GROUP 11 STEERING SYSTEM

(3000)

SECTION TITLE / PAGE

SECTION 11-00 Steering System—Service

SUBJECT / PAGE

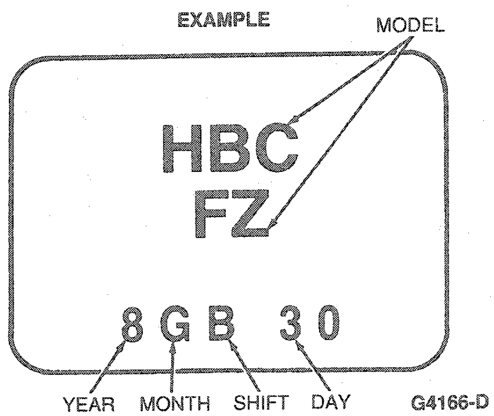
VEHICLE APPLICATION

Taurus / Sable and Taurus SHO.

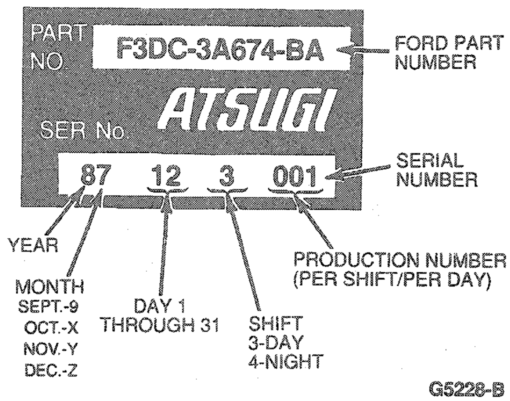
DESCRIPTION

The power steering pump has a service identification tag to identify assemblies for service purposes. The tag is located on reservoir body and contains information as shown below.

Power Steering Pump Model Identification



DESCRIPTION (Continued)



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3. Check hoses for cut O-rings.

Turning Effort Check

Ensure front wheels are properly aligned and tire pressure is correct before checking turning effort.

1. Park vehicle on dry concrete and set parking brake.
2. Idle engine for two to three minutes. Turn steering wheel to the left and right several times to warm fluid to 43-49°C (110-120°F).
3. With engine running, attach a pull scale to rim of steering wheel. Measure pull required to turn wheel one complete revolution in each direction. Refer to Specifications at end of this Section for acceptable measurements.

TESTING

Preliminary Tests

Make the following preliminary tests before power steering disassembly.

Air Bleeding

If bubbles are present in the power steering fluid, bleed the system as follows:

1. Fill reservoir.
2. Run engine until fluid reaches normal operating temperature of 74-79°C (165-175°F).

   CAUTION: Do not hold wheel in the far left or right position, or damage to power steering pump may result.
3. Turn steering wheel all the way to the left and right several times.
4. Check fluid level.
5. If air is still trapped in system, refer to Purging Power Steering System of Air.

Fluid Level Check

1. Idle engine for two to three minutes. Turn steering wheel all the way to the left and right several times to warm fluid to 43-49°C (110-120°F).

   CAUTION: Do not overfill reservoir.
2. Check fluid level in the power steering reservoir. Fluid level should be at the COLD FULL mark. If level is low, add Premium Power Steering Fluid E6AZ-19582-AA (ESW-M2C33-F) or equivalent.

Pump Belt Check

Replace and adjust broken, glazed or worn pump belts. Refer to Section 03-05 for adjustment procedures.

Fluid Leak Check

1. With engine idling, turn steering wheel left to right several times. Check all possible leakage points.
2. Tighten all loose fittings. Replace damaged lines and seals.

Pump Flow and Pressure Test

Before performing pump flow and pressure test, complete the following checks for conditions which could cause loss of power assist. Take corrective action if necessary.

1. Check pump reservoir for proper fluid level.
2. Check tires for correct air pressure.
3. Check pump belt for proper tension.
4. Check pump for correct model and vehicle application.
5. Check for correct size pulleys on pump and engine.
6. Check entire system for damage. Replace parts, if necessary.

If the above items are correct, or have been corrected, and the loss of assist still exists, test power steering pump flow and pressure to determine whether the trouble is in the pump, power steering gear or hoses.

Test Equipment

1. Engine tachometer.
2. Thermometer: -17.8° to 148.9°C (0° to 300°F).
3. Rotunda Power Steering System Analyzer 014-00207 or equivalent.
4. Set of adapter fittings.

The test procedure used in conjunction with the Rotunda Power Steering System Analyzer or equivalent provides a method for checking the complete power steering system. This analyzer can be used to determine the cause of hard steering and / or lack of assist concerns.

The analyzer provides readouts for the following:

- System Back Pressure
- Pump Flow
- Steering Gear Internal Leakage
- Pump Relief Pressure

TESTING (Continued)

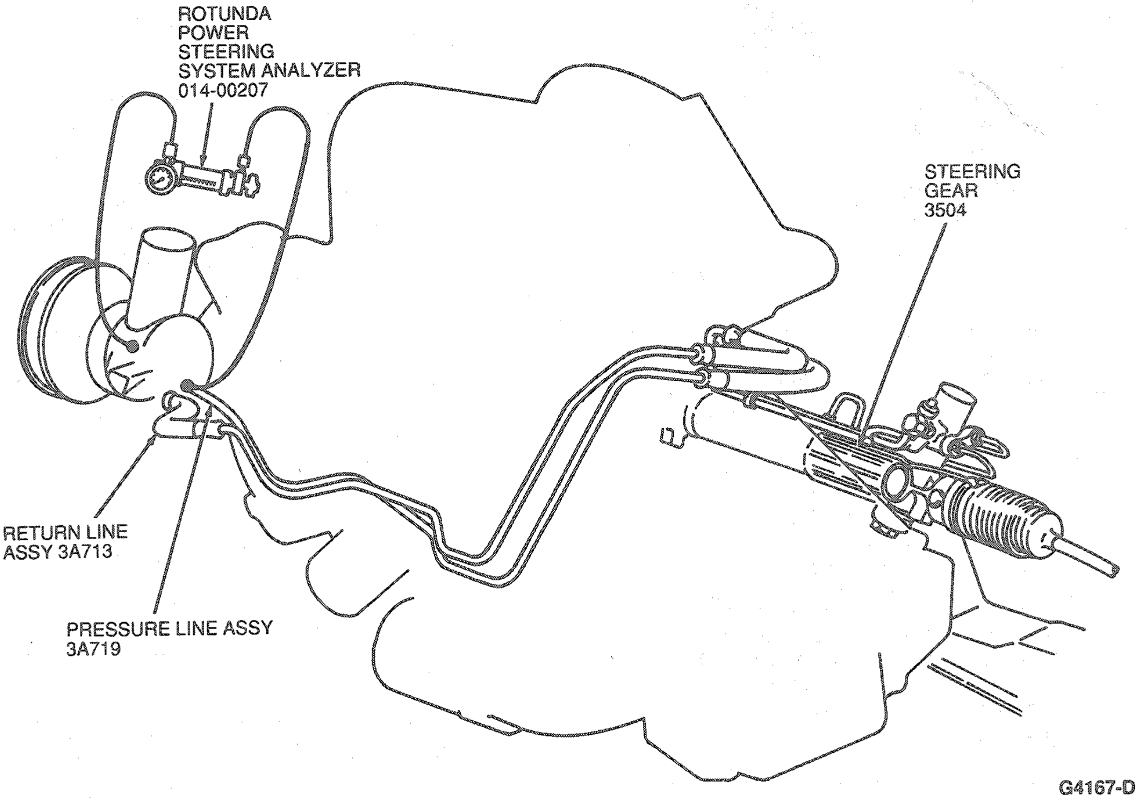
The interpretation of the above readouts will determine which of the following conditions or components are the cause of the concern:

- Restriction in Hoses or Fittings
- Sticking Gear Valve
- Inefficient Pump Cam Pack
- Sticking Relief Valve
- Binding in Suspension

Test Procedure

1. Loosen power steering line bracket at rear of engine.
2. Disconnect the high-pressure line from the pump and connect it into the appropriate hose adapter of the analyzer. For Taurus SHO, fitting 014-00208 or equivalent.
3. Thread the other analyzer adapter into pump. On Taurus SHO, thread the adapter into the steering gear.
4. Connect analyzer hoses to adapters. Tighten both connections to 20 N·m (15 lb-ft) maximum.

Taurus / Sable



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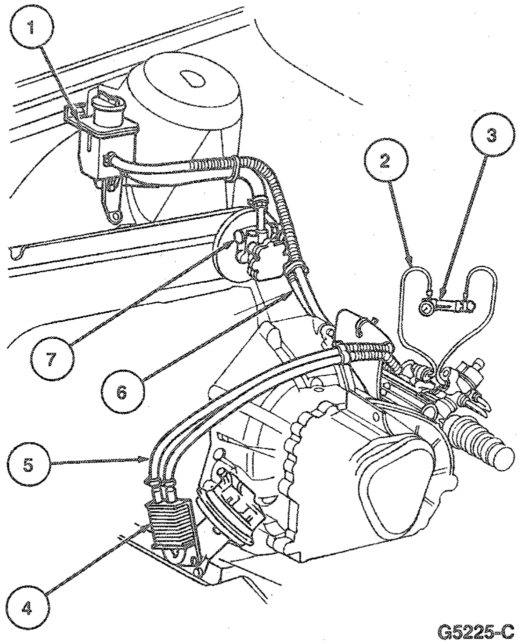
TESTING (Continued)

Taurus SHO



Item	Part Number	Description
1	3R700	Power Steering Reservoir
2	—	Pressure Hose From Pump
3	014-00207	Rotunda Power Steering System Analyzer
4	3D746	Cooler Assy
5	3F731	Hose Assy
6	3A719	Hose Assy
7	3A674	Power Steering Pump Assy

5. Add power steering fluid to the pump, on Taurus / Sable or reservoir on Taurus SHO if required. Start the engine and run it for approximately two minutes at idle.
6. Record the following:
   a. Flow: liters / min (gallons / min) at 78° ± 2°C (172° ± 5°F).
   b. Pressure: kPa (psi) at 78° ± 2°C (172° ±5°F) at idle with the gate valve fully open.
      - If flow is below 5.7 liters / min (1.5 gallons / min), Taurus / Sable, or 8.3 liters / min (2.2 gallons / min) Taurus SHO, the pump may require service. However, at this point, continue the diagnosis. Check flow and relief pressure against the model pump being tested.
      - If pressure is above 1034 kPa (150 psi), check hoses for restrictions.
7. Partially close the gate valve to build up 5100 kPa (740 psi). Observe and record flow, liters / min (gallons / min) at 78° ± 2°C (172° ± 5°F).

   If flow drops to a level lower than the value, disassemble the pump and replace the cam pack. If the pressure plates are cracked or worn, replace them. Continue with diagnosis.

   On Taurus SHO, if flow drops to a level lower than 3.4 liters / min (0.9 gallons / min) replace pump.
8. Completely close and partially open gate valve three times. (Do not allow valve to remain closed for more than five seconds.) Observe and record pressure, kPa (psi).

   Refer to the chart for pressure specification for the applicable pump model and vehicle application. If pressure recorded is lower than minimum specification, replace flow control valve in the pump used on Taurus / Sable. On Taurus SHO, replace pump.

   If the pressure recorded is above maximum specification listed, the flow control valve in the pump should be removed and cleaned or replaced on Taurus / Sable. On Taurus SHO, the pump should be removed and cleaned or replaced.
9. Increase engine speed from idle to approximately 1500 rpm. Observe and record flow, liters / min (gallons / min).

   If flow exceeds the maximum free flow specified, the flow control valve in the pump on Taurus / Sable should be removed and cleaned or replaced. On Taurus SHO, the pump should be removed and cleaned or replaced.
10. Check idle speed, and set if necessary. With the engine at idle, turn (or have an assistant turn) steering wheel to the left and right stops. Record pressure and flow at stops.

    Pressure developed at both stops should be nearly the same as maximum pump output pressure.

    At the same time, flow should drop below 1.9 liters / min (0.5 gallon / min). If the pressure does not reach maximum output or the flow does not drop below 1.9 liters / min (0.5 gallon / min), excessive internal leakage is occurring. Remove and disassemble steering gear. Replace damaged or broken . Pay particular attention to rack piston and valve seals for damage.
11. Turn (or have an assistant turn) steering wheel slightly in both directions, and release quickly while watching the pressure gauge. The needle should move from the normal back pressure reading and snap back as the wheel is released. If it comes back slowly or sticks, the rotary valve in steering gear is sticking or the column is binding. Ensure that the column is not binding before replacing the rotary valve.

    NOTE: If concern still exists, check ball joints and linkage. Refer to Diagnosis.

TESTING (Continued)

12. Remove, disassemble and clean the steering gear. Refer to Section 11-02 for disassembly. Also, flush power steering hoses and power steering pump before installing steering gear.
13. Disconnect and remove analyzer and connect lines.
14. Secure pressure line bracket at engine.

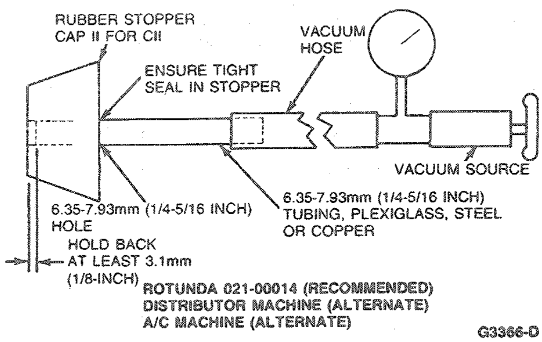
POWER STEERING PUMP SPECIFICATIONS

Engine	Pump Model	Minimum Flow* @ 5100 kPa (740 psi) Liters/Min. 78°C (172°F)	Gal./Min. 78°C (172°F)	Minimum Relief Pressure kPa	psi	Max. Relief Pressure kPa	psi	Maximum Free Flow @ 1500 Rpm Liters/Min.	Gal./Min.
3.0L and 3.8L Police	HBC-KE	3.4	.9	9650	1400	10550	1530	9.8	2.6
3.0L / 3.2L SHO	F3DC-3A674-BA	3.4	.9	9650	1400	10550	1530	9.8	2.6

*IMPORTANT: Flow depends on pump model, engine rpm and pulley drive ratio. Engine idle rpm must be set to specification when checking pump minimum flow capacity.

Purging Power Steering System of Air

Air trapped in power steering system, which causes a whine or moan-type noise, can be removed by using a power steering pump air evacuator assembly (devac tool). Fabricate as shown, or use Rotunda Vacuum Tester 021-00014 or equivalent.



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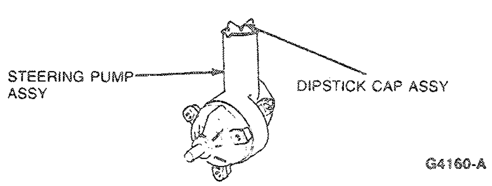
CAUTION: Under no circumstances should engine vacuum be utilized.

1. Remove pump dipstick cap assembly.



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2. Check and fill pump reservoir with Premium Power Steering Fluid E6AZ-19582-AA (ESW-M2C33-F) or equivalent to the COLD FULL mark on pump dipstick.
3. Disconnect ignition coil wire and raise front wheels off floor. Refer to Section 00-02.
4. Crank engine with starter motor and check fluid level. Do not turn steering wheel at this time.
5. Fill pump reservoir to COLD FULL mark on dipstick. Crank engine with starter motor while cycling steering wheel from lock-to-lock. Check fluid level.
6. Tightly insert rubber stopper of the air evacuator assembly into pump reservoir fill neck. Reconnect coil wire.
7. Apply 51 kPa (15 in-Hg) maximum vacuum on pump reservoir for a minimum of three minutes with engine idling. As air purges from system, vacuum will fall off. Maintain adequate vacuum with vacuum source.
8. Release vacuum and remove vacuum source. Refill reservoir to COLD FULL mark.
9. With engine idling, apply 51 kPa (15 in-Hg) vacuum to pump reservoir. Slowly cycle steering wheel from lock-to-lock every 30 seconds for approximately five minutes. Do not hold steering wheel on stops while cycling. Maintain adequate vacuum with vacuum source as air purges.
10. Release vacuum and remove vacuum equipment. Add fluid if necessary. Install dipstick.
11. Start engine and cycle steering wheel slowly. Check for fluid leaks at all connections. In severe cases of aeration, it may be necessary to repeat Steps 5 through 10.
12. Lower front wheels.

TESTING (Continued)

Start-Up Procedure

After Power Steering Pump or Gear Overhaul

After engine start up, follow these steps to eliminate excessive steering system noise due to air trapped in the system during service:

1. Disconnect ignition coil wire.
2. Fill reservoir and raise front wheels off floor.
3. Crank engine with starter and add fluid until level remains constant.

   NOTE: Front wheels must be off the floor during lock-to-lock rotation of steering wheel.
4. While cranking the engine, rotate steering wheel from lock-to-lock.
5. Check fluid level and add fluid if necessary.
6. Connect ignition coil wire and lower front wheels.
7. Start the engine, and allow it to run for several minutes.
8. Rotate steering wheel from lock-to-lock.
9. Turn engine off and check fluid level. Add fluid if necessary.
10. Purge system of air as outlined, if air is still present.

DIAGNOSIS

Drive vehicle to determine exactly what condition exists. Refer to the Steering System Diagnosis charts and service as required.

NOTE: The following diagnosis chart applies to a non-variable assist steering system.

STEERING SYSTEM

CONDITION	POSSIBLE SOURCE	ACTION
• Front End Wander—Condition where the vehicle wanders back and forth on the roadway when it is driven straight ahead while the steering wheel is held in a firm position.	• Check tire size and pressure (front and rear).	• Be sure tire sizes are correct, and adjust tire pressures.
	• Check if vehicle is unevenly or excessively loaded.	• Adjust load.
	• Loose tie rod ends.	• Replace tie rod end assembly. Refer to Section 11-02.
	• Gear assembly loose on sub-frame.	• Tighten mounting bolts. Refer to Section 11-02.
	• Loose suspension struts or ball joint(s).	• Tighten strut mounting bolts or replace ball joint(s). Refer to Section 04-01.
	• Column intermediate shaft connecting bolts loose.	• Tighten at gear and column. Refer to Section 11-04.
	• Column intermediate shaft universal joints loose/worn.	• Replace intermediate shaft assembly.
	• Improper toe adjustment.	• Adjust as required. Refer to Section 04-00.
	• Loose tie rod inner ball joints.	• Check ball housing torque. Refer to Section 11-02.

DIAGNOSIS (Continued)

STEERING SYSTEM (Continued)

CONDITION	POSSIBLE SOURCE	ACTION
• Pulls to One Side — Condition where the vehicle tends to pull to one side when driven on a level surface.	• Improper tire pressure.	• Adjust tire pressure.
	• Improper tire size or different type.	• Replace as required.
	• Vehicle is unevenly or excessively loaded.	• Adjust load.
	• Improper toe adjustment.	• Adjust toe as required. Refer to Section 04-00.
	• Damaged front suspension components.	• Refer to Section 04-01 for replacement.
	• Damaged rear suspension components.	• Refer to Section 04-00 for replacement.
	• Steering gear valve effort out of balance (Power Steering only).	• Place transmission in NEUTRAL while driving and turn engine off (coasting). If vehicle does not pull with the engine off, replace the steering gear valve assembly. Refer to Section 11-02. • If vehicle does drift with engine off: — Cross-switch front tire / wheel assemblies. — If vehicle pulls to opposite side, cross-switch tire / wheel assemblies that were on the rear to same side on the front. — If vehicle pull direction is not changed, check front suspension components and toe adjustment.
	• Check front and rear brakes for proper operation.	• Service as necessary. Refer to Section 06-00.
	• Check for damaged or sagging springs on front and / or rear suspension.	• Replace as required.
	• Check rear suspension for loose / worn shock absorber struts or suspension arm attaching fasteners.	• Replace shocks and / or tighten all attaching fasteners.
	• Bonded rubber outer tie rod ends not installed properly.	• Remove outer tie rod ends from front knuckle and install by aiming front wheels straight ahead and connect outer tie rod end to front knuckle.
• Feedback (rattle, chuckle, squeak, knocking noises in steering gear) — Condition where roughness is felt in the steering wheel by the driver when the vehicle is driven over rough pavement.	• Column intermediate shaft universal joints loose / worn.	• Replace intermediate shaft assembly. Refer to Section 11-04.
	• Loose tie rod end(s) and / or tie rod inner ball joints. Lack of lube in inner ball joint.	• Replace tie rod end(s) and / or tie rod assemblies. Refer to Section 11-02.
	• Gear assembly loose on sub-frame.	• Tighten mounting bolts. Refer to Section 11-02.
	• Column intermediate shaft connecting bolts loose.	• Tighten bolts at gear and column. Refer to Section 11-04.
	• Loose suspension bushings / fasteners or ball joints.	• Tighten suspension fasteners, replace worn bushings, or replace ball joints. Refer to Section 04-01.
	• Check column conditions.	• Refer to Section 11-04.

DIAGNOSIS (Continued)

STEERING SYSTEM (Continued)

CONDITION	POSSIBLE SOURCE	ACTION
• Poor Returnability-Sticky Feel—Condition noticed when the steering fails to return to center following a turn without manual effort from the driver. In addition, when the driver returns the steering wheel to center, it may have a sticky or catchy feel.	• Improper tire pressure. • Improper tire size or incorrect type. • Column flange rubbing steering wheel and / or flange. • Column intermediate shaft universal joints binding. • Check for boot tears and / or evidence of binding or damage to tie rod ends or ball joints. • Improper toe adjustment. • Column bearing binding. • System contaminated.	• Adjust tire pressures. • Replace as required. • Refer to Section 11-04. • Replace intermediate shaft assembly. Refer to Section 11-04. • Replace as necessary. Refer to Section 11-02. • Adjust toe as required. Refer to Section 04-00. • Replace bearing. Refer to Section 11-04. • Flush power steering system. Refer to Flushing procedure Section 11-02.

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NOTE: The following diagnosis chart applies to a variable assist steering system.

STEERING SYSTEM DIAGNOSIS

CONDITION	POSSIBLE SOURCE	ACTION
• High (Excessive) Steering Gear Efforts at All Vehicle Speeds is a Condition Recognized While Turning Corners and During Low Speed Maneuvers and Especially While Parking. The Assist Concerns May Occur in Both Directions or Only in One Direction, They May be Intermittent, or Consistent. NOTE: Discolored steering fluid in a rack-and-pinion steering system should not be misdiagnosed as a functional or noise concern.	• Low pump fluid. • Gear assembly external or internal leak. • Pump external leak. • Pump pressure and flow improper. • VAPS (Variable Assist Power Steering) system malfunction. • Improper drive belt tension. • Hose external leak. • Hose restriction. • Pump pulley loose / warped. • Power steering pump belt loose / glazed / broken or water on belt. • Engine idle too low. • Tires not properly inflated. • Suspension bent or interference. • System contaminated. • Valve screen plugged. • Flex coupling rubbing against housing face. • Column misaligned or binding.	• Fill as required and check for system leaks. • Replace steering gear assembly. Refer to Section 11-02. • Refer to Section 11-02. • Perform pump flow and relief pressure tests. Service as required. • Refer to VAPS system diagnostic procedure in Section 11-02. • Check for proper belt tension. • Service or replace as necessary. • Clean and replace as necessary. • Replace pulley. Refer to Section 11-02. • Inspect, adjust belt tension or replace as required. • Adjust idle. • Inflate. • Inspect service or replace as necessary. Refer to Section 04-00. • Inspect system for foreign object, kinked hose, etc. —flush system —refer to power steering pump, Section 11-02. • Prior to rebuilding a pump, examine the valve screen for contamination, Replace all valves which have plugged or contaminated valve screens. • Reposition flex coupling. • Align column assembly.
• High (Excessive) Efforts at Low Vehicle Speeds	• VAPS (Variable Assist Power Steering) system malfunction.	• Refer to VAPS system diagnostic procedure and service or replace components accordingly. Refer to Section 11-02.

DIAGNOSIS (Continued)

STEERING SYSTEM DIAGNOSIS (Continued)

CONDITION	POSSIBLE SOURCE	ACTION
• Low Efforts at All Vehicle Speeds	• VAPS system malfunction.	• Refer to VAPS system diagnostic procedure and service or replace components accordingly.
• Low Steering Gear Efforts Above 30 mph	• VAPS system malfunction	• Refer to VAPS system diagnostic procedure and service or replace components accordingly.
• External Leakage NOTE: Clean Off the Steering Gear Before Performing ANY Steering Gear External Leakage Checks.	• Leaks between actuator and gear. • Leaks between actuator and actuator bolts. • Gear fittings loose, cross threaded or stripped. • Leaks from steering gear seals (input shaft, pinion or either rack seals). • Housing cracked or leaking (due to a porous condition).	• Tighten actuator bolts. Refer to Section 11-02. • Tighten actuator bolts. • Replace two upper actuator seals. • Inspect and tighten or replace gear assembly. • Replace gear assembly. • Replace gear assembly. NOTE: The only serviceable components on the VAPS steering gear are the boots, tie rods, actuator, and actuator bolts and seals. All external leaks, which cannot be serviced by tightening tube fittings, are to be serviced by installing a "short rack" assembly (Part No. 3L547).
• Loose On Center NOTE: This Condition Should be Checked on Center Only. The Loose Condition Can be Detected With Greater Reliability With the Engine Off and Steering Wheel Straight Ahead. A Very Light Touch on the Steering Wheel Should be Used in Checking for This Condition.	• Steering gear mounting bolts loose. • Column intermediate shaft connecting bolt loose. • Intermediate shaft spring loaded U-bolt distorted. • Flex coupling clamp bolt loose. • Gear tie rod inner ball socket loose. • Column intermediate shaft joints loose or worn. • Steering column shaft clips missing or broken. • Flex coupling fractured. • Tie rod ends loose or worn. • Wheel loose or worn. • Loose wheel lug nuts.	• Tighten retaining nuts to specification. Refer to Section 11-02. • Tighten. Refer to Section 11-04. • Replace U-bolt. • Tighten. • Replace gear tie rod. • Replace intermediate shaft assembly. Refer to Section 11-04. • Replace as required. • Replace as required. • Tighten or replace as required. • Replace as required. Refer to Section 04-01. • Tighten. Refer to Section 04-04.
• Steering Wheel Not Centered Properly NOTE: Groove on Steel Hub of Steering Wheel Must Be In Line With Mark on Top End of Steering Shaft With Front Wheels in Straight Ahead Position to Line Up Steering Wheel Spokes Properly. Steering Wheel Centerline Should Be Within 10 Degrees of Vertical Plane After Toe-In Is Adjusted.	• Incorrect toe setting. • Flex coupling clamp bolts loose / missing. • Pinion installed in rack off location. • Improperly installed steering wheel. • Steering gear loose on frame. • Column intermediate shaft installed off location in column shaft V-block.	• Set. Refer to Section 04-00. • Replace and tighten. • Replace gear assembly. Refer to Section 11-02. • Reposition steering wheel. • Tighten. Refer to Section 11-02. • Index shaft to correct position.

DIAGNOSIS (Continued)

STEERING SYSTEM DIAGNOSIS (Continued)

CONDITION	POSSIBLE SOURCE	ACTION
• Smoothness / Sticky Feeling—Condition of Momentary Build Up, Hitch, Lump or Hesitation in Steering Efforts, Usually Occurring Just as the Turn is Begun. It May Occur Right or Left, and in Rare Cases, Occur in Both Directions. It May be Noticed During Parking, Low Speed Turns or at Road Speeds. If This Condition is Detected During Parking Maneuvers, it May Also be Noticed During Higher Speed Driving. NOTE: Discolored Steering Fluid in Rack-and-Pinion Steering System Should Not Be Misdiagnosed as a Functional or Noise Concern.	• Loose or worn pulley belt.	• Tighten or replace. Refer to Section 03-05.
	• Front lower control arm ball joint worn.	• Replace front lower control arm assembly. Refer to Section 04-01.
	• Column trim rubbing steering wheel.	• Reposition trim on column.
	• Binding in gear control valve assembly.	• Replace gear assembly. Refer to Section 11-02.
	• Water or oil on pulley belt.	• Clean or replace.
	• Column misaligned or binding.	• Align column assembly. Refer to Section 11-04.
	• Flex coupling distorted or fractured.	• Align or replace as required.
	• Flex housing rubbing against housing face.	• Align or reposition flex coupling.
	• Column intermediate shaft joints loose, worn or binding.	• Replace as required.
	• Column intermediate shaft connecting bolt loose.	• Tighten.
	• Steering linkage, shock absorbers or struts are loose, worn or binding.	• Lubricate, adjust or replace as necessary.
	• Tight steering column bearings.	• Lubricate or replace as required.
	• Column shaft clips missing or damaged.	• Service as required.
	• Steering gear retaining bolts loose or damaged.	• Tighten.
	• Wheel bearing loose or worn.	• Replace as required. Refer to Section 04-01.
	• Loose wheel lug nuts.	• Tighten. Refer to Section 04-04.
	• Bent or damaged rack assembly.	• Replace gear assembly.
	• Low tire pressure.	• Inflate.
	• Improper front end alignment.	• Align front end. Refer to Section 04-04.

DIAGNOSIS (Continued)

STEERING SYSTEM DIAGNOSIS (Continued)

CONDITION	POSSIBLE SOURCE	ACTION
• Uneven Drive Efforts, Pulls or Leads to One Side—Condition Recognized by the Driver While Turning the Steering Wheel in a Left or Right Turn. This Condition Will Reveal Lighter Efforts in One Direction, Very Noticeable to the Driver. Vehicle Pulls or Leads to One Side. Keep in Mind Road Conditions and Wind. Pulls or Leads Refers to the Tendency of a Vehicle to Drift Consistently to One Side on a Reasonably Flat Road. It May or May Not be Accompanied by Unequal Effort Requirements at the Steering Wheel. NOTE: Peform the Following Test to Determine if Concern is Related to Steering Gear or Vehicle System. At 15-55 mph on a flat straight surface, set vehicle in a straight line, place shift selector in NEUTRAL position and turn off ignition. If the vehicle continues to pull or drift in the same direction as the original concern, then the steering gear is not the cause. If the vehicle does not pull, but remains on a straight line this indicates a steering gear concern and steering efforts should also be noticeably light in direction of pull. This condition is normally due to an unbalanced steering gear valve assembly.	• Radial tires (misaligned belts). • Front or rear end misaligned. • Steering gear valve efforts unbalanced. (Efforts will be lighter in one direction.) • Front suspension components damaged. • Low tire pressure or incorrect front to rear. • Incorrect tire size or incorrect type. • Check front and rear brakes for proper operation. • Check for bent rear axle housing and for damaged or sagging springs in the front or rear suspension. • Check rear suspension for loose or worn shock absorber struts, suspension arm retaining fasteners. • Vehicle unevenly loaded. • Front or rear wheel bearing loose or worn. • Steering gear retaining bolts loose or damaged. • Column misaligned or binding. • Halfshaft or CV joint bind.	• Replace as necessary. • Align. • Replace gear assembly. Refer to Section 11-02. • Replace as required. Refer to Section 04-04. • Check pressure and inflate / deflate as necessary. • Correct as required. • Adjust if necessary. Refer to Section 06-00. • Replace if necessary. • Tighten all retaining fasteners. Refer to Section 04-02. • Correct as required. • Refer to Sections 04-01 or 04-02. • Tighten. • Align column assembly. • Replace CV joints. Refer to Section 05-04.
• Poor Returnability is a Condition Noticed When the Vehicle Fails to Return to a Nearly Straight Ahead Position After a Corner Maneuver. The Wheel Should Return Within a Reasonable Period of Time Without Undue Help From the Driver. Returnability Concerns May Occur From Both Directions or Only From One Direction. NOTE: This Condition is Accompanied By a Momentary Build Up, Hitch, Lump, or Hesitation, in Steering Efforts Usually Occurring Just Off Center Either in One Direction or Both. Concern Occurs Only During Driving, and Not During Parking Maneuvers.	• Column trim rubbing steering wheel. • Front lower control arms worn. • Brinelled or binding upper strut bearing. • Tight tie rod and / or tie rod end ball joints. • Steering valve assembly off balance. Efforts will be light in one direction and return will be poor in light direction. • Improper front end alignment. • Steering linkage, shock absorbers, struts, loose, worn or binding. • Tilt column bearing sideloaded by spring. • Intermediate column shaft joints binding. • Bent or damaged crossmember. • Column bearing binding. • Column misaligned or binding. • Low tire pressure or incorrect pressure front to rear. • Steering wheel clear vision off location. • Incorrect tire size or incorrect type.	• Reposition trim ring in column assembly slots. • Replace lower control arms. Refer to Section 04-01. • Replace bearing. • Replace tie rod and / or tie rod ends. • Replace gear assembly. Refer to Section 11-02. • Align front end. • Lubricate, adjust or replace as necessary. • Remove spring. If improved, replace tilt yoke, shaft or steering wheel. • Replace intermediate shaft assembly. • Replace as necessary. Refer to Section 01-00. • Replace as necessary. • Align column assembly. • Check pressure and inflate / deflate as necessary. • Adjust as required. • Replace as required.

DIAGNOSIS (Continued)

STEERING SYSTEM DIAGNOSIS (Continued)

CONDITION	POSSIBLE SOURCE	ACTION
• Noise / Rattle / Chuckle / Clicks / Pops / Squeaks / Creaks / Clunk / Squawk / Hiss There are Many System Noises Which Can be Misdiagnosed as Originating From the Power Steering Gear. Most System Noises are RPM Sensitive. Therefore, Turning the Steering Wheel will Vary the RPM and Consequently the Noise Pitch. Careful Diagnosis is Necessary to Prevent Unnecessary Services. Disconnecting of Belts and Re-evaluation is Essential in Many Cases, as is Partially Cycling the Steering Wheel With the Engine in OFF. NOTE: A Common Noise in the Rack-and-Pinion Steering Gear is a Hissing Sound. The Sound is Most Evident at Static Position or During Parking Maneuvers. There is No Relationship Between this Noise and Performance of the Steering. "Hiss" May Occur at End of Steering Wheel Travel or When Slowly Turning at Stand Still, or at a Particular Position.	• Column intermediate shaft connecting bolt loose.	• Tighten. Refer to Section 11-04.
	• Column trim rubbing steering wheel.	• Reposition trim on column.
	• Loose or worn pump belt.	• Adjust or replace as required. Refer to Section 03-05.
	• Front lower control arm worn or binding.	• Replace as required. Refer to Section 04-01.
	• Brinelled or binding upper strut bearing.	• Replace strut bearing. Refer to Section 04-01.
	• Flex coupling distorted.	• Align flex coupling.
	• Flex coupling clamp bolt loose.	• Tighten. Refer to Section 11-04.
	• Pump bracket loose or misaligned.	• Tighten and align. Refer to Section 11-02.
	• Lack of lubricant where horn brush contacts rub steering wheel plate.	• Lubricate or adjust as required.
	• Column shaft clips missing.	• Replace as required.
	• Column U-joints loose.	• Replace if necessary.
	• Loose tie rod ends or ball joints.	• Replace tie rod assembly.
	• Gear assembly loose on frame.	• Tighten. Refer to Section 11-02.
	• Loose suspension struts.	• Adjust or replace as required.
	• Flex coupling fractured.	• Replace as required.
	• Loose wheel lug nuts.	• Tighten. Refer to Section 04-04.
	• Pressure hose grounded against fender or vacuum canister.	• Reposition pressure hoses.
	• Front wheel bearing loose or worn.	• Replace bearing. Refer to Section 04-01.
	• Column misaligned or lower bearing out of position.	• Correct as necessary.
	• Steering shaft insulators cracked or dry.	• Replace or lubricate as required.
	• Kinked pressure hoses.	• Reposition pressure hoses. Refer to Section 11-02.
	• Steering gear or pump external leak.	• Inspect and replace or service as required.
	• Pulley loose or warped.	• Replace pulley assembly.
	• Aerated fluid.	• Purge and evacuate system.
	• Water in steering fluid.	• Purge and evacuate system.

DIAGNOSIS (Continued)

STEERING SYSTEM DIAGNOSIS (Continued)

CONDITION	POSSIBLE SOURCE	ACTION
• Wandering / Darting / Pointing — Condition Noticed When the Car is Driven in a Straight Ahead Position With the Wheel Held in a Firm Position, and the Vehicle Wanders to Either Side. Darting Refers to Down the Road Steering Feel, it is Not Smooth and Seems to be Sticky and the Driver Cannot Make Minor Correction With Ease. Pointing Refers to the Inability of the Vehicle to Return to a Straight Ahead Position After a Moderate to Higher Speed Lane Change. NOTE: Pointing Characteristics are Normal with the Rack-and-Pinion Steering System Up to 10 Degrees Off-Center.	• Steering gear retaining bolts loose or damaged.	• Tighten. Refer to Section 11-02.
	• Improper front or rear end alignment.	• Align.
	• Front lower control arm ball joint(s) worn.	• Replace as required. Refer to Section 04-01.
	• Brinelled or binding strut upper bearing.	• Replace bearing.
	• Steering wheel clear vision off location.	• Correct as required.
	• Column trim rubbing steering wheel.	• Reposition trim on column assembly.
	• Loose suspension struts or ball joints binding.	• Adjust or replace as required.
	• Loose tie rod ends.	• Replace tie rod ends.
	• Column intermediate shaft joint loose or worn.	• Replace intermediate shaft.
	• Column misaligned or binding.	• Align column assembly.
	• Gear tie rod inner ball joint loose or worn.	• Replace gear tie rods.
	• Column intermediate shaft connecting bolt loose.	• Tighten. Refer to Section 11-04.
	• Low tire pressure or incorrect pressure front to rear.	• Check tire pressure and inflate / deflate as necessary.
	• Incorrect tire size or incorrect type.	• Correct as required.
	• Radial tires (misaligned belts).	• Replace as required.
	• Front and / or rear wheel bearing loose or worn.	• Refer to Sections 04-01 and / or 04-02.
	• Loose or worn rear suspension.	• Tighten or replace as necessary. Refer to Section 04-00.
	• Loose flex coupling bolt.	• Tighten.
	• Improper brake operation or adjustment.	• Inspect and adjust. Correct as required. Refer to Section 06-00.
	• Vehicle unevenly loaded.	• Correct as required.

TG5402D

SPECIFICATIONS

STATIC STEERING WHEEL TURNING EFFORT

Vehicle	Power
Taurus / Sable, Taurus SHO with VAP	2.27 kg (5.0 Lb)
Taurus / Sable without VAP	3.18 kg (7.0 Lb)

POWER STEERING RELIEF PRESSURE

Vehicle	Min. Relief Pressure	
	kPa	psi
3.0L, 3.8L and Taurus Police 3.8L	9650	1400
3.0L / 3.2L SHO	9650	1400

SPECIAL SERVICE TOOLS

ROTUNDA EQUIPMENT

Model	Description
014-00207	Power Steering System Analyzer
021-00014	Vacuum Tester
014-00208	Taurus 3.0L / 3.2L SHO Fitting

SECTION 11-02 Steering System, Power

VEHICLE APPLICATION

Taurus / Sable.

DESCRIPTION

Steering Gear

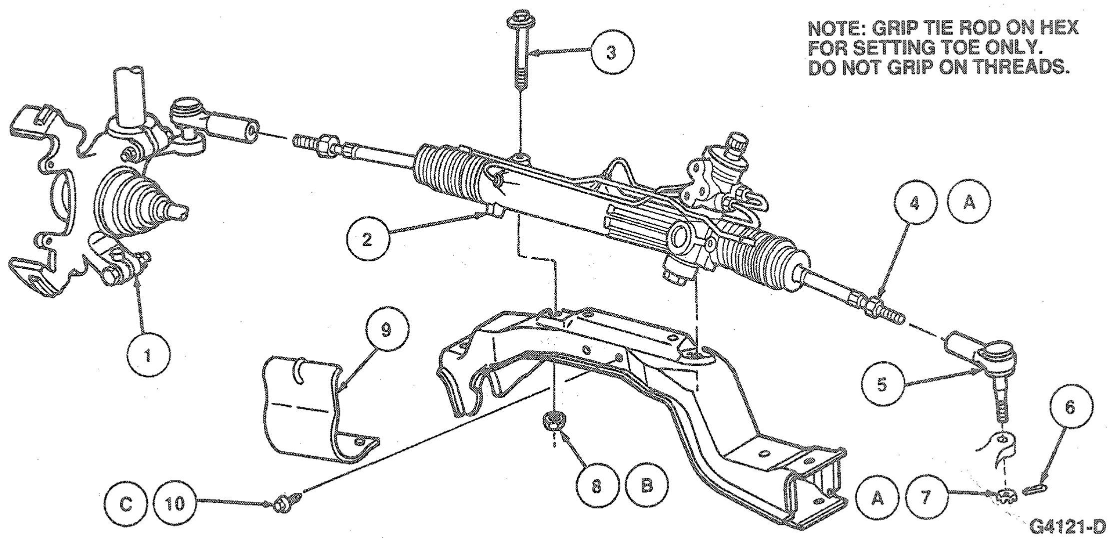
The power steering gear is a 16:1 constant ratio power rack-and-pinion design for all vehicles except Taurus LX and Sable.

The gear housing and valve housing are combined into a one-piece aluminum die casting. The gear design incorporates quick connect fittings for the pressure and return lines that allow the lines to swivel; this is normal and does not indicate loose fittings. If the fittings leak, check to ensure they are tightened to 14-20 N·m (10-15 lb-ft). Do not overtighten. If the leak is not corrected, replace the fitting seals.

The gear is a hydraulic-mechanical unit, which uses an integral piston and rack design to provide power-assisted vehicle steering control. Internal valving directs pump flow and controls pressure, as required, to reduce steering effort during operation. The unit contains a rotary hydraulic fluid control valve integrated to the input shaft and a boost cylinder integrated with the rack.

NOTE: The power steering gear used on the Taurus SHO utilizes travel restrictors mounted inboard of the ball joint housings. The restrictors limit wheel travel to prevent the tires from hitting the wheel housing.

DESCRIPTION (Continued)



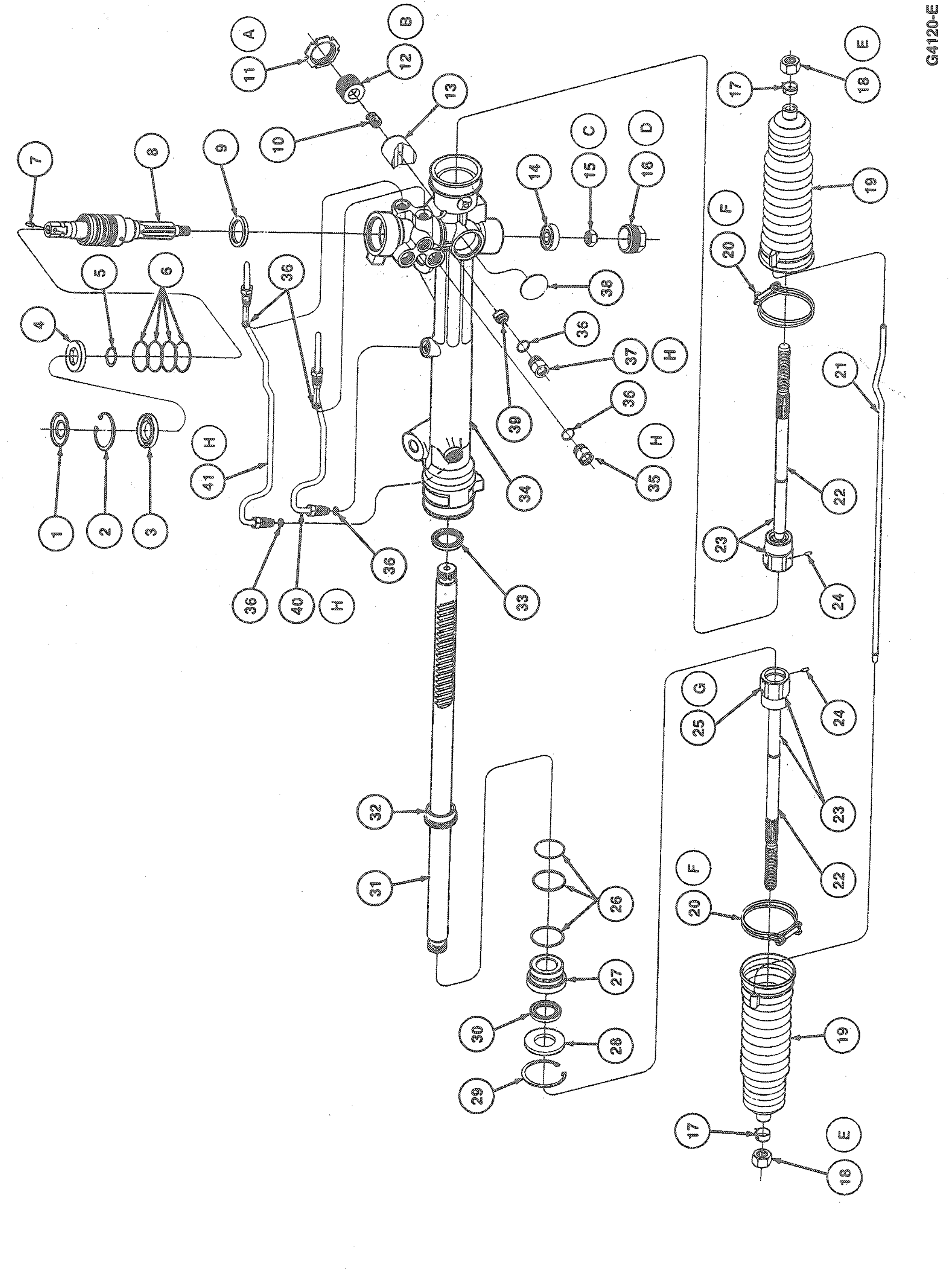
Item	Part Number	Description
1	3K1867	Spindle Assy
2	3504	Gear Assy
3	804246-S150	Bolt (2 Req'd)
4A	N803637-S36	Nut (2 Req'd)
5	3289	Tie Rod End Assy (2 Req'd)
6	—	Cotter Pin (2 Req'd)
7A	N803972-S150	Nut (2 Req'd)

(Continued)

Item	Part Number	Description
8B	N803956-S150	Nut (2 Req'd)
9	3F540	Shield
10C	N610957-S36	Bolt (2 Req'd)
A		Tighten to 47-68 N·m (35-50 Lb-Ft)
B		Tighten to 115-135 N·m (85-100 Lb-Ft)
C		Tighten to 5.5-8.0 N·m (49-71 Lb-In)

DESCRIPTION (Continued)

Taurus / Sable



DESCRIPTION (Continued)

Item	Part Number	Description
1	3D527	Power Steering Gear Input Shaft Dust Seal
2	6140	Snap Ring
3	3D526	Power Steering Gear Input Shaft Seal
4	3D525	Power Steering Gear Input Shaft Bearing
5	386387-S	Snap Ring
6	3D728	Seals
7	390920-S	Roll Pin
8	3D517	Power Steering Gear Input Shaft and Control Assy
9	3591	Seal
10	3F516	Spring
11A	3F606	Yoke Plug Locknut
12B	3580	Yoke Plug
13	3F515	Sector Shaft Support Yoke
14	3552	Steering Gear Worm Bearing
15C	34988-S100	Nut
16D	3568	Steering Gear Housing Cover
17	3C650	Clamp
18E	N803637-S	Nut
19	3332	Boot
20F	N803259-S	Clamp
21	3K762	Breathe Tube
22	—	Spindle Rod (Part of 3280)
23	3280	Tie Rod Assy
24	—	Roll Pin (Part of 3280)
25G	—	Ball Joint Housing (Part of 3280)

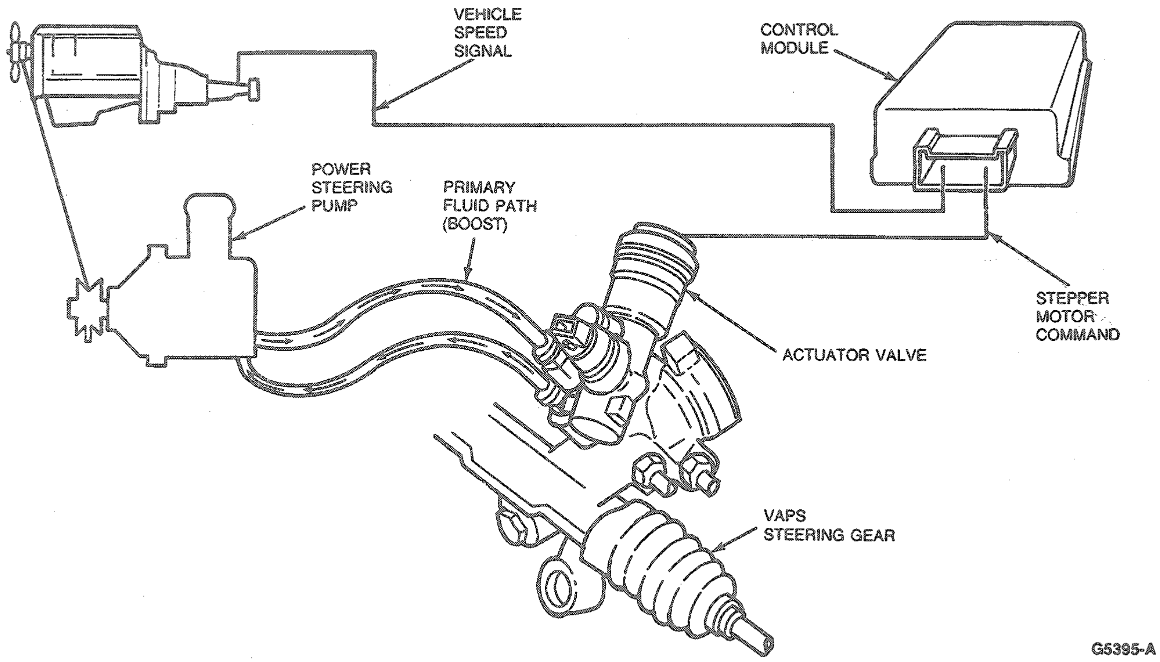
(Continued)

Item	Part Number	Description
26	N803637-S	Seal
27	3576	Bushing
28	3568	Plate
29	97630-S	Snap Ring
30	3F520	Seal
31	3575	Rack Assy
32	—	Piston (Part of 3575)
33	3F520	Rack Seal
34	3548	Steering Gear Housing Assy
35H	3R608	Transfer Tube Connector
36	388898-S	Seal
37H	3C751	Transfer Tube Connector
38	N804432-S	Plug
39	3N603	Check Valve
40H	3A714	Transfer Tube Assy
41H	3A717	Transfer Tube
A		Tighten to 60-89 N·m (44-66 Lb-Ft)
B		Tighten to 5-5.6 N·m (45-50 Lb-In)
C		Tighten to 41-54 N·m (31-39 Lb-Ft)
D		Tighten to 54-68 N·m (40-50 Lb-Ft)
E		Tighten to 47-68 N·m (35-50 Lb-Ft)
F		Tighten to 2.2-3.4 N·m (20-30 Lb-In)
G		Tighten to 75-88 N·m (55-65 Lb-Ft)
H		Tighten to 13-27 N·m (10-20 Lb-Ft)

DESCRIPTION (Continued)

Variable Assist Power Steering (VAPS)

The variable assist power steering (VAPS) system consists of a microprocessor-based module, a power rack-and-pinion steering gear, an actuator valve assembly, hose assemblies, and a high efficiency power steering pump for Taurus LX and Sable 3.0L and 3.8L.



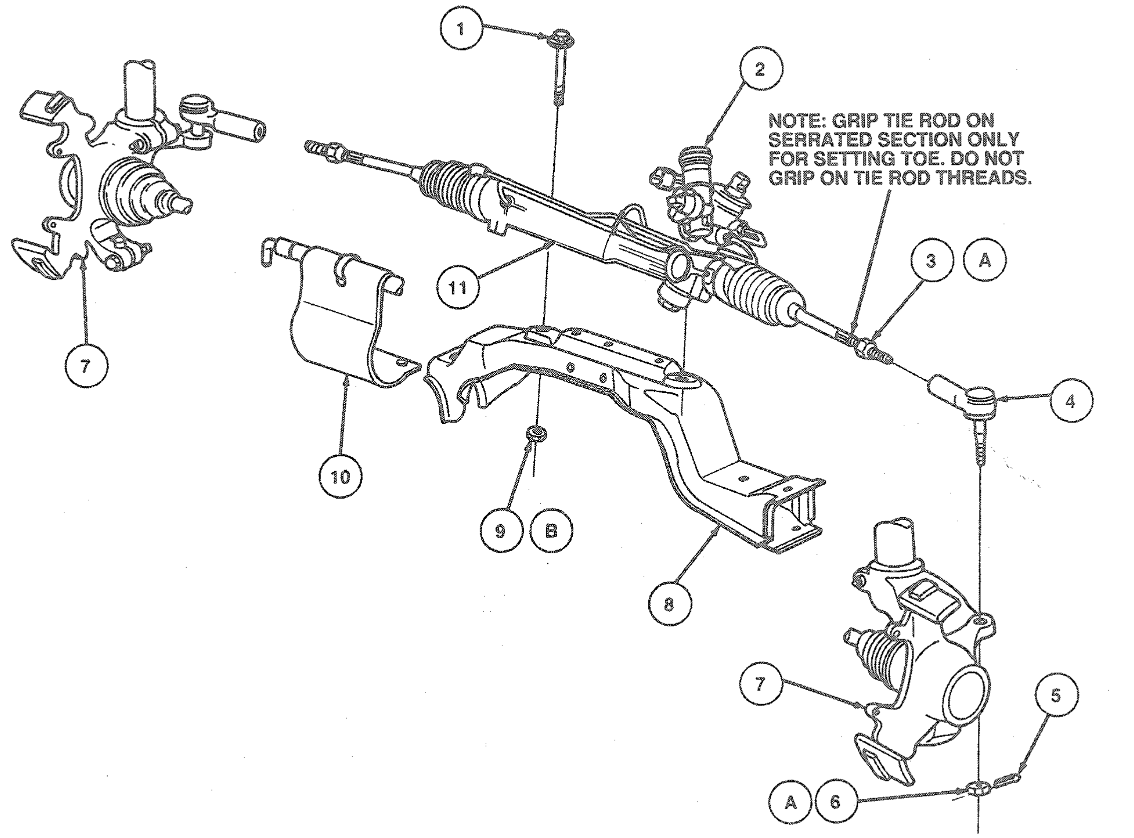
The system uses a modified rotary valve in the gear with two independent hydraulic circuits called the primary and secondary circuits. During parking and low speed operation, the flow from the pump is routed to the primary circuit by an electrically controlled actuator valve assembly. As vehicle speed increases, the actuator valve gradually opens, diverting an increasing amount of fluid to the secondary circuit.

The actuator valve is a pressure-balanced variable orifice valve, controlled by a stepper motor-driven linear spool. The VAPS module receives inputs from a vehicle speed sensor, and signals the stepper motor-driven spool to adjust the opening of the actuator valve.

The VAPS module is programmed to perform a self-diagnostic check every 16 milliseconds. If a concern is detected, the module microprocessor deactivates its outputs.

The VAPS module is programmed to perform a service diagnostic procedure when activated by the service technician.

DESCRIPTION (Continued)



Item	Part Number	Description
1	N804433-S150	Bolt (2 Req'd)
2	3N803	Actuator Assy
3A	N803637-S36	Nut (2 Req'd)
4	3289	Tie Rod End Assy (2 Req'd)
5	72044-S100	Cotter Pin (2 Req'd)
6A	N803972-S150	Nut (2 Req'd)
7	3K185 (LH) 3K186 (RH)	Spindle Assy

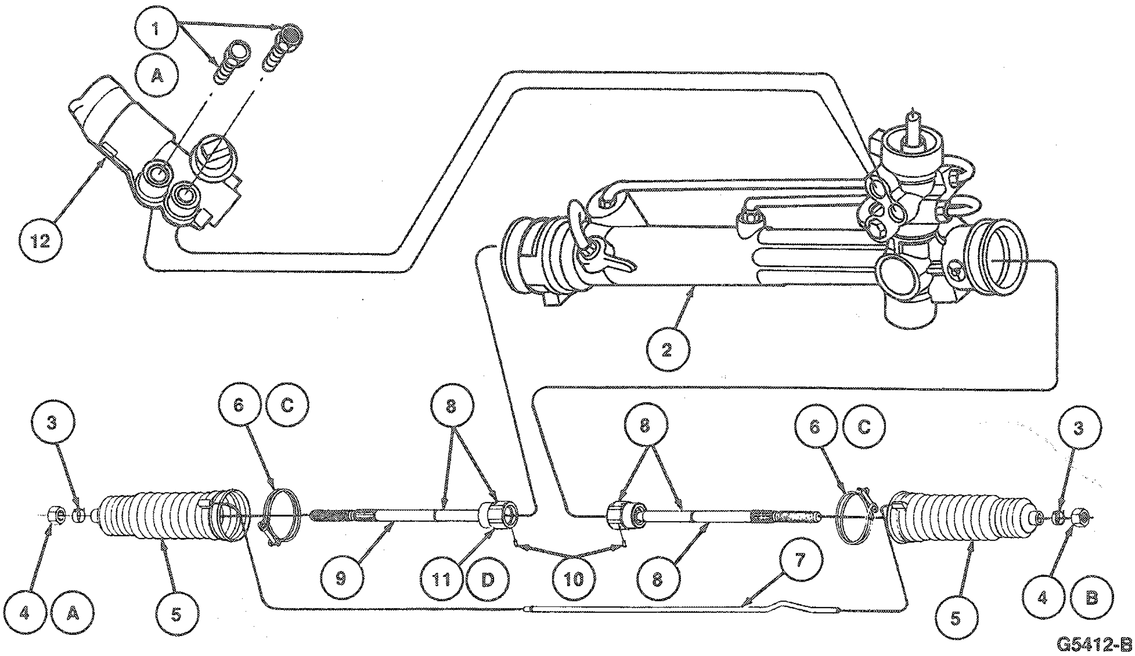
(Continued)

Item	Part Number	Description
8	—	Crossmember
9B	N803956-S150	Nut (2 Req'd)
10	3F570	Shield
11	3504	Gear Assy
A		Tighten to 47-68 N·m (35-50 Lb-Ft)
B		Tighten to 115-135 N·m (85-100 Lb-Ft)

TG4920C

DESCRIPTION (Continued)

VAPS Exploded View



Item	Part Number	Description
1A	3R659	Bolt
2	3548	Steering Gear Housing Assy
3	3C650	Clamp
4B	N803637-S	Nut
5	3332	Boot
6C	N803259-S	Clamp
7	3K762	Breather Tube
8	3280	Tie Rod Assy
9	—	Spindle Rod (Part of 3280)
10	—	Roll Pin (Part of 3280)

(Continued)

Item	Part Number	Description
11D	—	Ball Joint Housing (Part of 3280)
12	3N803	Actuator Assy
A		Tighten to 27-34 N·m (20-25 Lb-Ft)
B		Tighten to 47-68 N·m (35-50 Lb-Ft)
C		Tighten to 2.2-3.4 N·m (20-30 Lb-In)
D		Tighten to 75-88 N·m (55-65 Lb-Ft)

TG5412B

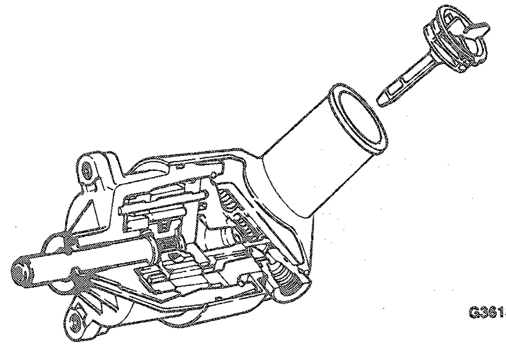
Steering Pump, CII

The Ford Model CII power steering pump is a belt-driven, 10-slipper type pump with a fiberglass-filled nylon reservoir. The reservoir is attached to the rear side of the aluminum pump housing, and the pump body is encased within the housing and reservoir. The pump design incorporates a pump pressure fitting which allows the pump pressure line to swivel. This is normal and does not indicate a loose fitting.

DESCRIPTION (Continued)

A pressure-sensitive identification tag is attached to the reservoir body. This tag indicates the basic model number and the suffix.

CAUTION: Always use the model codes on the tag when requesting service parts in case of differences in internal components. Refer to Section 11-00 for an example of this tag.



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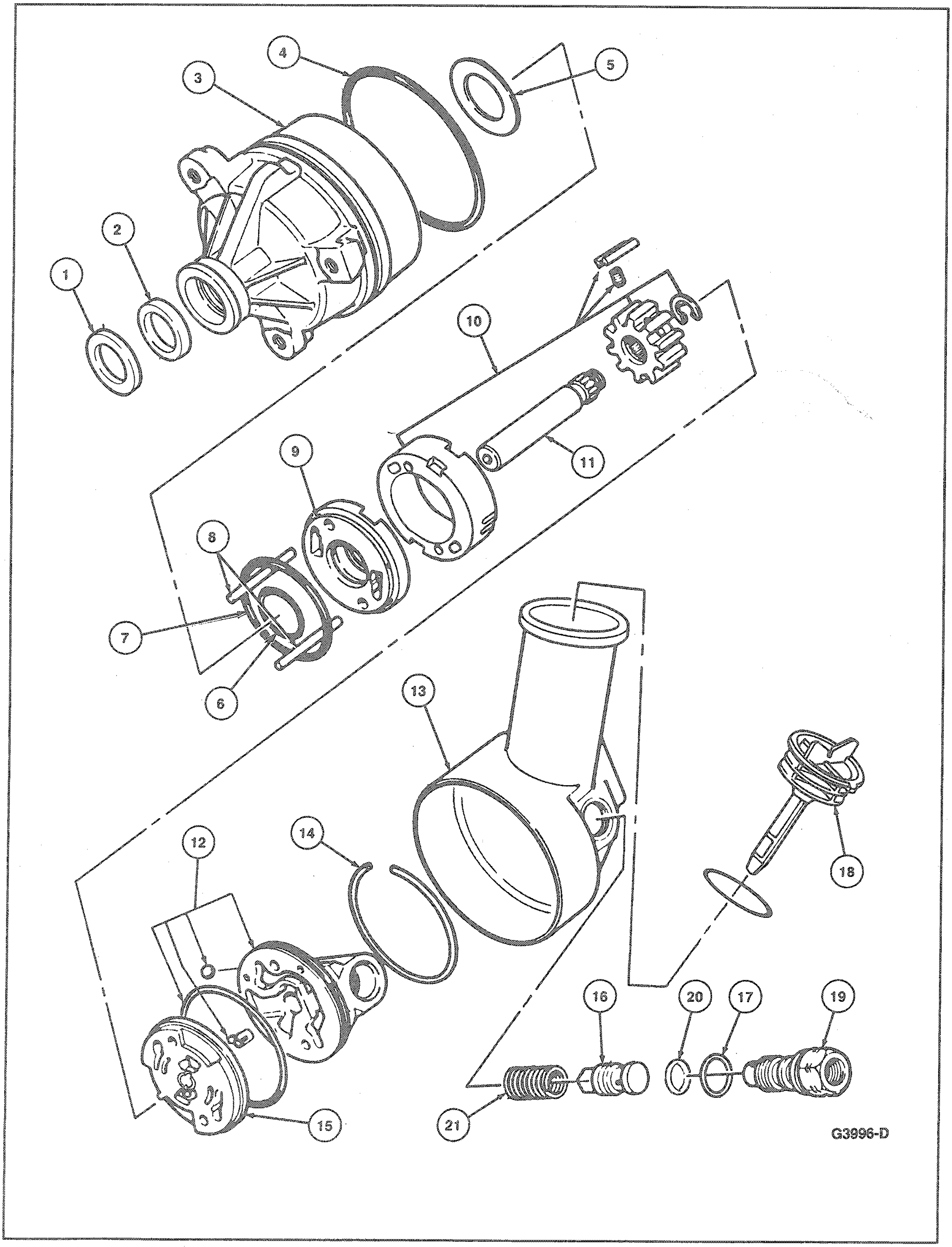
DESCRIPTION (Continued)



DESCRIPTION (Continued)

Item	Part Number	Description
1	3F655	Retainer Assy
2	3B592	Shaft Seal
3	3A643	Pump Housing Plate
4	387572-S100	Seal
5	3D596	Belleville Spring
6	387569-S100	Seal
7	3875700-S100	Seal
8	387579-S	Dowel Pin (2 Req'd)
9	3D590	Lower Plate
10	3D607	Cam and Rotor Assy
11	3B599	Shaft

(Continued)

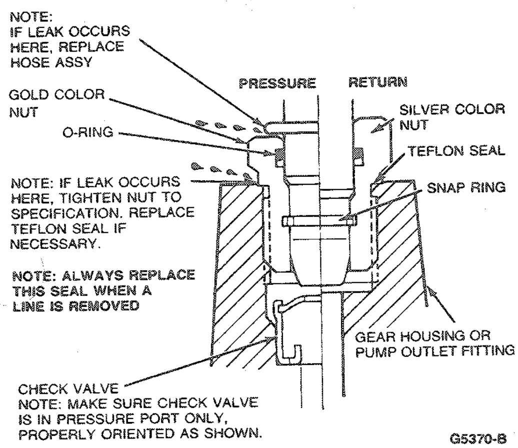
Item	Part Number	Description
12	3C544	Valve Cover Assy
13	3A578	Reservoir
14	387573-S	Retaining Ring
15	3A645	Upper Plate
16	3B604	Valve Body
17	389349-S	Seal
18	3A006	Dipstick
19	3D653	Outlet Fitting
20	384975-S94	Seal
21	3D586	Spring

TG3996D

Power Steering Hoses

The power steering hoses use O-ring seals at the quick connect fittings. Note that there are two possible leak points.

Power Steering Pump and Gear Connection



G5370-B

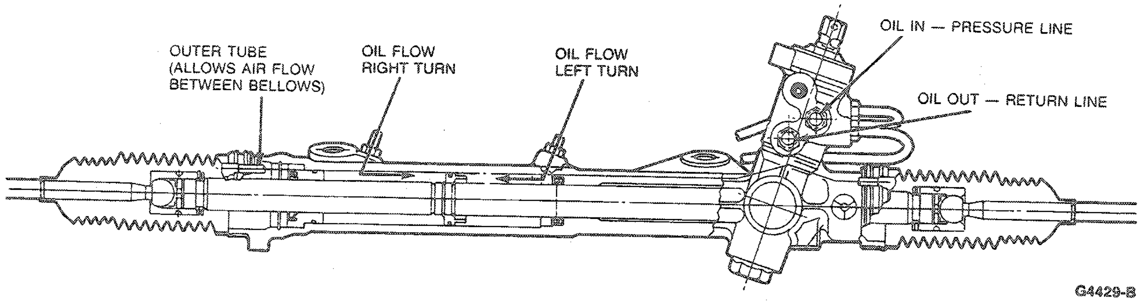
Atsugi Steering Pump

The Atsugi power steering pump is a belt driven, vane-type power steering pump. The pump uses a remote reservoir mounted on the RH fender apron, an oil cooler and a special quick connect fitting at the pump outlet.

OPERATION

Rotary Valve

The rotary design control valve uses relative rotational motion of the input shaft and valve sleeve to direct fluid flow.

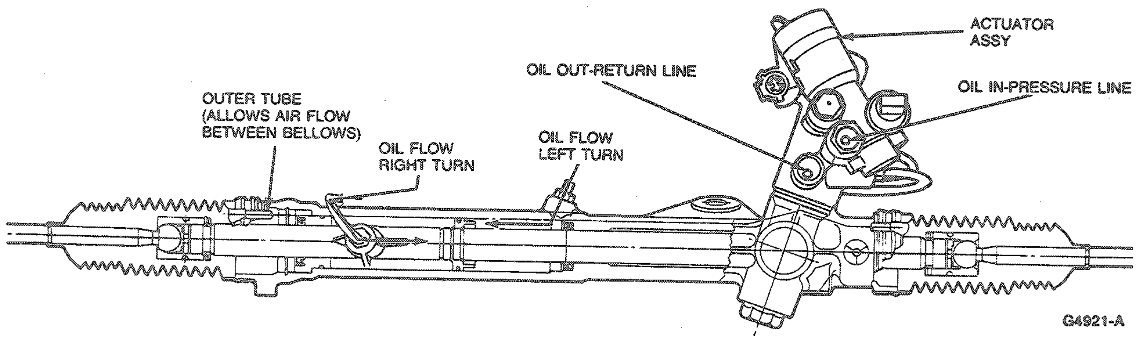


When the steering wheel is turned, resistance of the wheels and the weight of the vehicle cause a torsion bar to deflect. This deflection changes the position of the valve spool and sleeve ports, directing fluid under pressure to the appropriate end of the power cylinder. The difference in pressure forces on the piston helps move the rack to assist turning effort. The piston is attached directly to the rack, and the housing functions as the power cylinder. The oil in the opposite end of the power cylinder is forced to the control valve and back to the pump reservoir.

When the driver stops applying steering effort, the valve is forced back to a centered position by the torsion bar. When this occurs, pressure is equalized on both sides of the piston, and the front wheels tend to return to a straight-ahead position.

Rotary Valve, VAPS

The rotary design control valve directs fluid flow using relative rotational motion of the input shaft and valve sleeve.



OPERATION (Continued)

When the steering wheel is turned, resistance of the wheels and the weight of the vehicle cause a torsion bar to deflect. This deflection changes the position of the valve spool and sleeve ports, directing pressurized fluid to the appropriate end of the power cylinder. The difference in pressure forces on the piston helps move the rack to assist turning effort. The piston is attached directly to the rack, and the housing functions as the power cylinder. The oil in the opposite end of the power cylinder is forced to the control valve and back to the pump reservoir.

When the driver stops applying steering effort, the valve is forced back to a centered position by the torsion bar. When this occurs, pressure is equalized on both sides of the piston, and the front wheels tend to return to a straight-ahead position.

DIAGNOSIS AND TESTING

The diagnosis charts provide procedures to resolve typical customer concerns encountered with the power steering system.

Follow the sequence indicated to save time during condition identification and corrective action.

Power Steering Diagnosis

Before any internal service is performed on the rack and pinion power steering, diagnosis of the condition must be performed. Ensure that the tire size is correct, with matched tires (front and rear), all inflated to specifications. The following conditions, possible sources and corrective action will assist in performing the proper service.

POWER STEERING DIAGNOSIS

CONDITION	POSSIBLE SOURCE	ACTION
• Wander: Condition Where Vehicle Wanders Side-To-Side On The Roadway When Being Driven Straight Ahead While The Steering Wheel Is Held In A Firm Position. Evaluation Should Be Conducted On A Level Road (Little Road Crown).	• Loose tie rod ends. • Inner ball housing loose or worn. • Gear assembly mounting loose. • Loose suspension struts or ball joints. • Column intermediate shaft connecting bolts loose. • Column intermediate shaft joints loose or worn. • Improper wheel alignment.	• Replace tie rod end assemblies. • Replace tie rod assemblies. • Tighten mounting bolt to specification. • Adjust or replace as required. • Tighten bolts to specification. • Replace intermediate shaft. • Set alignment to specification.
• Feedback—Rattle, Chuckle, Knocking Noises In the Steering Gear. Condition Where Roughness Is Felt In The Steering Wheel By The Driver When The Vehicle Is Driven Over Rough Pavement.	• Column U-joints loose. • Loose tie rod ends. • Loose / worn tie rod ball. • Gear assembly mounting loose. • Piston disengaged or loose on rack. • Column intermediate shaft connecting bolts loose. • Loose suspension struts or ball joints.	• Replace if damaged or worn. • Replace tie rod end assemblies. • Replace tie rod assemblies. • Tighten mounting bolts to specification. • Replace rack assembly. • Tighten bolts to specification. • Adjust or replace as necessary.

DIAGNOSIS AND TESTING (Continued)

POWER STEERING DIAGNOSIS (Continued)

CONDITION	POSSIBLE SOURCE	ACTION
• Poor Returnability— Sticky Feel: Condition Where The Steering Fails To Return To Center Following A Turn Without Manual Effort From The Driver. In Addition, When The Driver Returns The Steering To Center, It May Have A Sticky Or Catchy Feel.	• Misaligned steering column or column flange rubbing steering wheel and / or flange.	• Align column.
	• Check rotational torque of intermediate shaft joints.	• If binding, replace intermediate shaft.
	• Tight inner tie rod ball joints.	• Replace tie rod as required.
	• Tight inner tie rod end ball studs.	• Replace tie rod end assemblies.
	• Binding in valve assembly.	• Replace input shaft valve assembly.
	• Bent or damaged rack.	• Replace rack assembly.
	• Bent or damaged subframe.	• Replace as necessary.
	• Column bearing binding.	• Replace bearing.
	• Tight suspension struts or lower control arm ball joints.	• Adjust or replace as required.
	• Improper wheel alignment.	• Set to specification.
	• Contamination in system.	• Flush power steering system.
	• Improper yoke clearance (tight).	• Set to specification.
• Heavy Steering Efforts — Poor or Loss of Assist: Condition Where A Heavy Effort And Poor Assist Condition Is Recognized By The Driver While Turning Corners And Especially While Parking. A Road Test Will Verify This Condition.	• Leakage / loss of fluid.	• Refer to external leakage diagnosis for service.
	• Low pump fluid.	• Fill as necessary.
	• Valve seal cut or twisted.	• Replace seal.
	• Damaged / worn Teflon® piston seal.	• Replace seal.
	• Loose / missing rubber backup piston O-ring.	• Replace / install O-ring.
	• Loose rack piston.	• Replace rack assembly.
	• Gear assembly oil passages restricted.	• Clear / service as required.
	• Bent / damaged rack assembly.	• Replace rack assembly.
	• Pump external leakage.	• Service per Pump Diagnosis.
	• Improper drive belt tension.	• Readjust belt tension.
	• Hose or cooler external leakage.	• Replace as necessary.
	• Improper engine idle speed.	• Readjust idle.
	• Pulley loose or warped.	• Replace pulley.
	• Pump / flow pressure not to specification.	• Refer to Pump Service Diagnosis.
	• Hose cooler line restrictions.	• Clear or replace as required.

TG3117F

FORD INTEGRAL POWER RACK-AND-PINION STEERING GEAR

CONDITION	POSSIBLE SOURCE	ACTION
• Hissing Sound NOTE: There is some noise in all power steering systems. One of the most common is a hissing sound most evident at standstill parking. There is no relationship between this noise and the performance of the steering gear. **CAUTION: Do not hold steering wheel at full lock more than five seconds, as damage to power steering pump may result.**	• Hiss may be expected when the steering wheel is at the end of travel or when turning at standstill.	• Hiss is a normal characteristic of rotary steering gears and in no way affects steering. Do not replace the rack assembly unless the hiss is extremely objectionable. A replacement rack will also exhibit a slight noise and is not always a cure for the condition. Investigate for a grounded column or a loose boot at the dash panel. Any metal-to-metal contact will transmit valve hiss into the passenger compartment through the steering column. Verify clearance between flexible coupling components. Ensure steering column shaft and gear are aligned so flexible coupling rotates in a flat plane and is not distorted as shaft rotates.

TG3022G

DIAGNOSIS AND TESTING (Continued)

External Leakage

When looking for leaks, use this procedure to pinpoint the exact cause and location to avoid mis-diagnosis:

1. Check for overfilled power steering pump reservoir.
2. Wipe suspected area dry.
3. Check for power steering pump overflow and aeration.
4. Check for exact source of oil. Example: Oil may be running down from another area (engine, etc.) and drip may not be leak point.

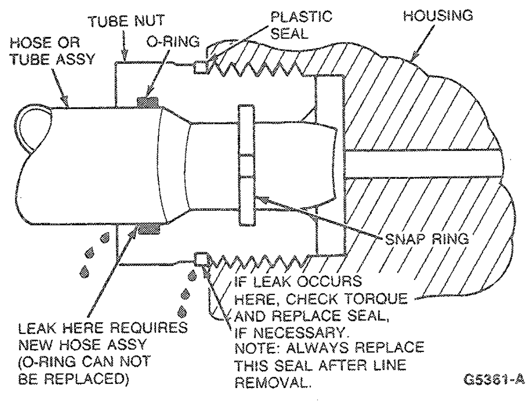
   CAUTION: Do not hold the steering wheel against a stop for more than three to five seconds at a time, as damage to power steering pump may result. Cycle the steering wheel from stop to stop 10 times and check for leaks. The bellows may have to be moved back from the housing to see the leak.
5. Some leaks are high pressure leaks and may require holding steering wheel against stops to seep out.
6. Power steering gear assembly leaks fall into several categories as listed in the Leakage Diagnosis chart. The category determines which seals or parts to replace. Refer to the corresponding illustrations for the leak category.

LEAKAGE DIAGNOSIS

Leak Category	Part Required to Service
1. Hose fittings.	● Loose—Tighten to specification—Do not over-tighten. ● Plastic seals at tube nut—Plastic seals should be replaced each time hose is disconnected. ● O-ring leaks—Replace hose.
2. Leak at (right or left) transfer line.	● Loose—Tighten to specification—Do not over-tighten. ● Replace plastic seals. ● Replace line assembly as required.
3. Leak at input shaft seal.	● Replace input shaft seal kit. Rack and tie rod assembly removal is not required.
4. Leak at either or both bellows.	● Replace all gear housing and rack bushing seals. Do not disturb transfer lines.
5. Leak at end of input shaft.	● Replace input shaft valve assembly along with input shaft seal kit. Rack and tie rod assembly removal is not required.
6. Housing—porosity, cracked or stripped threads.	● Replace the housing assembly.

TG3118F

NOTE: Whenever a gear assembly is disassembled for seal replacement, the gear seal contact surfaces should be checked for roughness and cleaned. Replace components such as input shaft / valve assembly or rack assembly only if the sealing surfaces cannot be cleaned satisfactorily with crocus cloth.



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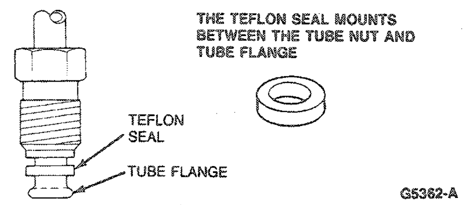
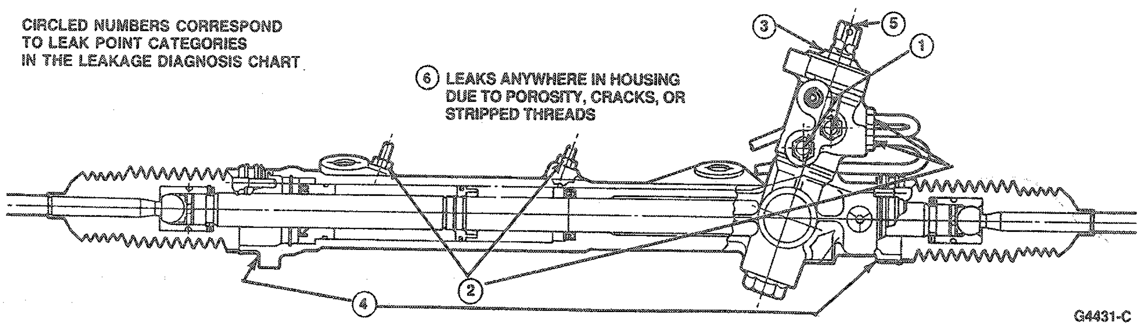
DIAGNOSIS AND TESTING (Continued)





Pump Noise, Atsugi

NOTE: The power steering pump is serviced as an assembly. If any service is required, the entire pump assembly must be replaced.

Refer to pump noise diagnosis chart.

Test Procedure

For test procedure refer to Section 11-00.

DIAGNOSIS AND TESTING (Continued)

Pump Noise, CII

Refer to the pump noise diagnosis chart.

PUMP NOISE DIAGNOSIS

CONDITION	POSSIBLE SOURCE	ACTION
• Power Steering	• Check belt for proper tension or glazing.	• Tighten or replace belt as required.
• Pump Noisy	• Low fluid level and possible leakage.	• Refill to specified level. Purge air from system. Check for leaks. Service as required.
• Swish-Type Noise	• Fluid flow into the bypass valve of the pump valve housing with fluid temperature below 54°C (130°F).	• Normal noise.
• Whine-Type Noise	• Aerated fluid, or cam contour damaged.	• Purge system of air. If condition is not resolved, replace rotor assembly.
• Clicking Mechanical-Type Noise	• Pump slippers too long, excessive wear of pumping elements. Excessive slipper to slot clearance, or out of square slipper springs.	• Replace rotor assembly.
• Chatter-Type Noise	• Chipped corners on rotor outside diameter or distorted slipper spring.	• Replace rotor assembly.
• Other Cause of Noise	• Improper assembly of components such as slippers.	• Rebuild pump and replace components as required.
	• Imperfections on rotor outside diameter or rotor end surface.	• Replace rotor assembly.
	• Damaged rotor splines.	• Replace rotor assembly.
	• Hairline crack on cam inner surface.	• Replace rotor assembly.
	• Interference between rotor and cam.	• Replace rotor assembly.
	• Excessively worn or scored pumping elements and pressure plates.	• Replace rotor assembly and pressure plates.

CG4058-C

The diagnosis charts provide procedures to resolve typical concerns encountered with the power steering system.

Follow the sequence indicated to save time during condition identification and corrective action.

Electrical Component Diagnosis

Tools Required:

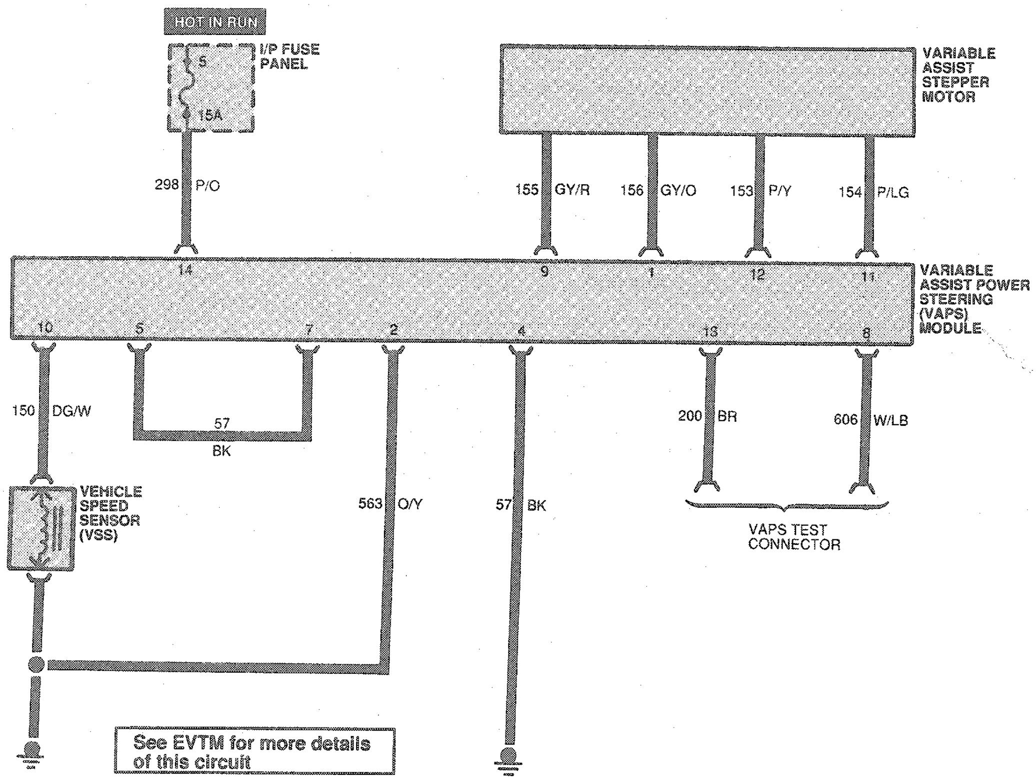
- Rotunda Digital Volt Ohmmeter 007-00001
- Rotunda Inductive Dwell-Tach-Volt-Ohm Tester 059-00010

This portion of the power steering diagnosis refers only to the electrical components of the VAPS system:

- VAPS Control Module
- Speed Sensor
- Actuator Valve
- Wiring Harness and Connectors

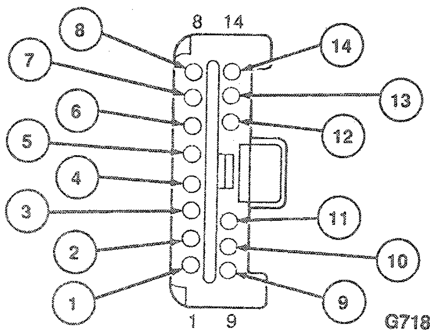
DIAGNOSIS AND TESTING (Continued)

The procedure is a systematic method of determining which of the above components, if any, require servicing. Testing can be done using Rotunda Digital Volt Ohmmeter 007-00001, Rotunda Inductive Dwell-Tach-Volt-Ohm Tester 059-00010 or equivalent.



G7176-A

VAPS Connector End View

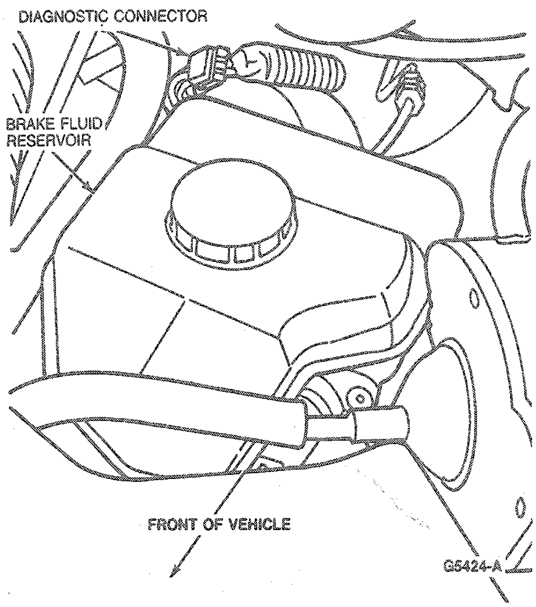


G7187-A

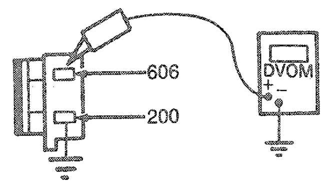
Item	Part Number	Description
1	156 (GY/O)	Stepper Motor
2	563 (O/Y)	Ground
3	—	Not Used
4	57 (BK)	Ground
5	57 (BK)	Ground
6	—	Not Used
7	57 (BK)	Ground
8	606 (W/LB)	VAPS Test Connector
9	155 (GY/R)	Stepper Motor
10	150 (DG/W)	Vehicle Speed Sensor (VSS) 9E731
11	154 (P/LG)	Stepper Motor
12	153 (P/Y)	Stepper Motor
13	200 (BR)	VAPS Test Connector
14	298 (P/O)	Hot in RUN

DIAGNOSIS AND TESTING (Continued)

A diagnostic connector is located in the engine compartment near the brake fluid reservoir and brake booster.

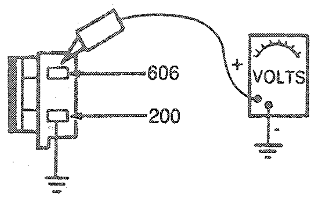


PINPOINT TEST A
VARIABLE ASSIST POWER STEERING ELECTRICAL COMPONENT DIAGNOSIS

TEST STEP		RESULT	▶	ACTION TO TAKE
A1	MODULE CHECK			
	• Turn ignition switch to OFF. • Locate test connector 14489 in engine compartment near brake booster. • Connect DVOM positive lead (R) to Circuit 606 and negative lead (BK) to vehicle ground.  G5315-A • Position DVOM where it can be observed. • Start engine. • Observe voltage reading on DVOM.	Voltage reads 11-14 volts Voltage reads zero Voltage reads above 14 volts	▶ ▶ ▶	GO to A2. GO to A3. CORRECT over-voltage condition then GO to A2.

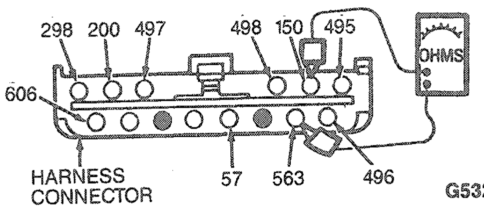
DIAGNOSIS AND TESTING (Continued)

PINPOINT TEST A
VARIABLE ASSIST POWER STEERING ELECTRICAL COMPONENT DIAGNOSIS (Continued)

	TEST STEP	RESULT ▶	ACTION TO TAKE
A2	MODULE CHECK		
	• Turn ignition switch to OFF. • Connect an analog voltmeter as in Step A1. • Use jumper wire and ground Circuit 200.  G5320-A • Start engine. • Rotate steering wheel for approximately 90 seconds noting any changes in steering effort. The effort required to turn the steering wheel should vary between light and heavy in both directions. • After approximately 90 seconds, voltmeter will show a sweep pattern four times between battery voltage and zero if module proveout is OK. Six or zero sweeps if a system component is malfunctioning. After a five second pause, the sweep pattern will be repeated. • Remove Circuit 200 ground before proceeding to next test.	Effort changes with 2 sweeps ▶	GO to **A4.**
		No effort change with 2 sweeps ▶	GO to **A7.**
		Effort change with 4 sweeps ▶	GO to **A19.**
		No effort change with 4 sweeps ▶	GO to **A19.**
		Effort change with 6 sweeps ▶	GO to **A20.**
		No effort change with 6 sweeps ▶	GO to **A12.**
		Effort change with 0 sweeps ▶	GO to **A20.**
		No effort change with 0 sweeps ▶	GO to **A12.**
A3	FUSE CHECK		
	• Inspect fuse located in fuse panel on LH side below instrument panel. • **Is fuse OK?**	Yes ▶	GO to **A16.**
		No ▶	REPLACE fuse. GO to **A1.**
A4	TEST DRIVE VEHICLE		
	• Ensure VAPS system is connected. • Drive vehicle up to 55 mph and set speed control. • **Do steering efforts change and is effort balanced (left vs. right turn direction)?** • While driving vehicle, note operation of speedometer.	Change in steering effort ▶	Diagnostics complete. System is OK.
		Assist only at high speed ▶	GO to **A11.**
		No change in steering effort ▶	GO to **A5.**
		Efforts unbalanced left to right ▶	REPLACE steering gear assembly. REPEAT **A4.**
A5	SPEEDOMETER CHECK		
	• Note operation of speedometer and speed control (from Step A4). • **Are speedometer and speed control operating properly?** • The VAPS system requires a speed signal from the vehicle speed sensor. If the speedometer or speed control does not work, these systems should be serviced using the appropriate diagnostic and service procedures.	Yes ▶	GO to **A6.**
		No ▶	SERVICE as required. GO to **A4.**

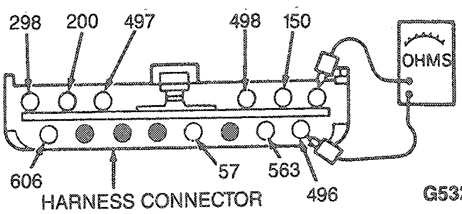
DIAGNOSIS AND TESTING (Continued)

PINPOINT TEST A
VARIABLE ASSIST POWER STEERING ELECTRICAL COMPONENT DIAGNOSIS (Continued)

<table>
<tr><th colspan="2">TEST STEP</th><th>RESULT ▶</th><th>ACTION TO TAKE</th></tr>
<tr><td>A6</td><td>SPEED SENSOR CIRCUIT CHECK
• Disconnect VAPS connector from module.
• Connect DVOM across Circuits 150 and 563.
• Measure resistance.


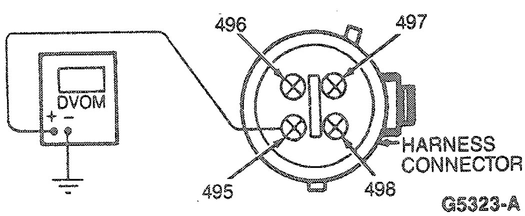
G5321-A</td>
<td>Resistance is between 150-225 ohms ▶

Resistance is less than 150 or greater than 225 ohms ▶</td>
<td>REPLACE VAPS module. GO to **A4.**

SERVICE harness. GO to **A4.**</td></tr>
<tr><td>A7</td><td>ACTUATOR (ELECTRICAL) CHECK
• Turn ignition switch to OFF.
• Disconnect VAPS harness connector from module.
• Connect DVOM to Circuits 495 and 496.
• Measure resistance.


G5322-A
• Connect DVOM to Circuits 497 and 498.
• Measure resistance.</td>
<td>Resistance between 43 and 70 ohms ▶

Resistance less than 43 or greater than 70 ohms ▶</td>
<td>GO to **A8.**

GO to **A10.**</td></tr>
<tr><td>A8</td><td>HARNESS VOLTAGE AT ACTUATOR CONNECTOR
• Turn ignition switch to OFF.
• Verify that VAPS connector is connected to VAPS module.
• Disconnect actuator connector from VAPS harness connector.
• Turn ignition switch to RUN.
• Wait five seconds.
• Measure DC voltage between Circuit 495 and ground. Then measure voltage between Circuit 496 and ground.
• One of these two circuits should be greater than 10 volts and the other less than 2 volts.
• Repeat the two steps above for Circuit 497 and 498.
• **Do voltage readings check OK?**


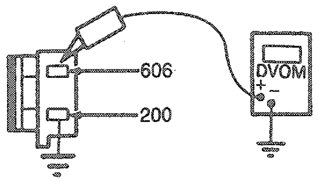
G5323-A</td>
<td>Yes ▶
No ▶</td>
<td>GO to **A9.**
REPLACE VAPS module. GO to **A2.**</td></tr>
</table>

DIAGNOSIS AND TESTING (Continued)

PINPOINT TEST A
VARIABLE ASSIST POWER STEERING ELECTRICAL COMPONENT DIAGNOSIS (Continued)

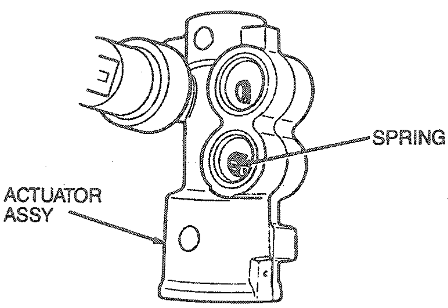
TEST STEP A9 — ACTUATOR (MECHANICAL) CHECK

- Turn ignition switch to OFF.
- Remove actuator as outlined.
- Reconnect actuator connector to VAPS harness connector.
- Attach DVOM to diagnostic connector (near brake booster) as shown.



G5315-A

- Turn ignition switch to ON.
- The module will go through a diagnostic check, consisting initially of the 90 second efforts change sequence.
- If the actuator is mechanically operable, the actuator valve will move between its two limits of travel. This movement can be detected by watching the valve spring expand and relax between the travel limits.
- **Does spring move?**

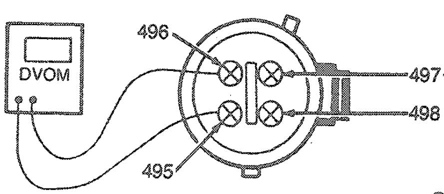


G5316-A

RESULT		ACTION TO TAKE
Yes	▶	REPLACE steering gear assembly. GO to **A2.**
No	▶	REPLACE actuator. GO to **A2.**

TEST STEP A10 — ACTUATOR (ELECTRICAL) CHECK

- Turn ignition switch to OFF.
- Disconnect actuator connector from harness connector.
- Connect DVOM to Circuits 495 and 496.
- Measure resistance.



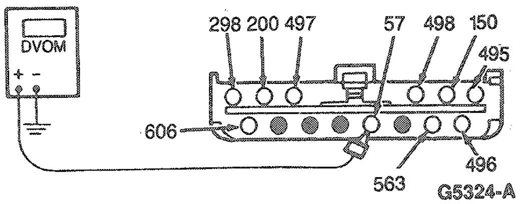
G5317-A

- Connect DVOM to Circuit 497 and 498.
- Measure resistance.

RESULT		ACTION TO TAKE
Resistance between 43 and 70 ohms	▶	GO to **A11.**
Resistance less than 43 or greater than 70 ohms	▶	REPLACE actuator. GO to **A2.**

DIAGNOSIS AND TESTING (Continued)

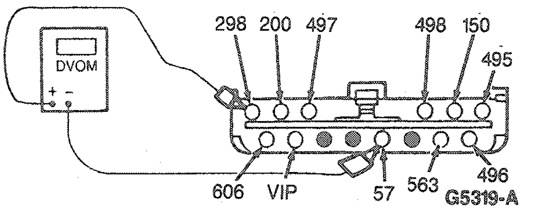
PINPOINT TEST A
VARIABLE ASSIST POWER STEERING ELECTRICAL COMPONENT DIAGNOSIS (Continued)

TEST STEP		RESULT ▶	ACTION TO TAKE
A11	CONTINUITY CHECK		
	• Turn ignition switch to OFF. • Disconnect module connector from module. • Disconnect actuator connector from actuator. • Check continuity of Circuit 495 from module connector to actuator connector. • Repeat for Circuits 296, 497 and 498. • **Do all circuits check OK?**	Yes ▶ No ▶	GO to **A9**. SERVICE harness. GO to **A2**.
A12	VAPS HARNESS AND CONNECTORS CHECK		
	• Turn ignition switch to OFF. • Disconnect VAPS connector from module. • Connect positive lead of DVOM to Circuit 57 and negative lead to ground. • Measure resistance. • **Is resistance greater than 15 ohms?**  NOTE: All doors and hood must be closed for proper resistance readings.	No ▶ Yes ▶	GO to **A13**. SERVICE harness. REPEAT **A12**.

DIAGNOSIS AND TESTING (Continued)

PINPOINT TEST A
VARIABLE ASSIST POWER STEERING ELECTRICAL COMPONENT DIAGNOSIS (Continued)

TEST STEP	RESULT ▶	ACTION TO TAKE
A13 VAPS HARNESS AND CONNECTORS CHECK		
• Disconnect VAPS connector from module. • Connect DVOM as shown.	Yes ▶	GO to **A14**.
	No ▶	SERVICE harness. REPEAT A13.



G5319-A

- Turn ignition switch to ON.
- Measure voltage at each circuit (Circuit 57 to ground).
- **Are voltage readings near given values?**

Row	Circuit	Function	Volts (DC)
Top	298	Power	Battery
Top	200	Diagnostic	<.1
Top	497	Actuator	<.1
Top	498	Actuator	<.1
Top	150	Speed Sensor	—
Top	495	Actuator	<.1
Bottom	606	Diagnostic	<.1
Bottom	57	Ground	<.1
Bottom	563	Speed Sensor	—
Bottom	496	Actuator	<.1
Bottom	—	VIP	<.1

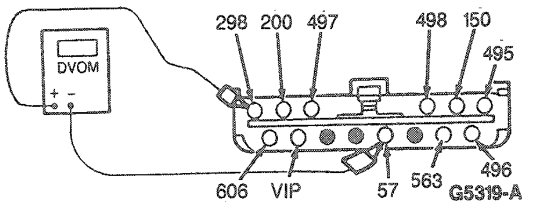
DIAGNOSIS AND TESTING (Continued)

PINPOINT TEST A
VARIABLE ASSIST POWER STEERING ELECTRICAL COMPONENT DIAGNOSIS (Continued)

TEST STEP — RESULT — ACTION TO TAKE

A14 VAPS HARNESS AND CONNECTORS CHECK

- Turn ignition switch to OFF.
- Measure resistance between Circuit 57 ground and all other indicated circuits.
- Connect DVOM as shown.



G5319-A

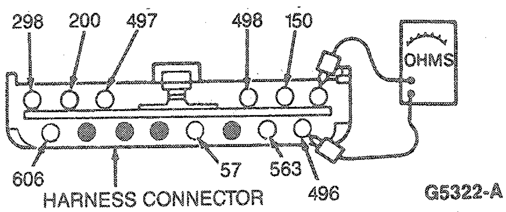
- Measure resistance of each circuit, by moving positive lead.
- **Is resistance near given values?**

Row	Circuit	Function	Typical Value (ohm)
Top	298	Power	3.6
Top	200	Diagnostic	Open
Top	497	Actuator	Open
Top	498	Actuator	Open
Top	150	Speed Sensor	195
Top	495	Actuator	Open
Bottom	606	Diagnostic	Open
Bottom	563	Speed Sensor	0.6
Bottom	496	Actuator	Open
Bottom	—	VIP	Open

Result	Action to Take
Yes	GO to **A15**.
No	SERVICE harness. GO to **A2**.

A15 ACTUATOR (ELECTRICAL) CHECK

- Connect VOM to Circuit 495 and 496.
- Measure resistance.



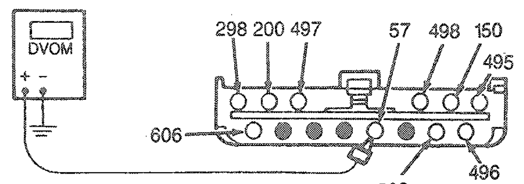
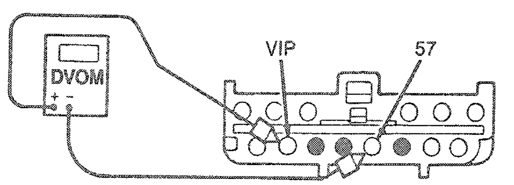
G5322-A

- Connect VOM to Circuit 497 and 498.
- Measure resistance.

Result	Action to Take
Resistance between 43 and 70 ohms	REPLACE VAPS module. GO to **A2**.
Resistance less than 43 or greater than 70 ohms	SERVICE harness or connectors. GO to **A2**.

DIAGNOSIS AND TESTING (Continued)

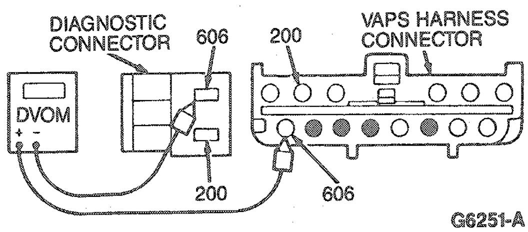
PINPOINT TEST A
VARIABLE ASSIST POWER STEERING ELECTRICAL COMPONENT DIAGNOSIS (Continued)

TEST STEP		RESULT ▶	ACTION TO TAKE
A16	VAPS HARNESS AND CONNECTORS CHECK		
	• Turn ignition switch to OFF. • Disconnect VAPS connector from module. • Connect positive lead of DVOM to Circuit 57 and negative lead to ground. • Measure resistance. • **Is resistance greater than 15 ohms?**  G5324-A NOTE: All doors and hood must be closed for proper resistance readings.	No ▶ Yes ▶	GO to **A17**. SERVICE harness. GO to **A1**.
A17	VAPS HARNESS AND CONNECTORS CHECK		
	• Connect positive lead of DVOM to Circuit 298 and negative lead to Circuit 57. • Turn ignition switch to ON. • Measure voltage. • Turn ignition switch to OFF. • **Does DVOM read 12 volts?**	Yes ▶ No ▶	GO to **A18**. SERVICE harness. GO to **A1**.
A18	CONTINUITY CHECK		
	• Check continuity of Circuit 606 from diagnostic connector to module connector. • **Is Circuit 606 OK?**	Yes ▶ No ▶	REPLACE module. GO to **A1**. SERVICE Circuit 606. GO to **A1**.
A19	VAPS HARNESS AND CONNECTORS CHECK (VIP PIN)		
	• Turn ignition switch to OFF. • Doors and hood must be closed for proper reading. • Connect DVOM as shown. • Measure resistance between Circuit 57 (ground) and VIP Pin 7. Typical resistance is infinite. • Measure voltage between Circuit 57 (ground) and VIP Pin 7. Typical voltage is less than 0.1 volt. • **Is resistance and voltage near given values?**  G5325-A	Yes ▶ No ▶	GO to **A4**. SERVICE harness. GO to **A2**.

DIAGNOSIS AND TESTING (Continued)

PINPOINT TEST A
VARIABLE ASSIST POWER STEERING ELECTRICAL COMPONENT DIAGNOSIS (Continued)

	TEST STEP	RESULT	ACTION TO TAKE
A20	VAPS HARNESS AND CONNECTOR CHECK (DIAGNOSTIC CONNECTOR)		
	• Turn ignition switch to OFF. • Doors and hood must be closed for proper readings. • Disconnect VAPS harness connector from module. • Connect DVOM as shown. • Measure resistance between Circuit 606 of VAPS harness connector and Circuit 606 of diagnostic connector. Typical resistance is 2.0 ohms or less. • Measure voltage between Circuit 606 of VAPS harness connector and Circuit 606 of diagnostic connector. Typical voltage is less than 0.1. • Move leads to Circuit 200. Measure resistance between Circuit 200 of VAPS harness connector and Circuit 200 of diagnostic connectors. Typical resistance is 2.0 ohms or less. • Measure voltage between Circuit 200 of VAPS harness connector and Circuit 200 of diagnostic connector. Typical voltage is less than 0.1 volt. • **Is resistance and voltage near given values?**	Yes ▶ No ▶	Go to **A2**. SERVICE harness. GO to **A2**.



G6251-A

TG5305D

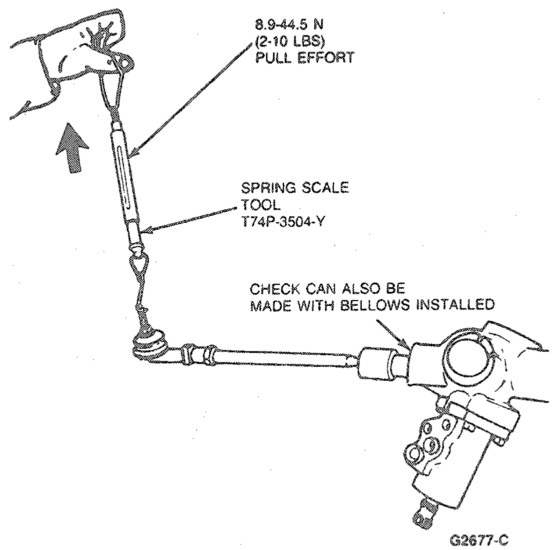
Tie Rod Articulation Torque Check

Tools Required:

- Hook Spring Scale T74P-3504-Y
- Tie Rod End Remover TOOL-3290-D

This check may be done with the gear on or off the vehicle.

1. Disconnect tie rod end from spindle using Tie Rod End Remover TOOL-3290-D or equivalent.
2. Hook Spring Scale T74P-3504-Y over tie rod end and measure force required to move tie rod.
3. If force required to move tie rods is not between 8.9N and 45N (2 lb and 10 lb), replace tie rod.



G2677-C

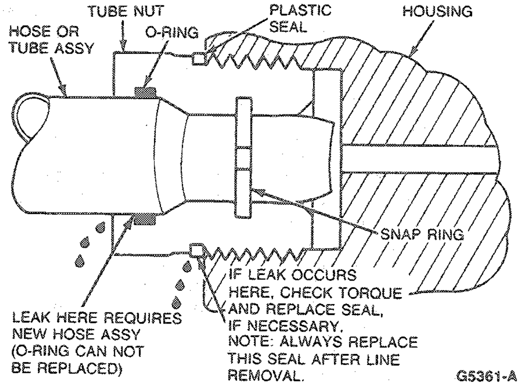
DIAGNOSIS AND TESTING (Continued)

External Leakage

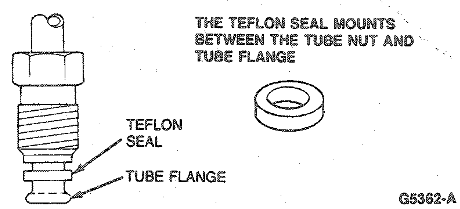
When looking for leaks, use this procedure to pinpoint the exact cause and location to avoid misdiagnosis:

1. Check for overfilled power steering pump reservoir.
2. Wipe suspected area dry.
3. Check for power steering pump overflow and aeration.
4. Check for exact source of oil. Example: Oil may be running down from another area (engine, etc.) and drip may not be leak point.

   CAUTION: Do not hold the steering wheel against a stop for more than three to five seconds at a time, as damage to power steering pump may result. Cycle the steering wheel from stop-to-stop 10 times and check for leaks. The bellows may have to be moved back from the housing to see the leak.
5. Some leaks are high-pressure leaks and may require holding steering wheel against stops to seep out.
6. Power steering gear assembly leaks fall into several categories as listed in the Leakage Diagnosis chart. If the leak cannot be serviced by tightening a fitting to the specified toque, replace the gear.



G5361-A

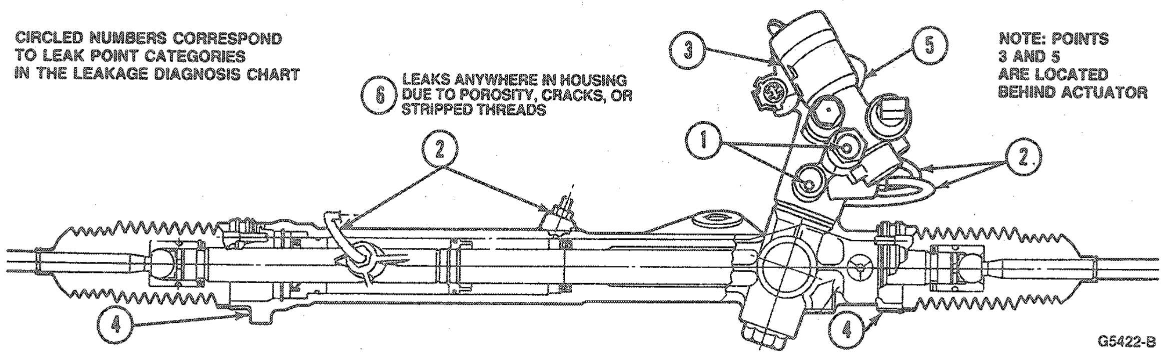


G5362-A

LEAKAGE DIAGNOSIS

Leak Category	Part Required to Service
1. Hose fittings.	a. Loose—Tighten to specification—Do not over-tighten. b. Plastic seals at tube nut—Plastic seals should be replaced each time hose is disconnected.
2. Leak at (right or left) transfer line.	a. Loose—Tighten to specification—Do not over-tighten.
3. Leak at input shaft seal.	a. Replace gear assembly.
4. Leak at either or both bellows.	a. Replace gear assembly
5. Leak at end of input shaft.	a. Replace gear assembly.
6. Housing—porosity, cracked or stripped threads.	a. Replace gear assembly.

TG5423A



G5422-B

REMOVAL AND INSTALLATION

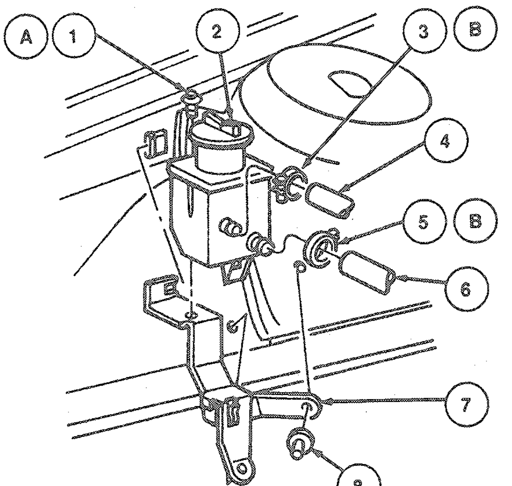
Remote Reservoir

Removal

1. Loosen inlet and outlet hose clamps.
2. Remove hoses and allow fluid to drain into a container.
3. Remove retaining screw and reservoir from attachments.

Installation

1. Position reservoir to attachments. Tighten retaining screw to 6-8 N·m (54-70 lb-in).
2. Install hoses. Tighten clamps to 1.4-2 N·m (13-17 lb-in).
3. Fill reservoir to proper level. Refer to Section 11-00.



HOSE CLAMP STUDS TO BE POSITIONED AS SHOWN

G5211-C

Item	Part Number	Description
1A	W611101-S2	Screw
2	3R700	Power Steering Reservoir Assy
3B	390462-S100	Clamp (3 Req'd)
4	3493	Hose
5B	97242-S100	Clamp (2 Req'd)
6	3691	Hose
7	3490	Bracket Assy
8	N803710-S	Rivet (2 Req'd)
A		Tighten to 6-8 N·m (54-70 Lb-In)
B		Tighten to 1.4-2 N·m (13-17 Lb-In)

Power Steering Pump

Removal

1. Disconnect negative battery cable.
2. Remove engine damper strut. Refer to Section 03-01B.
3. Remove power steering belt.
4. Raise vehicle on hoist. Refer to Section 00-02.
5. Remove right front wheel and tire assembly.
6. Position jack under engine. Remove right rear engine mount. Refer to Section 03-01B.
7. Remove power steering pump pulley.
8. Position drain pan. Remove pressure and return lines from pump.
9. Remove four pump retaining bolts (three in front, one in rear) and remove pump.

Installation

1. Position pump and install retaining bolts. Tighten retaining bolts to 20-32.5 N·m (15-24 lb-ft).
2. Install pressure and return lines to pump. Remove drain pan.
3. Install power steering pump pulley.
4. Install right rear engine mount and remove jack. Refer to Section 03-01B.
5. Install right front wheel and tire assembly. Tighten wheel lug nuts to 115-142 N·m (85-105 lb-ft).
6. Lower vehicle.
7. Install belt to pump pulley.
8. Install engine damper strut.
9. Connect negative battery cable.
10. Fill power steering fluid to proper level. Refer to Section 11-00.

Tie Rod End Replacement

Tools Required:

- Tie Rod End Remover TOOL-3290-D

Steering Gear Installed

Removal

1. Remove and discard cotter pin and nut from worn tie rod end ball stud.
2. Disconnect tie rod end from steering spindle, using Tie Rod End Remover TOOL-3290-D or equivalent.
3. Hold tie rod end with a wrench and loosen tie rod jam nut.
4. Note depth to which tie rod was located by using the jam nut as a marker. Grip tie rod with a pair of suitable pliers, and remove rod end assembly from tie rod.

Installation

1. Clean tie rod threads.
2. Thread new tie rod end into tie rod to same depth as removed tie rod end.

REMOVAL AND INSTALLATION (Continued)

3. Place tie rod end stud into steering spindle. Ensure front wheels are pointed straight ahead before connecting stud to spindle.
4. Install a new nut on tie rod end stud. Tighten nut to 48 N·m (35 lb-ft), and continue tightening nut to align next castellation of nut with cotter pin hole in stud. Install a new cotter pin.
5. Set toe to specification. Refer to Section 04-00. Tighten jam nut to 47-68 N·m (35-50 lb-ft).

Steering Gear

Except Taurus LX

Removal

1. From inside vehicle, remove nuts retaining steering shaft weather boot to dash panel.
2. Remove two bolts retaining intermediate shaft to steering column shaft.
3. Set weather boot aside. Remove pinch bolt at steering gear input shaft and remove intermediate shaft.
4. Raise vehicle on a hoist. Refer to Section 00-02.
5. Remove LH front wheel.
6. Remove heat shield.
7. Cut bundling strap retaining hydraulic pressure and return lines to gear.
8. Remove tie rod ends from spindles.

   NOTE: The pressure and return lines are on the front of the valve housing. Do not mix them with the transfer lines on the side of the valve.
9. Place a drain pan under vehicle and remove hydraulic pressure and return lines from steering gear.

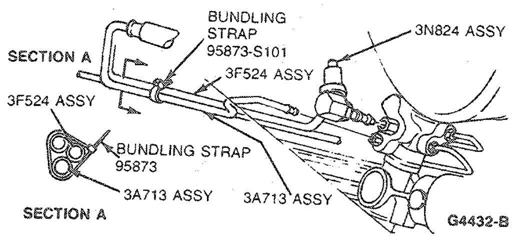
   NOTE: The bolts are pressed into the gear housing and should not be removed during gear removal.
10. Remove gear retaining nuts.
11. Push weather boot end into vehicle and lift gear out of mounting holes. Rotate gear so input shaft will pass between brake booster and floorpan. Carefully start working steering gear out through LH fender apron opening.

    NOTE: If steering gear seems to be stuck, check RH rod to ensure stud is not caught on any obstacle.
12. Rotate input shaft so that it clears LH fender apron opening and complete removal of steering gear.

Installation

1. Install new plastic seals on hydraulic line fittings as outlined.
2. Insert steering gear through LH fender apron. Rotate input shaft forward to completely clear fender apron opening. To allow gear to pass between brake booster and floorpan, rotate input shaft rearward.
3. Align steering gear bolts to bolt holes and install retaining nuts. Tighten to 115-135 N·m (85-100 lb-ft).
4. Lower vehicle.

   NOTE: Swivel movement of lines is normal when fittings are properly tightened.
5. From engine compartment, install hydraulic pressure and return lines. Tighten pressure line to 20-35 N·m (15-25 lb-ft), and return line to 20-35 N·m (15-25 lb-ft).
6. Raise vehicle.
7. Secure pressure and return lines to transfer tube with bundling strap as shown.



8. Install heat shield.
9. Install tie rod ends to spindles. Tighten castellated nuts to minimum of 48 N·m (35 lb-ft). If necessary, tighten slightly more to align slot in nut for the cotter pin.
10. Install a new cotter pin.
11. Install LH front wheel and lower vehicle.
12. From inside vehicle, pull weather boot end out of vehicle and install over valve housing.
13. From inside vehicle, install intermediate shaft to steering gear input shaft.
14. Install inner weather boot to floorpan.
15. Install intermediate shaft to steering column shaft.
16. Fill power steering system with premium power steering fluid E6AZ-19582-AA (ESW-M2C33-F) or equivalent.
17. Check system for leaks and proper operation.
18. Adjust toe setting. Refer to Section 04-00.

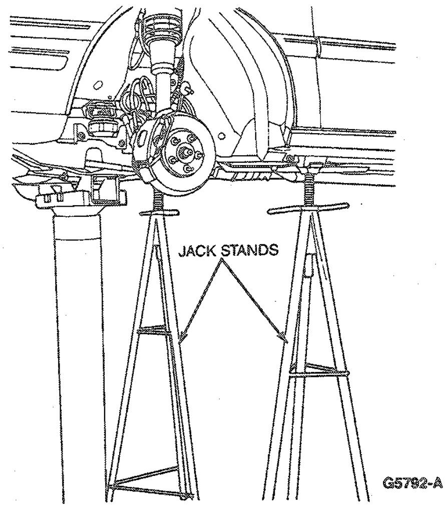
Taurus LX and Sable

Removal

1. From inside vehicle, remove nuts retaining steering shaft weather boot to dash panel.
2. Remove two bolts retaining intermediate shaft to steering column shaft.
3. Set weather boot aside. Remove pinch bolt at steering gear input shaft and remove intermediate shaft.

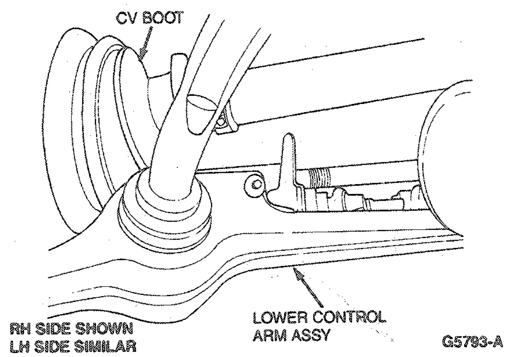
REMOVAL AND INSTALLATION (Continued)

4. Raise vehicle on a twin post hoist and remove front wheel and tire assemblies. Refer to Section 00-02.

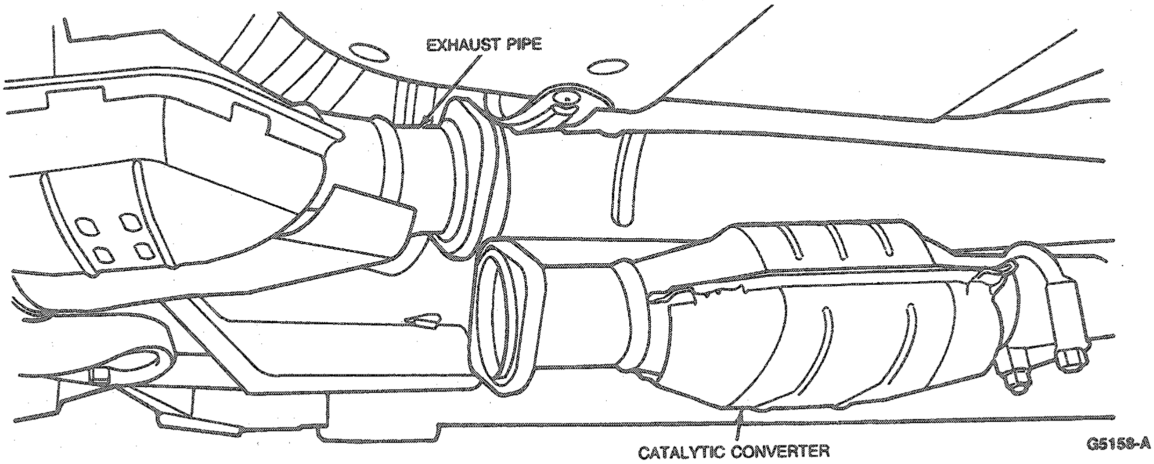


5. Support vehicle with jackstands under rear edge of subframe.

6. Remove tie rod cotter pins and nuts, and remove tie rod ends from spindle.
7. Remove tie rod ends from shaft. Mark position of jam nut to maintain alignment.
8. Remove nuts from gear-to-subframe retaining bolts.



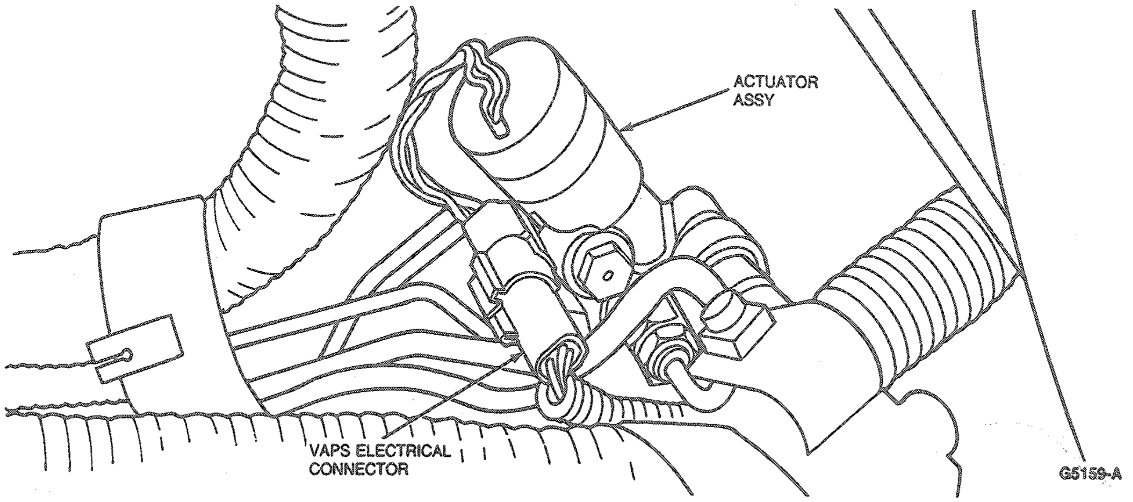
9. Remove rear subframe-to-body retaining bolts.
10. Remove exhaust pipe-to-catalytic converter attachment.



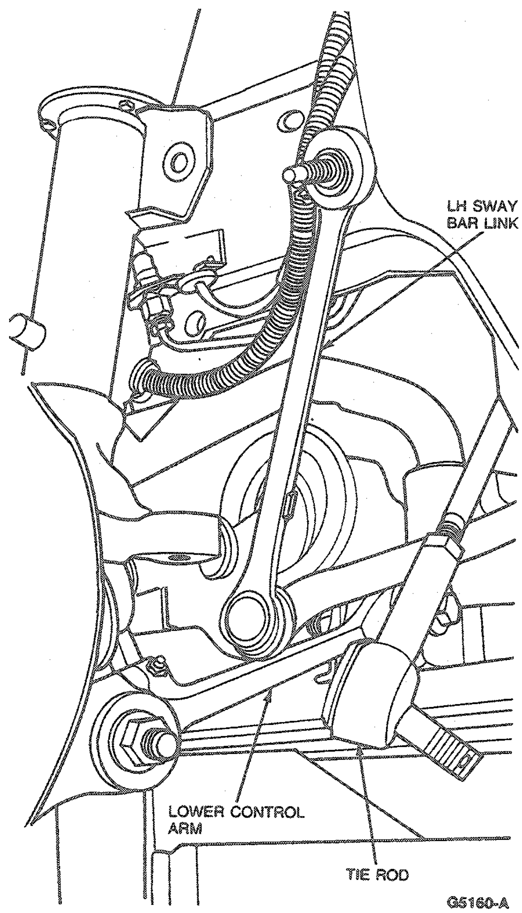
11. Lower twin post hoist carefully until subframe separates from body; approximately four inches.
12. Remove heat shield band and fold shield down.

REMOVAL AND INSTALLATION (Continued)

13. Disconnect VAPS electrical connectors.



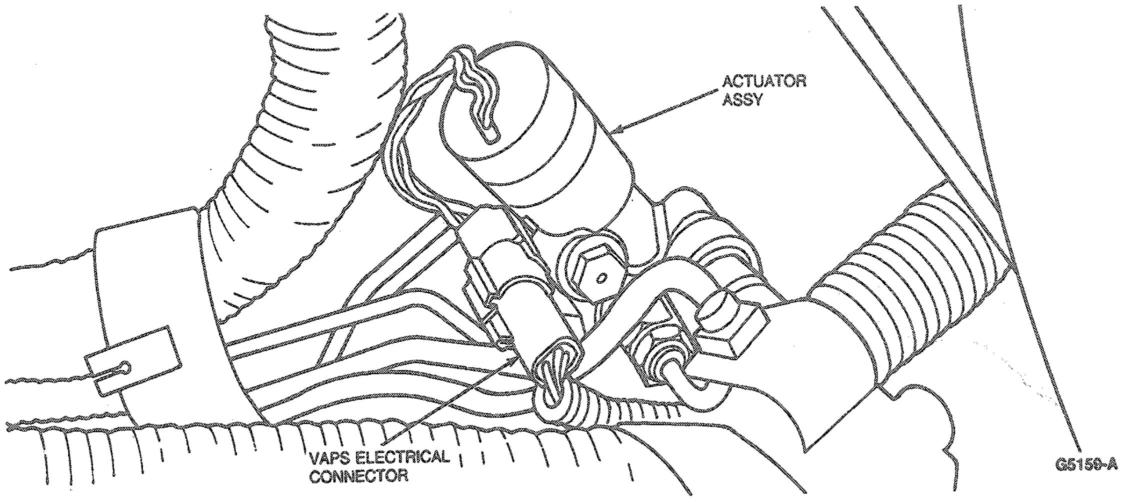
14. Rotate gear to clear bolts from subframe and pull left to facilitate line fitting removal.
15. Place a drain pan under vehicle and remove line fittings.
16. Remove LH sway bar link.
17. Remove gear assembly through LH wheel well.



REMOVAL AND INSTALLATION (Continued)

Installation

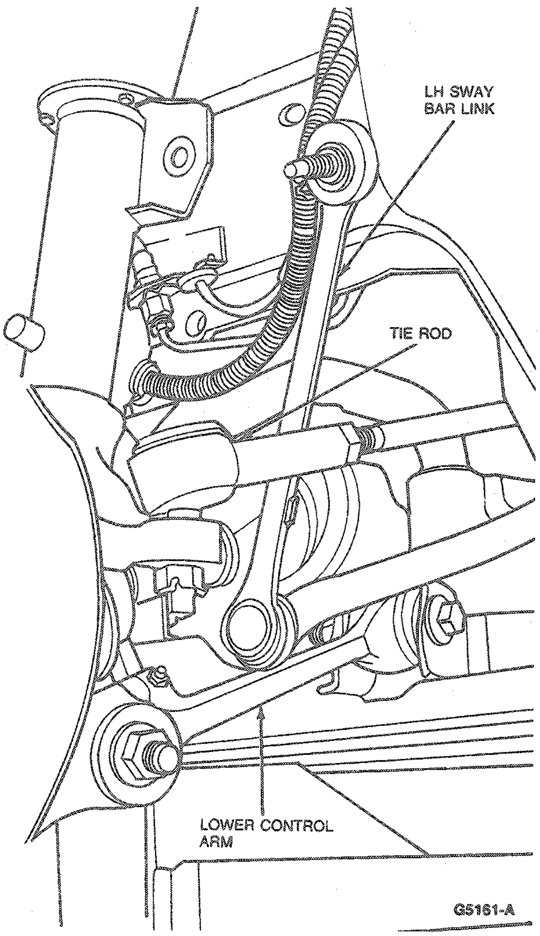
1. Install new TFE O-rings on line fittings as outlined in Pressure and Return Line Seal Replacement.
2. Place gear retaining bolts in gear housing.
3. Install gear through LH wheel well.
4. Install power steering line fittings to gear assembly.
5. Install VAPS electrical connectors.



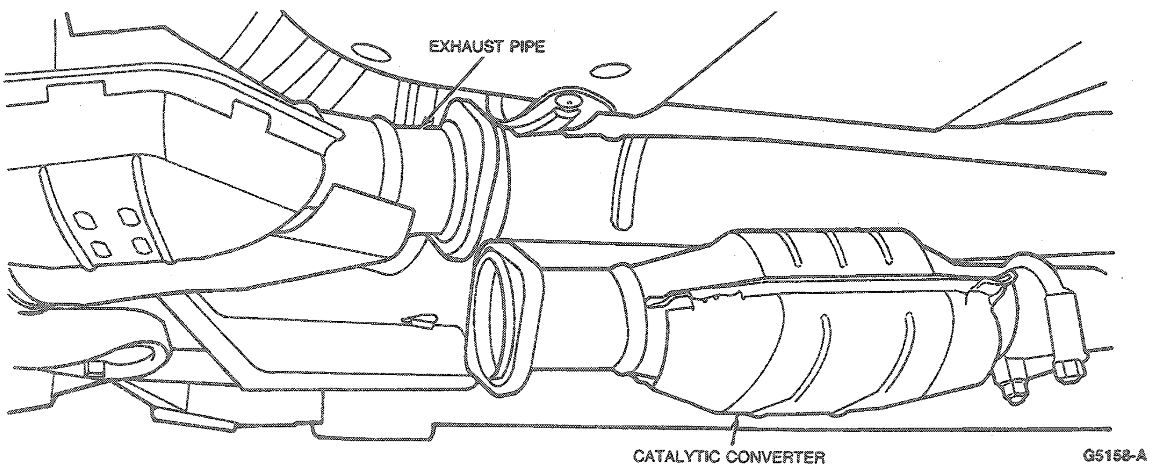
6. Position gear into subframe.
7. Install tie rod ends onto shaft.
8. Install band on heat shield.
9. Attach tie rod ends to spindle. Install nuts and new cotter pins.

REMOVAL AND INSTALLATION (Continued)

10. Attach sway bar links.



11. Raise hoist until subframe contacts body.
12. Install subframe retaining bolts.
13. Install gear-to-subframe nuts and tighten to 115-135 N·m (85-100 lb-ft).
14. Attach exhaust pipe to catalytic converter.



REMOVAL AND INSTALLATION (Continued)

15. Install tire and wheel assemblies. Tighten wheel lug nuts to 115-142 N·m (85-105 lb-ft).
16. Remove jackstands and lower vehicle.
17. From inside vehicle, push weather boot end out of vehicle and install over valve housing.
18. Install intermediate shaft to steering gear input shaft. Tighten bolt to 41-51 N·m (30-38 lb-ft).
19. Install inner weather boot to floorpan.
20. Install intermediate shaft to steering column shaft. Refer to Section 11-04.
21. Fill with premium power steering fluid E6AZ-19582-AA (ESW-M2C33-F) or equivalent.
22. Bleed power steering system. Refer to Section 11-00.
23. Check system for leaks and proper operation.
24. Adjust toe setting. Refer to Section 04-00.

Pressure and Return Lines

Taurus/Sable

Removal

1. Disconnect battery ground cable.
2. Remove remote air cleaner.
3. Disconnect electrical connector in back of radiator fan motor.
4. Disconnect electrical connector from purge valve.
5. Remove radiator fan shroud.
6. Disconnect integrated module harness from headlamp harness and place module on top of engine to provide accessibility to power steering lines.
7. Remove wiring harness guide retaining screws and position guide aside.
8. Remove screw at pressure and return line bracket.
9. Remove anti-rattle clip.

   NOTE: Removal of pressure switch may allow for additional tool clearance.
10. Disconnect electrical connector on power steering pressure switch at steering gear.
11. Remove plastic strap attaching tubes to steering gear.
12. Remove pressure line fitting at power steering pump using a 5/8-inch open-end wrench.
13. Loosen clamp and remove return line at pump.
14. Remove return line fitting at steering gear using an 18mm open-end wrench.
15. Remove pressure line fitting at steering gear, using an 11/16-inch open-end wrench.

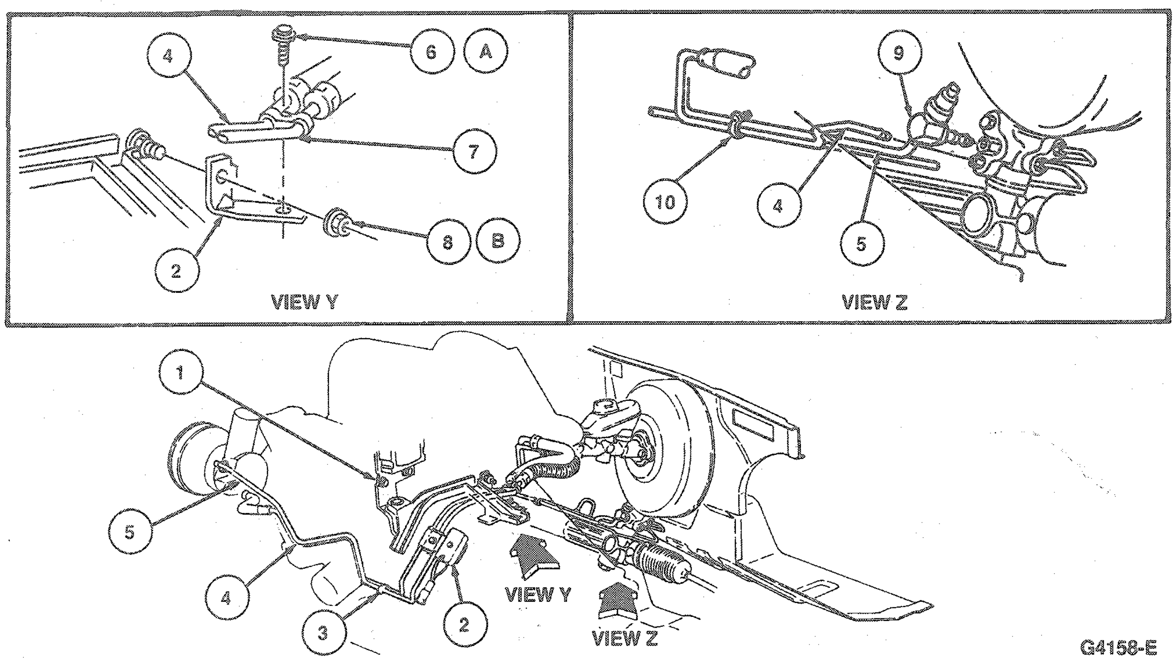
Installation

NOTE: Pressure and return fittings have the same thread size. Ensure the pressure nut (gold color) on line is installed in the pressure port, and that the check valve is properly oriented. The return fitting is silver colored and longer than the pressure line fitting.

1. Position power steering lines in vehicle and connect lines at power steering pump and steering gear. Tighten fitting(s) to 34-46 N·m (26-33 lb-ft). Tighten hose clamps to 1.4-2 N·m (13-17 lb-in).
2. Install screw at pressure and return line bracket.
3. Install anti-rattle clip.
4. Install plastic strap attaching lines to transfer tube on steering gear.
5. Connect power steering pressure electrical connector to switch.
6. Install wiring harness guide.
7. Position integrated module to top of fan shroud and connect module harness to headlamp harness.
8. Install fan shroud.
9. Connect electrical connector to purge valve.
10. Connect electrical connector to radiator fan motor.
11. Install remote air cleaner.
12. Connect battery ground cable.
13. Fill system. Refer to Section 11-00.

REMOVAL AND INSTALLATION (Continued)

3.0L Engine



Item	Part Number	Description
1	12257	Engine Coil Bracket
2	3C510	Bracket Assy
3	38511-S2	Clip
4	3A713	Power Steering Line Assy
5	3F524	Power Steering Line Assy
6A	N610959-S2	Bolt
7	3A719	Pressure Hose Assy
8B	N621939-S2	Nut
9	3N824	T-Fitting Assy
10	95873-S101	Retainer
A		Tighten to 4.5-5.7 N·m (40-50 Lb-In)
B		Tighten to 8.1-13 N·m (6-9 Lb-Ft)

(Continued)

Supply Line—Reservoir to Pump

Taurus SHO

Removal

1. Disconnect battery ground cable.
2. Remove engine damper shock. Refer to Section 03-01B.
3. Remove power steering belt.
4. Loosen supply line hose clamp at reservoir and remove hose.
5. Drain fluid into a suitable container.
6. Remove strap retaining supply line to return line.
7. Raise vehicle on hoist. Refer to Section 00-02.
8. Remove RH front wheel and tire.
9. Position adjustable jack under engine.
10. Remove RH rear engine mount. Refer to Section 03-01C.
11. Remove power steering pump pulley.
12. Position drain pan under pump.
13. Disconnect supply line at pump.
14. Remove supply line from vehicle.

Installation

1. Position supply line in vehicle.
2. Connect supply line hose to pump. Tighten hose clamp to 1.4-2 N·m (13-17 lb-in).
3. Install power steering pump pulley.
4. Install RH rear engine mount.
5. Remove jack.
6. Install wheel and tire. Tighten wheel lug nuts to 115-142 N·m (85-105 lb-ft).
7. Remove drain pan.
8. Lower vehicle.
9. Install engine damper shock.

REMOVAL AND INSTALLATION (Continued)

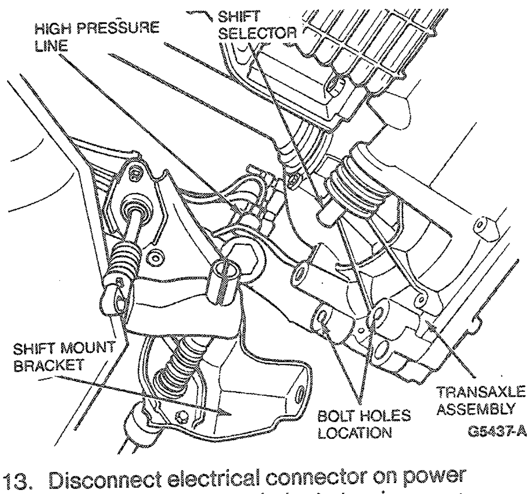
10. Install strap to secure supply line to return line.
11. Connect battery ground cable.
12. Fill system. Refer to Section 11-00.

Pressure Line

Taurus SHO

Removal

1. Disconnect battery ground cable.
2. Remove engine damper shock. Refer to Section 03-01B.
3. Remove power steering belt.
4. Raise vehicle. Refer to Section 00-02.
5. Remove RH front wheel and tire.
6. Position jack under engine.
7. Remove RH rear engine mount. Refer to Section 03-01B.
8. Remove power steering pump pulley.
9. Position drain pan under pump.
10. Remove pressure line fitting at power steering pump.
11. Cut tie straps and remove heat shield around steering gear assembly.
12. Remove shift linkage mount bracket from transaxle to gain access to high pressure line at gear housing.



13. Disconnect electrical connector on power steering pressure switch at steering gear.
14. Remove pressure line fitting at steering gear.
15. Remove high pressure line from vehicle.

Installation

1. Position high pressure line in vehicle and connect line at power steering pump and steering gear.
2. Connect electrical harness to power steering pressure switch.
3. Install shift linkage mount bracket to transaxle.
4. Position heat shield around steering gear assembly and install tie straps.
5. Remove drain pan.
6. Install power steering pump pulley.
7. Install RH rear engine mount.
8. Remove jack.
9. Install wheel and tire. Tighten wheel lug nuts to 115-142 N·m (85-105 lb-ft).
10. Lower vehicle.
11. Install power steering belt.
12. Install engine damper shock.
13. Connect battery ground cable.
14. Fill system. Refer to Section 11-00.

Cooler Lines

Steering Gear to Cooler

Taurus SHO

Removal

1. Disconnect battery ground cable.
2. Raise vehicle. Refer to Section 00-02.
3. Loosen hose clamp at cooler. Disconnect line and drain fluid into a suitable container.
4. Remove shift mount bracket.
5. Cut tie straps and remove heat shield from steering gear.
6. Disconnect hose at steering gear.
7. Lower vehicle.
8. Remove hose from vehicle.

Installation

1. Position hose in vehicle.
2. Raise vehicle.
3. Connect hose at steering gear.
4. Position heat shield and install tie straps.
5. Install shift mount bracket.
6. Connect line to cooler and tighten clamp to 1.4-2 N·m (13-17 lb-in).
7. Lower vehicle.
8. Connect battery ground cable.
9. Fill system. Refer to Section 11-00.

Cooler to Reservoir

Taurus SHO

Removal

1. Disconnect battery ground cable.
2. Raise vehicle. Refer to Section 00-02.

REMOVAL AND INSTALLATION (Continued)

3. Loosen hose clamp at cooler. Disconnect hose and drain fluid into a suitable container.
4. Remove shift mount bracket.
5. Cut tie straps and remove heat shield from steering gear.
6. Lower vehicle.
7. Loosen hose clamp at reservoir and disconnect return line.
8. Remove hose from vehicle.

Installation

1. Position reservoir-to-cooler hose in vehicle.
2. Connect hose to reservoir and tighten clamp to 1.4-2 N·m (13-17 lb-in).
3. Raise vehicle.
4. Position heat shield at steering gear and install tie straps.
5. Install shift mount bracket.
6. Connect hose to cooler and tighten clamp to 1.4-2 N·m (13-17 lb-in).
7. Lower vehicle.
8. Connect battery ground cable.
9. Fill system. Refer to Section 11-00.

Cooler

Taurus SHO

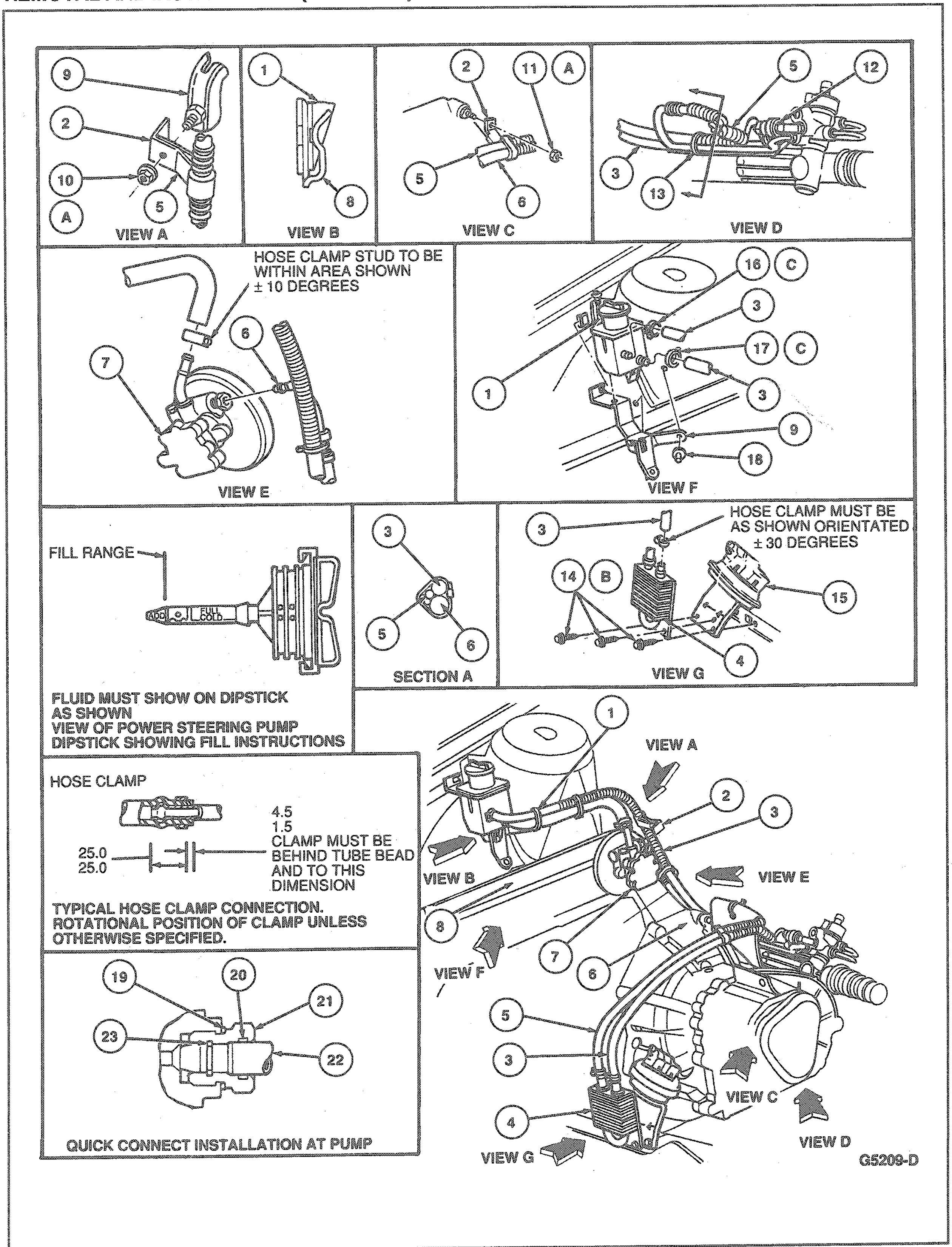
Removal

1. Disconnect battery cable.
2. Loosen hose clamps at cooler and remove return lines from cooler.
3. Remove two screws retaining cooler assembly to vehicle. Remove cooler.

Installation

1. Position cooler and install two screws. Tighten to 18-28 N·m (14-20 lb-ft).
2. Connect return line hoses to cooler. Position hose clamps and tighten to 1.4-2 N·m (13-17 lb-in).
3. Connect battery ground cable.
4. Fill system. Refer to Section 11-00.

REMOVAL AND INSTALLATION (Continued)



REMOVAL AND INSTALLATION (Continued)

Item	Part Number	Description
1	3R700	Power Steering Reservoir Assy
2	3C510	Clamp
3	3F751	Hose Assy
4	3D746	Cooler Assy
5	3F731	Hose Assy
6	3A719	Hose Assy
7	3A674	Power Steering Pump
8	3490	Bracket
9	—	Engine Mounted Stud
10A	N621939-S2	Nut
11A	N801310-S	Nut
12	3N803	Actuator Assy
13	95873	Strap

(Continued)

Item	Part Number	Description
14B	N610959-S2	Screw (3 Req'd)
15	—	Speed Control Servo
16C	390462-S100	Clamp (3 Req'd)
17C	383522-S	Clamp (2 Req'd)
18	N803710-S	Rivet (2 Req'd)
19	388898-S	Seal
20	N804753-S	Seal
21	3F656	Housing
22	—	Hose or Tube Assy
23	N804753-S	Snap Ring
A		Tighten to 23.3-31.7 N·m (17-23 Lb-Ft)
B		Tighten to 4.0-5.6 N·m (35-50 Lb-in)
C		Tighten to 1.6-2.2 N·m (14-20 Lb-in)

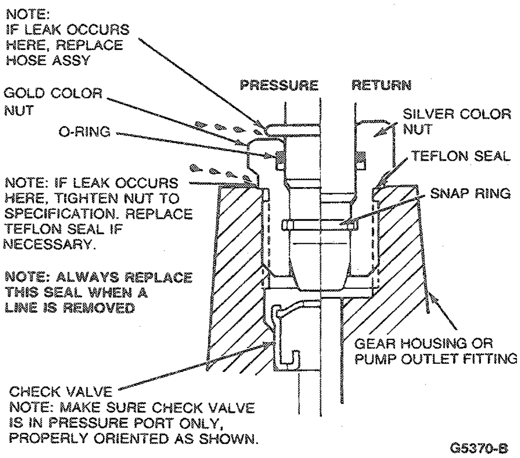
Pressure and Return Line Fitting at Steering Gear and Power Steering Pump

Tools Required:

- Teflon Seal Installer D90P-3517-A3

Seal Replacement

If a leak occurs between the tubing and tube nut, replace the hose assembly. If a leak occurs between the tube nut and the aluminum gear housing or pump outlet fitting, replace the plastic washer.



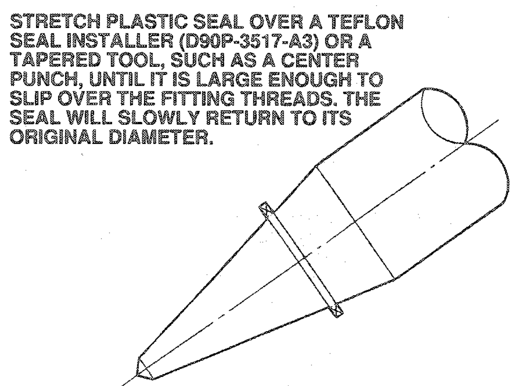
G5370-B

The following procedure should be used:

1. Check fittings to determine which fitting is leaking and whether leak is between tube and tube nut or between tube nut and gear housing or pump outlet fitting.

   CAUTION: DO NOT over-tighten. If tube nuts are overtorqued stripping of housing threads may occur and bores may concave.

2. If leak is between tube nut and gear housing or pump outlet fitting, check to ensure nut is tightened to 27-34 N·m (20-25 lb-ft).
3. If leak continues or if leak is between tube and tube nut, remove line.
4. Unscrew tube nut, and inspect plastic seal washer. Always replace plastic seal washer (pressure line plastic washer at gear, 388897-S, and return line plastic washer at gear or pump outlet, 388898-S) when line is removed. To facilitate assembly of new plastic seal washer, a tapered shaft may be required to stretch washer, so it may be slipped over tube nut threads.



G3023-C

5. The rubber O-ring cannot be serviced with this design. If leak is due to the O-ring, replace the hose assembly.

REMOVAL AND INSTALLATION (Continued)

6. Connect tube nuts and tighten to 27-34 N·m (20-25 lb-ft). Install plastic strap to attach pressure and return lines to LH turn transfer line.

The quick connect fittings may disengage if not fully assembled, if the snap ring is missing, or if the tube nut, or the hose end is not machined properly.

If the fitting disengages, replace the hose assembly. The fitting is fully engaged only when the hose will not pull out. To test for positive engagement, the system should be properly filled, the engine started, and the steering wheel cycled from lock-to-lock. Service hose assemblies have tube nuts, snap rings and O-rings already attached.

Pressure Switch

Tools Required:

- Rotunda Digital Volt Ohmmeter 007-00001

The pressure switch uses an O-ring seal. If a leak occurs, check that the switch is properly tightened to 7-14 N·m (5-10 lb-ft). If the leak continues, replace the O-rings, then the pressure tube, and finally the pressure switch.

Pressure Switch Functional Check

Check operation of the switch if either or both of the following concerns are noted:

- Engine stalls during parking maneuvers.
- Engine idles at high speed.

The following test is based on the fact that the switch is normally closed. As power steering load increases, the switch opens and increases the idle speed.

1. Disconnect the electrical connector at the pressure switch.
2. Connect a continuity tester, Rotunda Digital Volt Ohmmeter 007-00001 or equivalent, across the pressure switch terminals.
3. Start engine and let idle.
4. Switch should be normally closed (zero ohms) with steering wheel straight ahead.
5. Turn steering toward either stop while watching continuity tester. Switch should open near the stops (no continuity or infinite reading on ohmmeter).
6. If switch fails either test, replace the switch. If switch is OK, check the engine idle speed control system.

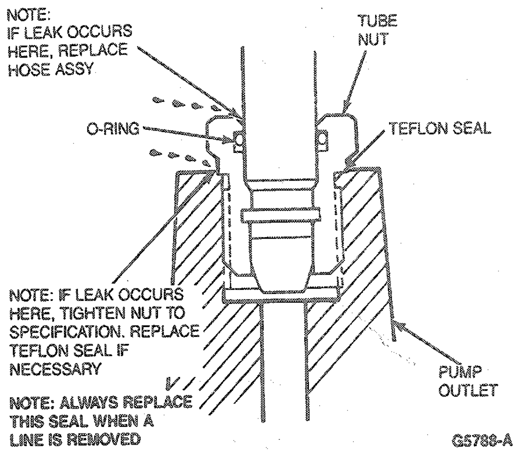
Quick Connect Power Steering Fitting, CII

Tools Required:

- Teflon Seal Installer D90P-3517-A3

Seal Replacement

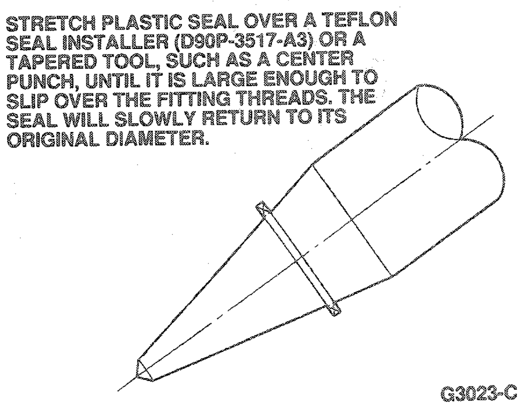
If a leak occurs between the tubing and tube nut, replace the hose assembly. If a leak occurs between the tube nut and the pump outlet, replace the plastic washer.



The following procedure should be used:

1. Check fitting to determine whether leak is between tube and tube nut or between tube nut and pump outlet

   CAUTION: DO NOT over-tighten. If tube nuts are overtorqued, stripping of housing threads may occur and bores may concave.
2. If leak is between tube nut and pump outlet, check to ensure nut is tightened to 27-34 N·m (20-25 lb-ft).
3. If leak continues or if leak is between tube and tube nut, remove line.
4. Unscrew tube nut, and inspect plastic seal washer. Always replace plastic seal washer (388898-S) when line is removed. To facilitate assembly of new plastic seal washer, a tapered shaft may be required to stretch washer, so it may be slipped over tube nut threads.



REMOVAL AND INSTALLATION (Continued)

5. The rubber O-ring cannot be serviced with this design. If leak is due to the O-ring, replace the hose assembly.
6. Connect tube nut and tighten to 27-34 N·m (20-25 lb-ft).

The quick connect fitting may disengage if not fully assembled, if the snap ring is missing, or if the tube nut or the hose end is not machined properly.

If the fitting disengages, replace the hose assembly. The fitting is fully engaged only when the hose will not pull out. To test for positive engagement, the system should be properly filled, the engine started, and the steering wheel cycled from lock-to-lock. Service hose assemblies have tube nuts, snap rings and O-rings already attached.

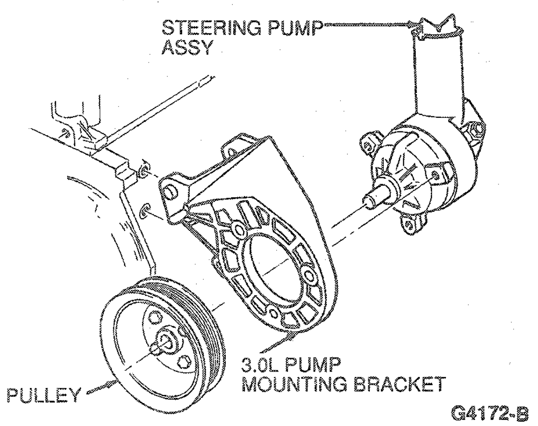
Steering Pump

Removal

1. Remove radiator overflow bottle to gain access to three bolts retaining pulleys to pulley hub.
2. Mark both pulley-to-hub positions with grease pencil or paint daub for reassembly to maintain balance.
3. Remove the three bolts and two pulleys from pulley hub.

Installation

1. Install two pulleys on hub, aligning marks put on hub and pulleys during removal.
2. Install the three bolts and tighten to 21-32 N·m (15-23 lb-ft).
3. Install radiator overflow bottle.



G4172-B

Steering Pump and Pulley Hub

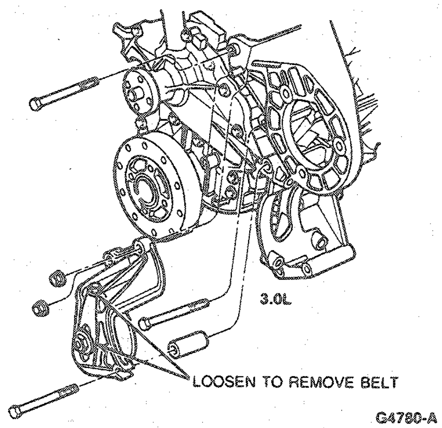
3.0L Engine

Removal

1. Disconnect battery ground cable.
2. Loosen idler pulley and remove power steering belt.
3. Remove pulley from hub.
4. Remove return line from pump.
5. Completely back off pressure line nut. Line will separate when pump is removed from bracket.
6. Remove three pump retaining bolts and remove pump.

Installation

1. Install pump on mounting bracket. Guide pressure line into pump outlet fitting while installing pump.
2. Install pressure and return lines.
3. Install pulley on hub.
4. Install steering pump drive belt and adjust tension. Refer to Section 03-05.
5. Connect battery ground cable.
6. Fill pump with fluid and check operation. Refer to Section 11-00.



G4780-A

Pump Reservoir

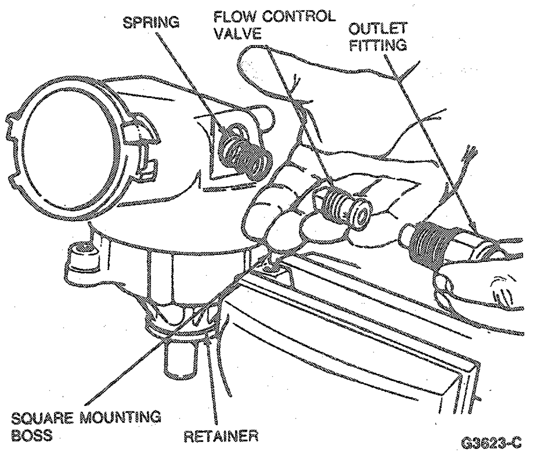
Take the following precautions when servicing the power steering pump reservoir:

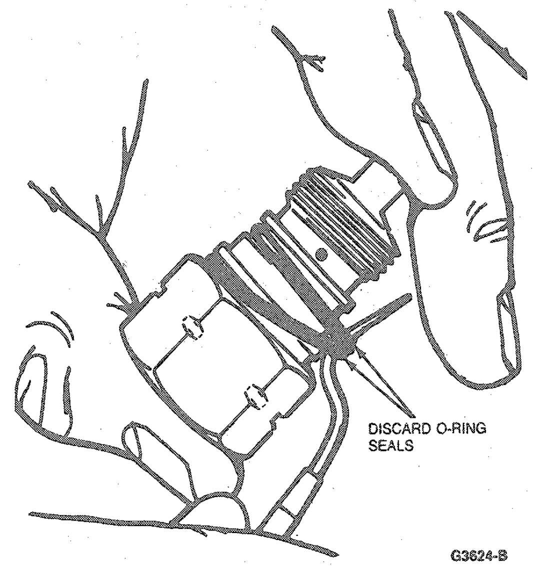
- Use clean work bench and tools.
- Plug inlet and outlet openings of pump with plugs or masking tape.
- Thoroughly clean exterior of pump with solvent.

REMOVAL AND INSTALLATION (Continued)

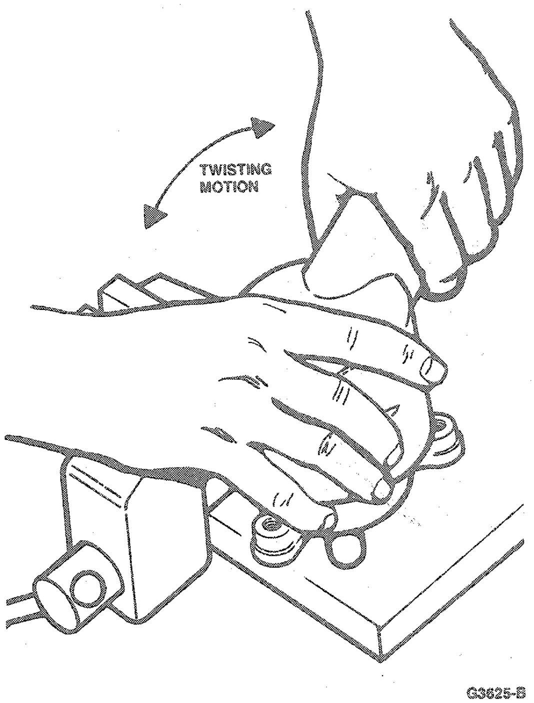
Removal

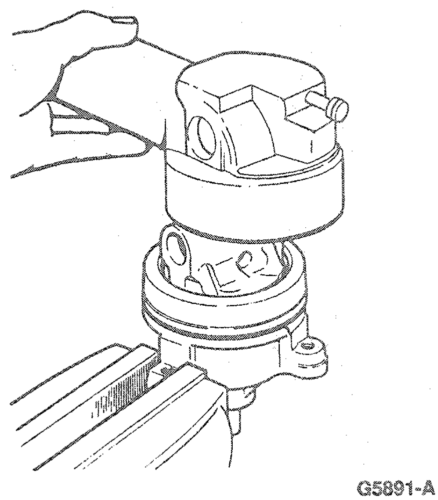
1. Place pump assembly in a bench vise with soft jaws and remove outlet fitting, flow control valve, and spring. Discard all seals.





2. Remove fiberglass reservoir by twisting side-to-side and lifting.

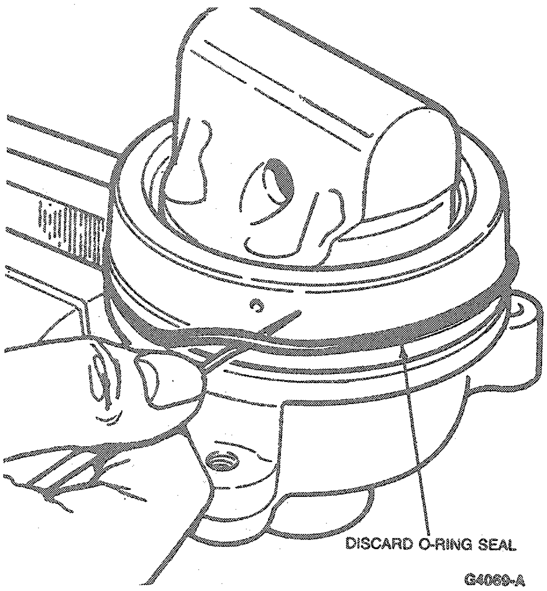




CAUTION: Do not hammer on the reservoir.

REMOVAL AND INSTALLATION (Continued)

3. Discard O-ring seal on pump housing.

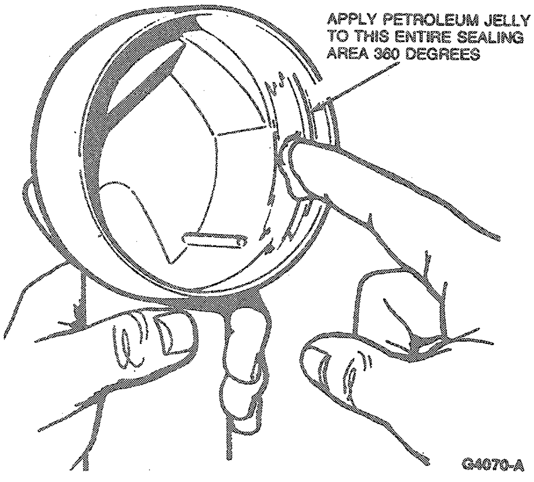


G4069-A

Installation

1. Install a new O-ring seal on pump housing.
2. Apply petroleum jelly to reservoir O-ring seal and inside edge of reservoir. Do not twist O-ring seal.
3. Install reservoir over pump and align outlet fitting hole in reservoir with hole in valve cover.

   CAUTION: If valve is cocked, it may become stuck in the valve cover. Do not force valve forward. Forcing the valve may shear off metal and carry the metal chips into the valve bore.
4. Place new O-ring seals on outlet fitting. Install flow control spring, flow control valve and outlet fitting into reservoir and valve cover. Tighten fitting to 33-47 N·m (25-34 lb-ft).

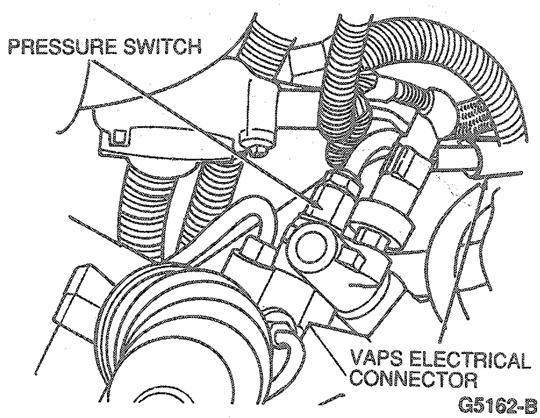


G4070-A

Steering Gear Actuator

Removal

1. Remove air inlet duct for access to actuator.
2. Disconnect VAPS electrical connector from actuator.
3. Disconnect pressure switch.
4. Remove two actuator-to-steering gear retaining bolts.
5. Lift actuator from gear assembly.



G5162-B

Installation

NOTE: Ensure that the two seals (between the actuator and gear assembly) are in place when setting the actuator on the gear assembly.

1. Align actuator on steering gear.
2. Install two actuator-to-steering gear retaining bolts. Tighten to 27-34 N·m (20-25 lb-ft).
3. Reconnect pressure switch and VAPS electrical connector.
4. Install the air inlet duct.

VAPS Module

The VAPS module is located below the instrument panel on the RH side of the steering column.

Removal

1. Disconnect wiring harness connector from VAPS module.
2. Remove three module fixture retaining screws from column mounting fixture and remove module.

Installation

1. Align mounting holes of new module to mounting holes on column mounting fixture.
2. Install three module fixture retaining screws and tighten to 4-5 N·m (35-45 lb-in).
3. Reconnect wiring harness connector to VAPS module.

DISASSEMBLY AND ASSEMBLY

Tie Rods, Bellows

Tools Required:

- Bench Mounted Holding Fixture T57L-500-B
- Nut Wrench T74P-3504-U
- Locknut Pin Remover D81P-3504-N

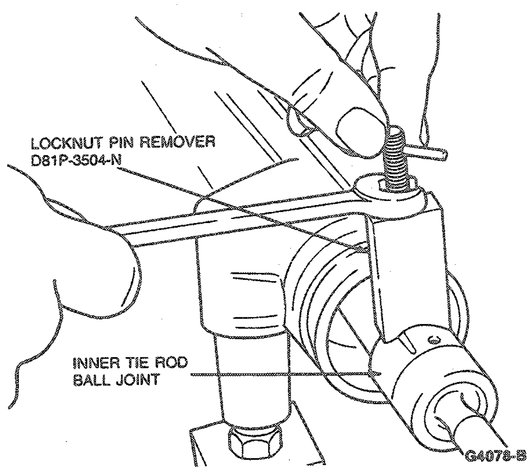
Disassembly

1. Mount gear assembly in Bench Mounted Holding Fixture T57L-500-B.

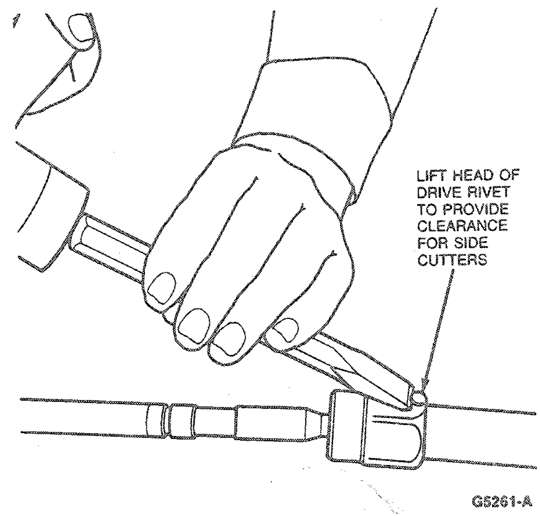
   NOTE: Drill out mounting holes in holding fixture with a 9 / 16-inch drill to allow the gear assembly mounting bolts to fit.
2. Remove tie rod ends.
3. Remove four clamps retaining bellows to gear housing and tie rods. Discard clamps if damaged or excessively corroded.

   CAUTION: Use care not to damage bellows.
4. Remove bellows along with breather tube.

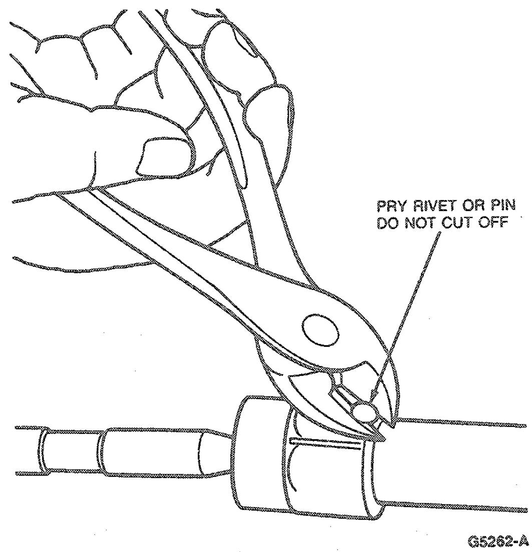
   NOTE: For units equipped with rivets in place of the coiled pins, perform Steps 6 and 7.
5. Using Locknut Pin Remover D81P-3504-N or equivalent, remove coiled lock pins from inner tie rod ball joints.



6. With a sharp chisel, gently tap around rivet head so it lifts away from ball joint. Use caution so the center pin is not sheared off.



7. Use side cutters to pry out drive pin.
8. Position rack so that several rack teeth are exposed. Hold rack with an adjustable wrench on end teeth only, while loosening ball joint nuts with Nut Wrench T74P-3504-U.

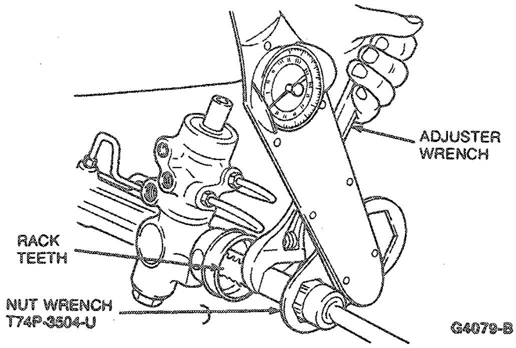


Assembly

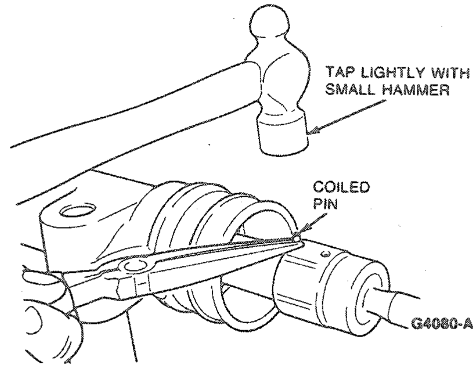
1. Expose several rack teeth and hold rack with adjustable wrench.

DISASSEMBLY AND ASSEMBLY (Continued)

2. Tighten each ball joint assembly separately to 75-88 N-m (55-65 lb-ft) using Nut Wrench T74P-3504-U.

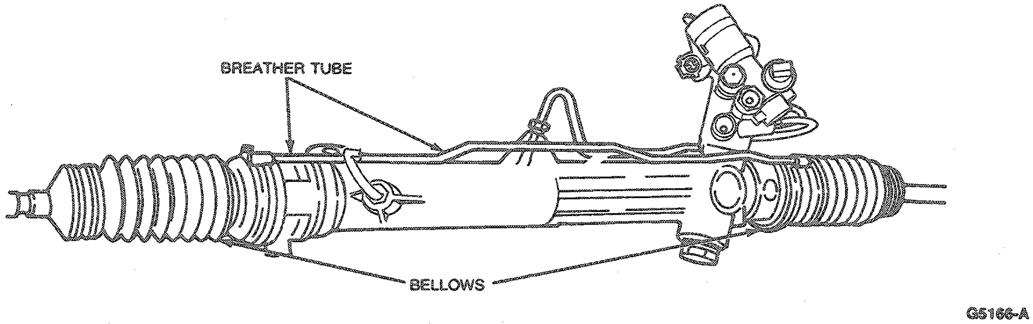


3. Install new coiled pins in tie rod ball housing by tapping lightly with a small hammer.



NOTE: Replenish any grease that may have been removed from rack teeth with Steering Gear Grease C3AZ-19578-A (ESW-M1C87-A) or equivalent.

4. Thoroughly clean rack and housing bore of any foreign material. Any abrasive material is extremely harmful to high-pressure oil seals.
5. Apply Steering Gear Grease C3AZ-19578-A (ESW-M1C87-A) or equivalent to groove in rods where bellows clamp to tie rod. This allows for toe-in adjustment without twisting bellows.
6. Install bellows and breather tube. Ensure breather tube is positioned as shown.

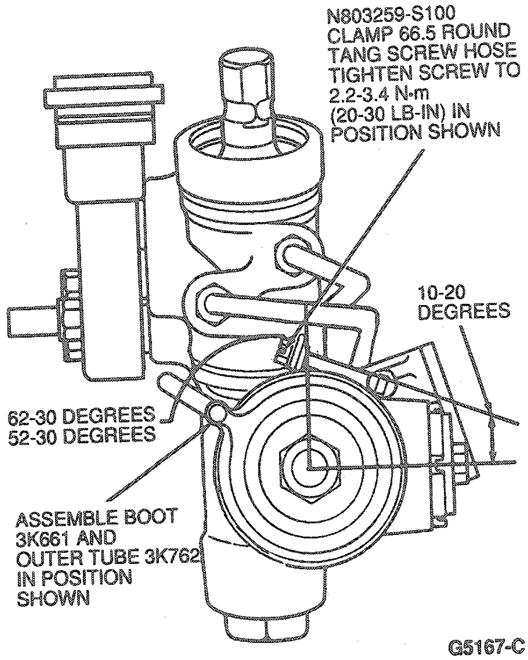


7. Install clamps and position screw axis as shown. Tighten to 2.2-3.4 N-m (20-30 lb-in).
8. Install new clamps retaining bellows to tie rods.

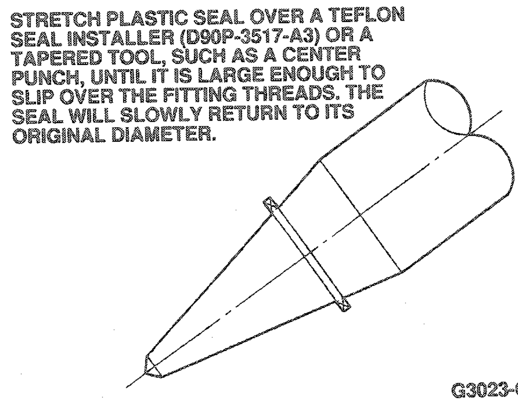
9. Apply Disc Brake Caliper Slide Grease D7AZ-19590-A (ESA-M1C172-A) or equivalent to tie rod threads.

DISASSEMBLY AND ASSEMBLY (Continued)

10. Install tie rod outer ends.



G5167-C



G3023-C

Pressure and Return Line Fitting

Tools Required:

- Teflon Seal Installer D90P-3517-A3

Seal Replacement

If a leak occurs between the tubing and the tube nut, replace the hose assembly. If a leak occurs at the tube nut threads, replace the plastic washer. The following procedure should be used:

1. Check to ensure that nuts are tightened to specification. Do not over-tighten.
2. Unscrew tube nut, and replace plastic seal washer. To facilitate assembly of new TFE seal, a tapered shaft may be required to stretch the washer, so it may be slipped over tube nut threads.

Steering Gear

Take the following precautions when servicing the steering gear:

1. Use a clean work bench and tools.
2. Thoroughly clean the exterior of the unit with solvent. Drain off excess hydraulic fluid.
3. Handle all parts carefully to avoid nicks, burrs, scratches and dirt.
4. Do not use solvent on seals.
5. Impact tools must not be used during any of the operations.

Tie Rod Ends, Bellows and Ball Joint Sockets

Tools Required:

- Bench Mounted Holding Fixture T57L-500-B
- Nut Wrench T74P-3504-U

Disassembly

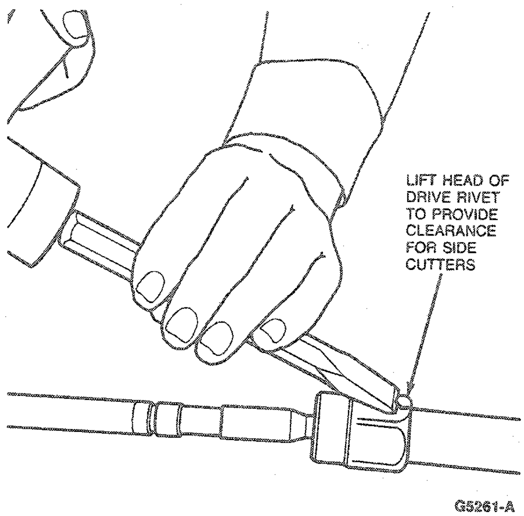
NOTE: Drill out mounting holes in holding fixture with a 9 / 16-inch drill to allow the gear assembly mounting bolts to fit.

1. Mount gear assembly in Bench Mounted Holding Fixture T57L-500-B.
2. Remove tie rod ends.
3. Remove four clamps retaining bellows to gear housing and tie rods. Discard clamps if damaged or excessively corroded.

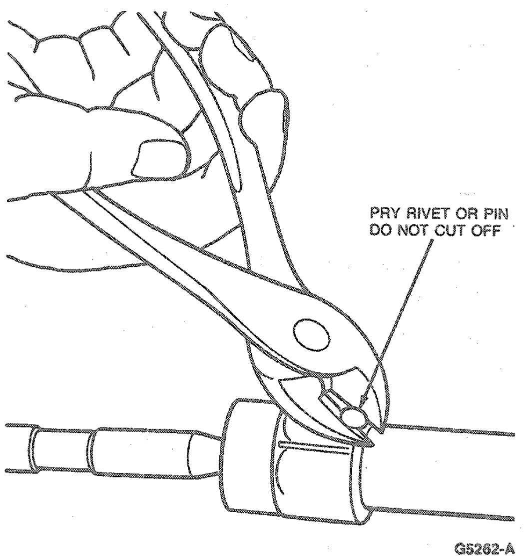
   CAUTION: Use care not to damage bellows.
4. Remove bellows along with breather tube.
5. If pinion requires removal, remove pinion before proceeding. Refer to Input Shaft and Valve Disassembly.

DISASSEMBLY AND ASSEMBLY (Continued)

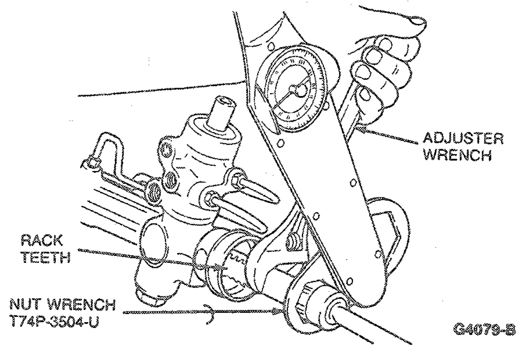
6. With a sharp chisel, gently tap around rivet head so it lifts away from ball joint. Use caution so the center pin is not sheared off.



7. Use side cutters to pry out drive pin.



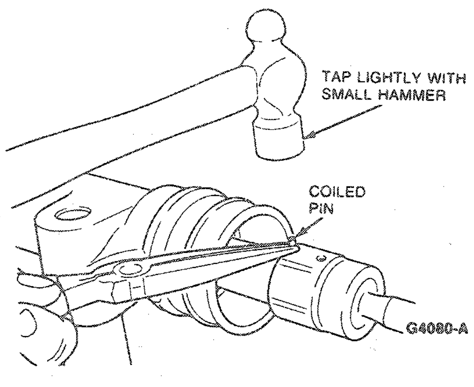
8. Position rack so that several rack teeth are exposed. Hold rack with an adjustable wrench on end teeth only, while loosening ball joint nuts with Nut Wrench T74P-3504-U.



Assembly

1. If pinion was not removed, expose several rack teeth and hold rack with adjustable wrench.

   Tighten each ball joint assembly separately to 75-88 N·m (55-65 lb-ft) using Nut Wrench T74P-3504-U.
2. If valve assembly was removed, hold one ball joint nut with a 1-5/16 inch open-end or box wrench while tightening other nut to 75-88 N·m (55-65 lb-ft) with Nut Wrench T74P-3504-U. Both ends are tightened simultaneously by this method.
3. Install new coiled pins in tie rod ball housing by tapping lightly with small hammer.

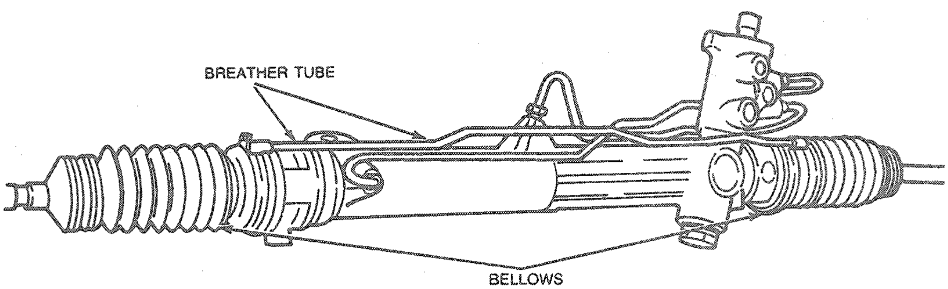


4. If valve assembly was removed, install valve assembly as outlined in Input Shaft and Valve Assembly.

   NOTE: Replenish any grease that may have been removed from rack teeth with Steering Gear Grease C3AZ-19578-A (ESW-M1C87-A) or equivalent.
5. Thoroughly clean rack and housing bore of any foreign material. Any abrasive material is extremely harmful to high pressure oil seals.
6. Apply Steering Gear Grease C3AZ-19578-A (ESW-M1C87-A) or equivalent to groove in rods where bellows clamp to tie rod. This allows for toe-in adjustment without twisting bellows.

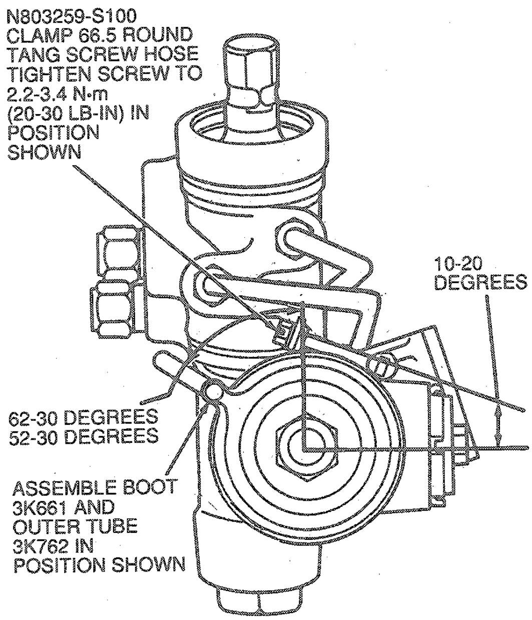
DISASSEMBLY AND ASSEMBLY (Continued)

7. Install bellows and breather tube. Ensure breather tube is positioned as shown.



G4081-B

8. Install screw-type clamps and position screw axis as shown. Tighten to 2.2-3.4 N·m (20-30 lb-in).



G4433-E

9. Install new clamps retaining bellows to tie rods.
10. Apply Disc Brake Caliper Slide Grease D7AZ-19590-A (ESA-M1C172-A) or equivalent to tie rod threads.
11. Install tie rod outer ends.

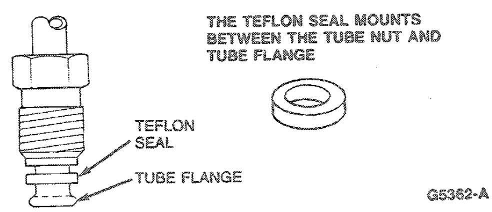
Input Shaft and Valve Assembly

Tools Required:

- Impact Slide Hammer T50T-100-A
- Bench Mounted Holding Fixture T57L-500-B
- Puller Attachment T58L-101-B
- Pinion Shaft Torque Adapter T74P-3504-R
- Seal Installation Kit T75L-3517-A1, A2, A3 and A4
- Valve Body (Screw) T78P-3504-B
- Valve Body Insert Tool T78P-3504-C
- Lower Pinion Bearing Replacer T78P-3504-G
- Upper Pinion Bearing Seal Replacer T78P-3504-D
- Retaining Ring Pliers D79L-7000-A
- Valve Body Puller (Bridge) T86P-3504-D
- Lower Pinion Seal Remover T86P-3504-F
- Lower Pinion Seal Replacer T86P-3504-G
- Lower Pinion Seal Remover Guide T86P-3504-J

Disassembly

1. Thoroughly clean areas of input shaft valve housing, yoke locknut and plug, and pinion bearing plug.
2. Mount gear in the Bench Mounted Holding Fixture T57L-500-B. Drill out mounting holes in holding fixture with a 9/16-inch drill to allow gear assembly retaining bolts to fit.
3. Do not remove transfer tubes (RH and LH turn lines), unless they are leaking or damaged. If these lines are removed, new Teflon® seals must be installed.

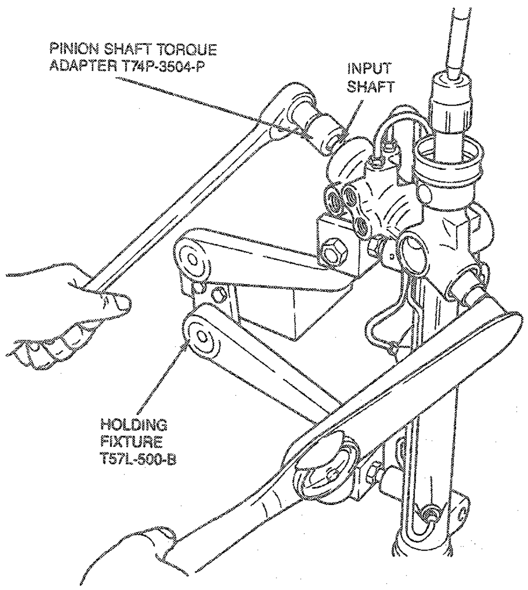


G5362-A

DISASSEMBLY AND ASSEMBLY (Continued)

4. Loosen yoke plug locknut and yoke plug to relieve preload on rack.
5. Remove pinion bearing cap.

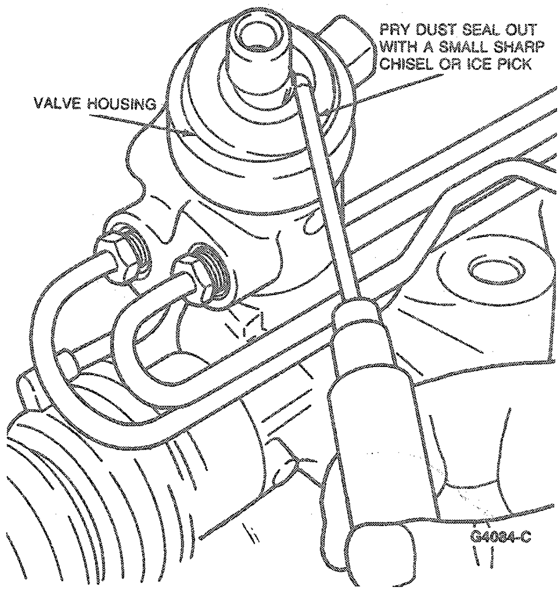
   CAUTION: Do not allow rack to reach full travel when loosening or tightening the locknut, as damage to rack teeth may occur.
6. Install Pinion Shaft Torque Adapter T74P-3504-R on input shaft. Hold input shaft, and remove pinion bearing locknut with an 11 / 16-inch socket. Discard locknut.



G4083-D

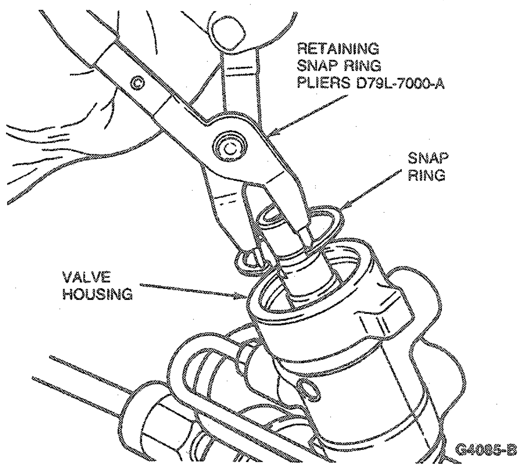
CAUTION: Use care not to damage any valve housing surfaces.

7. Pry input shaft dust seal out of valve housing with a small, sharp chisel or ice pick.



G4084-C

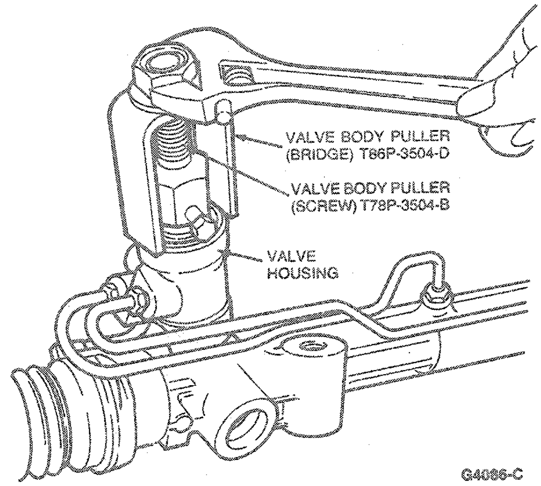
8. Using Retaining Ring Pliers D79L-7000-A or equivalent, remove retaining snap ring, located under dust seal from valve housing.



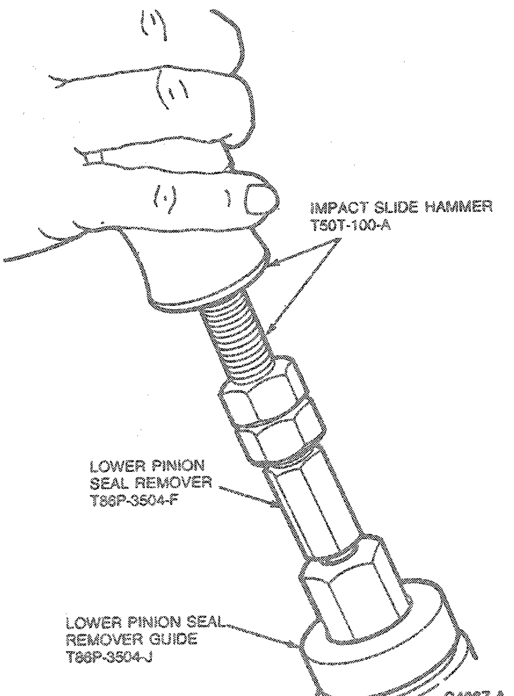
G4085-B

DISASSEMBLY AND ASSEMBLY (Continued)

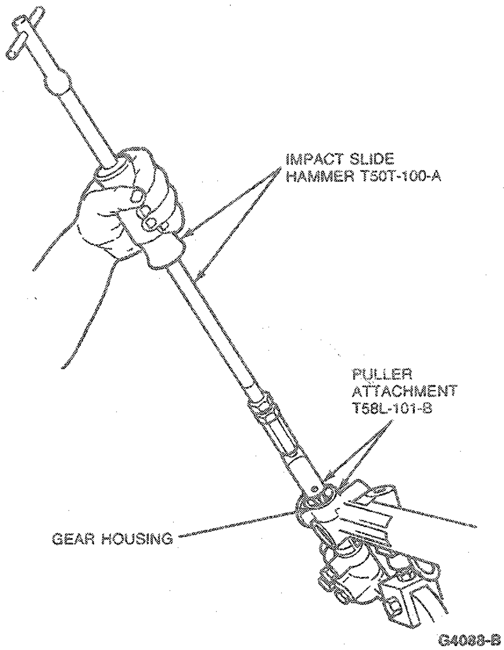
9. Attach Valve Body Puller (Bridge) T86P-3504-D and Valve Body Puller (Screw) T78P-3504-B, to input shaft. Turn nut to remove valve. Input shaft seal and bearing will come out with valve body.



10. To remove lower pinion shaft seal, insert Lower Pinion Seal Remover T86P-3504-F until it bottoms along with Lower Pinion Seal Remover Guide T86P-3504-J. Activate expander with a pair of wrenches by holding large nut and turning small nut until expander fully tightens. Pull tool and seal with Impact Slide Hammer T50T-100-A.

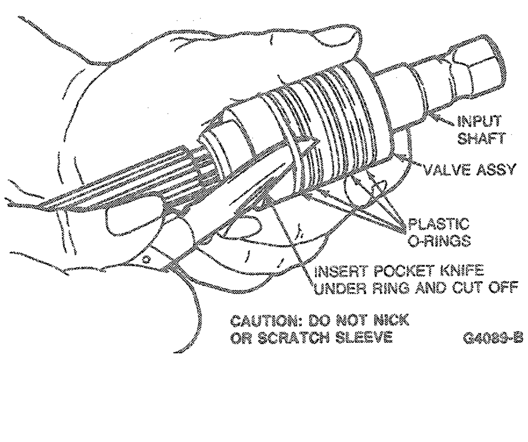


11. Remove pinion bearing from gear housing with Impact Slide Hammer T50T-100-A and Puller Attachment T58L-101-B.



CAUTION: Use care not to scratch valve sleeve. Internal leaking could occur causing power steering fluid to leak under the seals.

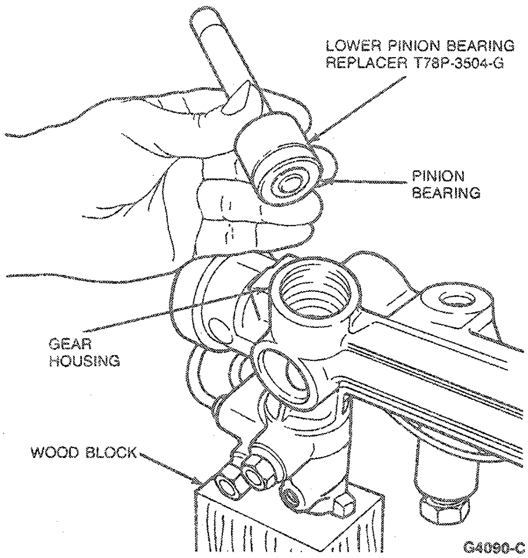
12. The only serviceable components of the input shaft and valve assembly are four plastic O-rings. Remove O-rings by pushing rings to one side, inserting a small pointed pocket knife under each ring, and cutting it off.



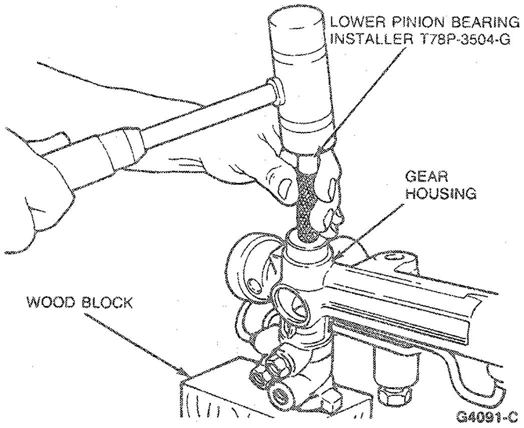
DISASSEMBLY AND ASSEMBLY (Continued)

Assembly

1. Install steering gear pinion bearing in gear housing using Lower Pinion Bearing Replacer T78P-3504-G.

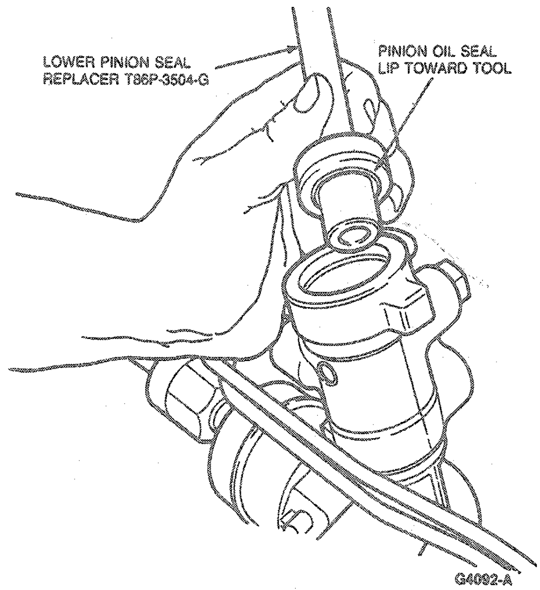


Seat bearing against shoulder in bore. Support valve housing with a wood block when seating pinion bearing.



2. Apply Steering Gear Grease C3AZ-19578-A (ESA-M1C172-A) or equivalent to pinion oil seal, and place it on Lower Pinion Seal Replacer T86P-3504-G or equivalent with seal lip toward tool. Support pinion housing on a flat clean surface.

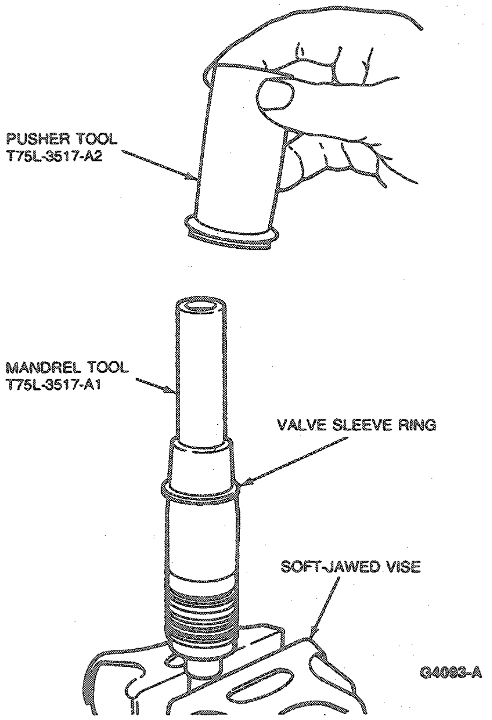
   Install seal in valve bore, seating it against shoulder.



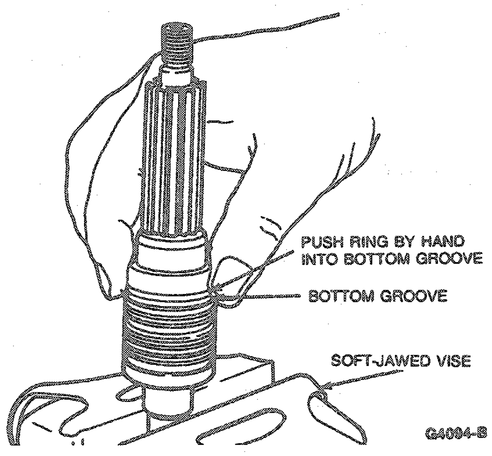
3. Mount input shaft end of valve assembly in a soft-jawed vise. Clamp shaft outside bearing and seal surface.
4. Lubricate Mandrel T75L-3517-A1 with power steering fluid and install over valve assembly. Slide one valve sleeve ring over tool.

DISASSEMBLY AND ASSEMBLY (Continued)

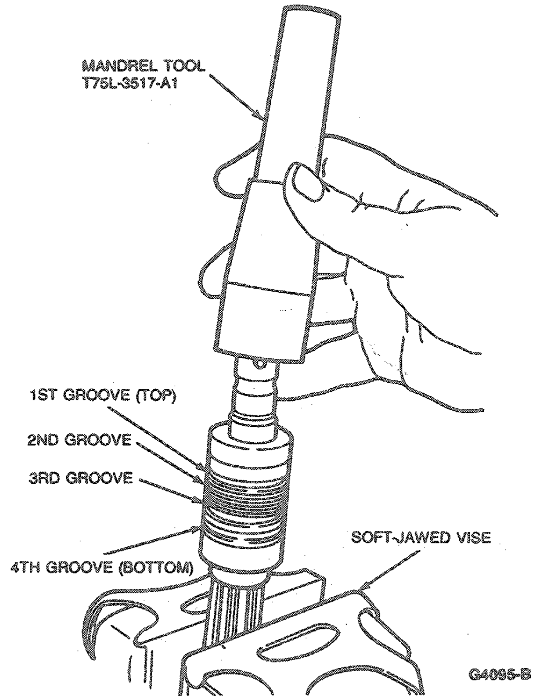
5. Slide Pusher T75L-3517-A2 over mandrel. Rapidly push down on pusher tool, forcing ring down ramp onto valve sleeve.



Complete installation by pushing ring into bottom groove.



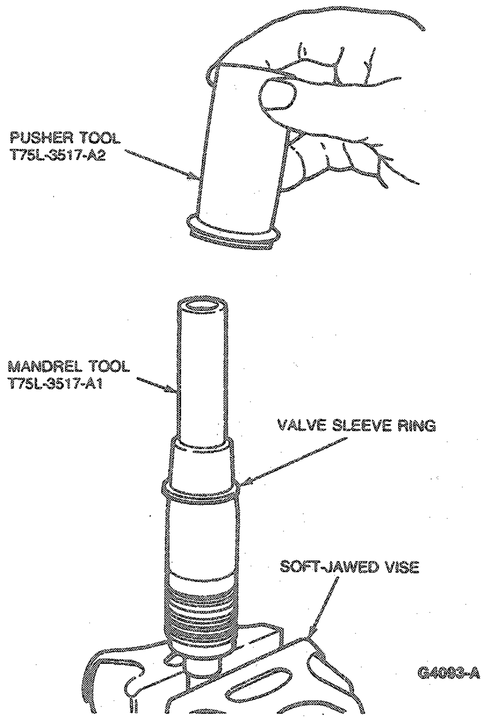
6. Remove valve assembly from vise and regrip it with pinion gear teeth.
7. Install Mandrel T75L-3517-A1 over input shaft. Mandrel will align with the third (next to bottom) groove.



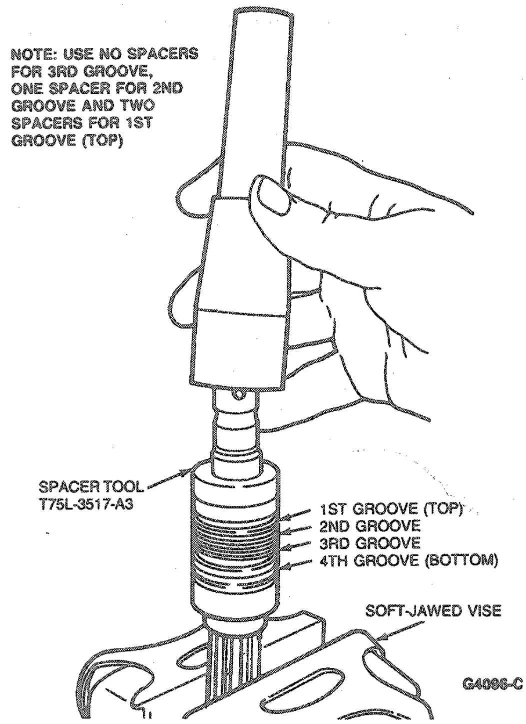
NOTE: Seal grooves do not have port holes. Ensure seals are installed in proper grooves.

DISASSEMBLY AND ASSEMBLY (Continued)

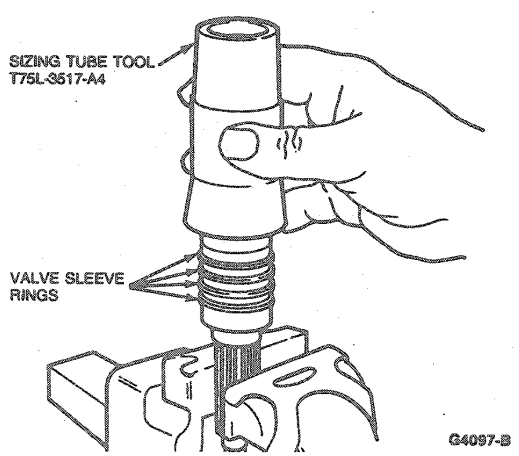
Install third valve sleeve ring by pushing on it rapidly with Pusher T75L-3517-A2. The ring will snap into proper groove.



8. Repeat Step 7 using one spacer for second valve sleeve ring (Spacer T75L-3517-A3).



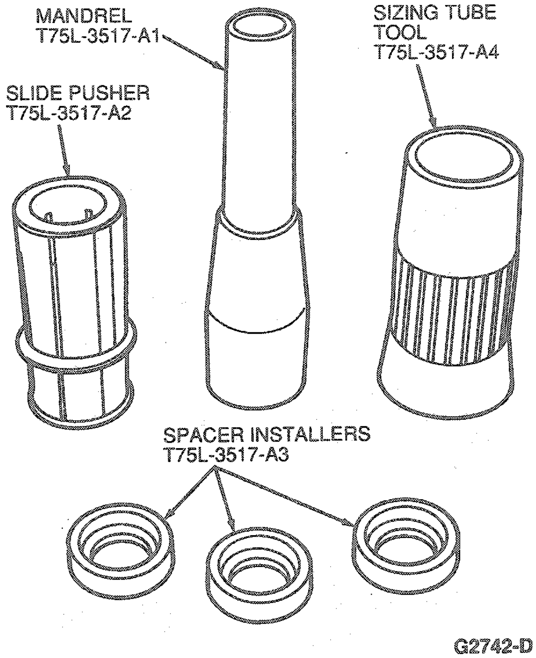
9. Repeat Step 7 using two spacers for the first (top) valve sleeve ring (Spacer T75L-3517-A3).
10. After installing four valve sleeve rings, apply a light coat of Steering Grease C3AZ-19578-A (ESW-M1C87-A) or equivalent to sleeve and rings.
11. Slowly install Sizing Tube T75L-3517-A4 over sleeve valve end of input shaft onto valve sleeve rings. Ensure that rings are not being bent over as tube is slid over them.



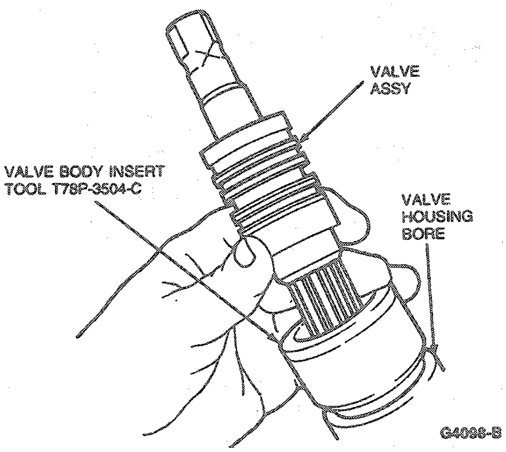
Remove sizing tube, and check condition of rings. Ensure that rings turn freely in grooves.

DISASSEMBLY AND ASSEMBLY (Continued)

The complete set of tools needed to perform the above operations is shown in the illustration. The Tool Kit is T75L-3517-A.

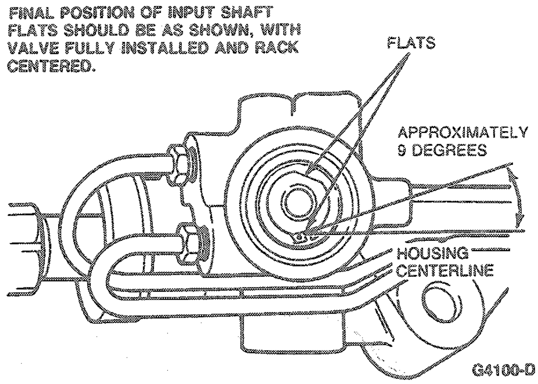


12. Center rack in housing so that equal amounts of rack shaft stick out of each end of housing. Position rack teeth so they will mesh with pinion.
13. Position Valve Body Insert Tool T78P-3504-C in valve housing bore.

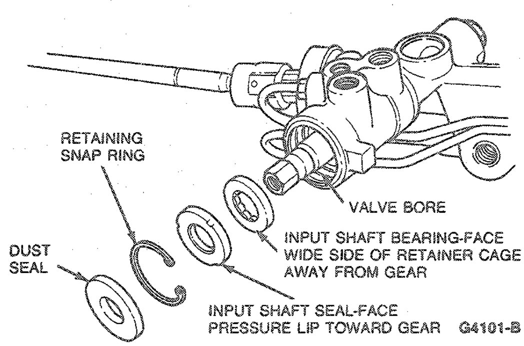


NOTE: If pinion is off one tooth, it will be obvious, since one tooth equals 45 degrees.

14. Insert valve assembly with flats on input shaft in position shown.

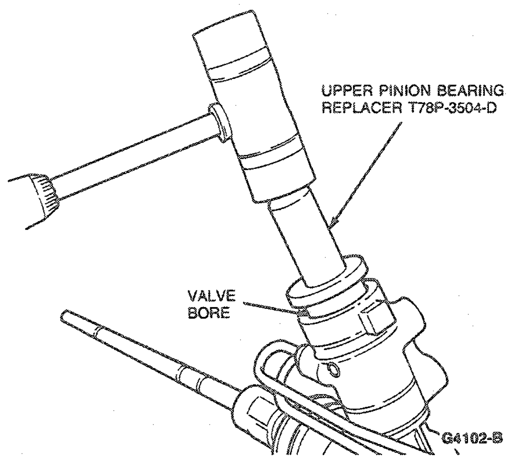


15. Using Pinion Shaft Torque Adapter T74P-3504-R count total turns, stop-to-stop (2.5 turns). From one stop, back off half the total (1-1/4 turns). The position should be as shown in illustration under Step 14. If it is approximately 45 degrees (one tooth) away from position, pull valve assembly out far enough to disengage pinion teeth and install to obtain proper position.
16. Install bearing assembly in valve bore and seat with Upper Pinion Bearing Seal Replacer T78P-3504-D.
17. Apply a film of Steering Grease C3AZ-19578-A (ESW-M1C87-A) or equivalent to input shaft seal, and install with lip toward valve.

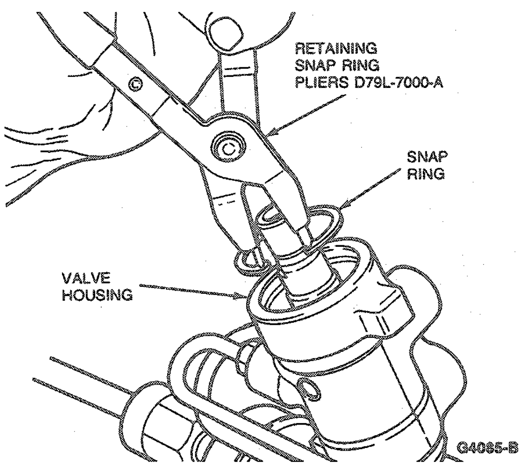


DISASSEMBLY AND ASSEMBLY (Continued)

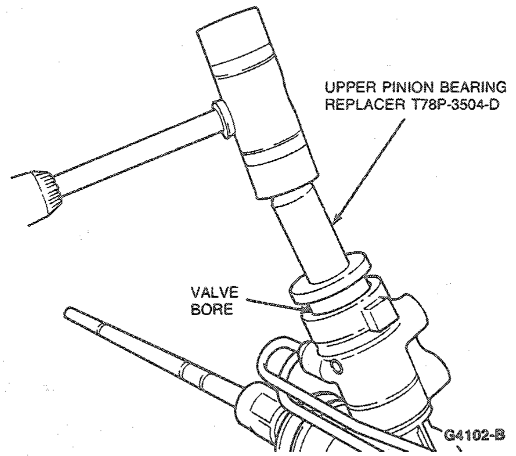
18. Seat seal with Upper Pinion Bearing Seal Replacer T78P-3504-D.



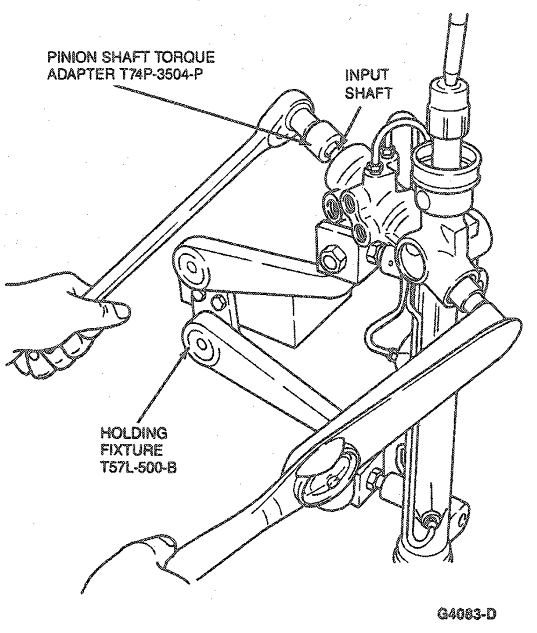
19. Install retaining snap ring in valve bore using Retaining Ring Pliers D79L-7000-A or equivalent.



20. Coat ID and OD of dust seal and input shaft with Multi-Purpose Grease D0AZ-19584-AA (ESR-M1C159-A and ESB-M1C93-A) or equivalent.
21. Install dust seal with Upper Pinion Bearing Seal Replacer T78P-3504-D.



22. Install nut on pinion end of valve assembly. Holding input shaft with Pinion Shaft Torque Adapter T74P-3504-R, tighten nut to 41-54 N·m (31-39 lb-ft). Rack must be away from stops during this operation.



23. Install steering gear pinion bearing cap. Tighten to 54-68 N·m (40-50 lb-ft).
24. Set rack yoke preload as outlined.

Gear Housing, Rack Yoke Plug, Rack Assembly, Rack Bushing and Oil Seals

Tools Required:

- Impact Slide Hammer T50T-100-A

DISASSEMBLY AND ASSEMBLY (Continued)

- O-Ring Tool T71P-19703-C
- Outer Rack Seal Replacer T74P-3504-F
- Teflon Ring Replacer T74P-3504-G
- Rack Seal Protector Sleeve T74P-3504-J
- Rack Oil Seal Remover T78P-3504-J
- Rack Bushing Holding Tool T78P-3504-L
- Teflon Ring Sizing Tool T78P-3504-M
- Rack Seal Protector T85L-3504-B
- Pinion Housing Yoke Locknut Wrench T86P-3504-E
- Yoke Plug Torque Gauge T88P-3504-A

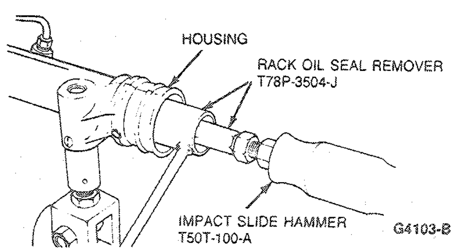
Disassembly

1. Remove tie rod and socket assemblies from both ends of the rack. Loosen yoke plug lock nut and yoke plug to relieve preload on rack. Remove valve assembly from gear housing as outlined. Refer to Input Shaft and Valve Assembly, Disassembly.

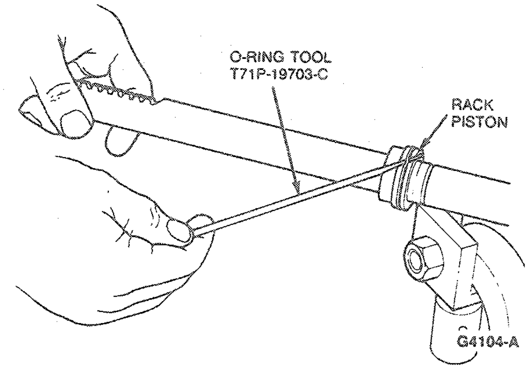
   NOTE: Yoke cannot be removed at this time.
2. Remove yoke plug and spring.
3. Working from RH side of gear (opposite pinion end), push rack in just far enough to facilitate removal of snap ring.
4. Remove snap ring from right end of housing.

   CAUTION: Do not hammer on the rack, aluminum rack bushing or housing. Damage may occur.
5. Slowly pull rack out of RH side of housing until rack piston contacts aluminum rack bushing. Apply pulling effort on rack until bushing is withdrawn from housing. Remove rack from the housing.

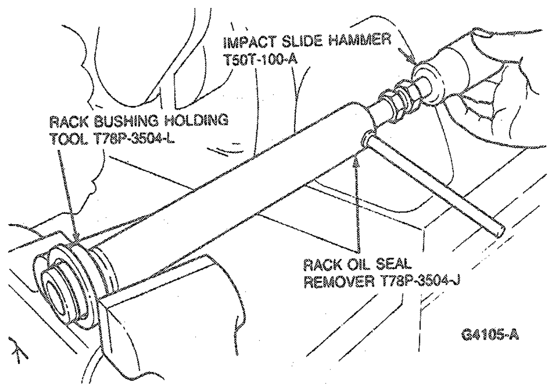
   NOTE: On the first attempt, the nylon ring may pull out of the seal, leaving the seal in the gear. Repeat the procedure, and the seal will come out.
6. To remove internal high-pressure rack oil seal, insert Rack Oil Seal Remover T78P-3504-J into housing until it bottoms. Activate expander with a wrench until expander fully tightens. Remove tool with oil seal from housing using Impact Slide Hammer T50T-100-A threaded into expander end. Discard seal.



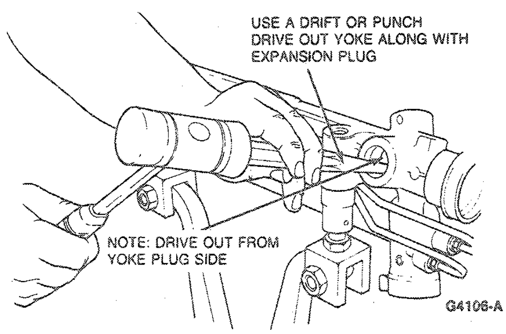
7. Remove plastic O-ring and rubber O-ring from rack piston with O-Ring Tool T71P-19703-C.



8. Insert rack bushing into Rack Bushing Holding Tool T78P-3504-L, seal end first. Place tool and bushing in vise. With Rack Oil Seal Remover T78P-3504-J and Impact Slide Hammer T50T-100-A, remove seal.



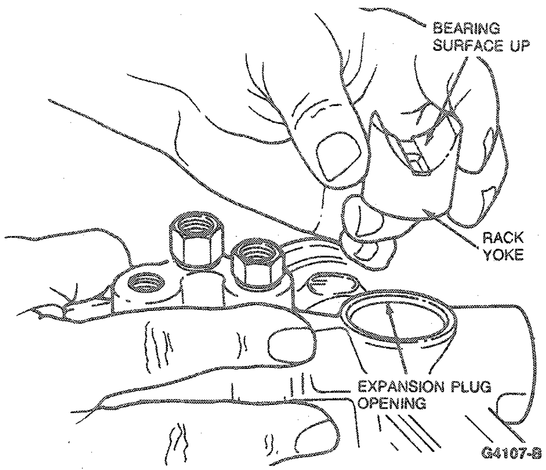
9. Remove rubber O-rings from rack bushing.
10. Inspect rack yoke while still in gear housing. If it is in good condition, do not remove it.
11. If yoke needs replacing, use a drift or punch to knock it out, along with expansion plug.



DISASSEMBLY AND ASSEMBLY (Continued)

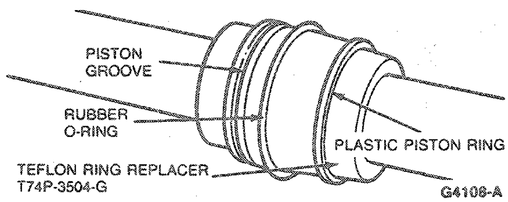
Assembly

1. If yoke was removed during disassembly, a new yoke is required. Coat new yoke with Steering Gear Grease C3AZ-19578-A (ESW-M1C87-A) or equivalent and install through expansion plug opening, rack bearing surface up.



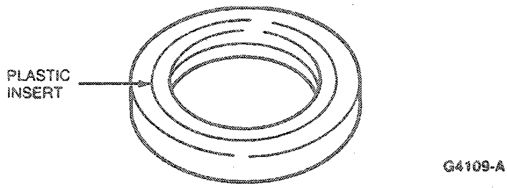
2. Slide Teflon Ring Replacer T74P-3504-G over plain end (without teeth) of rack up to piston.

   Roll rubber O-ring into piston groove, then slide plastic piston ring into piston groove over O-ring.

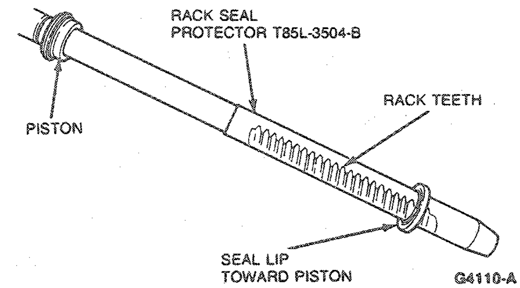


NOTE: Insert is integral part of seal. It is removed only to avoid damage during installation.

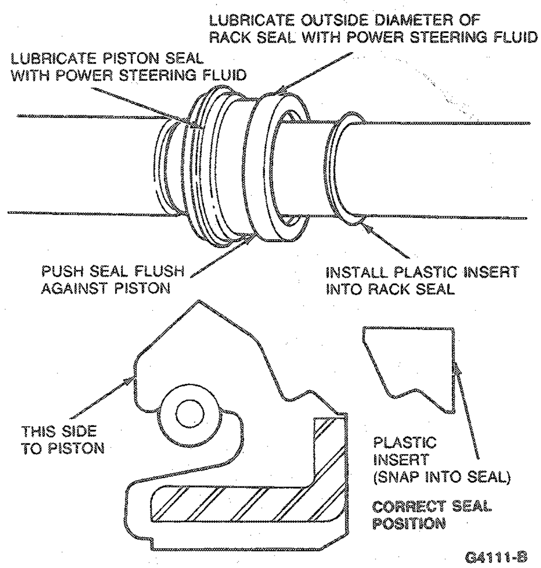
3. Remove plastic insert from rack seal. Save insert for installation.



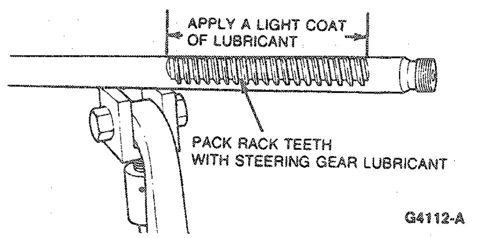
4. Install Rack Seal Protector T85L-3504-B over rack teeth.
5. Lubricate rack seal protector and rack with power steering fluid.
6. Install seal with lip toward piston. Push seal all the way against piston. Remove rack seal protector.



7. Install plastic insert in rack seal.



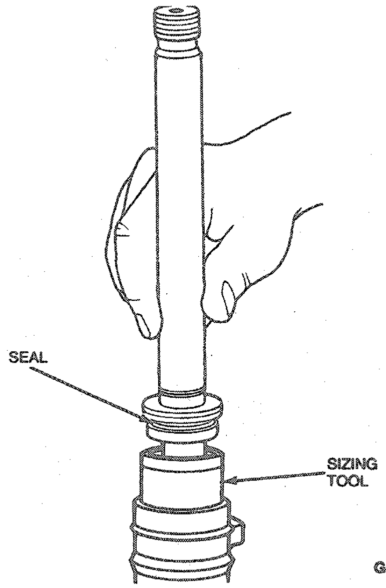
8. Pack rack teeth with Steering Gear Grease C3AZ-19578-A (ESW-M1C87-A) or equivalent. Apply a light coat of steering gear lubricant to yoke contact area on back of rack teeth.



9. Lubricate piston seal and rack seal outside diameter with power steering fluid. Refer to the illustration under Step 7.
10. Install Teflon Ring Sizing Tool T78P-3504-M into end of gear housing.
11. Ensure yoke is all the way in when installing rack.

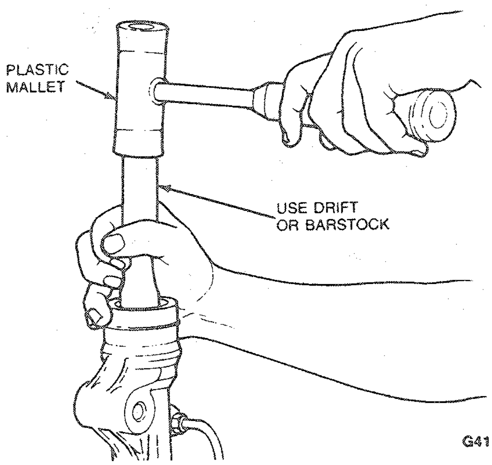
DISASSEMBLY AND ASSEMBLY (Continued)

12. Install rack, taking care NOT to scratch housing piston bore.
13. Carefully push piston through sizing tool. Continue pushing on rack until it bottoms. Remove sizing tool.



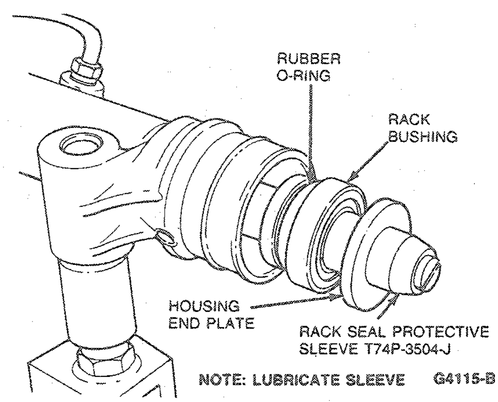
G4113-C

14. Seat rack seal with rack by driving end of rack with a drift or brass bar stock and plastic mallet. Several hits may be required to ensure proper seating. **DO NOT remove rack.**



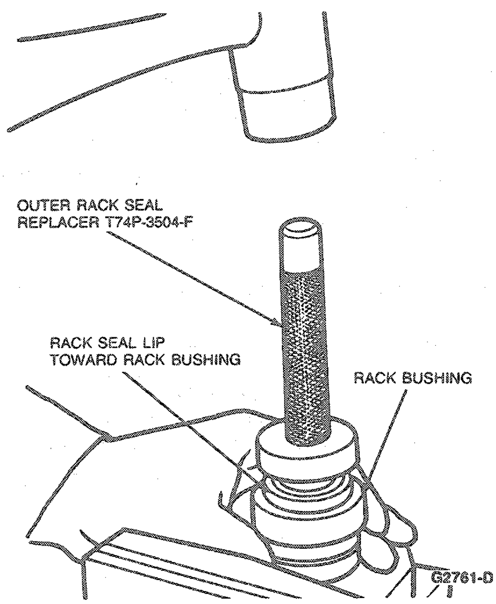
G4114-B

15. Move rack so it is centered in housing.
16. Thread Rack Seal Protector Sleeve T74P-3504-J over threads on RH side of rack. Apply power steering fluid to protective sleeve.



NOTE: LUBRICATE SLEEVE G4115-B

17. Install rubber O-ring on aluminum rack bushing.
18. Apply Steering Gear Grease C3AZ-19578-A (ESW-M1C87-A) or equivalent to the outer rack oil seal. With Outer Rack Seal Replacer T74P-3504-F, install high-pressure oil seal in rack bushing. Lip spring must face the inside of the bushing.

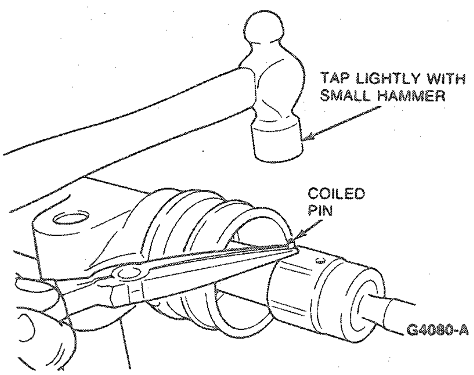


G2761-D

19. Lubricate short Rack Seal Protective Sleeve T74P-3504-J on rack end and rubber O-rings on rack bushing with Steering Gear Grease C3AZ-19578-A (ESW-M1C87-A) or equivalent. Refer to illustration under Step 16.

DISASSEMBLY AND ASSEMBLY (Continued)

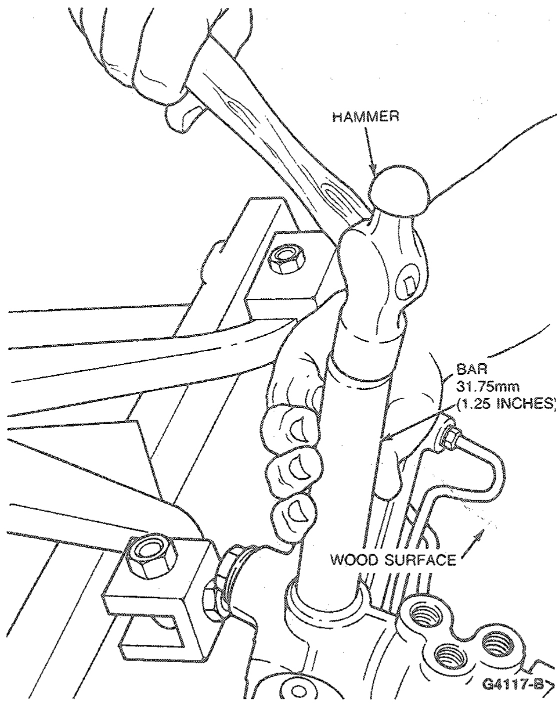
20. Start bushing, seal facing out, on rack. Pass bushing and seal over protecting sleeve and into housing bore. Place end plate against rack bushing. With Teflon Ring Sizing Tool T78P-3504-M apply hand pressure to end plate and rack bushing until bushing seats in gear housing. If rack bushing will not seat with hand pressure, a 1 1/8-inch deep socket (or larger) and a plastic mallet may be used to tap bushing in place. Install retaining ring (snap ring). Remove protective sleeve.
21. Install rod assemblies. Tighten both tie rod ball joint nuts simultaneously to 75-88 N·m (55-65 lb-ft) by holding one and turning the other.
22. Install coiled pins in ball joint nuts by lightly tapping with hammer until seated.



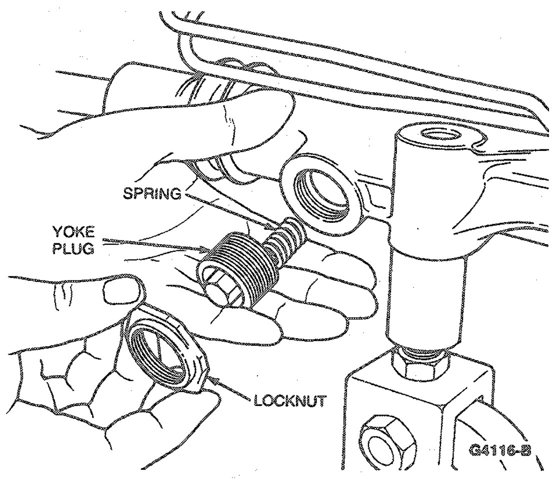
23. Install valve assembly.

    NOTE: Do not perform Step 24 if yoke was not removed.
24. Support gear on wood surface at yoke plug opening. Using a 31.75mm (1.25-inch) bar with a flat end and a hammer, flatten expansion plug until flat portion is approximately one-half to three-quarters of the total plug diameter.

    NOTE: Do not flatten plug completely or it will fall out.

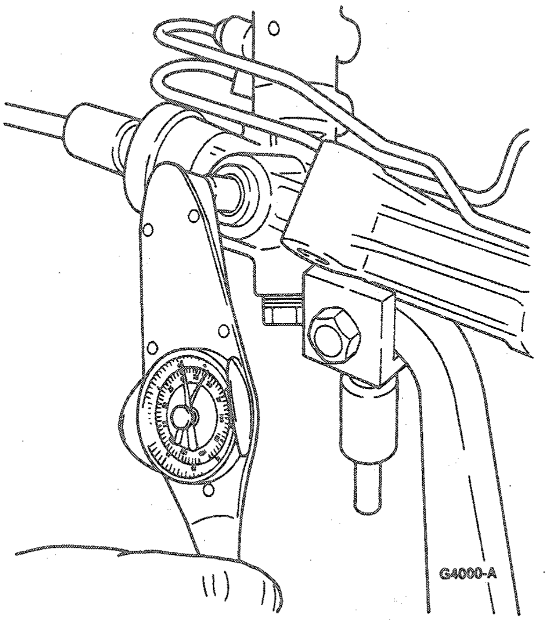


25. Install spring, plug, and locknut.



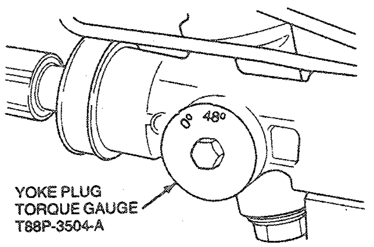
DISASSEMBLY AND ASSEMBLY (Continued)

26. With rack at center of travel, tighten yoke plug to 5-5.6 N·m (45-50 lb-in). Clean threads of yoke plug prior to tightening to prevent a false reading.



G4000-A

27. Install Yoke Plug Torque Gauge T88P-3504-A. Mark location of zero degree mark on housing. Back off adjuster so 48 degree mark lines up with zero degree mark.

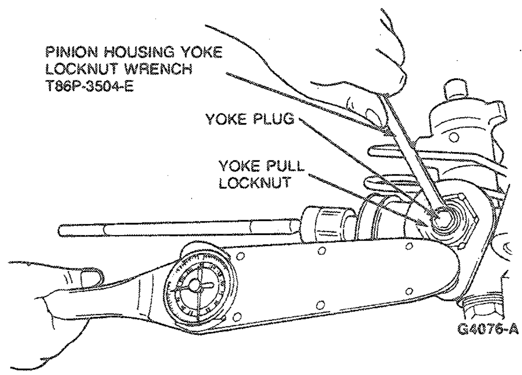


G4077-C

CAUTION: Do not allow yoke plug to move while tightening or preload will be affected.

28. Place Pinion Housing Yoke Locknut Wrench T86P-3504-E on yoke plug locknut. While holding yoke plug, tighten locknut to 54-68 N·m (40-50 lb-ft). Refer to illustration following Step 5.

    Check input shaft torque after tightening locknut.



G4076-A

29. If external transfer tubes were removed, they must be replaced with new service lines. Clean out Teflon® seal shreds from housing ports prior to installation of new lines.
30. Fully extend LH end of rack, so rack teeth are exposed. Using 57 grams (2 oz) of Steering Gear Grease C3AZ-19578-A (ESW-M1C87-A) or equivalent, pack rack teeth and pack any remaining grease into left end of gear housing. Return rack to center position.
31. Apply Steering Gear Grease C3AZ-19578-A (ESW-M1C87-A) or equivalent to groove in tie rods where bellows clamp to tie rods. This is required to keep bellows from twisting during toe-in adjustment.
32. Install bellows and pressure equalizer tube. Install clamps retaining bellows to gear housing.
33. Install clamps retaining bellows to tie rods.
34. Install jam nuts and tie rod ends on tie rods.

Pressure and Return Line Fitting

Tools Required:

- Teflon Seal Installer D90P-3517-A3

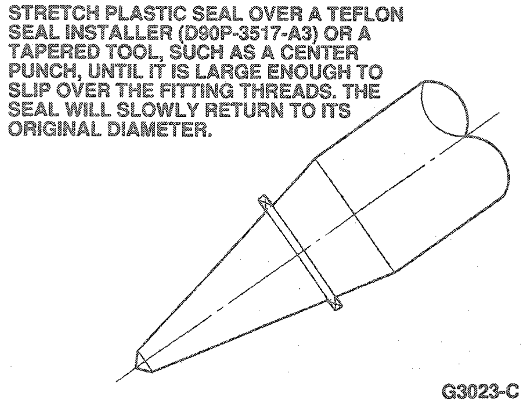
Seal Replacement

If a leak occurs between the tubing and the tube nut, the entire hose assembly, with a new fitting must be replaced. If a leak occurs between the tube nut and the aluminum gear housing, replace the plastic washer. The following procedure should be used:

1. Check fittings to determine which fitting is leaking and whether leak is between tube and tube nut or between tube nut and gear housing.
2. Check to ensure that nuts are tightened to specification. Do not over-tighten.

DISASSEMBLY AND ASSEMBLY (Continued)

3. Unscrew tube nut, and replace plastic seal washer. To facilitate assembly of new TFE seal, a tapered shaft may be required to stretch the washer, so it may be slipped over tube nut threads.



Steering Pump

Tools Required:

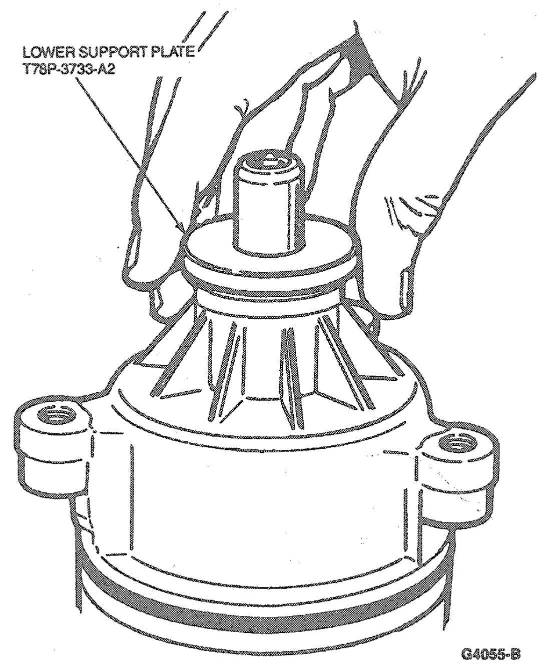
- C-Frame and Clamp Assy T74P-3044-A1
- Upper Support Plate T78P-3733-A1
- Lower Support Plate T78P-3733-A2
- Seal Driver T78P-3733-A3

The following precautions must be observed when servicing the power steering pump:

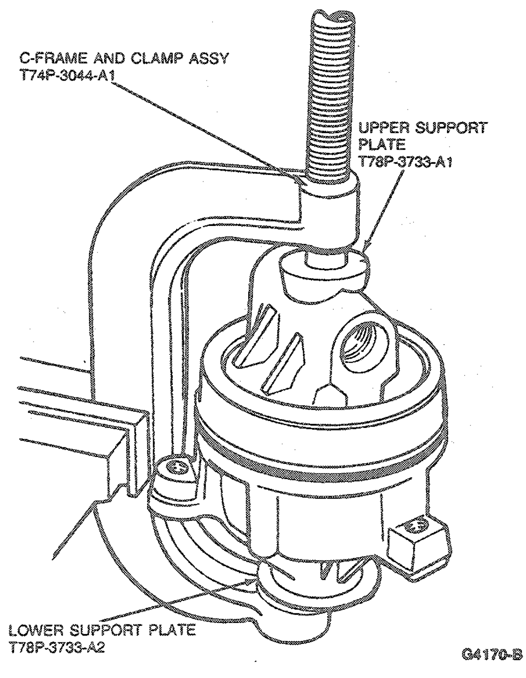
1. Use clean work bench and tools.
2. Thoroughly clean exterior of unit with solvent. Drain as much fluid from pump as possible.
3. If only the reservoir is to be removed, clean as outlined under Reservoir Removal.
4. Do not use cleaning solvents on seal.

Disassembly

1. Remove pump pulley as outlined.
2. Remove outlet fitting, flow control valve, and flow control spring from pump. Remove pump reservoir as outlined.
3. Place C-Frame and Clamp Assembly T74P-3044-A1 in a bench vise.
4. Place Lower Support Plate T78P-3733-A2 over pump rotor shaft.



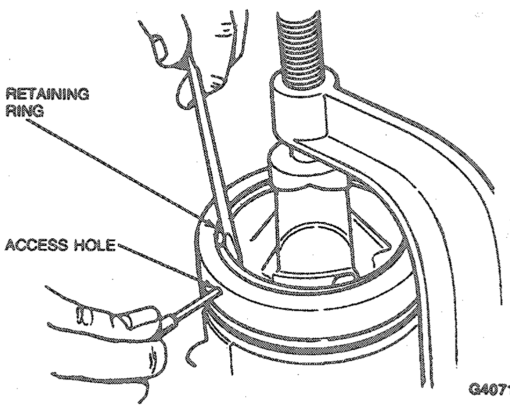
5. Install Upper Support Plate T78P-3733-A1 into upper portion of C-clamp.
6. Holding upper support plate, place pump assembly into C-clamp with rotor shaft facing down.



7. Tighten C-clamp until slight bottoming of valve cover is felt.

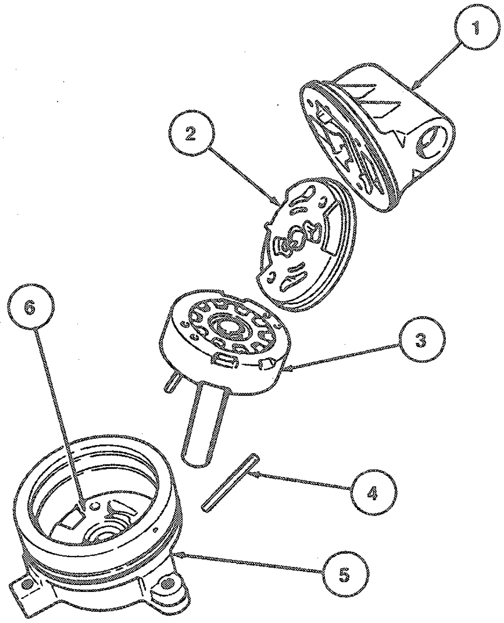
DISASSEMBLY AND ASSEMBLY (Continued)

8. In the side of the pump housing is a small hole. Through this hole, insert a small drift or suitable tool, and push inward on valve cover retaining ring. While applying inward pressure on retaining ring, place screwdriver under edge of retaining ring. Remove the ring.



G4071-A

9. Loosen C-clamp, upper compressor plate and pump assembly.
10. Remove pump valve cover. Discard O-ring seal.
11. Push on rotor shaft to remove shaft, upper plate, rotating group assembly and two dowel pins.

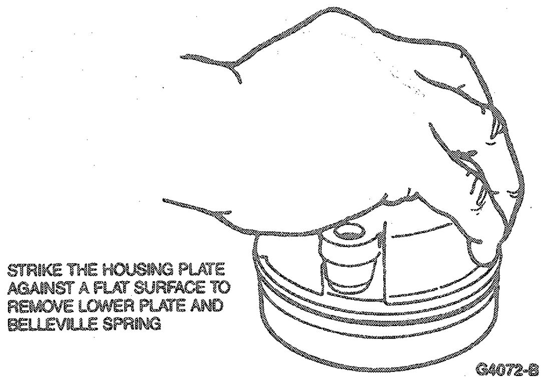


G4173-B

Item	Part Number	Description
1	3C544	Valve Cover Assy
2	3D590	Lower Plate
3	3D607	Cam and Rotor Assy
4	387579-S	Dowl Pin (2 Req'd)
5	3D643	Pump Housing Plate
6	3A645	Upper Plate

TG4173B

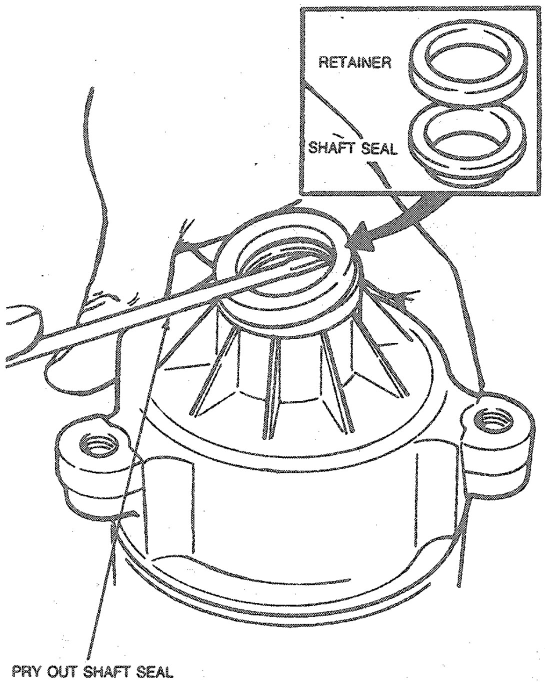
12. The lower plate and Belleville spring will remain in pump housing. To remove, place pump housing on a flat surface. Raise slightly and strike housing against flat surface until lower plate and Belleville spring fall out. Discard O-ring seals.



G4072-B

DISASSEMBLY AND ASSEMBLY (Continued)

13. Remove rotor shaft seal and seal retainer simultaneously by prying out with a screwdriver.



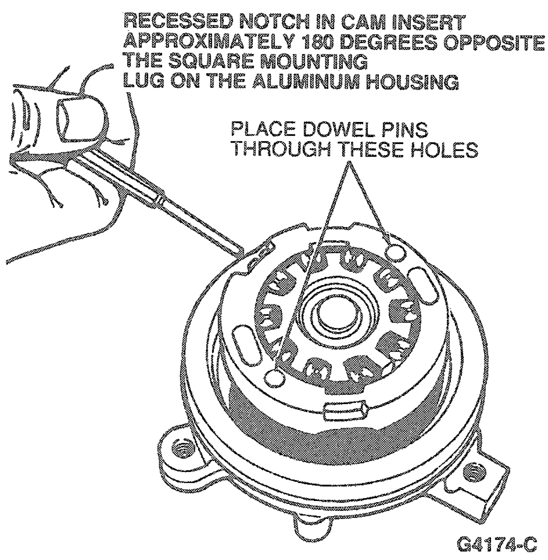
G2578-E

Assembly

If the rotating group was disassembled for cleaning and inspection, assemble as follows:

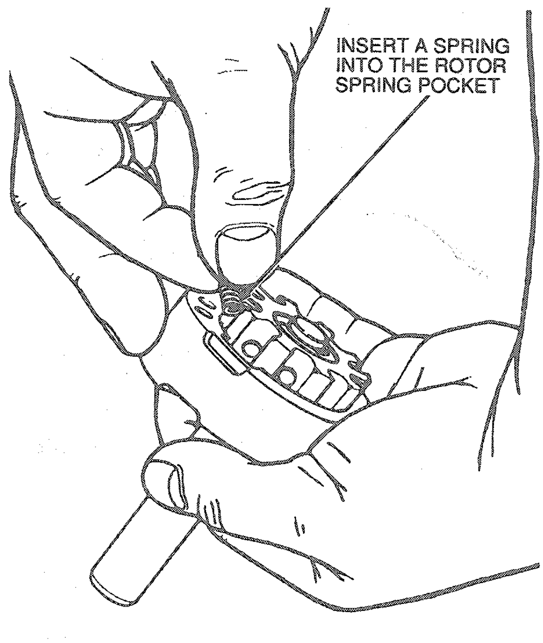
NOTE: Rotor is symmetrical, so it can be installed either way.

1. Place rotor on rotor shaft splines.



G4174-C

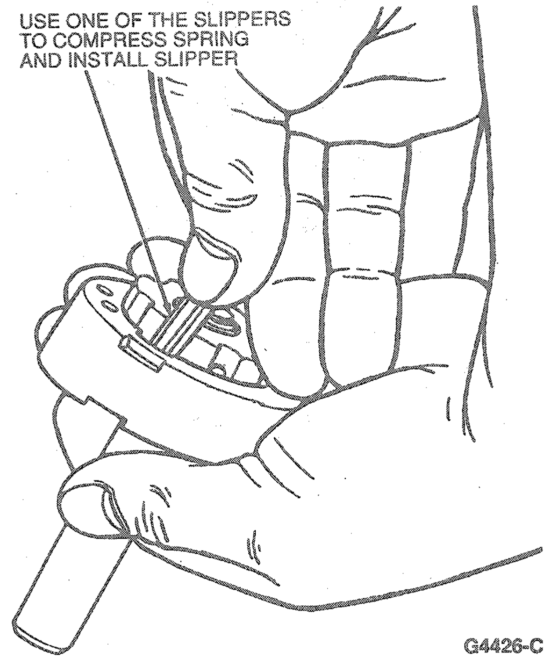
2. Install retaining ring in groove at end of rotor shaft.
3. Place insert cam over rotor. Ensure recessed notch on insert cam faces up.
4. With rotor extended upward approximately half way out of the cam, insert a spring into a rotor spring pocket. Work in rotor cavity directly beneath recessed flats on cam.



G4175-C

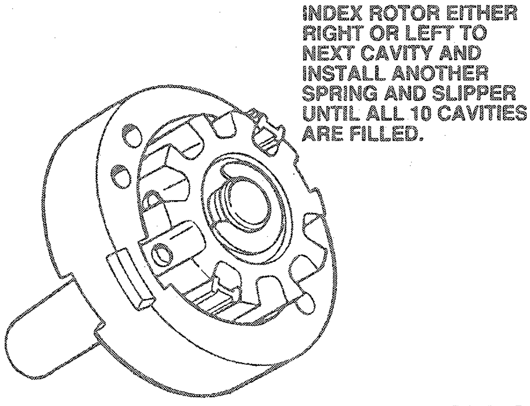
DISASSEMBLY AND ASSEMBLY (Continued)

5. Use one of the slippers to compress spring, and install slipper with groove facing cam profile. Repeat Steps 4 and 5 on slipper cavity beneath opposite inlet recess.



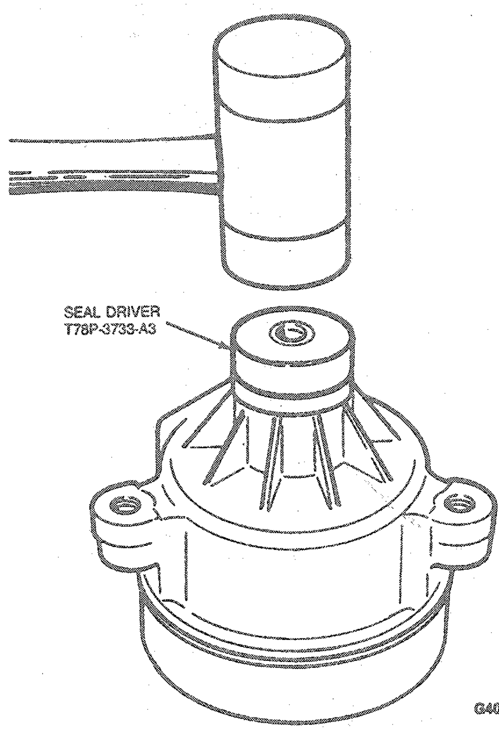
G4426-C

6. Holding cam stationary, index rotor either right or left one space and install another spring and slipper until all 10 rotor cavities have been filled. Turn rotor carefully so that springs and slippers already installed do not fall out.



G4427-D

7. Install a rotor shaft seal using Seal Driver T78P-3733-A3. Using a plastic mallet, drive seal into bore until it bottoms. Install seal retainer in same manner.

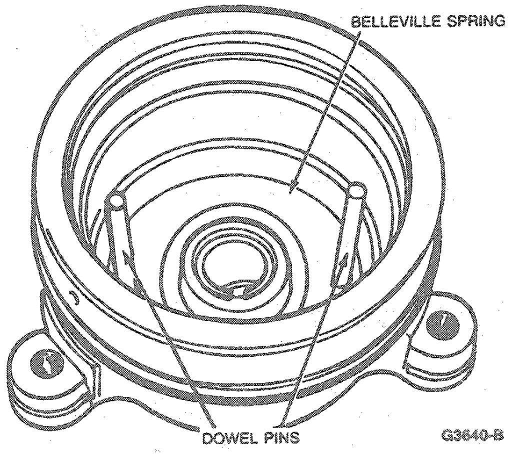


G4056-B

8. Place pump housing plate on flat surface with pulley side facing down.

   NOTE: The Belleville spring must be inserted with the dished surface upward.

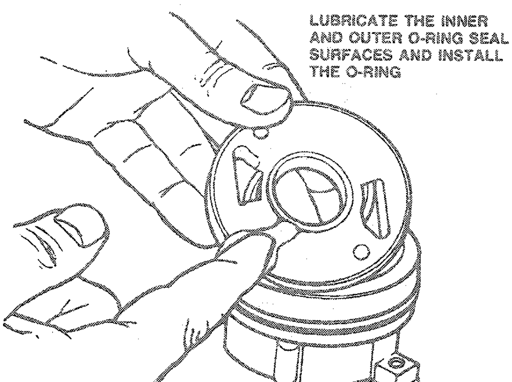
9. Insert two dowel pins and Belleville spring into housing.



G3640-B

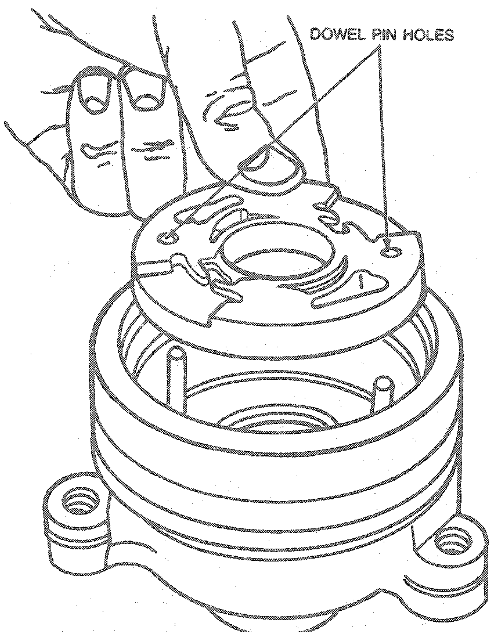
DISASSEMBLY AND ASSEMBLY (Continued)

10. Lubricate inner and outer O-ring seals with specified power steering fluid, and install these seals on lower pressure plate.



G4073-A

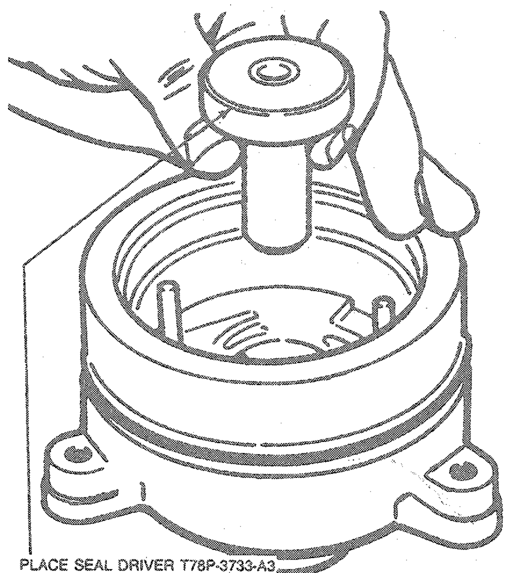
11. Insert lower pressure plate with O-ring seals toward front of pump into housing and over dowel pins.



INSTALL THE LOWER PLATE WITH THE SEALS FACING TOWARD THE PUMP HOUSING

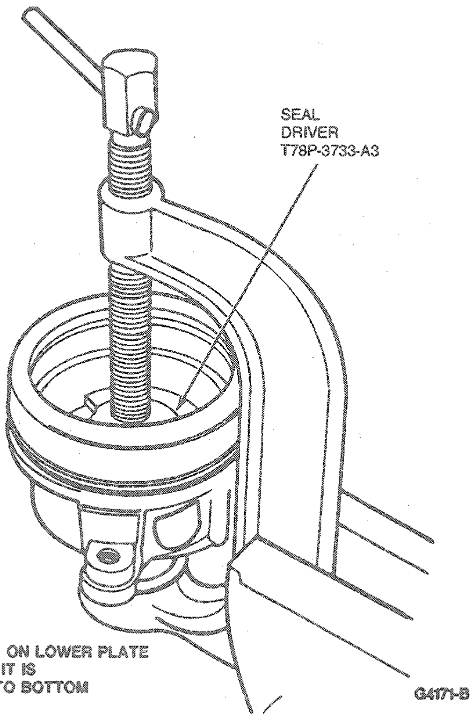
G4057-B

12. Place entire assembly on C-Frame and Clamp Assembly T74P-30441-A1. Place Seal Driver T78P-3733-A3 into rotor shaft hole. Press on lower plate lightly until it is felt to bottom into pump housing. This operation will seat outer O-ring seal.



PLACE SEAL DRIVER T78P-3733-A3 INTO ROTOR SHAFT HOLE

G2583-C



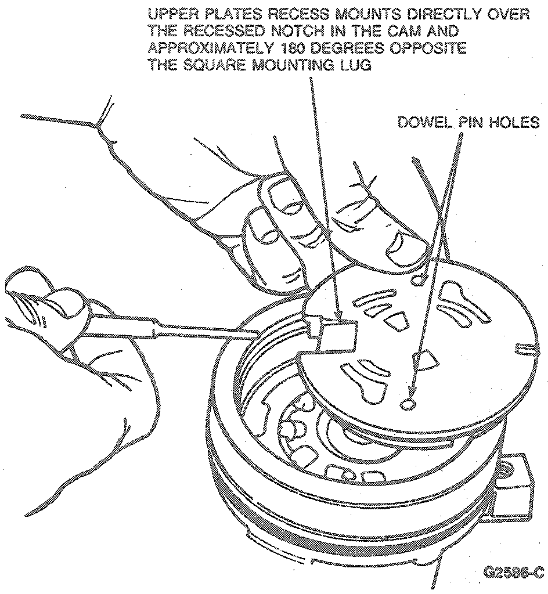
PRESS ON LOWER PLATE UNTIL IT IS FELT TO BOTTOM

G4171-B

NOTE: When installing this assembly into pump housing, stepped holes must be used for dowel pins, and the recessed notch in cam insert must face toward reservoir and approximately 180 degrees opposite the square mounting lug on aluminum housing. Refer to the illustration under Assembly, Step 1.

DISASSEMBLY AND ASSEMBLY (Continued)

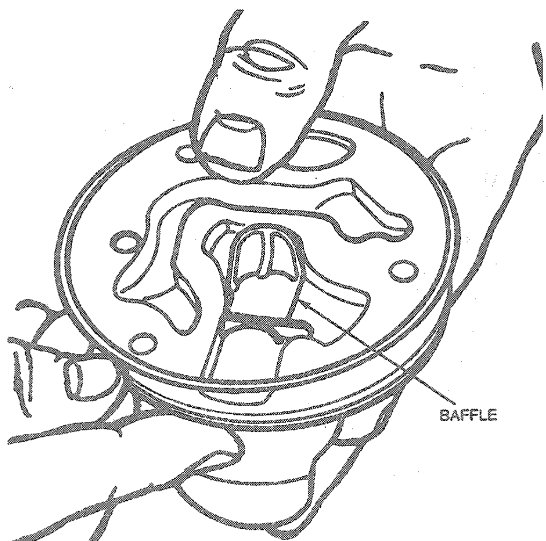
13. Install cam, rotor and slippers, and rotor shaft assembly into pump housing over dowel pins.
14. Place upper pressure plate over dowel pins with recess directly over recessed notch on cam insert and approximately 180 degrees opposite square mounting lug.



G2596-C

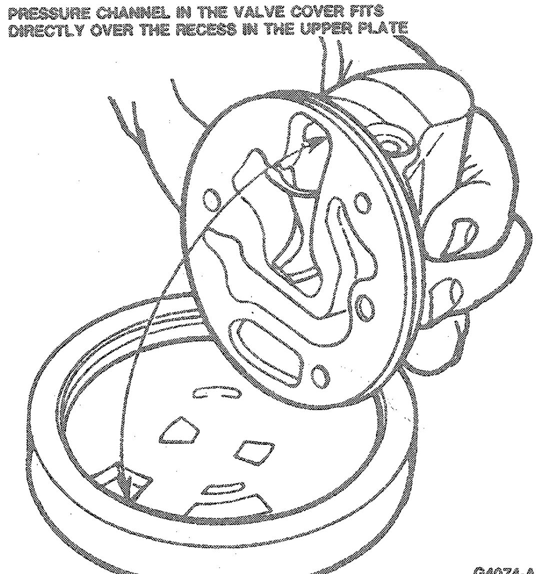
15. Place a new O-ring seal on valve cover. Lubricate this seal with specified power steering fluid.

    NOTE: Ensure the plastic baffle is securely in place in valve cover. If baffle is loose, apply a coating of petroleum jelly on the baffle, and install it into location on the valve cover.



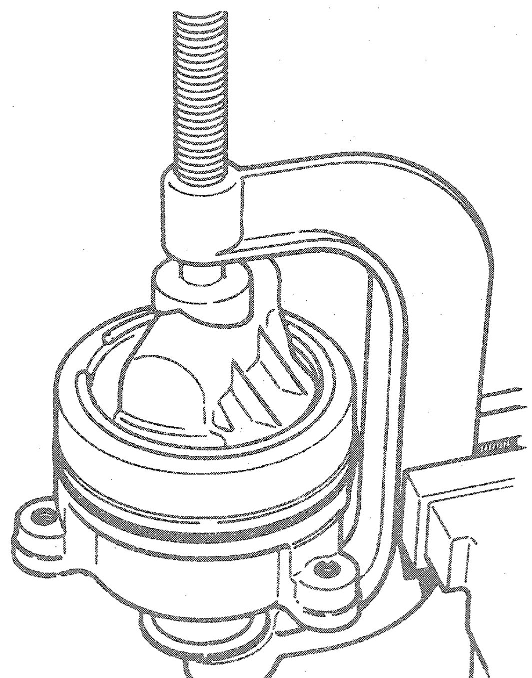
G2587-D

16. Insert valve cover over dowel pins. Ensure fitting hole in valve cover is directly in line with square mounting lug of aluminum housing.



G4074-A

17. Place entire assembly in C-clamp tool and compress valve cover into pump housing, until retaining ring groove is exposed in pump housing.
18. Install valve cover retaining ring with ends near access hole in pump housing.

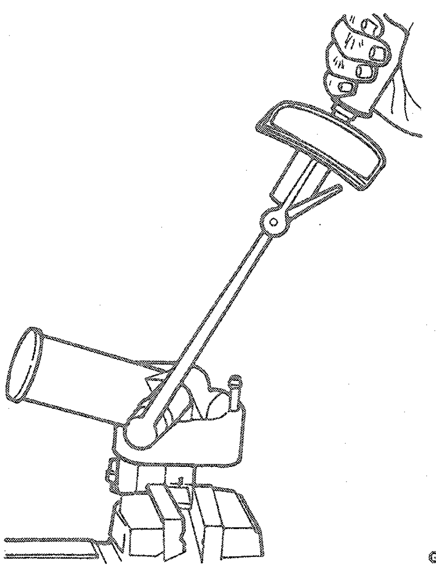


G3648-B

DISASSEMBLY AND ASSEMBLY (Continued)

19. Remove pump assembly from C-clamp tool.
20. Place a new O-ring seal on pump housing. Lubricate this O-ring seal with specified power steering fluid.
21. Install power steering reservoir.
22. Install flow control spring and flow control valve into valve cover.
23. Place new O-ring seals on outlet fitting. Lubricate these seals with specified power steering fluid.

    CAUTION: If the flow control valve is cocked, it may become stuck in the valve cover. Do not force the valve forward. Forcing the valve may shear off metal and carry the metal chips into the valve bore.
24. Install outlet fitting into valve cover. Tighten to 33-47 N·m (25-34 lb-ft).
25. Install pulley as outlined.



G3649-B

CLEANING AND INSPECTION

Steering Gear, Power

Cleaning

1. Use a clean work bench and tools.
2. Clean the exterior of the gear with solvent. If necessary, drain off excess hydraulic fluid.
3. Handle parts carefully to avoid nicks, burrs, scratches and dirt. Do not use solvent on seals.

Inspection

1. Inspect input shaft bearing. Check fit of bearing on input shaft. Replace bearing if necessary.
2. Inspect valve housing for wear, scoring or burrs.
3. Check fluid passages for obstruction or leakage.
4. Inspect gear housing for cracks and stripped threads and mating surfaces for burrs. Inspect piston bore for scoring or wear. If necessary, replace housing.
5. Ensure input shaft bearing rotates freely.
6. Inspect piston rack-and-pinion shaft teeth for nicks and burrs.

Steering Gear, Power—Flushing

Always flush power steering gear when replacing pump due to fluid contamination.

1. Disconnect fluid return hose at pump and place end in a container. Plug return hose nipple on reservoir.
2. Fill reservoir with Premium Power Steering Fluid E6AZ-19582-AA (ESW-M2C33-F) or equivalent.
3. Disconnect ignition coil wire and raise front wheels off floor. Refer to Section 00-02.
4. While adding approximately 1.9 liters (0.5 gallon) of fluid, turn ignition to START position (using the ignition key) and crank engine with starter while turning steering wheel from lock-to-lock.
5. When all fluid has been added, turn ignition to OFF position and connect ignition coil wire.
6. Remove plug from the reservoir return hose nipple. Attach return hose to nipple.
7. Check fluid level. Add fluid if necessary.

    CAUTION: Do not overfill reservoir.
8. Lower vehicle.
9. Start engine and turn steering wheel slowly from lock-to-lock several times. Check fluid level and adjust as required.

Steering Pump, Power—Flushing

If dirt is found in power steering gear, flush pump as follows:

1. Making sure all other hoses are connected, disconnect pressure hose at gear.
2. Place end of hose in a container.
3. Fill reservoir with Premium Power Steering Fluid E6AZ-19582-AA (ESW-M2C33-F) or equivalent.
4. Disconnect ignition coil wire.
5. While adding approximately 1.9 liters (0.5 gallon) of fluid, turn ignition to START position and crank engine with starter. As soon as all fluid has been added, turn ignition to OFF position.
6. Attach pressure hose at gear.
7. Check fluid level.
8. Connect ignition coil wire.
9. Start engine and turn steering wheel slowly from lock-to-lock to expel any air trapped in the system. Check and adjust fluid level.

CLEANING AND INSPECTION (Continued)

Steering Pump, Power

Cleaning

Wash all parts except seals in a chlorinated solvent and dry with compressed air.

Inspection

To determine when to replace power steering pump components, follow these guidelines.

NOTE: Some components must be replaced regardless of condition.

1. Reuse outlet fitting if corners are not rounded and threads are intact.
2. Replace all seals except the rotor shaft seal. Do not remove rotor shaft seal if it does not leak.
3. Reuse reservoir assembly if O-ring surfaces are not damaged.
4. Reuse housing or housing assembly if O-ring and snap ring surfaces are not damaged.
5. Reuse upper and lower pressure plates if there is no scoring on wear surface. Polish phosphate coating, if necessary, but do not remove it.
6. Reuse rotor and cam assembly if wear is limited to removal of phosphate coating on cam contour. Do not disassemble unit. Push rotor part-way through cam insert, being careful not to dislodge slippers and springs. Check cam ID for scoring or burring. Check rotor faces and OD for scoring and chipping.

   Do not service or refinish the upper and lower pressure plates, cam or rotor assembly. If wear or burring is evident, replace them with new components.
7. Install a new rotor and cam assembly if slippers are worn. Replace springs if they are bent or broken.
8. Reuse rotor shaft if thrust faces, bushing diameter and shaft seal diameter are not excessively worn or scored.
9. Reuse housing and bushing assembly if all threaded holes are not damaged beyond service, and bushing diameter is not scored or worn 0.01mm (0.0005-inch) over 18mm (0.6897-inch) maximum. Service threaded holes by drilling out the damaged threads and installing helicoil inserts. If bushing is scored or excessively worn, install a new housing and bushing assembly.
10. Reuse valve body if valve bore is free of nicks and scoring. Valve must fall freely in valve bore. Replace valve housing and / or valve if valve sticks in bore.

ADJUSTMENTS

Rack Yoke Plug Clearance

Tools Required:

- Bench Mounted Holding Fixture T57L-500-B
- Pinion Shaft Torque Adapter T74P-3504-R
- Pinion Housing Yoke Locknut Wrench T78P-3504-H
- Seal Installer D90P-3517-A3

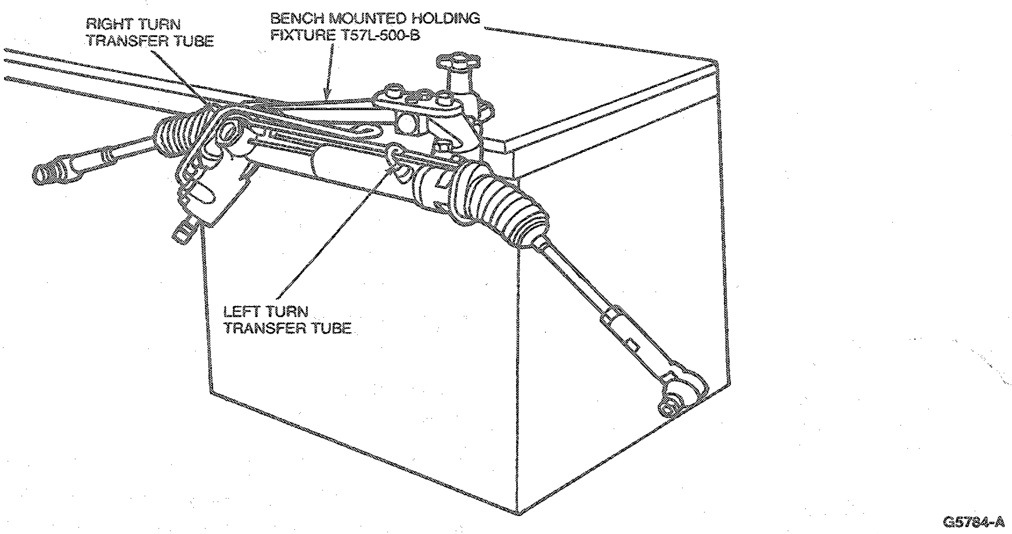
Steering Gear Removed

NOTE: The rack yoke clearance adjustment is not a normal service adjustment. It is only required when the input shaft and valve assembly is removed.

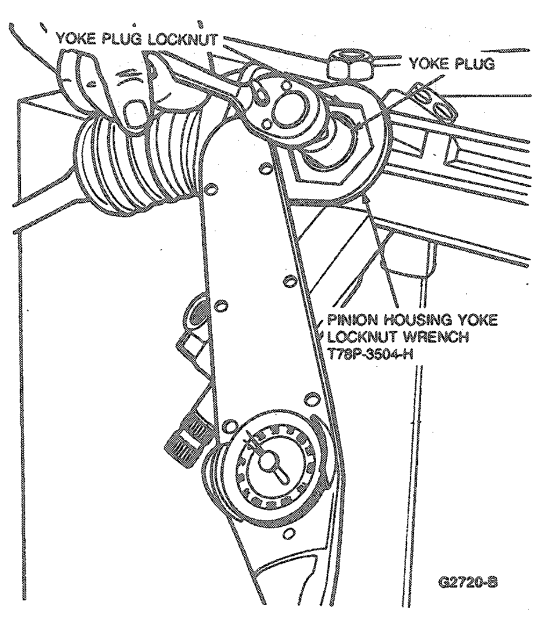
1. Clean exterior of the steering gear thoroughly.

ADJUSTMENTS (Continued)

2. Install two long bolts and washers through the bushings, and attach to the Bench Mounted Holding Fixture T57L-500-B.



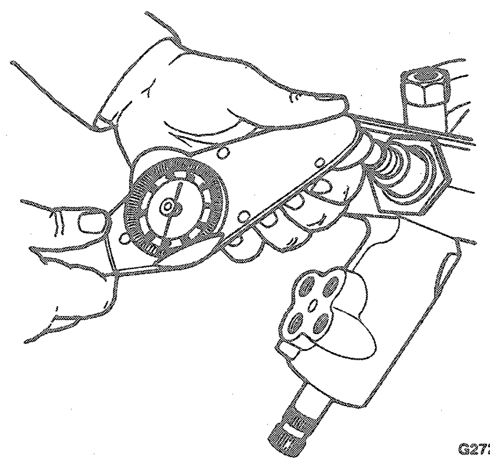
3. Do not remove the external transfer tubes unless they are leaking or damaged. If these lines are removed, they must be replaced with new lines.
4. Drain the power steering fluid by rotating the input shaft lock-to-lock twice using Pinion Shaft Torque Adapter T74P-3504-R. Cover ports on valve housing with shop cloth while draining gear to avoid possible oil spray.
5. Insert a lb-in torque wrench with maximum capacity of 3.39-6.77 N·m (30-60 lb-in) into the Pinion Shaft Torque Adapter T74P-3504-R. Position the adapter and wrench on the input shaft splines.
6. Loosen the yoke plug locknut with Pinion Housing Yoke Locknut Wrench T78P-3504-H.



7. Loosen yoke plug with a 3/4-inch socket wrench.

ADJUSTMENTS (Continued)

8. With the rack at the center of travel, tighten the yoke plug to 5-5.6 N·m (45-50 lb-in). Clean the threads of the yoke plug prior to tightening to prevent a false reading.



G2721-C

9. Back-off the yoke plug approximately one-eighth turn (44 degrees minimum to 54 degrees maximum) until the torque required to initiate and sustain rotation of the input shaft is to 0.78-2.03 N·m (7-18 lb-in).

   CAUTION: Do not allow the yoke plug to move while tightening or the preload will be affected.

10. Place Pinion Housing Yoke Locknut Wrench T78P-3504-H on the yoke plug locknut. While holding the yoke plug, tighten the locknut to 60-89 N·m (44-66 lb-ft).

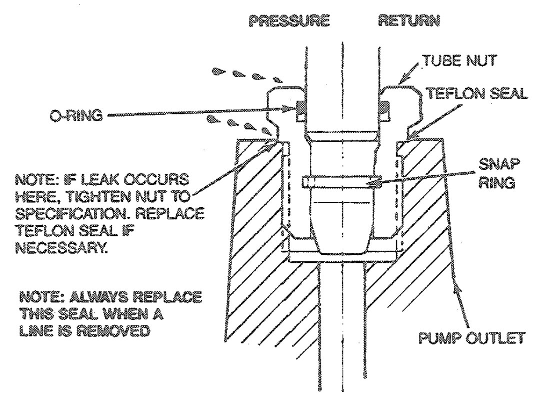
    Check input shaft torque (Step 9) after tightening locknut.

11. If the external transfer tubes were removed, they must be replaced with new service line. Remove the plastic seals from the housing ports prior to installation of new lines.

Quick Connect Power Steering Fitting, Atsugi

Seal Replacement

If a leak occurs between the tubing and tube nut, replace the hose assembly. If a leak occurs between the tube nut and the pump outlet, replace the plastic washer.



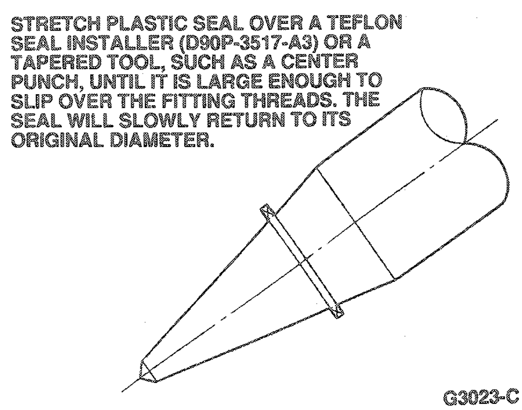
G5248-B

The following procedure should be used:

1. Check fitting to determine whether leak is between tube and tube nut or between tube nut and pump outlet fitting.

   CAUTION: DO NOT over-tighten. If tube nuts are overtorqued, stripping of housing threads may occur and bores may concave.

2. If leak is between tube nut, check to ensure nut is tightened to 20-35 N·m (15-25 lb-ft).
3. If leak continues or if leak is between tube and tube nut, remove line.
4. Unscrew tube nut, and inspect plastic seal washer. Always replace plastic seal washer (Part No. 388898-S) when line is removed. To facilitate assembly of new plastic seal washer, a tapered shaft may be required to stretch washer, so it may be slipped over tube nut threads.



G3023-C

5. The rubber O-ring cannot be serviced with this design. If leak is due to the O-ring, replace the hose assembly.

ADJUSTMENTS (Continued)

6. Connect tube nut and tighten to 20-35 N·m (15-25 lb-ft).

The quick connect fitting may disengage if not fully assembled, if the snap ring is missing, or the tube nut, or the hose end is not machined properly.

If the fitting disengages, replace the hose assembly. The fitting is fully engaged only when the hose will not pull out. To test for positive engagement, the system should be properly filled, the engine started, and the steering wheel cycled from lock-to-lock. Service hose assemblies have tube nuts, snap rings and O-rings already attached.

SPECIFICATIONS

Description	Specifications
Gear Ratio	15:1
Number of Turns	2.5
Pinion, Rack Lubricant Capacity	23-27 Grams
Power Steering Fluid Capacity (Including Steering Pump)	2.5 Pints
Pinion, Rack and Pinion Bearing Lubricant	C3AZ-19578-A (ESW-M1C87-A)
Seal Lubricant (Cavity under Dust Seal)	D0AZ-19584-A (ESB-M1C93-A)
Premium Power Steering Fluid	E6AZ-19582-AA ESW-M2C33-F
Effort Required to Initiate Proper Input Shaft Rotation (Power Cylinder drained and gear removed from Vehicle)	0.78-2.03 N·m (7-18 lb-in)
Tie Rod Articulation Effort (On Pull Scale)	2-10 lbs.
Tie Rod Outer End Lubricant	None (Bonded Rubber Design)

TORQUE SPECIFICATIONS

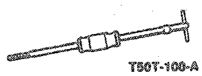
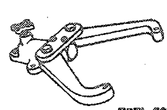
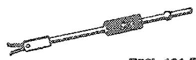
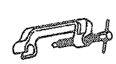
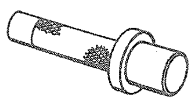
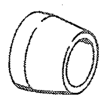
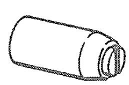
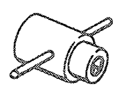
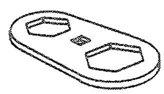
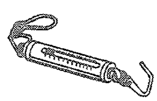
Description	N·m	Lb-Ft
Pressure Line Fitting (at Pump)	14-20	10-15
Gear-to-Crossmember Mounting Bolt Nut	115-135	85-100
Tie Rod End-to-Spindle Arm Nut	48-63	35-47
Intermediate Shaft-to-Steering Gear Bolt	41-51	30-38
Intermediate Shaft-to-Steering Column (2 Nuts)	21-33	15-25
Weather Boot-to-Dash Panel	5.5-6.7	4-5
Bellows Clamp Screw	2.2-3.4	20-30 (Lb-In)
Yoke Plug	5-5.6	45-50 (Lb-In)
Yoke Plug Locknut	60-89	44-66
Pressure Line Fitting at Gear	20-35	15-25
Return Line Fitting at Gear	20-35	15-25
Transfer Tube Fittings at Power Cylinder (Right and Left Turn Lines)	13-27	10-20
Pinion Bearing Locknut	41-54	31-39
Pinion Bearing Cap	54-68	40-50
Tie Rod Ball Socket Assembly to Rack	75-88	55-65
Rack and Pinion Shield Screws	5.5-8	49-71 (Lb-In)

(Continued)

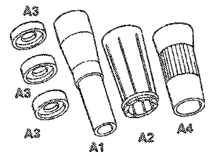
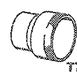
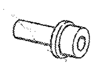
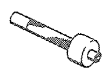
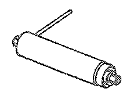
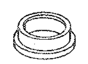
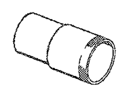
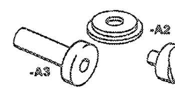
TORQUE SPECIFICATIONS (Cont'd)

Description	N·m	Lb-Ft
Reservoir Screws	6-8	54-70 (Lb-In)
Hose Clamps	1.4-2	13-17 (Lb-In)
Pump Retaining Bolts	20-32.5	15-24
Wheel Lug Nuts	115-142	85-105
Power Steering Line and Bracket	4.5-5.7	40-50 (Lb-In)
Bracket Assembly Bolt	21-32	15-23
Pump Cooler Screws	18-28	14-20
Tube Nut and Gear Housing Fitting	27-34	20-25
Pressure Switch	7-14	5-10
Outlet Fitting to Reservoir and Valve Cover	33-47	25-34
Jam Nut	47-68	35-50
Module Fixture Screws	4-5	35-45 (Lb-In)
Power Steering Line Fittings	34-46	26-33
Clamp Nut	21-32	15-23
Actuator-to-Steering Gear Retaining Bolts	27-34	20-25

SPECIAL SERVICE TOOLS

Tool Number / Description	Illustration
T50T-100-A Impact Slide Hammer	 T50T-100-A
T57L-500-B Bench Mounted Holding Fixture	 T57L-500-B
T58L-101-B Puller Attachment	 T58L-101-B
T71P-19703-C O-Ring Tool	 T71P-19703-C
T74P-3044-A1 C-Frame and Clamp Assembly	 T74P-3044-A1
T74P-3504-F Outer Rack Seal Replacer	 T74P-3504-F
T74P-3504-G Teflon® Ring Replacer	 T74P-3504-G
T74P-3504-J Rack Seal Protector Sleeve	 T74P-3504-J
T74P-3504-R Pinion Shaft Torque Adapter	 T74P-3504-R
T74P-3504-U Nut Wrench	 T74P-3504-U
T74P-3504-Y Hook Spring Scale	 T74P-3504-Y

(Continued)

Tool Number / Description	Illustration
T75L-3517-A Seal Installation Set Consists of: T75L-3517-A1 Mandrel T75L-3517-A2 Slide Pusher T75L-3517-A3 Spacer T75L-3517-A4 Sizing Tube	 T75L-3517-A
T78P-3504-C Valve Body Insert Tool	 T78P-3504-C
T78P-3504-D Upper Pinion Bearing Seal Replacer	 T78P-3504-D
T78P-3504-G Lower Pinion Bearing Replacer	 T78P-3504-G
T78P-3504-H Pinion Housing Yoke Locknut Wrench	 T78P-3504-H
T78P-3504-J Rack Oil Seal Remover	 T78P-3504-J
T78P-3504-L Rack Bushing Holding Tool	 T78P-3504-L
T78P-3504-M Teflon® Ring Sizing Tool	 T78P-3504-M
T78P-3733-A1 Upper Support Plate T78P-3733-A2 Lower Support Plate T78P-3733-A3 Seal Driver	 T78P-3733-A

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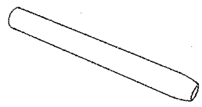
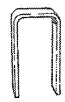
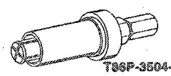
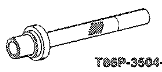
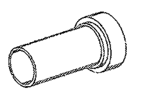
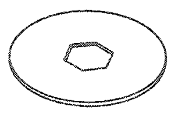
SPECIAL SERVICE TOOLS (Continued)

Tool Number/ Description	Illustration
T85L-3504-B Rack Oil Seal Protector	 T85L-3504-B
T86P-3504-D Valve Body Puller (Bridge)	 T86P-3504-D
T86P-3504-E Pinion Housing Yoke Locknut Wrench	 T86P-3504-E
T86P-3504-F Lower Pinion Seal Remover (Small OD)	 T86P-3504-F
T86P-3504-G Lower Pinion Seal Replacer	 T86P-3504-G
T86P-3504-J Part of Lower Pinion Seal Remover (Large OD)	 T86P-3504-J
T88P-3504-A Yoke Plug Torque Gauge	 T88P-3504-A

Tool Number	Description
D79L-7000-A	Retaining Ring Pliers
D81P-3504-N	Locknut Pin Remover
D90P-3517-A3	Seal Installer
TOOL-3290-D	Tie Rod End Remover

ROTUNDA EQUIPMENT

Model	Description
007-00001	Digital Volt Ohmmeter
059-00010	Inductive Dwell-Tach-Volt-Ohm Tester

SECTION 11-04 Steering Column

VEHICLE APPLICATION

Taurus / Sable.

DESCRIPTION

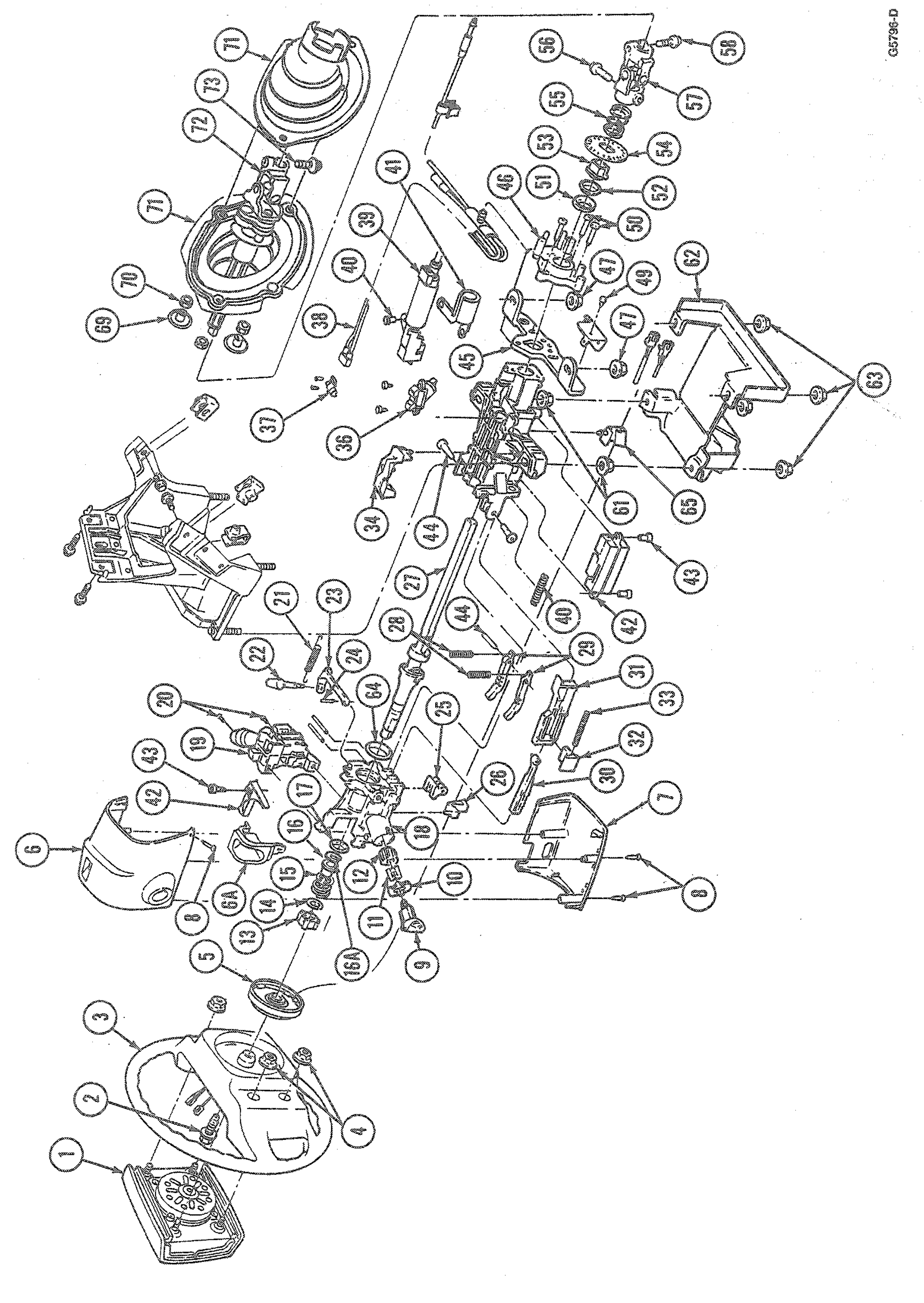
NOTE: All fasteners are important in that they could affect the performance of vital parts and systems, and / or could result in major service expenses. They must be replaced with fasteners of the same part number if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during assembly to ensure proper functioning of these parts.

The steering column has been redesigned for more efficient use of package space and improved strength. The structural part of the column is made of magnesium die castings. The column is attached to a support that is an integral part of the instrument panel. The column lower attachments are through a bracket that bends during column collapse. The upper attachments are through plastic shear modules that separate from the main casting during column collapse. A clip and washer are attached to the shear modules to reduce column shake and to assist in column installation to the beam.

A unique shifter mechanism has been installed on the column (column shift only). It has the insert plate located away from the shift lever and interacts with the shift lever through a linkage system. This system provides a positive interlock with no adjustments required.

DESCRIPTION (Continued)

Steering Column, Console Shift—Exploded View



DESCRIPTION (Continued)

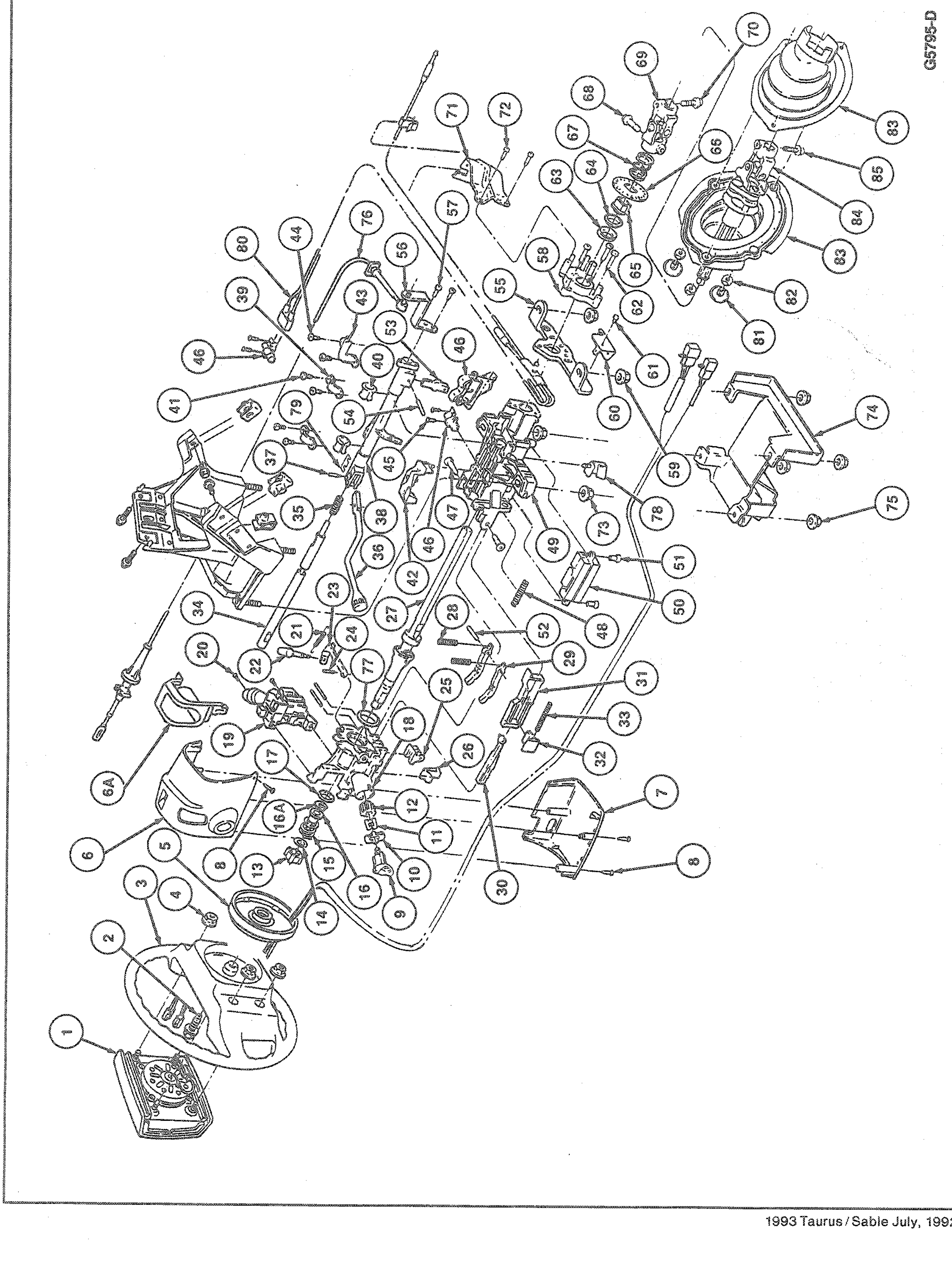
Item	Part Number	Description
1	—	Air Bag Module
2	N804385-S100	Steering Wheel Bolt
3	—	Steering Wheel
4	—	Air Bag Module Retaining Nuts
5	14A664	Air Bag Clockspring Contact Assy
6	3530	Upper Column Shroud
6A	3D677	Seal Assy
7	3533	Lower Column Shroud
8	55929	Shroud Retaining Screws
9	11572	Ignition Lock Cylinder Assy
10	3F579	Retainer
11	3E700	Bearing
12	3E717	Gear — Steering Lock
13	13318	Turn Signal Cancelling Cam
14	3C610	Snap Ring
15	3520	Spring — Upper Bearing
16	3518	Sleeve
16A	3L539	Ring
17	3517	Bearing — Upper (Small)
18	3F642	Lock Cylinder Housing
19	13K359	Multi-Function Switch
20	390345-S36	Screws
21	—	Spring
22	3F527	Tilt Release Lever
23	3D544	Tilt Actuator Lever
24	3F530	Tilt Actuator Lever Pin
25	3E695	Cam Steering Column Lock
26	14A163	Clip Wiring — Upper
27	3D657	Steering Shaft Assy
28	3C732	Spring Lock Lever
29	3B662 (RH) 3D653 (LH)	Lever Steering Column Lock
30	3E723	Lock Actuator Assy — Upper
31	3E715	Lock Actuator Assy — Lower
32	3E691	Pawl — Steering Column Lock (Shaft)
33	3E696	Spring — Steering Column Lock (Shaft)
34	14A099	Shield

(Continued)

Item	Part Number	Description
36	—	Solenoid and Bracket
37	2B623	Release Switch
38	2B654	Hose
39	3F719	Shift Interlock Cable
40	N806038	Screw
41	7H178	Bracket
42	3F527	Lever Assy
43	3F530	Pin
44	N805865	Tilt Pivot Screws
45	3D655	Spring — Steering Column Position Lock
46	3F723	Actuator Housing
47	—	Ignition Switch
48	N805858	Screws
49	3F530	Pin — Pivot Lever
50	3B632	Lower Column Bracket
51	3E738	Lower Bearing Housing Retainer
52	N801555	Lower Column Mounting Nuts
53	14A206	Bracket
54	N804409	Screw
55	805859	Lower Bearing Housing Retaining Screws
56	3A649	Lower Column Bearing Sleeve
57	3517	Lower Column Bearing
58	36539	Tolerance Ring — Lower
59	3C131	Sensor Ring
60	3C674	Spring
61	N803942	Bolt — Flange Yoke
62	3N725	Steering Shaft U — Joint Assy
63	N803942	Bolt
64	N801555	Upper Column Mounting Nuts
65	3E645	Absorber — Steering Column Impact
66	N801555	Nuts
67	3517	Bearing — Upper (Large)
68	14A163	Clip Wiring — Lower
69	N804326	Nut (2 Req'd)
70	N620012	Nut (3 Req'd)
71	3E735	Boot Assy
72	3C662	Intermediate Shaft Assy
73	N806393-S100	Bolt

DESCRIPTION (Continued)

Steering Column, Column Shift—Exploded View



DESCRIPTION (Continued)

Item	Part Number	Description
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3	—	Steering Wheel
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6A	3D677	Seal Assy
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8	55929	Shroud Retaining Screws
9	11572	Ignition Lock Cylinder Assy
10	3F579	Retainer
11	3E700	Bearing
12	3E717	Gear — Steering Lock
13	13318	Turn Signal Cancelling Cam
14	3C610	Snap Ring
15	3520	Spring — Upper Bearing
16	3518	Sleeve
16A	3L539	Ring
17	3517	Bearing — Upper (Small)
18	3F642	Lock Cylinder Housing
19	13K359	Multi — Function Switch
20	390345-S36	Screws
21	—	Spring
22	3F527	Tilt Release Lever
23	3D544	Tilt Actuator Lever
24	3F530	Tilt Actuator Lever Pin
25	3E695	Cam Steering Column Lock
26	14A163	Clip Wiring — Upper
27	3D657	Steering Shaft Assy
28	3C732	Spring Lock Lever
29	3B662 (RH) 3D653 (LH)	Lever Steering Column Lock
30	3E723	Lock Actuator Assy — Upper
31	3E715	Lock Actuator Assy — Lower
32	3E691	Pawl — Steering Column Lock (Shaft)
33	3E696	Spring — Steering Column Lock (Shaft)
34	7361	Plunger Trans Control Select
35	7B071	Spring — Trans Control Selector Return
36	7302	Shift Lever
37	7W441	Shift Lever Pin
38	7215	Trans Selector Control Tube
39	7E400	Trans Gear Shift Tube Clamps
40	7335	Bushings
41	N805858	Screws
42	14A099	Shield

(Continued)

Item	Part Number	Description
43	7A216	Trans Control Selector Position Insert
44	N805858	Screws
45	390345-S36	Screws
46	2B623	Parking Brake Vacuum Release Switch
47	N805865	Tilt Pivot Screws
48	3D655	Spring — Steering Column Position Lock
49	3F723	Actuator Housing
50	—	Ignition Switch
51	N805858	Screws
52	3F530	Pin — Pivot Lever
53	3E691	Pawl Steering Column Lock Shifter
54	3B663	Pin — Steering Column Lock Shifter
55	3B632	Lower Column Bracket
56	7D282	Trans Control Selector Lower Lever
57	805858	Screws
58	3E738	Lower Bearing Housing Retainer
59	N801555	Lower Column Mounting Nuts
60	14A206	Bracket
61	N804409	Screw
62	805859	Lower Bearing Housing Retaining Screws
63	3A649	Lower Column Bearing Sleeve
64	3517	Lower Column Bearing
65	3L539	Tolerance Ring — Lower
66	3C131	Sensor Ring
67	3C674	Spring
68	N803942	Bolt — Flange Yoke
69	3N725	Steering Shaft U — Joint Assy
70	N803942	Bolt
71	7E364	Shift Cable Bracket
72	805858	Shift Cable Bracket Mounting Screws
73	N806423-S56	Upper Column Mounting Nuts
74	3E645	Absorber — Steering Column Impact
75	N801555	Nuts
76	7E395	Shift Cable Assy
77	3517	Bearing — Upper (Large)
78	14A163	Clip Wiring — Lower
79	7C464	Clip
80	2B654	Hose
81	N804326	Nut (2 Req'd)
82	N620012	Nut (3 Req'd)
83	3E735	Boot Assy
84	3C562	Intermediate Shaft
85	N806393-S100	Bolt

TG5794D

DIAGNOSIS AND TESTING

Ignition Switch Electrical Diagnosis

Refer to Section 11-05 for Blade Terminal-Type Connector Switch—Mechanical Test.

Refer to the following chart for ignition switch diagnosis.

IGNITION SWITCH MECHANICAL DIAGNOSIS

CONDITION	POSSIBLE SOURCE	ACTION
• High Key Efforts	• Damaged lock cylinder.	• Lubricate cylinder and check for burrs on key and / or correct key cut. If effort is still excessive, replace lock cylinder.
	• Shrouds mis-aligned.	• Align shroud to fit properly.
	• Casting / actuator binds, sticks, grabs, with key rotation.	• If improper fit between casting and actuator exists, replace parts. • If burrs are found on actuator surfaces which contact the casting during key travel, gently file these surfaces until smooth. At no time attempt to file teeth of actuator. • If serious burrs are found on casting surface which contact actuator during key travel, replace the casting. • If actuator teeth show excessive wear or are burred, replace actuator. • Assemble lock housing assembly taking care to thoroughly lube all internal components with Multi-Purpose Grease D0AZ-19584-AA (ESR-M1C159-A, ESB-M1C93-A) or equivalent and check key efforts. If still high, replace lock housing assembly.
	• Damaged ignition switch.	• Replace the ignition switch.

TG5186C

Steering Column

Refer to the following charts for steering column diagnosis procedures.

STEERING COLUMN DIAGNOSIS

CONDITION	POSSIBLE SOURCE	ACTION
• Squeak, Moan When Steering Wheel Turned	• Gear rolled up or down allowing input shaft or pinch bolt to contact boot.	• Reposition rack and pinion to proper position and / or reposition boot.
• Engine Compartment Noise, Fumes, Heat, Vapors and / or Water and Liquids Enter Passenger Compartment	• Seal distorted leaving gap to lower shaft.	• Replace boots with visual gaps. Realign gear and / or boot to specifications. If condition isn't resolved, replace boot.
	• Seal missing.	• Replace boot.
	• Boot retaining nuts missing.	• Install nuts.
	• Boot mispositioned.	• Reposition boot.
	• Dash absorber under boot sealing surface.	• Reposition absorber under gap-hinder lip.
	• Dash panel surface deformed.	• Replace rope caulk on sealing surface of boot.
	• Boot missing.	• Install new boot.
	• Boot cut or torn.	• Install new boot.
	• Improper assembly of power steering isolator plastic sleeve.	• Replace boot.

DIAGNOSIS AND TESTING (Continued)

STEERING COLUMN DIAGNOSIS (Continued)

CONDITION	POSSIBLE SOURCE	ACTION
• Rubbing Noise	• **Intermediate Shaft Area**	
	• Boot mispositioned on intermediate shaft.	• Install properly.
	• U-joint bearings damaged or contaminated.	• Replace intermediate shaft.
	• **Lower Column Area**	
	• Damaged, fractured bearing or retainer.	• Replace bearing and retainer.
	• **Upper Column Area**	
	• Wheel rubbing on shroud.	• Install shroud to proper location.
	• Damaged upper bearing sleeve, lock housing or retainer.	• Remove shroud and check for proper installation of lock housing, upper bearing and upper bearing snap ring. Install as required.
	• Damaged bearing.	• Replace bearing.
		• Replace shaft, lock housing or outer tube.
• Clunk During Acceleration or Deceleration	• Loose intermediate shaft to gear.	• Tighten retaining bolts.
• Rattles, Loose Steering	• **Intermediate Shaft Area**	
	• Intermediate shaft to gear attachment not tight.	• Tighten attachments.
	• Improper boot assembly.	• Install and tighten screws.
	• Interference fit between plastic collar and intermediate shaft.	• Install to proper location. Replace if necessary.
	• Excessive universal joint lash.	• Replace intermediate shaft.
	• Power steering isolator rubber bond separation.	• Replace intermediate shaft.
	• **Lower Column Area**	
	• Loose intermediate shaft to column or column to support attachment.	• Tighten attachments.
	• **Upper Column Area**	
	• Improper shroud assembly.	• Install and tighten shroud.
	• Column to support bracket loose.	• Tighten attachment.
	• Loose shaft to upper bearing.	• Check that snap ring is engaged to shaft properly. Replace bearing or shaft.
	• Lock housing assembly.	• Replace parts as required.
• Binding / HeavyEffort / No Returnability / Column Grounded / Sticks / Binds / Grabs	• Improper installation of dash boot.	• Reposition boot.
	• Improperly assembled universal joint.	• Replace intermediate shaft.
	• Upper column.	• Remove column and check column for binding while disconnected from intermediate shaft. If it binds: A. Remove column shaft and check it for straightness — replace shaft. B. Check upper and lower bearing for ease of rotation—replace. C. Check for contact of shaft to other components—replace parts required.
	• Restrictor assembly on sensor ring not removed (during assembly).	• Replace sensor ring and bearing wedge. **DO NOT** install restrictor.

TG4444E

REMOVAL AND INSTALLATION

CAUTION: Do not remove the steering column, steering wheel and air bag module as an assembly from the vehicle unless the column is locked to prevent rotation, or lower end of steering shaft should be wired in such a way to prevent the steering wheel from being rotated.

Steering Wheel

Tools Required:

- Steering Wheel Puller T67L-3600-A

Removal

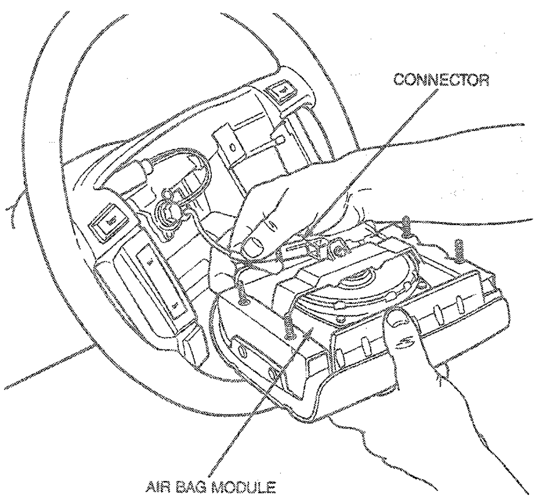
1. Center front wheels to the straight-ahead position.

   WARNING: THE BACKUP POWER SUPPLY MUST BE DISCONNECTED BEFORE ANY AIR BAG COMPONENT IS SERVICED.

2. Disconnect battery ground cable and air bag backup power supply. Refer to Section 01-20B.

   NOTE: Taurus SHO only, remove two steering wheel back cover plugs. Remove two air bag module retaining bolts and lift module off steering wheel.

3. Remove four air bag module retaining nuts and lift module off steering wheel.
4. Disconnect air bag wire harness from air bag module and remove module from wheel.

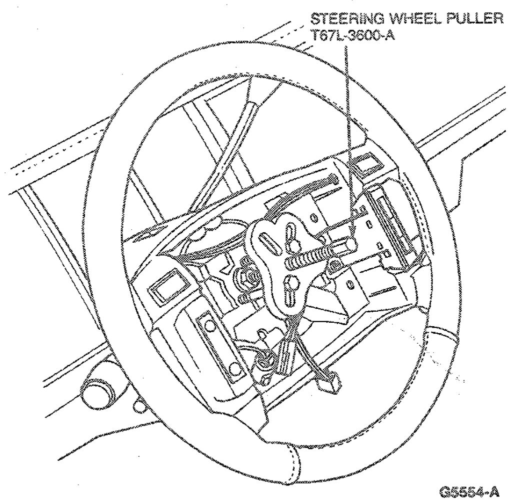


G5783-A

5. Disconnect speed control wire harness from steering wheel.

   CAUTION: Be sure contact assembly wire harness does not get caught on wheel assembly when lifting off shaft.

6. Remove and discard steering wheel retaining bolt.
7. Install Steering Wheel Puller T67L-3600-A or equivalent and remove steering wheel. Route contact assembly wire harness through steering wheel as wheel is lifted off shaft.



G5554-A

Installation

1. Ensure that vehicle's front wheels are in the straight-ahead position.
2. Route contact assembly wire harness through steering wheel opening at the three o'clock position and position steering wheel on steering shaft. The steering wheel and shaft alignment marks should be aligned. Be sure air bag contact wire is not pinched.
3. Install new steering wheel retaining bolt and tighten to 31-45 N·m (23-33 lb-ft).

   CAUTION: Be sure wiring does not get trapped between steering wheel and contact assembly.

4. Connect speed control wire harness to wheel and snap connector assembly into steering wheel clip.
5. Connect air bag wire harness to air bag module and install module to steering wheel. Tighten module retaining nuts to 4-5.4 N·m (36-47 lb-in). (Taurus SHO: Tighten retaining screws to 10.2-13.8 N·m (7.5-10 lb-ft.) Install back cover plugs.)
6. Connect air bag backup power supply and battery ground cable. Verify air bag warning indicator.

Tilt Lock Lever

Removal and Installation

1. To remove tilt lock lever, rotate lever counterclockwise.

REMOVAL AND INSTALLATION (Continued)

2. To install, position lever and rotate clockwise until tight.

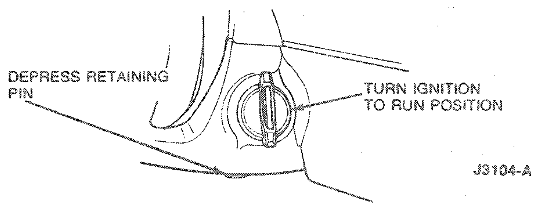
Ignition Lock Cylinder Assembly

Functional Lock

Removal

The following procedure applies to vehicles that have functional lock cylinders. Lock cylinder keys are available for these vehicles, or the lock cylinder key numbers are known and the proper key can be made.

1. Disconnect battery ground cable.
2. Turn lock cylinder key to RUN position.
3. Place a 3.17mm (1/8 inch) diameter wire pin or small drift punch in hole in trim shroud under lock cylinder. Depress retaining pin while pulling out on lock cylinder to remove it from column housing.



Installation

1. Install lock cylinder by turning it to RUN position and depressing retaining pin. Insert lock cylinder into lock cylinder housing. Ensure cylinder is fully seated and aligned in interlocking washer before turning key to OFF position. This will permit cylinder retaining pin to extend into cylinder housing hole.
2. Rotate lock cylinder, using lock cylinder key, to ensure correct mechanical operation in all positions.
3. Connect battery ground cable.

Non-Functional

Removal

The following procedure applies to vehicles in which the ignition lock is inoperative and the lock cylinder cannot be rotated due to a lost or broken lock cylinder key, unknown key number, or a lock cylinder cap that has been damaged and/or broken to the extent that the lock cylinder cannot be rotated.

1. Disconnect battery ground cable.
2. Remove steering wheel as outlined.
3. Using channel-lock pliers or vise-grip-type pliers, twist lock cylinder cap until it separates from lock cylinder.
4. Using a 3/8-inch diameter drill, drill down middle of ignition lock key slot approximately 44mm (1-3/4 inch) until lock cylinder breaks loose from breakaway base of lock cylinder. Remove lock cylinder and drill shavings from lock cylinder housing.
5. Remove retainer, washer, ignition switch and actuator. Thoroughly clean all drill shavings and other foreign materials from casting.
6. Carefully inspect lock cylinder housing for damage from the above operation. If damage is apparent, housing must be replaced.

Installation

1. Replace lock cylinder housing, if damaged.
2. Install actuator and ignition switch as outlined.
3. Install trim and electrical parts.
4. Install new ignition lock cylinder as outlined.
5. Install steering wheel as outlined.
6. Check lock cylinder operation.

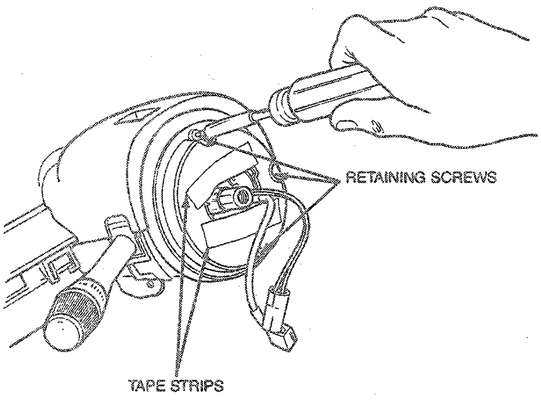
Contact Assembly

Removal

1. Ensure that vehicle's front wheels are in the straight-ahead position and steering column shaft alignment mark is at the 12 o'clock position.
2. Disconnect battery ground cable and air bag backup power supply.
3. Remove steering wheel as outlined.
4. Remove lower RH and LH mouldings from instrument panel by pulling up and snapping out of retainer.
5. Remove instrument panel lower trim panel and lower steering column shroud.
6. Disconnect contact assembly wire harness.
7. Apply two strips of tape across contact assembly stator and rotor to prevent accidental rotation.
8. Remove lock cylinder and remove key warning buzzer wire.
9. Detach harness 14401 mating connectors down column side.

REMOVAL AND INSTALLATION (Continued)

10. Remove three contact assembly retaining screws and pull contact assembly off steering column shaft.



G5555-A

Installation

1. Ensure that vehicle's front wheels are in the straight-ahead position and steering column shaft alignment mark is at the 12 o'clock position.
2. Align contact assembly to column shaft and mounting bosses and slide contact assembly on to the shaft.
3. Install three retaining screws. Tighten screws to 2-3 N-m (18-26 lb-in). Remove tape strips.

   NOTE: If a new contact assembly is being installed, remove the plastic lock mechanism after contact assembly is secured to column.
4. Route contact assembly down column assembly and connect to wire harness.
5. Install key warning buzzer into lock cylinder housing and secure lock cylinder.
6. Connect harness 14401 connectors down column side.
7. Install lower shroud and instrument panel cover.
8. Install steering wheel as outlined.
9. Connect air bag backup power supply and battery ground cable.
10. Verify air bag warning indicator.

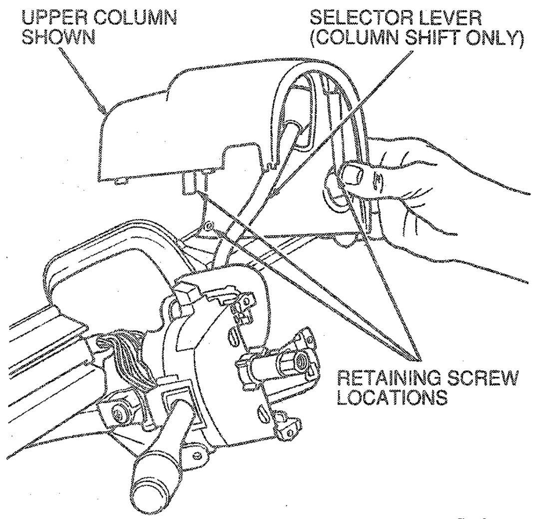
Steering Column

Ensure that vehicle front wheels are in the straight-ahead position.

Removal

NOTE: All steering column components are assembled with fasteners. They are designed with a thread locking system to prevent loosening due to vibrations associated with normal vehicle operation.

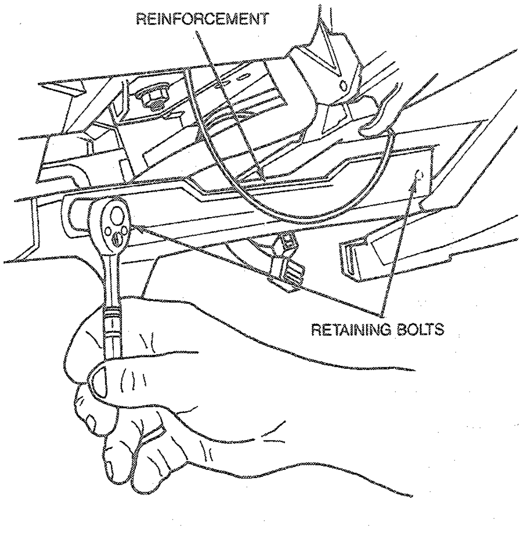
1. Disconnect battery ground cable and air bag backup power supply.
2. Remove steering wheel as outlined.
3. Remove instrument panel lower trim cover.
4. Remove air bag clockspring contact assembly as outlined.
5. Remove tilt lever by unscrewing it from column and remove four screws.
6. Rotate ignition lock cylinder to RUN position. Using a 1 / 8-inch drift, depress lock cylinder retaining pin through access hole and remove lock cylinder.
7. Remove four retaining screws from lower shroud and remove column shrouds.



G5813-B

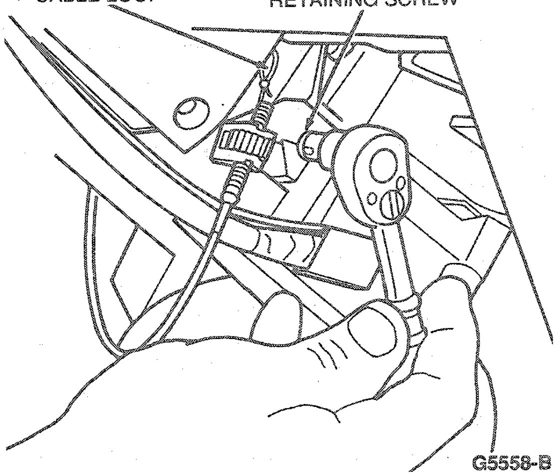
REMOVAL AND INSTALLATION (Continued)

8. Remove two instrument panel reinforcement brace retaining bolts. Remove reinforcement.



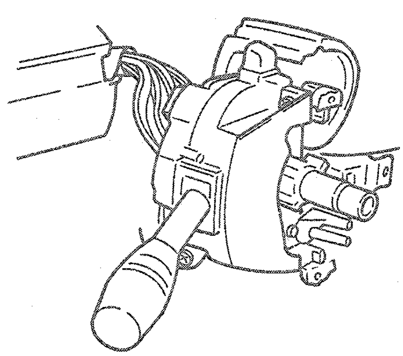
G5557-A

9. Disconnect transmission range selector cable from actuator housing by removing one screw (column shift).



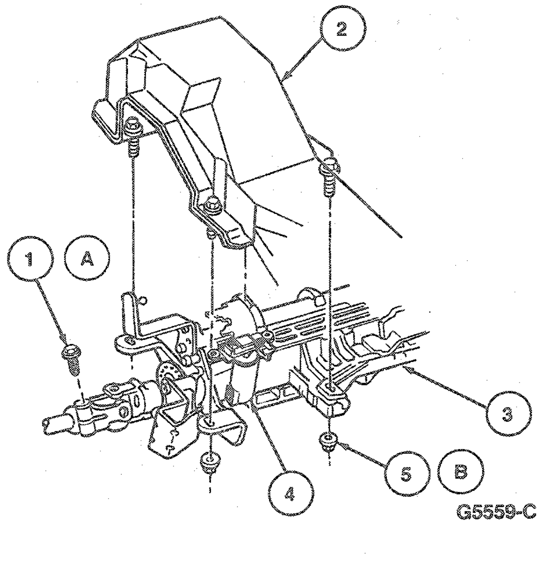
G5558-B

10. Disconnect transmission range selector cable loop from shift tube hook (column shift).
11. Remove two multi-function switch retaining screws and set multi-function switch aside. Remove wiring connector from ignition switch.



G5809-B

12. Remove column skid plate.
13. Remove pinch bolt from steering shaft flex coupling.
14. While supporting column assembly, remove four column assembly retaining nuts. Lower column and disconnect vacuum hoses at parking brake release switch or remove vacuum release assembly.
15. Disconnect shift cable from selector lever pivot.
16. Remove shift cable and bracket from lower column mounting.
17. Remove four brake shift interlock cable retaining screws and remove cable (console shift).
18. Remove column from vehicle.



G5559-C

REMOVAL AND INSTALLATION (Continued)

Item	Part Number	Description
1A	N803942-S100	Screw
2	—	Body
3	3C529	Steering Column Assy
4	3Z719	Brake Shift Interlock Solenoid
5B	N806423-S56	Nut (4 Req'd)
A		Tighten to 41-56 N·m (31-41 Lb-Ft)
B		Tighten to 13-19 N·m (9-14 Lb-Ft)

Installation

1. Align the column lower universal joint to lower shaft. Install one bolt and tighten to 41-56 N·m (31-41 lb-ft).
2. Connect parking brake release vacuum hoses.
3. Position Brake Solenoid Interlock cable and install four retaining screws (automatic console shift).
4. Support the column assembly to column support bracket. Install four retaining nuts and tighten to 13-19 N·m (9-14 lb-ft).
5. Position shift cable bracket (with shift cable attached) to lower two screws of column. Tighten to 7-11 N·m (5-8 lb-ft).
6. Snap shift cable onto shift selector pivot ball.
7. Position multi-function switch and install two retaining screws. Tighten to 2-3 N·m (18-26 lb-in).
8. Connect all electrical connectors.
9. Attach transmission range selector cable loop on shift selector hook, and install transmission range selector cable bracket to actuator housing. Install retaining screw.
10. Install steering column to parking brake control shake brace.
11. Install instrument panel reinforcement brace and secure with two retaining bolts.
12. Install lower instrument panel cover.
13. Install upper and lower column shrouds.
14. Install lock cylinder assembly.
15. Install tilt lever onto column.
16. Install air bag contact assembly screw. Tighten to 2-3 N·m (18-26 lb-in).
17. Install steering wheel onto column shaft. Install a new bolt and tighten to 31-48 N·m (22-33 lb-ft).
18. Position air bag module to wheel. Install four retaining nuts. Tighten to 4-5.4 N·m (36-47 lb-in).
19. Connect battery ground cable and air bag backup power supply.
20. Verify air bag warning indicator.

Steering Shaft, Intermediate

Removal

1. Remove bolt from upper U-joint-to-shaft connection. Collapse intermediate shaft.
2. Remove three nuts retaining primary boot-to-dash panel and remove boot.

   CAUTION: Be sure the steering column is in the locked position. The lower end of the steering column may be wired in such a way to prevent the steering wheel from being turned as air bag clockspring assembly will be damaged.
3. Remove bolt retaining intermediate shaft assembly to steering gear input shaft.
4. From inside of vehicle, remove intermediate shaft.
5. Remove secondary boot.

Installation

1. Turn secondary boot inside out and position over three mounting studs then mount to gear.
2. Install intermediate shaft through boot and to steering gear input shaft. Install new bolt and tighten to 41-56 N·m (31-41 lb-ft).
3. Install primary boot over intermediate shaft and down onto three studs in dash panel.
4. Install three boot retaining nuts. Tighten to 5-7 N·m (44-61 lb-in).
5. Extend shaft and insert into U-joint at end of steering column. Tighten bolt to 41-56 N·m (31-41 lb-ft).
6. Check steering column for proper operation.

Gear Shift Lever, Cover and/or Shift Lever Clip

Column Shift

Removal

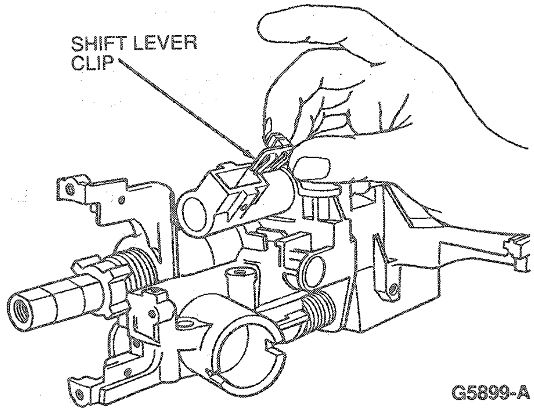
1. Remove tilt lever by unscrewing it from the column.
2. Turn ignition switch to RUN position. Using a 1/8-inch drift, depress lock cylinder retaining pin through access hole and remove lock cylinder.
3. Remove lower instrument panel cover retaining screws and remove cover.
4. Remove four retaining screws from lower shroud. Remove upper and lower shroud assemblies.
5. Remove shift lever cover, pin assembly and shift lever.
6. If necessary, remove shift lever clip.

Installation

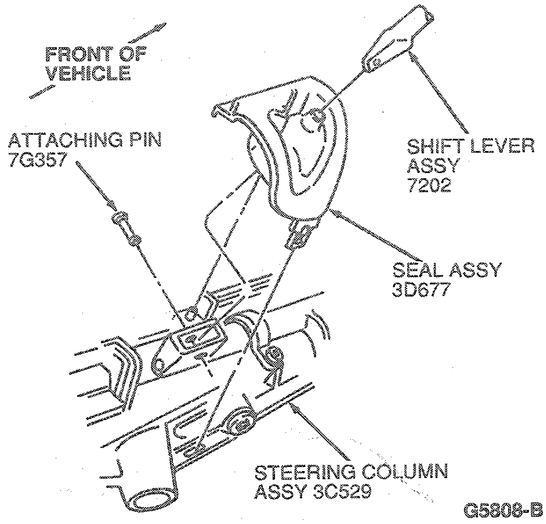
1. If removed, install shift lever clip into opening in shifter housing assembly as shown.
2. Insert shift lever through hole in PVC cover. Position cover on shift lever.

REMOVAL AND INSTALLATION (Continued)

3. Insert shift lever into opening in shifter housing assembly.
4. Install a new pin assembly into position and tap in place until the head seats against shifter housing assembly and the Tinnerman nut is visible on bottom of shifter housing.
5. Position shift lever cover on the lock cylinder housing. Insert lower attachment into the slot on side of housing.
6. Position upper attachment on mounting pin and press into place. Install a Tinnerman nut to secure cover to pedestal on lock cylinder housing.
7. Install upper and lower shrouds with four screws.
8. Install lower instrument panel cover and retaining screws.
9. Install lock cylinder into lock cylinder housing.
10. Install tilt lever onto column.
11. Check for proper start in PARK and NEUTRAL. Ensure start circuit cannot be actuated in DRIVE or REVERSE positions and the column is locked in the LOCK position.



G5899-A



G5808-B

Ignition Lock Cylinder

Removal

1. Rotate ignition lock cylinder to RUN position. Using a 1/8-inch drift, depress lock cylinder retaining pin through access hole and remove lock cylinder.

   CAUTION: Carefully note the position of the bearing retainer prior to removal.

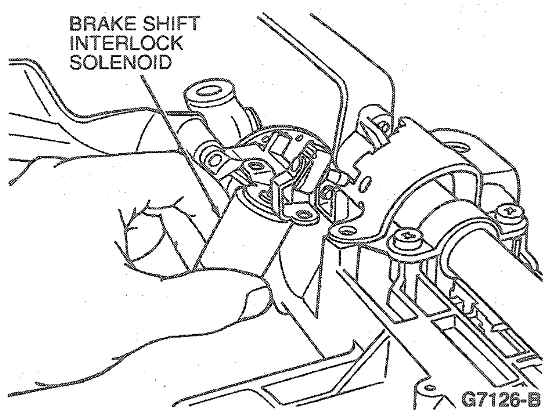
2. Remove blue plastic bearing retainer by inserting a screwdriver or similar tool, with a 90 degree bend on the tip, between bearing retainer and bearing and by prying upward.
3. Insert tip of a screwdriver into Double-D slot of bearing, then rotate 90 degrees. Remove bearing.
4. Remove lock drive gear. Carefully note relationship of lock drive gear to position of rack teeth.

Installation

1. Position lock drive gear in base of lock cylinder housing in the same position as that noted during removal procedure. The position of lock drive gear is correct if last tooth on drive gear is meshed with last tooth on rack.
2. Position bearing retainer in lock cylinder housing. Insert tip of a screwdriver into Double-D slot of bearing, then rotate 90 degrees.
3. Press blue plastic bearing retainer into lock cylinder housing. Ensure retainer is in its original position.
4. Line up flats of drive gear with flats of washer by pulling down on the column lock actuator.
5. Install lock cylinder assembly.

REMOVAL AND INSTALLATION (Continued)

6. Check for proper start in PARK and NEUTRAL. Also, check to ensure start circuit cannot be actuated in DRIVE or REVERSE positions and the column is locked in LOCK position.



Brake Shift Interlock Solenoid

Removal

1. Disconnect battery ground cable and air bag backup power supply.
2. Remove lower RH and LH mouldings from instrument panel by pulling up and snapping out of retainer.
3. Remove five retaining screws from instrument panel lower cover and remove cover.
4. Remove instrument panel reinforcement.
5. Disconnect transmission range selector cable from actuator housing by removing one screw.
6. Remove four column attaching nuts and lower column assembly.
7. Remove electrical harness from brake shift interlock (BSI) solenoid assembly.
8. Remove three screws attaching BSI solenoid and insert plate to column assembly and remove solenoid and insert plate. Separate solenoid from insert plate by removing tinnerman clip.

Installation

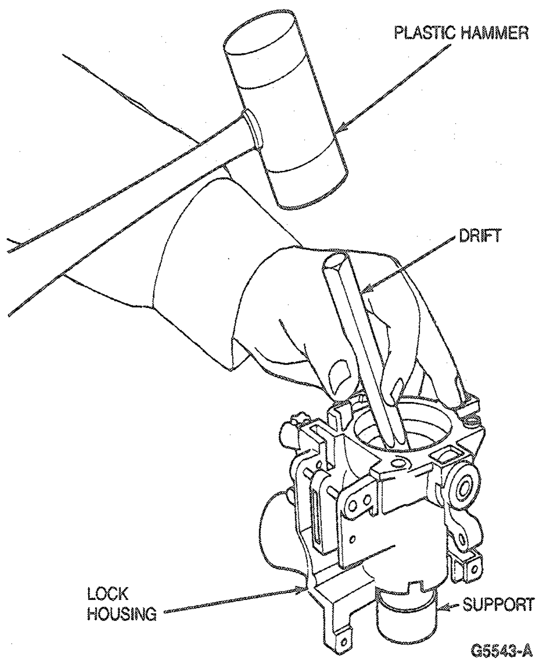
1. Position brake shift interlock solenoid and insert plate in place and attach to column assembly with three screws as shown.
2. Connect electrical harness to BSI solenoid.
3. Attach column assembly to half car beam with four nuts.
4. Connect transmission range selector cable to column assembly with one screw.
5. Attach instrument panel reinforcement brace with three bolts.
6. Attach instrument panel lower trim cover with five bolts.
7. Install RH and LH mouldings on instrument panel.
8. Connect air bag backup power supply and battery ground cable.

Shaft Bearing, Upper

Column Removed

Removal

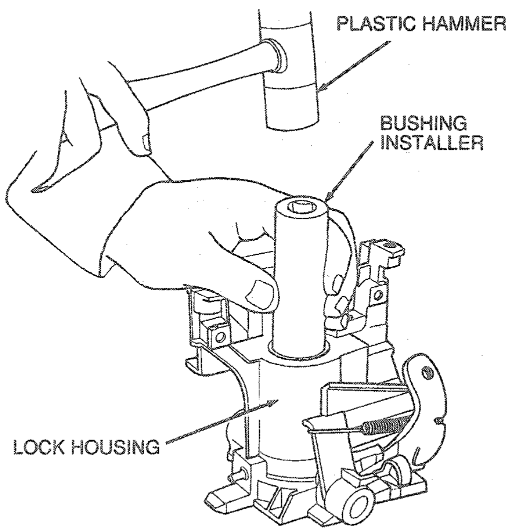
1. Remove lock housing from steering column assembly as outlined.
2. Suitably support housing and tap out small bearing with an appropriate drift and a plastic hammer.



REMOVAL AND INSTALLATION (Continued)

Installation

1. Suitably support housing. Position small bearing so that the opening between races is "up." Tap into place with a plastic hammer and a bushing driver installer or socket the same size as outer race of bearing.
2. Install housing on steering column as outlined.



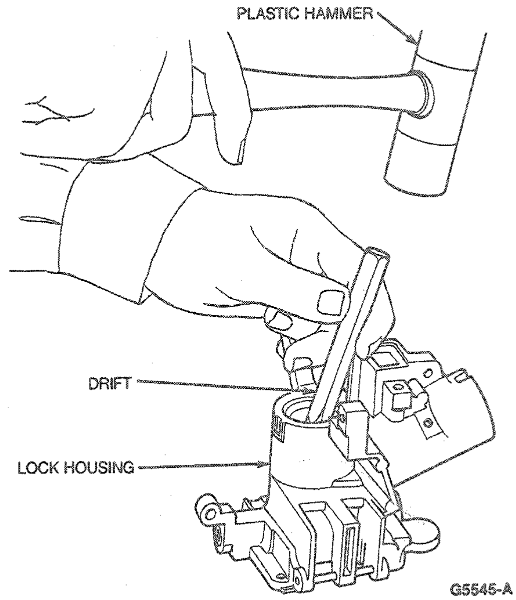
G5544-B

Shaft Bearing, Intermediate

Column Removed

Removal

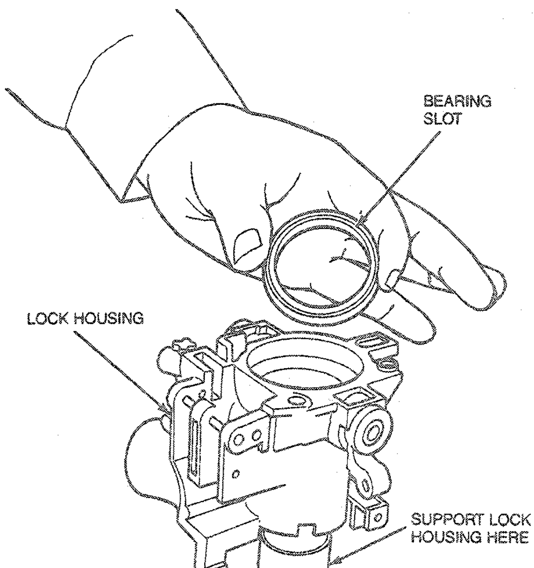
1. Remove lock housing as outlined.
2. Set housing flat on workbench and tap large bearing loose with suitable drift and a plastic hammer.



G5545-A

Installation

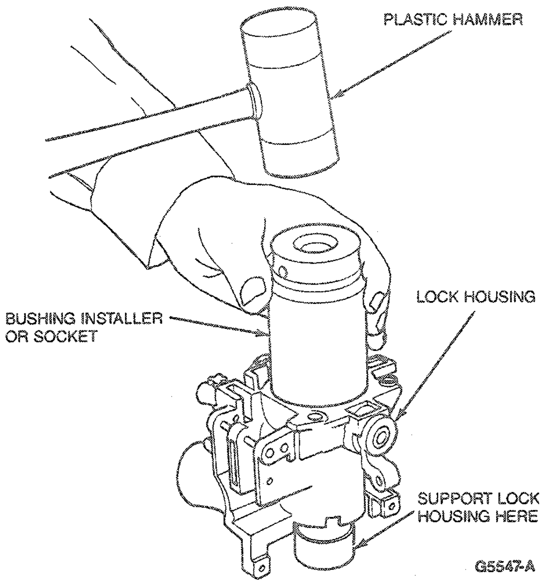
1. Support lock housing on workbench.
2. Position bearing so that the opening between races will face up, or out from housing, when installed.



G5546-A

REMOVAL AND INSTALLATION (Continued)

3. Using a socket or bushing driver the same size as outer race of bearing, tap bearing into housing with a plastic hammer until fully seated.

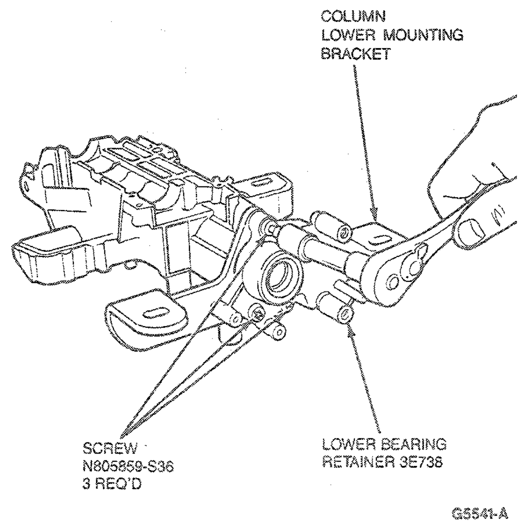


Shaft Bearing, Lower

Column Removed

Removal

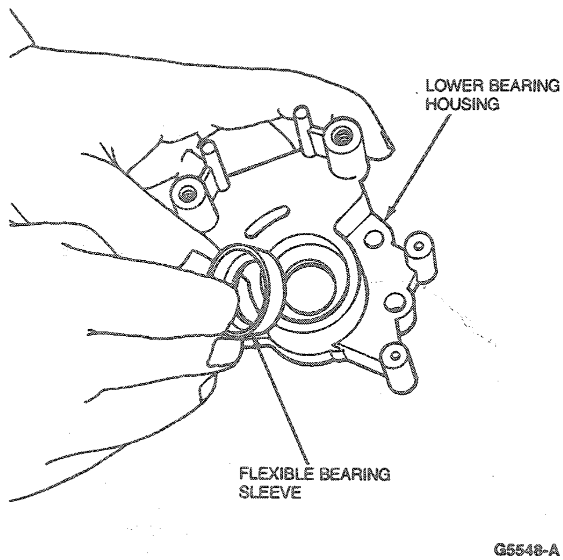
1. Remove lower steering shaft bearing and housing assembly as outlined.



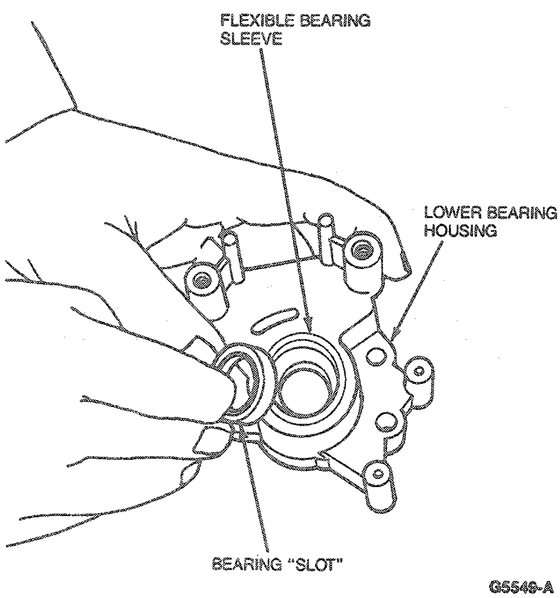
2. Suitably support housing and tap out bearing with a hammer and a drift.

Installation

1. Inspect flexible bearing sleeve. Replace if damaged.



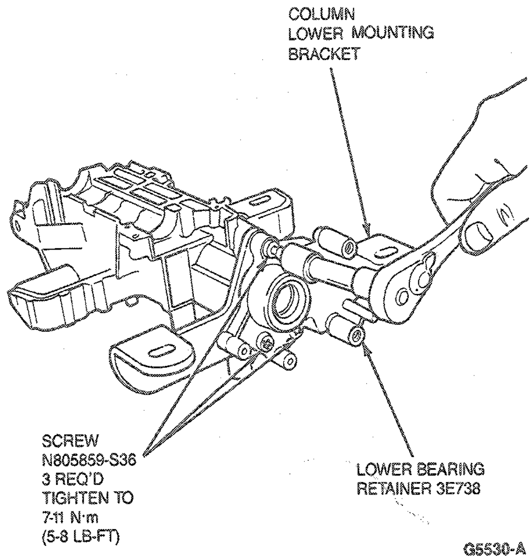
2. Position bearing sleeve in housing.



3. Press in the new bearing with thumb pressure until seated. Slot between inner and outer races should face down when installed in the vehicle.

REMOVAL AND INSTALLATION (Continued)

4. Install bearing housing on steering column as outlined.



DISASSEMBLY AND ASSEMBLY

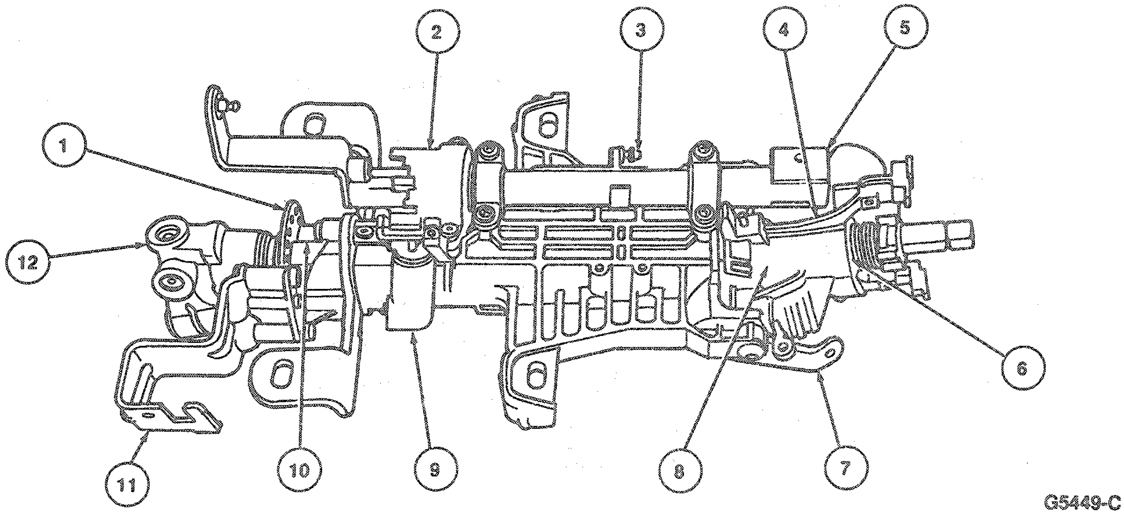
Steering Column

Disassembly

1. Disconnect battery ground cable and air bag backup power supply.

Column Shift Only

2. Remove steering wheel assembly as outlined.
3. Remove steering column from vehicle as outlined.
4. Remove lower U-joint, spring, sensor ring and bushing.



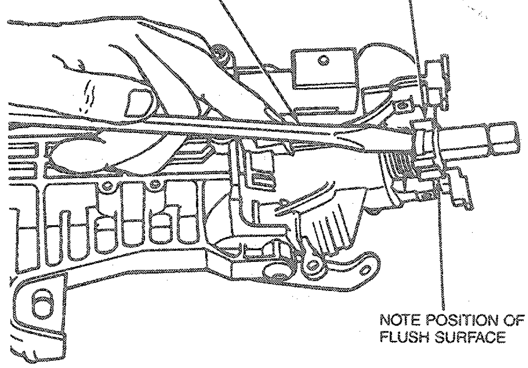
DISASSEMBLY AND ASSEMBLY (Continued)

Item	Part Number	Description
1	3C131	Sensor Ring
2	7A216	Shift Control Selector Bracket
3	7212	Shift Position Indicator Attaching Point
4	3511	Tilt Lock Housing
5	7212	Shift Selector Assy

(Continued)

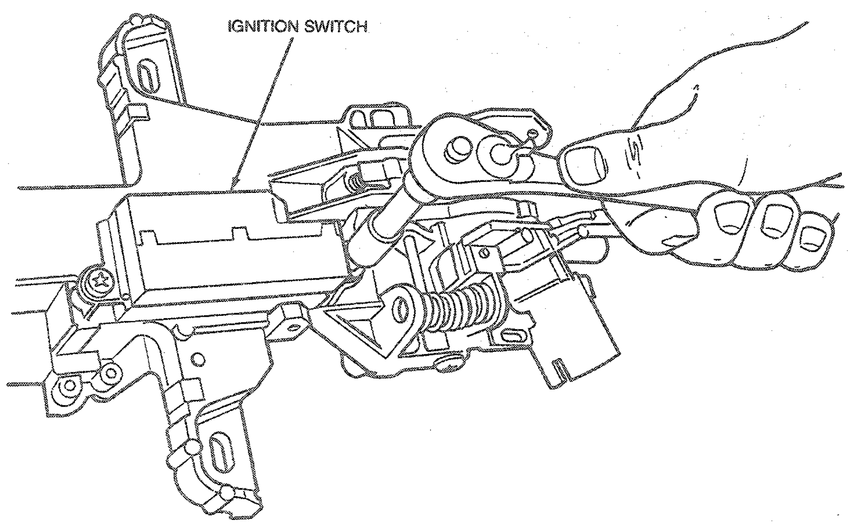
Item	Part Number	Description
6	3517	Upper Bearing (In Lock Housing)
7	3D544	Tilt Release
8	3517	Intermediate Bearing (In Lock Housing)
9	3Z719	Brake Shift Interlock Solenoid
10	3517	Lower Bearing Assy
11	7E364	Shift Cable Bracket
12	3N725	Flex Coupling

5. Remove turn signal cancelling cam by pushing up with flat-bladed screwdriver. Note direction of flush surface.



G5450-A

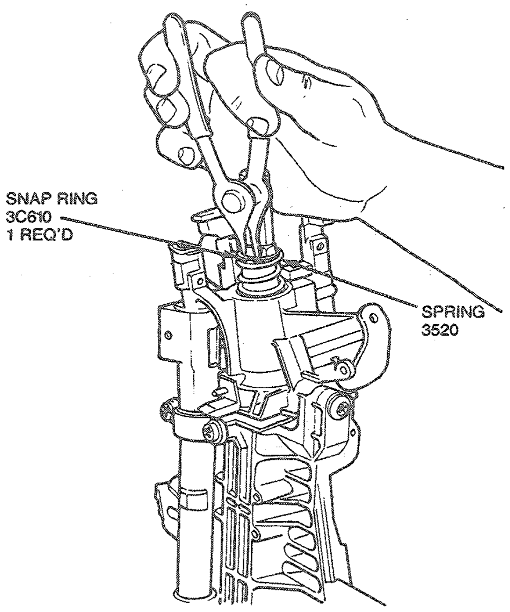
6. Remove ignition switch assembly.



G5538-A

DISASSEMBLY AND ASSEMBLY (Continued)

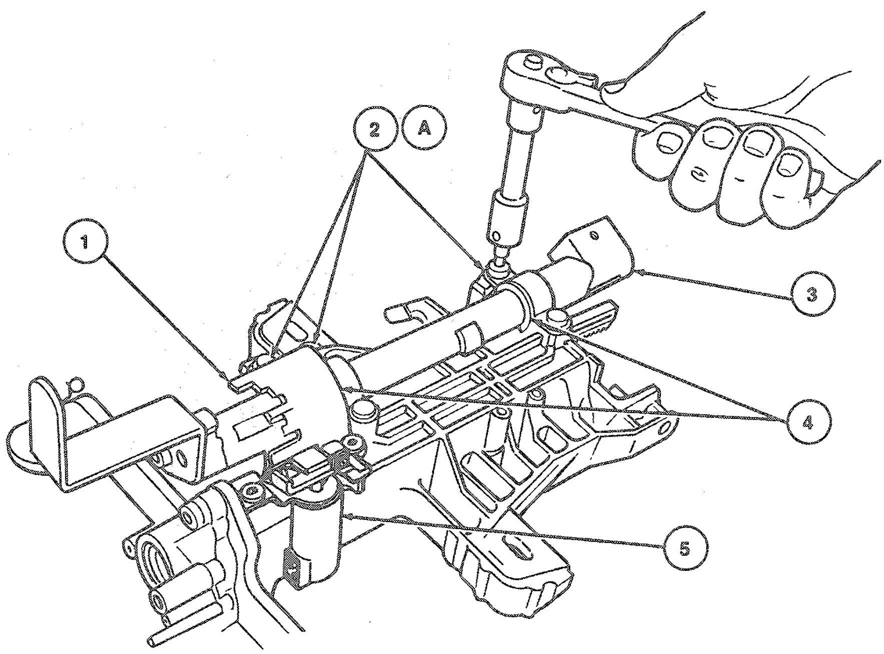
7. Remove upper snap ring and coil spring.



G5531-A

Column Shift

8. Remove steel sleeve and ring.
9. Remove shift control assembly and shift control bracket (column shift).
10. Remove brake shift interlock solenoid (column shift).
11. Remove shift cable bracket (column shift).

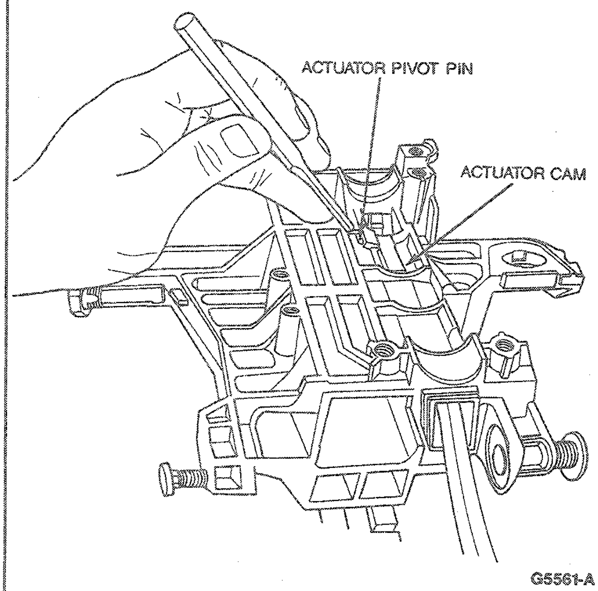


G5540-D

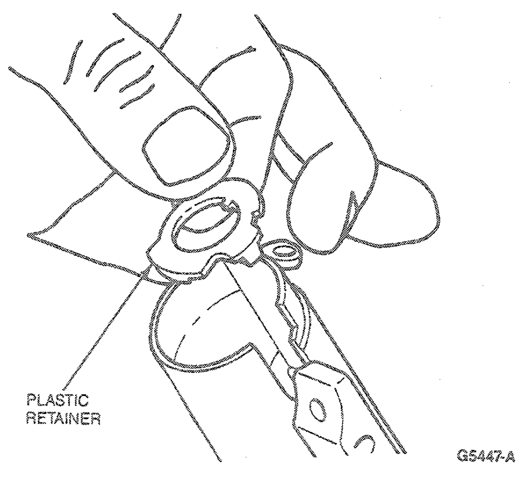
DISASSEMBLY AND ASSEMBLY (Continued)

Item	Part Number	Description
1	7A216	Shift Control Selector Bracket
2	N805858	Screws (6 Req'd)
3	7212	Shift Control Assy
4	7L278	Bushings
5	3Z719	Brake Shift Interlock Solenoid
A		Tighten to 7-11 N·m (5-8 Lb-Ft)

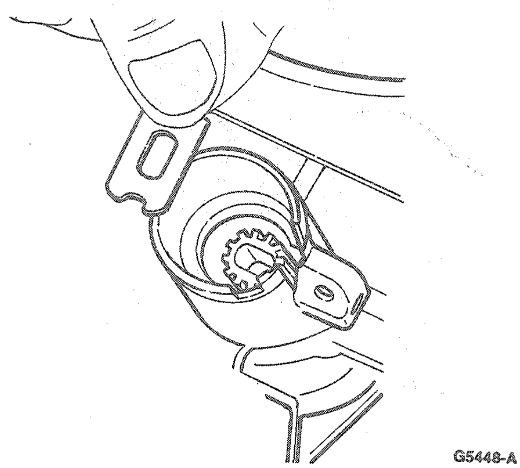
12. Using a drift tap lock actuator cam pivot pin loose. Remove with diagonal pliers.



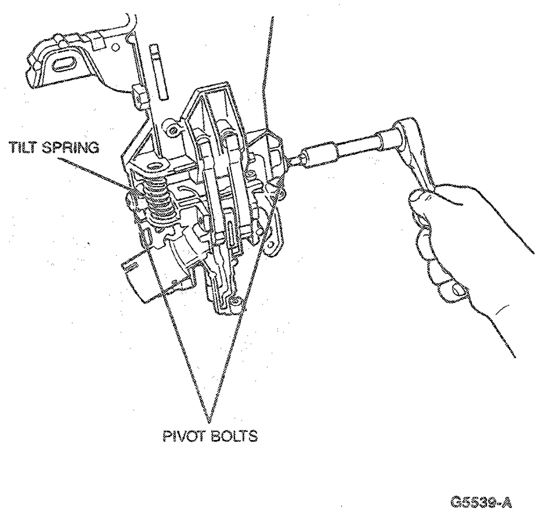
13. Remove plastic bearing retainer from lock cylinder bore.



14. Remove metal bearing from lock cylinder bore.



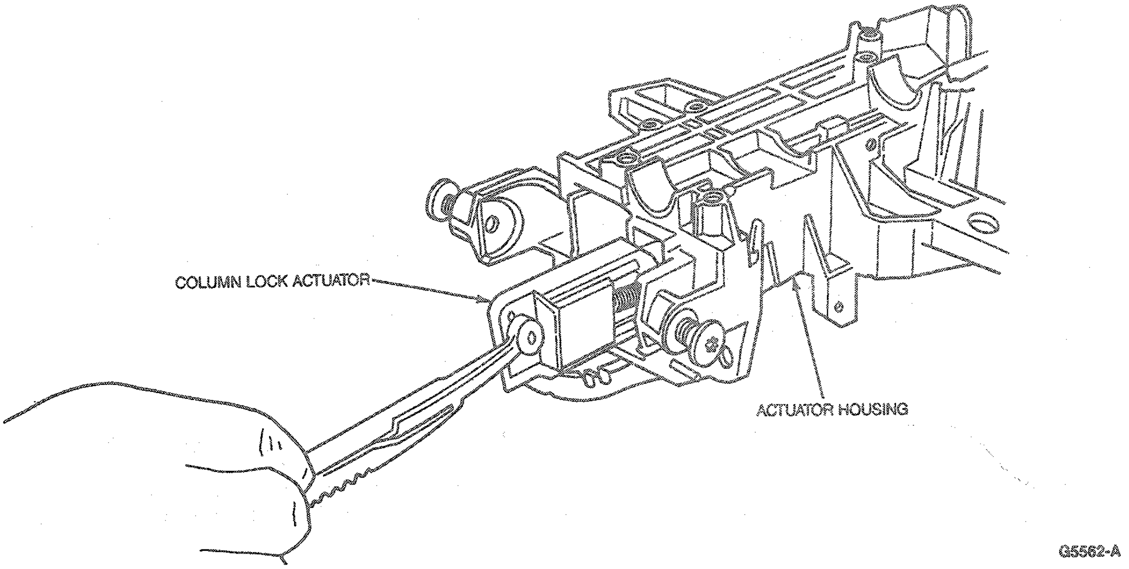
15. Remove ignition lock gear.
16. Remove two tilt pivot bolts. Use caution as tilt spring will release when bolts are removed. Remove lock cylinder housing.



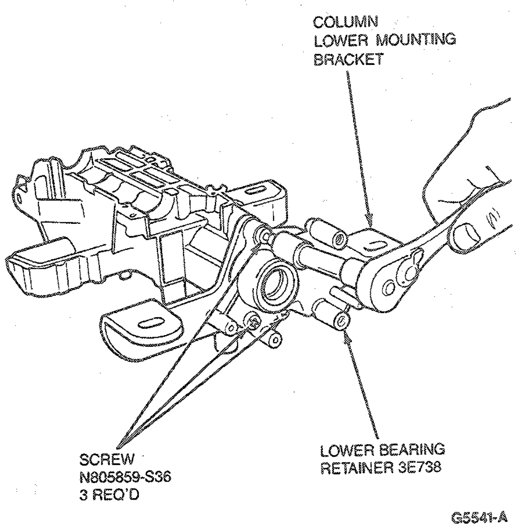
17. Remove steering shaft from column assembly.

DISASSEMBLY AND ASSEMBLY (Continued)

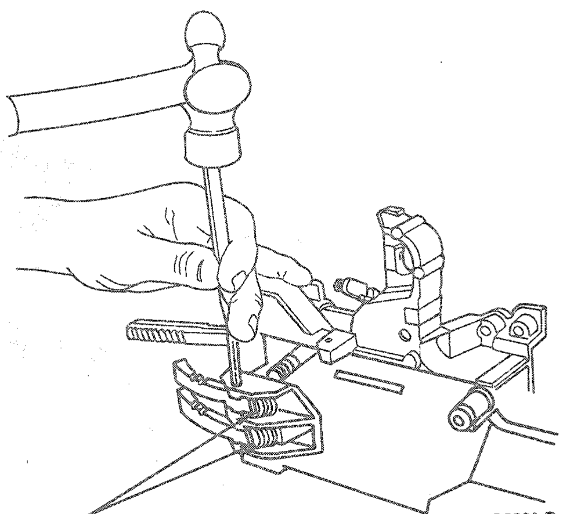
18. Remove column lock actuator.



19. Remove lower bearing and mounting bracket.



20. Remove tilt position lever arm pivot pin using a drift. Remove lever lock arms and springs.

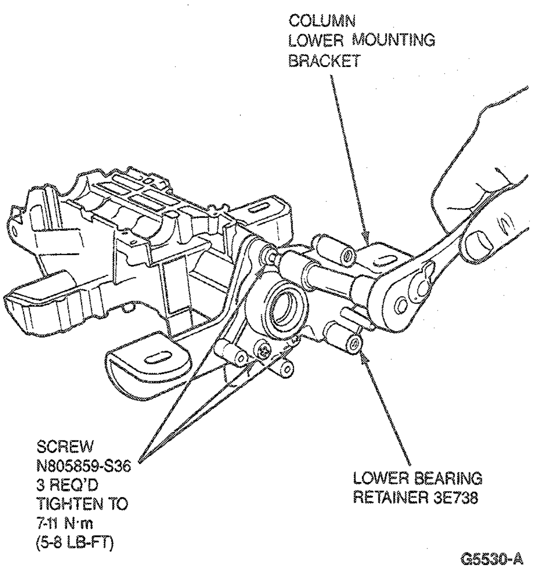


Assembly

1. Install steering shaft into housing.

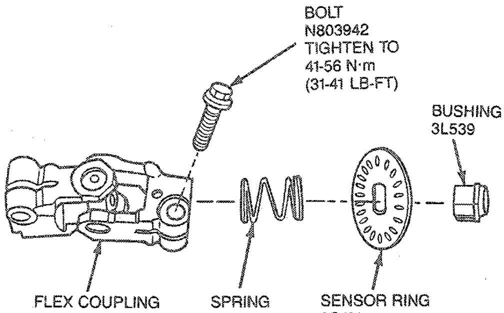
DISASSEMBLY AND ASSEMBLY (Continued)

2. Install lower bearing and column mounting bracket. Tighten screws to 7-11 N·m (5-8 lb-ft).



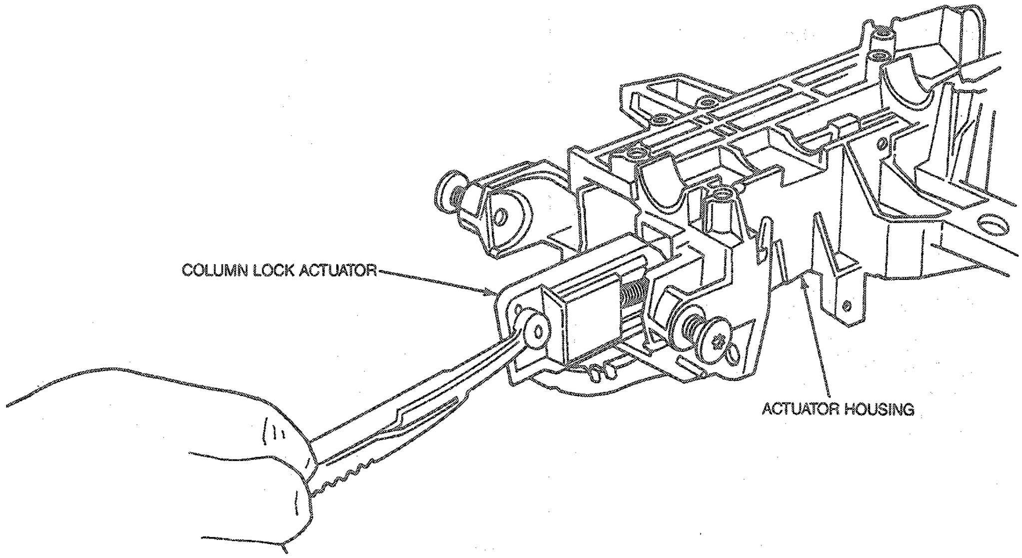
G5530-A

3. Install sensor ring, bushing, spring and flex coupling to steering shaft. Tighten pinch bolt to 41-56 N·m (31-41 lb-ft).



G5542-C

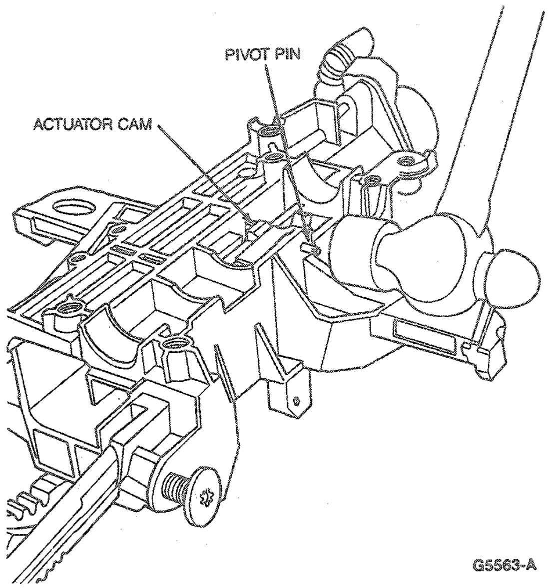
4. Position lock actuator assembly in housing. Spray upper and lower actuators with Multi-Purpose Grease D7AZ-19584-AA (ESR-M1C159-A, ESB-M1C106-B) or equivalent.



G5562-A

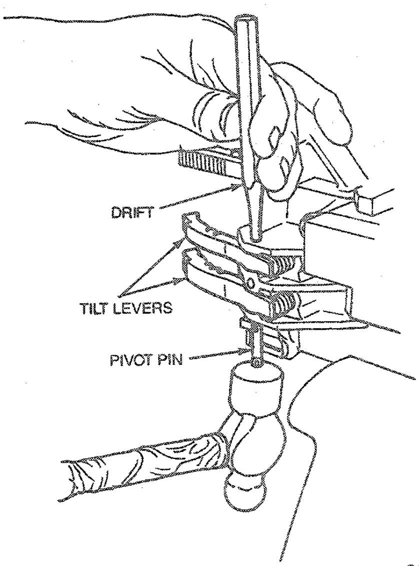
DISASSEMBLY AND ASSEMBLY (Continued)

5. Position actuator cam in lock housing and install cam pivot pin with small hammer. Tap pin in until flush with housing.



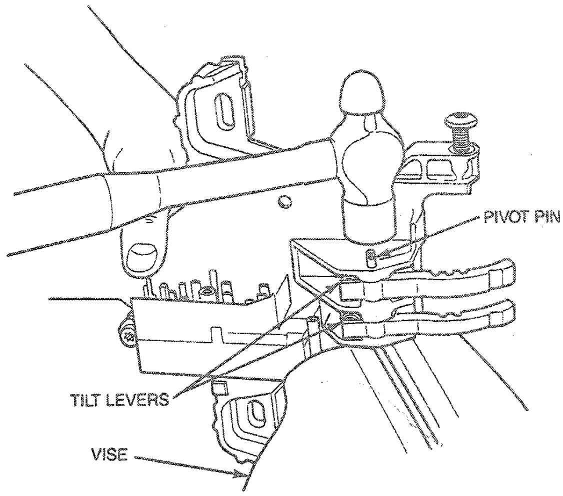
G5563-A

6. Install one tilt lever spring and arm into housing using a drift to hold in place.
7. Install the other lever spring and arm with pivot pin. Tap pin into place while driving out drift.



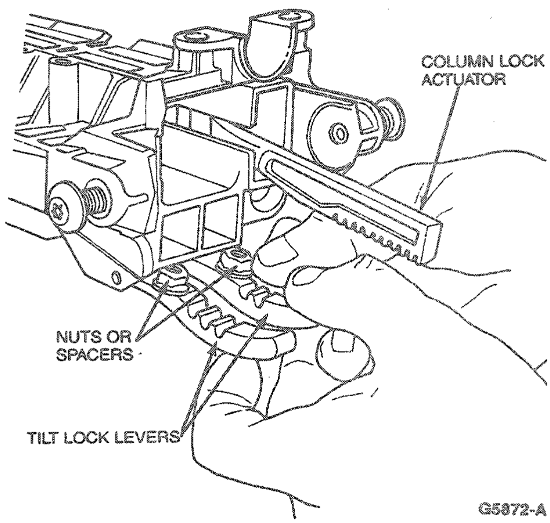
G5564-A

8. Support housing in a vise and drive pin flush with housing.



G5565-A

9. Place two nuts or spacers to hold tilt lock arms away from housing.

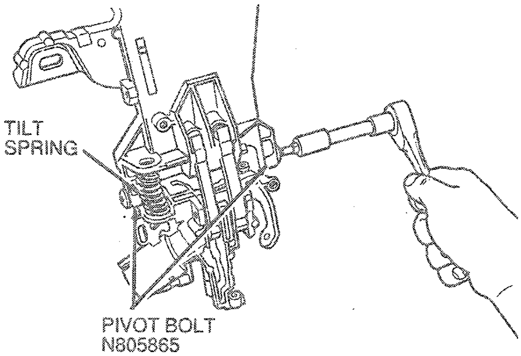


G5872-A

DISASSEMBLY AND ASSEMBLY (Continued)

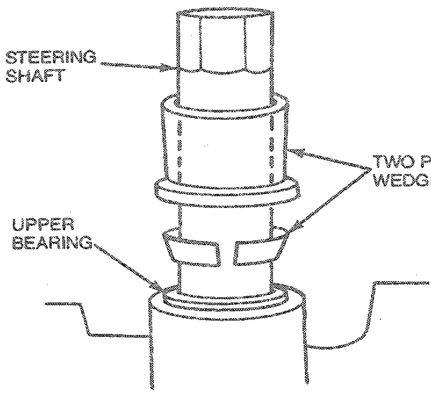
10. Position tilt spring on lock housing. With assistant, install lock housing and pivot bolts. Tighten to 20-28 N·m (14-20 lb-ft).

    NOTE: Lube pivot bolts with Multi-Purpose Grease D0AZ-19584-AA (ESR-M1C159-A, ESB-M1C93-A) or equivalent before installing.



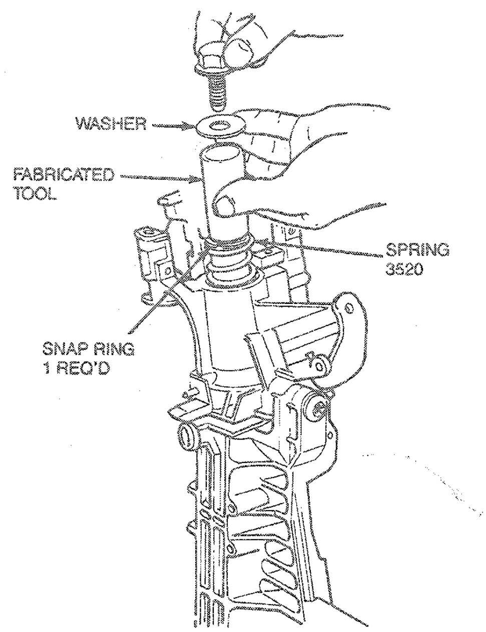
G5528-C

11. Install steel sleeve and ring over steering shaft to upper bearing.



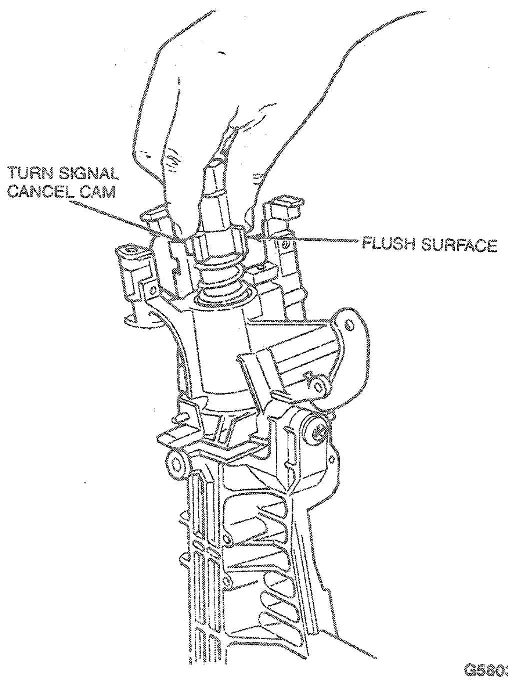
G5865-A

12. Install spring and new snap ring on top side of spring using a 3/4-inch by 2-1/4 inch PVC pipe.



G5802-A

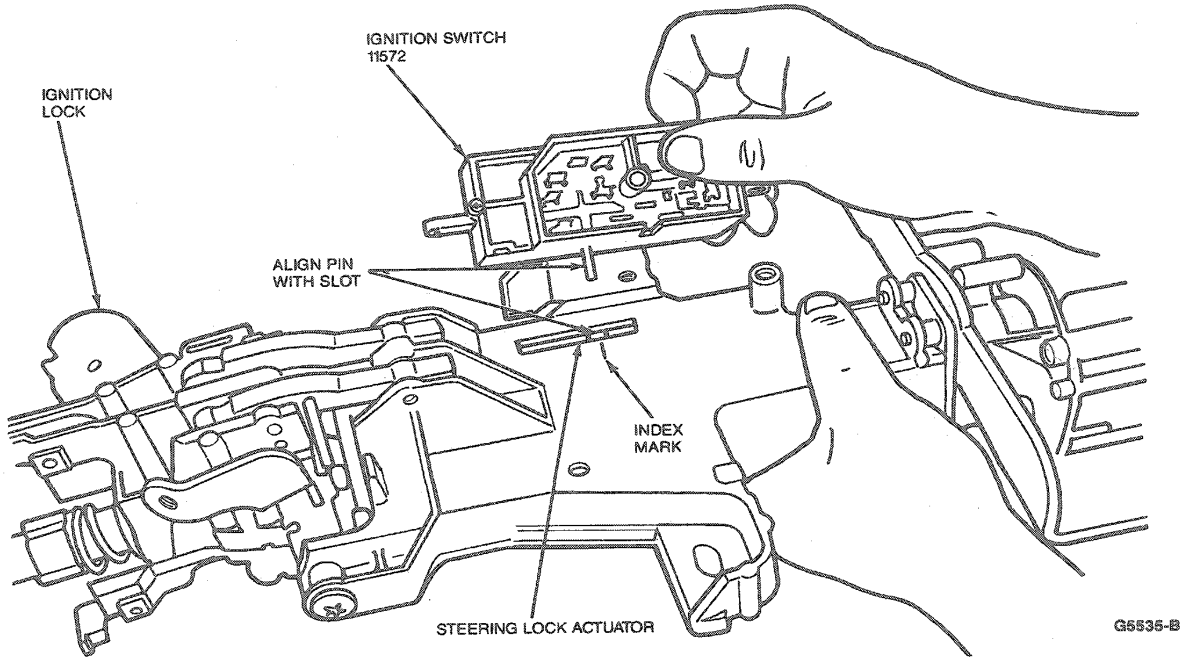
13. Install turn signal cancel cam, flush surface "up".

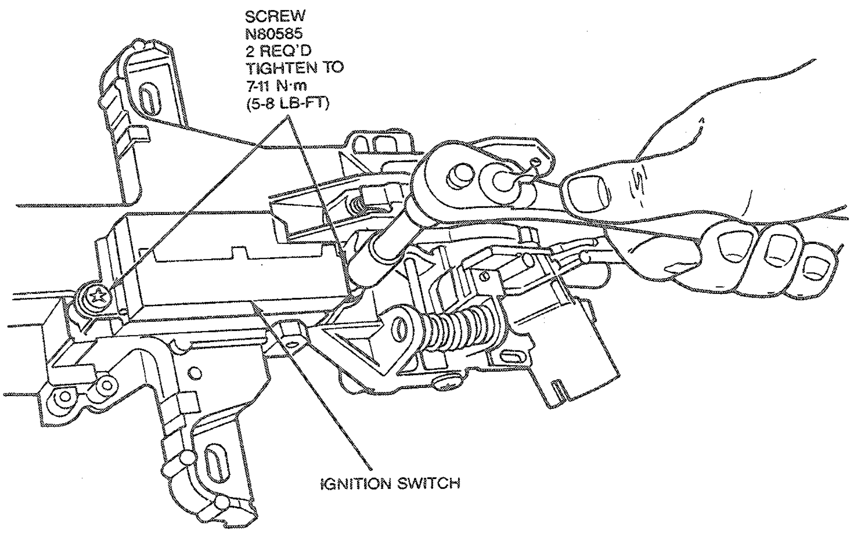


G5803-A

DISASSEMBLY AND ASSEMBLY (Continued)

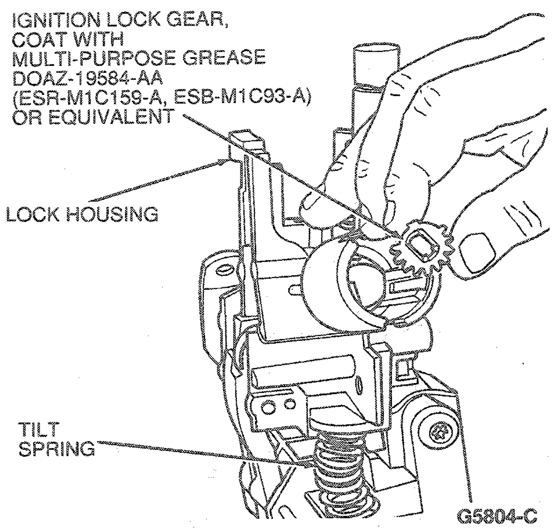
14. Install ignition switch. Align pin from switch with slot in lock / column assembly. Position slot in lock / column assembly with index mark on casting. Tighten two retaining screws to 7-11 N·m (5-8 lb-ft).



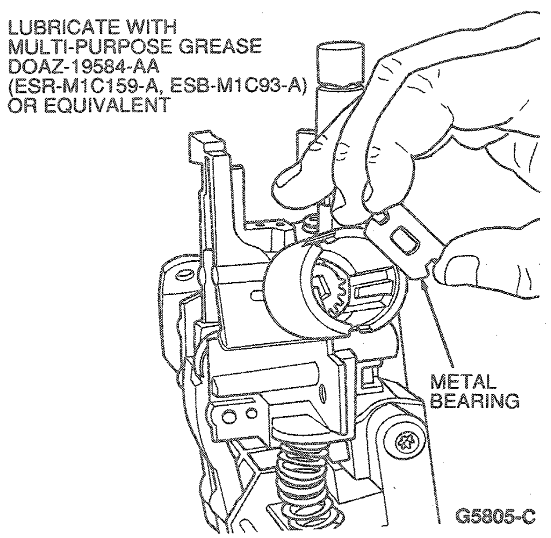


DISASSEMBLY AND ASSEMBLY (Continued)

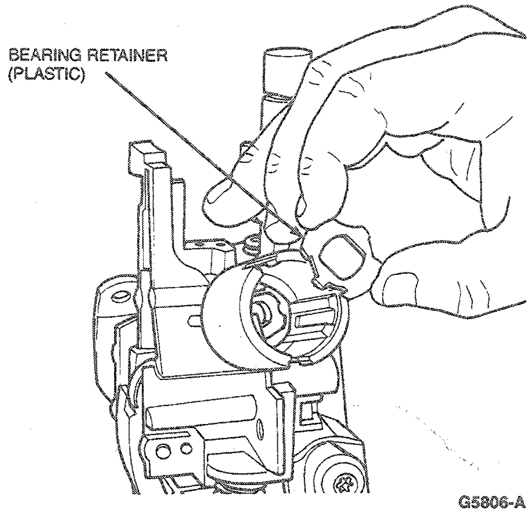
15. Install ignition lock gear. Coat gear with Multi-Purpose Grease D0AZ-19584-AA (ESR-M1C159-A, ESB-M1C93-A) or equivalent.



16. Install metal bearing. Lubricate with Multi-Purpose Grease D0AZ-19584-AA (ESR-M1C159-A, ESB-M1C93-A) or equivalent.



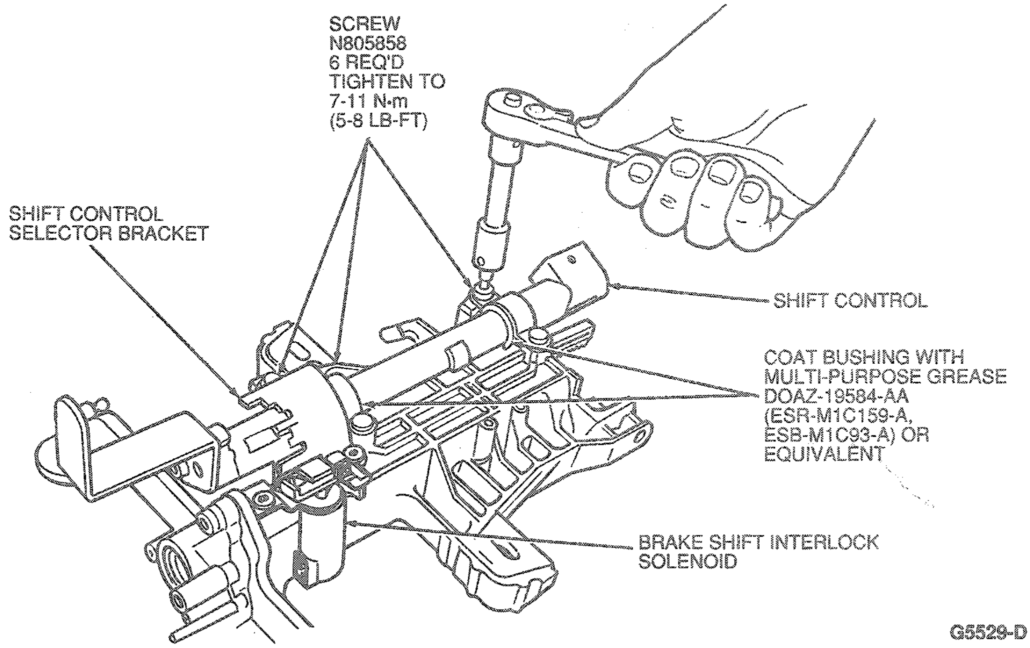
17. Install plastic bearing retainer.



18. Install shift control tube assembly (column shift only). Coat bushings with Multi-Purpose Grease D0AZ-19584-AA (ESR-M1C159-A, ESB-M1C93-A) or equivalent. Tighten screws to 7-11 N·m (5-8 lb-ft).
19. Install shift control selector bracket.
20. Install brake shift interlock solenoid.

DISASSEMBLY AND ASSEMBLY (Continued)

Column Shift

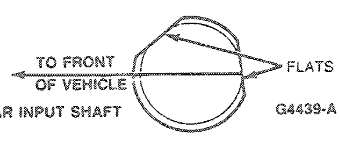


21. Install shift cable bracket on lower column bearing assembly with two bolts (column shift).
22. Install column in vehicle as outlined.
23. Install air bag clockspring contact as outlined.
24. Install steering wheel as outlined.
25. Install air bag module. Refer to Section 01-20B.
26. Connect battery ground strap and air bag backup power supply.
27. Verify air bag warning indicator.

ADJUSTMENTS

Steering Wheel Spoke Position

When the flats on the steering gear input shaft are positioned as shown, the front wheels should be in the straight-ahead position and the steering wheel spokes should be in their normal position. They can be repositioned by adjusting the tie rods or adjusting toe. Refer to Section 04-00. The steering wheel 12 o'clock mark must be aligned with steering shaft 12 o'clock mark when toe is adjusted.

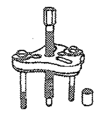


SPECIFICATIONS

TORQUE SPECIFICATIONS

Description	N·m	Lb-Ft
Steering Wheel Retaining Bolt	31-48	22-33
Contact Assembly Screw	2-3	18-26 (Lb-In)
Steering Column Mounting Nut	13-19	9-14
Steering Shaft Yoke Coupling Bolt	41-56	31-41
Column Lower Mounting Bracket Bolt	7-11	5-8
Lock Housing Pivot Bolt	20-28	14-20
Ignition Switch Screw	7-11	5-8
Shift Control Tube Screw	7-11	5-8
Air Bag Module Nuts	4-5.4	36-47 (Lb-In)
Lower Column Bearing Bolt	7-11	5-8
Intermediate Shaft Screw	41-56	31-41
Air Bag Screw	4-5.4	36-47 (Lb-In)
Tilt Lever	3.5-5	28-44 (Lb-In)
Steering Boot Nut	5-7	44-61 (Lb-In)

SPECIAL SERVICE TOOLS

Tool Number / Description	Illustration
T67L-3600-A Steering Wheel Puller	 T67L-3600-A

SECTION 11-05 Steering Column Switches

VEHICLE APPLICATION

Taurus / Sable.

DESCRIPTION AND OPERATION

Switch, Ignition

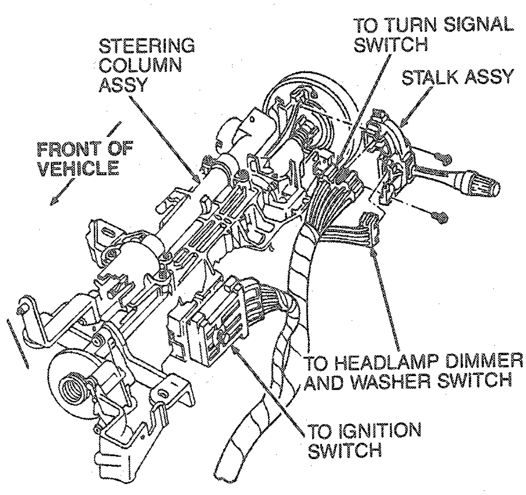
The ignition switch is mounted on the lock cylinder housing and is controlled by the lock cylinder through a pin which is part of the ignition switch.

The lock cylinder also controls the mechanism which provides a positive lock for the transaxle linkage and the steering system. The locking mechanism is located in the lock cylinder housing at the upper end of the steering column.

The lock cylinder positions are ACC, LOCK, OFF, RUN and START. With column shift automatic transaxle, the lock cylinder key can be removed from the lock cylinder only when the shift lever is in PARK position and the key is in LOCK position. The ACC position operates while the steering and transaxle systems remain locked. Turning the key to OFF position shuts off the engine without locking the steering or transaxle systems.

Switch, Blade-Type

The switch has blade-type terminals that engage with one multiple connector. The multiple connector is secured to the switch by an integral connector fastener.



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DESCRIPTION AND OPERATION (Continued)

Switch, Multi-Function

The multi-function switch unifies the turn signal, headlamp dimmer, headlamp flash-to-pass, hazard warning, cornering lamps (optional) and windshield washer / wiper. The multi-function switch assembly is mounted to the steering column.

Turn Signal Switching

The turn signal lever is located on the LH side of the upper steering column. To operate the turn signal(s), the key lock cylinder must be in the RUN position. To indicate a normal full turn, move the turn signal lever to the end-of-travel position for the turn desired. The lever will remain in position without effort until the turn is completed, at which time the steering wheel cancel cam will automatically cancel the turn signal.

The turn signal system also has a lane change feature. To operate the lane change feature, move and hold the turn signal lever to the first stop position when changing lanes. When the lane maneuver is completed, release the lever and it will return to its normal position.

Hazard Flasher Switching

The hazard flasher system operates independently from the key lock cylinder. All turn signal lamps can be made to flash in unison by depressing and releasing the hazard actuator located on the top part of the steering column. The switch is identified by a "double triangle" symbol.

The actuator will move out or away from the steering column to the ON position. The hazard flasher system is turned off by first pushing in the actuator and then releasing the actuator. The actuator should remain in or toward the steering column in the OFF position.

NOTE: The turn signal system is deactivated when the hazard flasher system is on and turn signal lever motion does not affect the hazard flasher system.

One flasher unit is used for both the turn signal and the hazard flasher system. Refer to the Wiring and Vacuum Diagram manual.

Headlamp Dimmer / Flash-to-Pass Switching

The turn signal lever also operates the headlamp dimmer switch and the flash-to-pass feature. High beam is selected by pushing the turn signal lever away from the driver to the stop. Releasing the lever will maintain high beams. Low beam is selected by moving the turn signal lever toward the driver from the high beam position. Release of the lever will maintain low beams.

To operate the flash-to-pass feature, pull the lever gently toward the driver. When the lever is released, it will return to the LO beam position. If driving without headlamps on, use of the flash-to-pass feature will turn on the high beams until the turn signal lever is released. If the headlamps are turned on, the low and high beams will be on until the turn signal lever is released.

NOTE: Excessive force used to hold the turn signal lever in the flash-to-pass function followed by quick release may result in incorrect headlamp dimmer selection of high beam. The driver must be cautioned to avoid this condition.

Cornering Lamp Switching

The cornering lamp switch is coordinated with the turn signal function. In order to operate the cornering lamp function, the headlamps must be turned on.

Windshield Washer Switching

The washer switch is located at the end of the turn signal lever. To operate the washer, the key lock cylinder must be in the RUN position. To actuate the washer, push the end of the turn signal lever in toward the steering column. Releasing the turn signal lever will then turn off the washer. The wiper blades will continue to operate for a few wipes and then automatically return to the wiper speed setting (OFF, LO, HI, or INT) previously selected. Washer operation is available in all positions of wiper operation.

Windshield Wiper Switching

Interval

The wiper switch is located in the knob at the end of the turn signal lever. To operate the wiper, the key lock cylinder must be in the RUN position. In addition to OFF, there are two fixed speed wiper positions LO (low) HI (high) and an interval position. The positions are selected by rotating the knob actuator relative to the turn signal lever. If interval position is selected, the time between wiper cycles will decrease as the knob is rotated away from OFF position and will increase as the knob is rotated toward OFF position. The time interval between wipes will vary depending on the knob's position from OFF position. The wiper speed for interval wiper operation is fixed at the LO speed setting.

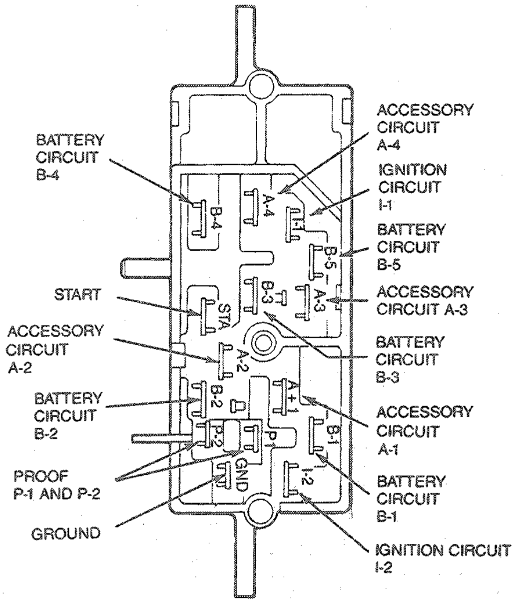
DIAGNOSIS AND TESTING

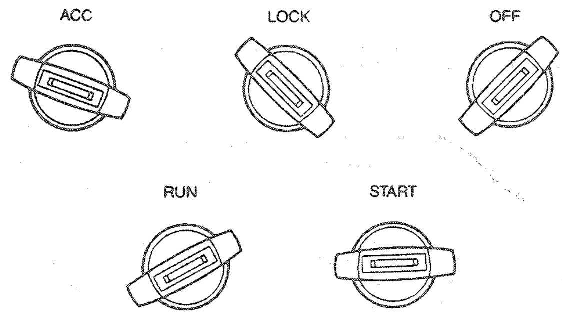
Continuity Test

Disconnect the multiple connector from the ignition switch. Test the switch continuity as described in the following illustration. Connect a self-powered test lamp or ohmmeter between the blade terminals indicated on the chart. No continuity between any blade and chassis ground should exist in any switch position except the proof Circuits, 41 and 977 in the START position only.

For an "engine won't crank" condition, determine if the condition exists with the shift lever in both PARK and NEUTRAL positions before performing the ignition switch continuity test. If the "no-crank" condition occurs in one shift lever position but not the other, a more probable cause is the neutral start switch located on the transaxle.

CONTINUITY TEST





SWITCH POSITION	CONTINUITY SHOULD EXIST ONLY BETWEEN
ACC	A-1 THROUGH B-5
LOCK	NO CONTINUITY
OFF	NO CONTINUITY
RUN	A-1 AND B-1, A-2 AND B-2, A-3 AND B-3, A4 AND B4, I1 AND B5
START	I-1 AND B-5, I-2 AND B-1, STA AND B-4, P-1 AND GRD, P-2 AND GRD.

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Mechanical Test

Test the steering column ignition system mechanical operation by rotating the lock cylinder / key through all switch positions. The movement should feel smooth with no sticking or binding. The ignition system should return from the START position back to the RUN position without assistance (spring return). If sticking or binding is encountered, check for the following:

- Burrs on the lock cylinder key
- Binding lock cylinder
- Shroud rubbing against lock cylinder
- Burrs or foreign material around rack-and-pinion actuator in lock cylinder housing
- Insufficient lube on actuator

  NOTE: Do not apply lubricant to the inside of the ignition switch.
- Binding ignition switch

Switch, Multi-Function

The multi-function switch is a combination turn signal, hazard and dimmer switch which has a number of on / off switches packaged as a single unit. Testing for electrical malfunctions can be accomplished with a continuity tester. Malfunctions can be determined by checking continuity between the feed and function terminals of the switch.

Prior to testing, make sure hazard knob is pushed in fully to the OFF position. If the suspect circuit is satisfactory, the concern is elsewhere in the system.

Refer to the diagnostic charts and the illustration to resolve concerns with the multi-function switch.

DIAGNOSIS AND TESTING (Continued)

MECHANICAL MULTI-FUNCTION SWITCH DIAGNOSIS

CONDITION	TEST STEP	ACTION
Hazard Warning Switch Will Not Turn On Warning Lamps	With hazard warning switch in the OFF position, fully depress knob and release.	If knob does not pop up to the ON position, the switch is damaged or worn. Replace switch.
Hazard Warning Switch Will Not Turn Off Warning Lamps	With hazard warning switch in the ON position, fully depress knob and release.	If knob does not pop up to the OFF position, the switch is damaged or worn. Replace switch.
Turn Signal Lever Will Not Stay In The LH / RH Turn Positions	With steering wheel locked in the straight ahead position, move lever to the RH and LH turn positions.	If lever does not stay in either turn position, the switch is damaged or worn. Replace switch. NOTE: If lever stays in the turn position, verify that there is an effort required to manually move the lever from either the LH or RH turn position to the neutral position.
Turn Signal Lever Cancels Before Steering Wheel Returns From the Desired Turn Position	Road test vehicle to verify condition.	If lever cancels before steering wheel return, the switch is damaged or worn. Replace switch.
Turn Signal Lever Will Not Cancel When Steering Wheel Returns From the Desired Turn Position	Check effort to switch from high beam to low beam and the effort to manually cancel turn signal lever from a turn position.	If effort required to switch from HIGH BEAM to LOW BEAM is less than manually cancelling turn signal lever from a turn position, switch is damaged or worn. Replace switch.
Headlamp Dimmer Switch Does Not Stop In LOW BEAM Position After The Flash-to-Pass Function is Operated	Gently pull turn signal lever to the FLASH-TO-PASS position and release.	If lever stops in the LOW BEAM position, switch is good. If lever travels beyond LOW BEAM position, the switch is damaged or worn. Replace switch.
Headlamp Dimmer Switch Does Not Return to LOW BEAM Position After The Flash-to-Pass Function Is Operated	Gently pull turn signal lever to the FLASH-TO-PASS position and release.	If lever does not return to the LOW BEAM position, the switch is damaged or worn. Replace switch.
Windshield Washer Switch Knob Does Not Return From The WASH Position	With ignition lock cylinder in the OFF position, push the washer switch knob to the ON position and release.	If washer switch knob does not return to the OFF position, the switch is damaged or worn. Replace switch.
Windshield Wiper Switch Knob Rotates Past The OFF and / or HI Stops	Slowly turn knob in both directions, observe and feel where the switch knob stops.	If knob rotates past OFF and / or HI, switch is damaged or worn. Replace switch.
Windshield Wiper Switch Knob Rotates Easily From OFF, LO HI or the INTERVAL Position During Turn Signal or Headlamp Dimmer Operation	Position finger on top of knob parallel to steering column. Gently pull finger back toward steering wheel and push down on lever toward LH turn position. Check each position, HI, LO, OFF and INTERVAL positions.	If knob rotates from any of the positions, switch is damaged or worn. Replace switch.

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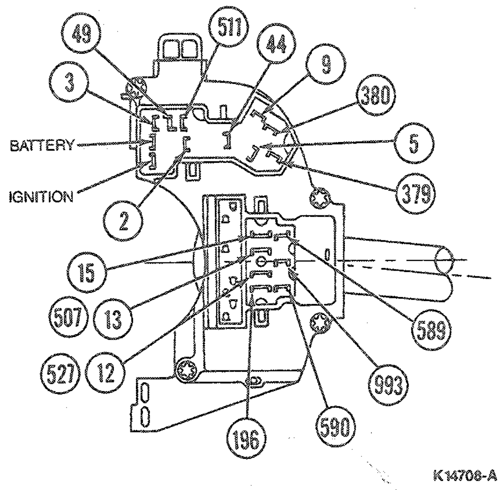
Switch Continuity

Tools Required:

- Rotunda Digital Volt-Ohmmeter 007-00001

DIAGNOSIS AND TESTING (Continued)

Testing for electrical malfunctions can be accomplished using a continuity tester and an ohmmeter, such as Rotunda Digital Volt-Ohmmeter 007-00001 or equivalent.



MULTI-FUNCTION SWITCH — BENCH CHECK CONTINUITY

SWITCH ACTUATOR POSITION	CONTINUITY BY CIRCUIT NUMBER
Turn Signal Lever in Neutral— Hazard OFF	**Turn Signal:** Closed 511 to 5 and 9; Ignition B+ to 49. Open 511 to 2, 3, 44 and 385; 44 to 2, 3, 5, 9 and 385; 385 to 2 and 3; Battery B+ to 49. **Cornering Lamp:** Open 15 to 379 and 380; 379 to 380.
Turn Signal Lever in Left Turn— Hazard OFF	**Turn Signal:** Closed 511 to 5; 44 to 3 and 9; Ignition B+ to 49. Open 511 to 3, 9, 44 and 385; 44 to 2, 5 and 385; 385 to 2; Battery B+ to 49. **Cornering Lamp:** Closed 15 to 380. Open 15 to 379; 379 to 380.
Turn Signal Lever in Right Turn— Hazard OFF.	**Turn Signal:** Closed 511 to 9; 44 to 2 and 5; Ignition B+ to 49. Open 511 to 2, 5, 44 and 385; 44 to 3, 9 and 385; 385 to 2; Battery B+ to 49. **Cornering Lamp:** Closed 15 to 380. Open 15 to 379; 379 to 380.
Hazard ON	Closed 44 to 2, 3, 5 and 9; Battery B+ to 49. Open 511 to 5, 9, 44, 2 and 3; Ignition B+ to 49.
Hazard OFF Turn Signal Lever, Right Turn	Closed 511 to 9; 44 to 2 and 5; 15 to 379. Open 511 to 2, 5, 44 and 385; 44 to 3, 9 and 385; 385 to 2.
Headlamp Beam Switching:	
●Lever at **High Beam**	Closed 15 to 12. Open 15 to 13 and 196; 196 to 12.
●Lever at **Low Beam**	Closed 15 to 13. Open 15 to 12 and 196; 196 to 13.
●Lever at **FLASH-TO-PASS**	Closed 15 to 13; 196 to 12. Open 15 to 12; 196 to 13.
Auto Dim Switching:	
●Lever in **Auto Dim Position**	Closed 15 to 507. Open 15 to 527 and 196; 527 to 196.
●Lever in **Low Beam**	Closed 15 to 13. Open 15 to 527 and 196; 527 to 196.
●Lever in **Flash-to-Pass**	Closed 196 to 527. Open 15 to 527, 507 and 196; 527 to 507; 507 to 196.

(Continued)

DIAGNOSIS AND TESTING (Continued)

MULTI-FUNCTION SWITCH — BENCH CHECK CONTINUITY (Cont'd)

SWITCH ACTUATOR POSITION	CONTINUITY BY CIRCUIT NUMBER
Wiper / Washer Switching:	
•Wash OFF and Wiper OFF	Resistance 993 to 590, 103.3K ohms ± 10%. Resistance 993 to 589, 47.6K ohms ± 10%.
•Wash ON and Wiper OFF	Closed 993 to 590; Resistance 993 to 589, 47.6K ohms ± 10%.
•Wiper OFF and Wash OFF	Resistance 993 to 590, 103.3K ohms ± 10%. Resistance 993 to 589, 47.6K ohms ± 10%.
•Wiper LO or Low Speed and Wash OFF	Resistance 993 to 590, 3.3K ohms ± 10%. Resistance 993 to 589, 4.08K ohms ± 10%.
•Wiper HI or High Speed and Wash OFF	Resistance 993 to 590, 3.3K ohms ± 10%. Closed 993 to 589.
•Wiper Interval and Wash OFF	Resistance 993 to 589, 11.33K ohms ± 10%. Resistance 993 to 590. Gradually decreasing from 103.3K ohms to 3.3K ohms from Maximum Delay to Minimum Delay.

TK8772F

REMOVAL AND INSTALLATION

Switch, Ignition

Removal

1. Disconnect battery ground cable. Remove the steering column shroud by removing the four or five self-tapping screws. Remove tilt lever (if so equipped).
2. Remove instrument panel lower steering column cover.
3. Disconnect the ignition switch electrical connector.
4. Rotate ignition key lock cylinder to the RUN position.
5. Remove the two screws retaining ignition switch.
6. Disengage the ignition switch from the actuator.

Installation

NOTE: A new replacement switch assembly will be set in the RUN position as received.

1. Adjust the ignition switch by sliding the carrier to the switch RUN position.
2. Check to ensure that the ignition key lock cylinder is in the RUN position. The RUN position is achieved by rotating the key lock cylinder approximately 90 degrees from the LOCK position.
3. Install the ignition switch pin into the actuator. It may be necessary to move the switch slightly back and forth to align the switch mounting holes with the column lock housing threaded holes.
4. Install retaining screws. Tighten to 5.6-7.9 N·m (50-69 lb-in).
5. Connect electrical connector to ignition switch.
6. Connect battery ground cable. Check ignition switch for proper function, including START and ACC positions. Also, make certain that the column is locked in the LOCK position.
7. Install instrument panel lower steering column cover.
8. Install the steering column trim shrouds and tilt lever (if so equipped).

Switch, Multi-Function

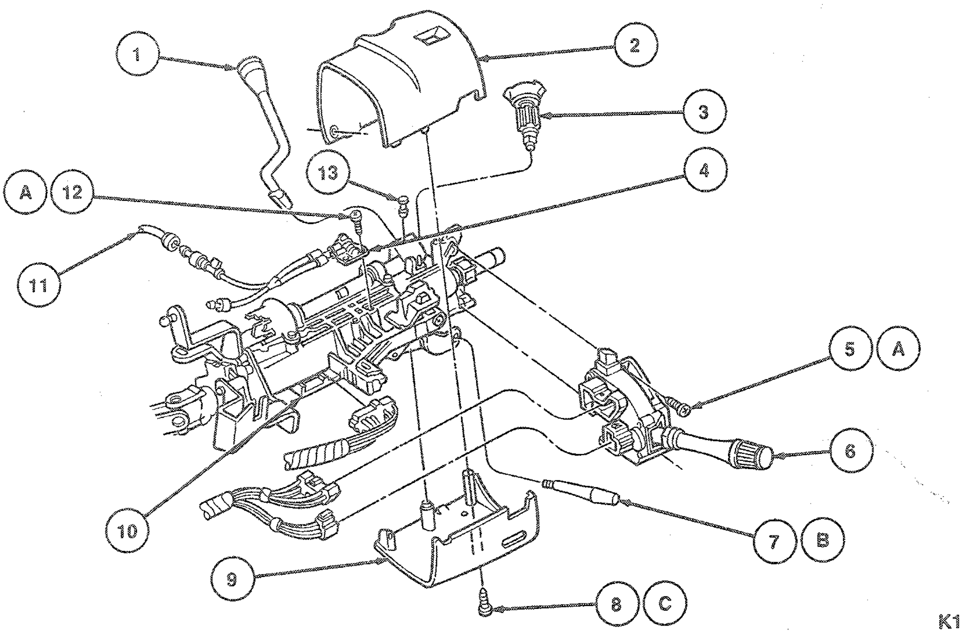
Removal

1. Disconnect battery ground cable.
2. Tilt column to lowest position and remove tilt lever.
3. Remove ignition lock cylinder as outlined.
4. Remove shroud screws and remove upper and lower shroud.
5. Remove two self-tapping screws that attach multi-function switch to steering column casting. Disengage switch from casting.
6. Disconnect the two electrical connectors.

Installation

1. Install two electrical connectors to full engagement.
2. Align multi-function switch mounting holes with corresponding holes in the steering column casting. Install two self-tapping screws making sure to start the screws in the previously tapped holes. Tighten to 2-3 N·m (17-26 lb-in).
3. Install upper and lower steering column shroud with screws.
4. Install ignition lock cylinder as outlined.
5. Attach tilt lever.
6. Connect battery ground cable.
7. Check steering column and switch for proper operation.

REMOVAL AND INSTALLATION (Continued)



Item	Part Number	Description
1	7202	Shift Lever Assy
2	3530	Upper Shroud
3	11A606	Ignition Lock Assy
4	2B623	Park Brake Release Assy
5A	390345-S36	Screw (2 Req'd)
6	13K359	Switch Assy
7B	3F609	Tilt Lever
8C	55929-S2	Screw (4 Req'd)
9	3533	Lower Shroud

(Continued)

Item	Part Number	Description
10	11572	Ignition Switch
11	2B653	Hose
12A	390345-S36	Screw (2 Req'd)
13	7G357	Pin
A		Tighten to 2-3 N·m (17-26 Lb-In)
B		Tighten to 3.5-5.0 N·m (30-44 Lb-In)
C		Tighten to 0.6-1.13 N·m (6-10 Lb-In)

Flasher Unit

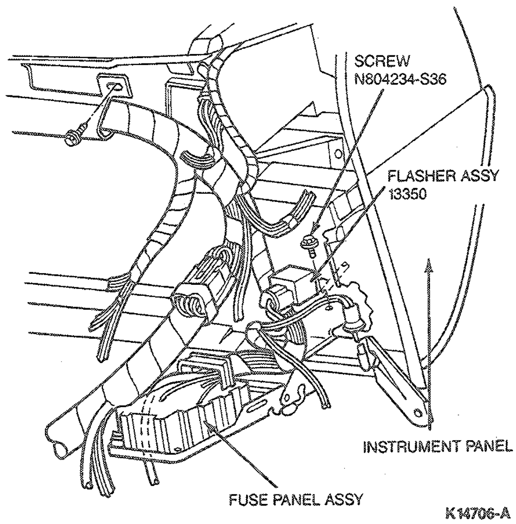
Removal and Installation

The turn signal flasher is located on the LH side of the instrument panel, and is retained by one screw to the lower instrument panel reinforcement.

REMOVAL AND INSTALLATION (Continued)

The combination turn signal and hazard flasher can be removed by tilting and sliding the flasher off the bracket. To install a new flasher, remove the bracket from the new unit, then align the existing bracket to the instrument panel with the track on the flasher housing. Then push the flasher forward until it snaps into the bracket.

NOTE: The electrical wiring connector can be removed before installing a new unit, and engaged into the new unit prior to snapping it into the bracket.



SPECIFICATIONS

TORQUE SPECIFICATIONS

Description	N·m	Lb-In
Multi-Function Switch -to-Column Bolts	2-3	17-26
Column Shroud Screws	0.6-1.13	6-10
Tilt Lever	3.5-5.0	30-44
Ignition Switch Screws	5.6-7.9	50-69

SPECIAL SERVICE TOOLS

ROTUNDA EQUIPMENT

Model	Description
007-00001	Digital Volt-Ohmmeter

GROUP 12 CLIMATE CONTROL SYSTEM

(18000 & 19000)

SECTION 12-00 Climate Control System—Service

VEHICLE APPLICATION

Taurus/Sable.

BASIC PRINCIPLES

Vehicle air conditioning is the cooling or refrigeration of the air in the passenger compartment. Refrigeration is accomplished by making practical use of three laws of nature. These laws of nature and their practical application are outlined.

Heat Transfer

If two substances of different temperature are placed near each other, the heat in the warmer substance will always travel to the colder substance until both are of equal temperature. For example, a cake of ice in an ice box does not communicate its coldness to the bottle of milk standing nearby. Rather, in obedience to nature's law, the heat in the warm milk automatically flows into the ice which has a lesser degree of heat. In order to determine the amount of heat that transfers from one substance to another, science has established a definite standard of measurement called the British Thermal Unit or BTU. One BTU is the amount of heat required to raise the temperature of one pound of water 0.55°C (1°F). For example, to raise the temperature of one pound of water from 0°C (32°F) to 100°C (212°F), one BTU of heat must be added for each 0.55°C (1°F) rise in temperature or a total of 180 BTUs of heat. Conversely, in order to lower the temperature of one pound of water from 100°C (212°F) to 0°C (32°F), 180 BTUs of heat must be removed from the water.

Latent Heat of Vaporization

When a liquid boils (changes to a gas), it absorbs heat without raising the temperature of the resulting gas. When the gas condenses (changes back to a liquid), it gives off heat without lowering the temperature of the resulting liquid.

For example, place one pound of water at 0°C (32°F) in a container over a flame. With each BTU of heat that the water absorbs from the flame, its temperature rises 0.55°C (1°F). Thus, after it has absorbed 180 BTUs of heat, the water reaches a temperature of 100°C (212°F). Here the law of nature is encountered. Even though the flame continues to give its heat to the water, the temperature of the water remains at 100°C (212°F). The water, however, starts to boil or change from the liquid to the gaseous state, and it continues to boil until the water has passed off into the atmosphere as vapor. If this vapor were collected in a container and checked with a thermometer, it also would show a temperature of 100°C (212°F). In other words, there was a rise of only 82°C (180°F), from 0 to 100°C (32-212°F) in the water and vapor temperature even though the flame applied many more than 180 BTUs of heat. In this case, the heat is absorbed by the liquid in the process of boiling and disappears in the vapor. If the vapor were brought in contact with cool air, the hidden heat would reappear and flow into the cooler air as the vapor condensed back to water. Scientists refer to this natural law as the latent (hidden) heat of vaporization.

Water has a latent heat of vaporization of 970 BTUs and a boiling point of 100°C (212°F). This means that one pound of water at 100°C (212°F) will absorb 970 BTUs of heat in changing to vapor at 100°C (212°F). Conversely, the vapor will give off 970 BTUs of heat in condensing back to water.

This tremendous heat transfer that occurs when a liquid boils or a vapor condenses, forms the basic principle of all conventional refrigeration systems.

For a liquid to be a good refrigerant, the amount of heat that it absorbs when vaporizing is not the only factor. It must also have a low boiling point. That is, the temperature at which it boils must be lower than the substance to be cooled. To illustrate with water, place a bottle of milk at room temperature 21.6°C (70°F) next to boiling water 100°C (212°F). The heat would flow from the (higher temperature) water to the (lower temperature) milk. The milk would be heated rather than cooled, because the boiling point of water is too high.

In order to make practical use of the heat transfer that takes place when a liquid boils, we must choose a liquid with a low boiling point. Refrigerant-12 is the liquid most commonly used in automotive air conditioning systems because it boils at -29.85°C (21.7°F) below zero in an open container. Here is a liquid that boils or vaporizes well below passenger compartment temperatures and, in vaporizing, will absorb tremendous amounts of heat without getting any warmer itself.

Effect of Pressure on Boiling or Condensation

The saturation temperature (the temperature where boiling or condensation occurs) of a liquid or vapor increases or decreases, according to the pressure exerted on it.

In the fixed orifice tube refrigerant system, liquid refrigerant (Refrigerant-12) is stored in the condenser under high-pressure. When the liquid Refrigerant-12 is released into the evaporator through the fixed orifice tube, the resulting decrease in pressure and partial boiling lowers its temperature to its new boiling point. As the Refrigerant-12 flows through the evaporator, passenger compartment air or outside air passes over the outside surface of the evaporator coils. As it boils, the Refrigerant-12 absorbs heat from the air and thus cools the passenger compartment. The heat from the passenger compartment is absorbed by the boiling refrigerant. The refrigeration cycle is now under way. To complete the cycle, the following remains to be done:

1. Dispose of the heat in the vapor.
2. Convert the vapor back to liquid for reuse.

BASIC PRINCIPLES (Continued)

3. Return the liquid to the starting point in the refrigeration cycle.

The compressor and condenser perform these functions. The compressor pumps the refrigerant vapor (containing the hidden heat) out of the evaporator and suction accumulator drier, then forces it under high-pressure into the condenser which is located in the outside air stream at the front of the vehicle. The increased pressure in the condenser raises the Refrigerant-12 condensation or saturation temperature to a point higher than that of the outside air. As the heat transfers from the hot vapor to the cooler air, the Refrigerant-12 condenses back to a liquid. The liquid under high-pressure now returns through the liquid line to the fixed orifice tube for reuse.

It may seem difficult to understand how heat can be transferred from a comparatively cooler vehicle passenger compartment to the hot outside air. The answer lies in the difference between the refrigerant pressure that exists in the evaporator, and the pressure that exists in the condenser. In the evaporator, the compressor suction reduces the pressure and the boiling point below the temperature of the passenger compartment. Thus, heat transfers from the passenger compartment to the boiling refrigerant. In the condenser, the compressor raises the condensation point above the temperature of the outside air. Thus, the heat transfers from the condensing refrigerant to the outside air. The fixed orifice tube and the compressor simply create pressure conditions that permit the laws of nature to function.

GENERAL INFORMATION

Tools Required:

- Rotunda Safety Shield Goggles 063-00003

Safety Precautions

The refrigerant used in the air conditioner system is Refrigerant-12. Some vehicles may have Refrigerant-134a in the system. The same safety precautions as for R-12 should be observed. Refrigerant-12 is non-explosive, non-flammable, non-corrosive, has practically no odor and is heavier than air. Although it is classified as a safe refrigerant, certain precautions must be observed to protect the parts involved and the person working on the unit. Use only Refrigerant-12 such as Motorcraft YN-1A or YN-7 or equivalent. Liquid Refrigerant-12, at normal atmosphere pressures and temperatures, evaporates so quickly that it has the tendency to freeze anything it contacts. **For this reason, extreme care must be taken to prevent any liquid refrigerant from coming in contact with the skin and especially the eyes.**

Refrigerant-12 is readily absorbed by most types of oil. For this reason, a bottle of sterile mineral oil and a quantity of weak boric acid solution must always be kept nearby when servicing the air conditioning system. Should any liquid refrigerant get into the eyes, immediately use a few drops of mineral oil to wash them out, then wash the eyes clean with the weak boric acid solution. Seek a doctor's aid immediately even though irritation may have ceased. **Always wear safety goggles such as Rotunda Safety Shield Goggles 063-00003 or equivalent, when servicing any part of the refrigerant system.** The Refrigerant-12 in the system is always under pressure. Because the system is tightly sealed, heat applied to any part could cause this pressure to build up excessively.

To avoid a dangerous explosion, never weld, use a blow torch, solder, steam clean, bake body finishes, or use any excessive amount of heat on or in the immediate area of any part of the refrigerant system or refrigerant supply tank, while they are closed to the atmosphere, whether filled with refrigerant or not.

Ensure that Refrigerant-12 is both stored and installed in accordance with all state and local ordinances.

When admitting Refrigerant-12 gas into the cooling unit, always keep the tank in an upright position. If the tank is on its side or upside down, liquid Refrigerant-12 will enter the system and may damage the compressor.

Service Precautions

1. **Never open or loosen a connection before removing the refrigerant from the system with a recycling machine such as the Rotunda A/C Refrigerant Reclaim System (078-00800) or equivalent.**
2. **When loosening a connection, if any residual pressure is evident, allow it to leak off before opening the fitting.**
3. **A system which has been opened to replace a component or one which has discharged through leakage must be evacuated before charging.**
4. **Immediately after disconnecting a component from the system, seal the open fittings with a cap or plug.**
5. **Before disconnecting a component from the system, clean outside of the fittings thoroughly.**
6. **Do not remove sealing caps from a replacement component until ready to install.**
7. **Refrigerant oil will absorb moisture from the atmosphere if left uncapped. Do not open an oil container until ready to use, and install cap immediately after using. Store oil only in a clean, moisture-free container.**

GENERAL INFORMATION (Continued)

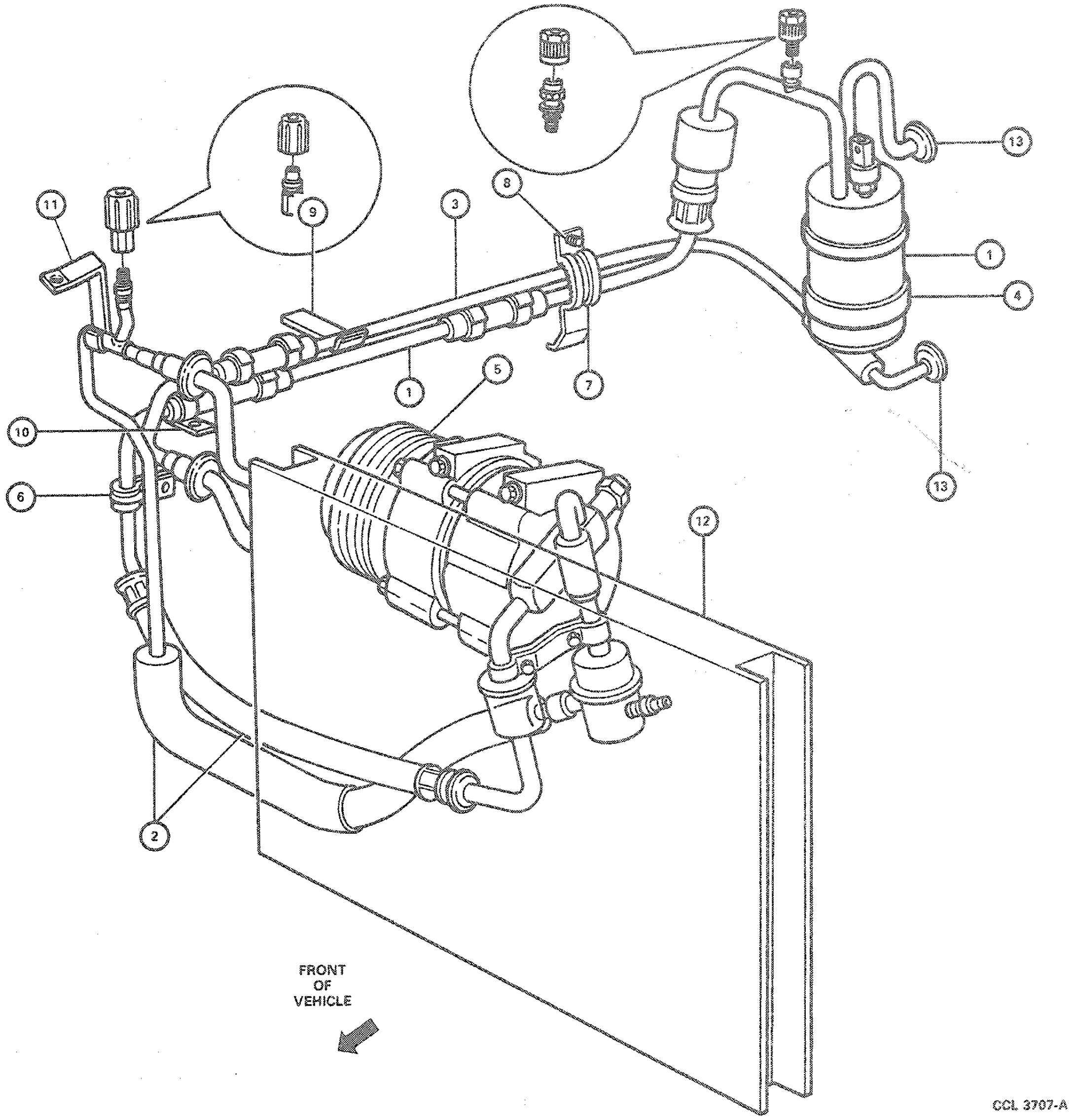
8. **Before connecting an open fitting, always install a new O-ring seal. Coat fitting and O-ring seal with refrigerant oil before connecting.**
9. **When installing a refrigerant line, avoid sharp bends. Position line away from exhaust or any sharp edges which may chafe the line.**
10. **Tighten fittings only to specified torque. Do not overtighten.**
11. **When disconnecting a fitting use a wrench on both halves of the fitting to prevent twisting of refrigerant lines or tubes.**
12. **Do not open a refrigerant system or uncap a replacement component unless it is as close as possible to room temperature. This will prevent condensation from forming inside a component which is cooler than surrounding air.**
13. **Keep service tools and work area clean. Contamination of a refrigerant system through careless work habits must be avoided.**
14. **Whenever components in engine compartment or instrument panel areas are being serviced, the battery ground cable must be disconnected to eliminate possibility of electrical shorts, burned-up wiring and dangerous fires. Extreme care must be exercised when performing electrical tests where the battery must be connected to operate the system.**

DESCRIPTION AND OPERATION

The A / C refrigerant system is the fixed orifice tube—cycling clutch type. The system components are the compressor and magnetic clutch, condenser, evaporator, suction accumulator / drier and the necessary connecting refrigerant lines. System operation is controlled by the fixed orifice tube and the clutch cycling pressure switch.

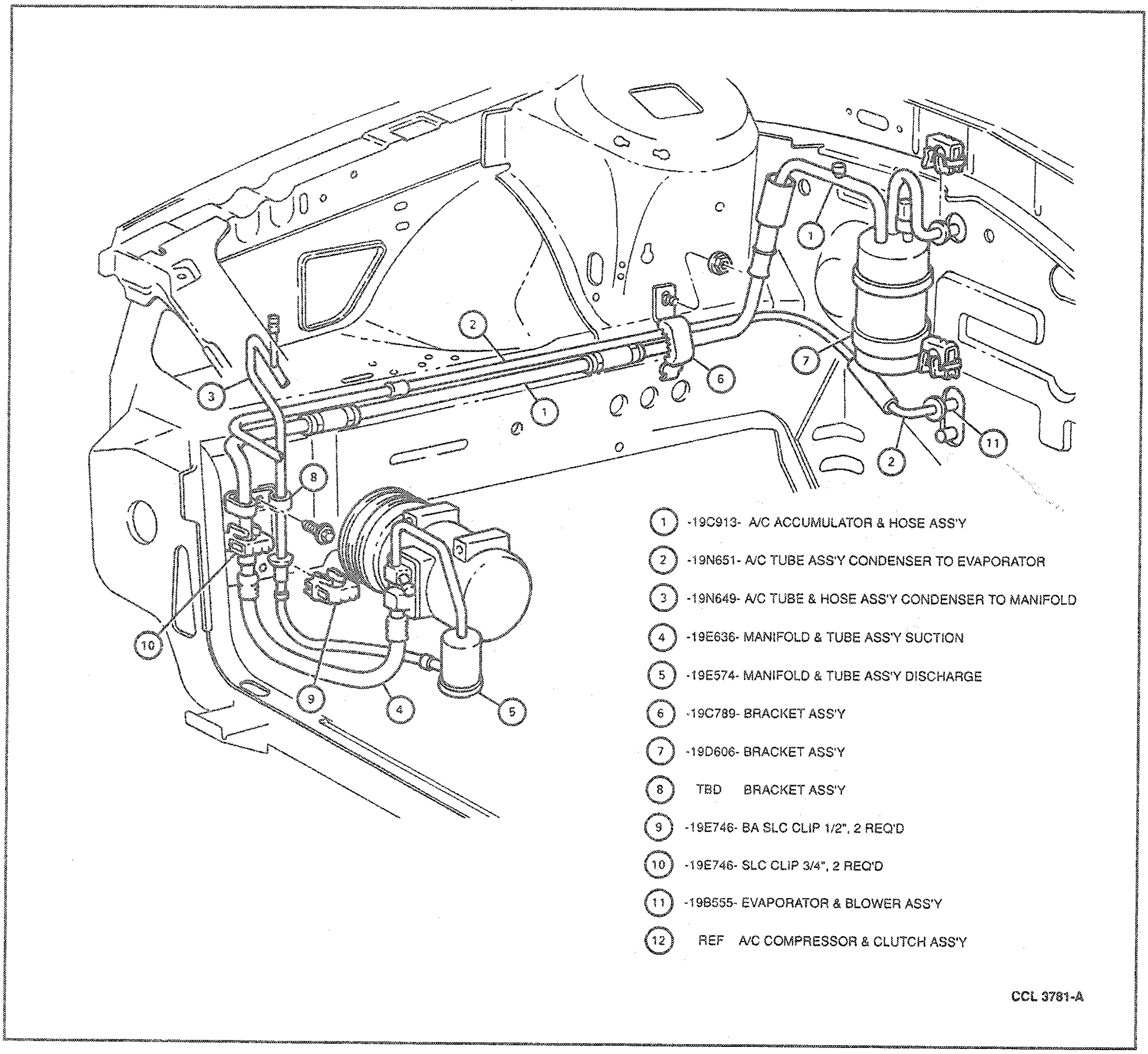
DESCRIPTION AND OPERATION (Continued)

A/C Refrigerating System



ITEM	DESCRIPTION
1.	ACCUMULATOR & HOSE ASSY - 19C913
2.	MANIFOLD & TUBE ASSY - 19D734
3.	CONDENSER TO EVAPORATOR TUBE ASSY - 19N651
4.	BRACKET ASSY - 19D606
5.	COMPRESSOR & CLUTCH ASSY - 19D629
6.	CLIP - N805191-S100
7.	CLIP - N806439-S100
8.	SCREW & RETAINER ASSY - N800358-S2
9.	CLIP - N805732-S
10.	CLIP - N804200-S100
11.	INLET TUBE BRACKET - 19D720
12.	CONDENSER
13.	TO EVAPORATOR

DESCRIPTION AND OPERATION (Continued)



Refrigerant Systems

Taurus / Sable vehicles offer two types of A / C systems. The main difference between these systems involve the mandatory requirement of the use of different refrigerants. The two types of A / C systems are:

1. Fixed orifice tube type system with cycling clutch using the chlorofluorocarbon (CFC) based Refrigerant 12 (R-12).
2. Fixed orifice tube type system with cycling clutch using the non-chlorofluorocarbon (Non-CFC) based Refrigerant 134a (R-134a).

NOTE: It is necessary to determine whether or not the refrigerant system contains R-134a refrigerant before any system service is performed. Refer to Refrigerant-134a (R-134a) Systems in this section.

NOTE: When diagnosing or servicing the A / C refrigerant system, time can be saved if the proper procedures are carefully followed.

DESCRIPTION AND OPERATION (Continued)

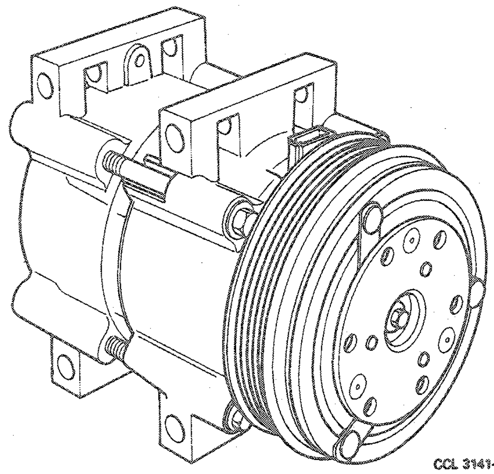
Compressor and Magnetic Clutch Assembly

FX-15 Compressor

NOTE: Whenever a compressor is replaced, it will be necessary to replace the suction accumulator / drier and orifice tube.

The FX-15 compressor is used in all Taurus / Sable vehicles equipped with a base 3.0L or 3.8L engine.

FX-15 Compressor



CCL 3141-A

The FX-15 compressor is manufactured by Ford and has a displacement of 171 cc (10.4 cu. in.). It is a ten cylinder axial design requiring a 7 ounce charge of Motorcraft YN-9 refrigerant oil.

The hose manifold is attached to the compressor rear head with one screw. A pressure relief valve is threaded into a hole in the manifold that is connected to the discharge port.

The clutch is unique to the FX-15 compressor and consists of three basic components: the pulley, the hub and the field coil. The field coil is pressed on the compressor front head and the pulley is retained with a snap ring. The compressor shaft and the clutch hub are splined for positive engagement and a screw is used to retain the hub on the compressor shaft.

The FX-15 is a swashplate design 10 cylinder aluminum compressor utilizing the tangential design mounting system.

10P15F Compressor

NOTE: Whenever a compressor is replaced, it will be necessary to replace the suction accumulator / drier and orifice tube.

The 10P15F compressor is used in Taurus SHO models. The compressor is a swashplate 10 cylinder axial design, driven by the accessory drive belt. Refer to Section 12-03B for 10P15F compressor and clutch service procedures.

High-Pressure Relief Valve

A pressure relief valve is used to prevent excessive high-pressure buildups of 3102 kPa and above (450 psi and above) and to prevent damage to the compressor and other system components. The pressure relief valve is located on the side of the discharge manifold on top of the compressor.

Condenser

NOTE: Whenever a condenser is replaced, it will be necessary to replace the suction accumulator / drier.

The air conditioning condenser is an aluminum fin and tube design heat exchanger located in front of vehicle radiator. It cools compressed refrigerant gas by allowing air to pass over fins and tubes to extract heat, and condenses gas to liquid refrigerant as it is cooled.

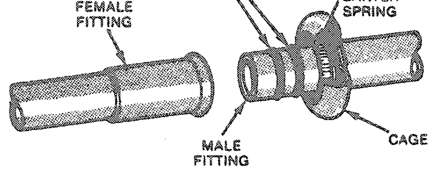
The condenser inlet and outlet connections are the male fitting of a spring lock coupling and require a special service tool to disconnect the refrigerant lines from the condenser. The procedure to disconnect and reconnect the spring lock coupling is shown in.

Spring Lock Coupling

The spring lock coupling is a refrigerant line coupling held together by a garter spring inside a circular cage. When the coupling is connected together, the flared end of the female fitting slips behind the garter spring inside the cage of the male fitting. The garter spring and cage then prevent the flared end of the female fitting from pulling out of the cage.

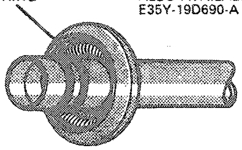
DESCRIPTION AND OPERATION (Continued)

Spring Lock Coupling

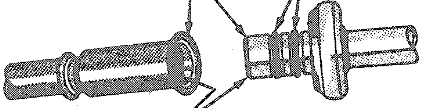


SPRING LOCK COUPLING DISCONNECTED

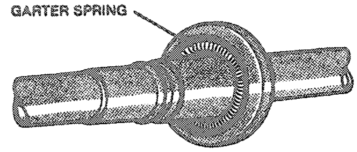
TO CONNECT COUPLING



1. CHECK FOR MISSING OR DAMAGED GARTER SPRING — REMOVE DAMAGED SPRING WITH SMALL HOOKED WIRE — INSTALL NEW SPRING IF DAMAGED OR MISSING.



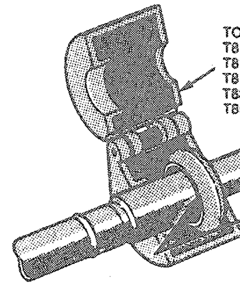
2.



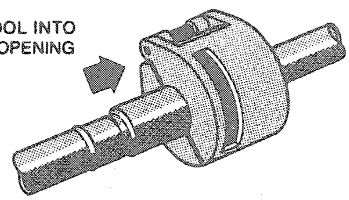
3. TO ENSURE COUPLING ENGAGEMENT, VISUALLY CHECK TO BE SURE GARTER SPRING IS OVER FLARED END OF FEMALE FITTING.

TO DISCONNECT COUPLING

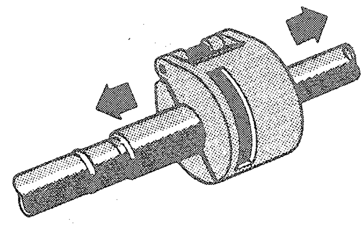
CAUTION — DISCHARGE SYSTEM BEFORE DISCONNECTING COUPLING



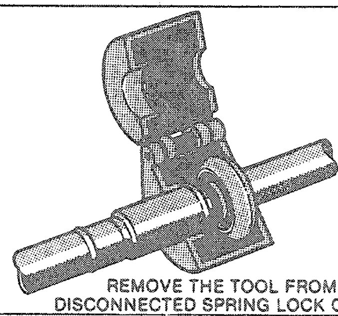
1. FIT TOOL TO COUPLING SO THAT TOOL CAN ENTER CAGE OPENING TO RELEASE THE GARTER SPRING.



2. PUSH THE TOOL INTO THE CAGE OPENING TO RELEASE THE FEMALE FITTING FROM THE GARTER SPRING.



3. PULL THE COUPLING MALE AND FEMALE FITTINGS APART.



4. REMOVE THE TOOL FROM THE DISCONNECTED SPRING LOCK COUPLING.

CCL 4011-C

DESCRIPTION AND OPERATION (Continued)

Two O-rings are used to seal between the two halves of the coupling. **These O-rings are green in color and are made of special material and must be replaced with an O-ring made of the same material.** The O-rings normally used in refrigerant system connections are not the same material and should not be used with the spring lock coupling. **Use only the green O-rings listed in the Ford Master Parts Catalog for the spring lock coupling.**

A plastic indicator ring is used on spring lock couplings to indicate, during vehicle assembly, that the coupling is connected. Once the coupling is connected, the indicator ring is no longer necessary but will remain captive by the coupling near the cage opening.

The indicator ring may also be used during service operations to indicate connection of the coupling. After the coupling has been cleaned, and new, green O-rings are lubricated and installed, insert the tabs of the indicator ring into the cage opening. Connect the coupling together by pushing with a slight twisting motion. When the coupling is connected, the indicator ring will snap out of the cage opening but will remain captured on the coupling by the refrigerant line.

Fixed Orifice Tube

The fixed orifice tube assembly is the restriction creating the dividing point between the high and low-pressure liquid refrigerant, and meters the flow of liquid refrigerant into the evaporator core. Evaporator temperature is controlled by sensing the pressure within the evaporator core and suction accumulator / drier with a pressure-operated electric switch. The pressure switch controls compressor operation as necessary to maintain the evaporator pressure within specified limits.

The fixed orifice tube is located in the liquid line near the condenser and has a filter screen located on the inlet ends of the tube body. The filter screens act as a strainer for the liquid refrigerant flowing through the fixed orifice opening. O-rings, on the tube body, prevent the high-pressure liquid refrigerant from bypassing the orifice. Adjustment or service cannot be made to the fixed orifice tube assembly which cannot be removed from the liquid line. The liquid line must be replaced, or an Orifice Tube Replacement Kit (E5VY-190695) installed if replacement of the orifice tube is necessary.

The fixed orifice tube should be replaced whenever a compressor is replaced. If the high pressure reading is higher than normal and the suction pressure drops rapidly creating a faster than normal clutch cycle rate, the orifice tube may be restricted and should be replaced. This condition is usually indicated by the compressor having a short ON time and a long OFF time.

Evaporator Core

NOTE: Whenever an evaporator core is replaced, the suction accumulator / drier must also be replaced.

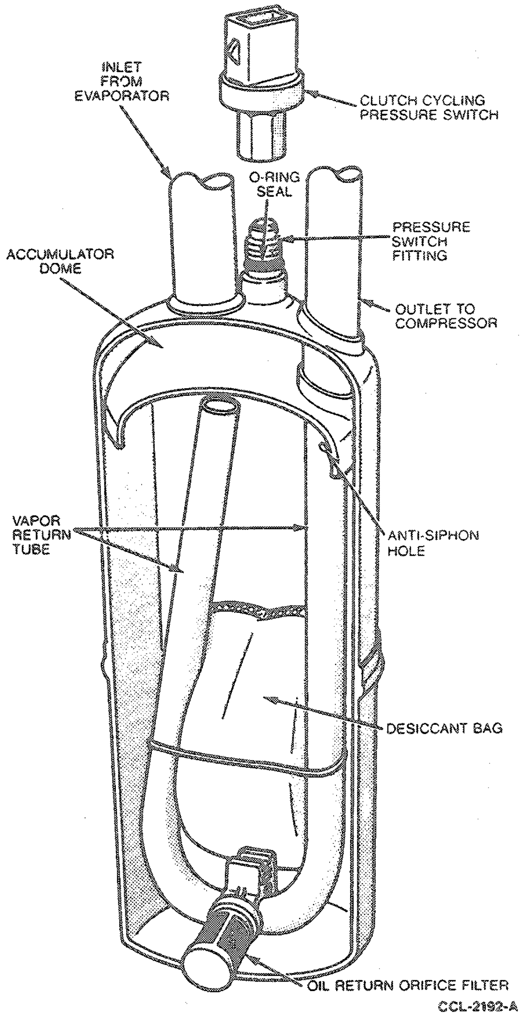
The evaporator core is the plate / fin type with an S-flow multi-pass refrigerant path. A mixture of refrigerant and oil enters the bottom of the core through the evaporator inlet tube and is routed so that it flows upward through the partitioned first three plate / fin sections. The next four plate / fin sections are partitioned to force the refrigerant to flow downward toward the bottom of the evaporator core. The refrigerant then continues over to the remaining five plate / fin sections and then moves upward and out of the evaporator via the evaporator outlet tube. This S-pass flow pattern accelerates the flow of refrigerant and oil through the evaporator core.

Suction Accumulator / Drier

The suction accumulator / drier is mounted to the engine side of the dash panel on the RH side of the vehicle. The inlet tube of the accumulator / drier attaches directly to the evaporator core outlet tube.

DESCRIPTION AND OPERATION (Continued)

Typical Suction Accumulator / Drier



Refrigerant enters the accumulator / drier canister from the evaporator core through the inlet tube and the heavier, oil-laden refrigerant falls to the bottom of the canister. A small diameter oil bleed hole is located in the side of the outlet tube near the bottom of the canister. This bleed hole is covered with a filter screen and allows a small amount of the heavier liquid refrigerant and oil mixture to re-enter the suction line at a controlled rate. When the heavier liquid refrigerant and oil mixture enters the compressor suction line, it has a second opportunity to vaporize and circulate through the compressor without causing damage to the compressor due to refrigerant slugging.

A desiccant bag is mounted inside the suction accumulator / drier canister to absorb any moisture which may be in the refrigerant system.

A fitting located on the top of the canister is used to attach the clutch cycling pressure switch. A long-travel Schrader-type valve stem core is installed in the fitting opening to prevent refrigerant loss when the clutch cycling pressure switch is removed.

If it is necessary to check the suction accumulator / drier for excessive refrigerant oil, the oil must be poured from the accumulator through the pressure switch fitting when the Schrader valve stem is removed.

Clutch Cycling Pressure Switch

The clutch cycling pressure switch is mounted on a Schrader valve-type fitting on the top of the suction accumulator / drier assembly (refer to Suction Accumulator / Drier illustration). A valve depressor, located inside the threaded end of the pressure switch, presses in on the Schrader valve stem as the switch is mounted and allows the suction pressure inside the accumulator / drier canister to act on the switch. The electrical switch contacts will open when the suction pressure drops to 22 to 28 psi on R-12 systems, 22-25 psi on R-134a systems. The contacts will close when the suction pressure increases to 40-47 psi on R-12 systems and 39-47.5 on R-134a systems.

Ambient temperatures below approximately 45-50°F during cold weather seasons will prevent the pressure switch contacts form closing. This is due to the pressure / temperature relationship of the refrigerant and the requirement of the system pressure to reach the pressure required psi to close the switch contacts. The switch contacts control the electrical circuit to the compressor magnetic clutch coil. When the switch contacts close, the signal to energize the A / C clutch is sent to the Constant Control Relay Module (CCRM). The CCRM then supplies the voltage to energize the magnetic clutch for compressor operation. When the pressure switch contacts open, the CCRM opens the clutch electrical circuit to de-energize the clutch and compressor operation stops. The clutch cycling pressure switch, when functioning properly, will control the evaporator core pressure at a point where the plate / fin surface temperature will be maintained slightly above freezing which prevents evaporator icing and the blockage of airflow.

Service Gauge Port Valves (R-12 System)

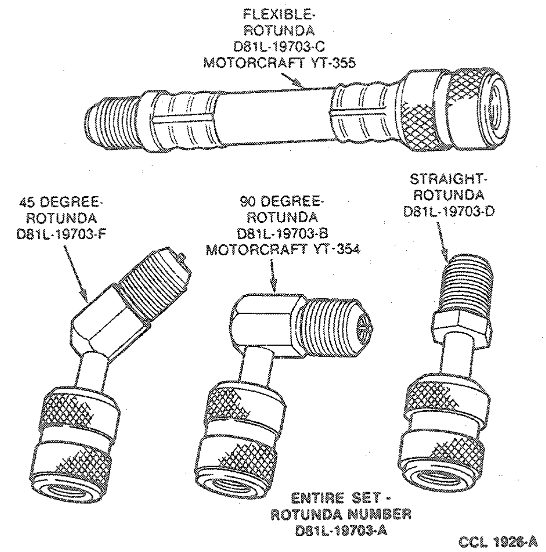
Tools Required:

- High Side Adapter Set D81L-19703-A
- Tee Adapter Tool D87P-19703-A

The refrigerant system has a high-pressure (discharge) and a low-pressure (suction) gauge port valve. These are Schrader-type valves which provide access to both sides (high-pressure and low-pressure) of the system for service hoses and a manifold gauge set so system pressures can be read. Rotunda High Side Adapter Set D81L-19703-A or Motorcraft® Tool YT-354 or 355 or equivalent, is required to connect a manifold gauge set or charging station to the high-pressure gauge port valve.

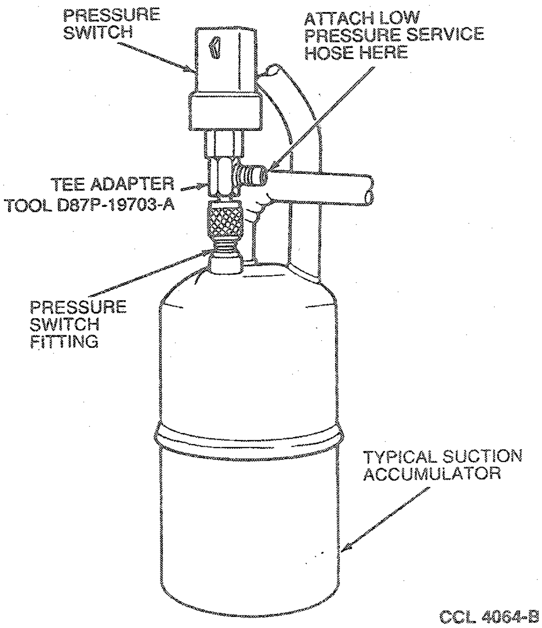
DESCRIPTION AND OPERATION (Continued)

R-12 System High Pressure Gauge Port Valve Adapters



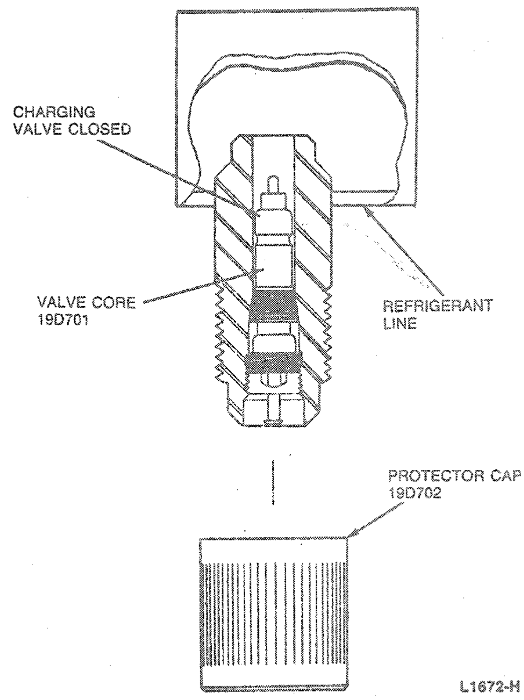
Tee-Type Service Adapter Tool D87P-19703-A or equivalent may be used when diagnosing the low-pressure side of the R-12 refrigerant system.

Tee Adapter Tool Installation



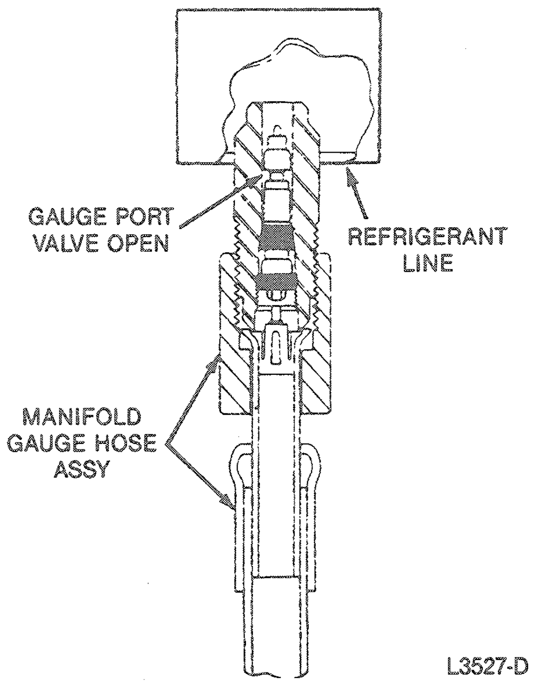
A service gauge port valve assembly is shown in the following illustration with the valve in the closed position. The next illustration shows a gauge port valve in the open position with a manifold gauge set hose attached.

R-12 System Service Gauge Port Valve



DESCRIPTION AND OPERATION (Continued)

R-12 System Manifold Gauge Set Hose Connected to Gauge Port Valve



DIAGNOSIS AND TESTING

Diagnosis is more than just following a series of interrelated steps in order to find the solution to a specific condition. It is a way of looking at systems that are not functioning the way they should and finding out why. Also, it is knowing how the system **should** work and whether it is working correctly. All good diagnosticians use the same basic procedure.

There are basic rules for diagnosis. If these rules are followed, the cause of the condition will usually be found the first time through the system.

Know the System

Know how the parts go together. Also, know how the system operates, its limits and what happens when something goes wrong. Sometimes this means comparing a system that is working properly with the one you are servicing.

Know the History of the System

Has it been serviced in the past in such a manner that might relate to the present condition? What is the service history? A clue in any of these areas might save a lot of diagnosis time.

Know the Probability of Certain Conditions Developing

It is true that most conditions are caused by simple things rather than by complex ones and they occur in a fairly predictable pattern. Electrical concern conditions, for instance, usually occur at connections rather than in components. An engine no-start is more likely to be caused by a loose wire or some component out of adjustment than a sheared-off camshaft. Know the difference between **impossible** and **improbable.** Many good technicians have spent hours diagnosing a system because they thought certain failures were impossible, only to eventually find out the failures were just "improbable" and actually had happened.

Don't Cure the Symptom and Leave the Cause

Recharging a refrigerant system may correct the condition of insufficient cooling, but it does not correct the original concern unless a cause is found.

Be Sure the Cause is Found

Do not be fooled into thinking the cause of the concern has been found. Perform the proper tests, then double check the results. The system should have been checked for refrigerant leaks. If no leaks were found, perform a leak test with the system under extremely high pressure.

Diagnosis Charts

No matter what form charts may take, they are simply a way of expressing the relationship between basic logic and a physical system of components. It is a way of determining the cause of a condition in the **shortest possible amount of time.** Diagnosis charts combine many areas of diagnosis into one visual display:

- **Probability** of certain things occurring in a system.
- **Speed** of checking certain components, or functions, before others.
- **Certainty** of narrowing down the search to a small portion before performing in-depth testing.
- **Simplicity** of performing certain tests before others.
- **Elimination** of checking huge portions of a system by performing simple tests.

The fastest way to find a condition is to work with the tools that are available, which means working with proven diagnosis charts and the proper special tools for the system being worked on.

System Visual Inspection

It is often possible to detect concerns by a careful visual inspection of the A / C refrigerant system. This includes broken belts, obstructed condenser air passages, excessive clutch air gap, loose or broken mounting brackets, disconnected or broken wires and refrigerant leaks.

DIAGNOSIS AND TESTING (Continued)

A refrigerant leak will usually appear as an oily residue at the leakage point in the system. The oily residue soon picks up dust or dirt particles from the surrounding air and appears greasy. Through time, this will build up and appear to be a heavy, dirt-impregnated grease.

Most common leaks are caused by damaged or missing O-ring seals at the various hose and component connections. When these O-rings are replaced, the new O-rings should be lubricated with silicone or refrigerant oil. Care should be taken to keep lint from shop towels or cloths from contaminating the internal surfaces of the connection. Leakage may occur at a spring lock coupling if the wrong O-rings are used at the coupling. Use **only** the green O-rings listed in the Ford Master Parts Catalog for the spring lock coupling.

Another type of leak may appear at the internal Schrader-type A / C charging valve core in the service gauge port valve fittings. If tightening the valve core does not stop the leak, it should be replaced with a A / C Charging Valve Core (19D701).

Missing Service Gauge Port Valve Caps (19D702) can also cause a refrigerant leak. If this important primary seal (the valve cap) is missing, dirt will enter the area of the A / C charging valve core. When the service hose is attached, the valve depressor in the end of the service hose forces the dirt into the valve seat area and the dirt will destroy the sealing surface of the A / C charging valve core. When a service gauge port valve cap is missing, the protected area of the A / C charging valve core should be cleaned and a new Service Gauge Port Valve Cap (19D702) should be installed.

CAUTION: Service gauge port valve caps must be installed finger-tight. If tightened with pliers, the sealing surface of the service gauge port valve may be damaged.

Electrical

Refer to the Taurus / Sable Electrical Vacuum Troubleshooting Manual for a complete schematic and wire colors.

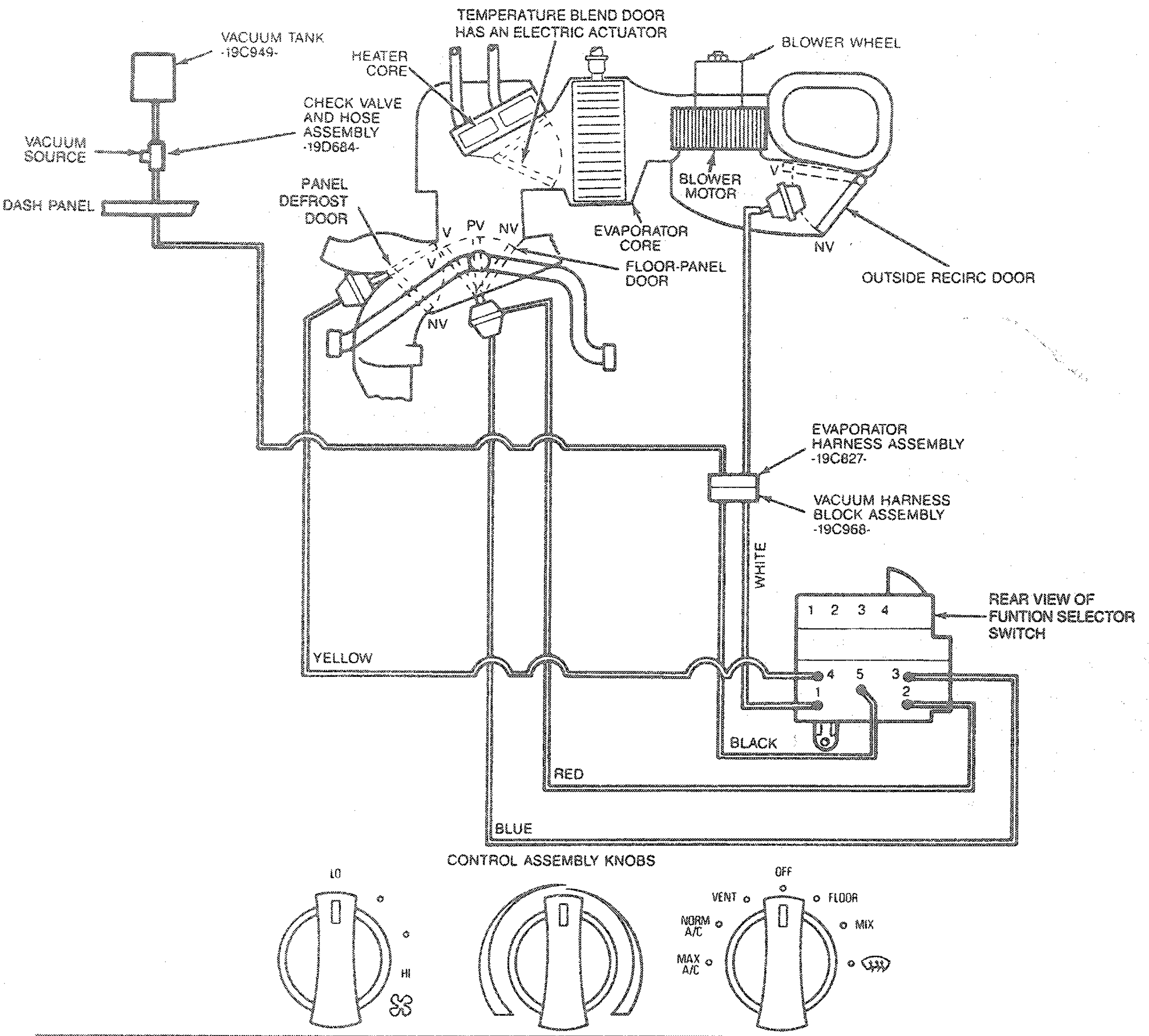
Vacuum System

To test the A / C-heater control system, start the engine and rotate the function selector control knob slowly from one position to another. A momentary hiss sound should be heard as the function control knob is rotated indicating that vacuum is available at the control assembly. A continuous hiss at the control assembly indicates a major leak **somewhere** in the system. It **does not** necessarily indicate that the leak is at the control assembly.

If a momentary hiss **cannot** be heard when the function selector control knob is rotated from one position to another, check for a kinked, pinched or disconnected vacuum supply hose. Also inspect the check valve between the intake manifold and the vacuum reservoir to ensure it is working properly.

DIAGNOSIS AND TESTING (Continued)

A/C System Schematic and Vacuum Control Chart



FUNCTION SELECTOR KNOB POSITION	OUTSIDE-RECIRC. AIR DOOR	FLOOR-PANEL DOOR	PANEL-DEFROST DOOR	BLOWER MOTOR
MAX — A/C	V	NV	V	ON
NORM — A/C	NV	NV	V	ON
VENT	NV	NV	V	ON
OFF	V	V	V	OFF
FLOOR	NV	V	NV	ON
MIX	NV	PV	NV	ON
DEFROST	NV	NV	NV	ON
VACUUM HOSE COLOR CODE	WHITE	RED / BLUE①	YELLOW	—

①BLUE — PARTIAL VACUUM; BLUE AND RED — FULL VACUUM

CCL 2608-F

DIAGNOSIS AND TESTING (Continued)

If a momentary hiss can be heard when the function selector knob is rotated from one position to another, vacuum is available at the control assembly, then cycle the function selector control knob through each position with the blower on HI and check the location(s) of the discharge air. The airflow schematic and vacuum control chart shows the vacuum motors applied for each position of the function control knob along with a system airflow diagram. The airflow diagram shows the position of each door when vacuum is applied and the no-vacuum position. Using this chart, airflow for each position of the control assembly can be determined. If a vacuum motor fails to operate, the motor can readily be found because the airflow will be incorrect.

If a vacuum motor is inoperative, check the operation of the motor with Rotunda Vacuum Tester 021-00014 or equivalent. If the vacuum motor operates properly, the vacuum hose is probably pinched, kinked, disconnected or has a hole in it.

If the vacuum system functions normally at idle but goes to defrost during acceleration, a small leak exists in the system. The leak can be located by turning off the engine and using a gauge to check for vacuum delay while selectively blocking off vacuum hoses.

Refrigerant System

System Using Refrigerant R-134a

The major components of R-134a A/C systems are similar to those used previously on Ford R-12 fixed orifice tube type systems. R-12 and R-134a components are similar in design and function. As a result, all Diagnosis and Testing procedures for R-12 components can be used for R-134a components. However, it is very important to note that R-134a system components can only be replaced with other R-134a components. R-134a components cannot be replaced with components used with R-12 systems. The same is true for R-12 components: they cannot be replaced with R-134a components.

CAUTION: R-12 and R-134a components are not interchangeable. Do not replace components from an R-134a system with components for an R-12 system. Also, do not replace components from an R-12 system with components for an R-134a system. Mixing components from these two types of systems may cause component failure and damage to the A/C system.

The best way to diagnose a condition in the refrigerant system is to note the system pressures (shown by the manifold gauges) and the clutch cycle rate and times. Then, compare the findings to the following charts.

- The system pressures are low (compressor suction) and high (compressor discharge).
- A clutch cycle is the time the clutch is engaged plus the time it is disengaged (time on plus time off).
- Clutch cycle times are the lengths of time (in seconds) that the clutch is ON and OFF.

R-134a Special Servicing Equipment

R-134a systems require the use of special servicing equipment designed specially for R134a systems. R-12 servicing equipment cannot be used when servicing R-134a A/C systems. R-134a special servicing equipment includes:

- R-134a Manifold gauge set
- R-134a Charging station
- R-134a Reclaimation system
- R-13a Leak detector

For more information on R-134a special tools and equipment, refer to the Rotunda Equipment Catalog.

CAUTION: Do not use R-12 Special Tools and Equipment when servicing an R-134a system. Also, do not use R-134a Special Tools and Equipment when servicing an R-12 system. Doing so may cause damage to the A/C system. Refer to the Rotunda Equipment Catalog for more information on R-134a Special Servicing Equipment.

Test equipment must be connected to the refrigerant system in order to make system tests. If a charging station is used, follow the instructions of the station manufacturer.

DIAGNOSIS AND TESTING (Continued)

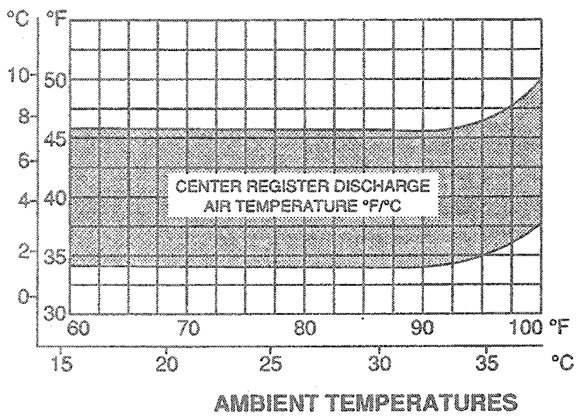
Normal Fixed Orifice Tube Refrigerant System Pressure Temperature Relationships

IMPORTANT TEST REQUIREMENTS

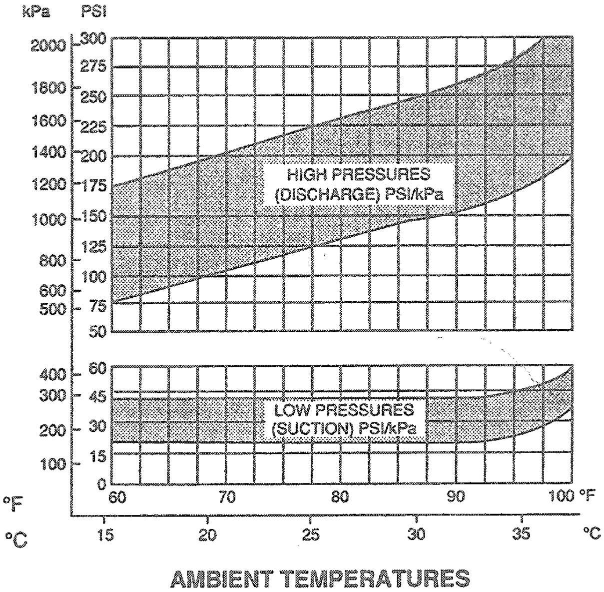
The following test conditions must be established to obtain accurate clutch cycle rate and cycle time readings:

- Run engine at 1500 rpm for 10 minutes.
- Operate A/C system on max A/C (recirculating air).
- Run blower at max speed.
- Stabilize in-car temperature ° 70° F. to 80° F. (21° C. to 22, C.).

NORMAL CENTER REGISTER DISCHARGE TEMPERATURES



NORMAL FIXED ORIFICE TUBE CYCLING CLUTCH REFRIGERANT SYSTEM PRESSURES



CCL 2839-C

DIAGNOSIS AND TESTING (Continued)

Normal Fixed Orifice Tube Refrigerant System Clutch Cycle Timing Rates

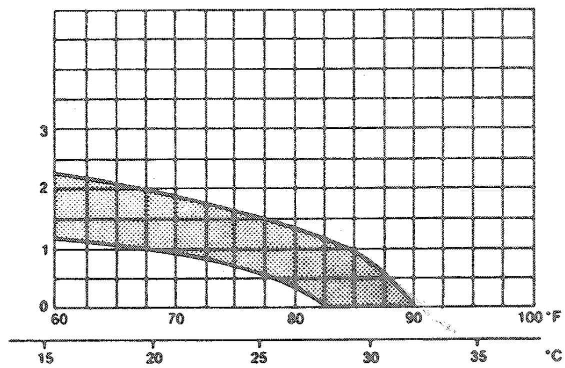
IMPORTANT — TEST REQUIREMENTS

The following test conditions must be established to obtain accurate clutch cycle rate and cycle time readings:

- Run engine at 1500 rpm for 10 minutes.
- Operate A/C system on max A/C (recirculating air).
- Run blower at max speed.
- Stabilize in car temperature @ 70°F to 80°F (21°C to 22°C).

NORMAL CLUTCH CYCLE RATE PER MINUTE

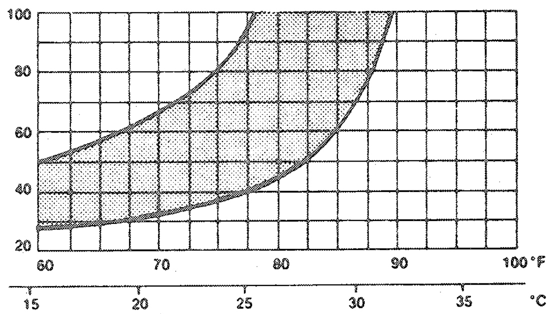
CYCLES/MINUTE



AMBIENT TEMPERATURES

SECONDS

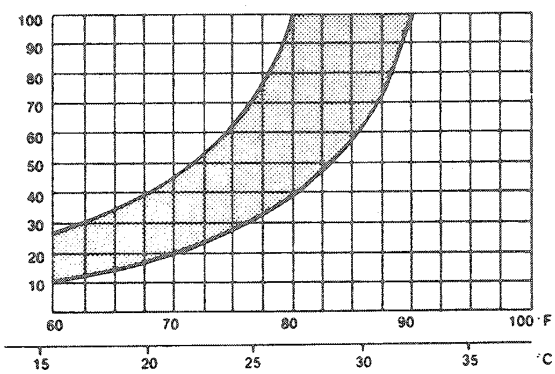
TOTAL CLUTCH CYCLE TIME — SECONDS



AMBIENT TEMPERATURES

SECONDS

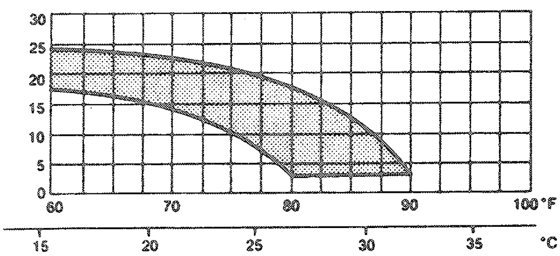
NORMAL CLUTCH ON TIME — SECONDS



AMBIENT TEMPERATURES

SECONDS

NORMAL CLUTCH OFF TIME — SECONDS



AMBIENT TEMPERATURES

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The following procedure is recommended for achieving accurate diagnosis results in the least amount of time.

NOTE: Steps 10 through 14 **DO NOT** apply to systems using refrigerant R-134a.

DIAGNOSIS AND TESTING (Continued)

1. Connect a manifold gauge set, part of Rotunda Air Conditioning Service Kit 063-00010 or equivalent, to the system. Purge air from red and blue hoses by loosening fittings at gauge set. Open only long enough for air to escape and then tighten fittings.

   NOTE: The test conditions, specified at the top of each chart, must be met to obtain accurate test results.
2. Start the engine and turn ON A/C system.
3. As soon as the system is stabilized, record the high- and low-pressures as shown by the manifold gauges. Normally the suction pressure should decrease to a range between 22 and 28 psi and the pressure switch should open. When the pressure switch opens, the suction pressure should start to rise to a range between 40 and 47 psi. Somewhere between 40 and 47 psi, the pressure switch should close and the suction pressure should start to drop.

   The discharge (high) pressure should operate the reverse of the suction pressure. When the suction pressure is dropping the discharge pressure should increase. When the suction pressure is increasing, the discharge pressure should decrease.
4. Determine the clutch cycle rate per minute (clutch on time plus off time is a cycle).
5. Record clutch OFF time in seconds.
6. Record clutch ON time in seconds.
7. Record center register discharge temperature.
8. Determine and record ambient temperatures.
9. Compare test readings with applicable previous charts.
   - Plot a vertical line for recorded ambient temperature from scale at bottom of each chart to top of each chart.
   - Plot a horizontal line for each of the other test readings from scale at LH side of appropriate chart.
10. Disconnect the electrical connector at the clutch cycling pressure switch and remove the switch from the switch fitting.
11. Install a new clutch cycling pressure switch and O-ring on the Tee-Adapter Tool. Leave it on the adapter as a permanent part of the tool. Be sure to lubricate the O-ring before installation.
12. Install the Tee Adapter Tool on the clutch cycling pressure switch fitting and tighten it securely.
13. Connect the low-pressure hose of the manifold gauge set to the side fitting of the Tee Adapter Tool.
14. Connect the electrical connector to the clutch cycling pressure switch on the Tee Adapter Tool.

With the Tee Adapter Tool installed in this manner, the refrigerant system can be operated under normal conditions with clutch cycling pressure switch control and evaporator (suction) pressure can be observed. This will give a more accurate low-pressure reading than can be obtained from a low-pressure gauge port located in the suction line or near the the compressor.

After completing service, disconnect the manifold gauge set from the Tee Adapter Tool. Disconnect the electrical connector from the clutch cycling pressure switch on the tool and remove the tool from the pressure switch fitting. Install the removed clutch cycling pressure switch and connect the electrical connector.

Always replace the protector caps on the gauge port valves after servicing the refrigerant system.

At the bottom of the chart, additional cause components are listed for poor compressor operation or a damaged compressor condition.

DIAGNOSIS AND TESTING (Continued)

Refrigerant System Pressure and Clutch Cycle Timing Evaluation Chart—Fixed Orifice Tube/Clutch Cycling Pressure Switch

REFRIGERANT SYSTEM PRESSURE AND CLUTCH CYCLE TIMING EVALUATION CHART FOR FIXED ORIFICE TUBE CYCLING CLUTCH SYSTEMS

NOTE: System test requirements must be met to obtain accurate test readings for evaluation. Refer to the normal refrigerant system pressure/temperature and the normal clutch cycle rate and times charts.

<table>
<tr><th rowspan="2">HIGH (DISCHARGE) PRESSURE</th><th rowspan="2">LOW (SUCTION) PRESSURE</th><th colspan="3">CLUTCH CYCLE TIME (b)</th><th rowspan="2">COMPONENT — CAUSES</th></tr>
<tr><th>RATE</th><th>ON</th><th>OFF</th></tr>
<tr><td>HIGH</td><td>HIGH</td><td colspan="3" rowspan="4">CONTINUOUS RUN</td><td>CONDENSER — Inadequate Airflow
Refrigerant overcharge</td></tr>
<tr><td>HIGH</td><td>NORMAL TO HIGH</td><td>ENGINE OVERHEATING</td></tr>
<tr><td>NORMAL TO HIGH</td><td>NORMAL</td><td>REFRIGERANT OVERCHARGE (a)
AIR IN REFRIGERANT.
HUMIDITY OR AMBIENT TEMP. VERY HIGH (b).</td></tr>
<tr><td>NORMAL</td><td>HIGH</td><td>FIXED ORIFICE TUBE — Missing
O-Rings Leaking/Missing</td></tr>
<tr><td>NORMAL</td><td>NORMAL</td><td>SLOW OR NO CYCLE</td><td>LONG OR CONTINUOUS</td><td>NORMAL OR NO CYCLE</td><td>MOISTURE IN REFRIGERANT SYSTEM
EXCESSIVE REFRIGERANT OIL</td></tr>
<tr><td>NORMAL</td><td>LOW</td><td>SLOW</td><td>LONG</td><td>LONG</td><td>CLUTCH CYCLING SWITCH —
Low Cut-Out</td></tr>
<tr><td>NORMAL TO LOW</td><td>HIGH</td><td colspan="3" rowspan="2">CONTINUOUS RUN</td><td>Compressor — Low Performance</td></tr>
<tr><td>NORMAL TO LOW</td><td>NORMAL TO HIGH</td><td>A/C SUCTION LINE — Partially Restricted
or Plugged (c)</td></tr>
<tr><td rowspan="4">NORMAL TO LOW</td><td rowspan="4">NORMAL</td><td rowspan="4">FAST</td><td>SHORT</td><td>NORMAL</td><td>EVAPORATOR - Low or Restricted Airflow</td></tr>
<tr><td>SHORT TO VERY SHORT</td><td>NORMAL TO LONG</td><td>CONDENSER, FIXED ORIFICE
TUBE, OR A/C LIQUID LINE —
Partially Restricted or Plugged</td></tr>
<tr><td>SHORT TO VERY SHORT</td><td>SHORT TO VERY SHORT</td><td>LOW REFRIGERANT CHARGE</td></tr>
<tr><td>SHORT TO VERY SHORT</td><td>LONG</td><td>EVAPORATOR CORE —
Partially Restricted or Plugged</td></tr>
<tr><td>NORMAL TO LOW</td><td>LOW</td><td colspan="3">CONTINUOUS RUN</td><td>A/C SUCTION LINE — Partially Restricted
or Plugged. (d)
CLUTCH CYCLING SWITCH — Sticking Closed</td></tr>
<tr><td colspan="2">ERRATIC OPERATION OR COMPRESSOR NOT RUNNING</td><td>—</td><td>—</td><td>—</td><td>CLUTCH CYCLING SWITCH — Dirty Contacts
or Sticking Open.
POOR CONNECTION AT A/C CLUTCH CONNECTOR OR
CLUTCH CYCLING SWITCH CONNECTOR.
A/C ELECTRICAL CIRCUIT ERRATIC — See A/C
Electrical Circuit Wiring Diagram
A/C Cut Out -- By Engine Control Assembly (ECA)</td></tr>
<tr><td colspan="6">ADDITIONAL POSSIBLE CAUSE COMPONENTS
ASSOCIATED WITH INADEQUATE COMPRESSOR OPERATION</td></tr>
<tr><td colspan="6">• COMPRESSOR DRIVE BELT — Loose • COMPRESSOR CLUTCH — Slipping
• CLUTCH COIL Open — Shorted, or Loose Mounting
• CONTROL ASSEMBLY SWITCH — Dirty Contacts or Sticking Open
• CLUTCH WIRING CIRCUIT — High Resistance, Open or Blown Fuse
• COMPRESSOR OPERATION INTERRUPTED BY ENGINE COMPUTER</td></tr>
<tr><td colspan="6">ADDITIONAL POSSIBLE CAUSE COMPONENTS
ASSOCIATED WITH A DAMAGED COMPRESSOR</td></tr>
<tr><td colspan="6">• CLUTCH CYCLING SWITCH - Sticking Closed or Compressor Clutch Seized
• SUCTION ACCUMULATOR DRIER — Refrigerant Oil Bleed Hole Plugged
• REFRIGERANT LEAKS</td></tr>
<tr><td colspan="6">(a) Compressor may make noise on initial run. This is slugging condition caused by excessive liquid refrigerant.
(b) Compressor clutch may not cycle in ambient temperatures above 80°F depending on humidity conditions.
(c) Low pressure reading will be normal to high if pressure is taken at accumulator and if restriction is downstream of service access valve.
(d) Low pressure reading will be low if pressure is taken near the compressor and restriction is upstream of service access valve.</td></tr>
</table>

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DIAGNOSIS AND TESTING (Continued)

The diagnosis charts provide the most direct and sure way to determine the cause of any concern in a poorly performing refrigerant system.

After servicing and correcting a refrigerant system concern, take additional pressure readings and observe the clutch cycle rate while meeting the conditional requirements to ensure the concern has been corrected.

In ambient temperatures above 27°C (80°F), the compressor clutch will not normally cycle off. This will depend on local conditions and engine/vehicle speed. Also, clutch cycling will normally not occur when the engine is operating at curb idle speed.

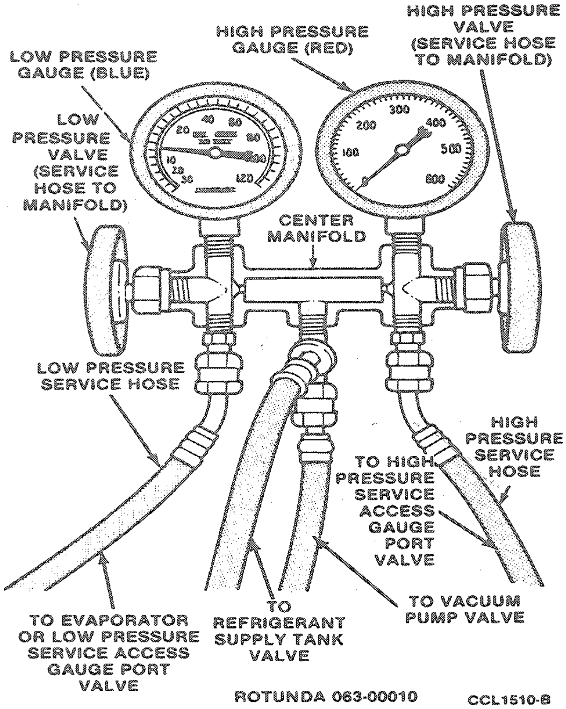
If the system contains no refrigerant or is extremely low on refrigerant, the clutch will not engage for compressor operation. A rapid cycling compressor clutch is usually an indication that the system is low on refrigerant. Refer to Insufficient or No A/C Cooling—Fixed Orifice Tube Cycling Clutch System Diagnosis chart.

Checking for Leaks

WARNING: GOOD VENTILATION IS NECESSARY IN THE AREA WHERE A/C LEAK TESTING IS TO BE DONE. IF THE SURROUNDING AIR IS CONTAMINATED WITH REFRIGERANT GAS, THE LEAK DETECTOR WILL INDICATE THIS GAS ALL THE TIME. ODORS FROM OTHER CHEMICALS SUCH AS ANTIFREEZE, DIESEL FUEL, DISC BRAKE CLEANER OR OTHER CLEANING SOLVENTS CAN CAUSE THE SAME CONCERN. A FAN, EVEN IN A WELL VENTILATED AREA, IS VERY HELPFUL IN REMOVING SMALL TRACES OF AIR CONTAMINATION THAT MIGHT AFFECT THE LEAK DETECTOR.

Attach the manifold gauge set. Leave both manifold gauge valves at the maximum clockwise (closed) position. Both gauges should show approximately 413-551 kPa (60-80 psi) at 24°C (75°F) with engine not running. If very little or no pressure is indicated, leave the vacuum pump valve closed, open the Refrigerant-12 cylinder valve, and set the low-pressure (suction) manifold gauge valve to the counterclockwise position. This opens the system to cylinder pressure.

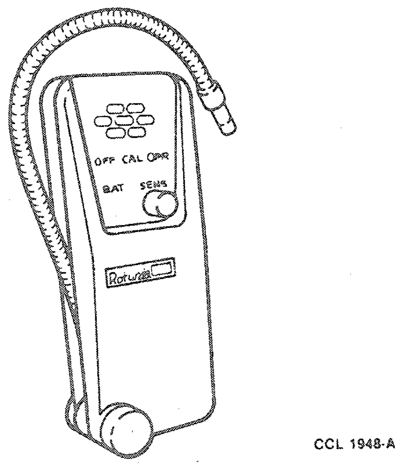
Manifold Gauge Set



Check all system connections, the compressor head gasket and shaft seal for leaks, using a good leak detector. Pass the leak detector along the underside of all points being checked. Refrigerant is heavier than air and will show most readily in those locations.

Use Rotunda Electronic Leak Detector 055-00014, 055-00015 or equivalent (R-12 systems only, systems with refrigerant R134a require different equipment).

R-12 Leak Detector—Electronic 055-00014 or 055-00015



DIAGNOSIS AND TESTING (Continued)

The electronic leak detector is operated by moving the control switch to the ON position. The detector automatically calibrates itself when it is turned on. Move the probe approximately 25mm (1 inch) per second in the suspected area. When escaping refrigerant gas is located, the ticking / beeping signal will increase in ticks / beeps per second. If the gas is relatively concentrated the signal will be increasingly shrill. Follow the instructions included with the detector to improve handling and operating techniques.

Leak Tracer Dye

Tools Required:

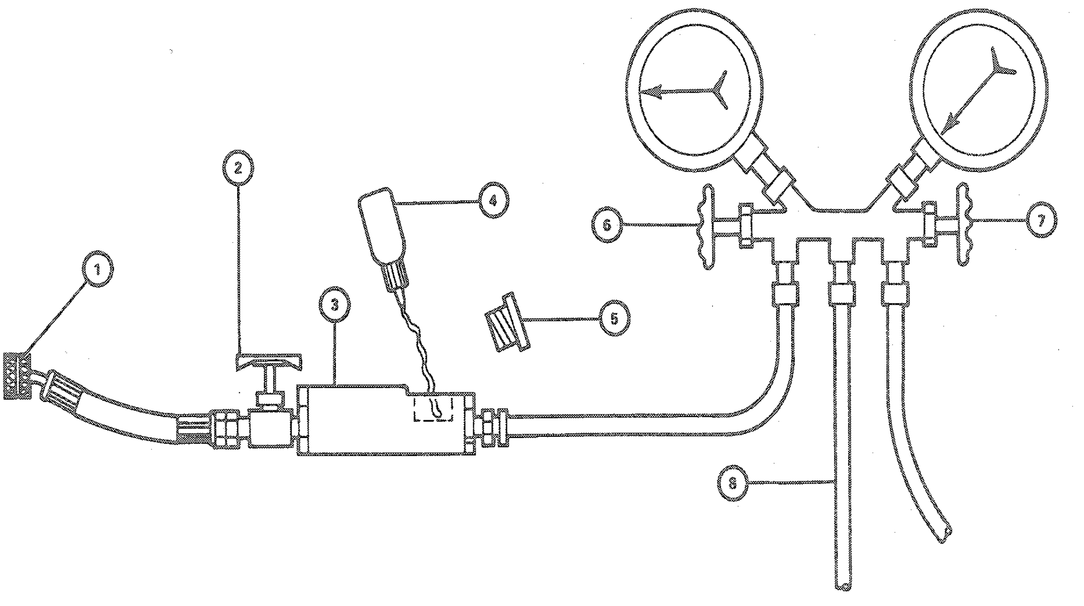
- Rotunda Fluoro-Lite Tracer Dyes 112-00027
- Rotunda A / C Tracer Dye Injector 112-00028
- Rotunda Ultraviolet Lamp 112-00021

NOTE: Rotunda Fluoro-Lite Leak Tracer Dye **CANNOT** be used in systems with refrigerant R-134a.

Rotunda Fluoro-Lite 112-00027 or equivalent may also be used to detect refrigerant leaks. With the tracer dye in the system, use Rotunda Ultraviolet lamp 112-00021 or equivalent to find the leak or leaks. The tracer dye will glow a bright yellow / green color at the point of refrigerant leakage when the light is directed toward the leak. If the system pressure is above 60 psi, there is no need to add refrigerant to the system for this operation.

Rotunda Fluoro-Lite tracer dye may be introduced into the A / C system using Rotunda A / C Tracer Dye Injector 112-00028 or equivalent. Inject the dye and check for leaks as follows:

Tracer Dye Injector 112-00028



ITEM	DESCRIPTION
1.	TO LOW PRESSURE SERVICE PORT
2.	RESERVOIR VALVE
3.	TRACER DYE RESERVOIR (1/4 OZ. CAPACITY)
4.	FLUORO-LITE TRACER DYE
5.	RESERVOIR CAP
6.	LOW PRESSURE VALVE
7.	HIGH PRESSURE VALVE
8.	TO R-12 CYLINDER

DIAGNOSIS AND TESTING (Continued)

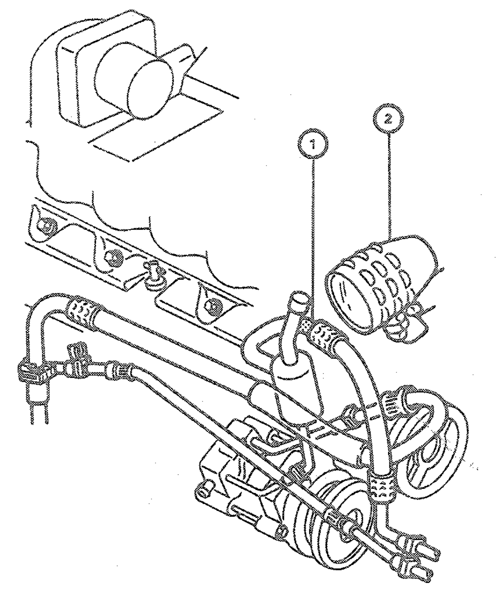
1. Close valve on dye injector.
2. Connect the hose end of the dye injector to the system low pressure gauge port valve. Tighten securely.
3. Close both valves on manifold gauge set and connect the center hose to a charging cylinder. Leave center hose loose at manifold gauge set. Momentarily open charging cylinder valve to purge air out of the center hose, then tighten the center hose at the manifold gauge set connection. Close the valve on the charging cylinder.
4. Connect manifold gauge set low pressure hose to dye injector, leaving the connection at the manifold gauge set loose.
5. Open dye injector valve to allow A/C system pressure to purge air from the dye injector reservoir and the low pressure hose to the manifold gauge set. Tighten the hose connection at the manifold gauge set. Close valve on dye injector.

   CAUTION: Do not overfill.
6. Remove reservoir cap from top of the dye injector and fill reservoir with 1/4 ounce of Fluoro-Lite tracer dye.
7. Replace reservoir cap and tighten securely.
8. Open valve on charging cylinder, then open manifold gauge low pressure valve. Open valve on dye injector for 5 to 10 seconds to allow the dye to be forced into the A/C system. Close dye injector valve. Close manifold gauge low pressure valve and valve on charging cylinder.
9. Start engine and operate the A/C system at MAX to stabilize the system (approximately 10-15 minutes).

   NOTE: Small leaks may require considerably longer before the tracer becomes evident under the ultraviolet light.
10. Shut OFF engine.
11. Disconnect all hoses slowly to dissipate any residual refrigerant pressure that may be present.
12. Using Rotunda Ultraviolet Lamp 112-00021 or equivalent, check system for leaks. The tracer dye will glow a bright yellow/green when the ultraviolet light hits it.

    NOTE: Periodically lubricate dye injector reservoir valve stem with refrigerant oil.

Ultraviolet Lamp 112-00021



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ITEM	DESCRIPTION
1.	PRESENCE OF DYE INDICATES LEAK HERE
2.	ULTRAVIOLET LIGHT ROTUNDA NO. 112-00021

Evaporator Core and Condenser On-Vehicle Leak Test

Tools Required:

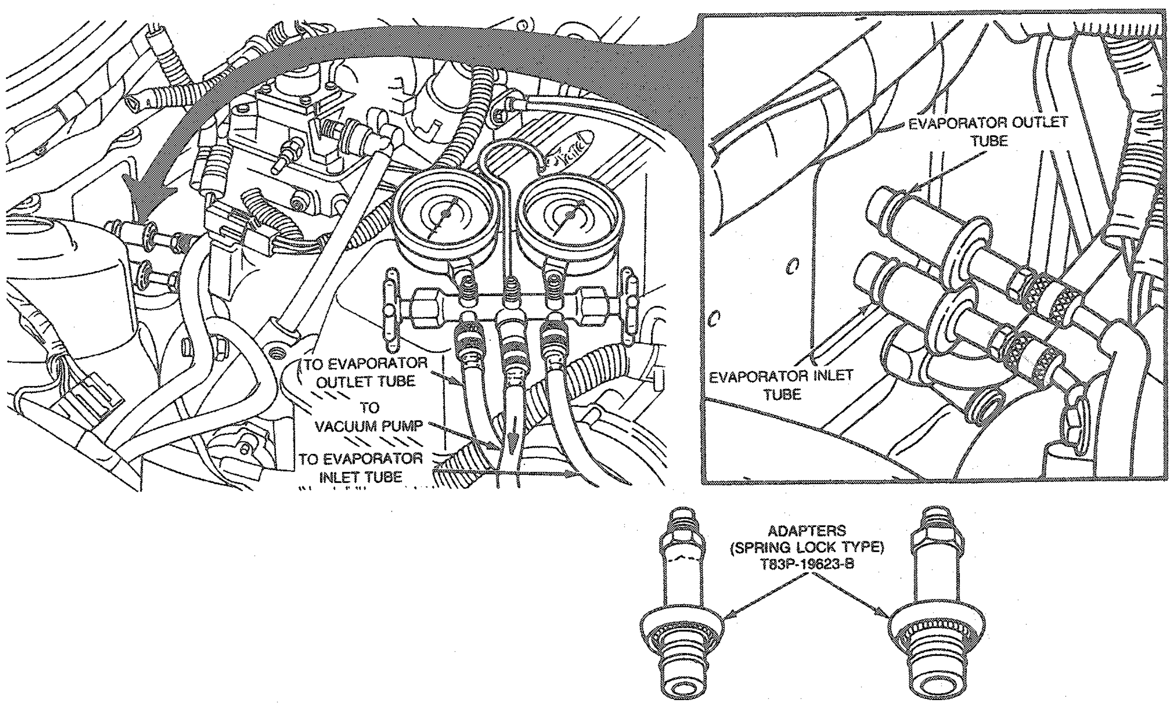
- Rotunda A/C Refrigerant Reclaim System 078-00800
- Leak Test Adapter Kit D88P-19703-B

If an evaporator core or condenser is suspected of leaking, the leak must be verified prior to removing the component from the vehicle. This leak test should be performed as outlined below. **DO NOT** rely solely on the results of an electronic leak detector as chemicals other than R-12 will activate the leak detector.

1. Remove the refrigerant from the system, with a refrigerant recovery machine such as the Rotunda A/C Reclaim system (078-00800) or equivalent following the recommended service procedure.
2. Disconnect the inlet and outlet connections from the evaporator core or condenser. Immediately install protective caps on the removed connections to prevent excess moisture from entering the system.
3. Install the mating adapters from the evaporator core/condenser Leak Test Adapter Kit, Tool D88P-19703-B, on both fittings of the component being tested.

DIAGNOSIS AND TESTING (Continued)

Evaporator Core / Condenser Leak Test Adapter Kit D88P-19703-B



4. Connect the two outside hoses of a manifold gauge set to the adapter fittings. Be sure the connections are tight.
5. Connect the center hose of the manifold gauge set to a vacuum pump. Start the vacuum pump and open the valves of the gauge set.
6. Operate the vacuum pump and watch the low pressure gauge. It should show almost 30 in-Hg within one or two minutes. Then, close the gauge set valves and stop the vacuum pump.
7. Observe the low pressure gauge for fifteen minutes and watch for a drop in the gauge reading. If a slow leak is suspected, leave component connected to gauge set overnight. If the gauge reading drops, the component is leaking and should be replaced. If the gauge reading does NOT drop, the component is not leaking. Look elsewhere for the source of the leak.
8. Disconnect the vacuum pump, manifold gauge set and the adapters from the component being tested.
9. Assemble the original component into the system if it was not leaking. Use new green O-rings lubricated with clean refrigerant oil.
10. If the component was leaking, install a new part and a new suction accumulator. Use new green O-rings lubricated with clean refrigerant oil.
11. Leak test, evacuate and charge the system following the recommended service procedures.

DIAGNOSIS AND TESTING (Continued)

PINPOINT TEST A:
INSUFFICIENT OR NO A/C COOLING—FIXED ORIFICE TUBE CYCLING CLUTCH SYSTEM

TEST STEP		RESULT	ACTION TO TAKE
A1	VERIFY THE CONDITION		
	• Check system operation. • **Does system cool properly?**	Yes ▶	INSTRUCT vehicle owner on proper use of the system.
		No ▶	GO to **A2**.
A2	CHECK A/C COMPRESSOR CLUTCH		
	• **Does the A/C compressor clutch engage?**	Yes ▶	GO to **A3**.
		No ▶	REFER to clutch circuit diagnosis in this section.
A3	CHECK OPERATION OF COOLING FAN		
	• Check to ensure electro-drive cooling fan runs when the A/C compressor clutch is engaged. • **Is cooling fan operational?**	Yes ▶	GO to **A4**.
		No ▶	REFER to engine cooling fan circuit diagnosis, Section 03-03.
A4	COMPONENT CHECK		
	• Underhood check of the following: — Loose, missing or damaged compressor drive belt. — Loose or disconnected A/C clutch or clutch cycling pressure switch wires/connectors. — Disconnected resistor assembly. — Loose vacuum lines or misadjusted control cables. • Inside vehicle check for: — Blown fuse/proper blower motor operation. — Vacuum motors/temperature door movement—full travel. — Control electrical and vacuum connections. • **Are components OK?**	Yes ▶	GO to **A6**.
		No ▶	SERVICE and GO to **A5**.
A5	CHECK SYSTEM		
	• Check system operation. • **Does system operate properly?**	Yes ▶	Condition corrected. GO to **A1**.
		No ▶	GO to **A6**.

DIAGNOSIS AND TESTING (Continued)

PINPOINT TEST A:
INSUFFICIENT OR NO A/C COOLING—FIXED ORIFICE TUBE CYCLING CLUTCH SYSTEM (Continued)

TEST STEP		RESULT	ACTION TO TAKE
A6	CHECK COMPRESSOR CLUTCH		
	• Use refrigerant system pressure / clutch cycle rate and timing evaluation charts. • After preparing vehicle as follows: — Hook up manifold gauge set. — Set function control at MAX A/C. — Set blower switch on HIGH. — Set temperature lever full COLD. — Close doors and windows. — Use a thermometer to check temperature at center discharge register, record outside temperature. — Run engine at approximately 1500 rpm with compressor clutch engaged. — Stabilize with above conditions for 10-15 minutes. • Compare readings with normal system pressure ranges.	Compressor cycles very rapidly (5 seconds on) (5 seconds off) Suction pressure within limits	GO to A7.
		Clutch cycles within limits, system pressure within limits	System OK. GO to A1.
		Compressor runs continuously (normal operation in ambient temperature above 27°C (80°F) depending on humidity conditions)	GO to A8.
		Compressor cycles high or low ON above 259 kPa (52 psi) OFF below 144 kPa (20 psi)	REPLACE clutch cycling pressure switch. Do not discharge system. Switch fitting has Schrader valve. CHECK system. OK—GO to A1.
			NOT OK—RE-INSTALL original switch. GO to A7.
A7	CHECK SYSTEM		
	• Leak check system. • **Is system leaking?**	Yes	SERVICE, discharge, evacuate and charge system. System OK, GO to A1.
		No	CHECK for restricted orifice tube or liquid line, SERVICE if necessary. GO to A1.
A8	CHECK CLUTCH CYCLING		
	• Disconnect blower motor wire and check for clutch cycling off at 152 kPa (22 psi) (suction pressure).	Clutch cycles OFF at 152-193 kPa (22-28 psi)	If ambient temperature is below 27°C (80°F) RECYCLE refrigerant-12 and charge to specified weight. If temperature is above 27°C (80°F), system is OK. GO to A1.
		Pressure falls below 152 kPa (22 psi)	REPLACE clutch cycling pressure switch. Do not discharge system. Switch fitting has Schrader valve. System OK, GO to A1.

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DIAGNOSIS AND TESTING (Continued)

Operation of the A/C compressor clutch is dependent on the ambient temperature and signals from the engine computer. Strategies are programmed into the engine computer to interrupt A/C compressor operation when certain conditions exist. The A/C compressor clutch can be shut off (or kept off) for several seconds at engine start-up, at high engine speeds, during acceleration, when the engine coolant temperature exceeds a predetermined temperature and during low engine idle conditions (approximately 200 rpm below low idle specifications. Refer to the following diagnostic procedures and, if necessary, the Powertrain Control/Emissions Diagnosis Manual[1] to correct an inoperative compressor clutch condition.

NOTE: The ambient temperature must also be above approximately 50°F for A/C compressor operation.

PINPOINT TEST B:
A/C CLUTCH CIRCUIT DIAGNOSIS

TEST STEP		RESULT ▶	ACTION TO TAKE
B1	CHECK SYSTEM OPERATION		
	• Start engine. • Set the A/C control MAX A/C. Check battery voltage (if not 12.5 volts or more, refer to Charging System Diagnosis). • **Does clutch engage?**	Yes ▶ No ▶	Circuit functioning properly GO to **B2**.
B2	BY-PASS PRESSURE SWITCH		
	• Disconnect electrical connector from pressure switch on accumulator. Jumper the harness connector pins. Engine must be running and system set at MAX A/C. • **Does clutch engage?**	Yes ▶ No ▶	GO to **B3**. GO to **B4**.
B3	CHECK REFRIGERANT SYSTEM PRESSURES		
	• Connect gauge set to service ports and observe pressure. • **Does pressure measure above 50 psi?**	Yes ▶ No ▶	REPLACE clutch cycling pressure switch. GO to **B1**. CHECK refrigerant system for leaks. SERVICE leak test and charge as necessary. GO to **B1**.
B4	CHECK VOLTAGE AT PRESSURE SWITCH		
	• Check for battery voltage at pressure switch electrical connector 348 circuit (LG/P wire) to ground. • **Is there battery voltage?**	Yes ▶ No ▶	GO to **B8**. GO to **B5**.
B5	CHECK A/C CONTROL SWITCH		
	• Check for battery voltage at the A/C control switch 348 circuit (LG/P wire). • **Is there voltage?**	Yes ▶ No ▶	SERVICE wiring as necessary. GO to **B1**. GO to **B6**.
B6	CHECK EATC OR CONTROL ASSEMBLY OUTPUT VOLTAGE		
	• Check for battery voltage at: EATC Control Assembly Pin 25 (clutch output signal). A/C Control Assembly output. • **Is there voltage?**	Yes ▶ No ▶	CHECK circuit between control assembly and pressure switch for open. SERVICE as necessary. GO to **B1**. GO to **B6**.

1 Can be purchased as a separate item.

DIAGNOSIS AND TESTING (Continued)

PINPOINT TEST B:
A/C CLUTCH CIRCUIT DIAGNOSIS (Continued)

TEST STEP		RESULT	ACTION TO TAKE
B7	CHECK FUSE		
	• Check for voltage at fuse panel 295 circuit (LB/PK wire). Ignition switch must be in the run position. • Ignition switch must be in the run position. • **Is there voltage?**	Yes ▶	SERVICE wiring between control assembly and fuse. GO to **B1**.
		Less than 10 volts ▶	CHECK charging system operation and for high resistance in clutch circuit.
		No ▶	CHECK fuse. SERVICE circuit as required. CHECK diode in IRCM for short. (Pins 16 and 23). GO to **B1**.
B8	CHECK CLUTCH CIRCUITS		
	• Check for voltage across harness connector at clutch field coil. — A minimum of 10 volts is required. • **Are there 10 volts or more?**	Yes ▶	GO to **B9**.
		No ▶	GO to **B11**.
B9	JUMP FIELD COIL		
	• Disconnect field coil and jump battery voltage and ground to clutch field coil. • **Does clutch engage?**	Yes ▶	CLEAN coil electrical terminals and RETEST.
		No ▶	GO to **B10**.
B10	CHECK CLUTCH AIR GAP		
	• Check air gap between clutch hub and pulley. • **Is air gap within specified limits?**	Yes ▶	REPLACE clutch field coil.
		No ▶	RESET clutch air gap (see compressor section of shop manual). GO to **B10**.
B11	CHECK IRCM OUTPUT VOLTAGE		
	• Check for voltage between Pins 16 and 23 of the IRCM. — A minimum of 10 volts is required. • **Is voltage present?**	Yes ▶	CHECK clutch coil wiring harness for open circuit. SERVICE as necessary. GO to **B1**.
		No ▶	GO to **B12**.
B12	CHECK CLUTCH SIGNAL AT IRCM		
	• Check for minimum of 11 volts at Pin 21 of the IRCM (clutch input signal). • **Is voltage present?**	Yes ▶	GO to **B13**.
		No ▶	CHECK circuit between pressure switch and Pin 21 of IRCM for open. SERVICE as necessary.
B13	CHECK A/C CUT-OUT SIGNAL		
	• Remove RED wire from Pin 22 of IRCM harness connector. Start engine and set system set at MAX A/C. • **Does the clutch energize?**	No ▶	REPLACE the IRCM.
		Yes ▶	GO to **B14**.

DIAGNOSIS AND TESTING (Continued)

PINPOINT TEST B:
A/C CLUTCH CIRCUIT DIAGNOSIS (Continued)

TEST STEP		RESULT ▶	ACTION TO TAKE
B14	CHECK POWERTRAIN CONTROL MODULE (PCM) 12A650 INPUT SIGNAL		
	● Check for minimum of 11 volts at Pin 10 of PCM. ● **Is there voltage?**	▶	The PCM is causing the CCRM to energize and interrupt the compressor circuit. Any of the following can be cause. REFER to PCM diagnosis in Service Manual. — **Throttle Position Sensor** - Sending WOT signal PCM. Disconnect electrical connector to remove sensor from circuit. Clutch will engage if sensor is sending WOT cut-out signal. — **Hot Engine Coolant** - Sensor sending hot coolant signal to PCM. Disconnect electrical connector from sensor. Clutch will engage if sensor is sending hot coolant signal to PCM. — **A/C On Circuit to PCM Open** - If this circuit is open, PCM will not receive signal from pressure switch to turn A/C clutch on.

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Wiring Diagrams and Actuators

The following illustrations provide an EATC system wiring diagram.

NOTE: Refer to the Taurus/Sable Electrical Vacuum Troubleshooting Manual for complete circuit schematics and wire colors.

EATC Self Test

1. Perform the EATC Functional Test. Record all error codes displayed during the test.
2. The control assembly will detect electrical malfunctions occurring during the self test.
3. Ensure engine is warm (at least 49°C (120°F) coolant temperature). To display the error codes for the malfunction detected, initiate the self test by pushing OFF and FLOOR simultaneously and then AUTOMATIC within two seconds. The test may run as long as 20 seconds, during which time the display will be blank. If the display is blank for more than 20 seconds, go to System Diagnosis When Self-Test and Functional Test indicate NO ERROR.
4. The Self Test can be initiated at any time with the resulting error codes being displayed. Normal operation of the system stops when Self Test is activated. To exit self-test and restart the system, push the blue button. Self Test should be deactivated before turning off the system. Refer to the Error Code Key in the following chart for an explanation of error codes.
5. If error codes appear during the EATC Functional Test, follow the diagnosis procedures outlined in the Error Code Key for each error code recorded.
6. If a malfunction exists but no error code appears during the test in Step 1, refer to Diagnosis When Self-Test Indicates No Error Found.

DIAGNOSIS AND TESTING (Continued)

ERROR CODE KEY

Error Code	Detected Condition	Troubleshooting/Repair Procedure
01	Replace Control Assembly	
02	Blend Door Problem	• Refer to Blend Door Actuator Diagnosis
03	In-Vehicle Temp Sensor Open or Short	• Refer to In-Vehicle Temp Sensor Diagnosis
04	Ambient Temp Sensor Open or Short	• Refer to Ambient Temp Sensor Diagnosis
05	Sunload Sensor Short	• Refer to Sunload Sensor Diagnosis
888	Testing Complete—No Test Failure (All Segments On)	• Refer to EATC System Functional Check

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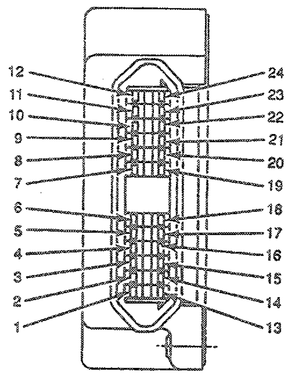
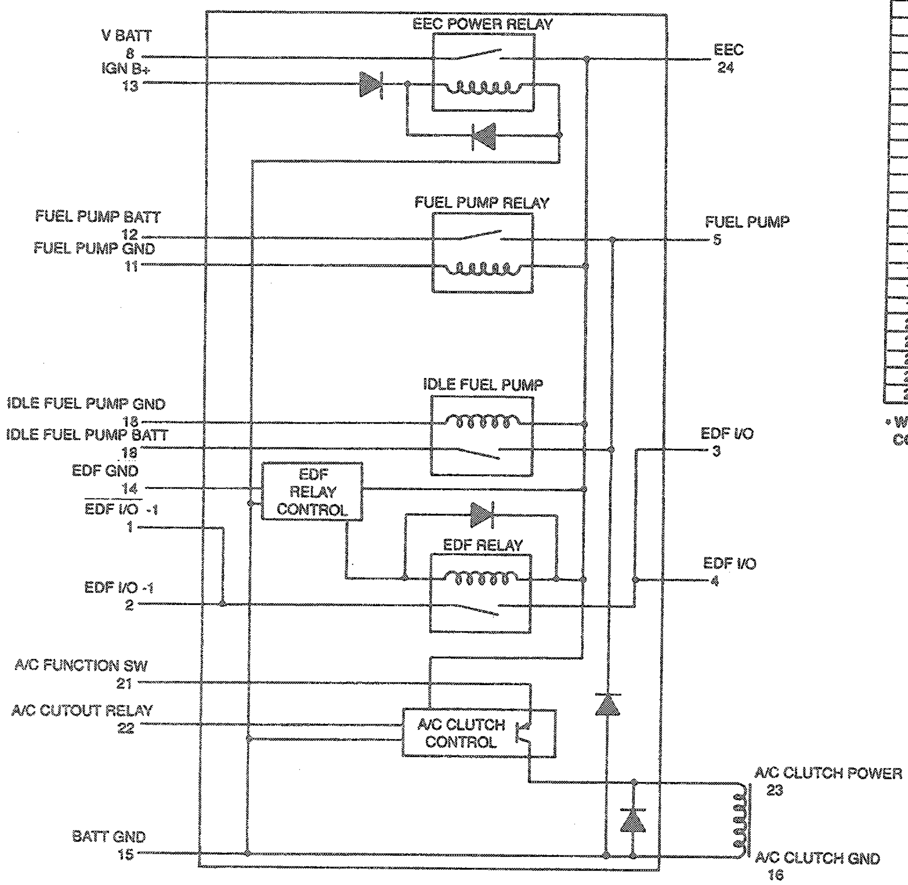
NOTE: The in-vehicle temperature must be greater than 10°C (50°F) for all error codes shown to be valid.

DIAGNOSIS AND TESTING (Continued)

CCRM Circuit and Pin-Outs

INTEGRAL CONNECTOR





TERM NO.	FUNCTION
1	EDF I/O-1
2	EDF I/O-1
3	EDF I/O
4	EDF I/O
5	FUEL PUMP
6	N. C.
7	N. C.
8	V BATT
9	EOL TEST
10	IDLE FUEL PUMP BATT
11	FUEL PUMP GND
12	FUEL PUMP BATT
13	IGN B+
14	EDF GND
15	BATT GND
16	A/C GND
17	N. C.
18	IDLE FUEL PUMP GND
19	EOL TEST
20	EOL TEST
21	A/C FUNCTION
22	A/C CUTOUT RELAY*
23	A/C CLUTCH
24	EEC PWR

* WIDE OPEN THROTTLE-A/C CONTROL SWITCH

NOTE: REFER TO THE EVTM PUBLICATION FOR COMPLETE CIRCUIT SCHEMATIC AND WIRE COLORS.

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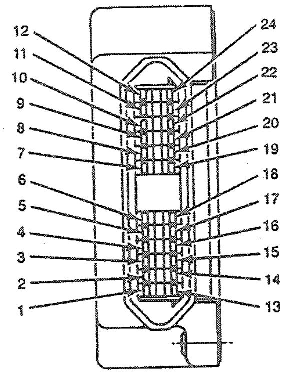
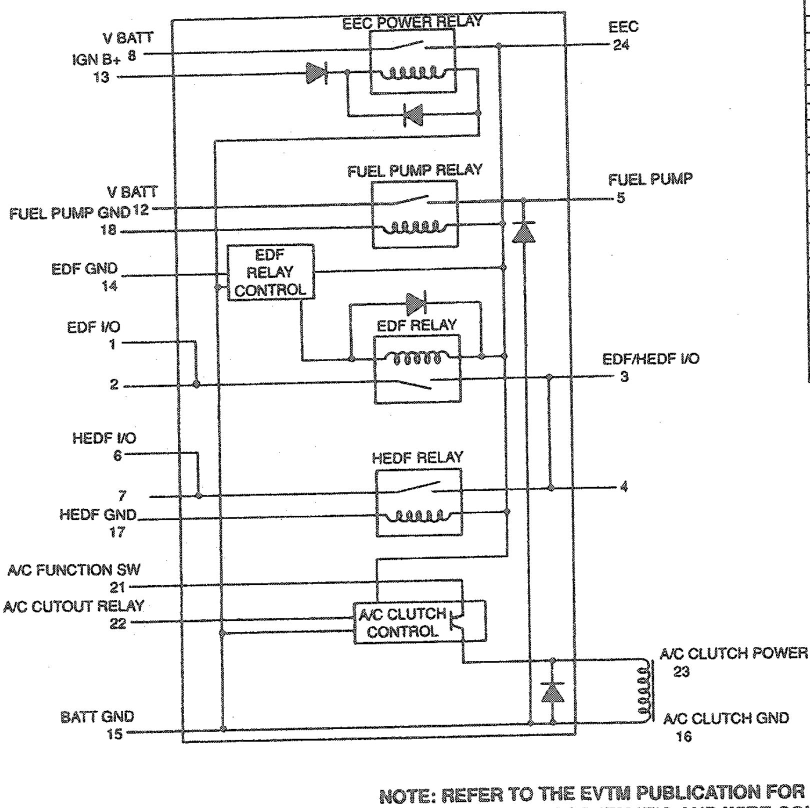
DIAGNOSIS AND TESTING (Continued)

INTEGRAL CONNECTOR





TERM NO.	FUNCTION
1	EDF I/O-1
2	EDF I/O-1
3	HEDF/EDF I/O
4	HEDF/EDF I/O
5	FUEL PUMP
6	HEDF I/O 2
7	HEDF I/O 2
8	V BATT
9	EOL TEST
10	N. C.
11	N. C.
12	FUEL PUMP BATT
13	IGN B+
14	EDF GND
15	BATT GND
16	A/C GND
17	HEDF GND
18	FUEL PUMP GND
19	EOL TEST
20	EOL TEST
21	A/C FUNCTION
22	A/C CUTOUT RELAY*
23	A/C CLUTCH
24	EEC PWR

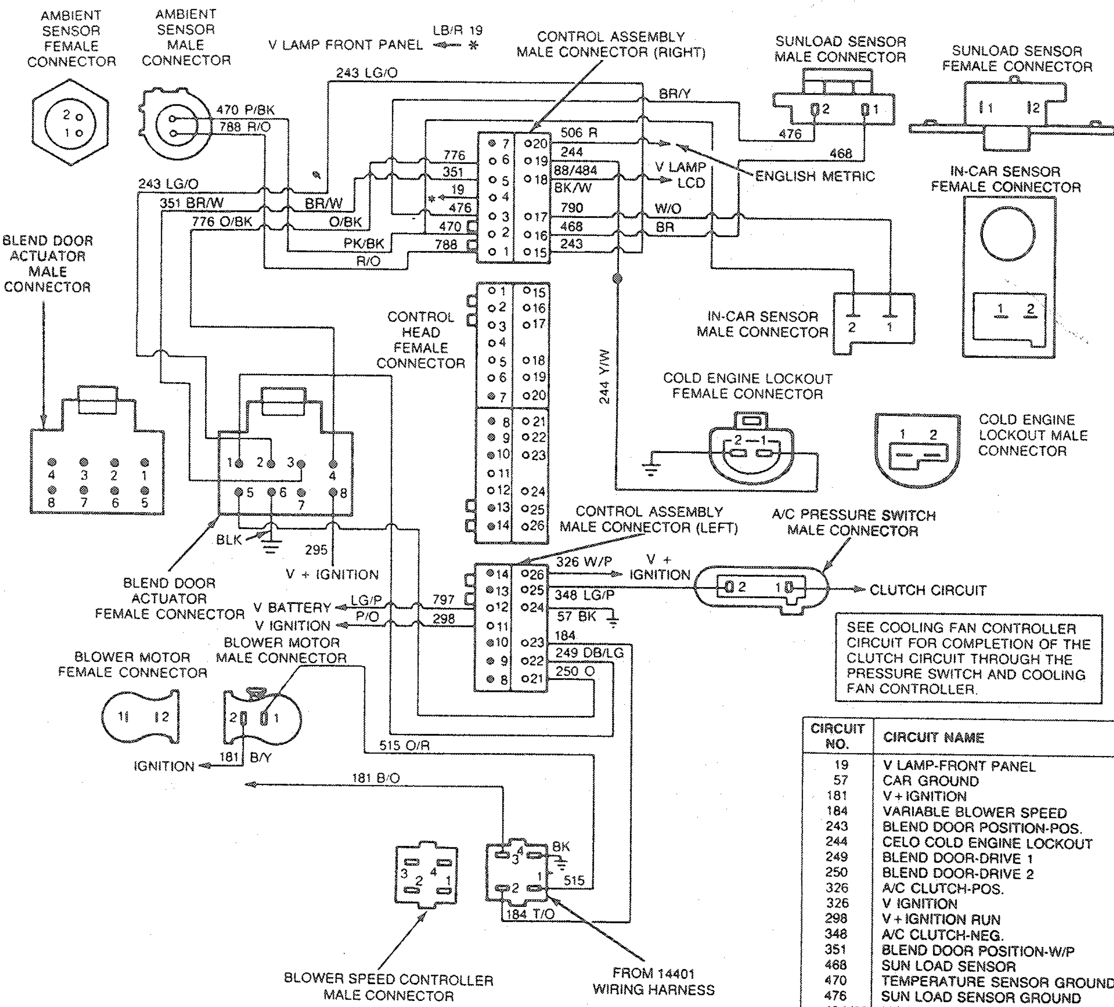
* WIDE OPEN THROTTLE-A/C CONTROL SWITCH

NOTE: REFER TO THE EVTM PUBLICATION FOR COMPLETE CIRCUIT SCHEMATIC AND WIRE COLORS.

CCL 3770-A

DIAGNOSIS AND TESTING (Continued)

EATC System Wiring Diagram



SEE COOLING FAN CONTROLLER CIRCUIT FOR COMPLETION OF THE CLUTCH CIRCUIT THROUGH THE PRESSURE SWITCH AND COOLING FAN CONTROLLER.

CIRCUIT NO.	CIRCUIT NAME
19	V LAMP-FRONT PANEL
57	CAR GROUND
181	V+IGNITION
184	VARIABLE BLOWER SPEED
243	BLEND DOOR POSITION-POS.
244	CELO COLD ENGINE LOCKOUT
249	BLEND DOOR-DRIVE 1
250	BLEND DOOR-DRIVE 2
326	A/C CLUTCH-POS.
326	V IGNITION
298	V+IGNITION RUN
348	A/C CLUTCH-NEG.
351	BLEND DOOR POSITION-W/P
468	SUN LOAD SENSOR
470	TEMPERATURE SENSOR GROUND
476	SUN LOAD SENSOR GROUND
484/88	V LAMP - VFD DISPLAY
506	ENGLISH-METRIC
515	BLOWER MOTOR
776	BLEND DOOR POSITION-NEG.
788	AMBIENT TEMPERATURE SENSOR
790	IN-CAR TEMPERATURE SENSOR
797	V+BATTERY

NOTE: REFER TO THE EVTM PUBLICATION FOR COMPLETE CIRCUIT SCHEMATIC AND WIRE COLORS.

CCL 3771-A

DIAGNOSIS AND TESTING (Continued)

EATC System Functional Test

- The EATC system functional test is designed to catch those system failures that the Self Test is unable to test.
- Ensure the engine is cold.
- The in-vehicle temperature should be greater than 10°C (50°F) for proper evaluation of system response.
- Refer to the following charts for testing instructions.

EATC SYSTEM FUNCTIONAL TEST

TEST STEP	RESULT	ACTION TO TAKE
1		
• Turn ignition switch to the RUN position. • Press the AUTOMATIC button. • Set control at 90°F setting. • **Does control display 90°F Auto?**	Yes ▶ No ▶	GO to 2. REFER to Diagnosis When Self-Test And Functional Test Indicate No Errors Found.
2		
• Verify that the blower does not come on. (Engine coolant temp. is less than 120°F). • **Does blower operate?**	Yes ▶ No ▶	REFER to CELO Inoperative. GO to 3.
3		
• Ensure that engine is warm (coolant temp. is greater than 120°F). • Set control at 75 setting. • **Does blower operate?**	Yes ▶ No ▶	GO to 4. REFER to Blower Speed Controller Diagnosis-No Blower.
4		
• Rotate blower thumbwheel fully down. • **Does blower go to low blower speed?**	Yes ▶ No ▶	GO to 5. REFER to Blower Speed Controller Diagnosis.
5		
• Rotate blower thumbwheel fully up. • **Does blower go to high blower speed?**	Yes ▶ No ▶	GO to 6. REFER to Blower Speed Controller Diagnosis.
6		
• Press the DEFROST button. • Verify that air is discharged from defroster nozzle with small bleed through the side window demistors. • Verify that the outside recirc door is in the outside air position. • **Are these conditions met?**	Yes ▶ No ▶	GO to 7. REFER to Vacuum System Diagnosis.
7		
• Press the FLOOR button. • Verify that the air is discharged through the floor ducts. • **Is this condition met?**	Yes ▶ No ▶	GO to 8. REFER to Vacuum System Diagnosis.
8		
• Press the VENT button. • Verify that the air is discharged through the panel registers. • **Is this condition met?**	Yes ▶ No ▶	GO to 9. REFER to Vacuum System Diagnosis.
9		
• Make sure that the ambient temperature is greater than 40°F. • Press the MAX A/C button. • Verify that the outside recirc door is in the recirc position. • **Is this condition met?**	Yes ▶ No ▶	GO to 10. REFER to Vacuum System Diagnosis.

DIAGNOSIS AND TESTING (Continued)

EATC SYSTEM FUNCTIONAL TEST (Continued)

TEST STEP	RESULT	▶	ACTION TO TAKE
10			
• Press the VENT button. • Verify that the VENT display is lit. • Verify that the clutch is off. • **Are these conditions met?**	Yes No	▶ ▶	GO to 11. REFER to Clutch Does Not Disengage When In OFF Diagnosis.
11			
• Press the MAX A/C button again. • Verify that the MAX A/C display is lit and that the clutch is on. • **Are these conditions met?**	Yes No	▶ ▶	GO to 12. REFER to No Clutch Operation Diagnosis.
12			
• Press the AUTOMATIC button.	Verify that the AUTO or function and fan VFDs are lit.	▶	REFER to Diagnosis When Self-Test And Functional Test Indicate No Errors Found.

TL5661E

Diagnosis When EATC Self Diagnostics Test Indicates No Errors Found

Refer to the chart below for symptoms, their possible causes and the test or service procedures required.

DIAGNOSIS WHEN SELF-TEST INDICATES NO ERRORS FOUND

CONDITION	POSSIBLE SOURCE	ACTION
• Cool Discharge Air When System is Set to AUTOMATIC and 90°F	• Heater system malfunction. • Blend door not in max. heat.	• Check coolant level. • Refer to heater system operating principles in appropriate Section (check engine thermostat). • Check position of blend door. • Check blend door shaft attachment. • Test per Blend Door Actuator Diagnosis (assume 2 was displayed in the Self-Test).
• Warm Discharge Air in Auto/60°F	• Clutch circuit malfunction. • Check refrigerant. • Blend door not in MAX. A/C position. • Outside/Recirc door not in recirc.	• Test clutch circuit per "No Clutch Operation" Diagnosis. • Check Refrigerant System Pressures. • Check position of blend door. • Check blend door shaft attachment. • Test per "Blend Door Actuator" Diagnosis (assume 2 was displayed in the Self-Test). • Test per "Vacuum Leak" Diagnosis.
• Cool Air in 85°F Max. Heat in 90°F	• Sensor shorted.	• TROUBLESHOOT according to Sensor Diagnosis.
• Heat in 65°F Max. Cool in 60°F	• Sensor open.	• TROUBLESHOOT according to Sensor Diagnosis.

DIAGNOSIS AND TESTING (Continued)

DIAGNOSIS WHEN SELF-TEST INDICATES NO ERRORS FOUND (Continued)

CONDITION	POSSIBLE SOURCE	ACTION
• No Blower	• Damaged CELO switch / wiring. • Damaged blower speed controller. • Damage HI blower relay. • Damaged control assembly. • Damaged blower motor. • Damaged wiring.	• Test per "No Blower" Section of Blower Speed Controller.
• High Blower Only	• Damaged control assembly. • Damaged blower controller. • Damaged wiring.	• Test per "High Blower Only" Section of Blower Speed Controller.
• Clutch is Engaged When System is Off	• Damaged control assembly. • Damaged wiring or interface components.	• Test according to "Clutch Does Not Disengage When in OFF". A/C Compressor Clutch Circuit Diagnosis.
• Control Assembly Digits and VFD Do Not Light Up, Blower Off	• Fuse. • Ignition Circuit 298 open. • Ignition Circuit 797 open. • Ground Circuit 57A open. • Damaged control assembly.	• Replace fuse. • Check Circuit 298. • Check Circuit 797. • Check Circuit 57A. • Replace control assembly.
• Cold Air is Delivered During Heating When Engine is Cold	• Damaged wiring. • Damaged or inoperative engine temperature switch.	• Place system at 90°F / Auto. With ignition off, ignition must be off when grounding Circuit 244 (for valid results) ground Circuit 244 at engine temp. switch. Start engine. If blower is off, replace cold engine lockout (CELO). If blower is on, check wiring. If OK, replace control assembly. • Replace engine temperature switch.
• Control Assembly Temperature Display Will Not Switch From Fahrenheit To Celsius grade When the E/M Trip Computer Button is Pushed	• Damaged or inoperative wiring tripminder or control assembly.	**CAUTION: Accidental shorting of the wrong pin could destroy the control assembly.** • Short Pin 20 of connector VA (Circuit 506) to ground. Turn on ignition. If the display does not switch from F to C, Circuit 506 is open at the control assembly and the control assembly is damaged. Otherwise check the wiring and the tripminder.
• System Does Not Control Temperature	• Sensor hose not connected to aspirator or sensor. • Aspirator not secured to evaporator case. • Sensor seal(s) missing or not installed properly. • Aspirator or sensor hose blocked with foreign material or kinked. • Damaged aspirator hose.	• Inspect and service. • Inspect and service. • Inspect and service. • Inspect and service. • Inspect and service.
• EATC Control Assembly Turns On and Off Erratically. No Control of System	• Damaged charging system. EATC will not function with too low or too high battery voltage.	• Check battery voltage. If battery voltage is less than 10 volts or greater than 16 volts, refer to charging system diagnosis, Section 14-00. Do not replace EATC control assembly.

TL7684B

DIAGNOSIS AND TESTING (Continued)

Sensor Diagnosis

Refer to the following charts for sensor diagnosis.

EATC—IN-VEHICLE TEMPERATURE SENSOR DIAGNOSIS

CONDITION	POSSIBLE SOURCE	ACTION
• Diagnostic-Test Error Code 03 (Warm air discharge at 65°F or cool air discharge at 85°F).	1. Sensor open or shorted.	• Disconnect wire harness connector at sensor. Measure resistance across sensor terminals and compare with Sensor Resistance Table below. • If resistance is out of specifications shown in the table, replace the sensor. If sensor is OK, GO to Step 2.
	2. Wire harness open or shorted.	• Disconnect battery cables. Disconnect wire harness connector from sensor and disconnect both connectors from control assembly. • Check for continuity and for possible shorting between the two wires (Pin 2 and Pin 17 of control assembly connector). Service if necessary. Reconnect wire harness and battery cables.

TL7685B

SENSOR RESISTANCE TABLE

APPROXIMATE TEMPERATURE	SENSOR RESISTANCE ACCEPTABLE RANGE
10°C to 20°C (50°F to 68°F)	37K to 58K ohms
20°C to 30°C (68°F to 86°F)	24K to 37K ohms
30°C to 40°C (86°F to 104°F)	16K to 24K ohms

TL6396B

EATC—AMBIENT TEMPERATURE SENSOR DIAGNOSIS

CONDITION	POSSIBLE SOURCE	ACTION
• Self-Diagnostics Error Code 04 and Outside Temperature Display is Reading—40°F or 140°F (Warm Air Discharge when set at 65°F or Cool Air Discharge when set at 85°F)	1. Sensor open or shorted.	• Disconnect battery cables (this is necessary to reset outside temperature display memory). Disconnect the wire harness connector ar sensor. Measure resistance across sensor terminal and compare with Sensor Resistance Table in In-Vehicle Temperature Sensor Diagnosis Chart. • If resistance is out of specifications shown in Sensor Resistance Table, replace sensor. If sensor is OK, GO to Step 2. Reconnect battery cables. NOTE: Install sensor and electrical connections before battery is reconnected.

DIAGNOSIS AND TESTING (Continued)

EATC—AMBIENT TEMPERATURE SENSOR DIAGNOSIS (Continued)

CONDITION	POSSIBLE SOURCE	ACTION
• Intermittent Heating and Cooling. Outside Temperature Display Sometimes Inaccurate	2. Sensor wire harness open or shorted.	• Disconnect battery cables. Disconnect wire harness connector from sensor and disconnect both connectors from the control assembly. • Inspect for crimped terminals. • Check for continuity and for possible shorting between the two wire (Pins 1 and 2). Service if necessary. Reconnect wire harness and battery cables.

TL6397C

EATC—SUNLOAD SENSOR DIAGNOSIS

CONDITION	POSSIBLE SOURCE	ACTION
• Self-Diagnostics Error Code 05	1. Sensor shorted.	• Disconnect battery cables. Disconnect wire harness connector at sensor and disconnect both connectors from control assembly. NOTE: Check the sensor for a short using an ohmmeter. Since the sensor is a Photodiode, there should be some unspecified resistance across the terminals dependent upon the available light in the area. The only test that should be made is for a short circuit (zero resistance). If resistance is zero ohms, replace the sensor. Check for continuity and for possible shorting between the two wires (Pin 3 and Pin 16). Repeat if necessary. Reconnect battery cables.

TL6398B

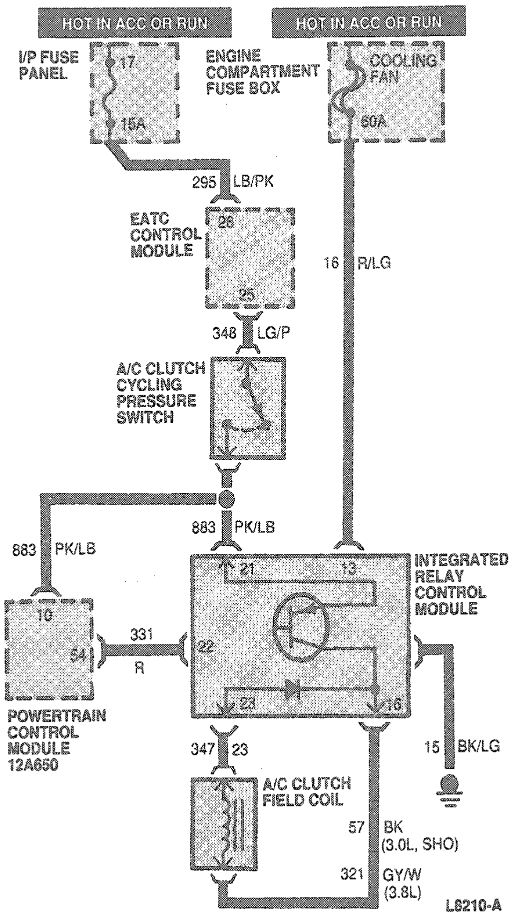
Compressor Clutch Circuit

Operation of the A/C compressor clutch is dependent on the ambient temperature and signals from the engine computer. The engine computer will interrupt A/C compressor operation when certain conditions exist. The A/C compressor clutch can be shut off (or kept off) for several seconds at engine start-up, at high engine speeds, during acceleration, when the engine coolant temperature exceeds a predetermined temperature and during low engine idle conditions. Refer to the following diagnostic procedures and, if necessary, the Powertrain Control/Emissions Diagnosis Manual[2] to correct an inoperative compressor clutch condition. The ambient temperature must also be above approximately 10°C (50°F) for the A/C compressor to operate.

2 Can be purchased as a separate item.

DIAGNOSIS AND TESTING (Continued)

Circuit Diagrams
3.0L, 3.8L SHO



PINPOINT TEST A
A/C COMPRESSOR CLUTCH CIRCUIT DIAGNOSIS

TEST STEP		RESULT	ACTION TO TAKE
A1	CHECK SYSTEM OPERATION		
	• Start engine. • Set the A/C control to MAX A/C. • Check battery voltage (if not 12.5 volts or more, refer to Section 14-00). • **Does clutch engage?**	Yes ▶ No ▶	Circuit functioning properly. **GO to A2.**
A2	BY-PASS PRESSURE SWITCH		
	• Disconnect electrical connector from pressure switch on accumulator. • Jumper harness connector pins. • Engine must be running and system set at MAX A/C. • **Does clutch engage?**	Yes ▶ No ▶	**GO to A3.** **GO to A4.**

DIAGNOSIS AND TESTING (Continued)

PINPOINT TEST A
A/C COMPRESSOR CLUTCH CIRCUIT DIAGNOSIS (Continued)

	TEST STEP	RESULT	▶ ACTION TO TAKE
A3	**CHECK REFRIGERANT SYSTEM PRESSURES** ● Connect gauge set to service ports and observe pressure. Reading should be above 50 psi. ● **Is pressure above 50 psi?**	Yes ▶ No ▶	REPLACE clutch cycling pressure switch. GO to **A1**. CHECK refrigerant system for leaks. SERVICE as necessary. GO to **A1**.
A4	**CHECK VOLTAGE AT PRESSURE SWITCH** ● Check for battery voltage at pressure switch electrical connector Circuit 348 (LG/P). ● **Is there voltage?**	Yes ▶ No ▶	GO to **A8**. GO to **A5**.
A5	**CHECK EATC CONTROL ASSEMBLY OUTPUT VOLTAGE** ● Check battery voltage at: — EATC Control Assembly Pin 25 (clutch signal output). — Circuit 348 (LG/P) of A/C Control Assembly. ● **Is there voltage?**	Yes ▶ No ▶	CHECK circuit between control assembly and pressure switch for open. SERVICE as necessary. GO to **A1**. GO to **A6**.
A6	**CHECK CONTROL ASSEMBLY INPUT VOLTAGE** ● Check for battery voltage at: — Pin 26 of EATC Control Assembly (clutch signal). — Circuit 295 (LB/PK) at A/C Control Assembly. ● **Is there voltage?**	Yes ▶ No ▶	REPLACE control assembly. GO to **A7**.
A7	**CHECK FUSE** ● Check for voltage at fuse panel Circuit 295 (LB/PK). ● Ignition switch must be in the ACC or RUN position.	Battery voltage present ▶ Voltage less than 10 volts ▶ No voltage ▶	SERVICE wiring to control assembly. GO to **A1**. CHECK charging system operation and for high resistance in circuit. CHECK fuse. SERVICE circuit as required. CHECK diode in CCRM for short (Pins 16 and 23). GO to **A1**.
A8	**CHECK CLUTCH CIRCUITS** ● Check for voltage across harness connector at clutch field coil. ● **Is there at least 10 volts?**	Yes ▶ No ▶	GO to **A9**. GO to **A11**.
A9	**JUMP FIELD COIL** ● Disconnect field coil and jump battery voltage and ground to clutch field coil. ● **Does clutch engage?**	Yes ▶ No ▶	CLEAN coil electrical terminals and RETEST. GO to **A10**.
A10	**CHECK CLUTCH AIR GAP** ● Check air gap between clutch hub and pulley. ● **Is air gap within specifications?**	Yes ▶ No ▶	REPLACE clutch field coil. RESET air gap (REFER to applicable Compressor and Clutch Section). GO to **A9**.
A11	**CHECK CCRM OUTPUT VOLTAGE** ● Check for voltage between Pins 16 and 23 of the CCRM. ● **Is there at least 10 volts?**	Yes ▶ No ▶	CHECK clutch coil wiring harness for open circuit. SERVICE as necessary. GO to **A1**. GO to **A12**.

DIAGNOSIS AND TESTING (Continued)

PINPOINT TEST A
A/C COMPRESSOR CLUTCH CIRCUIT DIAGNOSIS (Continued)

TEST STEP		RESULT	ACTION TO TAKE
A12	CHECK CLUTCH SIGNAL AT CCRM		
	● Check for a minimum of 11 volts at Pin 21 of the CCRM (clutch input signal). ● **Is there at least 11 volts?**	Yes ▶ No ▶	GO to **A13**. CHECK circuit between pressure switch and Pin 21 of CCRM for open. SERVICE as necessary.
A13	CHECK A/C CUT-OUT SIGNAL		
	● Remove red Wire from Pin 22 of CCRM harness connector. Then, start engine and set system at MAX A/C. ● **Does clutch energize?**	No ▶ Yes ▶	REPLACE CCRM. GO to **A14**.
A14	CHECK POWERTRAIN CONTROL MODULE (PCM) INPUT SIGNAL		
	● Check for a minimum of 11 volts at Pin 10 of Powertrain Control Module. ● **Is there at least 11 volts?**	▶	Engine coolant temperature sensor sending hot coolant signal to Powertrain Control Module, or Throttle Position Sensor sending cutout signal to Powertrain Control Module. DISCONNECT electrical connector from each sensor. Clutch will engage if sensor is sending incorrect signal. REFER to Powertrain Control/Emissions Diagnosis Manual[3]. A/C sense circuit to Powertrain Control Module open. SERVICE circuit as required.

TL8256A

Self Test

Refer to the following charts for Self-Test instructions involving clutch operation.

Self Test—Blower Speed Controller (BSC)

Tools Required:

- Rotunda Digital Volt-Ohmmeter 007-00001

Testing requires a Rotunda Digital Volt Ohmmeter 007-00001 or equivalent. Refer to the EATC System Wiring Diagram for terminal pin locations. Use the following charts for self-test procedures.

Condition No. 1

No blower, ignition in RUN position, engine warm, AUTOMATIC, 32°C (90°F) setting.

CELO TEST

TEST STEP		RESULT	ACTION TO TAKE
1			
	● Change temp. setting to 60° Auto. ● **Is blower on?**	Yes ▶ No ▶	GO to **2**. GO to **3**.
2			
	● Disconnect cold engine lockout (CELO) switch and change temp. to 90° setting Auto. ● **Is blower on?**	Yes ▶ No ▶	Faulty CELO switch. CELO wire grounded.

3 Can be purchased at a separate item.

DIAGNOSIS AND TESTING (Continued)

CELO TEST (Continued)

TEST STEP		RESULT	ACTION TO TAKE
3			
	• Connect voltmeter between BSC ignition Pin 3 and ground Pin 4. • **Is voltage greater than 10 volts?**	No ▶	CHECK V ignition circuit fuse, continuity in wiring. (thru HBR)
		Yes ▶	GO to 4.
4			
	• Connect voltmeter between BSC input Pin 2 and ground Pin 4. • **Is voltage greater than 3 volts?**	No ▶	GO to 5.
		Yes ▶	GO to 6.
5			
	• Connect voltmeter between BSC output Pin 1 and ground Pin 4. • **Is voltage greater than 1 volt?**	No ▶	Damaged motor, B+ feed to motor.
		Yes ▶	REPLACE BSC.
6			
	• Connect voltmeter between control assembly Pin 23 and Pin 24. • **Is voltage greater than 3 volts?**	Yes ▶	REPLACE control assembly.
		No ▶	CHECK circuit continuity.

TL5667D

Condition No. 2

High blower only: no low blower speed, AUTOMATIC, thumbwheel turned to LO.

VOLTMETER CONNECTIONS

TEST STEP		RESULT	ACTION TO TAKE
1			
	• Disconnect BSC electronic connections. • **Is blower on?**	Yes ▶	Faulty blower motor or blower wire circuit.
		No ▶	GO to 2.
2			
	• Reconnect BSC and connect voltmeter between BSC input Pin 2 and ground Pin 4 (auto function). Rotate blower thumbwheel from high to low blower. • **Is voltage greater than 7 volts?**	No ▶	REPLACE control assembly.
		Yes ▶	REPLACE BSC.

TL5668D

Condition No. 3

Blower operates but does not vary with thumbwheel movement.

VOLTMETER CONNECTION

TEST STEP		RESULT	ACTION TO TAKE
1			
	• Connect voltmeter between BSC input Pin 2 and ground Pin 4 (AUTOMATIC position). Rotate blower thumbwheel from min. to max. then back to min. • **Does voltage fluctuate?**	Yes ▶	GO to 2.
		No ▶	Replace control assembly.

DIAGNOSIS AND TESTING (Continued)

VOLTMETER CONNECTION (Continued)

TEST STEP		RESULT		ACTION TO TAKE
2				
	• Connect voltmeter between BSC output Pin 1 and ground Pin 4 (AUTOMATIC position). Rotate blower thumbwheel from min. to max. • **Does voltage fluctuate?**	Yes	▶	Faulty blower motor, or B+ feed to motor.
		No	▶	Replace BSC.

TL5084B

Condition No. 4

Cold Engine Lockout (CELO) inoperative: blower turns on immediately in AUTOMATIC, 32°C (90°F) setting, with cold engine.

TEST STEP		RESULT		ACTION TO TAKE
1				
	• Cold engine (engine coolant temp. below 120°) control set at AUTOMATIC 90°. • **Is blower on?**	Yes	▶	CHECK coolant and retest. If blower turns on again with a cold engine, REPLACE CELO. Check for short in circuit.
		No	▶	CELO OK.

TL5085E

EATC Control Assembly Connector and Blend Door Actuator Self Test

Refer to the following chart for control assembly connector and blend door Self-Test procedures. To test the control assembly vacuum valve, apply 50 kPa (15 in-Hg) of vacuum to the number five terminal.

BLEND DOOR ACTUATOR DIAGNOSIS

TEST STEP		RESULT		ACTION TO TAKE
1				
	NOTE: Letters in parentheses indicate (wire color, circuit no.). Refer to the EATC System Wiring Diagram for wiring schematic and connector pin diagrams. • Check error code during EATC functional test. • **Does code "02" display?**	Yes	▶	GO to 2.
		No	▶	REVIEW error code key.
2				
	• Disconnect both connectors from EATC control assembly and drive actuator in both directions using any 9-12 volt battery. • The following pins can be jumped to use the vehicle battery. Insure the ignition is in the RUN position. • All pins are located on the LEFT connector (E6DB-14489-VA). • Trial 1: Pin 24 (BK, 57) to Pin 22 (DB/LG, 249) • Trial 2: Pin 24 (BK, 57) to Pin 21 (0,250) • **Does actuator drive in both directions?**	Yes	▶	GO to 3.
		No	▶	GO to 6.
3				
	• Reconnect control assembly and test according to EATC functional test. • **Is test successful?**	Yes	▶	Done.
		No	▶	GO to 4.

DIAGNOSIS AND TESTING (Continued)

BLEND DOOR ACTUATOR DIAGNOSIS (Continued)

TEST STEP	RESULT	ACTION TO TAKE
4		
• Disconnect both connectors from EATC control assembly. Measure resistance as shown below at the control assembly connector with the connector disconnected. • All pins are located on the RIGHT connector (E6DB-14489-UA). • Pin 15 (LG/O, 243) to Pin 6 (O/BK, 776) 5000-7000 ohms • Pin 5 (O/W, 351) to Pin 6 (O/BK, 776) 300-7300 ohms • Pin 5 (O/W, 351) to Pin 15 (LG/O, 243) 300-7300 ohms • **Are all resistances OK?**	Yes ▶ No ▶	GO to 5. GO to 6.
5		
• Change control assembly and test according to EATC functional test. • **Is test successful?**	Yes ▶ No ▶	Done GO to 1.
6		
• Check vehicle wiring harness and connector continuity as shown below. Disconnect connectors from both control assembly and blend door actuator. Blend door actuator connector is accessible through glove compartment.	No ▶ Yes ▶	GO to 8. GO to 7.

Control Assembly Connector		Blend Door Actuator Connector
RH Side		
Pin 5 (O/W, 351)	to	Pin 7 (O/W)
Pin 6 (O/BK, 776)	to	Pin 8 (O/BK)
Pin 15 (LG/O, 243)	to	Pin 6 (LG/O)
LH Side		
Pin 21 (O/W, 351)	to	Pin 1 (O)
Pin 22 (DB/LG, 249)	to	Pin 2 (DB/LG)
Pin 24 (BK, 57)	to	Pin 3 (BK)

TEST STEP	RESULT	ACTION TO TAKE
• Reconnect all three connectors at end of this test. • **Is there continuity?**		
7		
• Change blend door actuator and test according to EATC functional test. • **Is test successful?**	Yes ▶ No ▶	Done. GO to 1.
8		
• Service/replace wiring harness, connect and test according to EATC functional test. • **Is test successful?**	Yes ▶ No ▶	Done. GO to 1.

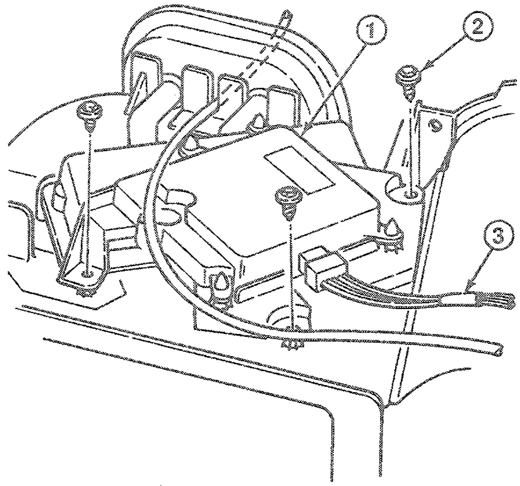
TL5669D

Manual A/C Heater Blend Door Actuator and Temperature Adjustment Potentiometer Diagnosis

Taurus/Sable vehicles with manual A/C heater systems have an electric temperature blend door actuator and temperature adjustment potentiometer.

DIAGNOSIS AND TESTING (Continued)

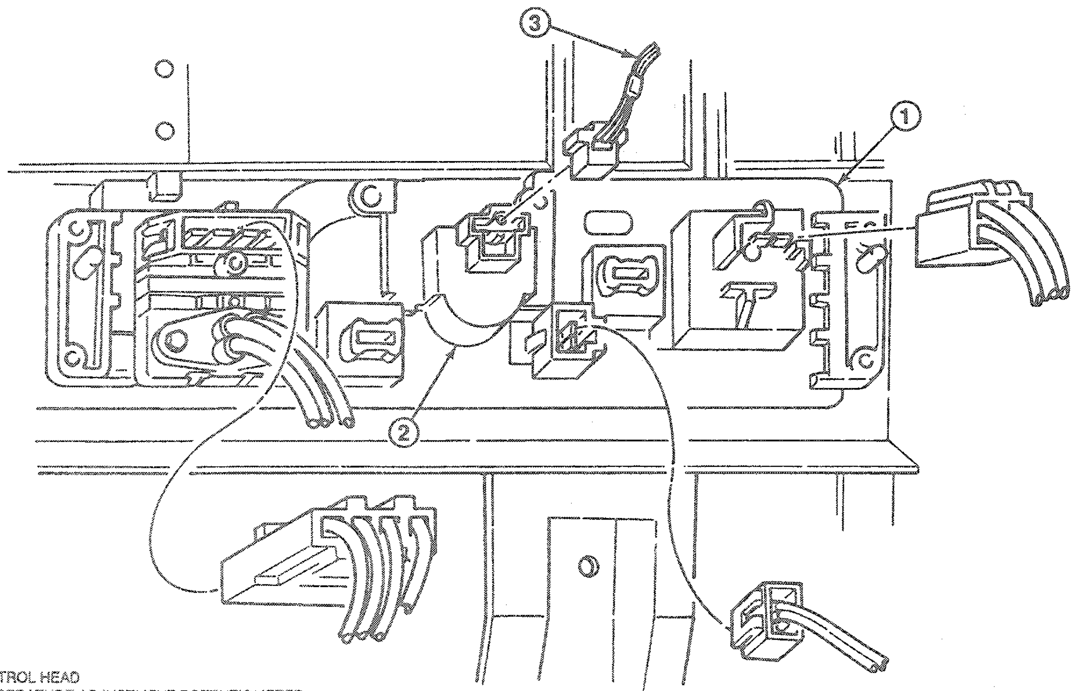
Electric Blend Door Actuator



1. BLEND DOOR ACTUATOR
2. ACTUATOR TO EVAPORATOR CASE MOUNTING SCREWS
3. JUMPER HARNESS FROM 14401 WIRING

CCL 3732-A

Temperature Adjustment Potentiometer



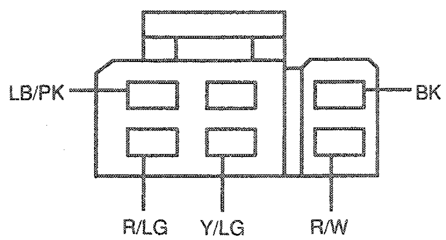
1. CONTROL HEAD
2. TEMPERATURE ADJUSTMENT POTENTIOMETER
3. FROM 14401 WIRING HARNESS

CCL 3733-A

DIAGNOSIS AND TESTING (Continued)

HEATER AND A/C BLEND DOOR ACTUATOR DIAGNOSIS

TEST STEP	RESULT ▶	ACTION TO TAKE
1 CHECK MANUAL A/C ELECTRIC BLEND DOOR ACTUATOR SYSTEM		
• Start vehicle and run engine until it reaches normal operating temperature. • Turn on MAX A/C mode. • Turn temperature adjust knob to full COOL (CCW) and check for cool discharge air. • Turn temperature adjust knob to full WARM (CW) and check for warm discharge air. • Vary temperature adjust knob from full WARM to full COOL. • **Does air temperature change?**	Yes ▶ No ▶	System is fully functional. GO to **2.**
2 CHECK MANUAL A/C ELECTRIC BLEND DOOR ACTUATOR SYSTEM FUSE		
• Check fuse No. 17 at fuse panel. • **Is fuse good?**	Yes ▶ No ▶	GO to **3.** REPLACE fuse, and GO to **1.** NOTE: If fuse blows again, check for shorts to ground in LB/PK wire (see **3.**) and service as needed.
3 CHECK MANUAL A/C ELECTRIC BLEND DOOR ACTUATOR SUPPLY VOLTAGE		
• Disconnect blue 6-way connector located on the evaporator case and accessed through the glove compartment opening. • **Is there battery positive voltage (B+) between LB/PK and BK?**	Yes ▶ No ▶	GO to **4.** CHECK wiring. NOTE: A quick check for the actuator can be done by connecting a replacement actuator and jumper harness to the connector then operate system and look for actuator operation.

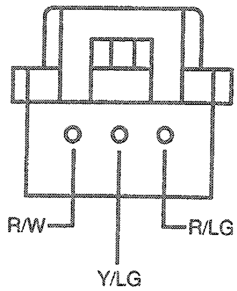
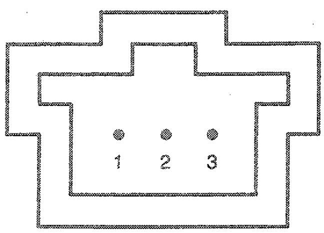


14401 BLUE 6-WAY CONNECTOR TO ACTUATOR JUMPER HARNESS LOCATED ON EVAPORATOR CASE

L8135-A

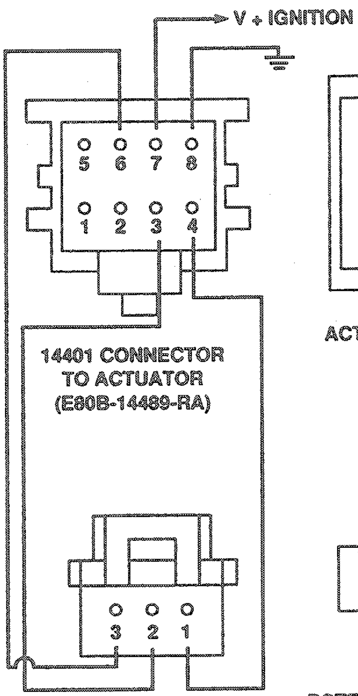
DIAGNOSIS AND TESTING (Continued)

HEATER AND A/C BLEND DOOR ACTUATOR DIAGNOSIS (Continued)

TEST STEP		RESULT	ACTION TO TAKE
4	CHECK CONTROL HEAD POTENTIOMETER SUPPLY VOLTAGE		
	• Connect blue 6-way connector at evaporator case. • Disconnect white 3-way connector from back of potentiometer at the control head. • **Is there reference voltage (approximately 1-2 volts less than battery voltage) between wires R/LG and R/W?** **CAUTION: Never short across wires R/LG and R/W or destructive damage could occur.**  **14401 CONNECTOR TO POTENTIOMETER** **L8136-A**	Yes ▶ No ▶	GO to 5. SERVICE as necessary. NOTE: If wiring to potentiometer is good, then replace electric actuator assembly.
5	CHECK CONTROL HEAD POTENTIOMETER		
	• Disconnect and remove control head potentiometer. • Check resistance between terminals No. 2 and No. 3. — With potentiometer @ full CCW resistance should equal 5000 OHMS. — With potentiometer @ full CW resistance should equal 300 OHMS. • **Is resistance linearly variable in between?**  **POTENTIOMETER BUILT — IN CONNECTOR** **L8137-B**	Yes ▶ No ▶	REPLACE electric actuator on evaporator case. NOTE: Check jumper harness on evaporator case for continuity during actuator replacement. REPLACE potentiometer.

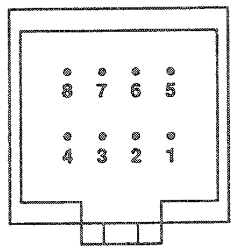
DIAGNOSIS AND TESTING (Continued)

TAURUS/SABLE (DN5) MANUAL A/C ONLY
BLEND DOOR ACTUATOR/POTENTIOMETER SYSTEM CONNECTIONS



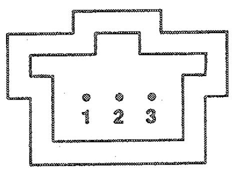
14401 CONNECTOR TO ACTUATOR (E80B-14489-RA)

14401 CONNECTOR TO POTENTIOMETER (F2DB-14489-HA)



ACTUATOR CONNECTOR

PIN #	CIRCUIT #	COLOR	DESCRIPTION
1	---	---	N.C.
2	---	---	N.C.
3	437	Y-LG	Control Pot Wiper
4	438	R-W	Control Pot Vs
5	---	---	N.C.
6	436	R-LG	Control Pot GND
7	295	LB-PK	Actuator V+
8	57	BK	Actuator GND



POTENTIOMETER CONNECTOR

PIN #	CIRCUIT #	COLOR	DESCRIPTION
1	436	R-LG	Control Pot Vs
2	437	Y-LG	Control Pot Wiper
3	438	R-W	Control Pot GND

CAUTION: NEVER JUMPER CIRCUIT #436 TO CIRCUIT #438 (COULD DESTROY ACTUATOR ELECTRONICS)

NOTE: THE ABOVE CONNECTIONS ARE FOR THE BUEHLER MANUAL A/C ACTUATOR ONLY. (DIFFERS FOR THE EATON MANUAL & EATC ACTUATORS)

CCL 3739-B

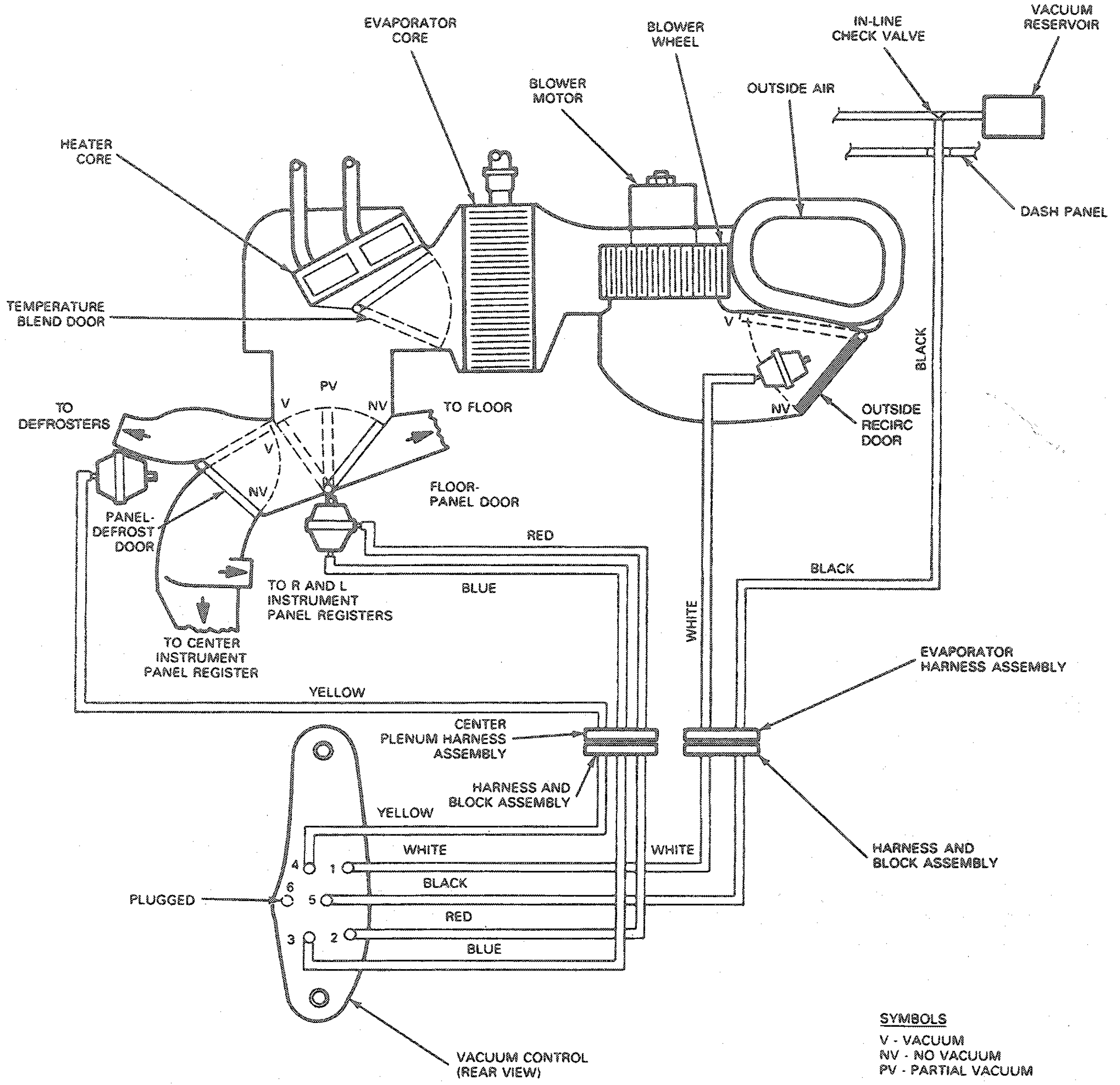
Vacuum System Diagnosis

To test the EATC vacuum system, start the engine and depress the function buttons slowly. A momentary hiss should be heard as each button is depressed from one position to another, indicating that vacuum is available at the control assembly. A continuous hiss at the control assembly indicates a major leak somewhere in the system. It does not necessarily indicate that the leak is at the control assembly.

If a momentary hiss cannot be heard as each function button is depressed from one position to another, check for a kinked, pinched, or disconnected vacuum supply hose. Also, inspect the check valve between the intake manifold and the vacuum reservoir to ensure it is working properly.

DIAGNOSIS AND TESTING (Continued)

EATC System Vacuum Schematic and Selector Test



VACUUM PORT	FUNCTION	SELECTION						
		OFF	DEFROST	FLOOR — PANEL (MIX)	FLOOR	FLOOR — PANEL (HI-LO)	PANEL	RECIRC.
1	Outside — Recirc	V	NV	NV	NV	NV	NV	V
2	Full Floor	NV	NV	NV	V	NV	NV	NV
3	Floor — Panel (Partial)	NV	NV	V	V	V	NV	NA
4	Panel — Defrost	NV	NV	NV	NV	V	V	V
5	Source	V	V	V	V	V	V	V
6	Plugged	—	—	—	—	—	—	—

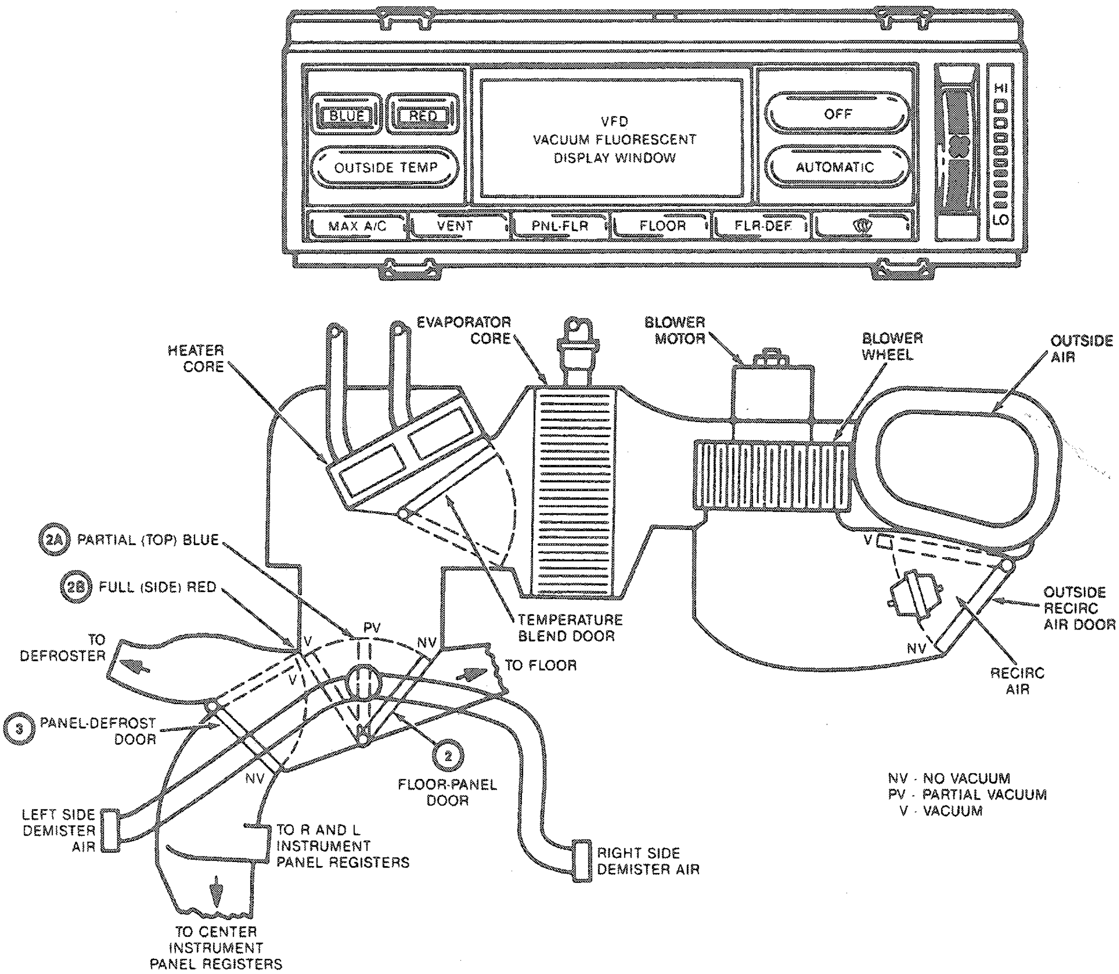
CCL 2650-B

DIAGNOSIS AND TESTING (Continued)

If a momentary hiss can be heard as each function button is depressed from one position to another, vacuum is available at the control assembly. Cycle the function buttons through each position with the blower on HI and check the location(s) of the discharge air. The EATC System Airflow Schematic and Vacuum Control Chart shows the vacuum motors applied for each function selection along with an airflow diagram of the system. The airflow diagram shows the position of each door when vacuum is applied and their no-vacuum position. With this chart, airflow for each position of the control assembly can be determined. If a vacuum motor fails to operate, the motor can readily be found because the airflow will be incorrect.

DIAGNOSIS AND TESTING (Continued)

EATC System Airflow Schematic and Vacuum Control Chart



EATC SYSTEM VACUUM MOTOR TEST CHART

FUNCTION	VACUUM MOTORS APPLIED WITH VACUUM			
	OUTSIDE-RECIRC AIR DOOR	FLOOR-PANEL DOOR PARTIAL	FLOOR-PANEL DOOR FULL	PANEL-DEFROST DOOR
OFF	1	—	—	—
DEFROST	—	—	—	—
FLOOR/DEFROST (MIX)	—	2A	—	—
FLOOR	—	2A	2B	—
FLOOR/PANEL (HI-LO)	—	2A	—	3
PANEL	—	—	—	3
PANEL/RECIRC.	1	—	—	3

— NO VACUUM (ATMOSPHERE)

CCL 2649-C

If a vacuum motor is inoperative, check the operation of the motor with Rotunda Vacuum Tester 021-00014 or equivalent. If the vacuum motor operates properly, the vacuum hose is probably pinched, kinked, disconnected or has a leak (See EATC System Vacuum Schematic and Selector Test).

If the system functions normally at idle, but goes to defrost during acceleration, a leak exists in the system. The leak can best be located by shutting off the engine and using a gauge to check for vacuum loss while selectively blocking off vacuum hoses.

DIAGNOSIS AND TESTING (Continued)

To check electrical system operation between the control assembly connector and the blend door actuator, refer to Diagnostic procedures.

Airflow

Refer to Section 12-03A to assist in performing airflow function and vacuum motor application tests.

Vacuum

Refer to Section 12-02 to assist in performing vacuum system and function selector valve tests. If a vacuum leak should occur, a hissing sound is most likely to exist at the point in the system where the leak originates. Refer to the Hissing Vacuum System or Control Assembly Selector Valve diagnosis chart to assist in pinpointing the vacuum leak location.

Electrical

Refer to Section 12-02 to assist in performing component and system electrical wiring and continuity tests. The blower switch chart also provides blower motor voltage and current information for each blower switch position.

Heater Testing

The following tests may be made on the heater: burned out fuses, loose wire connections, damaged wires or collapsed hoses. Loose defroster ducts and air leaks in the body may be determined by visual inspection of the parts.

Blower Switch Continuity Test

Refer to the appropriate electrical schematic. Check for continuity between connected terminals as shown in the schematic. Check terminal continuity at every lever position. The lamp should go on for each connected pair of terminals.

There should be no continuity between the battery terminal and the switch case.

Open Circuit Test

On all electrical circuits, continuity must exist from the source of power battery positive voltage (+) to the unit where the power is used and back up to the source of power battery ground (-) terminal. A check at each connection in a circuit, starting at the battery, will locate an open circuit or will show that the circuit is complete.

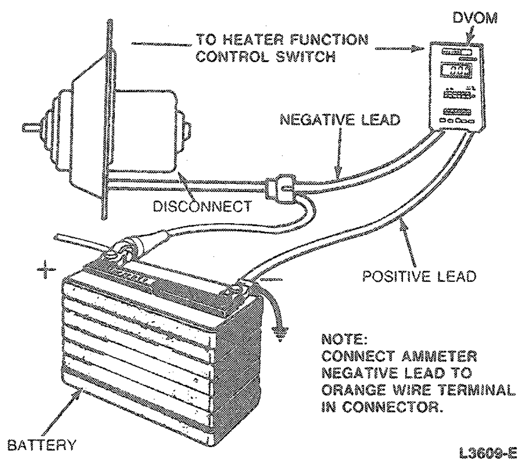
An ohmmeter or self-powered test lamp connected at any two points of a circuit, with the power removed from the circuit, will show if the circuit between the two connections is open or continuous.

If the meter does not move or has a slight movement (high resistance), the circuit may have a poor connection or broken wire. If the bulb lights, the circuit is continuous.

Heater Blower Motor Current Draw Test

This test will determine if the blower motor is operating properly. Connect a 0-30 ampere ammeter, ground the negative lead of the blower motor and measure the motor current draw at the high-speed setting. If the motor is operating properly, the current draw readings will be within specification.

Heater Blower Motor Current Draw Test—Schematic



Plugged Heater Core Test

Ensure the engine coolant is at the proper level, then start the engine and feel the heater outlet hose to see if it is hot. If it is not warm, flow through the heater core is restricted.

Heater Core Leak Test

Tools Required:

- Rotunda Radiator / Heater Core Pressure Tester 021-00012

Inspection

1. Inspect for visible evidence of coolant leakage at hose-to-heater core attachments. A coolant leak at hose could follow heater core tube to core and appear as a leak in heater core.

DIAGNOSIS AND TESTING (Continued)

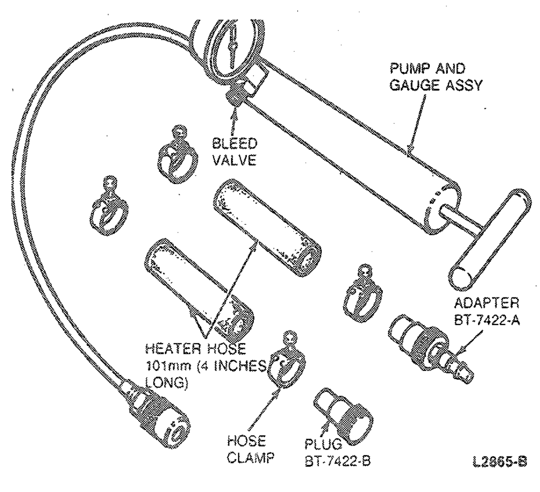
2. Check system for loose heater hose clamps. Clamps should be tightened to 1.81-2.49 N·m (17-22 lb-in).
3. If leakage is found and hose clamps are tight, check heater core tubes for distortion. Distorted heater core tubes are usually caused by over-tightening the hose clamps. Service tubes if distorted. Severe distortion of tubes could cause leakage at hose connections.

Pressure Test

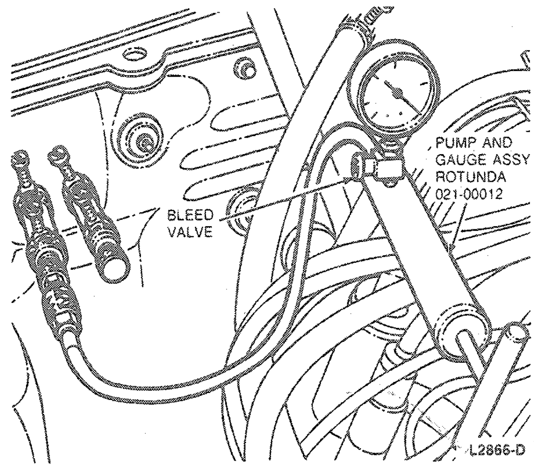
NOTE: Due to space limitations in the engine compartment, a bench test is recommended for heater core pressure testing.

1. Drain coolant from cooling system.
2. Disconnect heater hoses from heater core tubes.
3. Install a short piece of heater hose (approximately 101mm (4 inches) long) on each heater core tube.
4. Fill heater core and hoses with water and install Plug BT-7422-B and Adapter BT-7422-A from Rotunda Radiator / Heater Core Pressure Tester 021-00012 or equivalent in hose ends. Secure hoses, plug and adapter with hose clamps.
5. Attach Rotunda Radiator / Heater Core Pressure Tester 021-00012 or equivalent to adapter. Close bleed valve at base of gauge and pump 241 kPa (35 psi) of air pressure into heater core.

Rotunda Radiator / Heater Core Pressure Tester 021-00012 with Heater Hose and Clamps



Rotunda Radiator / Heater Core Pressure Tester 021-00012 Installed for Pressure Test



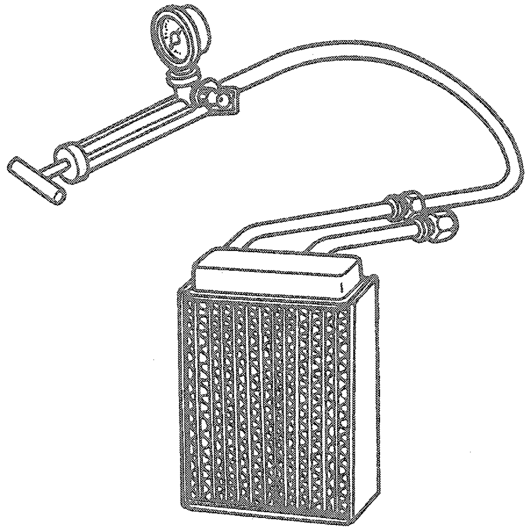
6. Observe pressure gauge for a minimum of three minutes. The pressure should not drop.
7. If pressure does not drop, no leaks are indicated.
8. If pressure drops, check hose connections to core tubes for leaks. If hoses do not leak, remove heater core from vehicle and test core as outlined.

Bench Test

1. Remove heater core from heater case.
2. Drain all coolant from heater core.
3. Connect 101mm (4 inch) test hoses with plug and adapter to core tubes. Then, connect air pump and gauge assembly to adapter.

DIAGNOSIS AND TESTING (Continued)

Heater Core Bench Test



CCL 3540-A

4. Apply 241 kPa (35 psi) of air pressure to heater core with Rotunda Radiator / Heater Core Pressure Tester and submerge core in water.
5. If a leak is observed, service or replace heater core, as necessary.

PINPOINT TEST A: MANUAL A/C-HEATER SYSTEM VACUUM LEAK DIAGNOSIS

TEST STEP		RESULT ▶	ACTION TO TAKE
A1	CHECK CONNECTORS		
	• Check in-line and control assembly multiple connectors for proper connection. • **Does hiss stop?**	Yes ▶ No ▶	RECHECK system for proper operation. GO to **A2**.
A2	DETERMINE LEAKING VALVE		
	• Rotate function knob to determine what selector switch positions are leaking. • **Do all positions leak?**	Yes ▶ No ▶	GO to **A3**. GO to **A5**.
A3	CHECK SOURCE TUBE		
	• Check vacuum source tube (black) from reservoir to control assembly for cut or disconnection. • **Does hiss stop?**	Yes ▶ No ▶	SERVICE tube. RECHECK system for proper operation. GO to **A4**.
A4	PINCH OFF SOURCE TUBE		
	• Pinch off source tube (black) at control assembly. • **Does hiss stop?**	Yes ▶ No ▶	REPLACE function selector switch valve. RECHECK system for proper operation. RECHECK source tube (black), connections, reservoir and check valve. SERVICE or REPLACE as required.

DIAGNOSIS AND TESTING (Continued)

PINPOINT TEST A:
MANUAL A/C-HEATER SYSTEM VACUUM LEAK DIAGNOSIS (Continued)

TEST STEP		RESULT	ACTION TO TAKE
A5	DETERMINE LEAKING HOSE(S)		
	• Determine what color hose(s) are used in leaking function selector switch position(s). (Refer to airflow schematic and vacuum control chart). • Pinch off suspect hose(s), one at a time, near each respective vacuum motor. • **Does hiss stop?**	Yes ▶	CHECK hose connection to vacuum motor and SERVICE and / or RECONNECT if loose or split. RECHECK for hiss. If hiss still continues, REPLACE vacuum motor. RECHECK system for proper operation. **CAUTION: Never manually operate any vacuum motor or vacuum motor controlled door—this may cause internal damage to the vacuum motor diaphragm.**
		No ▶	GO to **A6**.
A6	PINCH OFF SUSPECT HOSE(S)		
	• Pinch off suspect hose(s), one at a time, near control assembly and / or in-line connector. • **Does hiss stop?**	Yes ▶	CHECK hose for cut or damage. SERVICE as required. RECHECK system for proper operation.
		No ▶	REPLACE function selector switch.

TL8216A

DIAGNOSIS AND TESTING (Continued)

HEATER AND DEFROSTER DIAGNOSIS

CONDITION	POSSIBLE SOURCE	ACTION
• Insufficient, Erratic, or No Heat or Defrost	• Low radiator coolant due to: • Coolant leaks.	• Check radiator cap pressure. Replace if below minimum pressure. • Fill to level. Pressure test for engine cooling system and heater system leaks. Service as required.
	• Engine overheating.	• Remove bugs, leaves, etc. from radiator or condenser fins. • Check for: Inoperative electro-drive fan Sticking thermostat Incorrect ignition timing Water pump impeller damage Restricted cooling system • Leaks in cooling system. • Service as required.
	• Thermostat.	• Feel heater hoses. If too hot to handle, thermostat is OK.
	• Plugged or partially plugged heater core.	• Clean and backflush engine cooling system and heater core.
	• Loose or improperly adjusted control cables.	• Adjust to specifications.
	• Vacuum hoses crossed, collapsed, or linked (if applicable).	• Check to see if door vacuum motors respond properly to movements of the function selector lever. Visually check vacuum hoses, and service as required.
	• Airflow control doors sticking in binding.	• Check to see if door vacuum motors respond properly to movements of the function selector knob. If hesitation in movement is noticed, disconnect vacuum motor arm from door crank arm, and move crank arm by hand. Service sticking or binding door as required.
	• Vacuum motor or hose leaks (if applicable).	• Disconnect multiple vacuum connector from back of control assembly, and check each connector opening with hand operated vacuum pump. If one line leaks vacuum, test motor by itself before replacing (Be careful of vacuum hoses that operate two motors at same time). Service vacuum hose(s), or replace vacuum motor as required.
• Air Comes Out of Defroster Outlet In Any Function Selector Lever Position	• Vacuum system (indicates a very bad leak).	• Listen for vacuum system leak. Look for disconnected vacuum hose connector. Use hand-operated vacuum pump, and check vacuum motors for diaphragm leak. Also check for leaking function selector switch on control assembly, check valve, and leaking vacuum reservoir tank. Service hoses, or replace components as required.

DIAGNOSIS AND TESTING (Continued)

HEATER AND DEFROSTER DIAGNOSIS (Continued)

CONDITION	POSSIBLE SOURCE	ACTION
• Blower Does Not Operate Properly.	• Blower motor	• Run a No. 10 gauge jumper wire directly from the (grounded) negative battery terminal to the negative lead (black wire) of the blower motor. If the motor runs the problem must be external to the motor. If the motor will not run, check the ground connection for good electrical contact. If this connection is good, the motor is inoperative and should be replaced.
	• Blower resistor.	• Check continuity of resistors for opens or check thermal limiter for continuity, if so equipped. (A blown thermal limiter will allow motor operation on Hi blower only). Service or replace as required.
	• Blower wire harness.	• Check for proper installation of harness connector terminal connectors. • Check wire-to-terminal continuity. • Check continuity of wires in harness for shorts (a short to ground will cause motor to operate with no control over the motor), opens, abrasion, etc. • Service as required.
	• Blower switch(es).	• Check blower switch(es) for proper contact. Replace switch(es) as required.
	• Vacuum selector valve.	• Check vacuum selector valve for proper contacts. Replace if required.
• Airflow Changes Direction When Vehicle is Accelerated	• Vacuum system leak (if applicable).	• Check vacuum system with hand vacuum pump from control assembly connector. Service tubing, or replace damaged components as required.

REFRIGERANT SYSTEM SERVICE

Refrigerant-12 (R-12) System

Most Taurus / Sable vehicles use A / C systems that require the use of R-12 as a refrigerant. This type of system is very similar to the fixed orifice tube systems used previously. If there are no special R-134a identifying tags on the A / C system components and refrigerant lines, the system requires the use of R-12 refrigerant.

Refrigerant-134a (R-134a) Systems

NOTE: R-12 refrigerant and refrigerant oil is not compatible with R-134a and R-134a refrigerant oil.

CAUTION: Never mix the two refrigerants or the oils.

In an effort to avoid the use of CFC refrigerants that may harm the ozone layer of the atmosphere, Ford Motor Company has introduced a new refrigerant system on some 3.0L Taurus vehicles that requires the use of a Non-CFC based refrigerant known as R-134a. This new type of refrigerant has many of the same properties as R-12 and is similar in form and function. However, R-134a is a hydrofluorocarbon (HFC) based refrigerant while R-12 is a chlorofluorocarbon (CFC) based refrigerant. Because of the absence of chlorine in its molecular structure, the use of R-134a refrigerant will not have any harmful effects on the ozone layer of the atmosphere.

REFRIGERANT SYSTEM SERVICE (Continued)

Ford Motor Company has begun producing some 3.0L Taurus vehicles that have new A/C systems requiring the use of R-134a refrigerant. R-134a A/C systems have special service requirements that will be outlined later. The main thing to keep in mind about R-12 and R-134a systems is that they are different systems. R-12 refrigerant and components can only be used in R-12 systems while R-134a refrigerant and components can only be used in R-134a systems.

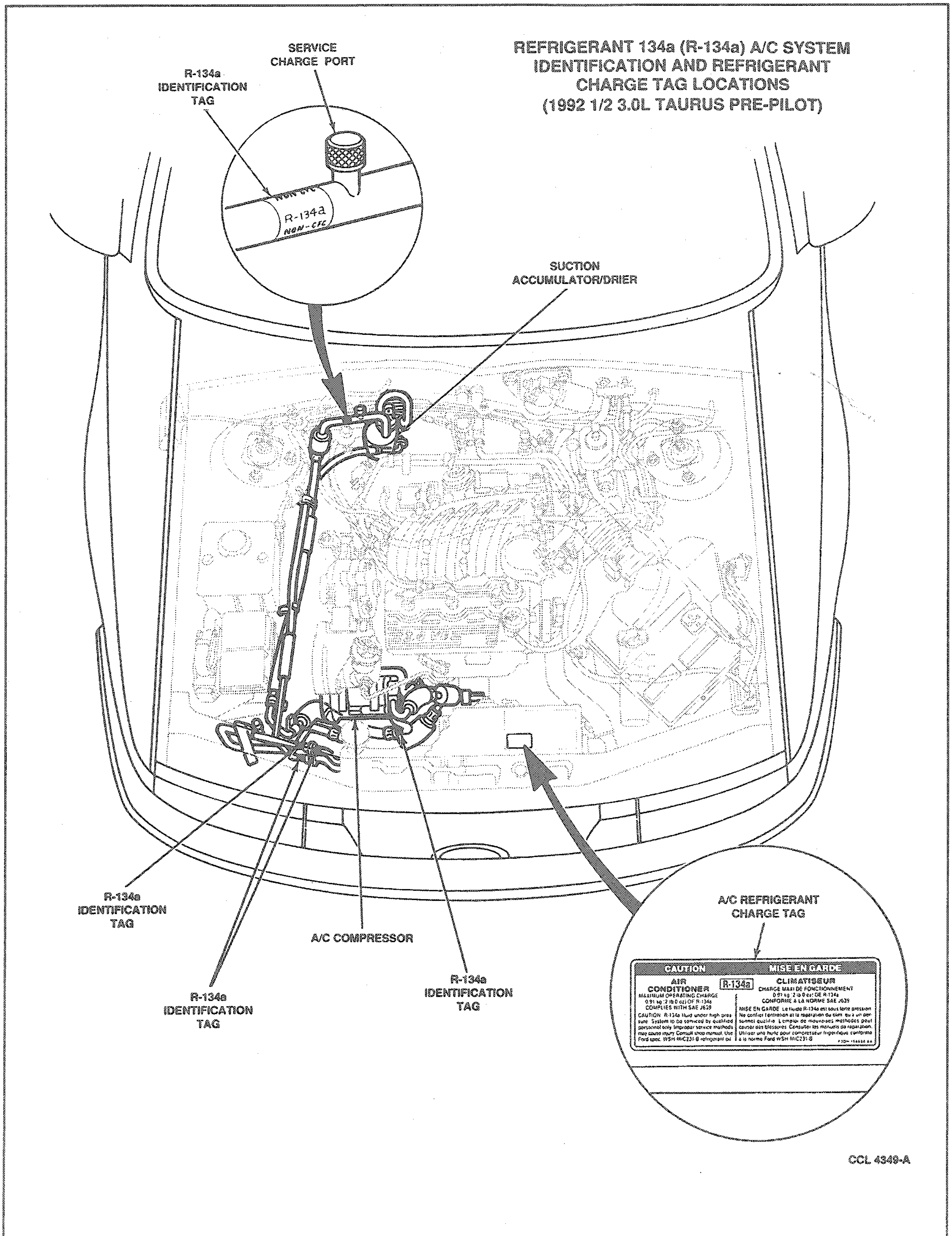
Identifying R-134a and R-12 Systems

NOTE: R-134a A/C systems can also be identified by a gold colored A/C compressor clutch.

CAUTION: Do not add R-12 refrigerant to an A/C system that requires the use of R-134a refrigerant. Also, do not add R-134a refrigerant to an A/C system that requires the use of R-12 refrigerant. These two types of refrigerant should never be mixed. Doing so may cause damage to the A/C system.

In order to find out which type of A/C system a particular vehicle has, the A/C system major components and refrigerant lines need to be inspected. If the system components have yellow R-134a NON-CFC tags as shown below, it is an R-134a system requiring the use of R-134a refrigerant.

REFRIGERANT SYSTEM SERVICE (Continued)



REFRIGERANT SYSTEM SERVICE (Continued)

If the A/C system has any of the R-134a identifying characteristics previously explained, R-134a refrigerant is the only type of refrigerant that can be used in the A/C system. If the A/C system is not identified as an R-134a system as previously explained, it is an R-12 system requiring the use of R-12 refrigerant.

R-134a Special Servicing Equipment

CAUTION: Do not use R-12 Special Tools and Equipment when servicing an R-134a system. Also, do not use R-134a Special Tools and Equipment when servicing an R-12 system. Doing so may cause damage to the A/C system. Refer to the Rotunda Equipment Catalog for more information on R-134a Special Servicing Equipment.

R-134a systems require the use of special servicing equipment designed specially for R-134a systems. R-12 servicing equipment cannot be used when servicing R-134a A/C systems. R-134a special servicing equipment includes:

- R-134a Manifold gauge set
- R-134a Charging station
- R-134a Reclamation system
- R-134a Leak detector

For more information on R-134a special tools and equipment, refer to the Rotunda Equipment Catalog.

Test equipment must be connected to the refrigerant system in order to make system tests. If a charging station is used, follow the instructions of the station manufacturer.

Refrigerant Recovery

Tools Required:

- Rotunda A/C Refrigerant Reclaim System 078-00800

CAUTION: Use extreme care and observe all safety and service procedures related to the use of refrigerants.

Refrigerant recovery systems and recycling stations are in use in most automotive A/C service facilities. The use of such equipment makes possible the recovery and reuse of A/C system refrigerant after contaminants and moisture have been removed.

If a refrigerant recovery or recycling station is used, the following general procedures should be observed, in addition to the operating instructions provided by the equipment manufacturer.

1. Connect refrigerant recycling station hose(s) to vehicle A/C service ports and recovery station inlet fitting.

   NOTE: Hoses should have shut off devices or check valves within 25.4cm (12 inches) of the hose end to minimize the introduction of non-condensable gases (air) into the recycling station and to minimize the amount of refrigerant released when the hose(s) is disconnected.
2. Turn power to the recycling station on to start recovery process. Allow recycling station to pump refrigerant from the system until the system pressure goes into a vacuum. On some stations, the pump will be shut off automatically by a low pressure switch in the electrical system. On other units it may be necessary to manually turn off the pump.
3. Once recycling station has evacuated vehicle A/C system, close the station inlet valve (if so equipped). Then, switch off electrical power.
4. Allow vehicle A/C system to remain closed for about two minutes. Observe system pressure level as shown on the gauge. If pressure does not rise, disconnect recycling station hose(s).
5. If system pressure rises, repeat Steps 2, 3 and 4 until the vacuum level remains stable for two minutes.
6. Perform required service operations, evacuate and recharge the A/C system.

Connecting the Manifold Gauge Set (R-12 System)

Tools Required:

- High Side Adapter D81L-19703-A
- Fitting Adapter T71P-19703-S, T71P-19703-R

If a manifold gauge set is used, connect it as outlined.

1. Turn both manifold gauge set valves all the way to the right, to close the high and low-pressure hoses to the center manifold and hose. A Rotunda Adapter D81L-19703-A (Motorcraft® Tool YT-354 or 355) or equivalent must be used to connect the manifold gauge set or charging station to the high-pressure service gauge port valve.
2. Remove the caps from the high and low pressure service (Schrader) gauge port valves.
3. If the manifold gauge set or charging station hoses do not have valve depressing pins in them, install Fitting Adapters T71P-19703-S and-R (which have pins) on the low and high-pressure hoses.
4. Connect the high- and low-pressure hoses, or adapters, to the respective high and low-pressure service gauge port valves. The adapter shown in must be used on the high-pressure gauge port valve.

   A service tee fitting which may be mounted on the clutch cycling pressure switch fitting is available for use in the low-pressure side of the system.

REFRIGERANT SYSTEM SERVICE (Continued)

System Discharging

Tools Required:

- Rotunda A / C Reclaim System 078-00800

In order to minimize the discharge of ozone depleting chlorofluorocarbons into the atmosphere, the Ford Motor Company supports the efficient usage, recovery and recycling of the R-12 used in passenger cars, compact trucks and light truck air conditioners. Ford Motor Company recommends the use of a U.L.-approved recovery / recycling device such as Rotunda Model Number 078-00800 or equivalent, (which meets SAE Standard J 1991), during any A / C system repair and recharge procedure which requires that the system be discharged.

System Evacuating

1. Connect manifold gauge set as outlined, if not yet connected.
2. Leak test the system as outlined.
3. Remove the refrigerant from the system as outlined.
4. Ensure both manifold gauge valves are turned all the way to the right (closed).
5. Ensure the center hose connection at the manifold gauge is tight.
6. Connect manifold gauge set center hose to a vacuum pump.
7. Open manifold gauge set valves and start the vacuum pump.
8. Evacuate the system with the vacuum pump until low-pressure gauge reads at least 99.4 kPa (29.5 in-Hg) (vacuum) and as close to 101.1 kPa (30 in-Hg) as possible. Continue to operate the vacuum pump for 30 minutes.
9. When evacuation of system is complete, close the manifold gauge set valves and turn the vacuum pump off.
10. Observe low-pressure gauge for five minutes to ensure system vacuum is held. If vacuum is held, charge the system. If vacuum is not held for five minutes, leak test the system, service the leaks, and evacuate the system again.

System Charging Set Up:

Ford Motor Company recommends using a charging station to perform evacuation and charging of the refrigerant system. Follow the instructions provided with the charging station.

If a charging station is not available, system charging may be accomplished using a separate vacuum pump, charging cylinder and manifold gauge set. The use of small cans of R-12 is NOT recommended.

If the charging cylinder method is used, the center port of the manifold gauge set should have two refrigerant hoses with integral shut-off valves built into the gauge set manifold. If the gauge set is the type that does not have shut-off valves and two hoses at the center port, a tee fitting and two hoses should be installed at the center port. In addition, the hoses attached to the center port should have shut-off valves at the other ends of the two center hoses to prevent air from entering the hoses when not connected to the vacuum pump and charging cylinder.

Charging with a Charging Cylinder:

1. If the vehicle suction (low) side service part is located on the accumulator, connect the gauge set center hose to the liquid port of the charging cylinder. If the suction (low) side service port is NOT on the accumulator (located on the suction hose), connect the center hose to the GAS port of the charging cylinder.

   WARNING: LIQUID CHARGE INTO THE VEHICLE SUCTION ACCUMULATOR ONLY. TO PREVENT COMPRESSOR SLUGGING, DO NOT LIQUID CHARGE INTO A REFRIGERANT HOSE WHILE THE ENGINE IS OPERATING.
2. When evacuating the system with the vacuum pump, the gauge set second center hose should be connected to the charging cylinder and opened to the gauge set so that the hose will be evacuated with the system.
3. When evacuation of the system is completed, close the center hose valve to the vacuum pump and turn the pump off.
4. Open the charging cylinder valve and the gauge set low side valve to allow refrigerant to enter the system.
5. When no more refrigerant is being drawn into the system, start the engine and select an A / C function on the control assembly. Then, move the blower speed controller to high to allow the remaining refrigerant to be drawn into the system. Continue to add refrigerant into the system until the specified weight of R-12 has been added. Then, close the charging cylinder valve and allow the system to pull any remaining refrigerant from the hose. When the suction pressure drops to approximately 30 psi, close the gauge set center hose valve.
6. Operate the system until the pressures stabilize to verify normal operation and system pressures.
7. In high ambient temperatures, it may be necessary to operate a high volume fan positioned to blow air through the condenser and radiator to aid in cooling the engine and prevent excessive refrigerant system pressures.
8. When charging is complete, close the valves at the ends of the low and high hoses if not equipped with automatic closing valves. Then, disconnect the manifold gauge set hoses from the vehicle and install the protective caps on the service gauge port fittings.

REFRIGERANT SYSTEM SERVICE (Continued)

To Disconnect Spring Lock Coupling

Tools Required:

- Spring Lock Coupling Tools T81P-19623-G1, T81P-19623-G2, T83P-19623-C, T85L-19623-A

1. Remove refrigerant from system as outlined. Fit Spring Lock Coupling Tools T81P-19623-G1 (3/8-inch), T81P-19623-G2 (1/2-inch), T83P-19623-C (5/8-inch) or T85L-19623-A (3/4-inch) or equivalent to the coupling (Fig. 3).
2. Close tool and push into open side of cage to expand garter spring and release female fitting.

   NOTE: The garter spring may not release if the tool is cocked while pushing it into the cage opening.
3. After garter spring is expanded, pull fitting apart.
4. Remove tool from disconnected coupling.

To Connect Coupling

1. Check to ensure that garter spring is in cage of male fitting. If garter spring is missing, install a new spring by pushing it into cage opening. If garter spring is damaged, remove it from cage with a small wire hook (do not use a screwdriver) and install a new spring.
2. Clean all dirt or foreign material from both pieces of coupling.
3. Install new green O-rings on male fitting.

   Use only the specified green O-rings as they are made of a special material. The use of any O-ring other than the specified green O-ring may allow the connection to leak intermittently during vehicle operation. Refer to service parts list.

Service Parts List

Part Number	Description
E35Y-19D690-D	O-ring Seal Kit - A/C Spring Lock Coupling (Kit contains 3/8, 1/2 and 5/8 inch coupling O-rings and 3/8, 1/2 and 5/8 inch coupling garter springs.)

CCL 3693-A

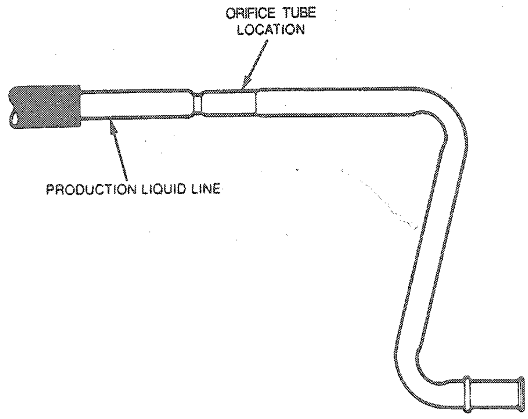
4. Lubricate male fitting and green O-rings and inside of female fitting with clean refrigerant oil.
5. Install plastic indicator ring into cage opening if indicator ring is to be used.
6. Fit female fitting to male fitting and push until garter spring snaps over flared end of female fitting.

   If plastic indicator ring is used, it will snap out of cage opening when coupling is connected to indicate engagement.
7. If indicator ring is not used, ensure coupling engagement by visually checking to verify garter spring is over flared end of female fitting.

Fixed Orifice Tube Replacement Kit Installation

1. Discharge the A/C refrigerant system. Refer to System Discharging. Observe all safety precautions.
2. Remove the liquid line from the vehicle.
3. Locate the orifice tube by the three indented notches or a circular depression in the metal portion of the liquid line (Fig. 30).

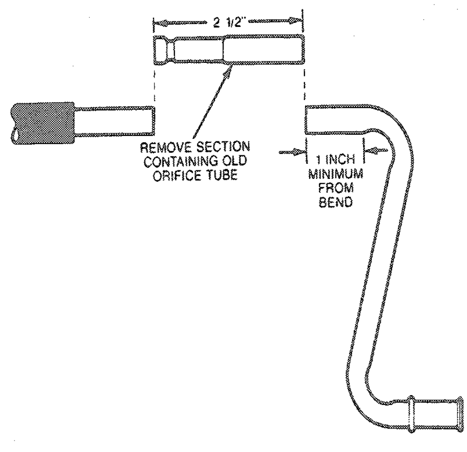
Fixed Orifice Tube Location



CCL 2485-A

4. Note the angular position of the ends of the liquid line so that it can be reassembled in correct position.
5. Cut a 63.5mm (2-1/2 inch) section from tube at orifice tube location. Do not cut closer than 25.4mm (1 inch) from the start of a bend in tube.

Orifice Tube Section Removed From Liquid Line



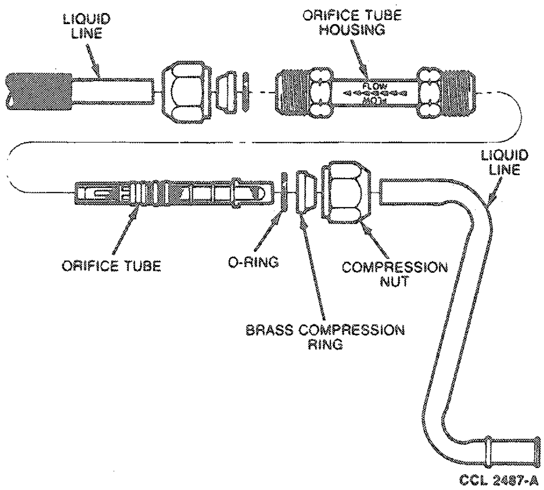
CCL 2486-A

6. Flush the two pieces of liquid line to remove any contaminants.

REFRIGERANT SYSTEM SERVICE (Continued)

7. Lubricate O-rings with clean refrigerant oil and assemble orifice tube kit (with orifice tube installed) to liquid line. Ensure flow direction arrow is pointing toward evaporator end of liquid line, and taper of each compressor ring is toward compression nut.

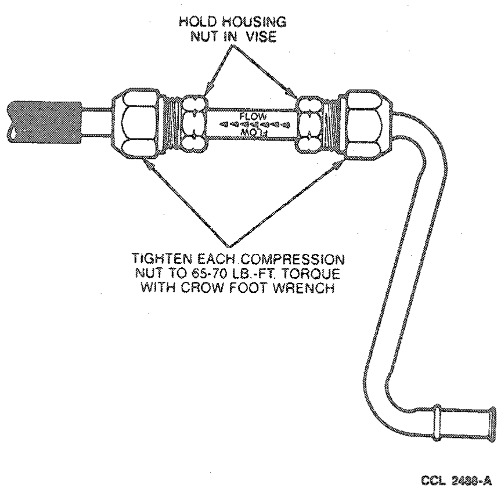
Orifice Tube Kit Disassembled



NOTE: The inlet tube will be positioned against the orifice tube tabs when correctly assembled.

8. While holding hex of tube in a vise, tighten each compression nut to 88-95 N·m (65-70 lb-ft) with a crow foot wrench.

Orifice Tube Kit Installed



9. Assemble liquid line to vehicle using new green O-rings lubricated with clean refrigerant oil. Use only specified green O-rings at spring lock coupling.
10. Leak test, evacuate and charge system following approved procedures.
11. Check system for proper operation.

Suction Accumulator/Drier

Replacement Guidelines

Replacement of the suction accumulator / drier is necessary anytime a major component of the refrigerant system is replaced. A major component includes condenser, compressor, evaporator core or a refrigerant hose / line. An orifice tube or O-ring is not considered a major component but the orifice tube should be replaced whenever the compressor is replaced for lack of performance.

In addition to the preceding condition, the accumulator / drier should also be replaced if one of the following conditions exist:

- The accumulator / drier is perforated.
- The refrigerant system has been opened to the atmosphere for a period of time longer than required to make a minor repair.
- There is evidence of moisture in the system such as internal corrosion of metal refrigerant lines or the refrigerant oil is thick and dark.

NOTE: The compressor oil from vehicles equipped with an FX-15 compressor may have a dark color while maintaining a normal oil viscosity. This is normal for this compressor because carbon from the compressor piston rings will discolor the oil and should not be confused with contaminated oil.

When replacing the suction accumulator / drier, the procedure given here must be followed to ensure that the total oil charge in the system is correct after the new accumulator / drier is installed.

1. Drain the oil from the removed accumulator / drier into a suitable measuring container. It may be necessary to drill one or two 1 / 2 inch holes in the bottom of the old accumulator / drier to ensure that all the oil has drained out.
2. Add the same amount of clean new refrigerant oil plus two fluid ounces to the new accumulator / drier. Use only the oil specified for the specific vehicle being serviced.

Charging From Small Containers

The refrigerant charge level of A / C systems currently being used is critical to optimum performance. An under-charge or an over-charge will adversely affect performance. Using small cans to charge these systems is not recommended because the charge level cannot be accurately controlled. A charging cylinder or a charging station is the only recommended method.

Refrigerant System Purging to Remove Air and Moisture Vapor

The triple evacuation procedures should be used when there are definite indications of moisture in the system. This procedure is effective in removing small amounts of moisture from the refrigerant system. However, if system is contaminated with a large quantity of water, complete system flushing will be required.

REFRIGERANT SYSTEM SERVICE (Continued)

The principle of the three evacuations is simple. The first pulldown removes approximately 90 percent of the air and moisture vapors.

The first purge with new, dry Refrigerant-12 mixes with the remaining 10 percent.

With the next evacuation, this mixture will be drawn out so that only approximately 10 percent of the remaining air and moisture vapors remain.

The second purge with new, dry Refrigerant-12 will mix with this 10 percent and the third evacuation will finish the job by drawing out practically all the remaining vapors.

If any water was present in the system at the start of this procedure, most of it will still be there. A short period of vacuum is not long enough to boil and vaporize the water. The Refrigerant-12 purges, in passing over the liquid, will absorb only a relatively small amount of water.

This procedure is effective only when no water is in the system, and should not be used if there is any indication of water in the system.

Adding Refrigerant Oil

It is important that only the specified type and quantity of refrigerant oil be used in the compressor. If there is surplus oil in the system, too much oil will circulate with the refrigerant, reducing the cooling capacity of the system. Too little oil will result in poor lubrication of the compressor.

The A/C compressors used on Taurus and Sable require a special refrigerant oil with special additives. Compressors used on R-12 systems require Motorcraft YN-9 oil. Compressors used on R-134a systems require oil, Ford Specification Number WSH-M1C231-B. Refer to Section 12-03A for compressor oil capacities and compressor replacement procedures.

When it is necessary to replace a component of the refrigeration system, the correct procedures must be followed to ensure the total oil charge on the system is correct after the new component is installed. During normal A/C operation, some refrigerant oil is circulated through the system with the refrigerant and some is retained in the compressor. If certain components of the system are removed for replacement, some of the refrigerant oil will go with the component. To maintain the original total oil charge, it is necessary to compensate for the oil lost by adding oil to the system with the replacement part. Refer to applicable Compressor and Clutch section for the procedure to replace lost oil.

R-134a Refrigerant Oil

CAUTION: Do not add R-134a refrigerant oil to an R-12 system. Also, do not add R-12 refrigerant oil YN-9 to an R-134a system. Mixing these two types of refrigerant oils may cause poor lubricant circulation resulting in component failure and damage to the A/C systems.

The refrigerant oil required for R-134a A/C systems is a polyalkalyiene glycol (PAG) oil, Ford specification WSH-M1C231-B or equivalent. This type of refrigerant oil was made specifically for R-134a systems and is not suitable for use in R-12 systems. Never use an R-134a refrigerant oil in R-12 systems.

R-12 systems for Taurus/Sable vehicles require the use of a mineral based refrigerant oil with special additives known as YN-9. This type of refrigerant oil was made specifically for R-12 systems and is not suitable for use in R-134a systems. Never use R-12 refrigerant oil YN-9 in R-134a systems.

Other Refrigerant System Components

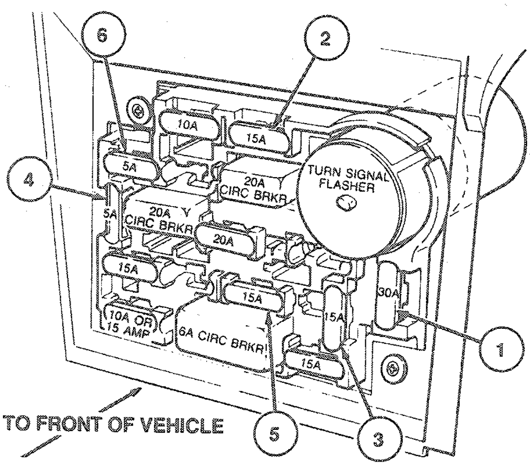
Replacement of other refrigerant system components such as hoses, compressor valves, and pressure switches does not require the addition of refrigerant oil.

SPECIFICATIONS

REFRIGERANT SYSTEM COMPONENTS AND CAPACITIES

Vehicle[2]	Compressor	Clutch Cycling Pressure Switch[3]	Fixed Orifice Tube	Refrigerant Capacity[1]	
				(oz.)	(kg)
3.0L EFI	FX-15	X	X	40 ± 1	1.13 ± 0.028
3.8L	FX-15	X	X	40 ± 1	1.13 ± 0.028
3.0L SHO	10P15F	X	X	40 ± 1	1.13 ± 0.028

1 Plus (2 oz) (.057 kg) minus (2 oz) (.057 kg)
2 All models equipped with Suction Accumulator/Drier.
3 Pressure switch opens at 169 kPa (24.5 psi)



THE FUSE PANEL IS LOCATED IN THE LOWER LH SIDE OF THE INSTRUMENT PANEL, BEHIND A COVER WHICH MUST BE REMOVED FOR ACCESS.

L6394-B

SPRING LOCK COUPLING COMPONENTS

O-Ring	3/8 inch—391302-S100 1/2 inch—391303-S100 5/8 inch—391304-S100 3/4 inch—391305-S100
Garter Springs	3/8 inch—E1ZZ-19E576-A (YF-990) 1/2 inch—E1ZZ-19E576-A (YF-991) 5/8 inch—E35Y-19E576-A (YF-1134) 3/4 inch—E69Z-19E576-A
Service Kits	
E35Y-19D690-D	Contains 391302, 391303, 391304, 391305 O-Rings. E1ZZ-19E576-A & B and E35Y-19E576-A Springs

TORQUE SPECIFICATIONS

Description	N·m	Lb-Ft
Orifice Tube Housing Compression Nut	88-95	65-70
Heater Hose Clamps	1.81-2.49	17-22 (Lb-In)

SPECIAL SERVICE TOOLS

Tool Number	Motorcraft Part Number	Description
T71P-19703-S and R	—	Fitting Adapters (R-12 System, Low Pressure)
D81L-19703-A	YT-367	Service Access Adapter (R-12 System, High Pressure)
T81P-19623-G1	—	Spring-Lock Coupling Disconnect Tool—3/8 inch
T81P-19623-G2	—	Spring-Lock Coupling Disconnect Tool—1/2 inch
T83P-19623-C	—	Spring-Lock Coupling Disconnect Tool—5/8 inch
T85L-19623-A	—	Spring-Lock Coupling Disconnect Tool—3/4 inch
D87P-19703-A	—	Tee Adapter Tool (R-12 System)
D88P-19703-B	—	Leak Test Adapter Kit (Evaporator/Condenser)

ROTUNDA EQUIPMENT

Model	Description
021-00012	Radiator/Heater Core Pressure Tester
023-00007	Dial Thermometer
055-00014 or 055-00015	Electronic Leak Detector
063-00003	Safety Shield Goggles
063-00010	Air Conditioning Service Kit
078-00800	A/C Reclaim System
112-00021	Ultraviolet Lamp
112-00027	Fluoro-Lite
112-00028	A/C Tracer Dye Injector

SECTION 12-02 Heating and Defrosting

VEHICLE APPLICATION

Taurus / Sable.

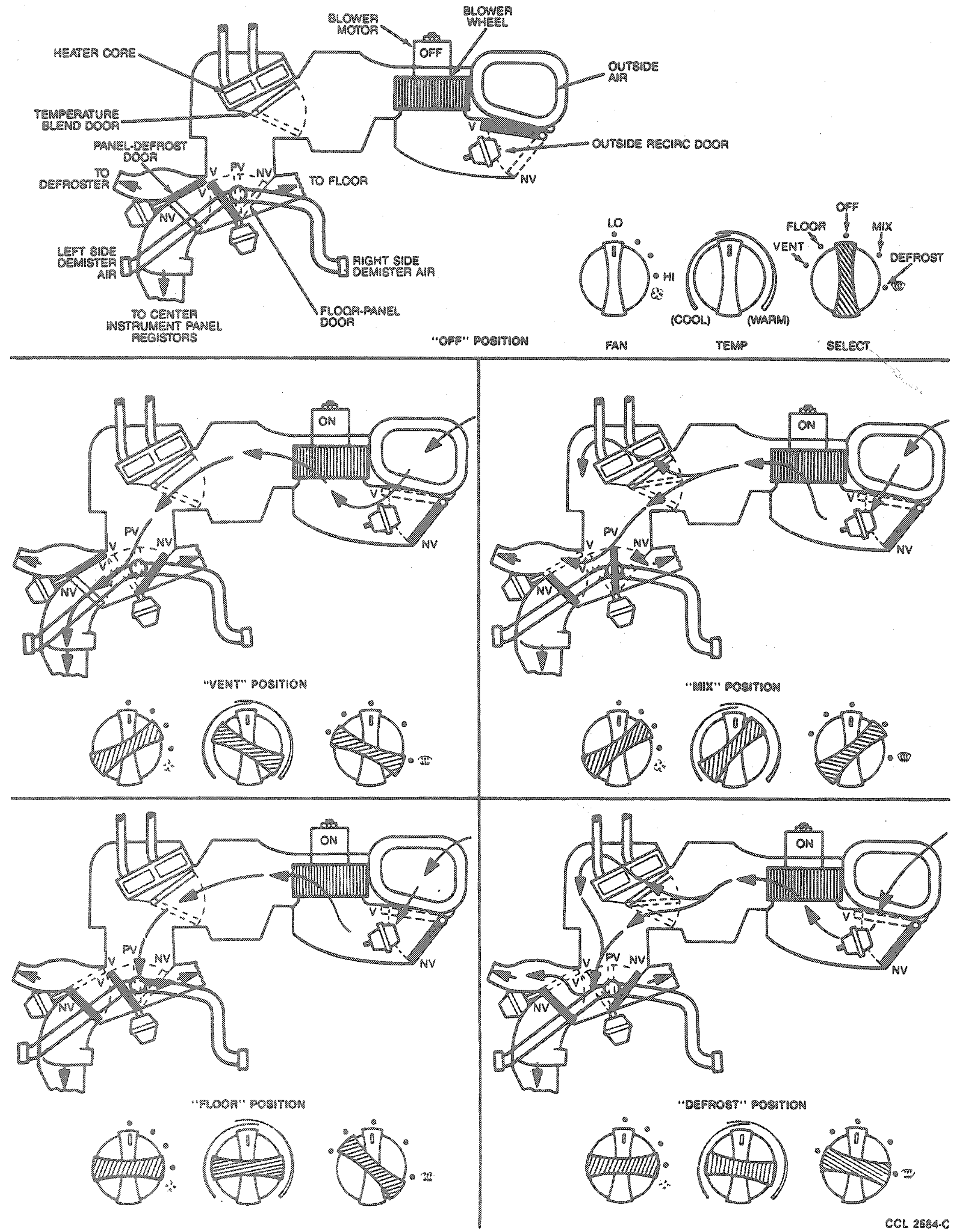
DESCRIPTION AND OPERATION

Airflow

The heater assembly is a blend air system, receiving outside air through the blower inlet, which is connected directly to an opening in the upper cowl. Outside air is drawn into the system from the cowl, through the blower inlet into the blower housing. It is forced through and / or around the heater core, mixed, and then discharged through outlets in the discharge air duct to the floor area or through the defroster outlets, depending upon the type of climate control desired. Several doors determine the amount of air that goes through the heater core and the particular outlet(s) through which it discharges. The following illustration shows the airflow through the system with the various function selections available.

DESCRIPTION AND OPERATION (Continued)

System Airflow Schematic



DESCRIPTION AND OPERATION (Continued)

OFF

When the function selector knob is in the OFF position:

- The outside-recirc door is at full vacuum. As a result, outside air is closed off and recirc air is admitted to the system.
- The panel-defrost door and the floor-panel door are both at full vacuum, closing off the passages to the defrosters.
- The blend door position may be anywhere within the range of its cable travel from FULL HEAT to FULL COOL.
- The blower motor is off.

PANEL

When the function selector knob is in the PANEL position:

- The outside-recirc door, with no vacuum being applied, will block recirc air and admit outside air. From there, airflow is directed through the system to the instrument panel registers.
- The floor-panel door is at no vacuum to block airflow to the floor registers, and the panel-defrost door is at full vacuum, closing off airflow to the defrosters.
- The temperature selector may be adjusted to heat the air, if desired.
- The blower motor is on.

FLOOR

When the function selector knob is in the FLOOR position:

- The outside-recirc door is in the no vacuum position to block recirc air and admit outside air.
- The floor-panel door is in the vacuum position which closes off all but a minimum of airflow to the defroster.
- The blend air door position will channel airflow so that a desired temperature level will be achieved.
- The panel-defrost door is in the no vacuum position to block air circulation to the panel registers.
- The blower motor is on.

MIX

When the function selector knob is in the MIX position:

- The outside-recirc air door and the panel-defrost door are in the no vacuum position.
- The floor-panel door is in the partial vacuum position.
- The blower motor is on.

DEFROST

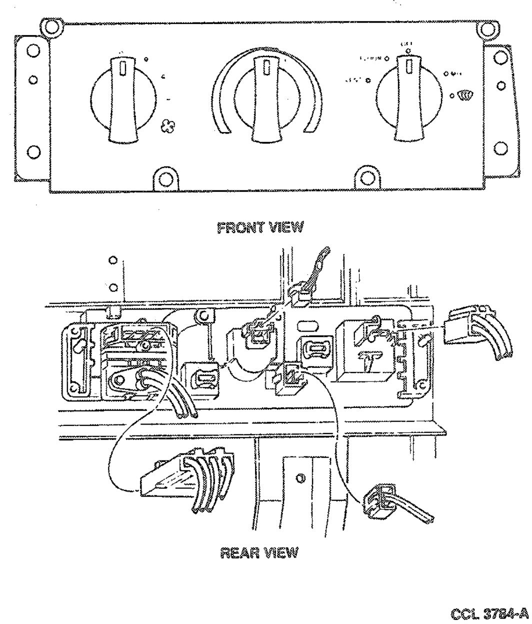
When the function selector knob is in the DEFROST position:

- The outside-recirc air door is in the no vacuum position to admit outside air.
- Both the floor-panel and the panel-defrost doors are in the no vacuum position so that most of the incoming air is directed to the defroster nozzles. There is a slight air bleed to the floor registers.
- The temperature control knob setting will determine the amount of heat being introduced into the airflow.
- The blower motor is on.

Control Assembly

The control assembly is located in the instrument panel at the right of the steering column. The control assembly contains a four position blower knob, a temperature control knob, a function control knob and illumination bulb.

Heater Control Assembly



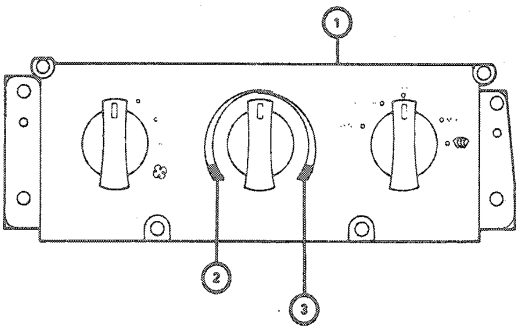
The heater and power ventilation control includes a function control knob for PANEL, FLOOR, OFF, MIX and DEFROST that determines the manner in which the system will operate, a temperature control knob for manually setting the desired comfort temperature, and a blower switch to control the volume of air movement. Each position of the function control knob and blower switch is detented for positive engagement. The blower switch provides four manually selected blower speeds and may be operated in any position to select the desired amount of airflow.

DESCRIPTION AND OPERATION (Continued)

Temperature Control

Temperature control of the heater and power ventilation system is determined by the position of the temperature control knob (between COOL and WARM) of the control assembly, and is accomplished by means of an electric blend door actuator between the control assembly and the temperature blend door. System airflow is manually controlled by the control assembly. A vacuum selector valve, controlled by the function control knob, distributes vacuum to the various door vacuum motors which in turn, direct the airflow through the system.

Control Assembly—Temperature Control Knob



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ITEM	DESCRIPTION
1.	CONTROL ASSEMBLY (HEATER/POWER VENTILATION SYSTEM) - 18549
2.	COOL BAND (BLUE)
3.	WARM BAND (RED)

The system uses a temperature blend method to provide controlled temperature to the vehicle interior. With this method, all outside airflow from the blower passes through the heater case to the plenum assembly. Temperature is then regulated by heating a portion of the outside air and blending it with the remaining cooler outside air to the desired temperature. Temperature blending is varied by the temperature blend door which controls the amount of air that flows through or around the heater core, where it is mixed and directed into the distribution plenum. The air is finally directed to the heater ducts, the defroster nozzles, or the instrument panel registers, depending upon the selection made with the function selector knob.

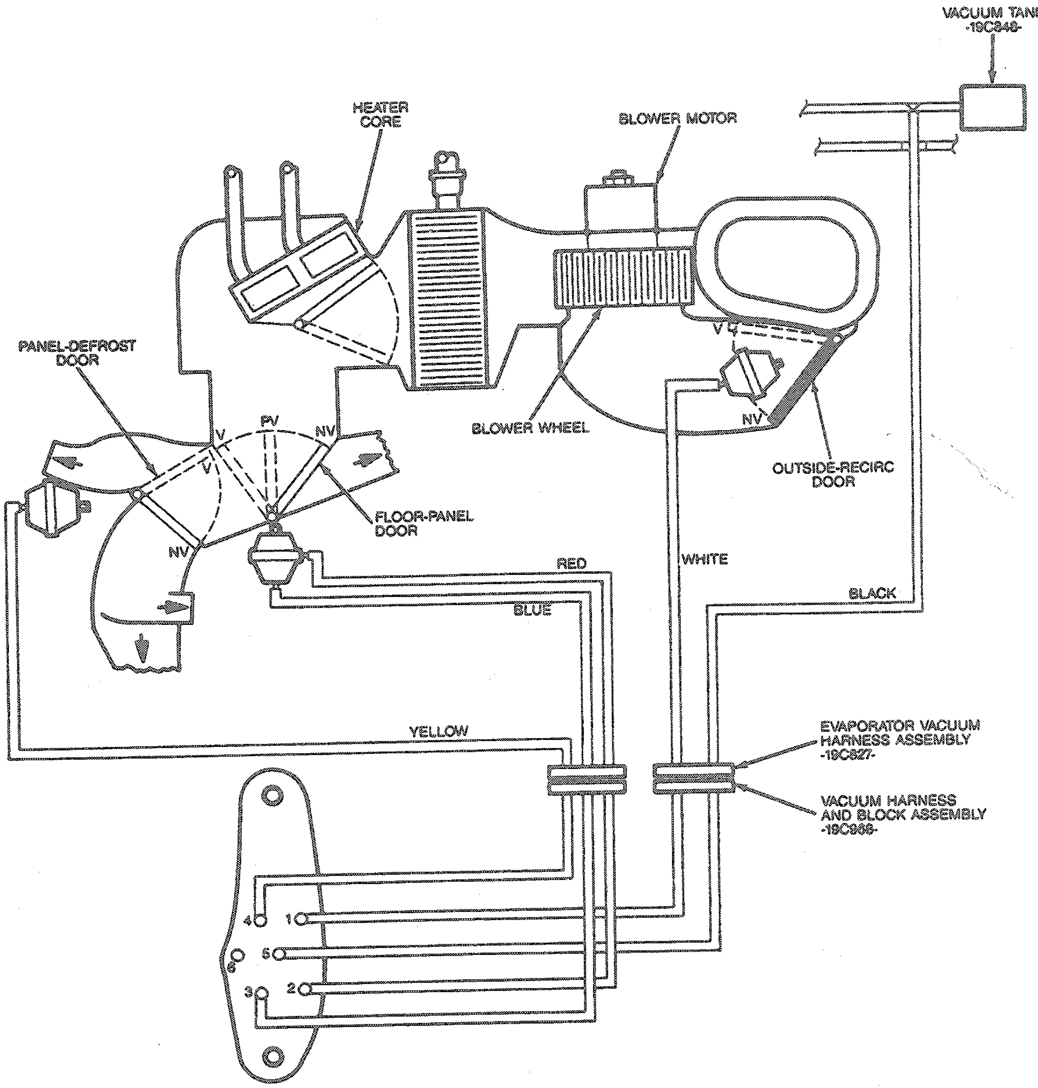
System Airflow and Vacuum Controls

The System Air Flow Schematic illustrates how air is circulated through the system when the function selector knob is in each of its detent positions. The following illustration adds a vacuum schematic and chart to a basic airflow schematic to show how the five lines in the vacuum harness are controlled by a selector valve assembly to operate three vacuum motors. The motors control the movement of:

- The outside-recirc door
- The panel-floor door
- The panel-defrost door

DESCRIPTION AND OPERATION (Continued)

Heater System Vacuum Schematic and Selector Test



VACUUM PORT	FUNCTION	SELECTION						
		OFF	DEFROST	FLOOR — PANEL (MIX)	FLOOR	FLOOR — PANEL (HI-LO)	PANEL	RECIRC.
1	Outside — Recirc.	V	NV	NV	NV	NV	NV	V
2	Full Floor	NV	NV	NV	V	NV	NV	NV
3	Floor — Panel (Partial)	NV	NV	V	V	V	NV	NA
4	Panel — Defrost	NV	NV	NV	NV	V	V	V
5	Source	V	V	V	V	V	V	V
6	Plugged	—	—	—	—	—	—	—

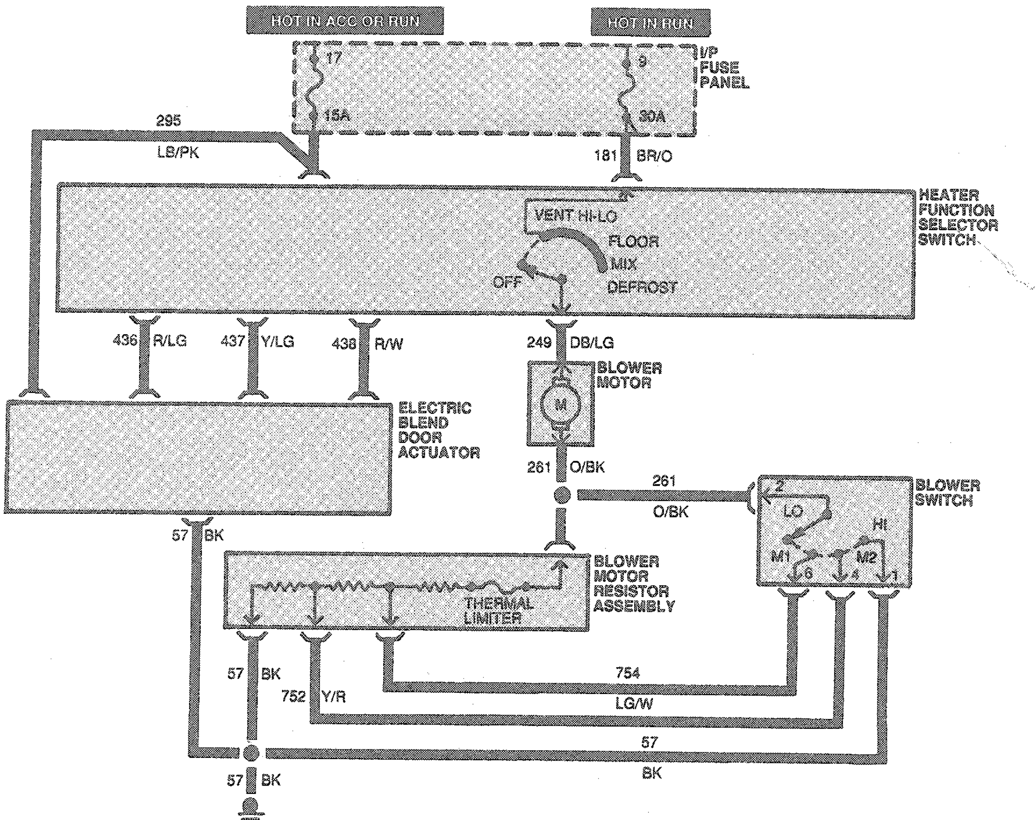
CCL 2567-B

DESCRIPTION AND OPERATION (Continued)

The panel-floor door vacuum motor has two vacuum lines. When vacuum is applied to both lines, the door moves to its full vacuum position. When vacuum is applied to the blue line only, the door moves to a partial vacuum position. If it is applied to the red line only (or neither line) the door will assume a no vacuum position.

The following illustration shows the system electrical wiring diagram and provides charts which contain some test data.

Heater System Electrical Wiring Diagram



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Safety Precautions

Whenever components in the engine compartment or instrument panel areas are being serviced, the battery ground cable must be disconnected to eliminate the possibility of electrical shorts, burned-up wiring, and dangerous fires. Extreme care must be exercised when performing electrical tests where the battery must be connected to operate the system.

WARNING: CARBON MONOXIDE IS COLORLESS, ODORLESS AND DANGEROUS. IF IT IS NECESSARY TO OPERATE THE ENGINE WITH THE VEHICLE IN A CLOSED AREA SUCH AS A GARAGE, ALWAYS USE AN EXHAUST COLLECTOR TO VENT THE EXHAUST GASES OUTSIDE THE CLOSED AREA.

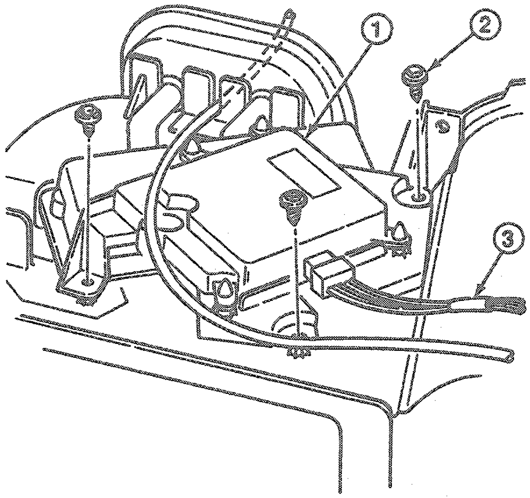
Components

Control Assembly

The control assembly consists of three main parts: 1) the function selector—a vacuum selector valve combined with an internal electrical switch; 2) blower switch—an electrical switch that provides four speeds of blower operation, and 3) the temperature control knob which connects through an electric actuator to the temperature blend door of the plenum assembly.

DESCRIPTION AND OPERATION (Continued)

Electric Blend Door Actuator



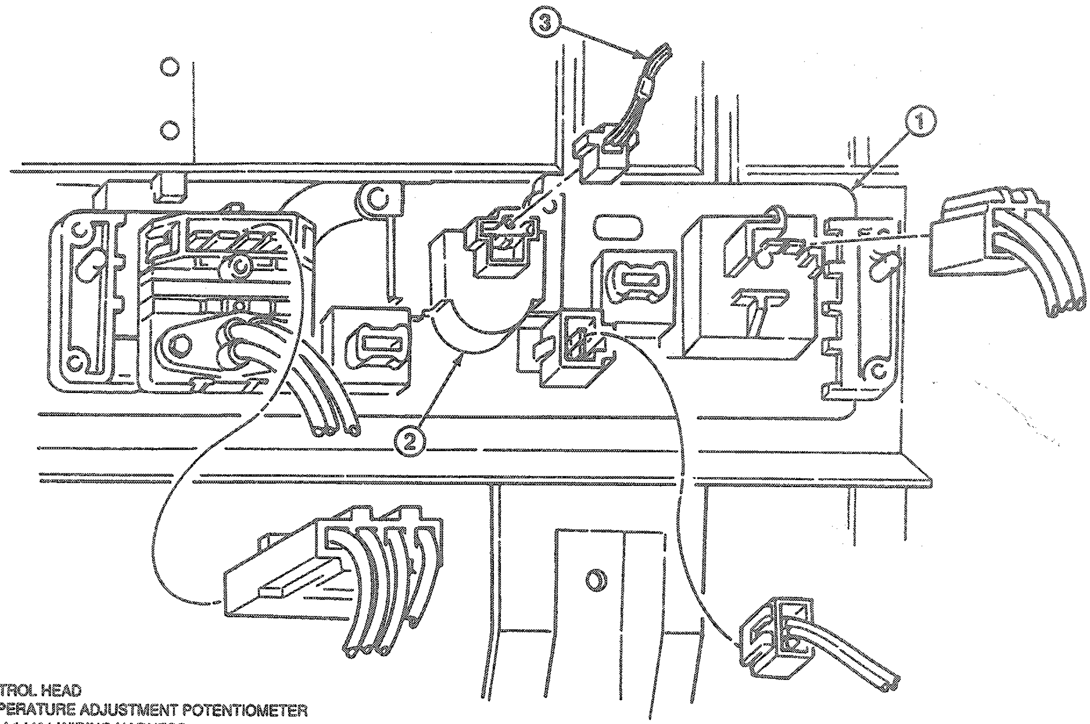
1. BLEND DOOR ACTUATOR
2. ACTUATOR TO EVAPORATOR CASE MOUNTING SCREWS
3. JUMPER HARNESS FROM 14401 WIRING

CCL 3732-A

1. The vacuum selector valve directs source vacuum to various vacuum motors. One internal single-pole electrical switch is also controlled by the selector. The internal electrical switch controls the electrical supply to the blower switch (refer to Heater System Electrical Wiring Diagram).
2. The four-speed blower switch controls blower speed and is manually set to select the desired airflow.
3. The temperature control knob (temperature adjustment potentiometer) is connected to the temperature blend door by an electric actuator. Movement of the control knob from COOL to WARM causes a corresponding movement on the temperature blend door and determines the temperature that the system will maintain.

DESCRIPTION AND OPERATION (Continued)

Temperature Adjustment Potentiometer



1. CONTROL HEAD
2. TEMPERATURE ADJUSTMENT POTENTIOMETER
3. FROM 14401 WIRING HARNESS

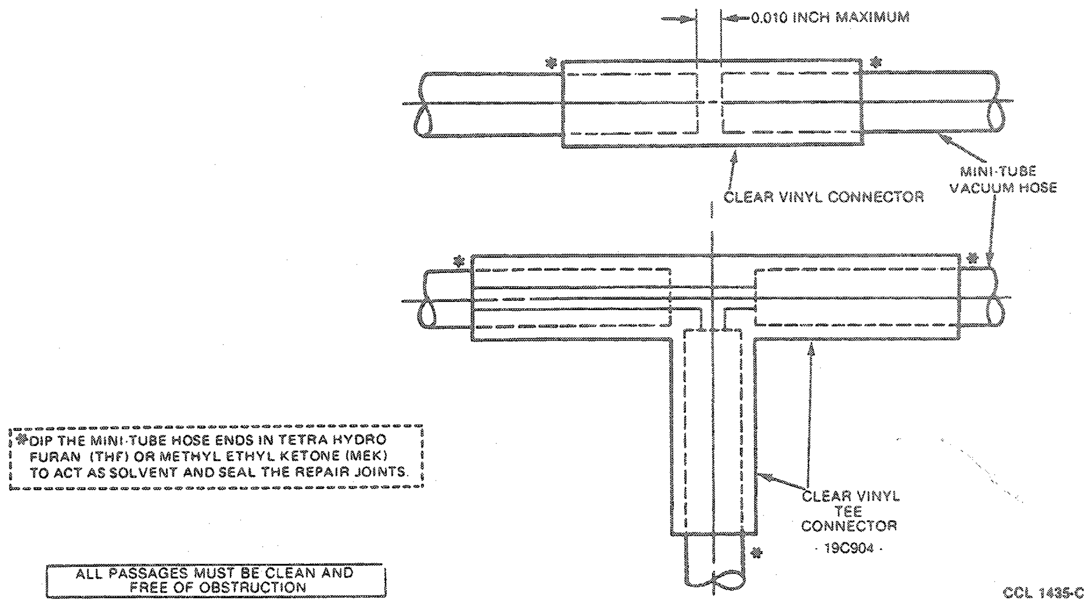
CCL 3733-A

Mini-Tube Vacuum Hoses

Mini-tube vacuum hoses are used in the vacuum harness assemblies. They provide greater flexibility with less tendency to collapse and are less susceptible to pinching. Service is easily performed using a short piece of standard 3mm (1/8 inch) ID vacuum hose and inserting the cut ends of the mini-tube into the ends of the standard 3mm (1/8 inch) ID vacuum hose. Refer to Adjustments.

DESCRIPTION AND OPERATION (Continued)

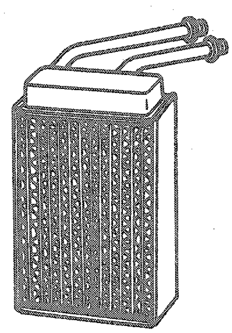
Mini-Tube Vacuum Hose Service



Heater Core

The heater core consists of a number of fins, and tubes in a geometry to extract available heat from the engine coolant and transfer that heat to the air that passes through the core.

Heater Core



Register Assemblies

The register assemblies have retaining pins on each end of the louver assembly that lock into pivot holes in the register housing. The housings are an integral part of the instrument panel applique assembly. The applique panel has four flexible tabs (two on top and two on the bottom) that lock the housing into the instrument panel. The louver assembly swivels, directing outlet air up or down while the louvers allow side-to-side air distribution.

A knob located on the LH front of the register assembly controls an air outlet shutoff door installed in the register housing assembly.

REMOVAL AND INSTALLATION

Instrument Panel

Refer to Section 01-12 for instrument panel removal and installation procedures.

Control Assembly

Removal

1. Disconnect battery ground cable.
2. Remove four screws attaching control assembly to instrument panel.
3. Pull control assembly from instrument panel opening and disconnect wire connectors from control assembly.
4. Disconnect vacuum harness and wire connectors from control assembly. Discard pushnuts used to retain vacuum harness.

Installation

1. Connect wire connectors and vacuum harness to control assembly using new pushnuts.

   CAUTION: Push on vacuum harness retaining nut. Do not attempt to screw onto post.

REMOVAL AND INSTALLATION (Continued)

2. Position control assembly to instrument panel opening and install four retaining screws.
3. Connect battery ground cable.
4. Check system for proper operation.

Blower Switch

Removal

1. Remove control assembly from instrument panel as outlined.
2. Remove switch knob.
3. Remove screw (from underside of control assembly) which attaches the switch to control assembly.
4. Disconnect wire connectors from switch and remove switch.

Installation

1. Position switch on control assembly.
2. Install screw to attach switch to control assembly.
3. Connect wire harness connector to switch.
4. Install control assembly in instrument panel.
5. Place switch knob on switch shaft and push knob all the way on.
6. Connect battery ground cable.
7. Check system for proper operation.

Vacuum Selector Switch

Removal

1. Remove control assembly from vehicle.
2. Pull knob off function selector shaft.
3. Remove screw attaching vacuum switch to control assembly and remove vacuum selector switch.

Installation

1. Rotate function selector shaft to OFF position.
2. Position vacuum selector switch on control assembly bracket.
3. Install screw attaching vacuum switch to control assembly.

Louver Assembly

All louver assemblies can be removed by rotating the assemblies downward and pulling outward. The RH instrument panel applique can be removed by inserting a flat-blade screwdriver under the retaining tabs and pulling outward.

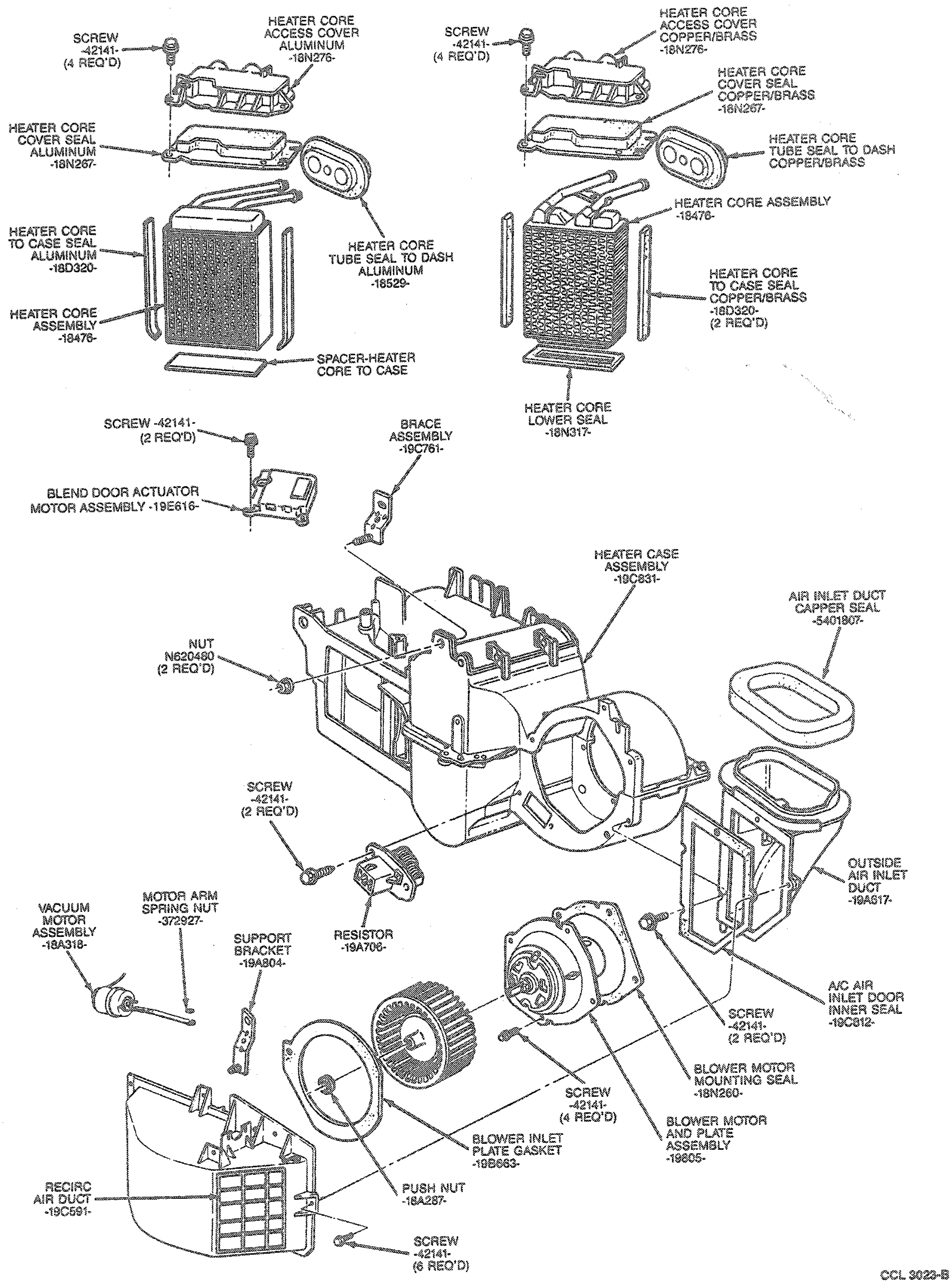
Heater Case Assembly

Removal

1. Disconnect battery ground cable.
2. Drain coolant from radiator into a clean container.
3. Disconnect heater hoses from heater core. Plug heater core tubes or blow any coolant from heater core with low-pressure air.
4. Disconnect vacuum supply hose from in-line vacuum check valve in engine compartment.
5. Remove instrument panel. Refer to Section 01-12.
6. Remove screw holding instrument panel shake brace to heater case. Remove instrument panel shake brace.
7. Remove floor register and rear floor ducts from the bottom of heater case.
8. Remove three nuts attaching heater case to dash panel in engine compartment.
9. Remove two screws attaching brackets to cowl top panel.
10. Carefully pull heater assembly away from dash panel and remove heater from vehicle.

REMOVAL AND INSTALLATION (Continued)

Heater Case Assembly



REMOVAL AND INSTALLATION (Continued)

Installation

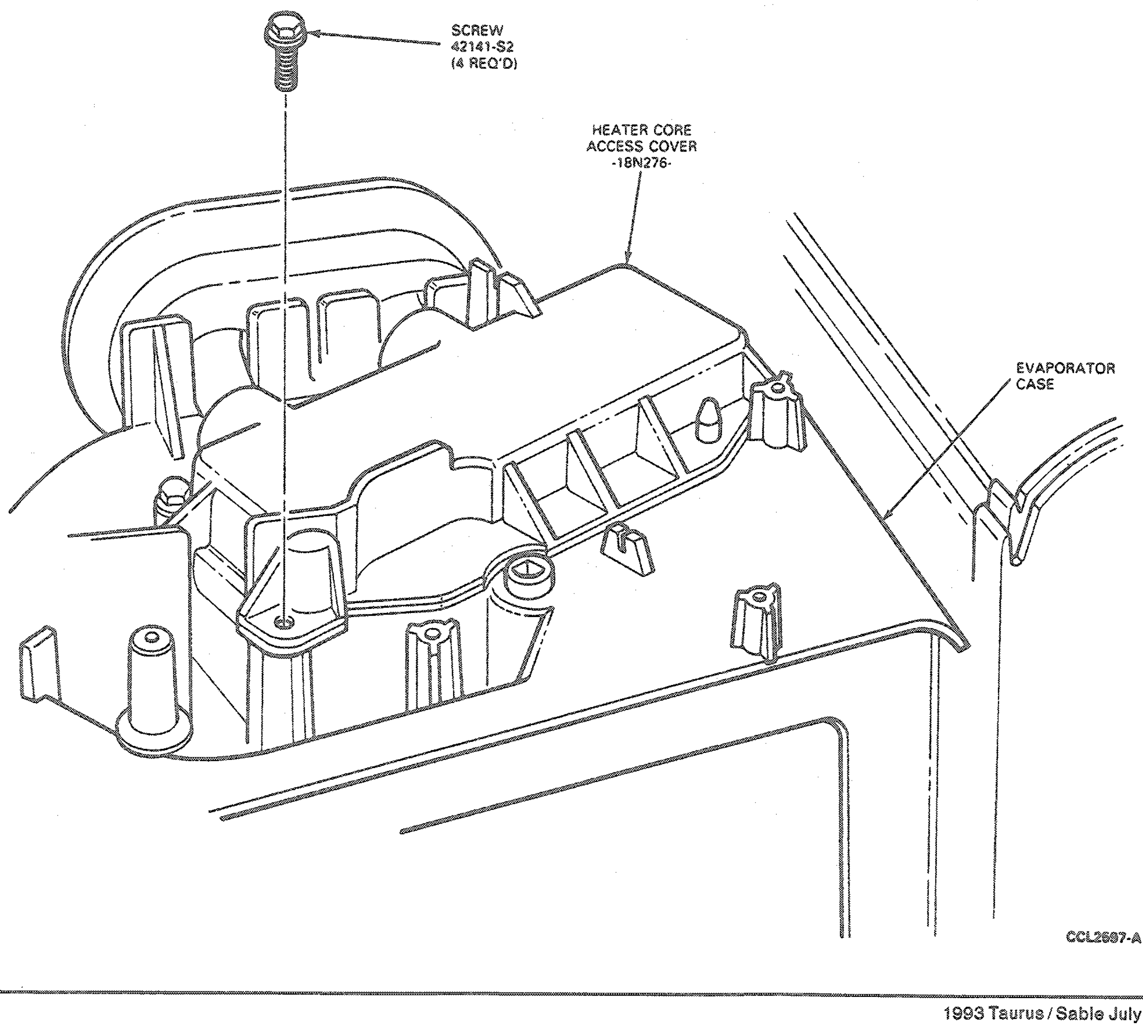
1. Position heater case assembly to dash panel and cowl top panel at air inlet opening. Install two screws to attach support brackets to cowl top panel.
2. Install three nuts in engine compartment to attach heater case to dash panel.
3. Install floor register and rear floor ducts on the bottom of the heater case.
4. Install instrument panel shake brace and screw to heater case.
5. Install instrument panel as outlined.
6. Connect heater hoses to heater core.
7. Connect black vacuum supply hose to vacuum check valve in engine compartment.
8. Fill radiator to correct level with previously removed coolant or specified mixture of coolant and water.
9. Connect battery ground cable.
10. Check system for proper operation.

Heater Core

Removal

1. Remove instrument panel and lay it on front seat.
2. Remove heater case assembly as outlined.
3. Remove vacuum source line from heater core tube seal.
4. Remove seal from heater core tubes (refer to Heater Case Assembly).
5. Remove four heater core access cover retaining screws and remove access cover from heater case.

Heater Core Access Cover Retaining Screws



REMOVAL AND INSTALLATION (Continued)

6. Lift heater core and seals from heater case.

Installation

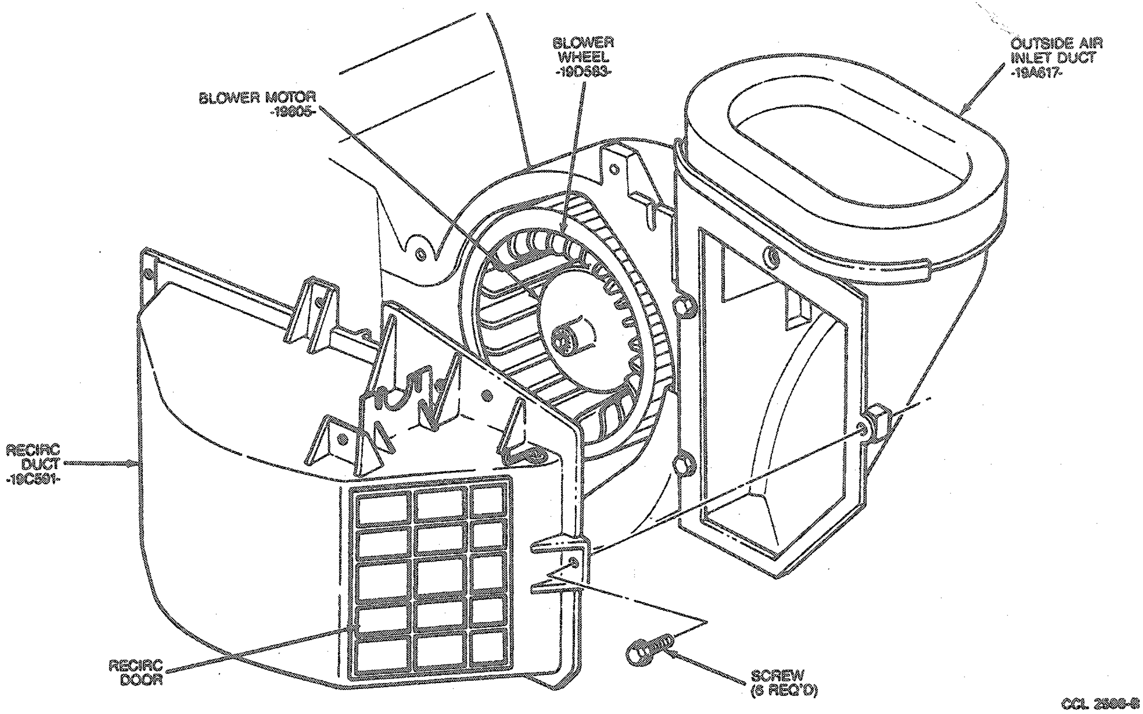
1. Transfer three foam core seals to new heater core.
2. Install heater core and seals into heater case.
3. Position heater case access cover on heater case. Install four retaining screws.
4. Install seal on heater core tubes.
5. Install vacuum source line through heater core tube seal.
6. Install heater case assembly into vehicle as outlined.

Recirc Duct Assembly

Removal

1. Open glove compartment door and release retainers, lowering door.
2. Remove screw attaching recirc duct support bracket to cowl.
3. Remove vacuum connection to recirc door vacuum motor.
4. Remove six screws attaching recirc duct to heater assembly.

Recirc Duct-to-Heater Assembly Attachment



5. Remove recirc duct from heater assembly, lowering recirc duct from between instrument panel and heater case.

Installation

1. Install recirc duct to heater, lifting recirc duct between instrument panel and heater case.
2. Install six screws retaining recirc duct to heater case.
3. Install vacuum connector to recirc door vacuum motor.
4. Install screw attaching support bracket to cowl.
5. Close glove compartment.

Blower Motor and Wheel Assembly

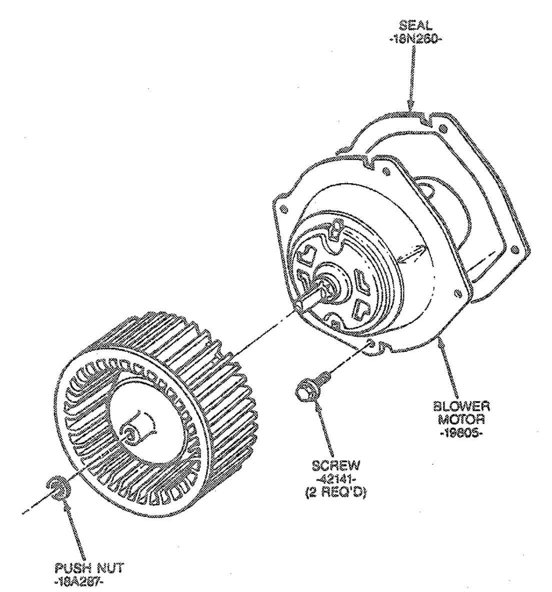
Removal

1. Remove recirc duct assembly from vehicle.
2. Disconnect blower electrical lead.

REMOVAL AND INSTALLATION (Continued)

3. Remove blower wheel pushnut and blower wheel.
4. Remove four blower motor mounting plate screws. Remove blower motor from evaporator case.

Blower Motor and Motor Mounting Plate



CCL 2598-C

Installation

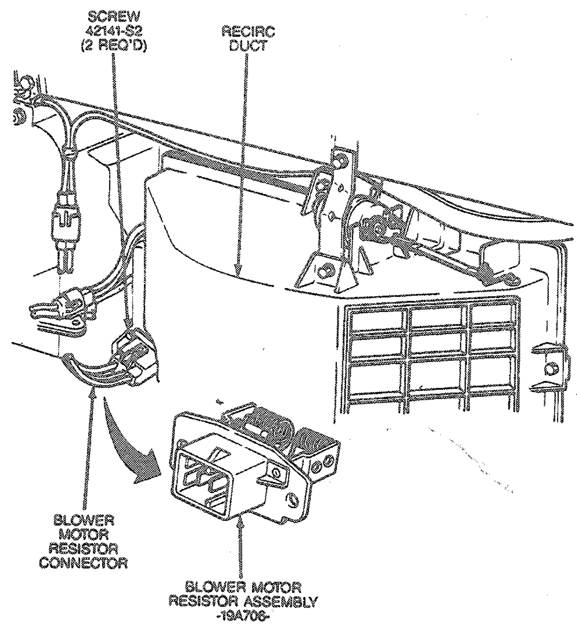
1. Assemble blower motor electrical lead through evaporator case.
2. Position blower motor into evaporator. Install four retaining screws.
3. Assemble blower wheel to blower motor shaft aligning the flat on the shaft with the flat on the inside diameter of the blower wheel hub. Slide the blower wheel onto the blower motor shaft until the wheel is fully seated.
4. Install a new pushnut on the blower motor shaft to retain the wheel.
5. Connect wiring harness to blower motor.
6. Install recirc duct assembly in vehicle.

Blower Motor Resistor

Removal and Installation

The blower motor resistor and thermal limiter assembly is installed on the passenger side of the heater case behind the glove compartment. Use only the specified resistor assembly for service replacement. Do not apply sealer to the resistor board mounting surface.

Blower Motor Resistor



CCL 2600-B

1. Open glove compartment and release glove compartment retainers so that glove compartment hangs down.
2. Disconnect wire harness connector from resistor assembly.
3. Remove two resistor retaining screws and remove resistor from heater case.
4. To install, position resistor assembly in heater case opening and install two retaining screws. Do not apply sealer to resistor assembly mounting surface.
5. Connect wire harness connector to resistor.
6. Check operation of blower motor.
7. Close glove compartment.

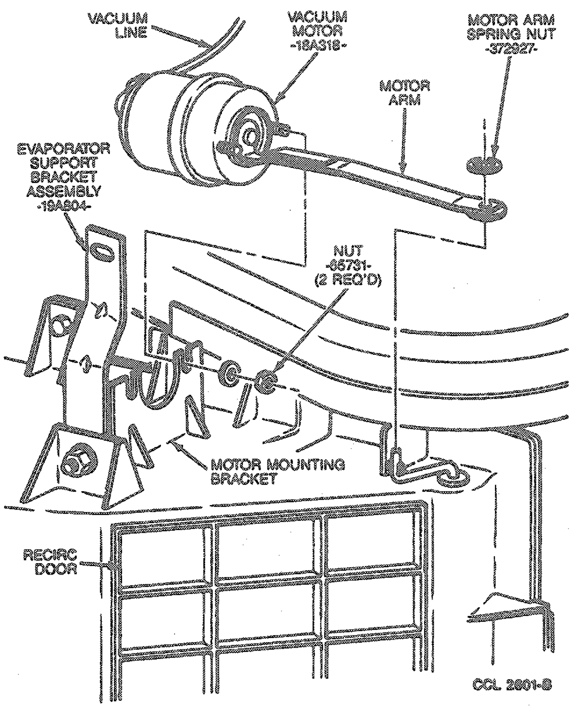
Outside-Recirc Door Vacuum Motor

Removal

1. Lower glove compartment door to provide access to recirc duct assembly.
2. Disconnect vacuum hose from end of vacuum motor.
3. Remove motor arm retainer from door crank arm.

REMOVAL AND INSTALLATION (Continued)

Motor Arm Retainer and Screw Removal



4. Remove two nuts retaining vacuum motor to recirc duct and remove motor.

Installation

1. Position vacuum motor to outside-recirc door crank arm. Position motor to recirc duct and install two retaining nuts.
2. Install retainer on door crank arm.
3. Connect white vacuum hose to vacuum motor and check operation of vacuum motor.
4. Lift glove compartment into position.

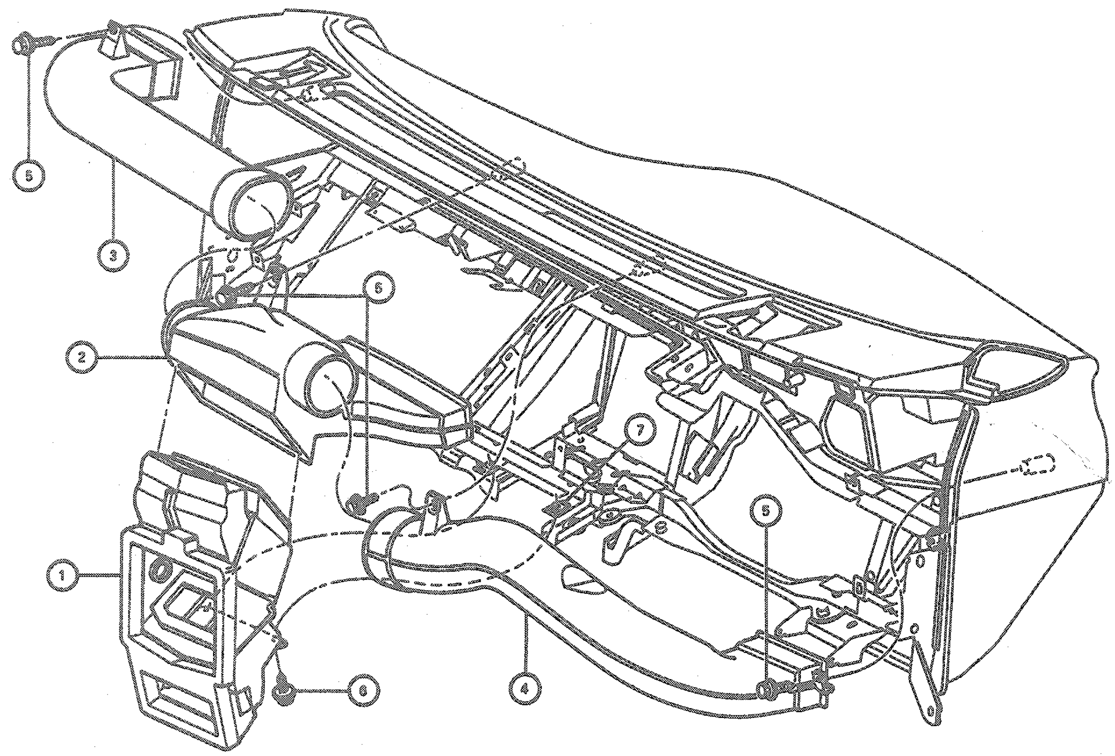
Plenum Chamber and Duct Assembly

Removal and Installation

1. Remove instrument panel. Refer to Section 01-12.
2. Remove two screws retaining plenum to instrument panel. Remove screw retaining defroster nozzle to plenum.
3. Disconnect vacuum hose connector retaining defroster nozzle.
4. Disconnect demister hoses.
5. Remove plenum chamber.
6. To install, reverse Removal procedure.

REMOVAL AND INSTALLATION (Continued)

Plenum Chamber — Taurus

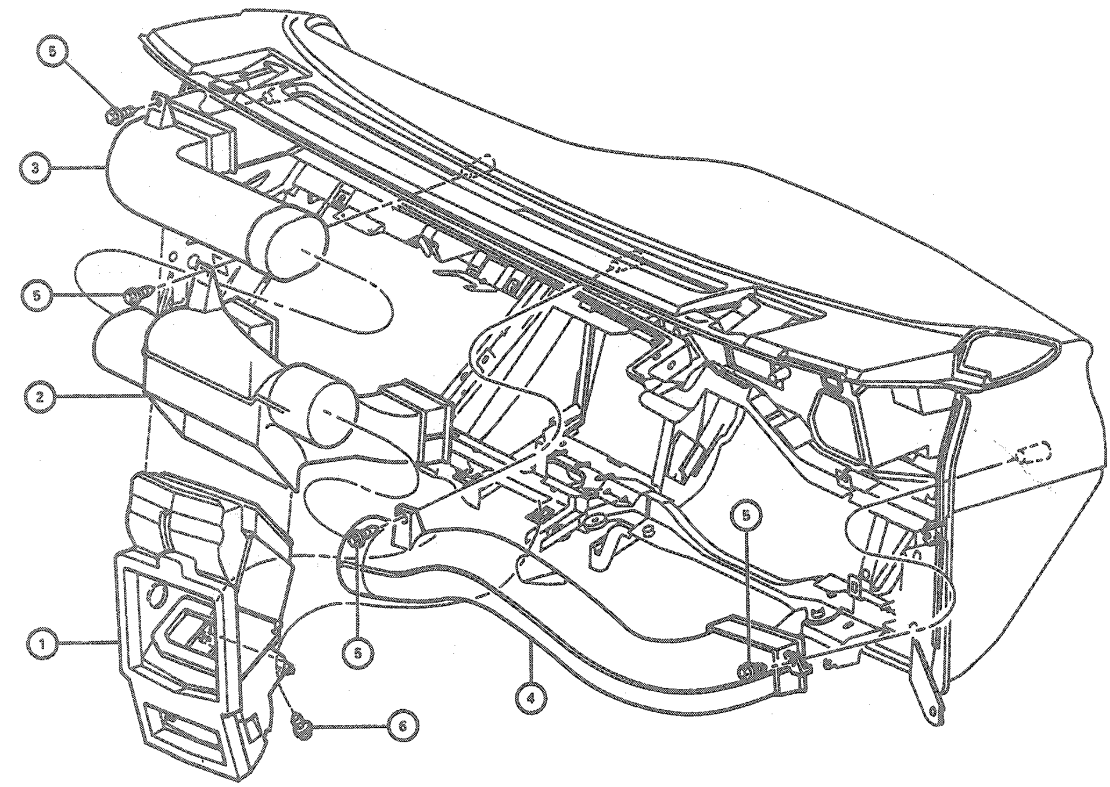


ITEM	DESCRIPTION
1.	A/C PLENUM ASSY - 19740
2.	A/C I/P CENTER LH REGISTER DUCT ASSY - 19C805
3.	A/C I/P RH REGISTER DUCT ASSY - 19B680
4.	A/C I/P LH REGISTER DUCT ASSY - 19A843
5.	SCREW - N803875-S36 (4 REQ'D)
6.	SCREW - N803876-S36B (2 REQ'D)
7.	SPRING NUT P.I.A. INSTRUMENT PANEL

CCL 3708-A

REMOVAL AND INSTALLATION (Continued)

Plenum Chamber and Duct Assembly — Sable



ITEM	DESCRIPTION
1.	PLENUM ASSY - 19740
2.	LH CENTER I/P REGISTER DUCT ASSY - 19C805
3.	RH I/P REGISTER DUCT ASSY - 19B680
4.	LH I/P REGISTER DUCT ASSY - 18A843
5.	SCREW - N803875-S36 (4 REQ'D)
6.	SCREW - N803876-S36B (2 REQ'D)

CCL 3709-A

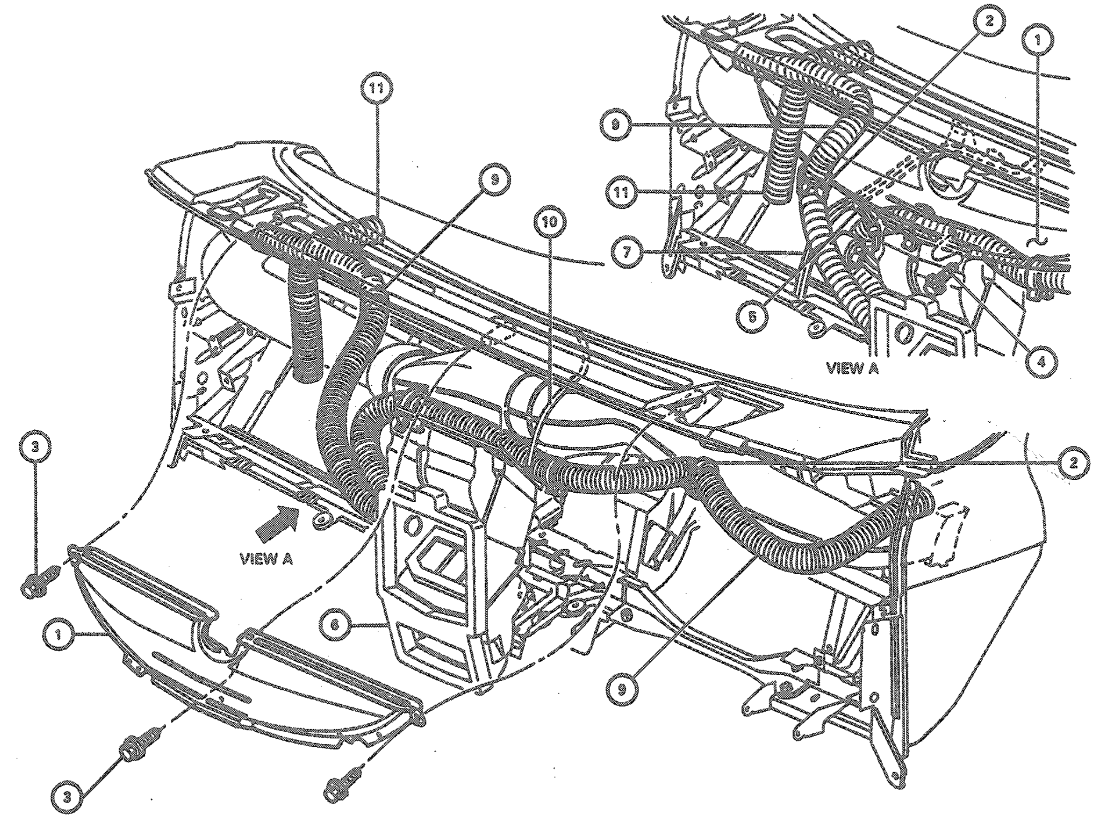
Defroster Nozzle

Removal and Installation

1. Remove instrument panel. Refer to Section 01-12.
2. Disconnect vacuum hose from retaining tab on defroster assembly.
3. Lower plenum chamber by loosening the two screws retaining it to instrument panel and screw retaining it to plenum.
4. Remove screw retaining defroster nozzle to plenum.
5. Remove three screws retaining defroster nozzle to instrument panel.
6. Disconnect LH demister hose from defroster nozzle and both RH hoses from plenum.
7. To install, reverse Removal procedure.

REMOVAL AND INSTALLATION (Continued)

Defroster Nozzle and Demister Hoses



ITEM	DESCRIPTION	ITEM	DESCRIPTION
1.	NOZZLE ASSY - 19D733	7.	VACUUM HARNESS P.I.A. CONTROL ASSY
2.	CLIP - 19B632 (4 REQ'D)	8.	TAB PART OF CENTER DUCT
3.	SCREW - N803875-S36 (3 REQ'D)	9.	DEMISTER & HOSE ASSY P.I.A. INSTRUMENT PANEL
4.	SCREW - 381801-S2 OR N803818-S55	10.	CABLE ASSY - 19D674
5.	STRAP - 95874-S	11.	TEMP CONTROL HOSE - 19D888
6.	PLENUM CHAMBER		

CCL 3710-A

Demisters and Demister Hoses

Removal and Installation

Refer to Defroster Nozzle and Demister Hoses illustration.

1. Remove instrument panel, resting it against front seat. Refer to Section 01-12.
2. Disconnect vacuum hose connector from vacuum harness where it is clipped to defroster nozzle.
3. Loosen two retaining screws to lower A/C plenum chamber from instrument panel.
4. Remove screw retaining defroster nozzle to plenum.
5. Remove three screws retaining defroster nozzle to instrument panel.
6. Disconnect LH demister hose from LH duct clip, two clips on center duct and RH side of plenum. Disconnect RH hose from clip on defroster nozzle and RH side of plenum chamber. Remove each hose from demister by rotating clockwise to remove the barb on demister.
7. Remove two screws holding demister assembly to instrument panel and from front side of instrument panel.
8. To install, reverse Removal procedure.

REMOVAL AND INSTALLATION (Continued)

Floor Air Distribution Duct

Front Heater

Removal and Installation

1. Remove two screws attaching duct to evaporator case assembly just below heat distribution duct.
2. Pull floor air distribution duct away from evaporator case.
3. To install, position duct to evaporator case. Ensure retainer at forward edge of duct is inserted over edge of opening in evaporator case. Install retaining screws.

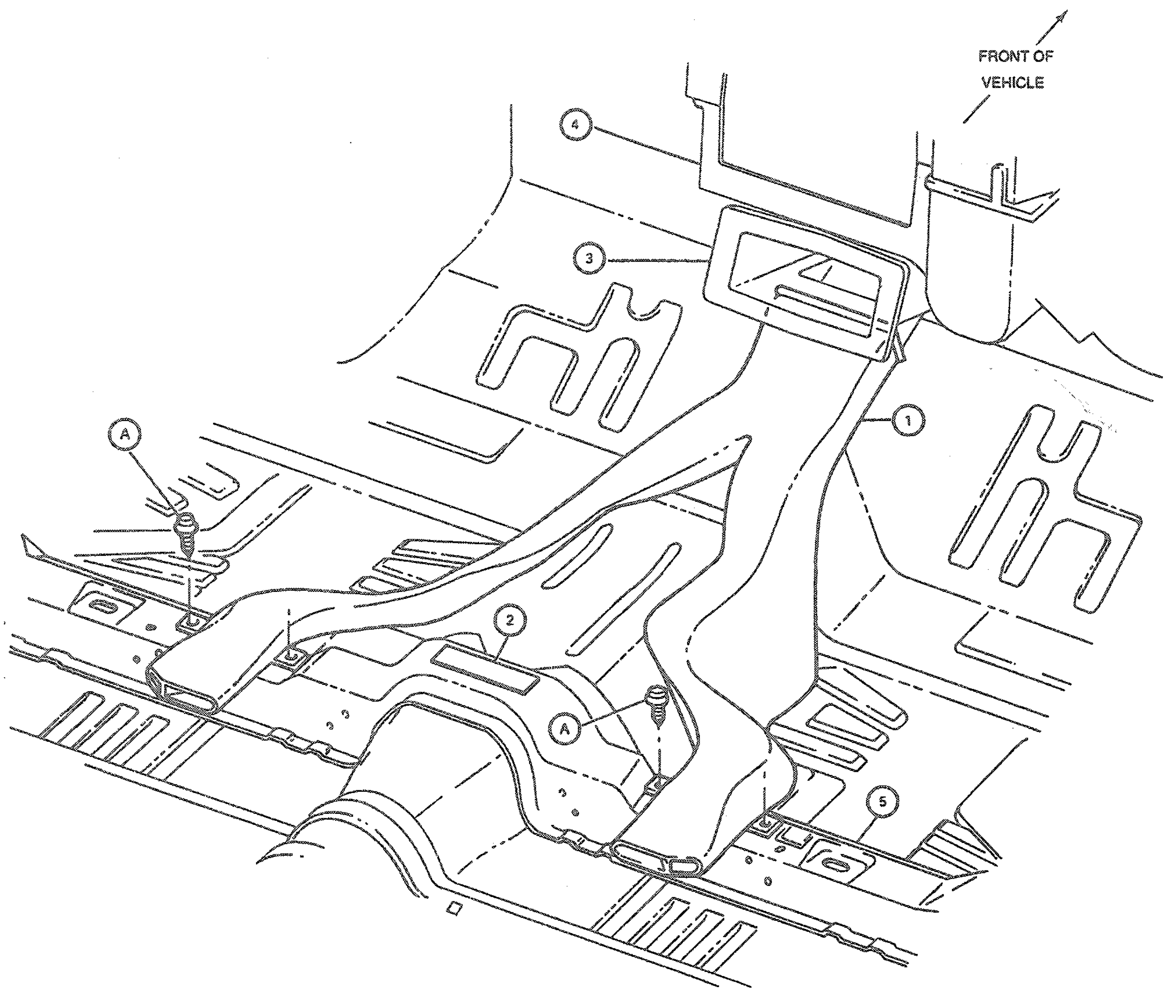
Floor Heater System

Removal and Installation

1. Remove carpet.
2. Remove nut holding rear duct on tunnel.
3. Remove two screws attaching floor duct to evaporator case assembly.
4. Pull floor duct away from evaporator case assembly.
5. Pull floor duct away from evaporator case.
6. To install duct, reverse Removal procedure.

REMOVAL AND INSTALLATION (Continued)

Heater Duct—Rear Seat



E3D64201/PMD/910622

1 -18C4640- DUCT ASY-HEATER REAR SEAT OUTLET

2 ESB-M3G58-A TAPE 7.00 LONG X 2.00 WIDE

3 18C422 ADAPTER ASY FOR INSTALLATION, SEE PAGE 650-01

4 19B555 EVAPORATOR AND BLOWER ASY FOR INSTALLATION SEE PAGE 650-1

5 REF CROSS MEMBER

A N800500-S2 SCREW, 4 REQD

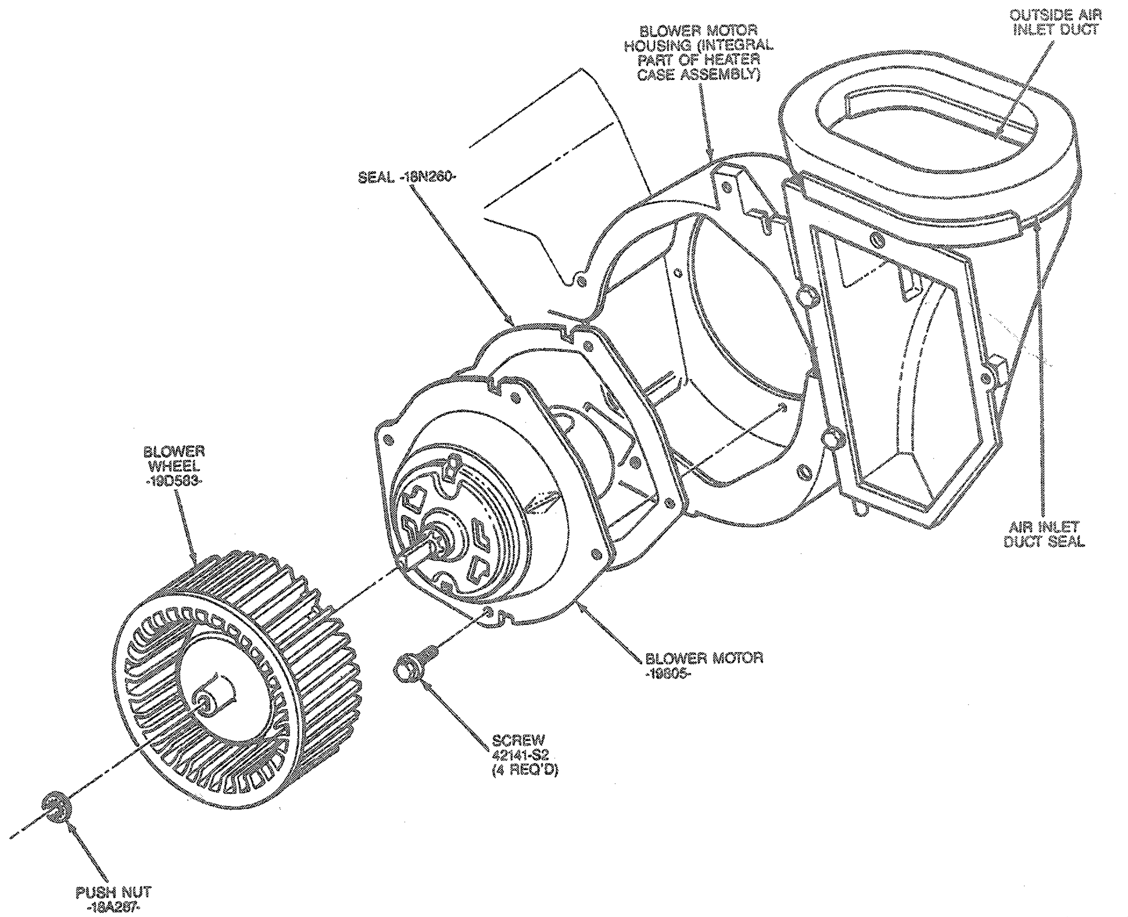
CCL 3785-A

REMOVAL AND INSTALLATION (Continued)

Air Inlet Duct and Blower Housing Assembly—Disassembled View

The following illustration shows the components of the air inlet duct and blower housing assembly.

Air Inlet Duct and Blower Housing Assembly—Disassembled View



Floor-Panel Door Vacuum Motor

Removal

1. Remove instrument panel, resting it against front seat. Refer to Section 01-12.
2. Remove heater case assembly as outlined.
3. Remove two nuts retaining motor to bracket on RH side of plenum and disconnect vacuum hoses.
4. Disconnect arm from pivot shaft on plenum.
5. Remove motor.

Installation

1. Position motor to bracket and secure with two nuts.
2. Connect vacuum hose to motor.
3. Install motor arm and clip.
4. Install heater case assembly as outlined.
5. Install instrument panel. Refer to Section 01-12.

Panel-Defrost Door Vacuum Motor

Removal

1. Disconnect battery ground cable.
2. Remove instrument panel. Refer to Section 01-12.

REMOVAL AND INSTALLATION (Continued)

3. Depress retaining tabs and disconnect vacuum motor arm from door shaft.
4. Remove two screws retaining vacuum motor to mounting bracket.
5. Remove vacuum motor from mounting bracket and disconnect vacuum hose.

Installation

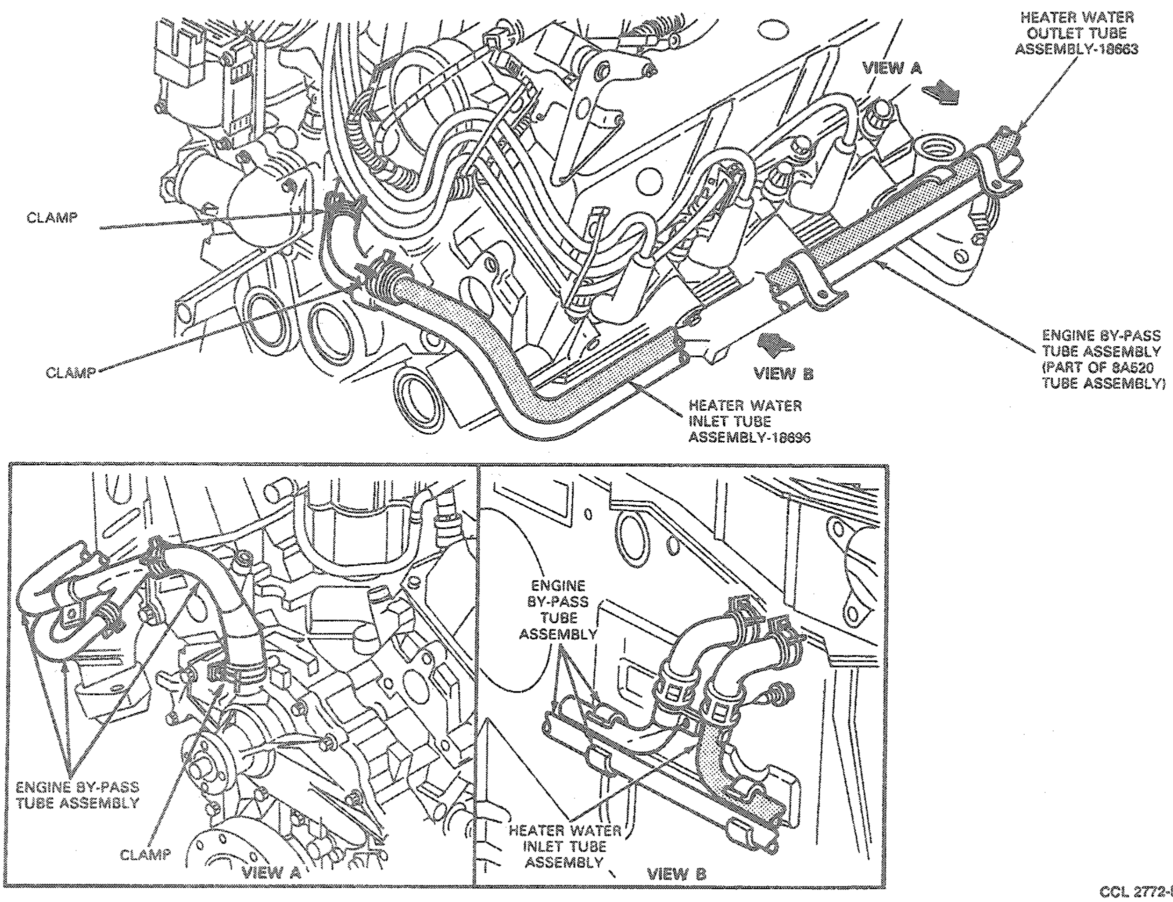
1. Position vacuum motor to mounting bracket and door shaft.
2. Install two screws attaching panel-defrost vacuum motor to mounting bracket.
3. Connect vacuum hose to defrost vacuum motor.
4. Install instrument panel.
5. Connect battery ground cable.

Heater Hoses

CAUTION: Ensure replacement heater hose is made of EPDM and Nomex materials. Hoses made of other materials may not be suitable for this application.

Heater Hose Installation, 3.0L with Manual A/C-Heater

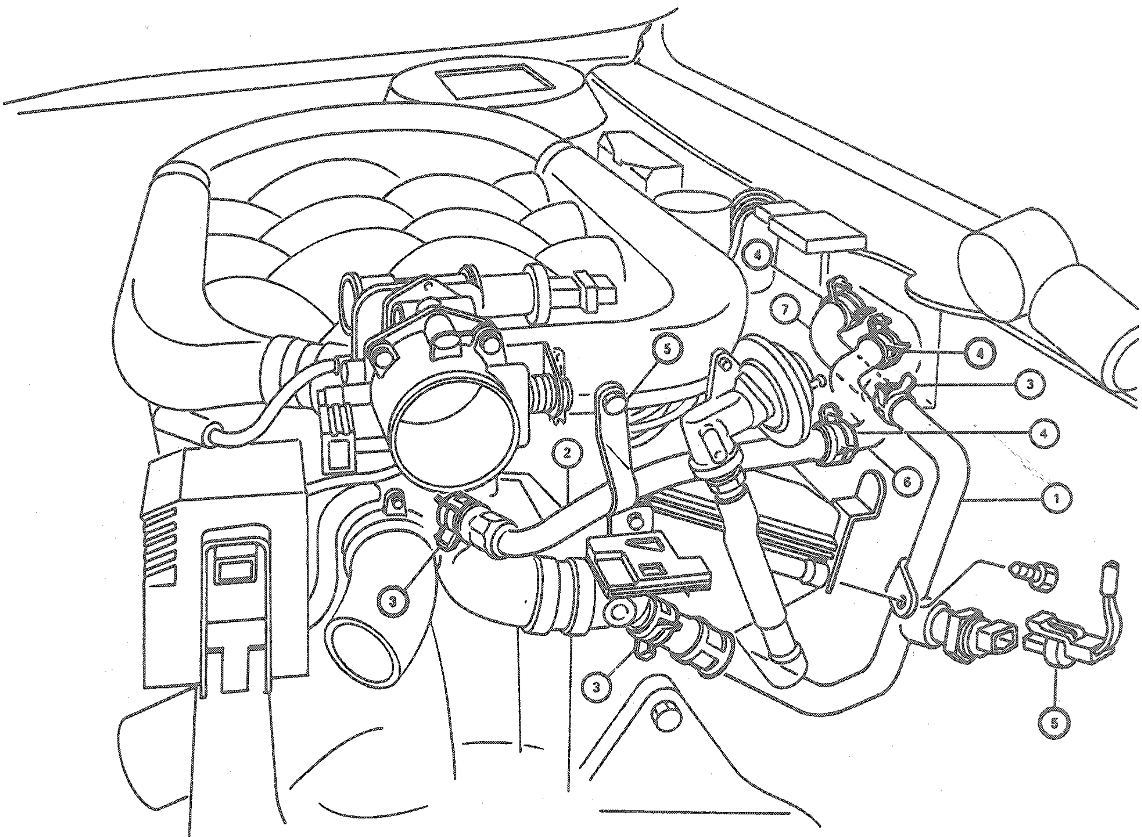
Refer to the following illustrations for heater hose installation.



CCL 2772-D

REMOVAL AND INSTALLATION (Continued)

Heater Hose Installation, 3.2L SHO with EATC

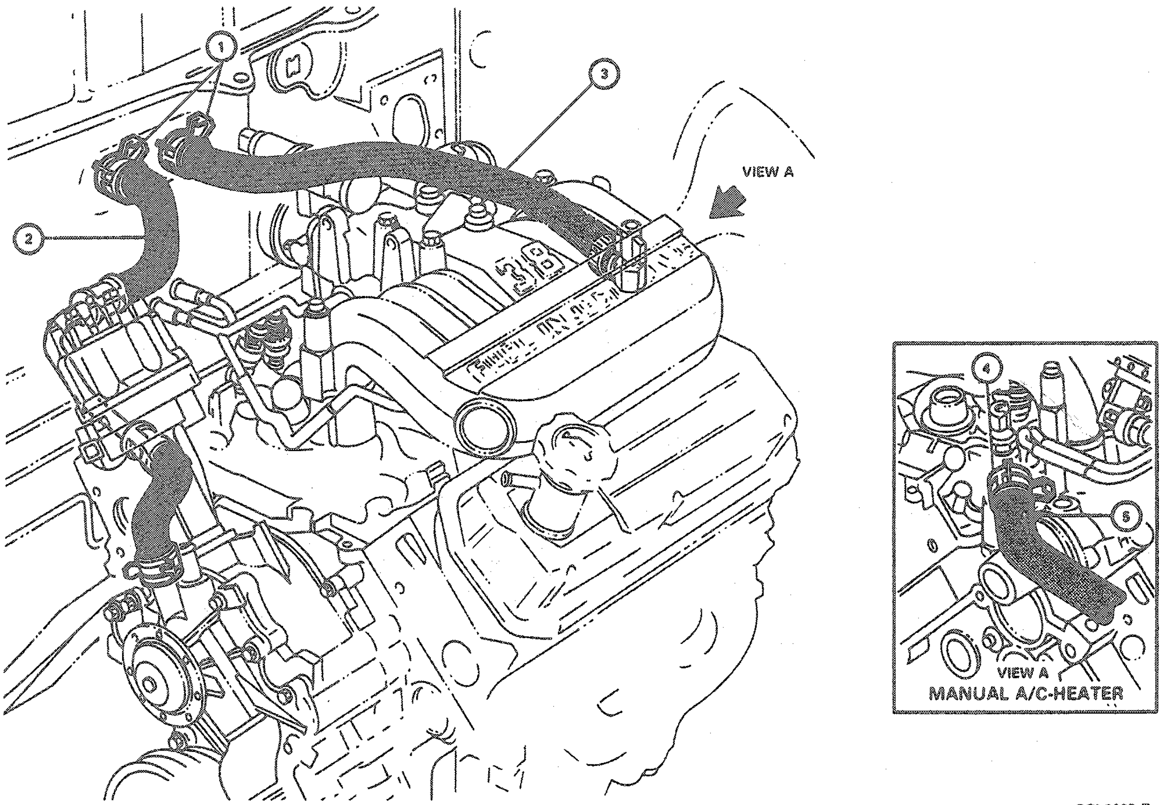


NOTE: DONOT REUSE THE SPRING CLAMPS.
REPLACE THEM WITH SCREW
TIGHTENED CLAMPS.

ITEM DESCRIPTION
1. HEATER INLET HOSE - 18D376
2. HEATER OUTLET HOSE - 18D663
3. SPRING CLAMP
4. SPRING CLAMP
5. WIRING HARNESS - 14401 ASS'Y
6. HEATER OUTLET HOSE - 18D359
7. HEATER INLET HOSE - 18D335

REMOVAL AND INSTALLATION (Continued)

Heater Hose Installation, 3.8L



ITEM	DESCRIPTION
1.	CLAMP - 390761 (2 REQ'D)
2.	HEATER OUTLET HOSE - 18D663
3.	HEATER INLET HOSE - 18D376 (EATC ONLY)
4.	CLAMP - 390762 (1 REQ'D)
5.	HOSE - 18D334

ADJUSTMENTS

Mini-Tube Vacuum Hoses

Service

1. Measure length of damaged area of mini-tube vacuum hose.
2. Cut a piece of standard 3mm (1/8 inch) ID vacuum hose approximately 25mm (1 inch) longer than damaged area of mini-tube vacuum hose.
3. Cut off mini-tube vacuum hose on each side of damaged area.
4. Dip mini-tube hose ends in Tetra Hydro Furan (THF) or Methyl Ethyl Ketone (MEK). This solvent will seal mini-tube in vacuum hose.
5. Insert ends of mini-tube vacuum hose approximately 9mm (3/8 inch) into ends of standard 3mm (1/8 inch) service vacuum hose section.
6. Shake service joint after assembly to ensure solvent is dispersed and vacuum line is not plugged.
7. Test system for a vacuum leak in service area.

SPECIFICATIONS

TORQUE SPECIFICATIONS

Description	N·m	Lb-In
Heater Hose Clamps	1.81-2.49	17-22
Upper Panel Retaining Screws	1.4-2.3	13-20
Lower Instrument Panel-to-Side Cowl Retaining Screws	7-11	6-8 (Lb-Ft)
Instrument Cluster Finish Panel Retaining Screws	2-2.9	18-25

(Continued)

SPECIFICATIONS (Continued)

TORQUE SPECIFICATIONS (Cont'd)

Description	N·m	Lb-In
Radio Applique Retaining Screws	2-2.9	18-25
Glove Compartment Retaining Screws	2-2.6	18-23
Sound Insulator Retaining Screws	2-2.6	18-23

SPECIAL SERVICE TOOLS

ROTUNDA EQUIPMENT

Model	Description
021-00012	Pressure Tester

SECTION 12-03A Air Conditioning System

VEHICLE APPLICATION

Taurus / Sable.

DESCRIPTION AND OPERATION

This section covers all Taurus / Sable vehicles.

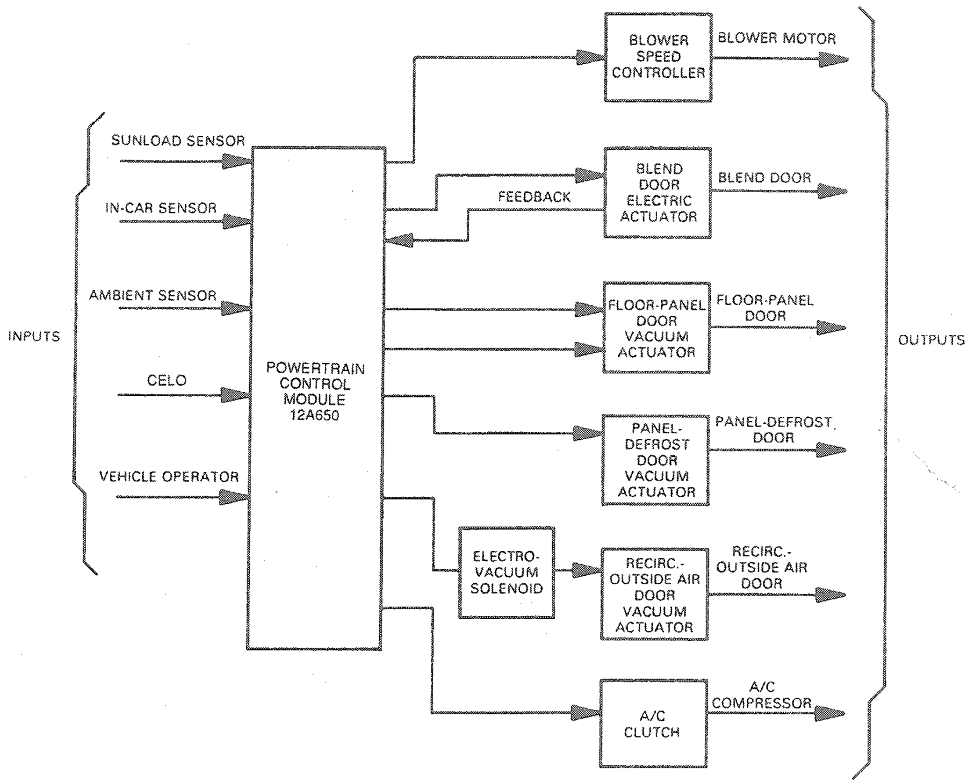
Taurus / Sable vehicles with 3.0L engines offer two types of A / C systems. The main difference between these systems involve the mandatory requirement of the use of different refrigerants. The two types of A / C systems are:

1. Fixed orifice tube type system with cycling clutch using the chlorofluorocarbon (CFC) based Refrigerant 12 (R-12).
2. Fixed orifice tube type system with cycling clutch using the non-chlorofluorocarbon (Non-CFC) based Refrigerant 134a (R-134a).

The electronic automatic temperature control (EATC) system is available as an option on Taurus / Sable vehicles. This system is graphically represented in a block diagram.

DESCRIPTION AND OPERATION (Continued)

System Block Diagram



L8212-A

With the use of a microcomputer, the control assembly analyzes inputs from six major sources:

1. Temperature, function, and blower selections (made by the vehicle occupants)
2. In-vehicle temperature
3. Ambient temperature
4. Cold engine lock out (CELO)
5. Sunload sensor
6. A/C system clutch cycling pressure switch

Using these inputs, the microcomputer determines the correct conditions for the following six outputs:

1. A/C compressor clutch engagement
2. Blower speed
3. Blend door position
4. Floor-panel door position
5. Panel-defrost door position
6. Outside-recirc door position

A small DC electric motor or actuator is used to operate the temperature blend door. Vacuum actuators are used to control each of the three remaining air distribution doors. A feedback circuit is used in the blend door actuator to supply the control assembly with blend door position information. The blower motor is controlled by the control assembly through the blower speed controller. The blower speed controller is necessary to react to the low power signal from the control assembly to provide high power signal required to drive the blower. The following system response chart shows the control assembly response to the function selections.

DESCRIPTION AND OPERATION (Continued)

System Response

<table>
<tr><th>Control Assembly Selection</th><th>Blend Door Response</th><th>Floor-Panel Door Response</th><th>Panel-Defrost Door Response</th><th>Recirc — Outside Air Door Response</th><th>Blower Response (Unless Manually Overridden)</th><th>A/C Clutch Response</th></tr>
<tr><td>Off</td><td>Remains fixed</td><td>Air to plenum</td><td>Fixed in defrost</td><td>Fixed in recirc</td><td>Blower off</td><td>Clutch off</td></tr>
<tr><td>Auto</td><td rowspan="7">Varies according to sensor temperatures and customer temperature selection. Door is in heat position when sensors are cool — door is in A/C position when sensors are hot.</td><td>Air to floor during heating; air to plenum during cooling; air to both between heating and cooling.</td><td>Air to defrost nozzle during heating; air to panel during cooling.</td><td>Fixed in recirc when engine temp. is below 120°F and heating req'd. Recirculates air when maximum air conditioning is required. Otherwise uses outside air.</td><td>Variable blower speeds when engine coolant temp. is above 120°F or A/C required. Blower is off when engine coolant is below 120°F and heating is required.</td><td>Clutch on if outside temperature is above 50°F.</td></tr>
<tr><td>A/C</td><td>From OFF or AUTO, air to plenum. Otherwise air is directed per mode override (i.e., floor, panel, defrost).</td><td>From OFF or AUTO, fixed in panel. Otherwise, door position is per mode override (i.e., floor, panel, defrost).</td><td rowspan="3">Recirculates air when maximum air conditioning is required. Otherwise uses outside air.</td><td rowspan="6">Variable blower speeds</td><td rowspan="4">Clutch on if outside temperature is above 50°F. Clutch will toggle on and off as A/C button is toggled on and off.</td></tr>
<tr><td>Panel</td><td>Air to plenum</td><td rowspan="2">Fixed in panel</td></tr>
<tr><td>Panel & floor</td><td>Air to plenum and floor</td></tr>
<tr><td>Floor</td><td>Air to floor</td><td rowspan="3">Fixed in defrost</td><td rowspan="3">Fixed in outside air</td></tr>
<tr><td>Floor & defrost</td><td>Air to plenum and floor</td><td rowspan="2">Although clutch is always on if outside temperature is above 50°F, A/C indicator may be toggled on and off.</td></tr>
<tr><td>Defrost</td><td>Air to plenum</td></tr>
</table>

CCL 2638-C

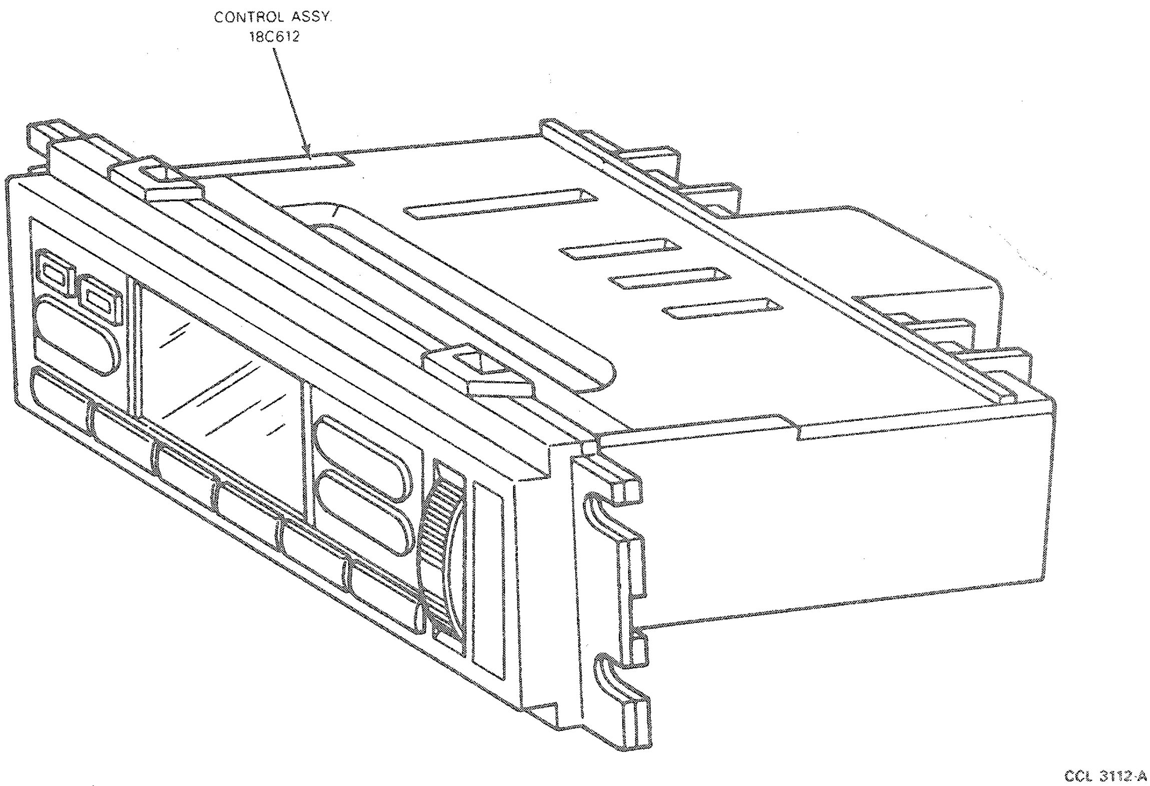
A Self Test feature has been included in the control assembly to supply the technician with air distribution error codes. These codes direct the technician to the damaged component. The Self Test is described as outlined.

DESCRIPTION AND OPERATION (Continued)

Control Assembly

The EATC assembly is located in the instrument panel and consists of 11 push buttons, a variable blower speed control knob for manual input and a vacuum fluorescent display (VFD) for displaying set temperature, ambient temperature, function, and diagnostic codes.

EATC Control Assembly



When the system is operating under AUTOMATIC control, the VFD display will show the preferred or target temperature to which the elements of the automatic control system respond. Blower motor speed, under automatic control, varies in response to ambient temperature changes and a predetermined delay factor. Temperature selection may be raised or lowered in one degree increments between 18°C (65°F) and 29°C (85°F) by pressing the red button to raise or the blue button to lower the desired temperature and automatic control will respond accordingly.

Other control assembly features include:

- A 16°C (60°F) setting for maximum cool and a 32°C (90°F) setting for maximum heat.
- An OUTSIDE TEMP button which, when depressed, will result in a four-second display of the air temperature outside the vehicle.
- An OFF button which, if depressed, will apply vacuum to close the outside-recirc air door shut off blower motor operation, and discontinue climate control functions through the system.

When the thumbwheel control for the blower motor is rotated out of the position it occupied under automatic control, it will remain under manual control until the automatic button is again depressed. Under automatic control, blower speed varies as required to accommodate the total automatic functions in the system. Under manual control, blower speed is constant based on the thumbwheel setting.

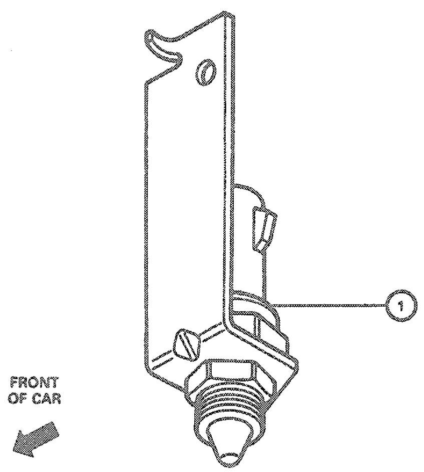
DESCRIPTION AND OPERATION (Continued)

An illumination bulb in the control assembly provides backlighting for the vacuum fluorescent display window. When the rheostat on the headlamp / parking lamp switch is rotated, the intensity of the light from this bulb will increase or decrease depending upon the direction of rotation. (The backlighting on the control assembly, as well as in other instrument panel locations, will dim whenever the light switch is engaged.)

Input Sensors

- **Ambient Temperature Sensor:** located in front of the condenser on the LH side of the vehicle and contains a thermistor which measures the temperature of the outside air.

Ambient Temperature Sensor

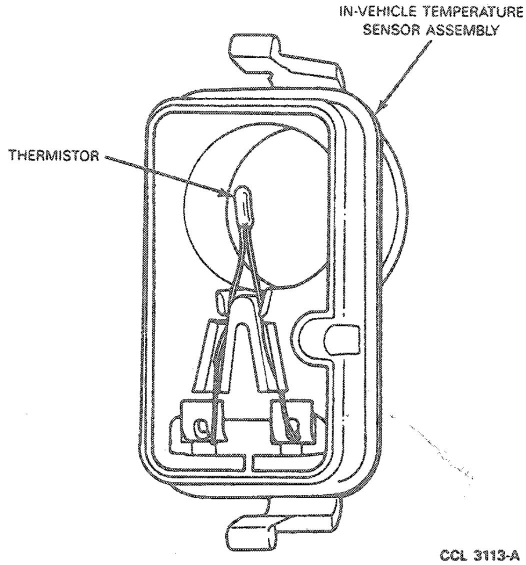


ITEM DESCRIPTION
1. AMBIENT TEMPERATURE SENSOR - 19E702

CCL 2640-C

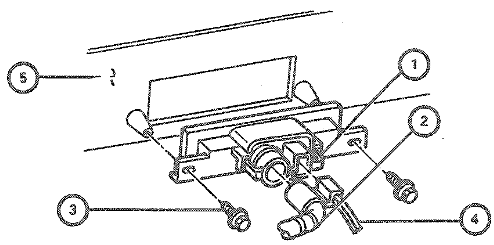
- **In-Vehicle Temperature Sensor:** located behind the instrument panel above the glove compartment, contains a thermistor which measures the temperature of the air inside the passenger compartment.

In-Vehicle Temperature Sensor—Taurus



CCL 3113-A

In-Vehicle Temperature Sensor—Sable

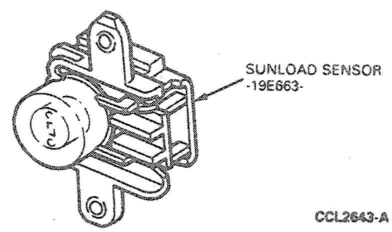


ITEM DESCRIPTION
1. A/C TEMPERATURE CONTROL SENSOR ASSEMBLY - 19C933
2. A/C TEMPERATURE CONTROL HOSE ASSEMBLY - 19D888
3. SCREW - N803876-S36 (2 REQ'D)
4. WIRING ASSEMBLY - 14401
5. INSTRUMENT PANEL ASSEMBLY

CCL 3553-B

- **Sunload Sensor:** located in the RH upper outer finish panel. The sunload sensor contains a photovoltaic (sensitive to sunlight) diode.

Sunload Sensor



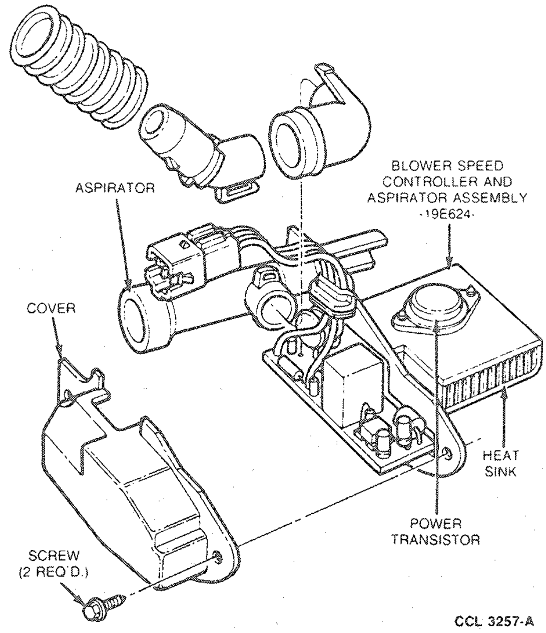
CCL2643-A

DESCRIPTION AND OPERATION (Continued)

Blower Speed Controller

The blower speed controller is located in the evaporator case, upstream of the evaporator core.

Blower Speed Control and Aspirator Assembly



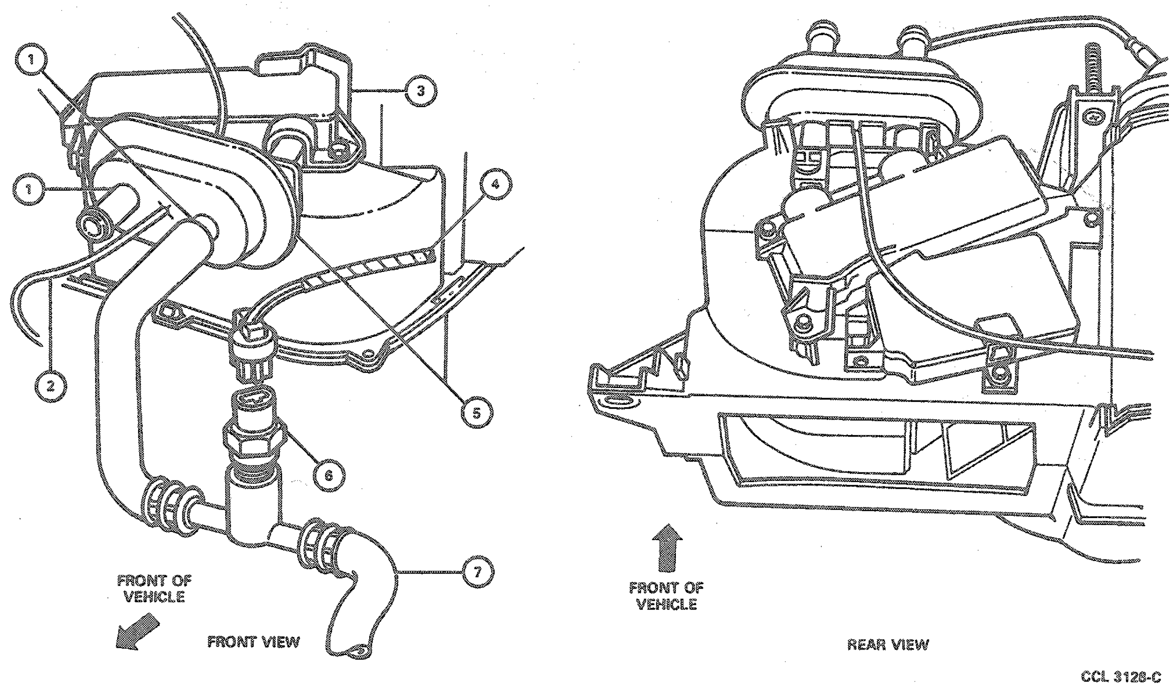
The function of the blower speed controller is to convert low power signals from the EATC control assembly to a high current, variable ground feed for the blower motor. Blower motor speed is infinitely variable and is controlled by the electronic control assembly software and blend door actuator position. A delay function provides a gradual increase or decrease in blower motor speed under all conditions. There is a high blower relay integrated into the blower speed controller which provides power for maximum air flow in the HI blower position.

CAUTION: The system should not be operated with the blower motor disconnected. Damage may occur to the electronic blower speed controller if cooling air is not provided by the blower motor.

DESCRIPTION AND OPERATION (Continued)

Cold Engine Lock Out Switch (CELO)

The Cold Engine Lock Out switch is shown in the system block diagram. Its function is to prevent blower operation when heating is required and the engine coolant temperature is below 120°F. When the coolant temperature exceeds 120°F, the CELO switch opens, turning the blower on when heating is required. The CELO will not prevent blower operation when cooling or defrost is required. The CELO is located in the heater core inlet hose.



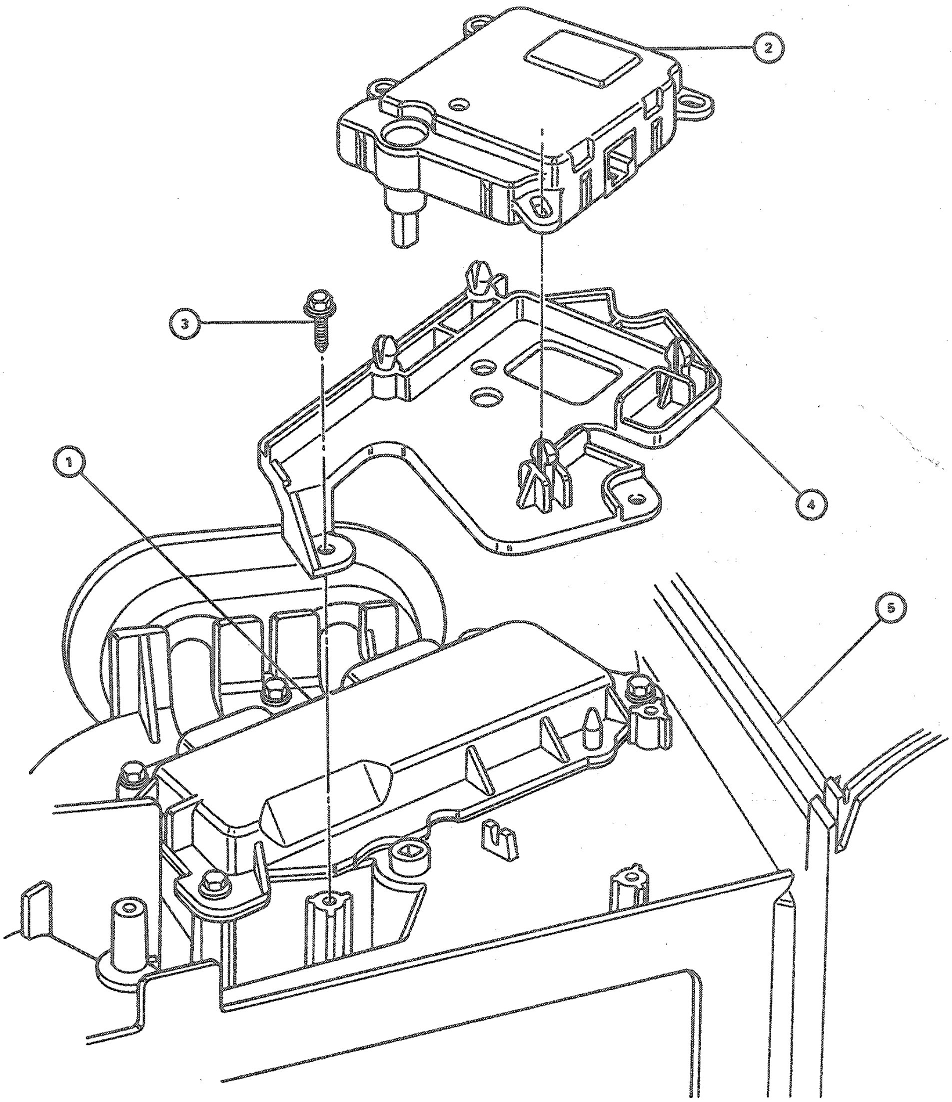
ITEM	DESCRIPTION
1.	HEATER CORE TUBES
2.	VACUUM SOURCE LINE
3.	HEATER CORE ACCESS COVER - 18N276
4.	PART OF HARNESS - 14401
5.	HEATER CORE TUBE SEAL (FOAM) - 18529
6.	CELO SWITCH
7.	ENGINE HEATER INLET TUBE

Blend Door Actuator, Electric

The blend door actuator is located on top of the evaporator assembly and controls blend door movement on command from the control assembly. Internally, an electronic circuit accepts commands from the control head and positions the blend door by electric motor. An integral potentiometer feeds blend door position information back to the control head.

DESCRIPTION AND OPERATION (Continued)

Blend Door Electric Actuator and Mounting Assembly



ITEM	DESCRIPTION
1.	HEATER CORE ACCESS COVER
2.	ACTUATOR ASSEMBLY - 19E616
3.	SCREW - 42141-S2 (3 REQ'D.)
4.	ACTUATOR MOUNTING PLATE - 19E693
5.	EVAPORATOR CASE

CCL 2646-E

DESCRIPTION AND OPERATION (Continued)

Pressure Relief Valve

A pressure relief valve is installed in the system to relieve pressure buildups above 3100 kPa (450 psi) and to prevent damage to the compressor and other A/C system components. The pressure relief valve is located on the discharge (high-pressure) line near the compressor manifold.

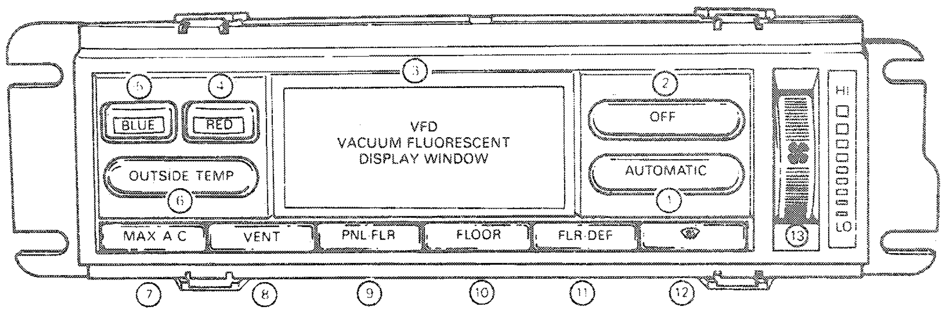
Normal System Operation (Automatic)

The electronic climate control system automatically maintains the temperature selected for driving comfort and regulates the airflow between the instrument panel registers, floor ducts, windshield defroster nozzle and side window demisters. The system also provides the option of manually overriding the blower speed and/or airflow direction as desired. Additionally, the system has automatic solar compensation for high sunload conditions. The sunload sensor is located in the upper LH corner of the instrument panel. The outside temperature can also be displayed at any time by momentarily depressing the OUTSIDE temperature button. The outside temperature will then be displayed for four seconds. For optimum automatic operation, the system should be in AUTO mode and set to the desired temperature setting. If the vehicle interior temperature is warmer or cooler than the set temperature, the climate control system will automatically provide heat (when the engine is warm) or air conditioning, as required, to reach the comfort setting as fast as possible. If it is necessary to adjust the comfort setting, the setting should be changed only in small increments (1-2 degrees) to maintain comfort and avoid large variations of in-vehicle temperature. Raising or lowering the set temperature in large increments from the comfort setting **will not** reduce the time required to reach stabilized comfort.

Refer to the following illustration. The balloon numbers in the illustration are referenced in the following text.

DESCRIPTION AND OPERATION (Continued)

Control Head Operational Diagram



1. AUTOMATIC ON BUTTON
2. A C SYSTEM OFF BUTTON
3. DISPLAYS SELECTED TEMP, OUTSIDE TEMP, OR OFF
4. BUTTON TO RAISE TEMPERATURE
5. BUTTON TO LOWER TEMPERATURE
6. BUTTON TO DISPLAY OUTSIDE TEMP
7. OVERRIDE BUTTON FOR MAX A C OPERATION
8. OVERRIDE BUTTON FOR VENT OPERATION
9. OVERRIDE BUTTON FOR PANEL-FLOOR OPERATION
10. OVERRIDE BUTTON FOR FLOOR OPERATION
11. OVERRIDE BUTTON FOR FLOOR-DEFROST OPERATION
12. OVERRIDE BUTTON FOR DEFROST OPERATION
13. BLOWER SPEED OVERRIDE CONTROL

CCL 3114-E

System Description

(1) AUTOMATIC

Depressing the AUTOMATIC button turns the system on for fully automatic operation. When functioning automatically the VFD window will be lighted to show the selected temperature. The system will maintain this temperature by controlling the airflow direction (functional setting), the airflow quantity (fan speed), and the discharge temperature required for comfort.

When heating is required, the airflow will automatically be directed through the floor ducts and demisters with a small amount of air through the defroster. During cool weather, the fan operation will be delayed until the engine has heated sufficiently to provide warm discharge temperatures.

When cooling is required, the airflow will be directed through the instrument panel registers. The registers can be adjusted for optimum comfort. When maximum cooling is required, the system will automatically operate with recirculated air for rapid cool-down and automatically change to outside air as the vehicle interior approaches the selected temperature.

In moderate conditions, the system will automatically operate in a split mode, with airflow directed through the floor ducts and through the windshield defroster ducts at a moderate temperature and fan speed.

(2) OFF

Depressing the OFF button will turn the system off completely and display the word OFF in the digital display window.

(3) Digital Display Window

The digital display window will indicate one of three displays depending upon the manual selection:

1. Selected comfort temperature.
2. Outside temperature.
3. OFF when system is off.

(4) RED

The red button is used to raise the temperature setting. Press the button once to raise the temperature one degree. Holding the button in will continuously raise the temperature setting in one-degree increments to 29°C (85°F) and then will jump to 32°C (90°F) in one step for continuous maximum heating.

(5) BLUE

The blue button is used to lower the temperature setting. Press the button once to lower the temperature one degree. Holding the button in will continuously reduce the temperature setting in one-degree increments to 18°C (65°F) and then will jump to 15°C (60°F) in one step for continuous maximum cooling.

(6) OUTSIDE TEMP

Depressing this button will display the outside temperature for four seconds and will automatically change back to the previous display. Outside temperature may be selected any time the ignition switch is in the RUN position whether the system is on or off.

DESCRIPTION AND OPERATION (Continued)

Manual Overrides

There are six manual override buttons along the lower edge of the control assembly. Each affects system operation as follows.

(7) MAX A/C

Depressing the MAX A/C button will display "60 MAX A/C" in the display window. The system will go to high blower with a maximum cool discharge temperature while also going into recirculation function.

(8) VENT

Depressing the VENT button will display "VENT" in the display window. The system will operate with fresh air in the panel function. The A/C clutch will be turned off.

(9) PNL/FLR

Depressing the PNL-FLR button will display "PANEL FLOOR" in the display window. The air will be discharged equally between the panel and the floor. The A/C clutch will be on.

(10) FLOOR

Depressing the FLOOR button will display "FLOOR" in the display window. The majority of the air distribution will be directed through the floor ducts with a small bleed to the side window demisters and the defroster nozzle.

(11) FLR-DEF

Depressing the FLR DEF button will display "FLOOR DEFROST" in the display window and results in a mix position, with the air distributed equally between the defroster nozzle and the floor ducts, with a small bleed out the side window demisters.

(12) DEFROST

Depressing the DEFROST button lights the "DEFROST" indicator and directs the majority of the airflow through the defroster nozzle, with a small bleed to the side window demisters and the floor ducts.

(13) Blower Speed Override Thumbwheel

Rotating the blower speed override thumbwheel more than 10 degrees will turn on the AUTOMATIC blower indicator and provide manual control of the blower speed. Rotating the wheel fully down against its lower stop locks the blower at its lowest speed. Rotating the wheel fully up against the stop, locks the blower at its highest speed.

Depressing the AUTOMATIC button will resume automatic blower control and the AUTO blower indicator will turn off.

Constant Control Relay Module (CCRM)

Vehicles equipped with an engine mounted in the transverse position are also equipped with an electric engine cooling fan. A constant control relay module (CCRM) incorporates circuit control provisions for various engine functions as well as for the engine cooling fan and the A/C compressor clutch coil. When the engine coolant temperature reaches approximately 105°C (221°F), the cooling fan is energized. If an A/C function is chosen, the compressor clutch coil will energize only when the engine cooling fan is operating.

NOTE: The following conditions may cause the A/C compressor to disengage due to the CCRM:

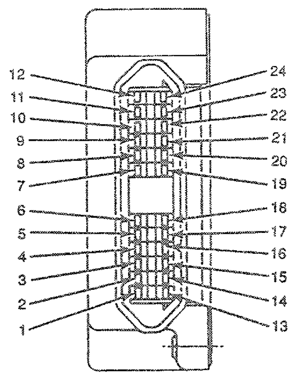
1. Wide Open Throttle (WOT)
2. Very high or too low engine speed
3. Engine cranking
4. High engine coolant temperature of 118°C (245°F)

The following illustrations provide schematics of the circuit involved. They also illustrate and chart the pin-outs in the integral connector for the module.

DESCRIPTION AND OPERATION (Continued)

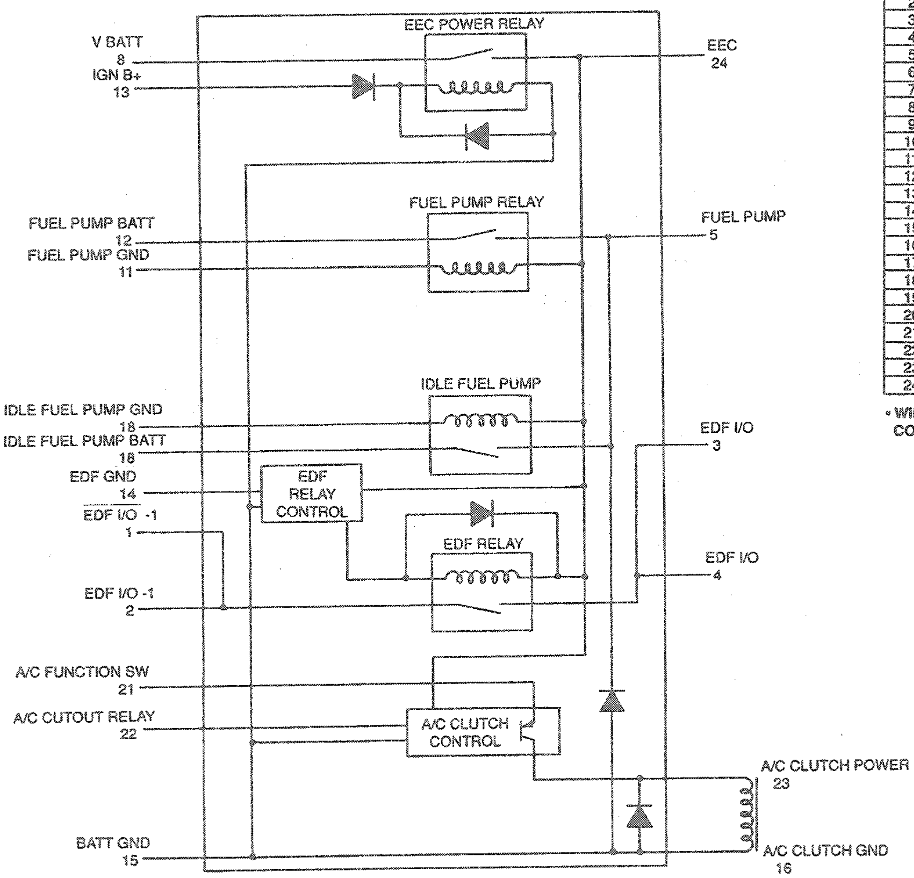
CCRM Circuit and Pin-Outs—3.0L SHO

INTEGRAL CONNECTOR



TERM NO.	FUNCTION
1	EDF I/O-1
2	EDF I/O-1
3	EDF I/O
4	EDF I/O
5	FUEL PUMP
6	N. C.
7	N. C.
8	V BATT
9	EOL TEST
10	IDLE FUEL PUMP BATT
11	FUEL PUMP GND
12	FUEL PUMP BATT
13	IGN B+
14	EDF GND
15	BATT GND
16	A/C GND
17	N. C.
18	IDLE FUEL PUMP GND
19	EOL TEST
20	EOL TEST
21	A/C FUNCTION
22	A/C CUTOUT RELAY*
23	A/C CLUTCH
24	EEC PWR

* WIDE OPEN THROTTLE-A/C CONTROL SWITCH



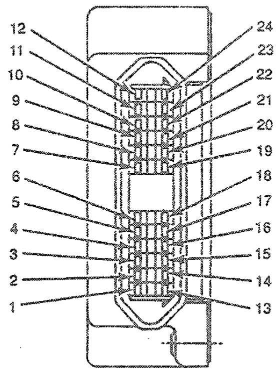
NOTE: REFER TO THE EVTM PUBLICATION FOR COMPLETE CIRCUIT SCHEMATIC AND WIRE COLORS.

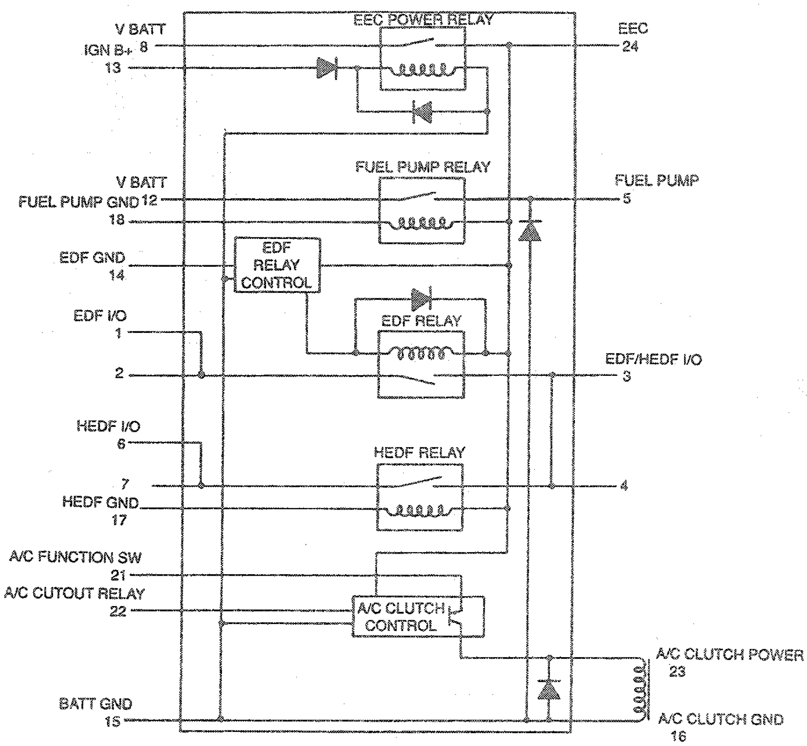
CCL3769-A

DESCRIPTION AND OPERATION (Continued)

CCRM Circuit and Pin-Outs—3.0L, 3.8L and 3.2L SHO

INTEGRAL CONNECTOR





TERM NO.	FUNCTION
1	EDF I/O-1
2	EDF I/O-1
3	HEDF/EDF I/O
4	HEDF/EDF I/O
5	FUEL PUMP
6	HEDF I/O 2
7	HEDF I/O 2
8	V BATT
9	EOL TEST
10	N. C.
11	N. C.
12	FUEL PUMP BATT
13	IGN B+
14	EDF GND
15	BATT GND
16	A/C GND
17	HEDF GND
18	FUEL PUMP GND
19	EOL TEST
20	EOL TEST
21	A/C FUNCTION
22	A/C CUTOUT RELAY*
23	A/C CLUTCH
24	EEC PWR

* WIDE OPEN THROTTLE-A/C CONTROL SWITCH

NOTE: REFER TO THE EVTM PUBLICATION FOR COMPLETE CIRCUIT SCHEMATIC AND WIRE COLORS.

CCL 3770-A

DESCRIPTION AND OPERATION (Continued)

NOTE: The following conditions may cause the A / C compressor to momentarily disengage:

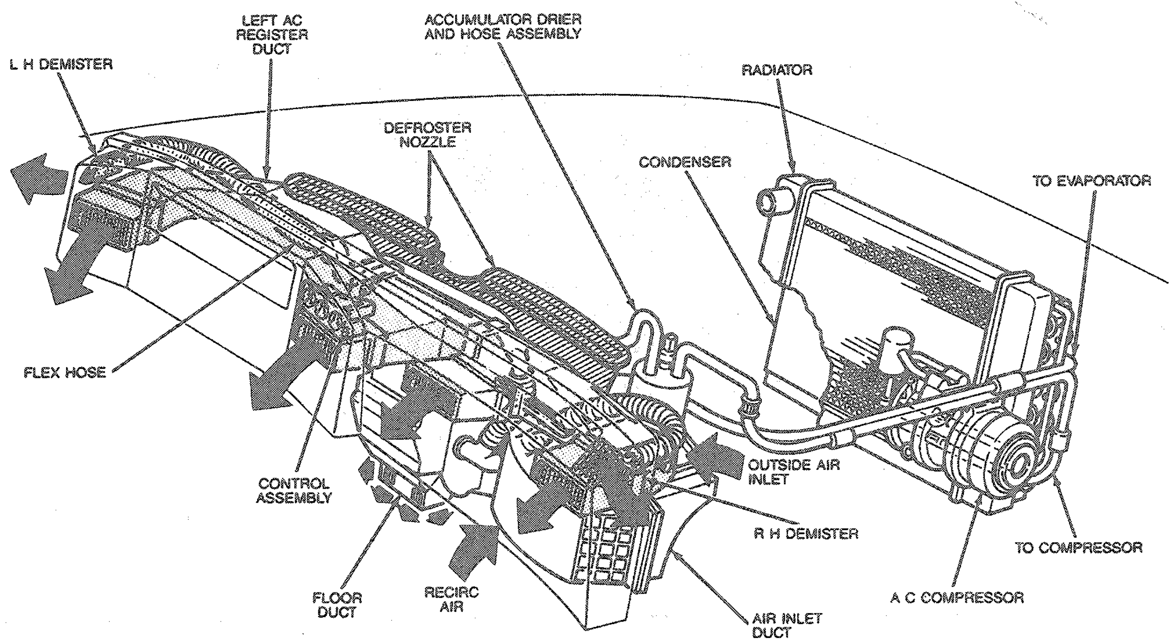
1. Wide open throttle (WOT)
2. Very high, or too low engine speed
3. Engine cranking
4. High engine coolant temperature

A low or no refrigerant condition will also prevent the A / C compressor from engaging.

A / C-Heater System

The manual A / C-heater system is a vibration welded, split-case design integral blower system that controls the temperature and reduces the relative humidity of air inside the vehicle. Control knobs are provided to adjust the desired temperature and system functions. The system will deliver heated or cooled air to maintain the vehicle interior temperature and comfort level. Blower speeds can be adjusted for more or less airflow as desired.

A / C System Installation and Airflow

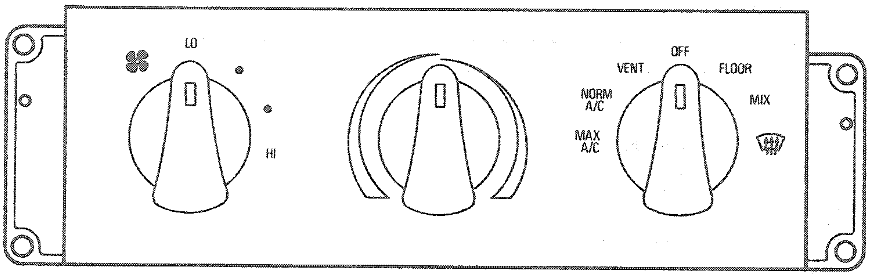


CCL 2606-B

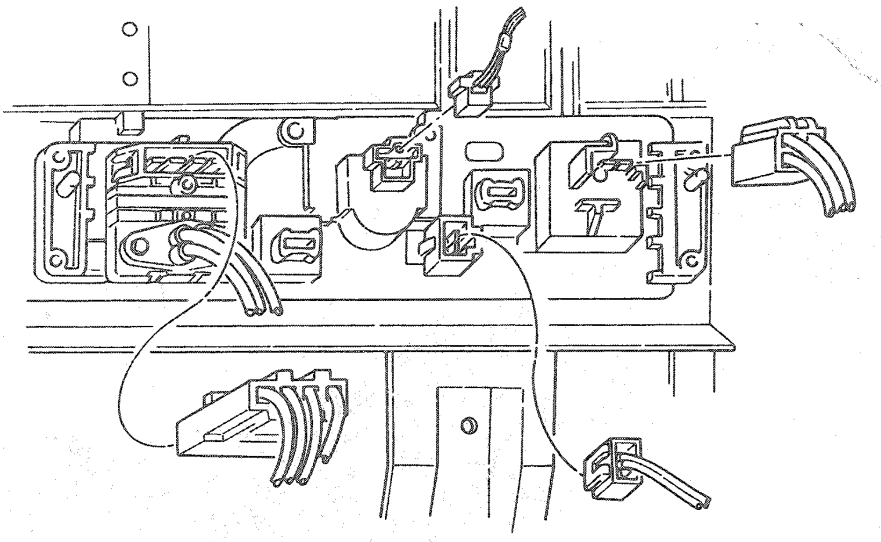
Manual control of the passenger compartment temperature may be maintained in all function control settings, except when the system is turned off. In hot weather, it will cool the vehicle to a comfortable level. Cooling or heating can then be adjusted as required to maintain the desired temperature.

DESCRIPTION AND OPERATION (Continued)

Control Assembly



FRONT VIEW



REAR VIEW

CCL 3546-D

For cold weather conditions, the system may be turned off by placing the function selector knob in the OFF position. This will minimize the discharge of cold air and delay the operation of the system while the engine coolant warms. After the engine is warm, the function selector knob can be turned on, and the system will heat the vehicle to the desired temperature.

Outside air is drawn from the cowl air inlet just below the windshield during all system operations except MAX A / C cooling, when recirculated air is used.

Control Operation

The manual A / C-heater control includes a function selector knob which has positions: OFF, MAX-A / C, NORM A / C, VENT, FLOOR, MIX and DEFROST. The position of the knob determines the manner in which the system will operate. A temperature control knob manually sets the desired comfort temperature, and a fan control knob controls the volume of air movement. Each position of the function selector knob and fan control knob is detented for positive engagement. The fan control knob provides four manually selected blower speeds, and may be operated in any position of the function selector knob to select the desired amount of airflow.

DESCRIPTION AND OPERATION (Continued)

Temperature Control

Temperature control of the manual A/C-heater system is determined by the position of the temperature control knob on the control assembly and is accomplished by means of a control cable between the control assembly and the temperature blend door. System airflow is manually controlled by the control assembly. A vacuum selector valve, controlled by the function selector knob, distributes vacuum to the various door vacuum motors, which in turn direct the airflow through the system.

The system uses what is called a ''reheat'' method to provide conditioned air to the vehicle interior. With this method, all airflow from the blower passes through the evaporator core, where it is cooled and dehumidified. Temperature is then regulated by reheating a portion of the cooled dry air and blending it with the remaining cool air to the desired temperature. Temperature blending is varied by the temperature blend door, which controls the amount of cooled air that flows through or around the heater core, where it is mixed and directed into the distribution plenum. The air is finally directed to the heater ducts, the defroster nozzles, or the instrument panel registers according to function selector knob position.

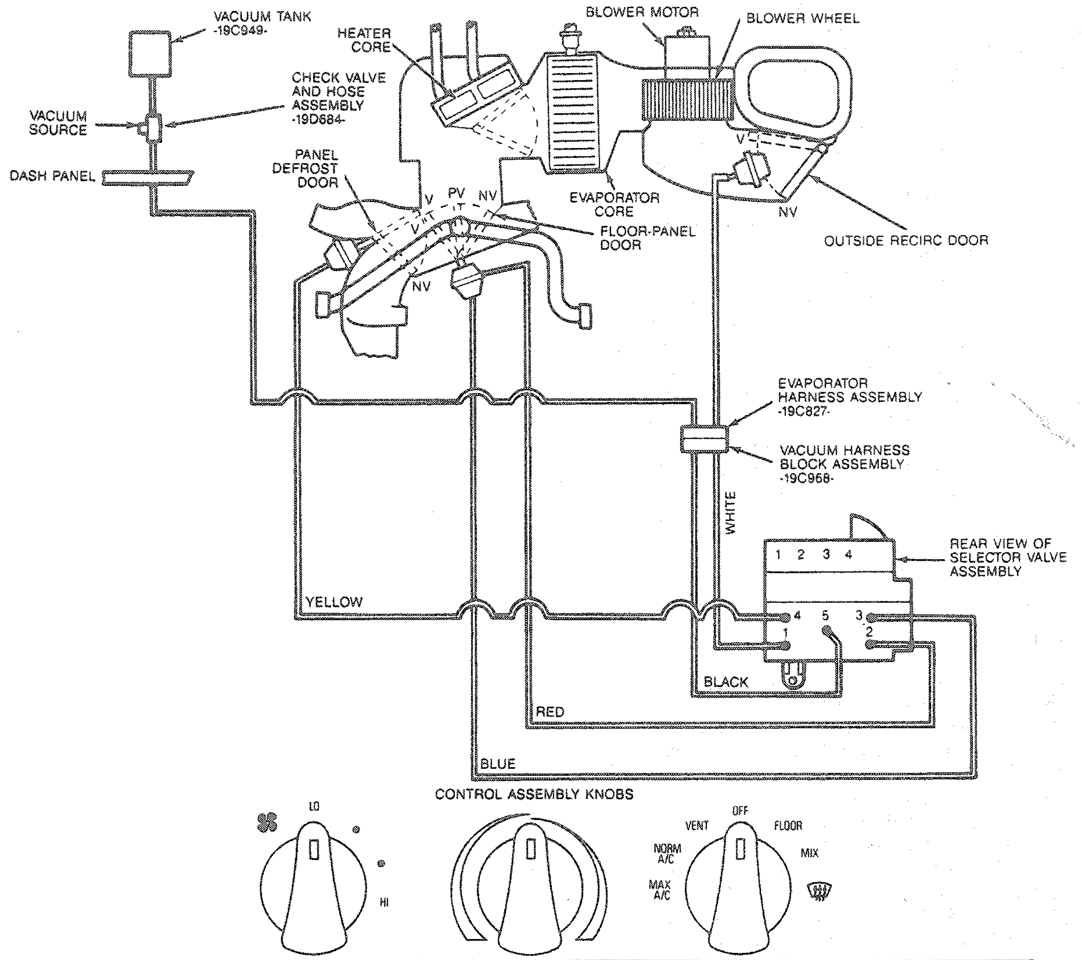
System Airflow

The following three illustrations correlate the action which takes place when the function select knob is rotated to each of its seven detent locations: MAX A/C, NORM A/C, VENT, OFF, FLOOR, MIX and DEFROST. The first illustration shows the control assembly with its function selector knob in the OFF position, and its temperature control knob midway between its maximum WARM and maximum COOL settings. The fan knob is set at a LO blower speed. Other blower speed settings include: MEDIUM LOW, MEDIUM HIGH and HI. The illustration also provides a schematic of the manual A/C-heater system and the doors which respond to full vacuum, partial vacuum, and no vacuum when supplied by a separate vacuum motor for each door. These doors are: air outside/recirc door, a panel-defrost door in the plenum chamber and a floor-panel door which is designed to provide full, partial or no vacuum positions. The blend door is manually controlled by a cable and moves according to the position of the temperature control knob.

- The blend door may be positioned anywhere within the range of its cable travel, from full heat to full cold.
- The blower motor is off.

DESCRIPTION AND OPERATION (Continued)

A/C System Schematic and Vacuum Control Chart



FUNCTION SELECTOR KNOB POSITION	OUTSIDE-RECIRC. AIR DOOR	FLOOR-PANEL DOOR	PANEL-DEFROST DOOR	BLOWER MOTOR
MAX — A/C	V	NV	V	ON
NORM — A/C	NV	NV	V	ON
VENT	NV	NV	V	ON
OFF	V	V	V	OFF
FLOOR	NV	V	NV	ON
MIX	NV	PV	NV	ON
DEFROST	NV	NV	NV	ON
VACUUM HOSE COLOR CODE	WHITE	RED / BLUE①	YELLOW	—

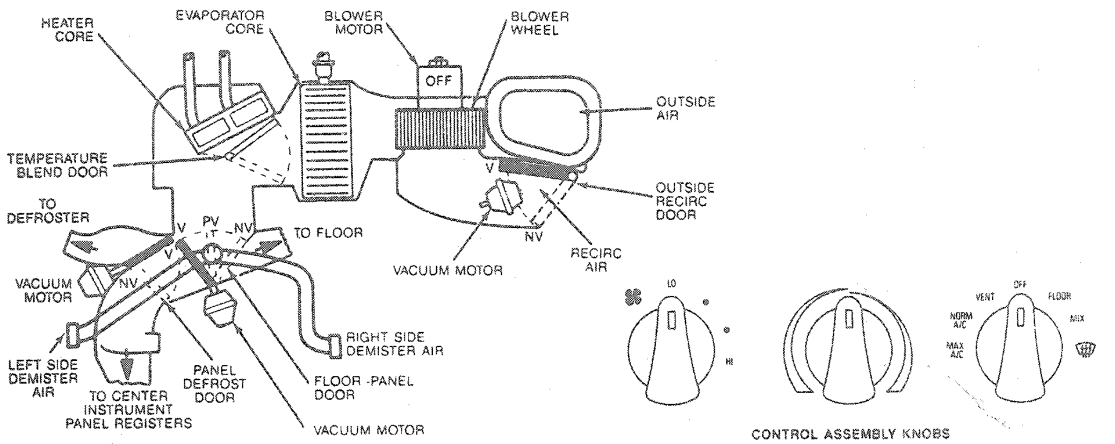
①BLUE — PARTIAL VACUUM; BLUE AND RED — FULL VACUUM

CCL 2608-E

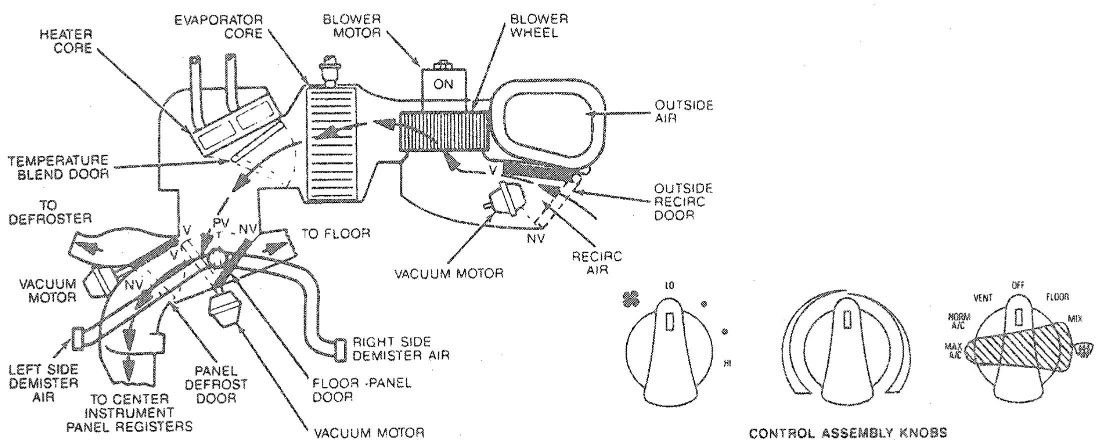
DESCRIPTION AND OPERATION (Continued)

Airflow Chart 1 (OFF, MAX A/C, NORM A/C)

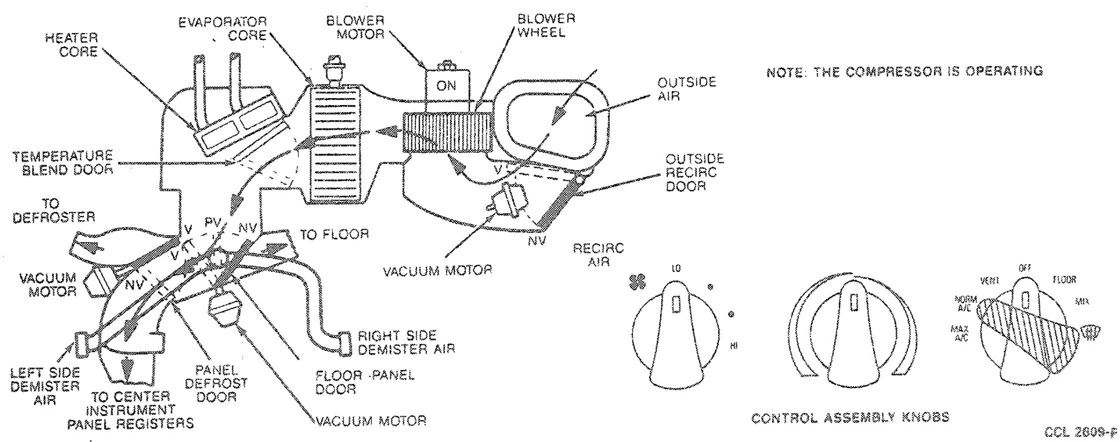
SYSTEM AIR FLOW SCHEMATIC - SELECTOR KNOB IN "OFF" POSITION



SYSTEM AIR FLOW SCHEMATIC - SELECTOR KNOB IN "MAX A/C" POSITION



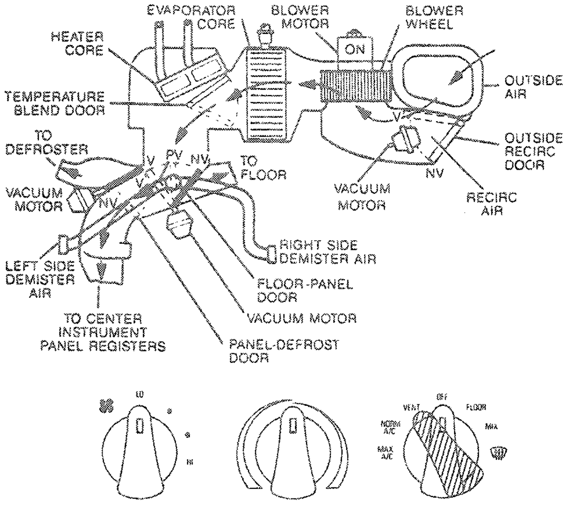
SYSTEM AIR FLOW SCHEMATIC - SELECTOR KNOB IN " NORMAL A/C" POSITION



CCL 2609-F

DESCRIPTION AND OPERATION (Continued)

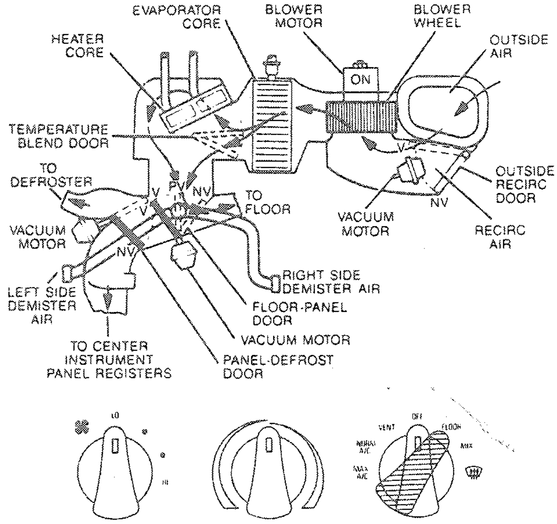
Airflow Chart 2 (VENT, FLOOR, MIX, DEFROST)



CONTROL ASSEMBLY KNOBS

NOTE: (1) NO REFRIGERATION CAN BE INTRODUCED WHEN THE SELECTOR KNOB IS IN THE VENT POSITION.
(2) THE TEMPERATURE SELECTOR MAY BE ROTATED TO HEAT OR COOL THE AIR FLOW AS DESIRED.

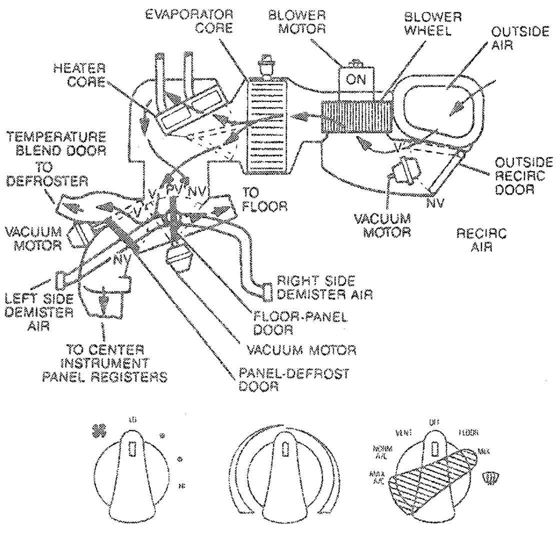
SYSTEM AIR FLOW SCHEMATIC - SELECTOR KNOB IN "VENT" POSITION



CONTROL ASSEMBLY KNOBS

NOTE: A SLIGHT AMOUNT OF HEATED AIR BY-PASSES THE FLOOR PANEL DOOR AND IS DIRECTED TO THE DEFROSTER.

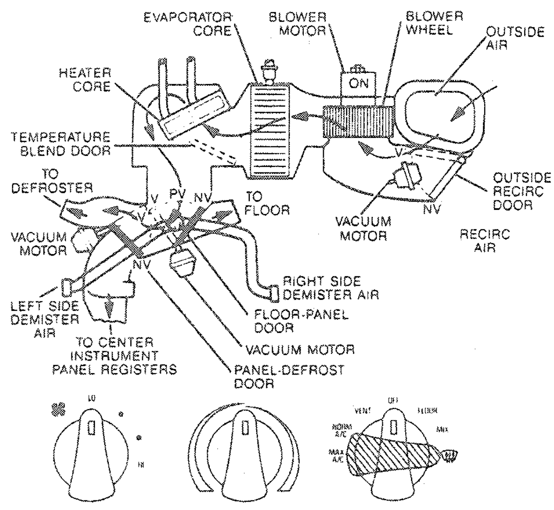
SYSTEM AIR FLOW SCHEMATIC - SELECTOR KNOB IN "FLOOR" POSITION



CONTROL ASSEMBLY KNOBS

NOTE: THE A/C CLUTCH IS OPERATING TO DEHUMIDIFY THE AIR AND MINIMIZE WINDSHIELD FOGGING.

SYSTEM AIR FLOW SCHEMATIC - SELECTOR KNOB IN "MIX" POSITION



CONTROL ASSEMBLY KNOBS

NOTE: (1) THERE IS A SLIGHT AIR BLEED TO THE FLOOR REGISTERS
(2) TEMPERATURE KNOB SETTING DETERMINES THE AMOUNT OF HEAT BEING INTRODUCED INTO THE SYSTEM
(3) THE A/C CLUTCH IS OPERATING TO DEHUMIDIFY THE AIR AND MINIMIZE WINDSHIELD FOGGING

SYSTEM AIR FLOW SCHEMATIC - SELECTOR KNOB IN "DEFROST" POSITION

CCL 2610-E

DESCRIPTION AND OPERATION (Continued)

MAX A/C (Recirculated Air)

When the function selector knob is in the MAX A/C position:

- The outside/recirc door is at full vacuum, closing off outside air.
- The floor-panel door is at no vacuum, blocking airflow to the floor registers.
- The panel-defrost door is at full vacuum, closing off airflow to the defrosters.
- Temperature control is usually set for maximum cold, but may be heated if desired.
- Air will be picked up at the recirc opening by the blower motor. Airflow across the evaporator core will be diverted past the heater core and then directed into the passenger compartment through the instrument panel registers.

The A/C System Schematic and Vacuum control Chart illustration shows the Function Selector Valve Detent Position chart and a schematic of mode selector knob functions.

Air flow charts 1 and 2 correlate specific airflow conditions which occur when a given function selector knob setting is made.

OFF

When the function selector knob is in the OFF position:

- The outside/recirc door is at full vacuum. As a result, outside air is closed off and recirc air is admitted to the system.
- The panel-defrost door and the floor-panel door are both at full vacuum, closing off the passages to the defrosters.

NORM A/C (Outside Air)

When the function selector knob is in the NORM A/C position:

- The outside/recirc door is set at no vacuum. This blocks the recirc passage and allows the admittance of outside air.
- All other door positions are the same as those previously described for the MAX A/C setting.
- Temperature setting can be changed manually as desired.
- The compressor will be operating when NORM A/C is selected.

VENT

When the function selector knob is in the VENT position:

- The outside/recirc door, with no vacuum being applied, will block recirculated air and admit outside air. From there, air flows through the system to the instrument panel registers.
- The floor-panel door is at no vacuum to block airflow to the floor registers.
- The panel-defrost door is at full vacuum, closing off airflow to the defrosters.
- The air conditioned airflow is admitted into the system when the function selector knob is in the VENT position, but the temperature control knob may be adjusted to heat the air, if desired.

FLOOR

When the function selector knob is in the FLOOR position:

- The outside/recirc door is in the no vacuum position, blocking recirc air and admitting outside air.
- The floor-panel door is in the vacuum position, closing off all but a minimum of airflow to the defrosters.
- The blend door is positioned to mix air flowing through the heater core and air from outside to achieve the desired temperature level.
- The panel-defrost door is in the no vacuum position, blocking air circulation to the panel registers.

MIX

When the function selector knob is in the MIX position:

- The outside/recirc air door and the panel-defrost door are in the no vacuum position.
- The floor-panel door is in the partial vacuum position, allowing airflow to both panel registers and floor duct.
- The A/C compressor operates to dehumidify the air and reduce windshield fogging.

DEFROST

When the function selector knob is in the DEFROST position:

- The outside/recirc door is in the no vacuum position, admitting outside air.
- Both the floor-panel and the panel-defrost doors are in the no vacuum position, so that the most of the incoming air is directed to the defroster nozzles. There is a slight air bleed to the floor registers.
- The temperature control knob setting will determine the amount of heat introduced into the airflow.
- The A/C clutch will also operate when the DEFROST position is selected. This dehumidifies incoming air and reduces windshield fogging.

Components

Control Assembly

The control assembly consists of three main parts:

- The function selector knob, a vacuum selector valve combined with an internal electrical switch
- Blower switch, an electrical switch that provides four speeds of blower operation
- The temperature control knob, which controls the position of the electric blend door actuator mounted on evaporator assembly

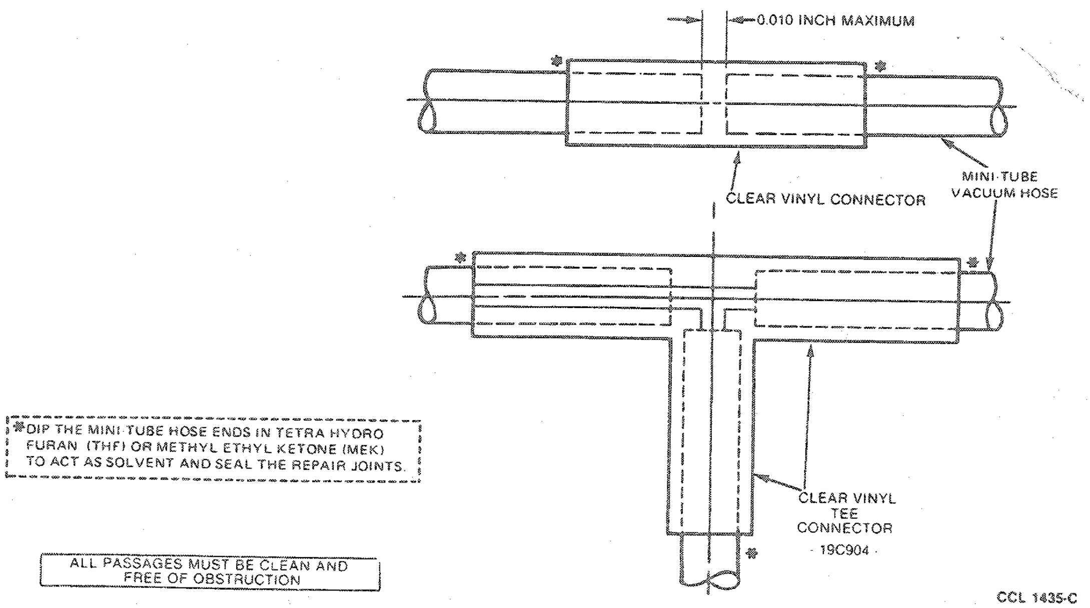
DESCRIPTION AND OPERATION (Continued)

1. The vacuum selector valve directs source vacuum to various vacuum motors. Refer to the A / C System Schematic and Vacuum Control Chart. Two internal single pole electrical switches are also controlled by the selector. The combination of these electrical switches controls the electrical supply to the A / C clutch and blower switch.
2. The temperature control knob is electrically connected to the temperature blend door by a blend door actuator. Movement of the control knob from COOL to WARM causes a corresponding movement on the temperature blend door and determines the temperature that the system will maintain.

Mini-Tube Vacuum Hoses

Mini-tube vacuum hoses are used in the vacuum harness assemblies. They provide greater flexibility with less tendency to collapse and are less susceptible to pinching. Repairs are easily made using a short piece of standard 3mm (1 / 8 inch) ID vacuum hose and inserting the cut ends of the mini-tube into the ends of the standard 3mm (1 / 8 inch) ID vacuum hose.

Mini-Tube Vacuum Hose Service

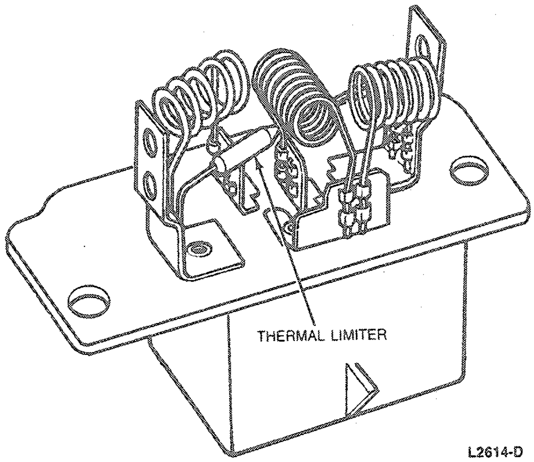


Thermal Limiter Resistor Assembly

The blower motor thermal limiter resistor assembly is located on the passenger side of the evaporator case behind the glove compartment. There are three resistance elements mounted on the resistor board to provide four blower speeds. Depending on the blower switch position, series resistance is added or bypassed in the blower motor circuit to decrease or increase blower motor speed.

DESCRIPTION AND OPERATION (Continued)

Thermal Limiter Resistor Assembly



The thermal limiter resistor assembly is similar to a standard resistor assembly, except an overheating protective device (thermal limiter) has been added to prevent heat damage to the evaporator case assembly. Overheating of the resistor coil(s) will occur when the system airflow is stopped as a result of the blower wheel being locked.

When the thermal limiter resistor circuit has opened as a result of excessive heat, it should be replaced only with an identical replacement thermal limiter resistor assembly. It must not be substituted with a standard resistor assembly which does not include a thermal limiter device.

Thermal Limiter

The thermal limiter, used in the thermal limiter resistor assembly, serves as a temperature protecting fuse. Located a predetermined distance from the resistor coils and in series with the coil circuit, it will open the resistor coil circuit when the temperature of the thermal limiter reaches 121°C (250°F) interrupting blower operation in all speeds except high blower. Internal spring-loaded contacts are held closed with wax material which has a melting point of 121°C (250°F). When the wax softens, the spring contacts separate, opening the resistor circuit. The spring contacts cannot be closed again. It will be necessary to replace the entire thermal limiter resistor assembly.

Register Assemblies

The rectangular register assembly consists of a set of horizontal louvers in front and a set of vertical louvers behind the front louvers. The control knob moves up and down and slides side-to-side to direct air in all directions.

Register Assemblies, LH

Sable

The assembly is an integral part of the cluster finish panel with the housing moulded as part of it. A knob, located on the RH side, controls an air shutoff door installed in the register housing assembly.

Register Assembly, RH

Taurus/Sable

The housing has four flexible tabs (two on the top and two on the bottom) that lock the assembly into the instrument panel. A knob, located on the LH front of the register assembly, controls an outlet shutoff door installed in the register housing assembly.

Register Assembly, LH and Center

Taurus

The assemblies are a part of the cluster finish panel and attached to the panel with two screws for the LH assembly and two screws and two heat stakes for the center assembly. A knob, located on the RH front of the register assembly, controls an air outler shutoff door installed in the register housing assemblies.

Register Assembly, Center

Sable

The two center assemblies are an integral part of the center finish panel (moulded as a part of it) and attached to the instrument panel. Knobs located on the edges of the finish panel, control air shutoff doors installed in the register housing assembly.

Refrigerant System

Refer to Section 12-00 for a description and service procedures for refrigerant system components.

Constant Control Relay Module (CCRM)

A constant control relay module (CCRM) is used on all engines with air conditioning. The CCRM cycles the engine cooling fan on whenever the A/C compressor is operating. The controller also allows for engine cooling fan operation whenever the engine coolant temperature reaches approximately 105°C (221°F).

The CCRM is located on the radiator support. A schematic of the electrical components and circuits involved is shown in previous CCRM circuit and pinouts illustration.

DIAGNOSIS AND TESTING

Refer to Section 12-00.

REMOVAL AND INSTALLATION

Refrigerant 134a (R-134a) Systems

In effort to avoid the use of CFC refrigerants that may harm the ozone layer of the atmosphere, Ford Motor Company has introduced a new refrigerant system on some 3.0L Taurus vehicles that requires the use of a Non-CFC based refrigerant known as R-134a. This new type of refrigerant has many of the same properties as R-12 and is similar in form and function. However, R-134a is a hydrofluorocarbon (HFC) based refrigerant while R-12 is a chlorofluorocarbon (CFC) based refrigerant. Because of the absence of chlorine in its molecular structure, the use of R-134a refrigerant will not have any harmful effects on the ozone layer of the atmosphere.

Most Taurus / Sable vehicles use A / C systems that require the use of R-12 as a refrigerant. If there are no special R-134a identifying tags on the A / C system components and refrigerant lines, the system requires the use of R-12 refrigerant.

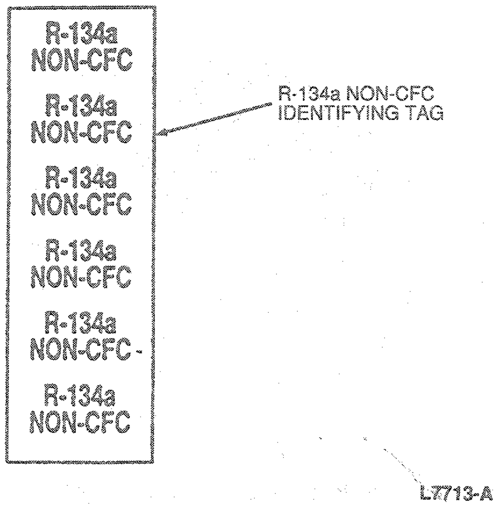
Ford Motor Company has begun producing some 3.0L Taurus vehicles that have new A / C systems requiring the use of R-134a refrigerant. R-134a A / C systems have special service requirements that will be outlined later. R-12 refrigerant and components can only be used in R-12 systems while R-134a refrigerant and components can only be used in R-134a systems.

Identifying R-134a and R-12 Systems

CAUTION: Do not add R-12 refrigerant to an A / C system that requires the use of R-134a refrigerant. Do not add R-134a refrigerant to an A / C system that requires the use of R-12 refrigerant. These two types of refrigerant should never be mixed. Doing so may cause damage to the A / C system.

NOTE: R-134a A / C systems can also be identified by a gold colored A / C compressor clutch and green colored O-rings used throughout the system.

In order to determine which type of A / C system a particular vehicle has, inspect the A / C system major components and refrigerant lines. If the system components have yellow R-134a NON-CFC tags as shown below, it is an R-134a system requiring the use of R-134a refrigerant.



If the A / C system has any of the R-134a identifying characteristics outlined, R-134a refrigerant is the only type of refrigerant that can be used in the A / C system. If the A / C system is not identified as an R-134a system as previously outlined, it is an R-12 system requiring the use of R-12 refrigerant.

R-134a System Components

CAUTION: R-12 and R-134a components are not interchangeable. Do not replace components from an R-134a system with components for an R-12 system and vice versa. Mixing components from these two types of systems may cause component failure and damage to the A / C system.

The major components of R-134a A / C systems are similar to those used previously on Ford R-12 fixed orifice tube type systems. R-12 and R-134a components are similar in design and function. As a result, all Removal and Installation procedures outlined for R-12 components can be used for R-134a components.

Control Assembly Blower Knob, Manual A / C

Removal and Installation

1. Grasp blower knob and pull it rearward from control assembly bezel.

   NOTE: Do not use a sharp instrument to pry the knob off the potentiometer shaft as damage to the surface of the bezel is likely to occur.

2. If the D-shaped spring clip which seats inside back end of knob remains on potentiometer shaft when knob is pulled off, remove it using needlenose pliers.

REMOVAL AND INSTALLATION (Continued)

3. To install knob, align its keyed surface with mating surface on potentiometer shaft. Press knob forward until its back edge is flush with surface of control assembly bezel.

   NOTE: This knob removal and installation procedure applies only to the control assembly blower knob. The buttons on the control assembly are not serviced in detail.

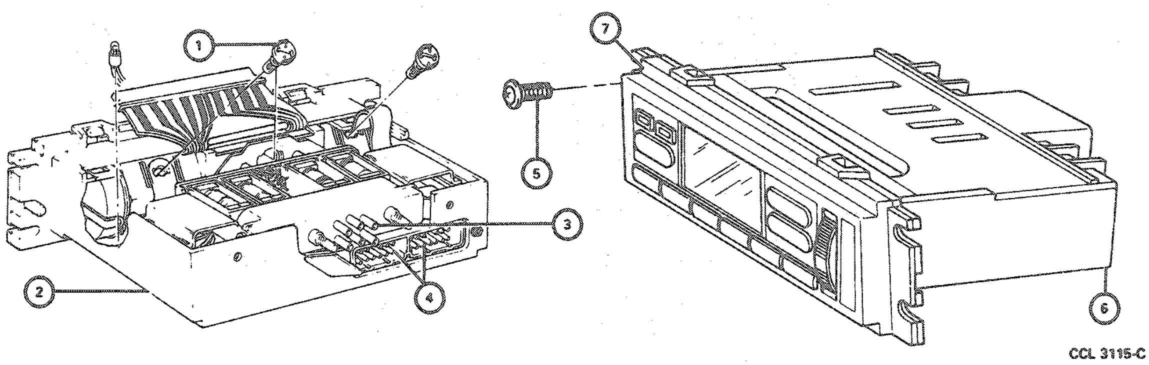
Control Assembly, Automatic

Removal

1. Disconnect battery ground cable.
2. Pull out lower LH and lower RH instrument panel snap-on finish panel inserts. Remove eight screws retaining upper finish panel.

   NOTE: Refer to Section 01-12 for instrument panel removal and installation procedures.
3. Pull lower edge of upper finish panel away from instrument panel. It is best to grasp finish panel from lower LH corner and pull panel away by walking hands around panel in a clockwise direction.
4. Remove four Torx® head screws retaining control head. Pull control head away from instrument panel into a position which provides access to rear connections.
5. Disconnect two harness connectors from control assembly by depressing latches at top of connectors and pulling.
6. Remove two nuts retaining vacuum harness. Pull control assembly away from instrument panel.

Control Head Attachment



ITEM	DESCRIPTION
1.	GENERAL ILLUMINATION BULB - NO. 2043
2.	AIR TEMPERATURE CONTROL ASSY - 18C612
3.	VACUUM CONTROL VALVE
4.	ELECTRICAL CONNECTIONS
5.	SCREW (4 REQ'D.) - N803876
6.	CONTROL ASSY - 18C612
7.	BEZEL

Installation

1. Connect two harness connectors to control assembly. Push keyed connectors in until a click is heard.
2. Attach vacuum harness to vacuum port assembly. Secure harness by tightening two nuts.
3. Position control assembly into instrument panel opening and install four retaining Torx® head screws. Ensure that, as control is positioned, locating posts are correctly aligned with their respective holes.
4. Carefully place instrument panel applique into its assembly position. Note that spring clips are aligned with their proper holes. Press applique into place. Ensure that all spring clips are secure.
5. Install eight screws retaining upper finish panel. Insert lower LH and lower RH instrument panel snap-on finish panel inserts.
6. Connect battery ground cable.

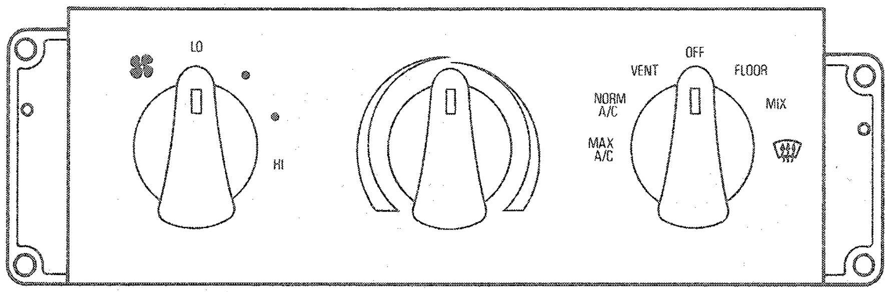
REMOVAL AND INSTALLATION (Continued)

Control Assembly, Manual A/C—Heater

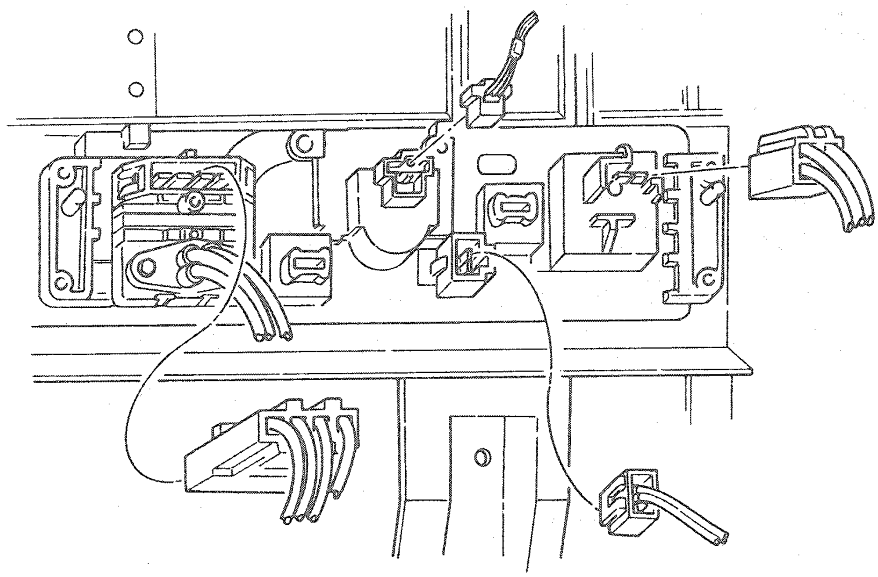
Removal

1. Disconnect battery ground cable.
2. Remove the instrument panel finish applique.
3. Remove four screws attaching control assembly to instrument panel.

Control Assembly Removal



FRONT VIEW



REAR VIEW

CCL 3546-D

4. Remove four Torx® head screws retaining control head. Pull control head away from instrument panel into a position which provides access to rear connectors.
5. Disconnect two harness connectors from control assembly by depressing latches at top of connectors and pulling.

Installation

CAUTION: Push on the vacuum harness retaining nuts. Do not attempt to screw them onto the post.

1. Connect wire connectors and vacuum harness to control assembly using new pushnuts.
2. Position control assembly to instrument panel opening and install four retaining screws.

REMOVAL AND INSTALLATION (Continued)

3. Install the instrument panel finish applique.
4. Connect battery ground cable.
5. Check system for proper operation.

Sunload Sensor Assembly

Removal

1. Disconnect battery ground cable.
2. Remove RH upper, outer finish panel assembly and remove sunload sensor assembly from two mounting studs.
3. Disconnect electrical connector from sunload sensor.

Installation

1. Connect electrical connector to sunload sensor.
2. Install sunload sensor assembly to LH speaker grille by pushing sunload sensor firmly over two mounting studs.
3. Install LH radio speaker grille assembly.
4. Connect battery ground cable.

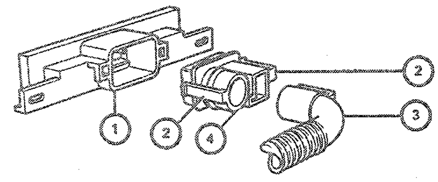
In-Vehicle Sensor Assembly

Refer to Section 01-12 for instrument panel removal and installation procedures.

Removal

1. Disconnect battery ground cable.
2. Disengage glove compartment door tabs and allow door to hang by hinge.
3. Remove sensor assembly from back bracket, attached to instrument panel.
4. Disconnect electrical connector from in-vehicle sensor.
5. Disconnect aspirator hose from in-vehicle sensor by carefully disengaging elbow latch.

In-Vehicle Temperature Sensor Installation



ITEM	DESCRIPTION
1.	BRACKET - 19D668
2.	DEPRESS ELBOW LATCH TO REMOVE
3.	ASPIRATOR HOSE - 19D888
4.	SENSOR - 19C734

CCL 3126-C

Installation

1. Connect electrical connector to in-vehicle sensor.
2. Connect aspirator hose to in-vehicle sensor. Ensure elbow latch engages locking ramp on sensor.
3. Position in-vehicle sensor assembly into bracket of instrument panel.
4. Replace glove compartment assembly.
5. Connect battery ground cable.
6. Check system for proper operation.

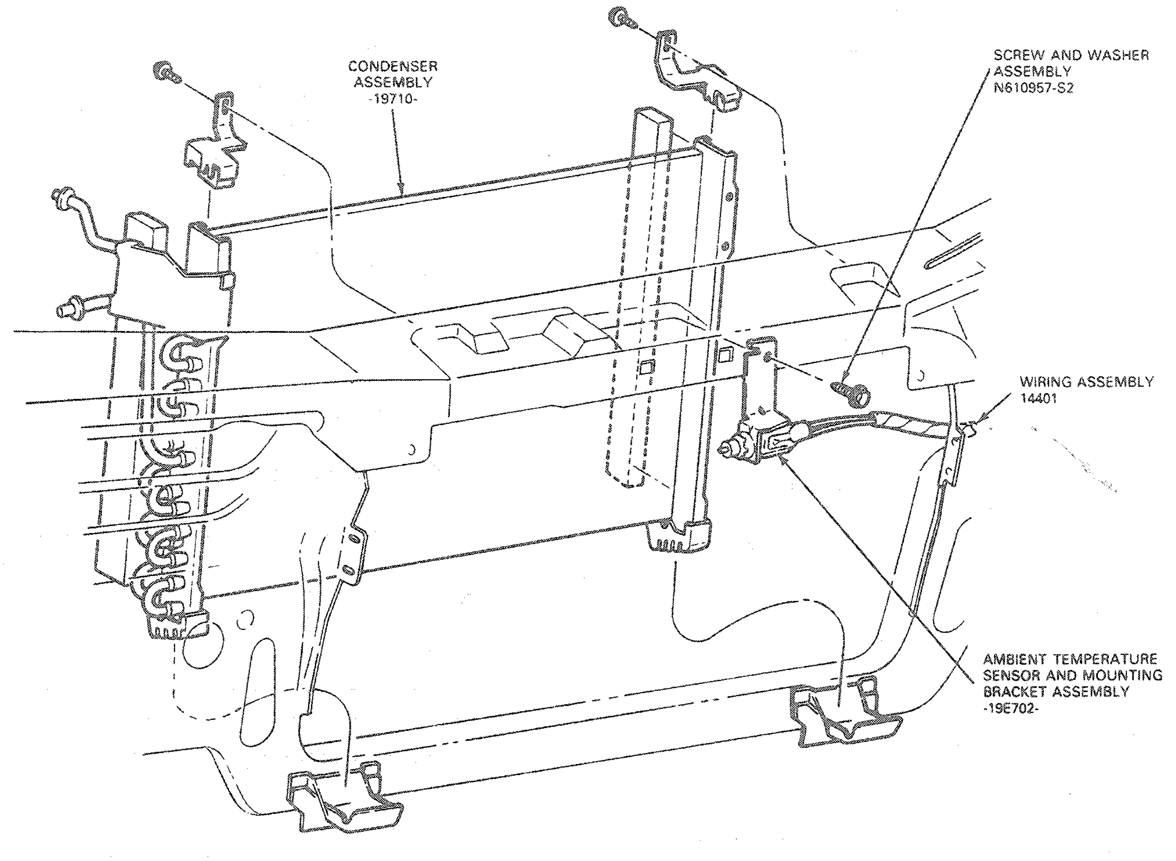
Ambient Sensor Assembly, Automatic

Removal

1. Disconnect battery ground cable.
2. Remove ambient sensor mounting nut and remove sensor.
3. Disconnect electrical connector from ambient sensor.

REMOVAL AND INSTALLATION (Continued)

Ambient Sensor Assembly



Installation

1. Connect electrical connector to ambient sensor.
2. Position ambient sensor and install retaining nut. Tighten to 6.2-7.3 N·m (55-64 lb-in).
3. Connect battery ground cable.
4. Check system for proper operation.

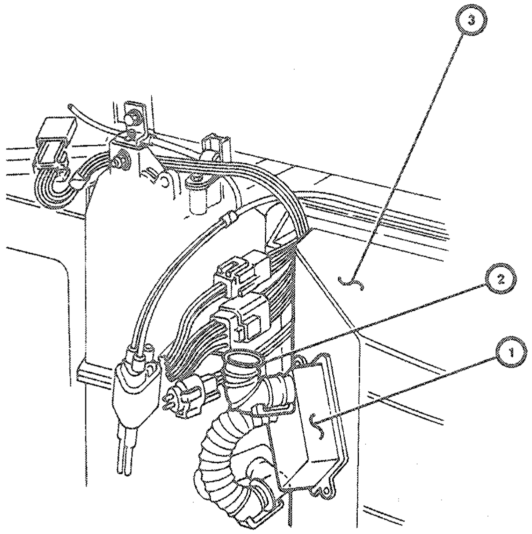
Blower Motor Speed Controller, EATC

Removal

1. Disengage glove compartment door tabs and allow door to hang by hinge.
2. Working through glove compartment opening, disconnect electrical snap-lock connector and aspirator hose at blower motor controller. Also, disconnect snap-lock connector from its mounting bracket.

REMOVAL AND INSTALLATION (Continued)

Blower Motor Speed Controller



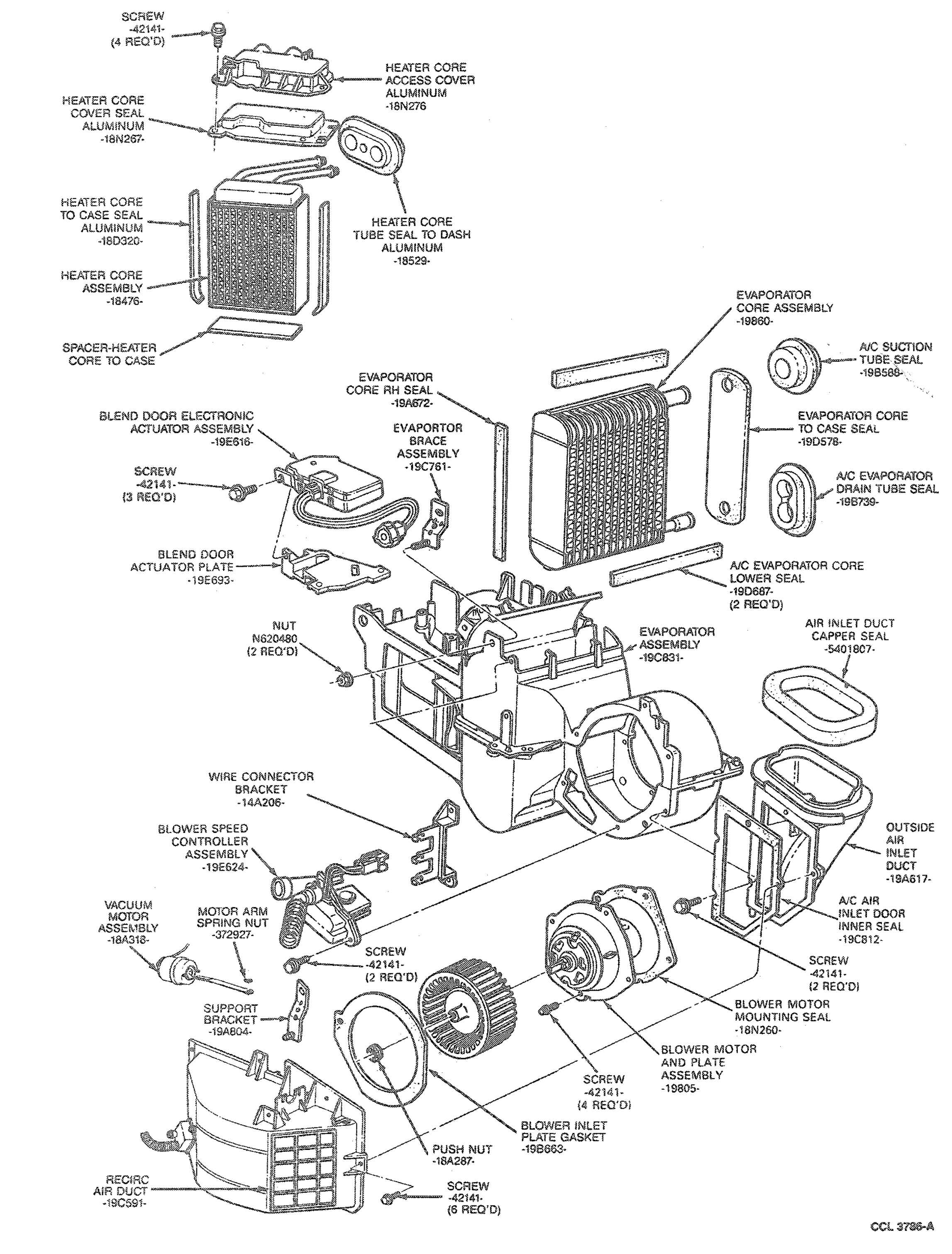
ITEM	DESCRIPTION
1	BLOWER MOTOR SPEED CONTROLLER AND ASPIRATOR ASSEMBLY
2	ASPIRATOR HOSE
3	A/C EVAPORATOR ASSEMBLY

CCL 3556-A

3. Remove two screws retaining blower controller to evaporator case and remove controller. Do not touch fins of controller until it has had sufficient time to cool.

REMOVAL AND INSTALLATION (Continued)

EATC Evaporator Assembly—Disassembled View



REMOVAL AND INSTALLATION (Continued)

Installation

1. Position blower controller on evaporator case and install two retaining screws.
2. Connect wire connector and aspirator hose to blower controller. Install connector on mounting bracket.
3. Close glove compartment door.
4. Check system for proper operation.

Blower Switch, Manual

Removal

1. Disconnect battery ground cable.
2. Remove control assembly from instrument panel.
3. Remove fan switch knob from switch shaft by pulling it off shaft.
4. Remove four screws attaching control assembly to instrument panel.
5. Remove one screw (from back side of control assembly) attaching switch to control assembly.
6. Disconnect wire connector from switch, rotate from locked position and remove switch.

Installation

1. Position switch in control assembly and rotate to lock into place.
2. Install screw attaching switch to control assembly.
3. Connect wire harness connector to switch.
4. Position control assembly in instrument panel opening. Install four retaining screws.
5. Place switch knob on switch shaft, push it all the way on.
6. Connect battery ground cable.
7. Check system for proper operation.

Vacuum Selector Switch, Manual

Removal

1. Remove control assembly.
2. Pull function selector knob off of shaft.
3. Remove one screw attaching vacuum switch to control assembly. Remove vacuum selector switch (refer to Control Assembly removal illustration).

Installation

1. Position vacuum selector switch on control assembly bracket.
2. Install one screw attaching vacuum switch to control assembly.
3. Install function selector knob by pushing it on shaft.
4. Install control assembly.

Instrument Panel

Refer to Section 01-12.

Louver Assemblies, Manual

Removal and Installation

1. Rotate louver assembly until it is in true horizontal position (not flush with applique).
2. Pull louver assembly out of the housing.
3. To install louver assembly, position it in the true horizontal positions and snap it into the housing.

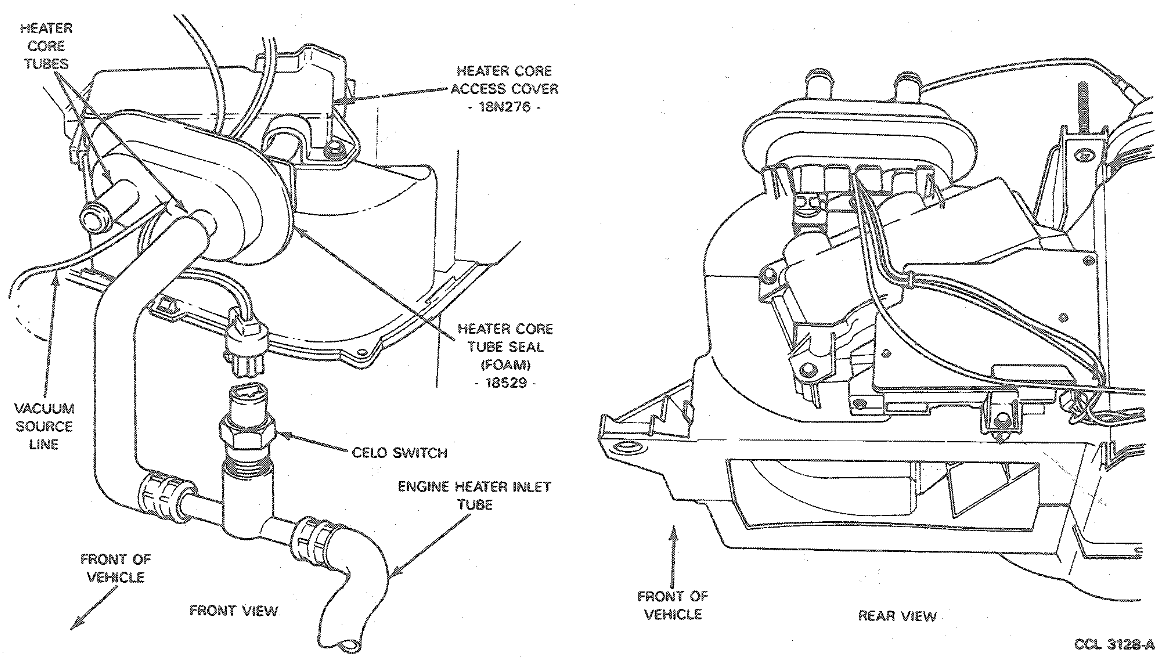
Cold Engine Lock Out Switch (CELO)

Replacement

1. The cold engine lock out (CELO) switch screws into a fitting in the heater core inlet tube in the engine compartment.
2. To replace the switch, disconnect the two wire connectors from the receptacle in the switch.
3. Partially drain the coolant from the radiator.
4. Unscrew the switch body from the fitting in the heater inlet tube.
5. Apply Pipe Sealant with Teflon® D8AZ-19554-A (ESG-M4G194-A) to the threads in the replacement switch and install it in the fitting. Tighten the switch to 19 N·m (14 lb-ft).
6. Attach the electrical connector to the top of the switch.
7. Refill the radiator with specified coolant.

REMOVAL AND INSTALLATION (Continued)

Cold Engine Lock Out Switch Replacement



Blend Door Actuator

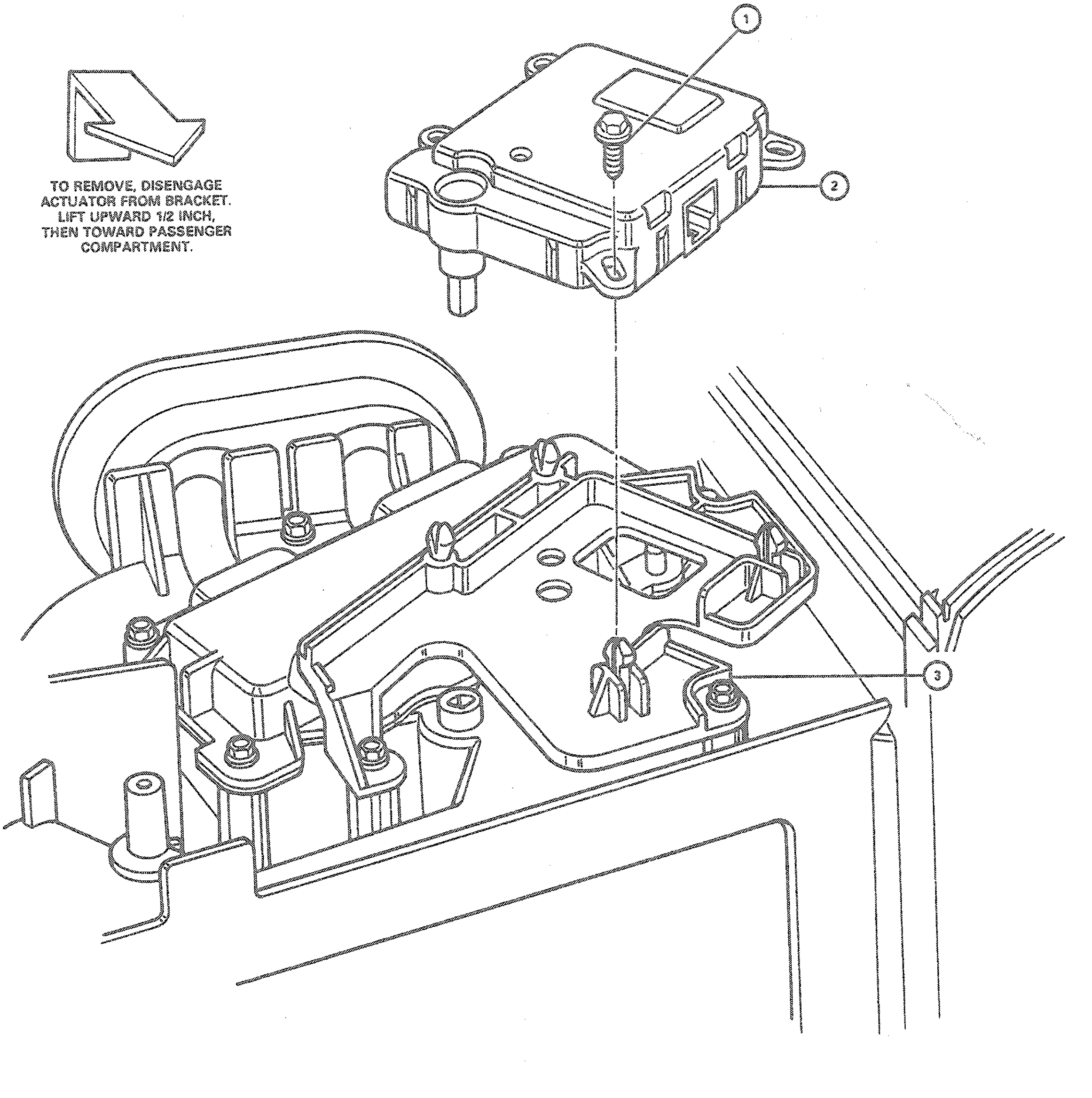
Removal

1. Disconnect battery ground cable.
2. Loosen instrument panel and pull back from cowl.

   NOTE: Refer to Section 01-12 for instrument panel removal and installation procedure.
3. Remove blend door actuator electrical connector from bracket on evaporator case.

REMOVAL AND INSTALLATION (Continued)

Electric Blend Door Actuator Attachment



ITEM	DESCRIPTION
1.	SCREW - 42141 (2 REQ'D.)
2.	BLEND DOOR ACTUATOR MOTOR ASSEMBLY - 19E616
3.	BLEND DOOR ACTUATOR MOTOR MOUNTING PLATE - 19E693

CCL 2658-E

4. Remove three actuator retaining screws.

5. Lift actuator vertically approximately 12mm (1/2 inch) to disengage it from bracket and blend door shaft, then pull actuator back toward passenger compartment.

   NOTE: The mounting bracket remains in place on the evaporator case.

REMOVAL AND INSTALLATION (Continued)

Installation

1. Insert blend door actuator horizontally over actuator bracket on evaporator case.
2. Insert actuator shaft into blend door. (Manually moving door will help engage shaft.)
3. Attach actuator bracket with three retaining screws.
4. Attach actuator electrical connector to bracket on evaporator case.
5. Install instrument panel.
6. Connect battery ground cable.

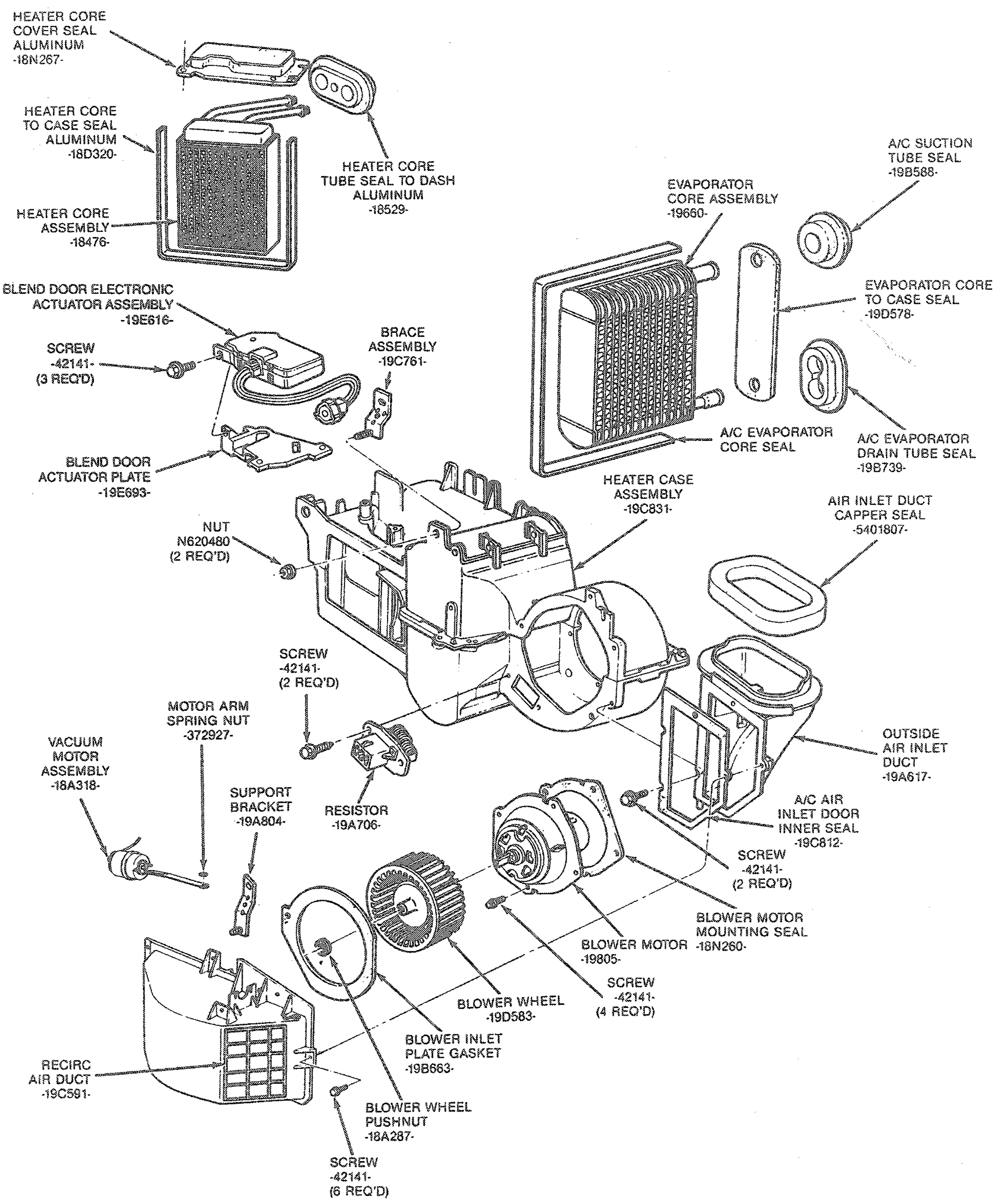
   NOTE: After replacement of the blend door actuator, the system MUST BE RECALIBRATED for proper operation. To recalibrate, remove the positive (+) lead from the battery terminal. After 30 seconds, install the terminal. Calibration will be performed automatically when the EATC control assembly is energized.

Evaporator Case Assembly

NOTE: Whenever an evaporator case is removed, it will be necessary to replace the suction accumulator / drier.

REMOVAL AND INSTALLATION (Continued)

Heater and Evaporator Installation, Manual



CCL 2615-E

REMOVAL AND INSTALLATION (Continued)

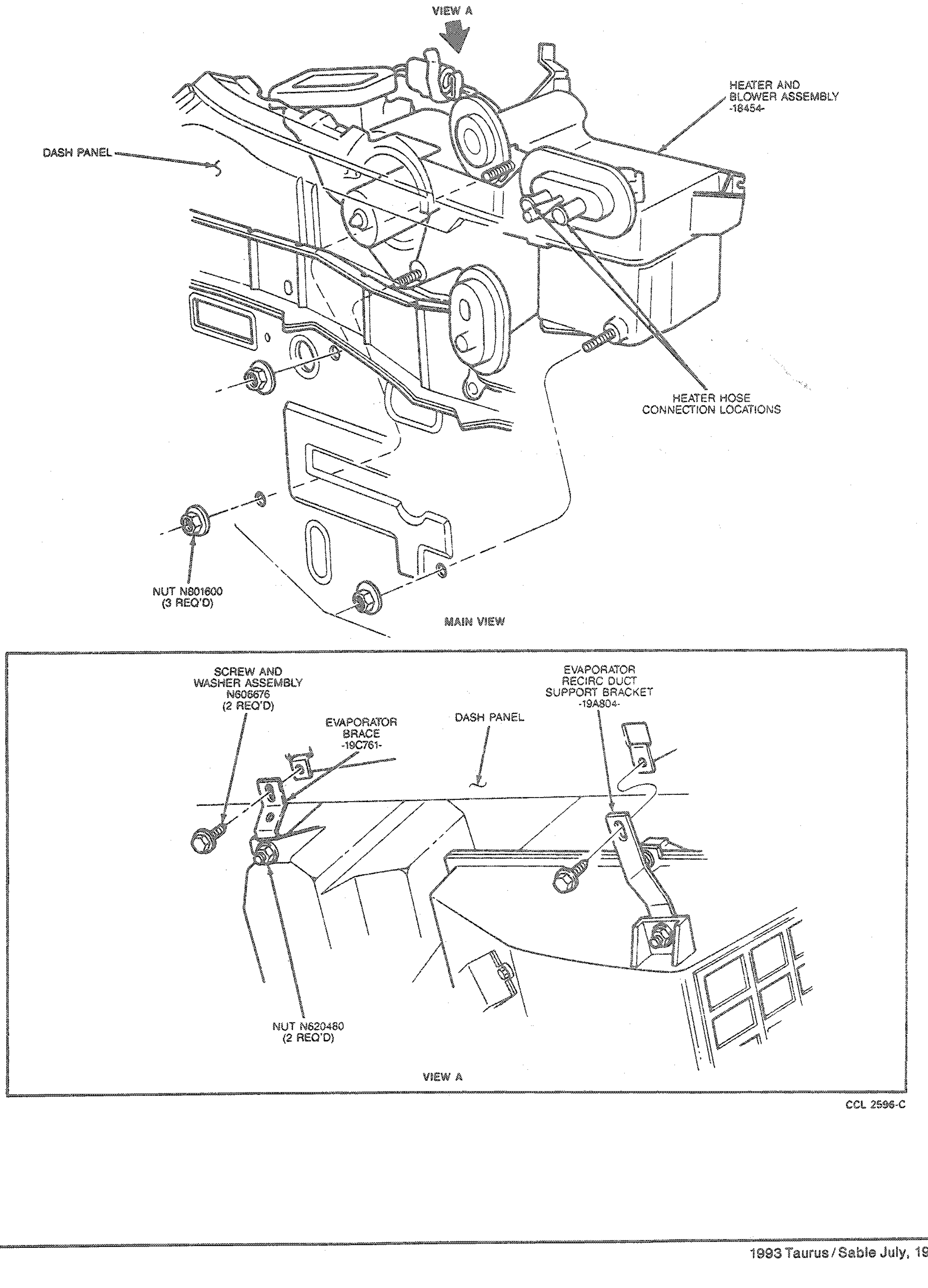
Removal

1. Disconnect battery ground cable.
2. Drain coolant from radiator into a clean container.
3. Discharge refrigerant from A / C system. Observe all safety precautions. Refer to Section 12-00.
4. Disconnect heater hoses from heater core. Plug heater core tubes, or blow any coolant from heater core with low-pressure air.
5. Disconnect vacuum supply hose from in-line vacuum check valve in engine compartment.
6. Disconnect liquid line and accumulator from evaporator core at dash panel. Cap refrigerant lines and evaporator core to prevent entrance of dirt and moisture.
7. Remove instrument panel as outlined and place it on front seat.

   Refer to Section 01-12 for instrument panel removal and installation procedures.
8. Remove screw holding instrument panel shake brace to evaporator case and remove instrument panel shake brace.
9. Remove two screws retaining floor register and rear seat duct to bottom of evaporator case.
10. Remove three nuts retaining evaporator case to dash panel in engine compartment (Main View).
11. Remove two screws retaining support brackets to cowl top panel (View A).
12. Carefully pull evaporator assembly away from dash panel and remove evaporator from vehicle.

REMOVAL AND INSTALLATION (Continued)

Heater and A/C Evaporator Installation



CCL 2596-C

REMOVAL AND INSTALLATION (Continued)

Installation

1. Position evaporator case assembly to dash panel and cowl top panel at air inlet opening. Install two screws retaining support brackets to cowl top panel.
2. Install three nuts in engine compartment retaining evaporator case to dash panel.
3. Install floor register and rear seat duct to evaporator case and tighten two retaining screws.
4. Install instrument panel shake brace and screw to evaporator case.
5. Install instrument panel as outlined.
6. Connect liquid line and suction accumulator to evaporator core.

   CAUTION: Make sure correct type O-rings are installed on A/C fittings.
7. Connect heater hoses to heater core.
8. Connect black vacuum supply hose to vacuum check valve in engine compartment.
9. Fill radiator to correct level with removed coolant or specified mixture of coolant and water.
10. Connect battery ground cable.
11. Leak test, evacuate and charge A/C refrigerant system. Refer to Section 12-00.
12. Check system for proper operation.

Evaporator Core

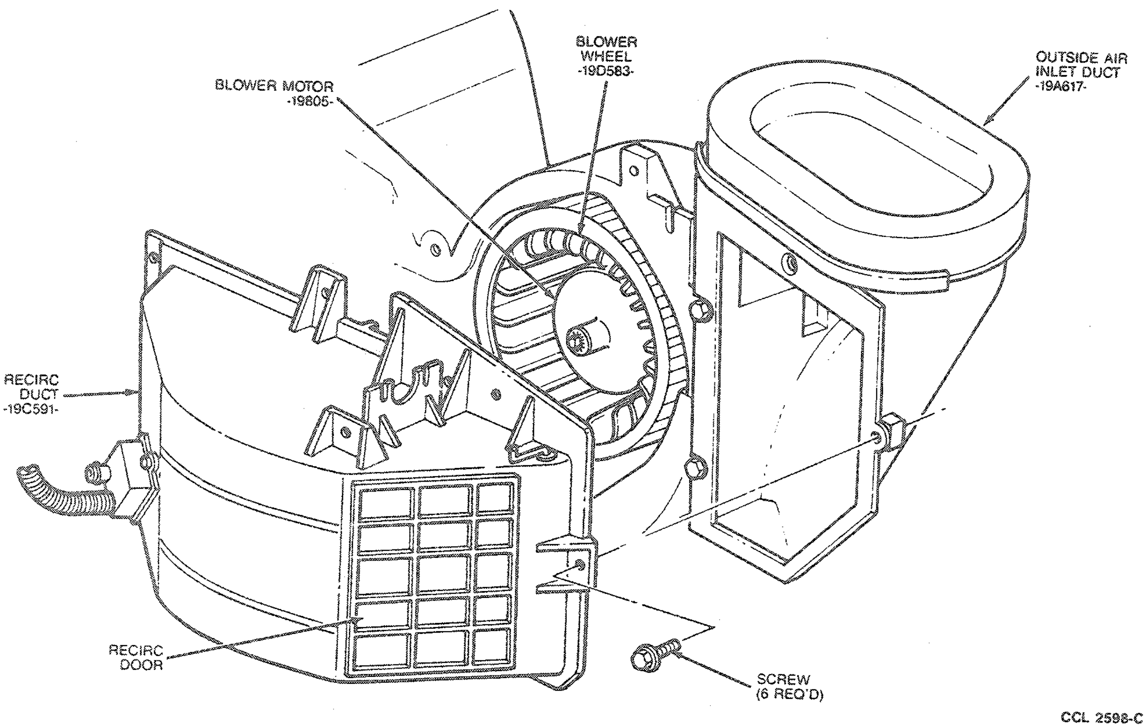
NOTE: Whenever an evaporator core is replaced, it will be necessary to replace the suction accumulator/drier.

CAUTION: If an evaporator core leak is suspected, the core must be leak tested before it is removed from the vehicle. Refer to Section 12-00 for the leak test procedure.

Removal

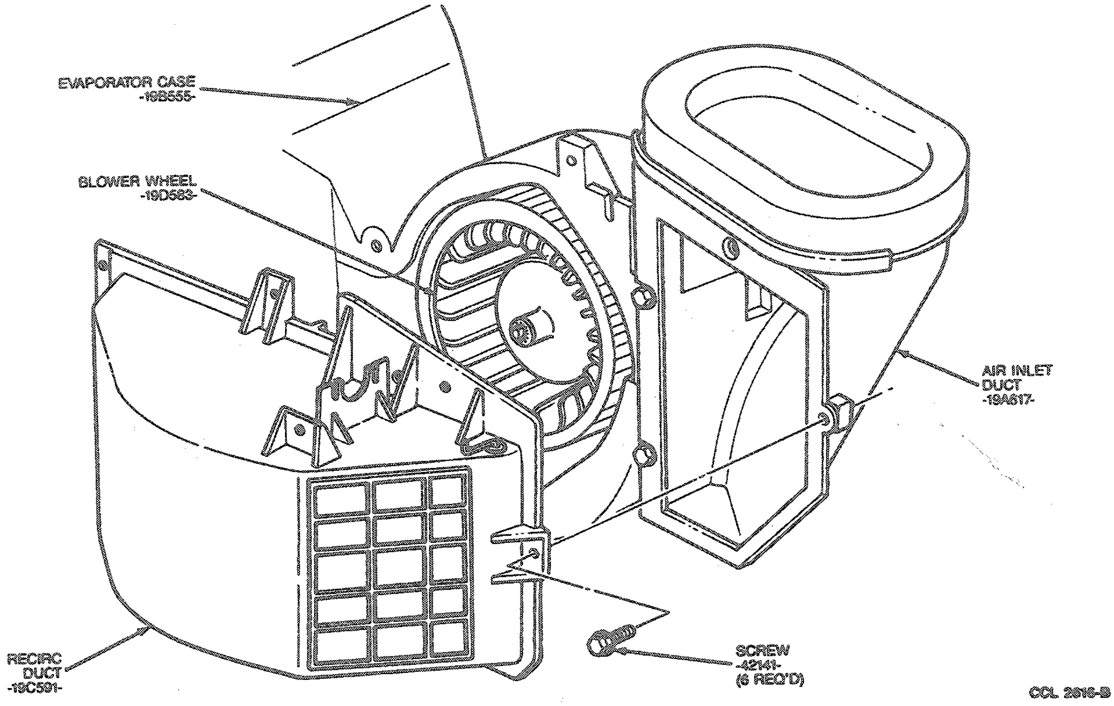
1. Remove evaporator case as outlined.
2. Disconnect and remove vacuum harness.
3. Remove six screws retaining recirc duct and remove duct from evaporator case.

Recirc Duct Removal from Evaporator Case, EATC



REMOVAL AND INSTALLATION (Continued)

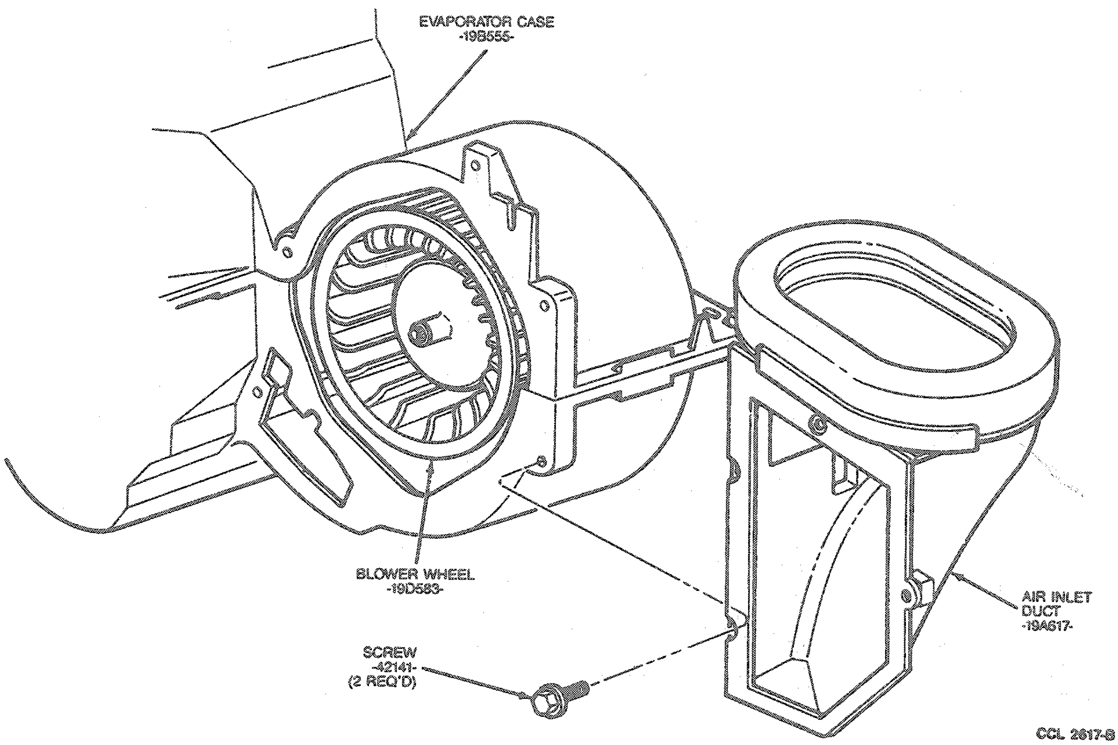
Recirc Duct Removal from Evaporator Case, Manual



4. Remove two screws from air inlet duct and remove duct from evaporator case.

REMOVAL AND INSTALLATION (Continued)

Air Inlet Duct Removal from Evaporator Case

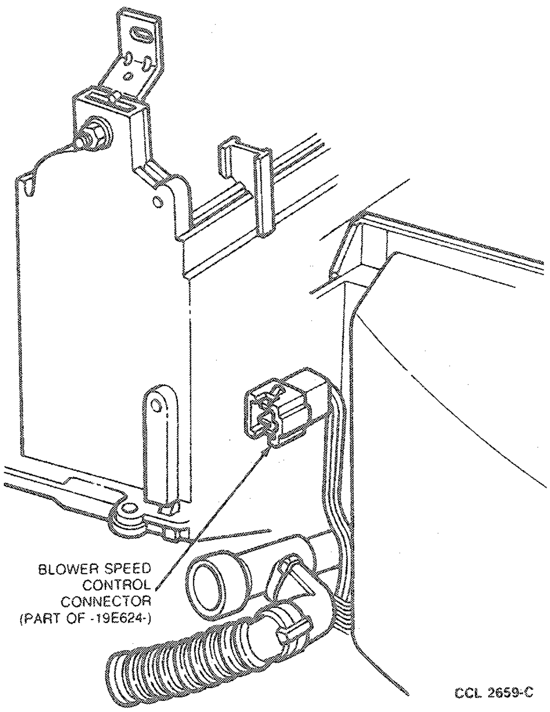


5. Remove support bracket from evaporator case (refer to Heater and A / C Evaporator Installation illustration, View A).

6. Remove screws holding electronic connector bracket to recirc duct. Disconnect engine harness 14401 from blower speed control connector. Release three connectors from bracket and remove bracket. Disconnect aspirator hose. (EATC only).

REMOVAL AND INSTALLATION (Continued)

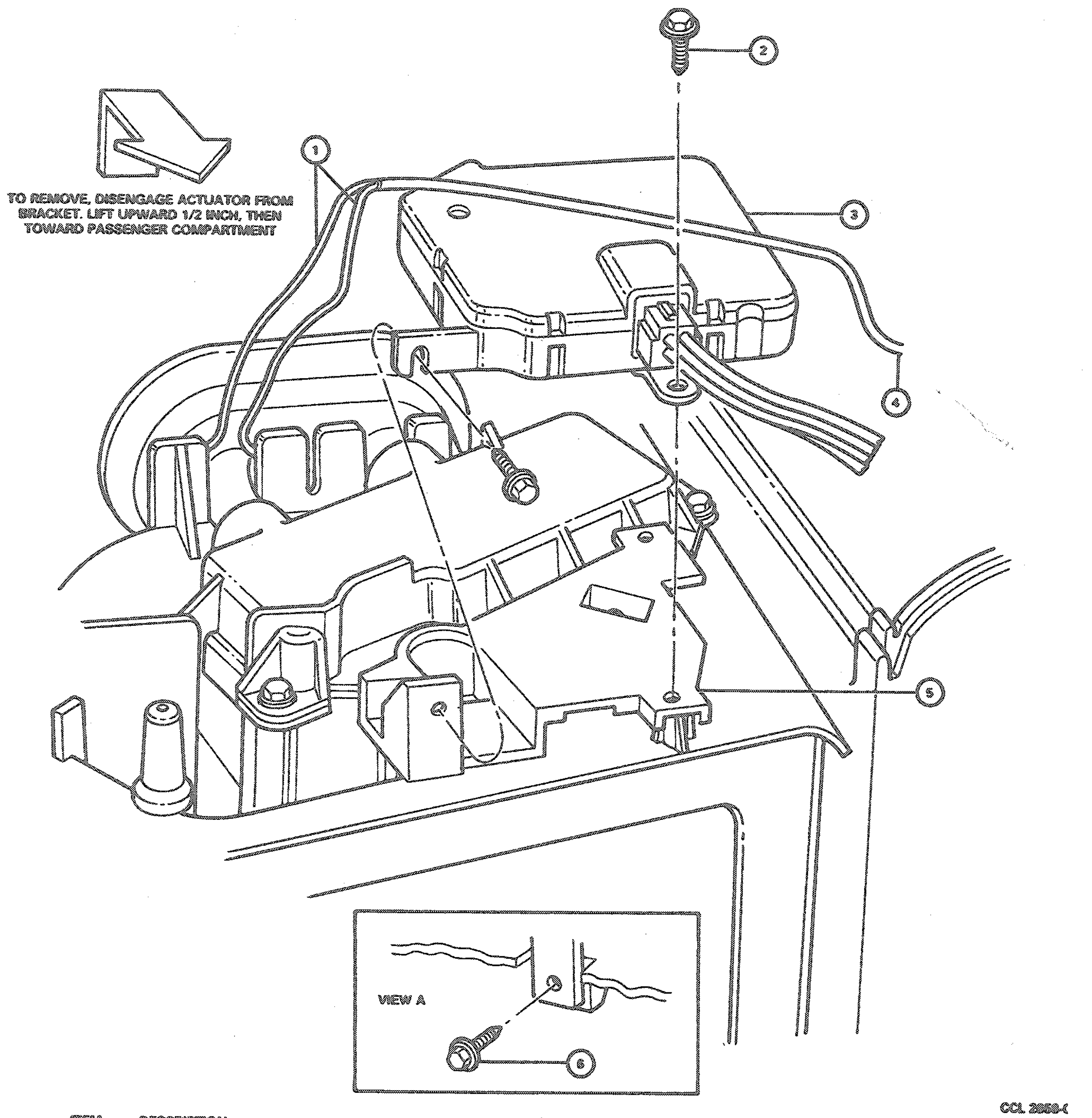
Blower Speed Control Connector



7. Remove blend door actuator (three screws) (EATC only).

REMOVAL AND INSTALLATION (Continued)

Blend Door Actuator



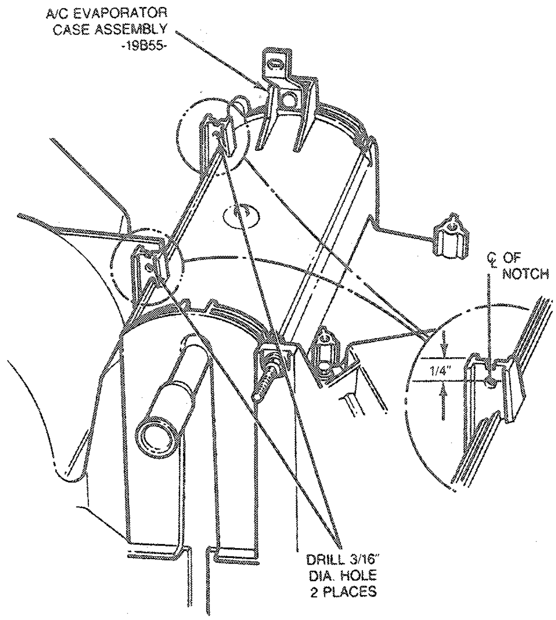
ITEM	DESCRIPTION	ITEM	DESCRIPTION
1.	TO COLD ENGINE LOCKOUT SWITCH	4.	TO ELECTRICAL CONNECTOR
2.	SCREW (2 REQ'D.) - 42141	5.	BLEND DOOR ACTUATOR MOTOR MOUNTING PLATE - 19E693
3.	BLEND DOOR ACTUATOR MOTOR ASSEMBLY - 19E616	6.	SCREW (1 OF 3 REQ'D) - 42141

8. Remove moulded seals from evaporator core tubes (refer to Heater and Evaporator installation Manual, illustration).

9. Drill a 4.75mm (3 / 16 inch) hole in both upright tabs on top of evaporator case.

REMOVAL AND INSTALLATION (Continued)

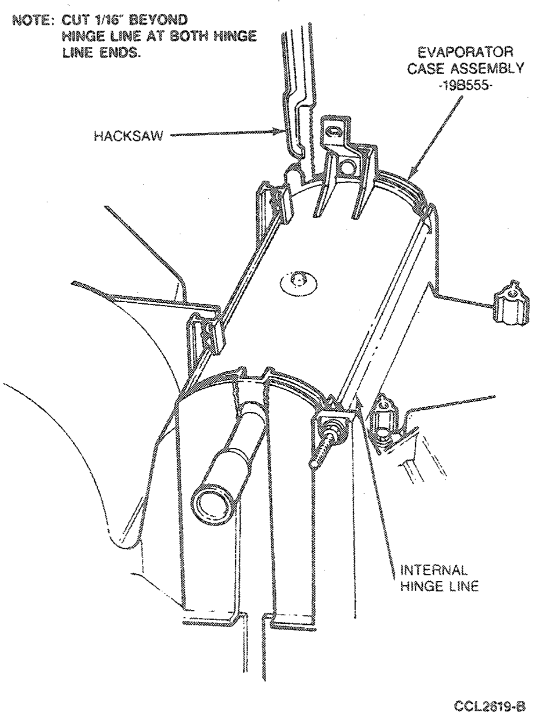
Drilling Holes in Evaporator Case Tabs



CCL2618-B

10. Using a hot knife or small saw blade, cut top of evaporator case between raised outline.

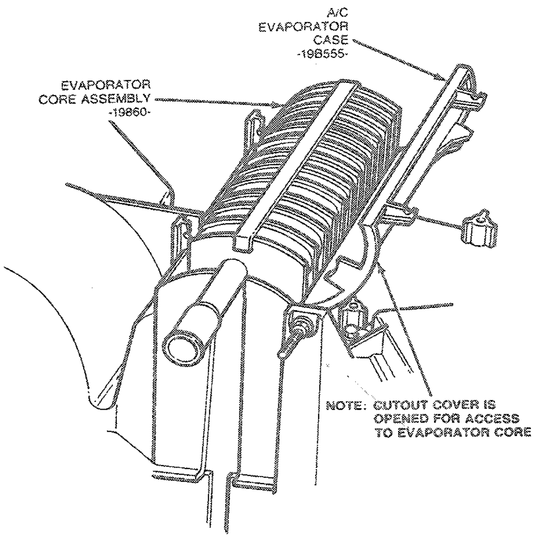
Evaporator Case Cutting



CCL2619-B

11. Fold cutout cover back from opening and lift evaporator core from case.

Evaporator Core Removal from Case



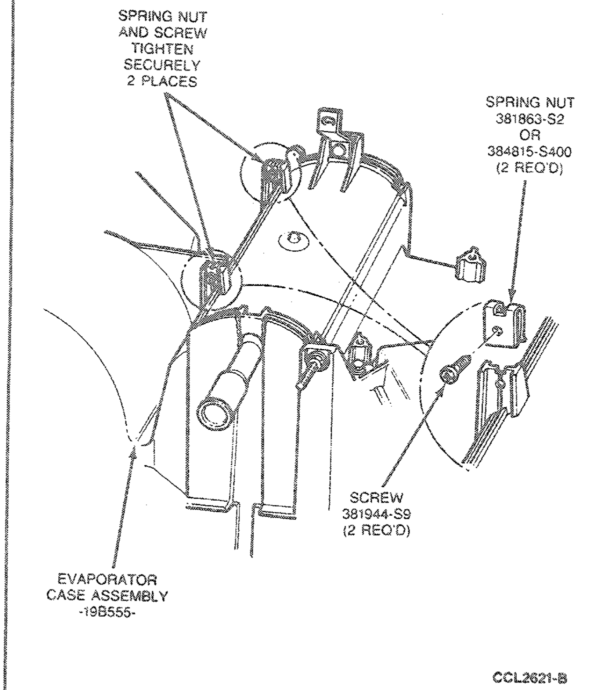
CCL2620-B

Installation

1. Transfer two foam core seals to new evaporator core.
2. Position evaporator core in case and close cutout cover.
3. Install a spring nut on each of two upright tabs with two holes drilled in front flange. Ensure hole in spring nut is aligned with 4.75mm (3 / 16 inch) holes drilled in tab and flange. Install and tighten screw in each spring nut (through hole in tab or flange) to secure cutout cover in closed position.

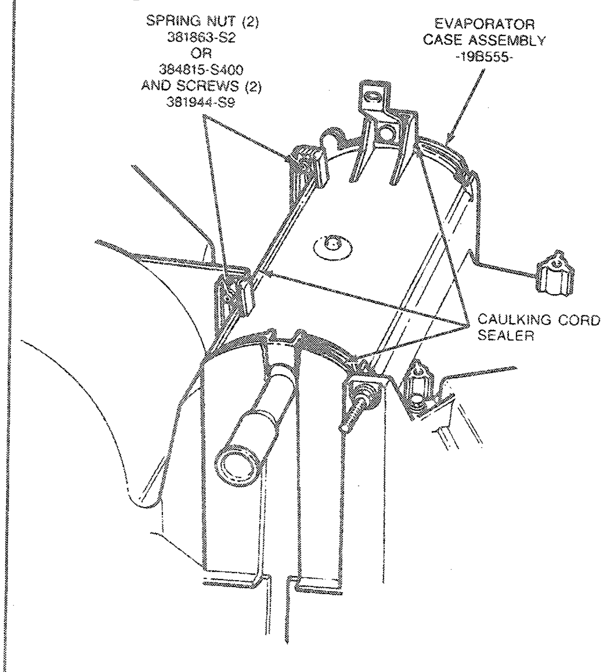
REMOVAL AND INSTALLATION (Continued)

Cutout Cover Secured in Closed Position



4. Install Caulking Cord D6AZ-19560-A (ESB-M4G32-A) or equivalent to seal evaporator case against leakage along cut line.

Caulking Cord Installation



5. Install air inlet duct to evaporator case and tighten two screws.
6. Install recirc duct to evaporator case and tighten six screws.
7. Install electrical connector bracket to recirc duct with one screw. (EATC only)
8. Install speed controller connector to bracket. (EATC only)
9. Attach blend door actuator to evaporator case and tighten three screws. Install electrical connector to bracket. Attach cold engine lock out switch by snapping spring clip in place on outermost heater core tube. (EATC only)
10. Install vacuum harness to evaporator case.
11. Install foam seals over evaporator tubes.
12. Assemble support bracket to evaporator case.
13. Install evaporator case assembly as outlined.

Heater Core

Vehicles may be equipped with an aluminum or a copper brass heater core. Use replacement cores made of copper brass. Always identify the type of core being replaced because there is a difference in the heater core to heater case seals (refer to Heater and Evaporator, Manual illustration). Having the correct seal is essential to provide satisfactory heater system performance.

Identification can be made by looking at one of the core tubes after a hose has been removed. An aluminum core will have a gray colored tube. A copper brass core will have a brass colored tube.

If the core is copper brass, the seal removed with the old core can be used with the new copper brass replacement bore, providing it is not damaged during removal.

If the core is aluminum, a new seal for the copper brass replacement core will be required. Refer to the Master Parts Catalog for heater core and heater hose seal part numbers.

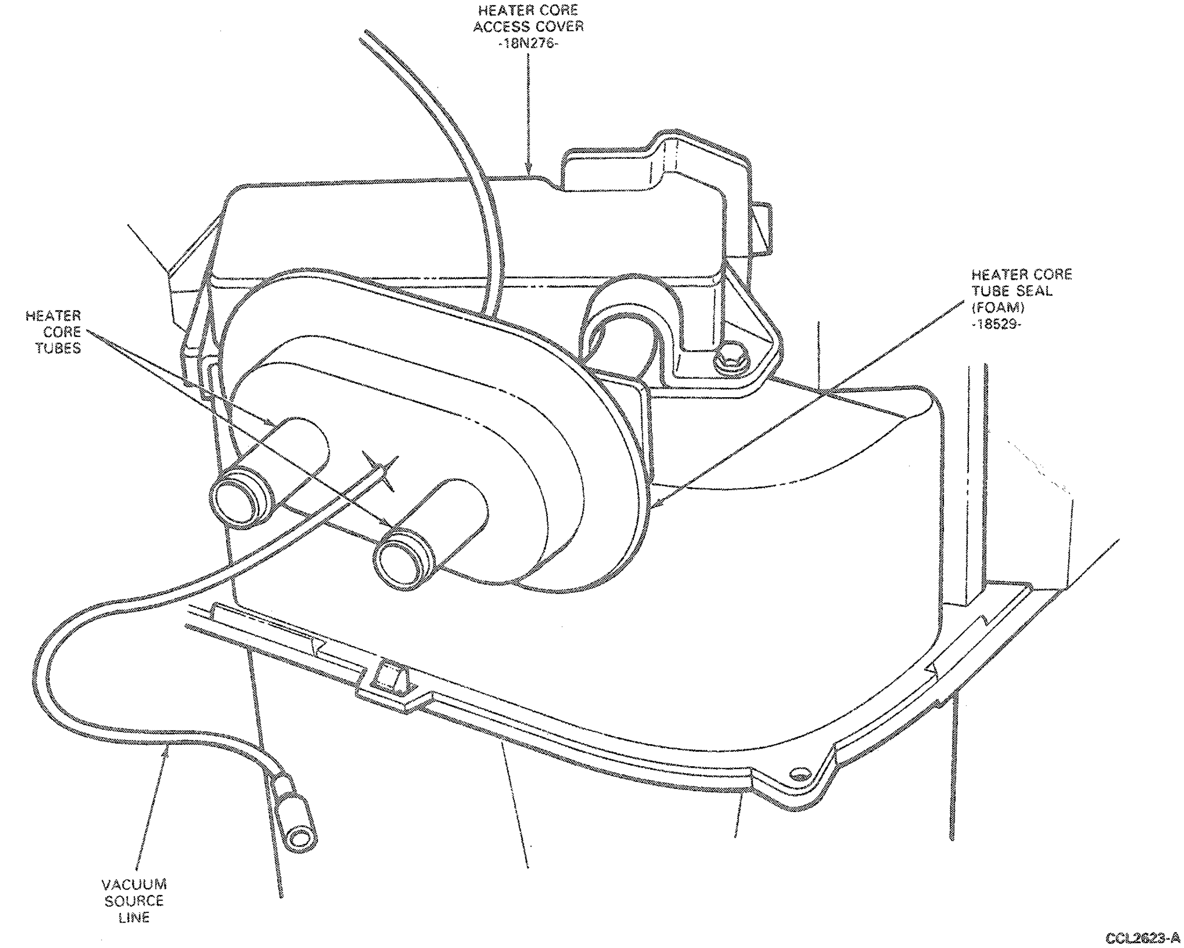
Removal

1. Remove instrument panel. Refer to Section 01-12.
2. Remove evaporator case assembly as outlined.

   NOTE: Whenever the evaporator case is removed, it will be necessary to replace the suction accumulator / drier.
3. Remove vacuum source line from heater core tube seal.

REMOVAL AND INSTALLATION (Continued)

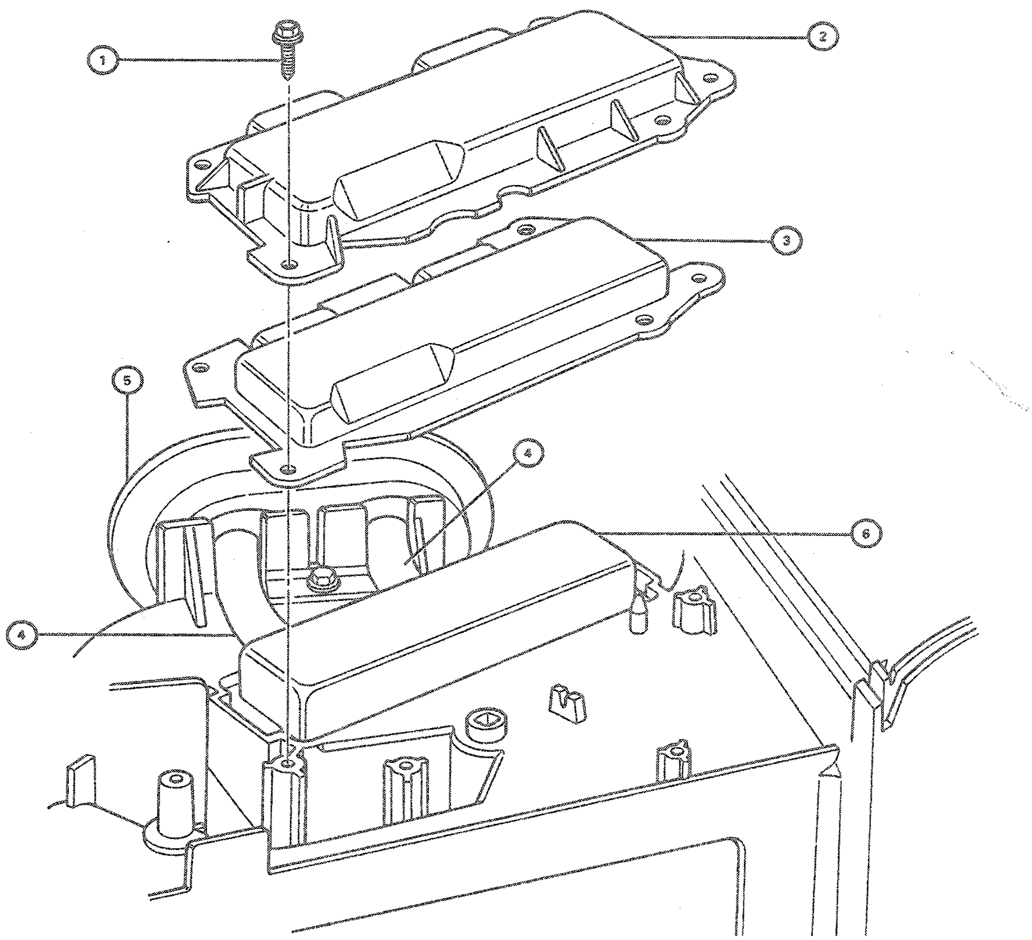
Vacuum Line Removal From Heater Core Tube Seal



4. Remove seal from heater core tubes (refer to HEater and Evaporator, Manual illustration).
5. Remove three screws retaining blend door actuator (Refer to Electric Blend Door Actuator Attachment illustration) to evaporator case. Remove actuator (EATC only).
6. Remove four heater core access cover retaining screws, and remove access cover and seal from evaporator case.

REMOVAL AND INSTALLATION (Continued)

Heater Core Access Cover Removal



ITEM	DESCRIPTION
1.	SCREW - 42141 (4 REQ'D)
2.	HEATER CORE ACCESS COVER - 18N276
3.	HEATER CORE SEAL - 18N267
4.	HEATER CORE TUBES
5.	HEATER CORE TUBE SEAL - 18529
6.	HEATER CORE - 18476

CCL 2624-B

7. Lift heater core and seals from evaporator case.

Installation

1. Transfer the seal to new heater core.
2. Install heater core and secure into evaporator case.
3. Position heater core access cover on evaporator case and install four retaining screws.
4. Position blend door actuator to blend door shaft. Install three screws retaining blend door actuator to evaporator case. (EATC only)
5. Install seal on heater core tubes.
6. Install vacuum source line through heater core tube seal.
7. Install evaporator case assembly into vehicle as outlined.
8. Install instrument panel as outlined.

REMOVAL AND INSTALLATION (Continued)

Recirc Duct Assembly

Removal

1. Open glove compartment and release retainers and lower door.
2. Remove screw retaining recirc duct support bracket to cowl (Refer to Heater and A/C Evaporator installation illustration.
3. Remove screw holding electrical connector bracket to recirc duct. Release three connectors from bracket and remove bracket (EATC only).
4. Remove vacuum connection to recirc door vacuum motor.
5. Remove six screws retaining recirc duct to evaporator assembly.
6. Remove recirc duct from evaporator assembly by lowering it between instrument panel and evaporator case.

Installation

1. Install recirc duct to evaporator, lifting recirc duct between instrument panel and evaporator case.
2. Install six screws retaining recirc duct to evaporator case.
3. Install vacuum connector to recirc door vacuum motor.
4. Install electrical bracket to recirc duct with one screw. Snap three connectors onto bracket (EATC only).
5. Install screw retaining support bracket to cowl.
6. Close glove compartment door.

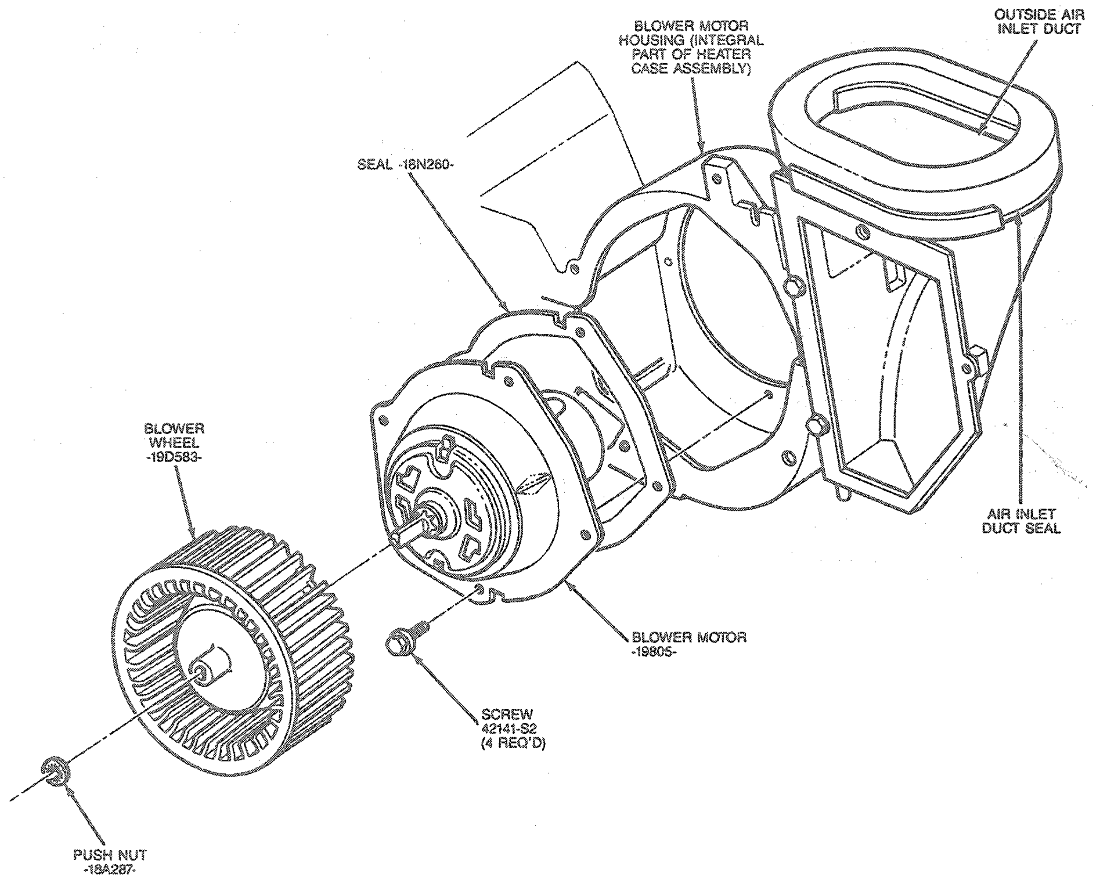
Blower Motor and Wheel Assembly

Removal

1. Remove recirc duct assembly as outlined.
2. Disconnect blower electrical lead.
3. Remove blower wheel pushnut and blower wheel.
4. Remove four blower motor mounting plate screws. Remove blower motor from evaporator case.

REMOVAL AND INSTALLATION (Continued)

Blower Wheel and Blower Motor Removal



Installation

1. Assemble blower motor electrical lead through evaporator case.
2. Position blower motor into evaporator. Install four retaining screws. Ensure new mounting seal is in place.
3. Assemble blower wheel to blower motor shaft aligning the flat on the shaft with the flat on the inside diameter of blower wheel hub. Slide blower wheel onto blower motor shaft until wheel is fully seated.
4. Install a new pushnut on blower shaft to retain wheel.
5. Connect blower motor electrical lead to wiring harness.
6. Install recirc duct assembly in vehicle.

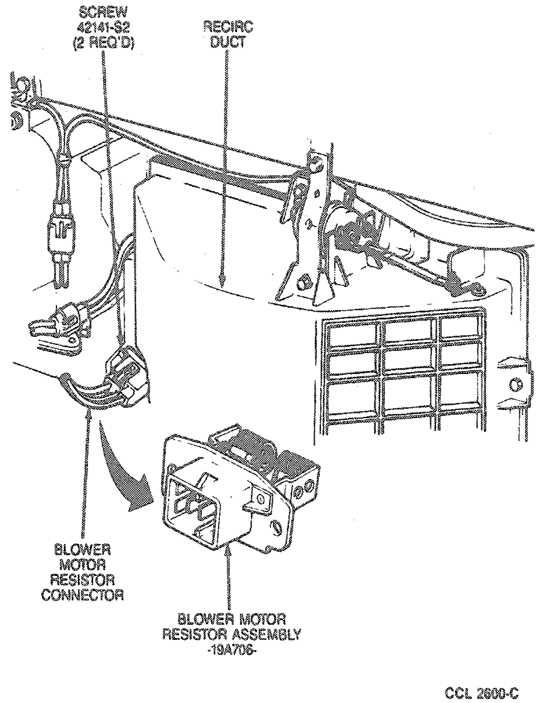
Blower Motor Resistor, Manual

Removal and Installation

The blower motor resistor and thermal limiter assembly are installed on the passenger side of the evaporator case behind the glove compartment. Use only the specified resistor assembly for service replacement. Do not apply sealer to the resistor board mounting surface.

REMOVAL AND INSTALLATION (Continued)

Blower Motor Resistor—Manual A/C



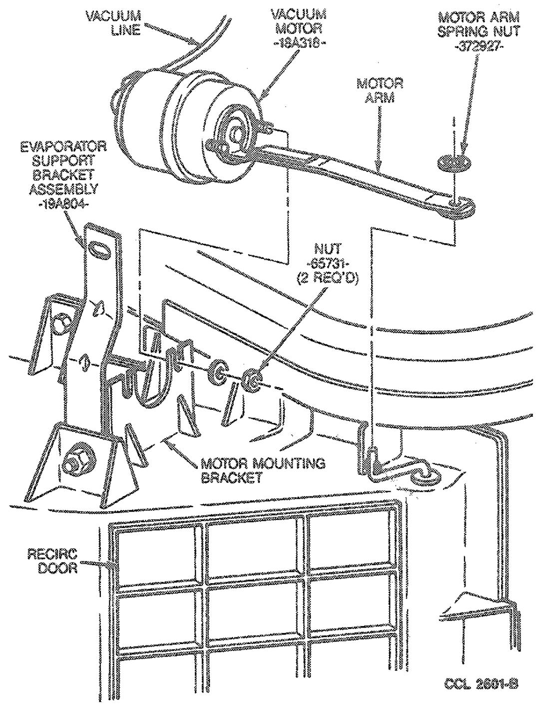
1. Open glove compartment door and release glove compartment retainers so that glove compartment hangs down.
2. Disconnect wire harness connector from resistor assembly.
3. Remove two resistor retaining screws and remove resistor from evaporator case.
4. To install, position resistor assembly in evaporator case opening and install two attaching screws. Do not apply sealer to resistor assembly mounting surface.
5. Connect wire harness connector to resistor.
6. Check operation of blower motor.
7. Install glove compartment to retainers and close glove compartment door.

Outside-Recirc Door Vacuum Motor

Removal

1. Lower glove compartment door to provide access to recirc duct assembly.
2. Disconnect vacuum hose from end of vacuum motor.
3. Remove motor arm retainer from the door crank arm.

Motor Arm Removal from Door Crank Arm



4. Remove two nuts retaining vacuum motor to recirc duct and remove motor.

Installation

1. Position vacuum motor to outside-recirc door crank arm, position motor to recirc duct and install two retaining nuts.
2. Install retainer on door crank arm.
3. Connect white vacuum hose to vacuum motor and check operation of vacuum motor.
4. Close glove compartment door.

Register Assemblies LH, Center Taurus

Removal and Installation

1. Remove cluster finish panel.
2. From the backside of the cluster finish panel, remove two screws retaining the LH register assembly. Remove two screws and, using a soldering iron, disconnect two heat stakes that retain the center register assembly.
3. To install the registers, reverse Removal procedure.

REMOVAL AND INSTALLATION (Continued)

Register Assemblies—RH Taurus/Sable

Removal and Installation

Removal is necessary only to replace a register.

1. Remove all front horizontal vanes by flexing until retaining pins disengage from side retainers.
2. With an ice-pick type tool, disengage from the inside of the housing two locking tabs located along the edge and pull top housing back. Using same tool, disengage the lower two locking tabs and pull entire assembly out of instrument panel.

Installation

1. Install new assembly into opening in instrument panel by pressing firmly on housing until four locking tabs engage.

Register Assemblies—LH, Center Sable

Removal and Installation

The LH register assembly is moulded as part of the cluster finish panel and the center register assemblies are moulded as part of the center finish panel. Register replacement requires the replacement of the appropriate finish panel, as outlined in Section 01-12.

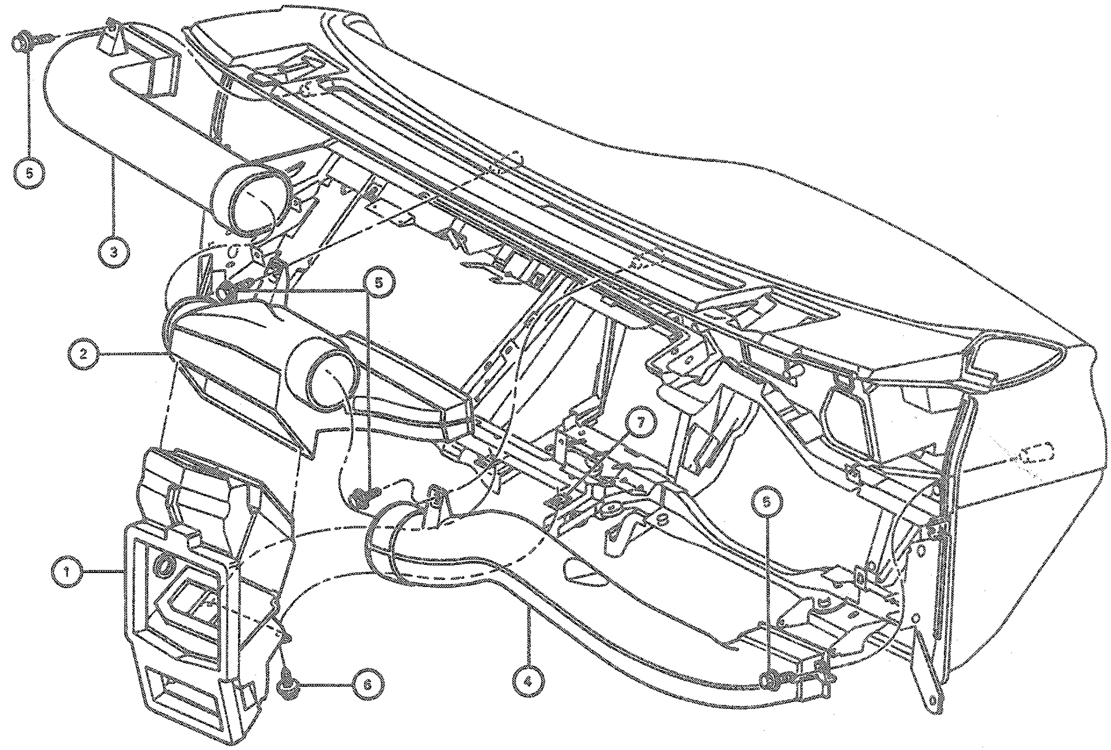
A/C Plenum Chamber

Removal and Installation

1. Remove instrument panel as outlined, and lay it back against front seat. Refer to Section 01-12.
2. Remove two screws retaining center plenum to instrument panel and one screw retaining defroster nozzle to plenum.
3. Disconnect vacuum hose connector from vacuum harness where it is strapped to defroster nozzle.
4. Disconnect demister hoses.
5. Remove plenum chamber.
6. To install, reverse Removal procedure.

REMOVAL AND INSTALLATION (Continued)

A/C Plenum Chamber Attachments—Taurus

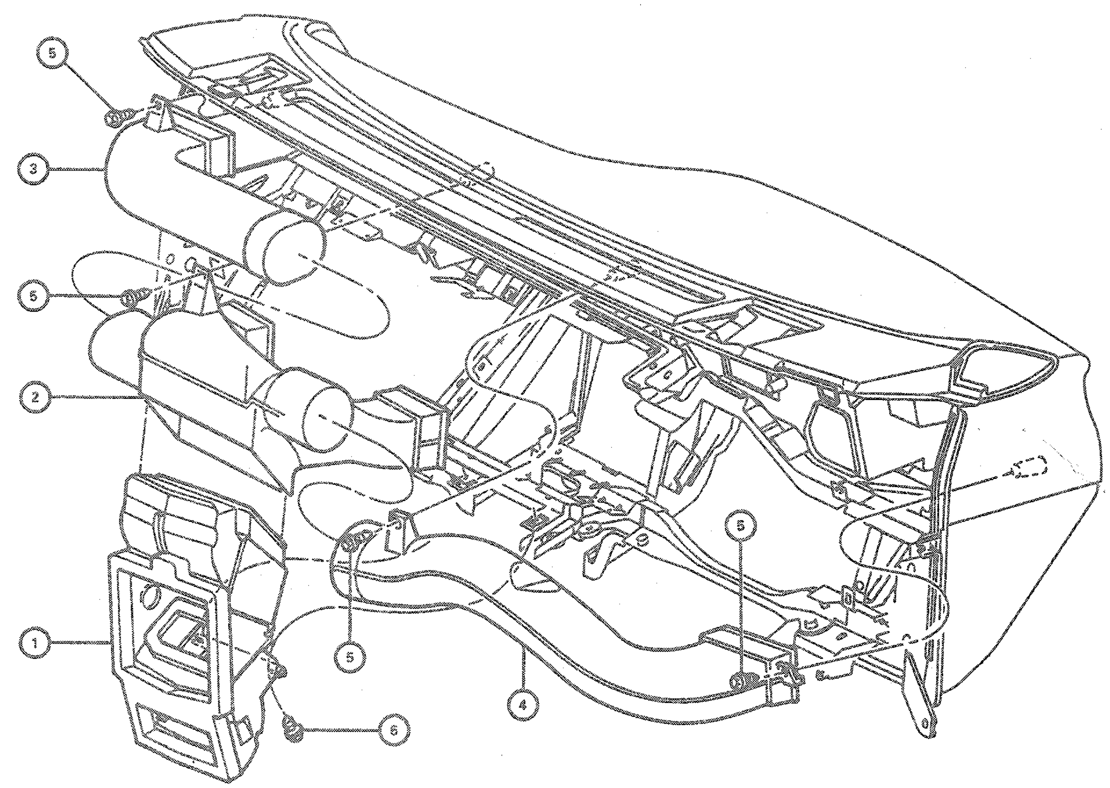


ITEM	DESCRIPTION
1.	A/C PLENUM ASSY - 19740
2.	A/C I/P CENTER LH REGISTER DUCT ASSY - 19C805
3.	A/C I/P RH REGISTER DUCT ASSY - 19B680
4.	A/C I/P LH REGISTER DUCT ASSY - 19A843
5.	SCREW - N803875-S36 (4 REQ'D)
6.	SCREW - N803876-S36B (2 REQ'D)
7.	SPRING NUT P.I.A. INSTRUMENT PANEL

CCL 3708-A

REMOVAL AND INSTALLATION (Continued)

A/C Plenum Chamber Attachments — Sable

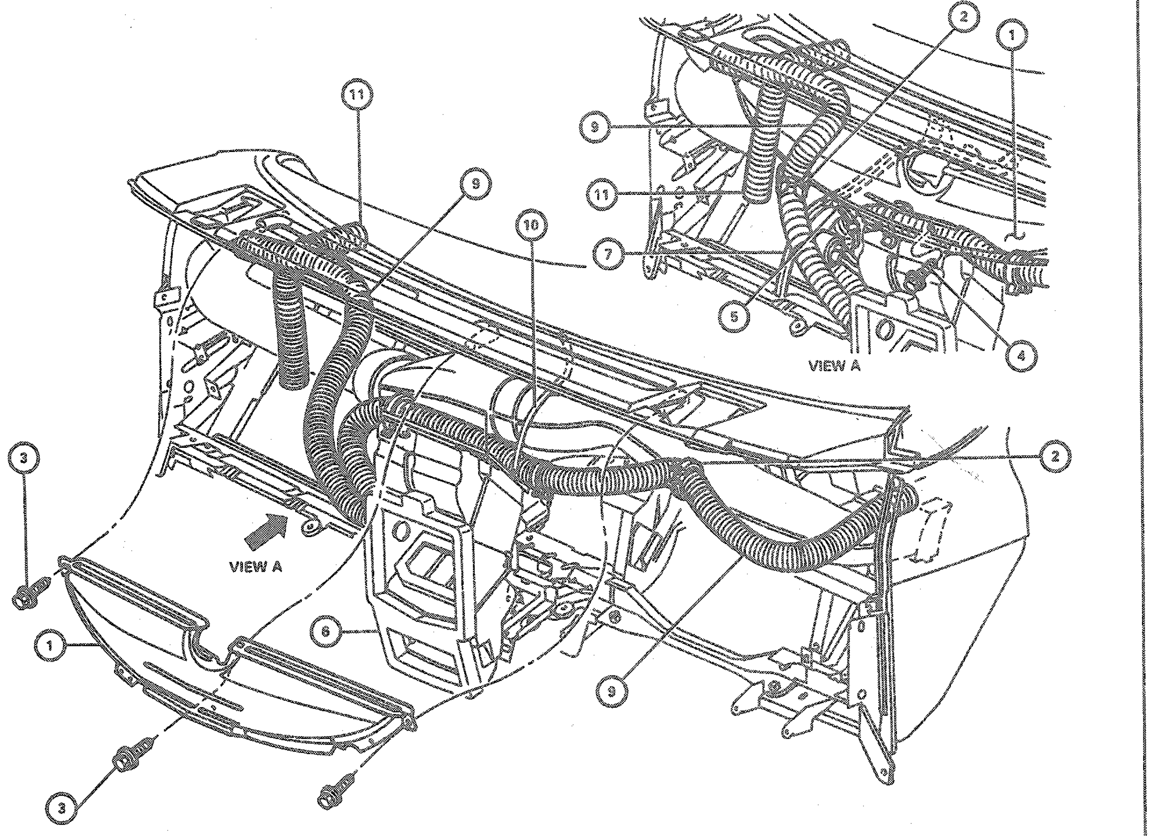


ITEM	DESCRIPTION
1.	PLENUM ASSY - 19740
2.	LH CENTER I/P REGISTER DUCT ASSY - 19C805
3.	RH I/P REGISTER DUCT ASSY - 19B680
4.	LH I/P REGISTER DUCT ASSY - 19A843
5.	SCREW - N803875-S36 (4 REQ'D)
6.	SCREW - N803876-S36B (2 REQ'D)

CCL 3709-A

REMOVAL AND INSTALLATION (Continued)

Defroster Nozzle and Demister Hose Assemblies



ITEM	DESCRIPTION
1.	NOZZLE ASSY - 19D733
2.	CLIP - 19B632 (4 REQ'D)
3.	SCREW - N803875-S36 (3 REQ'D)
4.	SCREW - 381801-S2 OR N803818-S55
5.	STRAP - 95874-S
6.	PLENUM CHAMBER
7.	VACUUM HARNESS P.I.A. CONTROL ASSY
8.	TAB PART OF CENTER DUCT
9.	DEMISTER & HOSE ASSY P.I.A. INSTRUMENT PANEL
10.	CABLE ASSY - 19D674
11.	TEMP CONTROL HOSE - 19D888

CCL 3710-A

Defroster Nozzle and Demister Duct/Hoses

Removal and Installation

1. Remove instrument panel as outlined, and place it back against front seat. Refer to Section 01-12 for instrument panel removal and installation procedures.
2. Disconnect vacuum hose connector from vacuum harness where it is clipped to defroster nozzle.
3. Lower A/C plenum chamber by loosening two screws retaining it to instrument panel.
4. Remove one screw retaining defroster nozzle to plenum.
5. Remove three screws retaining defroster nozzle to instrument panel.
6. Disconnect LH demister hose from LH duct clip, two clips on center duct and from RH side of plenum. Disconnect the RH hose from clip on defroster nozzle and RH side of plenum chamber. Remove each hose from the demister by rotating clockwise to disengage from the barb on the demister.
7. Remove two screws holding demister and hose assembly to instrument panel and remove from front side of instrument panel.
8. To install, reverse Removal procedure.

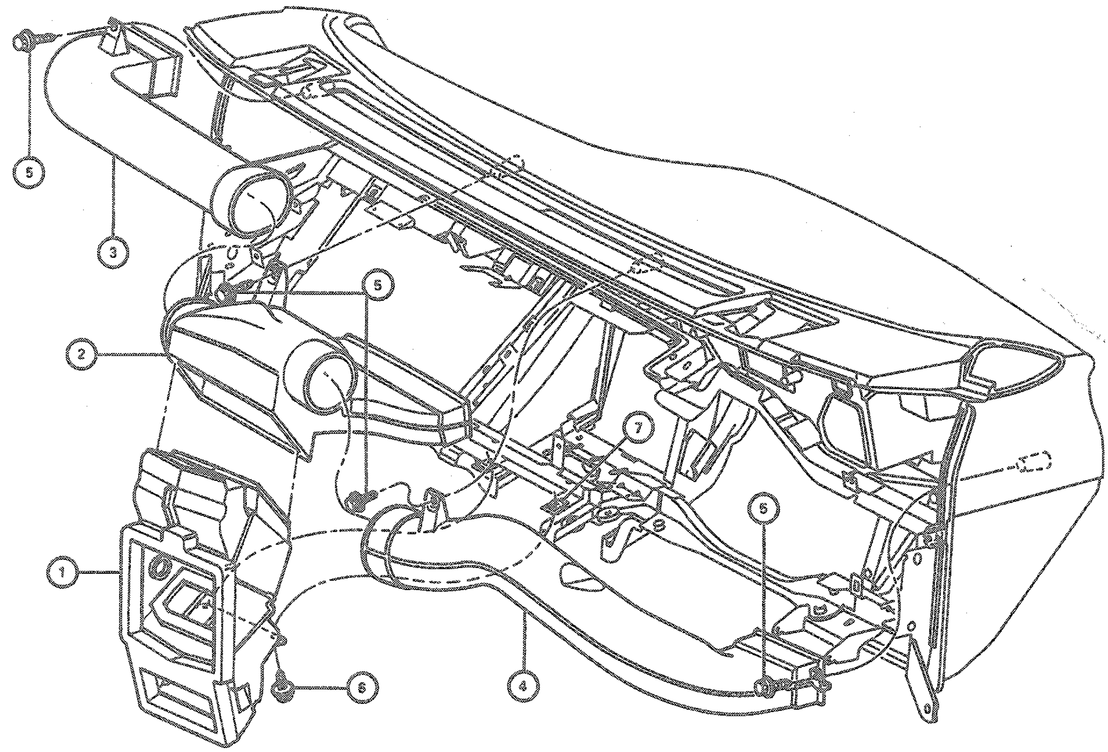
REMOVAL AND INSTALLATION (Continued)

Register Ducts

Removal

1. Remove instrument panel as outlined and lay it back against front seat. Refer to Section 01-12.
2. Lower A/C plenum chamber.
3. Remove defroster nozzle.
4. Remove four screws, center and/or LH and RH ducts as required.

Instrument Panel Register Duct—Taurus

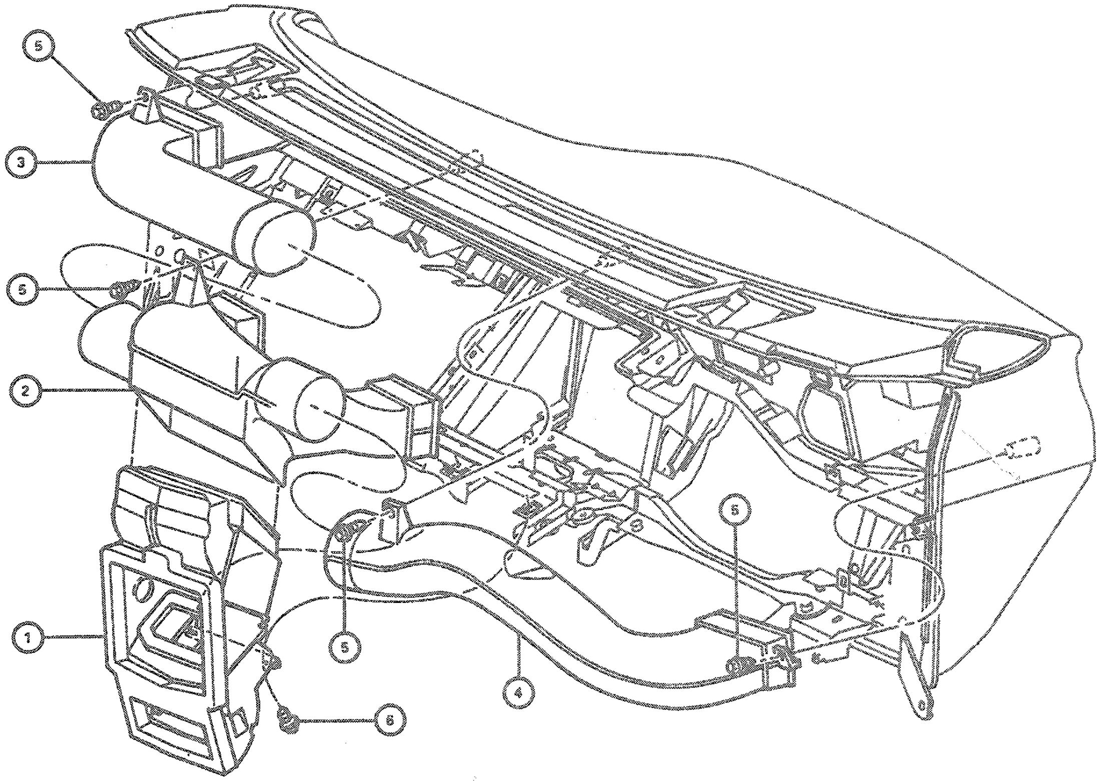


ITEM	DESCRIPTION
1.	A/C PLENUM ASSY - 19740
2.	A/C I/P CENTER LH REGISTER DUCT ASSY - 19C805
3.	A/C I/P RH REGISTER DUCT ASSY - 19B680
4.	A/C I/P LH REGISTER DUCT ASSY - 19A843
5.	SCREW - N803875-S36 (4 REQ'D)
6.	SCREW - N803876-S36B (2 REQ'D)
7.	SPRING NUT P.I.A. INSTRUMENT PANEL

CCL 3708-A

REMOVAL AND INSTALLATION (Continued)

Instrument Panel Register Duct—Sable



ITEM	DESCRIPTION
1.	PLENUM ASSY - 19740
2.	LH CENTER I/P REGISTER DUCT ASSY - 19C805
3.	RH I/P REGISTER DUCT ASSY - 19B680
4.	LH I/P REGISTER DUCT ASSY - 19A843
5.	SCREW - N803876-S36 (4 REQ'D)
6.	SCREW - N803876-S36B (2 REQ'D)

CCL 3709-A

Installation

1. Assemble LH, RH and center ducts together.
2. Position ducts to instrument panel and install four retaining screws.
3. Install defroster nozzle.
4. Position center plenum chamber as outlined.

Floor Air Distribution Duct

Front Heater System

Removal and Installation

1. Remove two screws retaining duct to evaporator case assembly just below A/C heat distribution duct.
2. Pull floor air distribution duct away from evaporator case.
3. To install duct, position it on evaporator case. Ensure retainer at forward edge of duct is inserted over edge of opening in evaporator case, and install two retaining screws.

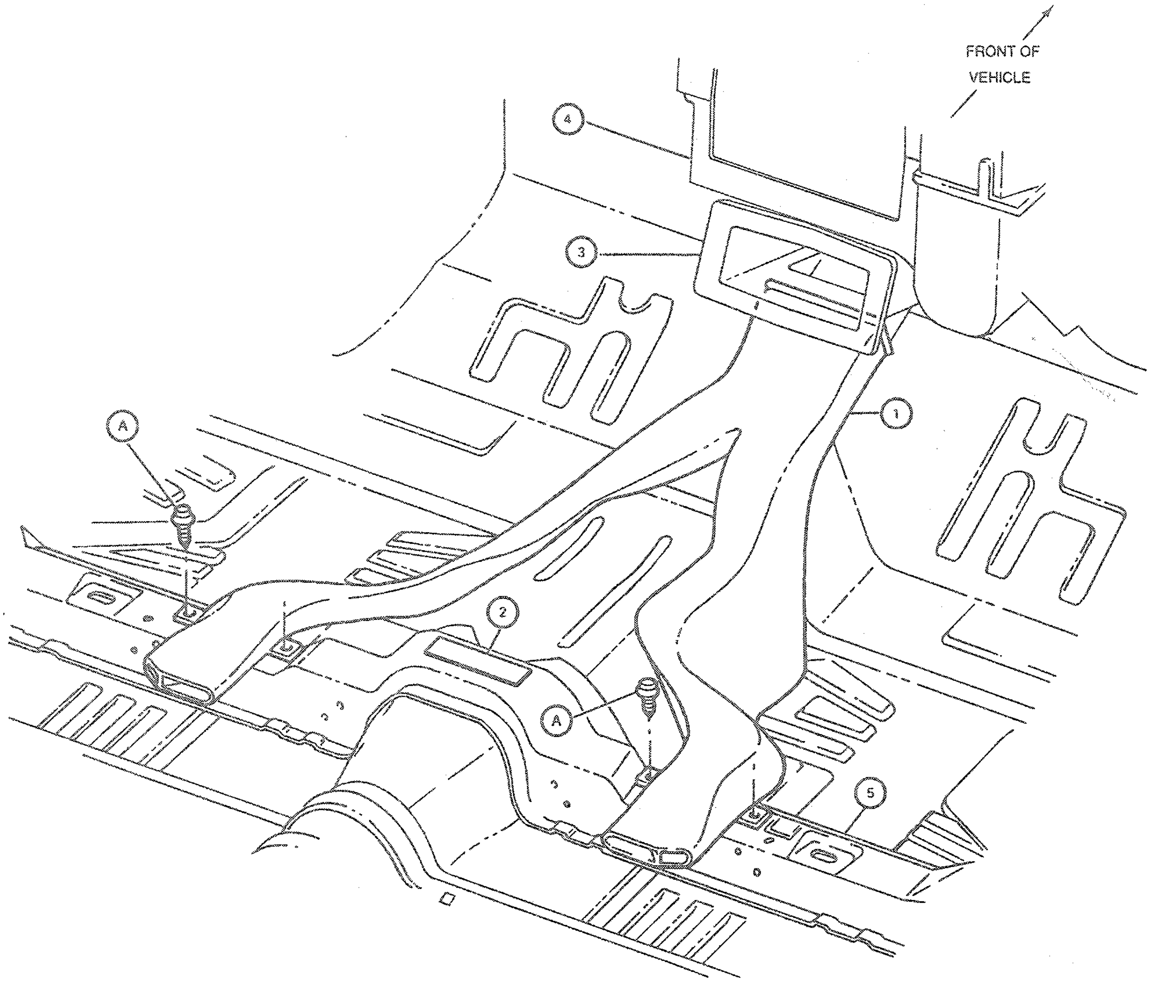
Rear Heater System

Removal and Installation

1. Remove carpet.

REMOVAL AND INSTALLATION (Continued)

2. Remove nut holding rear duct on tunnel.



E3D64201/PMD/910622

1 -18C4640- DUCT ASY-HEATER REAR SEAT OUTLET

2 ESB-M3G58-A TAPE 7.00 LONG X 2.00 WIDE

3 18C422 ADAPTER ASY FOR INSTALLATION, SEE PAGE 650-01

4 19B555 EVAPORATOR AND BLOWER ASY FOR INSTALLATION SEE PAGE 650-1

5 REF CROSS MEMBER

A N800500-S2 SCREW, 4 REQD

CCL 3785-A

REMOVAL AND INSTALLATION (Continued)

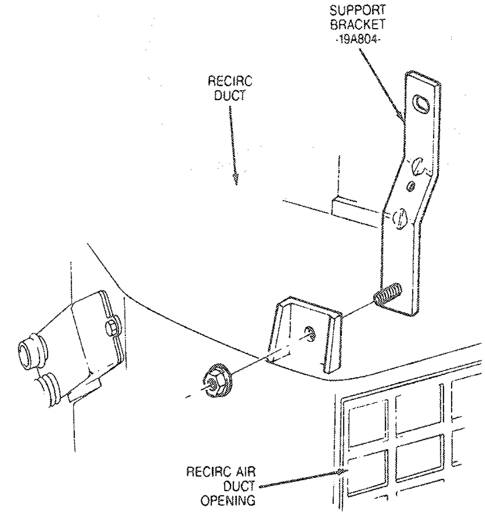
3. Remove two screws attaching rear seat heat duct to evaporator case and pull duct away from evaporator assembly.
4. To install duct, reverse Removal procedure.

Air Inlet Duct and Blower Housing Assembly

Removal

1. Remove glove compartment and disconnect hose from outside-recirc door vacuum motor.

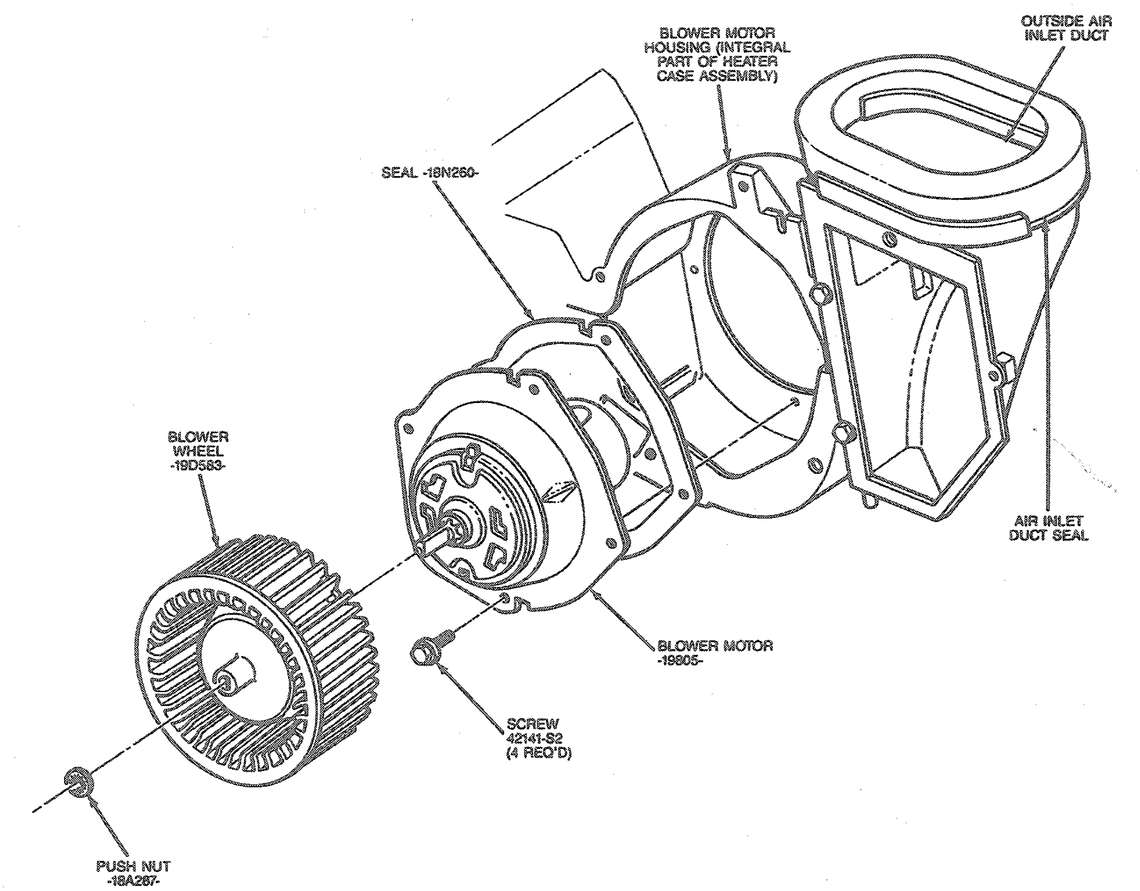
Bracket to Recirc Duct Attachment



2. Remove RH instrument panel to side cowl retaining bolt.
3. Remove screw retaining support brace to top of air inlet duct.
4. Disconnect blower motor power lead at wire connector.
5. Remove nut retaining blower housing lower support bracket to evaporator case.
6. Remove side cowl trim panel.
7. Remove one screw retaining top of air inlet duct to evaporator case.
8. Move air inlet duct and blower housing assembly down and away from evaporator case.

REMOVAL AND INSTALLATION (Continued)

Air Inlet Duct and Blower Housing Assembly



Installation

1. Tape blower motor power lead to air inlet duct to keep wire away from blower outlet during installation.
2. Position air inlet duct and blower housing assembly to evaporator case, inserting flange at top of blower outlet into opening in evaporator case. Slide blower housing lower bracket over stud and install retaining nut. Ensure blower wire is routed to RH side of evaporator case.
3. Install screw retaining air inlet duct to evaporator case.
4. Hold outside-recirc door open and rotate blower wheel to ensure it rotates freely. If an interference exists, remove blower motor and wheel and correct condition.
5. Connect blower motor power lead to harness at connector.
6. Install air inlet duct-to-cowl support brace retaining screw.
7. Connect vacuum hose to outside-recirc door vacuum motor and install glove compartment.
8. Install instrument panel lower RH side retaining bolt. Then, install RH cowl side trim panel.

Panel / Floor Door Vacuum Motor

Removal

1. Disconnect battery ground cable.
2. Remove instrument panel.
3. Depress tabs and disconnect vacuum motor arm from door shaft.
4. Remove two screws retaining vacuum motor to mounting bracket.
5. Remove vacuum motor from mounting bracket and disconnect vacuum hose.

REMOVAL AND INSTALLATION (Continued)

Installation

1. Position vacuum motor on mounting bracket and door shaft.
2. Install two screws retaining panel-defrost vacuum motor to mounting bracket.
3. Connect vacuum hose to defrost vacuum motor.
4. Install instrument panel.
5. Connect battery ground cable.

Panel-Defrost Door Vacuum Motor

Removal

1. Disconnect battery ground cable.
2. Remove instrument panel as outlined.
3. Remove panel-defrost door vacuum motor arm to door shaft.
4. Remove two nuts retaining vacuum motor to mounting bracket.
5. Remove vacuum motor from mounting bracket and disconnect vacuum hose.

Installation

1. Position vacuum motor to mounting bracket and door shaft.
2. Install two nuts retaining panel-defrost vacuum motor to mounting bracket.
3. Connect vacuum hose to panel-defrost vacuum motor.
4. Install instrument panel as outlined.
5. Connect battery ground cable.

Suction Accumulator/Drier

Tools Required:

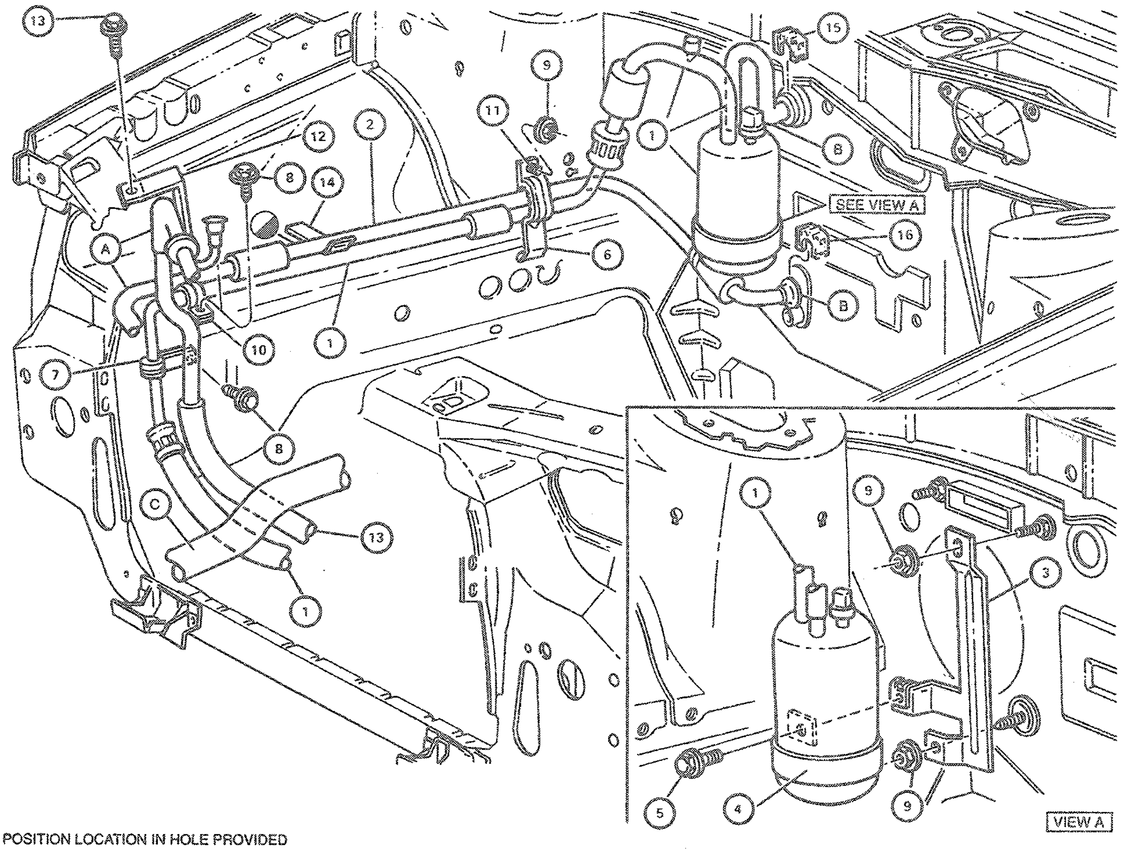
- Spring Lock Coupling Tool T85L-19623-A

Removal

1. Discharge refrigerant from A/C system following recommended service procedures. Observe all safety precautions. Refer to Section 12-00.
2. Disconnect suction hose at compressor. Cap suction hose and compressor to prevent entrance of dirt and moisture.
3. Disconnect accumulator/drier inlet tube from evaporator core outlet. Use Spring Lock Coupling Tool T85L-19623-A to reverse inlet tube.
4. Disconnect wire harness connector from pressure switch on top of accumulator/drier.
5. Remove screw holding suction accumulator/drier in accumulator bracket and remove suction accumulator/drier.

REMOVAL AND INSTALLATION (Continued)

Suction Accumulator Drier



POSITION LOCATION IN HOLE PROVIDED AT LOCATION INDICATED BY

1 -19C913- ACCUMULATOR & HOSE ASY.
2 -19N651- TUBE ASY. COND. TO EVAP.
3 -19D606- BRACKET ASY.-A/C ACCUMULATOR
4 BRACKET-P.I.A. OF 19D606 ASY.
5 SCREW-P.I.A. OF 19D606 ASY.
6 -19C789- BRACKET ASY.-A/C HOSE
7 N804069-S100 CLIP
8 N610957-S2 SCREW (2-REQD.)
9 N621906-S2 NUT & WASHER ASY. (3-REQD.)
10 N804200-S100 CLIP
11 N800358-S2 SCREW & RETAINER ASY.
12 -19D720- BRACKET A/C INLET TUBE
13 N610956-S2 SCREW
14 N805732-S CLIP
15 -19E746- SLC CLIP
16 -19E746- SLC CLIP
A TO A/C CONDENSER
B TO A/C EVAPORATOR
C LOWER RADIATOR HOSE (REF.)

CCL 3787-A

Installation

1. Position suction accumulator / drier to vehicle and route suction hose to compressor.

2. Using new O-rings lubricated with clean refrigerant oil, connect accumulator / drier inlet tube to evaporator core outlet.

   CAUTION: Make sure correct type O-rings are installed on A/C fittings.

REMOVAL AND INSTALLATION (Continued)

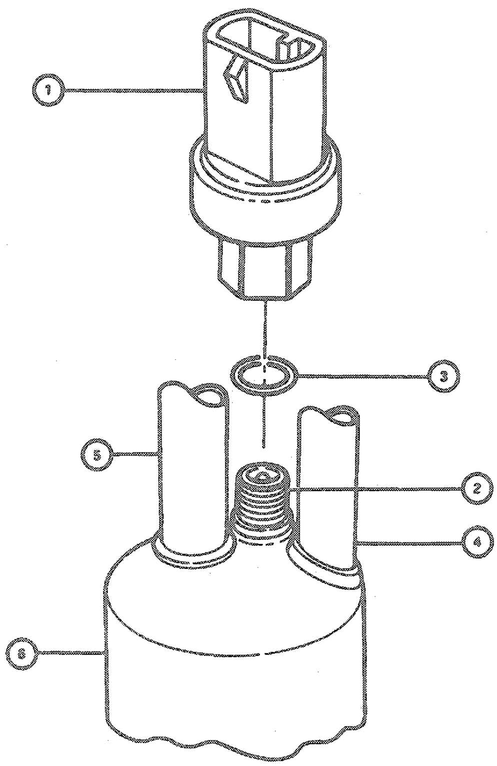
3. Install screw in suction accumulator / drier bracket.
4. Using new O-rings lubricated with clean refrigerant oil, connect suction hose to compressor. Install suction line spring lock coupling.
5. Leak test, evacuate, and charge the system following recommended service procedures. Observe all safety precautions. Refer to Section 12-00.
6. Check system for proper operation.

Clutch Cycling Pressure Switch

Removal

1. Disconnect wire harness connector from pressure switch.

Clutch Cycling Pressure Switch Harness Connector



ITEM	DESCRIPTION
1.	A/C CLUTCH CYCLING SWITCH - 19E561
2.	CYCLING SWITCH FITTING
3.	O-RING - 379737-S
4.	OUTLET TO COMPRESSOR
5.	INLET FROM EVAPORATOR
6.	ACCUMULATOR/DRIER - 19C913

CCL 2831-C

2. Unscrew pressure switch from top of suction accumulator / drier.

Installation

1. Install new O-ring, lubricated with clean refrigerant oil, on the accumulator pressure switch fitting.
2. Lubricate O-ring accumulator nipple with clean refrigerant oil.
3. Screw pressure switch on accumulator nipple and tighten switch hand-tight.
4. Connect wire connector to pressure switch.
5. Check pressure switch installation for refrigerant leaks.
6. Check system for proper operation.

Fixed Orifice Tube

Replacement Guidelines

The fixed orifice tube should be replaced whenever the compressor is replaced for lack of performance (internal damage).

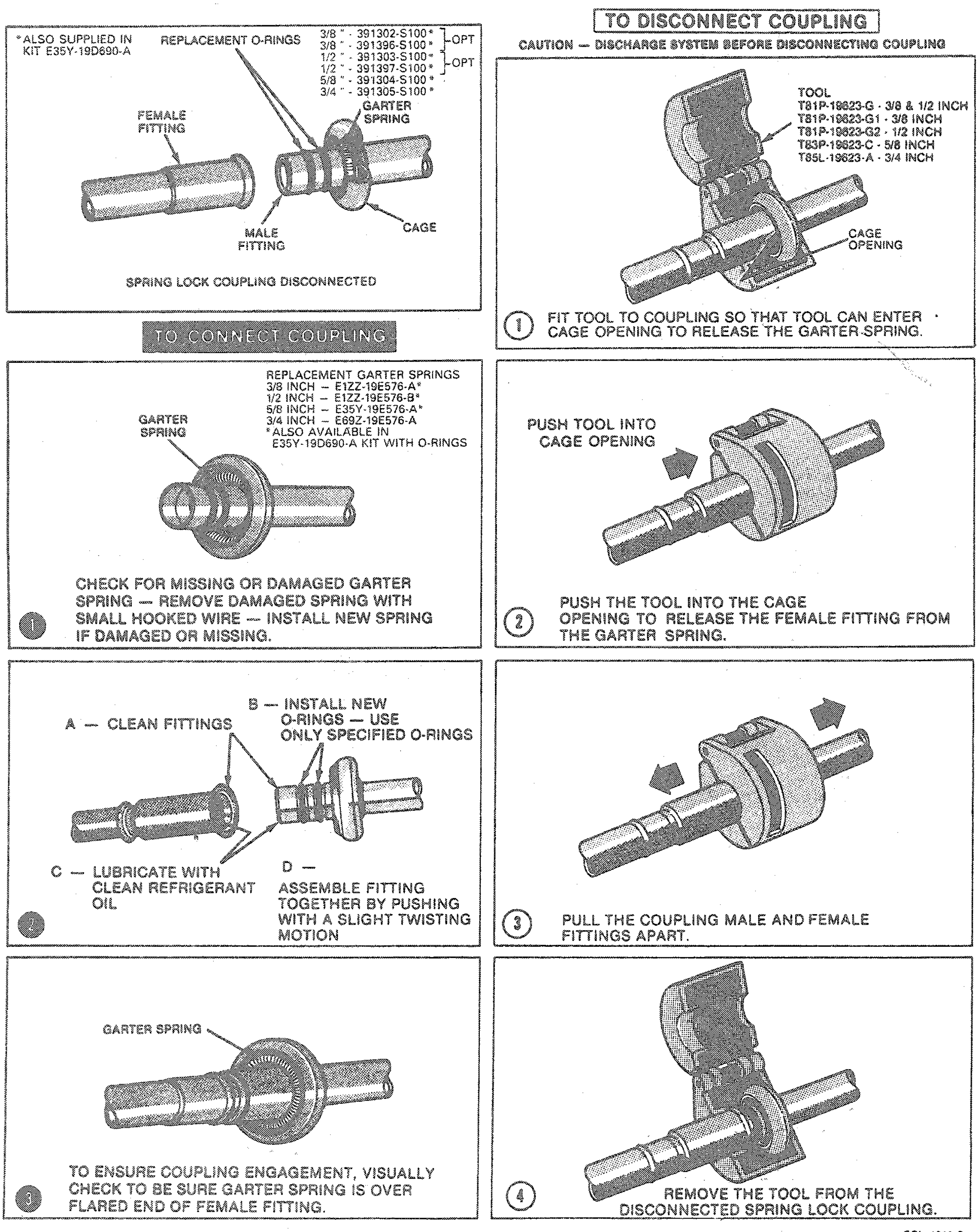
NOTE: **Do not** attempt to remove the fixed orifice tube. The fixed orifice tube is an integral part of the liquid line. When a new fixed orifice tube is required, a new liquid line (with integral fixed orifice tube) must be installed. Refer to Section 12-00.

Removal and Installation

1. Discharge refrigerant from A / C system following recommended service procedures. Observe all safety precautions. Refer to Section 12-00.
2. Disconnect refrigerant line at condenser outlet and evaporator inlet connections using procedure and Spring Lock Coupling Tool shown.

REMOVAL AND INSTALLATION (Continued)

Spring Lock Coupling



CCL 4011-C

REMOVAL AND INSTALLATION (Continued)

3. Remove line from vehicle.
4. Route new refrigerant line (and integral fixed orifice tube) with protective caps installed.
5. Remove protective caps and connect new refrigerant line into system using new O-rings lubricated with clean refrigerant oil. Connect spring lock couplings.

   CAUTION: Make sure correct type O-rings (green) are installed on spring lock coupling A/C fittings.
6. Leak test, evacuate and charge the refrigerant system following recommended service procedures. Observe all safety precautions. Refer to Section 12-00.

Spring Lock Coupling

The spring lock coupling is a two-piece refrigerant line coupling that is held together by a garter spring. When connected together, two O-rings seal between the two fittings of the connector. A garter spring within the cage of the male fitting expands over the flared lip of the female fitting and prevents connector separation.

Refer to Spring Lock Coupling illustration and relate the numbered illustrations to the following Steps:

Tools Required:

- Spring Lock Coupling Tool T81P-19623-G1 and G2
- Spring Lock Coupling Disconnect Tool T83P-19623-C
- Spring Lock Coupling Disconnect Tool T85L-19623-A

To Disconnect Coupling

1. Discharge refrigerant from system following approved procedures. Refer to Section 12-00. Then, fit Spring Lock Coupling Tool T81P-19623-G1 for 3/8 inch and T81P-19623-G2 for 1/2 inch couplings or Spring Lock Coupling Disconnect Tool T83P-19623-C for 5/8 inch couplings to coupling as shown. The 3/4 inch Spring Lock Coupling Disconnect Tool T85L-19623-A, is required for servicing the accumulator suction connection to the evaporator outlet.
2. Close tool and push tool into open side of cage to expand garter spring and release female fitting.

   NOTE: The garter spring may not release if the tool is cocked while pushing it into the cage opening.
3. After garter spring is expanded, pull fittings apart.
4. Remove tool from disconnected coupling.

To Connect Coupling

1. Ensure that garter spring is in cage of male fitting. If garter spring is missing, install a new spring by pushing it into cage opening. If garter spring is damaged, remove it from cage with a small wire hook **(do not use a screwdriver)** and install a new spring.
2. Clean all dirt or foreign material from both pieces of coupling.
3. Install new special green O-rings on male fitting.

   CAUTION: Make sure correct type O-rings are installed on spring lock coupling A/C fittings.
4. Lubricate male fitting and O-rings and inside of female fitting with clean refrigerant oil.
5. Fit female fitting to male fitting and push until garter spring snaps over flared end of female fitting.
6. To ensure coupling engagement, pull on female fitting and visually check to verify garter spring is over flared end of female fitting.

Condenser

NOTE: Whenever a condenser is replaced, it is also necessary to replace the suction accumulator/drier.

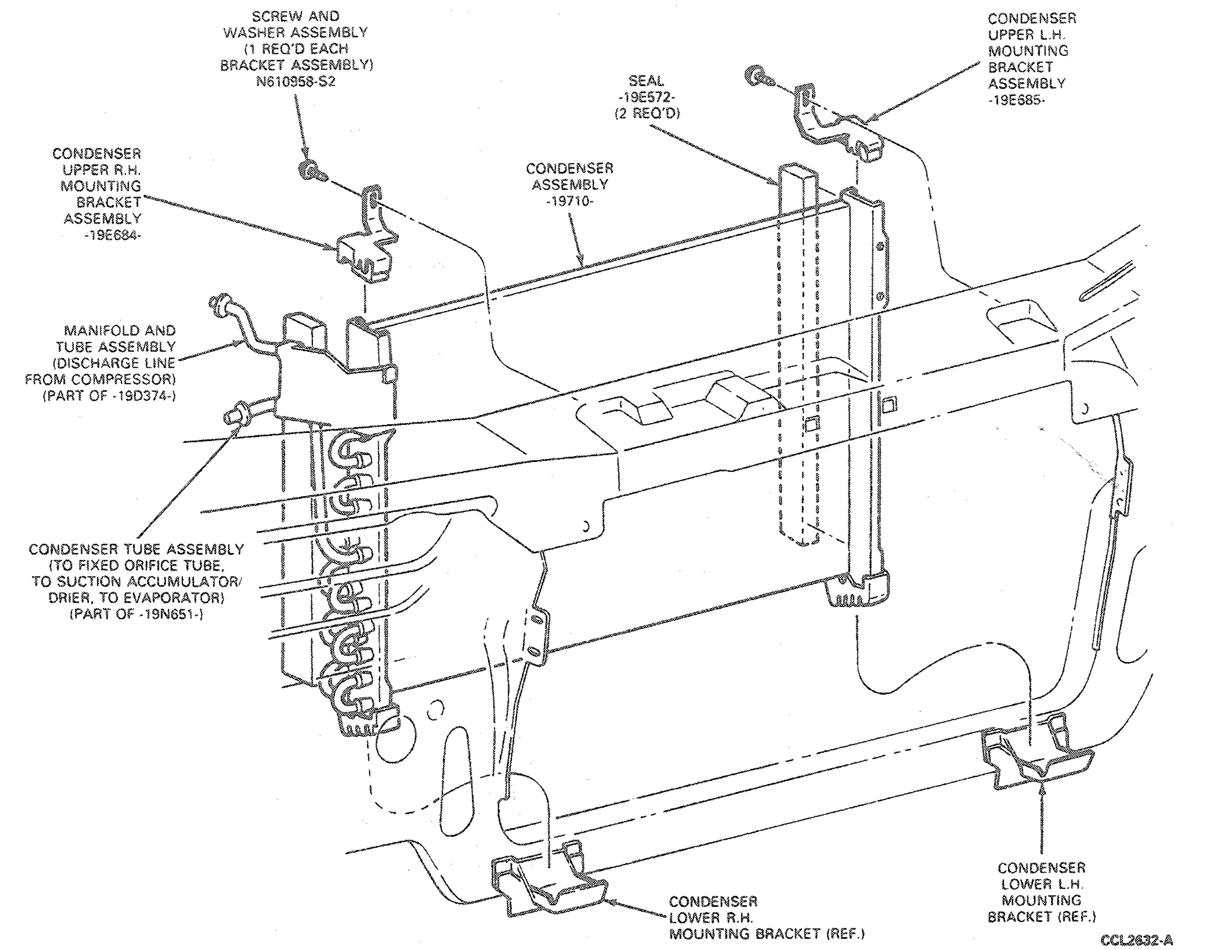
CAUTION: If a condenser leak is suspected, the condenser must be leak tested before it is removed from the vehicle. Refer to Section 12-00 for the leak test procedure.

Removal

1. Discharge refrigerant from A/C system at service access gauge port valve located on suction line. Observe all safety precautions. Refer to Section 12-00.
2. Disconnect two refrigerant lines at fittings on RH side of radiator following procedure for disconnecting spring lock couplings.
3. Remove four bolts retaining condenser to radiator support and remove condenser from vehicle.

REMOVAL AND INSTALLATION (Continued)

Condenser Assembly



Installation

1. Position condenser assembly to radiator support brackets. Install retaining bolts.
2. Connect refrigerant lines to condenser assembly using procedures for connecting spring lock couplings as outlined.

   CAUTION: Make sure correct type O-rings are installed on A/C fittings.
3. Leak test, evacuate and charge refrigerant system following recommended service procedures. Observe all safety precautions. Refer to Section 12-00.

Refrigerant Lines

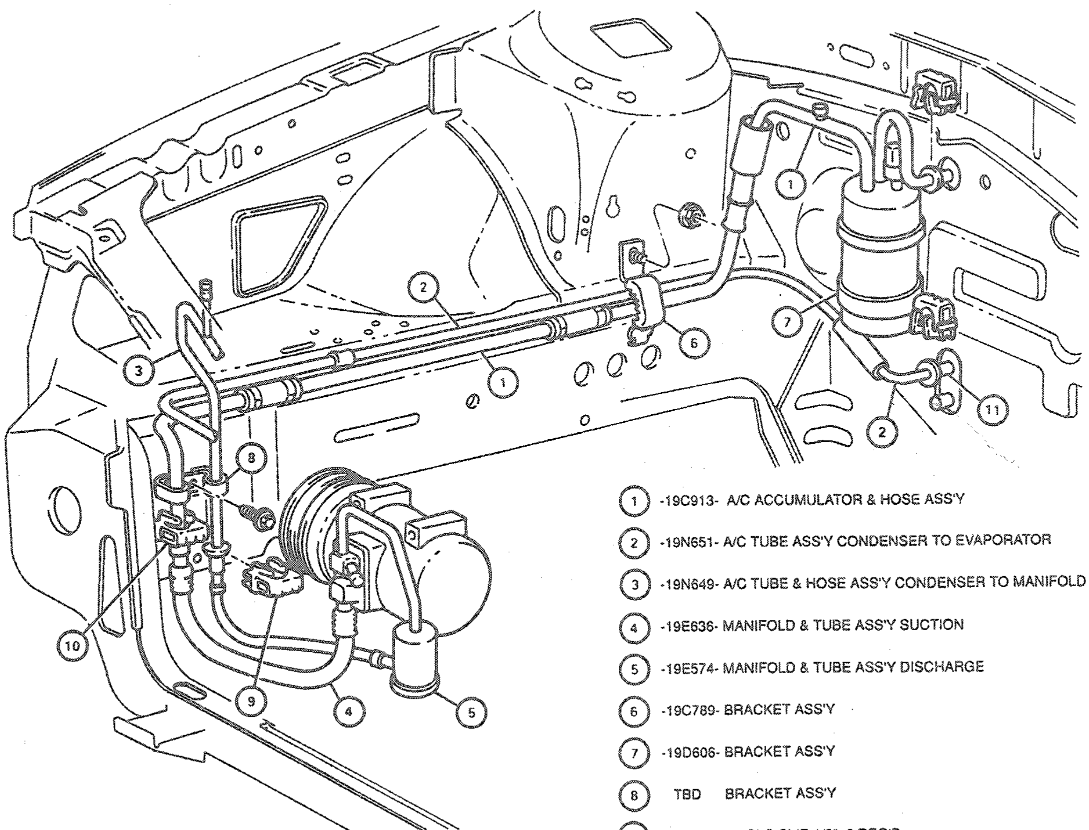
NOTE: Whenever a refrigerant line is replaced, it is also necessary to replace the suction accumulator/drier.

Removal and Installation

1. Discharge refrigerant from A/C system at low-pressure access gauge port valve located on suction line near suction accumulator/drier following recommended service procedure. Observe all safety precautions. Refer to Section 12-00.
2. Disconnect and remove refrigerant lines. At condenser, use disconnect procedure for spring lock couplings.
3. Route new refrigerant line with protective caps installed. Refer to the following illustration for 3.2L SHO engines and the next illustration for 3.0L and 3.8L engines.

REMOVAL AND INSTALLATION (Continued)

Refrigerant Lines—3.2L SHO

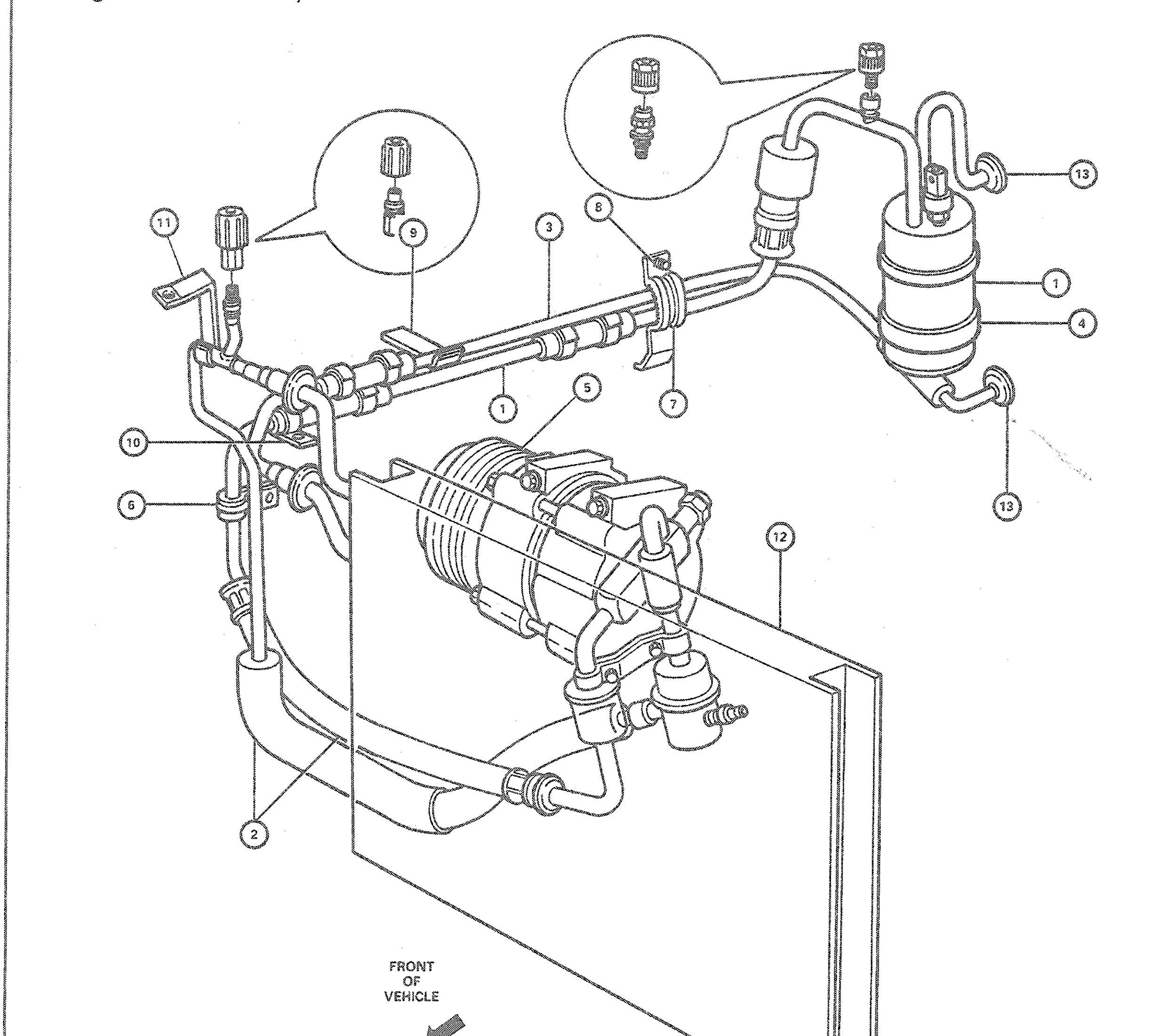


1. -19C913- A/C ACCUMULATOR & HOSE ASS'Y
2. -19N651- A/C TUBE ASS'Y CONDENSER TO EVAPORATOR
3. -19N649- A/C TUBE & HOSE ASS'Y CONDENSER TO MANIFOLD
4. -19E636- MANIFOLD & TUBE ASS'Y SUCTION
5. -19E574- MANIFOLD & TUBE ASS'Y DISCHARGE
6. -19C789- BRACKET ASS'Y
7. -19D606- BRACKET ASS'Y
8. TBD BRACKET ASS'Y
9. -19E746- BA SLC CLIP 1/2", 2 REQ'D
10. -19E746- SLC CLIP 3/4", 2 REQ'D
11. -19B555- EVAPORATOR & BLOWER ASS'Y
12. REF A/C COMPRESSOR & CLUTCH ASS'Y

CCL 3781-A

REMOVAL AND INSTALLATION (Continued)

Refrigerant Lines—3.0L, 3.8L



ITEM	DESCRIPTION
1.	ACCUMULATOR & HOSE ASSY - 19C913
2.	MANIFOLD & TUBE ASSY - 19D734
3.	CONDENSER TO EVAPORATOR TUBE ASSY - 19N651
4.	BRACKET ASSY - 19D606
5.	COMPRESSOR & CLUTCH ASSY - 19D629
6.	CLIP - N805191-S100
7.	CLIP - N806439-S100
8.	SCREW & RETAINER ASSY - N800358-S2
9.	CLIP - N805732-S
10.	CLIP - N804200-S100
11.	INLET TUBE BRACKET - 19D720
12.	CONDENSER
13.	TO EVAPORATOR

4. Connect refrigerant line into system using new O-rings lubricated with clean specified refrigerant oil. At condenser, use connecting procedure for spring lock couplings.

   CAUTION: Make sure correct type O-rings are installed on A/C fittings.

5. Leak test, evacuate and charge refrigerant system following recommended service procedures. Observe safety precautions. Refer to Section 12-00.

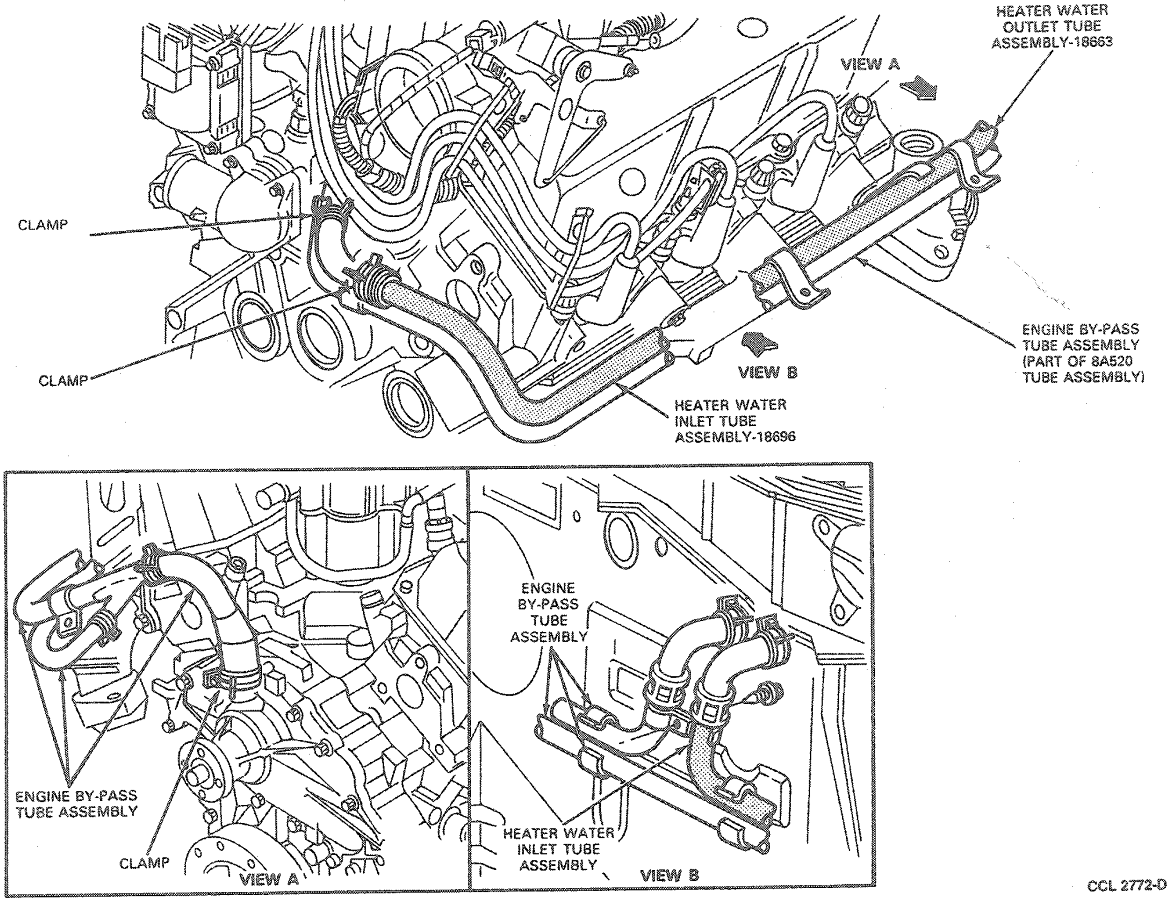
REMOVAL AND INSTALLATION (Continued)

Heater Hoses

Removal and Installation

Refer to the following illustrations for proper heater hose applications.

Heater Hose Installation—3.0L Engine



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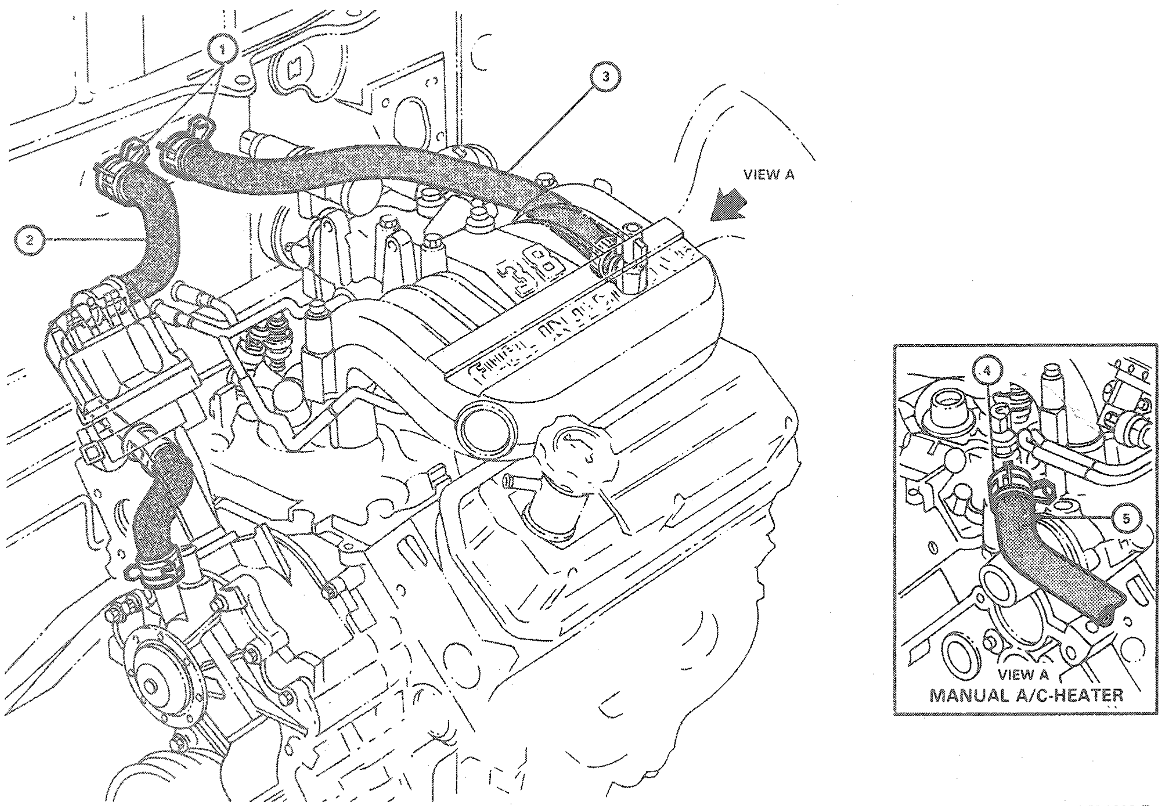
REMOVAL AND INSTALLATION (Continued)

Heater Hose Installation—3.8L Engine

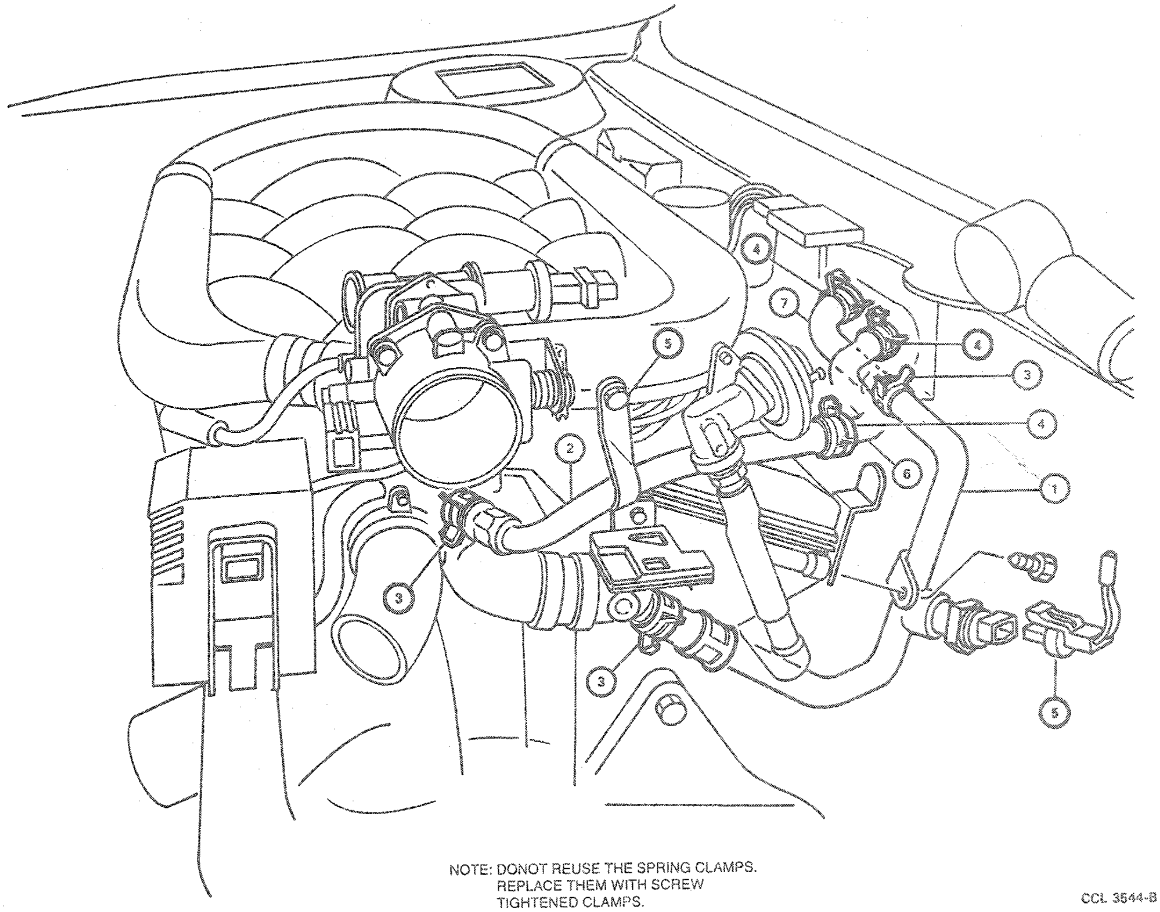


CCL3029-F

ITEM	DESCRIPTION
1.	CLAMP - 390761 (2 REQ'D)
2.	HEATER OUTLET HOSE - 18D663
3.	HEATER INLET HOSE - 18D376 (EATC ONLY)
4.	CLAMP - 390762 (1 REQ'D)
5.	HOSE - 18D334

REMOVAL AND INSTALLATION (Continued)

Heater Hose Installation — SHO Engine



NOTE: DONOT REUSE THE SPRING CLAMPS. REPLACE THEM WITH SCREW TIGHTENED CLAMPS.

ITEM DESCRIPTION
1. HEATER INLET HOSE - 18D376
2. HEATER OUTLET HOSE - 18D563
3. SPRING CLAMP
4. SPRING CLAMP
5. WIRING HARNESS - 14401 ASS'Y
6. HEATER OUTLET HOSE - 18D359
7. HEATER INLET HOSE - 18D335

Compressor

NOTE: Whenever a compressor is replaced, it will be necessary to replace the suction accumulator / drier. For compressor service procedures and specifications refer to Section 12-03C for the FX-15, and 12-03B for the 10P15F compressor.

Vehicles that have an inoperative A / C compressor, due to internal causes, should have the refrigerant system cleaned to remove any debris or contaminants that may be present, to prevent damage to the replacement compressor.

When a compressor fails and internal damage occurs, A / C system contaminants can be produced in several ways. Refrigerant loss, poor lubrication and internal component failure can cause a number of physical and chemical reactions inside the compressor, resulting in the addition of contaminants to the A / C system.

Regular flushing procedures will not remove this type of contamination from the system. Therefore, the following A / C system flushing procedure MUST be performed before a new compressor can be installed. A new compressor should never be installed without performing this mandatory filtering procedure.

REMOVAL AND INSTALLATION (Continued)

A/C System Filtering

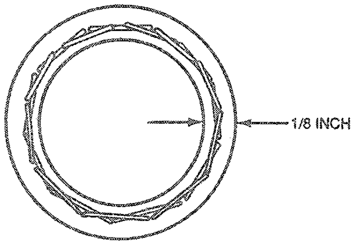
Two A/C service kits have been released to provide the necessary equipment and information to perform the new, mandatory A/C system filtering procedure. Filter kits with the service part number suffix "A" are to be used on vehicles that have a nylon lined suction hose between the suction accumulator/drier and the compressor. Filter kits with the service part number suffix "B" are for vehicles with rubber lined suction hose.

CAUTION: Follow all refrigerant system safety and service precautions as outlined.

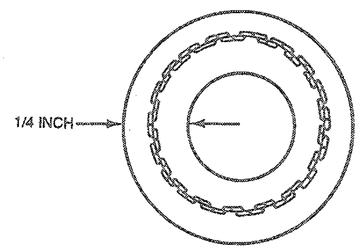
1. To Determine that the compressor has failed and must be replaced, remove the orifice tube and liquid line, if necessary. Look for a dirty orifice tube and/or a liquid line containing black refrigerant oil and particles.
2. Remove the damaged compressor and drain the oil into a calibrated container.

   NOTE: The proper amount of refrigerant oil must be added to the new compressor before it can be installed. The procedure for the FX-15 is given. However, the procedure is the same for all compressors. Refer to Section 12-00 for the quantity of oil required.
3. A new FX-15 service replacement compressor contains 207 ml (7 oz) of refrigerant oil. If the amount of oil drained from the removed compressor is between 90 and 148 ml (3 oz to 5 oz), pour the same amount of clean oil into the new compressor. If the amount of oil drained from the old compressor is greater that 148 ml (5 oz), pour only 148 ml (5 oz) of clean refrigerant oil into the new compressor. If the amount of refrigerant oil drained from the old compressor is less than 90 ml (3 oz), pour 90 ml (3 oz) of clean refrigerant oil into the new compressor.

   NOTE: It will be necessary to transfer the magnetic clutch from the old compressor to the new compressor.
4. Install the new compressor. Be sure the compressor mounting bolts are tightened to the proper specification. Check the tension of the compressor drive belt. Adjust, if necessary.
5. Remove the suction accumulator/drier assembly and drain the oil into a calibrated container.
6. Add clean refrigerant oil to the new accumulator/drier in the same amount that was removed from the old unit, plus an additional 60 ml of new refrigerant oil.
7. Install the suction accumulator/drier in the vehicle.
8. Determine the type of suction hose with which you are working. To do this, cut the suction hose into two pieces (make the cut closer to the compressor than the accumulator) and measure the hose wall thickness. Rubber lined hose has a wall thickness of 1/4 inch and nylon lined hose has a wall thickness of 1/8 inch.



NYLON HOSE

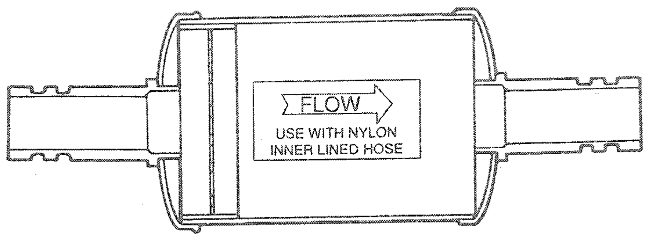


RUBBER HOSE

CCL 3765-A

REMOVAL AND INSTALLATION (Continued)

9. Get the proper service kit for the vehicle you're working on. Filter kits with the service part number suffix "A" are to be used on vehicles with a nylon lined suction hose. Filter kits with the service part number suffix "B" are for vehicles with rubber lined suction hose. The label on the filter shows which hose it is to be used with.



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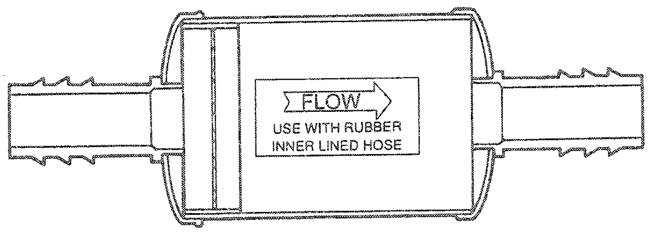


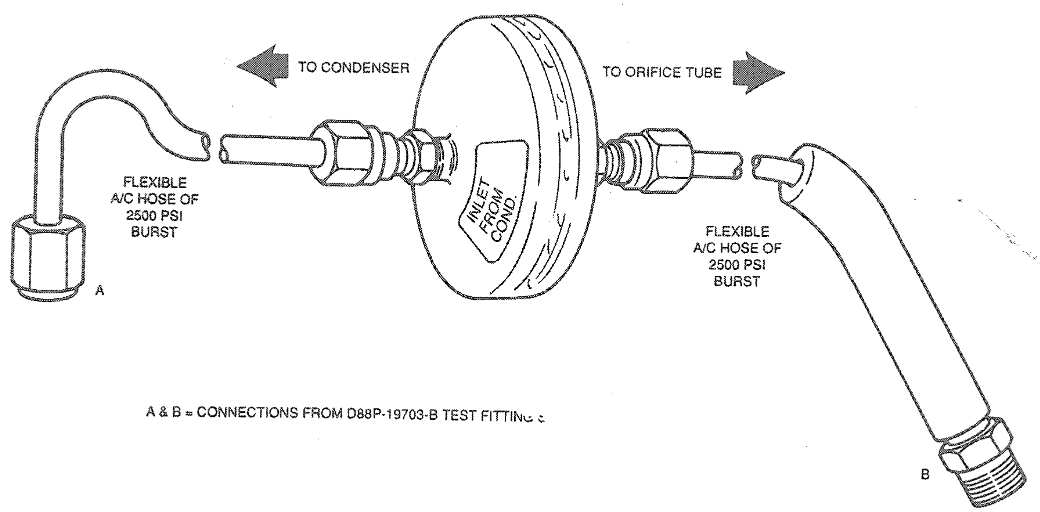
CCL 3731-A

10. Remove a length of suction hose to accommodate the suction filter and install the filter using the hose clamps provided with the kit. Be sure filter is correctly oriented for refrigerant system flow. Check the label on the filter. On the filter for nylon lined hose, install O rings (two on each filter tube being sure they are properly seated in the grooves on the tube). Tighten the hose clamps securely.

11. Install a new orifice tube. If the orifice tube is located in the liquid line between the condenser and the evaporator, replace the liquid line assembly. See Section 12-00.

REMOVAL AND INSTALLATION (Continued)

12. Install a pancake filter in the liquid line between the condenser and the orifice tube. Be sure the filter inlet is toward the condenser. Connections can be made using A / C Test Fitting Set D88P-19703-B or equivalent and flexible refrigerant hose of 2500 psi burst rating. Individual fittings are also available.



CCL 3729-A

13. Evacuate, charge and leak test the system
14. check all refrigerant system hoses, lines and the positioning of the newly installed filters to be sure they do not interfere with other engine compartment components. If necessary, use tie straps to make adjustments.
15. Provide adequate air flow to the front of the vehicle (with a fan, if necessary), set the A / C control at MAX A / C . Set the blower on HI and temperature control at full cool. Start the engine and let it idle briefly. Make sure the A / C system is operating properly.
16. Gradually bring the engine up to 1200 rpm by running it at lower rpms for short periods (first at 800 rpm, then at 1000 rpm). Set the engine at 1200 rpm and run it for an hour with the A / C system operating.
17. Stop the engine.
18. Allow the engine to cool sufficiently to remove the fittings, flexible hoses and pancake filter from the liquid line. (It will be necessary to discharge the system first.)
19. Discard the pancake filter. It can be used ONE TIME ONLY.
20. Reconnect the liquid line back into the system.
21. Evacuate, charge and leak test the system. Make any necessary adjustments.
22. Check the operation of the system in all modes.

3.0L, 3.2L SHO Engines

NOTE: Whenever a compressor is replaced, it will be necessary to replace the suction accumulator / drier.

Removal

1. Discharge system following recommended service procedures. Observe all safety precautions.
2. Disconnect compressor clutch wires at field coil connector on compressor.
3. Remove accessory drive belt.
4. Disconnect hose assemblies from condenser and suction line.
5. Remove four bolts.
6. Remove compressor and manifold and tube assembly from vehicle as a unit. Assembly will not clear sub frame and radio support if attempt is made to remove unit from bottom. It must be removed from top.

REMOVAL AND INSTALLATION (Continued)

7. Remove manifold and tube assembly as an on-bench operation.
8. If compressor is to be replaced, remove clutch and field coil assembly.

Installation

1. New service replacement FX-15 and 10P15F compressors contain 207ml (7 oz) of specified refrigerant oil. Before replacement compressor installation drain 120ml (4 fluid oz) of refrigerant oil from compressor. This will maintain total system oil charge within specified limits.
2. Install manifold and tube assembly on A/C compressor (two bolts).
3. Install compressor and manifold and tube assembly on A/C mounting bracket (four bolts).
4. Using new O-rings lubricated with clean refrigerant oil, connect suction line to compressor manifold and tube assembly. Attach discharge line to A/C condenser.
5. Connect clutch wires to field coil connector.
6. Install accessory drive belt. Adjust belt tension to 190-217 N·m (141-160 lb-ft).
7. Leak test, evacuate and charge system following recommended service procedures. Observe all safety precautions.
8. Check system for proper operation.

3.8L Engine

NOTE: Whenever a compressor is replaced, it will be necessary to replace the suction accumulator/drier.

Removal

1. Discharge the system following the recommended procedure.
2. Drain and save radiator coolant following the recommended procedure.
3. Disconnect negative battery cable.
4. Disconnect and remove the integrated relay module.
5. Disconnect and remove the fan and shroud assembly.
6. Disconnect upper and lower radiator hoses.
7. Remove the radiator.
8. Disconnect A/C compressor magnetic clutch wire at field coil connector on the compressor.
9. Remove top two compressor mounting bolts.
10. Raise vehicle on a hoist. The following operation should be performed from underneath the vehicle.
11. Loosen and remove accessory drive belt.
12. Disconnect Heated Oxygen Sensor (HO2S) 9F472 wire connector.
13. Remove A/C muffler supporting strap bolt from subframe.
14. Disconnect A/C system hose from condenser and suction accumulator/drier using the spring lock coupling tool or equivalent. Immediately install protective caps on open lines.
15. Remove bottom two compressor mounting bolts. Ensure compressor is properly supported as the bolts are removed.
16. Remove compressor, manifold and tube assemblies from vehicle as a unit. The assembly can be removed from the bottom using care not to scrape against the condenser.
17. Remove manifold and tube assemblies from compressor.
18. If the compressor is to be replaced, remove clutch and field coil assembly.

Installation

1. A new service replacement FX15 compressor contains 207ml (7 oz) of specified refrigerant oil. Before installing a new compressor, drain 120ml (4 oz) of refrigerant oil from the compressor. This will maintain total system oil charge within specified limits.
2. Using new O-rings, lubricated with clean refrigerant oil, install manifold and tube assemblies onto the new compressor.
3. Install compressor, manifold and tube assemblies onto compressor mounting bracket
4. Using new O-rings lubricated with clean refrigerant oil, connect suction line to compressor and manifold assembly.
5. Using new O-rings lubricated with clean refrigerant oil, connect discharge line to compressor and manifold assembly.
6. Install muffler support onto subframe.
7. Connect Heated Oxygen Sensor (HO2S) 9F472 wire connector.
8. Install accessory drive belt.
9. Lower vehicle to floor and perform the following operations from the top.
10. Install radiator using the recommended procedure.
11. Connect radiator hoses and tighten hose clamps to specification.
12. Install fan and shroud assembly.
13. Install and connect integrated relay connector.
14. Connect negative battery cable.
15. Fill radiator with the reserved coolant.
16. Leak test, evacuate and charge system following recommended procedures.
17. Check system for proper operation.

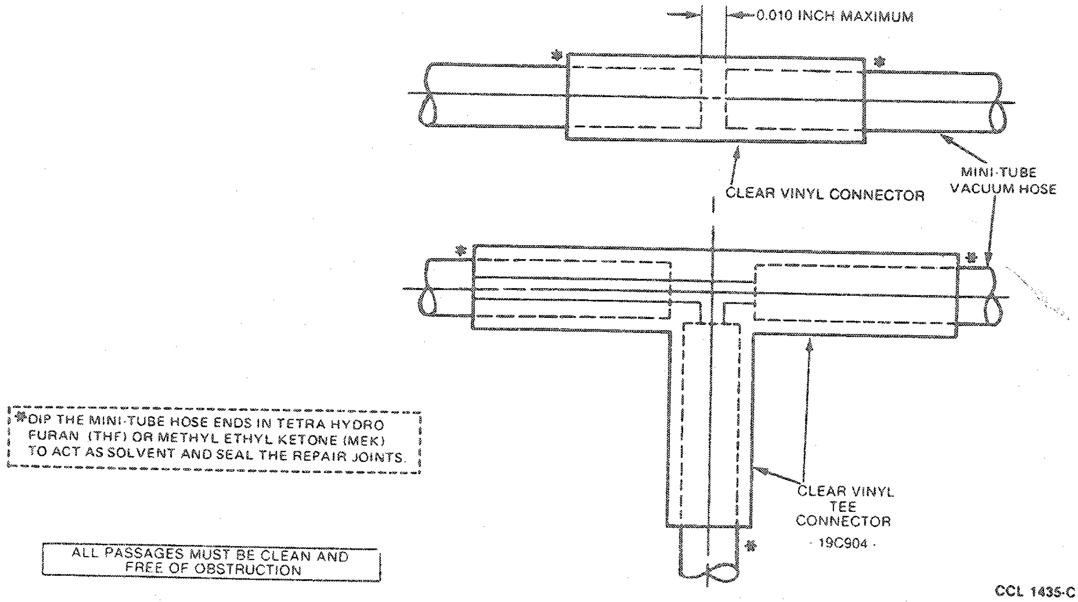
ADJUSTMENTS

Mini-Tube Vacuum Hose Service

1. Measure length of damaged area of mini-tube vacuum hose.

ADJUSTMENTS (Continued)

2. Cut a piece of standard 3mm (1/8 inch) ID vacuum hose approximately 25mm (1 inch) longer than the damaged area of mini-tube vacuum hose.
3. Cut off mini-tube vacuum hose on each side of damaged area.
4. Dip mini-tube hose ends in Tetra Hydro Furan (THF) or Methyl Ethyl Ketone (MEK). This solvent will seal mini-tube to vacuum hose.
5. Insert ends of mini-tube vacuum hose approximately 9mm (3/8 inch) into ends of standard 3mm (1/8 inch) service vacuum hose section.



6. Shake repair joint after assembly to ensure solvent is dispersed and vacuum line is not plugged.
7. Test system for a vacuum leak in service area.

Adding Refrigerant Oil

It is imperative that the specified type and quantity of refrigerant oil be maintained in the refrigerant system for proper operation. A surplus of oil, the wrong oil, the wrong viscosity or insufficient oil will all cause refrigerant system concerns. Insufficient oil or the wrong oil results in poor lubrication and possible compressor damage. A surplus of oil allows too much oil to circulate with the refrigerant causing the cooling capacity of the system to be reduced.

When it is necessary to replace a refrigeration system component, certain procedures must be followed to ensure that the total oil charge on the system is correct after the new component is installed. During normal A/C operation, some refrigerant oil is circulated through the system with the refrigerant and some is retained in the compressor. If certain components of the system are removed for replacement, some of the refrigerant oil will go with the component. To maintain the original total oil charge, it is necessary to compensate for the oil loss by adding oil to the system with the replacement part. Refer to Section 12-00 for oil adding procedures.

Compressor

NOTE: Whenever a compressor is replaced, it will be necessary to replace the suction accumulator/drier.

Refer to Section 12-03B or 12-03C for compressor refrigerant oil information and replacement.

ADJUSTMENTS (Continued)

Accumulator / Drier

Drain the oil from the removed accumulator / drier through the Schrader valve fitting of the pressure switch with the valve stem removed into a calibrated measuring container. Add the same amount of clean YN-9 refrigerant oil to the new accumulator / drier after installation.

NOTE: If more than 147.85ml (5 oz) of refrigerant oil is removed from an accumulator / drier, it is an indication that the oil drain hole in the accumulator / drier is plugged. Always check the accumulator / drier for excessive oil if the compressor has been replaced for lack of performance.

Evaporator Core

NOTE: Whenever an evaporator core is replaced, it will be necessary to replace the suction accumulator / drier.

Add 88.71ml (3 oz) of clean YN-9 refrigerant oil to the accumulator / drier inlet tube whenever the evaporator core is replaced. This will compensate for the refrigerant oil lost in the replaced evaporator core.

Condenser

NOTE: Whenever a condenser is replaced, it will be necessary to replace the suction accumulator / drier.

Add 29.57ml (1 oz) of clean YN-9 refrigerant oil to the condenser or the accumulator / drier if the condenser is replaced.

Other Refrigerant System Components

Replacement of other refrigerant system components such as hoses, compressor valves, pressure switch, etc. do not require the addition of refrigerant oil unless the hose burst during system operation. Then the amount of oil to be added must be determined by the technician. Refer to Section 12-00.

SPECIFICATIONS

REFRIGERANT SYSTEM COMPONENTS AND CAPACITIES

Vehicle (1)	Compressor	Clutch Cycling Pressure Switch (2)	Fixed Orifice Tube	Refrigerant Capacity (3)	
				(oz.)	(kg.)
3.0L EFI	FX-15	X	X	32 ± 1	.91 ± 0.028
3.8L	FX-15	X	X	32 ± 1	.91 ± 0.028
3.0L SHO	10P15F	X	X	32 ± 1	.91 ± 0.028

(1) All models equipped with Suction Accumulator / Drier

(2) Pressure switch open at 169 kPa (24.5 psi)

(3) Plus (2 oz.) (.57 kg.) minus (2 oz.) (.057 kg.)

REFRIGERANT SYSTEM

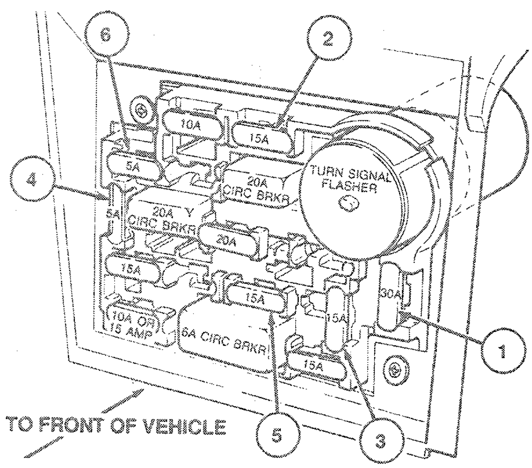
Description	Specification
System Protection Clutch Cycling Pressure Switch	Close Maximum 40-47 psi Open Minimum 22-28 psi
High Pressure Relief Valve[1]	3103 kPa (450 psi) minimum
Capacity 3.0L	32 Oz. ± 1 Oz.
3.8L	32 Oz. ± 1 Oz.
Type Refrigerant 12 (R-12)	Dichlorodifluoromethane CCL_2F_2
ESA-M17B2A	D4AZ-19B519-A, Ford YN1-A, 14 Oz. Can, Motorcraft YN-7, 30 Lb. Container
Refrigerant Oil	YN-9

ELECTRICAL SYSTEM

System Protection	Fuse No.	Fuse Amps Rating
Blower Motor	1	30 Amp
A/C Clutch, Accessory Run, Blend Door	2	15 Amp
EATC Power On	3	15 Amp
EATC Panel Lamps	4	5 Amp
EATC LCD (Display)	5	15 Amp Headlamps Off
	6	5 Amp Headlamps On
EATC Memory	7	5 Amp

1 Located in high pressure hose near compressor.

SPECIFICATIONS (Continued)



THE FUSE PANEL IS LOCATED IN THE LOWER LH SIDE OF THE INSTRUMENT PANEL, BEHIND A COVER WHICH MUST BE REMOVED FOR ACCESS.

L6394-B

TORQUE SPECIFICATIONS

Description	N·m	Lb-Ft
Ambient Sensor Retaining Nut	6.2-7.3	55-64 (Lb-In)
Cold Engine Lockout (CELO) Switch	19	14

SPECIAL SERVICE TOOLS

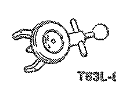
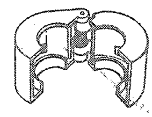
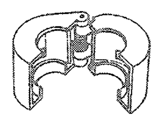
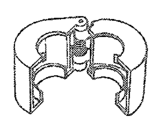
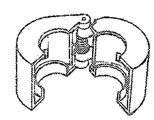
SPRING LOCK COUPLING COMPONENTS

Description	Part No.
O-Ring	3/8 inch — 391396
	1/2 inch — 391397
	5/8 inch — 391304
	3/4 inch — 391305
Garter Springs	3/8 inch — E1ZZ-19E576-A (YF-990)

(Continued)

SPRING LOCK COUPLING COMPONENTS (Cont'd)

Description	Part No.
	1/2 inch — E1ZZ-19E576-A (YF-991)
	5/8 inch — E35Y-19E576-A (YF-1134)
	3/4 inch — E69Z-19E576-A

Tool Number/ Description	Illustration
T63L-8620-A Belt Tension Gauge	 T63L-8620-A
T81P-19623-G1 Spring Lock Coupling Disconnect Tool— 3/8 inch	 T81P-19623-G1
T81P-19623-G2 Spring Lock Coupling Disconnect Tool — 1/2 inch	 T81P-19623-G2
T83P-19623-C Spring Lock Coupling Disconnect Tool — 5/8 inch	 T83P-19623-C
T85L-19623-A Spring-Lock Coupling Disconnect Tool — 3/4 inch	 T85L-19623-A

SECTION 12-03B Compressor and Clutch—10P15F

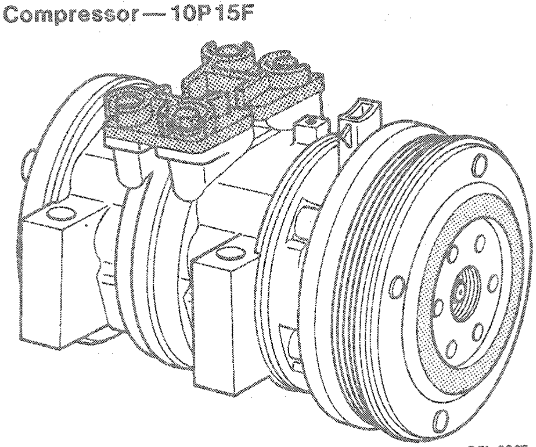
VEHICLE APPLICATION

Taurus SHO.

DESCRIPTION AND OPERATION

The 10P15F compressor is a 10 cylinder axial design compressor with mounting brackets for tangential mounting. The compressor shaft is driven by a belt from the engine accessory drive. Five double acting pistons, positioned axially around the compressor shaft, are actuated by a swashplate that is pressed on the compressor shaft. The swashplate uses the rotating action of the shaft to provide a reciprocating driving force to each of the five pistons. This driving force is applied, through balls and shoes, to the mid-point of each of the five double ended pistons.

Compressor—10P15F



CCL 3367-A

Reed-type suction and discharge valve plates are located between the cylinder assembly and the head at each end of the compressor. The heads are connected with each other by gas-tight passageways which direct refrigerant gas to a common output.

A magnetic clutch is used to drive the compressor shaft. When voltage is applied to the clutch field coil, the clutch plate and hub assembly, (which is solidly coupled to the compressor shaft) is drawn by magnetic force toward the pulley which rotates freely on the compressor front head casting. The magnetic force locks the clutch plate and hub assembly and the pulley together as one unit. The compressor shaft then turns with the pulley. When voltage is removed from the clutch field coil, a rubber bushing in the clutch plate and hub assembly moves the clutch plate away from the pulley, and the compressor shaft ceases to rotate.

MAINTENANCE

Adding Refrigerant Oil

The 10P15F compressor uses a special paraffin base refrigerant oil YN-9 (E73Z-19557-A) or equivalent refrigerant oil meeting Ford Specification ESH-M2C31-A2. A total oil charge of 240ml (8 fluid ounces) is used in a new system. It is important that only the specified type and quantity of refrigerant oil be used in the compressor. If there is a surplus of oil in the system, excessive oil will circulate with the refrigerant reducing the cooling capacity of the system. Too little oil will result in poor lubrication of the compressor.

When it is necessary to replace a component of the refrigerant system, the procedures in this Section must be followed to ensure that the total oil charge in the system is correct after the new part is installed. When the compressor is operated, oil gradually leaves the compressor and is circulated through the system with the refrigerant. Eventually a balanced condition is reached in which a certain amount of oil is retained in the compressor and a certain amount is continually circulated. If a component of the system is removed after the system has been operated, some oil will go with it. To maintain the original total oil charge, it is necessary to compensate for this by adding the lost oil to the new replacement part. The procedures for replacing oil follow.

During Compressor Replacement

NOTE: The suction accumulator / drier and the orifice tube should also be replaced whenever the compressor is replaced.

A new service replacement compressor contains 43ml (1.4 oz) of refrigerant oil YN-9 (E73Z-19557-A) or equivalent refrigerant oil. Prior to installing the replacement compressor, drain the oil from the removed (old) compressor into a clean calibrated container. Then, drain the oil from the new compressor into another clean calibrated container. If the amount of oil drained from the old compressor is between 3 and 5 ounces, pour the same amount of clean refrigerant oil into the new compressor. If the amount of oil drained from the old compressor is greater than 5 ounces, add 5 ounces of clean oil to the new compressor. If the amount of oil removed is less than 3 ounces, pour 3 ounces of clean oil into the new compressor. Use only the specified compressor oil.

This will maintain the system total oil charge within the specified limits.

During Component Replacement

NOTE: A new accumulator assembly contains 167-207 cc (5.65-6.99 ounces) of oil.

When replacing other components of the air conditioning refrigerant system, measured quantities of the specified refrigerant oil should be added to the component to ensure that the total oil charge in the system is correct before the system is operated.

Clean refrigerant oil YN-9 (E73Z-19557-A) or equivalent should be added to the replacement components as follows:

- Evaporator Core: Add 90ml (3 oz).
- Condenser: Add 30ml (1 oz).
- Accumulator: Drill a 12.7mm (1/2-inch) hole in the accumulator body and drain oil from accumulator through that hole. Drain existing oil from new accumulator then add same amount of oil removed, plus 28 grams (2 oz) of clean refrigerant oil to new accumulator.

Clean refrigerant oil should be poured directly into the replacement component. If any other components, such as an orifice tube or a hose are replaced, no additional refrigerant oil is necessary unless a hose bursts with a fully charged system. Then, the addition of 2 oz. refrigerant oil is recommended. The amount must be determined by the technician. The suction accumulator / drier should also be replaced under these circumstances.

TESTING

Compressor Manifold Leak Test

1. Tighten manifold retaining bolts to 18-23 N·m (14-16 lb-ft).
2. Leak test manifold O-ring seals.
3. If no leaks are found during leak test, manifold O-ring seals are good.
4. If a leak is found at manifold and manifold bolts are tightened to 18-23 N·m (14-16 lb-ft), install new manifold O-ring seals following procedure under Suction and Discharge Manifold Removal and Installation. Then, repeat leak test procedure.

Compressor External Leak Test

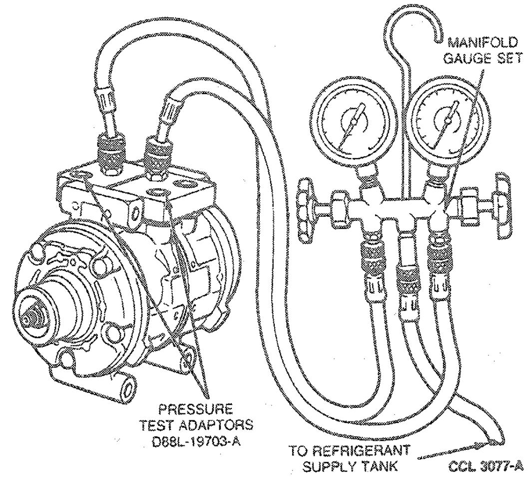
Tools Required:

- Pressure Test Plates D88L-19703-A
- Rotunda Electronic Leak Detector 055-00015

1. Remove compressor from vehicle observing all safety precautions.
2. Remove complete clutch assembly, including field coil, from compressor.
3. Install Pressure Test Plates D88L-19703-A or equivalent on compressor.

TESTING (Continued)

Compressor Testing for External Leaks



4. Prior to leak testing the shaft seal, rotate the compressor shaft 10 revolutions to distribute oil in the compressor.
5. Connect high- and low-pressure hoses of a manifold gauge set to fittings of pressure test adapters.
6. Attach center hose of manifold gauge set to a refrigerant drum standing in an upright position.
7. Open low-pressure gauge valve, high-pressure gauge valve, and valve on refrigerant drum to allow refrigerant vapor to flow into compressor.
8. Using Rotunda Electronic Leak Detector 055-00015 or equivalent, check for leaks at compressor rear head seal, compressor front head seal, compressor shaft seal, center joint seal and around compressor cylinder bolts. After checking, turn off manifold gauge valves and refrigerant drum valve.
9. If an external leak is found at either head or at shaft seal, service as necessary. If an external leak is found at center joint of compressor body, install a new compressor assembly.
10. If refrigerant leak is found around head of a cylinder bolt, install a new brass washer on the bolt and leak test as outlined. If a leak cannot be corrected with a new brass washer, install a new head, new cylinder bolt, and new brass washers on all bolts.
11. Carefully disconnect manifold gauge hoses from the pressure fitting / adapter(s), allowing the refrigerant in the compressor to escape. Remove the adapter(s) from the compressor.
12. Install compressor as outlined.

Compressor Rotating Torque Check

The rotational torque of a used compressor should be checked if excessive compressor drag is suspected.

1. Discharge refrigerant system following recommended service procedures. Observe all safety precautions.
2. Remove compressor from vehicle.
3. Rotate compressor shaft and note torque required for one complete rotation. Observe torque while rotating shaft, not starting torque.
4. If rotational torque exceeds 10 N·m (7 lb-ft), replace compressor assembly.
5. If rotational torque is less than specified, excessive drag does not exist in compressor. Install compressor, leak test, and evacuate and charge system.
6. Check system for proper operation.

REMOVAL AND INSTALLATION

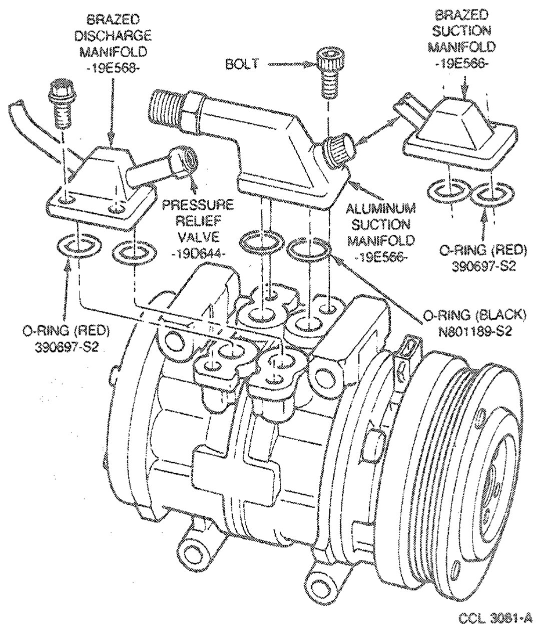
Suction or Discharge Manifold

NOTE: Two different O-rings are used on compressor manifolds and they are not interchangeable. One is **black** and is used with aluminum manifolds. The other O-ring is **red** and is used with brazed steel manifolds. Either O-ring must be replaced with one of the same color.

Removal

1. Discharge refrigerant from system following recommended procedures.
2. Remove two bolts attaching manifold to compressor, and remove manifold and O-rings.

Suction and Discharge Manifold Installation—Typical



REMOVAL AND INSTALLATION (Continued)

3. When replacing discharge manifold, transfer pressure relief valve to new discharge manifold.

Installation

1. Lubricate new O-rings with clean refrigerant oil and position them in O-ring grooves of manifold. Use only the same color O-ring as specified for the type of manifold being used.
2. Apply Pipe Sealant with Teflon® D8AZ-19554-A (ESG-M4G194-A) or equivalent to threads of manifold retaining bolts.

   NOTE: When replacing a compressor, use original manifold bolts from removed compressor to attach manifolds to new compressor. **DO NOT USE THE SHIPPING CAP BOLTS.**
3. Position manifold with O-rings to compressor and install two retaining bolts. Tighten bolts to 18-23 N·m (14-16 lb-ft).
4. Leak test, evacuate and charge system following recommended procedures. Observe all safety precautions.

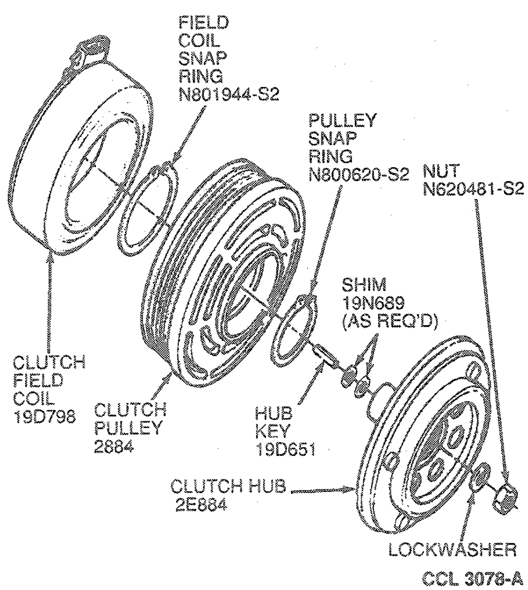
Compressor

Removal and Installation

Refer to Section 12-03A.

Clutch Hub and Pulley

Compressor Clutch Disassembled



CCL 3078-A

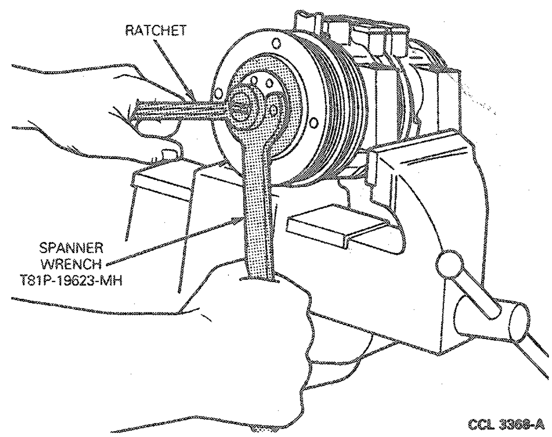
Tools Required:

- Spanner Wrench T81P-19623-MH
- Hub Remover T80L-19703-B
- Shaft Protector T80L-19703-G
- Pulley Puller D81P-19703-B or T71P-19703-B
- Pulley and Bearing Tool T80L-19703-J
- Plate Replacer T80L-19703-F

Removal

1. Remove clutch hub retaining nut and lockwasher. Use Spanner Wrench T81P-19623-MH if necessary.

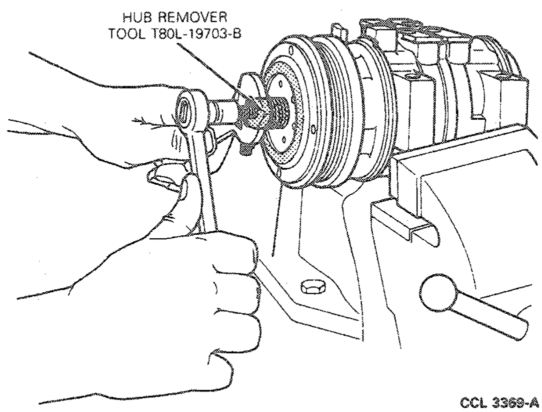
Clutch Hub Nut—Removal



CCL 3368-A

2. Remove clutch hub and shims from compressor shaft with Hub Driven Plate Remover T80L-19703-B. Hold tool with a 1-inch wrench and tighten bolt with a 1/2-inch wrench to pull hub from compressor shaft.

Clutch Hub—Removal

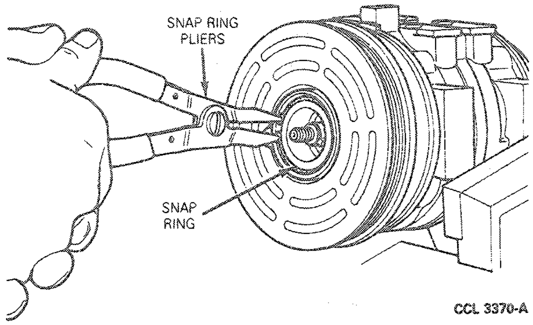


CCL 3369-A

3. Remove clutch pulley retaining snap ring.

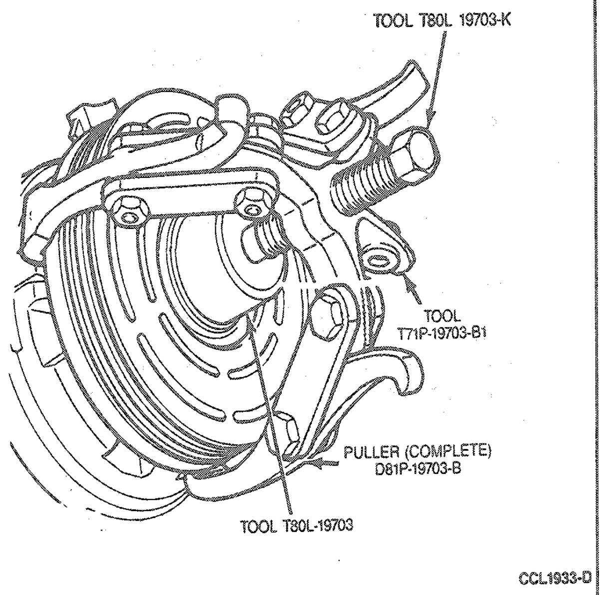
REMOVAL AND INSTALLATION (Continued)

Pulley Snap Ring—Removal



4. Pull pulley and bearing assembly from compressor. If pulley and bearing assembly cannot be removed by hand, use Shaft Protector T80L-19703-G and Pulley Puller D81P-19703-B or T71P-19703-B to remove pulley.

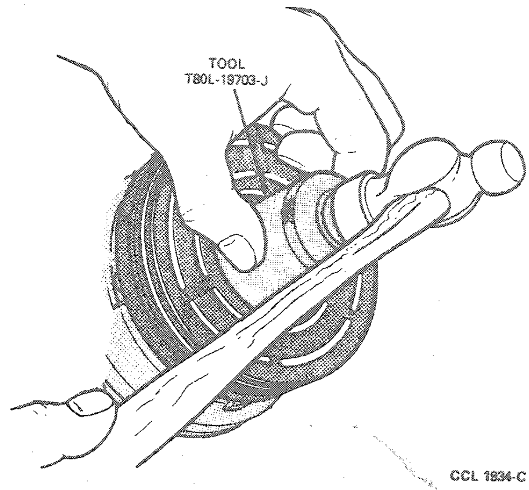
Removing Clutch Pulley with Puller



Installation

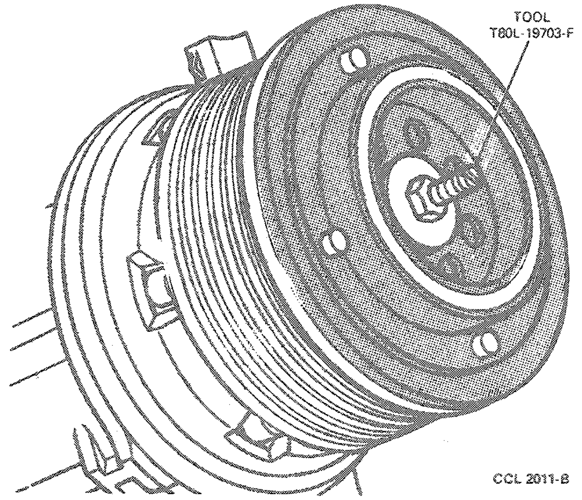
1. Clean the pulley bearing surface of the compressor head to remove any dirt or corrosion.
2. Install pulley and bearing on compressor. The bearing is a slip fit on compressor head and, if properly aligned, should slip on compressor head. If difficulty is encountered installing pulley, gently tap pulley on compressor using Pulley and Bearing Tool T80L-19703-J. Ensure the pulley bearing is aligned with compressor head.

Clutch Pulley—Installation



3. Install pulley retaining snap ring with bevel side of snap ring out.
4. Install clutch hub on compressor shaft using two thickest shims of shim pack between clutch hub and end of compressor shaft. Ensure shaft key is aligned with keyway of clutch hub. Use Hub Driven Plate Replacer T80L-19703-F to press hub on compressor shaft, if necessary. **DO NOT ATTEMPT TO DRIVE THE HUB ON THE COMPRESSOR SHAFT** as damage to compressor will result. Use only specified tool if hub will not easily slide on compressor shaft.

Clutch Hub—Installation

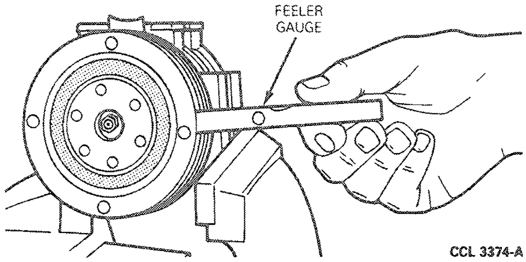


5. Install hub lock washer and retaining nut on compressor shaft. Tighten nut to 13-20 N·m (10-14 lb-ft). **DO NOT USE AIR TOOLS.**

REMOVAL AND INSTALLATION (Continued)

6. Check air gap between hub and mating pulley surface in three locations equally spaced around pulley. Record air gap readings.

Clutch Air Gap Check

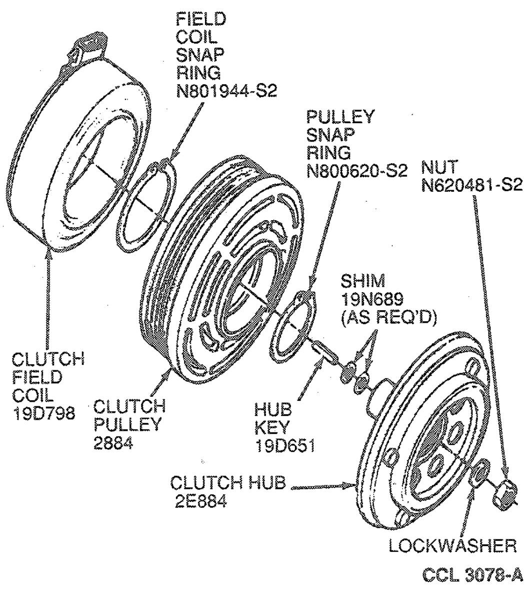


7. Rotate compressor pulley one-half turn (180 degrees) and again check air gap in three equally spaced locations. Smallest air gap must be within specified limits for air gap. Add or remove shims between hub and compressor shaft end as necessary until smallest air gap is within specification.

Clutch Field Coil

Removal

1. Remove clutch hub and pulley.
2. Remove snap ring retaining clutch field coil on the front of compressor.



3. Pull field coil from front of the compressor.

Installation

1. Position clutch field coil to compressor, engaging locator pin on compressor head with the hole in the clutch field coil mounting plate.
2. Install snap ring retaining clutch field coil on the compressor with bevel side of snap ring out.
3. Install pulley and hub on compressor and check air gap. Adjust as necessary.

Clutch Pulley Bearing

NOTE: Clutch pulley bearing is not a serviceable part.

Shaft Seal and Seat

Tools Required:

- Shaft Key Remover T81P-19623-NH
- Snap Ring Pliers T71P-19703-T
- Shaft Seal Seat Remover T87P-19623-BR
- Shaft Seal Remover T91P-19623-AH
- Shaft Seal Protector T71P-19703-H
- Shaft Seal Replacer T92P-19623-BH or T87P-19623-C
- Rotunda Electronic Leak Detector 055-00015

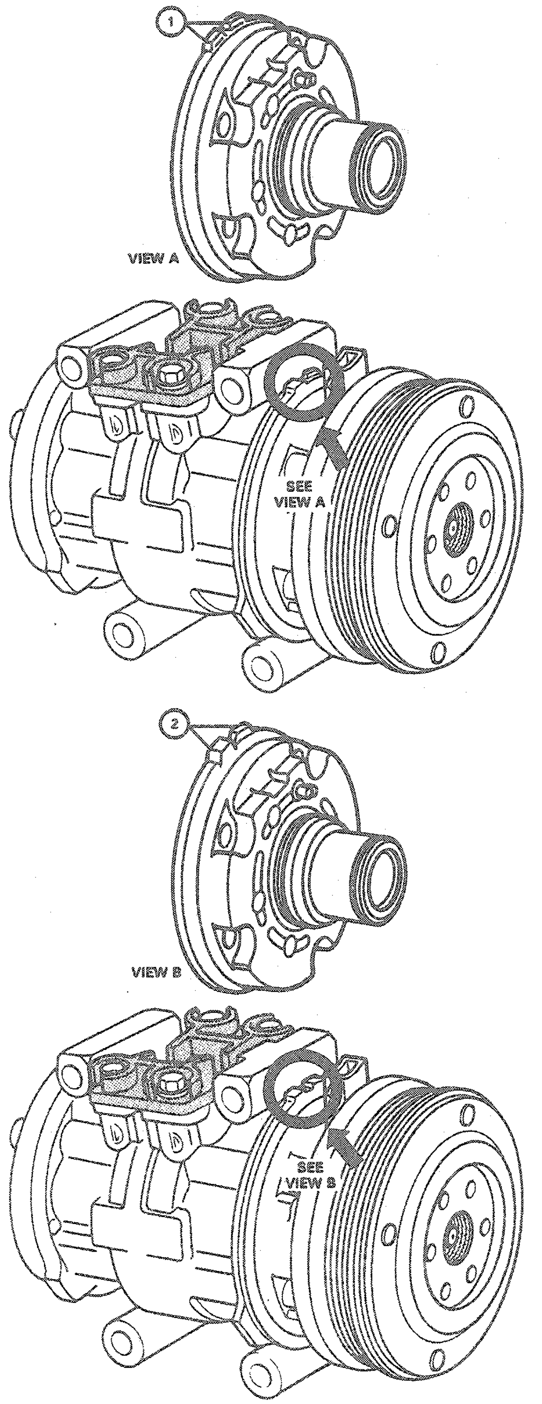
Removal

The refrigerant system must be discharged and the compressor removed from the vehicle to perform the shaft seal replacement operation.

The 10P15F compressor uses two different shaft seals. The shaft seal identification marks are located on the compressor front head.

REMOVAL AND INSTALLATION (Continued)

Compressor Shaft Seal Identification

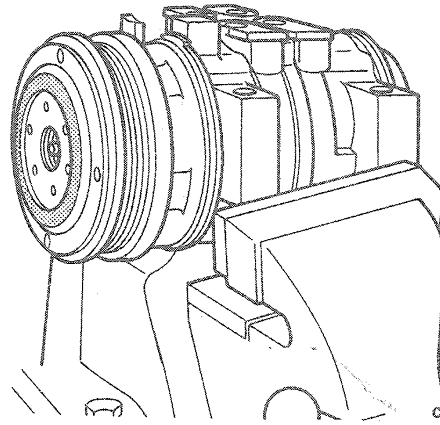


ITEM DESCRIPTION
1. 2 EQUAL SIZE TABS INDICATE OLD SHAFT SEAL DESIGN
2. 1 THICK & 1 THIN TAB INDICATE NEW SHAFT SEAL DESIGN

CCL 4134-A

1. Clamp the compressor in a vise as shown and remove clutch hub as outlined.

Compressor Clamped in Vise for Disassembly

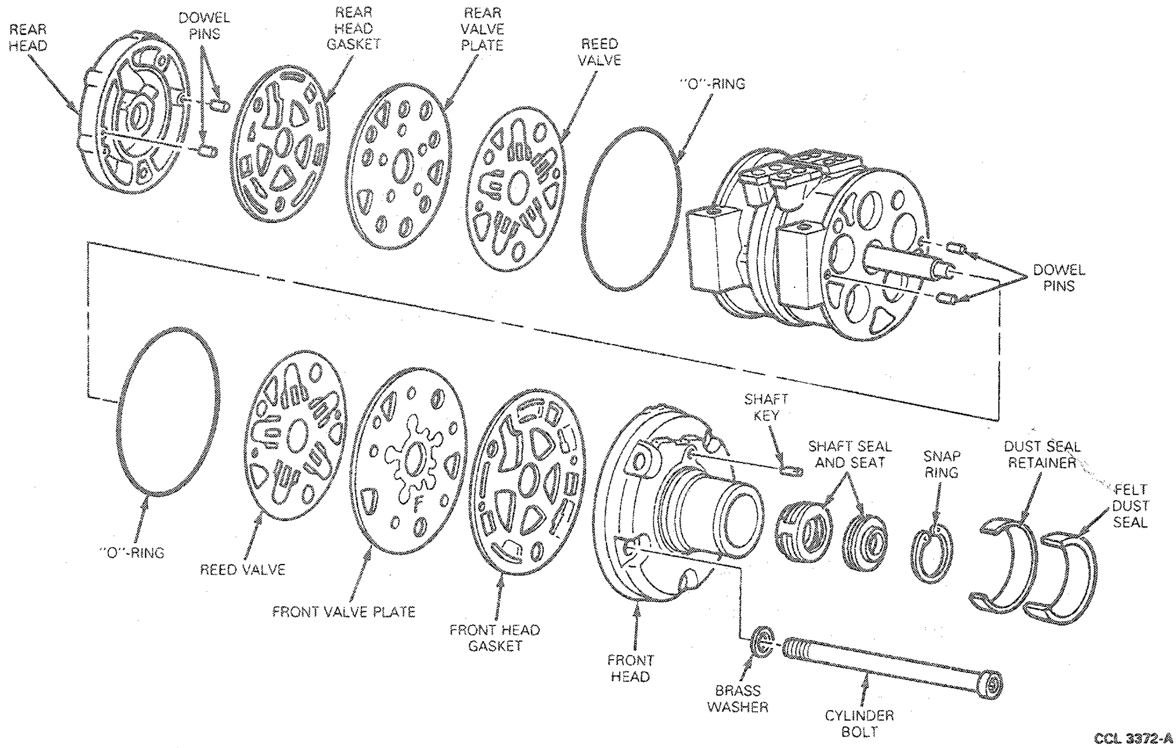


CCL 3371-A

2. Clean compressor front hub area to remove any accumulation of oil and dirt.
3. Carefully remove felt and retainer from inside nose of compressor.

REMOVAL AND INSTALLATION (Continued)

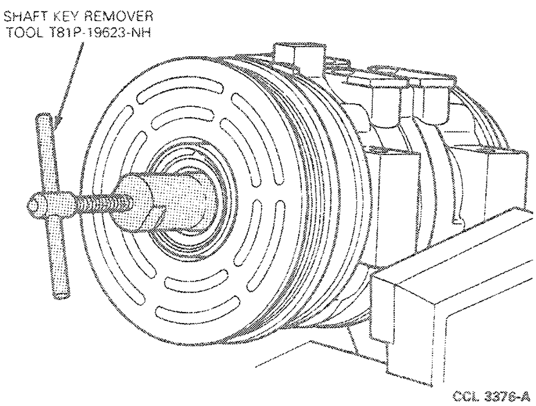
Compressor Disassembled



CCL 3372-A

4. Remove shaft key with Shaft Key Remover T81P-19623-NH.

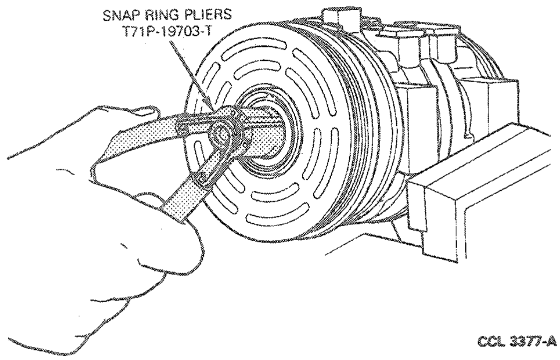
Shaft Key—Removal



CCL 3376-A

5. Remove shaft seal seat retaining snap ring with Snap Ring Pliers T71P-19703-T.

Seal Seat Retaining Snap Ring—Removal

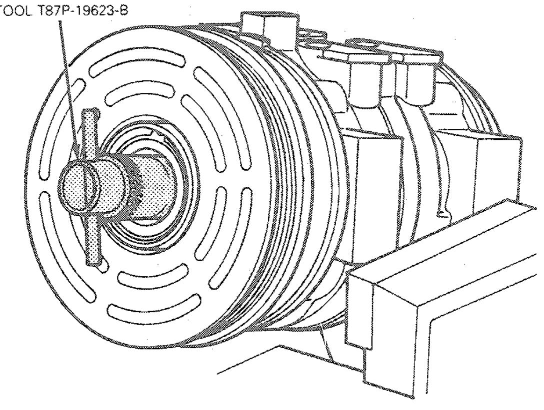


CCL 3377-A

6. Clean inner bore of compressor nose to prevent dirt from entering compressor when shaft seal seat is removed.
7. Remove shaft seal seat with Shaft Seal Seat Remover T87P-19623-BR.

REMOVAL AND INSTALLATION (Continued)

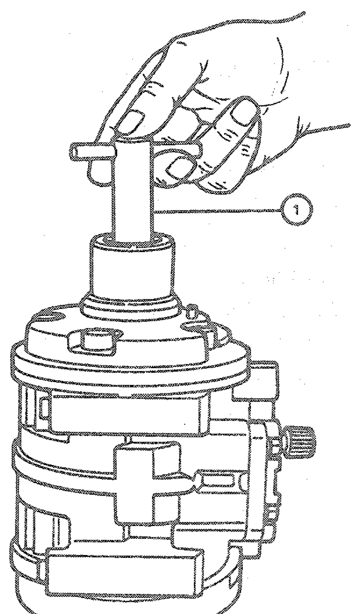
Shaft Seal Seat Removal



CCL 3378-A

8. Insert Shaft Seal Remover T91P-19623-AH into compressor nose opening on top of shaft seal. Turn tool 45 degrees while pushing tool inward until tool engages tangs of seal. Then pull shaft seal from compressor with tool.

Shaft Seal Removal



ITEM DESCRIPTION
1. SHAFT SEAL REMOVER - T91P-19623-AA

CCL 3711-A

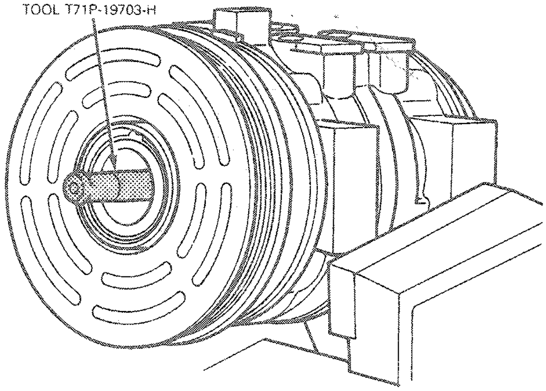
Installation

1. Place Shaft Seal Protector T71P-19703-H over the compressor shaft.
2. Lubricate new shaft seal with clean refrigerant oil and place it on protector.

   NOTE: DO NOT TOUCH the sealing surface of the shaft seal or seal seat with bare hands. To do so will damage the sealing surface.

   NOTE: Check the thin edge of the shaft seal protector for burrs or other damage. Replace the tool if burrs are found as the burrs could damage the internal sealing portion of the shaft seal assembly during installation.

Shaft Seal Protector Installed

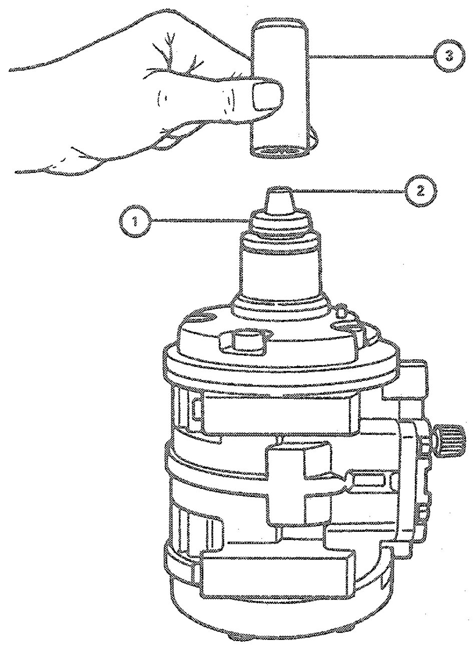


CCL 3380-A

3. Using Shaft Seal Replacer T92P-19623-BH insert the shaft seal into compressor. Rotate seal on compressor shaft while pushing inward until the flats of the shaft are aligned with flats of the shaft seal and the seal is positioned against the stops on the shaft.

REMOVAL AND INSTALLATION (Continued)

Shaft Seal—Installation

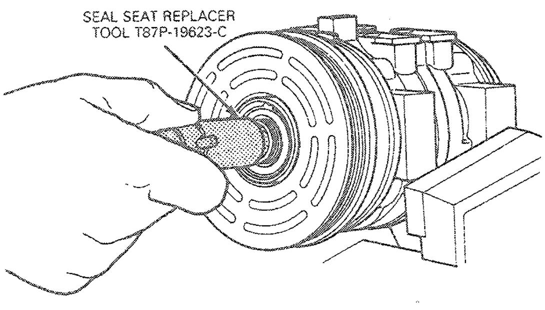


ITEM	DESCRIPTION
1.	SHAFT SEAL
2.	SHAFT SEAL PROTECTOR - T71P-19703-H
3.	SHAFT SEAL REPLACER - T91P-19623-BH

CCL 3712-A

4. Attach shaft seal seat to Shaft Seal Seat Remover T87P-19623-BR and lubricate seal seat and inside of compressor nose with clean refrigerant oil YN-9 (E73Z-19557-A) or equivalent. Then, insert seal seat into compressor. Push seal seat in against seal.

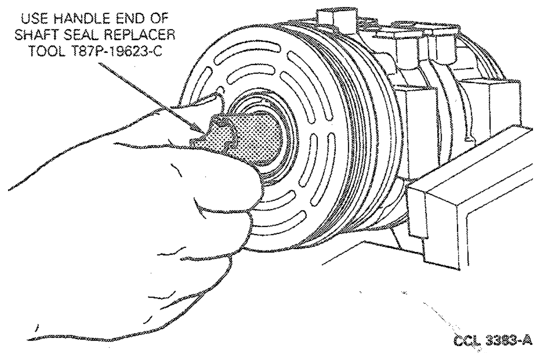
Shaft Seal Seat—Installation



CCL 3382-A

5. Install seal seat retaining snap ring into nose of compressor and push snap ring into groove with handle end of Shaft Seal Remover / Replacer T87P-19623-C.

Pushing Seal Seat Snap Ring into Groove



CCL 3383-A

6. Leak test shaft with Rotunda Electronic Leak Detector 055-00015 or equivalent.
7. Install a new felt strip and retainer into nose of compressor.
8. Install shaft key with rounder end inward.
9. Install clutch shims and clutch hub as outlined.

MAJOR SERVICE OPERATIONS

Compressor—Out of Vehicle

Head Gasket and O-Ring Seal

Tools Required:

- Shaft Key Remover T81P-19623-NH
- Snap Ring Pliers T71P-19703-T
- Shaft Seal Seat Remover T87P-19623-BR
- Shaft Seal Replacer T87P-19623-C
- Shaft Seal Protector T71P-19703-H
- Rotunda Electronic Leak Detector 055-00015

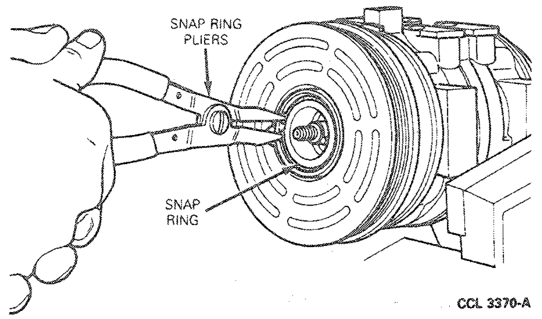
Disassembly

The refrigerant system must be discharged and compressor removed from vehicle to perform head gasket and O-ring replacement operation.

1. Drain refrigerant oil from compressor through suction and discharge port openings into a calibrated container. Record amount of oil removed from compressor.
2. Clamp compressor in a vise. Remove clutch hub, pulley and shims as outlined.

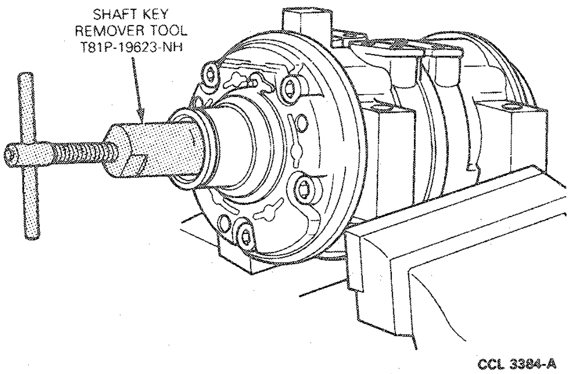
MAJOR SERVICE OPERATIONS (Continued)

3. Remove snap ring retaining clutch field coil on front of compressor. Then pull field coil from front of compressor.



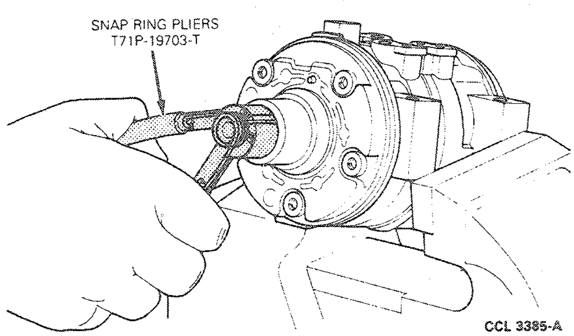
4. Carefully remove felt and retainer from inside nose of compressor.
5. Clean compressor front hub and head areas to remove any accumulation of oil and dirt.
6. Remove shaft key with Shaft Key Remover T81P-19623-NH.

Shaft Key—Removal



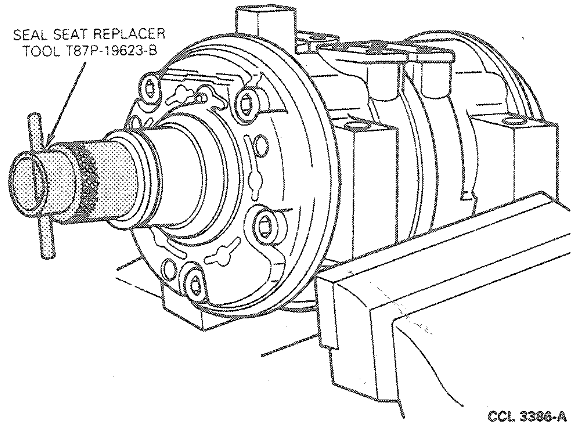
7. Remove shaft seal seat retaining snap ring with Snap Ring Pliers T71P-19703-T.

Seal Seat Retaining Snap Ring—Removal



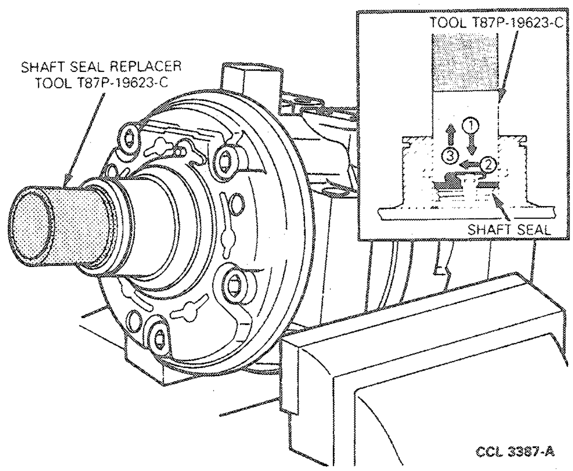
8. Clean inner bore of compressor nose to prevent dirt from entering compressor when shaft seal seat is removed.
9. Remove seal seat with Shaft Seal Seat Remover T87P-19623-BR.

Shaft Seal Seat—Removal



10. Insert Shaft Seal Remover / Replacer T87P-19623-C into compressor nose opening and on top of shaft seal. Rotate tool clockwise while pushing tool inward until tool engages tangs of seal. Then pull shaft seal from compressor with tool.

Shaft Seal—Removal



11. Hold front and rear heads in position on compressor. Remove five cylinder bolts and washers attaching heads to compressor.
12. Remove rear head, head gasket, rear valve plate, reed valve and dowel pins from rear of compressor.
13. Remove front head, head gasket, front valve plate, reed valve and dowel pins from compressor.

MAJOR SERVICE OPERATIONS (Continued)

Cleaning and Inspection

Clean all components in clean solvent and allow to dry. **Do not blow dry the valve plates or reed valves with compressed air.** Repeat the cleaning process using new cleaning solvent if necessary.

Inspect the cylinder bores for scratches, corrosion or other signs of damage or wear. Replace compressor if any of these conditions exist.

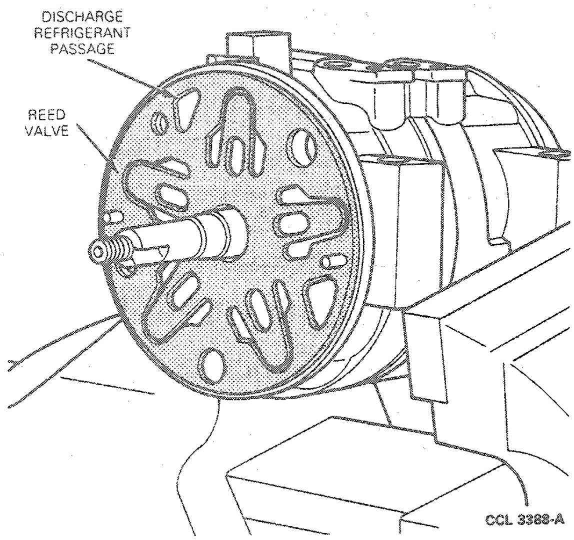
Inspect valve plates for scratches, corrosion or signs of wear or damage. Replace the compressor if valve plate damage is found.

Inspect the reed valves for cracks, scratches, deformation and corrosion. Replace the compressor if reed valve damage is found.

Assembly

1. Install two dowel pins in front dowel pin holes of the cylinder assembly.
2. Lubricate head O-ring and place it in groove on front of cylinder assembly.
3. Lubricate front reed valve with clean refrigerant oil and place it in position on front of cylinder assembly. Ensure the reed valve is properly positioned on cylinder assembly as shown in the following illustration.

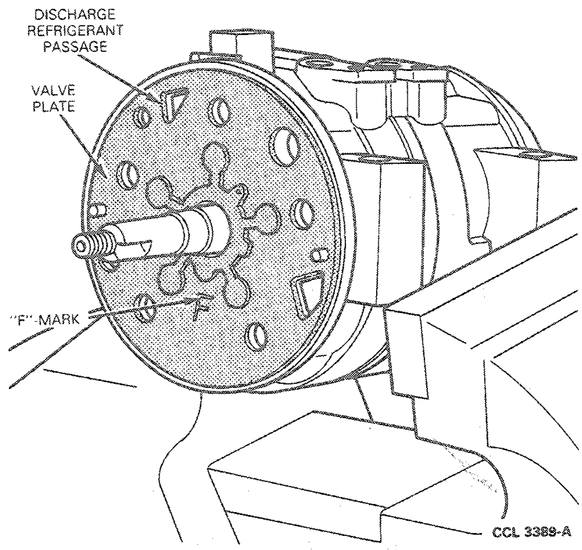
Reed Valve Installed



NOTE: The front and rear reed valves are identical and interchangeable.

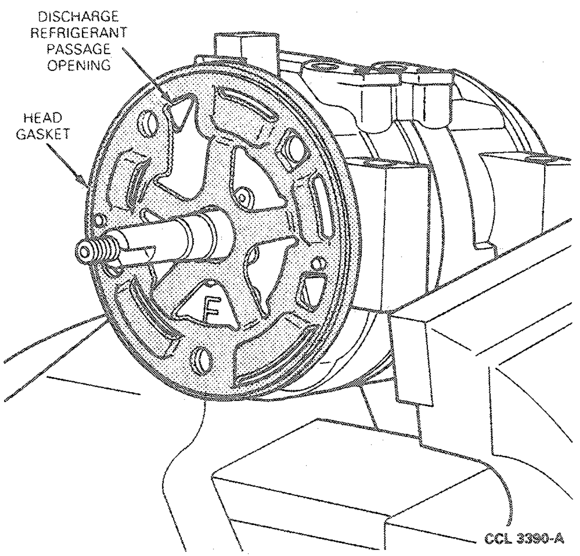
4. Lubricate front valve plate (marked with an "F") and place it in position on cylinder assembly. The "F" mark must be showing when the valve plate is properly installed.

Front Valve Plate Installation



5. Lubricate front head gasket and place it in position on the cylinder assembly. The front and rear head gaskets are not interchangeable so it is essential that the correct gasket is used. The raised portions of the gasket must be positioned away from the cylinder assembly and the gas passage opening must be positioned to the left of center as shown in the following illustration.

Head Gasket Installation

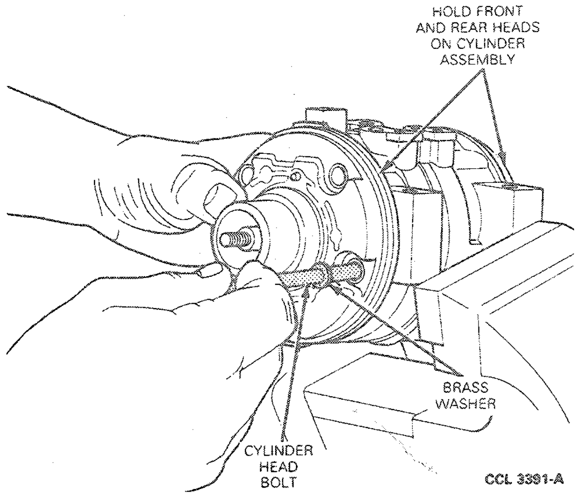


6. Position front head to cylinder assembly aligning dowel pins with dowel pin holes in front head.
7. Install dowel pins in dowel pin holes at rear of cylinder assembly.

MAJOR SERVICE OPERATIONS (Continued)

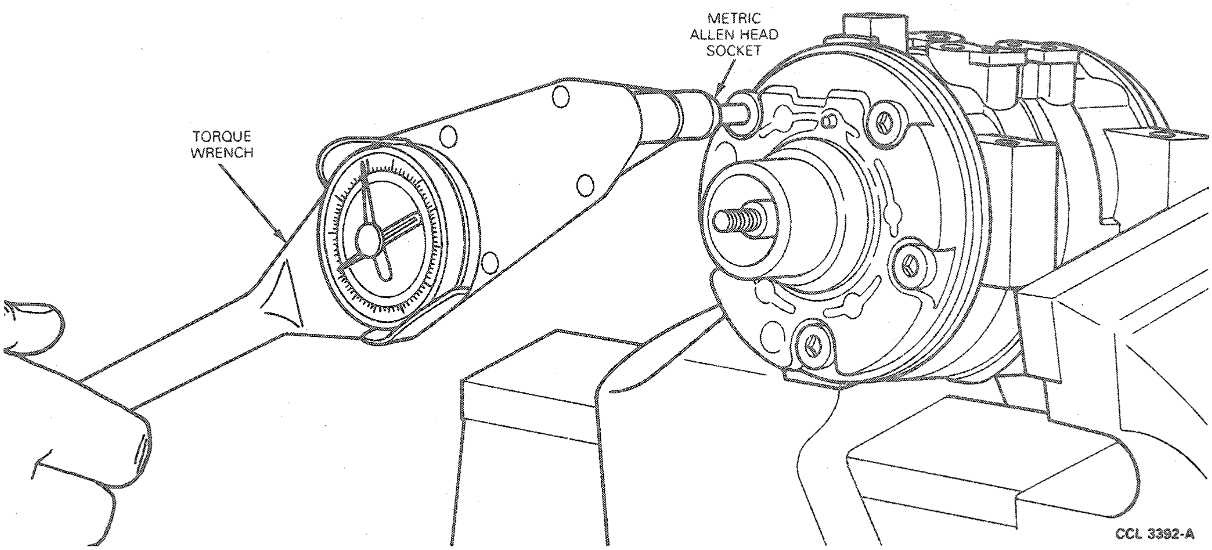
8. Lubricate rear reed valve with clean refrigerant oil and place it in position on the rear of the cylinder assembly. Ensure reed valve is properly positioned on cylinder assembly for cylinder bolts to pass through reed valve to rear head.
9. Lubricate rear valve plate (marked with an "R") and place it in position on rear of cylinder assembly. The "R" mark must be showing when valve plate is properly installed.
10. Lubricate rear head gasket and place it in position on cylinder assembly with raised portion of gasket away from cylinder assembly. Be certain gasket does not block cylinder bolt passages and gas passage opening is positioned to the right of center.
11. Lubricate rear head O-ring and place it in the groove on back of cylinder assembly.
12. Position rear head to cylinder assembly, aligning dowel pins with dowel pin holes in rear head.
13. Hold front and rear heads on the cylinder assembly. Install cylinder bolt until snug. This will prevent the rear head from separating from the cylinder assembly while the other cylinder bolts are installed.

Holding Cylinder Heads and Installing Cylinder Bolt



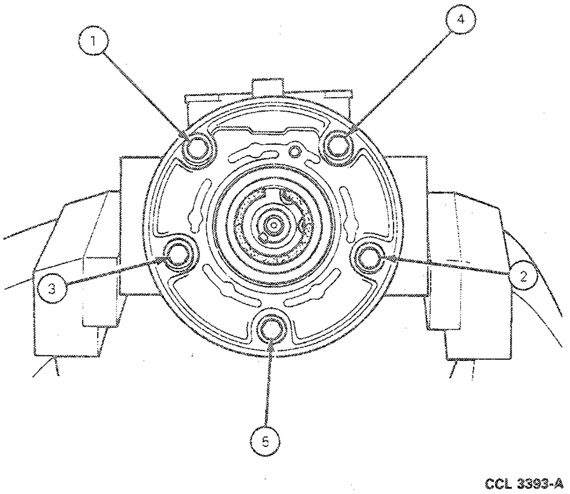
14. Using a torque wrench, tighten five cylinder bolts in three steps: 16 N·m (12 lb-ft), 20 N·m (15 lb-ft) and 25 N·m (19 lb-ft) in a diagonal sequence as shown in the illustration.

Tightening Cylinder Bolts with Torque Wrench



MAJOR SERVICE OPERATIONS (Continued)

Cylinder Bolt Tightening Sequence



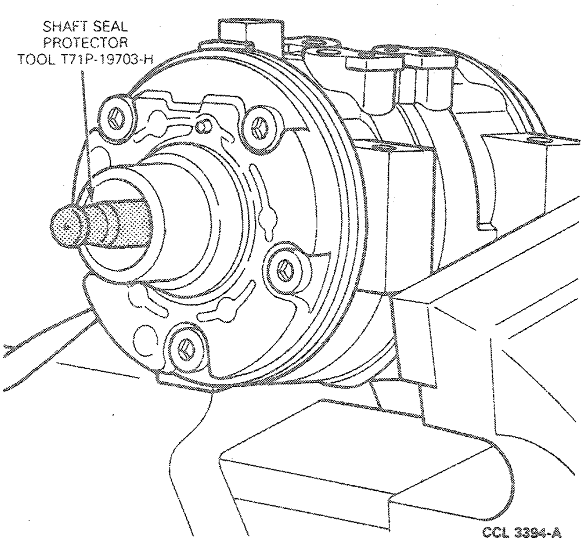
15. Lubricate new shaft seal with clean refrigerant oil and carefully attach shaft seal to Shaft Seal Remover / Replacer T87P-19623-C.

    NOTE: DO NOT TOUCH the sealing surface of the shaft seal or seal seat with bare hands. To do so will damage the sealing surface.

16. Place Shaft Seal Protector T71P-19703-H over end of compressor shaft.

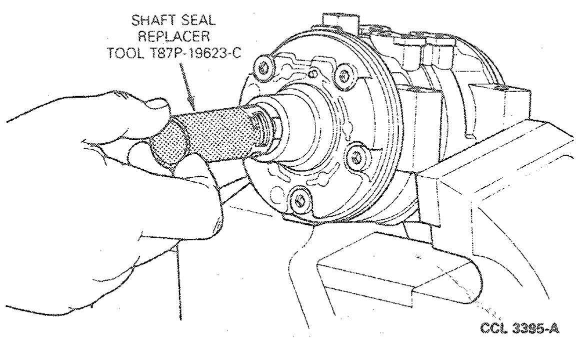
    NOTE: Check the thin edge of the shaft seal protector for burrs or other damage. Replace the tool if burrs are found as the burrs could damage the internal sealing portion of the shaft seal assembly during installation.

Shaft Seal Protector Installed



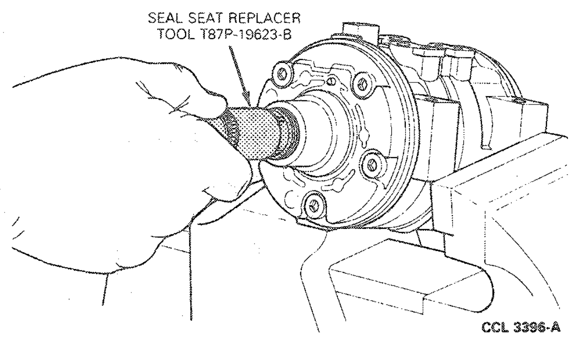
17. Using Shaft Seal Remover / Replacer T87P-19623-C insert shaft seal into compressor. Rotate seal on compressor shaft while pushing inward until flats of shaft are aligned with flats of shaft seal and seal is positioned against stops on shaft.

Shaft Seal—Installation



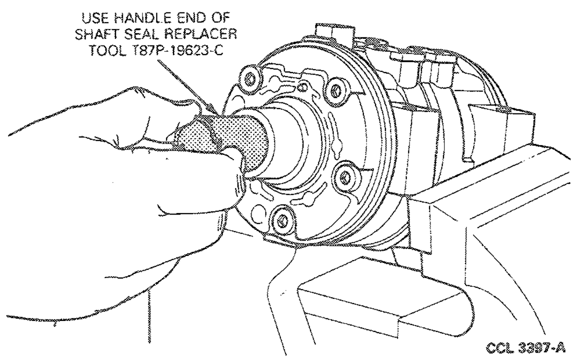
18. Attach shaft seal seat to Shaft Seal Seat Remover T87P-19623-BR and lubricate seat with clean refrigerant oil. Then insert seal seat into compressor. Push seal seat in against the seal.

Shaft Seal Seat—Installation



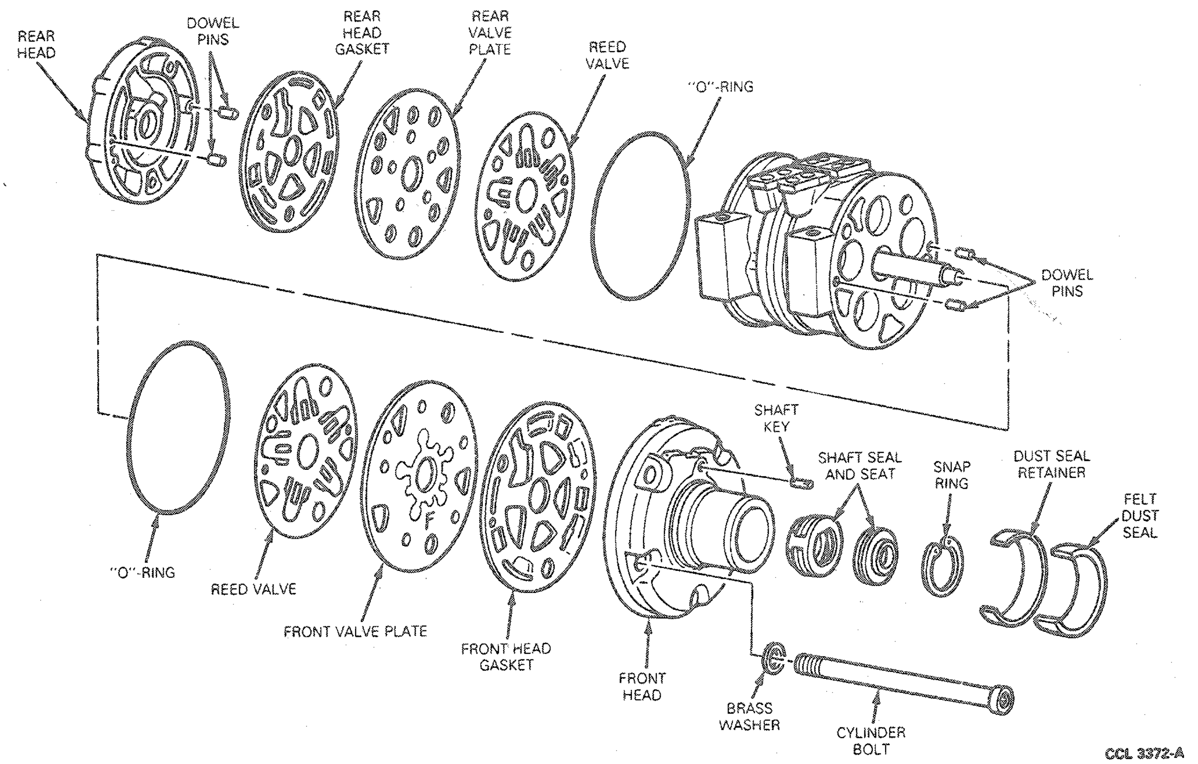
19. Install seal seat retaining snap ring into nose of compressor and push snap ring into the groove with handle end of Shaft Seal Remover / Replacer T87P-19623-C.

Pushing Seal Seat Snap Ring into Groove



MAJOR SERVICE OPERATIONS (Continued)

20. Install shaft key with rounded end inward.
21. Pour new refrigerant oil into the compressor. Refer to Adding Refrigerant Oil, During Compressor Replacement, as outlined.
22. Rotate compressor shaft about 10 revolutions to distribute oil through compressor and around shaft seal. Then leak test the shaft seal with Rotunda Electronic Leak Detector 055-00015 or equivalent.
23. Install a new felt strip and retainer into nose of compressor.



CCL 3372-A

24. Install clutch field coil with beveled side of snap ring out.
25. Install clutch pulley with bevel of snap ring out. Then install shims and clutch hub as outlined.

Head Replacement

If it is necessary to replace the front or rear head, refer to Head Gasket and O-Ring Seal, Disassembly.

SPECIFICATIONS

NOTE: Drive belt tension is maintained by an automatic tensioner. No adjustment is required.

COMPRESSOR SPECIFICATIONS

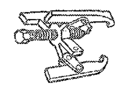
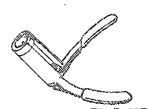
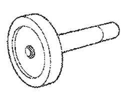
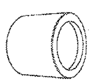
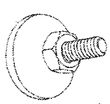
Description	Specification
Type 10P15F (10 Cylinder)	Swashplate, 5 Double Acting Pistons, Axial
Displacement	153cc (9.33 CID)
Rotation	Clockwise
Rotation Torque (Maximum Manifold Removed)	10 N·m (7 Lb-Ft)
Refrigerant Oil Type	ESH-M2C31-A2
System Capacity	8 Fluid Ounces
Part No.	E73Z-19577-A Motorcraft YN-9
Magnetic Clutch Air Gap Between Pulley & Hub	0.021-0.036 inch
Current Draw	4.67 Amps @ 12.8 Volts
Run-out (Maximum)	0.02 inch Radial or Axial

SPECIFICATIONS (Continued)

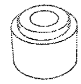
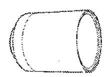
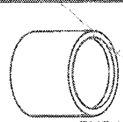
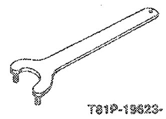
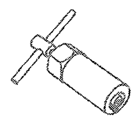
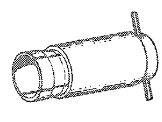
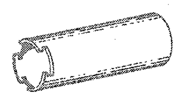
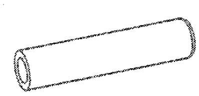
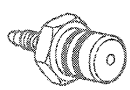
TORQUE SPECIFICATIONS

Description	N·m	Lb-Ft
Hose Manifold to Compressor Bolts	18-23	14-16
Clutch Hub Nut	13-20	10-14
Compressor Cylinder Bolts	24.5-26.5	18-19
Suction Hose to Manifold	28-36	21-26
Compressor to Mounting Bracket Bolts	40-55	30-40
Compressor Mounting Bracket to Engine	40-55	30-40
Cylinder Head Bolts	16	12
Cylinder Head Bolts	20	15
Cylinder Head Bolts	25	18

SPECIAL SERVICE TOOLS

Tool Number/ Description	Illustration
T71P-19703-B Pulley Puller Hub	 T71P-19703-B
T71P-19703-H Shaft Seal Protector	 T71P-19703-H
T71P-19703-T Snap Ring Pliers	 T71P-19703-T
T80L-19703-C Pulley Bearing Replacer	 T80L-19703-C
T80L-19703-E Clutch Pulley Support	 T80L-19703-E
T80L-19703-F Hub Driven Plate Replacer	 T80L-19703-F

(Continued)

Tool Number/ Description	Illustration
T80L-19703-G Shaft Protector	 T80L-19703-G
T80L-19703-J Puller and Bearing Tool	 T80L-19703-J
T80L-19703-K Pulley Puller Center Bolt	 T80L-19703-K
T87P-19623-C Clutch Pulley Support	 T81P-19623-J
T81P-19623-MH Spanner Wrench	 T81P-19623-MH
T81P-19623-NH Shaft Key Remover	 T81P-19623-NH
T87P-19623-BR Shaft Seal Seat Remover	 T87P-19623-BR
T87P-19623-C Shaft Seal Remover/Replacer	 T87P-19623-C
T91P-19623-AH Shaft Seal Remover	 T89P-19623-AH
T92P-19623-BH Shaft Seal Replacer	 T90P-19623-BH

SPECIAL SERVICE TOOLS (Continued)

Tool Number	Description
D80L-19703-AJ	Pulley Puller Jaws
D81P-19703-B	Complete Pulley Puller
D80L-19703-B	Pulley Hub Driven Plate Remover
D88L-19703-A	Pressure Test Plates

ROTUNDA EQUIPMENT

Model	Description
055-00015	Electronic Leak Detector

SECTION 12-03C Compressor and Clutch—FX-15

VEHICLE APPLICATION

Taurus / Sable with 3.0L and 3.8L engines.

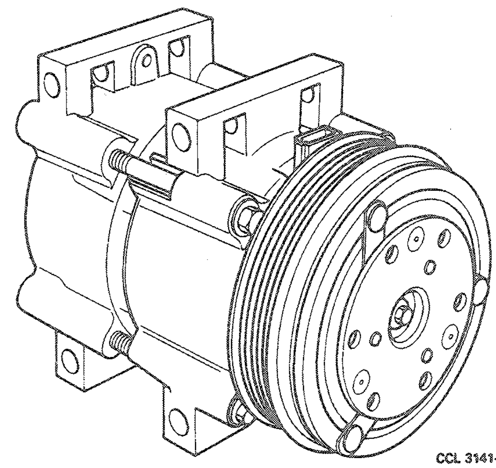
DESCRIPTION AND OPERATION

FX-15 Compressor

The FX-15 is a swashplate design ten-cylinder aluminum compressor utilizing the tangential design mount. The compressor mainshaft is driven by a belt from the engine crankshaft pulley. A one-piece lip-type seal (replaceable from the front of the compressor) is used to seal it at the shaft opening in the assembly. Five double-acting pistons, positioned axially around the compressor shaft, operate within the cylinder assembly. The pistons are actuated by a swashplate that is pressed on the compressor shaft. The swashplate changes the rotating action of the shaft to provide a reciprocating driving force to each of the five pistons. This driving force is applied, through shoes, to the midpoint of each of the double end pistons.

Reed-type discharge valves are assembled on the valve plate which is located with the suction reed valve between the cylinder assembly and the head at each end of the compressor. The heads are connected to each other by gas-tight passageways through the cylinder assembly which direct the refrigerant gas to the suction and discharge ports located in the rear head.

A magnetic clutch is used to drive the compressor shaft. When voltage is applied to the clutch field coil, the clutch plate and hub assembly (which is solidly coupled to the compressor shaft) is drawn rearward by magnetic force toward the pulley which rotates freely on the compressor front head casting. The magnetic force locks the clutch plate and hub assembly and the pulley together as one unit. The compressor shaft then turns with the pulley. When voltage is removed from the clutch field coil, springs in the clutch plate and hub assembly move the clutch plate away from the pulley. The clutch plate hub assembly and compressor shaft cease to rotate.



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DIAGNOSIS AND TESTING

Compressor Manifold Leak Test

Tools Required:

- Rotunda Electronic Leak Detector 005-00015

1. Tighten the manifold retaining bolt to 18-23 N·m (13-17 lb-ft).
2. Add refrigerant to the system if necessary.
3. Leak test the manifold O-ring seals using Rotunda Electronic Leak Detector 055-00015 or equivalent.
4. If no leaks are found, the manifold O-ring seals are good.
5. If a leak is found at the manifold and the manifold attaching bolt is tightened to 18-23 N·m (13-17 lb-ft), install new manifold O-ring seals as outlined. Then, repeat the leak test.

Compressor External Leak Test

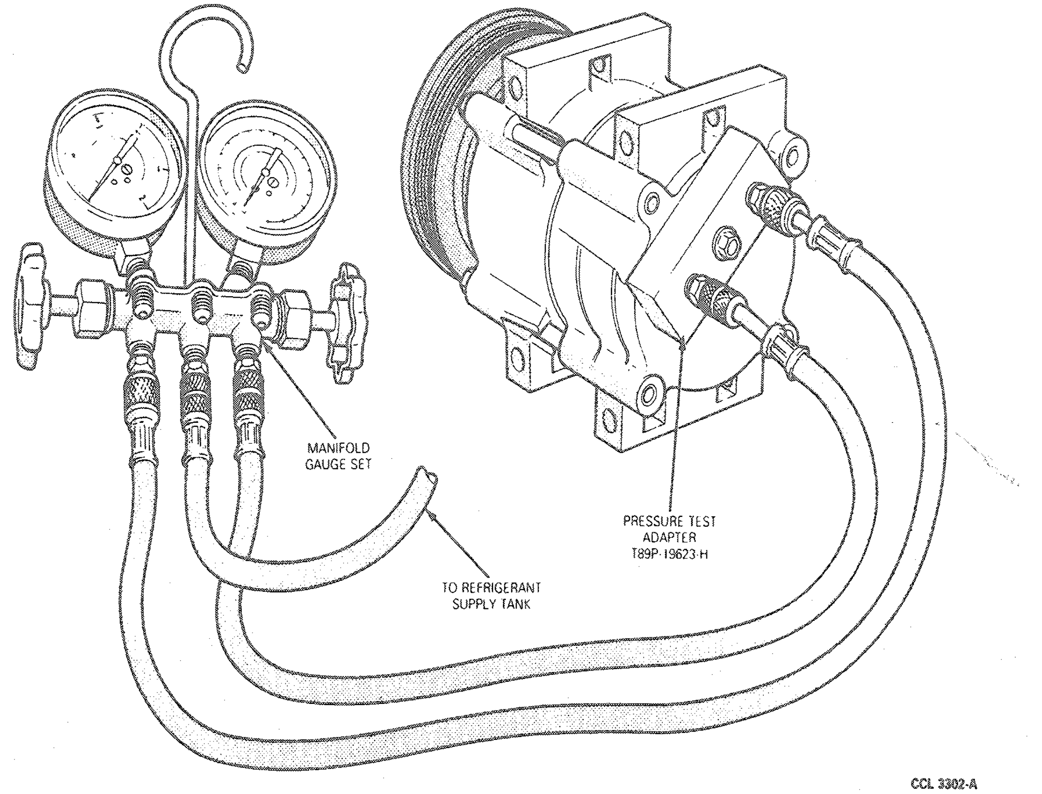
Tools Required:

- Rotunda Electronic Leak Detector 005-00015
- Pressure Test Plate T89P-19623-H

1. If the compressor is on the vehicle, discharge the system. Refer to Section 12-00. Remove the compressor from the vehicle. Observe all safety precautions.
2. Remove the manifold retaining bolt and remove the manifold from the rear head of the compressor. Install Pressure Test Adapter T89P-19623-H on the rear head of the compressor using the existing manifold attaching bolt.
3. Connect the high and low pressure lines of a manifold gauge set to the corresponding fittings on the Manifold Pressure Test Adapter.
4. Attach the center hose of the manifold gauge set to a refrigerant container standing in an upright position.
5. Using the clutch hub, hand-rotate the compressor shaft ten revolutions to distribute the oil inside the compressor.
6. Open the low pressure gauge valve, the high pressure gauge valve and the valve on the refrigerant container to allow the refrigerant vapor to flow into the compressor.
7. Using Rotunda Electronic Leak Detector 055-00015 or equivalent check for leaks at the compressor shaft seal and the compressor center seal.
8. If a shaft seal leak is found, install a new shaft seal as described in this section. If an external leak is found at the center joint of the compressor, install a new compressor assembly.
9. When the leak test is completed, close the manifold gauge valves (both high and low) as well as the valve on the refrigerant container.
10. Slowly remove the gauge set hoses from the pressure test fitting tool. (Allow the refrigerant to escape from the compressor).
11. Install the compressor on the vehicle.
12. Leak test, evacuate and charge the system. Refer to Section 12-00. Observe all safety precautions.

DIAGNOSIS AND TESTING (Continued)

Connecting Gauge Set to Check for Leaks



Compressor Rotating Torque Check

The rotational torque of a used compressor should be checked if excessive compressor drag is suspected.

1. Discharge refrigerant system. Refer to Section 12-00. Observe all safety precautions.
2. Remove refrigerant hose and manifold assembly from compressor. Use care not to allow dirt to enter compressor.
3. Remove the compressor from the vehicle. With the compressor clutch disengaged, rotate the compressor shaft and note the torque required to rotate the shaft one complete revolution. This is not the starting torque.
4. If the rotational torque exceeds 10 N·m (7 lb-ft) replace the compressor assembly.
5. If the rotational torque is less than specified, excessive drag does not exist in the compressor. Install the manifold and hose assembly and leak test, evacuate and charge the system.
6. Check the system for proper operation.

REMOVAL AND INSTALLATION

Compressor

Removal and Installation

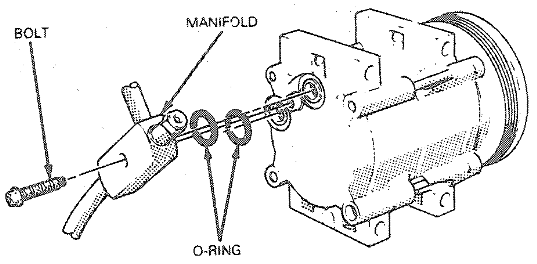
Refer to Section 12-03A.

REMOVAL AND INSTALLATION (Continued)

Manifold and Hose Assembly

Removal

1. Discharge the refrigerant from the system. Refer to Section 12-00. Remove bolt attaching manifold and hose / tube assembly to the rear head of the compressor.



CCL 3303-A

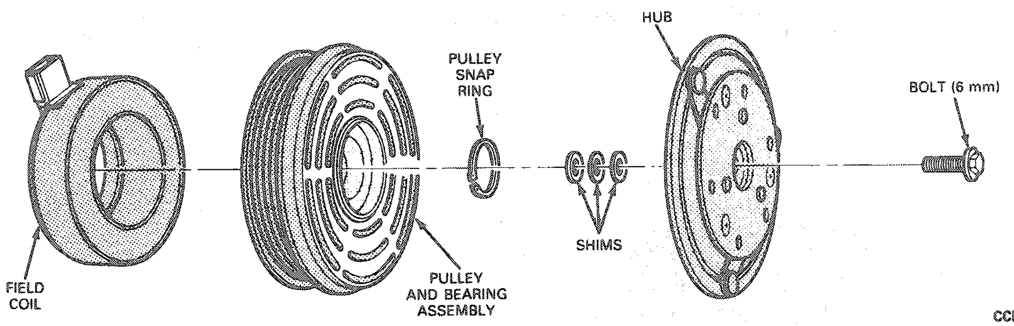
2. Disconnect other ends of suction and discharge lines. Remove any bracket attachments and remove manifold and nose / tube assembly from vehicle.

Installation

1. Lubricate new O-rings with clean refrigerant oil and position them in the O-ring grooves of the compressor rear head.
2. Position manifold and hose / tube assembly to rear head of compressor making sure manifold pilots are positioned in compressor port openings. Install manifold attaching bolt and tighten bolt to 18-23 N·m (13-17 lb-ft).
3. Connect other ends of suction and discharge lines using new lubricated O-rings. Install bracket attachments disconnected during removal.
4. Leak test, evacuate and charge the system. Refer to Section 12-00. Observe all safety precautions.

Clutch Hub and Pulley

A disassembled view of the clutch assembly and related parts is shown in the illustration.



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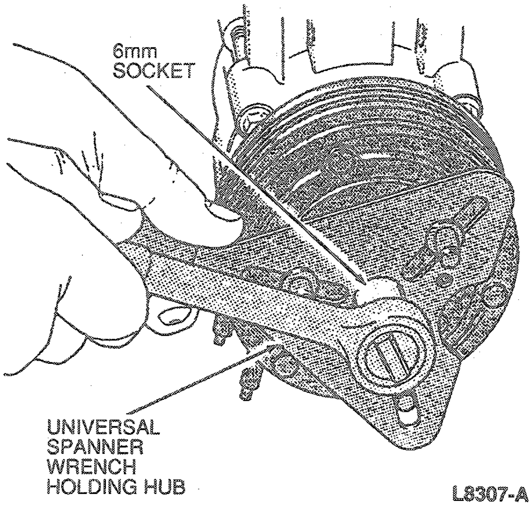
Tools Required:

- Spanner Wrench T70P-4067-A
- Snap Ring Remover T89P-19623-DH

REMOVAL AND INSTALLATION (Continued)

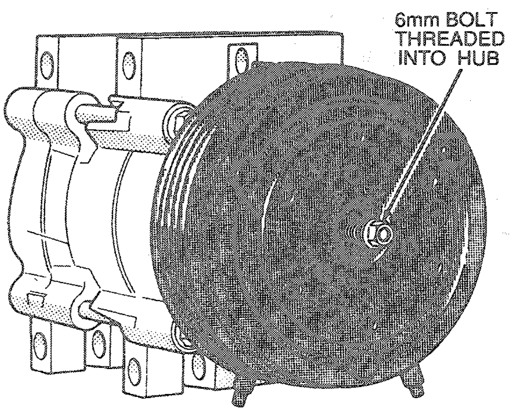
Removal

1. Remove the clutch hub retaining bolt. Use Spanner Wrench T70P-4067-A.



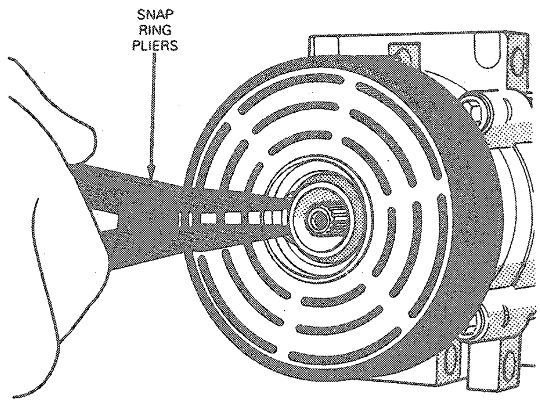
L8307-A

2. Pull clutch hub and shims from compressor shaft. If hub cannot be pulled from compressor shaft, screw a 6mm bolt into the shaft hole of the clutch hub to force the hub from the shaft.



L8308-A

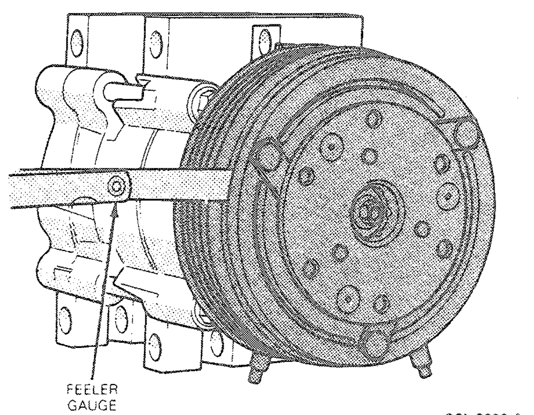
3. Remove pulley retaining snap ring.
4. Pull the pulley and bearing assembly from compressor.



CCL 3307-A

Installation

1. Clean pulley bearing surface of compressor head to remove any dirt or corrosion.
2. Install pulley and bearing assembly on compressor. The bearing is a slip-fit on the compressor head and, if properly aligned, it should slip on easily.
3. Install pulley retaining snap ring with bevel side of snap ring out.
4. Place one nominal thickness spacer shim inside the hub spline opening and slide the hub on the end of the compressor shaft.
5. Thread a new 8mm hub retaining bolt into end of compressor shaft. Tighten hub retaining bolt to 11-13 N·m (8-10 lb-ft). DO NOT USE AIR TOOLS.
6. Check clutch air gap between clutch hub and pulley mating surfaces with a feeler gauge. The air gap should be between 0.45 and 0.85mm (0.018 and 0.033 inch). Check at three locations equally spaced around the pulley.



CCL 3308-A

7. If clutch air gap is not within 0.45 to 0.85mm (0.018 to 0.038 inch), repeat Steps 4 through 6 with various thickness shims until air gap is within specified limits.

REMOVAL AND INSTALLATION (Continued)

8. When installing a new clutch, cycle it ten times at idle to burnish the clutch and prevent slippage.

Clutch Field Coil

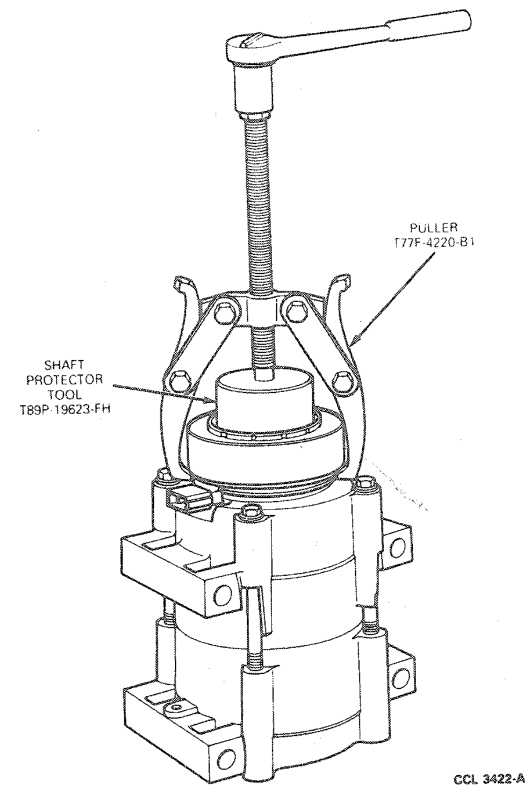
NOTE: The clutch field coil is pressed on the front head of the compressor. Special service tools are required to remove and install the coil.

Tools Required:

- Shaft Protector Tool T89P-19623-CH
- Shaft Protector T89P-19623-FH
- 2-Jaw Puller T77F-4220-B1
- Coil Pressing Tool T89P-19623-EH
- 2-Jaw Puller D80L-1002-L

Removal

1. Remove the compressor from vehicle. Refer to Section 12-03A.
2. Remove the clutch hub and pulley as described in this section..
3. Install Shaft Protector Tool T89P-19623-FH on the nose opening of the compressor.
4. Install 2-Jaw Puller T77F-4220-B1 on the compressor. Place the tip of the puller forcing screw in the center pilot of the shaft protector and the jaws of the puller around the back edge of the field coil.
5. Tighten the puller forcing screw to pull the coil from the compressor head. DO NOT USE AIR TOOLS.

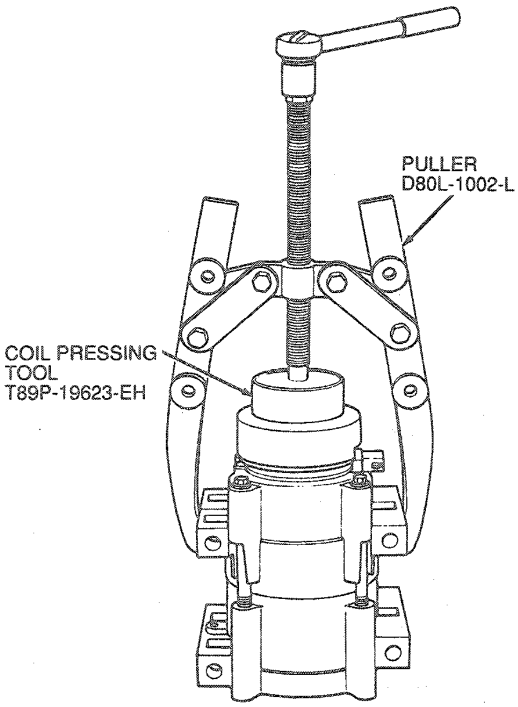


Installation

1. Clean the coil mounting surface on the front head to remove any dirt or corrosion.
2. With the compressor in a vertical position (nose up), place the field coil in position on the compressor front head. Make sure the coil electrical connector is positioned correctly.
3. Place the Coil Pressing (Installer) Tool T89P-19623-EH in position over the compressor nose and to the inner radius of the field coil.

REMOVAL AND INSTALLATION (Continued)

4. Position 2-Jaw Puller Tool D80L-1002-L or equivalent on the compressor and the coil pressing tool. The jaws of the puller should be firmly engaged with the rear side of the compressor front mounts. The forcing screw must be piloted on the center mark of the pressing tool.



L7716-A

5. Tighten the forcing screw with a hand wrench until the coil is pressed on the compressor front head. DO NOT USE AIR TOOLS. Check to make sure that the field coil bottoms against the head at all points around the coil outer diameter.
6. Install the clutch pulley and hub on the compressor as outlined. Adjust the air gap, as necessary.
7. Install the compressor on the vehicle following the recommended procedure.

Shaft Seal

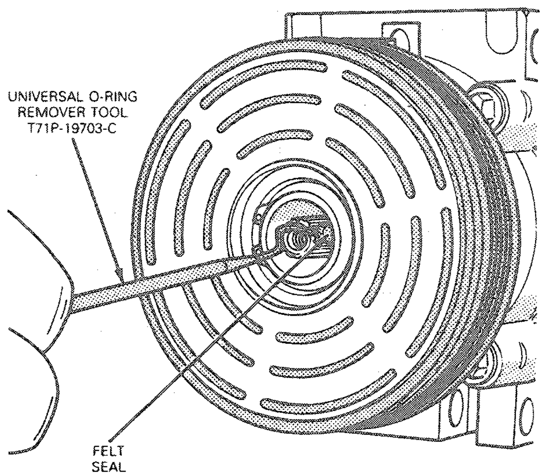
The refrigerant system must be discharged and the compressor must be removed from the vehicle prior to replacing the compressor shaft seal. Refer to Section 12-00.

Tools Required:

- O-Ring Tool T71P-19703-C
- Snap Ring Remover T89P-19623-DH
- Shaft Seal Remover Tool T89P-19623-BH
- Shaft Seal Protector T89P-19623-CH
- Shaft Seal Installer Tool T89P-19623-AH

Removal

1. Remove clutch hub from compressor as outlined.
2. Remove shaft seal felt from nose of compressor with O-ring Remover T71P-19703-C.

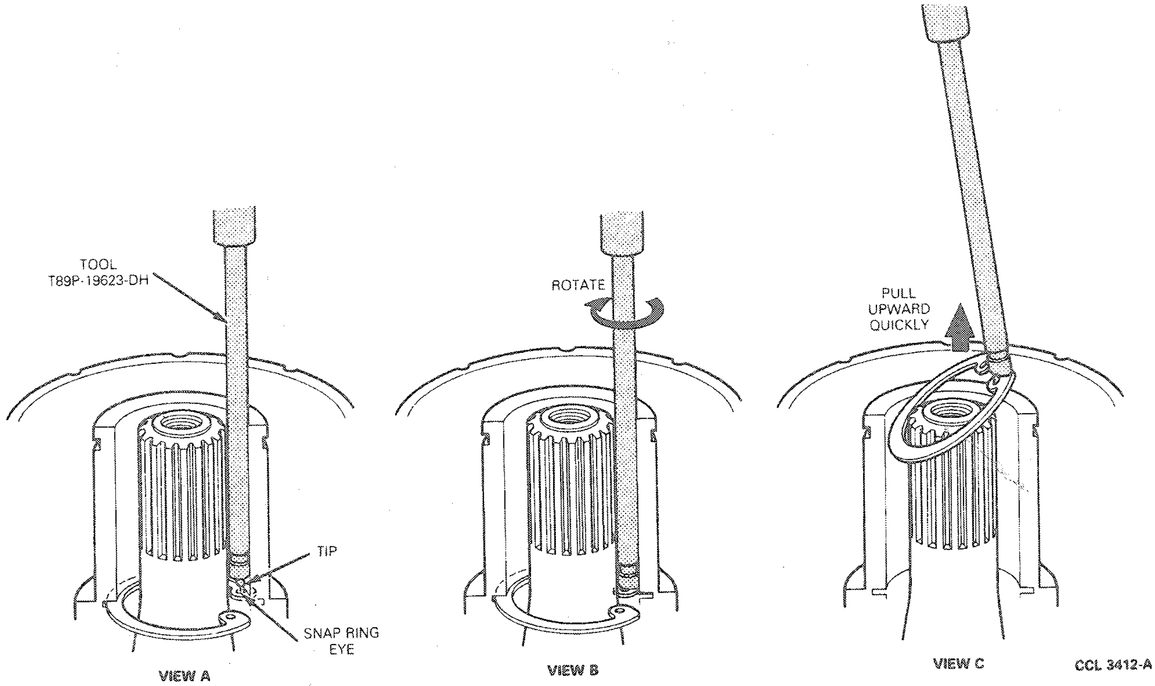


CCL 3309-A

3. Blow any debris from inside the compressor nose with **low pressure** compressed air. Then clean the inside and outside nose area of the compressor with a lint free cloth to remove any oil and dirt.
4. Remove shaft seal retaining snap ring from inside compressor nose with Snap Ring Remover T89P-19623-DH as described in the following steps. Refer to the illustrations.
5. Insert the tip of the Snap Ring Remover T89P-19623-DH into one of the snap ring eyes (View A).
6. Rotate the snap ring remover to position the tool tip and the snap ring eye closest to the compressor shaft (View B).
7. Pull the snap ring remover up quickly while keeping the tool shaft against the side of the nose opening and remove the snap ring (View C).

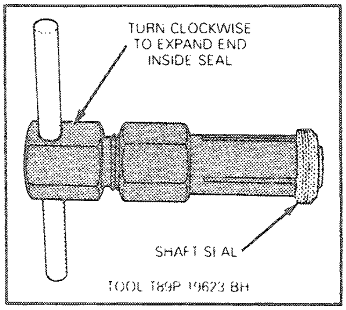
REMOVAL AND INSTALLATION (Continued)

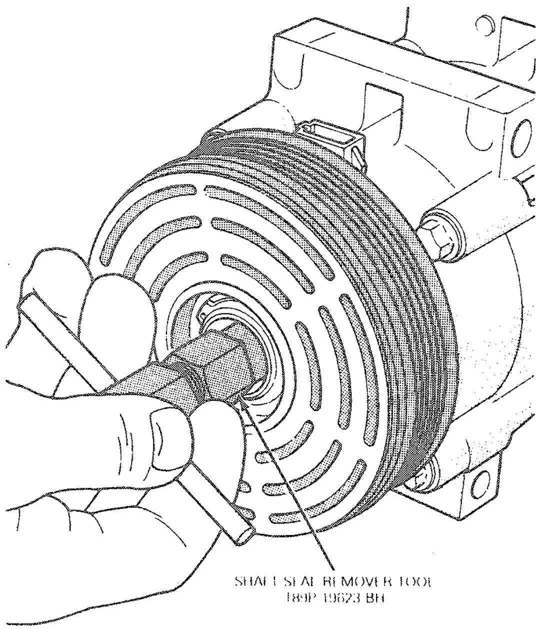
Snap Ring Removal



REMOVAL AND INSTALLATION (Continued)

8. Position Shaft Seal Remover Tool T89P-19623-BH over compressor shaft and push tool into nose of compressor and down against shaft seal. Engage end of tool with internal diameter of shaft seal. While holding the hex part of the tool, turn tool handle clockwise to expand tool tip inside seal inner radius. Then, pull shaft seal from the compressor with the tool.





CCL 3310-A

Installation

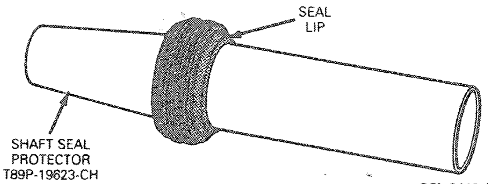
1. Obtain a new Shaft Seal Kit (Basic Part No. 19D665). Carefully remove the contents of the kit from the package. A plastic shaft seal protector is included with each kit. Inspect the protector for any burrs or other damage. Do not use the protector if it is damaged. Obtain another shaft seal kit, if necessary, and use the protector from it.

   CAUTION: Do not use protector if it is damaged. Obtain another shaft seal kit and use protector from it.

2. Using a clean lint free cloth, clean the compressor shaft and the seal pocket inside the compressor nose.

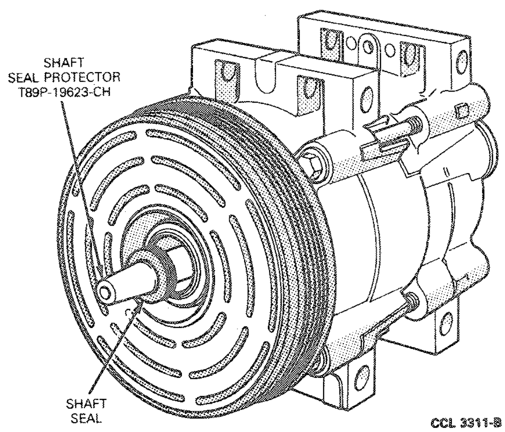
   CAUTION: Do not allow any dirt or foreign materials to enter the compressor.

3. Dip the shaft seal protector and shaft seal in clean Refrigerant Oil (E73Z-19577-A). Position the shaft seal on the protector with the lip of the seal pointing toward the large end of the protector.



CCL 3413-A

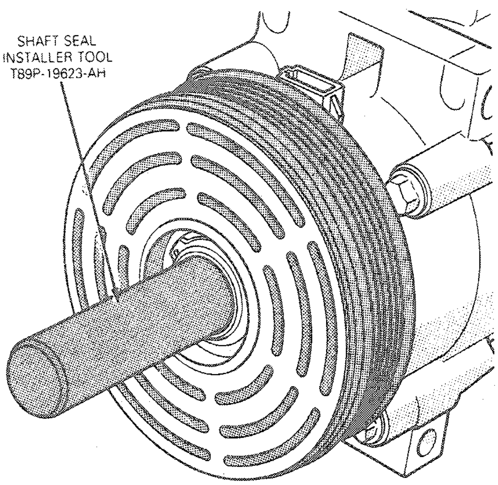
4. Place the shaft seal protector with shaft seal over the end of the compressor shaft.



CCL 3311-B

REMOVAL AND INSTALLATION (Continued)

5. Using Shaft Seal Installer Tool T89P-19623-AH, slowly push seal down shaft protector onto compressor shaft until seated.



CCL 3312-A

6. Remove installer tool and shaft protector from compressor shaft.
7. Place a new shaft seal retaining snap ring into the compressor nose opening and seat the snap ring into the groove.
8. Leak test the shaft seal installation after rotating the compressor shaft about ten revolutions with the clutch hub. Refer to Compressor External Leak Test.
9. Install a new shaft seal felt in nose of compressor.
10. Install clutch hub on compressor as outlined.
11. Check and adjust the air gap as necessary.

MAINTENANCE

Adding Refrigerant Oil

The FX-15 compressor uses a unique high-quality refrigerant oil (E73Z-19577-A), Motorcraft Part Number YN-9 or an equivalent refrigerant oil meeting Ford specification ESH-M2C31-A2. An oil charge of 207 ml (7 oz) is used in a new system. It is extremely important that only the specified type and quantity of refrigerant oil be used in the FX-15 compressor. If there is a surplus of oil in the system, it will circulate with the refrigerant, reducing the cooling capacity of the system. Using too little oil or oil not meeting the Ford specification will result in poor lubrication of the compressor.

When replacing a component of the refrigerant system, the procedures in this section must be followed to ensure that the total oil charge in the system is correct after the new part is installed.

When the compressor is operated, oil gradually leaves the compressor and is circulated through the system with the refrigerant. Eventually, a balanced condition is reached in which a certain amount of oil is retained in the compressor and a certain amount is continually circulated. If a component of the system is removed after the system has been operated, some oil will go with it. To maintain the original total oil charge add oil as required to the new replacement part.

The procedures for replacing oil are as follows:

During Compressor Replacement

A new service replacement FX-15 compressor contains 207 ml (7 oz) of refrigerant oil. Prior to installing the replacement compressor, drain the refrigerant oil from the removed compressor into a calibrated container. Then, drain the refrigerant oil from the new compressor into a clean calibrated container.

- If the amount of oil drained from the removed compressor was between 90 and 148 ml (3 and 5 oz), pour the same amount of clean refrigerant oil into the new compressor.
- If the amount of oil that was removed from the old compressor is greater than 148 ml (5 oz), pour 148 ml (5 oz) of clean refrigerant oil into the new compressor.
- If the amount of refrigerant oil that was removed from the old compressor is less than 90 ml (3 oz), pour 90 ml (3 oz) of clean refrigerant oil into the new compressor.

NOTE: The suction accumulator / drier and orifice tube should also be replaced when the compressor is replaced.

During Component Replacement

When replacing other components of the air conditioning system, measured quantities of the specified refrigerant oil should be added to the component to ensure that the total oil charge in the system is correct before the system is operated.

Clean refrigerant oil should be poured directly into the replacement components as follows:

- Evaporator core: add 90 ml (3 oz).
- Condenser: add 30 ml (1 oz).
- Accumulator: drain oil from removed accumulator / drier. Add same amount plus 60 ml (2 oz) of clean refrigerant oil to new accumulator.

If any other component such as an orifice tube or a hose is replaced, no additional refrigerant oil is necessary unless a hose bursts with a fully charged system. Then, the addition of refrigerant oil may be necessary with the amount to be determined by the technician. The suction accumulator / drier should also be replaced under these circumstances.

SPECIFICATIONS

COMPRESSOR SPECIFICATIONS

Description	Specification
TYPE	SWASHPLATE, 5 DOUBLE ACTING PISTONS — AXIAL TYPE
DISPLACEMENT	10.4 CID (170cc)
CYLINDER BORE (Dia.)	29.0mm
STROKE	25.7mm
ROTATION	CLOCKWISE
ROTATIONAL TORQUE (Maximum, manifold removed)	10 N·m — (7 Lb-Ft)
REFRIGERANT OIL Ford Specification	ESH-M2C31-A2
Capacity (System Total)	207 ml (7 ounces) 295 ml (10 ounces) with auxiliary A/C
Part Number	E73Z-19577-A Motorcraft YN-9
MAGNETIC CLUTCH Air Gap Between Pulley and Hub	0.45mm-0.85mm (0.018-0.033 inch)
Current Draw	4.36 Amps @ 12.8 volts
Run-Out (Maximum)	0.02 Inch-Radial or Axial
TORQUE LIMITS Hose & Manifold Assy. to Compressor Bolt	18-23 N·m (13-17 Lb-Ft)
Clutch Hub Bolt	11-13 N·m (8-10 Lb-Ft)

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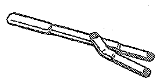
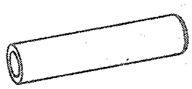
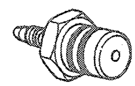
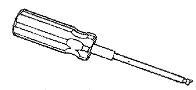
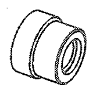
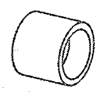
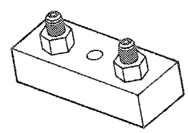
SPECIAL SERVICE TOOLS

Tool Number/ Description	Illustration
T70P-4067-A Spanner Wrench	 T70P-4067-A
T71P-19703-C O-Ring Tool	 T71P-19703-C
T89P-19623-AH Seal Installer Tool	 T89P-19623-AH

(Continued)

Tool Number/ Description	Illustration
T89P-19623-BH Shaft Seal Remover Tool	 T89P-19623-BH
T89P-19623-CH Shaft Protector Tool	 T89P-19623-CH
T89P-19623-DH Snap Ring Remover	 T89P-19623-DH
T89P-19623-EH Coil Pressing (Installer) Tool	 T89P-19623-EH
T89P-19623-FH Shaft Protector Tool	 T89P-19623-FH
T89P-19623-H Pressure Test Fitting Tool	 T89P-19623-H

Tool Number	Description
D80L-1002-L	2-Jaw Puller

ROTUNDA EQUIPMENT

Model	Description
055-00015	Electronic Leak Detector