

# REPOWERING

GOOD ADVICE FOR SUCCESSFUL REPOWERING



**VOLVO  
PENTA**

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# REPOWERING. A GOOD IDEA?

## **Thinking about a new engine for your boat?**

This publication is about engine replacement and all the questions the boat owner faces. We want to guide you through the various stages of repowering and offer a little sound advice about the various choices you face.

We hope you will benefit from the advice and we wish you good luck with your repowering!



## HOW DO YOU BENEFIT FROM A NEW ENGINE?

The engine is the heart of your boat. Without a reliable and durable engine that does its job in any situation, owning a boat is no pleasure but instead a neverending struggle against the elements – irrespective of whether you have a sailing boat or a powerboat.

If you have a boat you like and are satisfied with but find that it is powered by an engine that no longer meets your requirements, you stand to gain a lot by replacing it. Thanks to the fast pace of technological developments in recent years, you are going to notice some major changes when you change to a new engine:

- Increased safety and reliability**
- Improved comfort**
- Better driving pleasure and more secure manoeuvring**
- Higher performance**
- Immensely reduced environmental impact**
- Easier adaptation to modern accessories**
- Better fuel economy**
- Increased value for your boat**

A new engine increases your boat's value. By just how much depends on the type of boat and how attractive your particular boat model is on the market. Having said that, it is unusual for the entire cost of repowering to be recovered in terms of enhanced resale value. However, if you make a comparison over a number of years between having a new engine with all that means in terms of high operating reliability, and running an old engine that may require major and perhaps even recurring repairs, repowering may well make sound economic sense. The main reason for repowering, however, is quite simply because it gives you so much more enjoyment out of your boat. You invest in security and peace of mind, knowing that your boat will power you safely every time you want to head out to sea.

## RECONDITION?

Reconditioning instead of fitting a new engine is an alternative to consider. However, no matter how you look at it, an engine ages and there comes a time when it simply doesn't make economic sense to repair or recondition it. The challenge is to avoid repairs and reconditioning that involve major investments in an engine that will still never be able to deliver the performance and reliability you want.

A new marine engine from one of the established manufacturers gives you reliability and the protection of a warranty and support from your dealer, on a scale unlike anything you might get from an old engine fitted with new internal components. The risk is that a reconditioned, but still old, engine might soon have to be reconditioned again.

In order to decide whether reconditioning is suitable or not, the best solution is to have a thorough discussion with a reputable engine dealer or boatyard.





# PLANNING AHEAD

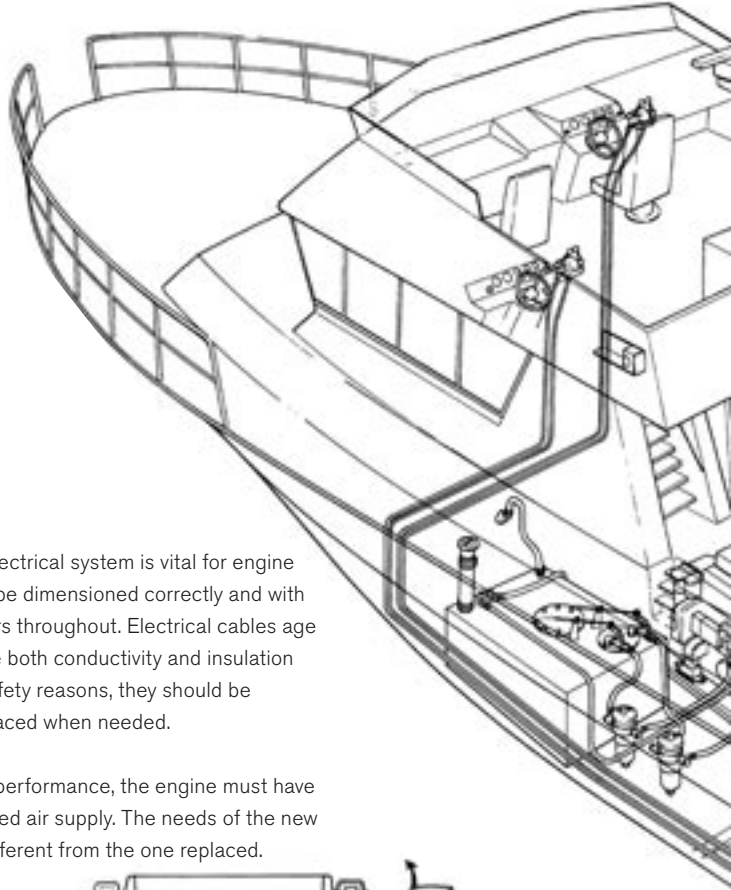
## **When is the right time?**

The ideal situation would be if you could predict exactly when your engine has given all it can, but this is not possible. So, the best advice is to change before the old one gives up the ghost. You avoid being left without a boat in the middle of the season, you can receive a trade-in price for your old engine and, if you plan the exchange carefully, you will also have the time to check other important parts of your boat.

The marine industry is seasonal and everyone works flatout during the boating season. This makes it more difficult to repower your boat during the busy season, at the same time as this is precisely when you want to have a properly functioning engine so you can enjoy your boat. It is therefore best to schedule your repowering for the off season. If you plan your repowering and your old engine still works, you can in fact usually trade it in when buying a new engine.

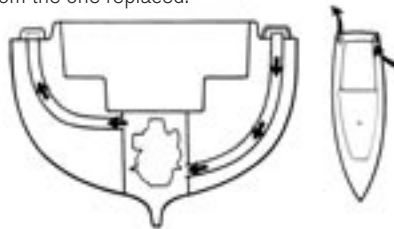
## REPOWERING INVOLVES MORE THAN JUST THE ENGINE

A marine engine installation consists of more than just the engine. It is connected to several systems that must all be optimised to suit both the engine's and the boat's characteristics. Planning well ahead with a competent partner is the key to getting a proper installation.



**Electrical.** The electrical system is vital for engine reliability. It must be dimensioned correctly and with reliable connectors throughout. Electrical cables age with time and lose both conductivity and insulation properties. For safety reasons, they should be checked and replaced when needed.

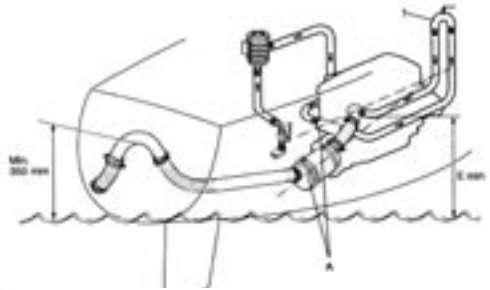
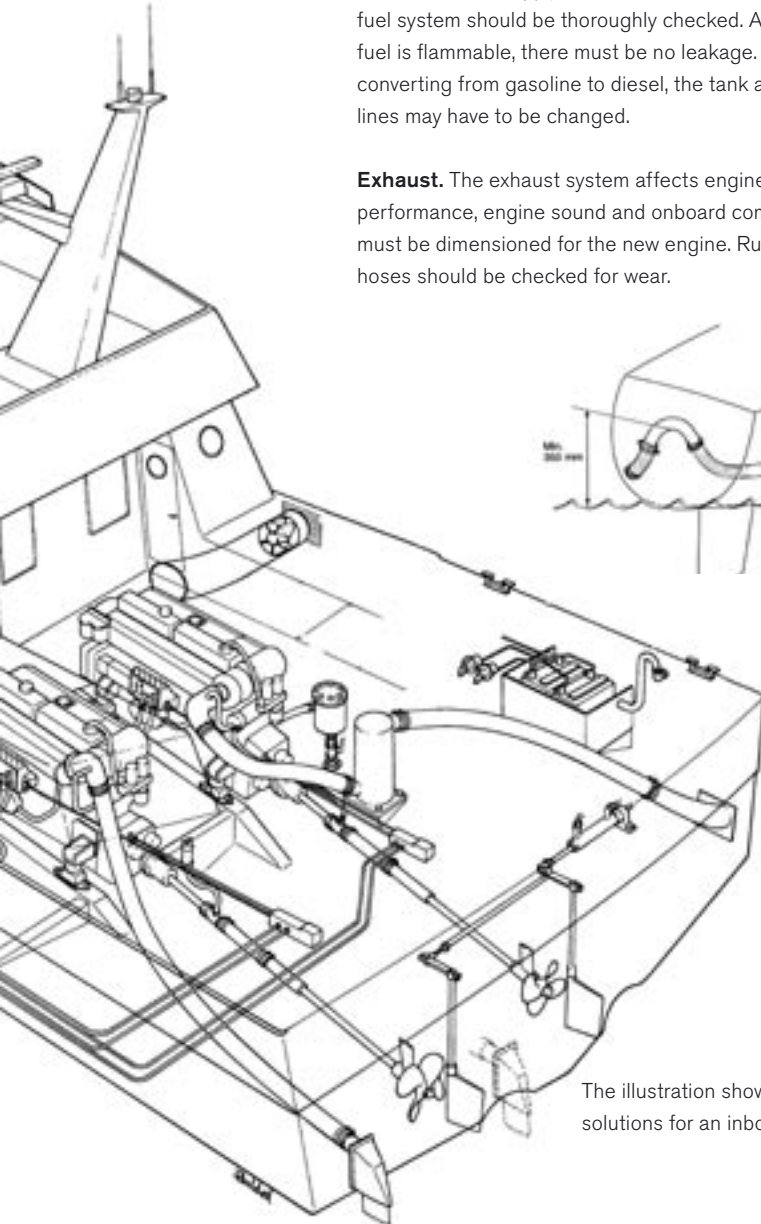
**Air.** For optimum performance, the engine must have a clean, undisturbed air supply. The needs of the new engine may be different from the one replaced.





**Fuel.** A reliable supply of clean fuel is crucial and the fuel system should be thoroughly checked. Also, since fuel is flammable, there must be no leakage. If converting from gasoline to diesel, the tank and fuel lines may have to be changed.

**Exhaust.** The exhaust system affects engine performance, engine sound and onboard comfort and must be dimensioned for the new engine. Rubber hoses should be checked for wear.



The illustration shows two optional exhaust solutions for an inboard installation.

## YOU NEED A COMPETENT PARTNER

Choosing a suitable partner for your repowering is as important as choosing the right engine. No matter whether you intended to sub-contract the entire job or do it all yourself, you will need to have contact with a dealer or boatyard that has experience and competence.

Look for a reputable dealer with experience of repowering jobs like the one you are planning. A competent partner is indispensable to a successful result, not least when the time comes for start-up and a test run. If you choose one of Volvo Penta's authorised dealers, you can take advantage of all the competence at their disposal, with detailed and continuously updated installation literature, tools for propeller calculation and so on. They also work with comprehensive programmes for quality-assuring the entire installation.



## COMPETENT DEALERS CLOSE TO YOU

Volvo Penta has the widest network of dealers on the market, so you are always close to service and support. Thanks to intensive and far-ranging training and easy access to online documentation, the staff is updated on the full range of products and the very latest technologies. Volvo Penta's dealers have access to all the necessary special tools, vital for correct calibration and diagnosis of modern electronically controlled engines. Fast access to parts and accessories and quality assurance programmes make them a complete, dependable partner.

You can find your nearest dealer by visiting [www.volvopenta.com](http://www.volvopenta.com). Use the "Dealer locator" function and choose Marine Leisure engines.

## HOW CAN YOU BE SURE YOU'RE GETTING THE RIGHT PRICE?

It may seem simplicity itself to find out what a new engine should cost, especially with all the information that is so easily accessible in today's modern electronic society. However, just don't forget to compare like with like!

The price of the engine itself is one part of the cost. The cost of installation, trade-in value, any additional components that are required and modifications to permit installation in your particular boat must also be considered. Once again it is the choice of dealer that is crucial.

Make sure you get a detailed and all-inclusive proposal from your dealer. The proposal should be based on a complete inspection of your boat that you and the dealer carry out together. Here, you should go through all the systems that are affected: water, exhaust, air, fuel, electrics/electronics as well as any other work that you may want to have done at the same time. Take advantage of the dealer's experience to find out what your possibilities are, and think carefully about exactly what you want improved in your boat.

The most secure solution for you is a "turnkey job" that includes everything. The dealer will carry out the entire repowering operation and guarantees that the boat will function correctly with the new engine. If you want more work carried out, this must be specified in the proposal. The same thing applies if you want to do all or part of the job yourself. Draw up an agreement that specifies exactly who does what and what the dealer's responsibility is regarding the final result.



# CHOOSING AN ENGINE

The right engine for your boat depends on a variety of factors: how fast you want to go, how much power margin you want, how important comfort is for you, how many passengers/how much load you generally carry and so on.

The engine must naturally fit as regards size and weight, and in addition the air and water supply must be matched to the needs of the new engine, the fuel system has to be appropriately dimensioned, instruments and controls must be added, and much more besides. If you switch to an engine with higher power, you need to examine the engine mountings, the transmission and propshaft or drive.

The correct choice of transmission and propeller requires specialist know-how and here, you really need the help of a highly competent partner. Some boats are also certified for a specific power range, which limits the choice.

These are important issues that have to be dealt with correctly right from the start. Volvo Penta's dealers have the experience as well as the tools and support needed to recommend the right engine.

The following pages contain information about what you need to think about, depending on the type of boat you have.

## ELECTRONICALLY MANAGED ENGINES

For many boat owners, repowering means switching from a mechanically governed engine to one with electronic management. It's a change that offers many benefits.

Electronic engine management is a precondition for being able to combine low emissions with high performance and low fuel consumption. Integrated safety functions provide effective engine protection, along with easier and better service. Routine service requirements are minimal.

Volvo Penta introduced electronic diesel control in 1995 and electronic fuel injection for gasoline engines in 1994. With today's Volvo Penta EVC system, the electronics have been further enhanced and many of the boat's functions can now be integrated into a single common system. The EVC system is based on the same technology that is employed in cars, aircraft and ships. EVC can also communicate with equipment supplied by other manufacturers.

EVC makes the installation of engines, controls and instruments far simpler thanks to the use of plug-in connectors. With fewer cables and fewer, more robust connections, reliability is also far better. The entire system is standardised and extremely easy to use. Engine service is easy, thanks to efficient diagnostic functions.



## THE NEWEST AND CLEANEST ENGINES

Volvo Penta's D series marine diesel engines are a comprehensive range with power outputs from 13 to 775 hp. They are an all-new generation of engines that combine fantastic performance with high reliability and exhaust emissions that meet the US/EU 2006/2007 emission standards.

For a boat owner who changes from a traditional diesel engine, the difference is enormous in every respect. Smoke and harmful exhaust emissions are as much as 90 percent lower and at the same time the engine offers far better operating characteristics. The unique marine torque offers fast and safe acceleration, even with a heavily laden boat and, with power in reserve to back you up in rough seas.

When it comes to gasoline engines, electronic fuel injection offer major advantages compared with engines equipped with carburetors – reliable starting, far better response to the driver's commands and low emissions that meet CARB's Ultra Low Emission requirements.



**LOW EMISSION**  
**2006** US EU

## SAILING BOATS AND DISPLACEMENT BOATS

Diesel engines are the usual alternative for these boat types. If you have a gasoline engine and switch to diesel, you get better operating properties, increased reliability and higher safety.

Choosing the right power output is important. The engine must have sufficient power for the cruising speed of your choice without needing to climb to max revs. This gives you a valuable power reserve, useful for example if you are running against a strong head wind. However, installing an engine that is too powerful doesn't give any benefits – it is unnecessarily heavy and uses more fuel without giving you any additional speed.

If you switch to an engine with higher power, you need to check the engine mountings, transmission and propshaft or drive. The engine must naturally also fit into the space available. The correct choice of propeller is essential for getting the maximum possible out of the engine's power potential.

### **Power for manoeuvring and charging**

The engine's torque is as important as its power output, particularly at low revs. An engine with high torque at low revs gives you power to manoeuvre and it also has sufficient reserves to charge your batteries at idling speed.

Be careful with the engine's optimum revs at cruising speed – the lower the better. An engine built to run at 2500–3000 rpm gives a totally different sense of onboard comfort, with lower noise and vibration levels, than a high-revving engine does.



For sailing boats that only use the engine sporadically, charging capacity is particularly important. Increasing amounts of electronics and other electrical equipment require more powerful alternators and larger battery banks than what is usually standard on a boat older than 10 years. To be adequate, the alternator output should be at least 25 percent of the battery bank capacity. An efficient charging regulator that guarantees full voltage at the battery is also crucial in order to gain the benefit of charging capacity.

The engine, transmission and propeller must be perfectly matched to create a successful installation. On a sailing boat you can benefit from the 3- and 4-blade folding propellers that give you high thrust in forward and reverse combined with very little drag under sail. Talk to your Volvo Penta dealer to learn more.



#### **A new engine gives you:**

- ☑ **Increased reliability.** Secure starts and reliable operation.
- ☑ **Quieter, lower emissions, less vibration.** Increases onboard comfort.
- ☑ **Better charging.** Even Volvo Penta's smallest engine has a 115 A alternator.
- ☑ **Freshwater cooling as standard.** Longer service life and the possibility of hot water or heating.
- ☑ **More power.** Straight from low revs, for easier manoeuvring, acceleration, stopping ability and power in strong head winds.
- ☑ **Increased value** for your boat.
- ☑ **Peace and quiet** with an engine you can rely on.

## PLANING BOATS WITH STERNDRIVE ENGINES

Boats in this category stand to gain a lot with a new engine/drive unit. There have been extensive improvements in the field of engines and drives and today's products are better in every respect. Engines with superior characteristics and more efficient drives with power steering offer immense pleasure behind the wheel.

In a planing boat, higher power means higher top speed. Better torque means faster acceleration up to planing speed and improved handling when the boat is heavily laden. Decide whether you are satisfied with your boat's current performance and discuss various engine alternatives with your dealer!

### **Gasoline or diesel?**

The greatest achievements in technical development have taken place with diesel engines. For example, the new Volvo Penta D series has electronically controlled common rail fuel injection, four valves per cylinder and various types of optimised supercharging with turbo and sometimes also compressor. All this gives performance equal to, sometimes even better than, that of gasoline engines of corresponding power. At the same time, fuel consumption is lower, reliability is greater, service life longer and second-hand value higher.

Gasoline engines offer high performance and relatively low weight. Electronic fuel injection gives high reliability, low emissions and fast response for an enjoyable experience at the helm. The price of a gasoline engine is generally lower than that of a diesel engine.

If you switch from gasoline to diesel, you can often specify a lower power output without actually losing anything in terms of performance, apart from outright top speed, since a diesel engine offers better torque as well as being designed to operate closer to its max rev limit. When changing from gasoline to diesel, the air, fuel and cooling systems need to be checked. Talk to your dealer to find out what exactly is necessary for your particular boat. He has the necessary specifications and documentation if you want to find out more for yourself.

## Single prop or Duoprop?

Duoprop with its twin counter-rotating propellers has several major advantages compared to drives with single props:

- Better acceleration
- Higher top speed
- Better fuel economy
- Directional stability and better grip when turning at high speed
- Easier low-speed manoeuvring since the boat steers entirely straight, even when reversing
- Better comfort thanks to lower vibration

Today, most Volvo Penta engines with sterndrive come with Duoprop technology.



### A new engine/drive gives you:

- ☑ **Increased reliability.** Secure starts and reliable operation.
- ☑ **Better operating economy.** Lower fuel consumption.
- ☑ **Better performance.** Immediate response to the driver's commands.
- ☑ **Fast acceleration.** Quickly reaches planing speed.
- ☑ **Better grip.** More stable at speed, easier manoeuvring.
- ☑ **Lower noise, emission and vibration levels.** Increased comfort onboard.
- ☑ **Increased value** for your boat.
- ☑ **Peace and quiet** with an engine you can rely on.



## PLANING BOATS WITH INBOARD ENGINES

Today, most inboard engines, whether gasoline or diesel, are electronically controlled. This offers many advantages, not least higher onboard comfort since the new engines are quieter, vibrate less and produce lower exhaust emissions. The latter results in greater comfort under way.

Diesel engines have undergone unparalleled development in recent years, and now offer an almost unbelievable combination of performance, comfort and environmental suitability. A modern diesel engine in an optimised installation is an unforgettable experience for any boat owner who has made the switch.

### **Choose the right engine power output**

Since your boat has a planing hull, increased power usually means higher top speed. In general, however, every hull is developed for a specific speed range and significantly exceeding this may in fact give the boat poorer operating characteristics. It is also important to think about the overall result. A more powerful engine may need sturdier engine mountings and a stronger transmission, propshaft propeller, etc. These are important details with which your Volvo Penta dealer can help you.



For inboard engines, the engine, transmission and propeller must be perfectly matched to create a successful installation. Here, there are many different ways of meeting every challenge; your Volvo Penta dealer has both the experience and a wide range of support systems to help you make an informed choice.

### **Distinct manoeuvring and quieter operation**

Electronically managed engines with electronic throttle and gear controls offer many advantages, particularly if you have a large boat with twin engines. Mechanical control cables are replaced with electric cables so vibration and noise is not passed on from the engine. Manoeuvring is uncomplicated with clear and distinct gear positions. Reliability is excellent and maintenance requirements are minimal.



## **REPOWERING ON THE INTERNET**

You can obtain more information about repowering on the Internet. At [www.volvopenta.com](http://www.volvopenta.com) you will find detailed information including a configurator that guides you to a suitable engine choice. Here, you can also obtain in-depth information including drawings, dimensions, weights and comprehensive engine specifications for the entire Volvo Penta range. Information about older engines also makes it possible for you to make comparisons between your current powerplant and the most modern alternatives.

**A new engine gives you:**

- ☑ **Increased reliability.** Secure starts and reliable operation.
- ☑ **Better operating economy.** Lower fuel consumption.
- ☑ **Electronic controls** for distinct manoeuvring and quieter operation.
- ☑ **Better performance.** Immediate response to the driver's commands.
- ☑ **Less noise, lower exhaust emissions and vibration.** Increases onboard comfort.
- ☑ **Fast acceleration.** Quickly and securely up to planing speeds and less sensitive to heavy loads.
- ☑ **Increased value** for your boat.
- ☑ **Peace and quiet** with an engine you can rely on.



# MORE OPPORTUNITIES

Properly planned repowering opens the door to several other improvements. Not least since it is easier to access certain parts of the boat once the engine has been removed.

Go through the boat system by system (air, seawater, electrics, etc.) together with your dealer, and agree on what should be done. Then think about which comfort improvements you would like. If you want to have everything done at the same time, you can usually negotiate a good total price. You also have the advantage of just one contact who can answer all your questions and attend to all your servicing requirements, whether they relate to the engine or any of your accessories.





One thing you should definitely take the opportunity to check is the sound insulation in the engine compartment. Old insulation exposed to years of oil and dirt should be removed. Clean things up and fit new insulation and you will enjoy a pleasantly reduced sound level onboard.

The electrical system probably needs to be modernised. The new engine most likely has a more powerful alternator than the old one and a new, properly dimensioned electrical system increases reliability onboard. Better charging capacity also makes it possible to add various other electrical devices onboard, such as a bow thruster and anchor winch.

A new engine also makes it possible to increase comfort onboard. Facilities such as hot water, heating, defroster and so on can all be seen at your dealer or at [www.volvopenta.com](http://www.volvopenta.com)

## **AN ENTIRELY NEW FEEL TO THE CONTROLS AND INSTRUMENTS**

Electronic controls give an entirely new feel with precise and distinct manoeuvring. They come as standard on most of Volvo Penta's electronically controlled diesel engines and are otherwise available on the options list. Electronic controls offer high reliability and minimum service needs.

The engine is delivered complete with a basic set of instruments. If you want to add more instruments, this is the perfect opportunity. Electronically controlled engines open up entirely new possibilities for intelligent instrumentation with displays that you can modify to suit your particular requirements.

Think also about what you want your instrument panel layout to look like, where the engine controls should be located and so on, so you get everything just the way you want.

# WHEN REPOWERING IS COMPLETE



## READY TO ENJOY MANY TROUBLE-FREE SEASONS!

When the repowering procedure has been completed it is important that you satisfy yourself that everything you specified has actually been done, and also to familiarise yourself with the new features on your boat. Volvo Penta has working procedures for handing over the boat and for supplying you with all the information you need so you can quickly and correctly come to terms with your boat's latest innovations. Make sure all your questions are answered, and also make sure that the boat behaves as you expect. See to it that you receive complete documentation and manuals for all the newly installed components, and do read through the information. Pay special attention to instructions related to running-in, daily inspection, warranty requirements and service.

You should receive the following documents together with your new engine:

- Operator's manual**
- Warranty and service booklet**
- Customer copy of the warranty card**

These three documents are vital if you are to be able to look after your new engine properly, and also so you can back up any warranty claim you may want to make. For other components and accessories, the documentation varies. In general, however, you should have a manual or user instructions as well as a warranty certificate. And of course you should file the receipts for everything you have paid for.

You are now ready for a new chapter in your boating life! Ahead of you are many enjoyable and trouble-free seasons.

Take care of your engine from the beginning! The investment you make in preventive maintenance is something you will be able to get back several times over in terms of better reliability and longer service life.

## CHECKLIST

- ☑ Play it safe. Plan your engine change well before your old engine breaks down.
- ☑ Make the change during the off season.
- ☑ Choose a reputable dealer with experience on your type of boat.
- ☑ Together with the dealer, choose the engine that is best suited to your boat – not necessarily one with the same power output, size or fuel as you have today.
- ☑ Together with your dealer, go through the other possibilities you have, for example sound insulation, the electrical system, controls, instruments and layout of the driver's area.
- ☑ Ask for a comprehensive, all-inclusive proposal based on a joint inspection, where everything is included and who does what is clearly specified.
- ☑ Test-drive the boat after the repowering together with the dealer, and make sure all the new engine's functions are properly demonstrated to you. Make sure you have all the necessary documentation, and go through it.
- ☑ Enjoy your boat for many trouble-free seasons to come!

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