MERCURY Racing **service bulletin**

☐ WARRANTY INFORMATION ☑ SERVICE INFORMATION **Sterndrive No. 2002-07**
☐ PARTS INFORMATION **OEM No. 2002-04**

Circulate to: ☐ Sales Manager ☐ Accounting ☑ Service Manager ☑ Technician ☐ Parts Manager

▲ Revised November 2002 - This Bulletin supersedes Sterndrive Bulletin No. 2002-07, dated prior to November 2002. Wherever the Diamond symbol appears, indicates where information was added or changed.

# H.P. 525 EFI Specifications

## Models Affected

Engine Serial Number 0L601000 & Up.

## ▲ Starting Procedure

Follow the procedures outlined in the Operation, Maintenance & Warranty Manual.

## Octane Requirements

| FUEL TYPE | MINIMUM POSTED OCTANE |
|---|---|
| Unleaded **(Note)** | (R+M)÷2=87 or RON=92 |

***NOTE:*** *Without alcohol whenever possible.*

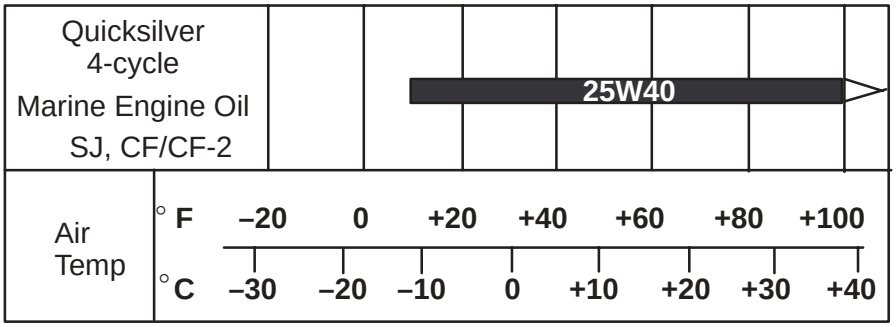
# Crankcase Oil Recommendations/Capacity

| PREFERRED OILS | API CLASSIFICATION |
|---|---|
| Quicksilver 4-Cycle Marine Engine Oil (25W-40) or equivalent | SJ, CF/CF-2 |
| **Oil filter should always be changed with oil** | |

| | |
|---|---|
| Crankcase Oil Capacity W/ New Filter **(NOTE)** | 6.6 L (7 U.S. qts) |
| Oil Filter Part No. | 35-16595T1 |

***NOTE:*** *Approximate, ALWAYS use dipstick to determine exact quantity of oil required.*

## TEMPERATURE/OIL VISCOSITY CHART



## IMPORTANT OIL PRACTICES

| Do Not Use |
|---|
| • Non-detergent oils |
| • Oils containing solid additives |
| • Multi-viscosity oils other than the ones recommended |
| • Low quality oils |
| **Do Not Mix** |
| • Straight weight and multi-viscosity oils |
| • Different brands of oils, straight weight or multi-viscosity |
| • Different weights of straight weight or different weights of multi-viscosity oils. |

# General

| | |
|---|---|
| ▲Crankshaft Kilowatts / Horsepower | 391 kw (525 hp) |
| Displacement L / cid | 8.2 L / 502 cid |
| Bore | 113.436 mm (4.466 in.) |
| Stroke | 101.6 mm (3.999 in.) |
| Compression Ratio | 8.75 :1 |
| Maximum RPM at Wide-Open-Throttle | 5200 |
| RPM Rev Limit | 5400 |
| Type of Ignition System | Inductive – Digital Control |
| Oil Pressure @ Idle (HOT) | 138 kPa (Min. 20 psi) |
| Oil Pressure @ WOT (HOT) | 241 kPa (Min. 35 psi) |
| Max. Allowable Engine Oil Temperature | 104 °C (220 °F) |
| Thermostat | 71 °C (160 °F) |
| Electrical System | 12-Volt Negative (–) Ground |
| Alternator Rating | 917 Watts (65 Amps) |
| ▲Recommended Battery Rating | Minimum 750 CCA, 950 MCA or 180 Amp/Hrs |

## Dimension/Weight

| | |
|---|---|
| Length - C/L of flywheel housing mounts to the front pulley | 868 mm (34.2 in.) |
| Width - Fuel filter bracket to oil filter bracket | 836 mm (32.9 in.) |
| Height - Crankshaft C/L to top of header hose | 601 mm (23.7 in.) |
| Weight W/headers,coolant and oil | 451 kg (994 lb) |

## Tune-Up

| | |
|---|---|
| Idle RPM in Gear | 700 RPM – ECM controlled |
| Idle RPM out of Gear | 750 RPM – ECM controlled |
| Timing @ Idle RPM | Non Adjustable |
| Spark Plug Type-P/N | NGK BPR6ES (33-813421) |
| Spark Plug Gap | 0.9 mm (.035 in.) |
| Valve Lash | 3/4 turn down from zero lash |
| Fuel Pump Pressure | Idle 276 kPa (40 psi)<br>WOT 262 kPa (38 psi) |
| Compression Pressure (Engine @ operating temperature) All cylinders should be within 20% of each other | 965 kPa (140 psi) |
| Serpentine Belt Tension **(Note 1)** | New 400 N (90 lb)<br>Used 489 N (110 lb) |

***NOTE: (1)*** *Special belt tension tool required.*

## Firing Order

| | |
|---|---|
| Firing Order | 1-8-4-3-6-5-7-2 |

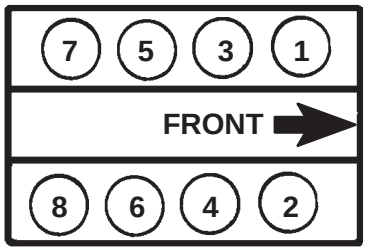
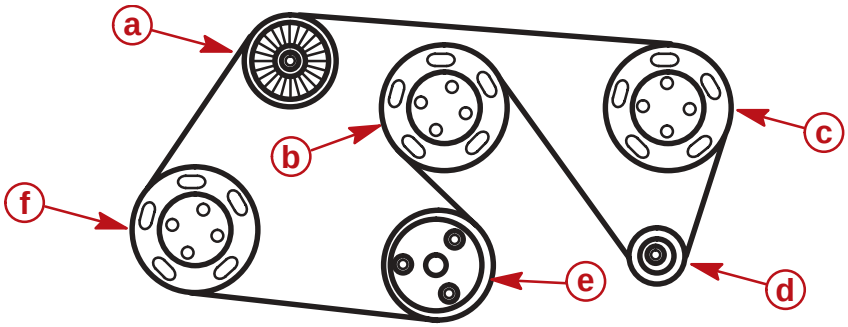



**Figure 1 L.H. Rotation**

## Cooling System

| | |
|---|---|
| Min. Allowable Seawater Pres. @ WOT | 138 kPa (20 psi) |

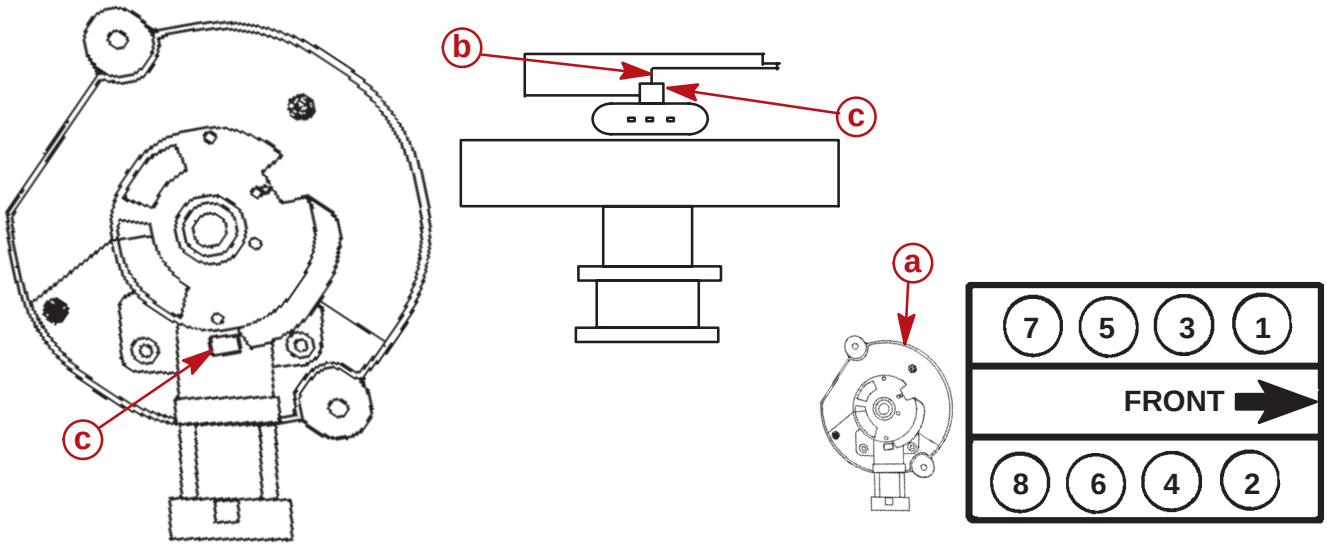
## Serpentine Belt Routing




**a -** Idler Pulley
**b -** Circulating Pump Pulley
**c -** Power Steering Pulley (Non Power Steering Models Will Have an Idler Pulley)
**d -** Alternator Pulley
**e -** Crankshaft Pulley
**f -** Seawater Pump Pulley

# Cam Position Sensor Pickup Setting

1. Rotate engine to have #1 Cyl at top firing position and Torsional Damper at 0° as indicated by the 0° marking on the damper aligned with the block mounted pointer.
2. Remove the cam sensor cover and install the cam sensor into the engine (at approximately the orientation shown below). The sensor will rotate clockwise as it engages with the cam teeth. Align the center of cam sensor pickup block with the falling edge of outer ring.
3. If the cam sensor is close but not correct, the lower body of the unit can be rotated to set. If the setting is too far off, the entire cam sensor will need to be lifted and repositioned. Secure the cam sensor shaft hold down.
4. Re-install the cam sensor cover.

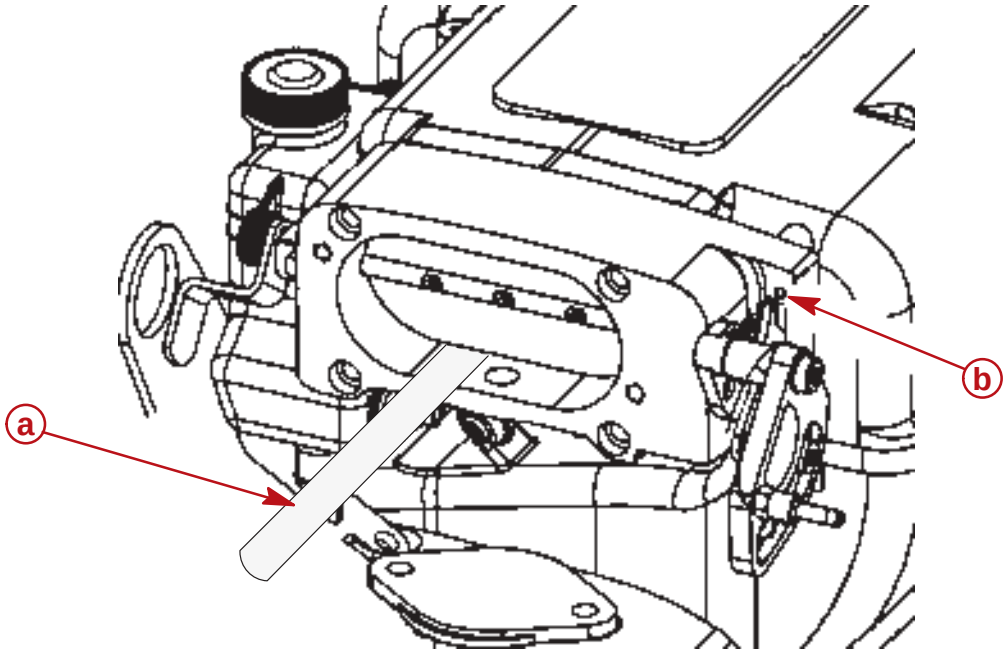



**a -** Cam Sensor installed at approximate orientation
**b -** Cam Sensor Wheel Falling Edge
**c -** Cam Sensor Pickup Block

## Procedures For Setting Throttle Stop Screw If Disturbed:

1. Disconnect throttle cable from cable end guide.
2. Remove flame arrestor.
3. Insert a 0.228 mm (0.009 in.) feeler gauge between throttle plate and throttle body to set the throttle plate opening on the throttle body. There should be drag on the feeler gauge for correct setting.
4. If adjustment is required, loosen the jamb nut and adjust throttle stop screw to set gap at 0.228 mm (0.009 in.). Ensure that throttle lever contacts throttle stop screw while making this adjustment. Re-tighten the jamb nut.

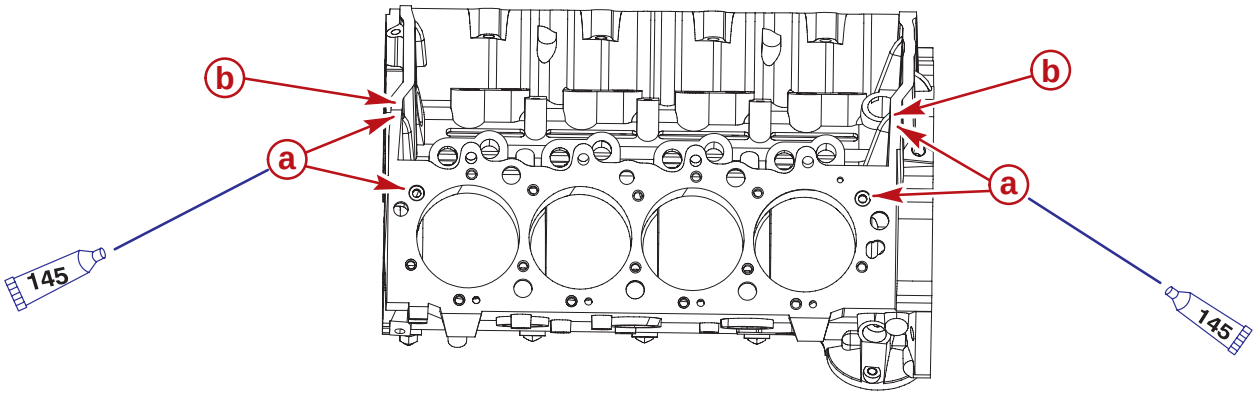
***NOTE:*** *The throttle stop screw should never be used to adjust engine idle speed.*




**a -** 0.228 mm (0.009 in.) feeler gauge
**b -** Throttle Stop Screw

# ▲Cylinder Head Gasket Replacement

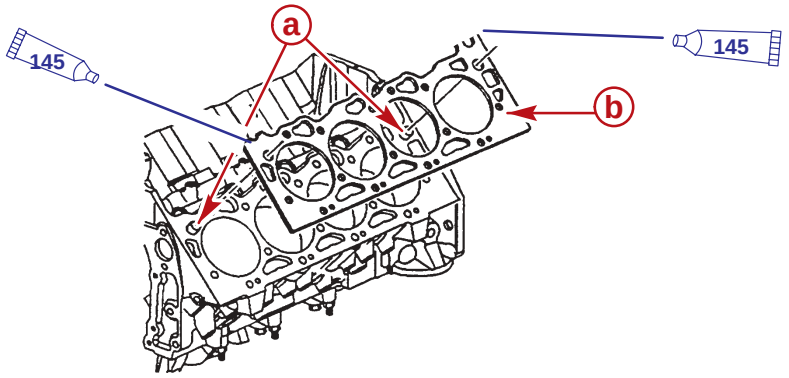
1. Clean cylinder block gasket surfaces with Loctite Natural Blue Biodegradable Cleaner Degreaser.
2. Apply a 0.63 cm (0.25 in.) bead of RTV Sealant along the front and rear of the engine block head gasket surface between the China Wall and the dowel for the cylinder head.




**a -** Where RTV Sealant is applied
**b -** Where China Wall begins

| Tube Reference Number | Description | Where Used |
|---|---|---|
|   | Loctite 598 RTV Sealant | Engine block head gasket surface between the China Wall and the dowel for the cylinder head |

3. Place head gasket in position over dowel pins. Apply a small bead of RTV Sealant where the head gasket meets the sealant that was applied earlier.

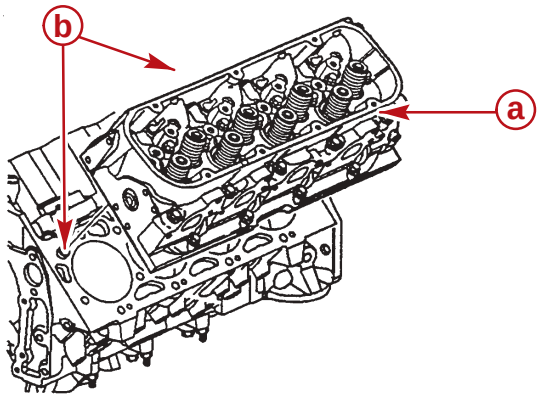



76700

**a** - Dowel Pins
**b** - Head Gasket

| Tube Reference Number | Description | Where Used |
|---|---|---|
| 145 | Loctite 598 RTV Sealant | Where the head gasket meets the sealant that was applied earlier |

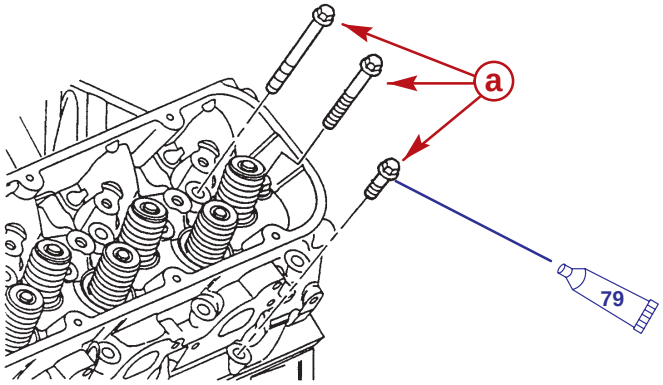
4. Carefully set cylinder head in place over dowel pins.




76699

**a** - Cylinder Head
**b** - Dowel Pins (One Not Visible)

5. Coat threads of head bolts and under bolt cap with oil and install bolts with washers finger-tight.

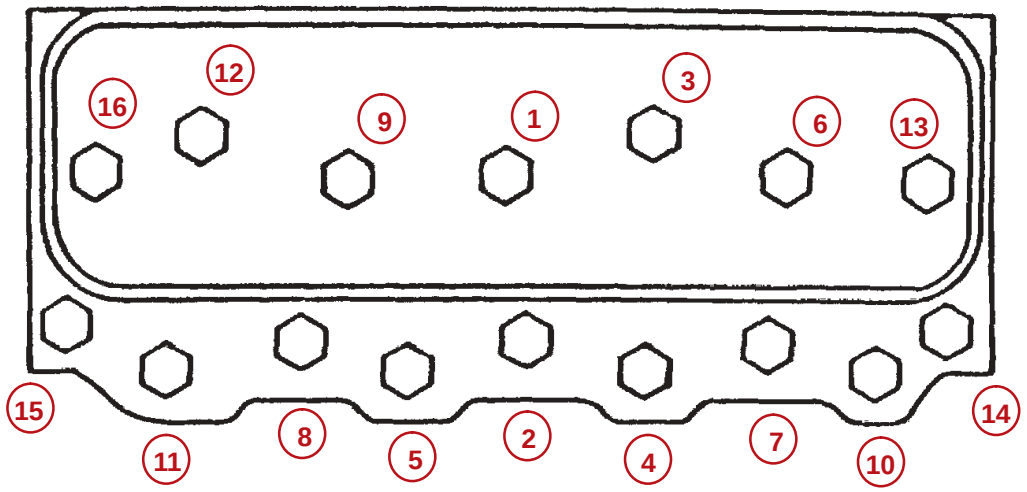



76698

**a** - Head Bolts

| Tube Reference Number | Description | Where Used |
|---|---|---|
| 79 | 4 cycle 25W40 engine oil | On bolt threads and under cap of bolt |

6. Torque head bolts in three steps, following torque sequence for each step and finish with a slow pull to the final torque. Repeat final torque sequence twice.



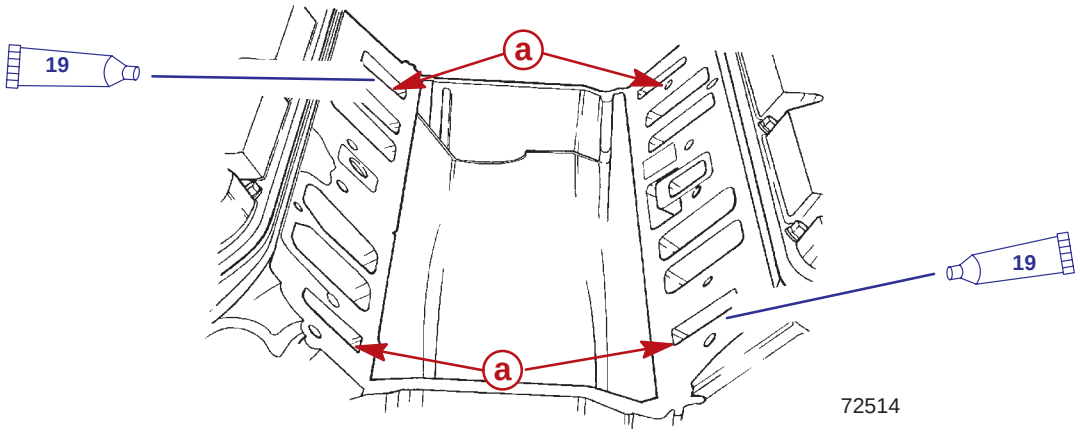

72944

| Component | | Torque | | | Sealants/ Lubricants |
|---|---|---|---|---|---|
| | | Nm | lb-in. | lb-ft | |
| Cylinder Head | Step #1 | 41 | | 30 | Oil under bolt head, and Oil on threads |
| | Step #2 | 68 | | 50 | |
| | Step #3 | 95 | | 70 | |

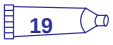
## ▲ Intake Manifold Installation

**IMPORTANT: Both gaskets are identical. When installing intake manifold gaskets, be sure to install gasket with marked side up.**

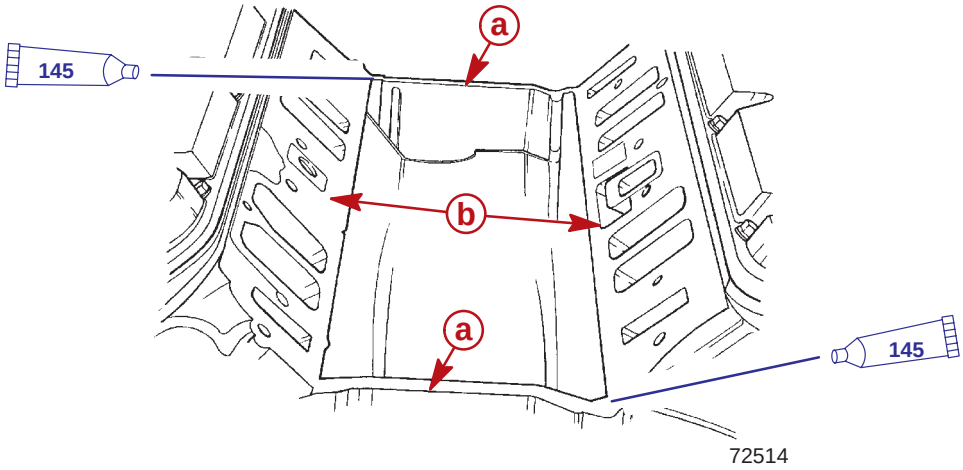
1. Apply Quicksilver Perfect Seal around intake manifold gasket coolant passages (both sides).




**a** - Coolant Passages

| Tube Reference Number | Description | Where Used |
|---|---|---|
|  19 | Perfect Seal | Coolant Passages |

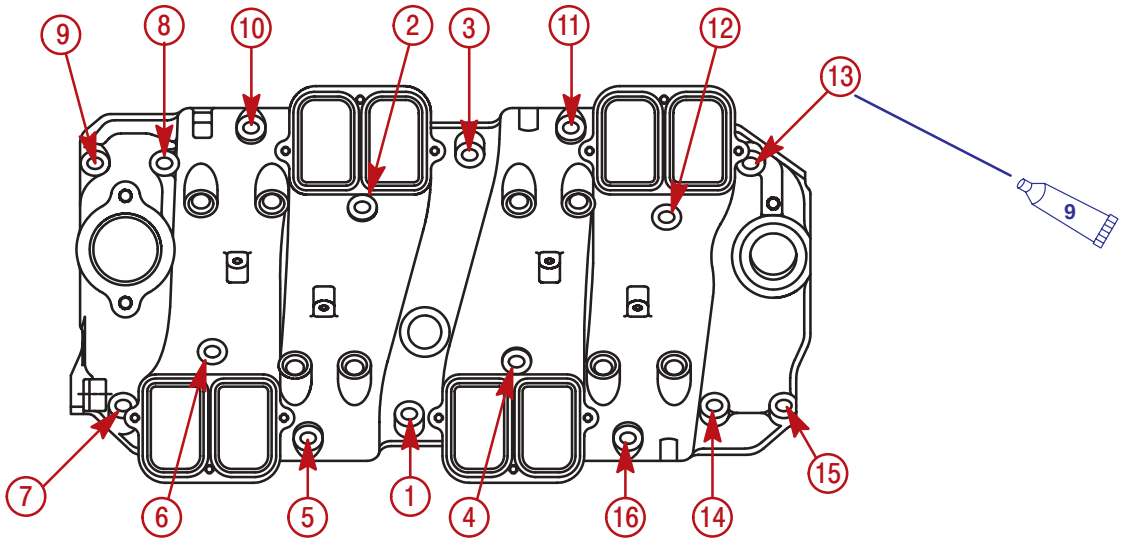
2. Apply a 1/4 in. bead of RTV Sealer on engine block China Wall between cylinder heads. The sealer should extend 12.7 mm (0.50 in.) onto the cylinder head.
3. Set intake manifold gaskets in place, aligning bolt holes. Apply a small amount of sealant where the intake gasket and the China Wall surface meet.




**a** - 1/4 in. Bead of RTV Sealer
**b** - Gaskets

| Tube Reference Number | Description | Where Used |
|---|---|---|
| 145 | Loctite 598 RTV Sealant | China Wall surface |

4. Carefully install manifold assembly.




**Intake Manifold Torque Sequence**

| Tube Reference Number | Description | Where Used |
|---|---|---|
| 9 | Loctite 567 Pipe Sealant | Intake Manifold bolt threads (oil under cap) |

| Component | | Torque | | | Sealants/ Lubricants |
|---|---|---|---|---|---|
| | | Nm | lb-in. | lb-ft | |
| Intake Manifold to cylinder head | Step #1 | 27 | | 20 | Oil under head of bolt - Pipe Sealant #567 on threads |
| | Step #2 | 47 | | 35 | |

# Electrical Specifications

### STARTER MOTOR SPECIFICATIONS

| Part No. | Mercury Marine 50-864340A-1 Delco 90000885 | | | |
|---|---|---|---|---|
| **No Load Test** | | | | |
| **Volts** | **Amps. (Min.)** | **Amps. (Max.)** | **RPM (Min.)** | **RPM (Max.)** |
| 11.5 | 35 | 85 | 2550 | 4150 |

# Internal Engine Specifications

### CYLINDER BORE

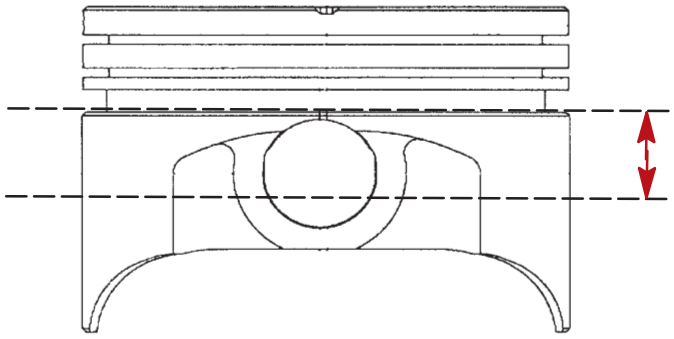
| UNIT OF MEASUREMENT: mm (in.) | | |
|---|---|---|
| Diameter | 113.4237 - 113.4415 mm (4.4655 - 4.4662 in.) | |
| Out of Round | Production and Service | 0.0254 mm (0.001 in.) |
| Taper | Production | 0.0127 mm (0.0005 in.) |
| | Service | 0.0381 mm (0.0015 in.) |

### PISTON

| | | |
|---|---|---|
| Clearance | Production | 0.101 - 0.152 mm (0.004 - 0.006 in.) |
| | Service | 0.101 - 0.1651 mm (0.004 - 0.0065 in.) |

## MEASURING PISTON

Measure piston 90° to the wrist pin and 19 mm (3/4 in.) below the bottom ring land.



## PISTON RINGS

## COMPRESSION RINGS

| Groove Side Clearance | | |
|---|---|---|
| Production and Service | Top & 2nd | 0.044 - 0.0814 mm (0.0017 - 0.0032 in.) |
| End Gap | | |
| Service | Top | 0.558 - 0.660 mm (0.022 - 0.026 in.) |
| | 2nd | 0.508 - 0.660 mm (0.020 - 0.026 in.) |

## OIL RINGS

| Groove Side Clearance | |
|---|---|
| Production and Service | 0.0635 - 0.1143 mm (0.0025 - 0.0045 in.) |
| End Gap | |
| Production and Service | 0.508 - 1.397 mm (0.020 - 0.055 in.) |

## PISTON PIN

| UNIT OF MEASUREMENT: mm (in.) | | |
|---|---|---|
| Piston Pin Style | | Press Fit |
| Diameter | | 25.13584 - 25.13838 mm (0.9896 -0.9897 in.) |
| Piston/Pin Clearance | Production | 0.02032 - 0.03048 mm (0.0008 - 0.0012 in.) |
| | Service | 0.02032 - 0.0381 mm (0.0008 - 0.0015 in.) |
| Fit to Rod Interference | Production & Service | 0.03048 - 0.04318 mm (0.0012 - 0.0017 in.) |

## CRANKSHAFT

## MAIN JOURNAL

| | | |
|---|---|---|
| Diameter | No. 1,2,3,4,5 | 69.8042 - 69.8220 mm (2.7482 - 2.7489 in.) |
| Taper & Out of Round | Production | 0.0127 mm (0.0005 in.) |
| | Service | 0.0254 mm (0.001 in.) |

## CONNECTING ROD JOURNAL

| | | |
|---|---|---|
| Diameter | | 55.855 - 55.8673 mm (2.1990 - 2.1995 in.) |
| Taper & Out of Round | Production | 0.0127 mm (0.0005 in.) |
| | Service | 0.0254 mm (0.001 in.) max. |

## MAIN BEARING CLEARANCES

| | | |
|---|---|---|
| Production & Service | No. 1,2,3,4 | 0.0457 - 0.07112 mm (0.0018 - 0.0028 in.) |
| | No. 5 | 0.0635 - 0.0889 mm (0.0025 - 0.0035 in.) |
| Crankshaft End Play | | 0.152 - 0.254 mm (0.006 - 0.010 in.) |

## ROD BEARING CLEARANCES

| | | |
|---|---|---|
| Rod Bearing Clearance | Production | 0.0558 - .0685 mm (0.0022 - 0.0027 in.) |
| | Service | 0.0588 - 0.0762 mm (0.0022 - 0.0030 in.) |
| Rod Side Clearance | | 0.330 - 0.584 mm (0.013 - .023 in.) |

## CAMSHAFT AND DRIVE

| UNIT OF MEASUREMENT: mm (in.) | | |
|---|---|---|
| Lobe Lift ± 0.051 mm (0.002 in.) | Intake | 9.118 mm (0.359 in.) |
| Lobe Lift ± 0.051 mm (0.002 in.) | Exhaust | 9.448 mm (0.372 in.) |
| Journal Diameter | | 49.48 - 49.51 mm (1.948 - 1.949 in.) |
| Journal Out-of-Round | | 0.0254 mm (0.001 in.) |
| Camshaft Run-Out | | 0.0381 mm (0.0015 in.) |
| Timing Chain Deflection | | 13 mm (0.500 in.) |

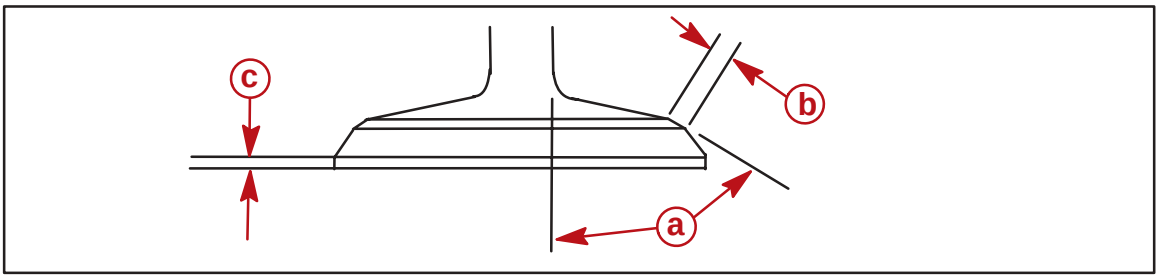
## VALVE SYSTEM

| | | |
|---|---|---|
| Lifter Type | | Hydraulic / Roller |
| Rocker Arm Ratio | | 1.7 to 1 |
| Valve Lash (Intake & Exhaust) | | 3/4 Turn Down From Zero Lash |
| Valve Face Angle (Intake & Exhaust) | | 45° |
| Valve Face Relief Angle (Intake Only) See Diagram | | 30° x 1.52 mm (.060 in.) wide |
| Seat Angle (Intake & Exhaust) | | 45° |
| Seat Run Out (Intake & Exhaust) | | 0.0508 mm (0.002 in.) |
| Seat Width | Intake & Exhaust | 1.52 mm (0.060 in.) |
| ▲ Valve Margin (minimum) | Intake | 1.143 mm (0.045 in.) |
| | Exhaust | 1.397 mm (0.055 in.) |

## VALVE SYSTEM

| Stem Clearance | | |
|---|---|---|
| Production | Intake | 0.025 - 0.064 mm (0.0010 - 0.0025 in.) |
| | Exhaust | 0.030 - 0.064 mm (0.0012 - 0.0025 in.) |
| Service | Intake | 0.025 - 0.076 mm (0.0010 - 0.003 in.) |
| | Exhaust | 0.030 - 0.076 mm (0.0012 - 0.003 in.) |
| Valve Spring | | |
| Valve Spring Free Length | | 55.88 mm (2.20 in.) |
| Valve Spring Installed Height | | 46.9 mm (1.850 in.) |
| Spring Pressure - Closed Spring Length 46.9 mm (1.850 in.) | | 556 N (125 lb-in.) |
| Spring Pressure - Open Spring Length 31.4 mm (1.240 in.) | | 1868 N (420 lb-in.) |

### ▲ VALVE RELIEF PROFILE (INTAKE VALVE ONLY)




**a -** 30°
**b -** 1.524 mm (.060 in.) Width
**c -** Intake 1.143 mm (0.045 in.) minimum, Exhaust 1.397 mm (0.055 in.) minimum

### CYLINDER HEAD

| | |
|---|---|
| Gasket Surface Flatness | 0.0127 mm (0.005 in.) Overall Width<br>0.0508 mm (0.002 in.) Overall Length |

### FLYWHEEL

| | |
|---|---|
| Run Out on Face Area | 0.203 mm (0.008 in.) Max (Face Area) |

## Torque Specifications

| Component | Torque | | | Sealants/ Lubricants |
|---|---|---|---|---|
| | Nm | lb-in. | lb-ft | |
| Alternator to Mounting Bracket | 27 | | 20 | |
| Alternator Mounting Bracket | 54 | | 40 | |
| Camshaft Sprocket/Gear | 34 | | 25 | Loctite #271 (Red) |
| Camshaft Thrust Plate | 11 | | 8 | Loctite #271 (Red) |
| Coils to Bracket | 14 | | 10 | |
| Coil Bracket to Cylinder Head | 54 | | 40 | |

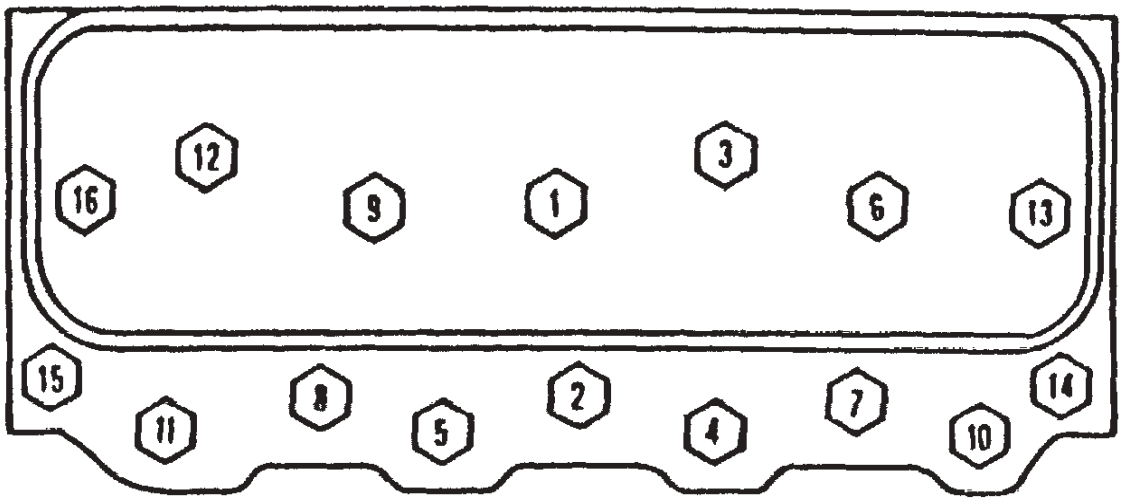
# Torque Specifications

| Component | Torque | | | Sealants/ Lubricants |
|---|---|---|---|---|
| | Nm | lb-in. | lb-ft | |
| Coupler to Flywheel | 47 | | 35 | Loctite #271 (Red) |
| Connecting Rod Caps | 98 | | 72 | Moly lube on threads, under bolt head and on washer |
| Crankshaft Main Bearing Cap | 149 | | 110 | |
| Crankshaft Pulley | 47 | | 35 | Loctite #271 (Red) |
| Crossover to Cylinder Head | 54 | | 40 | Pipe Sealant #567 |
| ▲Cylinder Head Step #1 | 41 | | 30 | Oil under bolt head, and Oil on threads |
| Step #2 | 68 | | 50 | |
| Step #3 | 95 | | 70 | |
| Driveline Housing to Flywheel Housing | 61 | | 45 | Loctite #271 (Red) |
| Exhaust Header to Cylinder Head | 41 | | 30 | High temp Anti-seize |
| Flame Arrestor to Throttle Body | 9 | | 7 | High temp Anti-Seize |
| Flywheel | 95 | | 70 | Loctite #271 (Red) |
| Flywheel Drive Plate to Flywheel | 47 | | 35 | Loctite #271 (Red) |
| Flywheel Housing to Block | 47 | | 35 | Loctite #271 (Red) |
| Front Engine Mount to Engine Block | 47 | | 35 | Loctite #271 (Red) |
| Fuel Separator Bracket to Crossover | 47 | | 35 | Pipe Sealant #567 |
| Fuel Separator to Bracket | 20 | | 15 | |
| Fuel rails to intake manifold | 14 | | 10 | |
| Heat exchanger to crossover | 20 | | 15 | Loctite # (Blue) |
| Idler Bracket (Top Bolts) | 54 | | 40 | Pipe Sealant #567 |
| (Bottom Bolt) | 47 | | 35 | |
| Idler Bracket (Replaces Power Steering Pump on Non Power Steering Models) | 47 | | 35 | Loctite #271 (Red) |

## Torque Specifications

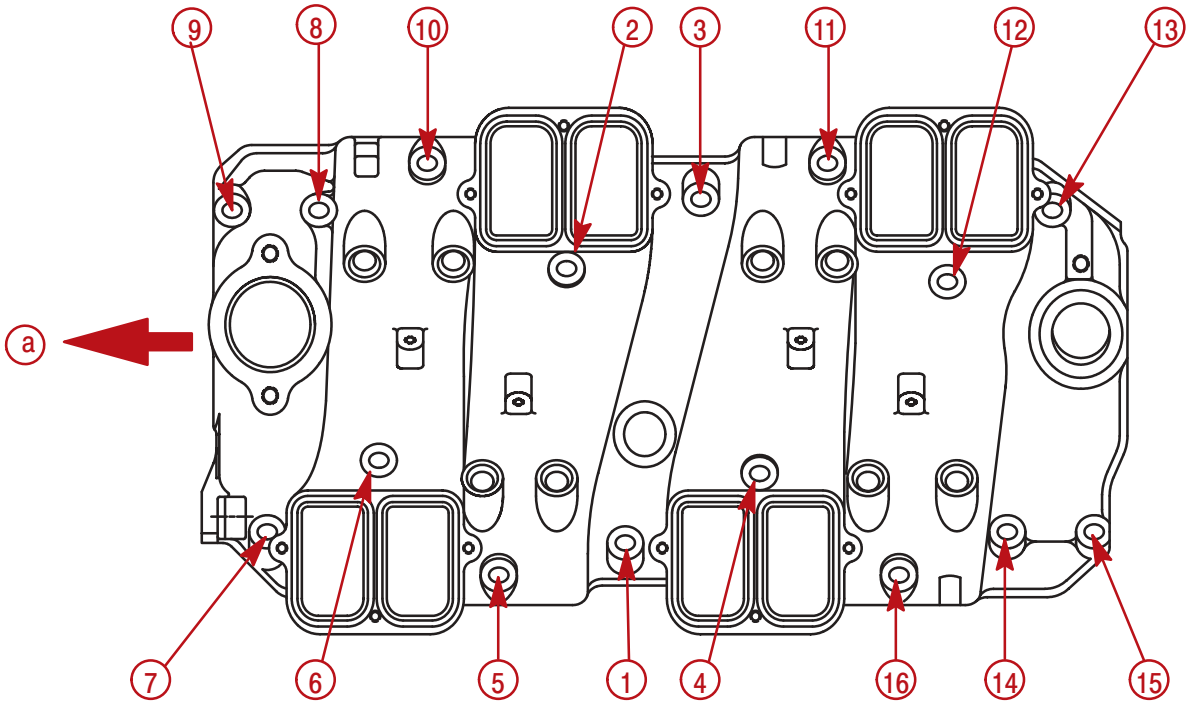
| Component | | Torque | | | Sealants/ Lubricants |
|---|---|---|---|---|---|
| | | Nm | lb-in. | lb-ft | |
| Intake Manifold to cylinder head | Step #1 | 27 | | 20 | Oil under head of bolt - Pipe Sealant #567 on threads |
| (Torque Sequence on Following Page) | Step #2 | 47 | | 35 | |
| Intake Plenum to Manifold | | 14 | | 10 | High temp Anti-seize |
| MerCathode Plate to Head | | 54 | | 40 | Pipe Sealant #567 |
| Oil Baffle Nuts | | 47 | | 35 | Loctite #271 (Red) |
| Oil Filter Thermostat Housing Fitting | | 34 | | 25 | Oil |
| Oil Filter Bracket to Alternator Bracket | | 47 | | 35 | Loctite #271 (Red) |
| Oil Filter Housing to Bracket | | 20 | | 15 | Loctite #271 (Red) |
| Oil Pan to Crankcase (5/16-18) | | 20 | | 15 | Loctite #271 (Red) |
| Oil Pump | | 95 | | 70 | Oil |
| Oil Pump Cover | | 11 | | 8 | Loctite #271 (Red) |
| Oil Pump / Cam Sensor Clamp Bolt | | 27 | | 20 | |
| PCM Bracket to Cylinder Head | | 54 | | 40 | |
| Power Steering Pump to Bracket | | 41 | | 30 | |
| Recirculating Pump Pulley | | 20 | | 15 | Loctite #242 (Blue) |
| Rocker Arm Stud | | 75 | | 55 | Pipe Sealant #567 |
| Rocker Arm Allen Locking Nut | | 34 | | 25 | |
| Rocker Arm Cover | | 11 | | 8 | |
| Seawater Pump Bracket | | 54 | | 40 | |
| Spark Plug | | 27 | | 20 | High temp Anti-seize |
| Starter Motor to Block | | 41 | | 30 | Loctite #271 (Red) |
| Throttle Body to Intake Plenum | | 27 | | 20 | Loctite #242 (Blue) |
| Timing Chain Cover Bolts | | 14 | | 10 | Loctite #271 (Red) |
| Torsional Damper | | 122 | | 90 | Loctite #271 (Red) |
| Transmission to Flywheel Housing | | 68 | | 50 | Loctite #271 (Red) |
| Valve Lifter Hold Down | | 20 | | 15 | Loctite #271 (Red) |
| Water Circulating Pump to Block | | 41 | | 30 | Pipe Sealant #567 |

## Cylinder Head Torque Sequence



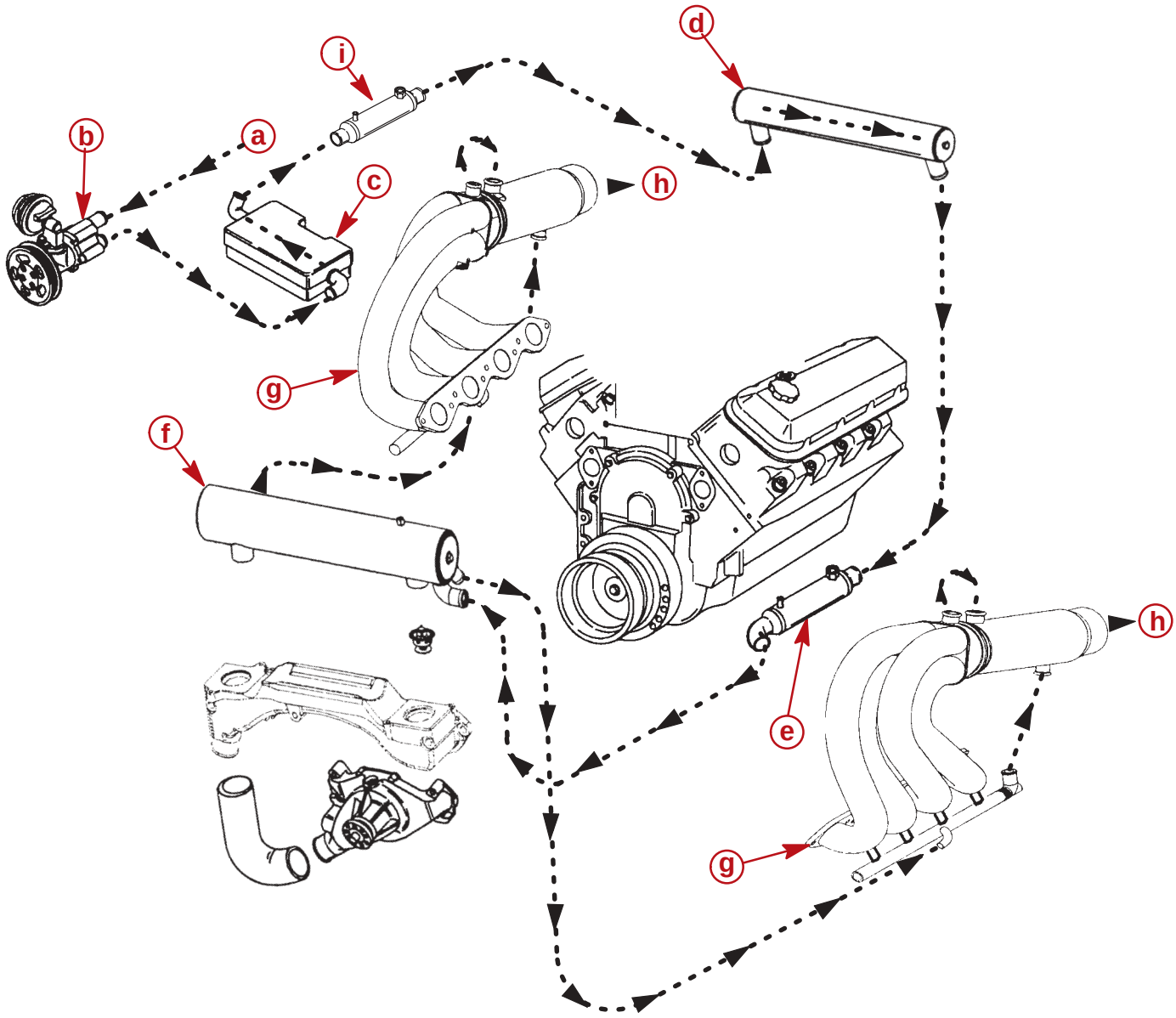

72944

## Intake Manifold Torque Sequence



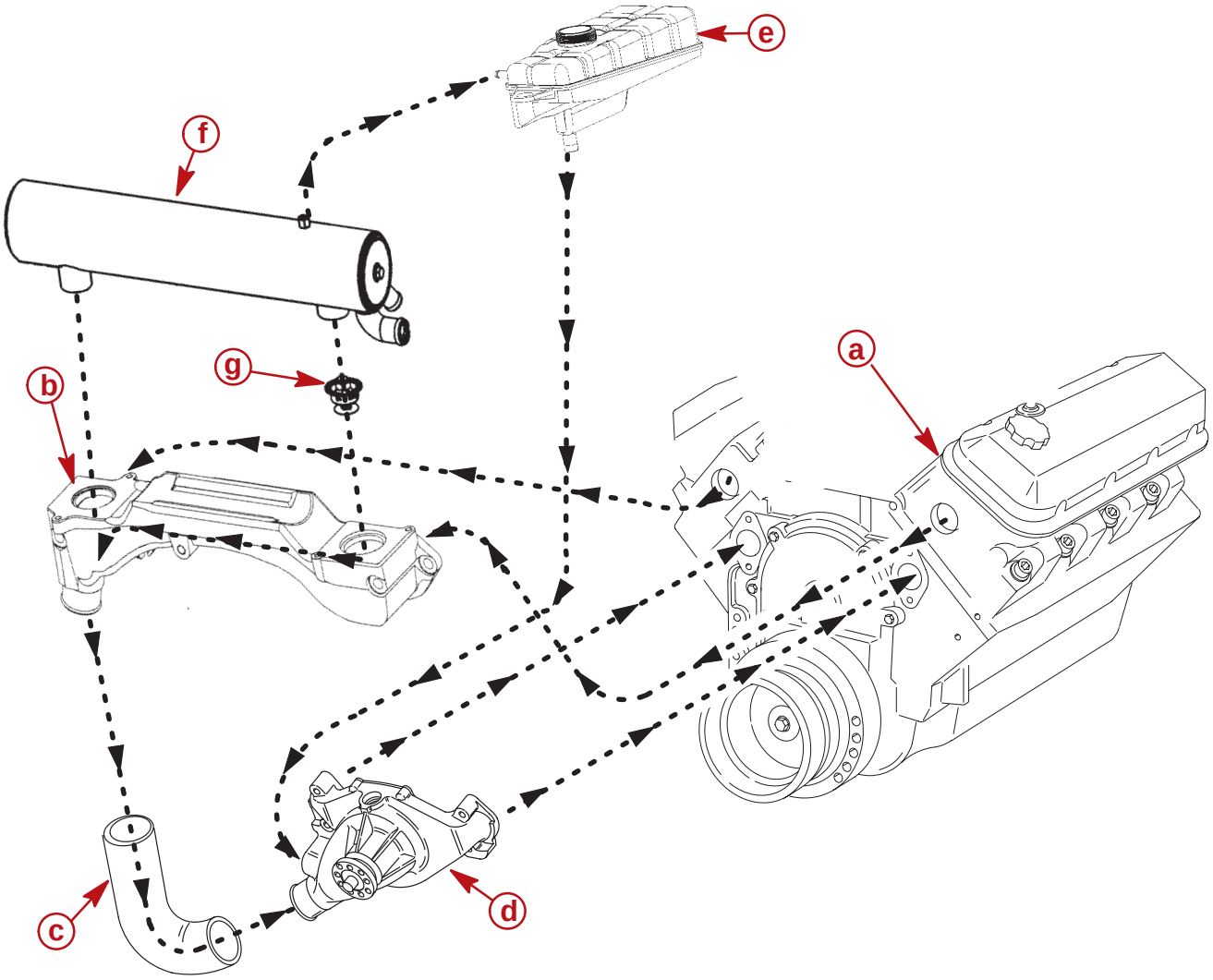

**a -** Engine Front

# Water Flow Diagram (Seawater)




**a -** Seawater Inlet
**b -** Seawater Pickup Pump
**c -** Fuel Cooler
**d -** Engine Oil Cooler
**e -** Power Steering Cooler (Power Steering Equipped Models Only)
**f -** Heat Exchanger
**g -** Exhaust Manifold
**h -** Seawater Overboard
**i -** Transmission Cooler (Transmission models only)

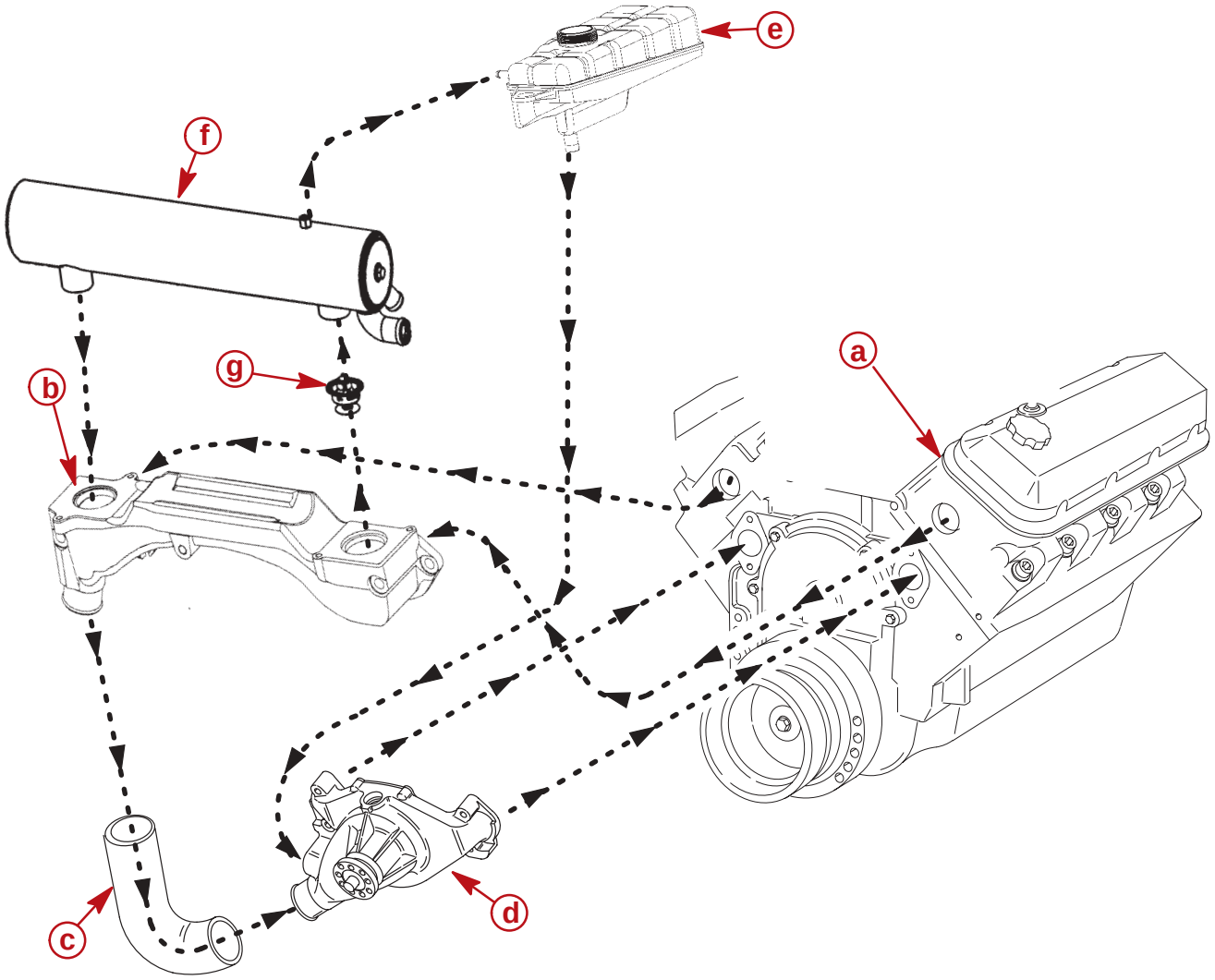
# Water Flow Diagram (Closed Cooling) (Thermostat Closed)




**a -** Engine
**b -** Heat Exchanger Crossover Manifold
**c -** Circulating Pump Hose
**d -** Circulating Pump
**e -** Coolant Reservoir
**f -** Heat Exchanger
**g -** Thermostat

***NOTE:*** *Even with the thermostat in the closed position some water will bypass the thermostat and enter the heat exchanger.*

# Water Flow Diagram (Closed Cooling) (Thermostat Open)




**a -** Engine
**b -** Heat Exchanger Crossover Manifold
**c -** Circulating Pump Hose
**d -** Circulating Pump
**e -** Coolant Reservoir
**f -** Heat Exchanger
**g -** Thermostat