OPERATOR'S MANUAL

3.0L, 4.3L, 5.0L, 5.7L, 8.1L
SX-A, DPS-A, XDP-B

ENG **This operator's manual is available in English.**
Complete the form at the end of the operator's manual to order a copy.

DEU **Diese Betriebsanleitung ist auch auf Deutsch erhältlich.**
Ein Bestellcoupon ist am Ende der Betriebsanleitung zu finden.

FRA **Ce manuel d'instructions peut être commandé en français.**
Vous trouverez un bon de commande à la fin du manuel d'instructions.

ESP **Este libro de instrucciones puede solicitarse en español.**
El cupón de pedido se encuentra al final del libro.

SVE **Den här instruktionsboken kan beställas på svenska.**
Beställningskupong finns i slutet av instruktionsboken.

ITA **Questo manuale d'istruzioni può essere ordinato in lingua italiana.**
Il tagliando per l'ordinazione è riportato alla fine del manuale.

NED **Dit instructieboek kan worden besteld in het Nederlands.**
De bestelcoupon vindt u achter in het instructieboek.

DAN **Denne instruktionsbog kan bestilles på dansk.**
Bestillingskupon findes i slutningen af instruktionsbogen.

SUO **Tämän ohjekirjan voi tilata myös suomenkielisenä.**
Tilauskuponki on ohjekirjan lopussa.

POR **Este manual de instruções pode ser encomendado em português.**
O talão de requerimento encontra-se no fim do manual.

Ελλ **Αυτό το εγχειρίδιο χρήσης διατίθεται στην αγγλική γλώσσα. Για να παραγγείλετε ένα αντίτυπο, συμπληρώστε τη φόρμα που βρίσκεται στο τέλος αυτού του εγχειριδίου χρήσης.**

TÜR **Bu kullanıcı el kitabı Türkçe dillerinde mevcuttur.**
Birnüshasını sipariş etmek için kullanıcı el kitabının sonundaki formu doldurun.

RUS Данное руководство оператора имеется на турецком и русском языках.
Для получения инструкции на нужном языке заполните форму в конце инструкции.

CALIFORNIA PROPOSITION 65 WARNING

Engine exhaust, some of its constituents, and a broad range of engine parts are known to the State of California to cause cancer, birth defects, and other reproductive harm. Additionally, lubricants, fuels, and other fluids used in engines–including any waste created through the wearing of engine parts–contain or produce chemicals known to the State of California to cause cancer and birth defects or other reproductive harm.

Battery posts, terminals, and related accessories contain lead and lead compounds. Wash your hands after handling. Used engine oil contains chemicals that have caused cancer in laboratory animals. Always protect your skin by washing thoroughly with soap and water.

This manual applies to the following engines and sterndrives.

	Raw Water Cooled			*Closed Cooling System*		
	Model	**Spec. No.**	**Drive**	**Model**	**Spec. No.**	**Drive**
3.0L	3.0GLP-J	3869388	SX-A	–	–	–
4.3L	4.3GL-J 4.3GXi-J	3869391 3869393	SX-A DPS-A	4.3GL-JF 4.3GXi-JF	3869392 3869394	SX-A DPS-A
	4.3OSi-J	3869395	XDP-B	4.3OSi-JF	3869396	XDP-B
5.0L	5.0GL-J 5.0GXi-J	3869397 3869399	SX-A DPS-A	5.0GL-JF 5.0GXi-JF	3869398 3869400	SX-A DPS-A
	5.0OSi-J	3869401	XDP-B	5.0OSi-JF	3869402	XDP-B
5.7L	5.7Gi300-J 5.7GXi-J	3869403 3869407	SX-A DPS-A	5.7Gi300-JF 5.7GXi-JF	3869404 3869408	SX-A DPS-A
	5.7OSi300-J 5.7OSXi-J	3869405 3869409	XDP-B	5.7OSi300-JF 5.7OSXi-JF	3869406 3869410	XDP-B
8.1L	8.1Gi-J 8.1GXi-J	3869411 3869415	DPS-A	8.1Gi-JF 8.1GXi-JF	3869412 3869416	DPS-A
	8.1OSi-J	3869413	XDP-B	8.1OSi-JF	3869414	XDP-B

Notes

VOLVO PENTA

Declaration of Conformity for Recreational Craft Propulsion Engines with the sound and exhaust emission requirements of Directive 94/25/EC as amended by 2003/44/EC

3.0 LITRE

Engine manufacturer

Volvo Penta of the Americas, Inc., 1300 Volvo Penta Drive, Chesapeake, VA 23320, USA

Body for exhaust emission assessment

International Marine Certification Institute
Rue Abbé Cuypres 3
B-1040 Bruxells
Belgium
ID Number: 0609

Modules used for exhaust emission assessment
B
EC Type Examination according to Annex VII

Body for sound emission assessment

International Marine Certification Institute
Rue Abbé Cuypres 3
B-1040 Bruxells
Belgium
ID Number: 0609

Module used for sound emission assessment
Aa
International production control
Test according to Annex VI

Other Community Directives applied: EMC 89/336/EEC

Description of engine(s) and essential requirements: 4 stroke gasoline engines with stern drive with integral exhaust.

Engine model(s) covered by this declaration

Engine Model(s)	Specification	Nominal Power	Exhaust: EC Type Certificate Number	Sound: EC Type Certificate Number
3.0 GLP	3869388	100 kW	EXVOL001	SDVOL008

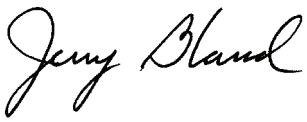
Essential Requirements	Standards Used	Other Normative Documents Used
Annex I.B – Exhaust Emissions		
Engine identification	Volvo Penta std	Annex I.B.1
Exhaust emission requirements	EN ISO 8178-1:1996	Annex I.B.2
Durability	Volvo Penta std	Annex I.B.3
Operator's manual	ISO 10240:2004	Annex I.B.4
Annex I.C – Noise Emissions		
Sound emission levels	EN ISO 14509:2000/prA1:2004	Annex I.C.1
Operator's manual	ISO 10240:2004	Annex I.C.2
EMC Directive	89/336/EEC	

This declaration of conformity is issued under the sole responsibility of the manufacturer. I declare on behalf of the engine manufacturer that the engine(s) mentioned above complie(s) with all applicable essential requirements in the way specified and is in conformity with the type for which above mentioned EC type examination certificate(s) has been issued.

Name and function: Jerry Bland,
Vice President of Engineering

(identification of the person empowered to sign on behalf of the engine manufacturer or his authorised representative)

Signature and title:
(or an equivalent marking)



Date and place of issue (yr/month/day): 2007/04/24 – Chesapeake, VA, USA

VOLVO PENTA

Declaration of Conformity for Recreational Craft Propulsion Engines with the sound and exhaust emission requirements of Directive 94/25/EC as amended by 2003/44/EC

4.3 LITRE

Engine manufacturer

Volvo Penta of the Americas, Inc., 1300 Volvo Penta Drive, Chesapeake, VA 23320, USA

Body for exhaust emission assessment

International Marine Certification Institute
Rue Abbé Cuypres 3
B-1040 Bruxells
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ID Number: 0609

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Body for sound emission assessment

International Marine Certification Institute
Rue Abbé Cuypres 3
B-1040 Bruxells
Belgium
ID Number: 0609

Module used for sound emission assessment
Aa
International production control
Test according to Annex VI

Other Community Directives applied: EMC 89/336/EEC

Description of engine(s) and essential requirements: 4 stroke gasoline engines with stern drive with integral exhaust.

Engine model(s) covered by this declaration

Engine Model(s)	Specification	Nominal Power	Exhaust: EC Type Certificate Number	Sound: EC Type Certificate Number
4.3 GL	3869391	141 kW	EXVOL002	SDVOL009
4.3 GL-F	3869392	141 kW	EXVOL002	SDVOL009
4.3 GXi	3869393	168 kW	EXVOL002	SDVOL009
4.3 GXi-F	3869394	168 kW	EXVOL002	SDVOL009
4.3 OSi	3869395	168 kW	EXVOL002	SDVOL003
4.3 OSi-F	3869396	168 kW	EXVOL002	SDVOL003

Essential Requirements	Standards Used	Other Normative Documents Used
Annex I.B – Exhaust Emissions		
Engine identification	Volvo Penta std	Annex I.B.1
Exhaust emission requirements	EN ISO 8178-1:1996	Annex I.B.2
Durability	Volvo Penta std	Annex I.B.3
Operator's manual	ISO 10240:2004	Annex I.B.4
Annex I.C – Noise Emissions		
Sound emission levels	EN ISO 14509:2000/prA1:2004	Annex I.C.1
Operator's manual	ISO 10240:2004	Annex I.C.2
EMC Directive	89/336/EEC	

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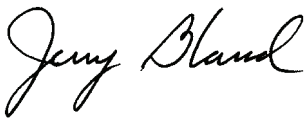

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VOLVO PENTA

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5.0 LITRE

Engine manufacturer

Volvo Penta of the Americas, Inc., 1300 Volvo Penta Drive, Chesapeake, VA 23320, USA

Body for exhaust emission assessment

International Marine Certification Institute
Rue Abbé Cuypres 3
B-1040 Bruxells
Belgium
ID Number: 0609

Modules used for exhaust emission assessment
B
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Body for sound emission assessment

International Marine Certification Institute
Rue Abbé Cuypres 3
B-1040 Bruxells
Belgium
ID Number: 0609

Module used for sound emission assessment
Aa
International production control
Test according to Annex VI

Other Community Directives applied: EMC 89/336/EEC

Description of engine(s) and essential requirements: 4 stroke gasoline engines with stern drive with integral exhaust.

Engine model(s) covered by this declaration

Engine Model(s)	Specification	Nominal Power	Exhaust: EC Type Certificate Number	Sound: EC Type Certificate Number
5.0GL	3869397	164 kW	EXVOL003	SDVOL010
5.0GL-F	3869398	164 kW	EXVOL003	SDVOL010
5.0 GXi	3869399	201 kW	EXVOL003	SDVOL010
5.0 GXi-F	3869400	201 kW	EXVOL003	SDVOL010
5.0 OSi	3869401	201 kW	EXVOL003	SDVOL005
5.0 OSi-F	3869402	201 kW	EXVOL003	SDVOL005

Essential Requirements	Standards Used	Other Normative Documents Used
Annex I.B – Exhaust Emissions		
Engine identification	Volvo Penta std	Annex I.B.1
Exhaust emission requirements	EN ISO 8178-1:1996	Annex I.B.2
Durability	Volvo Penta std	Annex I.B.3
Operator's manual	ISO 10240:2004	Annex I.B.4
Annex I.C – Noise Emissions		
Sound emission levels	EN ISO 14509:2000/prA1:2004	Annex I.C.1
Operator's manual	ISO 10240:2004	Annex I.C.2
EMC Directive	89/336/EEC	

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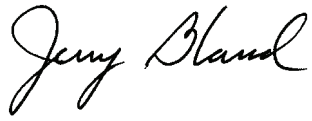

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VOLVO PENTA

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5.7 LITRE

Engine manufacturer

Volvo Penta of the Americas, Inc., 1300 Volvo Penta Drive, Chesapeake, VA 23320, USA

Body for exhaust emission assessment

International Marine Certification Institute
Rue Abbé Cuypres 3
B-1040 Bruxells
Belgium
ID Number: 0609

Modules used for exhaust emission assessment
B
EC Type Examination according to Annex VII

Body for sound emission assessment

International Marine Certification Institute
Rue Abbé Cuypres 3
B-1040 Bruxells
Belgium
ID Number: 0609

Module used for sound emission assessment
Aa
International production control
Test according to Annex VI

Other Community Directives applied: EMC 89/336/EEC

Description of engine(s) and essential requirements: 4 stroke gasoline engines with stern drive with integral exhaust.

Engine model(s) covered by this declaration

Engine Model(s)	Specification	Nominal Power	Exhaust: EC Type Certificate Number	Sound: EC Type Certificate Number
5.7 Gi-300	3869403	224 kW	EXVOL004	SDVOL011
5.7 Gi-300-F	3869404	224 kW	EXVOL004	SDVOL011
5.7 OSi-300	3869405	224 kW	EXVOL004	SDVOL006
5.7 OSi-300-F	3869406	224 kW	EXVOL004	SDVOL006
5.7 GXi	3869407	239 kW	EXVOL004	SDVOL012
5.7 GXi-F	3869408	239 kW	EXVOL004	SDVOL012
5.7 OSXi	3869409	239 kW	EXVOL004	SDVOL007
5.7 OSXi-F	3869410	239 kW	EXVOL004	SDVOL007

Essential Requirements	Standards Used	Other Normative Documents Used
Annex I.B – Exhaust Emissions		
Engine identification	Volvo Penta std	Annex I.B.1
Exhaust emission requirements	EN ISO 8178-1:1996	Annex I.B.2
Durability	Volvo Penta std	Annex I.B.3
Operator's manual	ISO 10240:2004	Annex I.B.4
Annex I.C – Noise Emissions		
Sound emission levels	EN ISO 14509:2000/prA1:2004	Annex I.C.1
Operator's manual	ISO 10240:2004	Annex I.C.2
EMC Directive	89/336/EEC	

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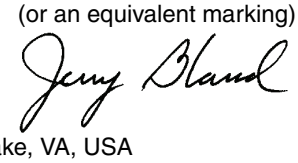

Date and place of issue (yr/month/day): 2007/04/24 – Chesapeake, VA, USA

VOLVO PENTA

Declaration of Conformity for Recreational Craft Propulsion Engines with the sound and exhaust emission requirements of Directive 94/25/EC as amended by 2003/44/EC

8.1 LITRE

Engine manufacturer

Volvo Penta of the Americas, Inc., 1300 Volvo Penta Drive, Chesapeake, VA 23320, USA

Body for exhaust emission assessment

International Marine Certification Institute
Rue Abbé Cuypres 3
B-1040 Bruxells
Belgium
ID Number: 0609

Body for sound emission assessment

International Marine Certification Institute
Rue Abbé Cuypres 3
B-1040 Bruxells
Belgium
ID Number: 0609

Modules used for exhaust emission assessment
B
EC Type Examination according to Annex VII

Module used for sound emission assessment
Aa
International production control
Test according to Annex VI

Other Community Directives applied: EMC 89/336/EEC

Description of engine(s) and essential requirements: 4 stroke gasoline engines with stern drive with integral exhaust.

Engine model(s) covered by this declaration

Engine Model(s)	Specification	Nominal Power	Exhaust: EC Type Certificate Number	Sound: EC Type Certificate Number
8.1 Gi	3869411	280 kW	EXVOL005	SDVOL013
8.1 Gi-F	3869412	280 kW	EXVOL005	SDVOL013
8.1 OSi	3869413	280 kW	EXVOL005	SDVOL001
8.1 OSi-F	3869414	280 kW	EXVOL005	SDVOL001
8.1 GXi	3869415	313 kW	EXVOL005	SDVOL013
8.1 GXi-F	3869416	313 kW	EXVOL005	SDVOL013

Essential Requirements	Standards Used	Other Normative Documents Used
Annex I.B – Exhaust Emissions		
Engine identification	Volvo Penta std	Annex I.B.1
Exhaust emission requirements	EN ISO 8178-1:1996	Annex I.B.2
Durability	Volvo Penta std	Annex I.B.3
Operator's manual	ISO 10240:2004	Annex I.B.4
Annex I.C – Noise Emissions		
Sound emission levels	EN ISO 14509:2000/prA1:2004	Annex I.C.1
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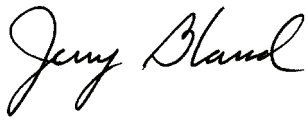

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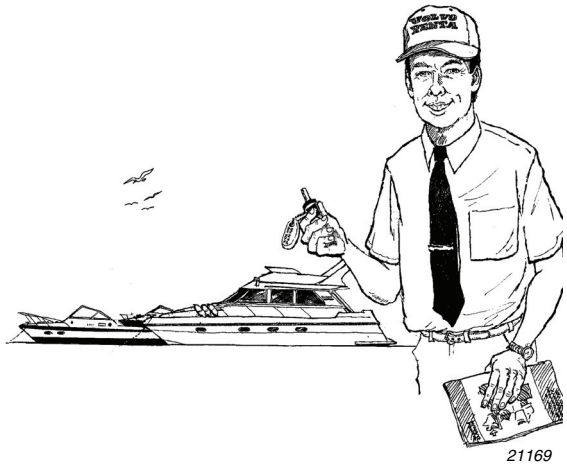


21169

Welcome Aboard

Congratulations on choosing a new boat equipped with a Volvo Penta marine engine. Volvo Penta has been building marine engines since 1907. Quality, operating reliability, and innovation have made Volvo Penta a world leader in the marine engine industry. From engineering design and manufacturing to support activities in Parts, Service, and Sales, high standards have been set to ensure your pride and satisfaction as the owner of a Volvo Penta product.

As owner of a Volvo Penta marine engine, we would also like to welcome you to a worldwide network of dealers and service workshops to assist you with technical advice, service requirements and replacement parts. Please contact your nearest authorized Volvo Penta dealer for assistance.

We wish you many pleasant voyages.

Our Core Values: Quality, Safety, Environmental Care

The values and qualities that Volvo Penta expresses are what make the company unique. From the very beginning, safety and quality have stood at the heart of the development of all of our products, processes, and services. It is on these values and qualities that the Volvo Penta corporate identity, brand position and legal status have been founded. Today's core values of quality, safety, and care for the environment remain central to Volvo Penta. They express what we believe in as a company and will ultimately help us to survive.

Quality is a value that traditionally referred to product quality but now encompasses all aspects of our products and services. In today's competitive environment, Volvo Penta's quality commitment extends beyond industrial craftsmanship and engineering ingenuity to embrace care for the customer throughout the life of the product.

Safety will always be our most distinguishing core value. Historically embedded in the quality of all Volvo products, it also encompasses personal, family, business, and environmental values.

Environmental Care in all operations, from design to production, distribution, service, and recycling, is an integral part of the Volvo quality commitment towards customers, employees, and the community. By embracing the environment as a core value, Volvo demonstrates its understanding of the environmental impact its products have upon nature and the shared urban and rural surroundings.

Volvo Penta continually commits a considerable part of its development resources toward minimizing the environmental impact of its products. Examples of areas where we are always looking for improvements are exhaust emissions, noise levels, and fuel consumption.

Regardless of whether your Volvo Penta engine is installed in a boat used for pleasure or commercial operation, incorrect operation or improper maintenance of the engine will result in disturbance or damage to the environment.

In this owner's manual there are a number of service procedures, which, if not followed, will lead to an increase in the engine's impact on the environment, and on running costs and a reduction in service life. Always observe recommended service intervals and make a habit of checking that the engine is operating normally every time you use it. Contact an authorized Volvo Penta dealer if you cannot correct the fault yourself.

Remember that most chemicals used on boats are harmful to the environment if used incorrectly. Volvo Penta recommends the use of biodegradable degreasing agents for all cleaning. Always dispose of engine and transmission oil waste, old paint, degreasing agents and cleaning residue etc. at proper disposal areas so that they do not harm the environment.

Adapt speed and distance during your boat trips so that swell and noise generated by the boat do not disturb or harm wildlife, moored boats, docks, etc. Wherever you land or cruise, please show consideration and always leave the areas you visit as you would like to find them yourself.

CONTACT INFORMATION

Consumer Affairs Department
Volvo Penta of the Americas, Inc.
1300 Volvo Penta Drive
Chesapeake, Virginia 23320, USA
Phone: (757) 436-5100 • Fax: (757) 436-5153
http://www.volvopenta.com

Volvo Action Service - North America
P.O. Box 26113
Greensboro, North Carolina 27402-6113
Toll Free: (877) 33-PENTA • Phone: (336) 393-4966
http://myactionservice.com/English/VAS_Penta.asp

World-wide Dealer Locator
http://dealerlocator.penta.volvo.se/zone.asp

Table of Contents

Notes

Safety Information

Read this chapter carefully. It concerns your safety. This section describes how safety information is presented in the operator's manual and on the engine. It also gives a general account of basic safety precautions to be taken when operating the boat and maintaining the engine.

Check that you have the correct operator's manual before you read on. If this is not the case please contact your Volvo Penta dealer.

This symbol is used in the book and on the engine to make you aware of safety information. Always read these safety precautions very carefully.

Incorrectly performed operations could result in personal injury, damage to property, or harm the engine. Read the operator's manual carefully before operating or servicing the engine. If anything is unclear, please contact your Volvo Penta dealer for assistance.

In the operator's manual warning texts have the following priority:

DANGER! Failure to comply with a danger symbol will result in death.

WARNING! Failure to comply with a warning may result in serious injury.

CAUTION! Failure to comply with a caution may result in injury.

NOTICE! Special attention should be used to prevent incorrect assembly, disassembly, or use. Failure to comply with a notice may result in equipment failure or damage.

General Information

This manual contains information you need to operate your boat engine and drive safely. Check that you have the correct manual for your engine and drive.

This manual also contains a considerable amount of information concerning model identification, preventive maintenance recommendations, fuel and oil recommendations, and other important points. Please keep this book with your boat at all times.

It is important that this manual stays with the boat when it is sold. Important safety information must be passed to the new owner. The service information provided in the manual gives the owner important information about maintaining the engine and transmission.

If you do not understand or are uncertain about any operation or information in this owner's manual, please contact your Volvo Penta dealer. He will be able to help you with an explanation or will demonstrate the operation.

Federal law requires manufacturers to notify owners in the event that a safety related defect is discovered on any of their products. If you are not the original owner of this engine, please notify us at our address or through an authorized Volvo Penta dealer about the change in ownership. This is the only way we will be able to contact you if necessary.

Carefully observe the safety alert symbols shown for dangers, warnings, and cautions. They warn you of possible dangers or important information contained in this manual. However, warnings alone do not eliminate hazards, nor are they a substitute for safe boat handling and proper accident prevention measures!

Warning Symbols Used in this Manual

Following is a list of symbols used in this manual as a quick reference visual warning of the dangers and risks associated with carrying out certain activities.

High Pressure: Fluid or gas may be ejected under a great deal of pressure causing damage to metals, fabrics, or human tissue.

Corrosive: Fluids, gases, or solids that can damage metals, fabrics, or human tissue through decay.

Toxic: Gases or other airborne corrosives that can damage human tissue, cause ill health, or endanger life.

Poisonous: Fluids, gases, or solids that, through a chemical reaction, can damage metals, fabrics, or human tissue.

Electrical: Danger of electrical discharge or shock which can cause burns or other serious injury.

Flammable: Fluids, gases, or solids that can–depending upon the degree of confinement–burn or explode upon ignition.

Explosive: Fluids, gases, or solids that can–depending upon the degree of confinement–burn or explode upon ignition.

Fan Belts: Loose clothing, hair, fingers or a dropped tool can be caught in revolving belts and cause serious personal injury.

Crushing Force: Heavy objects may break loose and fall, causing a crushing blow that can result in serious injury or death.

Rotating Fan: Loose clothing, hair, fingers or a dropped tool can be caught in rotating parts and cause serious personal injury.

Face Mask: Highly recommended that you wear a face shield, goggles, and/or respirator to protect face, eyes, and/or lungs.

Face Wash: Wash affected body area immediately using plenty of soap and water and seek medical assistance as necessary.

Gloves: Highly recommended that you wear protective gloves while engaging in activities that may harm your hands.

Hot Surface: Hot objects, (engine block, exhaust manifold, starter element, etc.) can cause burns and other serious injury.

No Smoking: By smoking in areas where these signs are posted, you risk starting a fire or causing an explosion.

No Open Flames: By using an open flame in areas where these signs are posted, you risk starting a fire or causing an explosion.

Safety Precautions (Maintenance and Service)

The following sections summarize the risks associated with carrying out certain activities while operating or maintaining your boat and engine and the safety precautions you should always observe while engaged in these activities.

Knowledge

The operator's manual contains instructions on how to carry out general maintenance and service operations safely and correctly. Read the instructions carefully before starting work.

Service literature covering more complicated operations is available from your Volvo Penta dealer. **Never carry out any work on the engine if you are unsure of how it should be done, contact your Volvo Penta dealer.**

Engine Decals

Check that the warning or information decals on the engine are always clearly visible. Replace decals that have been damaged or painted over.

Stop the Engine

Stop the engine before opening or removing engine hatches. Unless otherwise specified all maintenance and service must be carried out with the engine stopped.

To prevent accidental start of the engine, remove the ignition key, turn off the power supply to the engine at the main switches, and lock them in the OFF position, or disconnect the battery cables from the battery before starting work. Put up a warning sign in the control position that work on the engine is being carried out.

Approaching or working on an engine that is running is dangerous. Loose clothing, hair, fingers or a dropped tool can be caught in the rotating parts of the engine and cause serious personal injury. We recommend that all servicing with the engine running be undertaken by an authorized Volvo Penta workshop.

Lifting the Engine

To ensure safe handling and to avoid damaging engine components on top of the engine, use a lifting beam to raise the engine. All chains and cables should run parallel to each other and as perpendicular as possible in relation to the top of the engine. Always check that lifting equipment is in good condition and has sufficient load capacity to lift the engine and any extra equipment installed.

If extra equipment is installed on the engine, which alters its center of gravity, a special lifting device is required to achieve the correct balance for safe handling. Never carry out work on an engine suspended on a hoist.

Before Starting the Engine

Reinstall all protective parts removed during service operations before starting the engine. Make a point of familiarizing yourself with other risk factors, such as rotating parts and hot surfaces (exhaust manifold, starter, etc.). Check that no tools or other items have been left on the engine.

DANGER! To prevent a possible explosion hazard, operate the engine compartment/ bilge blower as recommended by the boat manufacturer before starting the engine. If the engine compartment is not equipped with a blower, open the engine cover or hatch before starting so as to disperse any gasoline fumes that may be present. Leave the hatch open until after the engine is running.

Washing the Engine

Never use a high-pressure washer when washing the engine.

Fire and Explosion

Fuel and Lubrication Oil

All fuels, most lubricants, and many chemicals are flammable. Read and follow the instructions on the packaging.

When carrying out work on the fuel system make sure the engine is cold. A fuel spill onto a hot surface or electrical components can cause a fire.

Store fuel soaked rags and other flammable material so that there is no danger of them catching fire. Fuel soaked rags can self-ignite under certain conditions.

Do not smoke when filling fuel, oil, or while in the proximity of a filling station or in the engine room.

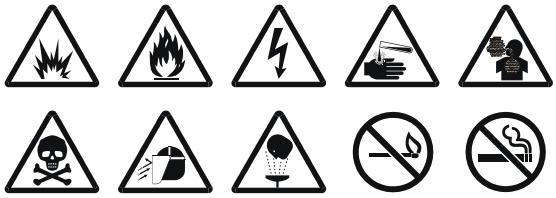
Certain engine oils are flammable. Some of them are also dangerous if inhaled. Whenever you use these agents, follow the manufacturer's instructions on the product packaging. Ensure that ventilation in the work place is good. Use a protective mask when spraying.

Non-Original Components

Components in the electrical, ignition, and fuel systems on Volvo Penta products are designed and constructed to minimize the risk of fire and explosion.

Using non-original Volvo Penta parts that do not meet the above standards can result in fire or explosion on board. Damage caused by using non-original Volvo Penta replacement parts will not be covered under any warranty provided by Volvo Penta.

Batteries



Never allow an open flame or electric sparks near the battery or batteries. Never smoke in proximity to the batteries. The batteries give off hydrogen gas during charging which, when mixed with air, can form an explosive gas. This gas is easily ignited and highly volatile.

Incorrect connection of the battery can cause a spark, which would be sufficient to cause an explosion. Do not disturb battery connections when starting the engine (spark risk) and do not lean over batteries.

Always ensure that the positive and negative battery leads are correctly installed on the corresponding terminal posts. Incorrect installation can result in serious damage to electrical equipment.

Always use protective goggles or a face mask when charging and handling batteries. Battery electrolyte contains sulphuric acid, which is highly corrosive. If battery electrolyte comes into contact with unprotected skin, wash it off immediately using plenty of water and soap. If battery acid comes in contact with the eyes, immediately flush with an abundant amount of water and obtain medical assistance.

Start Spray

Never use start spray or similar agents to start an engine. This may cause an explosion in the inlet manifold.

Hot Surfaces and Fluids

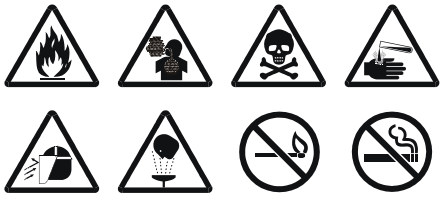
There is always a risk of burns when working with a hot engine. Beware of hot surfaces. For example: the exhaust pipe and manifold, oil pan, starter element, hot coolant, and hot oil in oil lines and hoses.

Always turn off the engine before starting service procedures. Avoid hot surfaces and liquids in supply lines and hoses when the engine has just been turned off and is still hot.

Carbon Monoxide Poisoning

Only start the engine in a well-ventilated area. If operating the engine in an enclosed space, ensure that there is proper ventilation in order to remove exhaust gases and crankcase ventilation emissions from the working area. Please see ""Station Wagon" Effect & Carbon Monoxide" on page 11 for additional information.

Chemicals



Most chemicals such as anti-freeze, rust-proofing agents, inhibiting oils, degreasing agents, etc., are hazardous to your health. Read and follow the instructions on the packaging.

Some chemicals such as inhibiting oil are flammable and toxic if breathed. Ensure good ventilation and use a protective mask when spraying.

Read and follow the instructions on the packaging. Store chemicals and other hazardous materials out of the reach of children. To protect the environment please dispose of used or leftover chemicals at a properly designated disposal site for destruction.

Cooling System

There is a risk of flooding when working on the seawater system. Turn off the engine and close the sea cock (where installed) before starting work on the system.

Avoid opening the filler cap for engine coolant system (freshwater cooled engines) when the engine is still hot. Steam or hot coolant can spray out as system pressure is lost.

If opening the filler cap or drain/venting cock, or removing a plug or engine coolant line from a hot engine, open the filler cap slowly and release coolant system pressure gradually; otherwise, steam or hot coolant can spray out. Note that the coolant may still be hot and can cause burns.

Lubrication System

Hot oil can cause burns. Avoid skin contact with hot oil. Ensure that the lubrication system is not under pressure before commencing work on it. Never start or operate the engine with the oil filler cap removed; hot oil could spray out.

Fuel System

Always use protective gloves when tracing leaks. Liquids ejected under pressure can penetrate body tissue and cause serious injury. There is also a danger of blood poisoning.

Always cover the alternator if it is located under the fuel filter. The alternator can be damaged by spilled fuel.

Fuel filter replacement should be carried out on a cold engine to avoid the risk of fire caused by fuel spilling onto the exhaust manifold.

Electrical System

Always stop the engine and break the current using the main switches before working on the electrical system. Isolate shore current to the engine block heater, battery charger, or accessories mounted on the engine.

Safety Precautions While Operating the Boat

Your New Boat

Read the operator's manuals and other information supplied with your new boat. Learn to operate the engine, controls and other equipment safely and correctly. If this is your first boat, or is a boat type with which you are not familiar, we recommend that you practice controlling the boat in peace and quiet, away from other vessels, docks, shallow areas, and other obstacles. Learn how the boat behaves at different speeds, in varying weather conditions, and alternating loads before casting off for your "real" maiden voyage.

Remember that the person driving a boat is legally required to know and follow the current rules regarding traffic and safety at sea. Make sure you know the rules that apply to you and the waters you are sailing in by contacting the relevant authorities or organization. A good piece of advice is to take a course in seamanship. We recommend that you contact your local boating organization to find a suitable course.

Accidents

Statistics show that poor maintenance of boats and engines and a lack of safety equipment are often the main causes of accidents at sea. Ensure that your boat is maintained in accordance with the relevant user's documentation and that the necessary safety equipment is on-board and is serviceable.

Maneuvering

Avoid violent and unexpected changes in course and gear engagement. This could cause someone on the boat to lose their balance and fall over or overboard. A rotating propeller can cause serious injury. Check that nobody is in the water before engaging ahead or astern. Never drive near bathers or in areas where people could be in the water. Avoid trimming an outboard drive too much, as steering will be severely reduced.

Emergency Stop Switch

We recommend that you install and use an emergency stop switch (accessory), especially if your boat can travel at high speeds. The emergency stop switch acts as a safety breaker and stops the engine if the driver falls down and loses control over the boat.

NOTICE! When testing the emergency stop switch, do so at engine idle speed only. Activating the emergency stop switch at any speed above idle will allow water to be ingested into the engine, causing serious damage.

Daily Checklist

To prevent a possible explosion or fire, make a habit of checking the engine and engine compartment visually before operating the boat (before the engine is started) and after operating the boat (after the engine has been stopped). Also, smell for the presence of gas fumes. This will help you to quickly detect fuel, coolant, or oil leaks and to spot anything else unusual that has occurred or is about to happen.

If the engine compartment is not equipped with a blower, open the engine cover or hatch before starting it to disperse any gasoline fumes that may be present. Leave the hatch open until after the engine is running.

Refueling

When refueling there is always a danger of fire and explosion. Smoking is forbidden and the engine must be switched off. Never overfill the tank. Close the fuel tank filler cap properly.

Always use fuel recommended by Volvo Penta. The use of lower quality fuels can damage the engine. Poor fuel quality can also lead to higher maintenance costs.

Do not Start the Engine

Do not start or run the engine with a suspected fuel or LPG leak in the boat, nor when you are close to or in a discharge of explosive media, etc. There is risk of fire and/or explosion in explosive surroundings.

“Station Wagon” Effect & Carbon Monoxide

When a boat is moving forward, it will cause a certain vacuum to form behind the boat. In unfortunate circumstances, the suction from this vacuum—called “station wagon” effect—can be so great that the exhaust gases from the boat are drawn into the cockpit or cabin, causing carbon monoxide poisoning.

This problem is most prevalent on boats with sheer, broad transoms and high superstructures. In certain conditions, however, this suction can be a problem on other boats (e.g., when running with the cover up). Other factors that can increase the effect of the suction are wind conditions, load distribution, swells, trim, open hatches and portholes, and so on.

Most modern boats, however, are designed in such a way that this problem is very rare. If suction should arise anyway, open forward hatches or portholes. Try changing speed, trim, or load distribution instead. Try disassembling, opening, or in any other way changing the setup of the cover as well.

If you suspect that your boat exhibits this “station wagon” effect, please contact your Volvo Penta dealer for help in achieving the best solution for your boat.

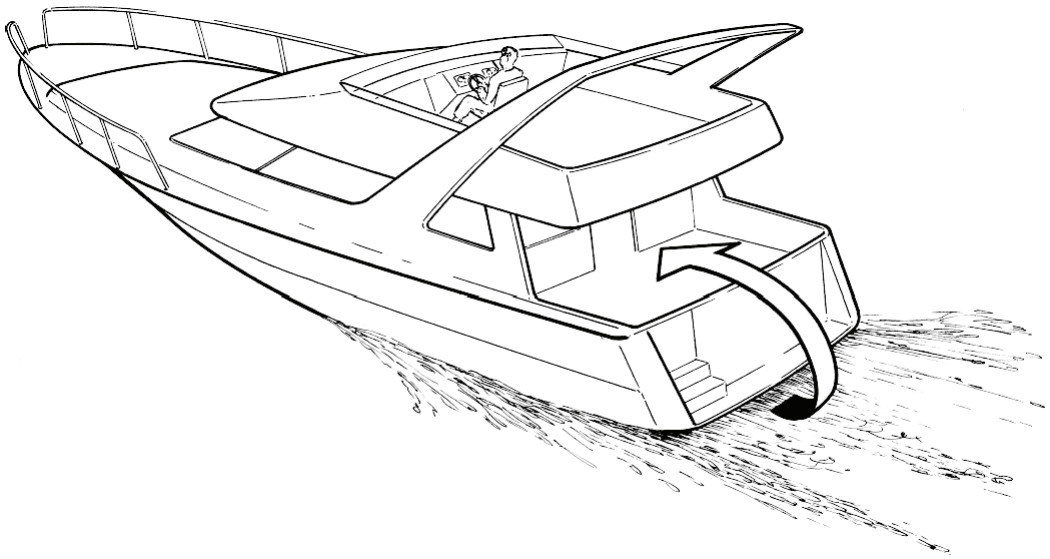
DANGER! Do not run the engine while there are people located on or near the swim platform and transom.

DANGER! DO NOT tow anyone using water sports equipment (such as skis and inner tubes) closer than twenty feet (20’) from the boat. DO NOT, under any circumstances, allow people to “body surf” using the swim platform as a means of being pulled along.

Travelling at slow or idle speeds may cause carbon monoxide to accumulate in and around the boat, especially if there is a tailwind.

Carbon monoxide accumulation is particularly likely when running the engine while docked. Be sure to minimize the amount of time spent at the dock while the engine is running.

For your safety, we recommend that you install a good quality carbon monoxide detector aboard your boat, in accordance with ABYC recommended practices.



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Safety Checklists

Planning Your Trip

Everyone wants to have a problem-free and pleasant time when they take their boat out. To help you do this, we have provided a pre-journey checklist below. Take extra time to check the engine and its equipment and the general maintenance of the boat.

Trip Checklist

- ❑ Get up-to-date charts for the planned route.
- ❑ Calculate distances and fuel consumption.
- ❑ Note places where you can refuel along your planned course.
- ❑ Listen to the weather reports.
- ❑ Tell friends or relatives about your route (that is, file a “float plan”). Remember to inform them if your plans have changed or been delayed.

Safety Equipment

The following list of recommended safety equipment can be expanded or modified as necessary because safety equipment and other requirements vary depending on the type of boat and how it is used.

Safety Equipment Checklist

- ❑ Life jackets for all passengers.
- ❑ Communication equipment.
- ❑ Emergency rockets or flare gun.
- ❑ Approved fire extinguisher, checked and charged.
- ❑ First-aid equipment.
- ❑ Life belt.
- ❑ Anchor, paddles, flares, and so on.
- ❑ Tell your passengers and crew where the safety equipment is stored and how to operate it.
- ❑ Make sure you are not the only person on board who knows how to start the boat and operate it safely.

Replacement Parts and Tools Checklist

- ❑ Extra propeller & prop hardware, impeller, fuel filters, fuses, tape, hose clamps, thermostat & gaskets, cap & rotor, start pump & fuel pump relays, and engine oil.
- ❑ Tools for any possible repairs while underway.

Basic Safety Rules of Boating

We recommend that you contact your local boating organization for more detailed information on safety afloat.

- Shut off the engine when people who are in the water come near the boat.
- Propellers are inherently dangerous and, as such, are potential safety hazards. Make sure that the propeller is not operating when people who are in the water come near the boat.
- Avoid standing up or shifting weight suddenly in small, lightweight boats.
- Keep your passengers seated in seats. The boat's bow, gunwale, transom, and seat backs are not intended for use as seats.
- Insist on the use of personal flotation devices by all passengers at all times.
- Know the "rules of the road" and obey them. If you are not familiar with the "rules of the road," take the U.S. Coast Guard's boater safety course. You may find information about boating safety at WWW.USCGBOATING.ORG and WWW.CGAUX.ORG/CGAUXWEB/PUBLIC/PUBFRAME.HTM.
- Prevent explosion and fire by maintaining your fuel delivery system in top condition. Fuel vapor is volatile; handle fuel with care.
- Keep your boat and equipment neat and in top operating condition. Carry a selection of spare parts for the engine. (Volvo Penta's on-board kit contains a selection of essential items that a boat owner should carry at all times. See your Volvo Penta dealer.)
- NEVER OPERATE THE BOAT IF YOU ARE UNDER THE INFLUENCE OF DRUGS OR ALCOHOL.
- If boating in waters that are unfamiliar, obtain appropriate charts to avoid damage from underwater objects.

High Performance Boat Operation

High performance is not only defined by engine size, but by a combination of engine power (horsepower), hull design, and the size of the boat. Your new engine(s) produce a high power output. Depending on the boat type, the top speed may be much higher than what you are accustomed to.

High speed operation requires an experienced operator who has mastered handling of high performance boats. It is advisable that you learn the boat's behavior before you take passengers on board. Inform your passengers about your boat's characteristics and the maneuvers you intend to do. Use the boat's performance with due consideration and care!

When operating at high speeds, remember that other boaters may not realize the speed at which you are travelling, especially when you close in on another boat from astern or from ahead. Always keep a good distance to allow for the unexpected! Always be prepared for what other boaters may do unexpectedly. High speed driving requires the driver to give a high degree of attention to boat operation and surrounding conditions.

A boat travelling at a speed of approximately 70 M.P.H. (60 knots) covers about 101 feet (30 meters) in 1 second. The faster you go the quicker things will happen. High speed driving requires a lot of water and a good distance from possible hazards! Always allow for adequate reaction time. Always reduce speed when visibility is reduced for whatever reason.

When driving, make sure that all passengers are safely seated. Emphasize this especially if you have a larger, high performance cabin cruiser where one normally moves about during operation. Reduce speed considerably, or stop completely if someone needs to move about the boat.

The driver should always use the emergency stop switch! The emergency stop switch lanyard which is securely connected to the driver, immediately shuts off the engine(s) should the driver be thrown from the driving position. Even if the risk of being thrown overboard is practically nonexistent in your type of boat, the risk of the driver falling and being dazed in rough seas can be even greater.

Remember, even when the engine(s) is stopped in a high performance boat that is planing, it will travel approximately 325 feet (100 meters) before dropping through the planing threshold and stopping!

Notes

This operator's manual has been compiled to help you get the most from your Volvo Penta engine. It contains information you need in order to operate and maintain your engine safely and correctly. Please read the operator's manual carefully and learn how to operate the engine, controls, and any other equipment safely.

Always have the operator's manual available. Keep it in a safe place and do not forget to give it to the new owner if you sell your boat.

Care of the Environment

We would all like to live in a clean and healthy environment—somewhere where we can breathe clean air, see healthy trees, have clean water in our lakes and oceans, and are able to enjoy the sunshine without being worried about our health. Unfortunately, this cannot be taken for granted nowadays; we must work together to achieve this vision.

As a manufacturer of marine engines, Volvo Penta has a special responsibility, where care of the environment is a core value in our product development. Today, Volvo Penta has a broad range of engines on which progress has been made in reducing exhaust emissions, fuel consumption, engine noise, and other detrimental side-effects. We hope you will take care in preserving these qualities.

Always follow any advice given in the manual—concerning fuel grades, operation, and maintenance procedures—and you will avoid unnecessarily harming the environment. Get in touch with your Volvo Penta dealer if you notice any changes such as increased fuel consumption or exhaust smoke.

Adapt speed and distance to avoid wash and noise disturbing or injuring animal life, moored boats, jetties, etc. Leave islands and harbours in the same condition as you want to find them.

Remember to always leave hazardous waste such as waste oil, coolant, paint and wash residue, flat batteries, and other toxic disposables at a suitable disposal site or destruction plant.

Our joint efforts will make an invaluable contribution to our environment.

Fuel and Oils

Only use the fuel and oils recommended in the chapter entitled *Technical Data* on page 133. Other grades of fuel and oil can cause operating problems, increased fuel consumption and—in the long-term—a shorter engine service life.

Always change oil, oil filters, and fuel filters at the recommended intervals.

Breaking-in

The engine must be broken-in for its first 20 operating hours as follows:

- Operate the engine normally.
- Do not operate it at full load except for short periods.
- Never run the engine at a constant engine speed for long periods during the breaking-in period.
- Check the oil level more often than is normally recommended; the engine can be expected to use more engine oil during the breaking-in period than would otherwise be normal.

For a more detailed explanation of the break-in period, please refer to the appropriate section in the chapter entitled *Maintenance* on page 69.

A First Service Inspection should be carried out after 50 running hours. For additional information please refer to the document entitled *Warranty Information North America* PN 7796733.

Certified Engines

If you own an engine certified for any area where exhaust emissions are regulated by law, the following is important:

Certification means that an engine type is inspected and approved by the authorities. The engine manufacturer guarantees that all engines manufactured of that type correspond to the certified engine.

This places special requirements for maintenance and service as follows:

- The maintenance and service intervals recommended by Volvo Penta must be observed.
- Only genuine Volvo Penta replacement parts may be used.
- The servicing of ignition, timing, and fuel injection systems must always be carried out by an authorized Volvo Penta workshop.
- The engine must not be modified in any way except with accessories and service kits approved by Volvo Penta.
- No modifications to the exhaust pipes and air supply ducts for the engine may be undertaken.
- Seals may only be broken by authorized personnel.

Otherwise the general instructions contained in this *Operator's Manual* concerning operation, service, and maintenance must be followed.

NOTICE! Late or inadequate maintenance/service or the use of spare parts other than Volvo Penta original spare parts will invalidate Volvo Penta's responsibility for the engine specification being in accordance with the certified variant.

Volvo Penta accepts no responsibility or liability for any damage or costs arising due to the above.

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Power Ratings

A great number of environmental factors, such as barometric pressure, ambient temperature, humidity, the quality of fuel, and exhaust back pressure can affect engine performance. When it comes to quoting and comparing ratings, it is important that there is a unified set of standards for measurement.

In September 1989, all major marine engine manufacturers agreed to quote engine power output according to a common set of conditions. These conditions are referred to as ISO 8665. All Volvo Penta engines meet the ISO 8665 standard. This ISO standard outlines the following fixed values or common conditions for determining the rating of the engine.

Condition	Value
Air temperature	25°C (77°F)
Barometric pressure	100 kPa (14.504 PSI)
Relative humidity	30%

A gasoline engine operates with very little surplus air. When conditions deviate from the standard values, the result can be a loss of power at full load. It can also cause a rise in exhaust emissions due to incomplete fuel combustion.

Marine engines can be rated according to one of several power standards, but power output itself is quoted in kilowatts (KW) or horsepower (HP), for a given engine speed, usually at maximum revolutions per minute (RPM).

Load Condition (Speed of Planing Hull)

The overall weight of the boat is another important factor in performance. Any increase in boat weight will slow down the boat speed, particularly on boats with planing and semi-planing hulls.

For example, a new boat tested with fuel and water tanks only half filled, and without any load, can easily drop 2 to 3 knots in speed when tested fully fuelled and loaded with all normal equipment and supplies for safe and comfortable cruising. This is because the propeller installed originally is frequently one that is designed to give maximum speed when the boat is new. For this reason it is often advisable to reduce the propeller pitch by as much as an inch or more in order to counter the effects of the increase in overall weight encountered in normal cruising, particularly in hotter climates. Although this will reduce top speed somewhat, overall ride conditions will improve and you should achieve greatly enhanced acceleration.

In considering the influence of weight, it is worth remembering that fiberglass boats absorb a significant amount of water into their hulls while left afloat for any length of time and so become progressively heavier. Another negative influence on boat performance is marine growth beneath the water line–a problem that is often overlooked.

Notes

Warranty Information

Volvo Penta's warranty package can be found in the accompanying warranty booklet. Along with the warranty information you will find other checklists and reports for Volvo Penta products.

Your new Volvo Penta marine engine is covered by a limited warranty according to the conditions and instructions contained in the document entitled *Warranty Information North America* PN 7796733.

Note that Volvo Penta's liability is limited to that contained in *Warranty Information North America*. Read this book as soon as you take delivery of the engine. It contains important information about warranty cards, service, and maintenance which you must be aware of, check, and carry out. Liability covered in the warranty may otherwise be refused by Volvo Penta.

The Volvo Penta International Warranty may apply outside the U.S. This warranty may contain different terms and conditions determined by prevailing national legislation and regulations. Information about these conditions can be obtained from Volvo Penta importers and dealers in those areas. Please contact your local Volvo Penta representative for a copy.

Warranty Registration Form

The Warranty Registration Form should always be filled out and sent in by the dealer. Make sure that this has been done, since delay of warranty claims can occur if no proof of the delivery date can be provided.

Please contact your Volvo Penta dealer if you have not received a copy of *Warranty Information North America* PN 7796733 and a customer copy of the warranty card.

Doing Your Own Maintenance and Repairs

If you plan to do your own maintenance and repairs on your Volvo Penta products, you should purchase a set of service manuals that pertain to your particular engine and drive. Keep in mind, however, that there are certain tasks which should only be performed by your Volvo Penta dealer. The dealer has the tools, expertise, and most current information needed to properly perform these tasks.

Volvo Action Service (VAS)

Volvo Action Service (VAS) is a consumer breakdown service available 24 hours each day, 365 days per year. If your engine breaks down, the VAS coordinator will quickly locate your nearest dealer. If you need a tow, parts, or mechanic, the VAS coordinator will make all arrangements necessary to get you back underway as soon as possible.

Membership to Volvo Action Service is provided automatically to all Volvo Penta engine owners. As long as your Volvo Penta engine is under factory warranty, this service covers Volvo Penta-related repairs. Refer to the accompanying warranty literature for detailed information regarding coverage.

If you have a question about Volvo Action Service, or need additional information, please call toll-free 1-877-33-PENTA.

Volvo Penta Dealer Network

The Volvo Penta worldwide network of authorized dealers are at your service. They are specialists in Volvo Penta products and have the accessories, original replacement parts, test equipment, and special tools necessary for high quality service and repair work.

Always take your Volvo Penta product to an authorized Volvo Penta servicing dealer for repair. Our dealers have the knowledge, factory-trained technicians, and special tools to take care of any necessary repairs. Ideally, take your product back to your selling dealer — he also knows you and your equipment.

Toll-free Dealer Locator Service

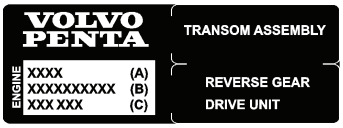
If you are away from your home waters, take your Volvo Penta product to the nearest Volvo Penta servicing dealer. For the name and location of your nearest Volvo Penta dealer, consult the Yellow Pages under Boat Dealers, search the dealer locator on the internet, or call 1-800-522-1959.

Volvo Penta on the Internet

The URL address for Volvo Penta of the Americas is http://www.volvopenta.com.

Informational Decals and Identification Plates

The following images provide graphical representations of various engine decals. The areas described are general locations and are intended to be guides only. Engine models and configurations do vary and, depending on the amount of space available, the exact locations of engine decals tend to vary also.



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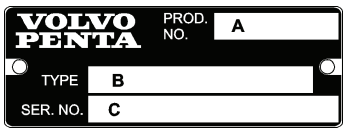
The engine decal is located on the engine cover.



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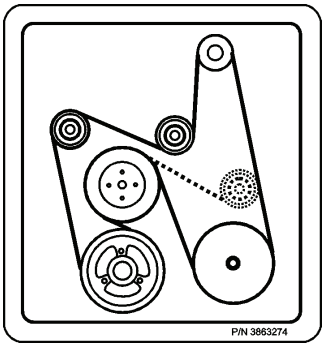
The engine plate is typically located on the port side of the engine flywheel housing, slightly below and aft of the exhaust manifold.



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The label depicting the serpentine belt configuration is typically mounted on a flat surface located on the front of the alternator/automatic tensioner bracket.

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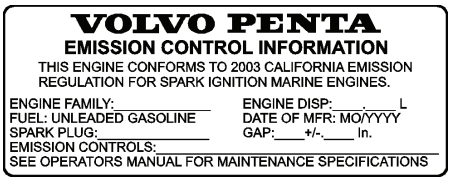
The California Emission sticker is located on the engine cover.



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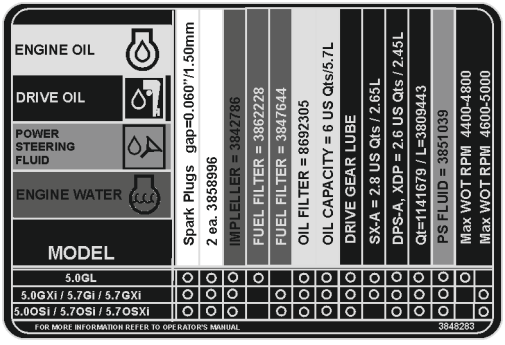
The Emission Control Information sticker is located on the flat outside face (port side of engine) of the alternator support bracket.



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The tune-up and color code decal is located on the engine cover.

Identification Numbers

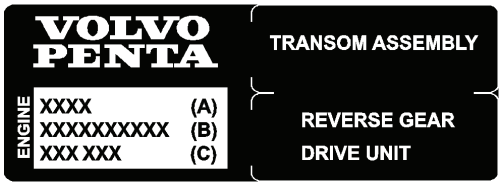
Always provide the engine, transom shield, and drive identification numbers when ordering service or replacement components. The engine identification numbers are on informational decals located in the spots described on the previous page. Make a note of the information on the lines provided below. Make a copy of this page and store the information so that it is available in event of the boat being stolen.

Engine - Decal

Product Designation (A) .....

Specification No. (B) .....

Serial No. (C) .....



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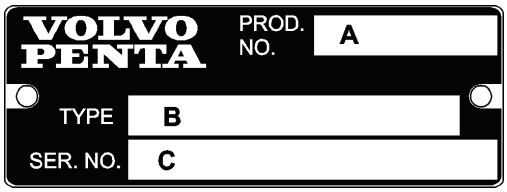
Engine - Plate

Product No. (A) .....

Type (B) .....

Serial No. (C) .....



22774

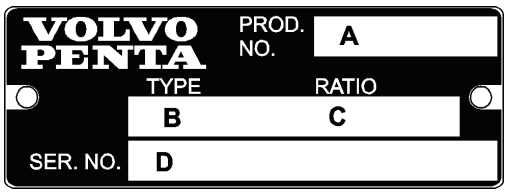
Transom Shield Plate

Product No. (A) .....

Type (B) .....

Ratio (C) .....

Serial No. (D) .....



22778

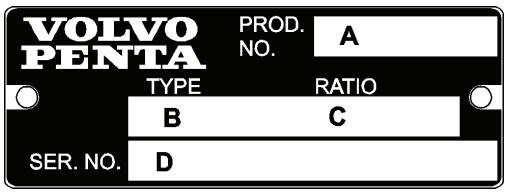
Drive

Product No. (A) .....

Type (B) .....

Ratio (C) .....

Serial No. (D) .....



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Transom Assembly & Drive Unit Stickers

Product Designation (A) ..... /.....

Specification No. (B) ..... /.....

Serial No. (C) ..... / .....

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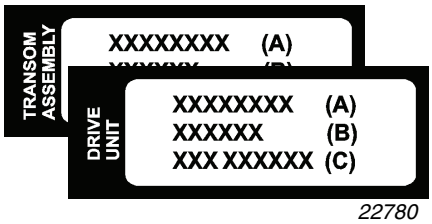

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The Transom Assembly & Drive Unit Stickers shown above should be located on the Engine Decal. Your Volvo Penta dealer will have attached these stickers at the time that the transom assembly and drive unit were mounted on your boat and attached to the engine.

Owner’s Identification Card

When you purchased your boat the dealer was required to register your power package with Volvo Penta. Your dealer should provide you with proof of ownership in the form of an Owner's Registration Card or a print-out of the Volvo Penta computer on-line registration screen. This provides proof of ownership and is required to validate warranty, should warranty service become necessary. Warranty coverage may be delayed until the warranty and registration form is on file at Volvo Penta.

Service, Replacement Parts, and Accessories

Genuine Volvo Penta parts are the result of many hours of strenuous testing and fulfill Volvo Penta’s strict quality and safety requirements. Also, Volvo Penta marine engines are designed for high operational reliability and a long service life. They are manufactured to withstand the marine environment while also affecting it as little as possible. Through regular service and the use of Volvo Penta original spare parts, these qualities will be retained.

When replacements are required, use only Volvo Penta genuine parts. Always follow the maintenance intervals contained in the operator’s manual. Remember to state the engine/transmission identification number when ordering service and replacement parts.

Purchase all Volvo Penta replacement parts, accessories, coolants, and lubricants from an authorized Volvo Penta dealer. The dealer has needed parts in stock for routine maintenance, as well as the information needed to order special parts and accessories for you.

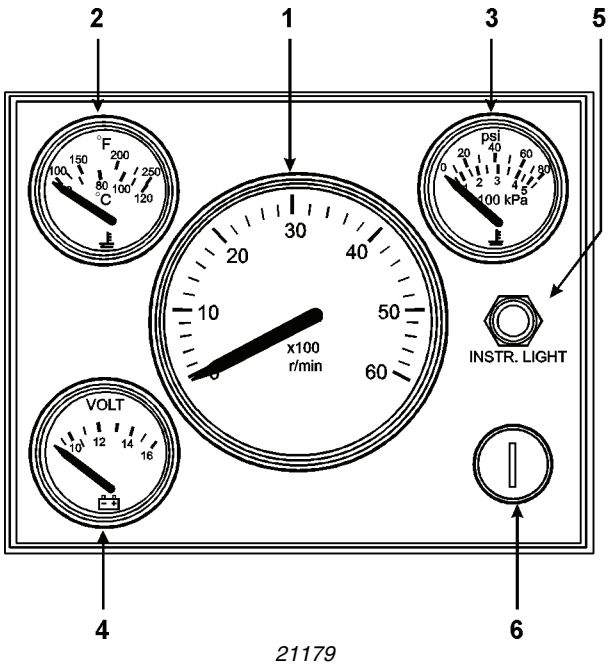
Instrument Panel

The following section contains a general description of the instrument panel. Please note that instrument panels are installed by the boat builder and will vary depending on the model installed. Commonly, instrument panels are equipped with a tachometer, temperature gauge, oil pressure gauge, voltmeter, instrument panel lighting switch, and an ignition switch.

Instruments and ignition switches can also be supplemented with extra Volvo Penta instruments such as: synchronization tachometers, fuel gauge, fresh water gauge, clock, speed log, or rudder indicator.

Note that the instrument cluster which is shown here installed in the instrument panels can be installed in other positions on some boats. If your boat is fitted with instruments not described here and you are not sure of their function, please get in touch with your boat dealer.

NOTICE! The instrument panel depicted below is a sample representation only.



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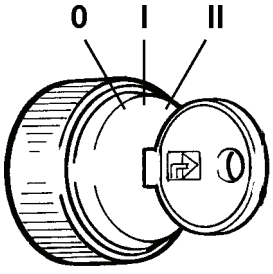

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1. Tachometer—Shows the engine RPM rate. Multiply this value by 100 or 1000 (depending on model) for revolutions per minute. Integral “Hours run” meter (optional and separately installed) displays the engine’s operating time in hours and tenths of an hour.

2. Temperature Gauge—Indicates engine temperature. Normal operating temperature for all 3.0–5.7L engines is 155°-178°F (68°-81°C) and 135°-158°F (57°-70°C) for 8.1L engines. Engines with closed cooling systems will typically run about 30°F (17°C) higher.

3. Oil Pressure Gauge—Indicates the engine oil pressure. Normal operating oil pressure should be approximately 18 psi (124 kPa) minimum at 2000 RPM on a warm engine. Lower oil pressure is normal and should be expected at idle after a sustained cruise.

4. Voltmeter—Indicates the charge voltage from the alternator which should normally be approximately 14 Volts. With the engine stopped and the switch on, battery voltage is normally indicated as 12 Volts.

5. Instrument Lighting—On Volvo Penta instrument panels, turns panel lights on or off (varies, depending on product manufacturer).

6. Ignition Switch—The ignition switch has three positions (varies, depending on product manufacturer):

- **0** The key can be inserted or removed.
- **I** RUN: Ignition is ON and engine is OFF. System voltage connected.
- **II** START position (momentary). The starter motor is engaged and starting the engine.

NOTICE! Read the starting instructions in the section entitled *Starting the Engine (Cold Start)* on page 36.

The ignition keys are marked with a code for use when ordering extra keys (varies, depending on product manufacturer). Record the code so that replacement keys can be ordered. Keep the code in a safe place where unauthorized persons do not have access to it.

Audible Alarm

If an audible alarm[1] has been installed on your boat, it will perform a brief self-test when the ignition key is turned to the RUN position. Following is a description of how the alarm performs the self test.

Carbureted Engines - When the ignition switch is turned to RUN (key on, engine off), the audible alarm will sound. The alarm will remain on until the engine starts and the oil pressure reaches normal operating levels. If the alarm persists, it indicates that there is a problem with oil pressure.

EFI Engines - When the ignition switch is turned to RUN (key on, engine off), the alarm emits three short beeps to indicate that the ECM is performing a check of the sensors. If there are any problems detected by the ECM, the alarm will sound; otherwise, it will remain off.

Emergency Stop Switch

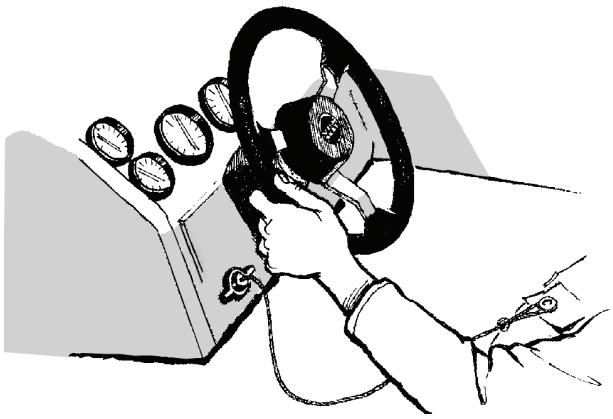
An emergency stop switch, also called a safety breaker, may be a feature of your boat. Use of this switch is highly recommended. To properly use this feature, attach the lanyard to clothing that will **NOT** tear away before the lanyard is pulled from the switch to stop the engine. If the lanyard is too long, shorten it by knotting or looping it. **DO NOT** cut and re-tie the lanyard.

Using this switch is simple and should not interfere with normal operation of the boat. **Care must be taken to avoid accidentally pulling the lanyard during boat operation. Unexpected loss of forward motion will occur, as well as possible damage to the engine.** This could cause occupants to be thrown forward. In an emergency situation, any occupant of the boat may attempt to restart the engine by pressing in and holding the emergency stop switch button, followed by normal starting procedures. When the button is released, the engine will stop.

If your boat is not equipped with an emergency stop switch and it falls into one of the following categories, installation of an emergency stop switch is recommended.

- High performance sport boats
- Small runabouts
- Boats with sensitive steering
- Boats where the distance from the top of the gunwale down to the driver's seat is less than one foot (30 cm).

Contact your Volvo Penta dealer for installation of an emergency stop switch.



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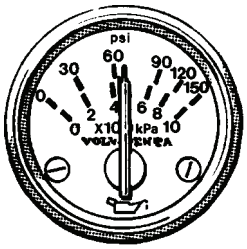
The emergency stop switch can only be effective when in good working order. Observe the following:

- Lanyard must always be free of entanglements that could hinder its operation.
- Once a month, check the switch for proper operation. **With engine running at idle speed,** pull lanyard. If engine does not stop, see your dealer for repairs.

1. While Volvo Penta provides an audible alarm with every engine, its installation is determined by the manufacturer of your boat. If your boat does not have an audible alarm available, we strongly recommend that you contact your dealer to have one installed.



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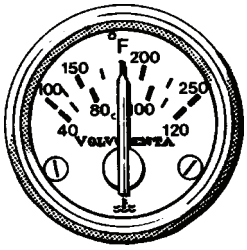

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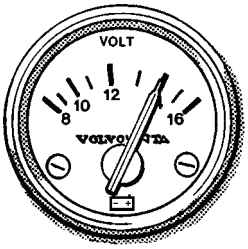

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Checking Instruments

Check instruments regularly. Stop the engine if there is an abnormal reading or if the engine alarm sounds.

Oil Pressure

All engines have what is considered a normal operating oil pressure range. At engine idle this is normally lower than at higher RPMs. For the normal operating oil pressure range for your model engine, please refer to the section entitled *Technical Data* on page 133.

Your boat is equipped with an audible low oil pressure alarm[1].

NOTICE! If oil pressure is too low: Stop the engine immediately and investigate. Operating the engine with oil pressure too low will damage the engine.

Engine Coolant Temperature

All engines have what is considered a normal operating temperature range. At engine idle this is normally lower than at higher RPMs. Normal operating temperature for all 3.0–5.7L engines is 155°-178°F (68°-81°C) and 135°-158°F (57°-70°C) for 8.1L engines. Engines with closed cooling systems will typically run about 30°F (17°C) higher.

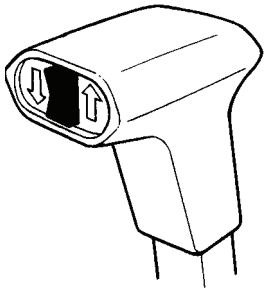
Your engine is equipped with an engine coolant and exhaust temperature acoustic alarm[1].

NOTICE! If engine coolant or exhaust temperature is too high: Idle the engine, shift to reverse and then to forward. Idle the engine for 2 - 3 minutes and shut off the engine if the temperature does not decrease. Investigate and correct the malfunction. Operating an engine with temperatures too high will damage the engine.

Voltage/Charge

The operating charge is approximately 14 V. When the engine is stopped and ignition is on, battery voltage is approximately 12 V. With the ignition turned off, the voltmeter will not register a charge.

1. While Volvo Penta provides an audible alarm with every engine, its installation is determined by the manufacturer of your boat. If your boat does not have an audible alarm available, we strongly recommend that you contact your dealer to have one installed.



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Power Trim/Tilt

Your Volvo Penta sterndrive is equipped with a power trim/tilt system as standard equipment. The power trim/tilt allows you to change the angle of the drive unit from the helm. Changing the angle of the drive unit in relation to the boat bottom is called trimming. Trimming provides these benefits:

- Improves acceleration to planing.
- Keeps the boat on plane at reduced throttle settings.
- Improves fuel economy.
- Provides smoother and/or drier ride in choppy water conditions.
- Increases maximum speed.

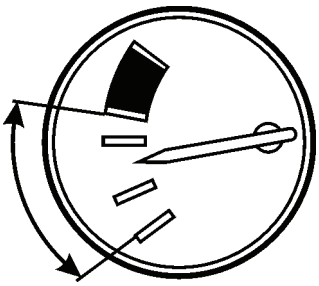
If you do not wish to use this feature, you may leave the drive unit trimmed to the position that works best for you.

Trim Instruments

The trim instrument indicates the current trim position. Your boat may be equipped with an analog or a digital trim instrument.

Analog Trim Instrument

The analog trim instrument has three main ranges:



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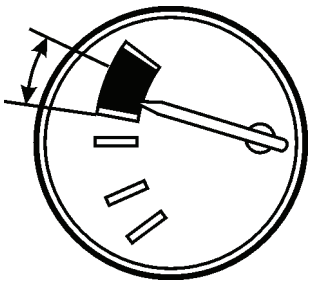

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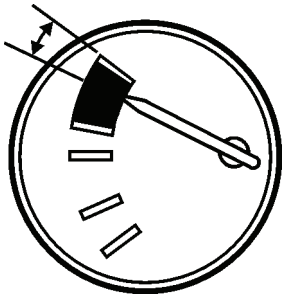


22783

- **Trim Range**–Use trim range for maximum comfort, under normal operation, from start to maximum speed.
- **Beach Range**–Use beach range for operating at reduced speed in shallow water, where water depth is uncertain. Also use this range when you launch and take your boat out of water onto a trailer ramp.
- **Lift Range**–Use lift range for lifting the drive to its maximum angle; however, this range cannot be used during boat operation. Use this range **ONLY** when you are transporting your boat.

⚠ **CAUTION! Operating in beach range or lift range will cause significant loss of maneuverability.**

NOTICE! The maximum safe engine speed in the Beach Range is 1000 RPMs. Operating in beach range above idle speed, or for prolonged periods of time, may cause serious drive damage. Always check that the cooling water intake is below the surface of the water when running in Beach Range.

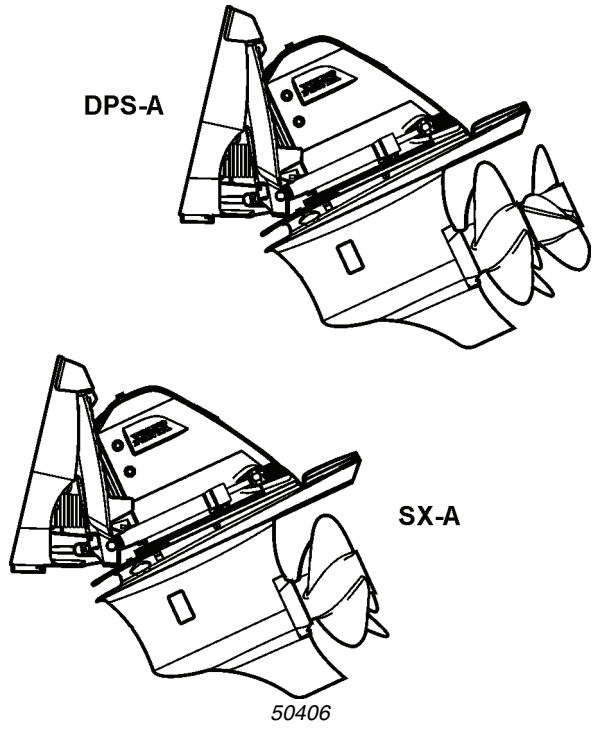
Trim/Tilt Motor Protection

NOTICE! Always allow the trim/tilt switch to return to its center position when the drive unit reaches its maximum raised or lowered position. This precaution will prevent your trim/tilt motor from overheating.

Impact Protection

The trim/tilt system provides impact protection in the trim/tilt cylinders. If an impact occurs while in forward motion, the cylinders will allow the drive to “kick up,” thereby helping to minimize drive damage. However, impact damage can occur in either FORWARD or REVERSE directions.

NOTICE! When backing-up in REVERSE, there is no impact protection. Be very careful when backing-up in REVERSE. Do not exceed 2500 RPM.



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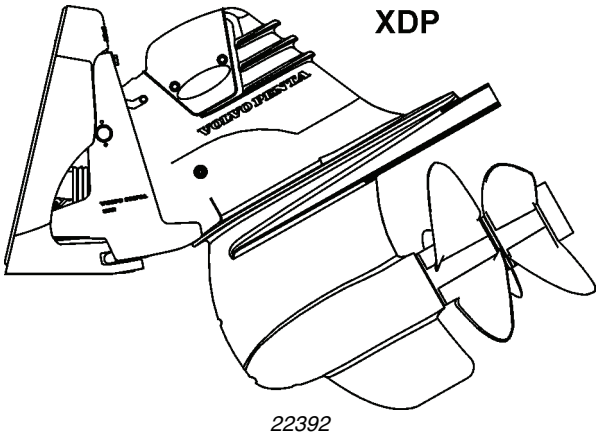

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You must be careful when:

- You operate in FORWARD or REVERSE.
- You are backing up.
- You trailer your boat.
- You launch your boat.

NOTICE! Impact damage is more likely to occur when you are in a turn where side loads are placed on the drive unit.

If you strike a solid object:

- Throttle back and shut off the engine immediately.
- Closely inspect the boat and drive unit (especially the transom shield assembly that contains steering system components).
- Check the engine compartment for water leakage.

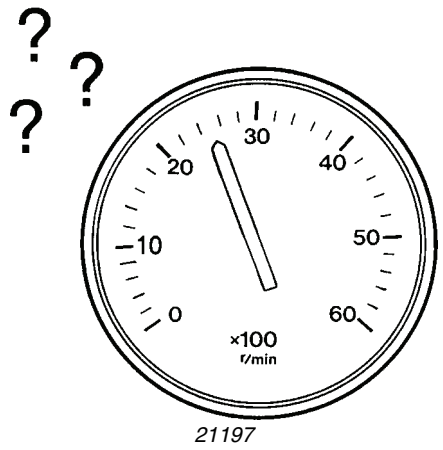
If there is damage, operate the boat at low RPM and take it to a Volvo Penta dealer for inspection. Operating a damaged unit could cause additional damage and could become very costly to repair. Have necessary repairs made immediately. Only operate your boat if absolutely necessary.

NOTICE! Always check your boat and engine for damage. Failure to inspect for damage may:

- Result in sudden loss of steering control.
- Adversely affect your boat’s capability to resist high-speed impacts.

Engine Protection Mode

In a low oil pressure, low voltage, engine overheat, or lack of exhaust cooling water situation, the Electronic Fuel Injection (EFI) system will enter an Engine Protection Mode (EPM). In such cases, if an acoustic alarm has been installed with your engine, the alarm will sound to notify you of a malfunction.



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⚠ CAUTION! If a malfunction triggers the engine protection mode, the engine may either return to idle or shut down, depending on the engine equipment and circumstances.

Under these conditions, engine operation is limited to 2500 RPMs or less. When the engine enters EPM, there will be a temporary reduction in power until the problem is resolved. **We strongly urge you to bring the engine to idle to investigate the problem.** If the acoustic alarm stops sounding, the malfunction has been cleared and the engine may now be operated normally.

If you are unable to locate and resolve the problem, you may continue to operate the engine at above idle speed, keeping in mind that the acoustic alarm will continue sounding and the engine speed will remain below 2500 RPMs[1].

NOTICE! Continuing to run the engine in engine protection mode without correcting the cause may result in engine damage.

Use the oil pressure and water temperature gauges to verify a problem exists, then inspect the engine crankcase for proper oil level and check the water inlets for obstructions. The low oil pressure/engine overheat problem must be corrected before the engine will return to normal operation.

To reset the Engine Protection Mode after the problem is corrected, reduce engine speed to idle, allow the engine to cool, and then continue with normal operation.

NOTICE! If the problem continues, contact your Volvo Penta dealer and have the engine inspected.

Engine Control Module (ECM)

The engine control module (ECM) is designed to maintain exhaust emission levels while maintaining excellent drivability and fuel efficiency. The ECM controls the following conditions:

- Fuel, ignition, and idle air control.
- Knock sensor system.
- Various other discrete outputs.

Other Instruments

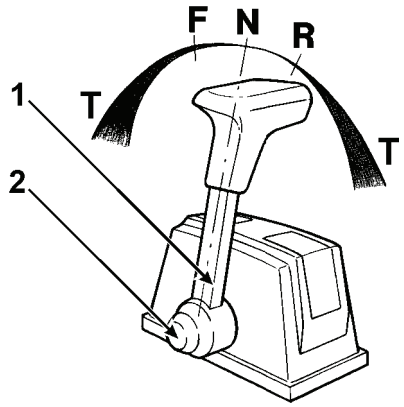
See your Volvo Penta dealer for additional accessories specifically designed for your Volvo Penta product.

1. If your boat is equipped with the Electronic Vessel Control system (EVC-mc), alarm handling is different. After the alarm is acknowledged, the buzzer is turned off. Please refer to the EVC-mc Operator's Manual in the appendix for additional information.

Remote Control Unit

The gear shift release, throttle lock, and engine speed control are combined in one lever. The gear shift release can be simply disengaged so that only engine speed is affected. The Volvo Penta controls are available for top or side mounting. The control levers have an adjustable friction brake. A neutral position switch, available as an accessory, allows the engine to be started with the drive disengaged.

Your boat may be equipped with remote controls other than those described below. If Volvo Penta controls are not used, ask your dealer for operating instructions for the remote control used in your boat since operation and function may differ from Volvo Penta remote controls.



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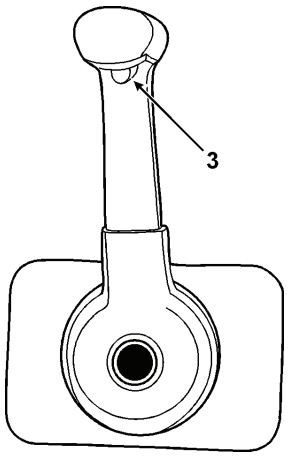

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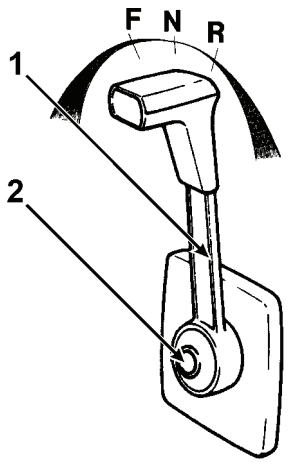


21186

Single Lever Control Operation

Both the gear shift release and engine speed control are operated using the single lever (**1**).

- **N** Neutral position (drive is disengaged and the engine runs at idle speed).
- **F** Drive/forward gear engaged for forward movement (ahead).
- **R** Drive/reverse gear engaged for backward movement (astern).
- **T** Engine speed control.

NOTICE! The engine can be started only if the drive is in neutral.

Shifting from Neutral

To move the remote control lever from the neutral detent position, depress the throttle lock (**3**)[1], then move the control lever in the desired direction.

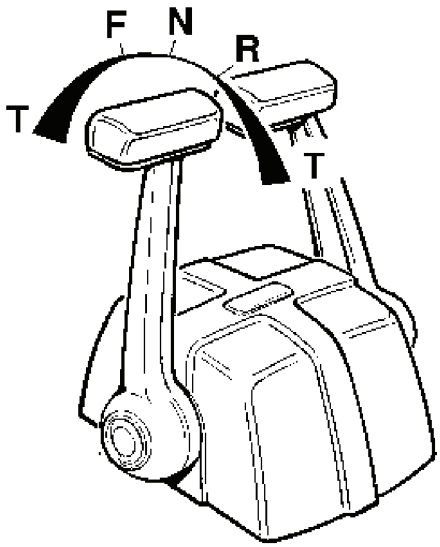
Disengaging the Shift Function

The gear shift can be disengaged so that the control lever affects only the engine speed.

1. Move the lever (**1**) to the neutral position (**N**).
2. Press the gear shift release button (**2**) in and hold it down while moving the control lever forward to the shift position (**F**).
3. Release the gear shift release button. The lever now affects only the engine speed (RPMs). When the lever is moved back to the neutral position it will automatically re-engage the gears.

NOTICE! Take care not to engage the reverse gear unintentionally as you move back to idle; with a hard shifting lever, it is possible to accidentally go past the neutral position into reverse gear.

1. The throttle lock only exists on side-mount controls.



22763

Twin Unit Maneuvering

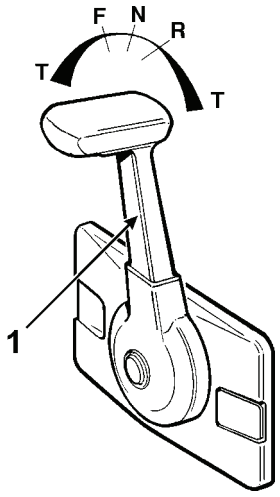
When leaving or approaching the dock, or for any close maneuvering at slow speed, place the port engine in neutral, on standby, and use the starboard engine. The use of one control is very effective and more convenient. In the event that the starboard engine (which is being used for maneuvering) stops, you can immediately go to the port engine (which has been on standby).

NOTICE! Both engines must be running during close maneuvering or at slow speeds. If only one engine is running, water may be forced back through the underwater exhaust outlet and cause serious engine damage. Do not attempt to plane boat while operating on a single engine; operating with a single engine at full throttle could cause engine or transmission damage.

How to Shift and Control Speed

If your boat is equipped with a non-Volvo Penta remote control system, ask your dealer how to properly operate it.

NOTICE! Carefully check function of all control and engine systems before leaving the dock.



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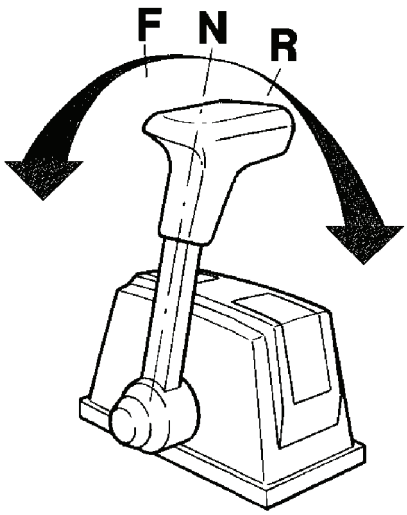
1. Move control handle (**1**) to the neutral detent (idle) position. Check in front and behind boat for people or obstructions before shifting.
2. To go forward: Move the shift handle forward from neutral detent to forward gear engagement detent position. Throttle movement will begin after the detent position for forward gear engagement. After the throttle is activated, continue to move the control handle slowly in the desired direction to increase speed.
3. To go in reverse: Move the shift handle backward until you reach the detent position for reverse gear engagement. Throttle movement will begin after reverse gear engagement. After the throttle is activated, continue to move the control handle slowly in the desired direction to increase speed.

NOTICE! Do not shift gears if engine speed is above 800 RPM.



22764

Shifting between Forward and Reverse

- To go from forward to reverse, or reverse to forward, always pause at neutral (**N**) and allow engine speed to return to idle.
- After shifting is completed, continue to move the control handle slowly in the desired direction to increase speed.

NOTICE! Do not shift gears if engine speed is above 800 RPM. Do not shift from forward to reverse when boat is planing. There is a danger that water will get into the engine and cause serious damage, while causing serious damage to the drive.

⚠ **CAUTION! Any time the boat is operated, be aware of changes in shift system operation. A sudden increase in shift effort at the remote control handle, or other abnormal operation, indicates a possible problem in the shift system. If you suspect there is a problem, see your Volvo Penta dealer as soon as possible for proper diagnosis and required service or adjustment. Continued operation could result in damage to the shift mechanism and loss of shift and throttle control that could result in personal injury.**

Cruising Speed

Operating the engine at wide open throttle (WOT) should be avoided since it is both uneconomical and uncomfortable. Volvo Penta recommends a cruising speed 25% lower than maximum RPM at WOT. Depending on hull type, choice of propeller, load and conditions, etc., the maximum engine speed at top speed can vary, but it should be within the WOT range.

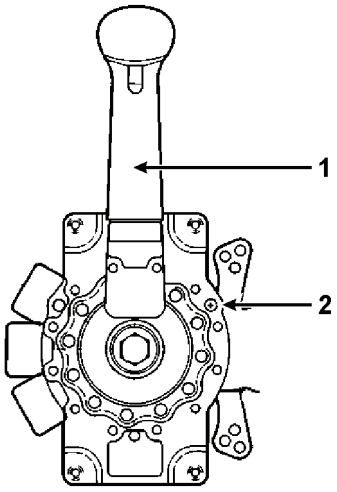
Engine	*WOT Range (RPM)*
3.0 GLP-J	4200–4600
4.3 GL-J(F)	4200–4600
4.3 GXi-J(F)	4400–4800
4.3 OSi-J(F)	4400–4800
5.0 GL-J(F)	4400–4800
5.0 GXi-J(F)	4600–5000
5.0 OSi-J(F)	4600–5000

Engine	*WOT Range (RPM)*
5.7 Gi300-J(F)	4600–5000
5.7 GXi-J(F)	4800–5200
5.7 OSi300-J(F)	4600–5000
5.7 OSXi-J(F)	4800–5200
8.1 Gi-J(F)	4200–4600
8.1 GXi-J(F)	4600–5000
8.1 OSi-J(F)	4200–4600

Friction Brake

The remote control has a friction brake, which can be adjusted as necessary, to provide lighter or heavier lever action. If you are using a Volvo Penta shift control and you wish to make adjustments to the friction brake, follow the instructions below to make the necessary changes.

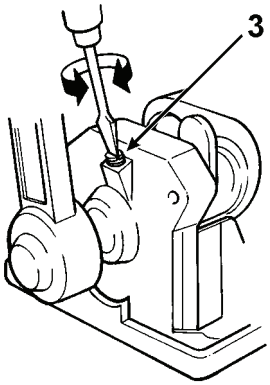
NOTICE! Each manufacturer has a particular method for making adjustments to the friction brake. For specific directions on how to adjust a non-Volvo Penta friction brake, please refer to your manufacturer's manual.



22762

Side Mount Remote Controls

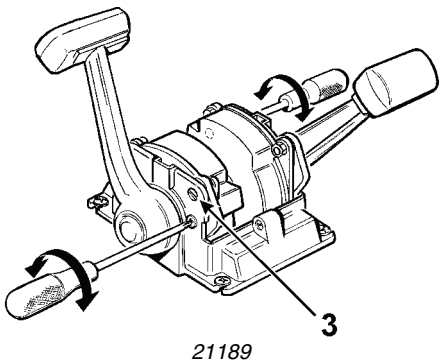
1. Make sure the engine is turned off by removing the key from the ignition switch.
2. Remove the remote control lever (**1**).
3. Remove the plastic cover that shields the remote control mechanism.
4. Using a screwdriver adjust the friction brake screw (**2**) as necessary. Turning the screw clockwise increases brake effect, while turning it counter clockwise provides lighter lever action.
5. Reinstall the plastic cover and remote control lever.



21188

Top Mount Remote Controls

1. Make sure the engine is turned off by removing the key from the ignition switch.
2. Remove the plastic cover that shields the remote control mechanism.
3. For single lever controls, move the throttle to the forward position. For dual lever controls, move the port side lever forward and the starboard side lever into reverse.
4. Using a screwdriver adjust the friction brake screw (**3**) as necessary. Turning the screw clockwise increases brake effect, while turning it counter clockwise provides lighter lever action.
5. Reinstall the plastic cover.



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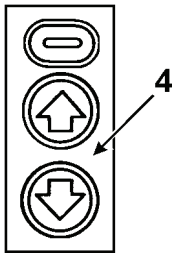

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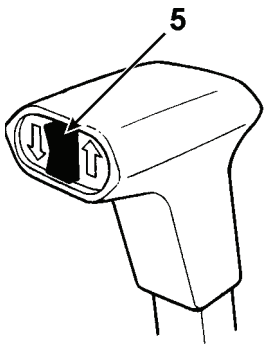


22767-1

Trim Controls

Trimming (raising and lowering the drive) can be performed by using:

- A separate control panel (**4**) on the instrument panel.
- A control button (**5**) on the remote control lever.
- The control buttons on the port control lever in a twin installation.

The current trim position is indicated on a trim gauge located on the instrument panel or elsewhere on the dashboard.

Operating Trim Controls

Control Panel

The control panel has two standard buttons for tilt control with a third (optional) button:

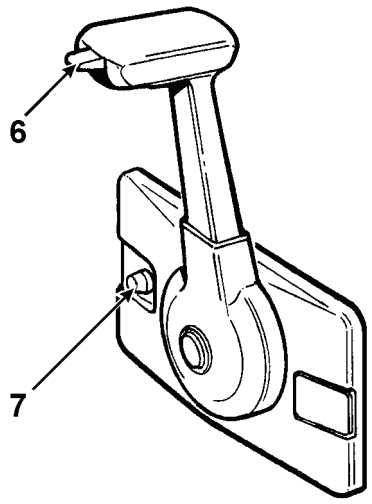
- The center button moves the drive trim out while raising the boat's bow.
- The lower button moves the drive trim in while lowering the boat's bow.
- The top button (optional) disconnects a "catch" so that the drive can be trimmed into the BEACH and LIFT positions. (Press this button and the center button at the same time.)

Remote Control Lever

The control button on the control lever has two functions:

- Pressing the top half of the button moves the drive trim out while raising the boat's bow.
- Pressing the bottom half of the button moves the drive trim in while lowering the boat's bow.

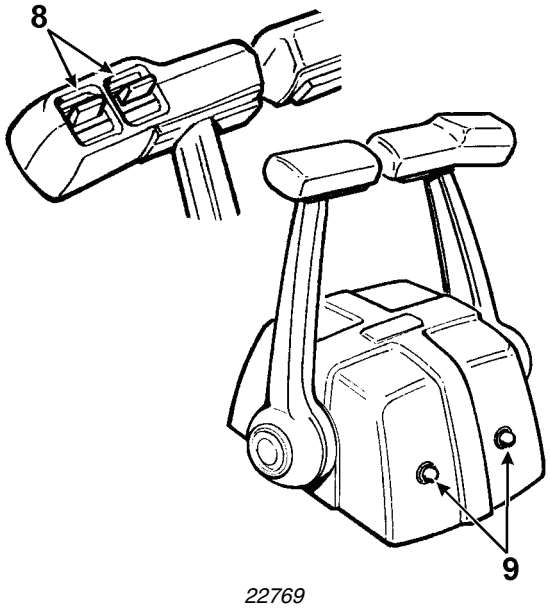
You must press a separate switch on the instrument panel to disconnect the "catch" (optional) so that the drive can be trimmed into the BEACH and LIFT positions.



22768

Control Lever with Catch Button (Single)
A switch on the control lever (**6**) allows you to trim the drive as follows:

- Pressing the switch up moves the drive trim out while raising the boat's bow.
- Pressing the switch down moves the drive trim in while lowering the boat's bow.
- The catch button (**7**–optional) disconnects a "catch" so that the drive can be trimmed into the BEACH and LIFT positions.



22769

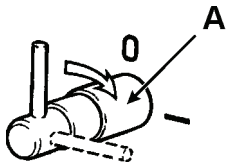
Control Lever with Catch Button (Dual)
There are two switches on the port control lever (**8**), which gives you the capability of individual adjustment of the drive trim.

- Pressing the switches up moves the drive trim out while raising the boat's bow.
- Pressing the switches down moves the drive trim in while lowering the boat's bow.
- The catch buttons (**9**–optional) disconnect a "catch" so that the drives can be trimmed into the BEACH and LIFT positions.

Operating the Engine

NOTICE! Do not start the engine out of the water unless you have connected a hose with running water to the flushing adapter. Please refer to the section entitled *Engine Flush* on page 96 for instructions on attaching and running the engine out of water.

Thoroughly familiarize yourself with the operation of the remote control supplied with your boat, then proceed as follows.



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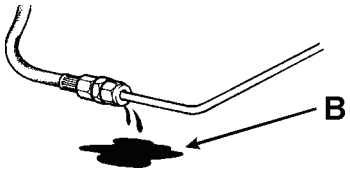

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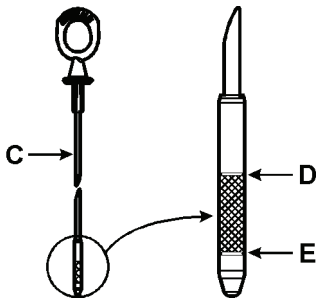

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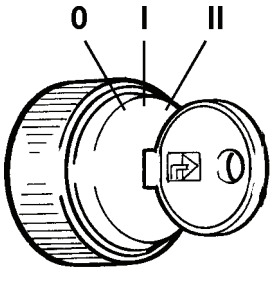

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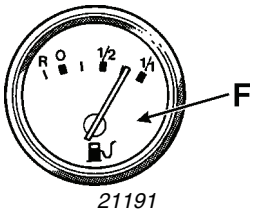


21191

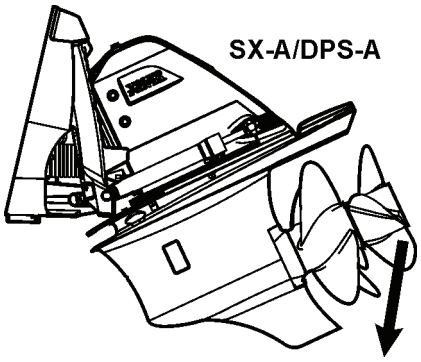
Before Starting

⚠ **DANGER! To prevent a possible explosion hazard, operate the engine compartment/ bilge blower as recommended by the boat manufacturer before starting the engine. If the engine compartment is not equipped with a blower, open the engine cover or hatch before starting so as to disperse any gasoline fumes that may be present. Leave the hatch open until after the engine is running.**

1. Start the boat's bilge blower and run as recommended by the boat manufacturer. Frequently check boat's bilge area for gasoline fumes.
2. Check the bilge for excessive water accumulation. Always keep the bilge clean and dry.

NOTICE! The water level in the boat's bilge will increase when you operate your boat at a high incline before you reach planing speed. Excessive water in the bilge can cause engine damage.

3. Open the fuel cock (**A**). Also, ensure that the sea cock is open–if so equipped.
4. Make sure that there are no fuel, engine coolant, or oil leaks (**B**).
5. Check engine oil level (**C**). Level must be between **D** and **E**. **Note:** The oil level may be higher than **D** at start up.
6. If equipped, turn on the main battery switches.
7. Insert the key into the ignition switch (**O**). Turn the key one step to the right (**I**) to switch on engine system voltage and instrumentation.
8. Make sure that the fuel gauge is operating and that you have enough gasoline (**F**).



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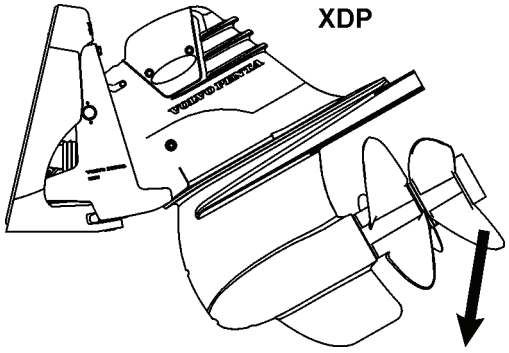
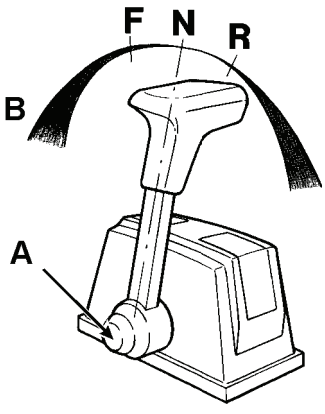


22392-1

9. Lower the drive unit to normal run position; make sure the water intakes are submerged. There should be no obstructions in the water near the propellers.

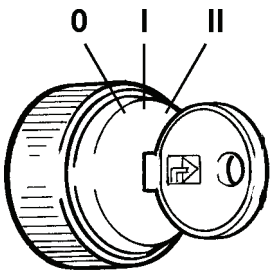
Starting the Engine (Cold Start)

GL Models
A cold engine may require priming before you can start it. To prime the engine:



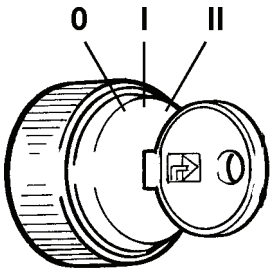
21183-1

1. Turn the ignition switch OFF (**0**).
2. Disengage the drive mechanism by pressing the gear shift release button (**A**).
3. Depress the throttle lock and move the control lever to FULL THROTTLE (**B**) in order to activate the accelerator pump and prime the engine.
4. Return the remote control handle to a fast idle position (about 1000 RPMs).
5. Turn the ignition switch to START (**II**) and hold it there until the engine starts, but for no longer than 10 seconds.
6. Once the engine starts, keep the throttle at a fast idle (about 1000 RPMs) for 30 seconds before returning to NEUTRAL.
7. Repeat priming if necessary.



21181

NOTICE! Too much priming may flood the engine. If the engine fails to start after a few attempts, there may be a problem that needs to be addressed. See your authorized Volvo Penta dealer for service.



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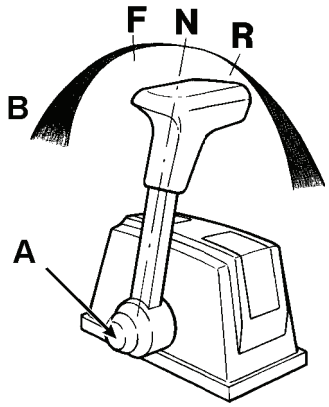

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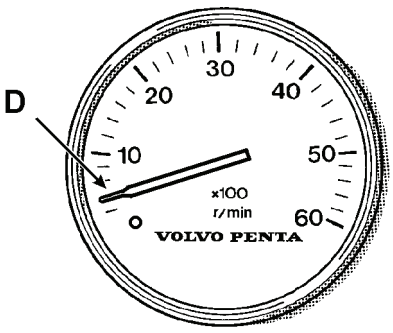

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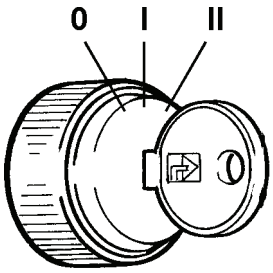


21181

Fuel Injected Models

1. Move the control handle to the NEUTRAL detent position.
2. Turn the ignition switch to START (**II**) and hold, for no longer than ten seconds or until engine starts. If the engine does not start, let go momentarily, then try again.
3. As soon as engine starts, release key to ON or RUN (**I**).

If the Engine Floods

GL Models

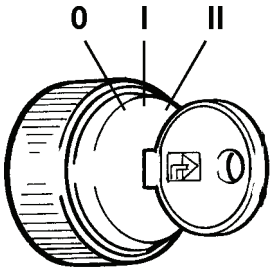
1. Disengage the shift mechanism.
2. Move the remote control lever to FULL THROTTLE (**B**).
3. Turn the key switch to START (**II**).
4. As soon as the engine starts:
   - Return the remote control handle to IDLE.
   - Turn the key to ON or RUN (**I**).
   - Move the remote control handle to FAST IDLE to warm up the engine. Do not exceed 1000 RPM.

Fuel Injected Models

Advance the control handle to FULL THROTTLE (**B**) to clear a flooded engine. In this throttle position, with the engine speed below 400 RPM (**D**–cranking speed), the ECM shuts off the fuel injectors so no fuel is delivered. When the throttle position is moved back to neutral, the ECM returns to normal operating mode.

NOTICE! Be prepared to quickly move the control handle to IDLE once the engine starts. This will avoid over-speeding and possibly damaging the engine.

NOTICE! Immediately after engine start-up, look at all instruments. If any readings are abnormal, stop the engine and determine the cause.



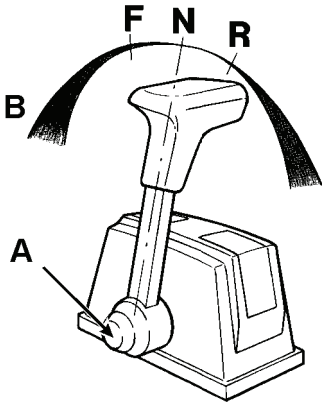
21181

Starting the Engine (Warm Start)

1. Move the control handle to the NEUTRAL detent position.
2. Turn the ignition switch to START (**II**) and hold, for no longer than ten seconds or until engine starts. If the engine does not start, let go momentarily, then try again.
3. As soon as engine starts, release key to ON or RUN (**I**).

NOTICE! Never leave the key in the ON (I) position with the engine not running. Never turn the key to START (II) when the engine is running. Either situation could damage the engine.

NOTICE! If the engine floods during a warm start, simply follow the directions provided in the section entitled *If the Engine Floods* on page 37 to restart the engine.



21183-1

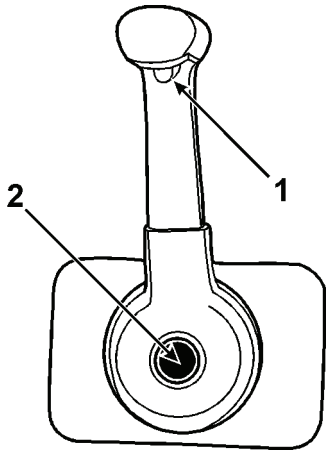
Stopping the Engine

1. Move the remote control lever to NEUTRAL (**N**).
2. Let engine return to idle.
3. Turn ignition key to OFF (**0**).

NOTICE! Do not stop the engine at speeds above idle or “speed up” the engine while turning off the ignition. Do not stop the engine while in gear or while the boat is moving. Engine damage could result.

Operating Remote Controls

Familiarize yourself with remote control operations before starting the engine.



22788-1

Using the Gear Shift Release Button

Method 1

To disengage the gear shift mechanism on remote controls **with** a throttle lock:

1. Place the control handle in NEUTRAL.
2. Depress the throttle lock (**1**) while pressing the gear shift release button (**2**).
3. Move control handle in the desired direction to increase throttle.

The throttle lock and gear shift release mechanism will automatically re-engage when the control handle is returned to the NEUTRAL position.

Method 2

To disengage the gear shift mechanism on remote controls **without** a throttle lock:

1. Push in and hold gear shift release button (**2**).
2. Move control handle FORWARD to increase throttle.

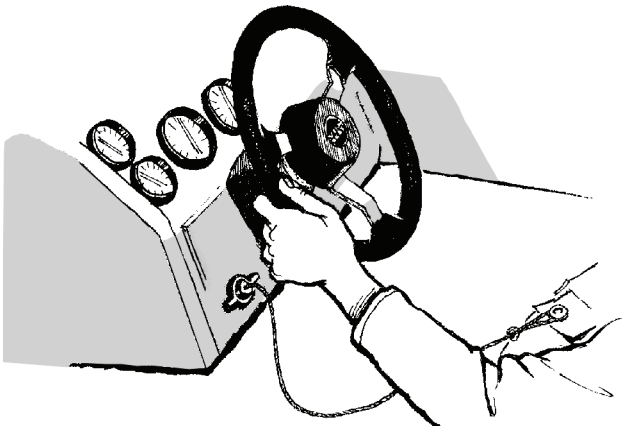
The gear shift release mechanism will automatically re-engage when the control lever is returned to NEUTRAL.

For additional information about remote control features and operation, please refer to the chapter entitled *Controls* on page 29.

Steering System Operation

The steering system for your Volvo Penta sterndrive is operated by a steering cable connected to the helm. Restricting movement of the steering cable will limit or stop the steering system's hydraulic assist.

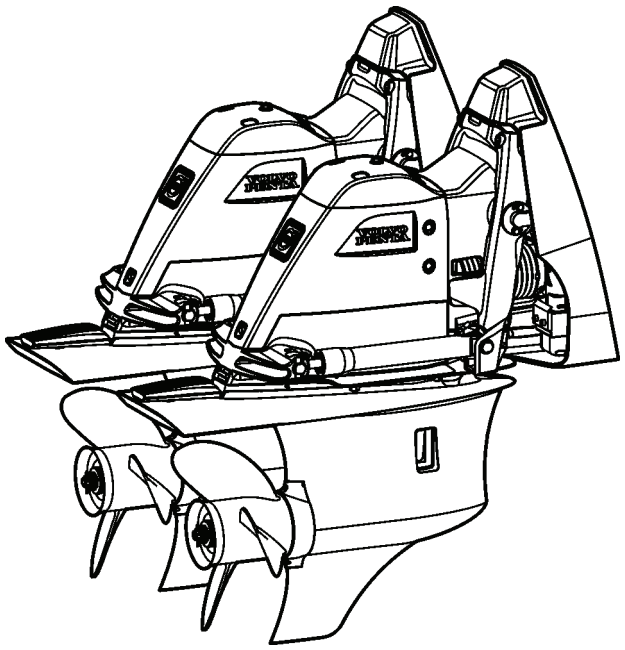
Do not interfere with or restrict steering cable movement through the last 90° of bend at the engine. Do not use cable retainers, clamps, or tie straps. Using one or all of these could restrict the cable movement near the engine. Do not tie wiring harnesses or other control cables to the steering cable. Make sure deck combing and bulkheads allow for steering cable movement.



21182

If the power steering system stops working, it will feel harder to steer. If this condition occurs, look for possible causes and fix them if possible. If the power steering system cannot be corrected on board, proceed at a reduced speed. You will be able to steer the boat, but with increased effort. See your authorized Volvo Penta dealer as soon as possible to correct your power steering system.

At slow speeds (no wake), your boat may tend to wander. This is normal and may be overcome by anticipating bow direction and correcting with steering wheel. A slightly higher throttle and trim setting may also lessen the tendency to "wander." Changing weight distribution, aft to forward, can also affect slow speed steering.



50405

Twin Unit Steering

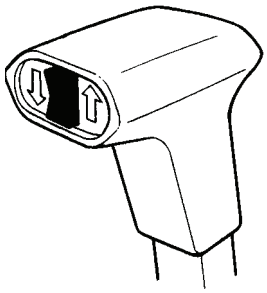
Twin engine boats may have only one engine with a fully operational power steering system. That power steering system is on the starboard engine; therefore, when operating on a single engine use the starboard engine.

Using a port engine that does not have a functional power steering system will cause an increased effort in steering control, due to absence of power assist.

NOTICE! Both engines must be running during close maneuvering or at slow speeds. If only one engine is running, water may be forced back through the underwater exhaust outlet and cause serious engine damage. Do not attempt to plane boat while operating on a single engine; operating with a single engine at full throttle could cause engine or transmission damage.

Power Trim and Tilt Operation

Trimming and tilting the drive is done from a control switch mounted on the remote control or by using the switches on the dash. When using the dash mounted switches, the bottom button lowers the bow and the top button raises the bow. The switch on the remote control lever raises and lowers the drive when its upper or lower segment is pressed.

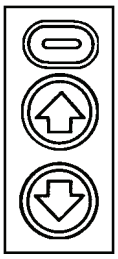


22767

NOTICE! Allow the trim/tilt switch to return to its center position when the drive unit reaches the maximum raised or lowered position. This will prevent your trim/tilt motor from overheating.

The trim/tilt motor is protected from overheating by an internal thermal overload switch. If the electric motor stops while tilting, release the switch and allow the overload switch to cool and automatically reset itself. When the overload switch has reset, tilting may be resumed. Make sure the drive unit is not being restrained, causing the motor to overheat. If the electric motor still does not operate, check the in-line 5-amp fuse in the remote control handle, the 10-amp fuse located in the fuse box, or the 40-amp[1] circuit breaker located in the fuse box.

For additional information about Trim and Tilt controls, please refer to the chapter entitled *Controls* on page 29.



22766-1

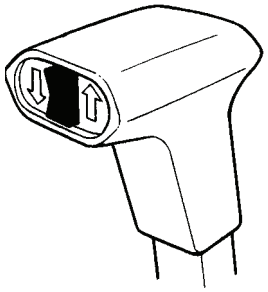
Power Trim Operation

The power trim is normally used before you accelerate onto plane, after you reach the desired RPM or boat speed, and when there is a change in water or boating conditions. Locate passengers and equipment in the boat so that the weight is balanced fore and aft, and side to side. Trimming will not cancel an unbalanced load.

To operate the trim, push and hold the switch “bow-up” or “bow-down” until the desired bow position is reached. The trim may be operated at any boat speed or at rest. Avoid operating the trim system when running in reverse.

Observe the trim/tilt gauge, which indicates the bow position achieved. The upper scale (0 to 5) of the trim gauge indicates the “bow-up” positions, and lower scale (6 to 10) of the trim gauge indicates the “bow-down” positions.

1. 50-amp on Ocean Series (OSi) engines.



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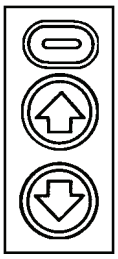


22766-1

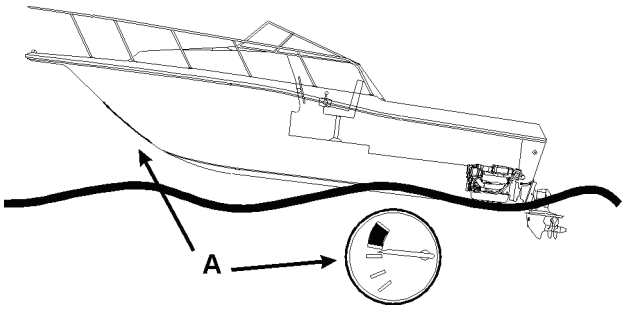
Determining the Proper Trim

The effect of the maximum “bow-up” and “bow-down” positions will be similar for most boats. The bow position best for your operating conditions could be at any trim setting between the maximum “bow-up” and “bow-down” positions.

The boat will be properly trimmed when the trim angle provides the best boat performance for your operating conditions. On models without power steering, the trim position that provides a balanced steering load is desirable.

To familiarize yourself with the power trim, make test runs at slower speeds and at various trim positions to see the effect of trimming. Note the time it takes for the boat to plane. Watch the tachometer and speedometer readings and the ride action of the boat.

The following sections entitled *Operating in “Bow-up” Position* and *Operating in “Bow-down” Position* provide additional information on this topic.

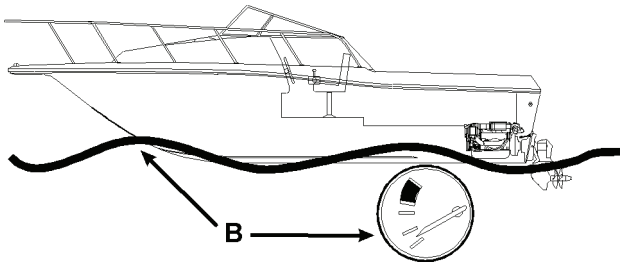


22796

Operating in “Bow-up” Position

The “bow-up” **A** position is normally used for cruising, running with a choppy wave condition, or running at full speed. In a full “bow-up” position the boat may tend to self-steer. You may have to compensate with the steering wheel to keep the boat in a straight-ahead path. In this position the boat’s bow will tend to raise clear of the water. Excessive “bow-up” trim will cause propeller ventilation resulting in propeller slippage. Engine RPM will also increase, but boat speed will not increase and may even drop.

⚠ CAUTION! Use caution when operating in rough water or crossing another boat’s wake. Excessive “bow-up” trim may result in the boat’s bow rising rapidly and possibly throwing the boat’s occupants into the water.



22797

Operating in "Bow-down" Position

The "bow-down" **B** position is normally used for acceleration onto plane, operating at slow planing speeds, and running against a choppy wave condition. In the fully "bow-down" position the boat may tend to self-steer. You may have to compensate with the steering wheel to keep the boat in a straight-ahead path. In this position the boat's bow will tend to go deeper into the water. If the boat is operated at high speed and/or against high waves, the bow of the boat will plow into the water. The boat may tend to bow steer or spin about rapidly and possibly eject occupants.

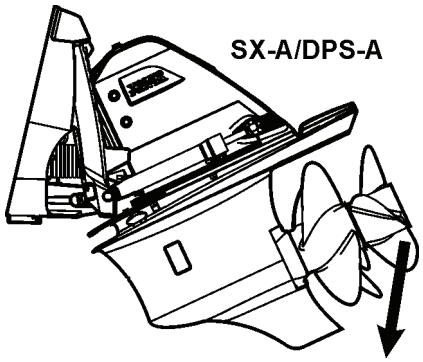
NOTICE! The boat trim should be adjusted to provide balanced steering as soon as possible each time you get underway. Some boat, engine, and propeller combinations may encounter boat instability and/or high steering torque when operated at or near the limits of the "bow-up" or "bow-down" positions. Boat stability and steering torque can also vary due to changing water conditions. If you experience boat instability and/or high steering torque, see your Volvo Penta dealer to correct these conditions.

Power Tilt Operation

Tilting is normally used for raising the drive unit to obtain clearance when beaching, launching from a trailer, or mooring. When tilting the drive unit, the boat should be at rest or at idle speed only.

The trim/tilt switch controls the tilting feature of the drive unit. When the trim/tilt switch is held in the "bow-up" position, the drive unit tilts up until the switch is released or the drive unit reaches the maximum tilt position. The trim/tilt gauge will indicate the "tilt" position whenever the drive unit is in the tilt range.

NOTICE! Never exceed 1000 RPM when operating the drive unit in the tilted position (6°-29°) because it may damage the drive system. Never RUN the engine when the drive unit is tilted more then 30° or the drive will be damaged.



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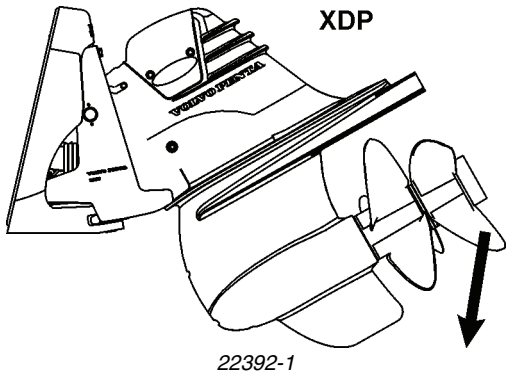
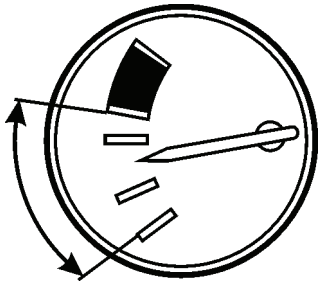


22392-1

Never operate the engine out of water or without water supplied to the engine. The water pump may be damaged or the engine may overheat. For additional information, see *Engine Flush* on page 96.

WARNING! To avoid possible contact with the propellers, never use the drive unit as a ladder or as a lift to board the boat. Never board at the rear of the boat when the engine is running, even if the engine is operating in neutral. Personal injury could result from contact with rotating engine parts and propellers.

Any malfunction of the trim/tilt system could result in a loss of impact protection. Malfunction can also result in loss of reverse thrust capability. If malfunction occurs, see your authorized Volvo Penta dealer.



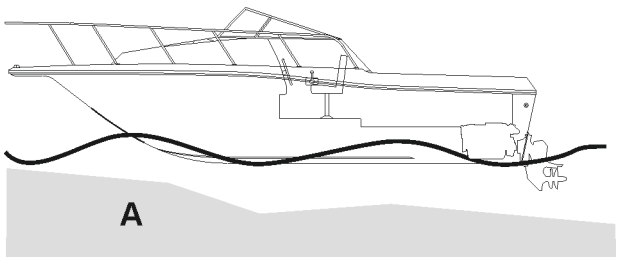
22781

Power Trim/Tilt Switch & Gauge Location

The power trim/tilt switch is located on the remote control handle or on the boat's dashboard. The trim indicator displays the drive position in the Trim range. With dual installations, it is permissible to individually trim the drive in Trim range. When the drive is in Beach range (7° to 10°), boat speed must be lower than planing speed. The engine must be stopped when fully tilted (Lift Range).

Special Boating Situations

The following section covers scenarios that are considered special boating situations. When using the boat in the following situations, there are some special procedures to take into consideration in order to keep the engine, transmission, drive, and propeller in top working condition.



22798

Shallow Water Operation

You may tilt the drive unit (6°-29°) to reduce the draft for shallow water **A** running as long as you do not exceed 1000 RPM. Exceeding 1000 RPM is not necessary. It will only increase the boat wake and will not increase boat speed appreciably.

NOTICE! Exceeding 1000 RPM with the drive unit tilted could damage drive train components. This type of damage is not covered by warranty. Never attempt to plane the boat or exceed 1000 rpm with the drive unit in a partially tilted position. Always return to the trim range as soon as possible to avoid damage to drive train. Never RUN the engine with the drive unit tilted more than 30° or the drive will be damaged.

When operating in shallow water, be sure the water intakes located in the lower gear unit are submerged at all times. Proceed at slow speed and lower drive unit immediately when deeper water is reached.

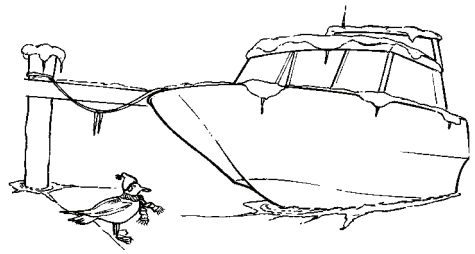
NOTICE! Be very careful when operating in shallow water; the intakes may pick up mud, sand, underwater vegetation, or other submerged debris. This may lead to overheating and engine damage.

22799

High Altitude Operation

Volvo Penta EFI engines have programmed altitude compensation; however, there may be a slight performance loss at altitudes above 5000 feet due to lower air density. If you are boating above 5000 feet for a short time, a lower pitch propeller will restore some of the lost performance. Long term use above altitudes of 5000 ft. may require a change in gear ratio which is not covered under the Volvo Penta Limited Warranty.

Volvo Penta carbureted engines may require mechanical modifications. See your Volvo Penta dealer for more information.



21199

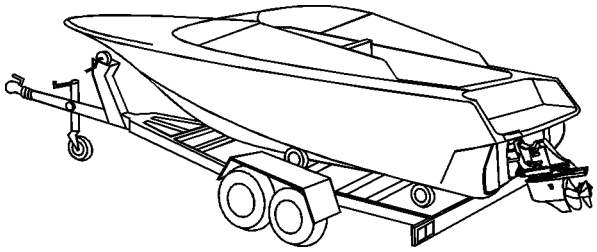
Operating in Freezing Temperatures

When freezing temperatures are forecast and the boat will be operated and left in the water, the drive unit must remain in the tilted down (submerged) position at all times to prevent water in the drive unit from freezing. Upon completion of engine operation, drain the engine as described in the maintenance section of this manual.

Salt Water Operation

You can use your Volvo Penta sterndrive in either fresh or salt water.

We recommend that you use fresh water to flush out the engine and drive as described in the maintenance section of this manual after you use it in polluted or salt water. This will prolong the service life of the manifolds and risers. For additional information, see *Engine Flush* on page 96.



22800

Trailering Your Boat

If your boat will be trailered, tilt the drive unit out of the water. After you remove your boat from the water, lower the drive unit to the RUN (down) position until the cooling system drains thoroughly.

Rinse the entire drive exterior with fresh water, then dry it and spray it with anti-corrosion spray.

Before trailering your boat on the road, check the ground clearance of the drive unit. When trailering, the drive unit may be in the up or down position. There must be at least 15 inches (38.1 cm) clearance between the lower gear unit and the ground. If the clearance is less than 15 inches (38.1 cm), raise the drive unit.

NOTICE! Be very careful when you back out of driveways or cross railroad tracks, so that the sterndrive does not hit the ground.

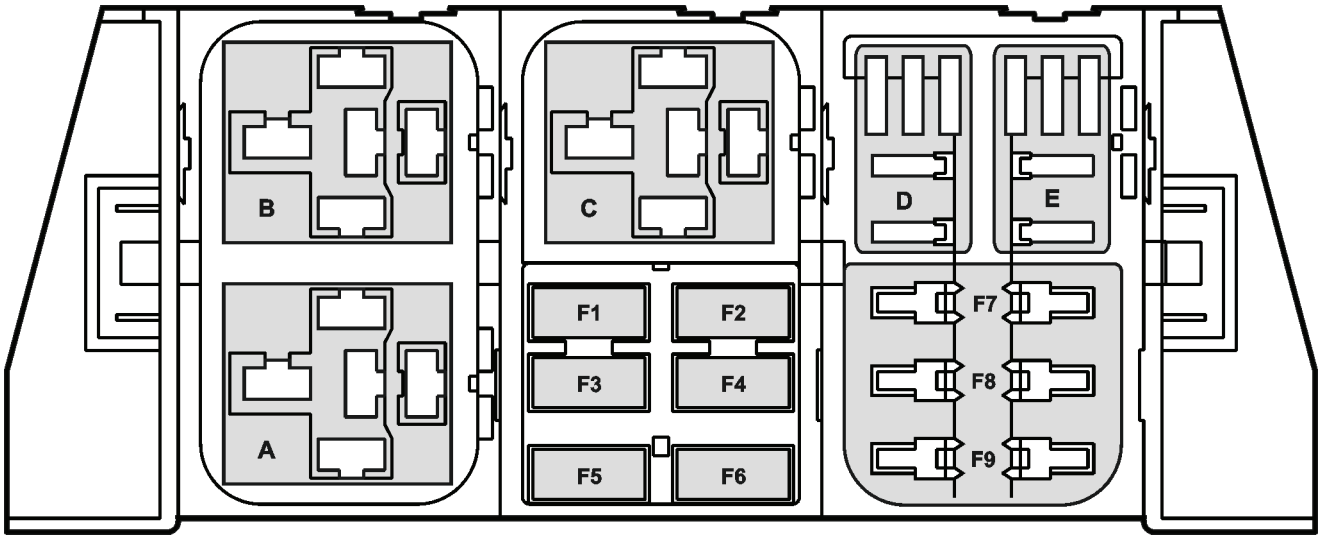
Make sure that the boat fits the trailer properly. In many cases, loss of performance and speed is due to improper trailer support and too much tie-down pressure, which causes the boat bottom to deform. The boat should rest firmly on the trailer with maximum tie-down pressure applied at the bow and transom only.

Your Volvo Penta product consists of three components: the engine, transom shield and the sterndrive. There are certain parts on each component that you, the owner, must take care of to make sure that your Volvo Penta product stays in optimum running condition. The important parts of each component are shown in the illustrations on the following “Features” pages. Explanations of these parts and systems are described below; the maintenance procedures are found in the Maintenance section.

Circuit Breakers and Fuses

Fuse and Relay Box Layout

Several spare fuses and relays are located on the inside of the fuse and relay box cover. In case of malfunctioning or faulty fuses and relays, use the spares provided.



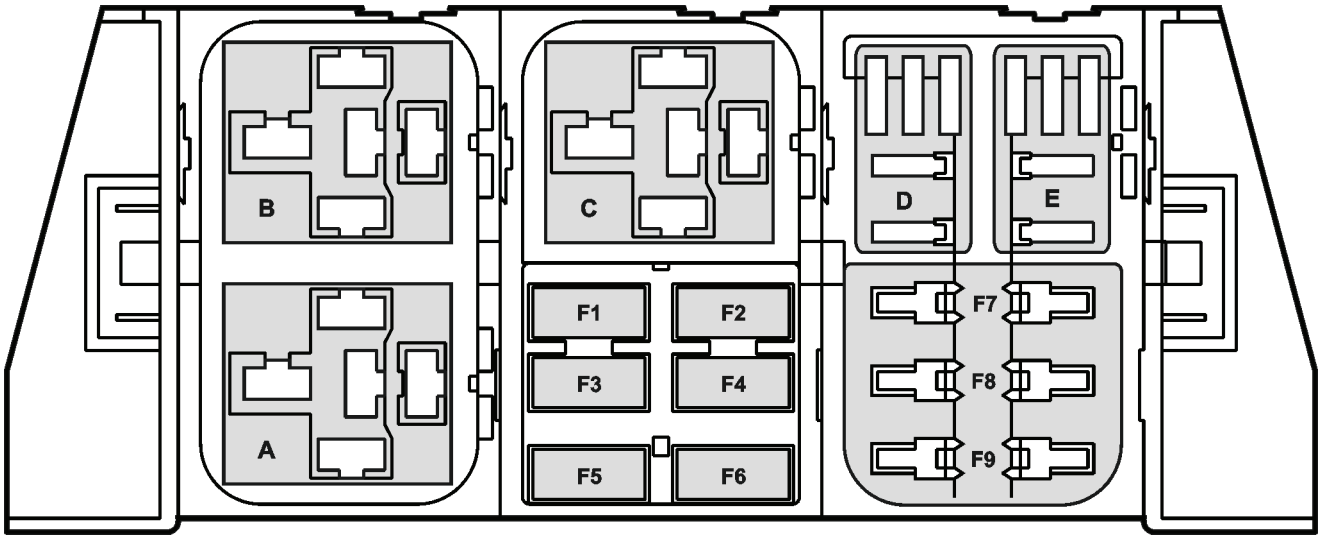
23672

3.0GLP-J

A Trim Down Relay
B Trim Up Relay
C Starter Relay
D Not Used
E Ignition Relay
F1 Not Used
F2 10 Amp Fuse (Trim Control)
F3 Not Used
F4 15 Amp Fuse (Ignition)
F5 Not Used
F6 Not Used
F7 40 Amp Fuse (Instrument Panel)
F8 40 Amp Circuit Breaker (Trim Pump)
F9 20 Amp Fuse (Starter)

4.3GL-J(F), 5.0GL-J(F)

A Trim Down Relay
B Trim Up Relay
C Starter Relay
D Fuel Pump Relay
E Ignition Relay
F1 Not Used
F2 10 Amp Fuse (Trim Control)
F3 7.5 Amp Fuse (Fuel Pump)
F4 15 Amp Fuse (Ignition)
F5 Not Used
F6 Not Used
F7 40 Amp Fuse (Instrument Panel)
F8 40 Amp Circuit Breaker (Trim Pump)
F9 20 Amp Fuse (Starter)

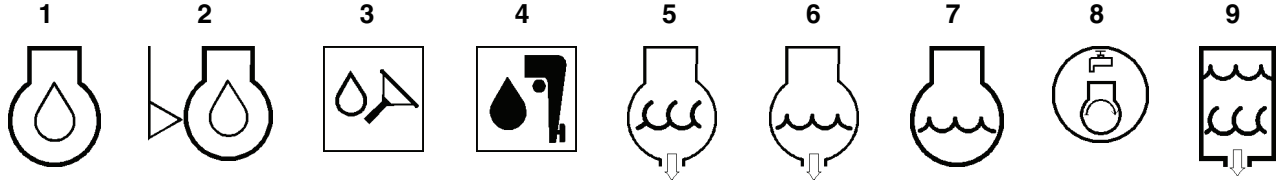


23672

4.3GXi-J(F), 4.3OSi-J(F), 5.0GXi-J(F), 5.0OSi-J(F), 5.7Gi300-J(F), 5.7GXi-J(F), 5.7OSi300-J(F), 5.7OSXi-J(F), 8.1Gi-J(F), 8.1GXi-J(F), 8.1OSi-J(F)

A Trim Down Relay
B Trim Up Relay
C Starter Relay
D Fuel Pump Relay
E Ignition Relay
F1 15 Amp Fuse (EVC)
F2 10 Amp Fuse (Trim Control)
F3 20 Amp Fuse (Fuel Pump)
F4 15 Amp Fuse (Ignition)
F5 5 Amp Fuse (Vessel Switch)
F6 20 Amp Fuse (ECM)
F7 40 Amp Fuse (Instrument Panel)
F8 40 Amp or 50 Amp Circuit Breaker (Trim Pump)[1]
F9 20 Amp Fuse (Starter)

Legend of Symbols Used in Engine Diagrams



22341 *22874* *22343* *22342* *22345* *22372* *22873* *22346* *22377*

1 Engine Oil
2 Engine Oil Level
3 Power Steering Fluid
4 Sterndrive Oil
5 Engine Raw Water Drain
6 Engine Coolant Drain (Closed Cooling)
7 Engine Coolant
8 Running Engine Flush
9 Heat Exchanger Raw Water Drain

1. Ocean Series (OSi) engines require the use of a 50 Amp fuse. All other engines require a 40 Amp fuse.

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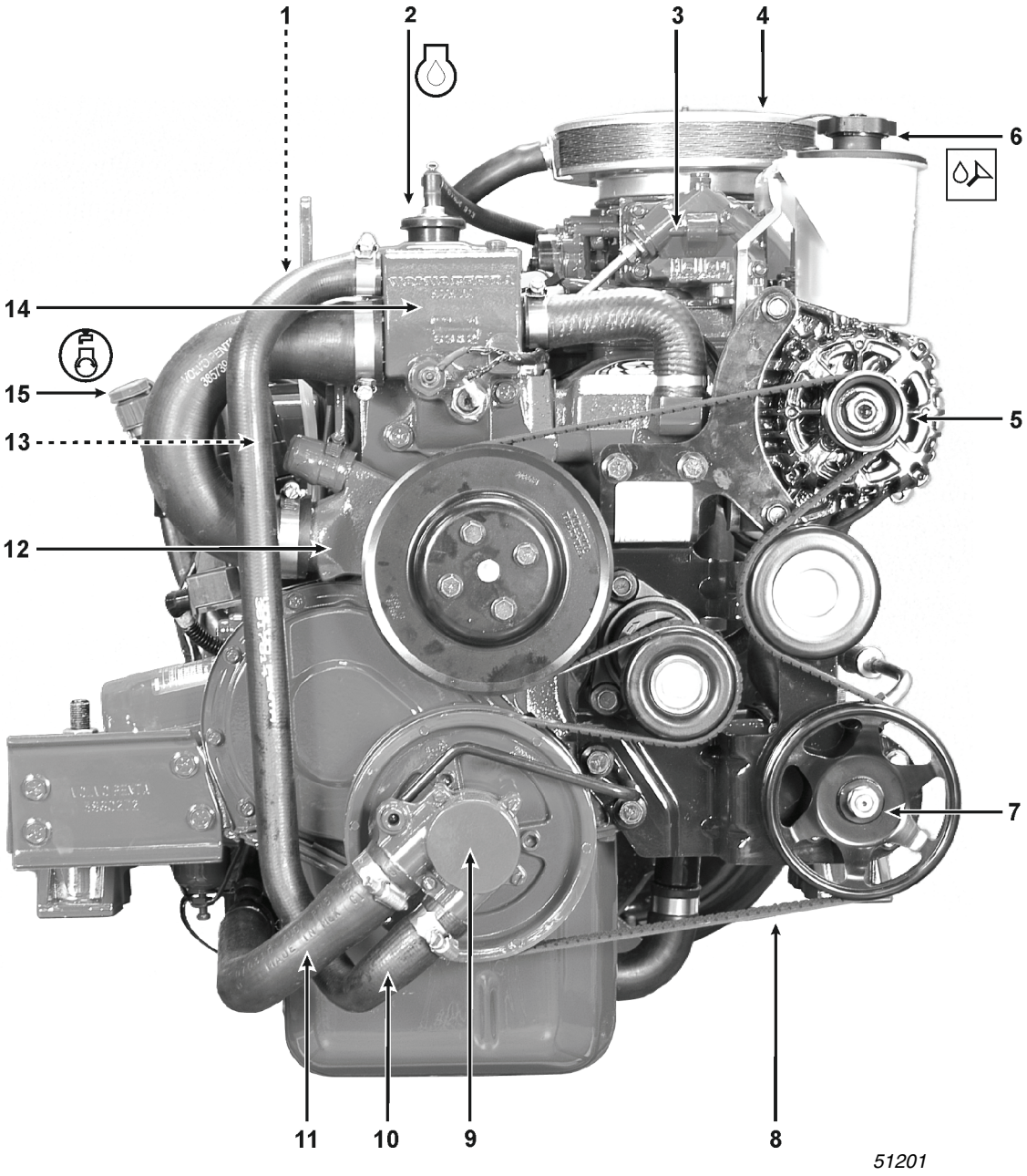
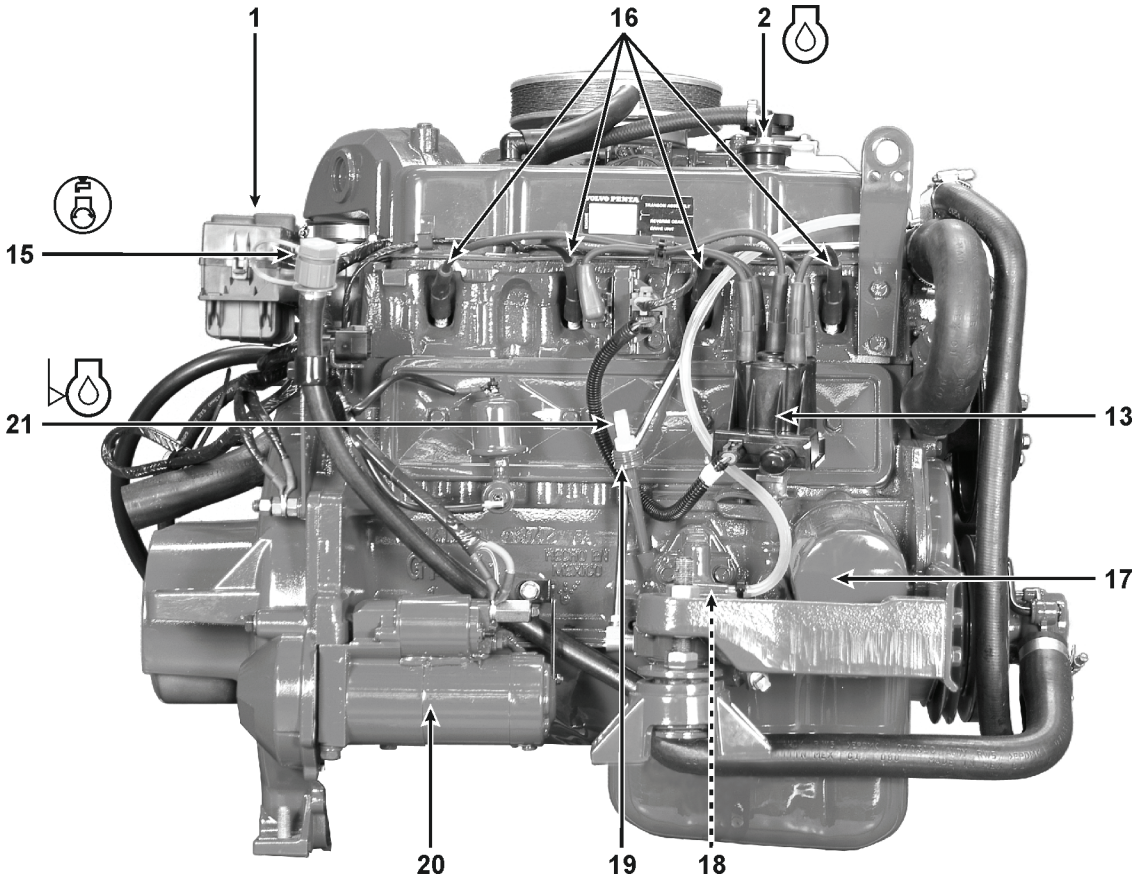
3.0GLP-J, 3.0GXi-J



1. Circuit Breaker and Fuses
2. Oil Fill Cap
3. Carburetor
4. Flame Arrestor
5. Alternator
6. Power Steering Fluid Fill
7. Power Steering Pump
8. Serpentine Belt
9. Raw Water Pump
10. Raw Water Outlet
11. Raw Water Inlet
12. Engine Water Circulation Pump
13. Distributor
14. Engine Thermostat Housing
15. Running Engine Flush Port
16. Spark Plugs
17. Oil Filter
18. Fuel Pump and Filter
19. Oil Siphon Tube
20. Starter
21. Oil Dipstick
22. Exhaust Riser
23. Exhaust Overheat Sensor
24. Exhaust Manifold Water Drain
25. Engine Raw Water Drain
26. Exhaust Manifold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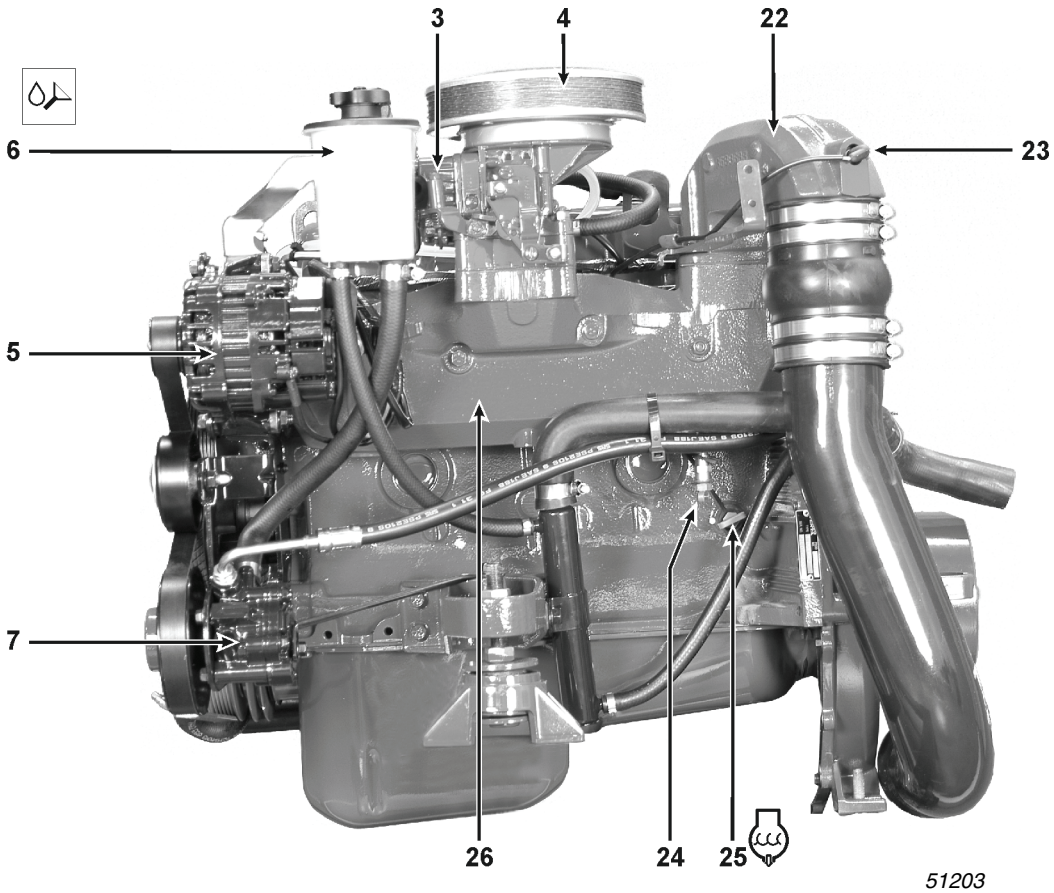
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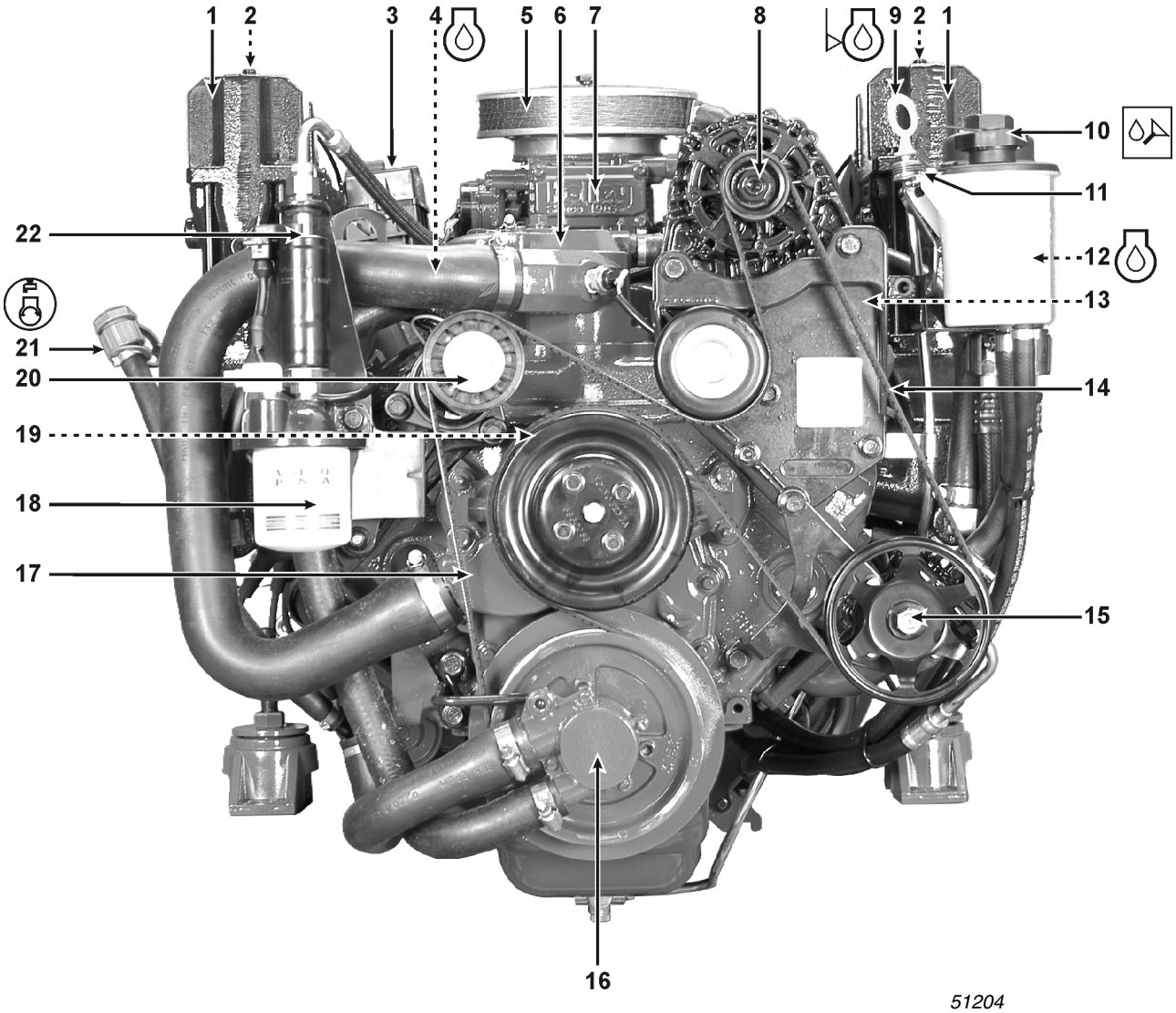
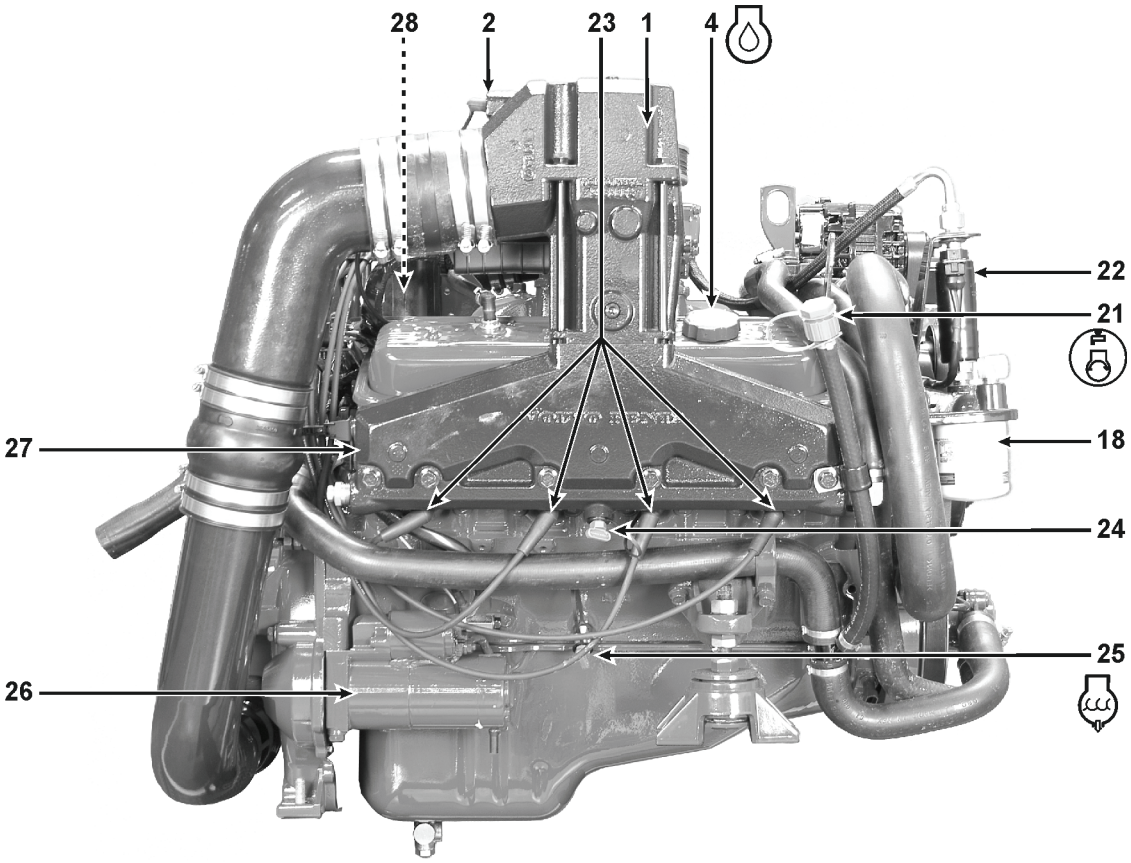
51203

4.3GL-J, 5.0GL-J

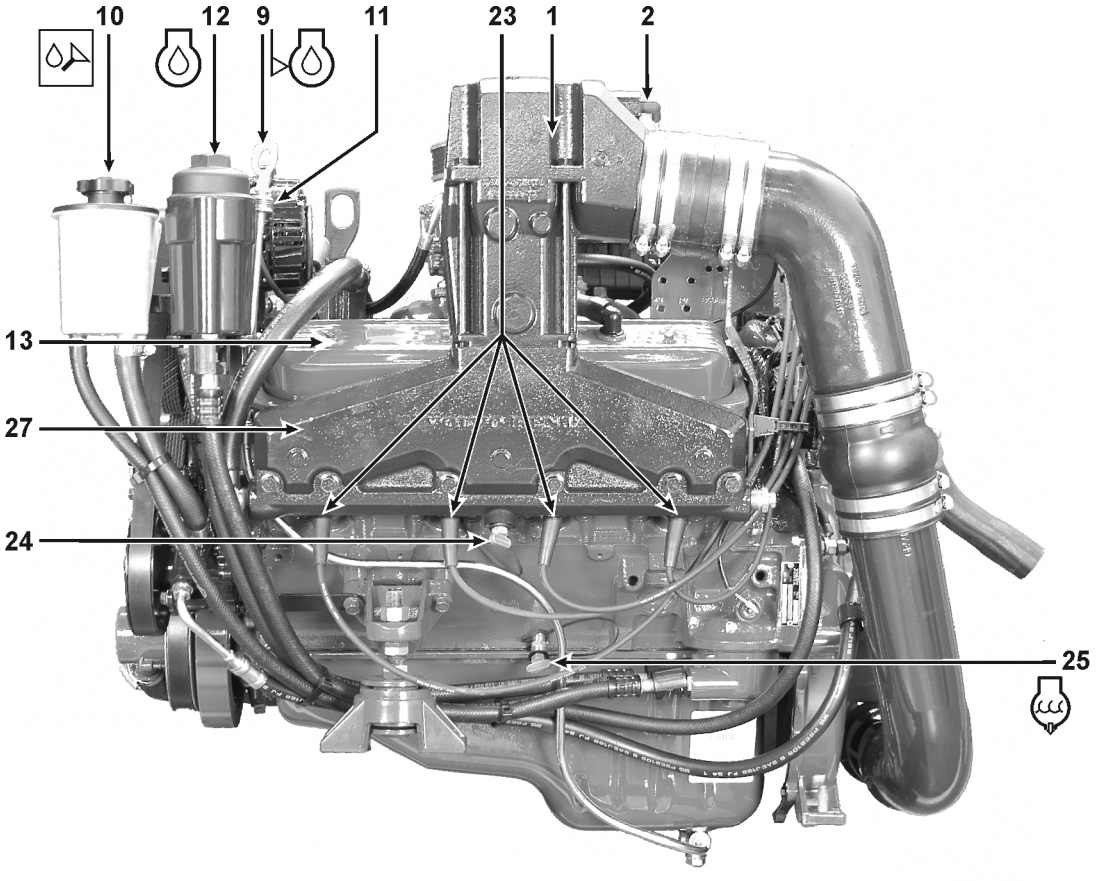


1. Exhaust Risers
2. Exhaust Overheat Sensors
3. Circuit Breaker and Fuses
4. Oil Fill Cap[1]
5. Flame Arrestor
6. Engine Thermostat Housing
7. Carburetor
8. Alternator
9. Oil Dipstick
10. Power Steering Fluid Fill
11. Oil Siphon Tube
12. Engine Oil Filter Assembly
13. Oil Fill Cap[2]
14. Serpentine Belt
15. Power Steering Pump
16. Raw Water Pump
17. Engine Water Circulation Pump
18. Fuel Filter
19. Intake Manifold Drain Plug[3]
20. Automatic Belt Tensioner
21. Running Engine Flush Port
22. Fuel Pump
23. Spark Plugs
24. Exhaust Manifold Water Drain
25. Engine Raw Water Drain[4]
26. Starter
27. Exhaust Manifold
28. Distributor

1. 5.0GL Only
2. 4.3GL Only (Not shown)
3. 4.3GL Only (Not shown)
4. Raw water cooled engines only.

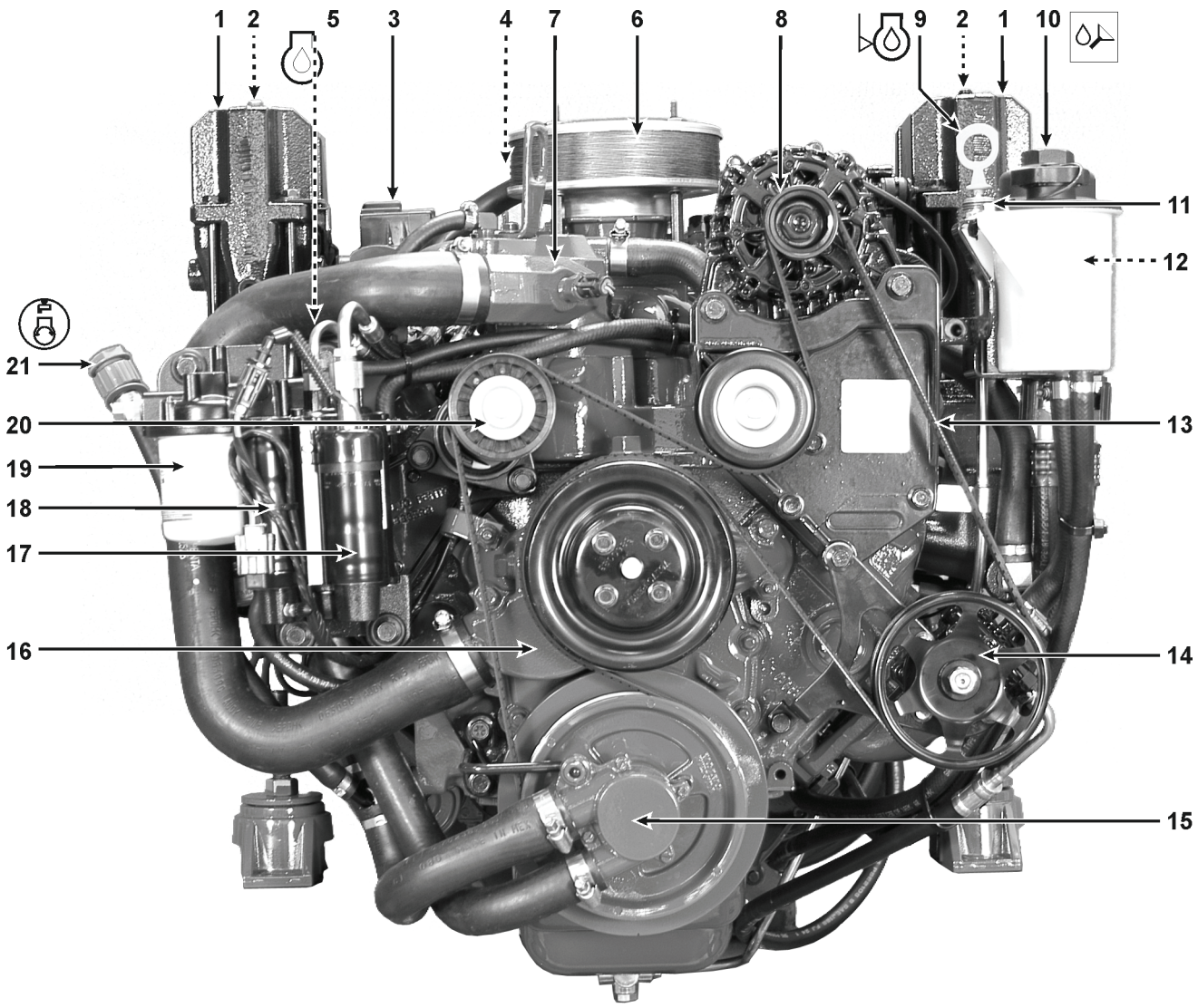


51205



51206

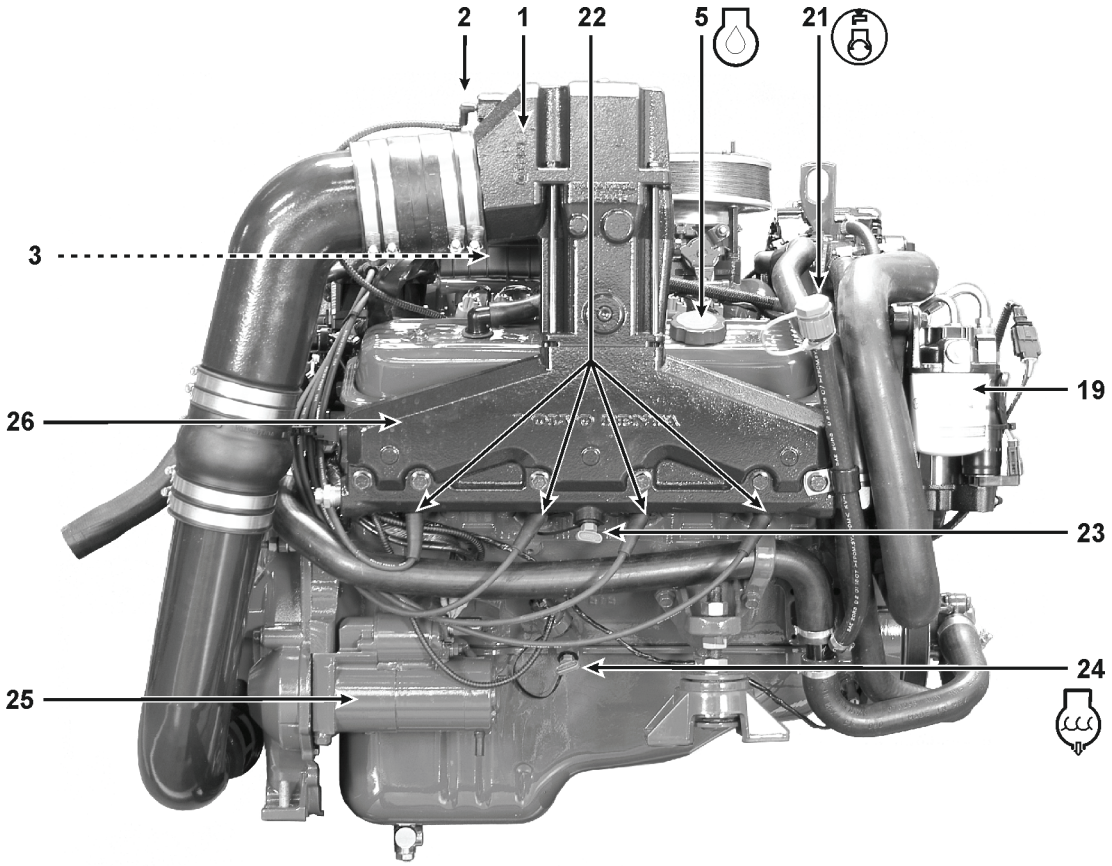
4.3GXi-J, 5.0GXi-J, 5.7Gi300-J, 5.7GXi-J



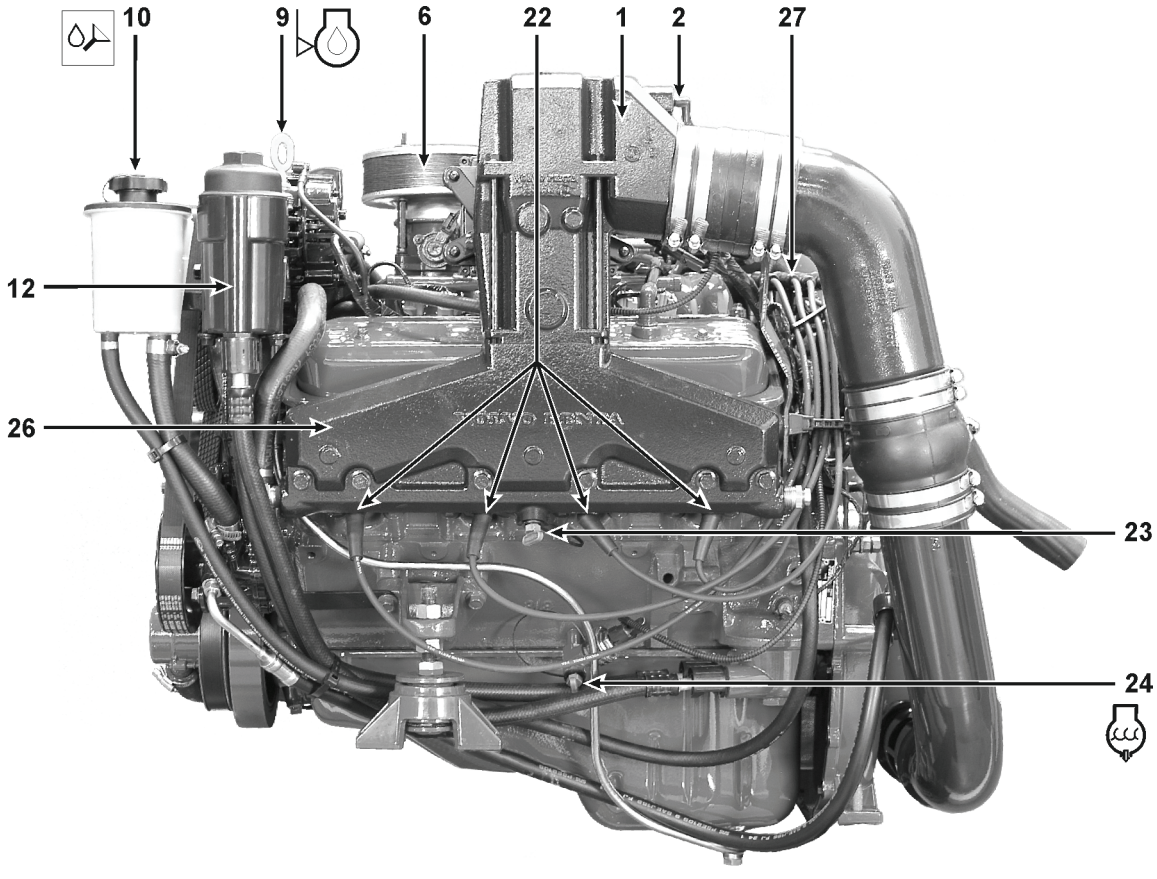
51207

1. Exhaust Risers
2. Exhaust Overheat Sensors
3. Circuit Breaker and Fuses
4. **4.3GXi Only:** Circuit Breaker and Fuses
5. Oil Fill Cap
6. Flame Arrestor
7. Engine Thermostat Housing
8. Alternator
9. Oil Dipstick
10. Power Steering Fluid Fill
11. Oil Siphon Tube
12. Engine Oil Filter Assembly
13. Serpentine Belt
14. Power Steering Pump
15. Raw Water Pump
16. Engine Water Circulation Pump
17. Fuel Pump (High Pressure)
18. Fuel Pump (Low Pressure)
19. Fuel Filter
20. Automatic Belt Tensioner
21. Running Engine Flush Port
22. Spark Plugs
23. Exhaust Manifold Water Drain
24. Engine Raw Water Drain[1]
25. Starter
26. Exhaust Manifold
27. Distributor

1. Raw water cooled engines only.

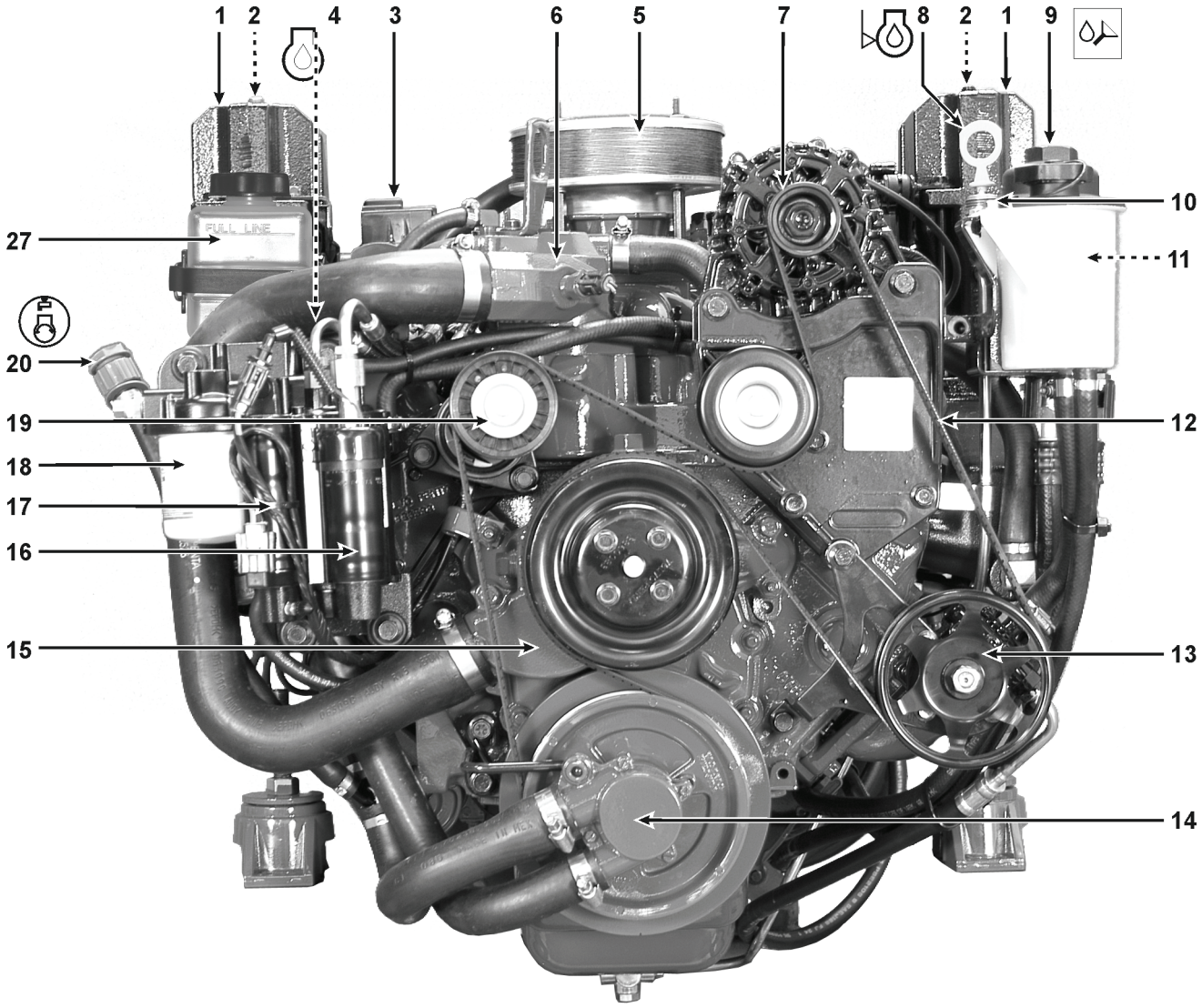


51208



51209

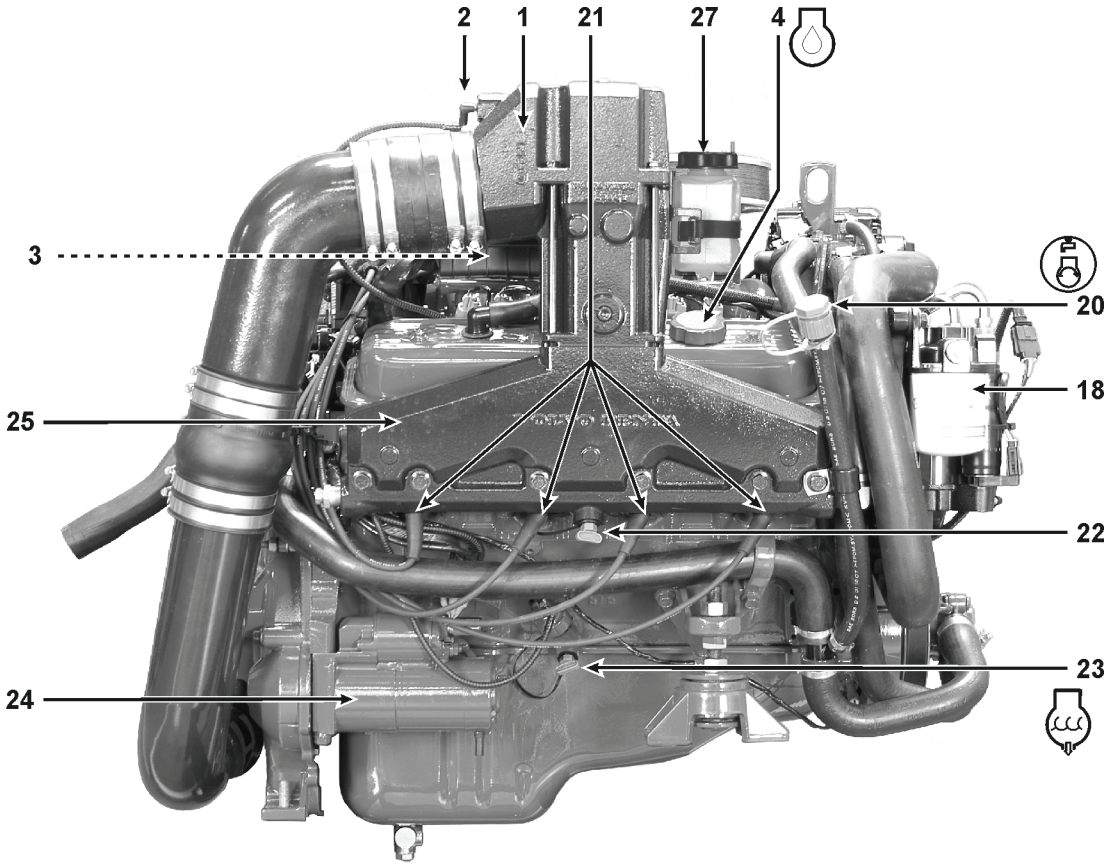
4.3OSi-J, 5.0OSi-J, 5.7OSi300-J, 5.7OSXi-J, 8.1OSi-J



51221

1. Exhaust Risers
2. Exhaust Overheat Sensors
3. Circuit Breaker and Fuses
4. Oil Fill Cap
5. Flame Arrestor
6. Engine Thermostat Housing
7. Alternator
8. Oil Dipstick
9. Power Steering Fluid Fill
10. Oil Siphon Tube
11. Engine Oil Filter Assembly
12. Serpentine Belt
13. Power Steering Pump
14. Raw Water Pump
15. Engine Water Circulation Pump
16. Fuel Pump (High Pressure)
17. Fuel Pump (Low Pressure)
18. Fuel Filter
19. Automatic Belt Tensioner
20. Running Engine Flush Port
21. Spark Plugs
22. Exhaust Manifold Water Drain
23. Engine Raw Water Drain[1]
24. Starter
25. Exhaust Manifold
26. Distributor
27. Drive Oil Bottle

1. Raw water cooled engines only.



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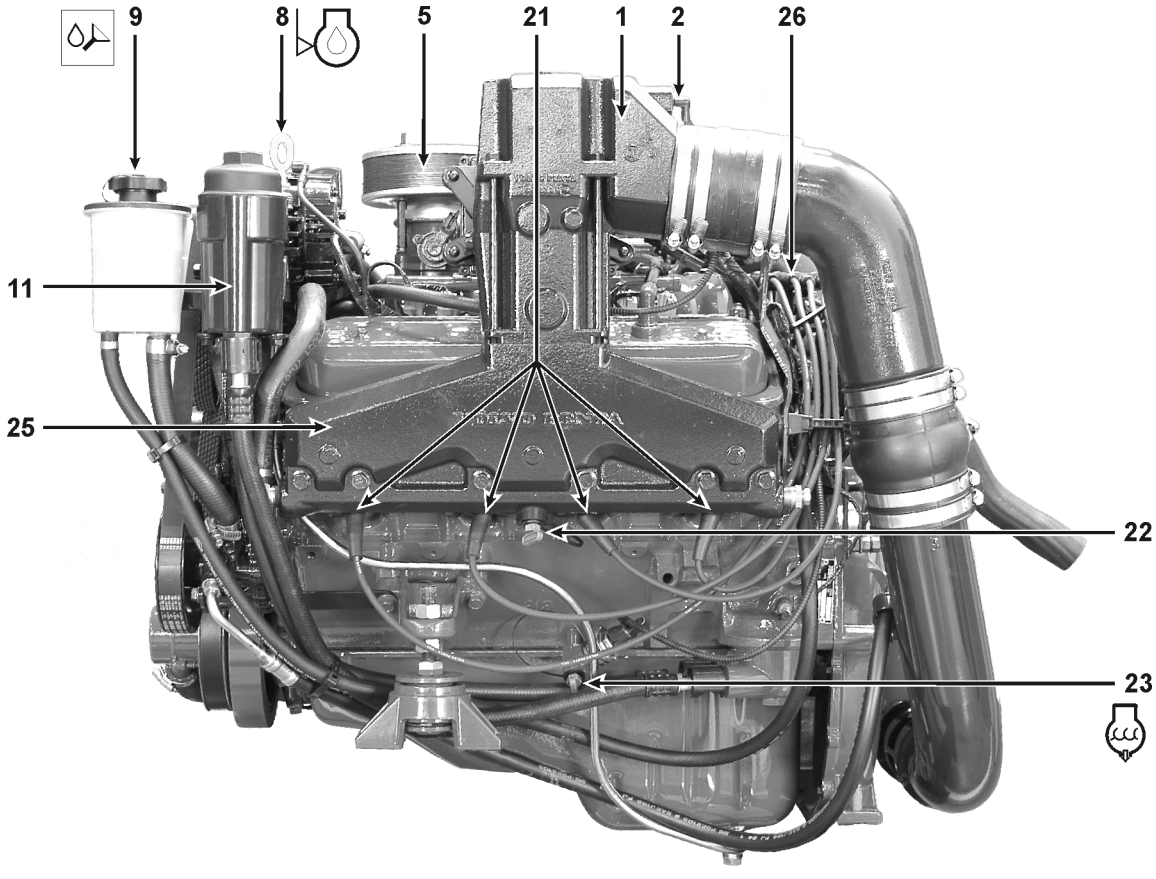
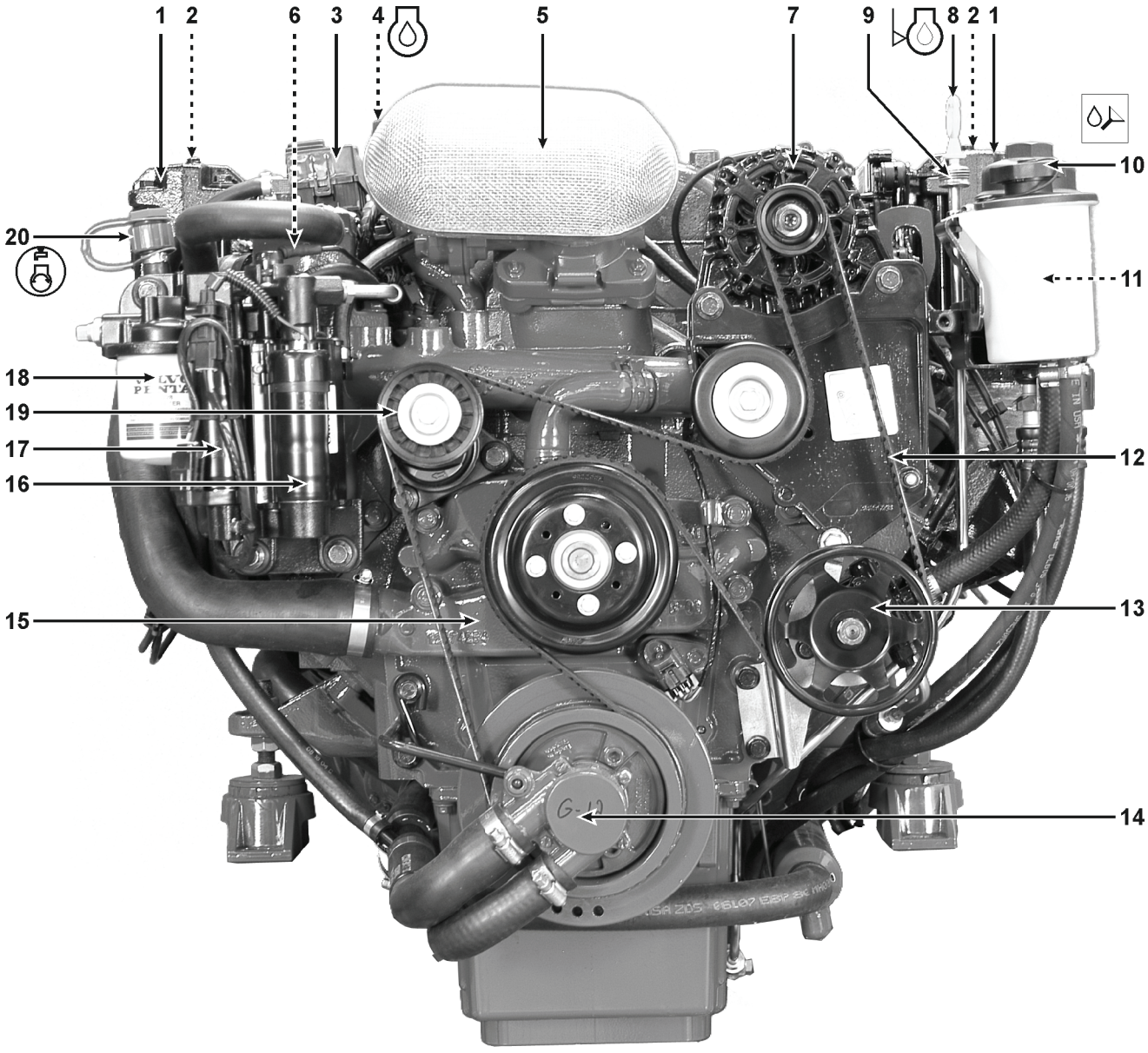


51223

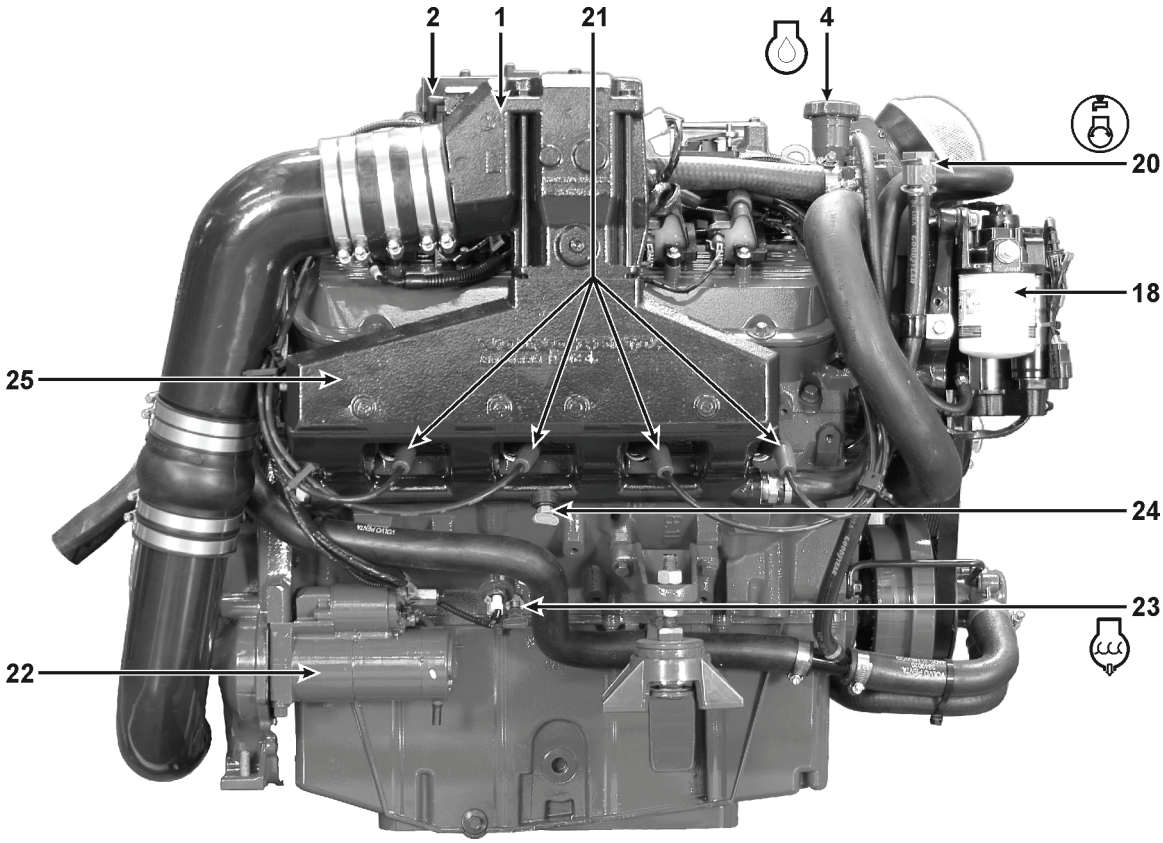
8.1Gi-J, 8.1GXi-J



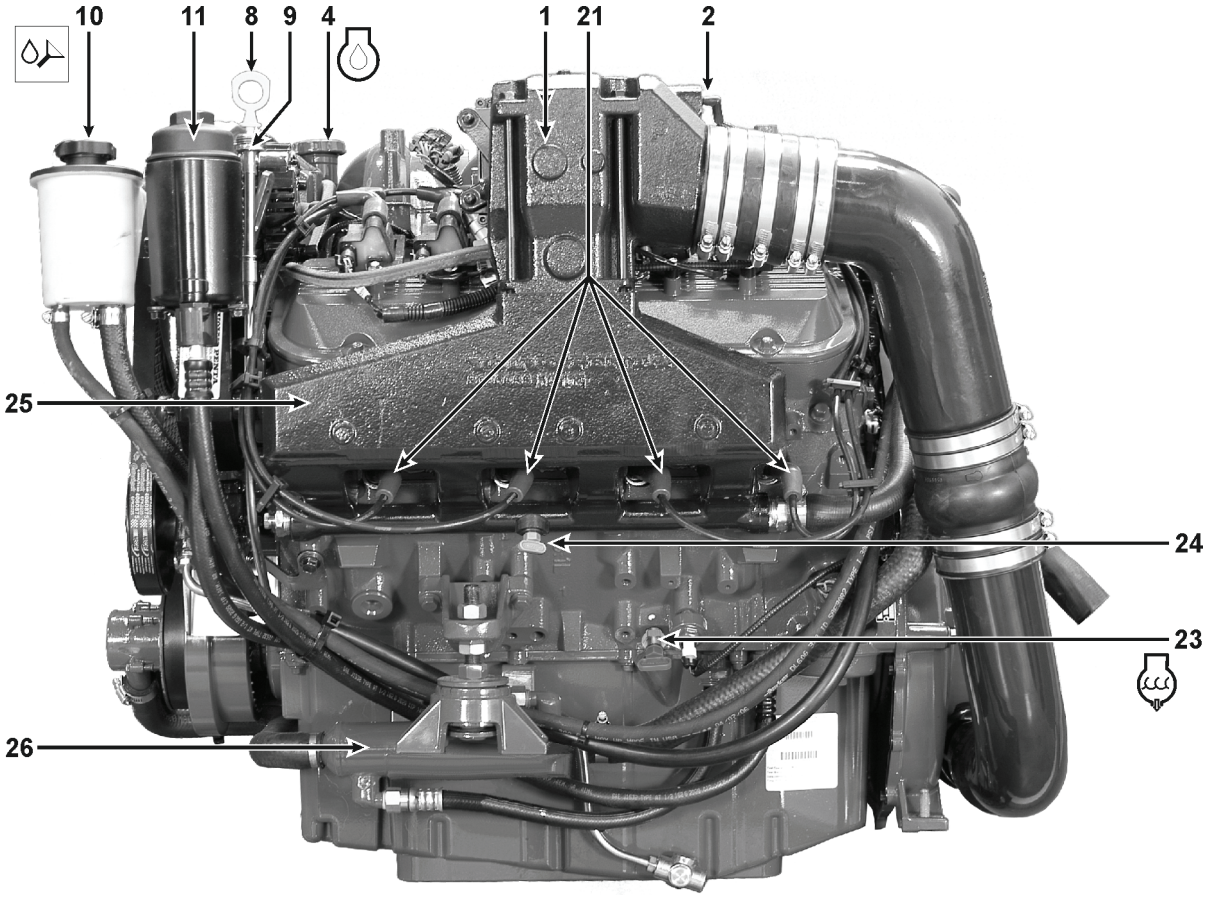
51210

1. Exhaust Risers
2. Exhaust Overheat Sensors
3. Circuit Breaker and Fuses
4. Oil Fill Cap
5. Flame Arrestor
6. Engine Thermostat Housing
7. Alternator
8. Oil Dipstick
9. Oil Siphon Tube
10. Power Steering Fluid Fill
11. Engine Oil Filter Assembly
12. Serpentine Belt
13. Power Steering Pump
14. Raw Water Pump
15. Engine Water Circulation Pump
16. Fuel Pump (High Pressure)
17. Fuel Pump (Low Pressure)
18. Fuel Filter
19. Automatic Belt Tensioner
20. Running Engine Flush Port
21. Spark Plugs
22. Starter
23. Engine Raw Water Drain[1]
24. Exhaust Manifold Water Drain
25. Exhaust Manifold
26. Engine Oil Cooler

1. Raw water cooled engines only.

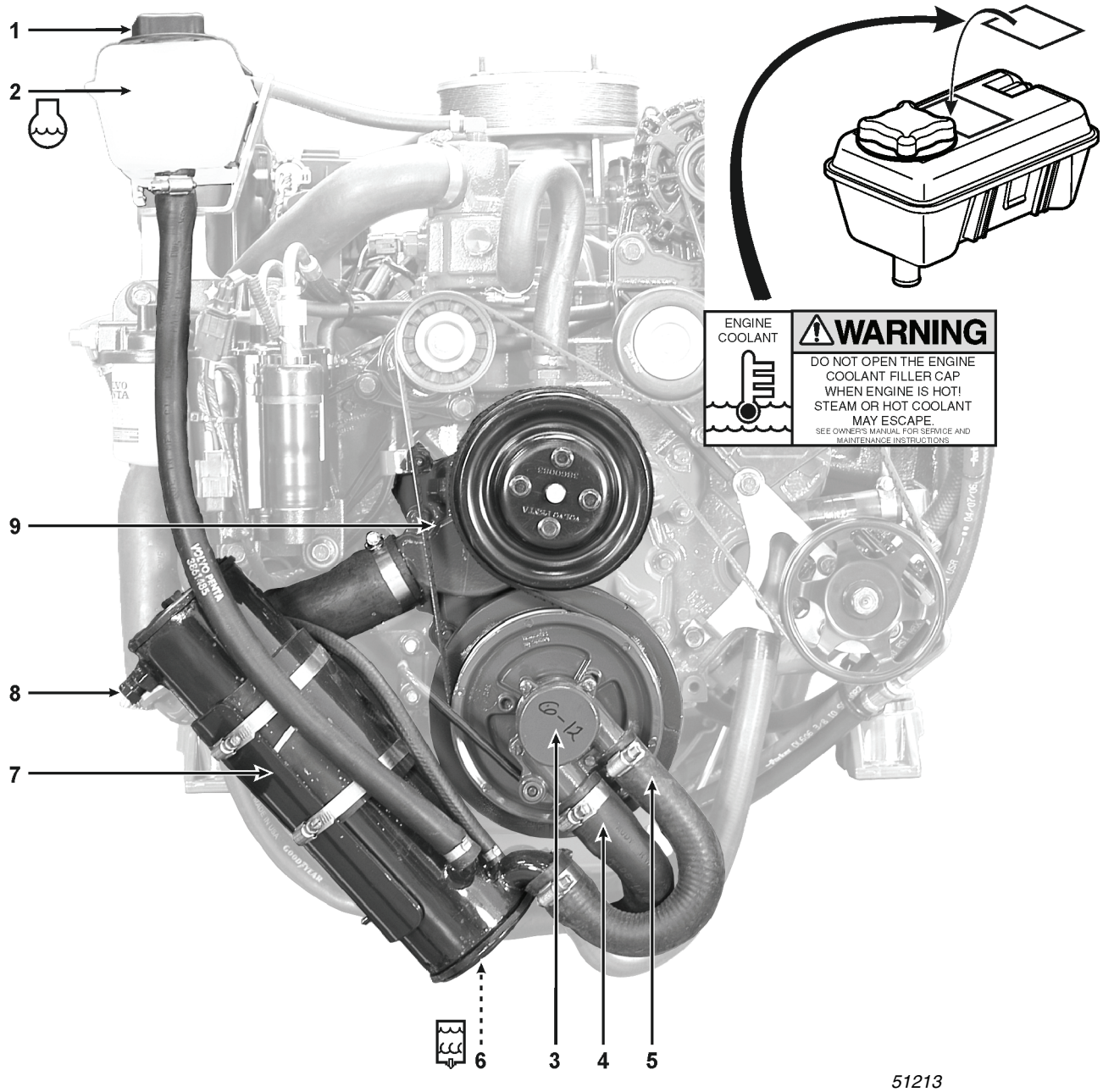


51211



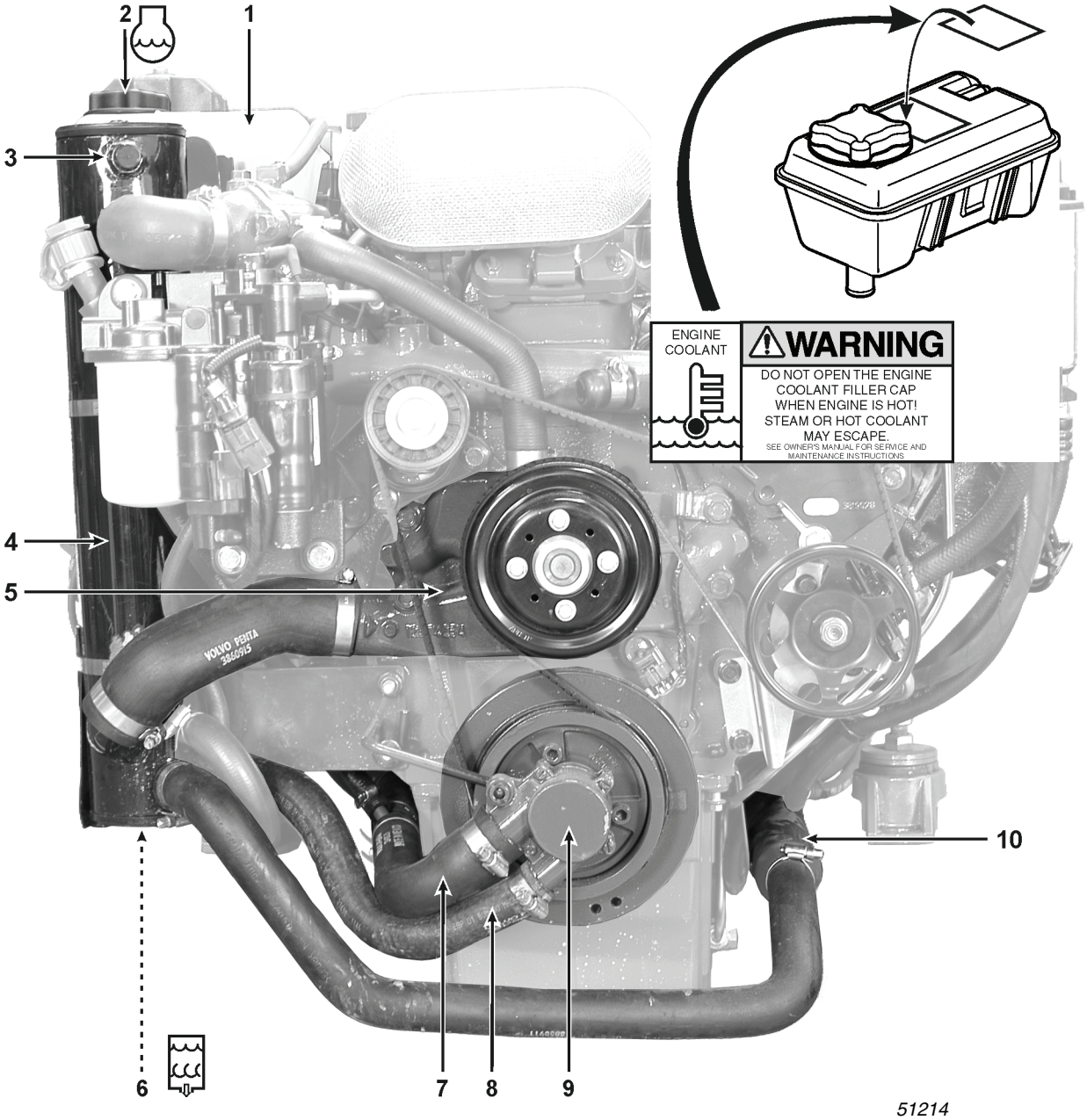
51212

4.3GL-JF, 4.3GXi-JF, 4.3OSi-JF, 5.0 GL-JF, 5.0GXi-JF, 5.0OSi-JF, 5.7Gi300-JF, 5.7GXi-JF, 5.7OSi300-JF, 5.7OSXi-JF



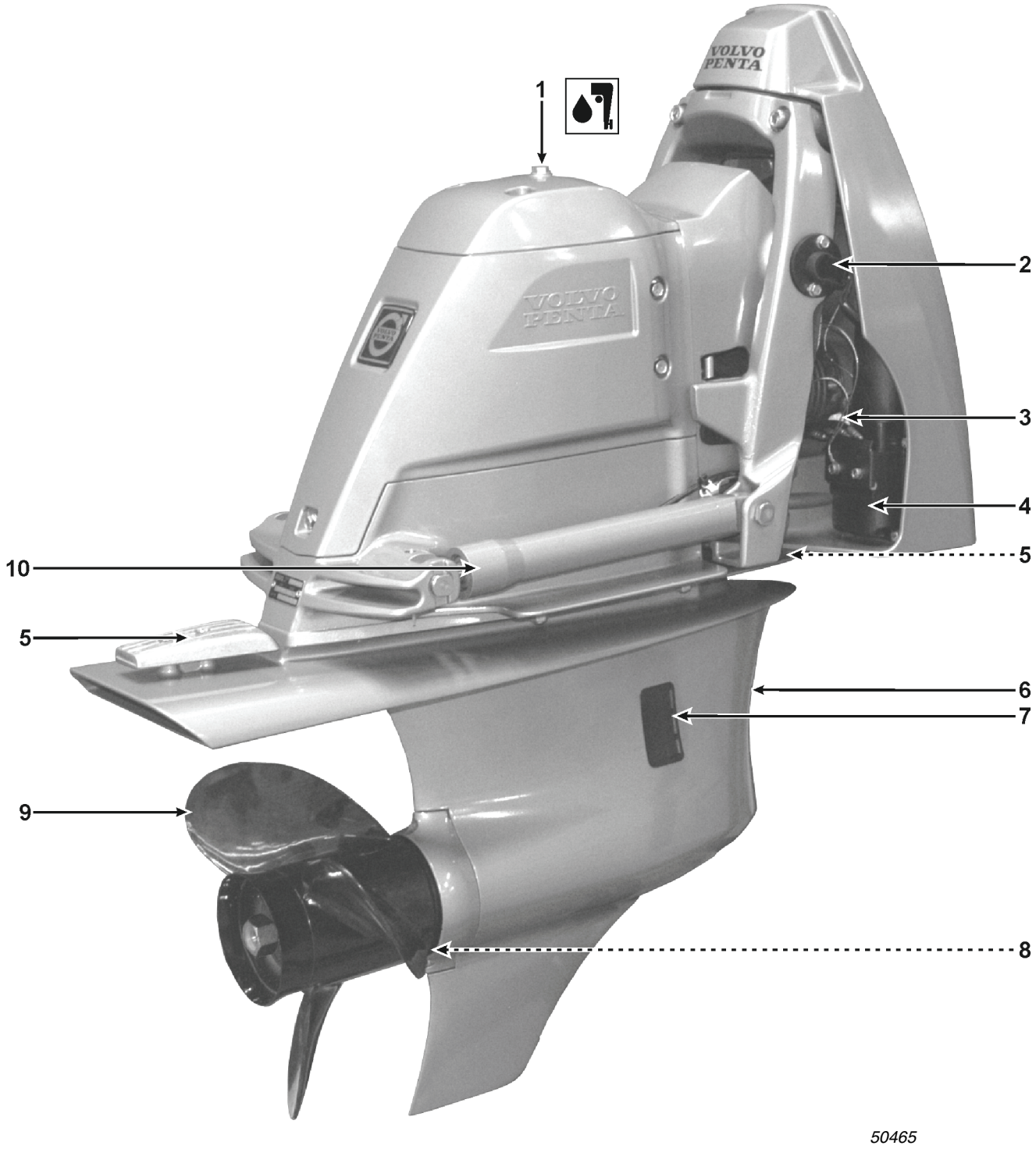
1. Engine Coolant Fill Cap
2. Engine Coolant Reservoir
3. Raw Water Pump
4. Raw Water Inlet
5. Raw Water Outlet
6. Heat Exchanger Drain Cap
7. Heat Exchanger
8. Heat Exchanger Anode
9. Engine Water Circulation Pump

8.1Gi-JF, 8.1GXi-JF, 8.1OSi-JF



1. Engine Coolant Reservoir
2. Engine Coolant Fill Cap
3. Heat Exchanger Anode
4. Heat Exchanger
5. Engine Water Circulation Pump
6. Heat Exchanger Drain Cap
7. Raw Water Inlet
8. Raw Water Outlet
9. Raw Water Pump
10. Engine Oil Cooler

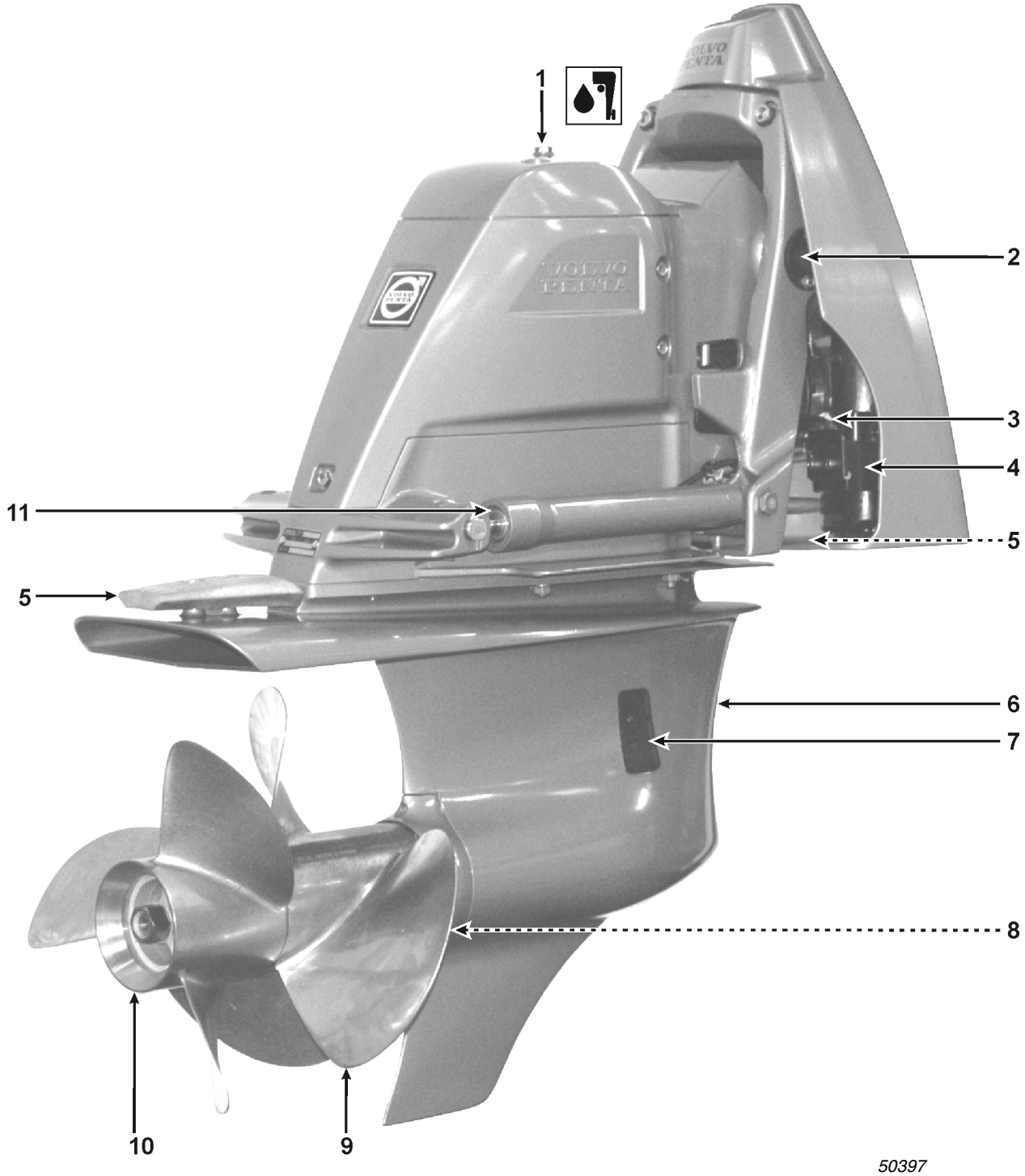
SX-A Sterndrive



1. Oil Fill
2. Trim Sender
3. Trim Pump Oil Fill[1]
4. Trim Pump
5. Anodes
6. Pitot Tube
7. Raw Water Intake
8. Oil Drain
9. Propeller
10. Trim Cylinder

1. Trim pump oil is not a regular maintenance item. Please refer to the section entitled *Power Trim/Tilt-Fluid: SX-A/DPS-A* on page 104 for additional information.

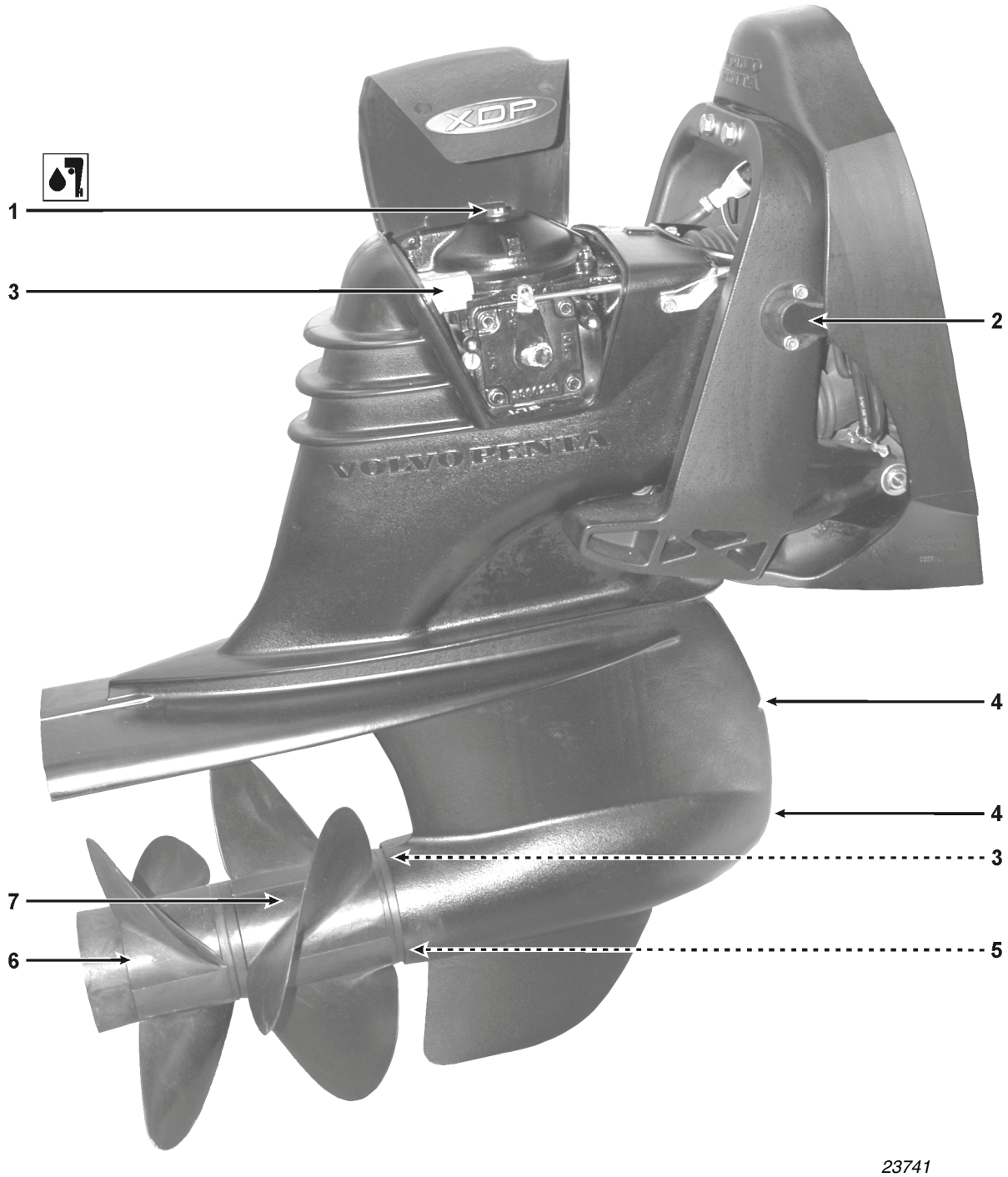
DPS-A Sterndrive



1. Oil Fill
2. Trim Sender
3. Trim Pump Oil Fill[1]
4. Trim Pump
5. Anodes
6. Pitot Tube
7. Raw Water Intake
8. Oil Drain
9. Front Propeller
10. Rear Propeller
11. Trim Cylinder

1. Trim pump oil is not a regular maintenance item. Please refer to the section entitled *Power Trim/Tilt-Fluid: SX-A/DPS-A* on page 104 for additional information.

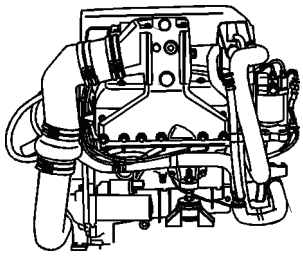
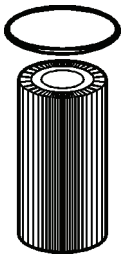
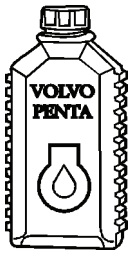
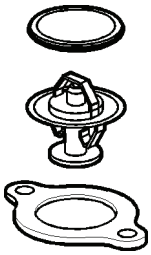
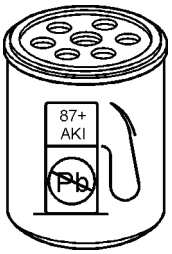
XDP-B Sterndrive



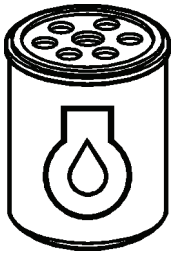
1. Oil Fill
2. Trim Sender
3. Anodes[1]
4. Raw Water Intake
5. Oil Drain
6. Rear Propeller
7. Front Propeller

1. A third anode (not shown) is located on the trim cylinder. See *Replacing Anodes (XDP-B)* on page 112.

Engine Parts & Accessories

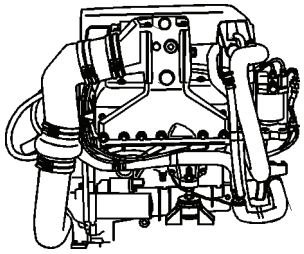
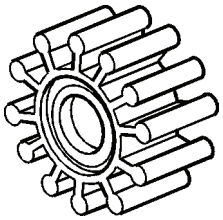
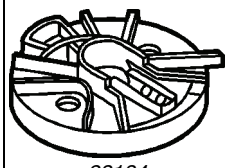
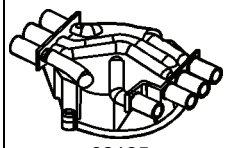
 23179		 51218	 23180	 23177	 23170
3.0GLP-J	**3869388**	835440[1]	3847302	3853799	3855104
4.3GL-J	**3869391**	8692305	3847302	3587597	3862228
4.3GL-JF	**3869392**	8692305	3847302	3831426	3862228
4.3GXi-J	**3869393**	8692305	3847302	3587597	3862228
4.3GXi-JF	**3869394**	8692305	3847302	3831426	3862228
4.3OSi-J	**3869395**	8692305	3847302	3587597	3862228
4.3 OSi-JF	**3869396**	8692305	3847302	3831426	3862228
5.0 GL-J	**3869397**	8692305	3847302	3587597	3862228
5.0 GL-JF	**3869398**	8692305	3847302	3831426	3862228
5.0 GXi-J	**3869399**	8692305	3847302	3587597	3862228
5.0 GXi-JF	**3869400**	8692305	3847302	3831426	3862228
5.0 OSi-J	**3869401**	8692305	3847302	3587597	3862228
5.0 OSi-JF	**3869402**	8692305	3847302	3831426	3862228
5.7 Gi300-J	**3869403**	8692305	3847302	3587597	3862228
5.7 Gi300-JF	**3869404**	8692305	3847302	3831426	3862228
5.7 GXi-J	**3869407**	8692305	3847302	3587597	3862228
5.7 GXi-JF	**3869408**	8692305	3847302	3831426	3862228
5.7 OSi300-J	**3869405**	8692305	3847302	3587597	3862228
5.7 OSi300-JF	**3869406**	8692305	3847302	3831426	3862228
5.7 OSXi-J	**3869409**	8692305	3847302	3587597	3862228
5.7 OSXi-JF	**3869410**	8692305	3847302	3831426	3862228
8.1 Gi-J	**3869411**	8692305	3847302	3853983	3862228
8.1 Gi-JF	**3869412**	8692305	3847302	3831426	3862228
8.1 GXi-J	**3869415**	8692305	3847302	3853983	3862228
8.1 GXi-JF	**3869416**	8692305	3847302	3831426	3862228
8.1 OSi-J	**3869413**	8692305	3847302	3853983	3862228
8.1 OSi-JF	**3869414**	8692305	3847302	3831426	3862228

1. Uses closed-canister style oil filter. See illustration below:

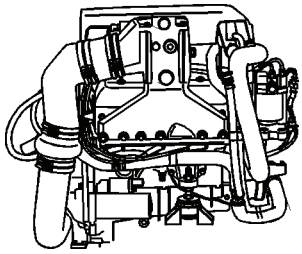
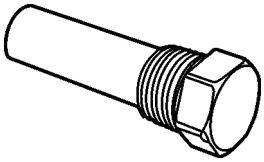
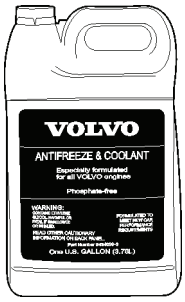


23169

Engine Parts & Accessories (Continued)

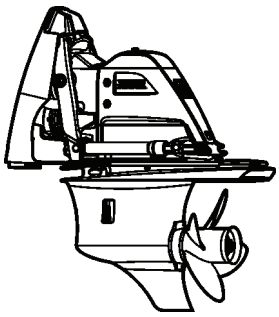
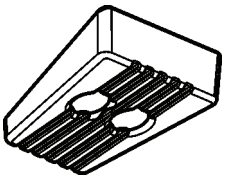
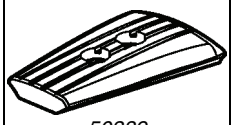
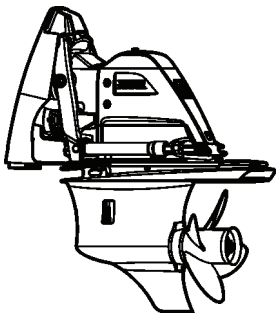
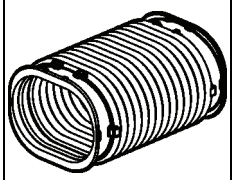
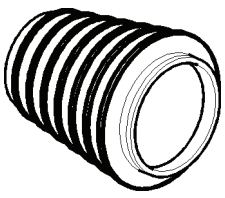
 23179		 23171	 23172-1	 23184	 23185
3.0GLP-J	**3869388**	3842786	3851857	3854261	3854260
4.3GL-J	**3869391**	3842786	3858997	3854311	3854331
4.3GL-JF	**3869392**	3842786	3858997	3854311	3854331
4.3GXi-J	**3869393**	3842786	3858997	3858977	3859019
4.3GXi-JF	**3869394**	3842786	3858997	3858977	3859019
4.3OSi-J	**3869395**	3842786	3858997	3854311	3859019
4.3 OSi-JF	**3869396**	3842786	3858997	3854311	3859019
5.0 GL-J	**3869397**	3842786	3858996 X 2	3862014	3854548
5.0 GL-JF	**3869398**	3842786	3858996 X 2	3862014	3854548
5.0 GXi-J	**3869399**	3842786	3858996 X 2	3858977	3858975
5.0 GXi-JF	**3869400**	3842786	3858996 X 2	3858977	3858975
5.0 OSi-J	**3869401**	3842786	3858996 X 2	3858977	3858975
5.0 OSi-JF	**3869402**	3842786	3858996 X 2	3858977	3858975
5.7 Gi300-J	**3869403**	3842786	3858996 X 2	3858977	3858975
5.7 Gi300-JF	**3869404**	3842786	3858996 X 2	3858977	3858975
5.7 GXi-J	**3869407**	3842786	3858996 X 2	3858977	3858975
5.7 GXi-JF	**3869408**	3842786	3858996 X 2	3858977	3858975
5.7 OSi300-J	**3869405**	3842786	3858996 X 2	3858977	3858975
5.7 OSi300-JF	**3869406**	3842786	3858996 X 2	3858977	3858975
5.7 OSXi-J	**3869409**	3842786	3858996 X 2	3858977	3858975
5.7 OSXi-JF	**3869410**	3842786	3858996 X 2	3858977	3858975
8.1 Gi-J	**3869411**	3842786	3861326 X 2	–	–
8.1 Gi-JF	**3869412**	3842786	3861326 X 2	–	–
8.1 GXi-J	**3869415**	3842786	3861326 X 2	–	–
8.1 GXi-JF	**3869416**	3842786	3861326 X 2	–	–
8.1 OSi-J	**3869413**	3842786	3861326 X 2	–	–
8.1 OSi-JF	**3869414**	3842786	3861326 X 2	–	–

Engine Parts & Accessories (Continued)

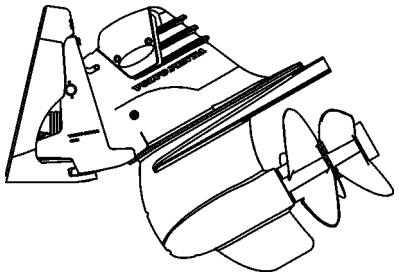
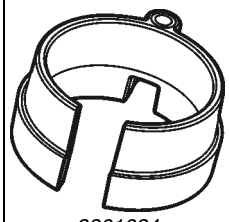
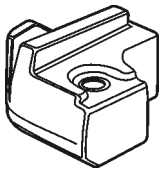
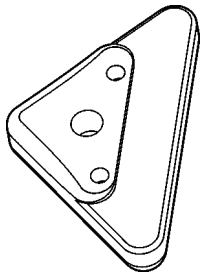
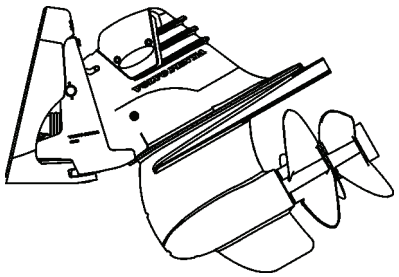
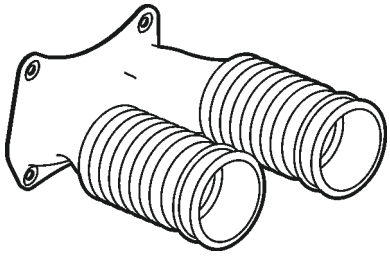
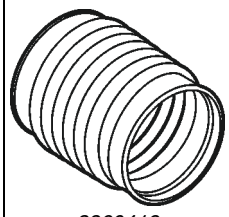
 *23179*	 *23382*	 *23389*	
All Engines with Closed Cooling Systems (F-Series)	3858995[1]	381081	

1. Applies to factory-installed Volvo Penta closed cooling systems only. After-market kits may have different anodes installed.

SX-A/DPS-A Drive Parts & Accessories

 *50395*		 *23180*	 *50388*	 *50389*	
SX-A DPS-A	**3883600, 3883601, 3883602, 3883603, 3883604, 3883605, 3883623, 3883599, 3883606, 3883607, 3883609, 3883610**	3851128	3888817 (Zn) 3888818 (Mg) 3888816 (Al)	3888814 (Zn) 3888815 (Mg) 3888813 (Al)	
 *50395*		 *50390*	 *23246*		
SX-A DPS-A	**3883600, 3883601, 3883602, 3883603, 3883604, 3883605, 3883623, 3883599, 3883606, 3883607, 3883609, 3883610**	3841293	3854127		

XDP-B Drive Parts & Accessories

 *22392-2*		 *23180*	 *3861634*	 *3861636*	 *23773-1*
XDP-B	**3869151** **3869152** **3869153**	3851128	3861634 # (Zn) 3861635 # (Mg)	3861636 # (Zn) 3861633 # (Mg)	3861583
 *22392-2*		 *3862048*		 *3860419*	
XDP-B	**3869151** **3869152** **3869153**	3862048 (X-B, X-BLT) 3862466 (XHP-B, XHP-BLT)		3860419	

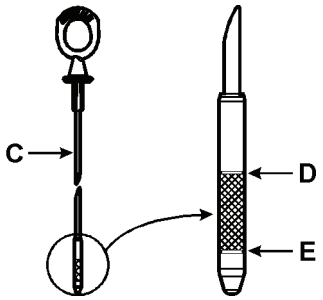
Engine Break-in Period

NOTICE! To ensure proper lubrication during the break-in period, do not remove factory break-in oil until after the 20-hour break-in is completed. The First Service inspection should be carried out after 50 hours of operation.

NOTICE! Failure to follow engine break-in procedures can result in serious engine damage.

NOTICE! Do not run engine at a constant RPM for prolonged periods of time during the break-in period.

All Volvo Penta engines have been run for a short time during a final test at the factory. You must follow the engine break-in procedure during the first 20 hours of operation to ensure maximum performance and longest engine life.



51216

Break-in Procedures

During the break-in period, watch out for the following items during the initial engine run:

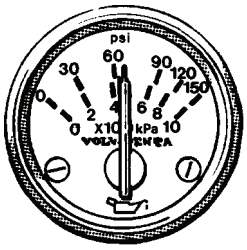
1. Check engine oil level frequently (**C**) with the boat in the water. Level must be between **E** (add) and **D** (full).

NOTICE! The engine may use more engine oil during the break-in period than would otherwise be normal. Be sure to check the oil level frequently during the first 20 hours of operation, since the oil consumption will be high until the piston rings are properly seated.

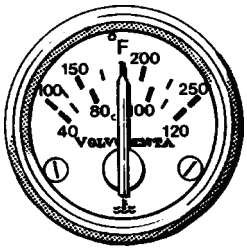
- Maintain oil level in the safe range, between the ADD and FULL marks on dipstick. Somewhat higher oil consumption is normal until the piston rings have seated.
- If you have a problem getting a good oil level reading on the dipstick, rotate the dipstick 180° in the dipstick tube.
- When adding engine oil, use Volvo Penta engine oils for gasoline engines, or a good quality oil (API Service CF/SH and ILSAC GF-4 grade or better) of the same viscosity. Use the following chart to select the SAE viscosity that matches the temperature range in which you expect to operate.

Lowest Anticipated Temperature	Recommended SAE Viscosity Oils
32° F (0° C) — above	SAE 30 SAE 20W/50 SAE 15W/50
0° F (-18° C) — 32° F (0° C)	SAE 20W-20
Below 0° F (-18° C)	SAE 10W

NOTICE! Use Volvo Penta Engine Oil, Synthetic or Mineral, recommended for 0°F (-18°C) and above. For additional information, see *Maintenance Schedule* on page 74.



21194



21195

2. Watch the oil pressure gauge.
   - Oil pressure will rise as RPM increases, and fall as RPM decreases. In addition, cold oil will generally show higher oil pressure for any specific RPM than hot oil. Both of these conditions reflect normal engine operation.
   - If the oil indicator fluctuates when the boat is turning, climbing on plane, etc., the oil pickup screen may not be covered with oil. Check the oil dipstick. If required add non-synthetic oil, but **do not overfill**. If the oil level is correct and the condition persists, ask your Volvo Penta dealer to check for possible gauge or oil pump malfunction.
3. Watch the engine temperature indicator to be sure there is proper coolant circulation.

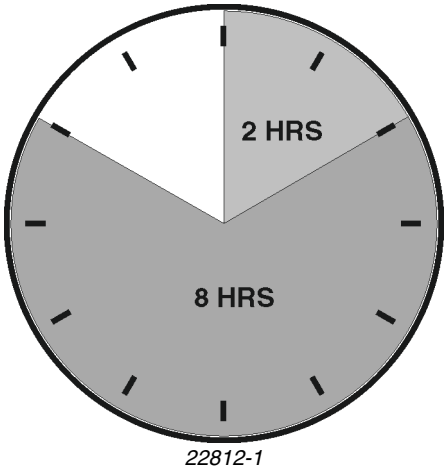
NOTICE! Failure to follow the break-in procedure may void the engine warranty.

First Two Hours

1. For the first five to ten minutes of operation, run the engine at a fast idle (above 1500 RPM).
2. During the remaining first two hours of operation, accelerate to bring the boat onto plane quickly; bring the throttle back to maintain a planing attitude.

   During this period, vary the engine speed frequently by accelerating to approximately ¾ throttle for two to three minutes, then back to minimum cruising speed.
3. After the engine has reached operating temperature, momentarily reduce engine speed, then increase engine speed, to assist break-in of rings and bearings. Maintain plane to avoid excessive engine load.

NOTICE! For this initial two hour break-in, do not run the engine at any constant RPM for prolonged periods of time.



22812-1

Next Eight Hours

1. During the next eight hours, continue to operate at approximately ¾ throttle or less (minimum cruising speed). Occasionally reduce throttle to idle speed for a cooling period.
2. During this eight hours of operation you may operate at full throttle for periods of less than two minutes.

22814

For the Next Ten Hours

1. During the final ten hours of break-in, you may operate at full throttle for five to ten minutes at a time.
2. After warming the engine to operating temperature, momentarily increase engine speed.
3. Occasionally reduce engine speed to idle to provide cooling periods.

After the first 50 hours of operation, drain the engine oil and replace the oil filter. Fill the crankcase with Volvo Penta's engine oil.

First Service Inspection (Dealer 50-Hour Check)

To ensure your continued boating enjoyment, we recommend that you return your Volvo Penta product to your Volvo Penta dealer for a 50-hour check. This 50-hour check will prevent a minor problem from getting worse and helps ensure a trouble-free boating season. When servicing your engine, your Volvo Penta dealer will use the following guidelines to inspect your product:

Start the engine and check that:

- No leakage of fuel, oil, water, or exhaust gases occurs.
- Engine oil pressure and temperature are within specification.
- All cables and controls operate correctly.
- All gauges, instruments, and alarms operate correctly.
- Steering system operates correctly.
- Engine ignition timing and idle RPM are within specifications.
- Power trim system operates correctly.

Stop the engine and:

- Change engine oil and oil filter.
- Change fuel/water separator filter.
- Clean seawater strainer (if equipped).
- Check fluid levels and fluid condition in sterndrive or inboard transmission, power steering pump, and trim pump.
- Check propeller(s) and propeller fasteners.
- Check condition of battery and battery cable connections.
- Lubricate all grease fittings and linkages following service recommendations.
- Check tightness of all water, fuel, exhaust clamps, fittings, drive bellows, and drains.

Restart the engine and recheck that:

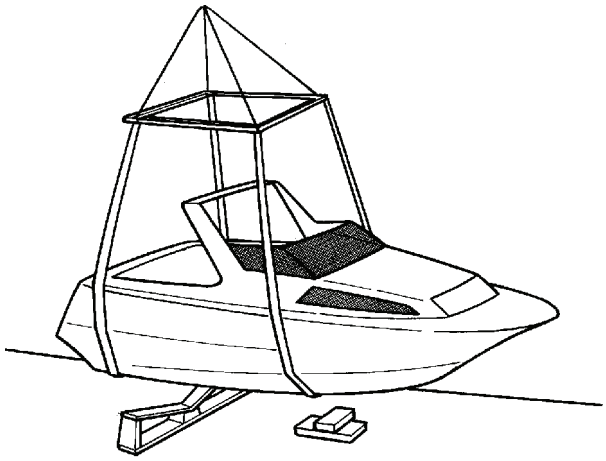
- No leakage of fuel, oil, water, or exhaust gases occurs.
- Engine oil pressure and temperature are within specifications.

This is a perfect time to discuss with your Volvo Penta dealer any questions about your engine that may have arisen during the first 50 hours of operation and establish a routine preventive maintenance schedule.

NOTICE! Always insist that your dealer use genuine Volvo Penta parts when replacing engine components.

Operating After Break-in Period

After the break-in period, the engine can be operated at any RPM from idle to full throttle. Cruising at 3600 RPM or less, however, saves fuel, reduces noise, and prolongs engine life.

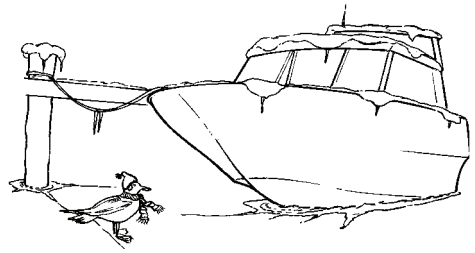


21201

Preparing for Boating (Launching)

When launching your boat for the first time or when starting out a new season, always carry out the steps provided in the following checklist:

- ❑ Replace all drain plugs.
- ❑ Replace rubber caps and clamps or plugs.
- ❑ Connect hoses and check their condition; tighten clamps and connections.
- ❑ Install boat drain plug, if removed.
- ❑ Remove and inspect distributor cap and rotor. Replace distributor with a new one, if necessary.
- ❑ Clean battery terminals and check battery charge.
- ❑ With ignition switch in OFF position, install battery and attach battery cables.
- ❑ Spray terminals with Volvo Penta anti corrosion spray.
- ❑ Open the fuel shut-off valve and check all fuel line connections for leaks.
- ❑ Check the flame arrestor and clean if necessary (see *Flame Arrestor* on page 83).
- ❑ Make a thorough check of boat and engine for loose or missing nuts and screws.
- ❑ Pump the bilge dry and air out engine compartment. Federal, state, and/or local regulations prohibit the pumping of oil into any navigable waters.
- ❑ Check all reservoir oil levels and fill as necessary.
- ❑ Check drive and transom shield anodes. Clean or replace as necessary.



21199

Off-Season Storage (Winterization)

Be sure that your Volvo Penta equipment is properly prepared for off-season storage. Engine or drive damage can result if some simple maintenance steps are overlooked prior to storage. Winterizing gives you the assurance that your engine will be protected during storage and will run more reliably when you put your boat back in the water.

We recommend that you have your Volvo Penta dealer “winterize” your engine and drive. Your dealer will provide the proper servicing and maintenance to ensure that your equipment is treated and stored properly.

Static Water Line

Check the static water line if the loading or weight distribution in the rear of the boat has changed significantly from the boat manufacturers original design. This would include the addition of an auxiliary outboard on brackets, on-board generators, towers, personal water craft mounted on the rear of the boat, coolers, and bait wells, and so on.

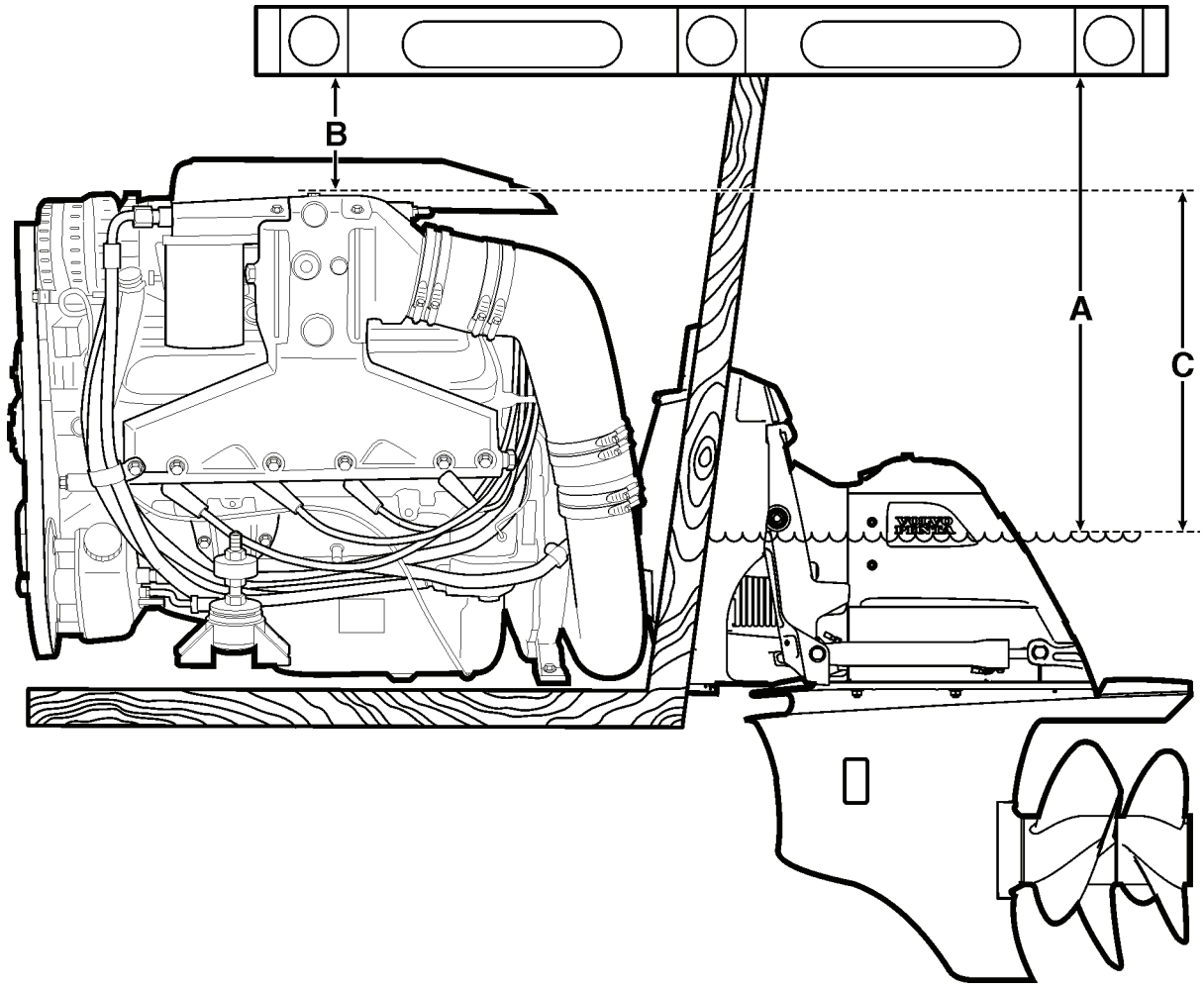
Static Water Line Test

NOTICE! The static water line height must be tested before the engine is started for the first time. Checking the static water line will help prevent the ingestion of water into the engine and the resultant damage.

1. Load the boat and distribute weight as you would for normal boating conditions.
2. Place a level on top of transom, measure from bottom of level to top of riser (**B**) and record measurement.
3. Measure from bottom of the level to static water line (**A**) and record measurement.
4. Subtract measurement **B** from measurement **A** and record result (**C**). Measurement **C** should not be less than 14 in. (35.6 cm).

   A – B = C
5. When the static water line does not meet these specifications, contact your Volvo Penta dealer for information on high rise extension kits. Make sure one is installed before the engine is started for the first time.

NOTICE! The addition of extra equipment such as a generator, auxiliary trolling motor, live wells, supplemental fuel or water tankage, etc. may alter the water line or balance point of your boat. This may cause water to enter the exhaust, causing serious engine damage. Before making changes that affect the boat's water line, consult your dealer to see if modifications will be required on your engine.



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Maintenance Schedule

The operation, maintenance, and care of the Volvo Penta engine and power package as outlined in this manual are the owner's responsibility. The owner must keep records of all maintenance services performed. This record of proper maintenance may be required to determine warranty coverage on certain repairs and should be transferred to each subsequent owner. If you are not sure of the proper maintenance procedures, contact the Volvo Penta Consumer Affairs Department at the address provided in the front of this manual.

In addition to the maintenance routines outlined on these pages, **we recommend that you return your Volvo Penta product to your authorized Volvo Penta dealer for a 50-hour check**. For additional information, see *First Service Inspection (Dealer 50-Hour Check)* on page 71.

NOTICE! All maintenance schedule frequencies listed in the following table apply to a maintenance schedule that begins AFTER the Dealer 50-Hour Check. Do not include the 50 hours prior to the dealer 50-hour check as part of your calendar or operating hour frequency. For example, the fuel filter needs to be replaced one year or 100 operating hours (whichever comes first) following the dealer 50-hour check, not after 50 operating hours.

⚠ **WARNING! To prevent fire or explosion, Volvo Penta ignition components meet U.S. Coast Guard requirements for external ignition proof parts. Do not substitute automotive or other non-approved parts.**

ENGINE PACKAGE						
MAINTENANCE POINT		***Calendar Frequency OR Operating Hours (WHICHEVER COMES FIRST)***				
Required Action(s) Important Notes	**Refer to Page**	**Each Usage**	**Monthly OR Every 50 Hours**	**Yearly OR Every 100 Hours**	**Once Every 2 Years OR Every 200 Hours**	**Once Every 3 Years OR Every 300 Hours**
Belt: Serpentine Check for wear	91			•		
Cooling System Check coolant level and check for leakage	92	•				
Distributor Cap and Rotor Clean, check to see if worn or damaged	88			•		
Engine Mounting Screws Tighten screws	121			•		
Engine Oil Check level	100–101	•				
Engine Oil, Mineral Replace	100–101			•		
Engine Oil, Synthetic – Every 200 hours for Volvo Penta synthetic oil. Replace	100–101			•		
Engine Oil Filter Replace with every oil change only	100–101			•		
Exhaust Manifold, Risers Check for corrosion, damage, and blockage	77			•		
Exhaust System, Rubber Boots Check for damage and blockage	77		•			
Flame Arrestor Check for damage/dirt and tighten mounting	83		•			
Fuel Filter Replace	83–84			•		
Fuel Filter (3.0 Liter Only) Check for damage, clean	82–85			•		
Fuel Pump, Electric Check for leaks	83–84	•				

ENGINE PACKAGE (CONTINUED)						
MAINTENANCE POINT		***Calendar Frequency OR Operating Hours (WHICHEVER COMES FIRST)***				
Required Action(s) Important Notes	**Refer to Page**	**Each Usage**	**Monthly OR Every 50 Hours**	**Yearly OR Every 100 Hours**	**Once Every 2 Years OR Every 200 Hours**	**Once Every 3 Years OR Every 300 Hours**
Fuel System, Hoses, Tank, etc. Check for leakage or blockage	80–85	•				
Impeller, Raw Water Pump Replace	92, 99		**Yearly OR every 50 hours**			
PCV Valve Check by shaking; listen for rattle. If no rattle is heard, replace	79		**Yearly OR every 50 hours**			
Spark Plugs (Except 3.0 Liter) Replace	89–90					•
Spark Plugs (3.0 Liter Only) Replace	89–90			•		
Spark Plug Wires/Boots Check for damage or deterioration	89–90		•			

DRIVE/TRANSMISSION PACKAGE						
MAINTENANCE POINT		***Calendar Frequency OR Operating Hours (WHICHEVER COMES FIRST)***				
Required Action(s) Important Notes	**Refer to Page**	**Each Usage**	**Monthly OR Every 50 Hours**	**Yearly OR Every 100 Hours**	**Once Every 2 Years OR Every 200 Hours**	**Once Every 3 Years OR Every 300 Hours**
Drive Shaft Splines Dealer to check for wear and lubricate	–			•		
Drive Unit Exhaust Bellow & Clamps Check for leaks, check clamps	77		•			
Drive Unit Oil Check level	105–110	•				
Drive Unit Oil Replace	105–110			•		
Power Trim/Tilt Check for smooth operation	41, 104	•				
Propeller, Shaft and Rubber Hub Check for damage or corrosion Lubricate shaft	118–120		•			
Sacrificial Anodes Visual Inspection Replace if eroded more than 30%	111	•				
Universal Joints, Gimbal Bearing and Engine Alignment Dealer to inspect for wear and lubricate	–			•		
Universal Joint Bellows and Clamps Check for damage, tighten clamps	78, 107, 110		•			
Universal Joint Bellows and Clamps Replace	78, 107, 110				•	

MISCELLANEOUS						
MAINTENANCE POINT		***Calendar Frequency OR Operating Hours (WHICHEVER COMES FIRST)***				
Required Action(s) Important Notes	**Refer to Page**	**Each Usage**	**Monthly OR Every 50 Hours**	**Yearly OR Every 100 Hours**	**Once Every 2 Years OR Every 200 Hours**	**Once Every 3 Years OR Every 300 Hours**
Battery and Connections Check that all connections are clean & tight	86–88		•			
Emergency Stop Switch Check clip and lanyard	10, 24	•				
General Inspection of Engine, Drive, and Transom Shield Hardware: Clamps, Fasteners, Screws, Nuts, etc. Check and tighten, see *General Torque Specifications* on page 146	–			•		
Power Steering Check for smooth operation	40, 103	•				
Power Steering Fluid Check level	103		•			
Remote Control and Shift System Check for smooth operation	29–34, 39	•				
Remote Control and Shift System Check cable retainer on pivot housing for engagement and secure cable attachment on sterndrive, lubricate cables	29–32			•		
Steering System Cables Check for smooth operation	40, 103	•				
Steering System Cables Lubricate	40, 103		**Yearly OR every 50 hours**			
Safety Equipment Check that all required and recommended equipment is on board	12	•				
Throttle Cable Check for damage & smooth operation Lubricate cable	103			•		

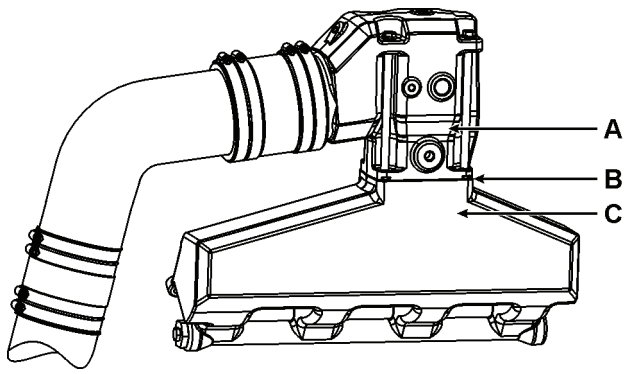
Maintenance of Boat's Systems

The following sections provide information about the maintenance of various systems aboard your boat, including the engine, drive, transmission, steering, fuel, electrical, and cooling systems. If you intend to do any maintenance on your engine, transmission, and drive, we urge you to be thoroughly familiar with the procedures described in this manual. **Always read and follow the safety warnings provided in this manual.** If you are uncertain about any procedures described in the manual, or you would like to purchase a workshop manual, please contact your Volvo Penta dealer.

Engine Exhaust System

Periodically inspect the engine exhaust system. Be sure to check for:

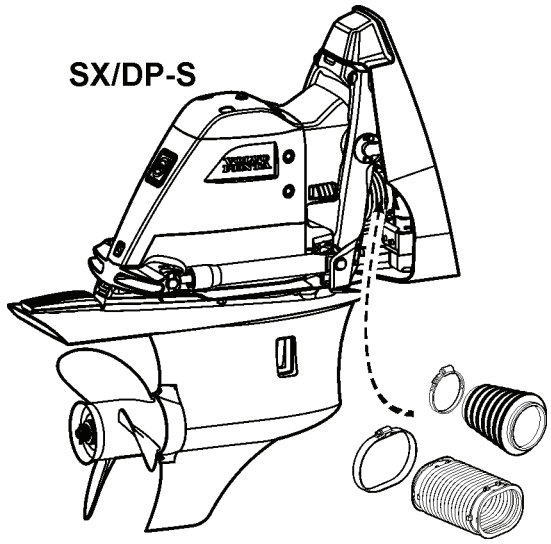
- ❑ Deteriorated hoses.
- ❑ Burned hoses.
- ❑ Loose clamps.
- ❑ Evidence of water leaks.
- ❑ Corrosion or blockage in the exhaust manifold and riser(s).



22132-1

Check the gasket surface (**B**), between the exhaust riser (**A**) and manifold (**C**), for damage caused by corrosion. The components should be replaced if the walls are thin or surface is pitted. Water may leak into the engine if this joint is damaged. If necessary, see your authorized dealer for this inspection.

⚠ **WARNING! Replace damaged or defective components, and securely tighten all clamps. Any exhaust leak must be repaired before you operate your boat. Exhaust leaks release fumes that can create hazardous conditions for operator and passengers.**



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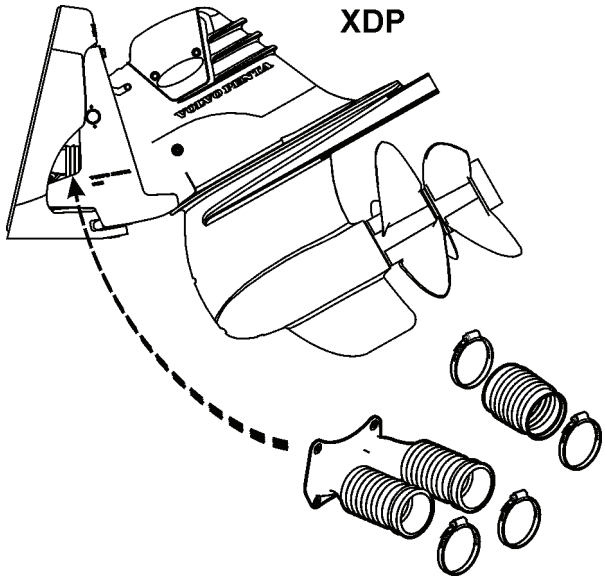

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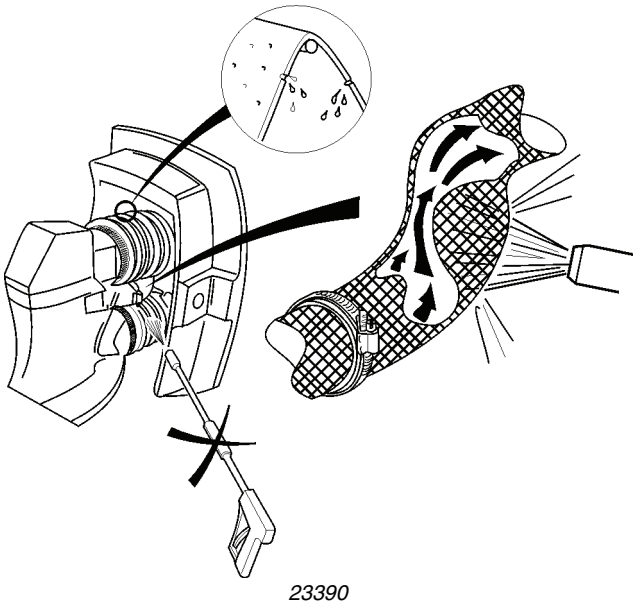


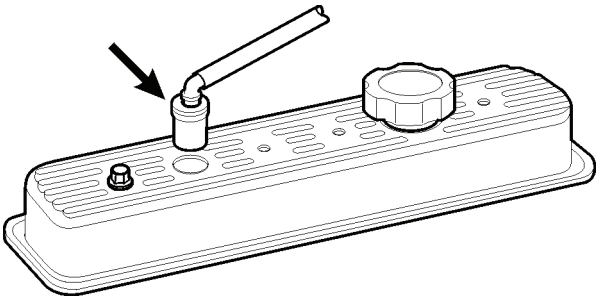
23390

Drive Unit Bellows

⚠ **WARNING! If you work on the drive bellows, secure the drive unit in a raised position in such a way that it cannot fall. A falling drive may cause serious injury.**

- ❑ Check the drive unit bellows for fractures and deterioration. Barnacle build-up on the bellows may cause punctures; keep the surfaces clean.
- ❑ Check tightness of all hose clamps.
- ❑ Check the drive unit bellows and clamps monthly or every 50 operating hours. You may order the bellows separately, or as part of an accessory kit. The accessory kit also includes O-rings, oils, washers, seals, and anodes.
- ❑ Inspect the inside of the bellows for signs of contact with the u-joint assembly, which indicates the engine was run at an RPM that was too high while the drive was in the tilted position.
- ❑ Be sure the clamps are installed as shown in the picture.

NOTICE! When washing the drive unit, do not use a pressure washer. Using a pressure washer will damage the water intake hose and the drive bellows.



23674

PCV Valve

The PCV (Positive Crankcase Ventilation) valve controls engine emissions by returning crankcase blowby gases to the engine's intake manifold to be burned. A clogged or stuck PCV valve may result in poor engine performance and stalling. For optimal engine performance, PCV valves should be inspected and replaced according to the maintenance schedule.

The 4.3 Liter PCV valve is integrated into the valve cover and can not be checked. The 8.1 Liter engine does not have a PCV valve.

Checking the PCV Valve

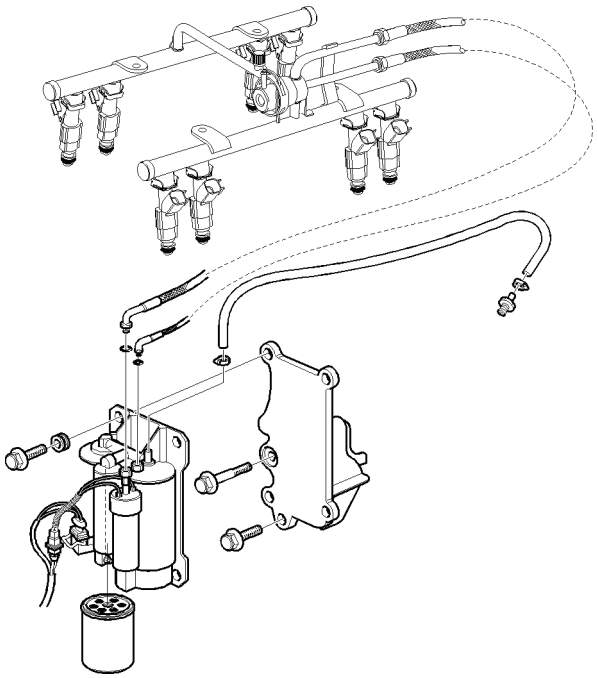
To check the PCV valve for clogs or malfunction, use the following steps:

1. Ensure that the engine is turned off and the key has been removed from the ignition.
2. Locate and remove the PCV valve from the valve cover by holding it at the elbow and pulling it out.

NOTICE! Do not pull on the hose to remove the PCV valve; the hose may come off, leaving the valve in place.

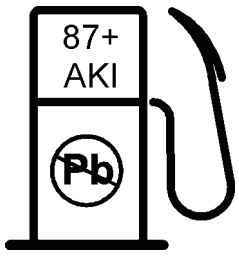
3. Shake the PCV valve. A rattling sound indicates that the valve is not clogged. If you do not hear a rattling sound, chances are the valve is clogged and needs to be replaced.
4. Replace the PCV valve by pressing it firmly back into PCV valve receptacle in the valve cover.

Fuel System



22790

DANGER! Gasoline is extremely flammable and highly explosive. ALWAYS turn off the engine before refueling. Do not smoke or allow open flames or sparks near the boat when adding fuel. 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 buildup that could cause sparks and ignite fuel vapors.



22823

Gasoline Recommendations

USE ONLY UNLEADED FUEL. Use lead-free gasoline with the following minimum or higher octane specification:

Inside the U.S.: (R+M)/2 (AKI) – 87

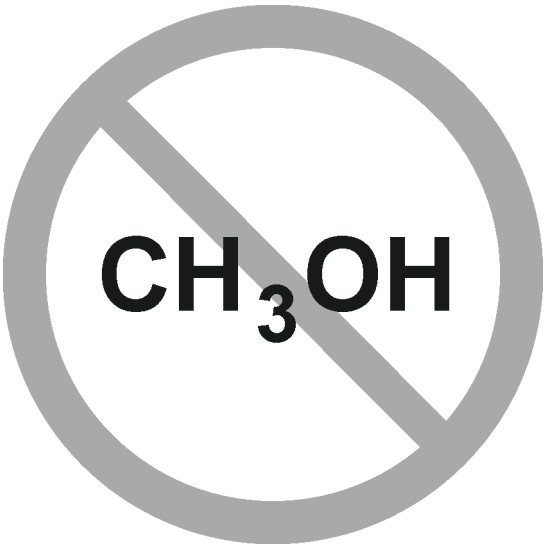
Outside the U.S.: (RON) – 90

If fuels with 89 AKI pump posted (93 RON) octane number or higher are used an increase in power can be expected with EFI models.

Mid-grade and premium fuels contain injector cleaners and other additives that protect the fuel system and provide optimum performance.

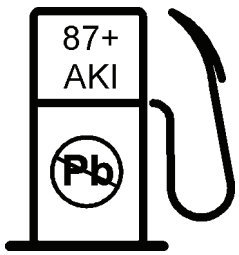
Gasoline will degrade over time. Always buy your gasoline from a reputable dealer.

NOTICE! Engine damage resulting from the use of a lower octane gasoline than 87 AKI (90 RON) is considered misuse of the engine. Any resulting engine damage will not be covered by the warranty.



22824

NOTICE! Do not use any gasoline that contains METHANOL. Serious damage will result from the continued use of fuel containing METHANOL. Any resulting engine damage will not be covered by the warranty.



22823

Gasoline Containing Alcohol

Many brands of gasoline being sold today contain alcohol. Two commonly used alcohol additives are Ethanol (ethyl alcohol) and Methanol (**CH_3OH**), also called methyl alcohol.

See your boat owner's manual to see if the boat's fuel system is compatible with alcohol blended fuels. If it is, your engine may be operated using gasoline blended with no more than 10% Ethanol meeting the minimum octane specification.

If you use gasoline that contains ethanol, be aware of the following:

- The engine will operate leaner with ethanol blended fuel. This may cause engine problems such as vapor lock, low speed stall, or hard starting.
- Ethanol 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.

Leaded Fuels

EFI models: Some marinas sell fuel with lead additives. Do not use leaded fuel, as it may block the fuel injectors and cause leakage.

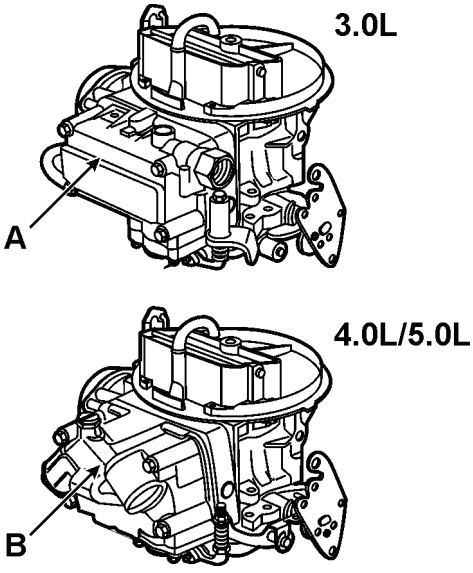
⚠ **DANGER! Fuel leakage can contribute to a fire and/or explosion. Frequently inspect non-metallic parts of the engine's fuel system and replace if excessive stiffness, deterioration, or fuel leakage is found.**

⚠ **DANGER! To prevent fire and explosion, perform all service procedures with the engine turned OFF.**

⚠ **DANGER! Failure to inspect your work may allow fuel leakage to go undetected. This could become a fire or explosion hazard.**

After completing service procedures, start engine and check entire fuel system for possible leaks.

To prevent fire and explosion, Volvo Penta fuel system components meet U.S. Coast Guard requirements for fuel and fuel vapor containment. Do not substitute automotive or other non-approved parts.



Carburetor (GL Only)

The carburetor (**A** & **B**) vaporizes fuel and mixes it with air in proper quantities to suit the varying needs of the engine. Except for changing the carburetor fuel filter screen, the carburetor requires no periodic maintenance or adjustment. If operational problems occur, see your Volvo Penta dealer.

Electronic Fuel Injection

The electronic fuel injection (EFI, not shown) fuel metering system delivers the correct amount of fuel to the engine under all operating conditions. The EFI system is controlled by a microprocessor, and requires no periodic maintenance or adjustment. If operational problems occur, see your Volvo Penta dealer.

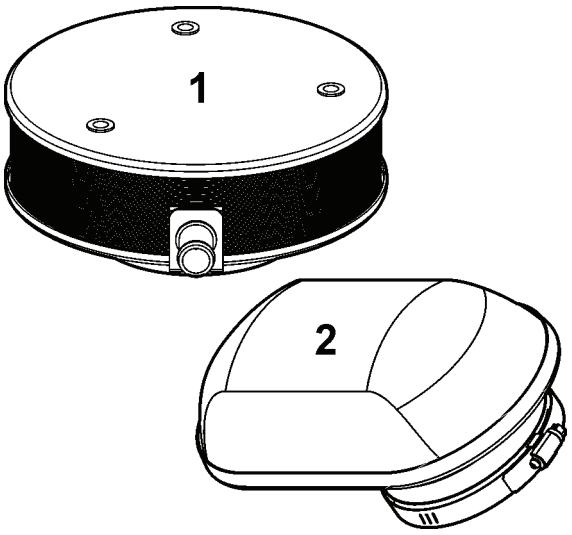
Detonation (Spark Knock)

Carbureted models: Detonation, or spark knock, in a marine engine is not necessarily audible. Overheating and continued running (“dieseling”) after ignition shut-off are indications of detonation in a marine engine. If you suspect detonation or spark knock, and the engine is tuned properly, change to a higher octane fuel.

EFI models: Detonation, or spark knock, is continually monitored by the electronic fuel injection (EFI) system. The EFI’s computer (ECM) will automatically alter spark advance to help prevent engine damage if knock is detected, and there will be a slight loss of power.

Preventing Gum Formation and Corrosion

To prevent gum formation and corrosion in the fuel system, use a fuel stabilizer in the gasoline if it will be in the tank for more than two weeks or if the boat is being prepared for winter storage. After adding fuel stabilizer, the engine should be run for ten minutes to allow stabilized fuel to reach all points of the fuel system. Fuel stabilizer is available from your Volvo Penta dealer.



23744

Flame Arrestor

Clean the flame arrestor (**1** or **2**) every 50 operating hours.

⚠ **WARNING! Use extreme care when removing flame arrestor on 8.1L engines (2). The electronic throttle plate, located behind the flame arrestor, has moving parts that are sharp and may severely cut or amputate fingers.**

- Clean in solvent, air dry, and inspect for damage.
- Replace if damaged.
- Reinstall flame arrestor; make sure unit is securely fastened.

To prevent fire and explosion in the engine compartment, the flame arrestor must always be in place, properly secured, and undamaged.

Electric Fuel Pumps

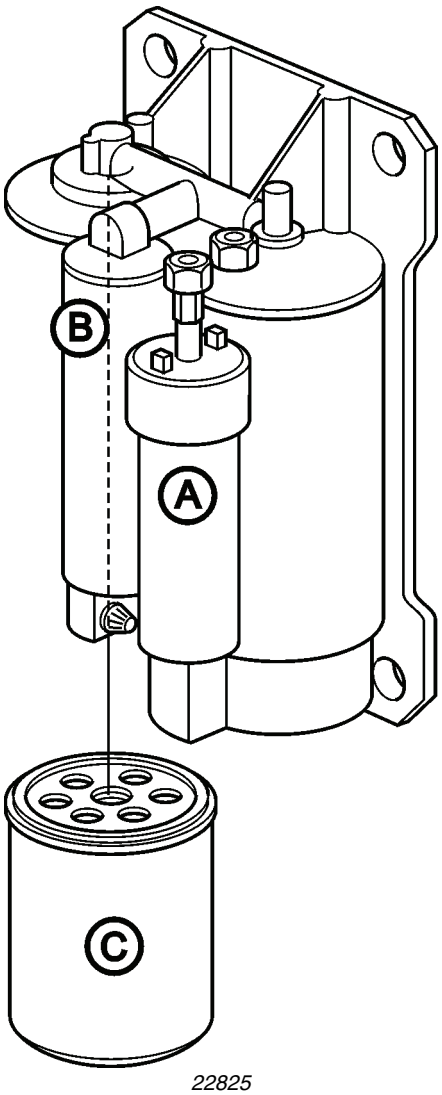
⚠ **WARNING! Check fuel pumps (A and B) frequently for signs of fuel leakage. If leakage occurs, have the fuel pump serviced immediately by your Volvo Penta dealer.**

EFI engines have two electric fuel pumps:

- A high-pressure pump (**A**) to supply the fuel injectors.
- A low-pressure pump (**B**) to bring fuel from the boat tank to the engine.

Both pumps are protected by a single 20-amp fuse. The pumps will operate only when the engine is cranking or running. If a pump does not function, check the fuses and replace them if necessary. See your Volvo Penta dealer if further service is required.

NOTICE! Do not run engine out of fuel or run the electric fuel pumps dry more than 20 seconds. Running the electric fuel pumps dry will damage the fuel pumps.



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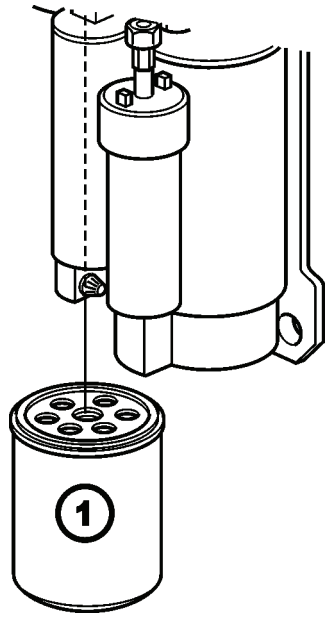

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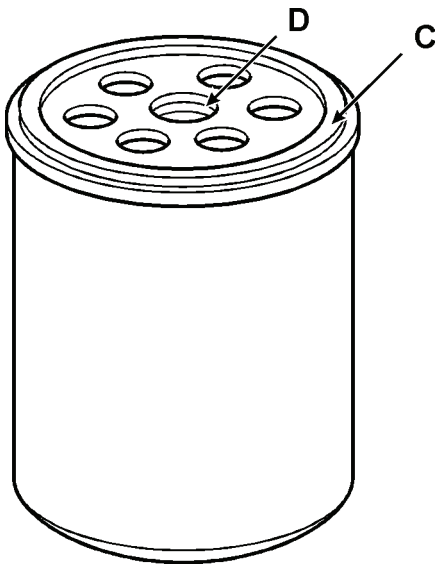


22839

NOTICE! A loud whining noise at idle may be due to a restricted fuel filter causing a noisy fuel pump. Operating the engine with a restricted filter may damage the pressure regulator or fuel pumps. See your Volvo Penta dealer if the pump makes an unusual noise.

Fuel Filter

All models have a fuel filter (**1**) in the fuel line before the fuel pump[1].

NOTICE! Volvo Penta EFI engines require a special marine filter with a 10 micron filtering capability. Do not substitute any other type of filter.

NOTICE! Accumulation of water and other fuel contaminants may form corrosive compounds that can damage the fuel filter, and result in fuel leakage. For this reason, annual replacement of the fuel filter is required to avoid risk of explosion or fire.

Engine Fuel Filter Replacement

Run the bilge blower for at least five minutes to vent the engine compartment, then start the engine and check for leakage. Smell for fuel in the bilge. Clean up the bilge until fuel cannot be detected by smell.

⚠ **DANGER! If you can smell fuel, turn the engine off immediately - EXPLOSION AND FIRE ARE AN EXTREME DANGER.**

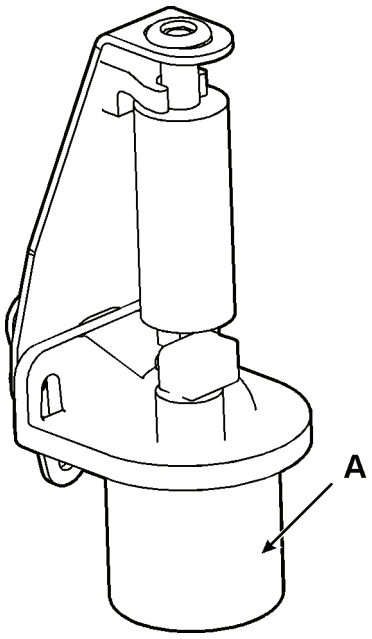
⚠ **DANGER! Turn off the main battery switch or disconnect the battery to prevent stray sparks.**

1. Turn off the engine.
2. Unscrew fuel filter, remove, and discard.

⚠ **DANGER! The old fuel filter contains flammable fuel. Dispose of safely.**

3. Using clean engine oil, lightly lubricate the gasket (**C**) and inner seal (**D**) on new fuel filter.
4. Screw on fuel filter and hand-tighten, following instructions on filter.
5. Clean up any spilled fuel.
6. Turn on the main battery switch or reconnect the battery.
7. Run the bilge blower for at least five minutes to vent the engine compartment.
8. Start the engine and check for leakage.
9. Smell for fuel in the bilge.
10. Clean up the bilge until fuel cannot be detected by smell.

1. The image to the left depicts EFI fuel pump and filter only. Refer to page 85 for illustrations of additional fuel pumps and filters.



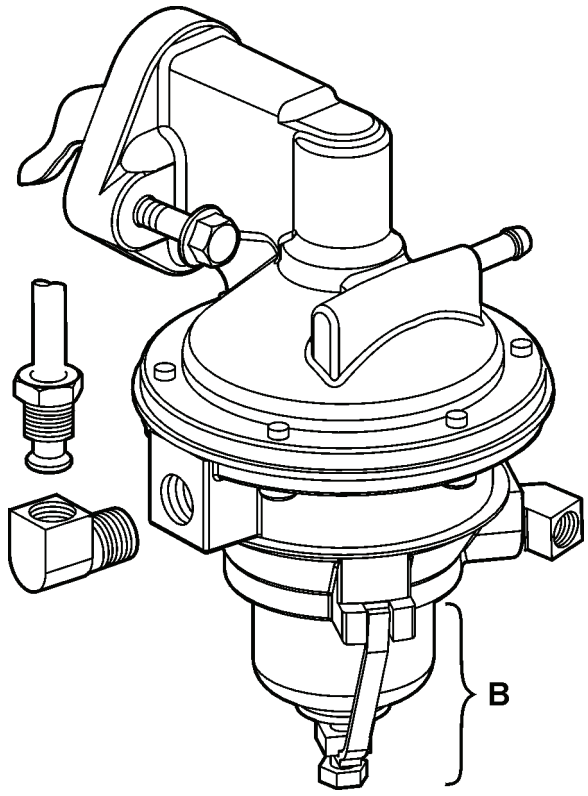
22900

Fuel Filter Replacement (V6/V8 Carb Engines)

1. Turn off the engine.
2. Unscrew fuel filter (**A**), remove, and discard.
3. Lightly lubricate the gasket and inner seal on new fuel filter.
4. Screw on fuel filter and hand-tighten, following instructions on filter.
5. Clean up any spilled fuel.
6. Run the bilge blower for at least five minutes to vent the engine compartment, then start the engine and check for leakage.
7. Smell for fuel in the bilge.

⚠ **DANGER! If you can smell fuel, turn the engine off immediately - EXPLOSION AND FIRE ARE AN EXTREME DANGER.**

8. Clean up the bilge until fuel cannot be detected by smell.



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Fuel Screen Replacement (3.0 Liter Carb Engines)

1. Turn off the engine.
2. Disconnect the fuel line at the carburetor.
3. Remove the fuel inlet nut, gasket, and ceramic screen (**B**). Discard ceramic screen and gasket.
4. Install new screen, new gasket, and fuel inlet nut.
5. Tighten the fuel inlet nut securely.
6. Reconnect the fuel line and tighten it securely.
7. Clean up any spilled fuel.
8. Run the bilge blower for at least five minutes to vent the engine compartment, then start the engine.
9. Smell for fuel in the bilge.

⚠ **DANGER! If you can smell fuel, turn the engine off immediately - EXPLOSION AND FIRE ARE AN EXTREME DANGER.**

10. Clean up the bilge until fuel cannot be detected by smell.

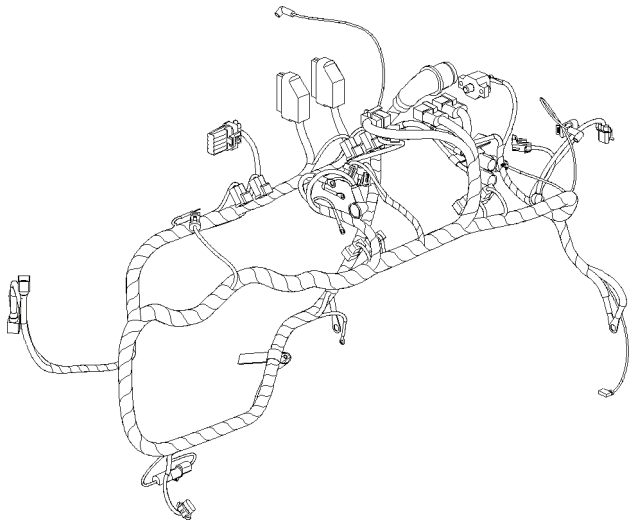
Electrical System

The engine's electrical system features cranking, charging, ignition, and trim/tilt circuits. A battery and all necessary wiring provide power.

WARNING! Do not expose the battery to electrical sparks or an open flame. Do not use jumper cables and a booster battery to start the engine. Remove the battery from the boat to recharge. Do not recharge the battery in the boat.

NOTICE! The battery terminal connections must always be insulated. If the battery mounting system does not cover the connections, install protective covers. This will help prevent shorting or arcing at the battery terminals.

NOTICE! If electrical connections are reversed, or wires are disconnected when the key switch is ON or the engine is running, sensitive electrical components may be immediately damaged. Do not turn off the main battery switch until the engine has stopped.



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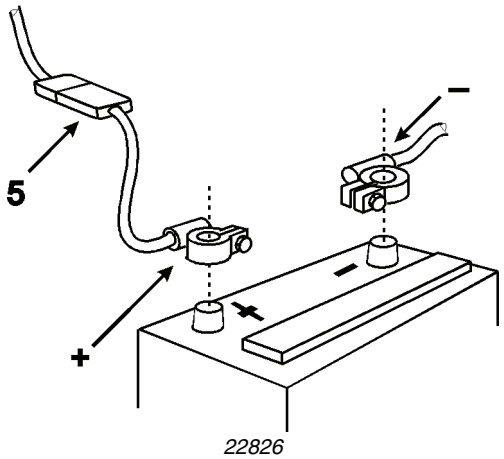


22826

Battery Cables

The following are the minimum specifications for multi-strand copper cables from the motor to the battery for all models. The maximum length is 20 feet per cable, regardless of diameter.

- 0 to 10 ft. (3.05 m) require a 1/0 AWG (80 MWG) cable.
- 10 to 15 ft. (3.05 to 4.6 m) require a 2/0 AWG (100 MWG) cable.
- 15 to 20 ft. (4.6 to 6.1 m) require a 3/0 AWG (120 MWG) cable.

NOTICE! Do not use aluminum core battery cables. Failure to use battery cables of recommended gauge and material could result in poor starting and electrical component damage.

Batteries and Connections

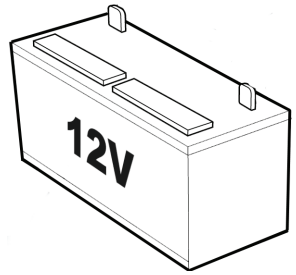
Battery Requirements:

All EFI engines ..... 650 CCA non-deep cycle

5.0GL engines .....650 CCA

3.0GL, 4.3GL engines .....360 CCA

NOTICE! Do not use deep cycle batteries on EFI engines. A deep cycle battery, while it may have enough cold cranking amps (CCA), will cause problems with EFI engines. The correct starting battery for all Volvo Penta EFI engines is a standard marine battery with a minimum of 650 CCA and a minimum of 135 minutes reserve capacity.



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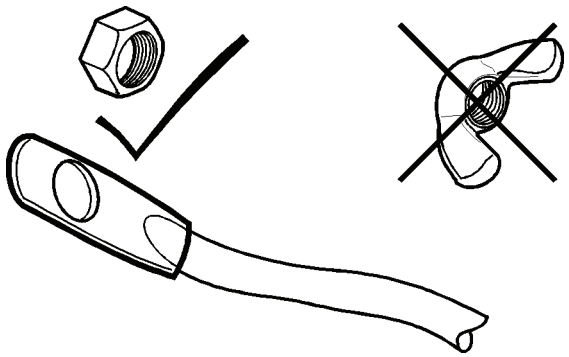


22840

- The battery used to start the engine must be a 12-volt, heavy duty marine battery, with adequate amperage for the engine model installed on your boat. Refer to the section entitled *Technical Data* on page 133 for the correct battery sizes.
- All other batteries must be heavy duty and constructed for marine use. They can be either vented/refillable, maintenance-free, or deep-cycle with a CCA.
- Use bolts and nuts to secure battery cables to the battery terminals. Do not use wing nuts to secure battery cables, even if they were supplied with the battery.
- Tighten all battery connections. Loose battery connections may cause damage to the engine's electrical system.

The service life of your battery depends largely on how it is maintained.

- Keep batteries dry and clean. Oxidation or dirt on the battery and battery terminals may cause short circuits, voltage drops, and discharges (especially in damp weather).
- Clean battery terminals and leads to remove oxidation.
- Tighten cable terminals tightly.
- Spray battery terminals and connections with an anti corrosive agent, or coat them with petroleum jelly.
- Check that all other electrical connections are dry and free of oxidation, and that there are no loose connections.
- Always switch off the charging circuit before removing the battery charger connectors.
- Inspect your battery at regular intervals for specific gravity (state of charge), individual cell water level, cleanliness and tight, greased connections.
- If the battery has become discharged for no apparent reason, check all electrical system components for malfunction or a switch left ON, before installing a recharged battery.
- Electrolyte levels should be above the plates in the battery and no higher than the fill indicator level. Top off if necessary, using distilled water. After topping off, run the engine at fast idle for at least 30 minutes to charge the battery.

⚠ **WARNING! Battery electrolyte is a corrosive acid and should be handled with care. If you spill or splash electrolyte on any part of the body, immediately flush the exposed area with liberal amounts of water and seek medical attention as soon as possible.**

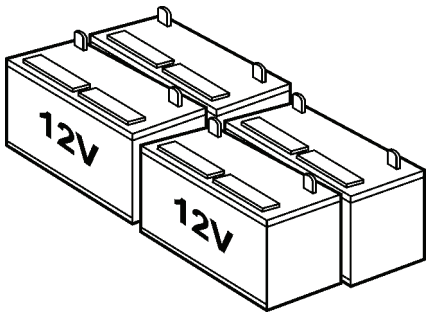
NOTICE! Some maintenance-free batteries have special instructions. Make sure to follow the battery manufacturers instructions carefully.

Battery Replacement

DANGER! Fumes vented during battery charging may cause an explosion. Failure to follow the safety precautions below may result in electrical sparks igniting fuel vapors causing fire or explosion.

NOTICE! When replacing your battery, read and understand the information supplied with it before you begin installation.

1. Service electrical components only while the motor is off. Be careful when identifying positive and negative battery cables and terminals. If you touch the wrong terminal with a battery cable, even briefly, the motor's charging system could be damaged.
2. Operate the boat's bilge blower for at least 5 minutes prior to servicing battery.
3. Open the engine cover or hatch and check the boat's bilge area for gasoline fumes. If any fumes can be detected by smell, do not operate the boat until you find the source, clean up the spill, and correct the cause.
4. Do not connect cables to battery until all other electrical connections have been made.
5. Make sure the ignition switch is OFF before removing or installing electrical equipment, checking any electrical connections, or installing battery cables.



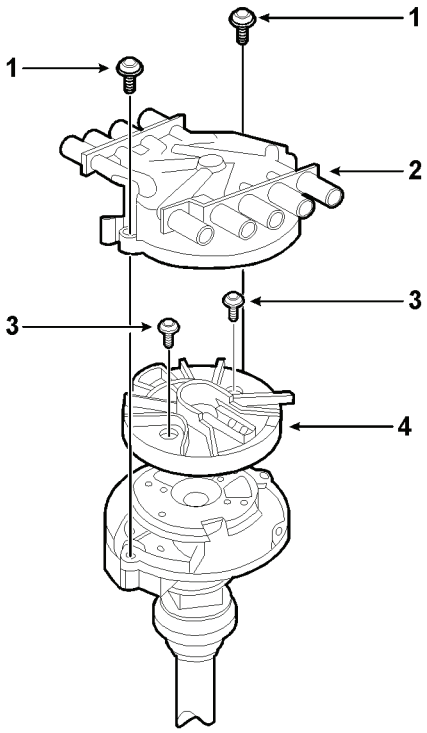
22827-2

Multiple Batteries and Selector Switch

See your Volvo Penta dealer for multiple battery installation recommendations.

If your boat is equipped with multiple batteries and a selector switch, the engine should be operated with the selector switch set to the ALL position. This will provide charging system output to all batteries.

A battery isolator is recommended if batteries will be switched for individual operation.



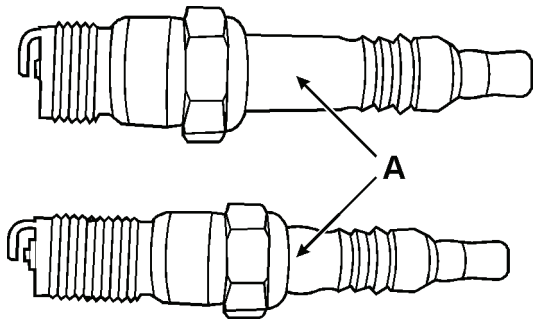
23765

Distributor Cap and Rotor

1. Remove the distributor cap screws (**1**) using a Torx[1] T20 screwdriver.
2. Remove the rotor screws (**3**) using a Torx T15 screwdriver.
3. Clean the distributor cap (**2**) and rotor (**4**) using compressed air. Inspect for damage, excessive wear, or corrosion. If necessary, replace these components with genuine Volvo Penta parts.
4. Reattach the rotor, torquing screws to 18 in. lb. (2 Nm).
5. Reattach the distributor cap, torquing screws to 21 in. lb. (2.4 Nm). If you reuse the original screws, apply thread locking compound (PN 1161053).

Be sure spark plug leads are replaced in the correct firing order. Firing order information is provided in the section entitled *Technical Data* on page 133.

1. Torx is a registered trademark of Textron Inc. DBA Camcar Division of Textron Inc.



23172

Spark Plugs

Before installing new spark plugs, always check for proper type and gap[1]. Incorrect spark plugs can cause operational problems and possible internal engine damage.

Before installing a spark plug, the spark plug seat in the cylinder head should be wiped clean. Tighten plugs to the proper torque value[1]. Make sure the spark plug terminals are fully seated on the spark plugs.

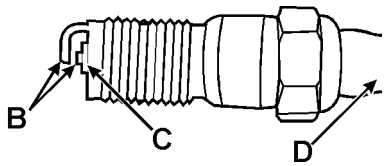
When spark plug leads are removed, be sure they are replaced in the correct firing order[1].

⚠ DANGER!

- Avoid abusive handling that could crack the spark plug's ceramic body (**A**). Damaged spark plugs can emit external sparks that could ignite any fuel vapors in the engine compartment, resulting in fire or explosion.
- Do not operate engine if spark plug boots or high-tension leads are torn or cracked. This condition could allow external sparks which could ignite any fuel vapors in the engine compartment, resulting in fire or explosion.

Checking and Changing Spark Plugs

⚠ CAUTION! To prevent possible injury caused by someone inadvertently starting the engine, remove the ignition keys from each starting location (especially if the engine room/engine compartment cannot be seen from various remote starting positions such as a flybridge or enclosed cabin).



23172-2

1. Twist and pull only on the spark plug wire boot (pulling on wire may cause separation of the core of the wire).
2. Remove spark plugs using a 5/8-inch spark plug socket or a 5/8-inch box wrench. Use care to avoid cracking the spark plug insulators (**D**).
3. Carefully inspect the insulators and electrodes of all spark plugs.
   - ❑ Replace any spark plug which has a cracked or broken insulator or which has loose electrodes (**B**).
   - ❑ If the insulator is worn away around the center electrode (**C**), or the electrodes are burned or worn, the spark plug is worn out and should be discarded.
   - ❑ Spark plugs that are in good condition, except for carbon or oxide deposits, should be thoroughly cleaned and gapped.

1. For additional information, see *Technical Data* on page 133.

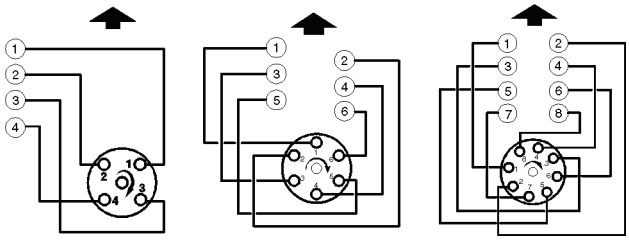
The spark plug wires are a special resistance type. The core is carbon-impregnated linen. This type wire is superior to copper core wire in its resistance to crossfire; however, it is more easily damaged than copper core. For this reason, pull on the spark plug boots to remove the spark plug wires, rather than pulling on the wire insulation. If the wire is stretched, the core may be broken with no evidence of damage on the outer insulation. If the core is broken, it will cause misfiring. In the case of wire damage, it is necessary to replace the complete wire assembly since a satisfactory repair cannot be made.

4. Clean ignition wires with a cloth moistened in kerosene, and wipe dry. Bend wires to check for brittle, cracked or loose insulation. Defective insulation may result in misfiring, cross-firing, or spark to ground; therefore, defective wires must be replaced.
5. If the wires are in good condition, clean any terminals that are corroded. Replace any that are broken or distorted. Replace any wires with broken or deteriorated cable nipples or spark plug boots.
6. Clean spark plugs.

   Spark plugs that have carbon or oxide deposits should be cleaned in a blast type spark plug cleaner. Scraping with a pointed tool will not properly remove the deposits and may damage the insulator. If spark plugs have a wet or oily deposit, dip them in a degreasing solvent and dry thoroughly with compressed air. Oily plugs will cause the cleaning compound to pack in the shell. Carefully follow the instructions of the manufacturer of the cleaner being used. Clean each plug until the interior of the shell and entire insulator are cleaned. Avoid excessive blasting.
7. Examine interior of plug in good light. Remove any cleaning compound with compressed air. If traces of carbon or oxide remain in plug, finish the cleaning with a light blasting operation. Clean firing surfaces of center and side electrodes with several strokes of a fine cut file.
8. When spark plugs have been thoroughly cleaned, carefully inspect them for cracks or other defects that may not have been visible before cleaning.
9. Use a round wire feeler gauge to check the gap between the spark plug electrodes. (Flat feeler gauges will not give a correct measurement if the electrodes are worn.) Adjust gap by bending the side electrode only. Bending the center electrode will crack the insulator. Setting the spark plug gap to any other specification in an attempt to improve idle or affect engine performance is not recommended.
10. See the diagrams for correct installation of spark plugs and wires.

For proper engine performance it is very important that the correct spark plugs be used. When installing spark plugs, make sure that the threads in the cylinder head and all surfaces on plugs and in cylinder heads are clean. Tighten spark plugs the specified amount. All engines use tapered seat plugs without gaskets.

DANGER! Do not operate engine if spark plug boots or high-tension leads are torn or cracked. This condition can allow external sparks, which could ignite any fuel vapors in the engine compartment.



22843

Spark plug wires must be arranged between the distributor cap and spark plugs in the order of firing sequence. If spark plug wires are not correctly installed, misfiring or cross-firing will result.

8.1Gi-H(F), 8.1GXi-G(F), 8.1GiE-A(F), 8.1GXiE-A(F), 8.1OSi-D(F), and 8.1OSiE-A(F) engines use a distributorless ignition system with one coil per cylinder. Refer to the section entitled *Technical Data* on page 133 for correct firing order information.

Circuit Breakers and Fuses

The engine and boat's electrical system is protected against current overload by a circuit breaker and fuses.

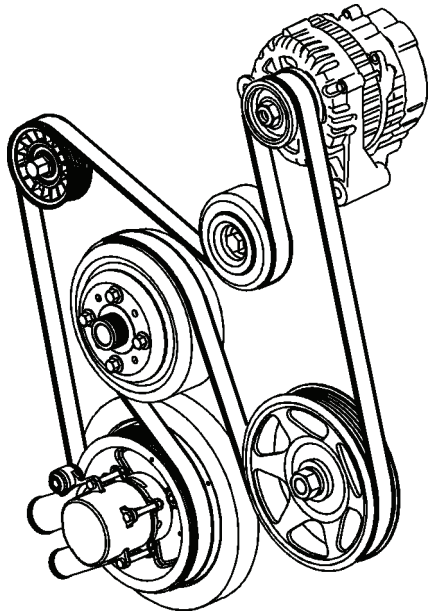
- If the circuit breaker trips, press button to reset.
- Replace any blown fuses.

NOTICE! Circuit breakers or fuses that repeatedly fail indicate a problem that requires immediate attention. See your Volvo Penta dealer.

NOTICE! If electrical connections are reversed, or connections removed when the key switch is on or the engine is running, the electrical system may be immediately damaged.

Belt Replacement

CAUTION! To prevent possible injury caused by someone inadvertently starting the engine, remove the ignition keys from each starting location (especially if the engine room/engine compartment cannot be seen from various remote starting positions such as a flybridge or enclosed cabin).



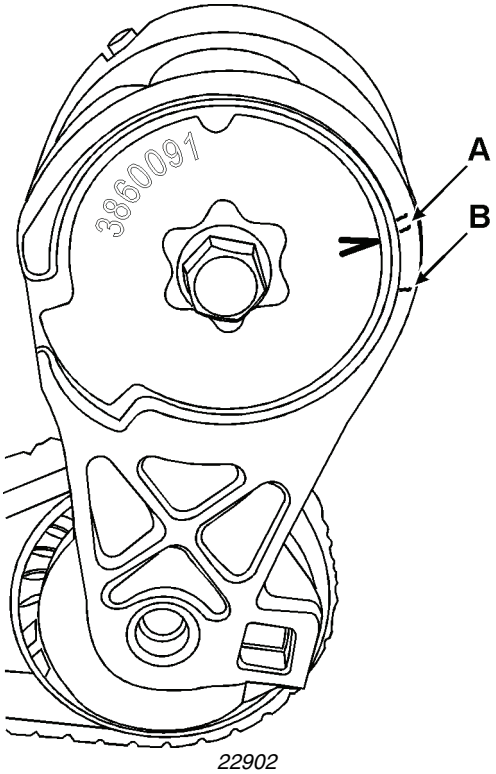
23770

Serpentine Belt Engines

All engine models use a serpentine belt, which is a continuous-loop belt threaded through the alternator pulley, circulating pump pulley, idler pulley, and power steering pump pulley.

This single belt replaces two separate belts (alternator and power steering pump belts). The serpentine belt tension is adjusted automatically and requires no tension adjustments. However, at least once per year, have your Volvo Penta dealer check the serpentine belt for wear or inspect the belt yourself for cracks, check marks, dry rot, exposed cords, oil or grease. An ideal time to perform this check is when you have the gimbal bearing lubricated.

Alternatively, you may check the indicators, located on the automatic tensioner housing, to determine the amount of wear. When tick marks **C** & **D** coincide (all engines, except 3.0L) and mark **B** is centered between tick marks **A** (3.0L engine only), it's time to replace the serpentine belt.



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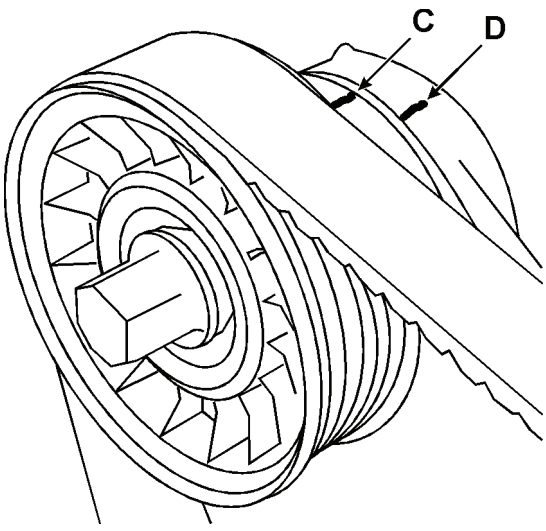
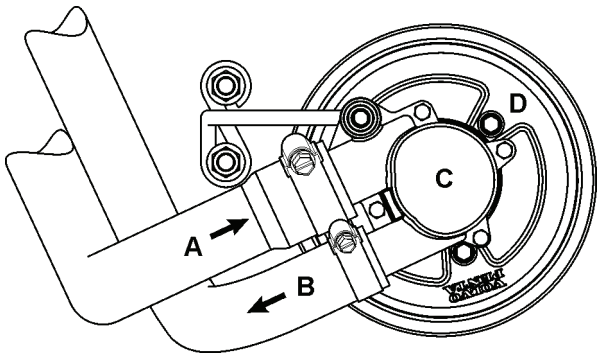


22901

Cooling System

If a situation should occur where the cooling system is unable to provide adequate cooling, be sure to check three possible causes before continuing to operate the engine:

- Drive water intakes blocked. Tilt the drive up and look for obstructions to the water intakes (e.g., seaweed, plastic bags, etc.).
- Raw water pump impeller damaged or blocked. For additional information, see *Impeller: Checking & Replacing* on page 99.
- Faulty engine thermostat. For additional information, see *Replacing the Engine Thermostat* on page 94.

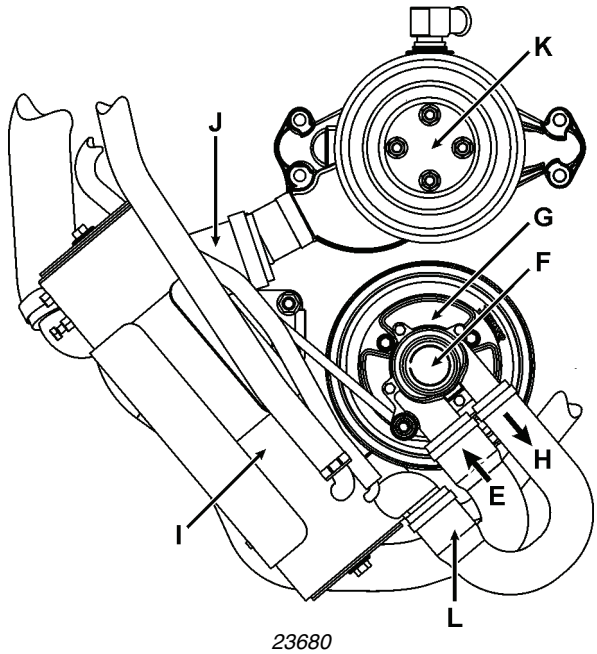


23681

Raw Water System

Various Volvo Penta engines have a thermostat-controlled raw water cooling system.

1. Cool water is drawn in through raw water intake (**A**) by an impeller (**C**) connected to the raw water pump (**D**) mounted on the front of the engine.
2. Water is pumped to the engine and routed by circulating water through the cooling system (**B**).
3. A thermostat inside the engine determines the amount of water to be taken in, recirculated, and discharged to control the engine's operating temperatures.

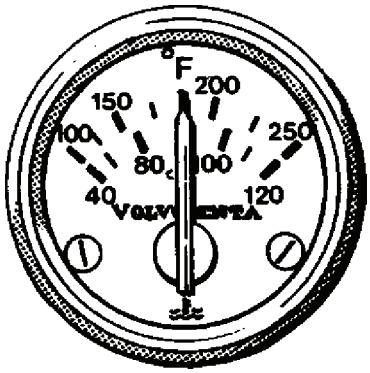


23680

Closed Cooling System (F-Series)

Various Volvo Penta engines have a thermostat-controlled, fresh water cooling system.

1. Cool water is drawn in through raw water intake (**E**) by an impeller (**F**) connected to the raw water pump (**G**) mounted on the front of the engine.
2. Water is pumped (**H**) to the heat exchanger (**I**), which cools the engine cooling fluid (**J**). The raw water is then routed to the exhaust manifolds where it is mixed with exhaust and dumped overboard through the sterndrive exhaust port.
3. The engine cooling fluid is recirculated between the engine and the heat exchanger by the engine circulation pump (**K**).
4. A thermostat inside the engine determines the amount of water to be taken in and circulated to the heat exchanger, then discharged to control the engine's operating temperatures.



21195-1

Engine Overheating (EFI Engines)

If the engine overheats at high engine speeds, the engine protection mode feature will activate and:

- Engine speed will be automatically reduced to approximately 2500 RPM. The engine will not operate above 2500 RPM. If an engine overheat alarm has been installed, an audible warning horn will sound.
- The engine protection mode feature will remain active until the engine has been reduced to idle speed and the overheating problem is corrected. For additional information, see *Engine Protection Mode* on page 28.

NOTICE! Do not remove the thermostat from the engine as the engine is likely to overheat.

While Volvo Penta provides an audible alarm with every engine, its installation is determined by the manufacturer of your boat. If your boat does not have an audible alarm available, we strongly recommend that you contact your dealer to have one installed.

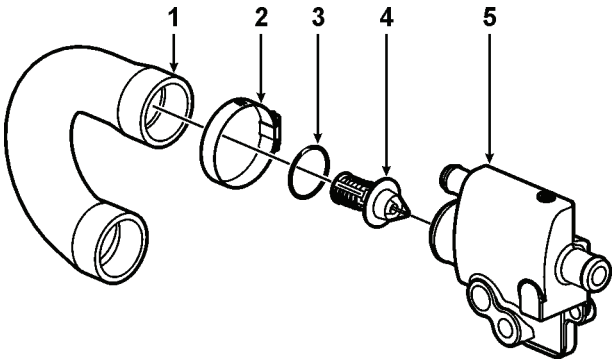
Engine Overheating (Carbureted)

If your engine overheats, the audible alarm will sound and a temperature gauge on your instrument panel will indicate your engine is overheating.

1. Turn off the engine.
2. Tilt the drive up and look for obstructions to the water intakes (e.g., seaweed, plastic bags, etc.).
3. Lower the drive unit.
4. Start engine and run in NEUTRAL at 1500 RPM.
5. Check the engine gauge to verify the condition.
6. If overheating still occurs, do not operate the engine unless it is an emergency. Only operate it until you are clear of the emergency and seek a tow to shore.

NOTICE! Continuing to operate an overheating engine will cause engine damage.

7. See your Volvo Penta dealer for assistance.

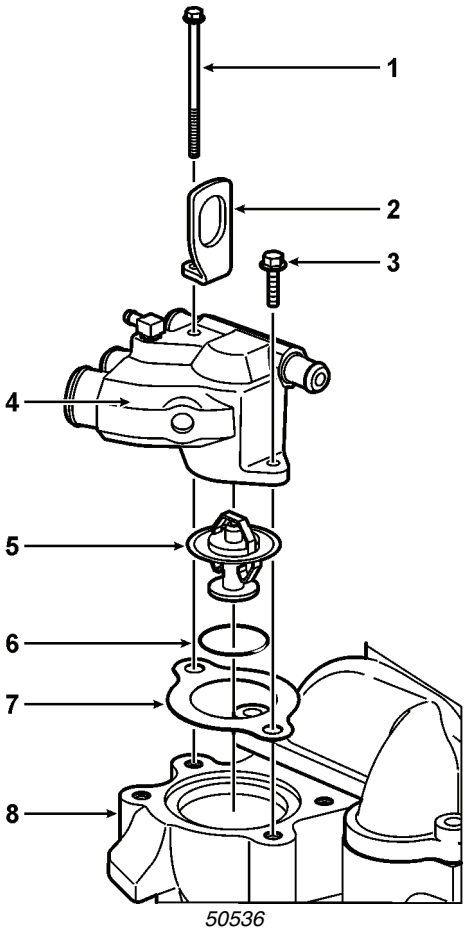


50535

Replacing the Engine Thermostat

3.0 Liter Engines

1. Loosen hose clamp **2**.
2. Remove hose **1** from thermostat housing **5**.
3. Remove O-ring **3** and thermostat **4** from housing. Discard thermostat. Inspect O-ring and, if damaged, replace.
4. Insert new thermostat and O-ring into housing.
5. Reattach hose and hose clamp. Torque clamp to 27–43 in. lb. (3.1–4.9 Nm).



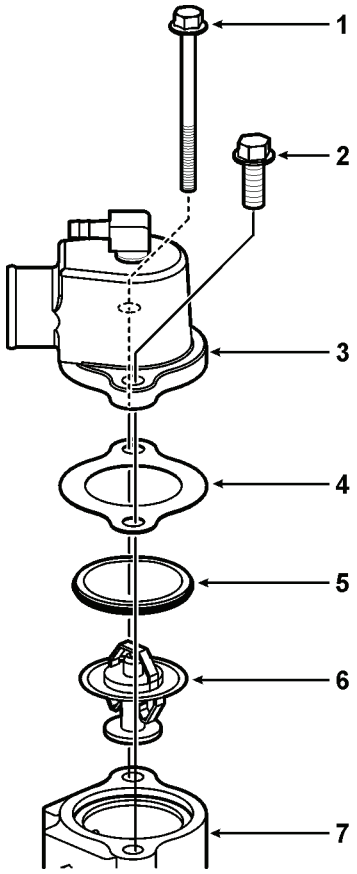
50536

4.3L–5.7L Engines (Raw Water Cooled)

1. Loosen and remove long bolt **1**; save for reuse.
2. Place lifting eye **2** in a secure location; you will need to reattach it later.
3. Loosen and remove short bolt **3**; save for reuse.
4. Remove thermostat housing **4**.
5. Remove thermostat **5**, O-ring **6**, and gasket **7** from intake manifold **8**. Discard gasket and thermostat. Inspect O-ring and, if damaged, replace.
6. Clean intake manifold and thermostat housing surfaces where the gasket makes contact. Remove any remnants of the old gasket.

NOTICE! Take care not to drop any debris into the intake manifold. Place a rag in the intake manifold to keep debris out; remove when cleaning is completed.

7. Place new gasket, new thermostat, and the O-ring into the groove in the intake manifold.
8. Replace thermostat housing.
9. Install bolts and lifting eye.
10. Torque bolts to18–30 ft. lb. (25–41 Nm).



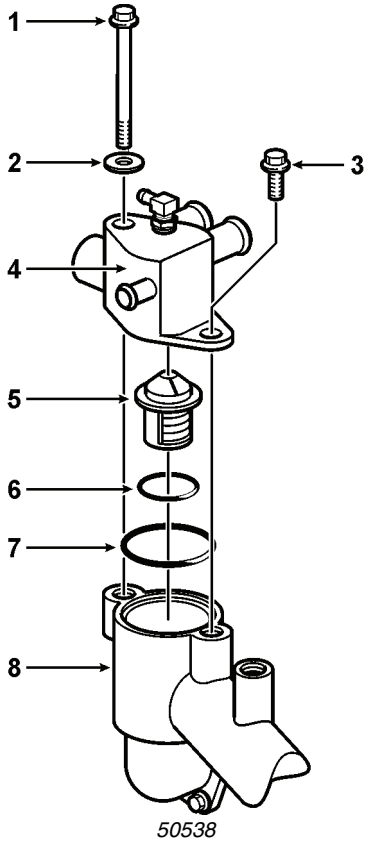
50537

4.3L–5.7L Engines (Closed Cooling System)

1. Loosen and remove long bolt **1** and short bolt **2**; save for reuse.
2. Remove upper thermostat housing **3**.
3. Remove gasket **4**, O-ring **5**, and thermostat **6** from lower thermostat housing **7**. Discard gasket and thermostat. Inspect O-ring and, if damaged, replace.
4. Clean thermostat housing surfaces where the gasket makes contact. Remove any remnants of the old gasket.

NOTICE! Take care not to drop any debris into the thermostat housings. Place rags in the housings to keep debris out; remove when cleaning is completed.

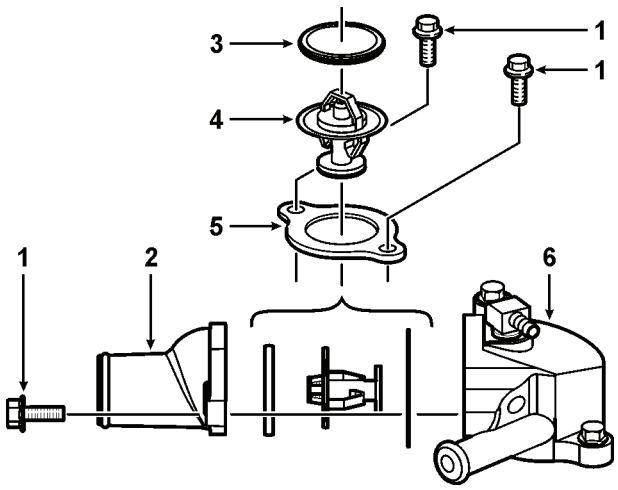
5. Place new gasket, new thermostat, and the O-ring into the groove in the lower thermostat housing.
6. Replace upper thermostat housing.
7. Install bolts and torque to18–30 ft. lb. (25–41 Nm).



50538

8.1 Liter Engines (Raw Water Cooled)

1. Loosen and remove long bolt **1**, washer **2**, and short bolt **3**; save for reuse.
2. Remove thermostat housing **4**.
3. Remove thermostat **5**, small O-ring **6**, and large O-ring **7**, from cross-over pipe housing **8**. Discard thermostat. Inspect O-rings and, if damaged, replace.
4. Place new thermostat and O-rings into the groove in the cross-over pipe housing.
5. Replace upper thermostat housing.
6. Install bolts and washer and torque to18–30 ft. lb. (25–41 Nm).



50539

8.1 Liter Engines (Closed Cooling System)

1. Loosen and remove bolts **1**; save for reuse.
2. Remove upper thermostat housing **2**.
3. Remove O-ring **3**, thermostat **4**, and gasket **5**, from lower thermostat housing **6**. Discard gasket and thermostat. Inspect O-ring and, if damaged, replace.
4. Clean thermostat housing surfaces where the gasket makes contact. Remove any remnants of the old gasket.

NOTICE! Take care not to drop any debris into the thermostat housings. Place rags in the housings to keep debris out; remove when cleaning is completed.

5. Place new gasket, new thermostat, and the O-ring into the groove in the lower thermostat housing.
6. Replace upper thermostat housing.
7. Install bolts and torque to18–30 ft. lb. (25–41 Nm).

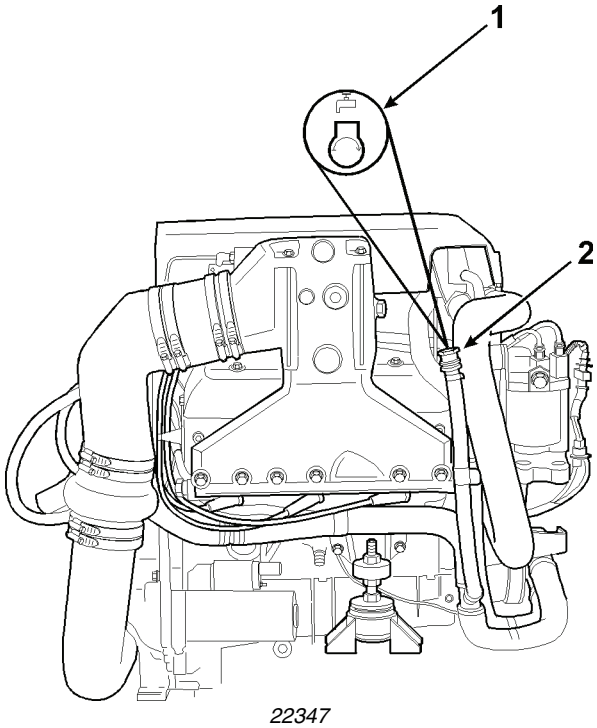
Engine Flush

Volvo Penta engines incorporate an engine flushing port designed to flush the engine with fresh water while the engine is running. If flushing the engine with the boat in the water, the engine should not be run higher than idle or sea water may be drawn in with the fresh water.

NOTICE! When flushing the engine with the boat in the water, fresh water pressure must be 17 psi (117 kPa) or greater.

1. If the engine is running, shut it down.
2. Remove the blue plastic cap from the hose that is clamped to the starboard side of the engine. It is marked with the running engine flush symbol (**1**).
3. Connect a water hose from a fresh water source to the flush connector on the engine (**2**).
4. Turn water on full and start the engine.
5. Let engine idle until engine temperature stabilizes at its normal operating range. This will allow the thermostat to open and ensure the fresh water circulates throughout the engine.
6. After engine is flushed, shut engine the down.
7. Disconnect water hose and reinstall the cap.

Drain the engine if freezing temperatures are expected. For details on draining the engine, please refer to the section entitled *Draining the Cooling System* on page 97.



22347

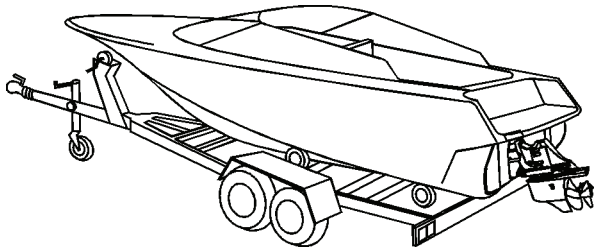
NOTICE! When re-installing the blue cap on the fresh water flush hose, tighten it by hand, then tighten 1/4 turn using a wrench. If the cap is too loose, air may be sucked in, causing the engine to overheat, resulting in damage.

Draining the Cooling System

NOTICE! When temperatures drop below freezing, failure to completely drain the cooling system will result in serious damage to the engine and exhaust manifolds. To assure complete drainage, probe all drain openings with a piece of wire to remove any blockage.

NOTICE! The following steps are very important in protecting your engine from damage in freezing conditions. If unsure of how to perform any of the following steps, see your Volvo Penta dealer for a complete end-of-season/winterization service. Freeze damage to the engine package is not covered by your Volvo Penta limited warranty.

NOTICE! When draining the starboard manifold, take care to direct the drained water away from the starter to prevent water damage to the starter.



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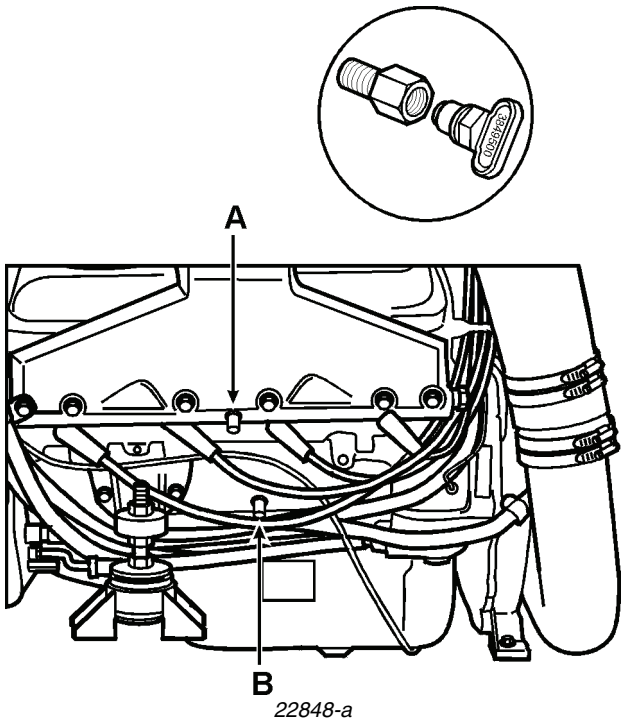
- Perform these procedures with the boat out of the water. It will prevent damage to cooling system components if temperatures drop below freezing.
- When draining the engine, raise or lower the bow of the boat to keep the engine level. This will provide for complete drainage of the block and manifold. If the bow of the boat is higher or lower than the stern, some water may be trapped in the block.

Raw Water Cooled Engines

1. With the engine turned off, locate and open the engine drain petcocks (**B**) located on both sides of the engine block.

NOTICE! Be sure that all water is drained from the engine. If no water drains when the petcocks are opened, remove the petcocks and use a piece of wire to clear any obstructions from the drain hole. Failure to drain all the water from the engine may result in engine damage during freezing temperatures.

2. Remove drain plugs from exhaust manifolds (**A**). Raise or lower the bow of the boat to ensure complete drainage. Probe the drains with a wire to ensure rust particles have not blocked the drain. After the water has completely drained, reinstall the drain plugs and tighten securely.
3. Note the hose orientation on the raw water pump. Loosen the hose clamps and remove the hoses from the raw water pump. Loosen the hose clamp on the large diameter hose and remove it from the circulation pump.



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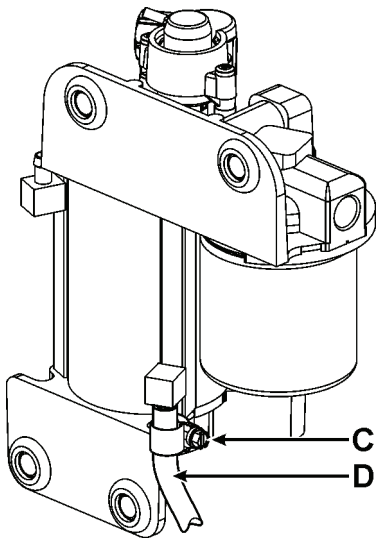

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4. Crank the engine briefly, (1 or 2 crankshaft revolutions) but do not start the engine, to clear the water from the pump.
5. Loosen clamp (**C**) and remove hose (**D**) from fuel pump. Allow water to drain from hose.
6. Reinstall all hoses and secure all clamps in the same orientation as removed.

NOTICE! Failure to connect the raw water pump hoses in the correct orientation may damage the raw water pump impeller.

4.3 GL Draining Only

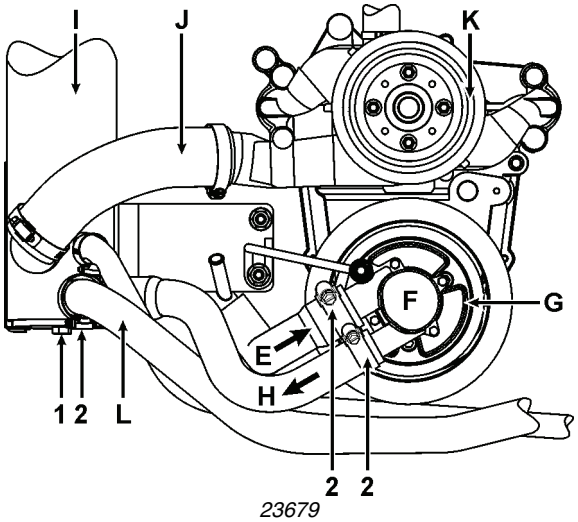
When draining the 4.3 GL carbureted engine, be sure to remove the intake manifold drain plug, located behind the alternator tensioning bracket (see item #19, *Intake Manifold Drain Plug* on page 52), to drain any remaining water in the intake manifold. In addition, follow the directions in *4.3, 5.0, and 5.7 Liter Engines (F-Series)* on page 99.

This procedure **does not apply** to F-series engines; this is for the 4.3 GL only.

Draining the Closed Cooling System

8.1 Liter Engines (F-Series)

NOTICE! Check the coolant level and antifreeze concentration (check coolant manufacturer's instructions). Make sure the coolant's freeze point is adequate for expected temperatures. Failure to maintain adequate antifreeze may result in engine damage during freezing temperatures.



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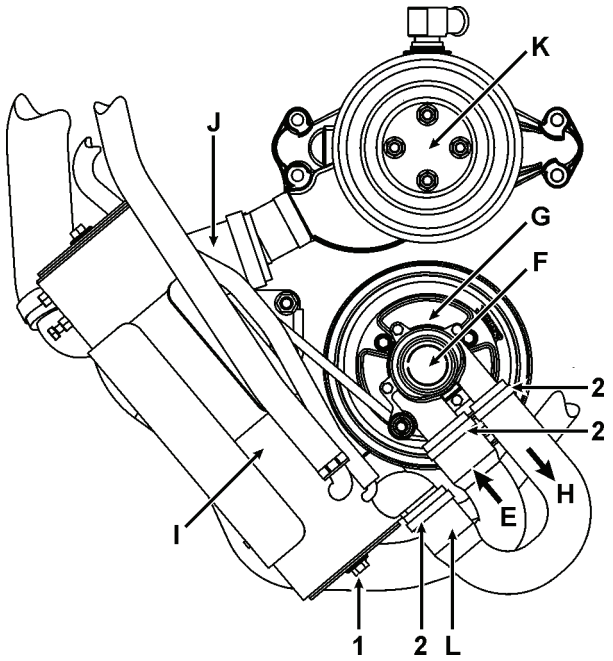
1. With the engine turned off locate and loosen the lower drain cap from the heat exchanger (**1**). After water has completely drained, retighten the lower drain cap of the heat exchanger to 18-30 ft. lb. (25-41 Nm).
2. Note the hose orientation on the raw water pump (**G**). Loosen the hose clamps (**2**) and remove the hoses (**E**, **H**, & **L**) from the raw water pump and heat exchanger. Crank the engine briefly, (1 or 2 crankshaft revolutions) but do not start the engine, to clear the water from the pump. Reinstall the hoses and secure the clamps in the same orientation as removed.
3. Remove drain plugs from exhaust manifolds. Change the level of the boat to ensure complete drainage. Probe the drains with a wire to ensure rust particles have not blocked the drain. After water is completely drained, reinstall drain plugs and tighten securely.



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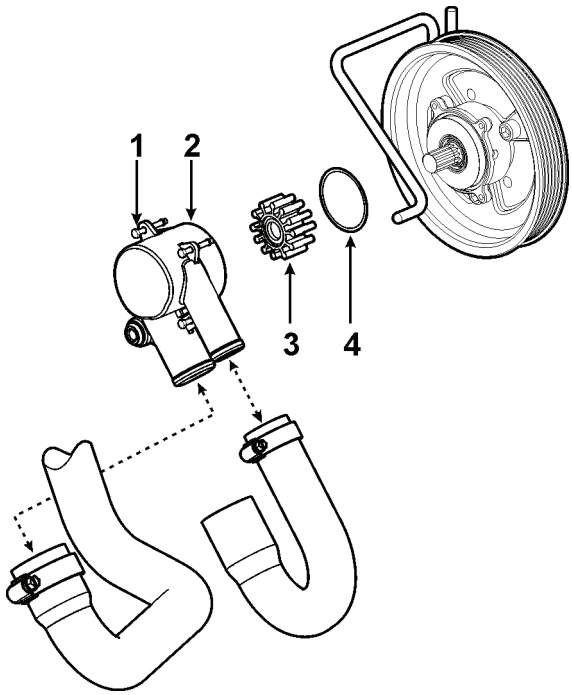

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4.3, 5.0, and 5.7 Liter Engines (F-Series)

NOTICE! Check the coolant level and antifreeze concentration (check coolant manufacturer's instructions). Make sure the coolant's freeze point is adequate for expected temperatures. Failure to maintain adequate antifreeze may result in engine damage during freezing temperatures.

To drain the raw water system of your Volvo Penta engine (with factory installed closed cooling):

1. With the engine turned off locate and loosen the lower drain cap from the heat exchanger (**1**). After water has completely drained, retighten the lower drain cap of the heat exchanger to 18-30 ft. lb. (25-41 Nm).
2. Note the hose orientation on the raw water pump (**G**). Loosen the hose clamps (**2**) and remove the hoses (**E** & **H**) from the raw water pump. Crank the engine briefly, (1 or 2 crankshaft revolutions) but do not start the engine, to clear the water from the pump. Reinstall the hoses and secure the clamps in the same orientation as removed.
3. Remove drain plugs from exhaust manifolds. Change the level of the boat to ensure complete drainage. Probe the drains with a wire to ensure rust particles have not blocked the drain. After water is completely drained, reinstall drain plugs and tighten securely.

Impeller: Checking & Replacing

NOTICE! If the engine is installed so that the seawater pump is located under the water line, there is a risk of water penetration. If you have a seacock installed, close it now.

NOTICE! Always carry a spare impeller on board.

1. Remove the hose clamps and hoses from pump.
2. Loosen the four screws (**1**) and remove the housing (**2**).
3. Inspect the impeller (**3**). If there are cracks, signs of burning or melting on the edges, or any other visible defects, the impeller must be replaced. Inspect the O-ring (**4**) for nicks, cuts, and wear. Replace as necessary.
4. Lubricate the pump housing with non-petroleum based lubricant, suitable for rubber, such as glycerine. If you have purchased the Volvo Penta impeller kit, a packet of glycerine is included.
5. Reinstall the impeller. Reinstall the housing.
6. Install the hoses and hose clamps.

Lubrication System

Engine/Crankcase Oil

To obtain the best engine performance and engine life, Volvo Penta recommends synthetic engine oil labelled for API Service CF/SH and ILSAC GF-4, or you may use an engine oil with the recommended quality and viscosity. Engine oils are specified by API service, letter designations, and SAE viscosity numbers. Refer to oil identification symbol on the container.

Initial factory fill is a high quality motor oil for API Service CF/SH and ILSAC GF-4. 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 between the ADD and FULL marks on the dipstick. The space between the marks represents approximately one quart (one liter). For oil level dipstick location, refer to the photographs in the section entitled *Features* on page 47.

Lowest Anticipated Temperature	Recommended SAE Viscosity Oils
32° F (0° C) — above	SAE 30 SAE 20W/50 SAE 15W/50
0° F (-18° C) — 32° F (0° C)	SAE 20W-20
Below 0° F (-18° C)	SAE 10W

NOTICE! Use Volvo Penta Engine Oil, Synthetic or Mineral, recommended for 0°F (-18°C) and above. For additional information, see *Maintenance Schedule* on page 74.

The sections entitled *Technical Data* on page 133 and *Maintenance Schedule* on page 74 provide detailed information about oil filter type and service intervals.

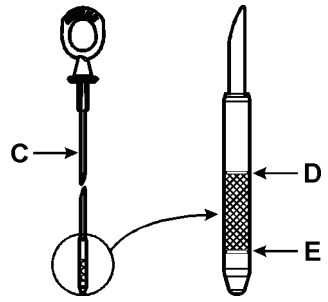
When you add or change engine oil, use Volvo Penta engine oils for gasoline engines. Use the viscosity chart to select the SAE viscosity that matches the temperature range in which you expect to operate.

All models are required to use a mineral-based oil for the first 150 hours. After the first 150 hours, the operator may continue to use mineral oil (requiring an oil change at 100 hour intervals or once per season) or switch to synthetic oil (requiring an oil change at 200 hour intervals or once per season). Switching between mineral based oils and synthetic oils is not recommended. For additional information, see *Maintenance Schedule* on page 74.

Use single viscosity oils in markets where available. The use of multi-viscosity oils such as 10W-30 and 10W-40 is not recommended unless single viscosity oils are unavailable.

At the first service interval (50 hours), change the crankcase oil and replace the oil filter. Refer to the Maintenance Schedule for recommended oil change intervals.

⚠ WARNING! Use only parts that are U.S.C.G. approved for marine use. Substituting automotive or generally supplied parts and hardware may result in product malfunction and possible injury to the operator and/or passengers. Never use parts of unknown quality.



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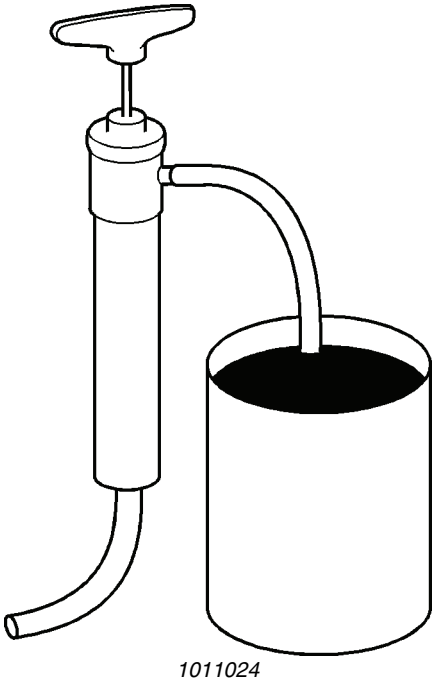
Checking Engine Oil Level

The oil level must be between the two level marks on the dipstick **C**. If engine is not in a horizontal position, the oil level on the dipstick will not be accurate. If the oil level is checked with a cold engine, the oil level on the dipstick could be above the actual level. If the oil level is checked directly after shutting the engine off the oil level on the dipstick will be low. To get an accurate oil level reading on the dipstick:

1. Run the engine to normal operating temperature, then shut off engine and wait at least 5 minutes.
2. Remove the dipstick and check oil level.
3. Add oil as necessary to maintain the proper level.

NOTICE! Do not allow the crankcase oil level to go below the ADD mark **E**, and do not fill above the FULL mark **D**. Overfilling results in high operating temperatures, foaming (air in oil), loss of power, and overall reduced engine life.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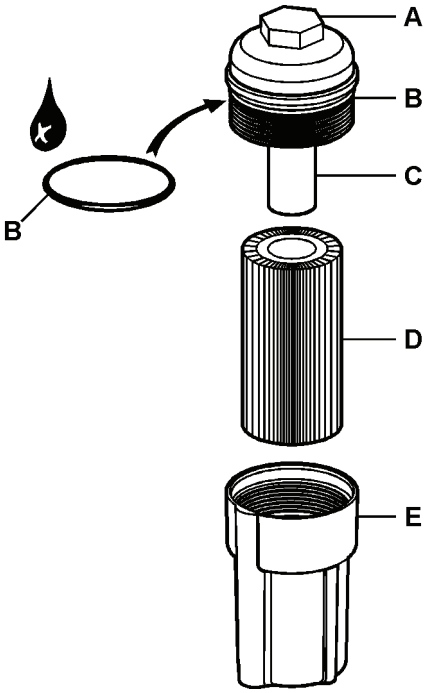
Changing Engine Oil

Engine oil and the oil filter are important factors affecting engine life. They affect ease of starting, fuel economy, combustion chamber deposits, and engine wear.

1. Run the engine at idle speed to warm the crankcase oil (for easier removal).
2. Turn off the engine.
3. Remove oil dipstick. Using the special fitting provided on the tube, drain the oil from the crankcase through the dipstick tube. This special fitting is provided so that the oil does not have to be drained into the bilge.
4. Withdraw oil with a suction pump.

   You may purchase either a manual or an electric suction pump from any marine supply store or from your Volvo Penta dealer.
5. Dispose of used oil according to any applicable federal, state, and local environmental regulations.
6. Replace the oil filter.
7. Remove the oil fill cap and fill the crankcase to the specified capacity with Volvo Penta premium engine oil.

For additional information, see *Maintenance Schedule* on page 74.



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Changing the Oil Filter

Replace the oil filter whenever the engine oil is changed.

⚠ WARNING! Hot oil and hot surfaces can cause burns.

1. To remove, unscrew filter canister cap **A** counter-clockwise. Wait a few minutes to allow any remaining oil to drain.
2. Remove the used filter **D** from canister **E** or canister cap and discard. Dispose of used filter according to all applicable federal, state, and local environmental regulations.
3. When replacing the O-ring **B**, coat it with a thin layer of clean engine oil. The O-ring fits in the widest groove below cap rim (second groove down).
4. Slide a new filter onto the filter support **C**. Screw the cap back onto the canister. Using a 36 mm socket, tighten to 18.4–22.1 ft. lb (25–30 Nm).
5. Fill the engine with new oil. Run engine and check for leaks. **Do not run engine without water**. Recheck the oil level once the engine has stopped.

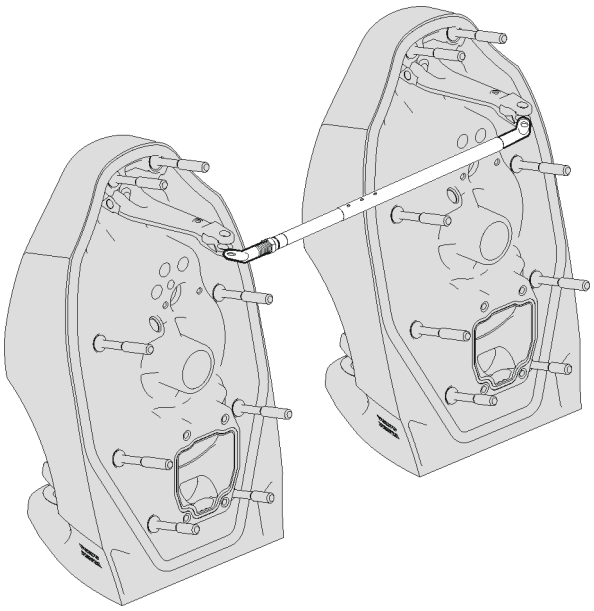
Shaft Spline and Bearing Lubrication

The primary shaft and bearings must be lubricated each year and whenever the drive unit is removed. This procedure requires the removal of the drive unit; therefore, your Volvo Penta dealer should do it. An ideal time to have this done is during the winterization process or in the spring when preparing to launch for the first time. Failure to have primary shaft splines and bearings lubricated each year may result in damage to the drive unit or seizure in the engine coupler.

Tie Rod (Twin Installations Only)

Check the rod connecting the drive units, particularly if you hit an obstacle. If the tie rod is bent, loose, or damaged, have it serviced immediately by your Volvo Penta dealer. In the meantime, operate your boat at slow speeds only.

⚠ CAUTION! The tie bar is an integral part of the steering system and is a vital safety part. A damaged tie rod may hinder steering operation or render it completely ineffective. Always replace a damaged tie bar. Never try to straighten or weld a damaged tie rod.



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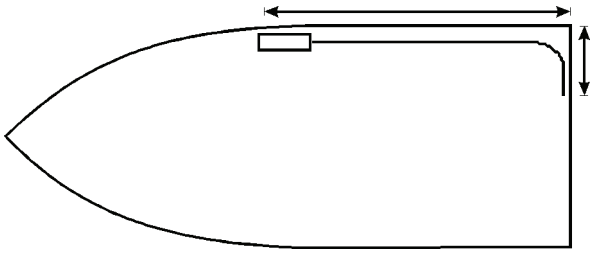

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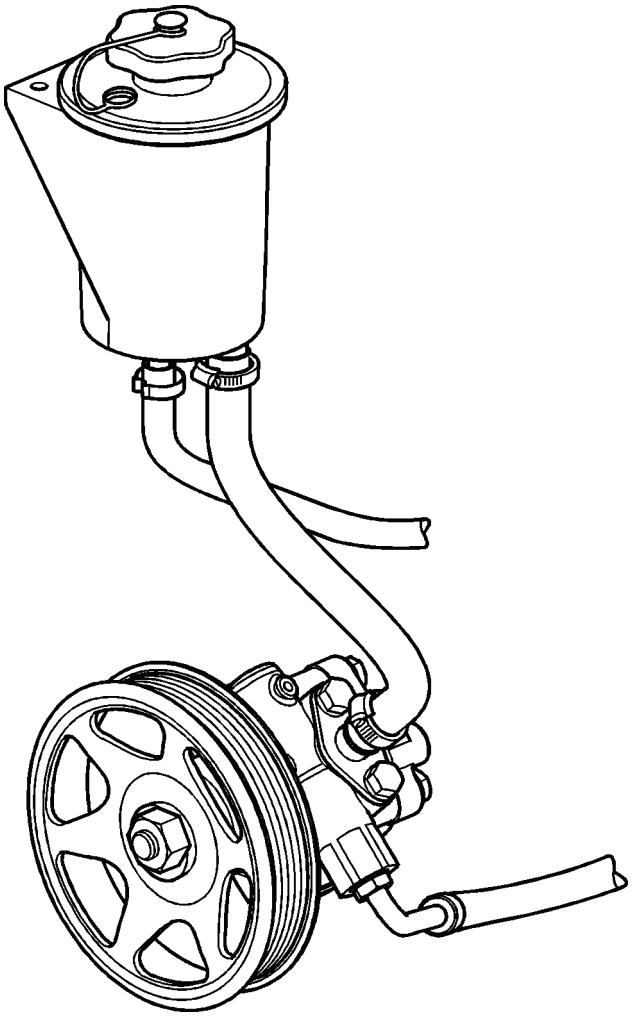
Steering System

1. Check steering and throttle cables for cracks and wear. Check all along the length of the cable, as shown in the diagram. Replace the cables if you suspect that they are not in optimum condition.
2. Check steering system hoses for cracks, leaks, and wear. Replace any hoses that you suspect are not in optimum condition.



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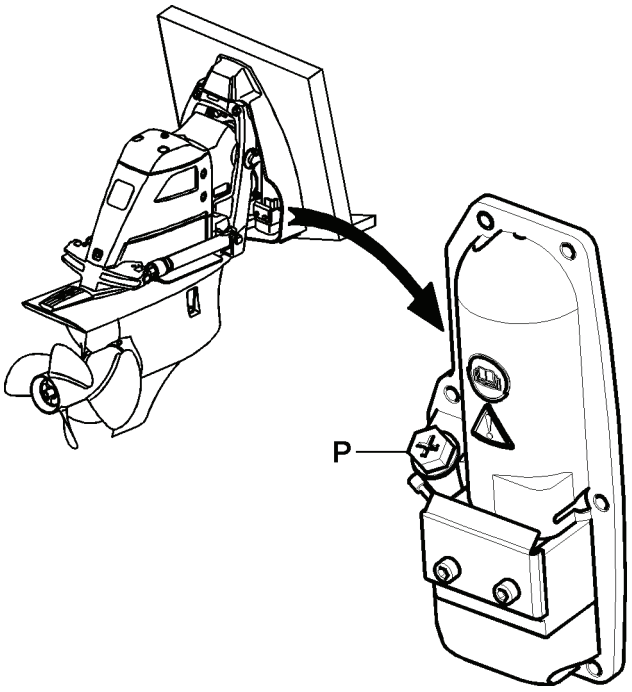
Power Steering Reservoir Fluid Level

Whenever you check the engine oil, also check the steering reservoir fluid level. The fluid level must be above the “Min” line and below the “Max” line. If needed, add Volvo Penta Power Trim/Tilt and Steering Fluid. Do not overfill the pump reservoir.

NOTICE! Never fill the steering system with oil of unknown quality. Non-recommended oil may cause steering operation impairment or component damage.

Do not allow contaminants to enter the reservoir when checking or filling the oil level.



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Power Trim/Tilt-Fluid: SX-A/DPS-A

The trim/tilt assembly is a closed hydraulic system that includes the trim pump assembly, trim cylinders and hydraulic lines. No regular oil level check is required unless trim system performance is poor.

If system performance is poor, check fluid level in pump.

1. Trim drive to full down position.

NOTICE! Failure to trim the drive to full down position when checking and filling the trim pump reservoir will result in an inaccurate fluid level; this may damage the trim system.

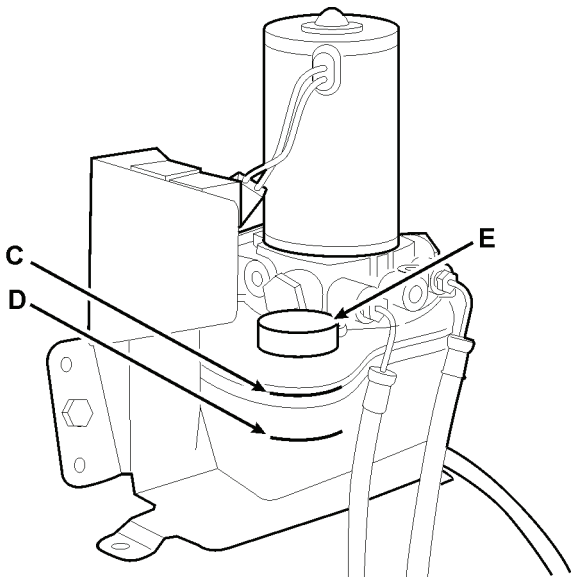
2. Turn drive full to port to provide better access to pump.

NOTICE! Clean area around cap before removing to check oil level. Debris in oil will damage the trim system.

3. Remove cap in pump **P**. Oil level should be at top of cap hole.

   If necessary, add Volvo Penta Power Trim/Tilt and Steering Fluid.

4. Replace cap and tighten to 18–35 in. lb. (2–4 Nm).



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Power Trim/Tilt Fluid: XDP-B

The power trim and tilt assembly contains an electric motor, hydraulic pump, and reservoir.

At the beginning of each boating season, check the fluid level in the reservoir:

1. With the drive unit trimmed in (down) as far as possible, remove the fill cap **E**.

NOTICE! Clean area around cap before removing to check oil level. Debris in oil will damage trim system.

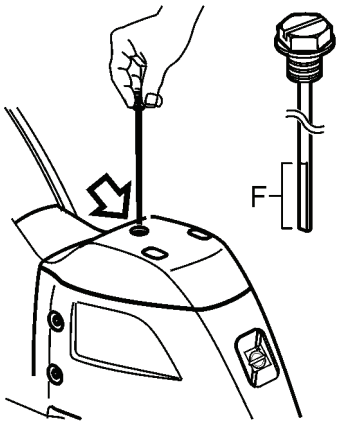
2. Check the fluid level. It should be between the minimum and maximum marks (**D** & **C**) on the reservoir. If needed, add Volvo Penta Power Trim/Tilt and Steering Fluid.

NOTICE! When topping up, use SAE 30W Engine Oil only.

3. Replace the fill cap and tighten securely.

Drive Components (SX-A/DPS-A)

The drive unit is filled at the factory with Volvo Penta Synthetic Gear Oil. Change lubricant every 100 hours or every 12 months, whichever occurs first. Use Volvo Penta Synthetic GL5 75W90 Gearcase Lubricant.



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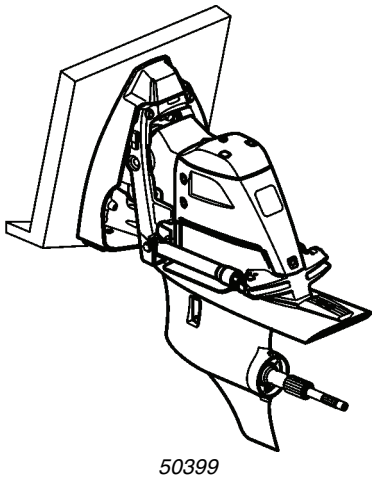

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Drive Unit Lubrication (SX-A/DPS-A)

Checking the Drive Unit Lubricant (SX-A/DPS-A)

NOTICE! Improper oil level, under- or overfilled, will result in serious internal sterndrive damage.

Check lubricant (oil) level in sterndrive at each usage. Oil level and condition checks are the best ways to catch sterndrive problems before serious damage occurs.

1. Screw dipstick fully into hole, then remove.
2. Check oil level on dipstick. Oil should show on flat portion **F** of dipstick.

   If oil level is low, add small amounts through dipstick opening until oil is at proper level.

   If level is too high, remove until oil is at proper level. See oil drain procedure below.
3. Check O-ring on dipstick for wear or nicks. Replace if needed. Tighten dipstick to 48–72 in. lb. (5.4–8.1 Nm).

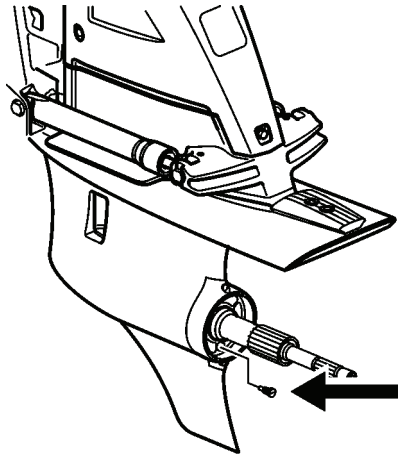
During oil level check, inspect oil for signs of water intrusion. The oil should be amber in color. Milky looking oil indicates water mixed with the oil. Also check for metal or other debris in oil. If moisture or metal flakes appear in the drive unit oil, take the boat to your Volvo Penta dealer.

Draining and Filling the Drive Unit (SX-A/DPS-A)

NOTICE! After oil change, check level with dipstick before operating drive.

When a complete change of sterndrive oil is required, proceed as follows:

1. Remove propeller(s). Oil drain plug is located in front of propeller(s). For additional information, see *Propeller Care* on page 118.
2. Place sterndrive in full down position.
3. Place a 4-quart or larger drain pan under lower gearcase skeg to catch oil.



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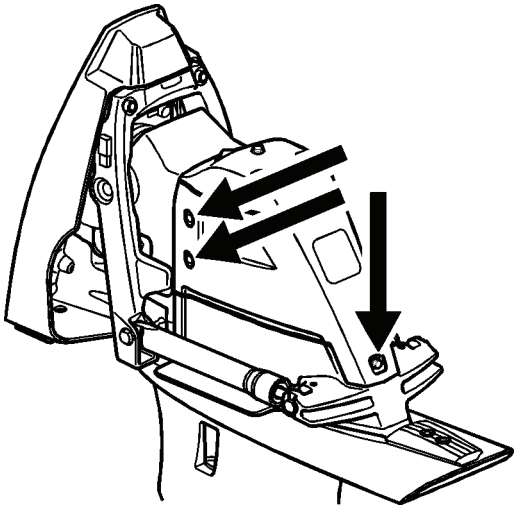
4. Remove oil drain plug.
5. Remove dipstick (top of sterndrive). Removing dipstick vents drive to improve oil draining.
6. Allow oil to drain completely.
7. Check magnet on drain plug for metal. A very fine metal powder on magnet is normal wear. Larger particles that can be felt between your fingers indicate problems with metal parts in drive.

   If metal flakes appear on the magnet, take the boat to your Volvo Penta dealer.

   Dispose of used oil and all oil soaked shop materials according to local laws and regulations.
8. Proper oil level is determined by filling drive until it appears at oil level hole beside shift mechanism. To access oil level hole, remove five screws securing shift cover.



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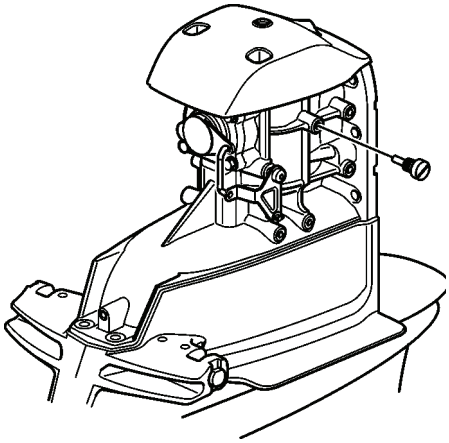
9. Remove oil level plug from hole.
10. Check magnet for metal (see **Step 7** above).
11. Check O-rings on both plugs and dipstick for wear or nicks. Replace if needed.



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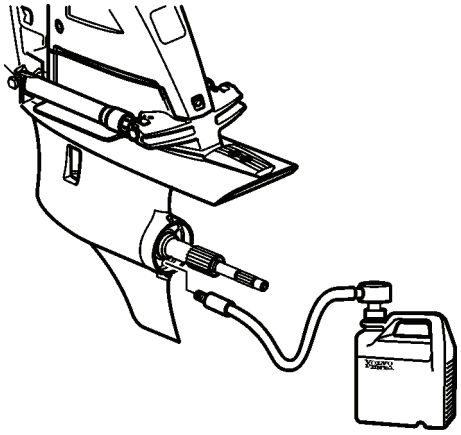

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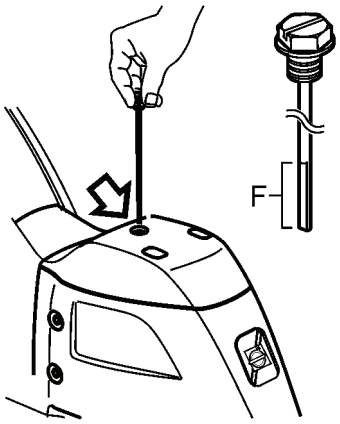

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NOTICE! When washing the drive unit, do not use a pressure washer. Using a pressure washer will damage the water intake hose and the drive bellows.

12. Fill drive with Volvo Penta Synthetic Gear Lubricant SAE 75W-90. Use a pump with 3/8-16 UNC threaded fitting to fill sterndrive through oil drain plug hole. Fill slowly to purge air. Sterndrive is properly filled when oil appears at the oil level plug hole.

NOTICE! Filling sterndrive too quickly may form air pockets that will cause an inaccurate oil level reading. Running the sterndrive with improper oil level will result in serious internal sterndrive damage.

13. When oil is filled to oil level hole, install and hand tighten dipstick and oil level plug to prevent excessive oil loss when pump is removed from drain hole.
14. Remove pump, then quickly install oil drain plug. Hand tighten drain plug. Make sure O-rings are correctly installed and seated.
15. Check oil level with dipstick. Oil should show on flat portion **F** of the dipstick. If necessary, add oil through the dipstick hole. See *Checking the Drive Unit Lubricant (SX-A/DPS-A)* on page 105.
16. Tighten drain and oil level plugs to 62–89 in. lb. (7–10 Nm).
17. Tighten dipstick to 48–72 in. lb. (5.4–8.1 Nm).
18. Install shift cover and tighten screws to 14.8–20.7 ft. lb. (20–28 Nm).
19. Reinstall propellers. See *Propeller Care* on page 118.
20. If lubricant has been completely changed, oil level must be rechecked after unit has been **briefly** run to purge trapped air. Add oil through dipstick opening to bring oil up to proper level.

Alternate Fill Procedure (SX-A/DPS-A)

If you cannot fill drive unit through oil drain plug, you can fill it by triming the drive up five degrees and adding oil through the oil level plug. When oil is at the oil level plug hole, place the drive in down position, then reinstall the oil level plug.

Be prepared to catch any excess oil dripping out of oil level plug hole.

Check the oil level with the dipstick. Oil should show on the flat portion of the dipstick. Add oil if required, through the dipstick hole. See *Checking the Drive Unit Lubricant (SX-A/DPS-A)* on page 105.

This alternate fill method is slow and you must be careful not to trap air in the drive. The oil level must be rechecked after the unit has been briefly run to purge trapped air. Several cycles may be needed to obtain the proper oil level.

Sterndrive Oil Capacity (SX-A/DPS-A)

All SX-A Models: 2.58 quarts (2.44 liters)

All DPS-A Models: 2.38 quarts (2.25 liters)

NOTICE! If your drive is equipped with a Drive Spacer, you will need to add more oil than the recommended amount. We urge you to check the oil level with the dipstick whenever you are changing or topping up the oil.

Pitot Tube (Speedometer Port)

The pitot tube, located at the leading edge of the lower unit, provides pressure input for the speedometer. If the pitot tube becomes clogged (e.g. the boat runs aground or the sterndrive drags through silt as the boat is loaded onto the trailer), the speedometer may stop functioning.

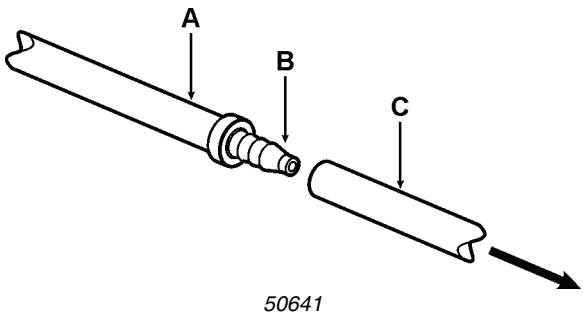
There are two methods for clearing debris from the pitot tube:

Method 1

Use a six inch length of stiff wire of 1/8 in. (3 mm) thickness or a wire coat hanger to push any debris in the pitot tube into the drive cavity.

Method 2

Use compressed air to clear the pitot tube.



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1. The pitot tube hose (**A**) is located at the transom shield, inside the boat and just behind the engine. Once you have located the pitot tube hose, remove the speedometer hose (**C**) from the plastic barb fitting (**B**).
2. Attach the hose from an air compressor to the barb fitting.
3. Have someone assist you by placing a rag in front of the pitot tube at the leading edge of the lower unit.
4. Blow air, pressurized to **no more than** 116 psi (800 kPa), into the pitot tube hose until your assistant can feel the air exiting the pitot tube.

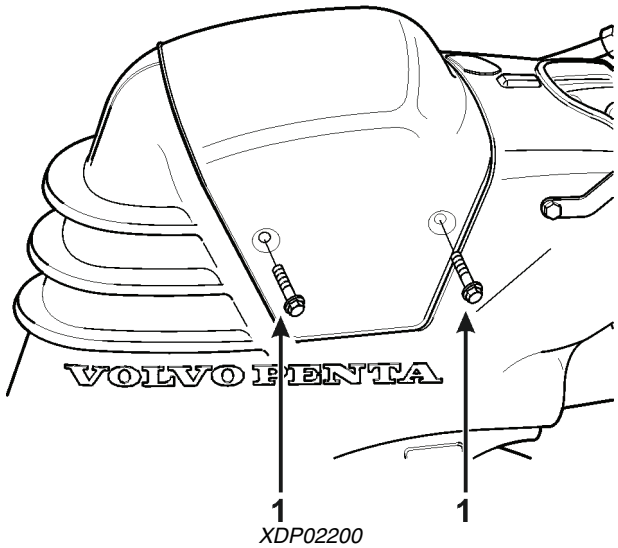
⚠ CAUTION! Do not place bare hand(s) in front of the pitot tube to check for air flow as debris may be ejected forcefully enough to cause an injury.

NOTICE! Do not exceed 116 psi (800 kPa) as this may damage the drive.

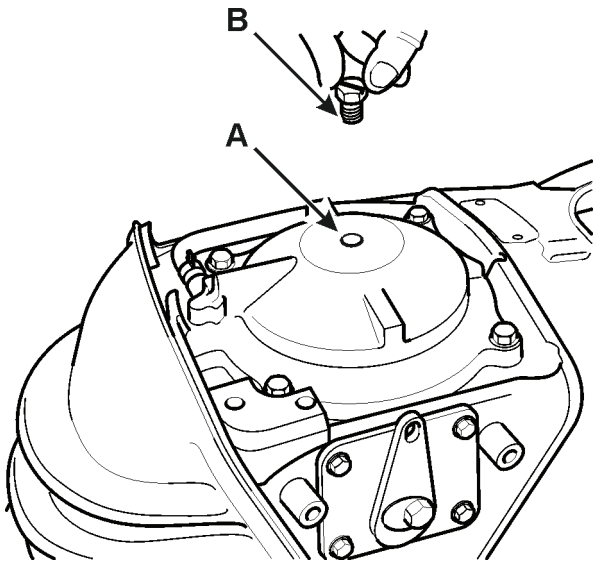
5. Reattach the speedometer hose to the barb fitting on the pitot tube hose.

Drive Components (XDP-B)

The drive unit is filled at the factory with Volvo Penta Synthetic Gear Oil.



XDP02200



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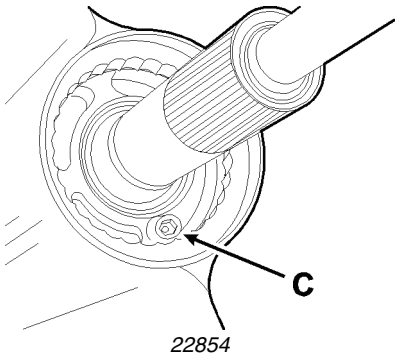


22854

Drive Unit Lubrication (XDP-B)

Checking the Drive Unit Lubricant (XDP-B)

At each usage, check the oil level in the drive unit by inspecting the drive oil reservoir.

- ❑ Make sure that the oil level is below the "**FULL LINE**" marking and above the "**MIN**" marking.
  - The oil should be amber-colored.
  - The oil will appear milky if any moisture is present. You can check the oil's appearance by removing the reservoir cap.
  - No metal flakes should appear in the oil.

NOTICE! The drain plug **C** is magnetized. Any metal flakes in the drive will generally attach to the drain plug.

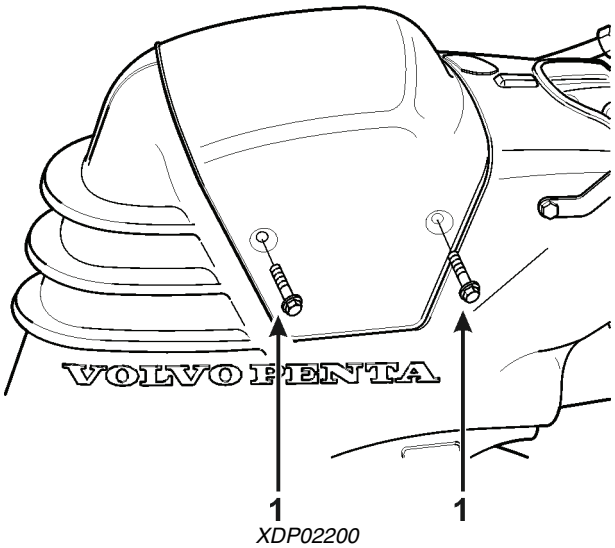
- ❑ If moisture or metal flakes appear in the drive unit oil, take the boat to your Volvo Penta dealer.
- ❑ If the oil level is low, add only enough lubricant to bring the oil level to just below the "**FULL LINE**" marking on the reservoir.
- ❑ You should completely drain and refill the drive unit at least once per season.

Draining the Drive Unit (XDP-B)

1. Place the drive unit in the run (down) position.
2. Remove propellers and mounting hardware.

NOTICE! Special tools are required to remove the Duoprop propellers.

3. Remove the two 10mm screws (**1**) securing the rear cover to access the oil vent plug.
4. Remove the oil drain plug **C** and the vent plug **B**.
5. Allow the drive unit to drain completely. Dispose of used oil according to applicable environmental regulations.



XDP02200

Filling the Drive Unit (XDP-B)

1. Remove the two 10mm screws (**1**) securing the rear cover to access the oil vent plug.
2. Fill the drive unit with Volvo Penta Synthetic Gear Oil. Fill through the oil drain plug location **C**. Fill slowly to purge air. The drive unit is properly filled when the oil appears at the oil vent hole **A**.
3. When filled to the proper level, install the oil vent plug, then the oil drain plug **C**.
4. Tighten oil vent and drain plugs securely.
5. Install the rear cover and tighten screws securely.

If you cannot fill the drive unit through the oil drain plug, you can fill the drive by trimming it up a few degrees and filling it through the oil vent hole. Reinstall the oil vent plug, and place the drive in the run (down) position. Remove the vent plug and check the oil level. Reinstall the vent plug and tighten securely.

NOTICE! If the drive unit was filled through the oil vent hole, wait 15 minutes before checking oil. This will help ensure all air is purged from the oil cavity. Leave the oil vent plug loose during the waiting period.

6. Re-install the propellers. You may refer to the section entitled *Propeller Care* on page 118 for instructions on replacing the propeller.
7. Check the oil level at the drive oil reservoir. If necessary, add oil through the reservoir cap. Please refer to the section entitled *Technical Data* on page 133 for drive unit oil capacity.

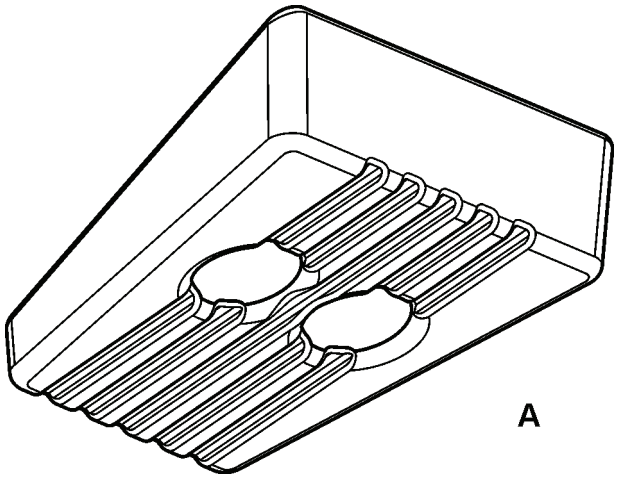
NOTICE! When washing the drive unit, do not use a pressure washer. Using a pressure washer will damage the water intake hose and the drive bellows.

Sacrificial Anodes

On the SX-A/DPS-A drives, sacrificial anodes are attached to the bottom of the gimbal housing and at the rear of the gearcase above the anti-ventilation plate. On the XDP-B drive, sacrificial anodes are attached as follows: one anode is located just in front of the front propeller (inside the propeller housing), a second is located on the bearing housing cover (just under the drive unit cover), and a third is located on the trim cylinder.

Anodes are slowly eroded away by galvanic action and require inspection. Additionally, anodes that are subjected to frequent wetting and drying require periodic scraping with sandpaper to remove scale and oxidation to maintain their effectiveness. Do not paint anodes, as this will destroy their effectiveness.

When you need to purchase new anodes, see your Volvo Penta dealer. The material composition of Volvo Penta anodes meets U.S. Military Specification 18001-H. Some after-market anodes may not meet mil-specs and are larger in size. Using after-market sterndrive anodes may cause cavitation bubbles due to poor fit, which may lead to propeller erosion. You may order the anodes separately, or as part of an accessories kit. (The accessories kit also includes o-rings, oils, washers, seals, and bellows.)



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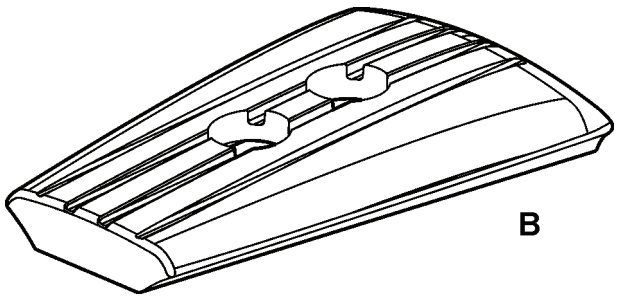

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Replacing Anodes (SX-A/DPS-A)

The amount of erosion from the drive anode is a good indication of the condition of the transom shield anode.

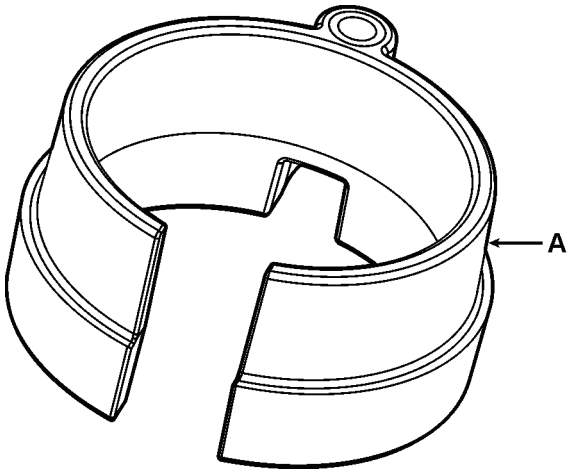
1. Inspect anodes at each usage. If an anode is 2/3 its original size (1/3 eroded), replace it.
2. Remove the two screws holding the anodes onto the gearcase (**B**) and/or the gimbal housing (**A**). Discard screws.
3. Remove the old anode.
4. Attach new anode and secure with two new screws (provided in kit).
5. Tighten screws to 14.8–20.7 ft. lb. (20–28 Nm).

If additional electronic or electrical equipment is installed, each item should have an individual anode or grounding device and all grounding devices must be interconnected. Follow equipment manufacturers recommendations.

NOTICE! Your Volvo Penta product has been shipped with either Zinc or Aluminum anodes. The table below provides replacement information and also specifies which anodes should be used, depending on water conditions.

SX-A/DPS-A ANODE REPLACEMENT INFORMATION

Anode	Material	Part No.	Water Condition	Weight when new	Replace when anode weighs less than:
Transom Shield	Zinc	3888817	Salt Water	2.55 lb (1.16 kg)	1.79 lb (0.81 kg)
Sterndrive	Zinc	3888814	Salt Water	2.86 lb (1.30 kg)	2.00 lb (0.91 kg)
Transom Shield	Aluminum	3888816	Brackish Water	0.90 lb (0.41 kg)	0.63 lb (0.29 kg)
Sterndrive	Aluminum	3888813	Brackish Water	1.00 lb (0.45 kg)	0.70 lb (0.32 kg)
Transom Shield	Magnesium	3888818	Fresh Water	0.61 lb (0.28 kg)	0.43 lb (0.20 kg)
Sterndrive	Magnesium	3888815	Fresh Water	0.68 lb (0.31 kg)	0.48 lb (0.22 kg)



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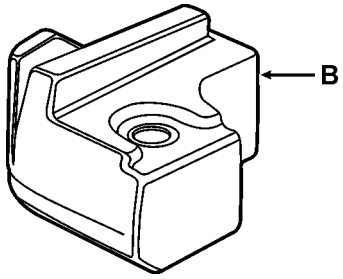

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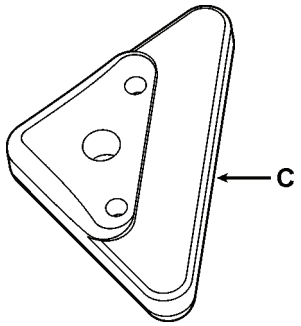

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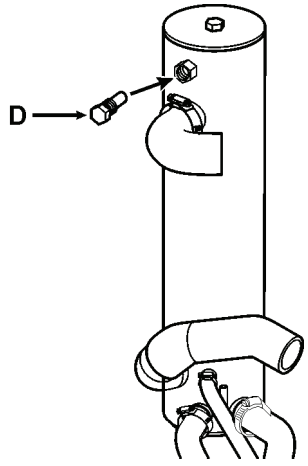


19511-1

Replacing Anodes (XDP-B)

1. Inspect anodes at each usage. If an anode is 2/3 its original size (1/3 eroded), replace it.
2. Remove the screw holding the anode inside the propeller housing (**A**), the screw holding the anode onto the bearing housing cover (**B**), and the screw holding the anode on the trim cylinder (**C**). Set these screws aside; you will reuse them.
3. Pull off the old anodes.
4. Insert new anodes and secure with the saved screw.
5. Tighten screws to 4.4–7.4 ft. lb. (6–10 Nm).

If additional electronic or electrical equipment is installed, each item should have an individual anode or grounding device and all grounding devices must be interconnected. Follow equipment manufacturers recommendations.

NOTICE! Your Volvo Penta product has been shipped with Aluminum anodes (except the trim cylinder anode, which is zinc). Aluminum is effective in both saltwater and in fresh water. If you will be boating in fresh water exclusively, we recommend switching the anodes to Magnesium.

Replacing Heat Exchanger Anodes

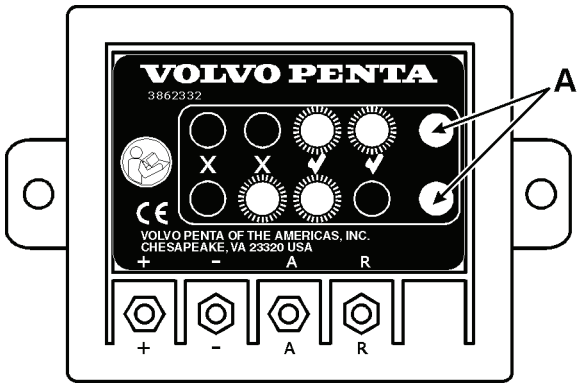
Engines with closed cooling systems have anodes located at the top of the heat exchanger. This anode (**D**) resembles a bolt and may be removed and replaced using a 3/4 inch (19mm) wrench. When installing, tighten the anode all the way by hand, then turn an additional quarter turn using a wrench.

Active Corrosion Protection System (SX-A/DPS-A Only)

Your boat may be equipped with a Volvo Penta active corrosion protection system (APCS). This system operates with very little current drain from the boat's electrical system. It keeps the voltage potential in the area around the drive unit in a range that is not corrosive to aluminum. (This is accomplished by changing the charge of water molecules so that they do not remove electrons from the drive unit's metal parts to cause corrosion.) If you do not have an active corrosion protection system already installed, you may purchase one from your authorized Volvo Penta dealer.

NOTICE! ACPS is designed for salt water applications only; using the system in fresh water–while harmless–will not protect your sterndrive from corrosion. If you will be operating your boat in fresh water exclusively, you must install magnesium anodes to adequately protect your sterndrive.

The protection system's control box has both red and green LED indicator lights (**A**). The lights will indicate the amount of protection that the unit is providing to protect the sterndrive and transom shield. The ACP system is designed to protect one sterndrive and transom shield assembly. If copper based antifouling paint is used or the drive is installed on a metal hull, the unit may be inadequate to protect the drive and transom shield.



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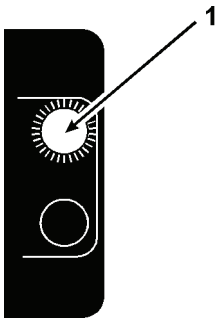
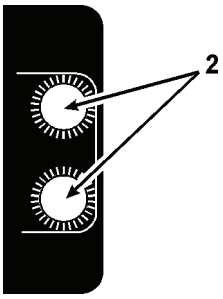


22863-1

1. The green LED (**1**) indicates the unit is adequately protected.
2. If the green and red LEDs (**2**: see next page) are illuminated, the drive is protected but the system is drawing power (between 3 to 150 mA) to protect the drive unit. Check the following conditions and solutions.
   - ❑ Water too severely contaminated or polluted. Install additional anode on the transom and bond to the grounding system.
   - ❑ Too much unpainted metal on the drive or transom shield. Clean and paint exposed metal on drive and transom shield. Please refer to the section entitled *Painting the Drive (SX-A/DPS-A Only)* on page 116 and *Propeller Care* on page 118 for paint repair procedures.
   - ❑ Corroded, missing, or painted anodes. Service or replace anode as required.
   - ❑ Stray current from shore power or surrounding boats. Disconnect shore power, wait 8 hours and recheck. If still present, temporarily relocate boat to another area away from the marina and check again.



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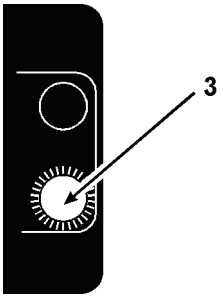
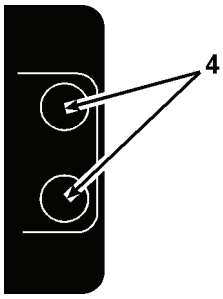


22863-3

- ❑ Loose or corroded terminals on the electronic unit or battery. Clean and tighten connectors.
- ❑ Copper bottom paint used and is in contact with the transom shield. Remove paint and ensure there is a 25mm (1 in.) border between transom shield and bottom paint.

3. If only the red LED (**3**) is illuminated, the drive is not adequately protected and may have one of the following conditions:
   - ❑ Water too severely contaminated or polluted. Install additional anode on the transom and ground to drive unit.
   - ❑ Too much unpainted metal on the drive or transom shield. Clean and paint exposed metal on drive and transom shield. Please refer to the section entitled *Painting the Drive (SX-A/DPS-A Only)* on page 116 and *Propeller Care* on page 118 for paint repair procedures.
   - ❑ Corroded, missing, or painted anodes. Service or replace anode as required.
   - ❑ Stray current from shore power or surrounding boats. Disconnect shore power, wait 8 hours and recheck. If still present, temporarily relocate boat to another area away from the marina and check again.
   - ❑ Loose or corroded terminals on the electronic unit or battery. Clean and tighten connectors.
   - ❑ Copper bottom paint used and is in contact with the transom shield. Remove paint and ensure there is a 25mm (1 in.) border between transom shield and bottom paint.



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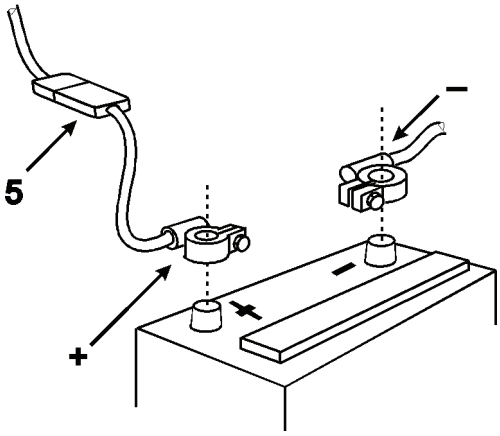

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4. If no LEDs are illuminated (**4**), the unit is not receiving power. Check the following conditions:
   - ❑ Dead battery. Check battery condition and charge as necessary.
   - ❑ Loose connection or corroded terminals on the electronic control unit or battery. Clean and tighten the connectors.
   - ❑ Blown fuse. Replace defective fuse. The fuse (**5**) is located near the battery connectors.
   - ❑ Broken anode or reference sensor unit. Replace damaged unit. Follow the installation instructions included with the replacement unit, or see your authorized Volvo Penta dealer for service.

NOTICE! The active corrosion protection system is designed to adequately protect one drive unit from galvanic corrosion under normal operating conditions. This system will not provide protection from stray currents emitted by a malfunctioning AC power source on your boat, the pier, or other boats in close proximity to yours. Although the zinc sacrificial anodes will last much longer with this system, they must still be cleaned and checked for material condition periodically.

If any of the malfunction conditions continue to exist after completing the steps above, see your authorized Volvo Penta dealer for further service.

Painting the Drive (SX-A/DPS-A Only)

The SX-A and DPS-A sterndrives and transom shield use a silicon-alloy aluminum casting process. The process requires a unique paint repair procedure.

Preparation

⚠ **WARNING! Always follow the manufacturers instructions regarding personal protection when handling chemicals. You should always wear eye protection and gloves as a good work habit.**

1. Remove all marine growth.
2. Use sandpaper or sandblast to remove loose paint and corrosion. Use a medium grit aluminum oxide sandpaper. If sandblasting use 55 - 25 grit (0.2 - 0.7mm) aluminum oxide blasting media.

NOTICE! Do not use steel wool or emery cloth. Small pieces of steel or iron oxide used to produce steel wool and emery cloth will become embedded in the aluminum and cause severe corrosion.

3. Wash with hot water and detergent to remove all traces of oil and grease.
4. Roughen any painted areas that will be re-coated with a medium synthetic scouring pad or equivalent (i.e. 3M Scotchbrite™).
5. Rinse with water thoroughly and allow to air dry. Do not use a rag to wipe the area as some rags may have silicone.
6. Clean the entire area with an acid cleaner that does not contain fluoride (i.e. DuPont® 5717). Scrub surface with a synthetic scouring pad until it is completely “wetted,” where no water beads on the surface. Follow all local laws and regulations when using or disposing of any chemicals used in this process.

NOTICE! Fluorine in a cleaner causes “smut” (a dark discoloration on silicon-alloy aluminum castings), and paint will not stick to “smut.” If this happens, sand the surface and start over using a different acid cleaner.

7. Rinse with water thoroughly and allow to air dry.

Paint Application (SX-A/DPS-A Only)

1. Treat any bare aluminum with chromate conversion coating.
2. Rinse thoroughly with water. The area must appear “wetted” or the surface is not clean and the paint will not adhere.
3. While the surface is still wet from rinsing, treat all bare aluminum with conversion solution. Brush the chromate solution on the surface. Add additional solution as necessary for 2 to 5 minutes to prevent it from drying on the surface. Rinse the surface thoroughly with water and allow to air dry. Follow the manufacturers instructions exactly.
   - If the chromate is allowed to dry anywhere on the bare aluminum surface, chromic acid salts will form which will prevent paint adhesion and promote corrosion. Sand the surface to bare metal.
   - Do not blow dry the part with compressed air unless it is completely free of dirt, oil and water.
   - Do not heat the part above 140°F before painting.
   - Do not touch the treated surface with bare hands before painting.
   - The part should be primed soon after it dries, or at least within 24 hours.
   - It is best to let the part air dry, but if you must wipe the surface to speed up drying, use a lint free wipe not treated with anything that may contaminate the surface. Do not scrub the surface—wipe very lightly.
4. Where the primer coat is thin or where the surface is unpainted, prime with Volvo Penta primer P/N 11415627 or an equivalent epoxy primer (i.e. PPG® Super Koropon). Do not apply primer over a glossy hard finish coat without roughening. Primer solvents must be allowed to evaporate and the primer must harden before applying the finish coat. Follow the label instructions for method applications, drying times, and proper disposal of residual product.
5. Apply finish coat. Volvo Penta Parts Catalogs and the Volvo Penta Parts and Accessories Catalog list part numbers for the finishing products that apply to your Volvo Penta product.

Painting the Drive (XDP-B Only)

Preparation

WARNING! Always follow the manufacturers instructions regarding personal protection when handling chemicals. You should always wear eye protection and gloves as a good work habit.

1. Remove all marine growth.
2. Use sandpaper or sandblast to remove loose paint and corrosion. Use a medium grit aluminum oxide sandpaper. If sandblasting use 55 - 25 grit (0.2 - 0.7mm) aluminum oxide blasting media.
3. Wash with hot water and detergent to remove all traces of oil and grease.
4. Roughen any painted areas that will be re-coated with a medium synthetic scouring pad or equivalent (i.e. 3M Scotchbrite™).
5. Rinse with water thoroughly and allow to air dry. Do not use a rag to wipe the area as some rags may have silicone.

Paint Application (XDP-B Only)

1. The part should be painted soon after it dries, or at least within 24 hours.
2. Make sure that the surface is fully dry before painting.
   - Do not blow dry the part with compressed air unless it is completely free of dirt, oil and water.
   - Do not heat the part above 140°F before painting.
   - Do not touch the clean surface with bare hands before painting.
   - It is best to let the part air dry, but if you must wipe the surface to speed up drying, use a lint free wipe not treated with anything that may contaminate the surface. Do not scrub the surface — wipe very lightly.
3. Where the primer coat is thin or where the surface is unpainted, prime with Volvo Penta primer P/N 11415627 or an equivalent epoxy primer (i.e. PPG® Super Koropon). Do not apply primer over a glossy hard finish coat without roughening. Primer solvents must be allowed to evaporate and the primer must harden before applying the finish coat. Follow the label instructions for method applications, drying times, and proper disposal of residual product.
4. Apply finish coat. Volvo Penta Parts Catalogs and the Volvo Penta Parts and Accessories Catalog list part numbers for the finishing products that apply to your Volvo Penta product.

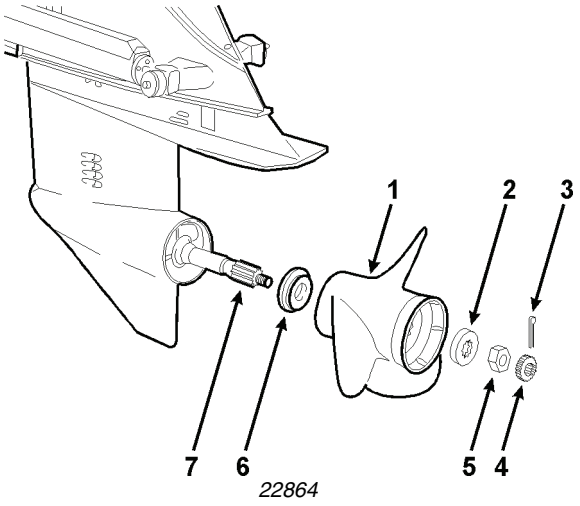
Propeller Care

A damaged or unbalanced propeller will cause excessive vibration and a loss of boat speed. Under these conditions, stop the engine and check the propeller for damage. If the propeller appears damaged, have it checked by your Volvo Penta dealer. Always carry a spare propeller and replace the damaged propeller as soon as possible.

A rubber hub in the propeller is the shock absorber that minimizes damage to drive units and engines. If the rubber hub should begin to slip, it can be easily replaced at an authorized Volvo Penta dealer or propeller service station.

⚠ **WARNING! Protect your hands from the sharp edges of the propeller blades. Wear gloves whenever you remove or replace a propeller. Do not attempt to hold propellers by hand when you remove or install propellers and propeller nuts. Serious injury could result.**

NOTICE! Never continuously run with a damaged propeller. Running with a damaged propeller can result in drive unit and engine damage.



Propeller Replacement — SX-A

Removing the SX-A Propeller

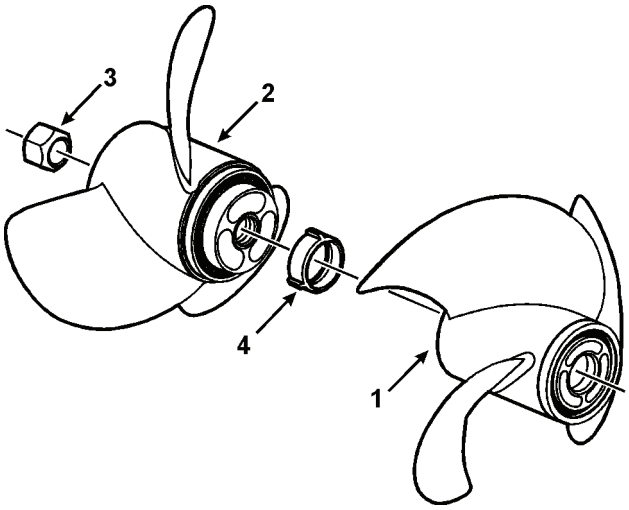
1. Ignition switch must be OFF.
2. Make sure the remote control is in NEUTRAL.
3. Remove the cotter pin (**3**) and keeper (**4**).
4. Shift the remote control into FORWARD to lock the propeller shaft.
5. Remove the propeller nut (**5**) using a 1-1/16 wrench.
6. Remove the thrust washer (**2**), propeller (**1**), and thrust bushing (**6**).
7. Wipe the propeller shaft (**7**) clean. Inspect for fishing line; remove if present.

Installing the SX-A Propeller

NOTICE! Failure to install all components could result in loss of propeller and damage to drive unit next time the boat is operated.

1. Ignition switch must be OFF.
2. Make sure the remote control is in NEUTRAL.
3. Coat the full length of the propeller shaft and the inside of the propeller hub with Volvo Penta propeller shaft grease P/N 828250; removal of the propeller will be difficult if this is not done.
4. Place the thrust bushing on the propeller shaft with the inner taper toward the gearcase to match the taper on the propeller shaft.
5. Install the propeller onto the propeller shaft, aligning splines, and push the propeller onto the thrust bushing until the splines are exposed.
6. Install thrust washer on propeller shaft splines.
7. Shift the remote control into REVERSE gear to lock the propeller shaft.
8. Install and tighten the propeller nut until it is seated against the thrust washer.
9. Loosen the nut, then turn it back against the thrust washer until finger tight. Tighten the nut an additional 1/3 to 1/2 turn.
10. Index the keeper on the propeller nut until it is aligned with the cotter pin hole.
11. Install the cotter pin and bend the ends to secure; use a new cotter pin if necessary.
12. Shift the remote control into NEUTRAL. The propeller should turn freely.

Before your next outing, use a torque wrench to tighten the propeller to 70 – 80 ft. lb. (96 – 108 Nm). The thrust washer, nut, keeper, and cotter pin must be installed as shown.



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Propeller Replacement — DPS-A

Removing the DPS-A Propeller

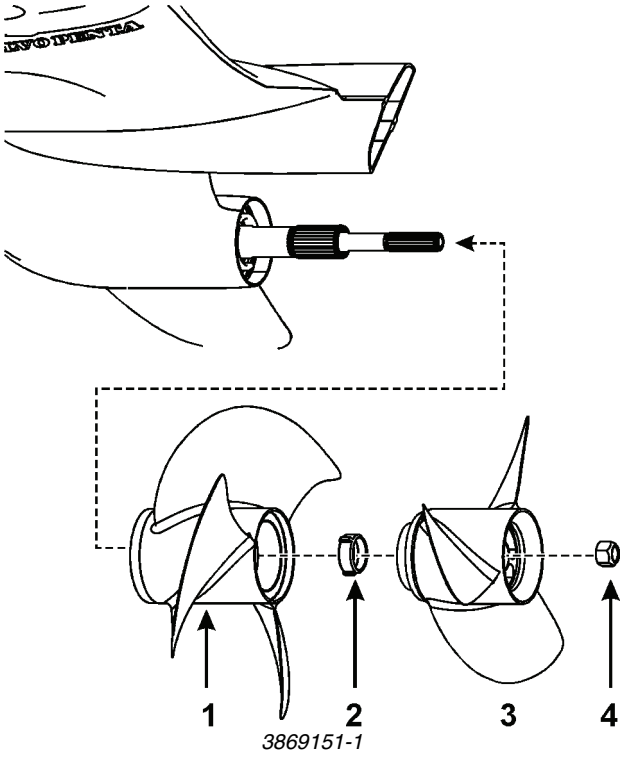
This procedure requires you to use Volvo Penta special tools.

1. Ignition switch must be OFF.
2. Make sure the remote control is in FORWARD to lock the propeller shaft.
3. Remove the rear propeller nut (**3**).
4. Remove the rear propeller (**2**).
5. Change the remote control position to REVERSE to lock the propeller shaft.
6. Remove the front propeller nut (**4**).
7. Remove the front propeller (**1**).
8. Wipe the propeller shaft clean. Inspect for fishing line; remove if present.

Installing the DPS-A Propeller

NOTICE! Failure to install all components could result in loss of the propeller and damage to the drive unit the next time the boat is operated.

1. Ignition switch must be OFF.
2. Make sure the remote control is in FORWARD.
3. Coat the full length of the propeller shaft and the inside of the propeller hub with Volvo Penta propeller shaft grease P/N 828250; removal of the propeller will be difficult if this is not done.
4. Install the front propeller (**1**).
5. Install the front propeller nut (**4**) and tighten it to 45 ft. lb. (60 Nm).
6. Shift the remote control into REVERSE to lock the propeller shaft.
7. Install the rear propeller (**2**).
8. Install the rear propeller nut (**3**) and tighten it to 50 ft. lb. (70 Nm).
9. Shift the remote control into NEUTRAL. The propeller should turn freely.



Propeller Replacement — XDP-B

Removing the XDP-B Propeller

This procedure requires you to use Volvo Penta special tools.

1. Ignition switch must be OFF.
2. Make sure the remote control is in FORWARD to lock the propeller shaft.
3. Remove the rear propeller nut (**4**).
4. Remove the rear propeller (**3**).
5. Change the remote control position to REVERSE to lock the propeller shaft.
6. Remove the front propeller nut (**2**).
7. Remove the front propeller (**1**).
8. Wipe the propeller shaft clean. Inspect for fishing line; remove if present.

Installing the XDP-B Propeller

NOTICE! Failure to install all components could result in loss of the propeller and damage to the drive unit the next time the boat is operated.

1. Ignition switch must be OFF.
2. Make sure the remote control is in FORWARD.
3. Coat the full length of the propeller shaft and the inside of the propeller hub with Volvo Penta propeller shaft grease P/N 828250; removal of the propeller will be difficult if this is not done.
4. Install the front propeller (**1**).
5. Install the front propeller nut (**2**) and tighten it to 45 ft. lb. (60 Nm).
6. Shift the remote control into REVERSE to lock the propeller shaft.
7. Install the rear propeller (**3**).
8. Install the rear propeller nut (**4**) and tighten it to 50 ft. lb. (70 Nm).
9. Shift the remote control into NEUTRAL. The propeller should turn freely.

Boat Bottom

The condition of the boat's bottom can affect your boat's performance. Marine growth, present in fresh water as well as salt water, will reduce boat speed. A boat bottom with evidence of marine growth can cause a reduction in top speed of 20 percent or more. Periodically clean the bottom of your boat following the manufacturer's recommendations. Bottom painting may also be desirable.

NOTICE! Always be sure to follow the paint manufacturer's recomendations for preparation and application of bottom paint.

Bottom Painting

If your boat is in water where marine growth is a problem, using an antifouling paint may reduce the growth rate. Be aware of laws that may limit your paint choice and its use.

- A pure Teflon®-based agent is recommended.
- Copper-based antifouling paint may be used.

NOTICE! Do not paint transom shield or drive with copper-based paint. If you do use copper-based paint on your boat bottom, leave a 1-inch border between the paint and the transom shield. Failure to follow this instruction will result in severe corrosion of the transom shield and drive system.

- Vinyl-butyl based antifouling paint is a recommended alternative.

See your Volvo Penta dealer for an EPA-approved antifouling paint suitable for your area.

Engine Alignment

Because of the special tools required, a Volvo Penta dealer must do the engine alignment. This should be done during off-season storage preparations.

NOTICE! Failure to periodically check engine alignment may result in premature failure of the engine coupler.

If you wish to align the engine yourself, please refer to the Volvo Penta publication entitled *Installation: Sterndrive Gasoline Engines* (PN 7745960) or *Installation: Ocean Series* (PN 7797384).

Engine Submersion

1. Remove the engine from the water as quickly as possible.
2. Contact your local Volvo Penta dealer for service.
   - Your dealer will need to drain all water from the engine and immediately lubricate all internal parts.
   - All electrical devices must also be dried and inspected for water damage.
3. Frequently check engine compartment for gasoline fumes and excessive water accumulation. In addition, make sure that the water depth in the bilge is kept well below the flywheel housing.

NOTICE! Delay in completing the above actions will result in extensive engine damage.

Replacement Parts

⚠ WARNING! Improper parts substitution can result in fire or explosion.

Use genuine Volvo Penta parts when replacement parts are needed. Volvo Penta replacement parts are designed to meet USCG requirements and ABYC standards for marine applications.

Failure to use genuine Volvo Penta parts may result in product malfunction and possible injury to the operator and/or passengers.

In your Volvo Penta product, certain fuel and electrical system components have been designed to comply with U.S. Coast Guard regulations. Parts or components that comply with these regulations are designed so they will not emit fuel vapors or cause ignition of fuel vapors in the engine compartment.

To prevent explosion or fire, do not substitute automotive or general hardware parts for the following:

- Circuit breakers, alternator, and related wiring.
- Starter and related wiring.
- Distributor, distributor cap, spark plugs, high tension leads, and related ignition parts.
- Fuel pumps, relays, filter, and related parts.
- Rubber caps (manifold), hoses (water and exhaust), and attaching clamps.
- Fuel injector O-rings, injector fuel line pressure relief valve and caps, fuel reservoir vent hose and cover gasket, high pressure fuel pump mounting O-rings, fuel pressure regulator, and fuel rails.

Your Volvo Penta product was designed to operate in a marine environment. This can involve operating:

- At high RPM for long periods.
- In salt or brackish water.
- In water laden with silt and minerals.

Substituting automotive or generally supplied parts and hardware may result in product malfunction and possible injury to the operator and/or passengers. Never use parts of unknown quality. See your Volvo Penta dealer. You can depend on your dealer to furnish expert service and Volvo Penta parts.

Troubleshooting - System Isolation

The following troubleshooting guide is provided to help you isolate a malfunction of one or more of your boat's systems. After determining which systems are affected by the malfunction, refer to the individual system troubleshooting charts to isolate the specific cause.

System Isolation

Engine Does Not Start	**Cranking System**	Engine should crank at specified RPM. If not, check for: 1. Discharged or dead battery. 2. Loose or corroded connections. 3. Cranking System Troubleshooting Chart in the Electrical Ignition/Fuel Service Manual.
	Ignition System	Must have good spark at spark plugs. If not, check the: 1. Distributor cap. 2. Coil and spark plug leads. 3. Ignition timing. 4. Automatic spark advance. 5. Appropriate Ignition Troubleshooting Chart in the Electrical/Ignition/Fuel Service Manual. 6. EFI Models: Refer to EFI Diagnostic Manual.
	Fuel System	EFI Models: Refer to EFI Diagnostic Manual Carbureted Models: Carburetor accelerator pump should squirt fuel into the Venturi when throttle is advanced. If not, check the: 1. Fuel tank, valves, and lines. 2. Fuel pump and filter. 3. Carburetor and filter. 4. Refer to the following troubleshooting charts and *Fuel System* on page 80.
Engine Runs Improperly		Check the following: 1. Compression. 2. Ignition system. 3. Fuel and carburetor and injection system. 4. Lubrication system. 5. Cooling system. 6. Sterndrive and propeller. 7. PCV valve. 8. Troubleshooting Guides in this chapter and in the appropriate Engine Service Manual.

Engine Troubleshooting Guides

EFI Engines Only: Refer to *EFI Diagnostic 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 and keep a detailed record of the symptoms of the malfunction. Keep a record of pertinent facts, such as:

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

Whether servicing the boat's systems yourself or having your product serviced by a certified Volvo Penta dealer, you will need this record of information to identify potential causes of the malfunction.

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

- COMPRESSION - Mixture inducted into cylinder and compressed.
- SPARK - Proper intensity at the proper time.
- FUEL - Proper mixture of air and fuel.
- EXHAUST - Clear of any obstructions.

These are very old rules, but necessary for the engine to run. Use the following charts and the service information to which they refer. 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.

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/starter relay.
- ❑ Circuit breakers.
- ❑ Wiring, from battery to ignition switch.
- ❑ See *Electrical/Ignition/Fuel Service 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, or cracked/dirty insulator.
- ❑ Low battery voltage.
- ❑ See *Electrical/Ignition/Fuel Service 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.
- ❑ Correct diameter/unrestricted boat fuel lines.
- ❑ 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/relay/circuit breaker operation.
- ❑ External fuel filter canister and carburetor filter.
- ❑ Carburetor accelerator pump.
- ❑ See *Electrical/Ignition/Fuel Service 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 *Electrical/Ignition/Fuel Service Manual*.

Was Engine Unused For A Long Time? Check:

- ❑ For clean carburetor fuel filters.
- ❑ Empty carburetor float bowl due to evaporation.
- ❑ Water in fuel due to condensation.
- ❑ Fuel quality deterioration.
- ❑ See *Electrical/Ignition/Fuel Service Manual*.

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 *Electrical/Ignition/Fuel Service Manual*.

Hard Starting - Hot Engine

Ask these questions first:

Has Engine Always Done This? Check:

- ❑ Carburetor choke operation and adjustment.
- ❑ See *Electrical/Ignition/Fuel Service Manual*.

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(s) and/or ignition module.
- ❑ Engine timing.
- ❑ Carburetor choke operation and adjustment.
- ❑ See *Electrical/Ignition/Fuel Service Manual*.

Engine Runs Rough

If Fuel Injected, see *EFI Diagnostic Manual*

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 *Electrical/Ignition/Fuel Service Manual*.

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, or secondary vacuum diaphragm failure.
- ❑ External canister and carburetor fuel filters.
- ❑ Fuel pump pressure.
- ❑ Engine compression.
- ❑ Water or contaminants in fuel, or water in cylinders.
- ❑ See the *Electrical/Ignition/Fuel System Service Manual*.

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 appropriate section in the applicable Engine Service Manual.

Ignition System (Ping or Knock)

- ❑ Improper tuning.
- ❑ Incorrect spark plug wire routing.
- ❑ Use higher octane fuel.
- ❑ See *Electrical/Ignition/Fuel Service Manual*.

Engine Noises and Vibrations (Cont.)

Cooling System

- ❑ Supply pump.
- ❑ Loose belts and/or pulleys.
- ❑ See *Cooling System* on page 92.

Mountings

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

Crankshaft Balancer or Flywheel

- ❑ Loose bolt(s).

Alternator

- ❑ Loose pulley and/or worn bearings.
- ❑ Loose mounting bolts.

Sterndrive

- ❑ 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.
- ❑ Supply pump, circulating pump, and belt(s).
- ❑ Water intake screens–for blockage.
- ❑ Thermostat.
- ❑ Water supply hoses.
- ❑ Engine timing.
- ❑ Water leaks on pressure side of supply pump.
- ❑ Air leaks on suction side of supply pump.
- ❑ Engine compression.
- ❑ If equipped with a heat exchanger, check to be sure that it is free of debris.

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 *Electrical/Ignition/Fuel Service Manual*.

Loss Of Ignition - Check:

- ❑ Primary and secondary ignition circuits.
- ❑ Ignition switch.
- ❑ Circuit breakers.
- ❑ Wiring between engine and dash.
- ❑ Main engine harness wiring.
- ❑ See *Electrical/Ignition/Fuel Service 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, or slipping hub.
- ❑ Crankcase oil volume.
- ❑ Marine growth on hull and drive.
- ❑ Wrong Sterndrive gear ratio.
- ❑ Operating at high altitude.
- ❑ Restricted carburetor air intake.
- ❑ Restricted exhaust outlets in engine, transom bracket, or drive.
- ❑ Poor cylinder compression.

Engine Won't Reach Operating RPM (Cont.)

(Cont.) - Check:

- ❑ 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 blocked oil galleys.
- ❑ Dirty or defective hydraulic lifters or clogged push rod passages.
- ❑ Poor quality, or incorrect viscosity or quantity of oil.
- ❑ Incorrect hose routing on remote filter systems.
- ❑ Water in crankcase oil from condensation, or 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:
  - Meter reading of “0” indicates no draw; test battery and charging system.
  - Meter movement no matter how slight indicates draw from battery.
- ❑ Disconnect main engine harness 14-Pin Connector:
  - Meter drops back to “0” indicates problem caused by boat system; continue to isolate each boat electrical accessory until problem is found.
  - Meter does not drop back to “0” indicates problem caused by engine electrical system; continue to isolate each engine electrical accessory until problem is found.
- ❑ Repair or replace components as necessary.

Notes

Volvo Penta of the Americas, Inc., reserves the right to make changes in weight, construction, materials, or specifications without notice or obligation.

Engine	**3.0GLP-J**
Bore and stroke	4.00 x 3.60 inches (101.60 x 91.44 mm)
Cylinders (number)	4 in-line
Displacement	181 Cu. In. (3.0 liters)
Firing order	1 – 3 – 4 – 2
Full throttle operating range	4200 – 4600 RPM
Idle RPM	650 – 750 RPM in forward gear

Fuel System

Carburetor	Adjustable idle circuit, fixed main fuel jets, electric choke
Fuel Pump	Mechanical
Fuel filter (in fuel pump)	Water separating 10 micron fuel filter, Volvo Penta PN 3855104
Fuel filter location	Refer to photographs on Features pages.
Fuel type	Inside the U.S.: 87 octane (AKI) unleaded gasoline Outside the U.S.: 90 octane (RON) unleaded gasoline

Electrical System

Charging system	12 volt 75 amp alternator, with internal transistorized voltage regulator
Battery size	12 volt with 360 Cold Cranking Amp (CCA) rating
Starter	12 volt 1.7kW output, planetary reduction gear

Ignition System

Distributor	Delco EST
Ignition timing	2° ATDC, special tool Volvo Penta PN 885163 required
Spark plugs	Volvo Penta PN 3851857
Spark plug gap	0.045 inches (1.14 mm)
Spark plug installation torque	20 ft. lb. (27 Nm)

Cooling System

Raw water pump	Crankshaft mounted variable volume flexible impeller pump
Recirculating pump	Fixed impeller belt driven pump on engine
Thermostat	160°F (71°C) Volvo Penta PN 3853799

Oil Capacity

NOTICE! Overfilling the oil can cause engine and/or sterndrive damage. We urge you to use the dipstick to check the oil level whenever you are changing or topping up the oil.

Engine with filter	3.5 quarts (3.3 liters)
Drive unit SX-A	2.58 quarts (2.44 liters)
Engine oil filter (Location)	Volvo Penta PN 835440 (Refer to photographs on features pages).

Oil Type

Engine	Volvo Penta Premium engine oil labeled for API Service CF/SH and ILSAC GF-4
Drive unit	Volvo Penta SAE 75W/90 API service GL 5 synthetic gear oil
Power steering fluid U.S.	Volvo Penta power steering fluid PN 3851039
Power steering fluid non-U.S.	ATF oil Dexron 2 (PN 1161941) or higher classification

Oil Pressure (Minimum)

@ 1000 RPM	6 PSI (41 kPa)
@ 2000 RPM	18 PSI (124 kPa)
@ 4000 RPM	24 PSI (166 kPa)

Engine	**4.3GL-J, 4.3GL-JF**
Bore and stroke	4.000 x 3.480 in. (101.60 x 88.39 mm)
Cylinders (number)	90° V-6
Displacement	262 Cu. In. (4.3 liters)
Firing order	1 – 6 – 5 – 4 – 3 – 2
Full throttle operating range	4200 – 4600 RPM
Idle RPM	550 – 650 RPM in forward gear

Fuel System

Carburetor	Adjustable idle circuit, fixed main fuel jets, electric choke
Fuel Pump	Electric
Fuel filter	Water separating 10 micron fuel filter, Volvo Penta PN 3862228
Fuel type	Inside the U.S.: 87 octane (AKI) unleaded gasoline Outside the U.S.: 90 octane (RON) unleaded gasoline

Electrical System

Charging system	12 volt 75 amp alternator, with internal transistorized voltage regulator
Battery size	12 volt with 360 Cold Cranking Amp (CCA) rating
Starter	12 volt 1.7kW output, planetary reduction gear

Ignition System

Distributor	Delco EST
Ignition timing	1° BTDC special tool Volvo Penta PN 885163 required
Spark plugs	Volvo Penta PN 3858997
Spark plug gap	0.060 inches (1.50 mm)
Spark plug installation torque	20 ft. lb. (27 Nm)

Cooling System

Raw water pump	Crankshaft mounted variable volume flexible impeller pump
Recirculating pump	Fixed impeller belt driven pump on engine
Thermostat	4.3GL-J: 150°F (66°C) Volvo Penta PN 3587597
Closed Cooling System Thermostat	4.3GL-JF: 170°F (77°C) Volvo Penta PN 3831426. Closed cooling heat exchanger mounted on engine.
Coolant Type	Ethylene glycol. Volvo Penta PN 381081.

Oil Capacity

NOTICE! Overfilling the oil can cause engine and/or sterndrive damage. We urge you to use the dipstick to check the oil level whenever you are changing or topping up the oil.

Engine with filter	4.0 quarts (3.8 liters)
Drive unit SX-A	2.58 quarts (2.44 liters)
Drive unit DPS-A	2.38 quarts (2.25 liters)
Engine oil filter (Location)	Volvo Penta PN 3847302 (Refer to photographs on features pages).

Oil Type

Engine	Volvo Penta engine oil, or suitable pure synthetic oil alternative with the minimum API service rating CF/SH and ILSAC GF-4. See *Maintenance Schedule* on page 74.
Drive unit	Volvo Penta SAE 75W/90 API service GL 5 synthetic gear oil
Power steering fluid U.S.	Volvo Penta power steering fluid PN 3851039
Power steering fluid non-U.S.	ATF oil Dexron 2 (PN 1161941) or higher classification

Oil Pressure (Minimum)

@ 1000 RPM	6 PSI (41 kPa)
@ 2000 RPM	18 PSI (124 kPa)
@ 4000 RPM	24 PSI (166 kPa)

Engine	**4.3GXi-J, 4.3GXi-JF**
Bore and stroke	4.000 x 3.480 in. (101.60 x 88.39 mm)
Cylinders (number)	90° V-6
Displacement	262 Cu. In. (4.3 liters)
Firing order	1 – 6 – 5 – 4 – 3 – 2
Full throttle operating range	4400 – 4800 RPM
Idle RPM (fixed)	600 RPM in forward gear
Fuel System	
Fuel injection	Port injection
Fuel pumps	Electric
Fuel filter	Volvo Penta P/N 3862228
Fuel filter location	Refer to photographs on features pages.
Fuel type	Inside the U.S.: 87 octane (AKI) unleaded gasoline Outside the U.S.: 90 octane (RON) unleaded gasoline
Electrical System	
Charging system	12 volt 75 amp alternator, with internal transistorized voltage regulator
Battery size	12 volt with 650 Cold Cranking Amp (CCA) rating (135 minute reserve capacity). **Do not use a deep cycle battery as the start battery.**
Starter	12 volt 1.7kW output, planetary reduction gear
Ignition System	
Distributor	Delco EST
Ignition timing	10° BTDC Fixed
Spark plugs	Volvo Penta PN 3858997
Spark plug gap	0.060 inches (1.50 mm)
Spark plug installation torque	20 ft. lb. (27 Nm)
Cooling System	
Raw water pump	Crankshaft mounted variable volume flexible impeller pump
Recirculating pump	Fixed impeller belt driven pump on engine
Thermostat	4.3GXi-J: 150°F (66°C) Volvo Penta PN 3587597
Closed Cooling System Thermostat	4.3GXi-JF: 170°F (77°C) Volvo Penta PN 3831426. Closed cooling heat exchanger mounted on engine.
Coolant Type	Ethylene glycol. Volvo Penta PN 381081.

Oil Capacity

NOTICE! Overfilling the oil can cause engine and/or sterndrive damage. We urge you to use the dipstick to check the oil level whenever you are changing or topping up the oil.

Engine with filter	4.0 quarts (3.8 liters)
Drive unit SX-A	2.58 quarts (2.44 liters)
Drive unit DPS-A	2.38 quarts (2.25 liters)
Engine oil filter (Location)	Volvo Penta PN 3847302 (Refer to photographs on features pages).
Oil Type	
Engine	Volvo Penta engine oil or suitable pure synthetic oil alternative with min. API service rating CF/SH and ILSAC GF-4. See *Maintenance Schedule* on page 74.
Drive unit	Volvo Penta SAE 75W/90 API service GL 5 synthetic gear oil
Power steering fluid U.S.	Volvo Penta power steering fluid PN 3851039
Power steering fluid non-U.S.	ATF oil Dexron 2 (PN 1161941) or higher classification
Oil Pressure (Minimum)	
@ 1000 RPM	6 PSI (41 kPa)
@ 2000 RPM	18 PSI (124 kPa)
@ 4000 RPM	24 PSI (166 kPa)

Engine	**4.3OSi-J, 4.3OSi-JF**
Bore and stroke	4.000 x 3.480 in. (101.60 x 88.39 mm)
Cylinders (number)	90° V-6
Displacement	262 Cu. In. (4.3 liters)
Firing order	1 – 6 – 5 – 4 – 3 – 2
Full throttle operating range	4400 – 4800 RPM
Idle RPM (fixed)	600 RPM in forward gear

Fuel System

Fuel Pump	Electric
Fuel filter	Volvo Penta PN 3862228.
Fuel type	Inside the U.S.: 87 octane (AKI) unleaded gasoline. Outside the U.S.: 90 octane (RON) unleaded gasoline.

Electrical System

Charging system	12 volt 75 amp alternator, with internal transistorized voltage regulator.
Battery size	12 volt with 650 Cold Cranking Amp (CCA) rating (135 minute reserve). **Do not use a deep cycle battery as the start battery.**
Starter	12 volt 1.7kW output, planetary reduction gear.

Ignition System

Distributor	Delco EST
Ignition timing	10° BTDC special tool Volvo Penta part no. 885163 required.
Spark plugs	Volvo Penta PN 3858997.
Spark plug gap	0.060 inches (1.50 mm)
Spark plug installation torque	20 ft. lb. (27 Nm)

Cooling System

Raw water pump	Crankshaft mounted variable volume flexible impeller pump
Recirculating pump	Fixed impeller belt driven pump on engine.
Thermostat	4.3OSi-J: 150°F (66°C) Volvo Penta PN 3587597
Closed Cooling System Thermostat	4.3OSi-JF: 170°F (77°C) Volvo Penta PN 3831426. Closed cooling heat exchanger mounted on engine.
Coolant Type	Ethylene glycol. Volvo Penta PN 381081.

Oil Capacity

NOTICE! Overfilling the oil can cause engine and/or sterndrive damage. We urge you to use the dipstick to check the oil level whenever you are changing or topping up the oil.

Engine with filter	4.0 quarts (3.8 liters)
Drive unit XDP-B	2.6 quarts (2.5 liters)
Engine oil filter (Location)	Volvo Penta PN 3847302 (Refer to photographs on features pages).

Oil Type

Engine	Volvo Penta engine oil or suitable pure synthetic oil alternative with min. API service rating CF/SH and ILSAC GF-4. See *Maintenance Schedule* on page 74.
Drive unit	Volvo Penta SAE 75W/90 API service GL 5 synthetic gear oil.
Power steering fluid U.S.	Volvo Penta power steering fluid Part no. 3851039.
Power steering fluid non-U.S.	ATF oil Dexron 2 (PN 1161941) or higher classification

Oil Pressure (Minimum)

@ 1000 RPM	6 PSI (41 kPa)
@ 2000 RPM	18 PSI (124 kPa)
@ 4000 RPM	24 PSI (166 kPa)

Engine	**5.0GL-J, 5.0GL-JF**
Bore and stroke	3.740 x 3.480 inches (95.00 x 88.39 mm)
Cylinders (number)	90° V-8
Displacement	305 Cu. In. (5.0 liters)
Firing order	1 – 8 – 4 – 3 – 6 – 5 – 7 – 2
Full throttle operating range	4400 – 4800 RPM
Idle RPM	550-650 RPM in forward gear

Fuel System

Carburetor	Adjustable idle circuit, fixed main fuel jets, electric choke
Fuel Pump	Electric
Fuel filter	Water separating 10 micron fuel filter, Volvo Penta PN 3862228
Fuel type	Inside the U.S.: 87 octane (AKI) unleaded gasoline
	Outside the U.S.: 90 octane (RON) unleaded gasoline

Electrical System

Battery size	12 volt with 650 Cold Cranking Amp (CCA) rating.
Charging system	12 volt 75 amp alternator, with internal transistorized voltage regulator
Starter	12 volt 1.7kW output, planetary reduction gear

Ignition System

Distributor	Delco EST
Distributor module sensor gap	0,203 mm (0.008 inches) nonmagnetic feeler gauge required.
Ignition timing	10° BTDC (special tool Volvo Penta PN 885163 required)
Spark plugs	Volvo Penta P/N 3858996 (2 units)
Spark plug gap	0.060 inches (1.50 mm)
Spark plug installation torque	20 ft. lb. (27 Nm)

Cooling System

Raw water pump	Crankshaft mounted variable volume flexible impeller pump
Recirculating pump	Fixed impeller belt driven pump on engine
Thermostat	5.0GL-J: 150°F (66°C) Volvo Penta PN 3587597
Closed Cooling System Thermostat	5.0GL-JF: 170°F (77°C) Volvo Penta PN 3831426. Closed cooling heat exchanger mounted on engine.
Coolant Type	Ethylene glycol. Volvo Penta PN 381081.

Oil Capacity

NOTICE! Overfilling the oil can cause engine and/or sterndrive damage. We urge you to use the dipstick to check the oil level whenever you are changing or topping up the oil.

Engine with filter	5.0 quarts (4.7 liters)
Drive unit SX-A	2.58 quarts (2.44 liters)
Drive unit DPS-A	2.38 quarts (2.25 liters)
Engine oil filter (Location)	Volvo Penta PN 3847302 (Refer to photographs on features pages).

Oil Type

Engine	Volvo Penta engine oil, or suitable pure synthetic oil alternative with the minimum API service rating CF/SH and ILSAC GF-4. See *Maintenance Schedule* on page 74.
Drive unit	Volvo Penta SAE 75W/90 API service GL 5 synthetic gear oil
Power steering fluid U.S.	Volvo Penta power steering fluid PN 3851039
Power steering fluid non-U.S.	ATF oil Dexron 2 (PN 1161941) or higher classification

Oil Pressure (Minimum)

@ 1000 RPM	6 PSI (41 kPa)
@ 2000 RPM	18 PSI (124 kPa)
@ 4000 RPM	24 PSI (166 kPa)

Engine	**5.0GXi-J, 5.0GXi-JF**
Bore and stroke	3.740 x 3.480 inches (95.00 x 88.39 mm)
Cylinders (number)	90° V-8
Displacement	305 Cu. In. (5.0 liters)
Firing order	1 – 8 – 4 – 3 – 6 – 5 – 7 – 2
Full throttle operating range	4600 – 5000 RPM
Idle RPM (fixed)	600 RPM in forward gear

Fuel System

Fuel injection	Port injection
Fuel pumps	Electric
Fuel filter	Volvo Penta P/N 3862228
Fuel filter location	Refer to photographs on features pages.
Fuel type	Inside the U.S.: 87 octane (AKI) unleaded gasoline Outside the U.S.: 90 octane (RON) unleaded gasoline

Electrical System

Charging system	12 volt 75 amp alternator, with internal transistorized voltage regulator
Battery size	12 volt with 650 Cold Cranking Amp (CCA) rating (135 minute reserve capacity). **Do not use a deep cycle battery as the start battery.**
Starter	12 volt 1.7kW output, planetary reduction gear

Ignition System

Distributor	Delco EST
Ignition timing	10° BTDC Fixed
Spark plugs	Volvo Penta PN 3858996 (2 units)
Spark plug gap	0.060 inches (1.50 mm)
Spark plug installation torque	20 ft. lb. (27 Nm)

Cooling System

Raw water pump	Crankshaft mounted variable volume flexible impeller pump
Recirculating pump	Fixed impeller belt driven pump on engine
Thermostat	5.0GXi-J: 150°F (66°C) Volvo Penta PN 3587597
Closed Cooling System Thermostat	5.0GXi-JF: 170°F (77°C) Volvo Penta PN 3831426. Closed cooling heat exchanger mounted on engine.
Coolant Type	Ethylene glycol. Volvo Penta PN 381081.

Oil Capacity

NOTICE! Overfilling the oil can cause engine and/or sterndrive damage. We urge you to use the dipstick to check the oil level whenever you are changing or topping up the oil.

Engine with filter	5.0 quarts (4.7 liters)
Drive unit SX-A	2.58 quarts (2.44 liters)
Drive unit DPS-A	2.38 quarts (2.25 liters)
Engine oil filter (Location)	Volvo Penta PN 3847302 (Refer to photographs on features pages).

Oil Type

Engine	Volvo Penta engine oil or suitable pure synthetic oil alternative with min. API service rating CF/SH and ILSAC GF-4. See *Maintenance Schedule* on page 74.
Drive unit	Volvo Penta SAE 75W/90 API service GL 5 synthetic gear oil
Power steering fluid U.S.	Volvo Penta power steering fluid PN 3851039
Power steering fluid non-U.S.	ATF oil Dexron 2 (PN 1161941) or higher classification

Oil Pressure (Minimum)

@ 1000 RPM	6 PSI (41 kPa)
@ 2000 RPM	18 PSI (124 kPa)
@ 4000 RPM	24 PSI (166 kPa)

Engine	**5.0OSi-J, 5.0OSi-JF**
Bore and stroke	3.740 x 3.480 inches (95.00 x 88.39 mm)
Cylinders (number)	90° V-8
Displacement	305 Cu. In. (5.0 liters)
Firing order	1 – 8 – 4 – 3 – 6 – 5 – 7 – 2
Full throttle operating range	4600 – 5000 RPM
Idle RPM (fixed)	600 RPM in forward gear

Fuel System

Fuel injection	Port injection
Fuel pumps	Electric
Fuel filter	Volvo Penta PN 3862228.
Fuel filter location	Refer to photographs on features pages.
Fuel type	Inside the U.S.: 87 octane (AKI) unleaded gasoline. Outside the U.S.: 90 octane (RON) unleaded gasoline.

Electrical System

Charging system	12 volt 75 amp alternator, with internal transistorized voltage regulator.
Battery size	12 volt with 650 Cold Cranking Amp (CCA) rating (135 minute reserve capacity). **Do not use a deep cycle battery as the start battery.**
Starter	12 volt 1.7kW output, planetary reduction gear.

Ignition System

Distributor	Delco EST
Ignition timing	10° BTDC Fixed
Spark plugs	Volvo Penta PN 3858996 (2 units).
Spark plug gap	0.060 inches (1.50 mm)
Spark plug installation torque	20 ft. lb. (27 Nm)

Cooling System

Raw water pump	Crankshaft mounted variable volume flexible impeller pump. Please refer to *Maintenance Parts List* on page 65 for part number.
Recirculating pump	Fixed impeller belt driven pump on engine.
Thermostat	5.0OSi-J: 150°F (66°C) Volvo Penta PN 3587597
Closed Cooling System Thermostat	5.0OSi-JF: 170°F (77°C) Volvo Penta PN 3831426. Closed cooling heat exchanger mounted on engine.
Coolant Type	Ethylene glycol. Volvo Penta PN 381081.

Oil Capacity

NOTICE! Overfilling the oil can cause engine and/or sterndrive damage. We urge you to use the dipstick to check the oil level whenever you are changing or topping up the oil.

Engine with filter	5.0 quarts (4.7 liters)
Drive unit XDP-B	approximately 2.6 quarts (2.5 liters).
Engine oil filter (Location)	Volvo Penta PN 3847302 (Refer to photographs on features pages).

Oil Type

Engine	Volvo Penta engine oil or suitable pure synthetic oil alternative with min. API service rating CF/SH and ILSAC GF-4. See *Maintenance Schedule* on page 74.
Drive unit	Volvo Penta SAE 75W/90 API service GL 5 synthetic gear oil.
Power steering fluid U.S.	Volvo Penta power steering fluid Part no. 3851039.
Power steering fluid non-U.S.	ATF oil Dexron 2 (PN 1161941) or higher classification

Oil Pressure (Minimum)

@ 1000 RPM	6 PSI (41 kPa)
@ 2000 RPM	18 PSI (124 kPa)
@ 4000 RPM	24 PSI (166 kPa)

Engine	**5.7Gi300-J, 5.7Gi300-JF, 5.7GXi-J, 5.7GXi-JF**
Bore and stroke	4.000 x 3.480 inches (101.60 x 88.39 mm)
Cylinders (number)	90° V-8
Displacement	350 Cu. In. (5.7 liters)
Firing order	1 – 8 – 4 – 3 – 6 – 5 – 7 – 2
Full throttle operating range	
5.7Gi300-J, 5.7Gi300-JF	4600 – 5000 RPM
5.7GXi-J, 5.7GXi-JF	4800 – 5200 RPM
Idle RPM (fixed)	600 RPM in forward gear

Fuel System

Fuel injection	Port injection
Fuel pumps	Electric
Fuel filter	Volvo Penta PN 3862228
Fuel filter location	Refer to photographs on features pages.
Fuel type	Inside the U.S.: 87 octane (AKI) unleaded gasoline Outside the U.S.: 90 octane (RON) unleaded gasoline

Electrical System

Charging system	12 volt 75 amp alternator, with internal transistorized voltage regulator
Battery size	12 volt with 650 Cold Cranking Amp (CCA) rating (135 minute reserve capacity). **Do not use a deep cycle battery as the start battery.**
Starter	12 volt 1.7kW output, planetary reduction gear

Ignition System

Distributor	Delco EST
Ignition timing	10°BTDC Fixed
Spark plugs	Volvo Penta PN 3858996 (2 units)
Spark plug gap	0.060 inches (1.50 mm)
Spark plug installation torque	20 ft. lb. (27 Nm)

Cooling System

Raw water pump	Crankshaft mounted variable volume flexible impeller pump
Recirculating pump	Fixed impeller belt driven pump on engine
Recirculating pump	Fixed impeller belt driven pump on engine.
Thermostat	5.7Gi300-J, 5.7GXi-J: 150°F (66°C) Volvo Penta PN 3587597
Closed Cooling System Thermostat	5.7Gi300-JF, 5.7GXi-JF: 170°F (77°C) Volvo Penta PN 3831426. Closed cooling heat exchanger mounted on engine.
Coolant Type	Ethylene glycol. Volvo Penta PN 381081.

Oil Capacity

NOTICE! Overfilling the oil can cause engine and/or sterndrive damage. We urge you to use the dipstick to check the oil level whenever you are changing or topping up the oil.

Engine with filter	5.0 quarts (4.7 liters)
Drive unit SX-A	2.58 quarts (2.44 liters)
Drive unit DPS-A	2.38 quarts (2.25 liters)
Engine oil filter (Location)	Volvo Penta PN 3847302 (Refer to photographs on features pages).

Oil Type

Engine	Volvo Penta engine oil or suitable pure synthetic oil alternative with min. API rating CF/SH and ILSAC GF-4. See *Maintenance Schedule* on page 74.
Drive unit	Volvo Penta SAE 75W/90 API service GL 5 synthetic gear oil
Power steering fluid U.S.	Volvo Penta power steering fluid PN 3851039
Power steering fluid non-U.S.	ATF oil Dexron (PN 1161941) or higher classification

Oil Pressure (Minimum)

@ 1000 RPM	6 PSI (41 kPa)
@ 2000 RPM	18 PSI (124 kPa)
@ 4000 RPM	24 PSI (166 kPa)

Engine	**5.7OSi300-J, 5.7OSi300-JF, 5.7OSXi-J, 5.7OSXi-JF**
Bore and stroke	4.000 x 3.480 inches (101.60 x 88.39 mm)
Cylinders (number)	90° V-8
Displacement	350 Cu. In. (5.7 liters)
Firing order	1 – 8 – 4 – 3 – 6 – 5 – 7 – 2
Full throttle operating range	
5.7OSi300-J, 5.7OSi300-JF Only	4600 – 5000 RPM
5.7OSXi-J, 5.7OSXi-JF Only	4800 – 5200 RPM
Idle RPM (fixed)	600 RPM in forward gear

Fuel System

Fuel injection	Port injection
Fuel pumps	Electric
Fuel filter	Volvo Penta PN 3862228.
Fuel filter location	Refer to photographs on features pages.
Fuel type	Inside the U.S.: 87 octane (AKI) unleaded gasoline. Outside the U.S.: 90 octane (RON) unleaded gasoline.

Electrical System

Charging system	12 volt 75 amp alternator, with internal transistorized voltage regulator.
Battery size	12 volt with 650 Cold Cranking Amp (CCA) rating (135 minute reserve capacity). **Do not use a deep cycle battery as the start battery.**
Starter	12 volt 1.7kW output, planetary reduction gear.

Ignition System

Distributor	Delco EST
Ignition timing	10°BTDC Fixed
Spark plugs	Volvo Penta PN 3858996 (2 units).
Spark plug gap	0.060 inches (1.50 mm)
Spark plug installation torque	20 ft. lb. (27 Nm)

Cooling System

Raw water pump	Crankshaft mounted variable volume flexible impeller pump. Please refer to *Maintenance Parts List* on page 65 for part number.
Recirculating pump	Fixed impeller belt driven pump on engine.
Thermostat	5.7OSi300-J, 5.7OSXi-J: 150°F (66°C) Volvo Penta PN 3587597
Closed Cooling System Thermostat	5.7OSi300-JF, 5.7OSXi-JF: 170°F (77°C) Volvo Penta PN 3831426. Closed cooling heat exchanger mounted on engine.
Coolant Type	Ethylene glycol. Volvo Penta PN 381081.

Oil Capacity

NOTICE! Overfilling the oil can cause engine and/or sterndrive damage. We urge you to use the dipstick to check the oil level whenever you are changing or topping up the oil.

Engine with filter	5.0 quarts (4.7 liters)
Drive unit XDP-B	approximately 2.6 quarts (2.5 liters).
Engine oil filter (Location)	Volvo Penta PN 3847302 (Refer to photographs on features pages).

Oil Type

Engine	Volvo Penta engine oil or suitable pure synthetic oil alternative with min. API service rating CF/SH and ILSAC GF-4. See *Maintenance Schedule* on page 74.
Drive unit	Volvo Penta SAE 75W/90 API service GL 5 synthetic gear oil
Power steering fluid U.S.	Volvo Penta power steering fluid Part no. 3851039
Power steering fluid non-U.S.	ATF oil Dexron 2 (PN 1161941) or higher classification

Oil Pressure (Minimum)

@ 1000 RPM	6 PSI (41 kPa)
@ 2000 RPM	18 PSI (124 kPa)
@ 4000 RPM	24 PSI (166 kPa)

Engine	**8.1Gi-J, 8.1Gi-JF, 8.1GXi-J, 8.1GXi-JF**
Bore and stroke	107.95 x 111.00mm (4.250 x 4.370 inches)
Cylinders (number)	90° V-8
Displacement	496 Cu. In. (8.1 liters)
Firing order	1 – 8 – 7 – 2 – 6 – 5 – 4 – 3
Full throttle operating range Gi-J, Gi-JF	4200 – 4600 RPM
Full throttle operating range GXi-J, GXi-JF	4600 – 5000 RPM
Idle RPM (fixed) Gi-J, Gi-JF	600 RPM in forward gear
Idle RPM (fixed) GXi-J, GXi-JF	650 RPM in forward gear

Fuel System

Fuel injection	Port injection
Fuel pumps	Electric
Fuel filter	Volvo Penta PN 3862228
Fuel filter location	Refer to photographs on features pages.
Fuel type	Inside the U.S.: 87 octane (AKI) unleaded gasoline Outside the U.S.: 90 octane (RON) unleaded gasoline

Electrical System

Charging system	12 volt 75 amp alternator, with internal transistorized voltage regulator
Battery size	12 volt with 650 Cold Cranking Amp (CCA) rating (135 minute reserve capacity). **Do not use a deep cycle battery as the start battery.**
Starter	12 volt 1.7kW output, planetary reduction gear

Ignition System

Distributorless	Crankshaft and camshaft triggered ignition sensors.
Ignition timing	10° BTDC, fixed, See Workshop Manual for procedure.
Spark plugs	Volvo Penta PN 3861326 (2 units)
Spark plug gap	0.060 inches (1.50 mm)
Spark plug installation torque	20 ft. lb. (27 Nm)

Cooling System

Raw water pump	Crankshaft mounted variable volume flexible impeller pump
Recirculating pump	Fixed impeller belt driven pump on engine
Thermostat	8.1Gi-J, 8.1GXi-J: 160°F (71°C) Volvo Penta PN 3853983
Closed Cooling System Thermostat	8.1Gi-JF, 8.1GXi-JF: 170°F (77°C) Volvo Penta PN 3831426. Closed cooling heat exchanger mounted on engine.
Coolant Type	Ethylene glycol. Volvo Penta PN 381081.

Oil Capacity

NOTICE! Overfilling the oil can cause engine and/or sterndrive damage. We urge you to use the dipstick to check the oil level whenever you are changing or topping up the oil.

Engine with filter	6.5 quarts (6.2 liters)
Drive unit DPS-A	2.38 quarts (2.25 liters)
Engine oil filter (Location)	Volvo Penta PN 3847302 (Refer to photographs on features pages).

Oil Type

Engine	Volvo Penta engine oil or suitable pure synthetic oil alternative with min. API service rating CF/SH and ILSAC GF-4. See *Maintenance Schedule* on page 74.
Drive unit	Volvo Penta SAE 75W/90 API service GL 5 synthetic gear oil
Power steering fluid U.S.	Volvo Penta power steering fluid PN 3851039
Power steering fluid non-U.S.	ATF oil Dexron 2 (PN 1161941) or higher classification

Oil Pressure (Minimum)

@ 1000 RPM	5 PSI (34 kPa)
@ 2000 RPM	10 PSI (69 kPa)

Engine	**8.1OSi-J, 8.1OSi-JF**
Bore and stroke	107.95 x 111.00mm (4.250 x 4.370 inches)
Cylinders (number)	90° V-8
Displacement	496 Cu. In. (8.1 liters)
Firing order	1 – 8 – 7 – 2 – 6 – 5 – 4 – 3
Full throttle operating range	4200 – 4600 RPM
Idle RPM (fixed)	600 RPM in forward gear

Fuel System

Fuel injection	Port injection
Fuel pumps	Electric
Fuel filter	Volvo Penta PN 3862228.
Fuel filter location	Refer to photographs on features pages.
Fuel type	Inside the U.S.: 87 octane (AKI) unleaded gasoline. Outside the U.S.: 90 octane (RON) unleaded gasoline.

Electrical System

Charging system	12 volt 75 amp alternator, with internal transistorized voltage regulator.
Battery size	12 volt with 650 Cold Cranking Amp (CCA) rating (135 minute reserve capacity). **Do not use a deep cycle battery as the start battery.**
Starter	12 volt 1.7kW output, planetary reduction gear.

Ignition System

Distributorless	Crankshaft and camshaft triggered ignition sensors.
Ignition timing	10° BTDC, fixed, See Workshop Manual for procedure.
Spark plugs	Volvo Penta PN 3861326 (2 units).
Spark plug gap	0.060 inches (1.50 mm)
Spark plug installation torque	20 ft. lb. (27 Nm)

Cooling System

Raw water pump	Crankshaft mounted variable volume flexible impeller pump. Please refer to *Maintenance Parts List* on page 65 for part number.
Recirculating pump	Fixed impeller belt driven pump on engine.
Thermostat	8.1OSi-J: 160°F (71°C) Volvo Penta PN 3853983
Closed Cooling System Thermostat	8.1OSi-JF: 170°F (77°C) Volvo Penta PN 3831426. Closed cooling heat exchanger mounted on engine.
Coolant Type	Ethylene glycol. Volvo Penta PN 381081.

Oil Capacity

NOTICE! Overfilling the oil can cause engine and/or sterndrive damage. We urge you to use the dipstick to check the oil level whenever you are changing or topping up the oil.

Engine with filter	6.5 quarts (6.2 liters)
Drive unit XDP-B	2.6 quarts (2.5 liters)
Engine oil filter (Location)	Volvo Penta PN 3847302 (Refer to photographs on features pages).

Oil Type

Engine	Volvo Penta engine oil or suitable pure synthetic oil alternative with min. API service rating CF/SH and ILSAC GF-4. See *Maintenance Schedule* on page 74.
Drive unit	Volvo Penta SAE 75W/90 API service GL 5 synthetic gear oil.
Power steering fluid U.S.	Volvo Penta power steering fluid Part no. 3851039
Power steering fluid non-U.S.	ATF oil Dexron 2 (PN 1161941) or higher classification

Oil Pressure (Minimum)

@ 1000 RPM	5 PSI (34 kPa)
@ 2000 RPM	10 PSI (69 kPa)

Notes

Metric Conversion Chart

LINEAR

inches X 25.4 = millimeters (mm)

feet X 0.3048 = meters (m)

yards X 0.9144 = meters (m)

miles X 1.6093 = kilometers (km)

inches X 2.54 = centimeters (cm)

AREA

$inches^2$ X 645.16 = $millimeters^2$ (mm^2)

$inches^2$ X 6.452 = $centimeters^2$ (cm^2)

$feet^2$ X 0.0929 = $meters^2$ (m^2)

$yards^2$ X 0.8361 = $meters^2$ (m^2)

acres X 0.4047 = hectares (104 m^2) (ha)

$miles^2$ X 2.590 = $kilometers^2$ (km^2)

VOLUME

$inches^3$ X 16387 = $millimeters^3$ (mm^3)

$inches^3$ X 16.387 = $centimeters^3$ (cm^3)

$inches^3$ X 0.01639 = liters (l)

quarts X 0.94635 = liters (l)

gallons X 3.7854 = liters (l)

$feet^3$ X 28.317 = liters (l)

$feet^3$ X 0.02832 = $meters^3$ (m^3)

fluid oz X 29.57 = milliliters (ml)

$yards^3$ X 0.7646 = $meters^3$ (m^3)

MASS

ounces (av) X 28.35 = grams (g)

pounds (av) X 0.4536 = kilograms (kg)

tons (2000 lb) X 907.18 = kilograms (kg)

tons (2000 lb) X 0.90718 = metric tons (t)

FORCE

ounces - f (av) X 0.278 = newtons (N)

pounds - f (av) X 4.448 = newtons (N)

kilograms - f X 9.807 = newtons (N)

ACCELERATION

$feet/sec^2$ X 0.3048 = $meters/sec^2$ (m/s^2)

$inches/sec^2$ X 0.0254 = $meters/sec^2$ (m/s^2)

ENERGY OR WORK

foot-pounds X 1.3558 = joules (j)

calories X 4.187 = joules (j)

Btu X 1055 = joules (j)

watt-hours X 3500 = joules (j)

kilowatt - hrs X 3.600 = megajoules (MJ)

FUEL ECONOMY AND FUEL CONSUMPTION

miles/gal X 0.42514 = kilometers/liter (km/l)

Note:

235.2/(mi/gal) = liters/100 km

235.2/(liters/100 km) = mi/gal

LIGHT

footcandles X 10.76 = $lumens/meter^2$ (lm/m^2)

PRESSURE OR STRESS

inches HG (60°F) X 3.377 = kilopascals (kPa)

pounds/sq in X 6.895 = kilopascals (kPa)

inches H2O (60°F) X 0.2488 = kilopascals (kPa)

bars X 100 = kilopascals (kPa)

pounds/sq ft X 47.88 = pascals (Pa)

POWER

horsepower X 0.746 = kilowatts (kW)

ft-lbf/min X 0.0226 = watts (W)

TEMPERATURE

°Celsius = 0.556 X (°F -32)

°Fahrenheit = (1.8 X °C) +32

TORQUE

pound-inches X 0.11299 = newton-meters (N•m)

pound-feet X 1.3558 = newton-meters (N•m)

VELOCITY

miles/hour X 1.6093 = kilometers/hour (km/h)

feet/sec X 0.3048 = meters/sec (m/s)

kilometers/hr X 0.27778 = meters/sec (m/s)

miles/hour X 0.4470 = meters/sec (m/s)

General Torque Specifications

The following tables provide general torque specifications for a variety of bolt sizes and threads. Unless specific torque values are called out in the instructions, consult this table whenever you are tightening bolts.

NOTICE! Always use the specific torque values called out in the procedural steps. In the event that specific torque values are not provided, you may use the values in these tables. Failure to use the correct torque may cause parts to fail, leading to engine damage or injury to occupants of the boat.

METRIC - COARSE THREAD (ENGINE ONLY)		
Thread	**Torque Range (ft. lb.)**	**Torque Range (Nm)**
M6	4.4 – 7.4	6 – 10
M8	11 – 18	15 – 25
M10	23 – 38	31 – 51
M12	41 – 66	55 – 90
M14	66 – 103	90 – 140
M16	103 – 170	140 – 230

METRIC - COARSE THREAD (STERNDRIVE ONLY)		
Thread	**Torque Range (ft. lb.)**	**Torque Range (Nm)**
M6	6.3 – 8.5	8.5 – 11.5
M8	14.8 – 20.7	20.1 – 28.1
M10	29.5 – 41.3	40.0 – 56.0
M12	51.6 – 73.8	70.0 – 100

US STANDARD THREAD		
Thread	**Torque Range (ft. lb.)**	**Torque Range (Nm)**
1/4 – 20	5.2 – 8.1	7 – 11
5/16 – 18	10 – 16	14 – 22
3/8 – 16	18 – 30	25 – 41
7/16 – 14	30 – 49	40 – 67
1/2 – 13	44 – 74	60 – 100
9/16 – 12	66 – 111	90 – 150

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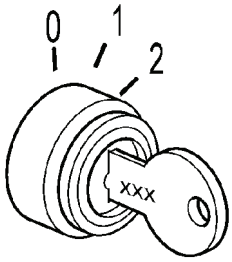
Notes

Appendix – EVC-mc User's Guide

Notes

This chapter describes the instrument and control panels, sold by Volvo Penta, for your engine. If you want to supplement the instrumentation, if your boat is equipped with instruments not described here, or if you are unsure about the functionality of your instrumentation, please contact your Volvo Penta dealer.



50822

Ignition Switch

The ignition switch has three positions (these positions are not marked):

0 The key can be inserted and taken out.

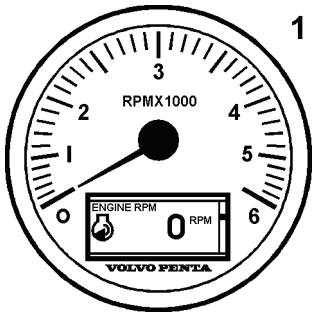
1 Operating and running position. System voltage connected.

2 Starter position (spring-loaded). The starter motor is engaged.

Please refer to your engine operator's manual for starting instructions.

Gauges

1. EVC system tachometer (with display)



50823

Optional Instruments

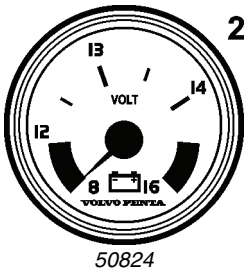
2. Voltmeter

3. Coolant temperature gauge

4. Fuel level gauge

5. Power trim gauge (analog)

6. Power trim gauge (digital)



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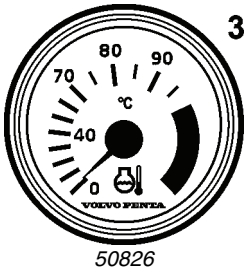

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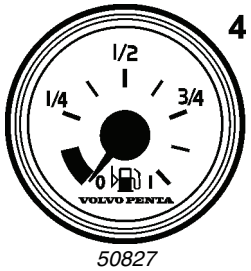

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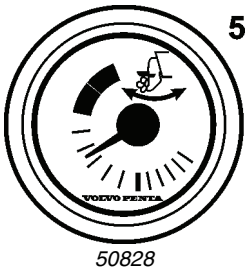

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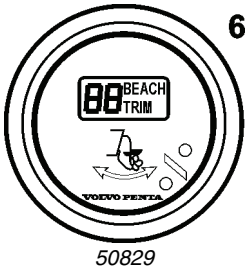

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50830

Alarm Display (Optional)

The following warning lamps should never light up during normal operation. However, the warning lamps do light up when the starter key is first turned to the drive position. Check that all lamps function. When the engine has started, all lamps should have gone out. The lamps flash if the diagnostic function has registered a malfunction. When the fault has been acknowledged, the lamp gives continuous light.

NOTICE! Warning lamps should never light up during normal operation.

General Warning: Red or Amber Indicator


50831

Red Warning Indication: Serious Fault

If the red warning indication is shown during operation, a serious fault has occurred.

For additional information, please see *Troubleshooting* on page A-27.

Amber Warning Indication: Fault

If the amber alarm indication is shown during operation, a fault has occurred.

For additional information, please see *Troubleshooting* on page A-27.

Oil Pressure: Red Indicator


50832

If the oil pressure lamp lights up during operation, the oil pressure in the engine is too low. Stop the engine at once.

- Check the oil level in the engine. Please refer to your engine Operator's Manual for additional information.
- Also check that the oil filter is not blocked. Please refer to your engine Operator's Manual for additional information.

For additional information, please see *Troubleshooting* on page A-27.

NOTICE! Continued operation when the oil pressure is too low can cause serious engine damage.


50833

Water in Fuel

Not active for gasoline engines.


50834

Battery: Amber Indicator

The battery lamp lights up if the alternator is not charging. Stop the engine if this lamp lights up during operation. If the lamp lights up, this can be due to a fault in the electrical system or because the alternator drive belt is slack.

- Check the alternator drive belt. Please refer to your engine Operator's Manual for additional information.

NOTICE! Do not continue operation if there is any problem with the alternator drive belts. This could cause serious engine damage.

- Check that there is no poor contact/broken wires.


50835

Coolant Temperature: Red Indicator

The coolant temperature lamp lights up when the coolant temperature is too high. Stop the engine if this lamp lights up during operation.

- Check the coolant level. Please refer to your engine Operator's Manual for additional information.

⚠ **WARNING! Do not open the coolant filler cap when the engine is warm. Steam or hot fluid could spray out, causing severe burns.**

- Check that the sea water filter, if installed, is not blocked. Please refer to your engine Operator's Manual for additional information.
- Check the impeller in the sea water pump. Please refer to your engine Operator's Manual for additional information.

For additional information, please see *Troubleshooting* on page A-27.


50836

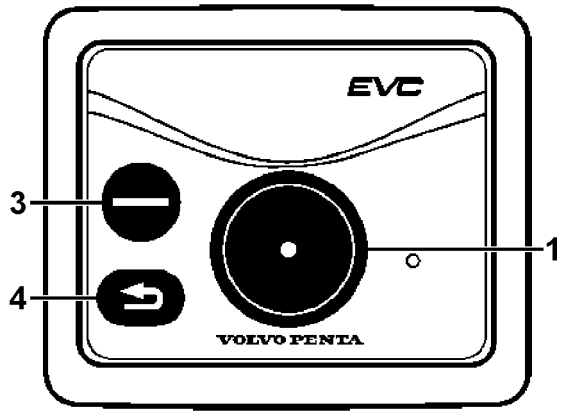
Coolant Level

Not active for gasoline engines.


50837

Oil Level

Not active for gasoline engines.



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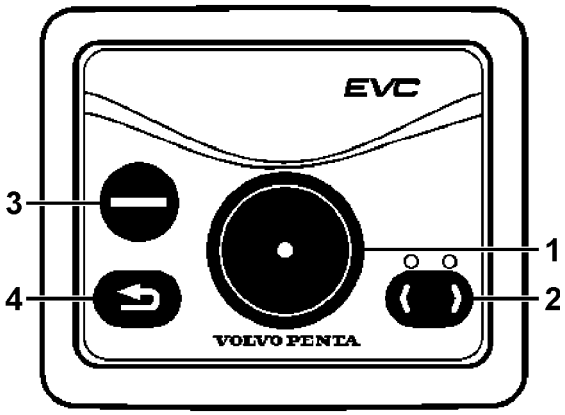


50839

EVC Control Panel

The control panel is used in combination with the EVC-system tachometer. The tachometer display shows operating information and menus that can be navigated from the control panel. The EVC control panel is available in two versions, for single or twin engine installations.

Navigation Wheel (1)

Used to navigate through the menus shown on the EVC-system tachometer display. Navigate through the menus by turning the wheel. Depress the wheel to confirm a selection.

Tachometer Display Selection (2)

Twin installation, port or starboard tachometer: Used to select which of the engine's menu systems should be navigable from the control panel. The menu is shown on the display of the corresponding engine's tachometer. Select port or starboard.

Indication (red/green):

Off: Not possible to navigate in menu.

Lit: Possible to navigate in menu for selected engine, port (red), starboard (green).

Multifunction Button (3)

Used to increase or decrease the instrument's and panel's backlighting.

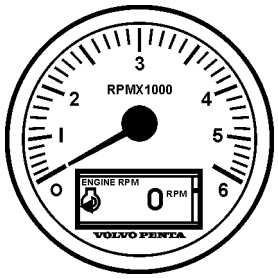
Depress the button for at least 1 second to turn the backlighting on or off. The backlighting can be adjusted in five stages by pressing the multifunction button.

If the button is pressed on an inactive control panel, operating information is shown on the display(s) and it is possible to navigate in the menus.

Back Button (4)

Used to back up a step in the menu.

Always press the buttons firmly and for at least one second each time.

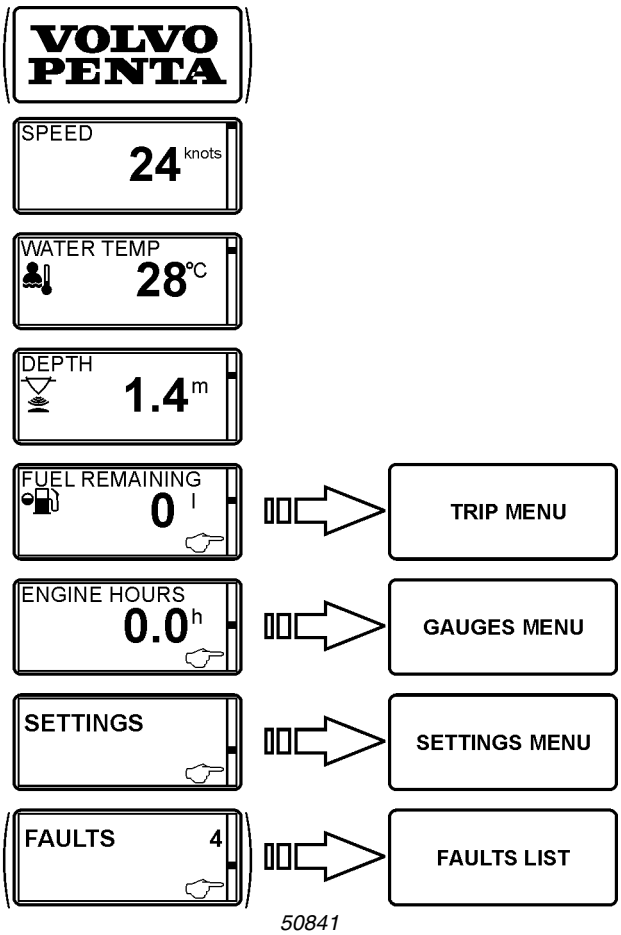


50823

VOLVO PENTA

50840

Main Menu Structure



50841

EVC System Tachometer

Volvo Penta EVC System Tachometer presents relevant boat and engine information to the helmsman. Information is presented on a display in the tachometer.

Information depends on engine model, number of sensors, and type of accessories.

Using the Instrument

Startup Screen

This is the startup screen for the EVC System Tachometer. After a few seconds the first item in MAIN MENU will appear.

Main Menu

Navigating the Menus

Navigate the menus by turning NAVIGATION WHEEL clockwise or counter-clockwise. Views with a POINTING HAND symbol indicate SUB-MENU items. To enter a SUB-MENU, push NAVIGATION WHEEL.

Speed (Optional)

Boat speed. Requires multisensor or GPS.

Water Temp (Optional)

Water temperature. Requires multisensor.

Depth (Optional)

Water depth. Requires multisensor.

Trip Menu (Optional)

Shows trip information. Requires the following:

- Multisensor or NMEA 0183/NMEA 2000 compatible component (plotter, GPS, paddle wheel, etc.).
- Fuel level sender.
- Trip computer software.

Gauges Menu

Shows data parameters.

Settings Menu

The SETTINGS MENU allows the user to set various options for the EVC System and to calibrate various parameters.

Faults List

Number after word FAULTS indicates number of faults stored in FAULTS LIST. List is reset when system is rebooted.

Faults list is not shown if no faults are registered.

Trip Menu (Optional)

In the TRIP MENU the user gets trip information from the EVC System and the user is allowed to select which view should be presented in the EVC System Tachometer's MAIN MENU as trip information. To get trip information, the following are required:

- Multisensor or NMEA 0183/NMEA 2000 compatible component (plotter, GPS, paddle wheel etc.)
- Fuel level sender
- Trip computer software

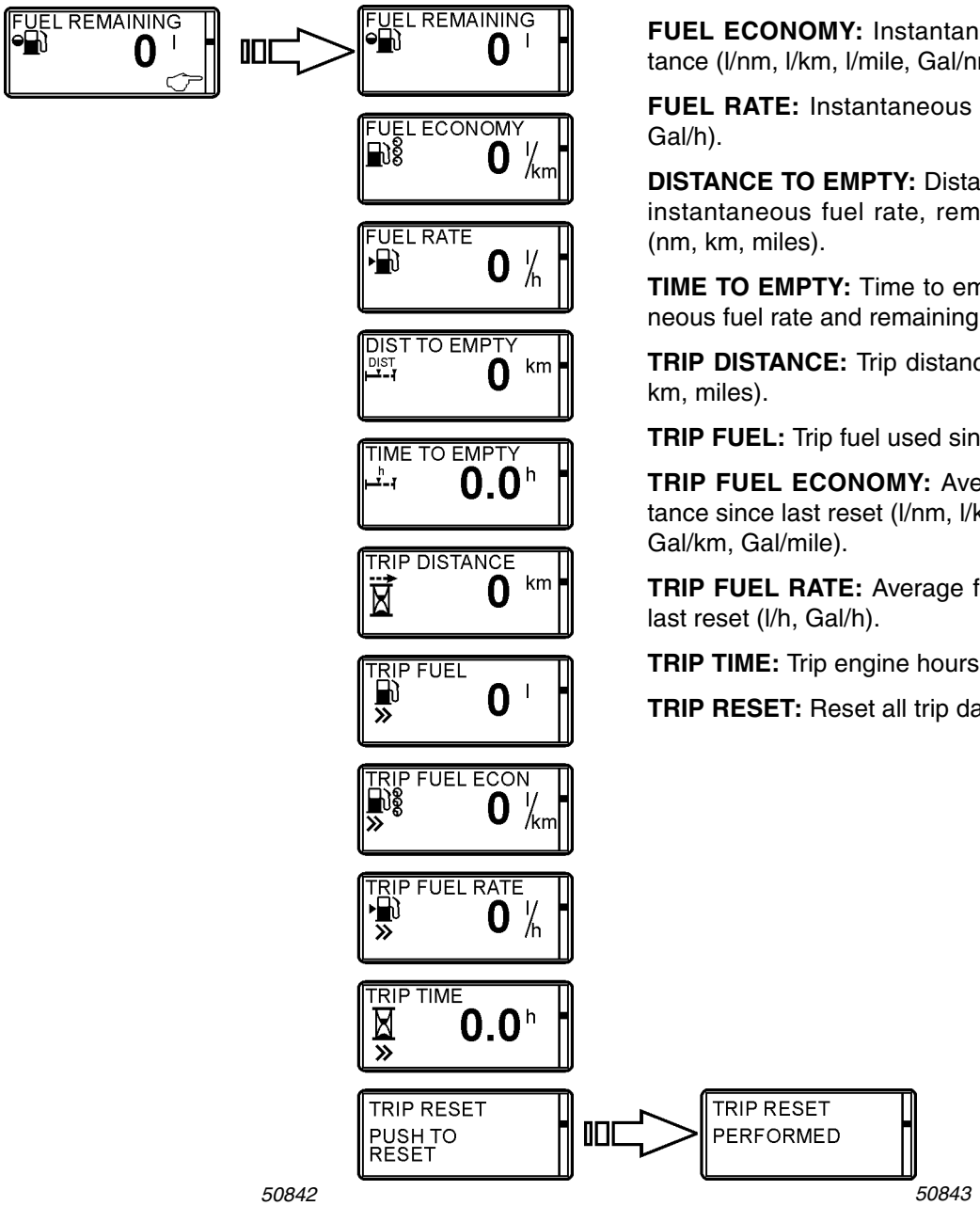
The accuracy of trip information concerning, and based on, remaining fuel volume depends on which method the user has chosen for calibrating the fuel tank.

When in TRIP MENU, select view by turning NAVIGATION WHEEL. To select view as favorite, push NAVIGATION WHEEL. System returns to MAIN MENU.

Push BACK BUTTON to return to MAIN MENU without setting a new favorite.

Units are user selectable. For additional information, please see *Select Units and Language* on page A-12.

Trip Menu Structure



50842 50843

FUEL REMAINING: Fuel remaining (l, Gal).

FUEL ECONOMY: Instantaneous fuel rate per distance (l/nm, l/km, l/mile, Gal/nm, Gal/km, Gal/mile).

FUEL RATE: Instantaneous fuel rate per hour (l/h, Gal/h).

DISTANCE TO EMPTY: Distance to empty based on instantaneous fuel rate, remaining fuel and speed (nm, km, miles).

TIME TO EMPTY: Time to empty based on instantaneous fuel rate and remaining fuel (h).

TRIP DISTANCE: Trip distance since last reset (nm, km, miles).

TRIP FUEL: Trip fuel used since last reset (l, Gal).

TRIP FUEL ECONOMY: Average fuel rate per distance since last reset (l/nm, l/km, l/mile, Gal/nm, Gal/km, Gal/mile).

TRIP FUEL RATE: Average fuel rate per hour since last reset (l/h, Gal/h).

TRIP TIME: Trip engine hours since last reset (h).

TRIP RESET: Reset all trip data.

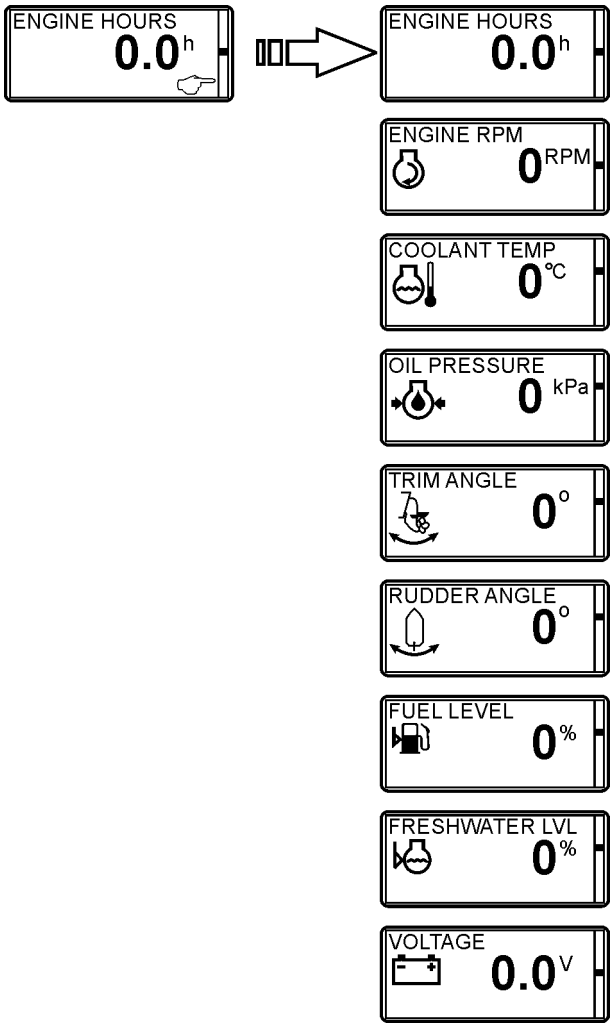
Gauges Menu

In GAUGES MENU the user gets information from analog senders placed on the engine. If the data is not available, the parameter will not be displayed.

When in GAUGES MENU, select view by turning NAVIGATION WHEEL. To select view as favorite, push NAVIGATION WHEEL. System returns to MAIN MENU.

Push BACK BUTTON to return to MAIN MENU without setting a new favorite.

Gauges Menu Structure



50844

ENGINE HOURS: (h)

ENGINE RPM: (RPM)

COOLANT TEMP: (°C, °F)

OIL PRESSURE: (kPa, PSI)

TRIM ANGLE: (°)

RUDDER ANGLE: (°)

FUEL LEVEL: (%)

FRESH WATER LEVEL: (%)

VOLTAGE: (V)

Settings Menu

In the SETTINGS MENU the user is allowed to set various options for the EVC system and to calibrate various parameters.

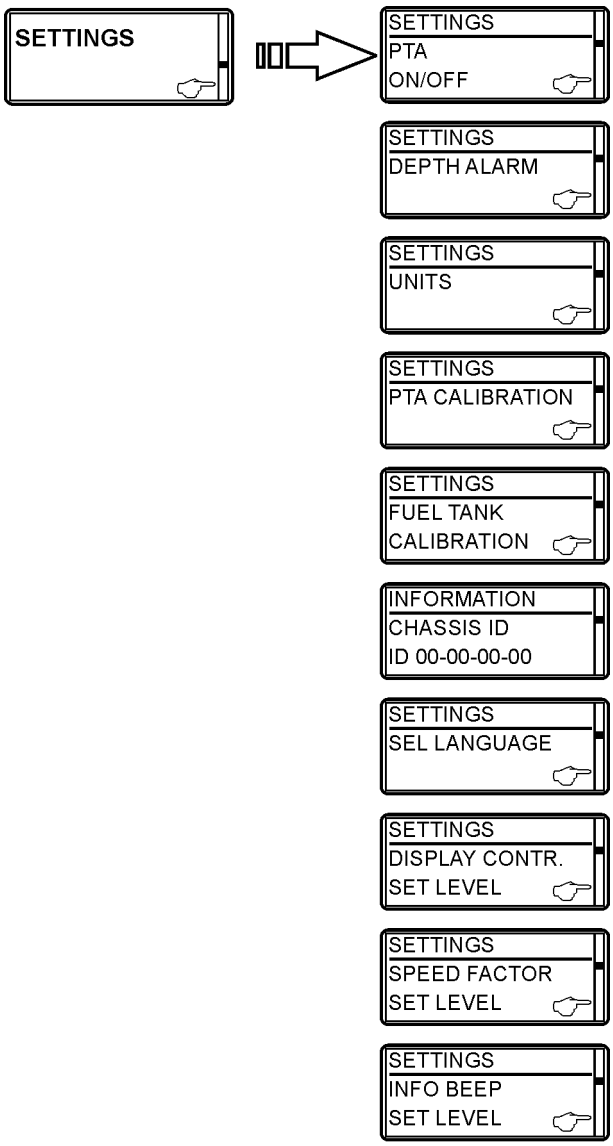
For all settings and calibration procedures: Activate helm station by pushing the ACTIVATION BUTTON.

For twin installations always perform the settings on the port side system. Port side is the master side.

When in SETTINGS MENU, select view by turning NAVIGATION WHEEL. Views with a POINTING HAND symbol indicate SUB-MENU items. To enter a SUB-MENU, push NAVIGATION WHEEL.

Push BACK BUTTON to return to MAIN MENU.

Settings Menu Structure



50845

PTA (Optional): Power Trim Assistant (On/Off)

DEPTH ALARM: Settings for depth alarm functions.

UNITS: Choose which units to display. Set US or metric and units for distance, nm, km, miles.

PTA CALIBRATION (Optional): Calibration of the Power Trim Assistant.

FUEL TANK CALIBRATION: Calibration of the fuel tank.

CHASSIS ID: Not active for gasoline engines.

SEL LANGUAGE: Select language (10 different).

DISPLAY CONTRAST: Adjust the contrast of the display.

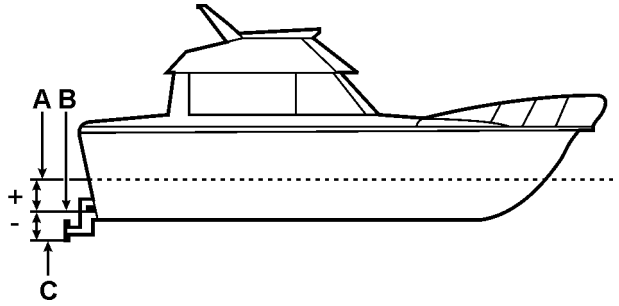
SPEED FACTOR: Set the calibration factor for the boat's paddle wheel speed sensor.

INFO BEEP: Set info beep sound level for the built-in buzzer in EVC tachometer.

Depth Alarm (Optional)

All depth alarm functions are accessed through this menu. A multisensor needs to be installed.

A. Waterline
B. Depth Sounder
C. Lowest Point



50846

DEPTH ALARM, ON/OFF

Depth alarm can be switched ON/OFF.

SET DEPTH

Adjust the depth alarm value by turning the NAVIGATION WHEEL. The value can be adjusted at a resolution of 0.1 m or 1 ft.

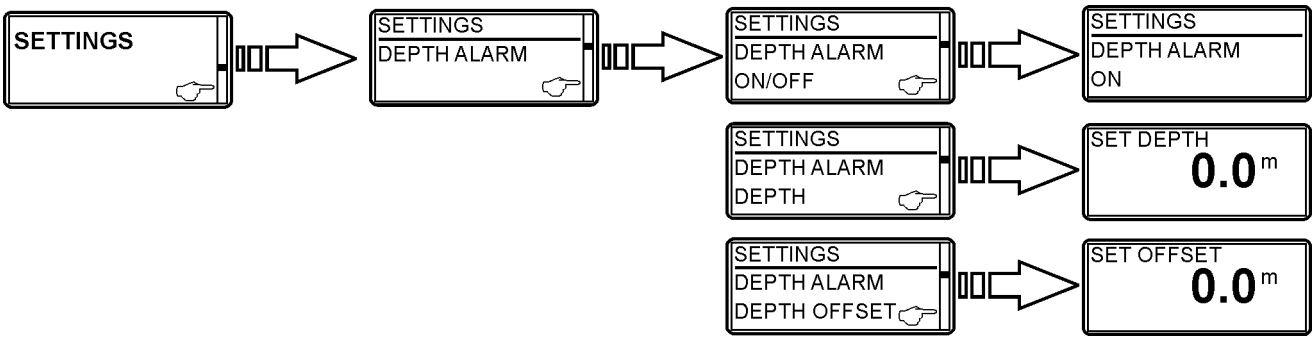
Once adjustment value is reached, the data is stored by pushing NAVIGATION WHEEL.

DEPTH OFFSET

The depth sounder can be placed somewhere on the hull that gives another depth than the desired depth. You can then add or subtract a distance so that the display shows the depth from, for example, the lowest depth sounder point on the boat, or from the surface.

Adjust the depth offset value by turning the NAVIGATION WHEEL. The value can be adjusted at a resolution of 0.1 m or 1 ft.

Once adjustment value is reached, the data is stored by pushing NAVIGATION WHEEL.



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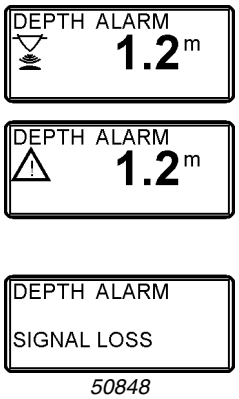


50848

Depth Alarm Popup

The depth alarm popup will appear when the depth is less than the depth alarm setpoint. The popup shows the actual depth.

Acknowledge depth alarm by pushing NAVIGATION WHEEL.

The depth alarm popup will reappear every 30 seconds until the depth increases and exceeds the depth alarm setpoint.

Depth Alarm Signal Loss

If the depth alarm is enabled and the depth signal is lost, for instance in the case of sensor malfunction, the depth alarm signal loss popup will appear.

Select Units and Language

Choose which units and languages to display.

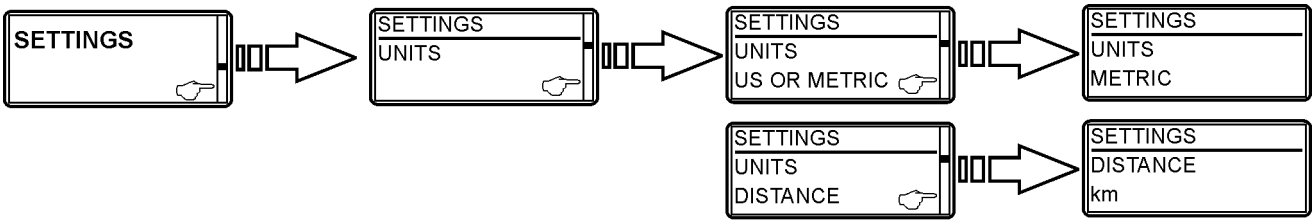
Language and unit settings must be performed in all EVC system tachometers.

US or METRIC

1. Activate helm station by pushing the ACTIVATION BUTTON.
2. Select UNITS and push NAVIGATION WHEEL.
3. Select US OR METRIC and push NAVIGATION WHEEL.
4. Set US or METRIC units by turning NAVIGATION WHEEL and confirm by pushing NAVIGATION WHEEL.

DISTANCE

1. Activate helm station by pushing the ACTIVATION BUTTON.
2. Select UNITS and push NAVIGATION WHEEL.
3. Select DISTANCE and push NAVIGATION WHEEL.
4. Set distance unit: km, nm or miles and confirm by pushing NAVIGATION WHEEL.



50849

LANGUAGE

1. Activate helm station by pushing the ACTIVATION BUTTON.
2. Select SETTINGS from MAIN MENU by turning NAVIGATION WHEEL. Push NAVIGATION WHEEL to enter SETTINGS MENU.
3. Select SEL LANGUAGE and push NAVIGATION WHEEL.
4. Select language and confirm by pushing NAVIGATION WHEEL.

50850

Power Trim Assistant, PTA (Optional)

The Power Trim Assistant adjusts trim angle automatically according to engine speed (rpm). It is possible to set five trim angles at five different engine speeds, including idle speed.

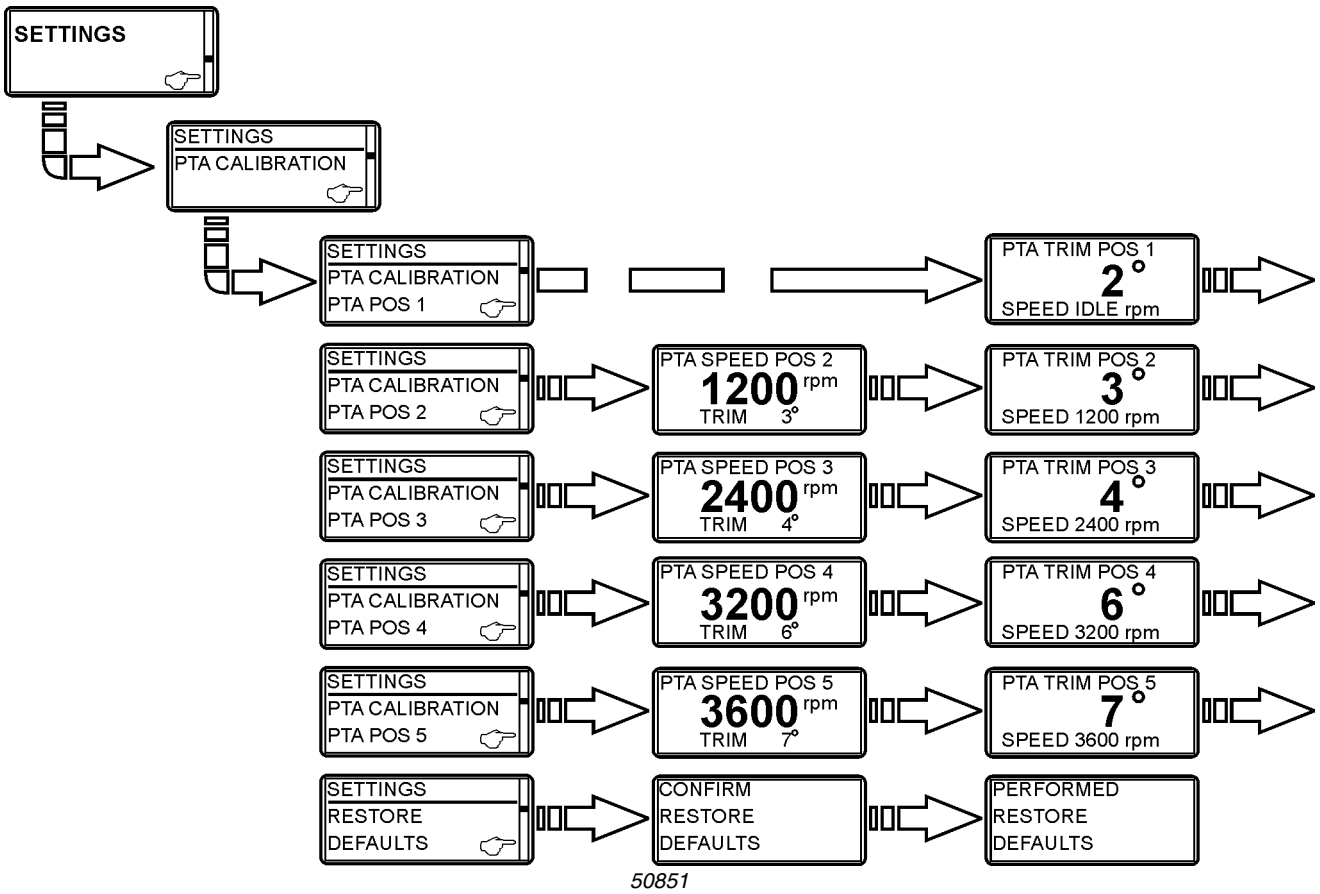
PTA CALIBRATION

NOTICE! For twin installations always perform the PTA CALIBRATION on the port side system. Port side is the master side.

1. Activate helm station by pushing the ACTIVATION BUTTON.
2. Select SETTINGS from MAIN MENU by turning NAVIGATION WHEEL. Push NAVIGATION WHEEL to enter SETTINGS MENU.
3. Select PTA CALIBRATION and push NAVIGATION WHEEL.
4. Select PTA CALIBRATION POSITION (1-5) by turning NAVIGATION WHEEL. Push NAVIGATION WHEEL to enter selected PTA CALIBRATION POSITION.
5. Set RPM for PTA CALIBRATION POSITION by turning NAVIGATION WHEEL and confirm by pushing NAVIGATION WHEEL.

   RPM can not be set for PTA CALIBRATION POSITION 1, idling speed.
6. Set TRIM ANGLE for selected PTA CALIBRATION POSITION by turning NAVIGATION WHEEL and confirm by pushing NAVIGATION WHEEL.

Use the same procedure for all PTA CALIBRATION POSITIONs (2-5). Push BACK BUTTON to return to SETTINGS MENU.



50851

Fuel Tank Calibration

There are two possible calibration methods for the fuel tank, FUEL FULL TANK CALIBRATION (approximate) and FUEL MULTIPOINT CALIBRATION (more precise). A fuel level sender needs to be installed for either method.

If FUEL TANK CALIBRATION is not shown in SETTINGS MENU, please contact your Volvo Penta dealer.

FUEL MULTIPOINT CALIBRATION

When FUEL MULTIPOINT CALIBRATION is selected, the fuel level sender is calibrated in five equally divided steps: 20% full (pos 1), 40% full (pos 2), 60% full (pos 3), 80% full (pos 4), and 100% full (pos 5).

To perform multipoint calibration, fuel tank must be LESS than 20% full. If calibration skips POS 1 and goes directly to POS 2, the fuel tank contains too much fuel and the calibration will not be correct.

The fuel multipoint calibration procedure differs depending on EVC software release.

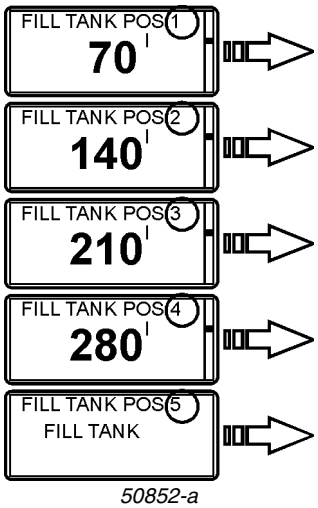
1. Activate helm station by pushing the ACTIVATION BUTTON.
2. Select SETTINGS from MAIN MENU by turning NAVIGATION WHEEL. Push NAVIGATION WHEEL to enter SETTINGS MENU.
3. Select FUEL TANK CALIBRATION and push NAVIGATION WHEEL.
4. Select FUEL MULTIPOINT CALIBRATION by turning NAVIGATION WHEEL. Push NAVIGATION WHEEL to enter FUEL MULTIPOINT CALIBRATION.

50852

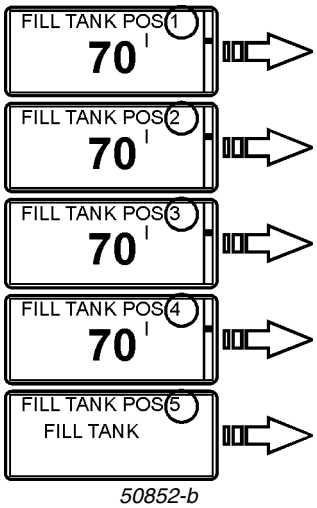
5. Depending on EVC software release, use one of the following methods to calibrate fuel tank:

If the number after “POS” in the display is flashing, fill fuel tank with displayed volume (POS 1) and push NAVIGATION WHEEL. Add fuel (do not reset the pump) up to displayed volume for each POS until the tank is filled.

If the number after “POS” is not flashing, fill fuel tank with displayed volume (POS 1) and push NAVIGATION WHEEL. Repeat procedure for each POS until the tank is filled.



50852-a



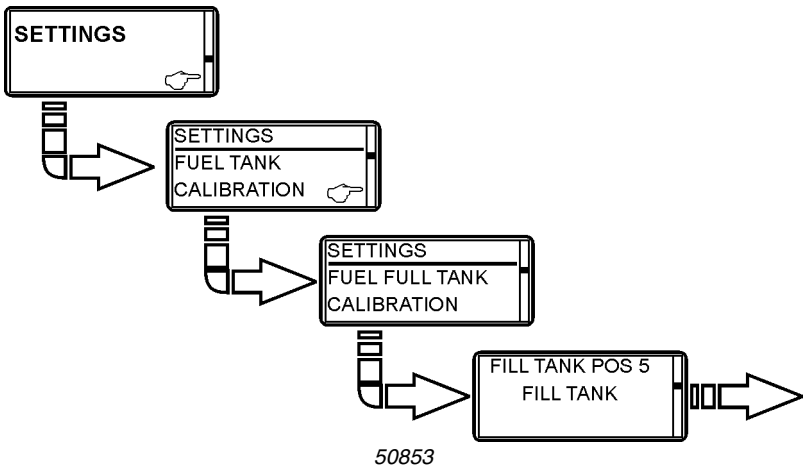
50852-b

6. Push BACK BUTTON to return to SETTINGS MENU.

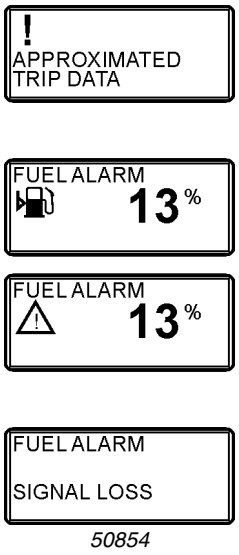
FUEL FULL TANK CALIBRATION

When FUEL FULL TANK CALIBRATION is selected, the fuel level sender is calibrated in one step. This only gives an approximated value of the fuel level. Therefore all trip data, concerning and based on, remaining fuel volume should be recognized as approximated values only.

1. Activate helm station by pushing the ACTIVATION BUTTON.
2. Select FUEL TANK CALIBRATION and push NAVIGATION WHEEL.
3. Select FUEL TANK CALIBRATION by turning NAVIGATION WHEEL. Push NAVIGATION WHEEL to enter FULL TANK CALIBRATION.
4. Fill fuel tank and push NAVIGATION WHEEL. Push BACK BUTTON to return to SETTINGS MENU.



50853



50854

Approximated Trip Data

This popup will be shown every time after startup if FUEL FULL TANK CALIBRATION is performed.

Fuel Alarm Popup

The fuel level alarm popup will appear when the fuel level is lower than fuel alarm setpoint. The popup shows the percentage of fuel remaining.

Acknowledge fuel alarm by pushing NAVIGATION WHEEL.

Fuel level alarm popup will reappear every 10 minutes until the fuel level in tank is higher than fuel alarm setpoint.

Fuel Level Signal Loss

If the fuel level has been set and the fuel level signal is lost, for instance in the case of sensor malfunction, the fuel level alarm signal loss popup will appear.

Speed Factor

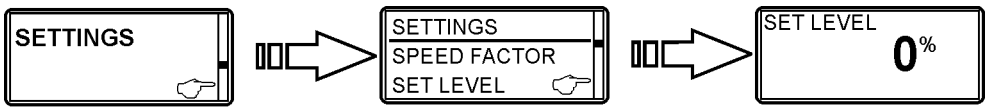
The speed factor for the boat's paddle wheel speed sensor can be adjusted at a resolution of 1% and is used by the EVC to apply a correction to the output from the speed sensor.

Set Speed Factor

Set speed factor while driving the boat. Compare displayed speed with speed data from GPS (or other boat) and adjust the speed factor until they correspond.

Adjust the speed factor by turning the NAVIGATION WHEEL.

Once adjustment value is reached, the data is stored by pushing NAVIGATION WHEEL.

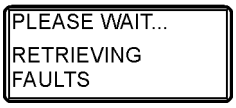


50855

Information Message

Approximated Trip Data

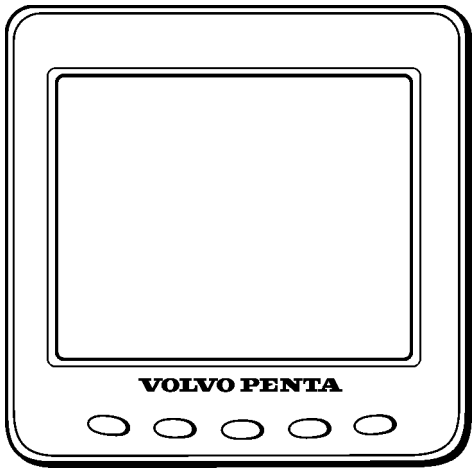
This popup will be shown every time after startup if FUEL FULL TANK CALIBRATION is performed.



50856

Retrieving Faults

The EVC system is retrieving faults from its nodes.



50857

EVC System Display (Optional)

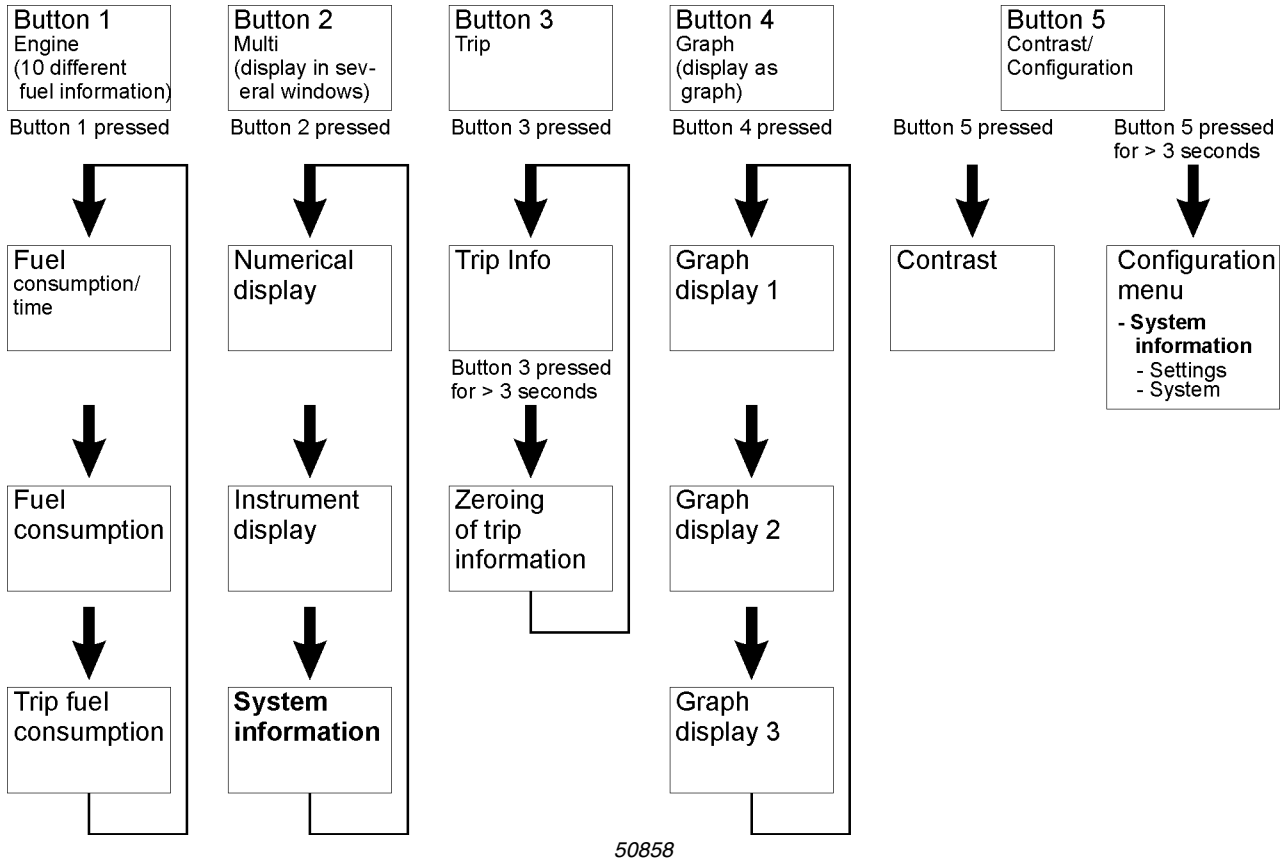
The Volvo Penta EVC system display is an instrument which displays operating information about the engine and allows you to communicate with the engine's electrical system.

Operation information is shown on an LCD display. The driver can select the display mode with the aid of the five buttons on the front of the instrument.

The four buttons on the left left are used to display operating information in different ways. The rightmost button is used to adjust the display contrast and to access the configuration menu. Various settings can be made in the configuration menu. You can also use the this menu to reach the display mode SYSTEM INFORMATION, which can also be reached via button 2 (please refer to the illustration below). This display mode functions in the same way as the display in the tachometer. For additional information, see *EVC System Tachometer* on page A-7.

Before the display is used, it may be necessary to modify the way that the display shows operating information, to comply with user requirements. For additional information, see *Configuration Menu (Button 5)* on page A-19.

Structure of the Display Functions



50858

50859

Start Image

This is the starting image that is shown on the display for a brief period after starting.

If the unit gives a constant audible warning after starting, the self-test has failed. The unit will still work, but may behave in an unexpected manner.

Symbols for Operating Information


Engine speed


Coolant temperature


Engine temperature


Oil pressure (current)


Coolant temperature


Speed


Fuel consumption/time

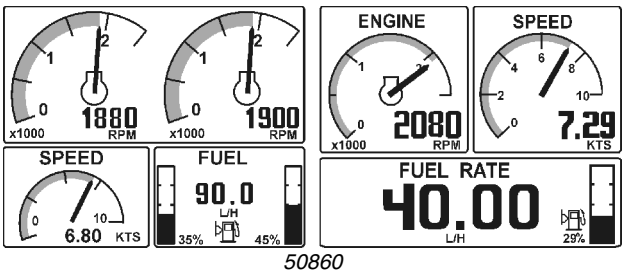

Intake Manifold Air Temperature


Voltage

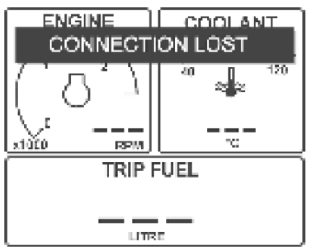

Fuel level

Figure for single engine installation:

Figure for twin engine installation:



50860



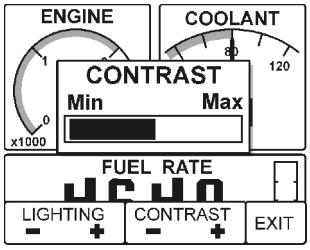
50861

Display After Starting Screen

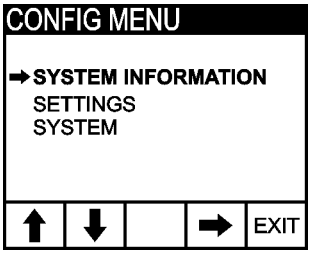
Display mode ENGINE (button 1) is always shown after the starting screen when the display is first started up (more information about this display mode can be found below in the instructions). Once the display has been used, it will always show the last display mode viewed before it was last switched off.

Connection Fault

If the display does not register transfer of operating information from the electrical system, the popup window will flash CONNECTION LOST. When operating information has been registered/reset, the popup window disappears.



50862



50863

Set Display Contrast

Press button 5 (rightmost) to set display contrast. Press the appropriate buttons to alter the levels, then save the settings by pressing EXIT. The display unit has 5 contrast settings.

Configuration Menu (Button 5)

Must be pressed for longer than 3 seconds.

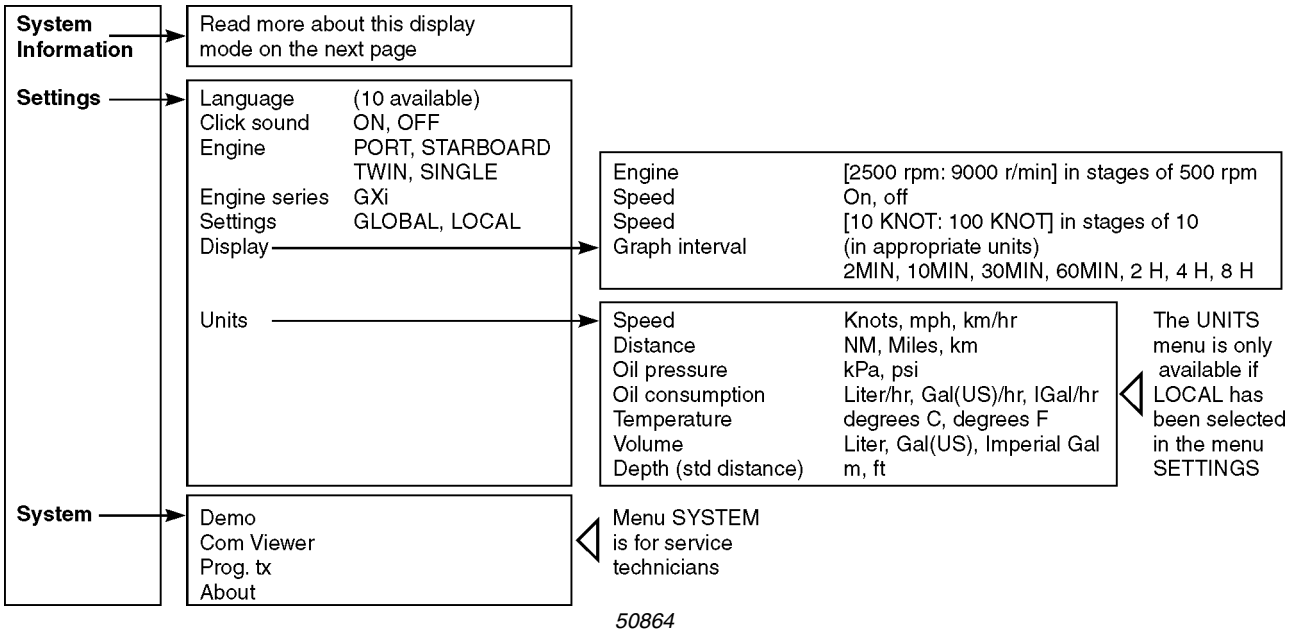
The configuration menu is used to:

- Access the display mode SYSTEM INFORMATION.
- Change various display settings.
- Reach information and functions for servicing the display.

Please refer to the configuration menu structure below and read the following section, which explains each item in the menu.

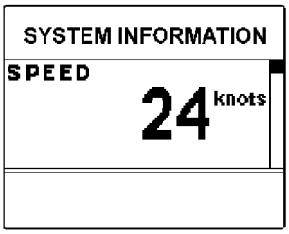
The port engine or both engines must have the ignition switched on when display settings are changed.

Configuration Menu Structure



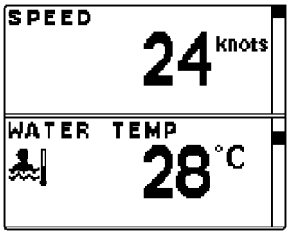
50864

SYSTEM INFORMATION display mode for single engine installations:



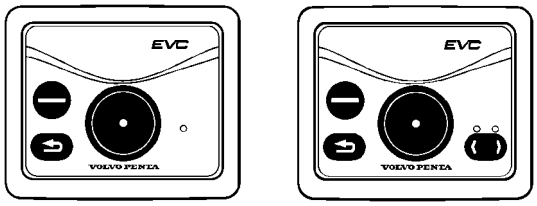
50865

SYSTEM INFORMATION display mode for twin engine installations:



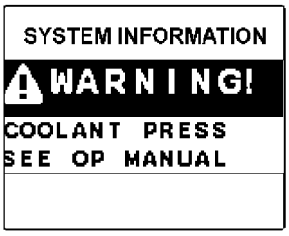
50866

Control Panel

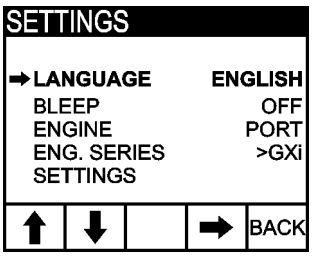


50867

Alarm Example



50868



50869

Display Mode System Information

SYSTEM INFORMATION is a display mode that functions in the same way as the display in the tachometer (EVC System Tachometer). You navigate around these functions using the buttons on the free-standing control panel.

In display mode SYSTEM INFORMATION there are several functions:

- Display of operating information, information messages and alarms (**NOTE!** The display is adapted to suit the size of the panel in the tachometer).
- Settings for displaying operating information in this display mode.
- All calibrations.

Detailed instructions for the functions in display mode SYSTEM INFORMATION are found in *EVC System Tachometer* on page A-7.

Information Message and Alarm

The display automatically switches to display mode SYSTEM INFORMATION when the electrical system needs to show information messages or alarms. Instructions about how information messages and alarms should be handled are found in *Troubleshooting* on page A-27.

Settings

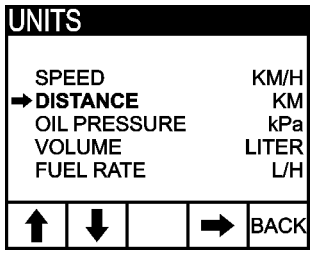
Menu SETTINGS is used to change various display settings.

LANGUAGE: This is where you select the language that the display should use (10 different languages are available).

BLEEP: This is where you select whether a beep should be heard when any button is pressed. Set to ON or OFF.

ENGINE: This is where you select the engine for which operating data will be displayed: SINGLE, PORT, STARBOARD, or TWIN.

ENGINE SERIES: This is where you select the engine model for which the display has been installed.



50870

DISPLAY: This is where you set the measurement intervals of the speedometers and tachometers. Rpm engine: [2500 rpm to 9000 rpm] in stages of 500 rpm.

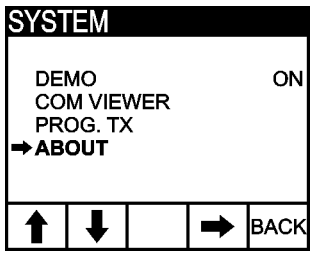
- Speed: Change speed display (ON/OFF)
- Speed: [10 KNOT to 100 KNOT] in stages of 10 (in the appropriate speed intervals)
- Graph Interval: 2 MIN,10 MIN, 30 MIN, 60 MIN, 2 H, 4 H, 8 H

UNITS: This menu is only displayed if LOCAL has been selected in menu SETTINGS. This is where you select the measurement units to be used to display operating information. GLOBAL is pre-set, which means that the units of measurement are pre-set, but they can be changed if LOCAL is selected in menu UNITS.

- Speed: KNOT, MPH, KM/H
- The distance is adjusted to suit the speed unit: NM, MILE, KM
- Oil pressure: kPa, PSI
- Volume: LITER, GAL, Imperial GAL
- Fuel consumption/time: Adjusted to suit the volume unit (L/H, GAL/H, IGAL/H)
- Temperature: °C (CELSIUS), °F (Fahrenheit)

System

Menu SYSTEM is intended to provide the necessary functions and information for service technicians.



50871

DEMO: Switches between demo mode ON/OFF. The unit is in normal operation mode when Demo is OFF.

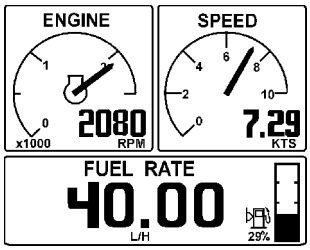
COM VIEWER: Shows the latest messages received on the communication inputs.

PROG TX: Transfers the contents of the application program in the flash memory to other CANtrak units on the same CANbus link.

ABOUT: Shows the following information:

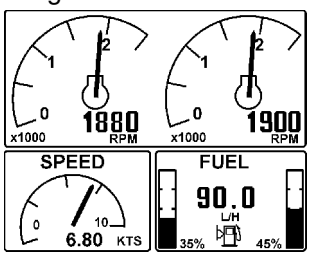
- ID No: Display serial number
- Eeprom: No. of writes to the EEPROM
- Vers: Software version number
- Chk: Flash memory checksum
- Part no: Volvo's part number for the software
- Source: Shows the source of the received data
- Label: Label allocated on the bus. Each unit on the same bus must have its own unique label

Figure for single engine installation:



50872

Figure for twin engine installation:



50873

Display Mode Engine (Button 1)

This display mode shows the engine speed and boat speed in the form of standard instruments, together with a trip computer and fuel level gauge. The fuel level gauge and fuel rate are only displayed if there is a tank sender. The trip computer shows various types of information if you repeatedly press the button ENGINE (button 1). Please refer to the trip computer menu below.

Trip information is only displayed if following are installed:

- Multisensor or NMEA 0183/NMEA 2000 compatible component (plotter, GPS, paddle wheel, etc.).
- Fuel level sender.
- Software for trip computer (order and download from VODIA website).

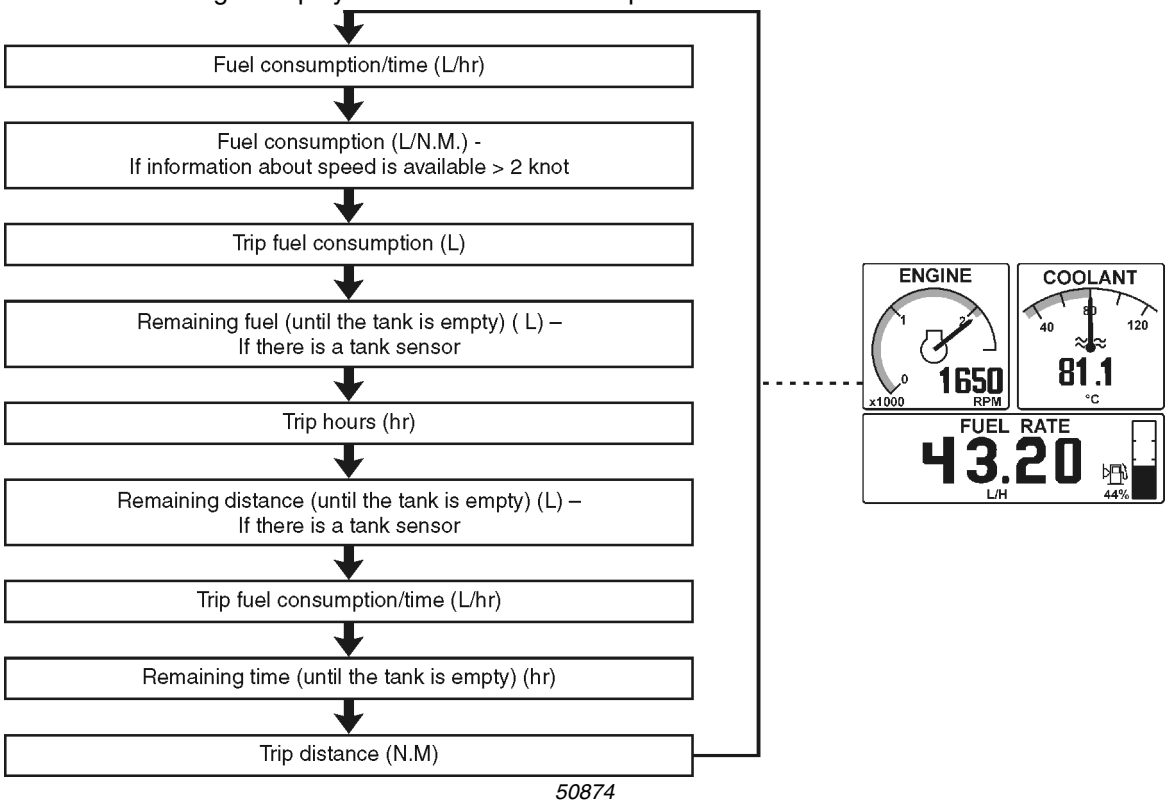
Only metric values are displayed, but other units can be displayed if they have been chosen in the configuration menu.

The scale values for maximum engine speed and maximum speed can be set in the configuration menu.

If information about boat speed is not available, the display shows coolant temperature instead.

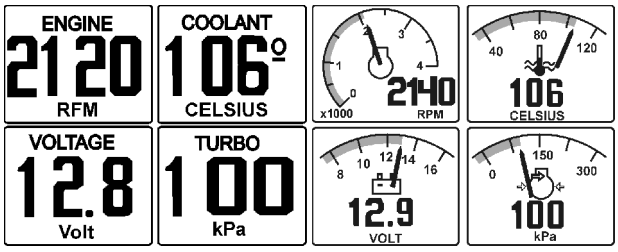
Menu, Trip Computer

Button 1
Changes display each time the button is pressed



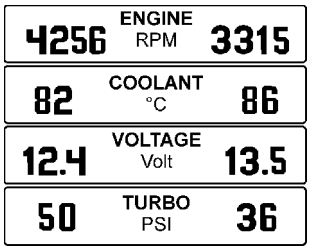
50874

Example of display in several windows for single engine installation:

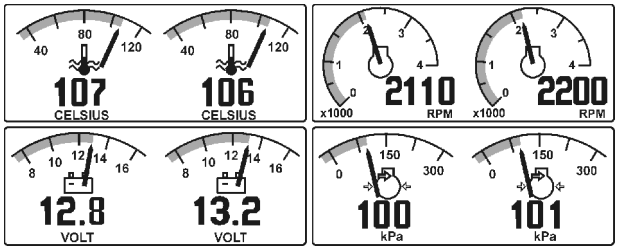


50875

Example of display in several windows for twin engine installation:



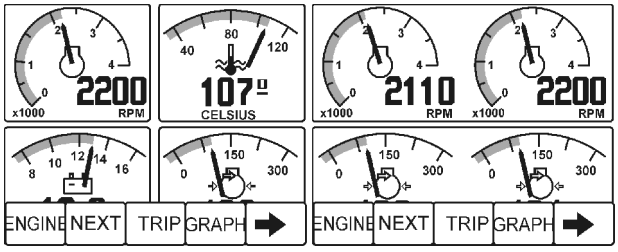
50876



50877

Figure for single engine installation:

Figure for twin engine installation:

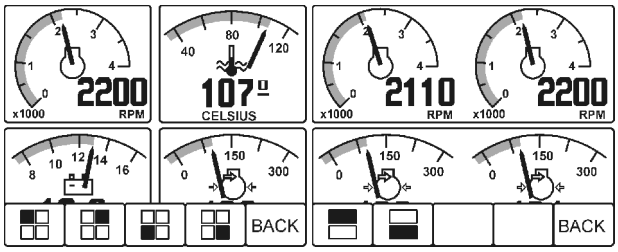


50878

Press button 5 to choose setting mode

Figure for single engine installation:

Figure for twin engine installation:



50879

Buttons 1 to 4 are used to adjust the corresponding window (please refer to the black markings)

Display Mode Multi (Button 2)

This display mode shows operating information in four different windows (see below). The user can choose the operating information to be displayed in each window.

The information can be displayed as figures or as standard instruments. Display indication shifts between the two modes when you press button 2 repeatedly.

If an item of operating information is not available, the unit displays "–" and the analog gauge needle is not shown.

From this display mode MULTI, you can also reach display mode that functions in the same way as the smaller display in the tachometer. Read more about this display mode SYSTEM INFORMATION in the configuration menu section.

Set the Appearance of the Display Mode Multi

Display mode MULTI has a mode to set the operating information to be displayed in each window.

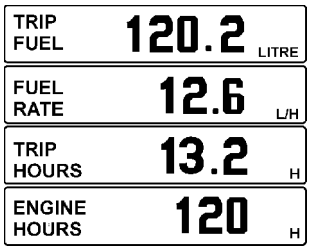
The setting mode is reached by pressing button 5 (rightmost), when you are in the display mode MULTI. Please refer to the illustrations below.

The type of operating information available depends on the electrical system in the boat and the sensors with which the boat is equipped. Optional sensors include depth gauge, water temperature, speed, trim angle, and rudder angle.

This applies to the graphic display:

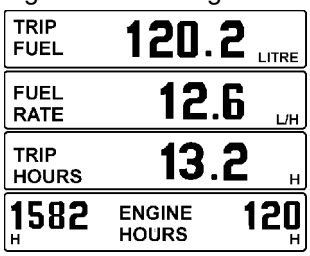
- The maximum engine speed range can be set on the configuration menu.
- The voltage interval can be [8V: 16V] or [16V: 32V] and is changed automatically, depending on the latest data value.

Figure for single engine installation:



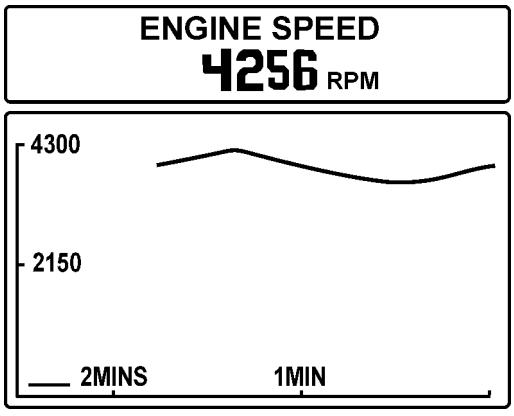
50880

Figure for twin engine installation:



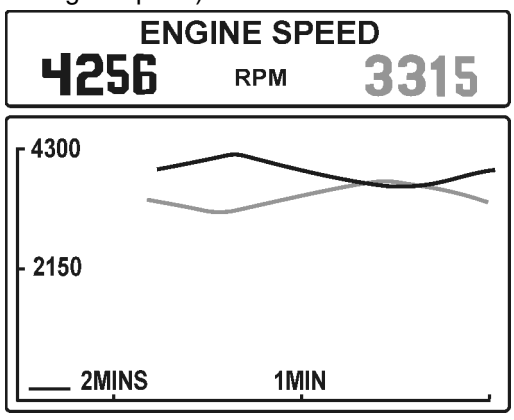
50881

Window with curve for single engine installation (shows engine speed)



50882

Window with curve for twin engine installation (shows engine speed)



50883

Display Mode Trip (Button 3)

This display mode shows:

- Fuel used after last zeroing.
- Instantaneous fuel consumption (amount of fuel used per hour). If speed information is available, instantaneous fuel consumption can also be calculated in relation to distance.
- Operation time after last zeroing.
- Total operating time (can not be zeroed).

If you want to zero the trip values (trip fuel consumption and trip operating time), keep button 3 depressed for 1 second. The unit beeps and the values are zeroed.

When the display is set for a twin engine installation, the information displayed for each engine will be the sum of the values from both engines, apart from operating time. Operation times for twin engines are shown separately.

The size of the operating hours figures shown on the display is reduced if the number does not fit in the window.

Display Mode Graph (Button 4)

In this display mode, operating information is displayed in the form of a histograph. Press button 4 repeatedly to show different operating information.

If an item of operating information is not available, that window cannot be chosen.

If contact with the relevant information is lost during display, the curve will no longer be drawn, but the line will continue to scroll across the window.

Data for the port engine or single engine information is drawn with a black line.

Data for the starboard engine information is drawn with a gray line.

The maximum time interval can be set to one of the following values in the configuration menu: 2 min, 10 min, 30 min, 1 h, 2 h, 4 h, 8 h. The interval on the Y axis is automatically adjusted for best indication.

Reading the Instruments

Read all instruments and alarm displays directly after starting, and then regularly during your voyage. All the readings on the analog instruments are also available in the Menu system on the LCD display.

50830

Check the LEDs

Each time the ignition is turned on, all LEDs on the main control panel are illuminated. Check that all LEDs function.

If the boat has more than one control panel, the LEDs on the other panel(s) are not checked until the control panel(s) is(are) activated.

Check the Tachometer Display

If a fault is registered, it will be shown in the tachometer display.

Alarm

If a fault occurs, the audible warning will sound, the relevant warning lamp on the optional alarm display will start to flash, and the tachometer display will show an alarm pop-up.

1. Reduce engine speed to idle.
2. Acknowledge the alarm by pressing the navigation wheel on the control panel once.

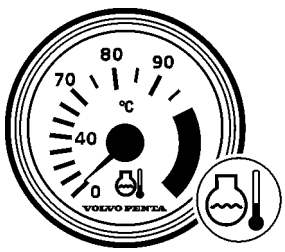
When the fault has been acknowledged, the relevant lamp remains lit and the audible warning becomes silent.

Please refer to *Troubleshooting* on page A-27 for detailed information about recommended actions when responding to faults.

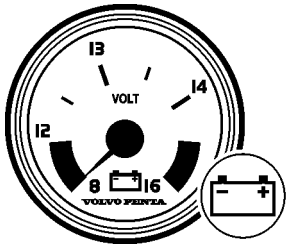
The fault will also be stored in the form of a fault code for as long as the malfunction persists. It is possible to read the fault code during a subsequent service.

Coolant Temperature (Optional)

The temperature gauge should normally indicate between 75–100°C (167–212°F) in normal operation. If the coolant temperature is too high, the audible warning will sound automatically while the warning lamp flashes.



50894



50895

Charging (Optional)

During operation, system voltage should be about 14V. During warming of the engine the voltage is slightly higher.

If there is a charge failure the warning lamp will flash.

Trim Instrument

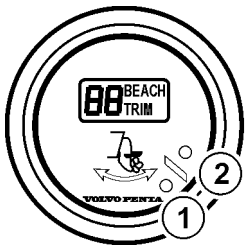
If a tachometer with LCD display is installed the trim angle will also be available in the Gauges menu.

Digital Trim Instrument

The display window will show TRIM while the drive angle[1] is in valid Trim range.

The display window will show BEACH while the drive angle[1] is in valid Beach range. LED **1** lights amber.

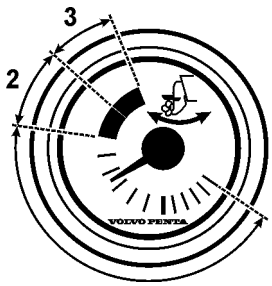
While the drive angle[1] is over +30° (tilt range), the LED **2** will light red. No text in display window.



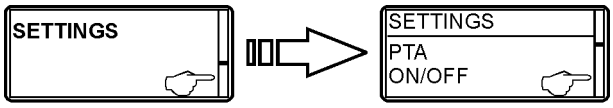
50896

Analog Trim Instrument

This instrument shows the current position of the drive. Beach range is marked with an amber zone and lift range with a red zone.



1. Trim range
2. Beach range (amber)
3. Lift range (red)



50898

Power Trim Assistant (Optional)

The Power Trim Assistant adjusts trim angle automatically according to engine speed (rpm). It is possible to set five trim angles at five different engine speeds (Idle speed included). For additional information, see *EVC System Tachometer* on page A-7.

The Power Trim Assistant is turned on and off in the EVC system tachometer menu SETTINGS, sub-menu PTA.

1. The number corresponds to the drive angle in relation to the horizontal (stationary boat). The lowest value shows that the drive is at max trim in and the highest value that the drive is raised to max. Observe that the lowest value can vary from boat to boat depending on the angle of the transom.

Malfunction Message: Engine and EVC-System

If the diagnostic function discovers a malfunction, the boat operator is warned by popups in the tachometer display and the warning alarm sounding.

Popups will alternate between "cause of fault" and "measures to take."

To acknowledge the alarm, press the NAVIGATION WHEEL. When the fault has been acknowledged, the alarm will become silent. Press the NAVIGATION WHEEL again. The popup will disappear and normal display window will be shown.

NOTICE! To enable engine start, the alarm must be acknowledged.

50899

Danger Popup

If the Danger popup is shown during operation, a serious fault has occurred.

NOTICE! Acknowledge the alarm and stop the engine at once, if it is safe to do so.

For additional information, please see *Fault Register* on page A-29.

50900

Warning Popup

If the Warning popup is shown during operation, a fault has occurred.

NOTICE! Acknowledge the alarm and stop the engine at once, if it is safe to do so.

For additional information, please see *Fault Register* on page A-29.

50901

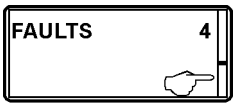
Caution Popup

If the Caution popup is shown during operation, a fault has occurred.

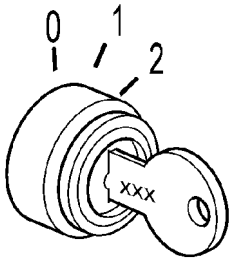
Acknowledge the alarm.

For additional information, please see *Fault Register* on page A-29.

Faults are stored and malfunctions have been registered:



50902



50822

Faults List

A faults list can be viewed from the MAIN MENU, if a fault is registered.

When in MAIN MENU, select FAULTS by pushing NAVIGATION WHEEL. The number after FAULTS indicates number of faults stored in list. Show faults in the list by turning NAVIGATION WHEEL.

Shown fault popups will alternate between "cause of fault" and "measures to take."

For additional information, please see *Fault Register* on page A-29.

Erasing Faults in Faults List

Any fault popups in the diagnostic function are automatically erased every time the starter key is turned to the stop position **0**.

Stop the engine and check that the ignition key(s) is(are) in position 0 **at all helm control stations.**

When system voltage is switched on again, the diagnostic function checks to see whether there are any faults in the EVC system. If this is the case, new fault popups are shown.

This means that:

- Faults which have been attended to or have disappeared are automatically erased.
- Faults which have not been attended to must be acknowledged every time the system voltage is switched on.

Fault Register

WARNING! Read the safety precautions for maintenance and service in the section entitled *Safety information* in your engine Operator's Manual before starting work.

The following table is a description of possible faults, the warning lamp and color associated with the fault that will be activated, an indication of whether the audible alarm will sound, and the associated popup that will appear on the EVC tachometer display.

If you are unsure how to proceed any time an action is required, please refer to the appropriate section in your engine Operator's Manual.

Fault Description	Lamp	Color	Alarm	EVC Tach Display
Engine Speed: Fault in engine speed sensor. **EVC Action:** Engine power is reduced. **Operator Action:** Please contact a Volvo Penta workshop.	 *50831*	Red	 *50903*	 *50904*
Air Temperature: Manifold air temperature too high. **EVC Action:** Engine power is reduced. **Operator Action:** Please contact a Volvo Penta workshop.	 *50831*	Red	 *50903*	 *50905*
Coolant Temperature: Coolant temperature too high. **EVC Action:** Engine power is reduced. **Operator Action:** • Check coolant level. • Check that the seawater intake is clear. • Check the impeller in the seawater pump. • Check that no leakage occurs. • If the cooling water flow ceases, the exhaust hose should be inspected internally and replaced if the hose shows signs of damage. • Please contact a Volvo Penta workshop if the fault persists.	 *50835*	Red	 *50903*	 *50906*
Engine Oil Pressure: Oil pressure too low. **EVC Action:** Engine power is reduced. **Operator Action:** • Check the oil level in the engine. • Check that the oil filters are not blocked. • Check that no leakage occurs. • Please contact a Volvo Penta workshop if the fault persists.	 *50831*  *50832*	Red	 *50903*	 *50907*
Exhaust Temperature: Exhaust temperature too high. **EVC Action:** Engine power is reduced. **Operator Action:** Please contact a Volvo Penta workshop.	 *50831*	Red	 *50903*	 *50908*

Fault Description (Continued)	Lamp	Color	Alarm	EVC Tach Display
Battery Voltage: Battery voltage too low. **EVC Action:** None **Operator Action:** • Check battery fluid level. • Check belt tension. • Please contact a Volvo Penta workshop if the fault persists.	 50831  50834	Amber	–	 50909
Primary Battery: Poor battery or charging. **EVC Action:** None **Operator Action:** • Check battery fluid level. • Check belt tension. • Please contact a Volvo Penta workshop if the fault persists.	 50831  50834	Red	 50903	 50910
Secondary Battery: Poor battery or charging. **EVC Action:** None **Operator Action:** • Check battery fluid level. • Check belt tension. • Please contact a Volvo Penta workshop if the fault persists.	 50831  50834	Red	 50903	 50911
Power Trim: Fault in power trim system. **EVC Action:** Cannot change trim position. **Operator Action:** • Emergency Trimming. • Please contact a Volvo Penta workshop if the fault persists.	 50831	Red Amber	 50903	 50912  50913
Check EVC System: Internal fault in the EVC system. **EVC Action:** Engine power is reduced. **Operator Action:** • Restart engine(s). • If the engine cannot be operated from the chosen control panel, use an alternative control panel. • Please contact a Volvo Penta workshop if the fault persists.	 50831	Red Amber	 50903	 50914  50915
System Failure: Miscellaneous fault. **EVC Action:** None **Operator Action:** • Restart engine(s). • Please contact a Volvo Penta workshop if the fault persists.	 50831	Red	 50903	 50916

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Notes

DAN

Send kuponen med post eller fax til:

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http://www.volvopenta.com/manual/coupon

Ja tak,

jeg vil gerne gratis have en Instruktionsbog på dansk.

Publikationsnummer: 7744934

Navn

Adresse

Land

Bemærk at tilbudet gælder i 12 måneder fra bådens leveringsdato, Derefter kun så længe lager haves.

42200/615001/155099900192

VOLVO PENTA

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Ja,

ich will kostenlos eine Betriebsanleitung in deutscher Sprache erhalten.

Drucksachennummer: 7744938

Name

Anschrift

Land

Bitte beachten Sie, dass dieses Angebot für die Dauer von 12 Monaten ab dem Lieferdatum des Bootes gilt, danach bis zum Aufbrauchen des Lagerbestandes.

42200/615001/155099900192

VOLVO PENTA

ESP

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Sí gracias,

deseo recibir gratuitamente un libro de instrucciones en español.

Número de publicación: 7744942

Nombre

Dirección

País

Nótese que el ofrecimiento vale durante 12 meses después de la fecha de entrega de la embarcación, y posteriormente solamente mientras duren las existencias.

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Ταχυδρομήστε αυτό το κουπόνι στην παρακάτω διεύθυνση ή στείλτε το με φαξ στον παρακάτω αριθμό φαξ:

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Μπορείτε επίσης να δώσετε την παραγγελία σας μέσω του Internet, στη διεύθυνση:

http://www.volvopenta.com/manual/coupon

Ναι,

Θα ήθελα ένα αντίτυπο του εγχειριδίου χρήσης στην αγγλική γλώσσα χωρίς καμιά χρέωση.

Αριθμός έκδοσης: 7744939

Όνομα

Διεύθυνση

Χώρα

ΠΡΟΣΟΧΗ: Αυτή η προσφορά ισχύει για χρονική περίοδο 12 μηνών από την παράδοση του σκάφους. Μετά το πέρας της εν λόγω χρονικής περιόδου η διαθεσιμότητα των αντιτύπων θα εξαρτάται από την ποσότητα των αποθεμάτων.

42200/615001/15509990192

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Oui merci,

Je souhaite recevoir un manuel d'instructions gratuit en français.

Numéro de publication:7744937

Nom

Adresse

Pays

Notez que l'offre est valable pendant 12 mois à partir de la date de livraison du bateau, ensuite seulement en fonction des stocks disponibles.

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ITA

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Sì, grazie,

desidero ricevere gratuitamente un manuale d'istruzioni in lingua italiana.

Public. No.: 7744940

Nome e Cognome

Indirizzo

Paese

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NED

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U kunt ook bestellen via internet:

http://www.volvopenta.com/manual/coupon

Ja graag,

Ik wil kosteloos een instructieboek in het Nederlands ontvangen.

Publicatienummer: 7744935

Naam

Adres

Land

Denk eraan dat het aanbod geldt gedurende 12 maanden na de datum waarop de boot werd afgeleverd, daarna alleen indien nog verkrijgbaar.

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POR

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Sim, obrigado(a)!

Gostaria de receber gratuitamente um manual de instruções em português.

Número de publicação: 7744941

Nome

Endereço

País

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Заказы также можно размещать через Интернет :

http://www.volvopenta.com/manual/coupon

Да, пожалуйста,

Я бы хотел иметь бесплатное руководство оператора на русском языке.

Номер издания: 7748128

Имя

Адрес

Страна

К Вашему сведению, это предложение действительно в течение 12 месяцев от даты поставки двигателя; в дальнейшем оно зависит от наличия.

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http://www.volvopenta.com/manual/coupon

Kyllä kiitos,

haluan suomenkielisen ohjekirjan veloituksetta.

Julkaisunumero: 7744936

Nimi

Osoite

Maa

Huomaa, että tarjous on voimassa 12 kuukautta veneen toimituspäivämäärästä lukien ja sen jälkeen vain niin kauan kuin kirjoja riittää.

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Ja tack,

jag vill kostnadsfritt ha en instruktionsbok på svenska.

Publikationsnummer: 7744943

Namn

Adress

Land

Observera att erbjudandet gäller i 12 månader från båtens leveransdatum, därefter endast i mån av tillgång.

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Evet lütfen,

Ücretsiz Türkçe kullanım el kitabı istiyorum.

Yayın numarası: 7748129

İsim

Adres

Ülke

NB! Bu teklif, teknenin teslim edilmesinden itibaren 12 aylık bir süre için geçerlidir. Bu süre sonunda ürün dağıtımı stoklarla sınırlıdır.

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VOLVO PENTA

VPA 7744933 English 12-2008