

<h1 style="margin: 0;">SUSPENSION, STEERING, WHEELS AND TIRES</h1>	<h1 style="margin: 0;">GROUP 3</h1>
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PART 3-1 SUSPENSION, STEERING, WHEELS AND TIRES GENERAL SERVICE

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1 DIAGNOSIS AND TESTING

Table 1 lists various suspension, steering, and wheel and tire trouble symptoms and their possible causes. The possible causes are listed in the table in the order in which they should be checked. For example, refer to the fourth trouble symptom in Table 1, "Hard Turning When Stationary." When checking the possible causes, check item 1 (tire pressure) and item 2 (tire size) before proceeding with items 11, 16, and 20 as indicated.

PRELIMINARY CHECKS

The following preliminary checks should always be made before performing any trouble shooting operations. Also, see Table 1.

CHECK FLUID LEVEL

Run the engine until the fluid is at normal operating temperature. Then turn the steering wheel all the way to the left and right several times, and shut off the engine.

Check the fluid level in the reservoir. If the level is low, add enough automatic transmission fluid to raise the level to a point one inch from the top, or to the F mark on the

dip stick. **Do not overfill the reservoir.**

CHECK FOR FLUID LEAKS

With the engine idling, turn the steering wheel from stop to stop several times. Check all possible leakage points. Tighten all loose fittings, and replace any damaged lines or defective seats.

CHECK TURNING EFFORT

With the front wheels properly aligned and tire pressures correct, check the effort required to turn the steering wheel.

1. With the car on dry concrete, set the parking brakes.
2. With the engine warmed up and running at idle speed, turn the steering wheel to the left and right several times to warm the fluid.
3. Remove the steering wheel hub cap assembly. Attach a torque wrench to the steering wheel nut. Measure the pull required to turn the wheel at least one complete revolution in both directions. The steering effort should not exceed 5 lbs. pull at the steering wheel rim. If a torque wrench is used, **re-check nut torque after test.**

FLUID PRESSURE TEST

A fluid pressure test will show whether the pump or some other unit in the power steering system is causing trouble in the system.

The pressure testing gauge set, tool 3500-E, requires modification to make it adaptable for installation in the power steering hydraulic system. The parts required and the modification procedure are as follows:

- a. Power Steering Pressure Line C1VV-3A719-A or subsequent lines released for this application. (Refer to the appropriate Parts Catalog.)
- b. Inverted Flare Connector (3/8 inch O.D. Tube x 1/4 inch Pipe Thread).
- c. Inverted Flare Connector (3/16 inch O.D. tube x 1/4 inch Pipe Thread).
- d. Flared Tube Female Coupling (3/8 inch O.D. Tube x 1/4 inch Pipe Thread).

The connectors and the coupling are standard-type fittings and can be purchased locally.

TABLE 1—Trouble Symptoms and Possible Causes

POSSIBLE CAUSES OF TROUBLE	TROUBLE SYMPTOMS													
	Jerky Steering	Loose Steering	Hard Steering and/or Loss of Power Assist	Hard Turning When Stationary	Steering and Suspension Noises	Shimmy or Wheel Tramp	Pull to One Side	Side-to-Side Wander	Body Sway or Roll	Tire Squeal on Turns	Binding or Poor Recovery	Abnormal or Irregular Tire Wear	Sag at One Wheel	Hard or Rough Ride
1. Incorrect Tire Pressure			X	X		X	X	X	X	X	X	X	X	
2. Tire Sizes Not Uniform			X	X			X	X		X		X	X	
3. Overloaded or Unevenly Loaded Vehicle							X				X	X	X	
4. Power Steering Fluid Level Low-Leak	X		X	X	X									
5. Sagging or Broken Spring					X		X	X	X			X	X	X
6. Rear Spring Tie Bolt Off Center							X				X			X
7. Broken Rear Spring Tie Bolts					X	X	X	X	X		X			X
8. Rear Spring Front Hanger Mislocated							X				X			X
9. Bent Spindle Arm							X	X		X	X			
10. Bent Spindle							X	X		X	X			
11. Lack of Lubrication	X		X	X	X						X			X
12. Air in Power Steering System	X		X		X	X								
13. Obstruction in Power Steering Lines			X	X	X									
14. Loose or Weak Shock Absorber					X	X		X	X		X			X
15. Loose or Worn Suspension Arm Bushings					X	X					X			X
16. Binding Front Suspension Ball Joints or Steering Linkage	X		X	X	X					X				X
17. Loose, Worn, or Damaged Steering Linkage or Connections	X	X			X	X		X		X		X		
18. Loose Steering Gear Mountings	X	X			X	X		X						
19. Insufficient Steering Pump Pressure			X	X						X				
20. Incorrect Steering Gear Adjustment	X	X	X	X	X	X		X	X		X	X		
21. Incorrect Brake Adjustment	X				X		X				X			
22. Incorrect Front Wheel Bearing Adjustment	X	X			X	X	X	X			X			
23. Wheel Out of Balance	X					X					X			X
24. Incorrect Front Wheel Alignment			X		X	X	X	X		X	X	X		
25. Out-of-Round Wheel or Brake Drum						X					X			X
26. Frame or Underbody Out of Alignment							X				X			X
27. Bent Rear Axle Housing					X		X				X			X
28. Excessive Wear of Power Steering Pump Internal Parts			X		X									
29. Steering Gear Valve Spool Binding or Out of Adjustment			X	X			X			X				
30. Obstruction Within Steering Gear	X		X	X						X				

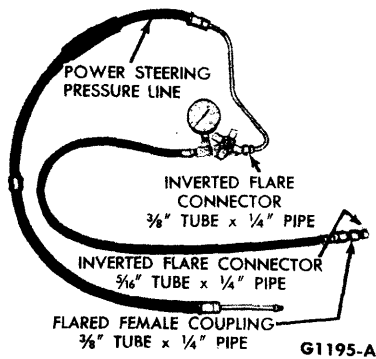


FIG. 1—Modified Pressure Gauge Assembly

- e. To modify tool 3500-E, remove the hose from the hand shut-off valve block. Install the $\frac{3}{8}$ inch x $\frac{1}{4}$ inch inverted flare connector in the valve block, and assemble the pressure line, CIVV-3A719-A (or subsequently released line) to the connector (Fig. 1). Assemble the $\frac{3}{8}$ x $\frac{1}{4}$ inch coupling and the $\frac{5}{16}$ -inch connector to the free end of the hose leading to the pressure gauge.

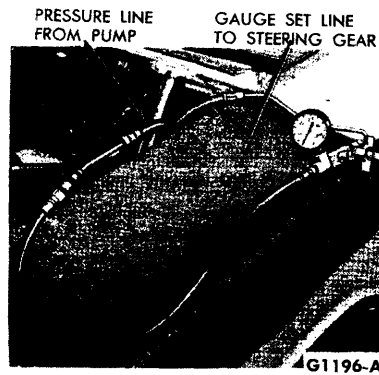


FIG. 2—Pressure Testing Gauge Installation

1. To check the pump pressure, disconnect the pressure line (upper line) at the steering gear. Connect the modified pressure-testing gauge assembly, tool 3500-E, between the pressure line from the pump and the steering gear. (See Fig. 2.)

2. Make sure the hand-valve at the gauge is fully opened. Start the engine and cycle the steering gear from stop to stop until the gear housing is warm. Check the fluid level in the reservoir and add fluid, if necessary.

3. Turn the steering wheel to the

full right and full left turn positions and observe the gauge readings.

CAUTION: Hold the wheels in this position only long enough to obtain an accurate reading.

The gauge should read between 1120 and 1250 psi. If the pressure is less than 1120 psi, close the valve at the gauge and note the pump pressure. If it is low with the valve closed, it indicates that the pump is not operating properly. If the pressure goes up with the valve closed, it indicates that the low pressure in the system must be due to internal leakage in the power unit, providing all connections are tight.

4. Remove the pressure testing gauge set, and connect the pressure line at the steering gear. Fill and bleed the system.

VALVE SPOOL CENTERING CHECK

The valve spool centering check requires the use of the modified pressure testing gauge set, tool 3500-E. The parts required and the modification procedure are outlined above.

For the complete Valve Spool Centering procedure, refer to Part 3-3, Section 4, "Assembly of Steering Gear."

2 COMMON ADJUSTMENTS AND REPAIRS

WHEEL ALIGNMENT ADJUSTMENTS

After front wheel alignment factors have been checked, make the necessary adjustments. **Do not attempt to adjust front wheel alignment by bending the suspension or steering parts.**

CASTER

1. Position the car on a level floor or on runway-type wheel alignment equipment. Position a suitable gauge on the front wheels and check the caster angle. Correct caster is negative $\frac{3}{4}$ ° to negative 2 $\frac{1}{4}$ °. Maximum difference between wheels should not exceed $\frac{1}{2}$ ° with $\frac{1}{4}$ ° preferred.

2. To adjust caster, raise the hood. Loosen the bolts that secure the upper suspension arm shaft to the frame member and, with the aid of a pry bar, move the shaft in or out, as required. A movement of approximately $\frac{3}{32}$ inch at either the front or rear bolt location will change the caster $\frac{1}{2}$ °. Inboard movement of the front bolt, or outboard movement of

the rear bolt, will change caster in the negative direction. Outboard movement of the front bolt, or inboard movement of the rear bolt, will change caster in the positive direction.

3. When the caster is correct, torque the shaft retaining bolts to specification and recheck the caster and camber to insure the readings have not changed.

CAMBER

1. With the car on runway-type wheel alignment equipment, or on a level floor, position a suitable gauge on the wheels and check the camber angle. Correct camber is 0° to positive $\frac{3}{4}$ °. Maximum difference between wheels should not exceed $\frac{1}{2}$ ° with $\frac{1}{4}$ ° preferred.

2. To adjust camber, raise the hood. Loosen the bolts that secure the upper suspension arm shaft to the frame member and, with the aid of a pry bar, move the shaft in or out, as required. A movement of approximately $\frac{3}{64}$ inch of the entire

shaft will change the camber $\frac{1}{4}$ °. Inboard movement will change the camber in the negative direction. Outboard movement will change the camber in the positive direction.

3. When the camber is correct, torque the shaft retaining bolts to specification and recheck the camber and caster to insure the readings have not changed.

TOE-IN AND STEERING WHEEL ALIGNMENT ADJUSTMENTS

TOE-IN

Toe-in is adjusted by means of the sleeve at the outer end of each spindle connecting rod. The toe-in specification is $\frac{1}{16}$ inch to $\frac{3}{16}$ inch.

1. Set the front wheels in the straight-ahead position. To be sure the wheels are straight-ahead, push the car backward about six feet; then, pull it forward about three feet. The last movement of the car must be forward to position the wheels properly.

2. Remove the cap from the steer-

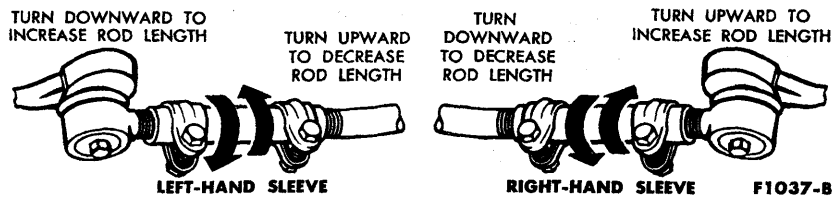


FIG. 3—Spindle Connecting Rod Adjustments

ing wheel hub by pressing downward and turning the cap to the left. Make sure the alignment mark on the hub of the steering wheel is lined up with the mark on the end of the steering shaft. The mark on the end of the shaft indicates the high-point of the steering gear. With the front wheels straight-ahead, the alignment marks should be vertical and the steering wheel spokes should be in their normal position. If repositioning is required, refer to STEERING WHEEL SPOKE POSITION adjustment procedure which follows.

3. To adjust toe-in, loosen the two clamps on each spindle connecting rod sleeve. Lengthen or shorten both spindle connecting rods an equal amount to obtain the correct toe-in. Lengthening both rods increases toe-in. Shortening both rods decreases toe-in (Fig. 3).

4. Torque the adjusting sleeve

clamp bolts to specification. **To prevent interference, both bolts should be in a vertical position on the rear side of the sleeve and the clamps should not project beyond the ends of the sleeve.**

STEERING WHEEL SPOKE POSITION

When the steering gear is on the high-point, the front wheels should be in the straight-ahead position and the steering wheel spokes should be in their normal position. The marks on the end of the steering shaft and on the hub of the steering wheel should also be lined up and in a vertical position. If necessary, the spokes can be repositioned without changing the toe-in setting (Fig. 4).

1. Loosen the clamps on both spindle connecting rod sleeves (Fig. 3).

2. Turn both sleeves upward or

downward the same number of turns to move the steering wheel spokes to their normal position. If the wheel is turned clockwise from its normal position, turn both sleeves upward (viewed from the rear). If the wheel is turned counterclockwise, turn both sleeves downward (viewed from the rear).

3. Tighten the sleeve clamp bolts to specified torque.

TURNING ANGLE

The angular relationship of one front wheel to the other must change as the vehicle makes a turn. The turning angle of an outside wheel should be $17^{\circ} 42'$ when the inside wheel is turned 20° . If the turning angle does not check to these specifications, crosswear of tires will result. Bent parts are generally the cause of an incorrect turning angle.

THEORETICAL KING PIN INCLINATION

Theoretical king pin inclination is the tilt of the top of the spindle toward the centerline of the car. King pin inclination is merely a theoretical value as the desired inclination is built into a car at the time of manufacture and cannot be adjusted. Unless related parts are bent, the angle will be 7° when the camber angle is positive $\frac{3}{4}^{\circ}$.

WHEEL INSPECTION

Wheel hub nuts should be inspected and tightened to specification during pre-delivery inspection. Loose wheel hub nuts may cause shimmy and vibration. Elongated stud holes in the wheels may also result from loose hub nuts.

Keep the wheels and hubs clean. Stones wedged between the wheel and drum, and lumps of mud or grease can unbalance a wheel and tire.

Check for damage that would affect the runout of the wheels. Wobble or shimmy caused by a damaged wheel will eventually damage the wheel bearings. Inspect the wheel rims for dents that could permit air to leak from the tires.

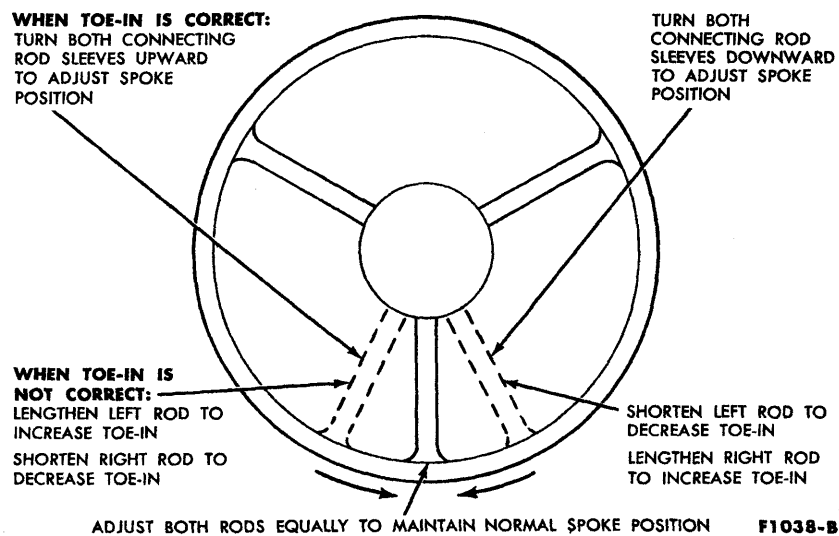


FIG. 4—Toe-In and Steering Wheel Spoke Alignment Adjustments

3 CLEANING AND INSPECTION

FRONT END GENERAL INSPECTION

Whenever possible, front wheel

alignment checks should be performed on stationary wheel aligning equipment. In the absence of such

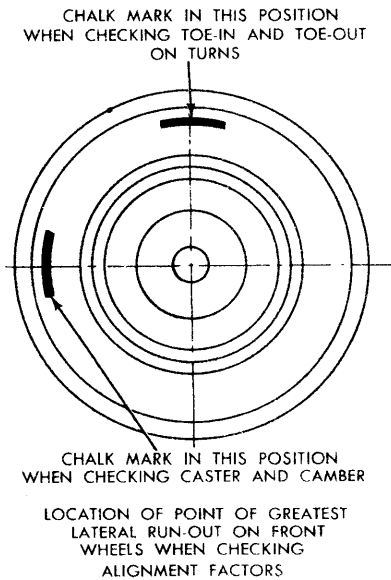
equipment, portable equipment may be used and the work may be performed on a level floor. The floor

area should be level within ¼ inch from front to rear of the car and within ⅛ inch from side to side. It might be well, if portable equipment is used frequently, to mark off a known level area on the shop floor.

Prior to checking or setting the front wheel alignment, be sure all front suspension and steering system nuts and bolts are properly torqued. It is especially important to have the drag strut nut and the upper arm shaft bolts tightened to the proper torque specification, as a loose nut or bolt can directly affect the caster or camber reading. The items which follow also should be checked and, if necessary, corrected before aligning the wheels.

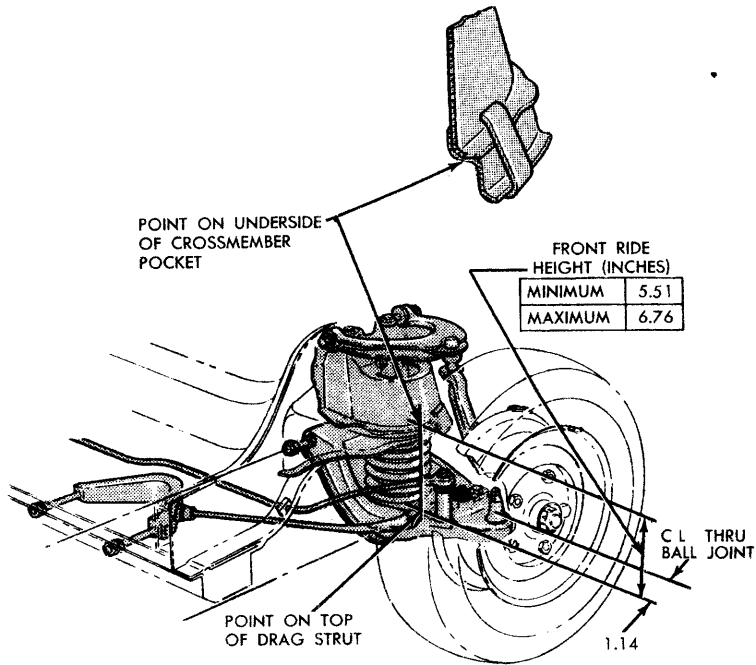
1. Be sure the tires are inflated to the proper pressure at all four wheels.
2. Be sure the front wheel bearings are adjusted properly and that the wheels turn freely.
3. Check the shock absorbers for leaks. Replace the shock absorbers if necessary.
4. Check for looseness at the tie-rod ends. Looseness can affect the toe-in readings and adjustment. To inspect the front suspension for looseness or wear, it will be necessary to raise the car.

CAUTION: Do not raise the car by means of the lower suspension arms. This will release the tension on the lower ball joints.



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FIG. 5—Front Wheel Position for Checking Alignment



F1217-A

FIG. 7—Front Suspension Riding Height Measurement

5. Be sure the wheels are balanced.
6. Check the runout of each front wheel and tire using a dial indicator against the rim outer band. If the runout exceeds ⅛ inch, correction may be made by rotating the wheel on the drum. When the minimum runout has been obtained, mark the point of greatest runout so the wheels can be positioned as shown in Fig. 5 when checking the front end alignment. Hold a piece of chalk against the wheel rim or the tire sidewall while spinning the wheel. The chalk will mark the rim or tire at the point of greatest runout.

WHEEL ALIGNMENT DEFINITIONS

An understanding of the factors involved in wheel alignment is necessary, before an accurate job of alignment can be performed.

CASTER

Caster is the forward or rearward tilt of the top of the wheel spindle. If the spindle tilts to the rear, caster is positive. If the spindle tilts to the front, caster is negative (Fig. 6).

CAMBER

Camber is the amount the front wheels are tilted at the top. If a

wheel tilts outward, camber is positive. If a wheel tilts inward, camber is negative (Fig. 6).

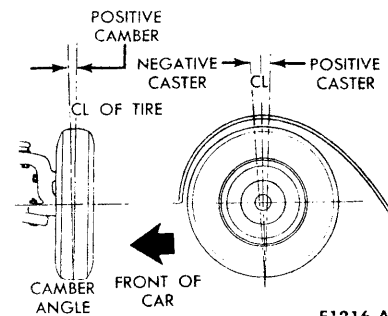
TOE-IN

Toe-in is the turning inward of the front wheels, so that they are closer together at the front than at the rear.

BALL JOINT INSPECTION

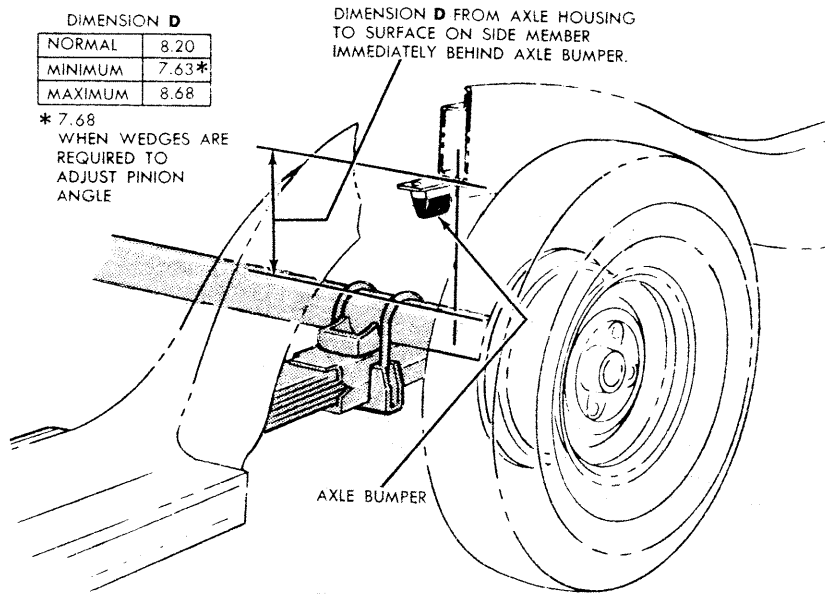
LOWER ARM

1. Raise the front of the car.
2. Adjust wheel bearing to no end play (see Part 3-4 for bearing adjustment procedure).
3. Attach a dial indicator to the lower arm. Position the indicator



F1216-A

FIG. 6—Caster and Camber Angles



F1218-A

FIG. 8—Rear Suspension Riding Height Measurement

plunger on the wheel rim at the bottom of the tire.

4. Grasp the tire at the top and bottom, and slowly move the tire in and out, noting the reading on the dial indicator.

5. If the reading exceeds 0.250 inch, replace the ball joint (refer to Part 3-2, Section 2, for the replacement procedure).

UPPER ARM

Refer to Part 3-2, Section 2, for the procedure required to disconnect the ball joint from the spindle prior to checking ball joint stud rotating torque.

RIDING HEIGHT MEASUREMENT

In cases of vehicle riding height complaints, accurate measurements of the front and rear suspension will be necessary to determine which spring should be replaced, if any. Some riding height variation between similar models must be expected due to the weight of optional accessories. In addition, a vehicle in customer usage can gain 100 or more pounds

over several thousand miles usage due to mud deposits on the underbody. This weight increase can account for a noticeable reduction in riding height. Therefore, excessive accumulations of mud should be removed before checking the riding height.

Before checking the front or rear curb weight suspension riding height, perform the following steps:

1. Position the vehicle on a smooth, level floor.
2. Inflate all tires to 24 psi. The fuel tank should be full. Any loading must be removed from the passenger and luggage compartments.
3. Place the front seat in its rear-most position.

FRONT SUSPENSION

1. Push the front bumper downward at the center about one inch. Release very slowly so that suspension friction stops the car. Measure between the points shown in Fig. 7. Measure and record the reading obtained on each side of the car.

2. Raise the front bumper at the center about one inch and release very slowly. Again measure and record the readings obtained on each side of the car as in Step 1.

3. Average the two readings obtained on each side of the car to obtain the true riding height. The difference between one side of the car and the other should not be more than ½ inch.

REAR SUSPENSION

1. To measure the riding height, push downward on the center of the rear bumper about one inch and release it slowly. Measure between the points shown in Fig. 8.

2. Raise the rear bumper at the center about one inch and release it slowly. Again measure the riding height. The average of the two measurements is the true riding height. The riding height specifications are shown in Fig. 8.

POWER STEERING PUMP CLEANING AND INSPECTION

1. Wash all parts in clean solvent, and dry them with clean cloths or compressed air.

2. Inspect the rotor shaft for wear, scoring, nicks, or burrs. Replace the shaft if it is damaged or if the inner keyway is damaged.

3. Inspect the rotor, rollers, and the cam ring for wear or scoring.

4. Make sure the inner faces of the cover and the housing are free of paint, nicks, or burrs. Check all oil passages for restrictions.

5. Inspect the valving surfaces (areas where the rotor and rollers contact) for wear or scoring. Replace the pressure plate or the cover if worn or scored. Inspect the bushing in the pressure plate for wear or scoring, and replace the plate if necessary.

6. Inspect the control valve for scores, nicks, or burred edges. Replace the valve if damaged. **Do not disassemble the valve.** Check the valve for free movement in the housing bore.

7. Inspect the tube seat in the housing. If damaged, remove it with an E-Z-Out and install a new seat.

PART 3-2 SUSPENSION

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3 Removal and Installation	3-9
4 Major Repair Operations	3-13

1 DESCRIPTION AND OPERATION

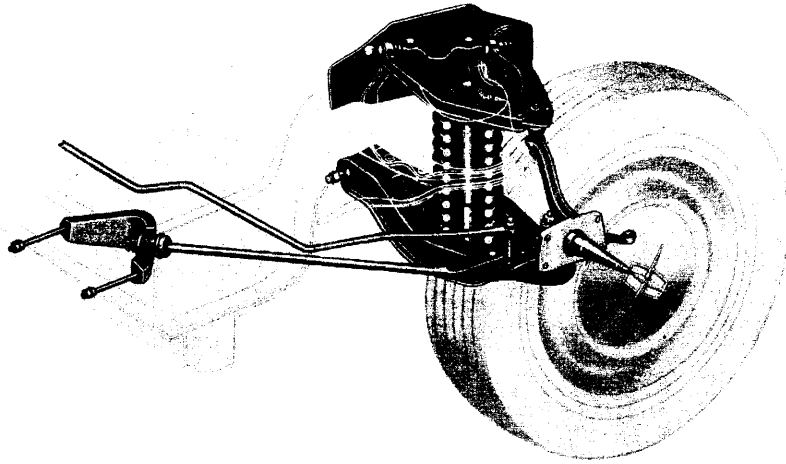
FRONT SUSPENSION

The front wheel suspension is a ball joint type utilizing coil springs and double acting shock absorbers. Fore and aft movement of each front wheel is controlled by a non-adjustable type stabilizing strut (drag strut) connected to the suspension lower arm and to a point forward on the number one crossmember (Fig. 1). A single rubber-cored bushing is used at the inner end of the suspension lower arm. Caster and camber are adjusted without the use of shims. Adjustment is accomplished by movement of the serrated upper arm shaft.

REAR SUSPENSION

The major components of the rear suspension system are the leaf springs which are mounted to the underbody (Hotchkiss Design) and the restricted, double-acting, telescopic-type shock absorbers (Fig. 2).

The springs are insulated from the axle with rubber-lined clamps and attached to the axle with U-bolts. Laterally slotted holes in the axle



F1219-A

FIG. 1—Front Suspension

mounting pads are provided for spring-to-axle alignment.

The rear shock absorbers are the direct-acting type which have an integral stud at the upper end and are

attached to the crossmember by a mounting plate. The shock absorber lower end is stud mounted to a bracket welded to the forward side of the axle housing.

2 IN-CAR ADJUSTMENTS AND REPAIRS

BALL JOINT REPLACEMENT

The lower ball joint is riveted to the lower arm whereas the upper ball joint is bolted to the upper arm. When replacing a ball joint, use all the parts supplied in the kit.

LOWER ARM

1. Raise the car. Place a support under each rail to the rear of the lower arm in the lifting pad area.

2. Remove the wheel and tire, then remove the hub and drum.

3. Remove the brake backing plate, and wire it to the underbody to prevent damage to the brake hose.

4. Remove the cotter pin from the lower ball stud, and loosen the nut one to two turns.

5. Using a brass hammer, tap the spindle until the ball stud pops loose against the nut.

6. Place a jack under the spring pocket in the lower arm, and raise the arm slightly. Place a support stand under the lower arm as a safety precaution.

7. Remove the nut from the ball joint stud. Raise the upper arm and spindle until the spindle clears the ball stud. Prop the upper arm in the raised position.

8. Remove the ball joint rivet heads with a chisel. Punch the remaining portion of the rivets from the holes, and remove joint.

9. Install the new joint using the parts supplied in the kit. Torque the nuts to specification. Make sure the joint is completely filled with the specified lubricant.

10. Lower the upper arm while guiding the spindle over the ball stud. Install the stud nut and tighten it to specification. Continue to tighten the

nut to line up the cotter pin hole. Install the cotter pin.

11. Install the brake backing plate, and tighten the retaining nuts to specified torque.

12. Install the hub and drum and the wheel and tire. Torque the wheel nuts to specification.

13. Adjust the wheel bearings, and lower the car.

UPPER ARM

1. Place a jack under the outer end of the lower arm, and raise the arm. Place a support stand under the side rail in the lifting pad area.

2. Remove the wheel and tire.

3. Remove the cotter pin from the upper ball stud, and loosen the nut one to two turns.

4. Pry the arm upward and, using a brass hammer, tap the spindle at

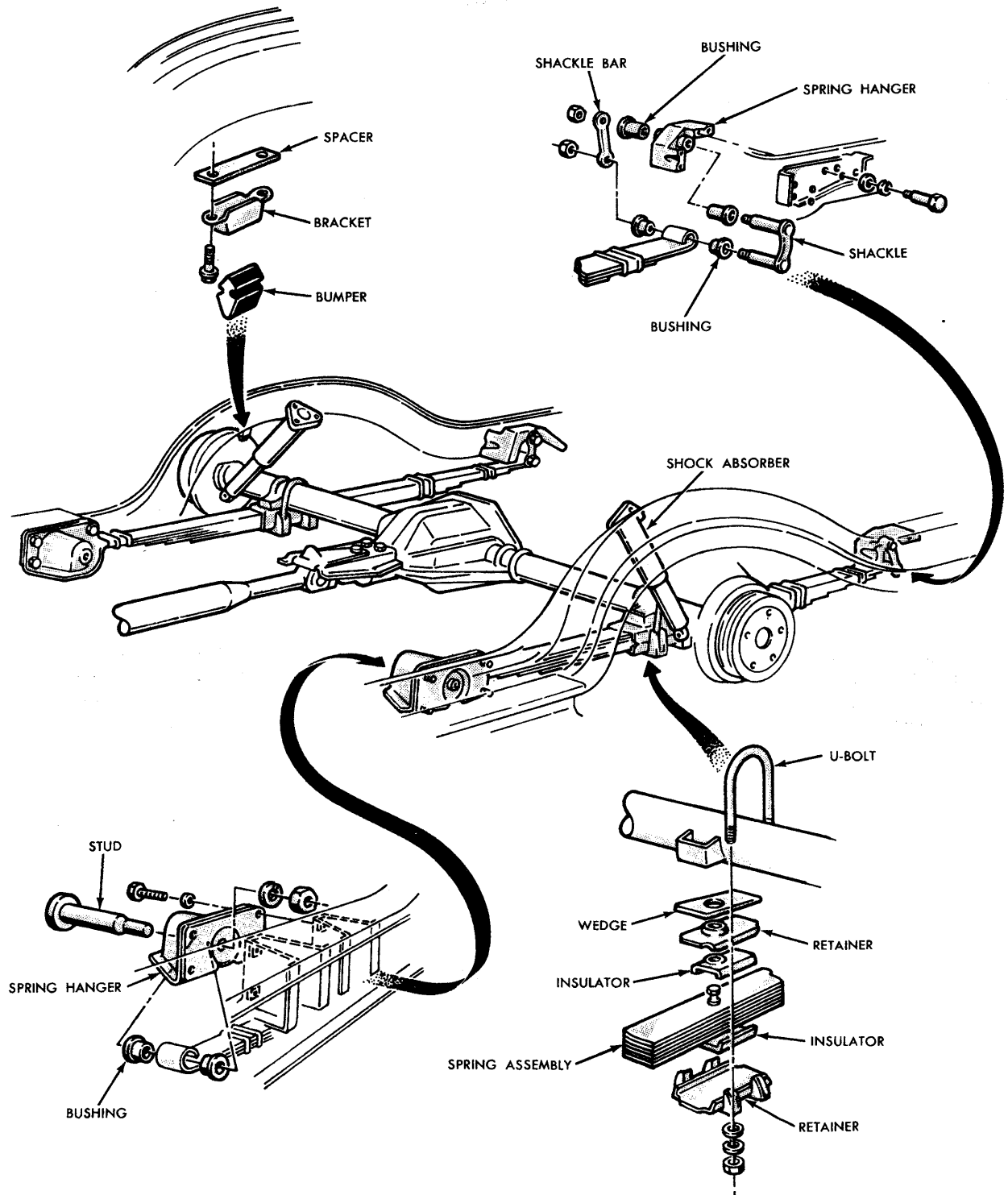


FIG. 2—Rear Suspension Components

F1220-A

the stud boss until the ball stud loosens against the nut. Remove the nut.

5. Raise the upper arm to free the ball stud from the spindle. Wire the upper end of the spindle to the underbody to prevent damage to the brake hose.

6. Check the torque required to

rotate the ball joint stud. If the torque is found to be less than 12 in-lbs, replace the ball joint.

7. Remove the ball joint retaining nuts and bolts, and remove the joint.

8. Install the new joint using the parts supplied in the kit. Torque the nuts to specification. Make sure the joint is completely filled with the

specified lubricant.

9. Guide the ball joint stud into the spindle. Install the stud nut and torque it to specification. Continue to tighten the nut to line up the cotter pin hole. Install the cotter pin.

10. Install the wheel and tire. Torque the wheel nuts to specification.

3 REMOVAL AND INSTALLATION

FRONT WHEEL SPINDLE

REMOVAL

1. Raise the car. Place a support under each side rail to the rear of the lower arm in the lifting pad area.

2. Remove the wheel and tire, then remove the hub and drum.

3. Remove the brake backing plate, and wire it to the underbody to prevent damage to the brake hose.

4. Disconnect the spindle arm connecting rod from the spindle arm with tool 3290-C. See Fig. 3.

5. Remove the cotter pins from both ball joint stud nuts. Loosen the nuts one to two turns.

6. Using a brass hammer, tap the spindle at the lower ball joint until the ball stud pops loose against the nut. Pry upward on the upper arm, and tap the spindle at the upper ball joint until the ball stud loosens against the nut.

7. Place a jack under the outer end of the lower arm, and raise the arm several inches. Remove both ball stud nuts, and remove the spindle.

INSTALLATION

1. Position the new spindle onto the upper and lower ball joint studs, install the stud nuts and tighten the nuts to specifications. Continue to tighten both nuts until the cotter pin holes line up with the slots, then install new cotter pins.

2. Connect the spindle connecting rod to the spindle arm. Install the retaining nut and tighten the nut to specification. Continue to tighten the nut until the cotter pin hole lines up with the slot, then install a new cotter pin.

3. Assemble the brake carrier plate, gaskets and dust shield to the spindle. Install the retaining bolts

and nuts, and tighten to specifications (Fig. 3).

4. Install the wheel, hub and drum, and adjust the wheel bearing.

5. Lubricate the steering stop on the lower arm and the mating flat on the spindle with specified lubricant.

6. Remove the safety stands, lower the car and check camber, caster and toe-in.

FRONT SHOCK ABSORBER

REMOVAL

1. Remove the stud nut at the upper eye of the shock absorber. Remove the upper eye stud bracket to crossmember retaining bolt and remove the stud bracket. Refer to Fig. 3.

2. Remove the bolts which retain the shock absorber to the suspension lower arm. Lower, and remove the shock absorber.

3. Examine the shock absorber unit and rubber bushings. Replace parts that are defective, deteriorated, or worn.

INSTALLATION

1. Fully extend the shock absorber and position it inside the coil spring. Connect the lower end of the shock absorber to the suspension lower arm. Torque the retaining nuts to specification.

2. Insert the upper bracket stud through the bushing in the shock absorber upper eye. Install the stud bracket to crossmember retaining bolt. **Do not tighten the bolt at this time.**

3. Install the upper eye bracket stud nut. Torque the nut to specification.

4. Torque the stud bracket to crossmember retaining bolt to specification. **The shock absorber upper eye stud nut must be tightened to compress the rubber bushing before the stud bracket is bolted to**

the crossmember; otherwise, the upper attachment could be loose and noisy.

FRONT SPRING AND LOWER ARM

REMOVAL

1. Raise the vehicle. Place a support under each underbody side rail to the rear of the lower arm in the lifting pad area. Refer to Fig. 3.

2. Remove the wheel and tire assembly; then, remove the hub and drum.

3. Loosen the brake backing plate to provide clearance at the end of the arm when it is lowered.

4. Remove the shock absorber.

5. Disconnect the stabilizing strut (drag strut) from the lower arm.

6. Disconnect the stabilizer bar from the suspension arm.

7. Remove the cotter pin from the slotted nut attaching the lower ball joint to the end of the spindle boss. Loosen the nut one to two turns.

8. Using a brass hammer, tap the spindle until the ball stud pops loose against the nut.

9. Place a jack under the outer end of the lower arm and raise the arm several inches.

10. Install the spring compressor tool 5310-A (Fig. 4) inside the spring with the jaws of the tool toward the center of the car.

11. Remove the nut from the ball joint stud. Lower the jack until the spindle and spring are free, and remove the spring and insulators.

12. Remove the lower arm to crossmember nut, bolt, washers, and spacer, then remove the arm.

INSTALLATION

1. Connect the inner end of the lower arm to the underbody crossmember. **Do not tighten the retaining nut at this time.** Refer to Fig. 3.

2. Place a jack under the outer end of the arm.

3. Tape the upper and lower spring insulators to the spring.

4. Compress the coil spring with tool 5310-A (Fig. 4) and place the spring and insulators in position. Be sure both ends of the spring are properly seated, and raise the arm. Guide the spindle boss over the ball joint stud.

5. Install the ball joint stud retaining nut and torque it to specification. Continue tightening the nut to line up the cotter pin hole. Install a new cotter pin.

6. Connect the stabilizer bar to the lower arm. Torque the nut to specification.

7. Connect the drag strut to the lower arm. Torque the nuts to specification.

8. Install the shock absorber.

9. Tighten the brake backing plate retaining nuts to specification.

10. Install the hub and drum, and the wheel and tire assembly. Torque the wheel nuts to specification. Adjust the wheel bearings. Remove the support stands.

11. With the front end weight of the car on the wheels, torque the lower arm to crossmember bolt retaining nut to specification.

UPPER ARM

REMOVAL

1. Place a jack under the outer end of the suspension lower arm and raise the arm. Refer to Fig. 3.

2. Remove the wheel and tire assembly.

3. Remove the cotter pin from the upper ball joint stud. Loosen the nut one or two turns. Pry upward on the upper arm and, using a brass hammer, tap the spindle at the stud boss until the ball joint stud loosens against the nut. Remove the nut.

4. Raise the upper arm to free the ball joint stud from the spindle. Wire the upper end of the spindle to the underbody to prevent damage to the brake hose.

5. Mark the position of the upper arm shaft on the underbody member to facilitate making caster and camber adjustments after installation of the upper arm.

6. Remove the suspension upper arm-to-underbody retaining bolts, lock washers, and retaining nuts. Then remove the upper arm.



F1222-A

FIG. 4—Coil Spring Compressed for Installation

INSTALLATION

1. Position the upper arm shaft on the underbody member. Line up the shaft with the marks made before removal of the arm.

2. Install the retaining bolts and lock washers. Fabricate a tool as shown in Fig. 5 to hold the nut in place while starting the retaining bolt into the nut. Remove the tool, then tighten the retaining bolts to specification.

3. Guide the ball joint stud into the spindle. Install the retaining nut and torque it to specification. Continue tightening the nut to line up the

cotter pin hole. Install a new cotter pin.

4. Install the wheel and tire, and torque the wheel nuts to specification.

5. With the front end weight of the car on the wheels, torque the bolts at the ends of the upper arm shaft to specification if the bushings were replaced.

6. Check the front wheel alignment.

REAR SHOCK ABSORBER

REMOVAL

1. Lift the car and place support stands under the axle housing. Position the car with a hoist to relieve tension on the shock absorbers.

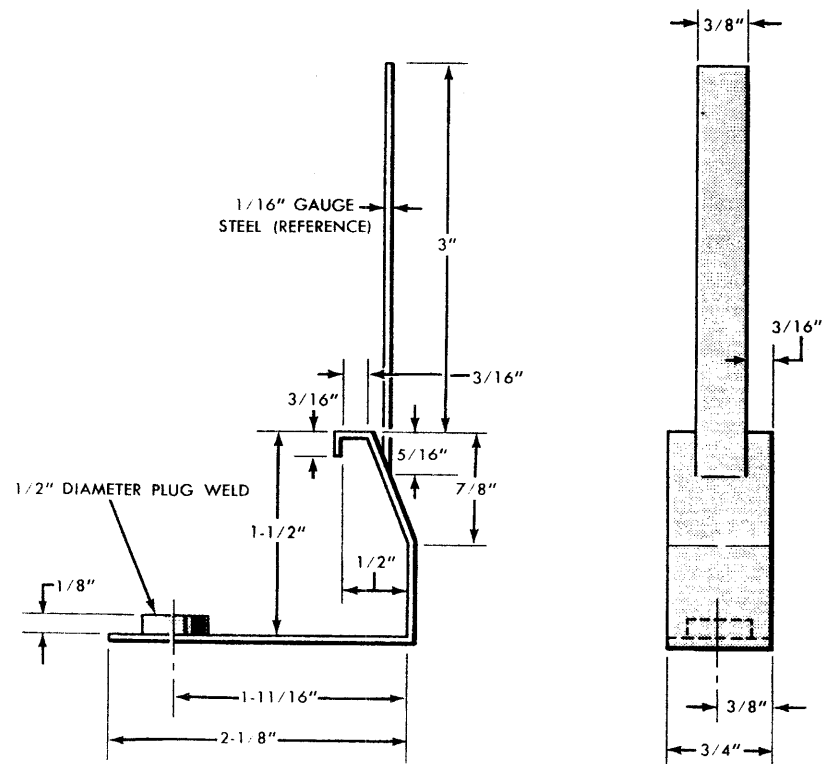
2. Remove the screws that retain the shock absorber mounting plate to the crossmember (Fig. 6).

3. Remove the retaining nut and washers from the lower end of the shock absorber.

4. Remove the shock absorber.

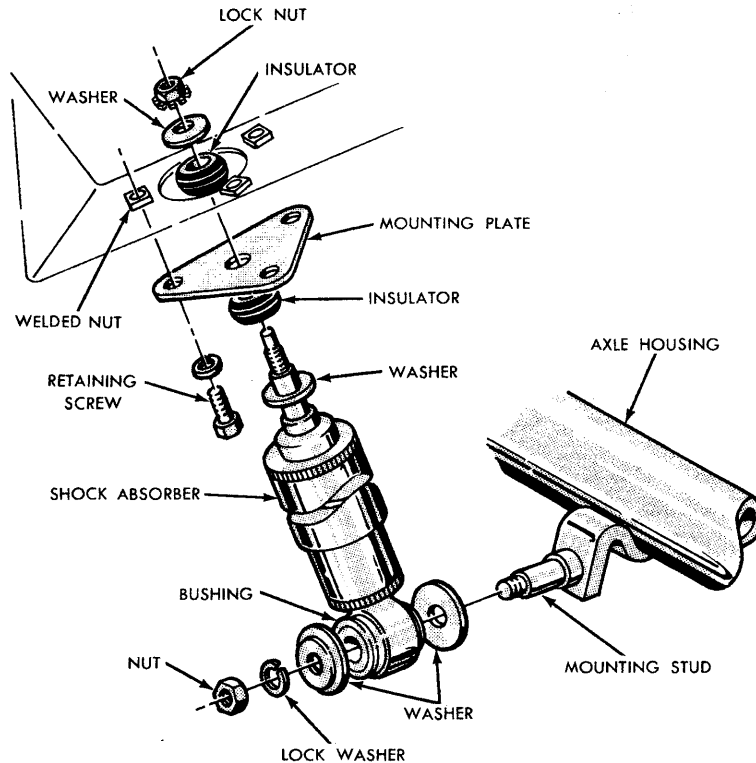
5. Remove the nut, outer washer, and insulator that retain the shock absorber to the mounting plate; then remove the plate.

6. Inspect the shock absorber for damage or leaks. If the bushing must



F1223-A

FIG. 5—Upper Arm Shaft Installation Tool



F1224-A

FIG. 6—Rear Shock Absorber Mounting

be replaced, the operation may be performed without the use of special tools. Wet the rubber bushing with brake fluid and press it into the shock absorber eye by hand. Replace the insulators if they appear worn or damaged.

INSTALLATION

1. Place the inner washer and insulator on the upper (stud) end of the shock absorber (Fig. 6).
2. Install the mounting plate, outer insulator, washer and nut on the stud. Torque the nut to specification.
3. Attach the mounting plate and shock absorber to the crossmember with the retaining screws and washers. Torque the screws to specification.
4. Connect the lower end of the shock absorber to the mounting stud with the washers and retaining nut. Torque the nut to specification.

LOWER MOUNTING STUD REPLACEMENT

If the shock absorber mounting stud is damaged, replace the stud as follows:

1. Cut off the old stud as close to the bracket as possible.
2. Grind off the weld at both ends of the stud and bracket face.
3. Drive out the balance of the stud with a brass drift. Do not enlarge the hole in the bracket.
4. Remove any weld remaining on the sides of the bracket.
5. Attach the service stud to the axle housing bracket with a nut. Torque the nut to specification.
6. Stake the nut to prevent loosening.

REAR SPRING

REMOVAL

1. Raise the car and place support

stands under the sidemembers on the rear of each rear spring hanger.

2. Lower the rear axle slightly to reduce some of the spring load; then, remove the spring U-bolts.

3. Remove the nut and front mounting bolt. Refer to Fig. 2.

4. Remove the rear shackle nuts and mounting plate. Remove the lower, inner insulator. Remove the spring. **If the rear shackle insulators are to be replaced, it will be necessary to remove the rear hanger assembly. (Hanger attaching bolts must be torqued to specification when reinstalled.)**

5. Remove the insulators from the spring.

6. Examine all parts for wear or damage. Note the condition of the spring center bolt.

7. The spring center bolt can be replaced by clamping the spring in a vise, thus keeping the spring compressed during bolt removal and installation.

INSTALLATION

1. Install the spring to the rear shackle assembly with the insulators in position. **Do not tighten the nuts at this time.** Refer to Fig. 2.

2. Attach the spring to the front hanger with the insulators in position. **Do not tighten the nut at this time.**

3. Place the insulator and retainers in position on the spring.

4. Lower the axle housing onto the insulator and retainer assembly.

CAUTION: If a wedge was located between the upper retainer and mounting pad, reinstall the same thickness wedge with the taper in the original direction. Raise the axle until the spring is approximately horizontal with the floor.

5. Install the lower insulator retainer and U-bolts. **Do not tighten the U-bolt nuts at this time.** Torque the rear shackle nuts to specification.

6. Torque the front shackle nut to specification.

7. Tighten the U-bolt nuts evenly to the specified torque.

8. **Make sure the lower insulator retainer contacts the upper retainer.**

4 MAJOR REPAIR OPERATIONS

LOWER ARM OVERHAUL— ARM REMOVED

Inspect the lower arm, bushings and pivot bolt for cracks, bends, wear or other damage. Replace the arm if necessary.

Install the nut on the ball joint stud, and turn the stud in the ball joint with a torque wrench to check rotating torque. If the turning effort is not within specifications, replace the ball joint.

Note: Do not wash the ball joint with solvent. The solvent may attack parts within the joint.

BALL JOINT REPLACEMENT

See Section 2 for the complete in-car ball joint replacement procedure.

Refer to Section 3 for the lower arm removal procedure.

1. To remove the ball joint, if it requires replacement, remove the rivet heads with a chisel. Punch the remaining portion of the rivets from the holes.

2. Press the bushings out of the arm with tool 3069—details H, AA, and AA2 (Fig. 7).

3. Apply silicone or liquid soap to the shell of the new bushing. Place the bushing in the arm with the flange end (large end) of the bushing at the front of the arm.

4. Press the bushing into the arm until the shoulder on the bushing shell seats against the arm. Use tool 3069—details H, AA2, and M5 (Fig. 8).

5. If the ball joint was removed,

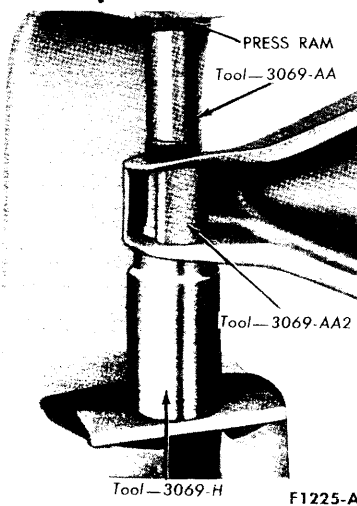


FIG. 7—Removing Lower Arm Bushing

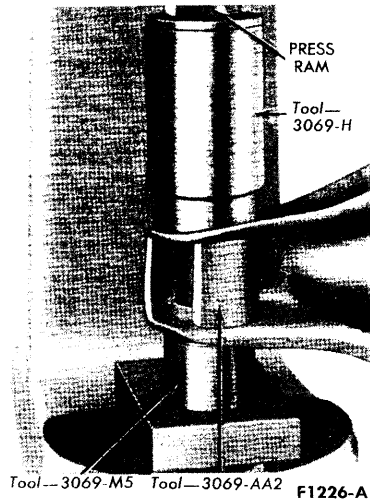


FIG. 8—Installing Lower Arm Bushing

install the new joint using the parts supplied in the ball joint kit. Torque the nuts to specification. Make sure the joint is completely filled with the specified lubricant.

UPPER ARM OVERHAUL— ARM REMOVED

Inspect the upper arm and the inner shaft for cracks, bends or other damage. Replace the parts as required.

Replacement arms come with the bushings, inner shaft, and ball joint installed. If the original arm is to be used, these components should be replaced on the bench.

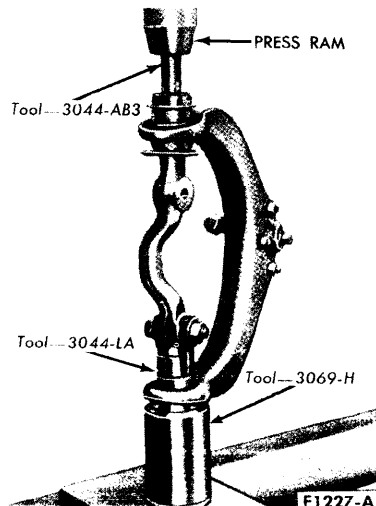


FIG. 9—Removing Upper Arm Front Bushing

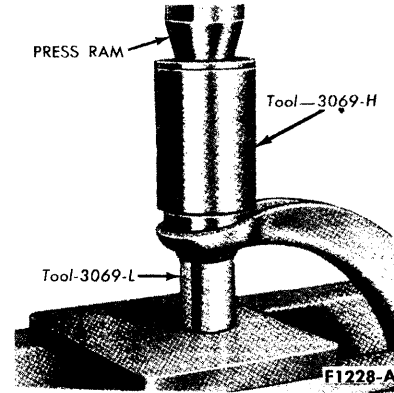


FIG. 10—Removing Upper Arm Rear Bushing

Note: Do not wash the ball joint with solvent. The solvent may attack parts within the joint.

BUSHING AND INNER SHAFT REPLACEMENT

Always replace both upper arm bushings, if either bushing is worn or damaged. Install only new bushings when replacing the inner shaft. Refer to Section 3 for the upper arm removal procedure.

1. Remove the bolts, lockwashers, and cup washers from the ends of the upper arm shaft.

2. Assemble the remover, tool 3044-LA, to the shaft at the front bushing. Press the bushing out of the arm using the support cup, tool 3069-H, and the remover tool 3044-AB3 (Fig. 9).

3. Remove the shaft and rear bushing inner cup washer.

4. Remove the upper arm rear bushing using the support cup, tool 3069-H, and the remover, tool 3069-L (Fig. 10).

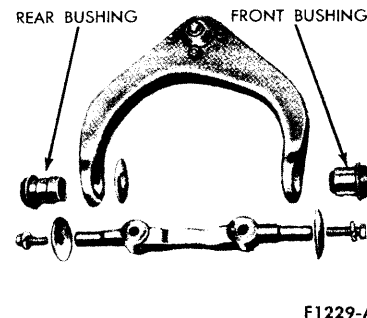


FIG. 11—Upper Arm, Shaft, and Bushing Assembly

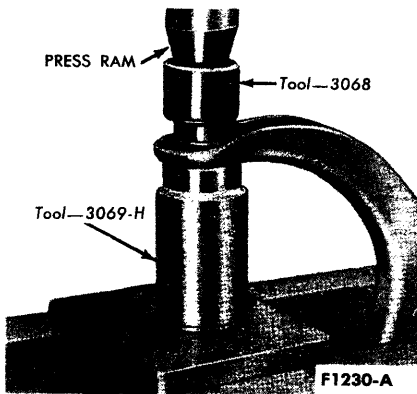


FIG. 12—Installing Upper Arm Rear Bushing

5. Both upper arm bushings are pressed into the arm from the outside toward the inside of the arm. To facilitate installation, use silicone or liquid soap as a lubricant. See Fig. 11 for proper assembly of the shaft and bushings.

6. Press the upper arm rear bushing into the arm using the support cup, tool 3069-H, and the replacer, tool 3068 (Fig. 12). Press the bushing in until the shoulder stop is reached.

7. With the rear bushing cup washer on the shaft, insert the end of the shaft into the rear bushing. Press the front bushing onto the shaft and into the arm using the replacer, tool 3068 (Fig. 13). Bottom the bushing flange against the flange in the arm.

8. Install the cup washers, lockwashers, and bolts at the ends of the upper arm shaft. **Do not tighten the bolts at this time. These must be tightened after the arm assembly has been installed, and when**

the front end weight of the car is on the wheels.

CAUTION: These bolts are made of a special material. Use only the specified bolt if replacement is necessary.

BALL JOINT REPLACEMENT

Check the ball joint stud rotating torque as detailed in Section 2. If the turning effort is not within specifications, or the ball joint shows signs of wear or damage; then follow the ball joint replacement procedure as outlined in Section 2.

REAR SPRING OVERHAUL—SPRING REMOVED

FRONT HANGER ASSEMBLY

If the front hanger or bushings are to be replaced, proceed as follows.

1. Remove the nut and lock washer from the spring front mounting bolt (Fig. 2).

2. Tap the spring mounting bolt out of the bushing and hanger, then separate the hanger from the spring. Remove the bushings.

3. Position the bushings in the front eye of the spring. Assemble the front hanger to the spring eye and install the spring mounting bolt through the hanger, bushings, and spring eye as shown in Fig. 2.

4. Install the lockwasher and nut on the mounting bolt and tighten to the specified torque.

REAR SHACKLE AND HANGER ASSEMBLY

Inspect the rear shackle, bushings, and studs for wear or damage. Re-

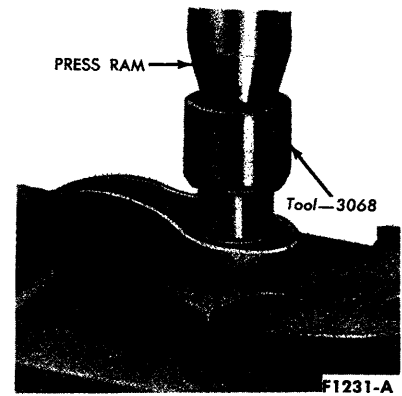


FIG. 13—Installing Upper Arm Front Bushing

place parts where necessary (Fig. 2).

If the rear shackle bushings are to be replaced, it will be necessary to remove the rear hanger assembly. Torque the hanger attaching bolts to specification when re-installed.

SPRING LEAVES AND TIE-BOLT

Check for broken spring leaves. Inspect the anti-squeak inserts between the leaves, and replace them if they are worn. **The spring leaves must be dry and free of oil and dirt before new inserts are installed.**

Inspect the spring clips for worn or damaged threads (Fig. 2). Check the spring clip plate and insulator retainers for distortion.

If the spring center tie-bolt requires replacement, clamp the spring in a vise to keep the spring compressed during bolt removal and installation.

PART 3-3 STEERING

Section

Page

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2 In-Car Adjustments and Repairs	3-17
3 Removal and Installation	3-20
4 Major Repair Operations	3-21

1 DESCRIPTION AND OPERATION

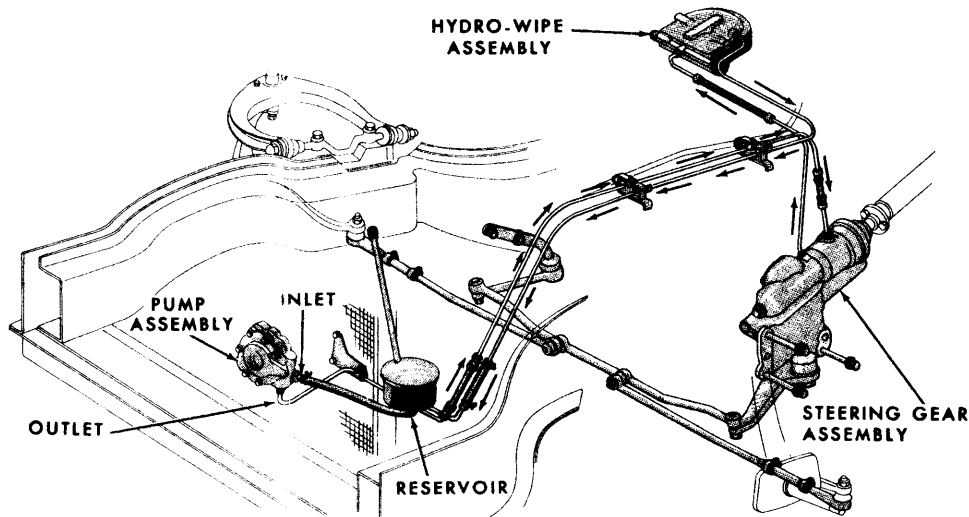


FIG. 1—Power Steering System

G1198-A

POWER STEERING SYSTEM

The power steering system includes the crankshaft-driven pump, the torsion bar type steering gear, a fluid reservoir, pressure and return lines, and the steering linkage (Fig. 1).

The basic pump consists of a housing and cover, a rotor and rollers which rotate within a cam ring, and a pressure plate. A flow control valve in the pump housing governs the flow of fluid. Maximum pump pressure is controlled by a relief valve inside the flow control valve.

The major details of the power steering gear are the sector shaft, ball nut and worm shaft, torsion bar and control valve, and the power cylinder and piston. These details all are contained within a one-piece housing.

The movement of the control valve depends upon the twisting of the torsion bar. The resistance of the front wheels to being turned governs the amount of torsion bar twist. As the torsion bar twists, the control valve moves to direct fluid under pressure in the side of the piston which requires power assist.

The windshield wiper system

obtains its operating oil pressure from the power steering hydraulic system.

TORSION BAR STEERING GEAR

The power steering unit is a torsion-bar type of hydraulic assisted system. This system furnishes power to reduce the amount of turning effort required at the steering wheel. It also reduces road shock and vibrations.

The torsion bar power steering unit includes a rack and piston, and a worm and ball nut assembly which is meshed to the gear on the steering sector shaft. The unit also includes a hydraulic valve, valve sleeve, and torsion bar assembly which are mounted on the end of the worm shaft and operated by the twisting action of the torsion bar.

The torsion-bar type of power steering gear is designed with all components in one housing (Fig. 2). This makes possible internal fluid passages between the valve and cylinder, thus eliminating all external lines and hoses, except the pressure and return hoses between the pump and gear assembly.

The power cylinder is an integral part of the gear housing. This piston is double acting, in that fluid pressure may be applied to either side of the piston. The one-piece piston and power rack is meshed to the sector shaft.

The operation of the hydraulic control valve is governed by the twisting of a torsion bar. All effort applied to the steering wheel is transmitted directly through the torsion bar to the ball nut and worm assembly. Any resistance to the turning of the front wheels results in twisting of the bar. The twisting of the bar increases as the front wheel turning effort increases. The control valve spool, actuated by the twisting of the torsion bar, directs fluid to the side of the piston where hydraulic assist is required.

The lower end of the torsion bar is splined to the lower end of the inside diameter of the worm shaft. The upper end of the worm shaft is coarsely splined to the inside diameter of the torsion bar and input shaft assembly upper end. This spline fit is sufficiently loose so that the upper end of the torsion bar

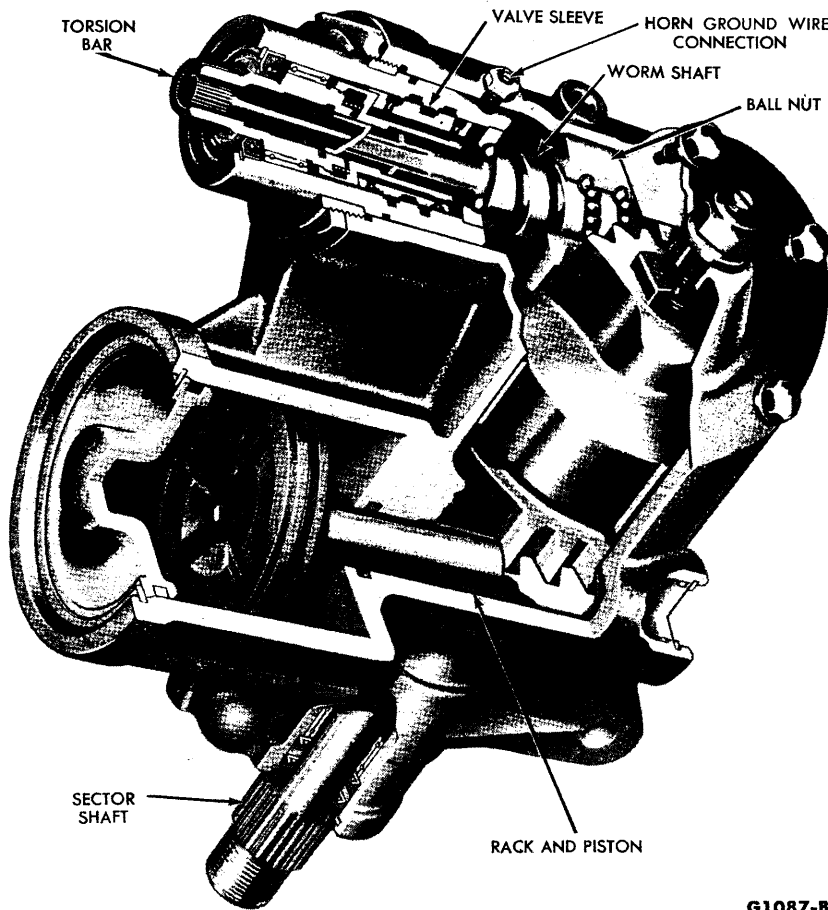


FIG. 2—Power Steering Gear

G1087-B

and input shaft assembly can twist in the actuator, and thus move it up and down. This movement results from a short length of helical splines on the inside diameter of the actuator which engage the outside diameter of the input shaft. The actuator is held in the spool by a snap ring. Therefore, as the torsion bar twists, its radial motion is transferred into axial motion by helical threads. Thus, the valve spool is moved off center, and fluid is directed to one side of the piston or the other (Fig. 3).

The restricting of the fluid flow to one side of the piston increases the fluid pressure proportionately to the reaction of turning the front wheels.

The resistance of the torsion bar gives the driver a feel of the road at all times. The more the torsion bar twists, the greater the feel of the road and at the same time the driver is receiving a greater power assist in steering.

STRAIGHT-AHEAD POSITION

When the power unit is not assisting in the steering effort, the valve spool is in the neutral (straight-ahead) position (Fig. 4). The fluid flows from the pump, through the open-center valve, and returns to the pump through the worm bearing. Therefore, no area of the valve spool or steering gear is under high pressure in this position. The amount of pressure in neutral position is approximately 30 psi at normal operating temperatures.

The pump has no influence on the valve spool, but the spool, housing, and power cylinder are full of fluid at all times when the pump operates.

RIGHT TURN

When the steering wheel is turned to the right, the ball nut on the worm resists being turned due to load on the sector shaft from the front end weight of the vehicle. Thus the torsion bar will start to twist (Fig. 4).

For a right turn the valve spool moves up, allowing fluid from the pump to enter against the upper side of the power piston. The fluid on the lower side of the piston is free to return through the valve to the pump. Therefore, the power assist is to the upper side of the piston, pushing it downward and providing assist in turning of the sector shaft.

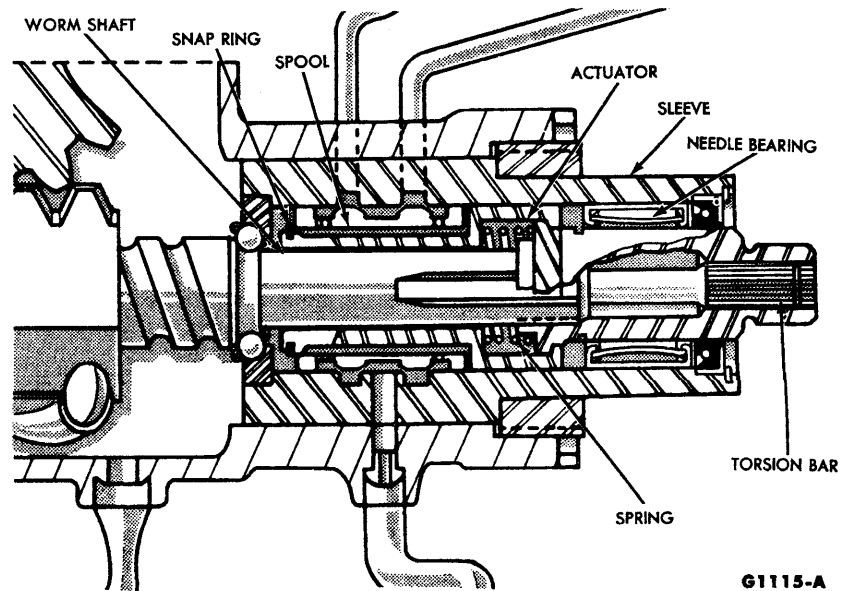
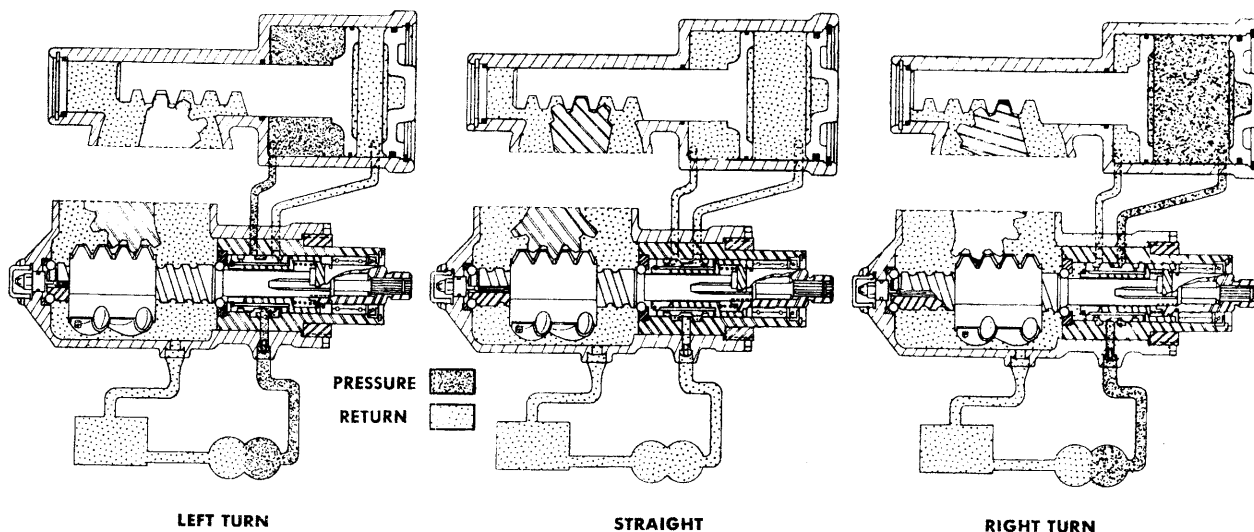


FIG. 3—Valve Detail

G1115-A

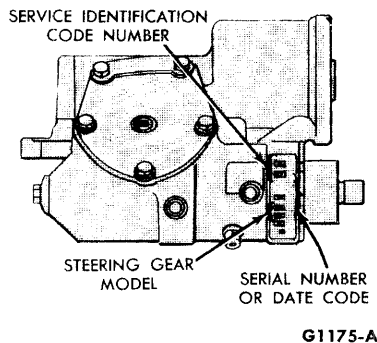


G1114-B

FIG. 4—Power Flows

LEFT TURN

If the steering wheel is turned to the left, it will cause a similar action but in the opposite direction (Fig. 4). The torsion bar twists to the left moving the valve spool **downward**, allowing fluid from the pump to enter against the lower side of the power piston. The fluid on the upper side of the piston is free to return through the valve to the pump. Therefore, the power assist is to the lower side of the piston, pushing it upward. The instant the driver stops applying steering effort to the steering wheel the valve spool is returned to its neutral position by the unwinding of the torsion bar. With the valve



G1175-A

FIG. 5—Steering Gear Identification Tag

spool returning to neutral position, the torsion bar straightening also helps to return the wheels to the straight-ahead position.

PUMP

The roller-type hydraulic pump, driven by the crankshaft, draws automatic transmission fluid from the reservoir and provides fluid pressure for the system. Steering gear lubrication is also provided by the same fluid from the reservoir. Within the pump itself is a flow-control and pressure-relief valve which governs the pressures within the steering system according to the varying conditions of operation. After fluid has passed from the gear, it returns to the reservoir.

An identification tag is attached to machined pad on top of the steering gear housing (Fig. 5) with a self-tapping screw.

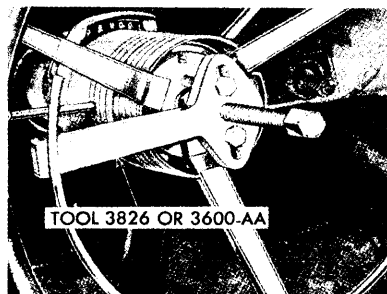
2 IN-CAR ADJUSTMENTS AND REPAIRS

STEERING WHEEL SPOKE POSITION

See Part 3-1, Section 2, for this adjustment.

STEERING WHEEL REPLACEMENT

1. Remove the hub cap from the steering wheel.
2. Remove the steering wheel nut, and then remove the steering wheel as shown in Fig. 6.
3. Transfer all serviceable parts to the new steering wheel.
4. Position the steering wheel on the shaft so that the alignment mark on the hub of the wheel is adjacent to the one on the shaft. Install and torque the nut to specification. Stake



G1199-A

FIG. 6—Removing Steering Wheel

the nut securely.

5. Install the hub cap.

STEERING COLUMN UPPER BEARING REPLACEMENT

REMOVAL

1. Disconnect the battery ground cable.
2. Loosen the Allen head screw that secures the flexible coupling to the steering shaft.
3. Remove the steering wheel.
4. Remove the turn signal lever from the column.
5. Remove the horn wire and turn signal switch attaching screws (Fig. 7). Lift the switch and horn wire from the flange and place them to one side.
6. Remove the upper bearing re-

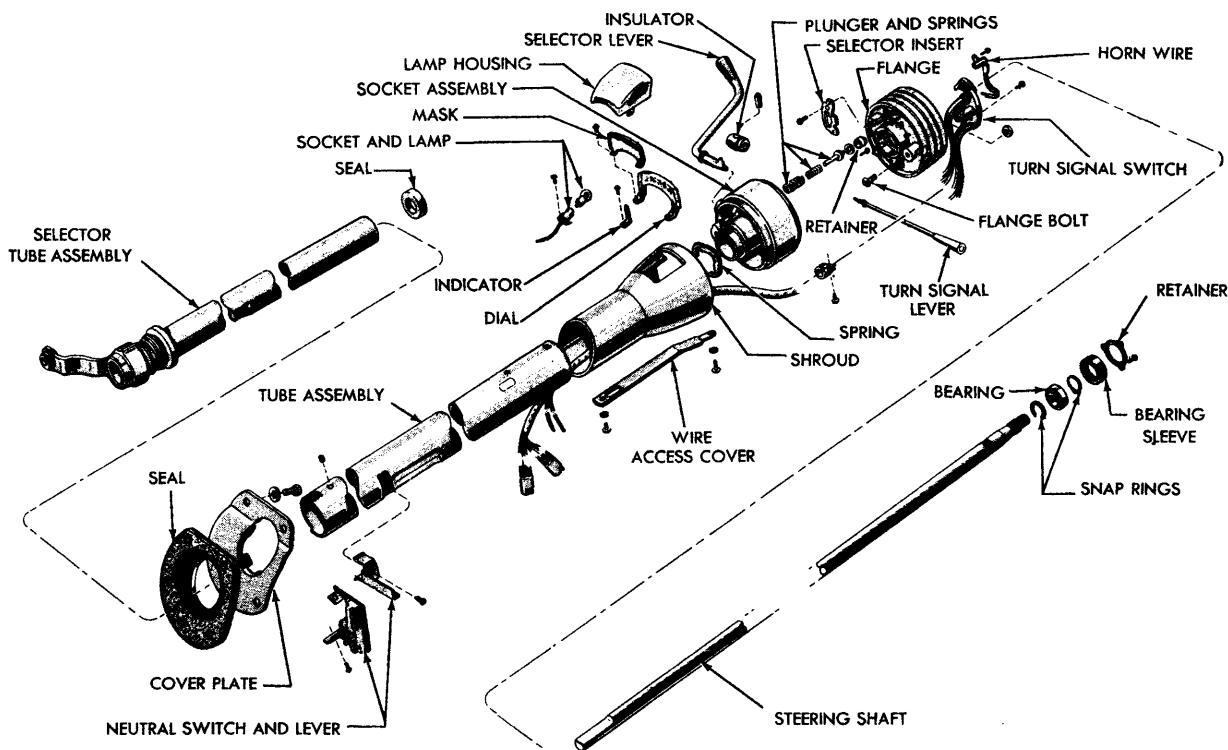


FIG. 7—Steering Column and Selector Lever Tube Details

G1200-A

tainer attaching screws and remove the retainer.

7. Install the steering wheel attaching nut on the steering shaft.

8. Grasp the nut and pull the shaft from the column.

9. Remove the upper bearing snap ring and pull the bearing off the shaft.

10. Remove the rubber insulator from the bearing.

INSTALLATION

1. Pack the bearing with Lubriplate.

2. Install the rubber insulator on the bearing (Fig. 7).

3. Install the bearing and upper snap ring on the shaft.

4. Position the shaft and bearing in the column making sure that the flat on the lower end of the shaft enters the flex coupling.

5. Position the bearing retainer on the flange and secure it with the attaching screws.

6. Secure the turn signal switch and the horn wire to the flange.

7. Install the turn signal lever.

8. Install the steering wheel.

9. Secure the steering shaft to the flex coupling with the Allen head screw.

10. Connect the battery ground cable.

11. Check the turn signal operation and the horn.

STEERING COLUMN AND SELECTOR TUBE REPLACEMENT

REMOVAL

1. Disconnect the battery.

2. Disconnect the rod from the lever at the lower end of the selector tube. Loosen the clamp bolt that locks the flexible coupling to the steering shaft.

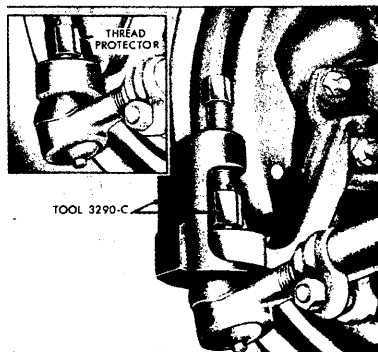


FIG. 8—Pressing Out Ball Stud

G1201-A

3. Remove the cap from the steering wheel hub. Press downward on the cap and turn counterclockwise. Remove the steering wheel as shown in Fig. 6.

4. Disconnect the wires at the steering column. Remove the screws that hold the wire access cover to the underside of the column. Slide the cover toward the steering wheel to remove it (Fig. 7).

5. Remove the screws that hold the column cover plate to the dash panel.

6. Remove the column-to-instrument panel bracket clamp. Remove the column.

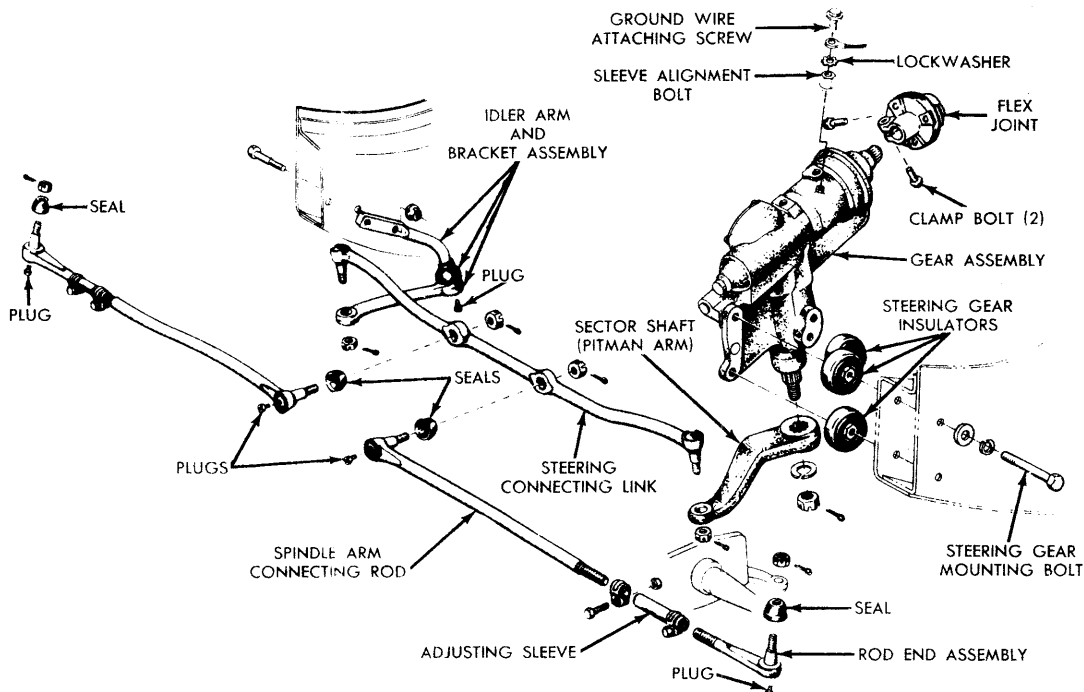
INSTALLATION

1. Position the steering column. Install the column-to-instrument panel bracket clamp.

2. Fasten the column cover plate to the dash panel.

3. Connect the wires at the steering column. Install the wire access cover.

4. Align the steering shaft and steering wheel hub index marks and install the steering wheel. Torque the retaining nut to specification and stake securely.



G1161-B

FIG. 9—Components of Steering Linkage

5. Install the steering wheel hub cap.

6. Connect the shift rod to the lever at the lower end of the selector tube.

7. Tighten the clamp bolt which locks the flexible coupling to the steering shaft.

8. Connect the battery.

STEERING LINKAGE REPLACEMENT

REMOVAL

1. Remove the cotter pins and nuts from the ball studs in the spindle arms and the steering gear (Pitman) arm. Install the thread protector on the ball stud as shown in the inset in Fig. 8. Install the remover detail making sure the end of the slot in the tool is against the ball stud. Press the ball stud from the arm. **Because of the special design of the ball stud seals, a wedge type ball stud separator must not be used.**

2. Remove the nuts and bolts that attach the idler arm bracket to the sidemember, and remove the linkage.

3. To disassemble the linkage use tool 3290-C to press the ball stud out of the steering connecting link and the idler arm (Fig. 9).

INSTALLATION

1. Install the seal over the ball stud of the center link, then assemble the connecting link to the idler arm and torque the ball stud retaining nut to specification. Install the cotter pin.

2. Install new ball stud seals and assemble the connecting rod ball studs to the spindles. Torque the stud retaining nuts to specification and install the cotter pins.

3. Attach the idler arm bracket to the body sidemember with the mounting bolts and tighten the nuts to the specified torque.

4. Install the connecting link ball stud seal on the ball stud, then assemble the connecting link ball stud to the steering arm. Torque the stud retaining nut to specification and install the cotter pin.

5. Make certain all the ball joints are full of lubricant.

6. Check toe-in and steering wheel spoke position.

STEERING GEAR

Worm Bearing Preload and Sector Mesh Adjustment.

1. Remove the fluid from the power steering reservoir with a suction gun.

2. Disconnect the fluid return line from the reservoir. Place the end of the return line in a container and

turn the steering wheel in both directions as required to discharge the fluid from the gear.

3. Working from under the car, disconnect the Pitman arm from the steering gear.

4. Remove the hub cap from the steering wheel.

5. Attach an inch-lb torque wrench to the steering wheel attaching nut (Fig. 10).

6. Measure the force required to move the worm shaft approximately 20° away from the stop.

7. If reading is not within 6-8 in-lbs, loosen the adjuster lock nut and turn the bearing adjuster to obtain the proper reading. Tighten the lock nut, making sure the adjuster does not turn. Re-check pre-load.

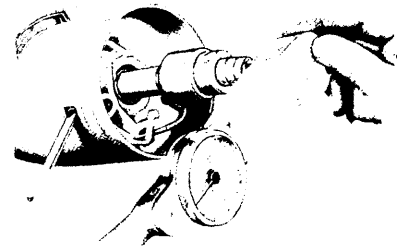
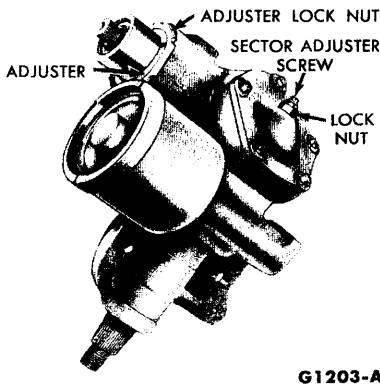


FIG. 10—Checking Steering Gear Pre-load

G1202-A



G1203-A

FIG. 11—Pre-load and Mesh Load Adjustments

8. Locate the mechanical center of the steering gear by rotating the steering wheel right or left to the stop, then back it off $1\frac{3}{4}$ turns.

9. Rotate the steering gear to the left stop. Using an inch-pound torque wrench, back it off at a constant pull, reading the torque at exact mechanical center.

Rotate the gear to the right stop and take the reading in the opposite direction.

If two slightly different readings are obtained, the larger should be recorded as total on-center meshload.

10. If total over-center meshload is not within 15-17 in-lbs, loosen the sector adjuster lock nut (Fig. 11) and turn the adjuster screw to obtain proper adjustment.

NOTE: $\frac{1}{16}$ turn of the adjuster will increase the meshload approximately 2 in-lbs.

Tighten the adjuster lock nut making sure the adjusting screw does not turn. Re-check the meshload.

AIR BLEEDING

Air in the system (shown by bubbles in the fluid) should be purged. Furthermore, the power steering system should be purged after any part of it has been opened to the atmosphere or disconnected for repair or replacement.

1. Run the engine at idle speed. Check the fluid level in the pump reservoir. If necessary, add the specified automatic transmission fluid to bring the level to the "F" mark on the dipstick.

2. Turn on the windshield wipers. Rotate the steering wheel from stop to stop several times to bleed the air from the system. **Do not hold the wheels against the stops.** Recheck the fluid level in the reservoir.

3 REMOVAL AND INSTALLATION

STEERING GEAR

REMOVAL

1. Disconnect the pressure line and the return line from the steering gear housing. Plug the openings and cap the lines.

2. Disconnect the horn ground wire from the sleeve alignment bolt. Remove the bolt that secures the flexible coupling to the steering gear worm shaft (Fig. 9).

3. Raise the car. Remove the transmission linkage splash shield.

4. Remove the exhaust manifold to resonator pipe, and remove the front end crossmember.

5. Remove the Pitman arm from the sector shaft as shown in Fig. 12.

6. Remove the transmission linkage rods from the equalizer shaft. Force the shaft outward. This compresses a spring within the shaft which frees it from the inner ball joint.

7. Loosen (or remove) the retaining bolts at the lower edge of the fender splash shield to obtain clearance; then remove the gear housing-to-body member mounting bolts.

8. Pull the steering gear from the flexible coupling.

INSTALLATION

1. If a new gear is being installed, transfer the insulators from the old gear to the new one if they are in a serviceable condition.

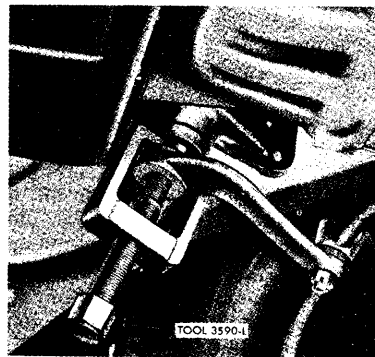


FIG. 12—Removing Pitman Arm

G1204-A

2. Center the gear by turning the worm shaft to either stop, then, turn it back approximately two turns.

3. Center the steering wheel and insert the input shaft in the flexible coupling. Secure the steering gear to the body member with the attaching bolts. Torque the bolts to specification.

4. Position the Pitman arm on the sector shaft and secure it with a lock washer and nut. Torque the nut to specification.

5. Position the equalizer shaft and install the transmission linkage rods.

6. Install the manifold-to-resonator pipe.

7. Attach the front crossmember and the splash shield lower edge.

8. Lower the car. Connect the

pressure and the return line to the steering gear.

9. Connect the horn ground wire to the sleeve alignment bolt. Install and torque the flexible coupling retaining bolt to specification.

10. Fill the fluid reservoir and start the engine. Cycle the steering wheel, with the windshield wipers operating, and check for oil leaks. Do not hold the wheels against their stops and cause the fluid to overheat.

11. If the gear has been overhauled, adjust the position of valve spool as detailed in "Assembly of Steering Gear," Section 4.

PUMP RESERVOIR—WITHOUT AIR CONDITIONING

REMOVAL

1. Remove the reservoir cover and gasket. Withdraw the fluid with a suction gun.

2. Remove the reservoir bracket to cylinder block upper cap screw and the lower cap screw and spacer.

3. Disconnect the reservoir inlet line and the outlet line at the reservoir, and remove the reservoir.

INSTALLATION

1. Connect the reservoir to pump line (outlet line) at the reservoir, but do not tighten the clamp.

2. Attach the reservoir and bracket to the cylinder block with the upper cap screw and the lower cap screw and spacer. Tighten the cap screws.

3. Tighten the outlet line clamp at the reservoir. Connect the reservoir inlet line to the reservoir.

4. Fill the reservoir with the specified automatic transmission fluid. Run the engine, and bleed the system by cycling the steering gear with the windshield wipers turned on. Check for leaks, and recheck the fluid level.

PUMP RESERVOIR—WITH AIR CONDITIONING

REMOVAL

1. Raise the front of the car. Remove the reservoir to pump line (outlet line) clamp at the reservoir, but do not disconnect the line at this time.

2. Disconnect the reservoir inlet line at the reservoir.

3. Remove the reservoir bracket to the cylinder block upper cap screw. Support the reservoir and remove the lower cap screw and spacer.

4. With a drain pan under the reservoir, disconnect the outlet line hose from the reservoir tube and allow the fluid to drain.

5. Remove the reservoir cover retaining nut and the cover. Position the cover and the reservoir out of the way and allow them to rest in the engine compartment.

6. Lower the front of the car. Remove the fan shroud.

7. Remove the reservoir and the cover by manipulating them through the opening between the radiator and the compressor drive belt.

INSTALLATION

1. Position the reservoir in the engine compartment. Loosely attach the reservoir and bracket to the cylinder block with the upper cap screw.

2. Install the fan shroud, then raise the front of the car.

3. Connect the reservoir to pump line (outlet line) at the reservoir.

4. Install the reservoir bracket to cylinder block lower cap screw and spacer. Tighten both the upper and the lower cap screws.

5. Connect the reservoir inlet line at the reservoir. Install the clamps on both lines. Lower the car, and install the reservoir cover and retaining nut.

6. Fill the reservoir with the specified automatic transmission fluid. Run the engine, and bleed the system by cycling the steering gear with the windshield wipers turned on. Check for leaks, and recheck the fluid level.

POWER STEERING PUMP

REMOVAL

1. Open the hood, and install fender covers.

2. If the car is equipped with air conditioning, loosen the compressor adjusting and support bracket bolts and remove the drive belt.

3. Loosen the generator adjusting and support bracket bolts, and remove the drive belts.

4. Remove the fan, pulley, and spacer.

5. Raise the car.

6. Remove the crankshaft damper bolt and washer. Remove the damper with tool 6306-AG. Remove the

drive key.

7. Disconnect the pump inlet line at the pump, and plug the end of the line to prevent the loss of fluid. Disconnect the pump pressure line at the pump.

8. Remove the pump to engine front cover cap screws, and remove the pump. Remove the seal from the front cover.

INSTALLATION

1. Install a new seal on the engine front cover.

2. Align the slot in the pump rotor shaft with the drive key in the crankshaft, and slide the pump onto the shaft. Install the pump to engine front cover cap screws. Torque the cap screws to specification.

3. Connect the pump inlet line and the pressure line.

4. Install the damper drive key, damper, washer and bolt. Torque the bolt to specification.

5. Install the fan, pulley, and spacer. Install the generator drive belts. Adjust the belt tension, and tighten the adjusting and support bracket bolts.

6. If the car is equipped with air conditioning, install the compressor drive belt. Adjust the belt tension, and tighten the adjusting and support bracket bolts.

7. Run the engine at idle speed, and check the fluid level in the reservoir. If required, add the specified automatic transmission fluid. Turn on the windshield wipers. Rotate the steering wheel from stop to stop several times to bleed the air from the system. Recheck the fluid level.

4 MAJOR REPAIR OPERATIONS

STEERING GEAR DISASSEMBLY

Use only parts specified for the Lincoln steering gear.

1. Drain the hydraulic fluid from the ports, and thoroughly clean the exterior of the unit with a suitable solvent.

2. Mount the unit for disassembly on a stand adapter or in a vise.

3. After removing the cylinder plug snap ring, use compressed air to remove the cylinder plug from the piston rack bore.

4. After removing the snap ring, remove the cylinder cap from the piston bore (Fig. 13). Remove the cylinder cap O-ring.

5. Check the amount of backlash between the sector gear and the

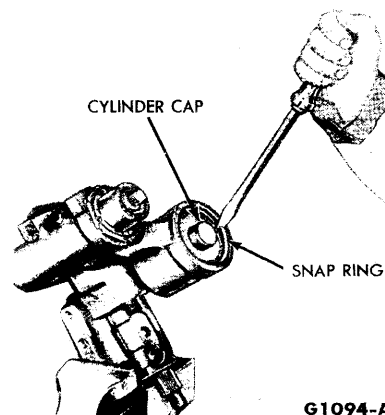
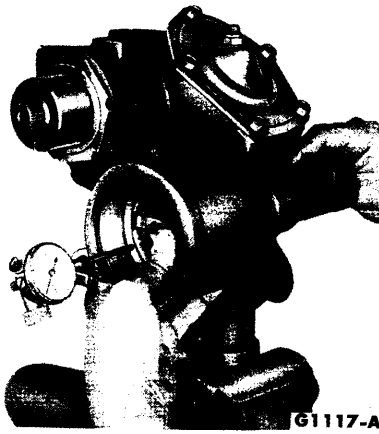


FIG. 13—Removing Cylinder Cap Snap Ring

piston rack as follows:

- a. Position a dial indicator against the piston. Locate the dial indicator shaft on the machined surface at the outside diameter of the piston, and set it at zero (Fig. 14).
- b. While holding the sector shaft firmly, push the piston by hand as far as it will go first in one direction and then the other, to obtain total deflection of the needle (Fig. 14). Note the indicator reading.
- c. The backlash should not exceed .004 inch. If the backlash is excessive, install a new piston or sector shaft as required when assembling the gear.



**FIG. 14—Checking
Piston Backlash**

6. Turn the worm shaft all the way to the stop and back it off about one and three-quarters turns, using the tool shown in Fig. 15.

7. Loosen the sector shaft adjusting screw lock nut and adjusting screw. Remove the cap screws that attach the steering gear housing cover to the housing. Tap on the lower end of the sector shaft with a soft-faced hammer until the sector shaft and cover can be removed (Fig. 16). Remove and discard the housing cover gasket and cover bolts (not re-usable). Slide the cover to one side to release the adjusting screw from the sector shaft, and remove the adjusting screw from the cover.

8. Push the piston out of the housing. Remove the piston O-ring. Remove the piston rack bore O-ring as shown in Fig. 17.

9. Loosen the valve sleeve alignment bolt.

10. Remove the valve adjuster cap and remove the O-ring from the cap.

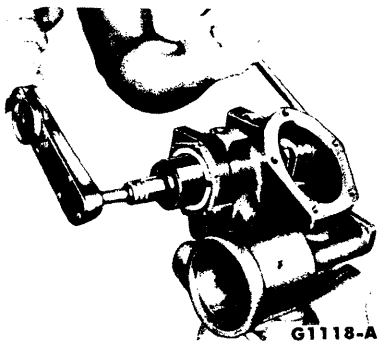


FIG. 15—Pre-load Check



**FIG. 16—Removing
Sector Shaft**

11. Remove the bearing adjuster lock nut and the bearing adjuster.

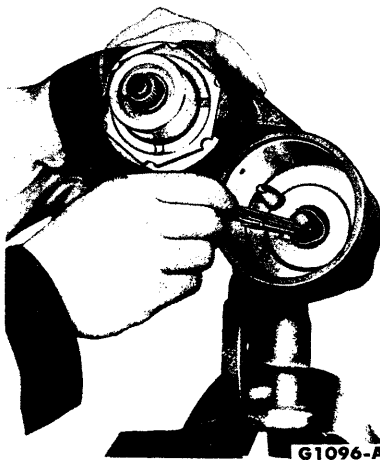
12. Remove the torsion bar and sleeve assembly (Fig. 18) by lightly tapping on the lower end of the torsion bar with a soft-faced hammer.

13. Remove the sector shaft oil seal retaining snap ring (Fig. 21). Remove the outer seal with tool 1175-AE, then remove the spacer. Remove the inner seal with tool 1175-AE.

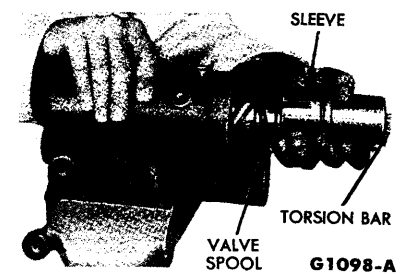
TORSION BAR AND SLEEVE DISASSEMBLY

1. Position the ball nut assembly in a vise. Use a clean cloth in the vise to protect the ball nut assembly. Remove the valve spool sleeve from the torsion bar assembly (Fig. 21). Remove the O-ring from the sleeve.

2. Remove the valve spool adjuster lock nut from the lower end of the torsion bar. Remove the valve spool adjuster from the torsion bar.



**FIG. 17—Removing
Piston O-Ring**



**FIG. 18—Removing
Torsion Bar and Sleeve**

3. Remove the torsion bar, valve spool, actuator, seal, bearing and race from the worm shaft (Fig. 19). Tap the end of the torsion bar with a soft-faced hammer, if necessary. **The valve spool and the actuator assembly are spring-loaded.** Discard the lower bearing race seal. Separate the valve spool and the actuator assembly from the torsion bar by turning the valve spool and actuator while turning the torsion bar.

4. Remove the valve spool snap ring. Remove the valve spool from the actuator.

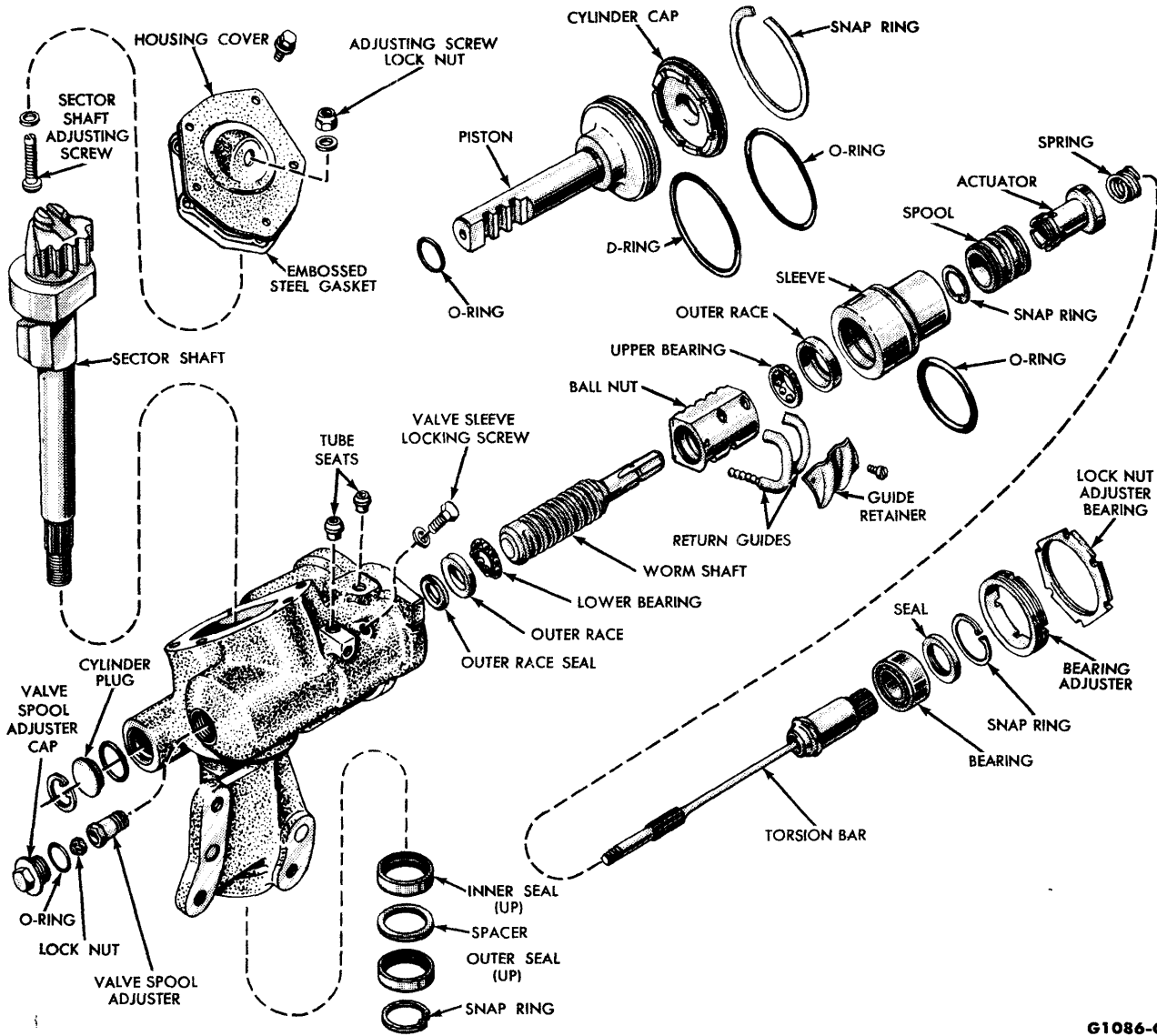
5. Check the ball nut assembly for evidence of binding or rough spots in the assembly itself. **Do not disassemble unless there is evidence of binding or rough spots. Be sure, however, that there is sufficient lubrication throughout the ball nut. The ball nut is not preloaded and should move freely throughout the entire travel. Do not rotate the ball nut against the end of the worm shaft as damage will result. To disassemble the ball nut proceed as follows.**

6. Remove the ball nut guide retainer and the ball guides. Turn the nut over and remove the balls by rotating the worm shaft from side to side. Catch the balls in a clean pan or a clean cloth. Remove the ball nut from the worm shaft. **Note the position of the ball nut on the worm shaft (Fig. 22).**

7. Wash all parts in clean solvent and dry them with compressed air.

8. Inspect the worm and ball nut grooves, and all of the balls for wear or scoring. If either the worm or ball nut needs replacing, both must be replaced as a matched assembly. Inspect the ball nut teeth for pitting, wear or scoring.

9. Make certain that the ball return guide ends are not damaged.

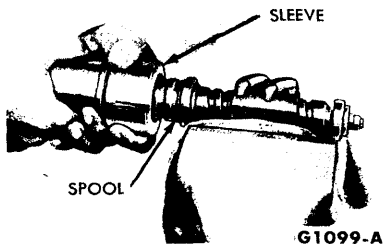


G1086-C

FIG. 19—Power Steering Gear Disassembled

TORSION BAR AND SLEEVE ASSEMBLY

1. Slide the ball nut over the worm. See Fig. 22 for the correct position.



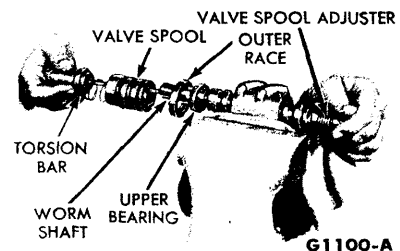
G1099-A

FIG. 20—Removing Valve Spool Sleeve

Align the ball return guide holes with the worm groove. Count 31 balls (one half the number of balls) into a suitable container. This is the number of balls required to fill one circuit. Drop 21 of these balls into one guide hole to fill the one circuit in the ball nut. It may be necessary to oscillate the shaft slightly to circulate the balls. Make sure that none of the balls come out the other end of the circuit and enter the worm groove between the two circuits.

2. Coat the groove of one-half of a return guide with clean oil-soluble grease and place 10 balls in the guide. Place the other half of the guide

over the balls. While holding the two halves together, push the guide into the guide holes in the ball nut. If the guide does not push all the



G1100-A

FIG. 21—Removing Valve Spool Adjuster

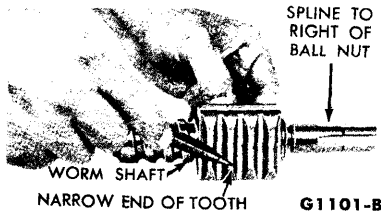


FIG. 22—Ball Nut Position

way down easily, tap it lightly with a soft-faced hammer to seat it. Fill the second circuit in the same manner and then attach the guide clamp with the lockwashers and retaining screws.

3. Inspect the torsion bar splines for nicks, pitting, wear or scoring. Make sure the blind spline on the torsion bar lines up with the punch dot on the upper end of the assembly (large splined end). If they do not line up, replace the torsion bar assembly.

4. Check the fit of the actuator on the torsion bar assembly, with the spring in place. Hold the torsion bar while turning the actuator. When the actuator is released, the spring should cause the actuator to pop off the threads. If it does not pop off, replace the spring and check the gear teeth for burrs. If there are any burrs that cannot be removed, replace the defective parts.

5. Check the sleeve ball bearing for freedom of rotation. If the bearing is satisfactory, remove the snap ring and replace the oil seal. If the bearing must be replaced, remove the seal, and then remove the bear-

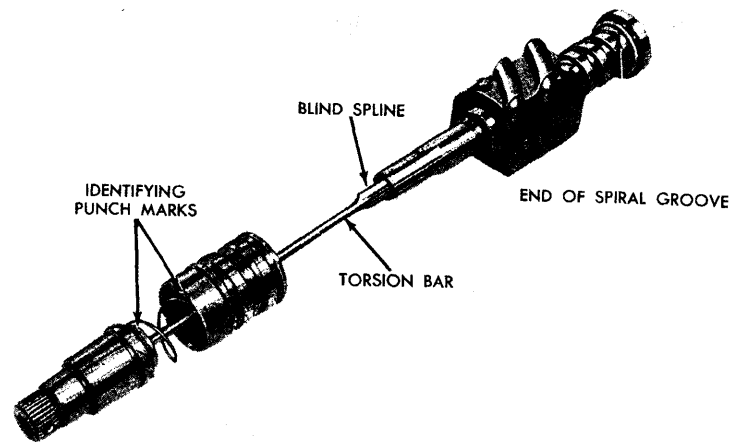


FIG. 24—Installing Torsion Bar

ing, using the tools shown in Fig. 23.

6. Install the bearing in the sleeve, using the tool shown in Fig. 23. **The bearing must be pressed in so that there is 0.035-0.045-inch between the upper surface of the bearing and the seal seat surface of the sleeve.** To install the seal, use the tool shown in Fig. 23. Install the snap ring and check bearing rotation.

7. Lubricate the parts with automatic transmission fluid.

8. Check the fit of the upper bearing race to insure that it is a slip fit in the sleeve. Install the bearing race and bearing on the worm shaft.

9. Install the valve spool on the actuator and retain with a new snap ring. Check the valve spool for free rotation.

10. Install the torsion bar spring

and the actuator on the torsion bar. Turn the lower end of the shaft so that the two identifying punch marks are aligned (Fig. 24). Hold the assembly together and insert the torsion bar into the worm shaft, aligning the blind spline on the torsion bar with the end of the spiral groove on the lower end of the worm and shaft. **The torsion bar assembly is properly installed when the valve spool bottoms against the upper bearing and race.**

11. Hold the lower bearing, race and seal in position on the worm shaft and install the valve spool adjuster on the torsion bar, but do not tighten. Install the lock nut. Lubricate the lip of the input shaft seal with automatic transmission fluid.

12. Install the valve sleeve over the valve spool so that the upper bearing outer race is seated in the recess of the sleeve. Install a new O-ring seal on the sleeve.

ASSEMBLY OF STEERING GEAR

Refer to Fig. 19.

1. Align the slot in the sleeve with the lock screw in the housing, and install the torsion bar and sleeve assembly in the housing. **Be sure that the seal and the lower bearing outer race are properly seated.** Tap on the sleeve until it bottoms. Torque the lock screw to 15-20 ft-lbs. **The lock screw and the brass washer must be seated against the housing when they are properly installed.**

2. Install the bearing adjuster and lock nut.

3. Install the valve spool centering wrench (Fig. 25) on the valve

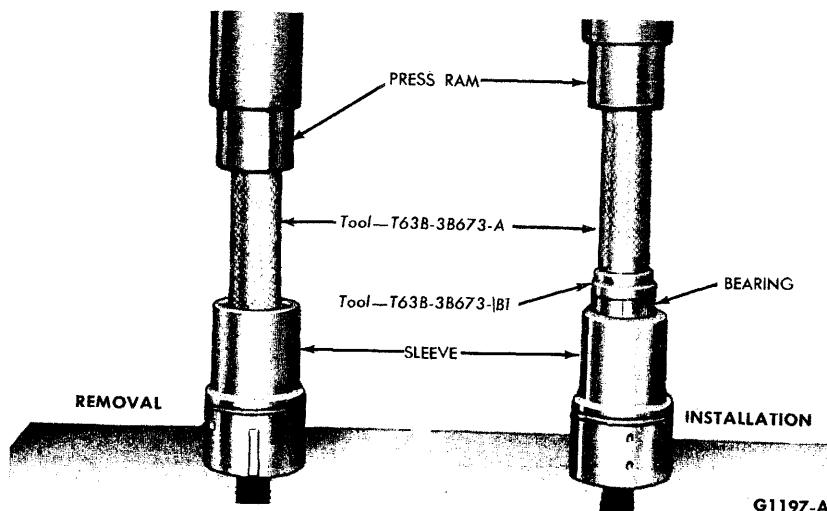


FIG. 23—Replacing Sleeve Seal and Bearing

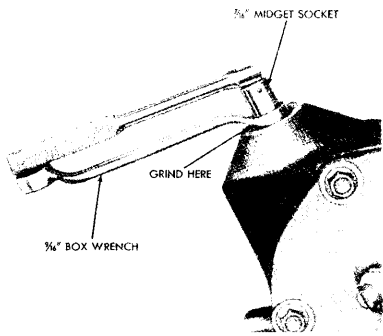


FIG. 25—Valve Spool Preliminary Centering G1205-A

spool adjuster, and locate the valve spool so that the valley between the lands can be seen through the pressure port. Lock the adjuster with the lock nut, as shown in Fig. 25. This is only a preliminary adjustment.

4. Center the ball nut with the centerline of the sector shaft opening.

5. Install a new O-ring in the piston rack bore of the housing, and lubricate the parts.

6. Carefully hone the edges of the piston rack teeth with a hand stone to prevent cutting the piston rack bore O-ring during installation.

7. Install a new O-ring on the piston and install the piston in the housing. Lubricate the parts thoroughly and rotate the piston while inserting it. Align the center rack teeth with the sector bore in the housing.

8. Grease the sector shaft splines and install the shaft. Make sure that the sector shaft is centered by rotating the worm shaft. Count the turns from one stop to the other. There should be at least 3 1/2 turns. If there are fewer than 3 1/2 turns, remove the sector shaft and install correctly.

9. Position the sector shaft inner seal in the steering gear housing with the rubber sealing lip facing inward. Seat the seal in the housing with tool T61B-3576-A and adapter

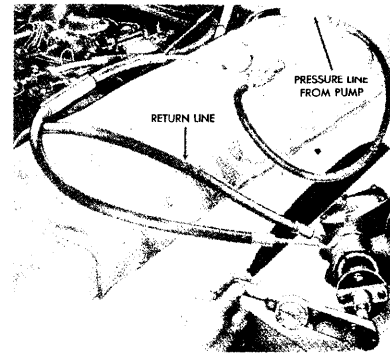


FIG. 27—Pressure Gauge Installed G1206-A

T62B-3576-A as shown in Fig. 26. The long flange of the adapter should press against the seal.

10. Install the metal spacer against the inner seal, then position the sector shaft outer seal with the sealing lip facing inward against the spacer. Seat the seal with the tool and adapter (Fig. 26). The short flange of the adapter should press against the outer seal.

11. Install the seal retaining snap ring. If the outer seal has blocked off the snap ring retaining groove in the casting, tap the tool and adapter against the snap ring so that the snap ring will seat into the groove of the casting.

12. Install the sector shaft adjusting screw with the proper shim to obtain proper clearance (0.002). Shims are available in thicknesses of 0.063, 0.065, 0.067 and 0.069. Place the housing cover, with a new gasket in place, over the adjusting screw, and turn the screw until the cover is seated. Install new cover attaching screws, and torque them to specification.

13. Adjust the worm bearing preload and the sector mesh as detailed in Section 2. This adjustment can be accomplished with the steering gear out of the car by attaching a 3/4-inch socket (12 point) and an in-lb torque wrench to the input shaft instead of the steering wheel attaching nut.

14. Check the piston rack backlash as detailed under "Steering Gear Disassembly" in this Section.

15. Install a new cylinder plug O-ring and the cylinder plug in the piston rack bore. Secure the cylinder plug with a snap ring.

16. Install a new cylinder cap O-ring in the piston bore, then install the cylinder cap and snap ring.

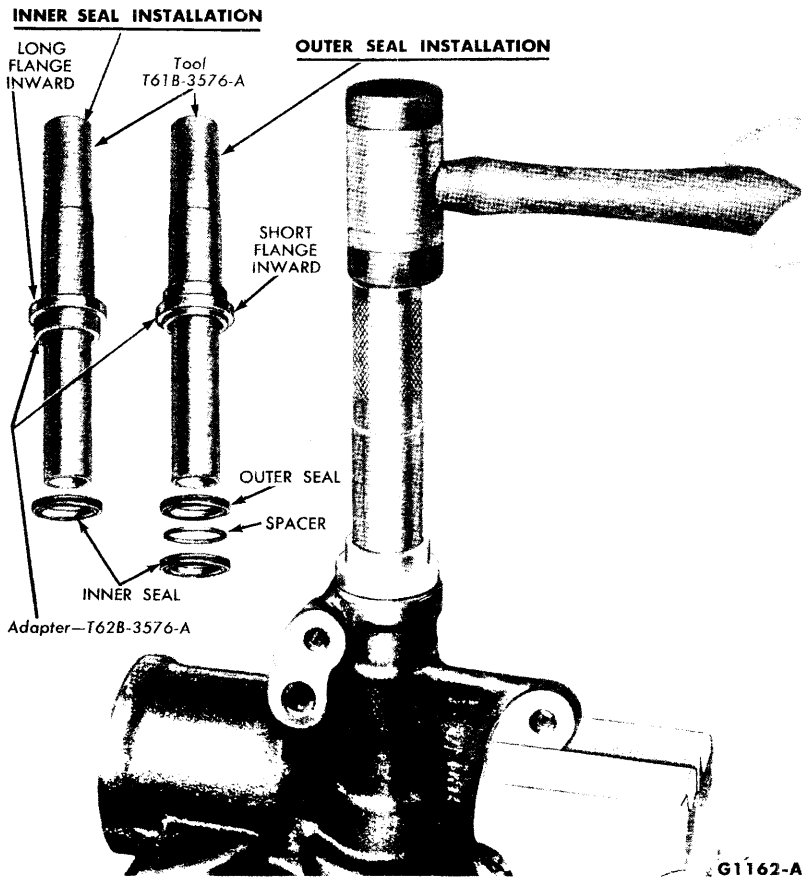


FIG. 26—Installing Sector Shaft Oil Seals G1162-A

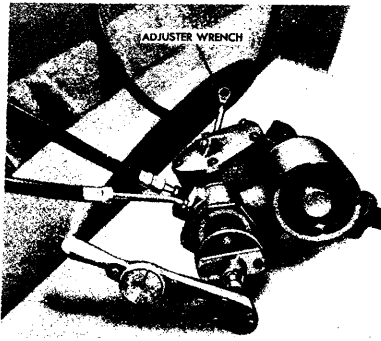


FIG. 28—Adjusting Centering Spool

G1207-A

17. To adjust the centering spool, connect a 0-2000 psi pressure gauge between the car pump pressure line and the inlet port (upper hole) in the gear (Fig. 27).

18. Connect the return hose to the outlet port (lower hole) in the gear.

19. Make certain that the gauge hand valve is in the fully open position.

20. Fill the power steering pump reservoir to the correct level with the specified fluid.

21. Start the engine and cycle the steering gear from stop-to-stop until the fluid reaches normal operating temperature. Recheck the reservoir and add fluid as necessary.

22. Using an inch-pound torque wrench with a $\frac{3}{4}$ -inch socket at the input shaft, rotate the gear to the left stop, adding sufficient torque to the torque wrench to simultaneously obtain 300 psi on the pressure gauge, and the required torque on the torque wrench gauge.

Repeat this process again in the opposite direction.

The torque required to obtain a gauge reading of 300 psi in both directions should not differ more than 3 inch-pounds.

23. If the torque wrench reading is more than 3 inch-pounds between the right and left turns, loosen the valve spool adjuster lock nut and rotate the adjuster in the direction of the low reading (Fig. 28). Only a slight movement of the adjuster is required to move the valve spool. Tighten the adjuster lock nut before each reading is made.

24. Install the steering gear in the car.

25. Recheck the torque in both directions as in step No. 22. If the readings are within 3 inch-pounds of each other, install the adjuster cap. Disconnect the test gauge.

POWER STEERING PUMP DISASSEMBLY

A clean working area should be used when overhauling the power

steering pump. Foreign matter picked up on working parts may cause damage or failure of the unit. Clean containers should be used for parts.

1. Drain the fluid from the pump. Remove the pump cover to housing cap screws (Fig. 29). Place the pump on the bench, cover side down. Lift the housing from the cover.

2. Remove the large and the small O-rings from the pump cover. Remove the O-ring from the pressure plate hub.

3. Remove the pressure plate to cover screws, and remove the plate. Lift the cam ring off the dowel pins.

4. Remove the rollers. Lift the rotor off the shaft, and remove the drive key from the shaft. Remove the dowel pins from the cover.

5. Remove the rotor shaft from the cover. Do not remove the snap ring from the shaft unless it, or the shaft, is damaged.

6. Pry the rotor shaft seals out of the cover and the housing.

7. Do not disturb the control valve unless diagnosis indicated a control valve problem or foreign matter in the valve. To remove the valve, drive the roll pin out of the housing. Remove the plug and O-ring, control valve, and the spring. If the plug or valve is stuck, tap the end of the housing on a piece

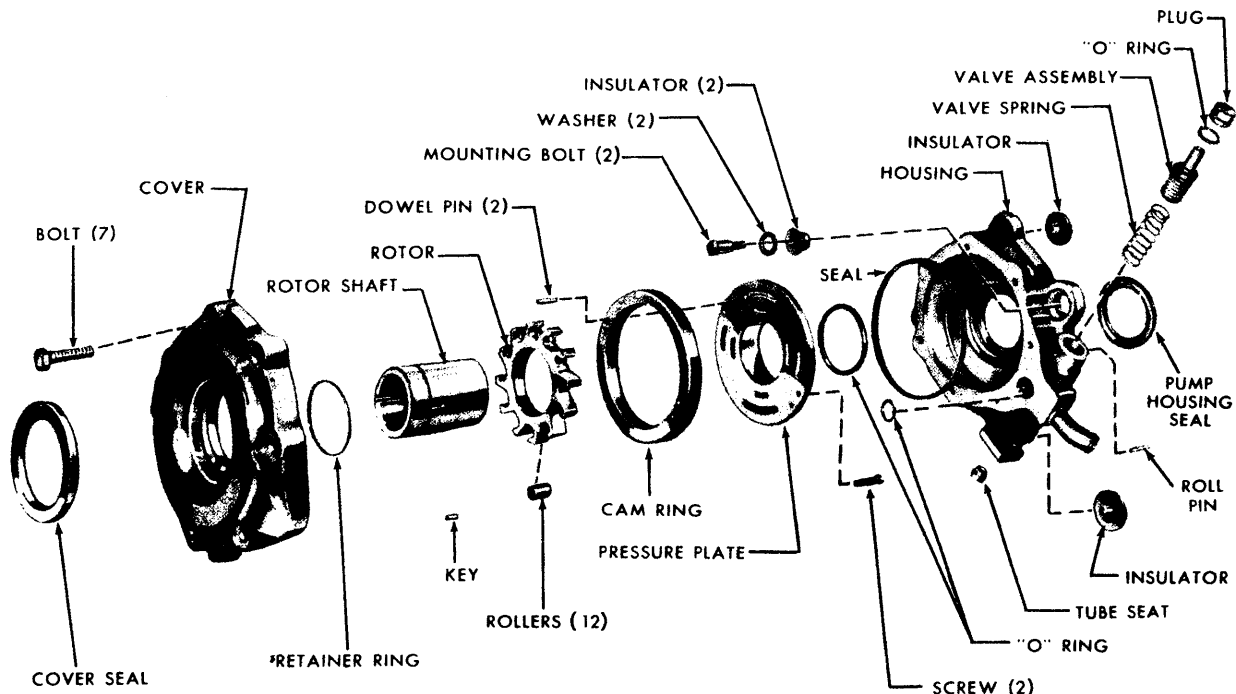


FIG. 29—Power Steering Pump

G1208-A

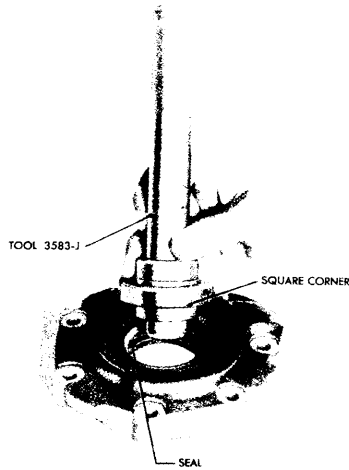


FIG. 30—Preparation for Installing Rotor Shaft Seals G1209-A

of wood or tap it with a soft-faced hammer. Remove the O-ring from the plug.

POWER STEERING PUMP ASSEMBLY

Apply automatic transmission fluid to all parts as they are assembled. Always use new seals and O-rings.

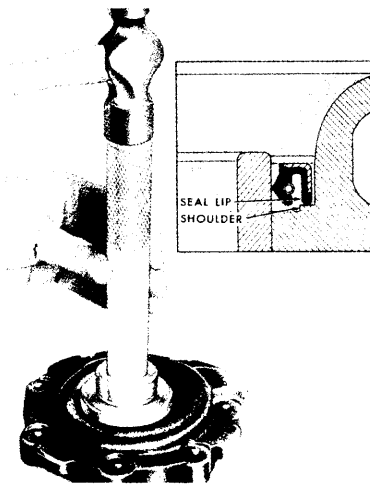


FIG. 31—Installing Rotor Shaft Seal G1210

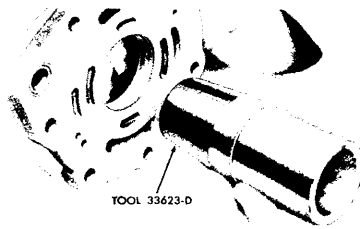


FIG. 32—Installing Rotor Shaft in Cover G1211

1. Install the control valve spring in the housing. Install the valve with the small sensing hole in the end of the valve toward the spring. Install a new O-ring on the plug. The plug O-ring is 1/8 inch smaller in diameter than the bypass O-ring. Make sure the proper O-ring is used. Install the plug and a new roll pin (Fig. 29).

2. The rotor shaft oil seals are installed in the cover and the housing with tool 3583-J, which consists of a driver and an adapter. The procedure is as follows:

- a. Support the cover on wood blocks (Fig. 30) to provide tool clearance. Use clean blocks that will not nick or damage the inner face of the cover.
- b. Start the seal (metal shell upward) squarely into the bore with finger pressure. Place the adapter on the driver with the square corner of the adapter toward the seal (Fig. 30). Drive the seal into the cover, as shown in Fig. 31 until it bottoms.

Driving the seal beyond this point can damage it. Install the seal in the pump housing in the same manner.

3. Install the rotor shaft in the cover as shown in Fig. 32 to prevent damage to the seal.

4. Install the dowel pins in the cover. Place the rotor drive key in the shaft. Install the rotor on the shaft with the drive key groove aligned with the key and the coun-

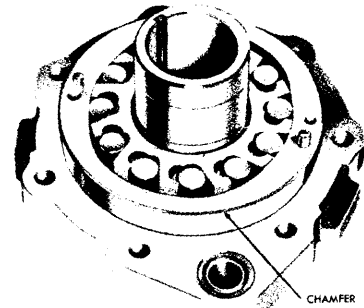


FIG. 33—Cam Ring Installation G1212

terbored side of the rotor toward the cover so that it goes over the snap ring.

5. Place the cam ring on the dowel pins with the chamfered edge upward (Fig. 33). Place the rollers in the rotor.

6. Place the pressure plate on the dowel pins. Install and tighten the screws to 20 in-lbs torque. Install the O-ring on the pressure plate hub. Install O-rings in the groove at the oil bypass hole and around the cam ring (Fig. 34).

7. Place the tool shown in Fig. 32 in the rotor shaft to prevent damage to the oil seal, then install the housing on the cover. Install and torque the cap screws to 15-20-ft-lbs.

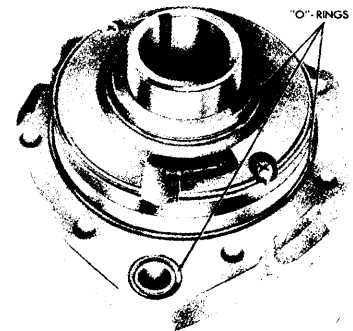


FIG. 34—O-Ring Installation G1213

PART 3-4 WHEELS AND TIRES

Section	Page
1 Description and Operation	3-28
2 In-Car Adjustments and Repairs	3-28
3 Removal and Installation	3-29
4 Major Repair Operations	3-29

1 DESCRIPTION AND OPERATION

FRONT WHEEL ASSEMBLY

Each front wheel and tire assembly is bolted to its respective front hub and brake drum assembly. Two opposed, tapered roller bearings are installed in each hub. A grease retainer is installed at the inner end of the hub to prevent lubricant from leaking into the drum. The entire assembly is retained to its spindle by the adjusting nut, nut lock and

cotter pin (Fig. 1). The front wheel assemblies rotate freely on their respective spindles and are driven by the motion of the car.

REAR WHEEL ASSEMBLY

The rear wheel hub and brake drum assembly is retained to studs on the rear axle shaft flange by three speed nuts. The wheel and tire assembly mounts on the same rear axle

shaft flange studs and is held against the hub and drum by the wheel nuts. The rear wheel bearing is pressed onto the axle shaft just inside the shaft flange, and the entire assembly is retained to the rear axle housing by the bearing retainer plate which is bolted to the housing flange.

The inner end of each axle shaft is splined to the engine powered differential. The rear wheels are, therefore, driven by the engine.

2 IN-CAR ADJUSTMENTS AND REPAIRS

FRONT WHEEL BEARING ADJUSTMENT

The front wheel bearings should be adjusted if the wheel is loose on the spindle or if the wheel does not rotate freely. The following procedure will bring the end play to specification.

1. Raise the car until the wheel and tire clear the floor.
2. Pry off the wheel cover and remove the grease cap (Fig. 1) from the hub.
3. Wipe the excess grease from the end of the spindle, and remove the adjusting nut cotter pin and nut lock.
4. While rotating the wheel, hub, and drum assembly, torque the adjusting nut to 15-20 ft-lbs to seat the bearings (Fig. 2).
5. Locate the nut lock on the adjusting nut so that the castellations on the lock are aligned with the cotter pin hole in the spindle.
6. Back off both the adjusting nut and the nut lock together until the

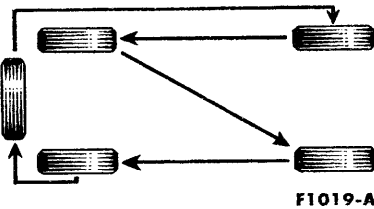


FIG. 3—Tire Cross-Switching Diagram

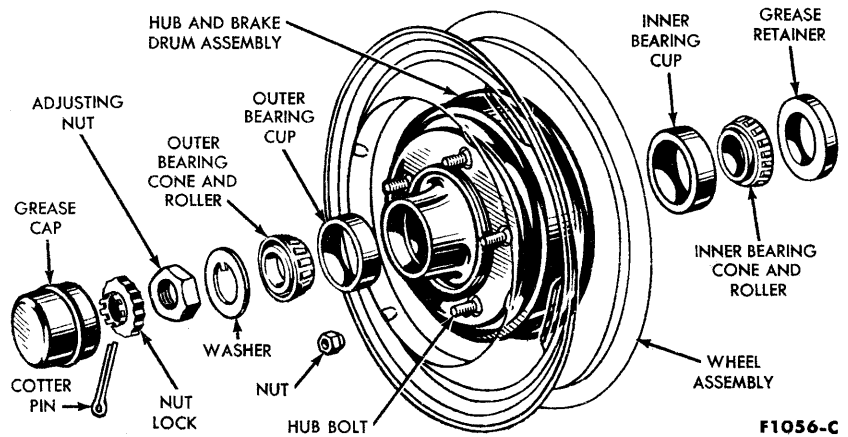


FIG. 1—Front Hub, Bearings & Grease Retainer

next castellation on the nut lock aligns with the cotter pin hole in the spindle.

7. Install a new cotter pin, and bend the ends of the cotter pin

around the castellated flange of the nut lock (Fig. 2).

8. Check the front wheel rotation. If the wheel rotates properly, install the grease cap and the hub cap or

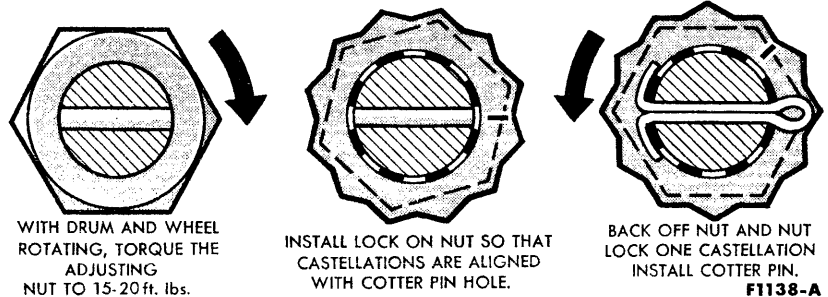


FIG. 2—Front Wheel Bearing Adjustment

wheel cover. If the wheel still rotates roughly or noisily, clean or replace the bearings and cups as required.

TIRE ROTATION

For longer tire life, all five tires should be cross-switched as shown in

Fig. 3. See Group 19 for the specified intervals.

3 REMOVAL AND INSTALLATION

WHEEL AND TIRE ASSEMBLY

REMOVAL

1. Pry off the wheel hub cap or cover. Loosen but do not remove the wheel hub nuts.

2. Raise the car until the wheel and tire clear the floor.

3. Remove the wheel hub nuts from the bolts, and pull the wheel and tire assembly from the hub and drum.

DEMOUNTING TIRE FROM WHEEL

The tire can be demounted on a mounting machine. Be sure that the outer side of the wheel is positioned downward. If tire irons are used follow the procedure given here.

1. Remove the valve cap and core, and deflate the tire completely.

2. With a bead loosening tool, break loose the tire side walls from the wheel (Fig. 4).

3. Position the outer side of the



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FIG. 4—Bead Loosening Tool

wheel downward, and insert two tire irons about 8 inches apart between the tire inner bead and the back side of the wheel rim. Use only tire irons with rounded edges or irons designed for demounting tubeless tires.

4. Leave one tire iron in position, and pry the rest of the bead over the rim with the other iron. Take small "bites" with the iron around the tire in order to avoid damaging the sealing surface of the tire bead.

5. Stand the wheel and tire upright with the tire outer bead in the drop center well at the bottom of the wheel. Insert the tire iron between the bead and the edge of the wheel rim, and pry the wheel out of the tire.

MOUNTING TIRE TO WHEEL

1. If a used tire is being installed remove all dirt from the tire.

If a tire is being mounted to the original wheel, clean the rim with emery cloth or fine steel wool. Check the rim for dents.

If a new wheel is being installed, coat a new valve with RUGLYDE or similar rubber lubricant and position the valve to the new wheel. Use a rubber hammer or a valve replacing tool to seat the valve firmly against the inside of the rim.

2. Apply RUGLYDE or a similar rubber lubricant to the sealing surface on both tire beads. With the outer side of the wheel down, pry the beads over the wheel rim with two tire irons. Do not use a hammer or mallet to force the beads over the rim.

3. Align the balance mark on the tire with the valve on the wheel.

4. Hold the beads against the rim flanges by positioning a tire mount-

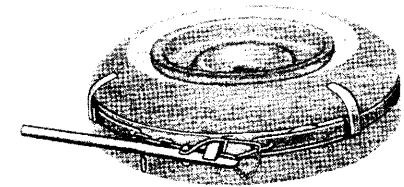
ing band over the tire (Fig. 5). If a mounting band is not available, tie a tourniquet of heavy cord around the circumference of the tire. Tighten the cord with a tire iron. Center the tire on the wheel with a rubber mallet.

5. Give the tire a few quick bursts of air to seat the beads properly, then inflate the tire to 40 pounds pressure. Check to see that the bead positioning rings (outer rings near the side walls) are evenly visible just above the rim flanges all the way around the tire. If the rings are not even, deflate the tire completely and inflate it again.

6. When the rings are properly positioned, deflate the tire to the recommended pressure.

INSTALLATION

1. Clean all dirt from the hub and drum.



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FIG. 5—Tubeless Tire Mounting Band

2. Position the wheel and tire assembly on the hub and drum. Install the wheel hub nuts and tighten them alternately in order to draw the wheel evenly against the hub and drum.

3. Lower the car to the floor, and torque the hub nuts to specification.

4 MAJOR REPAIR OPERATIONS

FRONT WHEEL GREASE SEAL AND BEARING REPLACEMENT AND/OR REPACKING

If bearing adjustment will not eliminate looseness or rough and noisy operation, the hub and bear-

ings should be cleaned, inspected, and repacked. If the bearing cups or the cone and roller assemblies are worn or damaged, they should be replaced.

1. Raise the car until the wheel

and tire clear the floor.

2. Insert a narrow screwdriver through the brake adjusting hole at the inner side of the brake adjusting plate, and disengage the adjusting lever from the adjusting screw. While

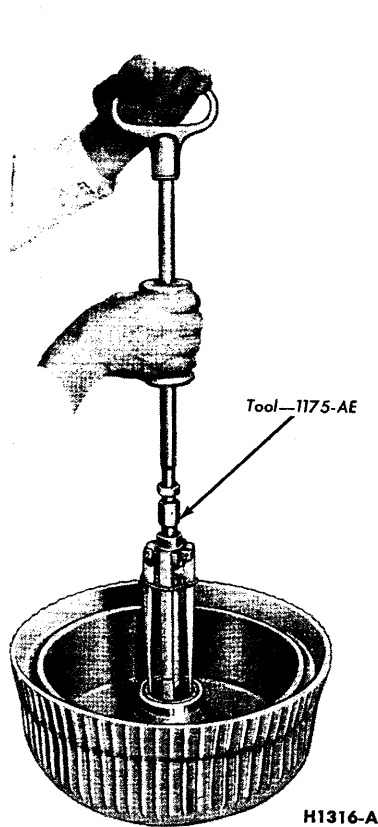


FIG. 6—Removing Grease Retainer

holding the adjusting lever away from the screw, back off the adjusting screw with the brake adjusting tool. **Be very careful not to burr, chip, or damage the notches in the adjusting screw; otherwise the self-adjusting mechanism will not function properly.**

3. Remove the wheel cover or hub cap. Remove the grease cap from the hub. Remove the cotter pin, nut lock, adjusting nut, and flat washer from

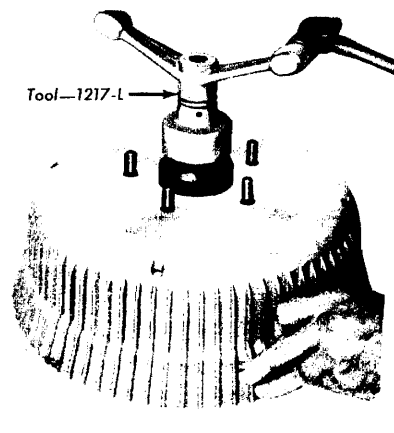


FIG. 7—Front Wheel Bearing Cup Removal

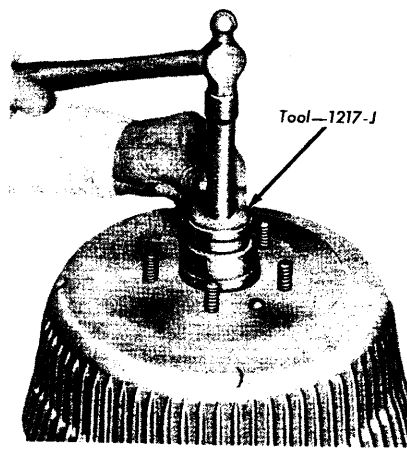


FIG. 8—Front Wheel Bearing Cup Installation

the spindle. Remove the outer bearing cone and roller assembly (Fig. 1).

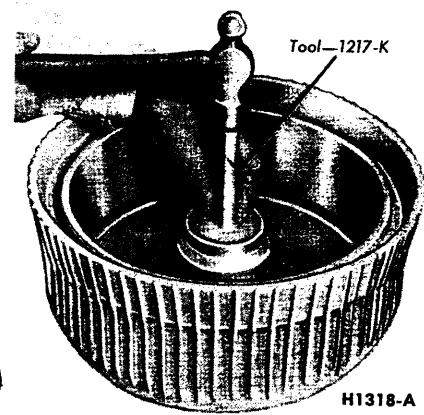
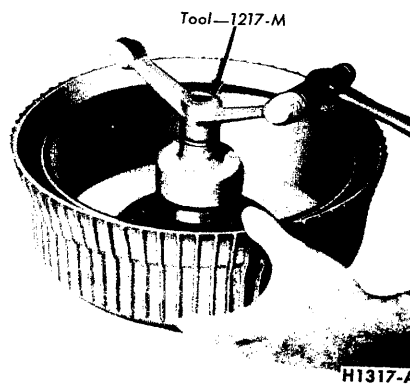
4. Pull the wheel, hub, and drum assembly off the wheel spindle.

5. Remove the grease retainer (Fig. 6) and the inner bearing cone and roller assembly from the hub.

6. Clean the lubricant off the inner and outer bearing cups with solvent and inspect the cups for scratches, pits, excessive wear, and other damage. If the cups are worn or damaged, remove them with the tools shown in Fig. 7.

7. Soak a new grease retainer in light engine oil at least 30 minutes before installation. Thoroughly clean the inner and outer bearing cones and rollers with solvent, and dry them thoroughly. **Do not spin the bearings dry with compressed air.**

Inspect the cones and rollers for wear or damage, and replace them if necessary. The cone and roller assemblies and the bearing cups should be replaced as a set if damage to either is encountered.



8. Thoroughly clean the spindle and the inside of the hub with solvent to remove all old lubricant.

Cover the spindle with a clean cloth, and brush all loose dust and dirt from the brake assembly. **To prevent getting dirt on the spindle, carefully remove the cloth from the spindle.**

9. If the inner and/or outer bearing cup(s) were removed, install the replacement cup(s) in the hub with the tools shown in Fig. 8. **Be sure to seat the cups properly in the hub.**

10. Pack the inside of the hub with specified wheel bearing grease. Add lubricant to the hub only until the grease is flush with the inside diameter of both bearing cups.

11. Pack the bearing cone and roller assemblies with wheel bearing grease. A bearing packer is desirable for this operation. If a packer is not available, work as much lubricant as possible between the rollers and cages. Lubricate the cone surfaces with grease.

12. Place the inner bearing cone

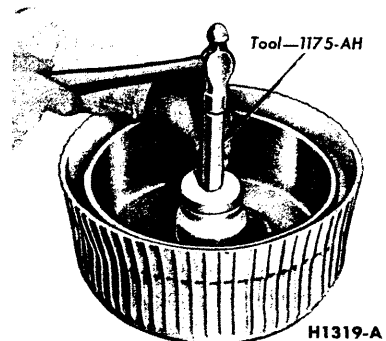


FIG. 9—Grease Retainer Installation

and roller assembly in the inner cup, and install the new grease retainer with the tool shown in Fig. 9. **Be sure the retainer is properly seated.**

13. Install the wheel, hub, and drum assembly on the wheel spindle. **Keep the hub centered on the spindle to prevent damage to the grease retainer or the spindle threads.**

14. Install the outer bearing cone and roller assembly and the flat washer on the spindle, then install the adjusting nut.

15. Adjust the wheel bearings as outlined in Section 2, and install a new cotter pin. Bend the ends of the cotter pin around the castellations of the nut lock to prevent interference with the radio static collector in the grease cap. Install the grease cap.

16. Adjust the brake shoes. Install the wheel cover.

NOTE: All old grease should be completely cleaned from the bear-

ings before repacking with new grease.

FRONT HUB AND DRUM ASSEMBLY REPLACEMENT

When the hub and drum assembly is replaced, new bearings, cups, and grease retainer must be installed in the new assembly. The new grease retainer should be soaked in light engine oil at least 30 minutes before installation.

1. Raise the car until the wheel and tire clear the floor. Pry off the hub cap or wheel cover, and remove the wheel and tire assembly from the hub and drum assembly.

2. Back off the brake shoe and remove the old hub and drum assembly from the wheel spindle.

3. Remove the protective coating from the new hub and drum with carburetor degreaser. Install new inner and outer bearing cups in the new hub with the tool shown in Fig. 8. **Be sure to seat the cups properly in the hub.**

4. Grease and install the inner

bearing cone and roller assembly in the inner bearing cup. Install the grease retainer.

5. Install the new hub and drum assembly to the wheel spindle. **Keep the hub centered on the spindle to prevent damage to the grease retainer.**

6. Install the outer bearing cone and roller assembly and the flat washer on the spindle, then install the adjusting nut.

7. Position the wheel and tire assembly on the new hub and drum assembly. Install the wheel hub nuts and tighten them alternately in order to draw the wheel evenly against the hub and drum.

8. Adjust the wheel bearings as outlined in Section 2, and install a new cotter pin. Bend the ends of the cotter pin around the castellations of the nut lock to prevent interference with the radio static collector in the grease cap. Install the grease cap.

9. Adjust the brake shoes as outlined in Part 2-2, Section 2.

10. Install the hub cap or wheel cover.

PART 3-5 SPECIFICATIONS

TIRES

Inflation Pressure (P.S.I.) (Cold)	24
Size	9.15 x 15

FRONT WHEEL ALIGNMENT

Caster (Degrees) (Within $\frac{1}{2}^{\circ}$ one Side of Car to Other, $\frac{1}{4}^{\circ}$ preferred)	$-\frac{3}{4}^{\circ}$ to $-2\frac{1}{4}^{\circ}$
Camber (Degrees) (Within $\frac{1}{2}^{\circ}$ One Side of Car to Other, $\frac{1}{4}^{\circ}$ Preferred)	0° to Plus $\frac{3}{4}^{\circ}$
Kingpin Inclination—Theoretical (at $+\frac{3}{4}^{\circ}$ camber)	7°
Angle of Outside Wheel When Inside Wheel is at 20°	$17^{\circ} 42'$
Riding Height: Allowable Difference—One Side of Car to Other	$\frac{1}{2}$
Toe-In Maximum Minimum	$\frac{3}{16}$ $\frac{1}{16}$
Tread	Rear—61.0 Front—62.1
Turning Circle (Feet) (Curb to Curb to Outside of Tire)	45.7

FRONT SUSPENSION TORQUE LIMITS

Description	Ft-lbs
Brake Backing Plate to Spindle—Upper —Lower	25-35 70-95
Front Wheel Spindle Nut (Back off one Slot after Torque Check)	15-20
Jounce Bumper to Drag Strut	22-28
Lower Ball Joint to Lower Arm	22-28
Lower Suspension Arm to No. 2 Crossmember	110-140
Shock Absorber Bracket to No. 2 Crossmember	20-30
Shock Absorber to Lower Suspension Arm	20-30
Shock Absorber to Shock Bracket Stud	40-55
Spindle Arm Connecting Rod Ball Stud to Spindle Arm	40-55
Spindle Connecting Rod Adjusting Sleeve Clamp Nut	22-28
Spindle to Lower Ball Joint Stud	70-90
Spindle to Upper Ball Joint Stud	55-75
Stabilizer Bar to Lower Suspension Arm	8-13
Upper Arm Bushings to Shaft	70-90
Upper Ball Joint to Upper Arm	21-29
Upper Arm Shaft to No. 2 Crossmember	100-125
Wheel Nuts	75-110
Ball Joint Stud Torque Check (Minimum Acceptable Torque Required to Turn the Ball Joint Stud)	12 in-lbs

REAR SUSPENSION TORQUE LIMITS

Description	Ft-lbs
Rear Shock Absorber to Axle	30-40
Rear Shock Absorber Bracket to Crossmember	17-25
Rear Shock Absorber Stud to Rear Axle (Service Only)	65-80
Rear Spring to Shackle	16-22
Rear Spring Front Bracket to Sidemember	50-90
Rear Spring Front Eye Bolt (Front Shackle Nut)	50-70
Rear Spring Leaves Retaining Bolt	40-50
Rear Spring U-Bolts	50-60
Shackle to Mounting Hanger	16-22
Shackle Mounting Hanger to Side Rail	40-62

STEERING CHECKS AND ADJUSTMENTS

Description	Ft-lbs
Sector Shaft Mesh—Total Center Mesh Load (Measure with torque wrench at mechanical center)	in-lbs 15-17
Worm Bearing Pre-Load (Measure with torque wrench 20° off either stop)	in-lbs 6-8
Piston Backlash (Maximum)	0.004
Ratios: Overall Steering Gear	20.5:1 17.0:1
Steering Wheel: Diameter Number of Turns (Full Left to Right)	16 $3\frac{3}{4}-4$
Thrust Screw to Sector Slot Clearance (Maximum)	0.002
Fluid (M2C33-C-D)	C1AZ-19582

STEERING TORQUE LIMITS

Description	Ft-lbs
Gear Cover to Gear Housing	18-22
Control Valve Spool Lock Nut	5-9
Control Valve Spool Adjuster Cap	10-15
Mesh Load Adjusting Screw Lock Nut	25-30
Sleeve Adjusting Lock Nut	60-80
Ball Return Guide Clamp Screw	18-36
Pressure Line to Gear	10-15
Return Line to Gear	20-30
Connecting Link Ball Stud to Idler Arm	40-55
Connecting Link Ball Stud to Pitman Arm	40-55
Crankshaft Damper Attaching Bolt	75-90
Gear Housing to Sidemember	35-50
Idler Arm Bracket to Sidemember	20-30
Lock Screw to Sleeve	15-20
Pitman Arm to Shaft	100-130
Pump to Engine Front Cover	8-11
Spindle Arm Connecting Rod Ball Stud to Connecting Link	40-55
Spindle Arm Connecting Rod Ball Stud to Spindle Arm	40-55
Steering Wheel Nut* *Stake nut after tightening.	18-24