



HANDLEIDING

# Prins Boxer –III

## Table of Contents

|                                                   |           |
|---------------------------------------------------|-----------|
| <b>1. FOREWORD.....</b>                           | <b>3</b>  |
| <b>2. IMPORTANT.....</b>                          | <b>4</b>  |
| <b>3. GENERAL SAFETY REGULATIONS .....</b>        | <b>5</b>  |
| <b>4. PARTS OVERVIEW .....</b>                    | <b>8</b>  |
| <b>5. OPERATING THE FORKLIFT .....</b>            | <b>9</b>  |
| <b>5.1 Starting and stopping the engine .....</b> | <b>9</b>  |
| <b>5.2 Moving and stopping the forklift.....</b>  | <b>11</b> |
| <b>5.3 Optional.....</b>                          | <b>13</b> |
| <b>5.4 Settings .....</b>                         | <b>14</b> |
| 5.4.1 Steering column adjustment .....            | 14        |
| 5.4.2 Seat Setting.....                           | 14        |
| <b>5.5 Loading and unloading of goods .....</b>   | <b>15</b> |
| <b>6. MAINTENANCE OF THE FORKLIFT .....</b>       | <b>16</b> |
| <b>6.1 The drive .....</b>                        | <b>16</b> |
| <b>6.2 The engine .....</b>                       | <b>18</b> |
| 6.2.1 Engine .....                                | 18        |
| 6.2.2 Cooling water system.....                   | 19        |
| 6.2.3 Fuel filter .....                           | 20        |
| 6.2.4 Air filter .....                            | 22        |
| 6.2.5 Battery.....                                | 23        |
| 6.2.6 Fan belt.....                               | 24        |
| <b>6.3 The Hydraulic System.....</b>              | <b>25</b> |
| <b>6.4 Other maintenance.....</b>                 | <b>26</b> |
| 6.4.1 Sleep mode.....                             | 27        |
| <b>7. OVERVIEW OF MAINTENANCE INTERVALS .....</b> | <b>28</b> |
| <b>8. FAILURE ANALYSIS .....</b>                  | <b>29</b> |
| <b>8.1 Vehicle.....</b>                           | <b>29</b> |
| <b>8.2 Engine.....</b>                            | <b>29</b> |

## 1. Foreword

We thank you for the purchase of this Prins Boxer III forklift truck from Prins. In this manual you will find all the important data you need when operating and maintaining your forklift. Before using the forklift, we recommend that you read this manual very carefully. Let other users read the manual as well. After studying this manual, keep it in a place where you can easily find it, so that you always have information about maintenance, defects and the like.

If you want to order parts for your Prins forklift, or if you have any questions and/or comments about the forklift, please contact Prins.

When you call us, you will always be asked for the **service number** and **serial number** of your forklift. These are listed on the plates mounted in the top left and right corner of the dashboard. Please keep it at hand at all times when you call us.

We wish you the best of luck with the use of your new forklift.

**Prins**

## 2. Important

This manual contains important information regarding the correct and safe use of your forklift. Always follow the instructions given in this manual.

You will find the symbol below in various places in this manual:



***Please note!:*** Important information.

If you see this symbol, always read carefully what is written next to the symbol before you start the action. This concerns information regarding your personal safety and the safety of others. Always be alert to dangerous situations.



### 3. General Safety Regulations



When working with and performing maintenance on the forklift, you should always be aware of the dangers that can be involved. Pay close attention to the safety rules. Failure to do so may result in serious bodily injury to you or others.

The manufacturer cannot foresee every unsafe situation. As a user, you must therefore also ensure your own and other people's safety during the use and maintenance of the forklift. Always use the tools and products recommended by the manufacturer and use only original parts when repairing.

#### **For your own and others' safety:**

- Never overload the forklift above the maximum permitted lifting weight.
- Pay close attention to the load diagram on the bonnet of your forklift.
- In the unlikely event that you are forced to take the load on one fork, keep in mind that the maximum load is halved. However, try to avoid this as much as possible.
- When driving with a load, keep your speed low (never top speed!) and keep the load as low as possible above the ground. Think of 10 to 20 cm.
- When the load is lifted, keep the speed as low as possible and pay attention to the headroom of the forklift.
- Always carry out the necessary preventive checks on the forklift before working with it. Never start working with the forklift truck until you have fully checked it. This prevents accidents. Pay particular attention to the tires, battery, brakes, steering, fuel system and electrical components.
- Never add fuel while the engine is running. During refueling or changing / topping up oil, smoking is not allowed and there may be no fire and sparks in the immediate vicinity. Explosive gases are released during refueling.
- After refueling or oil change/topping up, always remove spilled liquid from the forklift.
- Before refueling or oil change/topping up, check the machine for oil or fuel stains and check where they are coming from. If they are the result of a technical defect, repair this first before working with the forklift.
- When exiting the forklift, always apply the handbrake and put the gearbox in the neutral position.

- An incorrect sitting posture can lead to accidents. Therefore, always adjust the seat in such a way that you can operate all levers properly and that you have a good view.
- Never work with a forklift without a safety cage or roll bar (as supplied as standard).
- Always wear a seat belt when using the forklift.
- Always drive at a speed that gives you good control of the forklift. Speeding can be dangerous. Sudden braking, accelerating or turning can also cause a dangerous situation.
- When working in places with limited clearance height and where you have to drive in and out, keep the following things in mind:
  - Always check that there is enough space next to and above the forklift.
  - Always keep all parts of the body within the safety cage, hands on the handlebars and your feet on the pedals.
  - Be careful where you drive.
- Operate the levers calmly. This significantly extends the lifespan of your forklift and is much safer.
- Never allow people to walk under the forks with load. This is very dangerous.
- Never let anyone ride on the forklift or use the forks to lift anyone.
- Always lower the load slowly and do this with a horizontal fork or with a slightly backward sloping fork. Never do this with a fork that slopes forward.
- The condition of the machine can be checked by numerous factors. Changes in noise, vibration, or reactions to control levers can be indicative of defects or flaws. If you suspect a defect, immediately pull over the forklift and stop the engine. Check the cause and take the necessary measures.

**Table 3.1 | Meaning of safety symbols**

|                                                                                     |                                                 |                                                                                      |                                                    |
|-------------------------------------------------------------------------------------|-------------------------------------------------|--------------------------------------------------------------------------------------|----------------------------------------------------|
|  | <b>Follow the directions for use and safety</b> |  | <b>Wear safety goggles and protective clothing</b> |
|  | <b>Smoking and open flames prohibited</b>       |  | <b>Electrolyte is highly corrosive</b>             |

|                                                                                   |                                            |                                                                                    |                                                                            |
|-----------------------------------------------------------------------------------|--------------------------------------------|------------------------------------------------------------------------------------|----------------------------------------------------------------------------|
|  | Connectors under tension, avoid contact    |  | Areas where batteries are located or charged must be adequately ventilated |
|  | Risk of explosion, avoiding short circuits |                                                                                    |                                                                            |

## 4. Parts overview

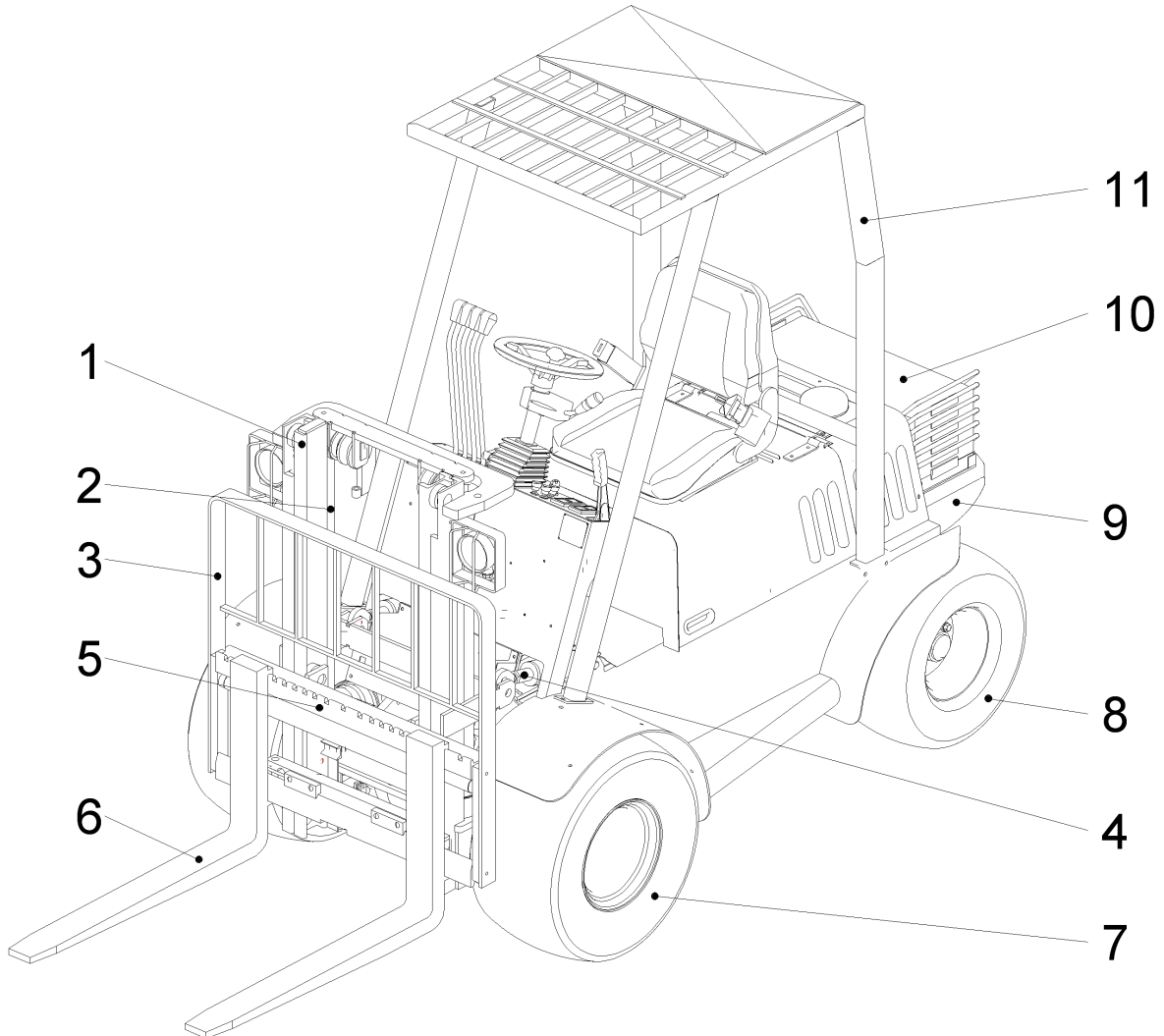


**Figure 4.1 | Overview**

- 1 – Lifting mast
- 2 – Lifting cylinder
- 3 – Welding Strain
- 4 – Tilt cylinder
- 5 – Fork carriage
- 6 – Forks
- 7 – Front wheel
- 8 – Rear (steering) wheel
- 9 – Counterweight
- 10 – Ballast plates
- 11 – Safety cage

## 5. Operating the Forklift

### 5.1 Starting and stopping the engine

1. Before starting the engine, the sink pedal must be fully depressed. Make sure that the gear lever on the left side of the steering wheel is in the neutral position (see Figure 5.1)

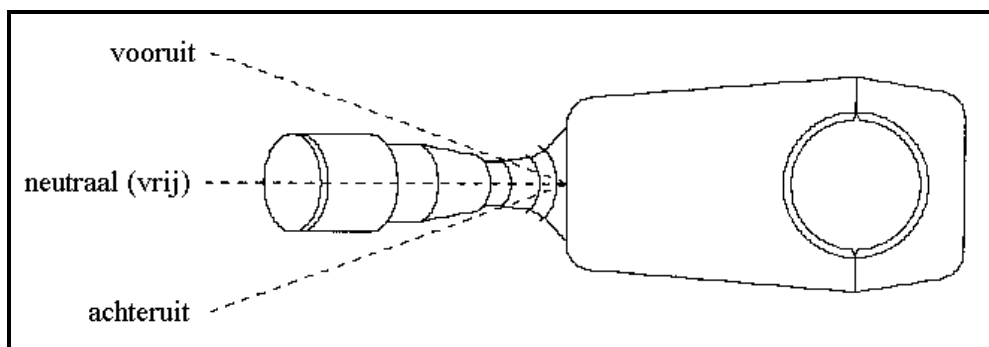


Figure 5.1 | Gear lever

2. Turn the ignition key to the "ON" position. If all goes well, 2 lights will now come on, namely that of oil pressure and that of the battery.

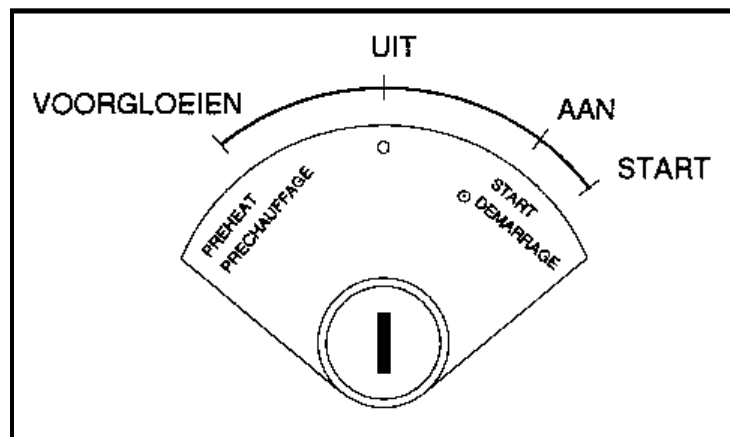


Figure 5.2 | The contact

3. When both lights are on, the ignition key must be turned back from "OFF" to "PREHEAT". When the pre-heating light goes out, the ignition key can be turned to "START" and the engine will start.



**Please note!:** The pre-glow light is adjusted to about 6 seconds. At very low temperatures, it is desirable to pre-heat for longer than 6 seconds. In Table 5.1 shows how long to continue preheating after the light has gone out.

**Table 5.1 | Pre-heating times**

| Temperature                            | Extra pre-heating time |
|----------------------------------------|------------------------|
| above 10°C                             | Not necessary          |
| between -5°C and 10°C                  | About 5 sec.           |
| below -5°C                             | About 10 sec.          |
| Maximum continuous preheating interval | 20 sec.                |

4. Do not start the engine within 10 seconds, then turn the ignition key back to "OFF" and wait 30 seconds before attempting again. Start each new attempt from step 1.



**Caution!:** Never leave the starter motor in continuous operation for more than 20 seconds.

5. After starting the engine, check that the oil pressure and charging light has gone out. If this is **not** the case, switch off the engine immediately and investigate the following possible causes.

Oil pressure light stays on:

- Is the oil level up to standard?
- Is there no dust or other contaminants in the crankcase oil?
- Is there no short circuit and are there no other wiring defects?

Charging light stays on:

- Is the battery charged?
- Is the battery acid level up to standard?
- Is there no short circuit and are there no other wiring defects?

If you have checked all these items and found no defects, please contact your dealer.

6. If the engine is cold, it will run a bit erratically. As the engine heats up, it will run more regularly. Let the engine come up to temperature by running the engine at half throttle without load.

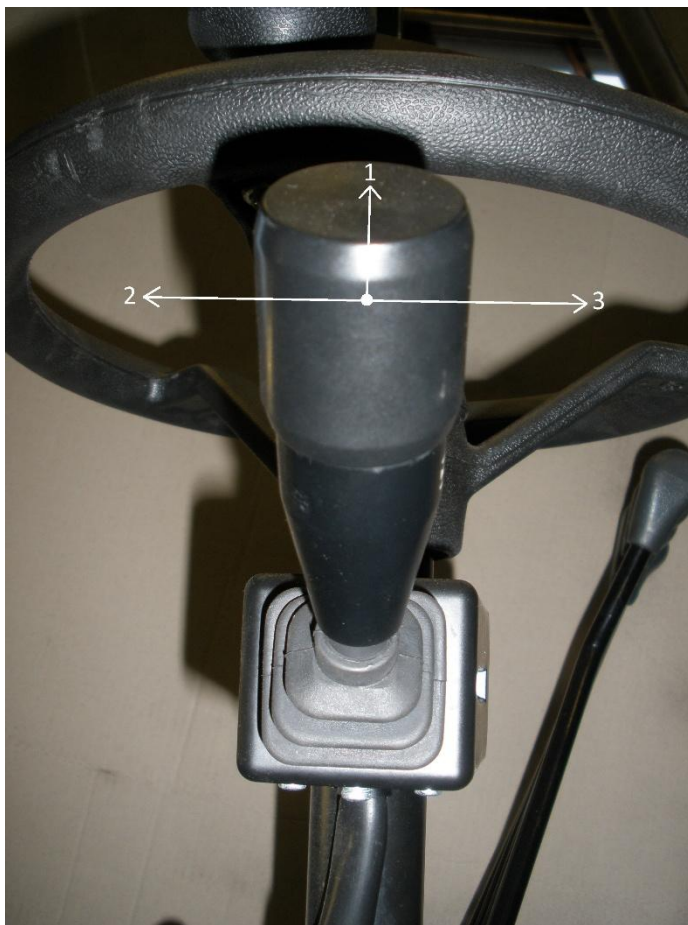
7. If you want to stop the engine, make sure that the gear lever on the left side of the handlebar is in neutral position. Also make sure that the forks of the forklift are resting on the ground (this is to avoid unnecessary strain on the lifting cylinders and to prevent accidents). Turn the ignition key to "OFF".



**Caution!:** Before getting off the forklift, the gear lever must be in neutral and the handbrake must be applied. Now it is safe to get off the forklift.

## 5.2 Moving and stopping the forklift

The Prins Sprinter is equipped with a hydrostatic drive that enables fully automated driving. The direction of travel can be selected by means of a direction selector switch on the steering column.



1. Horn
2. Forward
3. Backwards

Figure 5.3 | Direction selector switch

Lift the direction selector slightly and move it forwards or backwards to select the direction of travel forward or backward respectively. By now pressing the accelerator pedal, the machine will move in the desired direction. If you need to change direction, the machine must first be stopped and the switch can be moved in the desired direction.

To be able to choose between extra speed and extra pulling power, the machine is equipped with two gears. The choice between the two gears can be made by means of a rotary shift on the steering column. It is not necessary to pull away in first gear. It is recommended to determine which gear is desired and to choose it before starting off. First gear can always be selected as standard. The maximum pulling force is then available. This results in the best driving characteristics and the most consistent driving speed.

If long distances have to be driven and the load will not be maximum, you can opt for second gear. The driving speed will be higher. Make sure that the conditions, such as the condition of the surface, allow this higher speed.

It is possible to choose between the two gears while driving slowly. Always release the accelerator pedal when shifting gears. During gear changes, a shock may occur in the drive. This will not harm the machine, but keep in mind that it may affect the load.

The two gears are indicated on the central dashboard by a symbol of a hare and a turtle respectively.

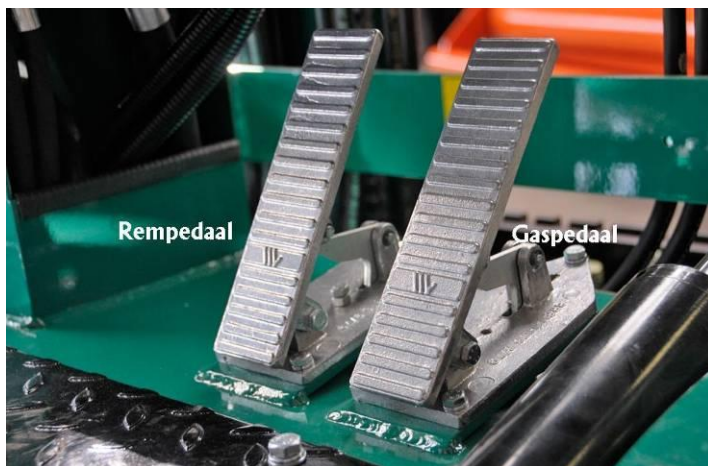


**Figure 5.4 | Pedals**

To bring the forklift to a stop, release your accelerator pedal and press the brake pedal in a controlled manner until the forklift has come to a complete stop. When the truck has come to a complete stop, move the gear lever to neutral. The Prins Sprinter with automatic transmission is equipped with an "inching" pedal as standard.

The machine is equipped with an electrically operated parking brake. The switch on the dashboard switches it on and off. A signal light on the central dashboard indicates when the parking brake is engaged.

When leaving the forklift, the forks must always be fully lowered and the parking brake must be applied. The machine cannot move away with the parking brake engaged.

When leaving the forklift, the forks must always be fully lowered and the parking brake must be applied. The machine cannot move away with the parking brake engaged.



1. Light for
2. Rear light
3. Accumulator
4. Gear selector
5. Ignition switch
6. Parking brake switch

**Figure 5.5 | Overview Dashboard**

## 5.3 Optional

The machine can optionally be equipped with an accumulator. This is switched on by means of the switch shown in figure 5.5

The accumulator serves as a shock absorber for the load that is transported with the forklift. For correct operation, the accumulator must be adjusted to the weight of the load being transported. Consult the technical service of Prins or your dealer for this.

In the event of an overload, the accumulator may suffer irreparable damage. If you drive unloaded or if you are transporting loads that are substantially greater (more than 25%) than the load to which the accumulator is adjusted, always switch off the accumulator. The accumulator must also be switched off for accurate positioning of the load.

In occasional cases, the position of the switch of the accumulator can be taken by that of another optional function. Make sure that the optional equipment of the machine is available before operating and using it.

## 5.4 Settings

Before starting the machine, the correct sitting position must first be adopted.

### 5.4.1 Steering column adjustment

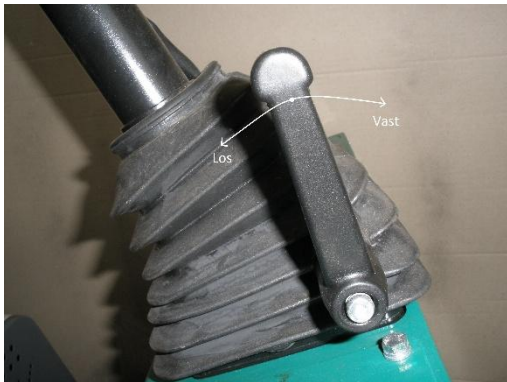


**Figure 5.6 | Steering column operation**

Turn the handle as indicated in Figure 5.6 and adjust the steering column to a comfortable position. Then tighten the lever again by moving the lever upwards.

### 5.4.2 Seat Setting

With the standard chair, the adjustment can take place in the longitudinal direction if the angle of the backrest can be adjusted. In Figure 5.7 the adjustment options are displayed. Adjust the chair in such a way that a comfortable and safe sitting position is obtained.



**Figure 5.7 | Seat adjustment**

## 5.5 Loading and unloading of goods



**Caution!:** Always make sure that the load is properly stacked and balanced. Falling cargo may result in injury to yourself or others.

1. Place the forklift right in front of the goods to be unloaded. Make sure that the load is evenly distributed among the forks.
2. Make sure the mast doesn't lean backwards or forwards, then bring the forks to the correct height.
3. Drive forward slowly until the load meets the welding rack. Then lift the load 5 to 10 cm. It may be that the load is not completely on the edge of the trailer or from the warehouse rack. In this case, insert the forks as far as possible and then lift them up a bit.



**Caution!:** Make sure to lift the load so that it does not tip forward. Therefore, always make sure that the forks are inserted at least 2/3 – 3/4 into the load (depending on the weight of the load)

4. Then drive back a little bit until the load is positioned in such a way that it can be taken entirely on the forks. Put the load down again and then insert the forks all the way into the load until it meets the welding rack and lift the load up 5 to 10 cm.
5. Lower the forks with load to just above the ground (think 10 to 20 cm).
6. Incline the mast backwards to the maximum and drive backwards carefully.
7. Drive the load to the desired location.



**Caution!:** Brake and steer with extreme caution with load on the forks. Sudden changes in speed and direction can lead to a toppling load.

8. Once you have arrived at the desired location, make sure that the forks are in a vertical position so that the load is parallel to the unloading area.
9. Lower the load to about 5 cm above the unloading area. Drive forward slowly and put the load down 10 to the final place. 20 cm

10. Then drive the same 10 to 20 cm backwards and lift the load again approximately upwards and finally put it down in the correct position (the latter is to prevent that, if the forks protrude from the load at the front, the ends of the forks cause damage to obstacles in front of the forklift that cannot be seen by the forklift driver due to the presence of cargo on the forks).5 cm

## 6. Maintenance of the forklift

It is very important for your forklift to be well maintained. A well-maintained forklift will last considerably longer. Therefore, Prins strongly recommends that you carry out the matters that will be covered in this manual strictly and with care.

This manual will give indications when these actions should be performed. The prescribed times, indicated in hours, are the operating hours of the forklift, which can be found on the hour meter on the dashboard. The indications given are the times when used under normal conditions. Under harsh or extreme conditions, it may be necessary to perform certain activities more often.



**Caution!:** Only carry out the operations covered in this manual if you are aware of the work procedure to be carried out. And are aware of the safety regulations and the dangers that can arise if you ignore them. If you are not or too little aware of the regulations, have your dealer or the technical department of Prins carry out the work.

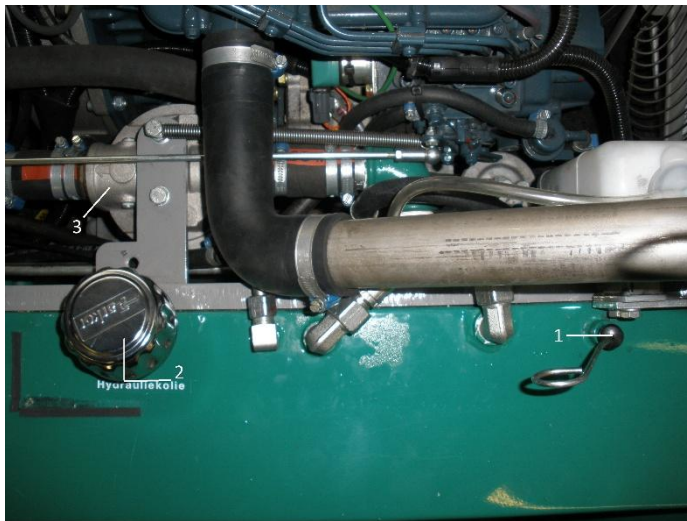
### 6.1 The drive

The Prins Sprinter is equipped with a so-called hydrostatic drive. This means that the drive is done by means of hydraulic oil, by means of a pump and a motor. For proper functioning and long life, it is extremely important that the oil is kept in top condition. Please follow the instructions below carefully. Failure to monitor or contaminate the system can lead to serious shortening of the lifespan or expensive repairs.

It is expressly advised that work on the hydraulic system should only be carried out by Prins.

#### **During break-in time (first 50 hours):**

1. After every 10 hours of operation, check the oil level of the transmission with the oil dipstick (see No. 1 in Figure 6.1). If necessary, top up with oil (see No. 2 in Figure 6.1).



1. Oil level stick
2. Oil filler opening
3. Oil filter

**Figure 6.1 | Hydraulic oil**



**Caution!:** Perform the check when the engine is idling and the oil is at working temperature.

2. The transmission should be checked regularly for oil leaks.

**After entry time (after 50 hours):**

- Replace oil filter (see No. 3 in Figure 6.1).

**Periodically:**

Every 200 hours:

- Check the oil level of the transmission and top up if necessary.

Every 500 hours:

- Replace oil filter.

Every 1000 hours of runtime:

- Change the oil in the transmission.



**Please note!:** If the duration is less than 1000 hours on an annual basis, the oil change must take place every two years.



**Caution!:** When working on the hydraulic system or checking the oil level, absolutely no dirt must enter the tank or oil. The smallest dirt particle can cause damage.

## Oil change data

### Contents

Tank: 70 litres

## The engine

### 6.1.1 Engine

The engine of your new Prins forklift truck also needs a break-in time. This takes about 50 hours. Here are the actions necessary to keep your forklift's engine in optimal condition and prevent problems. On Page 28 **Fout! Bladwijzer niet gedefinieerd.** you will find a table that lists all actions related to the maintenance of the forklift.

#### **During break-in time:**

1. Regularly check the oil level in the crankcase of the engine with the oil level tape measure. If necessary, top up with oil (even after the break-in time)



**Caution!:** Carry out the check before starting the engine or at least 5 minutes after switching off the engine.

2. The engine should be checked regularly for oil leaks.

#### **After run-in time:**

1. Replace the oil filter

#### **Replacing the oil filter:**

- Remove the old filter using a filter key
- Apply a film of oil to the gasket of the new filter
- Manually tighten the filter
- After the filter is installed, the oil level generally drops a little. First check that the filter is not leaking and then check the oil level and top up oil if necessary

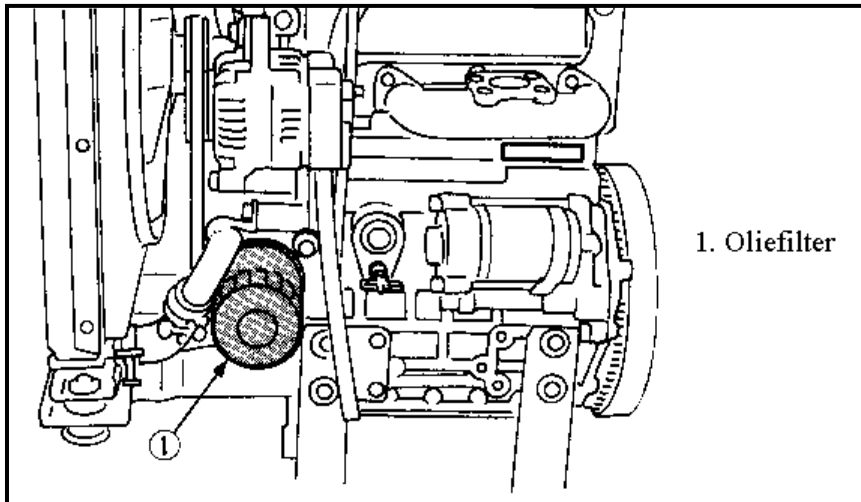


**Figure 6.2 | Oil filter**

2. Change the oil. First drain the old oil from the crankcase through the drain at the bottom of the engine.

**Periodically:**

Every 200 hours of runtime:

1. Replace the oil filter
2. Change the oil.

**Oil change data**

Contents

Crankcase: 5 litres

Oil

ELF Multiperformance 3C 15W40 or  
 Corresponding to specifications MIL-L-2104C or  
 API classification, CD level or higher

## 6.1.2 Cooling water system

It is important that the coolant level is at the right level. If this is not the case, the motor will overheat, leading to damage. Therefore, check the coolant level every day.

To do this, perform the following operations.



**Caution!:** Always wait until the engine has cooled down before opening the coolant reservoir.

1. Carefully open the valve slightly and first let air escape against any overpressure.
2. Then remove the shut-off valve completely and check that the coolant reaches the edge.
3. If necessary, top up coolant.
4. Tighten the shut-off valve properly after topping up coolant.

#### Coolant

ELF COOLELF

### 6.1.3 Fuel filter

The fuel filter should be replaced at least once every six months.

#### **Venting the fuel system**

To prevent damage to the engine or its parts, it is sometimes necessary to bleed it.



**Caution!:** Never bleed the fuel system when the engine is still warm. This may create a risk of explosion or fire. Toxic fumes can also be released by evaporating fuel.

When is venting necessary?

- If one or more fuel system pipes have been loose
- If the fuel tank has been completely empty
- If the engine has not been in operation for a long time

The venting process goes as follows:

1. Fill the fuel tank with fuel
2. Open the fuel tap attached to the fuel filter
3. Loosen the 2 bleeder bolts on top of the fuel filter
4. Wait for fuel to seep through the vents and retighten the vent bolts

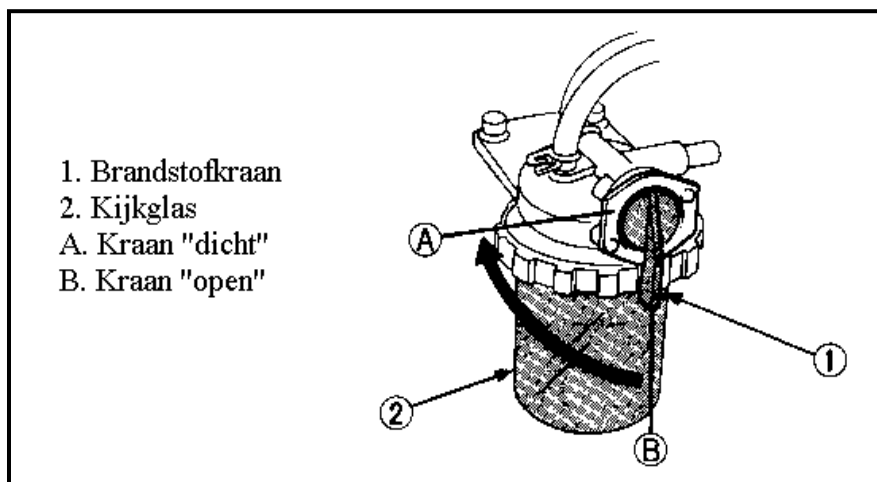


Figure 6.3 | Fuel filter

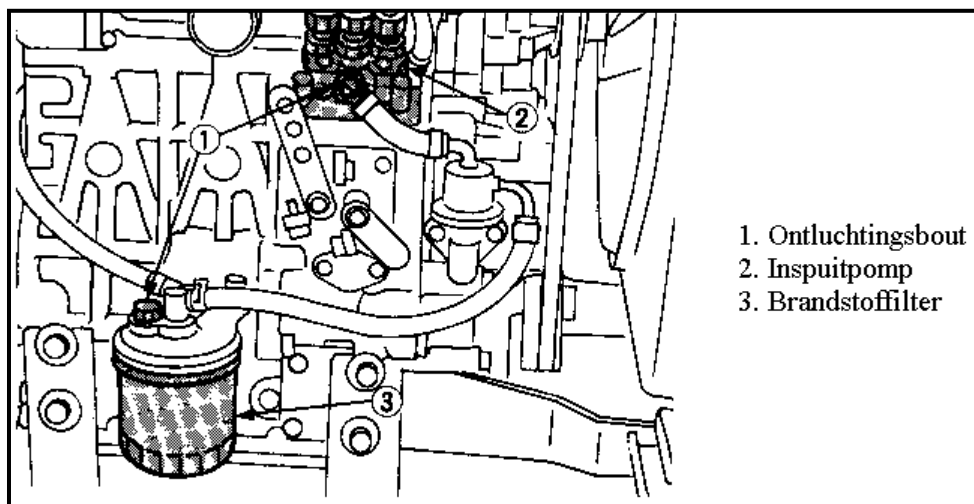


Figure 6.4 | Fuel filter in engine block

## 6.1.4 Air filter

The air filter is used to filter the air sucked in for the engine. This is a dry filter that is not suitable for use with oil. The filter should be replaced once every six months. It is permissible to blow the filter clean if necessary. However, it must always be blown from the inside to the outside with a maximum air pressure of 7 bar.

It is extremely important that when the filter element is placed back in the filter housing, the filter element is properly secured. If it vibrates loosely while the engine is running, dust will get into the engine. This will result in damage to the engine (see Figure 6.5 and Figure 6.6).

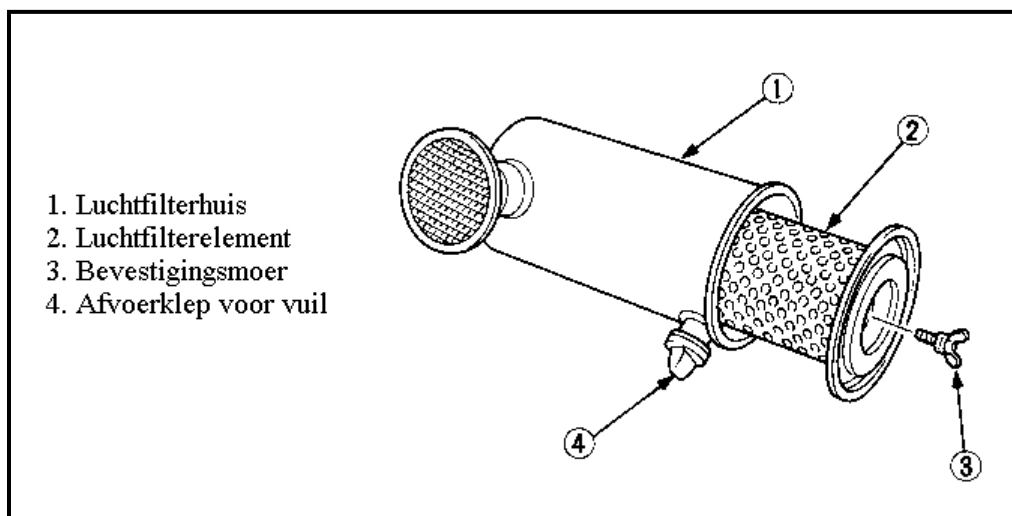


Figure 6.5 | Air filter

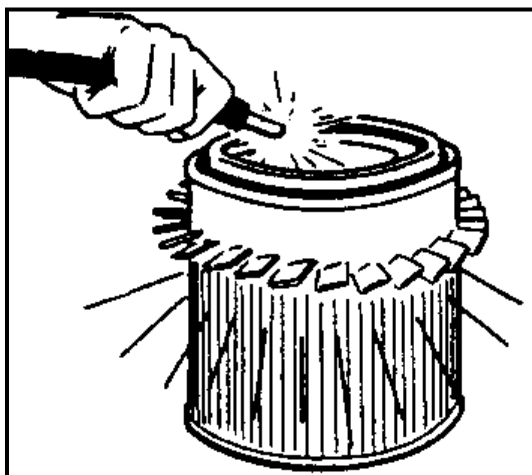


Figure 6.6 | Hose down air filter element

## 6.1.5 Battery

Electrical energy is needed for the starter motor of the forklift, among other things. This is provided by the battery which in turn is charged by the alternator, which is driven via the output shaft of the engine. The battery may not work properly for a variety of reasons. One of the reasons may be that the connection of the wiring to the battery is not good. This can be due to rust, for example. Therefore, always grease the piles with, for example, petroleum jelly to prevent rust.

Another cause may be that the level of battery acid in the battery is too low. To remedy this, you need to top up the battery with distilled water. For that the following actions.



**Caution!:** Do not touch the electrolyte of the battery! The diluted sulfuric acid solution burns the skin and makes holes in clothing. In case of accident, rinse immediately with running water.

1. Remove the protective cover from the battery
2. Next, first detach the MIN pole
3. Then disconnect the PLUS pole
4. Turn the filler opening and check the liquid level and refill it if necessary (see Figure 6.7 and Figure 6.8)
5. When reconnecting the battery, the PLUS terminal must be fixed first and then the MIN terminal

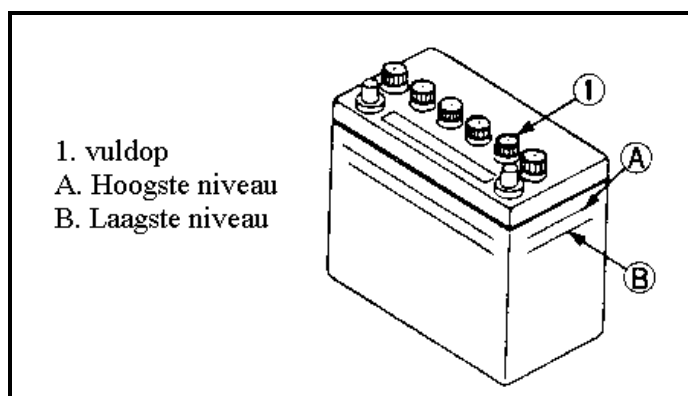


Figure 6.7 | The battery

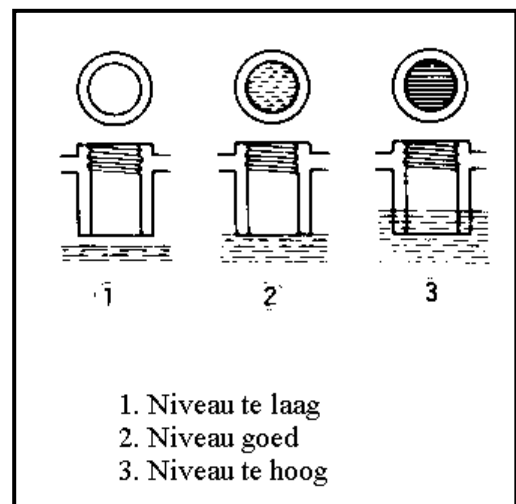


Figure 6.8 | The level of battery acid

## 6.1.6 Fan belt

The fan belt or V-belt takes care of the drive of the fan and the alternator. If it is not sufficiently tense, it will slip. As a result, the fan, which cools the engine block, cannot function properly. This causes the engine to overheat. The same applies to the alternator. This cannot function properly either, so the battery does not get sufficiently charged. This can cause problems when starting, among other things. Therefore, always make sure that the V-belt is properly tensioned. This is pretty easy to check.



**Caution!:** Always make sure the motor is off when checking the V-belt.

1. Take the piece of V-belt between the alternator and the motor shaft. Press your finger on the center of the belt. The deviation of the V-belt from the rest position may not be less than 7 mm and not more than 9 mm.
2. If this is the case, unscrew the two mounting bolts of the alternator.
3. Position the alternator so that the V-belt has the correct tension and screw the bolts back on.

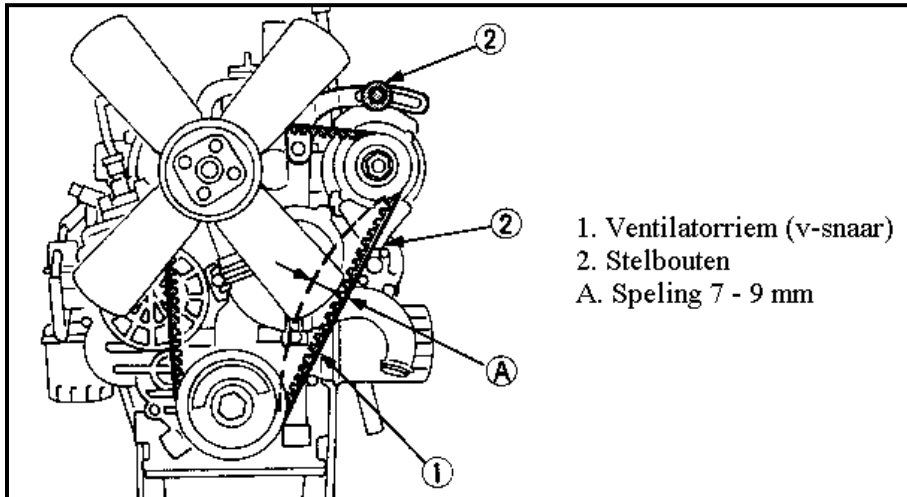


Figure 6.9 | V-belt tensioning

## 6.2 The Hydraulic System

For optimal operation of the hydraulic parts of the forklift, it is important that the hydraulic tank is 2/3 full when the lifting cylinder is in the down position.

### Oil for Hydraulics

ESSO H46 or

OLNA H 46

### **Bleeding the hydraulic system**

Sometimes it is necessary to bleed the hydraulic system

### **When is venting necessary?**

- If you have problems steering and lifting.

The venting process goes as follows:

1. Unscrew the hydraulic hose above the pump 1 to 2 turns.
2. Start the engine.
3. Wait for oil to run out of the opening.
4. Retighten the hose.

## 6.3 Other maintenance

### Lubrication

The following components should be lubricated at least once a month:

- Side-shift cylinder
- Steering cylinder
- Axle tilter
- Tilt cylinders

### Tires

The pressure of the tyres should be checked every week. The pressure in the tires must be:

- Driven (front) wheels : 3.0 bar
- Steering (rear) wheels : 2.5 bar

The valves are located in the rim of the rim. If the machine is equipped with the optional twin wheel rims, the valve of the inner rim is located at the rear (the side of the chassis) in the rim of the rim. Raise the mast to maximum height and check from the front to see if the valve is accessible. If necessary, drive the machine forward or backward a little to gain better access to this valve.



Figure 6.10 | Valve outside rim



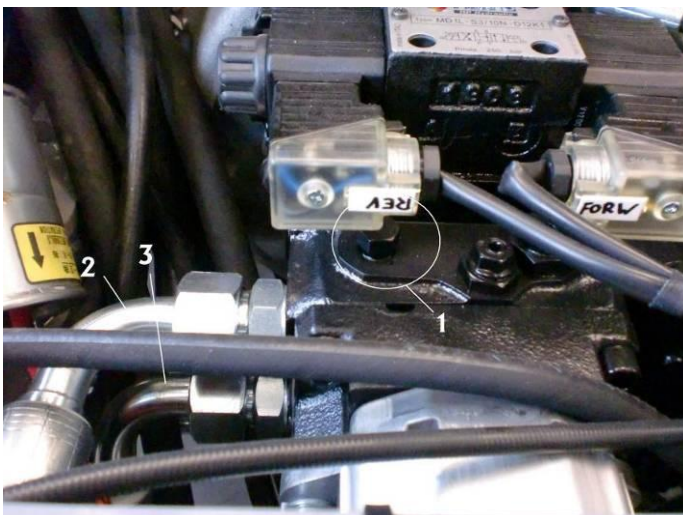
**Caution!:** Always fill the outer wheel with twin tyres with at least 0.5 bar difference compared to the inner wheel.



**Figure 6.11 | Valve inside rim**

### 6.3.1 Sleep mode

If you want to use the tow position function, loosen the bolt on top of the hydraulic pump a few turns so that lines 2 and 3 are connected to each other and the wheels are free. The above operation must be carried out with the engine running.



- 1. Bolt for function drag position
- 2. Leadership
- 3. Leadership

**Figure 6.12 | Bolt for drag position**

## 7. Overview of maintenance intervals

Below, in Table 7.1 and Table 7.2 you will find an overview of the actions to be carried out for maintenance on your forklift truck.

**Table 7.1 | The hydraulic drive**

| Operation                                   | Entry time<br>First 50 hours | Every<br>500<br>hours | Every<br>1000<br>hours | Each<br>year | Every 2<br>years |
|---------------------------------------------|------------------------------|-----------------------|------------------------|--------------|------------------|
| Oil change                                  |                              |                       | X                      |              | X                |
| Replacing the filter at the filling opening | X                            | X                     |                        | X            |                  |

Daily oil levels and system check for leaks.

**Table 7.2 | The engine**

| Operation                | Entry time<br>First 50<br>hours | For<br>every<br>use | Every<br>100<br>hours | Every<br>200<br>hours | Every<br>1000<br>hours | Every 6<br>months |
|--------------------------|---------------------------------|---------------------|-----------------------|-----------------------|------------------------|-------------------|
| Oil change               | After 50<br>hours               |                     | X                     |                       |                        |                   |
| Oil filter replacement   | After 50<br>hours               |                     |                       | X                     |                        |                   |
| Replacing the air filter |                                 |                     |                       |                       |                        | X                 |
| Check fan belt tension   |                                 | X                   |                       |                       |                        |                   |
| Fan belt replacement     |                                 |                     |                       | X                     |                        |                   |
| Battery acid level Check |                                 |                     | X                     |                       |                        |                   |
| Coolant level Check      |                                 | X                   |                       |                       |                        |                   |
| Fuel filter replacement  |                                 |                     |                       |                       |                        | X                 |

## 8. Failure analysis

### 8.1 Vehicle

| Malfunction                                                   | Possible cause                           | Solution                                                           |
|---------------------------------------------------------------|------------------------------------------|--------------------------------------------------------------------|
| Front/rear lights fail                                        | . Fuse blown                             | Check fuse                                                         |
| Forklift does not drive away after pressing the inching pedal | . Direction selector switch not engaged. | Check that the travel direction selector switch is switched on.    |
|                                                               | . Cable gets stuck                       | Check that the cable of the inching pedal is coming back properly. |
| Forklift does not get up to speed properly                    | . Hydraulic oil not up to standard       | Check that the hydraulic oil is at the correct level.              |

### 8.2 Engine

| Malfunction            | Possible cause                                                     | Solution                                                                       |
|------------------------|--------------------------------------------------------------------|--------------------------------------------------------------------------------|
| The engine won't start | . No fuel                                                          | Replenish the fuel tank                                                        |
|                        | . Air in the fuel system                                           | Venting                                                                        |
|                        | . Water in the fuel system                                         | Replace fuel and repair or replace the fuel system                             |
|                        | . Fuel line clogged                                                | Clean fuel line                                                                |
|                        | . Fuel filter clogged                                              | Clean or replace filter                                                        |
|                        | . Excessive viscosity of the fuel or engine oil at low temperature | Use prescription fuel or engine oil                                            |
|                        | . Fuel with too low a cetane content.                              | Use prescribed fuel                                                            |
|                        | . Fuel leak due to loose injection lines                           | Tighten nut                                                                    |
|                        | . Wrong injection timing                                           | Adjust                                                                         |
|                        | . Fuel camshaft worn                                               | Replace                                                                        |
|                        | . Atomizer clogged                                                 | Atomizer cleaning                                                              |
|                        | . Injection pump not working properly                              | Repair or replace injection pump                                               |
|                        | . Compression leak in the cylinder                                 | Replace head gasket, tighten cylinder head bolt, glow plug and injector holder |
|                        | . Wrong valve timing                                               | Improve or replace timing gear                                                 |
| Starter not working    | . Piston rings and liner worn                                      | Replace                                                                        |
|                        | . Too much valve clearance                                         | Adjust                                                                         |
|                        | . Battery is empty                                                 | Charges the battery                                                            |
|                        | . Starter not functioning                                          | Repair or replace                                                              |

|                                              |                                                            |                                                                                    |
|----------------------------------------------|------------------------------------------------------------|------------------------------------------------------------------------------------|
|                                              | · Switch does not work                                     | Repair or replace                                                                  |
|                                              | · Wiring is not connected properly                         | Connecting Wiring                                                                  |
| <b>Engine does not run regularly</b>         | · Fuel filter clogged or dirty                             | Clean or replace                                                                   |
|                                              | · Air filter clogged                                       | Clean or replace                                                                   |
|                                              | · Fuel leak due to loose injection lines                   | Tighten nut                                                                        |
|                                              | · Injection pump does not function properly                | Repair or replace                                                                  |
|                                              | · Wrong nozzle opening pressure                            | Adjust                                                                             |
|                                              | · Atomizer defective or clogged                            | Repair or replace                                                                  |
|                                              | · Regulator does not work properly                         | Repair                                                                             |
| <b>White or blue exhaust fumes</b>           | · Surplus of engine oil                                    | Reduce to prescribed level                                                         |
|                                              | · Piston rings and liner worn or defective                 | Repair or replace                                                                  |
| <b>Grey or black exhaust fumes</b>           | · Wrong injection timing                                   | Adjust                                                                             |
|                                              | · Too much load                                            | Reduce the load                                                                    |
|                                              | · Too low fuel level                                       | Fill up to the prescribed level                                                    |
|                                              | · Fuel filter clogged                                      | Clean or replace                                                                   |
|                                              | · Air filter clogged                                       | Clean or replace                                                                   |
| <b>Too low output power</b>                  | · Wrong injection timing                                   | Adjust                                                                             |
|                                              | · Uneven fuel injection                                    | Repair or replace the injection pump                                               |
|                                              | · Too low atomizer pressure                                | Repair or replace the atomizer                                                     |
|                                              | · Compression leak                                         | Replacing head gasket, tightening cylinder head bolt, glow plug or injector holder |
| <b>Excessive lubricating oil consumption</b> | · Piston ring openings are facing the same direction       | Change the direction                                                               |
|                                              | · Oil circuit worn or defective                            | Replace                                                                            |
|                                              | · Piston ring groove worn                                  | Replace the piston                                                                 |
|                                              | · Valve stem and valve guide worn                          | Replace                                                                            |
| <b>Fuel mixed with lubricating oil</b>       | · Injection pump piston worn                               | Replace the pump element or the entire pump                                        |
|                                              | · The injection pump is defective                          | Replace                                                                            |
| <b>Water mixed with lubricating oil</b>      | · Head gasket is defective                                 | Replace                                                                            |
|                                              | · Cylinder block or cylinder head broken                   | Replace                                                                            |
| <b>Low oil pressure</b>                      | · Too little engine oil                                    | Refill                                                                             |
|                                              | · Clogged oil filter                                       | Filter cleaning                                                                    |
|                                              | · Too much crankshaft bearing bearing play                 | Replace                                                                            |
|                                              | · Too much bearing clearance of the connecting rod bearing | Replace                                                                            |

|                               |                                                              |                                                      |
|-------------------------------|--------------------------------------------------------------|------------------------------------------------------|
|                               | · Too much bearing clearance of the rocker arm shaft bearing | Replace                                              |
|                               | · Oil passage clogged                                        | Cleaning                                             |
|                               | · Wrong type of oil                                          | Use of prescription oil                              |
|                               | · Oil pump defective                                         | Repair or replace                                    |
|                               |                                                              |                                                      |
| <b>High oil pressure</b>      | · Wrong type of oil                                          | Use of prescription oil                              |
| <b>Engine overheating</b>     | · Too little engine oil                                      | Topping up engine oil                                |
|                               | · V-belt broken or incorrectly tensioned                     | Replace or tension properly                          |
|                               | · Too little cooling water                                   | Refill cooling water                                 |
|                               | · Radiator and radiator rib guard clogged                    | Cleaning                                             |
|                               | · Radiator rusted inside                                     | Clean or replace                                     |
|                               | · Cooling water supply rusted                                | Clean or replace                                     |
|                               | · Radiator cover defective                                   | Replace                                              |
|                               | · Too much load                                              | Reduce Load                                          |
|                               | · Head gasket defective                                      | Replace                                              |
|                               | · Wrong injection timing                                     | Adjust                                               |
|                               | · Unsuitable fuel used (mixed with gasoline)                 | Use prescribed fuel                                  |
|                               |                                                              |                                                      |
| <b>Fast battery discharge</b> | · Too little battery acid                                    | Refilling distilled water and recharging the battery |
|                               | · Slipping V-belt                                            | V-belt tensioning or replacing                       |
|                               | · Wiring is not connected properly                           | Connecting Wiring                                    |
|                               | · Voltage regulator defective                                | Replace                                              |
|                               | · Alternator defective                                       | Replace                                              |
|                               | · Battery faulty                                             | Replace                                              |