



SR01

Steering, Gearbox

**Uniform
Procedures For
Collision Repair
UPCR**

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v.4.0



1. Description

This procedure describes the diagnosis, repair, and inspection of a gearbox-type 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 gearbox-type 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
SU21 Twin I-Beam
SU31 Solid Axle, Coil Springs
WA01 Wheel Alignment, Front
WH01S Wheel

3.2 Other Information

Equipment-specific information
Vehicle-specific repair information
Vehicle-specific diagnostic information



4. Equipment And Material Requirements

4.1 Equipment

The use of this equipment is included in this procedure:

- dial indicator
- tie-rod end puller and wedge tools
- pitman arm puller
- 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 steering gearbox or linkage parts
- 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 systems

5.2 Gearbox Checks

Check the steering gearbox for these indications of wear or damage:

- noise or binding when the worm shaft is rotated with the pitman arm joint and steering-column shaft coupling disconnected
- visible twist of the sector shaft splines
- sector shaft end play no more than 0.1 mm (.004"), as measured with a dial indicator
Note: Some vehicle makers specify a smaller tolerance. Follow the vehicle maker's recommendations.
- fluid leakage at gasket or seal areas
- cracked housing
- damaged mounting locations
- cracks in the sector shaft at or below the seal

5.3 Linkage Checks

Check the steering linkage for these indications of excessive wear or damage:

- tie-rod end, idler arm, or pitman arm 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

(cont'd)



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:

- steering gearbox
- steering knuckle and spindle assemblies
- tie rods, adjusting sleeves, and clamps
- pitman arm
- idler arm
- drag link or center link
- steering damper or stabilizer
- 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 or suspension 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 apply pulling force to any suspension part.



9. Repair Procedure

9.1 Steering Gearbox Replacement

To replace a steering gearbox:

- 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 coupling.
- 6. Remove the pitman arm, using the proper tools.
- 7. Disconnect and seal the power steering hoses, if applicable.
- 8. Disconnect and remove the gearbox. Compare the replacement part to the original part. Verify that the mounting locations and gear ratio are correct.
- 9. Check the mounting area for misalignment.
- 10. Install the replacement gearbox, 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.
- 11. Ensure that the sector shaft is internally centered.
- 12. Trial-fit the pitman arm and sector shaft before reconnecting the steering shaft coupling.
- 13. Reconnect the steering-shaft coupling, and install the pitman arm.
- 14. Verify that the airbag clock spring is centered before turning the steering wheel or road-testing the vehicle.
- 15. Drain and flush the power steering system, if required. Follow the vehicle maker's recommendations.
- 16. Reconnect the power steering hoses.
- 17. Refill the system with the recommended power steering fluid.
- 18. Bleed the power steering system following the vehicle maker's recommendations. Refill the power steering fluid to the proper level.
- 19. Torque all fasteners to the vehicle maker's recommendations.
- 20. Lower the vehicle.
- 21. Check and adjust the front wheel toe, if required.
- 22. Continue vehicle reassembly.
- 23. Road-test the vehicle. See **11.2**.
- 24. Refill the power steering fluid to the proper level.

9.2 Steering Linkage Parts Replacement

To replace steering linkage parts:

- 1. Properly lift and support the vehicle, if required.
- 2. Note any linkage parts that use left-hand threads.

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9. Repair Procedure (cont'd)

- 3. Remove the linkage fasteners and loosen the tie-rod clamps, if required.
- 4. Use pullers and wedges to separate the linkage parts, if required.
- 5. Remove the linkage parts. Compare the replacement parts to the original parts.
- 6. Install the replacement linkage parts, duplicating the original mounting methods. Replace one-time or damaged fasteners and cotter pins. Use replacement fasteners that are the same grade, size, and type as the original fasteners.
- 7. Torque the fasteners to the vehicle maker's recommendations.
- 8. Lower the vehicle.
- 9. Check and adjust the front-wheel toe, if required.
- 10. Continue vehicle reassembly.
- 11. 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. Whenever possible, 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 having any of 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 Steering System Inspection

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

- proper installation of all fasteners, brackets, clamps, and retaining clips
- proper replacement and installation of cotter pins
- proper mounting of all parts
- no binding or parts hitting against each other
- 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 and linkage centered, with equal turns to the left and right locks
- proper steering ratio
- proper tire inflation

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 while driving straight ahead

Correct any defects.