

# **Workshop manual**

**TAD1630G/GE/P/V, TAD1631G/GE, TID162AP,  
TWD1620G/GH, TWD1630G/GE/P/V,  
TD164KAE**



# Workshop manual

## TAD1630G/GE/P/V, TAD1631G/GE, TID162AP, TWD1620G/GH, TWD1630G/GE/P/V, TD164KAE

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# Safety Precautions


## Introduction


This Workshop manual contains descriptions and instructions for the repair of the Volvo Penta products or product types. Check that you have the correct Workshop manual for your engine.

Before starting work on the engine, read these safety precautions with care as well as "General information" and "Service procedures".

## Important


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


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


 **IMPORTANT!** Used to draw your attention to something that can cause damage or malfunctions on a product or damage to property.


**Note:** Used to draw your attention to important information that will facilitate the work or operation in progress.


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


 Immobilize the engine by turning off the power supply to the engine at the main switch (switches) and lock it (them) turned off before starting work. Set up a warning notice at the engine control point.


 As a general rule all service operations must be carried out with the engine stopped. However, some work, for example certain adjustments require that the engine is running when they are carried out. 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 working in proximity of an engine which is operating, careless movements or a dropped tool can result in personal injury. Take care to avoid contact with hot surfaces (exhaust pipes, Turbocharger (TC), air intake pipe, starter heater etc.) and hot liquids in lines and hoses on an engine which is running or which has just been stopped. Reinstall all protective parts removed during service operations before starting the engine.


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


 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 products or similar when starting the engine. They may cause an explosion in the inlet manifold. Danger of personal injury.

 Avoid opening the coolant filler cap when the engine is hot. Steam or hot coolant can spray out and the system pressure will be lost. When needed, open the filler cap slowly and release the pressure in the system. Be very careful if a cock or plug or engine coolant line must be removed when the engine is hot. It is difficult to anticipate in which direction steam or hot coolant can spray out.














 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.






 Stop the engine before carrying out operations on the engine cooling system.

 Only start the engine in a well-ventilated area. If operating the engine in an enclosed area ensure that there is exhaust ventilation leading out of the engine compartment or workshop area.

## Safety Precautions

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-  Always use protective glasses or goggles when carrying out work where there is a risk of splinters, grinding sparks, acid splashes or where other chemicals are used. The eyes are extremely sensitive, an injury could result in blindness!
-  Avoid getting oil on the skin! Repeated exposure to oil or exposure over a long period can result in the skin becoming dry. Irritation, dryness and eczema and other skin problems can then occur. Used oil is more dangerous than fresh oil from a health aspect. Use protective gloves and avoid oil soaked clothes and shop rags. Wash regularly, especially before eating. There are special skin creams which counteract drying out of the skin and make it easier to clean off dirt after work is completed.
-  Many chemicals used on the product (for example engine and transmission oils, glycol, gasoline and diesel oil), or chemicals used in the workshop (for example degreasing agents, paint and solvents) are dangerous to health. Read the instructions on the product packaging with care! Always follow the safety precautions for the product (for example use of protective mask, glasses, gloves etc.). Make sure that other personnel are not exposed to hazardous chemicals, for example in the air. Ensure good ventilation in the work place. Follow the instructions provided when disposing of used or leftover chemicals.
-  Exercise extreme care when leak detecting on the fuel system and testing the fuel injector nozzles. Use eye protection. The jet from a fuel injector nozzle is under extremely high pressure and has great penetrative energy, so the fuel can penetrate deep into the body tissue and cause serious personal injury. Danger of blood poisoning.
-  **WARNING!** The delivery pipes must under no circumstances be bent. Damaged pipes should be replaced.
-  All fuels and many chemical substances are flammable. Do not allow naked flame or sparks in the vicinity. Fuel, certain thinner products and hydrogen from batteries can be extremely flammable and explosive when mixed with air. Smoking is not to be permitted in the vicinity! Ensure that the work area is well ventilated and take the necessary safety precautions before starting welding or grinding work. Always ensure that there are fire extinguishers at hand when work is being carried out.
-  Ensure that rags soaked in oil or fuel and used fuel or oil filters are stored safely. Rags soaked in oil can spontaneously ignite under certain circumstances. Used fuel and oil filters are environmentally dangerous waste and must be deposited at an approved site for destruction together with used lubricating oil, contaminated fuel, paint remnants, solvent, degreasing agents and waste from washing parts.
-  Never expose a battery to naked flame or electrical sparks. Never smoke in proximity to the batteries. The batteries give off hydrogen gas during charging which when mixed with air can form an explosive gas - oxyhydrogen. This gas is easily ignited and highly volatile. Incorrect connection of the battery can cause a 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.
-  Always ensure that the Plus (positive) and Minus (negative) battery cables 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 at once.
-  Turn the engine off and turn off the power at the main switch(es) before carrying out work on the electrical system.
-  Clutch adjustments must be carried out with the engine stopped.
-  Use the lifting eyes fitted on the engine 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 gearbox, if fitted, and any extra equipment installed). Use an adjustable lifting beam or lifting beam specifically for the engine 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 in relation to the top 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.
  -  Never work alone when removing heavy engine components, even when using lifting devices such as locking tackle lifts. When using a lifting device two people are usually required to do the work, one to take care of the lifting device and another to ensure that components are lifted clear and not damaged during the lifting operations. Always check before starting work if there is enough room to carry out removal work without risking personal injury or damage to the engine or parts.
  -  **WARNING!** The components in the electrical system and in the fuel system on Volvo Penta products are designed and manufactured to minimize the risk of fire and explosion. The engine must not be run in areas where there are explosive materials.
  -  Always use the fuels recommended by Volvo Penta. Refer to the Instruction Book. Use of fuels that are of a lower quality can damage the engine. On a diesel engine poor quality fuel can cause the control 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 rules when cleaning with high-pressure water jets: Never direct the water jet at seals, rubber hoses, electrical components or the radiator.
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# General information

## About this Workshop manual

This Workshop manual contains descriptions and instructions for the repair of engines in standard format.

The Engine Designation and Engine Numbers can be found on the product plate (see page 10). Please always include both the engine designation and the engine number in all correspondence.

The Workshop manual is produced primarily for the use of Volvo Penta workshops and service technicians. For this reason the manual presupposes a certain basic knowledge and that the user can carry out the mechanical/electrical work described to a general standard of engineering competence.

Volvo Penta products are under a continual process of development and we therefore reserve all rights regarding changes and modifications. All the information in this manual is based on product specifications available at the time the book was published. Any essential changes or modifications of the product or revised service methods introduced after the date of publication will be provided in the form of Service Bulletins.

## Spare parts

Spare parts for the electrical and fuel systems are subject to various national safety requirements. Volvo Penta Original Spare Parts meet these specifications. Any type of damage which is the result of using spare parts that are not original Volvo Penta parts for the product in question will not be covered under any warranty or guarantee provided by AB Volvo Penta.

## Certified engines

When performing service and repairs on an emissions certified engine that is used in an environment where exhaust emissions are governed by law, it is important to be aware of the following:

Certification means that an engine type is controlled and approved by the appropriate authority. The engine manufacturer warrants that all engines of the same type that are being made, are equivalent to the certified engine.

The following special requirements regarding service and repairs apply:

- Service and maintenance intervals recommended by Volvo Penta must be followed.
- Only Volvo Penta Original Spare Parts may be used.
- Service work on the injection pump, pump settings, and injectors must always be carried out by an authorized Volvo Penta workshop.
- The engine must not be altered or modified in any way, except for accessories and service kits approved by Volvo Penta for that engine.
- No modifications to the exhaust pipes and engine air intake pipes are allowed.
- Any seals on the engine may not be broken by unauthorized persons.

For other matters, the general instructions in the Instruction Book apply.



**IMPORTANT!** Neglected or substandard operation or service, as well as use of replacement parts other than AB Volvo Penta Original Parts will result in AB Volvo Penta being unable to assume any liability that the engine corresponds to the certificated engine variant.

AB Volvo Penta excludes any liability for all and any type of damage or costs caused by the use of replacement parts that are not Volvo Penta Original Parts for the product in question.



# Repair instructions

The working methods described in the Workshop manual apply to work carried out in a workshop. The engine has been removed and is installed in an engine fixture. Unless otherwise stated reconditioning work which can be carried out with the engine in place follows the same working method.

Warning symbols used in this Workshop manual (for full explanation of the symbols refer to the section "Safety Precautions")

 **WARNING!**

 **IMPORTANT!**

**Note:**

are not in any way comprehensive since it is impossible to predict every circumstance under which service work or repairs may be carried out. AB Volvo Penta can only indicate the risks considered likely to occur as a result of incorrect working methods in a well equipped workshop using working methods and tools tested by AB Volvo Penta.

All operations described in the Workshop manual for which there are Volvo Penta Special Tools available assume that these tools are used when carrying out the repair. Volvo Penta Special Tools have been specifically developed to ensure as safe and rational working methods as possible. It is therefore the responsibility of anyone using other tools or other working methods than we recommend to determine that there is no risk of personal injury or mechanical damage or malfunction as a result.

In some cases special safety precautions and user instructions may be required in order to use the tools and chemicals mentioned in the Workshop manual. Always follow these precautions. There are no specific instructions given in the Workshop manual.

By following these basic recommendations and using common sense it is possible to avoid most of the risks involved in the work. A clean work place and a clean engine will eliminate many risks of personal injury and engine malfunction.

Especially when working on the fuel system, engine lubrication system, air intake system, turbocharger unit, bearing seals and seals, it is extremely important to avoid dirt or foreign objects entering the parts or systems, since this can result in reduced service life or malfunctions.

## Our common responsibility

Every engine consists of many systems and components that work together. If one component deviates from the technical specifications this can have dramatic consequences on the environmental impact of the engine even if it is otherwise in good running order. It is therefore critical that the stated wear tolerances are observed, that systems which can be adjusted are correctly set up and that only Volvo Penta Original Parts are used on the engine. The stated service intervals in the Maintenance Schedule must be followed.

Some systems, such as the components in the fuel system, require special expertise and special testing equipment for service and maintenance. Some components are factory sealed for environmental and product specific reasons. Under no circumstances attempt to service or repair a sealed component unless the service technician carrying out the work is authorized to do so.

Bear in mind that most chemical products, incorrectly used, are hazardous to the environment. Volvo Penta recommends the use of bio-degradable degreasing agents for all cleaning of engine components unless otherwise stated in the Workshop manual. Pay special attention to make sure that oils and washing residue etc are handled correctly for destruction, and do not unintentionally end up in nature.

## Torque

Correct torque for critical joints which must be tightened using a torque wrench are listed under "Technical Data - torque" and stated in the method descriptions in the Workshop manual. All torque data apply to cleaned threads, bolt heads and mating surfaces. Torque data stated apply to lightly oiled or dry threads. Where grease, locking or sealing agents are required for screwed joints this is stated in both the operation description and in "torque". Where no torque is stated for a joint use the general torque shown in the table below. The torques stated are a guide and the joint does not have to be tightened using a torque wrench.

Dimension	Torque Nm
M5 .....	6
M6 .....	10
M8 .....	25
M10 .....	50
M12 .....	80
M14 .....	140

## Torquing with Protractor tightening (angle tightening)

When torquing with protractor (angle tightening), the fastener is tightened to a predetermined torque and then turned a predetermined angle. Example: a 90° protractor tightening means that the joint is tightened a further 1/4 turn in one operation after the stated torque has been applied.

## Lock nuts

Do not re-use lock nuts that have been removed during disassembly operations as these have reduced service life when re-used. For lock nuts with a plastic insert such as Nylock® the torque stated in the table is reduced if the Nylock® nut has the same head height as a standard hexagonal nut without plastic insert. Reduce the torque by 25% for bolt size 8 mm or larger. Where Nylock® nuts are higher, where the metallic thread is of the same height as a standard hexagonal nut, the torques given in the table apply.

## Strength classes

Bolts and nuts are divided up into different classes of strength; the class is indicated by the number on the bolt head. A higher number indicates stronger material. For example, a bolt marked 10-9 indicates a higher strength than one marked 8-8. It is therefore important that bolts removed during the disassembly of a bolted joint must be reinstalled in their original position when assembling the joint. If a bolt must be replaced check in the spare parts catalogue to make sure the correct bolt is used.

## Sealant

A number of sealants and locking liquids are used on the engines. The agents have varying properties and are used for different types of jointing strengths, operating temperature ranges, resistance to oil and other chemicals and for the different materials and gap sizes in the engines.

To ensure service work is correctly carried out it is important that the correct sealant and locking fluid type is used on the joint where the agents are required.

In this Volvo Penta Workshop manual the user will find that each section where these agents are applied in production states which type was used on the engine.

During service operations use the same agent or an alternative from a different manufacturer.

Make sure that mating surfaces are dry and free from oil, grease, paint and anti-corrosion agent before applying sealant or locking fluid.

Always follow the manufacturer's instructions for use regarding temperature range, curing time and any other instructions for the product.

Two different basic types of agent are used on the engine and these are:

### 1. RTV agent (Room temperature vulcanizing).

Used for gaskets, sealing gasket joints or coating gaskets. RTV is visible when a part has been disassembled; old RTV must be removed before resealing the joint.

The following RTV agents are mentioned in the Workshop manual: Loctite® 574, Permatex® No. 3, Permatex® No 77. Old sealant can be removed using denatured alcohol in all cases.

**2. Anaerobic agents.** These agents cure in an absence of air. They are used when two solid parts, for example cast components, are installed face-to-face without a gasket. They are also commonly used to secure plugs, threads in stud bolts, cocks, oil pressure switches etc. The cured material is glass-like and it is therefore colored to make it visible. Cured anaerobic agents are extremely resistant to solvents and the old agent cannot be removed. When reinstalling the part, degrease it carefully and then apply new sealant.

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

Note: Loctite® is a registered trademark of Loctite Corporation, Permatex® is a registered trademark of the Permatex Corporation.