Workshop manual

Inlet, exhaust, cooling systems

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TAMD61A, TAMD62A, TAMD63L-A, TAMD63P-A
TAMD71A, TAMD71B, TAMD72A, TAMD72P-A,
TAMD72WJ-A

Group 25 Inlet and exhaust system
Group 26 Cooling system

Marine engines
TAMD61A • TAMD62A • TAMD63L-A • TAMD63P-A
TAMD71A • TAMD71B • TAMD72A • TAMD72P-A
TAMD72WJ-A

Contents

Information on Safety

Introduction

This Workshop Manual contains technical data, descriptions and repair instructions for Volvo Penta products or product versions contained in the contents list. Ensure that the correct workshop literature is being used.

Read the safety information and the Workshop Manual “General Information” and “Repair Instructions” carefully before starting work.

Important

In this book and on the engine you will find the following special warning symbols.

⚠ **WARNING!** If these instructions are not followed there is a danger of personal injury, extensive damage to the product or serious mechanical malfunction.

⚠ **IMPORTANT!** Used to draw your attention to something that can cause damage, product malfunction or damage to property.

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

Below is a summary of the risks and safety precautions you should always observe or carry out when operating or servicing the engine.

⚠ Immobilize the engine by turning off the power supply to the engine at the main switch (-switches) and lock it (them) in the OFF position before starting work. Set up a warning notice at the engine control point or helm.

⚠ Generally, all servicing should be carried out with the engine switched off. Some work (carrying out certain adjustments for example) requires the engine to be running. Approaching a running engine is dangerous. Loose clothing or long hair can fasten in rotating parts and cause serious personal injury.
If working in proximity to a running engine, careless movements or a dropped tool can result in personal injury. Avoid burns. Take precautions to avoid hot surfaces (exhausts, turbochargers, charge air pipes and starter elements etc.) and liquids in supply lines and hoses when the engine is running or has been turned off immediately prior to starting work on it. Reinstall all protective parts removed during service operations before starting the engine.

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

⚠ Engine with turbocharger: Never start the engine without installing the air cleaner (ACL). The rotating compressor in the turbocharger can cause serious personal injury. Foreign objects entering the intake ducts can also cause mechanical damage.

⚠ Never use start spray or similar to start the engine. The starter element may cause an explosion in the inlet manifold. Danger of personal injury.

⚠ Avoid opening the filler cap for engine coolant system (freshwater cooled engines) when the engine is still hot. Steam or hot coolant can spray out. Open the coolant filler cap carefully and slowly to release pressure before removing the cap completely. Take great care if a cock, plug or engine coolant line must be removed from a hot engine. It is difficult to anticipate in which direction steam or hot coolant can spray out.

⚠ 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, otherwise oil could be ejected.

⚠ Stop the engine and close the sea cock before carrying out operations on the engine cooling system.

⚠ Start the engine only in a well-ventilated area. If operating the engine in an enclosed space, ensure that exhaust gases and crankcase ventilation emissions are extracted from the working area.

⚠ Always use protective goggles where there is a danger of pieces of metal, sparks from grinding, acid or other chemicals being thrown into your eyes. Your eyes are very sensitive, injury can lead to loss of sight!

⚠ Avoid skin contact with oil. Long-term or repeated contact with oil can remove the natural oils from your skin. The result can be irritation, dry skin, eczema and other skin problems. Used oil is more dangerous to health than new oil. Use protective gloves and avoid oil soaked clothes and rags. Wash regularly, especially before meals. Use the correct barrier cream to prevent dry skin and to make cleaning your skin easier.

⚠ Most chemicals used in products (engine and transmission oils, glycol, petrol and diesel oil) and workshop chemicals (solvents and paints) are hazardous to health Read the instructions on the product packaging carefully! Always follow safety instructions (using breathing apparatus, protective goggles and gloves for example). Ensure that other personnel are not unwittingly exposed to hazardous substances (by breathing them in for example). Ensure that ventilation is good. Handle used and excess chemicals according to instructions.

⚠ Be extremely careful when tracing leaks in the fuel system and testing fuel injection nozzles. Use protective goggles! The jet ejected from a fuel injection nozzle is under very high pressure, it can penetrate body tissue and cause serious injury There is a danger of blood poisoning.

⚠ All fuels and many chemicals are inflammable. Ensure that a naked flame or sparks cannot ignite fuel or chemicals. Combined with air in certain ratios, petrol, some solvents and hydrogen from batteries are easily inflammable and explosive. Smoking is prohibited! Ensure that ventilation is good and that the necessary safety precautions have been taken before carrying out welding or grinding work. Always have a fire extinguisher to hand in the workplace.

⚠ Store oil and fuel-soaked rags and fuel and oil filters safely. In certain conditions oil-soaked rags can spontaneously ignite. Used fuel and oil filters are environmentally dangerous waste and must be deposited at an approved site for destruction together with used lubricating oil, contaminated fuel, paint remnants, solvent, degreasing agents and waste from washing parts.

⚠ Never expose the batteries to a naked flame or electric sparks . Never smoke in proximity to the batteries. The batteries give off hydrogen gas during charging which when mixed with air can form an explosive gas - oxyhydrogen. This gas is easily ignited and highly volatile. Incorrect connection of the battery can cause a spark which is sufficient to cause an explosion with resulting damage.

⚠ Do not disturb battery connections when starting the engine (spark risk) and do not lean over batteries.

⚠ Never mix up the positive and negative battery terminals when installing. Incorrect installation can result in serious damage to electrical equipment. Refer to wiring diagrams.

⚠ Always use protective goggles when charging and handling batteries. The battery electrolyte contains extremely corrosive sulfuric acid. If this comes into contact with the skin, wash immediately with soap and plenty of water. If battery acid comes into contact with the eyes, immediately flush with copious amounts of water and obtain medical assistance.

⚠ Turn off the engine and turn off power at main switch(es) before carrying out work on the electrical system.

⚠ Clutch adjustments must be carried out with the engine turned off.

⚠ Use the lifting eyes mounted on the engine/reverse gear when lifting the drive unit.
Always check that lifting equipment is in good condition and has sufficient load capacity to lift the engine (engine weight including reverse gear and any extra equipment installed).

To ensure safe handling and to avoid damaging engine components on top of the engine, use a lifting beam to raise the engine. All chains and cables should run parallel to each other and as perpendicular as possible in relation to the top of the engine.

If extra equipment is installed on the engine altering its center of gravity, a special lifting device is required to achieve the correct balance for safe handling.

Never carry out work on an engine suspended on a hoist.

⚠ Never remove heavy components alone, even where secure lifting equipment such as secured blocks are being used. Even where lifting equipment is being used it is best to carry out the work with two people; one to operate the lifting equipment and the other to ensure that components are not trapped and damaged when being lifted.
When working on-board ensure that there is sufficient space to remove components without danger of injury or damage.

⚠ Components in the electrical system, ignition system (gasoline engines) and fuel system on Volvo Penta products are designed and constructed to minimize the risk of fire and explosion. The engine must not be run in areas where there are explosive materials.

⚠ Always use fuels recommended by Volvo Penta. Refer to the Instruction Book. The use of lower quality fuels can damage the engine. On a diesel engine poor quality fuel can cause the control rod to seize and the engine to overrev with the resulting risk of damage to the engine and personal injury. Poor fuel quality can also lead to higher maintenance costs.

⚠ **WARNING!** The engine has pretensioned delivery lines. These pipes must under no circumstances be bent. Damaged pipes should be replaced.

⚠ Observe the following rules when cleaning with high-pressure water jets: Never direct the water jet at seals, rubber hoses or electrical components. Never use a high pressure jet when washing the engine.

General information

About the Workshop Manual

This Workshop Manual contains technical data, descriptions and repair instructions for the standard version of engine units TAMD61A, TAMD62A, TAMD63P-A, TAMD63L-A, TAMD71A, TAMD71B, TAMD72A, TAMD72WJ-A, and TAMD72P-A.

The Workshop Manual shows the work procedure conducted on an optional engine as per the above specification, and therefore the illustrations and photographs of certain details may not fully correspond with other engines. The repair methods, however, remain the same in all their critical parts. If this should not be the case important differences will be reported separately. The engine designation and number is indicated on the rating plate (see Workshop Manual Group 21 Engine page 15). The engine designation and number should be stated on all correspondence concerning an engine.

The Workshop Manual is primarily produced for Volvo Penta service workshops and their qualified personnel. It is therefore assumed that persons using this manual have basic competence on marine drive systems and can conduct work of a mechanical/ electrical nature attendant to this profession.

Volvo Penta continuously develops its products, and therefore we reserve the right to change technical specifications without prior notice. All information in this manual is based on product data available prior to press. Any modifications of critical importance introduced on the product or service methods after this date are confirmed in the form of Service Bulletins.

Spare parts

Spare parts for the electrical and fuel systems are subject to different national safety regulations, e.g. US Coast Guard Safety Regulations. Volvo Penta Genuine Parts comply with these regulations. All types of damage occurring as a result of the use of non genuine Volvo Penta parts for the product in question will not be regulated by the warranty undertakings of Volvo Penta.

Certified engines

For engines which are certified for national and regional environmental legislation the manufacturer undertakes to ensure compliance with environmental regulations both for new engines and those in use. The product must comply with the approved example on certification. In order for Volvo Penta as manufacturer to ensure that engines in use comply with the set environmental regulations the following requirements for service and spare parts must be fulfilled:

- Service intervals and maintenance procedures recommended by Volvo Penta must be followed.
- Only Volvo Penta Genuine Parts, intended for the certified engine version, must be used.
- Service which includes the ignition system, ignition adjustment and fuel injection system (petrol) or injection pumps, pump adjustment and injectors (diesel) shall always be conducted by an authorised Volvo Penta workshop.
- The engine must not be rebuilt or modified in any way, with the exception of the accessories and service sets which Volvo Penta has developed for the engine.
- Installation modifications on exhaust pipes and air intake channels for engine chambers (ventilation channels) must not be made, since this can influence exhaust emissions.
- Seals must not be broken by unauthorised personnel.

⚠ **IMPORTANT!** When spare parts are required use only Volvo Penta Genuine Parts.
The use of non genuine parts implies that AB Volvo Penta no longer assumes responsibility for the compliance of the engine with the certified version.
All types of damage or costs occurring as a result of the use of non genuine Volvo Penta parts for the product in question will not be regulated by Volvo Penta.

Repair instructions

The work methods described in the Workshop Manual are applicable for a workshop environment. The engine is therefore removed from the boat and mounted in an engine block. Renovation work which does not require removal of the engine is conducted in situ with the same work methods, unless otherwise stated.

The warning symbols used in the Workshop Manual (see *Information on Safety* for implication)

⚠ **WARNING!**

⚠ **IMPORTANT!**

NOTE!

These are in no way comprehensive, since we obviously cannot foresee everything, in that service work is conducted under the most various conditions. We can therefore only point out the risks which we consider can arise as a result of incorrect handling during work in a well-equipped workshop with work methods and tools which are proven by us.

In the Workshop Manual all the work procedures for which there are special Volvo Penta tools are conducted with these. The special tools are specially produced to facilitate the most safe and rational work method possible. It is therefore the responsibility of persons using other tools or another work method than that which we recommend to ensure that no risk of personal injury, material damage or malfunction can occur.

In some cases there may be special safety instructions and user instructions for the tools and chemicals named in the Workshop Manual. These instructions shall always be followed and there are no special instructions for this in the Workshop Manual.

By means of taking certain elementary procedures and using a modicum of common sense, most risk factors can be prevented. A clean workplace and a clean engine eliminate many risks both of personal injury and malfunction.

Especially during work on the fuel system, lubrication system, induction system, turbo, bearing unions and sealing unions, it is of the greatest importance that dirt or foreign particles do not get in, since this can result in malfunctioning or shorten the repair service-life.

Our joint responsibility

Each engine consists of a large number of interactive systems and components. The deviation of a component from the technical specification can dramatically increase the environmental impact from an otherwise first-rate engine. It is therefore of extreme importance to maintain the given wear tolerances, that systems capable of adjustment receive the correct setting, and that Volvo Penta Genuine Parts are used for the engine. The time intervals in the engine's maintenance schedule must be followed.

Certain systems, e.g. components in the fuel system, may require special competence and special test equipment. Certain components are sealed at the factory for environmental reasons. Work on sealed components must not be conducted unless authorisation for such work is held.

Remember that most chemical products, incorrectly used, are hazardous to the environment. Volvo Penta recommends the use of biologically decomposing degreasing agents for all cleaning of engine components, unless otherwise stated in the Workshop Manual. When working on board a boat pay special attention to make sure that oils and washing residue are handled correctly for destruction, and do not unintentionally end up in the nature, e.g. in the bilge-water.

Tightening torques

Tightening torque for vital unions, which should be tightened with dynamometric wrenches, is listed in "Specifications: Tightening torque" and indicated in the manual's work descriptions. All torque indications are applicable for cleaned threads, screw heads and mating surfaces. The torque indications refer to lightly oiled or dry threads. If lubricants, locking liquids or sealants are required for the screw union, the type is indicated in the work description and in "Tightening torques". General tightening torque as per the table below is applicable for unions where special torque indications are not given. The torque indication is a standard value and the union does not require tightening with a dynamometric wrench.

Size	Tightening torques	
	Nm	lbf.ft
M5	6	4.4
M6	10	7.4
M8	25	18.4
M10	50	36.9
M12	80	59.0
M14	140	103.3

Angular tightening torque

For angular tightening torque the screw union is tightened with a given torque, thereafter further tightening with a predetermined angle. Example: at 90° angular tightening the union is tightened and an additional
1/4 turn is made in a work procedure after the given tightening torque has been reached.

Lock nuts

Dismantled lock nuts shall not be reused but replaced with new items, since the locking properties diminish or are lost with repeated use. For lock nuts with plastic inserts, e.g. Nylock®, the tightening torque given in the table shall be reduced if the Nylock® nut has the same nut height as a standard full-metal hexagonal nut. The tightening torque is reduced by 25% for screw size 8 mm or larger. For Nylock® nuts with higher nut heights, where the full-metal thread is equally high as a standard hexagonal nut, the tightening torque as per the table are applicable.

Strength classes

Screws and nuts are divided into different strength classes; affiliation is indicated by the marking on the screw head. A higher number on the marking represents a stronger material, e.g. a screw marked 10-9 has a higher strength than a screw marked 8-8. It is therefore important when dismantling screw unions that the screws are refitted in their original places. For replacement of screws see the Parts Catalogue to ensure that the correct version is obtained.

Sealants

A number of different sealants and locking liquids are used on the engine. The properties of the mediums differ, and they are intended for different union strengths, temperature ranges, resistance to oils and other chemicals, and for the different materials and column sizes in the engine.

In order to conduct satisfactory service work it is therefore important that the correct type of sealant and locking liquids are used for the unions where such are required.

In the Workshop Manual we have indicated in respective chapters the agents which are used in our engine production.

During service work the same agent, or agent with similar properties but of other manufacture, shall be used.

When using sealants and locking liquids it is important that the surfaces are free from oil, grease, paint and anti-rust agent, and that they are dry.

Always follow the instructions of the manufacturer concerning application temperature, hardening time and other instructions for the product.

Two different basic types of agents are used on the engine, and these are characterised by:

RTV-agent (Room temperature vulcanising). Most often used with gaskets, e.g. sealing of gasket joints or applied on gaskets. RTV-agent is fully visible when the part has been dismantled: old RTV-agent must be removed before the union is sealed again.

The following RTV-agents are named in the Workshop Manual: Loctite® 574, Volvo Penta 840879-1, Permatex®. No. 3, Volvo Penta 1161099-5, Permatex® No. 77. Old sealant is removed in each case with denatured spirit.

Anaerobic agents. These agents harden on the absence of air. The agent is used when two solid parts, e.g. cast components, are fitted together without gasket. A common application is also to secure and seal plugs, threads on pin bolts, taps, oil pressure relays, etc. Hardened anaerobic agents are transparent and therefore they are coloured to make them visible. Hardened anaerobic agents are very resistant to solvents and old agent cannot be removed. Careful degreasing is conducted prior to refitting, and new sealant is applied.

The following anaerobic agents are named in the Workshop Manual: Loctite® 572 (white), Loctite® 241 (blue).

NOTE! Loctite® is a registered trade-mark for Loctite Corporation, Permatex® is a registered trade-mark for Permatex Corporation.

Safety instructions for fluorocarbon rubber

Fluorocarbon rubber is a common material used in seals for shafts and O-rings.

When fluorocarbon rubber is exposed to high temperatures (over 300° C) **hydrofluoric acid** can be formed, which is strongly corrosive. Contact with the skin can result in serious burn injuries. Contact with the eyes can result in malignant ulcers. Inhalation of fumes can injure the respiratory passages.

⚠ **WARNING!** Observe great care during work on engines which can have been exposed to high temperatures, e.g. overheating during seizing or fire. Seals must never be burned loose during dismantling or subsequently burned in an uncontrolled manner.

- Always wear gloves of chloroprene rubber (gloves for handling chemicals) and protective goggles.
- Handle the removed seal in the same way as corrosive acid. All residue, including ash, can be strongly corrosive. Never use compressed air to blow clean.
- Place the residue in a sealed plastic tin provided with a label. Gloves are washes under running water before taking them off.

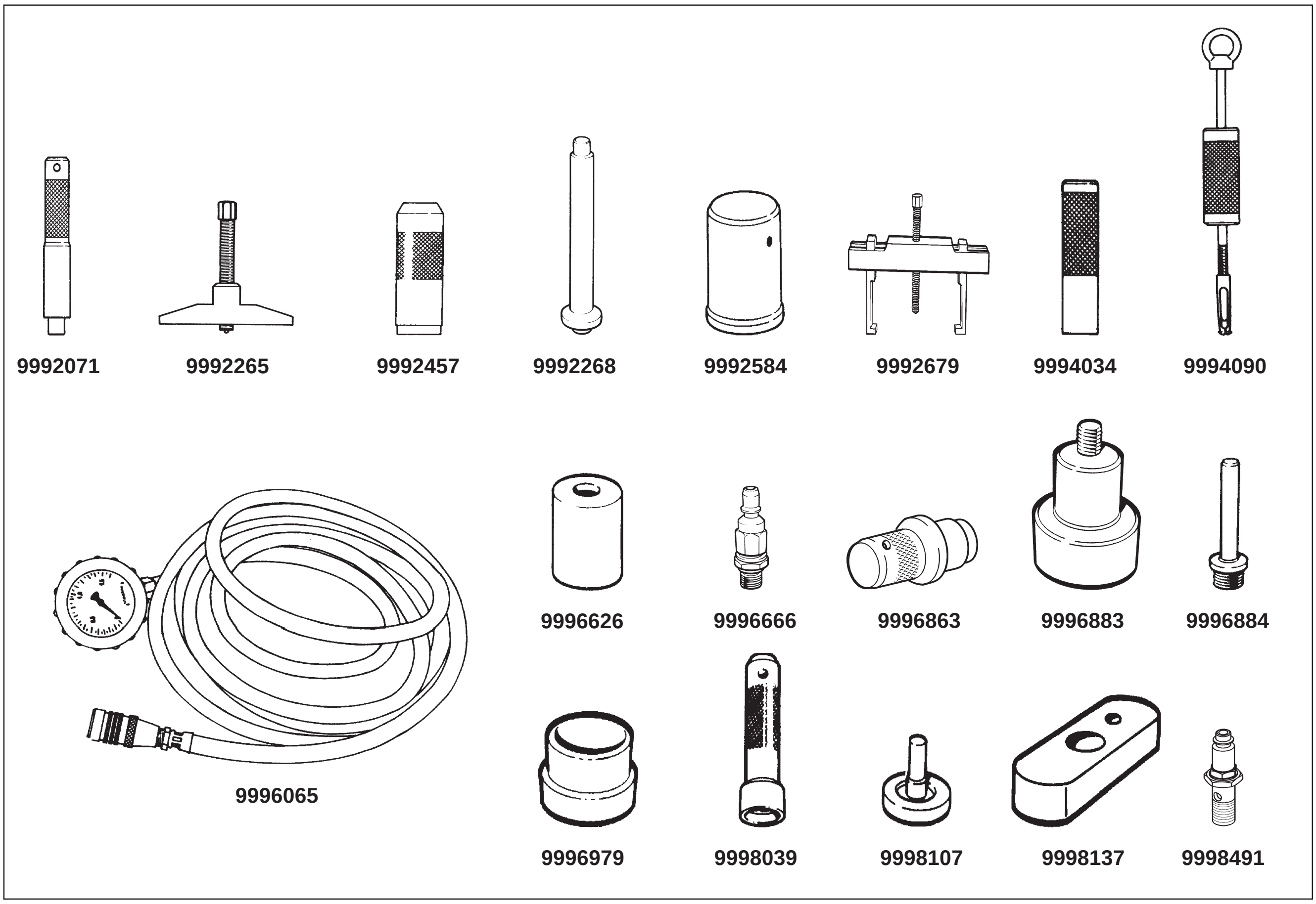
The following seals are in all probability manufactured of fluorocarbon rubber:

Seals for crankshafts, camshafts, intermediate shafts.

O-rings irrespective of where they are fitted. O-rings for cylinder lining sealing are almost always of fluorocarbon rubber.

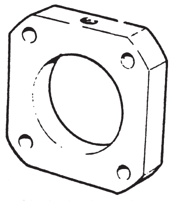
Note that seals which have not been exposed to high temperatures can be handled as normal.

Special tools

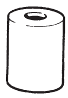


9992071-2	Mandrel for coolant pump, for removing gear wheel from shaft stub and for installing impeller with shaft.
9992265-0	Extractor
9992268-4	Mandrel
9992457-3	Mandrel
9992584-4	Hollow drift for coolant pump for removal of gear wheel from shaft stub and installation of circlip
9992679-2	Extractor
9994034-8	Mandrel for coolant pump, for removing shaft stub with bearing and gear wheel, and installing gear wheel.
9994090-0	Extractor for coolant pump renovation
9996065-0	Pressure gauge with hose for connecting to banjo nipple 6666 for checking turbo boost pressure.
9996626-9	Hollow drift for installing shaft stub with bearing in coolant pump
9996666-5	Nipple with quick release connector for connection to 6065
9996863-8	Mandrel for replacing piston thermostat seal
9996883-6	Tool for coolant pump. Used together with 6884 and 884985 for removing impeller with shaft.
9996884-4	Mandrel for removing impeller with shaft from coolant pump. Used together with 6883 and 884985.
9996979-2	Ring for renovating coolant pump
9998039-3	Mandrel for renovating coolant pump
9998107-8	Counterhold for renovating coolant pump
9998137-5	Mandrel for renovating coolant pump
9998491-6	Nipple for connecting 6065

Other special equipment



884970



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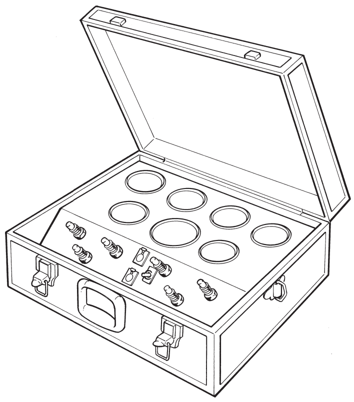

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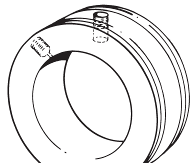


885164

884970-5 Flange kit complete for measuring exhaust back pressure on TAMD61, -62, -71, - 72

884985-3 Mandrel for pressing out coolant pump drive shaft

885151-1 Test instrument kit for measuring exhaust back pressure and exhaust temperature.

885164-4 Flange kit complete for measuring exhaust back pressure on TAMD 61, -62, -71 late model and TAMD63, -72.

Group 25 Inlet and exhaust system
Design and function

General

All engines are equipped with an exhaust-driven turbocharger which provides the engine with air at raised pressure.

This increases the amount of oxygen provided to the engine. More fuel can be burned at the same time as combustion becomes more efficient. The result is higher power, lower specific fuel consumption and cleaner exhaust emissions.

The TAMD63P-A, -72A, -72P-A have a turbocharger with wastegate valve (pressure relief valve). This permits a smaller turbocharger to be used. A smaller turbo receives enough exhaust gas to give high turbine speed/boost pressure at lower engine speeds. I.e. the engine is given considerably better power at lower speeds at the same time as it reacts faster to changes in load.

At higher engine speeds, the wastegate valve opens and leads some of the exhaust gas past the turbocharger, and straight out into the exhaust pipe.

On the TAMD63P-A and TAMD72P-A, the wastegate valve is integrated with the turbocharger, whereas on the TAMD72A, it is installed on a joining piece between the exhaust manifold and the turbocharger.

The induction air from the turbocharger then passes though an aftercooler which lowers the temperature of the induction air. This means that a larger amount of oxygen comes into the combustion chambers, which increases the power of the engines together with increased fuel supply.

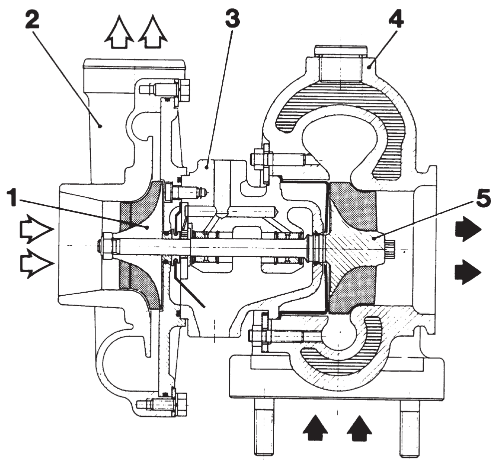
TAMD61, -62 and -63 have aftercoolers whereas TAMD71 and TAMD72 have twin series-connected aftercoolers. The aftercoolers are located on the right-hand sides of the engines.

Turbocharger

The turbocharger, which has plain bearings, consists of a turbine housing (4) with turbine wheel (5), bearing housing (3) and compressor housing (2) containing the compressor wheel (1). The turbocharger is driven by the exhaust gas which passes through the turbine housing and then on out into the exhaust system. By putting a turbine wheel (5) in the exhaust gas stream (outlet side) and having it drive a compressor wheel (1) on the same shaft, on the inlet side, the induction air is compressed so that the amount of air supplied to the engine is increased.

The compressor wheel is located in a housing which is connected between the air filter and the induction manifold of the engine. When the compressor wheel rotates, air is sucked in from the air filter, the air is compressed and pressed into the cylinders of the engine.

The turbocompressor is located on the exhaust manifold at the rear of the engine and is both lubricated and driven by the lubrication oil of the engine. The oil is supplied and drained through external oil pipe connections.



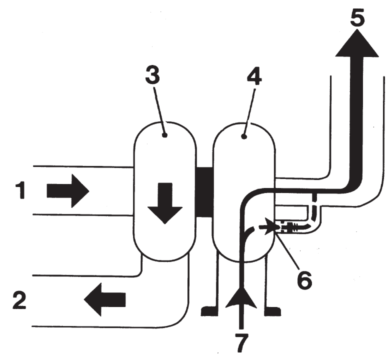
The turbine housing is cooled by fresh water to reduce the heat radiated to the engine bay.

Turbocharger for TAMD72A

1. Compressor wheel
2. Compressor housing
3. Bearing housing
4. Turbine housing (fresh water cooled)
5. Turbine wheel with shaft

Wastegate valve

The purpose of the wastegate valve is to prevent the small turbine from over-speeding at high engine speeds. The valve is controlled by a pressure box containing a spring-loaded diaphragm which is controlled by boost pressure via a hose from the compressor housing. When a specific boost pressure has been obtained, the wastegate valve opens and allows a proportion of the exhaust gas (6) to bypass the turbine wheel and go straight to the exhaust pipe.



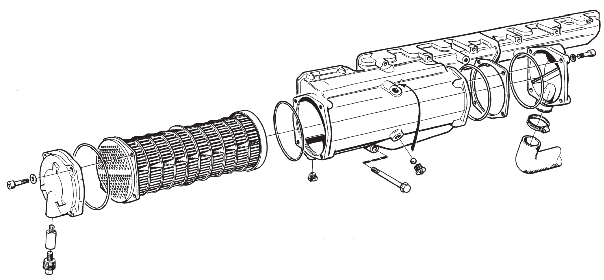
TAMD63P-A, TAMD72P-A: Principle sketch of turbocharger with wastegate valve.

1. Air from air filter
2. Compressed air to engine
3. Compressor housing
4. Turbine housing
5. Exhaust outlet
6. Exhaust flow past turbine wheel via wastegate valve at high engine loading
7. Exhaust gas from engine

Aftercooler

The induction air passes the aftercooler(s) which is/are cooled by sea water, after compression in the turbocharger. The aftercooler then lowers the temperature of the air and thus considerably increases cylinder filling by reducing the volume of the air. More air (oxygen) can then be pressed into the cylinders of the engine and can burn a larger amount of fuel per stroke. I.e. engine power can be raised.

A turbocharged diesel engine with intercooling has the highest specific efficiency of all (internal) combustion engines.



Bypass valve for aftercooler

The following engines are equipped with by-pass valves for intercooling: TAMD61A, TAMD62A, TAMD71A and -71B.

The bypass system consists of a butterfly valve housing with delay valve. The butterfly valve housing is located on the induction manifold of the engine.

At low engine loading, the passage through the aftercooler is closed by the butterfly valve in the valve housing. The induction air passes through a pipe straight from the turbocompressor to the induction manifold of the engine. This gives the engine warmer induction air at low loadings.

When the load on the engine increases, and the boost pressure has increased to about **0.4 kp/cm²**, the butterfly valve position in the housing changes. The bypass pipe is closed and the induction air passes through the aftercooler before being forced into the induction manifold of the engine. With the butterfly valve in this position, the engine functions as an ordinary intercooled engine.

Repair instructions

Turbocharger, removal

A vital requirement for satisfactory operation of the turbocharger unit is that the lubrication system of the engine is kept in good repair and the correct grade of oil is used (please refer to the workshop manual, “Technical data”, page 15).

Please consider changing the engine oil and lubrication oil filter before the turbocharger is removed, so that the engine can be run for a few minutes with the new oil.

1

Clean the area round the turbocharger.

2

Drain some of the coolant from the fresh water system and remove the coolant pipes to and from the turbocharger.

3

Undo the exhaust pipe by the outlet from the turbocharger.

4

Remove the air filter.

5

Only applies to the TAMD61, -62, -71

Remove the connection pipe between the turbocharger and the by-pass valve. Remove the lubrication oil pipe to and from the turbocharger.

6

Does not apply to the TAMD61, -62, -71

Remove the connection pipe between the turbocompressor and the induction manifold.

7

Bend up the lock tab and remove the turbocharger from the exhaust manifold.

Turbocharger, installation

NOTE! Always find out the reason for turbine replacement when it is changed. Then attend to the reasons for the failure before installing the new turbocharger.

For satisfactory operation of the turbocharger unit, the lubrication and induction systems of the engine must be kept in good repair. I.e. engine oil, lubrication oil filters and air filter must be replaced at the specified change intervals in the instruction manual, and the correct grade of oil must be used.

1

Change the engine oil and the engine lubrication oil filter when the turbocharger is changed.

Use the correct grade of oil, please refer to “Technical Data” on page 15 of the workshop manual.

Be careful to observe the change intervals for the oil and the lubrication oil filters.

Replacements must be done as advised in the instruction manual to guarantee that the engine is kept clean.

Clean the turbocharger oil supply and oil return pipes.

Bearing failure in turbochargers is almost always caused by sludge deposits in the engine lubrication system.

Sludge formation can be found by lifting one of the valve covers on the engine.

If there are any sludge deposits, the entire lubrication system must be carefully cleaned before a new or renovated turbocharger is installed.

2

Clean any loose soot, carbon or metal particles from the exhaust manifold and install the turbocharger on the engine.

Note: To facilitate spare part handling, turbochargers are only stocked in some cases with a single angle between the compressor outlet and the exhaust flange of the turbine housing.

This means that the mutual angle may need to be adjusted to fit the turbocharger to the engine. Compare it with the turbocharger previously installed on the engine.

3

Clean the inlet pipe between the compressor and the engine. After a turbine failure, foreign bodies such as fragments of a burst compressor wheel can be left behind, which can smash the new compressor or turbine wheel.

4

Applies to engines with aftercoolers

It is important that the aftercooler is checked and cleaned as well.

If a turbine failure with burst compressor wheel has occurred, the aftercooler must be removed and proof tested in accordance with the instruction on pages 29–33.

5

Clean the connection pipe carefully.

6

Only applies to TAMD61, -62, -71

Install the connection pipe between the turbocharger and the bypass valve. Use new seal rings.

7

Does not apply to TAMD61, -62, -71

Install the connection pipe between the turbocharger and the induction manifold. Use new seal rings.

8

Does not apply to TAMD63

Install the new air filter insert on the air filter.

Particles from a burst compressor wheel etc. can travel against the air stream and go out to the filter.

9

Only applies to TAMD63

Clean the air filter carefully.

Particles from a burst compressor wheel etc. can travel against the air stream and go out to the filter.

10

Install the oil return pipe for the turbocharger.

11

Connect the coolant pipes to the turbine housing.

Fill up with coolant and vent the system as in the instruction on page 28.

12

Connect the exhaust pipe to the turbocharger.

13

Only applies to TAMD61 and TAMD71

Install the battery earth connection.

14

Squirt some lubricating oil into the turbocharger bearing housing with an oil can.

Install the oil supply pipe.

15

Put a suitable vessel beneath the turbocharger oil return pipe to collect oil.

NOTE! To avoid damage to the turbocharger, the engine should be cranked with the start motor and with the stop solenoid connected/stop control pulled out until oil pressure is obtained.

Start the engine.

Immediately loosen the union for the oil return pipe and check that the oil circulates correctly.

Tighten the oil return union and check that no leakage occurs.

Remove the oil collection vessel.

16

After the turbocharger has been changed or renovated, check the boost pressure.

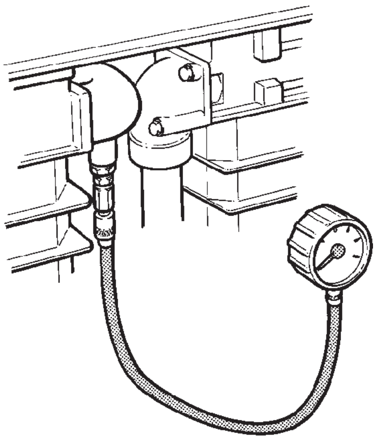
Boost pressure, checking

Special tools: 9996065, 9996666, 9998491

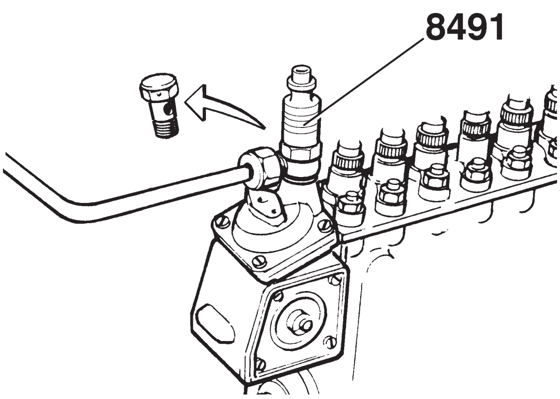
When the exhaust emissions are highly sooty or if the engine is very down on power, the function of the turbocharger can be suspected. The boost pressure must always be checked before turbocharger replacement is considered.

Note that low boost pressure can depend on other reasons than the turbocharger. Please refer to "Measures for low boost pressure" on page 16.

1



Outlet for checking boost pressure on TAMD61, -62, -71, -72WJ-A



Outlet for checking boost pressure on TAMD63

Only applies to TAMD61, -62, -71, -72WJ-A

Remove the plug/sensor fitted beneath the induction manifold between the aftercooler and the induction manifold.

Install a standard M18x1.5 nipple in the hole.

Install nipple 9996666 on the standard nipple.

Connect pressure gauge 9996065.

Only applies to TAMD63

Remove the hollow screw in the banjo union for the smoke limiter.
Replace the existing hollow screw with nipple 9998491.
Connect pressure gauge 9996065 to 9998491.

Only applies to TAMD72P-A

Diagnosis tool 885242 is used to measure the turbo pressure on the TAMD72P-A.
Please refer to the "Fuel system EDC" instructions in the Workshop Manual on pages 31–33.

2

Run the engine(s) and start measurement as follows:

Measurement should be carried out at full load with full throttle whilst the engine speed relatively slowly passes the engine speed specified for the engine type.

Please refer to the "Technical Data" in the Workshop Manual on pages 18 and 19.

During this test, the boost pressure should not fall below the minimum value specified for the engine type.

Check the engine speed with a workshop tachometer.

NOTE! It is important that full load is maintained for long enough to allow the pressure to stabilise, to give a fair result.

Actions for low boost pressure

- **Air inlet**

  Check that the air inlet to the engine bay is not blocked.
  Check that the air inlet is correctly dimensioned where appropriate, please refer to the manual.

- **Air filter**

  Check that the air filter is not blocked.
  Replace it where necessary.

- **Sealing**

  Check sealing
  The inlet and exhaust pipes and all hose unions must not have any leaks.
  Also check that the aftercooler seals against the induction manifold.

- **Throttle control (Does not apply to TAMD72P-A)**

  Check that the control can move the injector pump fuel increase lever to the maximum position.

- **Turbocharger**

  Check whether the rotor shaft runs stiffly or if either the turbine wheel or compressor wheel contact their housings.
  Turn the wheel under light pressure, then when applying axial force. If the wheel does not run freely, the turbocharger must be changed or renovated.
  Check the wheels for damage.

  ⚠ **WARNING!** Never operate the engine if damage to the turbocharger compressor wheel is suspected since fragments from a burst wheel can be sucked into the engine.

- **Cleaning**

In daily operation in dusty or oily air, and if the change interval for the air filter has not been observed, the compressor housing and compressor wheel may need to be cleaned.
A dirty compressor wheel can cause low boost pressure.
The compressor section can be cleaned with the turbo still in its housing as follows:
Remove the compressor housing.
Clean the compressor housing, compressor wheel and shield with paraffin (kerosene) or equivalent.
Install the compressor housing and measure the boost pressure again.

If the boost pressure is still too low, check the following.

- **Injection pump**

  Check the injection advance and high idle speed.

  Check the function of the injection pump smoke limiter.

- **Fuel supply pressure**

  Check the fuel supply pressure.

  Change the fuel filter and any pre-filters if necessary.

- **Injectors**

  Check the opening pressure and spray pattern.

- **Engine**

  Check valve clearance and compression pressure.

- **Exhaust back pressure**

  Check that the back pressure in the system is not excessive. Maximum value is 15 kPa (1500 mm water pillar).

If the boost pressure still can not be accepted, the turbocharger must be renovated or changed.

Back pressure, checking

Special tools: 885151
TAMD61, -62, -71 and TAMD72WJ-A: 884970
TAMD61, -62, -71 late model, TAMD63, -72P-A: 885164

If the exhaust system has too much back pressure, the boost pressure falls and gives reduced engine power, increased exhaust smoke and higher exhaust temperature. This, in its turn, can cause burned valves and turbine failure.

1

Remove the exhaust pipe from the turbocharger exhaust outlet.

Does not apply to TAMD61, -62, -71 late model and TAMD63, -72P-A

Remove the studs.

2

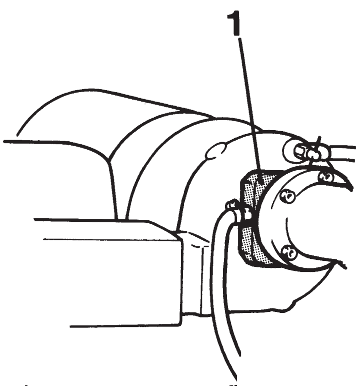
Clean the mating surfaces.

3

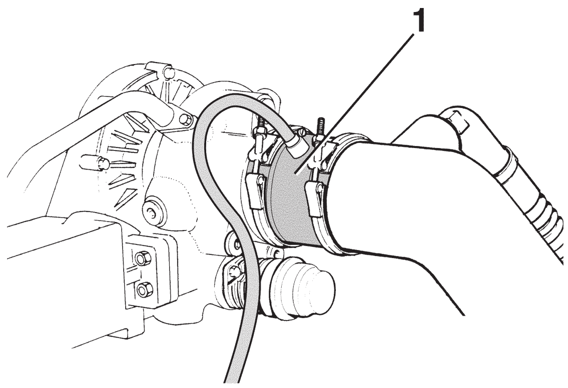
Does not apply to TAMD61, -62, -71 late model and TAMD63, -72P-A

Install the longer studs which are included in the flange kit.

4



Connecting the measurement flange to TAMD61, -62, -71, -72WJ-A, early model.



Connecting the measurement flange to TAMD61, -62, -71, -72WJ-A, late model and TAMD62, 72P-A

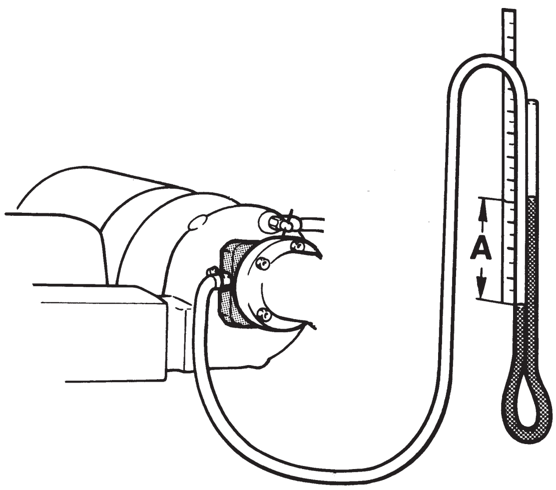
Does not apply to TAMD61, -62, -71 late model and TAMD63, -72P-A

Install the measurement flange (1) on the turbine housing, using gaskets on both sides. Install the exhaust pipe.

Applies to TAMD61, -62, -71, -72WJ-A late model and TAMD63, -72P-A

Install the centre flange (1) with a V-clamp on the turbine housing flange.

Install the exhaust pipe on the measurement flange with a V-clamp.



5

Connect a pressure gauge graduated to **24 kPa (2440 mm water pillar)** with a pressure hose and a suitable nipple for connection to the measurement flange.

Alternatively, a transparent plastic hose can be connected to the measurement flange as illustrated.

The difference between the water pillars (A) shows the exhaust pipe back pressure in mm wp (wp=water pillar).

Run the engine **at full load** and full throttle opening for about a minute and check that the back pressure does not exceed the permitted value.

Permitted exhaust back pressure = 15.0 kPa (1500 mm wp).

Exhaust temperature, checking

Special tools: 885151
TAMD61, -62, -71 and TAMD72WJ-A: 884970
TAMD61, -62, -71 late model, TAMD63, -72P-A: 885164

Exhaust temperature reflects the thermal loading of the engine. The temperature of the exhaust, relative to the highest permitted exhaust temperature, gives a measure of how well combustion in the engine functions at the loading in question.

If the permitted exhaust temperature is exceeded, the thermal loading of the engine increases, bringing a risk of engine failure (or shortened service life) of the pistons and valve system in the first instance.

Using exhaust temperature measurement, you can easily check that the engines in a twin installation are working at the same loading.

Note that the engines might well be running at the same speed but have different thermal loadings.

1

Remove the exhaust pipe from the turbocharger exhaust outlet.

2

Does not apply to TAMD61, -62, -71 late model and TAMD63, -72P-A

Remove the studs.

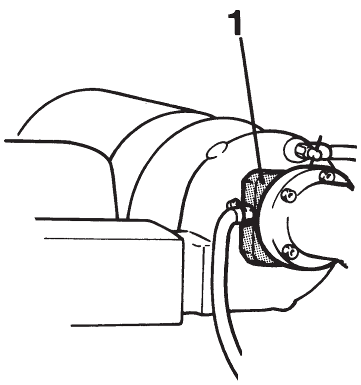
3

Clean the mating surfaces.

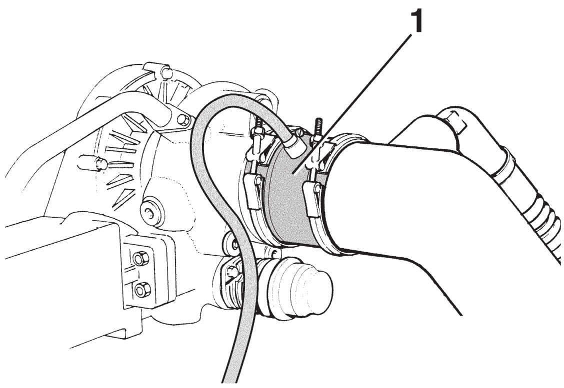
4

Does not apply to TAMD61, -62, -71 late model and TAMD63, -72P-A

Install the longer studs included in the flange kit.



Connection of measurement flange to TAMD61, -62, -71 -72WJ-A, early model



Connection of measurement flange to TAMD61, -62, -71 -72WJ-A, late model and TAMD63, -72P-A

Does not apply to TAMD61, -62, -71 late model and TAMD63, -72P-A

Install the measurement flange (1) on the turbine housing, using gaskets on both sides. Install the exhaust pipe.

Applies to TAMD61, -62, -71, -72WJ-A late model and TAMD63, -72P-A

Install the centre flange (1) with a V-clamp on the turbine housing flange.

Install the exhaust pipe on the measurement flange with a V-clamp.

5

Connect the pyrometer sensor to the outlet* provided on the measurement flange.

* Measurement flange 884970 must be supplemented by a hole for the pyrometer sensor.
Please refer to the instruction in Service Bulletin 18-4 No. 15

6

Run the engine(s) at full load for about a minute at the engine speed specified for each engine variant in the Workshop manual.

“Technical Data” on pages 19 and 20.

7

Measure the exhaust temperature and check that the temperature agrees with the values specified in the Workshop manual, “Technical Data” on pages 19 and 20.

Group 26 Cooling system
Design and function

General

The engines are water cooled and have a sealed cooling system. The system is divided into two circuits.

In the inner circuit (fresh water system), the coolant is pumped round by a centrifugal coolant pump (circulation pump).

On the TAMD63, the engine is driven by a belt from the vibration damper. On the other engines, the pump is gear driven from the timing gear train.

From the coolant pump, the coolant is pumped out into a gallery in the cylinder block and is then taken round the cylinder liners and further up through the cylinder block.

The coolant then passes from each cylinder block and from the turbocharger turbine housing back to the thermostat housing where a thermostat regulates the coolant temperature. The coolant from the engine oil cooler is also taken up to the thermostat housing.

As long as the coolant is cold, the thermostat closes off the flow to the heat exchanger. The coolant then passes through a by-pass duct beneath the thermostat, directly back to the inlet side of the pump.

When the coolant temperature has risen to a previously chosen value, the thermostat opens and allows coolant to flow to the heat exchanger, at the same time as the by-pass duct is closed.

In the heat exchanger, the heat from the coolant is transferred to the sea water before the coolant is drawn back into the coolant pump again.

Large quantities of heat are also transported away by the lubricating oil, which transports heat to the fresh water system via the oil cooler.

The lubricating oil is also used to transport heat from the pistons in the engine. Please refer to the Workshop manual “Group 22 lubrication system”, page 13.

The cooling system can operate at a certain excess pressure. The risk of boiling is thus reduced if the temperature rises. If the pressure is higher than normal, a pressure relief valve in the filler cap opens.

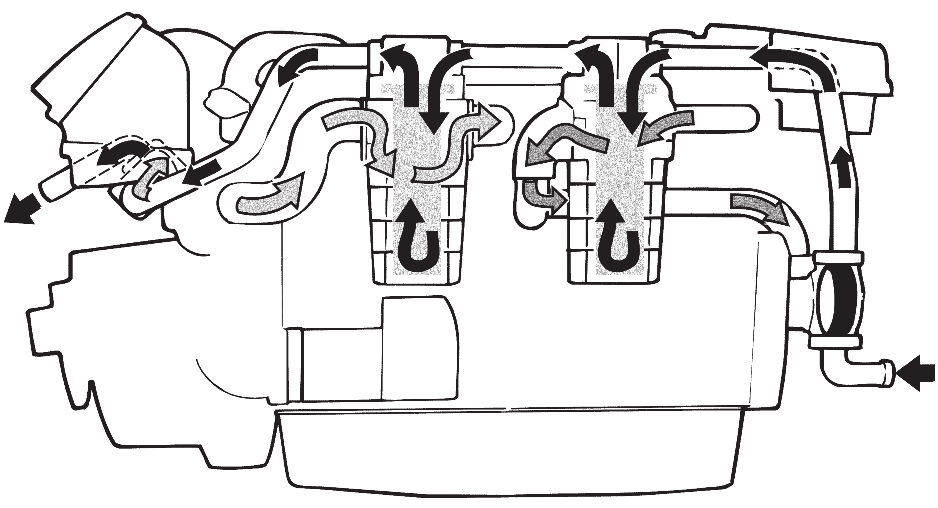
Sea water flow is obtained from a gear-driven impeller pump mounted on the front of the engine.

The sea water passes through the engine heat exchanger*, aftercooler and reverse gear oil cooler. There is a zinc anode in the reverse gear oil cooler to counteract corrosion.

The TAMD63 also has one zinc anode in the heat exchanger and another one in the aftercooler. It is important that the condition of the anode(s) is checked in accordance with the maintenance schedule, to avoid corrosion damage.

The engine can have a separate expansion tank as an accessory.

* **Note:** On the TAMD63, the sea water passes through the aftercooler before it goes to the heat exchanger and the reverse gear oil cooler.



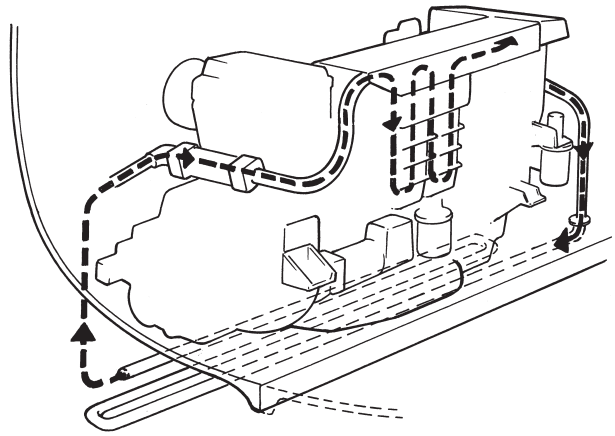
Hull cooling TAMD61, -62, -71B

The hull cooling system on the TAMD61, -62, -71B is a single circuit, sealed fresh water system which cools the engine through contact with the sea water.

When the engine is equipped with a hull cooling system, it replaces the ordinary heat exchanger on the engine.

The coolant in the system circulates through the reverse gear oil cooler, the aftercooler, engine, turbocharger and engine oil cooler.

Coolant circulation is arranged by the ordinary engine coolant pump.



1-circuit hull cooling system for TAMD61, -62, -71B

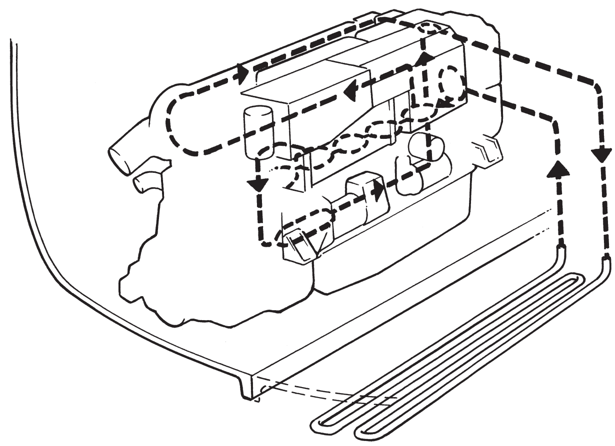
Hull cooling TAMD63, -71A, -72

The hull cooling system on the TAMD63, -71A, -72 consists of two separate, sealed circuits, with cooling coils which cool the engine through contact with the sea water.

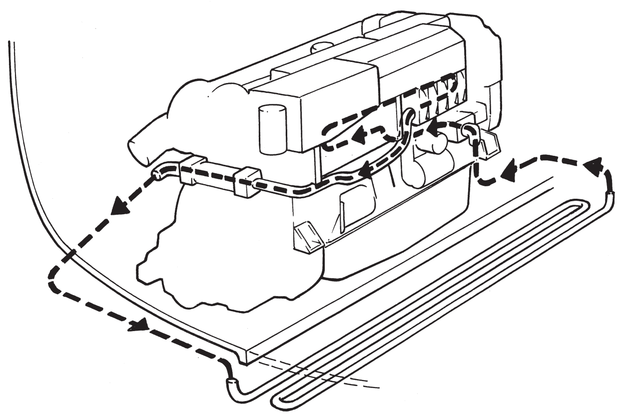
The hull cooling system, which replaces the heat exchanger function, has a separate circulation pump and expansion tank for each circuit.

In circuit 1, where the coolant circulates by means of the ordinary engine cooling pump, the engine, turbo and engine oil cooler are cooled.

In circuit 2, the sea water pump is used as the circulation pump, and cools the aftercooler and reverse gear oil cooler.



Hull cooling circuit 1 for TAMD71A,-72, -63



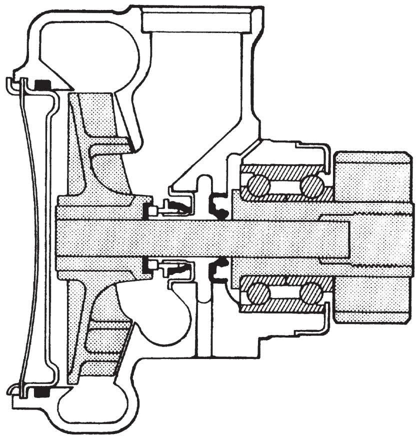
Hull cooling circuit 2 for TAMD71A,-72, -63

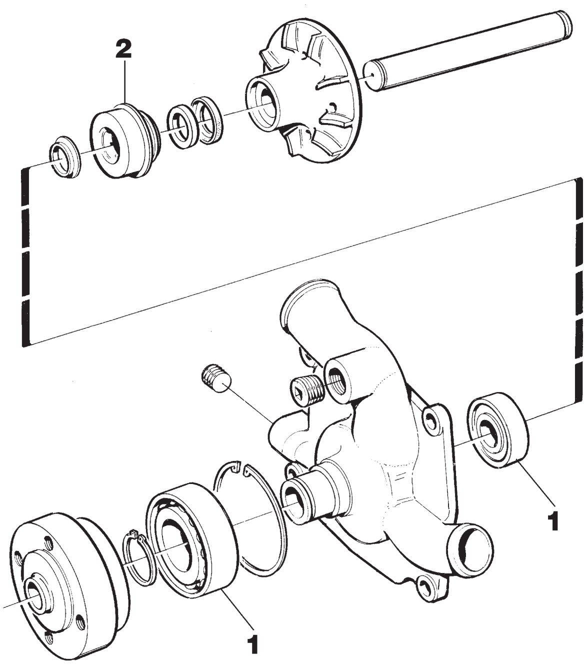
Coolant pump TAMD61, -62, -71, -72

The coolant pump is mounted on the timing drive cover and is driven by a gear wheel from the timing drive system.

The pump has three seals. Two coolant seals and an oil seal.

The pump rotates on a double row ball bearing.





Coolant pump TAMD63

The coolant pump is mounted on the front of the engine block and is driven by a belt from the crankshaft.

The pump rotates on two single row ball bearings (1) and has a seal (2) which effectively prevents the coolant from seeping out.

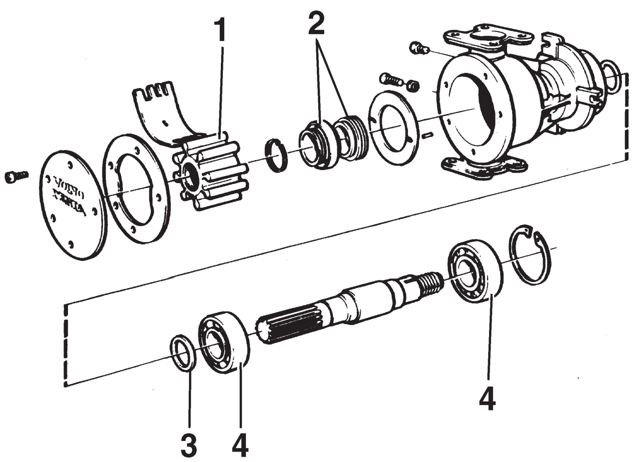
Sea water pump

The sea water pump is mounted on the timing drive cover and is driven by a gear wheel from the timing drive system.

The pump impeller (1) is made of rubber and is replaceable.

The pump has three seals. Two sea water seals (2) and an oil seal (3). The pump shaft rotates on one or two ball bearings (4).

Note: The pump impeller can be damaged if the pump is run dry.



Heat exchanger and aftercooler

TAMD61, -62 have one of each, whereas TAMD71, -72 have two series-connected heat exchangers and aftercoolers. The aftercooler(s) and heat exchanger(s) are mounted on the right-hand side of the engine with the heat exchanger(s) in front.

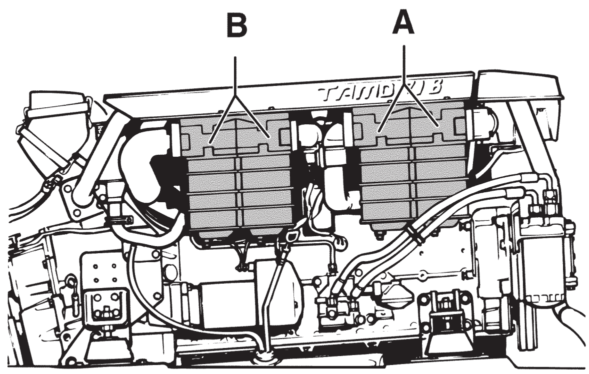
In the heat exchanger, the heat from the inner cooling system of the engine (fresh water system) is transferred to the outer circuit (sea water).

The aftercoolers transfer heat in the induction air from the turbocharger to the outer circuit (sea water).

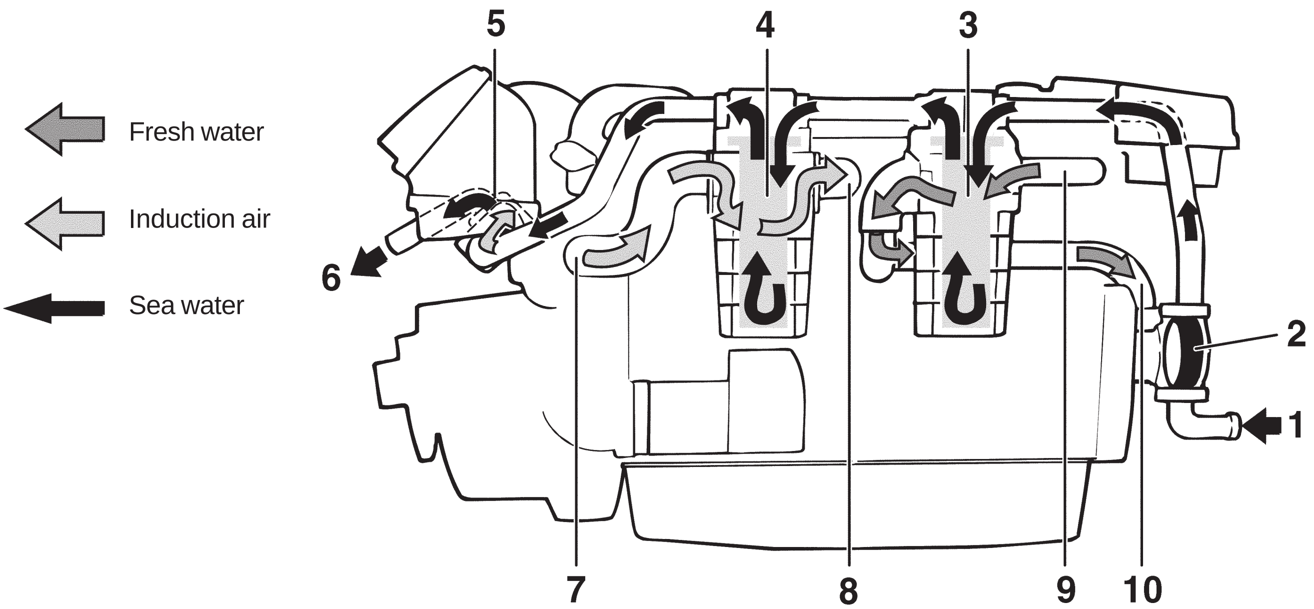
The heat exchangers consist of an aluminium housing with a tube-type heat exchange insert.

The sea water passes through the tubes and the fresh water (in the heat exchanger) or the induction air (in the aftercooler) passes between the tubes.

Note: On the TAMD61, -62 and TAMD71, -72, the heat exchangers and aftercoolers are identical. This means that the heat exchange inserts etc. are mutually exchangeable.



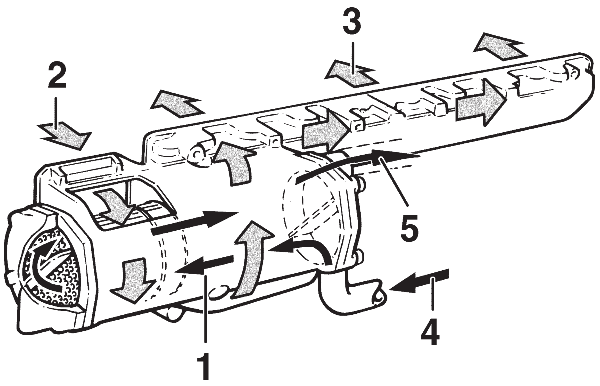
Heat exchanger (A) and aftercooler (B) on TAMD 71/72



Flow through heat exchanger and aftercooler on TAMD61, -62 and TAMD71, -72*

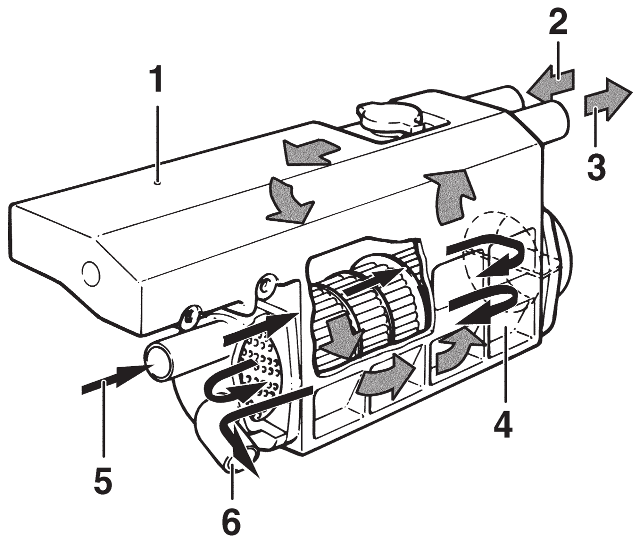
1. Sea water inlet
2. Sea water outlet
3. Heat exchanger
4. Aftercooler
5. Oil cooler, reverse gear
6. Sea water outlet
7. Induction air from turbocompressor
8. Cooled induction air to engine inlet manifold
9. Fresh water from engine thermostat housing
10. Fresh water to coolant pump inlet side

*** Note:** TAMD71 and TAMD72 have twin, series-connected heat exchangers and aftercoolers.



Flow through aftercooler on TAMD63

1. Aftercooler
2. Heated air from turbocompressor
3. Cooled induction air to engine combustion chambers
4. Sea water inlet (from sea water pump)
5. Sea water outlet (to heat exchanger)



Flow through heat exchanger TAMD63

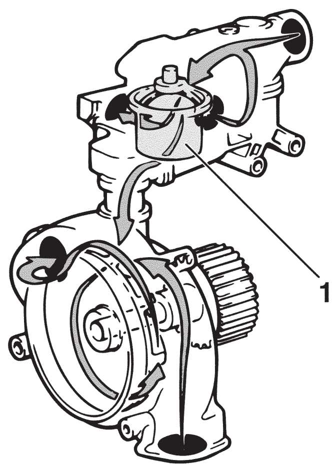
1. Expansion tank
2. Hot coolant from engine thermostat housing
3. Coolant to coolant pump inlet side
4. Heat exchanger
5. Sea water inlet (from aftercooler)
6. Sea water outlet (to reverse gear oil cooler)

Thermostat

The engines have a piston thermostat (1) whose sensor body contains wax. When the engine is cold, the thermostat keeps the passage to the heat exchanger completely closed. The coolant is then led through a by-pass duct straight back to the engine.

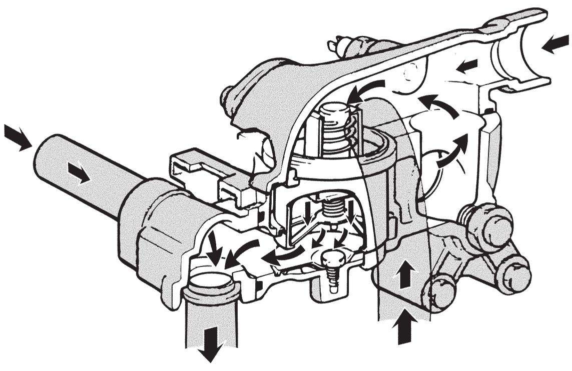
As the engine warms up, the wax increases its volume and the thermostat progressively opens the passage to the heat exchanger at the same time as the by-pass duct is closed.

Please refer to the Workshop manual “Technical Data” page 21 for opening temperatures and colour markings.

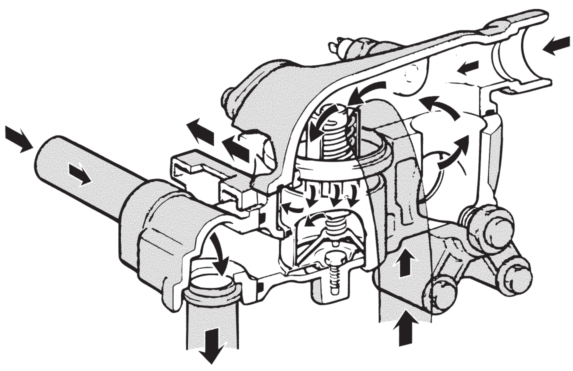


TAMD71, -72. Coolant pump (circulation pump) and thermostat housing

1. Piston thermostat



Thermostat function, cold engine



Thermostat function at operating temperature

Oil cooler, engine

The lubricating oil transports heat away from the hottest parts of the engine and evens out the temperature differences in the engine as it circulates.

In the oil cooler, the heat is taken out of the oil. The oil temperature can thus be kept at a lower level under heavy loading and high engine speeds.

This is beneficial for wear since the lubricating properties of the oil are impaired if the oil temperature gets too high.

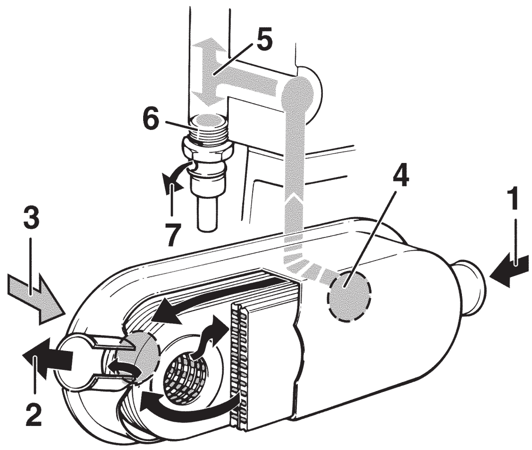
Low quality oils are most sensitive in this respect.

The engine oil cooler is located beneath the left-hand side of the engine, beneath the injection pump.

The lubrication oil circulates inside the heat exchange matrix whereas the coolant passes between the cell plates.

The oil cooler is connected to the fresh water system.*

* On the TAMD 63 with hull cooling, the engine oil cooler is connected to the coolant pump cooling circuit (circuit 1).



Flow through the engine oil cooler

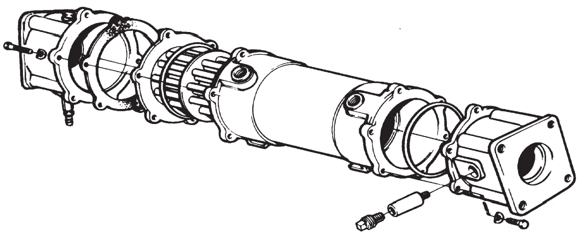
1. Inlet, coolant
2. Outlet, coolant
3. Inlet, oil
4. Outlet, oil
5. Oil for piston cooling
6. By-pass valve
7. Surplus oil returns to the sump

Oil cooler, reverse gear

The reverse gear oil cooler is mounted on a bracket above the flywheel housing at the rear of the engine.

The oil cooler is connected to the sea water system*. Sea water flows through the pipes in the oil cooler insert and takes away the heat which passes through the pipes.

* On the TAMD 63 with hull cooling, the engine oil cooler is connected to the sea water pump cooling circuit (circuit 2).



Coolant

⚠ **NOTE! Glycol and rust-prevention agents are hazardous (dangerous to drink).**

The engine's internal systems (fresh water system) contain a mixture of fresh water and anti-freeze or rust-preventer.

NOTE! It is very important that the engine is not filled up with pure fresh water without any additives.

To avoid frost and corrosion damage to the engine, the following mixture ratios are recommended:

If there is a risk of frost

Use a mixture of 50% Volvo Penta anti-freeze (glycol) and 50% clean fresh water. This mixture protects the engine from frost damage down to about –40°C and should be used all the year round.

The coolant must contain at least 40% anti-freeze to give full corrosion protection.

If there is no risk of frost

If the engine is used in areas where there is never any risk of frost, the coolant can be mixed with Volvo Penta rust prevention additive (part no. 1141526-2).

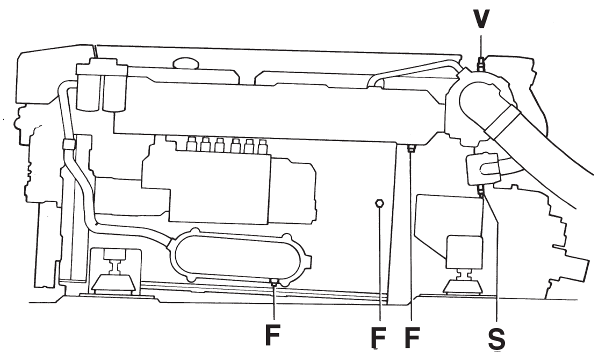
NOTE! Never mix rust preventer with glycol. Foam may be generated which will seriously impair cooling.

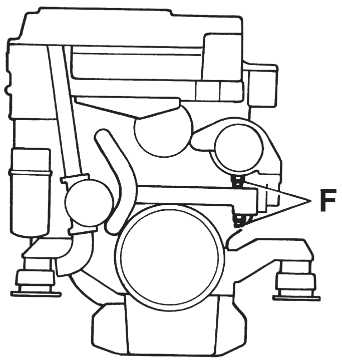
Draining the coolant

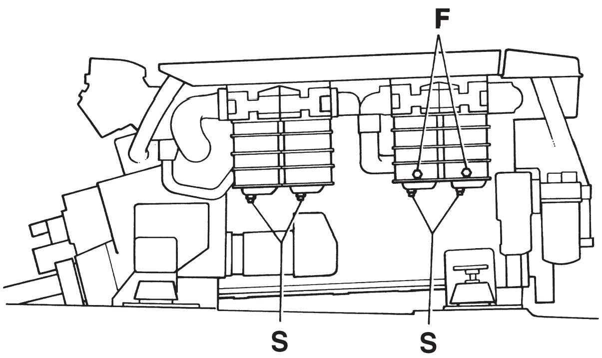
NOTE! Before the coolant is drained, the engine must be stopped, the filler cap unscrewed and the sea cocks shut.

1

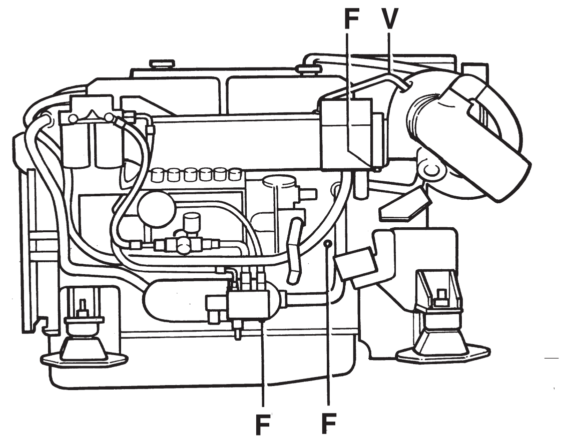
TAMD 61, -62, -71, -72

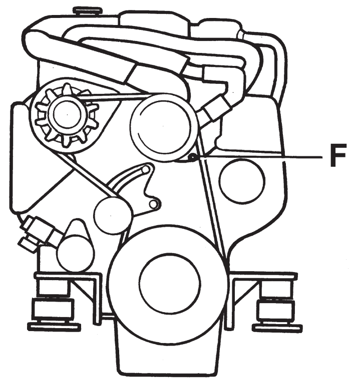


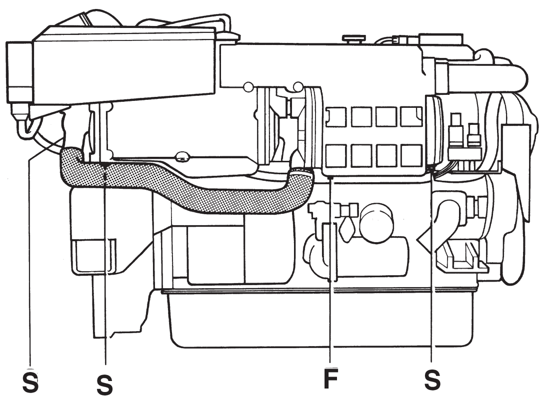




TAMD63







Open the drain taps and remove the drain plugs on the fresh water and sea water systems of the engine.

F = Fresh water shut-off tap/plug

S = Sea water shut-off tap/plug

V = Ventilation tap

2

Check that all water really runs out. There may be blockages behind the tap/plug which must be cleared out. There is otherwise a risk that the water could remain and cause severe damage.

Check whether the installation has further taps or plugs at the lowest points of the cooling water and exhaust pipes.

3

Remove the lid of the sea water pump plus the lid of any other pumps.

On the TAMD63, the hose between the heat exchanger and the reverse gear oil cooler must also be removed.

4

Shut the taps, install the plugs and the sea water pump lid, plus any extra pumps.

5

Pump the bilges if necessary. Check that no leakage occurs before you leave the boat.

Cleaning the cooling system

⚠ **NOTE! Shut the sea cocks before doing any work on the cooling system.**

The coolant should be changed and the cooling system should be flushed through at least once per year to avoid loss of cooling performance because of sludge in the cooling system.

A further reason for changing is to avoid the risk of corrosion damage to the fresh water system because the rust-prevention additives become used up in time.

When the coolant is changed, flush the system carefully with fresh water. Flush until the water which flows out of the drain openings is clean.

Filling coolant

⚠ **Note! DO NOT open the pressure cap or ventilation tap when the engine is hot. Steam or hot coolant will spray out at the same time as the built-up pressure will be lost.**

Filling must be done with the engine stationary.

Filling must not be done so quickly that air pockets are formed in the system. The air must be able to flow out through the filling openings and ventilation taps.

When an empty system is filled or if the coolant level has fallen so low for any reason that it is not visible in the filling opening, the ventilation tap on the turbocharger must be opened and the system ventilated during filling.

The engine must not be started until the system is vented and entirely filled.

If a heater unit is connected to the engine cooling system, the heater control must be opened and the system vented during filling.

1

Fill with coolant* until the level is about 50 mm below the sealing plane of the filling cap, or to between the MIN and MAX markings on the plastic expansion tap (optional equipment).

Please refer to the “Coolant” heading on page 24 for coolants.

The system should be topped up with the same mixture as it already is filled with.

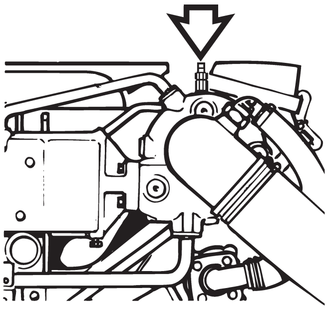
2

Alow the engine to stand for about 1 hour after filling. Then top up with coolant as necessary, start and warm the engine up. Check the coolant level.

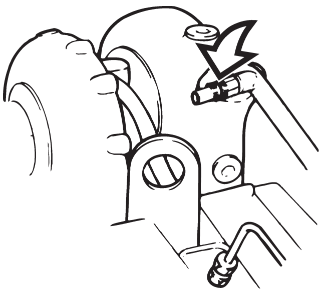
*** Note.** Coolant volume for:

TAMD61, -62	30 litres
TAMD63	27 litres
TAMD71, -72	35 litres

3



Venting tap for TAMD61, -62, -71, -72



Venting tap for TAMD63

Check that the cooling system is properly vented by **carefully opening the ventilation tap** after you have started the engine and it has reached operating temperature.

Evacuate any remaining air in the same way.

Sea water filter, inspection and cleaning

NOTE! Close the bottom taps and drain any water in the sea water system before cleaning the sea water filter.

Volvo Penta sells two kinds of sea water filter.

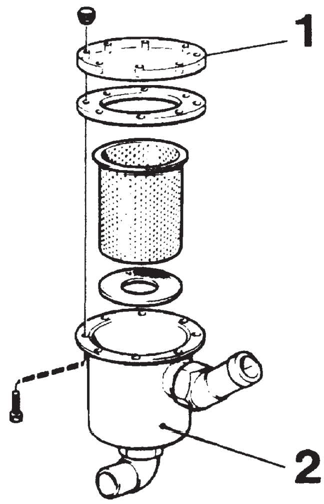
A smaller filter with a transparent perspex (plexiglass) lid and a larger filter with a sheet metal lid.

Since the time interval between cleaning is strongly dependent on operating conditions, the interval should be determined by experience after a period of operation.

This means that the filter may have to be cleaned more often than specified in the maintenance schedule.

NOTE! When the engine is running, it is very important that the sea water supply is never restricted.

1



Remove lid (1) and lift the insert up.

2

Clean the insert and the housing (2).

3

Install the components as in the figures above. Check the gasket and O-ring. Change if necessary.

4

Open the sea cocks and check that no leakage occurs.

Heat exchanger/aftercooler, cleaning

TAMD61, -62, -71, -72

Note: On engines with hull cooling, there is no heat exchanger.

NOTE! Shut the sea cocks and drain the water in the sea water and fresh water systems before doing any work on the cooling system.

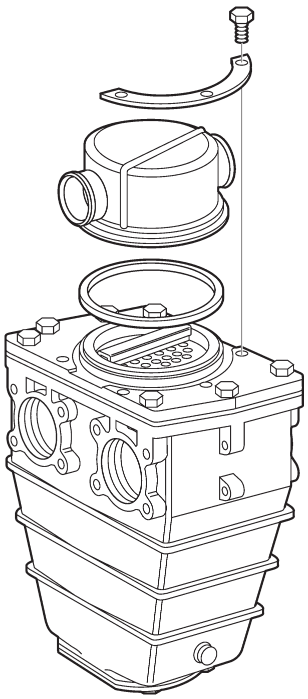
1

Undo the screws on the shields above the heat exchanger and aftercooler, and remove them.

2

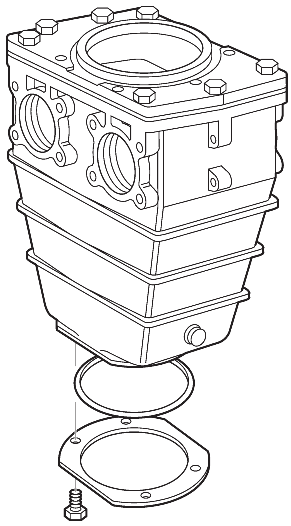
Remove the pipes between the sea water pump and the heat exchanger, and between the aftercooler and the reverse gear oil cooler.

3



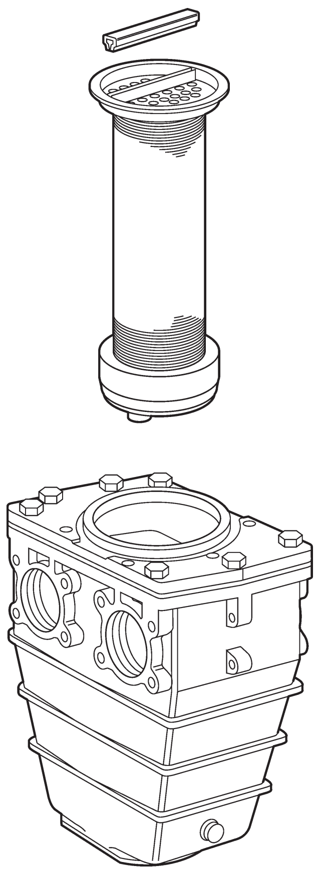
Remove the lids on the heat exchanger and aftercooler. Remove the connection pipe(s) between the lids.

4



Remove the clamp rings beneath the housing. Remove the O-rings from the lower seal.

5

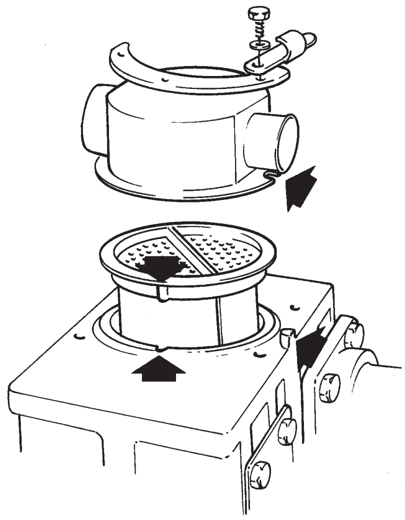


Lift up the inserts.

Flush and clean the inserts, both internally and externally. Use suitable brushes.
Also clean the housing.

Note. Be careful to avoid getting any contamination into the inlet manifold of the engine via the aftercooler.

6



Install the inserts in the housing.

NOTE! Be careful to ensure that the inserts are installed in the correct positions.

The guide heels beneath the top flanges of the inserts must be aligned outwards (from the engine) and fit in the corresponding cutouts in the engine (see illustration).

7

Put the seal mouldings on the shield plate of the inserts and install the lid together with the connection pipe(s) between the lids. Use new seal rings.

Note. The lids must be fitted with the cutout on the lid flange aligned forwards, please refer to the illustration.

8

Install the O-rings and clamp rings beneath the housings.

9

Install the coolant pipe between the sea water pump and the heat exchanger, and between the aftercooler and the reverse gear oil cooler.

Use new seal rings.

10

Install the shield plates above the heat exchanger and aftercooler.

11

Fill the engine up with coolant, please refer to "Filling the cooling system" on page 25. Open the sea cocks, start the engine and check that no leakage occurs.

Aftercooler, proof testing

If you suspect leakage, the insert of the aftercooler or heat exchanger should be removed from the engine and proof tested separately. Use water for proof testing. Apply the pressure for 1 minute. No pressure drop is permitted. Proof pressure 200 kPa (2 kp/cm^2).

NOTE! Observe the applicable regulations.

Heat exchanger/aftercooler, cleaning or replacement

TAMD63

Note: On engines with hull cooling, there is no heat exchanger.

Heat exchanger/aftercooler, removal

NOTE! Shut the sea cocks and drain the water in the sea water and fresh water systems before doing any work on the cooling system.

1

Remove both battery cables.

2

Undo the belt tensioner on the alternator and remove the vee-belt.

Undo the alternator bracket and lift the alternator away together with the bracket for the oil pressure sensor and oil pressure monitor.

3

Remove the cable harness clamps beneath the heat exchanger and aftercooler.

4

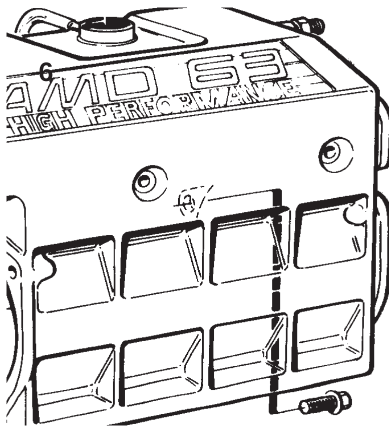
Remove the coolant hoses to and from the heat exchanger and aftercooler.

5

Remove the ventilation pipe at the front of the heat exchanger and the pressure hose for the smoke limiter from the front edge of the inlet pipe on the aftercooler.

Note. Mark up the hoses to ensure that they are fitted in the correct places on re-assembly.

6



Remove the screw behind the heat exchanger.

7

Remove the 5 remaining screws which hold the heat exchanger and lift it away from the engine.

8

Remove the air filter housing and the air supply pipe to the turbocharger.

9

Remove the hose between the turbocharger and the aftercooler.

10

Remove the pipe for the boost pressure sensor from the inlet pipe on the aftercooler (optional equipment).

11

Remove all screws from the inlet pipe on the aftercooler.

12

Loosen both the screws behind the aftercooler a few turns and lift off the aftercooler with inlet pipe.

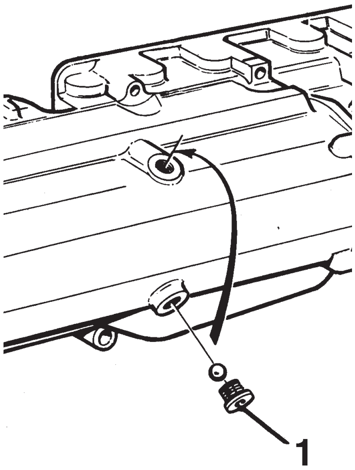
Aftercooler and heat exchanger, disassembly

13

Remove the end panels on the heat exchanger or aftercooler (6 mm socket cap).

Remove the O-rings and intermediate rings.

14



Unscrew the plugs (1) over the two guide balls for the aftercooler insert a few turns (10 mm socket cap).

15

Press the inserts out.

Note: The inserts can only be pressed out backwards since they have a flange at the rear.

Aftercooler and heat exchanger, cleaning

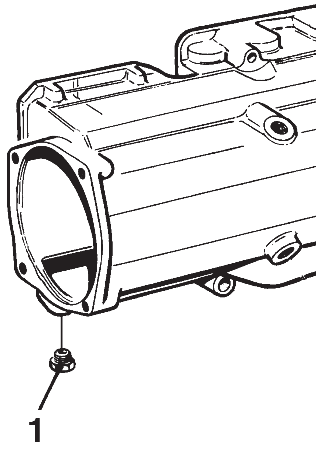
16

Flush and clean the inserts, both internally and externally. Use suitable brushes.

Also clean the housing.

Note. Be careful to avoid getting any contamination into the inlet manifold of the engine via the aftercooler.

17



Check that the drain hole (1) at the rear of the aftercooler is not blocked.

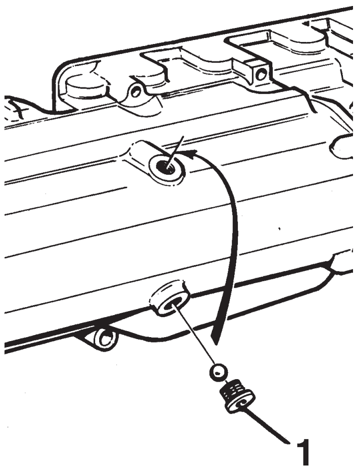
Aftercooler and heat exchanger, assembly

18

Install the inserts in the housing. Use new seal rings.

Note. The intermediate rings should be installed with the hole downwards. Inserts and intermediate rings can only be installed in one position because of the hole spacing.

19



Install the end lid with new sear rings. Tighten plugs (1) on the aftercooler.

Aftercooler and heat exchanger, installation

20

Lift the aftercooler with inlet pipe into place. Install and tighten all screws for the inlet pipe.

21

Tighten the screws behind the aftercooler.

22

Install the air supply pipe and hoses between the turbocharger and the aftercooler.

Note. Carefully dry the mating surfaces of the hose against the turbocharger and air supply pipe to ensure that it is entirely free of grease. Use a suitable solvent.

23

Install the air filter housing.

24

Install the heat exchanger loosely on the engine, using the 5 outer screws.

Install the screw behind the heat exchanger and tighten all screws.

25

Connect all coolant hoses to the heat exchanger and aftercooler. Tighten the hose clamps.

26

Connect the vent pipe at the front of the heat exchanger. Connect the pressure hose to the smoke limiter at the front of the inlet pipe on the heat exchanger.

Note. Check that the correct hose is connected to each nipple.

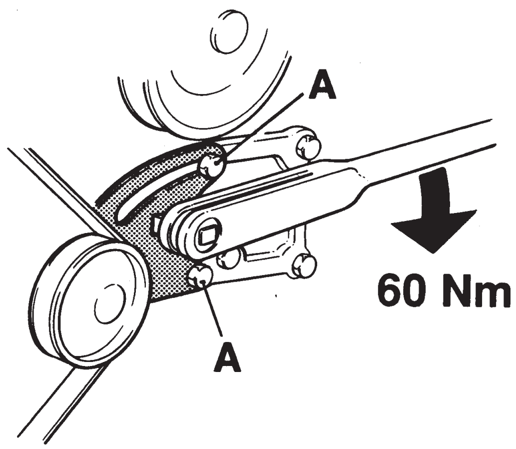
27

Connect the plastic pipe from the thermostat housing to the heat exchanger.

28

Install the alternator bracket with the alternator and the bracket with the oil pressure sensor and oil pressure monitor.

29



Tighten the drive belt as follows:

Put the nose of a torque wrench in the square hole in the jockey roller bracket. Tighten the belt using a torque of **60 ±3 Nm (6 ±0.3 kpm)**.

Tighten the screws (A).

30

Connect the battery cables.

31

Fill up the engine with coolant and ventilate the system as in the “Filling coolant” instructions on page 26.

32

Open the sea cocks and start the engine.

Check that no leakage occurs.

Oil cooler, reverse gear, cleaning

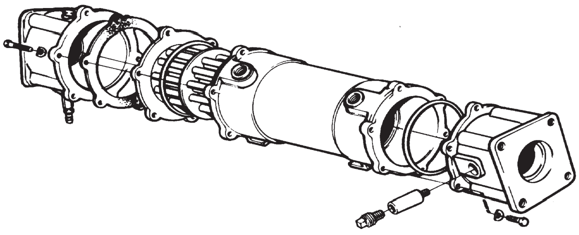
NOTE! Close the sea cocks and drain the water in the sea water system.

1

Open the drain tap on the oil cooler.

Remove the cooling hoses to and from the oil cooler.

2



Remove both the end lids and press the insert out (the insert can only be pulled out on the left side because there is a flange on this side).

3

Wash the insert with **white spirit** and blow it dry with compressed air (or leave it to drain). Clean the tubes internally and clean the sides of the end pieces with suitable brushes.

Also clean the housing.

4

Assemble the components in reverse order.

Use new seal rings.

5

Close the drain tap and open the sea cocks.

Start the engine and check that no leakage occurs.

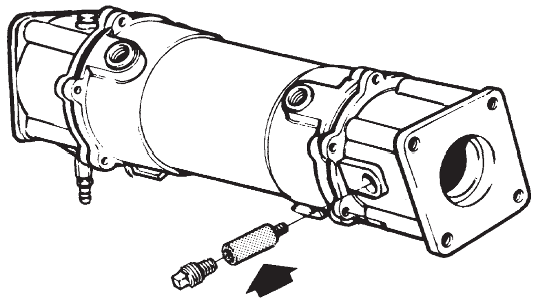
Zinc anodes, checking/ replacement

NOTE! Close the sea cocks and drain the water in the sea water system.

1

Open the drain tap on the rear of the reverse gear oil cooler.

2

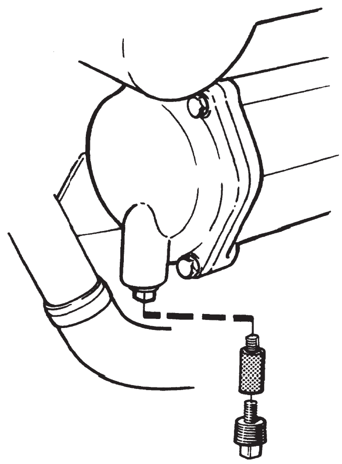


Applies to all engines

Unscrew the zinc anode on the reverse gear oil cooler.

3

Zinc anode in the front end piece lid on TAMD63



Zinc anode in the rear end piece lid on TAMD63

Only applies to TAMD63

Drain the sea water from the heat exchanger and aftercooler at the same time.

Unscrew the zinc anode in the front end piece lid of the heat exchanger and in the rear end piece lid of the aftercooler.

4

Change the anode if more than 50% of its original size has been used up. Otherwise clean the anode with emery cloth to remove the oxide coating.

NOTE! Do not use a steel wire brush or other steel tools for cleaning, since this can impair the galvanic protection.

5

Install the zinc anode(s)

Make sure that there is good metallic contact between the anode and its seat.

6

Shut the drain tap.

Open the sea cocks before starting the engine.

Check that no leakage occurs.

Coolant pump, replacement

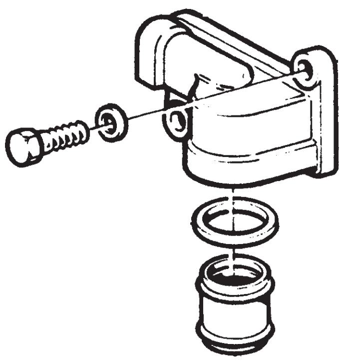
TAMD61, -62, -71 , -72

NOTE! Close the sea cocks and drain the water in the sea water system.

1

Drain the coolant from the cooling system.

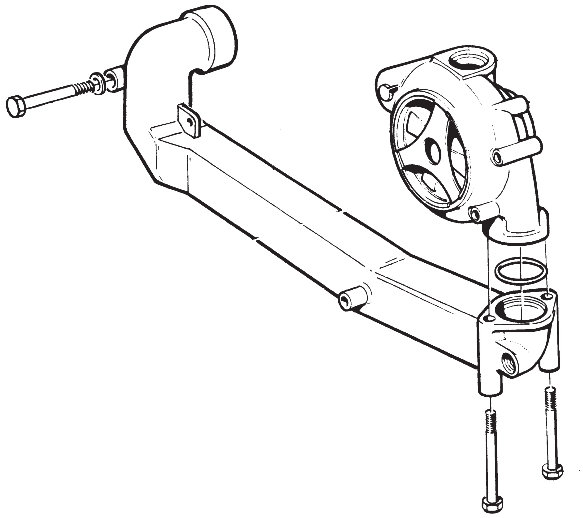
2



Remove the front lid from the thermostat and the pipe for the coolant pump.

.

3



Remove the pipe between the coolant pump and the heat exchanger.

4

Remove the fastening screws and lift the coolant pump away.

5

Clean all pipes.

Install new seal rings on the pipe between the front lid of the thermostat housing and the pump.

Install the pipe and the front lid of the thermostat housing on the coolant pump.

6

Install new seal rings to seal the coolant pump against the timing drive cover and cylinder head.

7

Install a new seal on the front lid of the thermostat housing. Lift the coolant pump into place and screw it down.

8

Tighten the screws holding the front lid of the thermostat housing.

9

Install the pipe between the coolant pump and the heat exchanger. Use new seal rings.

Coolant pump, replacement

TAMD63

NOTE! Close the sea cocks and drain the water in the sea water system.

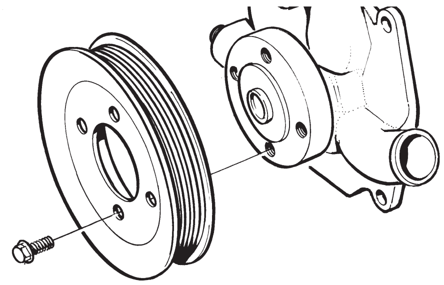
1

Drain the coolant from the cooling system.

2

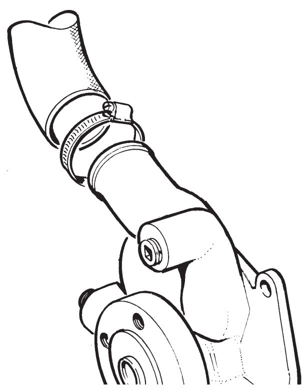
Undo the belt tensioner and remove the drive belt.

3



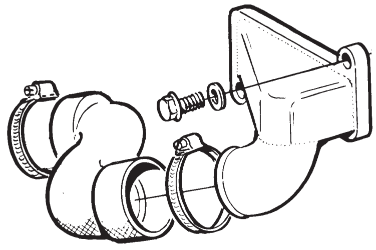
Undo the screws holding the coolant pump pulley. Remove the pulley by tapping carefully with a plastic mallet.

4



Remove the hose between the heat exchanger and the coolant pump.

5



Undo and remove the front lid of the thermostat housing together with the hose for the coolant pump.

6

Remove the coolant pump fastening screws and lift the coolant pump away.

7

Clean all mating surfaces. Install a new seal ring between the coolant pump and the timing drive cover. Apply sealant 1161231-4 to the surface between the coolant pump and the timing drive cover.

8

Install the coolant pump and tighten the fastening screws.

9

Install a new seal on the front lid of the thermostat housing. Install the coolant hose on the pump and tighten the screws holding the thermostat housing.

Tighten the coolant hose clamp by the pump.

10

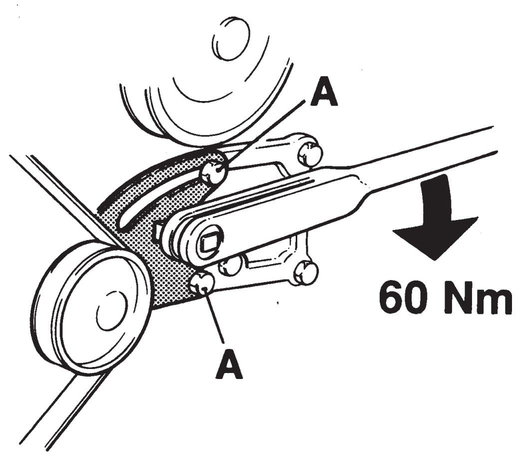
Connect the coolant hose between the heat exchanger and the coolant pump, and tighten the clamps.

11

Install the coolant hose between the heat exchanger and the coolant pump, and tighten the clamps.

Install the drive belt and tension it as follows:

12



Put the nose of a torque wrench in the square hole in the jockey roller bracket. Tighten the belt using a torque of **60 ±3 Nm (6 ±0.3 kpm)**.

Tighten the screws (A).

Coolant pump, renovation

Pump already removed

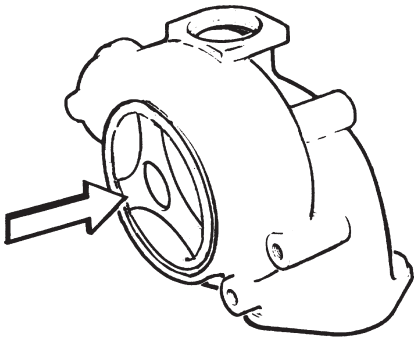
TAMD61, -62, -71, -72

Special tools: 2071, 2268, 2584, 4034, 4090, 6626, 6883, 6884, 6979, 8039, 8107, 8137

Other special equipment: 884985

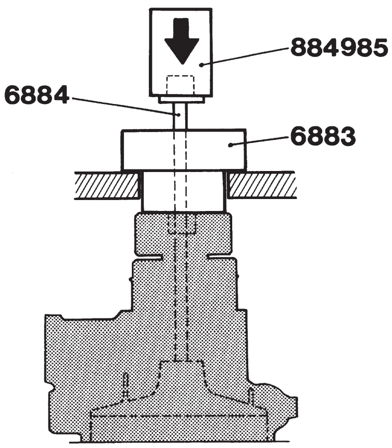
Disassembly

1



Remove the lock tab, lid and O-ring.

2



Screw adaptor 999 6883 onto the drive shaft of the coolant pump.

Place mandrel 9996884 on mandrel 884985.

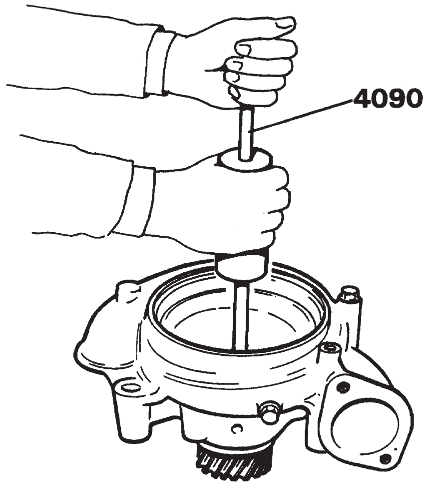
Insert the narrow mandrel 999 6884 through tool 999 6883.

3

Put the coolant pump in a hydraulic press with a counterhold beneath the tool 999 6883.

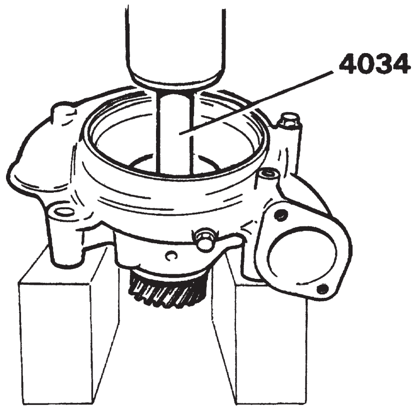
Press the impeller out with its shaft.

4



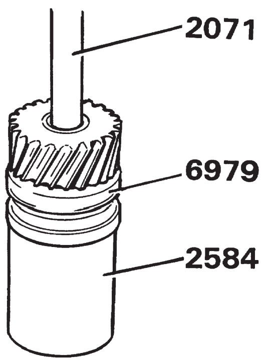
Remove seal ring with extractor 999 4090.

5



Press the shaft stub out together with bearing and gear wheel, using tool 999 4034.

6



Press the gear wheel off the shaft stub using mandrels 999 2071, 999 6979 and sleeve 999 2584.

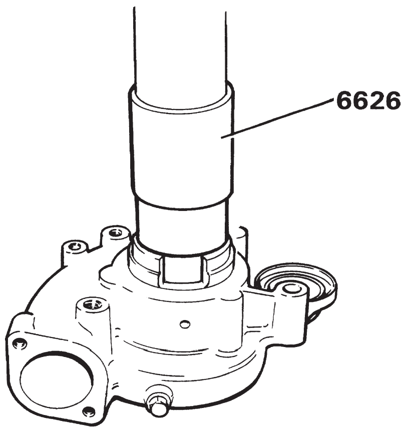
Inspection

Replace all old components and replace them with the new ones in the repair kit.

Check that the pump housing is not damaged before re-assembly.

Assembly

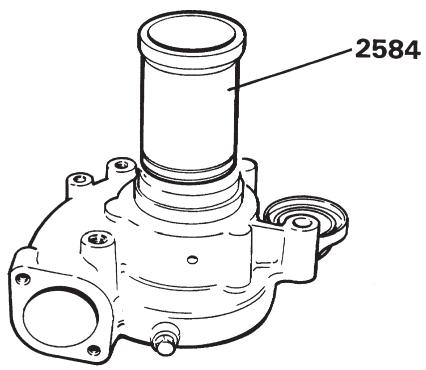
7



Press the shaft stub and bearing into the pump housing using sleeve 999 6626.

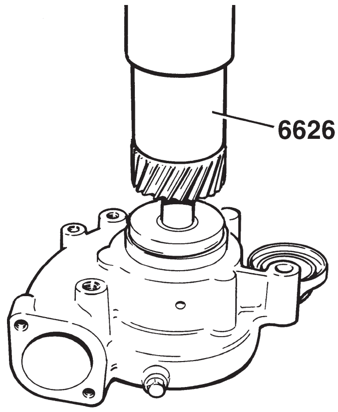
Note: Press the outer ring of the bearing. Use assembly paste on the press fit surfaces.

8



Press the circlip with sleeve 999 2584.

9



Put the coolant pump into a hydraulic press, using mandrel 999 4034 as a counterhold beneath the shaft stub.

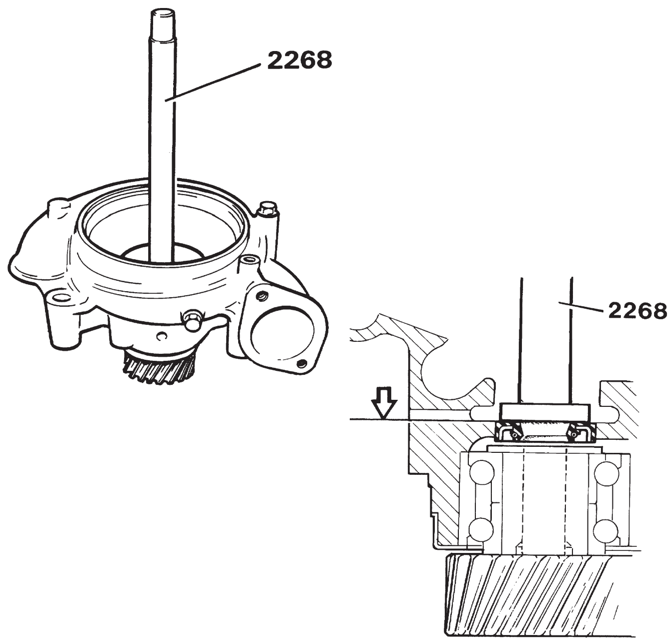
Press the gear wheel on using mandrel 999 6626 until it contacts the bearing.

Note: Use assembly paste on the press fit surfaces.

10

Check that the shaft stub with gear wheel rotates easily. No bearing noise or end float must occur.

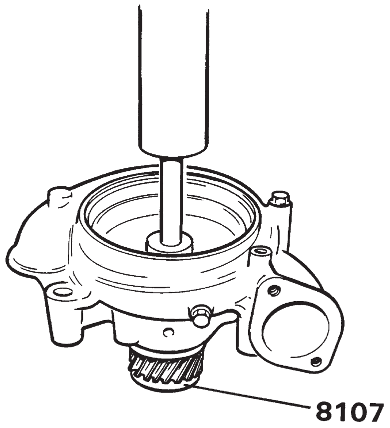
11



Put the engine oil seal ring into the pump housing, using mandrel 999 2268.

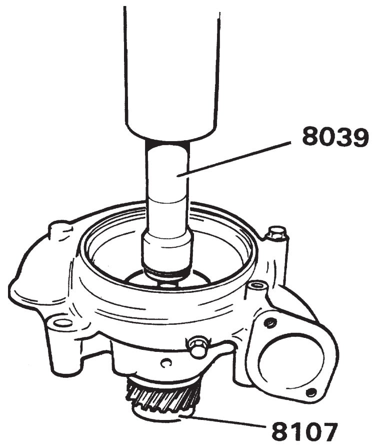
Note. Check that the seal is installed with the edge downwards. Press the seal ring carefully until it is flush with the edge of the pump housing, please refer to the illustration.

12



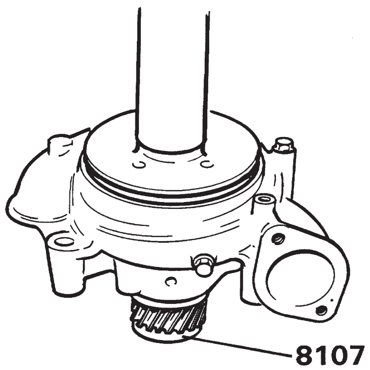
Press the impeller shaft in place. Use 9998107 as a counterhold beneath the gear wheel. Press it until it bottoms.

13



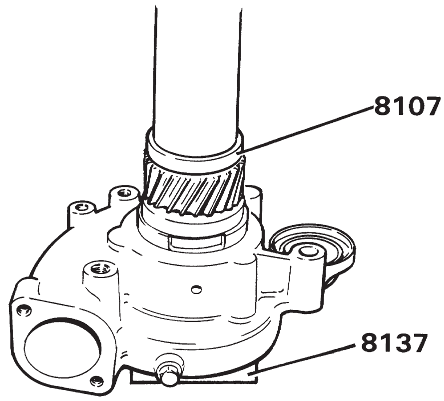
Press the seal ring in place, using tool 9998039 until it bottoms in the pump housing. Put 9998107 underneath as a counterhold.

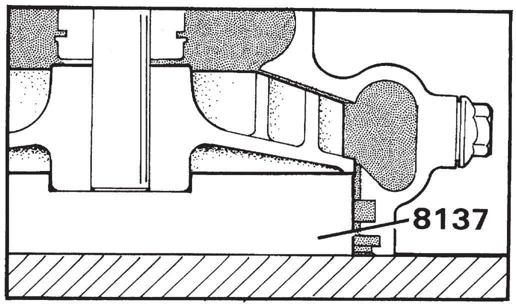
14



Press the impeller about **15 mm** onto the shaft. Put 9998107 underneath the gear wheel as a counterhold.

15



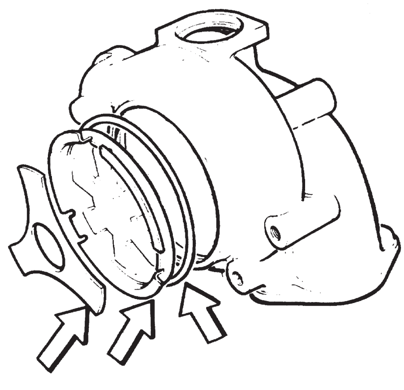


Turn the pump over so that the impeller comes downwards and set it up with the impeller resting on tool 999 8137.

Press the pump carefully with tool 9998107 until it contacts the press table.

Note: Tool 9998137 gives the correct dimension between the impeller and the pump housing.

16



Install a new O-ring. Install the lid and lock tab.

Coolant pump, renovation

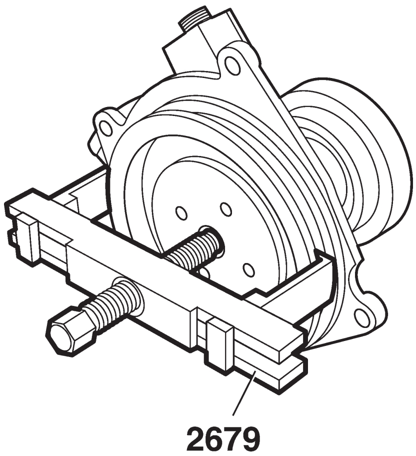
Pump already removed

TAMD63

Special tools: 999 2265, 999 2679

Disassembly

1



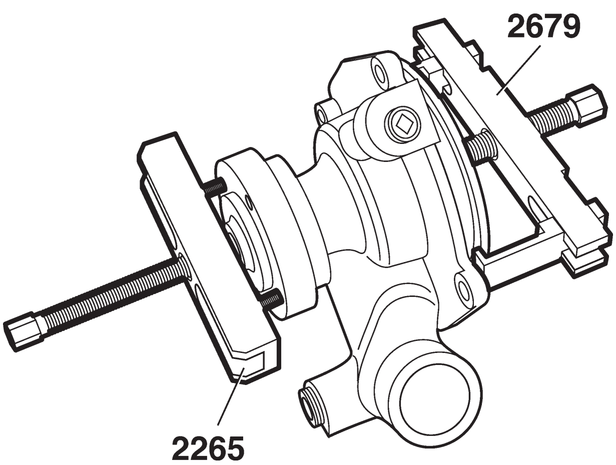
Install tool 999 2679 on the impeller shaft as a counterhold.

Note. Do not tighten the tool too hard.

2

Remove the large circlip on the inside of the hub.

3



Remove the hub, using extractor 999 2265 or a claw extractor.

4

Remove the circlip on the shaft stub and pull the extractor off with a claw puller.

5

Put the pump housing in a press and press the shaft and impeller out together.

6

Tap out the inner bearing and seal with a drift.

7

Replace the old components by new ones from the repair kit.

8

Put the pump housing in a bench press and put the large circlip on the pump housing shaft stub.

Press the large bearing with a suitable mandrel.

Note: The sealed side of the bearing should face the pump housing

Grease the bearing, using **4.5 cm³** bearing grease.

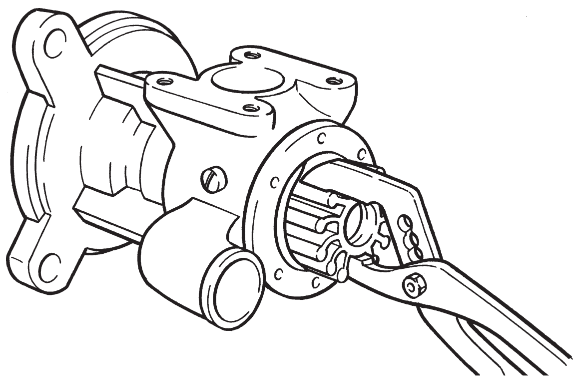
9

Install the small circlip. Press the hub in and put the large circlip back into the hub.

Sea water pump, impeller replacement

NOTE! Close the sea cocks and drain the water in the sea water system.

1



Remove the end lid of the pump. Pull the impeller out and turn it with a pair of water pump pliers.

2

Clean the inside of the housing. Grease the pump housing and inside of the lid with a small amount of grease.

3

Press the new impeller in with a turning motion:

TAMD61, -62, -71, -72: Anticlockwise

TAMD 63: Clockwise

4

Install the lid together with a new gasket.

Make sure that a spare impeller and gasket are always kept on board.

5

Close the drain taps and open the sea cocks.

Start the engine and check that no leakage occurs.

Sea water pump replacement

NOTE! Close the sea cocks and drain the water in the sea water system.

1

Remove the coolant pipes to and from the pump.

2

Undo the screws in the intermediate flange or pump housing and lift the pump away from the timing cover.

3

When the pump is installed, replace the seal rings by new ones.

The seal against the timing cover should also be replaced.

4

Install the pump and tighten the screws holding the intermediate flange or pump housing to the timing cover.

5

Install the coolant hoses. Check the rubber hose at the inlet and replace as necessary.

Check that the pump lid is screwed down.

Open the sea cocks before starting the engine.

Sea water pump, renovation

Pump already removed

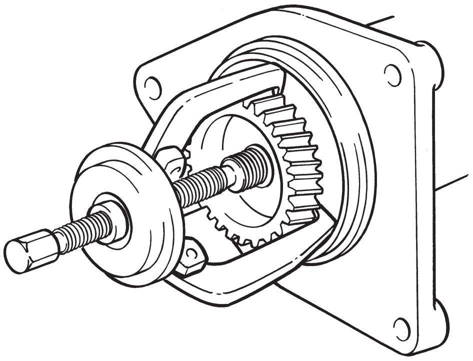
TAMD61, -62, -71, -72

Special tool: 999 4034

1

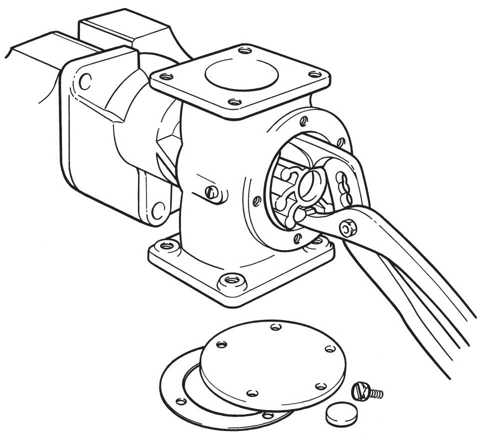
Fix the pump in a vice with soft jaws.

2



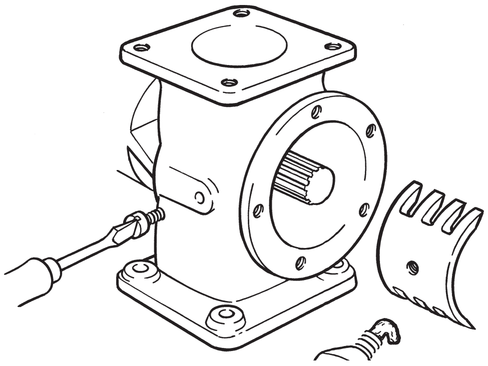
Remove the nut and pull the gear wheel off with an extractor. Look after the key.

3



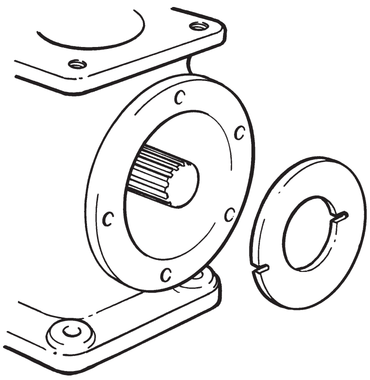
Remove the lid and pull the impeller out with a pair of water pump pliers.

4



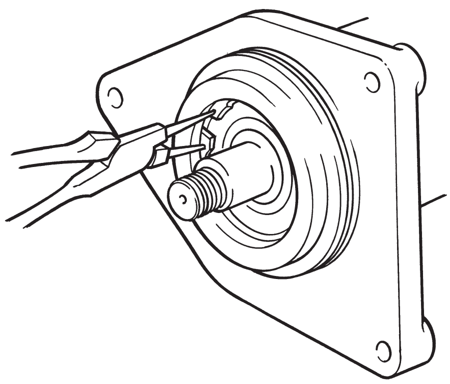
Remove the comb by removing the screw on the outside of the housing.

5



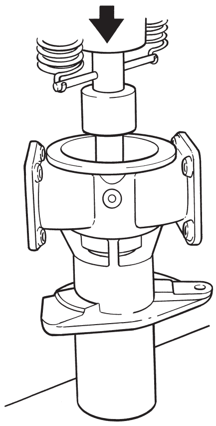
Remove the wear washer

6



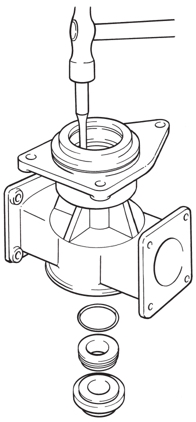
Remove the circlip.

7



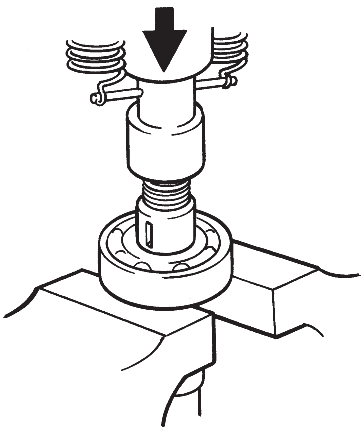
Press the shaft and bearing out of the housing.

8



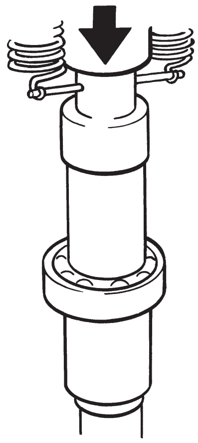
Drive the seals out of the housing.

9



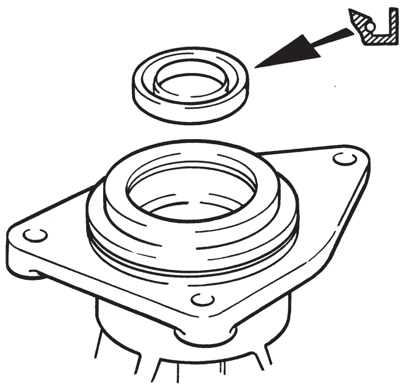
Press or pull the bearing off the shaft.

10



Press the new bearing onto the shaft.

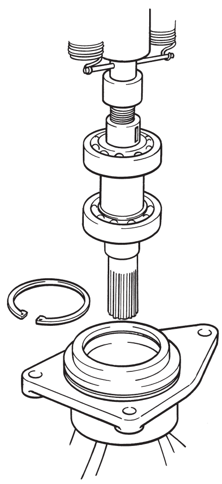
11



Install the seal on the oil side.

NOTE! Align the spring side of the bearing against the bearings.

12

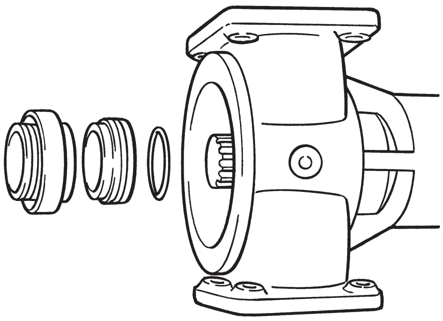


Press the shaft and bearing into the housing and install the circlip.

13

Install the throwout ring on the shaft.

14



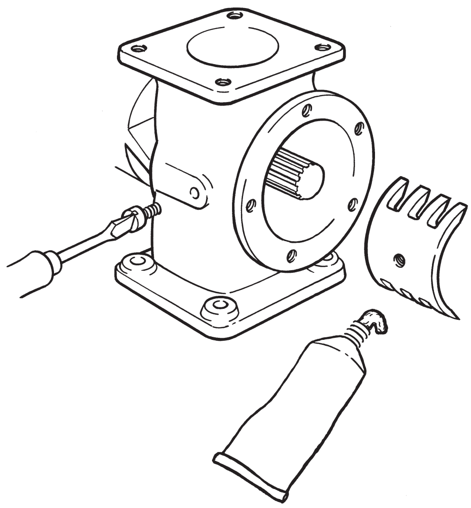
Install the ceramic portion of the seal, using mandrel 999 4034.

Put a piece of plastic foil (from a plastic bag) on the ceramic seal to protect it from grease and finger marks.

15

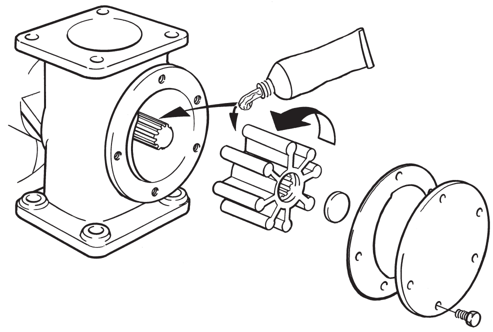
Install the carbon track, using mandrel 999 4034.

16



Install the wear track and install the comb with a small amount of Permatex® No. 77 on the rear.

17

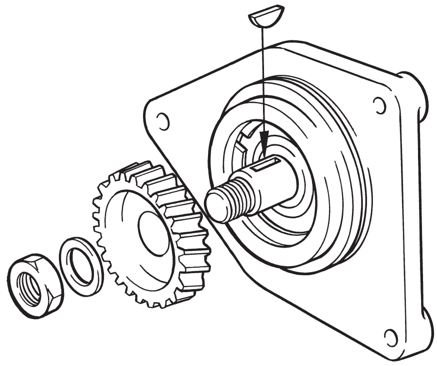


Grease the shaft and install the impeller by turning it anti-clockwise. Use soapy water to facilitate insertion.

Install the small lid on the impeller.

Install the pump lid with a new gasket.

18



Install the key and gear wheel.

Tighten the nut.

Sea water pump, renovation

Pump already removed

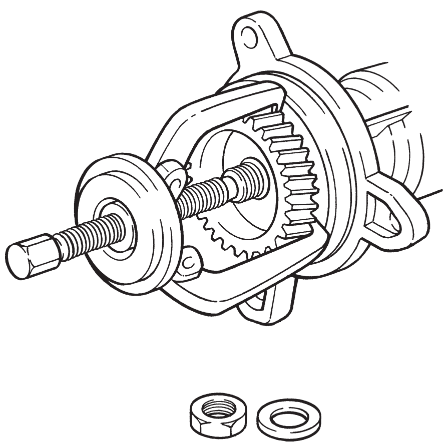
TAMD63

Special tools: 9992457, 9994034

1

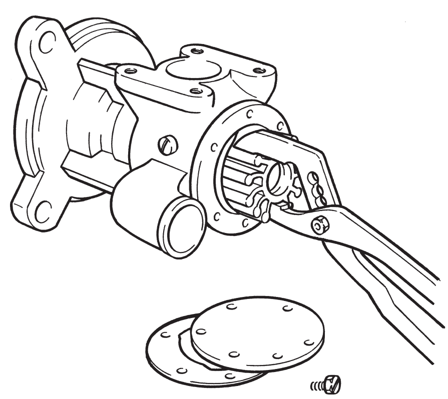
Fix the pump in a vice with soft jaws.

2



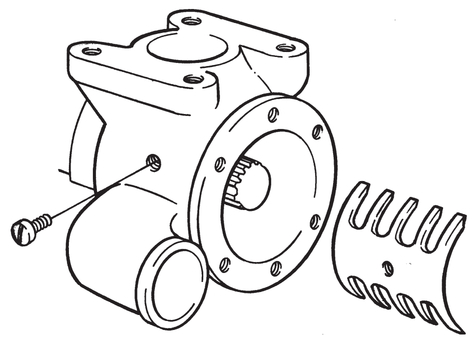
Remove the nut and pull the gear wheel off with an extractor. Look after the key.

3



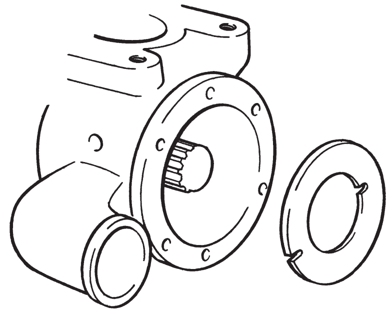
Remove the lid of the impeller housing. Pull the impeller out with a pair of water pump pliers.

4



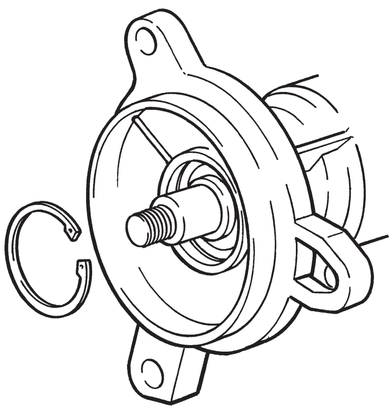
Remove the comb by removing the screw. Remove the sealer on the comb and inside the housing.

5



Remove the wear washer from the pump

6

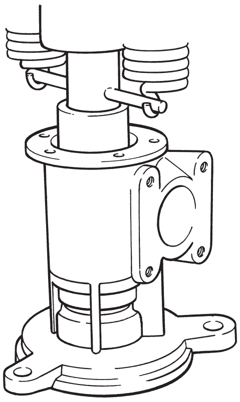


Remove the large circlip.

7

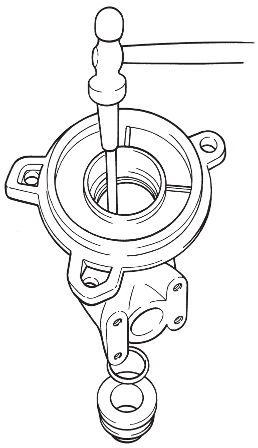
Remove the small circlip.

8



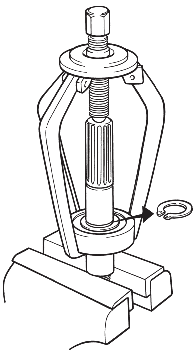
Put the pump in a press and press the shaft out of the pump.

9



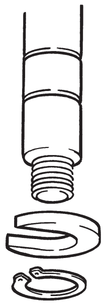
Drive the oil seal and ceramic seal out with a drift.

10



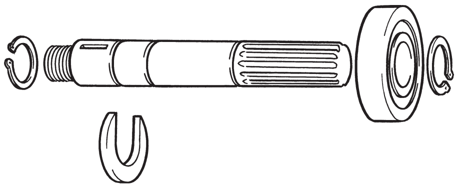
Put the shaft in a vice with soft jaws. Undo the bearing circlip and pull the bearing off the shaft.

11



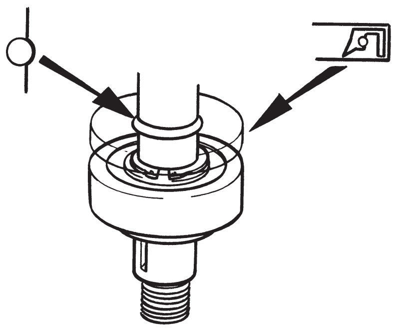
Remove the circlip and thrust washer.

12



Install the new bearing, circlip and thrust washer. Install the bearing circlip.

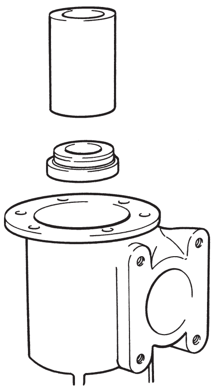
13



Install the oil side seal ring.

NOTE! The seal lip should face the bearing.

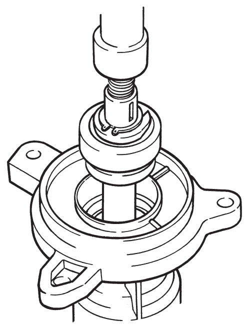
14



Install the ceramic portion of the seal.

NOTE! Put a piece of plastic foil (from a plastic bag) on the ceramic seal to protect it from grease. It is easiest to install with mandrel 9992457.

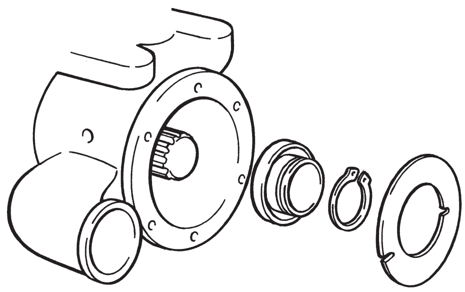
15



Put the O-ring between the oil side seal and the ceramic seal. Press the shaft into place.

NOTE! Make sure that the O-ring is located in its groove on the shaft. Install the large circlip.

16



Install the outer seal with the carbon track facing the ceramic seal. It is easiest to install with mandrel 9994034.

NOTE! Make sure that the carbon track does not come into contact with grease.

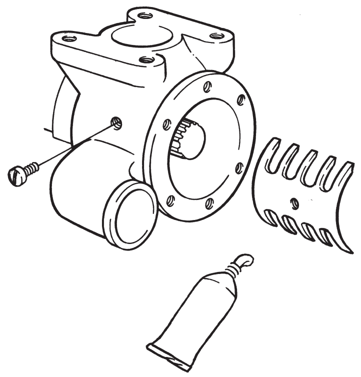
17

Install the small circlip. Press it into place with mandrel 9994034.

18

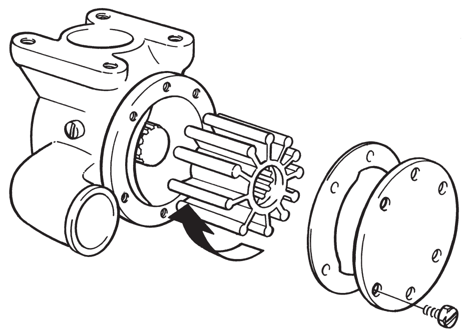
Install the wear washer. Make sure that the dowel in the housing is located in the cutout in the washer.

19



Apply Permatex® No. 77 around the screw hole on top of the comb and install the comb.

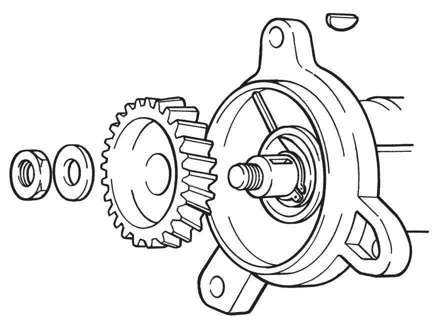
20



Grease the shaft and install the impeller by turning it anti-clockwise down into the housing. Use soapy water to facilitate insertion.

Install the new seal and lid for the impeller housing.

21



Put the key into its groove and drive or press the gear wheel on. Tighten the nut.

Thermostat replacement

Special tool: 9996863

1

Drain the requisite amount of coolant.

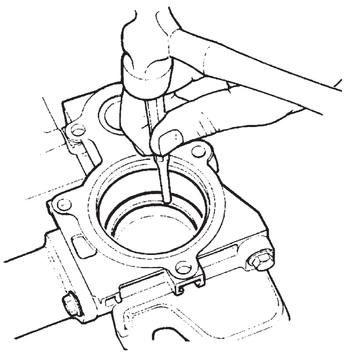
2

Shut the fuel taps and remove the fuel filters from the thermostat housing lid.

3

Remove the thermostat housing lid and lift the thermostat out.

4



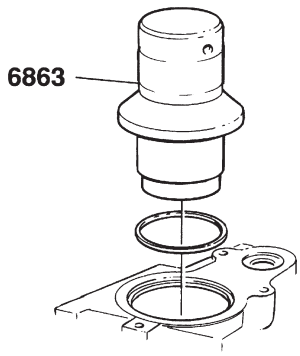
Remove the old seal ring by tapping it with a drift so that it tips and can be removed.

Note. Be careful not to damage the mating surface of the seal ring against the thermostat housing.

5

Clean the mating surfaces in the thermostat housing and lid.

6



Put a new seal ring on mandrel 9996863.

Tap the seal ring carefully until the mandrel bottoms in the thermostat housing.

7

Put the new, or checked and approved thermostat into the housing and install the lid. Use new seal rings.

8

Install the fuel filters. Open the fuel taps and vent the fuel system if necessary, in accordance with the "Group 23, Fuel System" instruction in the workshop manual on page 39.

9

Top up with coolant.

See "Filling coolant" on pages 26 and 27.

Thermostat, function check

A function check should be done before the thermostat is replaced.

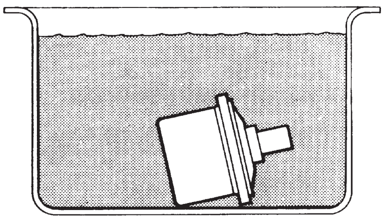
1

Check that the thermostat closes fully.

Hold the thermostat up against the light and check that no air gap is visible at the parting line.

If the thermostat does not close fully, it must be replaced.

2

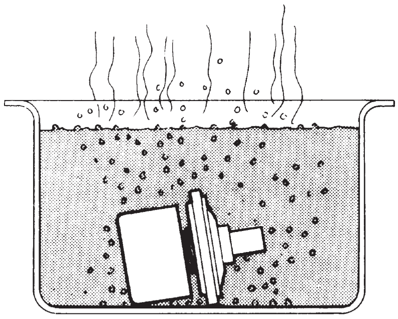


Heat up water in a vessel to **75°C (170°F)** and put the thermostat in, as in the illustration.

3

Check after at least **½ minute** that the thermostat is still closed.

4



Heat the water up to boiling point, **100°C (212°F)** and check after at least **½ minute** that the thermostat has opened at least **7 mm (9/32")**.

If the thermostat does not open, replace it.

Report form

Do you have any complaints or other comments about this manual. Please make a copy of this page, write your comments down and send them to us. The address is at the bottom. We would prefer you to write in English or Swedish.

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