1965-73 FORD MOTOR CO. TORSION BAR

Ford, Mercury, Meteor (1965-73)
Montego, Torino (1972-73)
Thunderbird (1965-73)
Lincoln Continental (1965-73)
Continental Mark III & IV (1969-73)

NOTE – Some of the above models also use the "Saginaw Rotary Valve", or "Bendix Linkage".

DESCRIPTION

Torsion bar power steering unit includes a worm and one-piece rack piston, which is meshed to the gear teeth on steering sector shaft. It also includes a hydraulic valve, valve actuator, input shaft and torsion bar assembly which are mounted on the end of the worm shaft and operated by twisting action of the torsion bar. It is designed with the one-piece rack-piston, worm and sector shaft in one housing and valve spool in an attaching housing, making possible internal fluid passages between valve and cylinder, thus eliminating all external lines and hoses (except pressure and return hoses between pump and gear assembly).

LUBRICATION

Check fluid level every 6000 miles. Run engine until fluid is at normal operating temperature. Turn steering wheel all the way left and right several times, shut off engine. Check fluid in reservoir, level must show on cross hatching between bottom of dipstick and full mark. *CAUTION – Do not overfill reservoir.*

BLEEDING SYSTEM

Air in power steering system (shown by bubbles in fluid) must be bled. Make sure reservoir is filled to specification, fluid at normal operating temperature, turn steering wheel through its full travel three or four times. If necessary, add more fluid. *CAUTION – Do not hold wheels against their stops.*

TESTING

Hydraulic Pressure

Power steering flow and pressure tests can be made on the car to determine if steering troubles are caused by pump, steering gear, or control valve. These tests require special test set-up as detailed below.

Pressure Test Set-up – Test tools T56L-33610-D and T68L-33610-A are required. Use regular power steering hoses to make connections indicated in diagram. Connect both lines to power steering pump fittings or connect pressure line at pump outlet fitting and return line to regular pump return line after this has been disconnected at steering gear fitting. Open both manual valves "A" and "B" fully and connect tachometer to engine.

Pump Flow Test – Operate engine at idle speed until reservoir fluid temperature reaches 165-175°F and maintain this temperature throughout tests (Valve B may be partially closed to create a back pressure up to 350 psi to hasten fluid warm-up). With engine idling and fluid temperature correct, close valve "B" and note gauge reading. If gauge reading is below minimum shown below, pump is defective and should be repaired.

Pump Flow Pressures

Ford, Mercury, Meteor	620 psi
Lincoln, Continental Mark III & IV, Thunderbird	900 psi

Pump Pressure Test – With manual valves "A" and "B" fully open, operate engine at idle speed. Close manual valve "A", then close valve "B" momentarily and note gauge reading. *CAUTION – Do not keep both valves closed for more than 5 seconds – this would cause abnormal fluid temperature and pump or gear wear.* If gauge reading is below minimum shown below, pump is defective and should be repaired. If pressure is up to specifications and steering operation is not satisfactory, steering gear or control valve should be repaired.

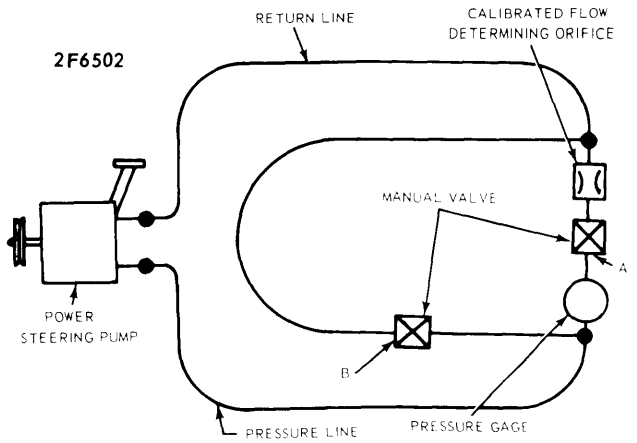
1965-72 Pump Static Pressure

Ford, Mercury, Meteor, Torino, Montego	1000 psi
Continental, Thunderbird, Mark III & Mark IV	① 1175 psi

① – These vehicles equipped with A/C & 429" engine, pressure should be 1275 psi.

1973 Pump Static Pressure

Ford, Mercury, Meteor, Torino, Montego	1125 psi
Continental, Mark IV, Thunderbird	1350 psi



POWER STEERING PUMP TEST DIAGRAM

ADJUSTMENT

All Models – Using a suitable belt tension gauge, adjust belt tension to 120-150 lbs. (new belt), 90-120 lbs. (used belt). A belt that has been run for more than 20 minutes is considered to be a used belt.

Checking Turning Effort

NOTE – Front wheels must be properly aligned and tire pressures must be correct. With vehicle on dry concrete, set parking brake. With engine warm and running at idle speed, turn wheel to left and right to warm power steering fluid. Attach a pull scale to rim of steering wheel. Measure pull required to turn wheel one complete revolution in each direction. Effort required to rotate steering wheel should not exceed 5 lbs. on Ford, Mercury and Meteor. On Lincoln Continental, Mark III & IV, and Thunderbird effort should not exceed 4 lbs.

Valve Spool Centering Check

Install a 0-2000 psi pressure gauge in pressure line between power steering pump outlet port and integral steer-

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ing gear inlet port. *CAUTION – If gauge equipped with shut off valve, make sure it is open.* With fluid in system at normal operating temperature and proper level, steering wheel centered and engine idling at 1000 RPM, attach an INCH pound torque wrench to steering wheel retaining nut. Apply sufficient torque to wrench in each direction, either side of center, to get a gauge reading of 250 psi. Torque reading should be the same in both directions when 250 psi is reached. If difference exceeds 4 INCH lbs., steering gear must be removed and valve centering shim replaced. If steering effort is greater toward left side, increase shim thickness, if effort is less toward left side, decrease shim thickness. *See Valve Centering Shim Replacement under OVERHAUL for procedure.*

Steering Gear Adjustment

NOTE – Only adjustment which can be performed is total over center position load, to eliminate excessive lash between sector and rack teeth. Disconnect pitman arm from sector shaft. Disconnect fluid return line at reservoir, cap reservoir return line pipe. Place end of return line in container and cycle steering wheel in both directions to discharge fluid from gear. Remove ornamental cover from steering wheel hub, turn steering wheel to 45° from left stop. Using a INCH-lb. torque wrench on steering wheel nut, determine torque required to rotate shaft through an approximately 1/8 turn from the 45° position. Turn steering gear back to center, determine torque required to rotate shaft back and forth across center position. Loosen adjuster nut and turn adjusting screw in until reading is 11-12 INCH lbs. greater than torque 45° from the stop. Tighten locknut while holding screw in place.

1965-67 Sector Shaft Mesh Load Specifications

Car Model	① Torque (Inch Lbs.)
Ford & Mercury	6-10 (14 max.)
Lincoln & Thunderbird	9-13 (17 max.)

① – Greater than off center position.

1968-69 Sector Shaft Mesh Load Specifications

Car Model	① Torque (Inch Lbs.)
Lincoln Continental	11-12 (17 max.)
All Other Models	8-9 (14 max.)

① – Greater than off center position.

1970-73 Sector Shaft Mesh Load Specifications

Car Model	② Torque (Inch Lbs.)
All Models	17 max.

② – Must be 9 to 13 Inch Lbs. greater than worm bearing preload which is 2-8 Lbs.

TROUBLE SHOOTING

Jerky Steering

Fluid level low, pump belt loose, broken or glazed. Air in system. Binding suspension joints or steering linkage. Steering linkage loose, worn, or damaged. Steering gear loose on mounting. Steering gear adjustments incorrect. Brakes not adjusted properly. Front wheel bearing adjustment incorrect. Wheel out of balance.

Loose Steering

Steering linkage faulty. Steering gear loose on mountings. Steering gear adjustments incorrect. Front wheel bearing adjustment incorrect.

Hard Steering/Loss Of Power Assist

Tire pressure incorrect or tire sizes not the same. Fluid level low. Pump belt glazed, loose, or broken. Insufficient lubrication. Air in system. Hydraulic hoses obstructed. Front suspension of steering linkage binding. Insufficient pump pressure. Steering gear adjustments incorrect. Front wheel alignment incorrect. Valve spool binding or out of adjustment. Internal obstruction in steering gear.

Hard Turning When Stopped

Tire pressure incorrect or tire sizes not the same. Fluid level low. Pump belt glazed, loose, or broken. Insufficient lubrication or hydraulic hoses obstructed. Front suspension or steering linkage binding. Insufficient pump pressure. Steering gear adjustments incorrect. Valve spool binding or improperly adjusted. Internal obstruction in steering gear.

Binding Or Poor Recovery

Insufficient lubrication. Front suspension or steering linkage binding. Insufficient pump pressure. Steering gear adjustments incorrect. Front wheel alignment incorrect. Valve spool binding or incorrectly adjusted. Internal obstruction in steering gear.

REMOVAL & INSTALLATION

Steering Gear

Disconnect pressure and return lines from steering gear. Plug lines and ports in gear to prevent entry of dirt. Remove bolts securing flex coupling to steering gear and to column. Raise vehicle and remove sector shaft attaching nut. Using a suitable tool, remove pitman arm. *CAUTION– Do not damage seals.* If equipped with standard transmission, remove clutch release lever retracting spring to provide clearance for removing steering gear. Support steering gear, remove steering gear attaching bolts. Work gear free of flex coupling and remove it from vehicle. If flex coupling remained on input shaft, lift it off shaft at this time. To install, reverse removal procedure.

OVERHAUL

Valve Centering Shim Replacement

1) Hold steering gear (inverted) over drain pan and drain fluid. Mount gear in soft jawed vise. Turn input shaft to either stop, turn it back approximately 1¾ turns to center gear. Remove sector shaft cover attaching screws and identification tag. Tap lower end of sector shaft to loosen it, lift cover and shaft from housing as an assembly. Discard O-ring.

2) Remove valve housing attaching bolts. Lift valve housing from steering gear housing while holding piston to prevent it from rotating off worm shaft. Remove valve housing and lube passage O-ring and discard them.

3) Place valve housing, worm and piston assembly in a suitable holding fixture, with piston on top. Rotate piston upward (back off) 3½ turns. Insert tool (T66P-3553-C), with arm facing away from piston, into a bolt hole in valve housing. Rotate arm into position under piston, loosen allen head race nut setscrew from valve housing, then use Tool T66P-3553-B to loosen worm bearing race nut. Lift piston-worm assembly from housing *(CAUTION – Hold piston to prevent it spinning off the shaft during removal).* Install correct thickness power steering valve centering shim (see Note below).

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VALVE CENTERING SHIM NOTE – There are five different sized shims. Notches identify shim thickness. The shim with no notch is .006" thick. The addition of a notch indicates an increased thickness of .002". Therefore a shim with three notches is .012" thick. Two shims may be used as long as their combined thickness does not exceed .030". Determine which size shim to use by the torque difference between left and right turns. Efforts heavy to the left required an **increased** shim thickness, efforts to the right required a **decreased** shim thickness. Efforts can be changed about two inch pounds in each direction with every shim change.

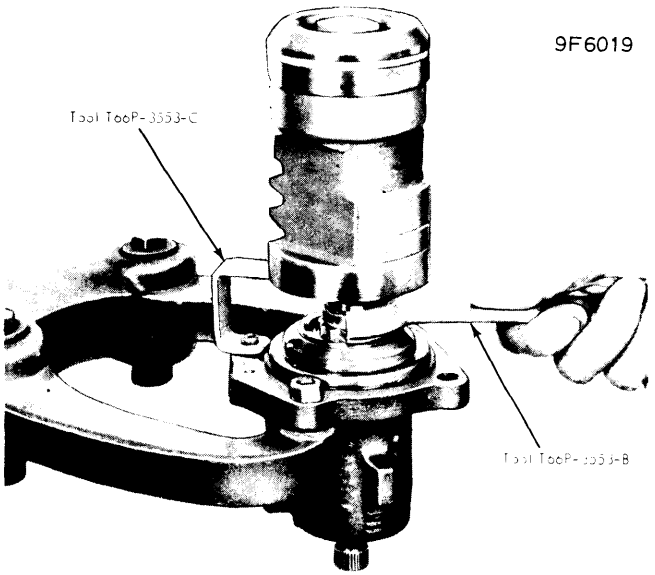
For example: If steering efforts are 17 Inch Lbs. to the left and 10 Inch Lbs. to the right, there is a difference of 7 Inch Lbs. Therefore by changing to a shim two sizes larger (remember about 2 Inch Lbs. for each shim) which would be 4 Inch Lbs, the new efforts would be 13 Inch Lbs. left, and 14 Inch Lbs. right. If there is to be a slight difference, it is preferable that the heaviness be to the right.

4) Reassemble steering gear by reversing disassembly procedure and tighten all bolts to specified torque. When installing sector shaft and cover assembly, before tightening cover attaching bolts, install inch-lb. torque wrench on input shaft and adjust mesh load to approximately 4 In. lbs. After tightening cover attaching bolts to specified torque, adjust mesh load as directed under "Steering Gear Adjustment".

Steering Gear Disassembly

1) Drain steering gear and mount it in a soft jawed vise. Remove lock nut and washer from adjusting screw. Turn input shaft to either stop, turn back 1¾ turns to center gear. Remove sector shaft cover screws and identification tag. Tap lower end of sector shaft with a soft hammer, lift cover and shaft from housing as an assembly. Discard O-ring.

2) Turn sector shaft cover counterclockwise off adjuster screw. Remove valve housing attaching bolts. Lift valve housing from steering gear housing while holding piston to prevent it from rotating off worm shaft. Remove valve housing and lube passage O-rings and discard them. Stand valve body and piston on end with piston end down. Rotate input shaft counterclockwise out of piston allowing ball bearings to drop into the piston. Place cloth over piston, invert and remove bearings.



REMOVING WORM BEARING LOCK NUT

3) Remove ball guide clamp attaching screws, remove clamp and guides. Install valve body assembly in a suitable holding fixture, loosen allen head race nut screw from valve housing and remove worm bearing race nut. Carefully slide input shaft, worm and valve assembly out of the valve housing *(CAUTION – Due to close clearance, slightest cocking of the spool may cause it to jam in housing)*. Remove shim from valve housing bore.

Valve Housing

Remove dust seal and snap ring, discard seal. Invert housing, using a suitable tool, tap out bearing and seal (discard seal). *CAUTION – Do not damage valve bore.* Remove inlet and outlet tube seats with an EZ-out if they are damaged. Coat new tube seats with vaseline. Position seats, install and tighten tube nuts to press seats in proper location. Coat bearing and seal surface of housing with vaseline. Position bearing in housing, and using a suitable tool press bearing in position. *NOTE – Make sure bearing is free to rotate.* Dip new oil seal in gear lubricant and place it in housing metal side out. Drive seal into housing until outer edge of seal does not quite clear snap ring groove. Place snap ring in housing, and using a suitable tool, drive on the ring until ring seats in its groove to properly locate seal. Place dust seal in housing with dished side facing out. *NOTE – Seal must be located behind undercut in input shaft.*

Worm & Valve

Remove snap ring from end of actuator. Slide control valve spool off actuator. Install valve spool evenly and slowly with a slight oscillating motion into flanged end of valve housing. Valve identification groove must be outward. Valve should move freely in housing, and valve spool should enter housing bore freely and fall by its own weight. If valve spool is not free, check for burrs at outward edges of working lands in housing and remove with a hard stone. *NOTE – Stone valve in radial direction only.* Remove spool from housing and slide onto actuator making sure groove in spool annulus is toward worm. install snap ring to retain spool (with beveled ID of snap ring toward spool). Check clearance between spool and snap ring. Clearance should be .0005-.035". If not within these limits, select a snap ring that will allow a clearance of .002".

Piston & Ball Nut

Remove teflon ring and O-ring from piston and ball nut. Dip new O-ring in gear lubricant and install it on piston and ball nut. Install new teflon ring on piston and ball nut. *CAUTION – Do not stretch teflon ring more than necessary.*

Steering Gear Housing

Remove snap ring and spacer washer from lower end of housing. Using a suitable puller, remove lower seal, spacer washer and upper seal from housing. Lubricate seals and sector shaft bore. Position sector shaft inner seal into housing, lip facing inward. Press seal into place. Place a .090" spacer washer on top of seal, press outer seal into place with lip facing inward. Place a .090" spacer washer on top of seal and install snap ring.

Steering Gear Reassembly

CAUTION – Do not clean, wash or soak seals in cleaning solvent. **1)** Mount valve housing in suitable holding fixture, flanged end up. Place required thickness valve spool centering shim in housing, carefully install worm and valve in housing. Install race nut and tighten it to specifications, then install allen head race nut setscrew through valve housing and torque it to specifications.

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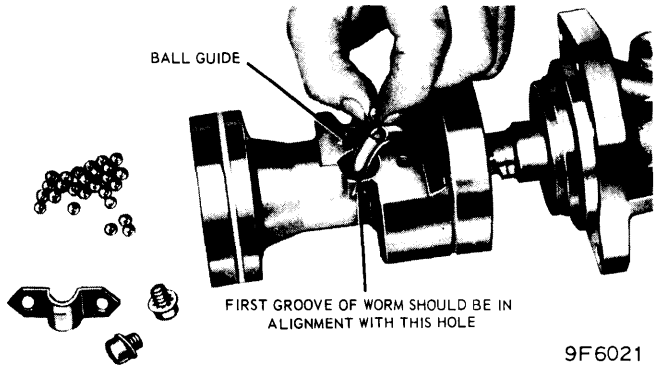
2) Place piston on bench, ball guide holes facing up. Insert worm shaft so that first groove is in alignment with hole nearest to center of piston. Place ball guide in piston. Place the 27 to 29 balls in ball guide, turning worm in clockwise direction. If all balls have not been fed into guide upon reaching the right stop, rotate input shaft in one direction and then in the other while installing the balls. After balls have been installed, do not rotate input shaft or piston more than 3½ turns off right stop. This prevents balls from falling out of circuit.



ASSEMBLING PISTON ON WORM SHAFT

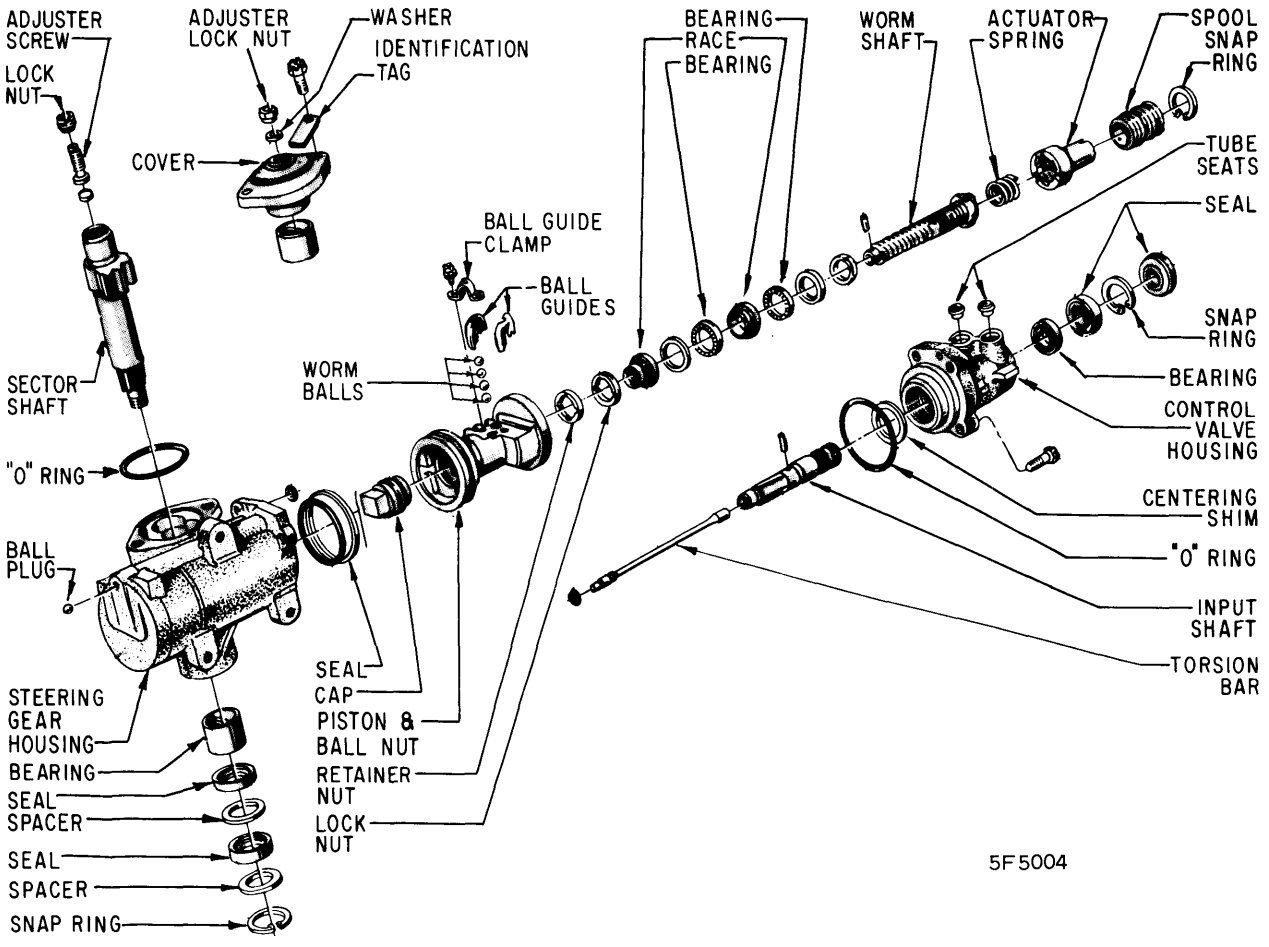
3) Secure guides in ball nut with clamp. Position new lube passage O-ring in counterbore of gear housing. Apply vaseline to teflon seal on piston. Place new O-ring on valve housing. Slide piston and valve into gear housing. *CAUTION – Do not damage teflon seal.* Align lube passage in valve housing with one in gear housing, and install but do not tighten bolts. Rotate ball nut so teeth are in same plane as sector teeth. Tighten valve housing attaching bolts to specifications.

4) Position sector shaft cover O-ring in steering gear housing. Turn input shaft as required to center piston. Apply vaseline to sector shaft journal, position sector shaft and cover assembly in gear housing. Install steering identification tag and attaching bolts, torque to specifications. Attach an Inch lb. torque wrench to input shaft. Adjust mesh load to specification.

TIGHTENING SPECIFICATIONS

	Ft. Lbs.
Sector Shaft Cover Bolts	55-70
Mesh Load Adj. Screw Locknut	35-45
Ball Return Guide Clampscrew	(IN. LBS.) 42-70
Valve Housing-to-Gear Housing Screw	35-45
Race Retaining Nut	See Note
Race Nut Setscrew (allen head)	(IN. LBS.) 20-25
Piston End Cap	70-110

Race Retaining Nut Note – Tool used with torque wrench will affect observed reading of torque wrench. To obtain required torque wrench reading, multiply length of torque wrench by 60 (desired tightness) and divide this product by sum of torque wrench length plus length of tool (5.5").



FORD MOTOR CO. "TORSION BAR" POWER STEERING GEAR

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VEHICLE PULLS/WANDERS DIAGNOSTIC PROCEDURE