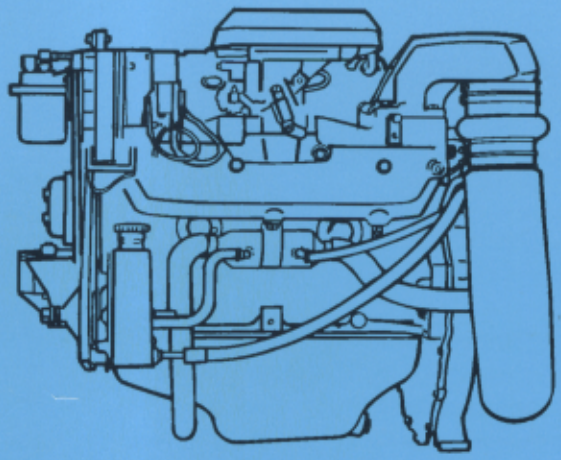
P/N 7788856-8
8-1995

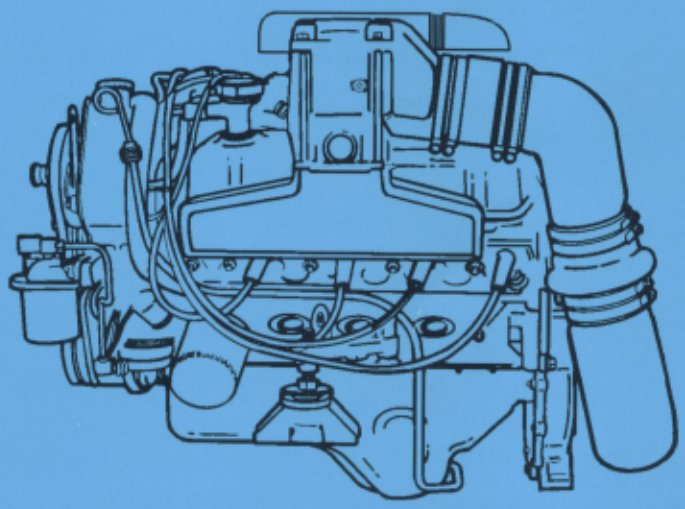
Workshop Manual

"HU" Models

Early "NC" 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 decided if your actions might injure people or damage the Volvo Penta product.

Contents

This workshop manual is one of a set of nine that covers *Volvo Penta* stern drive models. All nine books can be ordered as a set from *Volvo Penta Parts.* Order P/N 7788850-1.

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

- **P/N 7788851-9 *SX Drive Unit 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 7788856-8 *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 7788857-6 *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 7788858-4 *Fuel System***
  Includes service and troubleshooting information on all carburetor, MFI and TBI fuel systems and related components.

- **P/N 7788852-7 *MFI Diagnostic Manual (5.0 Fi, 5.8 Fi/FSi) - Ford***
  Includes step by step troubleshooting procedures for all MFI Ford related components and wiring.

- **P/N 7788853-5 *TBI Diagnostic Manual (4.3 Gi, 5.7 Gi) - GM***
  Contains troubleshooting procedures for all TBI GM models and related components.

- **P/N 7788855-0 *SP and DP Workshop Manual***
  Includes Upper Gear Unit and Lower Gear Unit overhaul procedures, installation and removal.

- **P/N 7788854-3 *MFI Diagnostic Manual (7.4 Gi, 7.4 GSi) - GM***
  Includes step by step troubleshooting procedures for all MFI GM related components and wiring.

- **P/N 7788859-0 *DPX - Lower Unit Workshop Manual***
  Includes specific information for repair and overhaul of the DPX Lower unit and Xact™ steering systems not covered in the SP and DP Workshop manual.

This *Volvo Penta* Stern Drive Workshop Manual Covers The Following *Volvo Penta* "HU" Models

SX™

Engine	Model Nr.	Transom Shield	Drive Unit	Options
3.0 GS SX NPS	3868181	3868288/SX-LIMITED TRIM	3868159/SX-CT/1.85:1	3868176/SX-C
3.0 GS SX	3868182	3868288/SX-LIMITED TRIM	3868159/SX-CT/1.85:1	3868176/SX-C
4.3 GL SX	3868184	3868176/SX-C	3868160/SX-C/1.66:1	3868159/SX-C/1.85:1/H.A.
4.3 GS SX	3868186	3868176/SX-C	3868160/SX-C/1.66:1	3868159/SX-C/1.85:1/H.A.
5.0 FL SX	3868189	3868176/SX-C	3868160/SX-C/1.66:1	3868159/SX-C/1.85:1/H.A.
5.0 FI SX	3868193	3868176/SX-C	3868161/SX-C/1.60:1	3868160/SX-C/1.66:1/ H.A.
5.8 FL SX	3868190	3868176/SX-C	3868162/SX-C/1.51:1	3868160/SX-C/1.66:1/ H.A.
5.8 FI SX	3868194	3868176/SX-C	3868162/SX-C/1.51:1	3868160/SX-C/1.66:1/ H.A.
5.8 FSI SX	3868195	3868176/SX-C	3868208/SX-C/1.43:1	3868162/SX-C/1.51:1/H.A.

H.A. = high altitude applications

DuoProp®

Engine	Model Nr.	Transom Shield	Drive Unit	Options
4.3 GI DP	3868320	3868299/DP-S	3868008/DP-C1/2.30:1	
4.3 GS DP	3868321	3868299/DP-S	3868008/DP-C1/2.30:1	
5.0 FL DP	3868322	3868299/DP-S	3868002/DP-C1/1.95:1	3868008/DP-C1/2.30:1/H.A.
5.0 FI DP	3868323	3868299/DP-S	3868002/DP-C1/1.95:1	3868008/DP-C1/2.30:1/H.A.
5.7 GI DP	3868325	3868299/DP-S	3868002/DP-C1/1.95:1	3868008/DP-C1/2.30:1/H.A.
5.8 FL DP	3868324	3868299/DP-S	3868002/DP-C1/1.95:1	3868008/DP-C1/2.30:1/H.A.
5.8 FI DP *	3868326	3868299/DP-S	3868002/DP-C1/1.95:1	3868008/DP-C1/2.30:1/H.A.
5.8 FSI DP	3868327	3868299/DP-S	3868002/DP-C1/1.95:1	3868022/DP-D1/1.78:1
7.4 GL DP	3868328	3868299/DP-S	3868022/DP-D1/1.78:1	3868002/DP-C1/1.95:1/H.A.
7.4 GI DP	3868335	3868299/DP-S	3868022/DP-D1/1.78:1	N.A.

* = export only H.A. = high altitude applications N.A. = Not Available

DPX™

Engine	Model Number	Transom Shield	Drive Unit
7.4 GSI DPX-CA	3868198	3868289/DPX-C	3868020/DPX-C /1.59:1
7.4 GSI DPX-CB	3868198	3868289/DPX-C	3868021/DPX-C /1.68:1
7.4 GSI DPX-CC	3868198	3868289/DPX-C	3868023/DPX-C /1.78:1
8.2 GL DPX-CA	3868133	3868289/DPX-C	3868020/DPX-C /1.59:1
8.2 GL DPX-CB	3868133	3868289/DPX-C	3868021/DPX-C /1.68:1
8.2 GL DPX-CC	3868133	3868289/DPX-C	3868023/DPX-C /1.78:1

This *Volvo Penta* Stern Drive Workshop Manual Covers The Following *Volvo Penta* "NC" Models

SX™

Engine	Model Nr.	Transom Shield	Drive Unit	Options
3.0 GS SX NPS	3868181	3868432/SX-LIMITED TRIM	3868396/SX-CT/1.85:1	3868397/1.97/SXC 386404/TSK
3.0 GS SX	3868182	3868432/SX-LIMITED TRIM	3868396/SX-CT/1.85:1	3868397/1.97/SXC 386404/TSK
4.3 GL SX	3868184	3868404/SX/DP	3868395/SX/1.66	3868465/SX/1.85
4.3 GS SX	3868186	3868404/SX/DP	3868395/SX/1.66	3868465/SX/1.85
5.0 FL SX	3868414	3868404/SX/DP	3868395/SX/1.66	N.A.
5.0 Fi SX	3868416	3868404/SX/DP	3868394/SX/1.60	3868395/SX/1.66
5.7 GI SX	3868429	3868404/SX/DP	3868393/SX/1.51	N.A.
5.8 FL SX	3868415	3868404/SX/DP	3868393/SX/1.51	N.A.
5.8 FSi SX	3868418	3868404/SX/DP	3868393/SX/1.51	N.A.

H.A. = high altitude applications

DuoProp®

Engine	Model Nr.	Transom Shield	Drive Unit	Options
4.3 GL DP	3868184	3868404/SX/DP	3868163/DP/2.30	N.A.
4.3 GS DP	3868186	3868404/SX/DP	3868163/DP/2.30	N.A.
4.3 GI DP	3868185	3868404/SX/DP	3868163/DP/2.30	N.A.
5.0 FL DP	3868414	3868404/SX/DP	3868164/DP/1.95	N.A.
5.0 FI DP	3868416	3868404/SX/DP	3868164/DP/1.95	N.A.
5.7 GI DP	3868429	3868404/SX/DP	3868164/DP/1.95	N.A.
5.8 FL DP	3868415	3868404/SX/DP	3868164/DP/1.95	N.A.
5.8 FSI DP	3868418	3868404/SX/DP	3868164/DP/1.95	3868165/DP/1.78
7.4 GL DP	3868196	3868404/SX/DP	3868022/DP-D1/1.78:1	N.A.
7.4 GI DP	3868450	3868404/SX/DP	3868166/DP/1.68	N.A.

* = for export only H.A. = high altitude applications N.A. = Not Available

DPX™

Engine	Model Nr.	Transom Shield	Drive Unit
7.4 GSi DPX-CA	3868198	3868289/DPX	3868020/DPX /1.59:1
7.4 GSI DPX-CB	3868198	3868289/DPX	3868021/DPX /1.68:1
7.4 GSi DPX-CC	3868198	3868289/DPX	3868023/DPX /1.78:1
8.2 GL DPX-CA	3868133	3868289/DPX	3868020/DPX /1.59:1
8.2 GL DPX-CB	3868133	3868289/DPX	3868021/DPX /1.68:1
8.2 GL DPX-CC	3868133	3868289/DPX	3868023/DPX /1.78:1

Section 1

General Information

Table of Contents

⚠ Safety Warning

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

Introduction

This workshop manual covers *Volvo Penta* stern drive 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* stern drives is generally one of three kinds:

- **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 raw-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 stern drives 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 *Volvo Penta's* 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 Bulletins, Letters and Promotions, Special Tools and this Workshop Manual represent *Volvo Penta's* efforts to assist dealers in giving consumers the best and most prompt service possible. This Workshop Manual covers all phases of servicing the *Volvo Penta* stern drive 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 *Volvo Penta's* 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 of the engines and drives. The exploded views in the Parts Catalogs are for illustration of parts only, not a source of assembly instructions. The workshop manual has detailed information and is the only source of information for disassembly and reassembly.**

⚠ DANGER ***Failure to follow workshop manual procedures and cautions may result in death, personal injury to yourself or bystanders and damaged equipment.***

Special Service Tools

Volvo Penta has specially designed tools to simplify disassembly and reassembly operations. These tools are illustrated in this Workshop Manual. All *Volvo Penta* special tools can be ordered from *Volvo Penta Parts Department.* Non-dealer users of Workshop Manuals must order Special tools through and authorized *Volvo Penta* Dealer.

Product References, Illustrations and Specifications

Volvo Penta reserves the right to make changes at anytime, without notice, to specifications, models, and procedures. Also, 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. The right is reserved to make changes at any time without notice.

Photographs and illustrations used in this manual may not depict actual models or equipment. 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 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.

⚠WARNING ***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.

⚠WARNING ***Hearing and eye protection required to prevent injury while using compressed air.***

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

⚠ d. **To Prevent Sparking:**

- 3.0, GS, 4.3 GL, GS, Gi, 5.7 Gi, and 7.4 Gi, GSi Models - **remove 2-wire connector from distributor.**
- 5.0, 5.8 FL, and 7.4, 8.2 GL Models - **remove both distributor primary wires from the ignition coil, and tape wire terminals to prevent accidental grounding.**
- 5.0, 5.8 Fi, FSi Models - **unplug 2-way connector at ignition coil.**

e. With choke and throttle plates wide open, crank engine through at least four compression strokes, or until compression gauge reading stops rising.

Test Conclusion

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

Example:

If the highest pressure reading was 140 psi, 140 X .75 = 105. Therefore, any cylinder reading less than 105 psi indicates valve, piston, or piston ring problems.

If one or more cylinders read low, squirt approximately one tablespoon (25 ml) of engine oil in the cylinders with the low readings. Repeat test on the cylinders with low readings. This is commonly referred to as a "Wet Test."

1. If compression improves considerably, the piston rings are at fault.
2. If compression does not improve, valves are seating poorly or burnt valves are suspect.
3. If two adjacent cylinders indicate low compression pressures, and a wet test does not improve compression on either cylinder, the head gasket may be leaking between the cylinders. This problem may or may not be accompanied by coolant in the cylinders. If coolant is discovered in the cylinders, this may be cause for further investigation on fresh water cooled engines with unexplained coolant loss.

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. PSI	Min. PSI	Max. PSI	Min. PSI	Max. PSI	Min. PSI	Max. PSI	Min. PSI
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 Lead
- Ignition Switch
- Circuit Wiring and Connectors
- ECM

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
- Fuel Pump and Line
- Carburetor Fuel Filter or Screen
- Carburetor Adjustments
- Engine PCV Valve (if equipped)
- Flame Arrestor
- Pressure Regulator and Injectors
- TBI Unit

All of the above listed 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. *Volvo Penta* marine components are specially designed not to cause ignition of fuel vapors in the bilge or engine compartment. The use of automotive parts can result in fire and explosion.**

Gasoline Requirements

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

Inside the U.S., (R+M)/2 (AKI) - 89
Outside the U.S., (RON) - 93

4.3 GL Models - The ignition timing will have to be retarded if lower octane fuels, with minimum 86 AKI (90 RON) octane, are used. Refer to "Timing" in Tune-up Specifications. When ignition timing is retarded, a slight decrease in power can be expected.

Note Use of gasoline with lower than 89 AKI (93 RON) octane in 4.3 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, with minimum 86 AKI (90 RON) octane, can be used. With the use of lower octane fuel, a slight decrease in power can be expected.

Note **Engine damage resulting from the use of gasoline with octane lower than 86 AKI (90 RON) is considered misuse of the engine and will void the engine warranty.**

Some marinas sell fuel with lead additives. **Do not use leaded fuel as it may plug the fuel injecton.** Premium fuel contains injector cleaners and other additives that protect the fuel system and provide optimum performance. **The use premium grade fuels in all models is strongly recommended.** To prevent gum formation and corrosion in the fuel system, use Fuel Conditioner in the gasoline. Fuel Conditioner is available from your *Volvo Penta* stern drive dealer.

⚠ **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. Sparks or flames may cause an explosion resulting in personal injury.**

⚠ **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 which could cause sparks and ignite fuel vapors. Sparks or flames may cause an explosion resulting in personal injury.**

Gasolines Containing Alcohol

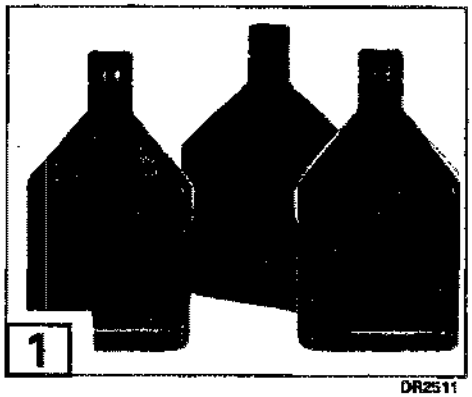
Many gasolines being sold today contain alcohol. Two commonly used alcohol additives are Ethanol (ethyl alcohol) and Methanol (methyl alcohol).

See the boat's Operators 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 boat or engine fuel systems.

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.



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⚠ **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 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 liter (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 GM-6094-M or *Ford* Specification ESE-M2C153-E. *Volvo Penta DuraPlus™* Motor Oils are recommended.

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 100 hours of operation or once a season, whichever occurs first.

⚠ **To prevent fire and explosion, always make sure engine compartment is free of gasoline fumes before using any spark-producing tools such as the electric drill motor used with oil withdrawal pump kit. Fire and explosion can result in personal injury.**

1 ⇒ 4 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 meets *General Motors* Standard GM-6094-M or *Ford* Specification ESE-M2C153-E. 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 both manufacturers standards.

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.

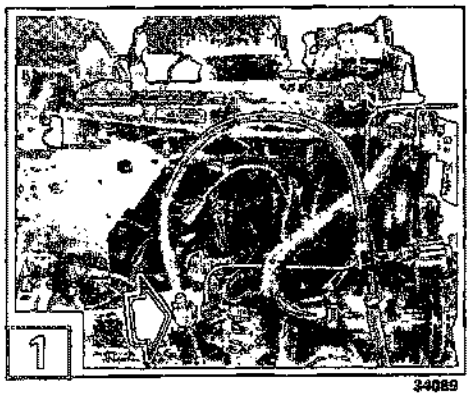
Lowest Anticipated Temperature	Viscosity Oil Recommended
32°F (0°C) and above	SAE 30
0°F (-18°C) to 32°F (0°C)	SAE 20W-20
Below 0°F (-18°C)	SAE 10W

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.

Model	Less Filter	With Filter
3.0 GS	3.5 qts. (3,3 liters)	4.0 qts. (3,8 liters)
4.3 GL, GS, and Gi	4.0 qts. (3,8 liters)	4.5 qts. (4,3 liters)
5.0 FL	5.0 qts. (4,7 liters)	6.0 qts. (5,7 liters)
5.7 Gi	5.0 qts. (4,7 liters)	6.0 qts. (5,7 liters)
5.8 FL	5.0 qts. (4,7 liters)	6.0 qts. (5,7 liters)
5.0 Fi	5.0 qts. (4,7 liters)	6.0 qts. (5,7 liters)
5.8 Fi, FSi	4.0 qts. (3,8 liters)	5.0 qts. (4,7 liters)
7.4, 8.2 GL	6.0 qts. (5,7 liters)	7.0 qts. (6,6 liters)
7.4 Gi, GSi	8.0 qts. (7,5 liters)	9.0 qts. (8,5 liters)

Oil Filter

2 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 and discard. When attaching a new filter, be sure the gasket is lightly lubricated with motor oil. Hand tighten only, run engine and check for leaks. Do not run engine without suppling cooling water. See Tune-up Specifications for model and filter requirements.



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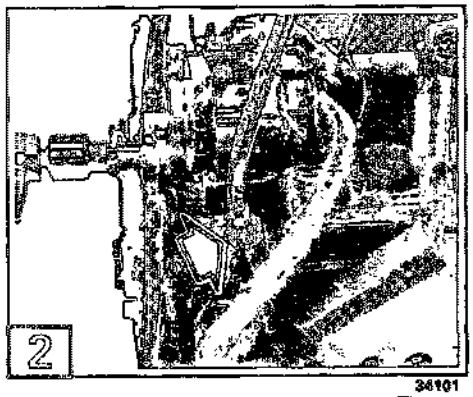

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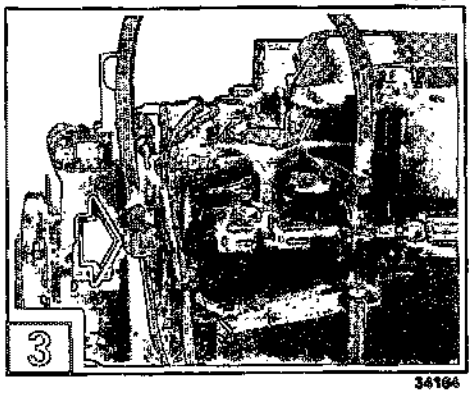

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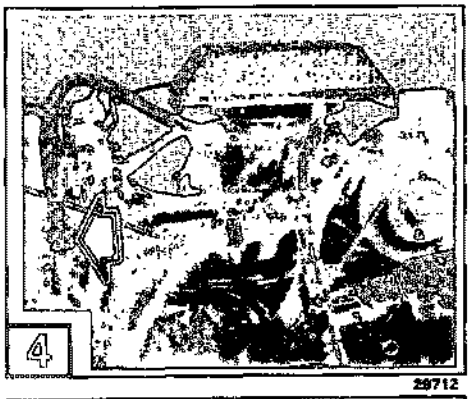

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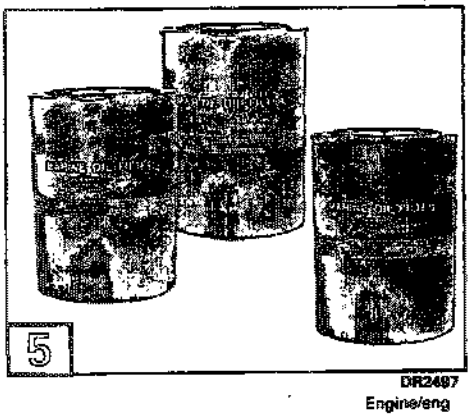

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Power Steering Fluid Level

[3] [4] Maintain the level with *Volvo Penta 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

[5] [6] Every 60 days, grease the steering ram Ⓐ with *Volvo Penta* Grease.

Power Trim/Tilt-Fluid Level - *SX* Models

[7] 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 *Volvo Penta power trim/tilt & steering fluid.* Replace the level/fill plug and tighten securely.

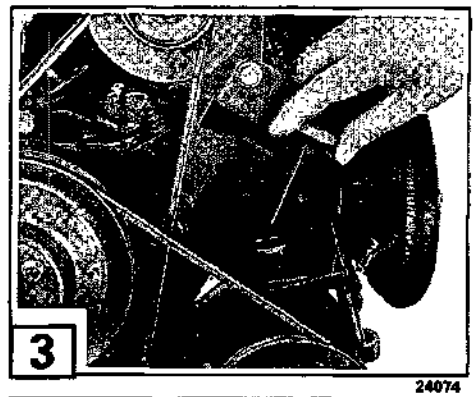
Off-Season Storage Preparations

Note There are nine steps that must be completed for off-season storage preparation.

Step 1. Condition Fuel System:

Add Fuel Conditioner 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 fuel system.



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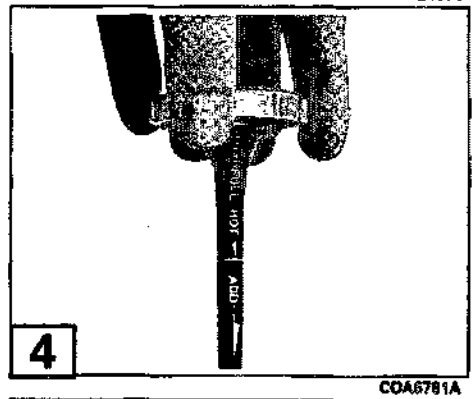

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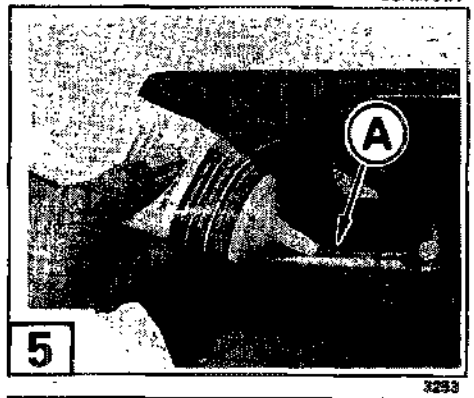

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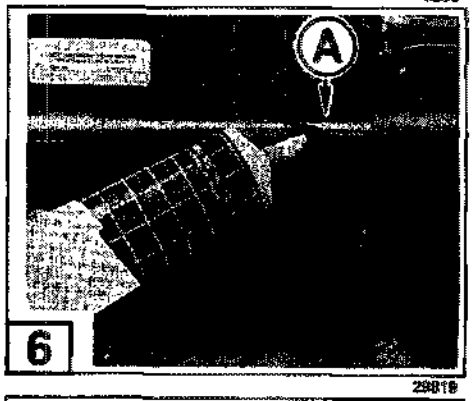

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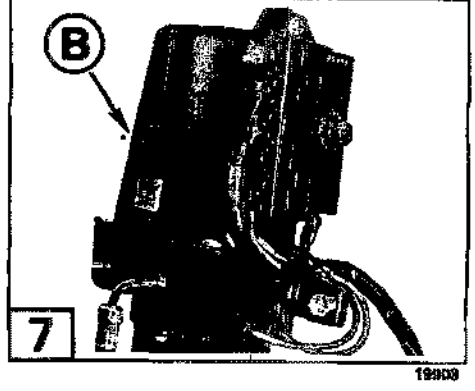

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Step 2. Change Motor Oil and Oil Filter:

- 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. With drive unit 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.

Note Drive unit 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 moving propeller. If propeller is not removed, personal injury may result.**

Step 3. Change Drive Unit Lubricant:

Drain and refill with fresh *DuraPlus synthetic GL5* gear oil. Refer to **Drive Unit Workshop Manual.**

Step 4. Fog Engine:

Carbureted and TBI Models

- Warm up engine to ensure fuel conditioner is throughout fuel system. Use ½ pint (0,24 litre) of Fogging Oil or 12 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 pour or spray ⅔ of fogging oil into carburetor. Keep engine running while pouring fogging oil into carburetor throat.

- Rapidly add remaining ⅓ of fogging oil to carburetor, then reduce throttle to idle and let engine die. Turn off ignition and replace flame arrestor. Close fuel shutoff valve (if so equipped).

Fi Models

Preparing an engine "storage mixture" in a six gallon fuel tank. It must consist of a 5 gallons (18,9 liters) fuel; 4 pints (64 oz., 1892.7 ml) Fogging Oil; and $^1/_3$ cup (2.5 oz., 73.9 ml) Fuel Conditioner. Mix these ingredients thoroughly.

- Disconnect fuel line at the engine. Connect the "storage mixture" and run engine for approximately 5 minutes at 1500 RPM. This will ensure that all fuel systems and internal engine components are thoroughly protected. Shut off engine **before** the "storage mixture" is depleted.

⚠CAUTION ***Do not run engine out of fuel. The electric fuel pumps will be damaged.***

Step 5. Drain Cooling System:

⚠CAUTION ***When draining engine, raise or lower the bow to position engine in a horizontal plane. This will provide for complete drainage of block and manifolds. If bow of boat is higher or lower than stem, some water may be trapped in the engine block or manifolds. Improper or incomplete draining may result in freeze damage to the engine, manifolds, drive unit or other components. FREEZE DAMAGE IS NOT COVERED UNDER VOLVO PENTA'S LIMITED WARRANTY.***

3.0 GS Models

1 Front

① Loosen and slide clamp back. Remove and drain long hose at thermostat housing.

2 Starboard

② Disconnect an drain large hose at circulating pump.

3 Port

③ Remove exhaust manifold petcock stem. Clear hole with a small wire to ensure complete drainage.

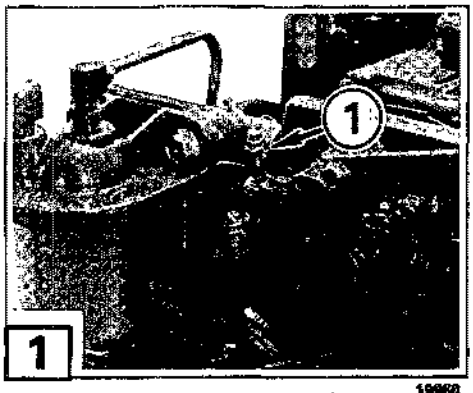
④ Remove cylinder block petcock stem. Clear hole with a small wire to ensure complete drainage.

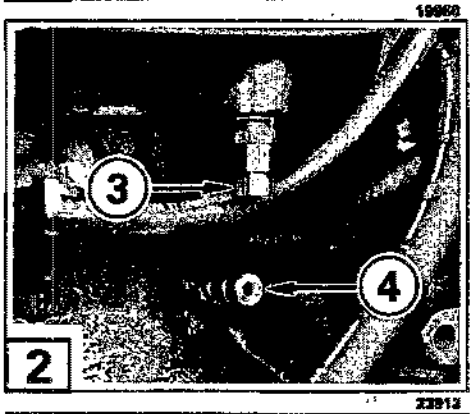
4.3 GL, GS, and 5.7 Gi Models

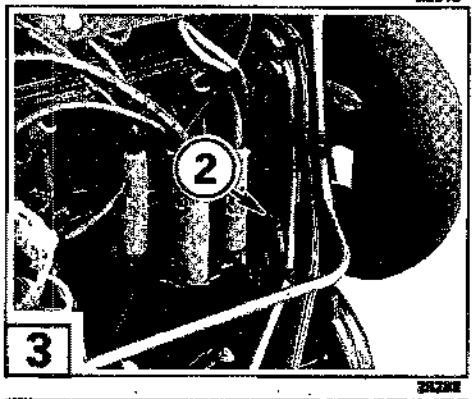
4 Front

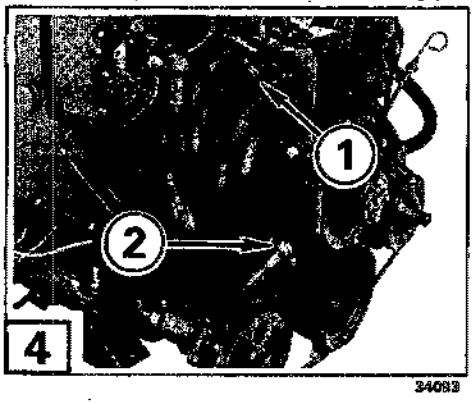
① Disconnect and drain long hose at thermostat housing.

② Disconnect and drain large hose at circulating pump.





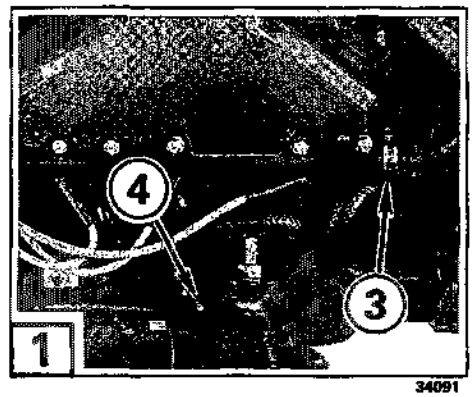




1 **Starboard**

③ Loosen clamp and remove hose.

④ Remove cylinder block petcock stem. Clear hole with a small wire to ensure complete drainage.



2 **Port**

⑤ Loosen clamp and remove hose.

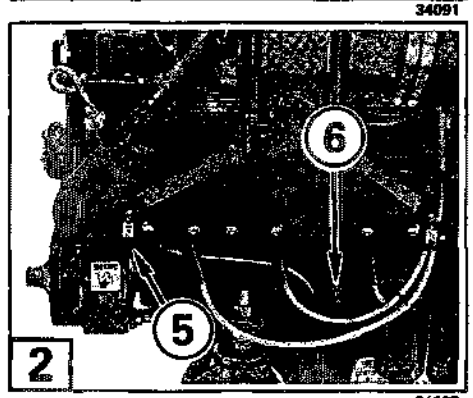
⑥ Remove cylinder block petcock stem. Clear hole with a small wire to ensure complete drainage.

5.0 and 5.8 Fi, FSi Models

3 **Front**

① Disconnect the lower water bypass hose at large diameter of check-valve.

- Drain or blow out check-valve and short hose to thermostat housing.
- Drain or blow out long hose to fuel reservoir.



All 5.0 and 5.8 Models

4 **Front**

② Disconnect and drain long hose at thermostat housing.

③ Disconnect an drain large hose at circulating pump.

5 **Starboard**

④ Loosen clamp and remove rubber hose.

⑤ Remove cylinder block petcock stem. Clear hole with small wire to ensure complete drainage.