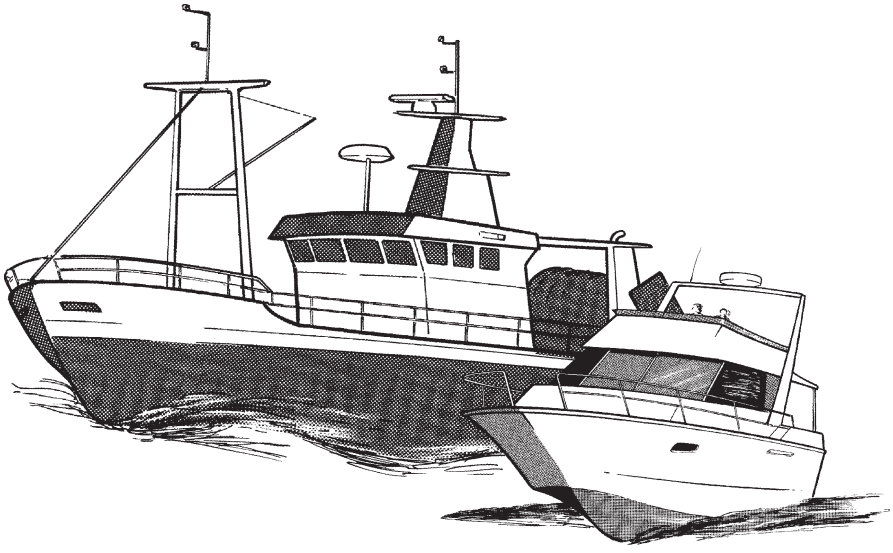
INSTRUCTION BOOK

TAMD162C, TAMD163A, TAMD163P

Contents



CALIFORNIA

Proposition 65 Warning

Diesel engine exhaust and some of its consistituents are known to the state of California to cuse cancer, birth defects, and other reproductive harm.

Safety Precautions

Introduction

This Instruction Book contains the information you will need to operate the engine correctly. Check that you have the correct Instruction Book for your engine.

Read the book carefully before operating or servicing the engine. If operations are performed incorrectly it could result in personal injury, or damage to property or the engine.

If you do not understand or are uncertain about any opertion or information in this manual, please contact your Volvo Penta dealer who will be able to assist with an explanation and demonstration of the operation.

Important

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

WARNING! Possible danger of personal injury, damage to property or mechanical malfunction if the instructions are not followed.

Read the Instruction Book.

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

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

Always turn the engine off before starting service procedures. Avoid burns. Take precautions to avoid hot surfaces and liquids in supply lines and hoses when the engine has been turned off immediately prior to starting work on it and it is still hot.

Reinstall all protective parts removed during service operations before starting the engine. Make a point of familiarizing yourself with other risk factors, such as rotating parts and hot surfaces (exhaust manifold, turbocharger, charge pipe, starter element, charge air cooler, intake pipe etc.).

Approaching an engine which is operating is a safety risk. Loose clothing or long hair can fasten in rotating parts and cause serious personal injury.

If the service operation requires that the engine is operating let your Penta authorized dealer carry out the work. If working in proximity of an engine which is operating, careless movements or a dropped tool can result in personal injury.

Immobilize the engine by turning off the power supply to the engine at the main switches (breakers) so it is impossible to start, and lock the switches (breakers) in the OFF position before starting work. Set up a warning notice at the engine control point or helm.

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

Never use start spray or similar agent to start the engine, it could cause an explosion in the inlet manifold. Danger of personal injury.

Steam or hot coolant can be ejected and the pressure built up will be lost. Steam or hot coolant can spray out and the system pressure will be lost. Open the filler cap slowly and release coolant system pressure, if the filler cap or a drain cock/venting cock must be opened, or if a plug or engine coolant line must be removed on a hot engine. Steam or hot coolant can spray out.

Stop the engine and close the seacock valve before carrying out operations on the engine cooling system.

Only start the engine in a well-ventilated area. If operating the engine in a closed area ensure that there is exhaust ventilation leading out of the work area to remove exhaust gases and crankcase ventilation emissions.

Anti-corrosion agents are hazardous to health. Read the instructions on the product packaging!

Anti-freeze agents are hazardous to health. Read the instructions on the product packaging!

Certain engine conservation oils are inflammable. Some of them are also dangerous if breathed in. Ensure good ventilation in the work place. Use a protective mask when spraying.

Hot oil can cause burns. Avoid getting hot oil on the skin. Ensure that the lubrication system is not under pressure before carrying out any work. Never start or operate the engine with the oil filler cap removed, otherwise oil could be ejected.

⚠ Never allow an open flame or electric sparks near the batteries. Never smoke in proximity to the batteries. The batteries give off hydrogen gas during charging which when mixed with air can form an explosive gas -oxyhydrogen. This gas is easily ignited and highly volatile. Incorrect connection of the battery can cause a single spark which is sufficient to cause an explosion with resulting damage. Do not shift the connections when attempting to start the engine (spark risk) and do not lean over any of the batteries. Refer to instructions in the Instruction Book.

⚠ Always ensure that the Plus (positive) and Minus (negative) battery leads are correctly installed on the corresponding terminal posts on the batteries. Incorrect installation can result in serious damage to the electrical equipment. Refer to the wiring diagrams.

⚠ Always use protective goggles when charging and handling the batteries. Battery electrolyte contains sulfuric acid which is highly corrosive. Should the battery electrolyte come into contact with unprotected skin wash off immediately using plenty of water and soap. If battery acid comes in contact with the eyes, immediately flush with plenty of water and obtain medical assistance without delay.

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

⚠ Clutch adjustments, where a clutch is fitted, must be carried out with the engine turned off.

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

Use a lifting beam to raise the engine to ensure safe handling and to avoid damaging engine parts installed on the top of the engine.

All chains and cables should run parallel to each other and as perpendicular as possible against the side of the engine.

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

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

⚠ **WARNING!** The components in the electrical system and in the fuel system on Volvo Penta products are designed and manufactured to minimize risks of fire and explosion.

The engine must not be run in areas where there are explosive materials.

⚠ Fuel filter replacement should be carried out on a cold engine in order to avoid the risk of fire caused by fuel spillage on the exhaust manifold. Always cover the generator (alternator), if it is located under the fuel filter. The generator (alternator) can be damaged by spilled fuel.

⚠ **WARNING!** The delivery pipes must not be bent, twisted or subjected to other stress. Replace damaged delivery pipes.

⚠ Always use protective gloves when detecting leaks. Liquids ejected under pressure can penetrate the body tissues and cause serious injury. Danger of blood poisoning.

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

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

General Information

Welcome aboard

Thank you for choosing a Volvo Penta marine engine.

Volvo Penta have been building marine engines since 1907. Quality, operating reliability and innovation have made Volvo Penta a world leader in the marine engine industry.

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

We would like to wish you many pleasant voyages.

AB VOLVO PENTA

Technical Information

Your new boat

Every new boat has it own special characteristics. Even experienced boat owners are advised to note carefully how the boat behaves at different speeds, weather conditions and loads. If your boat and engine combination permit high-speed use, we strongly recommend that a safety breaker is fitted, regardless of the type of boat. If your boat is not fitted with a safety breaker contact your Volvo Penta dealer who can assist you in selecting one.

Running-in

When the engine is new, it should be run normally. However, full loading should be avoided for more than brief periods during the first ten hours of use. **Unnecessary idling of an unloaded engine should always be avoided.**

Check the instrumentation extra carefully during this period so that any abnormal conditions may be discovered in good time.

Check also that there are no leaks.

With a new or reconditioned engine, the valve clearance should first be checked after 150 hours of operation.

The oil and oil filter* in the Twin Disc reverse gear should first be changed at this point too. Remove and clean the reverse gear's oil screen at the same time. In the case of MPM reverse gears, the oil screen should be cleaned after 10 and 50 hours of operation, and the first oil and filter change* should be made after 50 hours of operation.

The disengageable clutch should be checked more closely during the first few days. It may be necessary to adjust it to compensate for wear to the laminate.

*Only the TD MG516, and MPM IRM 350 have oil filters.

Fuel and lubricants

Only use lubricants and fuels recommended on page 16 or under "Technical Data". Use of other qualities can cause malfunctions and reduced service life.

Spare parts

⚠ **Warning!** The components in the electrical system and in the fuel system on Volvo Penta products are designed and manufactured to minimize risks of fire and explosion.

Using parts that are not Original Volvo Penta parts which do not correspond to the demands above, can result in fire or explosion on board. Any type of damage which is the result of using replacement parts that are not original Volvo Penta replacement parts for the product in question will not be covered under any warranty or guarantee provided by AB Volvo Penta.

Safety

Everyone wants and expects to have a problem-free and pleasant time when they take their boat out. To help you do this we have provided a pre-journey checklist below, which can of course be added to according personal experience. A major area is naturally the engine, its equipment and that the boat in general is properly maintained.

Planning your trip

– Get out up-to-date charts for the route planned.
– Calculate distance and fuel consumption.
– Note down if there are fuel points on your planned course.
– Tell friends or relatives about your trip plans.

Boat equipment

– Rescue and emergency items such as lifevests and signal rockets. Does everyone know where they are?
– Spare parts on board, for example Kit with water pump impeller etc.
– Proper tools for the equipment.
– Fire extinguisher (checked and charged).

Warranty and guarantee

A Service and Warranty book with conditions for Volvo Penta's International Limited Warranty is supplied with every engine. Contact your nearest Volvo Penta dealer or importer for your copy if you have not received one.

Some markets can have other warranty conditions depending on national legislation and regulations. These conditions are provided by the Volvo Penta importer or distributor for the market in question. If you wish to have a copy of the conditions please contact your local Volvo Penta representative.

Warranty Registration Card

The Warranty Registration Form (North American market) or Warranty Card (other markets) should always be filled out and sent in by the dealer. Make sure that this has been done, if no proof of the delivery date can be provided the warranty undertakings might not be honored.

Our joint responsibility

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

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

In this instruction book there are a number of service procedures, which, if not followed will lead to a deterioration of engine characteristics with regard to how it effects the environment, its service life and cost of operation. Always follow the recommended service intervals and make a habit of checking that the engine is operating normally every time you use it. One example is excessively smoky exhaust. Contact an authorized Volvo Penta workshop if you cannot correct the fault yourself.

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

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

Maintenance and care

– PDC (Pre-Delivery Commissioning) delivery undertaking for marine engines: "PDC" enables us to ensure that Volvo Penta products operate correctly after installation in a boat, and further that the end-user gets acquainted with the product, its functions and care (refer to checklist in the Warranty and Service book). Delivery undertaking "PDC" is carried out at the time of the delivery of the boat to the end-user. The cost of this work is covered by the Volvo Penta company's International Limited Warranty.
– **First Service inspection:** A First Service inspection must be carried out after 150–300 running hours or within 180 days of delivery, or at the end of the first season, whichever comes first. Labor and material costs in connection with the First Service Inspection are **not** covered by the Volvo Penta International Limited Guarantee (for checklist see your Warranty and Service book).

Regular maintenance should be carried out after the First Service Inspection in accordance with the maintenance scheme in this book. Any work carried out in addition to maintenance services should be documented (refer to the Warranty and Service book).

It is an absolute condition for the Volvo Penta International Limited Warranty to apply that the Pre-Delivery Commissioning and First Service Inspection have been carried out by an authorized Volvo Penta service dealer.

Volvo Penta Service

Volvo Penta has a comprehensive dealer network that offers both service and spare parts for Volvo Penta engines. These dealers have been carefully selected and trained to provide professional assistance for service and repairs. They also have the special tools and testing equipment required for maintaining a high standard of service. Volvo Penta dealers and vendors must maintain a stock of original spare parts and accessories to cover most requirements of Volvo Penta owners.

When ordering a service or spare parts always quote the engine and drive/reverse gear complete type designation and serial number. You will find this information on the engine product plate and on a label on the front valve cover (see page 7).

Certificated engines

Important information for engines certificated for Lake Constance and Switzerland

All Volvo Penta engines and products are developed to minimize environmental impact.

National and regional legislation is not identical in all the markets where Volvo Penta sells its products. Occasionally legislation requires that we build special engine variants, or that an engine must be approved in advance, that is, certificated by the local authorities.

An engine with certification means that we, as the manufacturer, guarantee that all engines manufactured are of the same type as the certificated and approved example. Certification is not only a requirement covering engines from the factory, but also that engines in use must meet the environmental demands set for that engine. In order for Volvo Penta as the manufacturer to take responsibility for engines in use, certain requirements pertaining to service and spare parts must be met. We do not wish to discourage owners from carrying out service work themselves, rather the opposite since an owner can quickly notice if an engine is not operating normally.

However, a number of service operations demand access to special expertise, workshop manuals, special tools and other equipment designed for the engines. These service operations may only be carried out by an authorized Volvo Penta Service workshop. Always contact your Volvo Penta dealer if you are not sure about anything concerning your engine's function or maintenance.

As an owner or operator of a certificated Volvo Penta engine it is important that you are aware of the following:

- The Service Intervals and maintenance operations recommended by Volvo Penta must be followed.
- Only Volvo Penta Original Spare parts intended for the certificated engine may be used.
- Service work on the injection pump and injectors or pump settings must always be carried out by an authorized Volvo Penta workshop.
- The engine may not be altered or modified in any way, with the exception of accessories and service kits developed by Volvo Penta for that engine.
- No modifications to the exhaust pipes and air supply ducts for the engine room (ventilation ducts) may be undertaken as this may effect exhaust emissions.
- Any seals on the engine may not be broken other than by authorized persons.

⚠ **Important!** If spare parts are required use only Volvo Penta Original parts.

Use of spare parts other than AB Volvo Penta Original spare parts will result in AB Volvo Penta cannot assume any liability for the engine meeting requirements under the engine certification. Any type of damage which is the result of using replacement parts that are not original Volvo Penta replacement parts for the product in question will not be covered under any warranty or guarantee provided by AB Volvo Penta.

Identifying Numbers

Immediately after you have taken delivery of your boat, make a note of the serial number and model designation of the engine and reverse gear. Include the serial number and model designation of the boat and any extra equipment. This information is necessary when you contact your Volvo Penta or boat sales representative for service and spare parts. Take a copy of the information. Take a copy of the information and keep it in a safe place so it is available should the boat be stolen.

Engine type .....

Serial No. .....

Reverse gear type .....

Serial No. .....

Propeller designation .....

Boat type .....

Serial No. .....

Other equipment .....

Serial No. .....

The engines

TAMD162C, TAMP163A, TAMD163P-A

The basic engine is an in-line six cylinder, water-cooled diesel engine with direct fuel injection and piston cooling. It has a displacement of 16 liters.

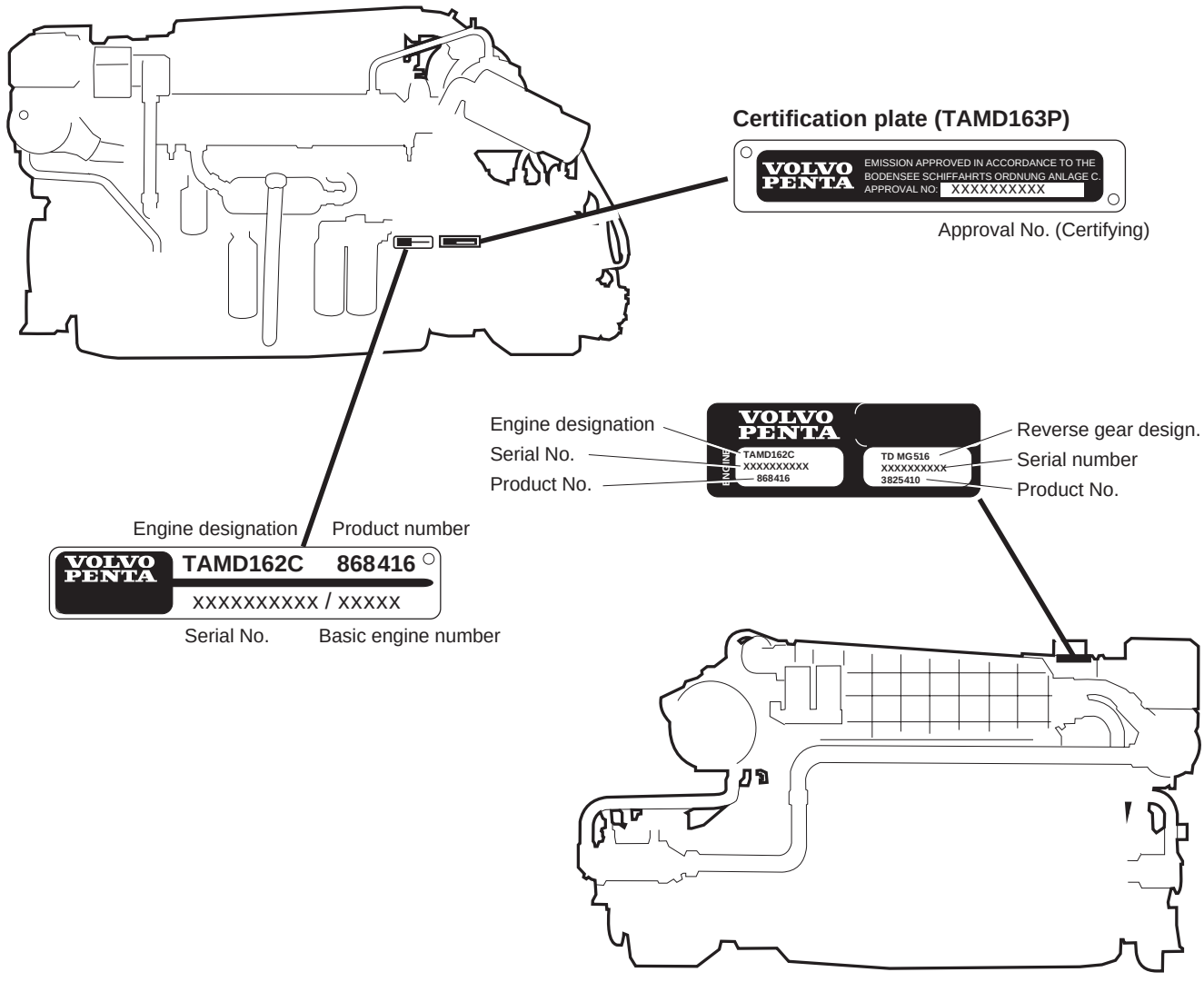
The engine uses a seawater cooled charge air cooler (CAC). The CAC reduces the temperature of the intake air to the engine after it has been compressed in the turbocharger. This permits a high power output while keeping the combustion and exhaust gas temperatures to appropriate levels.

The engine has separate cylinder heads, one for each cylinder. There are four valves per cylinder head, two inlet and two exhaust. The pistons are cooled by lubricant oil via special jets in the engine block. The cylinder liners are of the wet type and are replaceable.

The cooling system is thermostatically controlled. Freshwater in the engine is cooled by seawater in a heat exchanger.*

For a more detailed description of the engine, its fuel, lubrication, and cooling systems, etc., see under “Technical Specification” on pages 36–62.

*** Note:** TAMD162C and TAMD163A can also be delivered for connection to keel cooling systems.



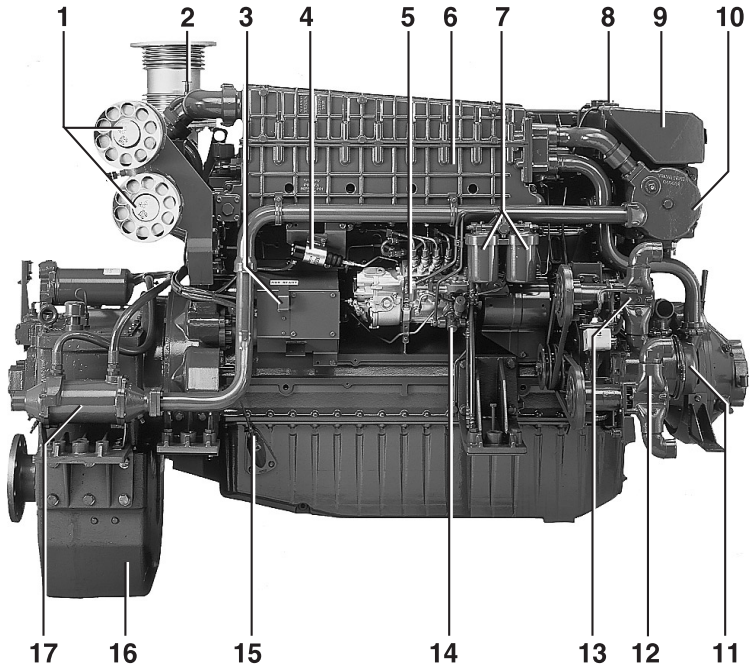


Fig. 1. TAMD162C from starboard (classifiable version).

1. Air cleaner (ACL)
2. Freshwater system bleed tap
3. Emergency start button
4. Stop solenoid
5. Injection pump
6. Intake manifold with charge air cooler (CAC)
7. Fine fuel filters
8. Coolant filler cap
9. Expansion tank
10. Heat exchanger
11. Seawater pump
12. Flushing pump
13. Bilge pump
14. Fuel feed pump
15. Oil dipstick
16. Oil cooler, reverse gear
17. Twin Disc reverse gear MG516

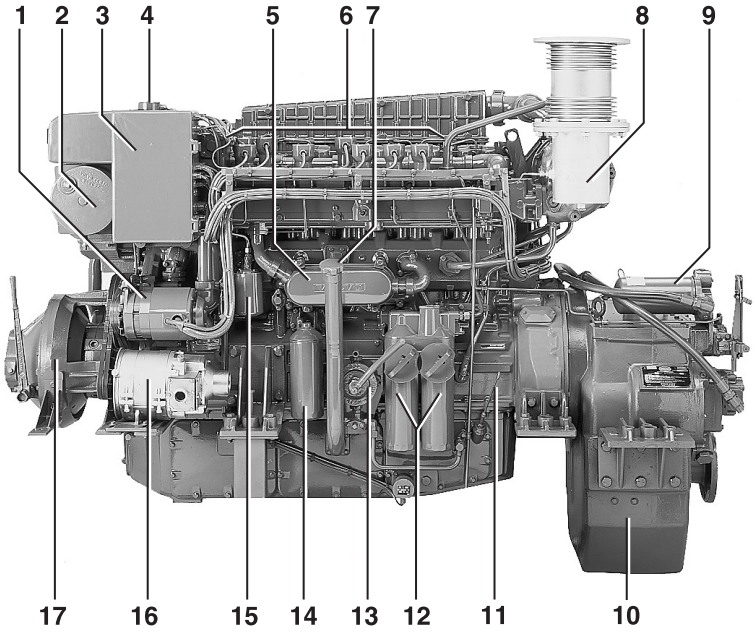


Fig. 2. TAMD162C from port (classifiable version).

1. Generator (GEN)
2. Heat exchanger
3. Electronics terminal box
4. Coolant filler cap
5. Oil cooler, engine
6. Sender console with switches and senders for monitoring the engine
7. Oil filler, engine
8. Exhaust elbow for dry exhaust gases
9. Oil filter, reverse gear
10. Twin Disc reverse gear MG516
11. Oil dipstick
12. Lubricating oil filters (full flow type)
13. Oil scavenging pump
14. Lubricating oil filter (part flow type)
15. Coolant filter
16. Extra generator
17. Disengageable clutch

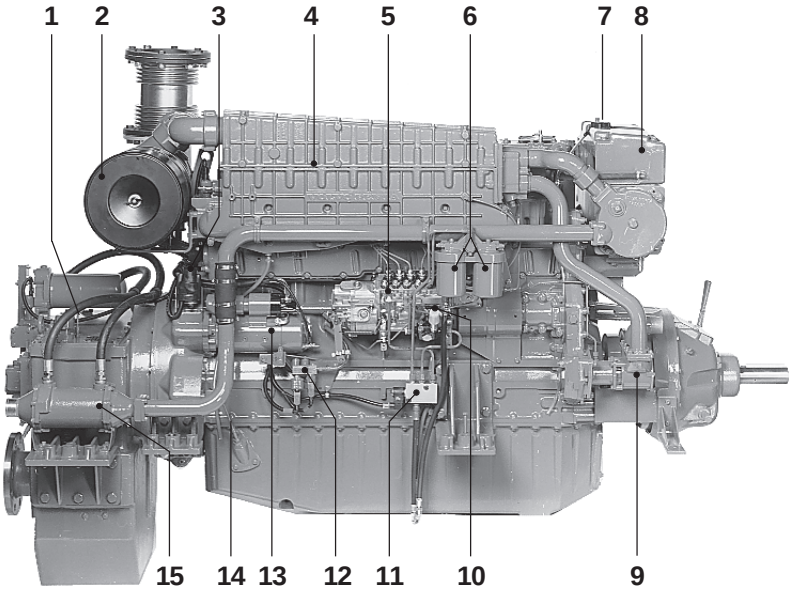


Fig. 3. TAMD163A from starboard.

1. Oil dipstick, reverse gear
2. Air cleaner (ACL)
3. Starter relay
4. Intake manifold with charge air cooler (CAC)
5. Injection pump
6. Fine fuel filters (switchable, optional equipm.)
7. Coolant filler cap
8. Expansion tank
9. Seewater pump
10. Fuel feed pump
11. Fuel shut-off valve
12. Oil pressure sender and -switch
13. Starter motor
14. Oil dipstick
15. Oil cooler, reverse gear

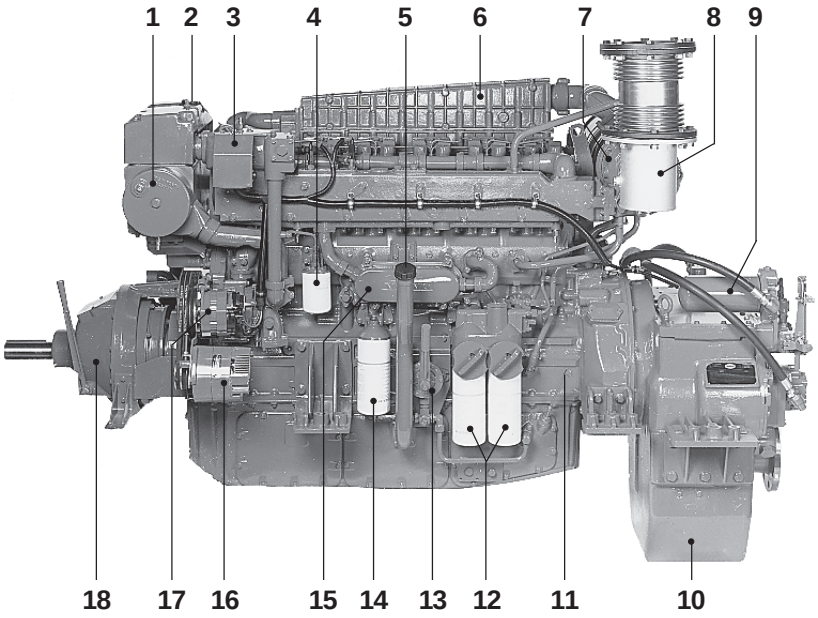


Fig. 4. TAMD163A from port.

1. Heat exchanger
2. Coolant filler cap
3. Electronics terminal box
4. Coolant filter
5. Oil filler, engine
6. Charge Air Cooler (CAC)
7. Turbobocharger
8. Exhaust elbow for dry exhaust gases
9. Oil filter, reverse gear
10. Reverse gear, Twin Disc MG516
11. Oil dipstick
12. Lubricating oil filters
13. Oil scavenging pump
14. Lubricating oil filter (part flow type)
15. Oil cooler, engine
16. Extra generator
17. Generator (GEN)
18. Disengageable clutch

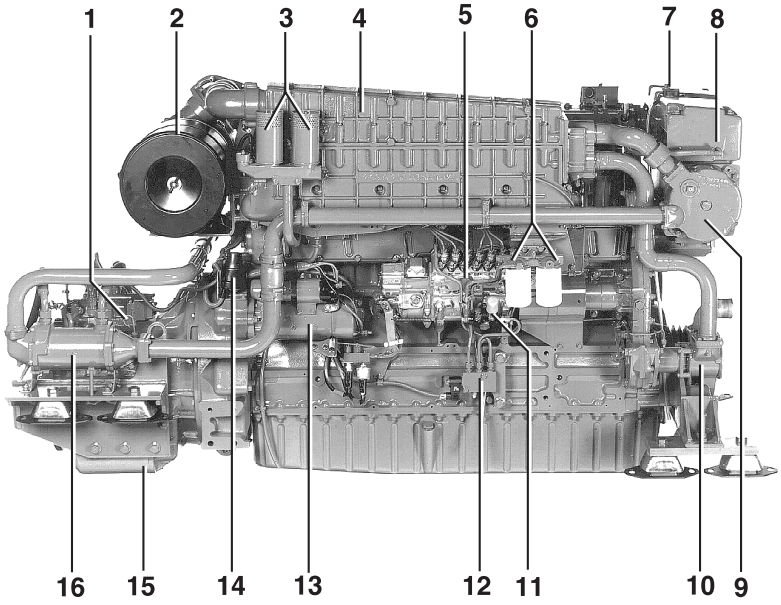


Fig. 5. TAMD163P from starboard.

1. Oil dipstick, reverse gear
2. Air cleaner (ACL)
3. Filters for crankcase ventilation
4. Intake manifold with charge air cooler (CAC)
5. Injection pump
6. Fine fuel filters
7. Coolant filler cap
8. Expansion tank
9. Heat exchanger
10. Seawater pump
11. Fuel feed pump
12. Fuel shut-off valve
13. Starter motor
14. Starter relay
15. Reverse gear MPM IRM350
16. Oil cooler, reverse gear

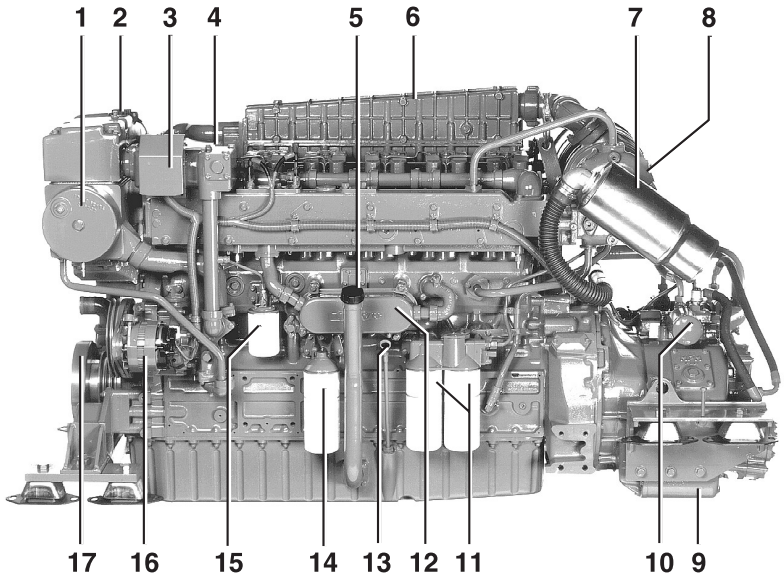


Fig. 6. TAMD163P from port.

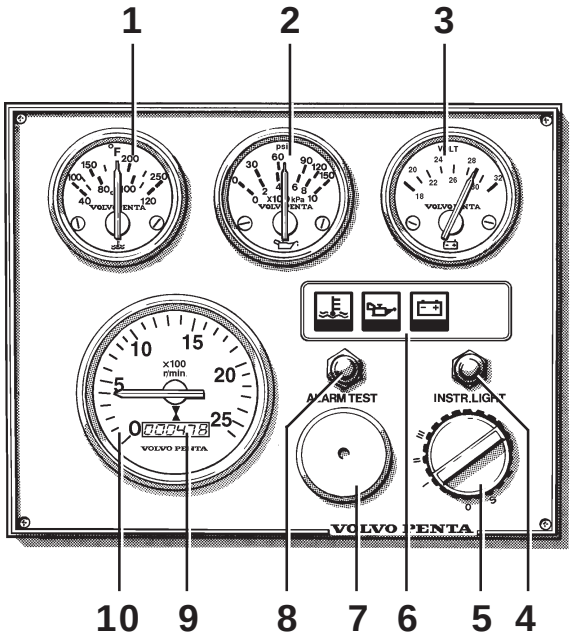
1. Heat exchanger
2. Engine coolant filler cap
3. Electronics terminal box
4. Thermostat housing
5. Oil filler, engine
6. Charge Air Cooler (CAC)
7. Water-cooled exhaust elbow
8. Turbocharger
9. Reverse gear MPM IRM350
10. Oil filter, reverse gear.
11. Lubricating oil filters (full flow type)
12. Oil cooler, engine
13. Oil dipstick
14. Lubricating oil filter (part flow type)
15. Coolant filter
16. Generator (GEN)
17. Vibration damper

Instrument

The instrument panels used are the main panel, the Flying Bridge (instrument panel for alt. control position) and the auxiliary panel. In addition there is an extra alarm panel.

Instrument panels supplied only with classifiable engines are not described in this section. See “Electrical system, function and installation, TAMD162” instead.

The instrumentation is also supplied separately in sets if Volvo Penta instrument panels are not used. These sets include three smaller panels for starting, stopping and alarm functions.



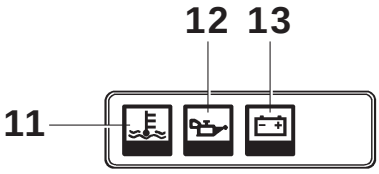
Instrument panels

Main panel

1. Engine coolant temperature (ECT) gauge
2. Oil pressure gauge, engine.
3. Voltmeter. Displays start batter voltage.
4. Pressure switch for instrument lighting.
5. Key switch (start lock) with start and stop functions and a built-in restart inhibitor (starter motor protection).

   The restart inhibitor prevents the key being moved to the start position unless it has first been returned to the stop position (S).
6. Alarm panel with warning symbols (pos.11–14).
7. Alarm (siren) warning for mechanical faults. Sounds when lubricating oil pressure is too low (engine), when coolant temperature is too high or there is a loss of charge.
8. Pressure switch for testing alarm functions or acknowledging alarms.
   - **No alarm:** Alarm test (all warning lights are on and the siren sounds).
   - **If the alarm sounds**: Alarm acknowledgement.*
9. Hour counter. Displays the engine’s operating time in hours and tenths of an hour.
10. Tachometer, engine speed. Multiply this value by 100 for revolutions per minute

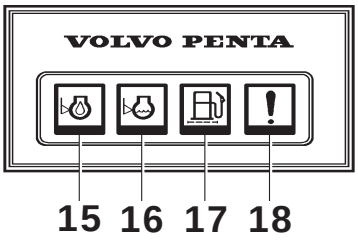
* **Note** The siren stops but the warning lamps continue flashing until the malfunction has been corrected. If there is a new alarm the siren sounds again at the same time as the next warning lamp starts to flash etc.



Alarm panel

This panel has four “windows”. If the acoustic alarm sounds, one of the windows “11–13” starts to flash (red) to show the cause of the alarm.

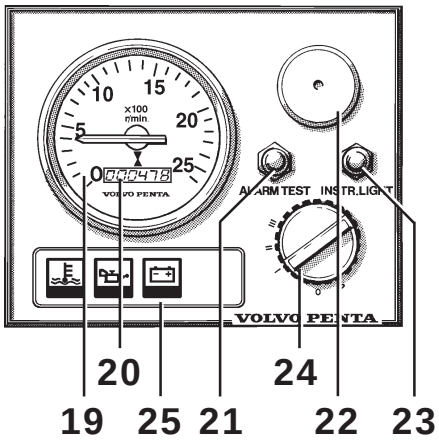
11. Warning lamp – high coolant temperature.
12. Warning lamp – low lubricating oil pressure, engine.
13. Warning lamp – comes on if the charging current from the generator stops.



Extra alarm panel

This panel has four “windows”. If the acoustic alarm comes on, one of the windows starts to flash (red) to show the cause of the alarm.

15. Lubricating oil level too low. Top up to correct level before starting.
16. Coolant level too low. Top up to correct level before starting.
17. Water in extra fuel filter. Drain off water in filter. See maintenance schedule on page 32 (item 13).
18. Extra alarm.

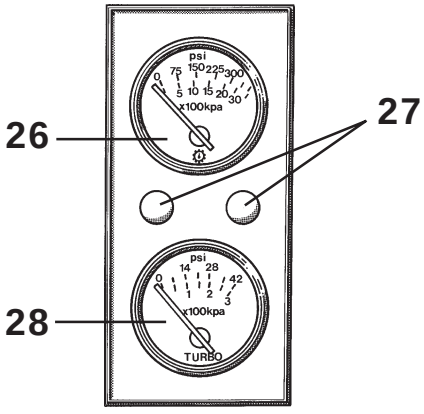


Panel for alternative control position

(“Flying Bridge”)

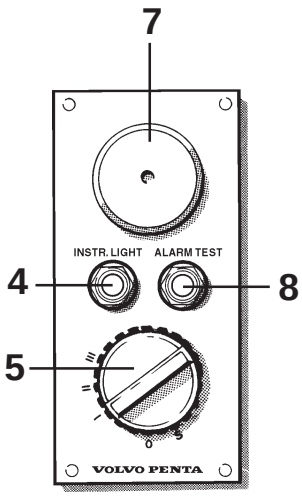
19. Tachometer, engine speed. Multiply this value by 100 for revolutions per minute
20. Hour counter. Displays the engine’s operating time in hours and tenths of an hour.
21. Pressure switch for testing the alarm function.
22. Alarm for malfunctions, corresponding to alarm on main panel.
23. Pressure switch for instrument lighting.
24. Key switch (start lock) with start and stop functions and a built-in restart inhibitor (starter motor protection).

    The start lock prevents restarting unless the key has first been returned to the stop position (S).
25. Alarm panel with warning symbols corresponding to main panel.



Auxiliary panel

26. Oil pressure gauge for reverse gear.
27. Blind plugs. Space for extra switch etc.
28. Pressure gauge for turbocharger boost pressure.



Pilot house

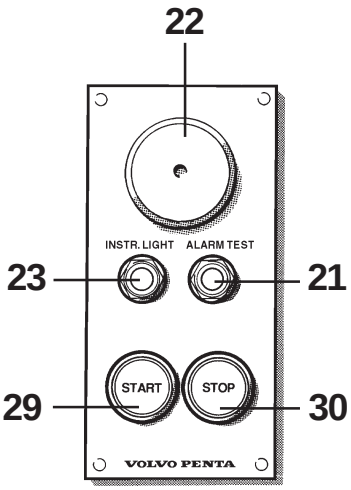
Instrument kits

The instrumentation is also supplied separately in sets. There are also the following three smaller panels for starting and stopping the engine and using the alarm functions.

Control panel for pilot house

(main panel)

The pilot control panel has the same functions as the main panel (pos. 4–5 and pos. 7–8).



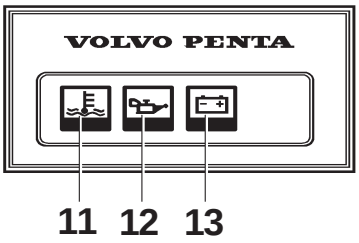
Alt. operation position

Control panel for alt. operating position

The control panel at the alternative operating position has the same functions as the panel for the alternative operating position (pos. 21–23).

Note The key switch in the pilot house control panel must be in position I (operating position) for starting to be carried out from the secondary operating position.

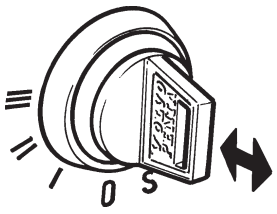
29. Start button The starter motor is engaged when this button is pressed. Release the button as soon as the engine has started.
30. Stop button The stop solenoid or stop valve is engaged when this button is pressed.



Alarm panel

Alarm panel

The alarm panel has warning symbols corresponding to those on the main panel (pos. 11–13).



Key switch

The key switch has five positions, including the 0 position:

Pos. 0 = The key can be inserted and taken out.

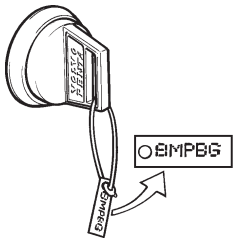
S = Stop position (stop solenoid or fuel shut-off valve engaged). The key springs back automatically to the 0 position after stopping.

I = Operating position. The key springs back automatically to the operating position after start.

II = Intermediate position (not used).

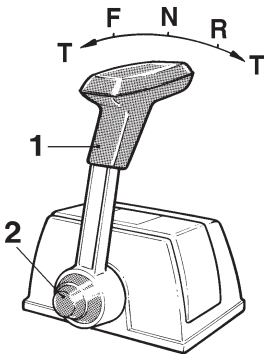
III = Starting position (starter motor engaged).

See also instructions for starting.



Starter keys

The starter keys are tagged with a key code. Use this code when ordering new keys. Do not keep the tag on your boat. The code must not be divulged to unauthorized persons.



VP single control

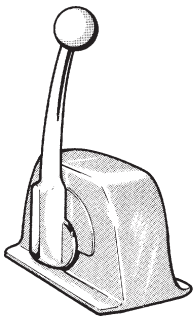
Controls

Volvo Penta uses two types of controls, single lever and dual lever. With single lever controls, both acceleration and reverse gear maneuvers are controlled using one lever, while the dual lever controls have a separate lever for each function.

Lever (1) for reversing maneuvers and controlling engine speed

Position N – Neutral
From N to F – reverse gear engaged for forward movement.
From N to R – reverse gear engaged for reverse movement.
T – control of engine speed (rpm)

Disengaging the reverse gear from the control:
Push the button (2) when the lever is in neutral, then push the lever forwards. The lever can then be used as a throttle with disengaged reverse gear. **Take care not to engage the reverse gear unintentionally.**
The shift function is engaged automatically when the lever is returned to the Neutral position.



Type S controls for maneuvering trolling valve

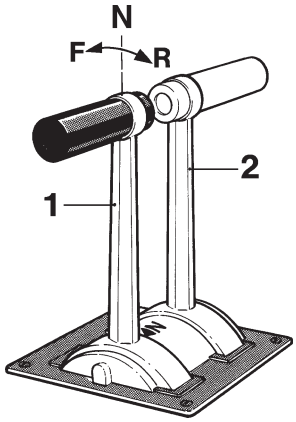
Single lever control

Volvo Penta single lever controls have functions for acceleration and reverse gear maneuvers combined in one lever. When starting, for example, the shift function can be easily disengaged so that only the engine speed (rpm) is affected by the lever. When maneuvering the boat astern or ahead the control mechanism in the unit ensures that the engine speed drops to idle speed at the moment shifting occurs.

The control lever has an adjustable friction brake. A neutral contact which allows the engine to be started only when the reverse gear is disengaged is available as an accessory.

A double single-lever unit is available for use with twin engine installations.

Single lever controls with a single function are suitable for controlling a trolling valve, if fitted. One of these is the type S control.

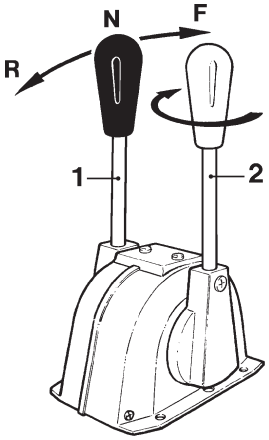


VP dual controls

1. Lever for reverse gear maneuvers (black handle)
   Position N – Neutral
   From N to F – reverse gear engaged for forward movement.
   From N to R – reverse gear engaged for reverse movement.
2. Lever for controlling engine speed (rpm) (red handle)

Dual lever control

These controls have separate levers for acceleration and shifting. A mechanical lock means you can shift only when the acceleration lever is in the idling position. The controls have a neutral switch to prevent starting with the reverse gear engaged. Both control levers have separately adjustable friction brakes.



NB dual controls

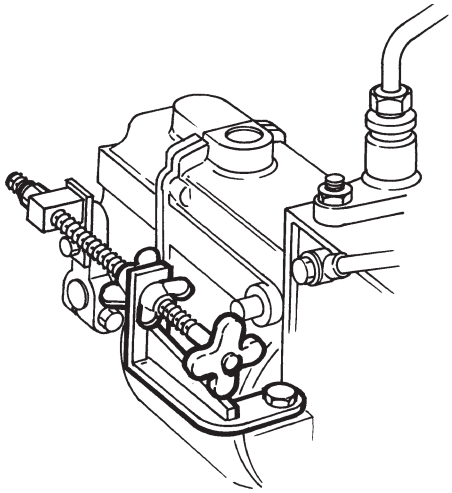
1. Lever for reverse gear maneuvers (black handle)
   Position N – Neutral
   From N to F – reverse gear engaged for forward movement.
   From N to R – reverse gear engaged for reverse movement.
2. Lever for controlling engine speed (rpm) (red handle)
   One brake can be adjusted by turning this handle in order to counteract the regulator power.

Engine speed (rpm) control on pump

Engine speed can be controlled by hand with a single engine speed control on the pump. This control is primarily intended for engines with fixed engine speeds.

To change its setting – hold the wheel. Undo the wing nuts and screw them one way or another until the correct engine speed is achieved.

Tighten wing nuts (against each other). This locks the engine speed (rpm) setting.



Mechanical engine speed (rpm) control on injection pump

Fuel, Oils, Coolant

Diesel fuels

The composition of the fuel is vital for operation of the engine, its service life, and emissions. To meet the performance specified and to run your boat cleanly and quietly, it is vital that you use fuel as recommended below:

Fuel specifications

The fuel must be approved according to national and international standards for commercial fuels, for example:

– EN 590 (With environmental and sub-zero temperature specifications according to national requirements)

– ASTM-D 975 No. 1-D and 2-D

– JIS KK 2204

Sulfur content: According to current legislation in the respective country.

Use of fuel with an extremely low sulfur content (Urban Diesel fuel in Sweden and City Diesel in Finland) can result in a reduction in output of approx. 5% and increase in fuel consumption of approx. 2–3%.

Lubricating oil, engine

A lubricating oil of a grade in accordance with the table below should be used:

Designation	Standard
VDS*	VDS* Volvo Drain Specification
CD,CE	API (American Petroleum Institute)
MIL-L-2104D	US Government Military Spec.

* A VDS oil must be used if there is to be a long period between oil changes. See also the maintenance schedule and “Technical Data”.

We do not advise that you run on an oil of a grade which does not meet the above requirements. This is a poor solution with respect to both economy and operating safety.

For viscosity and capacities, see “Technical Data” on page 74.

Lubricating oil, reverse gear

For the reverse gear, a single grade oil of grade CC, CD or CE according to the API system should be used. Oil according to the MIL-L-2104D standard may also be used.

For viscosity and capacities, see “Technical Data” on page 76.

Oil for servo unit system, hydraulic pump

(accessory)

ATF oil* should be used in the servo unit system.

* ATF = Automatic Transmission Fluid (oil for automatic gearboxes).

Coolant

The engine’s internal cooling system (freshwater system) is filled with a mixture of freshwater and additives.

NOTE! Never use freshwater without additives. The following recommendations should be followed to prevent frost and corrosion damage to your engine:

When there is a chance of freezing

Use a mixture of 50% Volvo Penta antifreeze (glycol) and 50% pure water (as neutral as possible). **This mixture will protect against freezing to a temperature of approx. –40°C (–40°F) and should be used all year round.**

Note. There should be at least 40% antifreeze in the system for complete protection against corrosion.

⚠ **NOTE! Glycol is harmful to health (dangerous if ingested).**

When there is no chance of freezing

When there is no risk of freezing the engine coolant mixture additive is Volvo Penta anti-corrosion agent* (P/N 1141526-2) which must be used unless an antifreeze mixture is used all year round. Mixture ratio = 1:30.

See instructions on page 55 for topping up engine coolant. Run the engine once the coolant has been topped up to allow the additives to work.

⚠ **NOTE! Anti-corrosive agents are harmful to health (danger if ingested).**

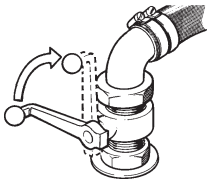
*** Note** Never mix antifreeze (glycol) and anti-corrosive agents. The two combined can produce foam and drastically reduce the coolant’s effectiveness.

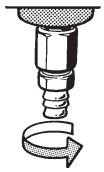
Replacing the coolant

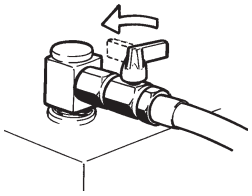
The coolant should be replaced and the system flushed at least once every second year. See maintenance schedule.

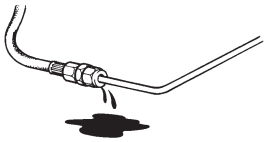
Volvo Penta products

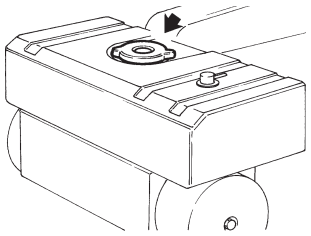
See also under the heading See also under the headings “Accessories” on page 78.

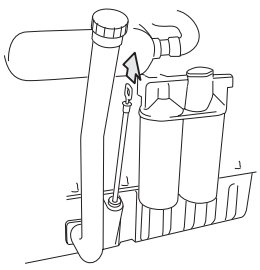


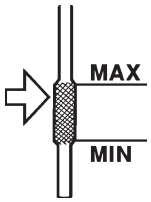


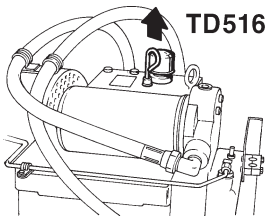


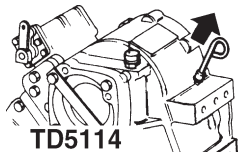


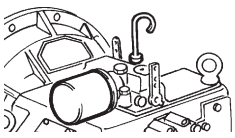












IRM 350 A

Before starting

1. Open the cooling water intake sea cock.

2. Check that all the drain cocks are closed and all the drain plugs are fitted.

For location of cocks/plugs see illustrations on page 24.

3. Open the fuel cocks.

4. Check that no fuel, water or oil is leaking out.

5. Check the coolant level. The level should reach the lower edge of the filler pipe. See page 55 for topping up instructions

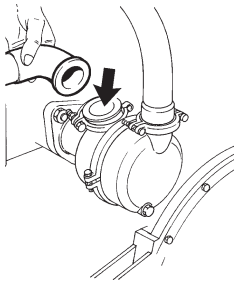
⚠ **Note! Do NOT open the pressure cap on a hot engine. Steam or hot coolant can spray out and the system pressure will be lost.**

6. Check the engine oil level. This should be within the area marked on the dipstick.

The oil level must never be below the MIN mark on the stick.

7. Check the oil in the reverse gear.

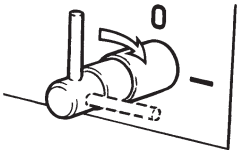
Note Since the marks on the dipstick apply for operating temperature (with the engine idling and the control in neutral), the correct level before starting must be judged by experience.



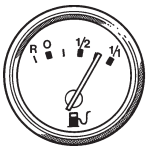
8. **TAMD162C and TAMD163A with centrifugal seawater pump:**

Before starting for first time

Fill seawater pump intake side with water.



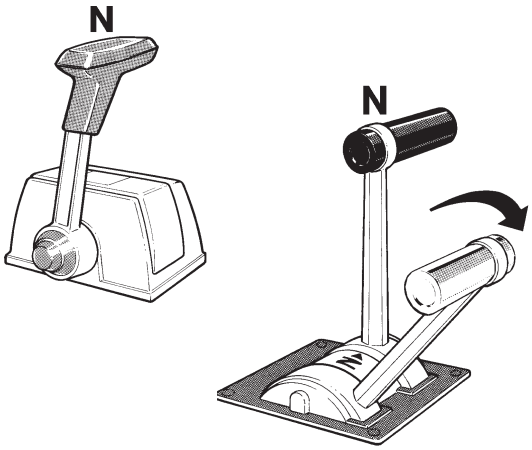
9. Turn on the main switches.



10. Check the amount of fuel.

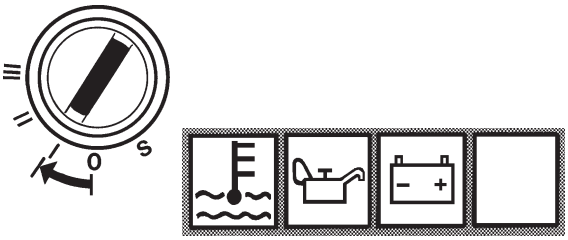
Starting the engine

⚠ **Warning!** Never use start spray or similar to start the engine. There may be an explosion in the inlet manifold. **Danger of personal injury.**

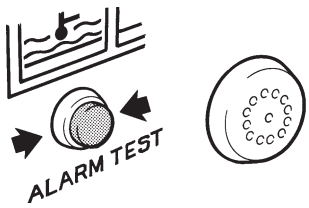


1. **Single lever control**: Check that the lever is in neutral “N”. This means that the throttle control is set to idling and the reverse gear is disengaged.

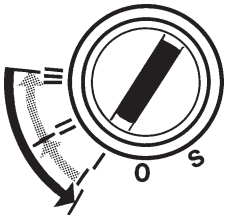
Dual lever control: Move the forward/reverse lever into neutral in order to start. Pull the throttle lever right back (idling position).



2. Put the key in the key switch. Turn it to the “I” position (operating position). All warning lights will come on and stay on for max. 20 seconds. The coolant temperature high warning light will then go off.



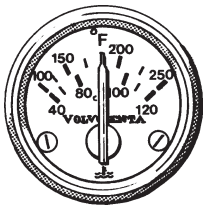
3. Push the “Alarm test” button and check that the alarm sounds (warning lamps come on). The alarm stops when the button is released.



4. Turn the key to position “III” to start. Release the key as soon as the engine starts.

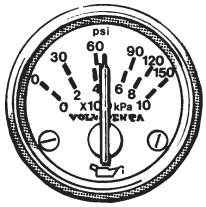
The key switch has a restart inhibitor. Always start repeated start attempts from position “S”. Turn the key to position “III” to start. Release the key as soon as the engine starts.

Warm up the engine at low speed and low load. **Do not race the engine while it is cold.**



When warming up the engine, check that the instruments display normal values.

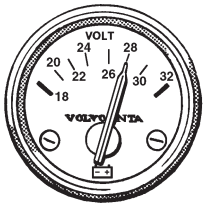
The needle on the temperature gauge should rise slowly to operating temperature, 75–90°C (167–194°F).



At operating speed, the engine's oil pressure gauge should show at least approx:

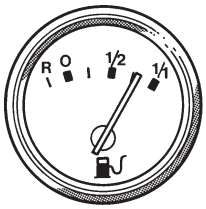
300–500 kPa (3.1 kp/cm^2 = 43.5–72.5 psi)

At low idle approx. 190 kPa (1.93 kp/cm^2 = 27.5 psi).

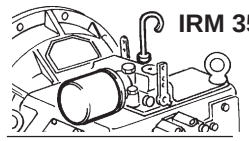


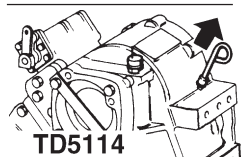
The system voltage should be approx. 28 V.

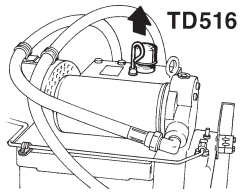
The warning lights should be off and the alarm off.

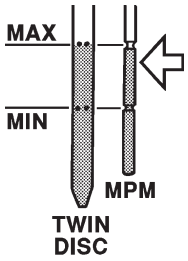


Check the amount of fuel.









Check the oil level in the reverse gear when it has reached **operating temperature** (with the engine idling and the control in neutral). The oil level should reach the upper mark on the dipstick.

⚠ **NOTE! Never break the circuit with the main switches while the engine is running.**

The voltage regulator and generator may be seriously damaged.

The starter motor must **never** be engaged while the engine is running. The starter motor and starter gear on the flywheel may be seriously damaged.

Starting using auxiliary batteries

⚠ **Warning!**

The batteries (auxiliary batteries in particular) contain extremely explosive oxyhydrogen gas. One spark, which may be formed if the auxiliary batteries are connected incorrectly, is sufficient to explode a battery and cause damage and injury.

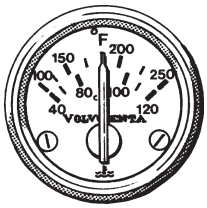
1. Check that the auxiliary batteries are connected (in series or in parallel) so that their rated voltage is the same as the engine's system voltage.
2. First connect the red jump lead (+) to the auxiliary battery, then to the discharged battery.

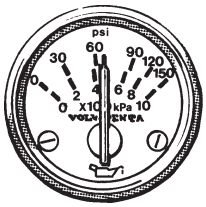
   Then connect the black jump lead (–) to the auxiliary battery, then to a spot **a distance from the discharged batteries**, for example at the main switch on the negative cable or at the negative cable's connection to the starter motor.
3. Start the engine. **NOTE! Do not shift the connections when attempting to start the engine (spark risk) and do not lean over any of the batteries.**
4. Remove the jump leads in exactly the opposite order to which you put them on. **NOTE! The normal leads to the standard batteries should under no circumstances be moved.**

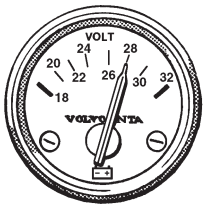
Checks during operation

Check instruments. Normal operating values are:

Engine coolant temperature	Oil pressure, engine	System voltage
75–90° (167–194° F)	300–500 kPa (3–5 kp/cm^2 = 43.5–72.5 psi), at low idle approx. 190 kPa (1.9 kp/cm^2 = 27.5 psi)	28V







If the oil pressure drops, the temperature rises above the permitted values or there is a loss of charge, the alarm will sound and one of the warning lamps will start to flash to indicate the source of the malfunction.

If the alarm sounds:

- Engine coolant temperature too high. **Reduce the speed to idling (in neutral) until the temperature drops. Investigate the cause of the alarm** (e.g. blocked cooling water intake). **Stop the engine if the temperature does not drop.**
- Low lubricating oil pressure. **Stop the engine immediately and investigate the cause of the alarm.**
- Keel cooled engine version: High charge air temperature. **Reduce the speed to idling (in neutral) until the temperature drops. Investigate the cause of the alarm** (e.g. clogged charge air cooler–CAC).

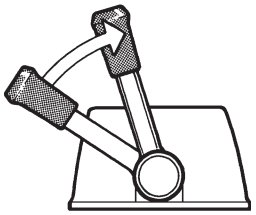
If an extra alarm panel is fitted, the alarm will also sound if the lubricating oil or coolant levels are too low before starting or if there is water in the extra fuel pre-filter. An extra alarm function may also be connected.

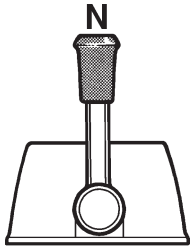
Note. When running the engine for long periods the engine oil level must be checked **at least every day, or if the engine is run continuously every 8 hours.**

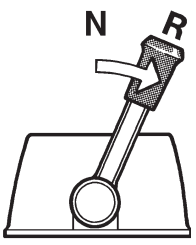
Maneuvring during operation

For economic running it is necessary to select an optimal cruising speed. **The recommended cruising speed is the maximum speed which can be achieved at any given time minus 200 r/min.**

All forward/reverse maneuvering should be done at idling speed. Maneuvering at higher speeds may damage the reverse gear and will also be uncomfortable for those on board. Maneuver as follows:







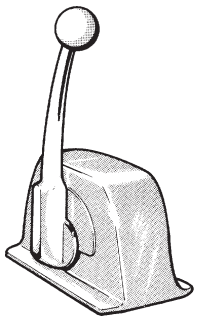
Reverse gear

1. Reduce engine speed to idling and, if possible, let the boat lose most of its speed.

2. Move the reverse gear control lever quickly and firmly into the neutral position, then wait for a moment.

3. Move the control lever quickly and firmly into reverse, then increase the speed.

Note If the boat has two engines, it is vital that both engines are running, particularly when maneuvering forwards and backwards. If one engine has not been started and the other is used to reverse, water may enter the stopped engine via the exhaust port and cause serious damage.



Type S controls for maneuvering trolling valve

Note The equipment shown on this page can be obtained only for propulsion engines in working boats.

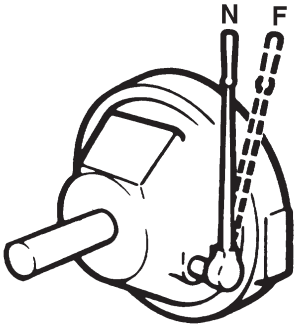
Trolling valve

If the reverse gear has a trolling valve (accessory), this should be used when the boat is to move very slowly.

Engage the trolling valve to max. slip when the reverse gear control is in neutral. After selecting “Forward” or “Reverse”, the trolling valve can then be set in the required trolling position within the permitted speed range.

⚠ **The engine speed must never exceed 1100 rpm when using the trolling valve.**

Note For full propeller power during operation, the trolling valve control lever should always be in the “Disengaged” position when the valve is not in use.



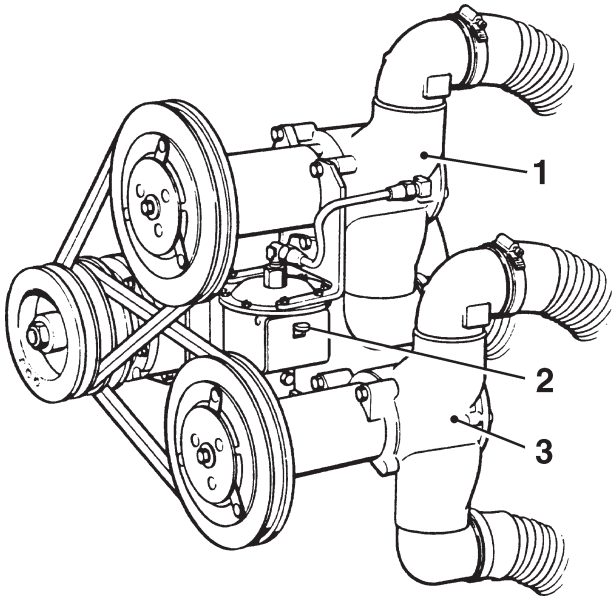
Disengageable clutch

F = Engaged
N = Neutral

Disengageable clutch

The clutches have two positions on the control lever. Lever towards engine for declutching, away from it for neutral.

When engaging and disengaging the clutch, the engine speed must not exceed 800 rpm.



Flushing pump

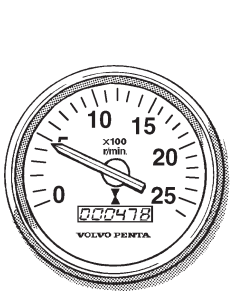
1. Bilge pump
2. Actuating lever
3. Flushing pump

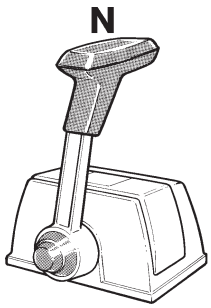
Disengageable scavenging/bilge pump

These pumps are engaged and disengaged via electromagnetic connections and switches on the instrument panel. The bilge pump has a vacuum switch which automatically disengages it when the level is so low that no water is being sucked into the pump. The vacuum switch also has a lever for manually engaging the pump.

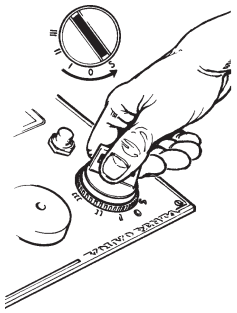
The lever should be depressed 20 secs. when engaging the pump.

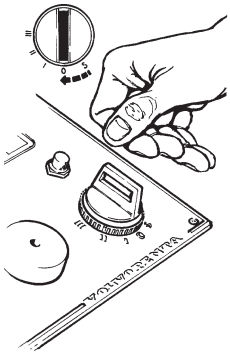
After operation



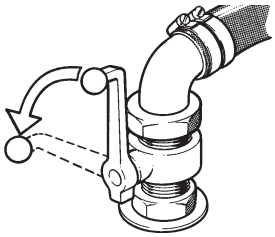


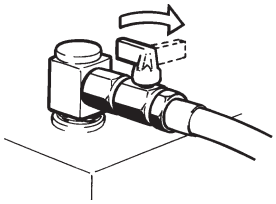
1. Let the engine idle for a few minutes with the reverse gear in neutral after landing. This will even out the engine temperature and prevent local overheating which may cause the coolant to boil.





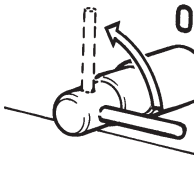
2. Turn the key to stop position “S”. Release the key when the engine has stopped (key will spring back automatically into the 0 position). The key can then be taken out.



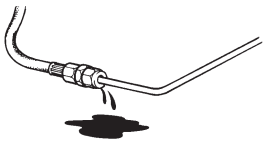


Safety measures:

3. Close the cooling water intake sea cock and the fuel cocks. For antifreeze protection, see “Coolant” on page 16. See also under the heading “When there is a risk of freezing” on the next page.



4. Switch off the main switches if the boat is not to be used for some time.



5. Inspect the engine and engine compartment for any leaks.

Propeller shaft brake

Under certain operating conditions, the propeller may make the propeller shaft rotate when the engine is stopped. This rotation may damage the reverse gear since its oil pump, which is driven by the integral shaft, stops when the engine stops.

The propeller shaft can be permitted to rotate with the engine stopped for up to 6–8 hours. After this time the engine must be started for at least 5 minutes to ensure the reverse gear is lubricated and cooled.

If the shaft is likely to rotate more quickly than during normal operation, e.g. during sailing, a temperature gauge should be fitted which monitors the temperature of the oil.

The max. permitted temperatures are 110°C (230°F) for Twin Disc and 95°C (203°F) for MPM reverse gears.

If the above conditions cannot be met a brake must be installed. A temporary solution is to lock the propeller carrier mechanically instead.

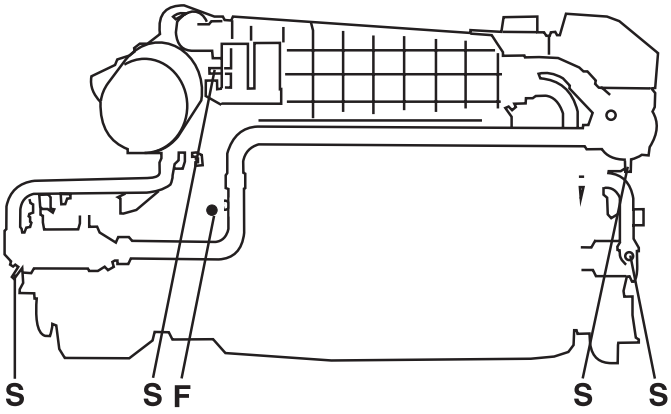
Note On Twin Disc MG516 the mechanical safety coupling can be engaged, see instructions on page 25.

When there is a risk of freezing

Check the antifreeze in the freshwater system after the engine has stopped if there is a risk of freezing. See under the heading. “Coolant” on page 16.

Drain the water from the seawater system as described below. Check that all the water has drained out.

Check batteries in accordance with instructions on page 62. A poorly charged battery can burst if it freezes.



Draining coolant

Before draining the coolant, the engine should be stopped, the filler cap unscrewed and the boat’s sea cock closed. Then open the drain cocks or remove the drain plugs of the engine’s freshwater and seawater systems, see Figures.

Check that all the water runs out. There may be deposits by the cock/plug which must be removed. Otherwise there is a risk that water may remain in the system and cause serious damage.

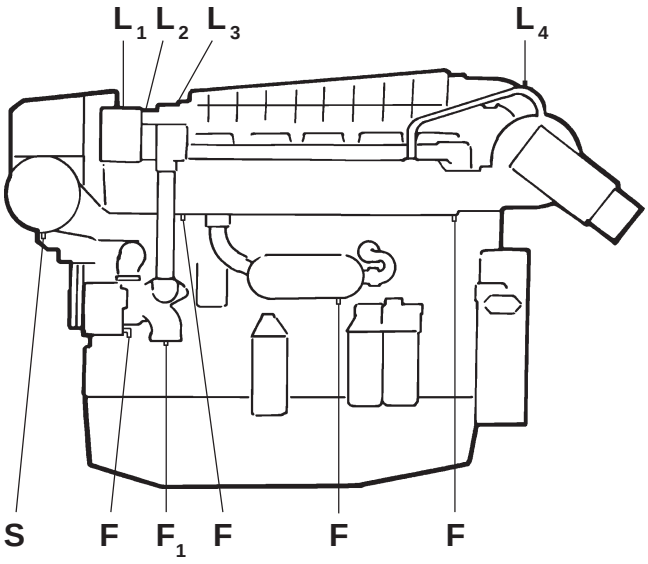
Check whether the installation has any more cocks or plugs on the cooling water and exhaust pipes’ lowest points.

Remove the cover from the seawater pump and the cover on any extra pump.

Close the cocks, fit the plugs and put the cover on the seawater pump (and any extra pump fitted).

Pump out the boat if required. Ensure that there are no leaks before you leave the boat.

See the instructions on page 55 for topping up the coolant.



F = Freshwater cocks/plugs

F_1 = TAMD163A: Freshwater cock

S = Seawater cocks/plugs

L_1 = Bleeder cock,
TAMD163A: At the rubber hose at the rear of the expansion tank
TAMD163P: On the front side of the collector pipe from the cylinder heads

L_2 = TAMD163A, TAMD163P: Bleeder cock (on the cover of the thermostat housing)

L_3 = TAMD163A (keel cooled): Bleeder cock (on pipe at the charge air cooler)

L_4 = Bleeder cock (on the coolant pipe from the turbocharger)

Mechanical safety clutch

(get-you-home device)

The MPM IRM 350A and Twin Disc MG516 have a mechanical safety clutch for both Forward and Reverse clutches.

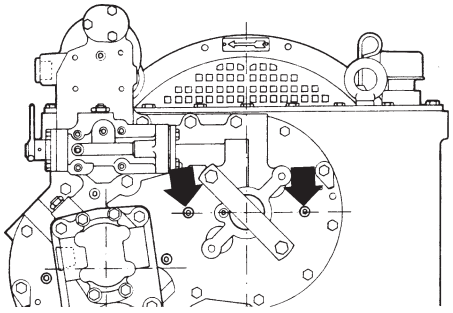
If there is a fault in the hydraulic system the clutch can be engaged so that the boat can be brought to a harbor.

When engaging – “Forward” clutch is locked mechanically by tightening the screws that press the clutch together.

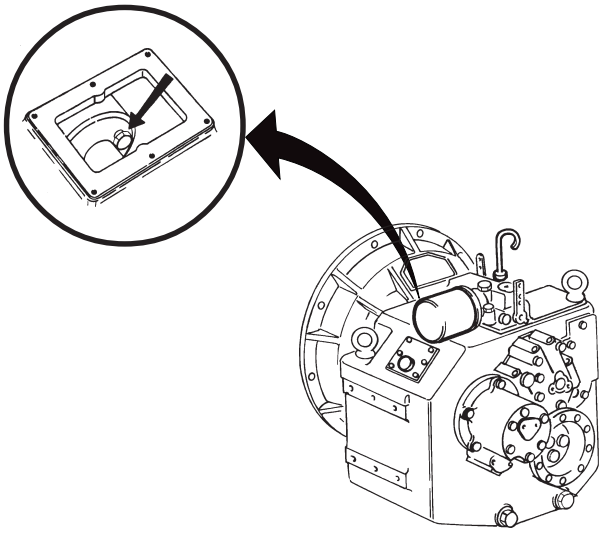
⚠ **NOTE! When the clutch has been engaged, reverse or neutral cannot be engaged. Start and run at reduced speed and do not use the controls. Leave it in Neutral.**

A fault in the hydraulic system can reduce the oil pressure in the reverse gear. To avoid damage the volume of oil in the reverse gear must be increased so that gear wheels and bearings are lubricated through flinging.

For twin installations, extra precautions must be taken so that the clutch used for running ”Forward” is engaged in both reverse gears (counter-rotating propellers).



Emergency clutch TD MG516



Emergency clutch IRM 350A

Engaging the emergency clutch

Twin Disc MG516

⚠ **Rotating parts. Take care not to avoid personal injury.**

1. Stop the engine and brake the propeller shaft.
2. Unscrew both allen plugs for the “Forward” clutch.
3. Turn the engine (the screws in the clutch are opposite both the plug holes). Tighten two screws. Turn the engine further and tighten the other two screws.
4. Reinstall plugs in holes.
5. Set the reverse gear lever to “Neutral” and disconnect the control cable from the lever.

Run at reduced speed, there is no reverse. Repair the fault at the earliest possible opportunity.

MPM IRM 350A

⚠ **Stop engine before engaging! There is otherwise a risk of serious personal injury.**

Unscrew the inspection cover (where the oil filler plug is mounted). Turn the engine so that the locking screws in the clutch (3 x 19 mm hexagonal) are accessible. Tighten the screws alternately (clockwise).

After engagement the input and output shafts are mechanically locked to each other and **the reverse gear cannot be put in neutral**.

⚠ The control lever **must be in the neutral position** when the engine is running and the emergency clutch is engaged. Otherwise the clutch plates will be damaged. **Disconnect the gear cable for safety’s sake.**

Run at reduced speed, there is no reverse. Repair the fault at the earliest possible opportunity.

Note Unscrew the locking screws to their original position when the fault has been remedied. Lock screws with Loctite 242.

Emergency stop*

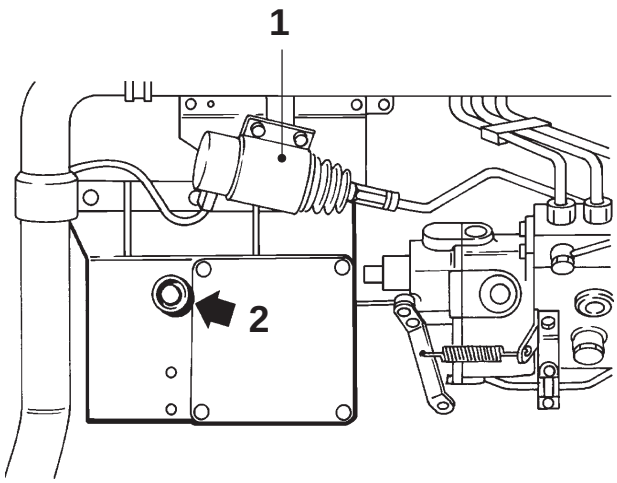
TAMD162C**, TAMD163A

If the engine must be stopped immediately the emergency stop can be used.

The emergency stop is engaged by pressing the separate “STOP”-button at the control position, in the engine room or at any other position.

When the stop solenoid is activated, the injection pump’s control rod is moved into the zero delivery position and the engine stops as the flow of fuel is cut off.

* **Note.** Applies to classifiable engines.
** Classifiable engines are fitted with a fuel shut-off valve for normal stop).



Emergency stop/-start (TAMD162C, TAMD163A)

1. Emergency stop (stop solenoid)
2. Emergency start button

Emergency start*

TAMD162C, TAMD163A

There is an emergency start button at the starter motor.

The emergency start button functions independent of the key switch being on or off. The button has no start interlock function and should therefore **never** be pressed while the engine is running.

⚠ **If the button is used for starting, first ensure that no damage can be caused.**

*** Note.** Applies to classifiable engines.

Emergency operation, engine coolant system

Certain classification organizations prescribe that it should be possible to replace the seawater and freshwater pumps temporarily.

This relatively easy to do as follows. The scavenger pump can be used as a temporary engine coolant pump in emergencies. Otherwise a separate pump mounted by the engine must be available.

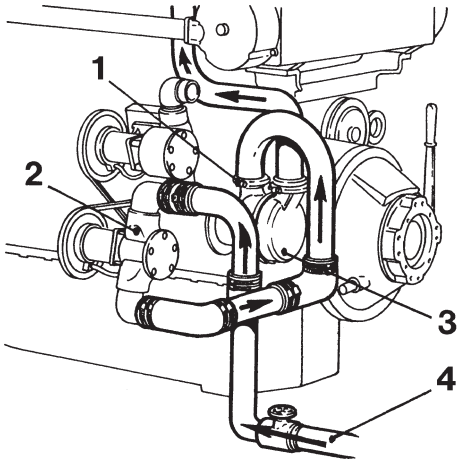
The following components must be obtained by the boat owner, Volvo Penta does not keep them in stock.

Emergency seawater circuit.

The piping for an emergency seawater circuit is as illustrated. The scavenger pump can then be used as a seawater pump. Internal pipe diameter 54 mm (2").

⚠ **Close sea cock before working on seawater cooling system.**

1. Undo clamp (1) on water pipe.
2. Connect hoses and pipes as illustrated. Use two hose clamps on either end of the hoses. Tighten connections properly.
3. Open the sea cock and check for leaks.



Emergency seawater circuit

1. Clamp
2. Scavenger pump
3. Ordinary seawater pump
4. Seawater from seawater filter

Emergency freshwater circuit

Manufacturing components

Pipe elbow (1) is available as a spare part. Pipe elbow (4) is available as a spare part for engines with radiator cooling systems.

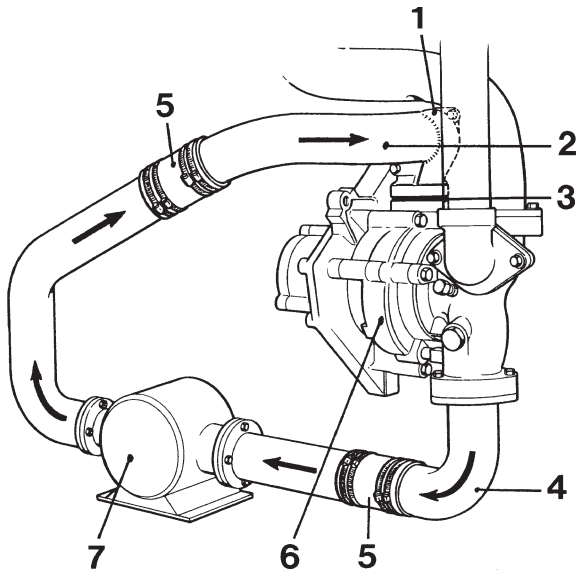
1. Drill a hole in extra pipe elbow (1) and weld on a pipe elbow (2) with an internal diameter of 60 mm (2.36”) as illustrated. The hole in the pipe elbow to the ordinary seawater pump is sealed with a washer (3) welded onto the elbow (1).
2. Install pipe elbow (4) with seal at lower pump hole. Make the other necessary pipes.
3. Cut two hoses to the right length (5). Use two hose clamps on either end of the hoses.

Installation

1. Drain engine coolant in the freshwater system if possible. Otherwise remove sealing cover at the bottom where pipe (4) is to be installed.

   ⚠ **Be careful of hot engine coolant, there is a danger of burns.**
2. Remove the existing pipe elbow and install the new one (1) as illustrated.
3. Install pipes and hoses to the extra pump (7).

   The extra pump must have a capacity of at least 200 liters (44 Imp. gals/52.8 US gals) per minute and a maximum of 600 liters (132 Imp. gals/158.4 US gals) per minute.
4. Close the drain cocks. Fill with engine coolant and start pump and engine.



Emergency freshwater circuit

1. Pipe elbow
2. Pipe to be welded (internal diameter 60 mm (2.36")
3. Seal inside elbow.
4. Lower pipe elbow
5. Hose clamps (length approx. 200 mm (7.87")
6. Ordinary circulation pump
7. Extra circulation pump or scavenger pump.

Maintenance

Periodic maintenance

If your engine and its fittings are to function reliably, periodic maintenance in accordance with the maintenance schedule is required. Several of the points below cover the replacement of consumables such as oil and fuel filters etc.

To ensure continued trouble-free use of your engine, it is important always to use original spares. Always state the type designation and serial number of your engine and its fittings when ordering parts.

Some operations require professional experience and special tools. Therefore, get authorized service personnel to carry out more extensive work.

For further information, see under the heading “Maintenance” in accordance with the respective section in “Technical Description”.

New engine with reverse gear

See “Running-in” on page 4.

Layout of the maintenance schedule

No.	Action	TAMD162C					TAMD163P					Instructions	Info. pages
		50 hours	500 hours	1000 hours	2000 hours	24 months	50 hours	400 hours	800 hours	1200 hours	24 months		
17.	Vent the fuel system.											Open vent screw (1). Pump with hand pump (2) until fuel containing no air flows out. Then pump a further 10–20 times with the hand pump. Tighten the venting screw (1). Check for leaks. If the engine does not start, vent the pressure pipes on the injectors. **Observe strict cleanliness!** The fuel in the system must not become contaminated.	51
18.	Have authorized personnel [illegible] injectors.											If necessary take the injectors to an authorized workshop. Tightening to [illegible] Nm (5.1 kpm), delivery line 15-25 Nm [illegible]	
21.	[illegible] ger, charg[illegible] (CAC), and the engine reverse gear oil coolers.												56
22.	Clean the engine coolant system and change coolant.											Close the sea cock and drain the water from the seawater and freshwater systems with the drain cocks (A).	24,55

Shaded area indicates simple operations which the boat owner can carry out.

Stripes indicate operations which require experience and/or special tools. This work should therefore be left to authorized service personnel.

Under the heading. “**Instructions**” is a brief summary of what should be rectified when carrying out the maintenance job in question.

Under the heading. **“Info. pages”** are references to the information pages towards the back of the manual. In most cases, these pages provide a more detailed description of the operations required.

Preventive maintenance

To achieve maximum operating safety and service life, it is vital to maintain the engine and its fittings in accordance with the maintenance schedule. This gives instructions on when and how to carry out maintenance. Always consult an authorized Volvo Penta service dealer, who will have the equipment and trained staff to help you.

For boats used for commercial purposes, there is also a program of preventive maintenance known as “Condition Test”, which is part of the “Cost Control Programme”. This program is carried out every 6 months, and every other time in accordance with an extended program.

A maintenance program well carried out gives better operating economy and fewer unplanned periods of non-operation.

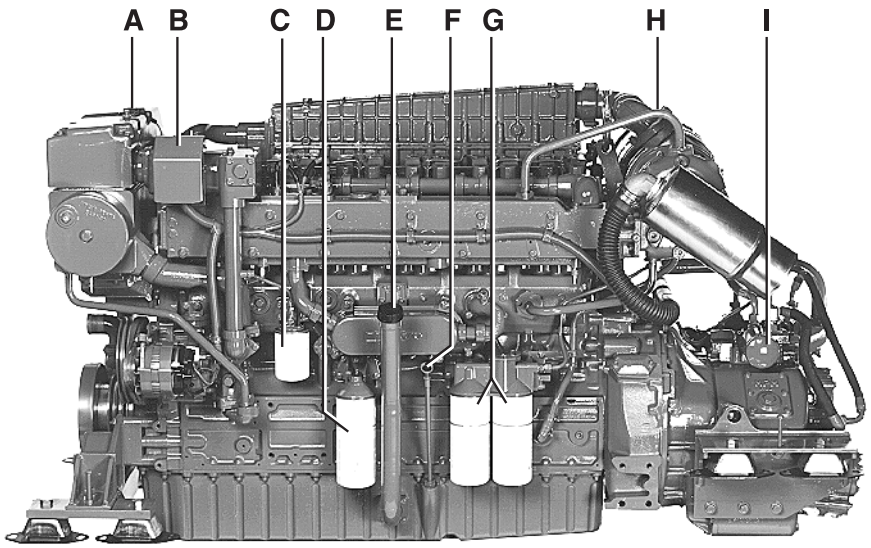
Engine, oil change intervals

Dependent on the fuel’s sulfur content and the quality of the lubricating oil

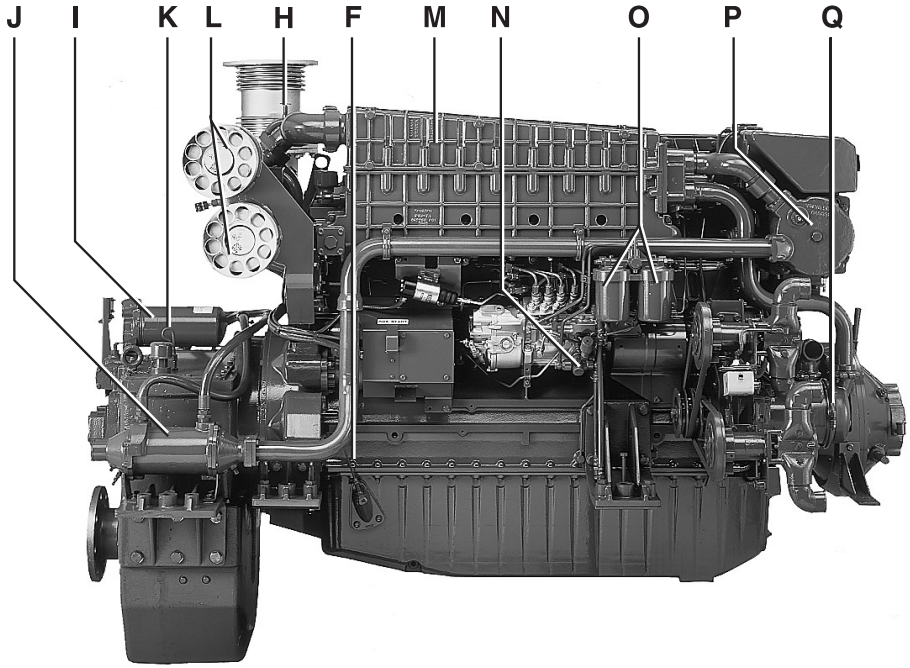
Note However, the oil should always be changed at least once a year even if the operating times in the table are not achieved.

Engine	Oil type	Fuel sulfur content, % by weight		
		<0.5	0.5–1.0	>1.0
		Hours	**Hours**	**Hours**
TAMD162C, TAMD163A	VDS or VDS-2*	500	250	125
	API: CD or CE	250	125	60
TAMD163P	VDS or VDS-2*	400	200	100
	API: CD or CE	200	100	50

* VDS = Volvo Drain Specification



A. Engine coolant, checking and topping up
B. Electronics Terminal box with semi-automatic fuses.
C. Freshwater filter
D. By-pass (partial flow)engine oil filter
E. Topping up oil, engine.
F. Oil dipstick, engine
G. Full flow engine oil filter
H. Venting cocks
I. Oil filter, reverse gear.
J. Oil cooler, reverse gear
K. Oil dipstick, reverse gear.
L. Air Cleaner (ACL)
M. Charge air cooler (CAC)
N. Feeder pump, fuel hand pump
O. Fine fuel filters
P. Heat exchanger
Q. Seawater pump



Maintenance schedule

The description applies generally for all engines unless otherwise stated. Some of the maintenance points deal with extra equipment or options, for example, for classifiable engines. The Maintenance schedule also shows which service intervals apply for the TAMD162C, TAMD163A or TAMD163P engines.

If longer oil change intervals are required than those stated below the oil's condition must be tested regularly by submitting oil test samples for analysis by the oil manufacturer.

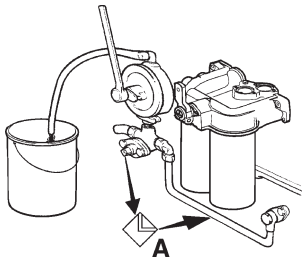
The time intervals are guides which apply to normal operating conditions. For new or reconditioned engines see under the heading. "Running-in" on page 4.

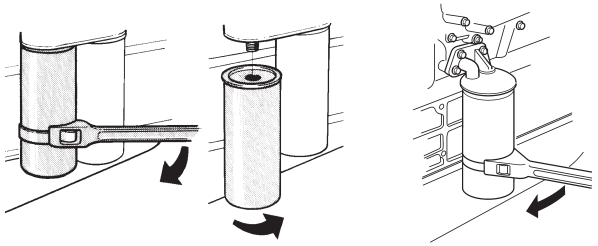
Every day before starting the engine (or every 8 hours in continuous operation) check the engine oil level, engine coolant level, the air cleaner (ACL) pressure drop indicator and the reverse gear oil level.

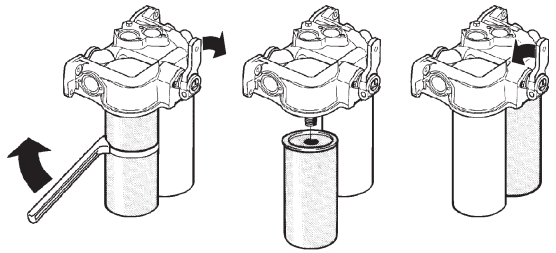
All points must be checked at least once every year with the exception of points 18, 22, 28, 30 and 31 even if the operating times stated are not reached. Points 18, 22, 28, 30 and 31 apply every other year.

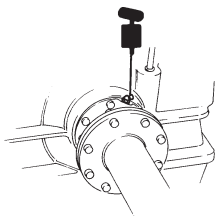
⚠ **NOTE! Always turn the engine off before starting service procedures.**

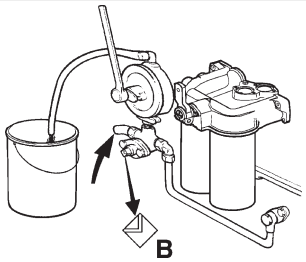
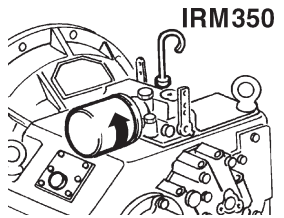
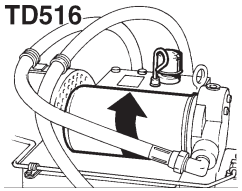
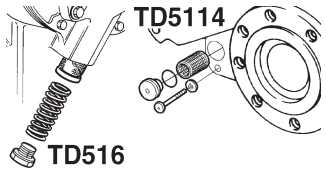
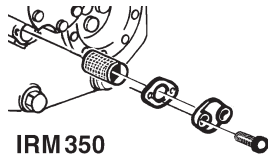
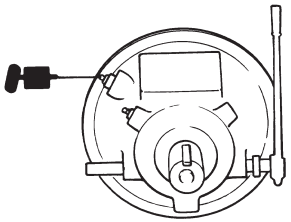
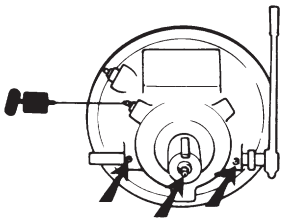
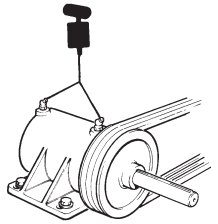
No.	Action	TAMD162C, TAMD163A					TAMD163P					Instructions	Info. pages
		50 hours	500 hours	1000 hours	2000 hours	24 months	50 hours	400 hours	800 hours	1200 hours	24 months		
1.	**Engine oil change.** **Note.** See table "Engine, oil change intervals" for information on oil change intervals in relation to oil quality and the sulfur content of the fuel.		■					■				Engine oil VDS or CD or CE as per API system. Drain or pump out oil while engine is hot. Use the engine scavenging pump or remove the oil plug. ⚠ **Hot oil can cause burns.**	44
2.	**Replace engine oil and bypass filter.**		■					■				Remove the oil filter using the special tool. Lubricate gasket and screw on new filters by hand. Tighten a further 3/4 turn once gasket is in contact with the mounting. Top up oil, start, check for leaks. Stop engine and check oil level again.	44
3.	**Engine oil filters, replacement while engine is running.**		■					■				Take the oil filter off-line using the control lever. Replace the filter as in the previous operation. Change the other filter in the same way. Top up oil, start, check for leaks. Stop engine and check oil level again.	45
4.	**Lubricate seal at output shaft on Twin Disc reverse gear** **(if grease nipple is fitted).**	■					■					Use a grease gun and lithium grease: Mobilux EP2, Statoil Uniway EP2N, Texaco Multifak EP2, Q8 Rembrandt EP2.	–

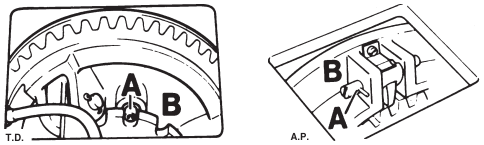
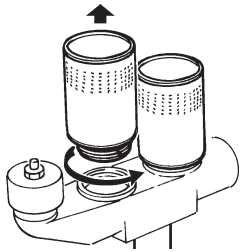
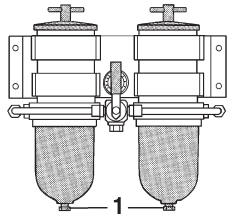
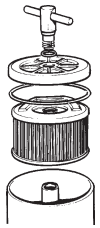
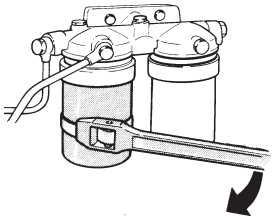
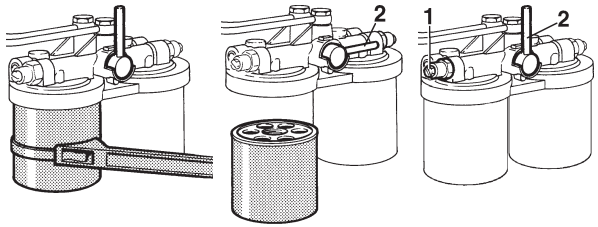


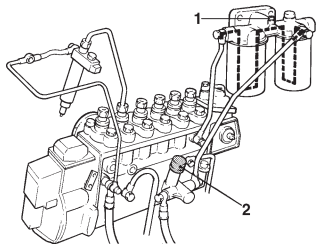
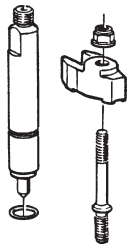
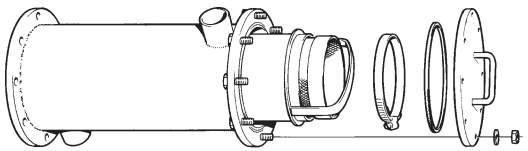
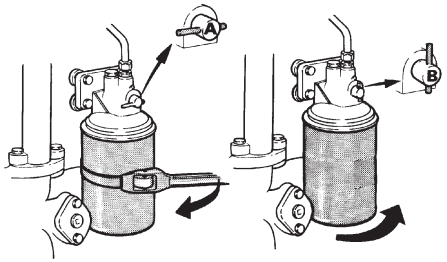
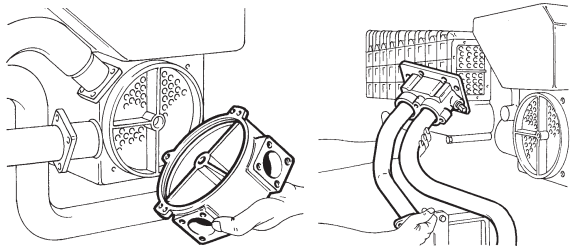
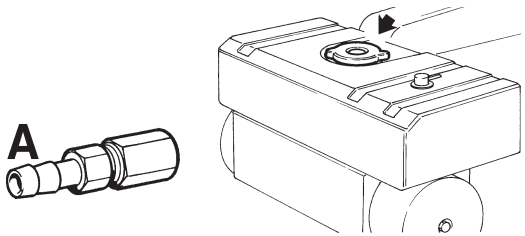


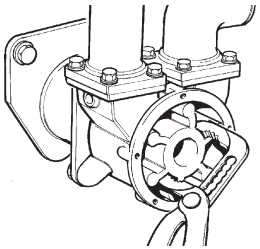
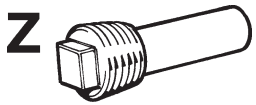
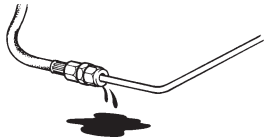
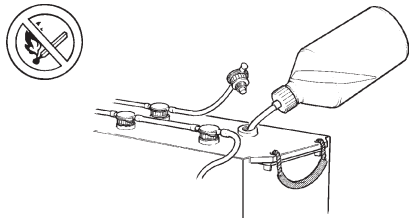
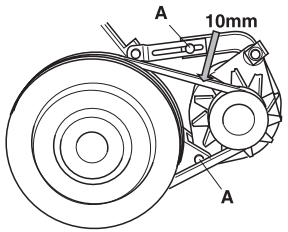
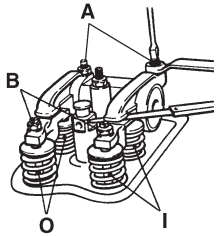


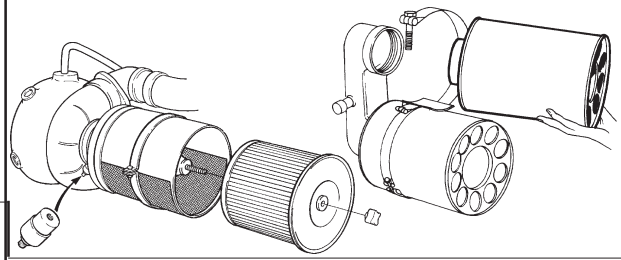
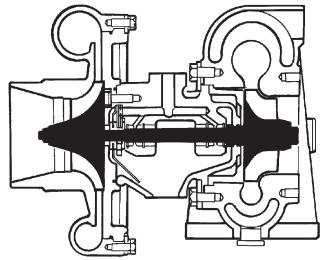
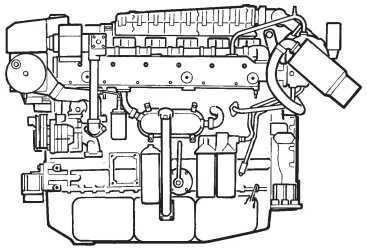


No.	Action	TAMD162C, TAMD163A					TAMD163P					Instructions	Info. pages
		50 hours	500 hours	1000 hours	2000 hours	24 months	50 hours	400 hours	800 hours	1200 hours	24 months		
5.	**Change oil in reverse gear.**											 Use CD, CE or CC engine oil, but **not multigrade oil.** For oil quality, see "Technical Data". Use the engine scavenging pump with hose to the reverse gear pipe for the dipstick. Or unsrew the drain plug. Check the oil level with the dipstick. **Note!** The markings apply at operating temperature (engine at idle and control in neutral position).	45
6.	**Replace oil filter on MPM IRM350 and Twin Disc MG516 reverse gear.**											Remove the oil filter using the special tool. Lubricate gasket and screw on new filters by hand. Tighten a further 3/4 turn once gasket is in contact with the mounting.  	46
7.	**Clean oil screen in reverse gear.**											Remove and clean the oil screen. Check the gasket. Reinstall the parts removed and check for leaks.  	45
8.	**Lubricate release bearing on disengageable clutch.** **Note.** Every 50 hours if the clutch is used more than 15 times per day. Otherwise every 500 hours.											 Use lithium-based lubricating grease: Mobilux EP2, Statoil Uniway EP2N, Texaco Multifak EP2, Q8 Rembrandt EP2.	46
9.	**Lubricate disengageable clutch (if fitted).**											 Do not lubricate support bearing (a grease nipple is fitted), main bearings, disengaging shaft and moving parts of clutch mechanism. Lubricate sparingly (20–30 g for main bearings). Quality: Use lithium-based lubricating grease: Mobilux EP2, Statoil Uniway EP2N, Texaco Multifak EP2, Q8 Rembrandt EP2.	46
10.	**Lubricate side mounted power take-off.**											3–4 pumps on each nipple. 	–

No.	Action	TAMD162C, TAMD163A					TAMD163P					Instructions	Info. pages
		50 hours	500 hours	1000 hours	2000 hours	24 months	50 hours	400 hours	800 hours	1200 hours	24 months		
11.	**Check/adjust disengageable clutch (if fitted).**											⚠ Adjustments must be made with the engine stopped. Remove the inspection cover. Release the catch (A) and turn the adjuster ring (B) clockwise. Engage the catch. The clutch plates must not slip after engagement. 	79
12.	**Replace crankcase ventilation filter.** **Note.** Replace the crankcase ventilation filters earlier if air mixed with oil starts to escape via the valve.											Remove the filter by turning counterclockwise. Screw on the new filter by hand. 	40
13.	**Check/drain extra fuel filter.**											Wait a few hours after the engine has been turned off before checking/draining the filter. Drain off water/contaminants through the cock/plug (1). 	50
14.	**Replace insert in extra fuel pre-filter.**											 Alternatively change at a vacuum of 16–20 in. HG measured at full RPM, loaded engine, in the suction line between the filter and the feeder pump.	50
15.	**Replace fine fuel filters.**											 Remove the fuel filter using the special tool. Screw on the new filters by hand. Then turn a further half turn when the rubber gasket on the filter base in contact with the filter housing mounting. Vent fuel system. **Observe strict cleanliness!** The fuel in the system must not become contaminated.	50
16.	**Engine fine fuel filters, replacement while engine is running.**											Set lever (2) towards the filter which is to be on-line, replace the other filter as per instructions in operation 15. Vent by opening the venting screw (1). Move lever (2) to vertical (on-line) position. Close the vent screw when no more air bubbles are visible in the fuel. Repeat the procedure for both filters. **Observe strict cleanliness!** The fuel in the system must not become contaminated. 	51

No.	Action	TAMD162C, TAMD163A					TAMD163P					Instructions	Info. pages
		50 hours	500 hours	1000 hours	2000 hours	24 months	50 hours	400 hours	800 hours	1200 hours	24 months		
17.	**Venting the fuel system.**											 Open vent screw (1). Pump with hand pump (2) until fuel containing no air flows out. Then pump a further 10–20 times with the hand pump. Tighten the venting screw (1). Check for leaks. If the engine does not start, vent the pressure pipes on the injectors. **Observe strict cleanliness!** The fuel in the system must not become contaminated.	51
18.	**Have authorized personnel check injectors.**											If necessary take the injectors to an authorized workshop. Tightening torque: Injector 50 Nm (5 kpm), delivery line 15–25 Nm, (1,5–2,5 kpm). 	–
19.	**Check and clean seawater filter.** **Note.** The seawater filter can require cleaning more frequently (experience will indicate the best interval after a period of running the engine).											Close the sea cock. Remove cover and lift the insert. Clean insert and housing. Reinstall components. Open the sea cock and check for leaks. 	55
20.	**Replace freshwater filter.**											 **Not** to be carried out at the same time the engine coolant is changed as the concentration of anti-corrosion agent in the coolant may be too high.	–
21.	**Check/clean heat exchanger, charge air cooler (CAC), and the reverse gear oil cooler.**											 Close sea cock and drain the water from the seawater and freshwater systems.	56
22.	**Clean the engine coolant system and change coolant.**											Close the sea cock and drain the water from the seawater and freshwater systems with the drain cocks (A). 	24,55

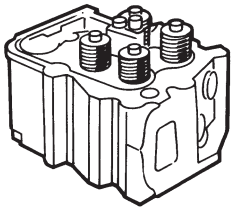
No.	Action	TAMD162C, TAMD163A					TAMD163P					Instructions	Info. pages
		50 hours	500 hours	1000 hours	2000 hours	24 months	50 hours	400 hours	800 hours	1200 hours	24 months		
23.	**Inspect/Replace impeller wheel in the seawater pump and in the bilge/scavenging pump where fitted.** **Note.** Does not apply to centrifugal type seawater pumps.											 Close the sea cock and drain the water from the freshwater system.	57
24.	**Check/replace zinc anodes.** **Note.** Replacement interval dependant on local conditions.											⚠ **Warning!** Hot engine coolant can cause burns. When only 50% of the anodes remains they must be replaced. A good electrical contact is vital. Also replace the zinc anode on the reverse gear oil cooler. 	57
25.	**Check that no fuel, water or oil is leaking out.**											Check all connections and check for leaks. Rubber hoses must not be cracked or damaged. All hose clamps and connections must be tight. 	–
26.	**Check the electrolyte level in the batteries.**											 Distilled water approx. 10 mm (0.4") over cell plates.	62
27.	**Check/tension drive belts.**											 Undo the screws (A). It should be possible to depress the belts 10 mm (0.4"). Check the belt(s) for wear. Belts which work in pairs should be replaced at the same time.	39
28.	**Have authorized personnel check valve clearance.**											A. Valve clearance adjuster B. Caliper adjuster O. Outlet valve I. Intake valve 	–

No.	Action	TAMD162C, TAMD163A					TAMD163P					Instructions	Info. pages
		50 hours	500 hours	1000 hours	2000 hours	12 months	50 hours	400 hours	800 hours	1200 hours	24 months		
29.	**Check/replace air cleaner (ACL) filter.** **Note.** The filter must be changed when the ACL indicator shows completely red field when engine stopped.											 Take care that no contaminants enter the engine. Reset the air cleaner (ACL) filter indicator by pressing the button.	40
30.	**Have authorized service personnel check charging pressure and the turbo-charger's condition.**												–
31.	**Have authorized personnel carry out a general check of engine and equipment.**												–

Technical description

Engine

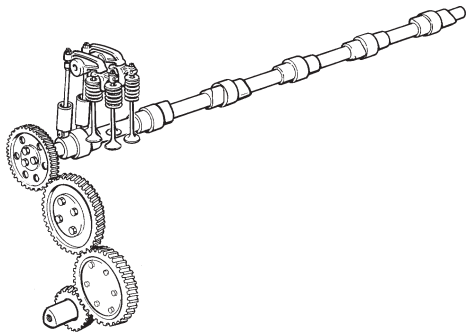
Cylinder heads



Individual cylinder heads, one head for each cylinder. They are interchangeable and bolted into place with 6 bolts.

There is no cylinder head gasket for the joint, but the oil and coolant passages have inset sealing rings of special rubber.

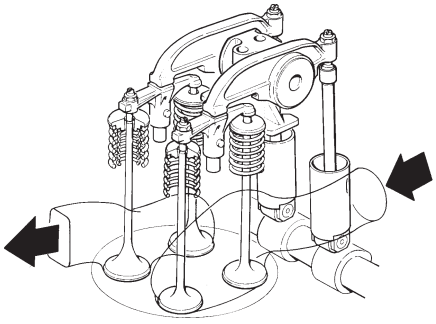
Valve system



The seven-bearing camshaft is gear driven and located high up.

The valve lifters are located in the cylinder head and activated by the cams via roller. The push rods are relatively short.

The rocker arms work the valves over a bridge, which is controlled by a spindle located in the head. There are four valves per cylinder head, two inlet and two exhaust.

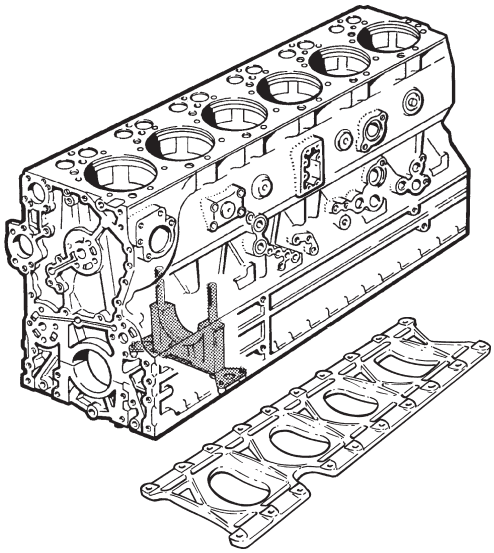


Exhaust Intake

Cylinder block

The cylinder block and crankcase is cast as one unit using a special alloy cast iron. This construction together with reinforcements in the form of steel plates (foot plates) make for great durability. TAMD163P as of and incl. engine No. xxxx/27111 and all TAMD163A engines have a separate ladderframe screwed to the underside of the cylinder block.

The cylinder liners are of the wet type and are replaceable.



Crankshaft

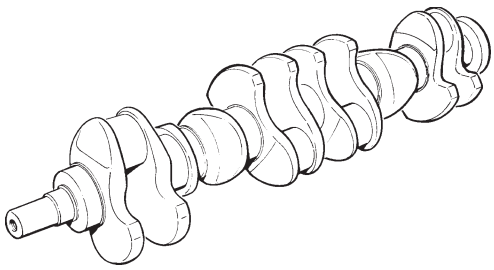
The crankshaft is journalled in seven main bearings. The bearing journals are nitrocarburized. This ensures a hard surface while avoiding heat stress.

The vibration damper(s)* is/are bolted onto the polygon hub at the front of the crankshaft. The polygon provides greater strength at the joint for power take-offs that a splined or keyed joint.

The rear crankshaft seal is a ring with a lip type seal. There is no need for a front seal since the front section of the crankshaft is located inside the timing gear cover.

The gudgeon pin bearing in the connecting rod is trapezoid to provide a larger surface area where the load is greatest.

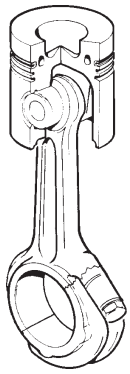
*** Note.** The TAMD163A and TAMD163P are fitted with two vibration dampers.



Pistons

The pistons are of aluminum and have two compression rings and one oil scraper ring. The upper compression ring, a Keystone ring, is coated with molybdenum which contributes to reduced cylinder wear. There is a ring carrier of a special tempered cast iron alloy for the upper compression ring which considerably increases the service life of the pistons, rings and liners. The pistons are cooled by a regulated quantity of oil directed against the bottom of the pistons from a jet in the cylinder block. The oil cools the piston and is returned to the sump.

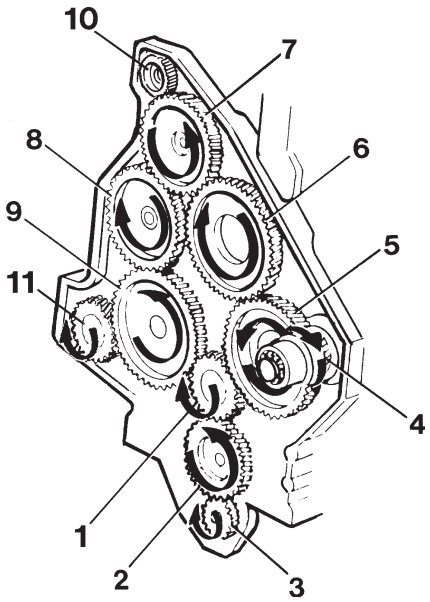
The combustion area at the crown of the piston is designed to provide uniform distribution of the fuel and effective combustion.



Timing gears

The camshaft, engine oil pump, injection pump, seawater pump and hydraulic pump, if fitted, are all driven off the crankshaft via helical spur gears.

Helical spur gear wheels are used in order to keep engine noise to a minimum.



The illustration shows the gears for:

1. Drive gear, crankshaft
2. Intermediate gear, oil pump
3. Drive gear, oil pump
4. Drive gear, engine coolant pump
5. Intermediate gear, right
6. Intermediate gear, upper
7. Drive gear, camshaft
8. Drive gear, injection pump
9. Intermediate gear, left
10. Drive gear, hydraulic pump
11. Drive gear, seawater pump

Crankcase ventilation

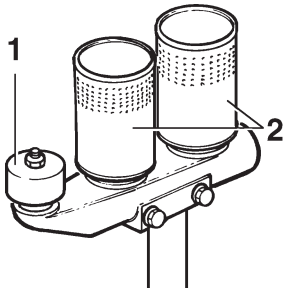
The engines have ventilation devices to prevent overpressure and to disperse diesel fumes, water vapor and other gaseous products of combustion.

On the TAMD162C and TAMD163A the crankcase gases are ventilated by transfer from the engine compartment via a pipe connected to the cylinder block.

On the TAMD163P there are two replaceable paper filters for crankhouse ventilation. These separate any oil mist before the gases are led out. Any oil is returned to the oil sump by a drainage hose.

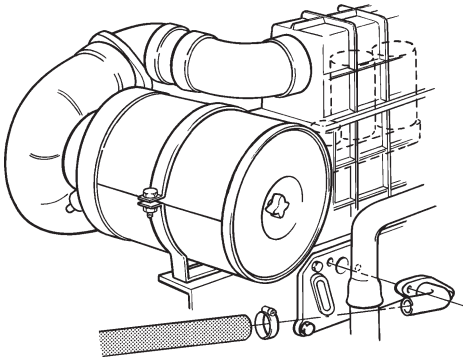
The filter holder on the TAMD163P is installed on the right side of the engine and connected to the air cleaner (ACL). On the filter casing is also a relief valve which opens if the pressure in the crankcase becomes too high due to a blocked filter. If oil mist is escapes from the relief valve then the filter must be replaced.

Alternatively the crankcase ventilation emissions can be removed from the engine compartment by a hose in the same way as for the TAMD162C, -163A. A pipe bend with hose mounting is supplied with the engine for this reason. This can be installed on the rear inspection hatch on the right of the engine instead of the standard crankcase ventilation device.



TAMD163P: Crankcase ventilation with replaceable paper filters

1. Relief valve
2. Paper filter

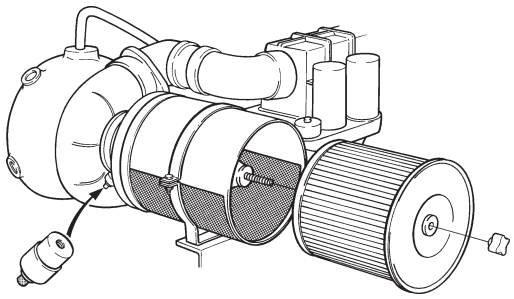


TAMD163P: Crankcase ventilation, alternative installation

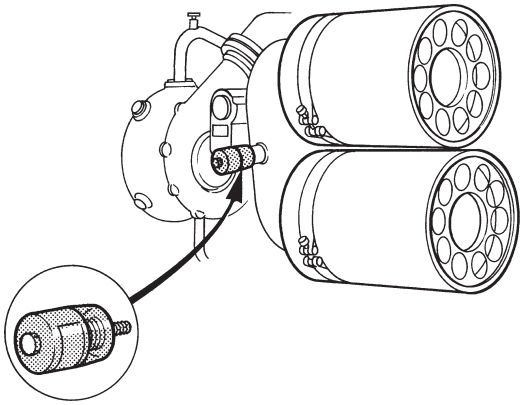
Air Cleaner (ACL)

– The TAMD163A and TAMD163P engines have a dry filter with a filter element (disposable) of folded paper.
– The TAMD162C engine has two air cleaners (ACL) which are replaceable as a unit.

The air cleaner prevents harmful particles from being sucked into the engine. A blocked air cleaner (ACL) results in reduced engine performace, incorrect fuel/air mixture, incomplete combustion and smoke in the exhaust. A pressure drop indicator is located on the air cleaner (ACL) unit. When the indicator shows all red on an engine which is not running the air cleaner must be replaced with a new one.



TAMD163A, TAMD163P: Air Cleaner (ACL)



TAMD162C: Air Cleaner (ACL)

Turbocharger

The turbocharger (TC) unit consists of an exhaust turbine, bearing housing and compressor.

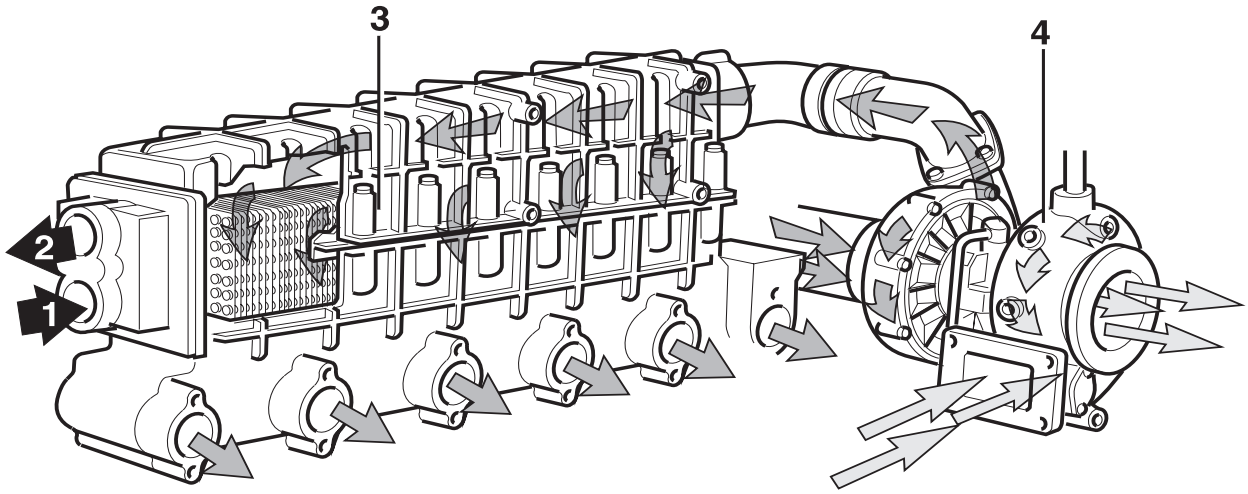
The turbine wheel is rotated by the stream of exhaust gas entering the turbine housing on its way to the exhaust system. The turbine wheel, which is on a common shaft with the compressor, drives the compressor wheel. The compressor wheel is located in a compressor housing which is connected between the air pipe from the air cleaner (ACL) and the engines intake pipe.

Air is sucked in by the compressor wheel from the from the air cleaner (ACL) and then compressed and forced in to the engine cylinders at charge pressure after passing through the seawater-cooled charge air cooler (CAC). The larger volume of air means that the amount of fuel that can be injected is greater and the fuel combustion process is more effective. This results in greater engine output, lower specific fuel consumption and cleaner emissions.

The turbocharger is lubricated and cooled by the engine's lubrication system. An external oil line connection supplies and removes the oil required. The turbine housing is cooled by freshwater.

Charge air cooler (CAC)

The intake air enters the charge air cooler (CAC) after compression in the turbocharger. The charge air cooler lowers the temperature of the air and thereby considerably improves the output ratio as the volume of the air is reduced. More air (oxygen) can therefore be forced into the engine's cylinders and burn more fuel per compression stroke; thus increasing output. Charge air cooling also helps reduce the thermal load on the engine.



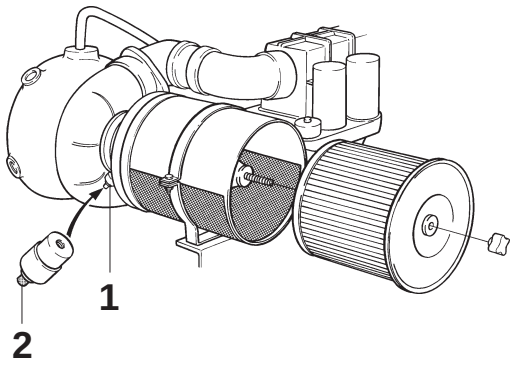
Turbocharger (TC) and charge air cooler (CAC)

1. Seawater (inlet)
2. Seawater (outlet)
3. Intake pipe with charge air cooler (CAC)
4. Turbocharger (freshwater cooling)

Air cleaner (ACL) replacement

TAMD163A, TAMD163P

1. Unscrew the center screw on the end of the filter. Lift out and remove the filter for disposal. The filter cannot be re-used.
2. Clean inside the filter housing using a damp cloth.
3. Reinstall using a new filter insert. Check the filter is completely in the air cleaner filter housing. Tighten the center screw.
4. Reset the pressure drop indicator by pressing in the button (2).
5. Check for air leaks after starting the engine.



TAMD163A, TAMD163P: Filter insert replacement

1. Pressure drop indicator
2. Reset button

Air cleaner (ACL) replacement

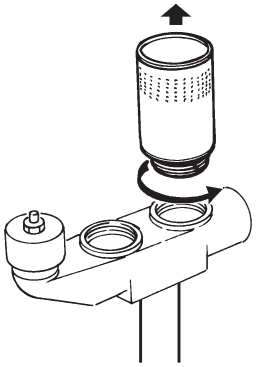
TAMD162C

1. Detach clamps on the air cleaner (ACL) mounting. Remove the old air filter.
2. Install the new filters. Tighten the clamps.
3. Reset the pressure drop indicator by pressing in the button.
5. Check for air leaks after starting the engine.

Filter replacement for crankcase ventilation (2 filters)

TAMD163P

1. Remove the old filters by unscrewing counterclockwise.
2. Check the rubber gasket in the mounting, replace if necessary. Screw on the new filters by hand.



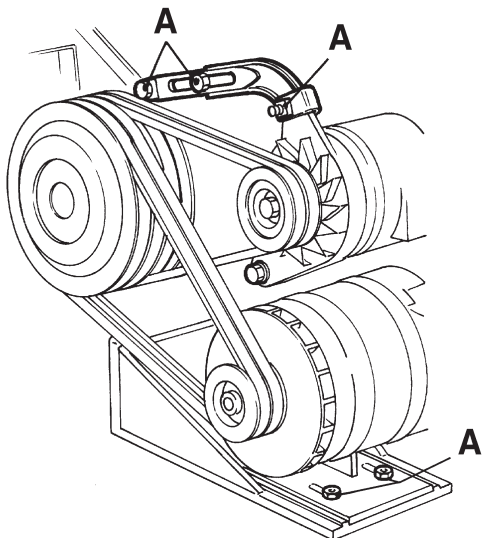
Inspecting/adjusting belt tension

Check the belt(s) for wear. Belts which work in pairs should be replaced at the same time.

Undo screws (A) before tensioning the belt(s).

It should be possible to depress the belts 10 mm (0.4").

Tighten screws (A).



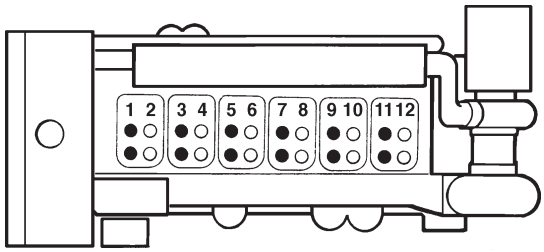
Tensioning drive belts

A. Locking screws

Checking valve clearance

This check should be left to authorized service personnel.

NOTE! The clearance must never be checked with the engine running – the engine must be stopped – cold or at operating temperature.



Valve location

❍ Intake ● Exhaust

Checking the Turbocharger (TC)

This check should be left to authorized service personnel.

However when cleaning/replacing the filter a **cursory** check of the turbocharger may be carried out as follows:

1. TAMD163A, TAMD163P: Remove the air cleaner (ACL) filter housing.

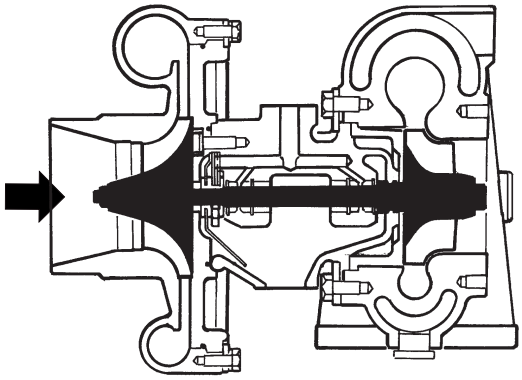
   TAMD162C: Remove the air cleaner (ACL)and its holder.

2. ⚠ **Warning! Check that the turbocharger's impeller is stationary before checking.**

3. Check if the shaft is stiff or if the turbine or compressor wheels are touching their housings. Turn the shaft using light pressure, followed by pulling it gently in the axial plane.

   If the rotor is difficult to turn, the turbocharger must be replaced or reconditioned as soon as possible.

Note. If the turbocharger unit is to function satisfactorily, it is vital that the engine's lubrication system be maintained according to the maintenance schedule and that the correct type of lubricating oil be used in the engine.



Turbocharger rotor shaft

Technical description

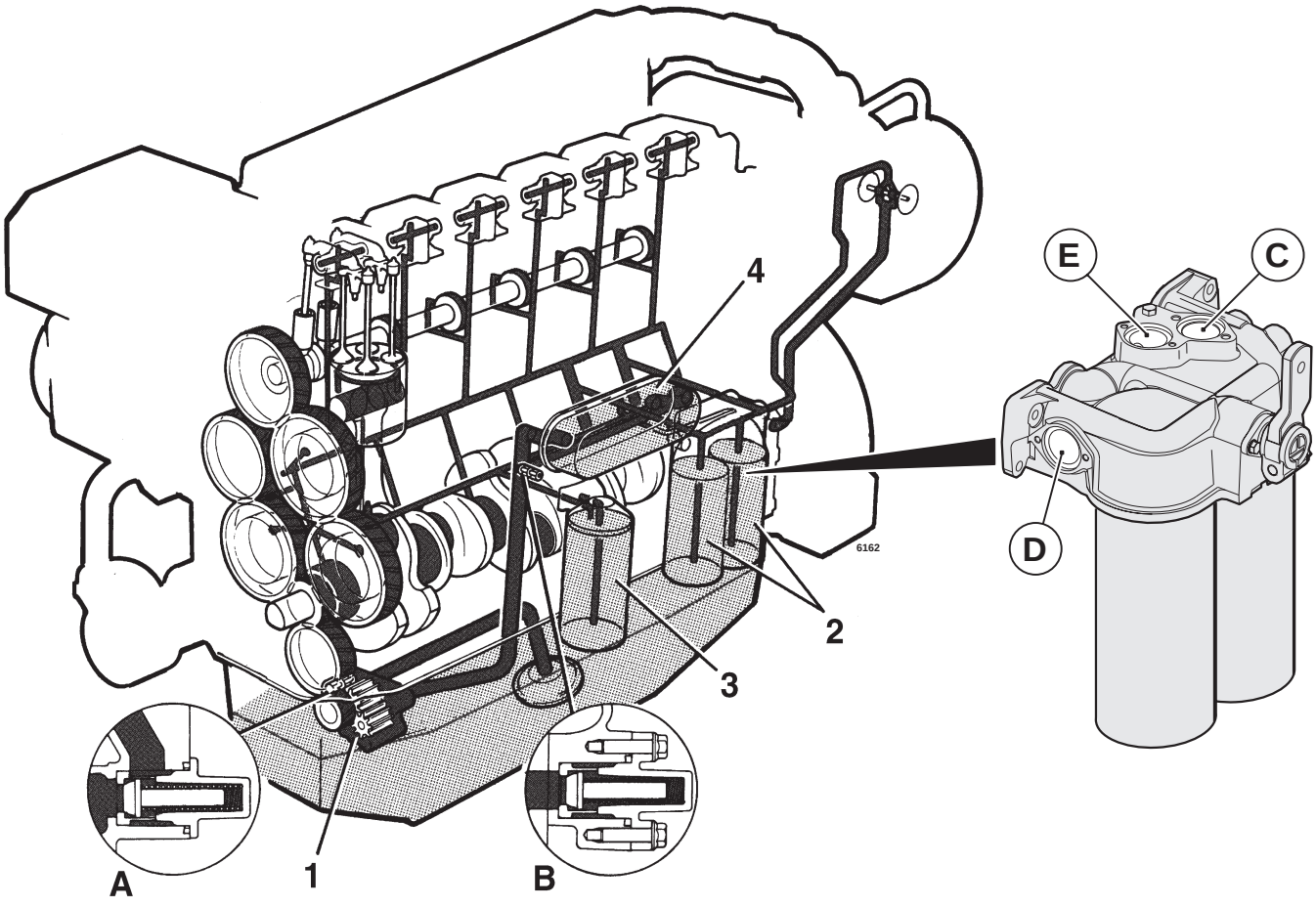
Lubrication system

The engine has a pressurized lubrication system with piston cooling. The oil pump is located at the front end of the oil sump and driven via a gear from the engine's timing gears.

The lubricating oil is continuously filtered through two full-flow oil filters and one partial flow filter.

The injection pump camshaft housing and regulator housing are connectied to the engine's pressurized lubrication system and are lubricated directly, as is the turbocharger.

Lubrication system, diagram



A. Relief valve (opens when pressure is too high)
B. By-pass valve (by-passes oil past the oil cooler, if the engine is cold)
C. Reducing valve (limits oil pressure)
D. Relief valve (opens if resistance in the filter is too great)
E. Piston cooling valve (releases oil to the piston cooling at RPM greater than idle)

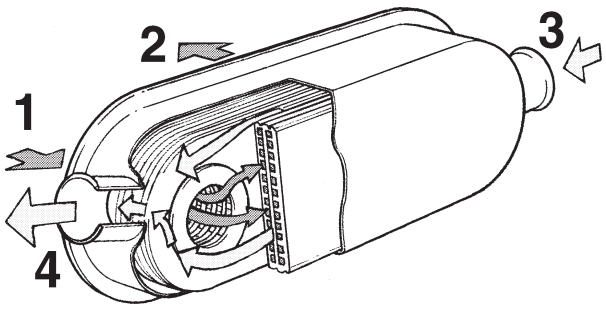
1. Oil pump
2. Full-flow filters, 2
3. Partial flow filter, 1
4. Oil cooler

Oil valves

The oil valve in the lubrication system are used to control the oil pressure and volume of oil flow from the oil pump to the different galleries, to the injector pump camshaft housing, to the turbocharger and to the piston cooling. To obtain the most effective system the valves have different opening pressures. Relief valve (D) opens if resistance in the filter is too great. The oil supply to the lubrication points is thus assured even if the filters are clogged, but of course the oil is not filtered.

Oil cooler

The engine oil temperature is maintained at a relatively low level by the oil cooler which ensures less wear and retention of the oil's lubricating properties.



1. Hot oil from the engine lubrication system
2. Cooled oil to the engine lubrication system
3. Coolant in to the oil cooler
4. Coolant out from oil cooler

Lubricating oil filters

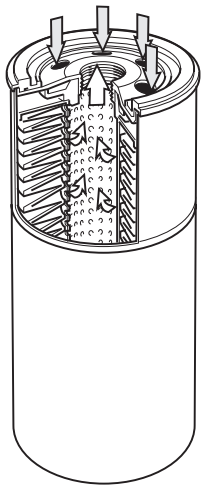
The oil filters filter contaminants from the oil. The filter elements are made of folded filter paper.

One filter is of the partial flow bype which means that less of the oil passes through the filter. Since the flow through the filter is lower the filter can separate more small particles from the oil.

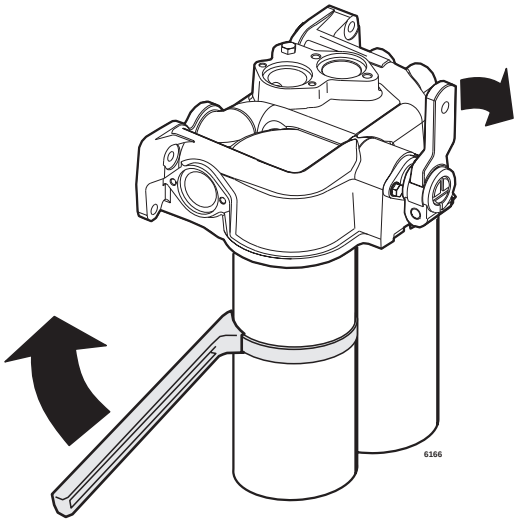
The two full-flow oil filters filter all oil before it is passed on to the lubrication system.

The oil filter insert and housing are one unit and cannot be disasssembled. When it is replaced the complete unit must be replaced. The old filter cannot be reused and must be scrapped.

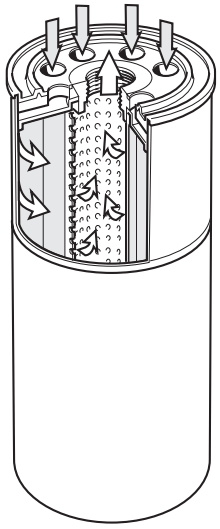
On classifiable engines there is a filter mounting which allows the full-flow filters to be replaced while the engine is running. With the fuel flow turned off to one of the filters at a time the full-flow filters can be replaced while the engine is running.



Partial flow filter (By-pass filter)



Replacement of switchable oil filters with engine running



Full-flow filters

Maintenance – Lubrication System

Oil Change – Engine

The oil should be changed when the engine is hot.

⚠ Warning! Hot oil can cause burns.

Engines with manual oil scavenger pump:

Turn the knob to position (A) for engine pumping, see illustration. Pump out the oil and collect in a container.

Engines with power oil scavenging pump (accessory):

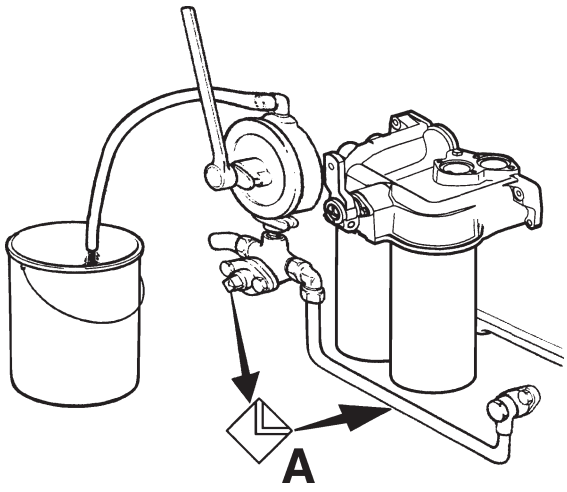
Remove the oil dipstick and connect the suction pipe to the dipstick tube. Start the pump and collect the oil in a container.

The oil can also be drained by removing the oil pan drain plug.

Fill with oil through the filler pipe. Oil quality: “Oil quality and capacity” on page 16, refer to “Technical Data” on page 74.

The oil level should be within the area marked on the dipstick. **The level must never be allowed to drop beneath the lower mark.**

NOTE! Collect up the old oil and deposit at a proper site for disposal. Never dump oil overboard into the water.



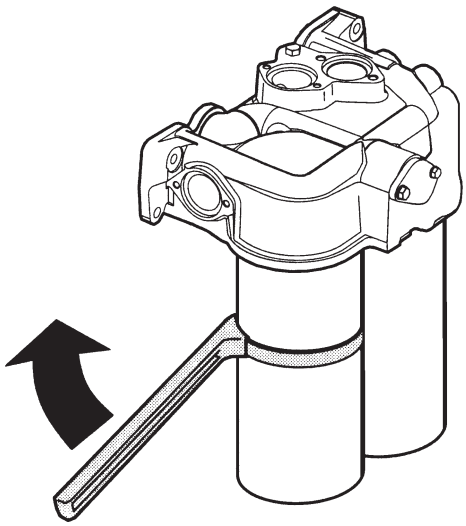
Replacing the engine oil/by-pass filters

Note: Place a container beneath the filter when removing to avoid spillage.

1 Unscrew the oil filters using the special tool, discard the filters.

⚠ Warning! Hot oil can cause burns.

2. Lightly oil the new filter’s rubber gasket and check its mating surface on the mounting.
3. Screw on the new filter by hand until the gasket is in contact with the sealing surface. Then tighten the filter a further 3/4 of a turn (approx.).
4. Replace both full-flow filters and the by-pass filter.
5. Fill with oil, start the engine and check for leaks. Stop engine and check the oil level.



Oil filter replacement

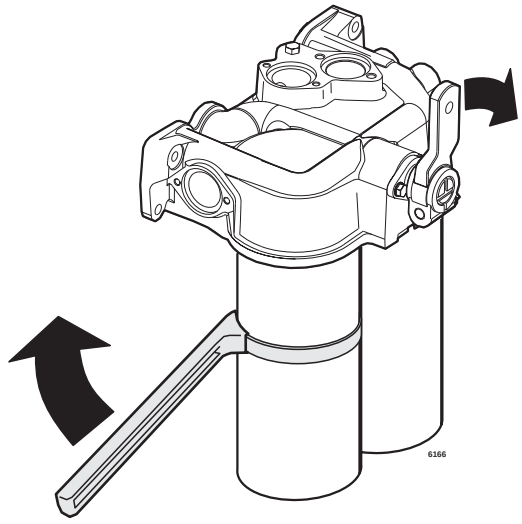
Replacement of full-flow oil filters while engine is running

(switchable filters)

Note: Place a container beneath the filters when removing to avoid spillage.

1. Disconnect oil flow through the filter by turning the control lever counterclockwise to the stop.
2. Use the special tool to unscrew the disconnected oil filter.

   ⚠ **Warning! Hot oil can cause burns.**
3. Lightly oil the new filter's rubber gasket and check its mating surface on the mounting.
4. Screw on the new filter by hand until the gasket is in contact with the sealing surface. Then tighten the filter a further 3/4 of a turn (approx.).
5. Put the filter on-line by turning the control lever clockwise to the stop.
6. Replace the other full-flow filter as above.



Replacement of full-flow filters with engine running

Oil Change – Reverse Gear

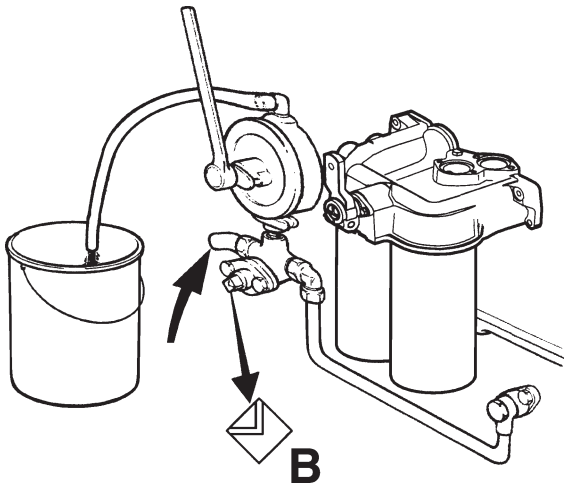
Connect a hose from the oil scavenging pump to the oil dipstick tube on the reverse gear. Turn the knob under the pump housing to the position for pumping the reverse gear (B).

Alternatively, drain the oil by removing the drain plug.

See also instructions in "Oil change Engine"

1. Fill with oil through the filler opening on the top of the reverse gear. For Oil quality and capacity refer to "Technical data" on page 76.
2. Start the engine and run it until the reverse gear reaches operating temperature.
3. Check the oil level with the engine idling and with the neutral position selected.

   The oil level should reach the upper mark on the dipstick. Top up if required.

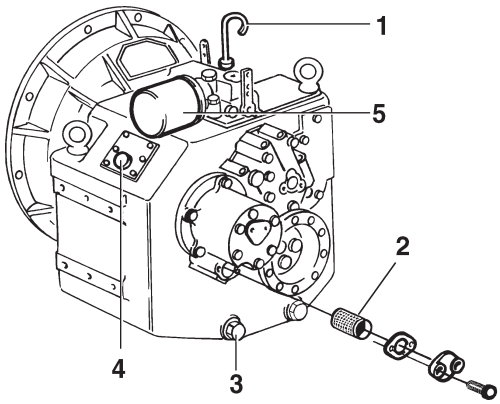


Pumping out oil from the reverse gear using a hand pump

Reverse gear oil filter replacement

MPM IRM350A, Twin Disc MG 516

Remove the oil filter using the special tool. Moisten the filter gasket with oil and screw into position by hand. Tighten filter in place with a further 3/4 turn.

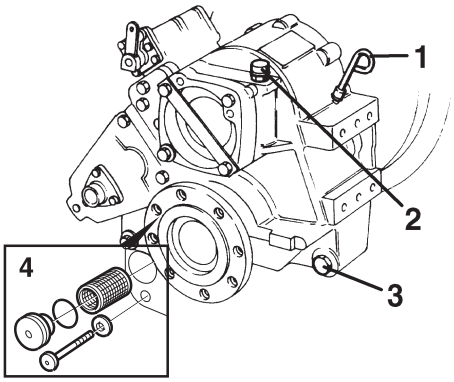


MPM IRM 350A

1. Oil dipstick
2. Oil strainer
3. Drain plug
4. Oil filler plug
5. Oil filters

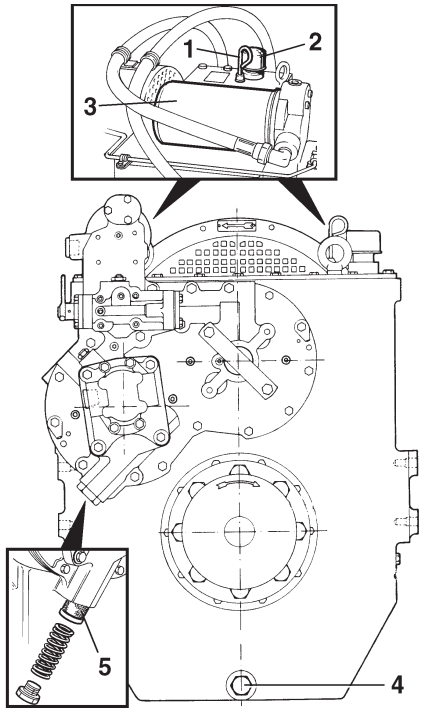
Cleaning the reverse gear oil screen

Remove and clean the oil screen. Check gaskets. Reinstall the parts removed and check for leaks.



Twin Disc MG 5114A

1. Oil dipstick
2. Ventilation cap, oil filler
3. Oil plug
4. Suction screen



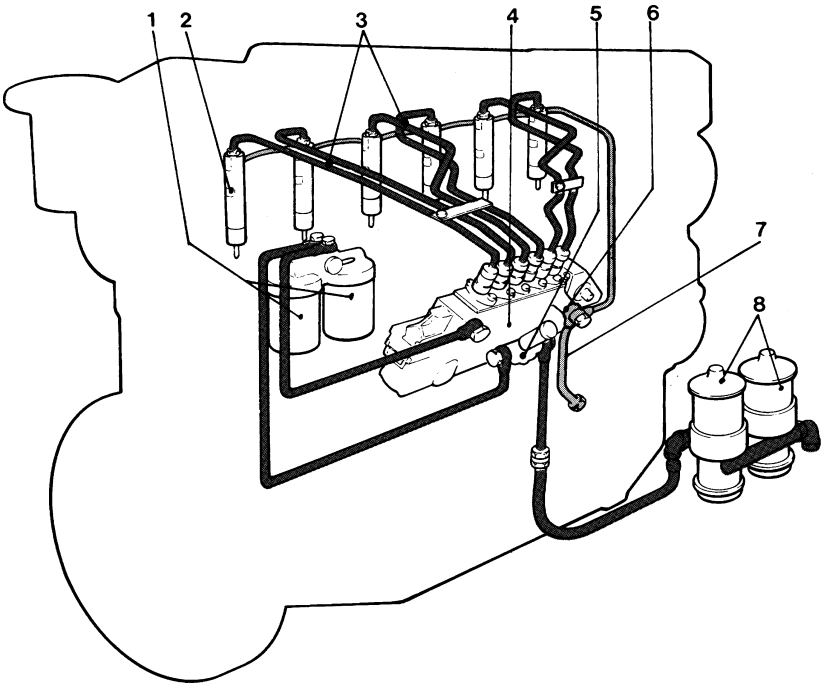
Twin Disc MG 516

1. Oil dipstick
2. Ventilation cap, oil filler
3. Oil filters
4. Oil plug
5. Suction screen

Fuel system

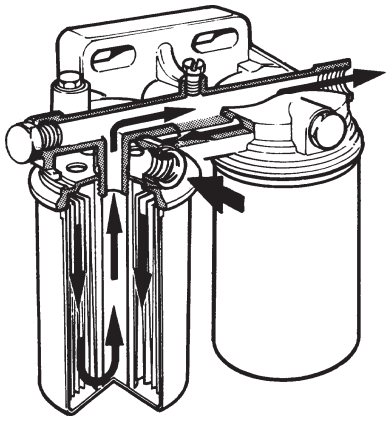
The fuel is drawn up by the feed pump from the fuel tank through the pre-filters and is forced through the fine filters to the injection pump. The injection pump then forces the fuel at high pressure into the injectors. The fuel is atomized when it is sprayed into the combustion chamber where a powerful air rotation assists uniform combustion of the mixture.

Fuel returned from the overflow valve and leak-off from the injectors is returned to the fuel tank.

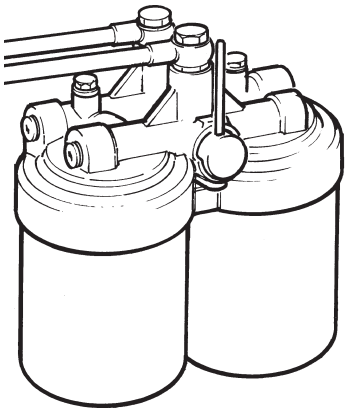


Fuel system

1. Fine fuel filter
2. Injector
3. Pressure line to injectors
4. Injection pump
5. Feeder pump, fuel hand pump
6. Overflow valve
7. Return line to fuel tank
8. Double pre-filter



Fine fuel filters



Fuel fine filters for replacement while engine is running

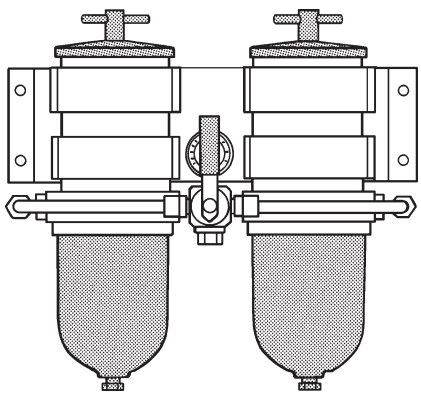
Fuel filters

The fuel system has two fine fuel filters connected in parallel have the same cover. These filters are disposable, and the filter insert is made of a spirally wound paper filter.

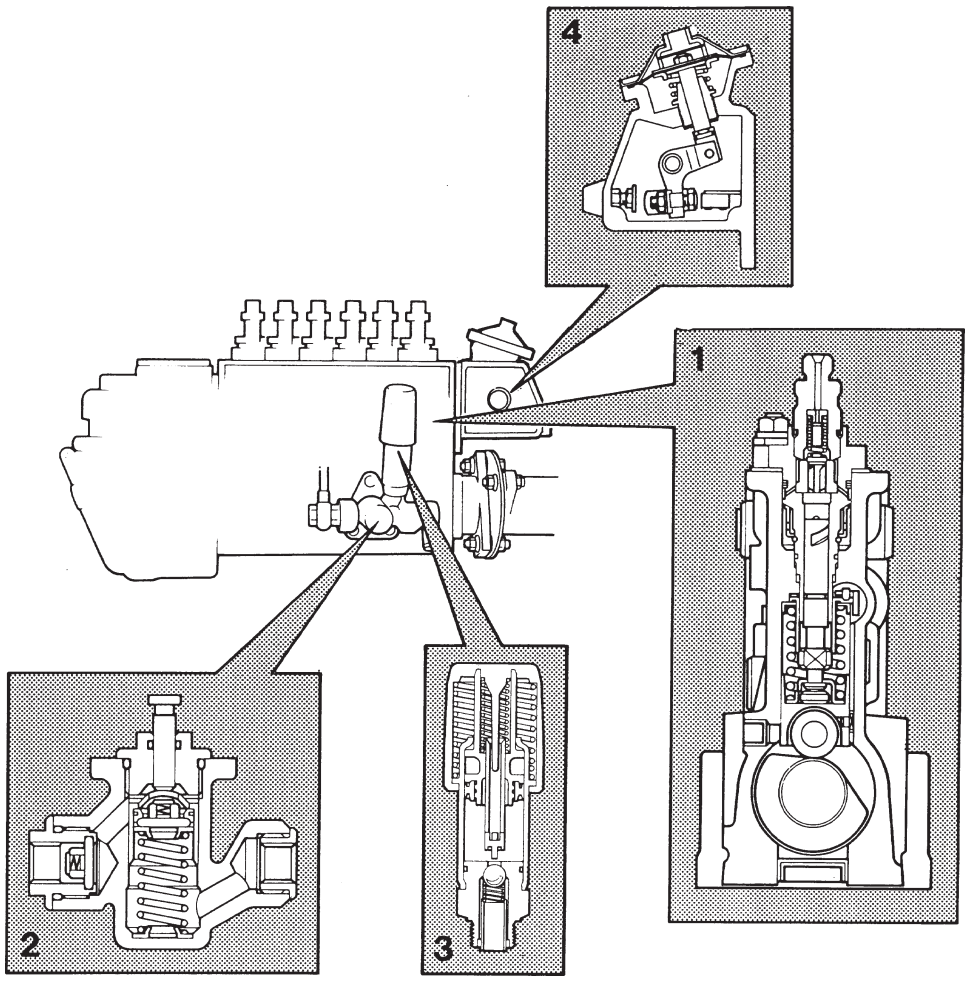
On classifiable engines the fuel fine filters can be replaced with the engine running.

A double water-separating pre-filter which is connected in parallel is also available as an accessory. The inserts of the double pre-filter can be replaced while the engine is running if necessary.

It is important that the fuel filters are replaced according to the maintenance schedule. Blocked filters make the engine difficult to start and contribute to loss in engine output.



Pre-filter



Injection pump (1)

The injection pump is located on the right side of the engine and is driven by the timing gears. The pump, which is of piston type, has a centrifugal governor.* This governor regulates the fuel feed to the engine so that the speed set by the driver using the control is achieved. It also limits the engine's max. speed if the load should suddenly drop.

*** Note:** Auxiliary engines are fitted with an electronic governor.

Hand pump (3)

The feed pump's hand pump can be used on a stopped engine to pump fuel to the filters and injection pump when venting the fuel system, for example after replacing the fuel filters.

Feeder pump (2)

If the injection pump is to work, it requires a supply of fuel at pressure. This is provided by the feed pump, which is of piston type. The feed pump is located on the injection pump and is driven by the injection pump's camshaft.

The feed pressure is determined by an overflow valve located on the injection pump. This valve both limits the feed pump pressure and ensures continuous venting of the fuel system.

Smoke limiter (4)

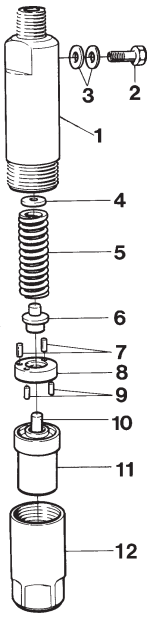
The injection pump has a pressure-dependent full load stop (smoke limiter) which is located at the front of the pump. Its job is to reduce sooty exhaust gases during hard acceleration from low speeds when the flow of exhaust gases through the turbocharger is too small to provide the full amount of air to amounts of fuel injected by the injection pump. The smoke limiter is connected to the inlet manifold via a plastic tube.

Injectors

The job of the injectors is to atomize and spray the fuel, metered precisely by the injection pump, into the engine's combustion chambers. This injection takes place under extremely high pressure so that atomization and combustion of the fuel takes place as effectively as possible.

Each injector basically comprises a nozzle holder and a nozzle (jet). When the fuel pressure increases to a set value (opening pressure), the nozzle needle (10), which is pressed in its seat by the pressure spring (5), is raised, and atomized fuel is sprayed into the engine through carefully calibrated holes in the nozzle body. The tension of the pressure spring determines the opening pressure of the injector.

The injectors should be checked regularly by authorized personnel, refer to maintenenance chart. An incorrect opening pressure or faulty nozzle will result in smoky exhaust gases and lower engine output.



Injectors

1. Injector mounting
2. Hollow screw
3. Gasket
4. Adjustment shim
5. Spring
6. Thrust pin
7. Guide pin
8. Guide
9. Guide pin
10. Nozzle needle
11. Jet
12. Jet nut

Maintenance – Fuel system

Fuel pre-filter. Checking/draining

Check the fuel filter and drain off any water and contaminants through the drain plugs (5).

The engine should be off and allowed to stand for a few hours before carrying out this check. Install plugs.

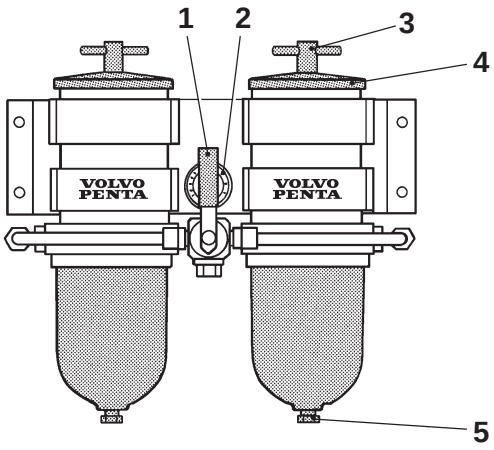
Fuel pre-filter. Installing new insert

As a rule, the filter inserts should be replaced when the pressure gauge indicates a vacuum of 6–10 in. Hg* (at engine idle) or 16–20 in. Hg (wide open throttle (WOT), loaded engine). Otherwise replacement as recommended in the maintenance schedule.

Close the fuel cocks at the tank before dismantling if the inserts are to be replaced with the engine stopped.

If inserts are to be replaced when the engine is running, shut off the filter unit with the insert to be replaced by turning the valve handle (1) to the horizontal position.

*** Note:** In. Hg = Inches of mercury.



Double pre-filters

1. Valve knob (both filters on-line in this position)
2. Pressure gauge
3. Retaining screw
4. Cover
5. Drain plug

The inserts can be replaced while the engine is running

Positions of the valve knob

Up: Normal operating position. Both filters on-line.

Right: Left side filter insert can be replaced.

Left: Right side filter insert can be replaced.

Down: Both filters are off line.

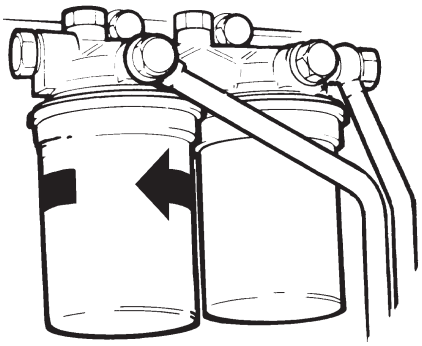
1. Place a container beneath the fuel filters. Remove the cover (4) and lift out the insert by rotating it.
2. Drain off any water or contaminants through the drain plug (2).
3. Install new filter insert and fill container with clean diesel oil. Fit the cover with a new gasket and tighten it by hand.

   Note. Moisten the gasket with diesel oil before installation. **Cleanliness!** The fuel in the system must not become contaminated.
4. Replace the other filter insert in the same way.
5. Both filter units on-line (turn the knob (1) up to the vertical position).
6. Open the fuel line taps and check that there are no leaks.

Fine fuel filters – Replace

1. Clean the filter mounting carefully.
2. Unsrew the old fuel filters and discard. Use special tool to remove filter if necessary.
3. Check that the new filters are absolutely clean and that the gaskets are undamaged. Lightly moisten the gaskets with oil.
4. Screw on the new filters by hand until the gaskets come into contact with the filter mounting. Then tighten **a further half turn** by hand.

5 . Vent the fuel system according to the instructions on the next page. Start the engine and check for leakage around the filters.

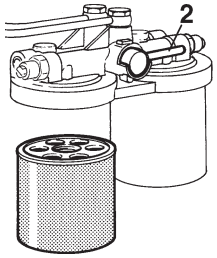


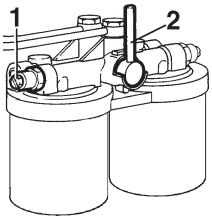
Replacing the fine fuel filters

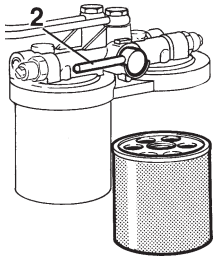
Switchable fine fuel filters

(replacement while engine is running)

1. Place a container beneath the fuel filters. Carefully clean the filter mounting.
2. Valve lever (2) in the filter cover to its **right** end position.
3. Unscrew the **left** fuel filter and discard it. If necessary, use special tool to remove.
4. Screw on the new filter by hand until the gasket comes into contact with the filter mounting. Then tighten it **a further half turn** by hand.
5. Open left vent screw (1) on the filter mounting. Move lever (2) to vertical (on-line) position. Close the vent screw when no more air bubbles are visible in the fuel.
6. Lever in its **left** end position and replace the **right** fuel filter in the same way.





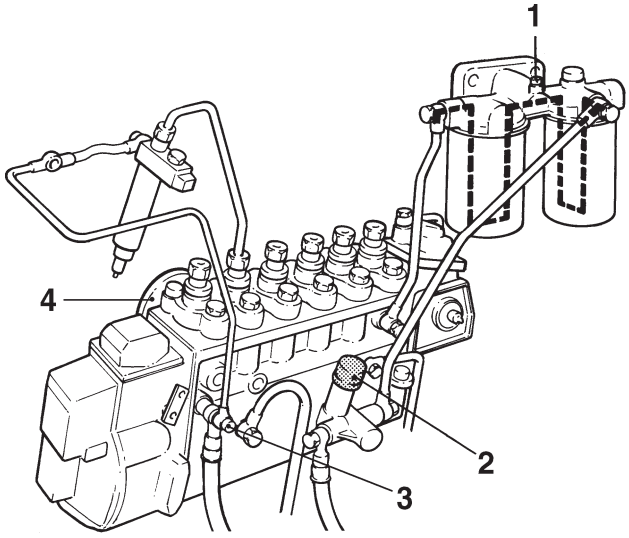


Venting the fuel system

The fuel system must be vented after the fuel filters have been replaced or after refilling the fuel tank after it has been run dry.

1. Place a container beneath the fuel filters. Open vent screw (1) on the filter mounting.
2. Pump fuel using the feed pump's hand pump (2) until no air bubbles are visible in the fuel. Tighten the screw while fuel is flowing.
3. Pump a further 10–20 strokes with the vent screw closed so that sufficient feed pressure is obtained. **Further venting is not normally required.**

   If the injection pump needs to be vented anyway, undo the overflow valve (3) connection at the pump and continue to pump by hand until no air bubbles are visible in the fuel. Tighten the connection while fuel is flowing. Pump a further 10–20 strokes so that sufficient feed pressure is obtained.
4. Check for leaks.



Cooling system

The engine uses a liquid coolant system and most engines incorporate a seawater cooled heat exchanger* in the system. The coolant in the freshwater system is pumped round by the engine coolant pump. When the engine is cold the coolant is directed through an inner circuit in the engine by the thermostats. When the engine reaches operating temperature the coolant is directed into the heat exchanger where the excess heat is removed.

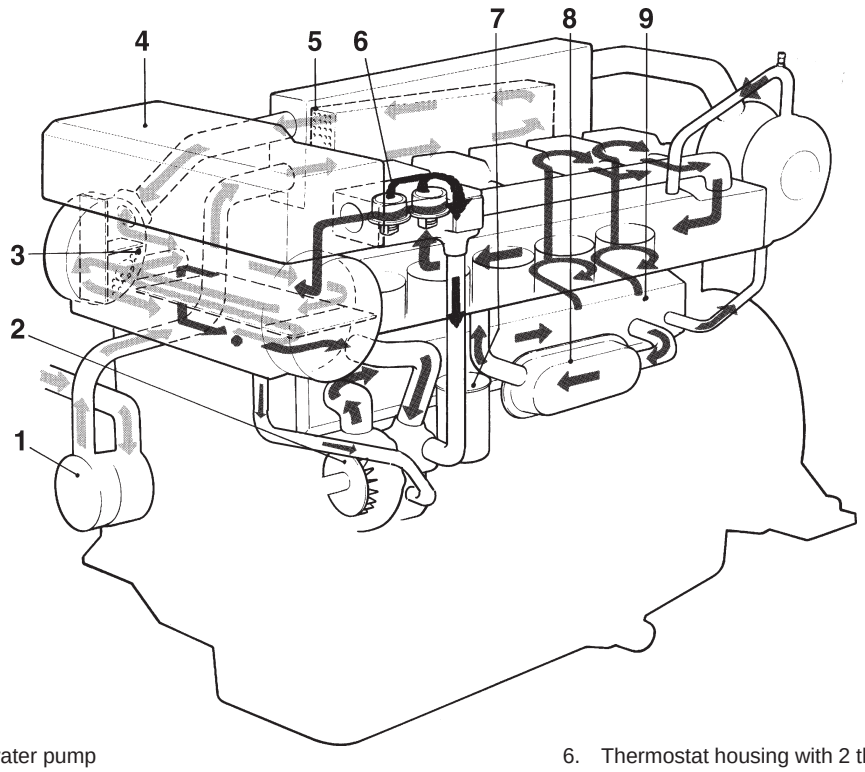
The seawater pump sucks in cooling water through the sea cock and then pumps it through the charge air cooler (CAC) circuit and then on to the heat exchanger. The reverse gear is also cooled by seawater.

The freshwater pump and the seawater pump are driven via the timing gears.

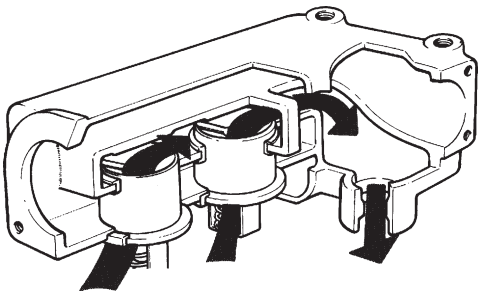
The intake air to the engine is cooled in the charge air cooler (CAC).

A freshwater filter which is connected as a partial flow filter, maintains the correct pH value in the coolant and protects the coolant system from clogging and corrosion.

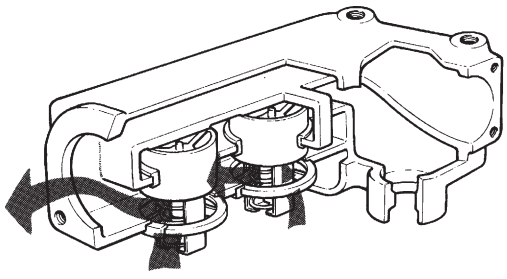
*** Note:** TAMD162C and TAMD163A can also be delivered for connection to keel cooling systems.



1. Seawater pump
2. Circulation pump
3. Seawater cooled heat exchanger
4. Expansion tank
5. Charge Air Cooler (CAC)
6. Thermostat housing with 2 thermostats
7. Coolant filter (freshwater)
8. Oil cooler
9. Distribution galleries for coolant



Engine coolant flow when engine is cold



Engine coolant flow when engine is at normal operating temperature

Thermostats

The engines have two piston thermostats with wax-filled activators. When the engine is cold, the thermostats keep the heat exchanger circuit completely closed. The coolant is then fed directly back to the engine through a by-pass line. After the engine has warmed up, the volume of the wax increases and the thermostats gradually increase the flow to the heat exchanger circuit, while closing the by-pass line.

Seawater pump

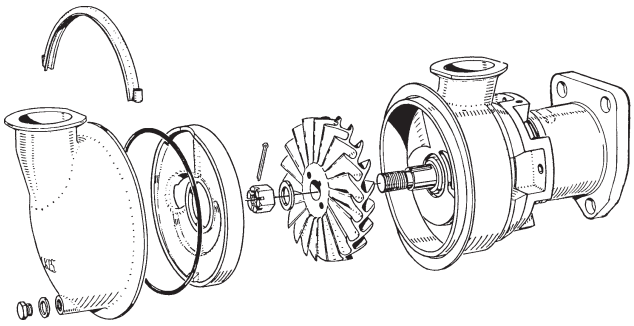
The seawater pump is fitted to the timing gear cover at the front of the engine. his pump is driven via the timing gears.

The TAMD162C and TAMD163A can be equipped with a centrifugal type seawater pump. This pump has an impeller of bronze.

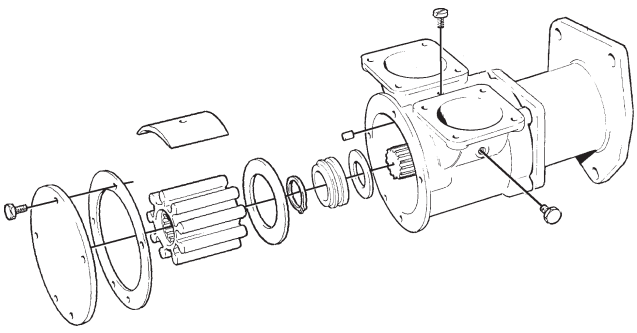
Impeller replacement and other repair or service work on this type of pump must be carried out at an authorized workshop.

The TAMD163P is equipped with a rubber impeller seawater pump. This type of pump is also used on the TAMD162C and TAMD163A.

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



Seawater pump, centrifugal type



Seawater pump, rubber impeller type

Charge air cooler (CAC)

The charge air cooler (CAC) is supplied with seawater directly from the seawater pump through the lower line connection on the front edge of the CAC.

The CAC insert is divided into two sections; the lower intake section and the upper outlet section. Overflow between the sections occurs in the rear edge of the CAC.

Heat exchanger

The seawater passes on through the charge air cooler (CAC) outlet to the heat exchanger. The engine coolant is cooled in the heat exchanger in the freshwater circuit so the engine maintains a correct operating temperature. The heat exchanger insert consists of a number of cooling pipes which the seawater flows through. Intake and outlet are located in the heat exchanger end section on the starboard side. The heat exchanger is divided up into three sections; intake, flow and outlet sections. Overflow between the sections occurs in the endsection cover on the port side.

NOTE! In tropical waters and in water where there is excessive algae growth the charge air cooler and the heat exchanger can rapidly become clogged. This can result in the engine running hot. Inspect and clean the charge air cooler and heat exchanger regularly.

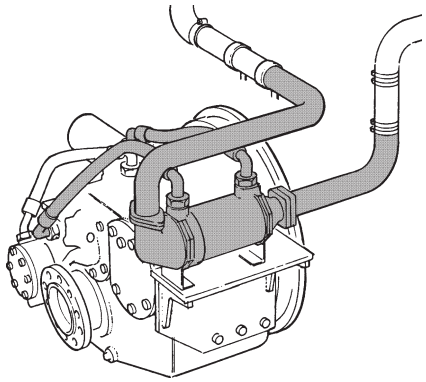
Oil cooler, engine

The lubricating oil transports heat from the high temperature parts in the engine and equalizes the temperature differences within the engine. Heat is removed from the lubricating oil in the oil cooler. This keeps the oil temperature lower at high engine load and speeds. This reduces engine wear as the oil's lubricating properties are impaired if the oil temperature gets too high. Lubricating oils of lower quality are most sensitive to high temperatures.

The engine's oil cooler is on the left side just above the oil filter. The engine oil circulates inside the cooler assembly while the coolant passes between the cell plates. The cooler is connected to the freshwater system.

Oil cooler, reverse gear

The reverse gear oil cooler is installed on a mounting on the right side of the reverse gear. The cooler is connected to the seawater system. The seawater passes through the pipes in the cooling core and draws heat off from the oil which passes between the pipes.



Oil cooler, reverse gear IRM 350A

Maintenance – Cooling System

Antifreeze and anti-corrosion, cleaning

⚠ **Close sea cock before working on cooling system.**

To avoid loss of cooling performance caused by scaling in the coolant system the coolant must be changed at least once every other year. Another reason for changing the coolant is the risk of damage from corrosion in freshwater systems due to corrosion inhibitor additives losing their effect over time.

The system should be flushed carefully with tapwater when changing the coolant. Flush until the water which runs out of the draining holes is clean.

NOTE! Some parts of these engines' cooling system are made of aluminum. Chemical agents must not be used for cleaning the system.

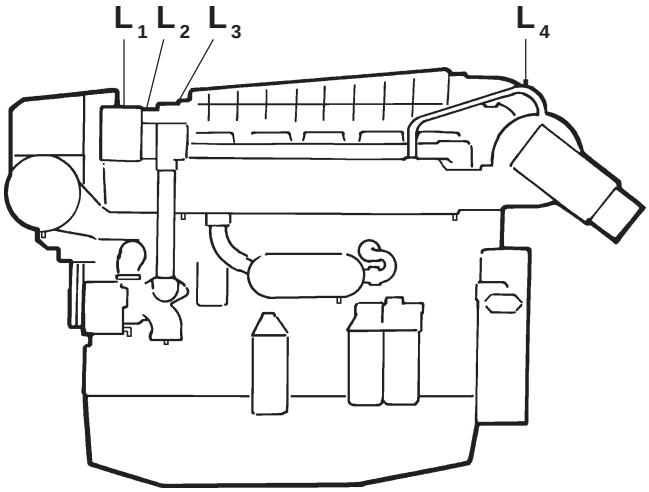
For information on draining the coolant, refer to: "Draining the coolant" on page 24. For coolant info. see "Coolant" on page 16.

Filling with coolant

⚠ **Note! Do NOT open the pressure cap or the venting nipple(s) on a hot engine. Steam or hot coolant can spray out and the system pressure will be lost.**

Filling should be carried out with the engine stopped.

Do not fill so quickly that air locks form in the system. Allow the air to flow out via the filling opening or venting nipple(s).



L = Venting nipples

1. TAMD163A: At the rubber hose at the rear of the expansion tank
   TAMD163P: On the front side of the collector pipe from the cylinder heads
2. On the thermostat housing cover (Not TAMD162C)
3. TAMD163A (keel cooled): On pipe at the charge air cooler
4. On the coolant pipe from the turbocharger

1. Open all venting nipples (L) during filling. The TAMD162C has only one venting nipple.
2. Fill with coolant until the system is completely filled up. Close the venting nipple(s) when no bubbles can be seen in the water flowing out of the venting nipple(s).
3. Run engine at idle speed for approx. two minutes.
4. Check the coolant level. Top up if required. Install pressure cap.
5. Run engine to normal operating temperature at approx. 1500 rpm. and at low load for at least 1 hour in order to ensure the engine coolant system has no air in it.
6. Check coolant level on the engine when **COLD**. Top up coolant if required. The level should reach the lower edge of the filler pipe.

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

For information on coolants refer to section "Coolant" on page 16. Top up coolant with the same mixture as used in the coolant system.

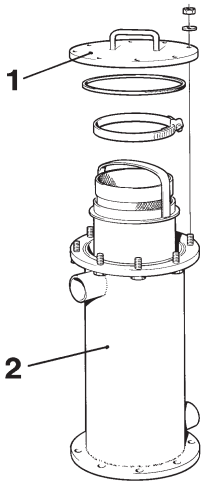
Seawater filter. Checking/cleaning

How often the filter is cleaned is dependent on the operating conditions. The interval can be decided based on experience after running the engine for a time. If necessary, clean the filter more often than specified in the maintenance schedule.

It is vital that the flow of seawater is never restricted in any way.

⚠ **Close sea cock before working on cooling system.**

1. Remove cover (1) and lift up the insert.
2. Clean the insert and housing (2).
3. Reinstall the parts as shown below. Check the O-ring. Replace if required.
4. Open the sea cock and check for leaks.



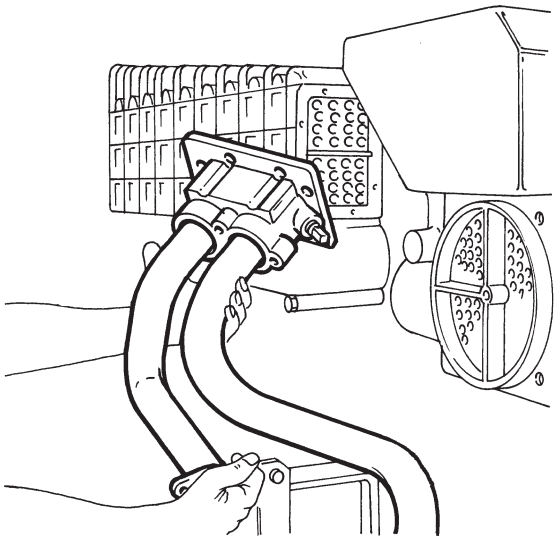
Seawater filter

Cleaning the charge air cooler (CAC)

⚠ Close the sea cock and drain the water from the seawater system.

1. Remove the end cover and pipes to the heat exchanger and seawater pump.
2. Connect a hosepipe to the charge air cooler insert drain cock on the charge air cooler rear end.
3. Flush the charge air cooler insert pipes through at high pressure. Clean pipes at the same time using a suitable brush.

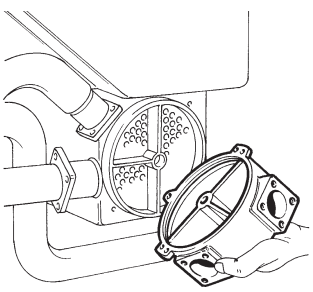
   If there is reason to believe the charge air cooler is clogged the cover must be removed and the insert lifted out. This work requires special procedures and must be carried out at an authorized workshop.
4. Check the end cover gasket and the O rings at the pipe connections. Replace if required. Reinstall the end cover and pipes to the heat exchanger and seawater pump.
5. Open the sea cock. Fill with water in the centrifugal seawater pump. See “Before starting the engine”, point 8, page 18.
6. Start the engine and check for leakage in the seawater system.

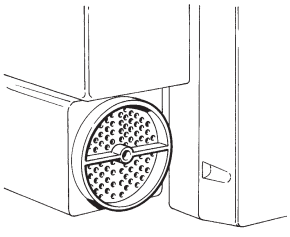


Cleaning the heat exchanger

⚠ Close the sea cock and drain the water from the seawater and freshwater systems before working on the cooling system.

1. Remove the pipe connections from the heat exchanger end section on the starboard side.
2. Remove both ends of the heat exchanger.
3. Clean the heat exchanger insert core using a brush and then flush the core through with water.
4. Reinstall the heat exchanger’s end covers.
5. Reinstall the pipe connections to the starboard end cover. Check the gaskets and replace if required.
6. Open the sea cock. Fill with water in the centrifugal seawater pump. See “Before starting the engine”, point 8, page 18.
7. Start the engine and check for leakage in the seawater system.

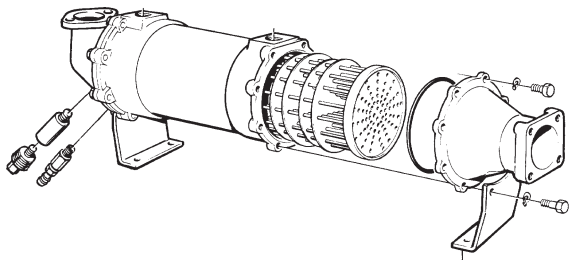




Cleaning oil cooler, reverse gear

⚠ Close sea cock before working on cooling system.

1. Open the drain cock on the oil cooler. Remove the cooling water pipes to and from the oil cooler.
2. Remove both end covers and push out the insert.
3. Wash the insert in (e.g.) white spirit and blow it dry using compressed air (or let it stand and dry). Clean the tubes internally and the ends of the core using suitable brushes. Clean the housing too.
4. Reinstall all parts in the opposite order. Use new sealing rings.
5. Close the drain cock and open the sea cock. Start the engine and check for leaks.



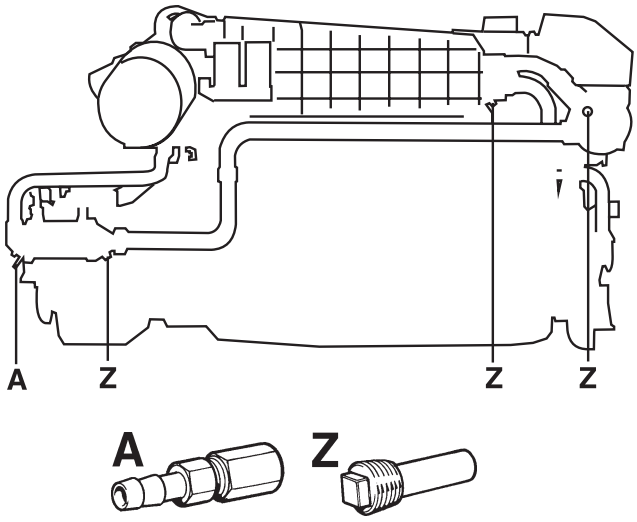
Oil cooler, reverse gear

Checking/replacing zinc anodes

Close sea cock before working on cooling system.

1. Open the drain cock (A) on the reverse gear's oil cooler.
2. Unscrew and inspect the zinc anodes (Z) on:
   - heat exchanger's starboard side.
   - heat exchanger's port side
   - lower front edge of the charge air cooler (CAC).
   - rear of the reverse gear oil cooler
4. Replace the anode if more than 50% of it has been consumed. Otherwise clean the anode with an emery cloth to remove the oxide layer.

   NOTE! Do not use a wire brush or other steel tools when cleaning, as these may damage the galvanic protection.
5. Reinstall the zinc anodes. Ensure that there is good metallic contact between the anode and the material.
6. Close the drain cock. Open the sea cock before starting the engine. Check for leaks.



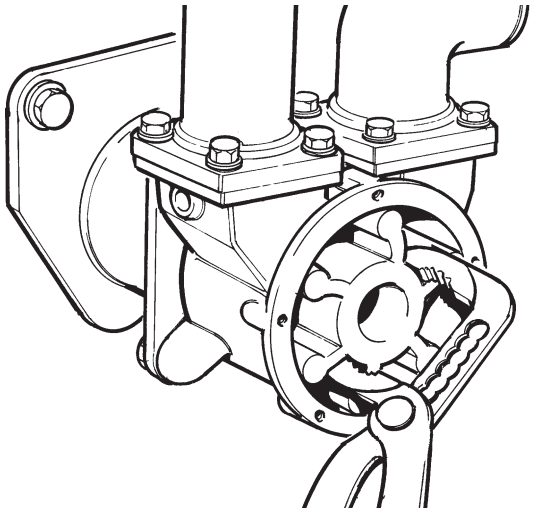
Replacing the seawater pump impeller

(Rubber impeller)

Close sea cock before working on cooling system.

1. Remove the pump's end cover. Pull and twist out the pump impeller counter clockwise using pump pliers.
2. Clean inside the housing. Lubricate the pump housing and the inside of the cover with a little lubricating grease.
3. Push in the new impeller with a clockwise rotating movement.
4. Reinstall the cover together with a new gasket.

   Always keep a spare pump impeller and gasket on board.
5. Open the sea cock. Start the engine and check for leaks.



Removing the seawater pump impeller

Technical description

Electrical system

These engines have an electrical system with a generous generator capacity for a normal-sized boat. When an extra power supply is required, we recommend that you fit an extra generator or install a separate generator unit.

These engines have a two-pole electrical system with an alternating current generator. Supply voltage is 24V.

The electrical system also includes senders for monitoring the engine's coolant temperature and oil pressure. Keel cooled engine versions are also fitted with a switch for monitoring the charge air temperature.

For engines that can be subject to certification there is a more comprehensive monitoring system. These type of engines are not dealt with in this section. For more information refer to the manual "Electrical systems, Function and installation".

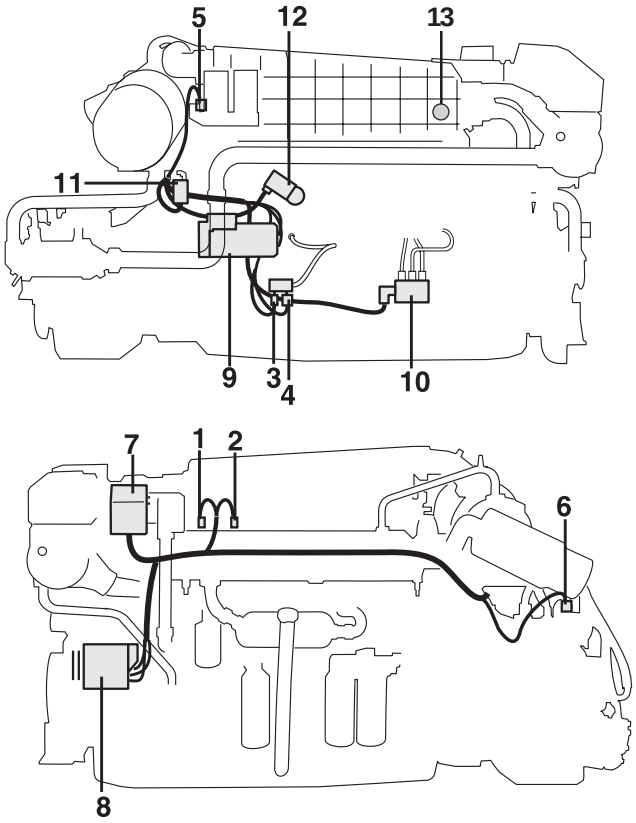
Location of electrical components in engine and reverse gear:

(Does not apply to engines with classifiable electrical systems)

TAMD162C, TAMD163A and TAMD163P (non-classifiable engine specification)

1. Engine coolant temperature (ECT) sender
2. Engine coolant temperature (ECT) switch
3. Oil pressure switch, engine
4. Oil pressure sender, engine
5. Turbo pressure sender (accessory)
6. Reverse gear oil pressure sender (accessory)
7. Terminal box with two semi-automatic fuses
8. Generator (GEN)
9. Starter motor
10. TAMD162C*, TAMD163A, TAMD163P: Fuel shut-off valve
11. Starter relay
12. TAMD162C**: Stop solenoid
13. Keel cooled engine version: Switch, high charge air temperature (alarm)

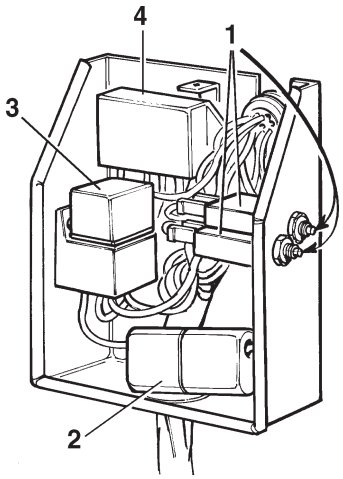
* TAMD162C: Applies as of engine No. 1101052587/xxxx.
** Applies up to and incl. engine No. 1101052586/xxxx.



Electronics Terminal box

TAMD162C, TAMD163A and TAMD163P (non-classifiable engine specification)

1. Semi-automatic fuses (8A)
2. TAMD162C: Ceramic fuse (8A) for stop solenoid
3. TAMD162C with stop solenoid: Stop relay TAMD163A, -P: Starter relay
4. Ground plate



Fuses

TAMD162C, TAMD163A and TAMD163P (non-classifiable engine specification)

Two semi-automatic 8A fuses are located in the terminal box. The fuses break the circuit on overload and can be reset by pushing in the buttons on the side of the terminal box.

The TAMD162C (with a stop solenoid) is also fitted with a ceramic 8A fuse for the stop solenoid.

Starter motor

The starter motor is mounted on the flywheel casing on the starboard side of the engine.

When the starter motor is engaged, a drive on the starter motor's rotor shaft is moved in an axial direction so that it engages with a spur ring on the engine's flywheel. The drive's axial movement and the engagement of the starter motor are controled by a control solenoid on the starter motor.

The starter motor's control solenoid is engaged in turn via the starter relay* when the ignition key is held in position III.

* Pos. 7 in the engine wiring diagram on page 68, and pos. 5 on page 69.

Generator for alternating current

The generator is belt driven and located at the front of the engine.

The engine's standard generator can be fitted with a charge distributor as an accessory. Two independent battery circuits can then be charged simultaneously. The charge distributor separates the two groups from one another so that the engine's storage batteries are kept fully charged even if the "accessory batteries" are weak or almost discharged.

Note. The charging voltage from the 28V/60A generator is thermally compensated. The voltage increases at low temperatures and is reduced at higher temperatures.

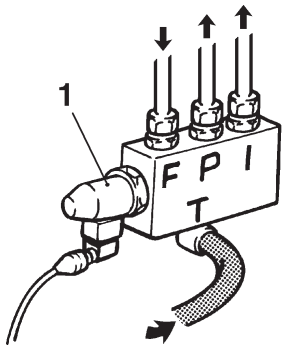
Fuel shut-off valve

TAMD162C*, TAMD163A, -163P – for normal stop

The engine is stopped via a solenoid valve (fuel shut-off valve) which is activated during stopping. The valve changes the direction of the fuel flow to and from the feed pump so that a vacuum is created in the fuel chamber of the injection pump. This makes it impossible for the pump element to fill up and the engine stops.

This valve is located on a bracket beneath the injection pump.

* Applies to engines as of engine No. 1101052587/xxxx. Applies also to engines with a classifiable electrical system and fitted with an emergency stop.



Fuel shut-off valve

1. Solenoid valve

Connections in valve housing, markings:

T. Inlet from fuel tank (**T**ank)
P. Outlet to feed pump (**P**ump)
F. Inlet from fuel finefilters (**F**ilters)
I. Outlet to injection pump (**I**njection pump)

Stop solenoid

TAMD162C – for normal stop* or as emergency stop**

TAMD163A – as emergency stop**

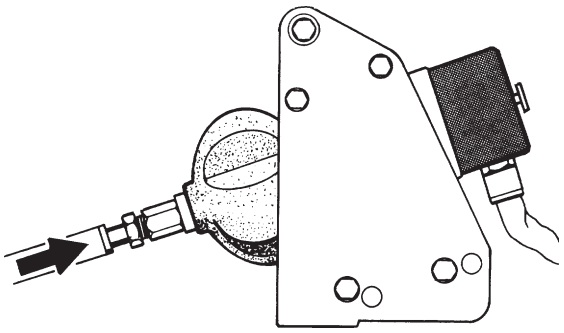
Normal stop: The solenoid is connected via the stop relay when the key switch is turned and held in the stop position (**S**).

Emergency stop: The solenoid is engaged by pressing the separate “STOP”-button at the control position, in the engine room or at any other position.

When the solenoid is activated, the injection pump’s control rod is moved into the zero delivery position and the engine stops as the flow of fuel is cut off.

* Applies to engines up to and incl. engine No. 1101052586/xxxx.

** Applies to engines with a classifiable electrical system and fitted with an emergency stop.



Stop solenoid

General Information

Electrolytic corrosion

Your boat and its engine/reverse gear have sacrificial anodes made of zinc as protection against galvanic corrosion. This protection may be rendered ineffective if there are any leakage currents from the electrical system due to faulty equipment or incorrectly connecting electrical components on the negative side (grounding, protector ground). The following should always be observed:

The main engine switches should be mounted on both the positive (+) and the negative (–) battery leads. The main switches should break the current to all parts consuming electricity. Electrical leads should be fitted in such a manner that they are not exposed to moisture and there is no risk of them being exposed to bilgewater in the keelson.

If there are several battery circuits, there must be separate switches for the extra equipment. There must also be a main switch between the extra battery’s positive (+) pole and the fuse block for the boat’s electrical equipment. The main switch for the extra battery circuit should break the current to all power consuming equipment connected to this circuit and be switched off when there is no requirement for extra current. The main switches to the engine must be switched off when the boat is not in use.

The propulsion package must not be electrically connected to other equipment such as the trim tab, steps etc. Nor should it be used as ground for radio or navigational equipment or other electrical equipment where there are separate ground cables. All separate ground connections should be collected together to form a joint ground connection which is separate from the propulsion package.

If shore power is connected, protector ground should not be connected to the engine or to any other ground on the boat.

A transformer connected to shore power must be installed so that the protective ground terminal on the inlet side (120/220V) and the negative connection on the outlet side (24V) are not cross-connected.

⚠ **Warning!** Electrolytic corrosion as a consequence of leakage currents may cause serious and expensive damage to your boat’s equipment within a short time. Work on the boat’s low tension circuit should only be carried out by qualifed or experienced persons. Installation or work on the shore power equipment **may only** be carried out by electricians authorized to work with high-voltage installations.

Electrical system – Important!

⚠ **Turn the engine off and switch off power at the main switches before carrying out work on the electrical system.**

1. **Main switch**

   Never break the circuit between the generator and batteries while the engine is running. In other words, the main switches must never be disconnected before the engine has stopped. If the circuit is broken while the engine is running, the voltage regulator may be destroyed and the generator seriously damaged.

   Charging circuits must not be switched over while the engine is running, for the same reason. To simultaneously charge two independent battery circuits, fit a Volvo Penta charge distributor to the regular generator (accessory).

2. **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. The battery terminal posts should always be well cleaned and the cable terminals well tightened and greased to prevent open circuits.

   Avoid boost charging the batteries. If the battery must be booster charged, first remove both battery leads.

   NOTE! Follow relevant safety regulations when charging batteries. When charging, unscrew filler plugs but leave them in their holes. Ventilation should be good, particularly if the batteries are being charged in an enclosed area. Always switch off the charging circuit **before** removing the battery charger connectors.

   ⚠ **Warning!** Never allow an open flame or electric sparks near the battery compartment. 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.

   ⚠ Always use protective goggles when charging and handling batteries.

   ⚠ The battery electrolyte contains extremely corrosive sulfuric acid. If this should come in contact with the skin, immediately wash with soap and plenty of water. If battery acid comes in contact with the eyes, immediately flush with plenty of water and obtain medical assistance without delay.

3. **See instructions on page 20 for how to start using auxiliary batteries.**

4. **Connecting accessories and extra equipment**

   All extra equipment should be connected to a separate junction box and fused. Avoid installing additional power points directly from the instrument panels. However permitted extra power points must not exceed max. **5A** (for all instrument panels together).

Arc welding

Remove the positive and negative leads from the batteries. Then remove all leads to the generator.

Always connect the weld clamp to the component to be welded and as close to the welding point as possible. The clamp should never be connected to the engine or in such a manner that the current is able to pass over any bearings.

⚠ **When welding is complete:** Always connect the leads to the generator **before** replacing the battery leads.

Maintenance – Electrical System

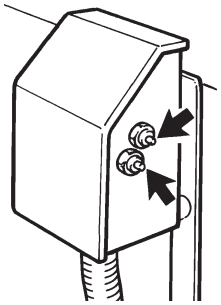
NOTE! Always stop the engine and break the current using the main switches before working on the electrical system.

Also read the section entitled "Electrical system – Important" on the previous page.

Resetting semi-automatic fuses

Semi-automatic fuses

The semi-automatic fuses are reset by pressing the respective fuse's button.



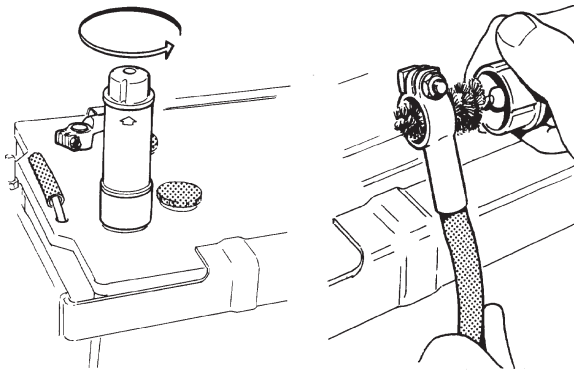
Electronics terminal box with semi-automatic fuses

Checking batteries and electrical connections

Read the section entitled "Electrical system – Important" on the previous page.

The service life of your batteries depends largely on how they are maintained. Keep batteries dry and clean. Dirt on the batteries may cause tracking and discharge them, particularly in damp weather.

Clean the battery terminals and connections using suitable wire brushes. Poor contact may cause unnecessary voltage drops. Tighten the cable terminals well and spray the battery terminals and connections with anti-corrosive agent or coat them with Vaseline.



Cleaning the battery terminals

Check that the batteries are connected properly.

Also check that all other electrical connections are dry and free of oxidation and that there are no loose connections. If necessary, spray these connections with a water-repellent spray (Volvo Penta Universal oil).

Charge condition

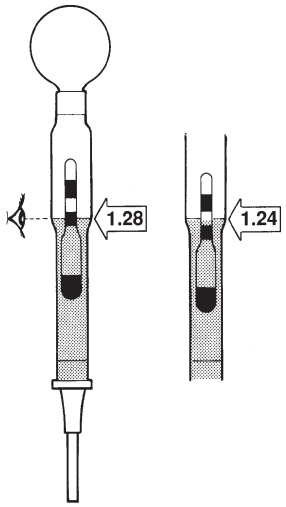
Check the batteries' charge condition using a hydrometer. The battery electrolytic density should be 1.28 g/cm^3.* Charge battery if reading has dropped to 1.24 g/cm^3* (approx. 75% charge).

Note. If an aerometer-type hydrometer (see figure) is used, the value read off applies at a temperature of approx. +25°C (77°F). At other temperatures the reading must be compensated as follows:

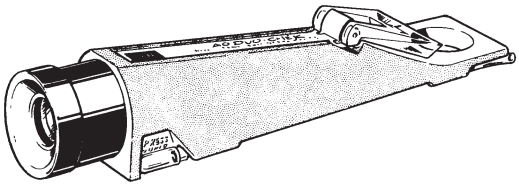
at –20°C (–4°F)	compensate by –0.03
at –5°C (23 °F)	compensate by –0,02
at +10°C (50°F)	compensate by –0.01
at +40°C (104°F)	compensate by +0.01

Example: A value of 1.24 measured at –5°C (23°F) should be corrected to 1.22, and means extra charging is needed.

*** Note:** For batteries with tropical acid substitute 1.24 g/cm^3, and 1.20 g/cm^3.



Aerometer-type hydrometer



Optical-type hydrometer

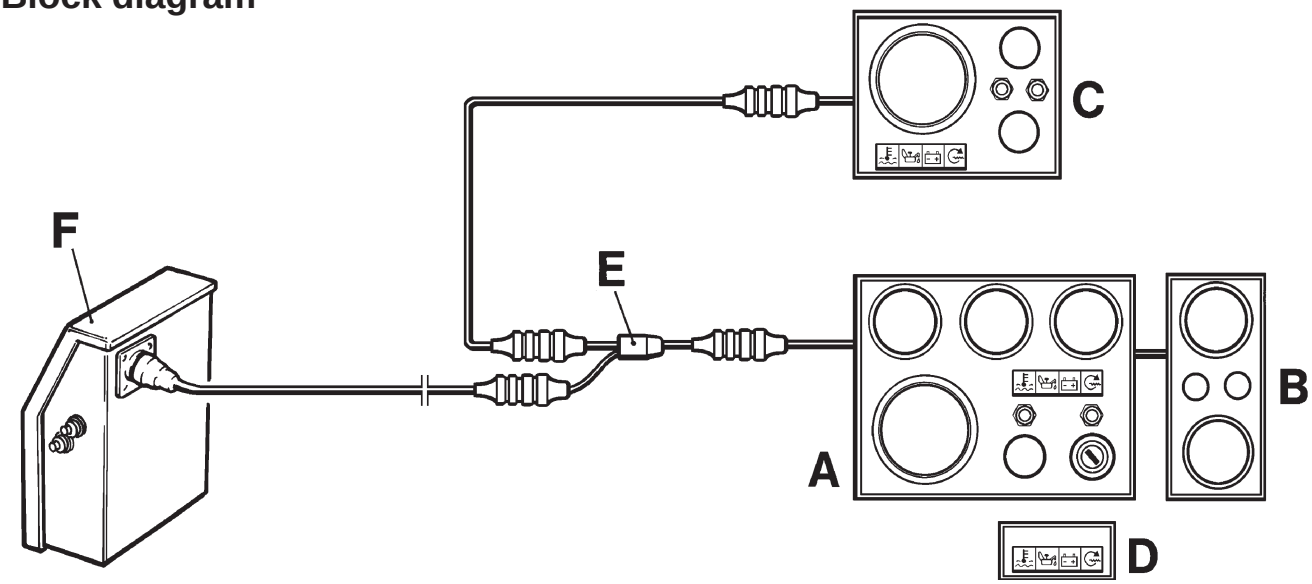
Note. An optical-type hydrometer is thermally compensated.

The various battery cells should display relatively even values. Uneven results may mean that the battery is more or less ready for replacement.

Wiring diagrams

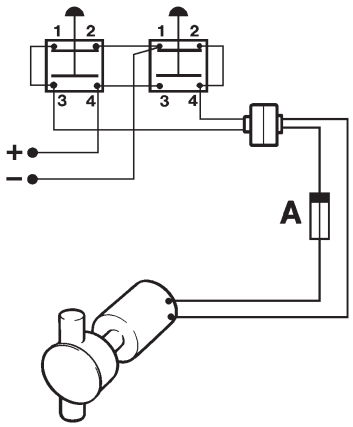
This section does not include wiring diagrams for the TAMD162C and TAMD163A engine with classifiable electrical system. For more information refer to the manual “Electrical systems, Function and installation”.

Block diagram



A. Main panel
B. Auxiliary panel
C. Control panel for auxiliary control position (Flying Bridge)
D. Alarm panel (Used only when there is no main panel A)
E. Y connection
F. Electronics Terminal box

Oil scavenging pump

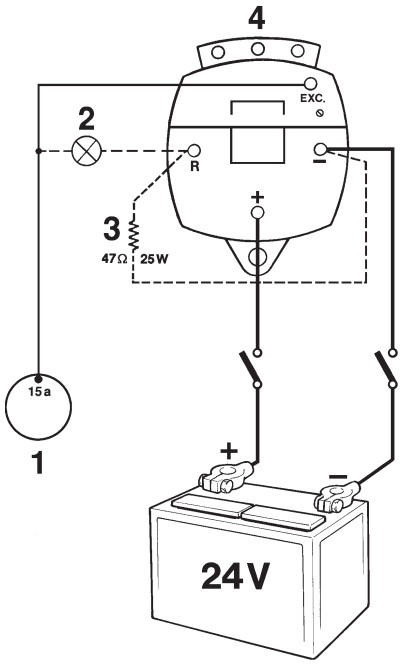


Suggested connection of oil scanvenger pump (pumping and filling)

Cable area 1. 5mm^2

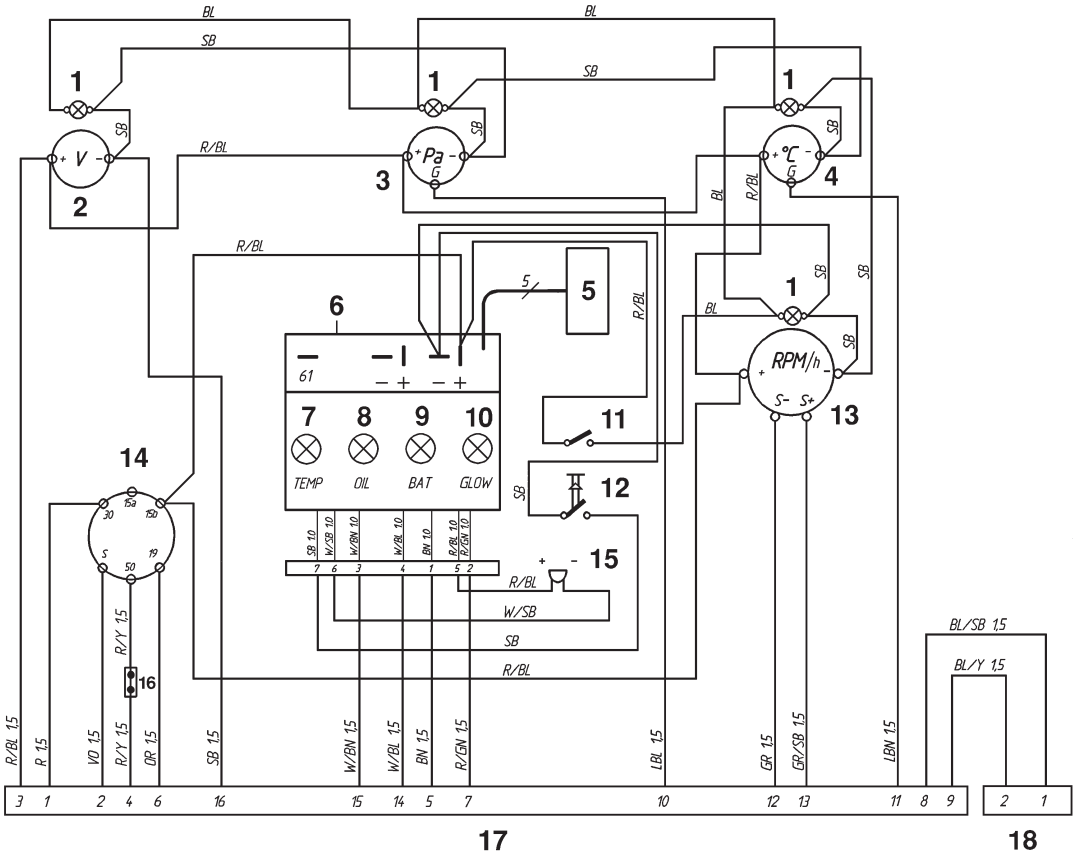
A. Fuse (8A)

Extra generator 28V/100A



1. Key switch
2. Charge warning lamp
3. Resistance (47Ω/25W, P/N 863400-8)
4. Generator (GEN)

Instrument panel, (Main panel)

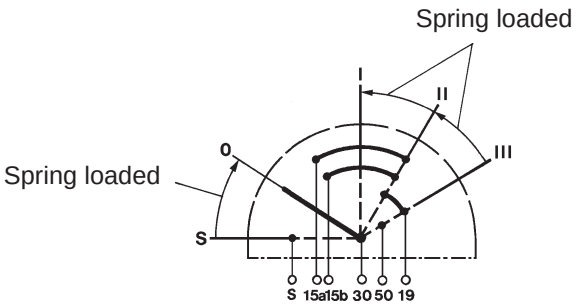


1. Instrument panel lighting
2. Voltmeter
3. Oil pressure gauge
4. Engine coolant termperature (ECT) gauge
5. Connector for connecting extra warning display (accessory)
6. Control module (alarm)
7. Warning light, engine coolant termp. (ECT)
8. Warning light, oil pressure
9. Warning light, charge
10. Control lamp (not used)
11. Instrument lighting switch
12. Alarm test/acknowledgement switch
13. Tachometer with built-in hours run meter
14. Key switch
15. Alarm
16. Connector for connecting neutral position switch (accessory)
17. 16-pin connection
18. 2-pin connector (for supplementary panel)

Cable color

BL	=	Blue
R	=	Red
LBL	=	Light-blue
SB	=	Black
BN	=	Brown
LBN	=	Light-brown
GN	=	Green
VO	=	Violet
GR	=	Gray
W	=	White
OR	=	Orange
Y	=	Yellow
PU	=	Purple

Key switch

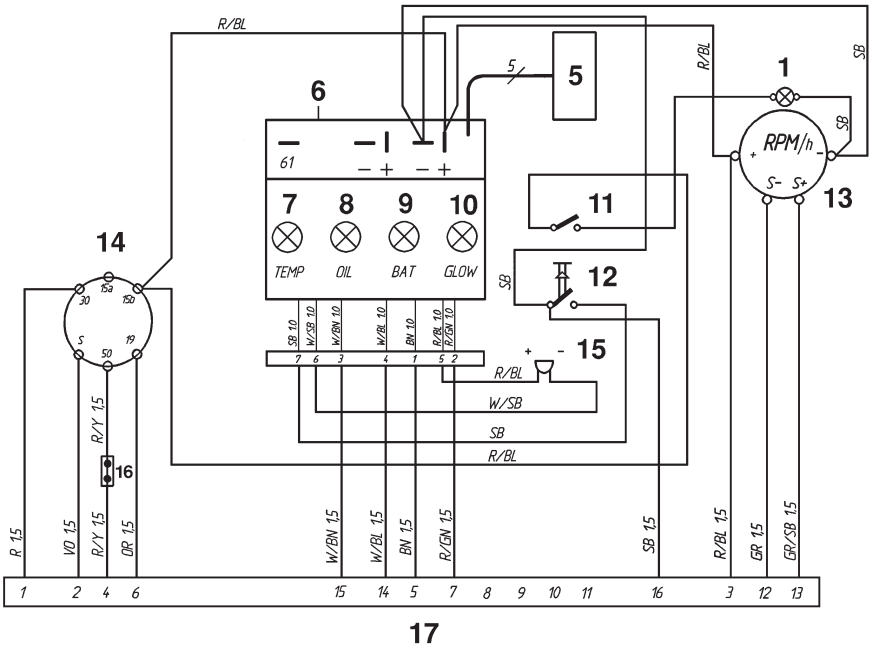


Conversions mm²/AWG*

*American Wiring Gauge

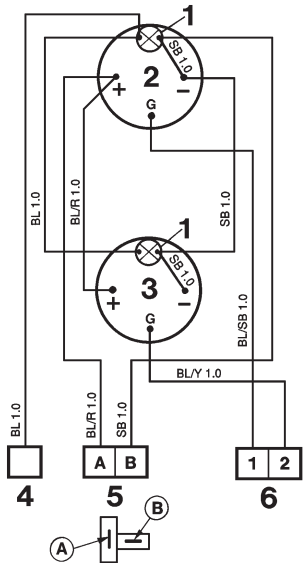
mm²	1.0	1.5	2.5	10	16
AWG	16 (17)	15 (16)	13	7	5

Instrument panel for alternative control position (Flying Bridge)



1. Instrument panel lighting
5. Connector for connecting extra warning display (accessory)
6. Control module (alarm)
7. Warning light, engine coolant termp. (ECT)
8. Warning light, oil pressure
9. Warning light, charge
10. Control lamp (not used)
11. Instrument lighting switch
12. Alarm test/acknowledgement switch
13. Tachometer with built-in hours run meter
14. Key switch
15. Alarm
16. Connector for neutral position switch, if fitted
17. 16-pin connection

Auxiliary panel



1. Instrument panel lighting
2. Oil pressure gauge, reverse gear
3. Turbo charging pressure gauge
4. Connection to instr. light. on main panel
5. Connection to printed circuit card on main panel
6. Connection to connector (18) on main panel

Cable color

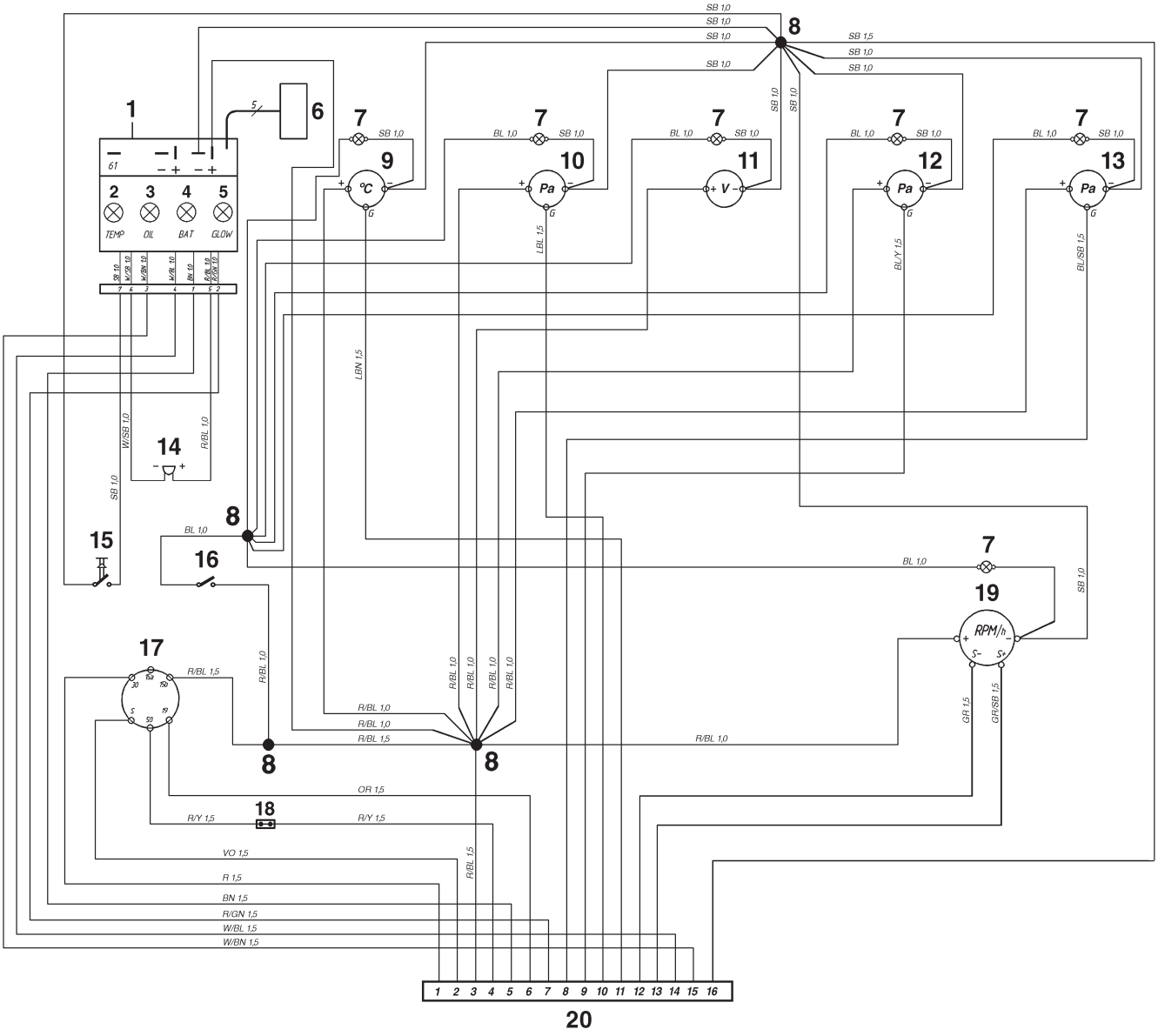
BL	=	Blue
R	=	Red
LBL	=	Light-blue
SB	=	Black
BN	=	Brown
LBN	=	Light-brown
GN	=	Green
VO	=	Violet
GR	=	Gray
W	=	White
OR	=	Orange
Y	=	Yellow
PU	=	Purple

Conversions mm²/AWG*

* American Wiring Gauge

mm²	1.0	1.5	2.5	10	16
AWG	16 (17)	15 (16)	13	7	5

Instrument kit for pilot house



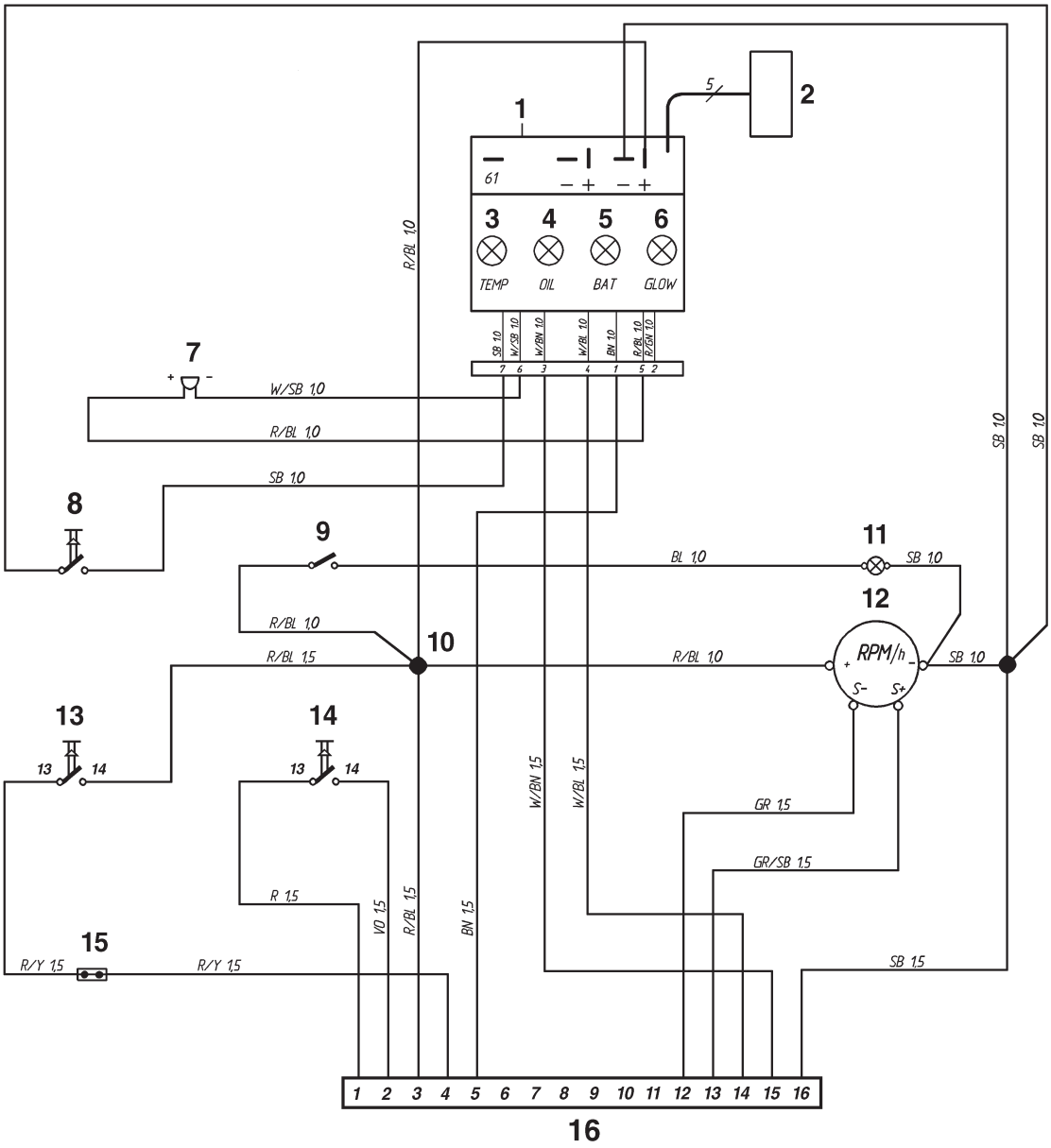
1. Control module (alarm)
2. Warning light, coolant temperature
3. Warning light, oil pressure
4. Warning light, charging
5. Control lamp (not used)
6. Connector for connecting extra warning display (accessory)
7. Instrument panel lighting
8. Connector (cannot be opened)
9. Engine coolant termperature (ECT) gauge
10. Oil pressure gauge
11. Voltmeter
12. Turbo charging pressure gauge
13. Oil pressure gauge, reverse gear
14. Alarm
15. Alarm test/acknowledgement switch
16. Instrument lighting switch
17. Key switch
18. Connector for connecting neutral position switch (accessory)
19. Tachometer with built-in hours run meter
20. 16-pin connection

Cable color

BL	=	Blue
LBL	=	Light-blue
BN	=	Brown
LBN	=	Light-brown
GN	=	Green
GR	=	Gray
OR	=	Orange
R	=	Red
SB	=	Black
VO	=	Violet
W	=	White
Y	=	Yellow

Cable areas in mm² are noted after the color codes in the wiring diagrams.

Flying Bridge instrument kit



1. Control module (alarm)
2. Connector for connecting extra warning display (accessory)
3. Warning light, engine coolant termp. (ECT)
4. Warning light, oil pressure
5. Warning light, charge
6. Control lamp (not used)
7. Alarm
8. Alarm test/acknowledgement switch
9. Instrument lighting switch
10. Connector (cannot be opened)
11. Instrument panel lighting
12. Tachometer with built-in hours run meter
13. Start button
14. Stop button
15. Connector for connecting neutral position switch (accessory)
16. 16-pin connector

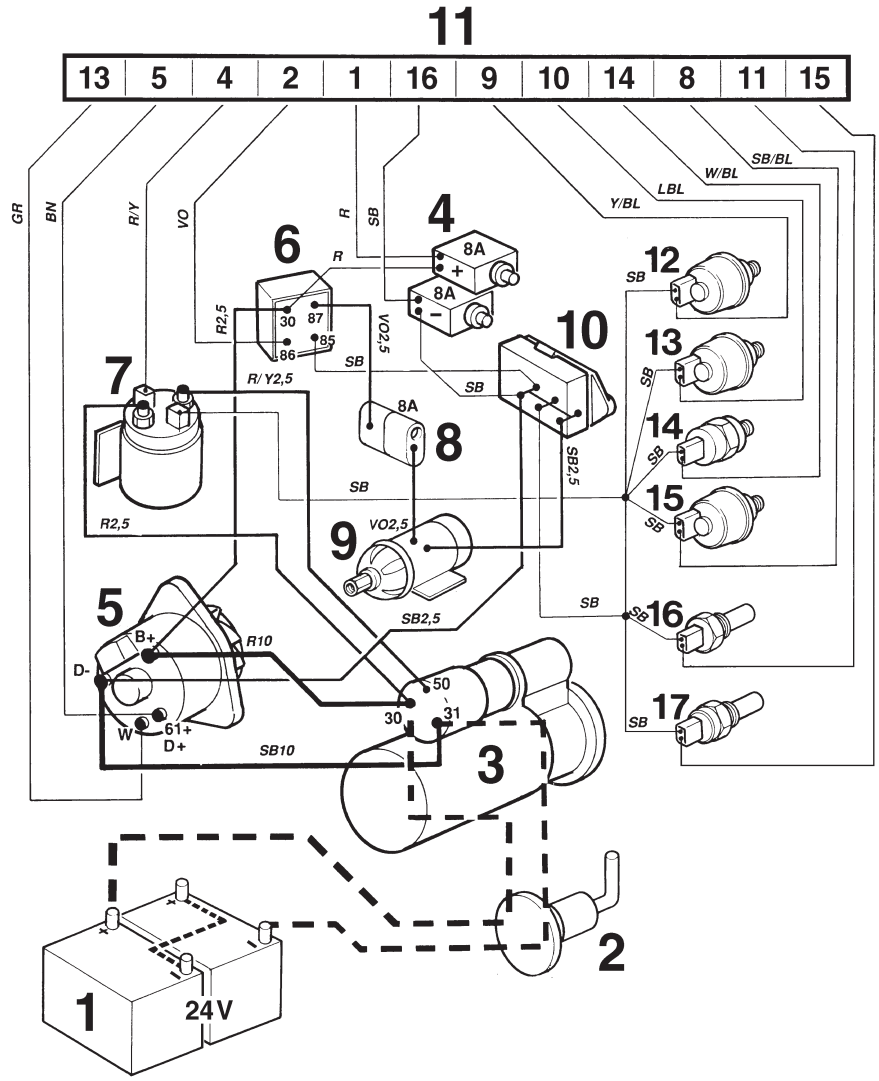
Cable color

BL	=	Blue
LBL	=	Light-blue
BN	=	Brown
LBN	=	Light-brown
GN	=	Green
GR	=	Gray
OR	=	Orange
R	=	Red
SB	=	Black
VO	=	Violet
W	=	White
Y	=	Yellow

Cable areas in mm² are noted after the color codes in the wiring diagrams.

TAMD162C*, engine (non-classifiable engine specification)

*** Applies up to and incl. engine No. 1101052586/xxxx.**



1. Battery
2. Main switch
3. Starter motor
4. Semi-automatic fuses (8A)*
5. Generator (GEN)
6. Stop relay (16S)*
7. Start relay (16MS)
8. Ceramic 8A fuse for stop solenoid*
9. Stop solenoid
10. Ground terminal block*
11. Connector, 16-pin*
12. Turbo pressure sender (accessory)
13. Oil pressure sender, engine
14. Oil pressure switch, engine
15. Oil pressure sender, reverse gear (accessory)
16. Engine coolant temp. (ECT) sender (40 – 120ºC)
17. Engine coolant temperature (ECT) switch (97°C/207°F), (normally open – closes if fault occurs)

* Located in terminal box.

Cable color

BL	=	Blue	R	=	Red
LBL	=	Light-blue	SB	=	Black
BN	=	Brown	VO	=	Violet
LBN	=	Light-brown	W	=	White
GR	=	Gray	Y	=	Yellow

Cable areas in mm² are noted after the color codes in the wiring diagrams.

If no cable area is stated the default is 1.0 mm²

Conversions mm²/AWG*

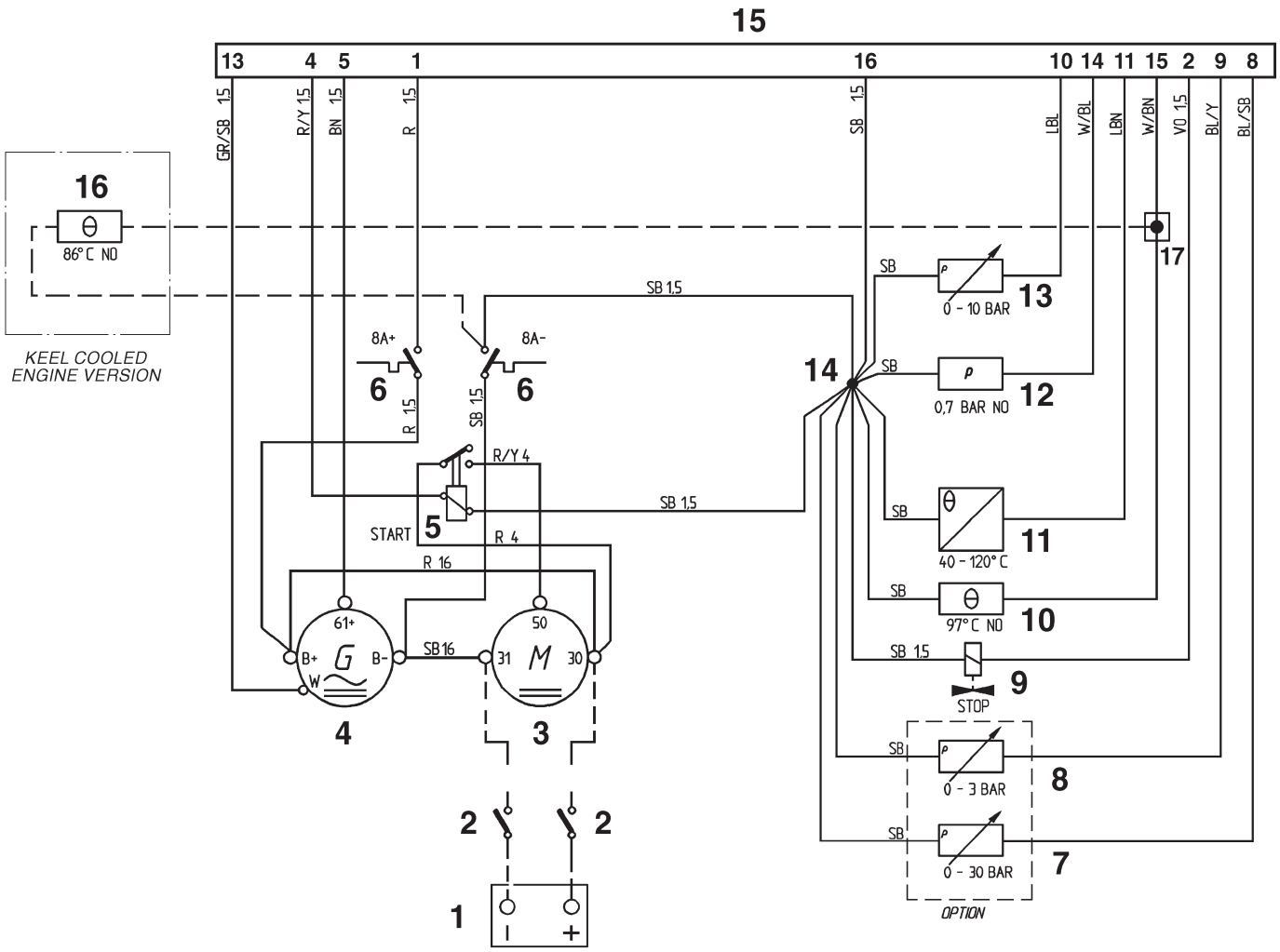
* American Wiring Gauge

mm²	0.75	1.5	4	16
AWG	18	15 (16)	11	5

TAMD162C*, TAMD163A, engine (non-classifiable engine specification)

TAMD163P, engine

*** Applies as of engine No. 1101052587/xxxx.**



1. Battery
2. Main switch
3. Starter motor
4. Generator (GEN)
5. Starter relay*
6. Semi-automatic fuses (8A)*
7. Oil pressure sender, reverse gear (accessory)
8. Turbo pressure sender (accessory)
9. Solenoid valve (fuel shut-off valve)
10. Engine coolant temperature (ECT) switch (97°C/207°F), (normally open – closes if fault occurs)
11. Engine coolant temperature (ECT) sender (40 – 120°C/ 104–248°F)
12. Oil pressure switch, engine
13. Oil pressure sender, engine
14. Joint
15. Connector, 16-pin*
16. TAMD163A (keel cooled engine version): Temperature switch, charge air temperature (86°C/187°F), (normally open – closes if fault occurs)
17. Connector

* Located in terminal box.

Cable color

BL	=	Blue	R	=	Red
LBL	=	Light-blue	SB	=	Black
BN	=	Brown	VO	=	Violet
LBN	=	Light-brown	W	=	White
GR	=	Gray	Y	=	Yellow

Cable areas in mm² are noted after the color codes in the wiring diagrams.

If no cable area is stated the default is 1.0 mm²

Conversions mm²/AWG*

* American Wiring Gauge

mm²	0.75	1.5	4	16
AWG	18	15 (16)	11	5

Inhibiting

WARNING! 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.

Boat unused for up to two months

If the boat is not expected to be used for up to two months, it is sufficient to start the engine and warm it up once a fortnight.

If there is a danger of freezing, the cooling system's seawater circuit should be drained after stopping. Check/top up the freshwater system's antifreeze to prevent damage. Empty freshwater tank if fitted.

Remove the drain plug (if fitted) on the exhaust pipe condensed water collector. Drain the water from any low-lying parts on the exhaust pipe.

Check the batteries' charge condition. A discharged battery may easily burst.

Boat unused for more than two months

1. Warm the engine up to normal operating temperature.
2. Check that the lubricating oil level in the reverse gear reaches the upper mark ("FULL") on the dipstick. Check the level with the engine idling and the control in neutral.
3. Stop the engine and drain or pump the lubricating oil from the oil sump.
4. **Boat unused max. 8 months:** Replace the lubricating oil filter and fill with Volvo Penta lubricating oil to the normal level. Warm the engine up after changing the oil.
5. **Boat unused for more than 8 months**: Fill the engine with inhibiting oil to just above the lower part of the mark on the dipstick. The oil companies sell inhibiting oil.

   Connect the fuel lines (suction and return) to a can filled with 1/3 inhibiting oil and 2/3 diesel. Some oil companies sell a ready-mixed oil for this purpose.

   Vent the fuel system according to the instructions on page 51. Start the engine and run on fast idle until approx. 2 liters have been used from the can.

   Stop the engine and drain or pump the lubricating oil from the oil sump. Connect the regular fuel lines.
6. Check that the coolant in the freshwater system has sufficient antifreeze and top up if required. Or drain the coolant. Close the sea cock and drain the water from the seawater system. See page 24.

   Remove the seawater pump impeller.
7. Check that the batteries are kept well charged. A discharged battery may easily burst.

   Batteries always have a certain amount of self-discharge which increases the higher the temperature. Batteries in storage should therefore be kept as cool as possible. The should be stored dry and clean and normally charged when the electrolyte density drops below 1.24 g/cm^3 (1.20 g/cm^3 for batteries with tropical acid).

   Preferably remove the batteries and hand them in for maintenance charging as instructed by the manufacturer.

   See also point 2 under "Electrical System – Important" on page 61.
8. When necessary, improve the external rust protection by brushing on anti-corrosion oil. The surfaces should be clean and dry before being treated.

   NOTE! Certain engine conservation oils are inflammable. Some of them are also dangerous if inhaled. Ensure that ventilation in the work place is good. Use a breathing mask when spraying.
9. Stick a decal on the engine stating the date of inhibition, type of inhibition and the inhibiting oil used.
10. Cover engine air intake, exhaust pipe outlet and engine if required.

Launching procedures

Check the condition of the propeller(s). Damaged propellers should be reconditioned or replaced.

Bringing out of storage

1. Remove any protective cover over the engine, air intake and exhaust pipe.
2. Remove any external inhibitors using white spirit.
3. Close the drain cocks and fit the drain plugs. Install the seawater pump impeller using a clockwise rotating movement.

   Fill the freshwater system if the coolant has been drained. See "Filling coolant" on page 55. For coolants, refer to page 16.
4. If necessary, fill the engine with lubricating oil of the correct quality. Install a new oil filter if this has not been done when changing the oil during inhibiting. Check the oil level in the reverse gear.
5. Check the batteries as described on page 62. Connect batteries.
6. Fit new fuel filters and vent the fuel system as described on pages 51.
7. Open the sea cock. Start the engine (see "Operation") and warm the engine up at a fast idle before loading the engine.
8. Check for any leaks of oil, fuel or cooling water.

1. Engine does not start

Starter motor does not turn engine over

CAUSE	REMEDY
• The reverse gear is not disengaged (applies to control with neutral position switch)	Put the reverse gear control lever into neutral
• Discharged batteries	Charge/replace the batteries (or connect up auxiliary batteries as shown on page 20)
• Main switches off	Switch on the main switches
• One of the semi-automatic fuses in the terminal box has tripped	Reset the fuse by pressing in the button
• Poor contact/break, electrical cables	Rectify any open-circuits/loose connections. Check for oxidation on the contacts. If required, clean them and spray with damp-inhibitor spray. See wiring diagrams, pp. 63–69.
• Key switch malfunction	Replace key switch
• Start relay malfunction	Replace starter relay
• Starter motor/solenoid (control solenoid) malfunction	Contact authorized service personnel
• Water in the engine	Contact authorized service personnel. Do not try to start the engine if there is a possibility that there is water in the engine.

Starter motor turns over slowly

CAUSE	REMEDY
• Discharged batteries	Charge/replace the batteries (or connect up auxiliary batteries as shown on page 20)
• Poor contact, electrical leads	Rectify any loose connections. Check for oxidation on the contacts. If required, clean them and spray with damp-inhibitor spray.

The starter motor turns the engine over but it does not start

CAUSE	REMEDY
• Air in fuel system	Vent the fuel system as shown on page 51
• Fuel starvation or no fuel	
– fuel cocks closed	Open the fuel cocks
– fuel tank empty/wrong tank on line	Fill with fuel/connect the correct fuel tank
– fuel filters clogged (due to contaminants/paraffin precipitation in the fuel as a result of low outside temperature)	Fit new fuel filters (pre-filter and/or fine filters) Vent the system as shown on page 51
• Stop solenoid incorrectly connected/seizing	Check stop solenoid has not been switched on unintentionally
• Solenoid valve (fuel shut-off valve) incorrectly connected	Check solenoid valve has not been switched on unintentionally

2. Engine starts but stops again/ runs unevenly

CAUSE	REMEDY
• Air in fuel system	Vent the fuel system as shown on page 51
• Fuel starvation or no fuel	
– fuel cocks closed	Open the fuel cocks
– fuel tank empty/wrong tank on line	Fill with fuel/connect the correct fuel tank
– fuel filters clogged (due to contaminants/paraffin precipitation in the fuel as a result of low outside temp.)	Fit new fuel filters (pre-filter and/or fine filters). Vent the system as shown on page 51
• Insufficient air flow to engine	
– air cleaner filter clogged	Fit a new air cleaner filter/clean air cleaner filter, check ventilation to engine compartment
• Break in pressure line	Install new pressure line(s)

3. Engine Coolant Temperature (ECT) too high

CAUSE	REMEDY
• Coolant level in engine too low (air in system)	Fill engine with coolant and vent system as shown on page 55
• Defective thermostats	Install new thermostats
• Seawater pump (pump impeller) defective	Replace the seawater pump impeller as shown on page 57
• Sea cock closed	Open the boat’s sea cock
• Seawater intake blocked	Clean the seawater intake
• Seawater filter blocked	Clean the seawater filter as shown on page 55
• Heat exchanger core clogged	Clean the insert as shown on page 56
• Circulation pump malfunction	Contact authorized service personnel

4. Engine Coolant Temperature (ECT) too low

CAUSE	REMEDY
• Defective thermostats	Install new thermostats

5. Engine does not reach correct speed at wide open throttle (WOT)

CAUSE	REMEDY
• Boat abnormally loaded	If possible, reduce/redistribute the load
• Fouling on underwater hull	Clean the bottom of the boat and treat it with anti-fouling paint
• Faulty/damaged propeller	Replace the propeller
• Insufficient fuel flow	
– fuel filters clogged (due to contaminants/paraffin precipitation in the fuel as a result of low outside temp.)	Fit new fuel filters (pre-filter and/or fine filters). Vent the system as shown on page 51
• Water in fuel	Clean the fuel tank Drain water from pre-filter
• Insufficient air flow to engine	
– air cleaner filter clogged	Fit new air cleaner filters/clean air cleaner filter
– air leak between turbo and engine's inlet manifold	Check the rubber hose between the turbo and the connecting pipe, plus other connections. Tighten the hose clips
– faulty turbocharger	Contact authorized service personnel
– poor engine compartment ventilation	Check that the ventilation ducts to the engine compartment are not blocked
• Throttle controls incorrectly adjusted	Adjust the throttle controls
• Charge air cooler (CAC) clogged	Clean the insert as shown on page 56
• Excessive pressure in the exhaust system	Check that the exhaust system is not restricted in any way
• Injector malfunction	Get authorized service personnel to check the injectors
• Incorrect adjustment of Injection pump	Contact authorized service personnel
• Smoke limiter malfunction	
– smoke limiter seizing	Contact authorized service personnel
– pressure pipe between inlet manifold and smoke limiter leaking	Fit a new pressure line
– defective membrane in smoke limiter	Contact authorized service personnel
– incorrectly adjusted	Contact authorized service personnel

6. Engine runs on

CAUSE	REMEDY
• TAMD162C: Stop solenoid fuse defective	Replace the fuse (8A)
• One of the semi-automatic fuses in the junction box has tripped	Reset the fuse by pressing in the button
• Poor contact/break open circuit in wiring	Rectify any open-circuits/loose connections. Check fo oxidation on the contacts. If required, clean them and spray with damp-inhibitor spray. See the wiring diagrams on pages 63–69.
• Faulty key switch	Replace key switch
• TAMD162C: Faulty stop relay	Replace stop relay (or change temporarily with start relay)
• TAMD162C: Faulty stop solenoid	Contact authorized service personnel*
• TAMD162C: Stop controls incorrectly adjusted/ seizing	Contact authorized service personnel*
• Faulty solenoid valve (fuel shut-off valve)	Contact authorized service personnel

* The stop solenoid shoul be adjusted by authorized service personnel. Incorrect adjustment may destroy the solenoid.

Technical Data

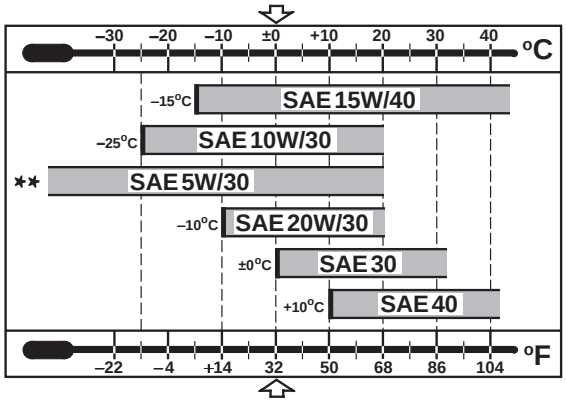
General

Type designation	TAMD162C	TAMD163A	TAMD163P-A
No. of cylinders	6	6	6
Cylinder displacement	16.123 dm^3 (liter), (984 in^3)	16.123 dm^3 (liter), (984 in^3)	16.123 dm^3 (liter), (984 in^3)
Firing order	1–5–3–6–2–4	1–5–3–6–2–4	1–5–3–6–2–4
Rotation, viewed from in front	Clockwise	Clockwise	Clockwise
Valve clearance, stopped, cold engine:			
inlet	0.30 mm (0.0118")	0.30 mm (0.0118")	0.30 mm (0.0118")
exhaust	0.60 mm (0.0236")	0.60 mm (0.0236")	0.60 mm (0.0236")
Compression pressure at starter motor speed, 180 rpm.	2760 kPa (28 kp/cm^2 = 400 psi)	2760 kPa (28 kp/cm^2 = 400 psi)	2760 kPa (28 kp/cm^2 = 400 psi)
Weight, engine with heat exchanger, without reverse gear or clutch, approx.	1705 kg (3759 lbs)	1750 kg (3858 lbs)	1655 kg (3649 lbs)

Lubrication system

	TAMD162C, TAMD163A*	TAMD163A*, TAMD163P-A
Oil pressure, engine hot at operating speed	300–500 kPa (3–5 kp/cm^2 = 43.5–72.5 psi)	300–500 kPa (3–5 kp/cm^2 = 43.5–72.5 psi)
Oil pressure, engine hot, piston cooling	180 kPa (1.8 kp/cm^2 = 26 psi)	180 kPa (1.8 kp/cm^2 = 26 psi)
Oil capacity incl. oil filters, approx.:	**Deep oil sump**	**Shallow oil sump**
engine inclination 0°	73 liters (16.1 Imp. gals/19.3 US gals)	51 liters (11.2 Imp. gals/13.5 US gals)
engine inclination 5°	55 liters (12.1 Imp. gals/14.5 US gals)	47 liters (10.3 Imp. gals/12.4 US gals)
engine inclination 10°	38 liters (8.4 Imp. gals/10.0 US gals)	42 liters (9.2 Imp. gals/11.1 US gals)
Difference between Max. and Min. levels		
engine inclination 0°	20 liters (4.4 Imp. gals/5.3 US gals)	13 liters (2.9 Imp. gals/3.4 US gals)
engine inclination 5°	20 liters (4.4 Imp. gals/5.3 US gals)	–
engine inclination 10°	14 liters (3.1 Imp. gals/3.7 US gals)	–
Oil grade	VDS (Volvo Drain Specification), or CD or CE as per API system	VDS (Volvo Drain Specification), or CD or CE as per API system

Viscosity at different ambient temperatures (Temperature based on constant ambient air temperature).



*** Note:** On TAMD163A a deep sump is fitted as standard but a shallow oil sump can be fitted as an option.

** Refers to synthetic or semi-synthetic oil. NOTE! **Only** SAE 5W/30 may be used.

Fuel system

	TAMD162C	TAMD163A	TAMD163P-A
Injection pump			
Designation	PE6P130A720RS7150	PE6P130A720RS7571	PE6R130/720RS1506
Injection angle	23° ±0.5° B.T.D.C.	17° ±0.5° B.T.D.C.	21° ±0.5° B.T.D.C.
Injectors			
Injector holders	KBAL 116 S 66	KBAL 116 S 75	KBAL 116 S 75
Nozzles	DLLA 140 S 1054	DLLA 146 S 1310	DLLA 148 S 1298
No. of holes/diameter	5 x 0.400 mm, (0.01575")	7 x 0.284 mm, (0.01118")	7 x 0.358 mm, (0.01409")
Injector complete, marking	635	K	G
Injectors, opening pressure	26.0 MPa, (265 kp/cm² = 3770 psi)	23.5 (+0.8) MPa (240 (+8) kp/cm² = 3408 (+116) psi)	29.0 (+0.8) MPa, (296 (+8) kp/cm² = 4206 (+116) psi)
Injector, adjustment pressure (new spring)	26.5 (+0.8) MPa, (270 (+8) kp/cm² = 3843 (+116) psi)	24 (+0.8) MPa 245 (+8) kp/cm² = 3481 (+116) psi)	29.5 (+0.8) MPa, (301 (+8) kp/cm² = 4279 (+116) psi)

Boost pressure

Min. values (measured in the engine's inlet manifold at 100% load and wide open throttle (WOT), air temperature approx. +25°C (77°F). If readings are taken at a different temperature, the boost pressure measured must be corrected (see Workshop Manual).

If full power cannot be achieved, the pressure is considerably lower.

	TAMD162C	TAMD163A	TAMD163P-A
Rating Pleasure (Power curve PD), Rating 4 (Power curve SLD):			
2100 rpm.	–	–	155 kPa, (1.55 kp/cm² = 22.5 psi)
Rating 3 (Power curve LD):			
2100 rpm.	–	–	135 kPa, (1.35 kp/cm² = 19.5 psi)
Rating 2 (Power curve MD):			
1400 rpm.	124 kPa, (1.25 kp/cm² = 18 psi)	164 kPa, (1.7 kp/cm² = 23.5 psi)	–
1600 rpm.	140 kPa, (1.4 kp/cm² = 20 psi)	182 kPa, (1.9 kp/cm² = 26 psi)	–
1800 rpm.	148 kPa, (1.5 kp/cm² = 21 psi)	193 kPa, (2.0 kp/cm² = 28 psi)	–
1900 rpm.	148 kPa, (1.5 kp/cm² = 21 psi)	–	–
Rating 1 (Power curve HD):			
1400 rpm.	112 kPa, (1.1 kp/cm² = 16 psi)	145 kPa, (1.5 kp/cm² = 21 psi)	–
1600 rpm.	132 kPa, (1.35 kp/cm² = 19 psi)	166 kPa, (1.7 kp/cm² = 24 psi)	–
1800 rpm.	140 kPa, (1.4 kp/cm² = 20 psi)	178 kPa, (1.8 kp/cm² = 25.5 psi)	–
Rating 1 (Power curve HD), "Auxiliary":			
1500 rpm.	–	140 kPa, (1.4 kp/cm² = 20 psi)	–
1800 rpm.	–	170 kPa, (1.7 kp/cm² = 24.7 psi)	–

Cooling system

	TAMD162C	TAMD163A, TAMD163P-A
Freshwater system capacity		
including head exchanger, approx.	88 liters(19.4 Imp. gals/23.2 US gals)	80 liters(17.6 Imp. gals/21.1 US gals)
Thermostats (2)		
starts opening at	82°C (180°F)	73–77°C (163–171°F)
fully opening at	95°C (203°F)	86–90°C (187–194°F)

Scavenger pump/bilge pump

	TAMD162C, TAMD163A, TAMD163P-A	
Type	Impeller	
Clutch	Electromagnetic	
Capacity (liters/minute) at engine speed:	**Column pressure 5 m (16.4 ft)**	**Column pressure 10 m (32.8 ft)**
900 rpm.	152 liters(33.5 Imp. gals/40.1 US gals)	138 liters(30.3 Imp. gals/36.4 US gals)
1200 rpm.	200 liters(44 Imp. gals/52.9 US gals)	185 liters(40.7 Imp. gals/48.8 US gals)
1500 rpm.	258 liters(56.8 Imp. gals/68.1 US gals)	243 liters(53.4 Imp. gals/64.1 US gals)
1800 rpm.	310 liters(68.2 Imp. gals/81.8 US gals)	295 liters(64.9 Imp. gals/77.9 US gals)
1900 rpm.	335 liters(73.7 Imp. gals/88.4 US gals)	318 liters(70 Imp. gals/84 US gals)

Electrical system

	TAMD162C	TAMD163A, TAMD163P-A
System voltage	24 V	24 V
Battery capacity	2 x 12 V (in series) max. 220 Ah	2 x 12 V (in series) max. 220 Ah
Generator for alternating current		
voltage/max. amperage	28 V/60 A	28 V/60 A
output approx.	1700 W	1700 W
brush length	min. 8 mm (0.315")	min. 8 mm (0.315")
Extra generator equipment (accessory)		
voltage/max. amperage	28 V/100 A	28 V/100 A
output approx.	2800 W	2800 W
brush length	min. 5 mm (0.2")	min. 5 mm (0.2")
Battery electrolyte density at +25°C (77°F)		
fully charged battery	1.28 g/cm³ (0.046 lb/in³)	1.28 g/cm³ (0.046 lb/in³)
battery recharged at	1.24 g/cm³ (0.044 lb/in³)	1.24 g/cm³ (0.044 lb/in³)

Reverse gear

MPM

Type designation	**IRM 350A**
Gear ratios	1.58:1; 2.07:1; 2.63:1
Angle (output shaft)	7°
Oil capacity, approx.	20 liters (4.4 Imp. gals/5.3 US gals)
Oil grade (in accordance with API system)	CC, CD, CE
Viscosity	SAE30*
alternative for operation in hot countries	SAE40*
Operating oil pressure at oil temperature 75 ±5°C (167 ±9°F):	
min.	1.9 MPa (19.3 kp/cm² = 275 psi)
max.	2.4 MPa (24.4 kp/cm² = 348 psi)
Max. oil temperature	85°C (185°F)
Weight, approx.	234 kg (515 lbs)

* **Note!** Only **single grade** lubricating oil (only one viscosity number) may be used in the reverse gear.

Twin Disc

	MG5114A	MG516
Type designation		
Gear ratios	1.48:1, 1.92:1, 2.50:1	3.07.1; 3.50:1; 4.04:1; 4.52:1; 5.05:1; 6.00:1
Angle (output shaft)	7°	0°
Oil capacity, approx.	10.5 liters (2.3 Imp. gals/ 2.75 US gals)	26 liters (5.7 Imp. gals/6.85 US gals)
Oil grade (in accordance with API system)	CC, CD, CE	CC, CD, CE
Viscosity:		
at oil temperature 66–85°C	SAE30*	SAE30*
at oil temperature 85–100°C	SAE40*	SAE40*
Operating oil pressure at oil temperature of 82°C (180°F), 1800 rpm.:		
"Neutral".	0.207–0.634 MPa (2.11–6.46 kp/cm^2 = 30–92 psi)	0.46–0.67 MPa (4.6–6.83 kp/cm^2= 66.7–97 psi)
"Forward".	1.57–1.63 MPa (16–16.6 kp/cm^2 = 228–236 psi)	1.41–1.67 MPa (14.4–17 kp/cm^2 = 205–242 psi)
Weight, approx.	256 kg (564 lbs)	720 kg (1586 lbs)

* **Note!** Only **single grade** lubricating oil (only one viscosity number) may be used in the reverse gear.

Clutch

Disengageable clutches at front of engine (accessory)

Twin Disc

Type	Double plate clutch ("over-center" type)
Gear ratios	1:1
Size	292 mm (11 ½")
Max. output at 1800 r/min	256 hk/188 kW
Permitted rpm, power take-off engaged	750–1800 rpm.
Max. permitted torque take-off	1000 Nm
Weight, approx.	115 kg (253 lbs)

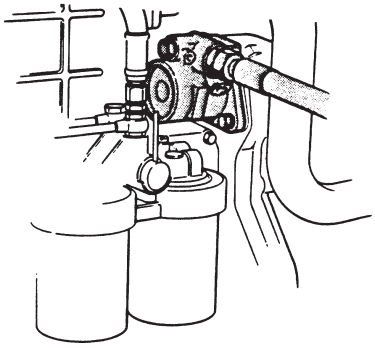
Disengageable clutch at rear of engine (accessory)

Automotive Products

Type designation	AP314
Type	Double plate clutch ("over-center" type)
Gear ratios	1:1
Size	356 mm (14")
Weight, approx.	159 kg (350 lbs)

Hydraulic pump

Type	Centrifugal pump
Drive	Gear wheel
Gear ratio	0.875 x engine speed
Capacity	16.5 liters (3.63 Imp. gals/ 4.35 US gals) per minute
Pressure at 650 rpm. and over	12.9 MPa (132 kp/cm^2 = 1878 psi)
Location	See illustration



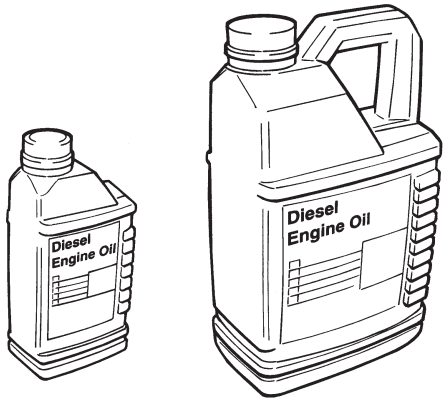
Accessories

Volvo Penta accessories

Below is a range of products available as accessories.

Note Not all accessories can be fitted to all engines. Ask your Volvo Penta service dealer for advice.

- Volvo Penta lubricating oils:
  – VDS*, SAE 15W/40
- Volvo Penta antifreeze (glycol) for the freshwater system
- Volvo Penta anti-corrosive agent** for the freshwater system
- Extra instrument panels:
  – Auxiliary panel
  – Panel for Flying Bridge (alternative operating position)
  – Extra alarm panel
- Extra generator incl. regulator to be fitted at the left hand side of the engine:
  – 28V/100A (2800W)
- Extra fuel pre-filters with water separator
- Electrical oil scavenging pump
- Manual oil scavenging pump
- Shallow oil sump
- Seawater filter
- Muffler
- Bilge/scavenging pumps, 24V (TAMD162C and TAMD163A in commercial operation). Capacity at 1800 rpm. and 5 m (16.4 ft) column pressure:
  – 2": 310 l/min (68.2 Imp. gals/81.8 US gals).
- Hydraulic pump
- Pulley for extra power take-off
- Extra power take-off at the front of the engine (engines in commercial operation):
  – Twin Disc 292 mm (11 ½")
- Extra power take-off at the rear of the engine (engines in commercial operation):
  – Automotive Products 356 mm (14").
- Toolkit



Volvo Penta VDS oil

* VDS oil allows longer intervals between oil changes (see maintenance schedule on page 29).
** Must not be used together with antifreeze (glycol).

Controls

On Volvo Penta controls, the control lever has an adjustable friction brake. Lever movements can thereby be adapted according to personal requirements.

Dual lever controls have individually adjustable friction brakes for each lever.

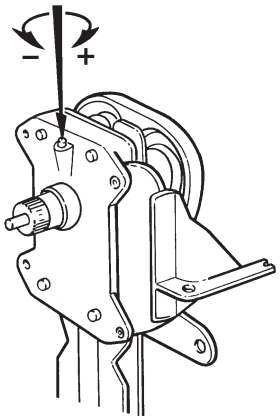
Adjusting the friction brake

Single lever control

This brake is intended for controlling speed and is adjusted at **half throttle with the reverse gear engaged**. The brake does not affect shifting.

1. Remove the cover over the control.
2. Adjust the friction by turning the screw at the arrow (see figure).

   Turning the screw **clockwise** (+) makes the lever movement **stiffer**, while turning **counterclockwise** (–) consequently makes it **easier** to move the lever.
3. Reinstall the cover over the control.



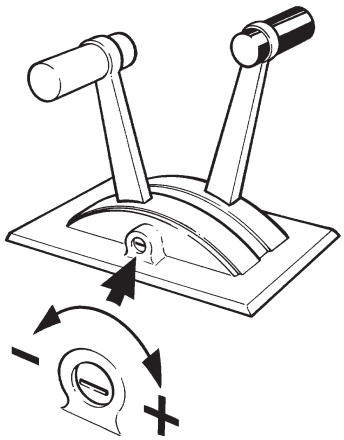
Adjusting the friction brake on single lever controls (single or double)

Dual lever control

The brake is for the engine speed control.

Adjust the friction by turning the screw at the arrow (see figure).

Turning the screw **clockwise** (+) makes the lever movement **stiffer**, while turning **counterclockwise** (–) consequently makes it **easier** to move the lever.

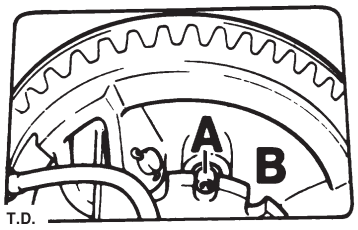


Adjusting the friction brake on dual lever controls

Disengageable clutch

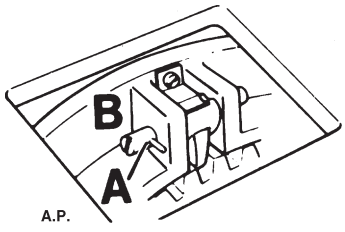
Adjustment

Turn off the engine and move the clutch lever to the neutral position. Remove the inspection cover and turn the clutch unitl the locking unit on the adjuster ring is accessible. The locking unit can be of different designs depending on the manufacturer (see illustrations).



Twin Disc (T.D.)

1. Press in the locking pin (A) and turn the adjuster ring (B) clockwise so many marks to the right that considerable force is required to engage the clutch.
2. Tighten the inspection cover.



Automotive Products (A.P.)

1. Undo the locking bolt (A) and turn the adjuster ring (B) clockwise until a considerable force is required to move the lever in order to engage the clutch.
2. Turn back the locking bolt (A) so that the locking tab locates in a space between the teeth. Tighten the inspection cover.

Notes

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