

Operation & Maintenance Manual

GENERATOR DIESEL ENGINE

P158LE

P180LE

P222LE
















FOREWORD

This manual is designed to serve as an instruction for the Operation & Maintenance of generating-set engines of Daewoo POLUS series: P158LE /P180LE /P222LE. The POLUS means 'Power Plus' that is represented more powerful Daewoo generating-set engines and it is marked on engine name as an initial P.

The first half is for operation and the latter half is for maintenance like disassembling, inspecting and re-assembling etc in order to help an understanding for the maintenance procedure more easily.

To keep the best performance and the durability of engine for a long time, CORRECT OPERATION and PROPER MAINTENANCE are essential.

In this manual, the following symbols are used to indicate the type of service operations to be performed.

	Removal		Adjustment
	Installation		Cleaning
	Disassembly		Pay close attention-Important
	Reassembly		Tighten to specified torque
	Align the marks		Use special tools of manufacturer
	Directional Indication		Lubricate oil
	Inspection		Lubricate grease
	Measurement		

If you have any question or recommendation in connection with this manual, please do not hesitate to contact our head office, dealers or authorized service shops near by your location for any services. Also some figures in this manual may be different from the actual appearance of the engine because of explaining them with the representative figure among these models
For the last, the contents of this instruction manual may be changed without prior notice for some quality improvement. Thank you.

Nov. 2003

DAEWOO Heavy Industries & Machinery LTD.

www.enginepark.com

CONTENTS

1. SAFETY REGULATIONS	1
1.1. General Notes	
1.2. Regulations Designed to Prevent Accidents	1.4. Regulations Designed to Prevent Pollution
1.3. Regulations Designed to Prevent Damage to Engine and Premature Wear	1.5. Notes on Safety in Handling Used Engine Oil
2. GENERAL INFORMATION	5
2.1. Engine Assembly	2.3. Engine Model and Serial Number
2.2. Engine Specification	
3. TECHNICAL INFORMATION	13
3.1. Engines	3.6. Intercooler
3.2. Engine Lubrication	3.7. Cooling
3.3. Engine Cooling System	3.8. Air Cleaner
3.4. Fuel System	3.9. Electrical Equipment
3.5. Turbocharger	
4. COMMISSIONING AND OPERATION	21
4.1. Preparations	4.4. During Operation
4.2. Starting	4.5. Shutting Down
4.3. Running In	
5. MAINTENANCE AND CARE.....	24
5.1. Engine Lubrication	5.4. Cooling
5.2. Fuel System	5.5. Turbocharger
5.3. Injector Maintenance	5.6. Air Cleaner
6. CHECKING AND SETTING	39
6.1. Checking and Adjusting Injection Timing	6.3. Tightening Cylinder Head Bolts
6.2. Checking and Adjusting Valve Clearance	6.4. V-belts
7. OPERATION TIP	47
7.1. Periodic Inspection Cycle	7.3. Causes and Remedies
7.2. Troubleshooting	
8. MAINTENANCE INFORMATION	58
8.1. General Repair Instructions	8.3. Preventive Maintenance
8.2. Engine Characteristics	

9. DISASSEMBLY AND REASSEMBLY OF MAJOR COMPONENTS	67
9.1. Engine Disassembly	9.3. Re-assembly
9.2. Inspection	9.4. Breaking-In
10. MAINTENANCE OF MAJOR COMPONENTS.....	112
10.1. Cooling System	10.4. Turbocharger
10.2. Lubricating System	10.5. Installation
10.3. Fuel Injection Pump	
11. SPECIAL TOOL LIST	145
● Appendix.....	147
● Parts & After service center	
● Applications for Daewoo Engine	
● Worldwide Network	

1. SAFETY REGULATIONS

1.1. General Notes

Handling diesel engines and the necessary resources is no problem when the personnel commissioned with operation and maintenance are trained accordingly and use their common sense.

This summary is a compilation of the most important regulations, These are broken down into main sections which contain the information necessary for preventing injury to persons, damage to property and pollution. In addition to these regulations those dictated by the type of engine and its site are to be observed also.



IMPORTANT : If despite all precautions, an accident occurs, in particular through contact with caustic acids, fuel penetrating the skin, scalding from oil, antifreeze being splashed in the eyes etc, consult a doctor immediately.

1.2. Regulations Designed to Prevent Accidents

1.2.1. During commissioning, starting and operation

- Before putting the engine into operation for the first time, read the operating instructions carefully and familiarize yourself with the “critical” points, If you are unsure, ask your DHI representative.
- For reasons of safety we recommend you attach a notice to the door of the engine room prohibiting the access of unauthorized persons and that you draw the attention of the operating personal to the fact that they are responsible for the safety of persons who enter the engine room.
- The engine must be started and operated only by authorized personnel. Ensure that the engine cannot be started by unauthorized persons.
- When the engine is running, do not get too close to the rotating parts. Wear close-fitting clothing.
- Do not touch the engine with bare hands when it is warm from operation risk of burns.
- Exhaust gases are toxic. Comply with the instructions for the installation of DHI Diesel engines which are to be operated in enclosed spaces. Ensure that there is adequate ventilation and air extraction.
- Keep vicinity of engine, ladders and stairways free of oil and grease. Accidents caused by slipping can have serious consequences.

1.2.2. During maintenance and care

- Always carry out maintenance work when the engine is switched off. If the engine has to be maintained while it is running, e.g. changing the elements of change-over filters, remember that there is a risk of scalding. Do not get too close to rotating parts.
- Change the oil when the engine is warm from operation.



CAUTION : There is a risk of burns and scalding. Do not touch oil drain plug or oil filters with bare hands.

- Take into account the amount of oil in the sump. Use a vessel of sufficient size to ensure that the oil will not overflow.
- Open the coolant circuit only when the engine has cooled down. If opening while the engine is still warm is unavoidable, comply with the instructions in the chapter "Maintenance and Care".
- Neither tighten up nor open pipes and hoses (lube oil circuit, coolant circuit and any additional hydraulic oil circuit) during the operation. The fluids which flow out can cause injury.
- Fuel is inflammable. Do not smoke or use naked lights in its vicinity. The tank must be filled only when the engine is switched off.
- When using compressed air, e.g. for cleaning the radiator, wear goggles.
- Keep service products (anti-freeze) only in containers which can not be confused with drinks containers.
- Comply with the manufacturer's instructions when handling batteries.



CAUTION : Accumulator acid is toxic and caustic. Battery gases are explosive.

1.2.3 When carrying out checking, setting and repair work

- Checking, setting and repair work must be carried out by authorized personnel only.
- Use only tools which are in satisfactory condition. Worn open-end wrench slip. which could lead to Injury.
- When the engine is hanging on a crane, no-one must be allowed to stand or pass under it. Keep lifting gear in good condition.
- When working on parts which contain asbestos, comply with the notes at the end of this chapter.
- When checking injectors do not put your hands under the jet of fuel. Do not inhale atomized fuel.
- When working on the electrical system disconnect the battery earth cable first. Connect it up again last in prevent short circuits.

1.3. Regulations Designed to Prevent Damage to Engine and Premature Wear

- 1) Never demand more of the engine than it was designed to yield for its intended purpose.
 - Detailed information on this can be found in the sales literature. The injection pump must not be adjusted without prior written permission of DHI.
- 2) If faults occur, find the cause immediately and have it eliminated in order to prevent more serious of damage.
- 3) Use only genuine DHI spare parts. DHI will accept no responsibility for damage resulting from the installation of other parts which are supposedly “just as good”.
- 4) In addition to the above, note the following points.
 - Never let the engine run when dry, i.e. without lube oil or coolant.
 - Use only DHI-approved service products (engine oil , anti-freeze and anticorrosion agent).
 - Pay attention to cleanliness. The Diesel fuel must be free of water. See “Maintenance and care”
 - Have the engine maintained at the specified intervals.
 - Do not switch off the engine immediately when it is warm, but let it run without load for about 5 minutes so that temperature equalization can take place.
 - Never put cold coolant into an overheated engine. See “Maintenance and care”.
 - Do not add so much engine oil that the oil level rises above the max. marking on the dipstick. Do not exceed the maximum permissible tilt of the engine. Serious damage to the engine may result if these instructions are not adhered to.
 - Always ensure that the testing and monitoring equipment (for battery charge, oil pressure, coolant temperature) function satisfactorily.
 - Comply with instructions for operation of the alternator. See “Commissioning and operation”.
 - Do not let the raw water pump run dry, If there is a risk of frost, drain the pump when the engine is switched off.

1.4. Regulations Designed to Prevent Pollution

1.4.1. Engine oil, filter elements, fuel filters

- Take old oil only to an oil collection point.
- Take strict precautions to ensure that oil does not get into the drains or into the ground. The drinking water supply could be contaminated.
- Filter elements are classed as dangerous waste and must be treated as such.

1.4.2. Coolant

- Treat undiluted anti-corrosion agent and / or antifreeze as dangerous waste.
- When disposing of spent coolant comply with the regulations of the relevant local authorities.

1.5. Notes on Safety in Handling Used Engine Oil

Prolonged or repeated contact between the skin and any kind of engine oil decreases the skin. Drying, irritation or inflammation of the skin may therefore occur. Used engine oil also contains dangerous substances which have caused skin cancer in animal experiments. If the basic rules of hygiene and health and safety at work are observed, health risks are not to the expected as a result of handling used engine oil



Health precautions ;

- Avoid prolonged or repeated skin contact with used engine oil.
- Protect your skin by means of suitable agents (creams etc.) or wear protective gloves.
- Clean skin which has been in contact with engine oil.
 - Wash thoroughly with soap and water, A nailbrush is an effective aid.
 - Certain products make it easier to clean your hands.
 - Do not use petrol, Diesel fuel, gas oil, thinners or solvents as washing agents.
- After washing apply a fatty skin cream to the skin.
- Change oil-soaked clothing and shoes.
- Do not put oily rags into your pockets.



Ensure that used engine oil is disposed of properly.

- Engine oil can endanger the water supply -

For this reason do not let engine oil get into the ground, waterways, the drains or the sewers.

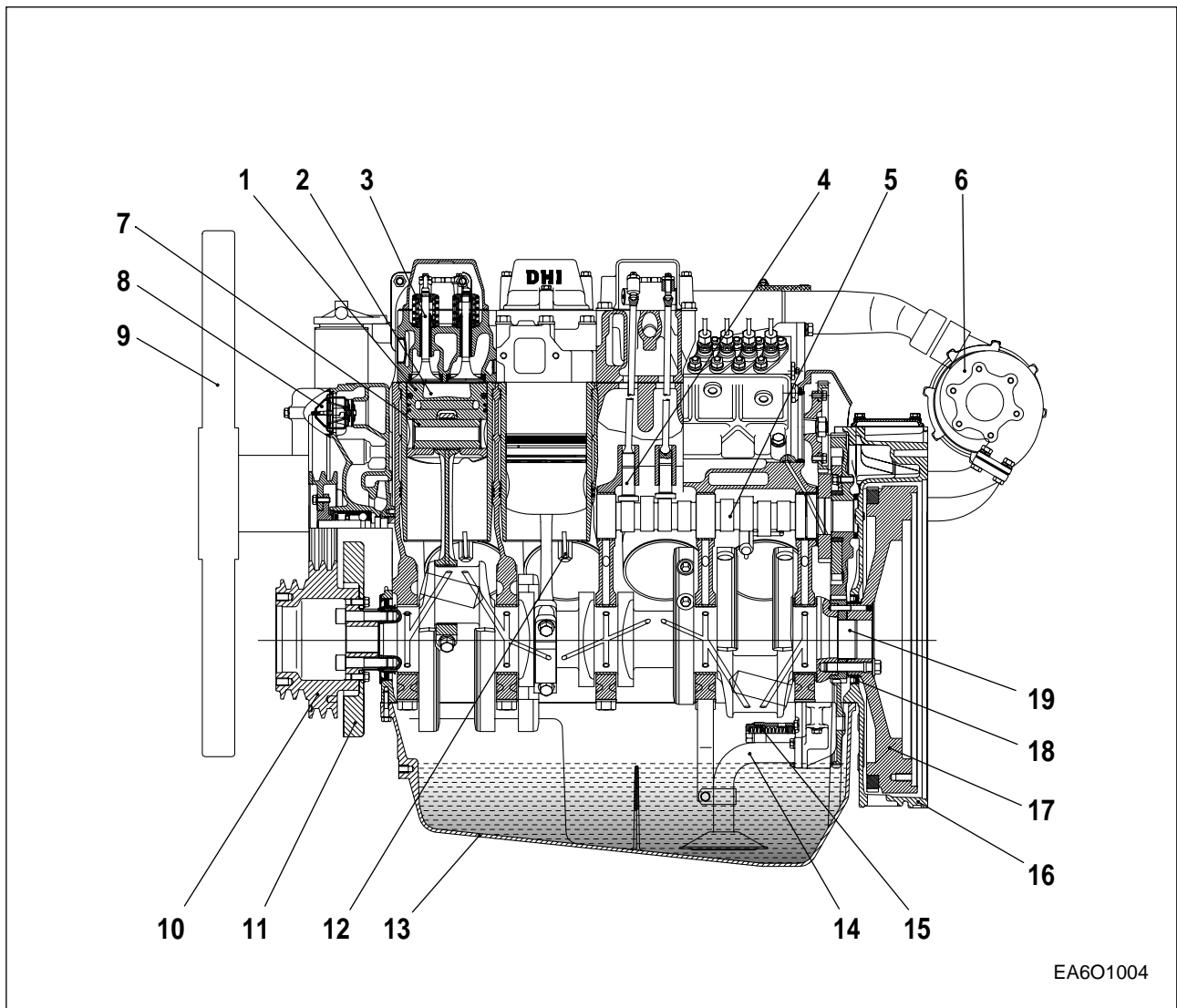
Violations are punishable.

Collect and dispose of used engine oil carefully. For information on collection points please contact the seller, the supplier or the local authorities.

2. GENERAL INFORMATION

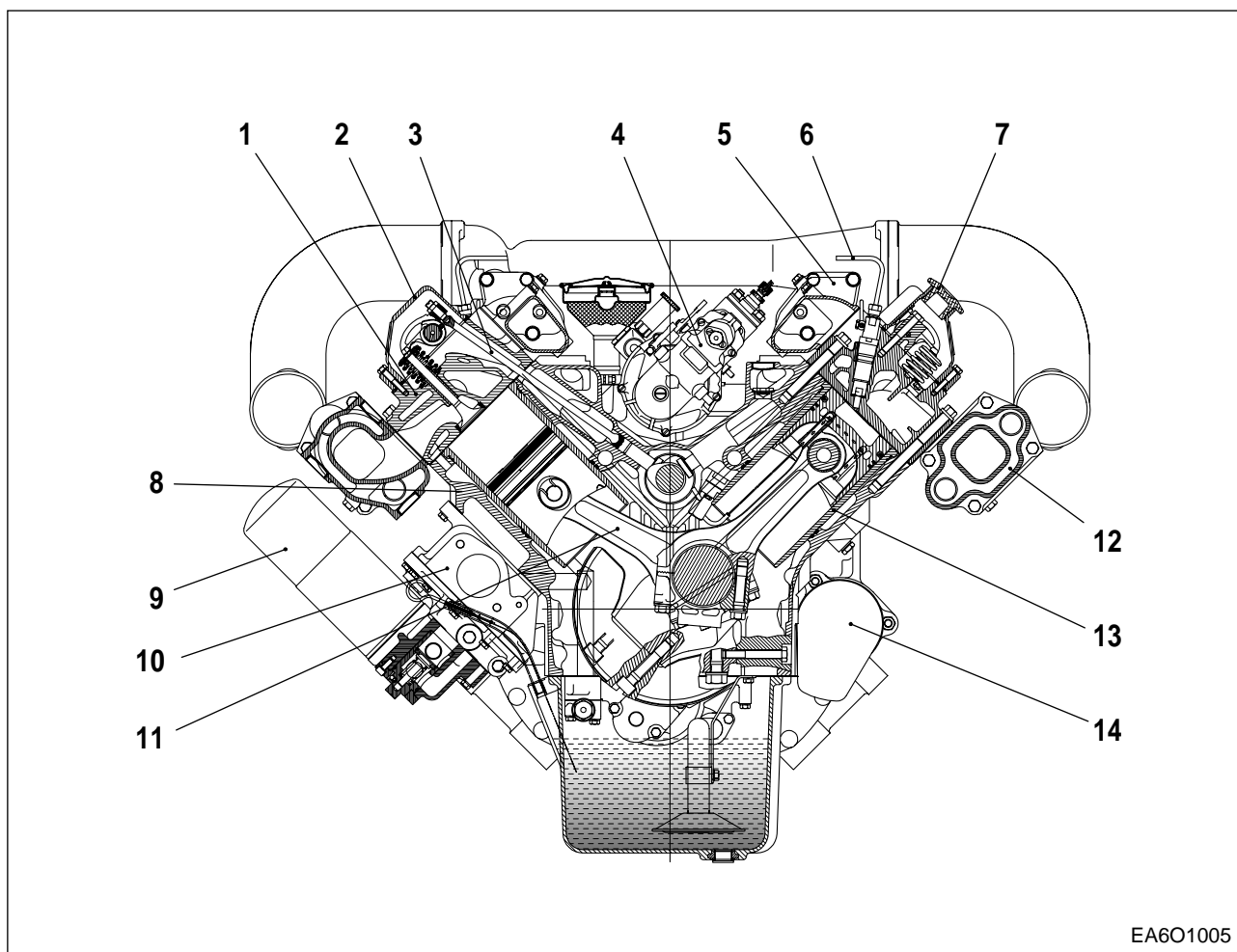
2.1. Engine Assembly

2.1.1. Engine sectional view (Longitudinal)



- | | |
|------------------------|---------------------------|
| 1. Piston | 11. Vibration damper |
| 2. Combustion chamber | 12. Oil spray nozzle |
| 3. Valve | 13. Oil pan |
| 4. Tappet | 14. Oil suction pipe |
| 5. Cam shaft | 15. Oil pump relief valve |
| 6. Turbocharger | 16. Flywheel housing |
| 7. Piston pin | 17. Flywheel |
| 8. Thermostat | 18. Oil seal |
| 9. Cooling fan | 19. Crank shaft |
| 10. Crank shaft pulley | |

2.1.2. Engine sectional view (Cross)



- | | |
|------------------------|----------------------|
| 1. Cylinder head | 8. Cylinder block |
| 2. Cylinder head cover | 9. Oil filter |
| 3. Push rod | 10. Oil cooler |
| 4. Injection pump | 11. Connecting rod |
| 5. Intake manifold | 12. Exhaust manifold |
| 6. Injection pipe | 13. Cylinder liner |
| 7. Oil filler cap | 14. Starter |