Power Steering Gears

FORD TORSION BAR

F100/F350 (2-WD), F150/350 (4-WD), Bronco

DESCRIPTION

Torsion bar type power steering unit consists of a worm and one-piece rack-piston, which is meshed to gear teeth on sector shaft. Hydraulic control valve, input shaft, and torsion bar assembly are mounted to end of worm shaft and operated by twisting action of torsion bar.

One-piece rack-piston, worm and sector shaft are mounted in one housing, while valve spool is mounted in an attached housing. This allows internal passage of fluid between valve and cylinder, thus eliminating the need for all external lines and hoses, except for pressure and return hoses between pump and gearbox assembly.

LUBRICATION

Check fluid level in pump reservoir every 5000 miles. Steering gear and fluid must be at normal operating temperature. If necessary, add power steering fluid to bring level to proper mark on dipstick.

ADJUSTMENT

OVERCENTER POSITION

1) Disconnect pitman arm from sector shaft. Disconnect fluid return line at pump reservoir, and cap reservoir return line pipe. Place end of return line in clean container and cycle steering wheel in both directions several times to discharge all fluid from steering gearbox.

2) Remove horn button from steering wheel, and turn steering wheel until positioned 45° from left steering stop. Using an INCH-lb. torque wrench on steering wheel attaching nut, measure force required to turn steering shaft $^1/_8$ turn from 45° position. Turn steering wheel back to center position and measure force required to move steering shaft back and forth across center position.

3) Loosen lock nut and turn adjusting screw until reading across center position is 14-18 INCH lbs. (1.5-2.0 N.m) greater than reading across 45° position. Tighten lock nut while holding adjusting screw in place. Replace pitman arm and reconnect hoses.

TESTING

VALVE SPOOL CENTERING

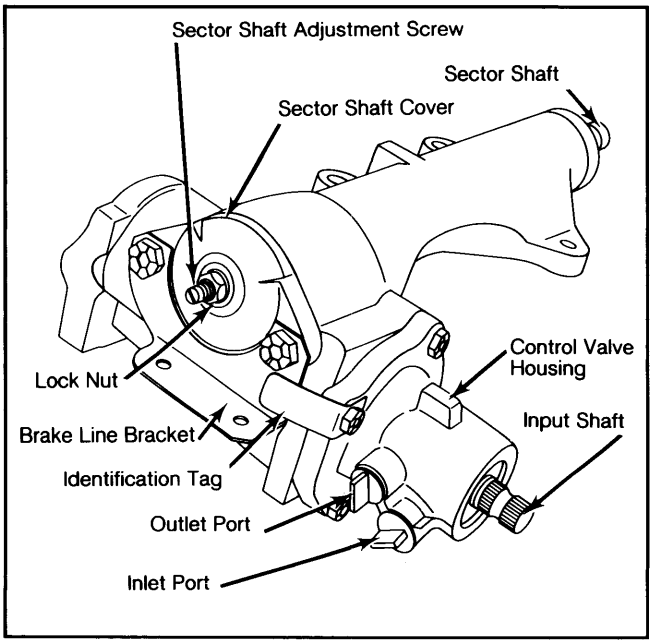
1) Install a 0-2000 psi pressure gauge and valve assembly between power steering pump and high pressure line. Open gauge valve completely, and remove horn button from steering wheel. Attach an INCH-lb. torque wrench to steering wheel attaching nut.

2) With power steering fluid at normal operating temperature and correct level, steering wheel in centered position, and engine at normal operating temperature, set engine idle to 1000 RPM. Using torque wrench, rotate steering shaft to either side of center to obtain gauge reading of 250 psi in each direction.

3) Torque reading should be same in both directions when 250 psi is reached. If difference between readings exceeds 6 INCH lbs. (.67 N.m), steering gear must be removed and the shaft and control assembly replaced.

NOTE: When performing test off vehicle, use same procedure, except take torque and pressure readings at right and left stops instead of either side of center.

Fig. 1: Ford Torsion Bar Steering Gear Assembly



REMOVAL & INSTALLATION

STEERING GEAR

Removal

1) Disconnect hydraulic lines at power steering gear, and cap lines. Plug ports in steering gear to prevent entry of foreign matter. Remove splash shield from flex coupling. Disconnect flex coupling at steering gear. Raise vehicle and remove pitmam arm, attaching nut and washer. Using puller, remove pitman arm from sector shaft, being careful not to damage seals.

2) Support steering gear and remove steering gear attaching bolts. Work the steering gear free of the flex coupling and remove steering gear from vehicle.

Installation

1) Slide flex coupling into position on steering shaft assembly and turn steering wheel so spokes are in horizontal position. Center steering gear input shaft with indexing flat forward. Install gearbox input shaft into flex coupling and into place on frame. Install and tighten attaching bolts.

2) With wheels in straight ahead position, install pitman arm on sector shaft. Install washer and nut to pitman arm and tighten. Install splash shield. Connect and tighten pressure and return lines to steering gear. Disconnect coil wire. Fill reservoir to proper level. Turn ignition on and turn steering wheel left to right to distribute fluid. Check fluid and add if necessary.

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OVERHAUL

NOTE: If complete gearbox assembly is not to be overhauled, remove unit to be overhauled and proceed to disassembly and reassembly of that unit.

STEERING GEAR

Disassembly

1) Drain steering gear completely, and mount gear in a soft-jawed vise. Remove lock nut and washer from adjusting screw. Turn input shaft to either stop, then turn shaft back 2 turns to center gear.

2) Remove sector shaft cover attaching bolts. Tap lower end of sector shaft with a soft faced hammer to loosen shaft in bore, then lift shaft and cover assembly from housing. Discard cover "O" ring.

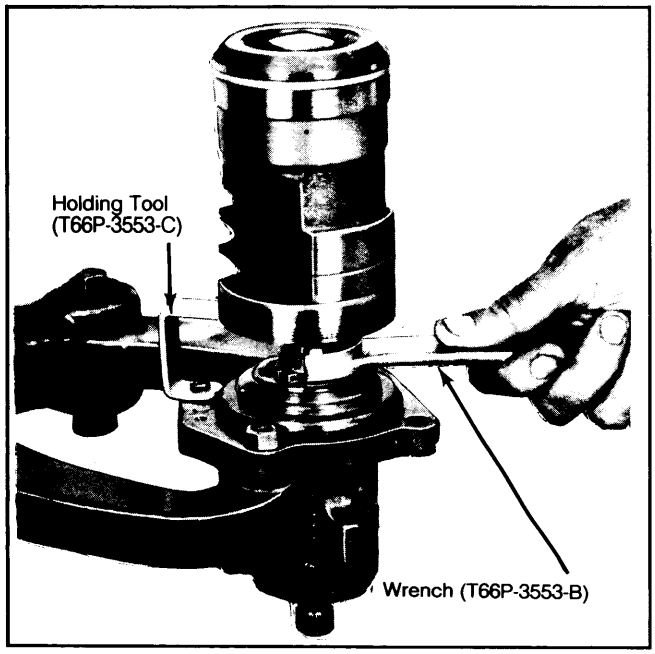
3) Turn sector shaft cover counterclockwise to remove it from adjusting screw. Remove valve housing attaching bolts and identification tag. Lift valve housing from steering gear housing while holding piston to prevent it from rotating off worm shaft. Remove valve housing and control valve gasket. Discard gasket.

4) With piston held so that ball guide faces up, remove ball guide clamp screws and ball guide clamp. Over a clean container, place finger over opening in ball guide, turn piston so ball guide faces down and let guide tubes fall into container.

5) Rotate input shaft stop to stop until all balls fall from the piston into the container. Remove valve assembly from piston. Inspect piston bore to make sure all balls have been removed.

6) Install valve body assembly in bench mounted holding fixture (T57L-500-B). Loosen hex head race nut screw from the bearing race nut as shown in *Fig. 2*. Carefully slide input shaft, worm and valve assembly out of valve housing.

Fig. 2: Removing Worm Bearing Race Nut



CAUTION: Due to close clearance, cocking of spool may cause it to jam in housing.

Reassembly

1) Mount valve housing in a holding fixture with flanged end upward. Apply a light coat of lubricant to Teflon rings on valve sleeve, then carefully install worm and valve in housing. Install race nut in housing and tighten securely. Install Allen head race nut set screw through housing and tighten.

2) Place piston on bench with ball guide holes facing up. Insert worm shaft into piston so that the first groove is in line with the hole nearest the center of the piston. Place the ball guide in the piston. Place a minimum of 27 ball bearings in the ball guide while turning worm counterclockwise as viewed from input end of shaft.

3) If all balls have not been fed into the guide upon reaching the left stop, rotate the input shaft in one direction and then the other while inserting the remaining balls. DO NOT rotate the input shaft more than 3 turns from the left stop or the balls will fall out of the circuit.

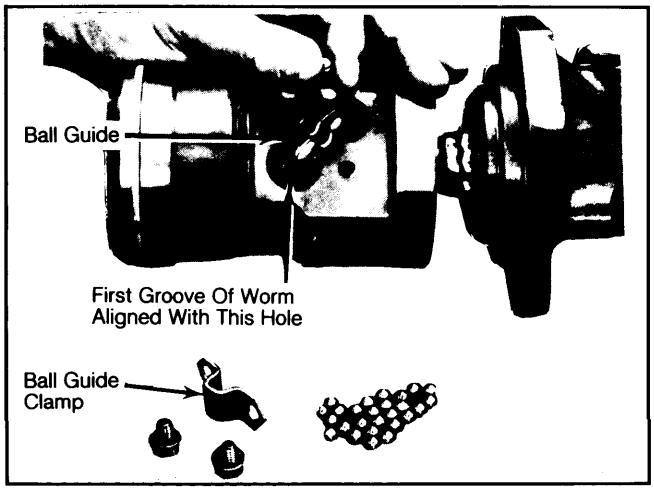
4) Secure guides in ball nut with guide clamp. Apply petroleum jelly to Teflon seal on piston and place a new "O" ring on valve housing. Slide piston and valve into gear housing, using care not to damage Teflon seal.

5) Align oil passage in valve housing with passage in gear housing. Place new "O" ring in oil passage hole of gear housing. Install identification tag on housing on upper right valve housing bolt.

6) Loosely install housing attaching bolts, rotate the ball nut so that teeth are in same place as sector teeth and tighten valve housing bolts. Position sector shaft cover "O" ring in steering gear housing. Turn input shaft as necessary to center piston.

7) Apply petroleum jelly to sector shaft journal, and position sector shaft and cover assembly in gear housing. Install and tighten cover attaching bolts. Adjust steering overcenter position. *See Overcenter Position Adjustment.*

Fig. 3: Installing Piston on Worm Shaft



STEERING GEAR HOUSING

Disassembly & Reassembly

1) Remove snap ring from lower end of housing. Using a puller, remove dust seal and pressure seal from housing. Lubricate new seals and sector shaft seal bore with Lubriplate.

2) Place dust seal on tool T77L-3576-A so the raised lip of the seal is toward the tool. Place pressure seal on tool so lip is away from tool. Flat back side of

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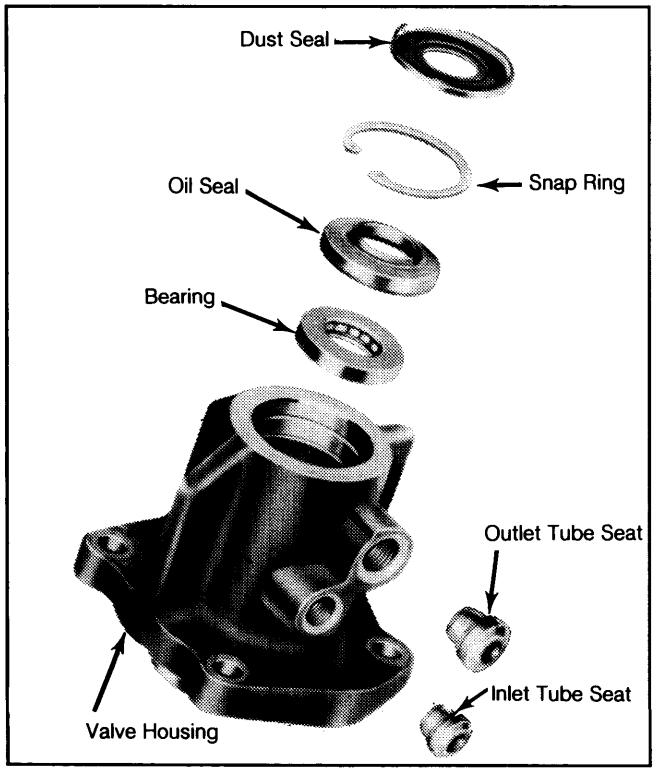
pressure seal should be against flat side of dust seal. Insert tool into sector shaft bore and drive in until seals clear snap ring groove. Do not bottom seals against bearing. Install snap ring in housing groove.

Fig. 4: Disassembled View of Control Valve Housing



CONTROL VALVE HOUSING

Disassembly

Remove dust seal from rear of valve housing using puller (T59C-100-B) and slide hammer (T58L-101-A). Discard seal. Remove snap ring from valve housing. Invert housing and using input shaft bearing/seal tool (T65P-3524-A2 & T65-3524-A3) in valve body assembly opposite oil seal end, tap bearing and seal out of housing. Discard seal. Remove fluid inlet and outlet tube seats with tube seat remover (T74P-3504-L) if damaged.

Reassembly

1) Coat fluid inlet and outlet tube seats with Vaseline and install bearing with metal side covering rollers facing outward. Press bearing into housing.

2) Dip a new oil seal in power steering fluid and place in housing with metal side out. Drive seal into housing until outer edge does not quite clear snap ring groove. Place snap ring in housing with dished rubber side out. Drive into place until seal is located behind undercut in input shaft.

WORM & VALVE SLEEVE

Disassembly & Reassembly

1) Remove rings from sleeve with a small knife. Mount worm end of worm and valve sleeve assembly in a soft-jawed vise and install a mandrell tool (T75L-3517-A1) over the sleeve. Install rings one at a time with the aid of a driver tool (T75L-3517-A2).

2) Rapidly push down on pusher tool to force ring down ramp and into fourth groove of valve sleeve. Repeat three more times, each time adding spacers (Tool T75L-3517-A3) under mandrell tool to line up next groove.

3) After all sleeve rings are installed, install sizing tool (T75L-3517-A4) over valve sleeve rings. Be sure rings are not bent over as tube is slid over them. Remove sizing tool and check condition of rings. They must turn freely.

PISTON & BALL NUT

Disassemby & Reassembly

Remove Teflon ring and "O" ring from piston ball nut assembly. Dip new "O" ring in power steering fluid and install it on piston and ball nut. Install new teflon ring on piston and ball nut, using care not to stretch ring more than necessary.

TIGHTENING SPECIFICATIONS

Application	INCH Lbs. (N.m)
Ball Return Guide Clamp Screw	42-70 (4.7-7.9)
Allen Head Race Nut Setscrew	15-25 (1.6-2.8)
	Ft. Lbs. (N.m)
Sector Shaft Cover Bolts	55-70 (75-95)
Sector Shaft Adj. Screw Lock Nut	35-45 (48-61)
Valve Housing-to-Gear Housing Bolts	35-50 (48-68)
Piston End Cap	70-110 (95-150)
Rack Retaining Nut	[1]

[1] - Tool used with torque wrench will affect observed reading at torque wrench. To obtain required torque wrench reading, multiply length of torque wrench by desired torque (72 ft. lbs.; 98 N.m), and divide this product by sum of torque wrench plus length of tool (5.5").

Fig. 5: Disassembled View of Ball Nut & Housing