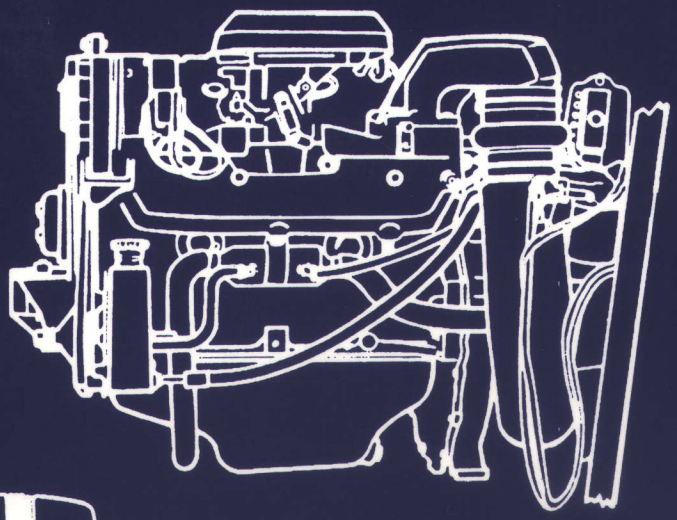
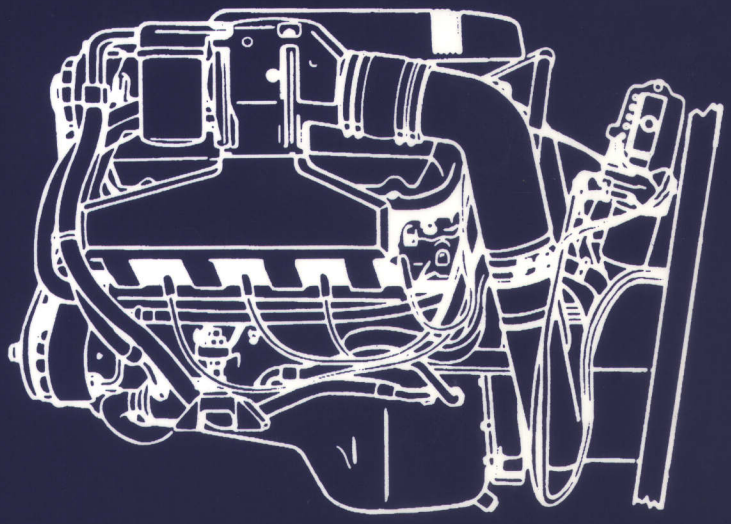
P/N 7797361-8
5-1997

Workshop Manual

"LK" Models

Engine Components





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.

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

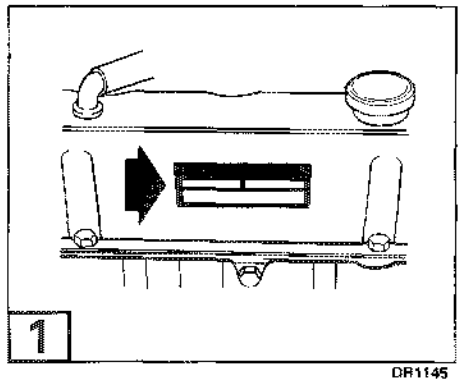
PJX-C	3868694
PJX-C1	3868694

Volvo Penta Model Identification

Note All sterndrive systems must be matched for either single or dual engine installations. Failure to properly match engine, transom bracket and sterndrive will result in poor boat performance, and risk or damage to the engine and or drive because of incorrect drive gear ratio.

The model identification is located on the engine valve cover, and **MUST** correspond with the transom bracket and sterndrive numbers as listed in this document.

- Engine Model Number 1 2 3
- Transom Bracket Model Number 4
- Sterndrive Model Number 5



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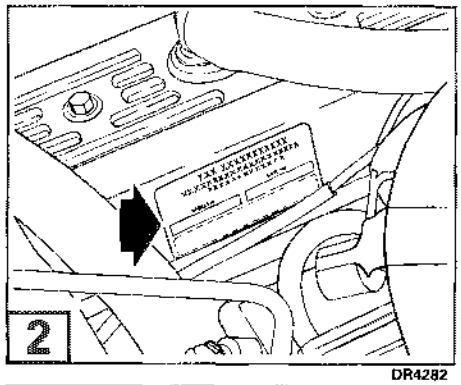

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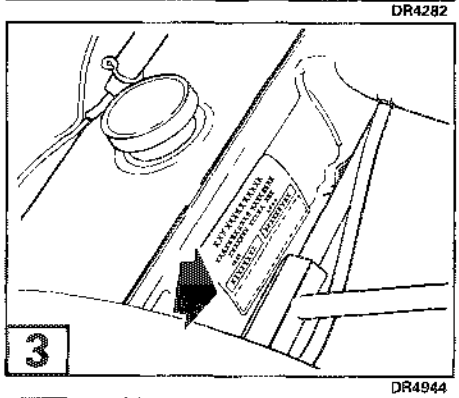

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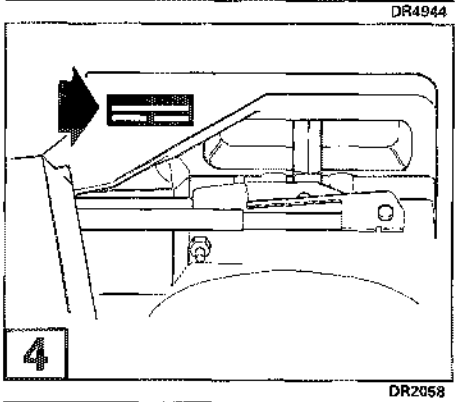

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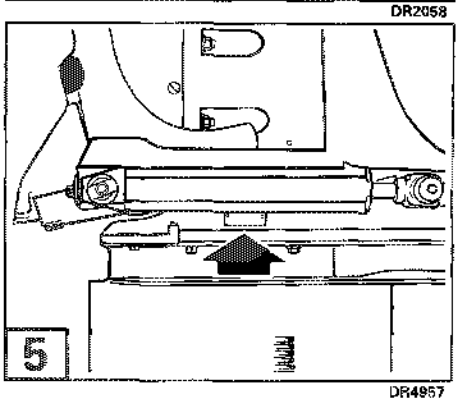

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Section 1

General Information

Table of Contents

⚠ Safety Warning

Before working on any part of any Volvo Penta® engine, read the section called Safety at the end of this manual.

Introduction

This service manual covers Volvo Penta Sterndrive models. 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 Volvo Penta Sterndrives is generally one of three ki nds:

- **Normal care and maintenance** - which includes putting a new stern drive 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 test tank, use proper test wheel. Failure to do so can damage supply 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 their products.

It is an Volvo Penta policy to provide dealers with service knowledge so they can give professional service demanded by today's consumer. Volvo Penta Training Centers, Service Bulletins, Letters and Promotions, Special Tools and this Service Manual represent the latest Volvo Penta effort to assist dealers in giving consumers the best and most prompt service possible. This Service Manual covers all phases of servicing the Volvo Penta Sterndrive unit. If a service question does not appear to be answered in this manual, you are invited to write or call the Volvo Penta Service Department for additional help. Always be sure to have complete information available, including engine model number and serial number.

Be sure that you are familiar with the Volvo Penta Warranty. 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 U.S. 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 are a good source of information for ordering parts. They are **NOT** a good source for disassembly and reassembly information of the engines, sterndrive, or related systems. The exploded views in the Parts Catalogs are representations and may not reflect details of the actual assembly.The Workshop Manual has detailed information and is the **ONLY** source of disassembly and reassebly information.

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 order from Volvo Penta Genuine Parts. Individual purchasers of Service Manuals must order Special Tools through an authorized dealer.

Product References, Illustrations & Specifications

Volvo Penta of the Americas, Inc. reserves the right to make changes at anytime, without notice, in specifications and models and also to discontinue models. Volvo Penta also reserves the right 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.

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 and deterioration of one or more components. In the normal operation of an engine, these changes can take place gradually at a number of points. It is seldom advisable to attempt improvement in performance by correcting one or two items only. Lasting results will be obtained by following a definite and thorough procedure of analysis and correcting all items affecting power and performance.

Economical, dependable operation can be ensured if a complete tune up is performed once every boating season, preferably at the beginning of the season when the boat is brought out of off season storage.

Components that affect power and performance can be divided into three groups:

- Components affecting compression
- Components affecting ignition
- Components affecting fuel system

Procedures for performing a complete engine tune-up will be covered in this manual.

Engine Compression Testing

1. Compression Check: Proper compression is essential for good engine performance. An engine with low or uneven compression cannot be properly tuned.

⚠ Use extreme care around engine while running or cranking. Remove loose clothing and jewelry to prevent entanglement with rotating pulleys and drive belts.

a. Run engine up to normal operating temperature.

Note Engine must **NOT** be started and run without water for cooling.

b. Remove any foreign matter from around spark plugs by blowing out with compressed air.

c. Remove and inspect all spark plugs. Install thread-type compression gauge in spark plug hole.

⚠ d. **To Prevent Sparking:**

- **All Models Except 5.7 GL, GS and 7.4 GL:** Remove (grey) 2-wire connector, with purple and grey wires, at ignition coil.
- **5.7 GL and GS Models Only:** Remove both distributor primary wires from the ignition coil Tape wire terminals to prevent accidental grounding.
- **7.4 GL Models Only:** Remove 14-wire connector at ignition module.

e. With choke and/or throttle plates wide open, crank engine through at least four compression strokes.

Test Conclusion

The indicated compression pressures are considered normal if the lowest reading cylinder is within 75% of the highest.

Example:

If the highest pressure reading was 140 PSI, 75% of 140 is 105. Therefore, any cylinder reading less than 105 PSI indicates an improperly seated valve, worn valve guides, piston, cylinder, or worn or broken piston rings. Any cylinder reading 105 PSI or greater is within specifications, and compression is considered normal.

If one or more cylinders read low, squirt approximately one tablespoon of engine oil on top of the pistons in the low reading cylinders. Repeat compression pressure check on the cylinders.

1. If compression improves considerably, the piston rings are at fault.

2. If compression does not improve, valves are sticking or seating poorly, or valve guides are worn.

3. If two adjacent cylinders indicate low compression pressures and squirting oil on the pistons does not increase the compression, the cause may be a cylinder head gasket leak between the cylinders. This problem could allow engine oil and/or coolant to enter the cylinders.

It is recommended the following quick reference chart be used when checking cylinder compression pressures. The chart has been calculated so that the lowest reading number is 75% of the highest reading.

Compression Pressure Limit Chart

Max	Min	Max	Min	Max	Min	Max	Min
134	101	154	115	174	131	194	145
136	102	156	117	176	132	196	147
138	104	158	118	178	133	198	148
140	105	160	120	180	135	200	150
142	107	162	121	182	136	202	151
144	108	164	123	184	138	204	153
146	110	166	124	186	140	206	154
148	111	168	126	188	141	208	156
150	113	170	127	190	142	210	157
152	114	172	129	192	144	212	158

After checking cylinder compression, repairs should be made as necessary. Subsequent adjustments to an engine that does not have proper compression will not measurably improve performance or correct operational problems. After verifying compression, check ignition and fuel system components.

Ignition System

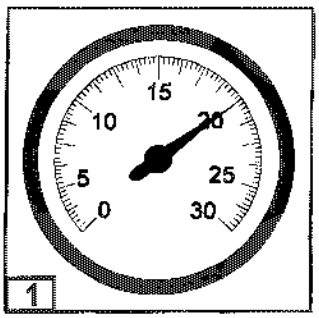
- Spark Plugs
- Spark Plug Leads
- Distributor Cap
- Rotor
- Ignition Coil
- High Tension Leads
- Ignition Switch
- Circuit Wiring and Connectors
- Electronic Control Module

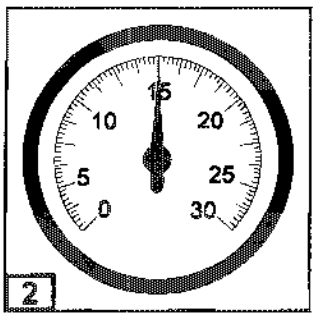
Fuel System

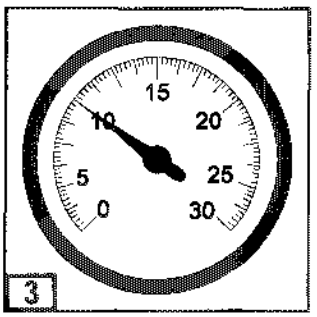
- Fuel Tank Pickup and Screen
- Fuel Tank Vent
- Anti-Siphon Valve (if equipped)
- Fuel Octane and Quality
- Boat Fuel Lines and Valves
- External Engine Fuel Filter or Screen
- Fuel Pumps and Lines
- Carburetor Fuel Filter or Screen
- Carburetor Adjustments
- Engine PCV Valve
- Flame Arrestor
- Pressure Regulator and Injectors

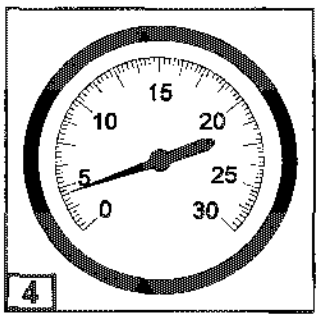
All of the these components are not necessarily part of an engine tune-up, but must be considered when attempting to correct engine/boat performance problems. Repair or replace components only as required.

⚠ **Do not substitute automotive parts. Volvo Penta marine components meet U.S. Coast Guard Regulations for external ignition proof operation and marine use. The use of automotive parts may result in fire and explosion.**









Intake Manifold Vacuum Tests

1. Install a vacuum gauge to a good intake manifold source, following the gauge manufacturer's instructions. Start and warm up the engine.

2. Observe the vacuum gauge while operation the engine over a range of engine speeds.

3. A steady vacuum reading between 18 and 22 in. Hg. (60,7 — 74,3 kPa) at idle indicates an engine in good mechanical condition.

4. A vacuum reading below 18 in. Hg. (60,7 kPa) at idle, indicates an engine that is not developing enough vacuum. Further testing for mechanical problems is required.

Test Results

1. A steady vacuum reading between 17 and 21 in. Hg. (60,7 — 74,3 kPa) at idle indicates normal engine vacuum.

2. A vacuum reading below 18 in Hg. (60,7 — 74,3 kPa) at idle indicates an engine that is not developing enough vacuum. Further testing for mechanical problems is needed.

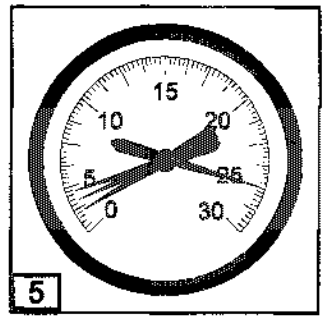
3. Possible causes of low vacuum are late ignition timing, low compression, poor engine sealing, leaks at vacuum line connections, or a bad MAP sensor.

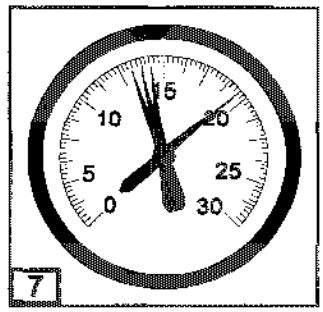
5. Vacuum gauge fluctuates at idle but smooths out as the engine RPM increases, poorly seating valves, worn camshaft, or a sticking hydraulic lifter.

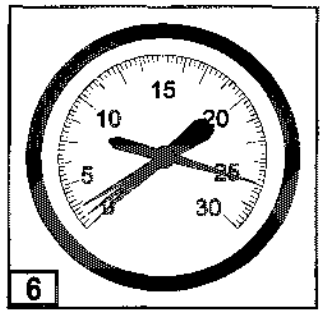
6. Vacuum gauge fluctuates more with increases in engine RPM, check for weak or broken valve springs, poorly seated valves, ignition miss, or a leaking head gasket.

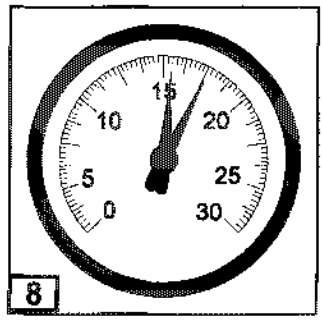
7. Vacuum gauge fluctuates with each engine cycle check for bad valve.

8. Vacuum reading drops steadily as RPM is increased, check for exhaust restriction.









1 NORMAL: Steady reading at 17-21 in. Hg.

2 LATE IGNITION TIMING: 14-17 in. Hg. at idle.

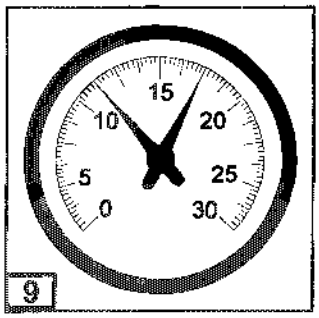
3 LATE VALVE TIMING: 8-15 in. Hg. at idle.

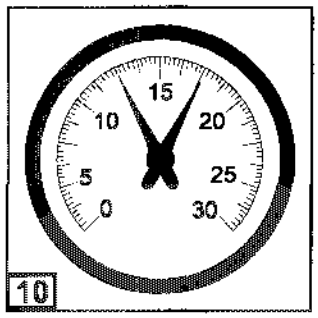
4 INTAKE LEAK: Low steady reading.

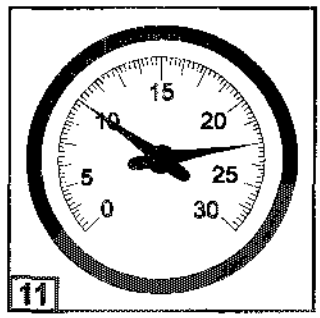
5 NORMAL CONDITION: Drops to 2, then rises to 25 when accelerated rapidly.

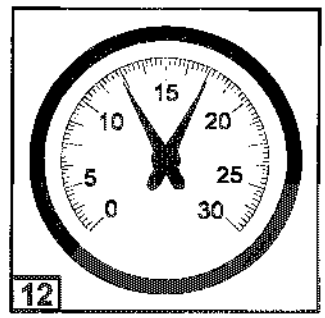
6 WORN PISTON RINGS: Drops to 0, then rises to 22 when accelerated rapidly.

7 STICKING VALVES: Normally steady, intemittently ficks downward 4 in. from highest reading.









8 LEAKING VALVE: Regular drop approximately 2 in. from highest reading.

9 BURNED OR WARPED VALVE: Vacuum gauge fluctuates evenly with a down-scale pulse approximately 5 in. with each engine RPM at idle, check for a burned or warped valve.

10 WORN VALVE GUIDES: Vacuum gauge oscillates approximately 4 in. Hg. Check valve guides for excessive wear.

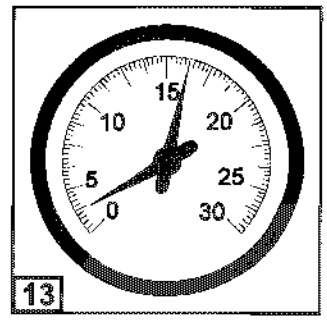
11 WEAK VALVE SPRINGS: Vacuum gauge give violent or sharp oscillations as the RPM is increased, check for weak valve springs.

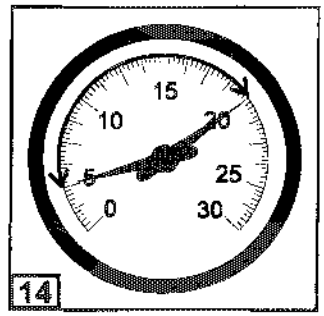
12 IMPROPER IDLE MIXTURE: Vacuum gauge steadily floats between 13 - 17 in. Hg., check and/ or adjust the idle mixture.

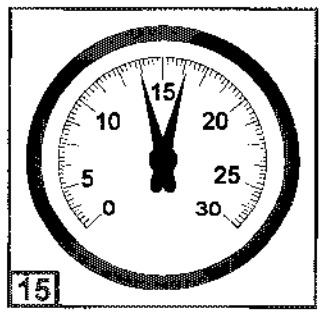
13 EXHAUST RESTRICTION: Vacuum gauge gives a normal reading on engine start but drops to 0 as engine RPM is increased. The vacuum may eventually rise to approximately 16 in. Hg. Check for restrictions in the exhaust system.

14 LEAKING HEAD GASKET: Vacuum gauge floats between 5 - 20 in. Hg., check for leaking head gasket.

15 SPARK PLUG GAP TO CLOSE OR DEFECTIVE POINTS: Vacuum gauge gives a slight float between 14 - 16 in. Hg. check for defective ignition points on engines equipped with ignition points or small spark plug gap.







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Gasoline Requirements

Volvo Penta engines are designed for maximum performance using gasoline with the following minimum octane specifications:

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

4.3GL, GS AND 5.7GL, GS Models: The ignition timing must be retarded if fuels are used with less than 86 AKI (90 RON) octane are used. Refer to "Timing and Fuel Requirements in the Tune Up Section of this manual for details. When ignition timing is retarded, a slight decrease in performance can be expected.

Note Use of gasoline with lower than 89 AKI (93 RON) octane in 4.3GL, GS and 5.7GL, GS models, without retarding ignition timing as specified, will result in serious damage to your engine and will **void the engine warranty.**

All Other Models: Lower octane fuels, lower than 86 AKI (90 RON) octane, can be used. With the use of lower octane fuel, a slight decrease in power can be expected.

Every attempt should be made to use unleaded fuel, however, some marinas only sell fuel with lead additives. If unleaded fuel is unavailable, the substitution of leaded fuel for temporary use will not harm the fuel system. 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. **Do not use leaded fuel in Certified Emission engines. Leaded fuel will void the certification of emissions.**

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

Note Engine damage resulting from the use of gasoline with octane lower than 87 AKI (91 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 Cleaner P/N 3855830-0 in the gasoline. DuraPlus™ Marine Fuel Cleaner P/N 3855830-0 is available through your Volvo Penta dealer.

⚠ **Gasoline is extremely flammable and highly explosive under certain conditions. Always stop engine and do not smoke or allow open flames near the boat when refueling. When fueling, always ground the tank to the fuel source by holding the hose nozzle firmly against the side of the deck filler plate, or ground it by some other means . This action prevents static electricity buildup which 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 Operator's Manual to determine if the boat's fuel system is compatible with alcohol blended fuels. If it is, your engine may use 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 Continued use of **METHANOL** (methyl alcohol) fuel will cause serious damage to the fuel system.

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

- The engine will operate leaner. This may cause engine problems such as vapor lock, low speed stalling, or hard starting.
- Alcohol blended fuels attract and hold moisture. Moisture can cause fuel tank corrosion. Inspect fuel tanks at least annually. Replace corroded or leaking fuel tanks.
- Frequently inspect non-metallic parts of fuel system and replace if excessively stiff, deteriorated or leaking.

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

Crankcase Oil

1 Initial factory fill is a high quality motor oil for API Service SG/CD. During the break-in period (20 hours), frequently check the oil level. Somewhat higher oil consumption is normal until the piston rings are seated. The oil level should be maintained in the safe range between the Add and Full marks on the dipstick. This range represents approximately 1 litre (1 quart). If it is necessary to add or change the motor oil, use a quality oil with API service category SG/CD that meets General Motors Standard GM6094-M.

At the end of the break-in period (20 hours), change the crankcase oil and replace the oil filter. Refer to **Lubrication and Inspection Chart** for recommended oil change intervals.

Note **The use of multi-viscosity oils, such as 10W-30 or 10W-40, is not recommended.**

Draining and Filling the Engine Crankcase

Drain and refill crankcase every 50 hours of operation or 6 months, whichever occurs first.

⚠ **To prevent fire and explosion, always make sure engine compartment is free of gasoline fumes before using any sparkproducing tools such as the electric drill motor used with oil withdrawal pump kit.**

[1] → [3] Check the motor oil frequently. When oil is to be changed, remove dipstick and draw oil from crankcase through dipstick tube with a suction pump. The dipstick tube is intended to be used for drainage of the engine oil so it will not have to be drained into the bilge.

Fill the crankcase to recommended capacity with a quality motor oil labeled for SAE service category SG which meet *General Motors* Standard GM-6094-M. Oils conforming to this standard contain detergent and anti-wear additives that will prolong engine life. *Volvo Penta Dura Plus™ Synthetic Motor Oil* P/N 3851230-7 exceeds this standard.

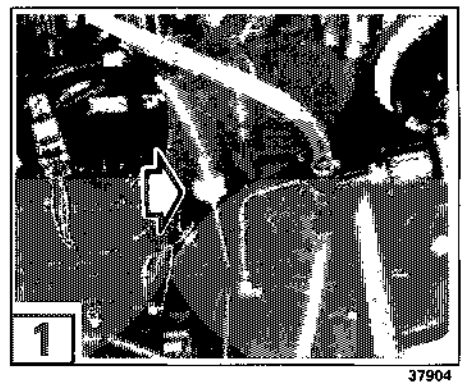
When changing motor oil, select the viscosity that matches the temperature range in which the boat will be operated. Use the same viscosity when adding motor oil, do not mix different viscosity oils.

Lowest Anticipated Temperature	SAE Viscosity Oil Recommended
32°F (0°C) and above	SAE 30
0°F (-18°C) to 32°F (0°C)	SAE 20W-20
Below 0°F (-18°C)	SAE 10W

⚠CAUTION: Do not fill above full mark. Overfilling results in high operating temperatures, foaming the oil (mixing air in the oil), loss of power, and reduced engine life.

Crankcase Capacities

Model	Less Filter	With Filter
3.0GS	3.5 qts. (3,3 liters)	4.0 qts. (3,8 liters)
4.3GL, GS, Gi	4.0 qts. (3,8 liters)	4.5 qts. (4,3 liters)
5.7GL, GS Gi and GSi	5.0 qts. (4,7 liters)	6.0 qts. (5,7 liters)
7.4GL, Gi, GSi	8.0 qts. (7,5 liters)	9.0 qts. (8,5 liters)
8.2GSi	8.0 qts. (7,5 liters)	9.0 qts. (8,5 liters)
DPX300	5.0 qts. (4,7 liters)	6.0 qts. (5,7 liters)
DPX385, DPX415, DPX500	8.0 qts. (7,5 liters)	9.0 qts. (8,5 liters)



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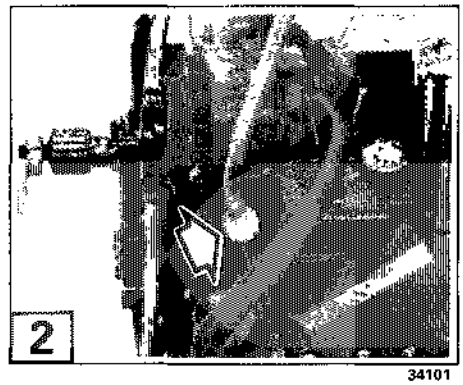

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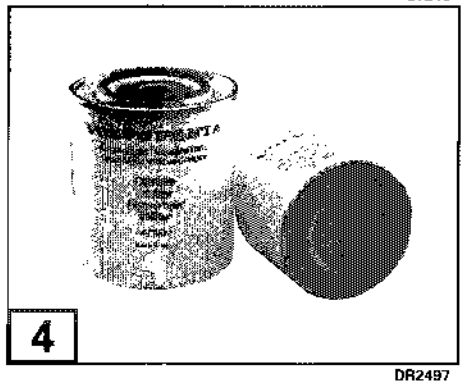

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Oil Filter

[4] Replace the oil filter whenever the motor oil is changed. This filter is a self contained, screw-on type. To remove, unscrew filter canister counterclockwise, remove and drain residual oil into a suitable container. Dispose of the oil and filter properly. When attaching a new filtwer, be sure the gasket is lightly lubricated with fresh motor oil. hand tighten only, run engine to check for leaks. Do not run engine without supplying cooling water. See **Tune-Up Specifications** for model and filter requirements.

Power Steering Fluid Level

[5] [6] Maintain the level with DuraPlus™ Power Trim/Tilt & Steering Fluid. Approved power steering fluids such as GM power steering fluid or *Dexron II* automatic transmission fluid can also be used. Do not overfill the pump reservoir.

Steering System Lubrication

[7] [8] Every 60 days, grease the steering ram Ⓐ with *Volvo Penta* Grease.

Power Trim/Tilt-Fluid Level

[9] At the beginning of each boating season, check the fluid level in the reservoir as follows:

⚠ **The trim/tilt hydraulics are pressurized when the drive unit is in the down position. The drive unit must be tilted full up to relieve hydraulic pressure before removing level/fill plug Ⓑ. Failure to tilt the drive unit to the full up position before removing level/fill plug would result in a hazardous spray of hydraulic oil. Caution should always be taken when removing level/fill plug by placing a rag over the level/fill plug to prevent residual pressure from spraying oil.**

1. With the drive unit tilted full up, slowly and carefully remove the level/fill plug.

2. Check the fluid level. The fluid should be level with the bottom of the fill hole when the drive unit is at full tilt. If necessary, add DuraPlus™ Power Trim/Tilt & Steering Fluid. Replace the level/fill plug and tighten securely.

Off-Season Storage Preparations

Step 1. Condition Fuel System:

Add DuraPlus™ Marine Fuel Stabilizer to fuel system. Follow instructions for adding conditioner and running engine as stated on the container. This will stabilize the fuel and prevent formation of varnish and gum in entire fuel system. Do this before continuing with the following procedures.

Note Models equipped with 4 BBL carburetors should be run under a load at a high enough throttle setting to circulate conditioner through the secondary float bowl.

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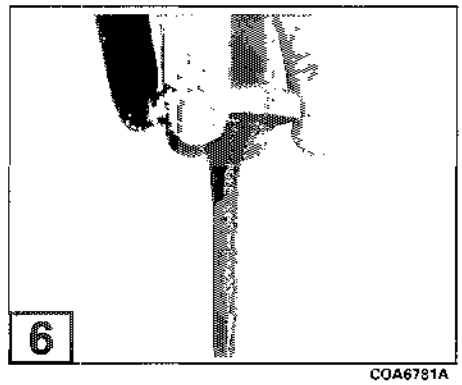

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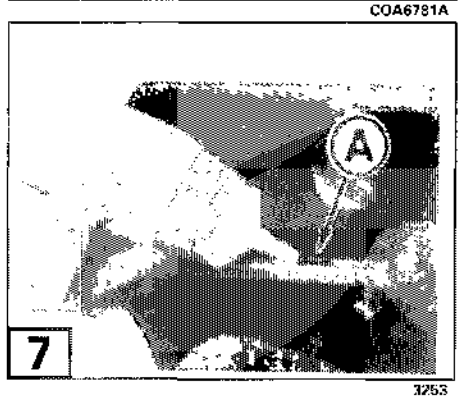

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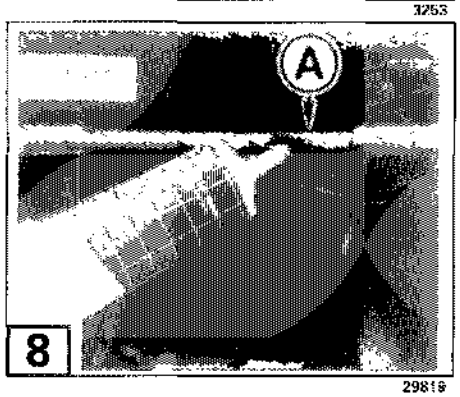

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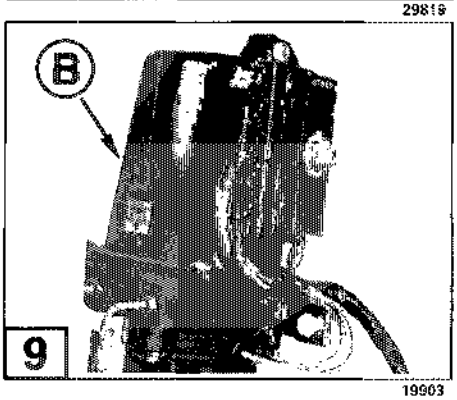

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Step 2. Change Motor Oil and Oil Filter:

- Engine should first be operated under load until oil is thoroughly warmed up. If oil is allowed to warm up before draining, a more complete draining will be accomplished. In addition, accumulated impurities will be held in suspension by the oil and be removed during draining operation.
- Remove motor oil by siphoning it out of oil withdrawal tube. Follow the procedure under Draining and Filling the Engine Crankcase.
- Install a new oil filter and fill crankcase with recommended oil.

Note! Vertical drive must be submerged in water or an accessory flushing adaptor must be used while operating engine.

When using a flushing adaptor, remove propeller before starting engine to prevent accidental contact with rotating propeller.

- With vertical drive in full down position, run engine at a fast idle for a few minutes to distribute clean oil through engine.
- Shut off engine and check oil level. Check oil filter gasket for leaks. Add oil if necessary to bring oil level up to, but not over, the full mark.

Step 3. Change Vertical Drive Lubricant:

Drain and refill with fresh DuraPlus™ GL-5 Synthetic Gear Lubricant. Refer to Vertical Drive Service Manual.

Step 4. Fog Engine:

Carbureted Models

- Warm up engine to ensure fuel conditioner is throughout fuel system. Use ½ pint (0,24 litre) of Volvo Penta Fogging Oil P/N 4414651-8 10 oz. (355 ml) spray can to fog engine.
- Remove flame arrestor from carburetor. Following instructions on container, bring engine up to a fast idle and slowly spray 2/3 of the fogging oil into carburetor. Keep engine running while spraying fogging oil into carburetor throat.
- Reduce throttle to idle and let engine die. Turn off ignition and replace flame arrestor. Close fuel shutoff valve (if so equipped).