the airbag system, if applicable. For retrofit airbag systems, follow the product maker's recommendations.
3. Place the front wheels in the straight-ahead position and lock the steering wheel.
4. Properly lift and support the vehicle. Remove all parts required for access.
5. Disconnect the steering shaft from the rack-and-pinion assembly.

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9. Repair Procedure (cont'd)

- 6. Disconnect the outer tie-rod ends from the steering knuckles.
- 7. Disconnect and seal the power steering hoses, if applicable.
- 8. Disconnect the anti-roll bar from the rack-and-pinion assembly, if required.
- 9. Disconnect and remove the rack-and-pinion assembly. Compare the original part to the replacement part. Verify that the mounting locations and gear ratio are correct.
- 10. Check the mounting area for misalignment.
- 11. Install the replacement rack-and-pinion assembly, duplicating the original mounting methods. Replace one-time or damaged fasteners. Use replacement fasteners that are the same grade, size, and type as the original fasteners.
- 12. Reconnect the steering-shaft coupling and tie-rod ends.
- 13. Verify that the airbag clock spring is centered before turning the steering wheel or road-testing the vehicle.
- 14. Drain and flush the power steering system, if required. Follow the vehicle maker's recommendations.
- 15. Reconnect the power steering hoses.
- 16. Fill the system with the recommended power steering fluid.
- 17. Bleed the power steering system following the vehicle maker's recommendations. Refill the power steering fluid to the proper level.
- 18. Reattach the anti-roll bar to the rack-and-pinion assembly.
- 19. Torque all fasteners to the vehicle maker's recommendations.
- 20. Lower the vehicle.
- 21. Check and adjust the front-wheel toe.
- 22. Continue vehicle reassembly.
- 23. Road-test the vehicle. See **11.2**.
- 24. Refill the power steering fluid to the proper level.

9.2 Boot And Tie-Rod End Replacement

To replace a boot, and inner or outer tie-rod end:

- 1. Properly lift and support the vehicle.
- 2. Disconnect and separate the outer tie-rod end from the steering knuckle.
- 3. Loosen the lock nut or adjusting sleeve clamps.
- 4. Mark the original position of the sleeve on the shaft.
- 5. Remove the outer tie-rod end.
- 6. Disconnect the boot clamps and remove the inner tie-rod boot.
- 7. Remove the inner tie-rod end using vehicle-specific tools.
- 8. Install the replacement inner tie-rod end.
- 9. Install the replacement boot, if required, and install the boot clamps, using the proper tool.
- 10. Install the replacement outer tie-rod end, if required.
- 11. Torque fasteners to the vehicle maker's recommendations.
- 12. Lower the vehicle.

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9. Repair Procedure (cont'd)

- 13. Check and adjust the front-wheel toe.
- 14. Continue vehicle reassembly.
- 15. Road-test the vehicle. See **11.2**.



10. Use Of Recycled (Salvage) Parts

10.1 Condition Of Salvage Parts

Use care in selecting and using salvage steering parts. Compare salvage parts to the original parts. Inspect salvage parts for any defects. Use magnaflux or dye penetrant if necessary.

Do not install salvage steering parts with these defects:

- unrepairable damage
- evidence of having been heated, welded, damaged, or straightened
- flaking metal or corrosion that may indicate damage to a part
- evidence of contaminated fluid

Do not install salvage bushings or fasteners.



11. Inspection And Testing

11.1 Rack-And-Pinion Assembly Inspection

When repairs are completed, inspect the steering system for these conditions:

- proper installation of all fasteners, brackets, clamps, retaining clips, and dust boots or seals
- proper replacement and installation of cotter pins
- proper mounting of all parts
- proper alignment and operation of parts
- proper lubrication of parts
- proper fluid levels
- no fluid leaks
- fasteners torqued to the vehicle maker's recommendations
- proper wheel alignment
- steering wheel centered, with equal turns to the left and right locks
- proper steering ratio
- proper tire inflation

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11. Inspection And Testing (cont'd)

Correct any defects.

11.2 Steering System Road Test

Road-test the vehicle and check for these conditions:

- steering wheel free-play exceeding 6 mm ($\frac{1}{4}$ ")
- poor steering wheel return
- pulling to one side
- vehicle wander
- abnormal steering effort, binding, or noise
- steering wheel shimmy
- bump steer conditions
- off-center steering wheel when driving straight ahead

Correct any defects.