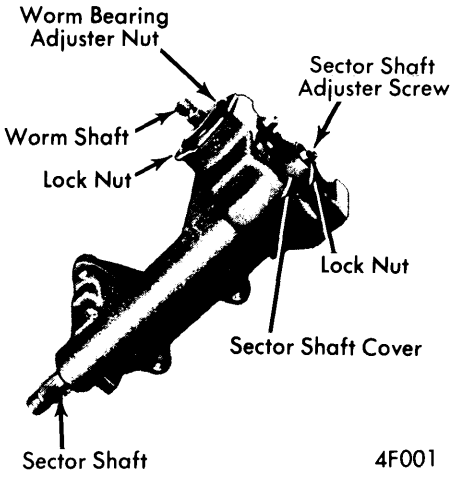
FORD MOTOR CO. (SAGINAW) RECIRCULATING BALL

F-100 & 250 (1965-74)
F-350 (1967-74)
"E" Models (1965-74)

NOTE – Some models use other units. See Ford Motor Co. (Gemmer/Ross) Worm & Roller.

DESCRIPTION & OPERATION

Steering gear is a recirculating ball type. Main components consists of worm shaft, ball nut, ball bearings, sector shaft, housing, bushings and bearings. Ball nut is mounted on steering worm shaft and minimizes friction by transferring steering motion to free rolling ball bearings between ball nut and worm. As worm is turned, ball nut moves along worm shaft as a nut moves on a screw thread. Ball nut rack is in mesh with sector shaft gear and linear motion of worm is changed into circular motion of sector shaft.

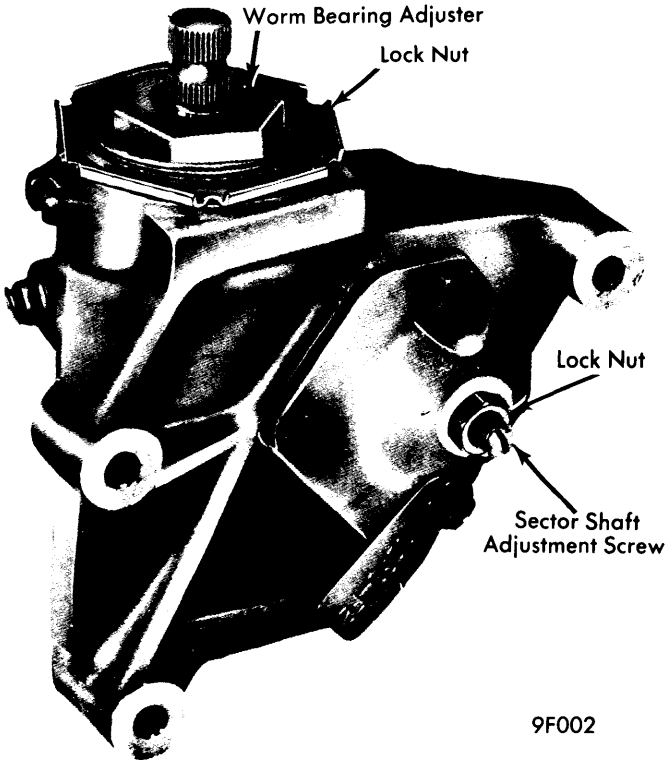


"F" MODEL STEERING GEAR ADJUSTMENT POINTS

LUBRICATION

1965-74 F-100, 250 & 350 Models – Check and fill steering gear with suitable steering gear lubricant (C3AZ-19578-A), as follows: Center steering wheel, remove housing filler plug and bolt that attaches lower cover to housing. Slowly turn steering wheel to left stop. Lubricant should rise in cover bolt hole. Slowly turn wheel to opposite stop and oil should rise in filler plug hole. If lubricant does not rise as described, add lubricant and repeat test.

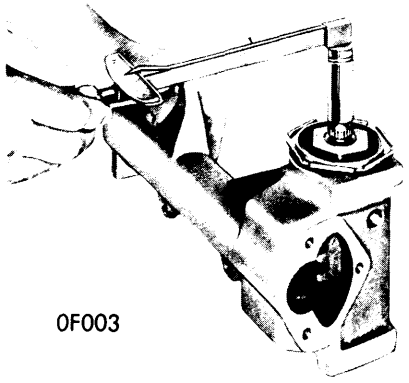
1965-74 "E" Models – Check and fill steering gear with suitable steering gear lubricant (C3AZ-19578-A), as follows: Center steering wheel. Remove housing filler plug. With a clean punch or similar tool, remove loose lubricant or push it into housing. Slowly turn steering wheel to left stop and then to right stop. Lubricant should rise in filler plug hole; if not, add lubricant and repeat procedure. To add lubricant, turn steering wheel to left stop to move ball nut away from filler plug hole. Use a curved length of tubing on grease gun and insert tube through plug hole down toward bottom of housing. This will fill lower housing cavity first and will expell air upward and out of housing.



"E" MODEL STEERING GEAR ADJUSTMENT POINTS

ADJUSTMENT

NOTE – Two adjustments can be made on steering gear; adjustments must be made carefully and in order given. Adjustment can be performed with gear in-vehicle, except with 1969-74 "E" models, gear must be removed. Check for misalignment of steering column which might result in column bind and incorrect torque readings before performing steering gear adjustments.



CHECKING WORM BEARING PRELOAD

WORM BEARING PRELOAD

1) Remove pitman arm from sector shaft, and with 1969-74 "E" models, remove gear from vehicle. With all other models, disconnect horn wire at horn relay, remove horn button and

FORD MOTOR CO. (SAGINAW) RECIRCULATING BALL (Cont.)

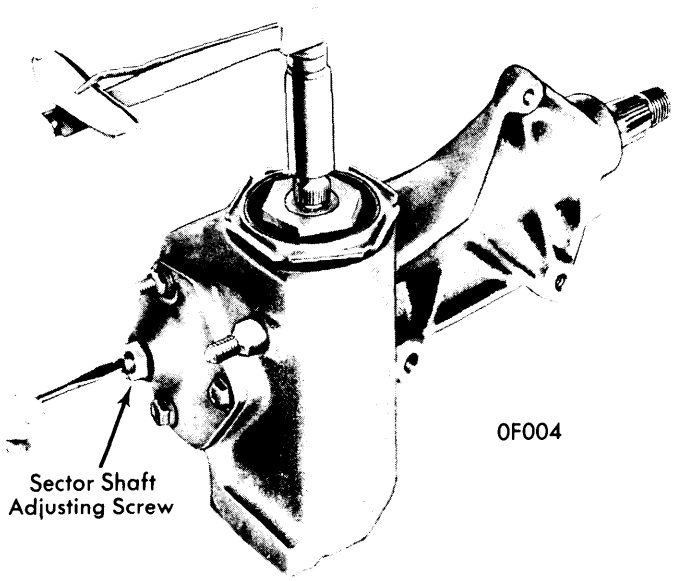
spring from steering wheel. Turn steering gear gently to end of its stop. *NOTE — Do not turn gear hard against worm shaft stops or damage to ball nut guides may result with steering linkage disconnected.* Use an INCH Lb. torque wrench to test preload on worm shaft or on steering wheel nut. Measure lowest torque required to turn wheel or gear at constant speed on either side of sector high spot (over-center). With "E" models, loosen sector shaft adjusting screw before measuring preload. If torque (preload) is not within specifications, adjust worm bearing adjuster.

2) To adjust preload, loosen worm shaft lock nut, and tighten or loosen worm bearing adjuster to bring preload to specification. Tighten lock nut and recheck preload. Repeat procedure until preload is correct before continuing to next adjustment.

OVER-CENTER PRELOAD

1) Turn worm shaft slowly from stop to stop counting total number of turns, then turn back exactly half-way to center steering gear sector. Turn sector shaft adjuster screw clockwise until specified preload is obtained. Measure torque (preload) required to turn worm shaft or steering wheel past its center position (see specifications).

2) To adjust ball nut and sector gear mesh, turn sector shaft adjusting screw in or out to obtain correct preload (Worm preload plus sector mesh), tighten adjuster screw lock nut and recheck preload. If preload is not correct, repeat adjustment procedure. With "E" models, check lash between ball nut, ball bearings and worm shaft as follows: With steering gear centered on sector mid-position, and sector shaft held to prevent rotation, apply a 15 INCH Lb. torque on worm shaft in both right and left directions. Total travel of steering wheel rim

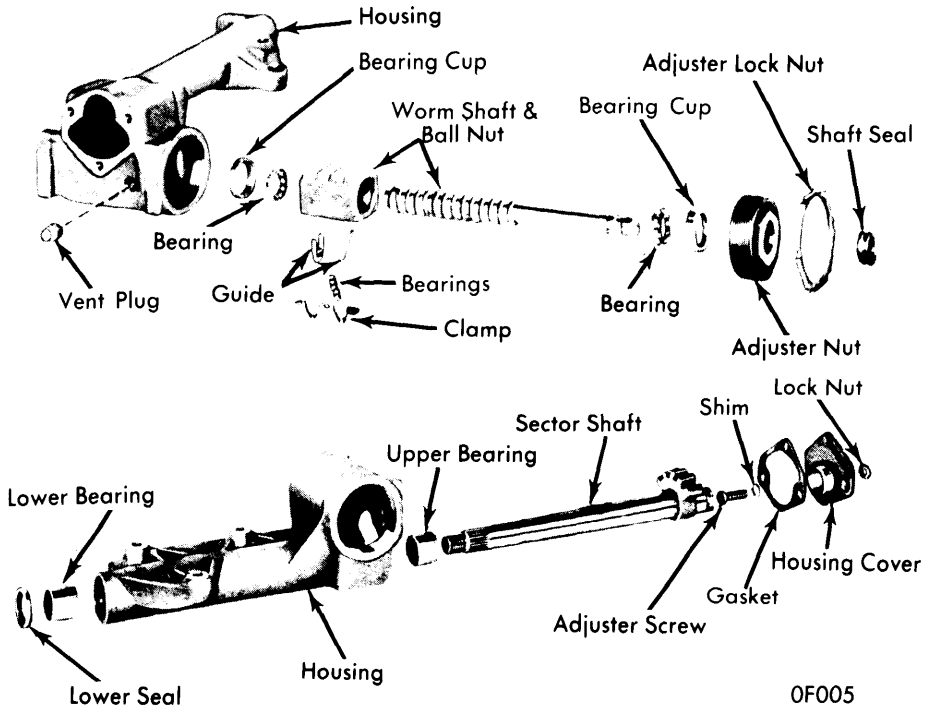


CHECKING OVER-CENTER PRELOAD

should not exceed 1 ¼ " for lash to be satisfactory. Install steering gear (if removed), pitman arm, horn button and reconnect horn wire. Torque all fasteners as specified.

Adjustment Specifications

Application	INCH Lbs.
Worm Bearing Preload (All Models)	4-5
Over-Center Preload (All Models)	9-10



"F" MODEL STEERING GEAR COMPONENTS

FORD MOTOR CO. (SAGINAW) RECIRCULATING BALL (Cont.)

REMOVAL & INSTALLATION

NOTE – Steering gear component fasteners are made of special quality materials. Replacement fasteners must be of same part number or equivalent. Torque all fasteners as specified.

STEERING GEAR

1965-68 "E" Models – 1) Disconnect horn and turn signal wires under instrument panel. Fold floor mat out of way and pull up rubber seal. Remove column floor pan cover. Loosen three steering column support bolts. Remove steering column clamp bolts. Disconnect transmission shift rods from shift tube arms.

2) Remove steering gear mounting bolts and pitman arm clamp bolt. Use a wedge to spread pitman arm and partially remove pitman arm from sector shaft, then move gear and sector shaft assembly from pitman arm. Lift steering column, shift tube and gear assembly out through passenger compartment. Remove steering wheel from column. Remove column clamp bolts and slide steering column, and shift tube assembly from gear housing. Catch worm shaft upper bearing sleeve and spring. To install, reverse removal procedure.

1969-74 "E" Models – Raise vehicle and remove bolt from lower half of flex coupling. Disconnect pitman arm from drag link using suitable tool (3290-C). Remove steering gear mounting bolts and lower gear. Remove pitman arm with suitable puller (T64P-3590-F). To install, reverse removal procedure.

1965-74 F-100, 250 & 350 Models – Remove bolt from flexible coupling on steering gear worm shaft. Remove brake line bracket. Raise front of vehicle and install safety stands. Disconnect clutch return spring from steering gear if equipped. Remove bolt attaching parking brake cable clamp to fender apron if necessary. Disconnect pitman arm from sector shaft using suitable puller. To install steering gear, reverse removal procedure and torque fasteners as specified.

OVERHAUL

NOTE – Clean entire outside surface of steering gear before disassembly to avoid contamination of worm shaft and ball nut.

DISASSEMBLY

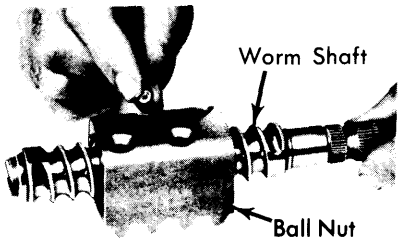
1965-74 All Models – 1) Rotate steering shaft to center sector and remove preload bearing adjuster lock nut. Remove worm shaft preload adjuster nut, seal and upper bearing. Remove sector adjusting screw lock nut and loosen screw one turn. Remove sector cover fasteners and remove cover by turning adjuster screw clockwise. Keep shim with adjuster screw. Carefully remove sector shaft from housing.

2) Carefully pull steering worm shaft and ball nut from housing, and remove lower bearing. *NOTE – Do not allow ball nut assembly to run down to either end of worm shaft or damage to ball return guides may result. Do not disassemble ball nut assembly unless there is indication of binding or tightness.*To disassemble ball nut, remove ball guide retainer and guides catching ball bearings in a clean container. Keep guide side of ball nut until ready to remove ball bearings. Turn ball nut over and remove bearings by rotating worm shaft, then remove shaft from ball nut.

3) Remove upper bearing cup from adjuster and lower bearing cup from housing. Tap housing or adjuster on a block of wood if necessary to remove bearing cups. Remove sector shaft seal and lower bearing from housing using suitable tool (T62F-3576-A). Use same tool to remove upper bearing. Remove sector shaft bearings only if wear is detected.

CLEANING & INSPECTION

All Models – Wash parts with clean solvent and blow dry with compressed air. Inspect bearings, races, bushings and shafts for signs of wear. Check ball nut and worm shaft assembly for binding or roughness when turning worm shaft.



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LOADING BALL RETURN GUIDES

REASSEMBLY

1965-74 All Models – 1) If sector shaft bearings were removed, install sector lower bearing in housing using suitable pressing tools. Install a new seal in same manner. With F-100, 250, and 350 models, turn gear housing over and install upper bearing in same manner. Apply steering gear lubricant to pocket in housing between sector shaft bearings. Install worm shaft upper bearing cup in adjuster and place bearing cup in housing. If seal in bearing adjuster was removed, install a new seal.

2) If ball nut was disassembled, coat ball nut and worm shaft with steering gear lubricant before reassembly. Insert ball guides in ball nut, tapping them lightly with a screwdriver if necessary, to seat them. Insert half of the balls into hole of each ball guide while rotating shaft back and forth to distribute balls in circuit. Repeat procedure for other ball guide and circuit. Install ball guide clamp and tighten as specified. Check worm shaft to make sure it rotates smoothly.

3) Lubricate bearing adjuster threads, housing cover bolts, and sector adjusting screw with a suitable oil-resistant sealing compound. *NOTE – Do not apply sealer to female threads, and avoid getting sealer on worm shaft bearings.* Coat worm

FORD MOTOR CO. (SAGINAW) RECIRCULATING BALL (Cont.)

bearings, sector shaft bearings and gear teeth with lubricant. Clamp housing in a vise with sector shaft axis horizontal. Install worm shaft lower bearing in its cup, and position worm shaft and ball nut assembly in housing. Place worm shaft upper bearing on top of worm and install worm bearing cup adjuster. Install adjuster lock nut with flat against adjuster and leave nut loose. Adjust worm bearing preload as previously outlined under Adjustments.

4) Install sector adjusting screw and adjusting shim. Clearance between screw head and end of sector shaft must not exceed .002". If clearance is over .002", add shims to reduce end play to within specification. Start sector shaft pilot into housing cover. Use a screwdriver through hole in cover and turn adjusting screw to pull pilot into cover. Install new gasket on housing cover. Tilt housing so ball nut tips toward cover opening, and rotate worm until ball nut teeth are in position to mesh with sector gear.

5) Lubricate sector shaft journal and install sector and cover in gear housing. Turn cover out of way and fill gear housing with lubricant to bottom of filler plug hole. Push sector shaft and housing cover into place, and install, but do not tighten cover bolts. Check for lash between ball nut and sector gear teeth. If lash is evident, hold cover away from ball nut and tighten cover bolts as specified. Loosely install sector shaft adjusting screw lock nut and adjust over-center preload (gear mesh) as specified in Adjustments.

TIGHTENING SPECIFICATIONS

Application	Ft. Lbs.
Worm Bearing Adjuster Lock Nut	60-80
Sector Adjusting Screw Lock Nut	32-40
Lubricant Fill Plug	① 3-9
Steering Gear-To-Frame Bolts	50-65
Pitman Arm-To-Sector Shaft	
"F" Models	170-230
"E" Models	
1965-68	125-165
1969-74	230-280
Sector Shaft Cover Bolts & Stud	
"F" Models	17-25
"E" Models	
1965-68	15-22
1969-74	30-40
Ball Return Guide Clamp	② 18-42
Steering Wheel-to-Shaft	
"F" Models	45-55
"E" Models	
1965-68	③ 25-35
1969-74	45-55

① – Minimum of one thread must remain exposed when installed.
② – INCH Lbs.
③ – Stake nut to shaft to lock.