



Preface

Dear user,

This operating manual provides the user of the Spierings folding crane with information concerning the crane's construction and operation. You will find detailed technical specifications and maintenance instructions in the maintenance part of this manual.

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Liability clause

SECTION 1. OPERATION

- 1.1 The Spierings truck may only be used for the purpose it was manufactured and designed for and only as described in the user manual or in the additions to it.
- 1.2 Any use of the Spierings truck that differs from its design purpose or as described in the use manual or the additions to it, will cause the product warranty and the manufacturer's liability, for any direct or indirect damage, to expire.
- 1.3 Only qualified, skilled personnel are allowed to operate the truck. The driver should have a special driving license for driving heavy vehicles. The driver/operator must be in good physical and mental health, so that he/she is able to carry out the work without restrictions and react with responsibility in all given situations.
- 1.4 The driver/operator/user of the Spierings truck should be informed immediately of any additions/changes to the user manual.

SECTION 2. SAFETY

- 2.1 For safety reasons the driver/operator/user should carry out all operations as stated in the user manual or in the additions to it.
- 2.2 If more stringent safety demands are locally placed on the truck/crane than specified in the Spierings truck user manual or additions to it, these more stringent requirements must be strictly complied with. If not, all warranty will expire and the manufacturer will not be liable for any damage or costs.
- 2.3 The Spierings truck manufacturer points out explicitly, that the driver/operator/user and local personnel should not enter the cranes/trucks danger zone. If, for any reason or cause, an unexpected situation occurs during operation one should contact the technical department or Spierings Service department first before proceeding.

SECTION 3. WARRANTY

- 3.1 It is prohibited to carry out modifications or welding to the Spierings truck without prior written permission of the manufacturer of the Spierings truck.
- 3.2 Frequent maintenance and periodic checks should be carried out in accordance with the user manual, or in the additions to it. If maintenance or checks are carried out otherwise, or less frequent, without prior written permission of the manufacturer of the Spierings truck, all warranty will expire and any liability, for direct or indirect damage, is explicitly excluded.



Explanation of the symbols used



CAUTION!



Wear safety goggles!



Wear safety gloves!



Wear safety boots!



Wear head protection!



Use safety belt!



Check!



Manual action!



Automatic action!



Wrong!



Right!



Information!



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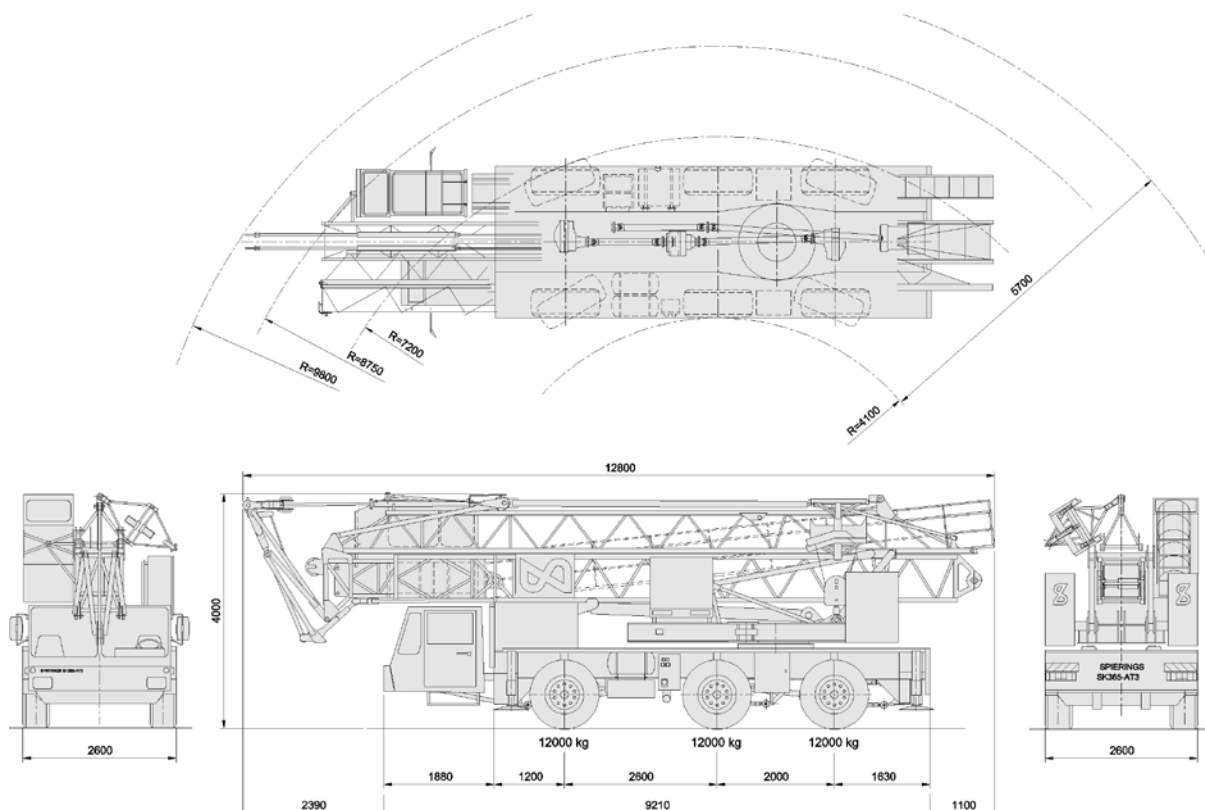


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1. General data AT3

The AT3 carriage is especially designed for the Spierings SK365 folding crane. Extra attention is paid to a smooth and comfortable transport to the work site. The crane is suited for driving on public roads, fully equipped with counterweight and tools. The chassis is an especially rigid structure to create a good crane support.

In *Picture 1-1* you will find the measurements of the SK365 with the AT3 carriage. The dimensions given are the overall dimensions, axle bases and turning circle.



Picture 1-1

Drive unit:

- 8.65 litres DAF diesel engine with turbo compressor and intercooler (type RS 222L).
- ZF gearbox with 8 gears forward, a slow speed gear and one gear reverse.
- STEYR high/low gear shift, transfer case, with high speed (road) and low speed (off the road) transmission.
- Three Ginaf axles, where axles one and three are driven.

**Steering:**

- Axles one and two are steered.
- Mechanically coupled steering, where axle three is steered in the opposite direction of axle one, realizing a small turning circle.
- Hydraulically powered 1-circuit steering system.
- Hydraulically powered 2-circuit steering system (serial no. 36550 and higher)
- Fitted with an emergency steering pump, so when the main steering pump malfunctions, the truck remains steerable until it is at a standstill.
- Provisions for driving off the road:
 - Axle height adjustable
 - high/low gear shift transfer case can be put in low gear for driving off the road
 - longitudinal and transverse differentials can be locked

Suspension:

- Hydro-pneumatic suspension
- The suspension can be blocked (e.g. when driving with erected tower).

Braking system:

- Pneumatic brakes.

4-point outrigger system:

- Wide support base : 6.90 m x 5.80 m
- Narrow support base : 6.90 m x 4.20 m

Power supply:

The superstructure can be supplied with power in two different ways:

- External power-supply 40 kVA during erecting and folding, 40 kVA during operation.

The truck built-in Leroy Somer 75 kVA generator is used for power supply to the superstructure when (sufficient) external power is lacking.

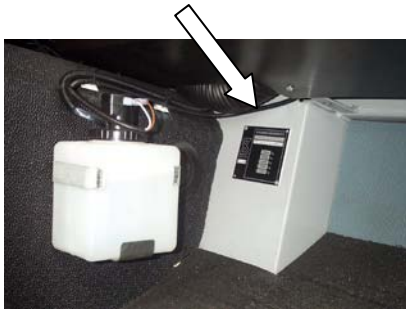
Further data:

- Maximum speed limited to 84 km/h.
- Minimum speed at 1400 rpm: 2.3 km/h (is 38 m/min) .
- Truck weight including superstructure and counterweight 36,000 kg.
- The axle load is 12,000 kg per axle.

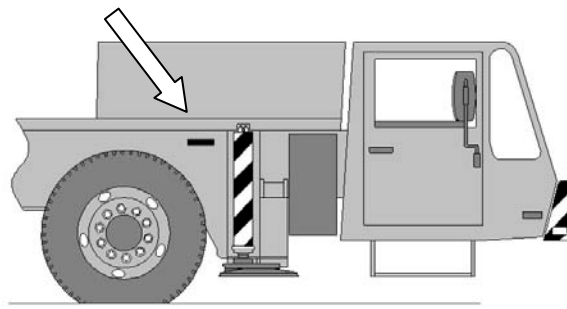


Identification:

- Engine number: on top of the engine block.
- Carriage frame number: On the identification plate in the co-driver's leg-room (See *Picture 1-2*) and stamped in the right frame girder in front of the first axle (See *Picture 1-3*)



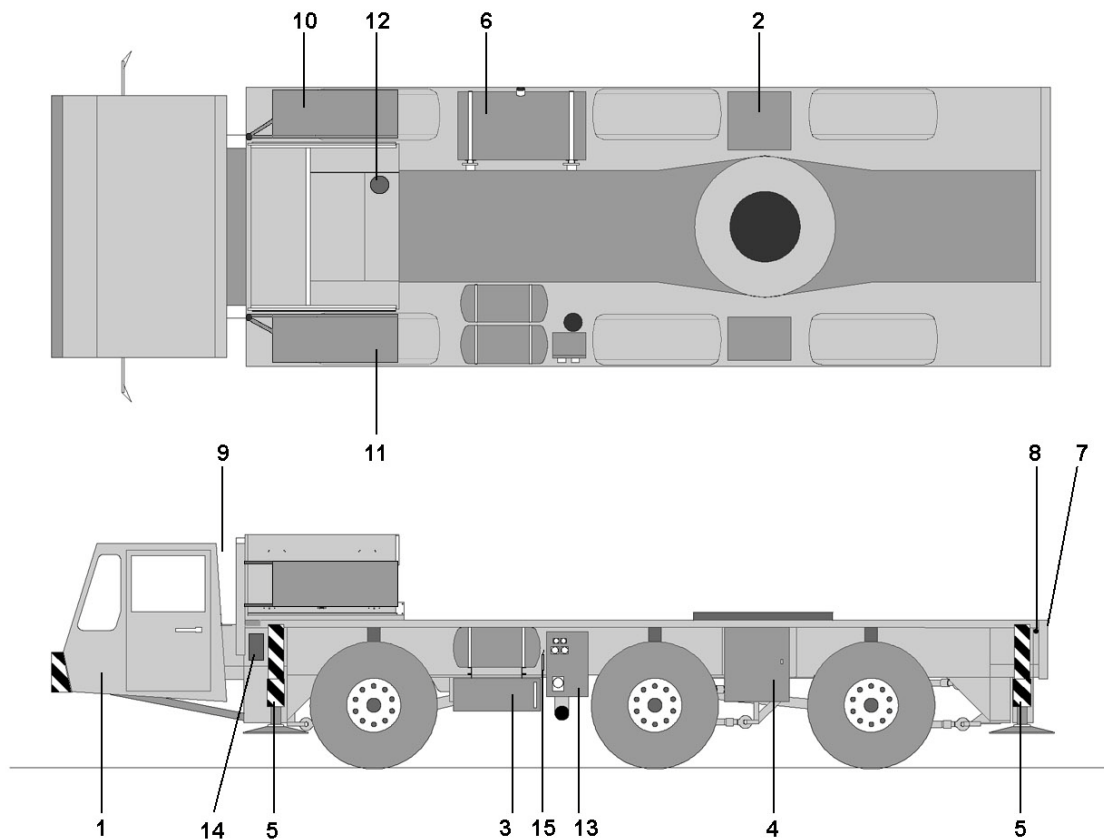
Picture 1-2



Picture 1-3

2. Operation

2.1. Get to know the truck



Picture 2-1

1. Truck cab

Besides driving the crane, with the controls in the truck cab you can adjust the carriage axle height and switch the generator (PTO) on and off.

2. Storage box / battery box

In this storage box, the batteries are placed.

3. Hydraulic oil tank / air pressure tanks

On this side of the truck you will find the hydraulic oil tank. A gauge glass is mounted for checking the level. On top of the oil tank, the air tanks are mounted.

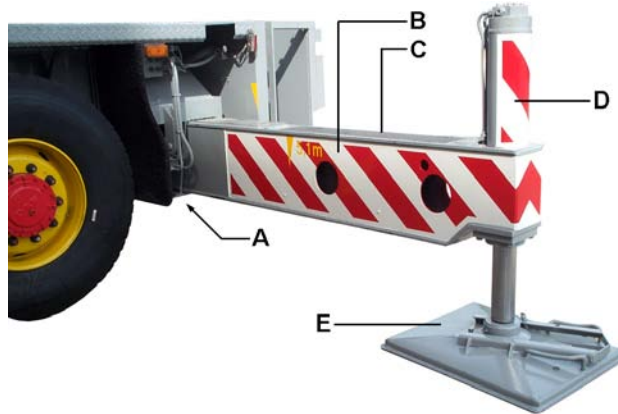
4. Storage box

This box is lockable and can be used for hoisting equipment.

5. Outriggers

At both sides of the truck there are 2 extending outrigger beams, and to each beam a hydraulically operated outrigger (See *Picture 2-2*). These outriggers provide stability during hoisting operation.

- A: Outrigger pad holder
- B: Outrigger beam
- C: Antiskid
- D: Outrigger cylinder
- E: Outrigger pad



Picture 2-2

6. Fuel tank and battery switch

The fuel tank capacity is 400 litres. Above the fuel tank the battery switch is mounted. Turn the battery switch off, before doing welding activities to the carrier or crane.

7. Bumper

The crane has a standard bumper at the rear.

8. Jib turning pipe

Through a hole in the deck you can reach the jib turning pipe. This pipe is used to swing the jib in front of the tower during erecting and folding the crane.

9. Work lamps

Behind the truck cab work lamps are mounted on each side, which can be switched on/off from the cab (see *Picture 2-3*).



Picture 2-3

10. Sling box (optional)

On the right-hand engine cowling (2) you can install a sling box (1) to store your chains and slings. The sling box can be turned aside so the engine housing remains accessible.



Picture 2-4

11. Spare tire / Sling box / pallet hook support / Hullo clamp support (optional)

On this location you can install one of the following options:

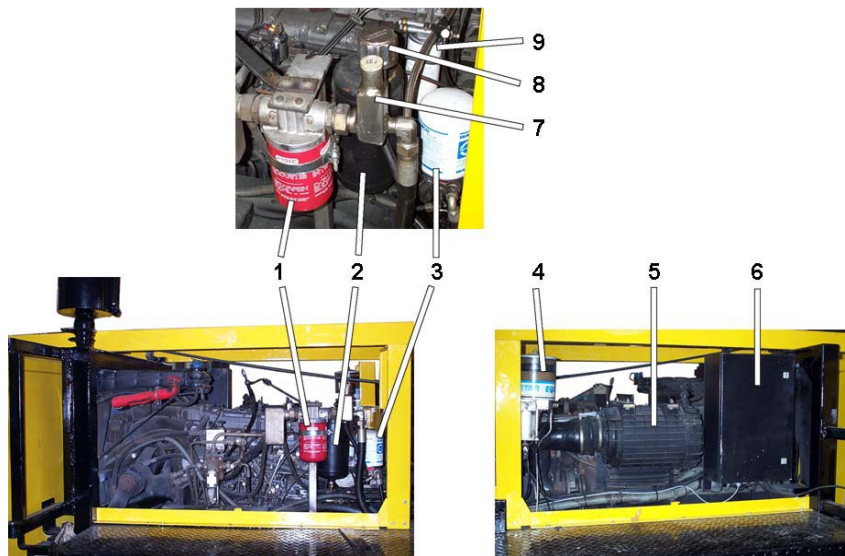
- Spare tire support fitted with a winch
- Sling box
- Pallet hook support
- Hullo clamp support

All these options can be turned aside so the engine housing remains accessible.

12. Underneath the engine cowling

Under the engine cowling at the left hand side the filter for the truck's hydraulics (1) can be found, as well as the breather (7) and the filler cap (8). Also, the fuel filter (9), the air dryer (3) and the air vessel (2) for the air dryer are mounted on the left side.

On the right hand side the inlet-air filter (5), grease pump (4) for automatic lubrication (optional) and the electrical cabinet (6) are located. (See Picture 2-5).



Picture 2-5

13. Power box

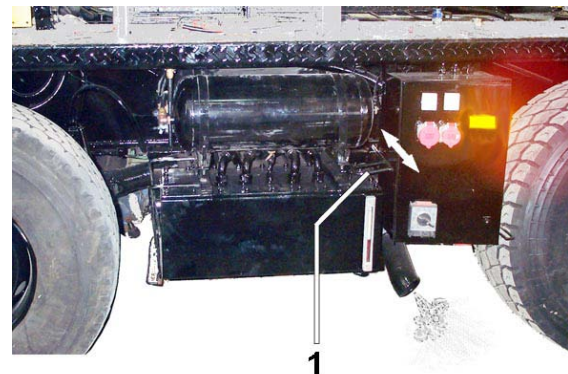
With the selector switch on the power-box, the power supply for the crane is selected. Either an external power supply can be connected to this power box, or the built-in generator supplies the power. Power can also be branched off for accessory equipment.

14. Outrigger control box

Two control boxes for the outriggers are located just behind the truck cabin. One on the left hand side and one on the right hand side.

15. Exhaust valve handle

By operating the exhaust valve handle (1) the engine exhaust gasses can be leaded either through the upper exhaust pipe or the lower exhaust pipe.



Picture 2-6

2.2. Truck cab

In the truck cab you drive the crane safely and comfortably to its destination. This chapter makes you familiar with the cab.

2.2.1. Getting in

Use the step under the door. Make use of the steering wheel to hold on to.

2.2.2. Doors

Turn the handle up to open the door from the inside. The door can only be locked up from the outside.

There is an ashtray on the inside of the door. After opening the ashtray, you push the locking device down to remove the ashtray from the holder to empty it.

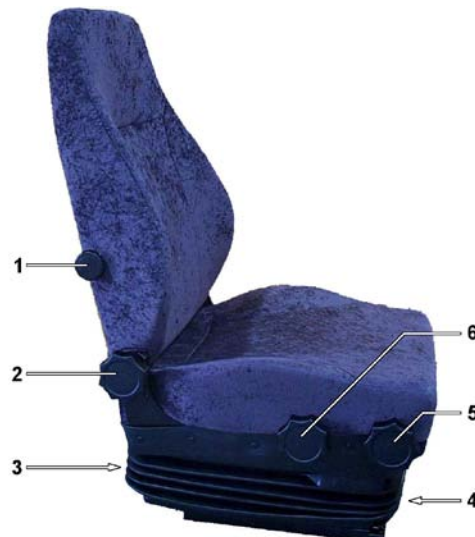
2.2.3. Wing mirrors

The wing mirrors may be adjusted by hand. Make sure the mirrors are adjusted before driving off, so that you have satisfactory view. The mirror heating (optional) can be switched on with the switch on the control panel.

2.2.4. Seats

The cab has room for the driver and a co-driver. Both seats are damped by spring load. The seats can be adjusted. This should only be done when the vehicle stands still.

1. Adjusting knob lumbar support
2. Adjusting knob back position
3. Height adjusting knob
4. Adjusting knob seat position
5. Adjusting lever seat forward/backward
6. Adjusting knob seat height



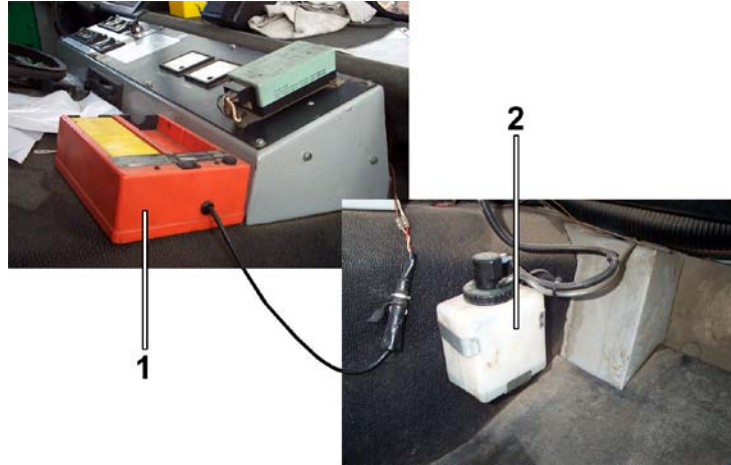
Picture 2-7

2.2.5. Fuse box

The fuse box is mounted right-handed at the co-driver's side. You will find the fuses listed in the enclosures.

2.2.6. Windscreen washer reservoir

The windscreen washer reservoir (2) is mounted on the left-handed side below the dashboard on the co-driver's side. (See *Picture 2-8*)



Picture 2-8

2.2.7. Battery charger remote control batteries

You will find the battery charger (1) for the remote control of the crane on the middle console of the cabin (See *Picture 2-8*). The remote control of the crane comes with 2 batteries.

While the batteries are charging, an indicator lamp will light up. As soon as they are fully charged, the lamp starts flashing.

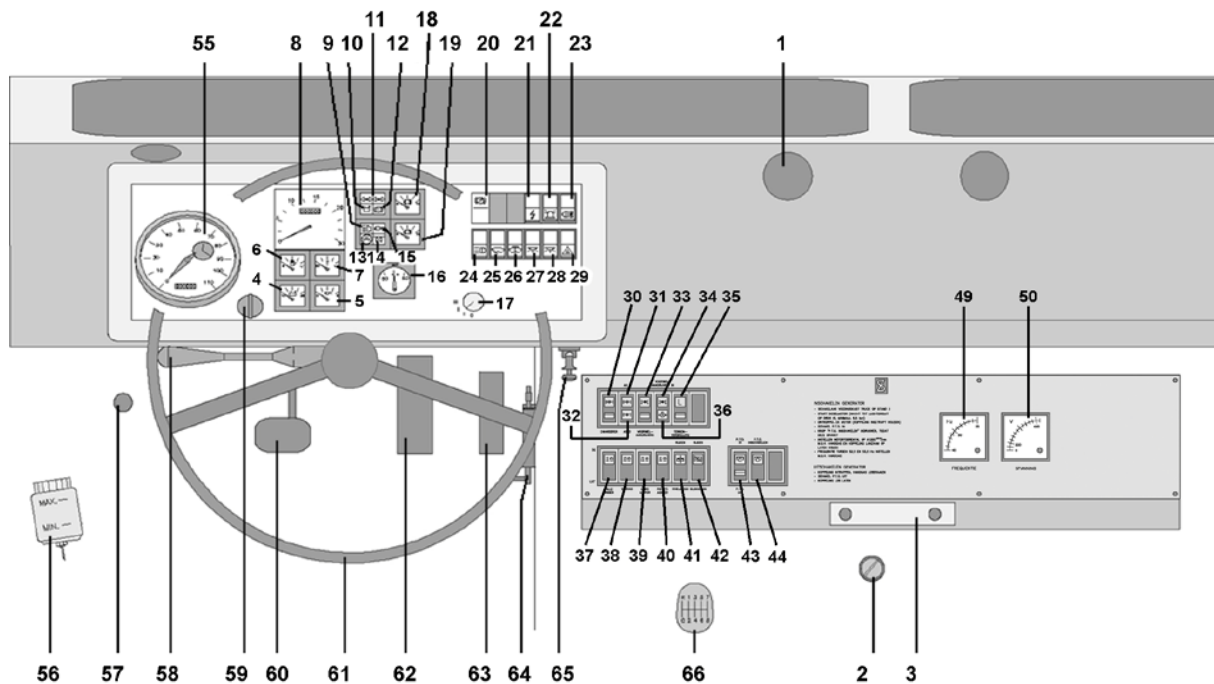
2.2.8. Fire Extinguisher

One fire extinguisher is behind the co-driver's seat.

On the right behind the control box in the crane cab is the second fire extinguisher.

The fire extinguishers must be inspected every year by a certified company.

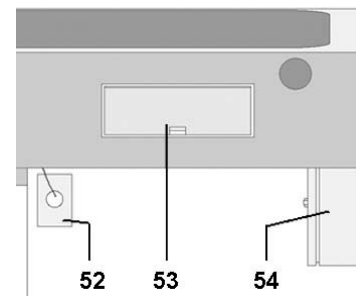
2.3. Control panel



Picture 2-9

- | | |
|---|---|
| 1. Airflow heater | 34. Indicator lamp front wheel drive |
| 2. Heater (this knob can also be located on the left hand side of the tunnel) | 35. Switch transfer case road/terrain gear |
| 3. Radio | 36. Maximum pressure outrigger system |
| 4. Voltmeter batteries | 37. Switch all axles in/out |
| 5. Oil-pressure gauge (diesel engine) | 38. Switch axle 1 in/out |
| 6. Fuel gauge | 39. Switch axles 2 and 3 left side in/out |
| 7. Coolant temperature gauge | 40. Switch axles 2 and 3 right side in/out |
| 8. Revolution counter, hours counter | 41. Switch drive/levelling |
| 9. Indicator lamp full head beam | 42. Switch suspension blocked |
| 10. Indicator lamp charging batteries | 43. Main switch PTO |
| 11. Indicator lamps blinker | 44. Switch PTO on/off |
| 12. Indicator lamp air pressure | 49. Frequency meter generator |
| 13. Indicator lamp air cleaner | 50. Voltmeter generator |
| 14. Indicator lamp flame starting system | 52. Reservoir windscreen washer fluid |
| 15. Indicator lamp oil pressure (diesel engine) | 53. Dashboard cabinet |
| 16. Battery charge gauge | 54. Fuse cabinet |
| 17. Speed switch fan heater | 55. Tachograph, speedometer, mileage, counter, clock |
| 18. Air-pressure gauge circuit 1 | 56. Reservoir clutch fluid |
| 19. Air-pressure gauge circuit 2 | 57. Vacuum brake / engine stop |
| 20. Indicator lamp parking brake | 58. Lever for blinker and full beam |
| 21. Switch / indicator lamp working lights | 59. Ignition lock |
| 22. Switch rotating beacon | 60. Clutch pedal |
| 23. Switch fog tail light | 61. Steering wheel |
| 24. Light switch; off, parking light, dipped beam | 62. Brake pedal |
| 25. Switch windscreen wiper | 63. Accelerator pedal |
| 26. Switch windscreen washer | 64. Manual pedal hold |
| 27. Switch cab interior light on the left | 65. Lever parking brake |
| 28. Switch cab interior light on the right | 66. Gear-lever |
| 29. Switch alarm light | 67. Indicator lamp emergency steering pump (optional) |
| 30. Switch transverse differential lock | |
| 31. Indicator lamp transverse differential lock axle 1 | |
| 32. Indicator lamp transverse differential lock axle 3 | |
| 33. Switch front wheel drive | |

Right hand side of the cab:



2. Knob heater warm / cold

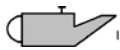
turning this knob the air of the heater can be set warmer or colder. This knob can also be located on the left hand side of the tunnel.

4. Voltmeter Batteries



On this meter you can read the battery condition. The meter must be in the middle (approx. 24 Volt)

5. Oil-pressure gauge diesel engine



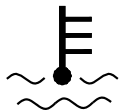
When starting this gauge will read approx. 5 bar. As soon as the oil of the diesel engine is warmed up it will read approx. 3 bar.

6. Fuel gauge



This gauge only functions when the ignition is switched on.

7. Coolant temperature gauge



On this gauge you can read the coolant temperature. In the diesel engine safety system an overheating sensor is built-in. As soon as the temperature exceeds 110 °C, it activates the horn. Also the Indicator light "oil pressure" (15) will light up. The engine must be switched off immediately.

10. Warning lamp charging voltage batteries



If the charging voltage of the batteries is too low, this indicator lamp will light up.

12. Warning lamp air-pressure



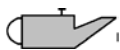
If the air-pressure in brake circuit 1 or 2 is below 5.5 bar, this indicator lamp will light up. The crane can and must not be driven. If this lamp is on after starting the engine, leave the engine running at idling speed until the air-pressure is 5.5 bar. The lamp will go out.

14. Indicator lamp pre-heating diesel engine



This lamp lights up when pre-heating the diesel engine. The light remains on while holding the ignition key in position 1. Check pre-heating times in chapter "driving with the crane"

15. Oil-pressure indicator lamp



Immediately stop the engine when this lamp lights up. The oil pressure of the diesel engine is too low or the coolant temperature is too high.

**18. Air-pressure gauge circuit 1**

It indicates the air-pressure in brake circuit 1. When the pressure is below 5.5 bar, indicator lamp 12 will light up. The crane must not be driven.

19. Air-pressure gauge circuit 2

This gauge indicates the air-pressure in brake circuit 2. When the pressure is below 5.5 bar, indicator lamp 12 will light up. The crane must not be driven.

20. Indicator lamp parking brake

As long as the parking brake is engaged, this lamp is on (when starting the engine the parking brake remains engaged as long as the air-pressure is below 5.5 bar).

21. Work Lamps (optional)

At the rear of the cab or at the rear truck bumper work lamps can be installed. With this switch the work lamps are switched on and off.

22. Rotating beacon

With this switch the Rotating beacon can be switched on and off.

23. Fog tail-light

With this switch the fog tail-light on the cab can be switched on and off.

24. Light switch

By pressing this switch halfway, the parking lights are switched on. By pressing the switch all the way, the dipped beams are switched on.

25. Windscreen wiper

By pressing this switch halfway, the windshield wipers wipe at normal speed. By pressing the switch all the way the windshield wipers wipe at high speed. There is no intermittent position.



26. Windscreen washer

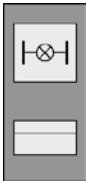
By pressing this switch the windshield wiper washer is activated.

27/28. Cab lighting



The driver can operate the cab lighting by operating the switches on the dashboard. The lighting will also go on when opening the door. We advise you not to switch on the cab lighting when driving in the dark, to prevent annoying reflections in the windscreen.

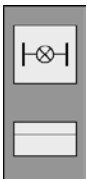
30/31/32. Switch / indicator lamp transverse differential lock.



Engage the transverse differential locks on axle 1 and 3. (30)

The two indicator lamps (31 and 32) show if the transverse differential locks on axle 1 and 3 are engaged.

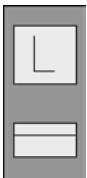
33/34. Switch / indicator lamp front wheel drive



Engage the front wheel drive. (33)

The indicator lamp (34) shows if the longitudinal differential lock on axle 1 is engaged.

35. Switch transfer case road/terrain gear

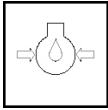


With this switch (35) the terrain (*Low*) or the road (*High*) gear can be selected on the transfer case.



Transfer case gear shift high (road) / low (terrain) may only be operated when the vehicle stands still!

36. Oil pressure suspension and outriggers



This lamp goes on and a buzzer sounds at the rear outriggers as soon as the pressure in the outrigger/suspension system becomes too high, due to the fact, that the outriggers, axles or outrigger beams are blocked while extending or retracting the cylinders.

During levelling operation and when moving the axles up or down, this light could also go on. This does not present a problem.

If no outrigger/suspension function is operated, the lamp indicates a malfunction.

37. Switch all axles in/out



With this switch the cylinders of all axles are moved in and out simultaneously (e.g. when supporting the crane on outriggers).

38. Switch axle 1 in/out



With this switch the cylinders of axle 1 are moved in and out.

39. Switch axles 2 and 3 left side in/out



With this switch the cylinders on the left side of axles 2 and 3 are moved in and out.

40. Switch axles 2 and 3 right side in/out



With this switch the cylinders on the right side of axles 2 and 3 are moved in and out.

41. Switch drive/levelling



With this selector switch either drive or levelling mode is selected.

42. Switch suspension blocked



When lowering the carrier – before putting the crane on outriggers – the suspension has to be blocked.

43. Main switch PTO

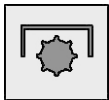


The PTO drives a generator, which supplies power for crane operation.



While the PTO is switched on, driving the crane is forbidden! It would cause severe damage!
When switching off the PTO, always check that lamp 36 goes out!

44. Engage PTO



To engage the de PTO (43) the main PTO switch must be switched on.

49. Frequency meter generator

Indicates the frequency in Hertz, supplied by the generator and must be between 52.5 and 53.5 Hz.

50. Voltmeter generator

Indicates the current supplied voltage by the generator. It should be approx. 400V.

55. Speedometer / tachograph

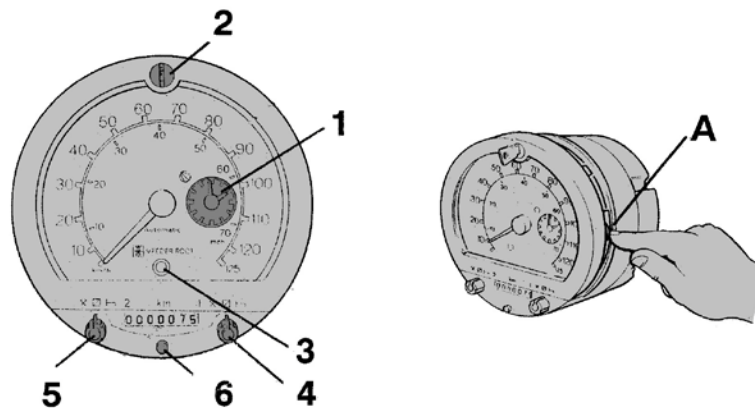
The truck is equipped with a VDO or VeederRoot tachograph. On this device you can read the driving speed and the number of kilometres driven. The tachograph also contains a clock (1). This clock drives a diagram disc. On this disc the activities of the driver are written by means of scribes. The disc can be replaced by opening slot 2 (See picture 2-10). Never leave a disc in the tachograph for longer than 24 hrs (else it would overwrite itself). In case there is no disc in the tachograph, indicator lamp 3 will light up.

By means of switches 4 and 5 the drivers' activities can be shown. Indicator lamp 3 goes on as soon as the driving speed exceeds 80 km/h. When at a certain speed button 6 is pressed, exceeding this speed will light up the indicator lamp. However, when the ignition is switched off, the indicator lamp will be set to 80 km/h.

The clock may be set to the correct time by operating wheel A.

For more details on how to use the tachograph we refer to the tachograph manual (in the glove compartment).

Note: registration of crane operation by the tachograph is not laid down by law.



Picture 2-10

58. Steering column switch



Picture 2-11

- A. With this switch the direction indicator is controlled.
- B. Pulling the switch backwards you can give light signals.
- C. Pressing the switch tip towards the steering wheel activates the horn

59. Ignition lock

By turning the key to the right, three positions are possible, from left to right:

- 1 = ignition on
- 2 = preheat engine (activate flame start system)
- 3 = starting

64. Manual accelerator hold

By turning this lever of the accelerator is being held so that the diesel engine revs up to approx. 1350 rev/min. High rev idling is necessary when using the PTO.. It also can be used when operating the outriggers, because the speeds of the outrigger movements increase.

65. Lever parking brake

Pulling this lever backwards the parking brake is engaged. Pulling out the knob and pushing the lever forwards will release the parking brake. To release the parking brake, the air pressure must be at least 5.5 bar.

67. Indicator lamp emergency steering pump (optional)

If this lamp is mounted it will light up in case the main steering pump fails. The emergency steering pump will in that case provide oil pressure for power steering until the crane stands still.

2.4. Driving the Spierings crane carrier

The driver is expected to have a driving license for driving a heavy truck and have sufficient technical knowledge. While driving and manoeuvring the crane, the driver must be aware of the crane's unusual form, measurements and steering characteristics;

- Crane parts sticking out at the front and rear
- Its height of four meters: pay attention to low passage ways and low breaches
- Its width of 2.5 meters: on narrow roads and passage ways it can form an obstruction for other traffic
- Steering conduct: thanks to the opposite steered rear wheels, the crane has a small turning circle. Hereby the rear end may swing out a bit.



Caution!

By taking a bend the crane's rear side swings out!

2.4.1. Starting

Before starting the engine, the transmission must be put in neutral and the parking brake must be engaged.

Because the engine has a direct diesel injection it needs no pre-heating over 0° C. You can start the engine by simply turning the ignition key to position 3. If the temperature is below freezing point, the engine must be pre-heated. Pre-heating times are:

- 30 seconds at temperatures between 0° C and -10° C
- 90 seconds at temperatures below -10° C

Pre-heating is done by turning the ignition key to position 2. While pre-heating the indicator lamp on the dashboard lights up. The time required for pre-heating the engine is not automatically regulated. When it is for instance freezing -8° C you have to hold the ignition key in position 2 for 30 seconds.

When the engine is running the indicator lamps for oil pressure and battery charging must go out. Only when the oil pressure lamp is out, the engine speed may be increased. When the engine runs too hot or the engine oil pressure is too low, the horn will sound. If the horn keeps sounding, the engine must be switched off immediately.

After a cold start you must drive in low gear and at low speed until the coolant temperature reaches 50° C.

The exhaust gasses from the engine can be released in two ways. One of the two possibilities can be chosen by operating the handle by the power box on the left-hand side of the carrier.

- While driving around the carrier, the lower exhaust pipe should be chosen. This way the crane construction is not blackened. Besides that, driving around when using the high exhaust pipe builds up too much pressure in the exhaust system.
- When operating the crane through the generator, it is suggested to use the higher exhaust pipe. This way the labour ambience is least polluted.

2.4.2. Turning off the engine

The engine can be switched off by pushing the engine stop. The fuel supply will then be interrupted and the engine stops running. Then turn off the ignition key. Also pulling the chain on the outside of the truck will turn off the engine. Use this chain when the engine-stop malfunctions.

If the engine has run for a longer period of time, we advise you to leave the engine running at idling speed for a few minutes before switching it off, to prevent the coolant and turbo from overheating.

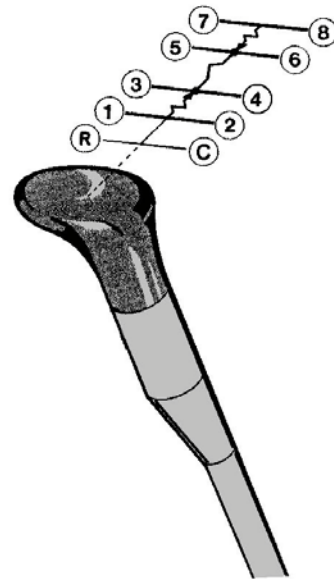
2.5. Driving on the road

The gearbox has 8 synchronized gears; they are divided in a low range (1st - 4th) and a high range (5th - 8th). To shift between the two ranges, the shift lever must be in neutral position and be pushed to the right through a slight resistance.

Subsequently the high range gears can be engaged. To return to the low range, the gear shift lever must be put in neutral and be pushed to the left.

Refer to the diagram in *Picture 2-12*.

Both Reverse and Crawl gear are not synchronized, they may only be engaged when the vehicle stands still and the engine runs at idling speed.



Picture 2-12



Caution!

While gearing down from high to low range, the driving speed must be below 30 km/h!



2.6. Driving off the road

2.6.1. Off the road gear shift road/terrain transfer case

When driving off the road or when low speed is required (e.g. driving with erected tower) you can turn the gear knob road/terrain in low speed (L).



Caution!

The gear knob road/terrain may only be operated when the vehicle stands still!

The position of the gear shift road/terrain is indicated by indicator lamps on the control panel (H or L).

2.6.2. Front wheel drive

When there is insufficient traction while driving off the road, the front wheel drive can be engaged with button 33.



Caution!

The front wheel drive may only be engaged/released when the vehicle stands still!

Driving and steering with engaged front wheel drive is only allowed off-road. When driving on the road again one is only allowed to drive in a straight line!

2.6.3. Transverse differential lock

If after engaging the front wheel drive there is still too little traction, also the differentials in the axles may be locked.

Do this by operating button 30.

Turn off the transverse differential lock before driving on the road.



Caution!

The transverse differential lock may be engaged/released provided the vehicle stands still and the front wheel drive is engaged.

Driving and steering with engaged transverse differential lock is only allowed off-road. When driving on the road again one is only allowed to drive in a straight line!



2.7. Braking system

All axles are equipped with drum brakes. The crane is equipped with three braking systems:

- Operating brake
- Parking brake (axle 2)
- Vacuum brake/engine stop

2.7.1. Operating brake

The operating brake is operated with the brake pedal and works fully pneumatically. The operating brake is a two-circuit system. The air pressure is indicated on the dashboard by two air-pressure gauges.

If the pressure is below 5.5 bar, it is indicated by the indicator lamp on the dashboard. The crane must not be driven.

2.7.2. Parking brake

The parking brake is engaged when the parking brake lever is moved backwards. This bleeds the spring loaded brake boosters and engages the brake. When pulled fully backwards, the lever is locked and the parking brake remains engaged. Pulling out the knob on the lever and pushing the lever forwards will release the parking brake.

If the air pressure for the operating brake is too low, the parking brake is used to slow down the moving vehicle. Move the parking brake lever gradually backwards. Once operated the parking brake can not be released until the air pressure is back to normal.

When towing the carrier without the engine running, the parking brake has to be released manually. Manually releasing the brake is done by partially turning out the bolts on the rear of the boosters of axle 2 (see also 2.9 Towing the crane).

2.7.3. Vacuum brake/engine stop

The vacuum brake works by closing the fuel supply. Also the exhaust is closed by means of a valve. The vacuum brake control is to the left of the clutch pedal on the truck cab floor. While this foot switch is pressed the vacuum brake is active.

The vacuum brake is used to slow down through the engine (e.g. when travelling down-hill) and to switch off the engine. The engine speed should not be above 2800 rpm.



Caution!

Do not use the vacuum brake when the gear is in neutral while you're driving. The engine will cut out!

2.8. Parking

Put the transmission in low range (1-4) and engage the parking brake. Fully lower the vehicle. Switch off the engine and subsequently the battery switch.

When parking up-hill: transmission in 1st gear, parking brake engaged.

When parking down-hill: transmission in reverse gear, parking brake engaged.

2.9. Towing the crane

2.9.1. Towing free

If the crane has got stuck in the ground, it must be pulled free. To tow, shift the transmission in neutral in the high range (5 to 8).

When the engine is not working, the parking brakes are engaged and must be released manually as explained in chapter 2.9.2.



Caution!

Tow the crane in a steady manner! Short and forcible pulls will damage the gearbox!

Forcibly towing or pulling will cause damage to the gearbox. Tow the crane slowly and with sufficient force to firm ground, where it can move in normal travel mode.

Couple the towing vehicle with a coupling-rod to the front of the crane and tow it slowly away from the dangerous situation. Then contact the Technical Department of Spierings Cranes.

In case of doubt always contact the Technical Department of Spierings Cranes.



Caution!

Before towing the crane over a long distance and with higher speed (> 20 km/h), contact Spierings Cranes!

2.9.2. Towing on the road

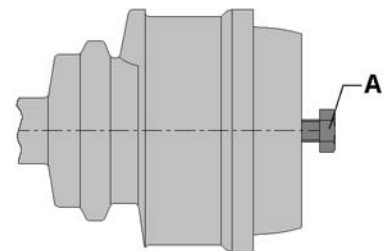
When towing on the road at normal driving speeds, some important points must be taken into account:

Towing with working engine

- Power steering is working via the engine;
- There is air pressure to release the parking brakes from the cabin;
- The transfer case should **not** be connected to the gearbox. Either the drive shaft between the transfer case and axle 3 should be disconnected in order to prevent damage to the engine, gearbox and transfer case or alternatively the transfer case can be switched to neutral, see 2.9.3.

Towing without working engine

- Power steering is impossible via the engine;
- The emergency steering pump on the transfer case can provide power steering when driving;
- When you want to tow the crane without its engine running or in case there is no air pressure, the parking brake must be released manually. To do this, you have to unscrew the bolts at the rear of the spring loaded brake boosters of axles 2 and 3 (See: "A", Picture 2-13). The spring tension is removed from the brake, so it is released;
- However the ingoing shaft of the transfer case must be switched off in order to prevent damage to the engine and the gearbox! See 2.9.3.



Picture 2-13


Caution!

The gearbox and transfer case should be disconnected when towing (this could cause serious damage). See chapter 2.9.3.

2.9.3. Switching the transfer case to neutral

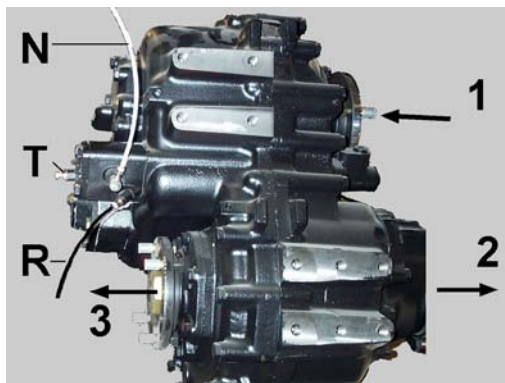


When preparing to shift the transfer case without engine power / air pressure pump, be careful not to release the hose under pressure. There will be no air pressure left!

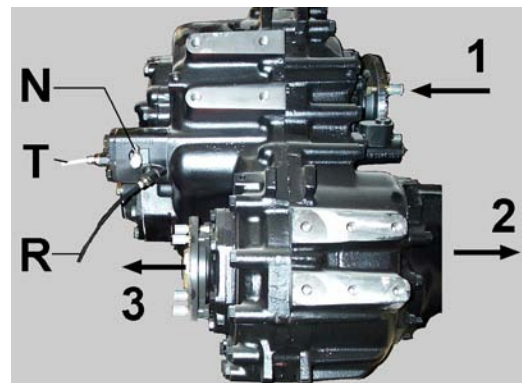
The transfer case is shifted with air pressure using three connection points on the transfer case:

- one for road travel (R / black hose),
- one for terrain mode (T / white hose),
- one for switching to neutral (N / normally not connected).

In terrain mode the white hose (T) will be under pressure, in road mode the black hose (R) is under pressure.



Picture 2-14



Picture 2-15

Follow the steps below:

1. Switch the transfer case to road gear in the carrier cab.
2. Picture 2-15 shows the normal situation: the connection points for road gear (R) and terrain gear (T) are connected and hose (R) is under pressure.
3. In that case remove the white hose for the terrain gear (T) and connect this hose to the free connection point (N) (as shown picture 2-14).
4. Now turn the selector switch in the carrier cab to terrain mode pressurising the white hose (N) / switching the transfer case to neutral.

The outgoing shafts (2) and (3) are free to rotate when towing, the ingoing shaft (1) is not driven.

2.10. Driving with erected tower

Refer to crane manual.

2.11. Axle height adjustment

The axles are connected to the chassis by means of hydraulic rams. Each ram is provided with an accumulator, so that the axles can compress (suspension).

The suspension system can be controlled from the truck cab (*See picture 2-9*). This system enables you to adjust the axle height according to your needs. The suspension can also be blocked; this is relevant when supporting the crane on outriggers and when driving with an erected tower.

2.11.1. Levelling

During levelling, the axle suspension is automatically adjusted in travelling mode. This is useful when the axle height had become unsettled due to e.g. outrigger operation or lengthy standstill.

After using the crane it should always be levelled!

The crane must be levelled on a horizontally level base and the levelling is finished when there is no more movement in the vehicle. Now reset the switch.

Levelling can only be done when the tower is resting on the truck.



Caution!

Switch "block suspension" must be off for levelling operation!

2.11.2. Block suspension

In the "Drive" position the suspension is activated. The switch must be in "Drive" position while driving on the road.

Before driving off, you have to level first.

In the "Block suspension" mode the axles can not compress, enabling a stable travel.

2.11.3. Off the road mode

To shift the crane in off the road mode, you have to proceed as follows:

- Block the axles (number 42, picture 2-9).
- Move the rams of all axles out (number 37). The rams will not fully extend, so that some room to move remains.
- Release the suspension block (switch no. 42) to re-activate the suspension.

3. Maintenance



For “normal working conditions” we have in view:

- A working-week of 5 day's/40 hours
- Surroundings temperature: -15 - +40°C (5 – 104F)



All specifications concerning oil and filters can be found in chapter “Technical data”.

3.1. General



All warning and safety prescriptions in this manual must be followed. Always look after safety in general.

Never repair the truck or change an adjustment without empathic permission and the correct education. Repairs or adjustments which are not correctly solved can result in dangerous situations.

3.1.1. Clothing



During maintenance on the truck, the right clothing suitable for the workshop must be worn. Avoid i.e. loose clothing, long hanging down hair and ornaments which can be entangled between moving components.

3.1.2. Surroundings



Keep the crane's surroundings clean and free of oil and other liquids. This to prevent dangerous situations.

3.1.3. Diesel engine



Do not run the engine in a closed or non-aired room. There is danger of suffocation.

3.1.4. Moving parts



Stay on a save distance from rotating and/or moving components.

3.1.5. Oils and coolant



Various kinds of oil, lubrications, coolant, window washer fluid, battery acid and diesel oil can be harmful to your health when touched. Avoid any physical contact with these substances.

3.1.6. Environment



In order to reduce environmental pollution to a minimum we advise you to comply with the following rules:

- Do not pour used oil, hydraulic fluid and coolant in sewers or in the ground.
- Make sure all used fluids, batteries, oil filters and other chemicals are separated and sent to the respective authorities for destruction or recycling.
- See to proper and regular truck maintenance. A well maintained engine contributes to saving fuel and reduces polluting exhaust fumes.

3.1.7. Welding

When welding on the truck or crane, the battery switch (right-hand side next to the driver's seat) must be switched off. Make sure welding spatter does not fall on hydraulic, pneumatic or electrical parts.



Carrying out modifications or welding on the crane is only allowed with specific permission of the manufacturer!

3.1.8. Refreshing oil/cooling system



Be careful with oil refreshing. Hot oil can cause serious bodily harm.

Do not remove the coolant tank filler cap when the engine is at operating temperature.

3.1.9. Fire extinguisher



The fire extinguisher must be inspected every year by an acknowledged instance.

3.1.10. Fire-risk



To prevent fire-risk, make sure no light inflammable substances are in the surroundings of the engine.

3.1.11. Cleaning of components



While cleaning with a high-pressure cleaner the following rules must be complied with:

- While cleaning the radiator/intercooler, make sure the cooler fins are not damaged.
- While cleaning the engine compartment, do not point the nozzle directly to electrical components like starter motor, alternator, etc.
- Make sure no water penetrates through the breathers of gearbox, transfer case and differentials.



3.2. Maintenance plan AT3 truck

Main group	Maintenance	Daily maintenance	Weekly maintenance	3-monthly / 500 hours maintenance	1000 hours maintenance	Yearly maintenance	2-Yearly maintenance	5- Yearly maintenance
Diesel engine	Engine oil	Check level		Change				
	Oil filter			Replace				
	Cooling system			Check				
	Coolant		Check level				Change	
	Anti-freeze					Check		
	Radiator/intercooler				Check / clean			
	Air system			Check				
	Air filter				Clean / replace			
	Fuel system			Check				
	Fuel filter				Replace			
	Water separator		Drain	Clean				
	Filter water separator			Clean	Replace			
	V-belts		Check					
	Exhaust system			Check				
	Valve clearance					Check		
Drive-line system								
	Gear box			Check				
	Oil gear box			Check		Change		
	Transfer case			Check				
	Oil transfer case			Check		Change		
	Axles			Check				
	Oil differentials			Check		Change		
	Oil hubs			Check		Change		
	Tires	Check						
	Tire pressure			Check				
	Brake lining					Check		
	Clutch			Vent				
	Oil clutch			Check				
	System			Check		Align		
Steering system								
Electrical system								
	Lighting	Check				Check		
	Instrument lighting	Check				Check		
	Batteries			Check				



Main group	Maintenance	Daily maintenance	Weekly maintenance	3-monthly / 500 hours maintenance	1000 hours maintenance	Yearly maintenance	2-Yearly maintenance	5- Yearly maintenance
Hydraulic system	<i>Hydraulic oil</i>			Check				Analyze / change
	<i>Return oil filters</i>					Replace		
	<i>Accumulators</i>					Check		
	<i>Hoses and connections</i>			Check				
Pneumatic system	<i>Air dryer filter</i>						Change	
	<i>Air vessels</i>		Drain					
	<i>Braking pressure</i>					Check		
	<i>Hoses and connections</i>			Check				
Grease system	<i>Central grease system</i>			Check				
	<i>Manual greasing</i>			Grease				
Diverse	<i>Window washer liquid</i>		Check					
	<i>Extinguisher</i>					Check		

4. Greasing

4.1. Central grease system (Option)



**Check all the greasing points of the central grease system every 3 months.
Also check the grease reservoir for sufficient grease.**

Joints, hinges and bearings must be greased regularly. A central (automatic) grease system is therefore used. Nevertheless all grease points must be checked for sufficient grease. If not, damage is the result.

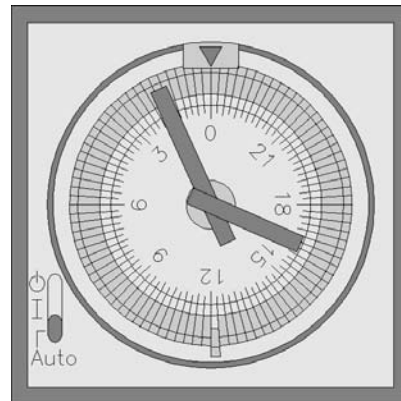
4.1.1. Timer central lubrication system (optional)

The central lubrication system is controlled by a timer on which the grease time in relation to the operating time can be set. (Picture 4-1)

The timer must be set in such a way that 24 hours of operation are followed by 15 minutes greasing. To do this one clock slide must be extended.

When the timer is set to "Auto" or "A" the timer starts functioning. If extra greasing is needed, the grease pump can be operated by setting the timer to "I". The timer must be set to "Auto" after 15 minutes.

The central lubrication system timer is in the centre console at the co-driver's side.



Picture 4-1

4.1.2. Grease reservoir central lubrication system

The grease pump with reservoir is mounted on the right hand side of the engine compartment. (picture 4-2)

For checking the grease level and topping it up the right-hand side cover plate must be removed.

The grease level must be above "min.". If not, fill it by means of a grease gun through the respective grease nipple.

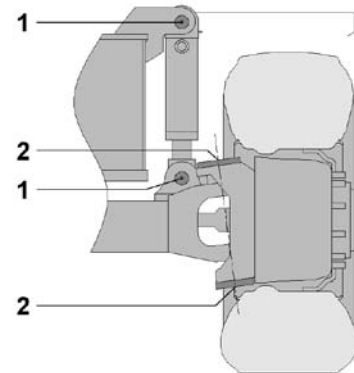
Use grease according the specifications in the chapter "Technical data".



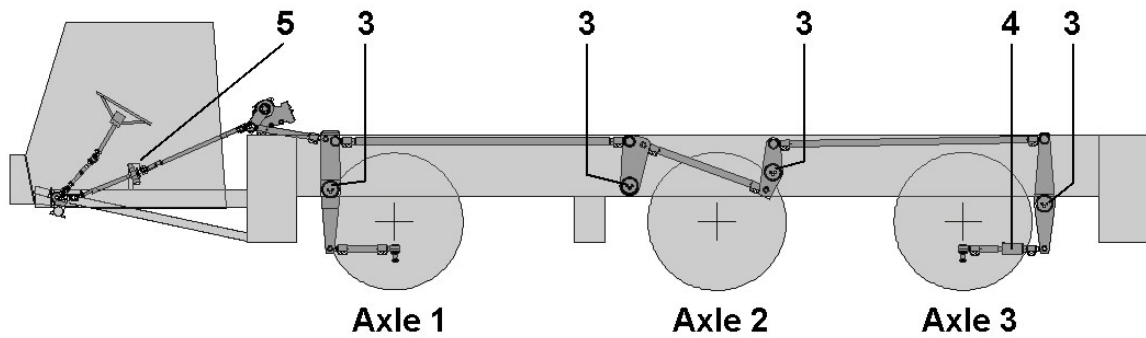
Picture 4-2

4.1.3. Greasing points central lubrication system

1. Pin joints (1) suspension cylinders above and below. (picture 4-3)
2. Hubs (2) above and below (Except axle 2)



Picture 4-3



Picture 4-4

3. Pin joints steering arms (3)
4. Spring-loaded rod (4)
5. Intermediate bearing steering shaft (5) (manual point on some models!)

4.2. Manual lubrication



The grease interval for all manual greasing points is 3 monthly.

Use a grease gun with EP2 grease for manual lubrication.

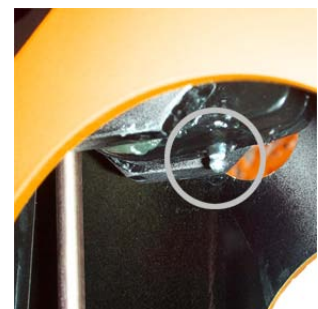
In case the truck is not equipped with an automatic central lubrication system all the grease point has to be greased manually. In the previous chapter the grease points of the automatic central lubrication system are described.

The points not covered by the central lubricating system, thus always have to be greased manually, are:

- Outrigger cylinder (4x)
- Gear shift lever ball (1x)
- Universal joints shifting rod (2x)
- Pedestal guides shifting rod (2x)
- Ball joints shifting rod (2x)
- Universal joints cardan shafts (10x)
- Support bearings cardan shaft (2x)
- Spline bushing steering rods (5x)
- Intermediate bearing steering shaft (1x) *(on some models in central system)*
- Gear shift lever (1x) *(on some models in central system)*
- Tower support (2x)

4.2.1. Outrigger cylinders

In *Picture 4-5* the outrigger cylinder greasing point is indicated. Extend the outriggers until its holes are seen outside the frame. Through these holes the greasing points are reachable. (1 grease point per outrigger)



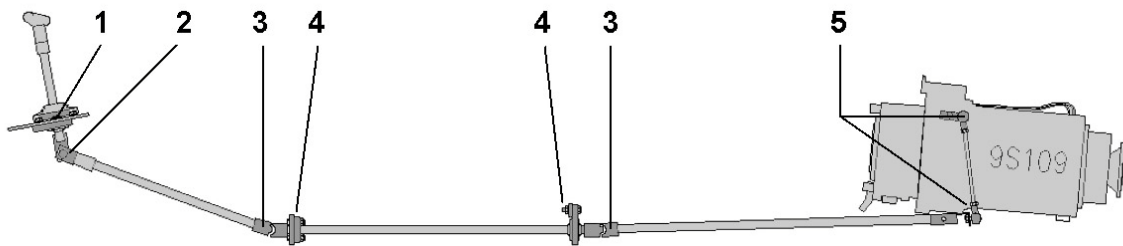
Picture 4-5

4.2.2. Gear change mechanism

In *Picture 4-6* the gear change mechanism grease points are indicated. Points 1 and 2 must be greased with EP2 grease. Points 3, 4 and 5 can be lubricated with chain spray.

When the crane is fitted with a central lubricating system, point 2 is lubricated automatically. The remaining grease points must be lubricated manually.

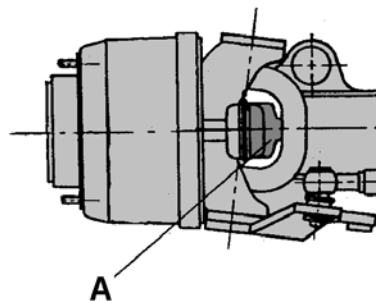
- (1) Gear shift lever ball (1x)
- (2) Pivot bolt under shift lever (1x) (sometimes in central system)
- (3) Universal joints shifting rod (2x)
- (4) Pedestal guides shifting rod (2x)
- (5) Ball joints shifting rod (2x)



Picture 4-6

4.2.3. Driven axles

The steering knuckles universal joints (A) grease points have to be lubricated with EP2 grease. (See *Picture 4-7*)



Picture 4-7

4.2.4. Tower support

The shear surfaces of the tower support have to be lubricated when the tower is upright. Use a brush to grease both sides.



Picture 4-8

4.2.5. Cardan shafts

The cardan shafts make up the connection between gearbox, transfer case, generator and axles. The cross pieces must be greased regularly through the grease nipples (See Picture 4-9). The next points however must be lubricated manually:

1. Universal joints cardan shaft gearbox -- transfer case (2x);

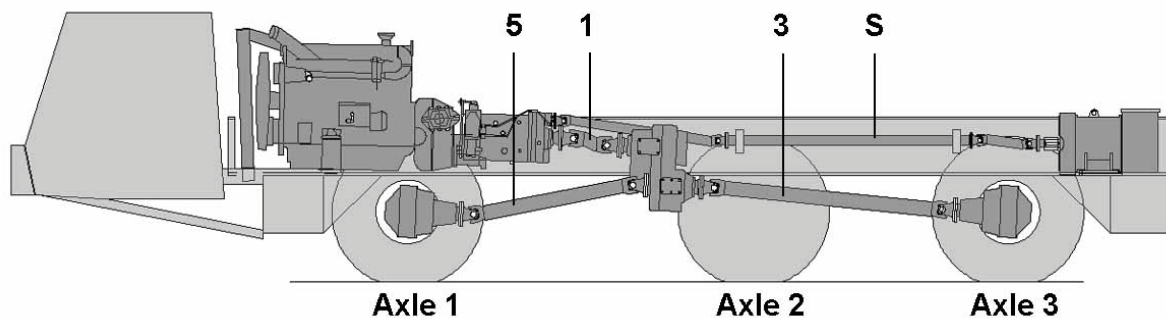
3. Universal joints cardan shaft transfer case – axle nr. 3 (2x);

5. Universal joints cardan shaft transfer case – axle nr. 1 (2x);

S. Support bearings cardan shaft transfer case – generator (2x),
(the grease nipples are situated behind the mud wings of axles 2 and 3 on the right side of the truck).



Picture 4-9



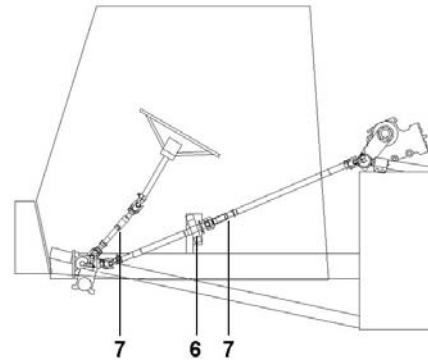
Picture 4-10

4.2.6. Steering system

The intermediate bearing under the cab (6) has to be manually lubricated (on some models in central system).

The various steering rods ball couplings are maintenance-free. Only the steering rod spline bushings (7) must be lubricated using grease spray.

The lubrication interval is every two months (or 350 hours). The grease to be used is EP2 grease. Besides lubrication, all connections must be inspected regularly.



Picture 4-11

4.2.7. Miscellaneous grease points

The following grease points have to be lubricated with EP2 grease:

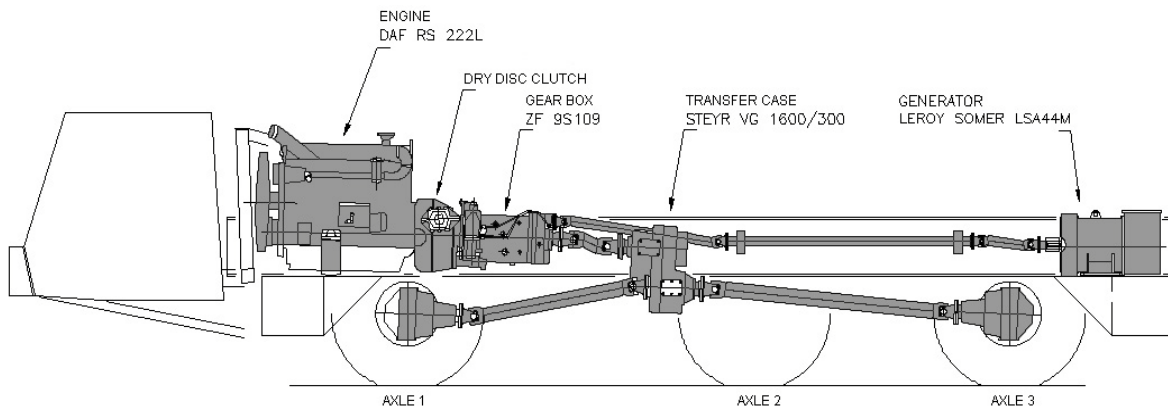
- Tool box hinges.
- The sling box frame and door hinges.
- The electrical cabinet hinges.

5. Drive line

The picture below shows the drive system make-up. The separate components are described on the following pages. Successively:

- Diesel engine
- Clutch and gearbox
- Transfer case
- Axles (1,2 and 3)
- Generator
- Remaining drive components

First a specification of every component is given. Subsequently the maintenance plan. Finally you will find an explanation of the way in which the maintenance work must be carried out. Parts and lubricant specifications are mentioned in the chapter "TECHNICAL DATA".



Picture 5-1

To carry out maintenance at the bottom of the engine and gearbox:

- Fully extend the axles.
- Loosen the fasteners and slide the cover plates one by one backwards between the wheels.

Reinstall them under the truck afterwards.



5.1. The diesel engine

5.1.1. Specification diesel engine

As drive source the Spierings AT3 is fitted with a DAF-turbo diesel engine with intercooler.

Data:

Brand/type	DAF RS 222L
Fuel system	Water cooled four stroke with direct injection
Inlet system:	Turbo-intercooler
Engine capacity:	8,65 litres
Maximum performance:	222 kW at 2300 ^{rpm} / _{min}
Maximum torque:	1130 Nm at 1400 ^{rpm} / _{min}
Compression ratio:	16,1:1
Bore x Stroke	118 x 132 mm
Unloaded idling speed	575 rpm
Unloaded maximum speed	2600 rpm

The engine is fitted with a water cooled two cylinder air compressor with a stroke volume of 440 cc for the pneumatic system. The fuel pump is driven by the crank shaft, as well as a hydraulic pump, which serves as main pump for the power steering. The starter motor is a Bosch JD 5.2 kW motor. For vacuum brake the engine is fitted with a valve in the exhaust system and a cut off valve in the fuel supply. Both are pneumatically operated.



5.2. Maintenance plan diesel engine

The maintenance system for the DAF diesel engine includes two service intervals, the A-service interval and the B-service interval.

Besides these service intervals, the oil level, coolant level must be checked daily.

Spierings Cranes advises you to employ the maintenance plan below.

A-service interval:	Every 500 hours
B-service interval:	Every 1000 hours (or at least once a year)

5.2.1. Maintenance A-service interval

The following activities have to be done:

- Change engine oil
- Replace oil filter
- Clean filter bolt fuel system
- Inspect / replace V-belt
- Inspect hoses cooling and fuel system
- Inspect hoses and seals air inlet system
- Check outlet system for connection and leaks

5.2.2. Maintenance B-service interval

Besides the maintenance A-service activities the following activities have to be carried out:

- Replace /clean air filter.
- Replace fuel filter.
- Clean / replace water separator.
- Inspect valve clearance.
- Inspect radiator and intercooler for pollution.
- Inspect coolant antifreeze concentration.

5.2.3. Check components and hose connections for leaks

Checking for leaks must be carried out before cleaning the engine and engine compartment, as all traces of leaks will have disappeared after cleaning.

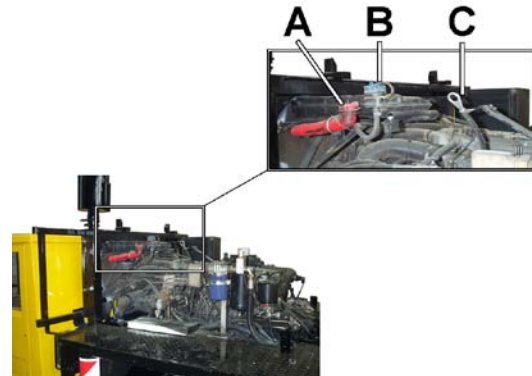
5.3. Engine oil

5.3.1. Check engine oil level



Check the engine oil level every day.

1. Make sure the crane stands on a horizontally flat base.
2. Switch off the engine and leave a hot engine at least 5 minutes so the oil sinks in the crank case.
3. Pull out the dipstick (C) and clean it with a non-fluff cloth.
4. Put the dipstick back in the holder and subsequently pull it out again.
5. Read off the level. The oil level must be between the two marks on the dipstick.
6. Put the dipstick back again in the holder.
7. If necessary, top up the oil. (See 5.3.2 Fill up engine oil)



Picture 5-2

5.3.2. Fill up engine oil

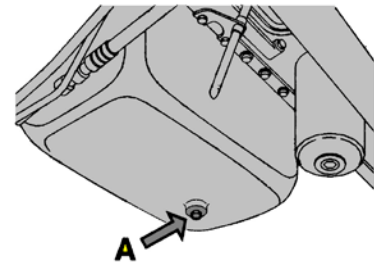
1. Make sure the crane stands on a horizontally flat base.
2. Unscrew the red filler cap (A) (Picture 5-2)
3. Always fill up the engine oil of the same brand and type. (In doubt consult Spierings Cranes)
4. Check the oil level with the dipstick. (See 5.3.1 Check engine oil level)

5.3.3. Engine oil change



Change the engine oil every 3 months at normal working conditions.

1. Make sure the crane stands on a horizontally flat base.
2. Draining the engine oil should preferably take place when the engine is at operating temperature. The engine must be switched off.
3. Put a trough under the drain plug. (*Picture 5-3, A*)
4. Remove the cap of the fast drainer at the bottom of the crank case and attach the provided drain hose. This hose will open the plug, so the oil can be drained.
5. Remove the drain hose, replace the seal ring (DAF no. 0119135) under the plug and place the cap on the fast drainer.
6. Fill the engine with approx. 24 litres engine oil. (*See 5.3.2 Fill up engine oil*)



Picture 5-3

5.4. Oil filter

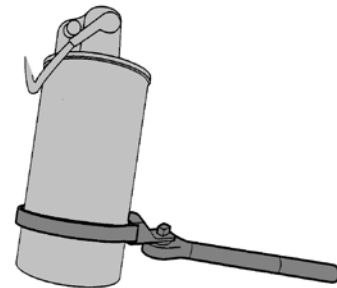
5.4.1. Oil filter replacement



Replace the oil filter every 3 months at normal working conditions.

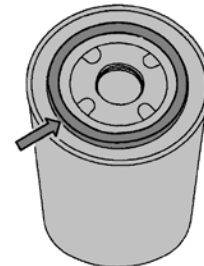
Always replace the oil filter for a new one. A used filter may never be cleaned and used again.

1. Place a trough under the filter.
2. Unscrew the filter by means of an oil filter wrench.



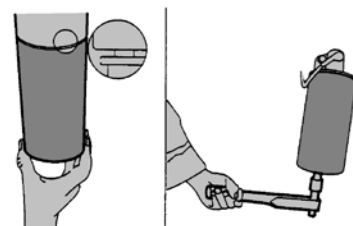
Picture 5-4

3. Fill the new filter element with engine oil.
4. Oil the new filter element seal ring with engine oil.



Picture 5-5

5. Mount the filter until the seal makes contact, then tighten the filter with 35-40 Nm torque.
6. Important: after changing oil and mounting the filter, operate the vacuum brake and let the engine run by means of the starter motor until the oil pressure indicator lamp goes out.
7. Leave the engine running for a short while and make sure the oil filter is properly sealed.
8. Now check the oil level.



Picture 5-6

5.5. Cooling system

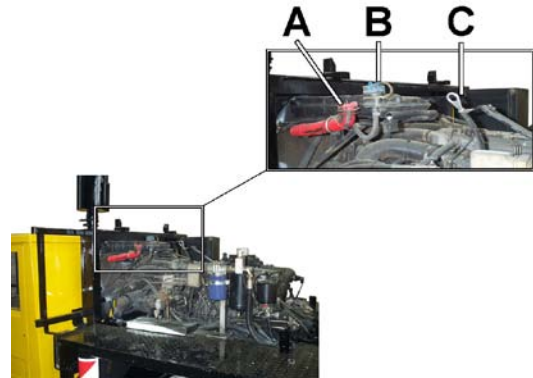
5.5.1. Check coolant level



Check the coolant level every week at normal use.

The coolant level can be checked:

1. Cool down the engine when hot.
2. Remove the cover plate on the left hand side of the engine cowling.
3. Carefully remove the filler cap from the coolant tank (see picture 5-7, B). While the coolant is warm, there is overpressure in the cooling system. In this case, first relieve the pressure by carefully opening the filler cap one turn.
4. Check the coolant level through the filler hole.
5. When the coolant level is not seen, fill the tank with coolant until it is halfway the filler neck.
6. Close the filler hole with the filler cap.
7. Close the cover plate.



Picture 5-7



Coolant is a harmful substance; prevent it from getting into contact with the skin.

Never remove the radiator cap when the engine is at working temperature.

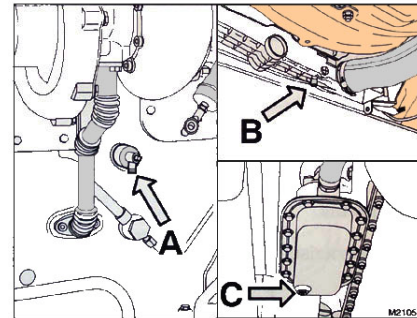
5.5.2. Changing coolant



Change the coolant every two years at normal use.

To prevent damage to the engine block, the engine may not be filled with cold coolant when it is still warm. Only use coolant or antifreeze which meets the specifications (see "TECHNICAL DATA").

1. Fully open the heater regulator in the truck cabin.
2. Remove the cooling system filler cap.
3. Drain the cooling system (the engine block through drain cock A, the radiator through drain plug B, the oil cooler through drain plug C). Collect the coolant - it must be removed as environmental hazardous waste.
4. Flush the cooling system.
5. Close all draining points.
6. Fill the cooling system with new coolant.
7. Let the engine run for a couple of minutes and check the coolant level. The system is self-bleeding. Make sure the breather line from the thermostat housing to the expansion reservoir is not bent or cut off.
8. Top up coolant if necessary.



Picture 5-8

5.5.3. Check antifreeze concentration

- Coolant exists of water and anti corrosion agent and, if necessary, an antifreeze agent. As antifreeze agent you can use i.e. ethylene glycol.
- Check the coolant antifreeze content. If necessary, add antifreeze to the cooling system.
- Refer to the producer's instructions for the proper mixing ratio of the antifreeze. Apply preferably 40% antifreeze on ethylene glycol basis. As this not only guarantees a reliable protection against frost, it also guarantees a good protection against corrosion.



Check the anti-frost concentration every year before winter season.

5.5.4. Radiator and intercooler element inspection/cleaning



Check the radiator and intercooler every 1000 hours for filthiness.

Check the detachable element (screen) for dirt, clean if necessary.

Clean the detachable element with a firm brush and blow it out carefully with compressed air (low pressure). In case of extreme filthiness the detachable element must be dismantled and cleaned.

Check the radiator and intercooler for filthiness, clean if necessary.

Clean the radiator/intercooler element by means of a high-pressure cleaner, spraying against the cooling air flow direction. Caution: Make sure you do not damage the element fins. In case of extreme filthiness the radiator/intercooler must be removed before cleaning it.



**Be careful concerning the electrical system when cleaning with water.
Never use a high pressure cleaner for cleaning the radiator.**



Wear safety glasses during cleaning the radiator.

- Cleaning the radiator with air pressure

Using air pressure for cleaning the radiator is the easiest way. Aim the air pressure nozzle always parallel to the radiator's cooling segments to prevent damage.

- Cleaning the radiator with cold or warm water

Use for preference a cold cleanser. Let this soak for approx. 10 minutes and wash it away with a dense water beam parallel to the radiator's cooling segments to prevent damage.

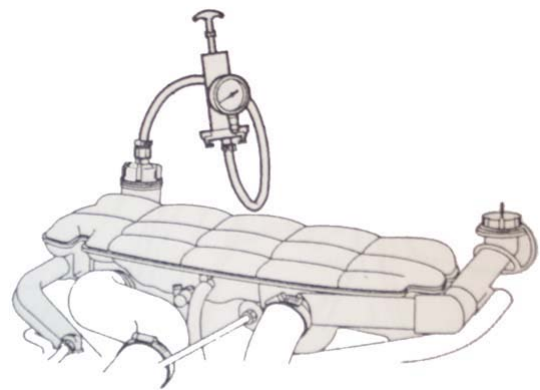
5.5.5. Cooling system hoses



Check the cooling system every 3 months at normal use.

The cooling system can be checked for leaks by means of a pressure pump

1. Remove the left-hand engine cowling and turn the coolant reservoir outside.
2. Remove the filler cap.
3. Mount the pressure test pump.
4. Pressurize the system; pressure between 0.4 - 0.5 bar.
5. Check the system for leaks.



Picture 5-9

5.6. Air inlet system

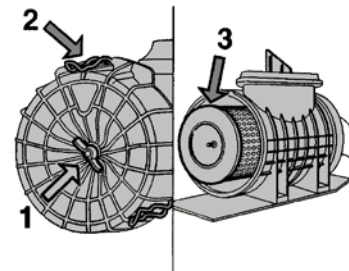
5.6.1. Air cleaner cleaning/replacement



Replace or clean the air cleaner element after every 1000 hours at normal working conditions.

The air cleaner element may be cleaned with compressed air only once, and then it must be replaced. Before cleaning or replacing the air cleaner element, the air cleaner housing (behind the right-hand engine cowling) must be removed.

1. Remove the air cleaner lid.
2. Remove the air cleaner element from the housing.
3. Clean the inside of the air cleaner filter housing and air cleaner lid.
4. If the air cleaner element or seal is damaged or is already cleaned once, the air cleaner element must be replaced (see "TECHNICAL DATA").



Picture 5-10

5. Shake out the air cleaner element.
6. Clean the air cleaner element by means of blowing compressed air from the inside (max. 3 bar).
7. Sparingly coat the seal ring inside with Vaseline.
8. Mount the air cleaner in the air cleaner housing. Tight the mounting nut.
9. Mount the air cleaner lid. Tight the mounting nut by hand.



Picture 5-11

5.6.2. Check the air inlet system



Check the air system every 3 months at normal use.

Visually check the air inlet system, the attachment and condition of air inlet lines/hoses.

Leaks in the air inlet system may be noticed by:

- Loss of power
- High fuel consumption
- Abnormal sounds

In case you doubt the sealing of the air inlet system, check it by means of a pressure test.

5.7. Fuel system

5.7.1. Fuel filter replacement



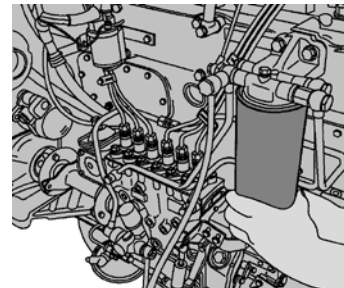
Replace the fuel filter after every 1000 hours at normal working conditions.

The fuel filter is a disposable filter, thus not suited to be cleaned and reused.



While removing the fuel filter, an amount of fuel can leak. Collect this fuel in a suitable trough and prevent fire risk!

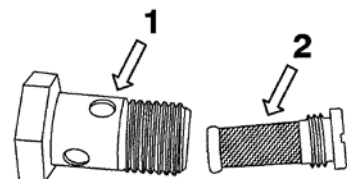
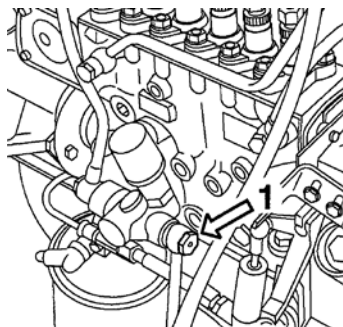
1. Place a trough under the fuel filter.
2. Unscrew the filter.
3. Remove the filter. Collect the leaking fuel.
4. Sparingly oil the sealing of the new filter (see "TECHNICAL DATA"). with engine oil.
5. Place the new filter.
6. Tighten the filter by hand.
7. When necessary bleed the fuel system.
8. Start the engine.
9. As the engine is running, check the fuel system for possible leaks.



Picture 5-12

5.7.2. Cleaning filter bolt fuel system

1. Remove the filter bolt.
2. Remove the strainer (2) from the filter bolt (1).
3. Clean the filter with clean diesel and dry it using compressed air.
4. Reinstall bolt and the strainer. Use new seal rings.
5. Bleed the fuel system.

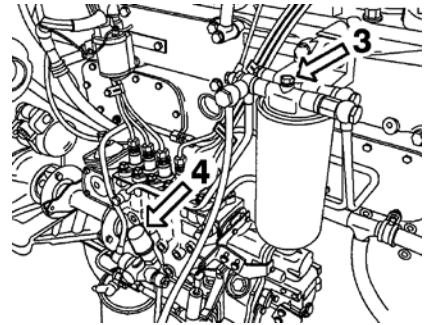


Picture 5-13

5.7.3. Bleeding the fuel system

The fuel filter is located on the left hand rear side of the diesel engine. To reach it, the left hand side of the engine cowling has to be removed.

1. Open the bleed screw (3) on the fuel filter body (left hand side of the diesel engine).
2. Pump fuel out of the bleed screw with the hand pump (4) until no more air bubbles are visible in the fuel hose.
3. Close the bleed screw.



Picture 5-14

5.7.4. Check for fuel leaks



Check the fuel system every 3 months at normal use.

Visually check the fuel system for leaks, pay special attention to the synthetic fuel lines attached to components or in line bundles.

In case the synthetic fuel line's condition is such that rubbing through is expected or already visible, it must be replaced.

5.8. Water separator

5.8.1. Draining water separator



Drain the water separator every week at normal working conditions.

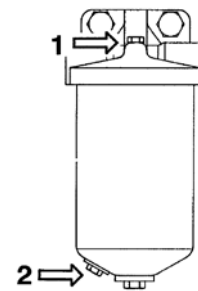


CAUTION!

While draining and de-aerating the water separator an amount of fuel can be set free. Collect this fuel in a suitable trough and prevent fire risk!

The water separator is located between axle 1 and the fuel tank on the right hand side.

1. Put a trough under the water separator.
2. Unscrew bleed plug (1).
3. Unscrew drain plug (2) and drain the water separator until clean fuel comes out.
4. Reinstall the plugs.
5. Bleed the fuel system if necessary.



Picture 5-15

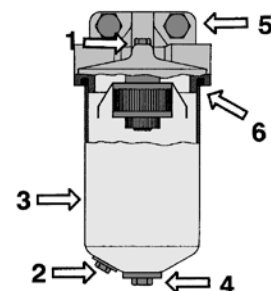
5.8.2. Clean filter water separator



Clean the filter of the water separator every 3 months / 500 hours at normal working conditions.

This model has a re-useable water separator.

1. Put a trough under the water separator.
2. Unscrew bleed plug (1) and the drain plug (2) and drain the water separator.
3. Remove bowl (3) of the water separator by unscrewing the bolt at the bottom of the bowl (4).
4. Clean all parts of the water separator thoroughly using clean diesel.
5. Sparingly oil the new sealing (see "TECHNICAL DATA").
6. Replace the bowl with new seal and fasten it manually.
7. Now bleed the fuel system.



Picture 5-16

5.8.3. Replace filter water separator



Replace the filter of the water separator every 1000 hours at normal working conditions.

Follow the procedure described in 5.8.2 except for step number 4, here the filter is replaced instead of being cleaned.

5.9. V-belts

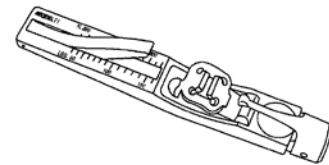
5.9.1. V-belts inspection



Check the V-belt for wear and correct tension every week at normal working conditions.

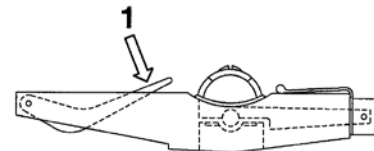
Check if the belt is worn or damaged. Replace if necessary (see TECHNICAL DATA).

Accurately adjusting the V-belt tension prolongs the belt's service life. The V-belt tension can be checked accurately with a belt tension gauge, DAF number 1240443 for multiple V-belt version or poly-V-belt version.



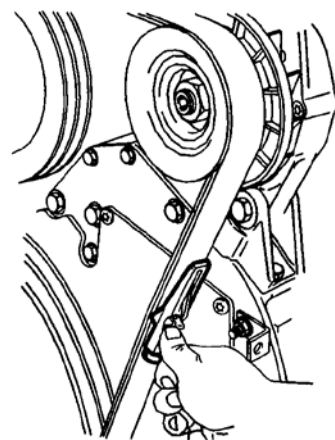
Picture 5-17

1. Set the gauge on zero by pressing the gauge arm (1).



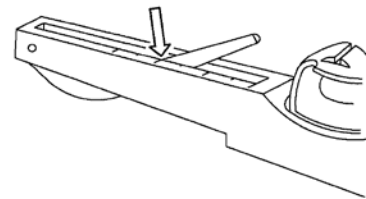
Picture 5-18

2. Place the gauge on the V-belt, in the middle of the maximum distance between two pulleys.
3. Slowly press the V-belt with the belt tension gauge until the gauge produces a click-sound. Then carefully remove the belt tension gauge.



Picture 5-19

4. Read the value indicated by the gauge arm position compared to the scale. Compare this value to the recommended pre-tension (refer to table 1). If necessary correct the v-belt tension.



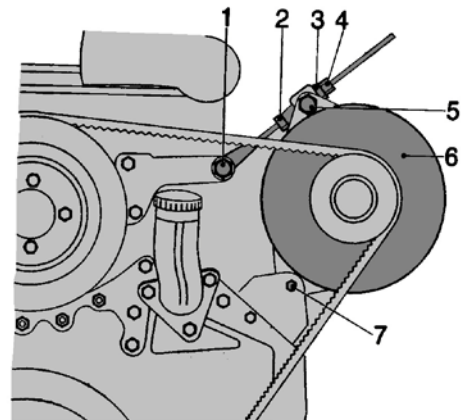
Picture 5-20

Table 1 - Belt tension "12.5 mm" V-belts in Newton (N)		
	Multiple V-belt	
	encased	open flank
New V-belt		
Adjustment tension	900	1200
Check tension	>600	>800
Worn in V-belt		
Lowest tension	400	500
Adjustment tension	450	700
<p>(1) Encased V-belts can be recognized by the textile fabric present in the rubber, at the inside as well as at the V-belt flanks. Construction: without teething.</p> <p>(2) V-belts with open flank can be recognized by the flanks and inside, at which opposite to the belt's top side, there is no textile fabric in the rubber (ground belt flank). Construction: with or without teething.</p> <p>(3) After mounting a new V-belt the pre-tension must be adjusted to the adjustment tension. After the test drive the pre-tension must at least equal the check tension. If necessary, adjust to the check tension.</p> <p>(4) If the worn-in V-belt is below the "lowest tension" it must be adjusted to the adjustment tension.</p>		

5.9.2. V-belts tensioning

Adjust the dynamo and water pump drive V-belt tension:

1. Unscrew the spindle lock nut (2), fixing bolt (1) and the dynamo fixing bolts (5) and (7).
2. Unscrew bush lock nut (3) and turn the bush (4) until the correct V-belt tension is achieved.
3. Retighten the fixing bolts and lock nuts.



Picture 5-21

5.9.3. V-belt replacement:

By turning the V-belt tension unit fully back, the belt can be removed and replaced by a new one. Meanwhile check the V-belt pulleys for damage, rust and grease deposit.

5.10. Exhaust system



Check the exhaust system every 3 months at normal working conditions.

Visually check the exhaust system for connection, leaks and damage that could cause more damage. Repair damage and leaks if necessary.

5.11. Valve clearance

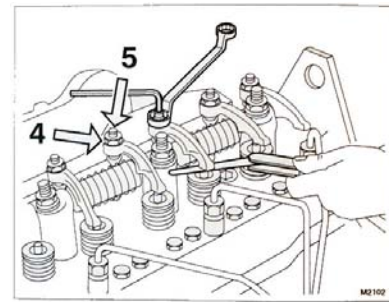
5.11.1. Valve clearance check and adjustment



Check and adjust the valve clearance every year at normal working conditions.

1. Clean the valve housing covers rim, remove the bleeding hose and oil change hose and remove the valve housing covers and gasket.
2. Make sure the fuel pump is in off position. If necessary lock the fuel pump in off position.
3. Turn the crankshaft by means of the fixing bolt on the dynamo pulley to the right, seen from the distributor side, (this is similar to the engine direction of rotation), until the 6th cylinder valves start to tumble. Now the first cylinder piston is in B.D.C. position of the compression stroke. With "tumble" we mean the moment at which the inlet valve starts to open and the outlet valve finishes to close.

4. Check and adjust the valve clearance of the 1st cylinder. The valve clearance of inlet as well as outlet must be 0.5 mm. Adjust the correct valve clearance by unscrewing the locknut and turn the adjustment bolt in the correct direction.
5. By repeatedly turning the crankshaft 1/3 of a turn, the valves can be adjusted in the injection sequence (1-5-3-6-2-4). See table 2.
6. Clean the sealing surface on the valve housing cover, and reinstall the valve housing cover with a new gasket (see TECHNICAL DATA). Tighten the fixing bolts on the valve housing cover with 35 Nm.
7. Reinstall the bleeding hose with new seal rings. Reinstall the oil change hose.



Picture 5-22

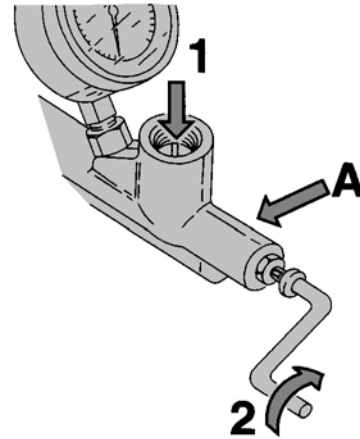
Table 2 - Injection sequence	
Tumbling valves of cylinder:	Adjusting valves of cylinder:
6	1
2	5
4	3
1	6
5	2
3	4

5.12. Injectors

5.12.1. Injectors opening pressure inspection and adjustment

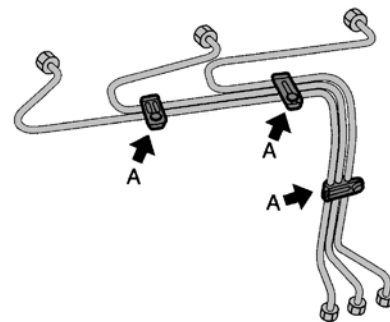
You can check the injectors' opening pressure by means of an injector test pump (DAF No. 0694966). This method has the advantage that the injectors do not have to be dismantled.

1. Bleed the test pump before starting the test:
2. Remove the filler cap from the test pump reservoir and fill the reservoir with test fluid (fuel). The fluid level must be approx. 1 cm under the top edge.
3. Tilt the pump in such a way that the line with the heading "BLEED" is level.
4. Press the bleed pin (1) and simultaneously turn the handle (2) to the right till the end of the stroke. While turning the handle, air bubbles are rising in the reservoir. Turn the handle back and fill the reservoir once more. Repeat these actions until the air bubbles stop coming. Now you may let go of the pin.
5. Turn the handle further until fuel escapes at the pressure side.
6. If necessary, top up the reservoir and screw on the cap. Now the pump is ready to use.



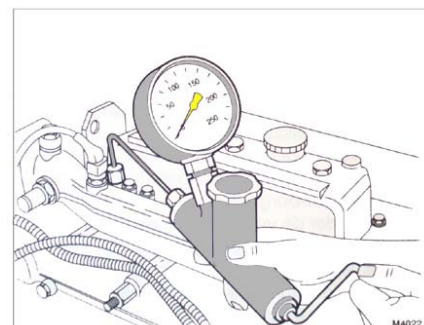
Picture 5-23

7. Remove the injector lines:
 - a) Clean the coupling nuts and the surrounding area of the injectors as well as the fuel pump.
 - b) Release the coupling nuts on the injector lines at the fuel pump side and at the injector side. When doing so, stop the couplings nut on the injectors with an open-end spanner.
 - c) Seal the freed openings immediately.
 - d) Remove the complete 3 lines set. Always keep the injector lines together as a set. Never remove or replace the clamping brackets (A) that hold the lines together.



Picture 5-24

8. Check the injectors' opening pressure:
 - a) Connect the test pump with the supplied injector line to the injector to be tested. Keep the test pump as level as possible.
 - b) Unscrew the filler cap from the reservoir on the test pump half a turn, so air can enter the reservoir. While testing make sure there is enough fluid in the reservoir.
 - c) By turning the test pump handle to the right, pressure is built up. The injector opening pressure may now be accurately determined, and must be between 200 and 240 bar.



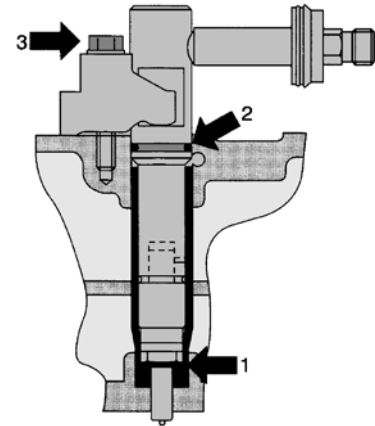
Picture 5-25

The test may be carried out 2 to 3 times. Repeating it too often will causes so much fuel on top of the piston, that the engine could get damaged.

When the injector opening pressure is determined outside the range of 200 to 240 bar, the injectors have to be adjusted. This has to be done by a certified specialist or exchange injectors can be purchased from Spierings.

Removing injectors:

1. Only remove the injector and clamp with special tools (DAF No. 1329309 and DAF No. 0694835). Remove the injector in order to adjust the opening pressure:
 - a) Clean the valve housing cover edge and remove the valve housing cover and gasket.
 - b) Remove the fixing bolt (3) on the injector clamp.
 - c) Use the DAF injector pulling device to dismount the injectors (DAF No. 0694835).
 - d) Make sure the copper washer (1) is not left behind in the injector bushing. If it is left behind, the injector could be installed wrongly. This could cause serious damage to the engine. The washer can be removed with special tools (DAF No. 1329309).
2. Blow out the injector bushing with compressed air.

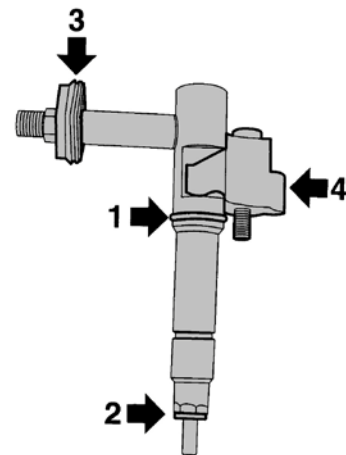


Picture 5-26

Mounting the injector in the engine:

The injector bushing must be clean and no copper washing may be left behind.

1. Mount a new O-ring (1) and a new washer (2) on the injector. Apply a small amount of acid-free grease on both rings.
2. Check the injector's valve housing sealing ring (3). Replace it in case of leaks and/or damage.
3. Mount the injector complete with clamp (4). Use a new fixing bolt with a light engine oil coating on the thread and tighten with a tightening torque of 25 Nm +60° angular deflection.
4. After testing and possible adjustment the injector lines can be reinstalled.
5. Blow out the injector lines with dry compressed air.
6. Mount the injector line set and tighten the coupling nuts on the injector lines with a tightening torque of 25 Nm.
7. Clean the sealing surface on the valve housing cover, and reinstall the valve housing cover with a new gasket. Tighten the fixing bolts on the valve housing cover with 25 Nm.



Picture 5-27

5.13. Clutch and gear box

5.13.1. Specifications gear box

The ZF 9S-109 gearbox, installed in the AT3, has 9 gears forward and one gear reverse.

The gearbox shifts automatically (by means of air pressure) between the low and high range.

The dry disc clutch (F&S) between gearbox and engine is single. The operation is hydraulic and air powered. On the gearbox, a hydraulic pump is installed, which is shift on continuously, and is intended for the suspension and outrigger system.

5.13.2. Check oil level gearbox



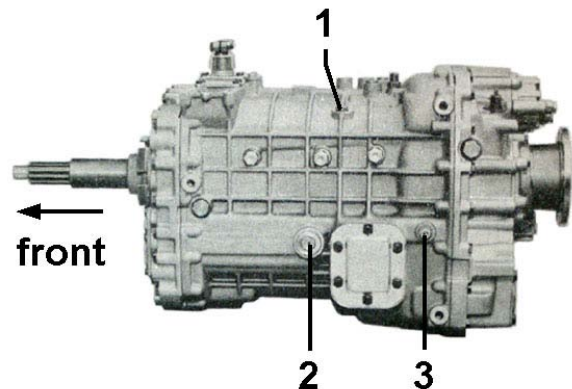
Check the oil level in the gearbox every 3 months and top up if necessary.



To prevent measuring faults: Do not check the oil level when the gear box is hot. The oil temperature must be below 40°C (104F).

To prevent measuring errors, the check must not be carried out immediately after operation. The oil temperature should be between 30-40°C.

Check the oil level by removing the oil filler plug (1) (picture 5-28).; If the oil level is below the filler edge, it must be topped up.



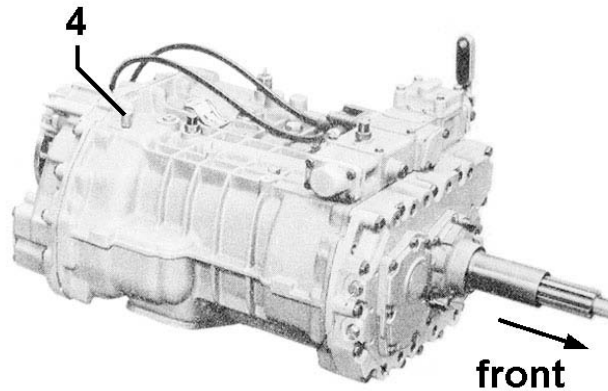
Picture 5-28, bottom view gearbox

5.13.3. Bleeding gearbox



Check and clean the breather of the gear box every 3 months.

The gearbox heats up during operation. This causes overpressure, which must be relieved through the breather (See arrow in picture 5-29). Make sure the breather is clean and it doesn't have a synthetic cap on it.



Picture 5-29

5.13.4. Gear box oil change



Change the gear box oil every year during the yearly maintenance service at normal working conditions.



Caution!

The gear box and oil are hot after driving the truck for a while.

1. Make sure the truck stands on a horizontally flat base.
2. Put a trough under the drain plugs.
3. Unscrew the magnetic drain plugs (2 and 3). (picture 5-28)
4. Clean the magnetic drain plugs and renew the seals.
5. Reinstall the drain plugs after draining the oil.
6. Fill the gear box with approx. 8 litres oil (6 litres when refreshing) through the filler hole till the oil level reaches the rim.

5.13.5. Clutch fluid level



Check the clutch fluid level every 3 months and top up if necessary.

The reservoir for the clutch fluid is at the right side of the steering wheel in the dashboard (refer to "Control panel"). The fluid level should be between MAX and MIN. Check the fluid level in the reservoir and, if necessary, top up with clutch fluid according to the specifications in "TECHNICAL DATA".



CAUTION!

Prevent spilling brake fluid on the synthetic dashboard. The synthetic material can easily be harmed by brake fluid, causing it to crack!



5.13.6. Clutch bleeding



Bleed the clutch every 3 months at normal use.

When you want to bleed the clutch, you first have to bleed the 10 litres accessory tank (press the nipple on this tank. The nipple for the clutch is on the operating cylinder under the clutch housing. While one person puts pressure on the clutch pedal, the other unscrews the nipple a little. (The clutch pedal must be under pressure, not fully kicked down). After opening the nipple liquid with possibly air will escape. When the clutch pedal feels "hard", the clutch has been de-aerated and the nipple must be tightened. Subsequently the clutch fluid must be topped up to Max.

Caution: *While bleeding the fluid level must not drop below Min.*

5.13.7. Check clutch

Put the transmission in neutral.

Kick down the clutch.

After max. 7 seconds, slowly put the transmission in reverse (it is a dog clutch type and not synchronized). If you hear a rattle, the clutch must be adjusted.

Put the transmission in 8th gear.

Slowly release the clutch and check if the diesel engine tends to stop running. If not the clutch has to be replaced.

5.13.8. Maintenance gear box



Check the gearbox every 3 months for external leakages and filth on the breather. Verify that the breather is clean and that there is no plastic cap on it.



Make sure no water penetrates through the breather by using a high pressure cleaner. This could cause serious damage to the gear box.

5.14. Transfer case

5.14.1. Specifications transfer case

The transfer case is a STEYR type VG1600/300. This transfer case divides the power at the inlet (1, by means of a cardan shaft connected to the driven shaft of the gear box) over two outlets. (picture 5-30)

One outlet (2) drives axle 1.

Outlet (3) drives axle 3. (See picture 5-1)

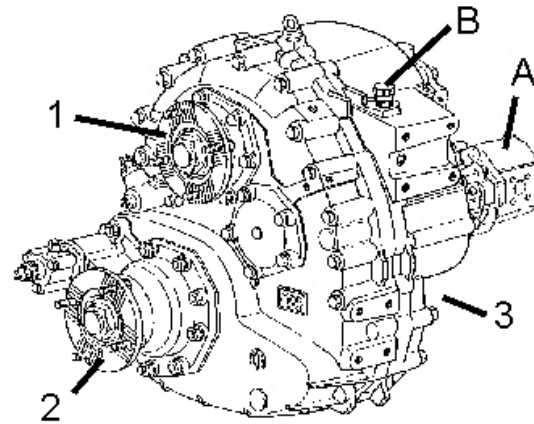
The transfer case has two transmission ratios:

High: 1 : 0,89

Low: 1 : 1,536

A hydraulic pump is driven by outlet axle (A). This emergency pump is used when the engine fails and the vehicle is still moving.

For releasing overpressure during operation, a breather (B) is mounted on top of the case.



Picture 5-30

5.14.2. Maintenance transfer case



Check the transfer case every 3 months for leakages and filth on the breather.



Make sure no water penetrates through the breather by using a high pressure cleaner. This could cause serious damage to the transfer case.

5.14.3. Check oil level transfer case

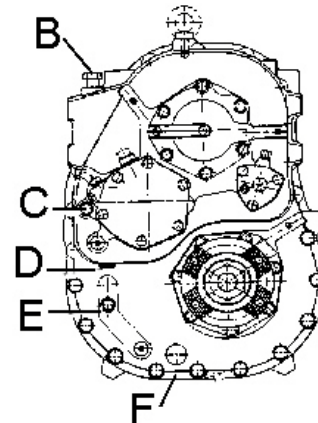


Check the oil level of the transfer case every 3 months at normal working conditions.



To prevent measuring faults: Do not check the oil level when the transfer case is hot. The oil temperature must be below 40°C (104°F).

1. Make sure the truck stands on a horizontally flat base.
2. Unscrew the plug from the filler hole (E). (picture 5-31)
3. The oil level should be at the rim of the filler hole. If not, fill it up through the filler hole (E).
4. Reinstall the plug.



Picture 5-31

5.14.4. Transfer case oil change



Change the oil of the transfer case every year during the yearly maintenance service at normal working conditions.



Caution!

The transfer case and oil are hot after driving the truck for a while.

1. Make sure the truck stands on a horizontally flat base.
2. Put a trough under the drain plugs.
3. Unscrew the drain plugs (D and F). (picture 5-31)
4. Clean the drain plugs and renew the seals.
5. Reinstall the plugs after draining the oil.
6. Remove the plugs from the filler holes (C and E).
7. Fill the transfer case with approx. 7.5 litres oil through the filler holes till the oil level reaches their rims.
8. Reinstall the plugs of the filler holes with renewed seals.

5.15. Axles

All axles are Ginfax axles. Axles 1 and 3 are steerable axles type APG 2600 and driven from the transfer case. Axle 2 can't be steered and is of type NOS 2600.

The total weight of the crane is divided over all three axles by 12,000 kg.

Axle number	Steered	Driven	Differential	reduction
Axle 1	Yes	Yes	Single	6,16
Axle 2	No	No	-	-
Axle 3	Yes	Yes	Single	6,16

5.15.1. Maintenance axles



Check the hubs and differentials of axles one and three every 3 months for leakages and filth on the breathers.



Make sure no water penetrates through the breathers by using a high pressure cleaner. This could cause serious damage to the hubs and differentials.

5.15.2. Check oil level differentials

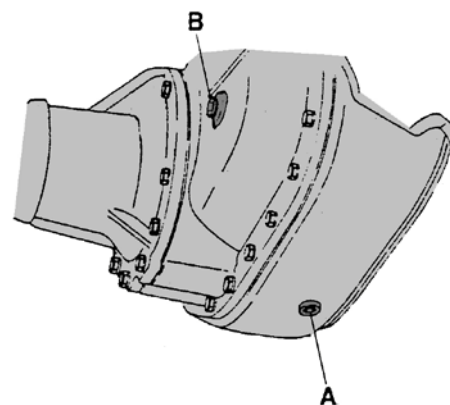


Check the oil level of the differentials every 3 months at normal working conditions.



To prevent measuring faults: Do not check the oil level when the differentials are hot. The oil temperature must be below 40°C (104°F).

1. Make sure the truck stands on a horizontally flat base.
2. Unscrew plug (B) from the filler hole of the differential. (picture 5-32)
3. The oil level should be at the rim of the filler hole. If not, fill it up through the filler hole (B).
4. Reinstall the plug.



Picture 5-32

5.15.3. Differential oil change



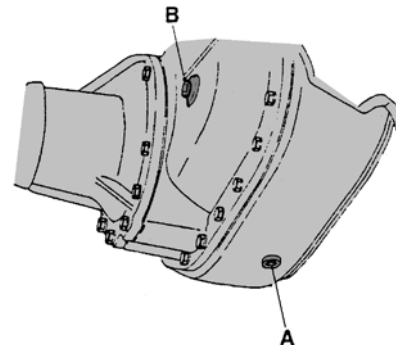
Change the oil in the differentials every year during the yearly maintenance service at normal working conditions.



Caution!

The differentials and oil are hot after driving the truck for a while.

1. Make sure the truck stands on a horizontally flat base.
2. Drain the oil through drain hole (A) concerning axle 1 and 3. (picture 5-33)
3. Reinstall the drain plug.
4. Fill the differentials with approx. 15 litres oil till the oil level reaches the rim. (B) Check the level after a while and refill if necessary.



Picture 5-33

5.15.4. Check oil level hubs

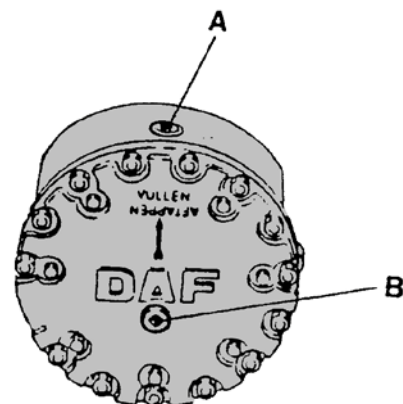


Check the oil level of the hubs every 3 months at normal working conditions.



To prevent measuring faults: Do not check the oil level when the hubs are hot. The oil temperature must be below 40°C (104F).

1. Make sure the truck stands on a horizontally flat base.
 2. Make sure that fill / drain plug (A) is at his highest point. (picture 5-34)
 3. Remove plug (B) from the level hole.
 4. The oil level should be at the rim of the level hole (B). If not, fill it up through the filler hole (A).
 5. Reinstall the plugs.
- Repeat this for all six hubs.



Picture 5-34

5.15.5. Hubs oil change



Change the oil of the hubs every year during the yearly maintenance service at normal working conditions.



Caution!

The hubs and oil are hot after driving the truck for a while.

1. Make sure the truck stands on a horizontally flat base.
2. Make sure that fill / drain plug (A) is at his lowest point.
3. Put a trough under the fill / drain plug.
4. Unscrew the fill / drain plug (A).
5. Clean the plug and renew the seal.
6. Reinstall the fill / drain plug after draining the oil.
7. Refill the hubs as explained in 5.15.4 Check oil level hubs (turn fill plug up again to highest point).

5.16. Tires

5.16.1. Maintenance tires



Check the tires and rims every day at normal working conditions.

To ensure safety, all tires and rims must be checked regularly for wear and damages. This has to be done on the outside as well on the inside of the wheels. To get better access, turn the wheels entirely to the left or right using the steering wheel.

If any object is stuck in a tire, it should be removed.

5.16.2. Tire pressure



Check the tire pressure every 3 months at normal working conditions.

Check all tires for a tire pressure of **10 bar**.
Correct this if necessary.

5.17. Check the brake lining thickness



Check the brake lining thickness every year during the annual maintenance service at normal working conditions.

To check the brake lining thickness, remove the synthetic sealing caps at the rear of the brake drums (See picture 5-35). Now you can check if the brake lining is still sufficient. If in doubt make use of the wear ridge to check. Proceed by first supporting the crane on outriggers and removing the wheels. Subsequently unscrew the 3 fixing bolts on the brake drums. Then the brake drum is pushed from the hub by means of screwing 3 bolts M12x50 in the respective bores. Now check in view of the wear ridge how far the brake lining is worn and replace it if necessary (*for specifications see "technical data"*). The brake lining must be replaced at a thickness of approx. 10 mm.



picture 5-35

5.17.1. Brakes

We advise to test the brakes every year on a brake tester.



6. The hydraulic system

6.1. Structure hydraulic system

The hydraulic diagram shows how the hydraulic system is built up (see enclosure). The hydraulic system exists of 4 subsystems, i.e.:

- Hydraulic pump system
- Hydraulic steering system
- Hydraulic suspension
- Hydraulic outrigger system

Below the various subsystems are dealt with separately.

6.1.1. Hydraulic pump system

The pump system consists of 3 pumps:

- Pump 1. The steering pump mounted on the DAF engine, supplies oil to steering circuit . Behind the steering pump a pressure relief valve is mounted, which limits the pressure to 150 bar.
- Pump 2. The emergency steering pump is connected to the transfer case, so it only works while the vehicle is moving. In case of a malfunction in the main steering pumps, this pump takes over. The crane has sufficient steering power until it stops. The return oil of pressure relief, flow control valve and hydraulic steering system flows in the hydraulic tank.
- Pump 3. The pressure needed for the suspension and outriggers is supplied by a pump, which is connected directly onto the gearbox. The pressure while operating the suspension and outriggers is limited to 200 bar.

Return oil from the overpressure valve, power control valve and the hydraulic steering system is being collected in the hydraulic oil tank.

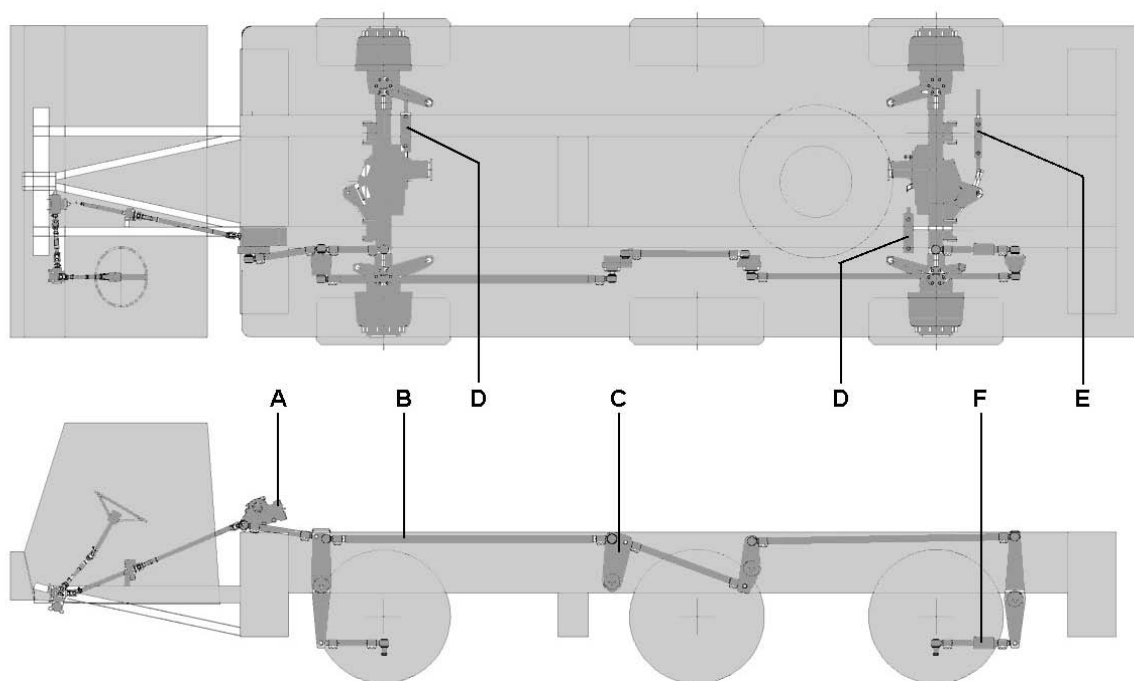
6.1.2. Hydraulic steering system

Picture 6-1 shows the steering system. In the steering servo control (A) the turning motion of the steering wheel is mechanically converted and powered to the motion of the steering rods (B). These in turn operate the steering arms (C), whereas the 3rd axle steers opposite compared to the first axle. This provides a small turning circle.

For power steering a one ZF servo control is used. The steering wheel motion is converted to a hydraulic power steering system, which operates the steering mechanism. The steering axles have a hydraulic auxiliary steering cylinder (D) each.

A brake valve is connected to the auxiliary steering cylinder on the rear axle. This valve causes the rear axle to only steer when a certain pressure is built up. Therefore, the rear axle reacts slower when taking a bend, securing better steering qualities.

When returning the steering wheel the brake valve is bridged by a signal from the middle position arm (E) and the axle will follow the steering without delay. (Also refer to the hydraulic diagram in the enclosures)



Picture 6-1

To prevent unstable handling of the crane during high velocities, a package of springs (F) is mounted between the steering rods of the third axle. In case of tiny steering corrections the 3rd axle will not steer.

6.1.3. Hydraulic suspension

The AT3 has a hydro pneumatic suspension with hydraulic cylinders which are connected to six accumulators (see the hydraulic diagram in the enclosures). The accumulators are fitted with a bellow filled with gas (pressure 110 bar), which is compressed when the suspension cylinder moves in. This provides the spring motion. The oil flowing in and out of the cylinders flows through a throttle which provides damping.

The oil flow can be cut off with hydraulic 2/2-control valves. Thus the suspension is blocked.

6.1.4. Hydraulic outrigger system

To operate the outrigger system, the outrigger beams as well as the outriggers can be operated separately. The outrigger cylinders are fitted with controlled non-return valves, so in case of a burst hose, there is no loss of pressure in the outrigger cylinder (see the hydraulic diagram in the enclosures).

6.2. Maintenance hydraulic system

Parts of the hydraulic system like valves, pumps and cylinders are built for a long service life without maintenance.

For hydraulic oil, the filter and the accumulators of the suspension system Spierings advises the following maintenance.

6.2.1. Check oil level



Check the hydraulic oil level every 3 months.

To check the oil level a gauge glass (3) is mounted on the hydraulic oil tank. All rams (including the suspension rams) must be retracted when checking the oil level. The oil level must be in the upper part of the gauge glass.

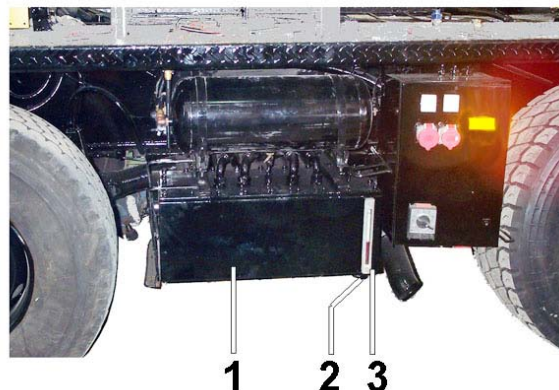
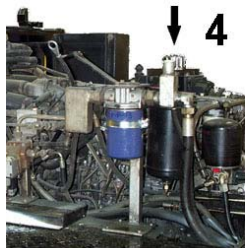
Change hydraulic oil



Change the hydraulic oil every five years after analysis.

The oil tank is mounted on the left side of the carrier between axles 1 and 2.

To change the hydraulic oil first an oil sample must be analyzed. To change the hydraulic oil all rams (including the suspension rams) must be retracted and the filler cap (no. 4, under left engine cowling) must be removed to release the pressure in the system. At the right-hand side below the hydraulic oil tank (1) is a drain plug (2). As soon as the oil is drained, reinstall the drain plug and pour approx. 125 litres oil through the filler hole (according to the specification in "Technical data").



Picture 6-2

6.2.2. Replace oil filter



Replace the hydraulic oil filter every year.

The hydraulic system return oil filter is situated behind the left hand engine cowling. If you want to replace it, you first have to unscrew filler cap (*Picture 6-2, 4*). Then unscrew the filter (*Picture 6-3, 2*) by means of a filter wrench. Before mounting the new filter element you first have to coat the sealing ring with oil. After replacing the return oil filter you have to check the oil level and top it up if necessary.



Picture 6-3

6.2.3. Check the accumulators of the suspension



Check the pressure of the accumulators of the suspension system every year.

The suspension system of the AT3 has six accumulators in the middle of the chassis.

Check the accumulators by means of a specially designed tool from Hydac. The pressure must be 110 bar.

6.2.4. Check the hydraulic system



Check the hydraulic system for leakage and damage every 3 months.

For safety the oil gauge, the hydraulic hoses, tubes and connections should be visually inspected. If there are leakages or damages all concerning parts should be renewed.

7. Steering system

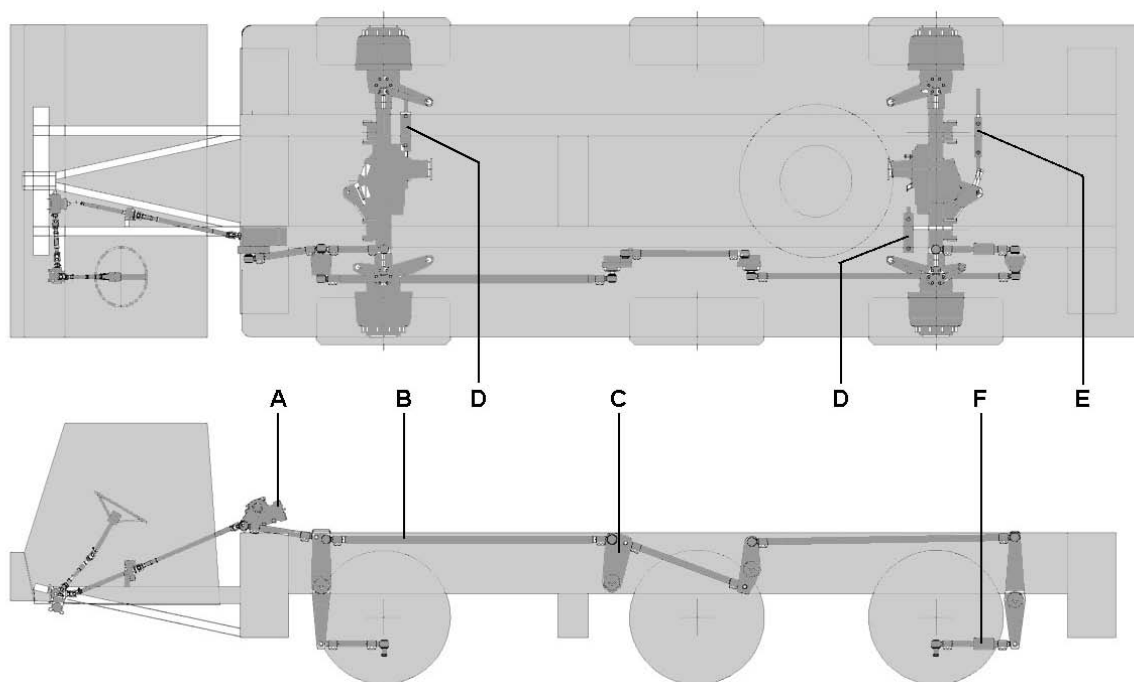
7.1. Structure mechanical steering system

The steering system is mechanical with hydraulic power steering (see hydraulic system). The mechanical system steers axle 1, whereas axle 3 is steered in opposite direction. This creates a small turning circle. The mechanical steering system consists of steering arms (C) and steering rods (B) with ball joints.

The turning motion of the steering wheel is mechanically converted to the motion of the steering rods. These in turn operate the steering arms, whereas the 3rd axle steers opposite compared to the first axle. This provides a small turning circle.

- A) Steering housing
- B) Steering rods (6x)
- C) Steering arms (4x)
- D) Hydraulic auxiliary steering cylinders (2x)
- E) Middle position arm
- F) Package of springs

Picture 7-1 shows how the steering system is built.



Picture 7-1

7.2. Maintenance mechanical steering system

7.2.1. Check steering arms, ball joints and steering rods for play and deformation



Check the steering arms, ball joints and steering rods for play and deformation every 3 months.

Check this with help of another person.

1. The crane must be fully folded.
2. Person 1: Wiggle the steering wheel to the left and right.
3. Person 2: Check the play of the steering arms, ball joints, steering housing (bolts) and steering rods.
4. Repair if necessary.

7.2.2. Check steering system joints and splines for sufficient lubrication



Check the steering system joints and splines for lubrication every 3 months.

Check and lubricate (EP2 grease) if necessary. See also chapter Lubrication.

7.2.3. Truck aligning



To prevent excessive tire wear we advise you to align the truck every year.

Before alignment of the wheels of the truck the steering arms, ball joints and steering rods have to be checked for play and deformation.

Please contact Spierings Cranes for instructions.



8. The pneumatic system

8.1. Structure pneumatic system

The pneumatic diagram in the enclosure shows how the pneumatic system is built up. The pressure is supplied by a compressor on the DAF engine.

The system can be divided into 2 subsystems:

1. The system for the truck brakes.
2. The system for the accessories.

The system is secured by a 4-circuit safety valve. If there is a leak in one of the circuits, this valve sees to it that the remaining circuits keep air pressure, so the truck brake can still be operated.

8.1.1. Braking system

The air brake circuit consists of three 40l air vessels. One vessel is located between axle 1 and 2 on the right hand side. The other two vessels are located between axle 1 and 2 on the left hand side on top of the oil tank. Check the air vessels for condensed water by pushing the drain valve ring under the air vessels. If the amount of condensed water increases, the drying element in the air dryer must be replaced.

The braking system has 3 air vessels for;

- Brake circuit 1; braking axle 1.
- Brake circuit 2; braking axles 2 and 3.
- The parking brake.

By stepping on the brake pedal the main brake valve is operated mechanically.

The parking brake operates on the basis of de-aeration. As soon as the brake lever is operated, the parking brake boosters on axle 2 are bled, engaging the brakes.

8.1.2. Accessories

There is a separate circuit for pneumatically operated components of the drive system.

These components receive their air from the 10 litres accessory vessel. The air pressure is 9.8 bar. The small 10 l tank is mounted inside the truck frame on top of axle 2.

The components operated by this circuit are:

- | | |
|----------------|--|
| Vacuum brake | - Close/open exhaust valve. |
| | - Switching on/off fuel pump. |
| Gearbox: | - Shifting high/low range. |
| | - Switch on/off PTO. |
| | - Powering clutch. |
| Transfer case: | - Shifting gear road / terrain. |
| | - Switching longitudinal differential lock (front axle drive). |
| Axles: | - Switching transverse differential locks axles 1 and 3. |

8.2. Maintenance pneumatic system

8.2.1. Change filter element air-dryer



Replace the air dryer every two years.

Important for proper operation and long service life of the pneumatic system is a dry and clean compressed air condition. Contaminations in the pneumatic system must be prevented. If water joins the air, it can cause corrosion to various components, resulting in bad operation and a short service life of the components.

Therefore, the pneumatic system is fitted with an air dryer. It is situated at the left hand side underneath engine cowling. The air dryer filter must be replaced every 2 years (*For type; refer to "Technical data"*). It can be removed by means of a filter wrench. After the seal ring is oiled, the new filter can be installed.



Picture 8-1

8.2.2. Check air vessels



Check the air vessel for the presence of condensed water every week. Drain if necessary.

Location of the air vessels:

One 10l tank is located on the inside of the truck frame on top of axle 2.

One 40l air vessel is located between axle 1 and 2 on the right-hand side underneath the frame.

Two 40l air vessels are located between axle 1 and 2 on the left-hand side on top of the oil tank.

Check the air vessels for condensate water by pushing the drainage valve mounted underneath the vessels. When there is regularly condensate water found, change the air dryer filter. (*See chapter Technical Specifications*)



Picture 8-2

8.2.3. Check air hoses and connections



Check the air hoses and connections for leakage, wear and damage every 3 months.

Check all air hoses for damage and wear (e.g. heat or rubbing). Check the air hose connections by pressurizing the brakes and the accessories and listen for leaks without the diesel engine running.

Check all hoses, connections, pneumatic valve blocks, filters, cylinders and air vessels for leakages and damages. If necessary replace the component as soon as possible to prevent serious damage.

8.2.4. Check brake pressure



Check the air pressure of the brakes every year.

The pressure gauge can be connected to the connections on the brake actuation cylinders. The actuation cylinders on axle 1 must have an air pressure of 9.8 bar. The actuation cylinders on axle 2 and 3 must have an air pressure of 4.1 bar.

The air pressure of the actuation cylinders on axle 1 (9.8 bar) can be adjusted using the relief valve on the air dryer (see *picture 8-1, A*). The air pressure of the actuation cylinders on axles 2 and 3 can be adjusted by two pneumatic valves located in the middle of the truck.



9. Electrical system

9.1. Structure electrical system

The on-board voltage is 24 Volt. It is supplied by two 12 Volt 165 Ah batteries, series connected. They are charged by a 24 Volt AC dynamo, with a maximum charging current of 35 A. The batteries are situated in a storage box on the right hand side between axle 2 and 3.

With the battery switch next to the diesel tank, the truck's electrical circuit can be cut off. E.g. it must be done in case of welding jobs on the truck.

On the right hand side underneath the engine cowling the main electrical cabinet of the truck is situated.

At the co-drivers side the fuse box is situated.

In the enclosures you will find the electrical diagrams of the truck.

9.1.1. Power for powering the crane

The truck is equipped with a generator to power the crane.

On the left-hand side of the carrier (between axle 1 and 2) you will find a power box with a selector switch. To this power box you can connect an external power supply to power the crane (100 A during crane operation and 80 A during erecting and folding). If (sufficient) external power is lacking, the crane can also be powered by the built-in generator. This generator is driven by the DAF-engine. The operating switch for selecting generator power or external power is located on the power box.

It is also possible to branch off power. Namely two sockets for 220 V (16 A max.) and two sockets for 380 V (16 A max.).

In the power box you will find fuses for the main power supply of the crane as well as fuses for the power, which can be branched off.

A heater in the power box is installed to keep the power box dry.

All electrical schemes are found in the enclosures.

9.1.2. Fuses

You will find the fuses listed in the enclosures. In this list the Amperage of each fuse is stated as well as its function. Never replace a defective fuse by a stronger fuse, as this could result in short circuit or fire.

Never remove a fuse in case of:

- Turned on ignition
- Running engine.
- Switched on user.



9.1.3. Lighting



Check the lighting of the truck every day before driving off and during the yearly maintenance service.

Replace a lamp as soon as possible when the lamp is dead or when the lamp shines too bright. Do this to guarantee optimal safety.



Check the dashboard lighting every day before driving off and during the yearly maintenance service.

Check the dashboard lighting for broken indicator lamps. Replace as soon as possible to prevent serious damage of the vehicle.

Table 10-1 is a survey of all lamps. Of each lamp the number, the capacity and the order and id number is mentioned.

Table 10-1 Survey Lamps			
Name	Number	Capacity	Order / ID Number
Head light	2	75/70 W	H4
Parking light	2	4 W	BA9S
Blinker front	2	21 W	BA15S
Blinker side	2	5 W	SV8,5-8
Rota flare	1	70 W	A14,5S
Rear light	2	10 W	BA15S
Fog tail-light	2	21 W	BA15S
Blinker rear	2	21 W	BA15S
Brake light	2	21 W	BA15S
Reverse light	2	21 W	BA15S
Cab lighting	2	10 W	BA15S
Lamp for ampmeter	1	3 W	BA7S
Dashboard lighting and indicator lamps	16	1.2 W	MF8 lamp foot B8,3D
Indicator lamps switches	9	1.2 W	W2x4,6d
Indicator lamps control panel	9	2.6 W	BA9S

9.1.4. Check the batteries



Check the batteries of the truck every 3 months.



Caution!

Battery acid is harmful for human and environment. Be very careful with it!

The batteries must be checked on the following points:

- Is the fluid level still acceptable (Fill it up with distilled water when necessary)?
- Is there no cable wear?
- Are the battery clamps still attached in the right way?
- Are the batteries still attached in the right way?
- Do the batteries need to be recharged?

9.1.5. Recharging the batteries

You need a charging device and a charging cable for recharging the batteries.

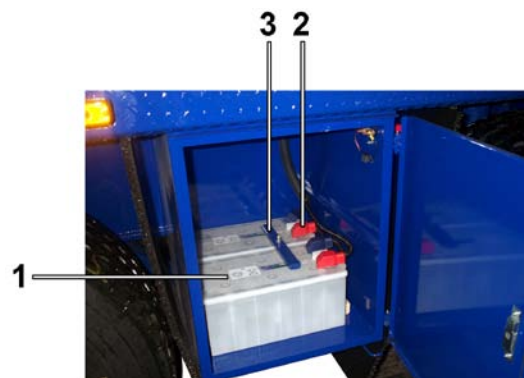
If you use a quick-charger, all battery cables must be disconnected in order to prevent damage to electronic components.

1. Be sure the engine is not running. (Remove the ignition key from the ignition slot)
2. Connect a cable on the truck and the charger.
3. Switch on the charger device.
4. First switch off the charger device after charging the batteries.
5. Remove the cable.
6. Start the engine and leave it for several minutes.

9.1.6. Replacing batteries

We advise to replace the batteries when the engine starts difficultly. (The batteries must be fully recharged.) Use new batteries with the same brand and dimensions.

1. Be sure the engine is not running. (Remove the ignition key from the ignition slot)
2. First remove the battery clamp (2) at the “-” poles. Next those on the “+” poles. (*Picture 9-1*)
3. Remove the battery-holder (3).
4. Remove the old batteries (1) and place the new ones.
5. Reinstall the battery-holder.
6. First connect the battery clamp at the “+” poles. Next those on the “-” poles. (Be sure to tighten them well)
7. Use Vaseline to grease the poles.
8. Start the engine and leave it for several minutes.



Picture 9-1



10. Technical data

Diesel Engine		Spierings no.
Engine oil	SAE 15W40 ACEA E4-98	OLSM00100010
Oil filter (2x)	MANN W962	SERV02100010
V-belt water pump, fan and dynamo drive	DAF No. 1289200	AADI09500625
Belt-tension gauge twin-belt	Kriket II (DAF No. 1240443)	
Coolant	SAE-J-1034 or ASTM D 3306 (e.g. COOLELF PLUS 37°C)	OLSM00100080
Water separator filter	MANN	SERV01600010
Air cleaner filter	MANN C25860	SERV03100050
Fuel filter	DAF No. 1318696, MAN W962/4	SERV01100010
Starter motor	Bosch JD 5.2 kW	AADI08000020R
Gearbox		
Oil gear box (At delivery)	SAE 15W40 ACEA E4-98	
Oil gearbox (maintenance at Spierings)	ELF: TRANSELF SYNTHES FE 75W90	OLSM00100120
Clutch fluid	Brake fluid DOT 4 ELF: Frelub 650	OLSM00300010
Transfer case		
Oil transfer case (at delivery)	SAE 80W90 API GL5/MIL-L-2105D	
Oil transfer case (maintenance at Spierings)	ELF: TRANSELF SYNTHES FE 75W90	OLSM00100120
Seal ring drain plug	D.ring-A22x27-Cu DIN 07603	

Axles/brakes/tyres		
Oil hubs and differentials (at delivery)	SAE 80W90 API GL5/MIL-L-2105D	
Oil hubs and differentials (maintenance at Spierings)	ELF: TRANSELF SYNTHES FE 75W90	OLSM00100120
Brake lining	Ferodo 3652 F	AAAS03000010R
Tyres	445/65 R22.5	AACA01100020
Tyre pressure	10 bar	
Rims	22,5" x 14"	AACA01100030
Hydraulics		
Oil hydraulics	ATF Dexron-IID, -IIE, -III of Mercon-M (±125 litres) (e.g. ELF Elfmatic G3 22051)	OLSM00100040
Oil filter	Hydac HD0160	SERV04200010
Pneumatics		
Air dryer filter	WABCO 432 410 222 7	SERV04100010
Miscellaneous		
Grease (general)	EP2 (e.g. AVIA Mystiek JT-6)	OLSM01500030
Grease automatic lubrication	EP2 (e.g. AVIA Mystiek JT-6)	OLSM01500030
Oil air lubricator	ISO/UNI FD22 (e.g. Berulit 75)	OLSM00400010



11. Enclosures

1. General
2. Hydraulics
3. Pneumatics
4. Fuses
5. Proximity switches
6. Electrical diagram
7. Electrical box and terminal boxes
8. Lubrication