

MAINTENANCE AND ADJUSTMENTS

LUBRICATION

The steering gear is factory-filled with steering gear lubricant. Seasonal change of this lubricant should not be performed and the housing should not be drained - NO lubrication is required for the life of the steering gear.

At intervals specified in Section 0B of this manual the gear should be inspected for seal leakage (actual solid grease - not just oily film). If a seal is replaced or the gear is overhauled, the gear housing should be refilled with #1051052 (on Corvette: #1052084) Steering Gear Lubricant which meets GM Specification GM 4673M, or its equivalent.

NOTE: Do not use EP Chassis Lube, which meets GM Specification GM 6031M, or equivalent to lubricate the gear. **DO NOT OVER-FILL** the gear housing.

The steering linkage should be lubricated with any water resistant EP type chassis lubricant at specified intervals. Lubrication points and additional information on chassis lubrication can be found in Section 0B.

ADJUSTMENTS

Manual Steering Gear

CAUTION: See **CAUTION** on page 1 of this section regarding the fasteners referred to in step 10.

Before any adjustments are made to the steering gear in an attempt to correct such conditions as shimmy, loose or hard steering etc., a careful check should be made of front end alignment, shock absorbers, wheel balance and tire pressure for possible cause.

Correct adjustment of the steering gear is very important. Perform adjustments following the sequence listed below.

1. Disconnect the battery ground cable.
2. Raise the vehicle.
3. Remove the pitman arm nut. Mark the relationship of the pitman arm to the pitman shaft. Remove the pitman arm with Tool J-6632 or J5504 as shown in Figure 3B-42.
4. Loosen the steering gear adjuster plug locknut and back the adjuster plug off 1/4 turn (fig. 3B-43).
5. Remove the horn button cap or shroud.
6. Turn the steering wheel gently in one direction until stopped by the gear; then turn back one-half turn.

CAUTION: Do not turn the steering wheel hard against the stops when the steering linkage is disconnected from the gear as damage to the ball guides could result.

7. Measure and record "bearing drag" by applying a torque wrench with a 3/4 inch socket on the steering wheel nut and rotating through a 90° arc (fig. 3B-44).

NOTE: Do not use a torque wrench having a maximum torque reading of more than 50 lbs. in. (6 N·m).

8. Adjust "thrust bearing preload" by tightening the adjuster plug until the proper "thrust loading preload" is obtained (see specifications section at rear of this Section). When the proper preload has been obtained, tighten the adjuster plug locknut to specifications and recheck torque. If the gear feels "lumpy" after adjustment, there is probably

damage in the bearings due to severe impact or improper adjustment; the gear must be disassembled for replacement of damaged parts.

9. Adjust "over-center preload" as follows:

a. Turn the steering wheel gently from one stop all the way to the other carefully counting the total number of turns. Turn the wheel back exactly half-way, to center position.

b. Turn the over center adjuster screw clockwise to take out all lash between the ball nut and pitman shaft sector teeth and then tighten the locknut.

c. Check the torque at the steering wheel, taking the highest reading as the wheel is turned through center position. See Specifications for proper over-center preload.

d. If necessary, loosen locknut and readjust over center adjuster screw to obtain proper torque. Tighten the locknut to specifications and again check torque reading through center of travel.

NOTE: If maximum specification is exceeded, turn over center adjuster screw counter-clockwise, then come up on adjustment by turning the adjuster lock nut in a clockwise motion.

10. Reassemble the pitman arm to the pitman shaft, lining up the marks made during disassembly. Torque the pitman shaft nut to specifications.

11. Install the horn button cap or shroud and connect the battery ground cable. Lower the vehicle to the floor.

Steering Wheel Alignment and High Point Centering

1. Set front wheels in straight ahead position. This can be checked by driving vehicle a short distance on a flat surface to determine steering wheel position at which vehicle follows a straight path.

2. With front wheels set straight ahead, check position of flat on wormshaft designating steering gear high point. This flat should be at the top side of the shaft at 12 o'clock position.

NOTE: The Corvette wormshaft is marked with a

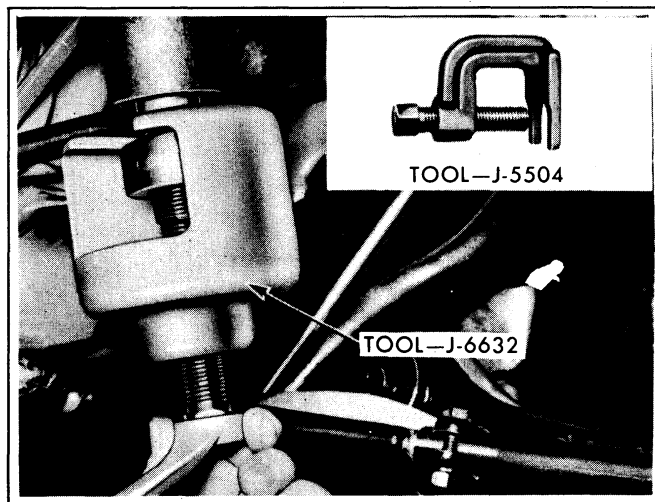


Fig. 3B-42--Removing Pitman Arm (Typical)

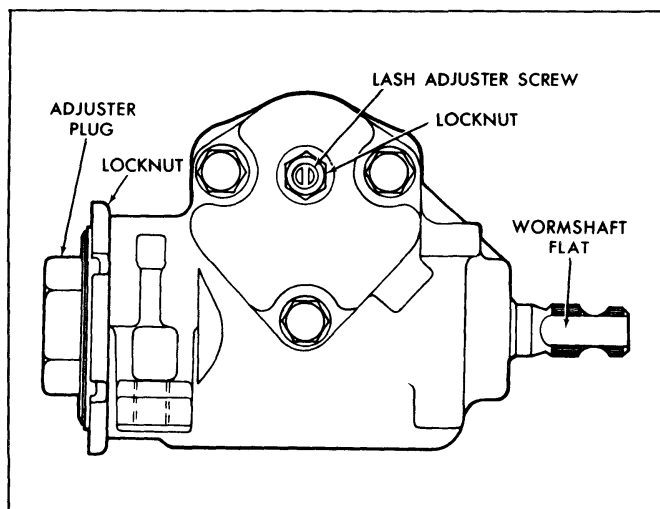


Fig. 3B-43--Steering Gear Adjustment Points Typical

scribe mark rather than with a "flat".

3. If gear has been moved off high point when setting wheels in straight ahead position, loosen adjusting sleeve clamps on both left and right hand tie rods, then turn both sleeves an equal number of turns in the same direction to bring gear back on high point.

NOTE: Turning the sleeves an unequal number of turns or in different directions will disturb the toe-in setting of the wheels.

4. Readjust toe-in as outlined in Section 3A (if necessary).

5. With wheels in a straight ahead position and the steering gear on highpoint, check the steering wheel alignment (fig. 3B-45). If the spokes are not within the limits specified, the wheel should be removed and centered. (See steering wheel removal in this section).

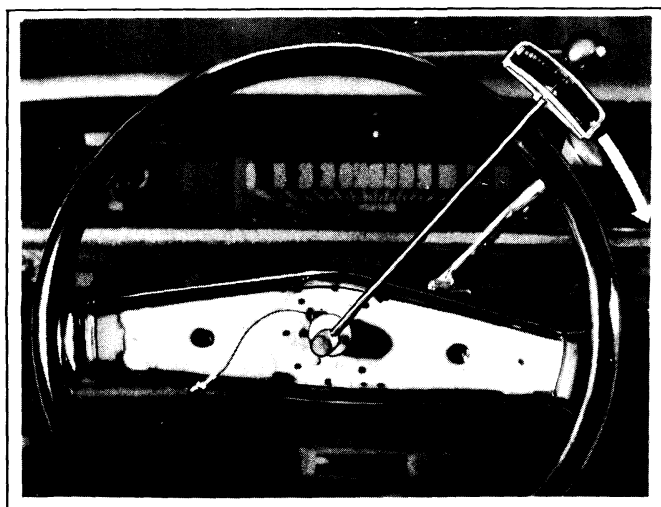


Fig. 3B-44--Checking Wheel Pull (Typical)

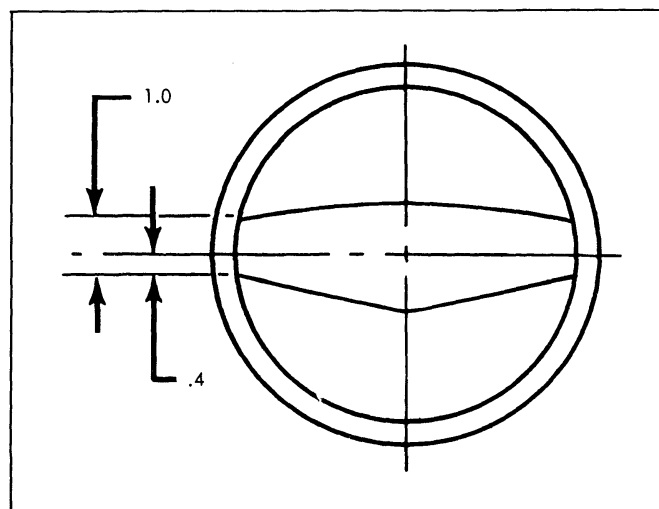


Fig. 3B-45--Steering Wheel Alignment Typical

Toe-In Adjustment

Adjust the steering linkage for proper toe-in setting as outlined in Section 3A.

POWER STEERING SYSTEM

BLEEDING HYDRAULIC SYSTEM

1. Fill oil reservoir to proper level and let oil remain undisturbed for at least two minutes.
2. Start engine and run only for about two seconds.
3. Add oil if necessary.
4. Repeat above procedure until oil level remains constant after running engine.
5. Raise front end of vehicle so that wheels are off the ground.
6. Increase engine speed to approximately 1500 rpm.
7. Turn the wheels (off ground) right and left, lightly contacting the wheel stops.
8. Add oil if necessary.
9. Lower the car and turn wheels right and left on the ground.
10. Check oil level and refill as required.
11. If oil is extremely foamy, allow vehicle to stand a few minutes with engine off and repeat above procedure.
 - a. Check belt tightness and check for a bent or loose pulley. (Pulley should not wobble with engine running.)
 - b. Check to make sure hoses are not touching any other parts of the car, particularly sheet metal and exhaust manifold.
 - c. Check oil level, filling to proper level if necessary, following operations 1 through 10. This step and step "D" are extremely important as low oil level and/or air in the oil are the most frequent causes of objectionable pump noise.
 - d. Check the presence of air in the oil. If air is present, attempt to bleed system as described in operations 1 through 10. If it becomes obvious that the pump will not bleed after a few trials, proceed as outlined under Hydraulic System Checks.

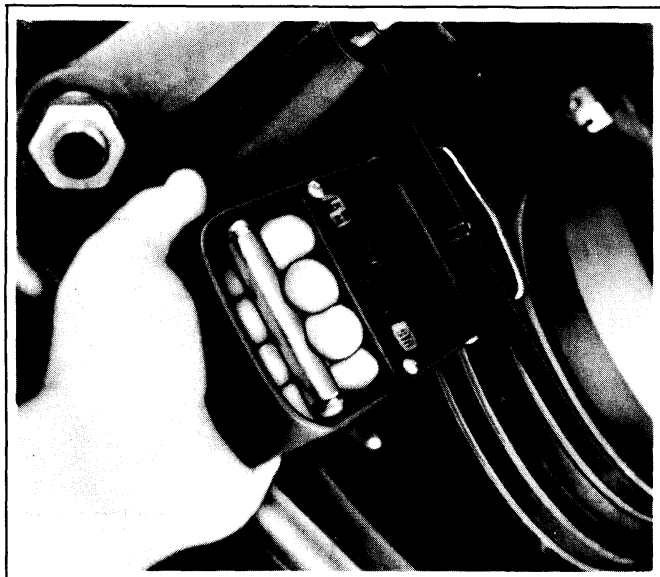


Fig. 3B-46--Checking Belt Tension with Tool J-23600

FLUID LEVEL

1. Check oil level in the reservoir by checking the dip stick when oil is at operating temperature.

2. Fill, if necessary, to proper level with GM Power Steering Fluid.

ADJUSTMENTS

Power Steering Gear

All Models Except Corvette

Adjustment of the power steering gear in the vehicle is discouraged because of the difficulty involved in adjusting the worm thrust bearing preload and the confusing effects of the hydraulic fluid in the gear. The steering gear adjustment is made only as a correction and not as a required periodic adjustment.

The effect of improperly adjusted worm thrust bearings or an improperly adjusted over-center preload could cause a handling stability complaint.

To properly adjust the power steering gear the assembly **MUST** be removed from the vehicle and adjustments performed as outlined later in this Section.

For removal of the power steering gear assembly follow the procedure as outlined under "Power Steering Gear" later in this section.

Corvette

The steering gear used with Corvette power steering is adjusted in the same manner as the manual steering gear.

Pump Belt Tension

Strand tension of belt should be 125 lbs. on new belts and 75 lbs. on old belts, as indicated by Tool J-23600 (fig. 3B-46).

1. Loosen pivot bolt and pump brace adjusting nuts.

NOTE: On B-car with V-8 engine, the power steering pump mounting bracket does not have a square drive hole for adjusting drive belt tension. A boss on the water pump housing provides a fulcrum for adjustment.

CAUTION: Do not move pump by prying against reservoir or by pulling on filler neck.

2. Move pump, with belt in place until belt is tensioned to specifications as indicated by Tool J-23600 (Fig. 3B-46).

3. Tighten pump brace adjusting nut. Then tighten pivot bolt nut.

HYDRAULIC SYSTEM CHECKS

The following procedure outlines methods to identify and isolate power steering hydraulic circuit difficulties. The test provides means of determining whether power steering system hydraulic parts are actually faulty. This test will result in readings indicating faulty hydraulic operation, and will help to identify the faulty component.

Before performing hydraulic circuit test, carefully check belt tension, fluid level and condition of driving pulley.

Power Steering Hydraulic System Test

Engine must be at normal operating temperature. Inflate front tires to correct pressure. All tests are made with engine idling, check idle adjustment and if necessary adjust engine idle speed to correct specifications listed in Section 6C and proceed as follows:

1. With engine NOT running, disconnect pressure hose from pump and install Tool J-5176 using a spare pressure hose between gage and pump. Gage must be between shut-off valve and pump. Open shut-off valve.

2. Remove filler cap from pump reservoir and check fluid level. Fill pump reservoir to full mark on dip stick. Start engine and, momentarily holding steering wheel against stop, check connections at Tool J-5176 for leakage.

3. Bleed system as outlined under Maintenance and Adjustments.

4. Insert thermometer (Tool J-5421) in reservoir filler opening. Move steering wheel from stop to stop several times until thermometer indicates that hydraulic fluid in reservoir has reached temperature of 150° to 170°F (65° to 77°C).

CAUTION: To prevent scrubbing flat spots on tires, do not turn steering wheel more than five times without rolling car to change tire-to-floor contact area.

5. Start engine and check fluid level adding any fluid if required. When engine is at normal operating temperature, the initial pressure read on the gage (valve open) should be in the 80-125 psi (550-860 kPa) range. Should this pressure be in excess of 200 psi (1380 kPa) - check the hoses for restrictions and the poppet valve for proper assembly.

6. Close gate valve fully 3 times. Record the highest pressures attained each time.

CAUTION: Do not leave valve fully closed for more than 5 seconds as the pump could be damaged internally.

a. If the pressures recorded are within the listed specs and the range of readings are within 50 psi (345 kPa), the pump is functioning within specs. (Ex. Spec. 1250 - 1350 PSI (8620-9310 kPa) readings - 1270 - 1275 - 1280 psi (8755-8790-8825 kPa).

- - b. If the pressures recorded are high, but do not repeat within 50 PSI (345 kPa), the flow controlling valve is sticking. Remove the valve, clean it and remove any burrs using crocus cloth or fine hone. If the system contains some

dirt, flush it. If it is exceptionally dirty, both the pump and the gear must be completely disassembled, cleaned, flushed and reassembled before further usage.

c. If the pressures recorded are constant, but more than 100 PSI (690 kPa), below the low listed spec., replace the flow control valve and recheck. If the pressures are still low, replace the rotating group in the pump.

7. If the pump checks within specifications, leave the valve open and turn (or have turned) the steering wheel into

both corners. Record the highest pressures and compare with the maximum pump pressure recorded. If this pressure cannot be built in either (or one) side of the gear, the gear is leaking internally and must be disassembled and repaired. See the Chevrolet Overhaul Manual Section 3B.

8. Shut off engine, remove testing gage, spare hose, reconnect pressure hose, check fluid level and/or make needed repairs.

COMPONENT REPLACEMENT AND REPAIRS

STEERING WHEEL

Regular Production (Except Corvette)--Fig. 3B-47

Removal

1. Disconnect battery ground cable.
2. Remove steering wheel shroud screws on underside of steering wheel.
3. Lift steering wheel shroud and horn contact lead assembly from the steering wheel.
4. Remove snap ring.
5. Remove steering wheel nut.
6. Using Tool J-2927, thread puller anchor screws into threaded holes provided in steering wheel. Turn center bolt of tool clockwise (butting against the steering shaft) to remove steering wheel (fig. 3B-50). Do not hammer on puller while turning.

NOTE: The tool centering adapters need not be installed.

Assembly

CAUTION: See *CAUTION* on page 1 of this section regarding the fastener referred to in step 1.

1. With turn signal in neutral position, set wheel onto steering shaft and secure with nut. Refer to torque specifications at rear of this section for correct torque values.

CAUTION: Do not over-torque shaft nut or steering wheel rub may result.

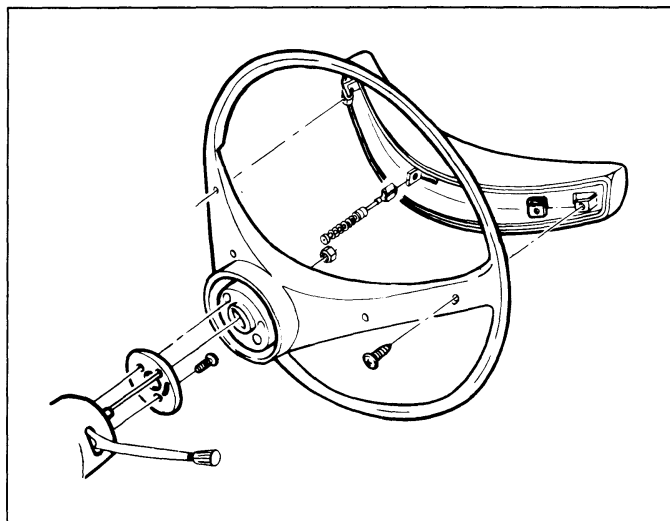


Fig. 3B-47--Steering Wheel and Horn

2. Install snap ring, making sure it is fully seated.
3. Place the steering wheel shroud onto the steering wheel while guiding the horn contact lead into the directional signal cancelling cam tower.
4. Install the shroud attaching screws on the underside of the steering wheel.
5. Connect the battery ground cable.

Cushioned Rim Wheel (Fig. 3B-49)

Removal

1. Disconnect battery ground cable.
2. Pry off horn button cap and remove snap ring.
3. Remove steering wheel nut.
4. Remove three screws securing the upper horn insulator and remove the insulator, receiver, belleville spring and shim.
5. Using Tool J-2927, thread puller anchor screws into threaded holes provided in steering wheel. Butt center bolt of tool against steering shaft and turn clockwise to remove steering wheel.

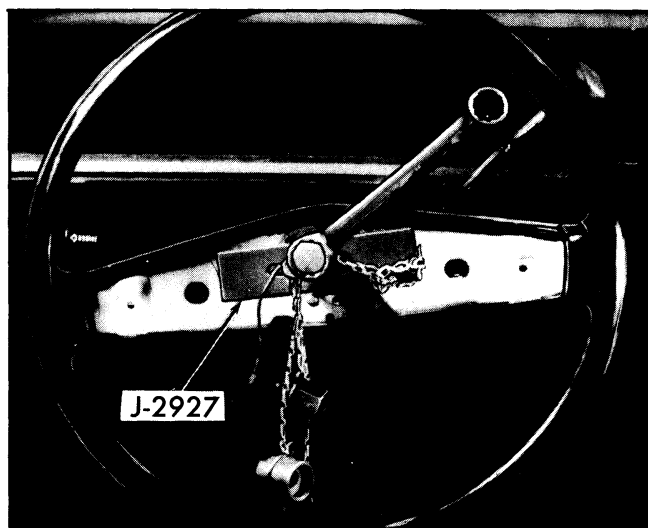


Fig. 3B-48--Removing Steering Wheel

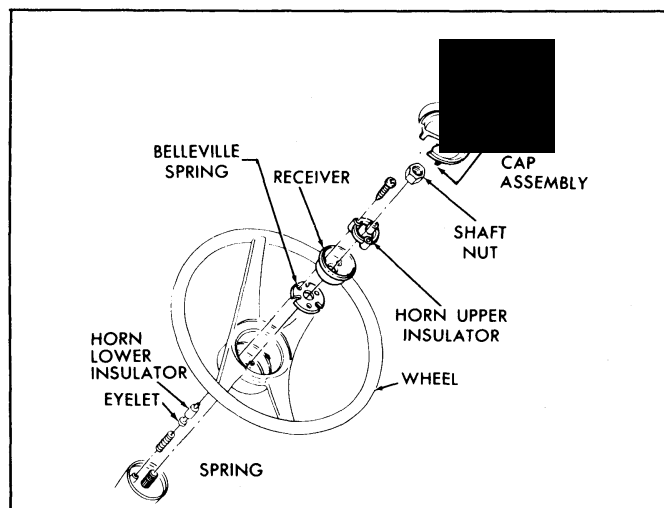
3B-40 STEERING

Fig. 3B-49--Cushioned Rim Steering Wheel Explode--Typical



Fig. 3B-50--Corvette Steering Wheel

Assembly

CAUTION: See **CAUTION** on page 1 of this section regarding the fastener referred to in step 1.

1. With turn signal in neutral position, set wheel onto steering shaft and secure with nut. Refer to torque specifications at rear of section for correct torque values.

CAUTION: Do not over-torque shaft nut or steering wheel rub may result.

2. Install snap ring, making sure it is fully seated.

3. After making sure that the horn lower insulator, eyelet and spring are in place in the horn contact tower, install the shim, belleville spring, receiver and horn upper insulator and secure with three screws.

4. Install horn button cap.

5. Connect battery ground cable.

Regular Production (Corvette)--Fig. 3B-50**Removal**

1. Disconnect battery ground cable.

2. Pry off horn button cap.

3. Remove snap ring.

4. Remove steering wheel nut.

5. Using Tool J-2927, thread puller anchor screws into threaded holes provided in hub assembly. Butt center bolt of tool against steering shaft and turn clockwise to remove hub assembly.

Installation

CAUTION: See **CAUTION** on page 1 of this section regarding the fastener referred to in step 1.

1. With turn signal in neutral position, install hub assembly on steering shaft and secure with nut. Refer to torque specifications at rear of manual for correct torque value.

2. Install snap ring, making sure that it is fully seated.

3. Attach steering wheel to hub assembly using the six attaching screws and tighten securely.

4. Place horn contact on steering wheel and attach with three screws. Tighten securely.

5. Snap horn button in place.

6. Connect battery ground cable.

Corvette Tilt Telescoping Wheel (Fig. 3B-51)**Removal**

1. Disconnect battery ground cable.

2. Pry off horn button cap.

3. Remove three screws securing the upper horn contact assembly and remove the contact.

4. Remove shim, if used. Remove screw securing the center star screw. Remove the star screw and lever.

5. Remove snap ring and nut from shaft and using steering wheel puller Tool J-2927, remove steering wheel assembly from vehicle.

6. Disassemble the steering wheel assembly as follows:

a. Remove three screws securing wheel and separate.

b. Remove four screws securing extension to steering wheel and separate.

Installation

1. Assemble the steering wheel assembly as follows:

a. Position extension to steering wheel and secure with four screws. Torque to specifications.

b. Position spring, eyelet and insulator to lower contact assembly. Position assembly to steering wheel and secure

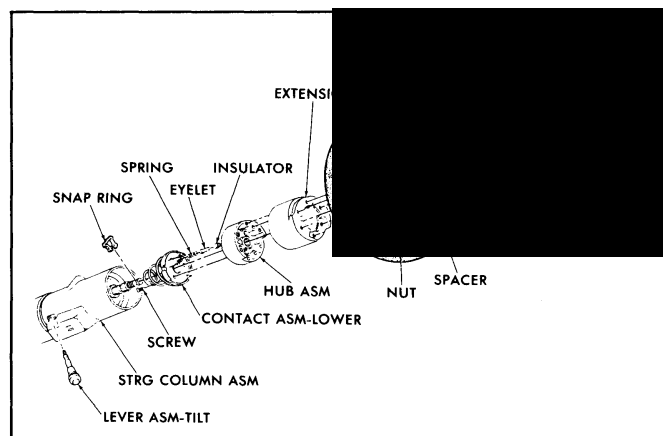


Fig. 3B-51--Corvette Tilt-Telescoping Column Steering Wheel Explode

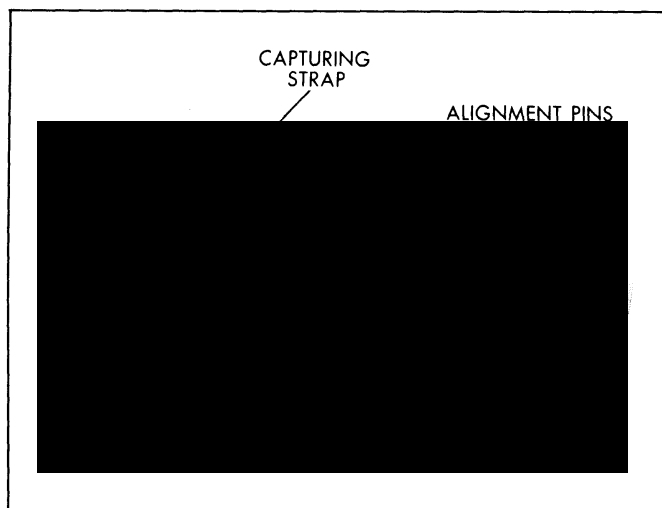


Fig. 3B-52--Flexible Steering Column Coupling (Typical)

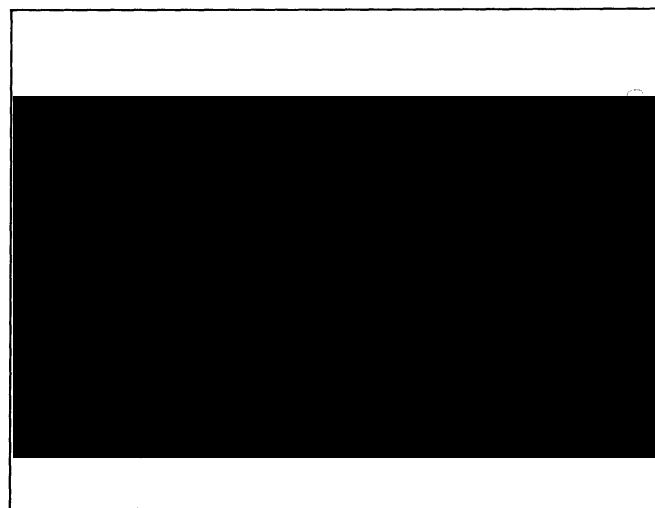


Fig. 3B-53--Pot Joint Steering Column Coupling (Typical)

with three screws. Torque to specifications.

2. Position steering wheel assembly to steering column and secure with nut. Torque to specification. Install snap ring.

CAUTION: See *Caution on page 1 of this section.*

3. Position lever to steering column and install star screw. Torque to specifications. Install screw securing the center star screw and torque to specifications.

4. Position upper contact assembly and, if used, the shim. Secure with three screws and torque to specifications.

5. Install retainer and horn button cap.

6. Connect battery ground cable.

STEERING COUPLING

Flexible Coupling-Malibu, Monte Carlo, Camaro and Nova Manual Steering;

Camaro and Nova Power Steering

Removal (Fig. 3B-54)

1. Disconnect the battery ground cable.

2. Remove the coupling shield if equipped.

3. Remove the intermediate steering shaft flange to flexible coupling bolts.

4. Push the intermediate shaft rearward until it clears the coupling and rotate it out of the way.

5. Remove the bolt from the coupling clamp and remove the flexible coupling.

NOTE: This is a special bolt and will require a 12-point socket or box-end wrench.

Installation

CAUTION: See *CAUTION on page 1 of this section regarding the fasteners referred to in steps 2, 4 and 5.*

1. Install the flexible coupling onto the steering gear wormshaft splined end, aligning the flat in the coupling with the flat on the shaft.

2. Install the coupling clamp bolt and torque to specifications.

NOTE: Be sure the coupling reinforcement is bottomed on the steering gear wormshaft.

3. Install the intermediate shaft to the flexible coupling

and loosely install the flange to coupling bolts.

4. Align flexible coupling pins in center of the intermediate shaft flange slots and then torque flange to coupling bolts to specifications.

5. Install coupling shield and connect battery ground cable.

Pot Joint Coupling--Malibu, Monte Carlo, Camaro and Nova Manual Steering; Camaro and Nova Power Steering

Removal

1. Disconnect the battery ground cable.

2. Remove coupling shield and the intermediate shaft flange to flexible coupling bolts.

3. Remove the pot joint clamp bolt at the steering shaft.

4. Push the intermediate steering shaft rearward until it bottoms in the pot joint and will clear the flexible coupling alignment pins. Replace the intermediate shaft and pot joint as an assembly.

Installation

CAUTION: See *CAUTION on page 1 of this section regarding the fasteners referred to in steps 2, 3 and 4.*

1. Align the flat in the end of the pot joint with the flat on the steering shaft and install the pot joint and intermediate shaft to the steering shaft. Install bolt and nut and tighten to specifications.

2. Install the intermediate shaft to the flexible coupling and loosely install the flange to flexible coupling bolts.

3. Align the flexible coupling pins in the center of the intermediate shaft flange slots and then torque the flange to coupling bolts to specifications.

4. Install coupling shield and connect battery ground cable.

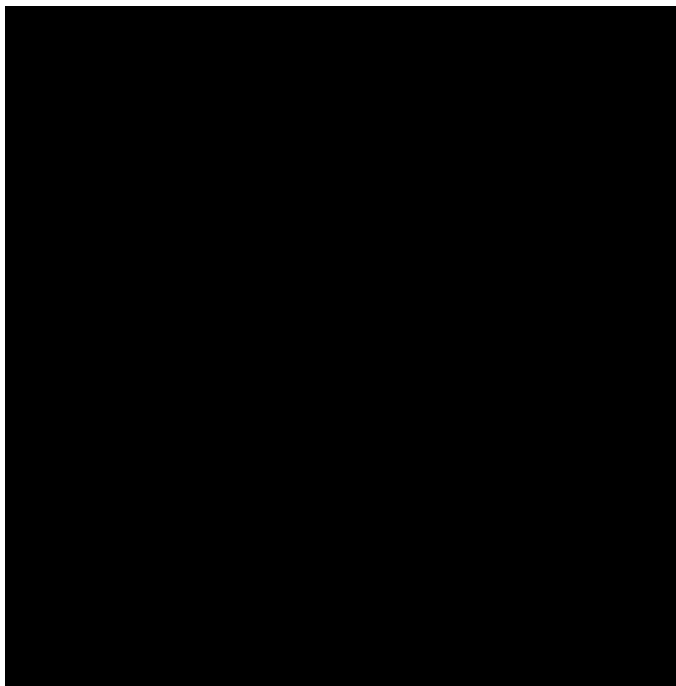
3B-42 STEERING

Fig. 3B-54--Separating Slip Shaft Assembly

Coupling, Intermediate Shaft Assembly and Shield**Chevrolet, Malibu and Monte Carlo Power Steering****Removal**

Remove the intermediate shaft from the vehicle as follows:

1. Disconnect battery ground cable.
2. Slide stone shield up intermediate shaft.
3. Remove pot coupling bolt and nut from lower intermediate shaft flexible coupling and the nut and bolt from the upper end of the intermediate shaft.

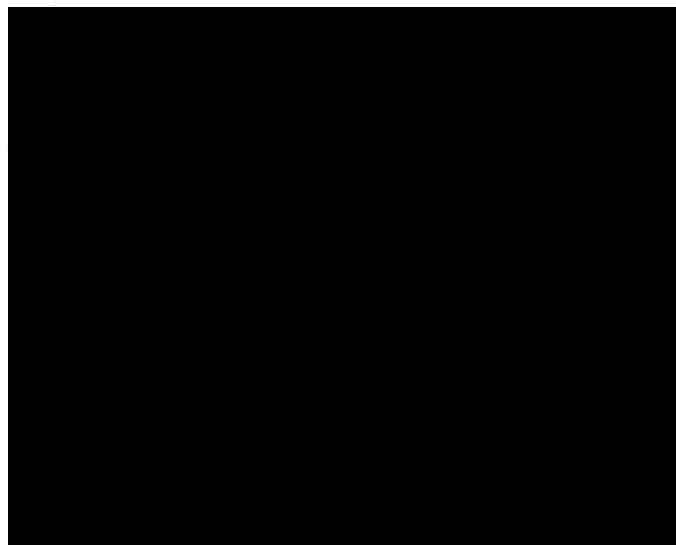


Fig. 3B-55--Removing Stake

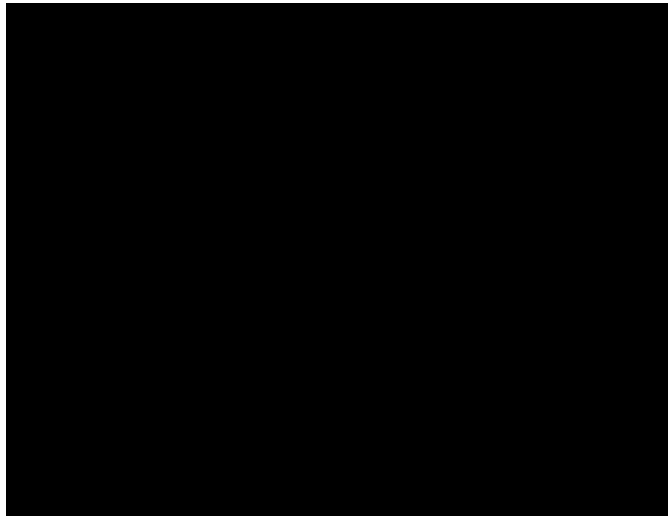


Fig. 3B-56--Assembling Slip Shaft

Component Replacement

1. Extend shaft to full length by pulling out on both couplings. Mark both couplings on one side to aid reassembly.

NOTE: This step is useful only when neither shaft needs replacing.

2. Separate shaft assembly by pressing through flexible coupling using 3/8" diameter rod, 15 inches long. Support back of coupling during disassembly (Fig. 3B-54).

3. Peen end of inner shaft to remove stake marks (Fig. 3B-55).

Installation

1. Install shield and reassemble intermediate shaft (Fig. 3B-56). Apply chassis lube to preload spring. Guide inner shaft into outer, making sure proper coupling alignment is maintained (Fig. 3B-57).

2. Reinstall intermediate shaft in vehicle.
3. Replace upper and lower attaching bolts and tighten to specified torque.

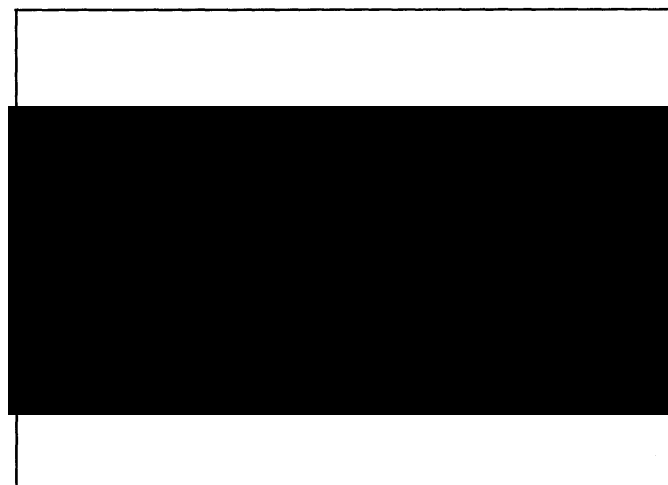


Fig. 3B-57--Aligning Coupling Slots

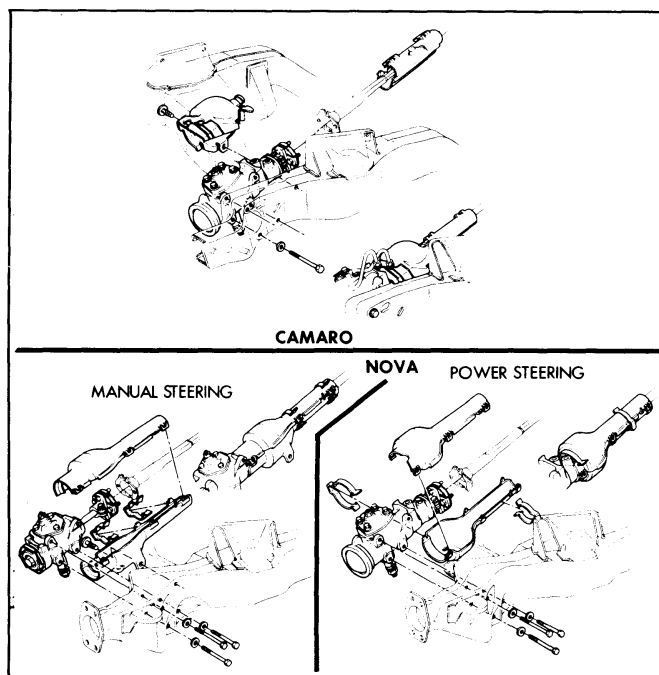


Fig. 3B-58--Steering Coupling Shields

Coupling Shield (Figs. 3B-58-3B-59)**Malibu, Monte Carlo and Nova Manual Steering****Nova Power Steering****Removal**

1. Remove the two clamps from around the outside of the steering coupling shield. Remove the retainer tab on the Nova with manual steering gear.
2. Disengage 6 tabs on lower half of coupling shield from upper section of shield use a small screwdriver to push the tab out of the upper section.
3. Remove both upper and lower sections from vehicle.

Installation

1. Position upper and lower shield sections around steering gear.
2. Snap and secure tabs into place so that each tab is properly locked.

Camaro**Removal**

1. Disengage 2 tabs on steering coupling upper shield, using a small screw driver to push the tab out of the locking slot.
2. Open shield sufficiently to remove from steering shaft and remove from vehicle.
3. Remove bolts (two on manual steering, one on power steering) retaining coupling to the frame.
4. Slide shield clear of steering shaft, fender skirt and pulley and remove.

Installation

1. Slide lower coupling shield over coupling and bolt to frame. Torque to specifications.
2. Open upper shield and slip over steering shaft with shaft pointing upward and to the engine side of the steering shaft.
3. Align shield so that mark on bottom position of shield lines up with slot on lower coupling shield.
4. Secure tabs in place.

Manual Steering Gear**Removal**

1. Disconnect battery ground cable and remove coupling shield if so equipped.
2. Remove retaining nuts, lock washers, and bolts at steering coupling to steering shaft flange.
3. Remove pitman arm nut and washer from pitman shaft and mark relation of arm position to shaft.
4. Remove pitman arm with Tool J-6632.
5. Remove screws securing steering gear to frame and remove gear from vehicle.

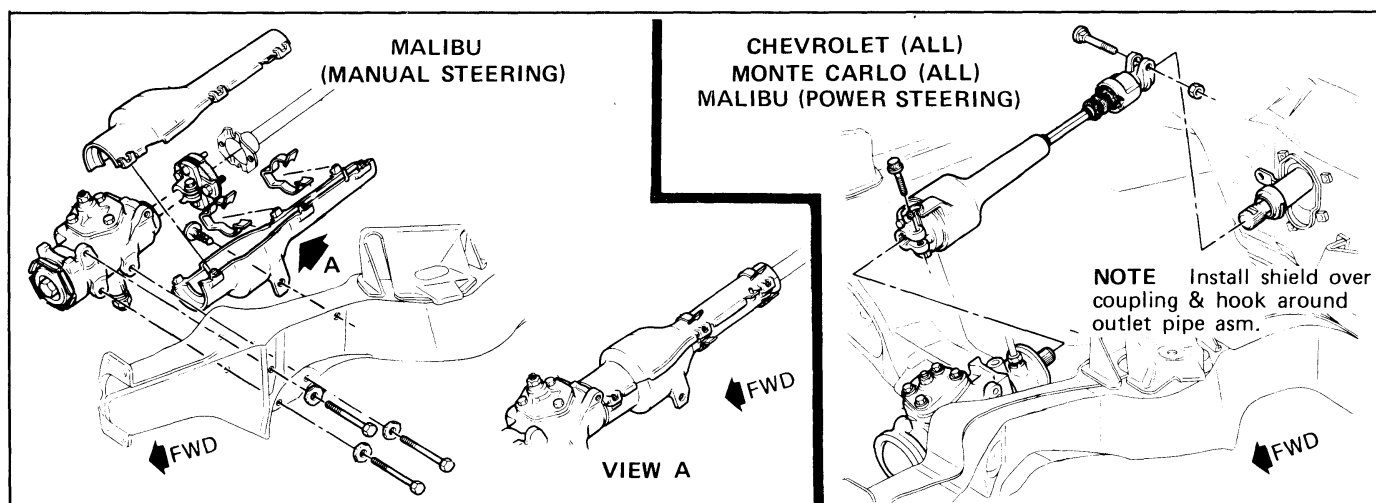


Fig. 3B-59--Steering Coupling Shields

3B-44 STEERING

Installation

CAUTION: See **CAUTION** on page 1 of this section regarding the fasteners referred to in steps 1, 2 and 3.

1. Place gear into position so that steering coupling mounts properly to flanged end of steering shaft. Secure gear to frame with washers and bolts. On Corvette models, install gear with bolts, washers, and nuts. Torque all gear to frame fasteners to specifications.

NOTE: Be sure the coupling reinforcement is bottomed on the wormshaft so that the coupling bolt passes through the undercut on the wormshaft.

2. Secure steering coupling to flanged end of steering column with lock washers, and nuts. Maintain coupling adjustments shown in Figures 3B-120 thru 3B-125. Torque nuts to specifications.

3. Install pitman arm, aligning marks made during removal, and with washer and retaining nut. Torque to specifications.

4. Install coupling shield and connect battery ground cable.

Manual Gear Pitman Shaft Seal Replacement

Manual Gear

A faulty seal may be replaced without removal of steering gear from car by removing pitman arm as outlined under Maintenance and Adjustments - Steering Gear Adjustments and proceed as follows:

1. Rotate the steering wheel from stop to stop, counting the total number of turns. Then turn back exactly half-way, placing the gear on center (the wormshaft flat should be at the 12 o'clock position).

2. Remove the three self-locking bolts attaching side cover to the housing and lift the pitman shaft and side cover assembly from the housing.

3. Pry the pitman shaft seal from the gear housing using a screwdriver and being careful not to damage the housing bore.

CAUTION: Inspect the lubricant in the gear for contamination. If the lubricant is contaminated in any way, the gear must be removed from the vehicle and completely overhauled as outlined in the Overhaul portion of this manual.

4. Coat the new pitman shaft seal with Steering Gear Lubricant meeting GM Specification GM4673M (or equivalent). Position the seal in the pitman shaft bore and tap into position using a suitable size socket.

5. Remove the lash adjuster lock nut. Remove the side cover from the pitman shaft assembly by turning the lash adjuster screw clockwise.

6. Place the pitman shaft in the steering gear such that the center tooth of the pitman shaft sector enters the center tooth space of the ball nut.

7. Fill the steering gear housing with Steering Gear Lubricant meeting GM Specification GM4673M (or equivalent).

8. Install a new side cover gasket onto the gear housing.

9. Install the side cover onto the lash adjuster screw by reaching through the threaded hole in the side cover with a small screwdriver and turning the lash adjuster screw counter-clockwise until it bottoms and turn back in 1/4 turn.

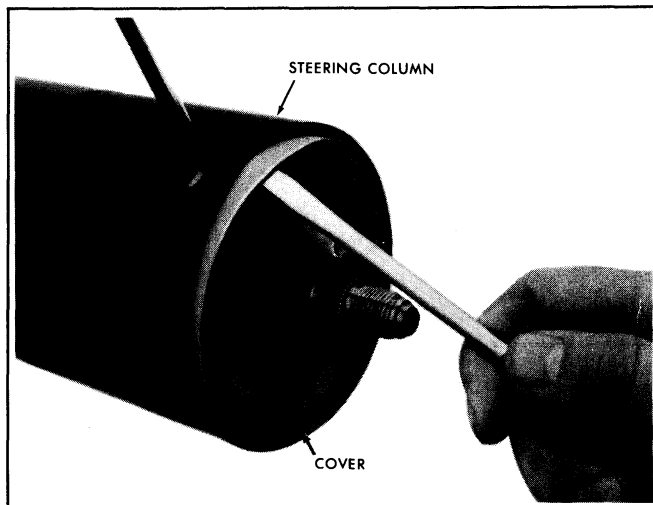


Fig. 3B-60--Removing Lock Plate Cover

10. Install the side cover bolts and torque to specifications.

11. Install the lash adjuster screw locknut, perform steering gear adjustment and install the pitman arm as outlined under "Maintenance and Adjustments".

DIRECTIONAL SIGNAL SWITCH

The directional signal switch can be removed with the steering column in the vehicle and without disturbing any of the column mountings.

All Except Tilt-Telescoping Columns

Removal

1. Remove the steering wheel as outlined under "Steering Wheel - Removal".

2. Remove the column to instrument panel trim cover.

3. Position screw driver blade into cover slot (Fig. 3B-61). Pry up and out to free cover from lock plate.

4. Screw the center post of Lock Plate Compressing Tool J-23653 onto the steering shaft as far as it will go. Compress the lock plate by turning the center post nut

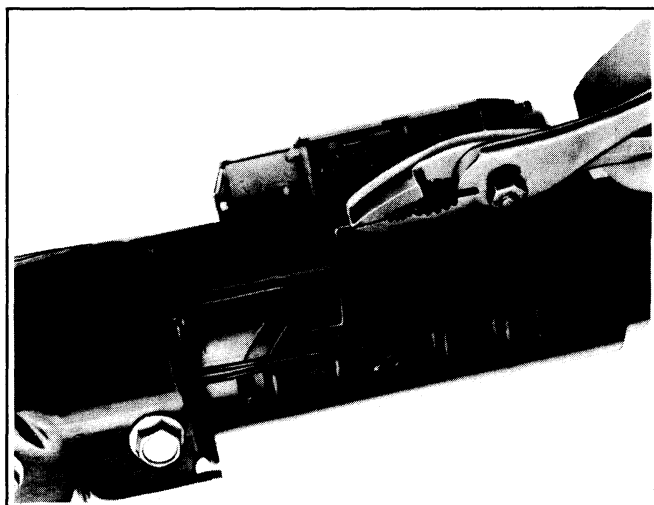


Fig. 3B-61--Removing Directional Signal Wire Protector

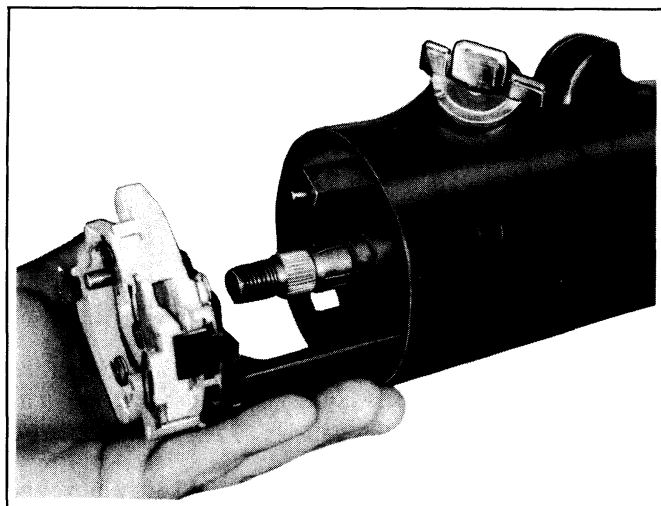


Fig. 3B-62--Removing Directional Signal Switch Assembly

clockwise (fig. 3B-60). Pry the round wire snap ring out of the shaft groove and discard the ring. Remove Tool J-23653 and lift the lock plate off the end of the shaft.

CAUTION: *If the column is being disassembled on the bench, with the snap ring removed the shaft could slide out of the lower end of the mast jacket, damaging the shaft assembly.*

5. Slide the directional signal cancelling cam, upper bearing preload spring and thrust washer off the end of the shaft.

6. Remove the directional signal lever screw and remove the lever. On Chevrolet there is no attaching screw, pull the lever straight out to disengage.

7. Push the hazard warning knob in and unscrew the knob.

8. Remove the three switch mounting screws. On Chevrolet, first remove the switch actuator arm mounting screw and arm (Fig. 3B-63).

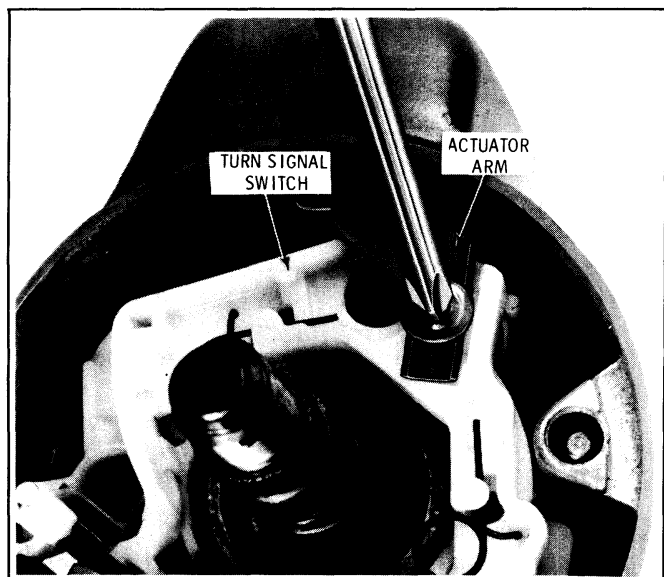


Fig. 3B-63--Removing Actuator Arm - Chevrolet

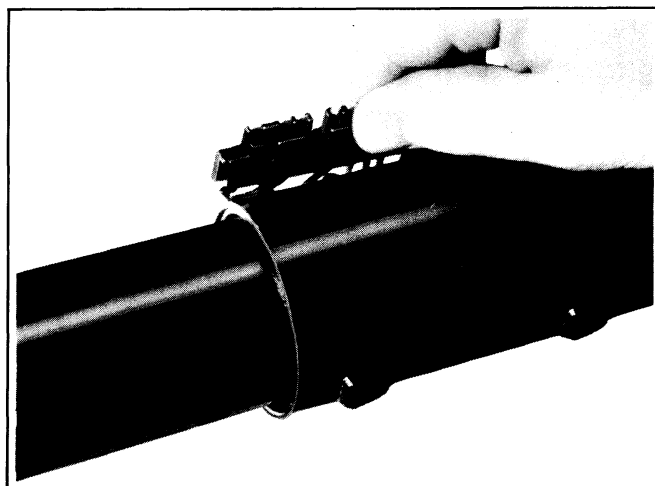


Fig. 3B-64--Installing Switch Connector onto Jacket Clips

9. All Columns - Pull the switch connector out of the bracket on the jacket and feed switch connector through column support bracket and pull switch straight up, guiding the wiring harness through the column housing and protector.

10. Remove wire protector by pulling downward out of column with pliers, using tab provided. (Fig. 3B-61).

TILT COLUMN - Position the directional signal and shifter housing in the "low" position. Remove the harness cover being careful not to damage the wires.

11. Pull the switch straight up, guiding the wiring harness and cover through the column housing (fig. 3B-62).

Installation

CAUTION: *It is extremely important that only the specified screws, bolts and nuts be used at assembly. Use of overlength screws could prevent a portion of the assembly from compressing under impact.*

1. **ALL EXCEPT TILT** - Be sure that the wiring harness is in the protector. Feed the connector and cover down through the housing and under the mounting bracket (column in vehicle.)

Tilt - Feed the connector down through the housing and under the mounting bracket. Then install the cover on the harness.

2. Install the three mounting screws and clip the connector to the bracket on the jacket (fig. 3B-64).

3. On Chevrolet, position ball of the signal switch actuator arm into dimmer pivot, and arm into switch slot. Install screw and tighten to 20 lbs. in. (2.3 N·m).

4. Install the column to instrument panel trim plate.

5. Install the hazard warning knob and directional signal lever. On Chevrolet, align lever pin with switch slot. Push on end of lever until seated securely.

6. Make certain that the switch is in "Neutral" and the hazard warning knob is out. Slide the thrust washer, upper bearing preload spring and cancelling cam onto the upper end of the shaft.

7. Place the lock plate onto the end of the shaft. Screw the center post of Lock Plate Compressing Tool J-23653 onto the steering shaft as far as it will go. Place a NEW snap ring over the center post. Place the "C" bar over the center

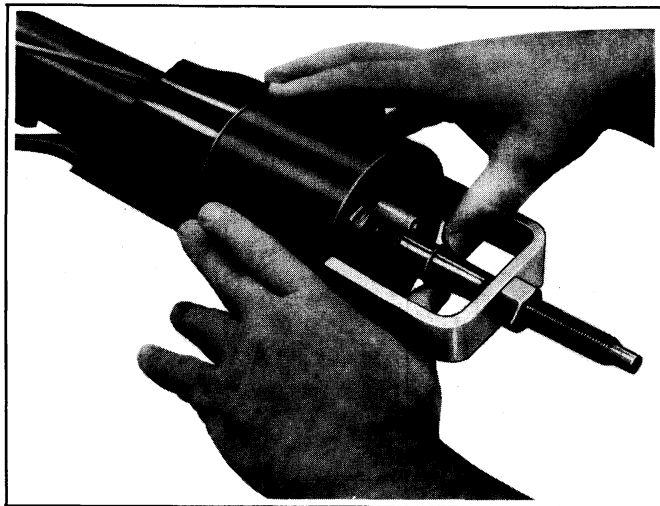
3B-46 STEERING

Fig. 3B-65—Installing Snap Ring

post and then compress the lock plate by turning the nut clockwise. Slide the new snap ring down the tapered center post and into the shaft groove (fig. 3B-65). Remove Tool J-23653.

CAUTION: Always use a new snap ring when re-assembling.

8. Place the cover on the lock plate and snap into position.

9. Install the steering wheel as outlined under "Steering Wheel - Installation".

Tilt-Telescopic Columns - Corvette**Removal**

1. Remove the steering wheel as outlined under "Steering Wheel - Removal".

2. Remove the column to instrument panel trim cover.

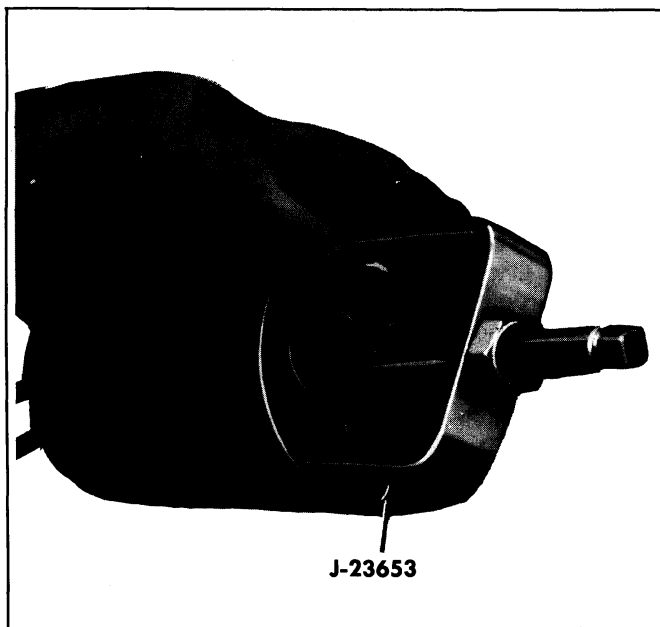


Fig. 3B-66—Removing Carrier and Lock Plate Retaining Ring Using Tool J-23653

3. Remove the rubber bumper and "C" ring plastic retainer (pry up carefully to prevent damage).

4. Place Tool J-23653 over the end of the steering shaft.

5. Place a 5/16" nut under each leg of the tool as shown in Figure 3B-66.

6. Using the shaft nut, compress the lock plate just enough to remove the "C" ring. Remove the "C" ring.

7. Remove the shaft nut, Tool J-23653, the two 5/16" nuts.

8. Lift the lock plate, horn contact carrier and upper bearing preload spring off the end of the shaft.

9. Pull the switch connector out of the bracket on the jacket, remove the harness cover and wrap the upper part of the connector with tape to prevent snagging the wires during switch removal.

10. Push the hazard warning knob in and remove the knob.

11. Remove turn signal lever. Pull Straight out to disengage.

12. Remove the switch actuator arm mounting screw and arm.

13. Place the directional signal and shifter housing in "Low" position. Remove the three directional switch screws and pull the switch straight up, guiding the wiring harness out of the housing.

Installation

CAUTION: It is extremely important that only the specified screws, bolts and nuts be used at assembly. Use of over-length screws could prevent a portion of the column from compressing under impact.

1. Feed the harness connector down through the housing and under the mounting bracket, reinstall the cover on the harness and clip the connector to the jacket.

2. Install the three switch mounting screws, lever and the hazard warning knob.

3. Position pin of signal switch actuator arm into slot of pivot switch assembly and arm into switch slot. Install screw and tighten. Install signal switch lever. Align lever pin with switch slot. Push on lever until seated.

4. Make certain that the switch is in "Neutral" and that the hazard knob is out. Place the upper bearing preload spring, horn contact carrier and lock plate onto the upper end of the shaft.

5. Place Tool J-23653 over the end of the steering shaft.

6. Place a 5/16" nut under each leg of the tool as shown in Figure 3B-66.

7. Using the shaft nut, compress the lock plate just enough to install the "C" ring. Install the "C" ring.

8. Remove the shaft nut, Tool J-23653, the two 5/16" nuts.

9. Install the "C" ring plastic retainer and the rubber bumper.

10. Install the column to instrument panel trim cover.

11. Install the steering wheel as outlined under "Steering Wheel Installation".

LOCK CYLINDER

The lock cylinder is located on the upper right hand side of the column. The lock cylinder should be removed in the "RUN" position only.



Fig. 3B-67--Lock Cylinder Removal

Removal

1. Remove the steering wheel as outlined under "Steering Wheel - Removal".

2. Remove the directional signal switch as outlined under "Directional Signal Switch - Removal".

NOTE: It is not necessary to completely remove the directional signal switch from the column. Pull the switch rearward far enough to slip it over the end of the shaft - do not pull the harness out of the column.

3. On all models except Corvette, do not remove the buzzer switch or damage to the lock cylinder will result.

4. Remove the lock cylinder with the switch in the "LOCK" position. Insert a small screw driver or similar tool into the turn signal housing slot as shown in Figure 3B-67. Keeping the tool to the right side of the slot, break the housing flash loose and at the same time depress the spring latch at the lower end of the lock cylinder. With the latch depressed, the lock cylinder can be removed from the housing.

NOTE: For further information on lock cylinder repair refer to the current Body Service Manual.

Assembly (Fig. 3B-68)

1. Place the key part way into the lock cylinder assembly. Place the wave washer and anti-theft ring onto the lower end of the lock cylinder.

NOTE: If the key is installed all the way into the lock cylinder, the plastic keeper in the lock cylinder protrudes and prevents installation of the sleeve assembly.

2. Make sure that the plastic keeper in the sleeve assembly protrudes from the sleeve (fig. 3B-69).

3. Align the lock bolt on the lock cylinder and the tab on the anti-theft washer and the slot in the sleeve assembly (fig. 3B-69). Push the sleeve all the way onto the lock cylinder assembly, push the ignition key the rest of the way in and rotate the lock cylinder clockwise.

4. Rotate the lock counter-clockwise into "LOCK"

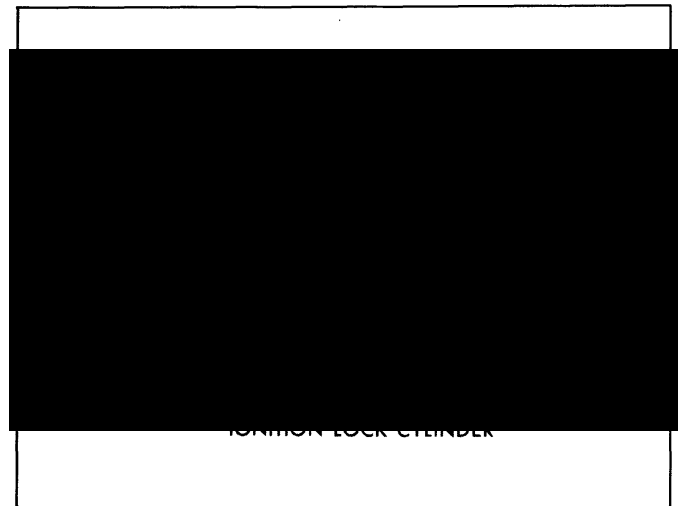


Fig. 3B-68--Ignition Lock Cylinder

position.

5. Place the lock in a brass jawed vise or between two pieces of wood.

NOTE: If a vise is used, place cloth around the knob to prevent marring the knob surface.

6. Place the adapter ring onto the lower end of the cylinder so that the finger of the adapter is located at the step in the sleeve and the serrated edge of the adapter is visible after assembly to the cylinder and before "staking" (fig. 3B-70). The key must be free to rotate at least 1/3 of a circle (120°).

NOTE: Tap the adapter onto the cylinder until it is stopped at the bottom of the cylinder flats (cylinder will extend above adapter approximately 1/16").

7. Using a small flat punch, at least 1/8" in diameter, stake the lock cylinder over the adapter ring in four places just outboard of the four dimples as shown in Figure 3B-70.

8. Check lock operation before reinstalling in vehicle.

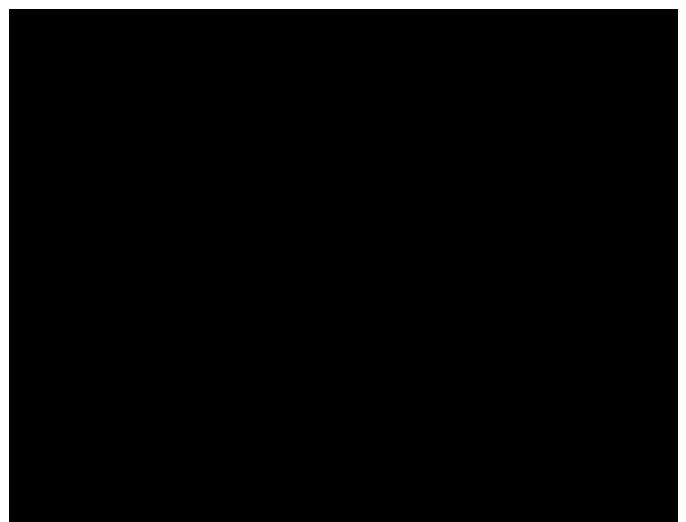


Fig. 3B-69--Ignition Lock Cylinder Assembly

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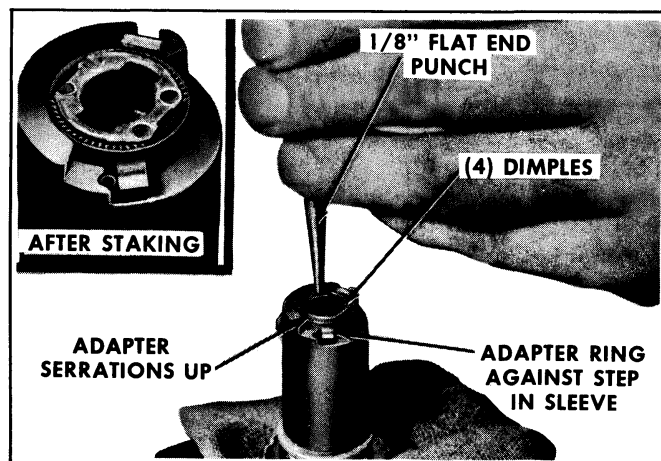


Fig. 3B-70—Installing Adapter Ring

Installation

1. Hold the lock cylinder sleeve and rotate the knob clockwise against the stop. Insert the cylinder into the housing bore with the key on the cylinder sleeve aligned with the keyway in the housing. Push the cylinder into abutment of cylinder and sector. Rotate the cylinder counter-clockwise, maintaining a light pressure until the drive section of the cylinder mates with the sector. Push in until the snap ring pops into the grooves and the lock cylinder is secured in the housing. Check lock cylinder for freedom of rotation.

2. Install the Direction Signal Switch and Steering Wheel as outlined previously in this section.

IGNITION KEY WARNING SWITCH

The ignition key warning switch (buzzer switch) is located within the column housing and cannot be removed until the steering wheel and directional signal switch are removed.

Removal

1. Remove the steering wheel and directional signal switch as outlined previously in this section.

NOTE: It is not necessary to completely remove the directional signal switch from the column. Pull the switch rearward far enough to slip it over the end of the shaft - do not pull the harness out of the column.

2. Obtain a short piece of small wire and fashion a right angle bend about 1/4" from one end. Hook the wire tool into the loop of the clip at the top of the switch near the base of the housing. Pull up and out on the clip to remove the switch and clip as an assembly (fig. 3B-71).

CAUTION: Do not attempt to remove the switch separately, as the clip may fall into the column assembly. If the clip is dropped into the column, it must be retrieved before reassembly.

If the lock cylinder is not removed before the switch, it must be in the "ON" position.

CAUTION: On Corvette, when the key alarm buzzer system is being serviced, the key should be turned to the "run" position and the lock cylinder removed.

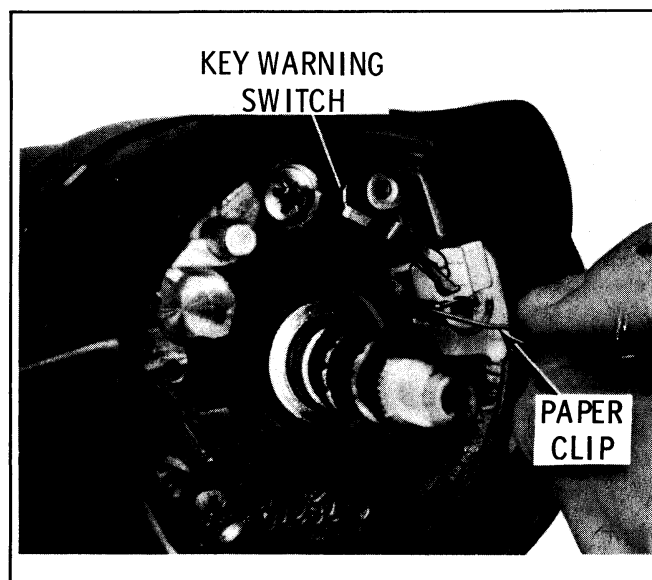


Fig. 3B-71—Removing Ignition Key Warning Buzzer Switch

Installation

CAUTION: On all models except Corvette, if the lock cylinder is in the column, the buzzer switch actuating button on the lock cylinder must be depressed before the buzzer switch can be installed.

On Corvette, if the lock cylinder is in the column, the cylinder must be in the "RUN" position before the buzzer switch can be installed.

1. Install the buzzer switch with the contacts toward the upper end of the steering column and with the formed end of the spring clip around the lower end of the switch.

2. Reinstall the directional signal switch and steering wheel as previously outlined in this section.

IGNITION SWITCH

The ignition switch is mounted on top of the column jacket near the front of the dash. For anti-theft reasons, the switch is located inside the channel section of the brake pedal support and is completely inaccessible without first lowering the steering column. The switch is actuated by a rod and rack assembly. A portion of the rack is toothed and engages a gear on the end of the lock cylinder, thus enabling the rod and rack to be moved axially (with respect to the column) to actuate the switch when the lock cylinder is rotated.

Removal

1. Lower the steering column as outlined under "Steering Column - Removal" later in this section. It is not necessary to remove the steering wheel.

CAUTION: If the steering column is not removed from the vehicle, be sure that it is properly supported, before proceeding.

2. The switch should be positioned in "Off-Unlocked" position before removing. If the lock cylinder has already been removed, the actuating rod to the switch should be pulled up until there is a definite stop, then moved down two detents, which is the "Off-Unlocked" position.

3. Remove the screw switch and remove the switch

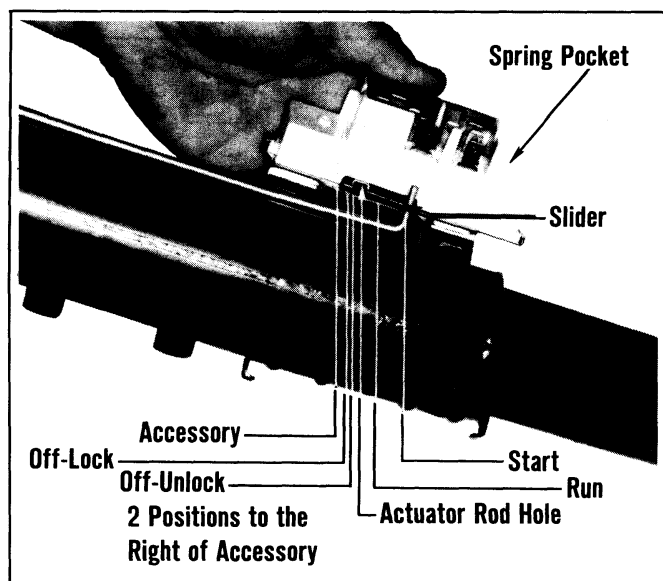


Fig. 3B-72--Positioning Ignition Switch

assembly.

4. On Chevrolet, remove the dimmer switch mounting screw and then the dimmer switch.

Installation

1. Turn the cylinder clockwise to stop, and then counterclockwise to "OFF-UNLOCK" position.

2. Position gearshift lever in "N" (neutral) position.

3. Place ignition switch in the "OFF-UNLOCK" position using the following procedure:

a. Position the ignition switch as it is shown in Fig. 3B-72.

b. Move the slider two positions to the right from "accessory" to "off-unlock" position.

c. Fit actuator rod into slider hole and assemble to column with two screws. Be careful not to move the switch out of detent. Use only the correct screws.

d. Tighten the bottom screw only to 35 lbs. in. (4 N·m).

Dimmer Switch - (B-A-Y Series)

Refer to Fig. 3B-73 for illustration of replacement procedure for dimmer switch.

STEERING COLUMN

All models are equipped with Function Locking Energy Absorbing Steering Columns. The columns are of four basic designs as follows:

1. **SYNCHROMESH** - The synchromesh column is used on models with the standard transmission and column mounted shift levers. The shift tube, within the outer column jacket, includes two lower shift levers for connection to the transmission control linkage.

2. **AUTOMATIC AND FLOOR SHIFT** - This column is used on models equipped with the column mounted automatic transmission shift lever and models with floor shift. This column has a single lower shift lever for shifting the automatic transmission or for attachment of the back-drive linkage (for locking the transmission) on floor shift models.

3. **TILT COLUMN OPTION** - The upper end and steering shaft of this column is specifically designed to

accommodate the optional tilt steering wheel.

4. TILT-TELESCOPIC COLUMNS (Corvette Only)

- This column is similar in design to the tilt column with the added feature of telescoping up to a maximum of 1.25".

To perform service procedures on the steering column upper end components, it is not necessary to remove the column from the vehicle.

The steering wheel, horn components, directional signal switch, ignition lock cylinder and ignition key warning switch may be removed with the column remaining in the vehicle as described earlier in this section.

CAUTION: The outer mast jacket shift tube, steering shaft and instrument panel mounting bracket are designed as energy absorbing units. Because of the design of these components, it is absolutely necessary to handle the column with care when performing any service operation. Avoid hammering, jarring, dropping or leaning on any portion of the column.

When reassembling the column components, use only the specified screws, nuts and bolts and tighten to specified torque. Care should be exercised in using over-length screws or bolts as they may prevent a portion of the column from compressing under impact.

Inspection

To determine if the energy absorbing steering column components are functioning as designed, or if repairs are required, a close inspection should be made. An inspection is called for in all cases where damage is evident or whenever the vehicle is being repaired due to a front end collision. Whenever a force has been exerted on the steering wheel or steering column, or its components, inspection should also be made. If damage is evident, the affected parts must be replaced.

The inspection procedure for the various steering column components is as follows:

Column Support Bracket

Damage in this area will be indicated by separation of the mounting capsules from the bracket. The bracket will have moved forward toward the engine compartment and will usually result in collapsing of the jacket section of the steering column.

Column Jacket

Inspect jacket section of column for looseness, and/or bends.

Shifter Shaft

Separation of the shifter shaft sections will be internal and cannot be visually identified. Hold lower end of the "shifter shaft" and move "shift lever" on column through its ranges and up and down. If there is little or no movement of the "shifter shaft", the plastic joints are sheared.

Steering Shaft

If the steering shaft plastic pins have been sheared, the shaft will rattle when struck lightly from the side and some lash may be felt when rotating the steering wheel while holding the rag joint. It should be noted that if the steering shaft pins are sheared due to minor collision with no appreciable damage to other components, that the vehicle can be safely steered; however, steering shaft replacement is recommended.

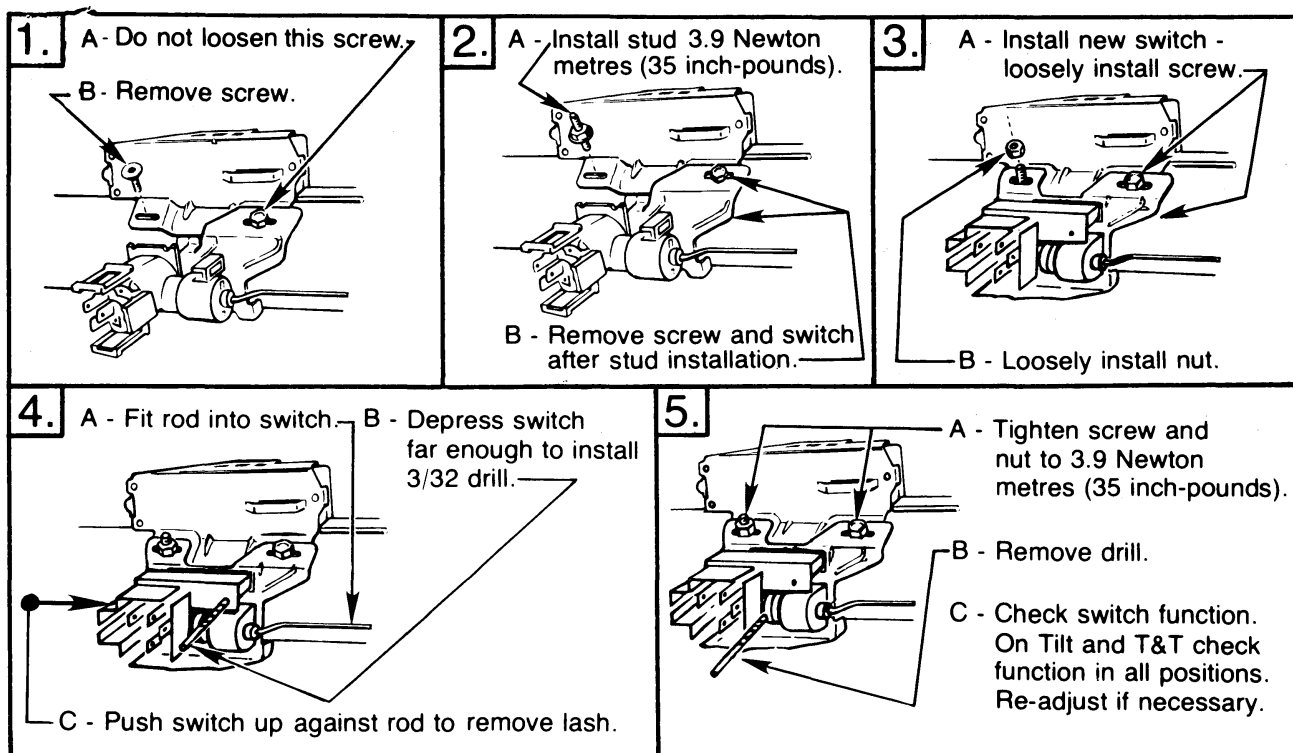
3B-50 STEERING

Fig. 3B-73-Dimmer Switch Replacement Procedure

Because of the differences in the steering column types, be sure to refer to the set of instructions below which apply to the column being service.

Column Removal-All Columns except Corvette

NOTE: Front of dash mounting plates must be loosened whenever the steering column is to be lowered from the instrument panel.

1. Disconnect the battery ground cable.
2. Remove the steering wheel as outlined under "Steering Wheel Removal".
3. Remove the nut and bolt from the upper

intermediate shaft coupling. Separate coupling from lower end of steering column.

4. Disconnect the transmission control linkage (backdrive linkage on floor shift models) from the column shift tube levers.

5. Disconnect the steering column harness at the connector. Disconnect the neutral-start switch and back-up lamp switch connectors if so equipped.

6. Remove the floor pan trim cover screws and remove the cover.

7. **MALIBU AND MONTE CARLO ONLY** - Remove the screws securing the two halves of the floor pan

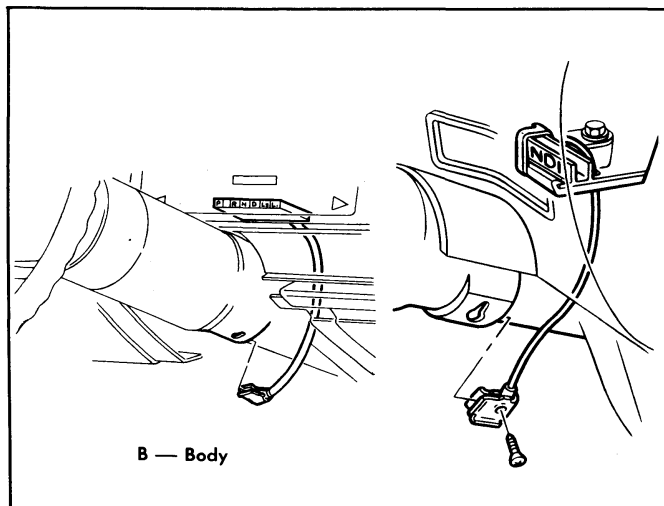


Fig. 3B-74-Automatic Transmission Indicator Connection (Typical)

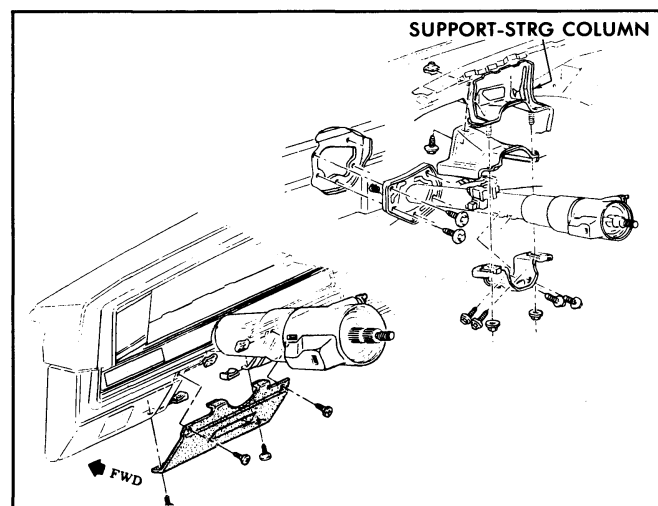


Fig. 3B-75-Steering Column to Dash Panel - Chevrolet

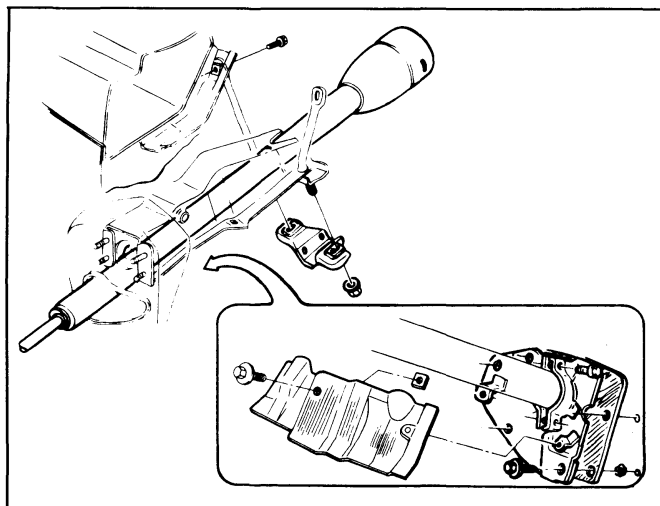


Fig. 3B-76--Steering Column to Dash Panel - Malibu and Monte Carlo

cover; then remove the screws securing the halves and seal to the floor pan and remove the covers (figs. 3B-75, 76 and 77).

CAMARO, NOVA AND CHEVROLET - Remove the column plate to floor pan screws (fig. 3B-75, 77 and 78).

CORVETTE - Remove the two nuts securing the floor pan bracket to the mounting studs (fig. 3B-79).

8. **ALL EXCEPT CAMARO AND NOVA** - Remove the instrument panel trim cover screws and remove the trim cover.

CAMARO ONLY

- a. Remove the ash tray assembly.
- b. Remove the (6) steering column panel to instrument panel screws and carefully lower the panel and heater (or air conditioning control) as an assembly.
9. Remove the transmission indicator cable, if so equipped (fig. 3B-74).
10. Move the front seat as far back as possible to provide maximum clearance.
11. Remove the two column bracket-to-instrument

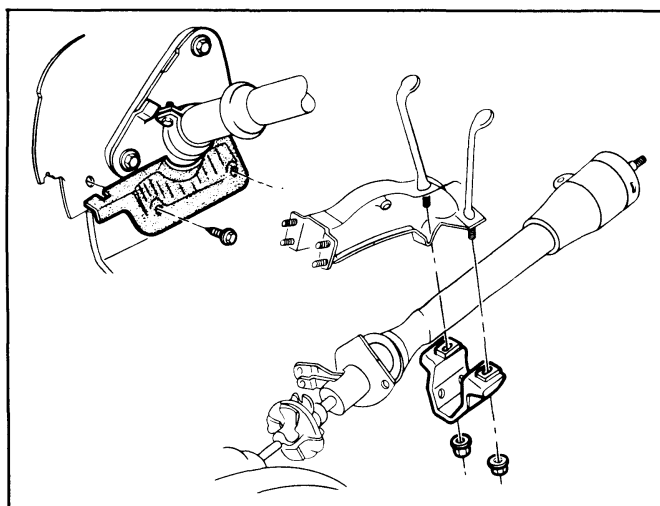


Fig. 3B-77--Steering Column to Dash Panel - Nova

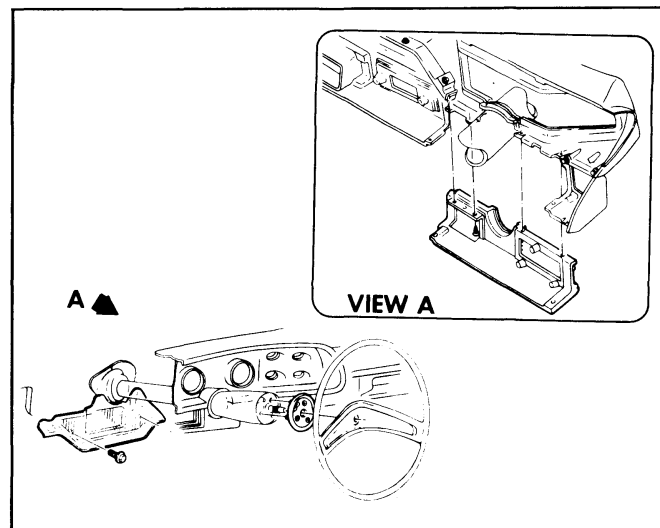


Fig. 3B-78--Steering Column Mounting - Camaro

panel nuts and carefully remove from vehicle. Additional help should be obtained to guide the lower shift levers through the dash panel opening.

Disassembly--All Except Tilt and Tilt-Telescoping Columns--(Fig. 3B-80)

1. Remove the four dash panel bracket-to-column screws and lay the bracket in a safe place to prevent damage to the mounting capsules.

2. Place the column in a vise using both weld nuts of either Set A or B as shown in Figure 3B-81. The vise jaws must clamp onto the sides of the weld nuts indicated by arrows shown on Set B.

CAUTION: Do not place the column in a vise by clamping onto only one weld nut, by clamping onto one weld nut of both sets A and B or by clamping onto the sides not indicated by arrows, since damage to the column could result.

3. Remove the Directional Signal Switch, Lock Cylinder, Ignition Key Warning Switch and Ignition Switch

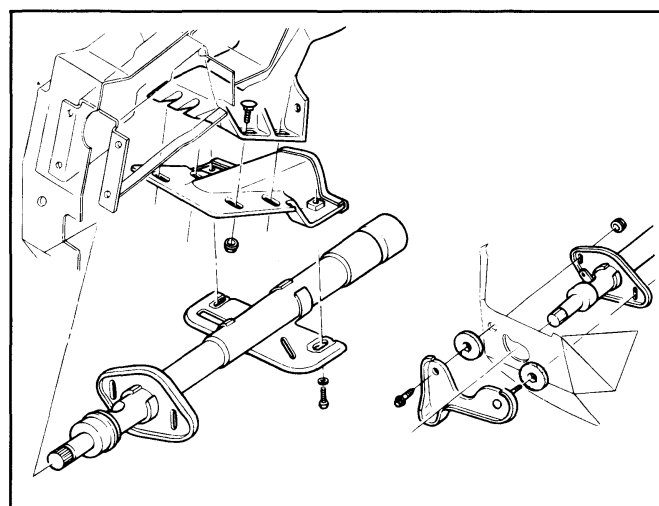
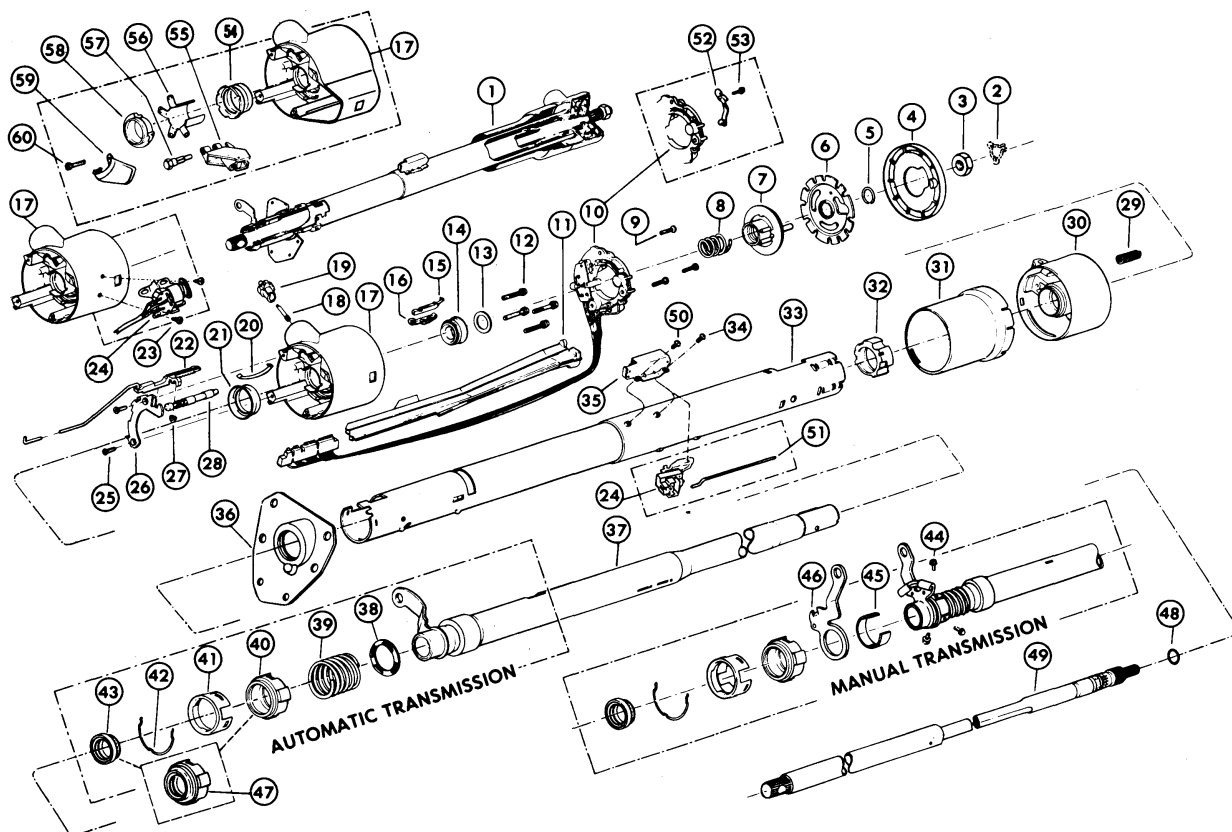


Fig. 3B-79--Steering Column to Dash Panel - Corvette

3B-52 STEERING**Key No. Part Name**

- 1-COLUMN ASSY., E/A STRG.
- 2-RETAINER
- 3-NUT, HEXAGON JAM
- 4-COVER, SHAFT LOCK
- 5-RING, RETAINING
- 6-LOCK, STEERING SHAFT
- 7-CAM ASSY., TURN SIGNAL CANCELLING
- 8-SPRING, UPPER BEARING
- 9-SCREW, PAN HEAD CROSS RECESS
- 10-SWITCH ASSY., TURN SIGNAL
- 11-PROTECTOR, WIRING
- 12-SCREW, HEX WASHER HEAD TAPPING
- 13-WASHER, THRUST
- 14-BEARING ASSY.
- 15-SWITCH ASSY., BUZZER
- 16-CLIP, BUZZER SWITCH RETAINING
- 17-HOUSING, STEERING COLUMN
- 18-SHAFT, SECTOR
- 19-SECTOR, SWITCH ACTUATOR
- 20-SPRING, RACK PRELOAD
- 21-CUP, THRUST
- 22-RACK ASSY., ROD &
- 23-SCREW, DIMMER SWITCH MOUNTING
- 24-SWITCH ASSY., DIMMER
- 25-SCREW, FLAT HEAD CROSS RECESS
- 26-GATE, SHIFT LEVER
- 27-WASHER, SPRING THRUST
- 28-BOLT ASSY., SPRING &
- 29-SPRING, UPPER SHIFT LEVER
- 30-BOWL, GEARSHIFT LEVER
- 31-SHROUD, SHIFT BOWL
- 32-BEARING, BOWL LOWER

- 33-JACKET ASSY., STEERING COLUMN
- 34-SCREW, WASHER HEAD
- 35-SWITCH ASSY., IGNITION
- 36-SEAL, DASH
- 37-TUBE ASSY., SHIFT
- 38-WASHER, SPRING THRUST
- 39-SPRING, SHIFT TUBE RETURN
- 40-ADAPTER, LOWER BEARING
- 41-RETAINER, BEARING ADAPTER
- 42-CLIP, LOWER BEARING ADAPTER
- 43-BEARING ASSY.
- 44-SCREW ASSY., LOCKWASHER &
- 45-SPACER, LOWER SHIFT LEVER
- 46-LEVER, LOWER SHIFT
- 47-BUSHING ASSY., STEERING SHAFT *
- 48-RING, RETAINING
- 49-SHAFT ASSY., STEERING
- 50-SCREW, FLAT HEAD
- 51-ROD, DIMMER SWITCH ACTUATOR
- 52-ARM ASSY., SWITCH ACTUATOR
- 53-SCREW, ROUND CROWN WASHER HEAD
- 54-BEARING ASSY.
- 55-PIVOT ASSY., SWITCH ACTUATOR &
- 56-RETAINER, BEARING
- 57-PIN, DIMMER SWITCH PIVOT
- 58-ADAPTER, SHIFT BOWL
- 59-COVER, HOUSING
- 60-SCREW, PAN HEAD CROSS RECESS

*USED AS ORIGINAL EQUIPMENT ON SOME COLUMNS. SERVICED WITH A COMBINATION OF 40 & 43 ON ALL COLUMNS.

Fig. 3B-80-Standard Steering Column Explode

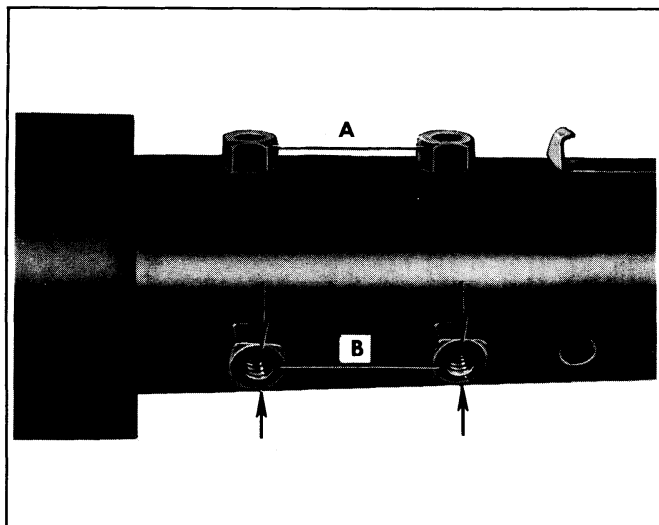


Fig. 3B-81--Installing Steering Column in Vise

as outlined previously in this section.

4. **COLUMN SHIFT MODELS** - Drive out the upper shift lever pivot pin and remove the shift lever.

5. Remove the upper bearing thrust washer. Remove the four screws attaching the turn signal and ignition lock housing to the jacket and remove the housing assembly (fig. 3B-82).

6. Remove the thrust cup (and, on Chevrolet only, the bearing retainer) from the lower side of the housing.

7. On Chevrolet only:

a. Remove the dimmer switch actuator rod.

b. If bearing replacement is necessary, press it out with a suitable size socket.

c. If pivot assembly requires removal or service, remove cover screw, cover, pivot pin and pivot pin assembly. See Figs. 3B-82A and 3B-82B.

8. Lift the ignition switch actuating rod and rack assembly, the rack preload spring and the shaft lock bolt and spring assembly out of the housing (fig. 3B-83).

9. Remove the shift lever detent plate (shift gate).

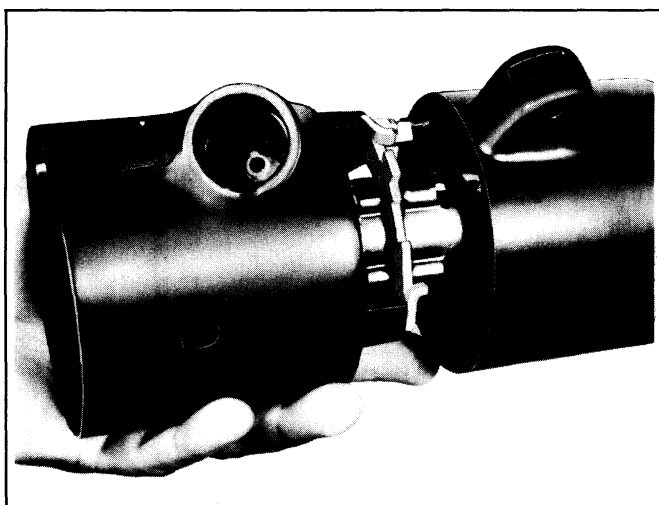


Fig. 3B-82--Removing Turn Signal Housing

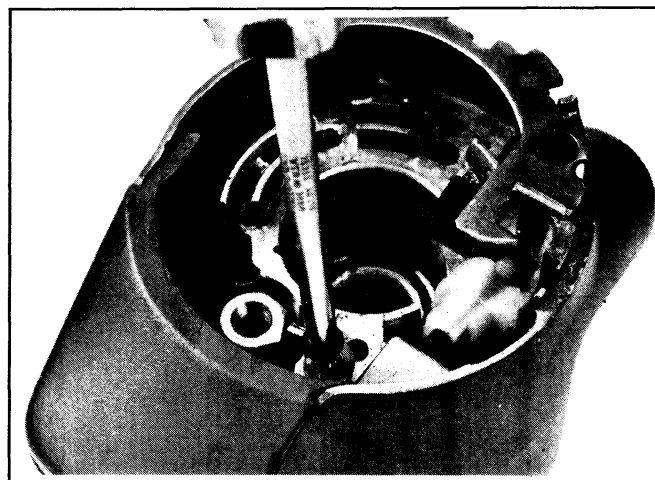


Fig. 3B-82A--Removing Cover Screw and Cover-Chevrolet

10. Remove the ignition switch actuator sector through the lock cylinder hole by pushing firmly on the block tooth of the sector with a blunt punch or screw driver (fig. 3B-84).

11. Remove the gearshift lever housing and shroud from the jacket assembly.

12. Remove the shift lever spring from the gearshift lever housing.

13. Pull the steering shaft from lower end of the jacket assembly.

14. Remove the two screws holding the back-up switch or neutral-safety switch to the column and remove the switch.

15. Remove the lower bearing retainer clip (fig. 3B-85).

16. **AUTOMATIC AND FLOORSHIFT COLUMNS**

- Remove the lower bearing retainer, bearing adapter assembly or bushing, shift tube thrust spring and washer. The lower bearing may be removed from the adapter by light pressure on the bearing outer race. Slide out the shift tube assembly.

NOTE: On some models, the bearing and adaptor is replaced by a one-piece bushing. Removal and replacement of both is the same. The bearing adaptor

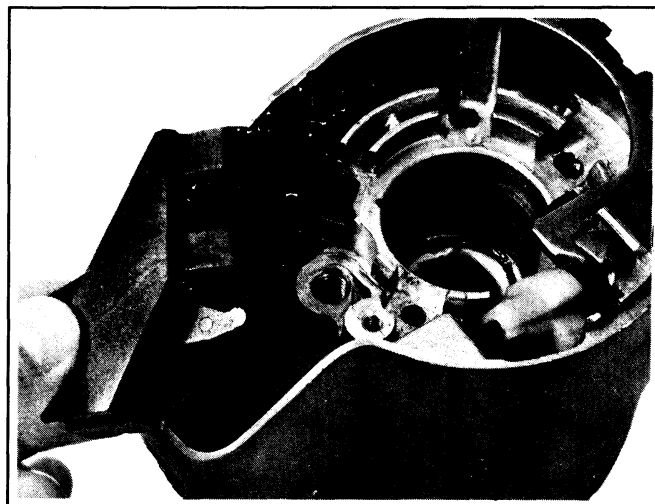


Fig. 3B-82B--Removing Pivot Pin and Pivot assembly-Chevrolet

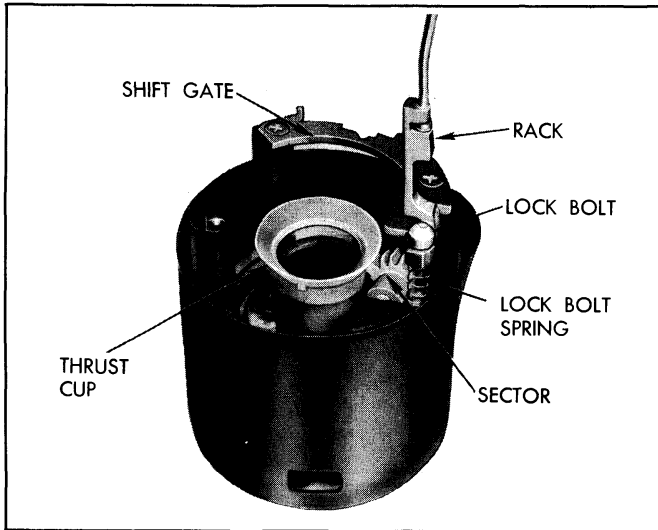


Fig. 3B-83--Turn Signal Housing Assembly

can be used to replace the bushing.

MANUAL TRANSMISSION - COLUMN SHIFT -

Remove the lower bearing adapter, bearing and the first-reverse shift lever. The lower bearing may be removed from the adapter by light pressure on the bearing outer race. Remove the three screws from bearing at the lower end and slide out the shift tube assembly.

17. Remove the gearshift housing lower bowl bearing from the upper end of the mast jacket.

Assembly - All Except Tilt and Tilt-Telescopic Columns

NOTE: Apply a thin coat of any lithium soap based grease to all friction surfaces.

1. Chevrolet only; if removed, assemble upper bearing and retainer.

2. Chevrolet only; if assembly was removed, fit assembly into place and install pivot pin. Tighten to 28 lbs. in. (3 N·m). Install pivot assembly cover and install screw.

3. Install the sector into the turn signal and lock

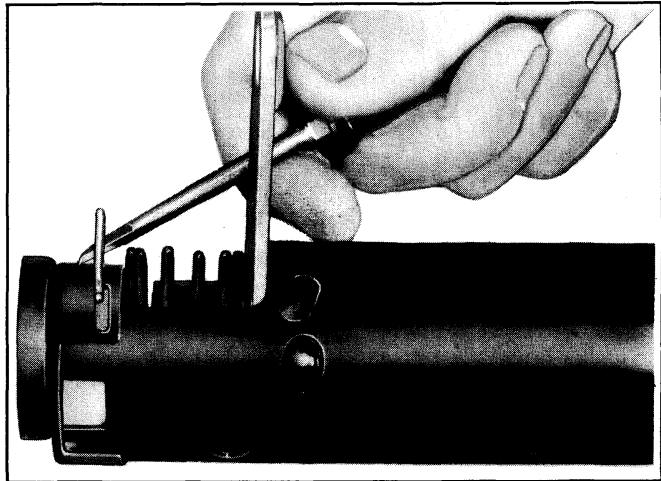


Fig. 3B-85--Removing Lower Bearing Retainer

cylinder housing. Install the sector in the lock cylinder hole over the sector shaft with the tang end to the outside of the hole. Press the sector over the shaft with a blunt tool. Sector should turn freely.

4. Install the shift lever detent plate onto the housing.

5. Insert the rack preload spring into the housing from the bottom side. The long section should be toward the handwheel and hook onto the edge of the housing (fig. 3B-86).

6. Assemble the locking bolt onto the crossover arm on the rack and insert the rack and lock bolt assembly into the housing from the bottom with the teeth up (toward handwheel) and toward the centerline of the column (fig. 3B-83). Align the 1st tooth on the sector with the 1st tooth on the rack; if aligned properly, the block teeth will line up when the rack assembly is pushed all the way in.

7. Install the thrust cup on the bottom hub of the housing (fig. 3B-83) on Chevrolet only; install thrust cup into retainer.

8. Install the gearshift housing lower bearing. Insert the bearing from the very end of the jacket, aligning the indentations in the bearing with the projections on the jacket (fig. 3B-87).

CAUTION: If the bearing is not installed correctly, it will not rest on all of the stops provided.

9. Install the housing and shroud assemblies onto the upper end of the mast jacket. Rotate the housing to be sure it is seated in the bearing. On Chevrolet only; before installing housing, fit dimmer actuator rod into pivot and feed both rods between jacket and bowl while assembling housing.

10. With the shift lever housing in place, install the turn signal and lock cylinder housing onto the jacket. The gearshift housing should be in "Park" position ("REVERSE" for manual shift) and the rack pulled downward. Be sure the turn signal housing is seated on the jacket and install the four screws.

11. Press the lower bearing into the adapter assembly, if removed.

12. Insert the shift tube assembly into the lower end of the jacket and rotate until the upper shift tube key slides into the housing keyway.

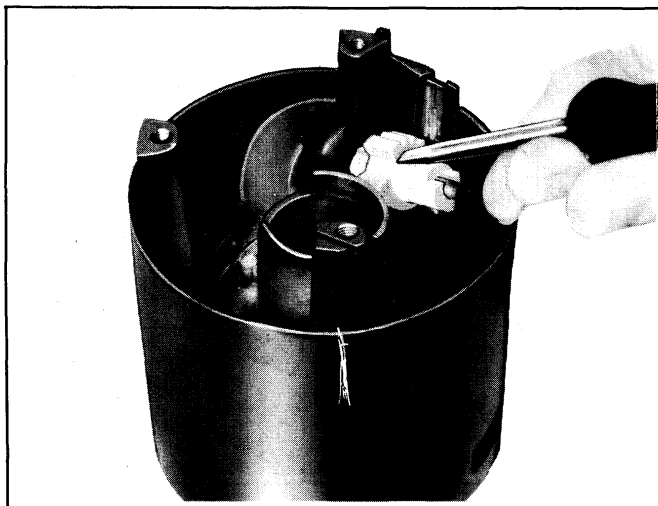


Fig. 3B-84--Removing Ignition Switch Actuator Sector

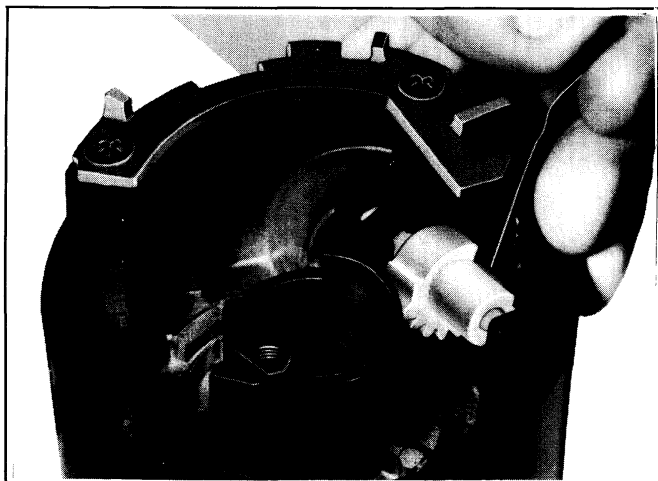


Fig. 3B-86--Installing Rack Preload Spring

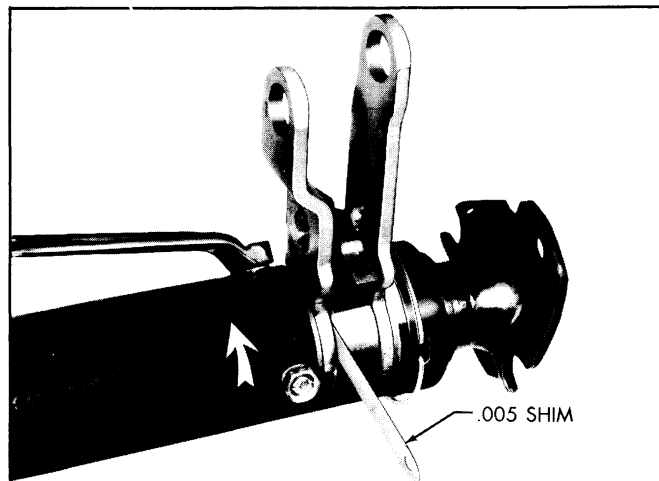


Fig. 3B-88--Adjusting Lower Bearing - Typical

13. AUTOMATIC AND FLOORSHIFT COLUMNS

- Assemble the spring and lower bearing and adapter assembly into the bottom of the jacket. Holding the adapter in place, install the lower bearing reinforcement and retainer clip. Be sure the clip snaps into the jacket and reinforcement slots.

14. MANUAL TRANSMISSION - COLUMN SHIFT - Loosely attach the three screws in the jacket and shift tube bearing. Assemble the 1st-Reverse lever and lower bearing and adapter assembly into the bottom of the jacket. Holding the adapter in place, install the bearing reinforcement and retaining clip. Be sure the retaining clip snaps into the jacket and reinforcement slots.

Place a .005" (0.13mm) shim between the 2nd-3rd lever and lever spacer and turn the upper shift tube bearing down and tighten the three screws. Remove the shim (fig. 3B-88).

15. Install the neutral-safety or back-up switch as outlined in Section 8 of this manual.

16. Slide the steering shaft into the column and install the upper bearing thrust washer.

17. Install the ignition key warning switch, turn signal switch, lock cylinder assembly and ignition switch as

previously outlined in this section.

18. Install the shift lever and shift lever pivot pin.

19. Remove the column from the vise.

20. Install the dash bracket to the column; torque the four screws to specifications.

Disassembly-Tilt

Columns (Fig. 3B-89)

NOTE: Steps 3-14 may be performed with the steering column in the vehicle.

1. Remove the four screws retaining the dash mounting bracket to the column and set the bracket aside to protect the breakaway capsules.

2. Mount the column in a vise using both weld nuts of either Set A or B as shown in Figure 3B-81. The vise jaws must clamp onto the sides of the weld nuts indicated by arrows shown on Set B.

CAUTION: Do not place the column in a vise by clamping onto only one weld nut, by clamping onto one weld nut of both Sets A and B or by clamping onto the sides not indicated by arrows, since damage to the column could result.

3. Remove the directional signal switch, ignition key warning switch, lock cylinder and ignition switch as outlined previously in this section.

4. Remove the tilt release lever. Drive out the shift lever pivot pin and remove the shift lever from the housing.

5. Remove the three housing screws and remove the housing cover.

6. Install the tilt release lever and place the column in the full "up" position. Remove the tilt lever spring retainer using a #3 Phillips screw driver that just fits into the opening. Insert the screw driver in the opening, press in approximately 3/16 (5mm), turn approximately 1/8 turn counter-clockwise until the ears align with the grooves in the housing and remove the retainer, spring and guide (fig. 3B-90).

On Chevrolet only; with cover removed, cap and dimmer rod actuator may be removed then remove pivot pin and pivot assembly if repair is necessary. Tilt lever opening shield may be removed if required.

7. Remove the upper bearing housing pivot pins using Tool J-21854-1 (fig. 3B-91).

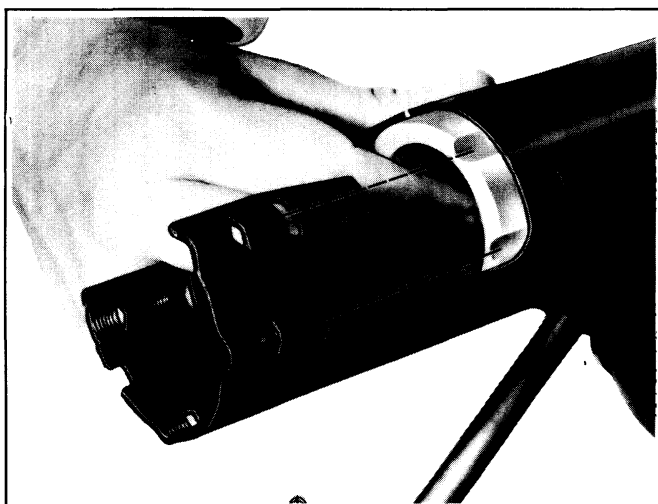


Fig. 3B-87--Installing Gearshift Housing Lower Bearing

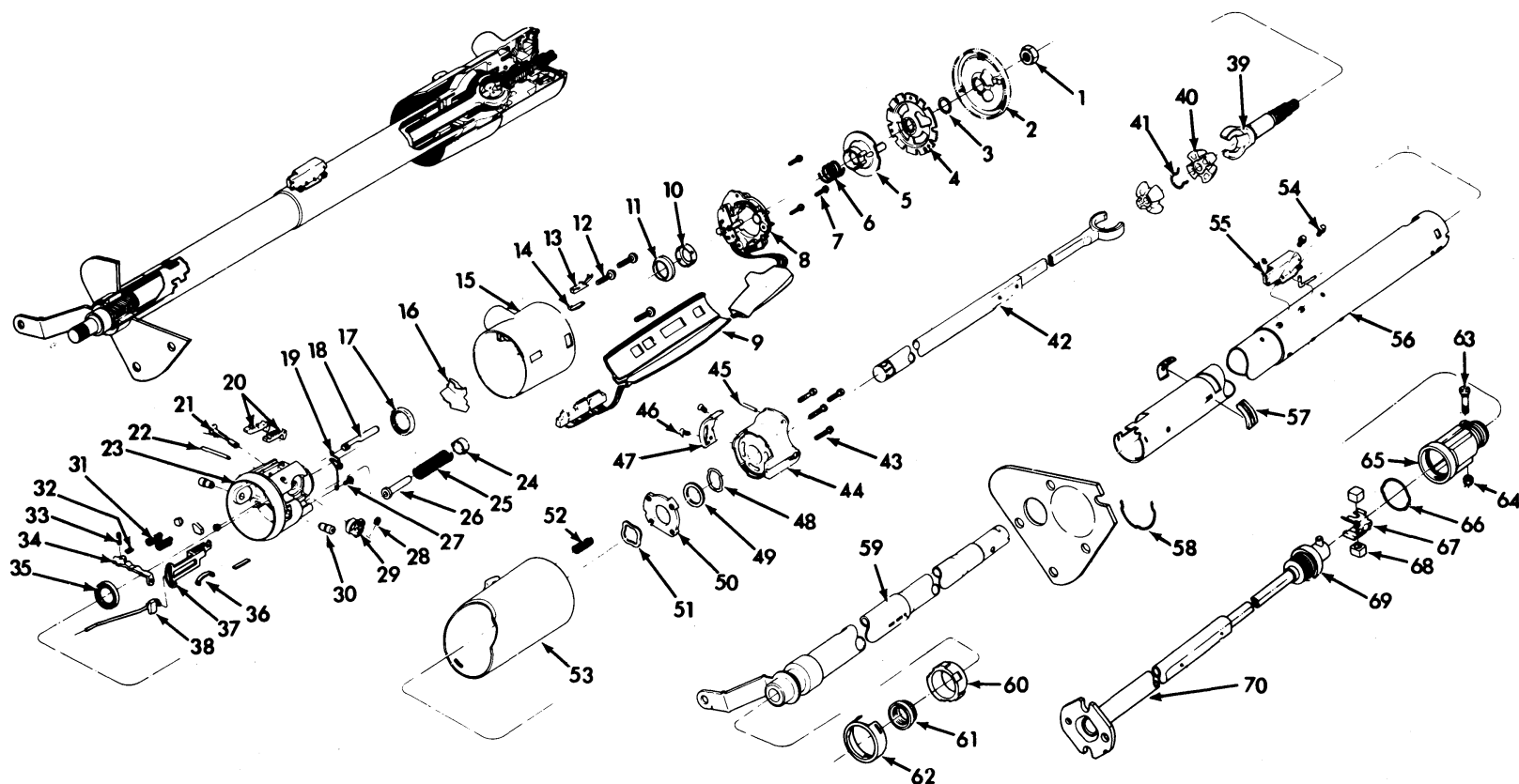


Fig. 3B-89--Tilt Steering Column Assembly (Typical)

1. Shaft Nut
2. Cover
3. Lock Plate Retaining Ring
4. Lock Plate
5. Cancelling Cam
6. Bearing Preload Spring
7. Turn Signal Screws
8. Turn Signal Switch
9. Protector Cover
10. Upper Bearing Seat
11. Upper Bearing Race
12. Turn Signal Housing Screws
13. Key Warning Switch
14. Switch Clip
15. Turn Signal Housing
16. Tilt Lever Opening Shield
17. Upper Bearing
18. Shaft Lock Bolt

19. Lock Bolt Spring
20. Lock Shoes
21. Sector Shaft
22. Lock Shoe Pin
23. Bearing Housing
24. Tilt Lever Spring Retainer
25. Tilt Lever Spring
26. Tilt Lever Spring Guide
27. Lock Bolt Spring Screw
28. Sector Snap Ring
29. Sector
30. Bearing Housing Pivot Pins
31. Shoe Release Springs
32. Spring
33. Shoe Release Lever Pin
34. Shoe Release Lever
35. Lower Bearing
36. Ignition Switch Rack Spring

37. Ignition Switch Rack
38. Ignition Switch Rod
39. Upper Steering Shaft
40. Centering Spheres
41. Center Sphere Spring
42. Lower Steering Shaft
43. Bearing Housing Support Screws
44. Bearing Housing Support
45. Pin
46. Shift Tube Index Plate Screws
47. Shift Tube Index Plate
48. Support Retaining Ring
49. Support Thrust Washer
50. Support Plate Lock
51. Support Wave Washer
52. Gearshift Lever Spring
53. Gearshift Lever Housing
54. Ignition Switch Screws

55. Ignition Switch
56. Mast Jacket
57. Neutral-Safety or Back-Up Switch Retainers
58. Retainer
59. Shift Tube
60. Lower Bearing Adapter
61. Lower Bearing
62. Lower Bearing Reinforcement
63. Pot Joint Bolt
64. Nut
65. Pot Joint Cover
66. Seal Retaining Ring
67. Bearing Spring
68. Bearing Blocks
69. Pot Joint Seal
70. Intermediate Shaft

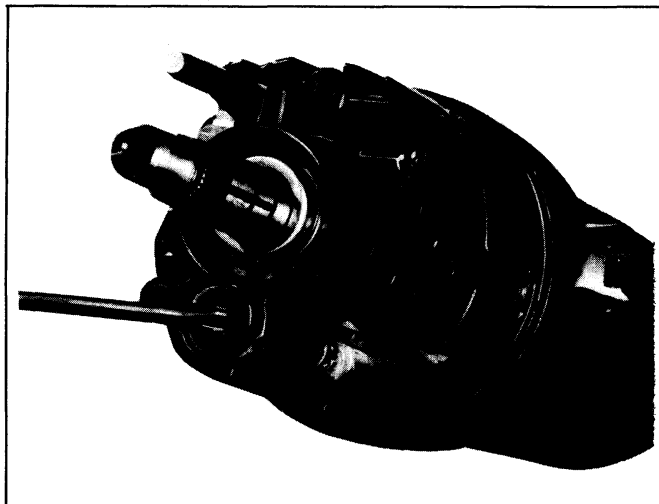


Fig. 3B-90--Removing Tilt Lever Spring Retainer

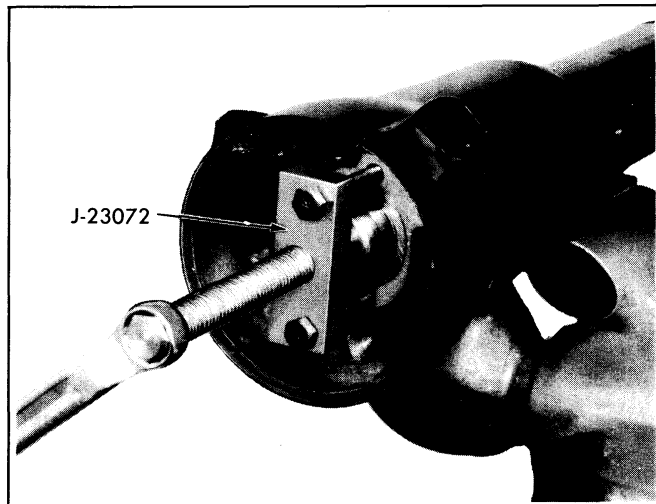


Fig. 3B-92--Removing Shift Tube

8. Install the tilt release lever and disengage the lock shoes. Remove the bearing housing by pulling upward to extend the rack full down, and then moving the housing to the left to disengage the ignition switch rack from the actuator rod.

9. On Chevrolet only; with housing disengaged, rotate it clockwise to free dimmer switch actuator rod.

10. Remove the steering shaft assembly from the upper end of the column. Remove upper bearing seat and inner race.

11. Disassemble the steering shaft by removing the centering spheres and the anti-lash spring.

12. Remove the transmission indicator wire, if so equipped.

13. Remove the four steering shaft bearing housing support to gearshift housing screws and remove the bearing housing support. On Chevrolet only; the dimmer switch actuator rod is removed with the support.

14. Remove the shift tube retaining ring with a screw driver and then remove the thrust washer.

15. Remove clip, bearing retainer and bearing adaptor

assembly (or bushing) from the lower end of jacket.

16. Install Tool J-23072 into the lock plate, making sure that the tool screws have good thread engagement in the lock plate. Then, turning the center screw clockwise, force the shift tube from the housing (fig. 3B-92). Remove the shift tube from the lower end of the mast jacket. Remove Tool J-23072.

CAUTION: When removing the shift tube, be sure to guide the lower end through the slotted opening in the mast jacket. If the tube is allowed to interfere with the jacket in any way, damage to the tube and jacket could result.

17. Remove the bearing housing support lock plate by sliding it out of the jacket notches, tipping it down toward the housing hub at the 12 o'clock position and sliding it under the jacket opening. Remove the wave washer.

18. Remove the shift lever housing from the mast jacket. Remove the shift lever spring by winding the spring up with pliers and pulling it out.

19. Disassemble the bearing housing as follows:

NOTE: Disassemble only the area that needs to be

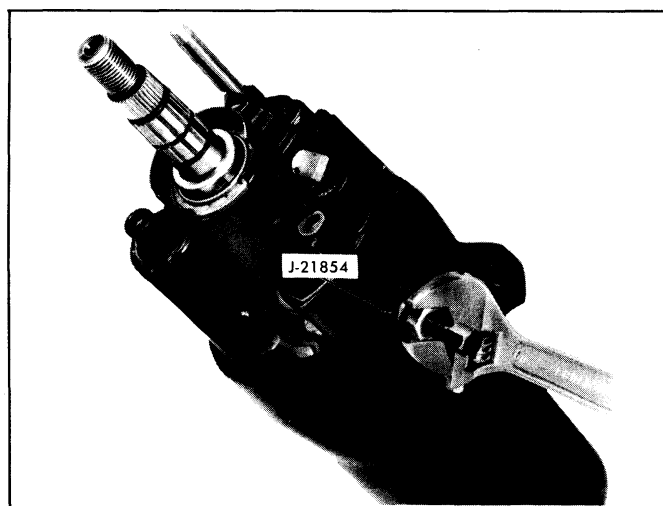


Fig. 3B-91--Removing Bearing Housing Pivot Pins

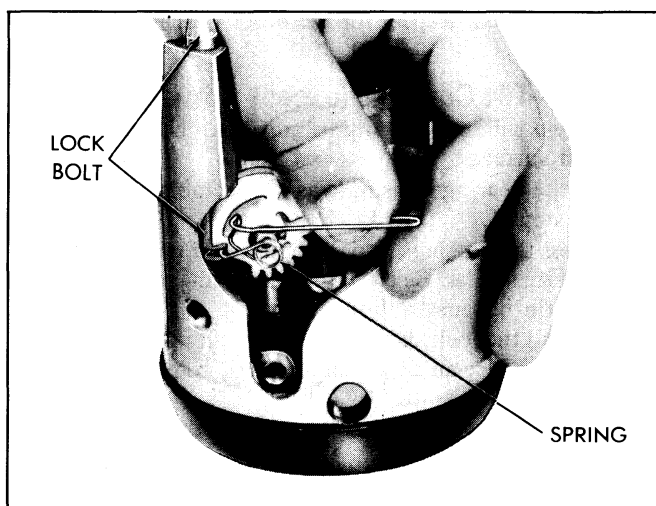


Fig. 3B-93--Replacing Lock Bolt Spring

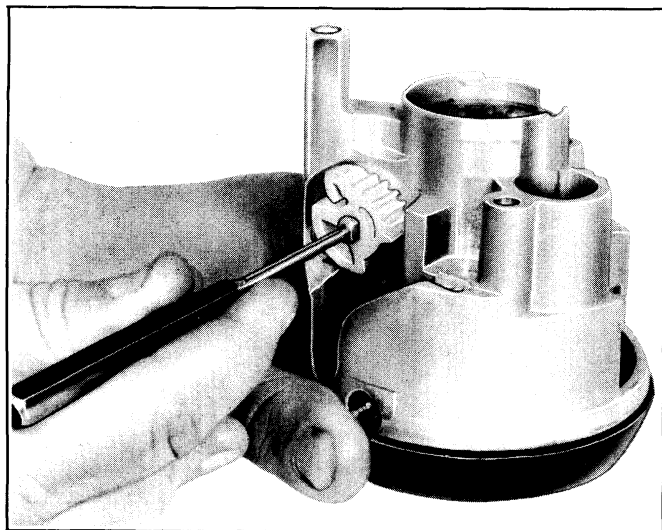


Fig. 3B-94--Removing Sector Drive Shaft

repaired.

a. Remove the tilt lever opening shield.

NOTE: This does not apply to Chevrolet, on which the shield on the column is removed with the cover.

b. Remove the lock bolt spring by removing the retaining screw and moving the spring clockwise to remove it from the bolt (fig. 3B-93).

c. With a small punch, lightly tap the drive shaft from the sector (fig. 3B-94). Remove the drive shaft, sector and lock bolt. Remove the rack and rack spring.

d. Remove the tilt release lever pin with a punch and hammer. Remove the lever and release lever spring. To relieve the load on the release lever, hold the shoes inward and wedge a block between the top of the shoes (over slots) and bearing housing.

e. Remove the lock shoe retaining pin with a punch and hammer. Remove the lock shoes and lock shoe springs.

f. Remove the bearings from the bearing housing only if they are to be replaced. Remove the separator and balls from the bearings. Place the housing on work bench and with a pointed punch against the back surface of the race, carefully hammer the race out of the housing until a bearing puller can be used. Repeat for the other race. Do not reuse bearings.

Assembly--Tilt Columns (except Corvette)

Apply a thin coat of any lithium soap based grease to all friction surfaces.

1. If the bearing housing was disassembled, repeat the following steps:

a. Press the bearings into the housing, if removed, using a suitable size socket. Be careful not to damage the housing or bearing during installation.

b. Install the lock shoe springs, lock shoes and shoe pin in the housing. Use an approximate .180" rod to line up the shoes for pin installation.

c. Install the shoe release lever, spring and pin.

NOTE: To relieve the load on the release lever, hold the shoes inward and wedge a block between the top of the shoes (over slots) and bearing housing.

d. Install the sector drive shaft into the housing.

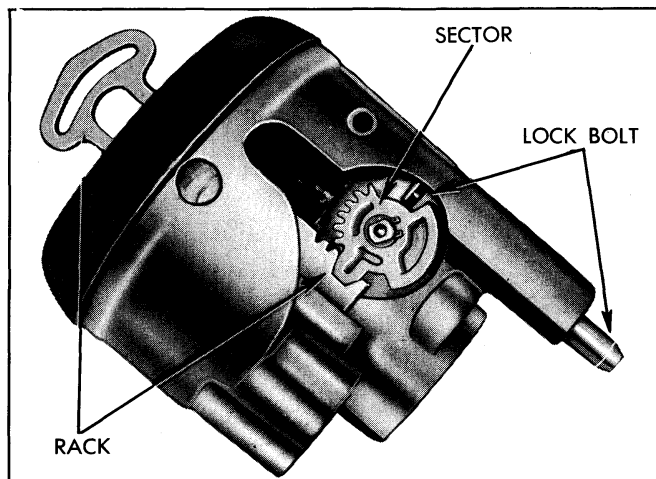


Fig. 3B-95--Installing Lock Bolt and Rack Assemblies

Lightly tap the sector onto the shaft far enough to snap sector in drive shaft groove. Install the snap ring.

e. Install the lock bolt and engage it with the sector cam surface. Then install the rack and spring. The block tooth on the rack should engage the block tooth on the sector (fig. 3B-95). Install the external tilt release lever.

f. Install the lock bolt spring and retaining screw (fig. 3B-93). Tighten the screw to 35 lbs. in. (4 N·m).

2. Install the shift lever spring into the housing by winding it up with pliers and pushing it into the housing.

3. Install the bearing support lock plate wave washer.

4. Install the bearing support lock plate. Work it into the notches in the jacket by tipping it toward the housing hub at the 12 o'clock position and sliding it under the jacket opening. Slide the lock plate into the notches in the jacket.

5. Carefully install the shift tube into the lower end of the mast jacket. Align keyway in the tube with the key in the shift lever housing. Install the wobble plate end of Tool J-23073 into the upper end of the shift tube far enough to reach the enlarged portion of the tube. Then install the adapter over the end of the tool, seating it against the lock plate. Place the nut on the threaded end of the tool and pull the shift tube into the housing (fig. 3B-96). Remove Tool J-23073.

CAUTION: Do not push or tap on the end of the shift tube. Be sure that the shift tube lever is aligned with the slotted opening at the lower end of the mast jacket or damage to the shift tube and mast jacket could result.

6. Install the bearing support thrust washer and retaining ring by pulling the shift lever housing up far enough to compress the wave washer.

7. On Chevrolet only; slip actuator rod through hole in support and between bowl and jacket.

8. Install the bearing support by aligning the "V" in the support with the "V" in the jacket. Insert the screws through the support and into the lock plate and torque to 60 lbs. in. (7.0 N·m).

9. Align the lower bearing adapter with the notches in the jacket and push the adapter into the lower end of the mast jacket. Install lower bearing, bearing reinforcement and retaining clip, being sure that the clip is aligned with the slots in the reinforcement, jacket and adapter.

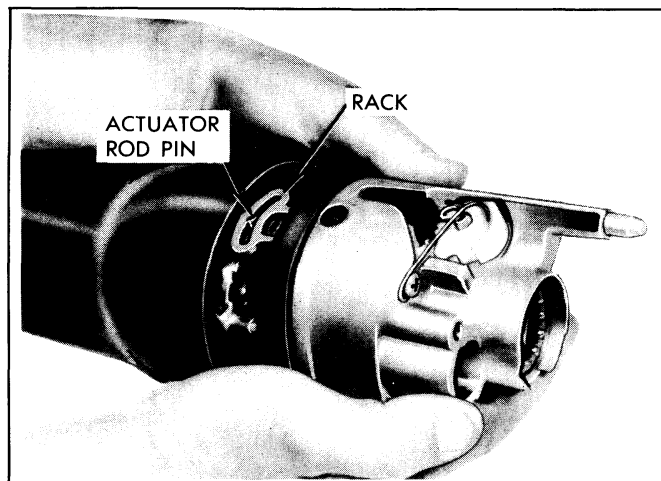


Fig. 3B-96--Installing Bearing Housing

10. Install the centering spheres and anti-lash spring in the upper shaft. Install the lower shaft from the same side of the spheres that the spring ends protrude.

11. Install the ignition switch actuator rod through the shift lever housing and insert in the slot in the bearing support. Extend the rack downward from the bearing housing.

12. Assemble the bearing housing over the steering shaft and engage the rack over the end of the actuator rod (fig. 3B-97) on Chevrolet only; position access hole of the bearing housing over the end of the actuator rod and rotate housing counterclockwise to assembly.

13. With the external release lever installed, hold the lock shoes in the disengaged position and assemble the bearing housing over the steering shaft until the pivot pin holes line up with holes in the support.

14. Install the pivot pin assemblies as far as possible using palm pressure to prevent broaching of support pivot hole. Once started, tap home with a small punch.

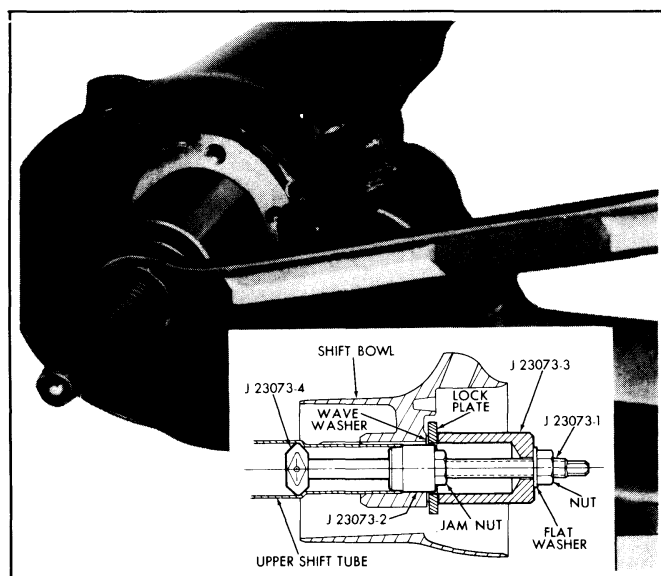


Fig. 3B-97--Installing Shift Tube

15. Place the bearing housing in the full "up" position and install the tilt lever spring guide, spring and spring retainer. With a suitable screw driver, push the retainer in and turn clockwise to engage in the housing.

16. On all except Chevrolet, install the tilt lever opening shield in housing.

17. On Chevrolet only; replace pivot assembly in cover, if removed, and install pivot pin. Replace tilt lever opening shield in cover if removed. Position cap over rod actuator. Guide end of rod actuator into pivot slot during cover assembly. Hold cap so that cover will slide over it.

18. Remove external tilt release lever. Install housing cover and seat screw at 12 o'clock position first, tighten screws 100 lbs. in. (11 N·m).

19. Install the tilt release lever and shift lever. Drive the shift lever pin in.

20. Install the ignition key warning switch, lock cylinder, turn signal switch and ignition switch as outlined previously in this section.

21. Install the neutral-safety switch or back-up switch as outlined in Section 8 of this manual.

22. Install the four dash panel bracket to column screws and torque to specifications.

CAUTION: Be sure that the slotted openings in the bracket (for the mounting capsules) face the upper end of the steering column.

Corvette Standard Column

CAUTION: All elements of energy-absorbing columns are sensitive to damage and must be handled with care.

Disassembly

Steps 1 thru 13 can be performed in or out of the vehicle.

1. Unsnap switch connector from jacket bracket.

2. Remove wheel nut retainer and then wheel nut.

CAUTION: Do not over expand the retainer.

3. Remove steering wheel using standard wheel puller.

CAUTION: Do not hammer on end of steering shaft, or plastic injections will loosen.

4. Position screw driver blade into one of the three cover slots. Pry up and out (at least two slots) to free cover from lock (Fig. 3B-98).

5. Depress shaft lock with finger and pry retaining ring out of groove with screw driver. Tool J-23653 can be used (Fig. 3B-99), but the full load of the spring should not be relieved as then the ring would rotate, making removal more difficult. Remove ring and lock plate.

CAUTION: Do not reuse ring.

CAUTION: With ring removed, shaft could slide out bottom of column and cause damage to the shaft.

6. Slide upper bearing preload spring and turn signal cancelling cam off upper steering shaft.

7. Slide thrust washer off upper steering shaft.

8. Remove multi-function lever. Rotate clockwise to stop (off position). Pull straight out to disengage.

9. Push hazard warning switch in and unscrew knob.

10. Remove two screws, pivot arm and spacer (Fig. 3B-100).

NOTE: Pivot arm retains spacer. Be careful not to lose spacer when removing arm.

11. Remove the three signal switch mounting screws.

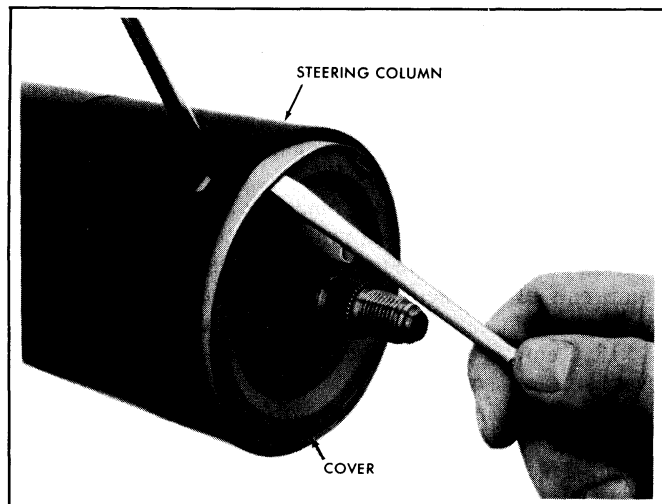


Fig. 3B-98--Removing Cover - Corvette

Pull the switch straight up being careful not to snag the connector in the housing.

12. The lock cylinder should be removed in the "run" position. Insert a thin tool (small screw driver or knife blade) into the slot next to the switch mounting screw boss (right hand slot) and depress retainer at bottom of slot. This releases the lock. Remove lock.

13. The buzzer switch can be pulled straight out of the housing. A "straightened" paper clip or similar piece of stiff wire with a hook bent on one end should be inserted in the exposed loop of the wedge spring, then a straight pull on the wire will remove both spring and switch (Fig. 3B-101). If the lock cylinder is not removed before the switch, it must be in the "on" position.

CAUTION: If wedge spring is dropped on removal, it could fall into the column, requiring complete disassembly to retrieve spring.

14. Remove upper attaching screw (Fig. 3B-102). This releases the dimmer switch.

15. To remove ignition switch. Position the switch in the "off-unlocked" position by pulling the actuator rod up

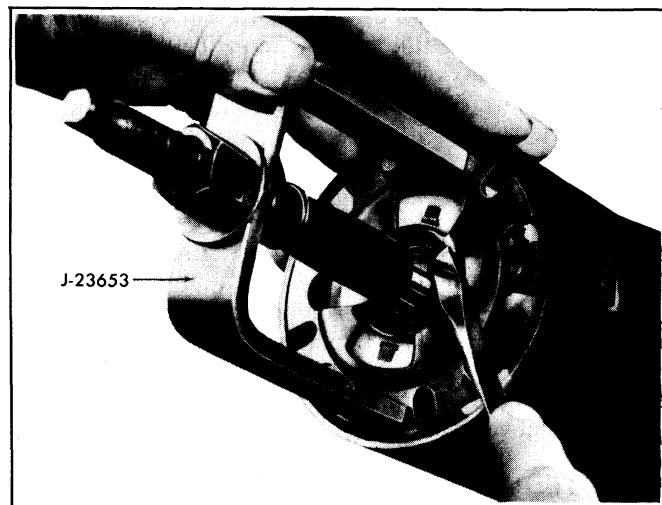


Fig. 3B-99--Removing Retainer Ring - Corvette

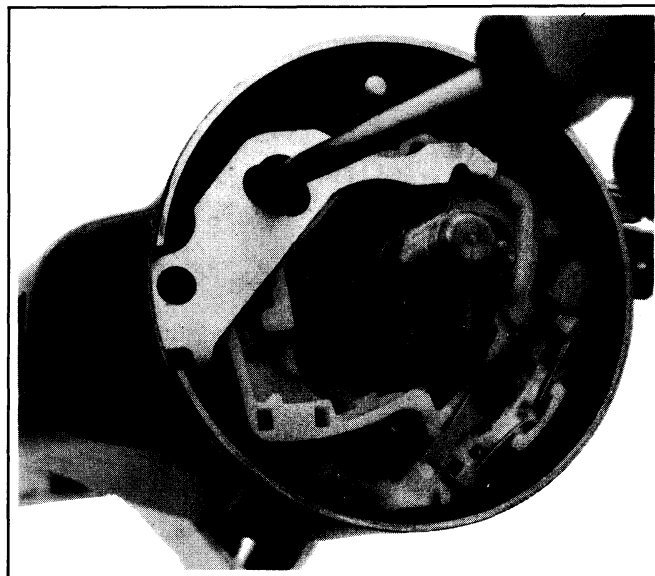


Fig. 3B-100--Removing Pivot Arm - Corvette

to a definite stop. Remove the lower attaching screw.

16. The washer/wiper switch and pivot assembly may now be removed (Fig. 3B-103).

17. Remove the three oval head screws securing the housing and shroud assembly to the jacket 3B-104.

18. Separate ignition switch actuator from rack.

19. Tip housing and shroud assembly upside down. Remove three screws (Fig. 3B-105). Separate shroud from housing. Wave washer may separate from lever boss. If not, remove. Remove release lever and spring.

20. Remove rack and bolt assembly (Fig. 3B-106). If required, pull rack away from lock bolt to separate.

21. Remove rack preload spring (Fig. 3B-107). Upper bearing and retainer can not be removed. Use suitable sized socket. Press bearing and retainer out (Fig. 3B-108).

NOTE: Do not remove bearing unless replacement is

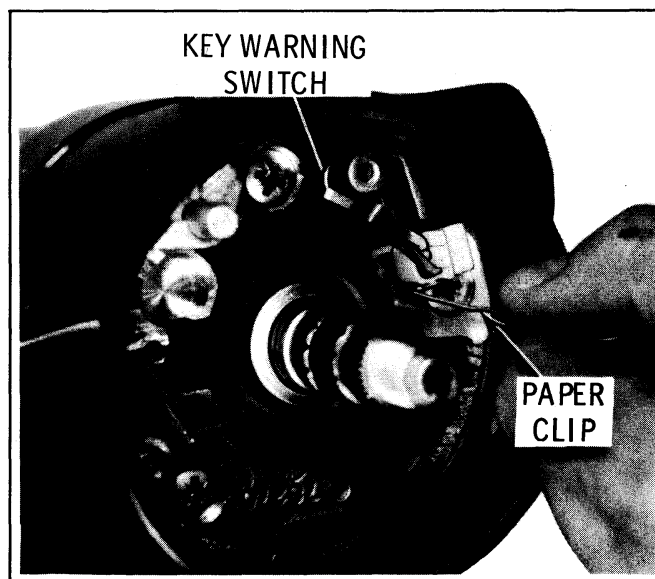


Fig. 3B-101--Removing Buzzer Switch and Spring Assembly

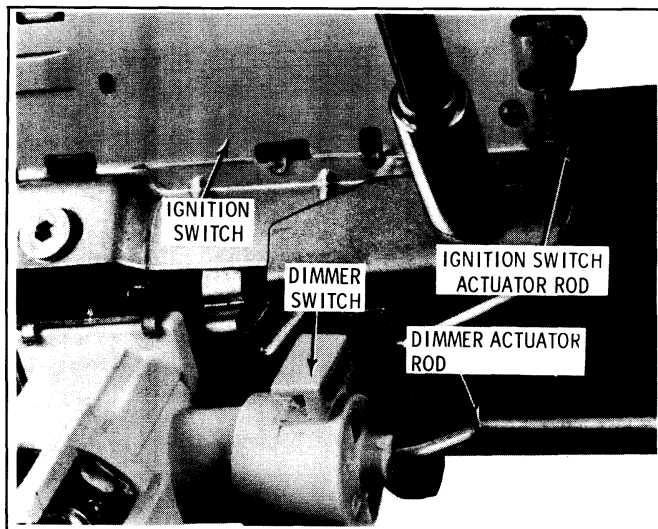


Fig. 3B-102--Removing Ignition and Dimmer Switch - Corvette

required.

22. Remove sector through the lock cylinder hole by pushing firmly on the block tooth of the sector with a blunt punch (Fig. 3B-109).

23. Pull steering shaft out through bottom of the column. If replacement is required, tap on adapter around the full diameter with hammer and punch (Fig. 3B-110). It is not uncommon to destroy the adapter when removing it.

NOTE: Removal of the lower bearing or adapter is discouraged unless replacement of either is required. The bearing and adapter are serviced as an assembly.

Reassembly

If removed, reassemble upper bearing and retainer.

1. Install sector in the lock cylinder hole over the sector shaft with tang end to outside of the hole. Press the sector over the pin with a blunt tool. Sector should turn freely when installed.

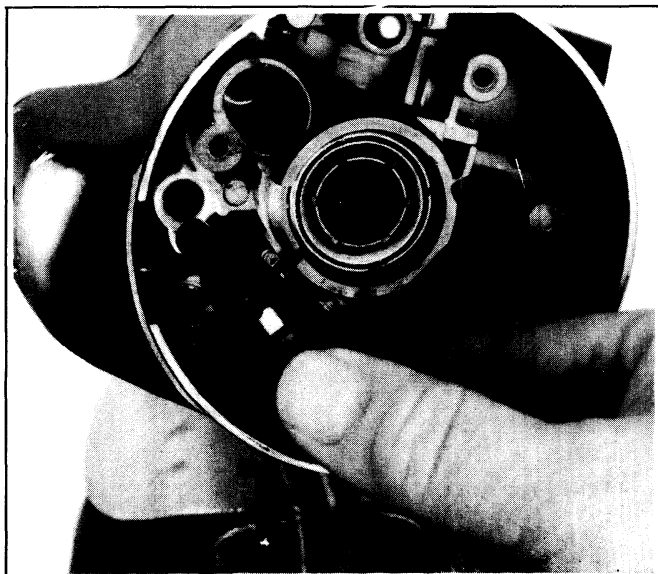


Fig. 3B-103--Removing Switch and Pivot Assembly - Corvette

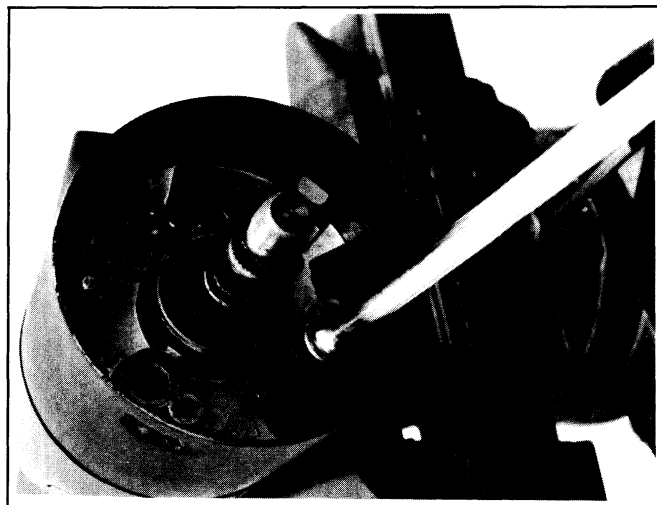


Fig. 3B-104--Removing Housing and Shroud to Jacket Screw - Corvette

2. Insert rack preload spring (Fig. 3B-107). Bow of spring out against rack.

NOTE: Spring is symmetrical so there is not up or down.

3. Assemble bolt to cross-over arm of rack (Fig. 3B-111).

4. Insert the rack and lock-bolt assembly (Fig. 30). Position rack tooth sector so that the block teeth match.

5. Position lever return spring over tapped post as shown (Fig. 3B-112). Slip lever finger into rack slot and hole over tapped post. Make sure inner end of spring contact lever as shown.

6. Raise lever slightly. Slip end of spring between lever and boss, and then down to secure.

7. Coat wave washer with chassis lube and place on tapped boss over release lever.

8. Carefully position shroud into housing so as not to un-seat wave washer. Drive three screws (washer first) and tighten to 18 lbs. in. (2.0 N·m).

9. Place ignition switch actuator rod into rack. (Short end of rod into rack).



Fig. 3B-105--Removing Shroud to Bowl Screws

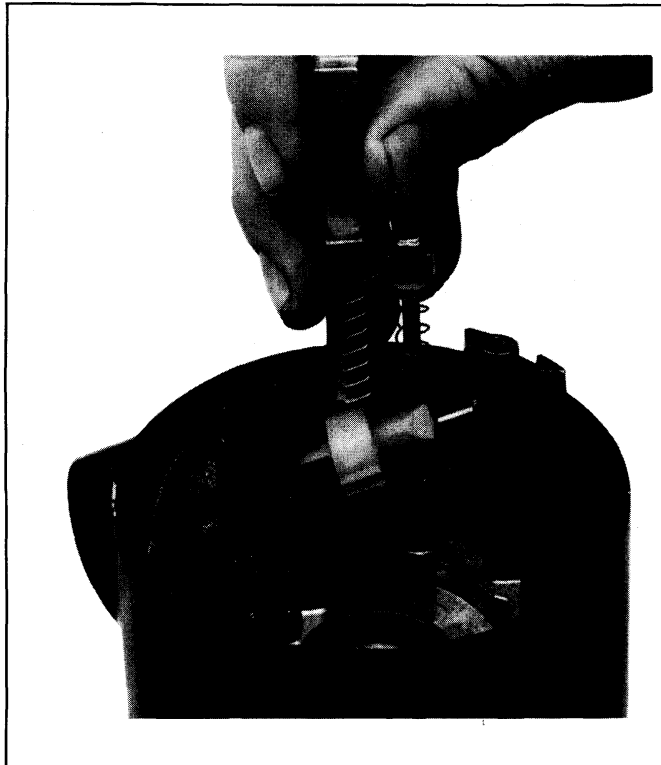


Fig. 3B-106--Rack and Bolt Removal - Corvette

10. Assemble washer/wiper switch and pivot assembly into housing, and feed connector down through bowl and shroud assembly (Fig. 3B-103).

11. Assemble buzzer switch into spring clip with formed end of clip around lower end of the switch (Fig. 3B-113). Push switch and spring assembly into hole with the internal switch contacts toward the lock cylinder bore.

12. Install lock cylinder. Hold cylinder sleeve in left hand and rotate knob (key in) clockwise to stop. (This retracts actuator). Insert cylinder into housing bore with key on cylinder sleeve aligned with keyway in housing. Push cylinder in until it bottoms. Rotate knob counterclockwise,

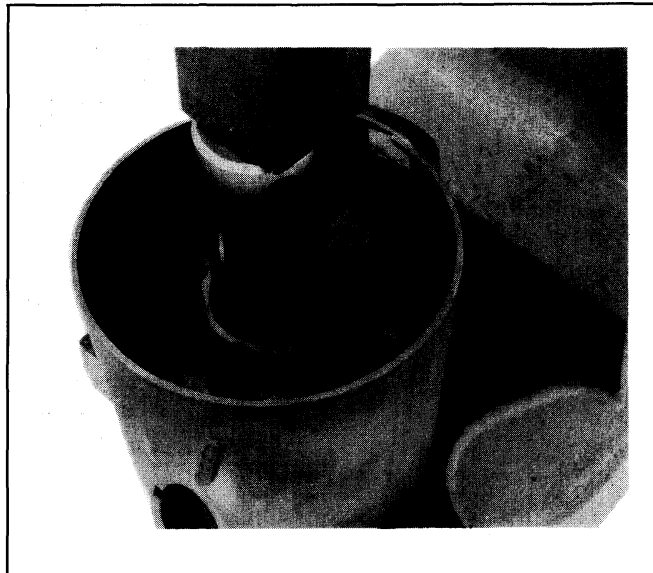


Fig. 3B-108--Removing Upper Bearing and Retainer-Corvette

maintaining a light pressure inward until drive section of cylinder mates with sector. Push cylinder in fully until retainer pops into housing groove. Cylinder cannot be removed by merely pulling on it.

13. Turn cylinder clockwise to stop and then counterclockwise to stop "off-unlock" position. Place ignition switch in the "off-unlock" position using the following procedure.

Position the ignition switch as it is shown in Fig. 3B-114. Move the slider two positions to the right from "accessory" to the "off-unlock" position. Fit the actuator rod into the slider hole and assemble to the column with two screws. Caution should be exercised to prevent moving the switch out of detent. Use only the correct screws. Tighten only bottom screw to 35 lbs. in. (4 N·m).

14. If lower bushing was removed, press in new. Align projection in bushing with slot in jacket. Press bushing into jacket until it bottoms.

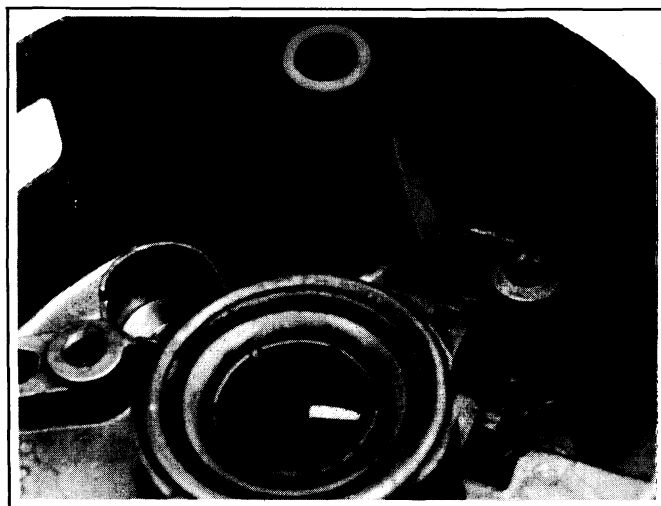


Fig. 3B-107--Rack Preload Spring Removal - Corvette

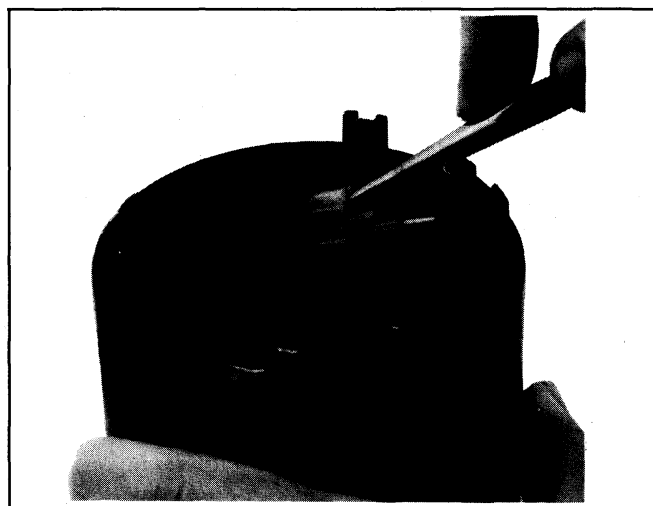


Fig. 3B-109--Sector Removal - Corvette

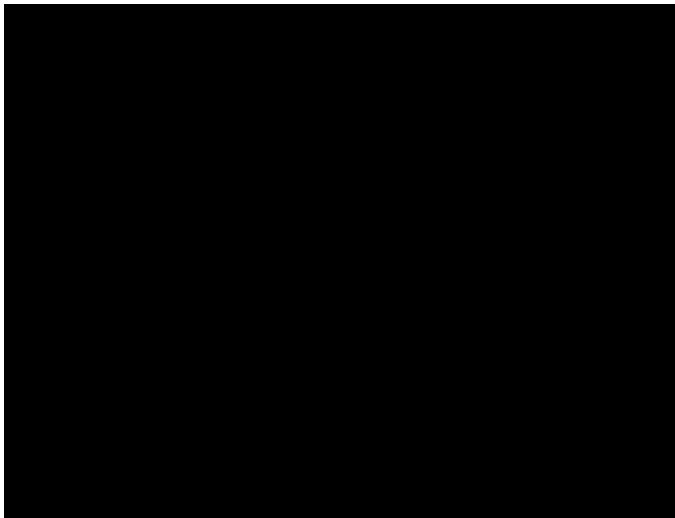


Fig. 3B-110--Lower Bearing Adapter Removal - Corvette

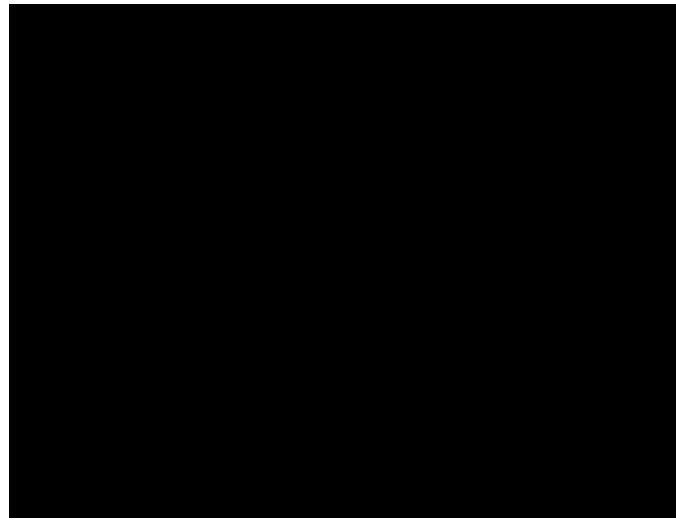


Fig. 3B-112--Spring and Lever Position - Corvette

15. Insert steering shaft up through lower bushing and upper bearing.

16. Position switch into housing assembly. Drive three screws. Replace spacer and pivot arm. Be sure spacer protrudes through hole in arm and that arm finger encloses signal switch frame. Tighten the truss head screw (screw that secures spacer to signal switch) to 20 lbs. in. (2.4 N·m), and the flat head to 35 lbs. in. (4.0 N·m).

17. Assemble washer, spring and cancelling cam on the steering shaft. The two lobes on cam to center between springs on switch (Fig. 3B-115). The signal switch must be in "neutral" position and the hazard warning plunger in "out" position.

18. Assemble the shaft lock onto the shaft. Using tool J-2365, depress the spring and snap a new retaining ring in groove on the shaft (Fig. 3B-116).

19. Install multi-function lever. Align lever pin with switch slot. Push on end of lever until seated securely.

Remove upper ignition switch screw. Fit pinched end of dimmer switch actuator rod into dimmer switch. Feed other end of rod into pivot switch. Drive, but do not tighten

the upper ignition switch screw. Depress dimmer switch slightly to feed 3/32 drill to lock switch to body " (Fig. 3B-117). Force switch up to remove lash between both switches and rod. Drive upper ignition switch screw and tighten to 35 lbs. in. (4 N·m). Remove drill and check dimmer switch function by actuating lever.

20. Remove mounting tool J-23074 and replace I.P. mounting bracket. Drive four screws and tighten to 22 lbs. ft. (30 N·m).

21. Replace dimmer switch and washer/wiper switch connectors.

22. Install steering wheel. Torque steering wheel nut to 30 lbs. ft. (41 N·m). Install nut retainer.

CAUTION: *Do not over-expand retainer.*

Corvette Tilt Telescopic Column (Fig. 3B-118)

Disassembly

NOTE: Steps 2 thru 7 may be performed with the steering column in the vehicle.

1. Mount the column in a vise using the column support bracket.

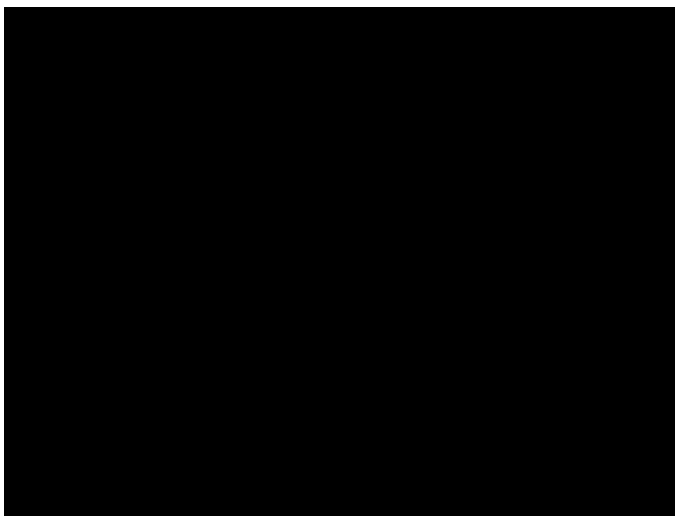


Fig. 3B-111--Bolt to Rack Assembly - Corvette

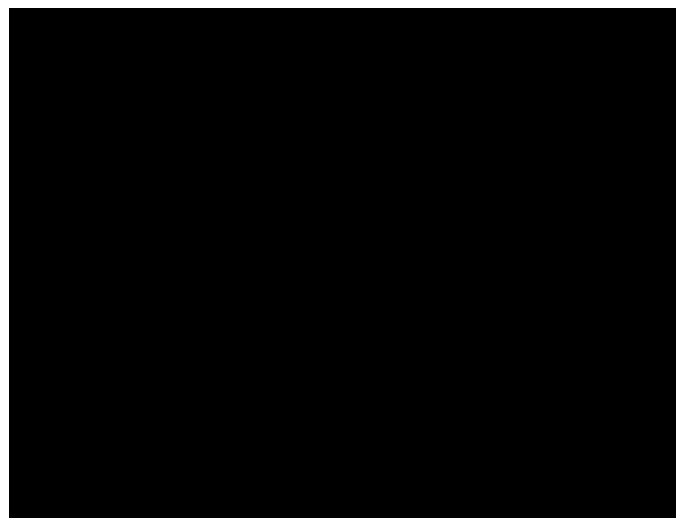


Fig. 3B-113--Position of Buzzer Switch and Spring Retainer - Corvette

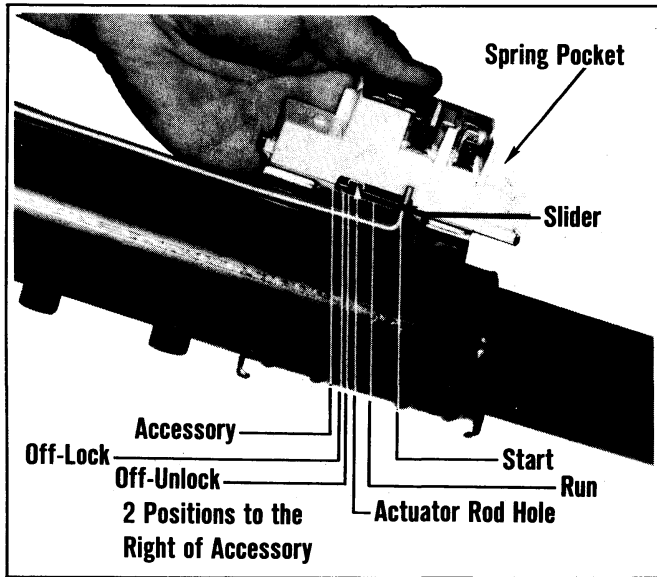


Fig. 3B-114--Positioning ignition switch - Corvette

CAUTION: Do not place the column in a vise by clamping onto the column itself. Clamp only to the column support bracket.

2. Remove the directional signal switch, ignition key warning switch, lock cylinder, ignition switch, housing and wash/wipe switch outlined previously in this section.

3. Install the tilt release lever and place the column in the full "up" position. Remove the tilt lever spring retainer using a Phillips screw driver that just fits into the opening. Insert the screw driver in the opening, press in approximately $\frac{3}{16}$ ", turn approximately $\frac{1}{8}$ turn counterclockwise until the ears align with the grooves in the housing and remove the retainer, spring and guide.

4. Remove upper attaching screw. This releases the dimmer switch and its actuator rod.

5. Remove ignition switch. Position the switch in the

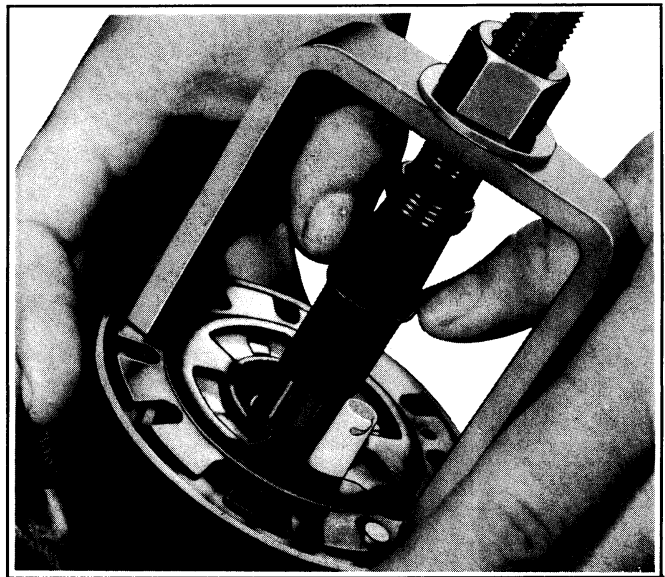


Fig. 3B-116--Installing Retaining Ring - Corvette

"off-unlocked" position by pulling the actuator rod up to a definite stop. Remove the attaching screw(s), and then the switch.

6. Remove the upper bearing housing pivot pins using Tool J-21854-1.

7. Install the tilt release lever and disengage the lock shoes. Remove the bearing housing by pulling upward to extend the rack full down, and then moving the housing to the left to disengage the ignition switch rack from the actuator rod.

8. Remove the steering shaft assembly from the upper end of the column.

9. Remove the four steering shaft bearing housing support to gearshift housing screws and remove the bearing housing support. Remove the ignition switch actuator rod.

10. Remove lock plate. Tip top of plate back and rotate to slightly counterclockwise to remove.

11. Separate the shroud from the jacket with a twisting, pulling motion.

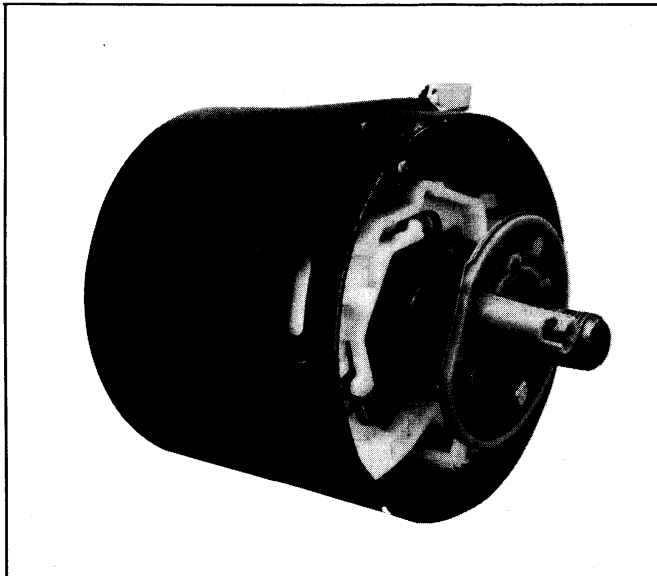


Fig. 3B-115--Position of Cancelling Cam Lobes in relation to Signal Switch Springs - Corvette

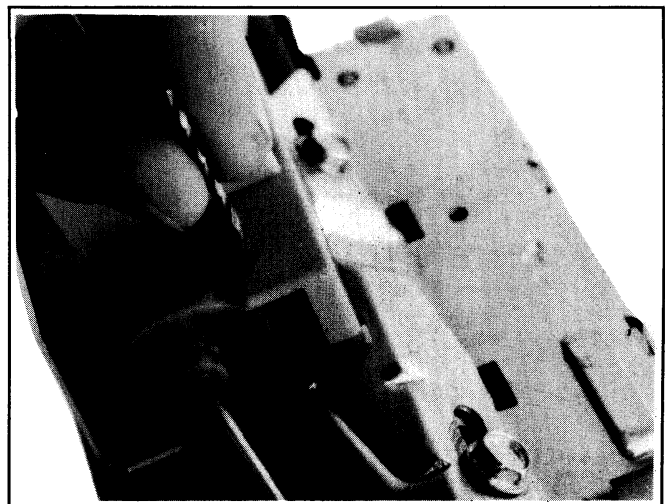
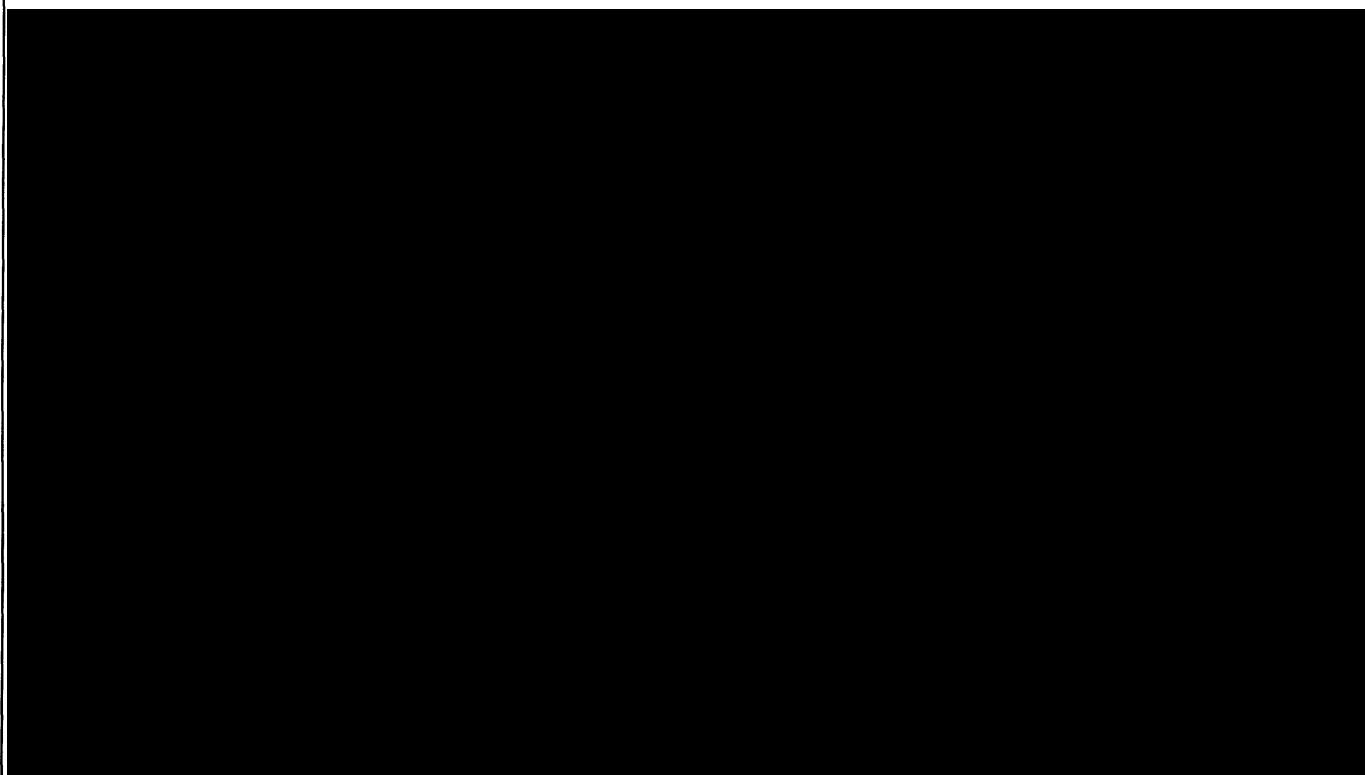


Fig. 3B-117--Positioning Dimmer Switch - Corvette



Key No.	Part Name
1	COLUMN ASSY., SHF. & E/A (T&T)
2	BEARING ASSY.
3	PIN, RELEASE LEVER
4	SPRING, RELEASE LEVER
5	SPRING, SHOE
6	PIN, PIVOT
7	PIN, DOWEL
8	SHAFT, DRIVE
9	SHOE, STEERING WHEEL LOCK
10	SHOE, STEERING WHEEL LOCK
11	SPRING, LOCK BOLT
12	BOLT LOCK
13	BEARING ASSY.
14	CLIP, BUZZER SWITCH RETAINING
15	SWITCH ASSY., BUZZER
16	SCREW, OVAL HEAD CROSS RECESS
17	RACE, INNER
18	SEAT, UPPER BEARING INNER RACE
19	SWITCH ASSY., TURN SIGNAL
20	SCREW, BINDING HD. CROSS RECESS
21	CARRIER ASSY.
22	LOCK, STEERING SHAFT
23	LEVER, HAZARD SWITCH
24	RETAINER, CARRIER SNAP RING

Key No.	Part Name
25	RING, RETAINING
26	SPRING, UPPER BEARING
27	PROTECTOR, WIRING
28	COVER, LOCK HOUSING
29	SHIELD, TILT LEVER OPENING
30	RETAINER, SPRING
31	SPRING, WHEEL TILT
32	GUIDE, SPRING
33	SCREW, HEX. WASHER HEAD
34	RING, RETAINING
35	SECTOR, SWITCH ACTUATOR
36	HOUSING, STEERING COLUMN
37	SPRING, RACK PRELOAD
38	RACK, SWITCH ACTUATOR
39	LEVER, SHOE RELEASE
40	ACTUATOR, ASSY., IGNITION SWITCH
41	BOWL, GEARSHIFT LEVER
42	SPRING, SHIFT LEVER
43	WASHER, WAVE
44	PLATE, LOCK
45	WASHER, THRUST
46	RING, SHIFT TUBE RETAINING
47	SCREW, OVAL HEAD CROSS RECESS
48	GATE, SHIFT LEVER

Key No.	Part Name
49	SUPPORT, STRG. COLUMN HOUSING
50	SCREW, SUPPORT
51	PIN, DOWEL
52	SHAFT ASSY., STEERING
53	SPHERE, CENTERING
54	SPRING, JOINT PRELOAD
55	YOKE ASSY., RACE & STRG.
56	SCREW, WASH. HD.
57	SWITCH ASSY., IGNITION
58	JACKET ASSY., STEERING COLUMN
59	CLIP, LOWER BEARING ADAPTER
60	SEAL, DASH
61	TUBE ASSY., SHIFT
62	RETAINER, BEARING ADAPTER
63	BEARING ASSY.
64	ADAPTER, LOWER BEARING
65	FLANGE, STEERING SHAFT
66	BOLT, 12 POINT
67	BUMPER, RETRACTED STRG. SHAFT
68	SHIELD, T/S LEVER OPENING
69	ROD, TELESCOPE LOCKING
70	SHAFT, UPPER STEERING
71	WEDGE, LOCKING

Fig. 3B-118--Tilt-Telescopic Column - Corvette

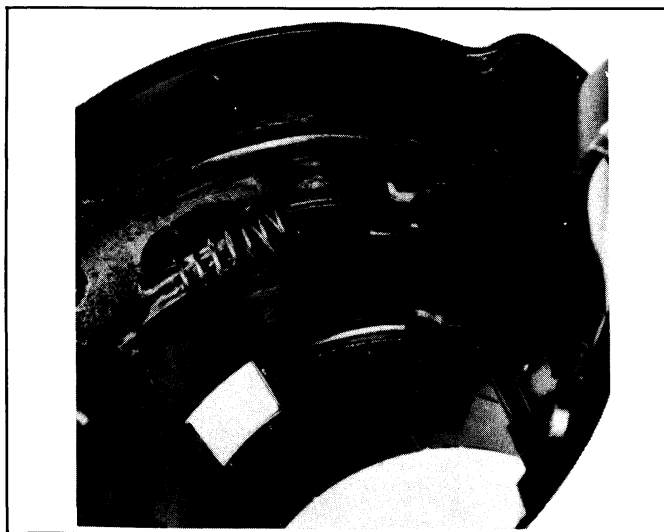


Fig. 3B-119—Remove Key Release Lever - Corvette

Bearing Housing Disassembly

12. Disassemble the bearing housing as follows:

a. Remove the lock bolt spring by removing the retaining screw and moving the spring clockwise to remove it from the bolt.

b. With a small punch, lightly tap the drive shaft from the sector. Remove the drive shaft, sector and lock bolt. Remove the rack and rack spring.

c. Remove the tilt release lever pin with a punch and hammer. Remove the lever and release lever spring. To relieve the load on the release lever, hold the shoes inward and wedge a block between the top of the shoes (over slots) and bearing housing.

d. Remove the lock shoe retaining pin with a punch and hammer. Remove the lock shoes and lock shoe springs.

e. Remove bearings from bearing housing only if they are to be replaced. Remove separator and balls from bearing. Place housing on work surface. With a pointed punch against back surface of race, carefully drive race, out of housing until bearing puller can be used. Repeat for other race. Do not re-use bearings.

Shroud Disassembly

1. Remove key release lever (Fig. 3B-119).

2. Tilt lever handle slightly toward center to clear stop on shroud.

3. Move lever counterclockwise until it stops.

4. Lift lever straight out.

Assembly-Tilt and Tilt-Telescopic Columns

Apply a thin coat of any lithium soap based grease to all friction surfaces.

Shroud Assembly

1. Position spring on key release lever into shroud slot. Compress spring by forcing with lever. With spring compressed, lever will slip into shroud slot.

2. If the bearing housing was disassembled, repeat the following steps:

a. Press the bearings into the housing, if removed, using a suitable size socket. Be careful not to damage the housing

or bearing during installation.

b. Install the lock shoe springs, lock shoes and shoe pin in the housing. Use an approximate .180" rod to line up the shoes for pin installation.

c. Install the shoe release lever, spring and pin.

NOTE: To relieve the load on the release lever, hold the shoes inward and wedge a block between the top of the shoes (over slots) and bearing housing.

d. Install the sector drive shaft into the housing. Lightly tap the sector onto the shaft far enough to install the snap ring. Install the snap ring.

e. Install the lock bolt and engage it with the sector cam surface. Then install the rack and spring. The block tooth on the rack should engage the block tooth on the sector. Install the external tilt release lever.

f. Install the lock bolt spring and retaining screw. Tighten the screw to 35 lbs. in. (4 N·m).

3. Assemble shroud to jacket.

4. Install lock plate into place. Work lock plate into notches in jacket by tipping lock plate toward 12 o'clock position and under jacket opening. Slide lock plate into notches in jacket.

5. Guide both dimmer actuator rod and ignition switch rod through the shroud. Line up "V" of support with notch in jacket. Press support into jacket. Press key release lever down to fully seat support. Start support screws in with fingers. With all started, tighten to 60 lbs. in. (7.0 N·m).

6. Install steering shaft assembly. Turn slowly as inserting to clear inner seal.

7. Holding lock shoes in disengaged position, assemble bearing housing over steering shaft until pivot pin holes line up with the holes in the support. Also making sure rack has engaged actuator.

8. Install pivot pins-assemble as far as possible using palm pressure of hand to prevent broaching of support pivot hole. Once started, tap home with a small hammer and punch.

9. Install tilt lever and place housing in full "up" position, install guide, make sure there is grease between the guide and peg on support, tilt spring and tilt spring retainer. Using screw driver in retainer slot, turn retainer clockwise to engage.

10. Remove tilt release lever, install cover end cap and housing cover and seat screw at 12 o'clock position first. Guide connector from pivot switch assembly through shroud. Tighten 3 screws to 100 lbs. in. (11 N·m).

Install ignition switch, lock cylinder ignition switch warning buzzer and directional signal switch as outlined previously in this section.

COLUMN INSTALLATION-MANDATORY SEQUENCE

Chevrolet (Fig. 3B-120)

Mandatory Instructions

1. Assemble steering column support bracket (A) to column (B).

2. Tighten screws in following sequence:

a. Screw (C) first,

b. Screw (D) second and

c. Screws (E) and (F) last.

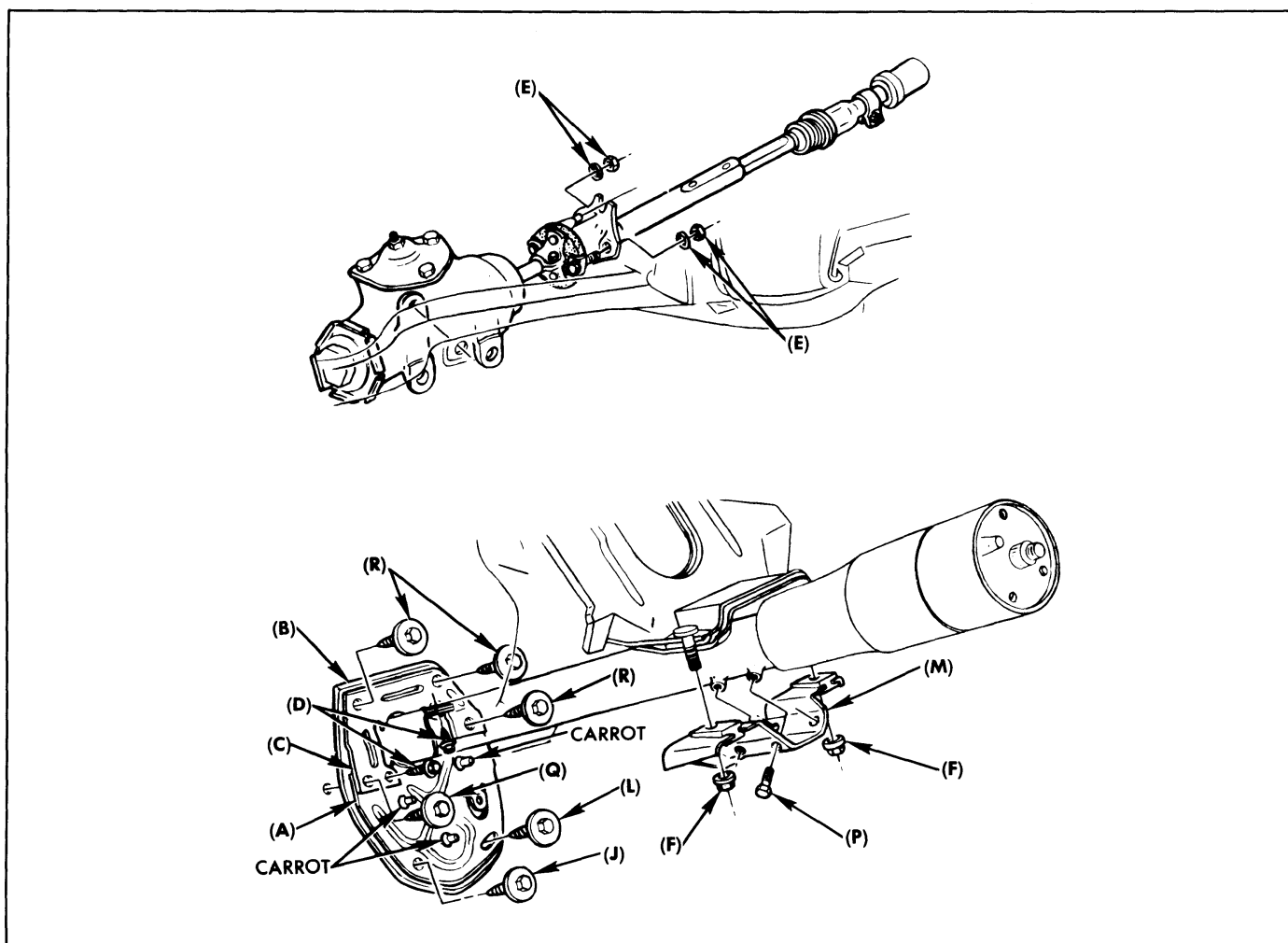


Fig. 3B-120--Steering Column Mounting-Chevrolet

Mandatory Installation Sequence

1. Locate steering column guide bracket (G) over studs on steering column support. Attach to support with screw (H) nut (J) and tighten to specified torque.
2. Install electrical connector (K) to ignition switch on column.
3. Locate column (B) to steering column guide bracket (G) and instrument panel, and loosely assemble capsule nuts (L) on studs.
4. Position cover and seal (M) to dash panel. Install and torque screw (N) at net location in upper L.H. corner of cover and seal (M).
5. Tighten capsule bracket nuts (L) to specified torque.
6. Install remaining screws (P) at slotted locations in cover and seal (M), and tighten to specified torque.

CAUTION: After column has been installed in body, the lower shaft protruding through dash panel must be protected from impact or other damage.

7. Install transmission indicator cable on column automatics.
8. Install the instrument panel trim cover.
9. Connect the transmission control linkage at the shift tube levers.

10. Install the steering wheel as outlined previously in this section.

11. Connect the battery ground cable.

Malibu and Monte Carlo (Fig. 3B-121)

Mandatory Instructions

1. Assemble lower dash cover (A) to seal with two "carrots" (part of seal).
2. Loosely assemble lower (A) and upper (B) dash cover with two screws (C) and (D); dash cover must be able to slide on column.
3. Attach bracket (E) to jacket and install bolt (F) first, bolt (G) second, and bolts (H) and (J) last and tighten to specified torque.

Mandatory Installation Sequence

1. Install ignition switch connector to ignition switch.
2. Position column in body and position the flange to the rag joint and install lock washers (K) and nuts (L) (may be tightened to specified torque at any time).
3. Loosely assemble nuts (M) at the instrument panel.
4. Position lower cover to dash using bench awl or by starting screw (N) in round net hole.

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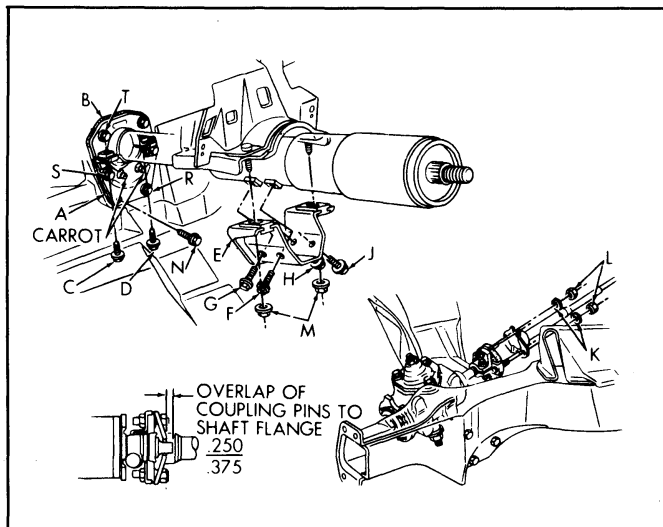


Fig. 3B-121—Steering Column Mounting-Malibu and Monte Carlo

5. Install screw (R) and tighten to specified torque.
6. Tighten screw (N) to specified torque.
7. Install screw (S) and (T) and tighten to specified torque.
8. Tighten clamp screw (C) to specified torque. Tighten clamp screw (D) to specified torque.
9. Install remaining two cover screws and tighten to specified torque.
10. Tighten two nuts (M) to specified torque.

Nova (Fig. 3B-122)

Mandatory Instructions

1. Attach column bracket (A) to jacket and attach bolt (B) first, bolt (C) second and bolts (D) and (E) last. Tighten to specified torque.

Mandatory Installation Sequence

(With intermediate shaft and shaft coupling installed)

1. Position column in body (with the help of an assistant), position flange to flexible coupling and install lock washers (F) and nuts (G) which may be tightened to specified torque at anytime.
2. Loosely assemble capsule nuts (H) on instrument panel studs.
3. Position cover and seal (J) to front of dash and install screw (K) at nut location and tighten to specified torque.
4. Tighten capsule nuts (H) to specified torque.
5. Install screws (L) at slotted locations and tighten to specified torque.
6. Install transmission indicator cable on automatic columns.
7. Connect the transmission control linkage at the shift tube levers.
8. Install the steering wheel as previously described.
9. Connect the battery ground cable.
10. Tighten two screws (C) to specified torque.
11. Loosen two screws (J).
12. Tighten two screws (K) to specified torque.
13. Tighten two screws (J) to specified torque.
14. Remove plastic spacers (L) from flexible coupling

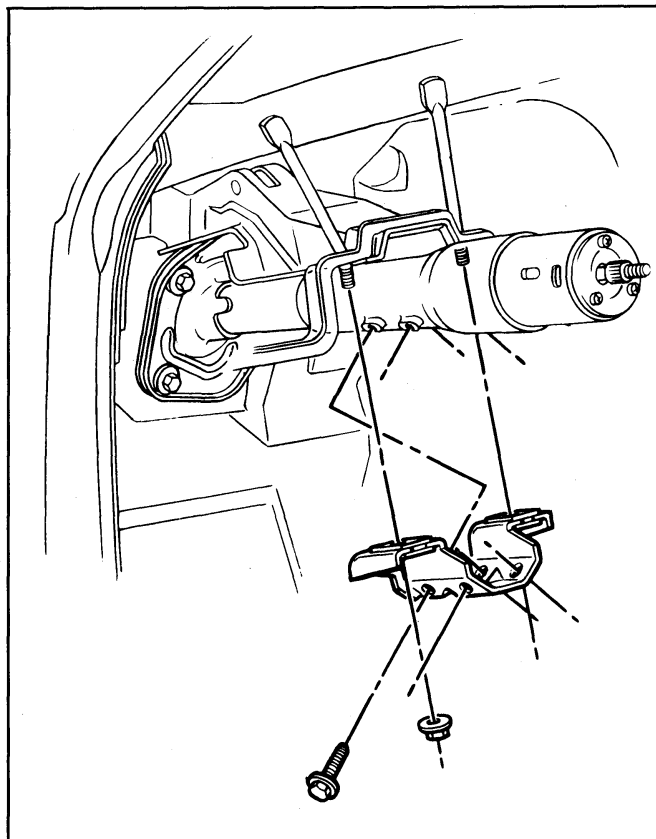


Fig. 3B-122—Steering Column Mounting-Nova

pins as shown in Figure 3B-123.

CAUTION: The alignment between the steering shaft and the steering gear must be such that a .04" gap (4-ply coupling) or a .07" gap (7-ply coupling) is maintained between the coupling rivets and the steering shaft flange with the steering shaft in straight ahead position and without torque on wheel. Less than .04" gap (4-ply) or .07" gap (7-

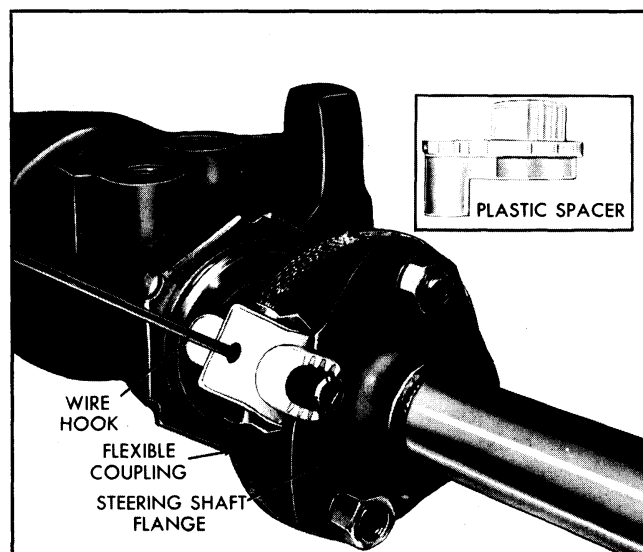


Fig. 3B-123—Removing Plastic Alignment Pin Spacers—Nova and Corvette

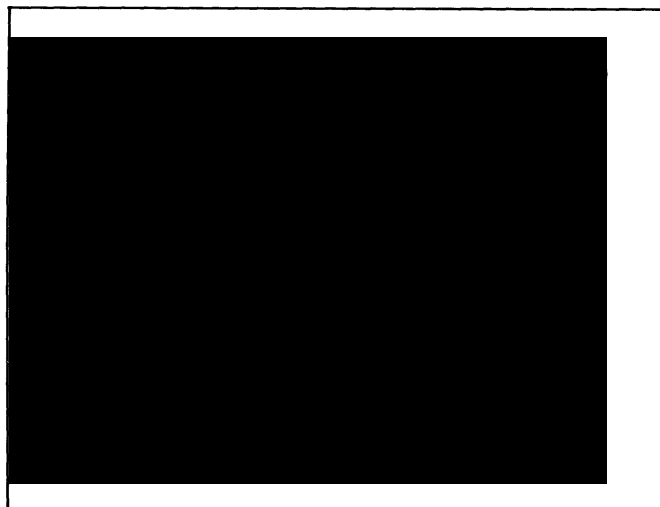


Fig. 3B-124--Steering Column Mounting-Camaro

ply) indicates that column must be realigned.

15. Install the transmission indicator cable on column automatics.

16. Install the instrument panel trim cover.

17. Connect the transmission control linkage.

18. Install the steering wheel as outlined previously in this Section.

19. Connect the battery ground cable.

Camaro (Fig. 3B-124)

1. Position the column in the vehicle, install all electrical connections, position the shaft flange to flexible coupling and install the lock washers and nuts (may be tightened to specified torque at any time).

2. Loosely assemble capsule nuts (D) to instrument panel studs.

3. Position plate (G) to floor pan and install screw (H) at (E) net location and tighten to specified torque.

NOTE: Align the column plate seal with the plate before tightening screw (H).

4. Tighten capsule nuts (D) to specified torque.

5. Install screws (H) at (F) slotted locations and tighten to specified torque.

CAUTION: *With the column installed, the following requirements must be met:*

a. The flexible coupling must not be distorted due to the pot joint bottoming in either direction.

b. The steering wheel should be free to rotate from stop to stop (front wheels off the ground) with no lumpiness, stickiness or binding.

c. Steering column intermediate shaft to upper control arm forward bolt clearance must be .15" minimum.

d. If any of the above conditions exist, the column must be removed and checked for bent or damaged parts, incorrectly installed components or possible frame damage.

e. After correcting the complaint, repeat Installation Steps 1-5.

6. Install the floor pan trim cover.

7. Install the steering column panel assembly to the instrument panel.

8. Install the ash tray.

9. Install the steering wheel as outlined under "Steering



Fig. 3B-125--Steering Column Mounting-Corvette

Wheel-Installation" in this section.

10. Connect the transmission control linkage (back-drive linkage on floor shift models).

11. Connect the battery ground cable.

Corvette (Fig. 3B-125)

1. Loosely assemble support (U) to bracket (T) with shoulder bolts (W) and nuts (Y).

2. Assemble upper end of rag joint (Z) to steering gear, torquing screws.

3. Position column assembly into vehicle, sliding splined end of steering shaft into upper end of rag joint (Z). Connect all electrical wiring.

4. Start two steering column to support (U) attaching screws (H).

5. Install transmission control cable bracket (N) with bolt (M) and hold in place.

6. Maintaining a gap of .30" $\pm$.05" between mast jacket and inside semi-circular surface of instrument panel, install nuts (K) and tighten to specified torque. Then pull support (U) rearward to accommodate height differential of instrument panel to bracket (T). With column position now defined, tighten screws (H) and then nuts (Y) to specified torque. Loosen nuts (K).

CAUTION: *Do not tighten column to instrument panel until vehicle is on its wheels or suspension.*

7. Maintaining flexible coupling dimension shown, torque upper Coupling flange pinch bolt (O).

8. Secure steering column lower plate to front of dash by tightening nuts (K) to specified torque.

9. Remove plastic spacers (L) from flexible coupling pins as shown in Figure 3B-123.

10. Install the steering wheel as outlined previously in this Section.

CAUTION: *The alignment between the steering shaft and the steering gear must be such that a .04" gap (4-ply coupling) or a .07" gap (7-ply coupling) is maintained between the coupling rivets and the steering shaft flange with the steering shaft in straight ahead position and without torque on wheel. Less than .04" gap (4-ply) or .07" gap (7-ply) indicates that column must be realigned.*

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11. Connect the battery ground cable.

STEERING LINKAGE (Fig. 3B-126)**Tie Rods**

There are two tie rod assemblies used on all models. Each assembly is of five piece construction, consisting of a sleeve, two clamps and two tie rod ends. The ends are threaded into the sleeve and locked with the clamps. Right and left hand threads are provided to facilitate toe-in adjustment and steering gear centering.

The tie rod ends are self-adjusting for wear and require no attention in service other than periodic lubrication and occasional inspection to see that ball studs are tight. Replacement of tie rod ends should be made when excessive up and down motion is evident or if any lost motion or end play at ball end of stud exists.

Tie rod adjuster components often become rusted in service. In such cases, it is recommended that if the torque required to remove the nut from the bolt after breakaway exceeds 7 lb. ft., discard the nuts and bolts. Apply any penetrating oil between the clamp and tube and rotate the clamps until they move freely. Install new bolts and nuts having the same part number to assure proper clamping at the specified nut torque.

Removal

1. Raise vehicle on hoist.
2. Remove cotter pins from ball studs and remove castellated nuts.
3. To remove outer ball stud, tap on steering arm at tie rod end with a hammer while using a heavy hammer or similar tool as a backing (fig. 3B-127). If necessary, pull downward on tie rod to remove from steering arm.
4. Remove inner ball stud from relay rod using same procedure as described in Step 2.
5. To remove tie rod ends from tie rods, loosen clamp bolts and unscrew end assemblies.

Installation

CAUTION: See *CAUTION* on page 1 of this section regarding the fasteners referred to in step 4.

1. If the tie rod ends were removed, lubricate the tie rod threads with any EP type Chassis lube and install ends on tie rod making sure both ends are threaded an equal distance from the tie rod.
2. Make sure that the threads on the ball stud and in the ball stud nuts are perfectly clean and smooth. In addition tapered surfaces should be clean and free from grease. Install seals on ball studs.

NOTE: If threads are not clean and smooth, ball studs may turn in tie rod ends when attempting to tighten nut.

3. Install ball studs in steering arms and relay rod.

NOTE: Bolts must be installed in the direction shown. Rotate both inner and outer tie rod housings rearward to the limit of ball joint travel before tightening clamps. Return the clamped tie rod assembly to the center of travel. All bolt centerlines must be between the angles shown after tightening clamps. The position of each tie rod end must be maintained as the clamps are tightened to ensure free movement of each joint.

4. Install ball stud nuts and torque to specifications, then advance nuts just enough to insert cotter pins and

install cotter pins. Lubricate tie rod ends.

5. Lower vehicle to floor.

6. Adjust toe-in as described in Section 3A.

CAUTION: Before tightening the tie rod adjusting sleeve clamp bolts, be sure that the following conditions have been met:

- a. The sleeve clamps must be positioned between the locating dimples at either end of the sleeve. On Corvette see Fig. 3B-128B View B.

- b. The clamps must be positioned within the angular travel indicated in Figures 3B-128A and 128B for the proper vehicle.

- c. The relationship of the clamp slot with the slit in the sleeve should be maintained as shown in Figures 3B-128A and 128B for the proper vehicle.

- d. Both inner and outer tie rod ends must rotate for their full travel. The position of each tie rod end must be maintained as the clamps are tightened to ensure free movement of each joint.

- e. All procedures for alignment, adjustment and assembly of tie rods applies to both left and right side.

Relay Rod (Intermediate Rod)--All Models Except Corvette**Removal**

1. Raise vehicle on hoist.
2. Remove inner ends of tie rods from relay rod as described under Tie Rod - Removal.
3. Remove damper from relay rod on Monte Carlo and Chevelle models with manual steering.
4. Remove cotter pin and nut from relay rod ball stud attachment at pitman arm.
5. Detach relay rod from pitman arm. Shift steering linkage as required to free pitman arm from relay rod.
6. Remove cotter pin and nut from idler arm and remove relay rod from idler arm.

Installation

CAUTION: See *CAUTION* on page 1 of this section regarding the fasteners referred to in steps 1, 2, 3 and 4.

1. Install relay rod to idler arm, making certain idler stud seal is in place, then install and torque nut. Advance nut just enough to align castellation with cotter pin hole and install pin.

2. Raise end of rod and install on pitman arm. Torque nut to specifications, then advance nut just enough to insert cotter pin and install cotter pin.

3. Install tie rod ends to relay rod as previously described under Tie Rods. Lubricate tie rod ends.

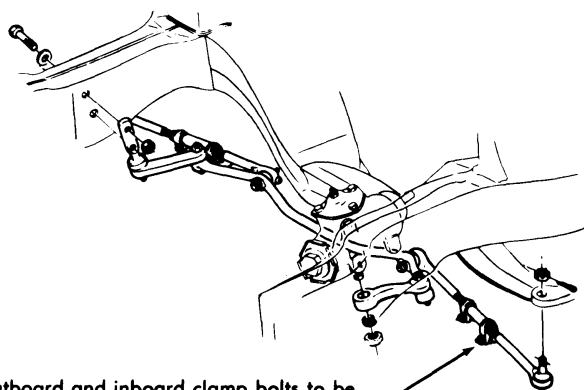
4. Install damper if equipped and torque to specifications.

5. Lower vehicle to floor.

6. Adjust toe-in (see Section 3A) and align steering wheel as described previously in this section under Steering Wheel Alignment and High Point Centering.

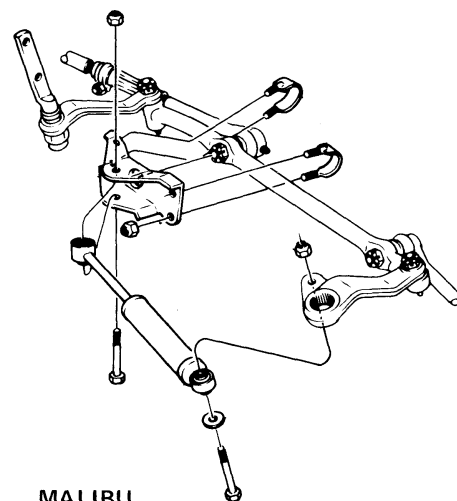
Corvette-Power Steering-Relay Rod**Removal**

1. Raise vehicle on hoist.
2. Remove inner ends of tie rods as described under Tie Rod Removal.
3. Remove the cotter pin and castellated nut from the

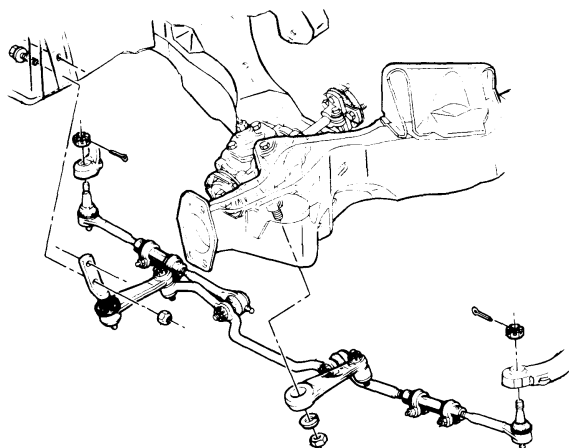


Outboard and inboard clamp bolts to be positioned within angle shown on fig. 102.

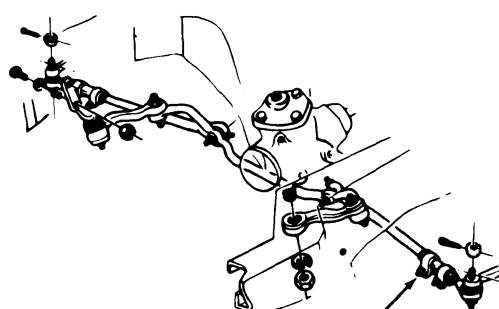
CHEVROLET & MALIBU
(WITH POWER STEERING)



MALIBU
(MANUAL STEERING)

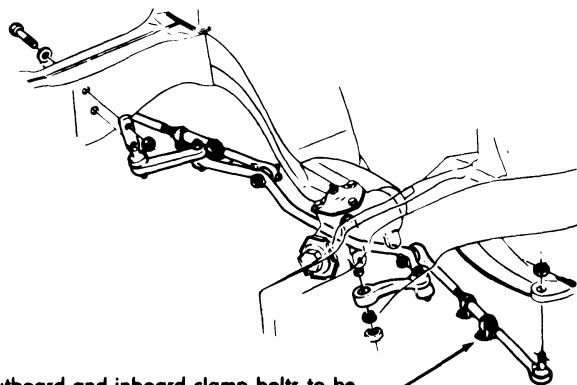


NOVA



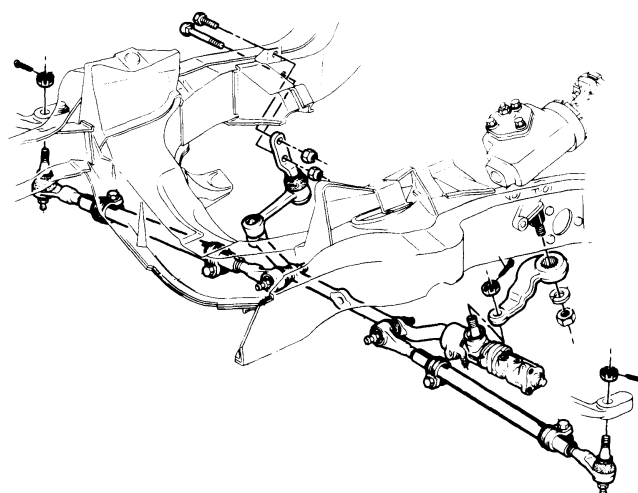
Outboard and inboard clamp bolts to be positioned within angle shown on fig. 102.

CAMARO



Outboard and inboard clamp bolts to be positioned within angle shown on fig. 102.

MONTE CARLO



CORVETTE

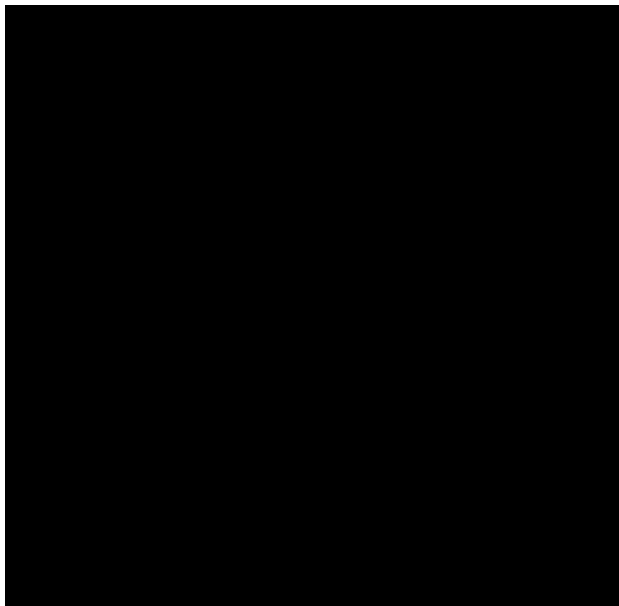


Fig. 3B-127--Freeing Ball Stud

idler arm and remove the relay rod from the idler arm.

4. Disconnect the relay rod from the power cylinder by removing the cotter pin and castellated nut.

5. Remove the control valve clamp bolt and lock washer.

6. Disconnect the relay rod from the control valve by backing out threaded end.

Installation

CAUTION: See *CAUTION* on page 1 of this section regarding the fasteners referred to in steps 1, 2, 3, and 4.

1. Thread the relay rod onto the control valve leaving .06" to .12" of clearance. Install control valve clamp bolt and lock washer. Torque clamp bolts to specifications.

2. Install the power cylinder to the relay rod and torque nut to 45 lbs. ft. (61 N·m). plus additional to align cotter pin. Do not back off nut.

3. Install the relay rod to the tie rods by following the procedure under tie rod installation.

4. Install the relay rod to the idler arm and torque nut to 35 lbs. ft. (48 N·m). Additional torque not to exceed 50 lbs. ft. (68 N·m) to align cotter pin.

5. Lower vehicle to floor.

6. Check and adjust toe-in if necessary (see Section 3A of Service Manual).

Idler Arm (Fig. 3B-126) (All Except Corvette)

Use of the proper diagnosis and checking procedure is essential to prevent needless replacement of good idler arms.

The proper checking procedure is as follows:

1. Raise the vehicle in such a manner as to allow the front wheels to rotate freely and the steering mechanism freedom to turn. Position the wheels in the straight ahead position.

2. Using a push pull type spring scale located as near the relay rod end of the idler arm as possible exert a 25 lb. force upward and then downward while noticing the total distance the end of the arm moves. This distance should not exceed $\pm 1/8$ inch for a total acceptable movement of $1/4$

inch (Fig. 3B-129). It is necessary to ensure that the correct load is applied to the arm since it will move more when higher loads are applied. It is also necessary that a scale or ruler be rested against the frame and used to determine the amount of movement because the actual movement is often overestimated when a scale is not used. The idler arm should always be replaced if it fails this test.

NOTE: Jerking the right wheel and tire assembly back and forth, thus causing an up and down movement of the idler arm, is not an acceptable method of checking because there is no control on the amount of force being applied.

Caution should be used in assuming shimmy complaints are caused by loose idler arms. Before suspecting suspension or steering components, technicians should eliminate shimmy excitation factors, such as dynamic imbalance, runout or force variation of wheel and tire assemblies and road surface irregularities.

Removal

1. Raise vehicle on hoist.

2. Remove idler arm to frame nut, washer, and bolt. No washer is used on Corvette.

3. Remove cotter pin and nut from idler arm to relay rod ball stud.

4. Remove relay rod from idler arm by tapping relay rod with a hammer using a heavy hammer as a backing.

5. Remove idler arm.

Installation

CAUTION: See *CAUTION* on page 1 of this section regarding the fasteners referred to in steps 1, 2 and 3.

1. On Chevrolet place seal in position on idler arm stud; position stud up through frame, and secure with lock washer and nut. Torque to specifications.

2. On Malibu, Monte Carlo, Nova and Corvette, position idler arm on frame and install mounting bolts, washers and nuts. No washer is used on Corvette. Torque nuts to specifications.

3. Install relay rod to idler arm, making certain seal is on stud. Install and torque nut to specification. Advance nut just enough to insert cotter pin and install cotter pin.

4. Lower vehicle to floor.

Pitman Arm

Removal

1. Raise vehicle on hoist.

2. Remove cotter pin from pitman arm ball stud and remove nut.

3. Remove relay rod from pitman arm by tapping on side of rod or arm in which the stud mounts with a hammer while using a heavy hammer or similar tool as a backing. Pull down on relay rod to remove from stud.

4. Remove pitman arm nut from pitman shaft and mark relation of arm position to shaft.

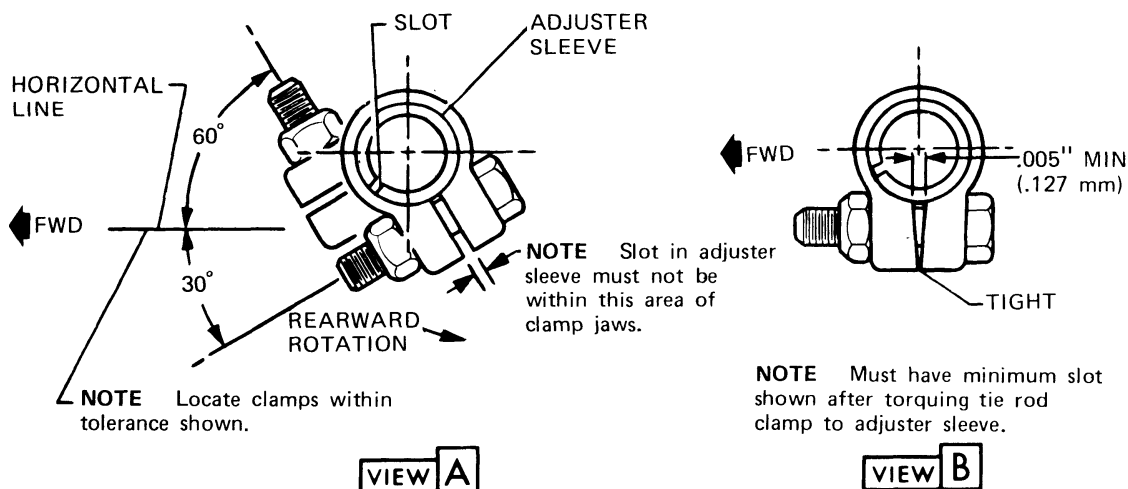
5. Remove pitman arm with Tool J-5504 or Tool J-6632.

Installation

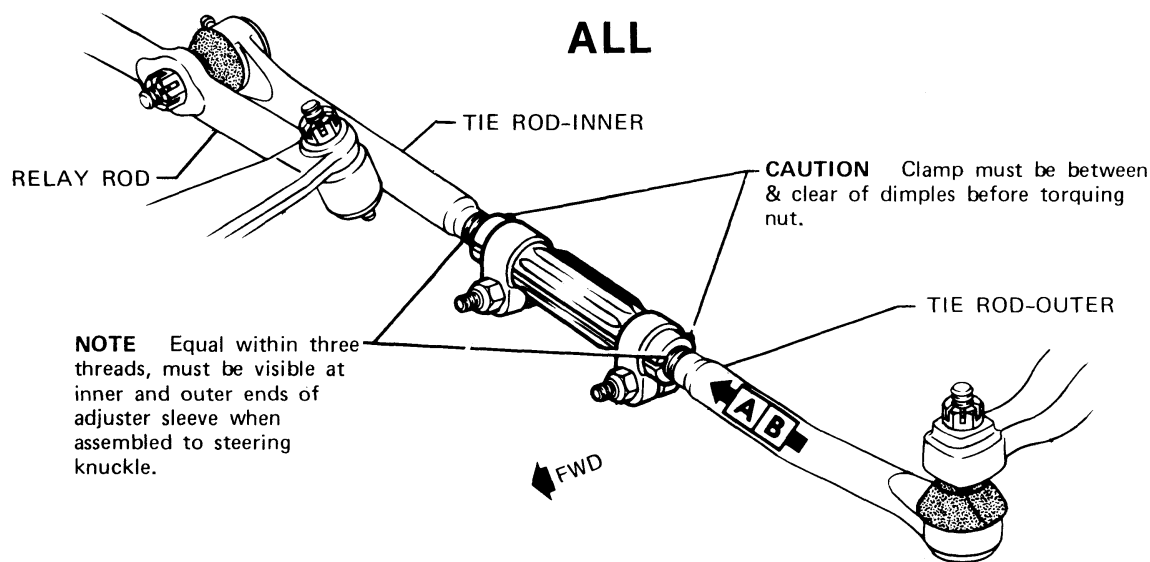
CAUTION: See *CAUTION* on page 1 of this section regarding the fasteners referred to in steps 2 and 3.

1. Install pitman arm on pitman shaft, lining up the marks made upon removal.

NOVA and CAMARO



ALL



CHEVROLET, MONTE CARLO and MALIBU

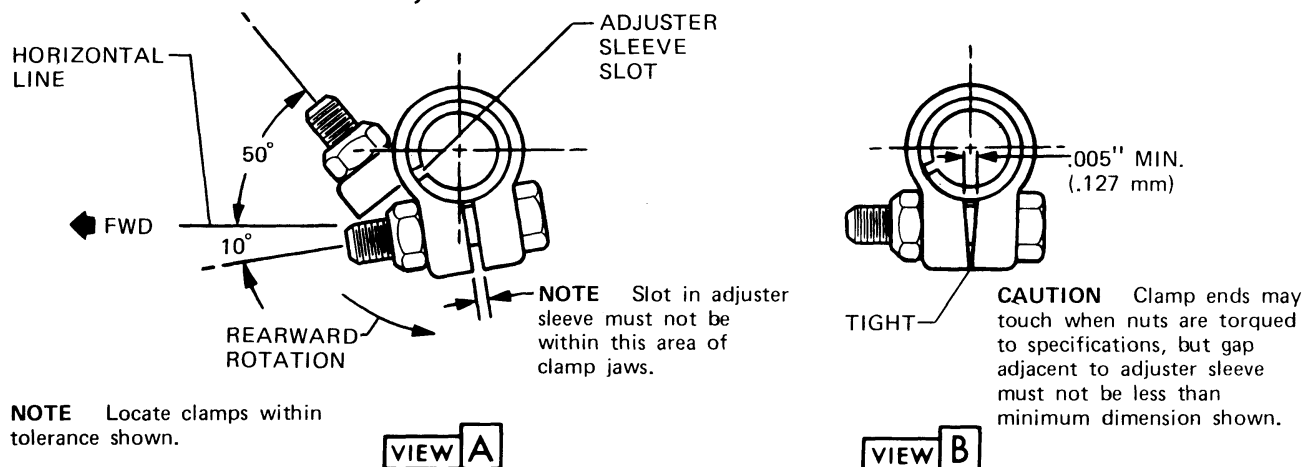


Fig. 3B-128A--Tie Rod Clamp and Sleeve Orientation

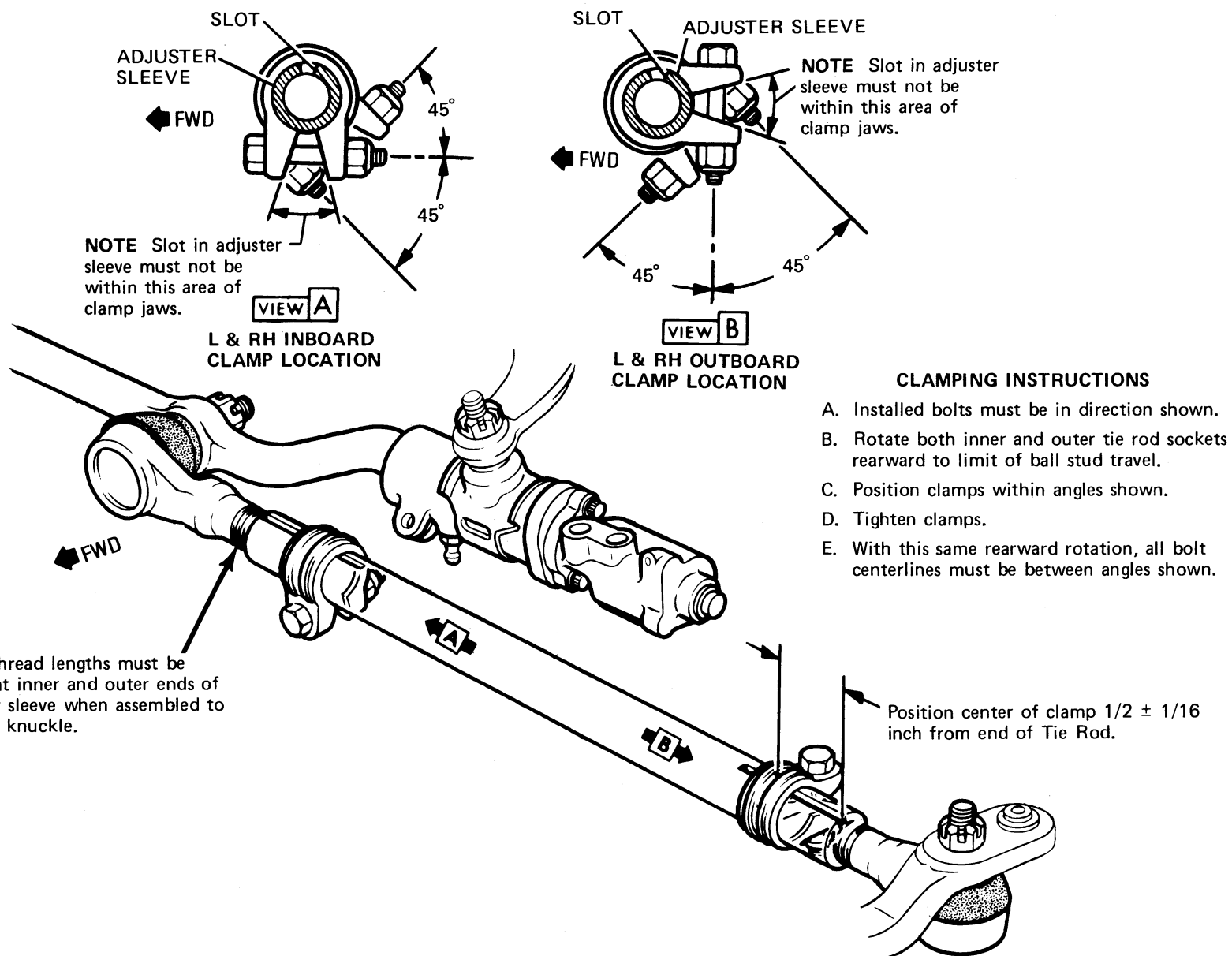


Fig. 3B-128B-Tie Rod Clamp and Sleeve Orientation

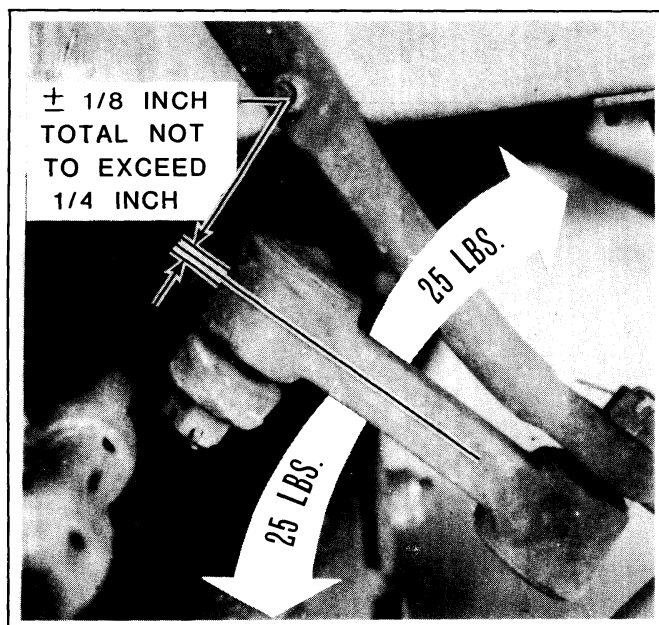


Fig. 3B-129--Checking Idler Movement

2. Install pitman shaft nut and torque to specifications.
3. Position relay rod on pitman arm. Install nut and torque to specifications. Continue to tighten nut enough to align castellation with hole in stud and install cotter pin.
4. Lower vehicle to floor.

Steering Arm

If, through collision or other damage, it becomes necessary to remove and replace either steering arm, proceed as follows:

Removal

1. Raise vehicle on hoist.
2. Remove tie rod from steering arm as outlined in this section.
3. Remove front wheel and hub and rotor assembly
NOTE: Refer to section 5 for disassembly.
4. With wheel and caliper and disc removed, steering arm retaining bolt heads are accessible and removal of steering arm from vehicle may be accomplished by removing retaining nuts.

Installation

CAUTION: See *CAUTION* on page 1 of this section regarding the fasteners referred to in steps 2, 3, 4, 6.

1. Place steering arm in position on vehicle and install retaining bolts.
2. Install nuts. Use only the special locknut listed for this use in the Parts Catalog or an equivalent Chevrolet approved part, torque to specifications.
3. Pack wheel bearings using a high quality wheel bearing lubricant. Install bearings and disc and caliper (see section 5).
4. Install keyed washer and spindle nut. Proceed as outlined under "Front Wheel Bearing Adjustment" in Section 3A.
5. Install tie rod ball stud in steering arm. Be sure that the dust cover is in place on ball stud.

6. Install castellated nut on ball stud, torque to specifications, advance nut enough to align castellation with hole in stud and install cotter pin.

7. Lower vehicle to floor.

8. Following directions given in Section 3A to check cornering wheel relationship and toe-in; correct as required.

POWER STEERING SYSTEM

POWER STEERING PUMP

Removal (Fig. 3B-130, 131 and 132)

1. Disconnect hoses at pump or steering gear. When hoses are disconnected, secure ends in raised position to prevent drainage of oil. Cap or tape the ends of the hoses to prevent entrance of dirt.
2. Install two caps at hose fittings to prevent drainage of oil from pump.
3. Remove pump belt.
4. Remove pump from attaching parts and remove pump from vehicle.

Installation

1. Position pump assembly on vehicle and install attaching parts loosely.
2. Connect and tighten hose fittings.
3. Fill reservoir. Bleed pump by turning pulley backward (counter-clockwise as viewed from front) until air bubbles cease to appear.
4. Install pump belt over pulley.
5. Tension belt as outlined under "Pump Belt Tension Adjustment" in this section. Do not pry on pump reservoir.
6. Bleed as outlined under "Bleeding Power Steering Systems".

POWER STEERING GEAR

All Models Except Corvette

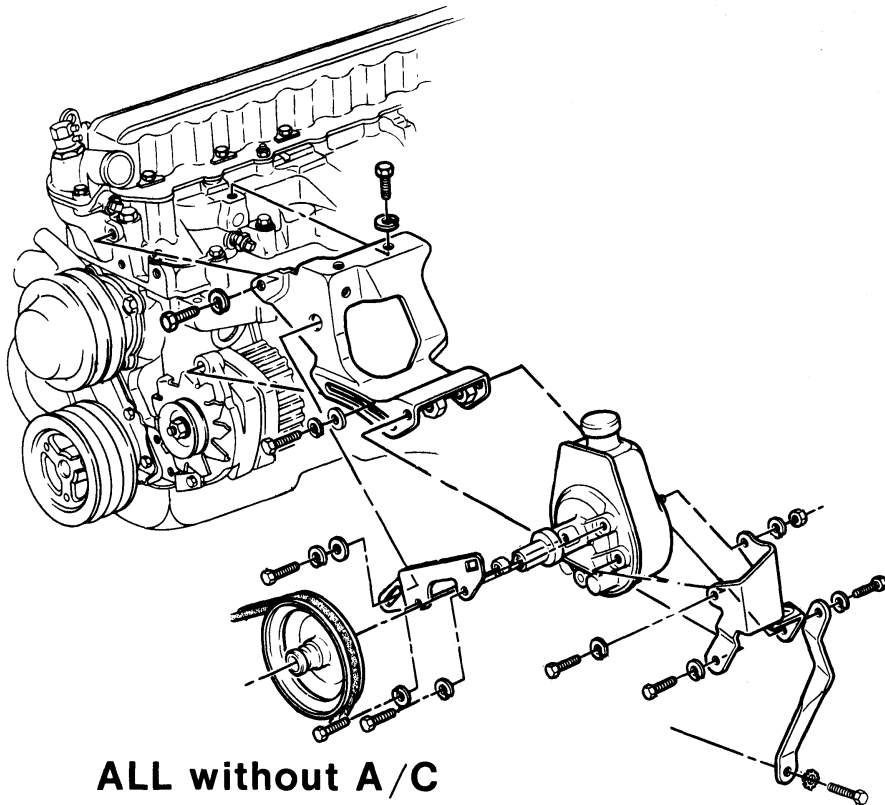
Replacement procedures for the power steering gear are the same as for the manual type steering gear. Refer to steering gear procedures near the beginning of this section "Component Replacement and Repairs". In addition, disconnect pressure and return hoses from the steering gear housing. Cap both hoses and steering gear outlets to prevent foreign material from entering the system. After service is performed and steering gear is installed, connect the pressure and return hoses to the steering gear housing. Install coupling shield if equipped. Bleed system as outlined under "Maintenance and Adjustments".

CONTROL VALVE AND ADAPTER ASSEMBLY--CORVETTE

Ball Stud Seal Replacement (Fig. 3B-133)

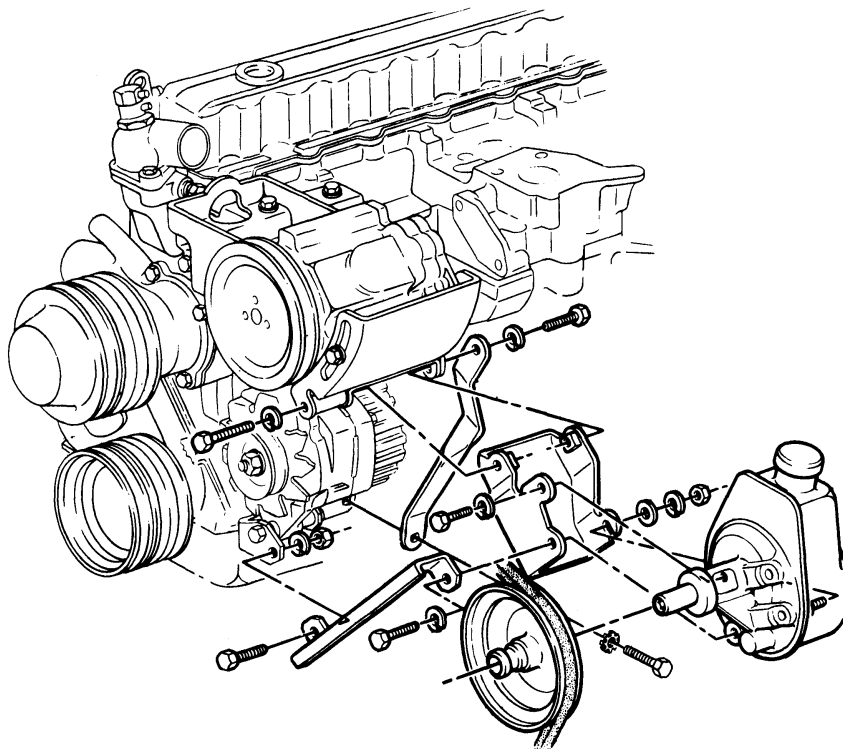
A ball stud seal is used on the power steering control valve. To replace the seal:

1. Raise vehicle on a hoist.
2. Remove the pitman arm as outlined under "Steering Linkage" in this section.
3. Remove clamp by removing nut, bolt and spacer or, if crimped type clamp is used, straighten clamp end and pull clamp and seal off end of stud.
4. Install new seal and clamp over stud so lips on seal mate with clamp. (A nut and bolt attachment type clamp replaces the crimped type for service.)
5. Center the ball stud, seal and clamp at opening in adapter housing, then install spacer, bolt and nut.



ALL without A/C

ALL with A/C EXCEPT CALIFORNIA



ALL with A/C CALIFORNIA

Fig. 3B-130--Power Steering Pump Mounting-L-6

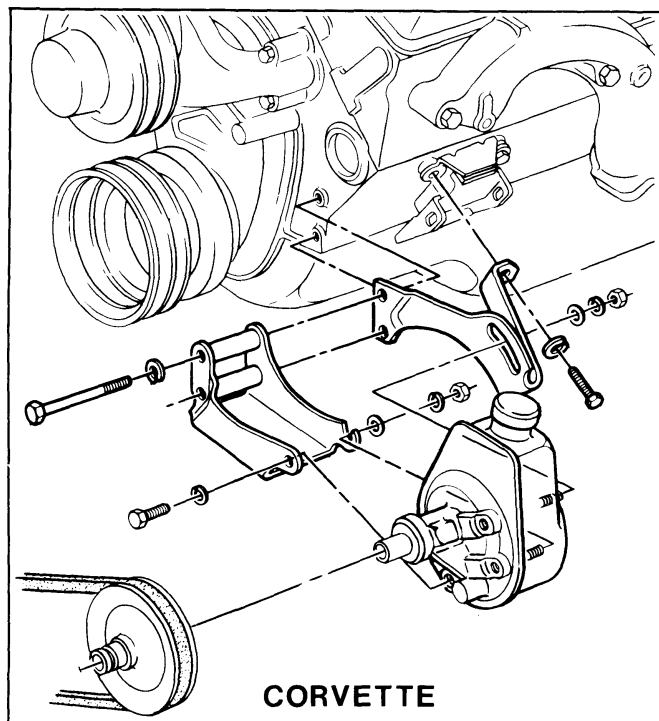


Fig. 3B-131--Power Steering Pump Mounting - Corvette

6. Reinstall the pitman arm as outlined under "Steering Linkage" and remove the vehicle from the hoist.

Removal

1. Raise the front of the vehicle off the floor and place it on stands.
2. Remove the relay rod to control valve clamp bolt.
3. Disconnect the two pump to control valve hose connections and allow fluid to drain into a container, then disconnect the two remaining valve to power cylinder hoses.
4. Remove the retaining nut from the ball stud to pitman arm connection and disconnect the control valve from the pitman arm.
5. Turn the pitman arm to the right to clear the control valve and unscrew the control valve from the relay rod.
6. Remove the control valve from the vehicle.

Installation

CAUTION: See *CAUTION* on page 1 of this section regarding the fasteners referred to in step 1.

1. Install the control valve on the vehicle by reversing the removal procedure.
2. Reconnect the hydraulic lines, fill the system with fluid and bleed out air using the procedure outlined under "Maintenance and Adjustments."

CAUTION: While lubricating, rock pitman arm, break seal at seat and relieve pressure, allowing grease to escape from seal.

Valve Balancing

CAUTION: See *CAUTION* on page 1 of this section regarding the fastener referred to in step 4.

The control valve must be adjusted, after being disassembled, as outlined in the following procedure. The

same procedure may be followed to correct a complaint of harder steering effort required in one direction than the other (Also see Diagnosis charts) See Figure 3B-134.

1. Install valve in vehicle. Connect all hoses and fill the pump reservoir with power steering fluid. Do not connect the piston rod to the frame bracket. If the vehicle is already in operation, it will be necessary to detach the piston rod from the frame bracket.

2. With the car on a hoist, start the engine. One of the following two conditions will exist:

a. If the piston rod remains retracted, turn the adjusting nut clockwise until the rod begins to move out.

Then turn the nut counter-clockwise until the rod just begins to move in. Now turn the nut clockwise to exactly one-half the rotation needed to change the direction of the piston rod movement.

b. If the rod extends upon starting the pump, move the nut counter-clockwise until the rod begins to retract, then clockwise until the rod begins to move out again. Now position the rod to exactly one-half the rotation needed to change the direction of the piston rod movement.

CAUTION: Do not turn the nut back and forth more than is absolutely necessary to balance the valve, as this is a special friction nut.

3. With the valve balanced, it should be possible to move the rod in and out manually.

4. Turn off the engine and connect the cylinder rod to the frame bracket, torque to specifications.

5. Restart the engine. If the front wheels (vehicle still on the hoist) do not turn in either direction from center, the valve has been properly balanced. Correct the valve adjustment if necessary.

6. When the valve is properly adjusted, grease end of valve and install the dust cap.

7. Lower vehicle to floor.

POWER CYLINDER (Fig. 3B-135)

Corvette

Removal

1. Raise vehicle on a hoist.
2. Disconnect the two hydraulic lines connected to the power cylinder and drain fluid into a container. Do not reuse.
3. Remove cotter pin, nut, retainer and grommet from power cylinder rod attached to the frame bracket.
4. Also remove grommet and retainer from bracket if replacement parts are required.
5. Remove cotter pin, nut and ball stud at relay rod.
6. Remove the power cylinder from the vehicle.

Inspection

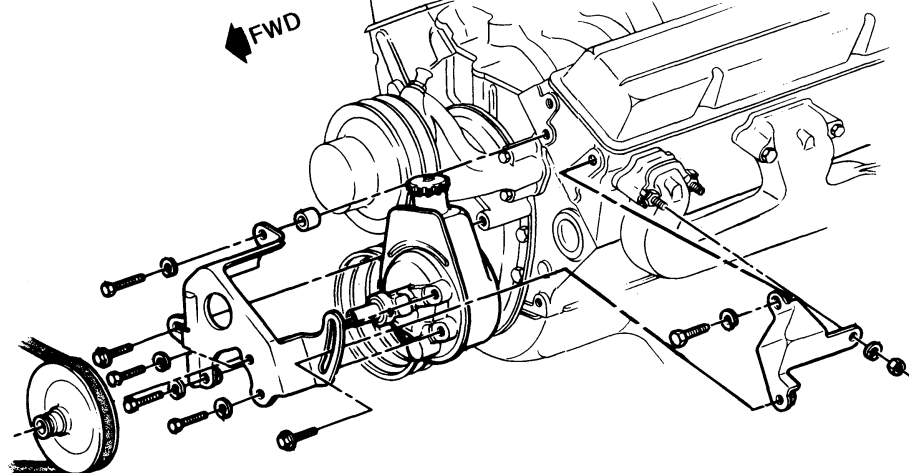
1. Inspect the seals for leaks; if leaks are present, replace the seals as outlined in the Chassis Overhaul Manual.

2. Examine the brass fitted hose connection seats for cracks or damage and replace if necessary.

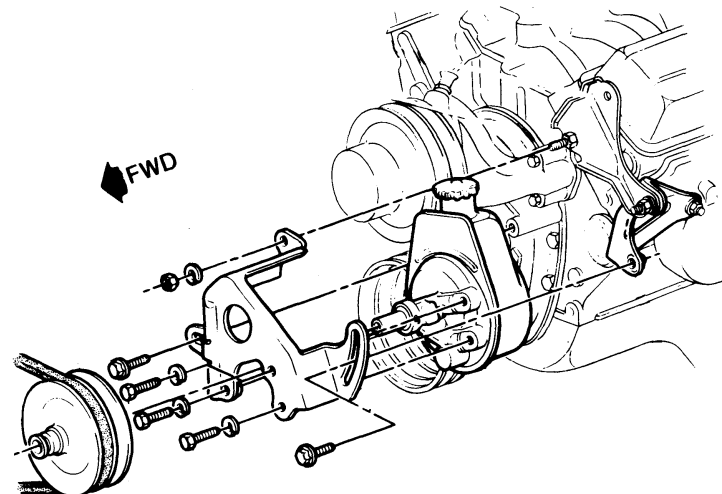
3. For service other than ball seat or seal replacement and ball stud removal, replace the power cylinder.

4. Check the frame bracket parts for wear.

CHEVROLET

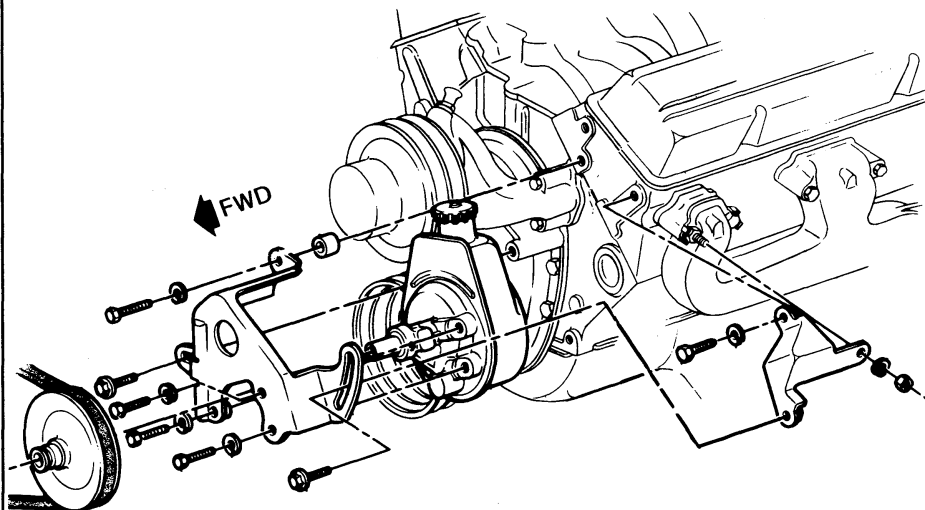


ALL without A/C

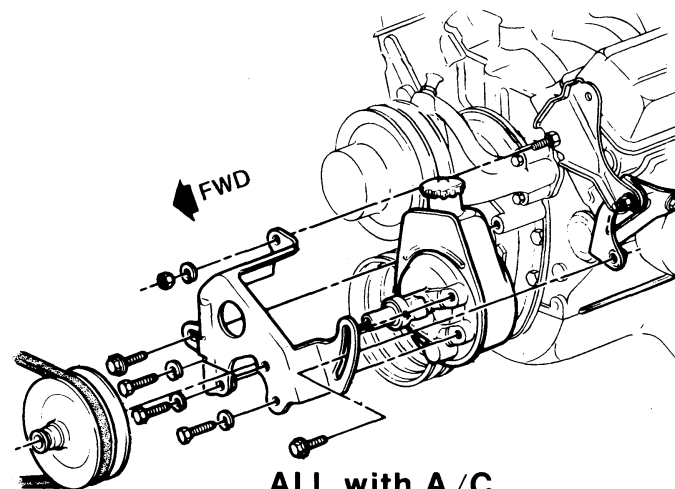


ALL with A/C

ALL EXCEPT CHEVROLET and CORVETTE



ALL without A/C



ALL with A/C

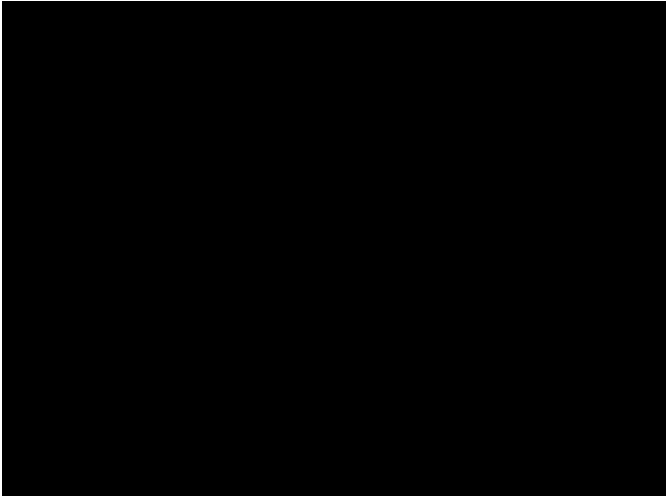


Fig. 3B-133--Control Valve Ball Stud Seal Replacement

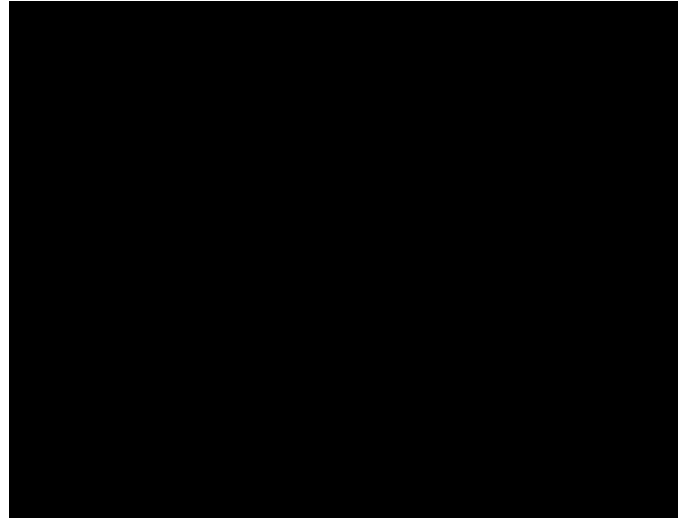


Fig. 3B-135--Power Cylinder Installation-Corvette

Installation

CAUTION: See *CAUTION* on page 1 of this section regarding the fastener referred to in step 1.

1. Install the power cylinder on the vehicle by reversing

the removal procedure.

2. Reconnect the two hydraulic lines, fill the system with fluid and bleed out air using the procedure outlined under "Maintenance and Adjustments." Grease ball joint

3. Lower vehicle to floor.

POWER STEERING HOSES

It is important that the power steering hoses be installed correctly. Hoses installed out of position may be subjected to chafing or other abuses during sharp turns. Always make hose installations on Corvette with the front wheels in straight ahead position. Do not twist hoses unnecessarily during installation.

CAUTION: Do not start engine with any power steering hose disconnected. After connecting the power steering hoses, make sure that ample clearance has been provided between the hoses and the fan belt, sheet metal or any other components where hose rub or interference could result.

CAUTION: If the return hose connections are removed for any reason at either connection, replace the existing "crimped" clamp with a "worm drive" clamp for proper sealing.

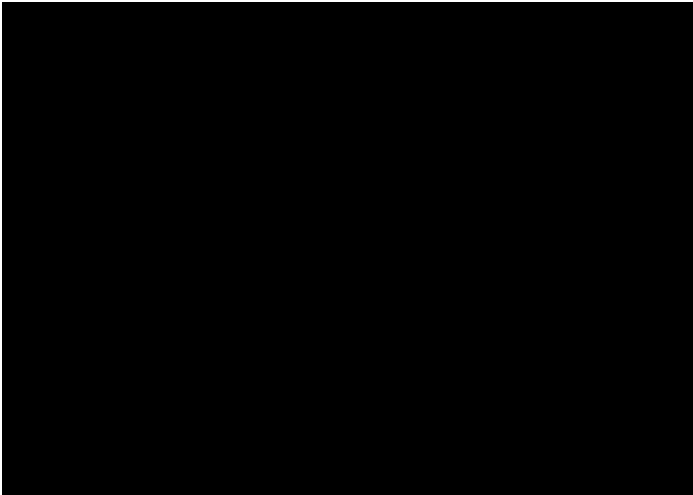


Fig. 3B-134--Balancing Valve

SPECIFICATIONS

STANDARD STEERING SPECIFICATIONS

Vehicle	Steering Gear		Linkage		
	Gear Ratio	Overall Ratio	Type	Location	Tie Rods
Malibu	28.1	28.7:1	Parallel Relay Rod	Front	2
Camaro	NA	NA	Parallel Relay Rod	Front	2
Nova	24:1	33.1:1	Parallel Relay Rod	Front	2

POWER STEERING SPECIFICATIONS

Vehicle	Constant Ratio		Variable Ratio			
	Gear	Overall	Gear (STD.)	Overall (STD.)	Gear (Fast)	Overall (Fast)
Malibu	-	-	16:1 to 12.4:1	18.6:1 to 15.1:1	-	-
Monte Carlo	-	-	15 to 13:1	18.6:1 to 15.1:1	-	-
Chevrolet Sedans & Coupes	-	-	14.1	16.5:1	-	-
Chevrolet Wagons	-	-	16:1 to 13:1	18.9 to 15.3:1	-	-
Camaro	-	-	16:1 to 13:1	15:1 to 11.3:1	-	-
Nova	-	-	16:1 to 13:1	18.9:1 to 14.7:1	16:1 to 13:1	14.3:1 to 11:1
Corvette	16:1	17.6:1	-	-	-	-

STEERING GEAR SPECIFICATIONS

Component	Manual Steering Gear	Power Steering Gear
Thrust Bearing Preload	5 to 8 in. lbs.	3 to 4 in. lbs.*
Adjuster Plug Locknut	85 ft. lbs.	80 ft. lbs.
Over Center Preload	4 to 10** in. lbs.	4 to 5** in. lbs.
Over Center Adjusting Screw Locknut	25 ft. lbs.	35 ft. lbs.
Total Steering Gear Preload	16 in. lbs. (Max.)	14 in. lbs. (Max.)

*In excess of valve assembly drag.

**In excess of ball drag and thrust bearing preload.

POWER STEERING PUMP PRESSURES

Vehicle	Constant Ratio Steering	Variable Ratio Steering
Malibu	-	1350-1450 psi
Monte Carlo	-	1350-1450 psi
Chevrolet	-	1350-1450 psi
Camaro	-	1350-1450 psi
Nova	-	1350-1450 psi
Corvette	900-1000 psi	-

TORQUE SPECIFICATIONS

Component	Malibu	Monte Carlo	Chevrolet	Camaro	Nova	Corvette
Steering Wheel Nut	30 ft. lbs.	30 ft. lbs.	30 ft. lbs.	30 ft. lbs.	30 ft. lbs.	30 ft. lbs.
Steering Wheel to Shroud Screws	18 in. lbs.	18 in. lbs.	18 in. lbs.	-	18 in. lbs.	-
Turn Signal Lever	20 in. lbs.	20 in. lbs.	20 in. lbs.	20 in. lbs.	20 in. lbs.	20 in. lbs.
Tilt Wheel Lever	35 in. lbs.	35 in. lbs.	35 in. lbs.	35 in. lbs.	35 in. lbs.	35 in. lbs.
Ignition Switch Screw	35 in. lbs.	35 in. lbs.	35 in. lbs.	35 in. lbs.	35 in. lbs.	35 in. lbs.
Turn Signal Switch Screws	25 in. lbs.	25 in. lbs.	25 in. lbs.	25 in. lbs.	25 in. lbs.	25 in. lbs.
Turn Signal Housing Screws	45 in. lbs.	45 in. lbs.	45 in. lbs.	45 in. lbs.	45 in. lbs.	45 in. lbs.
Telescoping Control Lever Screw (1)	-	-	-	-	-	25 in. lbs.
Telescoping Lever Screws (2)	-	-	-	-	-	30 in. lbs.
Telescoping Extension to Wheel Screws	-	-	-	-	-	20 in. lbs.
Lock Bolt Spring Screw (Tilt and Tilt-Telescoping)	35 in. lbs.	35 in. lbs.	35 in. lbs.	35 in. lbs.	35 in. lbs.	35 in. lbs.
Bearing Housing Support Screws (Tilt and Tilt-Telescoping)	60 in. lbs.	60 in. lbs.	60 in. lbs.	60 in. lbs.	60 in. lbs.	60 in. lbs.
Transmission Control Lock Tube Housing Extension Screws (Tilt-Telescoping)	-	-	-	-	-	40 in. lbs.
Steering Column Bracket Screws	19 ft. lbs.	19 ft. lbs.	19 ft. lbs.	150 in. lbs.	-	19 ft. lbs.
Steering Column Cover Screws	38 in. lbs.	38 in. lbs.	35 in. lbs.	35 in. lbs.	35 in. lbs.	-
Instrument Panel Steering Column Cover Screws	18 in. lbs.	18 in. lbs.	18 in. lbs.	(sm.) 8 in. lbs. (lg.) 13 in. lbs.	-	-
Column Support to Column Bracket Stud Nuts	20 ft. lbs.	20 ft. lbs.	20 ft. lbs.	20 ft. lbs.	20 ft. lbs.	150 in. lbs.
Column Support to Column Bolts	23 ft. lbs.	23 ft. lbs.	23 ft. lbs.	23 ft. lbs.	23 ft. lbs.	-
Column Support to Column Support Bolts	-	-	-	-	-	15 ft. lbs.
Floor Pan Screws	38 in. lbs.	38 in. lbs.	35 in. lbs.	35 in. lbs.	35 in. lbs.	35 in. lbs.
Floor Pan Cover Screws	45 in. lbs.	45 in. lbs.	35 in. lbs.	20 in. lbs.	40 in. lbs.	-
Floor Pan Cover Clamp Screws	45 in. lbs.	45 in. lbs.	35 in. lbs.	-	35 in. lbs.	-
Steering Coupling to Shaft Flange Nuts	20 ft. lbs.	20 ft. lbs.	20 ft. lbs.	20 ft. lbs.	18 ft. lbs.	20 ft. lbs.
Pot Joint Clamp to Intermediate Shaft	-	-	-	45 ft. lbs.	45 ft. lbs.	-
Steering Coupling Pinch Clamp Bolt	30 ft. lbs.	30 ft. lbs.	30 ft. lbs.	30 ft. lbs.	30 ft. lbs.	30 ft. lbs.
Steering Gear Mounting Bolts	70 ft. lbs.	70 ft. lbs.	70 ft. lbs.	70 ft. lbs.	70 ft. lbs.	30 ft. lbs.

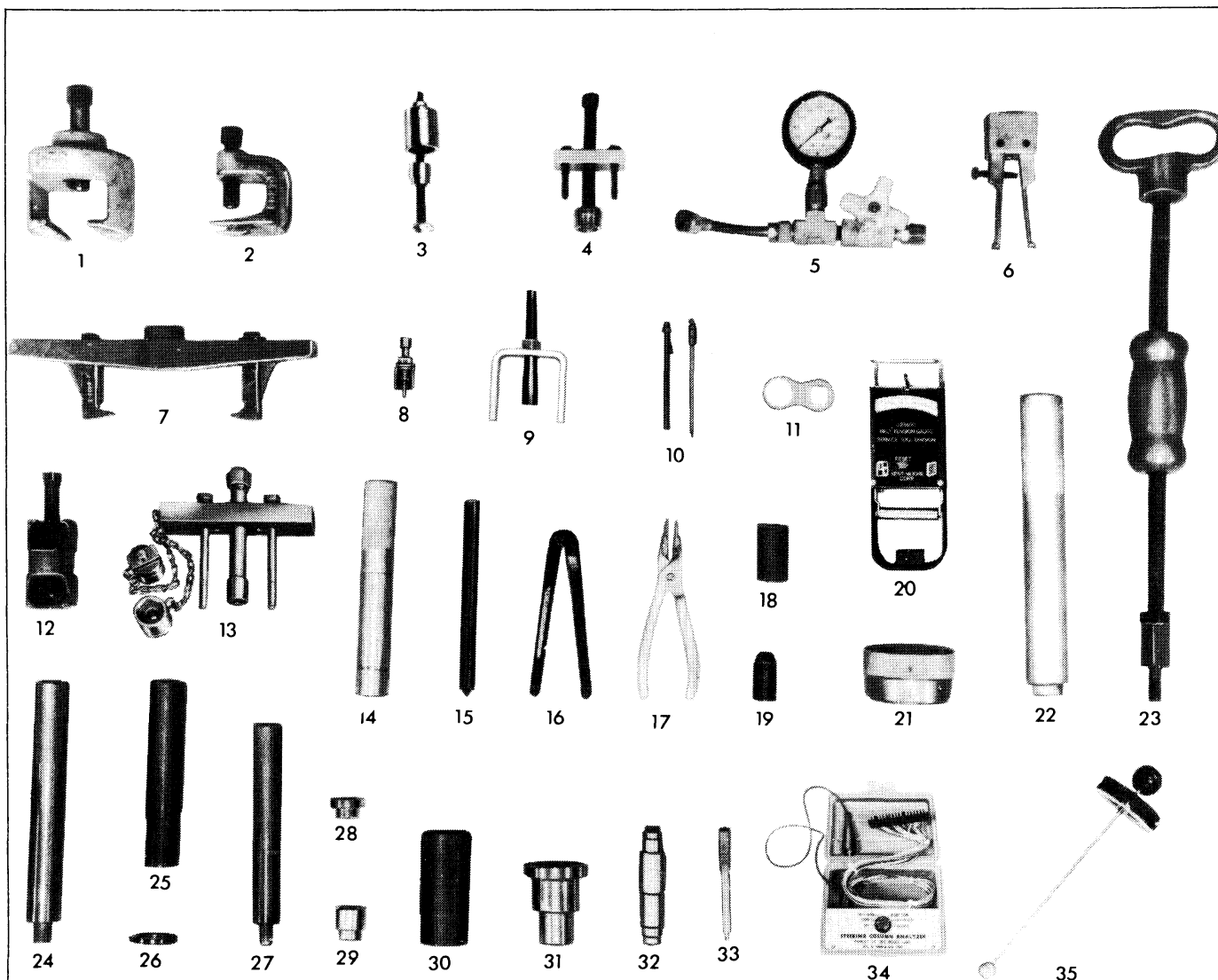
3B-82 STEERING**TORQUE SPECIFICATIONS**

Component	Malibu	Monte Carlo	Chevrolet	Camaro	Nova	Corvette
Tie Rod End Stud Nuts	35 ft. lbs.*	35 ft. lbs.*	35 ft. lbs.*	35 ft. lbs.*	35 ft. lbs.*	35 ft. lbs.*
Pitman Shaft Nut	185 ft. lbs.	185 ft. lbs.	185 ft. lbs.	185 ft. lbs.	185 ft. lbs.	185 ft. lbs.
Idler Arm to Frame Bolt Nuts	50 ft. lbs.	50 ft. lbs.	50 ft. lbs.	50 ft. lbs.	50 ft. lbs.	30 ft. lbs.
Idler Arm to Relay Rod Stud Nut	35 ft. lbs.*	35 ft. lbs.*	35 ft. lbs.*	35 ft. lbs.*	35 ft. lbs.*	35 ft. lbs.*
Pitman Arm to Relay Rod Stud Nut	45 ft. lbs.*	45 ft. lbs.*	45 ft. lbs.	45 ft. lbs.*	45 ft. lbs.*	45 ft. lbs.*
Tie Rod Clamp Nuts	22 ft. lbs.	22 ft. lbs.	22 ft. lbs.	22 ft. lbs.	22 ft. lbs.	132 in. lbs.
Absorber to Relay Rod Nut	40 ft. lbs.	45 ft. lbs.*	-	-	-	-
Absorber to Frame Bolt Nut	-	50 ft. lbs.	-	-	-	-
Absorber to Pitman Arm Stud Nut	35 ft. lbs.	-	-	-	-	-
Power Steering Pump Mounting Bracket Bolts	(L-6)18 ft.lbs. (V-8)25 ft.lbs.	(L-6)18 ft.lbs. (V-8)25 ft.lbs.	(L-6)18 ft.lbs. (V-8)25 ft.lbs.	(L-6)18 ft.lbs. (V-8)25 ft.lbs.	(L-6)18 ft.lbs. (V-8)25 ft.lbs.	(V-8)25 ft.lbs.
Power Steering Pump Mounting Bolts	(L-6)18 ft.lbs. (V-8)25 ft.lbs.	(L-6)18 ft.lbs. (V-8)25 ft.lbs.	(L-6)18 ft.lbs. (V-8)25 ft.lbs.	(L-6)18 ft.lbs. (V-8)25 ft.lbs.	(L-6)18 ft.lbs. (V-8)25 ft.lbs.	(V-8)25 ft.lbs.
Power Steering Pump Mounting Stud Nut	(L-6)18 ft.lbs. (V-8)25 ft.lbs.	(L-6)18 ft.lbs. (V-8)25 ft.lbs.	(L-6)18 ft.lbs. (V-8)25 ft.lbs.	(L-6)18 ft.lbs. (V-8)25 ft.lbs.	(L-6)18 ft.lbs. (V-8)25 ft.lbs.	(V-8)20 ft.lbs.
Power Cylinder to Relay Rod Stud Nut	-	-	-	-	-	45 ft. lbs.*
Power Cylinder to Frame Bracket Nut	-	-	-	-	-	23 ft. lbs.†
Power Cylinder Frame Bracket to Frame Nuts	-	-	-	-	-	17 ft. lbs.
Control Valve and Adapter Assembly to Relay Rod Clamp Bolt	-	-	-	-	-	25 ft. lbs.
Control Valve and Adapter Assembly to Pitman Arm Nut	-	-	-	-	-	45 ft. lbs.*
Power Steering Pump Hose Fittings	25 ft. lbs.	25 ft. lbs.	25 ft. lbs.	25 ft. lbs.	25 ft. lbs.	25 ft. lbs.
Power Steering Gear Hose Fittings	25 ft. lbs.	25 ft. lbs.	25 ft. lbs.	25 ft. lbs.	25 ft. lbs.	-
Power Cylinder Assembly Hose Fittings						95 in. lbs.
Control Valve and Adapter Assembly to Hose Fittings						INLET 103 in. lbs. OUTLET 25 ft. lbs.

*Plus additional torque required to align castellation with cotter pin hole in stud (not to exceed 50 ft. lbs.)

†Plus additional torque required to align castellation with cotter pin hole in stud (not to exceed 30 ft. lbs.)

SPECIAL TOOLS



- | | | | |
|-------------|--------------------------------------|--------------|-------------------------------------|
| 1. J-6632 | Pitman Arm Puller | 19. J-6222 | Shaft Seal Protector |
| 2. J-5504 | Pitman Arm Puller | 20. J-23600 | Belt Tension Gauge |
| 3. J-23073 | Shift Tube Installer | 21. J-8947 | Rack-Piston Seal Compressor |
| 4. J-23072 | Shift Tube Remover | 22. J-5755 | Wormshaft Bearing Race Installer |
| 5. J-5176 | Oil Pressure Gauge | 23. J-2619 | Slide Hammer |
| 6. J-5822 | Wormshaft Bearing Cup Remover | 24. J-8092 | Handle |
| 7. J-8433 | Pump Pulley Remover (Cast Pulley) | 25. J-6278 | Pitman Shaft Bearing Remover |
| 8. J-21854 | Column Pivot Pin Remover | 26. J-6278-2 | Pitman Shaft Bearing Installer |
| 9. J-23653 | Lock Plate Compressor | 27. J-7079-2 | Handle |
| 10. J-5421 | Thermometer | 28. J-8524-1 | Adjuster Plug Bearing Installer |
| 11. J-5860 | Torque Wrench Adapter | 29. J-8524-2 | Adjuster Plug Bearing Remover |
| 12. J-21239 | Pump Pulley Remover (Stamper Pulley) | 30. J-6219 | Pitman Shaft Seal Installer |
| 13. J-2927 | Steering Wheel Puller | 31. J-22407 | Pitman Shaft Bearing Installer |
| 14. J-1614 | Sector Shaft Bushing Remover | 32. J-8937 | Ball Seal Remover |
| 15. J-7539 | Ball Retainer | 33. J-6217 | Connector Seat Installer |
| 16. J-7624 | Spanner Wrench | 34. J-23980 | Steering Column Electrical Analyzer |
| 17. J-4245 | #23 Internal Pliers | 35. | Torque Wrenches |
| 18. J-22670 | Pump Shaft Seal Installer | | |

Fig. 3B-136--Special Tools