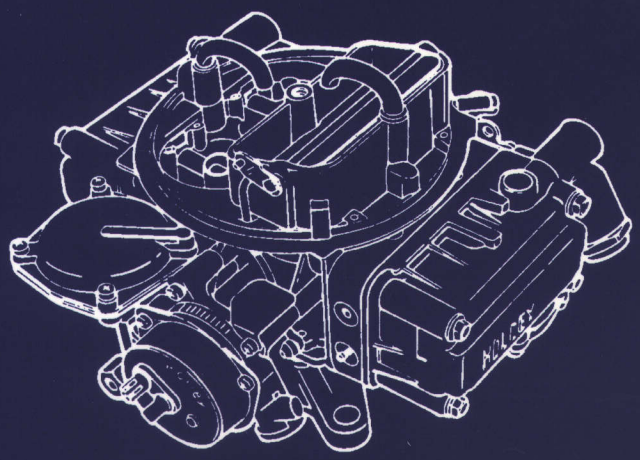
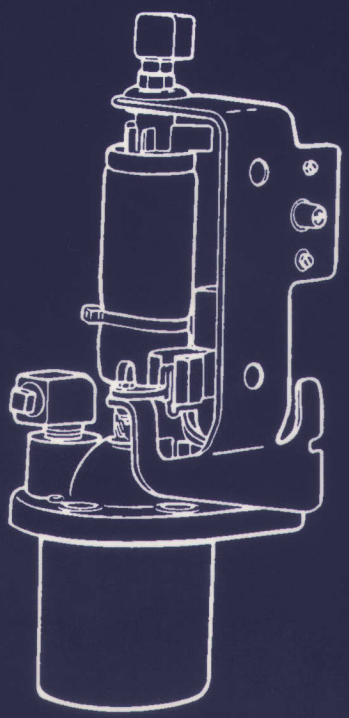
P/N 7797363-4
5-1997

Workshop Manual

"LK" Models

Fuel System





VOLVO PENTA

⚠ Safety Warning

This Workshop Manual will alert you to certain procedures that must be done very carefully. If you ignore this information, you could...

- **Injure yourself or people around you**
- **Injure the boat operator, boat passengers, or people around the boat**
- **Damage the Volvo Penta product or its systems**

Understand the following symbols before proceeding:

⚠ **Safety Warning**	Alerts you to the possibility of danger and identifies information that will help prevent injuries.
Note	Identifies information that will help prevent damage to machinery.
Important	Appears next to information that controls correct assembly and operation of the product.

This Workshop Manual is written for qualified, factory trained service technicians familiar with the use of Volvo Penta special tools.

This Workshop Manual tells you how to correctly maintain and service Volvo Penta products and systems. When correctly serviced, the Volvo Penta product will be reliable and safe to operate.

When Volvo Penta special tools are called for, use them. Where mentioned, the tools are required to perform the service procedure.

If you use service procedures or service tools that are not recommended in this manual, YOU ALONE must decide if your actions might injure people or damage the Volvo Penta product.

Contents

General Information 1

Carbureted Fuel System 2

GM Multiport Injection (MFI) System 3

GM Throttle Body Injection (TBI) System 4

Safety Section ..... S

This workshop manual is one of a set of eight that covers Volvo Penta sterndrive models. All eight books can be ordered as a set from Volvo Penta Parts. Order P/N 7797360-0.

Individual workshop manuals covering these models are also available. Order the following part numbers from *Volvo Penta Parts.*

• *P/N 7797361-8 Engine Components*

Includes information on Engine service and troubleshooting; Engine removal and installation; Steering systems; Throttle and Shift Control systems; and Cooling systems.

• *P/N 7797362-6 Electrical & Ignition System*

Includes service and troubleshooting information on Cranking systems; Charging systems; Trim/Tilt electrical systems; Ignition systems; and Engine and Instrument wiring diagrams.

• *P/N 7797363-4 Fuel System*

Includes service and troubleshooting information on all carburetor, MFI and TBI fuel systems and related components.

• *P/N 7797364-2 EFI Diagnostic Manual GM*

Contains troubleshooting procedures for all Electronic Fuel Injected GM models and related components.

• *P/N 7797365-9 PJX WaterJet*

Contains service information for repair and overhaul of the waterjet system.

• *P/N7797366-7 DPX - Workshop Manual*

Includes specific information for repair and overhaul of the DPX Sterndrive and Xact™ steering systems.

• *P/N 7797367-5 SX and DP-S Sterndrives and Transom Shield*

Includes information on Transom Shield, Upper Gear Unit and Lower Gear Unit service; Drive Unit removal and installation; Propellers; and Trim/Tilt hydraulic operation.

• *P/N 7797368-3 SP and DP Workshop Manual*

Includes Upper Gear Unit and Lower Gear Unit overhaul procedures, installation and removal.

This *Volvo Penta* Workshop Manual
Covers The Following Volvo Penta "LK" Models

Engine

3.0 LITER	
30GSMLKD	3868646
30GSPLKD	3868647

4.3 LITER	
43GLPLKD	3868618
43GSPLKD	3868619
43GiPLKDCE	3868620
5.7 LITER	
57GLPLKD	3868621
57GLPLKR	3868699
57GSPLKD	3868598
57GLiPLKDCE	3868732
57GiPLKDCE	3868623
57GSiPLKD	3868624
57GSiCPLKD	3868686

7.4 LITER	
74GLPLKD	3868626
74GiPLKDCE	3868627
74GSiPLKD	3868742
8.2 LITER	
82GSiPLKD	3868743

Transom Shield

SX-C1	3868404
SX-CLT1	3868432
SX-C1AC	3868515
SX-C2AC	3868820

Sterndrive

SX-C1	1.43:1	3868392
SX-C1	1.51:1	3868393
SX-C1	1.60:1	3868394
SX-C1	1.66:1	3868395
SX-CT1	1.97:1	3868397
SX-RT1	1.66:1	3868398
SX-RT2	1.66:1	3868587
SX-C2	1.41:1	3868581
SX-C2	1.51:1	3868582
SX-C2	1.60:1	3868583
SX-C2	1.66:1	3868584
SX-C1	1.85:1	3868465
SX-RT1	2.18:1	3868333
SX-RT2	2.18:1	3868588

DP-S	2.30:1	3868163
DP-S	1.95:1	3868164
DP-S	1.78:1	3868165
DP-S	1.68:1	3868166
DP-S1	2.30:1	3868601
DP-S1	1.95:1	3868602
DP-S1	1.78:1	3868603
DP-S1	1.68:1	3868604

DPX-S1	1.59:1	3868637
DPX-S1	1.68:1	3868638
DPX-S1	1.78:1	3868639

Jet Drive

PJX-C	3868694
PJX-C1	3868694

Reference to Service Bulletins

Group	*No.*	*Date*	*Subject*

Section 1

General Information

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⚠ Safety Warning

Before working on any part of a Volvo Penta sterndrive, read the section called **Safety** at the end of this manual.

Introduction

This service manual covers "LK" model Volvo Penta Sterndrives. It is divided into sections concerning various systems and assemblies. Refer to the Contents to locate the section covering the system or assembly requiring service. Each section title page has an additional listing that will describe the section's contents in more detail. Be sure to read the Safety Section at the end of this manual, and pay special attention to all safety warnings as they appear throughout the text. Since models are subject to change at any time, some photos may not depict actual product.

Good Service Practice

Service required for an Volvo Penta Stern Drive is generally one of three kinds:

- **Normal care and maintenance** - which includes putting a new sterndrive into operation, storing engines, lubrication, and care under special operating conditions such as salt water and cold weather.
- **Operating malfunctions** - due to improper engine or drive mounting, propeller condition or size, boat condition, or the malfunction of some part of the engine. This includes engine servicing procedures to keep the engine in prime operating condition.
- **Complete disassembly and overhaul** - such as major service or rebuilding a unit.

It is important to determine before disassembly just what the trouble is and how to correct it quickly, with minimum expense to the owner.

When repairing an assembly, the most reliable way to ensure a good job is to do a complete overhaul on that assembly, rather than just to replace the bad part. Wear not readily apparent on other parts could cause malfunction soon after the repair job. Repair kits and seal kits contain all the parts needed to ensure a complete repair, to eliminate guesswork, and to save time.

Repair time can also be minimized by the use of special tools. Volvo Penta special tools are designed to perform service procedures unique to the product that cannot be completed using tools from other sources. They also speed repair work to help achieve service flat rate times. In some cases, the use of substitute tools can damage the part.

Note **Do not operate engine out of water even momentarily.** If operated in a test tank, use the proper test wheel. Failure to do so can damage water pump, overheat engine, or allow excessive engine RPM.

Preparation for Service

Proper preparation is extremely helpful for efficient service work. A clean work area at the start of each job will minimize tools and parts becoming misplaced. Clean an engine that is excessively dirty before work starts. Cleaning will occasionally uncover trouble sources. Obtain tools, instruments and parts needed for the job before work is started. Interrupting a job to locate special tools or repair kits is a needless delay.

Use proper lifting and handling equipment. Working on sterndrives without proper equipment can cause damage and personal injury.

Always use clean, fresh fuel when testing engines. Troubles can often be traced to the use of old or dirty fuel.

Service Policy

Whether within or following the warranty period, Volvo Penta has a constant interest in its products.

It is a Volvo Penta policy to provide dealers with service knowledge so they can give professional service demanded by today's consumer. The Volvo Penta service schools, frequent mailing of Service and parts information bulletins, letters and promotions, special tools, and this service manual represent our continuing efforts to assist dealers in giving consumers the best and most prompt service possible. This service manual covers all phases of servicing a Volvo Penta sterndrive unit. If a service question does not appear to be answered in this manual, you are invited to write to the Volvo Penta Service Department for additional help. Always be sure to give complete information, including engine model number and serial number.

Be sure that you are familiar with the Volvo Penta Warranty statement. If you have any questions, write the Volvo Penta Service Department. If other than genuine Volvo Penta replacement components or parts are used, Volvo Penta may refuse subsequent warranty claims involving that engine.

When a brand-name product or specific tool is called for, another item may be used. However, the substitute must have equivalent characteristics, including type, strength, and material. You must determine if incorrect substitution could result in product malfunction and personal injury to anyone. To avoid hazards, equivalent products which are used must meet all current US Coast Guard Safety Regulations and ABYC standards.

Replacement Parts

When replacement parts are required, always use genuine Volvo Penta parts, or parts with equivalent characteristics, including type, strength, and material. Failure to do so may result in product malfunction and possible injury to the operator and/or passengers.

Parts Catalogs

Parts Catalogs contain exploded views showing the correct assembly of all parts, as well as a complete listing of the parts for replacement. These catalogs are helpful as a reference during disassembly and reassembly, and are available from Volvo Penta.

Special Service Tools

Volvo Penta has specially designed tools to simplify some of the disassembly and assembly operations. These tools are illustrated in this Service Manual, in many cases in actual use. All Volvo Penta special tools can be ordered from Volvo Penta *Genuine Parts* division. Individual purchasers of Service Manuals must order Special Tools through an authorized dealer.

Product References, Illustrations & Specifications

Volvo Penta of the Americas reserves the right to make changes at anytime, without notice, in specifications and models and also to discontinue models. The right is also reserved to change any specifications or parts at any time without incurring any obligation to equip same on models manufactured prior to date of such change. All information, illustrations and specifications contained in this manual are based on the latest product information available at the time of printing. The right is reserved to make changes at anytime without notice.

All photographs and illustrations used in this manual may not depict actual models or equipment, but are intended as representative views for reference only. The continuing accuracy of this manual cannot be guaranteed.

Tuning The Engine

The purpose of an engine tune-up is to restore power and performance that has been lost through wear, corrosion, or deterioration of one or more parts or components. In the normal operation of an engine, these changes can take place gradually at a number of points, so that it is seldom advisable to attempt an improvement in performance by correction of one or two items only. Time will be saved and more lasting results will be obtained by following a definite and thorough procedure of analysis and correction of all items affecting power and performance. Refer to the **Engine Service Manual** for all tune-up specifications.

Gasoline Requirements

Volvo Penta sterndrive models are designed for maximum performance with the use of gasoline with the following minimum or higher octane specification:

- Anti-Knock Index Number (AKI) - 89
- Research Octane Number (RON) - 93

EFI Models Only: Some marinas sell fuel with lead additives. **Do not use such fuel as it may plug the fuel injectors**. Premium grade fuels contain injector cleaners and other additives that protect the fuel system and provide optimum performance. **The use of premium grade fuels is strongly recommended.**

Carbureted Models Only: Use of lead-free or leaded gasoline is acceptable.

If fuels with 89 AKI (93 RON) octane or higher are not available, lower octane fuels, with a minimum of 87 AKI (90 RON) octane, can be used. When lower octane fuels are used, a slight decrease in power can be expected.

Note Engine damage resulting from the use of gasoline with octane lower than 87 AKI (90 RON) is considered misuse of the engine and will void the engine warranty. Volvo Penta suggests the use of 89 AKI or higher fuels. These fuels have additives that are beneficial to maximum engine performance and long life of service components.

To prevent gum formation and corrosion in the fuel system, use DuraPlus™ Marine Fuel Stabilizer in the gasoline.

⚠ **Danger! Gasoline is extremely flammable and highly explosive under certain conditions. Always stop engine and do not smoke or allow open flames or sparks near the boat when refueling gas tanks. When filling the gas tank, ground the tank to the source of gasoline by holding the hose nozzle firmly against the side of the deck filler plate, or ground it in some other manner. This action prevents static electricity build-up that could cause sparks and ignite fuel vapors.**

Gasolines Containing Alcohol

Many gasolines being sold today contain alcohol. Two commonly used alcohol additives are Ethanol (ethyl alcohol) and Methanol (methyl alcohol).

See the Owner's Manual for your boat to determine if the boat's fuel system is compatible with alcohol blended fuels. If it is compatible, your engine may be operated using gasolines blended with no more than 10% Ethanol (ethyl alcohol) meeting the minimum octane specification. **Do not use any gasoline which contains METHANOL (methyl alcohol).**

Note Serious damage to the boat or engine fuel systems will result from the continued use of fuel containing **METHANOL** (methyl alcohol).

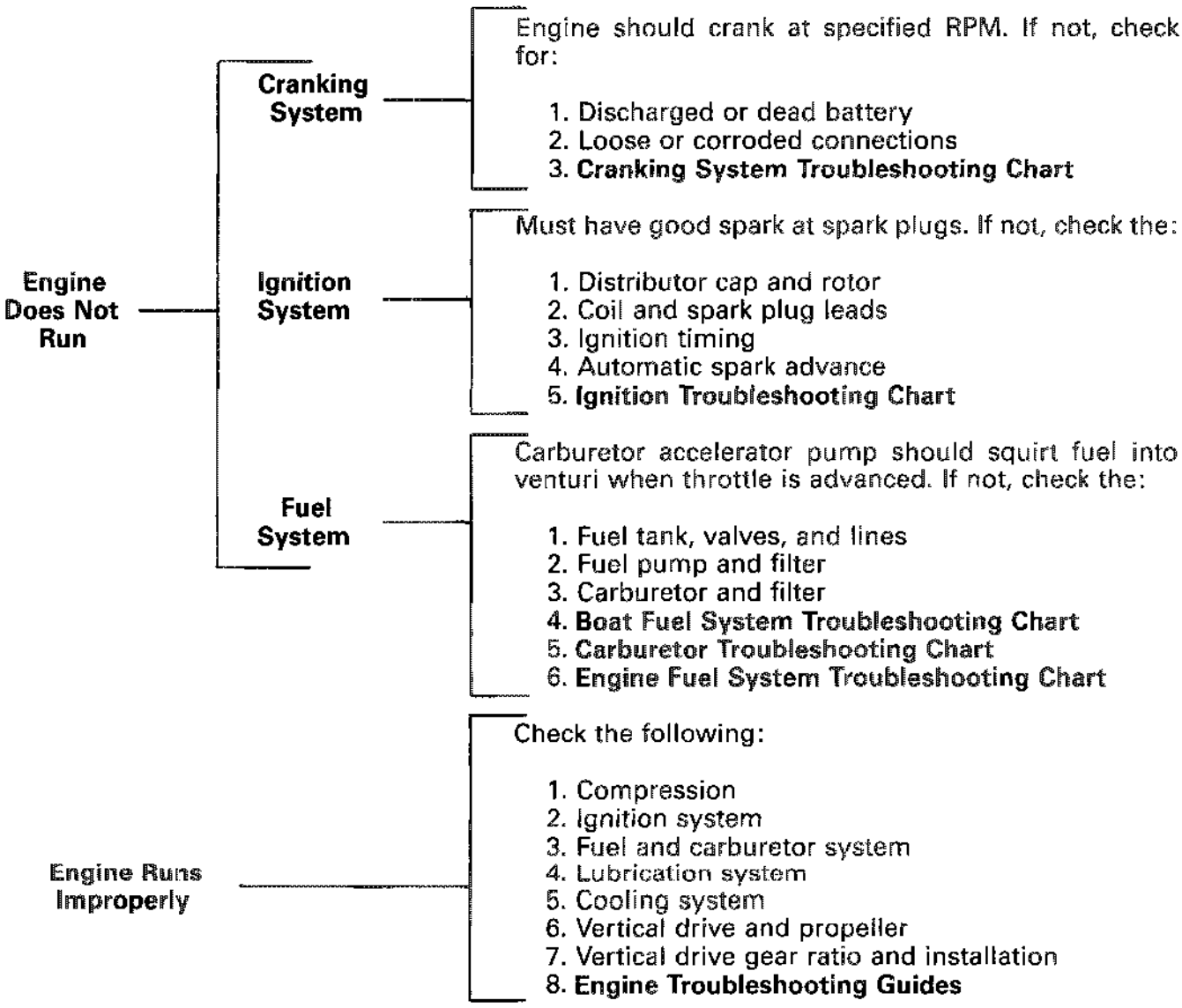
If you use gasoline containing alcohol, be aware of the following:

- The engine will operate leaner with alcohol blended fuel. This may cause engine problems such as vapor lock, low speed stall, or hard starting.
- Alcohol blended fuels attract and hold moisture. Moisture inside fuel tanks can cause corrosion of the tank material. Inspect fuel tanks at least annually. Replace fuel tanks if inspection indicates leakage or corrosion.
- Inspect non-metallic parts of fuel system frequently and replace if excessive stiffness, deterioration or fuel leakage is found.

⚠ **Fuel leakage can contribute to a fire and/or explosion.**

Troubleshooting - System Isolation

The following is to help you isolate a malfunction of one or possibly several systems. After determining which systems are related to the malfunction, refer to the individual system troubleshooting charts to isolate the specific cause.



Troubleshooting - Engine Guides

EFI Engines Only: Refer to ***GM* EFI Diagnostic Service Manual.**

These guides were written to help you trace the symptoms of the trouble to the source, without having to read through and prove every possibility. Much of the information here will be familiar to well informed mechanics.

Also, many factors will seem insignificant but when you think of it, usually the toughest problem to troubleshoot is caused by the smallest error. The greatest aid to solving a service problem is information. Start gathering information from the boat operator and write it on his job card or work ticket. Find out pertinent facts, such as:

- When did this trouble start?
- How was the boat loaded?
- Did the trouble occur suddenly, or start gradually?

Analyze this information and try to match it to similar situations you have experienced in the past. Keep in mind the fundamental rules:

1. **COMPRESSION** - Mixture inducted into cylinder and compressed.

2. **SPARK** - Proper intensity at the proper time.

3. **FUEL** - Proper mixture of air and fuel.

There are very old rules, but necessary for the engine to run. Use these charts and the service information they refer to. Do not try to remember tolerances, settings, measurements, etc., as they are written in the service manual. Leave your mind free to analyze the problem.

Following is a list of the troubleshooting guides which may be found on the pages indicated.

Title . . . . . Page

1. Engine Will Not Crank 1-9
2. Engine Cranks, But Will Not Start 1-9
3. Hard Starting - Cold Engine 1-10
4. Hard Starting - Hot Engine 1-10
5. Engine Runs Rough 1-11
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9. Engine Won't Reach Operating RPM 1-13
10. Defective Engine Lubricating System 1-14
11. Low Battery Voltage After Short Storage 1-14

Engine Will Not Crank

Starter Circuit - Check:

- Battery condition: weak, dead, sulfated, bad cells
- Battery cables for loose or corroded connections
- Shorted or open ignition switch
- Starter motor and solenoid for shorts, grounds or open circuits
- Starter assist solenoid/relay
- Circuit breakers
- Wiring from battery to ignition switch
- See respective **Cranking System** section of the **Electrical/Ignition** manual

Engine Cranks, But Will Not Start

Ignition Circuit - Check:

- Primary circuit wiring from ignition switch to ignition coil/ignition module
- Secondary circuit wiring from coil to spark plug
- Spark plugs for proper gap, fouling, burned electrodes, cracked or dirty insulator
- E.S.A. system, if so equipped, for improper activation
- See respective **Ignition System** section of the **Electrical/Ignition** manual

Fuel System - Check:

- Quantity and condition of fuel in boat tank
- Operation and flow capacity of boat anti-siphon valve
- Fuel tank vent is unrestricted
- Fuel tank pick-up screen is clean
- Boat fuel lines are proper diameter for engine size, and lines are unrestricted
- Fuel shutoff and multiple tank valves are open and operating properly
- Fuel pump vent hose for signs of fuel or oil that would indicate a fuel pump failure
- Fuel pump operation for correct vacuum and pressure readings
- External fuel filter canister and carburetor for clean filters
- Carburetor accelerator pump for fuel discharge
- See the appropriate **Fuel System** section

Cylinder Compression - Check:

- See **Engine** manual

Hard Starting - Cold Engine

Ask these questions first:

Has Engine Always Done This? Check:

- Carburetor choke operation and adjustment
- Fuel lines for obstructions
- For debris inside fuel tank
- See the appropriate **Fuel System** section

Was Engine Used For A Long Time? Check:

- For clean external canister and carburetor fuel filters
- Empty carburetor float bowl due to evaporation
- Water in fuel due to condensation
- Fuel quality deterioration
- See the appropriate **Fuel System** section

Is This A New Condition? Check:

- Carburetor choke operation and adjustment
- Carburetor accelerator pump
- Fuel system for leaks, dirt, or obstructions
- Engine timing and ignition system
- See **General Information, Ignition System** sections in the **Electrical/Ignition** and **Engine Service** manuals
- See the appropriate **Fuel System** section

Hard Starting - Hot Engine

Ask these questions first:

Has Engine Always Done This? Check:

- Carburetor choke operation and adjustment
- See the appropriate **Fuel System** section

Is This A New Condition? Check:

- Brand, type or octane of fuel
- Spark plugs
- Water in fuel
- Condition of battery and cables
- Starter motor for overheat damage

Did Engine Refuse To Start After Being Run? Check:

- Ignition system primary circuit
- Ignition coil/ignition module
- Engine timing
- Carburetor choke operation and adjustment
- See **General Information, Ignition System** sections of the **Electrical/Ignition** and **Engine Service** manuals
- See the appropriate **Fuel System** sections

Engine Runs Rough

If At Slow Speed - Check:

- Idle speed and idle mixture
- Engine timing and spark plugs
- Fuel pump pressure
- Water or contaminants in fuel
- Carburetor or manifold vacuum leak
- Internal carburetor fuel leak
- See **General Information, Ignition System** sections of the **Electrical/Ignition** and **Engine Service** manuals
- See the appropriate **Fuel System** section

If At High Speed - Check:

- Air leak on suction side of fuel system
- Too low octane fuel
- Ignition system secondary circuit
- Engine timing
- Wrong model or size carburetor, improper main jets or power valve, defective secondary fuel circuit, secondary vacuum diaphragm failure
- External canister and carburetor fuel filters
- Fuel pump pressure
- Engine compression
- Water or contaminants in fuel, water in cylinders
- See **General Information, Ignition System** sections of the **Electrical/Ignition** and **Engine Service** manuals
- See the appropriate **Fuel System** sections

Engine Noises and Vibrations

Valves - Hydraulic Lifters

- Rapping only when starting (oil too heavy for prevailing weather, varnish on lifter, oil needs to be changed)
- Intermittent rapping (leakage at lifter check ball)
- Idle noise (excessive leak down rate, faulty check ball seat)
- Generally noisy (excessive oil in crankcase, stuck lifter plunger)
- Loud noise at operating temperature (scored lifter plunger, fast leak down rate, oil viscosity too light for prevailing weather or operating temperatures)
- See **Engine** manual

Engine Noises and Vibrations, Cont.

Ignition System (Ping or Knock)

- Improper tuning
- Incorrect spark plug wire routing
- Use higher octane fuel
- See **General information** and appropriate **Ignition System** sections of the **Electrical/Ignition** and **Engine Service** manuals

Cooling System

- Water pump
- Loose belts, pulleys
- See **Cooling System** section of the **Engine** manual

Mountings

- Loose, broken or worn engine mounts
- Loose lag screws holding mounts to stringer

Crankshaft Balancer or Flywheel

- Loose bolt(s)

Alternator

- Loose pulley, worn bearings
- Loose mounting bolts

Vertical Drive

- Failed U-joints or gimbal bearing
- Damaged internal drive components
- Worn, bent or broken propeller hub or blades
- Loose, worn or damaged engine coupler

Engine Overheats - Check:

- Actual engine temperature by verifying with an accurate thermometer
- Gauge operation and wiring circuit
- Sending unit operation and wiring circuit
- Powerhead water pump and belt
- Water intake screens for blockage
- Thermostat
- Water supply hoses
- Engine timing
- Water leaks on pressure side of water supply pump
- Air leaks on suction side of water supply pump
- Engine compression
- See **Engine Service** manual

Engine Dies Out

Loss Of, Or Out Of, Fuel - Check:

- Fuel gauge operation and wiring
- Fuel level in tank
- Water or debris in fuel
- Fuel pickup tube and screen blockage
- Fuel tank vent blockage
- Plugged external canister or carburetor fuel filters
- Air leak on suction side of fuel system
- Fuel leak on pressure side of fuel system
- Inoperative, restricted or incorrectly sized anti-siphon valve
- Boat fuel lines too small in diameter
- Fuel pump pressure and suction
- Carburetor cleanliness and operation
- See the appropriate **Fuel System** section

Loss Of Ignition - Check:

- Primary and secondary ignition circuits
- Ignition switch
- Circuit breakers
- Wiring between engine and dash
- Main engine harness wiring
- See **General Information** and appropriate **Ignition System** sections of the **Electrical/Ignition** manual

Engine Stops Or Dies Out Due To Seizure - Check:

- Vertical drive for internal damage
- Oil pressure gauge and crankcase oil level
- Temperature gauge and cooling system operation
- Internal engine components as required

Engine Won't Reach Operating RPM - Check:

- Fuel type or octane
- Propeller pitch or diameter, damaged blades, slipping hub
- Crankcase oil volume
- Marine growth on hull and drive
- Wrong vertical drive gear ratio
- Operating at high altitude
- Restricted carburetor air intake
- Restricted exhaust outlets in engine, transom bracket or drive
- Poor cylinder compression
- Carburetor size and type correct for engine
- Fuel pump pressure and vacuum
- Boat overloaded, or load improperly placed
- Engine overheating
- Engine timing and ignition system operation
- Remote control cables and linkage for proper attachment and travel

Defective Engine Lubricating System

Engine Components - Check:

- Clogged or incorrect oil filter
- Worn oil pump gears, cover or shaft
- Worn or collapsed oil pump relief valve spring, or foreign material caught on valve seat
- Oil pump relief valve plunger loose in cover
- Damaged filter bypass grommet
- Clogged oil pickup screen, broken tube or housing
- Plugged crankshaft or block oil galleys
- Dirty or defective hydraulic lifters, clogged push rod passages
- Poor quality, incorrect viscosity or quantity of oil
- Incorrect hose routing on remote filter systems
- Water in crankcase oil from condensation, defective head gasket, oil cooler, or cracked manifold/block water passages

Oil Pressure Warning System - Check:

- Oil gauge/warning horn operation and wiring
- Engine temperature
- Oil pressure gauge and warning horn sender operation and wiring

Low Battery Voltage After Short Storage

Engine/Boat Components - Check:

- All electrical accessories including ignition circuit off
- Disconnect main battery negative cable from battery
- Connect ammeter or voltmeter in series between negative battery cable and negative battery post:
  1. Meter reading of "0" indicates no draw, test battery and charging system
  2. Meter movement no matter how slight indicates draw from battery
- Disconnect main engine harness 10-Pin Connector:
  1. Meter drops back to "0", problem caused by boat system, continue to isolate each boat electrical accessory until problem is found
  2. Meter does not drop back to "0", problem caused by engine electrical system, continue to isolate each engine electrical accessory until problem is found
- Repair or replace components as necessary