

OPERATOR'S MANUAL

FOR

BUKH MARINE DIESEL LIFEBOAT ENGINE TYPE D4 & D6



powering **marine** safety

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Foreword

Welcome!

Congratulations on your new boat equipped with a Bukh marine engine. Bukh engines are designed to fulfill Bukh's core values; quality, safety and environmental care. And after more than 100 years as an engine manufacturer, the Bukh brand has also become a symbol of reliability, technical innovation, top-of-the-range performance and long service life. Bukh marine engines are used all over the world, in all possible operating conditions for professional as well as leisure purposes.

Make sure to thoroughly read through this Operator's Manual and take necessary actions regarding running and maintenance before your maiden voyage. It contains the information you need to be able to operate and maintain the engine safely and correctly. Pay careful attention to the safety instructions included in the manual.

As the owner of a Bukh marine engine, you become part of a worldwide network of dealers and service workshops that assist you with technical advice, service requirements and replacement parts. Contact your nearest authorized Bukh dealer for assistance.

Information about your closest Bukh dealer and other useful information can be found at www.bukh.dk

Safety Information

Read this chapter very carefully. It concerns your safety. This chapter describes how safety information is presented in the operator's manual and on the product. It also provides you with an introduction to the basic safety rules for using and looking after the engine.



This symbol is used in the operator's manual and on the product to call your attention to the fact that this is safety information. Always read such information very carefully.

Safety texts in the operator's manual have the following order of priority:

DANGER!

Indicates a hazardous situation which, if not avoided, will result in death or serious injury.

WARNING!

Indicates a hazardous situation which, if not avoided, could result in death or serious personal injury.

CAUTION!

Indicates a hazardous situation which, if not avoided, could result in minor or moderate personal injury.

IMPORTANT:

Indicates a situation which, if not avoided, could result in property damage.

NOTICE! Used to draw attention to important information that will facilitate work or operations.



In some cases, this symbol is used on our products and refers to important information in the operator's manual. Make sure that warning and information symbols on the engine are clearly visible and legible. Replace symbols that have been damaged or have been painted over.

Daily Checks

Make a habit of giving the engine and engine bay a visual check before driving (before starting the engine) and after operation (when you have stopped the engine). This will help you to quickly discover whether there is any leakage of fuel, coolant, oil or any other abnormal event has occurred, or is about to occur.

WARNING!

Do not start the engine if there is reason to suspect fuel and/or propane leaks, or if there is explosive material nearby.

Maneuvering

To avoid passengers falling overboard, refrain from extreme and sudden rudder movements and ahead/astern movements.

A rotating propeller can cause severe injuries. Make sure that there is nobody in the water before engaging ahead/astern drive. Never drive close to bathers or in areas where it can be expected that people are in the water.

Lanyard Switch

We recommend installing and using a lanyard switch (optional), especially if the boat is capable of high speeds. The lanyard switch stops the engine if the driver loses control of the boat.

Fuel Filling

There is always a risk of fire and explosion during fueling. Smoking is forbidden and the engine must be stopped during fueling.

Never overfill the tank. Close the fuel filler cap securely.

Only use fuel recommended in the *Technical Data, page 130*. The wrong grade of fuel can cause serious malfunctions, power loss or stop the engine. In diesel engines, fuel of poor quality can cause damage to the fuel system or cause the engine to over-speed, with risk of personal injury.

Accidents at Sea

Maritime rescue statistics show that a large number of boat accidents are caused by inadequate engine and boat maintenance and the lack of safety equipment.

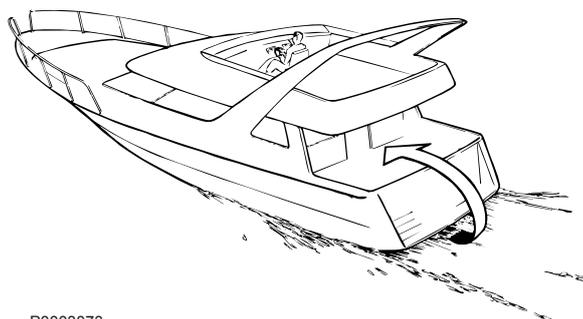
Make sure that the boat engine is properly maintained by making sure that the recommended service is performed, and that necessary safety equipment is available and functional.

Carbon Monoxide Poisoning

When the boat moves forward, an area of lower pressure air is formed behind the boat — so-called turbulence. In certain conditions, this turbulence can be powerful enough to draw the exhaust fumes into the cockpit or cabin, creating a risk of carbon monoxide poisoning to people on board.

The turbulence problem is most pronounced on tall, broad-beamed boats with a transom stern. But even for other boat types, low-pressure suction can be a problem in certain conditions, such as driving with cockpit awnings rigged. Other factors that can increase the effect of turbulence are wind conditions, load distribution, swell, trim, open hatches and ventilators etc.

Most modern boats are, however, designed so that the problem of low-pressure suction is very rare. Should turbulence nevertheless occur, hatches or ventilators must not be opened since this might exacerbate the problem. Instead, try to change the speed, trim or load distribution. If possible, take down or open the cockpit awning. Contact your boat dealer for the best solution for your boat.



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Remember

The list below includes some tips on what to remember to bring on any boat trip. The list can be extended since the need for safety equipment varies with the boat type and where or how it is used etc. We recommend you ask a regional boat or sea safety organization for more detailed maritime safety information.

Safety Equipment:

- life jackets
- communication equipment
- emergency rockets
- approved fire extinguisher
- first aid kit
- life buoy
- anchor
- paddle
- flashlights

Spare Parts and Tools:

- impeller
- fuel filters
- fuses
- tape
- hose clamps
- engine oil
- other tools that may be required

- Take your chart out and study your planned route. Calculate distance and fuel consumption. Listen to weather reports.
- Tell your friends/relatives about route plans if you undertake a long journey. Remember to notify changed plans or delays.
- Inform everybody aboard about where the safety equipment is located, and how it works. Make sure that there is more than one person aboard who can start and operate the boat safely.

Introduction

Check that you have received the correct operator's manual before continuing reading. If not, please contact your Bukh dealer.

For engine designations, refer to *Technical Data*, page 128. The designation is stated on the engine plate, refer to *Technical Data*, page 136.

About this manual

This Operator's Manual has been prepared to give you the greatest possible benefit from your Bukh marine engine. It contains necessary information regarding safe and correct engine operation and maintenance. Read the Operator's Manual carefully and learn to handle the engine, controls and other equipment in a safe manner before you cast off on your maiden voyage.

Always have the Operator's Manual available. Store it safely and do not forget to hand it over to the next owner if you sell your boat.

The Operator's Manual describes the engine and equipment sold by Bukh. The illustrations in this book may cover several product types, which means that there may be slight differences between the illustrations and the purchased product. This does, however, not affect the validity of the information and/or instructions in the manual. Bukh reserves the right to make alterations to specifications, design features, and illustrations without prior notice.

Your New Boat

Carefully read through the instructions and other information that is delivered with the new boat. Learn to handle the engine, controls and other equipment in a safe and proper manner. If this is your first boat or if the boat type is unfamiliar to you, we recommend that you practice maneuvering the boat before casting off on the maiden voyage. Make yourself familiar with the boat's seakeeping and maneuvering qualities at different speeds, sea states and load conditions.

Bear in mind that a person in charge of a boat under way bears the legal responsibility of knowing and following the regulations for passage and safety afloat. Learn which regulations apply to you and your waters by contacting the relevant authorities or maritime safety organization. We recommend that you complete a boat driver's course.

Warranty

Your new Bukh marine engine is covered by a limited warranty, subject to the conditions compiled in the 6.4-F2 Rev. 30.05.11 General Terms of Sale and Delivery

Read the information carefully, the information can be found on www.bukh.dk

Environmental Care

Bukh has special responsibility as an engine manufacturer, and for this reason environmental care is a natural cornerstone of our product development. Bukh currently has a broad engine program in which great advances have been made in reducing exhaust emissions, fuel consumption and engine noise etc. We hope that you will be keen to preserve these qualities. Always follow the directions in the Operator's Manual regarding fuel grades, operation and maintenance to avoid unnecessary environmental impact. Contact your Bukh dealer if you notice any changes such as increased fuel consumption or increased exhaust smoke.

Remember always to hand in environmentally hazardous waste such as drained oil, coolant, old batteries, etc. for treatment at a recycling facility.

Our united efforts can make a valuable contribution to the environment.

Running In

The engine must be run in during the first 10 hours of operation. Do this by using the engine in normal operation, where full load is only applied for short periods of time. Never run the engine at constant speed for any longer periods of time.

Since oil consumption is higher during the running in period, be sure to control the oil level more frequently than normally recommended.

Refer to *Maintenance, page 87* for more information.

Fuel, Oils and Coolant

Only use the fuels and oils recommended in the *Technical Data, page 129*, since other grades may cause malfunctions, increased fuel consumption, and possibly shorten the life of the engine.

Always change the oil, oil filters, and fuel filter at the specified maintenance intervals.

Make sure to always use suitable and correctly mixed coolant.

Future warranty claims related to engine and accessories may be denied if an unsuitable coolant has been used, or if the instructions for coolant mixture have not been followed.

Maintenance and replacement parts

Bukh engines are designed for maximum reliability and long life. They are not only built to withstand a demanding environment, but also to have the smallest possible environmental impact. These qualities will be maintained through regular servicing and the use of spare parts with the same quality as Bukh original spare parts. If reliable and purpose-built parts are not used, your safety, health, and the machine's function may be compromised. Bukh has a world-wide network of authorized dealers.

They are Bukh product specialists, and have the accessories, genuine parts, test equipment and special tools needed for high quality service and repair work. Always observe the maintenance intervals in the manual, the complete Service Protocol can be found at volvopenta.com. Remember to note the engine / transmission identification number when you **order service and spare parts**.

Excessive Strain On a Product and Components

Bukh products and their components are not dimensioned for external loads. Never stand or step onto an engine, transmission or its components. Loads can bring about damage and the malfunction of a product or property.

Instruments and Controls

This chapter describes the instruments, panels and controls Bukh sells for your engine.

If you would like to complement your instrumentation, or if your boat is equipped with instruments not described here, we ask that you contact your Bukh dealer.

Ignition Lock

There is always a helm station with an e-Key panel on a boat. The ignition must be switched on here in order to use other helm stations.

Read the starting instructions in *Starting, page 56* to make sure you use the correct start procedure.

e-Key panel

The Bukh e-Key consists of a panel and a key fob.

Hold the key fob in front of the  symbol on the panel to unlock the EVC system. A  sound confirms the system is unlocked.

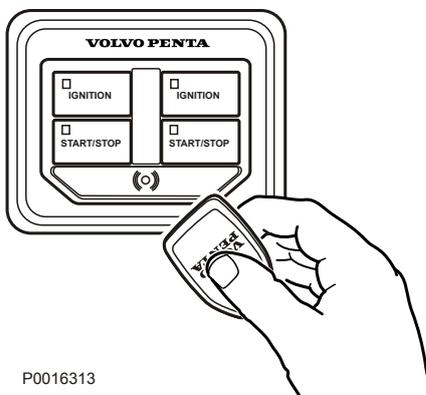
When the electrical system is locked, a red light will flash under the symbol. The lamp goes out to indicate the system is unlocked.

Key Management

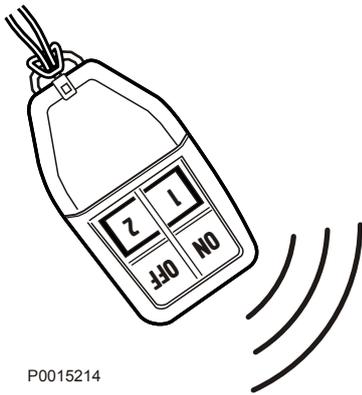
Two key fobs are provided at the time of delivery. It is possible to add additional keys; the system allows up to four keys. With a key already registered to the system other keys can be added or removed, see *Key Management, page 118*.

Safety Lanyard

A safety lanyard (optional extra) can be connected to the panel. Should the safety lanyard be removed, the engines will stop, the system alerts and a warning message will be displayed in the Information Panel.



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e-Key Remote

e-Key Remote Sender locks and unlocks the boat's electrical system and starts the engine's ignition via the e-Key Remote Receiver.

On the key there are also two buttons that control relays to optional functions such as deck light or anchor winches.

ON – turns on the start switch and other selected switches.

OFF – turns off the start switch and other selected switches.

1 and **2** – the buttons are used to turn optional boat functions off and on.

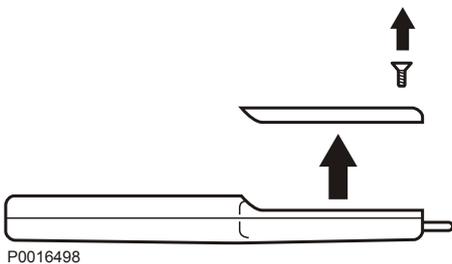
Battery replacement

Undo the screw on the battery cover and replace the battery. Battery types: CR2032.

Battery installation

Place the battery cover back fasteners and secure the gasket by pressing on the cover. Install the screw to secure the cover placement.

NOTICE! The e-Key remote can still be used as a regular key fob even if the battery is discharged, refer to *e-Key panel, page 12*.



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Control Panels

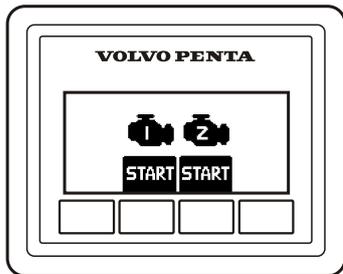
Bukh control panels can be installed in different combinations. The panels all look the same but are configured to handle different functionality. The number of available panels and their function depend on the boat's functionality setup.

Start/Stop Panel

The **Start/Stop** panel is used for starting and stopping the engine.

To start the engine, the ignition must be switched on at the main helm station.

Read the starting instructions in the chapter *Starting*, page 56 to make sure the correct start procedure is used.



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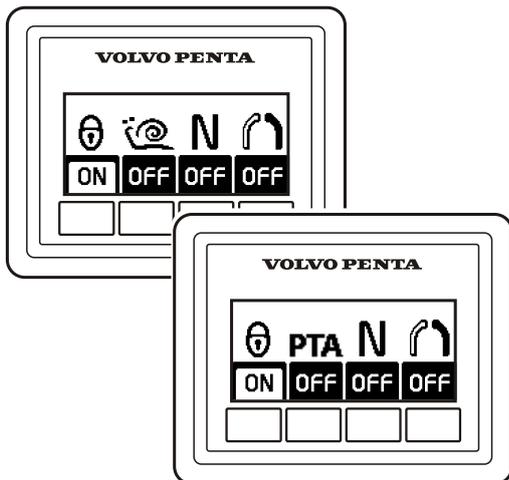
Station Panel

Activation

Activate the helm station with a single press of the button.

Further pressure locks the helm station.

To render the helm station inactive, hold the button down for 3 seconds.



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Inactive helm station



Active helm station



Locked helm station

Lowspeed and Power Trim Assistant (PTA)

Depending on the installation the optional functions lowspeed or Power Trim Assistant are engaged with the button.

Lowspeed

For further information about the function, refer to *Optional*, page 40.

PTA Power Trim Assistant (PTA)

For further information about the function, refer to *Instruments and Controls*, page 30.

N Neutral button

The gearshift function can be disconnected so that the control lever only operates the throttle. The neutral button disengages the drive/reverse gear so that engine speed may be increased without driving the boat; (warm-up mode).

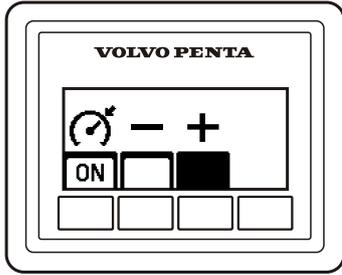
 The drive is disengaged.

 Drive engaged for movement ahead/astern.

Single lever

When the single-lever function is activated, the lever that is moved from its position first becomes the control lever for both engines. The other control lever has no function as long as the single-lever function is activated.

In order to activate the single-lever function, the control levers must in be roughly the same position, max 10% difference.



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Cruise Control

Switch on cruise control by pressing the  button. Make fine adjustments to the locked engine speed by pressing the + or – buttons to increase or reduce the speed.

Docking Panel

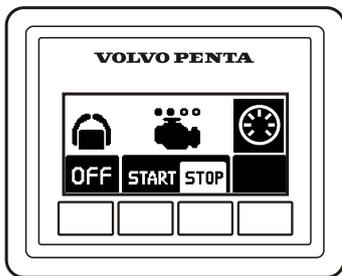
When the boat is operated from a docking station, engines can be stopped and started and messages can be managed using the docking panel. The joystick can be used for maneuvering when the docking station is activated; refer to the *Instruments and Controls*, page 35 section for further information.

Activation

Activate the helm station by depressing the on/off button. Further pressure on the button locks the helm station. To switch off the function, hold the button down for 3 seconds.

Twin installation

Both engines in a twin installation must be running before the docking station can be activated.



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The helm station is inactive.



The helm station is active and the docking function is switched on.

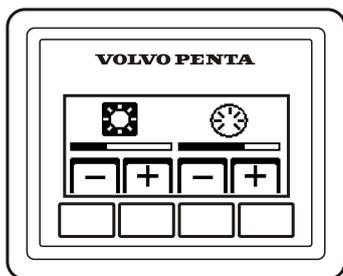


The helm station is locked.

Start/Stop

Press the STOP and START buttons to stop and start all engines.

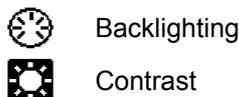
The circles above the engine symbols show which engines are running. An empty circle means an engine is running.



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Contrast and backlighting

The button on the far right is used to adjust contrast and panel backlighting. The button is also used to confirm fault messages.



Press the button to adjust the contrast and the backlighting.

Use + and – to increase or reduce the contrast or backlighting.

Adjustments affect all screens in the system.

Fault message

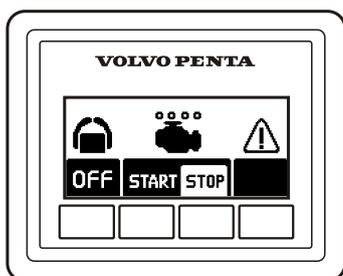
⚠ is displayed on the screen when the system discovers a fault.

All fault messages must be acknowledged.

Acknowledge by pressing the button; if the fault is accompanied by an audible signal, the signal will be silenced. Go to the information display to obtain information regarding the alarm.

Contact a Bukh workshop for a complete readout of all fault messages.

For further information on how to handle fault messages and recommended actions, refer to the *Fault Handling, page 67* and *Fault Code Register, page 71* chapters.



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Power Trim panel

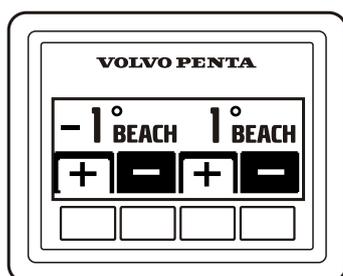
The Power Trim panel allows you to adjust the angle of the drive with respect to the transom.

For twin engine installations, the control panel can be used to make individual or simultaneous adjustments to the drives.

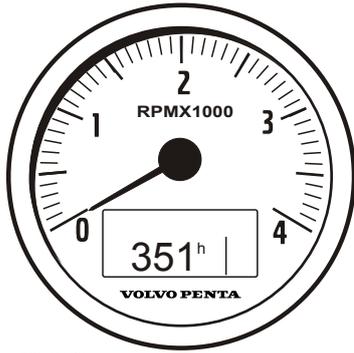
By trimming out the drive away from the transom, the bow will be "raised" in relation to the horizontal axis and trimming in the drive will "lower" the bow of the boat

- + Will trim the drive away from the transom, the bow will be "raised" in relation to the horizontal axis.
- Will trim the drive away towards the transom, "lower" the bow of the boat.

For further information on Power Trim refer to *Instruments and Controls, page 30*.



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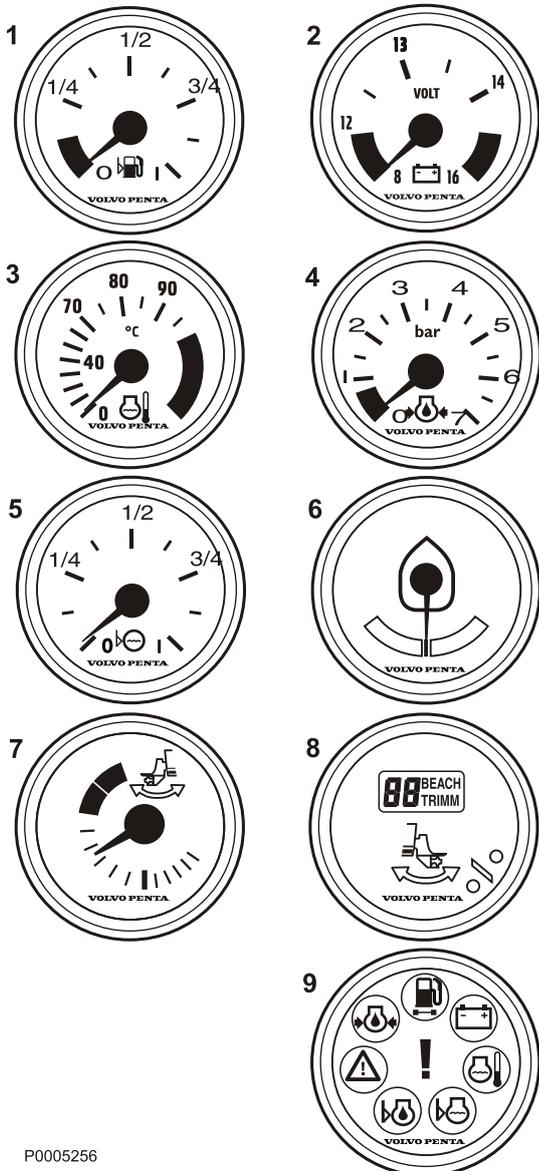
Gauges

These instruments are sold as engine options by Bukh.

Tachometer

The tachometer displays engine speed; multiply the value shown on the dial by 1,000 to get the number of engine revolutions per minute.

Engine hours are displayed in the tachometer window. When a function is activated a symbol is shown briefly on the display.



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1 Fuel level gauge

The fuel level gauge shows the quantity of remaining fuel.

2 Voltmeter, battery charging

The meter shows the alternator charge current. During operations the charge voltage should be around 14 V. When the engine is stopped and electrical power switched on the battery voltage should be around 12 V.

If a 24 V system is installed, the charge voltage should be around 28 V during operations.

3 Coolant temperature gauge

The instrument shows engine coolant temperature. During operations coolant temperature should normally be between 75-95°C (167-203°F).

4 Oil pressure gauge

The oil pressure gauge displays engine oil pressure. During operations the oil pressure gauge should normally show 3-5 bar. At idle, lower values are normal.

5 Fresh water level sensor

Freshwater tank level gauge.

6 Rudder position indicator

The instrument shows rudder position.

7 Trim indicator, analog, for Aquamatic engines

The analog indicator shows the position of the stern drive in relation to the transom shield.

8 Trim indicator, digital, for Aquamatic engines

The digital indicator shows the position of the stern drive in relation to the transom shield.

9 Alarm monitor

The alarm monitor gives a visual warning to call attention to any alarms that occur.

Displays

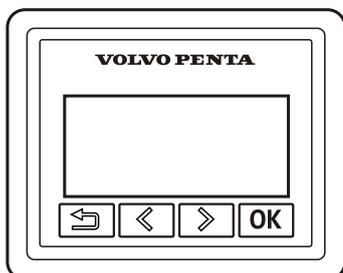
Information Display

The information display shows engine and operational information, messages and alarms.

There is one information display per driveline and helm station if no 7" or larger screen is installed.

The information shown can be set up according to personal preferences. The basic settings show:

- Engine speed
- Oil pressure
- Coolant temp
- Battery voltage



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Press this button to return to the previous menu.

To navigate back to the main menu, hold the button down for more than three seconds or press the button repeatedly.

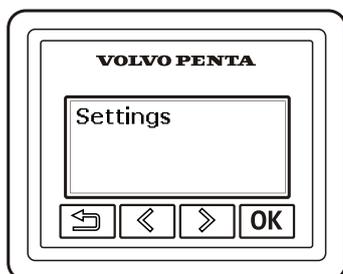


Press these buttons to navigate backwards and forwards in the menus.

Hold down a button to scroll through a menu.



Press this button to confirm a selection.

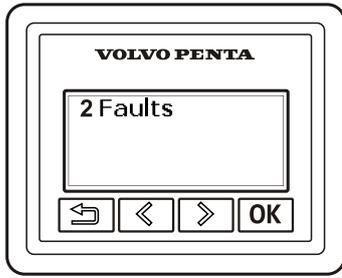


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Settings

Browse to the settings menu and press the **OK** button to proceed to the submenu.

For further information about settings, refer to *Settings Menu, page 111*.



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Fault Messages

If the system discovers a fault, the word **Fault** and the number of discovered faults, are shown on the display. To see the what faults have been detected, press the **OK** button.

For further information on how to handle fault messages and recommended actions, refer to *Fault Handling, page 67*.

Backlighting

Display backlighting can be adjusted by pressing the   buttons simultaneously.

4" Display

The 4" display is an optional supplement to the Bukh control system. Via the display it is possible to view and control all installed functions in the system.

IMPORTANT:

Prolonged exposure to strong sunlight may damage the screen and cause functional faults.

Make a habit of protecting the screen by using the protective cover when the boat is not in use.

The Bukh 4" screen is controlled using the panel buttons as follows:

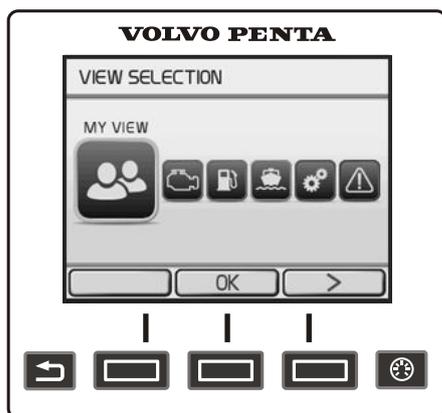
-  Return to the previous menu.
-  Adjust display contrast. If contrast changes are not confirmed, display contrast will automatically revert to its former state shortly after the button is released.
-  The button functions are shown on the display. Navigate back or forth or confirm a selection by pressing the appropriate button.

View Selection

When starting up the system, the last selected view is shown. To return to the main menu, press the  button. Use the arrow buttons to navigate to the desired screen.

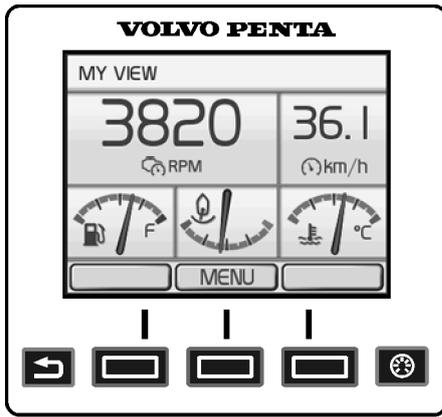
The following screens are available in the 4" display:

- **My View** shows operating information.
- **Engine View** shows engine information.
- **Fuel Economy** shows the trip computer.
- **Vessel** shows information regarding the boat installation
- **Settings** shows display settings and installed functions.
- **Warning Manager** shows detected faults and their corrective actions.
- **Battery View** shows battery information.



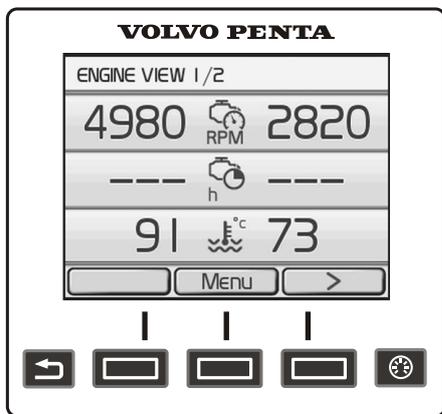
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View Selection



P0014748

My View



P0014718

Engine View

My View

Gauge and operations information is shown in the **My View** window.

Some functions are preset as quick selections. These can be switched on/off by pressing the **OK** button.

To change the gauge and information shown, refer to the part in this chapter entitled **Replace Gauge**.

Engine View

The view shows information about the engine and engine transmission. The information is displayed on two screens. Use the arrow buttons to toggle between the screens. Refer the part in this chapter entitled **Replace Gauge** for information on how to change settings for the displayed information.

Depending on the functions installed in the boat, the following can be displayed:

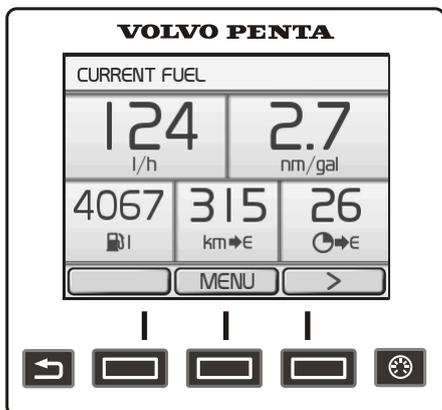
-  Engine Speed
-  Engine Hours
-  Engine Coolant Temperature
-  Battery Voltage
-  Engine Oil Pressure
-  Turbo Pressure
-  Exhaust Temperature
-  Transmission Oil Pressure
-  Transmission Oil Temperature
-  Propeller Rotation
-  Ahead Speed

Fuel

The **Fuel** view displays the trip computer in two screens; **Current Fuel** and **Average Fuel**. Use the arrow buttons to toggle between the screens.

The **Current Fuel** screen displays the following parameters:

- **Instant Fuel Rate** shows the current fuel consumption per hour.
- **Instant Fuel Economy** is based on the current fuel consumption.
- **Remaining In Tank** shows the amount of fuel left in the tank.
- **Distance Remaining** is based on the current fuel consumption and shows trip distance with remaining fuel.
- **Time To Empty** is based on current fuel consumption and shows the remaining operating time.

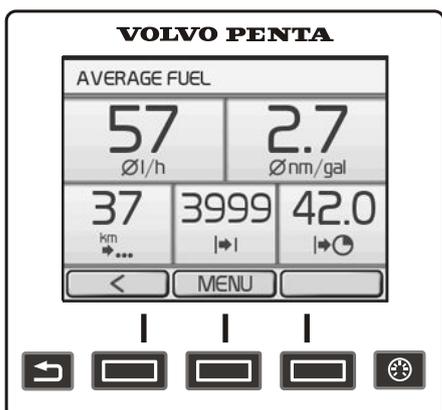


P0014717

Current Fuel

The **Average Fuel** screen displays the following parameters:

- **Average Fuel Rate** shows the average fuel consumption per hour since last trip computer reset.
- **Average Fuel Economy** is based on the average fuel consumption since last trip computer reset.
- **Trip Distance** shows the distance travelled since the latest trip computer reset.
- **Trip Fuel** shows the fuel consumption since the latest trip computer reset.
- **Trip Hours** shows the time travelled since last trip computer reset.

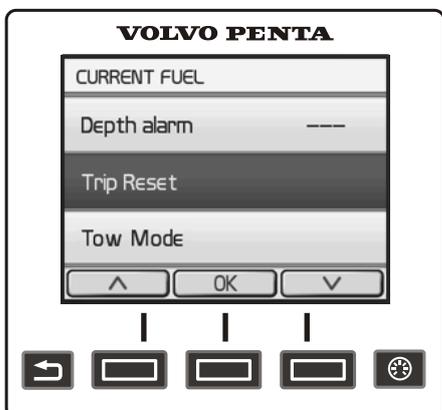


P0014740

Average Fuel

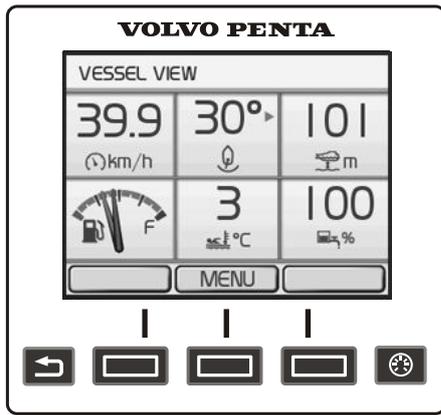
Trip Computer Reset

To reset all trip computer parameters, press the **Menu** button and select **Trip Reset**.



P0014741

Trip Computer Reset



P0014719

Vessel

Vessel

The view displays the boat's installation information. See the part in this chapter entitled **Replace Gauge** for information on how to change settings for the displayed information.

Depending on the functions installed, the following parameters can be displayed:

- **Boat Speed**
- **Rudder Angle**
- **Depth**
Refer to *Depth Alarm, page 112* for information about echo sounder settings.
- **Fuel Level**
- **Sea Water Temperature**
- **Freshwater Level**
- **Interceptor Position**
Refer to *Optional, page 52* for information about **Interceptor Position**.

Battery view

The Battery View shows the battery status for the batteries. Use the arrows to toggle between the different battery groups. Depending on the functions installed, the following parameters can be displayed:

- **SOC (State of Charge)**
- **Time to Empty / Time to Full**
- **Voltage**
- **Current**
- **Battery Health**

Settings

Display settings and various system function settings are dealt with in the **Settings** menu. The information shown varies depending on the installation.

Navigate to the desired setting and press the **OK** button to reach the submenu.

Key Management

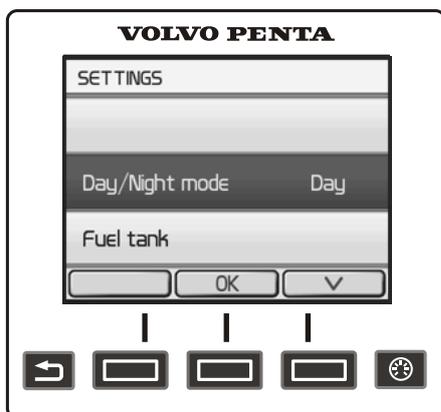
To add and remove keys to/from the system, refer to *Key Management, page 118*.

Day/Night Mode

Day mode shows dark colored text against a light colored background and **Night** mode shows light colored text against a dark colored background.

Fuel Tank

Fuel tank calibration and settings. For information regarding calibration, refer to *Fuel Tank, page 117*.



P0014723

Settings

Neutral Beep

Enable or disable the signal indicating when the control is in neutral position.

Info Beep

Enable or disable the signal confirming function activation and deactivation.

Info Beep Level

Set the volume of the **Info Beep**.

Trip Reset

Reset all trip computer data.

Depth Alarm

Set the depth alarm function. Refer to *Depth Alarm, page 112* for information on how to turn the function on or off and set the alarm limits.

Display Contrast

Set the display contrast for all displays.

Display Type

Define for which engines information shall be displayed.

Units

Set the unit settings for the system (metric, US or Imperial).

Language

Set the system language.

Speed Factor

If the speedometer is showing incorrect values, it is possible to correct this by adjusting the **Speed Factor**.

Refer to *Speed Factor, page 118* for more information.

EVC Information

Shows information about components, software, and functions. Installed functions are check marked.

Warning Manager

If the system discovers a fault, the helmsman is informed by a message on the display. The fault message must be acknowledged by pressing the **OK** button.

All fault messages are stored in **Warning Manager**, where the affected drivetrain is shown, the fault is described and suitable actions are suggested. Refer to *Fault Code Register, page 71* for more information about different fault messages.



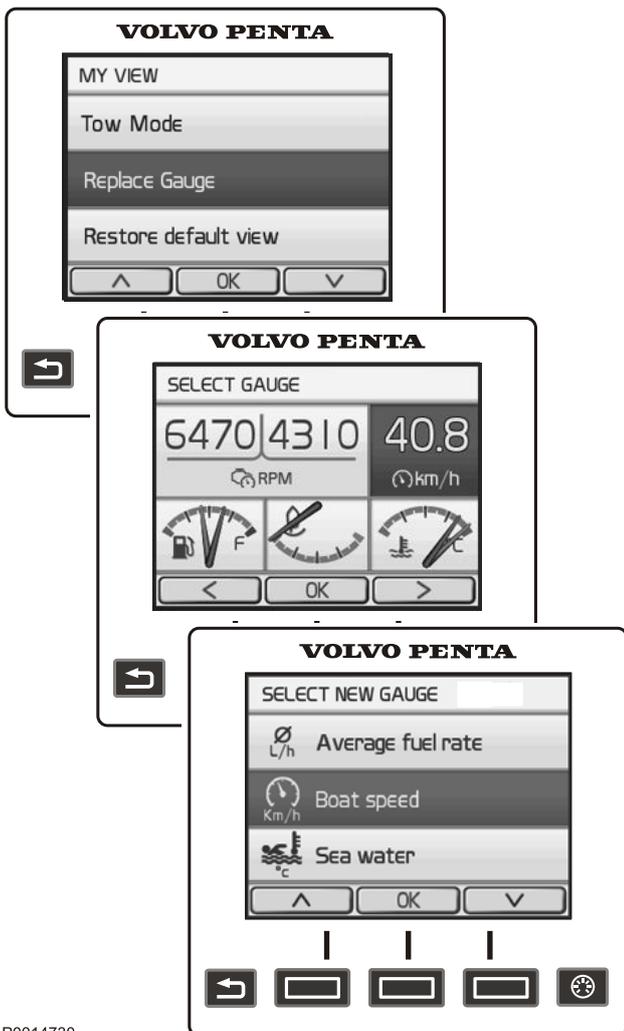
P0014724

Warning Manager

Replace Gauge

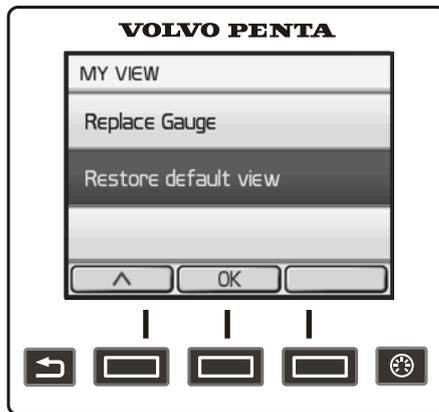
In **My View**, **Engine View** and **Vessel** you can decide on what information to show and where on the display the information is shown.

- 1 Press the **Menu** button and select **Replace Gauge**.
- 2 Navigate to the gauge to be replaced using the   buttons and press the **OK** button.
- 3 Select the gauge to replace the former one and press the **OK** button.



P0014730

Replace Gauge



P0014731

Restore Default View

Restore Default View

To revert to the basic display settings, navigate to **Restore Default View**.

- 1 Press the **Menu** button and select **Restore Default View**.
- 2 Press the **OK** button.

Glass Cockpit Display

The Glass Cockpit Display is switched on and off by pressing .

NOTICE!

For information on how to navigate and customize the Glass Cockpit display, refer to the integrated Glass Cockpit Manual. Go to **Info > Owner's Manual** to see the manual in the display or download the latest manual on www.garmin.com.

Warning Manager

Select **Info > Warning Manager** to navigate to Warning Manager.

If the system discovers a fault, the helmsman is alerted by a message on the display. Acknowledge the message by selecting OK.

All faults are stored in Warnings Manager.

The fault message describes the fault and suggests suitable actions.

For further information see *Fault Handling, page 67* and Bukh Glass Cockpit manual.



P0022469

Gauge View

Select **A/V, Gauges, Controls > Choose one of the available gauges views**.

Navigate between the different gauge views by selecting ◀ or ▶ in the gauges menu.



P0022479

This is an example of gauges that can be displayed in the different views:



Engine View

- Engine speed
- Engine hours
- Exhaust temperature, dry
- Coolant temperature
- Coolant pressure
- Voltage
- Oil pressure
- Turbo pressure (diesel)
- Transmission, oil pressure
- Transmission, oil temperature
- Load percent ⁽¹⁾
- Oil filter diff pressure



Vessel View

- Active corrosion protection info
- Depth with alarm
- Fuel level
- Fresh water
- Boat speed
- Power trim angle
- Rudder angle
- Water temp



Battery View

NOTICE! The Battery View shows battery status. The system requires a battery sensor to be able to show the status of the battery.

For installation without Battery Management System, *Voltage* is the only gauge displayed in this view.

- SOC (state of charge)
- Time to empty / Time to full
- Voltage
- Current
- Battery health



Fuel Economy View

- Instant fuel rate
- Average fuel rate
- Time to empty
- Instant fuel economy
- Average fuel economy
- Trip fuel economy
- Distance to empty
- Fuel level
- Fuel remaining



My View

- Boat speed
- Fuel level
- Fuel feed pressure
- Fresh water level
- Seawater temperature
- Seawater pressure
- Rudder angle
- Interceptor position
- Lowspeed mode, slip rate
- Propulsion speed
- Trip fuel
- Total fuel rate
- Trip distance
- Trip hours
- Total fuel economy

1. Shows engine torque output in percentage of available engine torque, at current engine speed.

Power Trim

Your Bukh drive is equipped with a hydraulic trim system, Power Trim, that allows you to adjust the angle of the drive with respect to the transom from the helm station. The angle of the drive effects the boat's passage through the water and other characteristics, e.g. improved acceleration to planing and planing with a lower throttle opening. Trimming can also be used to give a more gentle passage in short seas.

Trim Ranges

To be able to use the information on the trim instrument, it is important to be aware of the three trim ranges and the way they are used.

Trim range

The trim range are used to provide the best comfort when driving – from starting to top speed.

Beach range

The beach range is used for driving at low speed in shallow water or where the depth is unknown. The highest permitted engine speed when in the beach range is 1500 rpm.

IMPORTANT:

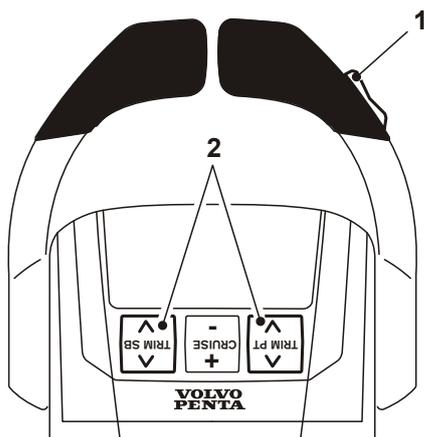
Make sure the drive's coolant inlet is never trimmed out of the water when operating in the beach range.

Lift range

The lift range is never used when sailing. It lifts the drive to maximum height and is used for e.g. transporting the boat on a trailer. Power Trim has an automatic stop that turns off the power when the end position is reached. The catch is released automatically when the stern drive is trimmed down.

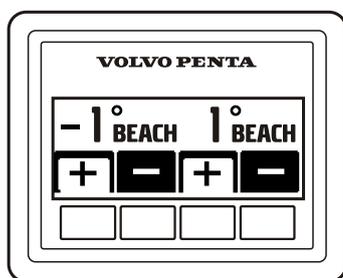
⚠ WARNING!

The engine must not be run with the drive in the "lift" range.



P0013214

Top mount control for twin installation



P0001189

Trim Controls

The drive can be trimmed with the Power Trim panel or with the button at the side of the control (1). For twin engine installations, the button at the side adjust the drives simultaneous. There is also a button for individual adjustments to the drives (2) on the control for twin installations.

NOTICE! The individual drive adjustments with the front buttons (2) is only available for installations without Bukh Interceptor System. For information about the Interceptor System, refer to *Optional*, page 52.

Power Trim panel

The Power Trim panel is used for both single and twin engine installations. For twin engine installations, the control panel can be used to make individual or simultaneous adjustments to the drives.

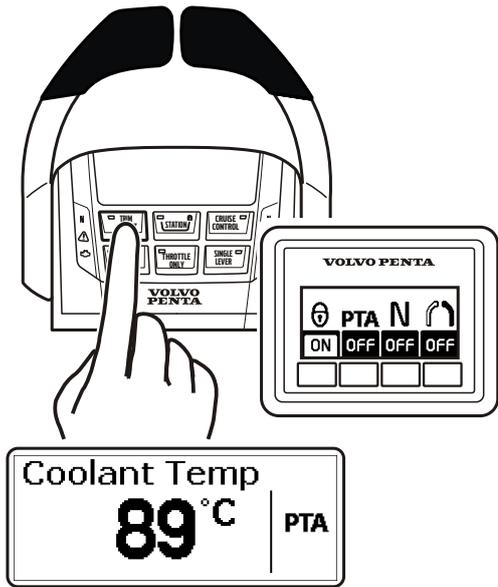
The drive's angle and position is shown on the Power Trim panel. By trimming out the drive away from the transom the bow will be "raised" in relation to the horizontal axis and trimming in the drive will "lower" the bow of the boat.

Trimming out the drive

On the Power Trim panel, press button + to trim the drive out, away from the transom. The bow will be "raised" in relation to the horizontal axis.

Trimming in the drive

Press button – to trim the drive in, towards the transom. The bow will be "lowered" in relation to the horizontal axis.



P0013276

Power Trim Assistant

The Power Trim Assistant, PTA, adjusts the trim angle automatically according to engine speed (rpm). It is possible to set five trim angles at five different engine speeds, idle speed included. To set the angles, please refer to *PTA Calibration*, page 116.

Press the PTA button on the helm station panel or the Trim Assist button on the control to activate or deactivate the function.

PTA is shown on the screen if the PTA function is active.

Trim Instruments

⚠ WARNING!

The engine must not be run with the drive in the “lift” range.

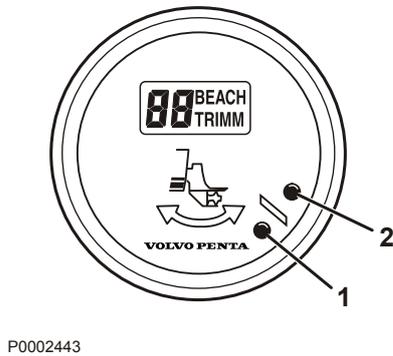
Digital trim instrument

The trim instrument shows the drive trim setting. The angle of the drive is given in relation to a horizontal line. The lowest value indicates that the drive is fully trimmed down and the highest value that the drive is fully trimmed up. Note that the lowest value can vary from boat to boat, depending on the angle of the transom.

When the drive angle is within the trim range, the text “TRIM” is shown on the display.

When the drive angle is within the beach range, lamp 1 lights orange and the text “BEACH” is shown on the display.

When the drive is in the lift range, the drive angle is greater than +30° and lamp 2 lights red. There is no text on the display.

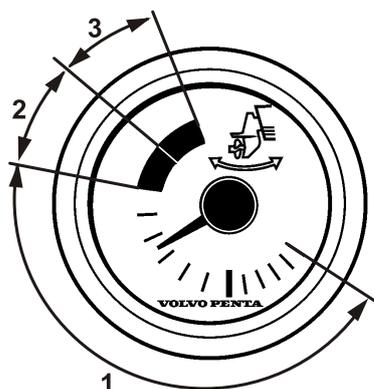


P0002443

Analog trim instrument

The trim instrument shows the drive trim setting. The beach range is marked with an orange zone and the lift range with a red zone.

- 1 Trim ranges
- 2 Beach range (orange)
- 3 Lift range (red)



P0002444

Maneuvering

The correct trim setting provides the best comfort when driving.

Every boat has its own unique characteristics and reacts differently to how you trim it. We can therefore only give general advice about how you reach the best trim angle for your boat. It can generally be said that when the boat feels well balanced, is easy to steer and comfortable to drive - than you have found the optimum trim angle.

Make a few trips at low speed to experience the effect of Power Trim and the different trim ranges, to see what effect they have on the boat. Note how long it takes for the boat to reach planing speed. Check the tachometer, speed and the response of the boat.

Trim the drive down

The bows are pressed down and the boat accelerates faster. It also provides better driving and steering response at speeds below the planing threshold.

Driving with "bow down"

The "bow down" position is normally used during acceleration up to planing speed, at low planing speeds or with a short sea. With full "bow down", the boat has a tendency to self-steer. You may have to compensate with the wheel to keep the boat on the right course. In this position, the bow of the boat tries to go deeper in the water. If the boat is driven at high speed or towards high waves, the bow will plough downwards into the water. The boat can start to steer with the bows or yaw suddenly so that passengers may be thrown overboard.

The boat's trim shall always be adjusted to give well balanced steering. Certain combinations of boat, engine and propeller can cause instability and/or self-steering tendencies when the boat is driven at or close to the maximum "bow up" or "bow down" positions. The stability and steering characteristics of the boat can also vary depending on the sea conditions. Contact your Bukh dealer to correct these tendencies if your boat shows instability an/or self-steering tendencies.

At planing speed

Trim the drive to the angle that gives the most stable and comfortable feeling. If the boat has a twin installation, the drive can be trimmed to different angles to compensate for side winds and, to a certain degree, uneven load distribution.

Driving with "bow down"

The "bow up" position is normally used for driving at cruising speed, in short seas, or at full speed. With full "bow up" the boat can have a tendency to self-steer. You may have to compensate with the rudder to keep the boat on the right course. In this position, the bow of the boat tries to lift out of the water. Excessive "bow up" trim causes propeller cavitation, so that the propeller loses its grip. The engine speed increases without the boat speed increasing, in fact the boat might even sink.

Be careful when driving in short seas. Excessive "bow up" trim may cause the boat to bounce quickly upwards, with the risk of throwing passengers overboard.

In short seas or heavy head seas

Trim the drive down so that the bow drops. This makes for a more comfortable journey.

Driving in Beach range

The beach range is used for driving at reduced speed in shallow water or where the depth is unknown.

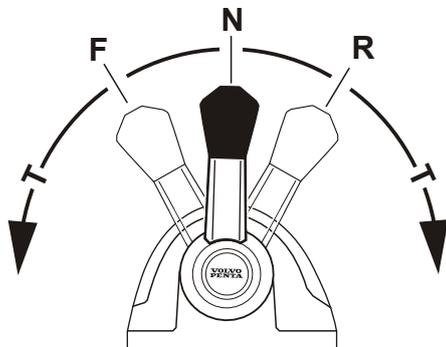
The highest permitted engine speed when in the Beach range is 1500 rpm.

IMPORTANT:

Make sure the drive's coolant inlet is never trimmed out of the water when operating in the beach range.

Controls

This section describes the controls Bukh sells for your engine. Contact your dealer if your boat is equipped with controls other than those described here, and you feel uncertain about their function.



P0012501

A single-lever control operates both gearshift and throttle functions with the same lever.

The engine can only be started with the control lever in the neutral position.

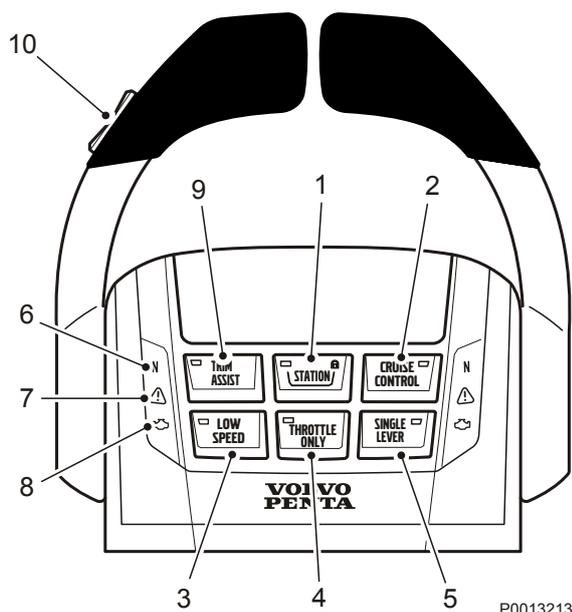
N = Neutral position. Reverse gear/drive disengaged and engine at idle.

F = Reverse gear/drive engaged for forward motion.

R = Reverse gear/drive engaged for rearward motion.

T = Engine rpm control (throttle).

Engine and drive features are controlled with push buttons on the control. The buttons and functions available depend on the installation.



P0013213

1 STATION

The button lamp is lit if the helm station is active and lit. Refer to *Operation, page 61* for further information.

2 CRUISE CONTROL

Switch on cruise control by pressing the button. Fine tune the locked engine speed by increasing (+) or reducing (-) engine rpm with the button at the other side of the control.

3 LOW SPEED (Optional)

See *Optional, page 40* for information.

4 THROTTLE ONLY

Disconnects the shift function so that the control lever only affects engine speed; refer to "Disengaging shift function" in this chapter for further information.

5 SINGLE LEVER

Switch on the single-lever function by pressing the button. The lever that is moved from its position first becomes the control lever for both engines. The other control lever has no function as long as the single-lever function is activated. The button lamp lights up to show that the function is active. Exit the single-lever function by pressing the button again.

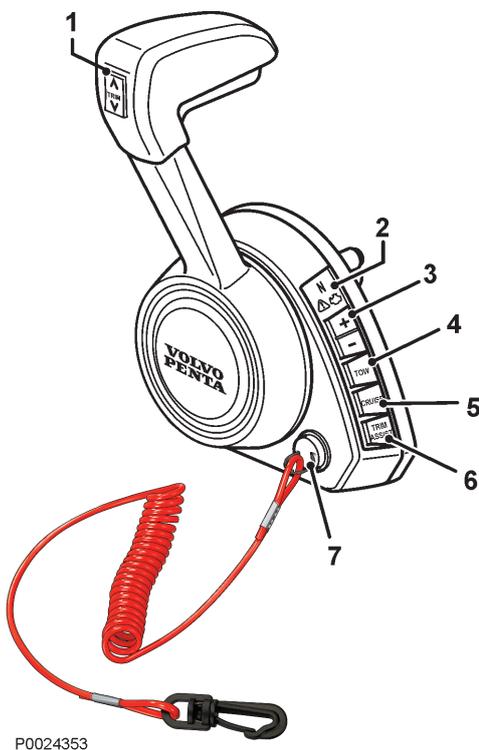
- 6 **N**
Neutral position. The symbol shows that the drive/reverse gear is disengaged.
- 7 
The warning triangle lights up if the system discovers a fault; refer to *Fault Handling, page 67* for information.
The warning triangle lights up on the same side as the driveline with the indicated fault.
- 8 This function is not available.
- 9 **TRIM ASSIST (Optional)**
The Power Trim Assistant, PTA, adjusts the trim angle automatically according to engine speed (rpm), see *Power Trim Assistant, page 32* for information.
Depending on installation this button can switch on/off the **Interceptor System**, refer to *Optional, page 52* for more information.
- 10 **TRIM (Optional)**
Trim the drive out//in.
For twin engine installations the adjustment of the drives are synchronized. For further information see *Instruments and Controls, page 30*.

Side mounted levers

- 1 **TRIM**
Trim the drive out//in.
For twin engine installations the adjustment of the drives are synchronized.
For further information on Power Trim see *Instruments and Controls, page 30*.
- 2 **N**
Neutral position. The symbol shows that the drive/reverse gear is disengaged.

The warning triangle lights up if the system discovers a fault; refer to *Fault Handling, page 67* for information.

This function is not available.
- 3 **+ / -**
Fine tune the locked engine speed for tow mode (4) or cruise control (5) by increasing (+) or reducing (-) engine rpm.
- 4 **TOW MODE**
Accelerates the boat to a preset rpm.
Switch on toe mode by pressing the button.
Fine tune the locked engine speed by increasing (+) or reducing (-) engine rpm with button (3).



P0024353

5 CRUISE CONTROL

Switch on cruise control by pressing the button. Fine tune the locked engine speed by increasing (+) or reducing (-) engine rpm with button (3).

6 TRIM ASSIST

The Power Trim Assistant, PTA, adjusts the trim angle automatically according to engine speed (rpm), see *Power Trim Assistant, page 32* for information.

7 Safety Lanyard

The safety lanyard is an accessory to increase the safety if the driver of the boat falls in the boat or overboard and the propulsion of the boat has to stop. If the lanyard loses contact with its socket on the lever, the engine will ramp down to idle and put itself in neutral gear. When idle and neutral is reached, the engine will shut down. If the safety lanyard is pulled out, a buzzer alarm as well as alarm on all displays will be activated. In order to regain control, the driver or the new driver must set lever to neutral and restart the engine. If the engine is started without the safety lanyard attached, an intermittent buzzer will be active. The intermittent buzzer is active until the safety lanyard is back in its socket.

⚠ CAUTION!

The safety lanyard should always be attached to the current driver.

8 THROTTLE ONLY

Disconnects the shift function so that the control lever only affects engine speed; refer to "Disengaging shift function" in this chapter for further information.

9 Neutral interlock

The neutral interlock prevents accidentally moving the throttle out of neutral.

Depress the interlock button to move control out of neutral.

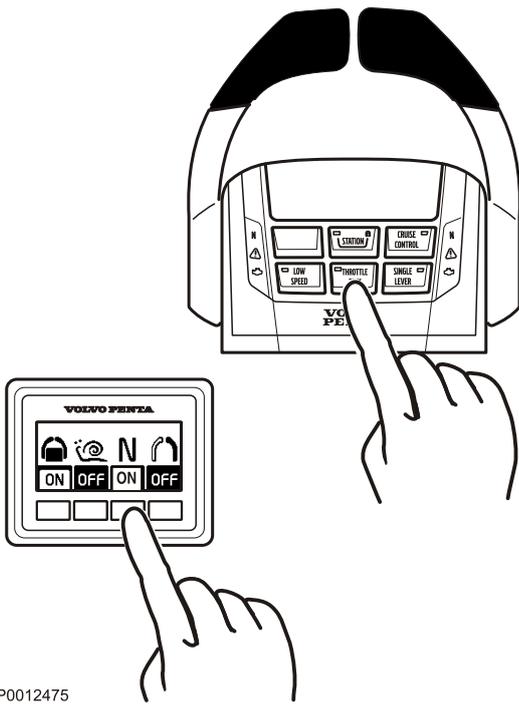
The neutral interlock will automatically re-engage when the control handle is returned to the neutral position.

Disengaging the Shift Function

The gearshift function can be disconnected so that the control lever only operates the throttle.

- 1 Put the control levers in neutral.
- 2 Press the control's "Throttle Only" button or the neutral button (N) on the helm station panel.
- 3 Release the button. The N symbol on the control will light up as confirmation that the gearshift function is disengaged and that the lever will only affect engine revolutions.

To exit neutral mode, press the button again.



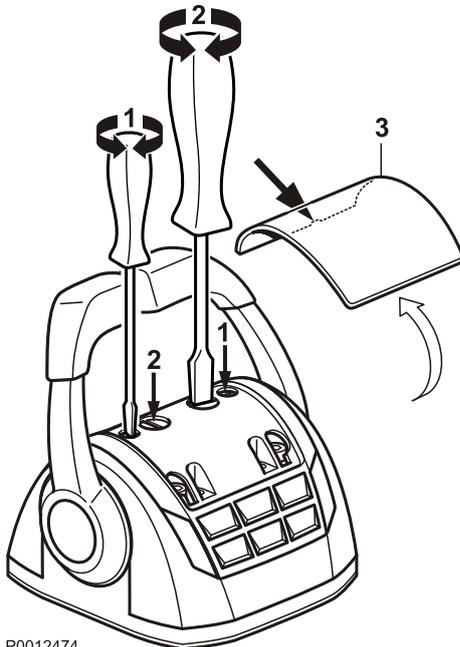
P0012475

Adjusting the friction brake

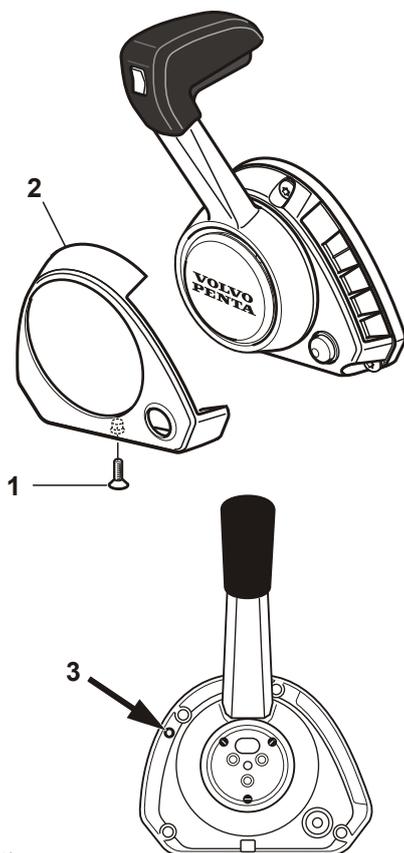
Top mounted lever

The control lever has a friction brake that can be adjusted for lighter or stiffer lever movement. Resistance in click mode can also be adjusted.

- 1 Switch off the engine.
- 2 Remove the cover (3).
- 3 Adjust the friction brake (1) and/or click mode (2) by turning the screw clockwise for stiffer lever movement, and counterclockwise for lighter lever movement.
- 4 Replace the cover.



P0012474

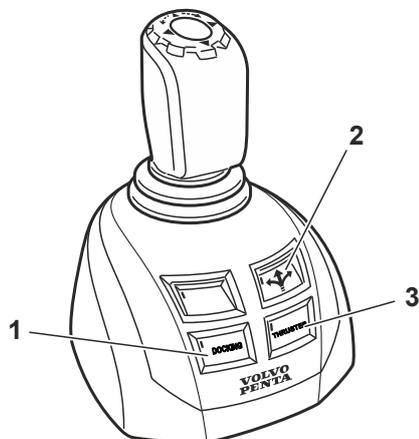


P0013443

Side mounted levers

Adjust the resistance in the lever click mode.

- 1 Switch off the engine.
- 2 Unscrew the screw (1) and remove the cover (2).
- 3 Adjust the detent by turning the screw (3) with a 2.5 mm hex wrench. Turn the screw clockwise for an increased detent, and counterclockwise to decrease the detent.
- 4 Replace the cover.



P0022688

Joystick

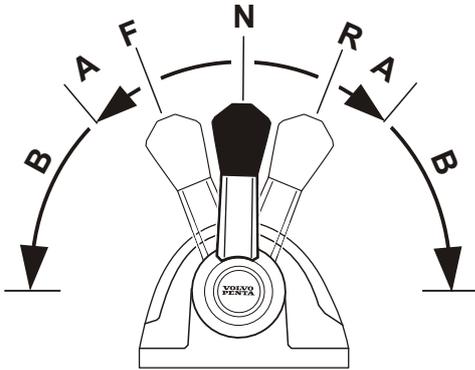
The joystick is optional. The features are controlled with push buttons on the control. The buttons and functions available depend on the installation.

- 1 Docking
For operation and further function information, refer to *Joystick for Docking, page 41*.
- 2 Joystick Driving
For operation and further function information, refer to *Joystick Driving, page 46*.
- 3 Thruster Mode / High Mode
Depending on installation the Thruster Mode or the High Mode button is fitted at number 3.
For operation and further function information, refer to *Thruster Mode, page 44* or *Joystick for Docking, page 41*.

Optional

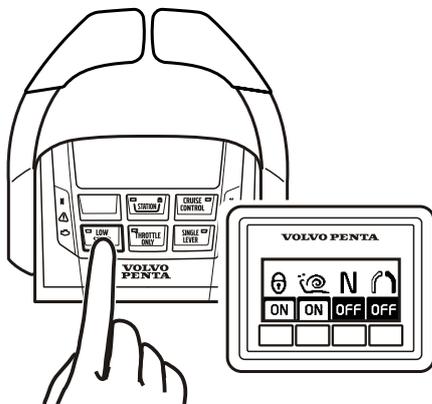
Lowspeed

The Bukh Lowspeed function is available for engines with hydraulic transmissions. Boats with powerful engines can have high speeds even at low revolutions; the low speed function reduces speed.



P0012499

- N** = Neutral position.
Transmission is disengaged and engine revolutions are at idle.
- F** = Forward at idle.
The transmission is engaged for operations ahead and the engine is at idle; this involves maximum trolling in the transmission.
- R** = Reverse at idle.
The transmission is engaged for operations astern and the engine is at idle; this involves maximum trolling in the transmission.
- A** = Low speed engaged.
The transmission affects propeller revolutions. The engine is not affected.
- B** = Low speed disengaged.
The control affects engine speed and propeller revolutions.



- A** Lowspeed Activated
- B** Coolant Temp 89°C
- C** Lowspeed Deactivated

P0012978

Engaging the lowspeed function

- 1 Move the lever to the neutral position.
- 2 Press the Lowspeed button on the control or  on the helm station panel to activate the lowspeed function.
An audible signal and the “Lowspeed activated” message (**A**) will be displayed on screen to confirm that the function is on.

 is shown on the screen if the low speed function is active (**B**).
When the low speed function is engaged, a delay may occur when shifting.

Disengage the lowspeed function

- 1 Move the lever to the neutral position.
- 2 Press the Lowspeed button on the control or  on the helm station panel to disengage the low speed function.
Two audible signals confirm that the function is switched off and the “Lowspeed deactivated” (**C**) message is displayed on the screen.

Joystick

Bukh Joystick is a control used for docking and maneuvering. Practise using the joystick and its functions in a safe and proper manner.

Practise how to operate the boat with both joystick docking and steering functions.

⚠ CAUTION!

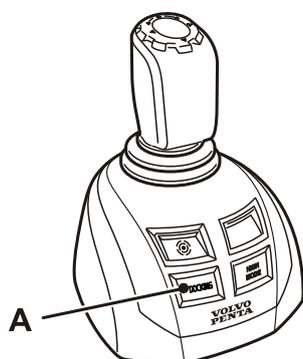
The joystick maneuvering works differently depending on if the docking function or steering function is active. Practise using all means of steering and throttle under all conditions.

Joystick for Docking

When the docking function is activated, engine revolutions are limited and the boat can only be steered by the joystick.

In order to activate the docking function, the following must be fulfilled:

- engines running
- control levers in neutral
- helm station active
- joystick in center position



P0012509

Activating the docking function

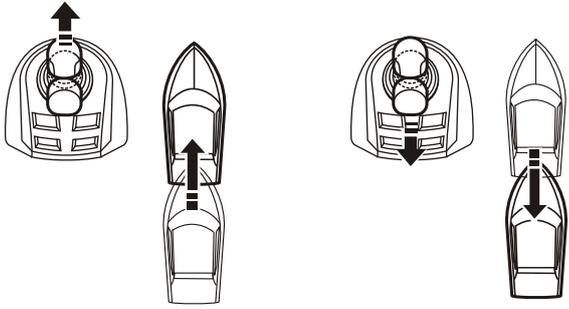
Activate docking mode by depressing the docking button (A) on the joystick.

An audible signal will confirm that docking mode is activated and the docking button lamp will light up.

Exiting the docking function

To exit the function, press the joystick docking button (A). An audible signal will sound twice to confirm that docking mode is deactivated, and the docking light will go out.

The docking function is also deactivated if the controls are moved from the neutral position.

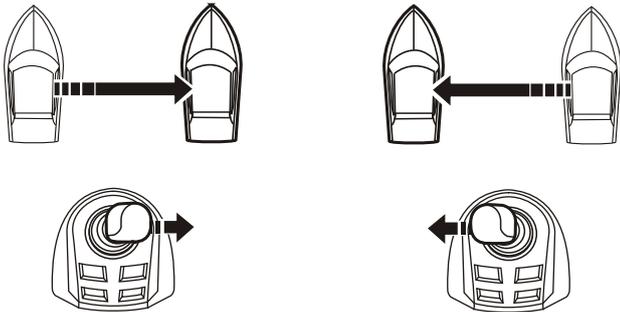


Bukh Joystick is a control used for docking and maneuvering. Practise using the joystick and its functions in a safe and proper manner. Practise how to operate the boat with both joystick docking and steering functions.

⚠ CAUTION!

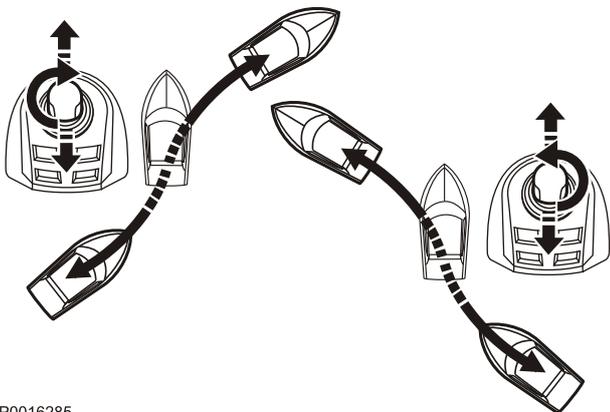
The joystick maneuvering works differently depending on if the docking function or steering function is active.

Practise using all means of steering and throttle under all conditions.

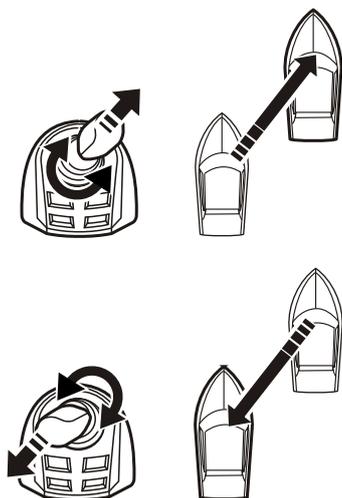


The docking function is designed to be used when docking or maneuvering in close quarters. Use the steering wheel and throttle control levers in all other situations.

The boat is maneuvered by moving the joystick forward, aft, abeam, twisting the top of the joystick and combinations of the movements.



P0016285



P0016286

⚠ CAUTION!

The boat will continue to move in the selected direction even when the joystick has been released.

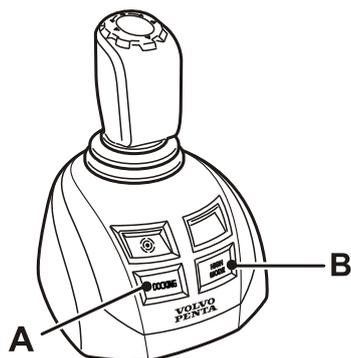
To slow the boat or reverse its direction, move the joystick in the opposite direction. In order to achieve a diagonal movement, move the joystick diagonally and use the joystick knob to adjust the boat's direction accordingly.

High Mode

If extra power, e.g. when there is a strong wind or strong current, the High Mode function may be engaged.

Activate High Mode

- 1 Activate the joystick by depressing the docking button (**A**). An audible signal confirms that the joystick is activated and the docking button lights up.
- 2 Activate the High Mode function by depressing button (**B**) on the joystick.
- 3 An audible signal confirms that the function is activated and the high Mode button lights up.



P0012510

Disengage High Mode!

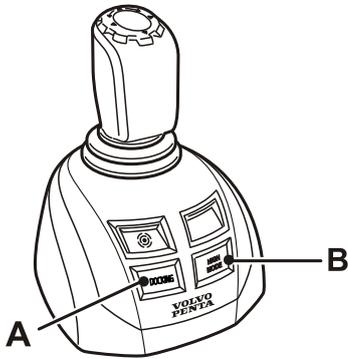
Disengage the function by pressing the button again. An audible signal will sound twice to confirm that docking mode is deactivated, and the light will go out. The system is now in normal docking mode.

High Mode

If extra power, e.g. when there is a strong wind or strong current, the High Mode function may be engaged.

Activate High Mode

- 1 Activate the joystick by depressing the docking button (**A**). An audible signal confirms that the joystick is activated and the docking button lights up.
- 2 Activate the High Mode function by depressing button (**B**) on the joystick.
- 3 An audible signal confirms that the function is activated and the high Mode button lights up.



P0012510

Disengage High Mode

Disengage the function by pressing the button again. An audible signal will sound twice to confirm that docking mode is deactivated, and the light will go out. The system is now in normal docking mode.

Thruster Mode

When Thruster Mode is activated, the joystick only controls the thruster(s) and the boat's movement is limited to rotational or rotational and sideways depending on installation.

The boat can still be maneuvered with the steering wheel and levers when Thruster Mode is activated.

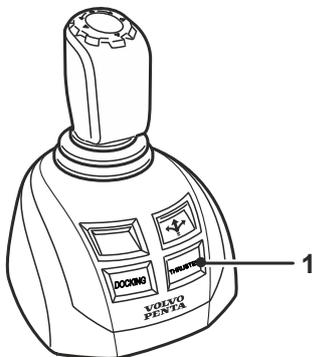
Activate Thruster Mode

Thruster Control is activated by pressing the **THRUSTER** button (1) on the joystick. An audible signal confirms that the function is activated and the thruster control button lights up.

Deactivate Thruster Mode

Deactivate the function by pressing the **THRUSTER** button (1). The light will go out and an audible signal will confirm that thruster control is deactivated.

NOTICE! The function is automatically deactivated if the boats speed exceed 10 knots.



P0022629

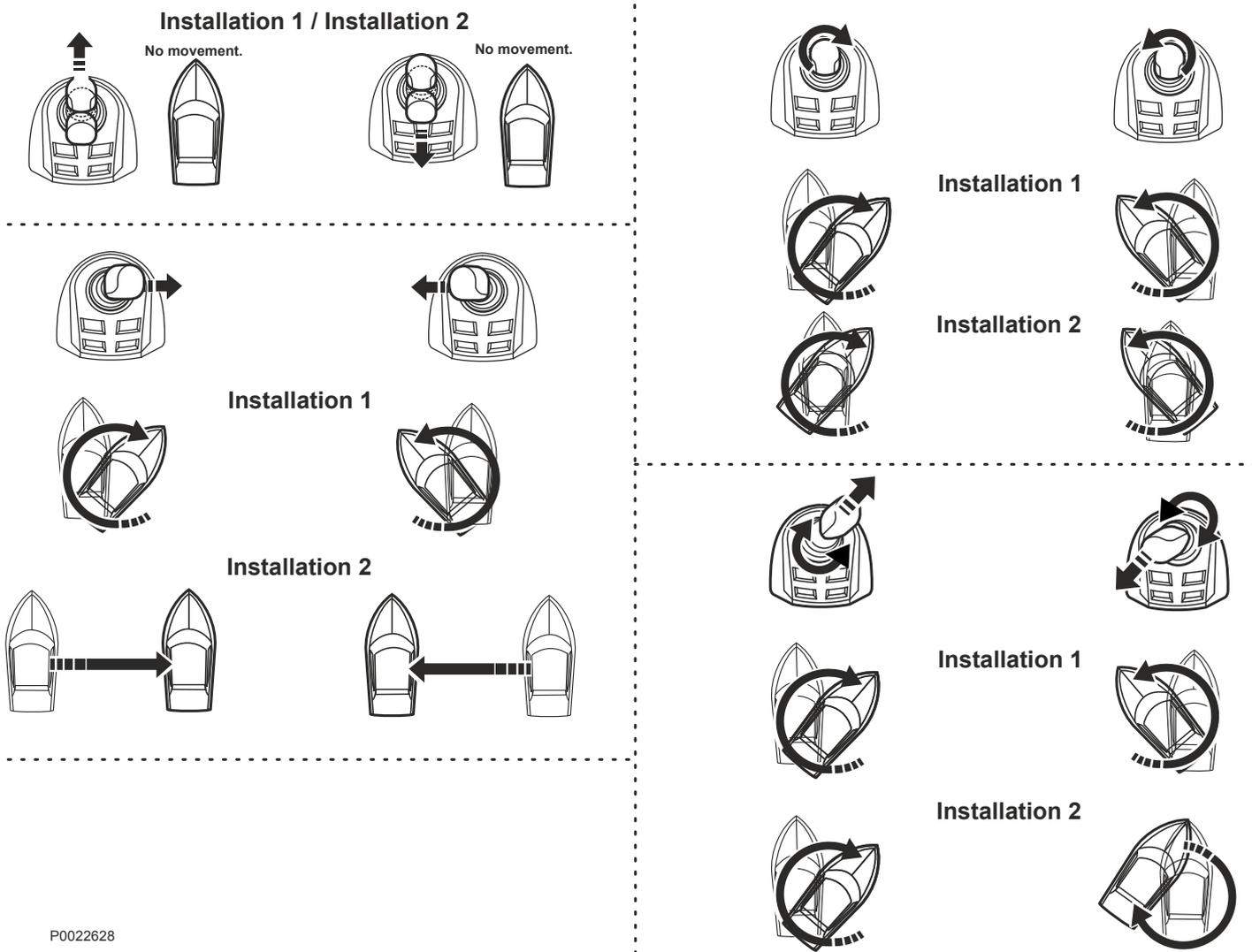
The boat can be equipped with just a bow thruster (**Installation 1**) or with both a bow and a stern thruster (**Installation 2**).

The boat is maneuvered by moving the joystick forward, aft, abeam, twisting the top of the joystick and combinations of the movements.

Depending on installation, the boat's movement may differ. The pictures shows the boat's movement for each installation.

⚠ CAUTION!

The boat will continue to move in the selected direction even when the joystick has been released. To slow the boat or reverse its direction, move the joystick in the opposite direction.



P0022628

Joystick Driving

NOTICE! Function Joystick Driving only works together with Bukh autopilot.

The Joystick Driving function allows the joystick to be used during passage to adjust the boat's heading and maneuver the boat in the same way as with the autopilot and helm steering unit.

Throttle and gear shift controls work in the normal manner.

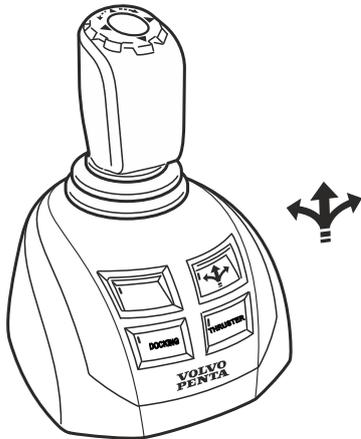
Learn to maneuver the boat with the joystick in calm, open waters.

Joystick Driving is activated and de-activated by pressing the  button on the joystick.

When Joystick Driving is activated, the autopilot is also started. While the boat is under joystick control the autopilot is in standby mode; when the joystick is released to its central position, the autopilot is activated and locks in on the new heading after a few seconds.

Like the autopilot, the helm steering unit is locked when the function is active but it may always be used for e.g. changing course or giving way to an obstacle. Twist the top of the joystick or move it sideways to reengage Joystick Driving.

If the autopilot is put in standby mode manually by means of the STBY button, Joystick Driving is switched off and must be reengaged using the button on the joystick.



P0022686

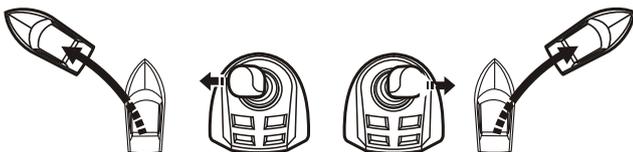


P0016293

Heading adjustments

Twist the top of the joystick to change heading incrementally. A short twist changes the heading by a fixed increment while a twist held firm will change the heading through several increments.

The autopilot shows the heading with a digital value and an indicator in shape of a blue triangle, a yellow arrow shows the new heading that the boat will be set to.



P0004011

Maneuvering

The joystick can also be used to maneuver the boat in the same manner as with a helm steering unit. Move the joystick sideways to steer the boat in the same direction. When the joystick is released, the autopilot will set a new heading that corresponds to boat heading.

NOTICE! Full joystick movement to one side corresponds to full helm. Maneuvering abeam provides a faster response than adjusting the heading by twisting the top of the joystick.

Autopilot

For information about Autopilot in glass cockpit displays, refer to the Glass Cockpit Manual. Go to **Info > Owner's Manual** to see the manual in the display or download the latest manual on www.garmin.com

Bukh **Autopilot** consists of a compass unit and the Glass Cockpit Display. The autopilot adjusts boat steering to hold the boat on a straight course. Several different steering patterns can be set and the autopilot also permits manual steering.

Read the instructions carefully and learn to maneuver the boat with the aid of the autopilot in calm, open waters.

NOTICE! The helmsman is responsible for piloting the boat in a safe, reliable manner, even when the autopilot is enabled. Avoid navigational hazards and never leave the helm unattended. Always be prepared to quickly take over the helm.

The autopilot is automatically in standby mode when the boat's electrical systems are switched on. The display will show the main menu or the last menu used.

When the autopilot is active, the helm steering unit is locked but may be used for e.g. changing course or giving way to obstacles. If the helm steering unit is used, the autopilot will automatically enter standby mode and must be reactivated again to function.

Battery Management System

The Battery Management system helps to ensure availability and robustness in power supply to the starter and other power consumers on board. Depending on installation, the local controls on the Battery Management unit(s) or both the local controls and the Battery Management Display can be used to control the system.

Local Control

The keypad on the BCM has four buttons, 3 for switches and one to disable remote control of the BCM. The switches not only switch power supply on and off but are also able when necessary to cross connect the service battery to the starter motor circuit when the start battery does not provide sufficient power to the starter motor.

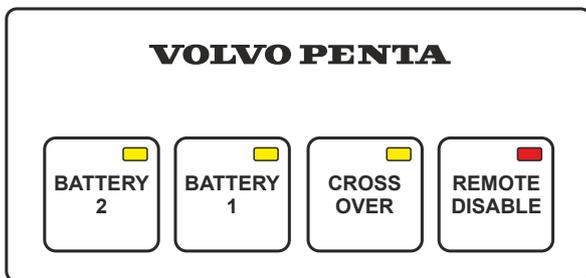
- BATTERY 1: Turns off/on the power supply for start motor and any power-user.
- BATTERY 2: Turns off/on the power supply for selected accessories.
- CROSSOVER: Crossover function. Activates cross over function between the batteries connected to the BCM. To secure power-supply.

Remote disable

In order to prevent inadvertent activation of the breakers (via the Battery Management display or external wired switches) when working on the boat's electrical system, remote control of the breakers can be deactivated.

Press REMOTE DISABLE (red LED on the button lights up) for deactivation of remote control. The breakers can still be controlled locally on the BCM.

Deactivation/activation is synchronized between all BCMs in the network.



P0021304

Remote disable.

Battery Management display

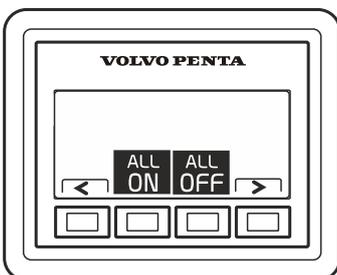
The menus are dynamic depending on the installation. Information about the battery's voltage as well as menus for battery control and settings are shown as standard.

Warning messages and other pop-up messages are also shown here. At start or during standby mode the display reverts to the view last shown.

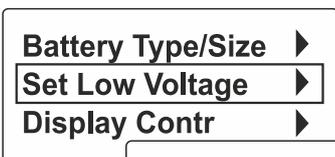
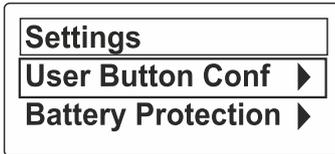
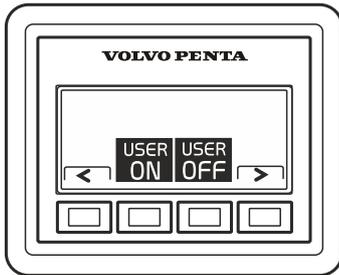
Scroll through the menus.

Return to the previous menu.

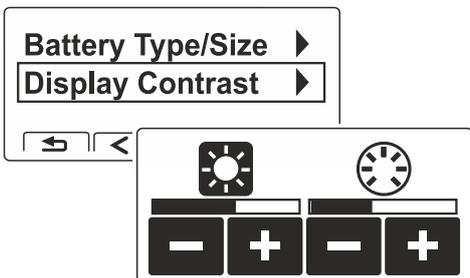
Proceed through the menus/confirm selection(s).



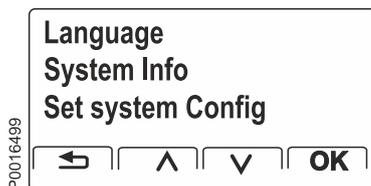
P0022807



P0016996



P0016998



P0016499

Settings

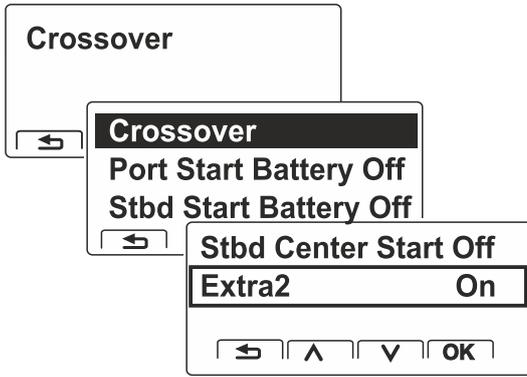
Manage and set viewing of drivelines, groups, batteries and alarm levels in the Battery Management display.

User Button Configuration. Battery and Accessory Groups. Set selection of groups to be affected by User ON and User OFF. The selected groups will then be handled simultaneously by: All ON respective All OFF.

Battery protection. Set alarm limits and levels for each battery. The values form the basis for when specified levels will alert/switch off to prevent total power loss or battery getting damaged or drained. The menu includes settings for Start Aid and Start Aid Level .

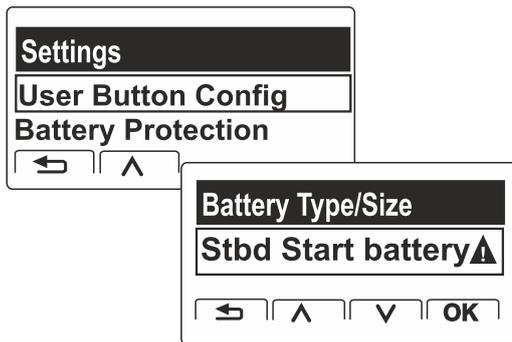
Display Contrast. Adjustment of contrast and backlighting.

Stand-alone system, non EVC installations also have the menus Language, System Information and Set System Configuration.



P0016995

Crossover Activate/deactivate the function for each individual BCM.



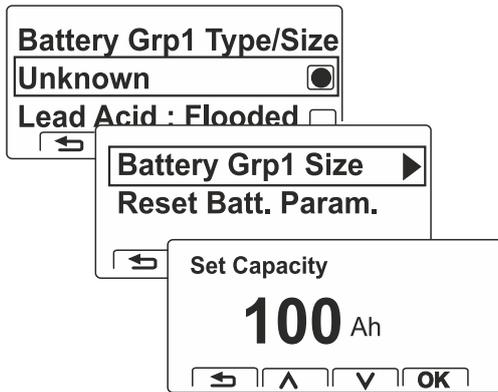
P0022173

Settings for Battery Sensor

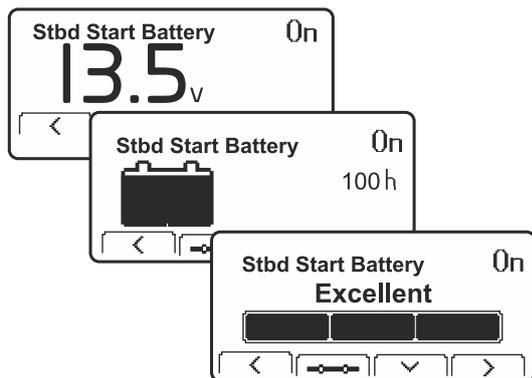
▲ The symbol indicates that settings are required.

Battery type/size. State the values stated on the manufacturer's battery. These form the basis for the information shown in the display. If a new battery or a battery sensor has been connected or removed, select **Reset** and set the current values.

NOTICE! Battery type/size is important so that the system is able to present accurate and correct information.



P0016997



P0015899

View Voltage/current

Relevant voltage and current in the battery.

Press to view:

Charging

Shows remaining capacity (%) (based on the battery's capacity when it was new) and hours remaining until battery is empty. During operations, the number of hours are shown until the battery is empty, and when the battery is charged, the number of hours are shown until a fully-charged battery.

Pressing again shows:

The battery's health status

The value shown is based on full capacity when the battery was new. The battery can have the following status:

- **Excellent** – no action required.
- **Good** – good status but the battery will not achieve its full capacity.
- **Poor** – replace the battery.

The batteries' status (On/Off) for the driveline is shown with a symbol at the bottom of the Battery Management display = Off.

Bukh Interceptor System

The Bukh interceptor system is a trim system that uses interceptors installed on the transom to act on a boat's running characteristics and provide a safer, more comfortable passage regardless of weather conditions.

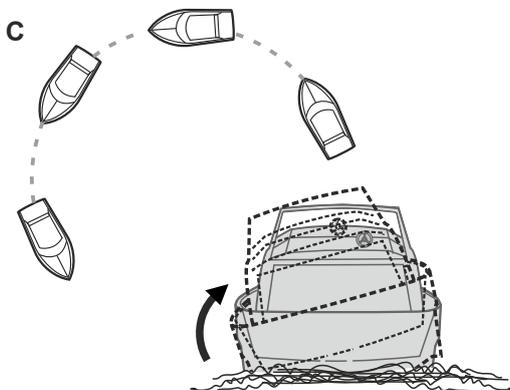
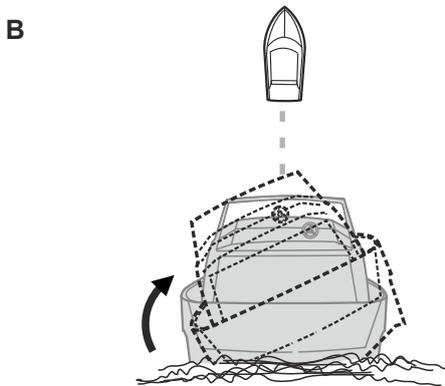
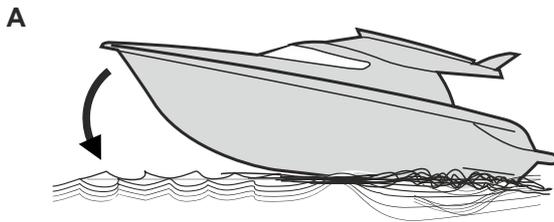
The IS system affects a boat's running characteristics at speeds of ≈ 10 knots and above.

Each interceptor has a blade that extends by varying amounts, depending on the preferred effect, and trims the boat in three axes. The IS system is available in two versions, manual and auto.

Manual means the helmsman controls the interceptor blades using control buttons.

Auto means the system is pre-calibrated and interceptor blade control is completely automatic to provide optimum safety and comfort.

For further information refer to *Operation, page 53*:



A Trimming angle of attack (the angle between the bow and the surface of the water). Improves the helmsman's visibility to provide safer passage.

B Trimming roll angle when moving dead ahead. Compensates boat heel to improve comfort e.g. when the boat is unevenly laden or in a side wind.

C Trimming roll angle in turns. Compensates boat heel, improves the helmsman's all-round visibility and provides for a more pleasant passage.

P0019746

Operation

CAUTION!

Learn to manage the system and how it affects your boat in a safe and proper manner at calm conditions.

Aquamatic

In the case of aquamatic installations the PTA (Power Trim Assist) function is always switched on. Individual adjustment of the sterndrives is not possible.

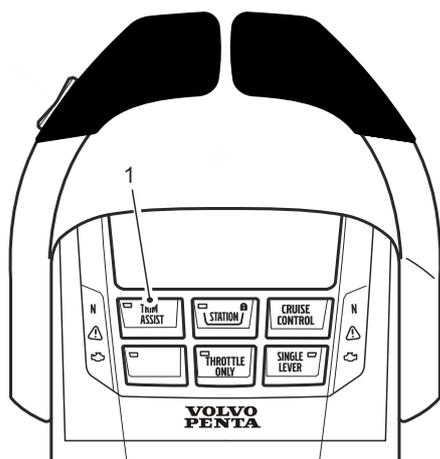
Auto

Press the TRIM ASSIST button (1) to switch on the Auto function; The button's green lamp indicates that the function is on. The system now controls the interceptors automatically.

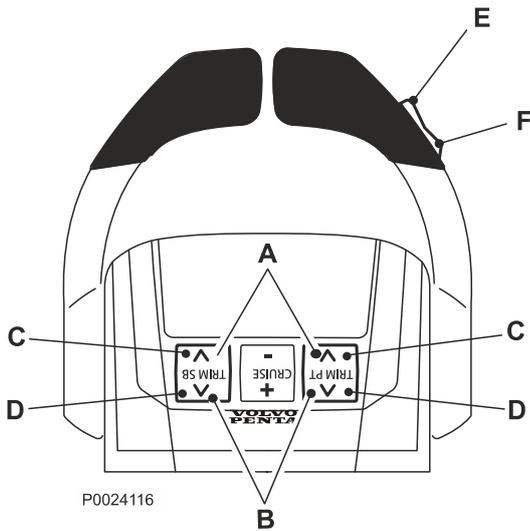
It is possible to switch between automatic and manual interceptor blade control in the Auto version. To take manual control, switch off the auto function by pressing the TRIM ASSIST button; when the button lamp is extinguished the function is off. The interceptor blades are now controlled entirely by the control buttons.

NOTICE! At start up, the system assumes the mode last selected, auto or manual.

The control buttons may be used to temporarily adjust boat trim even when the auto function is switched on. The auto function is still active but the system changes default mode. To revert to pre-calibrated auto mode, press the TRIM ASSIST button twice.



P0017629



Manual control using control buttons

Manual control of the interceptors is performed using the buttons at the back of the control.

- A All interceptors are trimmed **upward** simultaneously. The bow is raised.
- B All interceptors are trimmed **downward** simultaneously. The bow is lowered.
- C Port and starboard interceptors are trimmed **upward** individually. Used to correct heel.
- D Port and starboard interceptors are trimmed **downward** individually. Used to correct heel.
- E All drives are trimmed **upward** simultaneously.
- F All drives are trimmed **downward** simultaneously.

If both the port and starboard buttons at the back of the control are pressed at once all interceptors are trimmed in the same way as when using the control lever button.

In installations with four interceptors, the interceptors are trimmed in port and starboard pairs.

Screen Display

Interceptor blade position, i.e. how far the blades are extended, can be presented in one of the EVC system displays. The display will also indicate if the system is in auto or manual mode.

In installations with four interceptors, the interceptors are presented in port and starboard pairs.

Cleaning

The system automatically performs self cleaning by extending and retracting the blades once every 24 hours to prevent fouling of the interceptor blades. Self cleaning is performed whether or not the boat is in use.

During prolonged inactivity, e.g. winter lay-ups, self cleaning can be switched off by turning off the circuit breaker or disconnecting power.

Swim platform Interface

A swim platform interface can be connected to the EVC system in a boat with a movable swim platform. The interface will detect the position (up/down) of the swim platform and prevent the engine/s from cranking or drive/s to be trimmed up if the swim platform is lowered. It is possible to override the inhibit of crank and trim following the instructions for override in the display. Be aware of that perform override could damage the swim platform or drives. The interface will also disable the possibility to lower the swim platform when any engine is running, drive position is not centered or drive/s trimmed too high. To be able to control the swim platform when a swim platform interface is connected, all drivelines need to be in ignition ON.

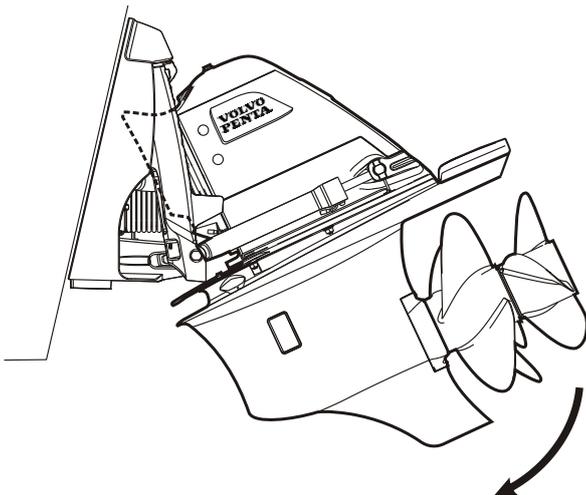
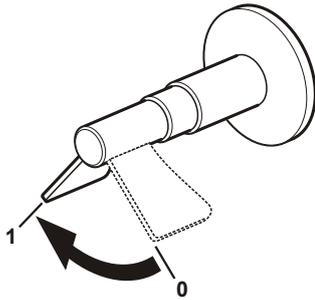
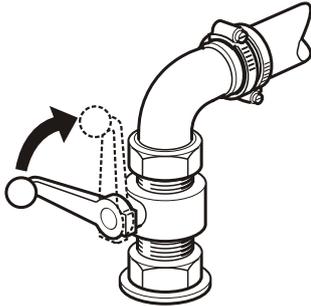
Starting

Make a habit of visually checking the engine, engine bay and transmission before start. This will help you to discover quickly if anything abnormal has occurred, or is about to occur. Also check that instruments and warning displays show normal values when you have started the engine.

To minimize cold start smoke we recommend you install an engine heater or engine bay heater if temperatures below +5°C (41°F) are encountered.

⚠ WARNING!

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



P0005850

Before Starting

- Check the engine and transmission oil level.
- Check the coolant level.
- Open the sea cock where fitted.
- Open the fuel cock.
- Turn the main switch(es) on.

IMPORTANT:

Never disconnect the current using the main switches when the engine is running. The alternator and electronics could be damaged.

- If the boat is fitted with an e-Key; unlock the EVC system with the e-Key.
- Start the engine bay fan, where fitted, and allow it to run for at least four minutes.
- Check that there is sufficient fuel for the planned trip.
- Lower the stern drive if it is up.

Starting the Engine

Shifting and adjusting speed is only possible at an active station.

On a boat with one station the station is always active.

On a boat with two or more stations the main station automatically becomes active when the engine is started up with the ignition key(s). If the engine(s) is/are started from another station this station automatically becomes active instead.

Shifting and adjusting speed is only possible at an active station. On a boat with one station, the station is always active.

The main station is automatically activated when the EVC-system is unlocked with the e- Key panel.

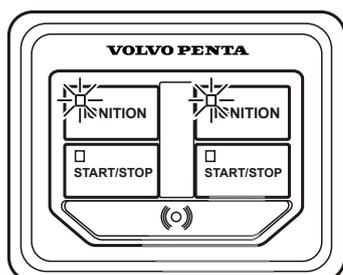
On a boat with two or more stations, the engine(s) can be started from another station with a start/stop panel – if the engine(s) are turned off. The station automatically becomes active when the engine(s) is/are started.



P0012457

Put the Gear in Neutral

Put the drive/reverse gear in **Neutral** by moving the control lever(s) to **Neutral (N)** at all stations.



P0016670

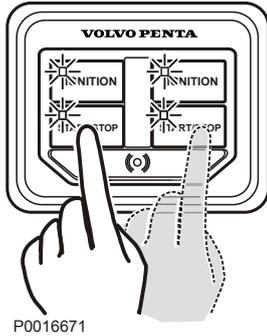
Turn On the Ignition

A green light in the **IGNITION** button indicates that the ignition is on.

Press the **IGNITION** button to switch on the ignition if the green light is not shining.

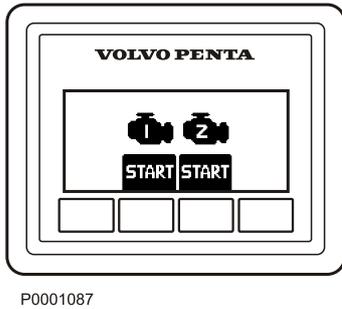
Check the instruments

If a fault is registered, it will be shown in the display; please refer to *Fault Handling, page 67* for further information and recommended actions.



Starting Using the e-Key Panel

To start, press the **START/STOP** button once for each engine.

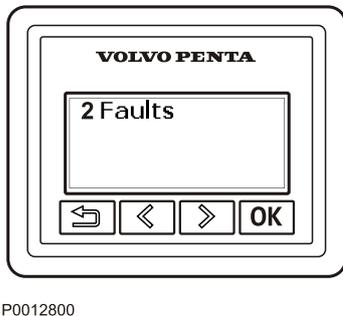


Starting Using the Start/Stop Panel

Press the **START/STOP** button for each engine. Release the button as soon as the engine has started.

Overheating protection

If the starter motor is engaged for its maximum activation time (30 seconds), the starter motor circuit is automatically cut to protect the starter motor from overheating. If possible, leave the starter motor to cool for at least five minutes before making a new start attempt.



Read the instruments and warm the engine up

Allow the engines to idle for the first ten seconds. Check that instruments and warning displays show normal values. Check that no messages are displayed and no warning signs are showing. If a fault is registered, please refer to section *Fault Handling, page 67* for further information and recommended actions. Warm the engine up at low speed and low load, so normal operating temperature is reached before full power is used.

IMPORTANT:

Never race the engine when it is cold. Racing the engine when it is cold may damage the engine components and decrease the engine lifetime.

Operation

Learn to handle the engine, controls and other equipment in a safe and proper manner before casting off on your maiden voyage. Remember to avoid sudden and extreme rudder maneuvers and gear shifts. There is a risk for passengers and crew falling over or falling overboard.

⚠ WARNING!

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.

Reading the Instruments

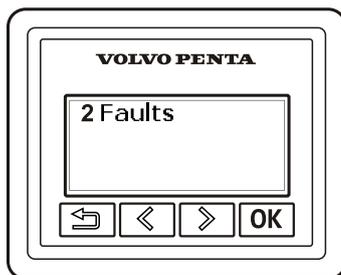
Read all instruments and alarm displays directly after starting, and then regularly during the voyage.

Alarms

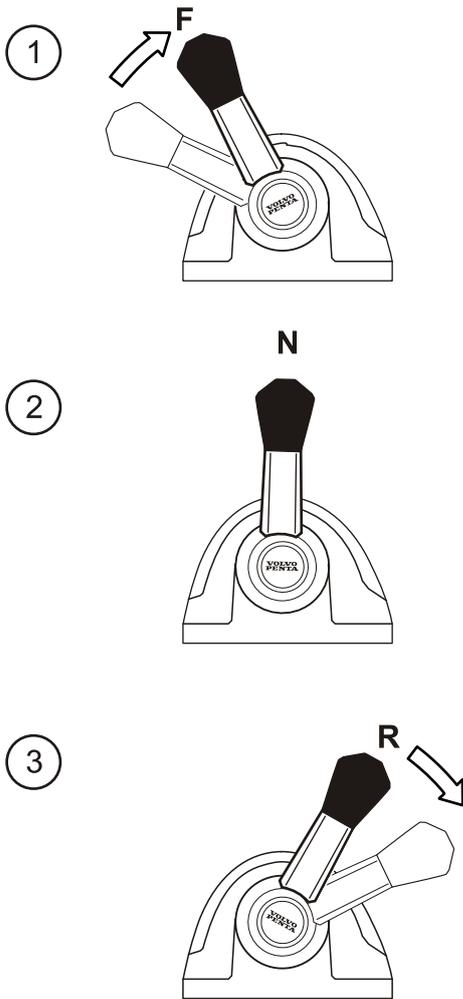
Alarms and messages are shown in the information display; some alarms do also have a sound alarm. If an alarm instrument is installed, the lamp in question will flash.

- 1 Read the message.
- 2 Acknowledge the alarm by pressing OK.
- 3 Take the indicated actions; see chapter *Fault Code Register*, page 71.

The fault will be stored as long as the fault remains. It will be possible to read out the fault code at an upcoming service.



P0012800



P0012502

Maneuvering

Shifting between forward and reverse is done at idling. Shifting at higher engine speeds can be uncomfortable for passengers and cause unnecessary stress on the transmission or cause the engine to stop.

If you attempt to shift gear at a high engine speed, a safety function is automatically activated, and will delay shifting until engine speed has fallen to 1000 rpm.

Execute a Forward/Reverse Operation as Follows:

- 1 Reduce engine speed to idle and let the boat, more or less, lose way.

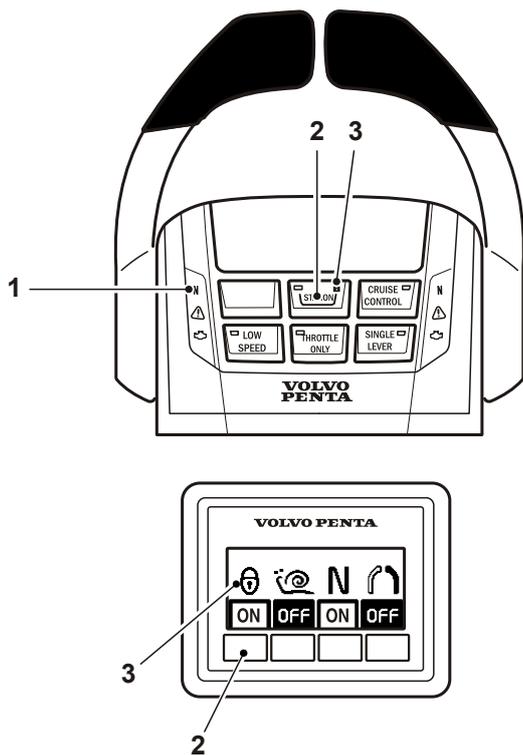
⚠ WARNING!

Never shift to reverse when the boat is planing.

- 2 Move the control lever to **Neutral (N)** with a rapid, distinct movement. Make a brief pause.
- 3 Move the control lever to **Reverse (R)** with a rapid, distinct movement and increase engine speed.

IMPORTANT:

To avoid water entering the stationary engine via the exhaust pipe, it is important that all engines are running during reverse maneuvers.



P0012976

Helm Station Change

- 1 Move the control lever(s) to neutral (**N**).
The neutral lamp (**1**) on the control lights up when the drive is in neutral.
- 2 If the helm station is locked, unlock it by pressing the **STATION** button (**2**). The padlock icon light (**3**) is switched off, indicating that the station is unlocked.
- 3 Activate the helm station being occupied by pressing the **STATION** button (**2**).
The lamp in the control button will light up when the helm station is active.

If the helm station is inactive, the lamp will be switched off.

If the padlock icon (**3**) flashes, the helm station cannot be activated. Another helm station is active and locked, or unlocked with a drive selected (not in neutral).

Locking/Unlocking Helm Stations

If a helm station is locked, it will only be possible to start and stop the engine or change helm stations from the locked helm station.

Lock or unlock an active helm station by pressing the **STATION** button (**2**).

The padlock icon (**3**) lights up when the helm station is locked.



P0003088

Cruising Speed

For best fuel economy operations at full speed must be avoided. We recommend a cruising speed that is at least 10% below the maximum engine revolutions at top speed (full throttle).

Depending on hull type, the choice of propeller, the load and sea state etc., the maximum revolutions at top speed may vary, but they should be within the full throttle range; refer to *Technical Data*, page 128.

If the engine is unable to reach its maximum throttle range, this may be due to a number of factors mentioned in *Fault Handling*, page 70.

Select a propeller with greater pitch if actual engine revolutions exceed the full throttle range. Contact your Bukh dealer for advice.

Synchronizing Engine Speed

When driving with twin engines, both the operating economy and comfort will be increased when the engines are operating at the same engine speed (rpm). When the synchronization function is activated, the engine speed (rpm) of the starboard engine is automatically adjusted to that of the port engine. The synchronization function is activated automatically if the following conditions are met.

- 1 The engine speed levers for both engines are in (approximately) the same position.
- 2 The engine speed levers are in a forward position.

The synchronizer is disengaged as soon as the conditions are no longer met or if the engines reach maximum throttle.

Engine Shutdown

Allow the engine to run at low idle, in neutral, for a few minutes after operations are completed. In this way after-boiling is avoided at the same time as temperature equalization takes place. This is especially important when the engine has been run at high rpm or under heavy load.

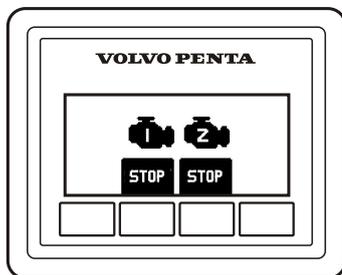
Stop the Engine

IMPORTANT:

Never disconnect the current using the main switches when the engine is running. The alternator and electronics could be damaged.

IMPORTANT:

Make sure the ignition is turned off before the main switches are switched off. Otherwise the alternator and electronics could be damaged.



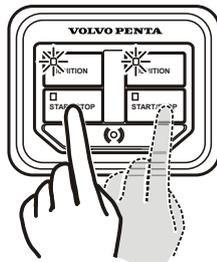
P0013099

Stopping Using the Start/Stop Panel

- 1 Disengage the drive/reverse gear by putting the control lever in neutral.
- 2 Stop the engine(s) by pushing the START/STOP button(s).

Stopping Using the e-Key

- 1 Disengage the drive/reverse gear by putting the control lever in neutral.
- 2 Push the stop button(s). Release the button(s) when the engine(s) has/have stopped.



P0016518

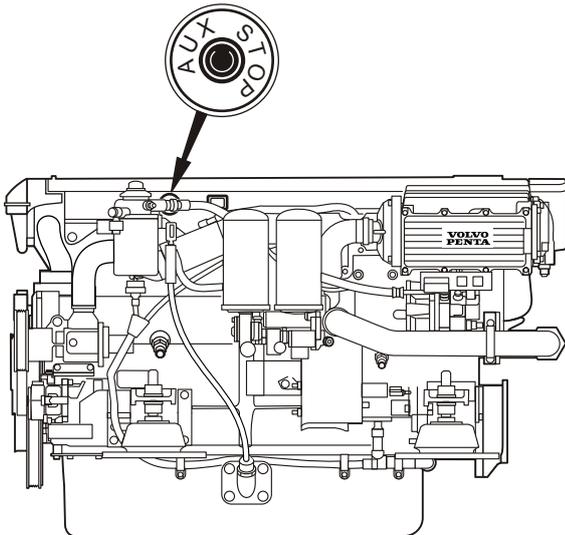
Turn the ignition off and lock the EVC system

To turn the ignition off, press the IGNITION button. The green lamp in the IGNITION button goes out to indicate the ignition is off.

To lock the EVC system, hold the key fob in front of the symbol on the e-Key panel. A flashing red light indicates the system is locked.

Auxiliary stop

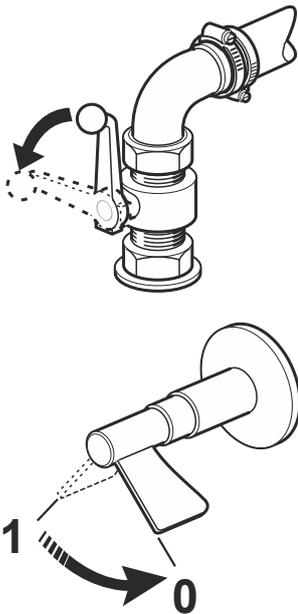
If the engine cannot be stopped in a normal procedure, it is possible to stop the engine via the auxiliary stop mounted on the side of the engine.



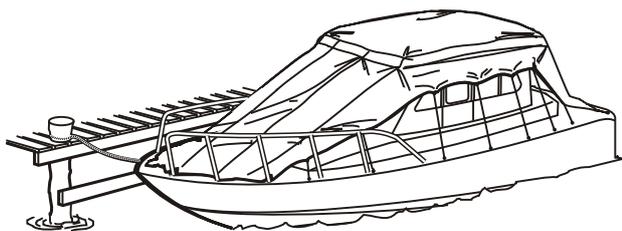
P0003709

After Engine Shutdown

- Check the engine and engine bay for leakages.
- Close the fuel tap.
- Close the sea cock where fitted.
- Take an hour meter reading and carry out preventive maintenance according to the maintenance schedule.
- Boats with stern drives: Trim the stern drive down to maximum to protect the trim ram piston's untreated surfaces from fouling.
If there is a risk of the boat striking bottom with the stern drive, the drive must instead be trimmed up to the maximum lift position.
- Turn off the main switch before any long stoppage.



P0005914



P0002451

Operation Break

Operation break with the boat in water

If the boat is not used, but left in the water, the engine must be warmed up at least once every fortnight. This prevents corrosion damage in the engine.

If you expect the boat to be unused for two months or more, it must be inhibited, please refer to *Storage, page 110*.

Operation break with the boat out of water

Where boats are kept laid up on land when not in use, there is a lower level of galvanic corrosion protection due to oxidation on the sacrificial anodes. Before launching the boat the sacrificial anodes on the drive and shield must be cleaned with emery paper to remove any oxidation.

If you expect the boat to be unused for two months or more, it must be inhibited, please refer to *Storage, page 110*.

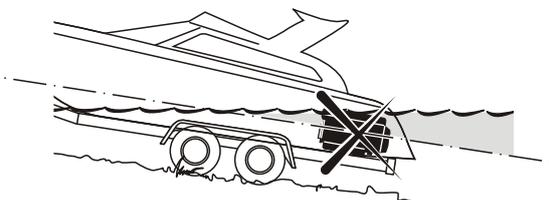
IMPORTANT:

Use emery paper. Do not use a wire brush or other steel tools when cleaning, as these may damage the galvanic protection.

Laying Up and Launching

IMPORTANT:

If the boat submerges significantly below the static waterline when it is laid up or launched there is a risk of water entering the engine through the exhaust system.



P0003798

Trailing Your Boat

Check local legislation in respect of boat transportation by trailer - there are differences in various national trailer regulations.

Boats with stern drives

Trim the stern drive up to its "lift position" (maximum lift) before the boat is pulled onto the trailer for transportation. It is possible to trim the stern drive without starting the engine. When the stern drive has reached the highest lift position an automatic catch switches off the current to the trim pump. The catch is released automatically when the stern drive is trimmed down.

Always secure the stern drive in the up position with a trailer kit (accessory) or similar so that it cannot fall onto the trailer during transportation.

▲ WARNING!

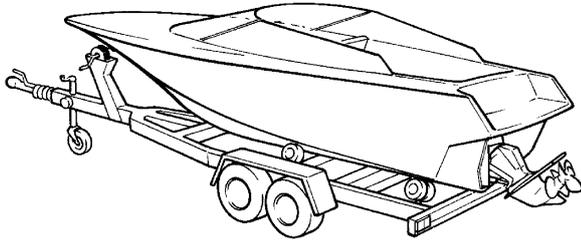
The engine must not be run with the drive in the "lift" range.

Boats with reverse gear

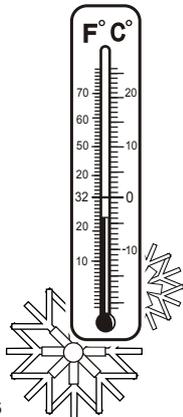
Drain the water from the exhaust system to prevent water entering the engine while the boat is being transported by trailer.

Cold Weather Precautions

If the engine bay cannot be kept frost free, the sea water system must be drained and the freshwater system coolant must have sufficient frost protection to prevent frost bursting; refer to *Maintenance, page 97* and *Seawater System, Draining, page 99* respectively for more detailed information. Check the charge status of the battery. A poorly-charged battery can freeze and burst.



P0002453



P0005905

Fault Handling

Despite regular maintenance according to the maintenance schedule and perfect operation conditions, faults that need to be attended to during travel, may occur. This chapter describes some possible alarms and fault handling. Note that the content of this chapter does not provide full coverage of the possible fault messages and alarms. Contact a Bukh workshop for assistance with diagnostic readouts and unresolved faults.

NOTICE! The thruster is not a Bukh product. For assistance with faults regarding the thruster, please contact the thruster supplier service center. If needed, contact your Bukh dealer for more information.

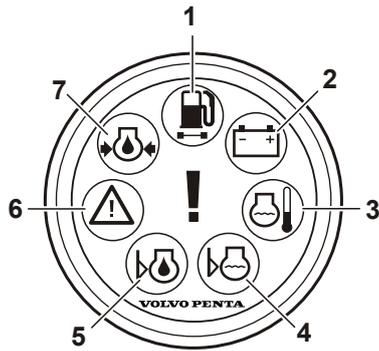
Alarm Handling

If a fault is discovered, the driver is warned via a buzzing alarm and a message in the display.

Refer to *Fault Code Register, page 71* for more information regarding cause of fault and measures to take.

The engine, transmission and EVC system are monitored by the diagnostic function. Should the diagnostics function discover a malfunction, it will ensure continued operation by protecting the engine. Depending on how serious the malfunction is, the affect on the engine will vary.

- Minor malfunction which does not damage the engine or transmission.
Affect on engine: None.
- Serious malfunction which will not immediately damage the engine or transmission, e.g. high coolant temperature.
Affect on engine: Engine power is reduced until faulty value becomes normal.
- Serious malfunction which will cause serious damage to engine or transmission.
Affect on engine: Engine power is reduced.
- Serious malfunction which makes it impossible to control the engine or transmission.
Affect on engine: Transmission is disengaged and engine speed is reduced.
- Serious malfunction on transmission or in the engine fuel injection system.
Affect on engine: Engine is stopped.



P0004761

Alarm Display (Optional)

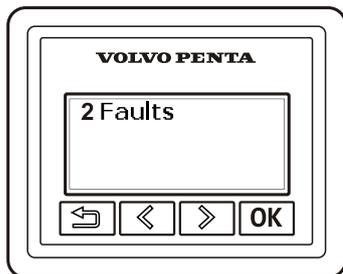
If a lamp in the alarm monitor flashes, it means a malfunction has been detected.

- 1 If the orange **Water in Fuel** lamp is lit, there is too much water in the water separator on the fuel prefilter.
- 2 If the **Charging** lamp is lit, the alternator has stopped charging.
- 3 If the **Coolant Temperature** lamp is lit, the coolant temperature is too high.
- 4 If the orange **Coolant Level** lamp is lit during operation, the coolant level is too low.
- 5 If the orange **Oil Level** lamp is lit during operation, the engine oil level is too low.
- 6 If the red **Warning** lamp is lit during operation, a serious malfunction has been detected.
If the orange **Warning** lamp is lit during operation a malfunction has been detected.
- 7 If the red **Oil Pressure** lamp is lit during operation, the engine oil pressure is too low.

Acknowledge message

- 1 Push OK to acknowledge the alarm. The buzzer will become silent.
- 2 Read the message.
- 3 Push OK again and the message will disappear.

The alarm must be acknowledged before the engine can be started.

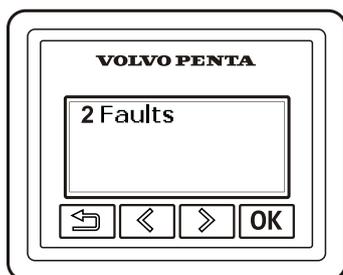


P0012800

Faults List

NOTICE!

In Glass Cockpit Displays, the faults are listed in Warning Manager. For information about how to deal with the fault messages in Warning Manager, see the integrated Glass Cockpit Operator's Manual. Go to **Info > Owner's Manual** to see the manual in the display or download the latest manual on www.garmin.com.



P0012800

Information Display

The number of registered faults is displayed in the Information Display.

- 1 Press the **OK** button to navigate to the submenu.
- 2 If more than one fault is registered, use the arrow buttons to browse through the fault list.
- 3 Press the **OK** button twice to see information about the cause of the fault and the corrective action.
- 4 Return to the previous menu by pressing the  button.

Deleting Faults From the List in Information Display

Acknowledged faults are automatically deleted from the fault list when the ignition is turned off. Stop the engine and check that the ignition is turned off at all helm stations. The faults are still stored in the system and can be accessed via diagnostic readout by a Bukh workshop.

When system power is reconnected, any remaining faults are displayed on the screen.

Faults that have not been remedied must be acknowledged every time system power is switched on.

Fault Tracing

A number of symptoms and possible causes of engine malfunctions are described in the table below. Always contact your Bukh dealer if problems occur which you can not solve by yourself.

Read through the safety advice for care and maintenance work in chapter *Safety precautions for maintenance and service operations* before starting work.

Symptoms and possible causes

Pop-ups are shown in the tachometer display	See chapter <i>Fault Code Register</i>
Starter motor not turning (or slow)	1, 2, 3, 24
Engine does not start	3, 4, 5, 6, 7, 24
Engine starts but stops again	6, 7, 24
Engine difficult to start	4, 5, 6, 7
Engine does not reach correct speed at wide open throttle (WOT)	5, 6, 7, 8, 9, 10, 11, 15, 18, 19, 20, 21, 24
Engine knocks	4, 5, 6, 7
Engine runs unevenly	4, 5, 6, 7, 10, 11, 17, 18, 20
Engine vibrates	15, 16
High fuel consumption	8, 9, 10, 12, 15, 21
Black exhaust smoke	10
Blue or white exhaust smoke	12, 21, 22
Low oil pressure	13, 14
Engine coolant temperature too high	17, 18, 19, 20, 21
No charge or poor charge	2, 23

- | | |
|--|--|
| <ol style="list-style-type: none"> 1. Flat batteries 2. Poor contact/open circuit in cables 3. Fuse tripped or faulty relay 4. Lack of fuel 5. Fouled fuel filter 6. Water/contaminants in the fuel 7. Leakage in the fuel system 8. Boat abnormally loaded 9. Fouling on underwater hull/propulsion unit/propeller 10. Insufficient air supply 11. Engine coolant temperature too high 12. Engine coolant temperature too low | <ol style="list-style-type: none"> 13. Lubricating oil level too low 14. Blocked oil filter 15. Defective/incorrect propeller 16. Defective engine mounting 17. Too little coolant 18. Blocked seawater intake/pipe/filter 19. Circulation pump drive belt slipping 20. Defective impeller 21. Defective/incorrect thermostat 22. Lubricating oil level too high 23. Alternator drive belt slipping 24. Stored diagnostic fault codes
The codes can only be read and erased by a service technician. |
|--|--|

Fault Code Register

⚠ CAUTION!

Read the safety precautions for maintenance and service in the Maintenance Safety Information chapter before starting work.

When a malfunction is discovered, the helmsman is warned by a sound alarm and a message is concurrently shown in the display.

This chapter gives a more detailed description of the messages together with suggested actions to take.

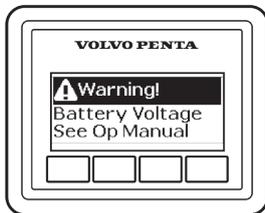
Contact your Bukh dealer if the fault remains after trying the corrective actions associated with the fault.

Message

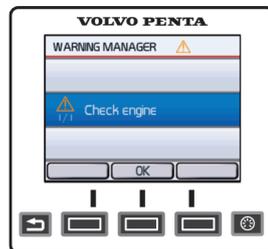
If a malfunction is discovered, a message is shown on the display. The message is presented in the list below together with a description of how the system might be affected and suggested actions to take.

Thruster fault messages

NOTICE! The thruster is not a Bukh product. For assistance with faults regarding the thruster, please contact the thruster supplier service center. If needed, contact your Bukh dealer for more information.



P0022689



Emergency Stop Switch

Reset the external stop button.

Battery Voltage

Possible cause: The alternator output voltage is too low.

Corrective action:

- Check the battery. Refer to *Battery, page 105*.
- Check belt tension. Refer to *Drive Belt, Check and Change, page 92*.

Can Not Start, Trim Too High

Possible cause:

- The drive is tilted too high.
- Trim sender failure.

Corrective action: It is possible to override the immobilizer by pressing the start button for 5 seconds and then stop pressing the button.

Check Control Lever

Possible cause:

- Shift and throttle incorrect.
- Slip function not available.

Corrective action: Acknowledge the fault by moving the control to **Neutral** and press the **OK** button. Engine power is reduced and the gear is automatically set to **Neutral**.

Check Engine

Possible cause:

- Battery voltage is incorrect.
- The fuel pressure is incorrect. Engine performance might be affected.
- Communication failure automatically sets the gear to **Neutral**. Engine performance might be affected.
- The oil pressure is too low and the engine power is reduced.

Corrective action:

- Check the battery. Refer to *Battery, page 105*.
- Check the oil level and that there is no leakage. Refer to *Oil level, checking and topping up, page 94*.

Check EVC System

Possible cause:

- Limited or no steering.
- Shift and throttle are unavailable and the gear has automatically been set to **Neutral** as engine power is reduced and the helm station has lost communication with the engine.
- Control panel failure.

Corrective action:

- Use alternative helm station if possible.
- Check if any buttons are stuck.

Check Joystick

Possible cause: Joystick failure.

Corrective action: Check if any button has stuck. Use steering wheel or choose alternative station.

Check Multilink

Possible causes: Limited instrumentation — the control unit has a communication fault.

Corrective action: Contact your Bukh workshop.

Check transmission

Possible cause:

- The gear is automatically set to **Neutral** and it is not possible to shift the gear until the fault has been acknowledged.
- The gear shift is malfunctioning.
- The slip function is limited.
- **Lowspeed** is not available.
- Transmission oil pressure is not available.
- Transmission oil temperature is not available.
- The engine is automatically emergency stopped.

Corrective action:

- Acknowledge the fault by moving the control to **Neutral** and press the **OK** button.
- Check transmission oil level.

Check Shift Actuator

Possible cause: The gear shift is unavailable.

Corrective action: Acknowledge the fault by moving the control to **Neutral** and pressing the **OK** button.

Check Steering Wheel

Possible cause: Steering is limited or unavailable.

Corrective action: Contact your Bukh workshop.

Coolant Level

Possible cause: The coolant level is too low. The sensor cable is disconnected.

Corrective action:

- Check the coolant level and also check for leakage. Refer to *Coolant Level, Checking and Topping Up*, page 98.
- Check the sensor cable connection.

Coolant Pressure

Possible cause: The coolant pressure is too low.

- Corrective action:
- Check the coolant level. Refer to *Coolant Level, Checking and Topping Up, page 98*.
 - Check that the seawater filter is not blocked. Refer to *Seawater Filter, Check and Cleaning, page 102*.
 - Check the impeller in the seawater pump. Refer to *Impeller, Check and Change, page 100*.
 - Check that there is no leakage.

Coolant Temperature

Possible cause: The coolant temperature is too high.

- Corrective action:
- Check the coolant level. Refer to *Coolant Level, Checking and Topping Up, page 98*.
 - Check that the seawater filter is not blocked. Refer to *Seawater Filter, Check and Cleaning, page 102*.
 - Check the impeller in the seawater pump. Refer to *Impeller, Check and Change, page 100*.
 - Check that there is no leakage.

Engine Oil Filter

Possible cause: There is an oil pressure difference and engine power is reduced.

Corrective action: Contact your Bukh workshop.

Engine Oil Level

Possible cause: The oil level is too low.

NOTICE!

In rough following seas or head seas, the system may incorrectly sense that the engine oil level is too low. If this happens, acknowledge the fault, and perform corrective actions just in case.

- Corrective action:
- Check the engine oil level. Refer to *Oil level, checking and topping up, page 94*.
 - Check that there is no leakage.

Engine Oil Pressure

Possible cause: Oil pressure is too low and the engine power is reduced.

Corrective action:

- Check the engine oil level. Refer to *Oil level, checking and topping up, page 94*.
- Check that there is no leakage.

Engine Oil Temperature

Possible cause: The engine oil temperature is too high and the engine power is reduced.

Corrective action:

- Check the oil level. Refer to *Oil level, checking and topping up, page 94*.
- Check that there is no leakage.

Engine Speed

Possible cause: Engine performance may be compromised and engine power is reduced.

Corrective action: Contact your Bukh workshop.

Exhaust Temperature

Possible cause: The exhaust temperature is too high and engine power is reduced.

Corrective action: Contact your Bukh workshop.

Fuel pressure

Possible cause: The fuel pressure is too low.

Corrective action:

- Check the fuel level.
- Check that there is no fuel leakage.
- Check that the fuel filters are not blocked. refer to, *Maintenance, page 95*.

Fuel Temperature

Possible cause: The fuel temperature is too high.

Corrective action:

- Check the fuel level.
- Check that there is no fuel leakage.

Helm Restarted

Possible cause: The engine has lost communication with a helm station and engine power is reduced.

Corrective action: The helm station is automatically restarted.

Intake Manifold Temperature

Possible cause: Charge air temperature is too high and engine power is reduced.

Corrective action: Contact your Bukh workshop.

Key Failure

Possible cause: A button on the e-Key panel is pressed down.

Corrective action: Verify that the button is not pressed down.

Power Trim Faults

Possible cause: Drive unintentionally moved in. Not possible to control the power trim.

Corrective action: Verify power trim angle before you continue your journey.
Refer to *In Case of Emergency*, page 85.

Primary Battery

Possible cause: Poor batteries or poorly charged batteries.

Corrective action: Change or charge batteries. Refer to *Battery*, page 105.

Secondary Battery

Possible cause: Poor batteries or poorly charged batteries.

Corrective action: Change or charge batteries. Refer to *Battery*, page 105.

Sensor Failure

Possible cause: A sensor failure may be affecting engine performance.

Corrective action: Contact your Bukh workshop.

Steering failure

Possible cause: The helm station has lost communication with the steering actuator.

Corrective action: Please contact a Bukh workshop.

Steering Oil High Temp

Possible cause: The temperature on the steering oil is too high.

Corrective action: Check hydraulic steering oil cooling system. refer to *Maintenance*, page 109.

Steering Oil Low Temp

Possible cause: If the temperature of the steering oil is below 5°C (41°F) a message will be displayed every thirty seconds until the oil reaches normal operating temperature.

Water in Bellows

Possible cause: Water in bellows.

Corrective action: Inspect bellows.

Water in Fuel

Possible cause: Water has entered the fuel filter(s).

Corrective action: Empty the water trap underneath the fuel filters. Refer to *Maintenance*, page 95.

In Case of Emergency

Despite regular service in accordance with the planned maintenance schedule and perfect operating conditions, faults may occur that must be remedied before the boat can continue its trip. This chapter provides advice on how to remedy a number of conceivable faults.

When certain faults occur safety functions engage to protect the engine. The following may occur:

- Engine cannot be started.
- The gear is in neutral and engine speed is limited
- The engine stops

If a fault occurs, confirm any fault alarm and take the necessary measures. Refer to this section and *Fault Code Register, page 71*.

Running Aground

The automatic kick-up function releases the drive in the event of running aground or colliding with an object in the water. If the function has been triggered and the drive has kicked up, it must be trimmed back to its original position using the control buttons.

The kick-up function only protects the drive when travelling forwards. There is no protection for the drive when travelling backwards.

After running aground, check that the drive and propeller are not damaged and that the drive does not vibrate. If there is damage/vibration, the boat should be driven (if possible) slowly to a harbor and lifted out of the water.

Lift the boat ashore. Check the oil level in the drive. If the oil is gray-colored, water has entered and the drive must be inspected by an authorized Bukh workshop. The same applies if there is damage to the drive. Replace the propeller if it is damaged.

To prevent galvanic corrosion, any paintwork damage on the drive and propeller shall be repaired before launching the boat again.

Checking the tie rod

Check the tie rod that holds the drive together if you have run aground.

If the tie rod is bent, loose or damaged, it must be checked immediately by an authorized Bukh workshop. Steer the boat to a harbor at low speed.

WARNING!

If the parallel strut (tie bar) shows signs of damage, run at reduced speed to harbor. The parallel strut is a vital safety component, damage may effect steering characteristics. In the worst case steering could be lost altogether. Never align or weld a damaged parallel strut. Please contact your nearest authorized Bukh workshop for assistance.



P0002107

Starting Using Auxiliary Batteries

▲ WARNING!

Explosion hazard. Batteries contain and give off an explosive gas which is highly flammable and explosive. A short circuit, open flame or spark could cause a violent explosion. Ventilate well.

▲ WARNING!

Never confuse the positive and negative poles on the batteries. Risk of arcing and explosion.

- 1 Check that the auxiliary battery has the same voltage as the engine system voltage.
- 2 Connect the red positive cable to the plus (+) terminal on the discharged battery and then to the plus terminal on the auxiliary battery.
- 3 Connect the black start cable to the minus (-) terminal on the auxiliary battery and to a place a little distance away from the discharged battery, e.g. the start motor's negative terminal.

▲ WARNING!

Under no circumstances may the black jumper cable (-) come in contact with the positive connection on the starter motor.

- 4 Start the engine and let it run at fast idle for approximately 10 minutes to charge the batteries. Make sure there is no extra equipment connected to the electrical system.

▲ WARNING!

Working with or approaching a running engine is a safety risk. Watch out for rotating components and hot surfaces.

▲ WARNING!

Do not touch the connections during the start attempt: Risk of arcing.

Do not bend over any of the batteries either.

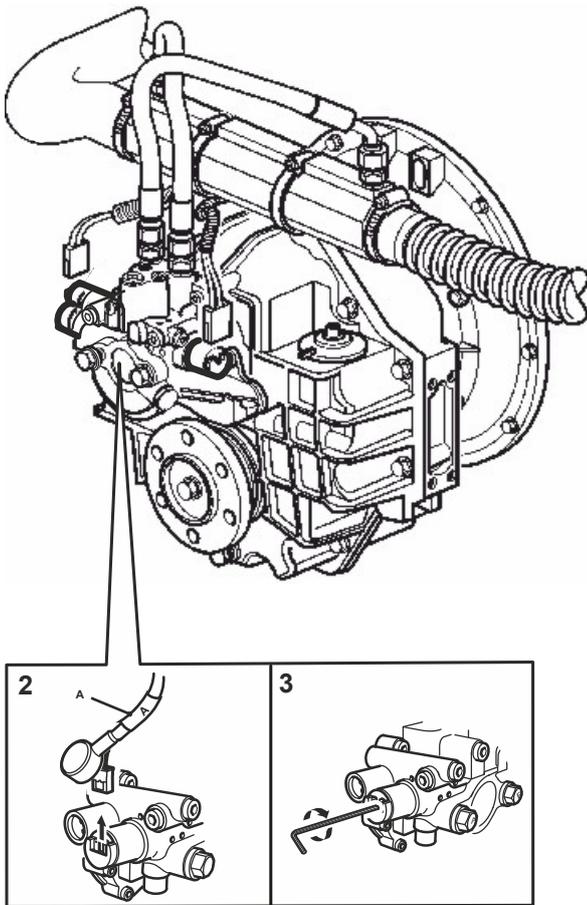
- 5 Turn off the engine. Remove the start cables in the exact opposite order to their connection.

Emergency Shifting

If a fault occurs that prevents engaging gears with the control lever (shifting), it is possible to engage them manually.

Manual shifting of gears

- 1 Stop the engine and turn off the ignition. If the boat is equipped with an ignition switch lock, take the key out of the switch lock.
- 2 Look for the "A" and "B" markings on the cable for the reversing gear shift solenoid valves. Use a screwdriver to pry off the black protective shroud enclosing the electrical connections to the solenoid valve. Then disconnect the white connector from the solenoid valves (2).
- 3 Normally the "A" side is set for forward motion in a single installation, and in a dual installation it is set for forward motion from the starboard engine. Insert a 2 mm Allen key into the "A" connection (3), then tighten the solenoid valve emergency screw at least 5 turns clockwise.
- 4 Now the gear operation has been activated for forward movement. Switch on the ignition. Fault codes can now come from the EVC system, which is normal as the shift solenoid valves are disconnected.



P0024013

NOTICE! Forward gear is now permanently activated and cannot be disengaged by the control lever. Adjust your speed accordingly!

Emergency Shifting, Drive

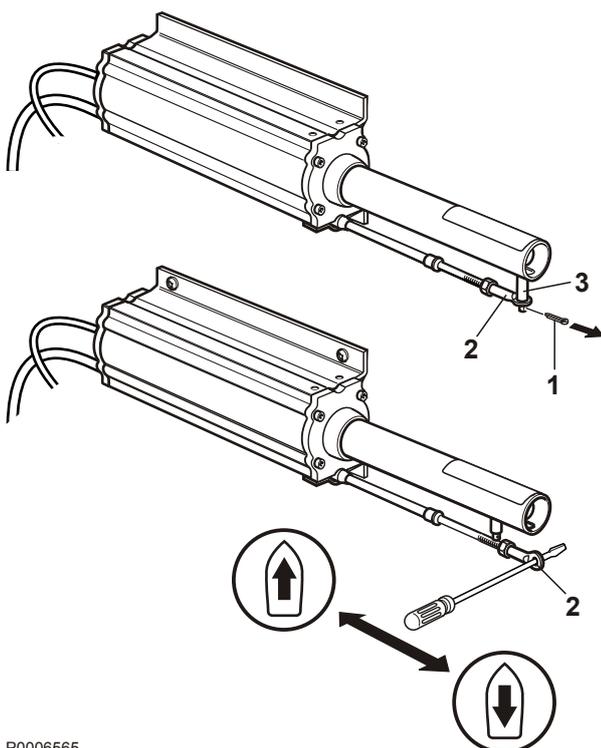
If a fault occurs which prevents the drive from being operated (shifted) with the control lever, it is possible to shift manually, using the description below.

⚠ WARNING!

In emergency shifting, the unit is locked in forwards operation. Please note that the drive can not then be disengaged with the control lever. Forward motion can only be cut off by stopping the engine with the ignition key or stop button..

Manual drive engagement

- 1 Stop the engine and take the starter key out of the starter switch.
- 2 Pull out the split pin (1) and lift the adapter (2) from the pin (3).
- 3 Place a screwdriver or similar tool in the adapter (2) hole and move the control wire horizontally.



P0006565

Emergency Steering

Emergency Alignment, Electrical Rudder Actuator

Electrical Rudder Actuator is available for inboard installations (reverse gear) with electrical steering.

If a fault occurs that prevents the electrical rudder actuator from being operated with the steering wheel, the electrical rudder actuator for straight forward operation can be aligned manually using the description in this chapter.

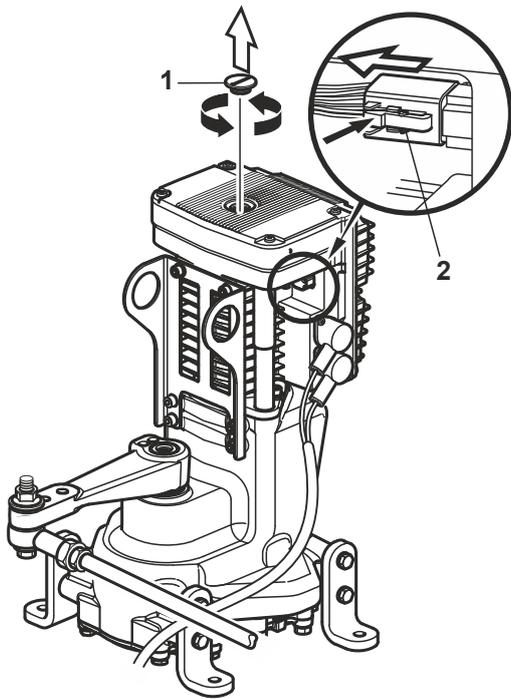
If steering is out of order, align the rudder actuator and use control levers to steer the boat.

The tools needed during this operation are supplied in a special tool box together with the boat.

WARNING!

Working with or approaching a running engine is a safety risk. Watch out for rotating components and hot surfaces.

The following procedure can be carried out with the engines running, even though it is not recommended. Wear hearing protection when in the engine room as there is a risk of harmful sound levels.

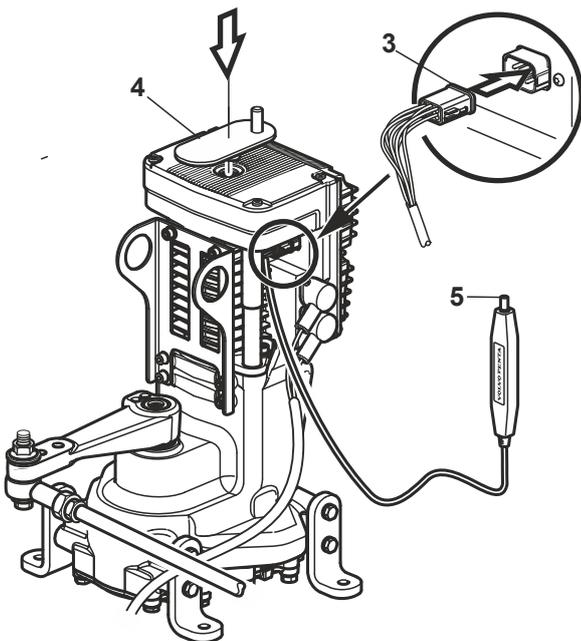


- 1 Unscrew and remove the plug (1). Disconnect the cable by pressing down the lock (2) and at the same time wiggle the connector in a forward position.
- 2 Connect the switch (3) and fit the crank tool (4).
- 3 Press down the switch button (5) and keep it pressed while carefully turning the crank tool.

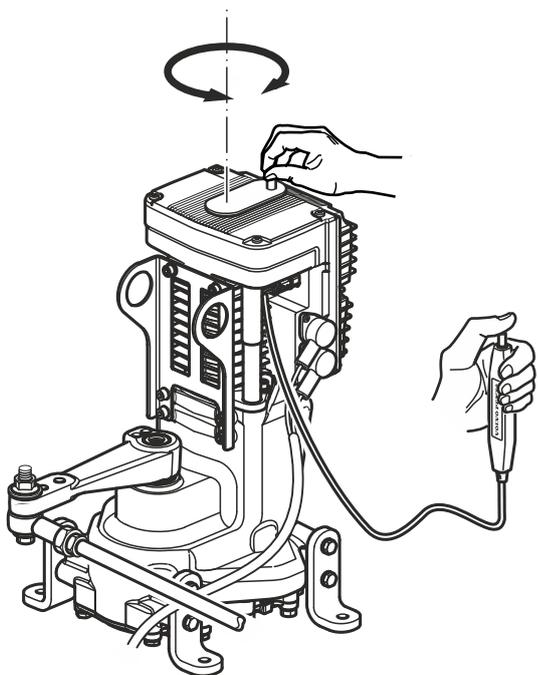
IMPORTANT:

Do not force the crank tool beyond the end position, it could damage the Electrical Rudder Actuator.

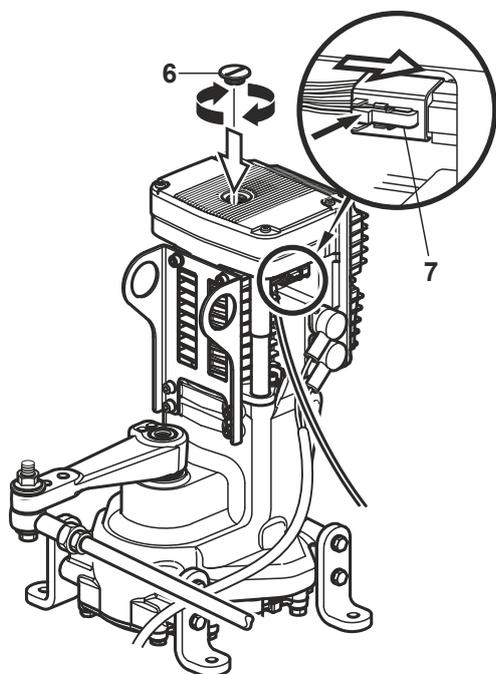
NOTICE! Do not use the crank tool while rampage.



P0022617

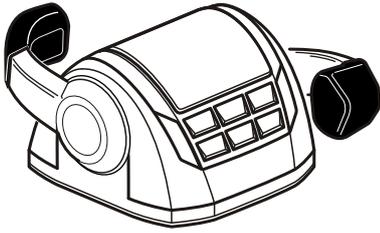


- 4 Turn the crank tool until the steering arm(s) is aligned for straight forward motion.
- 5 Remove the crank tool. Disconnect the switch by pressing down the lock and at the same time unplug the switch by slowly wiggling it. Screw the plug (6) back on.
- 6 Reconnect the cable (7) disconnected in step 1.



P0022619

Emergency steering with control levers



P0012505

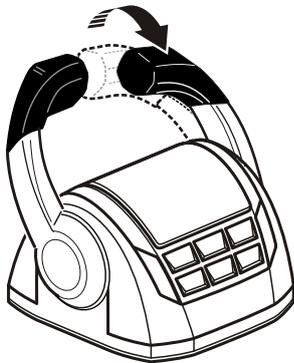


If a fault occurs that prevents the Electrical Rudder Actuator from being operated with the steering wheel, align the Electrical Rudder Actuator for straight forward operation and use the steering method described below to reach the nearest harbor.

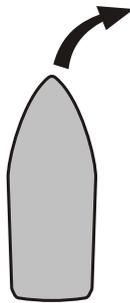
Rotate the boat

Put one control lever in the position for forward and put the other control lever in the position for reverse. Use a suitable engine speed for maneuvering.

The direction of rotation is determined by the lever which is put in the position for reverse. If the boat is to move to starboard, the starboard control lever should be put in the position for reverse.



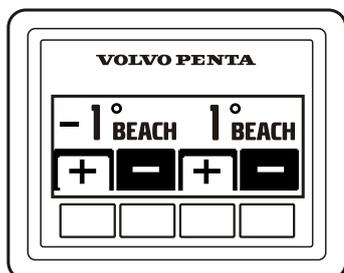
P0012506



Steering the boat

Put the control levers in forward. Use a suitable engine speed for maneuvering.

The direction of the steering is determined by the use of the control levers. If the boat is to turn to starboard, reduce speed on starboard engine. The greater the difference in speed between the control levers the more the boat turns. To make a sharp turn, move one of the control lever to reverse for a moment.



P0001189

Emergency Trimming

If a situation occurs that needs the drive to be trimmed over the trim limit, the drive can be emergency trimmed.

IMPORTANT:

When emergency trimming is performed, the automatic stop will not work. The drive can be trimmed outside the trim ranges, this can damage the boat and drive.

- 1 Press the trim button on the control or power trim panel in the direction the drive needs to be trimmed. Release the button when the trim limit is reached.
- 2 Press the button again and hold it depressed for more than 5 seconds. The drive starts trimming.

Start after crash-stop

If the engine crash-stops, the following routine must be performed before the engine can be started again.

- 1 Move control lever(s) to neutral.
- 2 Acknowledge any alarms and turn the ignition off.
- 3 Wait until the system is completely shut down and all lamps are out.
- 4 Turn the ignition on but do **not** start the engine.
- 5 Acknowledge any alarms. Start the engine.

Maintenance Schedule

Your Bukh engine and its equipment are designed for high reliability and long life. The engines are built to have the smallest possible environmental impact. If preventive maintenance is carried out, according to the maintenance schedule, these qualities will be retained and unnecessary malfunctions will be avoided. It is the owner's responsibility to make sure that the services in the service intervals are performed in order for the warranty to be valid.

NOTICE! For emission related warranty rights see *Emission Control System Warranty Statement*.

Service Intervals

Service intervals are shown below. The service content can be found in the Service Protocol available for download at www.volvopenta.com.

The Operator's Manual shows a selection of service points and how these should be carried out; also included are points that must be checked/implemented between regular scheduled services or points that the user/owner should be able to perform for reasons of safety in the event that anything unforeseeable should occur when under way. All service and maintenance points can be found in the product's Service and Maintenance Manual. Any owner wishing to carry out some maintenance and service himself can purchase this manual. For products covered by the warranty, please refer to the terms and conditions of the warranty with regard to documentation of completed services.

Extended service intervals

The interval between engine oil changes may be extended in certain circumstances. To determine whether the service interval may be extended, Volvo Penta's conditions for extended service intervals must be met and an oil analysis performed. Contact your Bukh dealer for further information.

Where both operational and calendar times are specified, perform the maintenance item at whichever time is the sooner.

In applications that include a reverse gear, the reverse gear manufacturer's service intervals must be complied with.

A-E = Type of service (regular service)

Type A Service	Every 200 hours of operation. (Recommended every 12 months)
Type B Service	Every 400 hours of operation. (Recommended every second year)
Type C Service	Every 800 hours of operation. (Recommended every second year) (Not applicable for inboard installations)
Type D Service	Every 800 hours of operation. (Recommended every fourth year) (Type C service for inboard installations)
Type E Service	Every 2000 hours of operation. (Recommended every fourth year) (Type D service for inboard installations)

NOTICE! Make sure that the service book is stamped after each performed service.

Maintenance

This chapter contains general technical information and instructions on how the prescribed maintenance items must be carried out. Read through the instructions carefully before starting work. The times when maintenance items must be carried are indicated in the *Maintenance Schedule, page 86*.

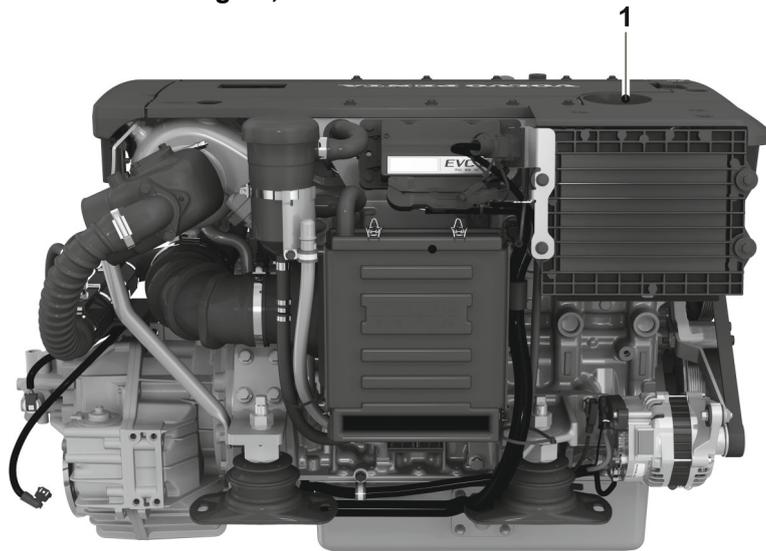
Read through the safety precautions for maintenance and service in the *Maintenance, page 90* chapter before work on the engine is begun.

Bukh recommend that all servicing with the engine running should be undertaken by an authorized Bukh workshop.

WARNING!

Care and maintenance work should be done with the engine stopped unless otherwise specified. Stop the engine before opening or removing the engine hatch/hood. Make it impossible to start the engine by removing the start key and cutting the system voltage with the main switches.

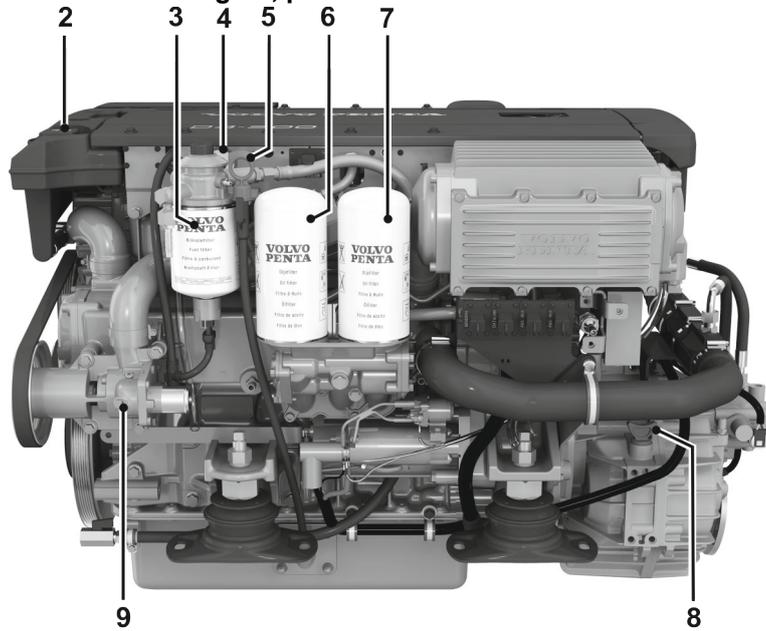
D4 with reverse gear, starboard



- 1 Oil filler cap, engine
- 2 Expansion tank
- 3 Fuel Filter
- 4 Auxiliary stop
- 5 Oil dipstick, engine
- 6 By-pass filter for engine oil
- 7 Oil filter
- 8 Oil dipstick, reverse gear
- 9 Seawater Pump

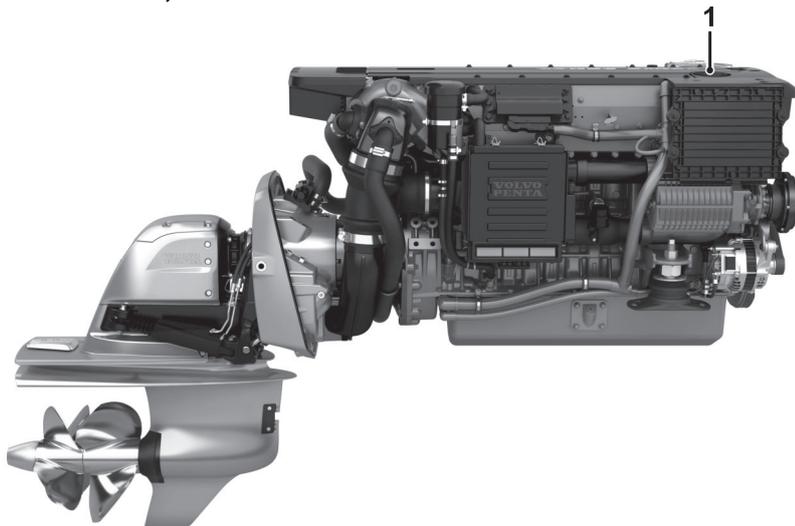
P0023076

D4 with reverse gear, port



P0023077

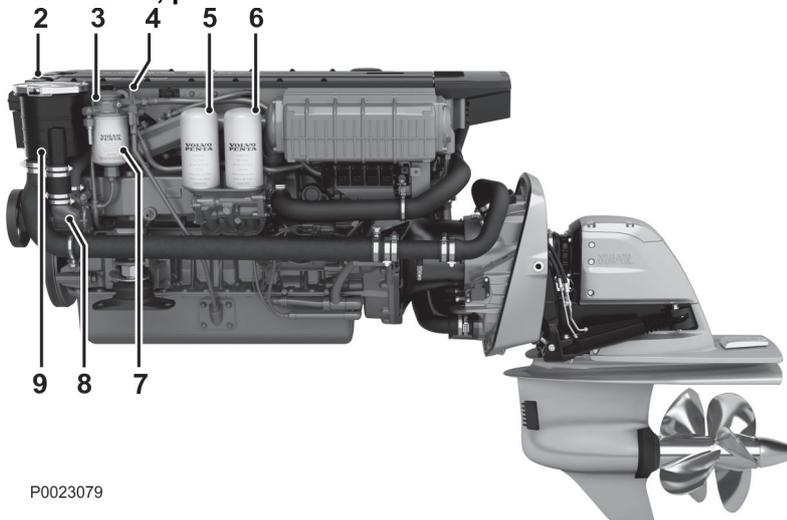
D6 with drive, starboard



P0023078

- 1 Oil filler cap, engine
- 2 Expansion tank
- 3 Auxiliary stop
- 4 Oil dipstick, engine
- 5 By-pass filter for engine oil
- 6 Oil filter
- 7 Fuel Filter
- 8 Seawater Pump
- 9 Seawater filter

D6 with drive, port



P0023079

Maintenance Safety Information

Preparations

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 Bukh dealer.

Never carry out any work on the engine if you are unsure of how it should be done; contact your Bukh dealer who will be glad to offer assistance.

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 boat engine, remove the ignition key, turn off the power supply to the engine at the main switches and lock them in the OFF position 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 a safety risk. Loose clothing, hair, fingers or a dropped tool can be caught in the rotating parts of the engine and cause serious personal injury.

Before starting the engine

Reinstall all protective parts removed during service operations before starting the engine. Check that no tools or other items have been left on the engine.

Never start a turbocharged engine without installing the air cleaner (ACL). The rotating compressor in the Turbocharger unit can cause serious personal injury. Foreign objects can also be sucked in and cause mechanical damage to the unit.

Fire and explosion

Fuel and lubrication oil

All fuel, most lubricants and many chemicals are inflammable. Read and follow the instructions on the packaging.

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, oil can spray out.

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 in proximity of a filling station or in the engine room.

Non-original components

Components used in the fuel and electrical systems on Bukh products are designed and constructed to minimize the risk of fire and explosion.

Using spare parts that comply with the specifications for Bukh original spare parts is recommended to avoid fire and explosion.

Start spray

Never use start spray or similar agents to start an engine equipped with air pre-heating (glow plugs/ starter element). This may cause an explosion in the inlet manifold. Danger of personal injury.

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, turbo unit, oil pan, charge air pipe, starter element, hot coolant and hot oil in oil lines and hoses.

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.

Chemicals

Most chemicals such as anti-freeze, rustproofing agent, inhibiting oil, degreasing agent etc. are hazardous to health. Read and follow the instructions on the packaging.

Some chemicals such as inhibiting oil are inflammable and dangerous if breathed in as well. 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 coolant filler cap when the engine is hot. Steam or hot coolant can spray out and cause burns.

If work must be carried out with the engine at operating temperature and the coolant filler cap or a cock open or a coolant hose disconnected, open the coolant filler cap carefully and slowly to release pressure before removing the cap completely. Note that the coolant may still be hot and can cause burns.

Fuel system

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

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

The engine and the area around the engine must be kept clean from fuel to avoid accidents, engine damage and injuries.

Electronic Vessel Control (EVC)

The boat has a advanced control system. Never cut or modify connectors, wiring or splice of the components.

Installing components that do not comply with the quality for Bukh original spare parts may cause the system to malfunction. We strongly recommend to use Bukh original spare parts.

Electrical system

Cutting off power

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.

Batteries

The batteries contain an extremely corrosive electrolyte. Protect your skin and clothes when charging or handling batteries. Always use protective goggles and gloves.

If battery electrolyte comes into contact with unprotected skin, wash off immediately using plenty of water and soap. If battery acid comes into contact with the eyes, flush immediately with plenty of water and obtain medical assistance without delay.

The batteries contain and emit oxyhydrogen gas, especially during charging. This gas is easily ignited and highly volatile.

Do not under any circumstances smoke or use naked flame or allow sparks in the vicinity of the batteries or battery compartment.

An incorrect connection of a battery terminal cable or jump-start cable can cause a spark which in its turn can be sufficient to cause an explosion.

Engine, General

General inspection

Make a habit of visually checking the engine and engine bay before starting, and after operations when you have stopped the engine. This will help you to quickly discover abnormalities, or if something is about to happen.

Look especially carefully for oil, fuel and coolant leakages, loose bolts, worn or poorly-tensioned drive belts, loose cable connections, damaged electrical cables and hoses. This inspection only takes a few minutes and can prevent serious malfunctions and expensive repairs.

⚠ WARNING!

Accumulations of fuel, oil and grease on the engine or in the engine room constitute a fire hazard and must be removed as soon as they are detected.

⚠ WARNING!

If an oil, fuel or coolant leak is detected, the cause must be investigated and the fault rectified before the engine is started.

Never direct the jet from a high-pressure washer at seals, rubber hoses or electrical components. Never use the high pressure setting for engine cleaning.

Drive Belt, Check and Change

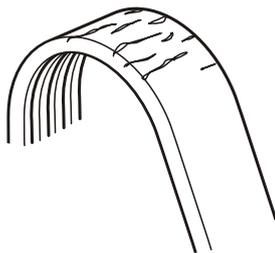
⚠ WARNING!

Stop the engine before doing any maintenance work.

General

Check belt tensions and condition regularly. A belt that is tensioned too tightly may damage bearings, while a belt too-loosely tensioned may slip.

Check and adjust the belt after operation, while the belt is still warm.



P0003090

IMPORTANT:

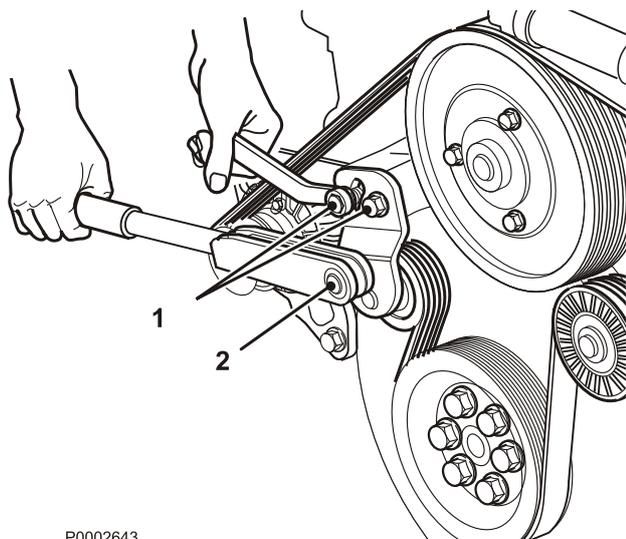
Always change a belt which looks worn or cracked.

Adjusting/replacement of drive belts

The standard alternator and water pump are driven by a poly-V belt for the best function and lifespan.

Replace/tension the belt as follows:

- 1 Loosen the screws (1) on the tension roller bracket. Remove and replace the belt as required.
- 2 Tension the belt by applying a torque to the tensioning roller square fitting (2) of **70 Nm** (52 lbf.ft). Lock the tensioning roller using screws (1). The screws must be tightened to **50 Nm** (37 lbf.ft).
- 3 Repeat the procedure when the engine is warm: Loosen screws (1) and tension the belt.



P0002643

Lubrication System

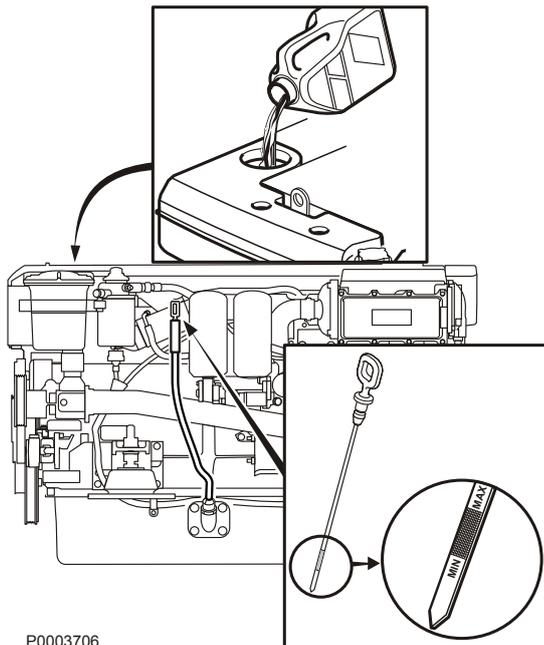
Oil change intervals can vary depending on oil grade and sulphur content of the fuel, please refer to *Technical Data, page 129*.

Oil change intervals must never exceed a period of 12 months.

If you want longer oil change intervals than stated in the table *Technical Data, page 129*, the condition of the oil must be checked by the oil manufacturers through regular oil testing.



P0002089



Oil level, checking and topping up

The oil level must be within the marked area on the oil dipstick and must be checked daily before the first start.

The oil in the engine needs some time to return to the sump before a correct oil level check can be performed.

Wait 15 minutes if the engine has been run at normal operating temperature. Wait an hour if the engine has been idling.

The oil level shall be between the MAX and MIN marks on the dipstick. Levels that are higher or lower than these marks can damage the engine.

IMPORTANT:

Do not fill up above the maximum oil level. Only use a recommended grade of oil.

See *Technical Data, page 129* for information about oil level and oil grade.

- 1 Fill the oil slowly via the filling hole on the top of the engine.
- 2 Wait 5 minutes to allow the oil time to reach the sump before checking the level again.
- 3 Then check the level again.

Fuel System

Only use the grades of fuel recommended in the fuel specification, refer to *Technical Data, page 130*. Always observe the greatest cleanliness during refueling and work on the fuel system.

All work on the unit injectors of the engine must be carried out by an authorized Bukh workshop.

▲ WARNING!

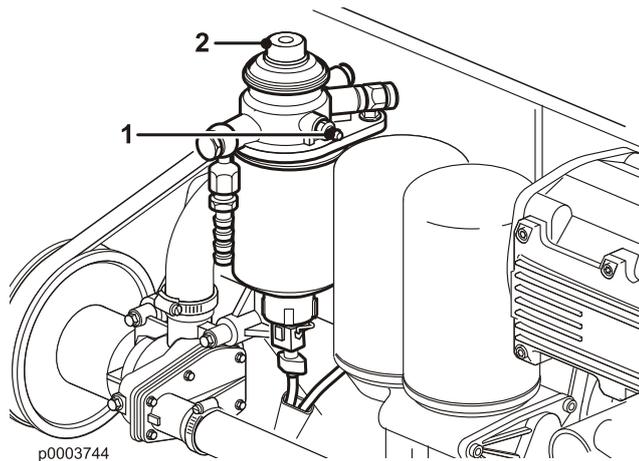
Fire hazard.

A fuel spill onto a hot surface or electrical components can cause fire.

When carrying out work on the fuel system, make sure the engine is cold.

▲ WARNING!

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



Fuel system, bleeding

The fuel system must be bled after a filter change, if the fuel tank has been run dry and after a long-term stoppage.

IMPORTANT:

Never disconnect the pressure pipe.

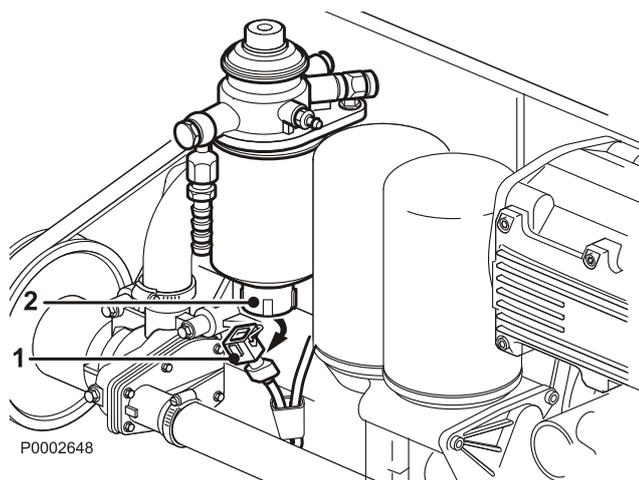
- 1 Connect a transparent hose to the bleed nipple (1). Feed the hose to a container to avoid spillage.
- 2 Open the bleeding nipple and pump fuel with the hand pump (2) until the fuel is free from bubbles. Close and tighten the bleed nipple.
- 3 Pump a further 10 times on the hand pump. Resistance in the hand pump can feel heavy, but this is completely normal and necessary to bleed the system.
- 4 Remove the hose and fit the protective cap to the bleed nipple.

Water in Fuel

If the EVC system warns for too much water in the fuel filter, the water separator needs emptying.

IMPORTANT:

Do not continue operating if there is water in the water separator, it can damage the engine.



Draining the fuel filter

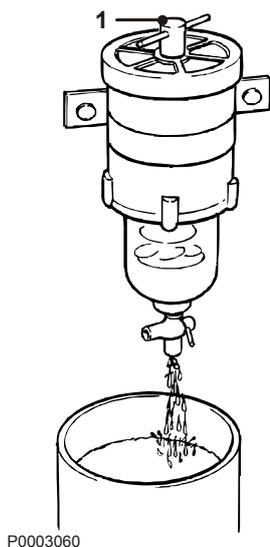
- 1 Stop the engine and turn off the ignition.
- 2 Remove the connector piece (1) from the sensor(2).
- 3 Place a container under the fuel filter and carefully unscrew the sensor (2). Let the water run out. When diesel runs out, screw in the sensor until you feel slight resistance. Then tighten an additional 1/4 to 1/2 turn.

IMPORTANT:

If the sensor is torqued more than 1/2 turn, the sensor can be damaged.

- 4 Refit the connecting piece (1).

Draining the fuel pre-filter (extra equipment)



- 1 Place a container beneath the fuel filter.
- 2 Open the bleed screw (1) on the fuel filter about 4 turns.
- 3 Drain the water and contaminants via the plug in the bottom of the filter.
- 4 Bleed the fuel system.

Freshwater System

The cooling system ensures that the engine operates at the correct temperature. It is a closed system that should always be filled with a coolant mixture.

IMPORTANT:

Coolant of a suitable chemical composition must be used all year round to protect the engine against internal corrosion, cavitation and frost bursting. This even applies when there is no risk for frost damage, to make sure the engine always has a complete corrosion protection.



Therefore, the use of anti-corrosion agents alone, or water alone as a coolant, is not permitted in Bukh engines.

The coolant must be based on Organic Acid Technology (OAT). Using an improper coolant or mixing with another coolant will rapidly reduce the performance and lifetime of the engine. Material incompatibility can lead to leakages, which - in the worst case - can cause engine breakdown.

Bukh strongly recommend the use of our own coolants, "Bukh Coolant VCS Ready Mixed" or the concentrate "Bukh Coolant VCS", which ensure the protection of the cooling system components from corrosion, ageing, swelling and cracking, thereby ensuring optimal engine lifetime.

Over time the corrosion protection additives become less effective, and consequently the coolant must be changed at regular intervals to maintain sufficient protection of the engine. The latest Service Protocol that specifies service intervals can be found at volvopenta.com.

Coolant, Mixing

It is extremely important that the system is filled with the correct coolant concentration; refer to *Technical Data, page 132*.

The coolant should be mixed with distilled, deionized water. For Bukh specified water requirements; refer to *Technical Data, page 132*.

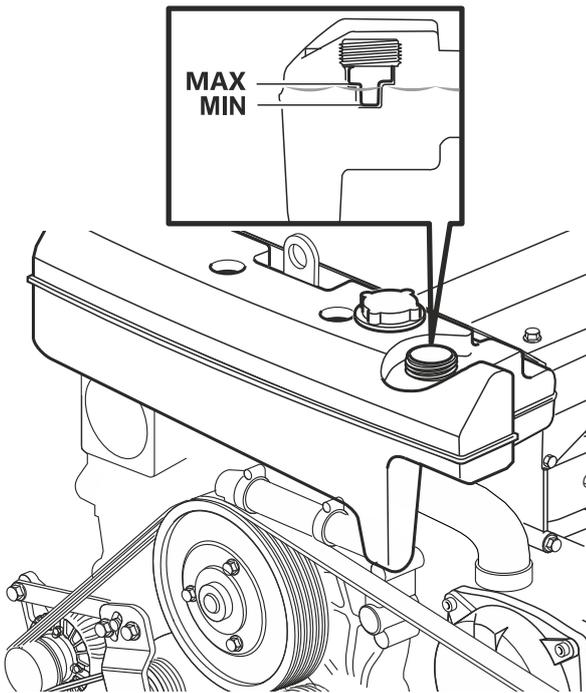
NOTICE! If water quality can not be guaranteed, use ready mixed coolant.

Coolant Level, Checking and Topping Up

▲ WARNING!

Do not open the coolant filler cap when the engine is hot, except in emergencies as this could cause serious personal injury. Steam or hot fluid could spray out.

- 1 Turn the filler cover slowly counter-clockwise and release any pressure from the system before removing the cover completely.
- 2 Top the coolant up as necessary. The coolant level shall be between the MAX and MIN marks on the expansion tank.
- 3 Screw the filler cover on.



p0017520

Seawater System

The raw water system is the engine's external cooling system. On engines with drives, the raw water pump sucks in water via the drive, through the control system's oil cooler to the raw water pump. The water then passes through the raw water filter before being pumped through the fuel cooler, intercooler, engine oil cooler and heat exchanger. Finally the water is fed out through the exhaust elbow, where it is mixed with the exhaust gases.

On engines with reverse gears, the raw water pump sucks in water via a raw water intake, after which the water passes a raw water filter (extra equipment) before being pumped through the intercooler, heat exchanger, engine oil cooler and gearbox oil cooler. Finally the water is fed out through the exhaust elbow, where it is mixed with the exhaust gases.

▲ WARNING!

Risk of water entry. Water will flow into the boat if any hose, plug etc. located below the waterline is removed when the boat is in the water. Always close the sea cocks. If the boat does not have sea cocks the water flow must be blocked in a safe manner. If this is not possible, the boat must be drawn up on land before work starts.

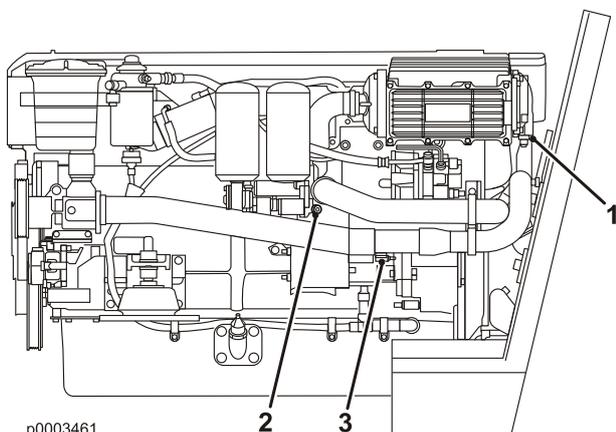
Seawater System, Draining**▲ WARNING!**

Risk of water entry. Close the seawater cocks before doing any work on the seawater system.

To prevent frost damage, the raw water system must be drained during cold weather if there is a risk for frost. An alternative to draining is to keep the engine room warm using an approved heater fan.

Draining:

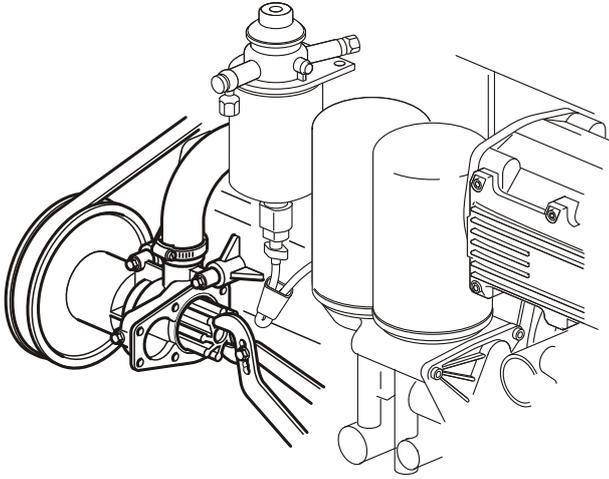
- 1 Close the sea cock where fitted.
- 2 Open the drain stop cock (1) by unscrewing it carefully.
- 3 Drain the coolant into a container. Screw in the stop cock by hand.
- 4 Move the hose on the stop cock (1) and connect to stop cock (2).
Open stop cock (2) and drain all coolant. Close the stop cock.
- 5 Move the hose to stop cock (3).
Open stop cock (3) and drain all coolant. Close the stop cock.
- 6 Refit the drain hose to stop cock (1).
- 7 Open the sea cock where fitted.



Impeller, Check and Change

⚠ WARNING!

Risk of water entry. Close the seawater cocks before doing any work on the seawater system.



P0002636

- 1 Remove the cover from the raw water pump and remove the impeller.
If the impeller is cracked or damaged it must be replaced.
- 2 If the pump shaft can be turned by hand, the flange must be replaced.
- 3 Lubricate the pump housing and inside of the cover with a little glycerin.

IMPORTANT:

The impeller may get damaged if other types of lubricant than glycerin are used.

- 4 Press the impeller in with an anti-clockwise rotating movement.
- 5 Fit the sealing washer on the center bearing of the shaft. Install the cover with a new O-ring.

Seawater System, Cleaning and Inhibiting

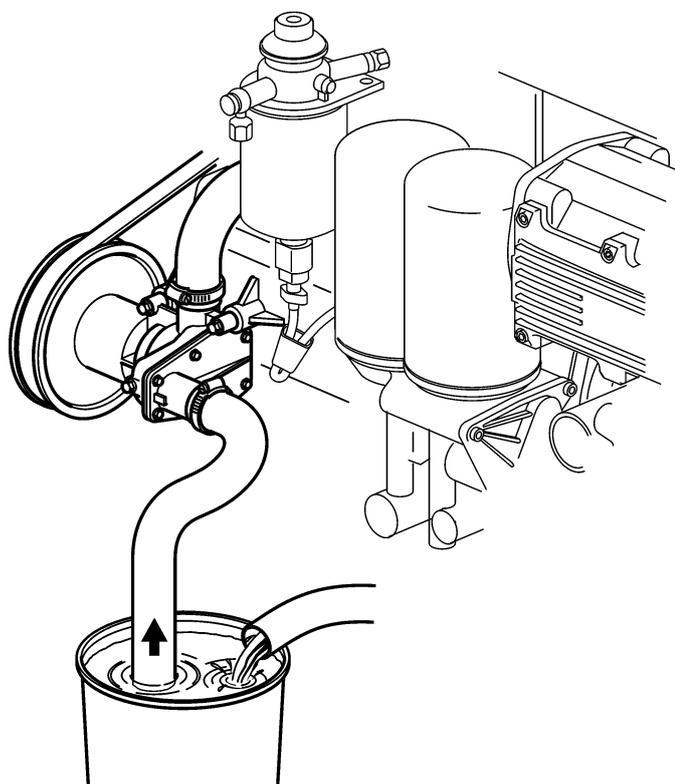
The raw water system must be flushed with fresh water, to prevent deposits and salt crystals from building up inside it. It must also be conserved when the boat is laid up for winter/out of season storage so that it is protected from internal corrosion.

⚠ WARNING!

Risk of water entry.
Cleaning and inhibiting the seawater system should be carried out with the boat on land.

⚠ WARNING!

Working with or approaching a running engine is a safety risk. Watch out for rotating components and hot surfaces.



- 1 On boats with reverse gears, open the sea cock.
- 2 Disconnect the hose from the raw water pump and install a hose which goes to a bucket filled with fresh water. Arrange re-filling.

IMPORTANT:

The impeller could be damaged if the pump runs dry.

- 3 Check that there is no one near the propeller and no one will be splashed by the exhaust outlet.
- 4 Set the control lever to neutral and start the engine. Let it run at fast idle for a few minutes. Stop the engine.
- 5 Fill a bucket with a mixture of 40% glycol and 60% fresh water, to conserve the system. Fix a container at the exhaust outlet.
- 6 Start the engine and let it idle. Stop the engine just before the mixture is used up. Repeat until the entire system has been flushed with the mixture.
- 7 Put the raw water hose back.
- 8 The system has now been conserved. The glycol mixture should remain in the system during storage.
Before launching the boat, drain the mixture and hand it to a re-cycling station for disposal

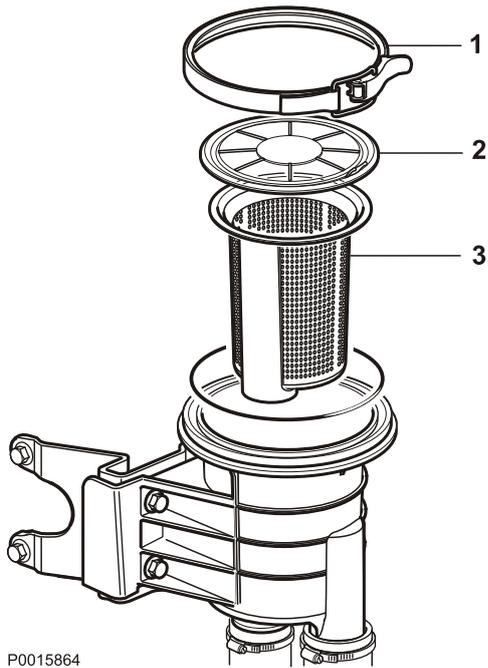
Seawater Filter, Check and Cleaning

▲ WARNING!

Risk of water entry. Close the seawater cocks before doing any work on the seawater system.

If the water where the boat is used contains contaminants, seaweed, etc. the filter should be checked more frequently than stated in the maintenance schedule. Otherwise there is a risk that the filter may be blocked resulting engine overheating.

- 1 Close the sea cock.
- 2 Unscrew the cover (1) and remove the sealing plate (2).
- 3 Lift out the insert (3) and clean it.
- 4 Replace parts as illustrated.
- 5 Open the sea cock and check for leaks.



P0015864

Electrical System

The engine is equipped with a 2-pole electrical system and an alternator.

⚠ WARNING!

Always stop the engine and break the current using the main switches before working on the engine.

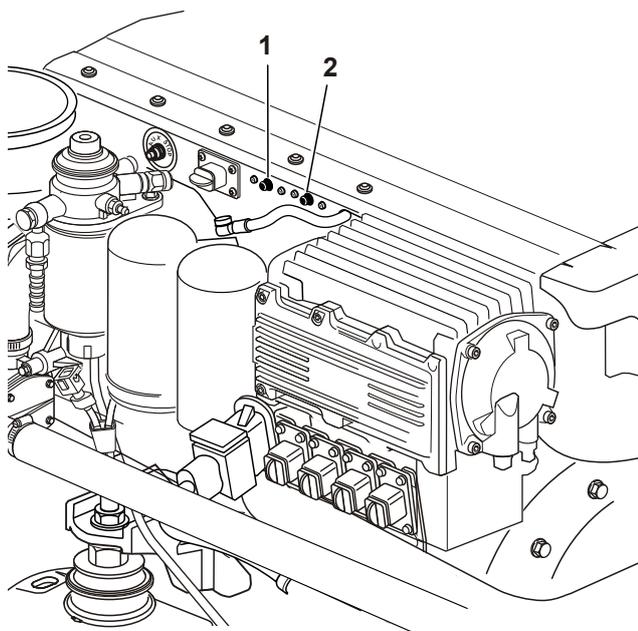
IMPORTANT:

Contact a Bukh dealer for information if any arc welding will be performed on the boat. Arc welding can cause damage to the engine and boat electronics.

Fuses

IMPORTANT:

Always investigate the cause of the overload. If the fuse trips frequently, contact an authorized Bukh workshop.



P0016486

Engine

The engine is fitted with a semi automatic circuit breaker. The circuit breaker cut the power if the system is overloaded.

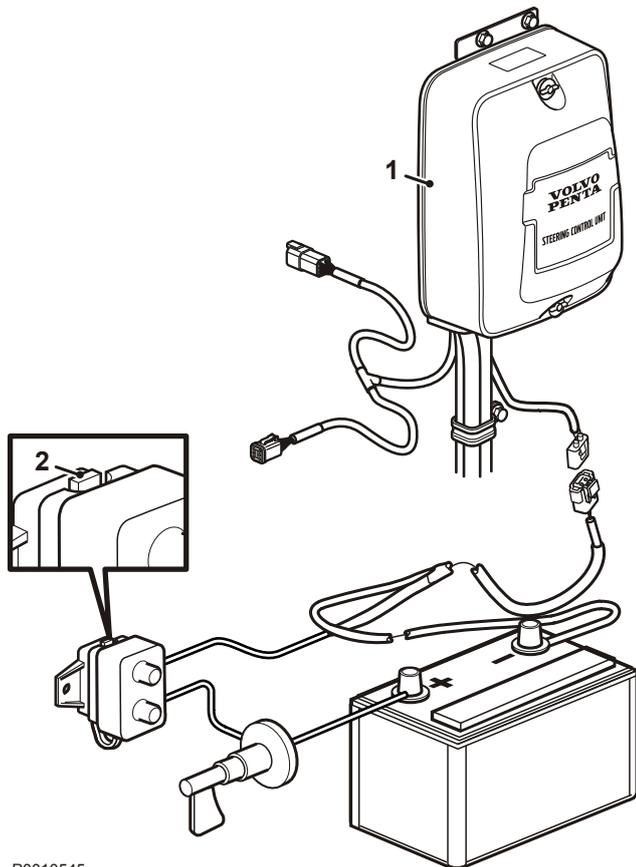
If it is not possible to start the engine or if the instrument stops working while running, the circuit breaker may have been activated.

Reset by pressing in the red circuit breaker (1).

Power Trim

Engines fitted with a drive have a semi automatic circuit breaker for the Power Trim engine.

The circuit breaker cuts the power if the Power Trim system is overloaded. Reset by pressing in the circuit breaker (2).



P0010545

Electronic Steering System

Engines fitted with a drive with electronic steering are equipped with an automatic circuit breaker for the SCU (1) The circuit breaker is located near the battery or the engine's main battery switch.

The circuit breaker cuts the power if the electrical system for the SCU is overloaded. Reset by pressing in the circuit breaker (2).

Electrical Connections

Check that electrical connections are dry, free from oxide, and that they are securely tightened.



P0002107

Battery

⚠ WARNING!

Risk of fire and explosion. Never allow an open flame or electric sparks near the battery or batteries.

⚠ 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.

⚠ WARNING!

Ventilate the engine compartment before working on batteries or battery connections.

IMPORTANT:

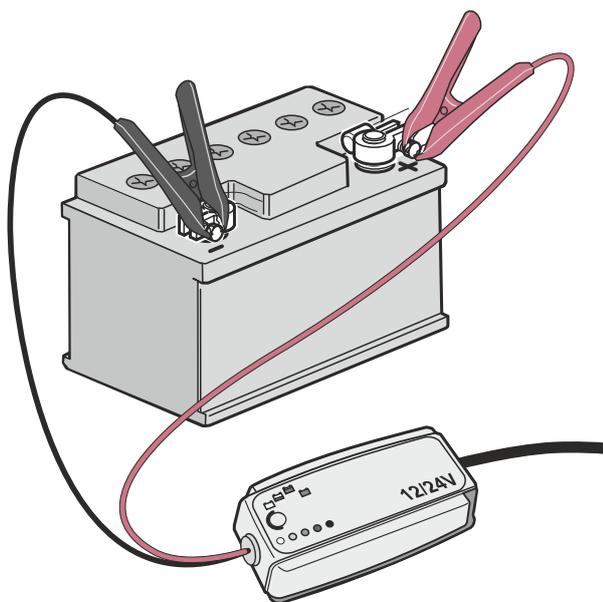
Batteries can be damaged if they are left discharged, and can also freeze and burst easier in cold weather. If the engine is not going to be used for a longer period of time, the batteries should be fully charged, trickle charged if possible.

Maintenance

It is important to always follow the battery manufacturer's recommendation and instruction when replacing and charging batteries. Depending on battery type, the instructions for maintenance and charging may vary.

Modern batteries are normally maintenance free, but there are some actions that are recommended to increase the battery service life and avoid accidents:

- Keep the batteries clean and dry. Contamination and oxide on the batteries and battery poles can result in stray currents, voltage drop and discharge, especially in wet weather.
- Remove oxidation from the battery poles and terminals, using a brass brush.
- Tighten the terminals securely and grease them with terminal grease or petroleum jelly. Loose battery connections may cause damage to the engine's electrical system.
- Charge the battery regularly. A battery that is kept fully loaded has a maximum service life. The easiest way to check if a battery needs charging is to use a voltmeter.



P0022892

Replacing Battery

IMPORTANT:

Make sure that the new battery fulfills the specifications in *Technical Data*. Read the information supplied with the battery before you begin the installation.

IMPORTANT:

Do not disconnect the batteries with the engine running as sensitive electrical components may be immediately damaged.

⚠ WARNING!

Never confuse the positive and negative poles on the batteries. Risk of arcing and explosion.

Disconnecting (A)

- 1 Untighten the nut and remove the – cable (black).
- 2 Untighten the nut and remove the + cable (red).

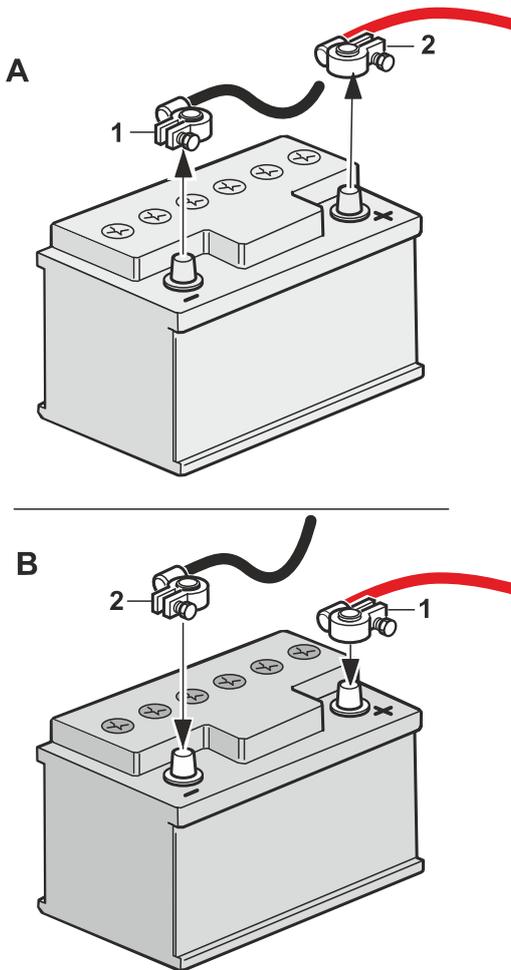
Remove the battery.

Connecting (B)

Place the new battery.

- 1 Connect the + cable (red) to the + pole on the battery and tighten the nut.
- 2 Connect the – cable (black) to the – pole on the battery and tighten the nut.

NOTICE! Hand in the old battery to a re-cycling station.



P0022893

Reverse Gear

The reverse gear is hydraulic, which means that shifting between ahead/astern and neutral is performed hydraulically. The reverse gear lubrication system is equipped with an oil filter and oil cooler. The reverse gear uses solenoid valves for electronically controlled shifting.

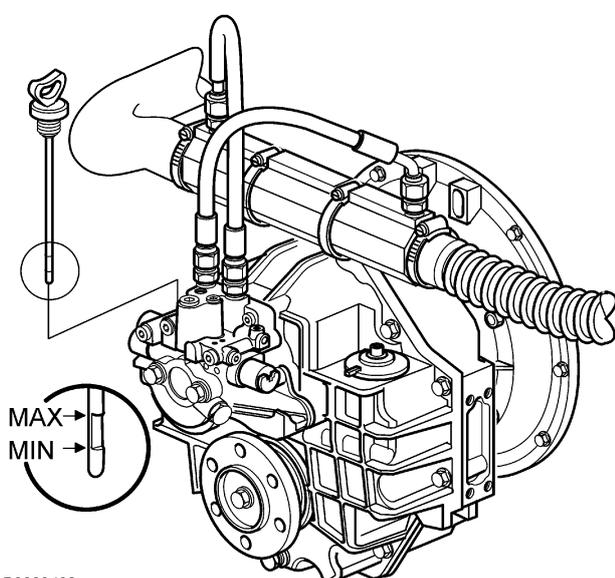
Bukh recommends that a seawater filter be fitted to guarantee the correct cooling water flow to the engine and reverse gear. Otherwise there is a risk of contaminants in the seawater blocking the reverse gear cooler and other cooling system components.

Oil level, checking and topping up

- 1 Start the engine and let it run on idle a few minutes.
- 2 Remove the dipstick by turning counter-clockwise.
- 3 Wipe the dipstick and reinsert it in the reverse gear without screwing it in. Remove the dipstick and check the oil level. The correct oil level is between the MAX and MIN markings.
- 4 Top up the oil as required using the dip stick tube. Please refer to section *Technical Data, page 133* for oil quality and capacity.

IMPORTANT:

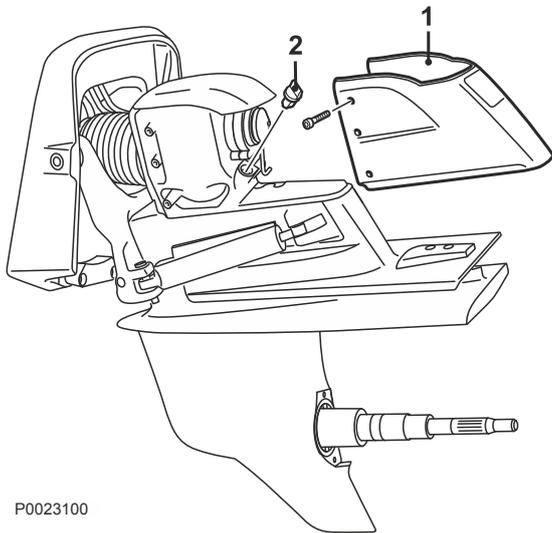
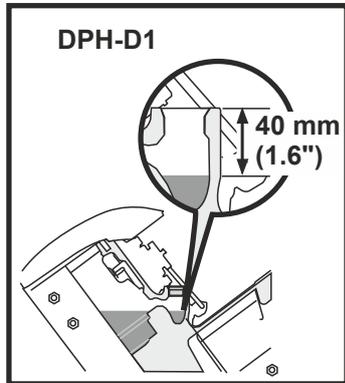
Never over-fill the reverse gear. The oil level must always be within the recommended range.



P0003462

Drive

Transmission lubricant, checking and topping up



- 1 Remove the cover (1).
- 2 Trim the sterndrive up until the oil filler hole is horizontal.
- 3 Remove the oil filler hole plug (2).
- 4 Check that the oil level is 40 mm (1.6") below the rim of the oil filler hole.
- 5 If the oil level is too low, fill oil to the level illustrated. Be careful not to overfill with oil. For oil grade and quantity, refer to the *Technical Data, page 134* section.
- 6 Tighten the plug and install the cover.

NOTICE! The oil must have a golden brown nuance. If the oil is gray, water has entered the sterndrive. In this case let a Bukh workshop carry out checks on the sterndrive.

P0023100

DPH-D1

Steering

The stern drive is fitted with a hydraulic steering system with an auxiliary servo that functions even when the engine is not running.

Hydraulic steering, fluid level checks

Check the fluid level every two weeks so that any changes are discovered. Check the helm pump level. The minimum level is **12 mm (0.47")** below the filler hole lower edge. If the boat has a flybridge the lower helm pump must not be opened; only check the level at the upper helm station.

The fluid level does not normally alter; annual consumption is negligible. If the level drops it is probably due to leakage or air in the system. The leakage must be traced and remedied immediately. Contact your Bukh service center for repairs. The steering system is filled with ATF oil. If the oil is red and does not contain visible contamination it does not need to be changed. If the oil is becoming black or contains visible contamination it must be changed. If the system has been dismantled for service it must be purged.

▲ WARNING!

Use only by Bukh recommended fluid and grade. Any non-approved fluid may cause loss of steering or result in damage to the components used in the steering system.

Fluid level checks, servo pump

The steering servo tank has a transparent reservoir which makes checking the level possible without opening the cap. The fluid level must be just below the reservoir neck.

If fluid filling is required the snap connector must be removed before the cap is opened.

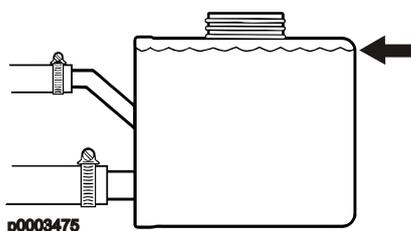
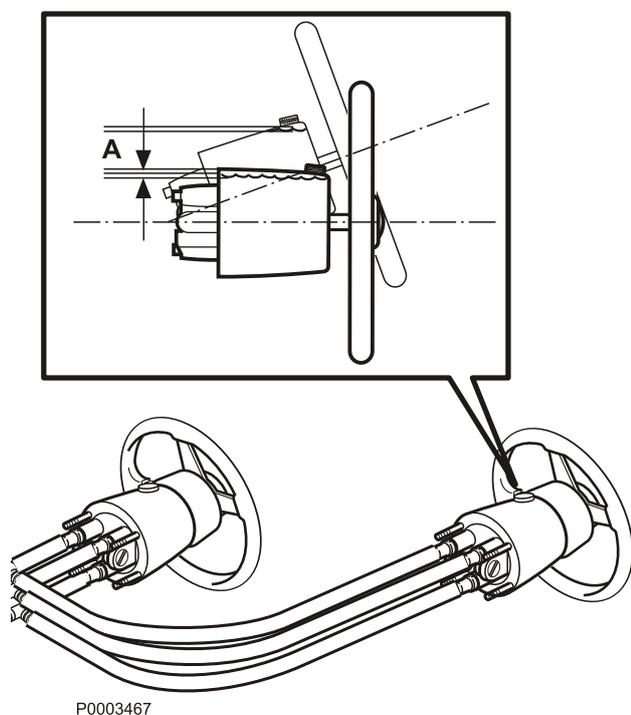
Hydraulic hoses

▲ WARNING!

A leaking hydraulic hose can negatively affect steering, and at worst steering can be lost altogether.

Hydraulic hoses, checks

- 1 Check carefully that no wear or cracks are present on the steering system hydraulic hoses.
- 2 Check external hoses thoroughly as they are exposed. Damaged hoses must be replaced.

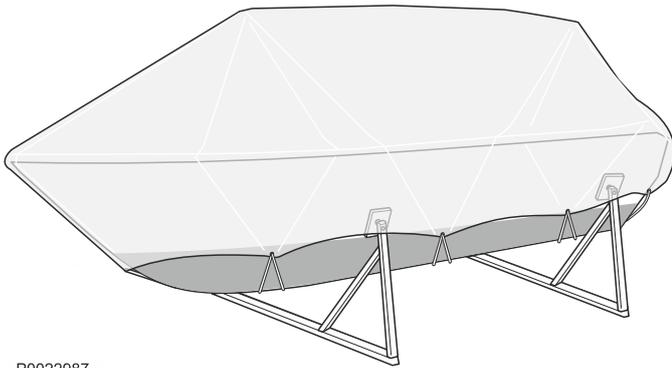


Storage

If the boat is not going to be used for two months or more, it is important to reduce the risk of damage to the engine and other equipment. The following proposals contain measures to prevent condensation and reduce the prevention of frost weathering and reduce the formation of condensation, mold and corrosion.

IMPORTANT:

When cleaning with a high pressure washer, make sure to never aim the water jet at seals, rubber hoses or electrical components. Never use a high pressure washer for engine cleaning.



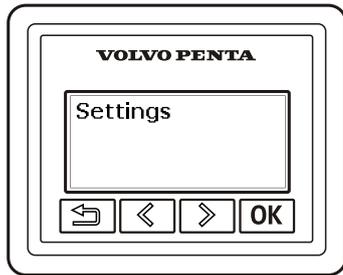
P0022987

- Check that the coolant offers sufficient frost protection. Check the level and top up as necessary.
- Drain all the remaining seawater from the cooling system, (heat exchanger, charge air cooler, impeller pump, hoses containing sea water).
- Remove the impeller from the seawater pump. Store the impeller in a sealed plastic bag and keep cool.
- Empty and clean the fuel tank if it contains water or dirt. Then fill the fuel tank with fuel to avoid condensation.
- Disconnect the battery cables; clean and charge the batteries. Trickle charge the batteries while the boat is laid up. Please note that a poorly charged battery may burst as a result of freezing if stored at freezing temperatures.
- Cover the alternator with a plastic bag. Clean the outside of the engine with a cleaning product from a boat accessory store using a sponge/brush. Rinse with lukewarm water afterwards, (do not use a high pressure washer). Wet vacuum the keelson and dry off.
- Touch up any paint damage with Bukh original paint or paint of the same quality.
- If necessary, cover the engine, air intake and exhaust pipe.
- Always ensure good ventilation in the engine compartment in order to prevent the formation of mold and corrosion (if possible, leave hatches open).

NOTICE! It is easier to discover leaks and damage and reduce the formation of corrosion and mold in a dry, clean engine room.

NOTICE! Attach a note on the engine/the filters with the date and type of oil that has been used so it is easier to remember what has been carried out when it is time to launch.

Calibration and Settings



P0012801

Settings

Settings Menu

Settings and calibrations are managed in the Settings menu.

- 1 Navigate to the **Settings** menu.
- 2 Press **OK** to open the settings menu.
- 3 Navigate backwards and forwards in the settings menu by pressing **←** **→**.

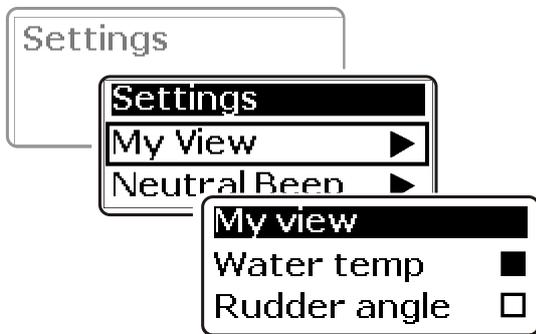


Return to the previous menu by pressing the button. Hold the button down for more than 3 seconds to get to the main menu.

My View

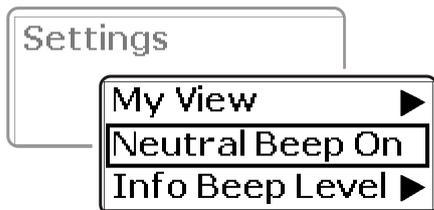
The information shown in the main menu can be adapted to suit personal preferences in **My View**.

- 1 Navigate from the settings menu to **My View**. Press **OK** to get to the submenu.
- 2 Navigate through the menu using **←** **→** to see available operating information.
- 3 Press **OK** to add or remove information for display in the main menu.



P0012518

My View



P0012519

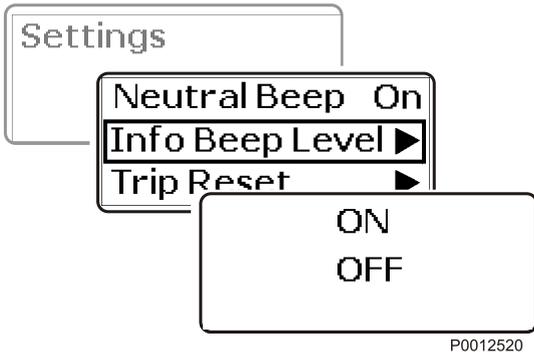
Neutral Beep

Neutral Beep

The neutral beep is an audible signal that sounds when the control is in the neutral position.

The setting must be entered at each helm station.

- 1 Navigate to **Neutral Beep** in the settings menu.
- 2 Press **OK** to switch the audible signal **On** or **Off**.



Information Beep

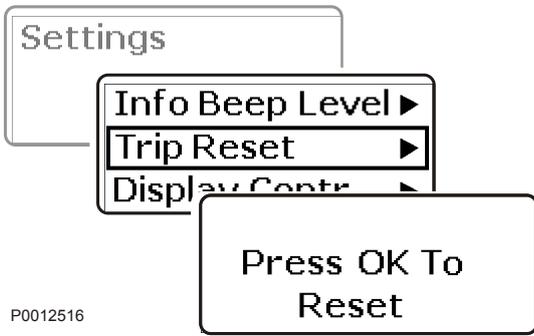
P0012520

Information Beep

InfoBeep is an audible signal that sounds when there is a message from the system.

- 1 Navigate to **Information Beep** in the settings menu.
- 2 Press **OK** to switch the audible signal on or off. If there is a tachometer (accessory) installed, the volume can be adjusted with the aid of **◀ ▶**. Press **OK** to confirm the selection. The setting is confirmed by an audible signal at the set level.

The screen will return automatically to the settings menu.

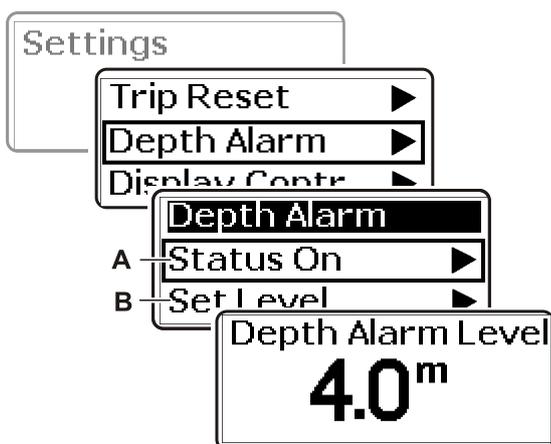


Trip Reset

P0012516

Trip Reset

- 1 Navigate to **Trip Reset** in the settings menu.
- 2 Press **OK** twice to zero the trip information.



Depth Alarm Level

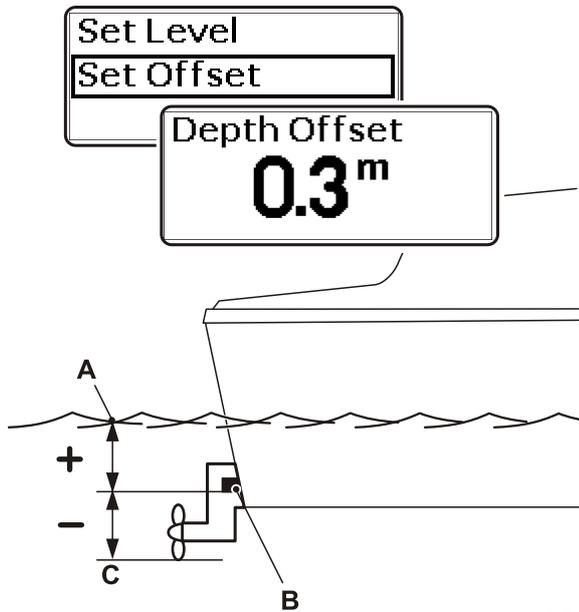
P0012513

Depth Alarm

Setting the level for the depth alarm on Bukh echo sounders.

The setting need only be made at one helm station.

- 1 Navigate to Depth Alarm in the settings menu. Press **OK** to proceed to the submenu.
- 2 Depth Alarm Off/On (A). Press **OK** to switch the alarm on or off.
- 3 Proceed to Set Level (B) and press **OK**. Use **◀ ▶** to set the limit where the alarm must begin sounding. Press **OK** to confirm the setting. The depth alarm is dependent on depth compensation; refer to the next section.



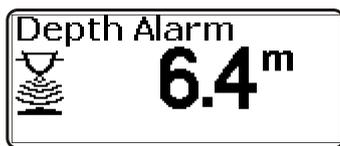
P0012515

Set Offset

- A Waterline
- B Echo-sounder
- C Lowest point

Set Offset

- 1 Go from the settings menu to Set Offset and press **OK** to reach the setting.
- 2 Use **←** **→** to set the depth compensation value so that it corresponds to the boat's lowest point or the waterline. The echo-sounder can be placed anywhere between these two points. Set the echo-sounder/waterline or echo-sounder/lowest point distance to the depth to be displayed. The distance between the echo-sounder (B) and the water line (A) has a positive (+) value. The distance between the echo-sounder (B) and the boat's lowest point (C) has a negative (-) number. Press **OK** to confirm the setting.

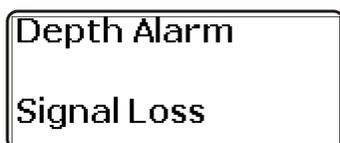


P0005853

Depth Alarm

Depth Alarm

When the depth is less than the alarm setting, a message will be shown on the display, followed by an audible signal. The message will be displayed every 30 seconds until the depth exceeds the alarm level. Confirm the alarm by pressing **OK**.

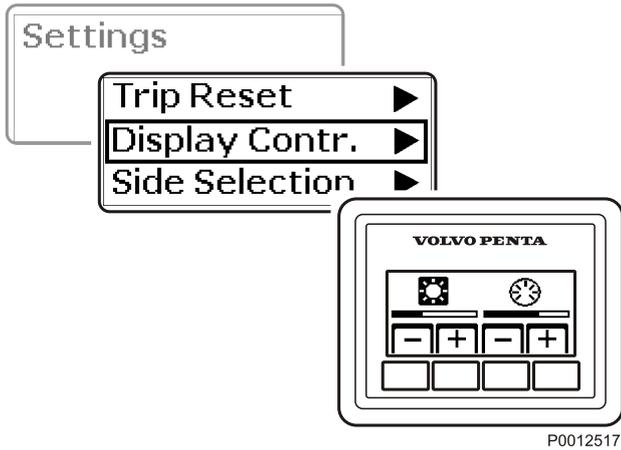


P0005855

Depth Alarm / Signal Loss

Signal fault

If the signal from the depth alarm is lost, e.g. if the sensor is not working, a message is displayed stating that the signal has been lost.



Display Contrast

P0012517

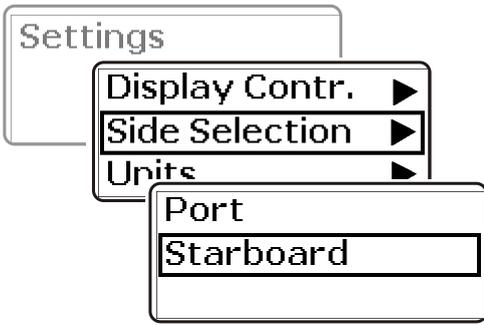
Display Contrast

Adjust the screen contrast. The adjustment will affect all screens.

- Backlighting
- Contrast

- 1 Navigate to **Display Contrast** in the settings menu and press **OK** to open the submenu.
- 2 Use + and – to increase or reduce the contrast or backlighting.

The screen will return automatically to the settings menu.

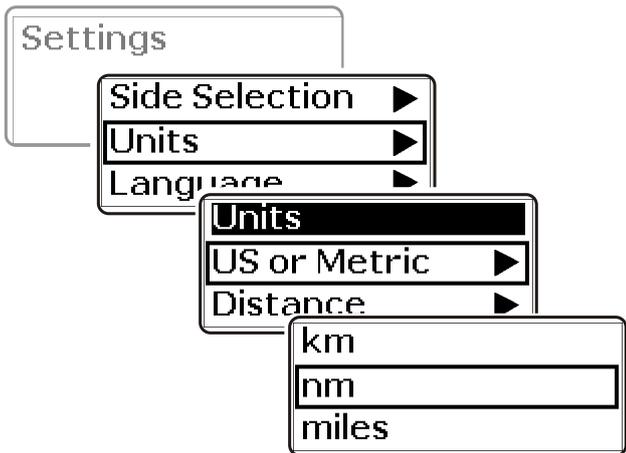


Side Selection

P0013071

Side Selection

Set from which engine information is to be shown in display.



Units

P0012522

Units

Setting the units in which information will be displayed.

- 1 Navigate to **Units** in the settings menu. Press **OK** to open the settings menu.
- 2 Open **US or Metric**, press **OK** and select American or metric units.
- 3 Navigate to **Distance**, press **OK** and then select kilometers, nautical miles or miles.
- 4 Press **OK** to confirm the selection.



P0012523

Language

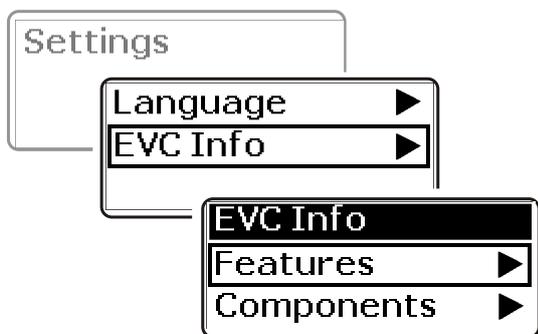
Language

Setting the language in which the information will be displayed. There are 10 languages to choose from. On boats with several helm stations and several screens it will suffice to select a language in one station for it to be displayed at all of them.

- 1 Navigate to **Language** in the settings menu. Press **OK** to open the language menu.
- 2 Navigate to the desired language and press **OK** to confirm the selection.
The screen will return automatically to the settings menu.

EVC Info

Information regarding accessories, components and the type of software installed in the boat is displayed here.



P0012977

Components

- 1 Navigate to **EVC Info** in the settings menu and press **OK** to open the submenu.
- 2 **Features** shows the accessories that are installed. Press **OK** to open the submenu.
- 3 **Components** shows what hardware components that are installed. Press **OK** to open the settings menu.
- 4 **Software** shows what software is installed. Press **OK** to open the submenu.

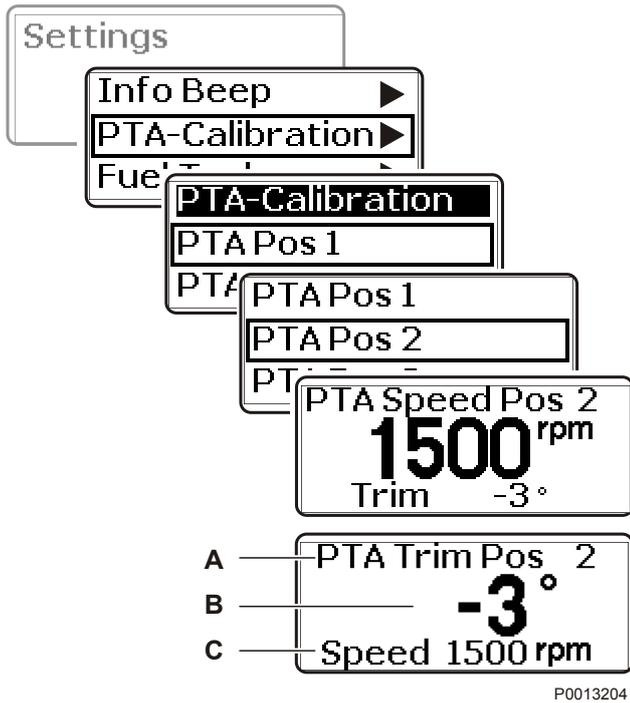
PTA Calibration

PTA (Power Trim Assistant) automatically adjusts the trim angle to boat speed. The system has a basic setting, but it is possible to set five different angles for five different speeds.

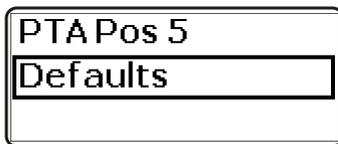
On boats with more than one station and with several displays it is enough to do the calibration on one display for it to be shown at all stations and on all displays.

For installations with several engines the calibration needs to be made for each engine

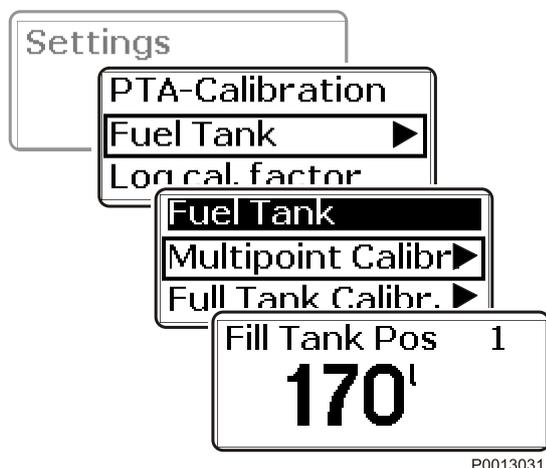
- 1 Navigate from the settings menu to **PTA Calibration**. Press **OK** to get to the submenu.
- 2 Use **◀ ▶** to set the trim angle for idle, PTA Pos 1. Press **OK** to confirm the setting.
- 3 Proceed to **PTA Pos 2**. Use **◀ ▶** to set the rpm. Press **OK** to confirm the setting.
- 4 Use **◀ ▶** to set the trim angle. Press **OK** to confirm the setting.
- 5 Repeat steps 4 to 5 for Pos 3, Pos 4 and Pos 5.
- 6 To return to basic settings, select **Defaults** and press **OK** to confirm return to basic settings.



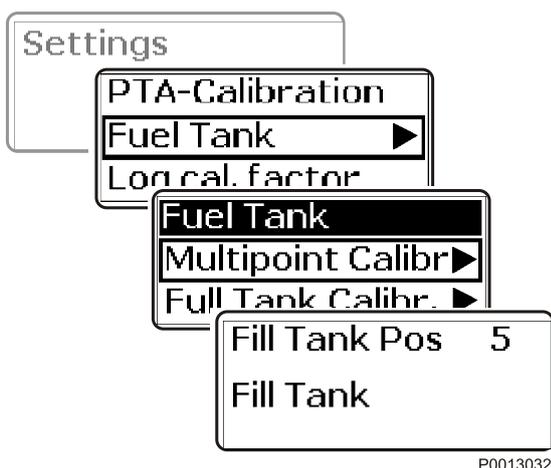
- A Trim position being set
- B Engine rpm
- C Trim angle



Defaults



Multipoint



Full Fuel Tank Calibration

Fuel Tank

There are two alternative methods for calibrating the level sensor in the fuel tank.

Multipoint provides more precise results while Full Fuel Tank Calibration is an approximate method.

Multipoint calibration is a prerequisite if the trip computer is to show fully accurate information.

Multipoint

In order for multipoint calibration to be carried out, the fuel tank must not be filled to more than 20% of its total capacity.

- 1 Turn to **Fuel Tank** in the settings menu and press **OK** to access the calibration menu.
- 2 Turn to **Multi Point Calibration** and press **OK**.
- 3 Calibration is carried out in 5 steps.
Fill the tank with the quantity shown in the display, (POS).
Wait 10 seconds.
Press **OK** to confirm that the tank has been filled to the indicated level.
- 4 Fill the tank with the quantity shown in the display, POS 2.
Wait 10 seconds.
Press **OK** to confirm that the tank has been filled to the indicated level.
- 5 Repeat the procedure for POS 3 , POS 4 and POS 5. Confirm by pressing the wheel at each position. **OK**.

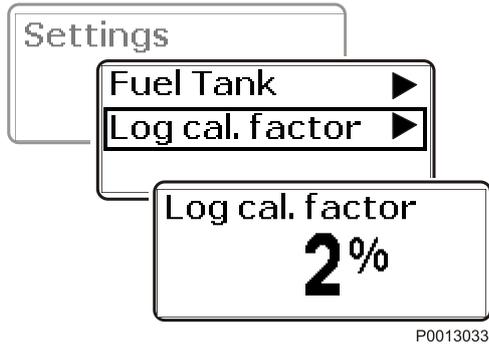
Full Fuel Tank Calibration

For this method the tank must be full and the fuel level sensor will be calibrated in one step. Thus, the fuel level value will be approximate, and therefore all trip data based on remaining fuel must be seen as approximate values.

- 1 Turn to **Fuel Tank** and press **OK** to reach the submenu.
- 2 Select **Full Fuel Tank Calibration** and press **OK**.
- 3 Fill the fuel tank. Confirm that the fuel tank is full by pressing **OK**.

IMPORTANT:

Settings for Fuel Tank Volume, Empty Tank Calibration and Fuel Alarm Level, should only be carried out by an authorized Bukh workshop.



P0013033

Speed Factor

Speed Factor

The speed factor must be set while the boat is under way. Compare the displayed boat speed value with GPS data (or another boat) and adjust the speed factor until the values agree. The setting just needs to be done on one display for it to be shown at all stations and on all displays

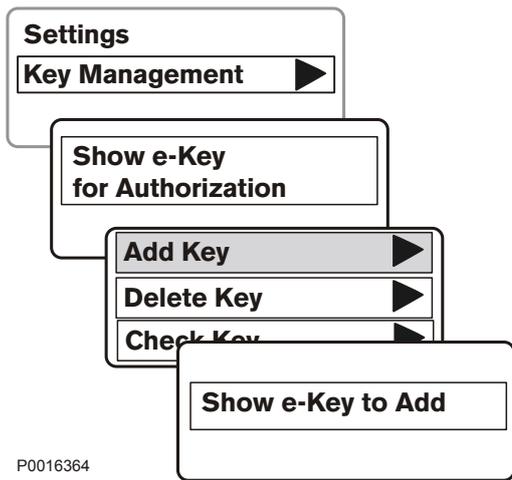
- 1 Go from the settings menu to **Speed Factor** and press **OK** to reach adjustment.
- 2 Use **←** **→** to set the value
Press **OK** to confirm the setting.

Key Management

Adding or removing a key to or from the system can be done in either the Battery Control Panel or the 2.5", 4" and 7" displays. A system can have up to four keys, which are numbered from 1-4.

Adding a key

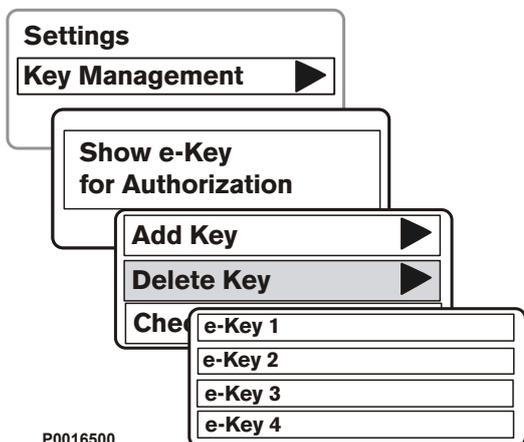
- 1 Navigate to the menu *Settings > Key Management*.
- 2 When the text *Show e-Key For Authorization* is shown, hold a key that is already registered in front of the key panel. The system will check that the key ID corresponds to a key registered in the system.
- 3 Select *Add a key*.
- 4 When the text *Show e-Key To Add* is displayed, hold the new key in front of the panel. The system will store the key ID.
- 5 The addition of the key is confirmed on the display.



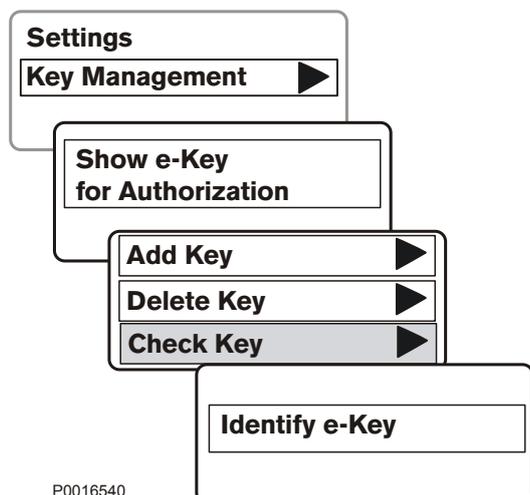
P0016364

Removing a key

- 1 Go to *Settings > Key Management*.
- 2 When the text *Show e-Key For Authorization* is displayed hold a registered key in front of the key panel. The system will check that the key ID corresponds to a key registered in the system.
- 3 Select *Remove key*.
- 4 Select which of the keys 1–4 is to be removed. Because the system must contain at least one key, the key used for approval cannot be removed.
- 5 The removal of a key is confirmed on the display.



P0016500



Checking keys

Checking a key ID

- 1 Go to *Settings > Key Management*.
- 2 When the text *Show e-Key For Authorization* is displayed hold a registered key in front of the key panel. The system will check that the key ID corresponds to a key registered in the system.
- 3 Select *Check keys*.
- 4 Hold the key to be checked in front of the panel. The key ID will be shown on the display.

Glass Cockpit, Settings

NOTICE! For further information about calibrations and settings in Glass Cockpit, go to **Info > Owner's Manual** to see the integrated Glass Cockpit manual in the display or download the latest manual on www.garmin.com.

Navigate to the settings menus:
Select **Settings > Preferences** or **> My Vessel** to open calibration and settings menus.

Select **Home** to return to main screen.



Glass Cockpit, Neutral Beep

The neutral beep is an audible signal that sounds when the control is in the neutral position.

Select **Settings > System > Beeper and Display** and turn the audible signal On or Off.

Glass Cockpit, Reset Trip

The trip information can be reset. Select **A/V, Gauges, Controls > Choose one of the available gauges views > Menu > Trip Reset** and follow the instructions on the display to zero the trip information.

Glass Cockpit, Fuel Tank

Go to **My Vessel > Fuel Tank**

Carry out calibration in the following sequence:

- 1 Fuel Tank Volume
- 2 Empty Tank
- 3 Full Tank
- 4 Multipoint

Select a calibration and OK to begin the wizard in question and then follow the instructions on the display.

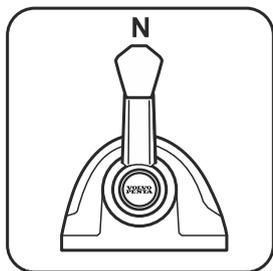


P0022495

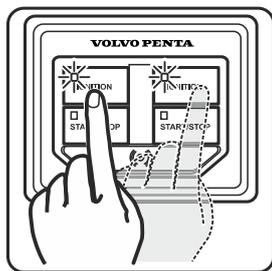
Add e-Key, Glass Cockpit

NOTICE! The ignition must be on and engine(s) stopped.

Up to four e-Keys can be added.



1. Move control to neutral.



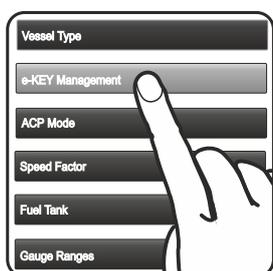
2. Turn the ignition on.



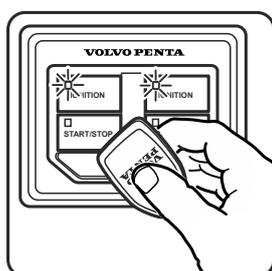
3. Main Menu > Settings.



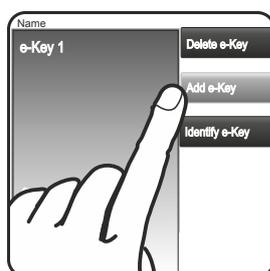
4. My Vessel.



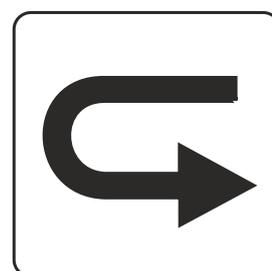
5. e-Key management. Select Add e-Key.



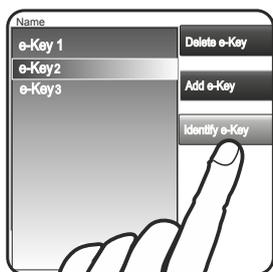
6. Hold the new e-Key in front of the Start/Stop panel. Confirm with OK.



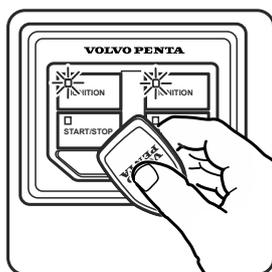
7. e-Key added. Remaining available locations for e-Key in display. Further options appear in right side menu.



8. Repeat step(s) 6 for additional e-Keys.



9. Settings Menu:
 • Delete key(s)
 • Identify e-Key
 Hold the new e-Key in front of the Start/Stop panel.



10. **NOTICE!** A valid e-Key is required as authorization for future e-Key Management.



11. Ignition must be turned off for at least 15 seconds to confirm the calibration.

Joystick

Joystick calibration need only be carried out if boat movements do not correspond to joystick movements. When calibrating the joystick, the boat must be driven on open waters in safe conditions. Avoid calibrating in high winds or currents that can influence the result of the calibration.

Allow the boat to run for a fairly long distance during calibration. Hold the joystick firmly in position.

Calibration can only be carried out at a helm station that is equipped with both a joystick and a control panel.

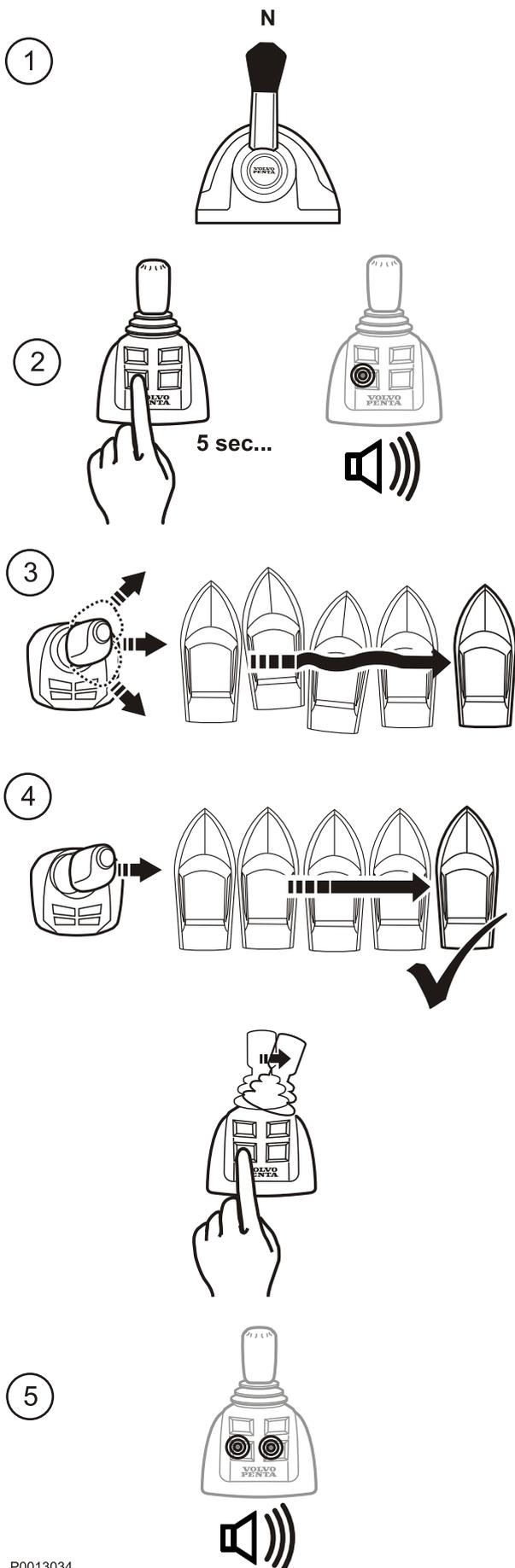
Calibration need only be done in one direction, port or starboard.

Joystick Docking calibration

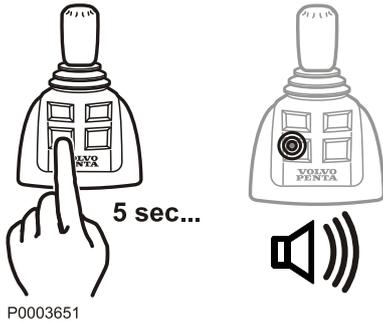
NOTICE! Only available for aquamatic installations.

- 1 Turn the ignition on and move the control levers to neutral.
- 2 Start the engines.
Activate calibration mode by depressing the docking button for 5 seconds.
An audible signal confirms that docking mode is activated and the docking button lights up.
- 3 Move the joystick sideways as far as it will go in one direction.
Correct boat movements by moving the joystick up and down, and by turning it.
- 4 When the boat is moving straight abeam, depress the docking button once again.
- 5 An audible signal will sound and both lower button lamps on the joystick will flash to confirm that calibration is complete and stored. The system is now in docking mode.

When the joystick returns to the central position the lamps will stop flashing and will instead show continuously.



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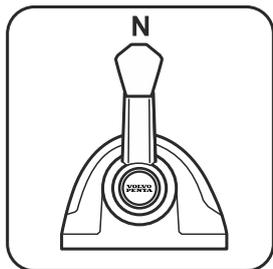
Resetting the calibration

- 1 Turn the ignition on and move the control levers to neutral.
Start the engines.
- 2 Activate calibration mode by depressing the docking button for 5 seconds.
An audible signal will confirm that docking mode is activated and the docking button lamp will light up.
- 3 Press the docking button. Calibration is now reset, which is confirmed by an audible signal.
The system is now in docking mode

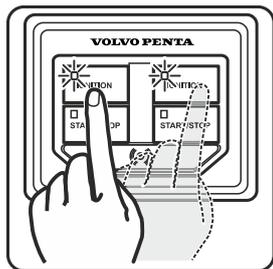
Joystick Inboard Docking calibration

NOTICE! Only available for inboard installations.

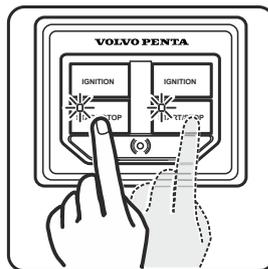
- Calibration may be done in either direction, port or starboard, at one station. To be performed in calm weather conditions.
- Calibration is carried out in two steps.
- Make sure there is sufficient space for maneuvering the boat.
- The Idling speed calibration might influence the docking feature. Regain good docking function by performing a Joystick Inboard Docking calibration again.



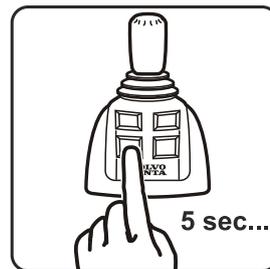
1. Move control to neutral.



2. Turn the ignition on.



3. Start the engines.



4. DOCKING: press and hold at least 5 seconds.

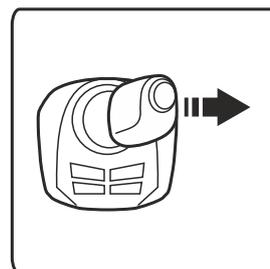


5. Buzzer and light confirm start of calibration.



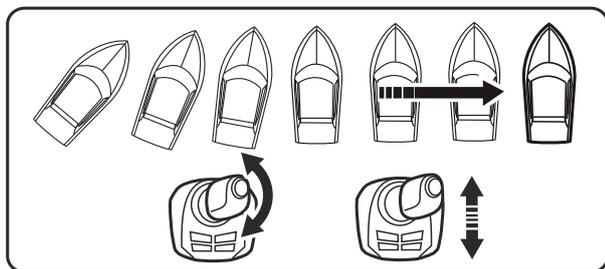
6. Docking calibration started.

NOTICE! If only one of the two steps is to be adjusted, both steps must still be confirmed.

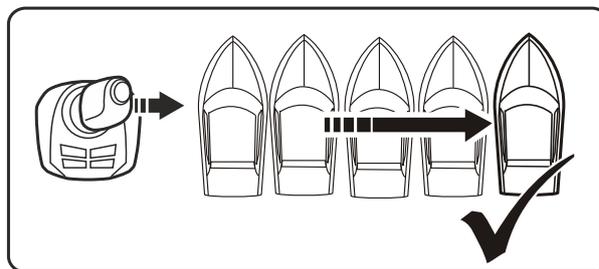


(7). Confirm previous setting by leaving the Joystick centered and push DOCKING.

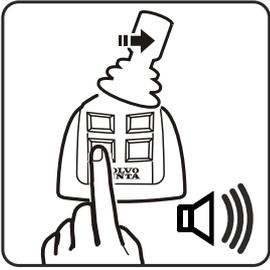
8. Keep Joystick in its outermost side position until confirmation in step 11.



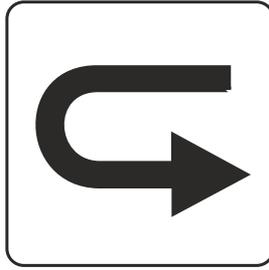
9. Compensate boat movements with the Joystick by rotating knob and moving it forward-backward.



10. The boat must move straight abeam.



11. Hold the Joystick position for 5 seconds and confirm by pushing DOCKING.



12. To complete the calibration: Repeat step(s) **8 –11**. (or finish the calibration by pushing DOCKING.)

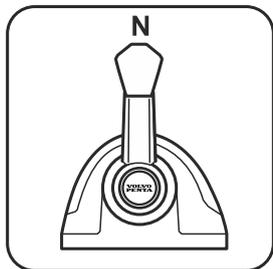


13. Steady light and buzzer confirm completed calibration. Ignition must be turned off for at least 15 seconds to confirm the calibration.

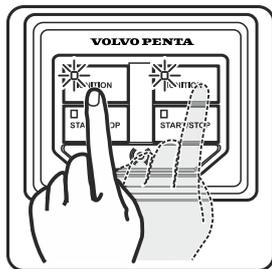
Drive Straight calibration

NOTICE! Only available for inboard installations.

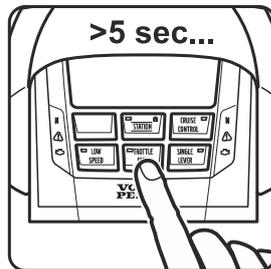
This calibration only needs to be performed if the boat does not travel straight after mechanical installation.



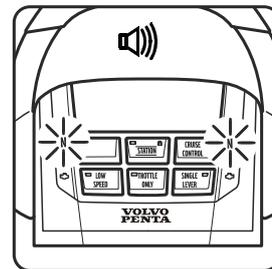
1. Move all controls to neutral.



2. Turn the ignition on.



3. THROTTLE ONLY: press and hold for at least 5 seconds.



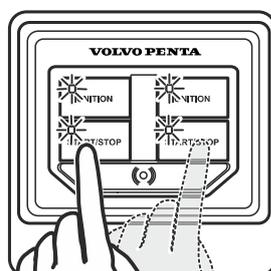
4. Turn the steering wheel to enter Calibration mode.



5. Manufacturer Calibrations > Rudder Steering.



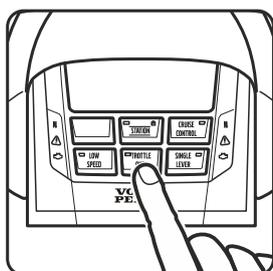
6. Follow instructions on screen.



7. If rudder end positions are calibrated: Start engines to perform Drive Straight Calibration

Drive Straight Calibration started. Keep speed below planning threshold and the direction straight forward.

8. Follow instructions on screen.



7. Press THROTTLE ONLY to confirm rudder position.



8. Ignition must be turned off for at least 15 seconds to confirm the calibration.

Technical Data

Engine

Type designation	D4	D6
No. of cylinders	4	6
Displacement	3,7 dm ³ (226 in ³)	5,5 dm ³ (336 in ³)
Bore	103 mm (4.05")	103 mm (4.05")
Stroke	110 mm (4.33")	110 mm (4.33")
Compression ratio	17,5:1	17,5:1
Engine, dry weight	483 kg (1064 lbs)	580 kg (1279 lbs)
Idling speed, rpm	700-750	600-650

Type designation	Aftermarket designation	Crankshaft power kW (hk) (1)	Propeller shaft kW (hk) (2)
D4-180I	D4-180I-F	132 (180)	128 (174)
D4-225I	D4-225I-F	165 (225)	160 (218)
D4-225A	D4-225A-F	165 (225)	158 (215)
D4-260I	D4-260I-F	191 (260)	186 (253)
D4-260A	D4-260A-F	191 (260)	184 (250)
D4-300I	D4-300I-F	221 (300)	212 (289) HS-63 214 (292) HS-80
D4-300A	D4-300A-F	221 (300)	214 (292)
D6-300I	D6-300I-F	221 (300)	212 (289) HS-63 214 (292) HS-80
D6-300A	D6-300A-F	221 (300)	219 (298)
D6-330I	D6-330I-F	243 (330)	237 (323)
D6-330 A	D6-330A-F	243 (330)	233 (317)
D6-370I	D6-370I-F	272 (370)	267 (363)
D6-370A	D6-370-F	272 (370)	261 (355)
D6-400A	D6-400-F	294 (400)	281 (382)
D6-435I	D6-435I-F	320 (435)	310 (422)
D6-435I WJ	D6-435I-WJ-F	320 (435)	-

1) According to ISO 8665

2) According to ISO 8665

Lubrication System

Engine:	D4	D6
Oil volume, (incl. oil filter)		
for all allowed installation inclinations	12 liters (3.2 US gal)	20 liters (5.3 US gal)
volume difference MIN – MAX	1.2 liters (0.3 US gal)	3.5 liters (0.9 US gal)
Oil pressure, hot engine,		
idling	125 kPa (18.1 PSI)	125 kPa (18.1 PSI)
at full speed	440 kPa (63.8 PSI)	440 kPa (63.8 PSI)
Oil, viscosity:		
	SAE 15W/40 (See table)	SAE 15W/40 (See table)

Oil Grade and Oil Change Interval

Oil grade ¹⁾	Sulphur content in fuel, by weight	
	< 0.5 – 1.0%	more than 1.0% ²⁾
	Oil change interval: Reached first in operation:	
All engines: VDS-3	200 hr. or 12 months	100 hr. or 12 months

NOTICE! Mineral based oil, either fully or semi-synthetic, can be used on condition that it complies with the quality requirements above.

1) Lowest recommended oil grade. Engine oil with higher oil grade is always possible to use.

2) If sulphur content is > 1.0% by weight, use oil with TBN > 15.

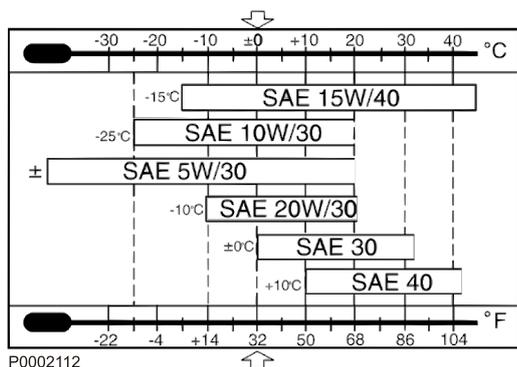
VDS = **Volvo Drain Specification**
TBN = **Total Base Number**

Viscosity

Select the viscosity according to the table.

The temperature values refer to stable ambient temperatures.

* SAE 5W/30 refers to synthetic or semi-synthetic oils.



Compressor, oil

	D4	D6
Oil volume	0.1 liters (0.2 US pint)	0.1 liters (0.2 US pint)
Oil grade	Bukh, part no. 1141641	Bukh, part no. 1141641

Fuel System

General fuel requirements

The fuel quality is essential for engine function, durability and emission compliance. Only fuels meeting relevant legal requirements and national and international standards shall be used; such as European EN590 diesel and North American ASTM D975 diesel.

Usage of fuels or fuel blends that do not comply with the below specifications given in this document is not allowed and Bukh will not accept warranty in case of fuel related engine damages.

Diesel fuel requirements

An insufficient **cetane number** (“ignitability”) leads to poor startability and increased exhaust emissions.

Requirement; cetane number min 45.

Insufficient **density and viscosity** will reduce the power and increase the fuel consumption.

Excessive density and viscosity will endanger the durability and function of the fuel injection equipment.

Requirement; viscosity 1.5-4.5 mm²/s (cSt at 40 °C and density 800-860 kg/m³ at 15 °C.

Sufficient **fuel lubricity** is essential to protect the fuel injection system against excessive wear.

Requirement; wear scar max 520 µm in the HFRR test (ISO 12156)

Excessive **sulfur content** will increase emissions and give engine corrosion and wear.

Requirement; The max allowed sulfur content is 5000 ppm, with the restriction that oil of quality VDS 3 must be used for sulfur content above 3000 ppm.

Water will give corrosion and wear of engine parts and enables microbial growth in the fuel tank

Organic contaminants (bacteria, fungi etc.) can block fuel filters and **inorganic contaminants** (dust, sand) can cause severe damage to the fuel injection system.

Requirement; max allowed water content 200 ppm and max allowed total contaminant content 30 ppm.

Cold flow properties are determined by the cloud point (the temperature when wax crystals start to fall out) and the CFPP (cold filter plugging point). The oil companies are always responsible for providing fuels with the correct cold flow properties for any time of the year.

FAME (“biodiesel”)

Requirement; The max allowed FAME content is the same as for fuels EN 590 (at present 7% FAME that complies with EN 14214) respectively ASTM D975 (at present 5% FAME that complies with ASTM D6751).

NOTICE! Other FAME types and higher FAME blends are allowed only after agreement with Bukh.

Paraffinic fuels (“Synthetic Diesel” — HVO GTL

HVO (Hydro-treated Vegetable Oil) are renewable, and GTL (Gas-To-Liquid) are fossil, paraffinic fuels. Usage of paraffinic fuels will give lower emissions, but also marginally higher fuel consumption.

NOTICE! Bukh approves usage of neat HVO and GTL that complies with EN 15940, as well as HVO and GTL blends into diesel fuels complying with the quality requirements above.

Kerosene (“Jet fuel”)

Usage of kerosene is not allowed.

Additives

The oil companies shall always ensure that their fuels meet relevant requirements and are fit for their purpose. Their responsibility includes any use of additives for proper engine performance and function.

NOTICE! It is not allowed to add secondary treatment additives ("diesel boosters"), lubricants, gasoline or alcohol into the fuel tank

Marine distillate fuels

NOTICE! Light marine distillate fuels, such as ISO 8217 DMX, are allowed only after agreement with Bukh.

Cooling System

Volume	
Fresh water system volume (ca)	D4: 13 litre (3.4 US gal) D6: 16.5 litre (4.4 US gal)
Thermostat	
The thermostats begins opening/fully open	82°C / 92°C (179.6°F / 197.6°F)

Water Quality

ASTM D4985:

Total solid particles	<340 ppm
Total hardness	<9,5° dH
Chloride	<40 ppm
Sulfate	<100 ppm
pH value	5.5–9
Silica (acc. ASTM D859)	<20 mg SiO ₂ /l
Iron (acc. ASTM D1068)	<0.10 ppm
Manganese (acc. ASTM D858)	<0.05 ppm
Conductivity (acc. ASTM D1125)	<500 µS/cm
Organic content, COD _{Mn} (acc. ISO8467)	<15 mg KMnO ₄ /l

Electrical System

System voltage	12V	24V
AC generator		
voltage/max. amperage	14V/115A	28V/80A
output, approx.	1610W	2240W
Battery capacity	2 connected parallely 12V, max. 88Ah	2 connected in series 12V, max. 88Ah
Battery electrolyte density at +25°C:		
fully charged battery	1,28 g/cm ³ (1,24 g/cm ³)(1)	1,28 g/cm ³ (1,24 g/cm ³)(1)
battery recharged at	1,24 g/cm ³ (1,20 g/cm ³)(1)	1,24 g/cm ³ (1,20 g/cm ³)(1)

1) Applies to batteries with tropical acid.

Reverse gear (excluding oil cooler)

Type designation	HS45AE
Oil capacity	2.5 liters (0.7 US gal)
Oil quality	ATF (Dexron II, III)

Type designation	HS63AE
Oil capacity	4.0 liters (1.0 US gal)
Oil quality	ATF (Dexron II, III)

Type designation	HS63IVE
Oil capacity	4.0 liters (1.0 US gal)
Oil quality	ATF (Dexron II, III)

Type designation	HS80/85AE
Oil capacity	5.0 liters/ 5.5 liters (1.3 US gal/1.5 US gal)
Oil quality	ATF (Dexron II, III)

Type designation	HS80/85IVE
Oil capacity	7.0 liters (1.8 US gal)
Oil quality	ATF (Dexron II, III)

Sterndrive

⚠ WARNING!

Use of other transmission oils than recommended may result in increased gear shifting delay and show other handling characteristics than what you are used to with the factory filled Bukh approved oil.

IMPORTANT:

For transmissions in the marine environment, it is extremely important that the correct transmission oil is used. Using an incorrect transmission oil may very quickly affect transmission life and function. Extensive testing has resulted in an oil developed to optimize the friction in clutch packages and maximize the lifetime for gears and bearings. Bukh accepts no responsibility or liability for any damage or cost arising due to use of other oils then recommended.

If you are unsure about which oil may be used, contact your nearest Bukh dealer.

Drive Type	DPH-B, DPH-C	DPH-D	DPH-D1
Oil capacity	5.2 liters (1.37 US gal)	5.2 liters (1.37 US gal)	5.1 liters (1.34 US gal)
Oil quantity with 1" extension	5.3 liters (1.4 US gal)	5.3 liters (1.4 US gal)	5.2 liters (1.37 US gal)
Oil volume difference MIN - MAX	0.2 liters (0.2 quart)	0.2 liters (0.2 quart)	0.2 liters (0.2 quart)
Oil quality	API GL5 synthetic		
Viscosity	SAE 75W/90	SAE 75W/90	SAE 75W/90
D6-400 Viscosity (Gear ratio 1.59:1)	SAE 75W/140	SAE 75W/140	SAE 75W/140

Power Trim

Oil quality	ATF (Dexron II, III)
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Steering

Oil quality	ATF (Dexron II, III)
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Cooling System

Coolant, Mixing

⚠ WARNING!

All coolant is hazardous and harmful to the environment. Do not consume. Coolant is flammable.

IMPORTANT:

Always use the same type of coolant that is already in the engine.

Different types of coolant must not be mixed with each other.

Risk of reduced cooling function and performance by clogging and isolation.

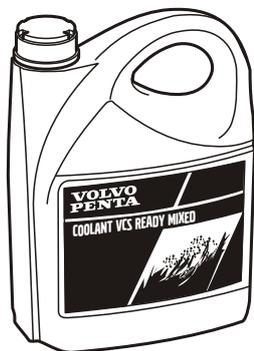
Coolant shall be based on Organic Acid Technology (OAT).

Follow the mixing recommendation on the product.

The coolant should be mixed with distilled, deionized water. For Bukh specified water requirements; refer to *Water Quality*.

NOTICE! Always use "Ready Mixed" coolant if water quality cannot be determined or if it does not fulfill ASTM D4985.

NOTICE! Never mix more than 60% concentrated coolant with water. A greater concentration provides reduced cooling effect with the risk for overheating and reduced frost protection.



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Identification Numbers

There are type plates on the engine and transmission, marked with identification numbers. This information must always be used as reference when service and spare parts are ordered. You will probably find similar plates on your boat and its equipment. Note this information below, make a copy of the page and store it in a safe place, so that you can have the information available if the boat is stolen.

The appearance and location of the type plates is shown below. The figures in brackets refer to the location of the identification number on the type plate.

Engine

Product designation (1):
 Serial number (2):
 Product number (3):

Transmission

Product designation (4):
 Gear ratio (5):
 Serial number (6):
 Product number (7):

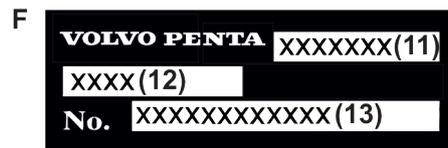
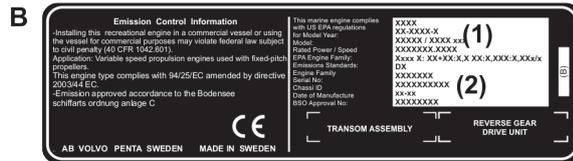
Shield (drive)

Product designation (8):
 Serial number (9):
 Product number (10):

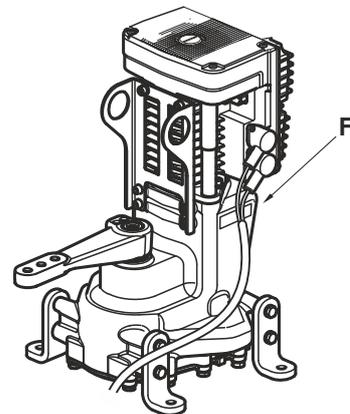
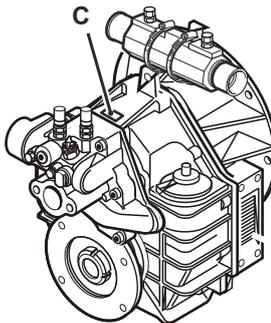
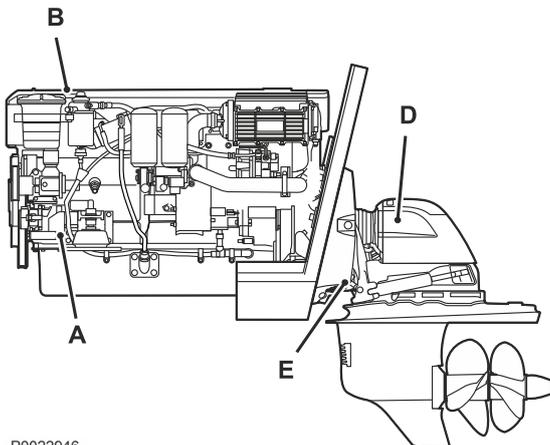
Electrical Rudder Actuator

Product number (11):
 Product designation (12):
 Serial number (13):

- A Engine Plate
- B Engine and transmission decal
- C Reverse gear Plate
- D Drive Plate
- E Shield Plate
- F Electrical rudder actuator Plate



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