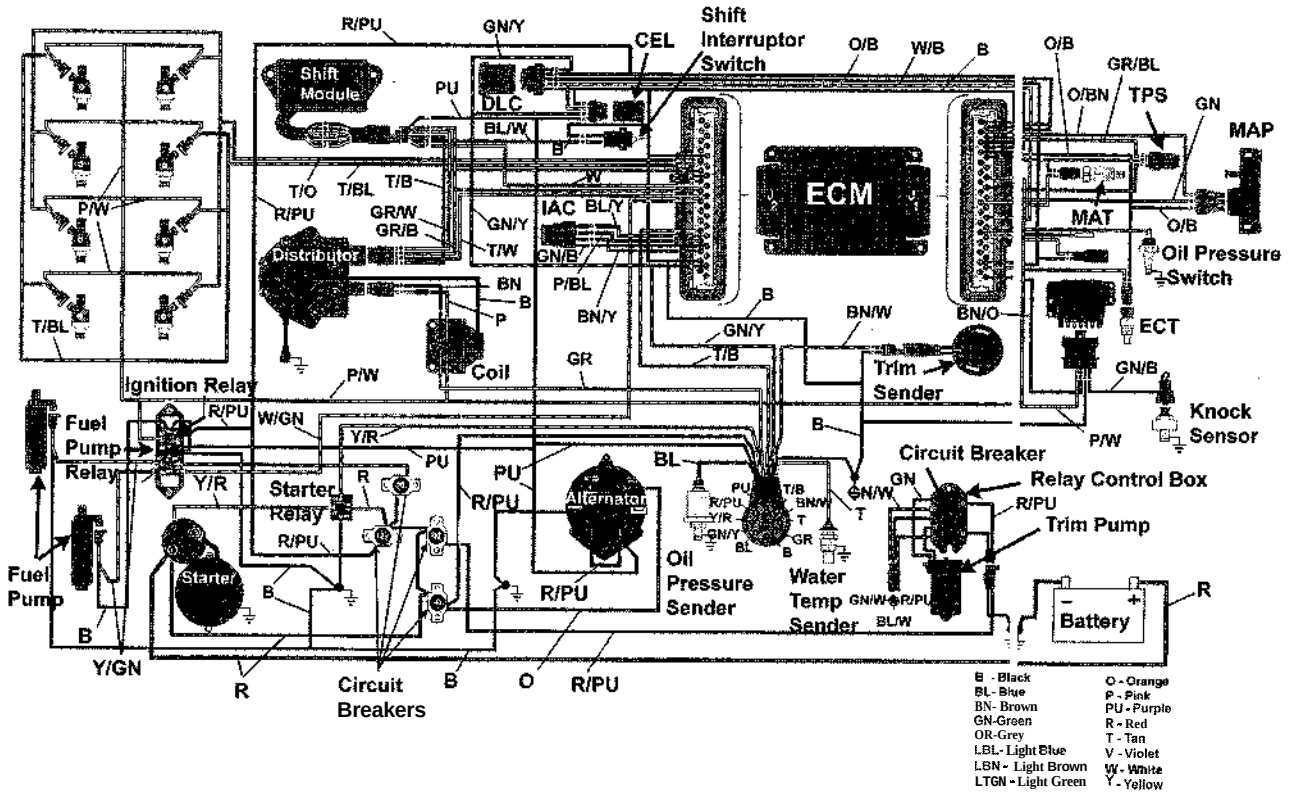
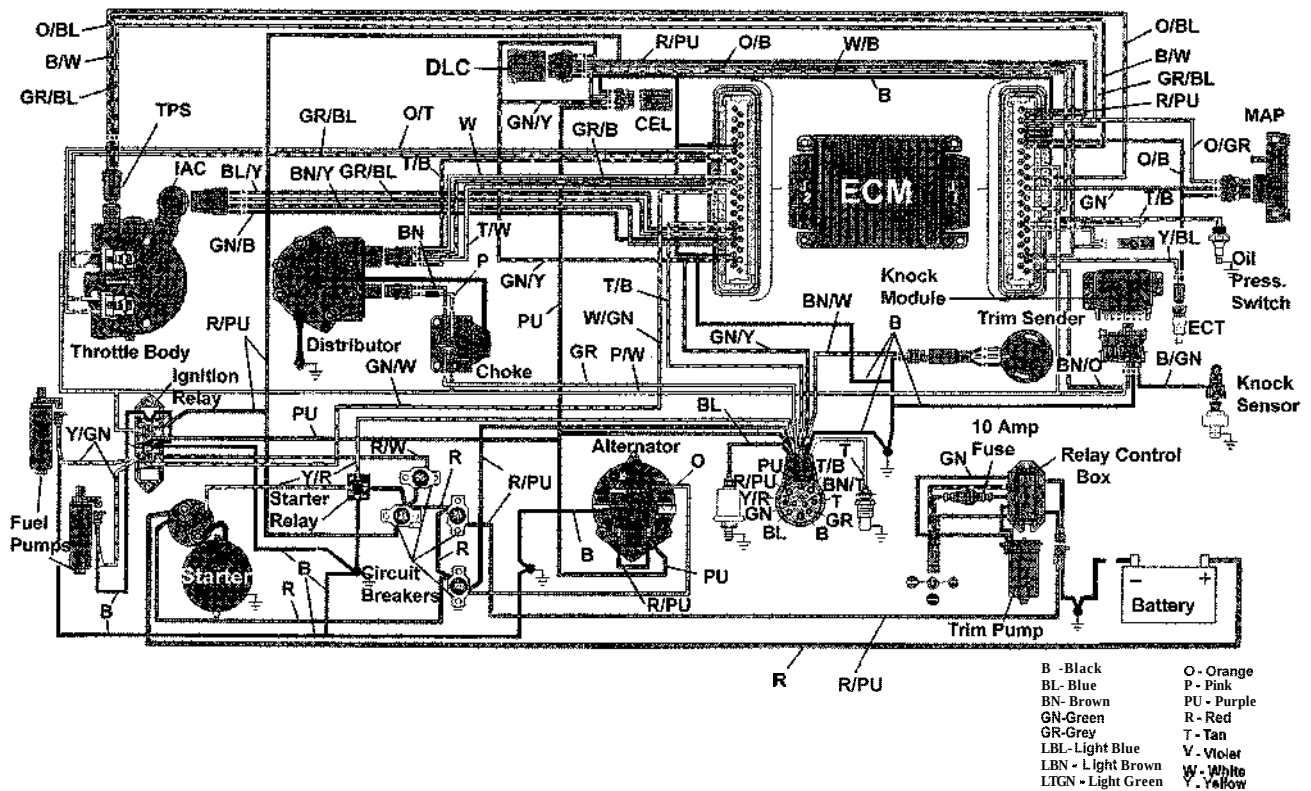




**Fig. 190 Engine wiring schematic—1995 7.4 EFI GM engines w/King Cobra**



**Fig. 191 Engine wiring schematic—1996 4.3Gi and 5.7Gi GM engines**

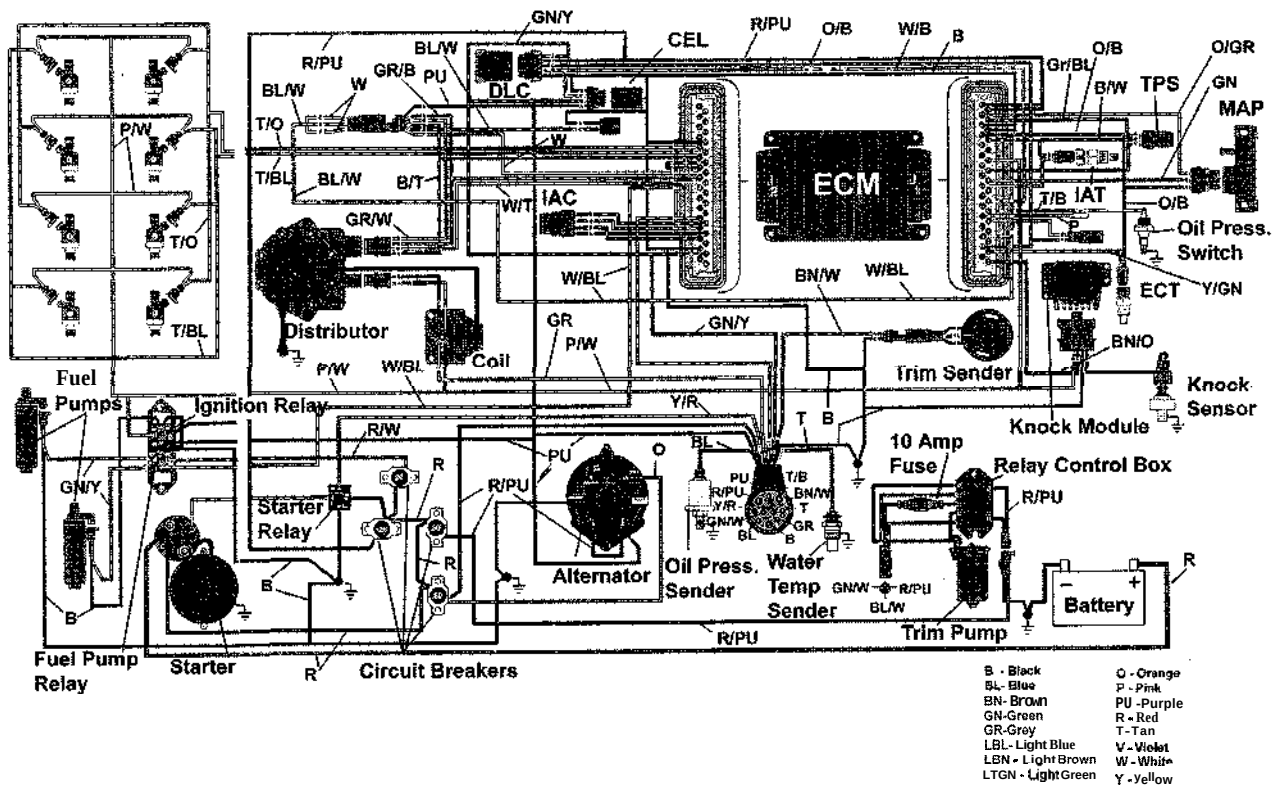


Fig. 192 Engine wiring schematic—1996 4.3L GM engines w/King Cobra

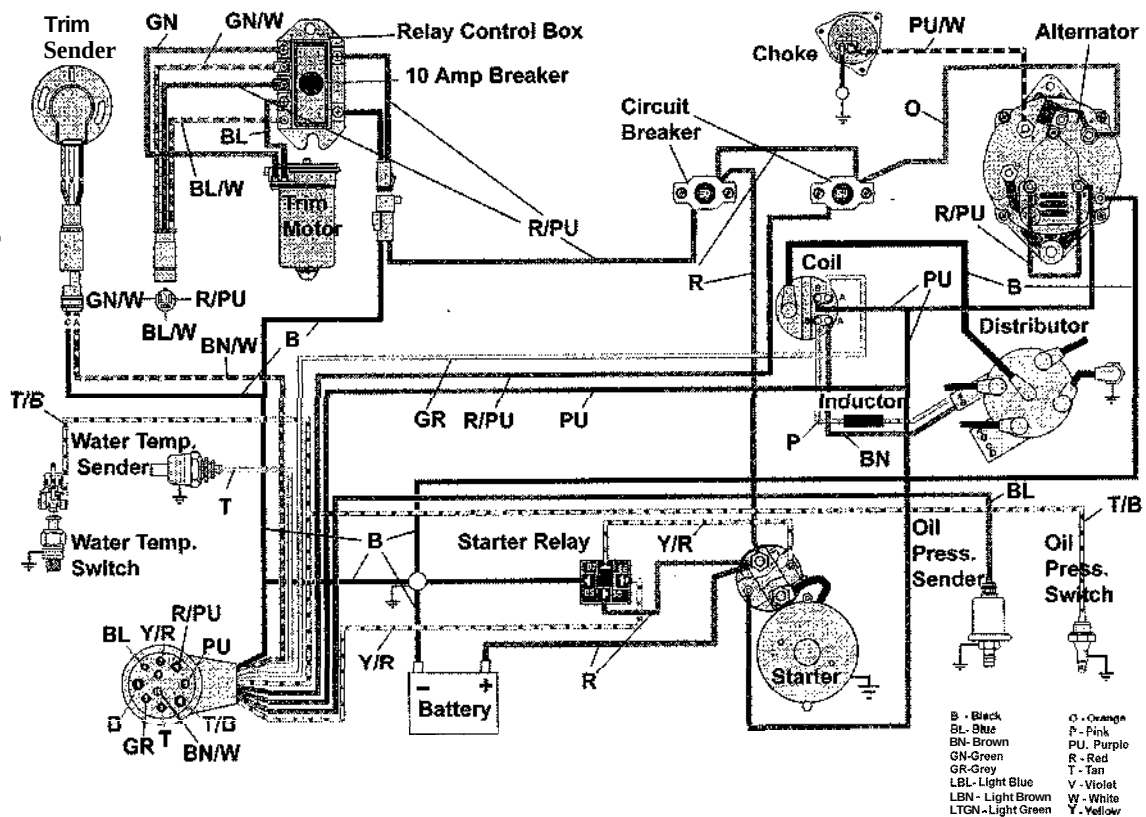


Fig. 193 Engine wiring schematic—1997-98 3.0L GM engines

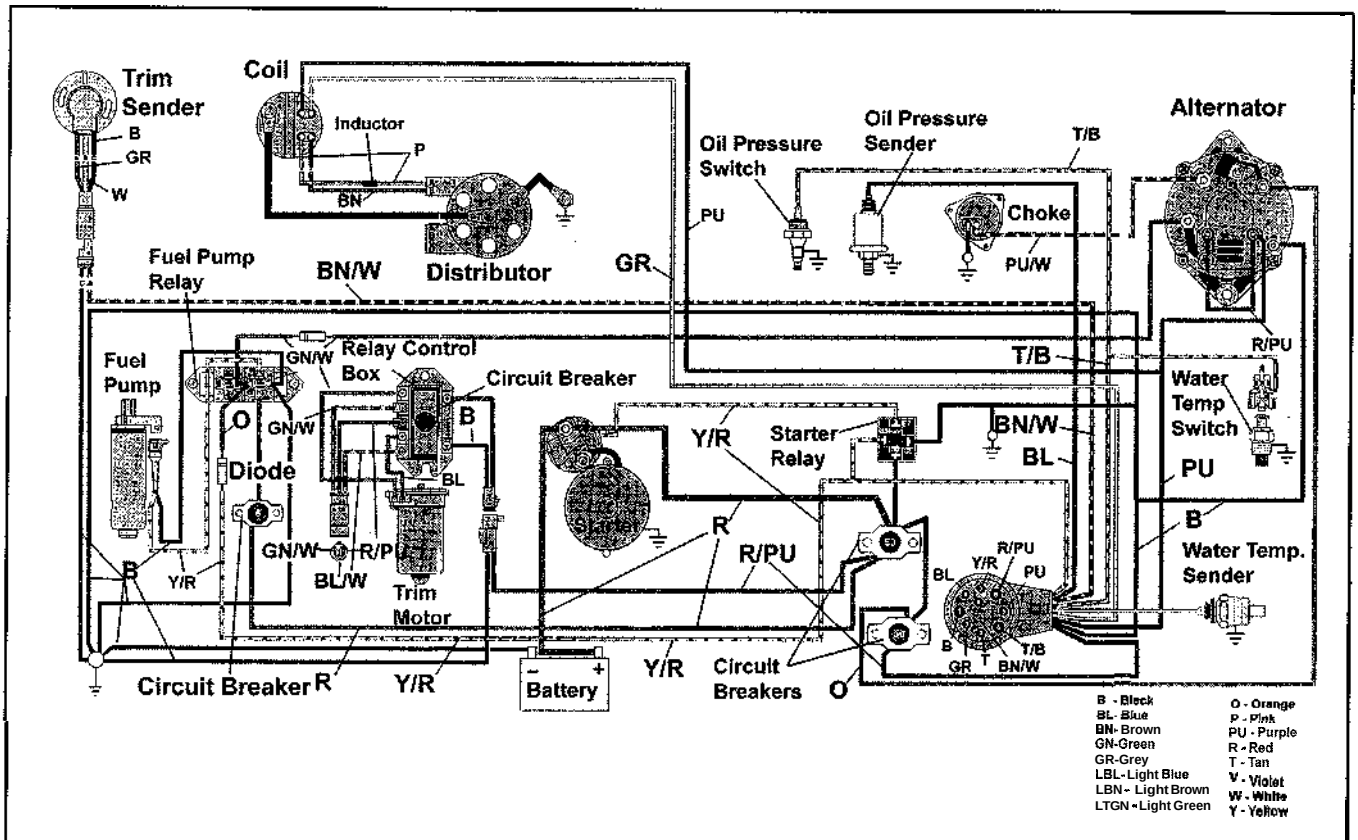


Fig. 194 Engine wiring schematic—1997-98 4.3GL/GS GM engines

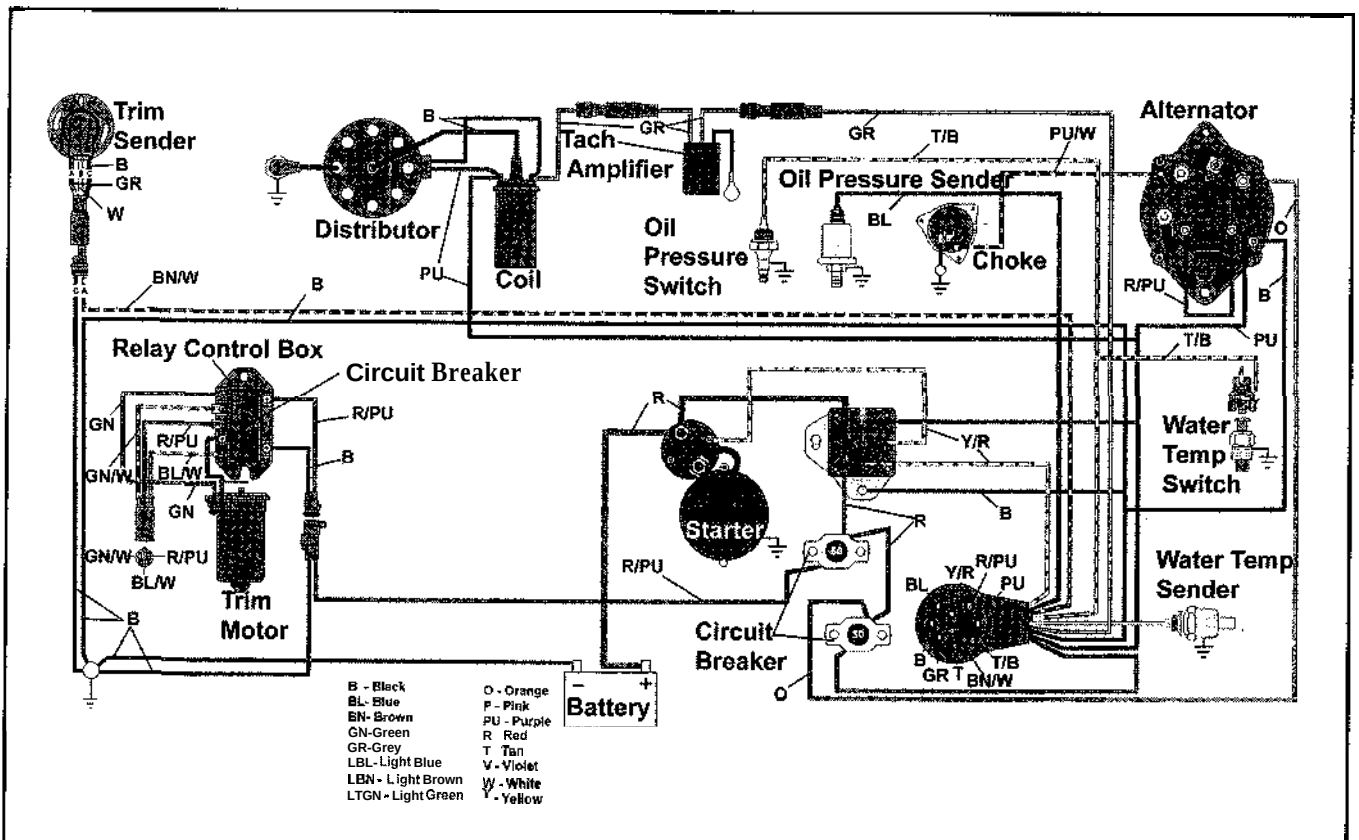
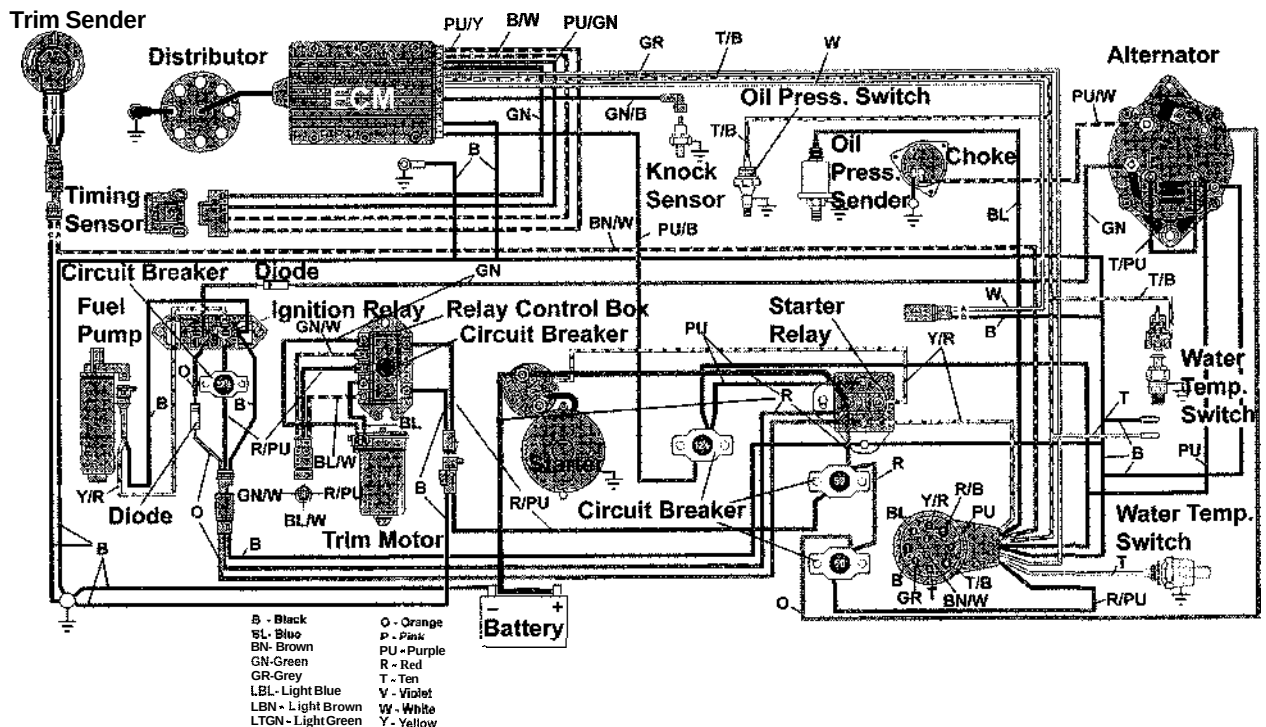
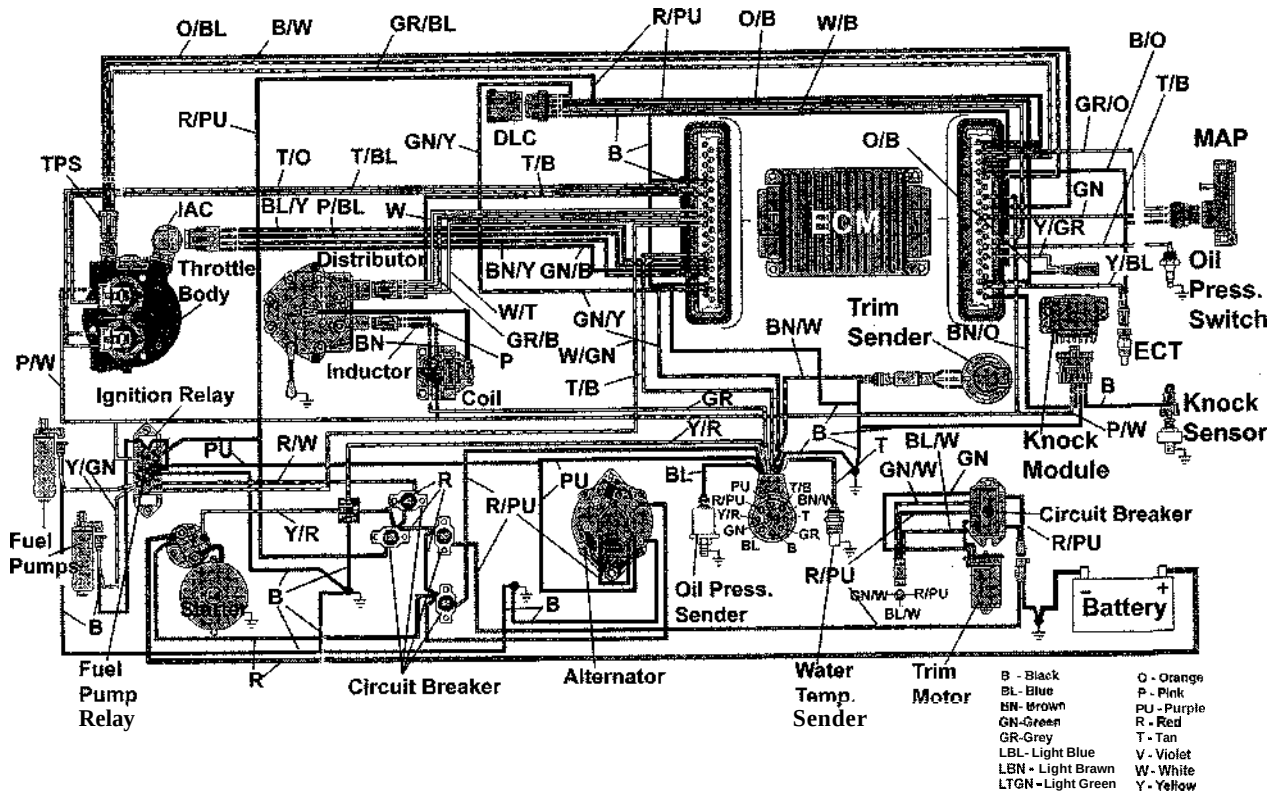


Fig. 195 Engine wiring schematic—1997-98 5.7GL/GS GM engines



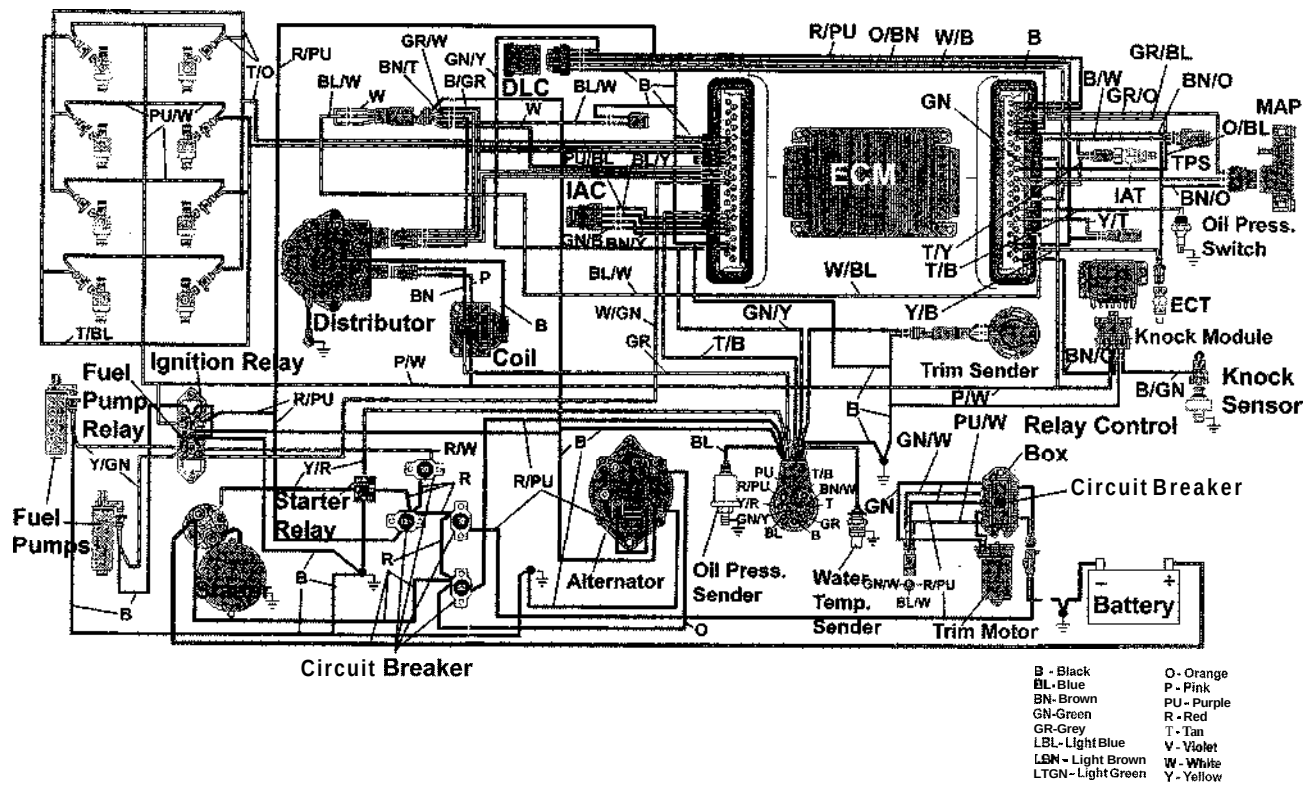


Fig. 198 Engine wiring schematic—1997 7.4Gi GM engines

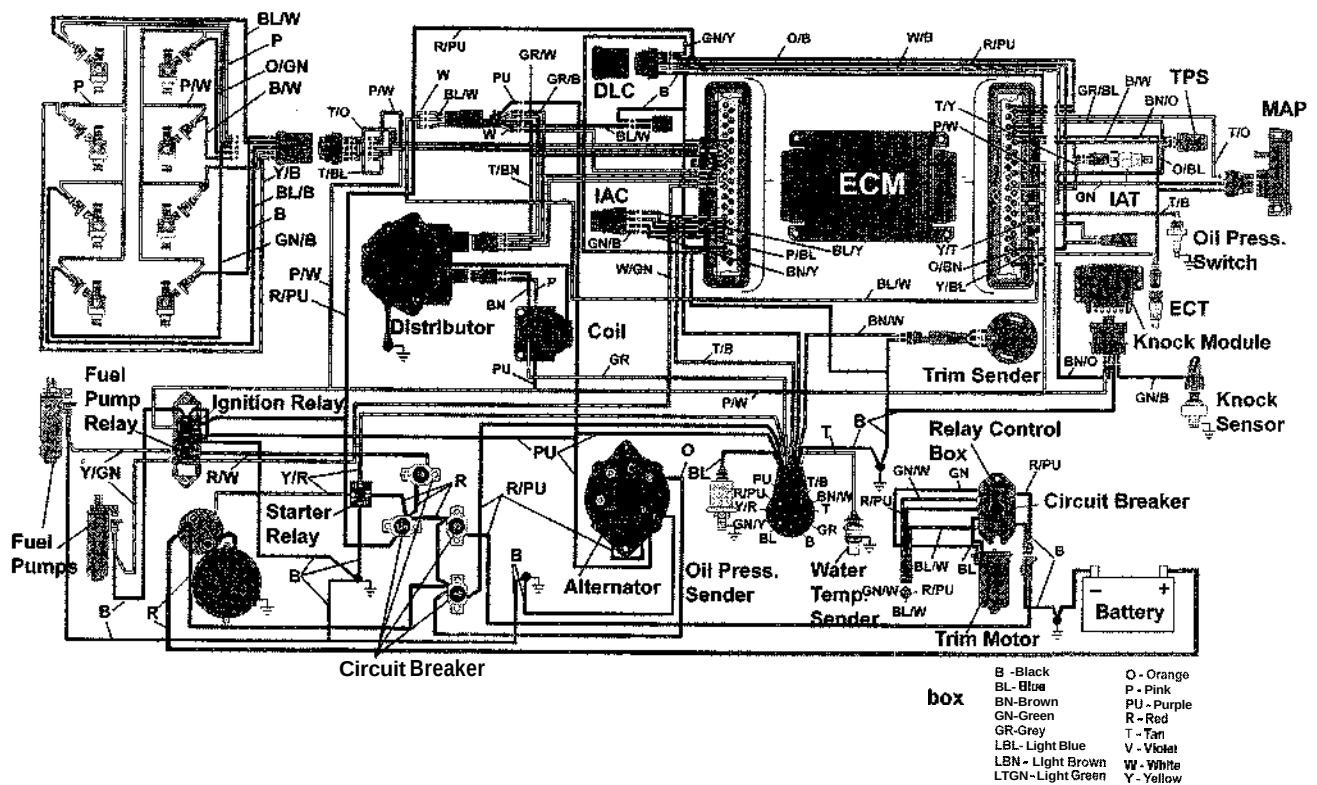


Fig. 199 Engine wiring schematic—1998 7.4Gi GM engines

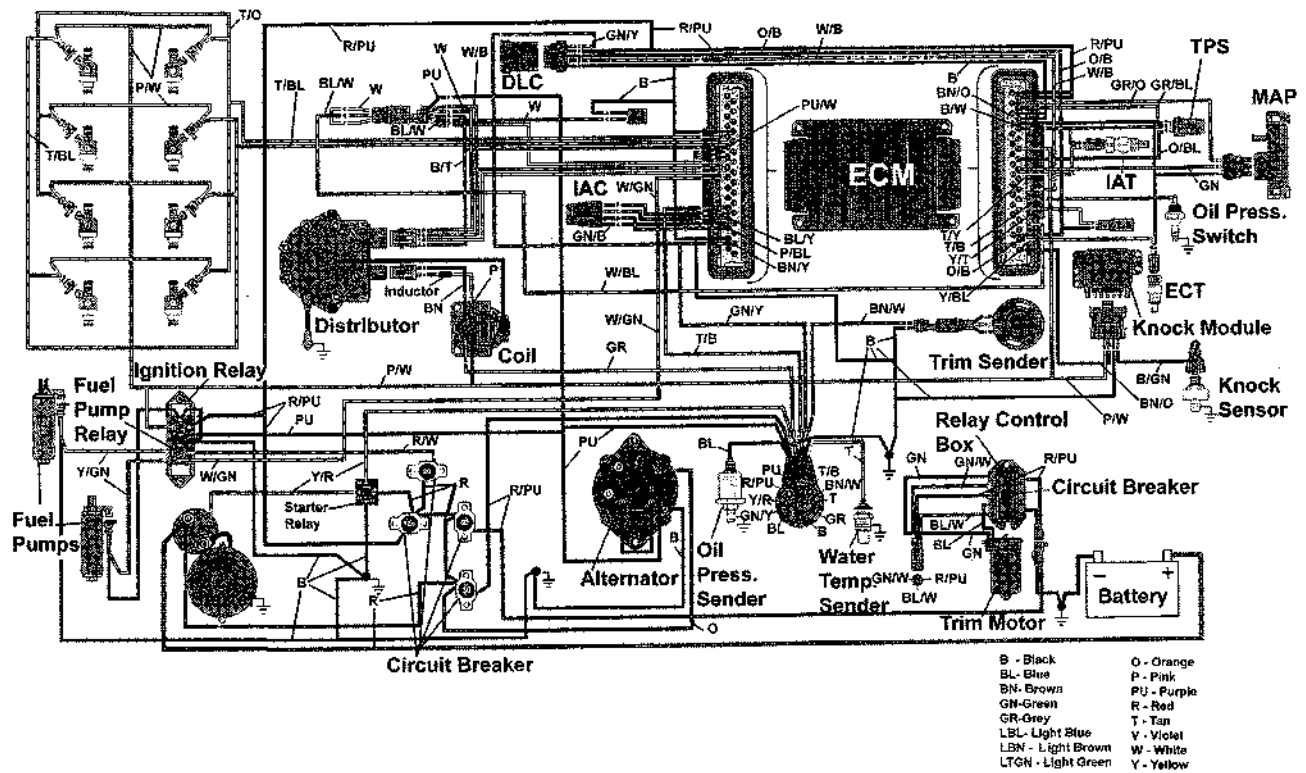


Fig. 200 Engine wiring schematic—1998 7.4GSI and 8.2GSI GM engines

## MAIN HARNESS

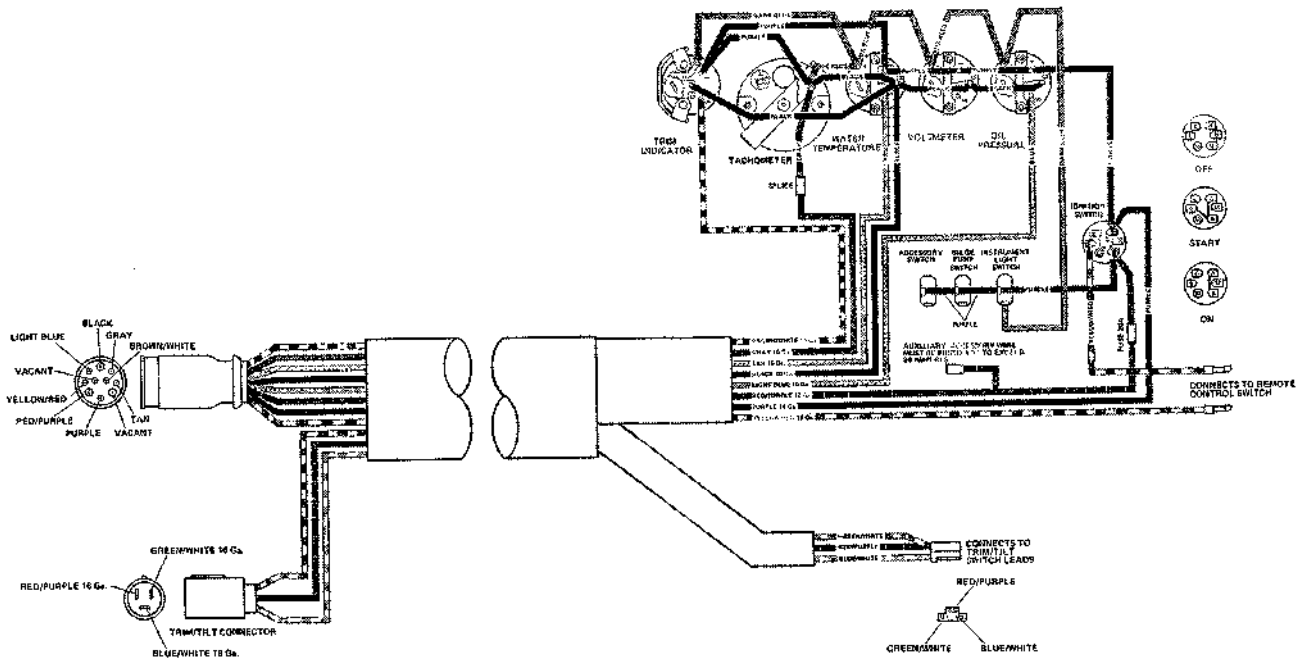
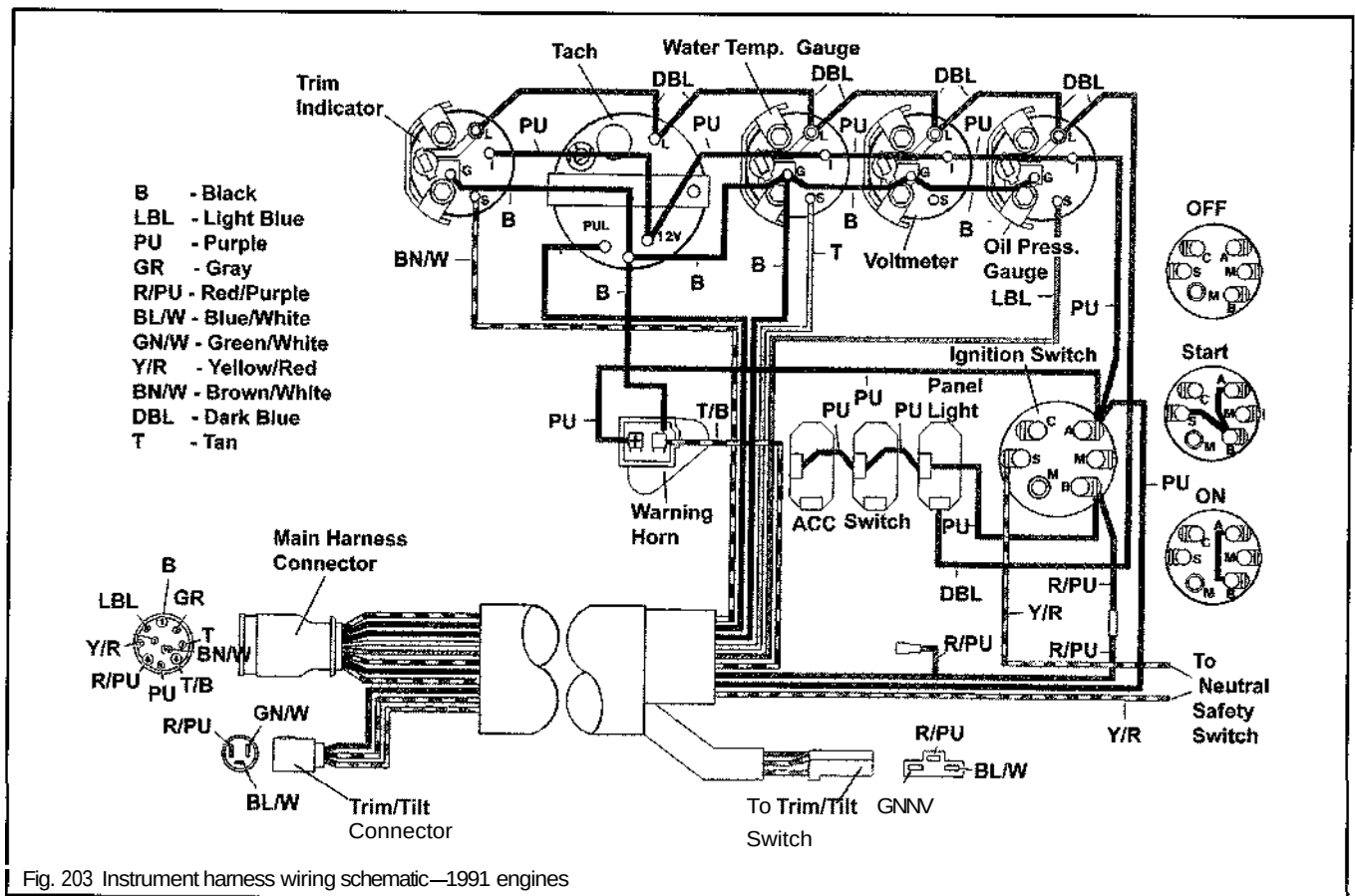
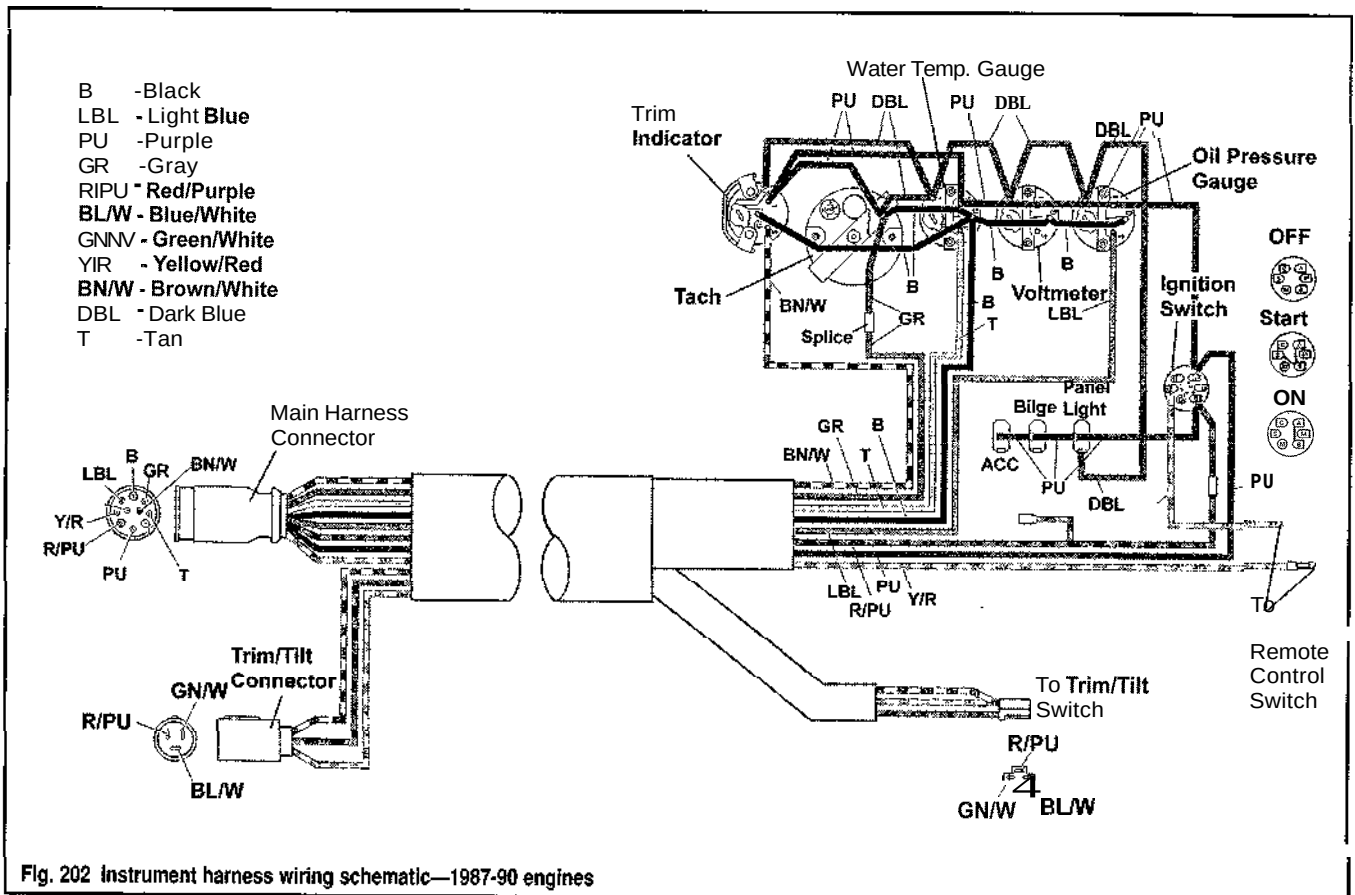


Fig. 201 Instrument harness wiring schematic—1986 engines



# 10-88 IGNITION AND ELECTRICAL SYSTEMS

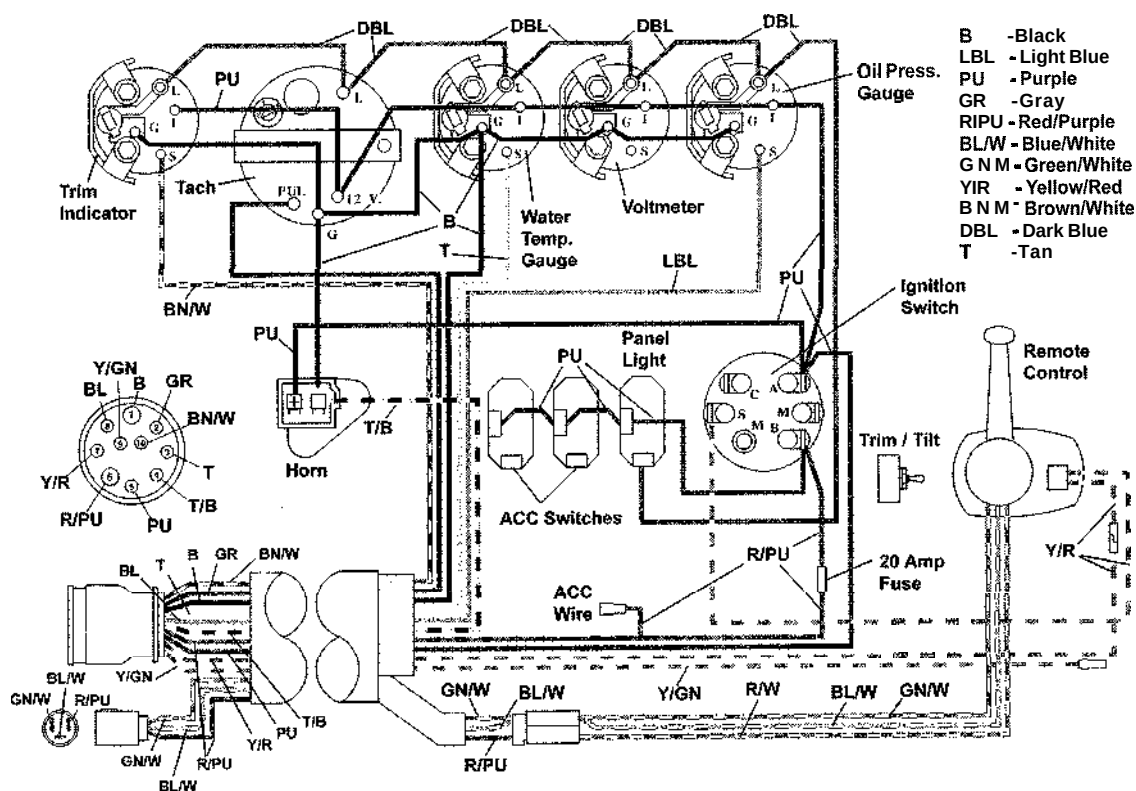


Fig. 204 Instrument harness wiring schematic—1992-93 engines

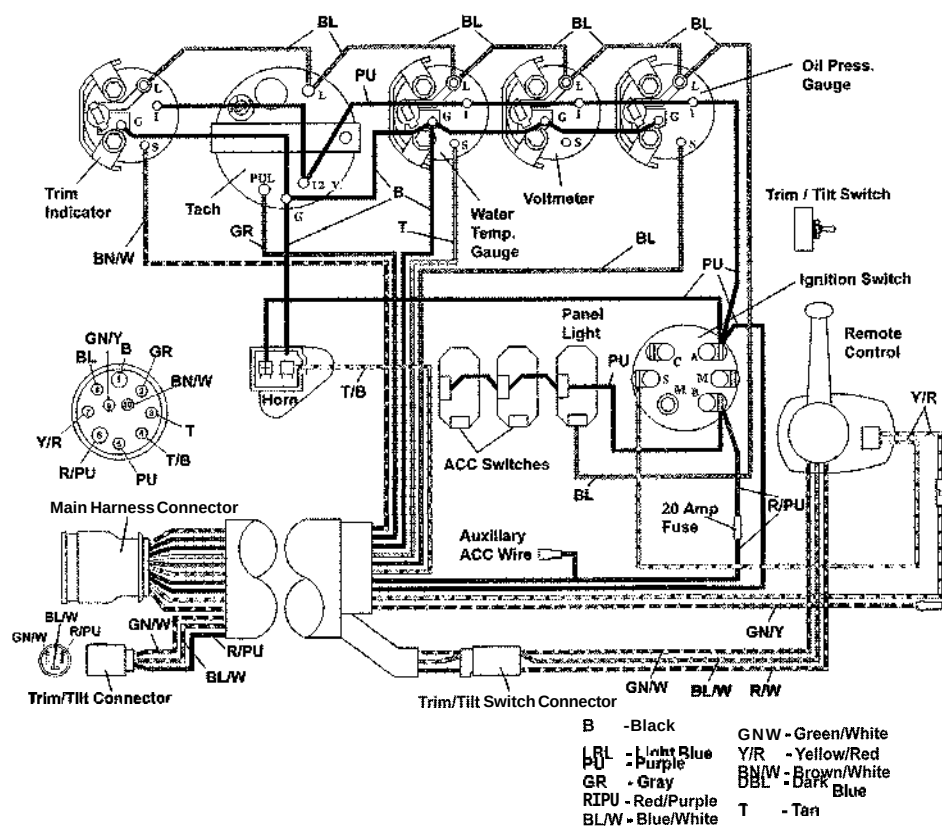


Fig. 205 Instrument harness wiring schematic—1994-98 engines

## SPECIFICATIONS

### ALTERNATOR TEST SPECIFICATIONS 1986

| Model        | Voltage Range (Volts) | Output (Amps) | Regulator | Belt Tension (in.) | Max. Output @ 600 rpm (Amps) | Max. Output @ 2000 rpm (Amps) | AC Stud (Volts) | Condenser Capacity (Microfareds) ① |
|--------------|-----------------------|---------------|-----------|--------------------|------------------------------|-------------------------------|-----------------|------------------------------------|
| Delcotron 42 | 13.9-15.5             | 42            | Internal  | 1/4-1/2            | 18                           | 37                            | 7-8             | +/- 0.1                            |

① Variation to the number stamped on the capacitor base

### ALTERNATOR TEST SPECIFICATIONS 1987-90

| Model | Voltage Range (Volts) | Output (Amps) | Regulator | Belt Tension (in.) | Max. Output @ 650 rpm (Amps) | Max. Output @ 1500 rpm (Volts) | Max. Output @ 3000 rpm (Amps) | AC Stud (Volts) | Condenser Capacity (Microfareds) |
|-------|-----------------------|---------------|-----------|--------------------|------------------------------|--------------------------------|-------------------------------|-----------------|----------------------------------|
| 51    | 13.9-14.7             | 51            | Internal  | 1/4-1/2            | 20                           | 13.9-14.7                      | 45                            | 7-8             | 0.4-0.6                          |

### ALTERNATOR TEST SPECIFICATIONS 1991-92

| Model | Min. Engine Speed @ Output (rpm) | Voltage Range (Volts) | Output (Amps) | Regulator | Belt Tension (in.) | Max. Output @ 650 rpm (Amps) | Max. Output @ 1700 rpm (Amps) | Light Stud (Volts) | AC Stud (Volts) | Condenser Capacity (Microfareds) |
|-------|----------------------------------|-----------------------|---------------|-----------|--------------------|------------------------------|-------------------------------|--------------------|-----------------|----------------------------------|
| 51    | 400                              | 13.9-14.7             | 51            | Internal  | 1/4-1/2            | 20                           | 51                            | 13.9-14.7          | 7-8             | 0.40-0.6                         |

### ALTERNATOR TEST SPECIFICATIONS 1993-96

| Model | Min. Engine Speed @ Output (rpm) | Voltage Range (Volts) | Output (Amps) | Regulator | Belt Tension (in.) | Max. Output @ 650 rpm (Amps) | Max. Output @ 1500 rpm (Amps) | Max. Output @ 2000 + rpm (Amps) | Light Stud (Volts) | AC Stud (Volts) | Condenser Capacity (Microfareds) |
|-------|----------------------------------|-----------------------|---------------|-----------|--------------------|------------------------------|-------------------------------|---------------------------------|--------------------|-----------------|----------------------------------|
| 51    | 400                              | 13.9-14.7             | 51            | Internal  | 1/4-1/2            | 20                           | 47                            | 51                              | 13.9-14.7          | 7-8             | 0.4-0.6                          |
| 65    | 400                              | 13.5-14.8             | 65            | Internal  | 1/4-1/2            | 20                           | 53                            | 56                              | 13.5-14.8          | 7-8             | 0.4-0.6                          |

### ALTERNATOR TEST SPECIFICATIONS 1997-98

| Model         | Min. Engine Speed @ Output (rpm) | Voltage Range (Volts) | Output (Amps) | Regulator | Belt Tension (in.) | Max. Output @ 650 rpm (Amps) | Max. Output @ 1500 rpm (Amps) | Max. Output @ 2000 + rpm (Amps) | L2 Terminal (Volts) | P Terminal (Volts) | Condenser Capacity (Microfareds) |
|---------------|----------------------------------|-----------------------|---------------|-----------|--------------------|------------------------------|-------------------------------|---------------------------------|---------------------|--------------------|----------------------------------|
| Prestolite 65 | 400                              | 14.0-14.7             | 65            | Internal  | 1/4-1/2            | 20                           | 53                            | 56                              | 13-14               | 6.5-7.5            | 0.4-0.6                          |

## STARTER SPECIFICATIONS GM Engines

| Model       |              |         |       |       |        |       |           |        | Solenoid<br>Current Draw         |                                               |
|-------------|--------------|---------|-------|-------|--------|-------|-----------|--------|----------------------------------|-----------------------------------------------|
|             | No-Load Test |         |       |       |        |       | Load Test |        | Hold-In<br>Winding<br>(Amps @ V) | Both<br>Windings<br>In Parallel<br>(Amps @ V) |
|             | Min.         | Max.    | Volts | Min.  | Max.   | Volts | Min.      | Max.   |                                  |                                               |
|             | (Amps) ①     | (Amps)① |       | (RPM) | (RPM)  |       | (Amps)    | (Amps) |                                  |                                               |
| 1986-87     |              |         |       |       |        |       |           |        |                                  |                                               |
| 3.0L & 5.0L | 60           | 85      | 9     | 6,800 | 10,300 | 4.8   | 440       | 490    | 15-20 @ 10                       | 47-55 @ 10                                    |
| 1986-87     |              |         |       |       |        |       |           |        |                                  |                                               |
| 4.3L & 5.7L | 65           | 95      | 9     | 6,800 | 10,300 | 4.3   | 490       | 560    | 15-20 @ 10                       | 47-55 @ 10                                    |
| 1988-98     | 65           | 95      | 9     | 6,800 | 10,300 | 4.3   | 490       | 560    | 15-20 @ 10                       | 47-55 @ 10                                    |

① Figure includes the solenoid

## STARTER SPECIFICATIONS Ford Engines

| Model            | Brushes            |                        |                         | Current Draw<br>Normal Load<br>(Max. Amps) | Cranking Speed<br>(rpm) | Cranking Power<br>(V) | Motor                           |                     |                   |
|------------------|--------------------|------------------------|-------------------------|--------------------------------------------|-------------------------|-----------------------|---------------------------------|---------------------|-------------------|
|                  | Length<br>In. (mm) | Wear Limit<br>In. (mm) | Spring Tension<br>(Oz.) |                                            |                         |                       | Min. Stall                      |                     | No Load<br>(Amps) |
|                  |                    |                        |                         |                                            |                         |                       | Torque<br>@ 5V<br>Ft, Lbs, (Nm) | Max. Load<br>(Amps) |                   |
| 1986-87          | 0.50 (12.7)        | 0.25 (6.35)            | 40                      | 150                                        | 110                     | 8                     | 9 (12)                          | 460                 | 70                |
| 1988             |                    |                        |                         |                                            |                         |                       |                                 |                     |                   |
| 2.3L             | 0.50 (12.7)        | 0.25 (6.35)            | 40                      | 150                                        | 110                     | 8                     | 9 (12)                          | 460                 | 70                |
| 7.5L             | 0.50 (12.7)        | 0.25 (6.35)            | 40                      | 150                                        | 110                     | 8                     | 10 (12)                         | 475                 | 85                |
| 1989-90          |                    |                        |                         |                                            |                         |                       |                                 |                     |                   |
| 2.3L, 5.0L, 5.8L | 0.50 (12.7)        | 0.25 (6.35)            | 40                      | 150                                        | 180                     | 8                     | 9 (12)                          | 480                 | 70                |
| 7.5L             | 0.50 (12.7)        | 0.25 (6.35)            | 40                      | 150                                        | 110                     | 8                     | 10 (12)                         | 475                 | 85                |
| 1991-92          | 0.50 (12.7)        | 0.25 (6.35)            | 40                      | 150                                        | 180                     | 8                     | 9 (12)                          | 460                 | 70                |
| 1993-94          | 0.66 (16.8)        | 0.25 (6.35)            | 64                      | 140-200                                    | 200-250                 | 8                     | 11 (15)                         | 800                 | 60-80             |

|                                    |             |                                       |             |
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# 11

## COOLING SYSTEM

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# 11-2 COOLING SYSTEM

## COOLING SYSTEMS

### Description & Operation

#### ◆ See Figures 1 and 2

Cooling water is a critical phase of engine operation. Cooling water passes through the cylinder heads and block, drawing off heat generated by fuel combustion and engine friction. Proper operation of the cooling system is critical to maintaining satisfactory engine operation and performance.

All OMC engines are cooled by means of one of two systems: an external-water, raw water system; or a Closed system, which actually incorporates the raw water system into a closed automotive-style anti-freeze system. Engines covered here may come equipped with either of the two systems. Please refer to the flow diagrams at the end of this section.

### RAW WATER SYSTEM

■ Please refer to the Water Flow Diagrams section for detailed views of your engine's cooling system.

As implied by the name, this system utilizes water from outside the boat to cool the engine and certain related components—this system is also frequently called a seawater system and the names can (and probably will) be used interchangeably. All versions of this system utilize two water pumps, hoses and a thermostat.

All 1986-93 engines and all King Cobras through 1995 utilize a water pump (impeller) mounted in the top of the upper gear housing to draw the water up through the drive unit and then on to the engine circulating pump attached to the front of the cylinder block—although different in construction, this pump is quite similar to a typical water pump you would find on your car or truck. From here the water is circulated through the engine block, cylinder heads and exhaust manifold(s); and then expelled back into the body of water where it originated.

All 1994-95 Cobra models and all 1996-98 models use a belt-driven raw water pump mounted on the lower starboard side of the engine to draw the water up through the drive unit and then on to the engine circulating pump attached to the front of the cylinder block—although different in construction, this pump is quite similar to a typical water pump you would find on your car or truck. From here the water is circulated through the engine block, cylinder heads and exhaust manifold(s); and then expelled back into the body of water where it originated.

The raw water pump is a self-priming impeller-style pump. Special compound nylon/rubber blades give the blades the ability to flex. The inside surface of the pump is eccentric, causing the blades to move (flex) from a larger volume area to a smaller volume area as they rotate within the pump body.

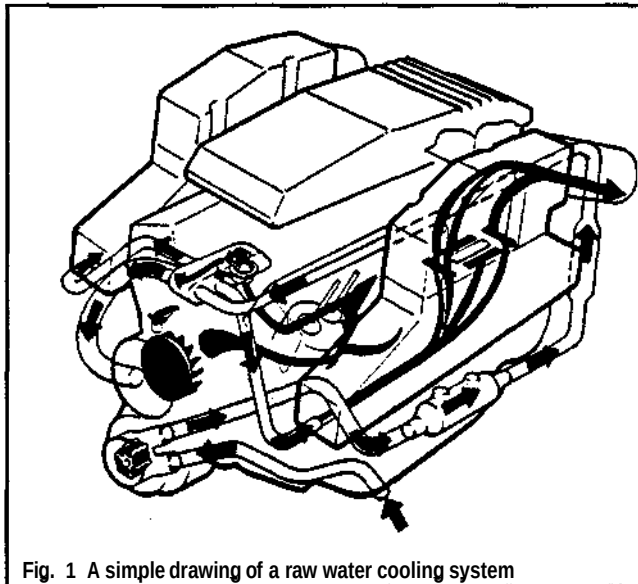


Fig. 1 A simple drawing of a raw water cooling system

During periods of low speed operation there will be very little resistance to water flow within the pump. The impeller blades will flex along the eccentric surface, thus providing a positive displacement action. As operational speed increases, resistance will begin to build within the pump; causing the ends of the impeller blades to begin flexing inward, slowly changing the pump action from positive displacement to that of a circulation-style pump.

The belt-driven engine circulating pump is mounted on the front of the cylinder block on all models—as mentioned previously, this pump looks identical and is positioned similar to that which you may be familiar with on your car or truck. A pulley is bolted to the forward edge of the pump shaft hub and is driven via a belt from the crankshaft pulley. The pump shaft and permanently lubricated bearing assembly is pressed into the pump cover—a seal pressed into the cover prevents any cooling water from escaping. Pump bearings are specifically manufactured for use in marine applications; never be tempted to substitute an automotive style pump!

Raw water is picked up through screened openings on either side of the lower unit. Water is then drawn through the lower and upper gear housing of the drive unit and through the transom plate. A line then carries the water to an oil or power steering cooler and then on to the water pump, or directly to the pump—some models do not use an oil cooler, while others position the cooler upstream of the water pump. After exiting the water pump, the cooling water then enters the inlet side of the thermostat housing and moves in a number of directions. Some water is routed through the hoses directly to the exhaust manifold(s) for cooling, while the remaining water moves down to the engine circulating pump where it is driven into the water jackets surrounding each cylinder. After working its way through all of the cylinders, the water is forced upward through two passages and into the cylinder head(s) where it cools the combustion chambers. Once at the forward side of the head(s), the water enters the thermostat housing; where, if sufficiently warm, it will cause the thermostat to open and be diverted partially back to the circulating pump and/or on to the exhaust manifolds where it will be introduced into the exhaust gas flow and out of the boat. If the water is not yet warm enough to cause the thermostat to open, it will be diverted entirely back to the circulating pump.

### CLOSED SYSTEM

■ Please refer to the Water Flow Diagrams section for detailed views of your engine's cooling system.

This system is actually two systems in one—a closed freshwater system and a raw or seawater system. All versions of this system utilize two water pumps, hoses, a thermostat and a heat exchanger.

In the closed portion of the system, a mixture of freshwater and anti-freeze is circulated through-out the engine block, cylinder head and a heat exchanger (similar to your car's radiator). The pressurized water/coolant never leaves the system and is thermostatically controlled.

Lacking a radiator and fan like an automobile, it is necessary to find another means of keeping the fluid in the closed system from boiling and this is where the second portion of this system comes into play. Raw water from outside the vessel is drawn in by means of the belt-driven engine-mounted seawater pump. Unlike true raw water models as described previously, the seawater is pumped into the heat exchanger rather than through the engine.

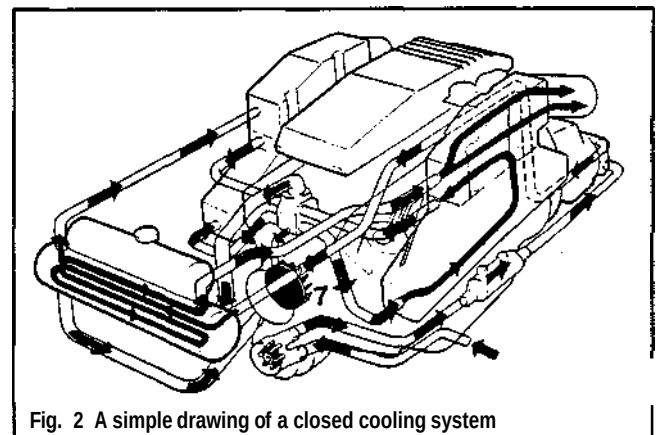


Fig. 2 A simple drawing of a closed cooling system

In fact, it bypasses the engine circulating pump altogether. Once in the exchanger, the seawater is routed through tubes surrounding the closed system tubes, thus cooling the fresh water/anti-freeze mix as it passes through the exchanger. The heated seawater is then routed through the exhaust manifold(s) and then back overboard.

The raw water portion of this system operates exactly like detailed in the previous section, with one exception—after exiting the seawater pump, the cooling water moves to (and through) the heat exchanger and then on to the exhaust manifolds. Raw water never enters the engine to cool the block and heads, since this has already been taken care of by the coolant in the closed portion of the system.

## Troubleshooting

The following paragraphs list troubles encountered in the various portions of the system with accompanying probable causes of the problem. The causes are given in a logical order of checking until the problem is corrected.

### ENGINE OVERHEATS—RAW WATER SYSTEM

- Loose or broken engine circulating pump belt or pick-up pump belt. Check belt condition and/or tension.
- Inaccurate temperature gauge or sender.
- Check ground wire connection at gauge. Disconnect sender wire and make contact with a good engine ground—the gauge should climb to full scale.
- An accessory or barnacles in front of water intakes on drive causing turbulence. Check screens for debris and perform the Raw Water Test.
- Defective raw water pump.
- Loose hose connections between pick-up and pump—sucking air.
- Pump fails to hold prime due to air leaks. Perform Raw Water Flow Test.
- Ice in water passages.
- Defective engine circulating pump. Check pump seals and gasket for leakage.
- Defective thermostat. Test thermostat as detailed in the Maintenance section.

## MAINTENANCE AND TESTING

First, the most important words in this manual: THE ENGINE CANNOT BE OPERATED FOR EVEN FIVE SECONDS WITHOUT WATER MOVING THROUGH THE WATER PICK-UP/RAW WATER PUMP OR THE PUMP IMPELLER WILL BE DAMAGED. THEREFORE, NEVER START THE ENGINE, EVEN FOR TESTING PURPOSES, WITHOUT THE BOAT BEING IN THE WATER, OR PROVISION HAVING BEEN MADE FOR WATER TO PASS THROUGH THE SEAWATER PICK-UP PUMP.

- ☐ Marine thermostats are generally rated at 140-160". An **automotive-type** thermostat must never be used because of the higher temperature ratings. Such a high rating would cause the engine to run much hotter than normal.

## Cooling System

The cooling system, raw water or closed, should be cleaned and flushed at least once every two years; more often if possible. Please refer to the Maintenance section for detailed flushing procedures.

### DRAINING, FLUSHING & FILLING

The cooling system should be drained, cleaned, and refilled each season, although OMC's recommendations are for every two years on normal anti-freeze systems. We think its cheap insurance to do it every season, but you certainly can't go wrong by following the factory's suggestion. The bow of the boat must be higher than the stern to properly drain the cooling system. If the bow is not higher than the stern, water will remain in the cylinder block and in the exhaust manifold. Insert a piece of wire into the drain holes, but not in the petcock, to ensure sand, silt, or other foreign material is not blocking the drain opening.

### ENGINES OVERHEATS—CLOSED SYSTEM

- ☐ In addition to items detailed under Raw Water:

- Closed cooling system reservoir level low.
- Plugged heat exchanger cores.
- Too much anti-freeze in closed system.
- Fresh water kit not installed properly.
- Exhaust elbow dump fittings "bottomed on inner water jacket.

### ENGINE OVERHEATS—MECHANICAL

- Incorrect ignition timing.
- Spark plug wires crossed.
- Lean air/fuel mixture.
- Pre-ignition—spark plugs are wrong heat range.
- Engine laboring—engine rpm below specifications at WOT.
- Poor lubrication.
- Water in cylinders—due to warped cylinder head.
- Distributor not functioning properly.
- Clogged exhaust elbows.
- Exhaust flappers stuck closed.
- Cabin hot water heater incorrectly connected to engine.

### WATER IN CYLINDERS

- Backwash through exhaust system.
- Loose cylinder head bolts.
- Blown cylinder head gasket.
- Warped cylinder head.
- Cracked or corroded exhaust manifold.
- Cracked block in valve lifter area.
- Improper engine or exhaust hose installation.
- Cracked cylinder wall.

### WATER IN OIL

- Backwash through exhaust system.
- Water seeping past piston rings from flooded combustion chamber.
- Thermostat stuck open or missing—condensation forms because engine is operating too cool.
- Cracked cylinder block.
- Intake manifold water passage leak.

If the engine is not completely drained for winter storage, trapped water can freeze and cause severe damage. The water in the oil cooler—if so equipped—must also be drained.

- ☐ For complete details, procedures and illustrations on draining, filling **and/or** flushing of the cooling system, please refer to the Maintenance section.

### DRIVE BELTS

- ☐ For complete details, procedures and illustrations on drive belt removal and adjustment, please refer to the Maintenance section.

### FLUID LEVEL CHECK

- ☐ For complete details, procedures and illustrations on checking the fluid level in the closed cooling system, please refer to the Maintenance section.

### PRESSURE TEST

- For complete details, procedures and illustrations covering pressure testing the cooling system, please refer to the Maintenance section.

### PRESSURE CAP TEST

- For complete details, procedures and illustrations covering testing the closed cooling system pressure cap, please refer to the Maintenance section.

## 11-4 COOLING SYSTEM

### RAW WATER COOLING TEST



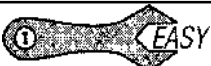
If you suspect that the raw water system is taking in air, perform the following test.

#### \*\*\* WARNING

This test **MUST** be performed with the vessel in the water. **DO NOT** perform this test with the vessel out of water with a flushing attachment attached.

1. Disconnect the water hose at the raw water pump outlet and then disconnect the same hose at the inlet on the thermostat housing.
2. Connect a clear vinyl hose of the same diameter between the pump and the housing. Tighten the clamps securely.
3. Start the engine and drive the boat at the lowest rpm at which the overheating problem has been observed. Have an assistant (do not do this yourself—stay at the helm!) check the clear hose for evidence of air bubbles being drawn through the system.
4. If air bubbles are present, air is being sucked into the system somewhere between the pump and the inlet holes on the lower unit. Check all hoses, clamps and fittings for damage or other signs of deterioration. Check the lower unit water tube, guide, seal, grommet and water passage cover gasket for damage, signs of deterioration or leakage. Check the pump impeller plate gasket and housing O-ring for damage and/or leakage.
5. If no bubbles are observed in Step 3, remove the clear hose and reconnect the original water hose.

### RAW WATER FLOW TEST



If you suspect that a low cooling water supply is causing an overheat condition, perform the following test.

#### \*\*\* WARNING

This test **MUST** be performed with the vessel in the water. **DO NOT** perform this test with the vessel out of water with a flushing attachment attached.

1. Disconnect the water hose at the thermostat housing inlet. Hold the hose vertically so that the open end is not higher than the top of the engine.
2. Start the engine and allow it to idle. A column of water should rise from the hose approximately 2-4 in. high. Less than 2 in. indicates a likely restriction in the supply line, or the raw water pump is defective. Check for a blocked inlet screen at the drive or a crimped/broken pivot housing at the gimbal housing/transom plate. Also, confirm that the pump impeller is not worn or broken.

#### \*\*\* CAUTION

Don't forget to shut the engine down immediately after observing the height of water coming out of the hose!

3. Reconnect the hose to the housing and tighten the clamp securely.

### Raw Water Pump (Impeller)

#### REMOVAL & INSTALLATION

Stern Drive Unit

All Models Except 1990-95 King Cobra

◆ See Figures 3 thru 11

■ As noted previously, all 1986-93 models and 1994-95 King Cobra models utilize a stern drive mounted raw water pump. There is no engine-mounted external water supply pump on these engines.

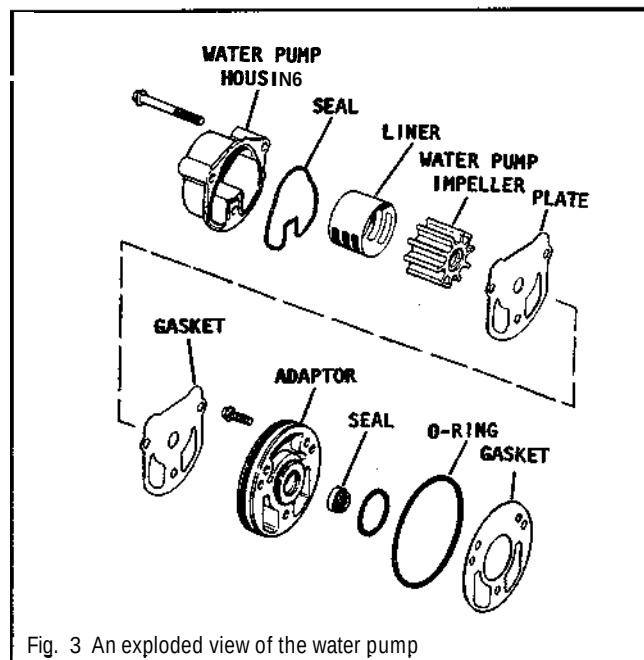
1. Loosen the 3 rear cover mounting bolts at the rear of the upper gear housing and lift off the cover.

2. Disconnect the small drain hose at the port side of the water pump.
3. Remove the 3 pump housing mounting bolts. Carefully tap the side of the housing (very lightly) with a rubber mallet and then pull of the housing. The seal, liner and impeller should all come off with the housing, but if not, remove them separately.
4. Insert a small prybar between the impeller plate and the adapter, twist it and remove the plate and gasket.
5. The adapter itself is held in place via 2 O-rings and some sealer. Removal requires driving it out from the other side with a 1 3/8 in. pipe. Obviously, access will require removal of the drive and then the U-joint shaft assembly (as detailed in the Drive Unit section). Once this is accomplished, remove the 2 adapter mounting bolts and then press the adapter out through the U-joint shaft opening on the front of the gear housing.

Occasionally, if you are lucky, you can pull the adapter out from the rear with a pair of vise grip pliers. If you attempt it this way, be very careful that you do not damage the adapter with the pliers.

To Install:

6. Clean all components in solvent and allow to dry thoroughly.
7. Clean all sealer from the adapter surfaces. Inspect the O-ring grooves and gasket surfaces for nicks or burrs.
8. Clean all sealer from the pump housing seal recess and the liner cavity. Make sure that the vent passage is clear. Check the housing for cracks, damage or obvious signs of wear.
9. Check the contact surfaces on the impeller plate for signs of wear, scoring or distortion. If worn, you can turn the plate over and reuse it when installing the pump.
10. The impeller blades should not be set in a bent position or have flat edges where they contact the liner.
11. If the you removed the liner from the pump housing, or if it just came out on removal, swab a light coating of Gasket Sealing Compound on the inside of the housing and then press the liner into the housing until it seats itself. Wipe off any excess sealer that may have been squeezed into the liner through the ports.
12. Lubricate the impeller with OMC HiVis Gearcase Lube, position the impeller over the liner so the drive pocket is facing out and twist the impeller into the liner in a clockwise direction.
13. If the adapter was removed, coat both sides of a new adapter gasket with Gasket Sealing Compound and position it onto the rear of the adapter. Coat both new O-rings with the same sealant and install them. Slide a Seal Protector (# 913501) over the end of the water pump shaft and then press the adapter into position—you may have to tap it into place with a rubber mallet. Coat the threads of the mounting bolts with Gasket Sealing Compound, install them and tighten to 12-14 ft. lbs. (16-19 Nm). Remove the tool.
14. Coat both side of a new impeller plate gasket with Sealing



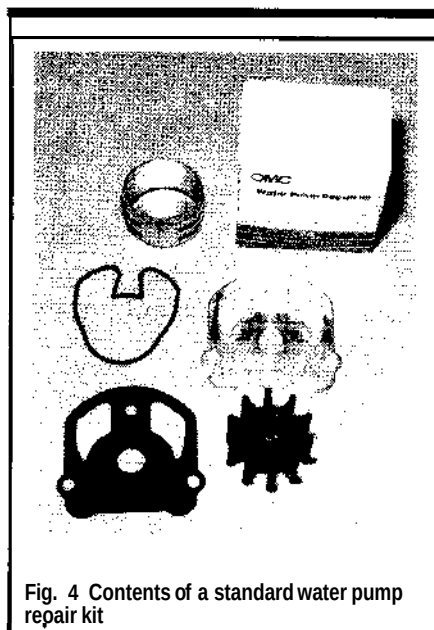


Fig. 4 Contents of a standard water pump repair kit



Fig. 4 Remove the rear cover...

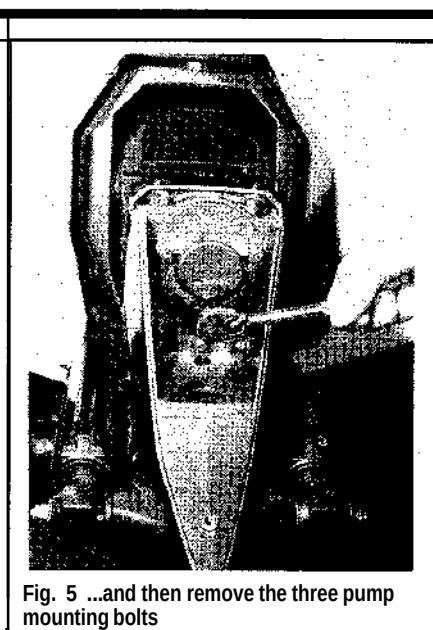


Fig. 5 ...and then remove the three pump mounting bolts

Compound and position it on the adapter. Make sure that the relief slot in the adapter remains clear.

15. Install the impeller plate, remembering that you can flip it over if one of the sides was worn.

16. Cover a new seal ring with Sealing Compound and position it into the groove in the pump housing. Reach in with a small screwdriver and rotate the impeller (clockwise only!) until the narrow end of the drive pocket is pointing at the lower bolt hole in the housing.

17. Now rotate the U-joint shaft until the narrow side of the drive wedge is pointing down at the lower mounting bolt hole in the impeller plate.

18. Position the housing assembly over the shaft until it seats on the impeller plate. Coat the threads of the mounting bolts with Gasket Sealing Compound and then tighten them to 108-132 inch lbs. (12-15 Nm).

19. Reconnect the vent hose to the pump housing.

20. Install the rear gear housing cover and then tighten the bolts to 108-132 inch lbs. (12-15 Nm)

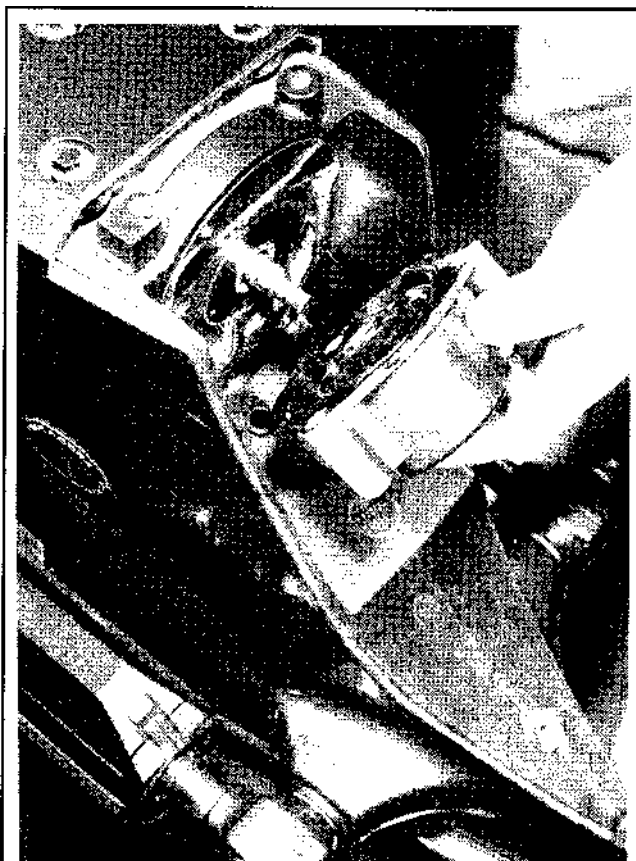


Fig. 7 Remove the pump housing (with the impeller and liner)...



Fig. 8 ...and then pry off the impeller plate

## 11-6 COOLING SYSTEM

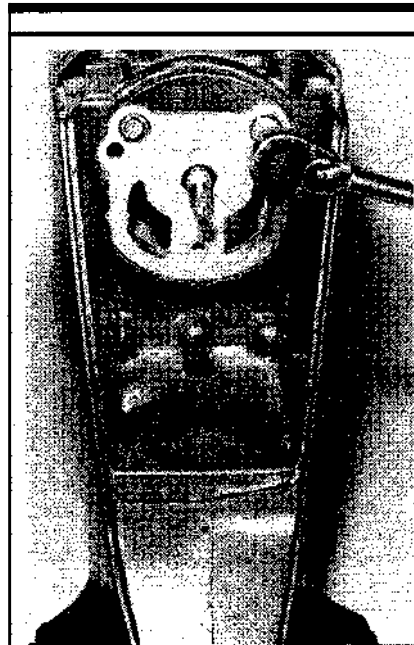


Fig. 9 Remove the two adapter mounting bolts...



Fig. 10 ...and then carefully pull it out of the housing

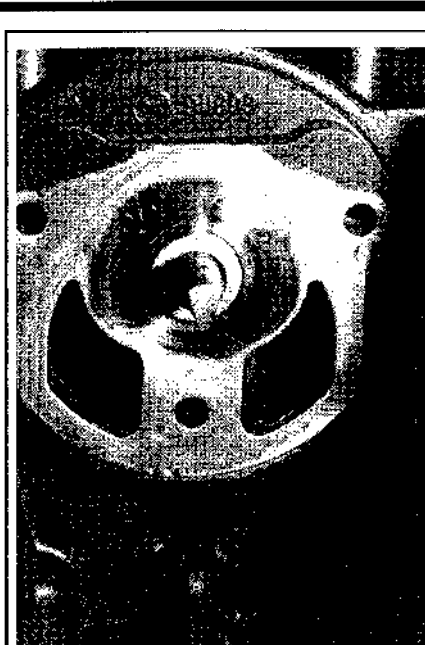


Fig. 11 Make sure that the wedge on the pump shaft is pointing down

### 1990-95 King Cobra

#### ◆ See Figure 12

As noted previously, all **1986-93** models and **1994-95** King Cobra models utilize a stern drive mounted raw water pump. There is no engine-mounted external water supply pump on these engines.

1. Loosen the 3 rear cover mounting bolts at the rear of the upper gear housing and lift off the cover.
2. Disconnect the small drain hose at the port side of the water pump (center on later King Cobra).
3. Remove the 3 pump housing mounting bolts. Carefully tap the side of the housing (very lightly) with a rubber mallet and then pull off the housing. The seal, liner and impeller should all come off with the housing, but if not, remove them separately.
4. Remove the 3 water pump plate bolts and carefully pry the plate off the adapter housing.
5. Remove the 4 adapter housing bolts and pry off the housing slowly, one corner at a time.

#### To Install:

6. Clean all components in solvent and allow to dry thoroughly.
7. Clean all sealer from the adapter surfaces. Inspect the O-ring grooves and gasket surfaces for nicks or burrs.
8. Clean all sealer from the pump housing seal recess and the liner cavity. Make sure that the vent passage is clear. Check the housing for cracks, damage or obvious signs of wear.
9. Check the contact surfaces on the impeller plate for signs of wear, scoring or distortion. If worn, you can turn the plate over and reuse it when installing the pump.
10. The impeller blades should not be set in a bent position or have flat edges where they contact the liner.
11. If the you removed the liner from the pump housing, or if it just came out on removal, swab a light coating of OMC Scotch Grip Rubber Adhesive 1300 on the inside of the housing and then press the liner into the housing until it seats itself. Wipe off any excess sealer that may have been squeezed into the liner through the ports.
12. Lubricate the impeller with OMC Ultra-HPF Gearcase Lube, position the impeller over the liner so the drive pocket is facing out (toward you) and twist the impeller into the liner in a counterclockwise direction.

13. If the adapter housing was removed, coat the housing bore with OMC Ultra-HPF Gearcase Lube and then position the unit onto the gearcase housing. Rotate the U-joint slightly until the gear teeth engage and then install the mounting bolts; the long ones go in the lower holes. Tighten all bolts to 10-12 ft. lbs. (14-16 Nm).

14. Coat both sides of a new adapter gasket with Gasket Sealing Compound and position it onto the adapter housing. Make sure that the slot in the gasket is facing down and to the left (when looking from the rear of the drive) and that there is no sealing compound in the slot. Install the pump plate over the gasket and tighten the bolts to 10-12 ft. lbs. (14-16 Nm).

15. Cover a new seal ring with OMC Scotch Grip Rubber Adhesive 1300 and position it into the groove in the pump housing. Reach in with a small screwdriver and rotate the impeller (counterclockwise only!) until the narrow end of the drive pocket is pointing at the lower bolt hole in the housing.

16. Now rotate the U-joint shaft until the narrow side of the drive wedge is pointing down at the lower mounting bolt hole in the impeller plate.

17. Position the housing assembly over the shaft until it seats on the plate. Coat the threads of the mounting bolts with Gasket Sealing Compound and then tighten them to 9-11 inch lbs. (12-15 Nm).

18. Reconnect the vent hose to the pump housing.

19. Install the rear gear housing cover and then tighten the bolts to 9-11 inch lbs. (12-15 Nm).

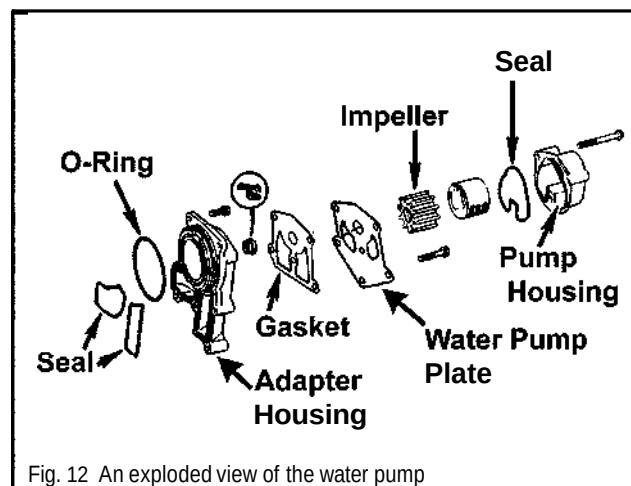


Fig. 12 An exploded view of the water pump

## Belt-Driven

### ◆ See Figure 13

If performing the following while boat is in the water, close the seacock. If your boat is not equipped with a seacock, disconnect and plug the seawater inlet line to prevent water from entering the system.

### □ The engine should be OFF and cool.

1. Drain the engine completely as detailed in the Maintenance section.
2. Loosen the hose clamps on the two water lines at the back of the pump. Wiggle the hoses off of their fittings and set them aside. Remember that the inside hose (closest to the engine) is the supply hose and goes to the inlet.
3. Loosen the pump mounting bolts at the cylinder block and brace. Swivel the pump in until you can remove the drive belt and then pull the bolts out and remove the pump assembly.

#### To install:

4. Inspect the pump assembly for cracks, damage or other signs of wear.
5. Position the pump in the mounting bracket so that the hose fittings are horizontal (inlet fitting on the inside) and the cam screw side of the housing facing upward—this is very important, reversing the positions will cause overheating and damage to the engine.
6. Attach the entire assembly to the cylinder block, screwing in the bolts only finger-tight.
7. Swivel the pump in until you can fit the drive belt over the pulley and then adjust the belt tension, tightening the mounting bolts securely.
8. Reconnect the water hoses, supply on the inside, and tighten the hose clamps securely.
9. Start the engine and check for leaks.

## DISASSEMBLY & ASSEMBLY

### Stern Drive Unit

■ Due to the nature of the removal process, disassembly procedures for the stern drive-mounted water pump are included in the Removal & Installation procedures.

## Belt-Driven

### All 1994 Engines And 1995 3.0L Engines

### ◆ See Figure 14

1. Remove the pump.
2. Remove the 3 bearing housing-to-impeller housing mounting bolts and their washers and separate the two housings. The easiest way to accomplish this is to stand the assembly on the pump pulley and hold the pulley shaft while lifting and turning the impeller housing counterclockwise.

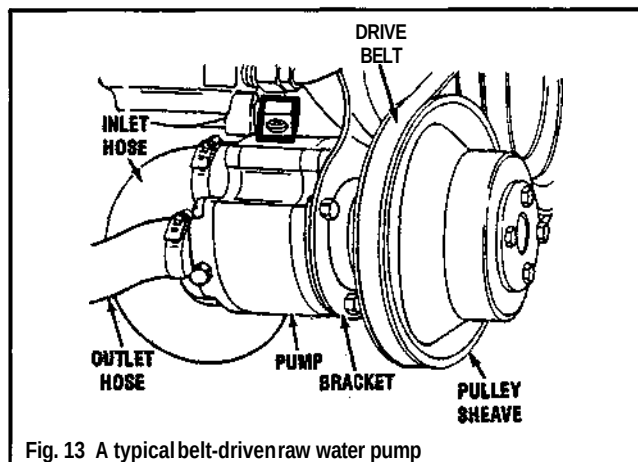


Fig. 13 A typical belt-driven raw water pump



3. The impeller should stay on the shaft, but if it sticks in the housing, carefully grasp it with pliers and pull it out. Remove the O-ring and discard it.
4. Remove the cam screw and its washer. Remove the cam only if necessary; otherwise leave it and the screw in place.
5. If the impeller remained on the pump shaft after splitting the cases, lift it off and pull out the shaft key.
6. Lift off the endplate and its gasket. Use #1 retaining ring pliers and pinch out the ring securing the seal assembly. Lift out the seal assembly. No further disassembly is necessary—the pulley, shaft, bearings and housing are serviced as an assembly only.

#### To assemble:

7. Remove all residual gasket material and then clean all parts with solvent. Allow them to dry completely, or use compressed air.
8. Inspect the impeller housing and cam for wear, cracks or any other signs of deterioration; replacing as necessary.
9. Inspect the end plate for wear, scoring or distortion, particularly the side that comes in contact with the impeller. If only wear is evident, turn the plate over when you install it; otherwise replace it.
10. Inspect the impeller for bent, cracked or broken blades. Also check out the blade contact surfaces to see that they are not flat. Replace as necessary.
11. Install the ceramic seal into the housing, pressing it and the retaining ring in until the ring snaps into the groove. Do not use any grease on the seal.
12. Coat the end plate gasket lightly with Gasket Sealing Compound and position it onto the housing. Drop the end plate over the shaft and into position on the gasket.
13. Install the shaft key in the slot and then lightly press the impeller onto the shaft.
14. If you replaced the cam, position it into the housing and then slide a new washer onto the screw. Coat the threads lightly with Sealing Compound and install the screw, tightening it securely.
15. Coat the impeller surfaces and the O-ring groove lightly with OMC Triple Guard grease. Press in a new O-ring and then install the impeller housing over the assembly, rotating it counterclockwise while lightly pressing it downward. Once in position, rotate the housing slowly until the assembly screw next to the boss is aligned with the cam screw. Install the three retaining bolts and tighten them securely.

### 1995 V6/V8 Engines And All 1996-98 Engines

1. Remove the pump.
2. Position the pump on a clean, flat surface with the pulley facing down. Remove the 3 end cover retaining screws and lift off the cover and gasket. Throw away the gasket.
3. Carefully grab the impeller with needle nose pliers and pull it out of the housing.

#### To assemble:

4. Remove all residual gasket material and then clean all parts with solvent. Allow them to dry completely, or use compressed air.
5. Inspect the impeller housing and cam for wear, cracks or any other signs of deterioration; replacing as necessary.

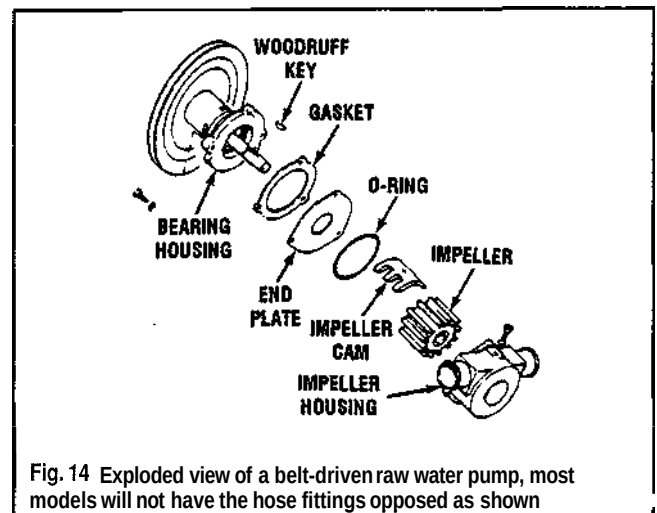


Fig. 14 Exploded view of a belt-driven raw water pump, most models will not have the hose fittings opposed as shown

## 11-8 COOLING SYSTEM

6. Inspect the end cover for wear, scoring or distortion, particularly the side that comes in contact with the impeller; replacing as necessary.
7. Inspect the impeller for bent, cracked or broken blades. Also check out the blade contact surfaces to see that they are not flat. Replace as necessary.
8. Coat the impeller surfaces lightly with **OMC Triple Guard** grease and slide it into the housing until it is flush with the upper housing gasket surface.
9. Position a new gasket (no sealant) and then install the end cover. Tighten the screws securely.
10. Install the pump.

### Thermostat

For all removal and testing procedures, please refer to the Maintenance section.

### Water (Engine) Circulating Pump

#### REMOVAL & INSTALLATION

##### GM Engines

###### ◆ See Figure 15



1. Disconnect the battery cables and then drain all water from the block and manifolds.
2. Drain all water/coolant from the cylinder block.
3. Loosen, but do not remove, the pump pulley mounting bolts.
4. Loosen the power steering pump and alternator bracket bolts and swivel them in until you are able to remove the belt(s). Different engines may have different systems, follow the belt back and loosen the appropriate components.
5. Now you can remove the pump pulley bolts along with the lock washers and clamping ring. Pull off the pulley.
6. Disconnect the water hoses at the pump.
7. Remove the mounting bolts and lift the pump off of the block.

###### To Install:

8. Carefully scrape any old gasket material off both mounting surfaces. Inspect the pump for blockage, cracks or any other damage. Inspect the impeller for cracks. Replace either if necessary.
9. Coat both sides of a new gasket(s) with sealant and position on the cylinder block. Coat the threads of the pump mounting bolts with sealant, install the pump and tighten the bolts to:
  - 13-17 ft. lbs. (18-23 Nm) on 4 cyl. engines
  - 30 ft. lbs. (41 Nm) on 4.3L V6 and 5.0L/5.7L/7.4L V8 engines
  - 35 ft. lbs. (47 Nm) on 8.2L V8 engines.
10. Reconnect the water hoses and tighten the hose clamps securely.
11. Position the pump pulley and clamping ring on the boss. Screw the mounting bolts and lock washers in and tighten them securely.
12. Install the drive belt(s) and adjust them as detailed previously. Start the engine and check the system for leaks.

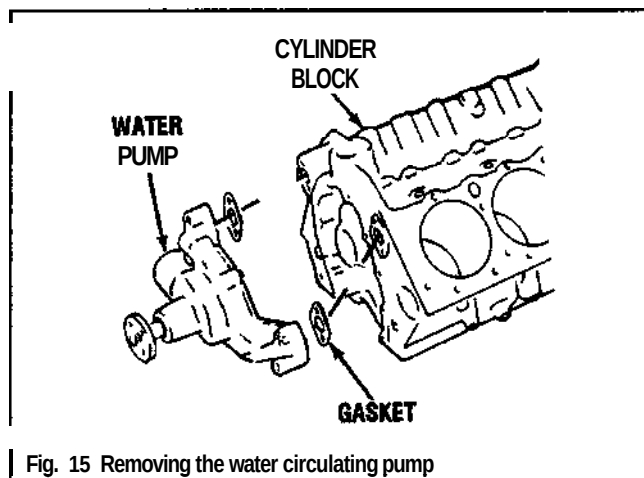


Fig. 15 Removing the water circulating pump

##### Ford Engines

###### ◆ See Figure 16



1. Disconnect the battery cables and then drain all water from the block and manifolds.
2. Drain all water/coolant from the cylinder block.
3. Loosen, but do not remove, the pump pulley mounting bolts.
4. Loosen the power steering pump (if equipped) and alternator bracket bolts and swivel them in until you are able to remove the belt(s). Different engines may have different systems, follow the belt back and loosen the appropriate components.
5. Now you can remove the pump pulley bolts along with the lock washers and clamping ring. Pull off the pulley.
6. Remove the two power steering pump bracket bolts, the brace from the alternator bracket, the Torx® retaining bolt and the pump.
7. Disconnect the large water hose at the pump.
8. Tag and disconnect the electrical leads at the alternator and move them out of the way. Remove the bracket bolts and lift off the alternator.
9. Remove the mounting bolts and lift the pump off of the block. There's a good chance you will need to persuade the pump—tap it lightly with a rubber mallet.

###### To Install:

10. Carefully scrape any old gasket material off both mounting surfaces. Inspect the pump for blockage, cracks or any other damage. Inspect the impeller for cracks. Replace either if necessary.
11. Coat both sides of a new gasket with sealant and position on the cylinder block. Make sure that all of the holes are lined up.
12. Position the pump and screw in all bolts except those that attach the alternator and power steering pump brackets. Tighten the bolts to 14-21 ft. lbs. (19-28 Nm) on the 2.3L, or 12-18 ft. lbs. (17-24 Nm) on the V8s.
13. Reconnect the water hoses and tighten the hose clamps securely.
14. Position the spacer and the Torx® bolt behind the rear power steering pump bracket and tighten it securely. Attach the other bracket to the pump and tighten the 2 bolts.
15. Install the alternator and tighten the bracket-to-pump bolts to 18-20 ft. lbs. (24-27 Nm).
16. Attach the steering pump brace to the alternator and tighten the bolt securely.
17. Position the pump pulley and clamping ring on the boss. Screw the mounting bolts and lock washers in and tighten them to 14-20 ft. lbs. (19-27 Nm).
18. Install the drive belt(s) and adjust them as detailed previously. Start the engine and check the system for leaks.

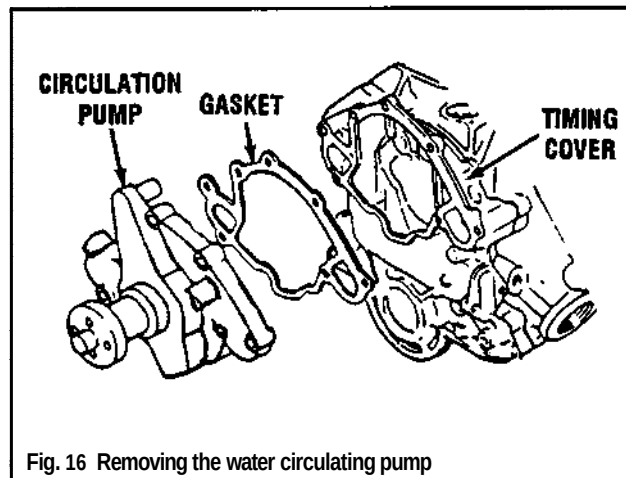


Fig. 16 Removing the water circulating pump

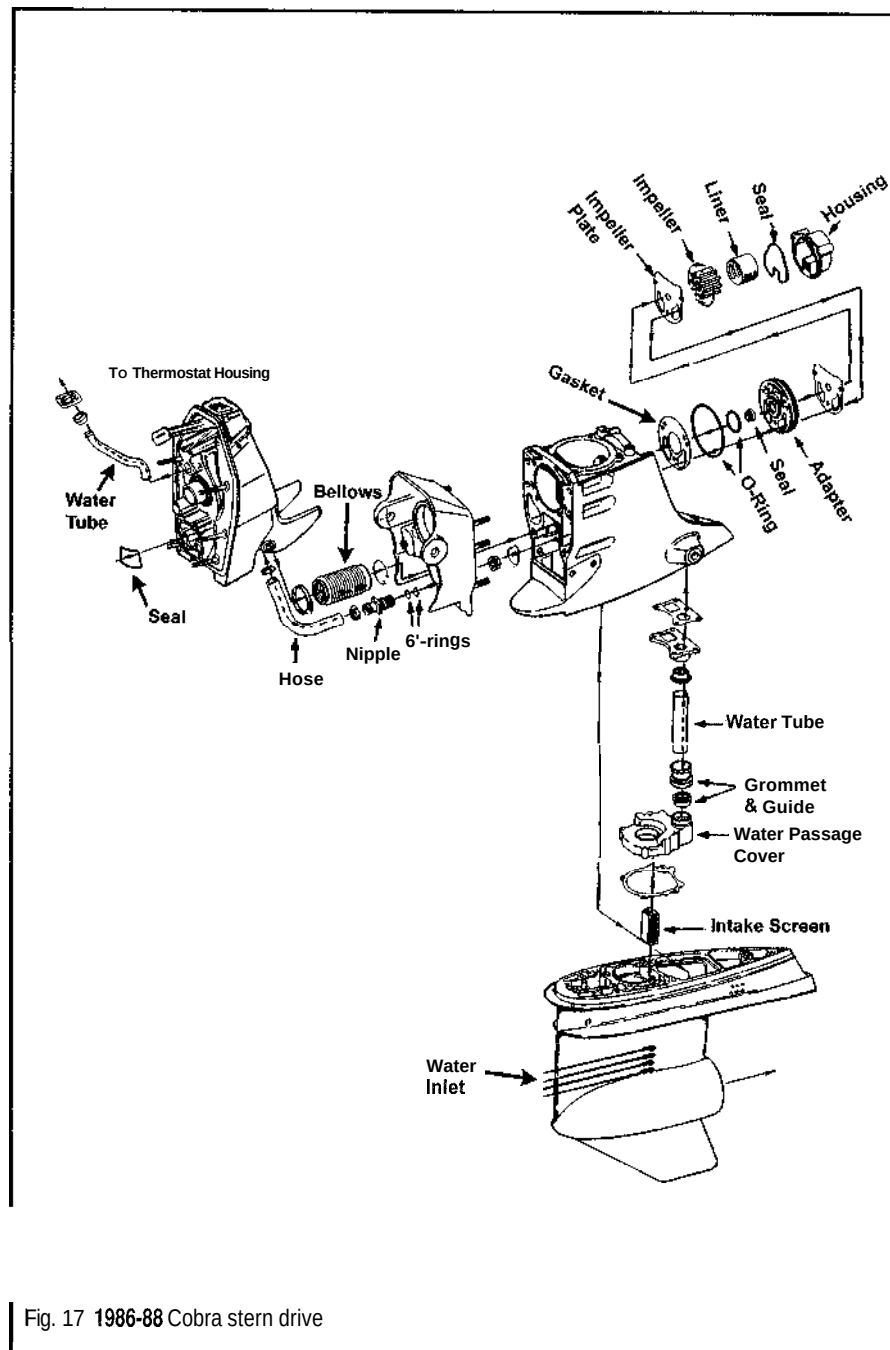


Fig. 17 1986-88 Cobra stern drive

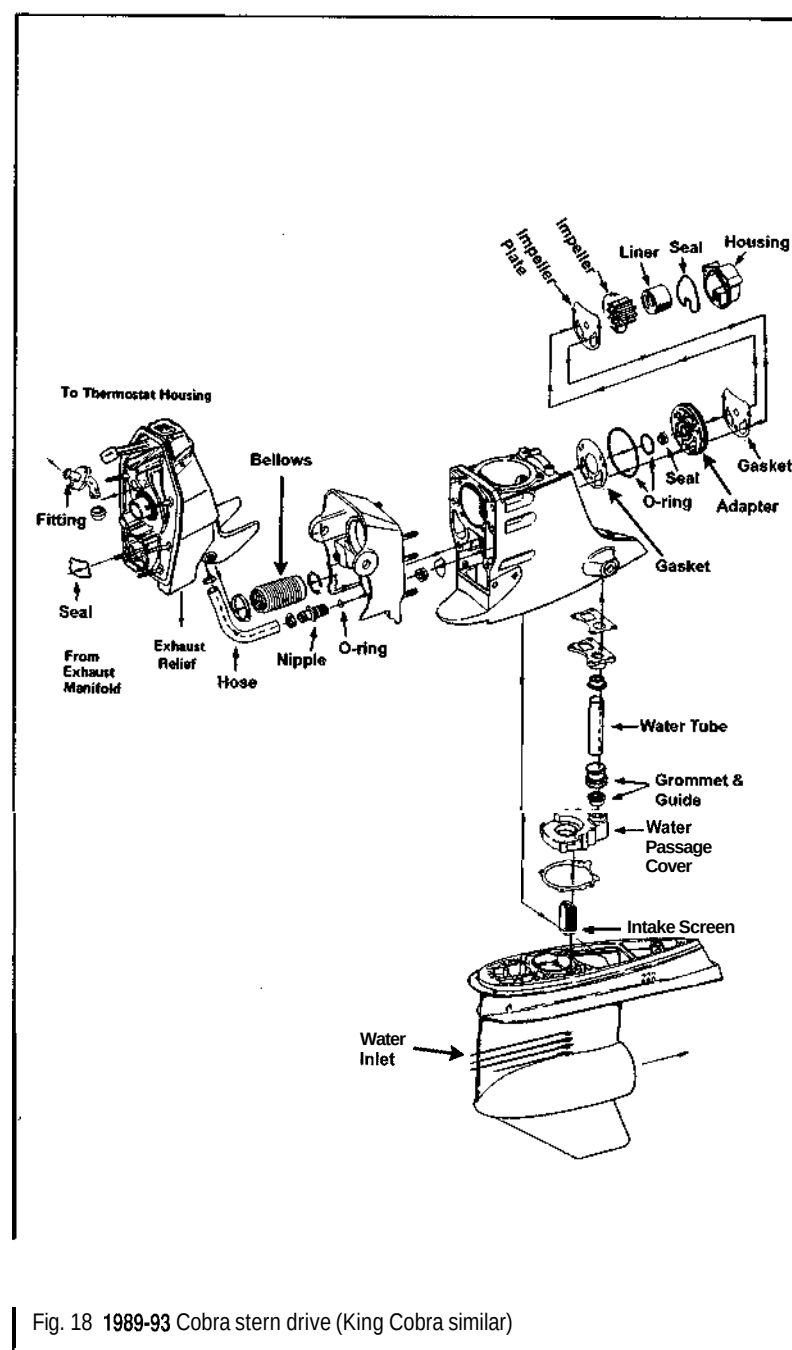


Fig. 18 1989-93 Cobra stern drive (King Cobra similar)

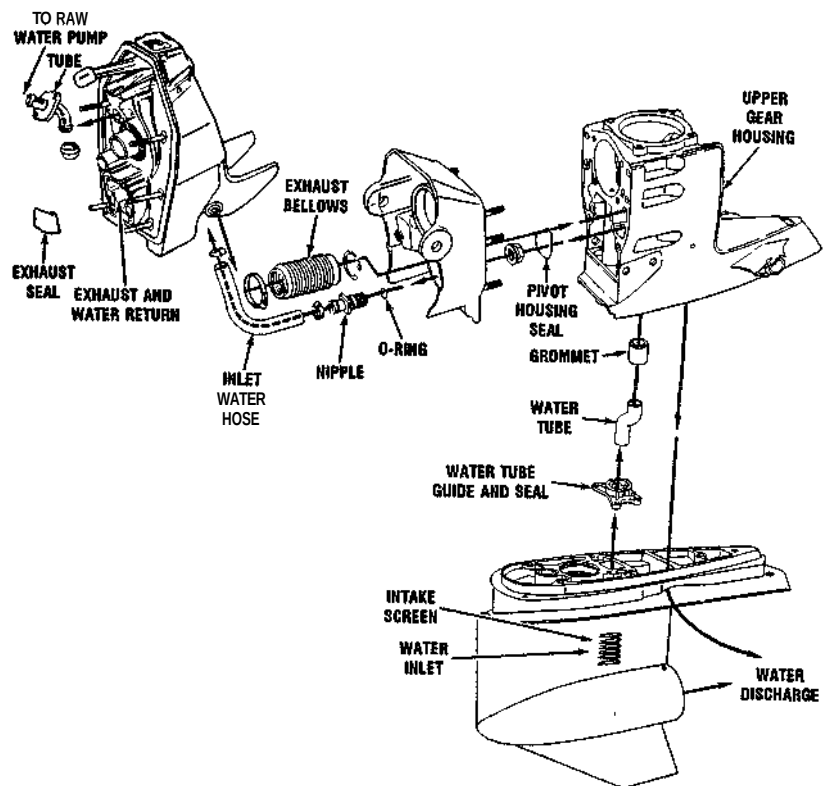


Fig. 19 1994-95 Cobra stern drive

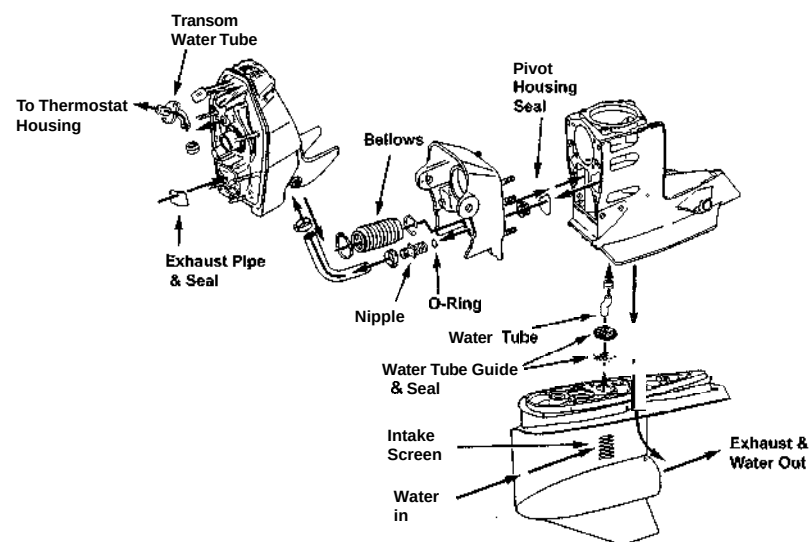
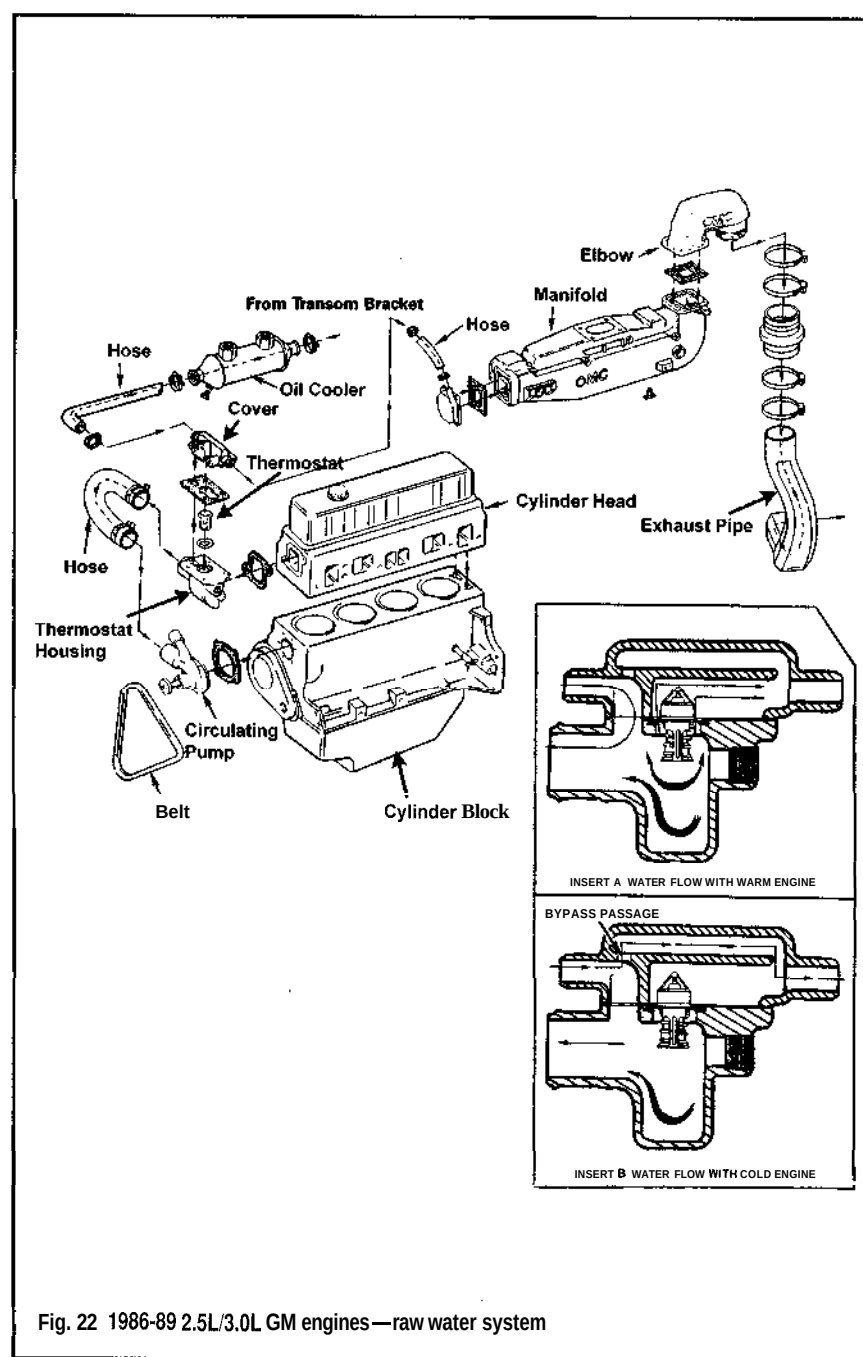
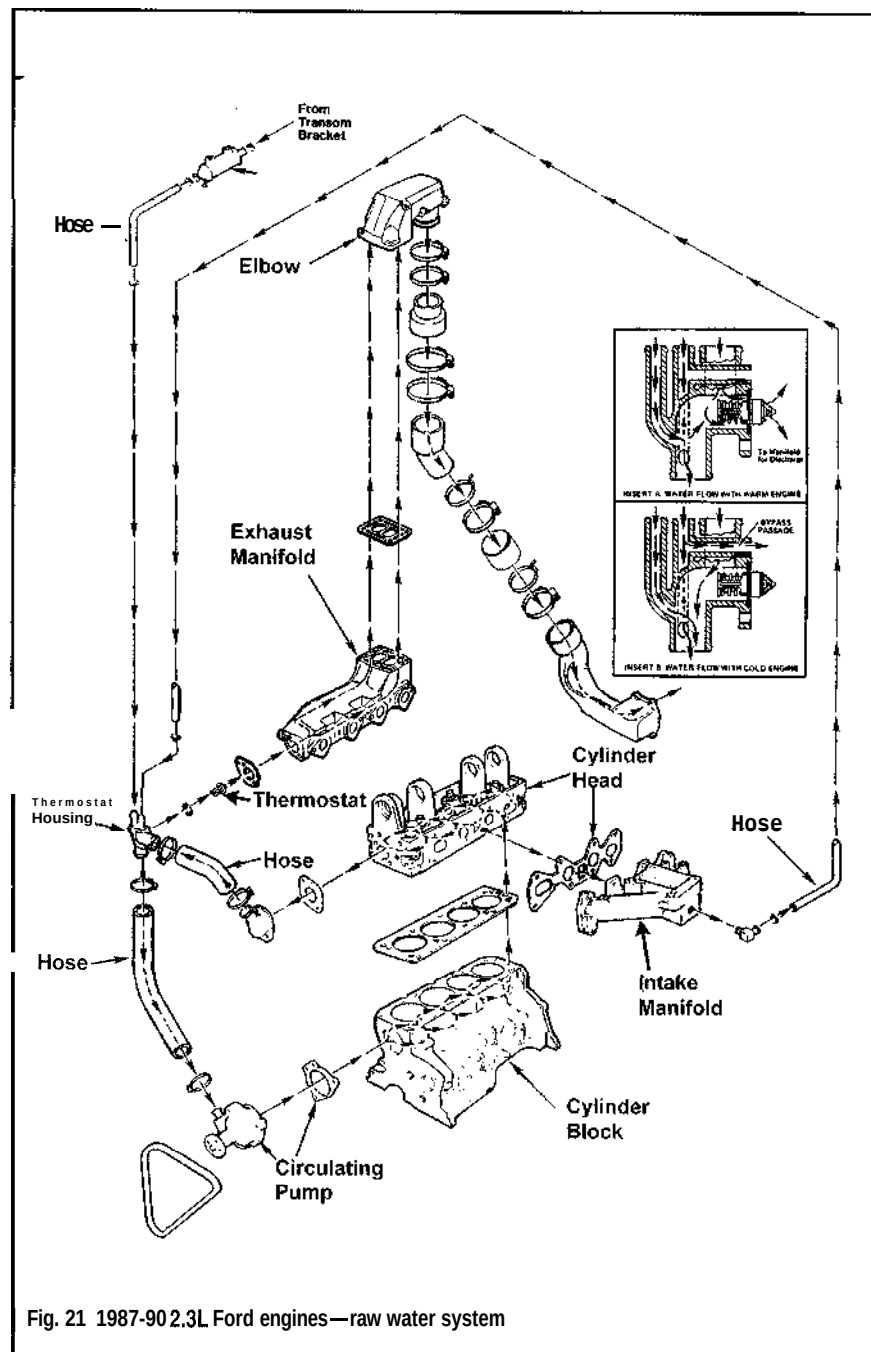


Fig. 20 1996-98 SP/DP stern drive



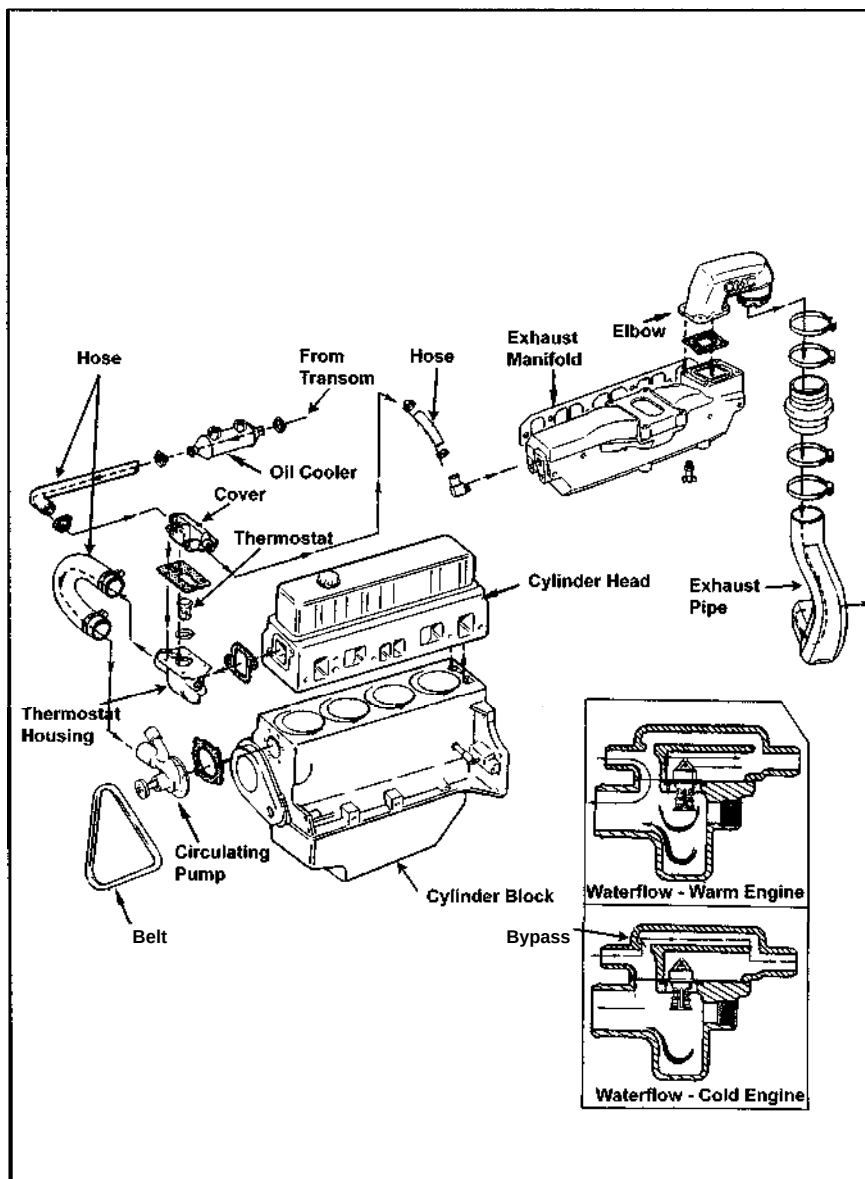


Fig. 23 1990-92 3.0L GM engines—raw water system

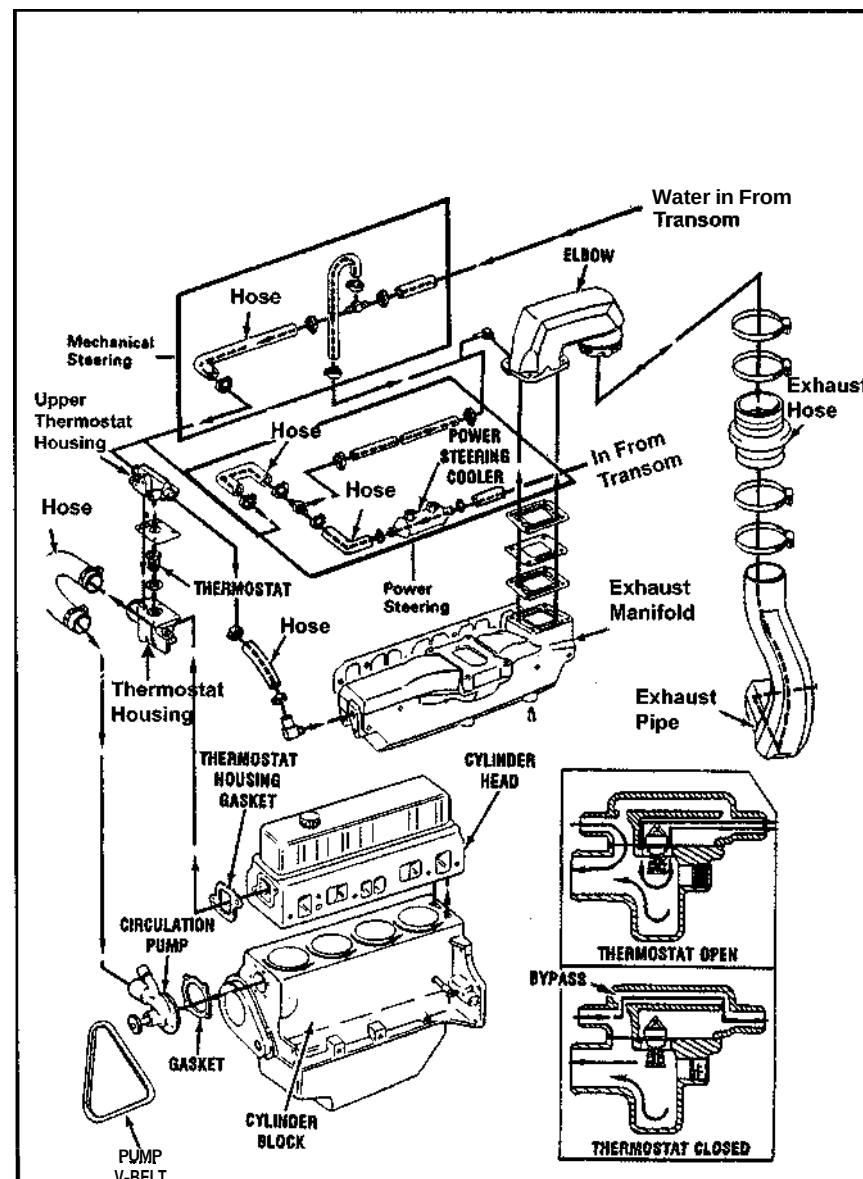


Fig. 24 1993 3.0L GM engines—raw water system

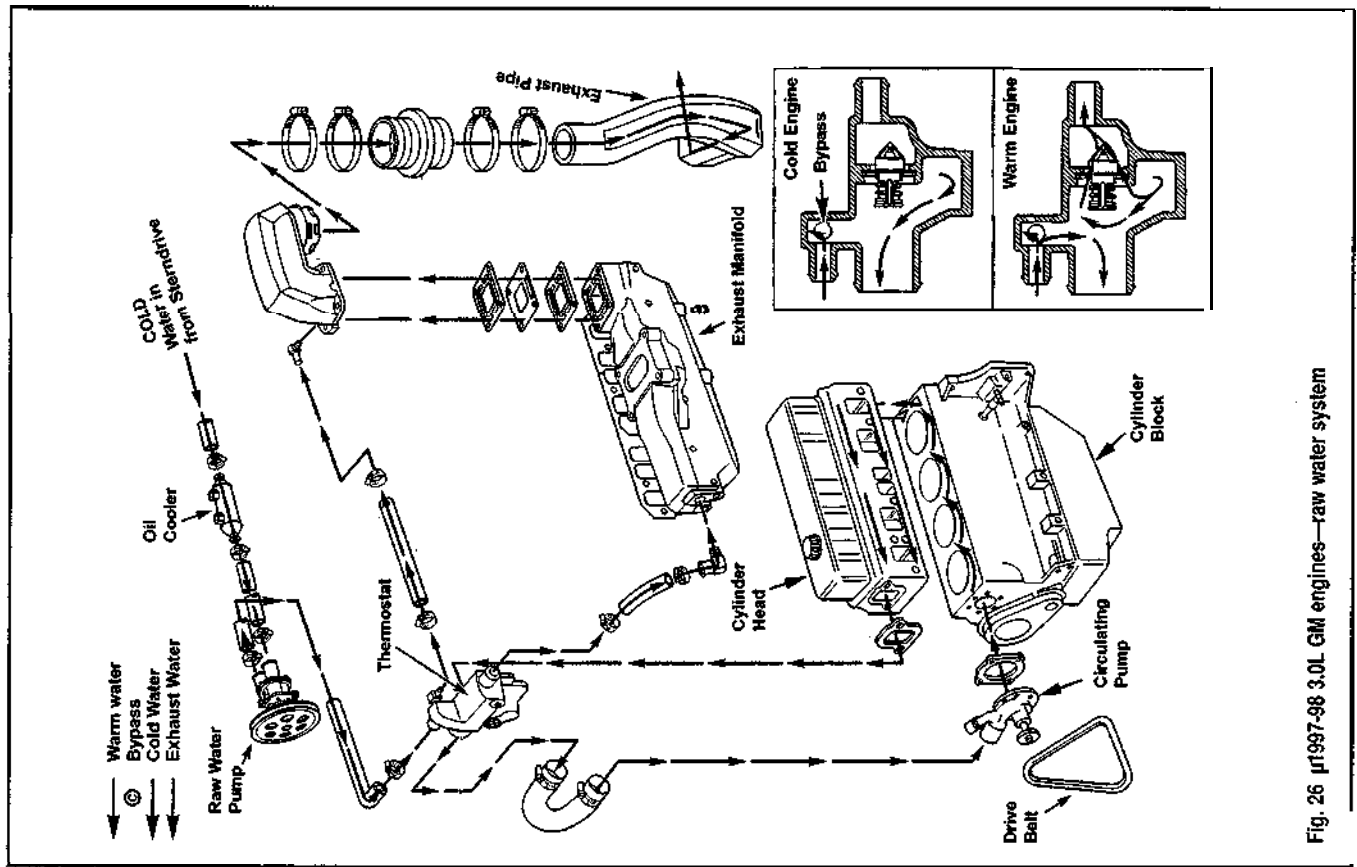


Fig. 26 1997-98 3.0L GM engines—raw water system

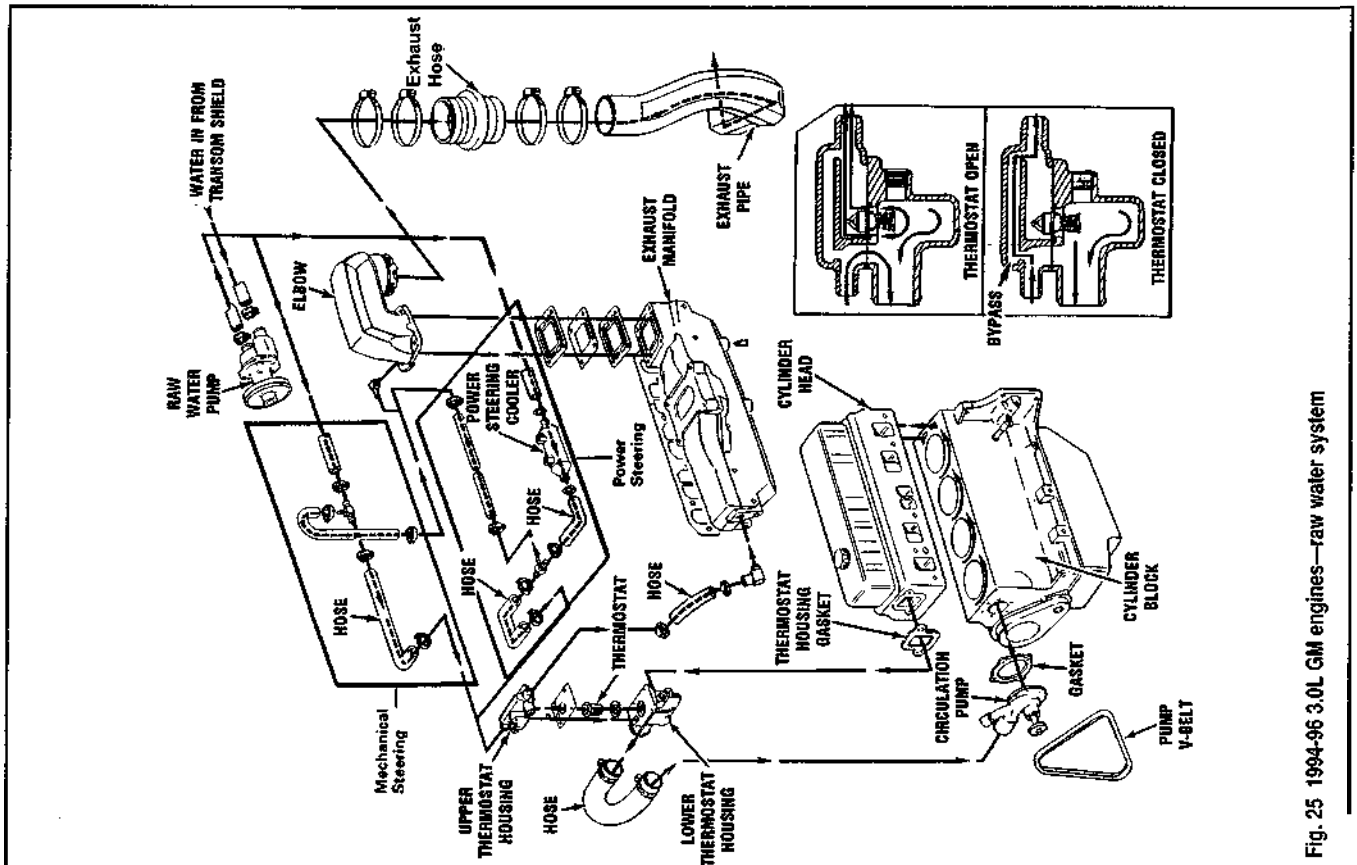


Fig. 25 1994-96 3.0L GM engines—raw water system

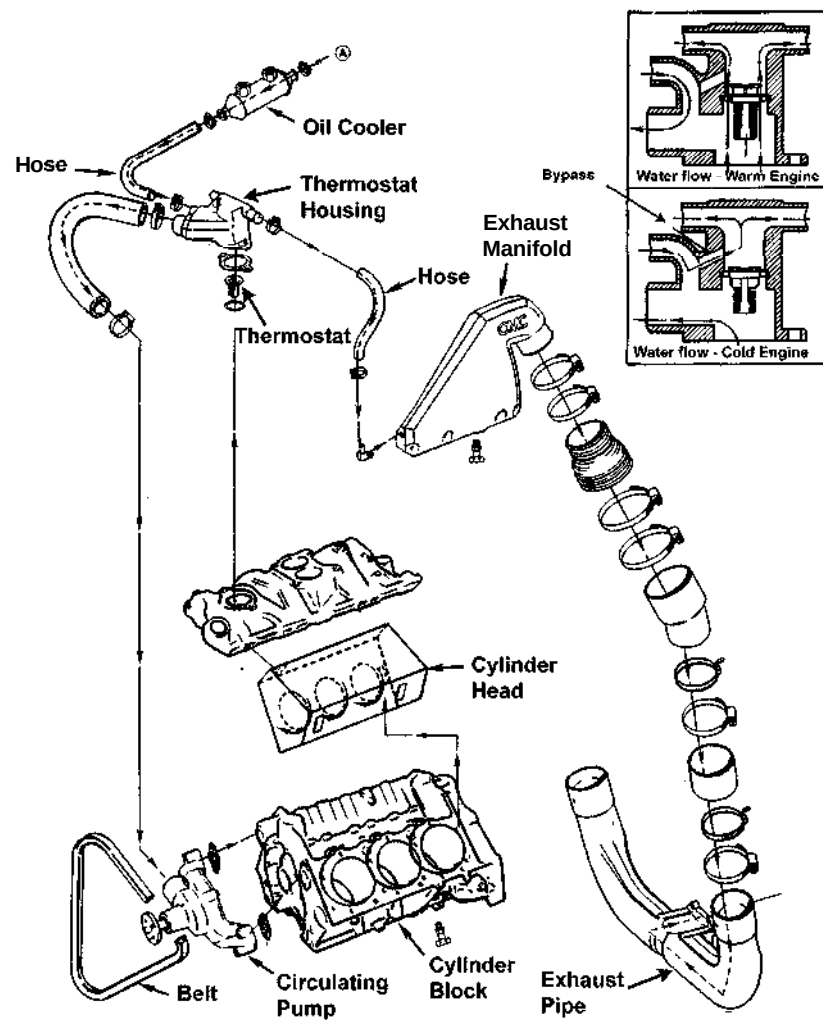


Fig. 27 1986-90 4.3L/262 V6 engines—raw water system

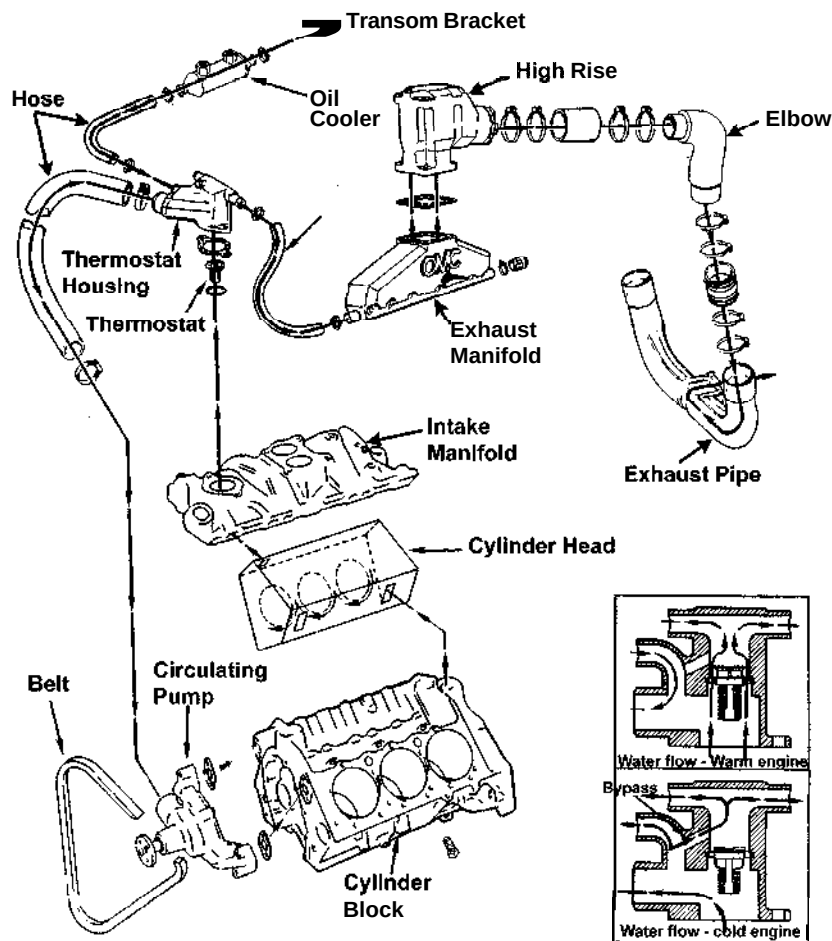
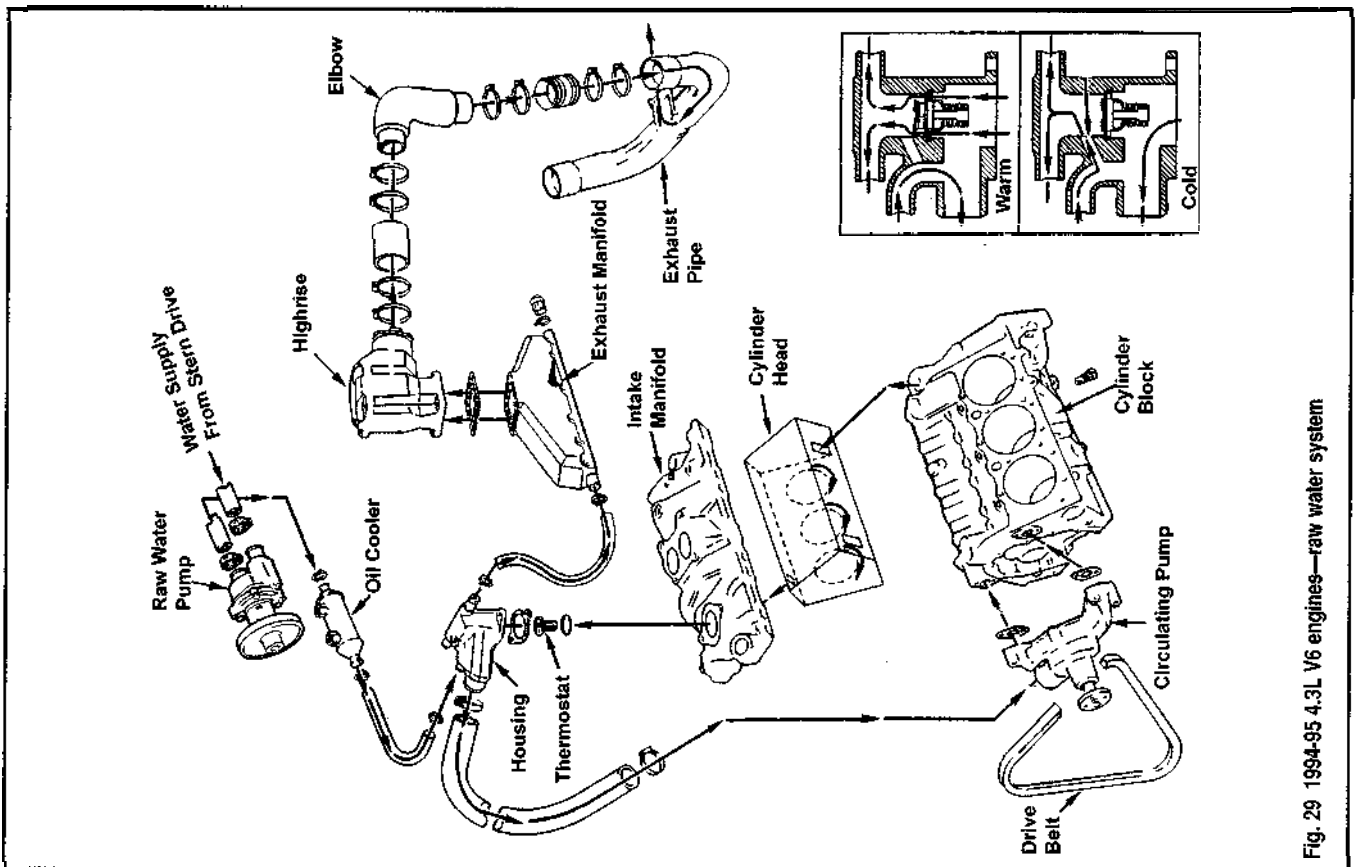
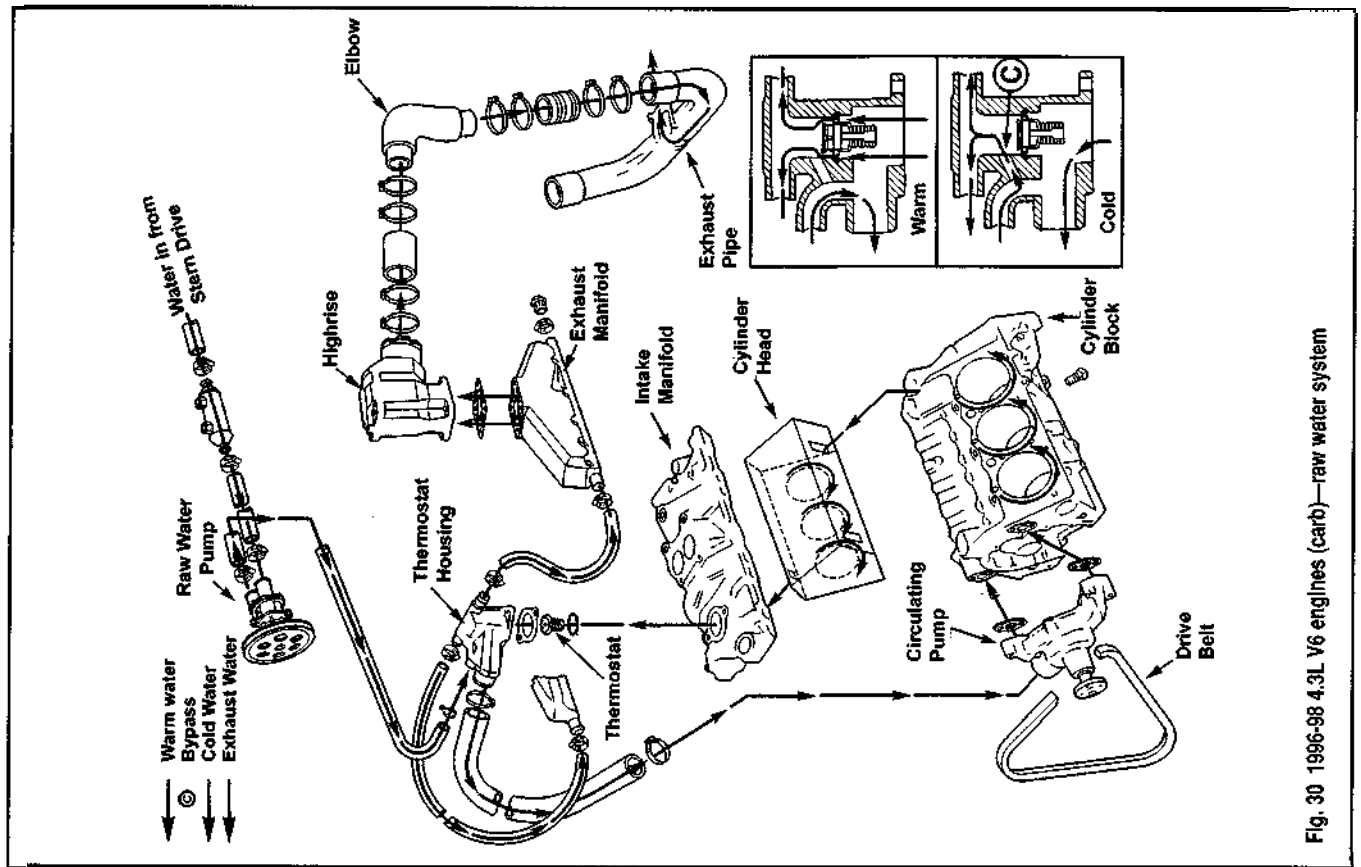


Fig. 28 1991-93 4.3L V6 engines—raw water system



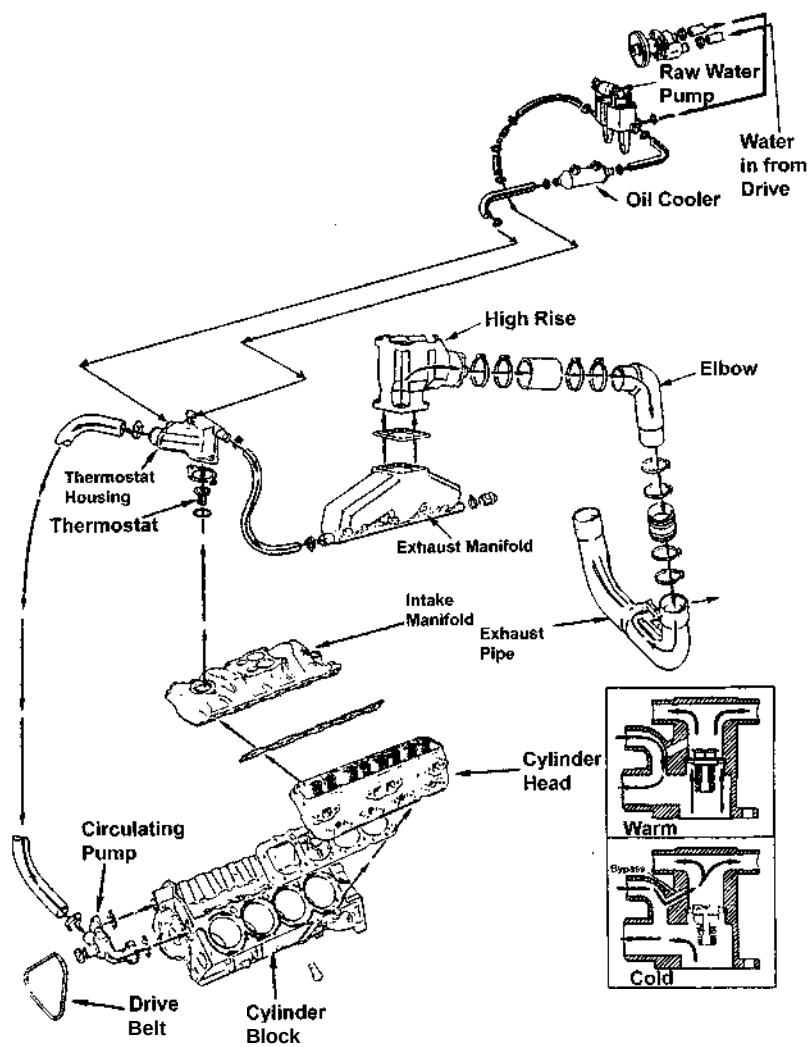


Fig. 31 1996 4.3L V6 engines (TBI)—raw water system

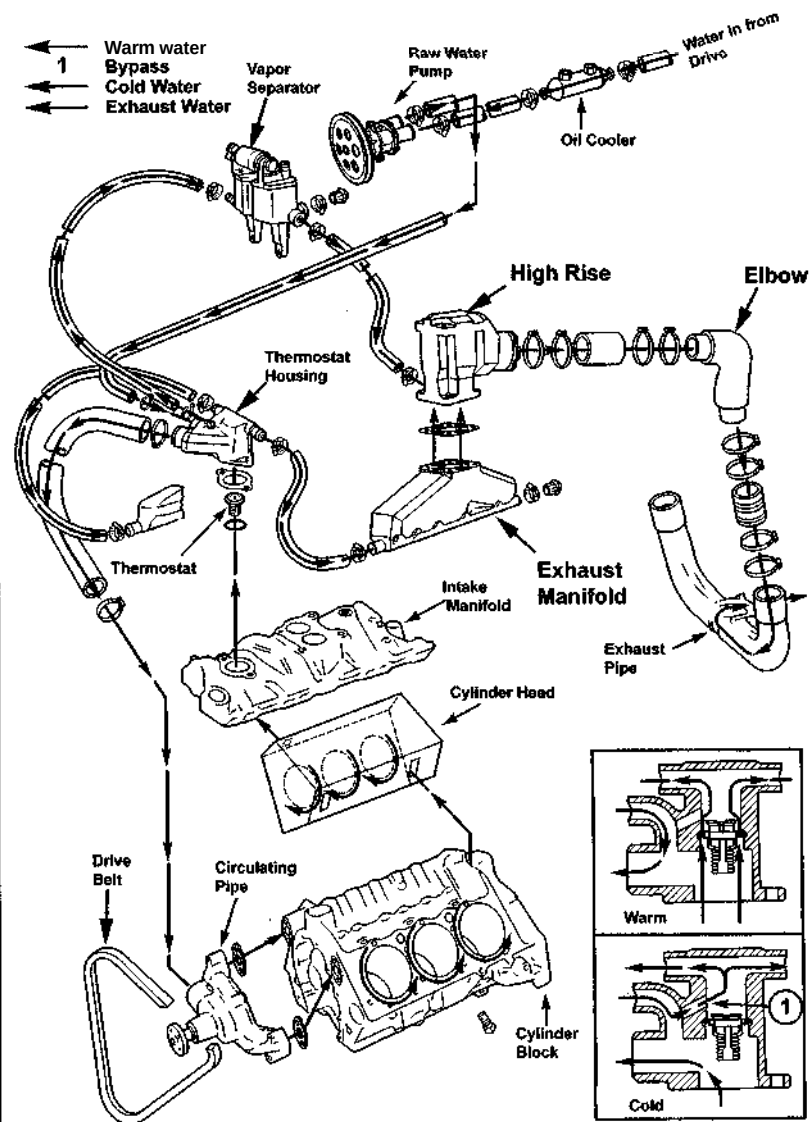


Fig. 32 1997-98 4.3L V6 engines (TBI)—raw water system

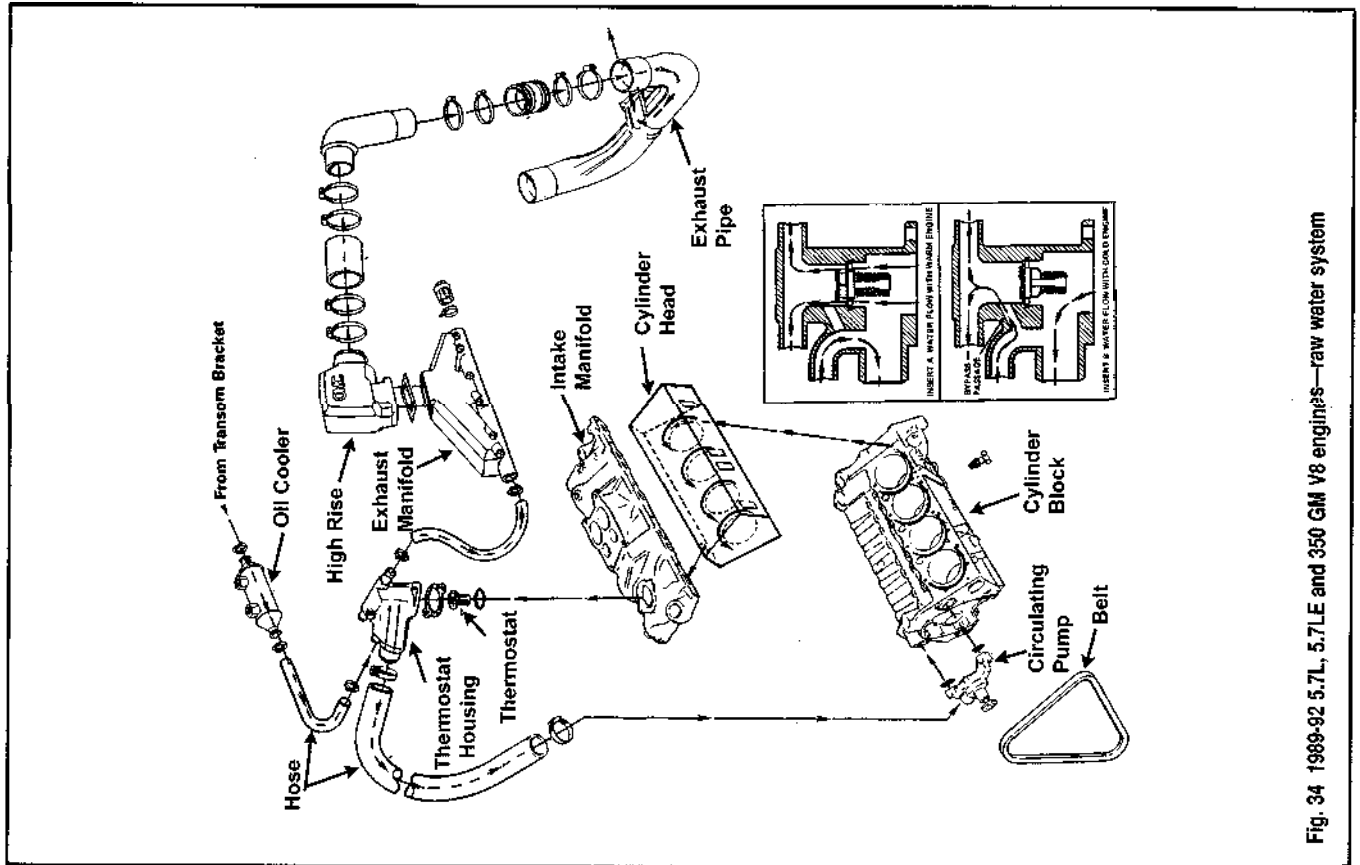


Fig. 34 1989-92 5.7L, 5.7LE and 350 GM V8 engines—raw water system

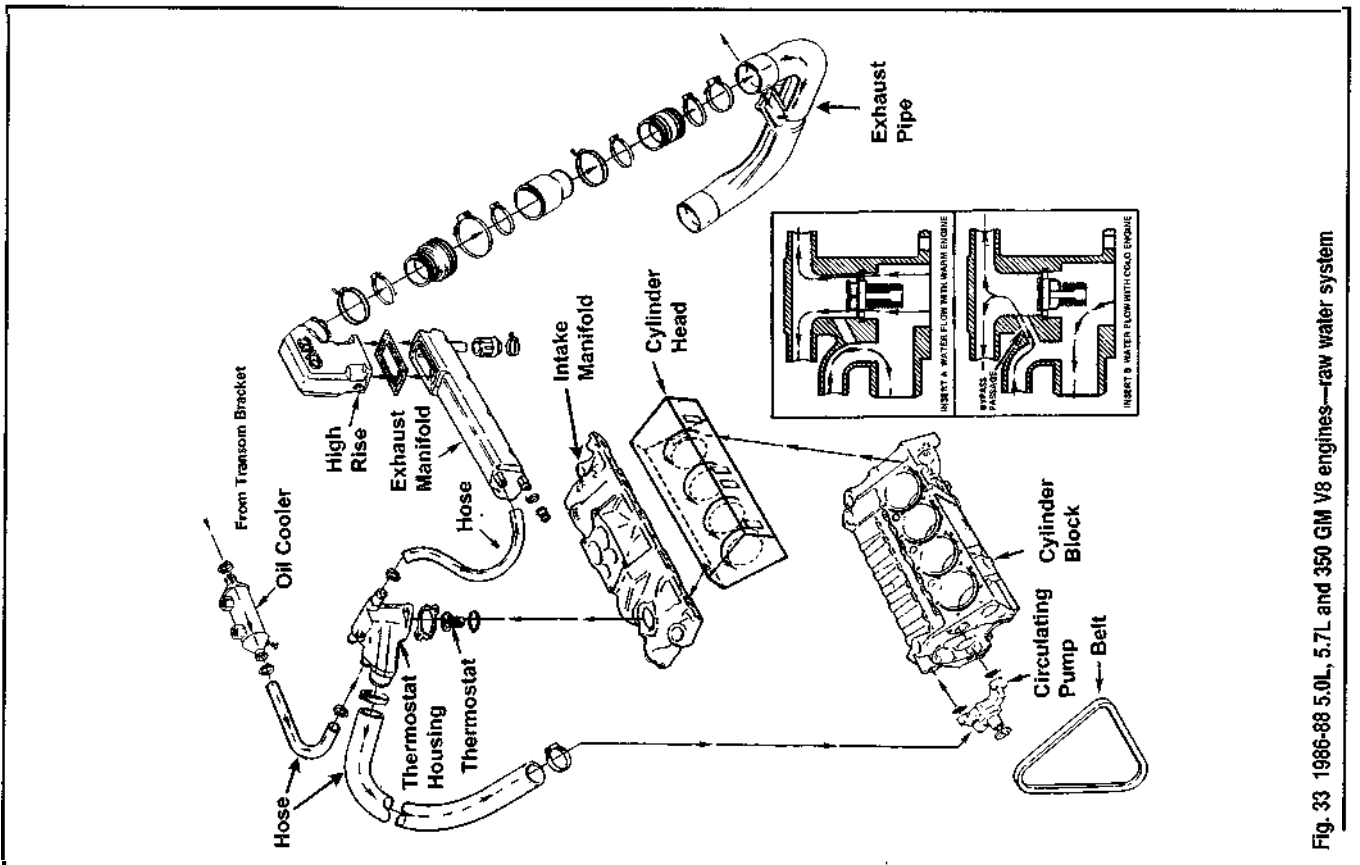


Fig. 33 1986-88 5.0L, 5.7L and 350 GM V8 engines—raw water system

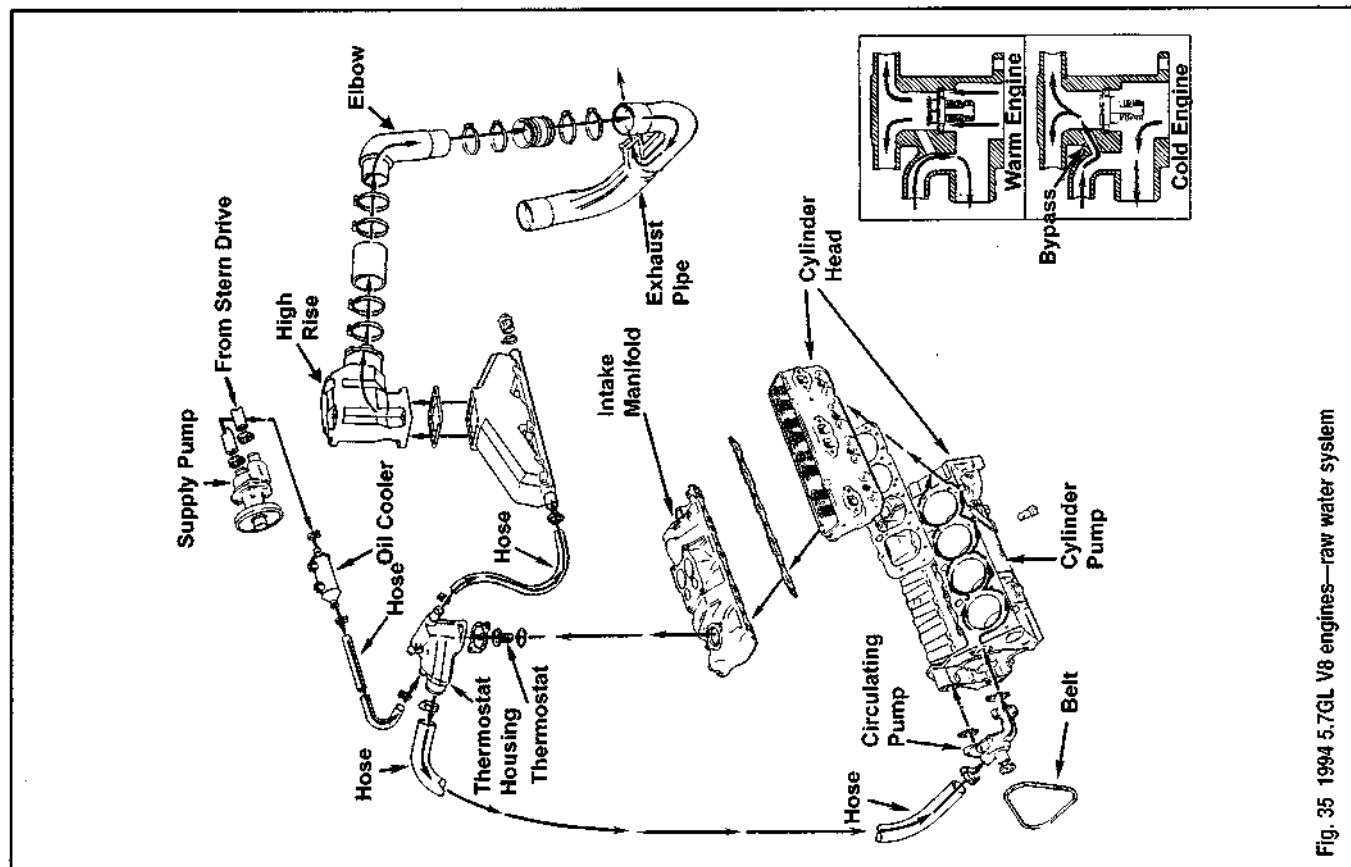


Fig. 35 1994 5.7GL V8 engines—raw water system

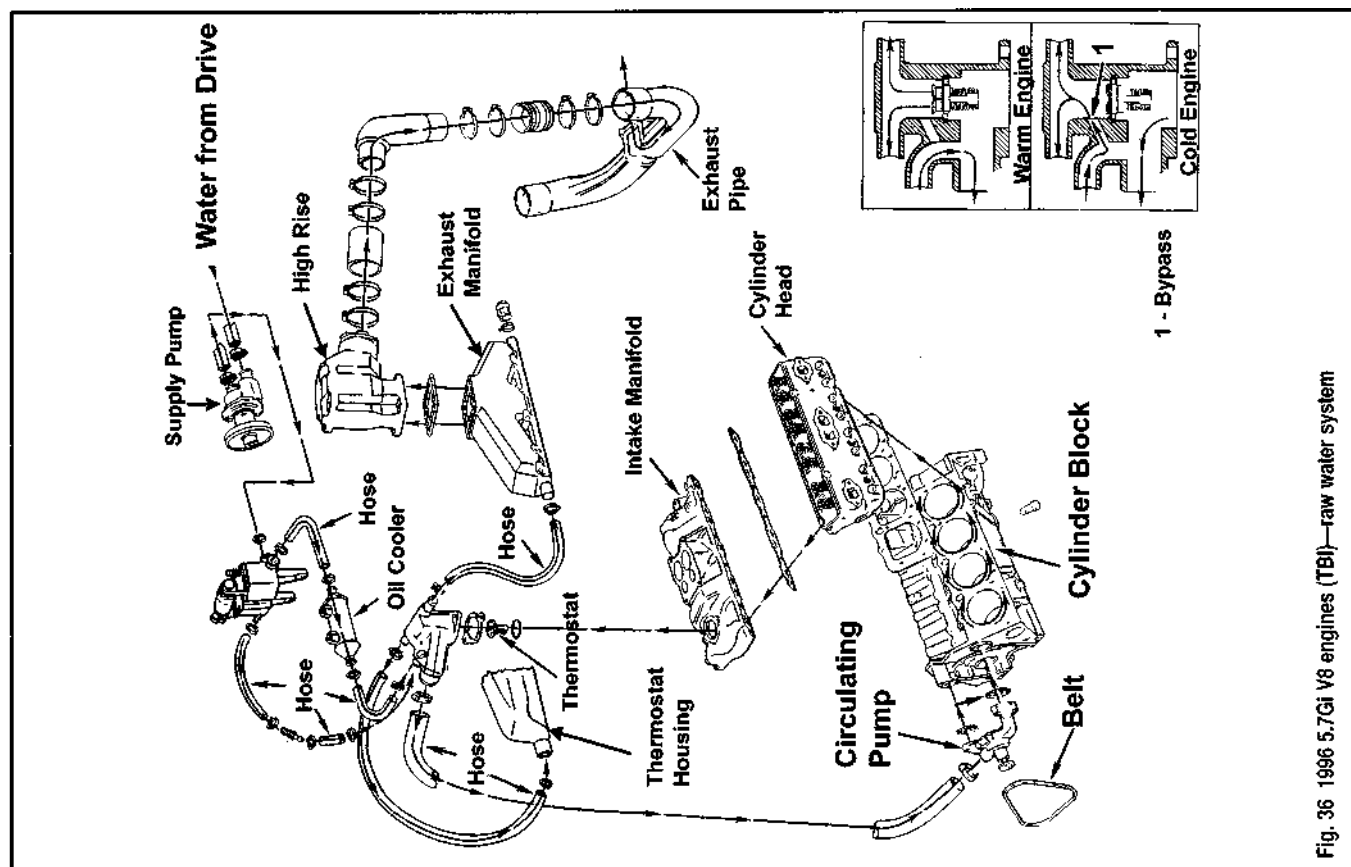


Fig. 36 1996 5.7Gi V8 engines (TBI)—raw water system

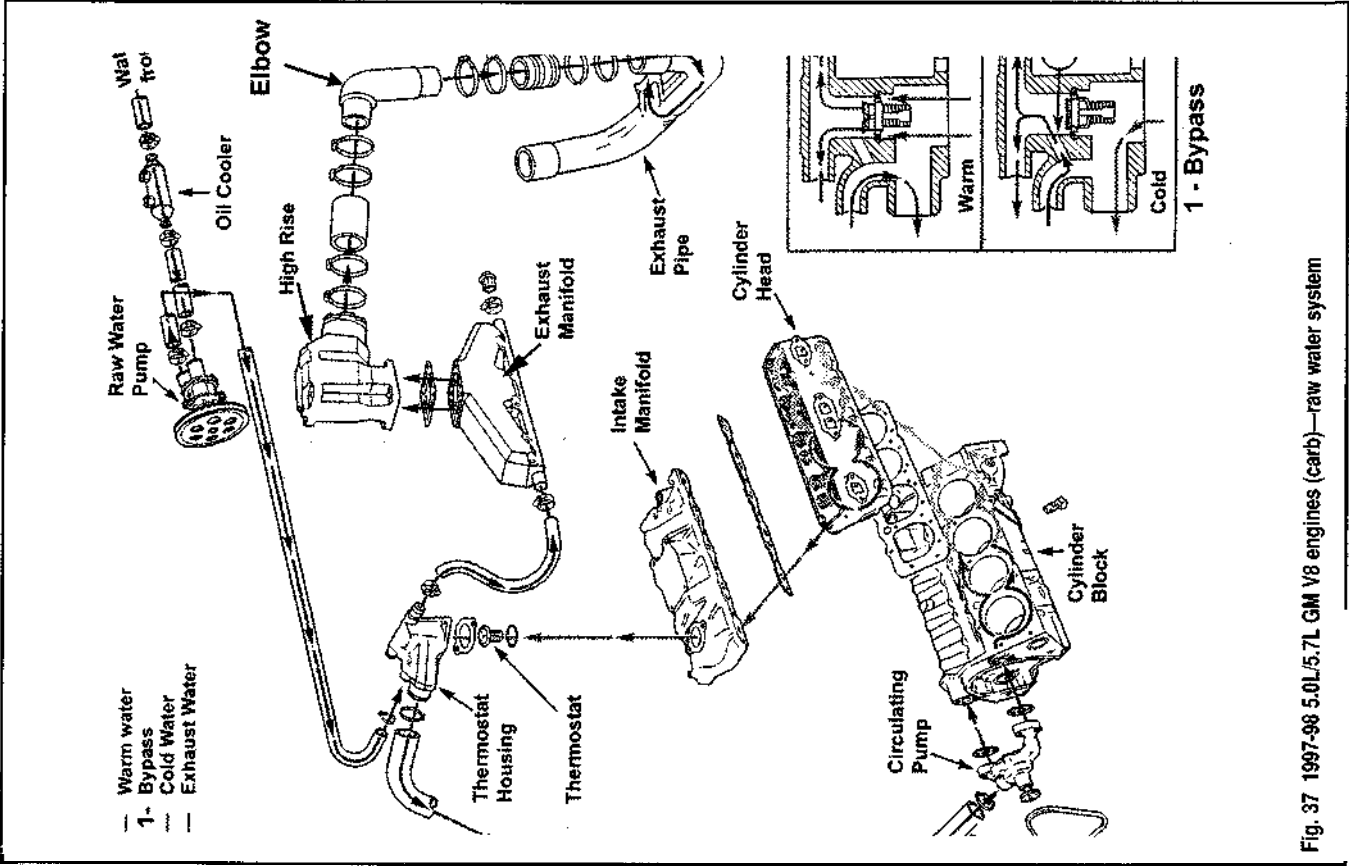


Fig. 37 1997-98 5.0L/5.7L GM V8 engines (carb)—raw water system

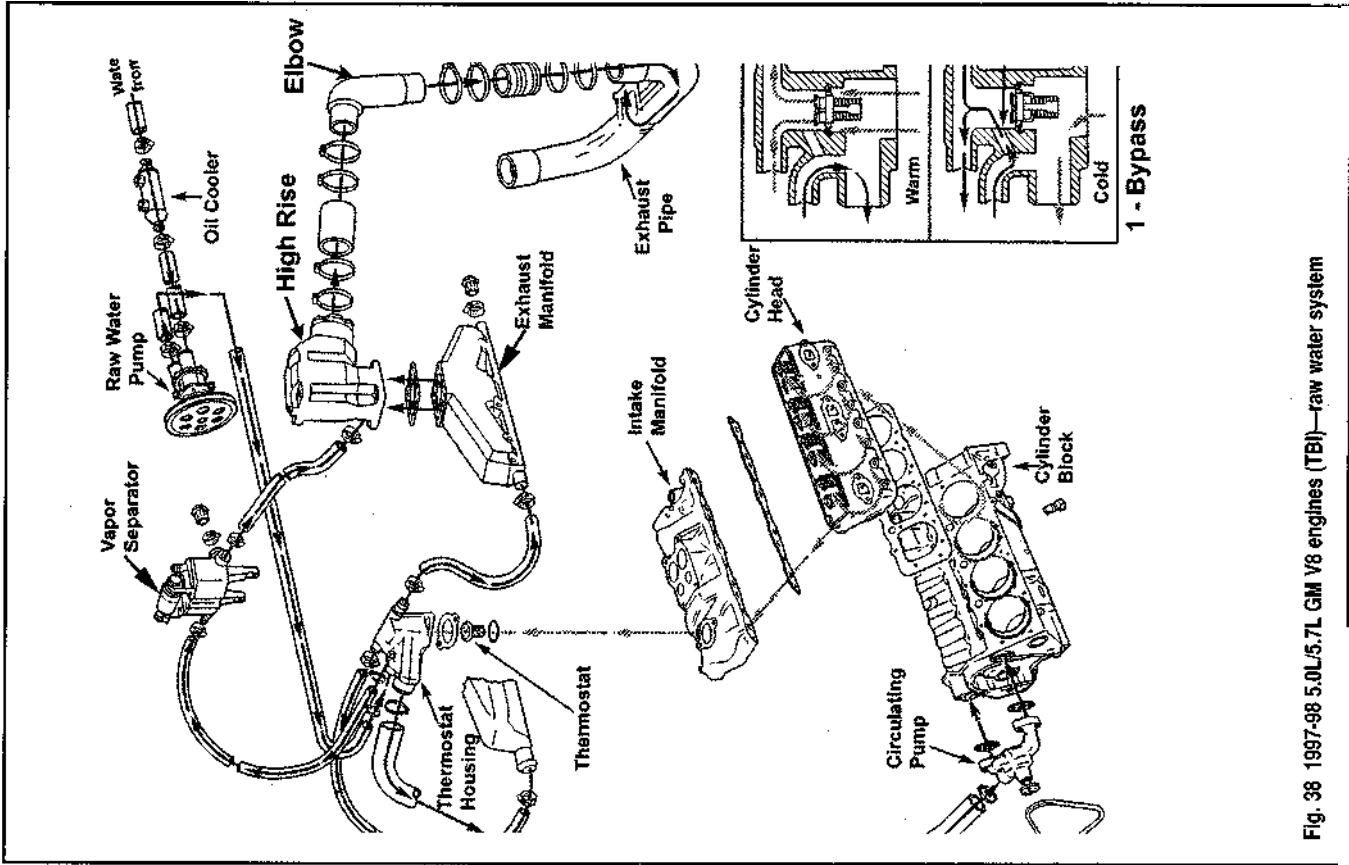


Fig. 38 1997-98 5.0L/5.7L GM V8 engines (TBI)—raw water system

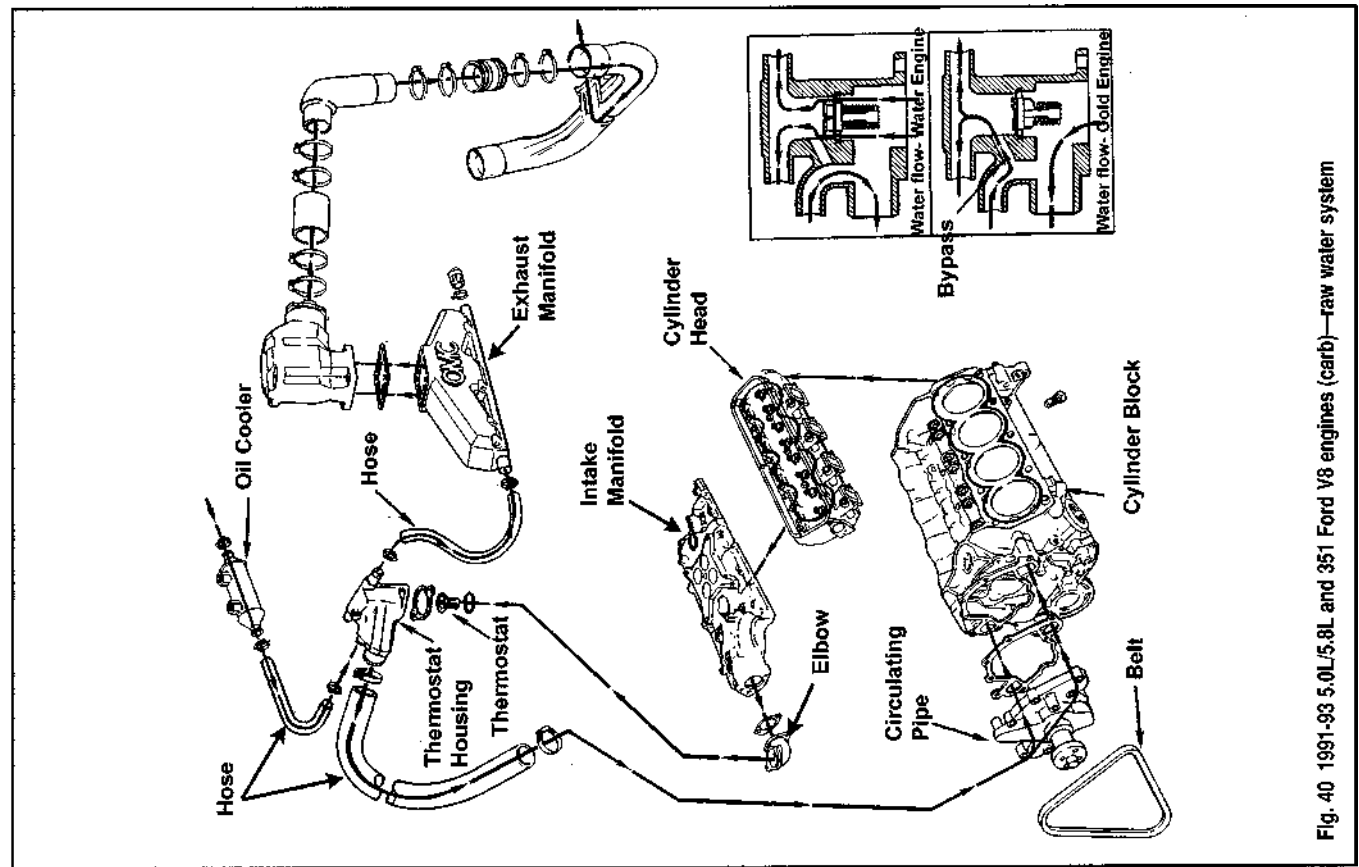


Fig. 40 1991-93 5.0L/5.8L and 351 Ford V8 engines (carb)—raw water system

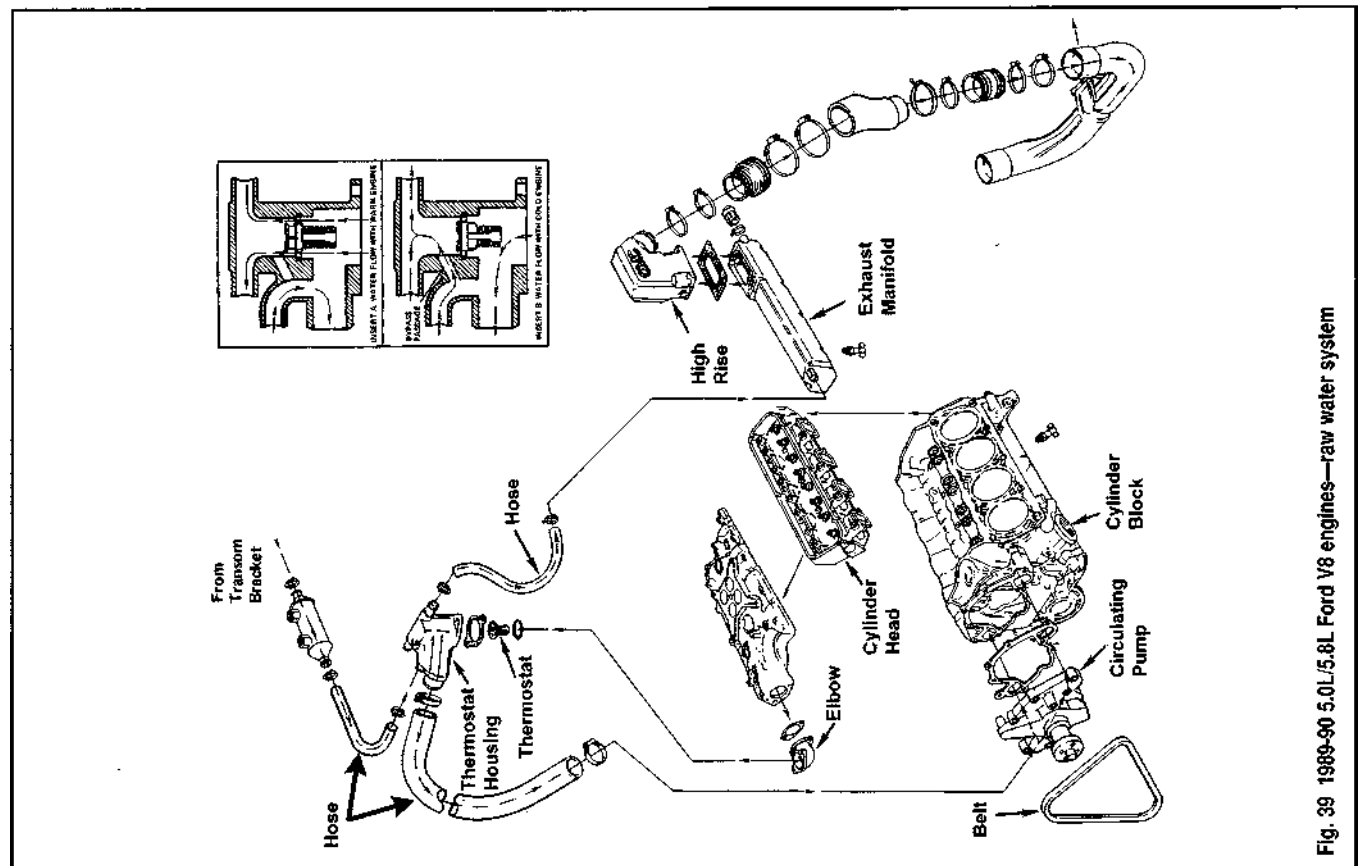


Fig. 39 1989-90 5.0L/5.8L Ford V8 engines—raw water system

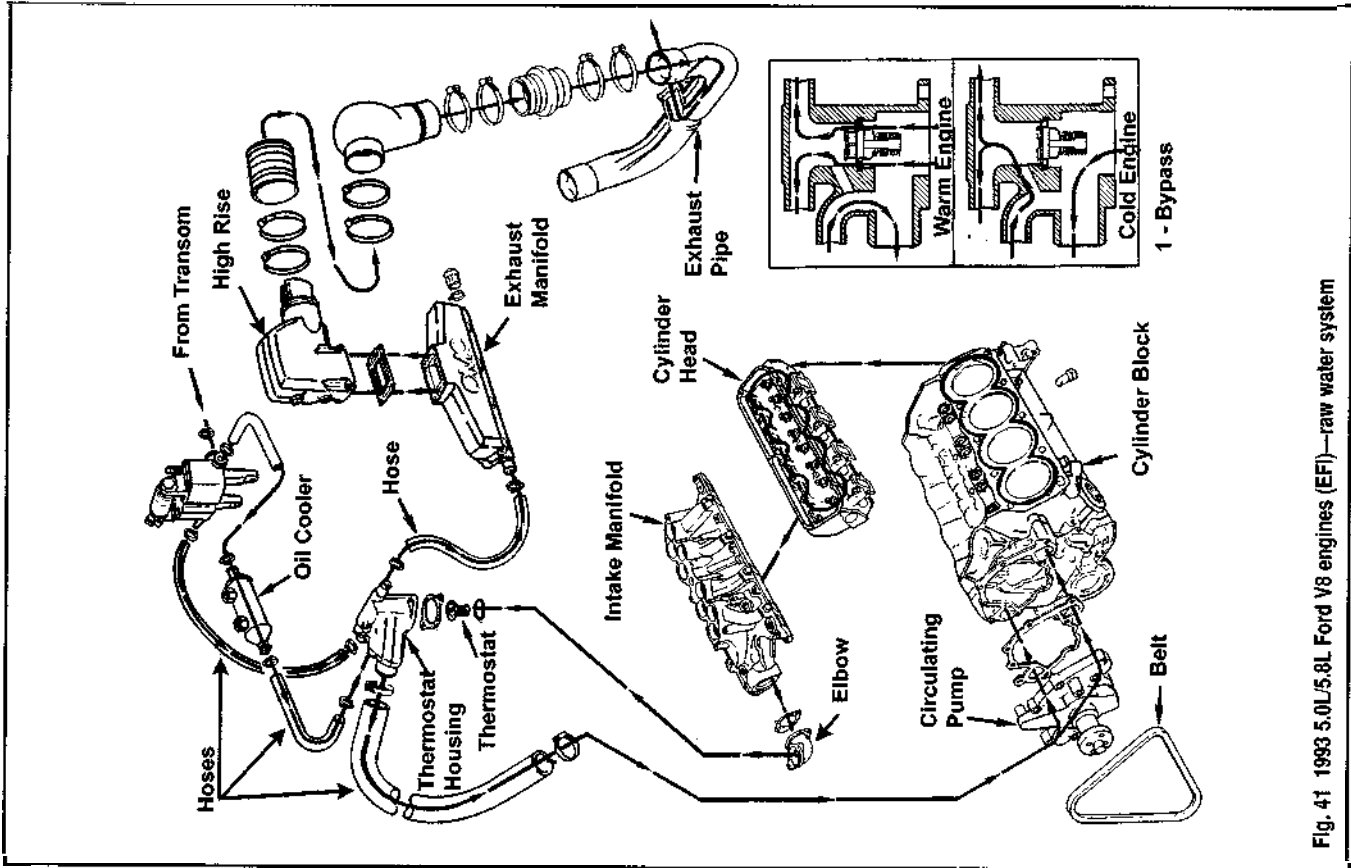


Fig. 41 1993 5.0L/5.8L Ford V8 engines (EFI)—raw water system

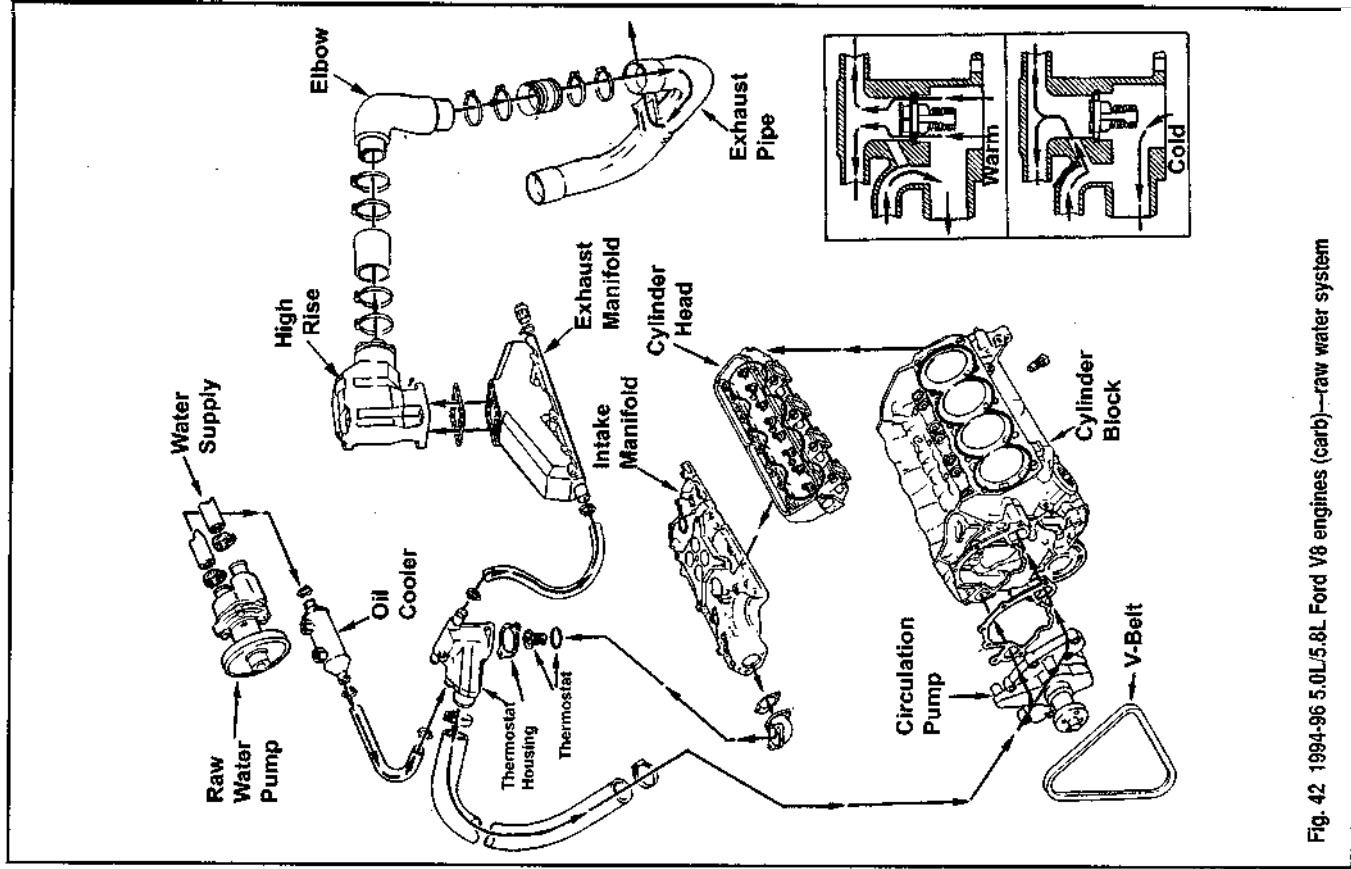


Fig. 42 1994-96 5.0L/5.8L Ford V8 engines (carb)—raw water system

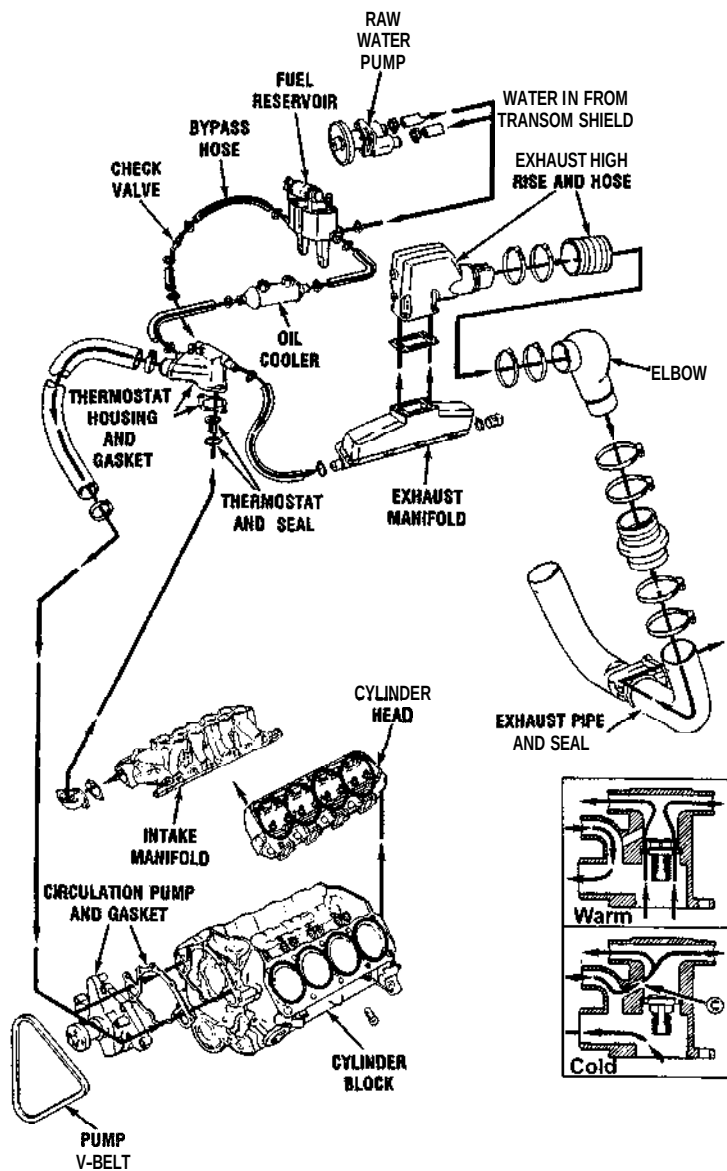


Fig. 43 1994-96 5.0L/5.8L Ford V8 engines (EFI)—raw water system

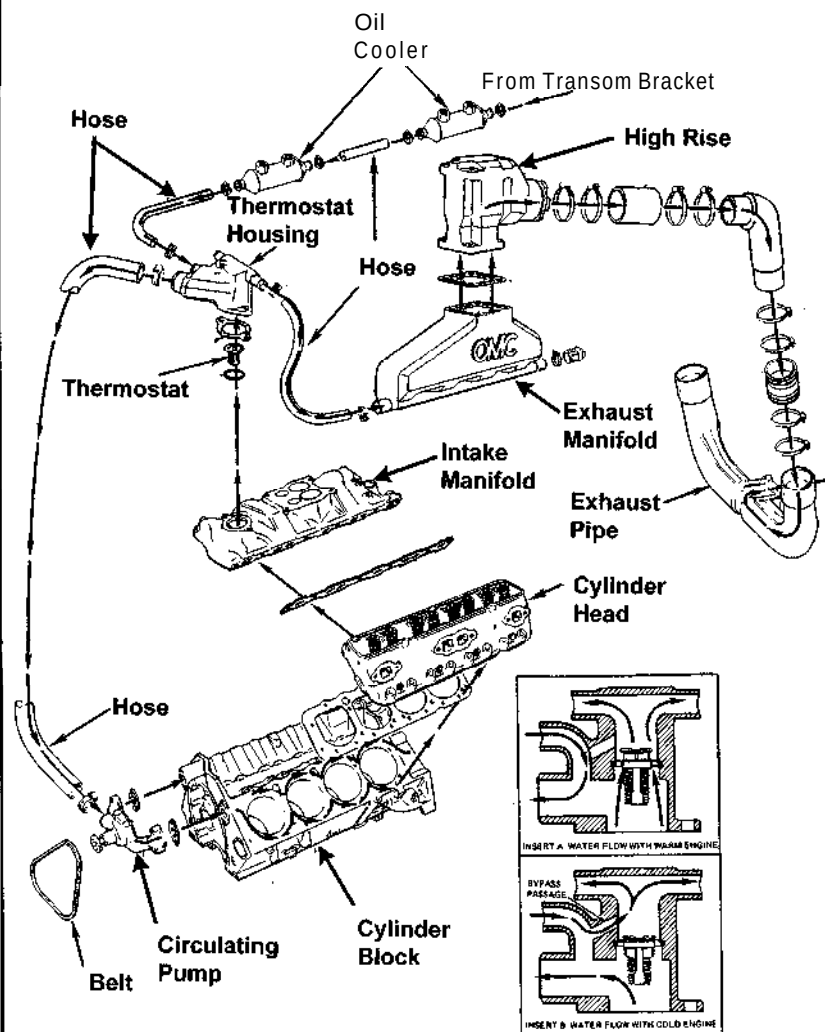


Fig. 44 1990-95 7.4L/454 and 8.2L/502 GM V8 engines (carburetor)—raw water system

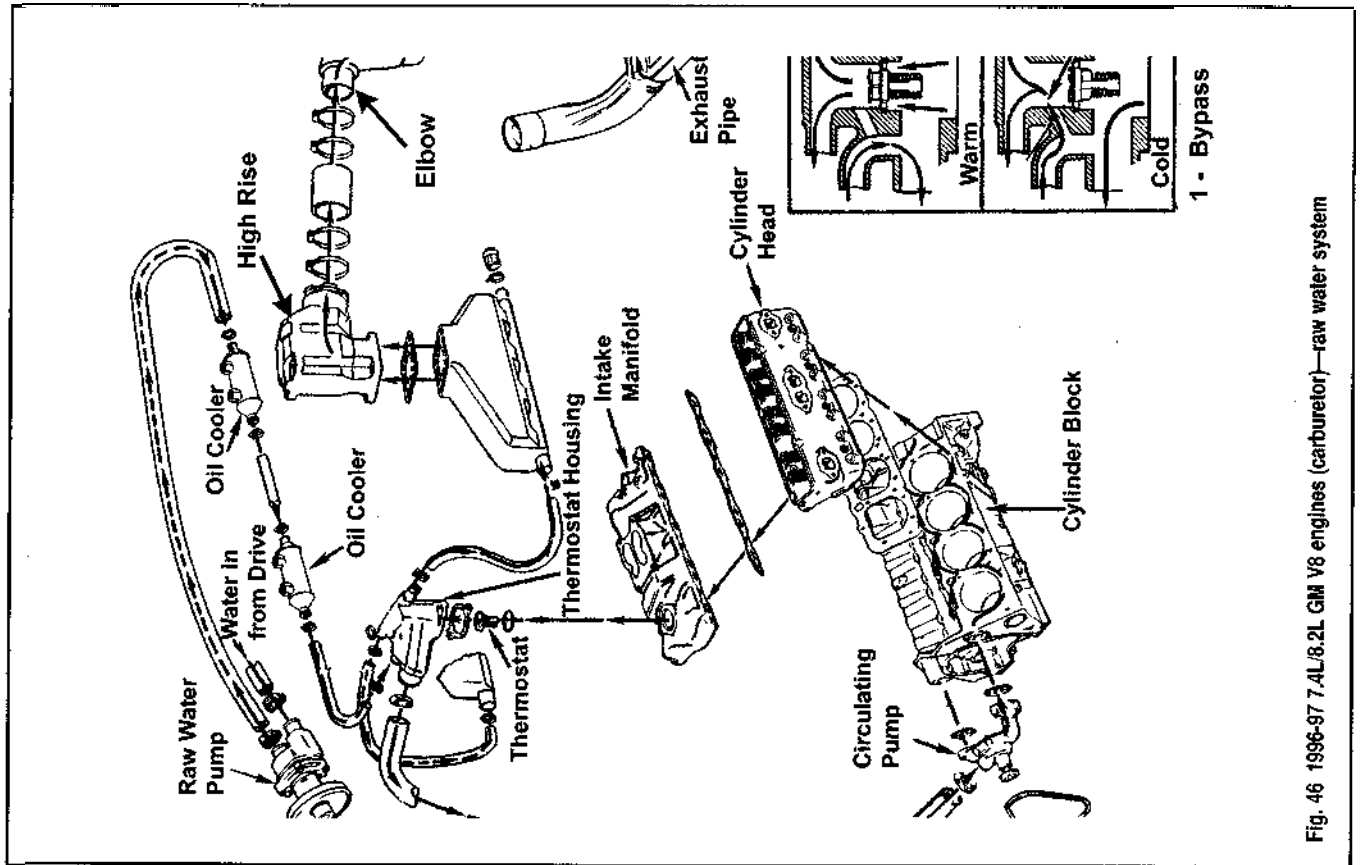


Fig. 46 1996-97 7.4L/8.2L GM V8 engines (carburetor)—raw water system

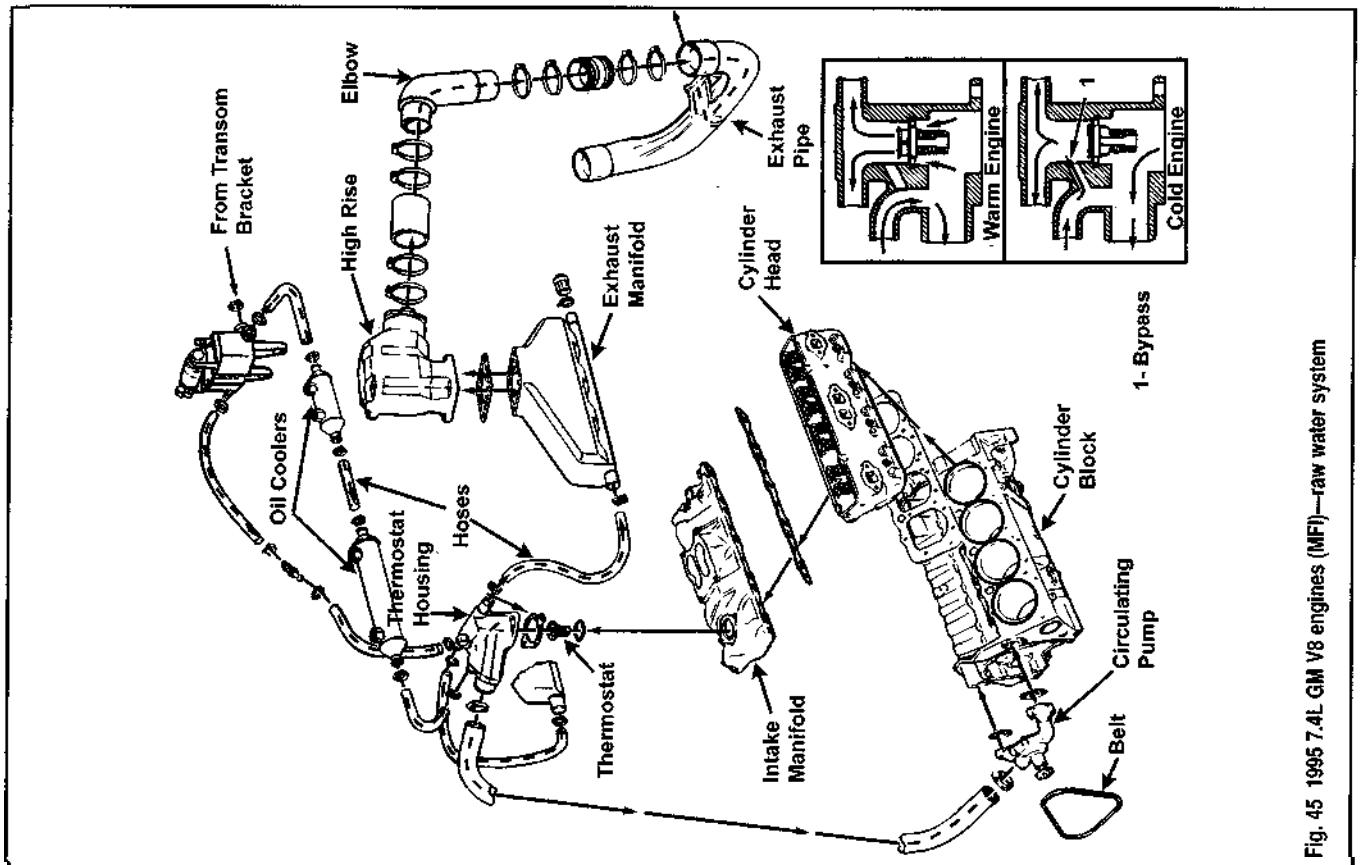


Fig. 45 1995 7.4L GM V8 engines (MPI)—raw water system

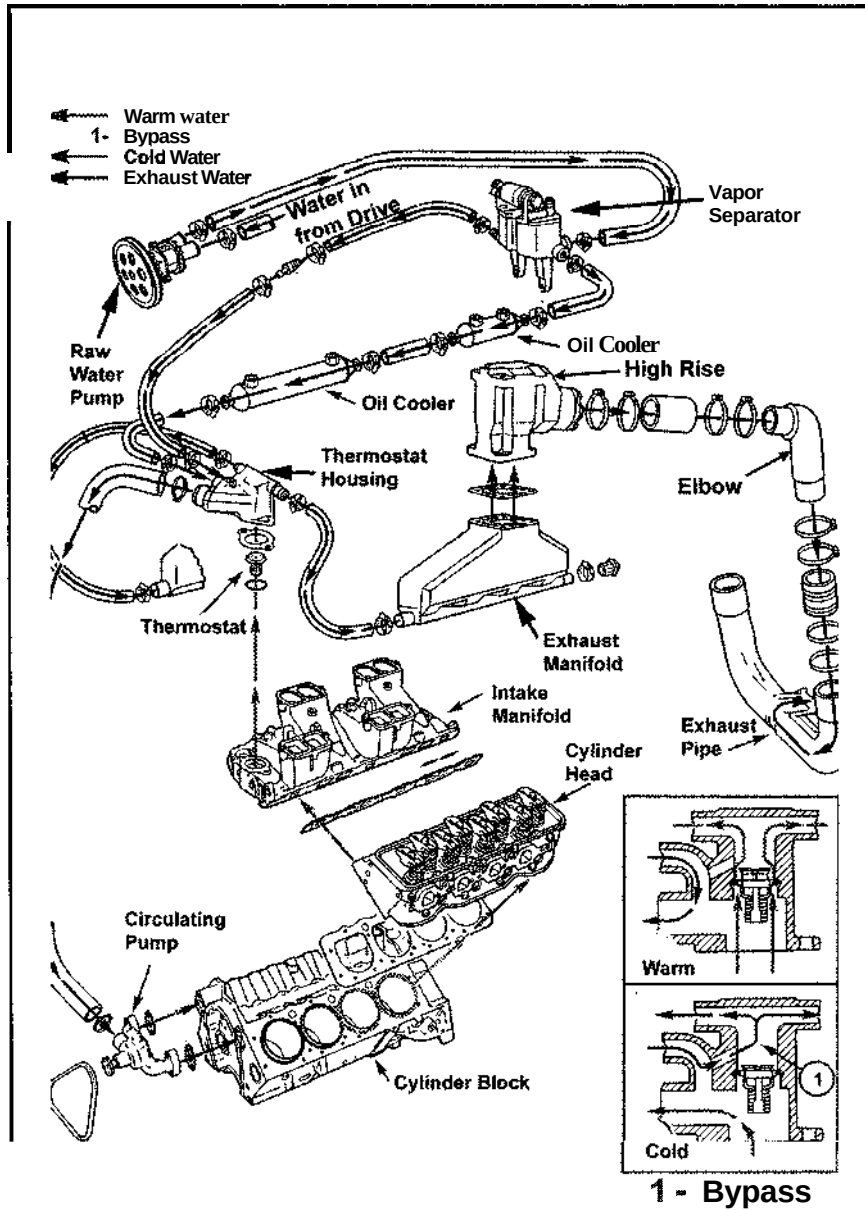


Fig. 47 1996-98 7.4L/8.2L GM V8 engines (MFI)—raw water system

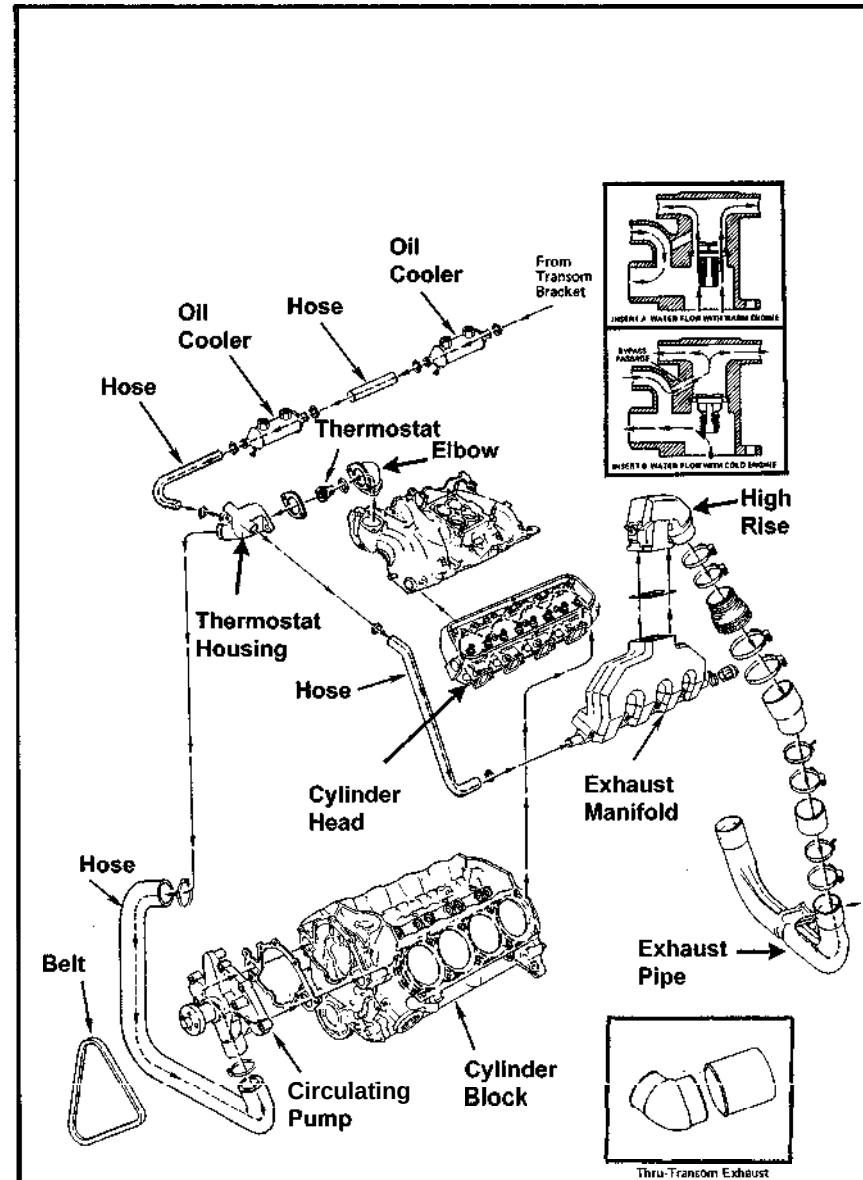


Fig. 48 1996-98 7.5L/460 Ford V8 engines—raw water system

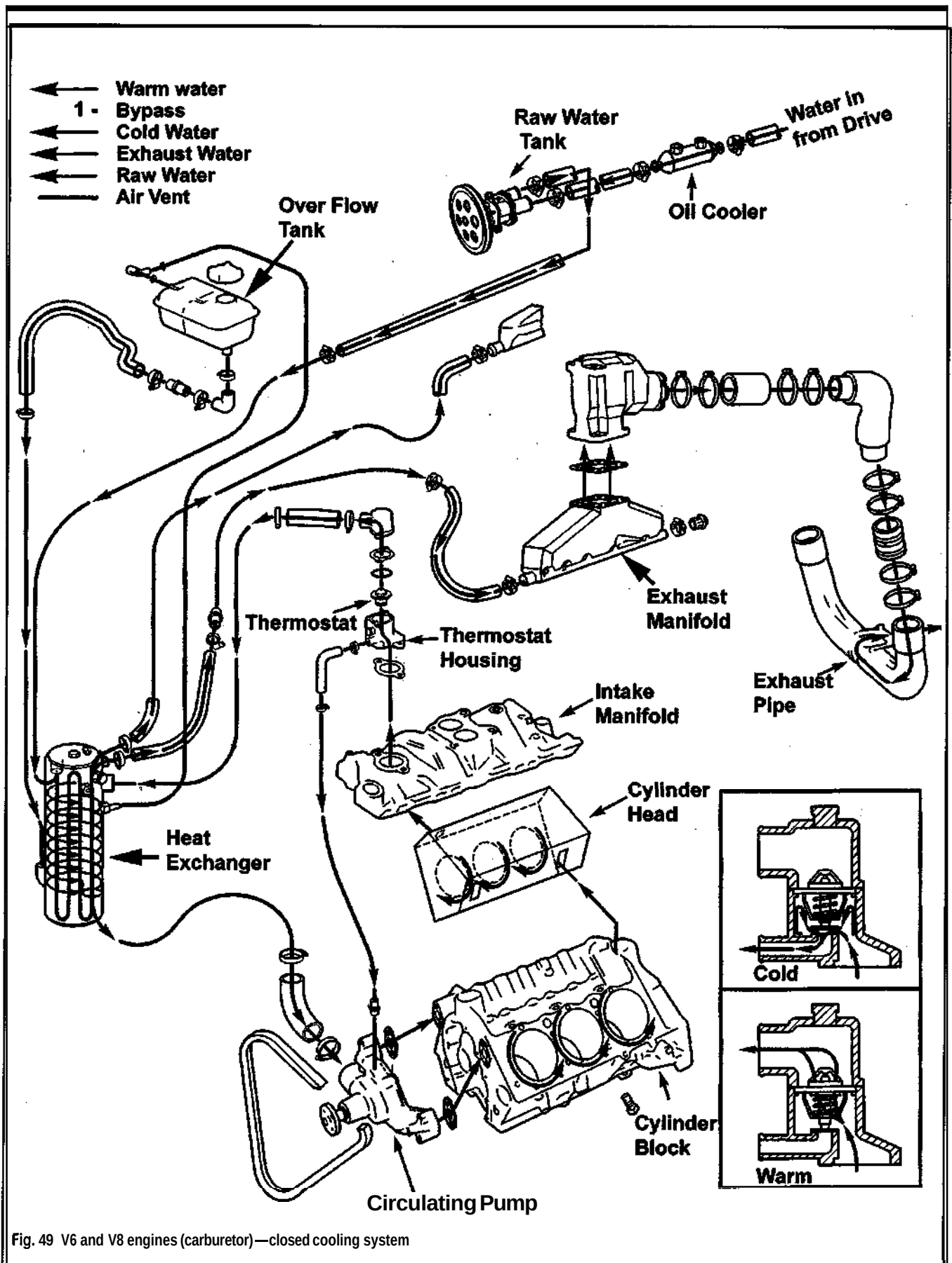


Fig. 49 V6 and V8 engines (carburetor)—closed cooling system

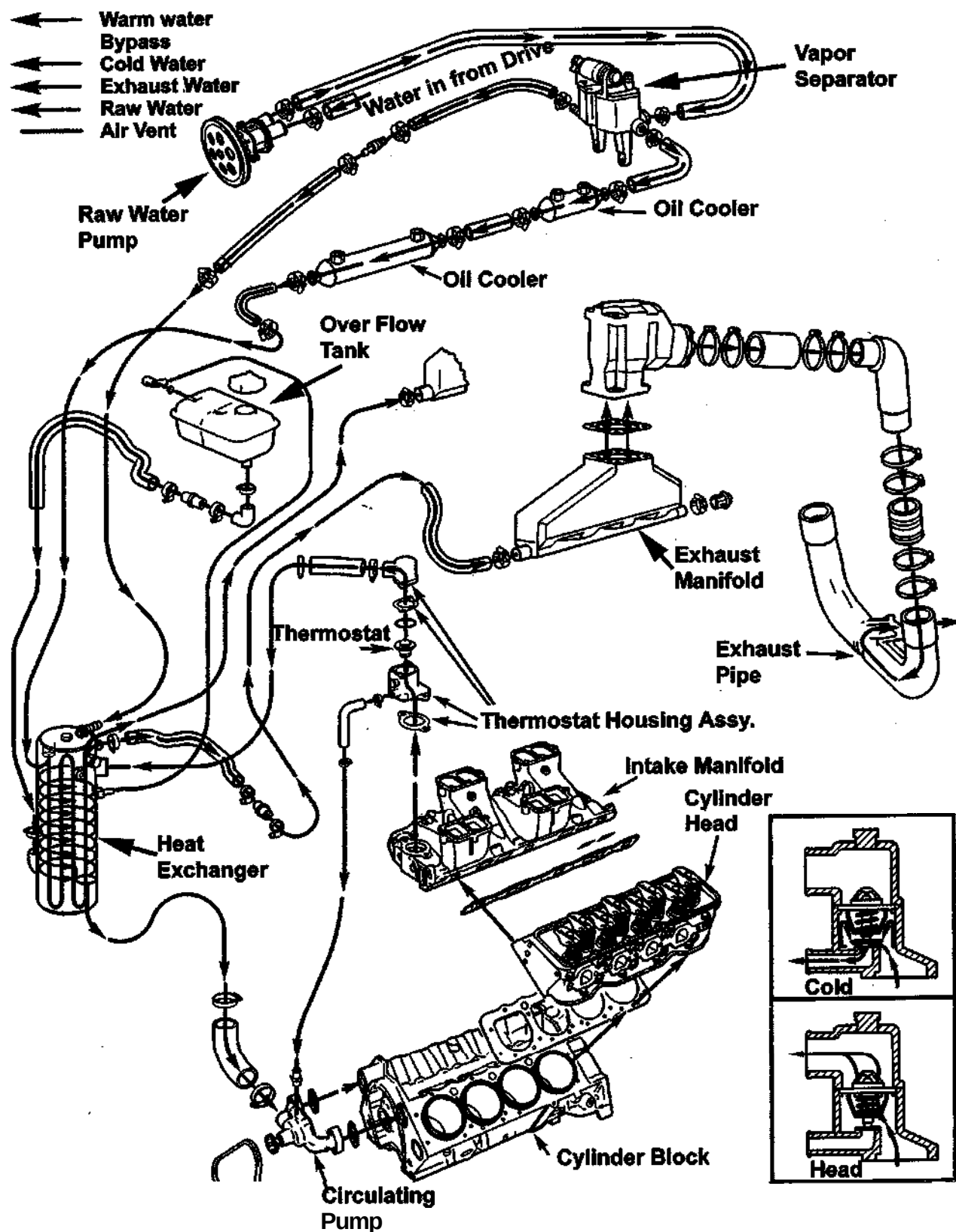


Fig. 50 V6 and V8 engines (fuel injection)—closed cooling system

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# 12

## STERN DRIVE SP/SX/SX COBRA, COBRA AND KING COBRA, DP/DP DUOPROP

|                                                                                              |       |
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# 12-2 STERN DRIVE – COBRA AND KING COBRA

## STERN DRIVE UNIT—COBRA, KING COBRA, SP, SX, SX COBRA, DP AND DP DUOPROP MODELS

### Description

Single propeller drives may have been labeled as Cobra, King Cobra, SP, SX or SX Cobra models. Dual propeller drives may have been labeled as King Cobra, DP or DP DuoProp models. For the purposes of this section, we will frequently refer to all single propeller models as SP and all duo prop models as DP.

That which we refer to as the stern drive is actually a number of individual components attached and working together to transfer the power of the engine into a viable propulsion system for your boat. All stern drive units can be broken down into their component assemblies.

The transom assembly consists of an inner transom plate, gimbal housing, gimbal ring, and a pivot housing—all attached to the transom of the vessel. The inner transom plate is, obviously, attached to the inner side of the transom.

On the other side of the transom, and attached to the transom plate, are the gimbal housing, gimbal ring and pivot housing. The pivot housing is attached to the gimbal ring via roller bearings and is what allows for the up and down (trim) movement of the stern drive unit itself. The gimbal ring is also attached to the gimbal housing via roller bearings and is what allows for side-to-side movement of the unit, or, steering.

The stern drive unit, or at least that thing that is most visible when viewing the stern of the boat, is made up of two component assemblies: the upper gear housing and the lower gear housing.

The upper gear housing, frequently called the driveshaft housing or simply the upper unit is attached to the pivot housing at the top and the lower gear housing at the bottom. Power from the engine, brought through the transom assembly via the splined driveshaft and universal joint is transferred via a pinion gear to the forward and reverse gears on the vertical shaft leading to the lower unit by means of a set of drive and driven gears. The pinion, forward and reverse gears are helical cut and are only available as a matched set.

A cone-type clutch (on all but the Cobra) is splined to the vertical shaft and engages the forward and reverse gears whenever the shift lever is moved to the appropriate position

The lower gear housing, or lower unit, is attached to the bottom of the upper housing. Power, or propulsion, comes through the vertical shaft from the upper unit, is transferred to the propeller shaft via a pinion gear, and causes the propeller to rotate.

On duo prop units, there is a matched set of three gears and dual propeller shafts. The lower pinion gear is splined to the vertical shaft and is in constant mesh with the two other gears; one on the inner and one on the outer propeller shafts. The forward gear is splined to the inner propeller shaft, while the aft gear is a machined part of the outer propeller shaft. As the vertical shaft rotates, the forward gear and inner shaft is driven in one direction while the aft gear and outer shaft are driven in the opposite direction. The aft gear is attached to the same pinion gear as the forward gear, but 180° opposite, so each shaft and propeller rotates at the same speed, but in opposite directions.

The horizontal and vertical driveshafts are both mechanically connected. Therefore, anytime the engine is operating, the horizontal and vertical driveshafts are constantly rotating with engine rpm. A double yoke universal joint assembly in the horizontal driveshaft allows the stern drive to be raised or lowered to a required trim/tilt position (within limits), while the engine is operating.

The trim/tilt system consists of an electrically driven hydraulic pump with dual hydraulic cylinders mounted between the transom assembly and the lower unit and the controls necessary for efficient operation.

### Troubleshooting

The following are a list of potential drive unit problems and their possible causes:

#### GEAR HOUSING NOISE

- Metal particles in the unit oil supply.
- Propeller incorrectly installed.
- Propeller or propeller shaft bent.
- Incorrect drive gear shimming--gear housing back-lash or pinion gear height.
- Worn or damaged gears or bearings.

#### DRIVESHAFT HOUSING NOISE

- Steering lever may be contacting the transom cut-out edges when turning.
- Flywheel housing on the engine coming in contact with the inner transom plate or the exhaust pipe.
- Bad propeller.
- U-joint cross and bearing assembly O-rings of incorrect size or installed wrong.
- U-joint cross and bearing assemblies have excessive side-play.
- Bearing caps on the U-joint are coming in contact with the center socket or the driveshaft housing bearing retainer.
- Rough or scored U-joint cross and bearings.
- Worn or missing O-rings on the U-joint shaft rattling against the gimbal bearing.
- Worn or damaged splines on the driveshafts and/or couplers.
- Incorrect engine alignment.
- Damaged, rough, worn or loose gimbal bearing.
- Gimbal bearing seated incorrectly.
- Incorrect clearance between the gimbal housing and plate.
- Bell housing and gimbal housing incorrectly aligned.
- Weak or flexing transom.
- Weak, missing or mis-aligned rear engine mount.

#### DRIVE UNIT WILL NOT SLIDE INTO BELL HOUSING

- U-joint and engine coupler splines not aligned.
- Unit not in Forward gear.
- Incorrectly aligned shift shaft coupler.
- Engine out of alignment.
- Incorrectly installed gimbal bearing.
- Damaged or worn splines on the driveshaft or coupler.

#### DRIVE UNIT WILL NOT SHIFT—SHIFT HANDLE MOVES

- Shift cables not adjusted properly.
- Shift cables not connected.
- Inner wire on cable broken.
- Gear housing crank installed incorrectly.

#### DRIVE UNIT WILL NOT SHIFT—SHIFT HANDLE DOES NOT MOVE

- Remote control box/assembly installed incorrectly.
- Broken, worn or damaged linkage.
- Shift shaft or lever stuck.
- Controls or cables installed or adjusted incorrectly.

#### HARD SHIFTING

- Shift cables out of adjustment.
- Shift cut-out switch broken or improperly adjusted.
- Shift cable too short, or too long.
- Corroded cables.
- Shift shaft bushings corroded or damaged.
- Shift crank or clutch actuating spool worn or damaged.
- Shaft shaft damaged, worn or broken.
- Shift cable attaching nuts too tight.

#### JUMPS OUT OF GEAR

- Incorrectly adjusted shift cables.
- Worn or damaged clutch or gears.

## Stern Drive Unit

### REMOVAL & INSTALLATION

1986-93 Cobra And 1988-95 King Cobra Models

◆ See Figures 1 thru 7



■ All special tool part numbers listed below are OMC factory tool numbers—we realize that if you reading this after 2001, they may be difficult, if not impossible, to obtain. With the exception of some of the earliest tools, the vast majority of these tools should be available from a Volvo Penta representative. Although the part numbers themselves may be different in many cases, the tool should be the same.

■ The vessel must be out of the water to perform this procedure.

1. Disconnect the battery cables.
2. Lower the drive unit into the full DOWN or IN position. Drain the stern drive unit oil as detailed in the Maintenance section—make sure that you remove the oil dipstick. Check the drained lubricant carefully to determine if it contains any water or metal particles. Rub some of the lubricant between your fingers. Any metal particles in the lubricant will thus be evident. Do not be mislead if the color of the lubricant is metal colored. This is not a harmful condition and is caused by the lubricant used in the unit the first time after manufacture.

3. Remove the propeller(s) if you have not already done so. Although not strictly necessary, we strongly suggest removing the propellers as a precaution.

4. Support the stern drive before detaching it from the transom. Use either an engine/drive hoist or a dolly. If using the hoist, make sure it is capable of a 500 lb. capacity. Screw a lifting eye (112 x 13 thread, available at any home center) into the oil dipstick hole as far as possible and then attach the hoist chain to the eye. Tighten the hoist chain just enough to relieve the weight of the drive. If using a dolly, slide it under the anti-cavitation plate and tighten the two clamps.

5. Remove the plastic cap on the drive end of each trim/tilt cylinder. Remove the lock nut and flat washer. Support the hydraulic cylinder and lightly tap the pivot rod out of the cylinders with a rubber mallet. Carefully lower the cylinders down until they rest against the spray plate.

6. Loosen and remove the 6 mounting nuts (3 per side) securing the upper unit to the transom bracket. Throw the nuts away.

7. Pull the drive unit backward and away from the transom bracket, making sure that you support the U-joints and shaft as they come out of the pivot housing bellows.

On the 1990-95 King Cobra, pull the unit back just far enough to expose the shift cable connectors. Pull up the latch, remove the connector pin and then pull the drive off all the way.

8. Support the drive in a suitable holding fixture.

To install:

The engine must be properly aligned or the input and output shaft splines will be destroyed after a short time of engine operation. If the engine has not been removed while the drive is out the alignment should still be satisfactory, but you must still use the proper alignment tools.

■ If you've gone through the trouble of removing the stern drive, we recommend this as a good time to perform some preventative, although not necessary, maintenance—remove the U-joint and exhaust bellows and replace them as detailed in the Gimbal Housing section; why not do the water hose also? Cheap insurance, so spend a few bucks and do it!

9. Inspect the condition of the water sealing seal and replace with a new seal if any doubts as to its condition.

10. Check the water hose and its fitting. Make sure the clamp nut is tightened to 96-120 inch lbs. (11-14 Nm).

11. Install a new pivot housing gasket and then coat the lip of the U-joint bellows lightly with Triple Guard grease.

12. Slide an alignment tool (# 912273), splined end first, through the bellows and gimbal bearing and into the engine coupler. The tool should slide into the coupler very easily; if not, the engine is out of adjustment and will have to be moved as detailed in the Engine Alignment procedures given in the appropriate section for your engine.

■ If you are not sure of which way that the engine needs to be adjusted, coat the splines of the tool with grease and reinsert it again until it binds and then remove it very carefully. The pattern left on the alignment tool should tell you which way to adjust the engine.

13. Once the engine is aligned correctly, remove the tool and shift the drive into Neutral; making sure that the shift rod in the drive is also in the Neutral position. Coat the shift lever pin liberally with Triple Guard grease.

14. Coat the 6 mounting studs with Drive Sealing compound.

15. Coat the splines on the driveshaft liberally with Moly Grease. Lubricate 2 new shaft O-rings with clean engine oil and slide them onto the shaft until they are seated in their grooves. Do not get grease in the grooves.

16. Use a grease gun on the U-joint zerk fitting and top out the joints. Coat the surface of the U-joint coupler with grease. Coat the mounting stud threads with Gasket Sealing compound.

17. On 1990-95 King Cobras, move the remote control shift handle protruding from the pivot housing up and into the Forward position. On the port side of the drive (next to the U-joint yoke), pull the shift linkage out and flip the connector latch up.

18. Raise the unit off of the holding fixture with your hoist and move it into position in front of the transom. Carefully slide the unit forward while guiding the driveshaft into the engine coupler and the drive over the mounting studs. Wiggle the propeller slightly once the shaft splines make contact with the coupler until they engage properly and then slide the unit all the way forward until the case mates with the pivot housing.

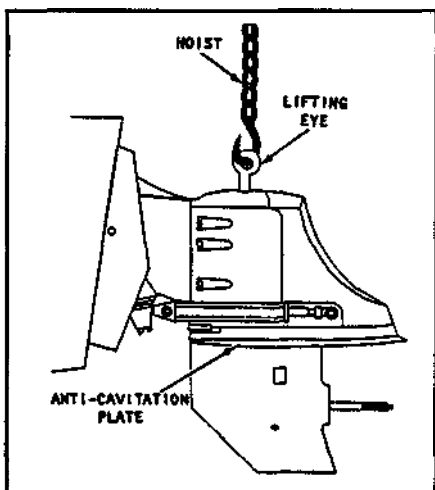


Fig. 1 Screw in a lifting eye and then attach a hoist



Fig. 2 Remove the plastic cap



Fig. 3 Loosen the mounting bolts...

## 12-4 STERN DRIVE – COBRA AND KING COBRA

On the 1990-95 King Cobras, stop the drive just at the point where it's possible to connect the shift handle to linkage. Line up the holes, insert the pin and press the latch down until it snaps into position. Now finish mating the drive to the housing.

18. Install 6 new locknuts and tighten them with a 5/8 in. swivel socket to 25 ft. lbs. (34 Nm) starting with the center nuts and then working back and forth in a criss-cross pattern. Now repeat the same sequence until they are tightened to 50 ft. lbs. (68 Nm).

19. Press the trim/tilt cylinder bushing into the boss on each side of the upper unit. Install bushings into the outer side of each cylinder, align the cylinder with the boss and press in the pivot pin very carefully. You may have to give it a few taps with a rubber mallet.

20. On cylinders with lock nuts, install the washers and then the nuts (new!). Tighten the nuts until there is an equal amount of threads exposed on each side of the pin and then tighten both nuts to 32-34 ft. lbs. (43-46 Nm), except on the 1990-95 King Cobras where it is 10-12 ft. lbs. (14-16 Nm). Replace the plastic caps.

21. Detach the lifting hoist. Install the oil level indicator and tighten it to 48-72 inch lbs. (5-8 Nm).

22. Adjust the trim sending unit and the shift mechanism.

23. Install the shift cover and tighten the bolt(s) securely. Fill the unit with oil, screw in the dipstick, install the propeller(s) and connect the battery cables.

1994-98 Single Propeller Models (SPISXISX Cobra)

1996-98 Dual Propeller Models (DPIRP DuoProp)



◆ See Figures 1, 2, 6, 7, 8, 9, 10 and 11

□ All special tool part numbers listed below are OMC factory tool numbers—we realize that if you reading this after 2001, they may be difficult, if not impossible, to obtain. With the exception of some of the

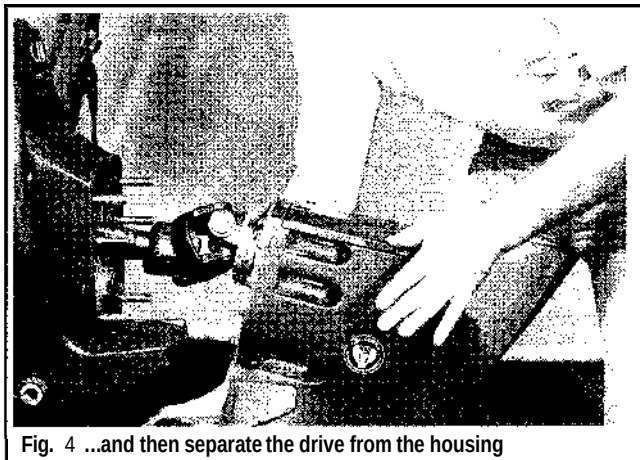


Fig. 4 ...and then separate the drive from the housing

earliest tools, the vast majority of these tools should be available from a Volvo Penta representative. Although the part numbers themselves may be different in many cases, the tool should be the same.

□ The vessel must be out of the water to perform this procedure.

1. Disconnect the battery cables.

2. Lower the drive unit into the full DOWN or IN position. Drain the stern drive unit oil as detailed in the Maintenance section—make sure that you remove the oil dipstick. Check the drained lubricant carefully to determine if it contains any water or metal particles. Rub some of the lubricant between your fingers. Any metal particles in the lubricant will thus be evident. Do not be misled if the color of the lubricant is metal colored. This is not a harmful condition and is caused by the lubricant used in the unit the first time after manufacture.

3. Remove the propeller(s) if you have not already done so. Although not strictly necessary, we strongly suggest removing the propellers as a precaution.

4. Support the stern drive before detaching it from the transom. Use either an engine/drive hoist or a dolly. If using the hoist, make sure it is capable of a 500 lb. capacity. Screw a lifting eye (112 x 13 thread, available at any home center) into the oil dipstick hole as far as possible and then attach the hoist chain to the eye. Tighten the hoist chain just enough to relieve the weight of the drive. If using a dolly, slide it under the anti-cavitation plate and tighten the two clamps.

5. Remove the 3 bolts securing the shift cover to the rear of the unit and lift off the cover. Remove the jam nut from the shift cable, pull out the cotter pin holding the shift cable end and remove the washer. Remove the pivot cube from the end of the cable and unscrew the brass nut if equipped.

6. Loosen the shift cable anchor clamp screw on the starboard side of the drive, slide the anchor over to relieve the cable and then turn the drive hard to point before removing the shift cable.

7. Remove the plastic cap on the drive end of each trim/tilt cylinder. Remove the elastic lock nut and flat washer; on certain 1998 units, the nut may have been replaced with an e-clip so remove the clip and flat washer from the rod.

8. Support the hydraulic cylinder and lightly tap the pivot rod out of the cylinders with a rubber mallet. Carefully lower the cylinders down until they rest against the spray plate.

□ If the bushings come out with the pivot rod, make sure that you keep the two grounding clips.

9. Loosen and remove the 6 elastic mounting nuts (3 per side) securing the upper unit to the transom bracket. Throw the nuts away.

10. Pull the drive unit backward and away from the transom bracket, making sure that you support the U-joints and shaft as they come out of the pivot housing bellows.

11. Support the drive in a suitable holding fixture.

To install:

The engine must be properly aligned or the input and output shaft splines will be destroyed after a short time of engine operation. If the engine has not been removed while the drive is out the alignment should still be satisfactory, but you must still use the proper alignment tools.

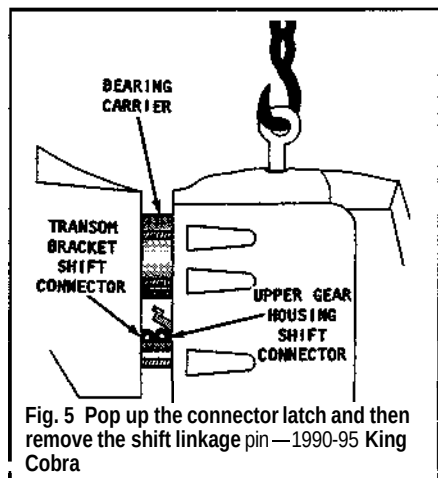


Fig. 5 Pop up the connector latch and then remove the shift linkage pin—1990-95 King Cobra

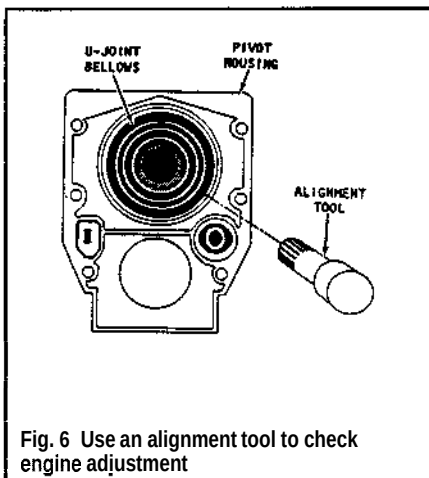


Fig. 6 Use an alignment tool to check engine adjustment

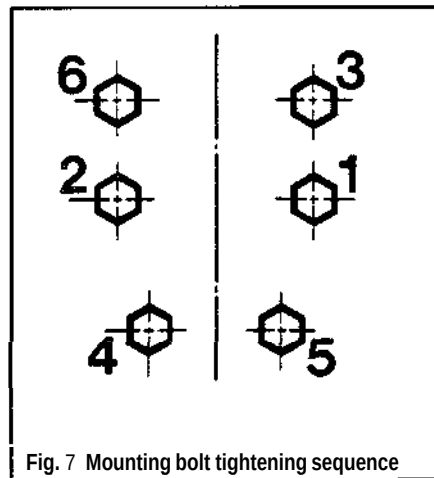


Fig. 7 Mounting bolt tightening sequence