

STEERING

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STEERING COLUMNS

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GENERAL

All models are equipped with an anti-theft, energy-absorbing steering column. The column is designed to compress during a front end collision. The ignition switch and lock cylinder are mounted in the column. When the lock is engaged, the ignition, the steering, and the gearshift mechanisms cannot be operated.

An Adjust-O-Tilt steering column is optionally available on all except CJ models. This column also has the energy-absorbing and anti-theft features.

A center slip-type (telescoping) intermediate shaft is used on all models. It is attached to the steering gear with a flexible-type coupling and to the steering column with a cardan joint.

STEERING COLUMN ALIGNMENT

- (1) Loosen two-piece toeboard seal cover and remove lower clamp bracket.
- (2) Remove instrument panel lower trim.
- (3) Loosen column mounting-bracket-to-instrument-panel attaching bolts.
- (4) Pull steering column upward. Maintain upward pressure and tighten instrument-panel-to-column mounting bracket bolts to 20 foot-pounds torque.
- (5) Install lower clamp bracket and tighten bolts to 15 foot-pounds torque.
- (6) Tighten seal cover bolts to 10 foot-pounds torque.
- (7) Install instrument panel lower trim.
- (8) On vehicles with automatic transmission, check gearshift manual linkage for proper operation. Refer to Automatic Transmission section.

STEERING WHEEL REMOVAL

CJ Models

- (1) Disconnect battery negative cable.
- (2) Place front wheels in straight-ahead position.
- (3) Remove rubber boot and horn button from steering wheel. Rotate button until lock tabs on button align with notches in contact cup and pull upward to remove.
- (4) Remove steering wheel nut and washer.

NOTE: If equipped with sport style wheel, remove button, nut and washer, button retaining ring, and horn contact ring.

- (5) Remove plastic horn contact cup retainer and remove horn contact cup and contact plate from steering wheel.

- (6) Remove horn contact pin and bushing from steering wheel.

- (7) Paint or scribe alignment marks on steering wheel and steering shaft for assembly reference.

- (8) Remove steering wheel using Puller J-21232.

Cherokee-Wagoneer-Truck Models

- (1) Disconnect battery negative cable.
- (2) Place front wheels in straight-ahead position.
- (3) Remove horn cover attaching screws from underside of steering wheel and remove horn cover.

NOTE: If equipped with sport style wheel, remove button, nut and washer, button retaining ring, and horn contact ring.



Service Diagnosis—All Columns

Lock System

Condition	Possible Cause	Correction
WILL NOT UNLOCK	(1) Sector stripped.	(1) Replace sector.
	(2) Lock bolt damaged.	(2) Replace lock bolt.
	(3) Defective lock cylinder.	(3) Replace lock cylinder.
	(4) Damaged housing.	(4) Replace housing.
	(5) Damaged sector.	(5) Replace sector.
	(6) Damaged rack.	(6) Replace rack.
	(7) Shear flange on sector shaft collapsed (tilt column).	(7) Replace sector.
WILL NOT LOCK	(1) Lockbolt spring broken or defective.	(1) Replace lock bolt spring.
	(2) Damaged sector tooth.	(2) Replace sector.
	(3) Defective lock cylinder.	(3) Replace lock cylinder.
	(4) Burr on lock bolt or housing.	(4) Remove burr.
	(5) Damaged housing.	(5) Replace housing.
	(6) Damaged rack.	(6) Replace rack.
	(7) Ignition switch stuck.	(7) Replace ignition switch.
	(8) Actuator rod restricted.	(8) Remove restriction.
	(9) Transmission gearshift linkage adjustment incorrect.	(9) Adjust linkage.
	(10) Sector installed incorrectly.	(10) Install correctly.
	(11) Interference between bowl (shroud) and remote rod (tilt column).	(11) Replace bowl (shroud) or remote rod as required.
HIGH EFFORT	(1) Lock cylinder defective.	(1) Replace lock cylinder.
	(2) Ignition switch defective.	(2) Replace ignition switch.
	(3) Rack preload spring broken or deformed.	(3) Replace preload spring.
	(4) Burrs on sector, rack, housing, support or actuator rod coupling.	(4) Remove burr.

Lock System (Continued)

Condition	Possible Cause	Correction
HIGH EFFORT (Continued)	(5) Bent sector shaft. (6) Defective rack. (7) Remote rod restricted. (8) Bent remote rod. (9) Ignition switch mounting bracket bent. (10) Extreme misalignment of housing to cover (tilt column). (11) Distorted coupling slot in rack (tilt column).	(5) Replace shaft. (6) Replace rack. (7) Remove restriction. (8) Straighten or replace. (9) Straighten or replace. (10) Replace either or both. (11) Replace rack.
WILL STICK IN "START"	(1) Remote rod deformed. (2) Any high effort condition.	(1) Straighten or replace. (2) Check items under high effort.
KEY CANNOT BE REMOVED IN "OFF-LOCK"	(1) Ignition switch is not set correctly. (2) Defective lock cylinder.	(1) Readjust. (2) Replace lock cylinder.
LOCK CYLINDER CAN BE REMOVED WITHOUT DEPRES- SING RETAINER	(1) Lock cylinder with defective retainer. (2) Lock cylinder retainer missing. (3) Burr over retainer slot in housing cover.	(1) Replace lock cylinder. (2) Replace lock cylinder. (3) Remove burr.
HIGH EFFORT ON LOCK CYLINDER BETWEEN "OFF" AND "OFF-LOCK"	(1) Distorted rack. (2) Burr on tang of shift gate (automatic column). (3) Linkage not adjusted.	(1) Replace rack. (2) Remove burr. (3) Adjust linkage.
LOCK BOLT HITS SHAFT LOCK IN "OFF" POSITION	(1) Ignition switch is not adjusted correctly (all except tilt column).	(1) Adjust ignition switch.



Ignition System

Condition	Possible Cause	Correction
ELECTRICAL SYSTEM WILL NOT FUNCTION	(1) Poor battery connection. (2) Connector body loose or defective. (3) Defective wiring. (4) Defective ignition switch. (5) Ignition switch not adjusted properly.	(1) Connect securely. (2) Tighten or replace. (3) Repair or replace. (4) Replace ignition switch. (5) Adjust switch.
SWITCH WILL NOT ACTUATE MECHANICALLY	(1) Defective ignition switch.	(1) Replace switch.
SWITCH CANNOT BE ADJUSTED CORRECTLY	(1) Switch remote rod deformed. (2) Sector to rack engaged in wrong tooth.	(1) Repair, straighten or replace. (2) Engage correctly.

Column

Condition	Possible Cause	Correction
NOISE IN COLUMN	(1) Coupling bolts not tightened. (2) Column not correctly aligned. (3) Coupling pulled apart. (4) Broken lower joint. (5) Horn contact ring not lubricated. (6) Lack of grease on bearings or bearing surfaces. (7) Lower shaft bearing worn or broken. (8) Upper shaft bearing worn or broken. (9) Shaft lock plate cover loose.	(1) Tighten pinch bolts to 30 ft.-lbs. torque. (2) Align column. (3) Align column and replace coupling. (4) Repair or replace joint and align column. (5) Lubricate with multi-purpose grease. (6) Lubricate with multi-purpose grease. (7) Replace bearing. Check shaft and replace if scored. (8) Replace bearing assembly. (9) Tighten three screws to 15 in.-lbs. torque, or if missing, replace. CAUTION: Use specified screws only.

Column (Continued)

Condition	Possible Cause	Correction
NOISE IN COLUMN (Continued)	(10) Shaft lock retaining ring not seated.	(10) Replace snap ring. Check for proper seating in groove.
	(11) One click when in "off-lock" position and the steering wheel is moved (all except automatic column).	(11) Normal—lock bolt is seating.
	(12) Loose sight shields (all except automatic column).	(12) Bend to eliminate rattle.
HIGH STEERING SHAFT EFFORT	(1) Column misaligned.	(1) Align column.
	(2) Defective upper or lower bearing.	(2) Replace as required.
	(3) Tight steering universal joint (tilt column only).	(3) Repair or replace.
	(4) Flash on I.D. of shift tube at plastic joint (tilt column only).	(4) Replace shift tube.
	(5) Frozen upper or lower bearings (all except manual column).	(5) Replace bearings.
MISCELLANEOUS	(1) Shroud loose on shift bowl. Housing loose on jacket—will be noticed with ignition in "off-lock" and a torque applied to the steering wheel.	(1) Bends on shroud over lugs on bowl. Tighten four mounting screws to 60 in.-lbs. torque.
LASH IN MOUNTED COLUMN ASSEMBLY	(1) Instrument panel bracket mounting bolts loose.	(1) Tighten to 20 ft.-lbs. torque.
	(2) Broken weld nuts on jacket.	(2) Replace jacket assembly.
	(3) Column bracket capsule sheared.	(3) Replace bracket assembly.
	(4) Column bracket to jacket mounting bolts loose.	(4) Tighten to 20 ft.-lbs. torque.
	(5) Loose lock shoes in housing (tilt column only).	(5) Replace shoes.
	(6) Loose tilt head pivot pins (tilt column only).	(6) Replace pivot pins.
	(7) Loose lock shoe pin in support (tilt column only).	(7) Replace pin.
	(8) Loose support screws (tilt column only).	(8) Tighten to 60 in.-lbs. torque.



Column (Continued)

Condition	Possible Cause	Correction
STEERING WHEEL UPPER HOUSING LOOSE (TILT COLUMN ONLY)	(1) Excessive clearance between holes in support or housing and pivot pin diameters. (2) Defective or missing anti-lash spring in centering spheres. (3) Upper bearing not seating in housing. (4) Upper bearing inner race seat missing. (5) Loose support screws. (6) Bearing preload spring missing or broken.	(1) Replace eighter or both. (2) Add spring or replace both spheres. (3) Replace bearing and housing. (4) Install seat. (5) Tighten to 60 in.-lbs. torque. (6) Replace preload spring.
STEERING WHEEL LOOSE—EVERY OTHER TILT POSITION (TILT COLUMN ONLY)	(1) Loose fit between lock shoe and shoe pivot pin.	(1) Replace lock shoes and pivot pin.
STEERING COLUMN NOT LOCKING IN ANY TILT POSITION (TILT COLUMN ONLY)	(1) Shoe seized on its pivot pin. (2) Shoe grooves may have burrs or dirt. (3) Shoe lock spring weak or broken.	(1) Replace both. (2) Replace shoe. (3) Replace lock spring.
STEERING WHEEL FAILS TO RETURN TO TOP TILT POSITION (TILT COLUMN ONLY)	(1) Pivot pins are bound up. (2) Wheel tilt spring is defective. (3) Turn signal switch wires too tight (improperly routed).	(1) Replace pivot pins. (2) Replace tilt spring. (3) Adjust position of wires.
NOISE WHEN TILTING COLUMN (TILT COLUMN ONLY)	(1) Upper tilt bumpers worn. (2) Tilt spring rubbing in housing.	(1) Replace tilt bumper. (2) Lubricate with multi-purpose grease.
ONE CLICK WHEN IN "OFF-LOCK" POSITION AND THE STEERING WHEEL IS MOVED	(1) Seating of lock bolt.	(1) None. Click is normal characteristic sound produced by lock bolt as it seats.

Column (Continued)

Condition	Possible Cause	Correction
HIGH SHIFT EFFORT (AUTOMATIC AND TILT COLUMN ONLY)	(1) Column not aligned correctly in car. (2) Lower bowl bearing not aligned correctly. (3) Lack of grease on seal or bearing areas.	(1) Align. (2) Assemble correctly. (3) Lubricate.
IMPROPER TRANS- MISSION SHIFTING (AFTER ANY NECES- SARY CORRECTIONS, THE NEUTRAL START SWITCH IS TO BE CHECKED AND AD- JUSTED AS REQUIRED) (AUTOMATIC AND TILT COLUMN ONLY)	(1) Sheared shift tube joint. (2) Improper transmission gearshift (3) Loose lower shift lever. (4) Improper shift gate.	(1) Replace shift tube assembly. (2) Adjust linkage. (3) Replace shift tube assembly. (4) Replace with correct part.
TURN SIGNAL WILL NOT CANCEL	(1) Loose switch mounting screws. (2) Switch or anchor bosses broken. (3) Broken, missing or out of position detent, return or cancelling spring. (4) Uneven or incorrect cancelling cam to cancelling spring interference. .120 in./side.	(1) Tighten to specified torque (25 in.-lbs.). (2) Replace switch. (3) Reposition springs or replace switch as required. (4) Adjust switch position. (a) If interference is correct and switch will still not cancel, replace switch. (b) If interference cannot be corrected by switch adjustment, replace cancelling cam or switch.

Turn Signal

Condition	Possible Cause	Correction
TURN SIGNAL DIFFICULT TO OPERATE	(1) Turn signal lever loose. (2) Yoke broken or distorted. (3) Loose or misplaced springs. (4) Foreign parts and/or materials. (5) Switch mounted loosely.	(1) Tighten mounting screw (12 in.-lbs.). (2) Replace switch. (3) Reposition springs or replace switch. (4) Remove foreign parts and/or material. (5) Tighten mounting screws (25 in.-lbs.).



Turn Signal (Continued)

Condition	Possible Cause	Correction
TURN SIGNAL WILL NOT INDICATE LANE CHANGE	(1) Broken lane change pressure pad or spring hanger. (2) Broken, missing or misplaced lane change spring. (3) Jammed base or wires.	(1) Replace switch. (2) Replace or reposition as required. (3) Loosen mounting screws, reposition base or wires and retighten screws (25 in.-lbs.).
TURN SIGNAL WILL NOT STAY IN TURN POSITION	(1) Foreign material or loose parts impeding movement of yoke. (2) Broken or missing detent or cancelling springs. (3) None of the above.	(1) Remove material and/or parts. (2) Replace switch. (3) Replace switch.
HAZARD SWITCH CANNOT BE TURNED OFF	(1) Foreign material between hazard support cancelling leg and yoke.	(1) Remove foreign material. (a) No foreign material impeding function of hazard switch—replace turn signal switch.
HAZARD SWITCH WILL NOT STAY ON OR DIFFICULT TO TURN OFF	(1) Loose switch mounting screws. (2) Interference with other components. (3) Foreign material. (4) None of the above.	(1) Tighten mounting screws (25 in.-lbs.). (2) Remove interference. (3) Remove foreign material. (4) Replace switch.
NO TURN SIGNAL LIGHTS	(1) Defective or blown fuse. (2) Inoperative turn signal flasher. (3) Loose chassis to column connector. (4) Disconnect column to chassis connector. Connect new switch to chassis and operate switch by hand. If vehicle lights now operate normally, signal switch is inoperative. (5) If vehicle lights do not operate check chassis wiring for opens, grounds, etc.	(1) Replace fuse. (2) Replace turn signal flasher. (3) Connect securely. (4) Replace signal switch. (5) Repair chassis wiring as required.

Turn Signal (Continued)

TURN INDICATOR LIGHTS (ON INSTRUMENT PANEL) ON, BUT NOT FLASHING	<ol style="list-style-type: none"> (1) Inoperative turn flasher. (2) Loose chassis to column connection. (3) Burned out or damaged front or rear turn signal bulb. (4) Inoperative turn signal switch. (5) To determine if turn signal switch is defective, substitute new switch into circuit and operate switch by hand. If the vehicle's lights operate normally, signal switch is inoperative. (6) If the vehicle's lights do not operate, check light sockets for high resistance connections, the chassis wiring for opens, grounds, etc. 	<ol style="list-style-type: none"> (1) Replace turn flasher. Note: There are two flashers in the system. Consult manual for location. (2) Connect securely. (3) Replace bulb. (4) Replace turn signal switch. (5) Replace signal switch. (6) Repair chassis wiring as required using manual as guide.
FRONT OR REAR TURN SIGNAL LIGHTS NOT FLASHING	<ol style="list-style-type: none"> (1) Burned out or damaged turn signal bulb. (2) High resistance connection to ground at bulb socket. (3) Loose chassis to column connector. (4) Disconnect column to chassis connector. Connect new switch into system and operate switch by hand. If turn signal lights are now on and flash, turn signal switch is inoperative. (5) If vehicle lights do not operate, check chassis wiring harness to light sockets for opens, grounds, etc. 	<ol style="list-style-type: none"> (1) Replace bulb. (2) Remove or repair defective connection. (3) Connect securely. (4) Replace turn signal switch. (5) Repair chassis wiring as required using manual as guide.



Turn Signal (Continued)

Condition	Possible Cause	Correction
STOP LIGHT NOT ON WHEN TURN INDICATED	<ul style="list-style-type: none"> (1) Loose column to chassis connection. (2) Disconnect column to chassis connector. Connect new switch into system without removing old. Operate switch by hand. If brake lights work with switch in the turn position, signal switch is defective. (3) If brake lights do not work check connector to stop light sockets for grounds, opens, etc. 	<ul style="list-style-type: none"> (1) Connect securely. (2) Replace signal switch. (3) Repair connector to stop light circuits using service manual as guide.
TURN INDICATOR PANEL LIGHTS NOT FLASHING	<ul style="list-style-type: none"> (1) Burned out bulbs. (2) High resistance to ground at bulb socket. (3) Opens, grounds in wiring harness from front turn signal bulb socket to indicator lights. 	<ul style="list-style-type: none"> (1) Replace bulbs. (2) Replace socket. (3) Locate and repair as required. Use service manual as guide.
TURN SIGNAL LIGHTS FLASH VERY SLOWLY	<ul style="list-style-type: none"> (1) Inoperative turn signal flasher. (2) System charging voltage low. (3) High resistance ground at light sockets. (4) Loose chassis to column connection. (5) Disconnect column to chassis connector. Connect new switch into system without removing old. Operate switch by hand. If flashing occurs at normal rate, the signal switch is defective. (6) If the flashing rate is still extremely slow, check chassis wiring harness from the connector to light sockets for grounds, high resistance points, etc. 	<ul style="list-style-type: none"> (1) Replace turn signal flasher. (2) Increase voltage to specified. Use service manual. (3) Repair high resistance grounds at light sockets. (4) Connect securely. (5) Replace signal switch. (6) Locate and repair as required. Use service manual as guide.

Turn Signal (Continued)

Condition	Possible Cause	Correction
HAZARD SIGNAL LIGHTS WILL NOT FLASH—TURN SIGNAL FUNCTIONS NORMALLY	(1) Blown fuse.	(1) Replace fuse.
	(2) Inoperative hazard warning flasher.	(2) Replace hazard warning flasher in fuse panel.
	(3) Loose chassis to column connection.	(3) Connect securely.
	(4) Disconnect column to chassis connector. Connect new switch into system without removing old. Depress the hazard warning lights. If they now work normally, the turn signal switch is defective.	(4) Replace the turn signal switch.
	(5) If the lights do not flash, check wiring harness "K" lead for open between hazard flasher and connector. If open, fuse block is defective.	(5) Repair or replace brown wire or connector as required.

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(4) Disconnect horn wire from switch in steering wheel cavity. Gently pull and wiggle connector to remove.

(5) Remove steering wheel nut and connector.

(6) Paint or scribe alignment marks on steering wheel and steering shaft for assembly reference.

(7) Remove steering wheel using Puller J-25115 (fig. 11-1).

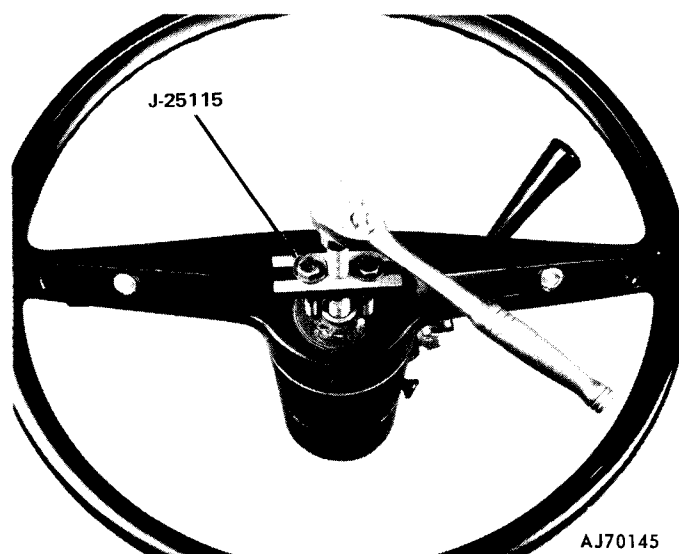


Fig. 11-1 Steering Wheel Removal—Typical

STEERING WHEEL INSTALLATION

CJ Models

(1) Align paint or scribe marks on steering wheel and steering shaft and install steering wheel.

(2) Install horn contact pin and bushing in steering wheel. Be sure bushing is seated fully.

(3) Assemble contact plate, horn contact cup, and plastic horn contact cup retainer. Install assembled parts in steering wheel and install attaching screws.

(4) Install steering wheel washer and nut. Tighten nut to 20 foot-pounds torque.

(5) Install rubber boot and horn button on steering wheel.

(6) Connect battery negative cable.

Cherokee-Wagoneer-Truck Models

(1) Align paint or scribe marks on steering shaft and steering wheel and install steering wheel.

(2) Install steering wheel washer and nut. Tighten nut to 20 foot-pounds torque.

(3) Connect horn wire to switch in steering wheel.

(4) Install steering wheel horn cover.

NOTE: If equipped with sport style wheel, install horn contact ring, button retaining ring, washer and nut, and button.

(5) Connect battery negative cable.

STEERING COLUMN REMOVAL

CAUTION: When removed from the vehicle, handle the column with special care. Sharp blows on the end of the steering shaft or shift levers, leaning on the column assembly, or dropping the assembly could shear or loosen the plastic fasteners that maintain column rigidity.

- (1) Disconnect battery negative cable.
- (2) Disconnect steering column wiring connectors from wiring harness and ignition switch.

NOTE: Steering wheel does not have to be removed to remove steering column.

- (3) Scribe alignment marks on steering shaft and universal joints for assembly reference.
- (4) Disconnect steering column gearshift linkage from shift lever on automatic column shift models.
- (5) Remove column to toeboard parts.
- (6) Remove lower instrument panel trim, steering column bezel, left side air conditioning duct (if equipped), and column-to-instrument panel bracket stud nuts (or bolts).
- (7) Remove bracket-to-column bolts and remove column mounting bracket.

CAUTION: Set bracket aside to protect breakaway capsules.

NOTE: Bracket capsules are slotted to permit column movement for adjustment.

- (8) Remove column from vehicle.

STEERING COLUMN INSTALLATION

WARNING: Use only specified screws, bolts, and nuts when servicing the column, and tighten only to the specified torque to maintain the energy-absorbing (compression) action of the steering column. Bolts longer than specifications must not be used as they may prevent the column from compressing under impact. The bolts or nuts securing the column mounting bracket to the instrument panel must be tightened to the proper torque so that the bracket will break away under impact.

- (1) Attach column mounting bracket to column. Tighten bolts to 15 foot-pounds torque.

CAUTION: Do not use substitute bolts. Position column and loosely attach column to instrument panel with rear attaching studs at mounting bracket. Be sure that column instrument panel mounting is never unsupported when either dash mounting or gear mounting is connected.

- (2) Align scribe marks on steering shaft and universal joints. Install universal joint pinch bolt. Tighten pinch bolt to 30 foot-pounds torque.

- (3) Pull steering column upward. Maintain upward pressure and tighten column mounting bracket-to-instrument panel attaching nuts to 20 foot-pounds torque.

CAUTION: Do not overtighten bolts and nuts. Correct torque on bolts and nuts is necessary to ensure breakaway action of column bracket and capsules.

- (4) Install toeboard parts.
- (5) Connect all electrical components and check for proper operation.
- (6) Install instrument panel trim, steering column bezel, and left side air conditioning duct (if equipped).
- (7) On vehicle with automatic transmission, check gearshift manual linkage for proper operation. Refer to Automatic Transmission section.
- (8) Connect battery negative cable.

STEERING COLUMN—MANUAL TRANSMISSION

Disassembly

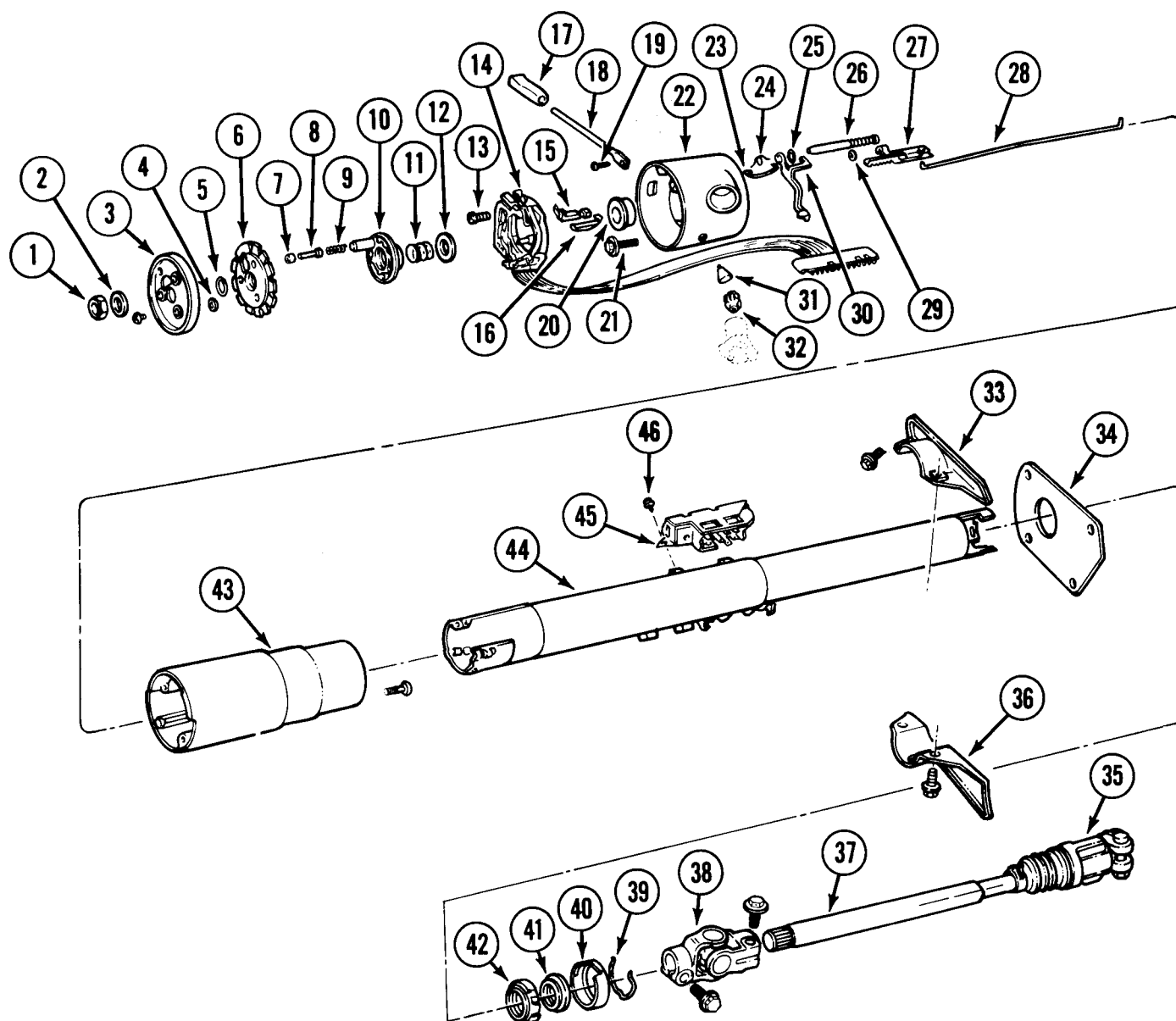
Column removal is not necessary if only the anti-theft cover lock plate and snap ring, cancelling cam turn signal switch, buzzer switch, upper bearing spring, or lock cylinder are to be serviced (fig. 11-2). The column must be removed in order to service any of the remaining components.

If the column is removed, remove the column-to-instrument panel mounting bracket (fig. 11-3), install Support Fixture J-23074 (fig. 11-4), and mount column in vise by clamping flange of support fixture in vise.

- (1) Place front wheels in straight-ahead position. Disconnect battery negative cable.
- (2) Cover painted areas of column.
- (3) Remove steering wheel.
- (4) Loosen anti-theft cover retaining screws and lift cover from column (fig. 11-5). It is not necessary to completely remove these screws as they are held on cover by plastic retainers.
- (5) Use Lock Plate Compressor Tool J-23653 to compress lock plate and unseat round wire snap ring from steering wheel shaft groove (fig. 11-6).

WARNING: Lock plate is under strong spring tension.

- (6) Remove lock plate compressor tool.
- (7) Remove snap ring, lock plate, turn signal canceling cam, upper bearing preload spring, and thrust washer from steering shaft.

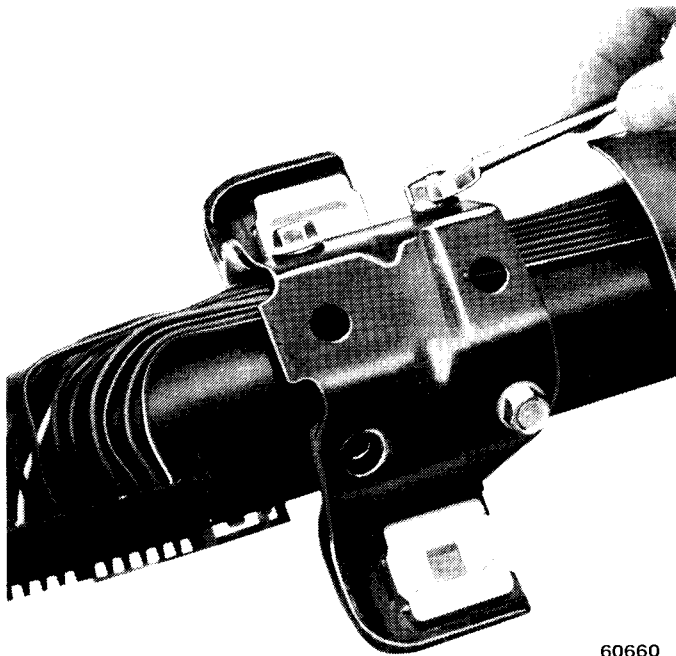


1. STEERING WHEEL NUT
2. WASHER
3. ANTI-THEFT COVER
4. ANTI-THEFT COVER SCREW RETAINER (3)
5. STEERING SHAFT SNAP RING
6. LOCKPLATE
7. BUSHING
8. HORN CONTACT PIN
9. SPRING
10. CANCELLING CAM
11. UPPER BEARING PRELOAD SPRING
12. THRUST WASHER
13. TURN SIGNAL SWITCH SCREW (3)
14. TURN SIGNAL SWITCH
15. BUZZER SWITCH
16. BUZZER SWITCH SPRING
17. TURN SIGNAL LEVER KNOB
18. TURN SIGNAL LEVER
19. TURN SIGNAL LEVER SCREW
20. UPPER BEARING
21. HOUSING RETAINING SCREW (4)
22. HOUSING
23. RACK PRELOAD SPRING

24. KEY RELEASE LEVER SPRING
25. WAVE WASHER
26. LOCK BOLT
27. LOCK RACK
28. REMOTE ROD
29. SPRING WASHER
30. KEY RELEASE LEVER
31. HAZARD WARNING SWITCH KNOB
32. SECTOR
33. TOE PLATE (UPPER HALF)
34. SEAL
35. INTERMEDIATE SHAFT COUPLING
36. TOE PLATE (LOWER HALF)
37. INTERMEDIATE SHAFT
38. INTERMEDIATE SHAFT-TO-STEERING SHAFT U-JOINT
39. SNAP RING
40. RETAINER
41. LOWER BEARING
42. LOWER BEARING ADAPTER
43. SHROUD
44. JACKET
45. IGNITION SWITCH
46. IGNITION SWITCH SCREW (2)

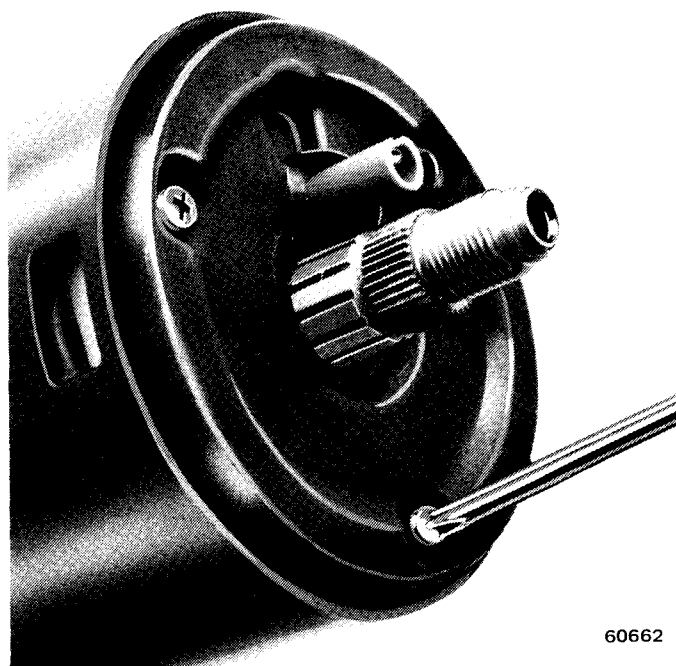
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Fig. 11-2 Steering Column—Manual Transmission



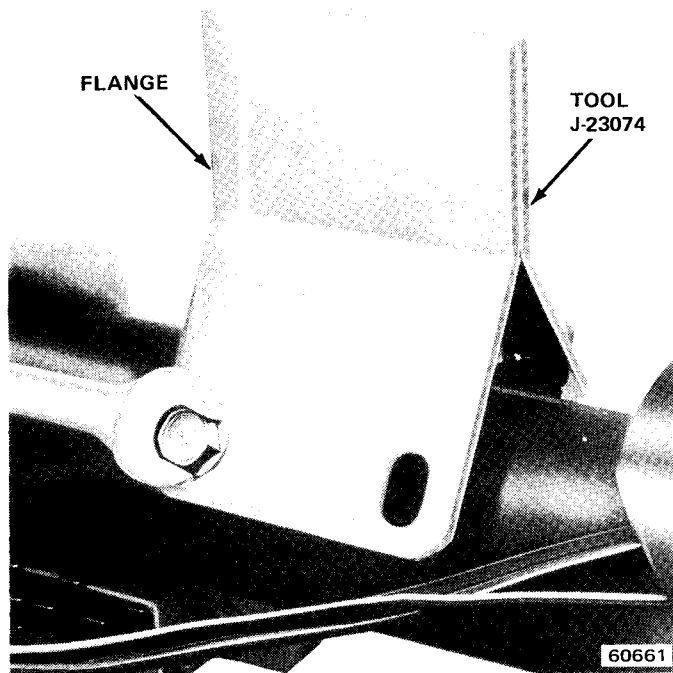
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Fig. 11-3 Removing-Installing Mounting Bracket



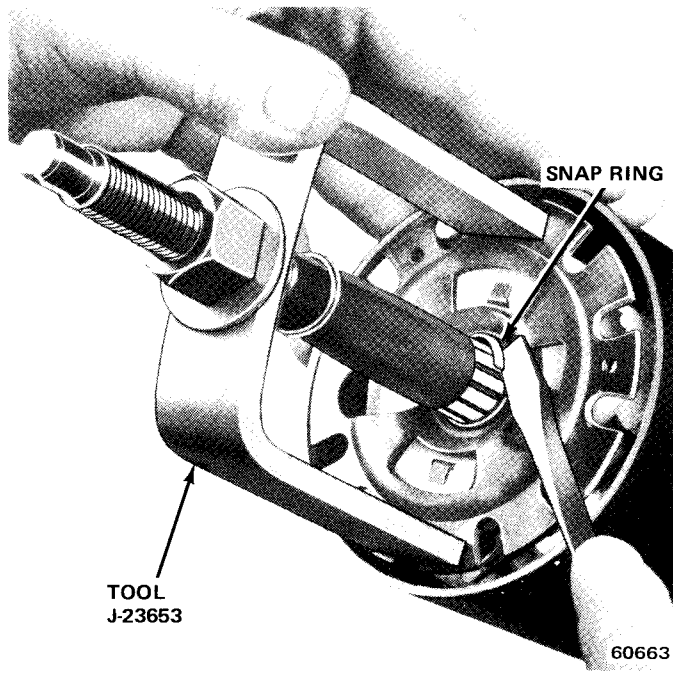
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Fig. 11-5 Removing Anti-Theft Cover



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Fig. 11-4 Attaching Support Fixture



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Fig. 11-6 Removing Lock Plate Snap Ring

NOTE: Steering shaft is now free in column. During bench overhaul, remove steering shaft by pulling out from lower end of column. If column is out of vehicle, do not allow shaft to fall out of column when snap ring is removed.

(8) Push hazard warning switch knob in, unthread knob, and remove from column.

(9) Remove turn signal lever attaching screw and remove lever. Remove column-to-instrument panel bracket.

(10) Unhook turn signal switch wire harness connector from bracket at lower end of column (under instrument panel). Unhook plastic lock tab and disconnect signal switch harness from instrument panel harness (fig. 11-7). Wrap tape around harness connector to prevent snagging during removal.

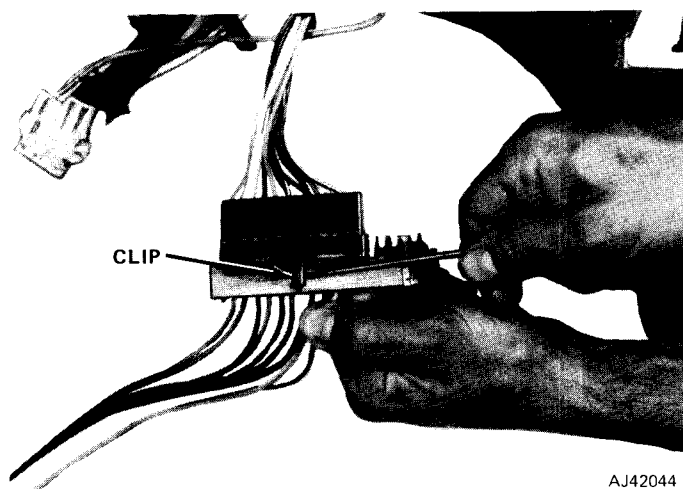


Fig. 11-7 Disconnecting Signal Switch Harness

(11) Remove three screws that attach turn signal switch to housing and remove switch. Pull switch and harness straight up and out of housing (fig. 11-8).

(12) Remove buzzer switch and spring from housing as assembly. Use needlenose pliers or straightened paper clip with 90° bend in it to remove spring and switch (fig. 11-9). Insert bent end of clip in spring and pull upward to remove spring and switch.

(13) Place ignition key in run position. Depress lock cylinder retaining tab using thin-bladed screwdriver and remove lock cylinder from column. Lock cylinder retaining tab is accessible through slot adjacent to turn signal switch mounting boss (fig. 11-10).

NOTE: If retaining tab is not visible through slot, scrape or knock flashing out of slot to provide access.



Fig. 11-8 Removing-Installing Turn Signal Switch

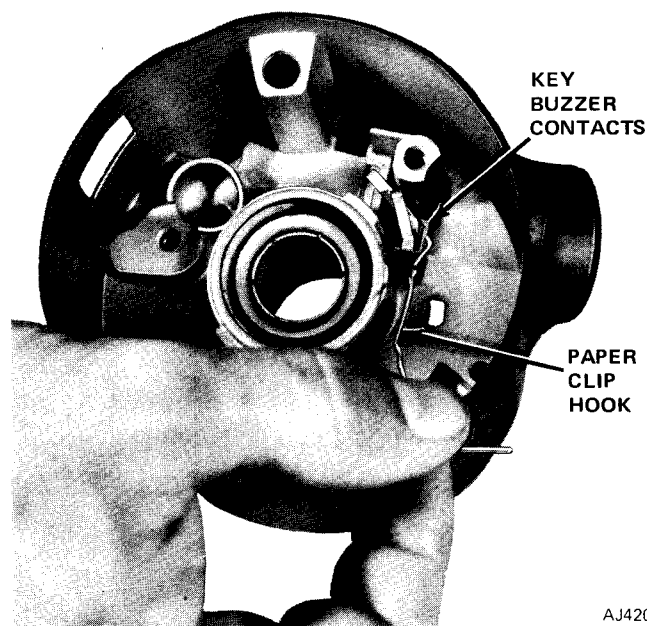


Fig. 11-9 Removing Buzzer Switch and Spring

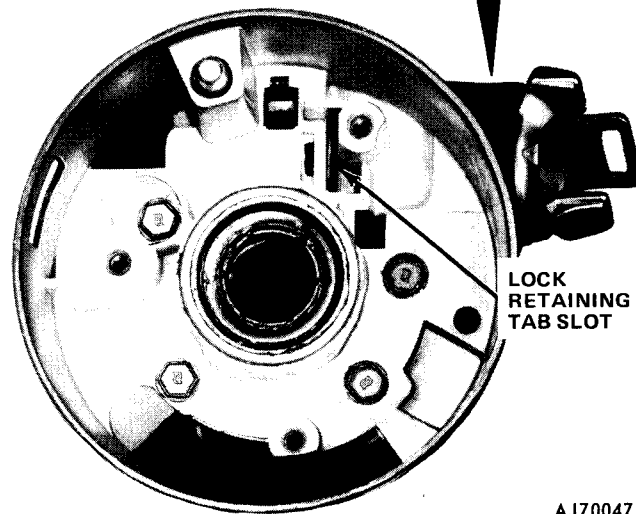
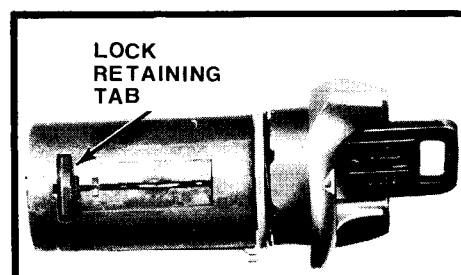


Fig. 11-10 Lock Cylinder Retainer Tab Location

(14) Remove ignition switch from jacket (fig. 11-11).

(15) Remove four screws attaching housing and shroud to jacket (fig. 11-12) and remove housing and shroud.

(16) Disengage remote rod from rack.

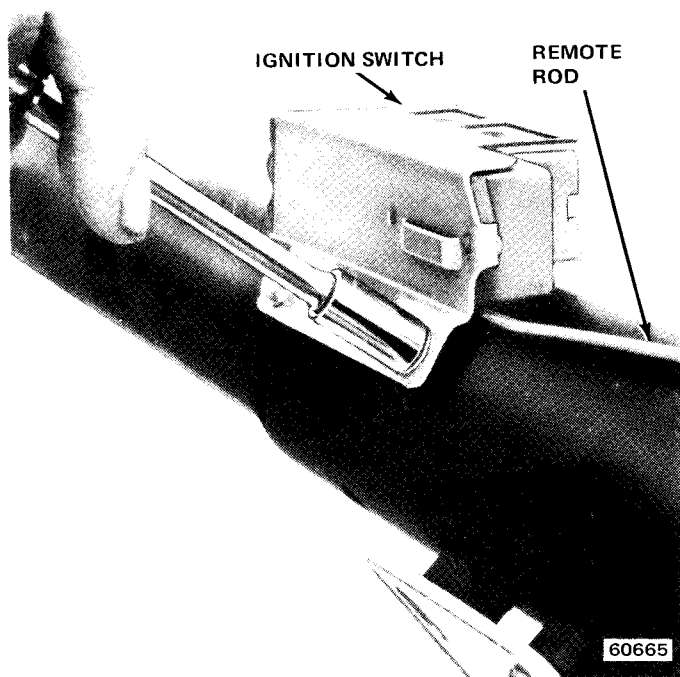


Fig. 11-11 Removing-Installing Ignition Switch

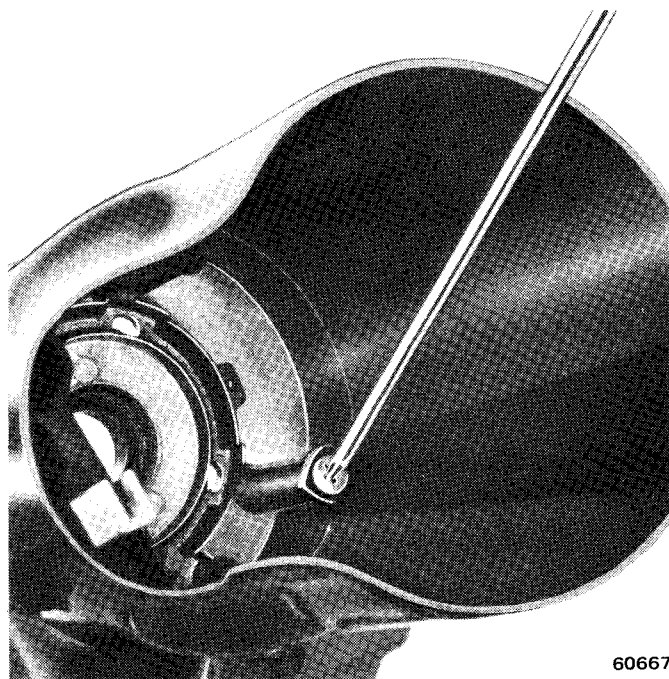


Fig. 11-13 Removing-Installing Shroud

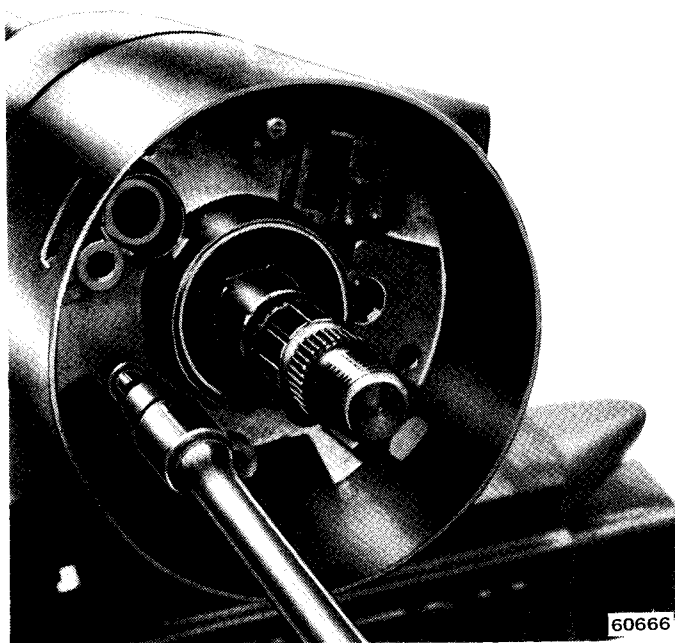


Fig. 11-12 Removing-Installing Housing

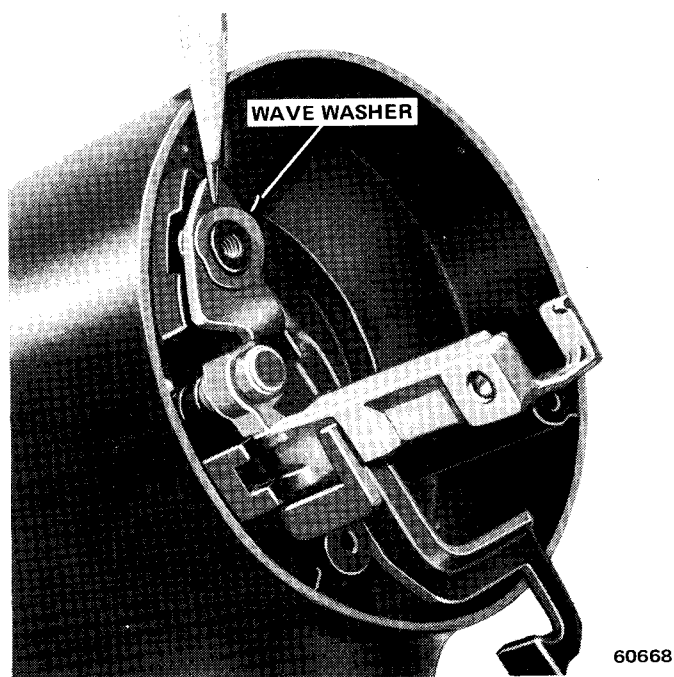


Fig. 11-14 Wave Washer Position

(17) Remove three screws attaching shroud to housing (fig. 11-3) and separate parts.

(18) Remove wave washer from release lever pivot and remove release lever and spring (fig. 11-14).

(19) Remove rack and lock bolt assembly (fig. 11-15).

(20) Remove rack preload spring (fig. 11-16).

(21) Remove sector through lock cylinder hole in housing. Push on block tooth of sector with blunt punch to remove (fig. 11-17).

NOTE: Although steps (1) through (23) can be performed with the column in the vehicle, steps (24) and (25) can be performed only if the column is removed.

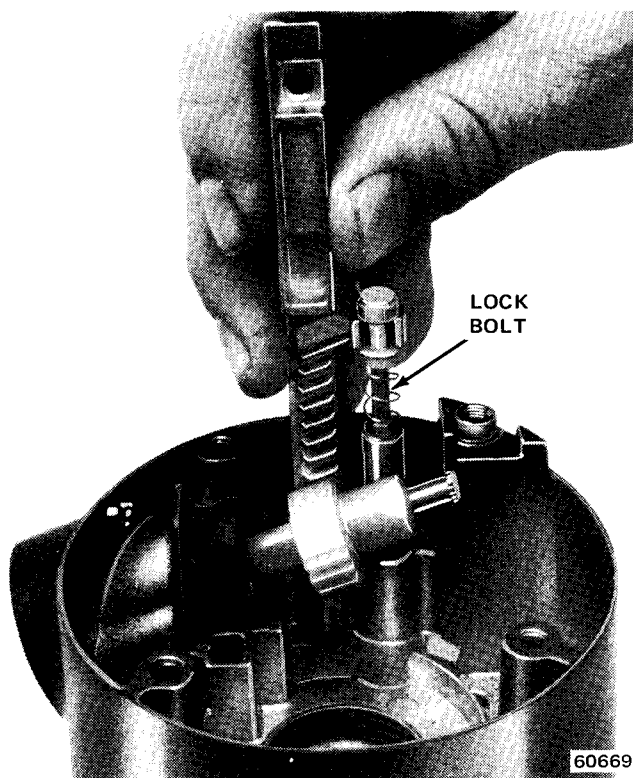


Fig. 11-15 Removing Rack and Lock Bolt

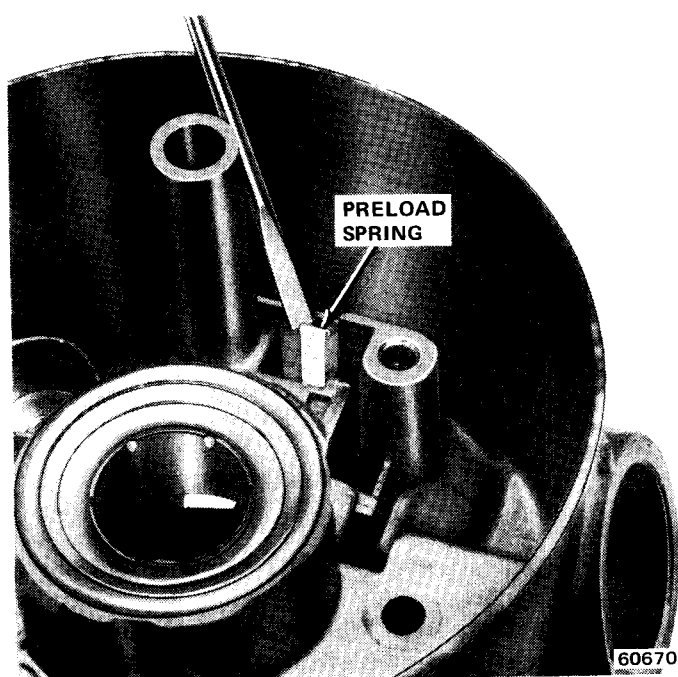


Fig. 11-16 Removing-Installing Preload Spring

- (22) Remove steering shaft.
- (23) Remove snap ring from lower jacket bearing retainer and remove retainer and bearing and adapter assembly.

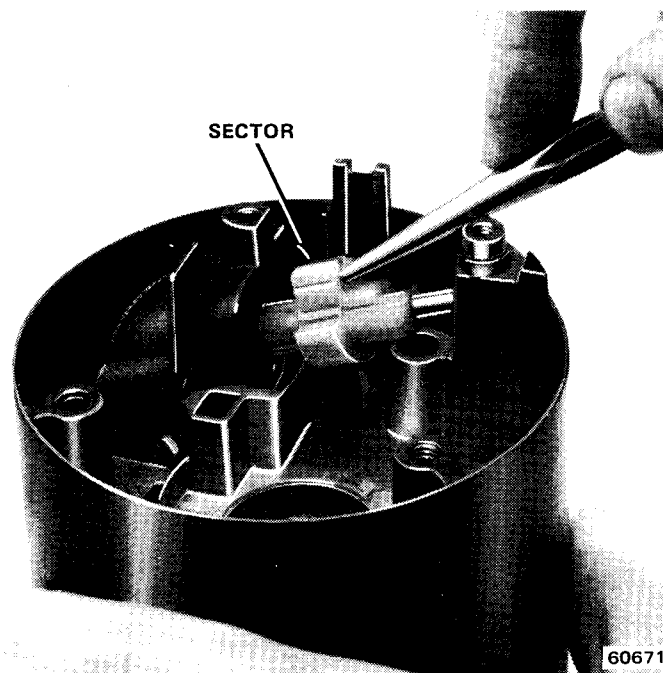


Fig. 11-17 Removing Sector

Assembly

WARNING: Use only specified screws, bolts, and nuts when servicing the column, and tighten only to the specified torque to maintain the energy-absorbing (compression) action of the steering column. Bolts may prevent the column from compressing under impact. The bolts or nuts securing the column mounting bracket to the instrument panel must be tightened to the proper torque so that the bracket will break away under impact.

(1) Install sector on sector shaft. Install sector through lock cylinder hole in housing (fig. 11-18). Use blunt tool to press sector onto shaft. Sector should turn freely after installation.

(2) Install rack preload spring (fig. 11-16). Bowed side of spring must bear against lock rack when rack is installed.

(3) Assemble lock bolt and lock rack (fig. 11-19).

(4) Install assembled lock bolt and lock rack in housing (fig. 11-20). Mate block tooth on rack with block tooth on sector (fig. 11-19 and 11-20).

(5) Install release lever return spring over post in housing (fig. 11-21). Insert release lever finger in slot in lock rack and position hole in lever over threaded hole in housing post (fig. 11-22). Be sure inner end of spring contacts release lever as shown in figure 11-22.

(6) Raise release lever slightly and install end of release lever spring between lever and housing boss (fig. 11-23).

(7) Coat wave washer with multi-purpose grease and install on post over release lever (fig. 11-14).

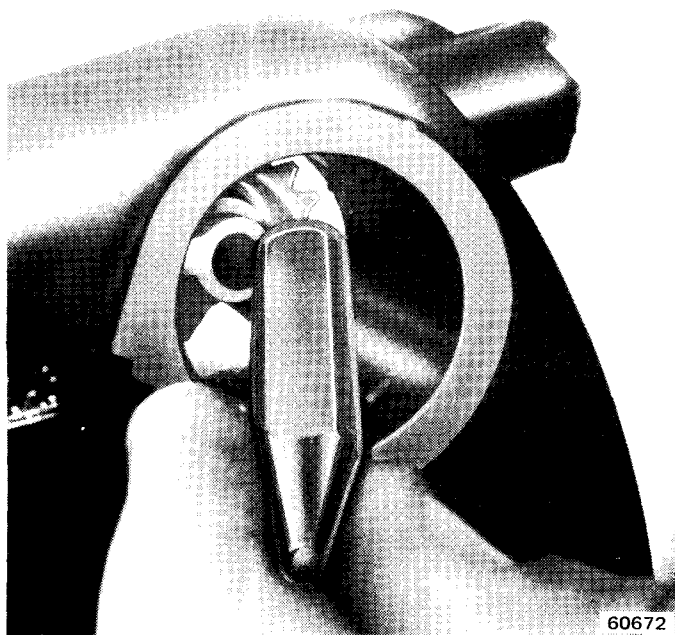


Fig. 11-18 Installing Sector

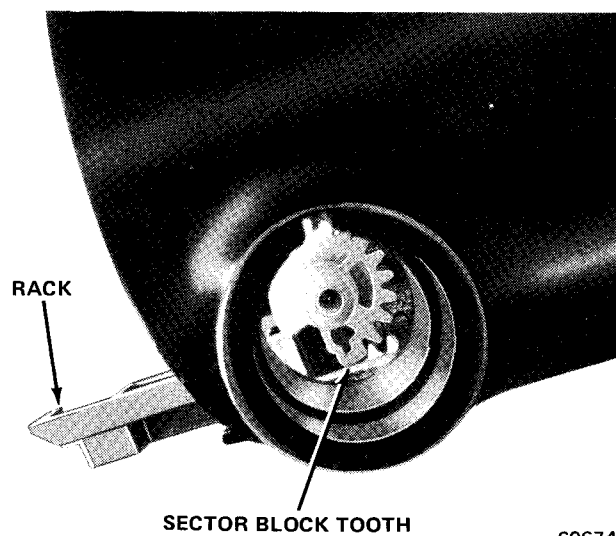


Fig. 11-20 Installing Lock Bolt and Rack

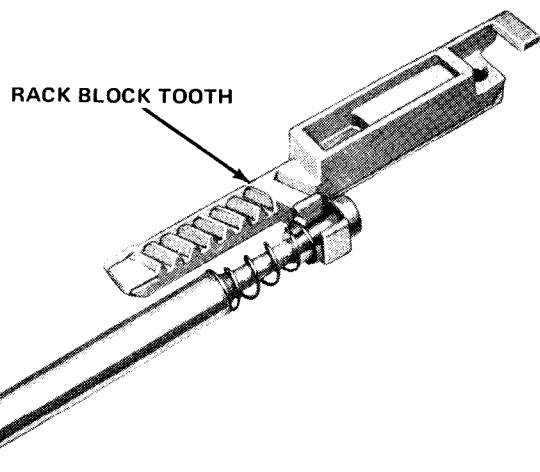


Fig. 11-19 Assembling Lock Bolt and Rack

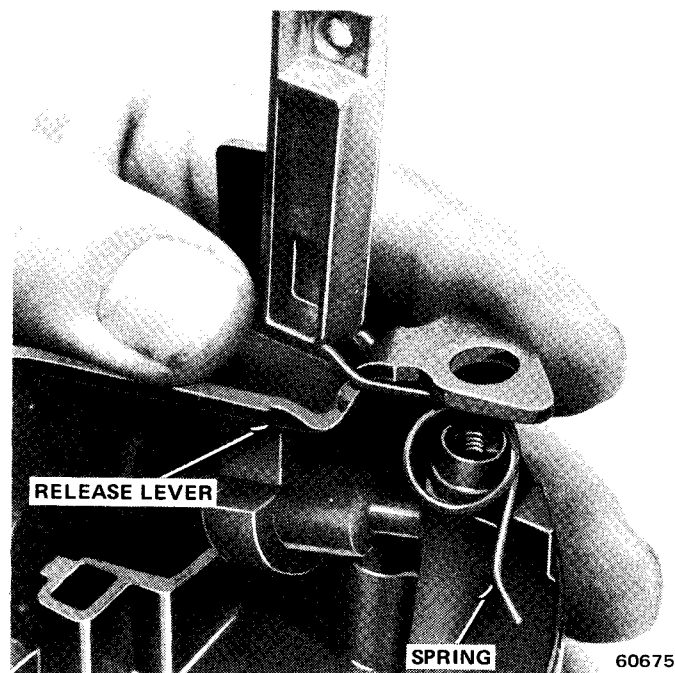


Fig. 11-21 Installing Release Lever and Spring

(8) Install shroud on housing and install three attaching screws. Tighten screws to 18 inch-pounds torque. Do not displace wave washer when assembling shroud and housing.

(9) Install remote rod on lock rack. Short hooked end of rod goes in rack.

(10) Install assembled shroud and housing on jacket and install four attaching screws (fig. 11-12). Tighten screws to 60 inch-pounds torque.

(11) Assemble buzzer switch and spring. Formed end of spring fits on lower end of switch (fig. 11-24). Insert assembled spring and switch in housing with switch contacts toward lock cylinder bore (fig. 11-9).

(12) Install lock cylinder in housing. Insert key in lock, hold cylinder sleeve in one hand, and rotate key clockwise until it steps. This retracts actuator. Insert cylinder in housing bore with tab on cylinder sleeve aligned with keyway in housing. Push cylinder in until it bottoms. Rotate key counterclockwise until drive section of cylinder mates with sector. Push cylinder in fully until tab engages in housing groove.

(13) Turn lock cylinder clockwise to stop, then counterclockwise to stop at Off-Unlock position. Place ignition switch in Off-Unlock position as follows:

(a) Position switch on jacket (fig. 11-25).

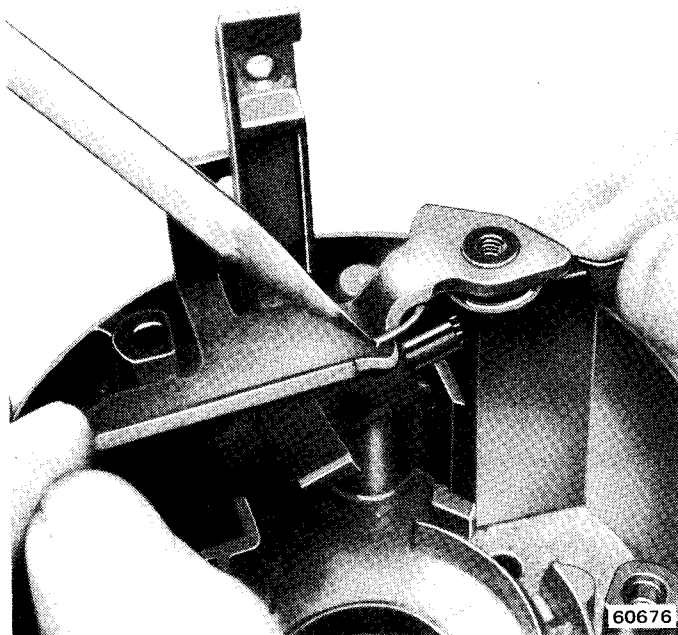


Fig. 11-22 Positioning Release Lever Spring

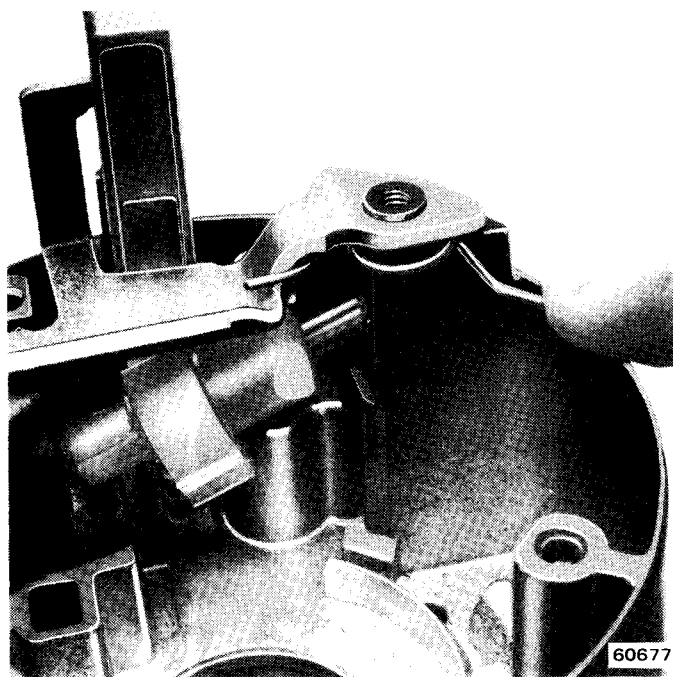


Fig. 11-23 Securing Release Lever Spring

(b) Move switch slider to extreme left to Accessory position.

(c) Move slider two positions to right from Accessory position to Off-Lock position.

(d) Insert remote rod into hole in switch slider, position switch on jacket, and install attaching screws. Tighten screws to 35 inch-pounds torque.

(14) Install lower bearing and adapter assembly, retainer, and snap ring in jacket.

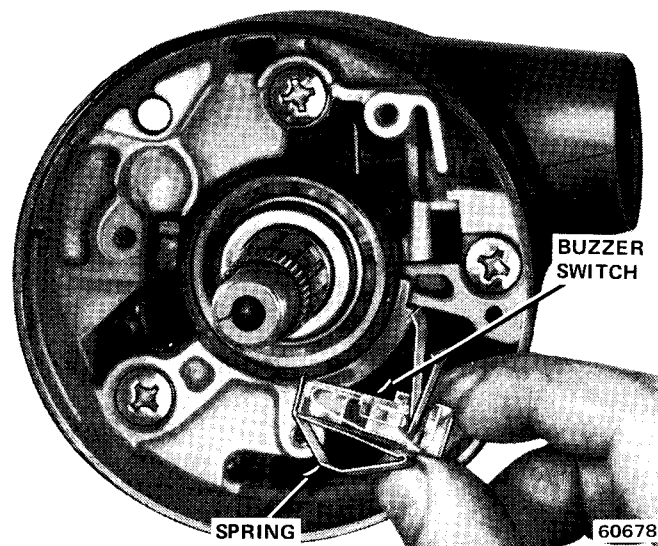
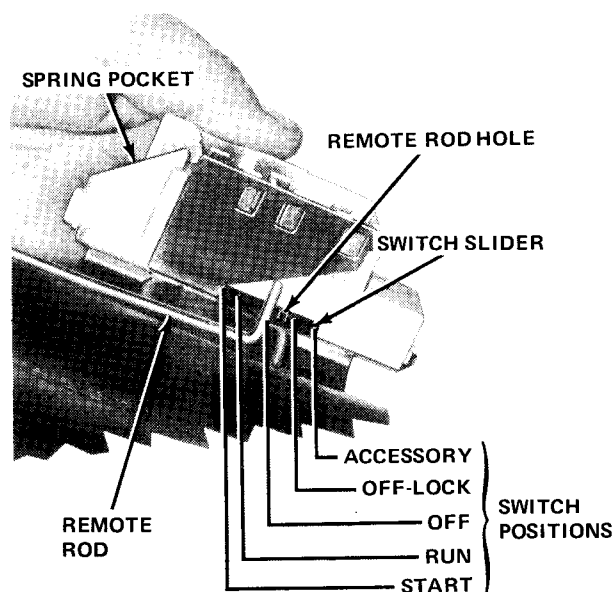


Fig. 11-24 Installing Buzzer Switch and Spring



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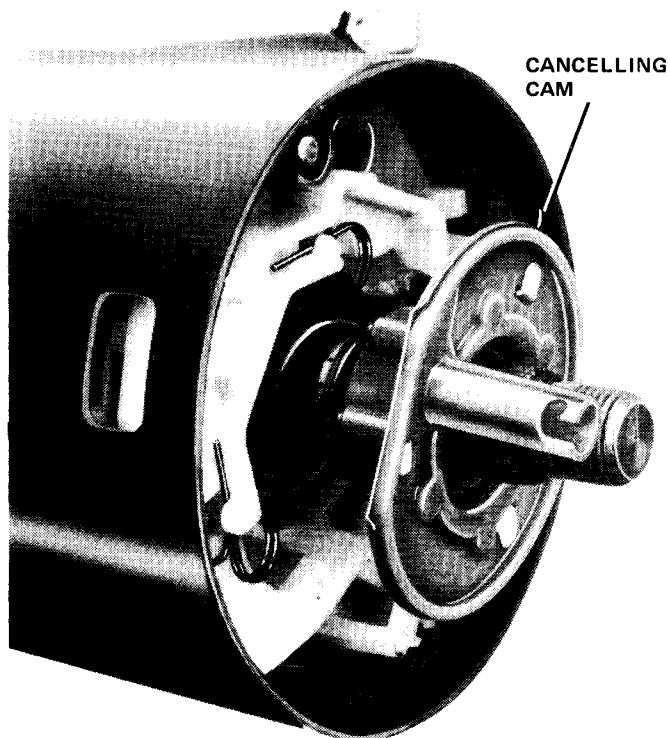
Fig. 11-25 Positioning Ignition Switch

(15) Install steering shaft through lower end of jacket and into upper bearing in housing.

(16) Install turn signal switch and wire harness. Bend wires against connector and feed connector through housing and shroud. Install signal switch and lever attaching screws. Install turn signal lever. Tighten screws to 35 inch-pounds torque.

(17) Install washer, upper bearing spring, and cancelling cam on steering shaft. Position cancelling cam as shown in figure 11-26.

(18) Place turn signal switch in neutral position and install hazard warning switch knob.

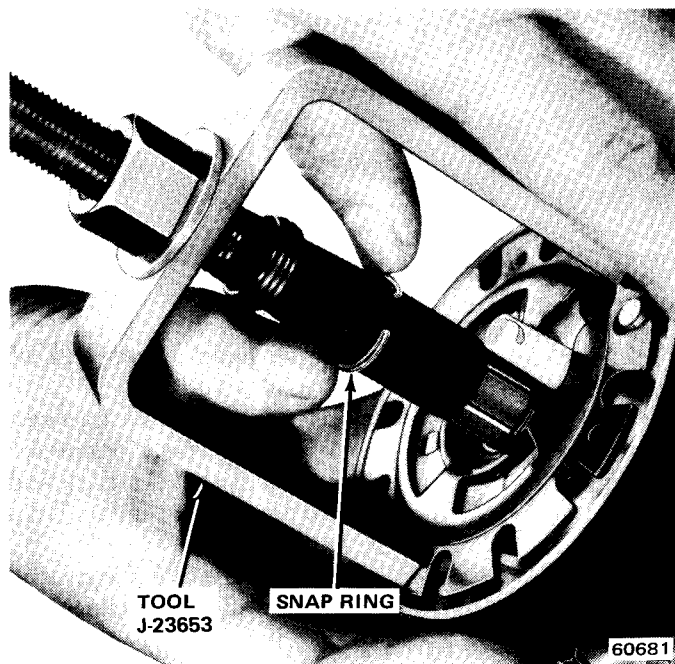


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Fig. 11-26 Positioning Cancelling Cam

(19) Install lock plate on steering shaft. Install snap ring on sleeve of Compressor Tool J-23653, thread sleeve onto end of steering shaft, compress lock plate, and install snap ring in groove of steering shaft (fig. 11-27).

(20) Install anti-theft cover. Tighten screws to 22 inch-pounds torque.



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Fig. 11-27 Installing Lock Plate and Snap Ring

(21) Remove Support Fixture Tool J-23074 and install column mounting bracket. Tighten screws to 22 foot-pounds torque.

(22) Install signal switch harness connector on mounting lugs of jacket.

(23) Install steering wheel. Tighten nut to 30 foot-pounds torque.

(24) Install steering column in vehicle (if removed).

(25) Connect battery negative cable.

STEERING COLUMN—AUTOMATIC TRANSMISSION

Disassembly—Upper Section

Column removal is not necessary if only the upper section is to be serviced. If the complete column or lower section is to be serviced, remove column, column mounting bracket, and install Support Fixture J-23074 to mount column in vise (fig. 11-4).

(1) Disconnect battery negative cable.

(2) Place front wheels in straight-ahead position.

(3) Remove column-to-instrument panel bezel and left air conditioning duct (if equipped).

(4) Cover painted areas of column.

(5) Remove steering wheel (fig. 11-1).

(6) Remove anti-theft cover (fig. 11-5). Do not unthread screws completely. They are secured to cover with plastic retainers.

(7) Compress lock plate using Compressor Tool J-23653 and unseat snap ring from groove in steering shaft (fig. 11-6).

WARNING: Lock plate is under strong spring tension.

(8) Remove compressor tool, snap ring, lock plate, cancelling cam, upper bearing preload spring, and thrust washer (fig. 11-28).

NOTE: Steering shaft is now free in column. If column is removed for bench overhaul, remove shaft from lower end of column. Do not let shaft fall out of column.

(9) Place turn signal switch lever in right turn position and remove lever.

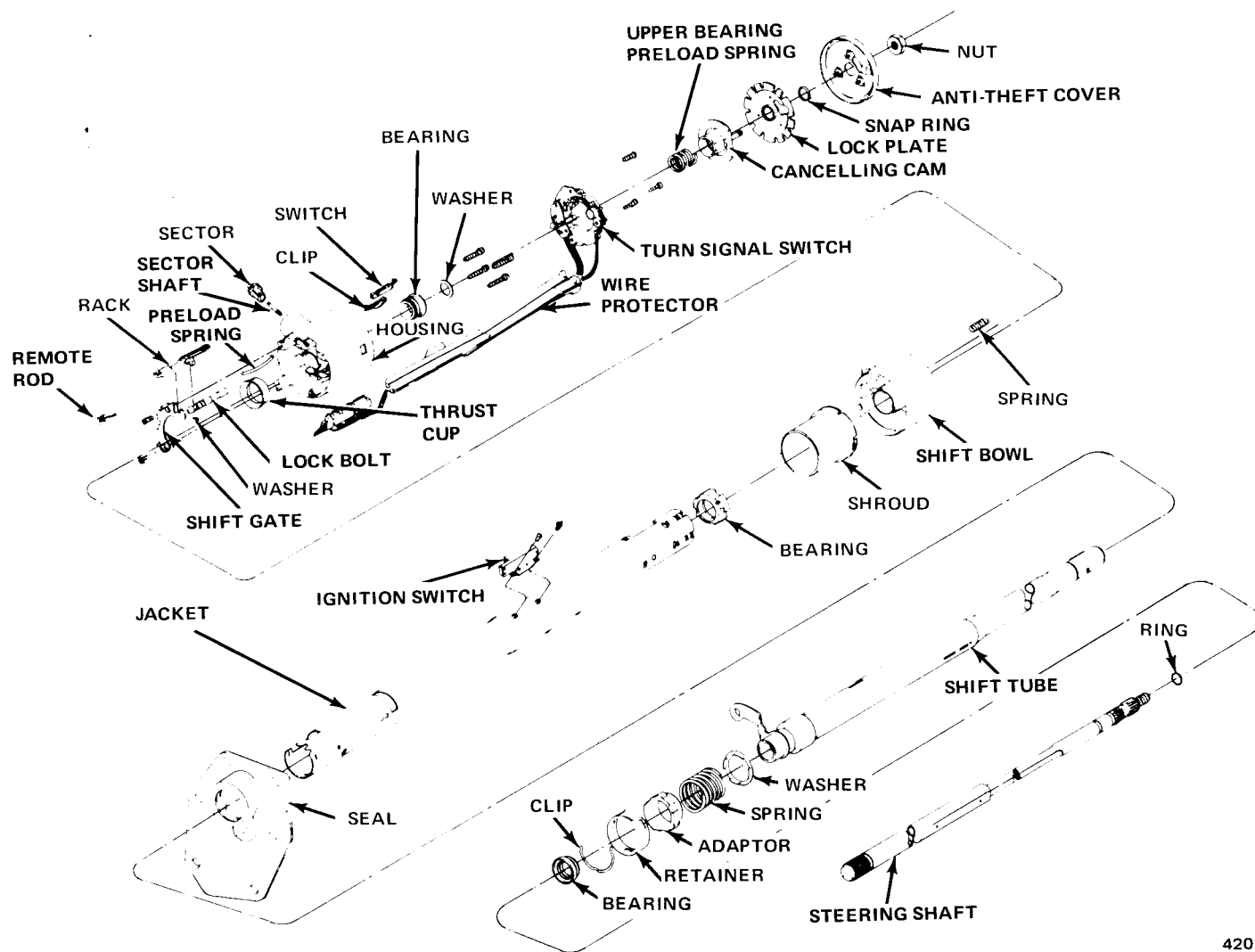
(10) Push inward on hazard warning switch knob and remove by unthreading knob in counterclockwise direction.

(11) Place gearshift lever in Park position. Remove lever by driving pivot pin out with punch.

(12) Unhook turn signal switch wire harness connector from jacket.

(13) Disconnect turn signal harness from instrument panel harness (fig. 11-7).

(14) Use stiff wire or paper clip to depress lock tab retaining shift quadrant light wire in connector block.



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Fig. 11-28 Steering Column—Automatic Transmission

(15) Remove lower column bracket and plastic harness protector from column jacket.

(16) Wrap piece of tape around upper harness connector to prevent snagging and remove harness (fig. 11-29).

(17) Place key in ON position and remove key warning buzzer contacts using wire hook (paper clip with right angle bend) or needlenose pliers (fig. 11-9).

CAUTION: Do not attempt to remove switch separately, as spring can fall into column.

(18) Place key in LOCK position, depress key cylinder retaining tab, and remove lock cylinder (fig. 11-10).

NOTE: If tab is not visible through slot, scrape or knock flashing from slot (fig. 11-10).

(19) Remove ignition switch from lower end of jacket.



Fig. 11-29 Signal Switch Harness Removal

(20) Remove four upper housing attaching screws and remove upper housing. Remote lock rod and automatic column shift quadrant light wire (if equipped) will be removed with upper housing.

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(21) Remove thrust cup from upper housing (fig. 11-30).

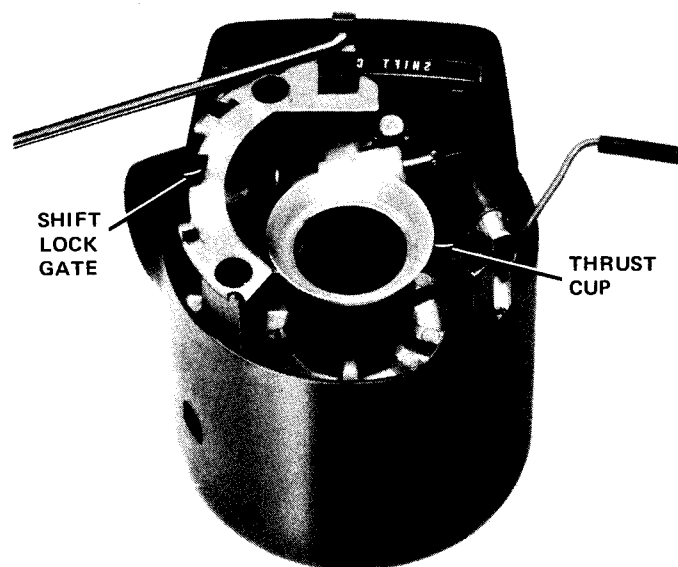
(22) Remove lock bolt and rack and remove rack preload spring (fig. 11-31).

(23) If sector gear requires service, note position of sector on shaft for assembly reference and remove by driving shaft out of lock cylinder hole with punch (fig. 11-17).

(24) Remove shift gate lock from upper housing. Examine shift gate lock detents for wear; replace if excessively worn.

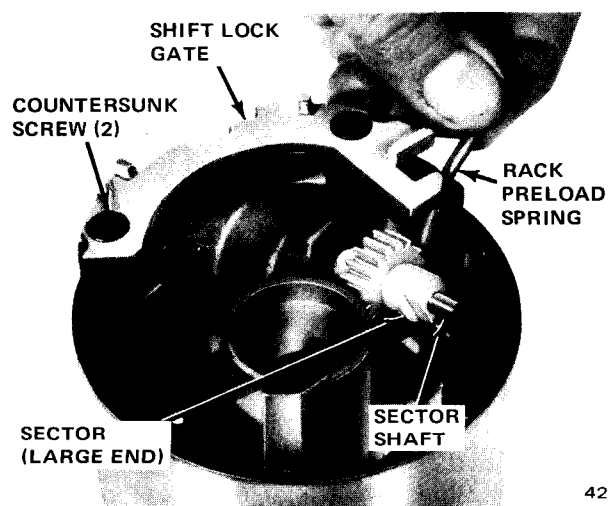
(25) Remove shift quadrant. Quadrant is retained by two clips which must be pried out with small punch (fig. 11-32).

(26) Remove shift quadrant light cover, remove screw which retains socket assembly, and remove assembly.



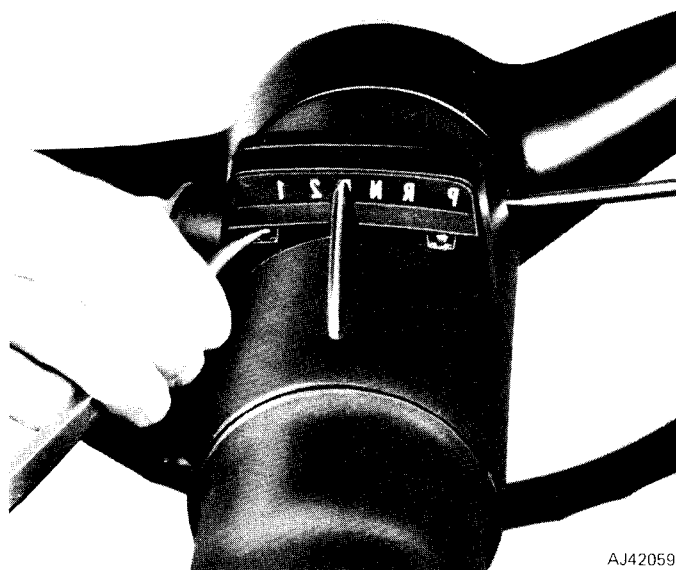
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Fig. 11-30 Thrust Cup Position



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Fig. 11-31 Housing Components



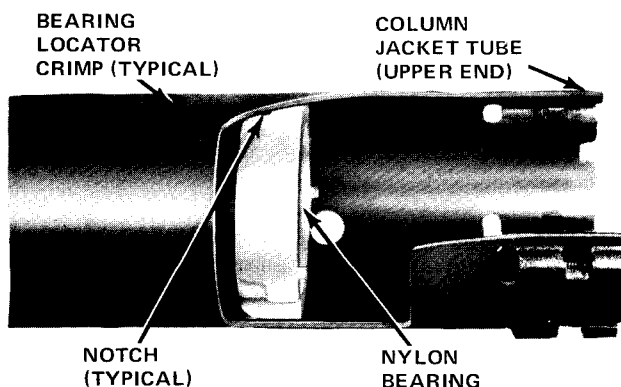
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Fig. 11-32 Retainer Clip Removal

(27) Remove shift bowl from column.

(28) Remove nylon lower bowl bearing from upper end of jacket tube (fig. 11-33).

NOTE: If lower section is also being disassembled, it is easier to remove nylon bearing after shift tube is removed.



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Fig. 11-33 Lower Bowl Bearing

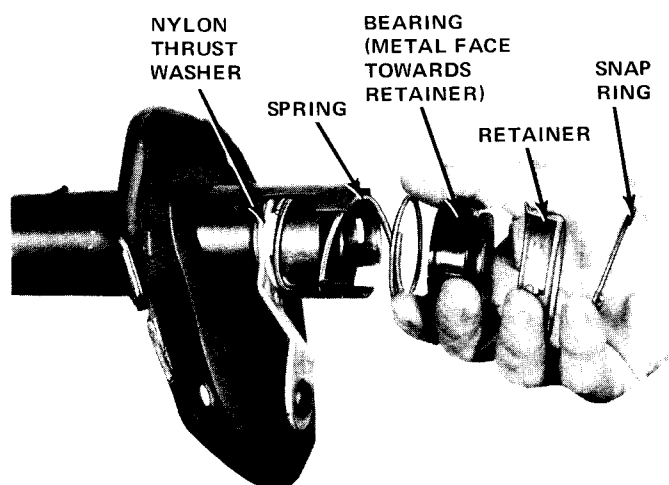
Disassembly—Lower Section

NOTE: The following steps require steering column removal.

(1) If lower section only is to be serviced, remove upper steering shaft snap ring, lock plate, turn signal switch, cancelling cam, upper bearing preload spring, and thrust washer as outlined in Disassembly—Upper Section. Further disassembly of upper section is not required.

- (2) Remove steering shaft from lower end of jacket.
- (3) Remove lower bearing retainer ring, lower bearing preload spring, and nylon washer (fig. 11-34).
- (4) Remove neutral safety and backup lamp switch.
- (5) Remove shift tube bearing retaining screws.
- (6) Remove shift tube.

NOTE: If nylon shift tube bearing was not removed during upper section disassembly, remove it at this time.



NOTE: FLOOR SHIFT STEERING COLUMNS HAVE NO THRUST WASHER OR SPRING

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Assembly—Lower Section

Apply multipurpose grease to all friction and bearing surfaces during assembly.

- (1) Install shift tube.
- (2) Install nylon thrust washer in lower end of shift tube with flat side of bearing toward top end of tube (fig. 11-34).
- (3) Install preload spring, lower bearing (with metal face toward retainer), bearing retainer, and locking.
- (4) Install neutral safety and backup lamp switch.

NOTE: If complete column overhaul is being performed, continue with Upper Section Assembly. Otherwise, install steering shaft, upper bearing thrust washer and preload spring, upper bearing, turn signal switch, canceling cam, lock plate, and snap ring as outlined in Assembly—Upper Section.

Assembly—Upper Section

- (1) Install nylon lower bowl bearing in upper end of jacket.

NOTE: Bearing must be installed with smaller inside diameter toward lower end of jacket, and bearing notches must engage three locator crimps in column (fig. 11-33).

- (2) Align shift bowl with shift tube spline and install bowl.
- (3) Install rack preload spring in upper housing (fig. 11-31).
- (4) Position large end of sector on sector shaft and press into place (fig. 11-18).
- (5) Install shift lock gate using two countersunk screws (fig. 11-31). Tighten screws to 45 inch-pounds torque.
- (6) Install shift quadrant lamp and install lamp cover.
- (7) Install shift quadrant indicator and press retainer clips into place with flat side toward bowl.
- (8) Assemble lock bolt and rack (fig. 11-19) and install in shift bowl (fig. 11-35).

NOTE: Block tooth of rack must engage block tooth of sector (fig. 11-19 and 11-20).

- (9) Install nylon thrust cup in upper housing with flared end facing out (fig. 11-30).

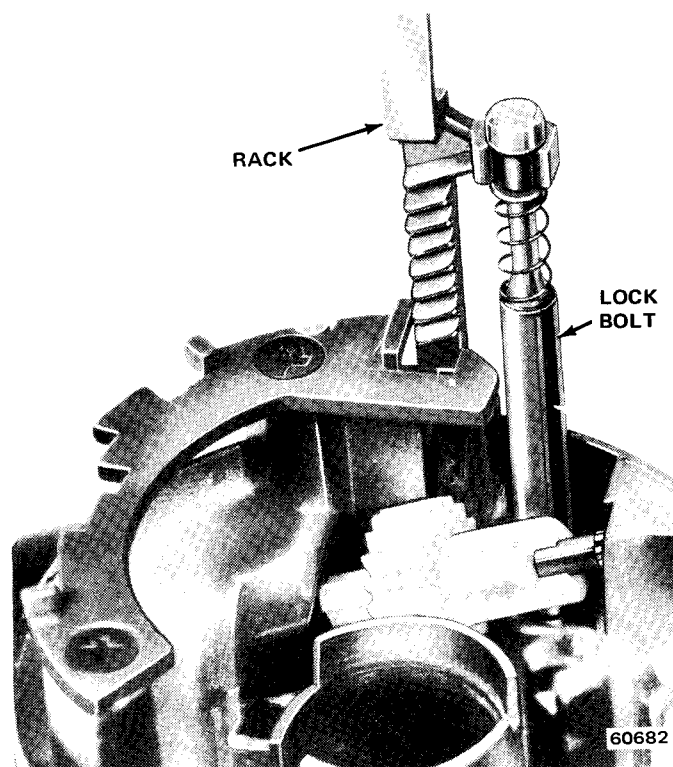


Fig. 11-35 Installing Rack and Lock Bolt

(10) Rotate shift bowl counterclockwise to stop and install upper housing. Tighten housing attaching screws to 60 inch-pounds torque.

NOTE: Shift bowl should be in Park position and the rack pulled downward.

(11) Guide shift quadrant lamp wire and remote lock rod into position between shift bowl and jacket.

(12) Assemble buzzer switch and spring. Install buzzer switch with brass tabs pointing upward toward shift indicator (fig. 11-24).

(13) Install turn signal switch assembly. Guide wire harness into position and carefully align switch assembly.

(14) Untape turn signal switch wire harness connector, assemble wires in protector and protector-to-column jacket, and install switch retaining screws. Be sure actuating lever pivot is correctly aligned and seated in upper housing pivot boss before installing retaining screws.

(15) Install turn signal lever and actuate turn signal switch to check operation.

(16) Install steering shaft.

(17) Install thrust washer, spring, and canceling cam on upper end of steering shaft.

(18) Align lock plate splines with steering shaft splines and place lock plate in position, with canceling cam shaft protruding through dogleg opening in lock plate (fig. 11-36).

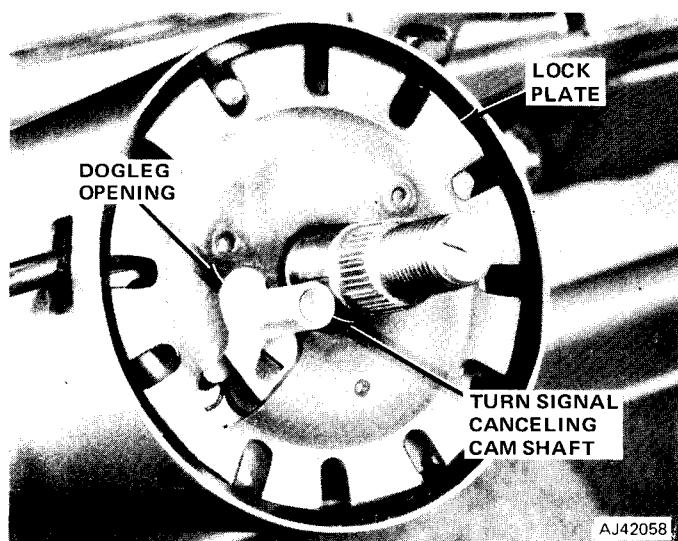


Fig. 11-36 Cancelling Cam and Lock Plate Position

(19) Place steering shaft snap ring on sleeve of Lock Plate Compressor Tool J-23653 (fig. 11-27).

(20) Install tool on steering shaft, compress lock plate, and push snap ring into place.

(21) Remove tool.

(22) Install anti-theft cover.

(23) Align canceling cam, index marks on steering shaft and steering wheel, and install steering wheel. Tighten steering wheel nut to 20 foot-pounds torque.

(24) Install hazard warning light switch knob and steering wheel trim cover.

(25) Install shift lever.

(26) Install key lock cylinder.

(27) Install ignition switch. Place shift bowl in any position except Park and rotate bowl counterclockwise until rack bottoms against lower surface of bowl. Place ignition switch in Off-Unlocked position as follows (fig. 11-27):

(a) Move switch slider to left (Accessory position).

(b) Move slider two positions to right to Off-Unlock position.

(c) Insert remote rod into slider hole and attach ignition switch to jacket. Tighten screws to 35 inch-pounds torque.

(d) Move switch out of Off-Unlock position when attaching switch to jacket.

(28) Adjust neutral safety and backup lamp switch.

(29) Install lower finish panel, air conditioning duct (if equipped), and column-to-instrument panel bezel.

(30) Remove protective wrapping from painted areas of column.

(31) Connect battery negative cable.

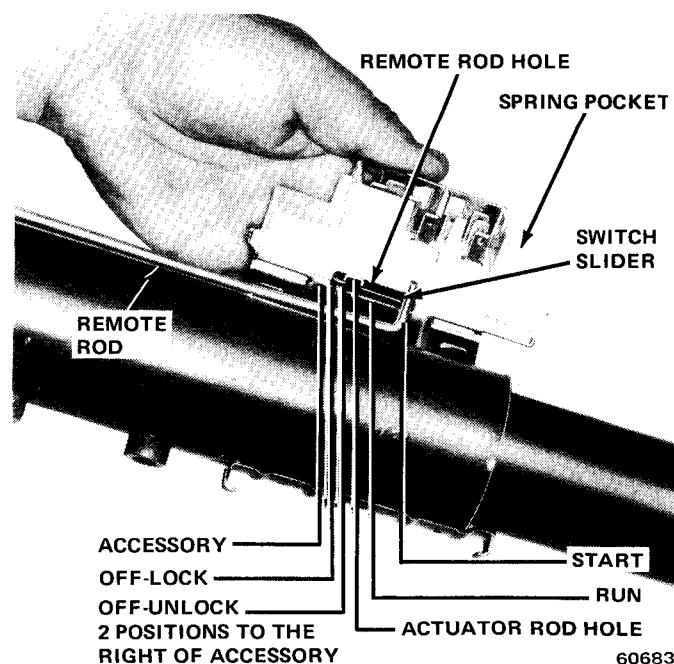


Fig. 11-37 Positioning Ignition Switch

ADJUST-O-TILT STEERING COLUMN

Disassembly—Upper Section

NOTE: Although it is possible to disassemble column down to the upper housing without column removal, the column must be removed if disassembly is to be more extensive. Use Steering Column Support Fixture J-23074 to mount column assembly in a vise (fig. 11-4).

- (1) Disconnect battery negative cable.
- (2) Cover painted areas of column.
- (3) Remove steering wheel.
- (4) Remove gearshift lever retaining pin and shift lever (if equipped).
- (5) Loosen anti-theft cover screws and lift cover from column. Do not remove screws completely. They are held on cover by plastic retainers.
- (6) Compress lock plate using Lock Plate Compressor Tool J-23653, and remove round wire snap ring from steering shaft groove (fig. 11-6).

WARNING: Lock plate is under strong spring pressure.

- (7) Remove lock plate compressor tool, snap ring, lock plate, cancelling cam, upper bearing preload spring, bearing race seat, and bearing race.
- (8) Place turn signal switch in right turn position and remove lever.
- (9) Press hazard warning light switch knob inward and remove by turning counterclockwise.
- (10) Remove turn signal wire harness connector from mounting bracket on lower right side of jacket.
- (11) Loosen toeboard bolts.
- (12) Remove support-bracket-to-jacket screws.
- (13) Remove support-bracket-to-instrument panel attaching nuts and remove bracket.
- (14) Remove turn signal harness plastic protector from jacket.
- (15) Wrap tape around harness connector to prevent snagging, and remove harness (fig. 11-29).
- (16) Remove turn signal switch retaining screws and remove switch and wire harness.
- (17) With key in ON position, remove key warning buzzer contacts using wire hook (paper clip with right angle bend), or needlenose pliers (fig. 11-9).

NOTE: Do not attempt to remove switch separately, as spring can fall into column.

- (18) Place key lock in LOCK position.
- (19) Press lock cylinder retaining tab and remove lock cylinder (fig. 11-10).

NOTE: If tab is not visible through slot, remove flashing from slot.

- (20) Remove shift quadrant.

NOTE: Quadrant is retained by a spring clip which may be removed with long-nose pliers (fig. 11-32).

- (21) Remove shift quadrant mounting bracket and light socket (if equipped).
- (22) Remove tilt release handle.
- (23) Remove three upper cover retaining screws.
- (24) Tap upper cover from column.
- (25) Remove lock sector tension spring retaining screw and remove spring.

NOTE: Spring must be unhooked from lock bolt.

- (26) Remove snap ring from lock sector shaft and remove sector, shaft, and lockpin.
- (27) Install tilt release handle and place upper housing in full upward tilt position.
- (28) Insert screwdriver in tilt spring retainer slot.
- (29) Depress retainer approximately 3/16 inch, rotate 1/8-turn counterclockwise and remove retainer and spring.

WARNING: Tilt spring is under strong spring tension.

- (30) Place upper housing in straight position.
- (31) Remove two pivot pins using Pivot Pin Remover Tool J-38854-1 (fig. 11-38).
- (32) Lift tilt release handle to disengage lock shoes and remove bearing housing assembly.
- (33) Remove tilt release lever.

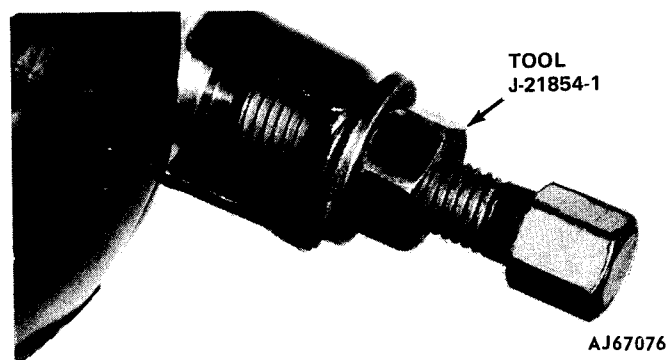


Fig. 11-38 Pivot Pin Removal

- (34) If lock shoes, release lever, or springs are to be serviced, remove release lever pin and lock shoe pin with a punch or Pin Remover and Installer Tool J-22635. Hold lock shoe springs in compression to relieve load on pins (fig. 11-39 and -40).

(35) Disconnect steering shaft at intermediate shaft. Remove steering shaft from top of column. Shaft is disassembled by folding it 90° (fig. 11-41).

- (36) Remove ignition switch.
- (37) Remove neutral safety and backup switch.

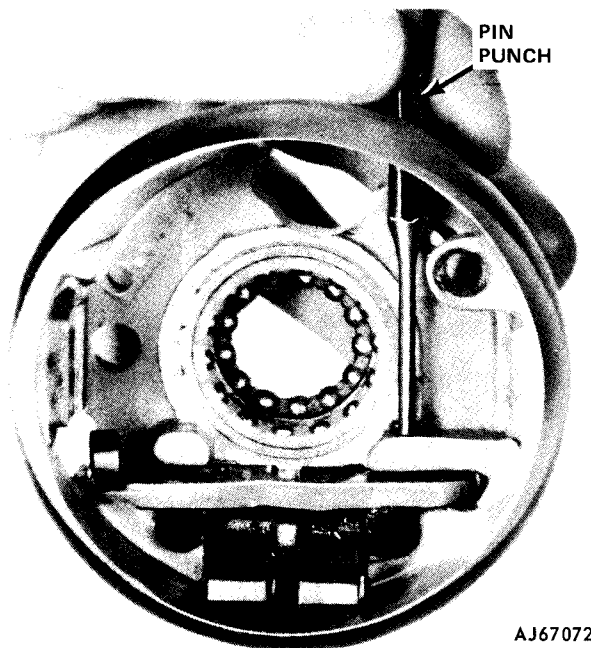


Fig. 11-39 Release Lever Pin Removal

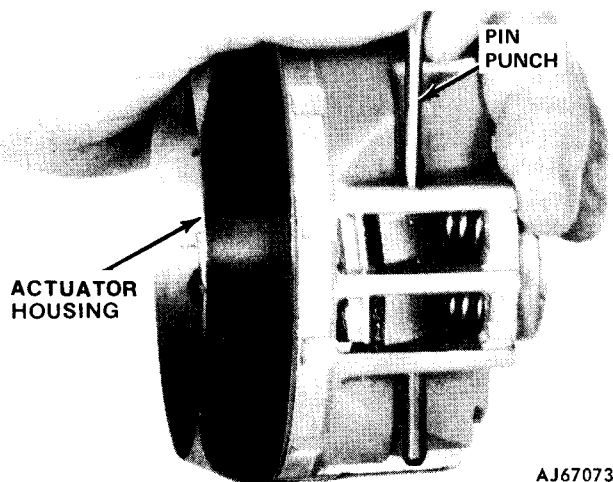


Fig. 11-40 Lock Shoe Pin Removal

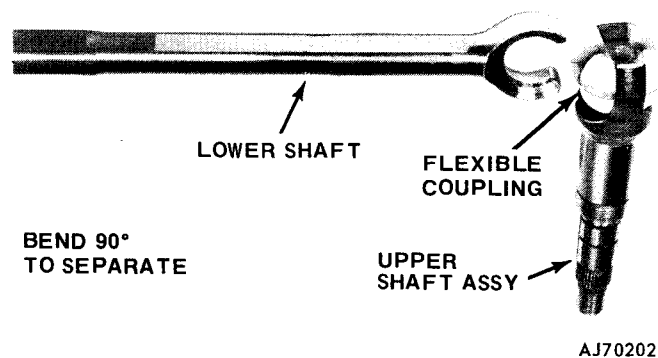


Fig. 11-41 Flexible Joint

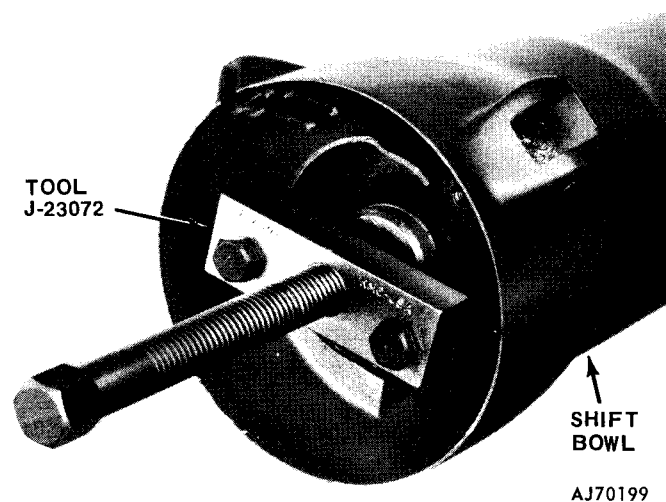


Fig. 11-42 Shift Tube Removal

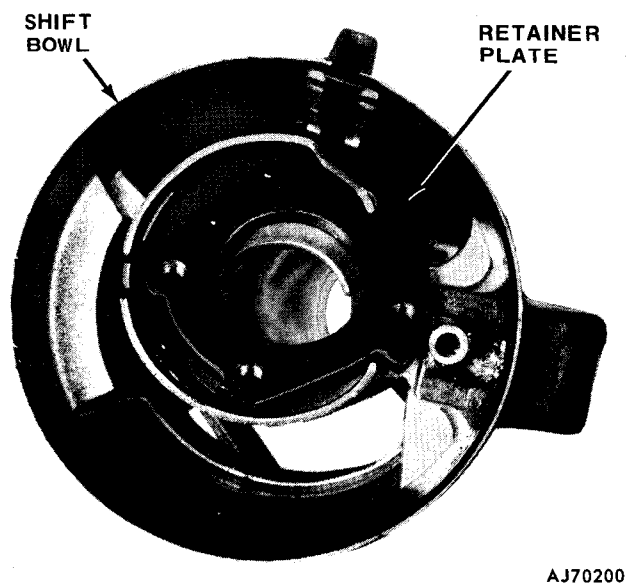
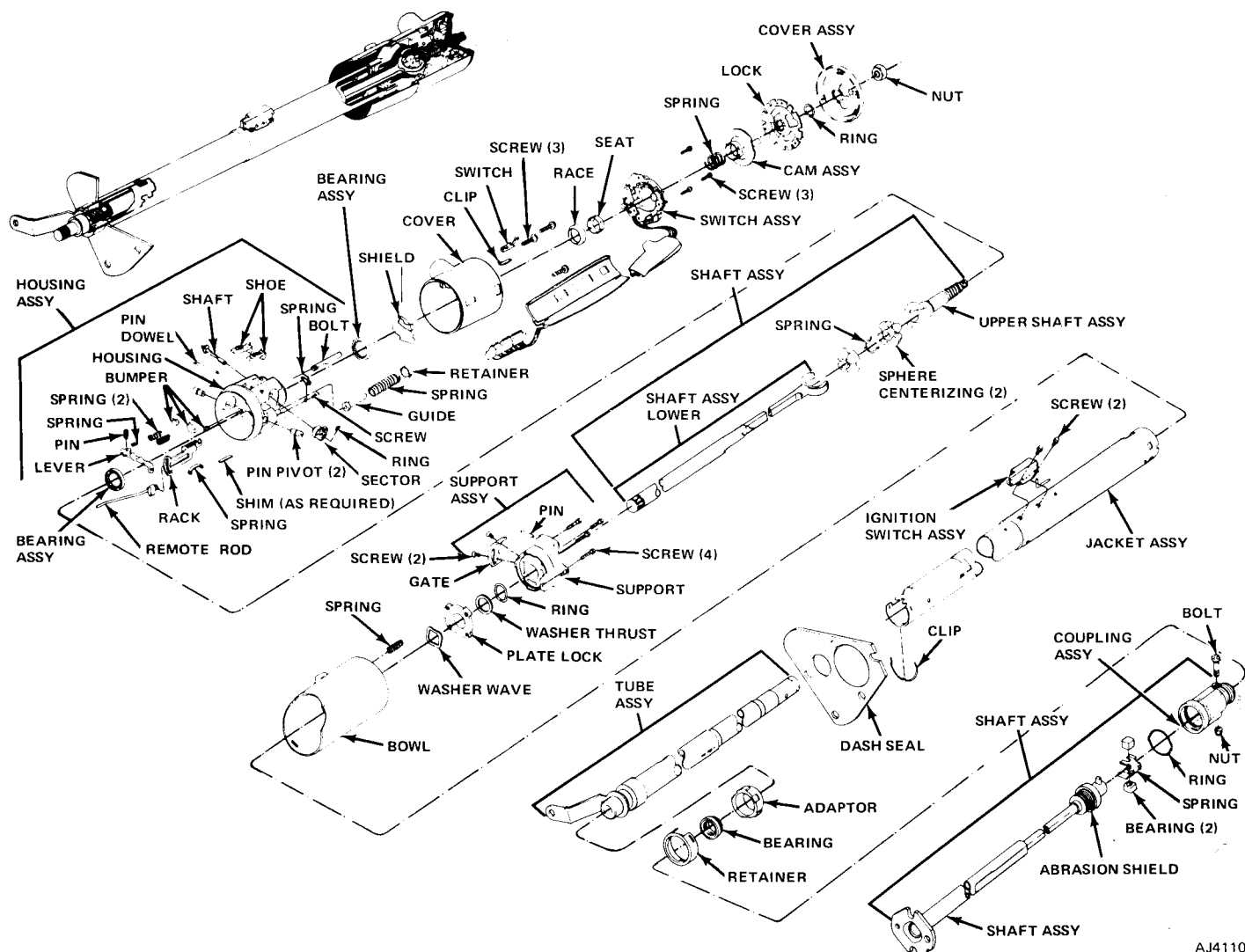


Fig. 11-43 Retainer Plate Removal

- (38) Remove lock rack and rod.
- (39) Remove lower bearing retainer snap ring, retainer, bearing, and adapter.
- (40) Remove upper support attaching screws and upper support. Remove shift gate pin and shift gate.
- (41) Remove shift tube retainer ring and thrust washer.
- (42) Remove shift tube using Shift Tube Remover Tool J-23072 (fig. 11-42).
- (43) Remove retainer plate by rotating shift bowl clockwise, sliding plate out of jacket notches, tipping it down toward shift bowl hub at 12 o'clock position and removing bottom side of plate first (fig. 11-43).
- (44) Remove wave washer, tube spring, and shift bowl from column.



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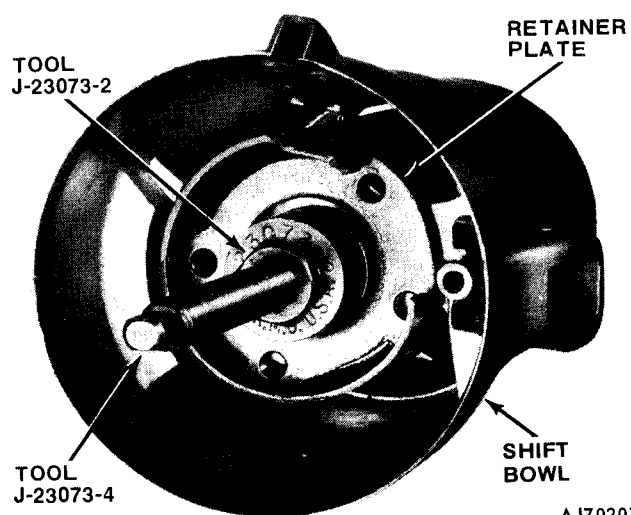
Fig. 11-44 Adjust-O-Tilt Steering Column

Disassembly and Assembly—Lower Section

For assembly and disassembly of lower section of Adjust-O-Tilt Column, refer to procedures outlined in Lower Section Disassembly and Assembly, Manual and Automatic Transmission Steering Columns.

Upper Section Assembly

- (1) Apply thin coat of multipurpose grease to all friction surfaces.
- (2) Mount shift bowl on column.
- (3) Install wave washer and retainer plate in column.
- (4) Install shift tube in lower end of jacket. Align spline on tube with keyway in shift bowl.
- (5) Insert Shift Tube Installer Tool J-23073-2 and -4 into shift tube (fig. 11-45). Spring-loaded lower foot must engage tube inner shoulder and guide should seat in tube. Tighten spring tension nut to snug fit.



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Fig. 11-45 Shift Tube Installer Seated in Tube

(6) Place Receiver Tool J-23073-3 and -4 over puller stud and tighten puller nut to pull tube into bowl (fig. 11-46).

(7) Install shift tube thrust washer and shift tube retainer snap ring.

(8) Install lower bearing (with metal face toward retainer), retainer, and snap ring.

(9) Install pin and shift gate on upper support and install upper support. Align V-notch in support with notch in column (located at 9 o'clock position).

(10) Install four retaining screws.

(11) Assemble steering shaft and install in column.

(12) Place bearings (14 balls each) in upper housing (if removed).

(13) Install tilt handle.

(14) Insert ignition switch remote rod between shift bowl and mast jacket and into guide channel in left side of upper support.

(15) Place lock rack on remote rod (fig. 11-47).

(16) Guide upper housing over steering shaft and lock rack. Align lock shoes with teeth in upper support.

(17) Align upper housing and upper support pivot pin holes and install pivot pins using fiber mallet or brass drift.

(18) Install lock shoes, lock shoe springs, tilt bumpers, and lockpin in upper housing.

(19) Install lock sector and sector shaft. Large tooth on sector must engage large slot in lock rack. Install sector shaft retaining snap ring.

(20) Hook lock sector tension spring on lockpin, engage sector, and install spring retaining screw (fig. 11-48).

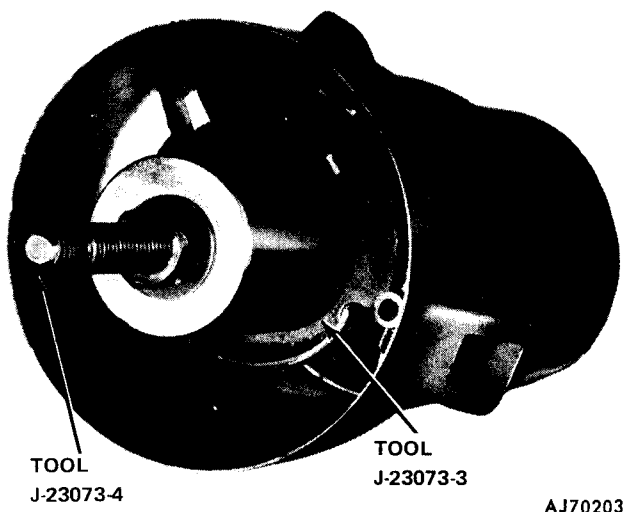


Fig. 11-46 Pulling Shift Tube into Bowl

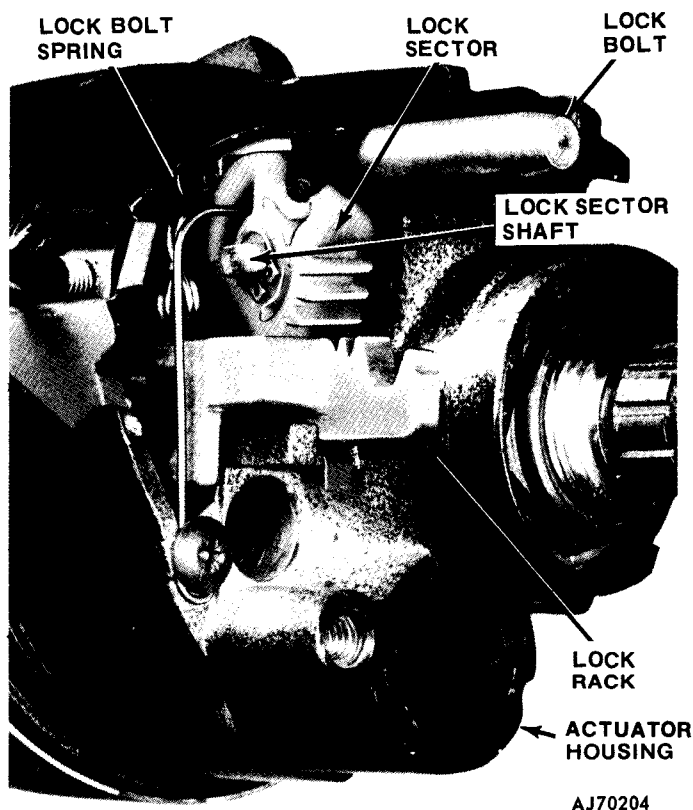


Fig. 11-48 Position of Lock Sector Tension Spring

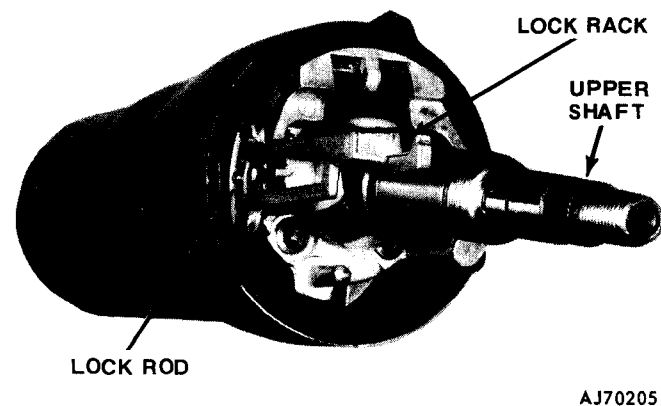


Fig. 11-47 Lock Rack and Remote Rod Position

(21) Place upper housing in full upward tilt position and install tilt spring and seat. Press spring retainer approximately 3/16 inch into housing. Rotate retainer approximately 1/8-turn clockwise to secure spring. Place housing in center tilt position and remove tilt handle.

(22) Install upper housing cover and install three retaining screws.

(23) Install key warning buzzer switch and tension spring. Buzzer switch brass contact should point upward, toward shift indicator.

(24) Guide shift quadrant light wire up through upper housing and down between shift bowl and mast jacket.

(25) Install shift quadrant mounting bracket and attach light socket.

(26) Hook base of shift quadrant over tabs on left side of retainer and place in position.

(27) Install shift pointer into bowl and engage with quadrant.

(28) Install quadrant retainer clip with flat side of clip facing down.

(29) Install tilt release handle.

(30) Install turn signal switch assembly. Guide wire harness between cover and mast jacket and carefully align switch assembly.

(31) Untape connector, assemble wires into protector and protector-to-column jacket, and install switch retaining screws. Assure that actuating lever pivot is correctly aligned and seated in upper housing pivot boss prior to installing retaining screws.

(32) Install column-to-instrument panel bracket and tighten toeboard bolts.

(33) Install turn signal switch lever and actuate switch to check operation.

(34) Install upper bearing race, bearing race seat, preload spring, and canceling cam on steering shaft.

(35) Align lock plate splines with steering shaft splines and install lock plate. Turn signal switch

canceling cam shaft should protrude through dogleg opening in lock plate (fig. 11-36).

(36) Place steering shaft snap ring on Lock Plate Compressor Tool J-23653. Install tool on steering shaft. Compress lock plate and push snap ring into place (fig. 11-27).

(37) Connect steering shaft to intermediate shaft.

(38) guide gear shift lever over tension spring and into shift bowl. Align pivot pin holes with pin punch. Drive pivot pin through lever with a fiber mallet or brass drift.

(39) Install key lock cylinder.

(40) Hold lock cylinder sleeve and rotate cylinder clockwise against stop. Insert cylinder into housing with key on cylinder sleeve aligned with housing keyway. Lightly push cylinder against sector and rotate cylinder counterclockwise until cylinder engages sector. Push in until cylinder retainer tab snaps into place and cylinder is secured.

(41) Install steering wheel.

(42) Adjust shift linkage and neutral safety and backup lamp switch.

(43) Install lower finish panel and air conditioning duct (if equipped). Install steering column-to-instrument panel bezel.

(44) Remove protection from painted column areas.

(45) Connect battery negative cable.

MANUAL STEERING GEAR

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LEFT-HAND DRIVE VEHICLES

Removal

(1) Disconnect steering gear from lower steering shaft by removing bolt and nut attaching coupling to wormshaft.

(2) Disconnect steering arm from connecting rod using Tool J-6632.

(3) Remove upper steering gear-to-frame bracket bolt.

(4) Remove two lower steering gear-to-frame bracket bolts and remove steering gear.

Disassembly

(1) Rotate wormshaft until at center of travel. Mark on shaft, beneath double spline, should be

centered between top and bottom of shaft when looking at shaft from side cover side (fig. 11-49).

(2) Remove adjuster locknut.

(3) Remove side cover bolts and lockwashers and turn lash adjuster screw clockwise to force side cover from housing. Remove side cover and gasket (fig. 11-50).

(4) Remove adjuster screw and shim from T-slot in pitman shaft. Keep shim with screw.

(5) Remove pitman shaft from housing. Do not damage seal in housing with pitman shaft splines or threads. If necessary, tap lightly to remove shaft.

(6) Remove worm adjuster nut, remove worm adjuster, and lower worm bearing.



Service Diagnosis

Condition	Possible Cause	Correction
HARD STEERING	(1) Incorrect tire pressure.	(1) Adjust.
	(2) Lack of lubrication.	(2) Lubricate steering linkage.
	(3) Tie rod ends worn.	(3) Replace.
	(4) Drag link ball joints tight.	(4) Adjust.
	(5) Steering gear parts worn.	(5) Replace.
	(6) Frozen steering shaft bearings.	(6) Replace bearings.
	(7) Lower coupling flange rubbing against steering shaft.	(7) Loosen bolt and assemble properly.
	(8) Steering gear adjusted incorrectly.	(8) Check adjustment. Disconnect pitman arm from gear or disconnect linkage from pitman arm and adjust gear if necessary.
	(9) Front spring sagged.	(9) Check front end jounce height. It should be approximately the same at both wheels. Replace front springs if sagged.
	(10) Frame bent or broken.	(10) Repair frame as necessary.
	(11) Steering knuckle bent.	(11) Install new knuckle.
	(12) Ball joint galled or too tight.	(12) Replace ball joint.
	(13) Steering knuckle ball studs binding.	(13) Reset studs.
	(14) Steering gear or connections binding.	(14) Test steering system with wheels off floor. Adjust and lubricate.
LOOSE STEERING	(1) Tie rod ends worn.	(1) Replace.
	(2) Drag link ball sockets worn.	(2) Replace.
	(3) Steering gear parts worn.	(3) Replace.
	(4) Steering gear improperly adjusted.	(4) Adjust.
EXCESSIVE ROAD SHOCK	(1) Axle clip loose.	(1) Repair as necessary.
	(2) Wheel bearings loose.	(2) Repair as necessary.
	(3) Shock absorbers worn.	(3) Replace.

Service Diagnosis (Continued)

Condition	Possible Cause	Correction
TURNING RADIUS SHORT ONE SIDE	(1) Center bolt in spring sheared off. (2) Axle shifted. (3) Steering arm bent.	(1) Repair as necessary. (2) Repair as necessary. (3) Replace.

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(7) If bearing is damaged, pry retainer out with screwdriver. Remove bearing from worm adjuster.

(8) Remove assembled wormshaft, ball nut, and upper worm bearing from housing (fig. 11-51). Do not

allow ball nut to rotate freely to end of worm travel; this could damage ball return guides. Do not damage oil seal with wormshaft splines.

(9) Remove upper bearing from shaft.

(10) If oil seals are damaged, pry them out of housing.

(11) Remove three screws attaching clamp to ball nut and remove ball guides from nut.

(12) Turn ball nut over and rotate wormshaft back and forth until all balls drop out on clean cloth (50 balls).

(13) Remove ball nut from shaft.

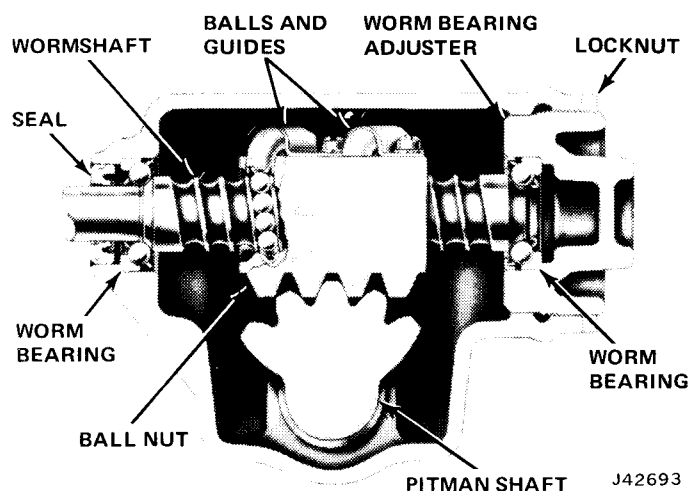


Fig. 11-49 Cross-Section of Steering Gear

Inspection

Wash all parts in clean solvent and wipe dry with a clean cloth.

Inspect bearing cups in worm adjuster and in housing. If damaged, remove them using Wormshaft Bearing Cup Remover Tool J-5754 and Slide Hammer J-2619 (fig. 11-52).

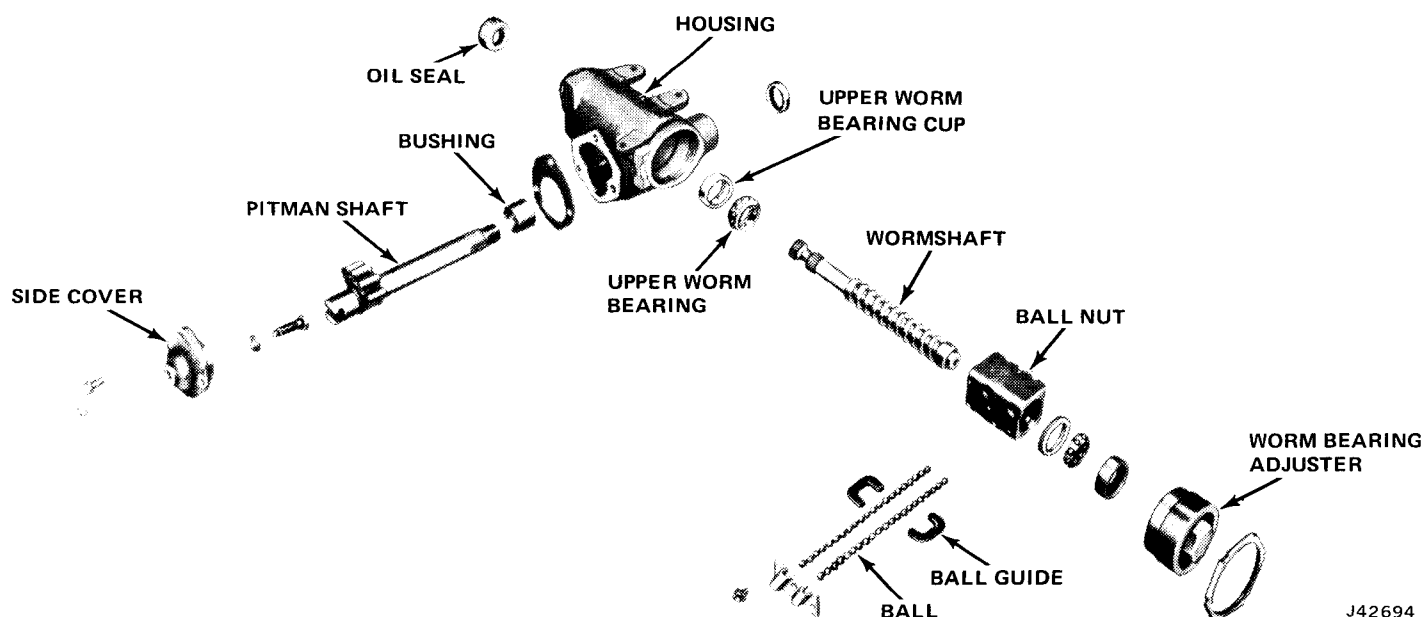


Fig. 11-50 Left-Hand Drive Manual Steering Gear

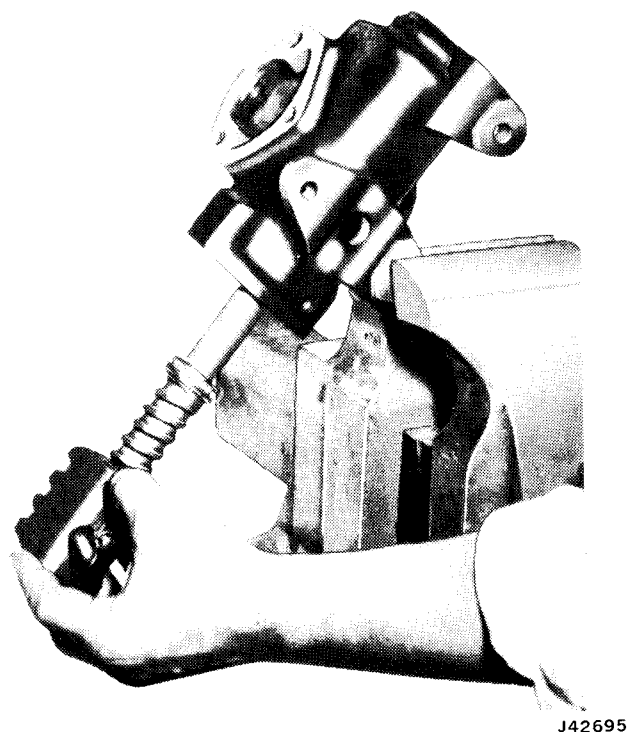


Fig. 11-51 Wormshaft and Ball Nut Removal

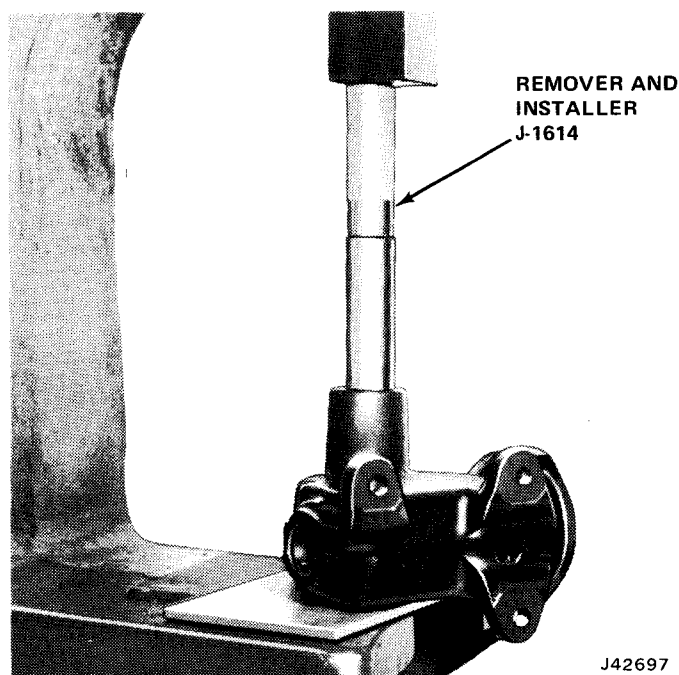


Fig. 11-53 Pitman Shaft Bushing Removal

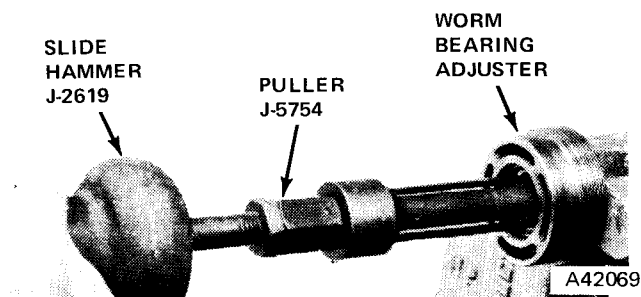


Fig. 11-52 Wormshaft Bearing Cup Removal

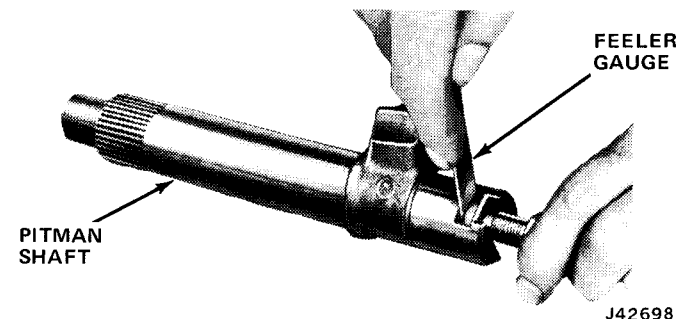


Fig. 11-54 Checking Lash Adjuster End Play

Inspect wormshaft, particularly in area near worm for pitting, grooving, or other damage; replace if damaged.

Inspect bushings for pitman shaft in housing and in side cover. If bushing in housing is damaged, drive bushing into housing with Remover and Installer Tool J-1614 (fig. 11-53). If bushing in side cover is damaged, replace side cover and bushing assembly.

Inspect teeth of ball nut and pitman shaft for pitting and heavy scoring. Replace ball nut or pitman shaft if pitted or scored.

Inspect ball guides, balls, and clamp for damage; if damaged, install new ball kit.

Check fit of lash adjuster screw and shim in T-slot of pitman arm (fig. 11-54).

Lash adjuster screw must be free to turn, and end play should not exceed 0.002 inch. If end play exceeds

this limit, change shim thickness to obtain correct end play. A lash adjuster shim kit is available for this purpose.

Assembly

NOTE: Lubricate all parts before assembly. Use special lubricant, Jeep part number 940657, or equivalent.

(1) Position ball nut on wormshaft so deep side teeth will be toward side cover when shaft is installed in housing.

(2) Install 20 balls in each circuit. Rock wormshaft back and forth to aid in installation. Use punch to install balls (fig. 11-55).

(3) Install ball guides in ball nut (fig. 11-56). Hold them in place with fingers and install 5 more balls in each circuit through hole in top of ball guide.

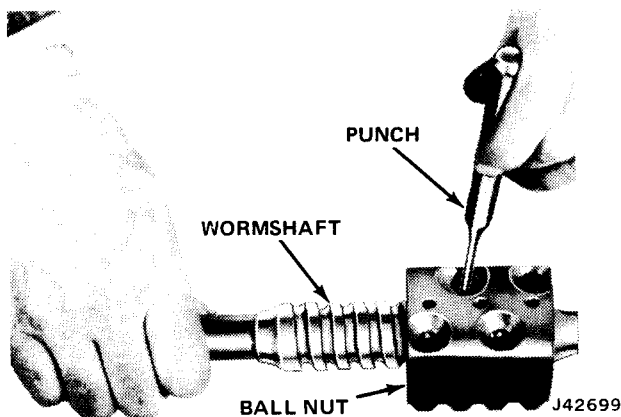


Fig. 11-55 Filling Ball Circuits

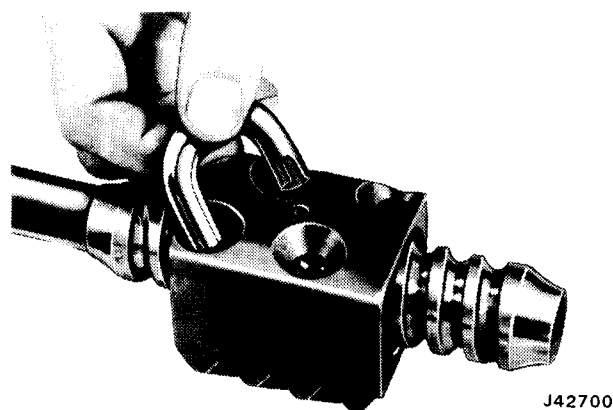


Fig. 11-56 Installing Ball Guides

(4) Install clamp over two ball guides and install attaching bolts and washers.

(5) Rotate worm through complete travel several times to be sure balls are installed correctly and rotate freely. Do not allow ball nut to bottom at end of worm travel; this could damage ball return guides.

(6) If bearing cups were removed from worm adjuster or housing, press in new bearing cup, using Wormshaft Bearing Cup Installer J-5755 (fig. 11-57).

(7) Install upper worm bearing on upper part of wormshaft and center ball nut on worm.

(8) Install assembly in housing with bearing seated in bearing cup.

(9) If bearing was removed from worm adjuster, install a new bearing and retainer in worm adjuster.

(10) Install adjuster in bottom of housing. Seat wormshaft in lower bearing in adjuster.

(11) Install bearing adjuster locknut, but do not tighten. Turn wormshaft until center tooth space of ball nut is centered in opening for side cover. Install correct shim, and lash adjuster screw in T-slot of pitman shaft.

(12) Install pitman shaft in housing, meshing center tooth of sector gear on shaft with center tooth space of ball nut.

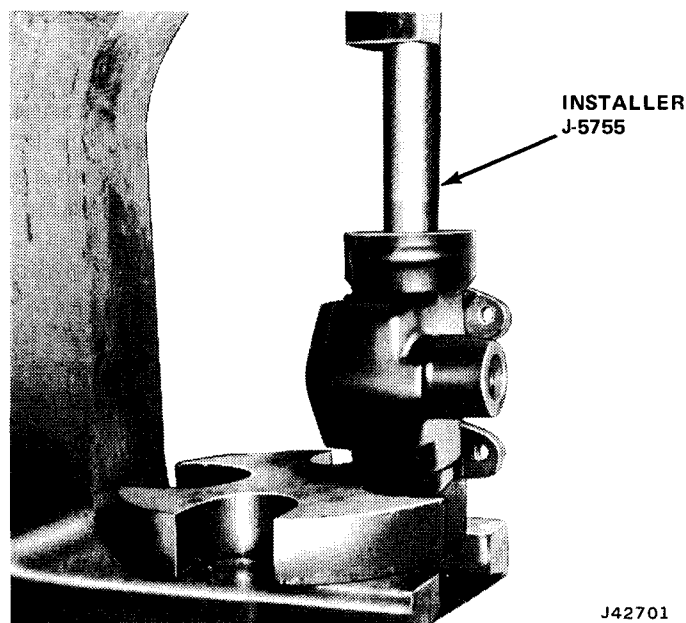


Fig. 11-57 Pressing in Bearing Cup

(13) Install gasket and side cover on housing; turn lash adjuster screw in threaded opening of side cover but do not tighten.

(14) Install side cover attaching bolts and lockwashers. Tighten bolts to 30 foot-pounds torque. Install nut on lash adjuster screw hand-tight.

(15) If pitman shaft oil seal was removed, use Pitman Shaft Oil Seal Protector J-5787 and Pitman Shaft Oil Seal Installer J-7171 to install oil seal in housing over pitman shaft threads and splines.

(16) If wormshaft oil seal was removed, use Wormshaft Upper Oil Seal Installer J-7017 to install oil seal in housing.

(17) Fill steering gear with 11 ounces of lubricant, Jeep part no. 940657, and adjust steering gear over-center and worm bearing preload torque.

Adjustments

NOTE: Worm bearing adjustment should always precede each adjustment of steering gear.

Worm Bearing Preload Adjustment

(1) Attach Torque Wrench J-7754 to splined end of wormshaft and turn shaft to either extreme left or right position. Do not hit travel stops.

(2) Tighten worm bearing adjuster until torque wrench registers 8 inch-pounds. Be sure adjustment is made within 1/2-turn of either extreme position of shaft.

(3) Tighten adjuster locknut to 90 foot-pounds torque. Recheck torque of wormshaft and adjust if necessary. Record torque reading.

Overcenter Adjustment

- (1) Turn steering gear from full left turn position to full right turn position, and count number of turns.
- (2) Turn gear back one-half total number of turns. This places steering gear on high point or straight-ahead position (total number of turns should be 6.14).
- (3) With Torque Wrench J-7754 on the pitman shaft, tighten lash adjuster screw until torque registered is 4 to 10 inch-pounds in excess of worm bearing preload. Total torque must not exceed 16 inch-pounds through center of travel. Make sure torque does not exceed this value in over center range.
- (4) Tighten nut on adjuster screw to 23 foot-pounds torque. Recheck torque and adjust if necessary.

Installation

- (1) Install coupling on splines of wormshaft, and secure coupling to shaft with attaching bolt and nut.
- (2) Position steering gear against side frame rail; secure with three bolts.
- (3) Check steering column alignment and adjust if necessary.
- (4) Install pitman steering arm on pitman shaft; secure with lockwasher and nut. Tighten nut to 185 foot-pounds.
- (5) Attach steering arm to connecting rod.

NOTE: After gear is installed in vehicle, it may produce a slightly rough feel. To eliminate this roughness, turn gear full left and full right for 10 to 15 complete turn cycles.

RIGHT-HAND DRIVE VEHICLES

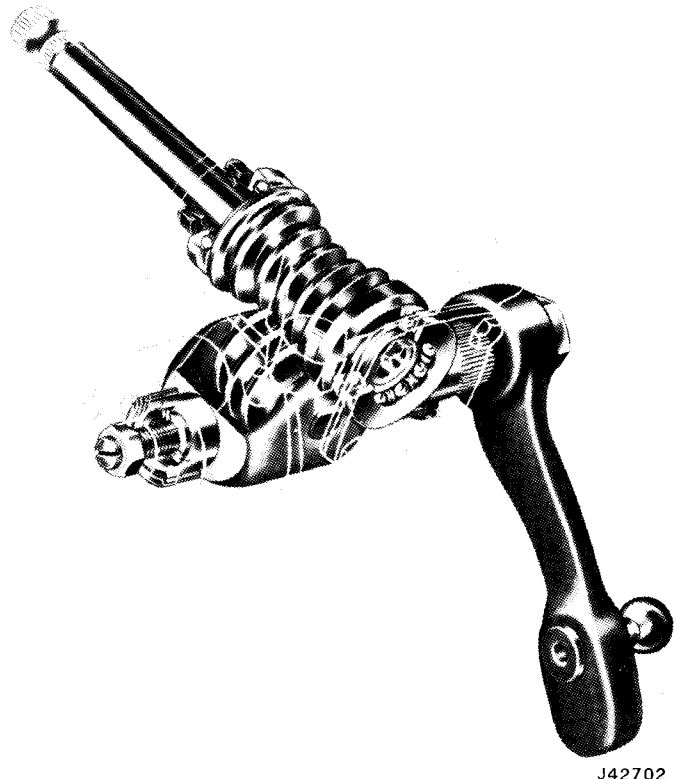
Removal

- (1) Disconnect steering gear from steering column by removing flexible coupling-to-gear allen-head clamping screw.

- (2) Disconnect connecting rod from steering arm.
- (3) Remove three bolts attaching steering gear to frame.
- (4) Remove steering gear by sliding it slightly forward and to right and lifting it out of engine compartment.

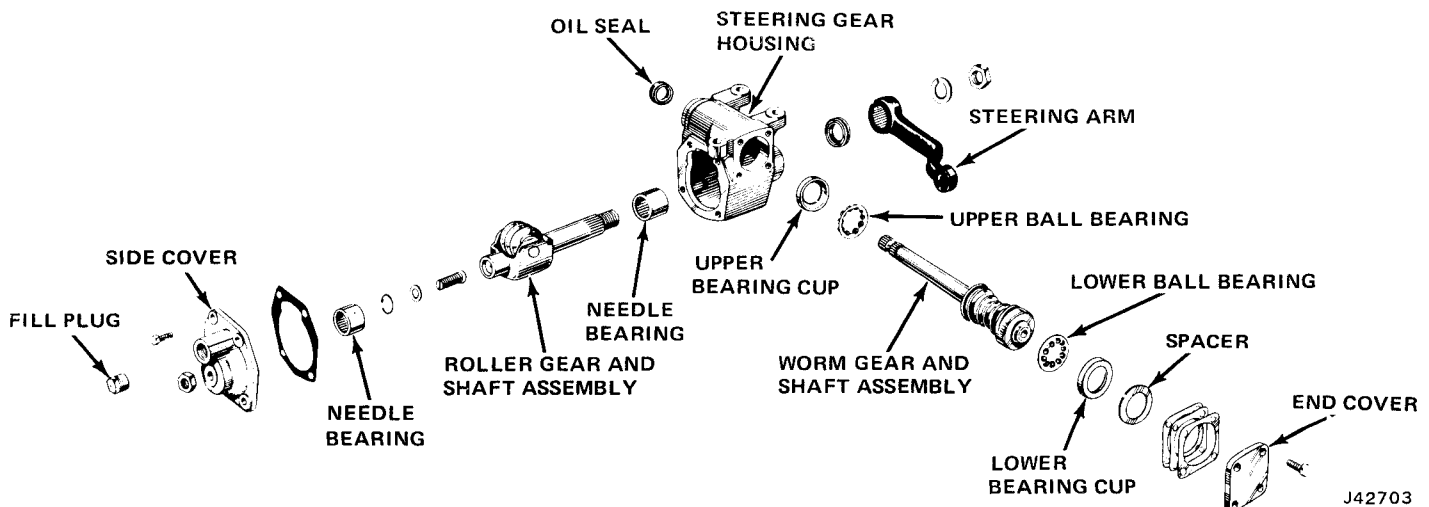
Disassembly

Refer to figures 11-58 and 11-59.



J42702

Fig. 11-58 Right-Hand Drive Steering Gear



J42703

Fig. 11-59 Steering Gear Exploded View

- (1) Clean exterior of steering gear.
- (2) Remove filler plug from steering gear housing and drain lubricant from gear.
- (3) Paint index marks on roller gear and shaft assembly on steering arm for correct alignment during assembly.
- (4) Remove nut and lockwasher from shaft.
- (5) Remove arm from shaft using pitman arm puller.

CAUTION: *Do not use a hammer or wedge to remove steering arm from roller gear and shaft assembly. This will damage gear and shaft assembly.*

- (6) Using fine file or emery cloth, remove any nicks or burrs from exposed portions of roller gear and shaft assembly and from worm gear and shaft assembly.
- (7) Remove four attaching capscrews, side cover, and gasket from steering gear housing. When cover is removed, attached roller gear and shaft assembly can also be withdrawn from housing.
- (8) Remove locknut from adjustment screw.
- (9) Turn screw clockwise until completely unthreaded from side cover; then remove roller gear and shaft assembly from cover.
- (10) Remove four attaching capscrews and end cover from steering gear housing.
- (11) Remove worm gear and shaft assembly.
- (12) Remove lower and upper bearing cups and ball bearings from shaft.
- (13) Remove worm gear shaft oil seal and roller gear shaft oil seal from housing. Discard both seals.

Inspection

Clean all parts with cleaning solvent and wipe dry.

Inspect the steering gear housing for cracks, breaks, or other damage. Replace if damaged.

Inspect the roller gear and shaft assembly for wear, scoring, or pitting. If necessary, polish lightly with a fine abrasive cloth. Be sure roller gear has proper freedom of movement and does not have excessive lash or roughness. Replace gear and shaft assembly if visibly worn or damaged.

Check adjustment screw of roller gear and shaft assembly for excessive end play. If end play exceeds 0.015 inch, remove the retaining ring, thrust washer, and screw from the gear and shaft assembly. Replace the retaining ring if unserviceable. Secure a new adjustment screw and thrust washer in the gear and shaft assembly with a retaining ring.

Inspect needle bearings, which carry roller gear and shaft assembly, in the side cover and the steering gear housing. Replace if visibly worn or damaged. Insert a shaft through each bearing and check for clearance. If clearance exceeds 0.010 inch, replace bearings.

To remove needle bearings, press them out using a piloted mandrel. To install new needle bearings, press the bearing into the side cover or steering gear housing so that the face of the bearing is flush with the bearing boss of the cover or housing.

Inspect the worm gear and shaft assembly visually for wear, scoring, or pitting. If necessary, polish lightly with a fine abrasive cloth. Replace assembly if it is visibly worn or damaged.

Inspect upper and lower ball bearings and cups of the worm gear and shaft assembly for wear and damage. Replace if visibly worn or damaged.

NOTE: *Bearing balls must be replaced as a full set in each bearing.*

Assembly

(1) Position new oil seals at wormshaft and roller gear shaft oil seal bores of steering gear housing with longer lip of each seal facing into housing.

(2) Press each seal into housing using suitable diameter tool that will contact seal bore of housing around its entire perimeter.

(3) Lubricate worm gear and shaft assembly and upper ball bearing and cup with Gear Lubricant Grade SAE 80W.

(4) Install bearing and cup on shaft.

(5) Install shaft assembly in steering gear housing. Be sure splined end of shaft does not damage oil seal.

(6) Lubricate lower end of worm gear and shaft assembly and lower ball bearing and cup with Gear Lubricant Grade SAE 80W.

(7) Install bearing, cup, and spacer on shaft.

(8) Install shims and end cover on steering gear housing and install attaching bolts. Tighten bolts hand-tight only.

(9) Adjust bearing preload.

(10) Mount tapped hole of side cover on adjustment screw of roller gear and shaft assembly.

(11) Thread screw counterclockwise into cover until end of shaft just touches inner face of cover.

(12) Install locknut on adjustment screw hand-tight.

(13) Install gasket on side cover.

(14) Lubricate gear of roller gear and shaft assembly with Gear Lubricant Grade SAE 80W.

(15) Insert gear and shaft assembly in housing. Be sure end of shaft does not damage oil seal in housing.

(16) Roller gear and worm gear must mesh to seat side cover to housing.

(17) Install cover to housing attaching bolts. Tighten bolts to 20 foot-pounds torque.

(18) Adjust gear clearance.

(19) Clamp exposed section of roller gear and shaft assembly in vise.

(20) Align index marks made during disassembly and install steering arm on splined end of shaft.

- (21) Install lockwasher and nut on shaft threads, and tighten nut to draw arm into position on spline.
- (22) Fill steering gear housing with Gear Lubricant Grade SAE 80W.
- (23) Adjustments

Bearing Preload Adjustment

This steering gear adjustment determines preload applied to upper and lower ball bearings which support the worm gear and shaft assembly. It is made by adding or subtracting shims from between the steering gear housing and end cover.

If necessary, loosen capscrews which attach the end cover to the steering gear housing (fig. 11-59).

Tighten capscrews alternately, and only a few turns at a time, while rotating the worm gear shaft. Tighten screws to 20 foot-pounds torque.

Check rolling torque required to rotate the worm gear shaft. When bearing preload is correct, this torque will be 2 to 5 inch-pounds. If necessary, remove end cover. Either add to or subtract from the number of shims, and repeat the above procedure to obtain correct bearing preload.

Steering Gear Clearance Adjustment

This steering gear adjustment sets proper backlash between the worm gear and the roller gear of the

steering gear assembly. It prevents gear wear resulting from insufficient backlash, and steering play which would result from excessive backlash. Gear backlash is adjusted by an adjustment screw which determines the longitudinal position of the roller gear and shaft assembly.

- (1) If necessary, loosen locknut and turn adjustment screw at the side cover counterclockwise until worm gear shaft turns freely through its entire range of travel (fig. 11-59).
- (2) Count number of turns necessary to rotate worm gear shaft through its entire range of travel.
- (3) Turn shaft to center of its travel.
- (4) Rotate shaft back and forth through center of travel and tighten adjustment screw until shaft shows slight bind at center of travel.
- (5) Adjust screw until rolling torque of 7 to 12 inch-pounds to rotate shaft through center of travel.
- (6) Hold adjustment screw in position and tighten locknut to 18 foot-pounds torque.
- (7) Recheck rolling torque necessary to rotate worm gear shaft through center of its travel. If necessary, repeat above procedure until rolling torque is correct.

STEERING LINKAGE

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Front Wheel Shimmy	11-40	Tie Rod	11-36

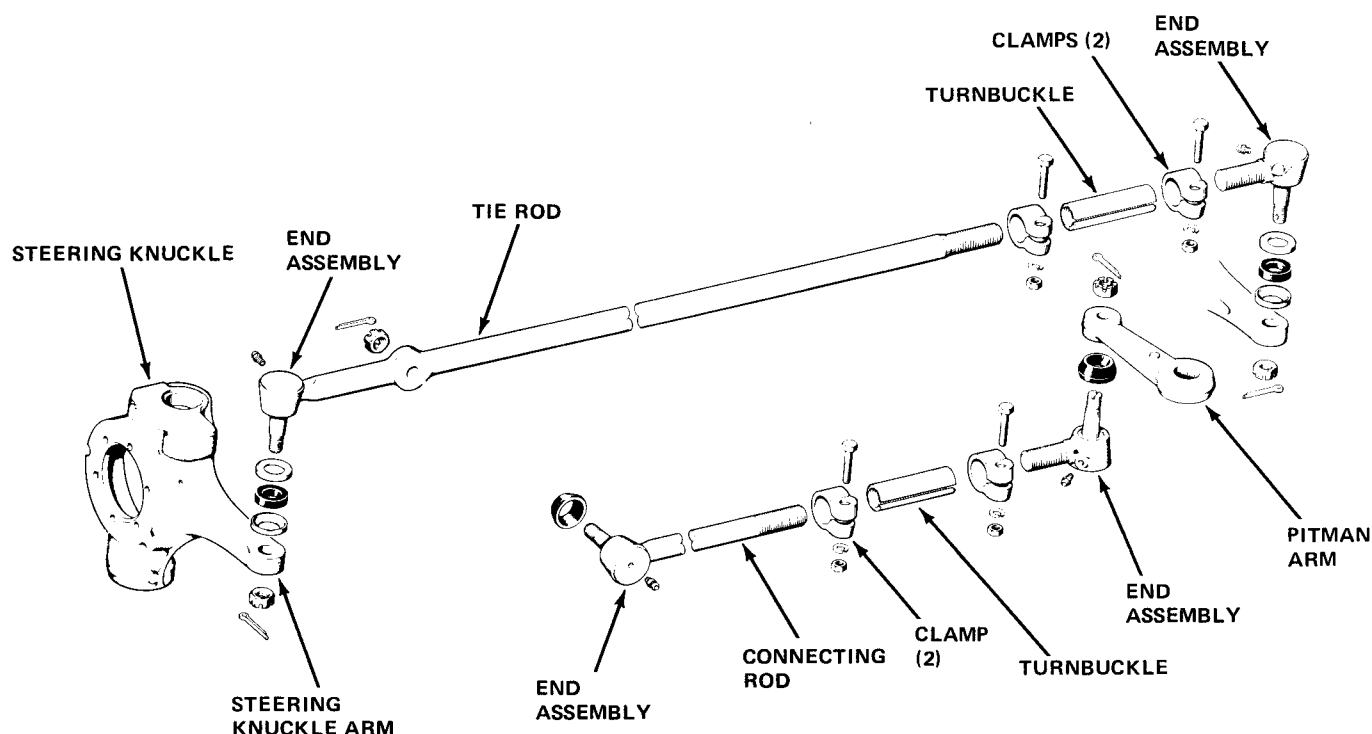
GENERAL

The steering linkage consists of a pitman arm attached to the steering gear assembly, a connecting rod, a tie rod, a steering damper, and a steering knuckle arm (integral with the steering knuckle). Ball-studs and adjusting tubes are used on the tie rod and connecting rod for the adjustments and steering wheel centering (fig. 11-60).

The connecting rod attaches to the pitman arm at one end and to the tie rod at the opposite end. The tie-rod ends are connected to the steering knuckle arms at the wheels. The steering damper is attached to the tie rod on one end and to a bracket on the left spring tie-plate at the other end.

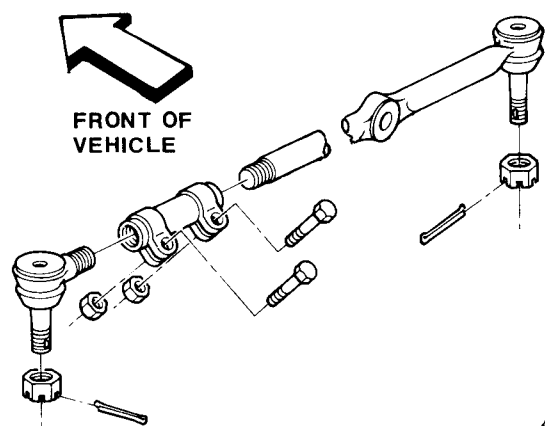
Tie Rod

On Cherokee, Wagoneer, and Truck models, the tie rod (fig. 11-61) consists of a solid rod that is threaded on one end, and has an integral ball-stud end assembly at the opposite end. An adjusting tube and removable ball-stud end complete the tie rod assembly. The threaded end of the tie rod has right-hand threads which accept the turnbuckle. On CJ models, the tie rod has ball-studs and adjusting tubes at both ends. The ball-stud tie rod end is threaded into the adjusting tube. A large boss is located on the tie rod about eight inches from the unthreaded right-hand end. A tapered hole machined into the boss accepts the steering connecting rod end. The steering damper is connected to a stud which is attached to a bracket that is clamped to the center of the tie rod.



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Fig. 11-60 Steering Linkage—Cherokee, Wagoneer, Truck



41059

Fig. 11-61 Tie Rod Exploded View

Tie Rod

Removal

- (1) Remove cotter pins and retaining nuts at both ends of tie rod, and from end of connecting rod where it attaches to tie rod.
- (2) Remove nut attaching steering damper push rod to tie rod bracket and move damper aside.
- (3) Remove tie rod ends from steering arms and connecting rod using puller.

NOTE: After removal, the tie rod ends can be removed from the tie rod by loosening the adjusting tube clamp bolts and unthreading the ends.

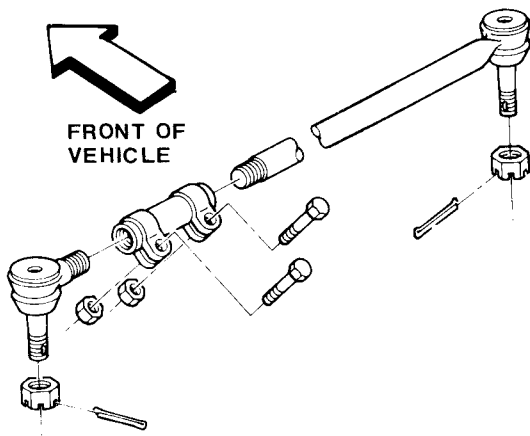
Installation

- (1) Attach tie rod ends to steering arms. Tighten nuts to 50 foot-pounds torque and use new cotter pins to secure nuts.
- (2) Attach connecting rod to tie rod. Tighten nut to 50 foot-pounds torque and use new cotter pin to secure nut.
- (3) Attach steering damper to tie rod bracket.
- (4) Adjust toe-in as necessary.

Connecting Rod

The connecting rod (fig. 11-62) consists of a rod threaded at the left end, with an integral ball-stud end assembly at the right end. An adjusting tube and removable ball-stud end complete the connecting rod assembly. On Cherokee, Wagoneer, and Truck models, the end having the integral ball-stud end assembly attaches to the tie rod. On CJ models, it is attached to the right side steering arm. The threaded end, with the adjusting tube and removable ball-stud end assembly, is attached to the pitman arm. However, the ball-stud end assembly can be replaced separately.

The steering connecting rod can be removed by removing the cotter pins and nuts from both ball stud ends, and then removing the rod. The steering connecting rod ball stud ends cannot be disassembled for service.



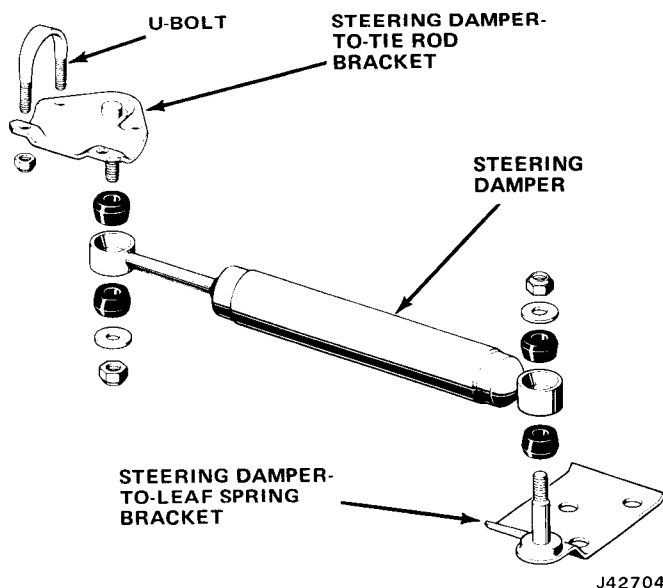
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Fig. 11-62 Connecting Rod Exploded View

When installing the steering connecting rod, place the wheels in the straight-ahead position and place the steering arm parallel to the centerline of the vehicle. Have the steering gear steering arm properly indexed, with line marks on the steering arm and gear shaft and the steering gear on center of high point. With the steering arm so positioned, install the connecting rod.

STEERING DAMPER

The steering damper (fig. 11-63) has eyelets at each end for mounting on studs. The body end of the damper attaches to a stud on a bracket mounted between the left axle spring and the axle spring pad. The push rod end is attached to a bracket that is clamped to the tie rod.



J42704

Fig. 11-63 Steering Damper

The steering damper is serviced as an assembly. If damaged or leaking, replace with a new assembly. The rubber bushings used in the damper eyelets can be replaced individually, if required.

Removal

- (1) Place front wheels in straight-ahead position.
- (2) Remove locknut securing damper to bracket on tie plate and lift damper off stud (fig. 11-63).
- (3) Remove locknut securing push rod end to tie rod bracket and remove damper assembly.

Installation

- (1) Insert rubber bushings in damper eyelets.
- (2) Secure eyelet at push rod end to stud on tie rod bracket with attaching parts.
- (3) Extend push rod by pulling back on damper body until eyelet can be located on, and secured to, stud on damper bracket at spring pad.
- (4) Tighten all locknuts securely.

FRONT WHEEL ALIGNMENT

Alignment should be checked and adjusted using an alignment rack. To ensure correct alignment, the following inspection is recommended.

- (1) Equalize tire pressures and place vehicle on level surface.
- (2) Check steering gear-to-steering column alignment.
- (3) Inspect steering knuckle pivots, spindle, and wheel bearings for looseness.
- (4) Check for spring sag.
- (5) Check brakes and shock absorbers for proper operation.
- (6) Check steering gear play.
- (7) Check caster.
- (8) Check toe-in.
- (9) Check camber.
- (10) Check tracking of front and rear wheels. Check for broken spring center bolts.

NOTE: Be sure all front suspension and steering system nuts and bolts are tight before checking wheel alignment.

Toe-In

Refer to figure 11-64. The use of an alignment rack to measure toe-in is recommended. To measure toe-in, without an alignment rack, raise the front of the vehicle and turn the front wheels to the straight-ahead position. Using chalk, draw a 1/2-inch wide strip around the circumference of each tire at the center of each tire tread while turning the wheels by hand. Using a steady rest, scribe a pencil line in the chalk strip at the exact center of each tire tread.

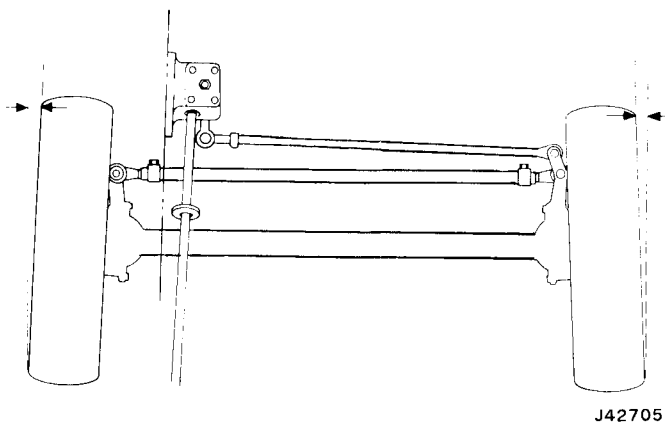


Fig. 11-64 Front Wheel Toe-In (Top View)—Typical

Measure the distance between the scribed pencil lines at the front and rear of the wheels. Be sure that both measurements are made at an equal distance from the floor. The distance between the lines should be greater at the rear than at the front by $\frac{3}{64}$ inch to $\frac{3}{32}$ inch. To adjust toe-in, loosen the clamp bolts and turn the tie rod with a small pipe wrench. The tie rod is threaded with right- and left-hand threads to provide equal adjustment at both wheels. After adjustment, tighten the clamp bolts to specified torque.

NOTE: It is common practice to measure between the wheel rims, which is a satisfactory method providing the wheels run true. However, by scribing a line on the tire tread, measurement is taken between the actual road contact points.

Camber

Refer to figure 11-65. Correct wheel camber of $1\frac{1}{2}^\circ$ is preset in the solid front axle at the time of manufacture and cannot be altered by adjustment. It is important that the camber is the same on both front wheels. Camber angle should be checked using wheel alignment equipment.

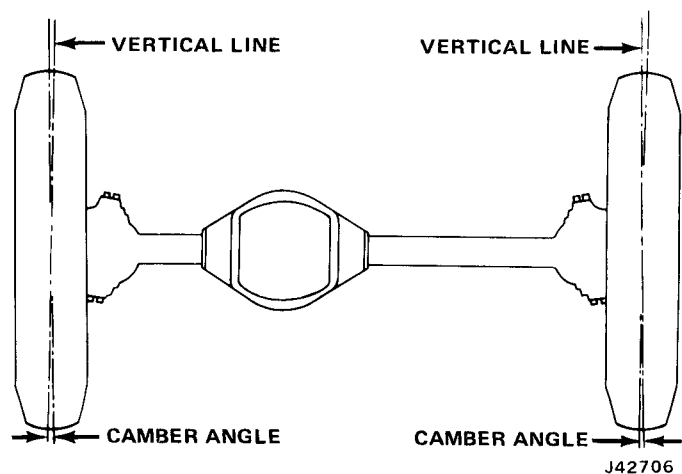


Fig. 11-65 Front Wheel Camber (Front View)

CAUTION: Do not attempt to adjust camber angle by heating or bending an axle or any suspension components. If camber is incorrect, the component(s) causing the camber angle to be incorrect should be replaced.

Caster

Refer to figure 11-66. Axle caster is preset at 3° for CJ models and 4° for Cherokee, Wagoneer, and Truck. Caster should be checked using wheel alignment equipment. If caster is incorrect, adjustment may be made by installing new parts or installing caster shims between the axle pad and the springs.

If the camber and toe-in are correct and it is known that the axle is not twisted, a satisfactory check may be made by road-testing the vehicle. Before road-testing, make sure all tires are properly inflated, being particularly careful that both front tires are inflated to exactly the same pressure.

If vehicle turns easily to either side but returns hard to straight-ahead position, incorrect caster is indicated.

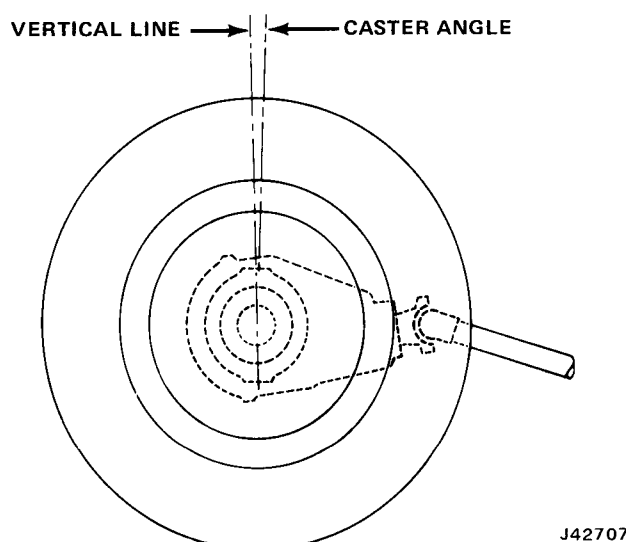


Fig. 11-66 Axle Caster (Side View)

STEERING WHEEL SPOKE ALIGNMENT

After checking and adjusting front wheel alignment, align the steering wheel spokes as follows.

(1) Center steering wheel by aligning spokes with steering gear in straight-ahead position and clamp wheel in position.

(2) Loosen connecting rod adjusting tube clamp and turn tube until front wheels are in straight-ahead position.

(3) Tighten adjusting tube clamps.

(4) Road-test to check spoke alignment adjustment.

FRONT WHEEL SHIMMY

Front wheel shimmy may be caused by one or more of the following conditions:

- Incorrectly adjusted front wheel bearings
 - Worn or out-of-balance or out-of-round front tires
 - Loose steering damper to tie rod bracket (CJ, Cherokee, Wagoneer, Truck)
 - Steering damper malfunction
 - Worn (loose) tie rod ends
 - Worn (loose) steering knuckle ball studs
 - Incorrect tire pressures
- The following procedure outlines a method of correcting the causes of wheel shimmy.
- (1) Raise and support front of vehicle.
 - (2) Inspect condition of front tires. Check and correct tire inflation pressure. Check for evidence of tire imbalance such as flat spots, scalloping, cupping or bald spots. If necessary, balance or replace tires.
 - (3) Check front wheel bearing adjustment. Correct wheel bearing adjustment if necessary. Refer to procedure outlined in Section 9 of this manual.
 - (4) Check for loose steering damper tie rod bracket on vehicles so equipped. If bracket is loose, center bracket on tie rod and tighten attaching bolts.
 - (5) Disconnect steering damper at tie rod bracket and check operation as follows:
 - (a) Alternately compress and extend damper. Damper should provide equal resistance throughout length of each stroke.
 - (b) Replace damper if lack of resistance is evident.
 - (6) Inspect all tie rod ends. If excessive play is observed in any tie rod end when checked, replace it.
 - (7) Inspect steering knuckle ball studs. Insert pry bar between knuckle and yoke, adjacent to ball stud, and pry against each ball stud. If none of the studs

- move or appear to be loose in their sockets, proceed to step (8). If any stud moves or appears to be loose in its socket, reseal both studs on that side of the axle as follows:
- (a) Remove wheels and tires. Remove axle shafts.
 - (b) Remove cotter pin and slotted nut from upper ball stud and loosen lower ball stud jamnut.
 - (c) Unseat upper and lower ball studs by striking upper ball stud with rawhide or lead hammer. Remove upper ball stud split ring seat using Tool J-25158. Discard split ring seat.
 - (d) Remove lower ball stud jamnut and remove steering knuckle. Discard lower ball stud jamnut.
 - (e) Clean upper ball stud split ring seat threads and lower ball stud taper in steering knuckle. Clean threads and tapered surfaces of both ball studs. Clean threads in upper ball stud retaining nut.
 - (f) Install steering knuckle. Support knuckle by hand and install new lower ball stud jamnut. Tighten jamnut finger-tight only. Install upper ball stud nut. Tighten nut until lower ball stud is drawn into tapered hole in axle yoke. Do not install split ring seat at this time.
 - (g) Tighten upper ball stud jamnut to 80 foot-pounds torque. Remove upper ball stud nut and install new upper ball stud split ring seat. Tighten split ring seat to 50 foot-pounds torque using Tool J-25158. Tighten lower ball stud jamnut to 100 foot-pounds torque and install cotter pin.
 - (h) Install axle shafts and steering spindles, and repeat step (7).
 - (i) Install wheels and tires.
 - (8) On CJ models not equipped with steering damper, if components inspected are O.K., install steering damper.
 - (9) Remove supports and lower vehicle.
 - (10) Road-test vehicle to verify repair.

POWER STEERING SYSTEM	
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GENERAL

The power steering system consists of a power steering gear, connecting hoses, and a hydraulic pump. The engine-driven pump supplies oil from its integral

reservoir through the pressure and return hoses which connect the gear and pump.

If for any reason the power system should malfunction, the steering gear will operate manually, giving the driver continued control of the vehicle. The steer-

ing gear, in this condition, operates as a typical recirculating ball-type manual steering gear. Hydraulic fluid is bypassed through the valve so that it does not restrict manual operation.

DESCRIPTION AND OPERATION

Steering Gear

All models use a recirculating ball-type power steering gear. Steel balls act as a rolling thread between the steering gear wormshaft and the rack-piston nut.

Wormshaft fore and aft thrust is controlled by a thrust bearing and two races at the lower end, and a bearing assembly in the adjuster plug at the upper end. The lower thrust bearing races are conical and provide continual spring-loaded pressure on the wormshaft to prevent loss of thrust bearing preload. The adjuster plug provides initial preload adjustment when servicing the gear.

As the wormshaft is turned right, the rack-piston moves upward, turning the wormshaft left moves the rack-piston downward.

The rack-piston teeth mesh with the sector which is forged as part of the pitman shaft. Turning the wormshaft turns the pitman shaft which, through mechanical linkage, turns the wheels.

Pump

The vane-type, constant-displacement pump develops the system oil pressure that is applied against the rack-piston nut to rotate the pitman shaft (fig. 11-67).

The integral pump reservoir provides a reserve supply of oil for the hydraulic system.

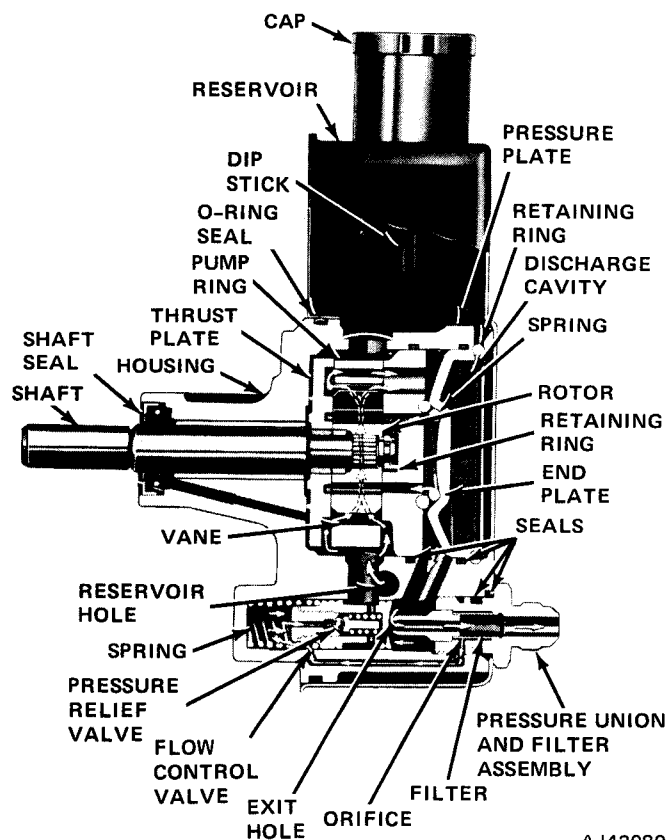
The reservoir cap is vented to maintain atmospheric pressure in the reservoir and to allow air trapped in the system to escape.

A flow control valve contained within the pump is used to control and maintain system operating pressure. A pressure relief valve is incorporated into the flow control valve. The flow control valve can be serviced without removing the pump from the engine.

Hydraulic Assist

The power steering gear has an open center, three-way, rotary valve to control hydraulic assist. Pump-supplied oil is applied to the pressure hole in the gear housing and then routed by the valve through the gear oil passages (fig. 11-68 and 11-69).

Through mechanical connections, the valve body, spool valve, torsion bar, and stub shaft which is pinned to the torsion bar, are, in effect, attached to the front wheels. Due to the pressure exerted on the front wheels by the weight of the vehicle, the wheels and,



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Fig. 11-67 Power Steering Pump

consequently, the valve body, tend to resist any turning effort that is applied. As resistance to turning by the wheels and valve body increases, the torsion bar deflects, permitting the stub shaft to rotate within the valve body. Since the spool valve is connected to the stub shaft by a locating pin, the spool valve also rotates within the valve body. As the spool valve rotates, the fluid directional passages machined into the spool valve are brought into alignment with machining passages in the valve body. When these passages are aligned, high pressure fluid from the pump is directed through the aligned passages and against either side of the rack-piston nut.

VARIABLE RATIO POWER STEERING

A variable ratio power steering gear is included in the optional power steering package offered on Cherokee, Wagoneer, and Truck models. CJ-5 and CJ-7 models are equipped with a constant ratio steering gear.

The ratio of a steering system is the relationship of steering wheel movement to that of the front wheels, in terms of the number of degrees that the steering wheel must be moved to turn the front wheels one degree.

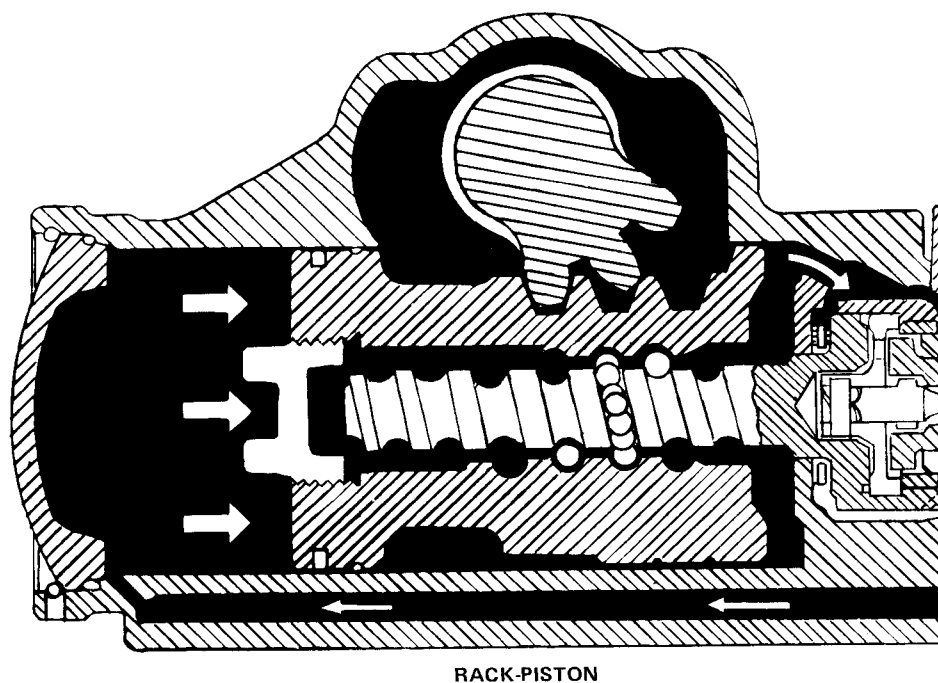
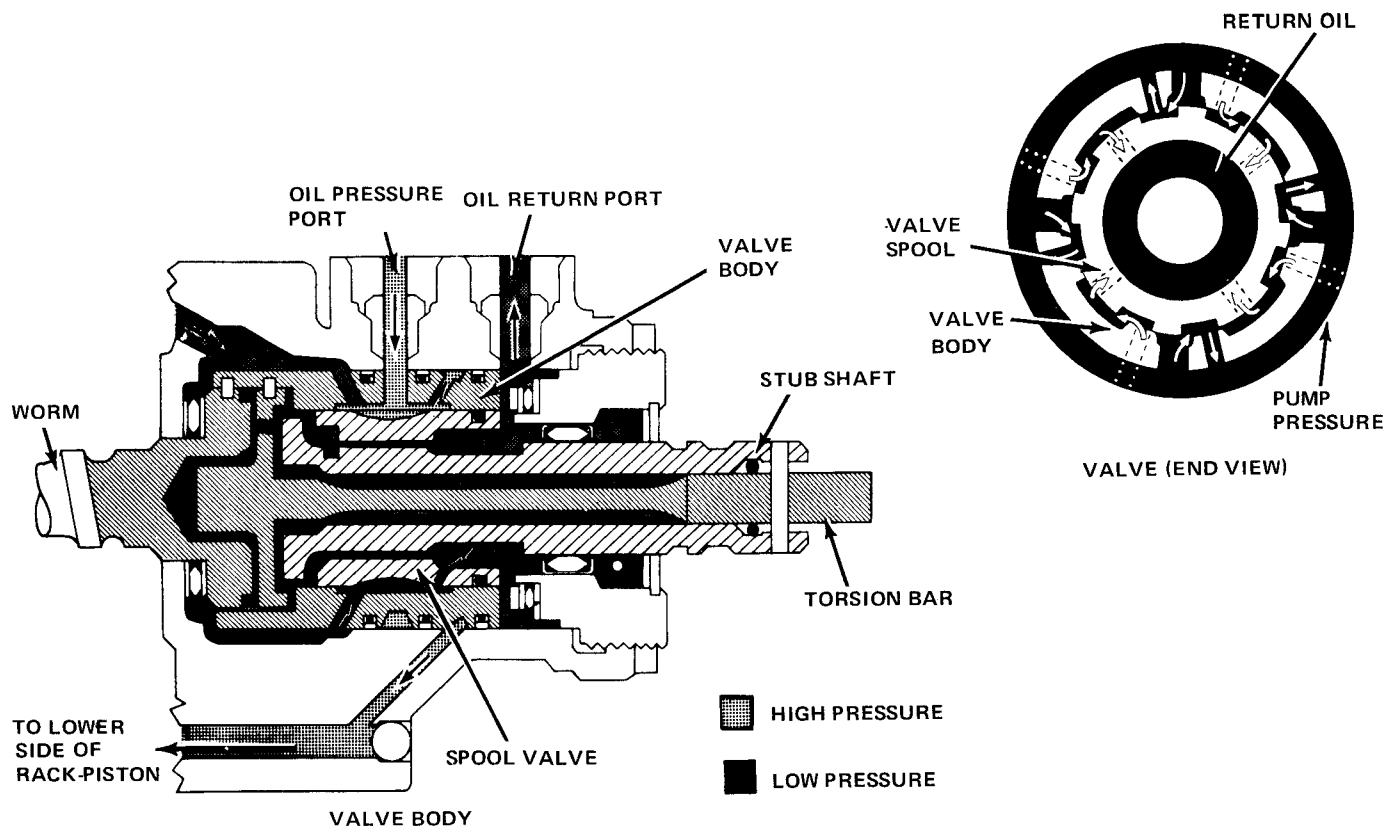


Fig. 11-68 Valve Oil Flow—Right Turn Position

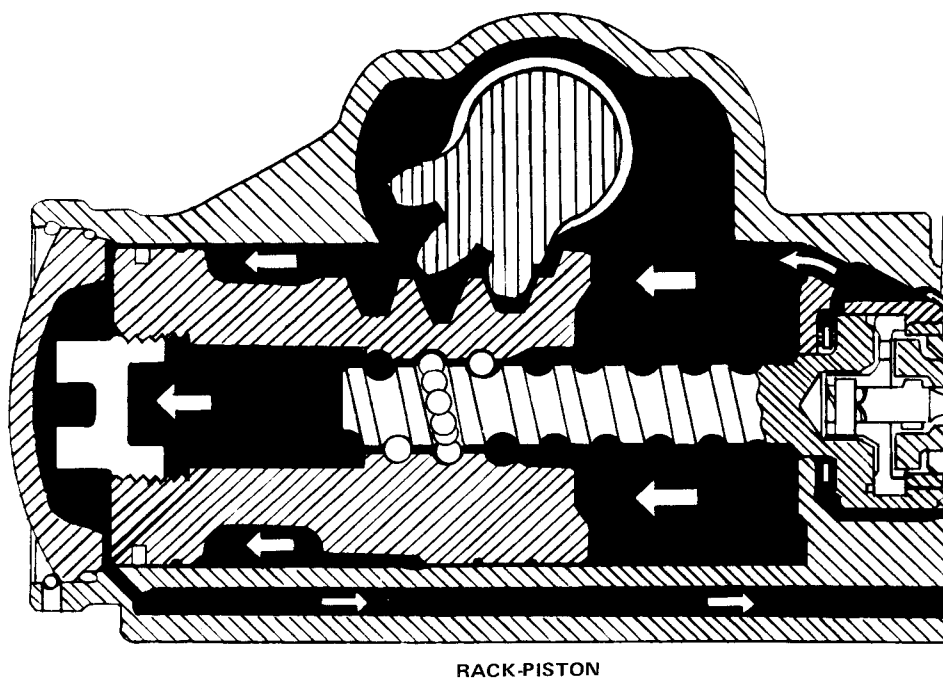
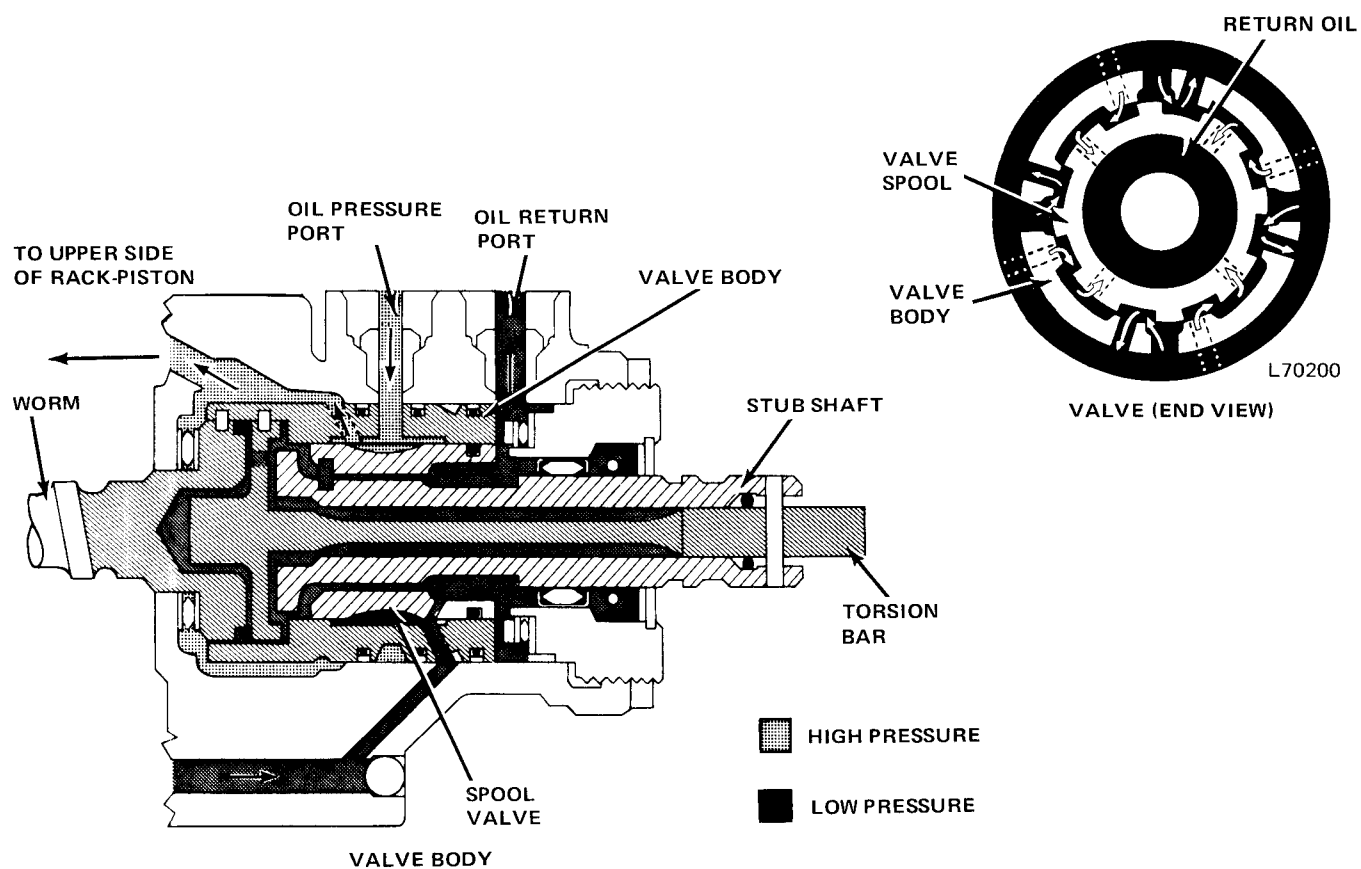


Fig. 11-69 Valve Oil Flow—Left Turn Position

Variable ratio steering is accomplished by a pitman shaft sector incorporating a short tooth on either side of a long center tooth, rather than a sector with three teeth of equal length, as in the constant ratio gear. Companion changes are also made in the rack-piston teeth (fig. 11-70).

Since the sector is basically a series of levers, any movement of the rack will cause the sector to swing the pitman arm in the same ratio; that is, it will turn the pitman arm the same number of degrees with each tooth in the sector.

To increase or decrease the ratio, it is only necessary to change the length of the sector teeth. A low ratio, or smaller radius sector with shorter teeth, produces greater pitman arm movement than the high ratio sector with its longer teeth and greater leverage.

On this basis, the variable ratio sector is in reality one long, high-ratio lever at the center, flanked by two lower-ratio levers for left and right turns.

Since only the tip of the long center tooth is in contact with the rack when the front wheels are straight, initial movement of the rack in either direction causes a relatively small response of the sector and pitman arm because of the high ratio that results from this long lever relationship.

As a result, the steering ratio remains a nearly constant 16.0:1 for the first 40 degrees of steering wheel movement in either direction from center.

Turning the steering wheel further reduces the length of the lever. The point of contact now rolls down the side of the center tooth, to act as a shorter radius, providing a steering ratio of 13.0:1 at full lock.

NOTE: Service procedures for constant and variable ratio steering are the same.

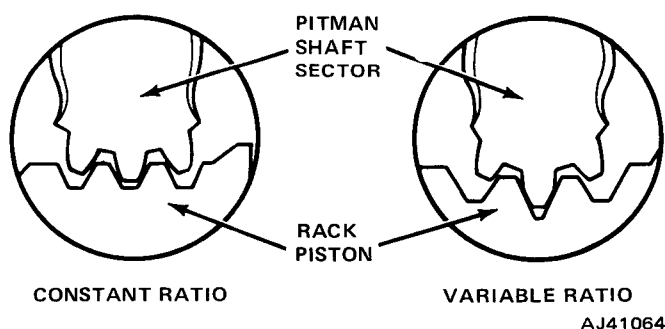


Fig. 11-60 Rack and Sector Comparison

PERIODIC MAINTENANCE—POWER STEERING

Oil must be maintained at the level indicated on the dipstick. If necessary, add fluid to correct the level.

Start the engine and operate it for ten minutes. Do not turn the steering wheel during this time. Raise the front wheels from the floor and perform several com-

plete power-operated turns. Do not hold the steering wheel at maximum turn position or overheating of the pump will occur.

Check the fluid level and, if necessary, fill reservoir to required level. Inspect the system for external leaks. Check the fluid in the system for foam, which indicates air in the system.

NOTE: Air bubbles circulating through the pump and gear will result in noise. Refer to Fluid Level and Initial Operation at the end of this section for hydraulic system bleeding procedure.

Pump Drive Belt Tension

Adjust belt so that tension is as specified when measured with Belt Tension Gauge J-23600. When using a belt tension gauge, make sure gauge is placed in the center of the longest belt span. When checking notched belts, make sure the center finger of the gauge is in the notched groove of the belt.

POWER STEERING GEAR SERVICE

Removal

(1) Disconnect hoses from return port and pressure port. Raise hoses above pump to prevent oil from draining.

(2) On CJ models, disconnect intermediate shaft coupling at steering gear stub shaft. On Cherokee, Wagoneer, and Truck models, disconnect flexible coupling at intermediate shaft.

(3) Remove pitman arm nut, lockwasher, and remove pitman arm using Tool J-6632.

(4) Remove mounting bolts attaching steering gear assembly to frame, and remove steering gear assembly.

Installation

(1) Mount steering gear on frame and install attaching bolts. Tighten bolts to 65 foot-pounds torque.

(2) Install pitman arm on pitman shaft. Install lockwasher and pitman arm nut. Tighten nut to 190 foot-pounds torque.

(3) On CJ models, connect stub shaft to intermediate shaft. Tighten clamp bolt to 40 foot-pounds torque.

(4) On Cherokee, Wagoneer, and Truck models, install flexible coupling on stub shaft, if removed, and tighten clamp to 30 foot-pounds torque. Connect intermediate shaft to flexible coupling and tighten attaching bolts and nuts to 20 foot-pounds torque.

(5) Connect hoses to power steering gear. Tighten hose fittings to 30 foot-pounds torque.

(6) Check and correct fluid level in power steering pump as outlined in Fluid Level and Initial Operation.

Service Diagnosis—Steering Gear and Pump

Condition	Possible Cause	Correction
HISSING NOISE IN STEERING GEAR	(1) There is some noise in all power steering systems. One of the most common is a hissing sound most evident at standstill parking. There is no relationship between this noise and performance of the steering. Hiss may be expected when steering wheel is at end of travel or when slowly turning at standstill.	(1) Slight hiss is normal and in no way affects steering.
RATTLE OR CHUCKLE NOISE IN STEERING GEAR	(1) Gear loose on frame. (2) Steering linkage looseness. (3) Pressure hose touching other parts of car. (4) Loose pitman shaft over center adjustment. NOTE: A slight rattle may occur on turns because of increased clearance off the "high point." This is normal and clearance must not be reduced below specified limits to eliminate this slight rattle. (5) Loose pitman arm.	(1) Check gear-to-frame mounting screws. Tighten screws to 65 foot-pounds torque. (2) Check linkage pivot points for wear. Replace if necessary. (3) Adjust hose position. Do not bend tubing by hand. (4) Adjust to specifications. (5) Tighten pitman arm nut to specifications.
SQUAWK NOISE IN STEERING GEAR WHEN TURNING OR RECOVERING FROM A TURN	(1) Damper O-ring on valve spool cut.	(1) Replace damper O-ring.
CHIRP NOISE IN STEERING PUMP	(1) Loose or damaged belt.	(1) Adjust belt tension or replace belt.
BELT SQUEAL (PARTICULARLY NOTICEABLE AT FULL WHEEL TRAVEL AND STAND STILL PARKING)	(1) Loose or damaged belt.	(1) Adjust belt tension or replace belt.



Service Diagnosis—Steering Gear and Pump (Continued)

Condition	Possible Cause	Correction
GROWL NOISE IN STEERING PUMP	(1) Excessive back pressure in hoses or steering gear caused by restriction.	(1) Locate restriction and correct. Replace part if necessary.
GROWL NOISE IN STEERING PUMP (PARTICULARLY NOTICEABLE AT STAND STILL PARKING)	(1) Scored pressure plates, thrust plate or rotor. (2) Extreme wear of cam ring.	(1) Replace parts and flush system. (2) Replace parts.
GROAN NOISE IN STEERING PUMP	(1) Low oil level. (2) Air in the oil. Poor pressure hose connection.	(1) Fill reservoir to proper level. (2) Tighten connector to specified torque. Bleed system by operating steering from right to left-full turn.
RATTLE NOISE IN STEERING PUMP	(1) Vanes not installed properly. (2) Vanes sticking in rotor slots.	(1) Install properly. (2) Free up by removing burrs, varnish, or dirt.
WHINE NOISE IN STEERING PUMP	(1) Pump shaft bearing scored.	(1) Replace housing and shaft. Flush system.
POOR RETURN OF STEERING WHEEL TO CENTER	(1) Tires not properly inflated. (2) Lack of lubrication in linkage and ball studs. (3) Lower coupling flange rubbing against steering gear adjuster plug. (4) Improper front wheel alignment.	(1) Inflate to specified pressure. (2) Lube linkage and ball studs. (3) Loosen pinch bolt and assemble properly. (4) Check and adjust as necessary. With front wheels still on alignment pads of front-end machine, disconnect pitman arm of linkage from pitman shaft of gear. Turn front wheels by hand. If wheels will not turn or turn with considerable effort, determine if linkage or ball joints are binding.
	(5) Steering linkage binding.	(5) Replace pivots.
	(6) Ball studs binding.	(6) Replace ball studs.
	(7) Tight or frozen steering shaft bearings.	(7) Replace bearings.

Service Diagnosis—Steering Gear and Pump (Continued)

Condition	Possible Cause	Correction
POOR RETURN OF STEERING WHEEL TO CENTER (Continued)	(8) Sticky or plugged spool valve. (9) Steering gear adjustments over specifications. (10) Steering gear poppet valve installed incorrectly.	(8) Remove and clean or replace valve. (9) Check adjustment with gear out of vehicle. Adjust as required. (10) Inspect and install valve correctly.
CAR LEADS TO ONE SIDE OR THE OTHER (KEEP IN MIND ROAD CONDITION AND WIND. TEST CAR IN BOTH DIRECTIONS ON FLAT ROAD)	(1) Incorrect tire pressure. (2) Front end misaligned. (3) Unbalanced steering gear valve.	(1) Check and adjust. (2) Adjust to specifications. (3) Replace valve.
MOMENTARY INCREASE IN EFFORT WHEN TURNING WHEEL FAST TO RIGHT OR LEFT	(1) Low oil level in pump. (2) Pump belt slipping. (3) High internal leakage.	(1) Add power steering fluid as required. (2) Tighten or replace belt. (3) Check pump pressure. (See pressure test)
STEERING WHEEL SURGES OR JERKS WHEN TURNING WITH ENGINE RUNNING ESPECIALLY DURING PARKING	(1) Low oil level. (2) Loose pump belt. (3) Insufficient pump pressure. (4) Sticky flow control valve.	(1) Fill as required. (2) Adjust tension to specification. (3) Check pump pressure. (See pressure test). Replace relief valve if defective. (4) Inspect for varnish or damage, replace if necessary.
LOOSE STEERING	(1) Steering gear loose on frame. (2) Steering gear flexible coupling loose on shaft or rubber disc mounting screws loose. (3) Steering linkage joints worn enough to be loose. (4) Worn poppet valve (Gear). (5) Loose thrust bearing preload adjustment (Gear). (6) Excessive overcenter lash in gear.	(1) Tighten attaching screws to specified torque. (2) Tighten flange pinch bolts to 30 foot-pounds, if serrations are not damaged. Tighten upper flange to coupling nuts to specified torque. (3) Replace loose pivots. (4) Replace poppet valve. (5) Adjust to specification with gear out of vehicle. (6) Adjust to specification with gear out of vehicle.



Service Diagnosis—Steering Gear and Pump (Continued)

Condition	Possible Cause	Correction
<p>HARD STEERING OR LACK OF ASSIST</p> <p>NOTE: If checks (1) through (3) do not reveal cause of hard steering, refer to pressure test.</p>	<p>(1) Loose pump belt.</p> <p>(2) Low oil level in reservoir.</p> <p>NOTE: Low oil level will also result in excessive pump noise.</p> <p>(3) Tires not properly inflated.</p> <p>Further possible causes could be:</p> <p>(4) Sticky flow control valve.</p> <p>(5) Insufficient pump pressure output.</p> <p>(6) Excessive internal pump leakage.</p> <p>(7) Excessive internal gear leakage.</p>	<p>(1) Adjust belt tension to specification.</p> <p>(2) Fill to proper level. If excessively low, check all lines and joints for evidence of external leakage. Tighten loose connectors.</p> <p>(3) Inflate to recommended pressure.</p> <p>In order to diagnose conditions such as listed in (4), (5), (6), (7) a test of the entire power steering system using gauge tool J 21567 is required.</p>
FOAMING AERATED POWER STEERING FLUID, LOW FLUID LEVEL AND POSSIBLE LOW PRESSURE	(1) Air in the fluid, and loss of fluid due to internal pump leakage causing overflow.	(1) Check for leak and correct. Bleed system. Extremely cold temperatures will cause system aeration should the oil level be low. If oil level is correct and pump still foams, remove pump from vehicle and separate reservoir from housing. Check welsh plug and housing for cracks. If plug is loose or housing is cracked, replace housing.
LOW PRESSURE DUE TO STEERING PUMP	<p>(1) Flow control valve stuck or inoperative.</p> <p>(2) Pressure plate not flat against cam ring.</p> <p>(3) Extreme wear of cam ring.</p> <p>(4) Scored pressure plate, thrust plate, or rotor.</p> <p>(5) Vanes not installed properly.</p> <p>(6) Vanes sticking in rotor slots.</p> <p>(7) Cracked or broken thrust or pressure plate.</p>	<p>(1) Remove burrs or dirt or replace. Flush system.</p> <p>(2) Correct.</p> <p>(3) Replace parts. Flush system.</p> <p>(4) Replace parts. Flush system.</p> <p>(5) Install properly.</p> <p>(6) Freeup by removing burrs, varnish, or dirt.</p> <p>(7) Replace part.</p>
LOW PRESSURE DUE TO STEERING GEAR	<p>(1) Pressure loss in cylinder due to worn piston ring or badly worn housing bore.</p> <p>(2) Leakage at valve rings, valve body-to-worm seal.</p>	<p>(1) Remove gear from car for disassembly and inspection of ring and housing bore.</p> <p>(2) Remove gear from car for disassembly and replace seals.</p>

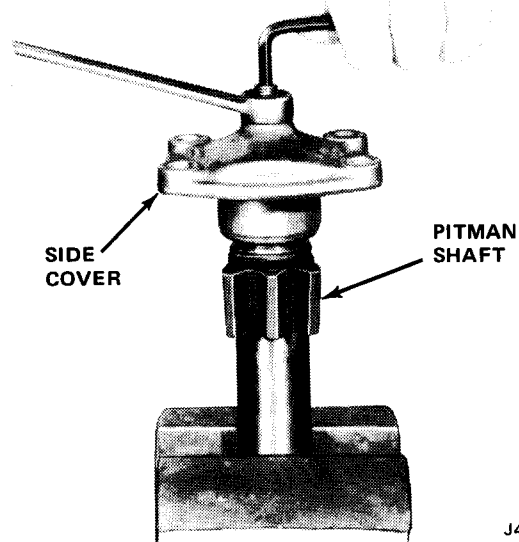
Disassembly

NOTE: In most cases, complete disassembly of the power steering gear will not be necessary. It is suggested that only those subassemblies that are malfunctioning should be disassembled. Disassembly and assembly operations must be performed on a clean work bench. As in repairing any hydraulically operated unit, cleanliness is of the utmost importance. The work bench, tools, and parts must be kept clean at all times. Thoroughly clean the exterior of the unit with a suitable solvent before disassembly.

Pitman Shaft and Side Cover

Refer to figure 11-71.

- (1) Drain oil from gear assembly and mount gear in holding fixture or clamp rear portion of housing in vise. Do not overtighten vise. This will distort housing.
- (2) Place pitman shaft on center or high spot.
- (3) Rotate stub shaft until pitman shaft gear is in center position and remove side cover bolts and lockwashers.
- (4) Tap end of pitman shaft with plastic mallet, and slide pitman shaft and side cover out of housing.
- (5) Remove and discard side cover O-ring seals.
- (6) Hold lash adjuster with allen wrench and remove lash adjuster nut (fig. 11-72). Discard nut.
- (7) Remove lash adjuster from side cover by threading adjuster clockwise into pitman shaft. **Do not remove** adjuster from pitman shaft.
- (8) Remove pitman shaft seal retaining ring, using internal Snap Ring Pliers J-4245.



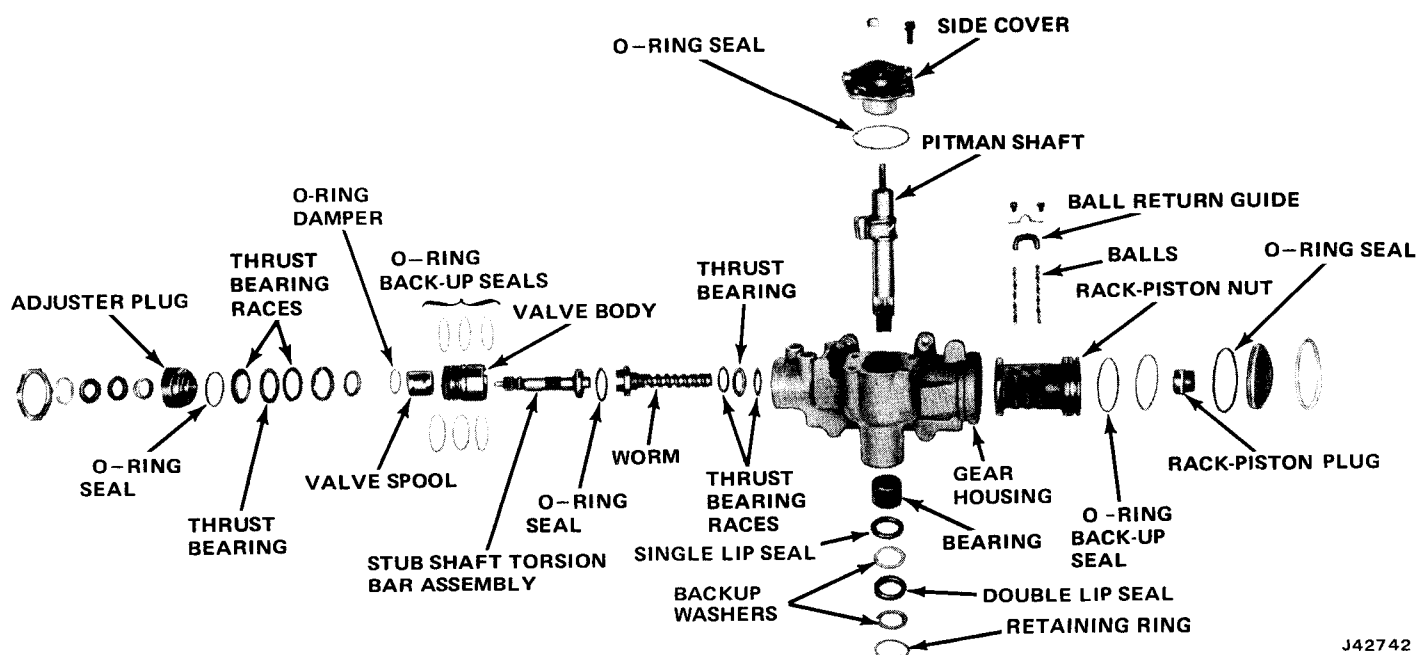
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Fig. 11-72 Removing Lash Adjuster Locknut

- (9) Remove outer backup washer. Tap screwdriver between outer seal and inner backup washer and pry out seal (fig. 11-73).

- (10) Insert screwdriver between inner seal and shoulder in gear housing and pry out second seal. Do not damage seal bore. Discard seals.

- (11) Remove needle bearing from housing using Tool J-6657. To remove bearing, drive it out of housing, **not** into housing. Discard bearing.



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Fig. 11-71 Power Steering Gear

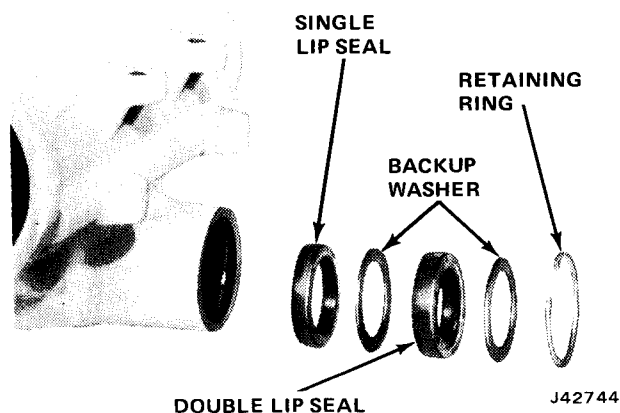


Fig. 11-73 Pitman Shaft Seal

Adjuster Plug Assembly

- (1) Loosen adjuster plug locknut using Wrench J-25194.
- (2) Loosen adjuster plug assembly using Tool J-7624 (fig. 11-74). Prevent stub shaft from turning and unthread adjuster plug assembly.

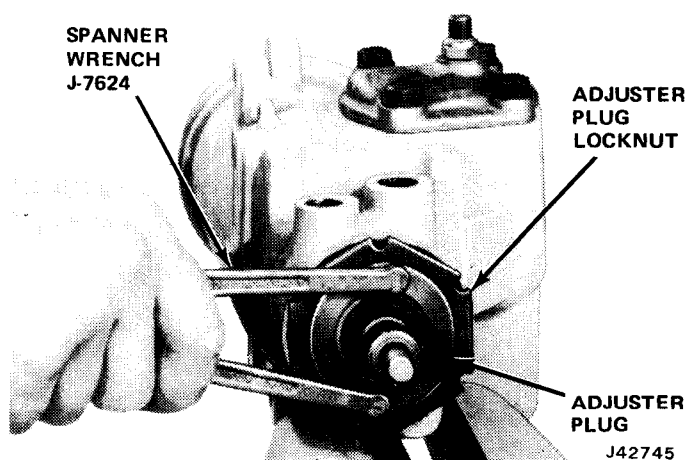


Fig. 11-74 Adjuster Plug Removal or Installation

(3) Remove thrust bearing retainer using screwdriver (fig. 11-75). Do not score needle bearing bore. Discard retainer.

(4) Remove thrust bearing spacer, thrust bearing, and thrust bearing races (fig. 11-71).

(5) Remove and discard adjuster plug O-ring seal.

(6) Remove stub shaft seal retainer ring and stub shaft dust seal from adjuster plug.

(7) Remove stub shaft seal by prying out with screwdriver. Discard seal.

(8) If adjuster plug needle bearing rollers are broken or pitted, drive bearing from plug using Adjuster Plug Bearing Removal and Installer Tool J-6221. Discard bearing.

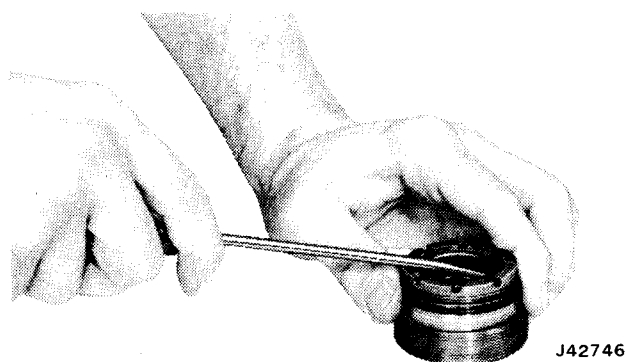


Fig. 11-75 Removal of Thrust Bearing Retainer

Valve Assembly

Refer to figure 11-71. The complete valve spool assembly is a precision unit with select-fit parts that are hydraulically balanced during manufacture.

NOTE: *It is uncommon to make service repairs of the valve assembly with the possible exception of the valve spool damper O-ring. Do not disassemble the valve unless absolutely necessary. This may result in damaging the assembly. If the valve spool damper O-ring requires replacement, remove the valve spool, replace the O-ring, and reinstall the spool immediately. If the valve spool or valve body requires replacement, it must be replaced as an assembly only. Do not attempt to interchange parts. If disassembly of the valve spool assembly is necessary, proceed as follows.*

(1) Remove valve body and stub shaft torsion bar assembly by grasping stub shaft torsion bar and pulling straight out.

(2) Remove cap-to-O-ring seal. Discard seal.

(3) Hold valve assembly in both hands with stub shaft pointing down. Tap stub shaft lightly against bench until shaft cap is free from valve body (fig. 11-76).

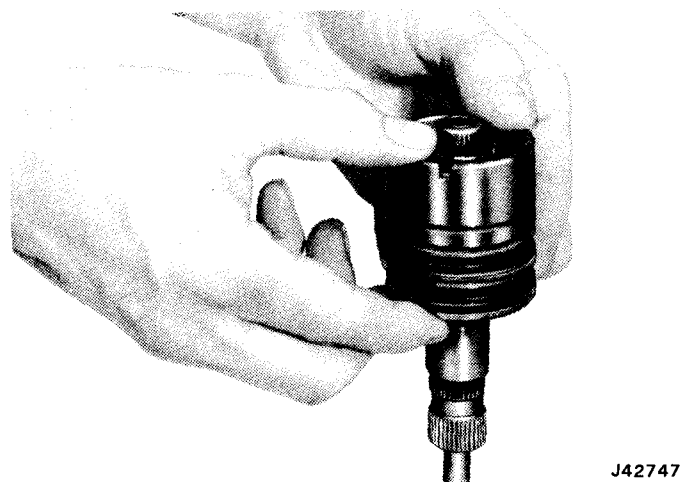


Fig. 11-76 Tapping Torsion Bar to Remove Valve Cap

(4) Pull shaft assembly until valve cap clears valve body approximately 1/4 inch.

CAUTION: Do not pull shaft assembly out too far or valve spool may become cocked in valve body.

(5) Disengage shaft pin from valve spool and carefully remove shaft assembly.

(6) Push valve spool out of valve body while rotating valve. If valve becomes cocked, carefully realign valve, and remove.

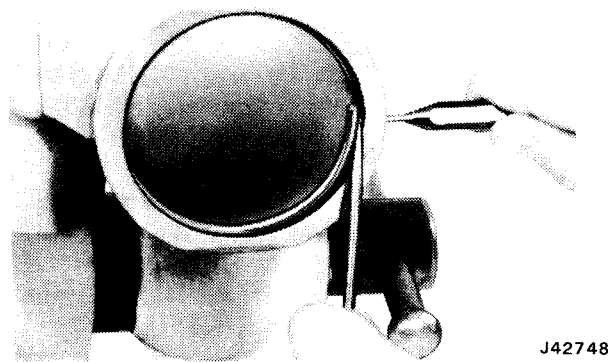
(7) Remove and discard damper O-ring from valve spool.

(8) Cut and remove valve O-rings and backup seals (fig. 11-71).

NOTE: Remove and discard seal rings and O-rings only if worn excessively. Valve seal rings are made of filled teflon, and it is unusual for replacement to be required.

Rack-Piston and Wormshaft

(1) Rotate end plug retainer ring so that one end of ring is over hole in housing. Unseat end of ring using punch inserted through hole. Use screwdriver to unseat and remove ring (fig. 11-77).



J42748

Fig. 11-77 End Plug Retaining Ring Removal

(2) Rotate stub shaft torsion bar using 12-point, 3/4-inch box end or socket wrench to extreme left-turn position to force plug out of housing.

CAUTION: Do not rotate farther than necessary or balls in rack and worm assembly will fall off end of worm.

(3) Remove and discard housing end plug O-ring seal.

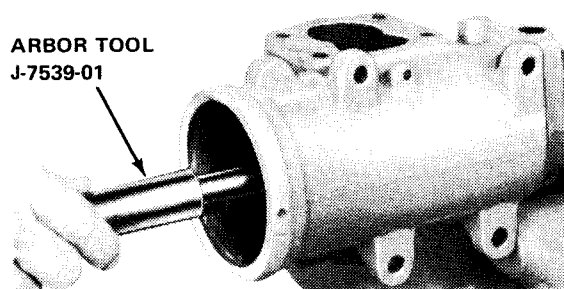
(4) Strike rack piston plug with brass drift and hammer to loosen and remove plug by inserting

1/2-inch drive socket extension into square hole in plug and turning counterclockwise.

NOTE: This can be done only with the pitman shaft in place.

(5) Remove rack-piston nut using Arbor Tool J-7539-01 (fig. 11-78). rack-piston nut (fig. 11-78). Rotate stub shaft torsion bar to left to force rack-piston nut onto arbor and remove rack-piston nut.

NOTE: The arbor prevents the balls from falling out of the rack-piston nut. After removing the rack-piston nut, place it on the workbench with the ring end toward the bench. Keep the arbor tool inserted in the rack-piston nut.



J42749

Fig. 11-78 Removing Rack-Piston Nut

(6) Remove valve body and adjuster plug assembly.

(7) Remove worm, lower thrust bearing, and races.

(8) Cut and remove piston ring and O-ring backup seal from rack-piston nut. Discard ring and seal.

(9) Remove screw and lockwasher assemblies from rack-piston nut using screwdriver.

(10) Remove return guide clamp.

(11) Place assembly on clean cloth, and remove ball return guides and arbor tool to release balls. Be sure all balls are caught in cloth.

Inspection and Repair

Gear Housing

(1) Inspect gear housing bore. If badly scored or worn, replace the gear housing.

(2) Check hose connectors. If damaged, scored, or brinelled, remove connectors as follows.

(3) Tap connector using 5/16-18 tap (fig. 11-79).

(4) Thread bolt with nut and flat-washer attached into connectors.

(5) Hold bolt and rotate nut from bolt to remove connectors (fig. 11-80).

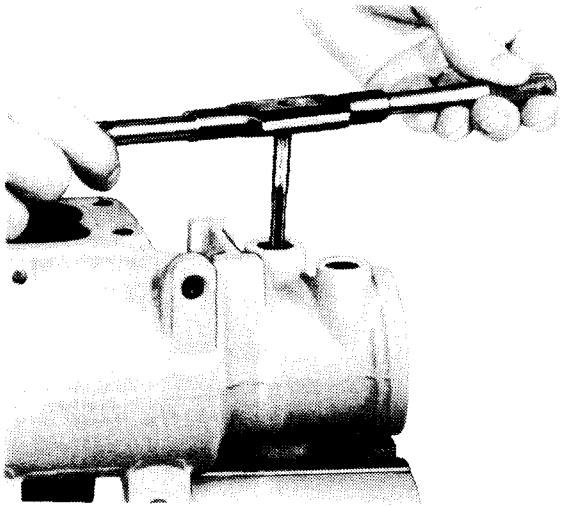


Fig. 11-79 Threading Connector with Tap

J42750

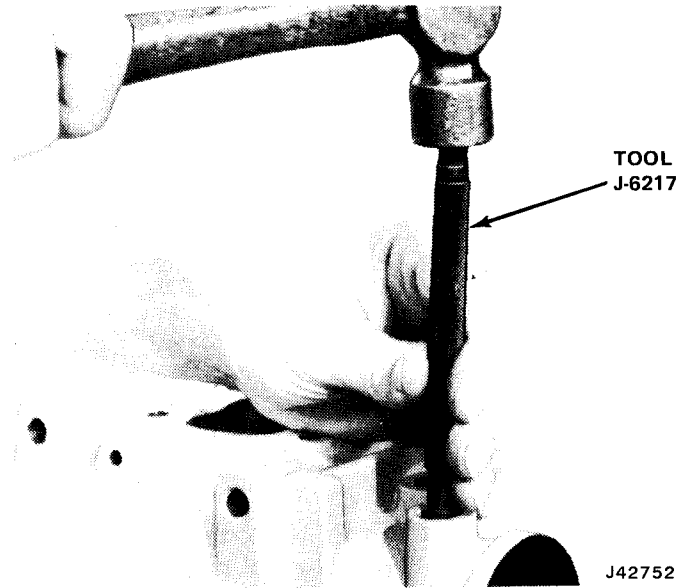


Fig. 11-81 Installing Connector

J42752

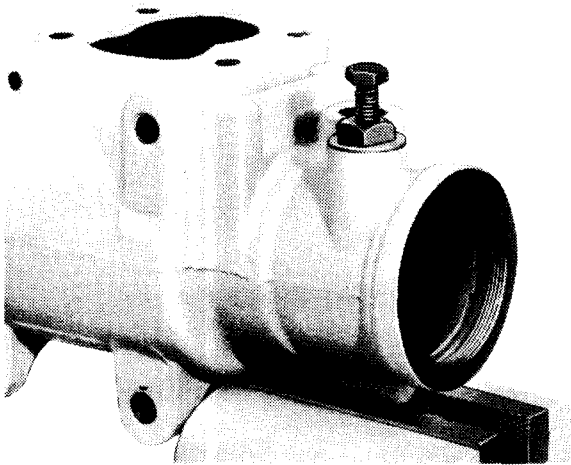


Fig. 11-80 Removing Connector

J42751

(6) If necessary to remove poppet valve from pressure port, use No. 5 screw extractor. Drive new connector into connector port using Installation Tool J-6217 (fig. 11-81).

NOTE: After installing the connector, compress the poppet valve with a pencil point. When correctly installed, the poppet valve will spring back when the pencil is removed.

(7) Inspect all seal surfaces and retaining ring grooves for damage. Replace housing if damaged.

(8) Inspect ball plug in housing. If prior leakage was noted around plug or if ball is raised above housing surface, drive it in until flush with or 1/16 inch below surface. Secure ball by staking housing around it.

NOTE: If gear is installed and fluid leaks past ball after it has been seated and staked in place, replace the steering gear housing.

Rack-Piston Nut, Worm, and Balls

(1) Inspect wormshaft for wear, scoring, pitting, distortion, nicked threads, or cracks.

(2) Inspect rack-piston nut for scored, pitted, or nicked ball races.

(3) Inspect exterior diameter of nut for wear or scoring. Make sure seal seats are clean and free from burrs.

(4) Inspect rack teeth for chips, cracks, dents, or scoring. If either wormshaft or the rack-piston are damaged, both must be replaced as a matched set.

(5) Carefully inspect each of the balls for dents, nicks, excessive wear, flaking, or flat spots. Replace as necessary.

(6) Inspect ball return guides. Be sure ends, where balls enter and leave guides, are free of burrs or distortion.

(7) Inspect lower thrust bearing and races for wear or scoring. Replace if damaged or worn.

Valve Assembly Components

(1) If fluid leaked externally between torsion bar and stub shaft, replace entire assembly.

(2) Check pin in valve body which engages cap. If badly damaged, replace entire valve assembly.

(3) Check worm pin groove in valve body. If smaller groove is damaged, replace entire valve assembly.

(4) Check spool drive pin in stub shaft. If cracked, broken, or worn badly, replace entire valve assembly.

(5) Examine outside diameter of spool for nicks and burrs. If any are found, remove with a very fine hone. A slight polishing is normal on the valve surfaces.

(6) Examine valve body for nicks or burrs. If any are found, polish with crocus cloth until spool turns freely in body. Do not remove any stock from surface.

of valve body. A slight polishing is normal on the valve surfaces.

Pitman Shaft, End Cover, and Bearings

(1) Inspect pitman shaft bushing in the side cover for excessive wear or scoring. If badly worn or scored, replace side cover and bushing assembly.

(2) Check pitman shaft sector teeth and bearing and seal surfaces. If badly worn, pitted, or scored, replace pitman shaft.

(3) Inspect needle bearings for rough or binding operation, scored or worn rollers, distorted cases, or other damage. Replace needle bearings if necessary.

Assembly

Rack-Piston and Wormshaft

NOTE: Thoroughly lubricate all internal parts with power steering fluid during assembly. Prevent entry of dirt into the assembly.

(1) Lubricate backup O-ring seal and install in ring groove on rack-piston nut (fig. 11-82).

(2) Install seal ring in ring groove on top of backup O-ring seal.

NOTE: The seal ring may be slightly loose after assembly. This is normal. The seal ring will tighten when subjected to hot oil in the system.

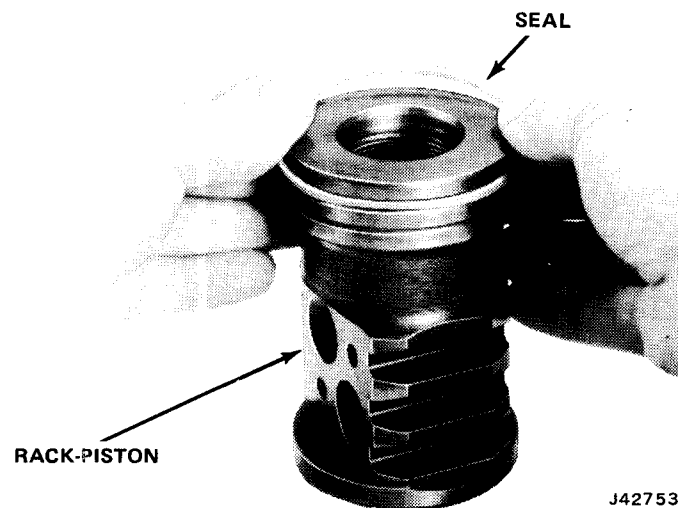


Fig. 11-82 Assembling Seal Ring on Rack-Piston Nut

(3) Install wormshaft in rack-piston as shown in figure 11-83.

(4) Align ball return guide holes with worm groove. Load 16 balls into guide hole nearest piston ring, while slowly rotating worm counterclockwise to feed balls through circuit (fig. 11-84). Alternate black balls with standard balls.

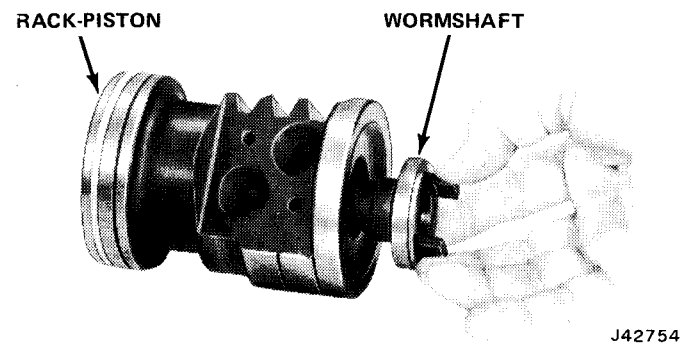


Fig. 11-83 Installing Wormshaft

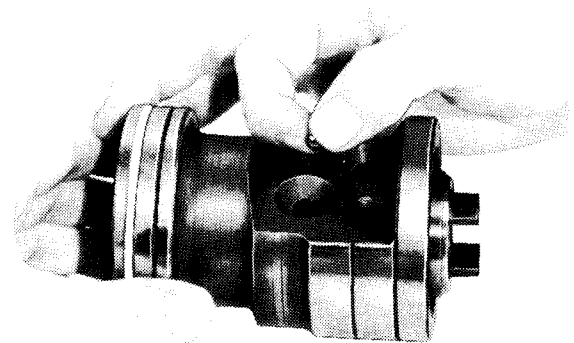


Fig. 11-84 Installing Balls in Rack-Piston Nut

(5) Fill one ball return guide with remaining balls. Place other guide over balls and plug ends with petroleum jelly to prevent balls from falling out when installing guide into rack-piston nut (fig. 11-85).

(6) Insert guides in guide holes of rack-piston nut (fig. 11-86). Guides should fit loosely.

(7) Place return guide clamp over guides and install attaching bolts and washers. Tighten bolts to 10 foot-pounds torque.

Do not allow the arbor to separate from the worm until the rack-piston nut is fully installed on the arbor.

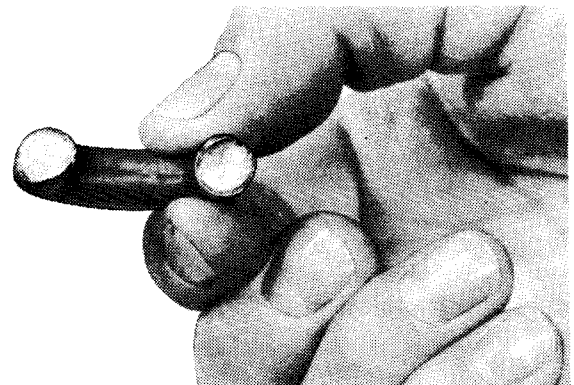
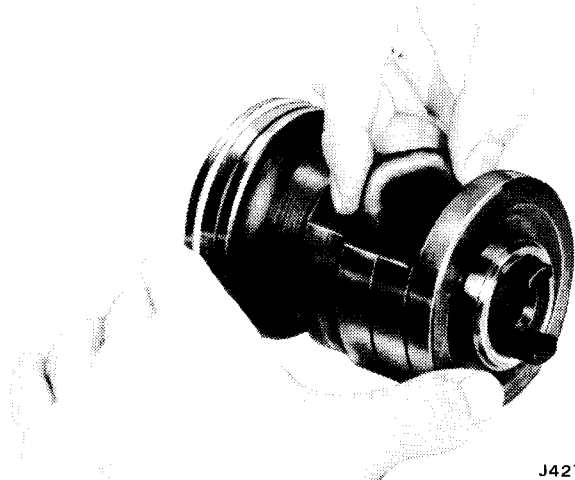


Fig. 11-85 Ball Return Guides Plugged with Petroleum Jelly



J42757

Fig. 11-86 Installing Ball Return Guides in Rack-Piston Nut

Valve Assembly

- (1) Lubricate three backup O-ring seals and install in ring grooves on valve body.
- (2) Install valve seal rings in ring grooves over O-ring seals (fig. 11-87). Rings may appear loose or twisted in grooves, but heat of oil in system will tighten them.
- (3) Install spool valve damper O-ring seal in valve groove.
- (4) Lubricate spool valve and valve body and install valve spool in valve body. Push valve spool through valve body until shaft pin hole is visible from opposite end (valve spool flush with shaft cap end of valve body).
- (5) Install shaft assembly into valve spool until



J42758

Fig. 11-87 Installing Valve Seal Rings

shaft pin can be placed into valve spool.

- (6) Align notch in shaft cap with pin in valve body and press valve spool and shaft assembly into valve body.

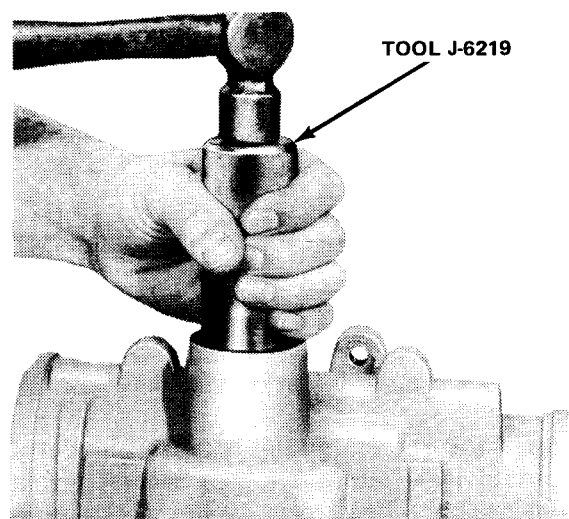
CAUTION: Make sure that shaft cap notch is mated with valve body pin before installing valve body into gear assembly.

- (7) Lubricate new cap-to-worm O-ring seal and install in valve assembly.

If the stub shaft and cap assembly are allowed to slip out of engagement with the valve body pin, the valve spool will extend too far into the valve body. This causes the damper O-ring seal to expand into the valve body oil grooves, preventing withdrawal of the valve spool. If this occurs, attempt to withdraw the spool with a slight pull and rotary motion. If this does not free the valve spool after several tries, make sure valve spool is free to rotate; place valve body on a flat surface with notched end up, and tap valve spool with wooden or plastic rod until the O-ring seal is cut and the valve spool can be removed. Replace damper O-ring seal and proceed with assembly. Make sure any cut pieces of O-ring are removed.

Power Steering Gear Subassemblies

- (1) Use Pitman Shaft Needle Bearing Tool J-6657 to install needle bearing in housing. Install bearing from inside of housing toward outside. Make sure identification end is toward inside of gear and that tool is placed against identification end during installation. Press bearing into housing until it clears shoulder in gear housing by 0.030 inch.
- (2) Lubricate and install pitman shaft seals. Install single lip seal first, then backup washer (fig. 11-73).
- (3) Use Seal Seating Tool J-6219 (fig. 11-88) to seat seal and washer far enough to provide clearance for second seal and backup washer. Make sure seal does not bottom in counterbore.
- (4) Install double lip seal and second backup washer using Seal Seating Tool J-6219. Make sure both seals are installed with lips toward gear housing.
- (5) Install retaining ring.
- (6) Assemble thrust bearings and races on worm of assembled worm and valve.



J42759

Fig. 11-88 Seating Pitman Shaft Seal in Housing

NOTE: Two types of thrust bearing races may be used. Conical races must be installed so top of cone is facing bottom of gear. Flat races can be installed in any manner as long as one is above bearing and one below.

(7) Install assembled valve and worm in housing as assembly. Align valve body drive pin in worm with narrow pin slot on valve body. Insert valve assembly into gear housing (fig. 11-89).

NOTE: Push only on valve body—NOT on stub shaft.

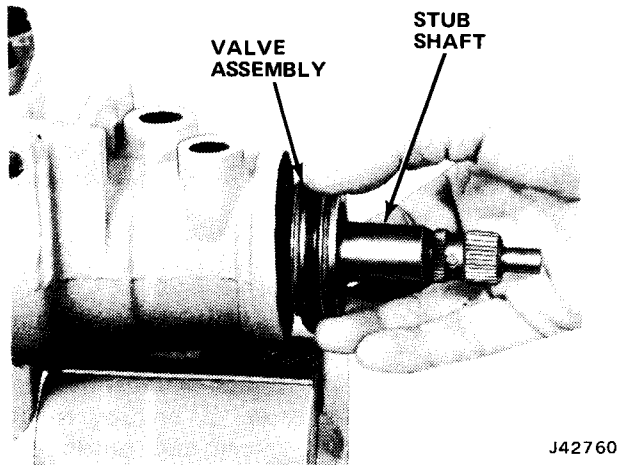


Fig. 11-89 Installing Valve Assembly

CAUTION: Do not push against stub shaft as this may cause stub shaft and cap to pull out of valve body, allowing valve spool O-ring to slip into valve body oil grooves. The valve assembly should be inserted by pressing against the valve body with the fingertips (fig. 11-90). Before assembling the adjuster plug assembly, be sure the valve is properly seated. Most of the oil return hole in the gear housing should be fully visible at this time. If not, valve and worm are misaligned or thrust bearings are improperly installed.

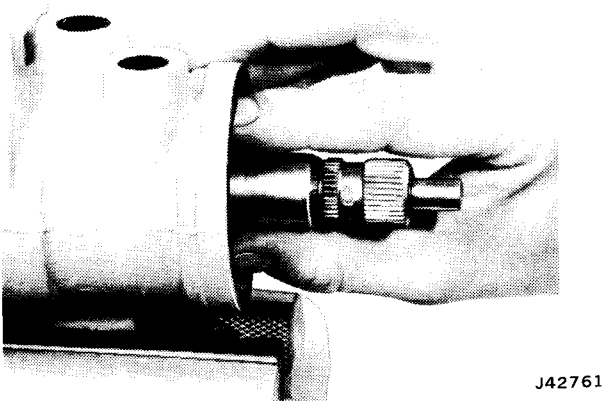


Fig. 11-90 Installing Valve Assembly Fully into Housing

(8) Install needle bearing in adjuster plug by pressing from thrust bearing end of adjuster plug against identification end of bearing, using Tool J-6621 (fig. 11-91). The end of the bearing must be flush with bottom surface of stub shaft seal bore.

(9) Lubricate new stub shaft seal and, using Tool J-5188 (fig. 11-92), install far enough to provide clearance for dust seal and retaining ring.

(10) Lubricate new dust seal and install with rubber surface facing out.

(11) Install retaining ring. Be sure ring is properly seated.

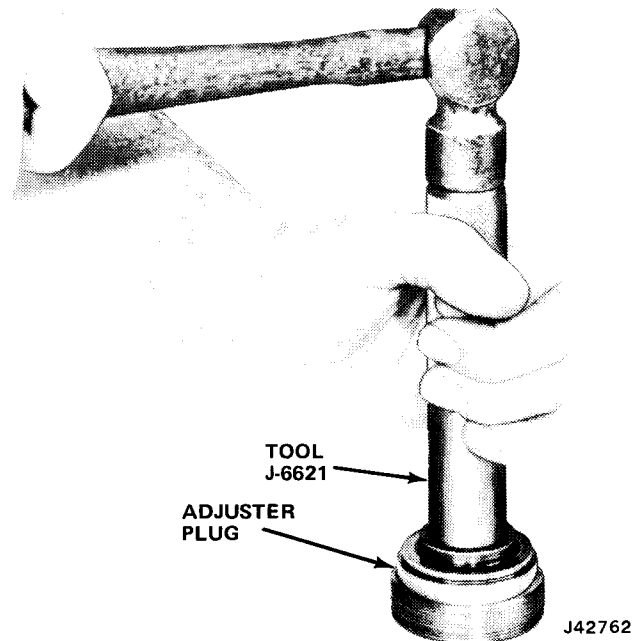


Fig. 11-91 Installing Needle Bearing in Adjuster Plug

(12) Lubricate O-ring seal with petroleum jelly and install on adjuster plug.

(13) Assemble large OD thrust bearing race, thrust bearing, small thrust bearing race, and thrust bearing spacer on adjuster plug. Do not flatten dimples. Spacer should rotate freely after assembly. Radial location of dimples is not important.

(14) Place Seal Protector Tool J-6222 over end of stub shaft.

(15) Install adjuster plug assembly in gear housing. Before adjusting preload, tighten adjuster plug to 20 foot-pounds torque.

(16) Adjust thrust bearing preload as follows:

With Conical Races

(a) Mark housing opposite one of the holes in adjuster plug (fig. 11-93).

(b) Measure counterclockwise $\frac{3}{16}$ to $\frac{1}{4}$ inch and remark housing (fig. 11-94).

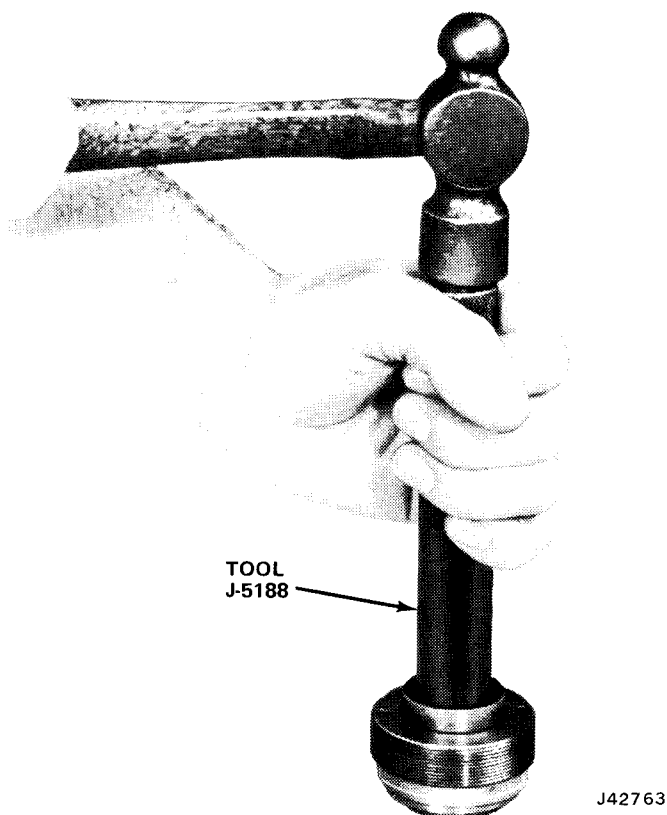


Fig. 11-92 Installing Stub Shaft Seal in Adjuster Plug

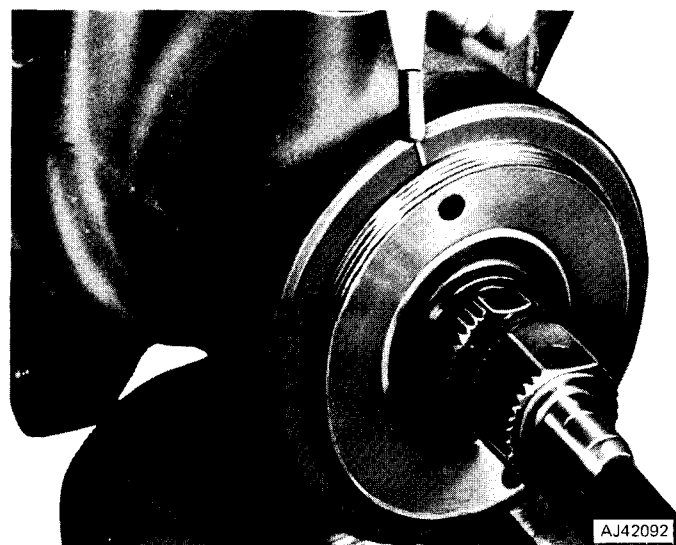


Fig. 11-93 Marking Housing

(c) Rotate adjuster plug counterclockwise until hole in plug is in line with second mark.

(d) Install and tighten adjuster plug locknut to 80 foot-pounds torque using Tool J-25194 while holding adjuster plug in position.

(e) Using an inch-pound torque wrench and 3/4-inch deep socket, measure drag torque required to turn stub shaft. Reading should be taken with beam of

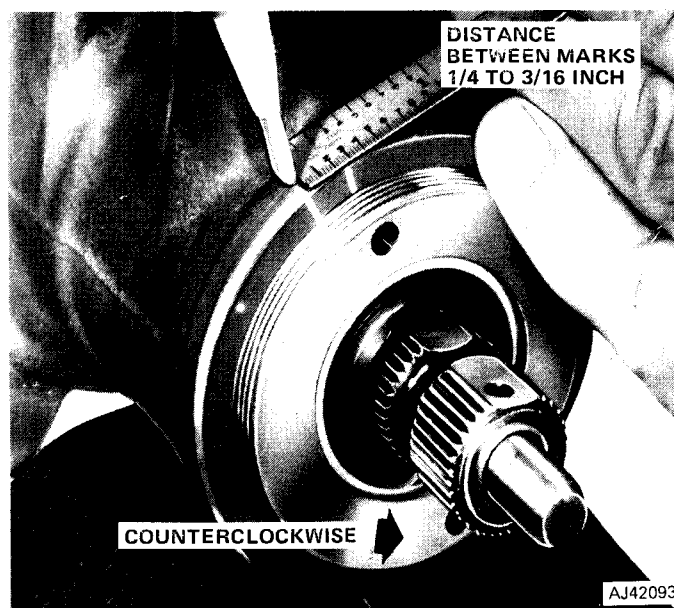


Fig. 11-94 Position of Second Mark

torque wrench near vertical while turning counterclockwise at an even rate. If reading is less than 4 inch-pounds or more than 10 inch-pounds, use adjustment procedure for flat races. If reading is within 4-to-10 inch-pound range, record and continue with overcenter adjustment (fig. 11-95).

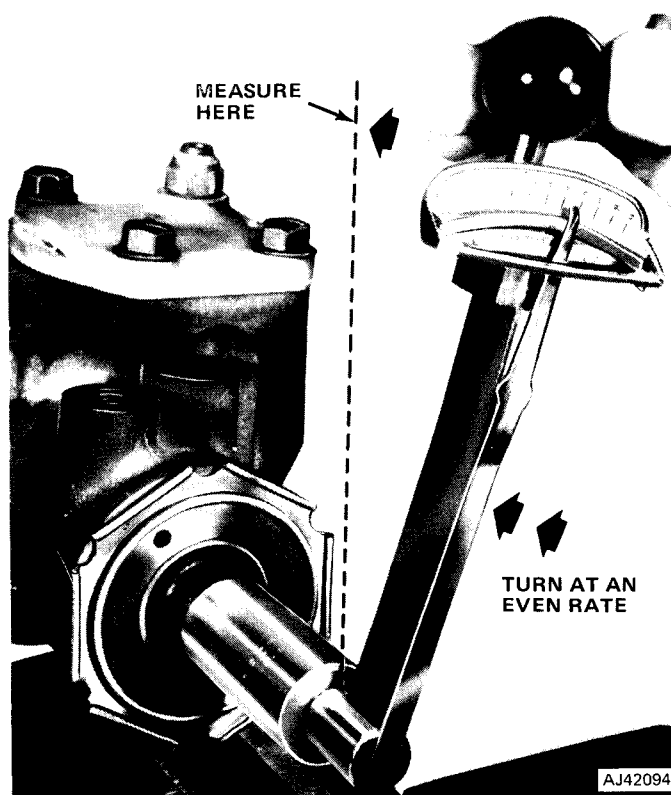


Fig. 11-95 Drag Torque Measurement

With Flat Races

(a) Tighten adjuster plug to 20 foot-pounds torque and back off 1/2-turn.

(b) Using inch-pound torque wrench and 3/4-inch deep socket, turn stub shaft and measure valve body drag torque. Record reading (fig. 11-95).

(c) Tighten or loosen adjuster plug to obtain an additional drag torque of 4 inch-pounds above torque obtained previously.

(d) Tighten adjuster plug locknut securely to 80 foot-pounds torque, while holding adjuster plug in position.

(e) Recheck torque and record reading.

NOTE: Preload tends to drop when locknut is tightened.

(17) Install Ring Compressor Tool J-8947 in gear housing. Hold it tightly against shoulder in housing. Insert rack-piston nut in housing until arbor engages worm. Turn stub shaft clockwise, to draw rack-piston nut into housing. When piston ring is in housing bore, remove arbor from rack-piston nut. Remove ring compressor tool. Move rack-piston to center position.

(18) Install rack-piston end plug using 1/2-inch drive socket extension in square hole of plug. Temporarily install pitman shaft to prevent rack-piston nut from turning. Tighten plug to 75 foot-pounds torque.

(19) Lubricate housing end plug O-ring and install in gear housing.

(20) Insert end plug in gear housing and seat against O-ring seal. Install end plug retainer ring. It is necessary to install one end of ring first, then work rest of ring into groove until seated. When installed, one end of retainer ring must be 1/2 inch from hole in body.

NOTE: If necessary, tap lightly on retainer ring to bottom ring in gear housing.

(21) Assemble side cover and bushing on pitman shaft. Thread lash adjuster through side cover until side cover bottoms on pitman shaft, then back off 1/2 turn. Lubricate new side cover O-ring seal and install in groove in side cover face. Hold O-ring in place with petroleum jelly.

(22) Rotate stub shaft until middle rack groove is aligned with center of pitman shaft needle bearing. Install pitman shaft gear so that center tooth in sector meshes with center groove of rack-piston. Make sure side cover O-ring is in place before seating side cover on gear housing.

(23) Install side cover attaching bolts and lockwashers. Tighten bolts to 38 foot-pounds torque. Install lash adjuster nut on lash adjuster but do not tighten nut.

(24) Measure total drag with gear on center and pitman shaft backed off. With gear on center, adjust pitman shaft thrust screw until preload is 4 to 8 inch-pounds in excess of total preload and drag but do not exceed 18 inch-pounds torque. Readings are to be made through an arc not exceeding 20 degrees with gear on center. Tighten locknut to 25 foot-pounds torque.

POWER STEERING PUMP SERVICE**Removal**

NOTE: It is not necessary to remove the pump to service the flow control valve. The flow control valve is retained in the pump housing by a pressure union and filter assembly.

(1) Remove pump drive belt and air pump belt (if equipped).

(2) Disconnect return and pressure hoses from pump. Cover the hose connector and union on pump and open ends of the hoses to avoid entry of dirt.

(3) On V-8, remove front bracket from engine

(4) Remove two nuts attaching rear of pump to bracket, and two bolts attaching pump to front bracket, and remove pump.

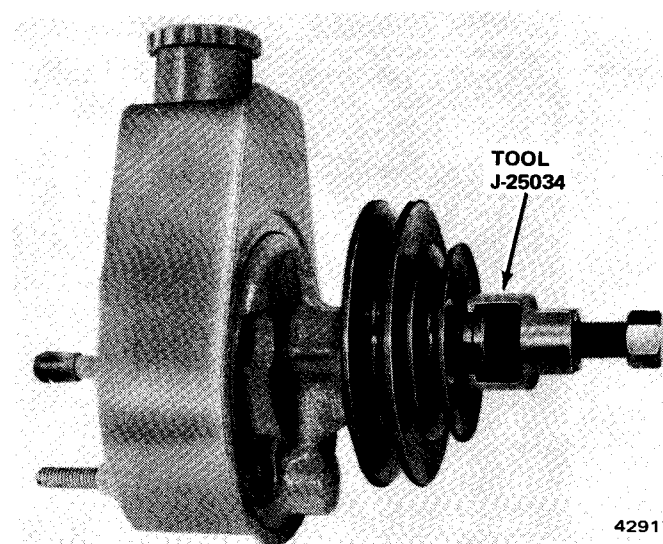
Pump Shaft Seal Replacement—Pump Assembled

(1) Remove pump drive belt from pulley.

(2) Remove pulley using Tool J-25034 (fig. 11-96).

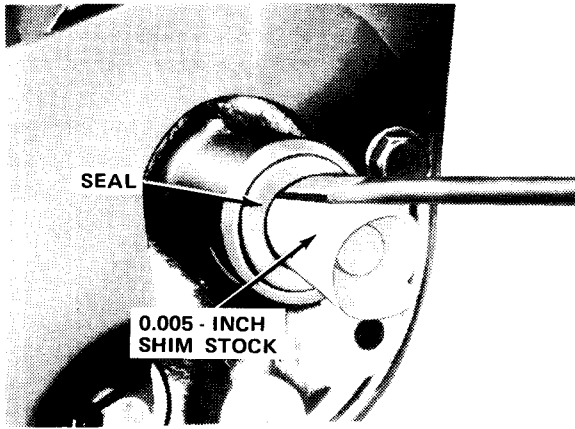
Do not hammer pulley from shaft.

(3) Wrap length of 0.005-inch shim stock, approximately 2-1/2 inches long, around shaft and push it past seal until it bottoms in pump housing (fig. 11-97).



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Fig. 11-96 Removing Pump Pulley



J42764

Fig. 11-97 Removing Oil Seal

(4) Remove seal by cutting metal body of seal using sharp tool and then prying out using screwdriver (fig. 11-97). **Do not damage shaft or pump housing.**

(5) Place Seal Protector J-7586-01 over shaft.

(6) Lubricate new seal with power steering fluid and install in pump housing, spring side first, using Installer J-7728 (fig. 11-98). Bottom seal in housing. Do not use excessive force when installing seal.

(7) Install pulley using Tool J-25033 (fig. 11-99).

(8) Install drive belt and air pump belt (if equipped).

(9) Adjust belt tension to specification.



J42765

Fig. 11-98 Installing Pump Shaft Seal

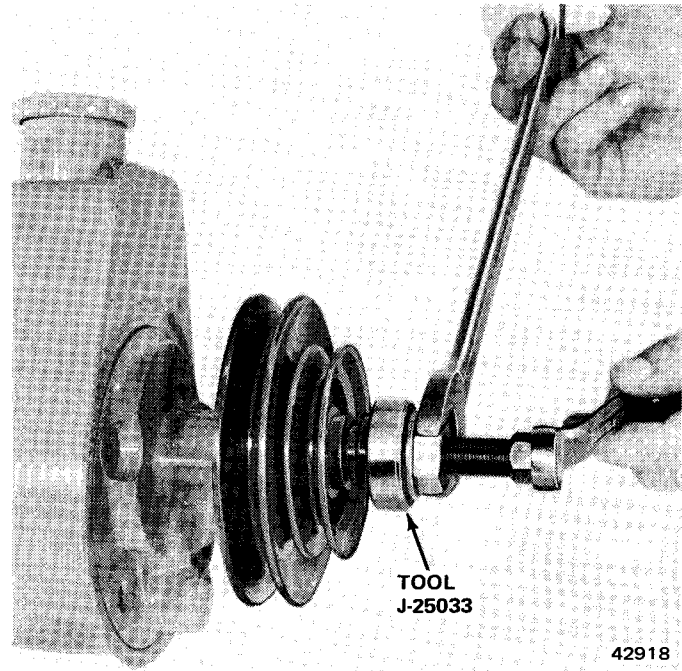


Fig. 11-99 Installing Pump Pulley

(10) Fill pump reservoir to proper level with power steering fluid and bleed pump as outlined in Fluid Level and Initial Operation.

Pump Disassembly

(1) Using masking tape, cover hose union and pipe on pump and clean exterior of pump.

(2) Remove pump pulley using Tool J-25034 (fig. 11-96).

(3) Remove reservoir cap and drain oil from pump reservoir.

(4) Mount pump in vise with pump shaft pointing down.

CAUTION: Do not clamp pump tightly in vise. This will distort bushing.

(5) Remove two reservoir-to-pump housing studs and O-rings. Discard O-rings.

(6) Remove pressure union. Remove O-ring from union and discard O-ring.

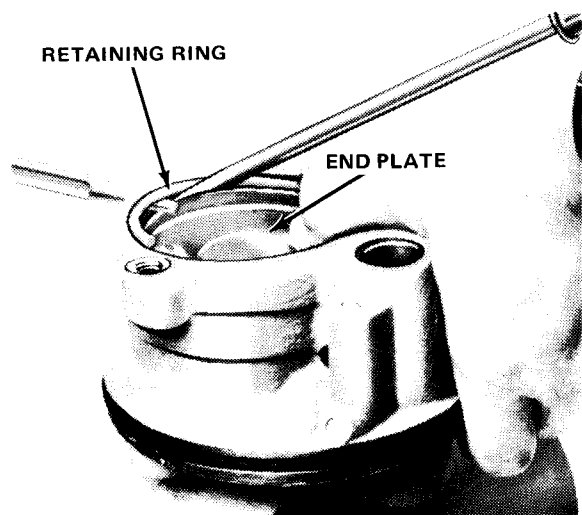
(7) Remove flow control valve and spring.

(8) Remove reservoir from pump by rocking reservoir back and forth and pulling upward.

(9) Remove reservoir O-ring seal on housing and discard.

(10) Remove small reservoir-to-housing O-ring seal from counterbore in housing and discard.

(11) Rotate end plate retaining ring until one end of ring is over hole in housing. Unseat ring using 1/8-inch punch and remove ring using screwdriver (fig. 11-100).



J42766

Fig. 11-100 End Plate Retaining Ring Removal

(12) Remove pump from vise. Invert pump and remove end plate, pressure plate spring, flow control valve and spring. If end plate should stick in housing, tap it lightly to remove it.

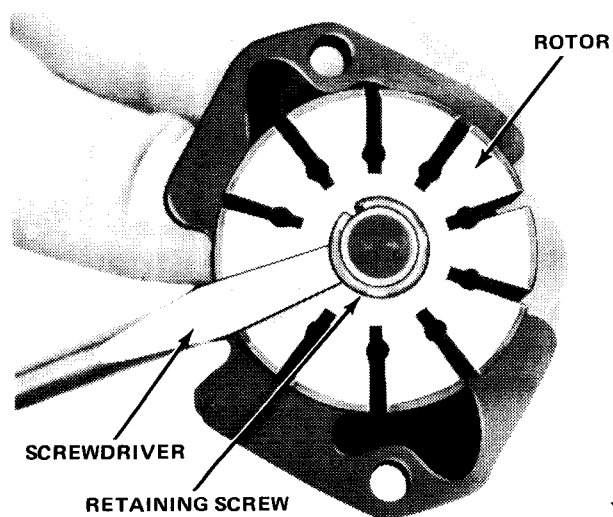
NOTE: Do not disassemble control valve.

(13) Remove and discard end plate O-ring seal.

(14) Place end of shaft on bench and press down on housing to force shaft out.

(15) Turn housing over and remove shaft and rotor assembly. Do not drop parts. If two dowel pins did not come out with assembly, remove dowel pins from housing.

(16) If shaft and rotor assembly must be disassembled, use screwdriver to remove retainer ring and separate parts (fig. 11-101).



J42767

Fig. 11-101 Rotor Retaining Ring Removal

(17) Remove and discard pressure plate O-ring seal.

(18) Remove shaft seal by prying out with small screwdriver.

Power Steering Pump Inspection

Clean all parts thoroughly in solvent and dry using clean, lint-free cloth.

Inspect shaft for wear.

Check fit of the ten Vanes in rotor slots. Vanes must slide freely but fit snugly in slots. Burrs or irregularities on vanes may be removed using an oil stone. Replace rotor if vanes are excessively loose in rotor slots, or if worn or scored. Light scoring on the rotor can be repaired by carefully lapping surface of rotor with crocus cloth. Clean thoroughly after lapping.

Inspect all ground surfaces of the rotor ring for roughness or irregular wear. Slight irregularities may be removed with an oil stone. Replace ring if inside cam surface is badly scored or worn and inspect outside radius of vanes very closely for damage.

Inspect the surfaces of the pressure plate and thrust plate for wear and scoring. Light scoring can be repaired by carefully lapping with crocus cloth until surface is smooth and flat. Clean thoroughly after lapping.

Inspect the flow control valve bore in the housing for scoring, burrs or other damage. Hairline scratches are normal. Replace valve if badly scored or if it is the cause of low pump pressure. Check the screw in the end of the valve. If loose, tighten it but do not damage the machined surfaces. Clean filter in end of screw with in solvent and dry with compressed air.

Check orifice in pressure union to be sure it is not plugged.

Power Steering Pump Assembly

Refer to figure 11-102.

(1) Lubricate seals and moving parts with power steering fluid during assembly. Be sure parts are clean.

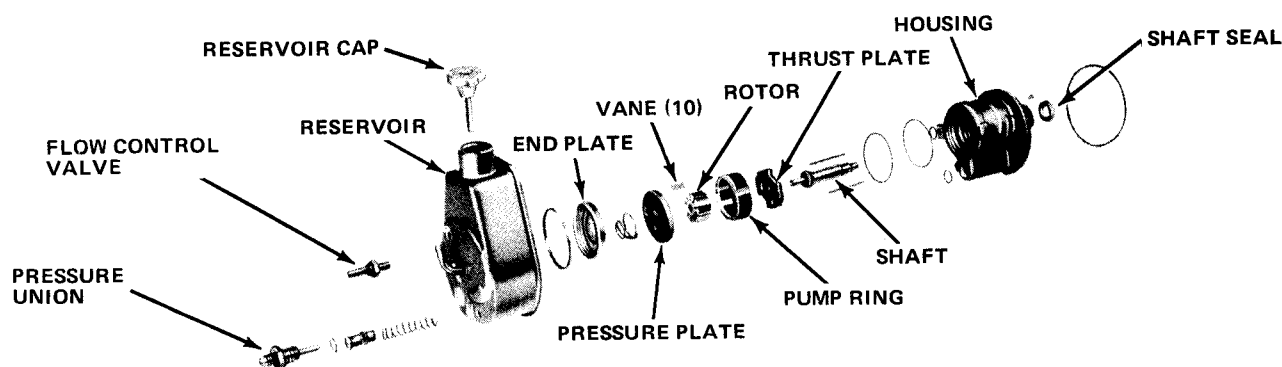
(2) Install shaft seal using Installer J-7017. Install seal with spring side of seal facing housing (fig. 11-103). Bottom seal in housing.

(3) Mount housing in vise with shaft end facing down. Install pressure plate O-ring seal in groove in housing bore.

(4) Insert shaft in housing and press down on splined end with thumb to seat shaft. Do not damage shaft seal in housing.

(5) Install two dowel pins in housing and install thrust plate on pins with ported face of plate to rear of housing.

(6) Install pump ring with small holes in ring on dowel pins and with arrow on outer edge of ring pointing to rear of housing.



J42768

Fig. 11-102 Power Steering Pump

(7) Install rotor on pump shaft with spline side of rotor to rear of housing. Rotor must be free on shaft splines.

(8) Install shaft retaining ring on pump shaft.

(9) Install ten vanes in rotor slots with rounded edge of vane facing pump ring and flat edge toward center of rotor.

(10) Lubricate outside diameter and chamfer of pressure plate with petroleum jelly and install on dowel pins with ported face toward rotor. Dowel pins fit into slots in plate that are nearest outside diameter of plate. Use plastic or wooden rod and tap lightly around outside diameter of pressure plate to seat it. Pressure plate will travel approximately 1/16 inch to seat.

CAUTION: *Never press or hammer on the center of the pressure plate. This will cause permanent distortion and result in pump failure.*

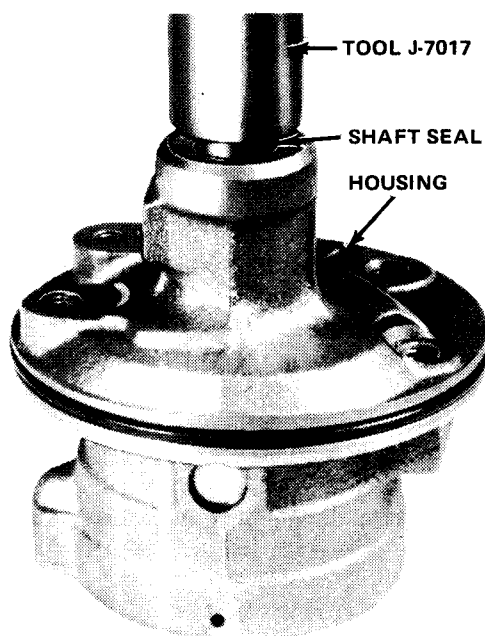
(11) Install end plate O-ring seal in groove in bore of housing. Do not install it in end plate retaining ring groove which is first groove from rear of housing (fig. 11-104).

(12) Install pressure plate spring.

(13) Lubricate outside diameter and chamfer of end plate with petroleum jelly and insert in housing.

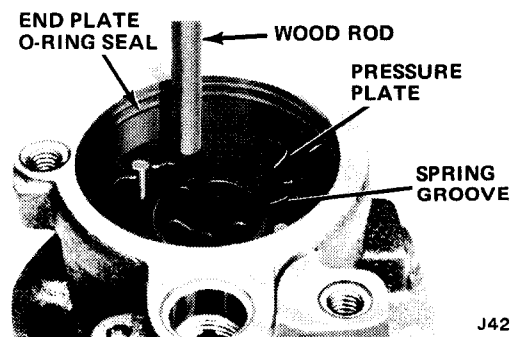
(14) Place end plate retaining ring on top of end plate. Using arbor press, install end plate in housing until ring groove in housing is evenly exposed. Be sure ring is completely seated in housing groove and end plate is aligned properly.

CAUTION: *Press end plate into housing only far enough to install retaining ring in groove.*



J42769

Fig. 11-103 Installing Pump Shaft Seal



J42770

Fig. 11-104 Seating Pressure Plate in Housing

(15) Install reservoir O-ring seal on housing.

(16) Install pressure union seal and two stud seals in proper counterbores at rear of housing.

(17) Install reservoir on housing and align stud holes. Tap reservoir with plastic mallet to seat it on housing. Install reservoir-to-housing studs with short end of stud installed in housing. Tighten studs to 35 foot-pounds torque.

(18) Install flow control valve spring in housing, and install flow control valve with hex head of valve facing into housing. Check for free movement of valve in housing.

(19) Install O-ring in groove nearest outlet end of pressure union. Install union in pump and tighten to 35 foot-pounds torque.

CAUTION: *If O-ring is installed in groove on pressure union that contains the flow orifice, pump will not build up pressure.*

(20) Remove pump from vise and install pulley using Tool J-25033 (fig. 11-87).

(21) Check for bind in pump by rotating drive shaft. Shaft must rotate freely by hand.

Power Steering Pump Installation

(1) Position pump in bracket and install rear attaching screws.

(2) On V-8, install front bracket.

(3) Connect hydraulic hoses.

(4) Fill reservoir with power steering fluid.

(5) Bleed air from pump by turning pulley counterclockwise (viewed from front) until bubbles cease to appear.

(6) Install drive belt.

(7) Using 1-5/8-inch open-end wrench on pump housing boss, pull outward on pump to adjust belt tension, and tighten pump attaching nuts.

(8) Check and adjust belt tension using Gauge J-23600. Refer to Specifications for desired belt tension.

(9) Tighten pump nuts to 30 foot-pounds torque.

(10) Tighten pump bracket nuts.

(11) Install and adjust air pump belt.

NOTE: *If pump or gear has been disassembled, refer to Fluid Level and Initial Operation.*

Fluid Level and Initial Operation

(1) Fill reservoir with power steering fluid.

(2) Operate engine until power steering fluid reaches normal operating temperature of approximately 170°F then stop engine. Remove reservoir filler cap and check fluid level.

(3) If fluid level is low, add power steering fluid as required and replace filler cap. When checking fluid level after steering system has been serviced, air must be bled from system. Proceed as follows:

(a) With wheels turned full left, add power steering fluid to Cold mark on dipstick.

(4) Start engine. With engine operating at fast idle, recheck fluid level. Add fluid if necessary to Cold mark on dipstick.

(a) Bleed system by turning wheels from side to side without hitting stops. Maintain fluid level just above pump housing. Fluid with air in it will have a light tan or red appearance. Air must be eliminated from fluid before normal steering action can be obtained.

(b) Return wheels to center position and continue to run engine for two or three minutes, then shut engine off.

(c) Recheck fluid level as described in steps (2) and (3), making sure fluid level is at Hot mark on dipstick after system has stabilized at normal operating temperature.

(d) Road-test car to make sure steering functions normally and is free from noise.

Oil Pump Pressure Check

NOTE: *The combination of any type tester and fittings is acceptable for this test and connection may be made to pump body or gear housing, whichever is most convenient. However, the gauge must, at all times, be connected **between** pump and tester valve in pressure line circuit.*

(1) Check belt tension and adjust if necessary.

(2) Position drip pan beneath engine.

(3) Disconnect power steering pump pressure hose, keeping hose end raised to prevent excess fluid loss.

(4) Connect pressure hose to Power Steering Pressure Tester Gauge J-21567.

(5) Connect tester hose to power steering pump.

(6) Open tester valve fully counterclockwise.

(7) Replenish fluid level.

(8) Operate engine until it reaches normal operating temperature.

(9) Note initial pressure on gauge (valve open). Initial pressure should be 80 to 125 psi. If pressure is in excess of 200 psi, check hoses for restrictions and poppet valve (in gear housing) for proper assembly.

(10) Close tester valve fully and reopen three times. Record highest pressure noted each time.

CAUTION: *Do not hold valve closed for more than five seconds as pump damage may result.*

(a) If pressures are within specification (1200 psi for CJ; 1400 psi for Cherokee, Wagoneer, and Truck), and range of readings is within 50 psi, pump is functioning within specifications.

EXAMPLE: On CJ models, if pressures noted are 1200-1210-1220 psi, pump operation is acceptable.

(b) If pressure recorded are high, but do not repeat within 50 psi, flow control valve is sticking. Remove and clean valve and remove any burrs with crocus cloth or fine hone. If system contains some dirt, flush the system.

CAUTION: *The power steering hydraulic system is a closed circuit. Contamination of fluid in either the pump or gear can be transferred to the other the pump or gear. If system is exceptionally dirty, both pump and gear must be disassembled, cleaned, and reassembled.*



(11) If pump performance is within specifications, with valve open, turn (or have assistant turn) steering wheel to both left and right stops and note highest pressures. Compare with maximum pump output.

CAUTION: *Do not hold wheel against stops over five seconds as pump may be damaged.*

If pump output cannot be met in either (or one) side of gear, gear is leaking internally and must be disassembled and repaired.

(12) Shut off engine and remove tester.

(13) Connect pressure hose to pump.

(14) Make necessary repairs or replenish fluid level.

(15) Remove drip pan.

SPECIFICATIONS

Power Steering Gear

Type	Recirculating Ball, Worm and Nut
Ratio	CJ - 17.5:1 Constant Ratio
	All Others 13/16:1 Variable Ratio
Bearings:	
Worm - Upper	Ball
Lower	Ball
Pitman Shaft	Bushing
Torque:	
Pitman Arm to Pitman Shaft	160-210 ft-lbs
Adjuster Plug Locknut	50-110 ft-lbs
Pitman Shaft Lash-Adjuster Locknut	27-37 ft-lbs
Pressure and Return Hose Fittings	25-35 ft-lbs
Rack-Piston Plug	50-100 ft-lbs
Return Guide Clamp Screws	3-6 ft-lbs
Side Cover Bolts	30-45 ft-lbs
Steering System Oil Capacity (Dry)	1 1/4 qts

Power Steering Pump

Capacity at 465 rpm	1.25 gpm
Flow Control Range	1.25-2.15 gpm
Relief Valve Setting:	
CJ Models	1100-1200 psi
Cherokee, Wagoneer, Truck	1400-1500 psi

Engine Drive Belt Tension

	New Belt*	Used Belt
Air Conditioner, Six-Cylinder	125-155	90-115
Air Conditioner, V-8	125-155	105-130
Air Pump (All except Six-Cylinder w/AC)	125-155	90-115
Air Pump Six-Cylinder w/AC (3/8 Inch Belt)	65-75	60-70
Fan	125-155	90-115
Idler Pulley	125-155	90-115
Power Steering Pump	125-155	90-115

*New belt specifications apply only to replacement belts. Once a belt has been tensioned and run, it is considered a used belt and should be adjusted to used belt specifications.

Manual Steering Gear

Left-Hand Drive Vehicles:

Type	Recirculating Ball
Ratio	24:1
Bearings -	
Upper	Ball
Lower	Ball
Pitman Shaft	Bushing

Torque:

Worm Bearing Adjuster Nut	8 in-lbs
Pitman Shaft Adjuster Screw	18 in-lbs
Cover Bolts	25-35 ft-lbs
Pitman Shaft Lash-Adjustment Locknut	18-27 ft-lbs
Worm Thrust-Adjustment Locknut	70-110 ft-lbs

Right-Hand Drive Vehicles:

Type	Cam and Lever
Ratio	24:1
Bearings -	
Upper	Ball
Lower	Ball
Lever Shaft	Roller and Bushing

Wheel Alignment

Torque:

Cam Bearing Preload	2-5 in-lbs
Input Torque Over Center (Maximum)	7-12 in-lbs
Cover to Housing Cap Screws	18-20 ft-lbs
Flexible Coupling to Flange	15-20 ft-lbs
Worm Gear Shaft Locknut	16-20 ft-lbs

Steering Axis Inclination

Caster

 CJ

 Cherokee, Wagoneer, and Truck

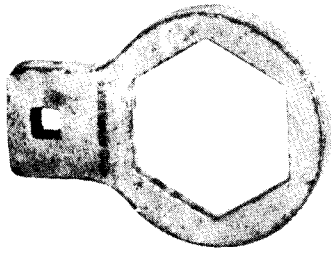
Camber

Toe-In

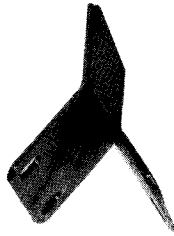
Turning Angle

 CJ

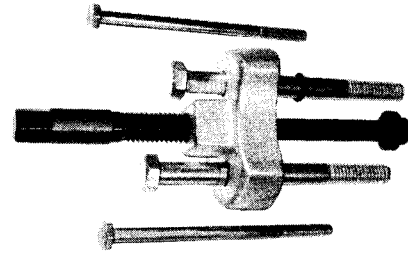
 Cherokee, Wagoneer, and Truck



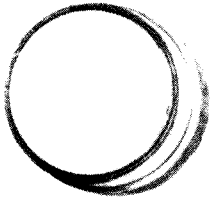
J-25194 THRUST BEARING
ADJUSTER WRENCH
(2-3/4" x 3-1/4")



J-23074 STEERING
COLUMN HOLDING
FIXTURE



J-25115 STEERING WHEEL PULLER



J-8947 PISTON INSTALLER
(POWER STEERING)



C-3780 WORM SHAFT BEARING
CUP REMOVER (MANUAL STEERING)



J-7624 ADJUSTER
PLUG ADJUSTABLE
SPANNER WRENCH



J-6217 OIL LINE CONNECTOR
(POWER STEERING)



J-7754 TORQUE WRENCH
(0 - 25 INCH POUNDS)



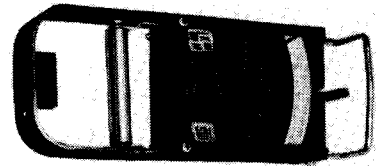
C-3777 WORM SHAFT BEARING CUP
INSTALLER (MANUAL STEERING)



J-7539-01 RACK PISTON BALLS
RETAINING ARBOR
(POWER STEERING)



J-1614 PITMAN SHAFT BUSHING
REMOVER AND INSTALLER



J-23600 BELT TENSION GAUGE



J-7171 PITMAN
SHAFT OIL SEAL
INSTALLER



J-5787 PITMAN
SHAFT OIL SEAL
PROTECTOR



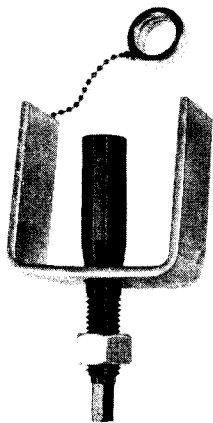
J-4245 SNAP RING
PLIERS (INTERNAL)



J-7017 WORM SHAFT UPPER
OIL SEAL INSTALLER



J-5188
ADJUSTER PLUG
OIL SEAL INSTALLER



J-23653 LOCK PLATE
COMPRESSOR AND
SNAP RING INSTALLER



J-6657 PITMAN SHAFT
NEEDLE BEARING REMOVER
AND INSTALLER



J-6219 PITMAN
SHAFT OIL SEAL
INSTALLER



J-6222 ADJUSTER
PLUG OIL SEAL
PROTECTOR



J-1586-01 PUMP
SHAFT OIL SEAL
PROTECTOR



J-25034
REMOVER



J-23073 SHIFT
TUBE INSTALLER



J-23072 SHIFT
TUBE REMOVER



J-25033
INSTALLER



J-21854-1 PIVOT
PIN PULLER