Service Manual

Wheel loaders

950/1150



Machine model	**347-03 / 347-04**
Starting serial no.	**347 03 0001 / 347 04 0001**
Edition	**1.0**
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Technical data, dimensions and weights are given as an indication only. Responsibility for errors or omissions not accepted.
The cover features the machine with possible optional equipment.

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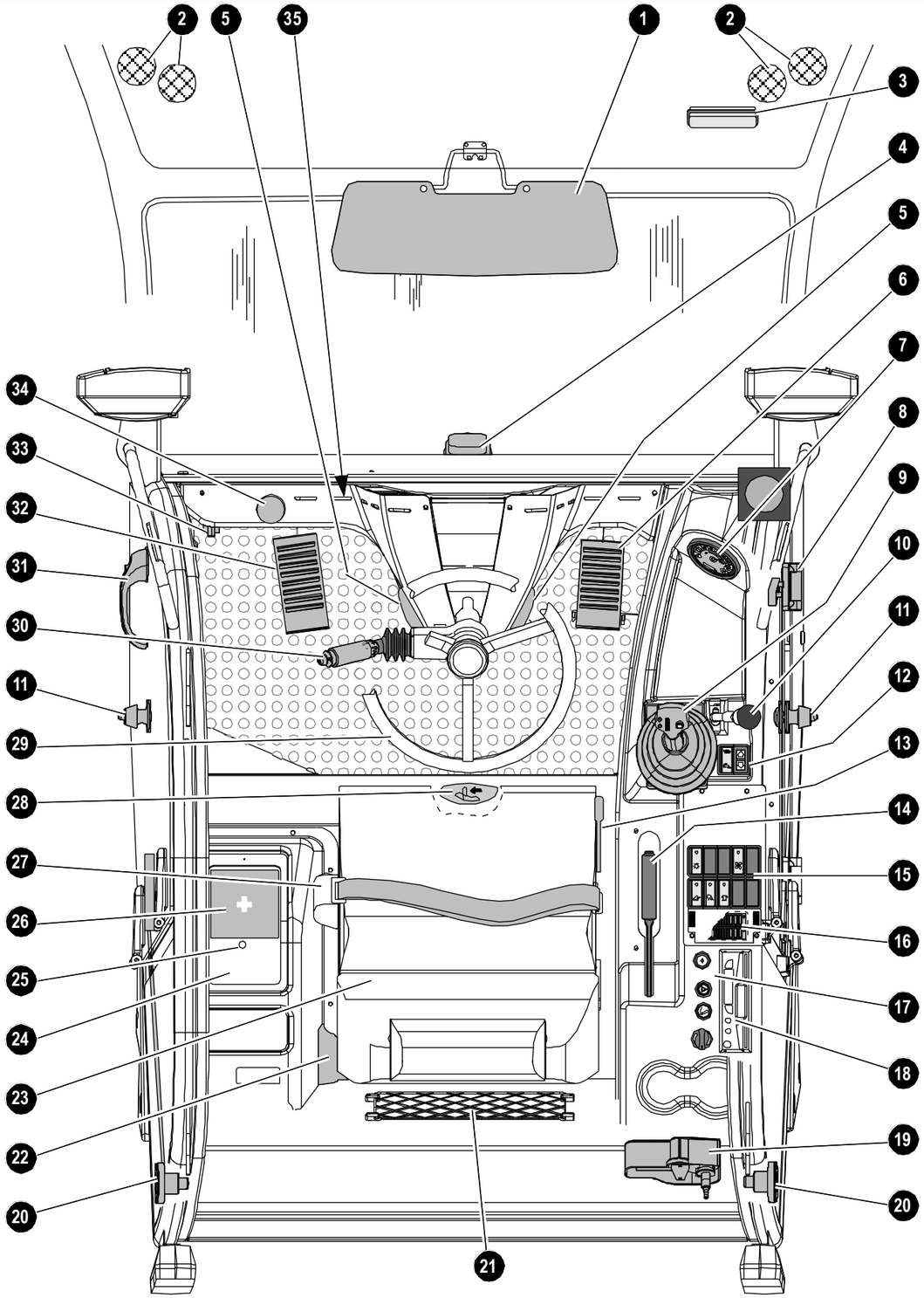
Cab overview, labels, options



1 Cab overview, labels, options

1.1 Inside of cab: overview

Roof console	
1	Sun visor
2	Air conditioning vent (option)
3	Interior light
Control stand	
4	Front wiper motor
5	Leg room air vent
6	Accelerator pedal
7	Instrument panel
8	Side window lock
9	Control lever (joystick)
10	3rd control circuit control lever
11	Arrester – left-hand side cab door/right-hand side window
12	Switch panel – speed range
13	Lever – horizontal seat adjustment
14	Parking brake lever
15	Switch panel
16	Fuse box
17	Instrument panel
18	Prepared installation for radio (option)
19	Rear wiper motor
20	Bracket – left-hand side cab door arrester/right-hand side window
21	Storage net for Operator's Manual
22	Lever – backrest adjustment – seat
23	Seat
24	Storage compartment[1]/air conditioning (option)
25	Air conditioning rotary switch (option)
26	Fixture[1] – first-aid kit
27	Seat belt
28	Weight adjustment lever
29	Steering wheel
30	Multifunctional lever
31	Outer door handle
32	Service brake pedal (hydrostatic)/inching
33	Tank – washer system
34	Brake fluid tank
35	Front window defroster vents

1. Not installed if equipped with air conditioning option

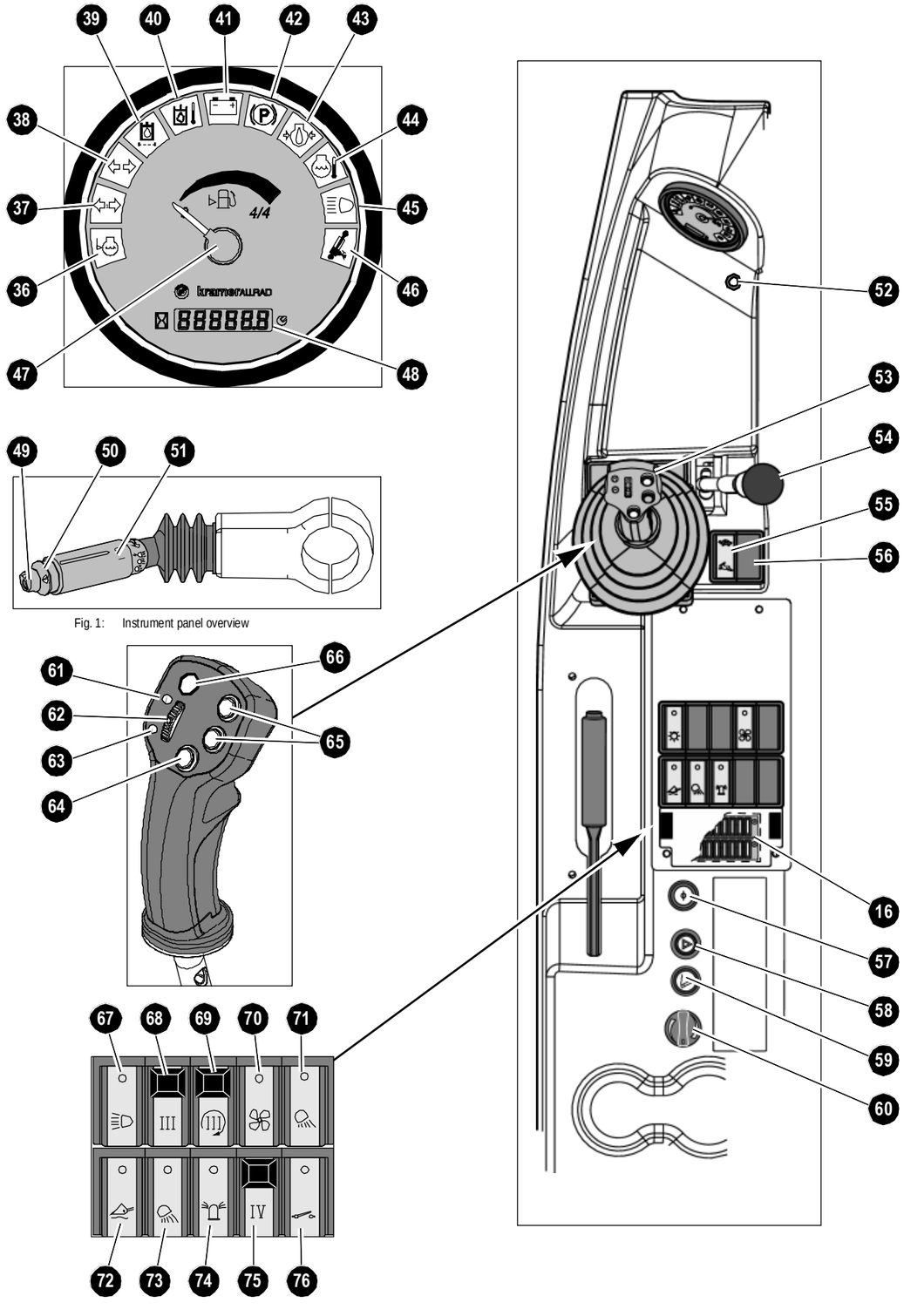


Fig. 1: Instrument panel overview

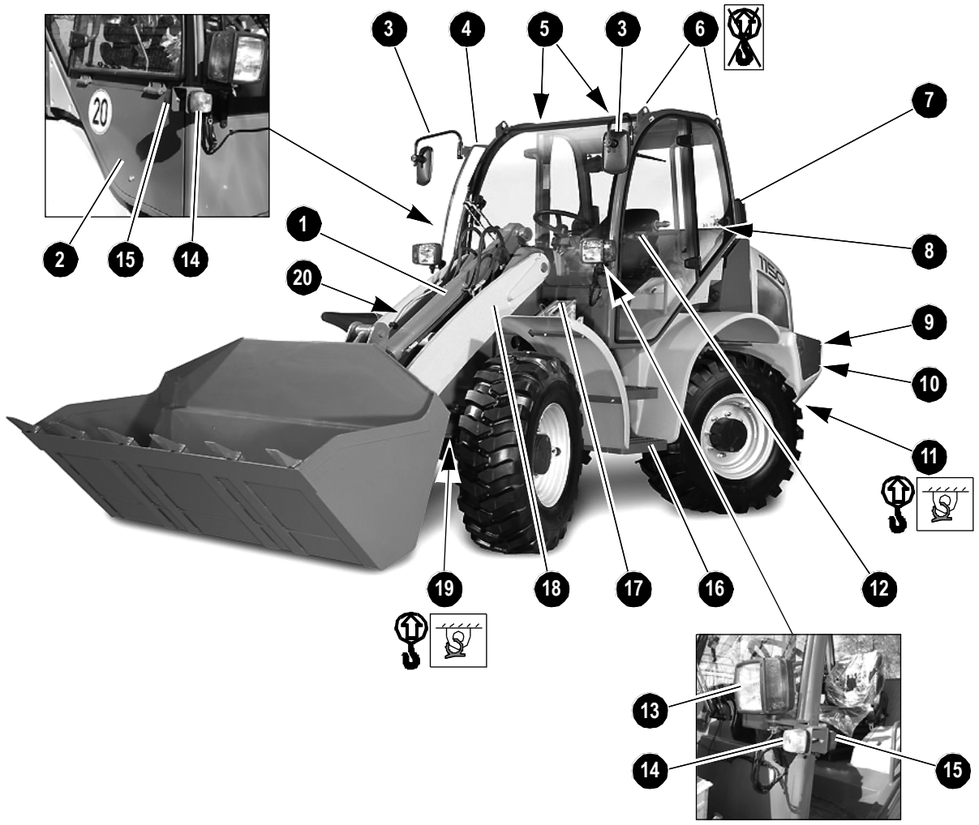
1.2 Instrument panel, multifunctional lever and drive lever: overview

Instrument panel	
36	Coolant level telltale (red)
37	Telltale (green) – right/left turn indicators for rear attachments
38	Telltale (green) – right/left turn indicators
39	Hydraulic oil filter telltale (red)
40	Hydraulic oil temperature telltale (red)
41	Alternator charge function telltale (red)
42	Parking brake telltale (red)
43	Engine oil pressure telltale (red)
44	Diesel engine temperature indicator
45	High beam telltale (blue)
46	Telltale (yellow) – hose burst valve [1](option)
47	Fuel level indicator
48	Hour meter
Multifunctional lever	
49	Horn tip switch
50	Tip switch – front/rear washer system
51	Rotary switch – front wiper
Switches and control lever (side console)	
52	Differential lock telltale (yellow)
53	Control lever with lock – loader unit
54	Control lever with lock – 3rd control circuit
55	Speed range selection switch
56	Tip switch for unlocking the skidsteer quickhitch (option)
57	Preheating start switch (engine start)
58	Hazard warning switch
59	Socket/cigarette lighter
60	Rotary switch – heating (warm/cold)
61	Forwards driving direction telltale (green)
62	Switch – driving direction selection
63	Reverse driving direction telltale (green)
64	Neutral speed range tip switch
65	Tip switch for locking/unlocking the 3rd control circuit (option)
66	Tip switch – differential lock
67	Lights switch
68	Switch with lock – 3rd control circuit (option)
69	Switch with lock – continuous operation of 3rd control circuit (option)
70	Heater fan switch
71	Rear working light tip switch (option)
72	Load stabiliser switch (option)
73	Working light switch
74	Rotating beacon switch (option)
75	Switch with lock – additional control circuit (option)
76	Front socket switch (option)

1. Hose burst valve is not functional with the load stabiliser switched on (telltale comes on)

Cab overview, labels, options

1.3 Overview of exterior of machine



Pos.	Description
1	Tilt ram
2	Service flap (fuses, relays, recirculated-air filter) below the side window on the outside right
3	Rearview mirrors
4	Handle
5	Rear working light (front option)
6	Eye hook[1] (for removing the cab)
7	Brake, rear and turn indicator lights
8	Door arrester
9	Towing facility
10	Reflectors
11	Rear eye hook for loading/tying down the machine

Pos.	Description
12	Door handle
13	Lights with turn indicators
14	Position lights (white) for model 347-04 (option on model 347-03)
15	Position lights (red) for model 347-04 (option on model 347-03)
16	Access
17	Wheel chock
18	Loader unit
19	Front eye hook for loading/tying down the machine
20	Lift ram

1. Eye hooks are for removing the cab only, and may not be used for crane-lifting the machine

1-3

1.4 Important information on this manual

This manual contains important indications, specifications and figures based on the information available at the time of print.

Specifications, tightening torques, pressures, dimensions, settings, figures and other indications can change any time. Theses changes can affect servicing and maintenance work.

Before starting any work, the complete and latest information must be obtained from your KRAMER ALLRAD dealer.

This manual contains safety instructions and warnings. Failure to observe these warnings can cause injuries resulting in death.

Careful and prudent working is the best way to avoid accidents!

In order to ensure warranty, operational safety and readiness, and the value of the machine, make sure only original spare parts are used for repair work.

Important!

Refer to the Operator's Manual for information on how to operate the wheel loader and use it with attachments!

Your Kramer Allrad dealer will be pleased to answer any further questions regarding the machine or the service manual.

Abbreviations/symbols

☞ *This symbol requires you to carry out the activity described*

☞ Subdivision within lists or an activity. Follow the steps in the recommended sequence

- This symbol stands for a list
  - Subdivision within lists or an activity. Follow the steps in the recommended sequence

➥ Description of the effects or results of an activity

"Option" = optional equipment

Stated whenever controls or other components of the machine are installed as an option.



Driving direction in drawings or figures.

1.5 Wheel loader warranty

Warranty claims can be made only if the conditions of warranty have been observed.

They are included in the General Conditions of Sales and Delivery for new machines and spare parts sold by the dealers. Furthermore, the instructions in this Operator's Manual must be observed.

1.6 Models and trade names: overview

Wheel loader model	Trade name
347-03	950
347-04	1150

1.7 Brief description of the wheel loader

The wheel loader is a self-propelled work machine according to German traffic regulations. Get informed on and follow the legal regulations of your country.

This machine is a versatile and powerful helper for moving earth, gravel and debris on construction sites and elsewhere.

The wide range of attachments accounts for the numerous applications of the machine: as a fork lift, a snow plough, a spreader for grit, salt etc., a sweeper or a tree replanter.

See chapter *Attachments with certified material densities* on page 1-7 for further applications. Retrofit the machine with appropriate safety features when using it in lifting gear operation (see section “Applications with lifting gear” in chapter Safety Instructions).

The main components of the machine are:

- ROPS/FOPS tested closed cab
  Check number: ROPS 04139-CE (cab without protective screen)
  Check number: FOPS 04140-CE (cab with optional protective screen)
- Water-cooled Deutz four-cylinder in-line engine, exhaust emissions according to EC standard 2004/26 EC
- Sturdy steel sheet frame; rubber-mounted engine
- Automotive drive, infinitely variable hydrostatic axial-piston gearbox; maximum speed 20 kph (30 kph option)
- Hydraulic four-wheel power steering with emergency steering features
- Front and rear planetary steering axles, rear axle with oscillation

  ➥Service brake (mechanical and hydrostatic), mechanical disc-type parking brake

Hydrostatic drive

The diesel engine permanently drives a hydraulic pump (variable displacement pump), whose oil flow is sent to a hydraulic motor flanged on the gearbox. The force of the hydraulic motor is transmitted to the rear axle via the transfer gearbox. At the same time, the front axle is driven by the cardan shaft, ensuring permanent 4 wheel drive.

Work hydraulics and 4 wheel steering

The diesel engine also drives the joint gear pump for work hydraulics and hydrostatic 4 wheel steering. The oil flow of this pump depends on the diesel engine speed only.

When the machine is in operation, the entire diesel engine output can be transmitted to the gear pump for work hydraulics and steering. This is made possible by a so-called inching valve which responds as soon as the service brake is used, reducing or cutting off power input of the drive. Therefore, engine output is fully available for the loader unit by pressing the accelerator pedal and the brake pedal at the same time.

Cooling system

A combined oil/water radiator (for the diesel engine and the hydraulic oil) is located at the rear of the machine.

The telltales on the instrument panel of the machine ensure constant monitoring of the coolant temperature and level, and of the hydraulic oil temperature.

1.8 Fields of application and using the wheel loader with an attachment

The attachments will decide in the first place how the machine is used.

Note that not all attachments listed in the table are allowed to be used on public roads.

The attachments complying with German road traffic regulations and the applicable provisions are listed in the **General Certification for Vehicles** (Germany) or the **data confirmation** (Germany)!

Attachments without **ABE (General Certification for Vehicles)** require an **EBE (separate certification for vehicles)** made out by the competent authority!

Get informed on and follow the legal regulations of your country.

Attachments with certified material densities

Description of attachment	Wheel loader	Part no. (model)	Dimensions mm (in)	ISO 7546 capacity struck/heaped m^3 (cu. yd.)	Use
Standard bucket – normal material	347-03	1000154547 1000154581	1950 (76.77) with teeth 1950 (76.77) without teeth	0.7/0.85 (0.91/1.11)	Loosening, picking up, transporting and loading loose or solid material (material density ≤ p = 1.8 t/m³)
		1000113366	1950 (76.77) without teeth, with screwed-on blade		
	347-04	1000154387[1] 1000154424[1]	2150 (84.64) with teeth 2150 (84.64) without teeth	0.95/1.15 (1.17/1.43)	
		1000185123[1] 1000185126[1]	2150 (84.64) without teeth, with screwed-on blade		
Standard bucket – lightweight material	347-03	1000112105	1600 (62.99) without teeth, with screwed-on blade	0.65/0.7 (0.85/0.91)	Picking up, transporting and loading very lightweight material (material density ≤ p = 1.3 t/m³)
		1000110166 1000110167	1700 (66.92) without teeth 1700 (66.92) without teeth	0.85/1.0 (1.11/1.30)	
		1000096394[1]	2150 (84.64) without teeth	0.95/1.15 (1.17/1.43)	
	347-04	1000155052[2] 1000169238[1]	2300 (90.55) without teeth	1.1/1.3 (1.43/1.70)	
Standard bucket – superlightweight material	347-03	1000096398[2]	2300 (90.55) without teeth		Picking up, transporting and loading lightweight material (material density ≤ p = 0.9 t/m³)
	347-04	1000154958[1, 3] 10001692391, 3	2300 (90.55) without teeth		
		10001793891, 3 10001801481, 3	2300 (90.55) without teeth, with screwed-on blade	1.4/1.7 (1.83/2.22)	
Side swing bucket	347-03	1000176121[3, 4]	1844 (72.59) without teeth	–	Standard bucket, however with benefits for filling and backfilling material (material density ≤ p = 1.8 t/m³)
	347-04	1000111056[3, 4]	2150 (84.64) without teeth	–	
Multipurpose bucket	347-03	1000114038[4] 1000114716[4]	1950 (76.77) with teeth 1950 (76.77) without teeth	0.65/0.8 (0.85/1.04)	Grading, removing and scraping vegetation, for example; picking up and evenly spreading material; grabbing bulky material; loading trucks (material density ≤ p = 1.8 t/m³)
	347-04	1000050782[2, 4] 1000050783[1, 4] 1000100554[2, 4] 1000100552[1, 4]	2050 (80.70) with teeth 2050 (80.70) with teeth 2050 (80.70) without teeth 2050 (80.70) without teeth	0.7/0.9 (0.91/1.17)	
Verge grading bucket[2, 4]	347-03	1000111078	Without teeth	–	For stripping and picking up verge material
High-tilt bucket[2, 4, 5]	347-03	1000156433 1000154475	1850 (72.83) without teeth	–	As standard bucket, however with a 80 – 100 cm higher dump height (material density ≤ p = 1.3 t/m³)

Description of attachment	Wheel loader	Part no. (model)	Dimensions mm (in)	ISO 7546 capacity struck/heaped m^3 (cu. yd.)	Use
Stone bucket with hydraulic clamp[2, 4, 5]	347-03	1000100611	1850 (72.83)	–	Picking up and transporting large stones, e.g. flags
Heavy duty bucket with hydraulic clamp2, 4, 5	347-03	1000111053	2050 (80.70)	–	Picking up and transporting e.g. bulky recycling material (material density ≤ p = 1.3 t/m³)
Pallet forks[2 ,4]	347-03	1000101820 1000101822	1000 (39.37) 1200 (47.24)	–	Picking up and transporting pallets
	347-04	1000101821 1000101823 1000163588	1000 (39.37) 1200 (47.24) 1200 (47.24)	–	
Pallet forks with foldable fork arms[4, 6]	347-03	1000147393	1200 (47.24)	–	Picking up and transporting pallets
Pallet forks, floating fork arms[2, 4]	347-03	1000177240	1000 (39.37)	–	
Material pusher[2]	347-03, 347-04	1000050660	3000 (118.11)	–	For moving loose bulk material
		1000100759	4000 (157.48)	–	
Tree replanter[2]	347-03, 347-04	1000100840	–	–	Digging and transporting nursery trees
Front scarifier[2]	347-03, 347-04	1000100841	–	–	Scarifying dense soil, loosening humus soil
Round bale clamp[2]	347-03, 347-04	1000177701	800 – 1800 (31.49 – 70.86)	–	Picking up and transporting silage, straw and hay bales
Rotary broom[2, 4, 7]	347-03, 347-04	1000139717	–	–	Winter service
Snow plough[3, 4, 6, 7]	347-03	1000142915	–	–	

1. Reverse mount the bucket with transport hook order no. 1000155020 when driving on public roads (Federal Republic of Germany). Get informed on and follow the legal regulations of your country.
2. Not certified for driving on public roads (Federal Republic of Germany) Get informed on and follow the legal regulations of your country.
3. Only in connection with additional lights order no. 1000105002 and mounting kit order no. 1000137629 when driving on public roads
4. See the Operator's Manual of the attachment for taking the attachment into service and using it
5. Only in connection with restrictor unit order no. 1000114139
6. Authorised for use on public roads only with EBE (separate certification for operation, Federal Republic of Germany). Get informed on and follow the legal regulations of your country!
7. Only in connection with rotating beacon order no. 1000133985

Get informed on the legal regulations of your country for further information on mounting attachments

1.9 Regulations

Driving licence

Earth moving machinery may be driven on public roads only if the driver has a driving licence for the machine, as defined by national traffic regulations.

German traffic regulations require the following driving licences for driving the machine:

Version (20 kph):

➥ Driving licence category **5** (old)

➥ Driving licence category **L** (new, European Union)

Version (up to 40 kph):

➥ Driving licence category **3** (old)

➥ Driving licence category **C1** (new, European Union)

Get informed on and follow the legal regulations of your country.

Licence/identification

§ 3 FZV (German vehicle licensing ordinance) requires self-propelled work machines with maximum speeds **over 20 kph** to be fitted with their own ein numberplates **in accordance with §8 FZV (German vehicle licensing ordinance)**.

§ 4b of FZV (German vehicle licensing ordinance) requires owners of self-propelled work machines with maximum speeds **below 20 kph** to affix their first name, surname and place of residence (company and registered office) in indelible print on the left-hand side of their machines.

Get informed on and follow the legal regulations of your country.

Equipment

§ 53 StVZO (German road traffic regulations) requires the following equipment to be supplied by the operator and to be fitted on the machine, for instance:

- 1 warning triangle with design certification
- 1 warning light with design certification
- 1 first-aid kit in accordance with the legal regulations of your country

Get informed on and follow the legal regulations of your country.

Machine inspections

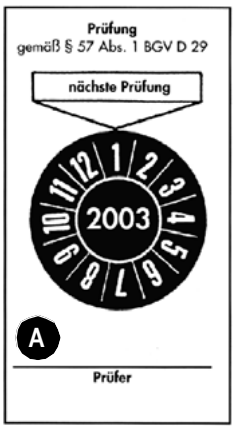


Fig. 1: Inspection tag

When operating the machines, the national safety regulations must be followed as well, for instance in Germany, the regulations for accident prevention “Deutsche Prüfstelle für Land- und Forsttechnik” (DPLF German inspection and certification body for agriculture and forestry) and the accident prevention regulation “Fahrzeuge (vehicles)” (BGV D29 § 57 clause 1).

In Germany, legislation requires all machine operators to have all machines and equipment inspected regularly.

Inspections must be carried out as required, but at least once a year, by an expert and must be documented in written form. Subsequent inspections of detected defects must be carried out, too.

The competent inspection authority may require the inspection report to be available at the place where the machine is used.

☞ *Fasten inspection tag **A** for evidence*

Bear in mind that all work equipment is inspected, i.e. not only the machine but also all technical auxiliary means, tools and attachments. (Work equipment is defined as all tools, attachments, machines or systems.)

This requirement is met, for instance, if the results are documented in a test logbook, a test log file or in a test report; see also policy of German employers' liability insurance association for construction engineering “Inspection of vehicles by experts” (BGG 916)

Get informed on and follow the legal regulations of your country.

Documents

German traffic regulations require to have the following documentation on board, e.g.:

- General Certification for Vehicles (Germany) or data confirmation (Germany)
- Driving licence
- Test report according to BGV D29 § 57 clause 2 (safety and health regulations of German employer's liability insurance association)
- Operator's Manual

Get informed on and follow the legal regulations of your country.

Machine warning identification (option)

From 01.10.1998 onwards, § 52 clause 4.1 of StVZO German road traffic regulations require wheel loaders that are used on public roads for the construction and maintenance of roads, and for the cleaning of roads or facilities, to be fitted with the red and white warning identification as per DIN 30 710 in connection with a yellow rotating beacon (option).

Get informed on and follow the legal regulations of your country.

1.10 Type labels and component numbers

Serial number

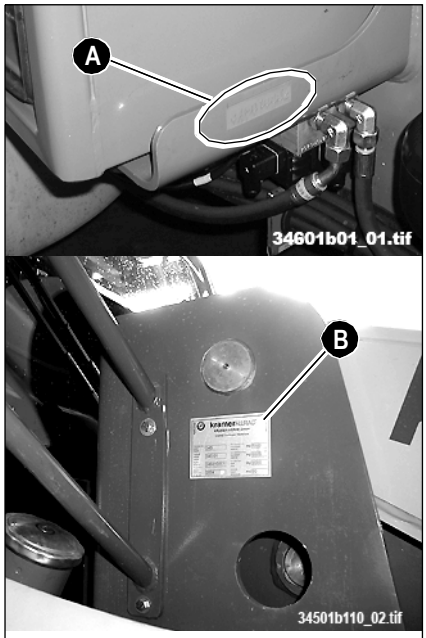


Fig. 2: Type label: location

The serial number is stamped on the machine frame **A** (next to the cab attachment, on the right in driving direction). It is also located on the type label **B**.

The type label **B** is located on the machine frame, at the front right in driving direction (on one side of the loader unit bulkhead).

Type label indications (example)	
Machine model:	347
Version:	347 03
Serial no.:	347 03 415
Year of construction:	2008
Front gross axle weight rating:	4000 kg
Rear gross axle weight rating:	4000 kg
Gross weight rating:	6500 kg
Output:	58 kW

Other information – *see chapter 2 "Specifications"* on page 2-1

Cab number

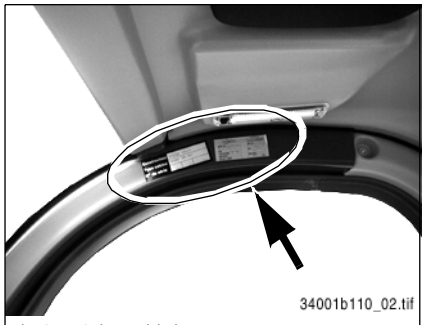


Fig. 3: Cab type label

The type label (arrow) is located in the cab, at the top right in driving direction.

Engine number

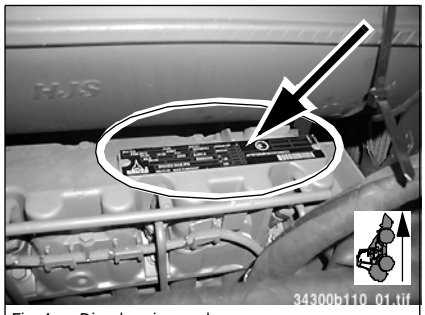


Fig. 4: Diesel engine number

The type label (arrow) is located on the cylinder-head cover (engine).

Example: Deutz TD 2011 L04 W

Hydraulic pump number

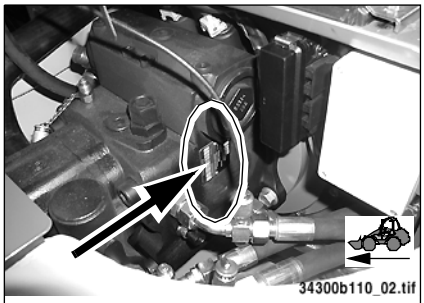


Fig. 5: Hydraulic pump type label

The type label (arrow) is located on the hydraulic pump housing (next to where the pump is installed on the diesel engine)

Hydraulic motor number

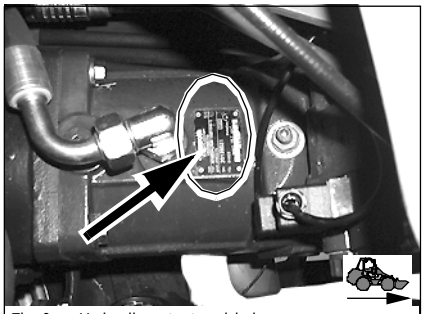


Fig. 6: Hydraulic motor type label

The type label (arrow) is located on the hydraulic motor, on the right in driving direction.

Rear axle number

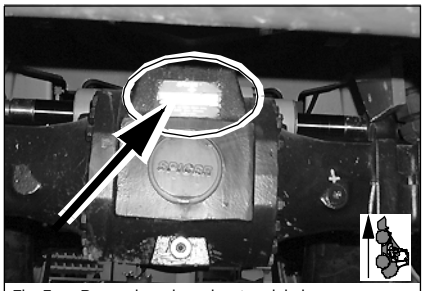


Fig. 7: Rear axle and gearbox type label

The type label (arrow) is located on the upper side of the differential housing, at the rear.

Front axle number

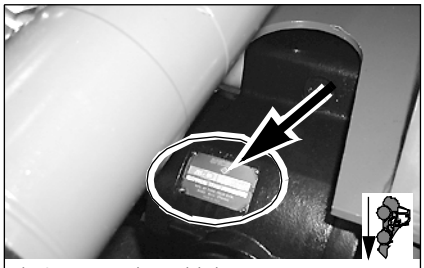


Fig. 8: Front axle type label

The type label (arrow) is located on the upper side of the differential housing, at the front.

1.11 Signs and symbols

Labels on the outside of the machine



Fig. 9: Eye hook label

Label: cab eye hooks

The eye hooks on the cab are for removing the cab only and may **not** be used for crane-lifting the machine.

Location

Cab roof (4x)

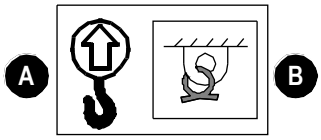


Fig. 10: Label for loading and tying down the machine

Label for loading and tying down the machine

Points for tying down the machine **B** during transport, and eye hooks **A** for loading the machine.

Location

On the left and right of the machine frame above the front axle attachment, and at the rear underneath the engine

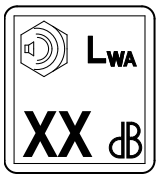


Fig. 11: Noise level label

Noise level label

Noise levels produced by the machine.

L_{WA} = sound power level

Other information – *see chapter 2 "Noise levels*" on page 2-9

Location

Rear window

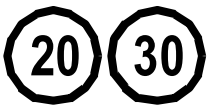


Fig. 12: Speed label

Label: maximum design-specific speed

Design-specific max. machine speed 20 kph (30 kph option)

Location

At the rear and on the left/right of the counterweight.



Fig. 13: Danger label

General indication of danger

This label warns persons standing or working near the machine of an existing danger within the area of increased danger around the machine.

Location

Front left and right of machine frame, and at rear of machine.



ce.ai

Fig. 14: CE mark

CE mark

The CE mark means that the machine meets the requirements of the Machine Directive and that the conformity procedure has been carried out. The machine meets all the health and safety requirements of the Machine Directive.

Location

On the rear window.

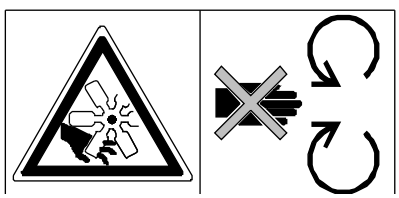


Fig. 15: Prohibitory label

Label: do not open the engine cover

Do not open engine cover before engine is at a standstill!

Do not touch any moving or turning parts!

Location

On the engine cover of the machine.

Labels inside the cab

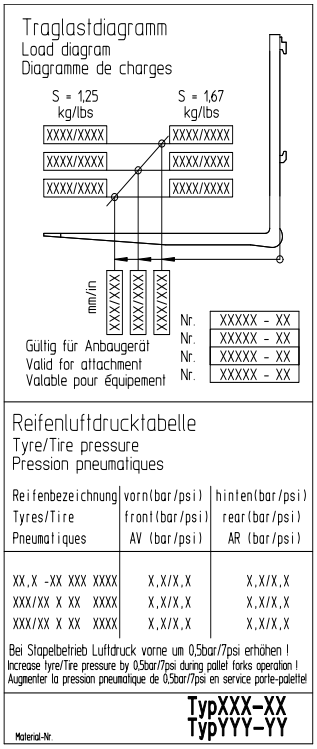


Fig. 16: Load diagram

Load diagram for pallet forks and tyre pressure table

The framed numbers state the maximum authorised load on the fork arms for industrial and offroad applications. The maximum load varies according to the distance from the load centre.

Example:

- Off-road operation → S = 1.67 (safety factor)
  Load distance = 500 mm
- The maximum load amounts to e.g. 465 kg!

Tyre pressure table

List of authorised types of tyres with prescribed tyre inflation pressures.

Other information – *see chapter 2 "Tyres"* on page 2-8

Location

Inside the cab, on left side of front window

Important!

The load diagram is valid only for applications with certified pallet forks.

- – *see Attachments on page 1-7*
- Observe the specific load diagrams of other attachments used, e.g. rotary crane jib!



Fig. 17: Brake fluid label

Brake fluid label

Use only LHM brake fluids.

➥ – *see chapter 3 "Brake system maintenance"* on page 3-41

➥ – *see chapter 3 "Fluids and lubricants"* on page 3-3

Location

On the brake-fluid tank

Label: control lever (joystick) operation

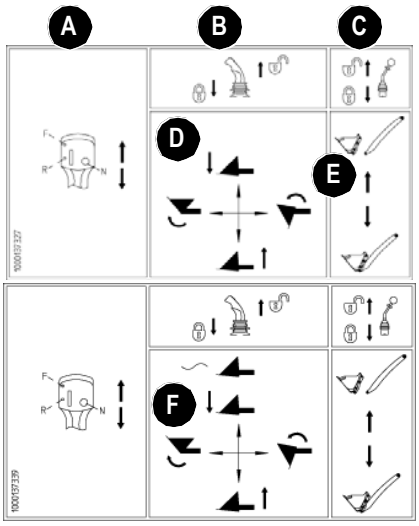


Fig. 18: Label: control lever operation: overview

- **A** = driving direction: (F) forwards/(R) reverse and (N) neutral position
- **B** = control lever (joystick) unlocked/locked for road travel
- **C** = control lever (3rd control circuit for attachments) unlocked/locked
- **D** = loader unit operation: raise, lower, dump in/out
- **E** = 3rd control circuit operation. Pick up/set down attachment
- **F** = loader unit operation: raise, lower with float position, dump in/out

Location

On the lower right on the side window

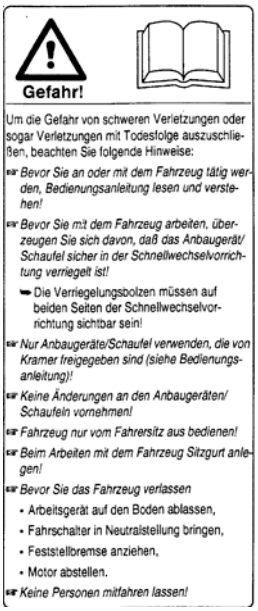


Fig. 19: Label: avoiding danger

Label: avoiding danger in general

Label for avoiding danger of serious injuries or of injuries resulting in death!

Danger!

Read and understand the Operator's Manual under all circumstances before taking the machine into service!

Location

Inside the cab on the right on the pillar

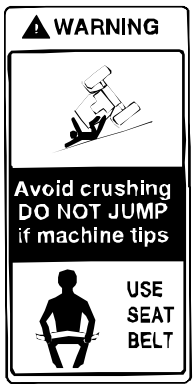


Fig. 20: Seat belt label

Seat belt label

Never drive or work without having fastened the seat belt – danger of injury!

Buckle up before moving or working with the machine!

Location

Inside the cab on the right on the pillar



Fig. 21: Label: biodegradable oil

Label for biodegradable lubricants (option)

Biodegradable lubricants (biodegradable oil) are used on the machine

➥ *– see chapter 3 "Important information for the use of biodegradable oil"* on page 3-22

Location

Inside the cab

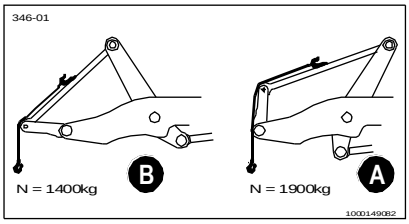


Fig. 22: Load diagram for load hook

Load diagram for load hook (option)

Example: Maximum load for model 346-03 (750)

- **A** Extended loader unit and quickhitch tilted in
  ➥ **Max N => 1900 kg**
- **B** Extended loader unit and quickhitch
  ➥ **Max N => 1400 kg**

Location

➥ Inside the cab, on left side of front window

1.12 Telltales and warning lights: description

Telltales and warning lights – instrument panel

Unfold pages *1-1* and *1-2* for a better overview!

Engine oil pressure telltale (red)



Comes on if the engine oil pressure is too low. In this case:

☞ *Stop the machine*

☞ *Stop the engine immediately and check the oil level*

The telltale comes on when the ignition is turned on and goes out as soon as the engine runs.

Diesel engine temperature indicator



Indicates the engine oil temperature detected by a sensor.



Caution!

Danger of engine breakdown if the telltale comes on with the engine running!

☞ *Stop engine immediately*

☞ *Check the engine oil*

- *– see chapter 3 "Checking/filling up the engine oil" on page 3-13*

☞ *Check the cooling system*

- *– see chapter 3 "Cleaning the radiator fins of the oil/water radiator" on page 3-16*

Coolant level telltale (red)

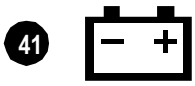


Indicates that the coolant level in the radiator is too low:

☞ *Check the coolant system for leaks, have possible damage repaired by an authorised workshop.*

☞ *Fill up coolant*

Alternator charge function telltale (red)



The telltale comes on when the ignition is turned on and goes out as soon as the engine runs.

The V-belt or the charging circuit of the alternator is faulty if the telltale comes on with the engine running. The battery is no longer charged.

Telltale (green) – right/left turn indicators



Flashes intermittently when the turn indicators are used

Telltale (green) – right/left turn indicators on rear attachment



Flashes intermittently when the turn indicators are used and a front or rear attachment is connected electrically.

45 

High beam telltale (blue)

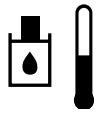
Comes on if high beam is switched on, or during headlight flashing.

42 

Parking brake telltale (red)

Comes on when the parking brake is applied.

The electric driving interlock prevents starting the engine with the parking brake applied.

40 

Hydraulic oil temperature telltale (red)

Comes on if hydraulic oil temperature exceeds 95 °C.



Caution!

Danger of hydraulic damage as soon as the telltale comes on!

☞ *Release the pressure on the work and drive hydraulics. To do this:*

- *Stop the machine in a suitable place*
- *Move the control lever of the loader unit to neutral*
- *Move the drive lever to neutral*
- *Run the engine at increased speed until telltale **40** goes out*

39 

Hydraulic oil filter telltale (red)

Indicates inadmissibly high pressure in the hydraulic reflux line to the tank. In this case:

☞ *Have the hydraulic oil reflux filter checked and, if necessary, replaced by an authorised workshop*

36 

Telltale (yellow) – hose burst valve (option)

Indicates that the hose burst valve is switched on. This avoids lowering or dumping out the loader unit without any resistance in the event of a burst hose or line.

52 

Telltale (green) – differential lock

➥ Indicates that the differential lock is switched on

1.13 Drive interlock with code input (option)

Keyboard for entering codes: overview

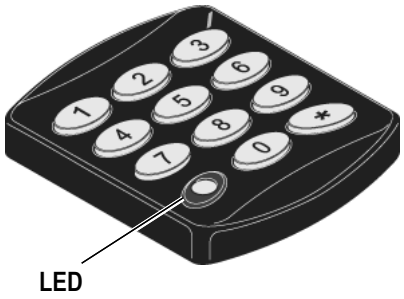


Fig. 23: Drive interlock (code input option)

The drive interlock is enabled or disabled with “personal” codes entered via the keypad. Two codes are available:

- The existing unchangeable six-digit **main code** for disabling the drive interlock, for entering a personal code or for changing the personal code
- The four, five or six-digit **personal code** is used for disabling the drive interlock and is entered by the driver

Caution!

We recommend using the personal code for disabling the system.

☞ *Keep the main code in a safe place.*

The keypad consists of:

- 10 numeric keys for entering the codes
- A (*) key for confirming the code that has been entered
- An LED (red telltale)
- An internal acoustic signal for signalling specific procedures

  ➥ Example: a signal sounds to confirm a key has been pressed

The keypad comes on:

- When pressing any key
- The keypad flashes to indicate specific system statuses

Entering/changing the personal code

In order to enter or change the personal code:

☞ *Disable the drive interlock by entering the main code (6 digits) and pressing the **(*)** key*

☞ *Turn the ignition key to position "Ignition **ON**" as soon as the LED goes out*

☞ *The LED comes on for 2 seconds*

☞ *Enter the 4, 5 or 6-digit new personal code and confirm with the (*) key within 20 seconds after the LED has gone out*

☞ *Enter the new personal code again and confirm it with the **(*)** key after a short flashing of the LED*

➥ Confirmation: LED flashes twice briefly, then comes on for 2 seconds

☞ *Turn the ignition key to the OFF position and remove it as soon as the LED goes out*

➥ The new personal code is now set and can be used for disabling the drive interlock.



Caution!

The personal code must be entered correctly twice consecutively otherwise an error is indicated by means of a single flashing of the LED:

☞ *Codes consisting of 3 and less, or of more than 6 digits are ignored by the system*

☞ *Simple codes (with identical or consecutive digits, e.g. 1, 2, 3, 4) are rejected by the system with four short acoustic signals*

☞ *Entering a new personal codes replaces the previous code. A code can be changed any time if the main code is known*

Enabling the drive interlock

☞ *Stop the engine and remove the ignition key*

➥ The drive interlock is automatically enabled

➥ Flashing LED (on the keypad)

Disabling the drive interlock

☞ *Enter the personal code or main code (6 digits).*

☞ *Press the **(*)** key.*

➥ Confirmation: 2 long acoustic signals and long LED flashing

➥ LED OFF = drive interlock is disabled

➥ Diesel engine can be started

The diesel engine will not start if a wrong code has been entered

➥ Confirmation: 4 short acoustic signals, flashing LED = wrong code

➥ Re-enter the code

☞ *Turn the ignition key and switch on the engine before the LED flashes again (30 seconds)*



Caution!

The keypad is blocked for 5 minutes and no codes can be entered if the wrong code is entered four times consecutively.

☞ *Enter the code after 5 minutes*

- *The keypad does not come on as long as it is blocked. It comes on briefly every 4 seconds and an acoustic signal sounds*

☞ *Press the **(*)** key after every code*

☞ *The LED comes on briefly when turning the ignition key to the engine start position*

Taking the drive interlock out of service

We recommend taking the drive interlock out of service if the machine has to stay in a workshop, for instance, or if the machine does not require any protection. This avoids having to communicate the code.

1 Disable the system by entering the personal or main code and by confirming with the **(*)** key

2 Turn the ignition key to position “ON” as soon as the LED goes out

3 The LED comes on for 2 seconds

4 As soon as the LED goes out, press the **(*)** key for about 2 seconds until a short acoustic signal, followed by two further signals, sounds (within 20 seconds after the LED has gone out)

5 The LED now flashes very slowly, and the keypad is disabled

6 Turn the ignition key to the OFF position and remove it

7 The engine can be started without entering the code. The system is out of service even if electric power is interrupted.



Caution!

With the system out of service,

☞ *the LED flashes slowly even if the ignition key is in position ON*

☞ *Entering the personal or main code does not have the effect of putting the system back into service again (the acoustic signals for confirmation are still given). See the following procedure (“Putting the drive interlock back into service again”) to leave the out-of-service status again.*

Putting the drive interlock back into service again

☞ *Press the **(*)** key for 2 seconds (ignition key in position OFF) until two short acoustic signals are given for confirmation*

➥ The system is enabled again. The code must be entered to start the engine.

Interruption of drive interlock power

If the drive interlock was **enabled** before electric power was interrupted, short acoustic signals are given upon switching on the keypad (similar to those that are given when entering the wrong code four times). In this case, wait until the acoustic signals are no longer given. Then disable the drive interlock with the personal or main code.

The LED still does not come on if the drive interlock was **disabled**. The engine can be started before the LED starts flashing again.

If the drive interlock was out of service, this status remains unchanged and the LED flashes slowly.

Drive interlock maintenance

The MED 310.1T drive interlock does not require any maintenance.

Protect the keypad and the control unit from heat and humidity

1.14 Key-based drive interlock (option)

Key-based drive interlock: scope of delivery

The drive interlock is integrated in the ignition lock and can be enabled only with the blue ignition keys!

Scope of delivery:

- Drive interlock installed in the machine
- 2 x blue keys (coded)
- 1 x red master key (for training the blue keys)

Coding (“training”) new ignition keys

New personal keys are coded with the master key (red). This is why it must be carefully stored outside the machine.



Caution!

Each drive interlock has only one master key!

☞ *The drive interlock must be replaced if the master key is lost*

- The master key is only used for coding new keys, and cannot be used for disabling the drive interlock
- Coding is carried out by inserting the master key in the ignition lock and by turning it to position '1' for a maximum 5 seconds. After the master key has been returned to position '0' and removed, you have 15 seconds for inserting a key that requires coding. It must be inserted in the ignition lock and turned to position '1' in order to be registered as a valid key.
- Coding is automatically stopped if no key requiring coding is detected within 15 seconds.
- Several keys requiring coding can be inserted one after another in the ignition lock
- Each key must remain at least 1 second in position '1'.
- Coding can be carried out for a maximum 10 keys

Enabling (locking) the drive interlock

☞ *Apply the parking brake*

☞ *Stop the engine*

☞ *Remove the ignition key (blue)*

➥ The drive interlock is enabled in 30 seconds

Caution!

The drive interlock remains disabled if the ignition key (blue) is **not** removed from the ignition lock!

Disabling (releasing) the drive interlock

Start and switch off the engine exactly as described in the Operator's Manual.

☞ *The system is enabled 5 seconds after the ignition key is inserted in the ignition lock*

☞ *Start the engine*

➥ The drive interlock is disabled as long as the engine runs

Deleting coded keys

Deleting coded keys is necessary whenever a coded key is lost

- All coded keys are deleted during deletion
- After deletion has been carried out, all existing keys can be recoded
- Deletion is carried out by inserting the master key in the ignition lock and by turning it to position '1' for a minimum 20 seconds.
- All coded keys are then deleted, and all existing keys can be recoded
- The master key code is not deleted during deletion

Safety functions

The drive interlock remains enabled for 15 minutes and does not accept any valid keys if more than 5 keys with different invalid codes are inserted and turned in the ignition lock within 1 minute. This function avoids 'finding' the correct key by chance by trying different keys. It is only available if the control valve relay is connected in addition with terminal 30. The drive interlock remains enabled for 15 minutes and does not accept any valid keys if several invalid keys have been detected without having set the ignition lock to position '0'. Valid keys are accepted only after 15 minutes and after the position '0' of the ignition lock has been detected. This avoids testing keys without actuating the mechanical ignition lock, e.g. by moving the ignition lock to position '1' by force.

Interruptions of the supply line or other control lines do not disable the drive interlock or delete data (e.g. data codes). All important data is saved in a non-volatile memory.

1.15 Battery master switch (option)

Interrupting power supply

The battery master switch is located in the engine compartment next to the battery

☞ *Turn and remove the key of the battery master switch (notched position)*

Switching on power supply:

☞ *Insert the key in the battery master switch*

☞ *Turn the key to the notched position*

1.16 Oil and fuel preheater (option)

This equipment is for cold-starting at temperatures below -5 °C.

Oil preheater operation

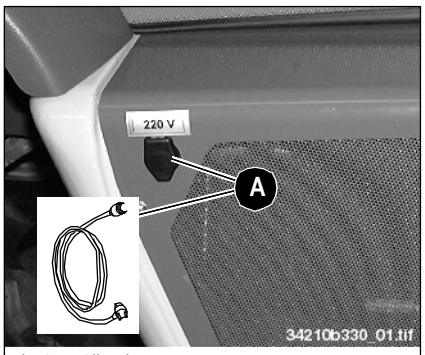


Fig. 24: Oil preheater

The engine and hydraulic oil is heated by means of heating elements with a capacity of 750 W in the engine oil pan and in the hydraulic oil tank, according to the gravity principle (warm oil rises and is replaced by cold oil). The oil can only be thoroughly warmed up to operating temperature if the oil preheater is connected over a longer period of time – preferably over night.

☞ *Connect the oil preheater as follows:*

- Park the machine near a 220 V socket
- First connect special cable **A** with machine socket **B**, then
- Insert the plug into the 220 V socket

☞ *Before starting the engine:*

- Remove the plug from the 220 V socket
- Unplug special cable **A** from machine socket **B**
- Close the engine cover

Fuel preheater operation

The fuel preheater prevents paraffin crystals forming, which otherwise clog the fuel filter at low temperatures.

A temperature switch automatically switches on a heating element in the fuel line between the tank and the fuel prefilter when ignition is switched on at temperatures below + 10 °C.

1.17 Jump-starting the engine (external battery)

Safety instructions regarding external starting aids

Danger!

Jump-starting the engine with a frozen battery –

Danger of explosion!

☞ *Replace the battery by a new one!*

If the jump-starting vehicle touches the wheel loader –

Danger of short circuit and sparks!

☞ *The jump lead connected to the positive (+) terminal of the starting battery must never be brought into connection with electrically conductive vehicle parts*

☞ *The external power source must deliver **12 V**; higher supply voltages will damage the electrical system of the vehicles!*

☞ *Use only authorised jump leads which conform to the safety requirements and which are in perfect condition!*

☞ *Route the jump leads so they cannot catch on rotating components in the engine compartment!*

Providing external starting aid

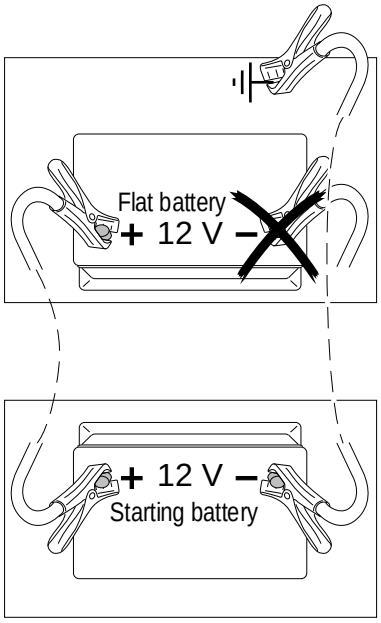


Fig. 25: Starting aid with jump leads

☞ *Drive the jump-starting vehicle close enough to the loader so that the jump leads can reach to connect the two batteries*

☞ *Let the engine of the jump-starting vehicle run*

☞ *First connect one end of the red jump lead (**+**) to the **+ terminal** of the flat battery, then connect the other end to the **+** terminal of the starting battery*

☞ *Connect one end of the black jump lead (**-**) to the – t**erminal** of the starting battery*

☞ *Connect the other end of the black jump lead (**-**) onto a solid metal component fimly mounted on the engine block or onto the engine block itself. Do not connect it to the negative terminal of the flat battery, as otherwise explosive gas emerging from the battery can ignite if sparks are formed!*

☞ *Start the engine of the machine with the flat battery*

Once the engine has started:

☞ *With the engine running, disconnect both jump leads in exactly the reverse order (first remove the – **terminal**, then the **+ terminal**) – this prevents sparking in the vicinity of the battery!*

1.18 Manual throttle (option)

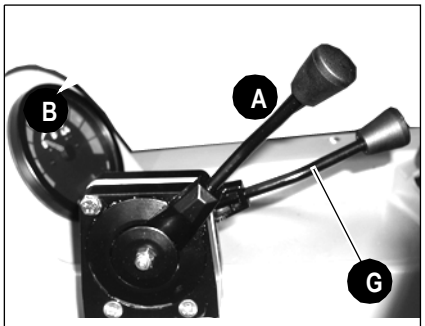


Fig. 26: Manual throttle (option)

The manual throttle is located on the right of the side console

Danger!

Do not actuate the manual throttle lever **G** when driving on public roads –

Danger of accidents!

☞ *Use the manual throttle **G** during work operation only!*

☞ *Before driving on public roads:*

- Move the manual throttle lever **G** to idling speed position **A**
- Set the engine speed with the accelerator pedal only

Function

Permanent setting of engine speed for work operation

Position	Engine speed
A	Idling speed = minimum engine speed
B	Full throttle = maximum engine speed

Important!

This function is especially useful for operating hydraulic attachments which need a continuous supply of hydraulic oil. Drive speed must be set with the brake/inching pedal or with the low-speed control (option).

1.19 Low-speed control (option)

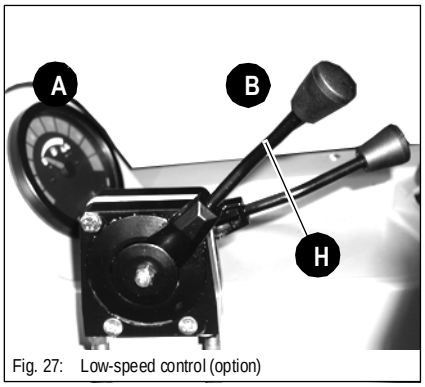


Fig. 27: Low-speed control (option)

The control lever is located on the right of the side console

Function

Wheel loader speed can be set more precisely and independently of the engine speed with control lever **H**.

This function corresponds to inching with the brake/inching pedal.
Maximum speed depends on the speed range selected.

☞ *Select the driving direction*

☞ *Select a speed range*

☞ *Set constant engine speed with the accelerator pedal or the manual throttle (option)*

☞ *Select the required drive speed*

➥ Move control lever **H** towards **A**

☞ *Stop the wheel loader*

➥ Move control lever **H** to limit **B**

Position	Drive speed
A	Maximum speed
B	Machine at a standstill

1.20 Electric connection – front socket (option)

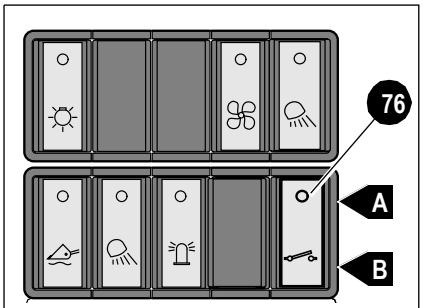


Fig. 28: Backup warning system (option)

The machine can be equipped with a 4 pole front socket. Switch **76** on the right on the instrument panel switches electric power supply on or off for electrically operated attachments such as a spray water pump for a rotary broom.

Power supply for front attachments (option)		
ON	☞ *Press switch **76** to position **B***	➥ Power supply at the socket is switched on ➥ Telltale in switch comes on
OFF	☞ *Press switch **76** to position **A***	➥ Power supply is switched OFF ➥ Telltale goes out

1.21 Working lights

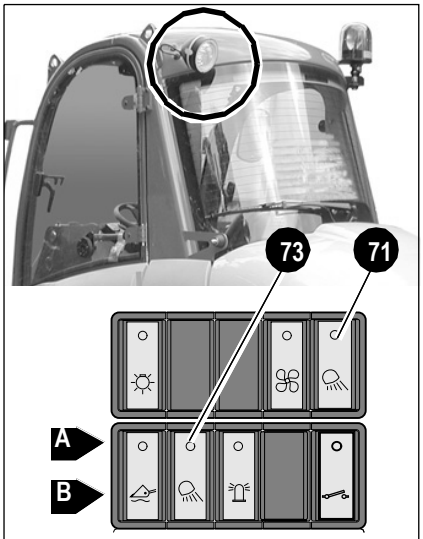


Fig. 29: Working light switch

Front and/or rear working lights (option)		
ON	☞ *Press switch **73** to position **B***	➥ Telltale in switch comes on
OFF	☞ *Press switch **73** to position **A***	➥ Telltale in switch goes out

2 front working lights (option)		
ON	☞ *Press switch **73** to position **B***	➥ Telltale in switch comes on
OFF	☞ *Press switch **73** to position **A***	➥ Telltale in switch goes out

2 rear working lights (option)		
ON	☞ *Press tip switch **71** briefly*	➥ Telltale in tip switch comes on
OFF	☞ *Press tip switch **71** briefly*	➥ Telltale in tip switch goes out

1.22 Rotating beacon (option)

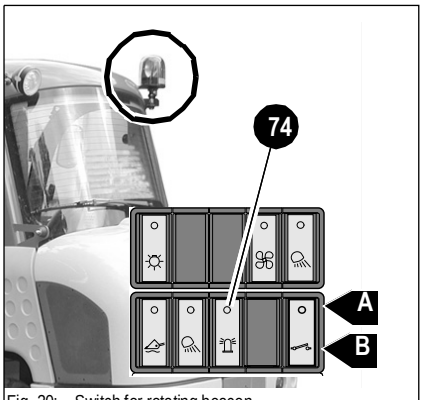


Fig. 30: Switch for rotating beacon

Rotating beacon (option)		
ON	☞ *Press switch **74** to position **B***	➥ Telltale in switch comes on
OFF	☞ *Press switch **74** to position **A***	➥ Telltale in switch goes out

Important!

Legal regulations of your country may require you not to switch on the rotating beacon on public roads unless the road is within the machine's working range and the machine represents an obstruction to the normal flow of traffic when the machine is in work operation. Get informed on and follow the legal regulations of your country.

1.23 Backup warning system (option)

Danger!

When backing up with the machine –

Danger of accidents!

☞ *Make sure nobody is within the danger area of the machine when changing the driving direction!*

☞ *Do not rely exclusively on the backup warning system (option)!*

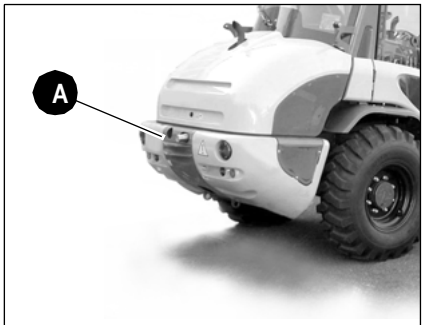


Fig. 31: Backup warning system (option)

Important!

In certain countries, a backup warning system is mandatory.
The backup warning system consists of a signal transmitter **A**, fitted on the inside of the cover over the towing device. The signal transmitter generates an acoustic signal when shifting into reverse. The acoustic level is about 103 dB (A) at a distance of 1 m and at a frequency of 2800 Hz.

1.24 Additional control circuit for attachments (option)

Danger!

Working with attachments!

Unintentionally actuating the lever (3rd control circuit) unlocks the quickhitch –

Danger of personal injury!

☞ *Secure control lever **10** (3rd control circuit) when working with an attachment*

The machine can be equipped with an additional front/rear control circuit (option) for the operation of hydraulic attachments.

Operation:

The additional control circuit is switched on and off by means of a solenoid valve and switch **75** on the right in the console.

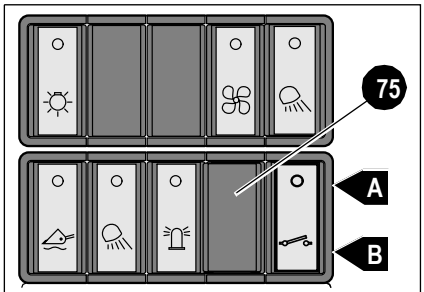


Fig. 32: Operation of 4th control circuit (option)

Operation of the additional control circuit (option)		
ON	☞ *Press switch **75** to position **B***	➥ 4th control circuit is switched on ➥ Telltale comes on
OFF	☞ *Press switch **75** to position **A***	➥ 4th control circuit is switched off ➥ Telltale goes out

1.25 “Hose burst valve” safety feature (option)

Important!

The “Hose burst valve” safety feature prevents the loader unit from being lowered or dumped out without being braked, in the event of a bursting hose or pipe.

Caution!

Switching on the load stabiliser automatically switches off the hose burst valve!

☞ *Switch off the load stabiliser to make sure the the hose burst valve works correctly during work!*

Danger!

The “Hose burst valve” safety feature is activated as soon as a hose or a pipe bursts –

Danger of accidents!

☞ *Have damage to the hydraulic system and to the hose burst valve immediately repaired and checked by technical staff with appropriate training*

In the event of damage, proceed as follows:

☞ *Stop the machine immediately*

☞ *If possible:*

- ☞ Carefully lower the loader unit to transport position
- ☞ Drive the machine out of the danger area with the loader unit lowered

☞ *Apply the parking brake*

☞ *Stop the engine*

☞ *Remove the ignition key and lock the cab*

☞ *Secure the machine and the attachment*

Environment!

Collect the drained hydraulic oil in a suitable container.

- ☞ Dispose of drained hydraulic oil by an ecologically safe method
- ☞ Always contact the relevant authorities or commercial establishments in charge of oil disposal before disposing of biodegradable oil.

☞ *Have the hose burst valve immediately repaired by an authorised workshop*

1.26 Towing the machine

Safety instructions for towing away

If the diesel engine and/or the hydraulic drive breaks down, the machine can be towed under the following conditions.

- The towing vehicle must have enough tractive power and be fitted with a safe brake system!
- The machine may only be towed using suitable towing equipment (towing bar) in connection with suitable towing facilities, such as a towing coupling, hooks and eyes!
- Make sure no-one is between the vehicles!
- The machine may be towed with a cable if the service brakes and steering are fully operational!

Getting ready for towing

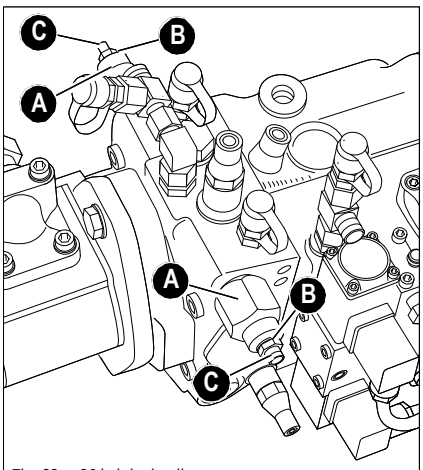


Fig. 33: 20 kph hydraulic pump

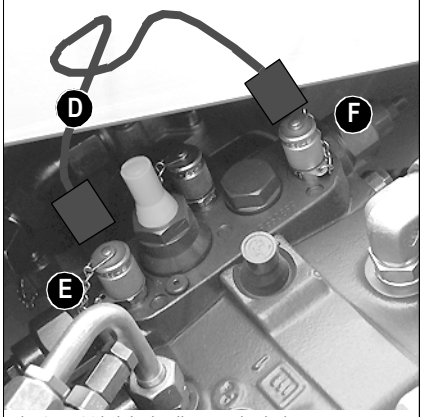


Fig. 34: 30 kph hydraulic pump (option)

Disabling the variable displacement drive pump

Caution!

The hydrostatic power train can be damaged when towing the machine!

☞ *Tow away the machine from the danger area only after you have opened the HP pressure relief valves*

☞ **Tow the machine out of the danger area only at walking pace and only over short distances**

☞ *Switch off the diesel engine*

☞ *Switch off ignition and remove the ignition key*

Variable displacement drive pump (20 kph)

☞ *Switch over the HP pressure relief valves **A** on the variable displacement pump. To do this:*

- Slacken hexagon lock nuts **B** on both HP valves **A**
- Screw in hexagon socket head screws **C** on both HP valves **A** until they are flush with lock nuts **B**
- Secure hexagon socket head screws **C** on both HP valves **A** with lock nuts **B**

Variable displacement drive pump 30 kph (option)

☞ *Mount hose **D** between test ports **E** and **F***

➥ The hose is included in the tool kit

☞ *If possible, run the diesel engine at idling speed when towing the machine*

Towing the machine

Danger!

Careful when towing away the wheel loader –

Danger of accidents!

☞ *The towing vehicle must have enough tractive power and be fitted with a safe brake system*

☞ *Only tow away with a towing bar*

➥ See chapter for the machine's dimensions and weights!

☞ *Eye hooks for towing the machine*

☞ *If possible, run the engine at idling speed when towing the machine*

➥ Steering and braking requires greater effort if the diesel engine breaks down.

☞ *Tow away the machine from the danger area only after you have opened the HP pressure relief valves on the variable displacement pump*

➥ **Tow the machine out of the danger area only at walking pace and only over short distances**

Once towing is over

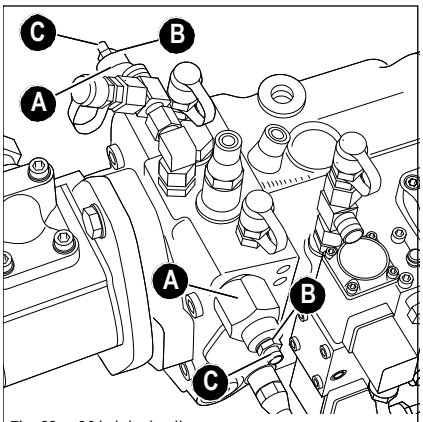


Fig. 33: 20 kph hydraulic pump

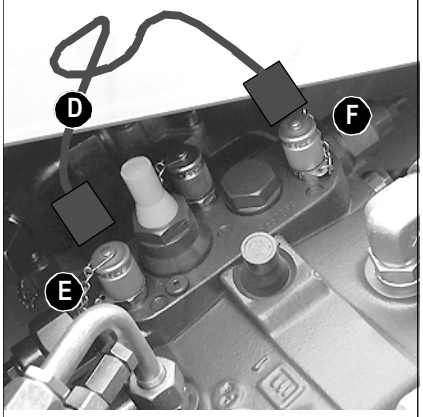


Fig. 34: 30 kph hydraulic pump (option)

Enabling the variable displacement drive pump (20 kph)

☞ *Switch over the HP pressure relief valves **A** on the variable displacement pump. To do this:*

- Slacken hexagon lock nuts **B** on both HP valves **A**
- Unscrew hexagon socket screws **C** on both HP valves **A** as far as they will go and secure them with locknuts **B**

Enabling the variable displacement drive pump (30 kph option)

☞ *Remove hose **D** between test ports **E** and **F**, and close the ports with caps*

➥ Store the hose in the tool box

Specifications

2 Specifications

2.1 Models and trade names: overview

Wheel loader model	Trade name
347-03	950
347-04	1150

2.2 Frame

Sturdy steel sheet frame, rubber-mounted engine

2.3 Engine

Engine	Wheel loader models 347-03/347-04
Product	Deutz diesel engine
Type	TD 2011 L04 W
Design	In line
No. of cylinders	4
Displacement	3619 cm^3
Bore and stroke	96 x 125 mm
Compression ratio	1:18
Output (as per ISO 14396)	58 kW at 2300 rpm
Max. torque	270 Nm at 1600 rpm
Minimum idling speed	900 rpm
Specific minimum fuel consumption	235 g/kWh
Fuel injection system	Direct fuel injection
Firing order	1-3-4-2
Starting aid	Glow plug
Max. inclined position (engine no longer supplied with oil):	30° in all directions **Observe the tilting limit of the machine!** **(20° laterally)**
Oil pressure	3.0 – 4.5 bar at 2300 rpm
Exhaust emissions according to EC standard	2004/26 EC

2.4 Drive

Variable displacement pump

Variable displacement pump	Wheel loader models 347-03/347-04
Design	Automotive, infinitely variable hydrostatic axial-piston gearbox
Displacement **20 kph**	0 – 56 cm³/rev
Displacement **30 kph (option)**	0 – 71 cm³/rev
Max. operating pressure	480 bar
Starting engine speed[1]	1150 – 1250 rpm at 50 bar HP
Droop	2200 – 2300 rpm at 250 bar HP

1. Speed measured at the engine's crankshaft

Boost pump

Boost pump	Wheel loader models 347-03/347-04
Design	Internal gear pump
Displacement **20 kph**	11.6 cm³/rev
Displacement **30 kph (option)**	19.8 cm³/rev
Charging/boost pressure	30 bar at 1500 rpm
Control	Speed-sensitive, hydraulic displacement adjustment with pressure cutoff
Driving direction	Electrohydraulic control
Inching	Inching valve

Variable displacement motor

Variable displacement motor	Wheel loader model 347-03	Wheel loader model 347-04
Design	Axial piston motor (swash plate design)	
Capacity **20 kph**	29.4 to 80.7 cm³/rev	29.4 to 107 cm³/rev
Capacity **30 kph (option)**	37.3 to 140 cm³/rev	
Drive speed **20 kph**	1st speed range: 0 – 6 kph, forwards and reverse 2nd speed range: 0 – 20 kph, forwards and reverse	
Drive speed **30 kph (option)**	1st speed range: 0 – 8 kph, forwards and reverse 2nd speed range: 0 – 30 kph, forwards and reverse	
Pushing power **20 kph**	44.0 kN[1]	59.0 kN[2]/54.0 kN[3]

1. With tyres 14.5-20
2. With tyres 16/70-20
3. With tyres 405/70-24

2.5 Axles

Front axle	**Wheel loader model 347-03**	**Wheel loader model 347-04**
Design	Planetary steering and drive axle, rigid screw connection with frame	
Differential lock	100 % differential	
King-pin inclination	0°	
Camber	0°	
Steering angle	40°	
Toe-in	0 mm	
Track width	1490 mm[1]	1490 mm[2]/1530 mm[3]
Rear axle	**Wheel loader model 347-03**	**Wheel loader model 347-04**
Design	Oscillating planetary steering and drive axle	
Differential lock	No	
King-pin inclination	0°	
Camber	0°	
Total oscillation angle	± 11°	
Steering angle	40°	
Toe-in	0 mm	
Track width	1490 mm[1]	1490 mm[2]/1530 mm[3]

1. Model 347-03 with tyres 14.5-20
2. Model 347-04 with tyres 16/70-20
3. Model 347-04 with tyres 405/70-24

2.6 Brakes

Service brake	**Wheel loader models 347-03/347-04**
Design	Foot-operated hydraulic disc brake
Location	Front axle input
Effect	On both axles via cardan shaft
Brake fluid	– *see chapter 3 "Fluids and lubricants"* on page 3-3
Parking brake	
Design	Manual mechanical disc brake
Location	Front axle input

2.7 Steering system

Steering system	Wheel loader model 347-03	Wheel loader model 347-04
Design	Hydrostatic 4 wheel steering with emergency steering features	
Steering mode	4 wheel steering	
Assemblies	Hydraulic pump, steering unit with priority valve, steering rams with automatic synchronisation in left and right final positions	
Max. pressure of hydraulic lines	175 – 180 bar	
Hydraulic pump (gear pump) displacement	32 cm³/rev	38 cm³/rev
Maximum steering angle	±40°	

2.8 Work hydraulics

Hydraulic pump, control valve, lift and tilt rams

Description	Wheel loader model 347-03	Wheel loader model 347-04
Hydraulic pump	Gear pump	
Displacement	32 cm³/rev	38 cm³/rev
	71 l/min at 2300 rpm	84 l/min at 2300 rpm
Control valve	3 sections (control circuits)	
Control lever (joystick)	Four-way lever – control of lift and tilt rams with mechanical lock against unintentional actuation, with electric control for driving direction and neutral position	
3rd control circuit control lever	Operation – quickhitch or hydraulic attachments with mechanical lock against unintentional actuation	
Max. operating pressure	210 bar	250 bar
Secondary protection tilt ram	Rod side 280 bar	
	Base side 120 bar	
Secondary protection lift ram		
Rod side	Anticavitation valve	Anticavitation valve
Base side	240 bar	280 bar
Filter	Suction reflux filter	

2.9 Electrical system

Electrical system	
Alternator	12 V 95 A
Starter	12 V 2.3 kW
Battery	12 V 72 Ah

Fuse box

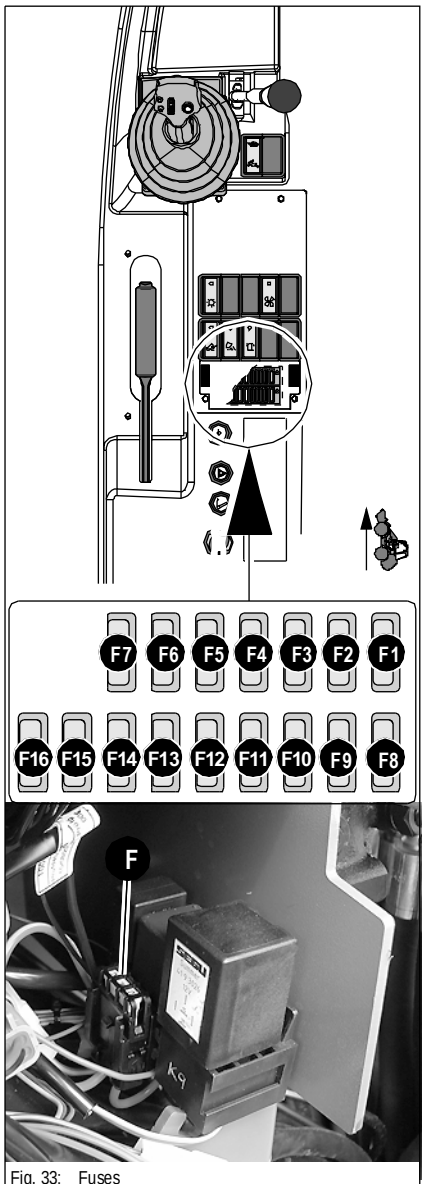


Fig. 33: Fuses

No.	Rated current	Protected circuit
F1	7.5	High beam (left)
F2	7.5	High beam (right)
F3	5	Left side marker and rear lights, front socket
F4	5	**Switch assignment:** 4th control circuit S11, front/rear working light, front attachments (option), rotating beacon (option) **Switch lights:** lights, heating S5, load stabiliser S8, 3rd control circuit, right side marker and rear lights, front socket (option)
F5	7.5	High current relay – preheating and starting, high current relay, interior light, relays – minus compensation, preheating telltale, hazard warning light
F6	25	Cigarette lighter, rotating beacon (option), front/rear working light
F7	25	High beam telltale
F8	7.5	Low beam (left)
F9	7.5	Low beam (right)
F10	5	Switching relay – front attachment (option), instrument panel, cutoff solenoid, sensor (coolant level indication)
F11	15	Washer pump, rear wiper, relays – wiper, front wiper, horn
F12	5	Solenoid valve 1st/2nd speed range, differential lock
F13	7.5	Relays – forwards/reverse, solenoid valve – forwards/reverse, backup warning system
F14	20	Front attachment (option), heater fan
F15	7.5	Relay – turn indicators, brake lights, solenoid valve (exhaust gas recirculation)
F16	5	Radio (option)
F	20	Air conditioning (option) Access: maintenance flap (outside right of cab)

Main fuse box with relays

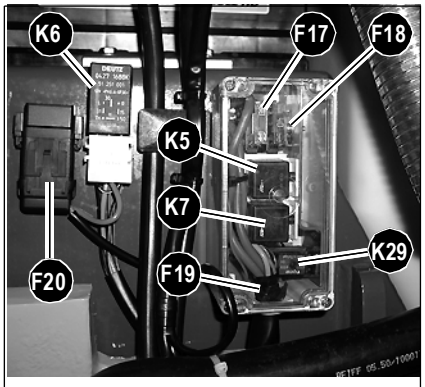


Fig. 34: Main fuse box

The main fuse box with the power relays and the preheating time control unit is located in the engine compartment on the left underneath the battery.

Fuse no.	Rated current (A)	Protected circuit
F17	80 A	Main fuse (machine)
F18	40 A	Preheating (intake-air preheating), starter fuse
F19	10 A	Minus compensation
F20	50 A	Preheating (2nd glow plug, intake-air preheating)

Relay no.	Protected circuit
K5	Preheating: power relay
K6	Preheating time control unit
K7	Start: starter relay
K29	Minus compensation

Switching relays underneath the switch panel

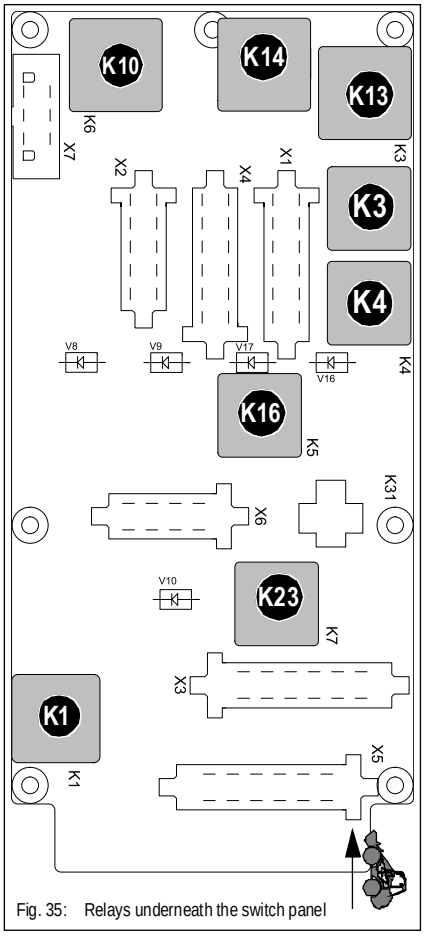


Fig. 35: Relays underneath the switch panel

The switching relays are located underneath the switch panel (side console on the right).
➥ Access: maintenance flap (outside right of cab).

Switching relay no.	Protected circuit
K1	High current relay
K3	Reverse driving switching relay
K4	Forwards driving switching relay
K10	Switching relay – turn indicators
K13	3rd control circuit switching relay
K14	
K16	Switching relay – front socket (option)
K23	Wiper switching relay

Switching relays for differential lock, warning sensor, air conditioning (option)

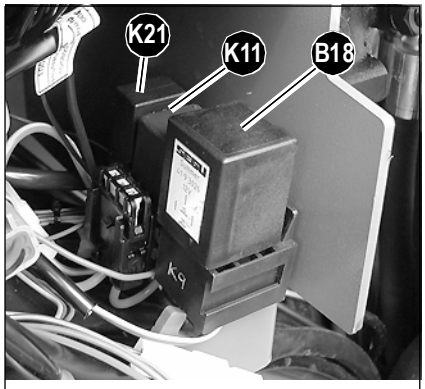


Fig. 36: Differential lock switching relay

The switching relays are located on the control valve bracket.

➥ Access: maintenance flap (outside right of cab).

Switching relay no.	Protected circuit
K21	Differential lock switching relay
K11	Air conditioning (option) switching relay
B18	Diesel engine temperature warning buzzer

2.10 Coolant compound table

Outside temperature	Water[1]	Antifreeze
Up to °C	% by volume	% by volume
4	99	–
- 10	79	20
- 20	65	34
- 25	59	40
- 30	55	45
- 42	**50**	**50**

1. Water quality at 20 °C = 6.5 – 8.5 ph/overall hardness 3 – 20 °dGH

2.11 Tyres

Tyres for wheel loader model 347-03

Tyre size	Tyre pressure[1]		Wheel rims	
	Front	Rear	Wheel rim	Wheel offset
14.5-20 MPT 04 12 PR	2.5	2.0	11 x 20	20 mm
375/75 R20 XM27 143 B				
375/70 R20 XZSL 143B				
365/80 R20 MPT81				
380/75 R20 XMCL 148B				
405/70 R20 EM TL SPT9			13 x 20	
425/75 R20 XZSL 155B				
16/70-20 MPT 04 TBL 14 PR				
405/70 R20 EM-01 143B				
405/70 R20 MPT 70E				
405/70 R20 MPT01 14PR 149B				
425/75 R20 MPT AC70G 148G				
12.00-20 SC15[2]			8.5-20	

1. Increase front tyre pressure by 0.5 bar during pallet forks operation!
2. Not included in the General Certification for Vehicles (Germany) or machine documentation. Separate certification required. Get informed on and follow the legal regulations of your country.

Tyres for wheel loader model 347-04

Tyre size	Tyre pressure[1]		Wheel rims	
	Front	Rear	Wheel rim	Wheel offset
16/70-20 MPT 04 14 PR	2.5	2.0	13 x 20	20 mm
425/75 R20 XZSL 155B				
405/70 R20 EM-01 143B				
425/75 R20 MPT AC70G				
12.00-20 SC15[2]			8.5-20	
405/70-24 MPT01 152 B			13 x 24	0 mm
405/70 R24 EM01 146B				
405/70 R24 14PR MPT-04T				

1. Increase front tyre pressure by 0.5 bar during pallet forks operation!
2. Not included in the General Certification for Vehicles (Germany) or machine documentation. Separate certification required. Get informed on and follow the legal regulations of your country.

2.12 Weights

Weight	Wheel loader model 347-03	Wheel loader model 347-04
Kerb weight[1]	4700 kg	5900 kg
Gross weight rating	6500 kg	7000 kg
Front axle weight rating	4000 kg	4500 kg
Rear axle weight rating		
Max. authorised load for towing facility	None	

1. With standard bucket, driver and full fuel tank

2.13 Noise levels

Sound power level models 347-03/347-04	dB(A)
Measured value	100.5
Guaranteed value	101
Noise level in the cab	78

Important!

Measurement of sound power level according to EC Directive 2000/14 EC.
Noise level at the driver's ear measured according to
EC Directives 84/532/EEC, 89/514/EEC and 95/27/EEC.
Measurements carried out on asphalted surface.

2.14 Vibration

Vibration	
Effective acceleration value for the upper extremities of the body	$< 2.5 \frac{m}{s^2}$
Effective acceleration value for the body	$< 0.5 \frac{m}{s^2}$

2.15 Tightening torques, conversion table

General tightening torques

Screw dimensions	Tightening torques in Nm[1]		
	8.8	10.9	12.9
M4	3	4	5
M5	5.5	8	10
M6	10	14	16
M8	23	34	40
M10	46	67	79
M12	79	115	135
M14	125	185	220
M16	195	290	340
M18	280	400	470
M20	395	560	660
M22	540	760	890
M24	680	970	1150
M27	1000	1450	1700
M30	1350	1950	2300

1. These values are valid for screws with untreated, non-lubricated surfaces

Specific tightening torques

Description	Tightening torque
Wheel nut	390 $^{\pm 10}$ Nm
Track-rod end (steering ram)	280$^{\pm 10}$ Nm
Piston rod (steering ram/track rod)	260$^{\pm 10}$ Nm

Conversion table: DIN standard – USA standard

All indications made without engagement.

Volumes
1 litre = 2.1 pts (pints)
1 litre = 1.06 qts (quarts)
1 litre = 0.26 gals (gallons)
1 cm^3 (cubic zentimeter) = 0.0611 cu. in. (cubic inches)
Lengths
1 mm (millimetre) = 0.03937 in (inches)
1 m (metre) = 3.281 feet
1 m (metre) = 1.0936 yards
1 km (kilometre) = 0.622 miles
Masses (weights)
1 kp/cm^2 (kilopond/cm^2) = 2.2 lbs.
1 kg (kilogram) = 2.205 lbs. (pounds)
1 g (gram) = 0.035 oz (ounces)
Torques
1 Nm (Newton metre) = 0.737 ft./lbs. (foot-pounds)
1 Nm (Newton metre) = 0.102 kp/cm^2 (kilopond/cm^2)
1 Nm (Newton metre) = 0.102 mkg (metre/kilogram)
Pressures
1 kp/cm^2 (kilopond/cm^2) = 14.22 psi
1 bar = 14.29 psi
Forces
1 N (Newton) = 0.225 lbs. (pounds)
1 hp (horse power) = 0.735 kW (kilowatt)
1 kW (kilowatt) = 1.36 hp (horse power)
1 hp (horse power) = 0.985 hp (horse power)

2.16 Payloads

Loader unit with bucket

Bucket[1]	Wheel loader model 347-03	Wheel loader model 347-04
Bucket capacity	0.95 m³ according to ISO	1.15 m³ according to ISO
Tipping load	3420 kg	4140 kg
Payload	1710 kg	2070 kg
Breakout force: lift ram	40.6 kN	48.4 kN
Breakout force: tilt ram	38.9 kN	43.7 kN
Scraping depth	53 mm	90 mm[2]

1. Model 347-03 with standard bucket 1000096385
   Model 347-04 with standard bucket 1000154387
2. - 50 mm with tyres 405/70-24

Loader unit with pallet forks

500 mm load distance	Wheel loader model 347-03	Wheel loader model 347-04
Payload, **safety factor 1.25**	2100 kg	2900 kg
Payload, **safety factor 1.67**	1550 kg	2170 kg
Transport position: movable payload, **safety factor 1.25**	2500 kg	3500 kg
Transport position: movable payload, **safety factor 1.67**	1850 kg	2620 kg
Lift height	3050 mm	3280 mm[1]

1. With tyres 405/70-24 (+ 50 mm)

Loader unit with pallet forks (foldable fork arms option)

500 mm load distance	Model 347-03	Model 347-04
Payload, **safety factor 1.25**	2000 kg	--
Payload, **safety factor 1.67**	1500 kg	--
Transport position: movable payload, **safety factor 1.25**	2350 kg	--
Transport position: movable payload, **safety factor 1.67**	1750 kg	--
Lift height[1]	3010 mm	--

1. With tyres 14.5-20

Loader unit with load hook (option)

Payload[1]	Model 347-03	Model 347-04
Payload with extended loader unit and quickhitch tilted in	1900 kg	2600
Payload with extended loader unit and quickhitch	1400 kg	1900

1. Payloads apply *with* lifting gear (chains, cables, suspension devices)

2.17 Dimensions wheel loader model 347-03

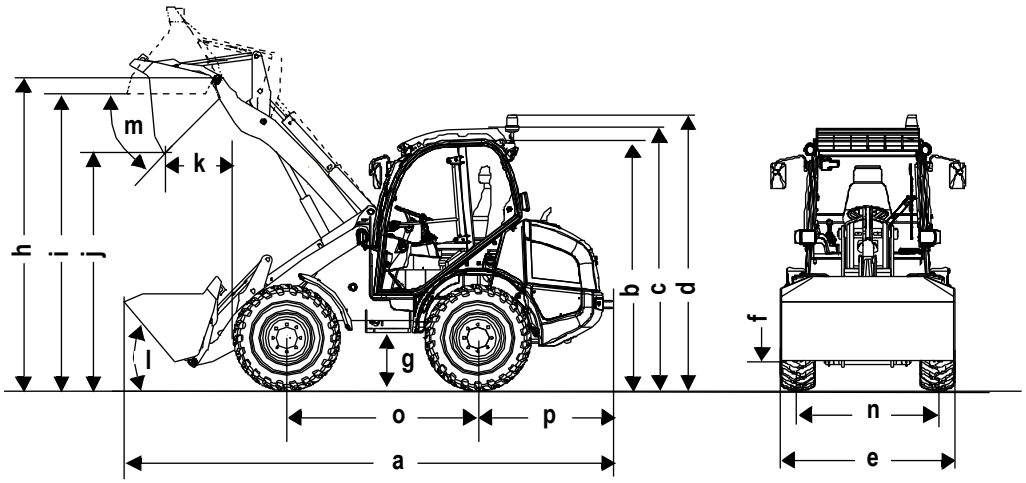


Fig. 37: Machine dimensions with bucket, model 347-03

Dimensions wheel loader model 347-03		
a	Overall length[1]	5360 mm
b	Overall height [2]	2650 mm
c	Overall height with protective screen[2]	2750 mm
d	Overall height with rotating beacon [2]	2850 mm
e	Overall width with bucket[1, 3]	1950 mm
e	Overall width without bucket[3]	1890 mm
f	Ground clearance in transport position of loader unit	200 mm
g	Ground clearance[2] below rear axle gearbox	325 mm
h	Pin height[2]	3270 mm
i	Load-over height[2]	3120 mm
j	Dump height[2]	2520 mm
k	Dump reach[1]	750 mm
l	Dump-in angle	50°
m	Dump-out angle	45°
n	Track width, front/rear	1490 mm
o	Wheelbase (front/rear axles)	2050 mm
p	Wheelbase (rear axle/rear of machine)	1430 mm
–	Turning radius[4]	2780 mm

1. With standard bucket (order no. 1000154547) tilted in
2. With tyres 14.5-20, without protective screen (FOPS)
3. With outside mirrors folded in
4. Measured at outer edge of wheel

2.18 Dimensions wheel loader model 347-04

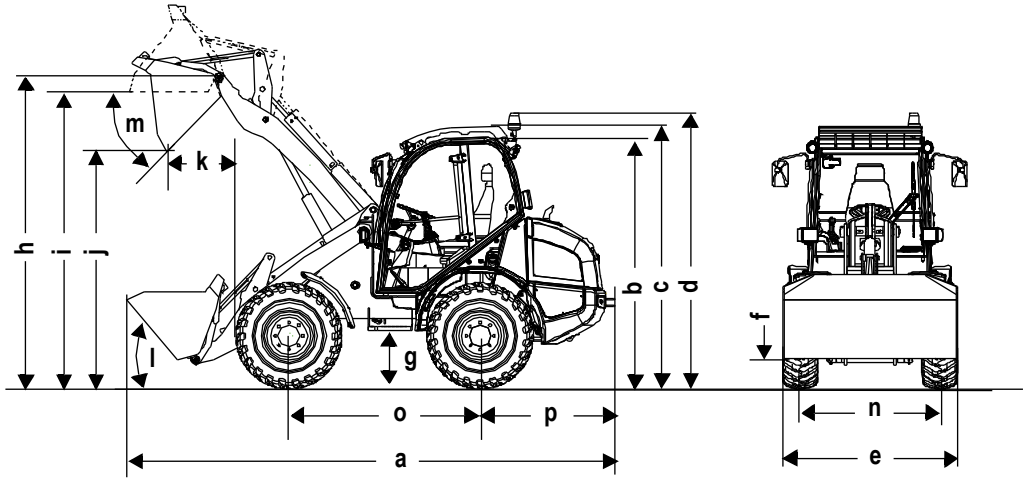


Fig. 38: Machine dimensions with bucket, model 347-04

Dimensions wheel loader model 347-03		
a	Overall length[1]	5800 mm
b	Overall height [2, 3]	2650 mm
c	Overall height with protective screen[2, 3]	2750 mm
d	Overall height with rotating beacon[2, 3]	2850 mm
e	Overall width with bucket[1, 4]	2150 mm
e	Overall width without bucket[4]	1890 mm
f	Ground clearance in transport position of loader unit	200 mm
g	Ground clearance[2, 3] below rear axle gearbox	325 mm
h	Pin height[2, 3]	3450 mm
i	Load-over height [2, 3]	3235 mm
j	Dump height[2, 3]	2670 mm
k	Dump reach[1]	660 mm
l	Dump-in angle	50°
m	Dump-out angle	45°
n	Track width, front/rear[5]	1490 mm
o	Wheelbase (front/rear axles)	2150 mm
p	Wheelbase (rear axle/rear of machine)	1480 mm
–	Turning radius[6]	2850 mm

1. With standard bucket (order no. 1000154387) tilted in
2. With tyres 16/70-20
3. + 50 mm with tyres 405/70-24
4. With outside mirrors folded in
5. With tyres 405/70-24 ==> 1530 mm
6. Measured at outer edge of wheel

2.19 Wheel loader dimensions with pallet forks (models 347-03/347-04)

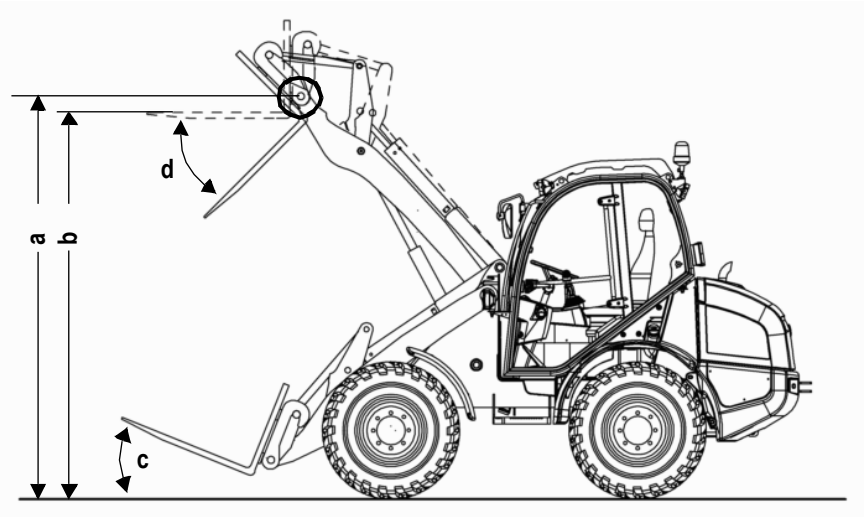


Fig. 39: Machine dimensions with pallet forks

Wheel loader model		347-03	347-04
a	Pin height	3270 mm[1]	3450 mm [2]
b	Pallet height	3010 mm[1]	3280 mm[2]
c	Dump-in angle in transport position[3]	17°	
d	Dump-out angle[3]	85°	

1. With tyres 14.5-20
2. With tyres 16/70-20 With tyres 405/70-24 (+ 50 mm)
3. With pallet forks order no. 1000101820 (1000 mm)

Other dimensions

➥ – *see Dimensions wheel loader model 347-03* on page 2-14
➥ – *see Dimensions wheel loader model 347-04* on page 2-15

Notes:

Maintenance and service work

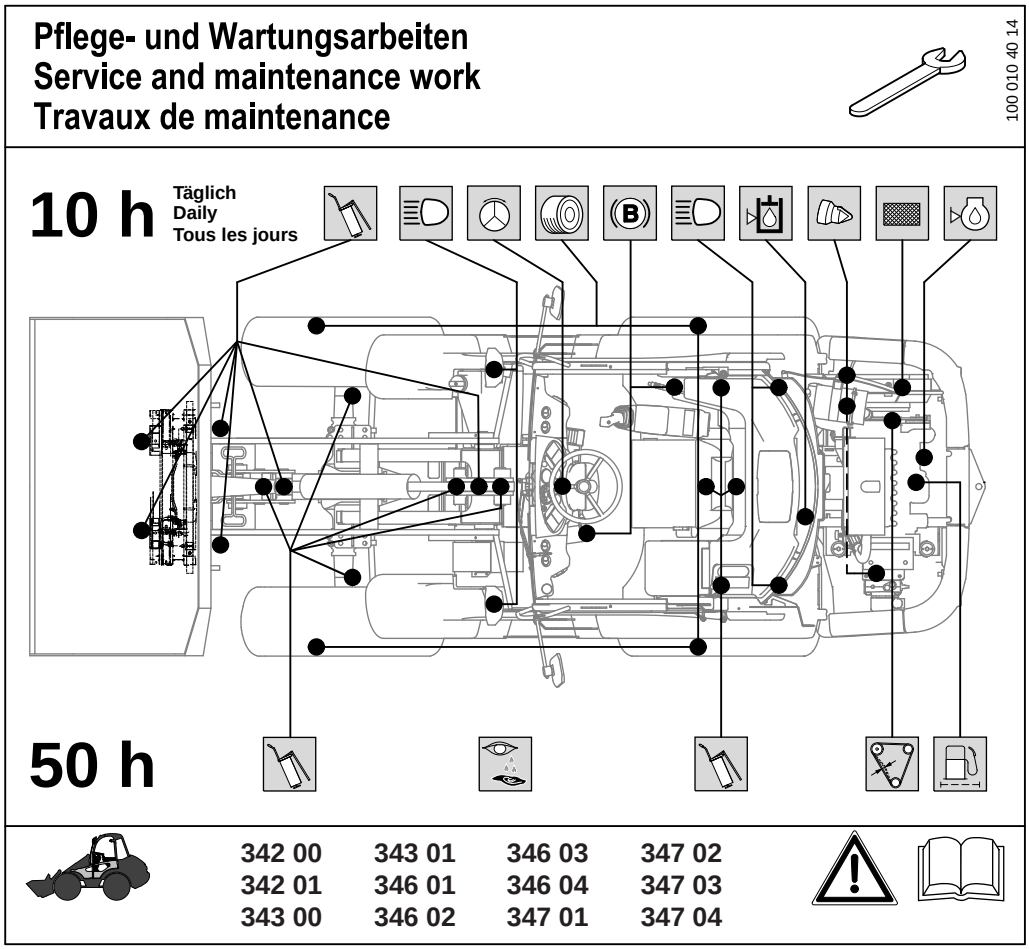
3 Maintenance and service work

3.1 Explanation of symbols on the maintenance label

Symbol	Explanation
	Before starting maintenance work, follow the safety instructions in the Operator's Manual!
	Before starting maintenance work, read the “Maintenance” chapter in the Operator's Manual!
	Carry out a functional check of the light system!
	Check tyres for damage, pressure and tread depth!
	Carry out a functional check and synchronise the steering system!
	Carry out a functional check of the brake system!
	Check hydraulic oil level. Fill up if necessary!
	Check engine oil level. Fill up if necessary!
	Compress the dust valve
	Check radiator for engine coolant and hydraulic oil for contamination. Clean if necessary!
	Check condition and initial tension of V-belt. Retighten or replace if necessary!
	Leakage check: Check for tightness, leaks and chafing: pipes, flexible lines and screw connections. Rectify if necessary!
	Leakage check: Check the fuel/water separator. Drain water if necessary!
	Lubrication service: Lubricate the assemblies concerned!

3.2 Maintenance label

Location: inside the cab on the rear window



3.3 Fluids and lubricants

Component/ application	Engine/machine fluid	SAE grade Specification	Season/temper-ature	Capacities[1]
Diesel engine	Engine oil with oil filter[2]	SAE 10W; EO10[3]	Below -5 °C	About 10.5 l
		SAE 20W20; EO20[3]	-10 to +10 °C	
		SAE 30; EO30[3]	5 to 30 °C	
		HD-C 10W-40; EO1040B[3]	Year-round	
		HD-C 15W-40; EO1540B[3]		
Gearbox	Gearbox oil[4]	85 W 90 API GL5 or SAE 90 LS (hypoid gear oil)	Year-round	0.8 l
Front and rear axle differentials				4.0 l
Planetary drives – left and right, front and rear axles				0.9 l each
Hydraulic oil tank	Engine oil[2]	SAE 5 W/30	Up to -25 °C	About 64 l
		SAE 5 W/40; EO 0540B[3]	–	
		SAE 10 W/40; EO 0540B[3]	Up to -15 °C	
		SAE 15 W/40; EO 1540B[3]	Up to -10 °C	
	Hydraulic oil[5]	HVLPD 46 (HYD0530[3])	Year-round	
	Biodegradable oil	AVILUB Syntofluid 46		
		PANOLIN HLP Synth 46		
Grease nipples, loader unit/axles	Multipurpose grease	Lithium-saponified brand-name grease MPG-A[3]	Year-round	As required
Battery terminals	Acid-proof grease	SP-B[3]	Year-round	As required
Aggressive media (option)	Anticorrosion sprotection	Anticorit BW 366[6]	Year-round	As required
Mounting[7] of pins, shafts	Special grease	Optimoly paste "TA"[8] White-Paste	Year-round	As required
Fuel tank	Diesel fuel	EN590	Year-round	About 60 l
Brake system	Brake fluid[9]	Agip LHM Super/Shell LHM	Year-round	–
Engine cooling	Antifreeze[10, 11, 12]	MS Frostschutz HAVOLINE XLC	Year-round -31 °C	Water 5.2 l (45 %) Antifreeze 4.3 l (55 %)
Washer system	Cleaning agent[11]	Water + antifreeze	Year-round -20 °C	Water 1.3 l (67 %) Antifreeze 0.7 l (33 %)

1. The capacities indicated are approximative values; the oil level check alone is relevant for the correct oil level
2. MIL-L-2104C; API CD/CE/CH4; CCMC-D4
3. Abbreviation for lubricants (Hauptverband der Deutschen Bauindustrie e. V. – German construction engineering association)
4. MIL-L-2105B; API-GL5
5. DIN 51 524
6. TI 8030-015/K 19/MIL-C-16 173 C-Grade 4
7. Important! Pins (hard-chromium plated or coated with Molykote 3400A) are inserted in dry state. Lubricate via grease nipples once assembly is over
8. 250 gr tube, order no.: 1000030311
9. Standard: B 71 2710
10. See Coolant compound table on page 2-7
11. See manufacturer's indications on the packaging and bear in mind the antifreeze compound table
12. Replace the coolant every 2 years!

3.4 Maintenance plan

Work description

For service and maintenance work on the attachment, please refer to the operation and maintenance manual of the attachment manufacturer as well.

	Maintenance plan/service hours (s/h)					
	Delivery inspection	Maintenance work (once a day)	"A" every 50 s/h once a week	1st Inspection[1] at 100 s/h	"B" every 500 s/h[2] 2nd Inspection	"C" every 1500 s/h once a year
Oil and filter changes ( ):						
Carry out the following oil and filter changes (check oil levels after test run):						
• Engine oil				●	●	●
• Engine oil filter				●	●	●
• Fuel filter, fuel prefilter				●	●	●
• Air filter insert [3,4] replace safety cartridge every 3rd time the air filter insert is replaced					●	●
• Gearbox oil in front and rear axle differentials and in rear axle gearbox				●		●
• Gearbox oil in front and rear axle planetary drives (left and right)				●		●
• Hydraulic oil[5]						●
• Microfilter (line filter option in drive)				●		●
• Hydraulic oil filter insert				●		●
• Hydraulic oil tank breather filter [4]						●
• Heating: fine-dust filter[6]					●	●
Inspection work ( ):						
Check the following material. Refill if necessary:						
• Engine oil	●	●	●			
• Hydraulic oil	●	●	●	●	●	●
• Engine coolant [7](also check antifreeze in autumn/winter and at temperatures below 4 °C!)	●	●		●	●	●
• Gearbox oil in front and rear axle differentials and in rear axle gearbox	●			●	●	●
• Gearbox oil in front and rear axle planetary drives (left and right)	●			●	●	●
• Brake fluid[8]	●	●	●	●	●	●
• Check radiator for engine and hydraulic oil for contamination. Clean if necessary[9]		●	●	●	●	●
• When using biodegradable oil: drain the condensation water in the hydraulic oil tank [5]					●	●
• Clean dust valve on air filter housing [3]	●	●	●	●	●	●
• V-belt: check condition and pre-tension. Retighten or replace if necessary[10]	●	●	●	●	●	●
• Check the fuel/water separator. Drain water if necessary			●	●	●	●
• Clean filter insert on fuel pump, replace if necessary			●	●	●	●
• Check valve clearance (engine management). Set if necessary				●		

3.4 Maintenance plan

Work description

For service and maintenance work on the attachment, please refer to the operation and maintenance manual of the attachment manufacturer as well.

	Maintenance plan/service hours (s/h)					
	Delivery inspection	Maintenance work (once a day)	"A" every 50 s/h once a week	1st Inspection[1] at 100 s/h	"B" every 500 s/h[2] 2nd Inspection	"C" every 1500 s/h once a year
Other inspection work ( ):						
• Battery: check charge condition					●	●
• Heating: clean the fine-dust filter			●			
• Check and set service and parking brake pads. Replace if necessary				●	●	●
• Tyre check (damage, air pressure, tread depth)	●	●	●	●	●	●
• Aggressive media (option): check anticorrosion protection, renew if necessary[11]		●		●	●	●
Check screws and nuts or screw connections for tightness on the following assemblies/components. Retighten if necessary						
• Engine and engine bearing				●	●	●
• Steering system				●	●	●
• Hydraulic system				●	●	●
• Loader unit (pin locking)				●	●	●
• Axle mounting, axle suspension				●	●	●
• Counterweight (attachment)				●	●	●
• Fastening screws of cardan shafts				●	●	●
• Fastening screws of cab				●	●	●
• Wheel nuts	●			●	●	●
Electrical system: check electric and earth connections, chafing on wiring harness, battery terminals	●			●	●	●
Lubrication service ( ):[12]						
Lubricate the following assemblies/components:						
• Hinges, joints and fittings (e.g. door arrester)		●	●	●	●	●
• Rear axle oscillating bearing	●		●	●	●	●
• Front and rear axle planetary drive bearings (left and right)	●		●	●	●	●
• Loader unit						
• Lift frame bearing	●	●	●	●	●	●
• Tilt rod bearing	●	●	●	●	●	●
• Tilt lever bearing	●	●	●	●	●	●
• Lift ram bearing	●		●	●	●	●
• Tilt ram bearing	●		●	●	●	●
• Quickhitch: bearing on lift frame	●	●	●	●	●	●

3.4 Maintenance plan

Work description

For service and maintenance work on the attachment, please refer to the operation and maintenance manual of the attachment manufacturer as well.

	Maintenance plan/service hours (s/h)					
	Delivery inspection	Maintenance work (once a day)	"A" every 50 s/h once a week	1st Inspection[1] at 100 s/h	"B" every 500 s/h[2] 2nd Inspection	"C" every 1500 s/h once a year
Functional check ( ):						
Check the function of the following assemblies/components. Rectify if necessary:						
• Service and parking brake	●	●	●	●	●	●
• Steering system	●	●	●	●	●	●
• Lights and electrical system	●	●	●	●	●	●
• Air conditioning (option)	●	●	●	●	●	●
Leakage check ( ):						
Check for tightness, leaks and chafing: pipes, flexible lines and screw connections of the following assemblies and components. Rectify if necessary:						
• Air intake line (air filter – engine)	●	●	●	●	●	●
• Engine lubrication (engine – filter)	●	●	●	●	●	●
• Fuel lines[13]	●	●	●	●	●	●
• Cooling system (engine – hydraulic oil)	●	●	●	●	●	●
• Steering system (flexible lines and rams)	●	●	●	●	●	●
• Hydraulic system/loader unit (flexible lines[14] and rams)	●	●	●	●	●	●
• Brake system (flexible lines and cylinders)	●	●	●	●	●	●
• Air conditioning flexible lines (option)	●	●	●	●	●	●

1. Work to be carried out once after the first 100 s/h. This work must be carried out by an authorised workshop for warranty claims to be acknowledged.
2. Work after the first 500 s/h (2nd Inspection) must be carried out by an authorised workshop for warranty claims to be acknowledged
3. Replace filter insert as indicated by the telltale on the air filter housing, however at least every 12 months or 1500 s/h.
4. When working in an acidic environment, replace the filter every 300 s/h!
5. When using biodegradable oil: drain the condensation water in the hydraulic oil tank every 500 s/h, in any case before the cold season.
6. Depending on operation and dust conditions, it may be necessary to replace the fine-dust filter more frequently
7. Replace the engine coolant every other year!
8. Replace every 2 years
9. Depending on operation and dust conditions, it can be necessary to clean the radiator more frequently
10. Replace the toothed belt every 3000 s/h or after 5 years at the latest (toothed belt must be replaced by authorised staff)
11. See maintenance instructions for aggressive media, order no. 1000108296
12. Lubricate attachment according to manufacturer's instructions!
13. Replace flexible fuel leak oil lines every 2 years
14. Replace flexible lines every 6 years (UVV, DIN 20066 part 5)

3.5 Important information on maintenance and service work

Danger!

Do not carry out assembly and maintenance work if the loader unit is raised and **not** secured –

Danger of crushing and injury!

☞ *Secure the loader unit with an appropriate prop or support to prevent it from being lowered unintentionally*

☞ *Also follow the instructions given in chapter 2 "SAFETY INSTRUCTIONS" of the Operator's Manual of the machine, and the instructions given in the Operator's Manuals of the attachments!*

Service and maintenance work according to the maintenance plan

• – *see Maintenance plan* on page 3-4

Important!

Daily and weekly service and maintenance work must be carried out by a specifically trained driver.

- **All other maintenance work must be carried out only by the trained and qualified staff of your sales partner or workshop.**

Service and maintenance work on the separate components

– *see chapter 4 "Engine"* on page 4-1
– *see chapter 5 "Power train"* on page 5-1
– *see chapter 6 "Axles"* on page 6-1
– *see chapter 7 "Brakes"* on page 7-1
– *see chapter 8 "Steering system"* on page 8-1
– *see chapter 9 "Hydraulic system"* on page 9-1
– *see chapter 10 "Electrical system"* on page 10-1

3.6 Fuel system

General safety instructions for refuelling

- Extreme caution is essential when handling fuel – high risk of fire!
- Never carry out work on the fuel system in the vicinity of naked flames or sparks!
- Do not smoke when working on the fuel system or when refuelling!
- Before refuelling, stop the engine and remove the ignition key!
- Do not refuel in closed rooms!

Environment!

Use a suitable container to collect the fuel as it drains and dispose of it in an environmentally friendly manner! Keep the machine clean to reduce the risk of fire and wipe away fuel spills immediately!

Diesel fuel specification

Caution!

In order to avoid engine damage, do not use diesel fuel with additives!

☞ Use only high-grade fuels

Grade	Cetane number	Use
DIN EN 590	Min. 49	Up to -44 °C outside temperature
DIN EN 14214 (biodiesel)	Min. 51	Up to -20 °C outside temperature

Stationary fuel pumps

General

Only refuel from stationary fuel pumps. Fuel from barrels or cans is usually contaminated. Even the smallest particles of dirt can cause

- Increased engine wear
- Malfunctions in the fuel system and
- Reduced effectiveness of the fuel filters

Refuelling from barrels

If refuelling from barrels cannot be avoided, note the following points:

- Barrels must neither be rolled nor tilted before refuelling
- Protect the suction pipe opening of the barrel pump with a fine-mesh strainer
- Immerse it down to a max. 15 cm above the floor of the barrel
- Only fill the tank using refuelling aids (funnels or filler pipes) with integral microfilter
- Keep all refuelling containers clean at all times

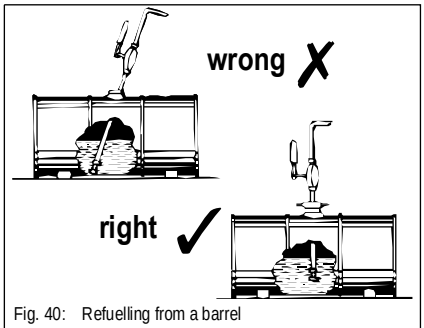


Fig. 40: Refuelling from a barrel

Refuelling

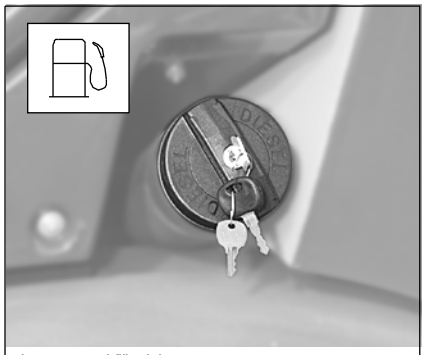


Fig. 41: Fuel filler inlet

The filler inlet of the fuel tank is located on the left-hand side of the machine

Danger!

All work involving fuel carries an increased

Danger of fire and poisoning!

☞ *Do not refuel in closed rooms*

☞ *Never carry out work on the fuel system in the vicinity of naked flames or sparks*

Checking/cleaning the additional fuel filter (water separator, option)

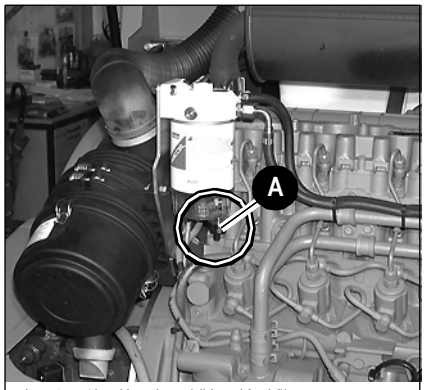


Fig. 42: Checking the additional fuel filter

The additional fuel filter is mounted on the engine near the air filter

Drain the condensation water every 50 s/h (service hours)

☞ *Proceed as follows:*

- Stop the engine
- Apply the parking brake
- Switch off ignition and remove the ignition key
- Place a container to collect the fuel
- Open stop cock **A** on the additional fuel filter and drain the condensation water
- Close stop cock **A** on the additional fuel filter
- Start the diesel engine and check the additional fuel filter for leaks

Environment!

Use a suitable container to collect the fuel as it drains and dispose of it in an environmentally friendly manner!

3.7 Replacing the fuel filter

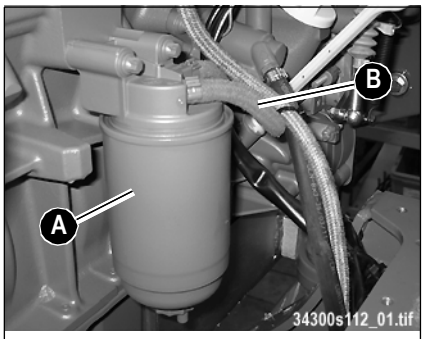


Fig. 43: Fuel filter position

Danger!

If the fuel, as it drains, comes into contact with hot engine parts or the exhaust system, there is an increased

Danger of burns!

☞ *Never change the fuel filter if the engine is hot!*

Environment!

Use a suitable container to collect the fuel as it drains and dispose of it in an environmentally friendly manner!

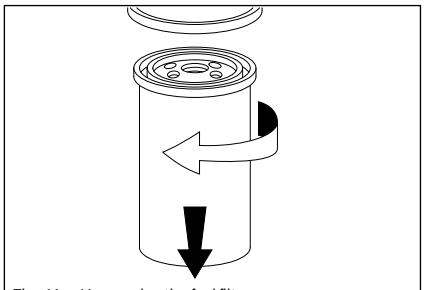


Fig. 44: Unscrewing the fuel filter

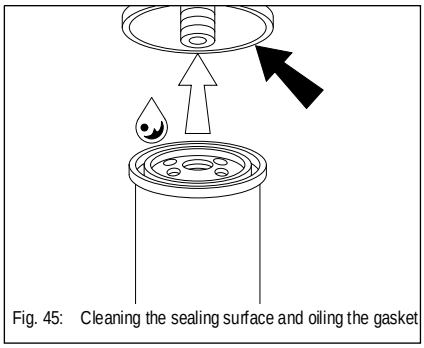


Fig. 45: Cleaning the sealing surface and oiling the gasket

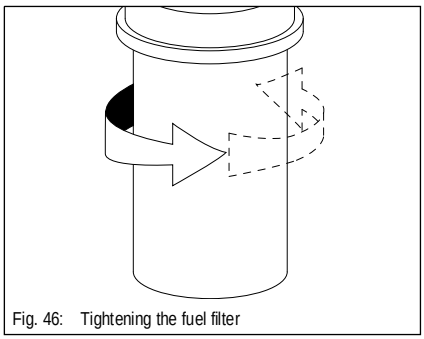


Fig. 46: Tightening the fuel filter

☞ *Change the fuel filter as follows:*

1 Pinch off fuel feed line *Fig. 43*/**B** with a suitable tool
2 Thoroughly clean the outside surfaces of fuel filter
3 Slacken and unscrew fuel filter cartridge using a commercially available tool
4 Collect the fuel as it drains
5 Clean the sealing surface of the filter carrier if it is fouled
6 Lightly oil the rubber gasket of the new filter cartridge or apply a thin coat of clean diesel fuel to it
7 Screw on the cartridge by hand until the gasket makes contact
8 Tighten the fuel filter cartridge by turning it a further half revolution
9 Remove the tool which has been used to pinch off the fuel feed line 43/**B**
10 Make a test run – and check for tightness!
11 Dispose of the old fuel filter cartridge by an ecologically safe method
12 Bleed the fuel system – see page *3-12*

3.8 Cleaning the fuel pump screen filter

Danger!

If the fuel, as it drains, comes into contact with hot engine parts or the exhaust system, there is an increased

Danger of burns!

☞ *Never clean screen the filter when the engine is hot!*

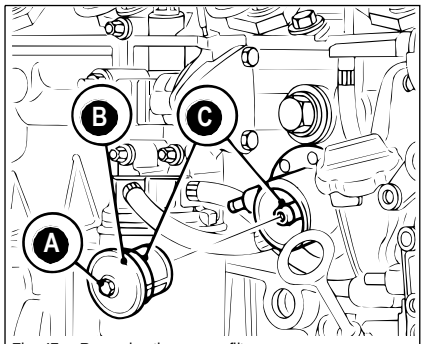


Fig. 47: Removing the screen filter

☞ *Proceed as follows:*

1 Pinch off fuel feed line *Fig. 43*/**B** with a suitable tool
2 Slacken and unscrew hexagon head screw **A**
3 Remove fuel screen **B** (cover and screen come out together)
4 Clean fuel screen **B** with fuel, replace if necessary
5 Position sealing rings **C**
6 Fit fuel screen **B** (cover with screen) back on
7 Tighten hexagon head screw **A**
8 Remove the tool which has been used to pinch off the fuel feed line 43/**B**
9 Bleed the fuel system – see page *3-12*
10 Make a test run – and check for tightness!

3.9 Bleeding the fuel system

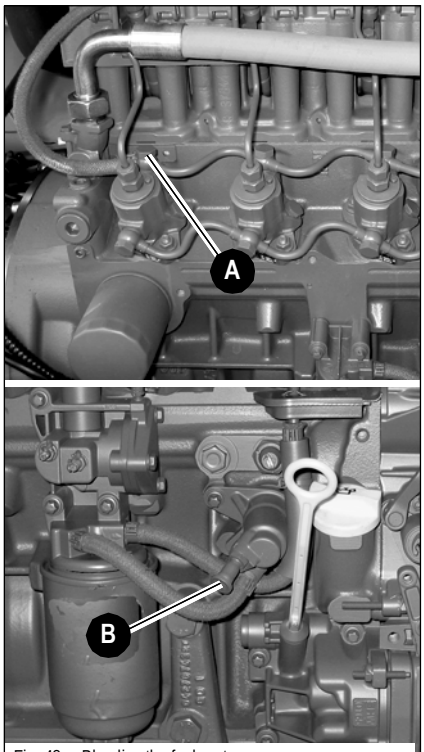


Fig. 48: Bleeding the fuel system

Danger!

If the fuel, as it drains, comes into contact with hot engine parts or the exhaust system, there is an increased

Danger of burns!

☞ *Never bleed the fuel system if the engine is hot!*

Environment!

Use a suitable container to collect the fuel as it drains and dispose of it in an environmentally friendly manner!

Bleed the fuel system in the following cases:

- After removing and fitting the fuel filter, prefilter or the fuel lines back on again
- After running the fuel tank empty
- After running the engine again, after it has been out of service for a longer period of time

☞ *Bleed the fuel system as follows:*

- Place the container under the engine
- Fill the fuel tank
- Slacken bleed screw **A** on the injection pump by a few turns
- Press button **B** on the fuel pump with your hand (pumping movement) until the fuel comes out free of air from the slackened bleed screw
- Tighten bleed screw **A**
- Start the engine

If the engine runs smoothly for a while, and then stops; or if it does not run smoothly:

- Stop the engine
- Check once again if there is any air in the fuel system
- Bleed the fuel system again as described above

3.10 Checking/filling up the engine oil

Caution!

If the engine oil level is too high or too low, or if an oil change is overdue, this can cause engine damage or loss of output!

☞ *Use only the specified engine oil*
– see Fluids and lubricants on page 3-3

Important!

Check the oil level every 10 service hours or once a day. After switching off a warm engine, wait at least 5 minutes before checking.

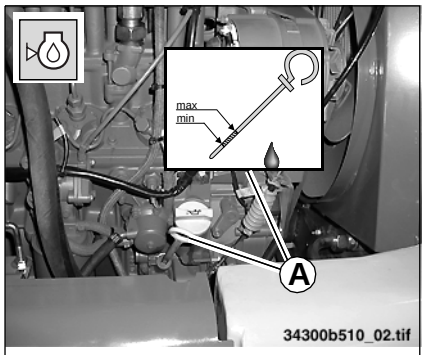


Fig. 49: Checking the oil level

☞ *Proceed as follows:*

1 Park the machine on level ground
2 Switch off the engine!
3 Apply the parking brake
4 Open the engine cover
5 Pull out oil dipstick **A**
6 Wipe it with a lint-free cloth
7 Push it back in as far as possible
8 Withdraw it and read off the oil level
9 However if necessary, fill up the oil at the latest when the oil reaches the MIN mark on the oil dipstick **A**

Environment!

Use a suitable container to collect the engine oil as it drains and dispose of it in an environmentally friendly manner!

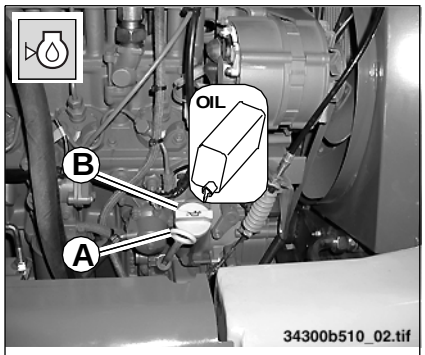


Fig. 50: Oil dipstick and oil filler cap

☞ *Proceed as follows:*

1 Clean the area around oil filler cap **B** with a lint-free cloth
2 Open filler cap **B**
3 Raise oil dipstick **A** a little to allow any trapped air to escape
4 Fill in engine oil
5 Wait a moment until all the oil has run into the oil sump
6 Check the oil level
7 Fill up if necessary and check the oil level again
8 Close filler cap **B**
9 Push oil dipstick **A** back in as far as possible
10 Completely remove all oil spills from the engine

3.11 Changing engine oil

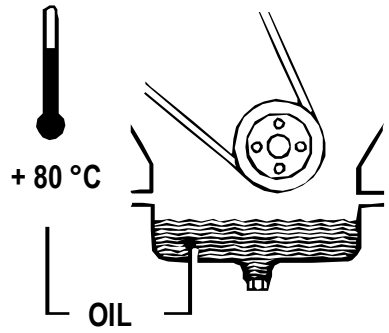


Fig. 51: Optimum engine oil temperature

Danger!

Caution when draining hot engine oil –

Danger of burns!

☞ *Wear protective gloves*

☞ *Use suitable tools*

Environment!

Use a suitable container to collect the engine oil as it drains and dispose of it in an environmentally friendly manner!

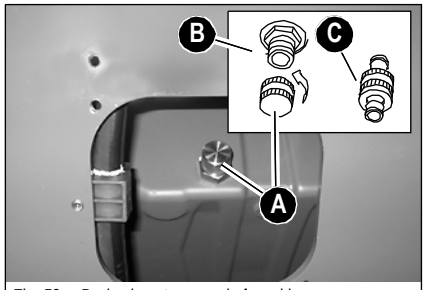


Fig. 52: Drain plug at rear end of machine

☞ *Change the engine oil as follows:*

1 Park the machine on level ground
2 Let the engine run until reaching operating temperature (oil temperature about 80 °C)
3 Stop the engine
4 Place a container (about 12 l capacity) under the opening to collect the oil as it drains
5 Remove the cover from the frame
6 Unscrew cap **A** of oil drain valve **B**
7 Screw in drain coupling **C** with a sufficiently long hose **D**, making sure the end of the hose is in oil drip tray **E**
8 Completely drain the oil
9 Unscrew drain coupling **C**
10 Screw filler cap **A** of the oil drain valve with a new seal
11 Fill in engine oil
12 Start the engine and let it run briefly at low speed
13 Stop the engine
14 Wait a moment until all the oil has run into the oil sump
15 Check the oil level again
16 Fill up if necessary and check again
17 Completely remove all oil spills from the engine

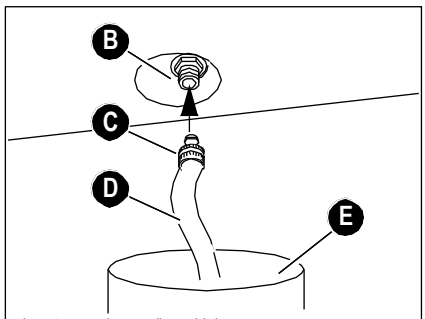


Fig. 53: Drain coupling with hose

3.12 Replacing the engine oil filter cartridge

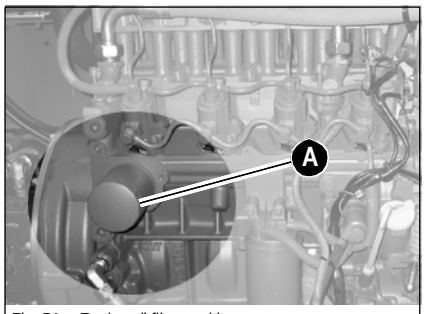


Fig. 54: Engine oil filter position

Danger!

Caution when handling hot engine oil –

Danger of burns!

☞ *Wear protective gloves*

Environment!

Collect the drained engine oil in a suitable container.
Dispose of used oil and filters in an environmentally friendly manner!

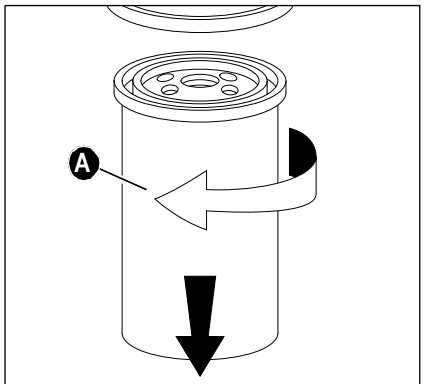


Fig. 55: Unscrewing the engine oil filter

1 Stop the engine
2 Place a suitable container underneath the oil filter to collect the oil as it drains
3 Slacken and unscrew oil filter cartridge **A** with an oil filter strap wrench
4 Make sure the thread adapter is correctly placed in the filter head

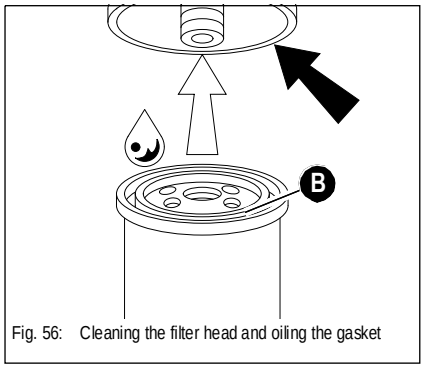


Fig. 56: Cleaning the filter head and oiling the gasket

5 Clean inside the filter head (arrow)
6 Apply a thin coat of engine oil to the rubber seal (fig. 56/**B**) of the new oil filter cartridge
7 Tighten the new filter cartridge by hand until the gasket makes contact

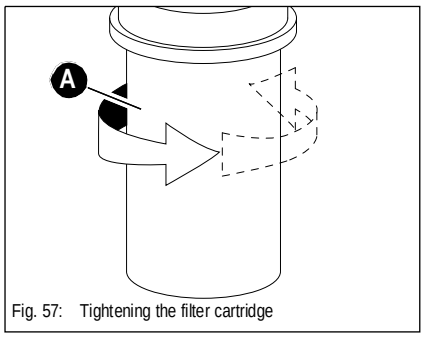
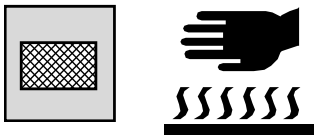


Fig. 57: Tightening the filter cartridge

8 **Tighten** oil filter cartridge **A** by hand by about a further ½ revolution or tighten it with an oil filter strap wrench to **15 Nm** (strap wrenches for torque wrenches are commercially available)
9 Check the engine oil level. Fill up if necessary
10 Completely remove all oil spills from the engine
11 Let the engine run briefly
12 Stop the engine
13 Check the seal of oil filter cartridge **A**
14 Check the oil level and fill in engine oil if necessary
15 Dispose of the used oil filter in an environmentally friendly manner

3.13 Cleaning the radiator fins of the oil/water radiator



Danger!

Careful when carrying out maintenance work on a hot engine and radiator –

Danger of burns!

☞ *Wait at least 10 minutes after switching off the engine*

☞ *Wear protective gloves and clothing during maintenance work*

Caution!

Dirt on the radiator fins reduces the radiator's heat dissipation capacity and can cause damage to the engine and the hydraulic system!
In order to ensure the radiator's optimal cooling capacity, do not damage the radiator fins as you clean them with a compressed-air gun!

☞ *Check the radiator **once a day*** for dirt and clean it if necessary

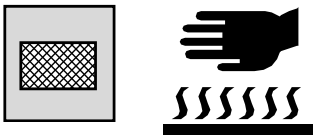
☞ *Clean the radiator more frequently in dusty or dirty work conditions*



Fig. 58: Cleaning the oil cooler

1 Park the wheel loader on level ground
2 Lower the loader unit fully
3 Apply the parking brake with the switch on the instrument panel
4 Stop the engine and let it cool down
5 Switch off ignition and remove the ignition key
6 Open the engine cover
7 Clean the radiator fins by blowing compressed air outwards from the engine side

3.14 Checking the coolant level



Danger!

Never open the filler cap of the coolant tank and never drain coolant on a warm engine since the cooling system is under high pressure –

Danger of burns!

☞ *Wait at least 10 minutes after stopping the engine!*

☞ *Wear protective gloves and clothing*

☞ *Always actuate the safety valve first on the filler cap of the expansion tank. To do this:*

☞ *Open the cap to the first notch and release the pressure*

Important!

Check the coolant level every **10 service hours** or once a day.
Check before starting the engine.

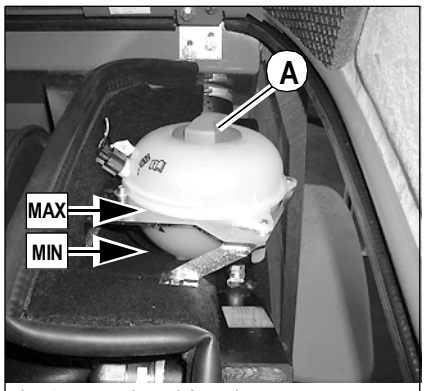


Fig. 59: Expansion tank for coolant

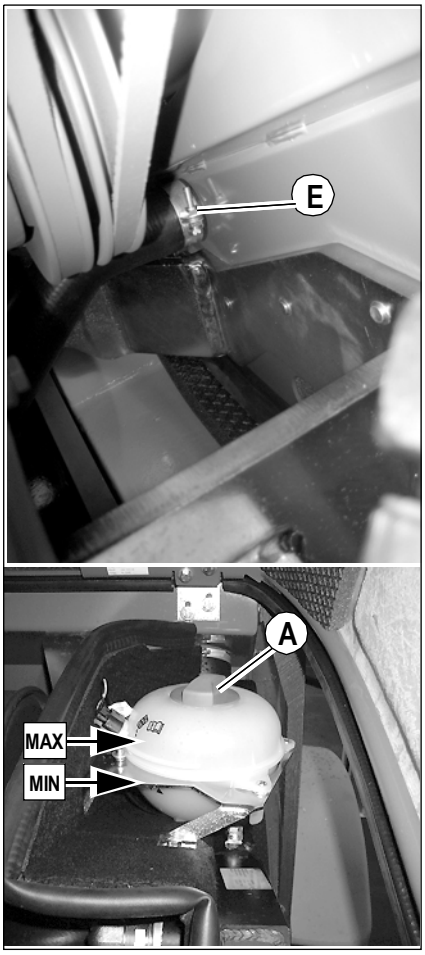
☞ *Check the coolant level as follows:*

1 Park the machine on level ground
2 Lower the loader unit fully
3 Apply the parking brake
4 Stop the engine
5 Switch off ignition and remove the ignition key
6 Open the engine cover
7 Check the coolant level in the expansion tank **A**

If the coolant level is below the **MIN** mark of the expansion tank:

8 Fill up coolant to the **MAX** mark
9 Check the coolant quality (antifreeze) with suitable testing equipment (antifreeze tester) – *see Coolant compound table* on page 2-7 or *Fluids and lubricants* on page 3-3

3.15 Draining coolant



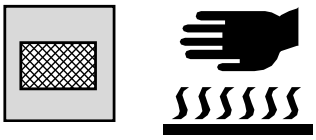
☞ ***Drain/replace the coolant*** *as follows:*

1 Park the machine on level ground
2 Lower the loader unit fully
3 Apply the parking brake
4 Stop the engine
5 Switch off ignition and remove the ignition key
6 Set the heating temperature controller to max. temperature in order to drain the coolant from the heating circuit as well.
7 Open the engine cover
8 Allow the engine/coolant to cool down
9 Place a suitable container underneath the outlet of the radiator to collect the coolant as it drains
10 Release the overpressure in the coolant expansion tank **A**. To do this:
11 Open cap **A** to the first notch and release the pressure
12 Open filler cap **A** fully
13 Remove the coolant hose below on the radiator **E** and drain the coolant

☞ ***Fill up coolant*** *as follows:*

1 Fasten the coolant hose back onto radiator **E** below
2 Fill up coolant up to about 30 mm below filler cap **A** of the expansion tank. Check the coolant quality (antifreeze) with suitable testing equipment (antifreeze tester) – *see Coolant compound table* on page 2-7 or *Fluids and lubricants* on page 3-3
3 Close filler cap **A** fully
4 Open the heating circuit fully
5 Start and warm up the engine until the thermostat opens
6 Stop the engine
7 Check the cooling system and the heating water circuit for leaks
8 Check the coolant (**MAX** mark)
9 If necessary, fill in coolant and repeat the procedure until reaching the correct coolant level

3.16 Filling up coolant



Danger!

Never open the coolant tank and never drain coolant if the warm engine is running since the cooling system is under high pressure –

Danger of burns!

☞ *Wait at least 10 minutes after stopping the engine!*

☞ *Wear protective gloves and clothing*

☞ *Always actuate the safety valve first on the filler cap of the expansion tank. To do this:*

☞ *Open the cap to the first notch and release the pressure*

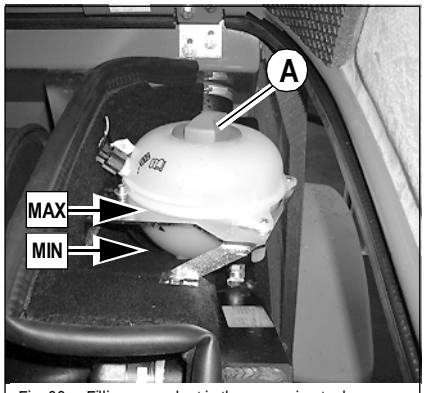


Fig. 60: Filling up coolant in the expansion tank

☞ *Fill up coolant as follows:*

1 Park the machine on level ground

2 Lower the loader unit

3 Apply the parking brake

4 Switch off ignition and remove the ignition key

5 Allow the engine/cooling system to cool down

☞ *Release the overpressure in the coolant expansion tank. To do this:*

1 Open filler cap **A** to the first notch and release the pressure

2 Open filler cap **A** fully

3 Fill up coolant to the **MAX** mark

4 Use brand-name antifreeze compounds with anticorrosion additives. Check the coolant quality (antifreeze) with suitable testing equipment (antifreeze tester) – *see Coolant compound table* on page 2-7 or *Fluids and lubricants* on page 3-3

5 Close filler cap **A**

6 Start and warm up the engine, as you do so:

7 Open the heating circuit fully

8 Stop the engine

9 Check the cooling system and the heating water circuit for leaks

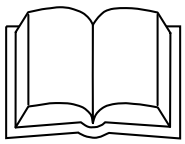
10 Check the coolant level again

11 If necessary, fill in coolant and repeat the procedure until reaching the correct coolant level

3.17 Hydraulic system

Specific safety instructions





- Release the pressure in all lines carrying hydraulic oil prior to any maintenance and repair work. To do this:
- Lower all hydraulically controlled attachments to the ground
- Move all control levers of the hydraulic control valves several times
- Apply the parking brake to prevent the machine from rolling away before you carry out service and maintenance work
- Hydraulic oil escaping under high pressure can penetrate the skin and cause serious injuries. Always consult a doctor immediately even if the wound seems insignificant – otherwise serious infections could set in!
- If the hydraulic oil in the sight glass is cloudy, this indicates that water or air has penetrated the hydraulic system. This can cause damage to the hydraulic pump!

☞ *Contact your KRAMER ALLRAD dealer immediately*



Caution!

Contaminated hydraulic oil, lack of oil or wrong hydraulic oil –

Danger of severe damage to the hydraulic system!

☞ *Take care to avoid contamination when working!*

☞ *Always fill in hydraulic oil using the filling screen!*

☞ *Only use authorised oils of the same type*
– see Fluids and lubricants on page 3-3

☞ *Always fill in hydraulic oil before the level gets too low*

☞ *If the hydraulic system is filled with biodegradable oil, then only use biodegradable oil of the same type for filling up – observe the sticker on the hydraulic oil tank!*

☞ *Contact customer service if the hydraulic system filter is contaminated with metal chippings. Otherwise, follow-on damage can result!*



Environment!

Collect drained hydraulic oil and biodegradable oil in a suitable container! Dispose of drained oil and used filters by an ecologically safe method. Always contact the relevant authorities or commercial establishments in charge of oil disposal before disposing of biodegradable oil.

3.18 Checking hydraulic pressure lines

Specific safety instructions

Danger!

Caution when checking hydraulic lines, especially when searching for leaks. Hydraulic oil escaping under high pressure can penetrate the skin and cause serious injuries.

Danger of personal injury!

☞ *Always consult a doctor immediately, even if the wound seems insignificant – otherwise serious infections could set in!*

☞ *Always observe the following instructions:*

- Retighten leaking screwed fittings and hose connections only when the system is not under pressure; i.e. release the pressure before working on pressurised lines!
- Never weld or solder damaged or leaking pressure lines and screw connections. Replace damaged parts with new ones!
- Never search for leaks with your bare hands, but wear protective gloves!
- Use paper or wood to check for minor leaks. Never use an unprotected light or naked flame!
- Have damaged flexible lines replaced by authorised workshops only!

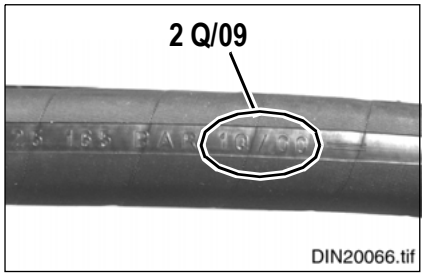
- Leaks and damaged pressure lines must be immediately repaired or replaced by an authorised workshop or after-sales staff.
  This not only increases the operating safety of your machine but also helps to protect the environment
- Replace hydraulic hoses every 6 years from the date of manufacture, even if they do not seem to be damaged

In this respect, we recommend that you observe all the relevant safety regulations for hydraulic lines, as well as the safety regulations regarding accident prevention and occupational health and safety in your country. Also observe DIN 20066, part 5.

The date of manufacture (month or quarter and year) is indicated on the flexible line.

Example:

The indication "**2 Q/09**" means manufactured in the 2nd quarter of 2009.



3.19 Monitoring the hydraulic oil reflux filter

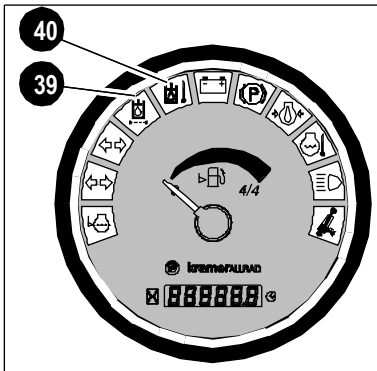


Fig. 61: Preheating start switch

On the instrument panel, the red telltale **39** monitors reflux pressure and the reflux filter, and telltale **40** monitors oil temperature.

☞ *If telltale **39** comes on*

➥ the reflux pressure in the filter is too high or

☞ *If telltale **40** comes on*

➥ the hydraulic oil temperature is too high

☞ *At the latest after 1500 service hours (once a year)*

Telltale **39** on the instrument panel can come on in cold weather immediately after starting the engine. This is caused by increased oil viscosity. In this case:

☞ *Set engine speed so that telltale **39** on the instrument panel goes out*

☞ *Bear in mind the instructions concerning warmup*

Important information for the use of biodegradable oil

- Use only the biodegradable hydraulic fluids which have been tested and approved by Kramer-Werke GmbH *Fluids and lubricants* on page 3-3. Always contact Kramer-Werke GmbH for the use of other products which have not been recommended. In addition, ask the oil supplier for a written declaration of guarantee. This guarantee is applicable to damage occurring on the hydraulic components, which can be proved to be due to the hydraulic fluid
- Use only biodegradable oil of the same type for filling up. In order to avoid misunderstandings, a label providing clear information is located on the hydraulic oil tank (next to the filler inlet) regarding the type of oil currently used! Replace missing labels! The joint use of two different biodegradable oils can affect the quality of one of the oil types. Therefore, make sure the remaining amount of initial hydraulic fluid in the hydraulic system does not exceed 8 % when changing biodegradable oil (manufacturer indications)
- Do not fill up with mineral oil – the content of mineral oil should not exceed 2 % in order to avoid foaming problems and to ensure biological degradability
- When running the machine with biodegradable oil, the same oil and filter replacement intervals are valid as for mineral oil – see maintenance plans in the appendix
- Have the condensation water in the hydraulic oil tank drained by an authorised workshop every 500 service hours, in any case before the cold season. The water content must not exceed 0.1 % by weight
- The instructions in this Operator's Manual concerning environmental protection are also valid for the use of biodegradable oil
- If additional hydraulic attachments are mounted or operated, use the same type of biodegradable oil for these attachments to avoid mixtures in the hydraulic system. **Subsequent change from mineral oil to biodegradable oil must be carried out by an authorised workshop or by your KRAMER-ALLRAD dealer**

3.20 Maintenance of the hydraulic oil reflux filter

The red telltale on the instrument panel monitors the filter. Replace the filter insert:

- If the telltale comes on when the hydraulic oil is at operating temperature
- At the latest after 1500 service hours (once a year)

In cold weather the telltale can come on immediately when the engine is started. This is caused by increased oil viscosity. In this case:

☞ *Set engine speed so that the telltale goes out*

☞ *Bear in mind the instructions concerning warmup (see Operator's Manual, chapter 3)*

Changing the filter insert

Caution!

Contamination can cause
Severe damage on the hydraulic system!

☞ *Take care to avoid contamination when working!*

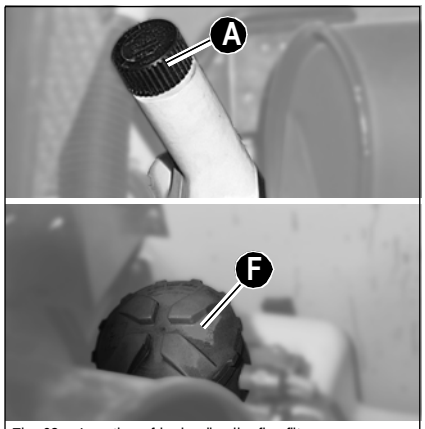


Fig. 62: Location of hydraulic oil reflux filter

☞ *Proceed as follows:*

1 Stop the engine
2 Open the engine cover
3 Open breather filter **A** of the hydraulic oil tank
4 Slacken cap **F** of the hydraulic oil filter by about 2 turns and wait for the oil level in the filter housing to drop to the oil level of the hydraulic oil tank
5 Remove cap **F** completely

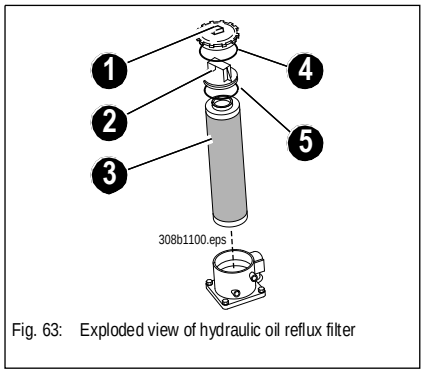


Fig. 63: Exploded view of hydraulic oil reflux filter

6 Pull out filler pipe **2** with filter insert **3**, turning them slightly
7 Remove filter insert **3** from filler pipe **2** and dispose of it
8 Check that flat gasket **4** on filter cover **1** and O-ring **5** on the filler pipe are in a perfect condition (replace if necessary).
9 Slide filler pipe **2** onto the new filter insert **3** and insert it into the filter
10 Mount cover **F** (tightening torque 20 Nm)
11 Mount breather filter 62/**A** (tighten by hand)
12 Carry out a test run of the hydraulic system
13 With the engine stopped: check filter for leaks

3.21 Checking the hydraulic oil level

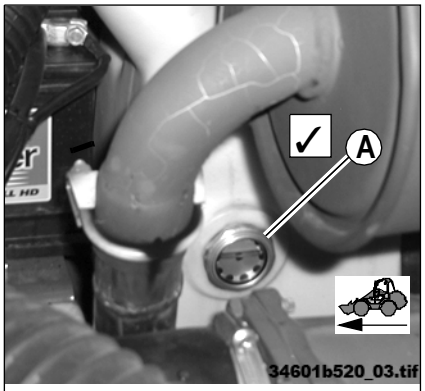


Fig. 64: Oil level sight glass on the hydraulic oil tank

☞ *Proceed as follows:*

1 Park the machine on level ground
2 Retract all hydraulic rams
3 Stop the engine
4 Apply the parking brake
5 Open the engine cover
6 Check the hydraulic oil level in sight glass **A**

If the oil level is visible in the lower half of the oil level sight glass

➥ OK

If the oil level is not visible in the oil level sight glass (not enough oil)

➥ Fill up the hydraulic oil

Caution!

Any excess quantity of hydraulic oil in the tank escapes via the breather as soon as the temperature rises!
If the oil level is no longer visible in the upper half of the oil level sight glass

☞ *Drain the hydraulic oil*

3.22 Filling up hydraulic oil

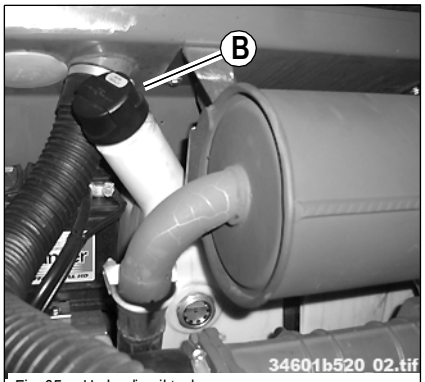


Fig. 65: Hydraulic oil tank

Do not fill up the hydraulic oil unless the engine is switched off.
Otherwise, hydraulic oil will run out of the filler opening on the hydraulic tank.

☞ *Fill up as follows:*

1 Park the machine on level ground
2 Retract all hydraulic rams
3 Stop the engine
4 Apply the parking brake
5 Open the engine cover
6 Clean the area around the filler and breather filter **B** with a cloth
7 Place a container to collect the oil as it drains
8 Open breather filter **B** by hand

With the filter insert in place

9 Fill up the hydraulic oil
10 Check the hydraulic oil level in the oil level sight glass (fig. 64/**A**)
11 Fill up if necessary and check again
12 Firmly close breather filter **B** by hand

3.23 Replacing hydraulic oil

Danger!

Caution when draining hot hydraulic oil and removing the filter element –

Danger of burns!

☞ *Wear protective gloves*

☞ *Use an oil drain coupling with a sufficiently long hose*

☞ *Proceed as follows:*

1 Park the machine on level ground

2 Lower the loader unit completely. To do this: push the lever forwards

3 Tilt in the bucket completely. To do this: push the lever to the left

4 Switch off the engine and prevent the machine from rolling away

5 Open the engine cover

6 Unscrew cap 65/**B** from the hydraulic oil tank

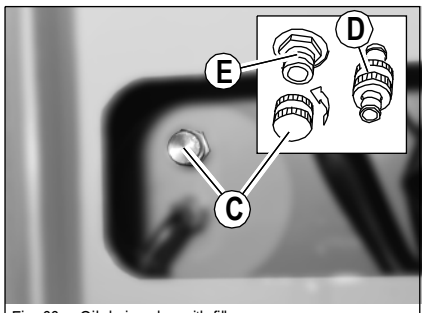


Fig. 66: Oil drain valve with filler cap

Under the rear end of the machine:

7 Place a suitable container of a minimum capacity of 55 l to collect the oil as it drains

8 Remove cap **C** of the oil drain valve

9 Screw oil drain coupling **D** onto the oil drain valve with a sufficiently long hose, making sure the end of the hose is in the oil drip tray

10 Oil drain valve **E** opens and the oil runs into the container

11 Rinse the hydraulic oil tank with a little hydraulic oil

12 Unscrew oil drain coupling **D** from oil drain valve **E**

13 Screw cap **C** of the oil drain valve back on again

14 Replace the hydraulic oil reflux filter – *see Maintenance of the hydraulic oil reflux filter* on page 3-23

15 Check whether the filling screen is installed and not damaged

Caution!

Contaminated hydraulic oil –
Danger of severe damage to the hydraulic system!

☞ *Always fill in hydraulic oil using the filling screen!*

16 Fill in fresh hydraulic oil up to the middle 64/**A** of the oil level sight glass

17 Screw cap 65/**B** back onto the hydraulic oil tank

18 Start the engine

With the engine running at low speed:

19 Fully extend the lift and tilt rams on the loader unit

20 Turn the steering wheel to the left and right several times, from lock to lock

21 Retract all the hydraulic rams again

22 Stop the engine

23 Check the hydraulic oil level again and fill up if necessary

3.24 Oil levels: rear axle transfer gearbox

Important!

Only use new sealing rings for oil filler and drain plugs. Drain oil only after running the machine for a longer period of time!

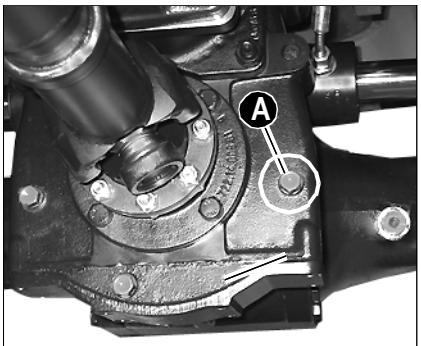


Fig. 67: Transfer gearbox oil level

Checking the oil level

☞ *Proceed as follows:*

1 Park the machine on level ground when the gearbox is at operating temperature

2 Clean and unscrew plug **A** on the transfer gearbox

If the oil level is below the opening or if the oil level cannot be seen at all:

3 Fill up the oil

If the oil level is correct:

4 Tighten plug **A** with a new sealing ring to make an oil-tight seal

Filling up oil

☞ *Proceed as follows:*

1 Park the machine on level ground when the gearbox is at operating temperature

2 Clean and unscrew plug **A** on the transfer gearbox

3 Fill in oil until it runs out of the filler opening

If the oil level in the gearbox remains constant:

4 Tighten plug **A** with a new sealing ring to make an oil-tight seal

Changing the oil

Danger!

Careful when draining hot gearbox oil –

Danger of burns!

☞ *Wear protective gloves*

☞ *Use suitable tools, e.g. for unscrewing the oil drain plug*

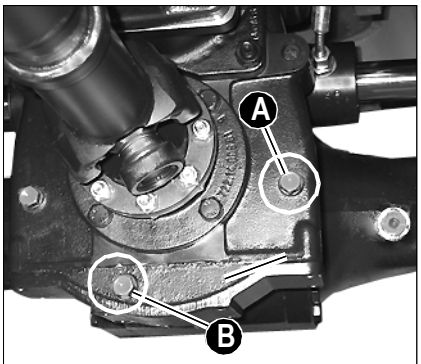


Fig. 68: Transfer gearbox oil level

☞ *Proceed as follows:*

1 Park the machine on level ground when the gearbox is at operating temperature

2 Place a sufficiently large container under the transfer gearbox to collect the oil

3 Clean and unscrew plug **A** on the transfer gearbox

4 Unscrew screw **B** on the transfer gearbox

5 Completely drain the old gearbox oil

6 Tighten plug **B** with a new sealing ring to make an oil-tight seal

7 Fill in oil until it runs out of the filler opening

If the oil level in the gearbox remains constant:

8 Tighten plug **A** with a new sealing ring to make an oil-tight seal

Run the machine warm

9 Check the oil level again after about 5 minutes, and fill up if necessary

3.25 Oil levels: front and rear axle differentials

Environment!

Use a suitable container to collect the gearbox oil as it drains and dispose of it in an environmentally friendly manner!

Important!

Only use new sealing rings for oil filler and drain plugs. Drain oil only after running the machine for a longer period of time!

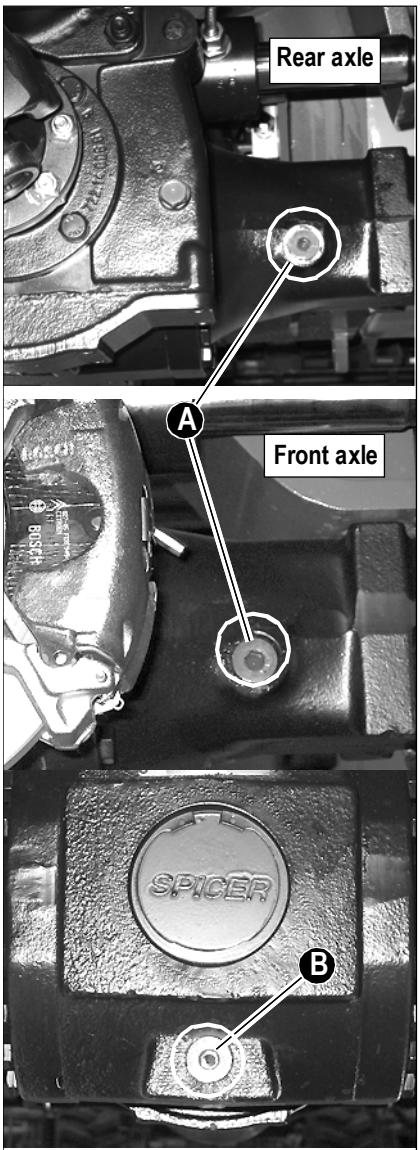


Fig. 69: Checking the oil level/draining the oil in the axle

Checking the oil level

☞ *Proceed as follows:*

1 Park the machine on level ground
2 Clean and unscrew plugs **A**
3 If the oil level is below the opening or if the oil level cannot be seen at all:
4 Fill up the oil

If the oil level is correct:

5 Tighten plugs **A** with new sealing rings to make oil-tight seals

Filling up oil

☞ *Proceed as follows:*

1 Park the machine on level ground
2 Clean and unscrew plug **A**
3 Fill in oil until it runs out of the filler opening
4 Tighten plug **A** with a new sealing ring to make an oil-tight seal

Changing the oil

☞ *Proceed as follows:*

1 Park the machine on level ground when it is at operating temperature
2 Place a container under plug **B** to collect the oil
3 Clean and unscrew plug **A** (axle tube)
4 Clean and unscrew plug **B**
5 Completely drain the old oil
6 Tighten plug **B** with a new sealing ring to make an oil-tight seal
7 Fill in fresh oil through opening **A** (axle tube) until it runs out of the filler opening
8 Tighten plug **A** (axle tube) with a new sealing ring to make an oil-tight seal

Run the machine warm

9 Check the oil level again after about 5 minutes, and fill up if necessary

3.26 Oil levels: front and rear axle planetary drives

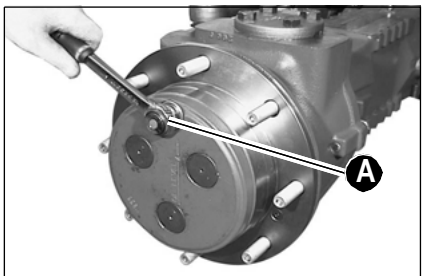


Fig. 70: Oil filler and inspection plug on planetary drive

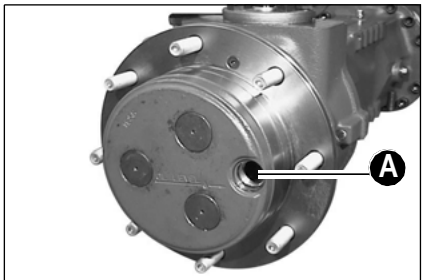


Fig. 71: Oil filler and inspection plug on planetary drive

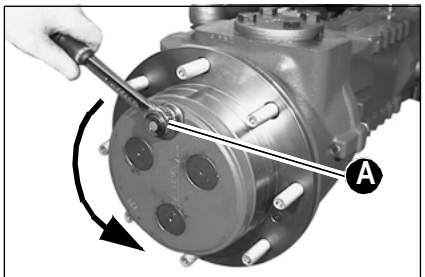


Fig. 72: Oil drain plug on planetary drive

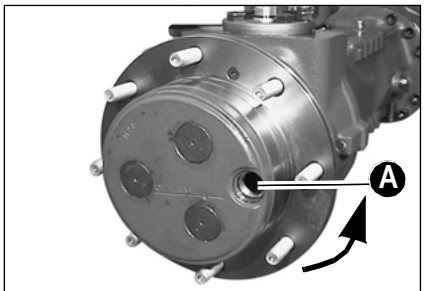


Fig. 73: Oil filler and inspection plug on planetary drive

Checking and filling up the oil level

Important!

Fit new sealing rings! Drain oil only after running the machine for a longer period of time!

☞ *Proceed as follows:*

1 Park the machine on level ground and secure it against rolling away
2 Place plug **A** in the position shown in fig. 70 (plug must be at the top)
3 Clean and unscrew plug **A** (to release possible overpressure)
4 Place plug **A** in the position shown in fig. 71 (plug must be in horizontal position)
5 Remove plug **A**

If the oil level is below the opening or if the oil level cannot be seen at all:

6 Fill in fresh oil through opening 71/**A** until it runs out of the filler opening
7 Tighten plug 71/**A** with a new sealing ring to make an oil-tight seal

Changing the oil

☞ *Proceed as follows:*

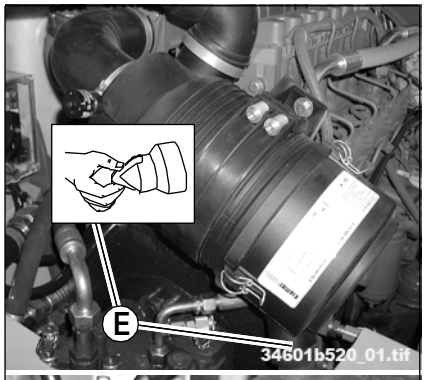
1 Park the machine at operating temperature on level ground and secure it against rolling away
2 Place a suitable container under drain plug **A**
3 Place plug **A** in the position shown in fig. 72 (plug must be at the top)
4 Clean and unscrew plug **A** (to release possible overpressure)

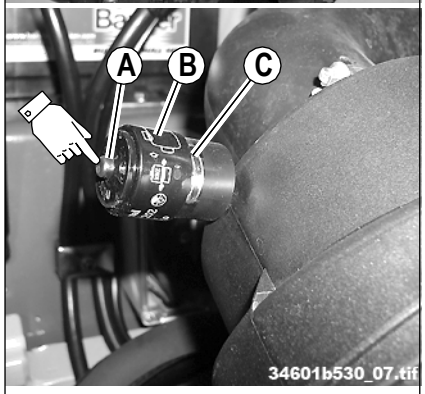
Never raise the machine on one side only for the following work!

5 Turn the planetary drive downwards (plug must be at the bottom)
6 Remove plug **A**
7 Completely drain the old oil
8 Place opening **A** in the position shown in fig. 73 (plug must be in horizontal position)
9 Fill in fresh oil through opening **A** until it runs out of the filler opening
10 Tighten plug **A** with a new sealing ring to make an oil-tight seal

3.27 Air filter maintenance

Checking the air filter for dirt





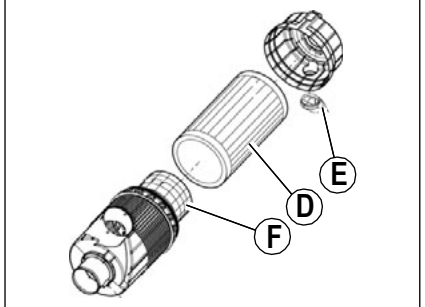


Fig. 74: Air filter with safety cartridge

Caution!

The filter cartridge will be damaged if it is washed or brushed out!
Bear in mind the following to avoid premature engine wear!

☞ *Do not wash, brush or clean the filter cartridge with compressed air*

☞ *Replace the filter cartridge when the telltale comes on*

☞ *Never reuse a damaged filter cartridge*

☞ *Ensure cleanliness when replacing the filter cartridge!*

Maintenance display **B** on the filter housing monitors the filter cartridge. The dust is removed by squeezing discharge slot **E** of the dust valve.

☞ *Checking the dust valve* **E**

1 Stop the engine
2 Remove the ignition key
3 Apply the parking brake
4 Squeeze the discharge slot of dust valve **E**
5 Remove hardened dust by compressing the upper area of the valve
6 Clean the discharge slot if necessary

☞ *Filter cartridge **D** must be replaced if:*

- If the **red** mark **C** in maintenance display **B** is visible
- At the latest after 1500 service hours (however once a year)

– see Replacing the air filter cartridge on page 3-30

Important!

For **applications in dusty environment**, the air filter is fitted with an extra safety cartridge **F** (standard). Do not clean the safety cartridge. Replace the safety cartridge every third time maintenance work is carried out!

Caution!

Filter cartridges degrade prematurely when in service in acidic air for longer periods of time. This risk is present for example in acid production facilities, steel and aluminium mills, chemical plants and other nonferrous-metal plants.

☞ *Replace filter cartridge **D** and safety cartridge **F** at the latest after 500 service hours!*

☞ *– see Replacing the air filter cartridge on page 3-30*

3.28 Replacing the air filter cartridge

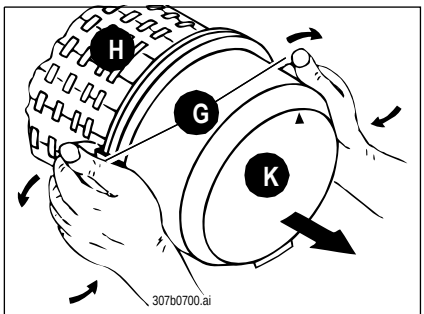


Fig. 75: Removing the lower housing section

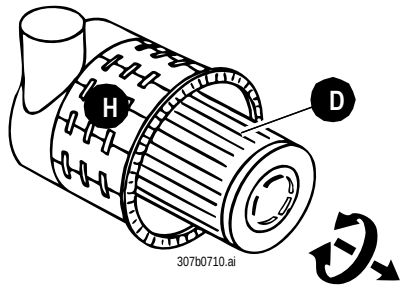


Fig. 76: Removing the filter element

☞ *Change the filter cartridge as follows:*

1 Stop the engine
2 Prevent the machine from rolling away and remove the ignition key
3 Open the engine cover
4 Fold both bow hooks **G** to the outside, off the notch of the upper housing section **H**
5 Remove the lower housing section **K**
6 Carefully remove filter cartridge **D** with slightly turning movements
7 In addition, every 3rd time the filter is replaced, carefully remove the safety cartridge fig. 74/**F** with slightly turning movements

Caution!

Bear in mind the following to avoid premature engine wear!

☞ **Make sure** *all contamination (dust) inside the upper and lower housing sections has been removed*

☞ *Carefully insert new safety cartridge 74/**F** into the upper housing section **H***

☞ *Carefully insert new filter cartridge **D** into the upper housing section **H***

☞ *Clean the dust valve fig. 74/**E***

☞ *Position lower housing section **K*** (make sure it is properly seated)

☞ *Fold and close both bow hooks **G** on the notch of the upper housing section **H***

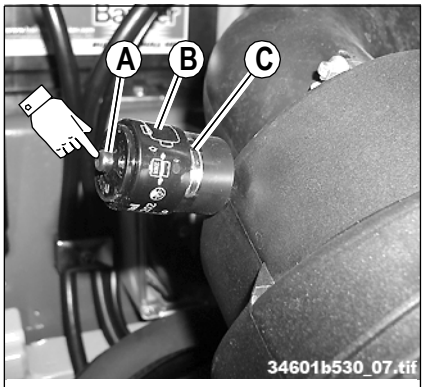


Fig. 77: Air filter with maintenance display

☞ *After replacing the filter:*

1 Reset the red mark **C** in the inspection window of indicator **B**
2 Press reset button **A**

3.29 Maintenance of the diesel engine V-belt

Danger!

Only check or retighten/replace the V-belt when the engine is switched off –

Danger of personal injury!

☞ *Switch off the engine before carrying out inspection work in the engine compartment!*

Caution!

Cracked and stretched V-belts cause engine damage

☞ *Replace the V-belt every 2 years at the latest*

☞ *Have the V-belt replaced by an authorised workshop*

Checking V-belt tension

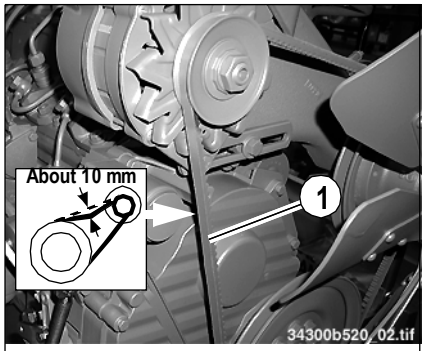


Fig. 78: Checking V-belt tension

Check the V-belt once a day or every 10 service hours, and retighten if necessary!

Retighten new V-belts after about 15 minutes of running time.

☞ *Check as follows:*

1 Stop the engine
2 Prevent the machine from rolling away and remove the ignition key
3 Carefully inspect V-belt **1** for damage
4 Press with your thumb to check whether the V-belt can be deflected between the pulleys by no more than **about 10 mm**
5 Retighten the V-belt if necessary

Retightening the V-belt

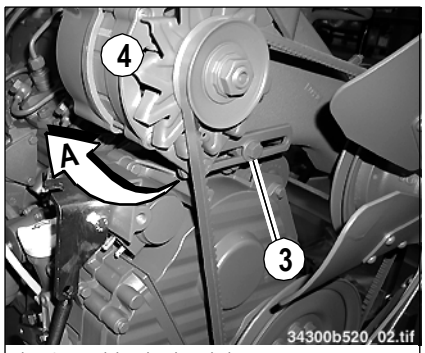


Fig. 79: Retightening the V-belt

☞ *Retighten as follows:*

1 Stop the engine
2 Prevent the machine from rolling away and remove the ignition key
3 Slacken *fastening* screws **3** of alternator **4**
4 Use a suitable tool to push the alternator in the direction of arrow **A** until the correct V-belt tension is obtained (fig. 78)
5 Keep the alternator in this position, and at the same time retighten fastening screws **3**
6 Check V-belt tension (fig. 78) again

3.30 Lubrication work

Caution!

In order to avoid damage to the lubrication points, lubricate with lithium-saponified brand-name grease

☞ – *see Fluids and lubricants on page 3-3*

Lubricating the rear axle oscillation-type bearing

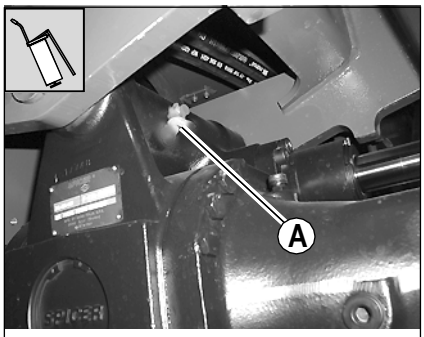


Fig. 80: Grease nipples for oscillation-type bearing

Important!

The machine has an oscillation-type rear axle. Grease the bearing at the latest after **every 50 service hours** or once a week.

☞ *Lubricate grease nipple **A** of the oscillation-type bearing*

Lubricating the front and rear axle planetary drive bearings

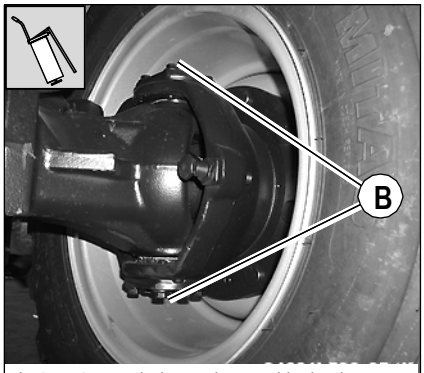


Fig. 81: Grease nipples on planetary drive bearings

☞ *Lubricate grease nipples **B** (2x) on each planetary drive bearing **every 50 service hours** or once a week*

3.31 Lubricating the loader unit

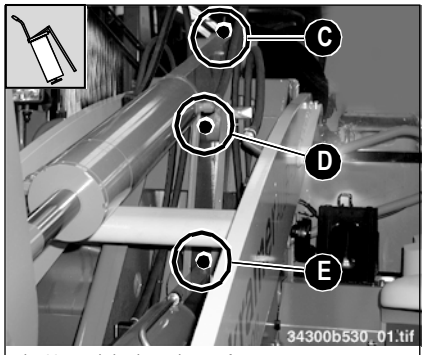


Fig. 82: Lubrication points on frame

Lubricate the following lubrication points on the loader unit of the machine:

☞ *Lubricate grease nipple **C** on the tilt ram bearing on the frame with grease **every 50 service hours** (or once a week). Lubricate more frequently when in heavy-duty operation (once a day)*

☞ *Lubricate grease nipple **D** on the loader unit bearing **every 50 service hours** (or once a week). Lubricate more frequently when in heavy-duty operation (once a day)*

☞ *Lubricate grease nipple **E** on the lift ram bearing on the frame **every 50 service hours** (or once a week). Lubricate more frequently when in heavy-duty operation (once a day)*

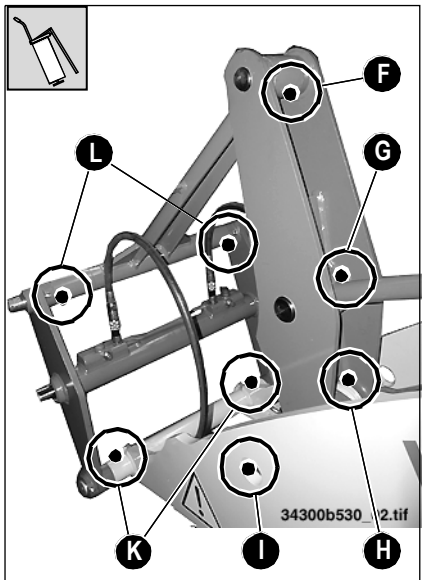


Fig. 83: Lubrication points for lift and tilt ram bearings

☞ *Lubricate grease nipple **F** on the tilt rod bearing **every 10 service hours** (or once a week). Lubricate more frequently when in heavy-duty operation (once a day)*

☞ *Lubricate grease nipple **G** on the tilt ram bearing **every 50 service hours** (or once a week). Lubricate more frequently when in heavy-duty operation (once a day)*

☞ *Lubricate grease nipple **H** on the lift ram bearing **every 50 service hours** (or once a week). Lubricate more frequently when in heavy-duty operation (once a day)*

☞ *Lubricate grease nipple **I** on the tilt lever bearing **every 10 service hours** (or once a week). Lubricate more frequently when in heavy-duty operation (once a day)*

☞ *Lubricate grease nipples **K** on the quickhitch bearing **every 10 service hours** (or once a week). Lubricate more frequently when in heavy-duty operation (once a day)*

☞ *Lubricate grease nipples **L** on the tilt lever bearing **every 10 service hours** (or once a week). Lubricate more frequently when in heavy-duty operation (once a day)*

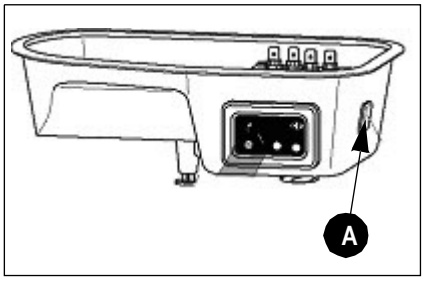
3.32 Maintenance of attachments

Important!

Correct maintenance and service is absolutely necessary for smooth and continuous operation, and for an increased service life of the attachments. Please observe the lubrication and maintenance instructions in the Operator's Manuals of the attachments!

3.33 Lubricating with the central lubrication system (option)

General functional description of the central lubrication system



The central lubrication system allows you to lubricate all lubrication points of the wheel loader in one single step.

- The yellow LED comes on for 1.5 seconds upon switching on ignition to indicate functional readiness of the controls (switch-on check). It stays lit during the entire lubrication procedure.
- The integrated electronic control unit has a data memory for saving the times that have been set or that have elapsed.
- The time is taken and saved if ignition is switched off during lubrication or during a break.
- The remaining lubrication time or break time is read from the memory upon switching ignition on again, and lubrication is resumed.
- Push button **A** for starting intermediate lubrication

Time control

Break and lubrication times can be set with the time-dependent control of the central lubrication system. Break times are the periods between two lubrication times – *see Setting the lubrication and break times* on page 3-35.

Control specifications:

- Supply voltage: 10 – 60 V DC
- Max. power load: I = 6.0 A
- Fuse (not included in device):
- F 6.3 A (5 x 20) medium time-lag
- Output for signal lamp: I = 0.4 A
- Temperature range: -35 °C to +75 °C
- Protective system: IP 65

Setting the lubrication and break times

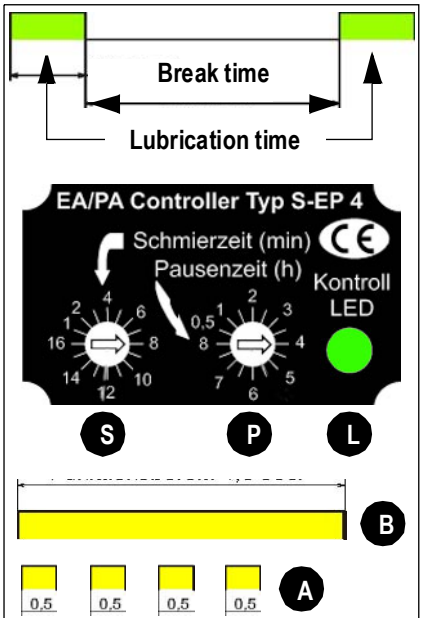


Fig. 84: Setting the lubrication times

Break times and lubrication times are set with the notched switches **S and P** in the window of the controls.

☞ *Remove the red frame on the protective motor housing of the pump with a flat screwdriver to set the time*

☞ *Slacken the four cross-slotted screws and remove the transparent cover*

☞ *Set the break time **P** and the lubrication time **S** with a flat screwdriver*

Lubrication times (S)

➥ 1 to 16 minutes (16 notches, 1 minute each)

➥ 2 to 32 minutes (16 notches, 2 minutes each)

Break time (P):

➥ 0.5 to 8 h (16 notches, 0.5 h each)

Yellow LED (L)

➥ **(B)** lubrication system in operation

➥ **(A)** lubrication under progress: 0.5 seconds LED ON/0.5 seconds LED OFF

☞ *Install the transparent cover (window) once the settings are carried out*

Caution!

Water can penetrate into the controls and damage them if the cover is not fitted and closed correctly!

Filling the central lubrication system

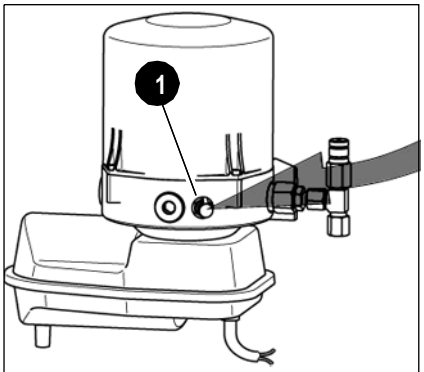


Fig. 85: Filling the central lubrication system

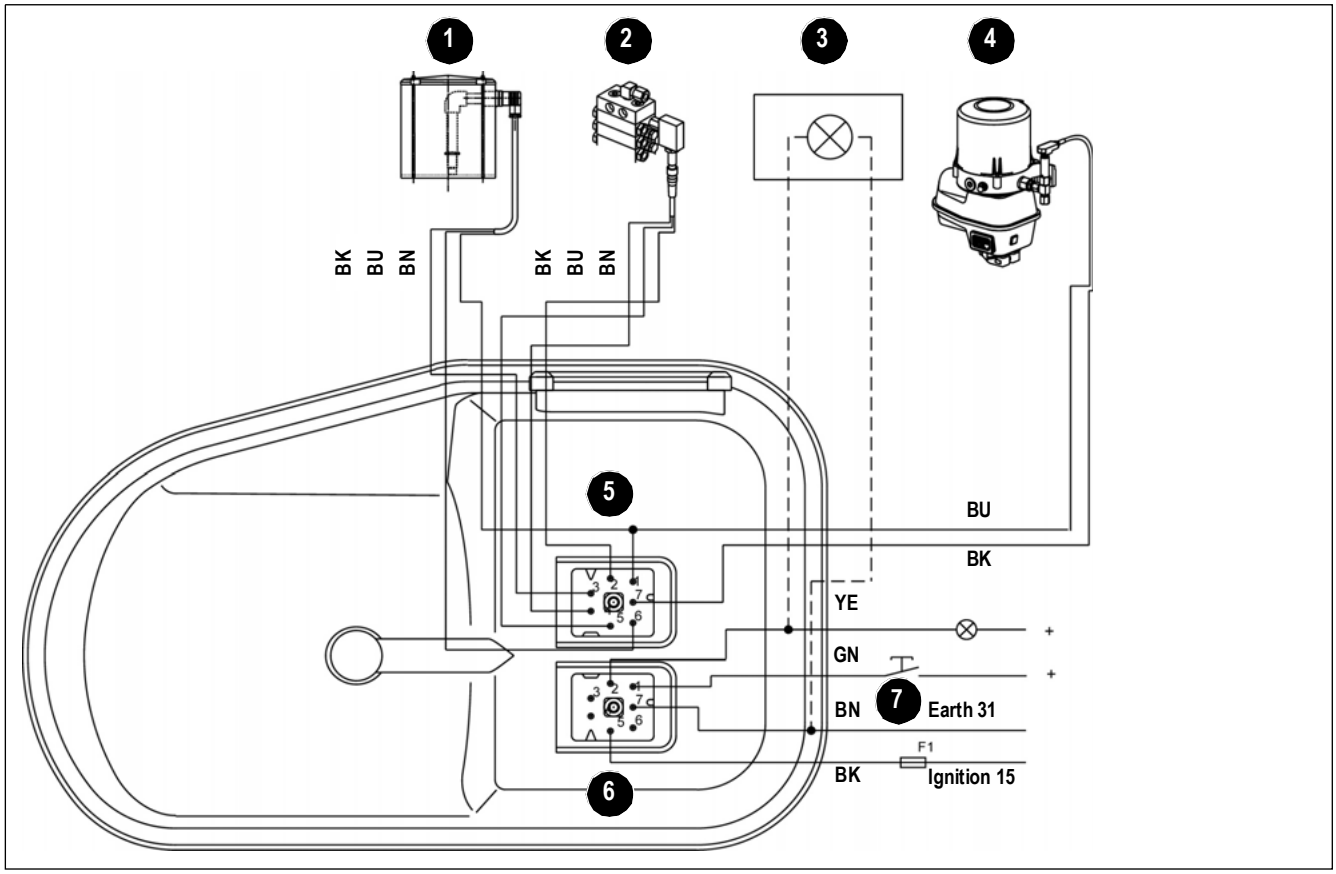
The lubrication system is filled via conical grease nipple **1** or a fill coupling with a manual or pneumatic grease gun.

Caution!

Use only commercially available greases up to NLGI-Kl. 2 to avoid damage to the lubrication system and the lubrication points!

☞ *– see Fluids and lubricants on page 3-3*

Central lubrication system diagram



Pos.	Description
1	Grease level check switch
2	Cycle control switch
3	Error message telltale (+)
4	Microswitch for pressure relief valve check
5	Plug socket for switch (cycle control), of microswitch, of grease level check
6	Plug socket (pump)
7	Push button – intermediate lubrication

Mounting the high-pressure hoses

A connection piece and a threaded sleeve at either end of the hose is required for connecting the high-pressure hose to the distributors.

Mounting the threaded sleeve

☞ *Hold the hose with vise-grip wrenches*

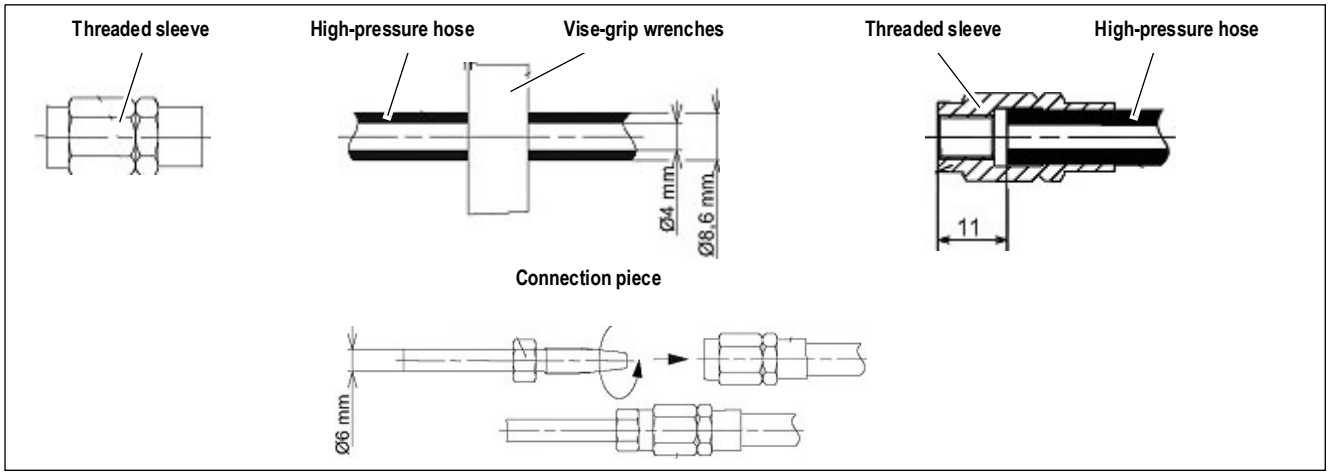
➥ Lubricate the end of the hose liberally with grease or oil

☞ *Mount the threaded sleeve (counterclockwise) on the hose (size 11 mm, see drawing)*

Mounting the connection piece

☞ *Apply oil liberally to the thread and the conical base of the connection piece.*

☞ *Screw the connection piece into the mounted threaded sleeve as far as it will go*



Important!

For reasons of production tolerances, the hose diameters can differ a little. If the diameter is smaller, the threaded sleeve can be fitted onto the hose without applying any force or without turning it.

Remedy: On the side on which the hose is connected, press the threaded sleeve about 1 to 2 mm to create an oval shape, so that the hose is not pressed out as the connection piece is screwed in.

Instructions for troubleshooting in case of central lubrication system blocking

Reasons for blocking:

- Squeezed or blocked lubrication line
- Bearing blocked or overfilled with lubricant
- Lubricant not suitable for central lubrication systems
- Blocked distributor output
- Blocked distributor

Blocking indication:

An overpressure rising beyond the operating pressure is a sign of blocking and is displayed as follows:

- Grease comes out at pressure relief valve
- Overpressure indication or pressure relief valve upon actuation of microswitch on pump (option)

How to detect the blocking:

Proceed as follows:

☞ *Unscrew the main line from the main distributor and actuate the pump. Check whether the lubricant is pumped correctly*

☞ *Screw the main line onto the main distributor*

☞ *Unscrew the male fitting screws of the distributor one after another, and actuate the pump every time*

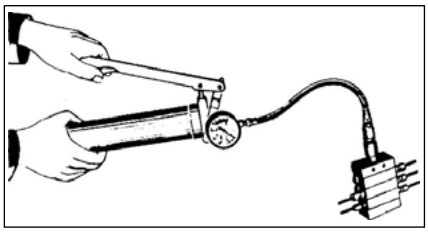
Important!

Blocked lubrication points are those where the pressure drops in the related line, or where the manual pump can be actuated!

After checking the main distributor and finding the blocking, the corresponding auxiliary distributor has to be checked up to the lubrication point in the same way.

In the case of large systems, we recommend screwing in a grease nipple at the distributors and then checking the function of the distributor with a manual pump.

☞ *See figure.*



Repairing a blocked distributor

☞ *Remove the distributor from the system*

➥ Make a note of the order of the distributor discs

☞ *Unscrew the screw plugs of the piston bores and move the pistons to and fro (do not push out)*

☞ *Screw the screw plugs back in again*

☞ *Check the next distributor disc until the blocked piston is found*

☞ *Push out the piston of the blocked distributor disc and check the bore of the distributor disc and the surface of the piston for scratches and damage*

☞ *Replace the distributor disc in case of heavy damage*

Caution!

The pistons cannot be exchanged among themselves!

☞ *If the piston and the bores of the distributor disc have deposits of hardened grease, remove them by washing or blowing them out*

☞ *There must be no traces of grease in the bores of the distributor disc.*

- *Check with a thin wire*

After checking all distributor discs:

☞ *Mount the distributor checks in the correct order*

☞ *Tighten the connecting rods to 12 Nm as you mount them to avoid jamming the pistons*

☞ *Check the distributor for correct function using oil or grease*

☞ *Mount the distributor in the system*

☞ *Run the system and check the operating pressure*

Caution!

Important! All repair work must be performed ensuring the greatest possible cleanliness!

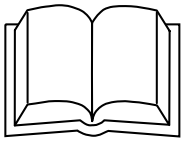
Troubleshooting table (overview)

Malfunction	Cause	Remedy
Pump does not work	• Defective integrated electronic controls • Electric line interrupted • Defective pump	• Replace lower part of protective engine housing • Replace the electric line • Replace pump
Pump works, but does not pump	• Air in piston • Below minimum level • Defective pump element	• Bleed the pump • Fill up the receptacle • Replace a pump element
No grease at any lubrication point	• Pump does not work • Break time too high or lubrication time too short • Blocked system	• Reduce break time or increase lubrication time
No grease at several lubrication points	• Burst or leaking feed line to auxiliary distributor • Screw connections leak	• Replace the line • Retighten or replace the screw connections
No grease at any lubrication point	• Burst or leaking feed line	• Replace the line • Retighten or replace screw connections
Reduced pump speed	• High system pressure	• Check system bearings • No damage (perform 1 or 2 intermediate lubrications if necessary)
Grease comes out at pressure relief valve	• System pressure too high • Blocked progressive distributor • Blocked system • Defective valve spring	• Check the system • Replace the distributor • Repair blocked/jammed bearing points • Replace pressure relief valve

3.34 Brake system maintenance

Specific safety instructions





Brakes are crucial to safety. Incorrect work can cause brake failure. Therefore all maintenance and repair work on the brakes must be carried out by trained staff. An exception to this is the following work which must be carried out by the driver of the machine:

☞ *Daily check of the level in the brake fluid tank!*



Danger!

Damaged brake lines or hoses –

Danger of accidents!

☞ *Replace damaged brake lines or hoses immediately*

Checking/filling up the brake fluid level

The brake fluid tank is located at the front left in the cab (next to the brake/inching pedal)

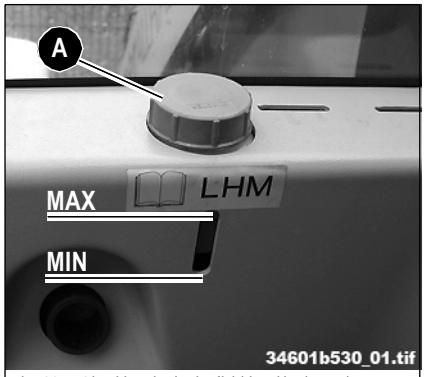


Fig. 86: Checking the brake fluid level in the tank



Danger!

An incorrect brake fluid grade or an insufficient brake fluid level can impair the safety of the brake system –

Danger of accidents!

☞ *Check the brake fluid in the tank at regular intervals*

☞ *Fill up brake fluid up to the upper edge of the sight glass*

☞ *The brake fluid **must** comply with the **LHM** SAE specification*
– see Fluids and lubricants on page 3-3

☞ *The brake fluid **must** be replaced every 2 years by an authorised workshop*

☞ *If the brake system loses too much brake fluid, have the brake system checked and repaired by an authorised workshop*

If the level is below the upper edge of the sight glass:

☞ *Clean the area around the opening with a clean cloth*

☞ *Open tank cover* **A**

☞ *Fill up brake fluid up to the upper edge of the sight glass* ***MAX***

☞ *Close tank cover* **A**

Repair work on the brake system

– see chapter 7 "Brakes" on page 7-1

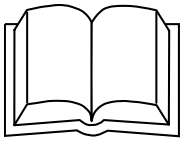
3.35 Tyre maintenance

Danger!

Improper tyre repairs –

Danger of accidents!

☞ *All repair work on tyres and rims may only be carried out by authorised workshops*

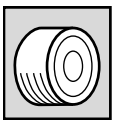


Important!

Regular inspections of the tyres

- Improve operating safety
- Increase the service life of the tyres
- Reduce machine downtimes
- Refer to the table in chapter “Specifications” on page *2-8* for the authorised tyre types and the correct tyre pressures. A tyre table sticker is also affixed on the front window of the machine.

Daily tyre checks



☞ *Carry out the following maintenance work once a day:*

- Check tyre pressure – see chapter “Specifications” on page *2-8*
- Check tyres and rims for damage (cracks, ageing etc.) – also on the inside
- Remove foreign bodies from the tyre tread
- Remove traces of oil and grease from the tyres

3.36 Changing wheels

Danger!

Use of wrong tyres or wheels –

Danger of accidents!

☞ *Use only wheels and tyres authorised for your machine*

- – see chapter “Specifications” on page 2-8

☞ *Check the wheel nuts for tightness after every wheel or tyre change*

- *– see chapter 2 “Specific tightening torques”* on page 2-10

Caution!

The wheels are heavy and can damage the threads on the wheel studs if they are handled incorrectly!

☞ *Use suitable assembly tools, such as covering sleeves for the studs, a jack etc.*

Removing the wheels

☞ *Proceed as follows:*

1 Park the machine on level and firm ground and prevent it from rolling away
2 Loosen the wheel nuts a little of the wheel you want to remove
3 Place a jack under the axle beam, making sure it is standing firmly
4 Raise the side of the axle from which you want to remove the wheel
5 Check the machine is standing firmly
6 Completely remove the wheel nuts
7 Remove the wheel

Fitting the wheels

☞ *Proceed as follows:*

1 Place the wheel onto the wheel studs
2 Tighten all wheel nuts part-way
3 Lower the raised axle
4 Tighten the wheel nuts to the prescribed tightening torque
– see chapter 2 “Specific tightening torques” on page 2-10

3.37 Maintenance of cab heating and fresh air filter

The heating system of the machine is equipped with a fine-dust filter (EU4, option) which must be cleaned at regular intervals and replaced once a year, as appropriate.

➥ – *see Maintenance plan* on page 3-4

The fine-dust filter is located behind the maintenance flap on the right on the outside of the cab.

Cleaning the dust filter of the heating system

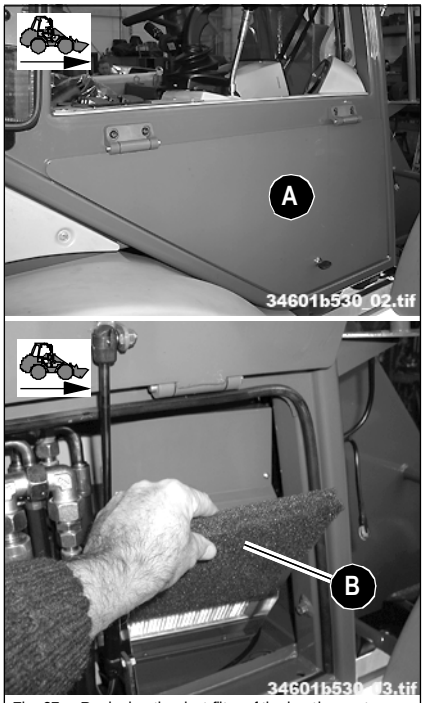


Fig. 87: Replacing the dust filter of the heating system

A fine-dust filter cleans the air taken in by the heater. The volume of warm air flowing out of the air vents decreases as filter contamination increases.

☞ *Clean the filter as follows:*

1 Open maintenance flap **A**

2 Remove dust filter **B**

3 Clean dust filter **B** with compressed air, replace if necessary

4 Close maintenance flap **A**

3.38 Air conditioning (option): maintenance

General instructions regarding the air conditioning system

For your own safety, please bear the following instructions in mind:

- Maintenance and repair work may only be carried out by trained staff or by an authorised workshop.
- Careful when carrying out maintenance and repair work – sharp-edged fins on the condensor and the heat exchanger.
- Wear protective equipment (protective gloves and goggles) during maintenance and repair work.
- Do not carry out maintenance work unless the heating and air conditioning systems are switched off.
- Bear in mind the pertinent regulations relevant to accident prevention, other generally acknowledged regulations regarding safety and occupational medicine.



Danger!

Lines and hoses containing refrigerants and cooling fluids are under pressure and can be hot!

Danger of burns!

☞ *Avoid touching parts containing refrigerants.*

☞ *Switch off the air conditioning during checks and when carrying out maintenance work.*

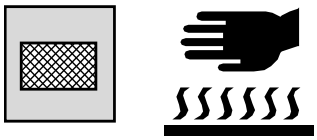
Soldering and welding work on the closed system –

Danger of explosion!

☞ *Have repair work carried out by an authorised workshop with trained staff only*

Daily functional and visual checks of the air conditioning

The driver must carry out visual checks once a day



Danger!

Careful when carrying out maintenance work on a hot engine and radiator –

Danger of burns!

☞ *Wait at least 10 minutes after switching off the engine*

☞ *Wear protective gloves and clothing during maintenance work*

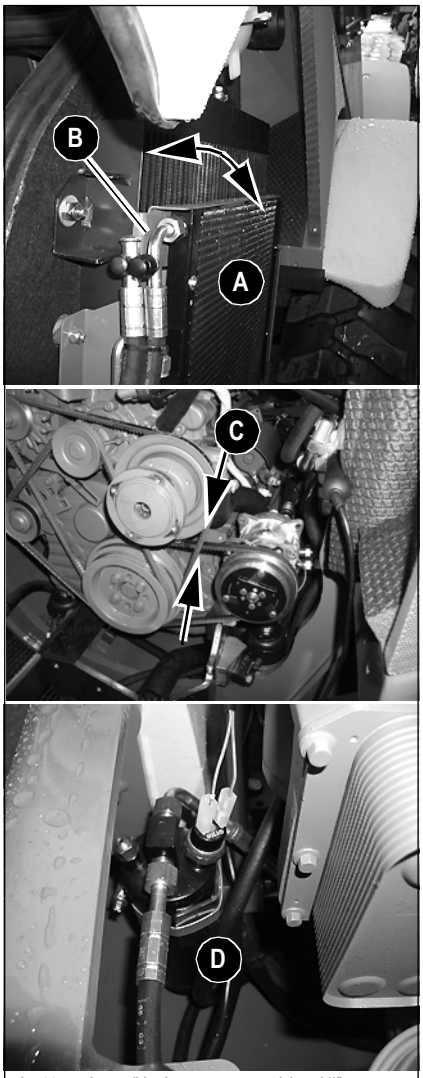


Fig. 88: Air conditioning: evaporator, dehumidifier

1 Stop the engine
2 Apply the parking brake
3 Switch off ignition and remove the ignition key
4 Check for damage of the refrigerating and heating lines
5 Check the hoses for tightness, leaks and chafing
6 Check the electric connections for correct condition and tightness

☞ *Clean the dirty condenser **A***

7 Remove fastening screws **B**
8 Fold away condenser **A**
9 Clean the condenser with compressed air or with a water jet (do not use high-pressure cleaners)

Caution!

Do not damage the fins as you clean the condenser!

10 Mount condenser **A** once cleaning is over
11 Press with your thumb to check whether the V-belt can be deflected between the pulleys by no more than **about 10 mm** (arrow)
12 Replace a damaged V-belt

Caution!

The air conditioning system **must** be checked and serviced **twice a year** by trained staff in an authorised workshop! Replace dehumidifier **D** every 2 years!

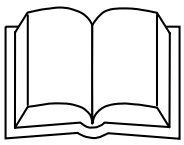
3.39 Maintenance of the electrical system

General instructions

Maintenance and repair work on the electrical system (including the battery) may be performed only by trained staff and/or authorised workshops!

Safety instructions regarding the electrical system and the battery





The battery contains sulphuric acid! This acid must not be allowed to come into contact with the skin, the eyes, clothing or the machine. Therefore when recharging or working near the battery, always wear goggles and protective clothing with long sleeves

If acid is spilt:

- Thoroughly wash any part of the body touched by the acid immediately with plenty of water and seek medical attention at once
- Immediately rinse acid splashes in the eyes with clear water for several minutes! Then seek medical attention at once
- Immediately neutralise acid splashes on skin or clothing with an acid neutraliser or soap, and rinse with plenty of water
- Immediately seek medical attention if acid has been swallowed
- Thoroughly rinse all affected surfaces immediately with plenty of water

Battery maintenance – danger of explosion!

- Avoid naked flames and sparks and do not smoke in the vicinity of open battery cells, otherwise gas can ignite
- When charging batteries, as well as during normal operation of batteries, an oxyhydrogen mixture is formed in the battery cells
- Do not attempt to jump-start the machine if the battery is frozen or if the acid level is low. The battery can rupture or explode
- Disconnect the negative (**-**) battery terminal from the battery before starting repair work on the electrical system

Jump-starting

- Use only 12 V power sources. Higher voltages will damage the electric components
- When connecting the battery leads, make sure the poles +/- are not inverted, otherwise sensitive electric components will be damaged
- Danger of sparking! Do not interrupt voltage-carrying circuits at the battery terminals
- Never place tools or other conductive articles on the battery – danger of short circuit!

Taking the machine out of service

- Remove the battery, store it in a dry and frost-free place
- If the machine is taken out of service for extended periods, charge the battery every 2 months or use a battery charge maintainer
- Always charge the battery when storing it. The sulphation of the electrodes causes lasting damage! A flat battery must be recharged as soon as possible

Before putting the machine into operation

- Charge the battery and clean the terminals before installing it

Disposal of old battery

- For safe transport to a recycling point, place the protective cap on the positive terminal of the old battery and dispose of if properly

3.40 Battery maintenance

Danger!

Battery acid is highly caustic!
Especially when charging batteries, as well as during normal operation of batteries, an oxyhydrogen mixture is formed in the battery cells!

Danger of explosions and caustic burns!

Therefore when recharging and/or working near the battery:

☞ *Always wear goggles and protective clothing with long sleeves*

If battery acid is spilt:

☞ *Thoroughly rinse all affected surfaces immediately with plenty of water*

☞ *Thoroughly wash any part of the body touched by the battery acid immediately with plenty of water and seek medical attention at once!*

☞ *Avoid naked lights and sparks in the vicinity of the battery and do not smoke!*

☞ *Do not attempt to jump-start the machine if the battery is frozen or if the acid level is low. The battery can rupture or explode!*

☞ *Always disconnect the negative terminal (-) from the battery before starting repair work on the electrical system!*

☞ *See page 3-47 for further information*

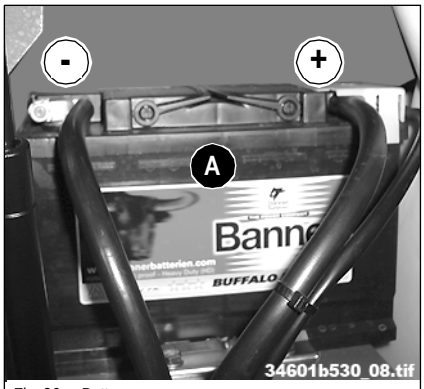


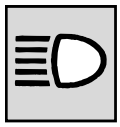
Fig. 89: Battery

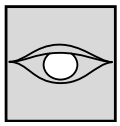
Battery **A** is located in the engine compartment, on the left next to the hydraulic oil tank. The battery is low in maintenance and no fluid needs to be refilled under normal operating conditions. However have the battery checked at regular intervals.
Always follow the specific battery safety instructions!

Important!

As an option, the machine can be fitted with a battery master switch.

Service and maintenance work at regular intervals





Before driving the machine

☞ *Check every time before driving the machine:*

- Is the light system OK?
- Is the signalling and warning system OK?

Every week

☞ *Check once a week:*

- Electric fuses – *see chapter 2 "Fuse box"* on page 2-5 and
– *see Main fuse box with relays* on page 2-6
- Cable and earth connections
- Charge condition of battery
- Condition of battery terminals

Electric lines, bulbs, ignition lock, relays and fuses

Always observe the following instructions:

- Defective components of the electrical system must always be replaced by an authorised expert. Bulbs and fuses may be changed by unqualified persons
- When carrying out maintenance work on the electrical system, pay particular attention to ensuring good contact in leads and fuses
- Blown fuses indicate overloading or short circuits. The electrical system must therefore be checked before installing the new fuse
- Only use fuses with the specified load capacity (amperage)

  ➥– *see chapter 2 "Fuse box"* on page 2-5

  ➥– *see Main fuse box with relays* on page 2-6

Alternator

Always observe the following instructions:

- Only test run the engine with the battery connected
- When connecting the battery, make sure the poles (+/-) are not inverted
- Always disconnect the battery before carrying out welding work or connecting a quick battery charger
- Replace defective charge telltales immediately

3.41 General maintenance work

Specific safety instructions

Cleaning the machine is divided into 3 separate areas:

- Inside the cab
- Exterior of the machine
- Engine compartment

The wrong choice of cleaning equipment and agents can impair the operating safety of the machine on the one hand, and on the other undermine the health of the persons in charge of cleaning the machine. Therefore always observe the following instructions.

Cleaning with washing solvents

- Ensure adequate room ventilation
- Wear suitable protective clothing
- Do not use flammable liquids, such as petrol or diesel

Cleaning with compressed air

- Work carefully
- Wear goggles and protective clothing
- Do not aim the compressed air at the skin or at other people
- Do not use compressed air for cleaning your clothing

Cleaning with a high-pressure cleaner or steam jet

- Electric components and damping material must be covered and not directly exposed to the jet
- Cover the vent filter on the hydraulic oil tank and the filler caps for fuel, hydraulic oil etc.
- Protect the following components from moisture:
  - Engine
  - Electric components such as the alternator etc.
  - Control devices and seals
  - Air intake filters etc.
  - Door and engine cover locks

Cleaning with volatile and flammable anticorrosion agents and sprays

- Ensure adequate room ventilation
- Do not use unprotected lights or naked flames
- Do not smoke!

3.42 Cleaning inside the cab

Caution!

Never use high-pressure cleaners, steam jets or high-pressure water to clean inside the cab. Water under high pressure can
• penetrate into the electrical system and cause short circuits and
• damage seals and disable the controls!

We recommend using the following aids to clean the cab:

- Broom
- Vacuum cleaner
- Damp cloth
- Bristle brush
- Water with mild soap solution

3.43 Cleaning the seat belt

Clean the seat belt (which remains fitted in the machine) only with a mild soap solution; do not use chemical agents as they can destroy the fabric!

Danger!

Soiled automatic seat belts can affect and impair winding –

Danger of personal injury!

☞ *Only wind the seat belt when it is dry!*

3.44 Cleaning the exterior of the machine

The following articles are generally suitable:

- High-pressure cleaner
- Steam jet

3.45 Cleaning the engine compartment

Danger!

Clean the engine at engine standstill only –

Danger of personal injury!

☞ *Stop the engine before cleaning*

☞ *Remove the ignition key*

☞ *Apply the parking brake*

☞ *Switch off ignition and remove the ignition key*

Caution!

The humidity penetrating the electronics causes it to fail and leads to engine damage!
When cleaning the engine with a water or steam jet

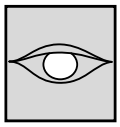
☞ *The engine must be cold*

☞ *Do not point the jet directly at any of the electric sensors such as temperature and oil pressure switches or control valves.*

☞ *Protect all electric parts, such as the alternator, connectors etc. from humidity*

☞ *If the water jet is unintentionally pointed at electric components, dry them with compressed air and apply contact spray to them.*

3.46 Screw connections, hinges



All screw connections must be checked regularly, even if they are not listed in the maintenance plans.
Tighten loose connections immediately. Refer to chapter “Specifications” for the tightening torques.



All mechanical pivot points on the machine (e.g. door hinges, joints) and fittings (e.g. door arresters) must be lubricated regularly, even if they are not listed in the lubrication plan.

3.47 Maintenance work “Aggressive Media” (option)

Your machine is specially protected against corrosion for work in aggressive media (e.g. a saline environment).

However, this anticorrosion protection is affected by external factors e.g. dirt, cleaning etc. This is why it only has ongoing effect if checked at regular intervals and renewed or reapplied as required.

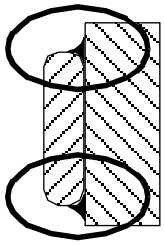
If no anticorrosion protection is applied to your machine, for instance for work in a saline environment, we recommend retrofitting your machine with the “Aggressive Media” option by your sales partner.

Anticorrosion protection applied in the factory

The following anticorrosive wax has been used in the factory:

Designation:	ANTICORIT BW 366
Manufacturer:	FUCHS MINERALOELWERKE GmbH/Mannheim (Germany)
Complies with specification:	TI 8030-015/K 19
	MIL-C-16 173 C – grade 4

Components coated with anticorrosive wax

Component	Remarks
All electric plug-and-socket, earthing and crimp connections	**Before applying the wax:** • Apply contact spray to contact surfaces and connect the plug and socket connections again • Apply a particularly thick anticorrosion layer to the connecting parts of the fuel level transmitter
All parts of the machine, e.g. Axles, gearbox, trim panels, servicing lids, loader unit, quickhitch	**Except:** • Piston rods (chromium layer) • Cab, cab bearings • Engine cover, engine mounting • Air filter • Counterweight • Fastening surfaces for mounting parts on frame • Radiator and insulating mats • Mudguards, rubber and plastic parts • Light elements
Flange surfaces 	**E.g. axles, engine and cab bearing:** • Seal gaps with anticorrosion wax after assembly

Measures for maintaining anticorrosive protection

Safety instructions

- When handling chemical substances of any kind, such as solvents, wax etc., observe the specific product-related safety regulations (safety data sheet)!
- When using volatile and easily flammable anticorrosive agents and solvents:
- Ensure adequate room ventilation!
- Do not use unprotected lights or naked flames!
- Do not smoke!
- Corrosion on electric connections or components can lead to dangerous operating malfunctions. Therefore check the electric functions of the machine with special care. Immediately take the machine out of service if you detect any defects and have defects rectified immediately.
- Carry out work on the electrical system only with the battery disconnected and the engine stopped!

Cleaning

- If the machine is used in corrosive environment over a longer period of time, we recommend removing the floor mat in the cab to avoid collecting corrosive humidity.
- Thoroughly clean machines that are taken out of service over a longer period of time.
- Clean the machine at least once a week. In particular, remove corrosive deposits (such as salt crusts) as fast as possible.
- Clean the machine with cold running water preferably.



Caution!

Contrary to the instructions given in Chapter "General maintenance work" in the Operator's Manual of the machine, neither clean the machine with a bristle brush nor with a steam jet or a high-pressure cleaner. Otherwise the anticorrosive protection will be heavily affected.

☞ *If cleaning the machine with these means cannot be avoided, check the wax coating very carefully and have it renewed or reapplied as required.*

If you replace components, check whether they are classified as in *Components coated with anticorrosive wax* on page 3-53 and whether they are subject to special treatment before assembly.

Applying the protective anticorrosion coating

Bear in mind the following instructions as you apply the anticorrosive wax:



Caution!

Carefully cover all fastening surfaces and **elements to which the anticorrosive protection may not be applied**
– *see Components coated with anticorrosive wax* on page 3-53

- ANTICORIT BW 366 can be applied with a brush, by means of immersion or with all commercially available spray guns.
- ANTICORIT BW 366 protective coating can be removed with petrol, RENOCLEAN E/K or FUCHS MULTICLEAN as required.
- ANTICORIT BW 366 spots are difficult to remove on clothing.
- Affix a “Wet paint!” or a similar sign to newly coated machines.

Treatment of oxidised surfaces

If in spite of all precautionary measures some components should be affected by corrosion (oxidised), proceed as follows depending on the affected component:

Electric connections

☞ *Remove the remaining protective wax in the oxidised area with petrol, RENOCLEAN E/K or FUCHS MULTICLEAN*

☞ *Treat all affected parts with an oxide solvent, such as KONTAKT 60*

☞ *Rinse the area with e.g. KONTAKT WL*

☞ *Treat the contact surfaces of the connection with e.g. KONTAKTSPRAY WD 40*

☞ *Establish the connection*

☞ *Apply/spray anticorrosion wax onto the electric connection from all sides*

Sheet-metal parts

☞ *Remove the remaining protective wax in the oxidised area with petrol, RENOCLEAN E/K or FUCHS MULTICLEAN*

☞ *Remove all remaining corrosion and paint coating from the affected area down to the bare material, otherwise the paint coating will not adhere properly!*

☞ *Clean the affected part with a cleaning solvent*

☞ *Apply a 2-component prime coating to the affected area and then a 2-component paint coating*

☞ *Preserve the area with anticorrosion wax*

Engine

4 Engine

4.1 Engine designation

Engine designation	Type
TD 2011 L04 W (58 kW)	347-03 (950), 347-04 (1150)

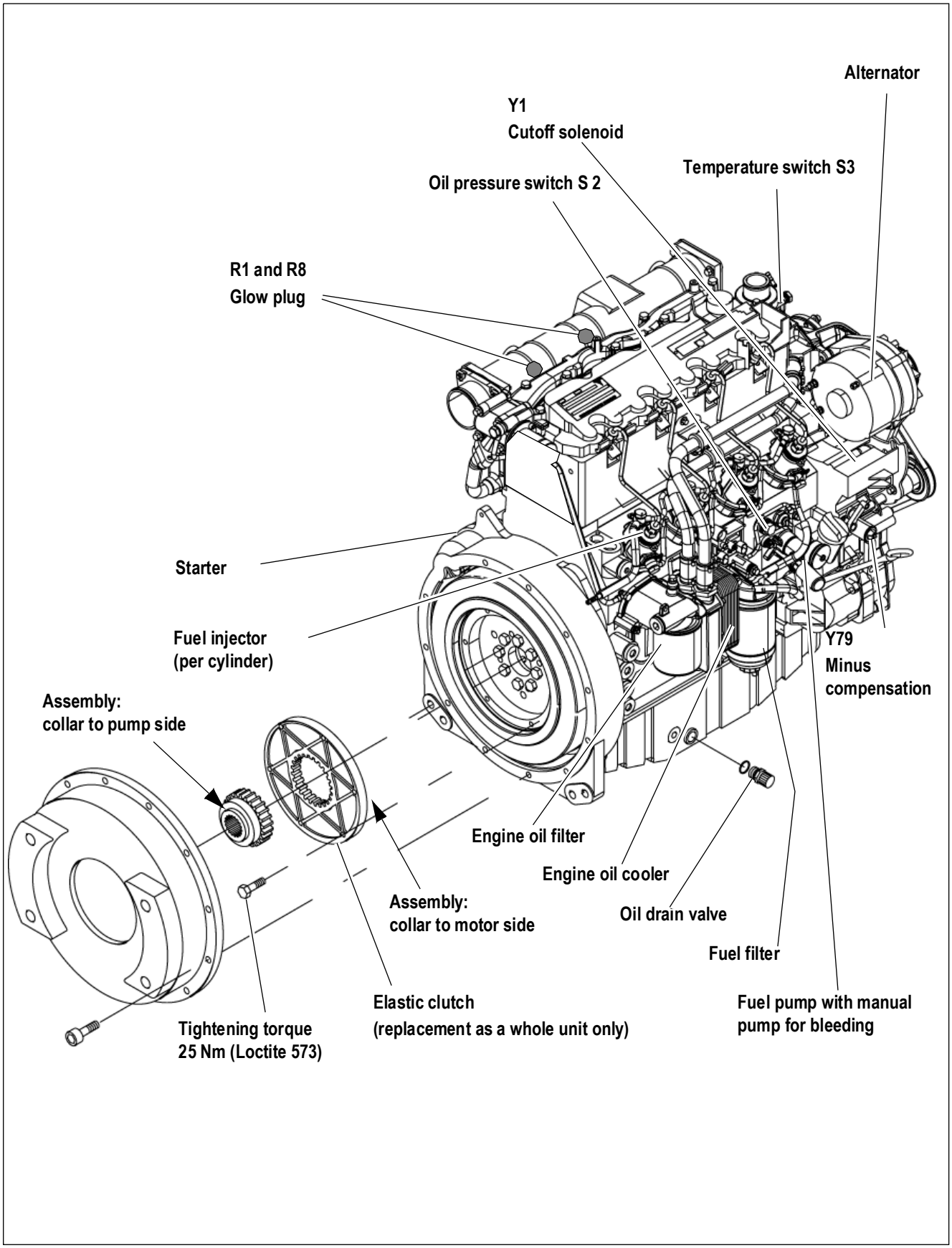
4.2 Fuel specification

Fuel specification	Country
No. 2-D, no. 1-D, ASTM D975-94	USA
DIN EN 590	European Union
ISO 8217 DMX	International
BS 2869-A1 or A2	United Kingdom
GB252	China

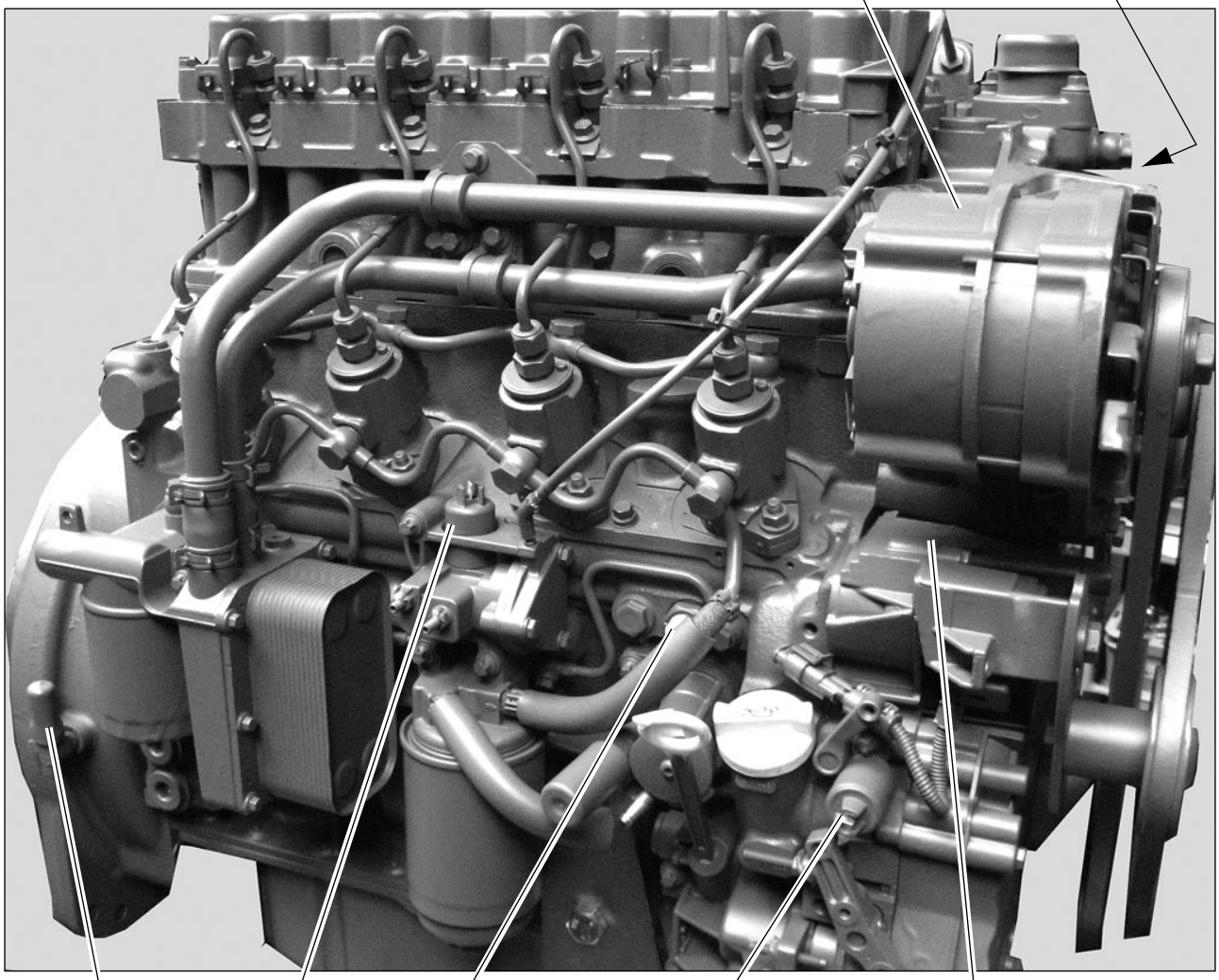
4.3 Coolant specification

Specification	Country
ASTM D6210, D4985	USA
SAE J814C, J1941, J1034 or J2036	International

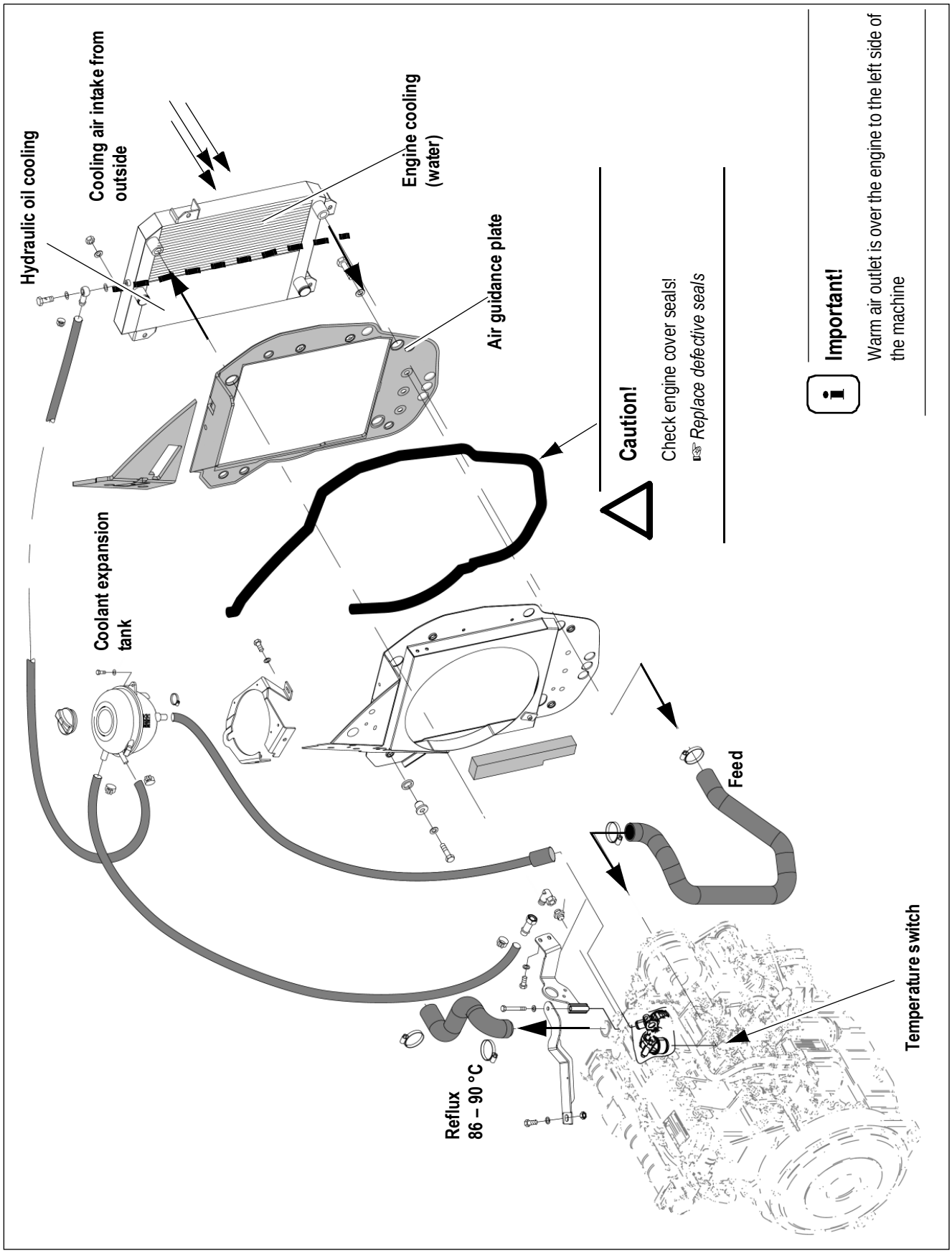
4.4 Diesel engine TD 2011 L04 W overview



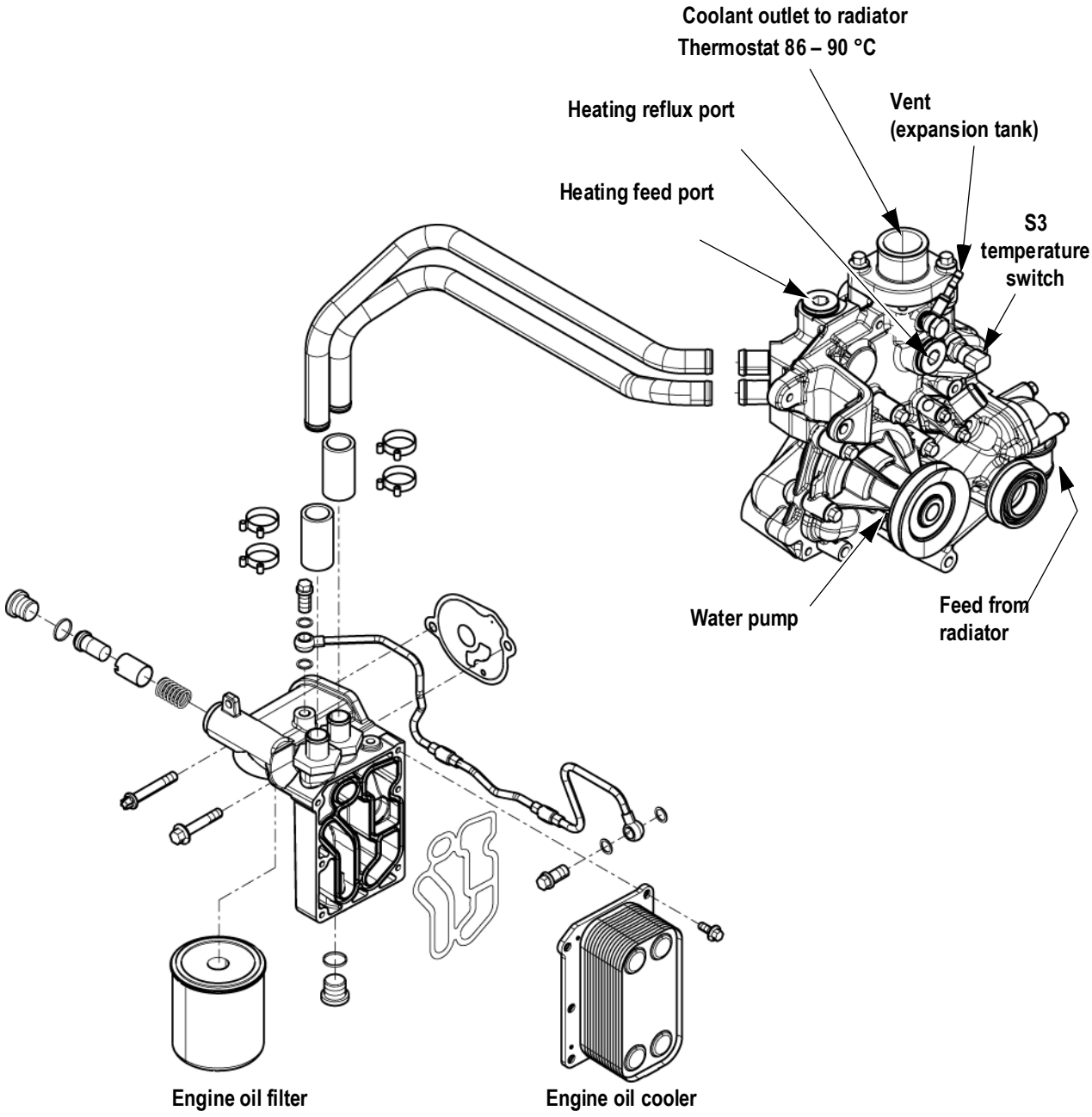
4.5 Electric components on engine (overview)



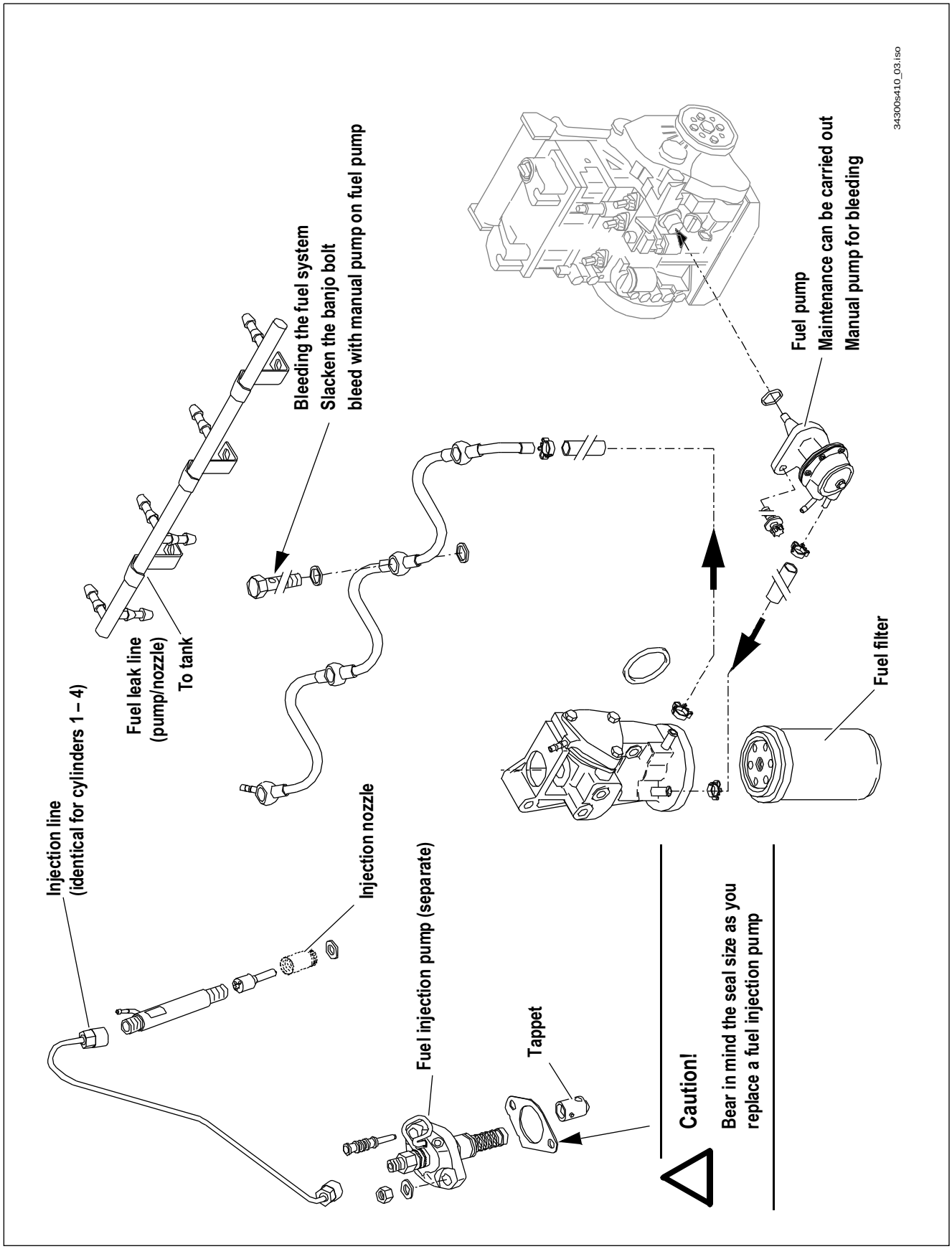
4.6 Engine oil cooling



4.7 Water circuit: water pump, thermostat



4.8 Fuel system



4.9 Checking and adjusting valve clearance

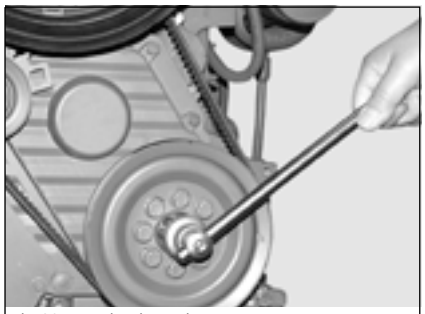


Fig. 90: Turning the engine

☞ *Standard setting of valve clearance is possible:*

➥ On a cold engine, or on a warm engine after it has cooled down for at least 0.5 h.

➥ Oil temperature = 80 °C

Important!

Increase valve clearance by 0.1 mm every time you replace the cylinder head gasket. Set the standard valve clearance after 1500 s/h.

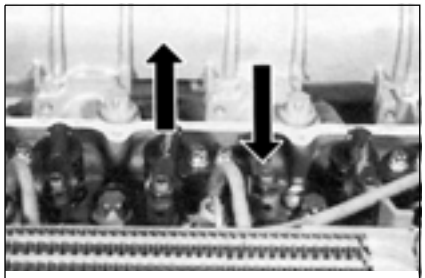


Fig. 91: Valve overlap

The cylinder-head cover has been removed

☞ *Turn the engine until reaching valve overlap, cylinder no. 1*

Important!

Valve overlap means the exhaust valve is not yet closed and the intake valve begins to open. Both push rods cannot be turned

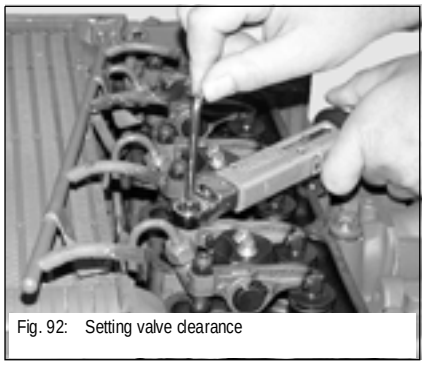


Fig. 92: Setting valve clearance

☞ *Set valve clearance at each cylinder with the feeler gauge.*

➥ Inlet valve clearance: 0.3 mm

➥ Exhaust valve clearance:0.5 mm

☞ *Tighten the locknut.*

➥ Tightening torque: 20 ± 2 Nm

➥ Check the setting again with the feeler gauge.

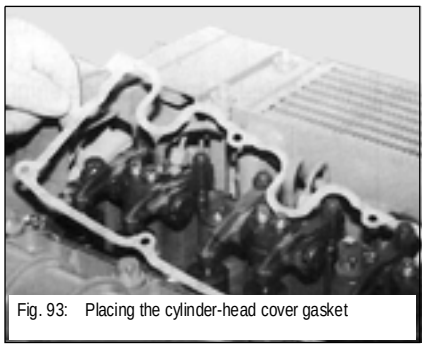


Fig. 93: Placing the cylinder-head cover gasket

☞ *Place the gasket.*

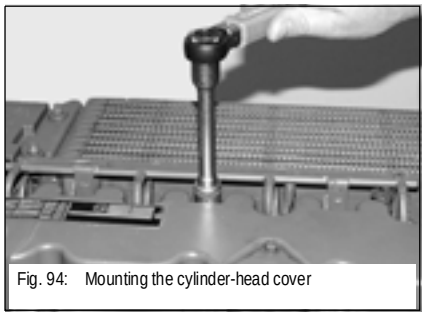


Fig. 94: Mounting the cylinder-head cover

☞ *Slide **new** rubber hoses onto the overflow line and the fuel injectors as far as they will go.*

☞ *Mount the cylinder-head cover and the overflow line.*

☞ *Tighten the screws.*

➥ Tightening torque: 8.5 Nm

4.10 Replacing the fuel injection pump

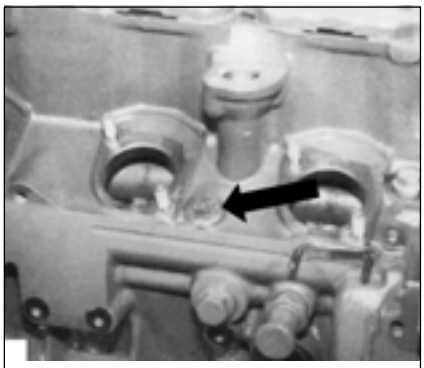


Fig. 95: Crankcase screw plug

☞ *Unscrew the screw plug on the crankcase*

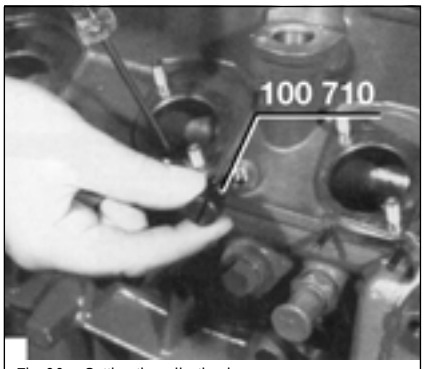


Fig. 96: Setting the adjusting lever

☞ *Set the adjusting lever to centre position.*

☞ *Screw in the adjusting pin for the adjusting lever into the crankcase as far as it will go*

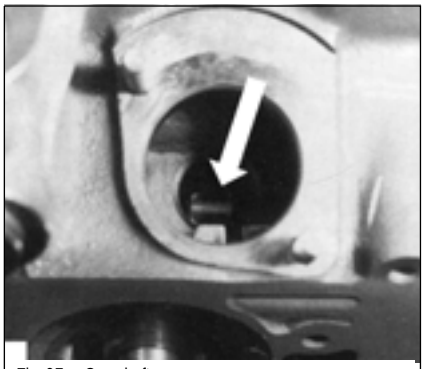


Fig. 97: Camshaft

☞ *Turn the camshaft until the tappet stroke of the cylinder is at lower dead centre*

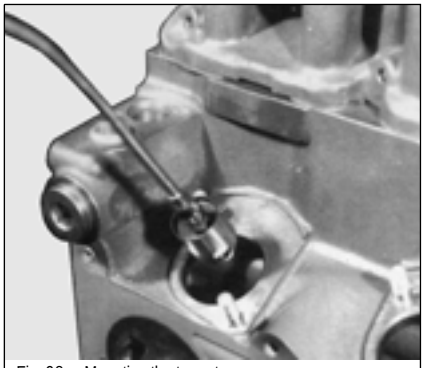


Fig. 98: Mounting the tappets

☞ *Mount the injection pump tappet*

Important!

Use a flexible magnetic tool.

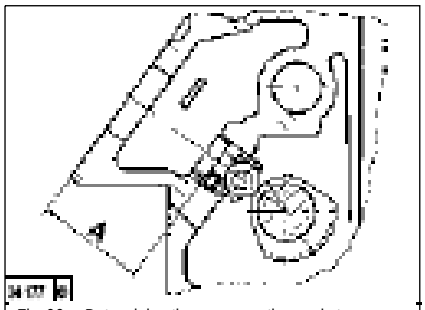


Fig. 99: Determining the compensation gasket

☞ *Determine the compensation gasket*

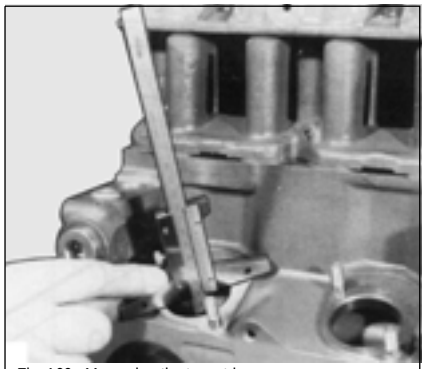


Fig. 100: Measuring the tappet base

☞ *Measure dimension "A" from the crankcase base to the tappet base.*

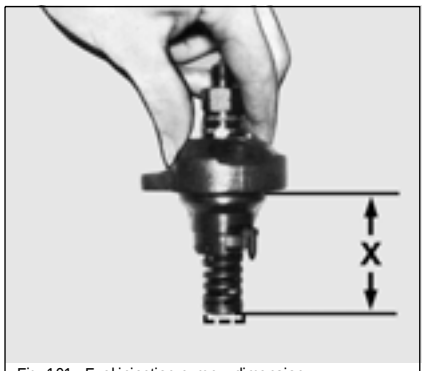


Fig. 101: Fuel injection pump – dimension

☞ *Dimension "X" of fuel injection pump =* ***60 mm***

Important!

Dimension "X" is used for calculating the compensation gasket and cannot be measured with the fuel injection pump removed.

☞ *Determine the difference between dimensions "X" and "A"*

Example:

Dimension "X"	= 60.00 mm
Dimension "A"	= 59.35 mm
Difference	= 0.65 mm

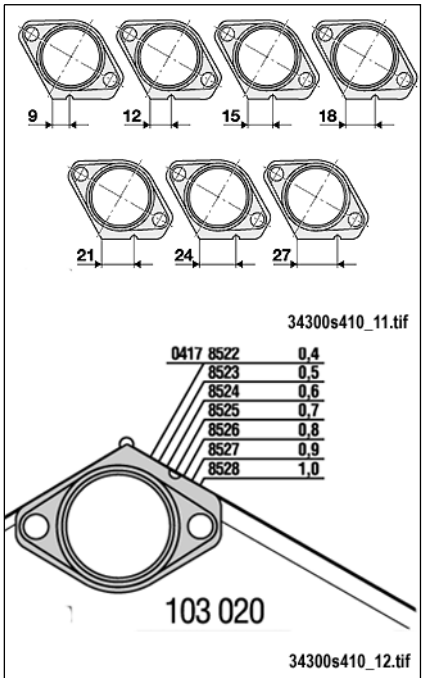


Fig. 102: Compensation gaskets

☞ *Select a compensation gasket according to the table and the identification*

Difference (mm)	Mark size (mm)
Up to 0.4	9.0
0.401 – 0.5	12.0
0.501 – 0.6	15.0
0.601 – 0.7	18.0
0.701 – 0.8	21.0
0.801 – 0.9	24.0
0.901 – 1.0	27.0

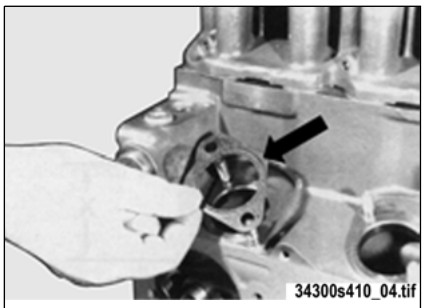


Fig. 103: Placing the compensation gaskets

☞ *Place the compensation gaskets as needed*

Important!

Make sure they are placed in the correct position.



Fig. 104: Lock pin

☞ *Remove the lock pin from the fuel injection pump*

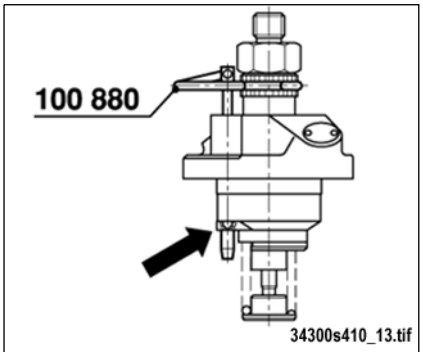


Fig. 105: Lock wire

☞ *Make sure the lock wire is locked in the pivot lever before mounting the fuel injection pump*

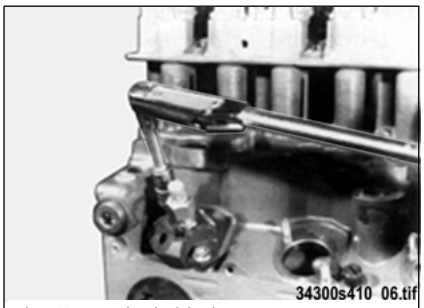


Fig. 106: Mounting the injection pump

☞ *Mount the fuel injection pump*

☞ *Press the fuel injection pump in evenly as far as it will go*

☞ *Tighten the nuts*

➥ Tightening torque: **21 Nm**



Fig. 107: Pulling out the lock wire

☞ *Pull out the lock wire*

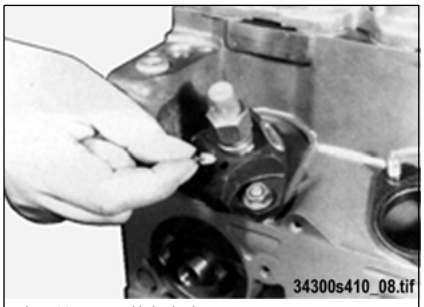


Fig. 108: Bore with lock pin

☞ *Lock the bore with the lock pin*



Fig. 109: Adjusting pin – adjusting lever

☞ *Remove the adjusting pin for the adjusting lever*


Fig. 110: Screw plug

☞ *Tighten the screw plug with a new copper sealing ring*

Tightening torque: **18 Nm**

4.11 Switching off minus compensation

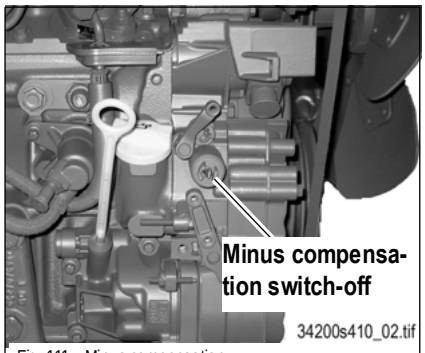


Fig. 111: Minus compensation

The engine receives more fuel during the start procedure, with the help of the start quantity spring.

In order to keep minus compensation from counteracting and neutralising the additional start quantity, minus compensation is switched off with a solenoid (terminal 50).

In order to do so, the solenoid separates the reversing lever from the compensation lever.

Some injection systems receive too much fuel as engine speed drops, i.e. the engine receives more fuel than fresh air.

➥ The engine smokes

☞ *The fuel quantity must be reduced*

Minus compensation – function

The reversing lever is loosely connected to the compensation lever. If the engine runs under load, engine speed drops and the compensation lever moves towards extra volume.

The reversing lever inverts this movement and the adjusting lever is moved towards less volume.

4.12 Heating connection

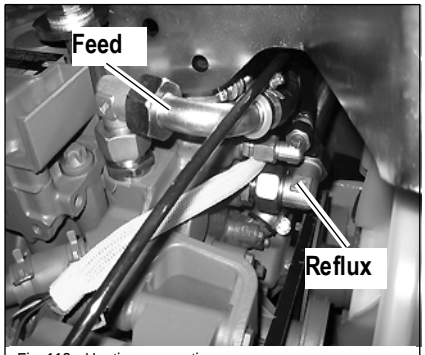


Fig. 112: Heating connection

4.13 Removing/mounting the cylinder head

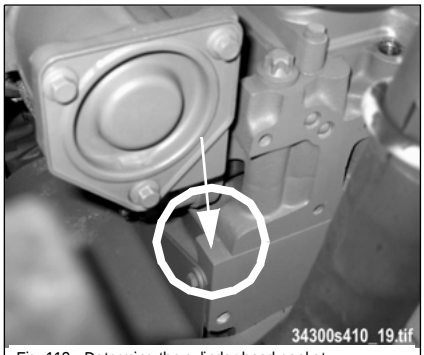


Fig. 113: Determing the cylinder-head gasket

☞ *Determine the cylinder-head gasket's identification (see circle)*

Piston projection (mm)	Identification (slot)
0.530 – 0.690	1 slot
0.691 – 0.760	2 slots
0.761 – 0.830	3 slots

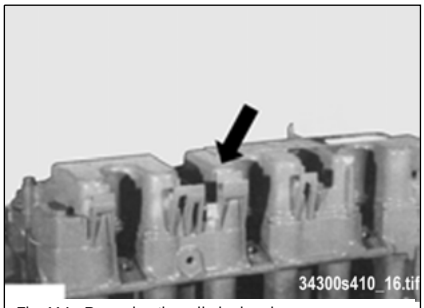


Fig. 114: Removing the cylinder-head cover

☞ *Remove the cylinder-head cover*

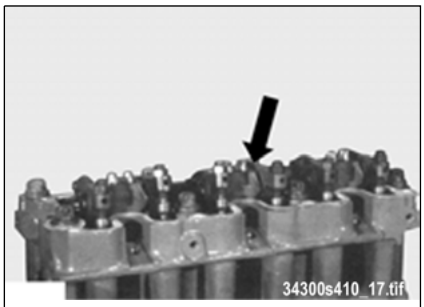


Fig. 115: Removing the rocker arm bracket

☞ Remove the rocker arm brackets

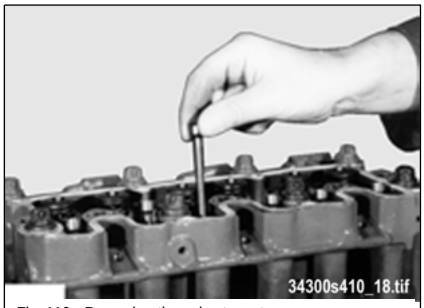


Fig. 116: Removing the valve tappets

☞ *Remove the valve tappets*

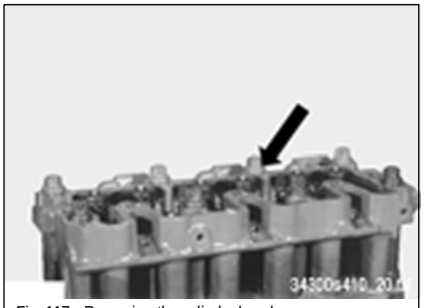


Fig. 117: Removing the cylinder head

☞ *Carefully raise the cylinder head from the engine block*

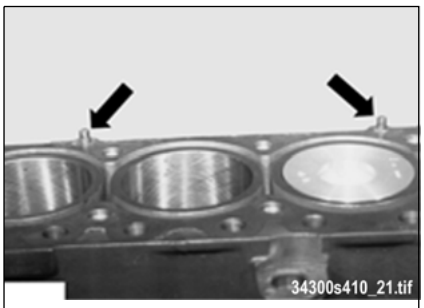


Fig. 118: Straight pins

☞ *Make sure the straight pins are in their positions.*

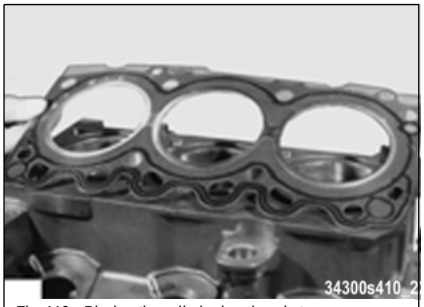


Fig. 119: Placing the cylinder-head gasket

☞ *Place the cylinder-head gasket*

Caution!

The sealing surfaces must be clean and free of oil



Fig. 120: Placing the cylinder-head gasket

☞ *Check the length of the cylinder-head bolts*

➥ **150 ± 0.8 mm**

☞ *Mount the cylinder head*

➥ Apply a thin coat of oil to the cylinder-head bolts

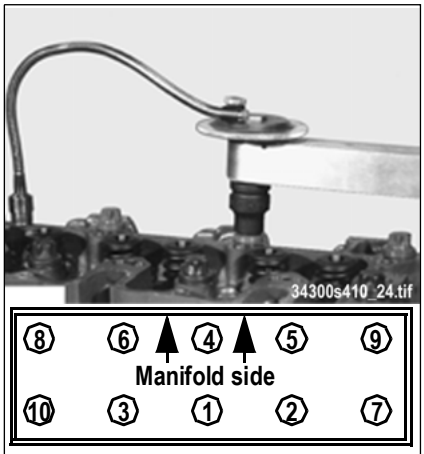


Fig. 121: Mounting the cylinder-head bolts

☞ *Mount the cylinder-head bolts*

➥ Tightening torque:

- 1st pass **30 Nm**
- 2nd pass **80 Nm**
- 3rd pass **160 Nm**
- Angle for retightening: **90°**

Caution!

Bear in the mind the order for tightening the cylinder-head bolts!

☞ *See figure*

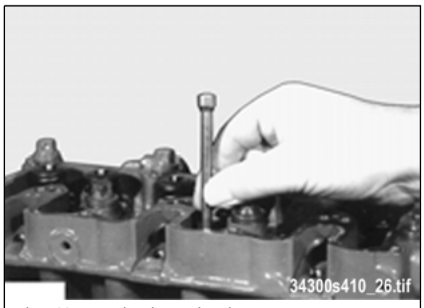


Fig. 122: Inserting the push rods

☞ *Insert the push rods*

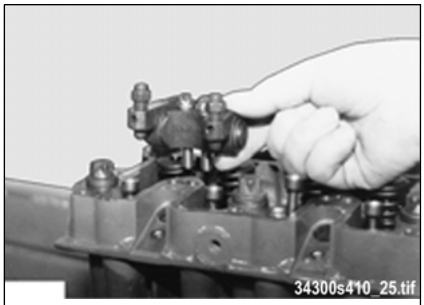


Fig. 123: Mounting the rocker arm bracket

☞ *Mount the rocker arm bracket and align it with the push rods*

➥ Tightening torque: **21 Nm**

☞ *Set the valve clearance*

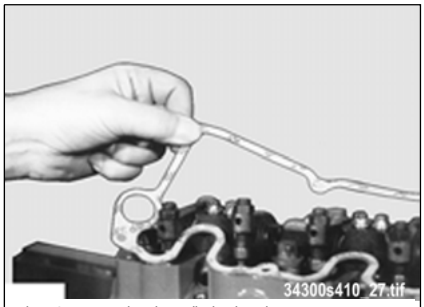


Fig. 124: Mounting the cylinder-head cover

☞ *Place the gasket for the cylinder-head cover*

☞ *Mount the cylinder-head cover*

➥ Tightening torque **8.5 Nm**

4.14 Sealing the bleed valve



Fig. 125: Bleed valve

☞ *Remove the cover*

☞ *Clean the bleed valve*

☞ *Mount a new O-ring*

☞ *Mount the cover*

➥ Tightening torque **8.5 Nm**

4.15 Sealing the intake/exhaust manifold



Fig. 126: Intake manifold seals

☞ *Mount new gaskets*

☞ *Mount the intake/exhaust manifold*

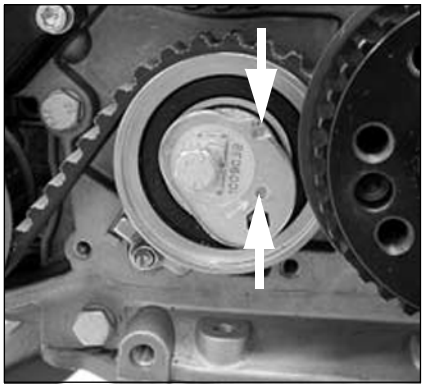
Tightening torque

➥ Intake manifold: **21 Nm**

➥ Exhaust manifold **55 Nm**

4.16 Replacing the toothed belt and the tensioning pulley

General instructions



Caution!

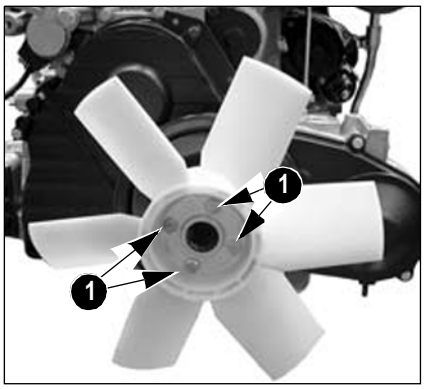
Replace the toothed belt by a new one every 3000 service hours or every 5 years, and every time it is removed, regardless of running time!

Important!

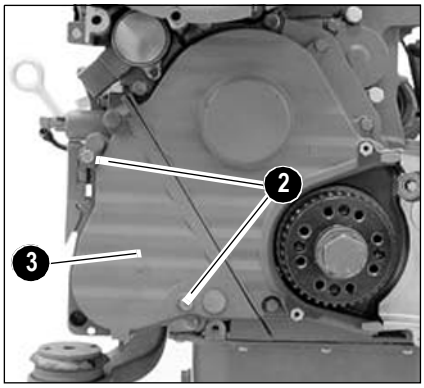
Distinctive features of new version tensioning pulley:

- Holes (arrows) are used setting and checking toothed-belt tension.
- The tensioning pulley has no detent on the front cover.

Removing the toothed belt and the tensioning pulley



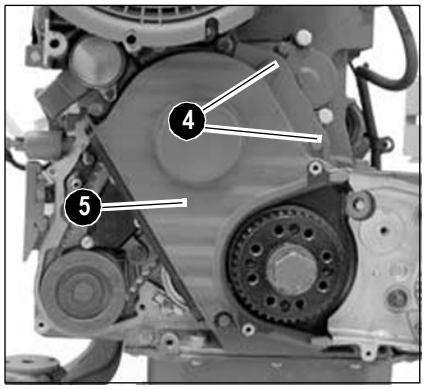
☞ *Unscrew screws (1) and remove the fan.*



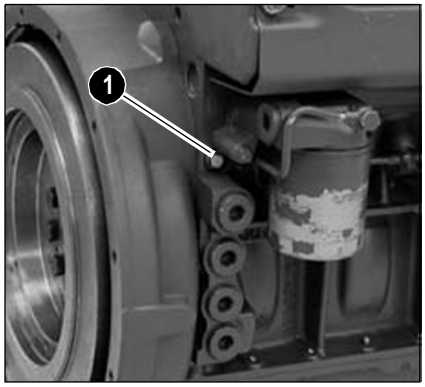
☞ *Unscrew securing screw (1).*

➥ Use a 70 mm special bit.

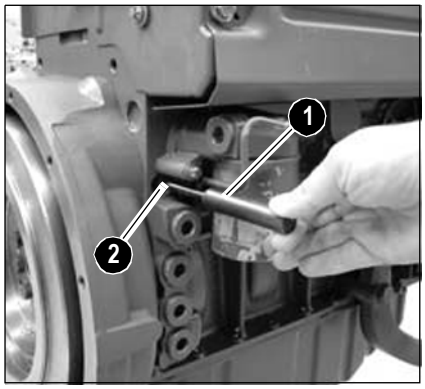
☞ *Unscrew screws (2) and remove protective hood (3).*



☞ *Unscrew screws (4) and remove protective hood (5).*



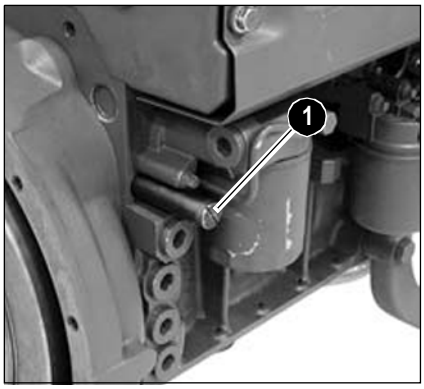
☞ *Unscrew screw plug (1) and remove the sealing ring.*



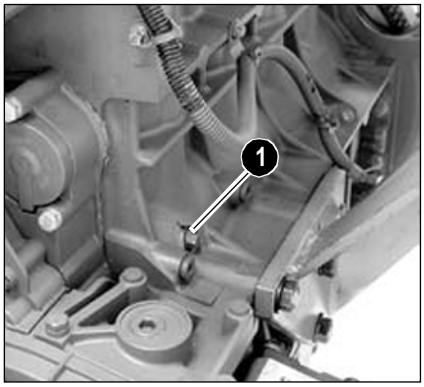
☞ *Insert adjusting pin (1) for blocking the camshaft, in hole (2).*



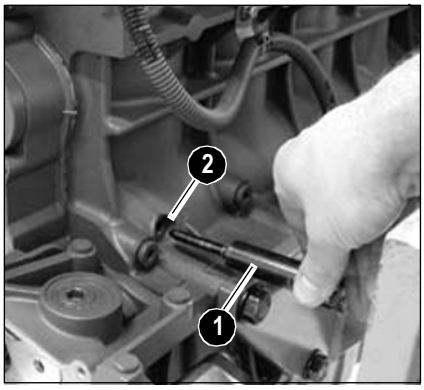
☞ *Hold the adjusting pin applying slight pressure and turn the crankshaft in the direction of rotation of the engine (clockwise) until the adjusting pin engages in the camshaft hole.*



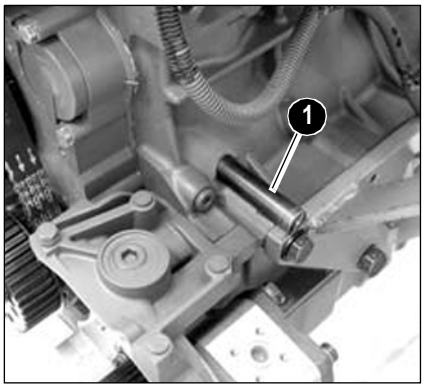
☞ *Screw adjusting pin (1) into the crankcase until it makes contact*



☞ *Unscrew screw plug (1) and remove the sealing ring.*

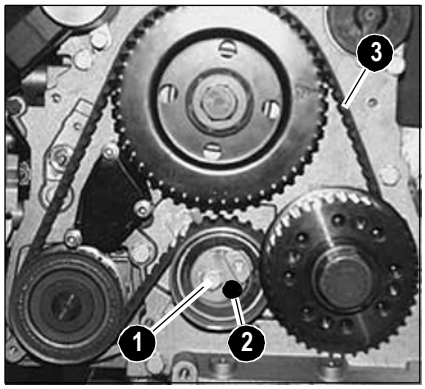


☞ *Insert adjusting pin (1) for blocking the crankshaft, in hole (2).*



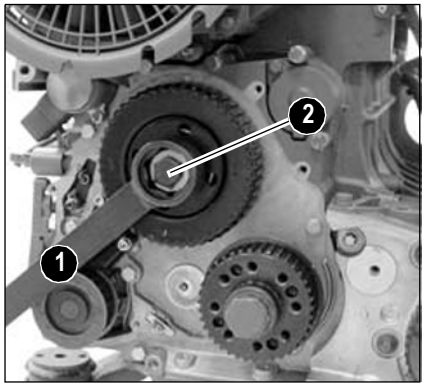
☞ *Screw adjusting pin (1) into the crankcase until it makes contact*

☞ *The cylinder at the front cover is now in the top dead centre position.*



☞ *Unscrew screw (1) and remove tensioning pulley (2).*

☞ *Remove toothed belt (3).*

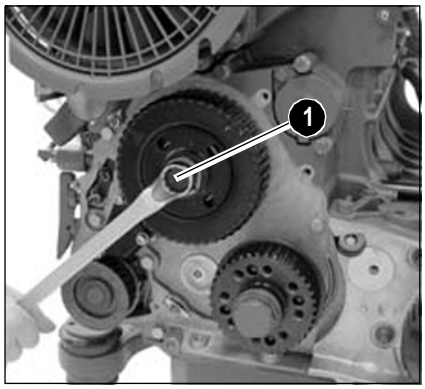


Slackening the toothed belt wheel of the camshaft

☞ *Position a counterbracket (1) and slacken the centre screw (2).*

Caution!

Do not turn the camshaft.



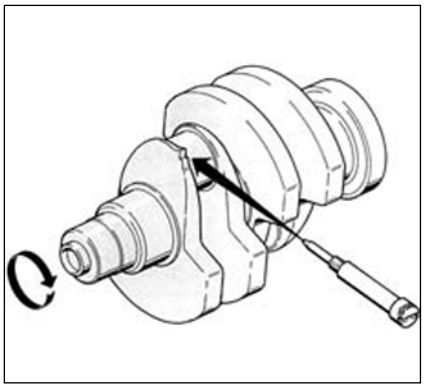
Mounting the toothed belt and the tensioning pulley

☞ *Tighten the centre screw (1) hand-tight.*

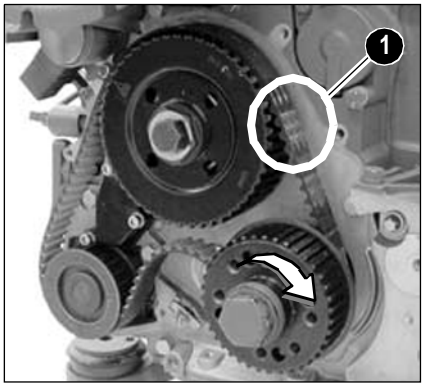
Caution!

In order to ensure the length compensation of the toothed belt, you must still be able to turn the toothed belt wheel of the camshaft.

☞ *Use a new centre screw.*



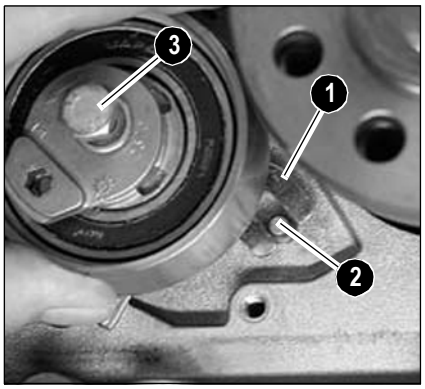
☞ Carefully turn the *crankshaft in the direction of rotation of the engine (clockwise) until contact is made with the adjusting pins.*



☞ *Place a new toothed belt.*

Caution!

Bear in mind the direction of rotation of the toothed belt, the arrows on the toothed belt (1) must show in the direction of rotation of the engine (arrow).



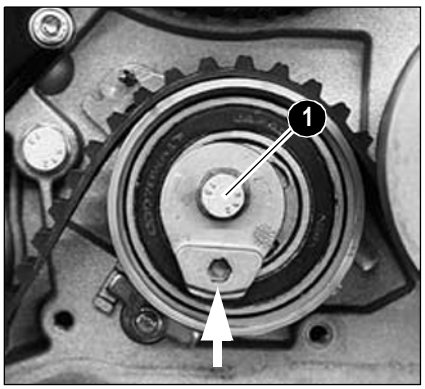
☞ *Mount a new tensioning pulley with guide fork (1) of the base plate in the guide pin (2) of the front cover.*

Caution!

Bear the different tensioning pulleys in mind when mounting a hydraulic pump.

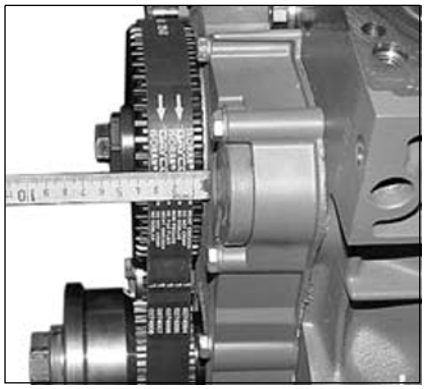
- *Tensioning pulley for camshaft drive: 30 mm*
- *Hydraulic pump drive: 35 mm*

☞ *Screw in screw (3) a few turns.*

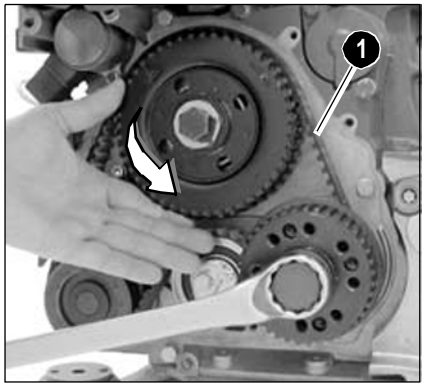


☞ *Put the adjustment eccentric (arrow) in the 6 o'clock position.*

☞ *Press the tensioning pulley against the toothed belt and put screw (1) under initial load.*



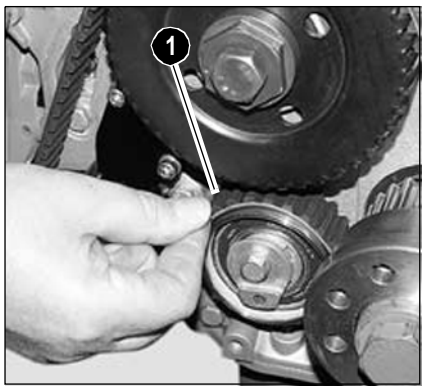
☞ *Align the toothed belt in order to ensure an equal distance of 8 to 9 mm from the cover to the toothed belt.*



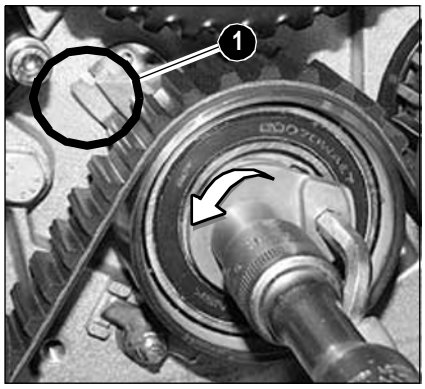
☞ *Tighten driving side (1) of the toothed belt by turning the toothed belt wheel of the camshaft in the direction of the arrow (counterclockwise).*

➥ Turn the toothed belt wheel of the camshaft by hand

➥ Press the crankshaft against the limit when adjusting the toothed belt.

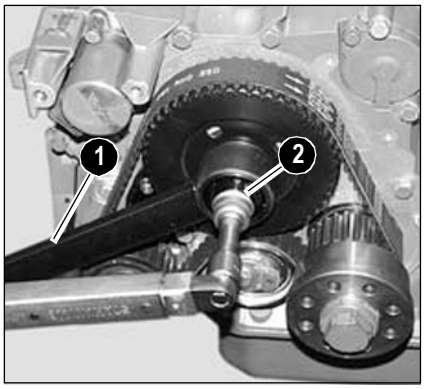


☞ *Remove detent pin (1).*



☞ *Turn the adjusting eccentric in the direction of the arrow (counterclockwise) until the pointer of the tensioning pulley is aligned with the notch (1)*

➥ Turn the adjustment eccentric with the hexagon socket screw. Tighten the screw to 21 Nm.



Fastening the toothed belt wheel of the camshaft

☞ *Apply a counterbracket (1) and tighten centre screw (2) to an initial 30 Nm.*

☞ *Tighten centre screw (2) with 210°.*

➥ Counter the toothed belt wheel.

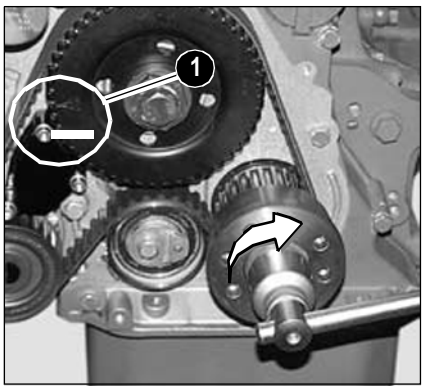
➥ Press the crankshaft against the limit.



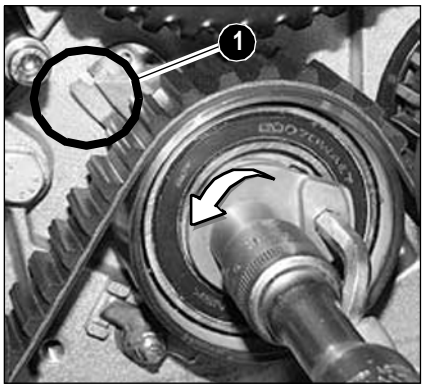
Checking toothed-belt tension

☞ *Unscrew the adjusting pin for the camshaft and crankshaft detent.*

☞ *Mark the toothed belt wheel of the camshaft and the opposite screw (arrow).*



☞ *Turn the crankshaft 2 revolutions in the direction of rotation of the engine (clockwise) until marks (1) are aligned.*

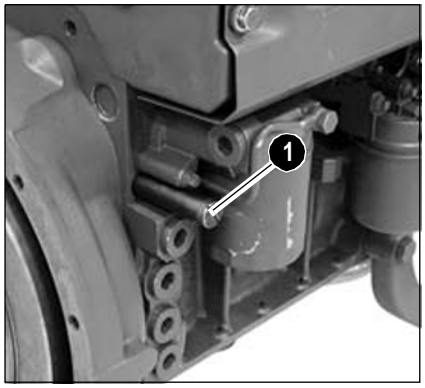


Correcting toothed-belt tension

☞ *Slacken the screw and pretighten it again.*

☞ *Turn the adjusting eccentric in the direction of the arrow (counterclockwise) until the pointer of the tensioning pulley is aligned with the notch (1). Tighten the screw to 21 Nm.*

Checking engine control times

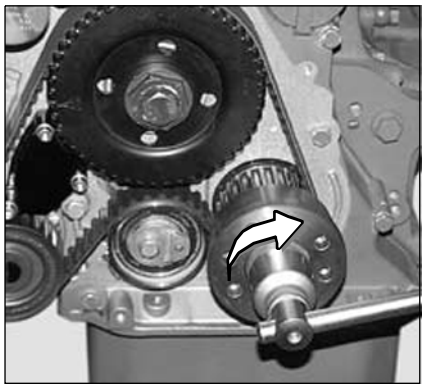


Blocking the camshaft

☞ *Insert adjusting pin (1) for blocking the camshaft in the hole and hold it applying slight pressure.*

☞ *Turn the crankshaft in the direction of rotation of the engine (clockwise) until the adjusting pin engages in the camshaft hole.*

☞ *Screw the adjusting pin into the crankcase until it makes contact.*

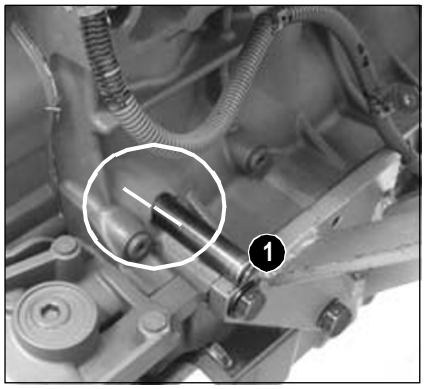


☞ *Tighten the centre screw to 40 Nm in the direction of rotation of the engine with a torque wrench.*

☞ *Carefully release the load on the torque wrench.*

Caution!

Do not turn the crankshaft any further.

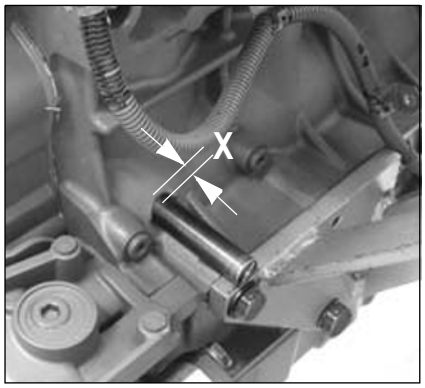


☞ *Screw in adjusting pin (1) for crankshaft detent until it touches the crankshaft a little*

Caution!

Do not turn the crankshaft as you screw in the adjusting pin.

☞ *Mark (arrow) the crankcase and the adjusting pin.*

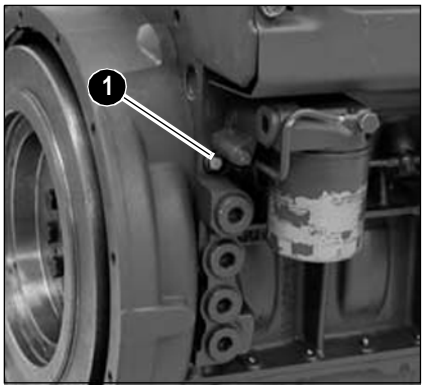


☞ *The engine control times are set correctly if you can still screw in the adjusting pin 0.75 to 2.25 revolutions to the limit in the crankcase.*

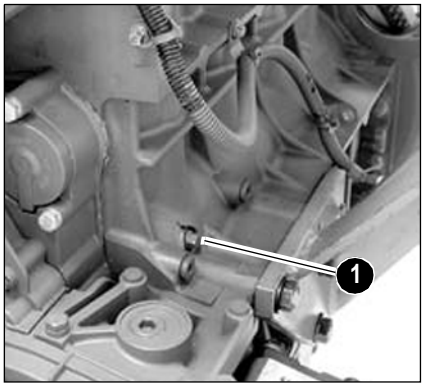
Caution!

If thread reach **"X"** does not coincide with the rated setting, replace the toothed belt and the tensioning pulley.

☞ *Unscrew the adjusting pin for the camshaft and crankshaft detent.*



☞ *Tighten screw plug (1) with a new copper sealing ring.*



☞ *Tighten screw plug (1) with a new copper sealing ring.*

4.17 Engine trouble

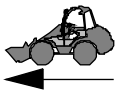
Engine trouble	Possible causes
Engine does not start or is not easy to start	Parking brake not applied
	Steering-column control lever not in neutral
	Engine starting temperature too low
	Wrong SAE grade of engine lubrication oil
	Fuel grade does not comply with specifications
	Defective or flat battery
	Loose or oxidised cable connections in starter circuit
	Defective starter, or pinion does not engage
	Wrong valve clearance
	Defective fuel injector
Engine starts, but does not run smoothly or faultless	Fuel grade does not comply with specifications
	Wrong valve clearance
	Injection line leaks
	Defective fuel injector
Engine overheats. Temperature warning system responds	Oil level too low
	Oil level too high
	Dirty air filter
	Defective air filter maintenance switch or gauge
	Dirty oil radiator fins
	Defective fan, torn or loose V-belt
	Cooling air heats up
	Resistance in cooling system too high, flow capacity too low
	Defective fuel injector
Insufficient engine output	Oil level too high
	Fuel grade does not comply with specifications
	Dirty air filter
	Defective air filter maintenance switch or gauge
	Wrong valve clearance
	Injection line leaks
	Defective fuel injector
Engine does not run on all cylinders	Injection line leaks
	Defective fuel injector

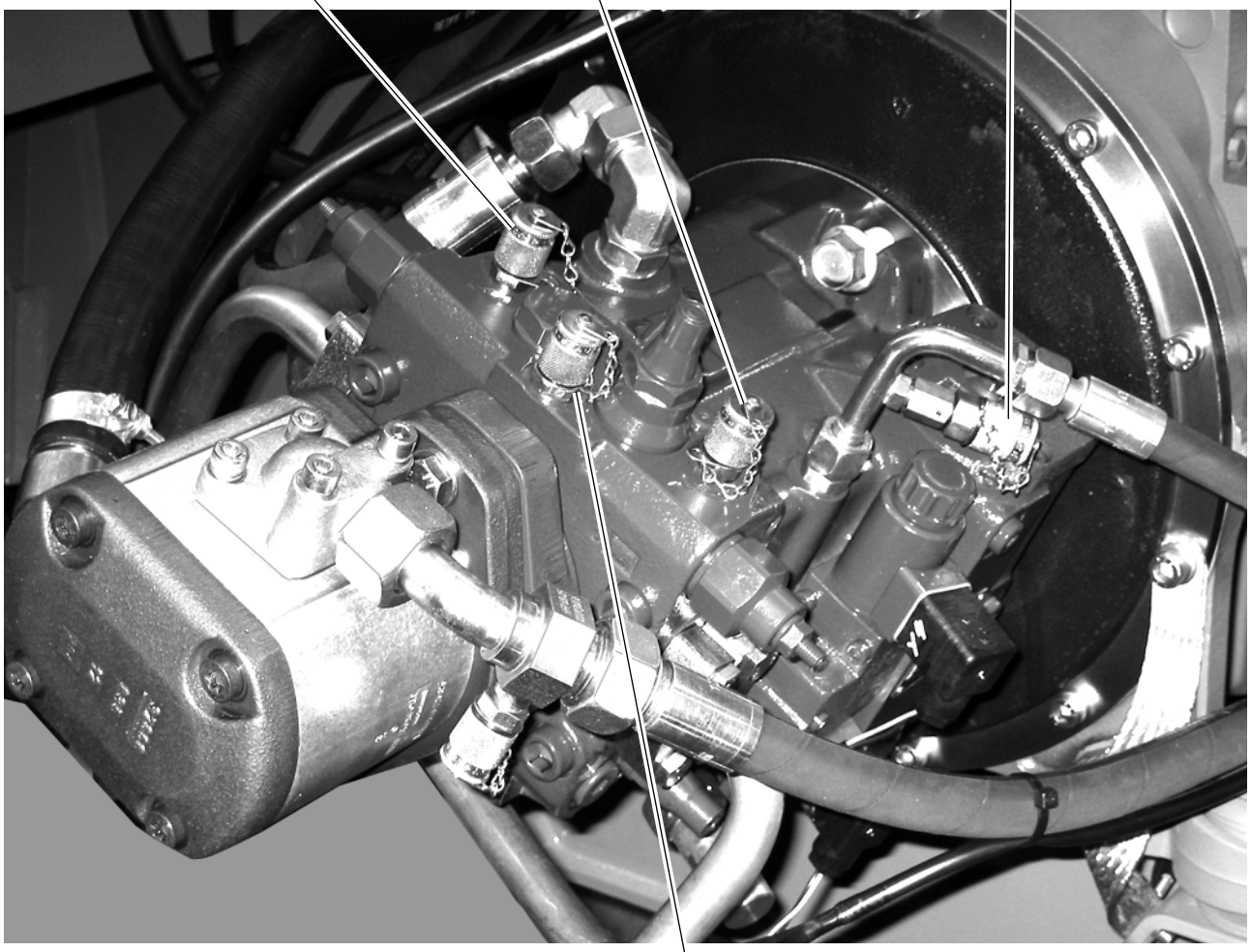
Engine trouble		Possible causes
Insufficient or no engine oil pressure		Oil level too low
		Engine inclination too high
		Wrong SAE grade of engine lubrication oil
Engine oil consumption too high		Oil level too high
		Engine inclination too high
Engine smoke	Blue	Oil level too high
		Engine inclination too high
	White	Engine starting temperature too low
		Fuel grade does not comply with specifications
		Wrong valve clearance
		Defective fuel injector
	Black	Dirty air filter
		Defective air filter maintenance switch or gauge
		Wrong valve clearance
		Defective fuel injector

Power train

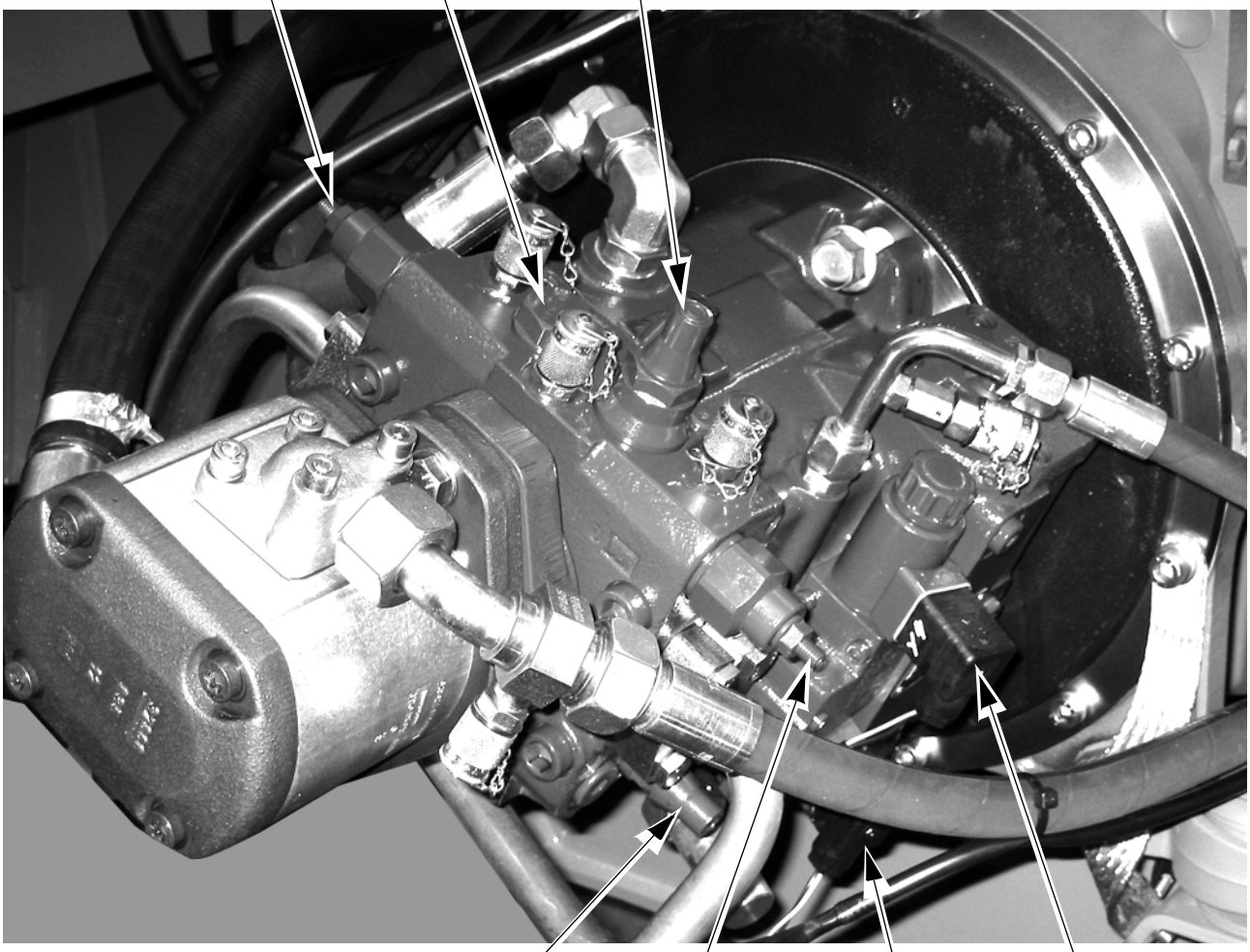
5 Power train

5.1 Variable displacement pump test ports (20 kph) for models 347-03 (950), 347-04 (1150)

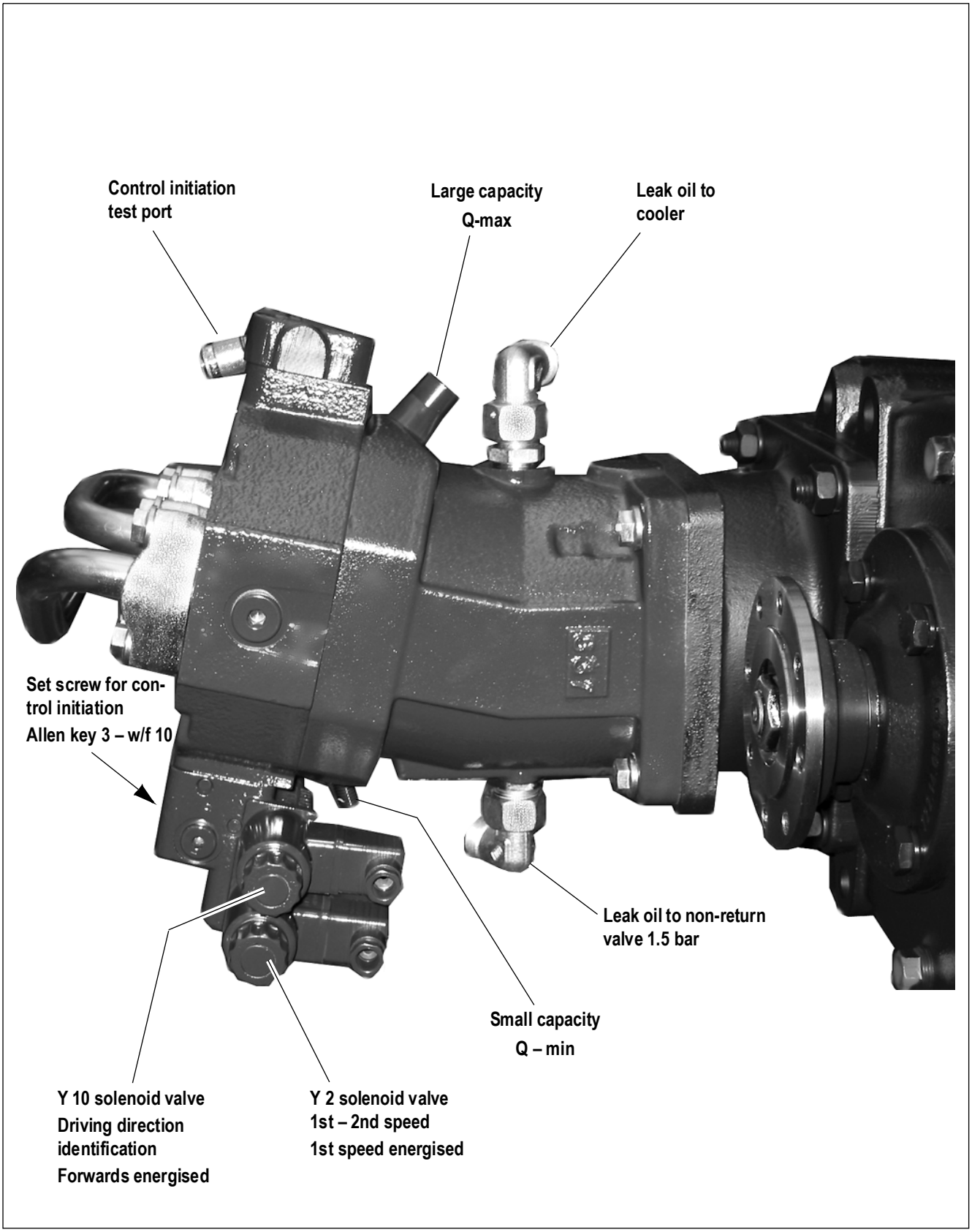




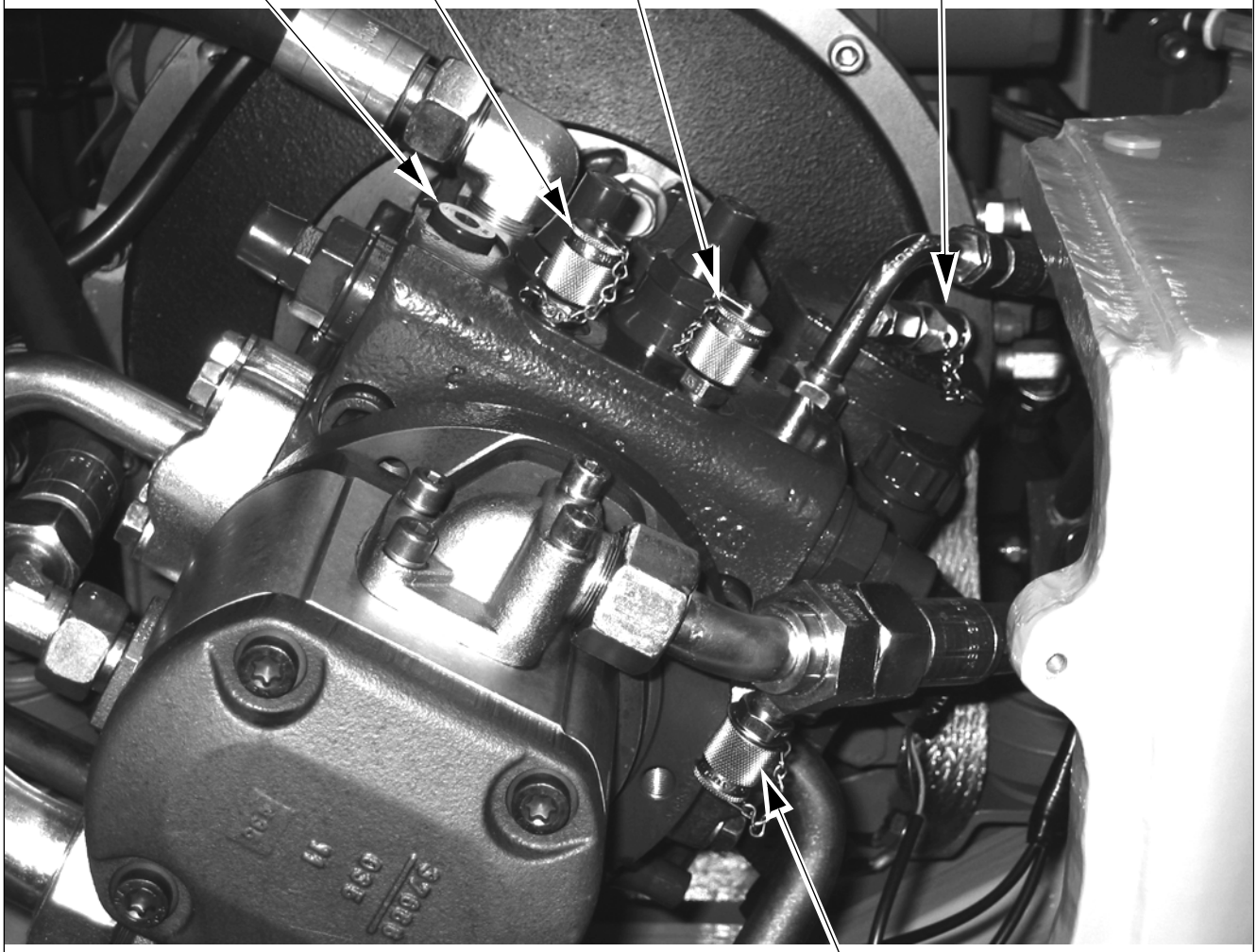
5.2 Variable displacement pump (20 kph) for models 347-03 (950), 347-04 (1150)



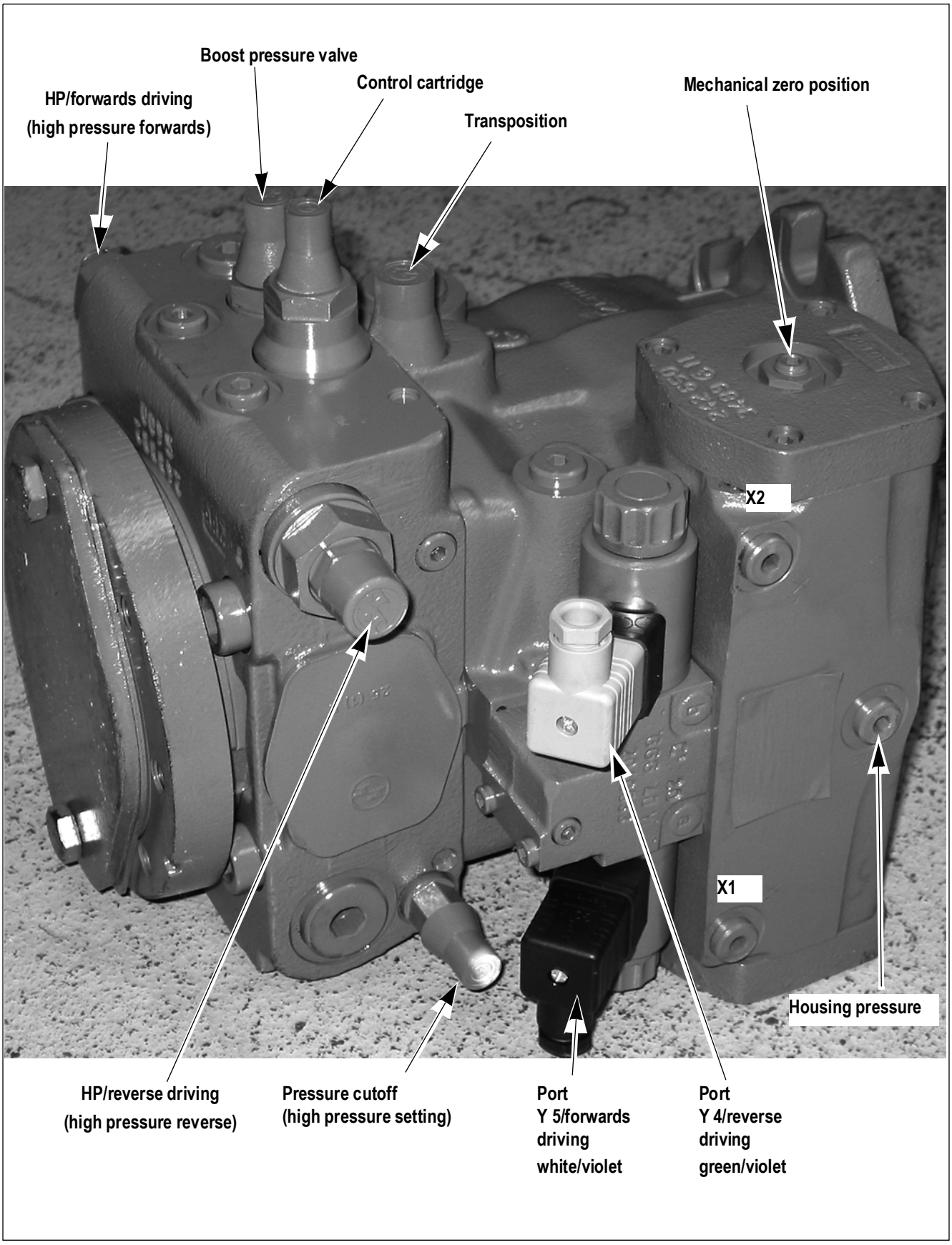
5.3 Variable displacement motor (20 kph) 950/1150 – 347-03/04



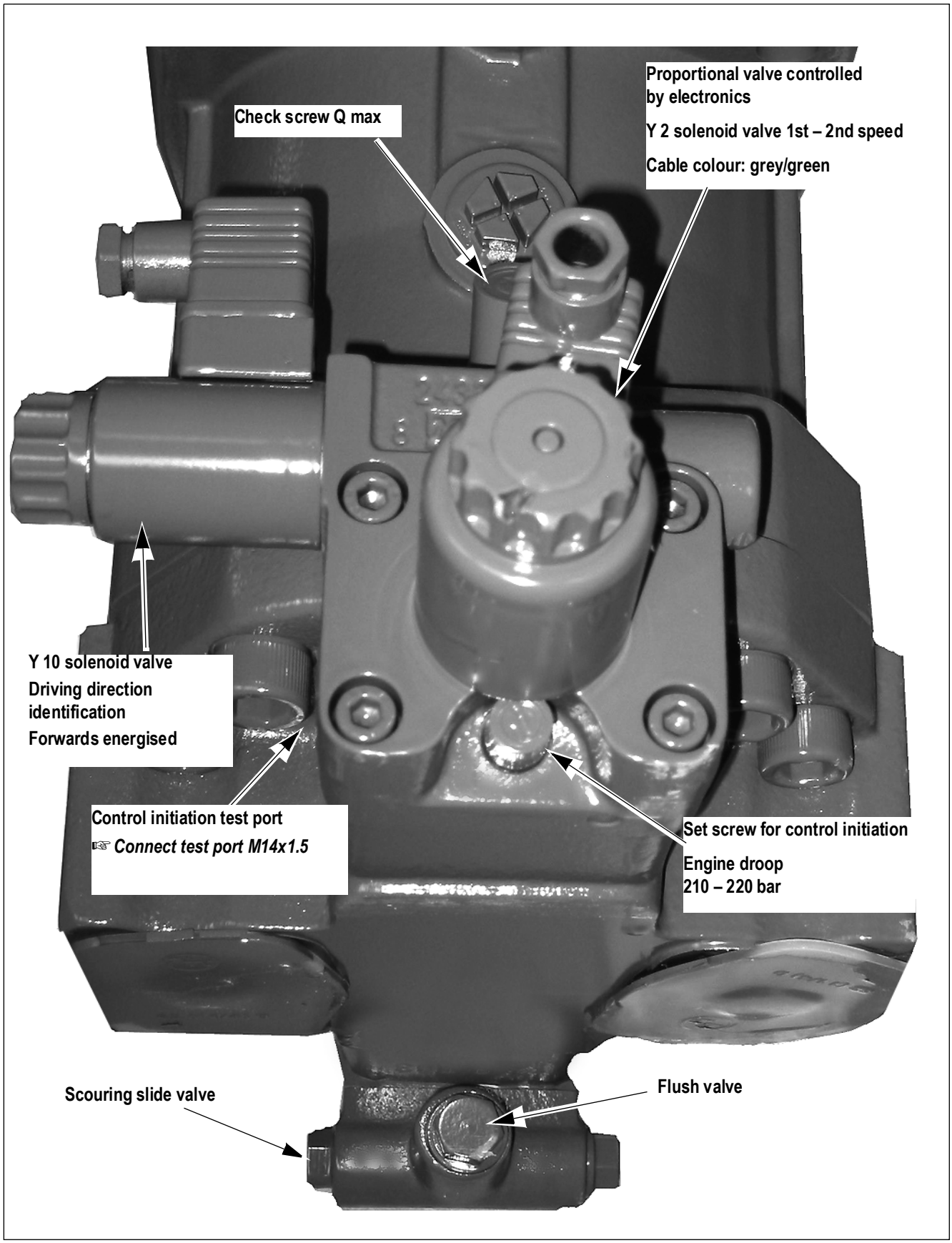
5.4 Variable displacement pump test ports (30 kph) for models 347-03 (950), 347-04 (1150)



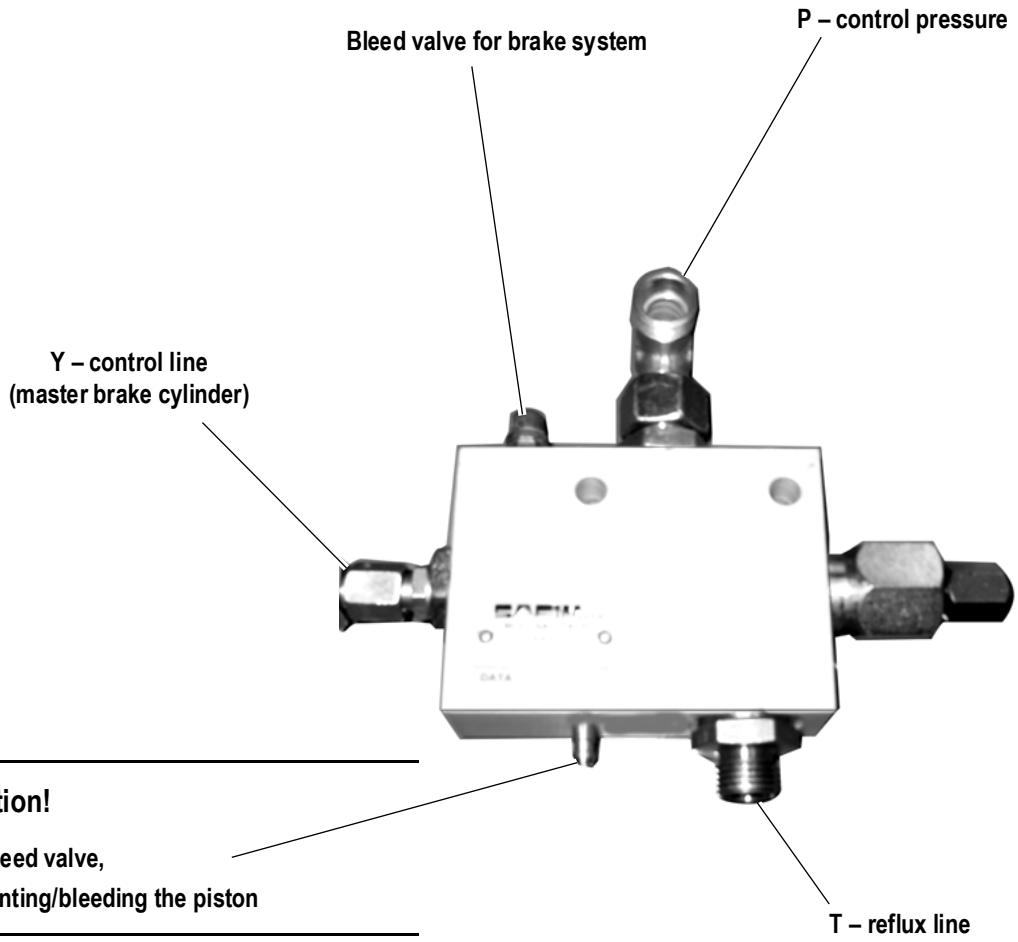
5.5 Variable displacement pump (30 kph) for models 347-03 (950), 347-04 (1150)



5.6 Variable displacement motor (30 kph) for models 341-03 (950), 347-04 (1150)



5.7 Inching valve overview



Caution!

No bleed valve,

☞venting/bleeding the piston

Description of inching valve

Actuating the brake pedal applies pressure to the inching valve and the service brake.

The machine is first braked by means of the hydraulic drive, and then with the service brake.

Functional description

Actuating the master brake cylinder applies brake pressure to port **Y** of the inching valve, which in turn controls the control spool in the inching valve and establishes a connection between port **P** and port **T**.

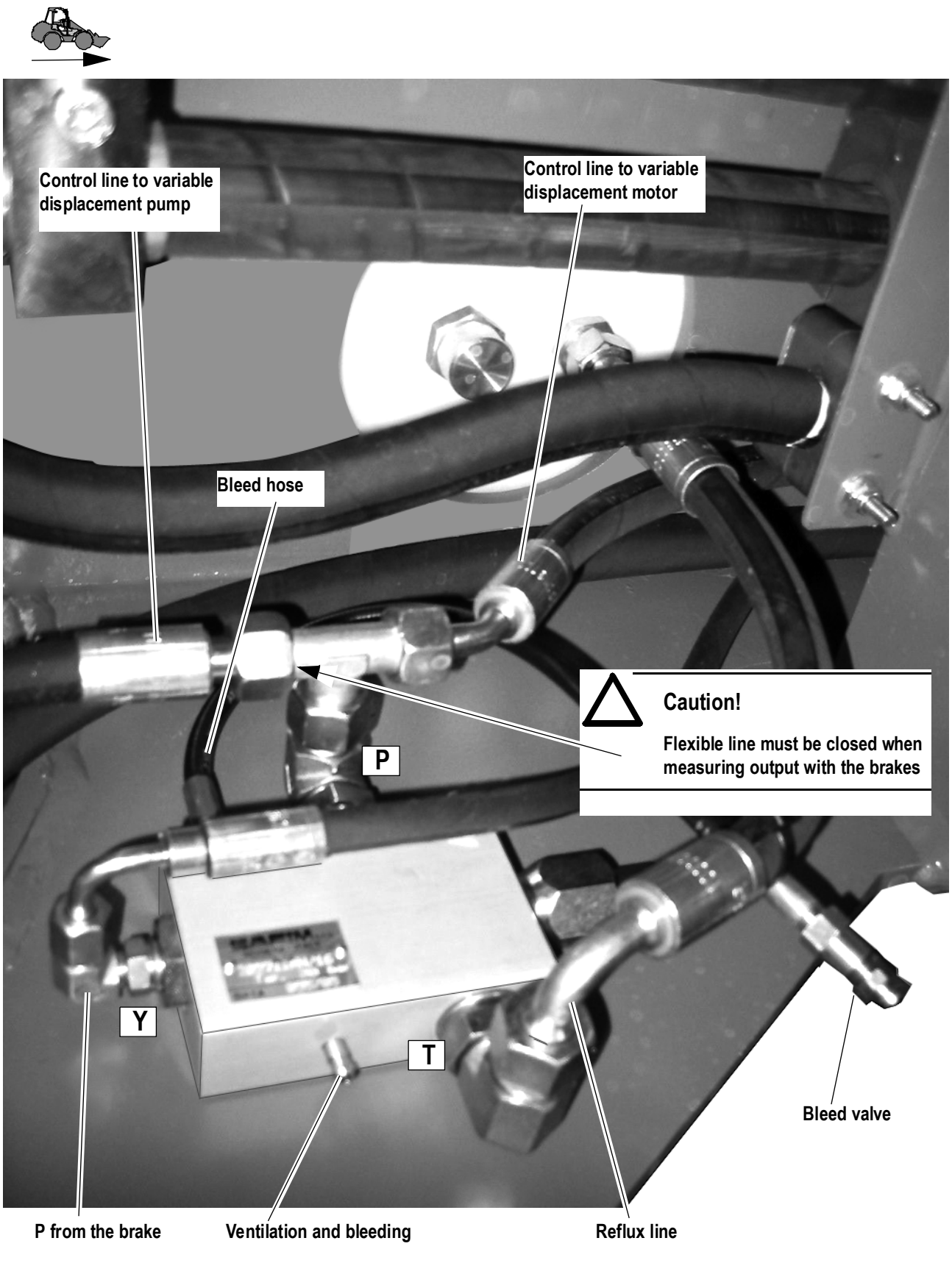
The control pressure of the variable displacement pump is reduced, and hence the flow rate of the variable displacement pump is reduced.

The machine slows down. At the same time, the brakes become active, proportionally to the brake pressure.

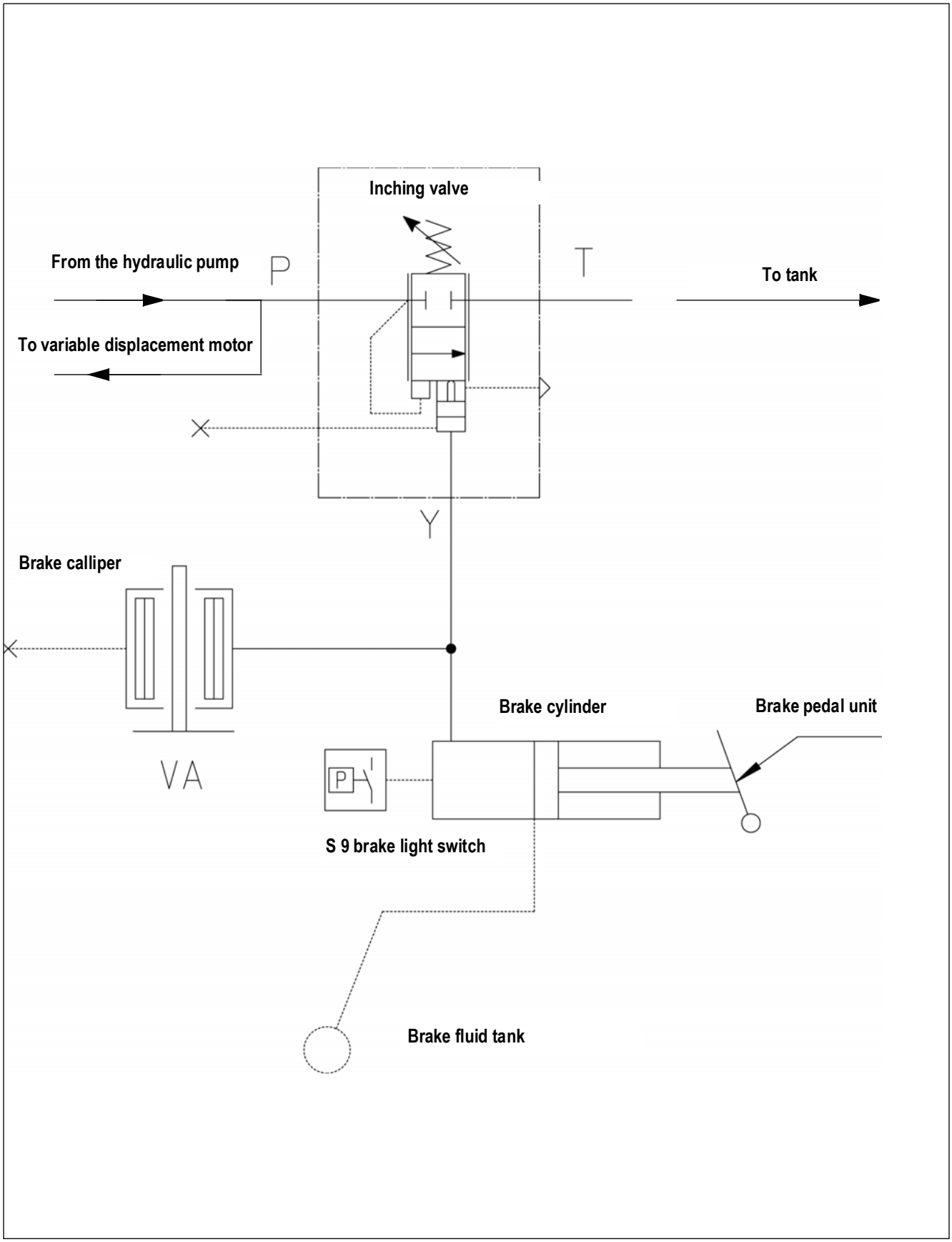
Danger!

The inching valve is a crucial safety component: no modifications are allowed to be carried out on it.

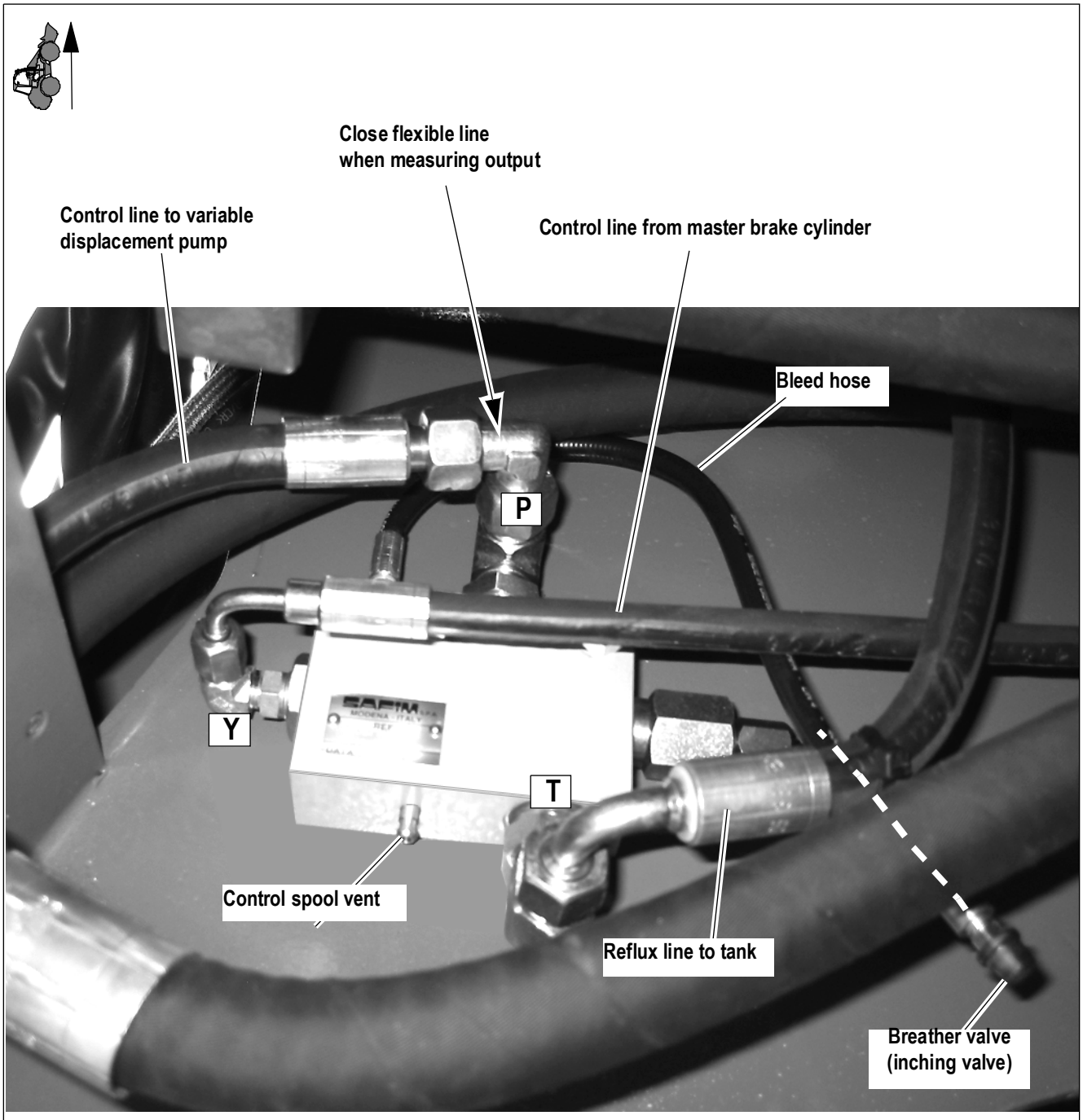
5.8 20 kph inching valve circuit



5.9 20 kph inching valve diagram



5.10 Inching valve circuit (30 kph) for models 347-03 (950), 347-04 (1150)



T = no pressure to tank

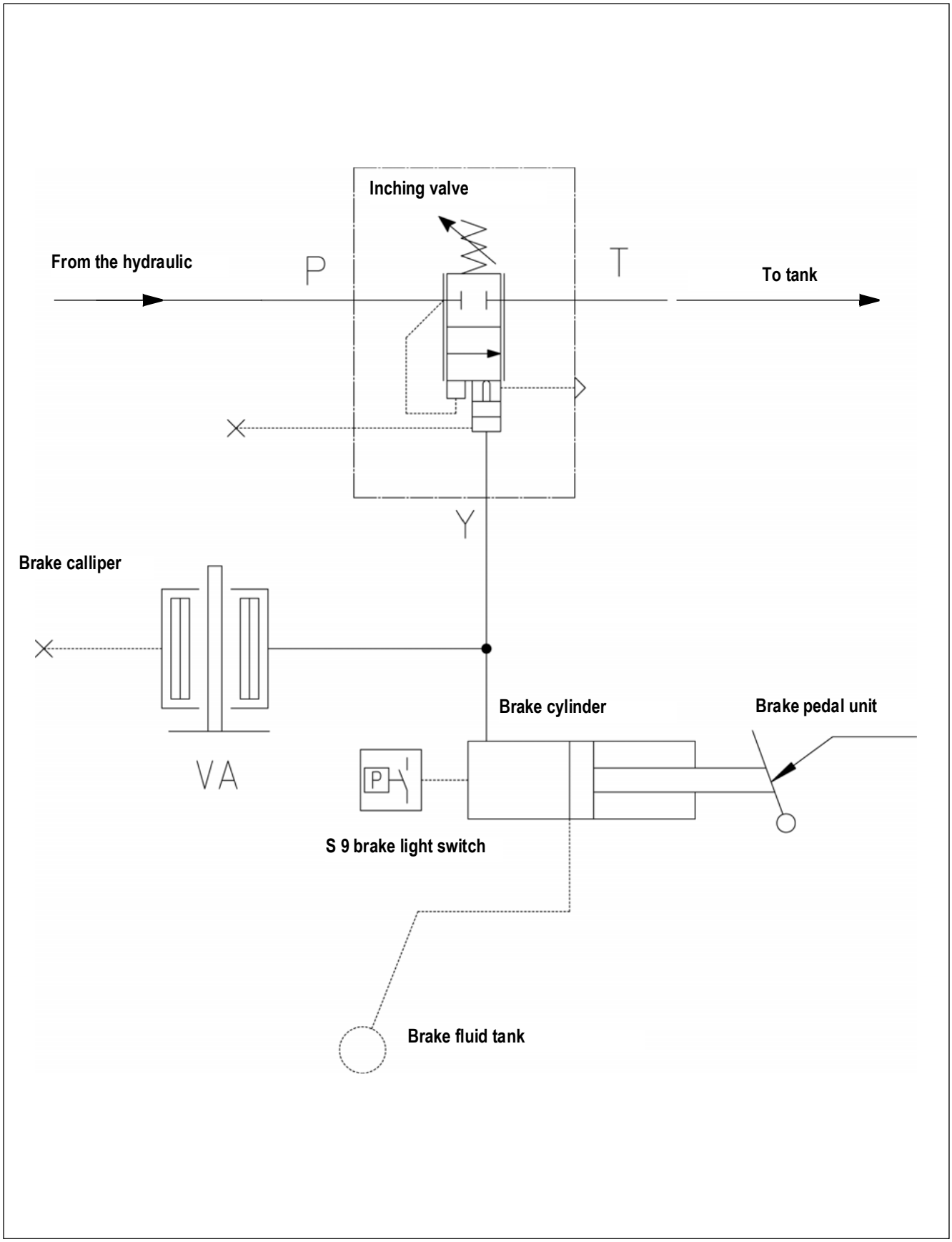
Y = control line from master brake cylinder

P = pressure line from variable displacement pump

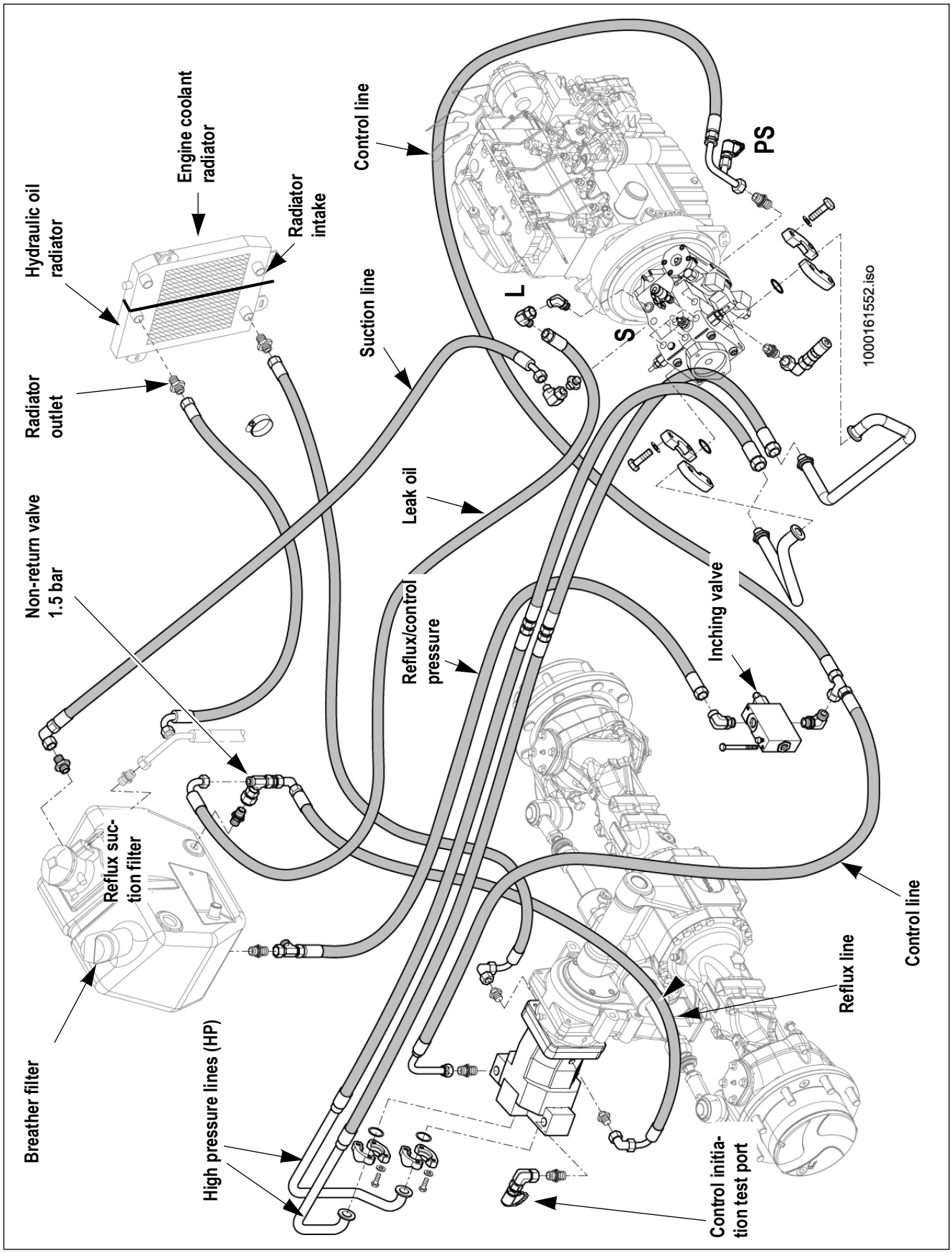
Caution!

For reasons of safety, no adjustments are allowed on the inching valve!

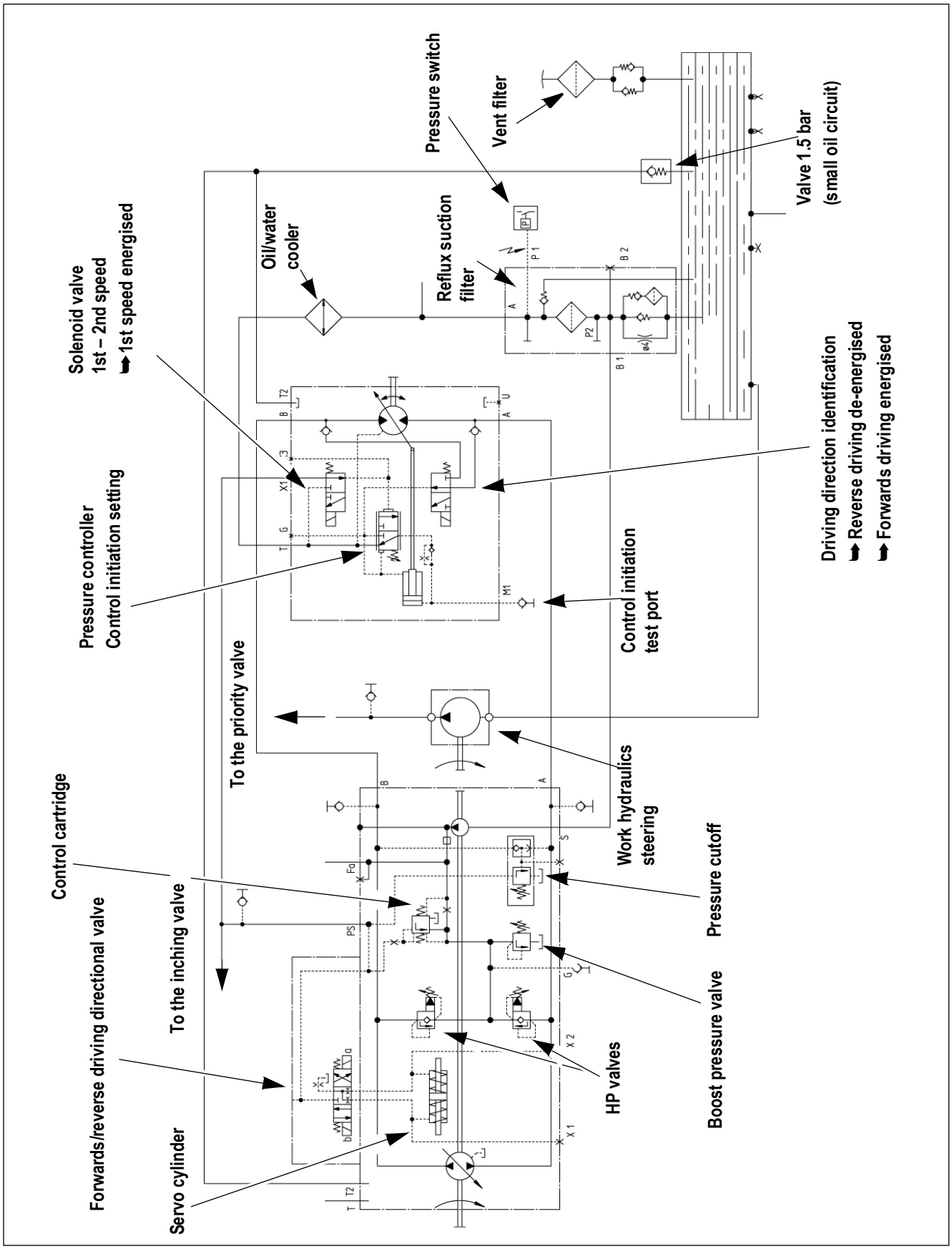
5.11 30 kph inching valve diagram



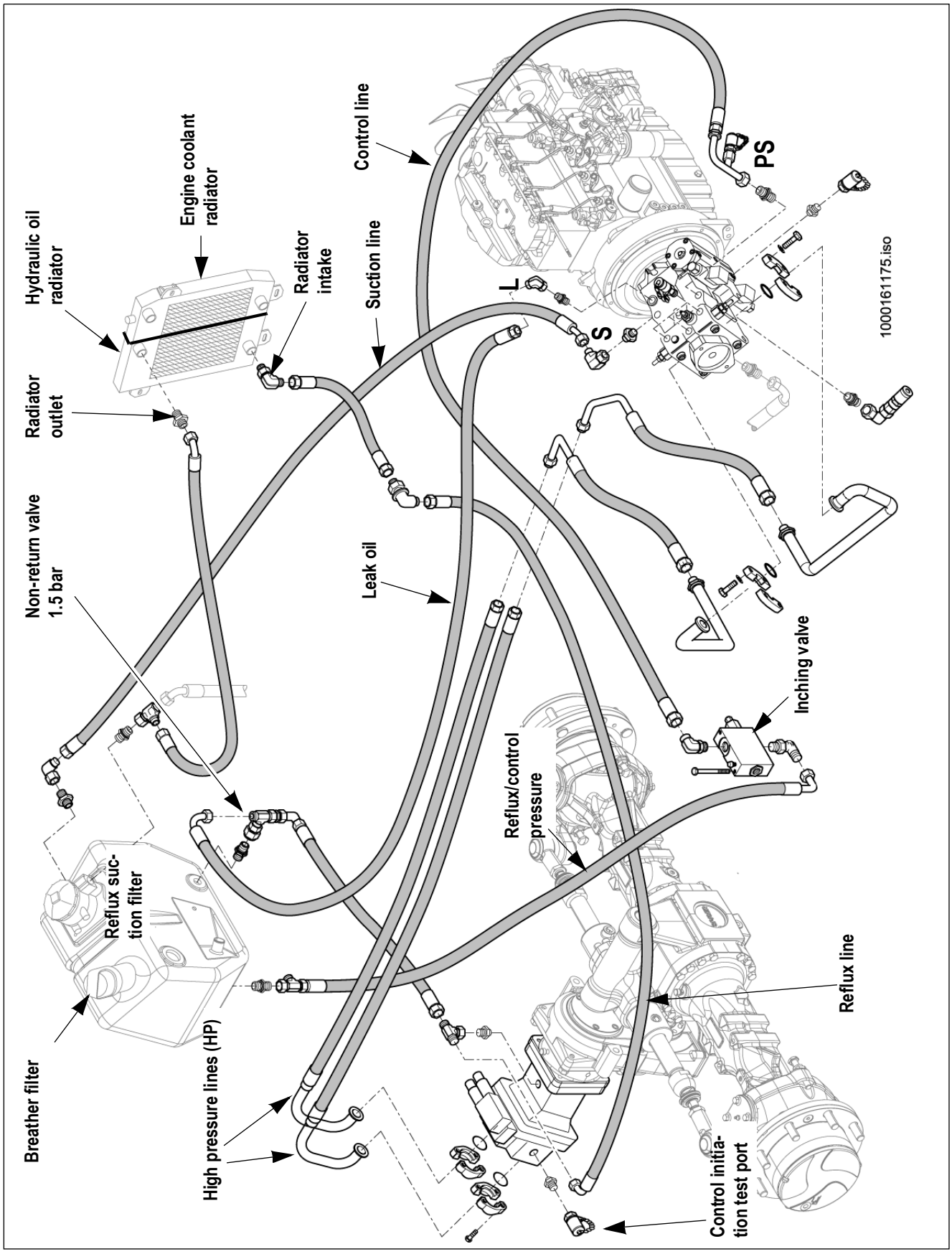
5.12 Drive circuit (20/30 kph) for models 347-03 (950), 347-04 (1150)



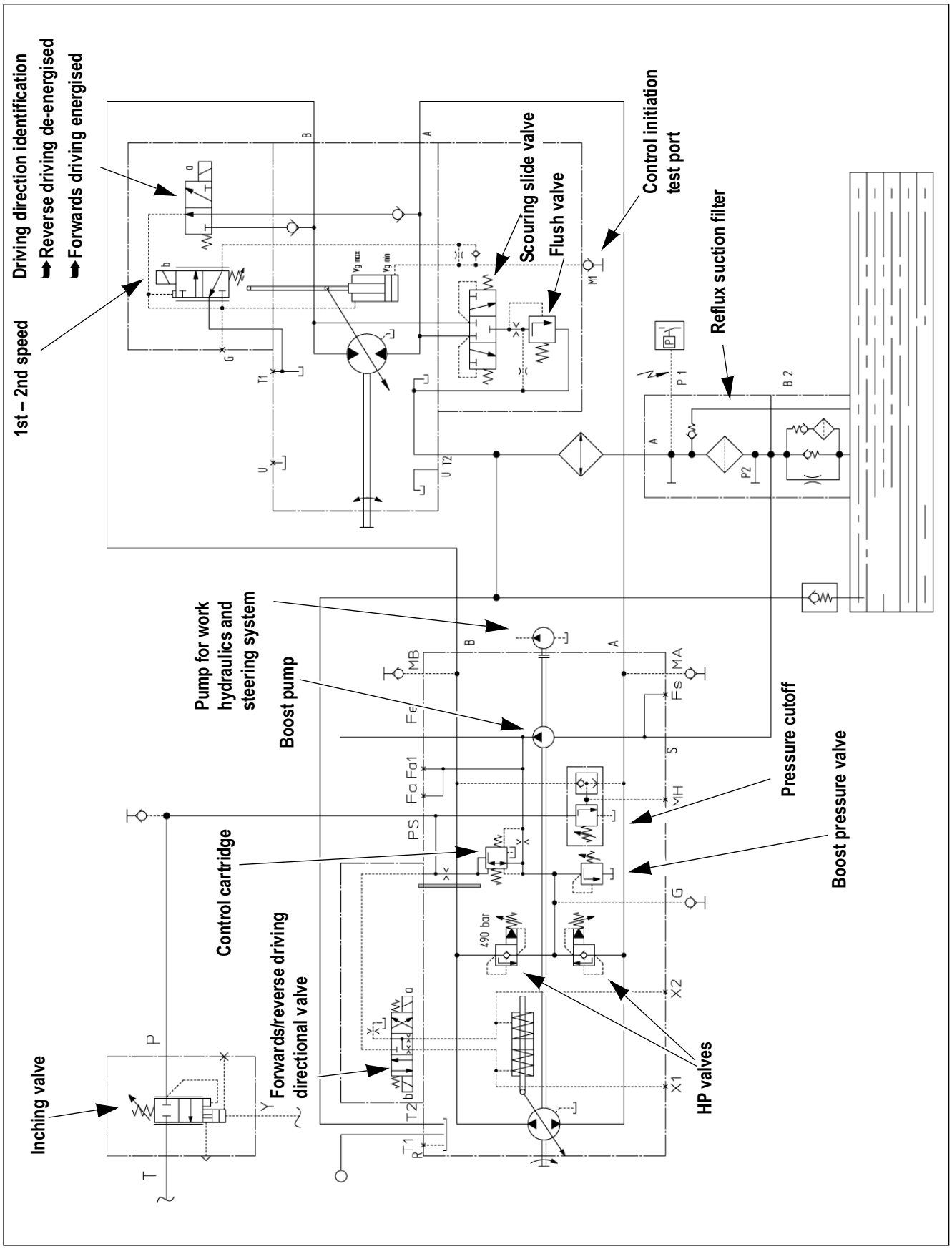
5.13 20 kph drive: diagram



5.14 Drive circuit (20 kph) for models 347-03 (950), 347-04 (1150)



5.15 Drive diagram (30 kph) for models 347-03 (950), 347-04 (1150)



5.16 Towing and transporting the machine

Safety instructions

- The machine may only be towed using suitable towing equipment (towing bar or cable) in connection with suitable towing facilities, such as a towing coupling, hooks and eyes!
- Move off slowly!
  Make sure no-one is dangerously close to the towing bar
- The machine may only be towed with a cable if the service brakes and steering are fully operational!

Getting ready for towing

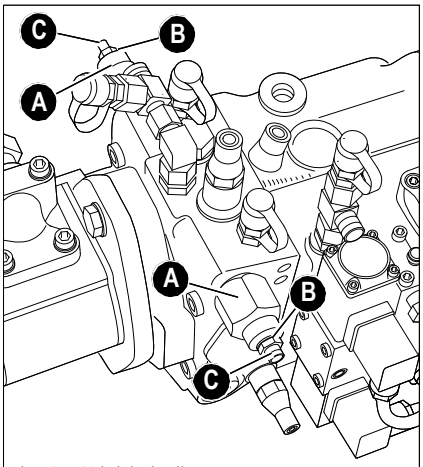


Fig. 127: 20 kph hydraulic pump

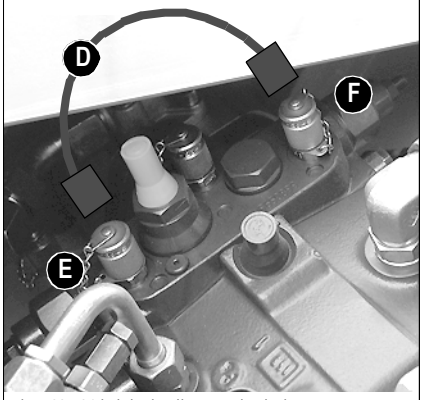


Fig. 128: 30 kph hydraulic pump (option)

Danger!

Turning the steering wheel requires greater effort if the diesel engine breaks down. Take this into account especially when towing the machine!

☞ *Use a towing bar!*

Caution!

The hydrostatic power train can be damaged when towing the machine!

☞ *Switch off the engine!*

☞ *Short-circuit the hydraulic circuit before towing (see below)*

☞ *Do not tow the machine for more than 100 meters and do not tow it faster than 3 – 4 kph!*

☞ *Tow away the machine as follows:*

- Fit an adequately sized towing bar to the towing facilities

20 kph hydraulic pump

☞ *Switch over the HP pressure relief valves **A** on the hydraulic pump. To do this:*

- Slacken hexagon lock nuts **B** on both HP valves **A**
- Screw in hexagon socket head screws **C** on both HP valves **A** until they are flush with lock nuts **B**
- Secure hexagon socket head screws **C** on both HP valves **A** with lock nuts **B**

30 kph hydraulic pump (option)

☞ *Mount hose **D** between test ports **E** and **F***

➥ The hose is included in the tool kit

☞ If possible, run the engine at idling speed when towing the machine

Once towing is over ...

☞ *... reset the HP valves **A** on the 20 kph hydraulic pump! To this effect, unscrew each of hexagon socket screws **C** as far as they will go and secure them with locknuts **B**, or*

☞ *Remove hose **D** in the case of the 30 kph hydraulic pump*

5.17 Test report for 20 kph model 347-03 (950)

Model:	Prod. no. variable displacement pump	Prod. no. variable displacement motor	Serial no.
_____	_____	_____	_____

Test conditions:	Oil temperature (rated): 50 – 60 °C Driving direction (rated): forwards

See page:	Test features:	Notes:		Actual value:	
–	Min. idling speed	Measured on the fan wheel	1100 – 1180 rpm		
–	Max. idling speed	Measured on the fan wheel	2920 – 2970 rpm		
5-21	Boost pressure	Max. engine speed	30 – 40 bar		
5-21	Control pressure	Max. engine speed Min. engine speed	28 – 29 bar About 6 bar		
5-21	Starting engine speed	2nd speed	1380 – 1500 rpm		
5-22	High pressure/drive pressure	2nd speed braked max. engine speed	470 – 520 bar		
5-23	Engine droop	1st speed braked max. engine speed 250 – 260 bar	2640 – 2760 rpm		
Hydraulic motor settings (variable displacement motor)					
5-24	Control piston pressure control initiation	2nd speed after braking	250 – 270 bar		
5-24	Wheel speed	Max. engine speed	95 – 100 rpm		

5.18 Test report for 20 kph model 347-04 (1150)

Model:	Prod. no. variable displacement pump	Prod. no. variable displacement motor	Serial no.
_____	_____	_____	_____

Test conditions:	Oil temperature (rated): 50 – 60 °C Driving direction (rated): forwards

See page:	Test features:	Notes:		Actual value:	
	Min. idling speed	Measured on the fan wheel	1200 – 1260 rpm		
	Max. idling speed	Measured on the fan wheel	2920 – 2970 rpm		
5-21	Boost pressure	Max. engine speed	30 – 40 bar		
5-21	Control pressure	Max. engine speed Min. engine speed	27 – 28 bar About 8 bar		
5-21	Starting engine speed	2nd speed	1380 – 1500 rpm		
5-23	High pressure/drive pressure	2nd speed braked max. engine speed	470 – 520 bar		
5-23	Engine droop Brake to 250 – 260 bar high pressure	1st speed range braked max. engine speed	2640 – 2760 rpm		

Hydraulic motor settings (variable displacement motor)

5-24	Control piston pressure control initiation (20 kph)	2nd speed after braking	250 – 270 bar		
5-24	Wheel speed Max. engine speed	Tyres 16/70-20 Tyres 405/70-24	100 – 105 rpm 90 – 95 rpm		

5.19 Test report for 30 kph model 347-03 (950)

Model:	Prod. no. variable displacement pump	Prod. no. variable displacement motor	Serial no.
_____	_____	_____	_____

Test conditions:	Oil temperature (rated): 50 – 60 °C Driving direction (rated): forwards

See page:	Test features:	Notes:		Actual value:	
–	Min. idling speed	Measured on the fan wheel	1100 – 1180 rpm		
–	Max. idling speed	Measured on the fan wheel	2920 – 2970 rpm		
5-21	Boost pressure	Max. engine speed	30 – 40 bar		
5-21	Control pressure	Max. engine speed Min. engine speed	23 – 24 bar About 8 bar		
5-21	Starting engine speed	2nd speed	1380 – 1500 rpm		
5-23	High pressure/drive pressure	2nd speed braked max. engine speed	470 – 520 bar		
5-23	Engine droop Brake to 190 – 200 bar high pressure	1st speed range braked max. engine speed	2640 – 2760 rpm		

Hydraulic motor settings (variable displacement motor)

5-24	Wheel speed	Max. engine speed	152 – 157 rpm		
5-24	Control piston pressure control initiation (30 kph)	2nd speed after braking	210 bar		

5.20 Test report for 30 kph model 347-04 (1150)

Model:	Prod. no. variable displacement pump	Prod. no. variable displacement motor	Serial no.
_____	_____	_____	_____

Test conditions:	Oil temperature (rated): 50 – 60 °C Driving direction (rated): forwards

See page:	Test features:	Notes:		Actual value:	
–	Min. idling speed	Measured on the fan wheel	1200 – 1260 rpm		
–	Max. idling speed	Measured on the fan wheel	2920 – 2970 rpm		
5-21	Boost pressure	Max. engine speed	30 – 40 bar		
5-21	Control pressure	Max. engine speed Min. engine speed	24 – 25 bar About 9 bar		
5-21	Starting engine speed	2nd speed	1440 – 1560 rpm		
5-23 5-23	High pressure Drive pressure	2nd speed braked max. engine speed	470 – 520 bar		
5-23	Engine droop Brake to 190 – 200 bar high pressure	1st speed range braked max. engine speed	2640 – 2760 rpm		

Hydraulic motor settings (variable displacement motor)

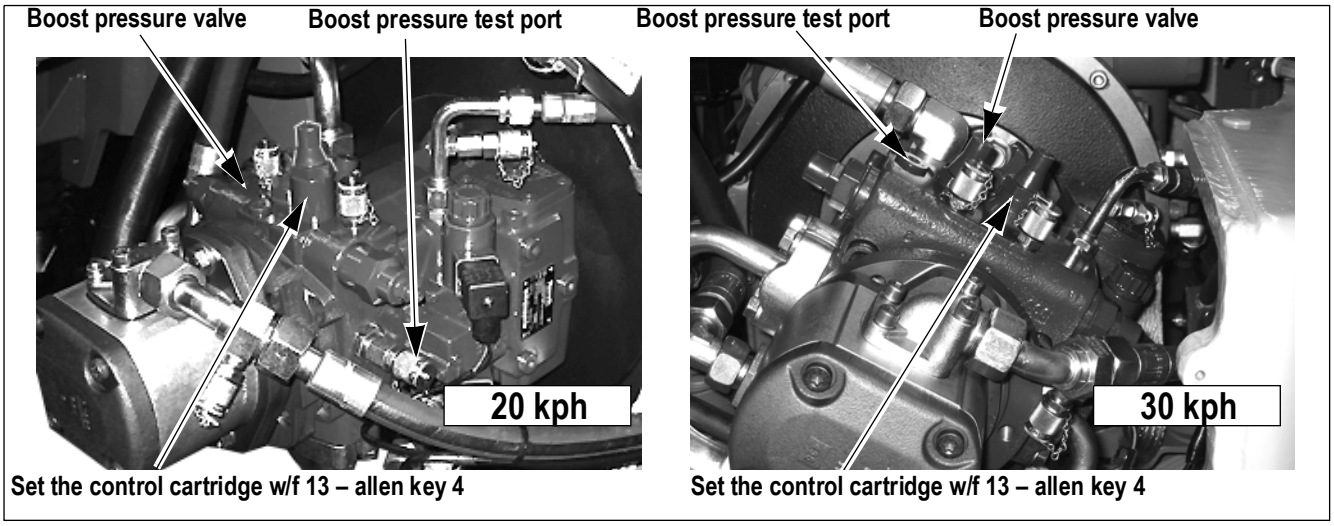
5-24	Wheel speed Max. engine speed	Tyres 16/70-20 Tyres 405/70-24	155 – 160 rpm 140 – 145 rpm		
5-24	Control piston pressure control initiation (30 kph)	2nd speed after braking	210 – 220 bar		

5.21 Adjustment work on power train

Important!

Run the machine warm before taking the measurement so the hydraulic system reaches its optimum operating temperature of 60 °C!
Brake the machine with the service brake when taking the measurement. Consequently, unscrew the brake-inching line from the hydraulic pump and fit a dummy cover! Only set the valves if the pressure has been released!

Adjusting boost pressure



Set the control cartridge w/f 13 – allen key 4

Set the control cartridge w/f 13 – allen key 4

- High pressure gauge (600 bar, 2 off)
- Pressure gauge (60 bar, 2 off)

Tachometer

The boost pressure valve can only be set by means of washers in the boost pressure valve

☞ *Remove the complete valve*

☞ *Set the pressure to **28 – 35 bar** by adding or removing washers*

Adjusting starting engine speed

20 kph for model 347-03 (950), 347-04 (1150)

➥ 50 bar high pressure, 1380 – 1500 rpm

30 kph for model 347-04 (1150)

➥ 50 bar high pressure, 1440 – 1560 rpm

☞ *Jack up the machine*

☞ *Select the driving direction*

☞ *Slowly increase the engine speed*

Set the starting speed on the control cartridge:

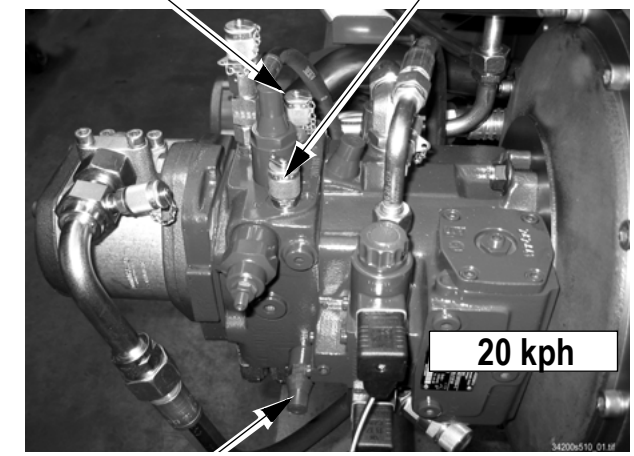
☞ *Screw in the control cartridge:*

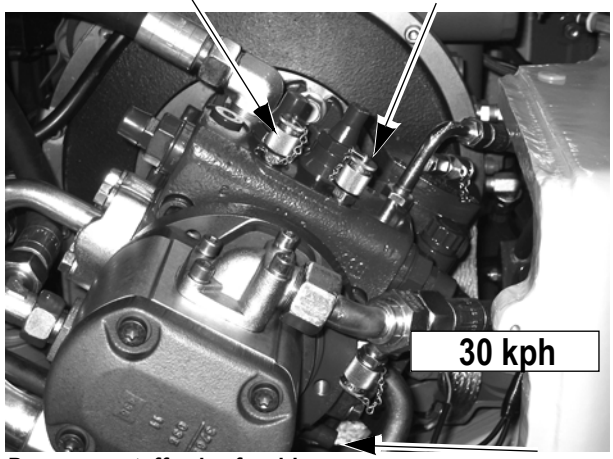
➥ Starts later

☞ *Unscrew the control cartridge*

➥ Starts sooner

Setting high pressure/drive pressure





Important!

The pressure cutoff corresponds to the hydraulic pressure measured at the forwards and reverse driving high pressure measurement ports!

☞ *Engage 1st or 2nd speed*

☞ *Drive the machine against "hydraulic resistance" (wheels not allowed to spin at full thrust)*

☞ *Read off the pressure on the forwards driving HP gauge*

Important!

Set the pressure at the pressure cutoff (w/f 13 – allen key 4)!

- High pressure/drive pressure must be **470 – 520 bar**

☞ *Screw in the pressure cutoff*

➥ Pressure increase

☞ *Unscrew the pressure cutoff*

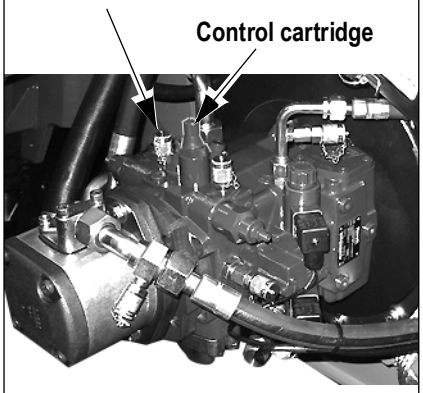
➥ Pressure reduction

Setting engine droop

High pressure test port

➥ **– Connect pressure gauge HP/ forwards driving 600 bar**

➥ **- Connect a tachometer (diesel engine)**



Setting: w/f 13/allen key 4

Measurement

☞ *Jack up the machine*

☞ *Pinch off brake inching*

☞ *Forwards driving direction, select 1st speed*

☞ *Brake the machine and at the same time, set full engine speed*

Measurement and adjustment values

➥ *- see Test report for 20 kph model 347-03 (950)* on page 5-17

➥ *- see Test report for 20 kph model 347-04 (1150)* on page 5-18

➥ *- see Test report for 30 kph model 347-03 (950)* on page 5-19

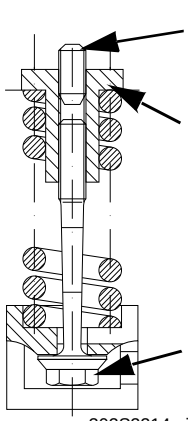
➥ *- see Test report for 30 kph model 347-04 (1150)* on page 5-20

If the engine droop is excessive:

☞ *Check the diesel engine*

☞ *Check the control cartridge*

Setting the secondary valves for forwards/reverse driving



Remove valve completely (w/f 32)

Important!

Pressure setting of secondary valves: about 10 % higher than pressure cutoff!

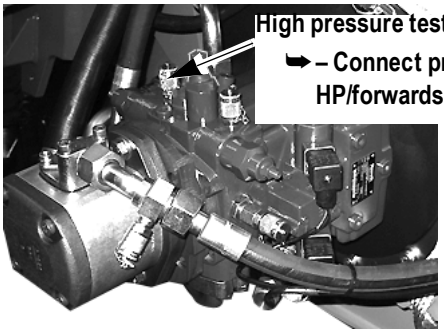
☞ *Set pressure cutoff to "hydraulic resistance"*

☞ *Connect the forwards – reverse driving high pressure gauges*

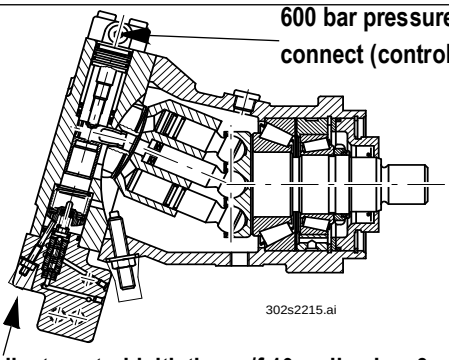
☞ *Drive the machine against hydraulic resistance*

☞ *Setting: see instructions on the left*

Setting control initiation on the variable displacement motor



High pressure gauge forwards driving 600 bar



Adjust control initiation w/f 10 – allen key 3
- Screw in = pressure increase
- Unscrew = pressure reduction

☞ *Jack up the machine*

☞ *Pinch off brake inching*

☞ *Forwards driving direction, select 2nd speed*

☞ *Run the diesel engine to full speed*

☞ *Slowly brake the machine with the service brake*

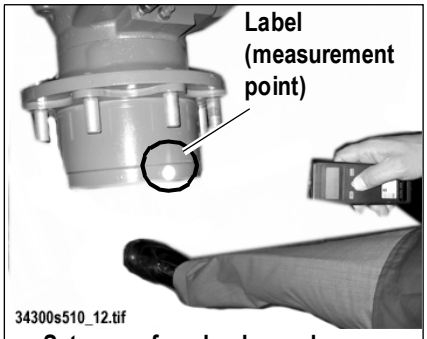
➥ Pressure on pressure gauge (forwards driving high pressure) and control piston slowly rises

Important!

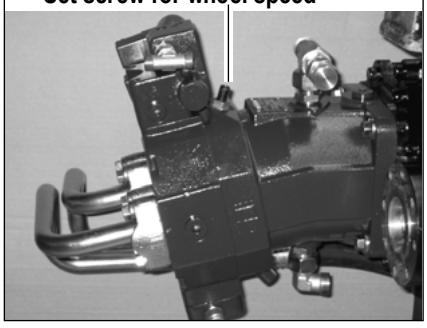
When the pressure in the control piston drops rapidly, **high pressure (forwards driving)** must be

- **About 250 – 270 bar** at 20 kph, and **about 210 – 220 bar** at 30 kph

Setting the wheel speed



Set screw for wheel speed



Measurement and adjustment values

➥ - *see Test report for 20 kph model 347-03 (950)* on page 5-17

➥ - *see Test report for 20 kph model 347-04 (1150)* on page 5-18

➥ - *see Test report for 30 kph model 347-03 (950)* on page 5-19

➥ - *see Test report for 30 kph model 347-04 (1150)* on page 5-20

☞ *Jack up the machine*

☞ *Forwards driving direction, select 2nd speed*

☞ *Run the diesel engine to full speed*

☞ *Read off the wheel speed with a tachometer*

Speed is adjusted at the variable displacement motor

☞ *Unscrew the set screw*

➥ Wheel speed is increased

☞ *Screw in the set screw*

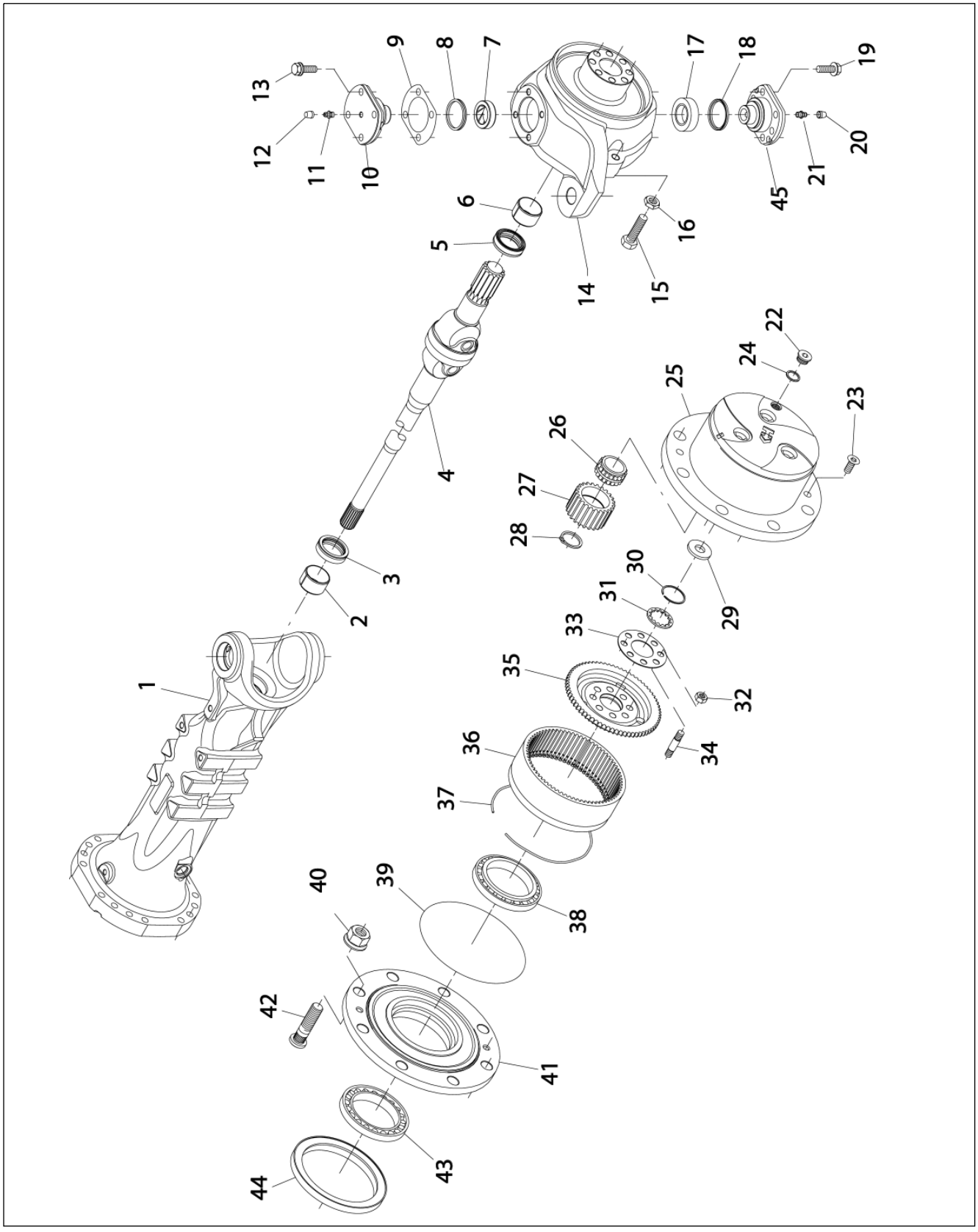
➥ Wheel speed is reduced

Notes:

Axles

6 Axles

6.1 Axle overview



6.2 Front axle screw connections

CONVERSION TABLES - TABELLE DI CONVERSIONE - UMRECHNUNGSTABELLEN
TABLAS DE CONVERSION - TABLEAUX DE CONVERSION

Units of pressure - Unità di pressione - Druckeinheiten
Unidad de presión - Unités de pression: 1 Atm ≅ 1 bar ≅ 10^5 Pa ≅ 14.4 Psi

Units of weight - Unità di peso - Gewichtseinheiten
Unidad de peso - Unités de poids

	N	daN	kN	kg	lbs
1N	1	0,1	0,001	0,102	0,225
1daN	10	1	0,01	1,02	2,25
1kN	1000	100	1	102	225
1kg	9,81	0,981	0,00981	1	2,205

Units of torque - Unità di coppia - Drehmomenteinheiten
Unidad de par - Unités de couple

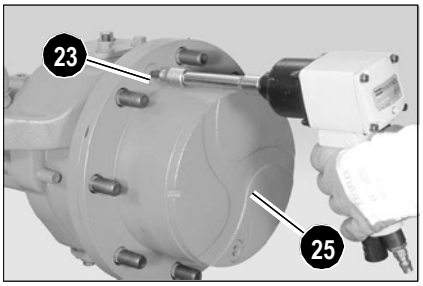
	Nm	daNm	kNm	kgm	lb-in
1Nm	1	0,1	0,001	0,102	8,854
1daNm	10	1	0,01	1,02	88,54
1kNm	1000	100	1	102	8854
1kgm	9,81	0,981	0,00981	1	86,8
1lb-in	0,1129	0,01129	0,0001129	0,01152	1

TIGHTENING TORQUES - COPPIE DI SERRAGGIO - ANZIEHDREHMOMENTE
PARES DE TORSION - COUPLES DE SERRAGE

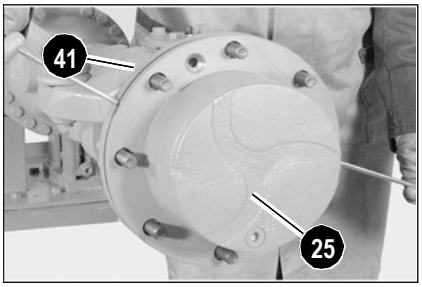
Unit - Unità di misura - Meßeinheiten - Unidad de medida - Unités de mesure: Nm

SIZE OF BOLT MISURA VITE SCHRAUBENMASS TAMAÑO TORNILLO MESURE VIS		TYPE OF BOLT - TIPO VITE - GEWINDE - TIPO DE TORNILLO - TYPE DE VIS					
		8.8		10.9		12.9	
		Normali	Normali + Loctite 270	Normali	Normali + Loctite 270	Normali	Normali + Loctite 270
COARSE PITCH - PASSO GROSSO - GROßER SCHRITT - PASO GRUESO - GROS PAS	M6 x 1	9,5-10,5	10,5-11,5	14,3-15,7	15,2-16,8	16,2-17,8	18,1-20,0
	M8 x 1,25	23,8-26,2	25,6-28,4	34,2-37,8	36,7-40,5	39,0-43,0	43,7-48,3
	M10 x 1,5	48-53	52-58	68-75	73-81	80-88	88-97
	M12 x 1,75	82-91	90-100	116-128	126-139	139-153	152-168
	M14 x 2	129-143	143-158	182-202	200-221	221-244	238-263
	M16 x 2	200-221	219-242	283-312	309-341	337-373	371-410
	M18 x 2,5	276-305	299-331	390-431	428-473	466-515	509-562
	M20 x 2,5	390-431	428-473	553-611	603-667	660-730	722-798
	M22 x 2,5	523-578	575-635	746-824	817-903	893-987	974-1076
	M24 x 3	675-746	732-809	950-1050	1040-1150	1140-1260	1240-1370
	M27 x 3	998-1103	1088-1202	1411-1559	1539-1701	1710-1890	1838-2032
	M30 x 3,5	1378-1523	1473-1628	1914-2115	2085-2305	2280-2520	2494-2757
FINE PITCH - PASSO FINE - KLEINER SCHRITT PASO FINO - PAS FIN	M8 x 1	25,7-28,3	27,5-30,5	36,2-39,8	40,0-44,0	42,8-47,2	47,5-52,5
	M10 x 1,25	49,4-54,6	55,2-61,0	71,5-78,5	78,0-86,0	86,0-94,0	93,0-103,0
	M12 x 1,25	90-100	98-109	128-142	139-154	152-168	166-184
	M12 x 1,5	86-95	94-104	120-132	133-147	143-158	159-175
	M14 x 1,5	143-158	157-173	200-222	219-242	238-263	261-289
	M16 x 1,5	214-236	233-257	302-334	333-368	361-399	394-436
	M18 x 1,5	312-345	342-378	442-489	485-536	527-583	580-641
	M20 x 1,5	437-483	475-525	613-677	674-745	736-814	808-893
	M22 x 1,5	581-642	637-704	822-908	903-998	998-1103	1078-1191
	M24 x 2	741-819	808-893	1045-1155	1140-1260	1235-1365	1363-1507
	M27 x 2	1083-1197	1178-1302	1520-1680	1672-1848	1834-2027	2000-2210
	M30 x 2	1511-1670	1648-1822	2138-2363	2332-2577	2565-2835	2788-3082

6.3 Sealing work (joint housing/axle carrier)

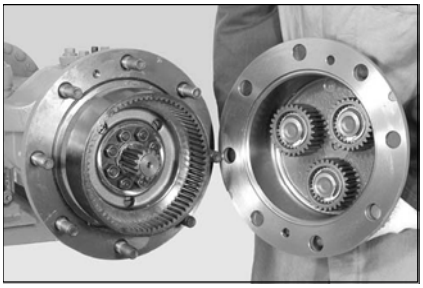


☞ *Unscrew fastening screws **23** from planetary cover **25** (allen key 8 mm)*



☞ *Remove planetary cover **25** from the joint housing by applying pressure with a screwdriver*

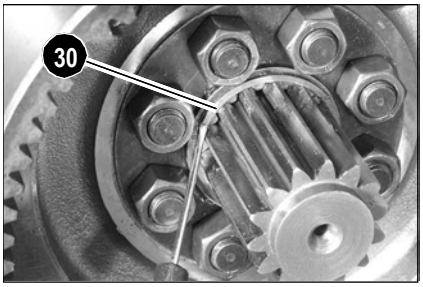
➥ Both parts **25** and **41** of the housing are sealed with an O-ring



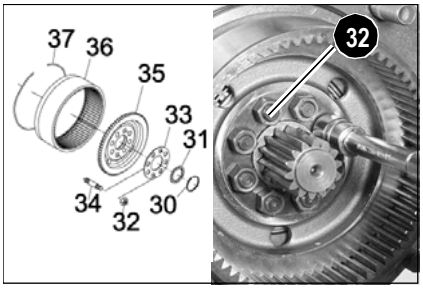
☞ *Remove the complete planetary cover*

➥ There are three planetary gears in each planetary drive

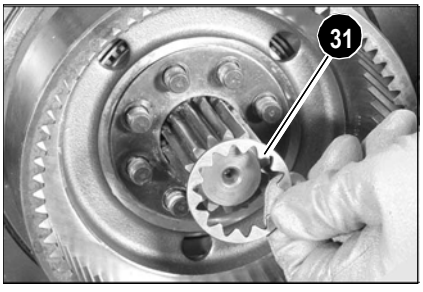
➥ 28 rollers per wheel are used for the planetary gear bearing



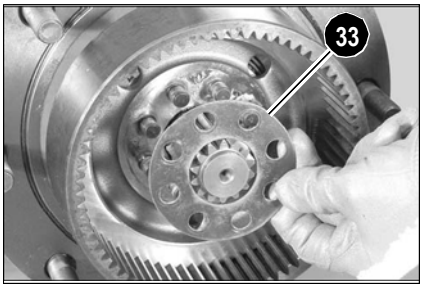
☞ *Remove circlip **30***



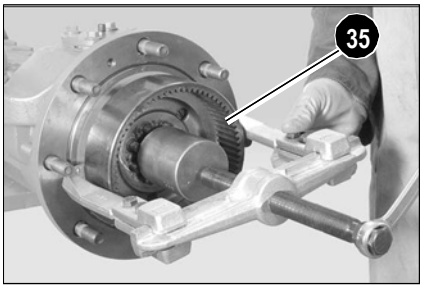
☞ *Unscrew fastening nuts **32** (w/f 19)*



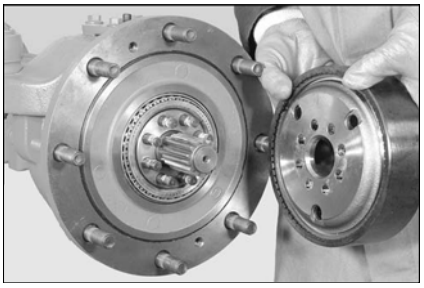
☞ *Remove thrust washer **31***



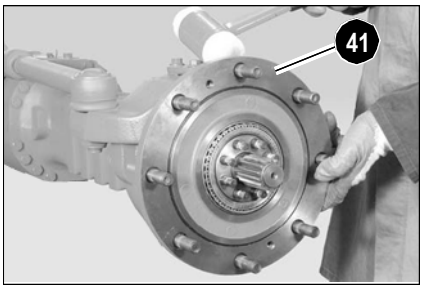
☞ *Remove tab washer **33***



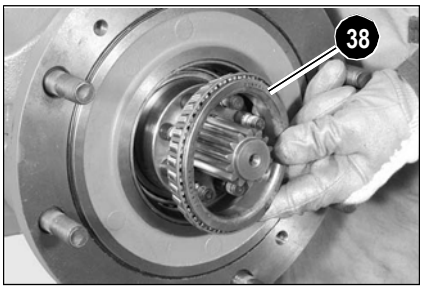
☞ *Remove internal-geared wheel **35** by applying pressure with an extractor or a mounting lever*



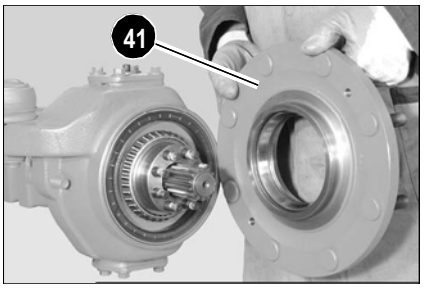
☞ *Remove the internal-geared wheel*



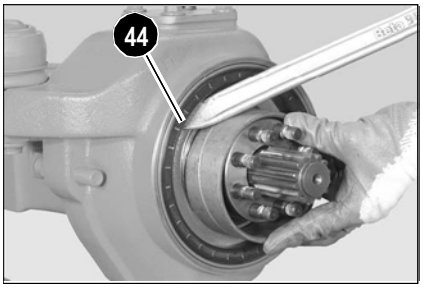
☞ *Remove wheel hub **41** with a plastic hammer*



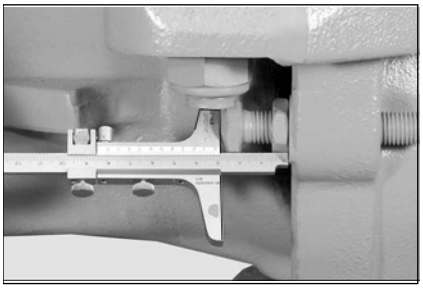
☞ *Remove inner ring **38** from the bearing*



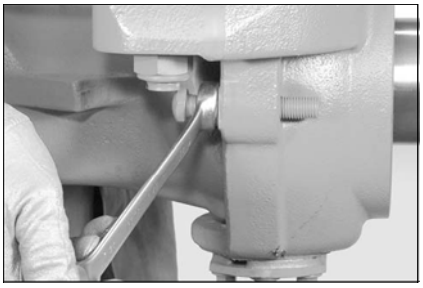
☞ *Remove wheel hub **41***



☞ *Remove cassette ring **44** with a mounting lever*

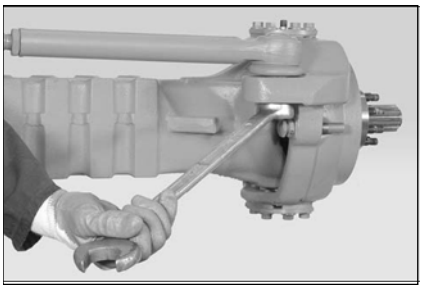


☞ *Make a note of the measure of the screw restricting the steering angle*

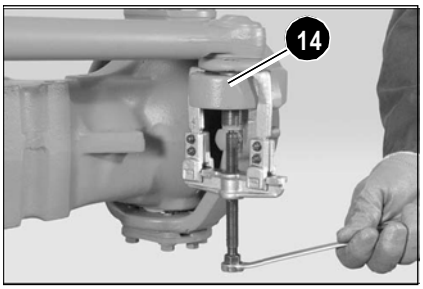


☞ *Slacken the locknut and screw in the stop screw*

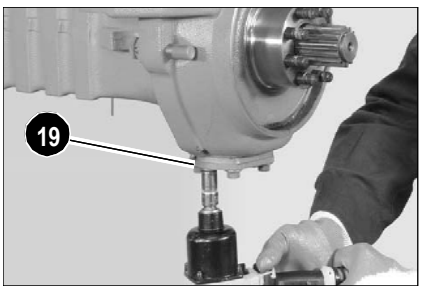
➥ in order to be able to slacken the fastening nut of the track rod



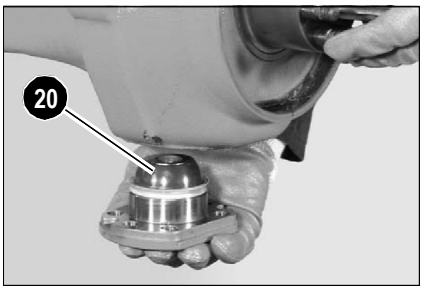
☞ *Unscrew fastening nut (w/f 30) of the track rod*



☞ *Remove the track rod from joint housing **14** by applying pressure with an extractor*

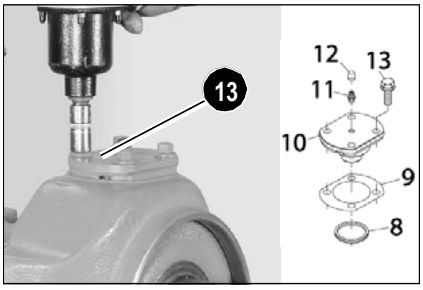


☞ *Unscrew fastening screws **19** from the lower planetary drive bearing (w/f 15)*

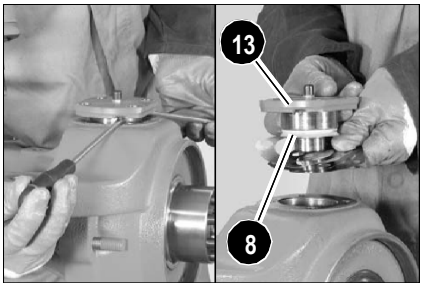


☞ *Remove bearing pin **20***

➥ Lower pin with ball half

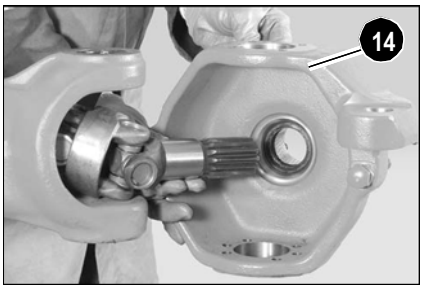


☞ *Unscrew fastening screw **13** from the upper bearing pin (w/f 15)*

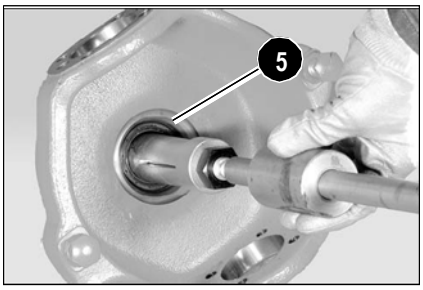


☞ *Remove bearing pin **10** by applying pressure with two mounting levers*

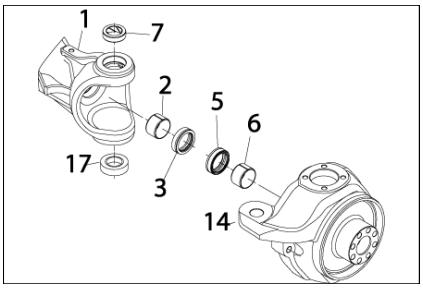
☞ *Remove sealing ring **8***



☞ *Remove the complete joint housing **14***



☞ *Remove sealing ring **5***

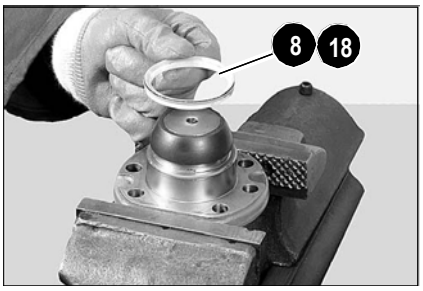


☞ *Joint housing **5** and axle carrier **3** sealing*



☞ *Remove the double cardan shaft*

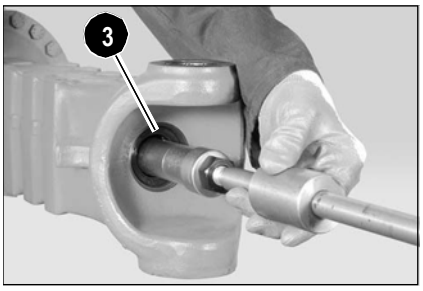
➥ There is no risk of anything falling into the differential



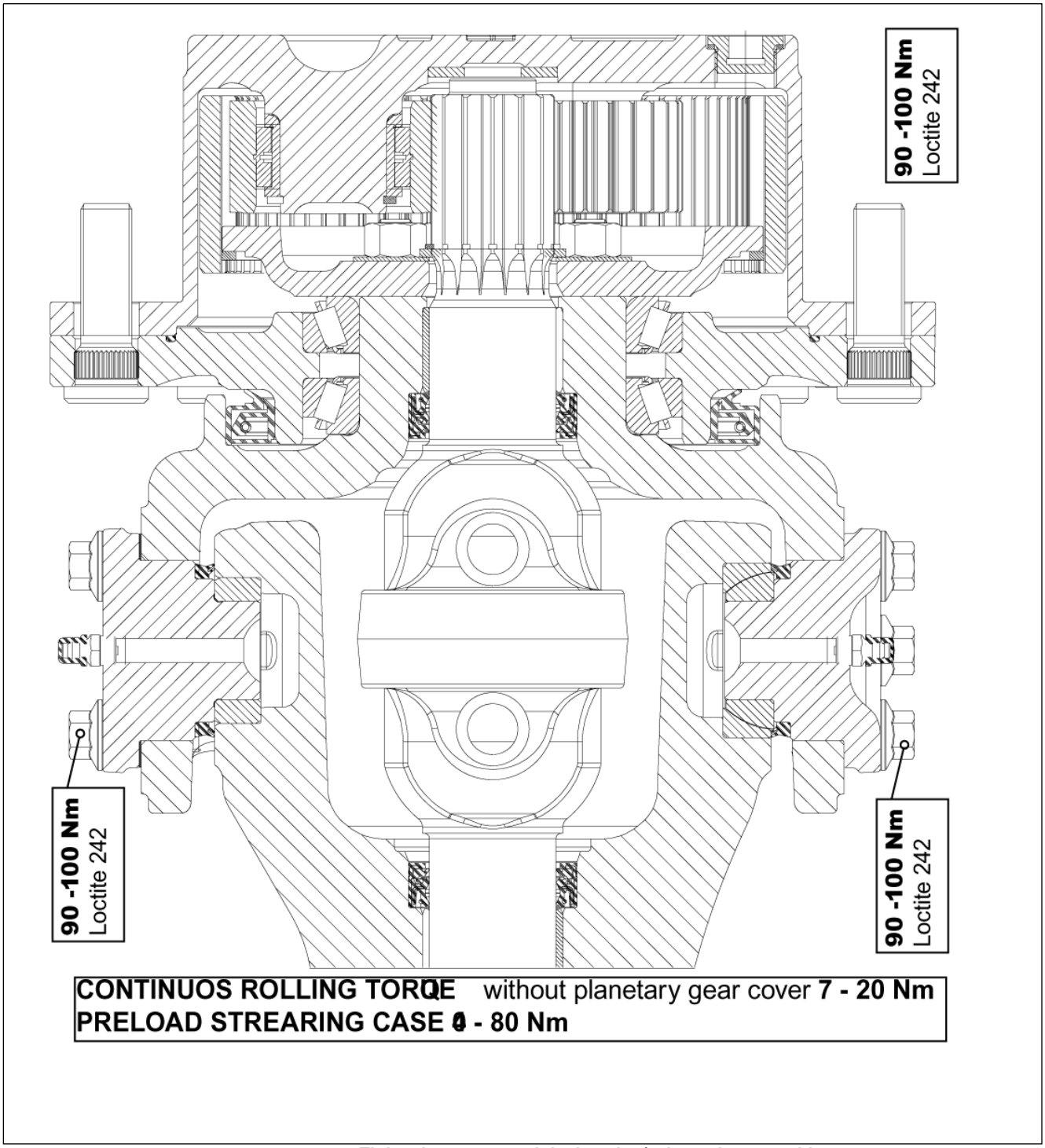
☞ *Remove sealing rings **8** and **18** from the pin*

Caution!

Make sure they are placed in the correct position



☞ *Remove sealing ring **3** from the axle carrier*

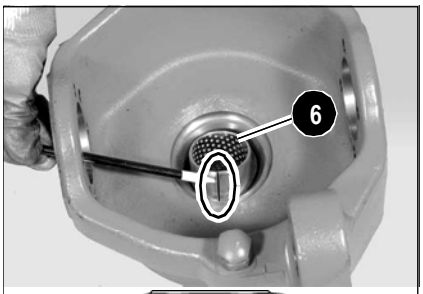


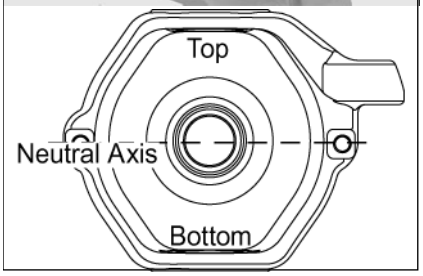
Tightening torques – joint housing/axle carrier assembly

☞ *Even rolling resistance of* ***7 – 20 Nm*** *(without planetary gears)*

☞ *Initial stress of bearing pins*

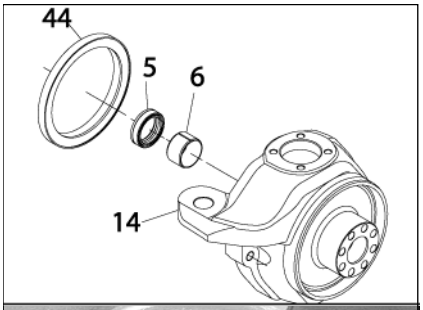
➥ Torque about **40 – 80 Nm**



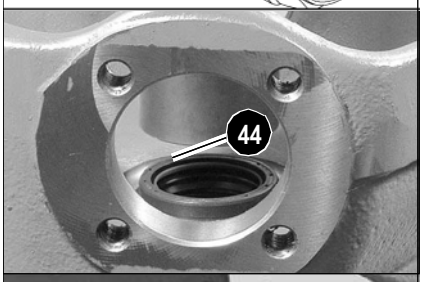


Bushing **6** is not slotted

☞ *Use an adapter to mount the bushing*



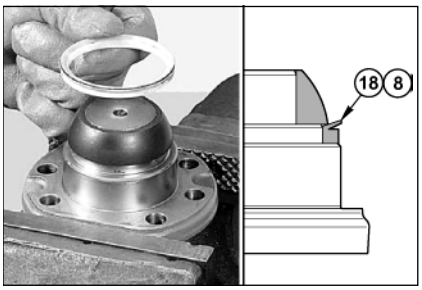
☞ *Mount sealing ring **5** and cassette ring **44** in the joint housing with an adapter*





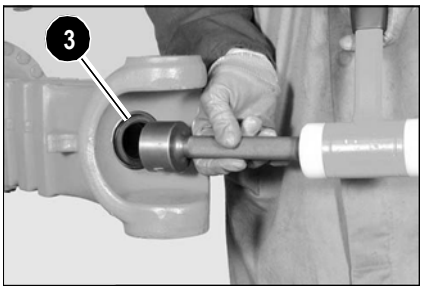
Caution!

Insert cassette ring **44** without grease!

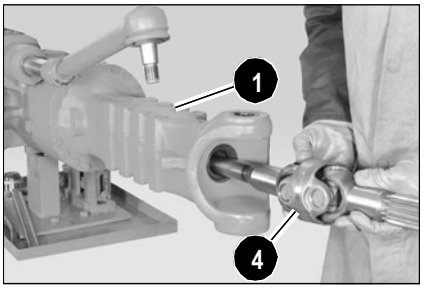


☞ *Mount sealing rings **8** and **18***

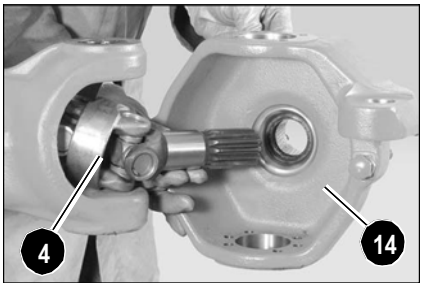
➥ Larger diameter upwards



☞ *Mount sealing ring **3** in the axle carrier with an adapter*



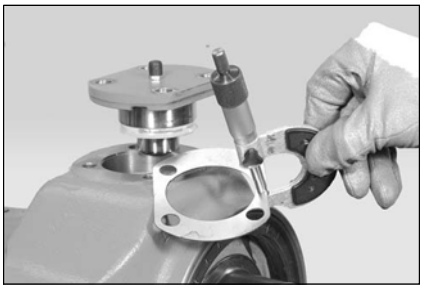
☞ *Insert double cardan shaft **4** into axle carrier **1***



☞ *Carefully place joint housing **14** onto the axle carrier*

Caution!

Do not damage the sealing ring!

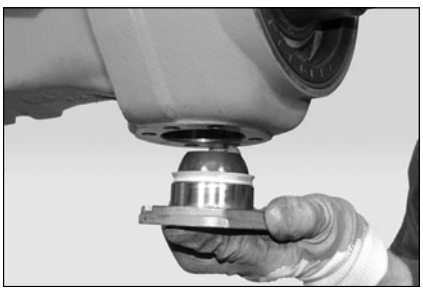


☞ *Place **0.4 – 0.7 mm** spacers on the upper pin*



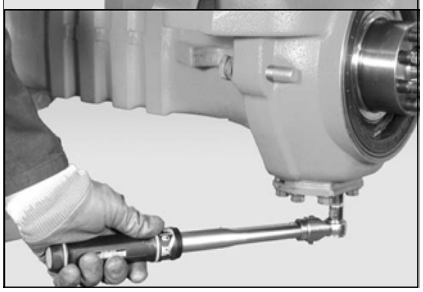
☞ *Mount the upper pin with a sealing ring*

➥ Larger diameter downwards



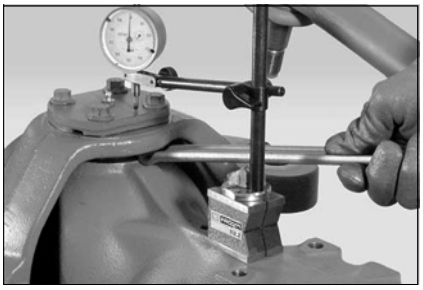
☞ *Mount the lower pin with a sealing ring*





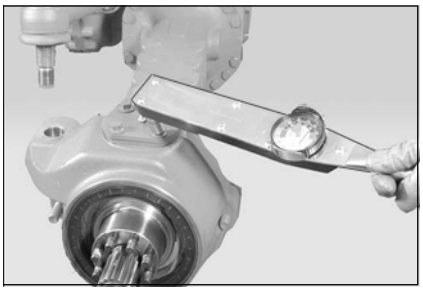
☞ *Tighten the fastening screws of the upper and lower bearing pins*

➥ **90 – 100 Nm**



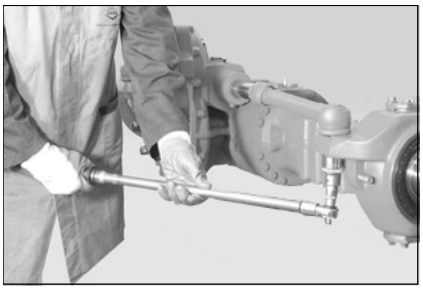
☞ *Check vertical play with a mounting lever and a dial gauge*

➥ No play allowed!



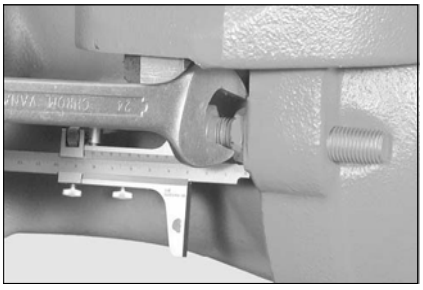
☞ *Check the tightening torque of the planetary drive bearing*

➥ The tightening torque must be **40 – 80 Nm**



☞ *Hook the track rod of the steering ram into the joint housing and tighten it*

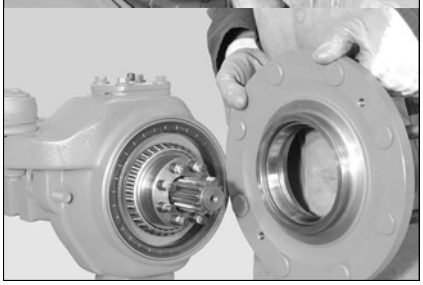
➥ Tightening torque **270 – 300 Nm**

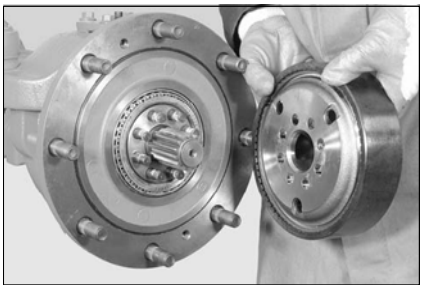


☞ *Adjust the steering angle with the stop screw to the measure taken before*

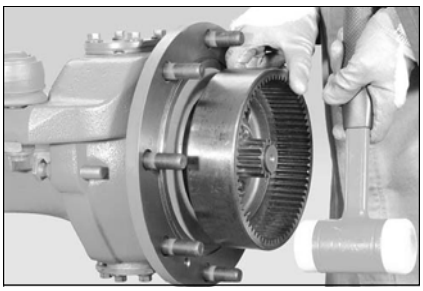


☞ *Mount the bearing and the wheel hub*

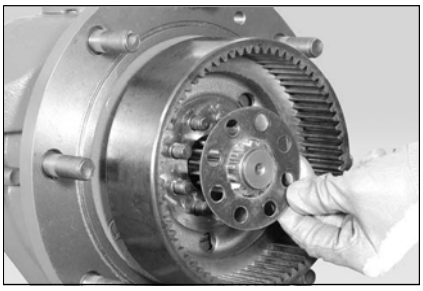




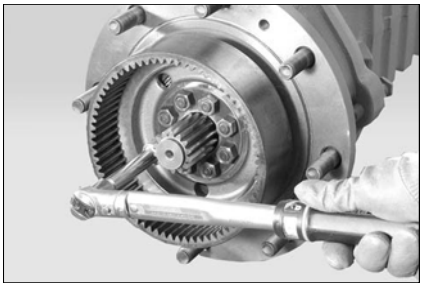
☞ *Mount the internal-geared wheel*



☞ *Mount the internal-geared wheel onto the seat of the planetary carrier with a plastic hammer*



☞ *Mount the lock washer*

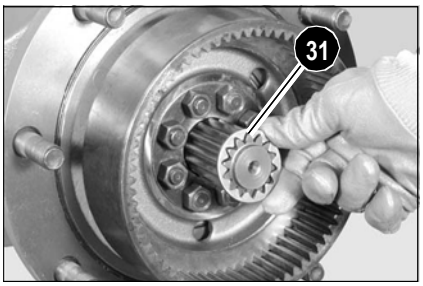


☞ *Put the fastening nuts in place with Loctite 242 and*

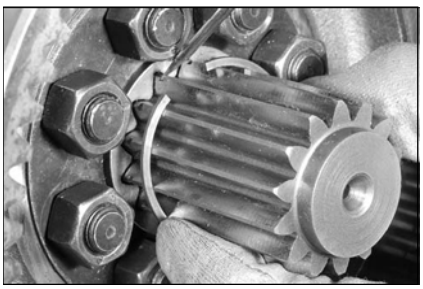
☞ *tighten them in 2 steps with a torque wrench (w/f 19)*

➥ **1st pass = 90 Nm**

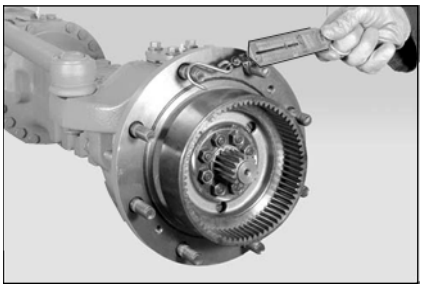
➥ **2nd pass = 100 Nm**



☞ *Mount thrust washer **31***



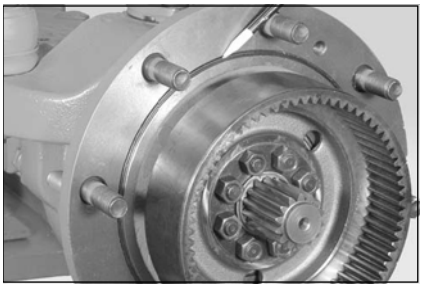
☞ *Mount the circlip*



☞ *Check the rolling resistance of the wheel bearings*

➥Check without the planetary gears

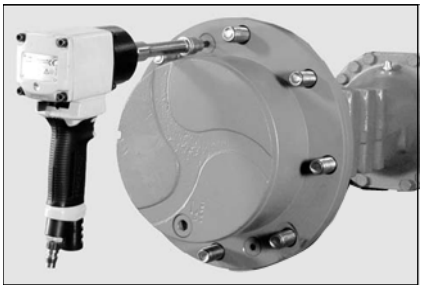
➥**7 – 20 Nm**



☞ *Mount the O-ring*



☞ *Mount the planetary cover*



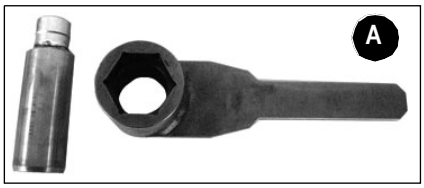
☞ *Mount and tighten the fastening screws*

➥Allen key 8 mm

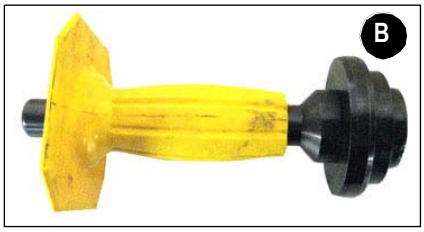
☞ *Fil in oil*

☞ *Carry out a test run and check for leaks*

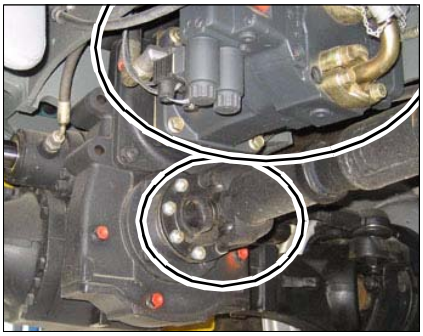
6.4 Sealing the rear axle in case of oil migration (axle/gearbox)



☞ *Special tool **A***



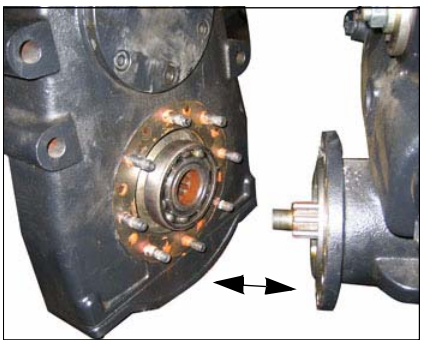
☞ *Special tool **B***



☞ *Remove the cardan shaft and the variable displacement motor*

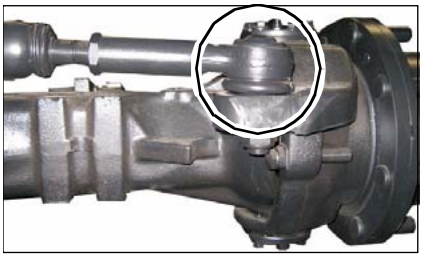


☞ *Remove the intermediate gearbox from the flange (w/f 17)*



☞ *Remove the intermediate gearbox and the bearing from the axle*

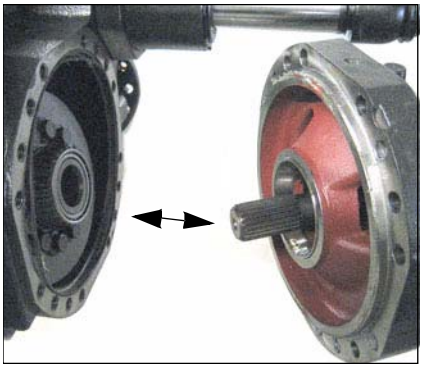
☞ *If the roller bearing remains in the axle, pull it out with an extractor*



☞ *Remove the track-rod end on the right in driving direction (w/f 36)*



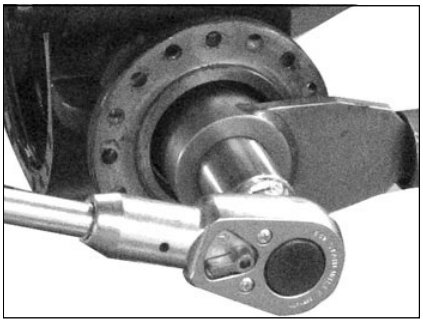
☞ *Drain the gearbox oil from the rear axle differential*



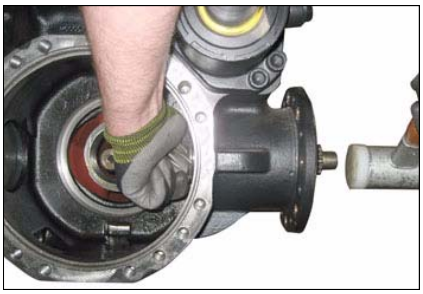
☞ *Remove the axle half on the right in driving direction (w/f 19)*



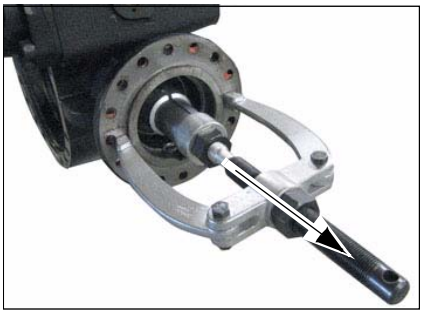
☞ *Remove the differential and the O-ring*



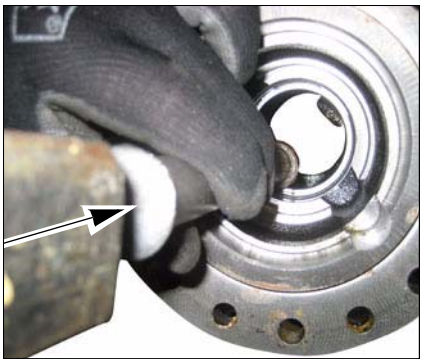
☞ *Remove the nut from the pinion shaft with special tool “A”* *on page 6-14*



☞ *Expel the pinion shaft backwards into the housing with a plastic hammer*



☞ *Remove the outer bearing shell with an inside extractor*



☞ *Remove the rotary shaft lip seal*

☞ *Drive out the inner bearing shell towards the housing by means of a soft drift*

➥ Take care not to damage the spacers





☞ *Remove the circlip and the cover*

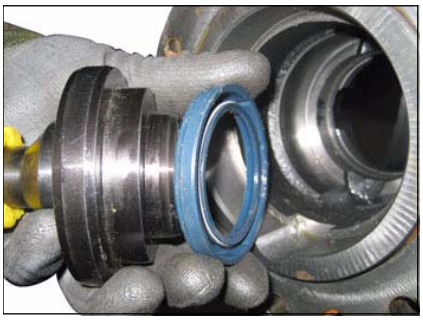
6.5 Assembly



☞ *Mount a new bearing shell with spacers*
(the number of spacers can vary)

➥ The old spacers can be used if the old gear drive is used

☞ *Setting – see Setting the gear drive on page 6-20*



☞ *Mount the rotary shaft lip seal with the special tool ("B" on page 6-14)*

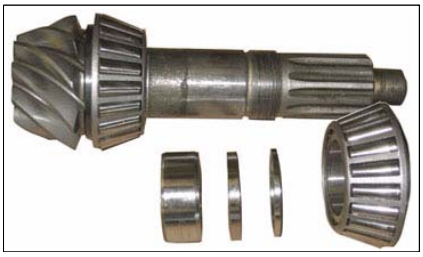
➥ Drive in the rotary shaft lip seal until the mandrel makes contact

☞ *Apply a thin coat of grease to the rotary shaft lip seal*

➥ Make sure it is placed in the correct position: rotary shaft lip seal with the opening towards the housing



☞ *Mount the new bearing shell on the front side with the special tool ("B" on page 6-14)*



☞ *Mount the new taper roller bearing on the pinion shaft*

☞ *Then put the spacer sleeve in place*

☞ *Then place the spacer for the bearing pre-tension*

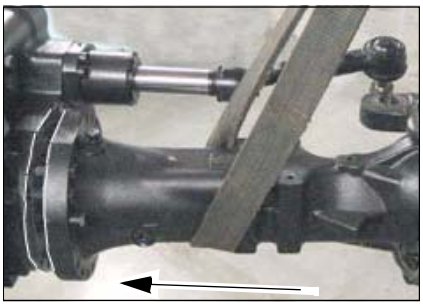


☞ *Mount the pinion shaft in the housing*

☞ *Tighten the nut of the pinion shaft with the special tool ("A" on page 6-14) and Loctite 270, to 400 – 500 Nm*

☞ *The rolling resistance should be 80 – 90 Nm*

➥ If the rolling resistance is not reached, modify the spacer for the bearing pre-tension

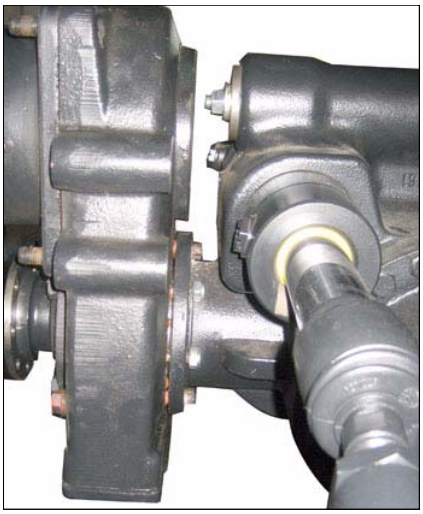


☞ *Mount the differential*

☞ *Mount the new O-ring on the axle half*

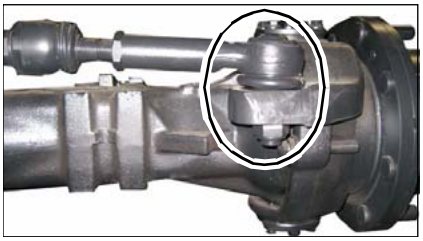
☞ *Mount the axle half*

➥ Tighten the screws with Loctite 242, to 128 Nm



☞ *Mount the intermediate gearbox*

➥ Tighten the screws with Loctite 242, to 129 – 150 Nm



☞ *Mount the track-rod end and tighten it to 300 Nm*

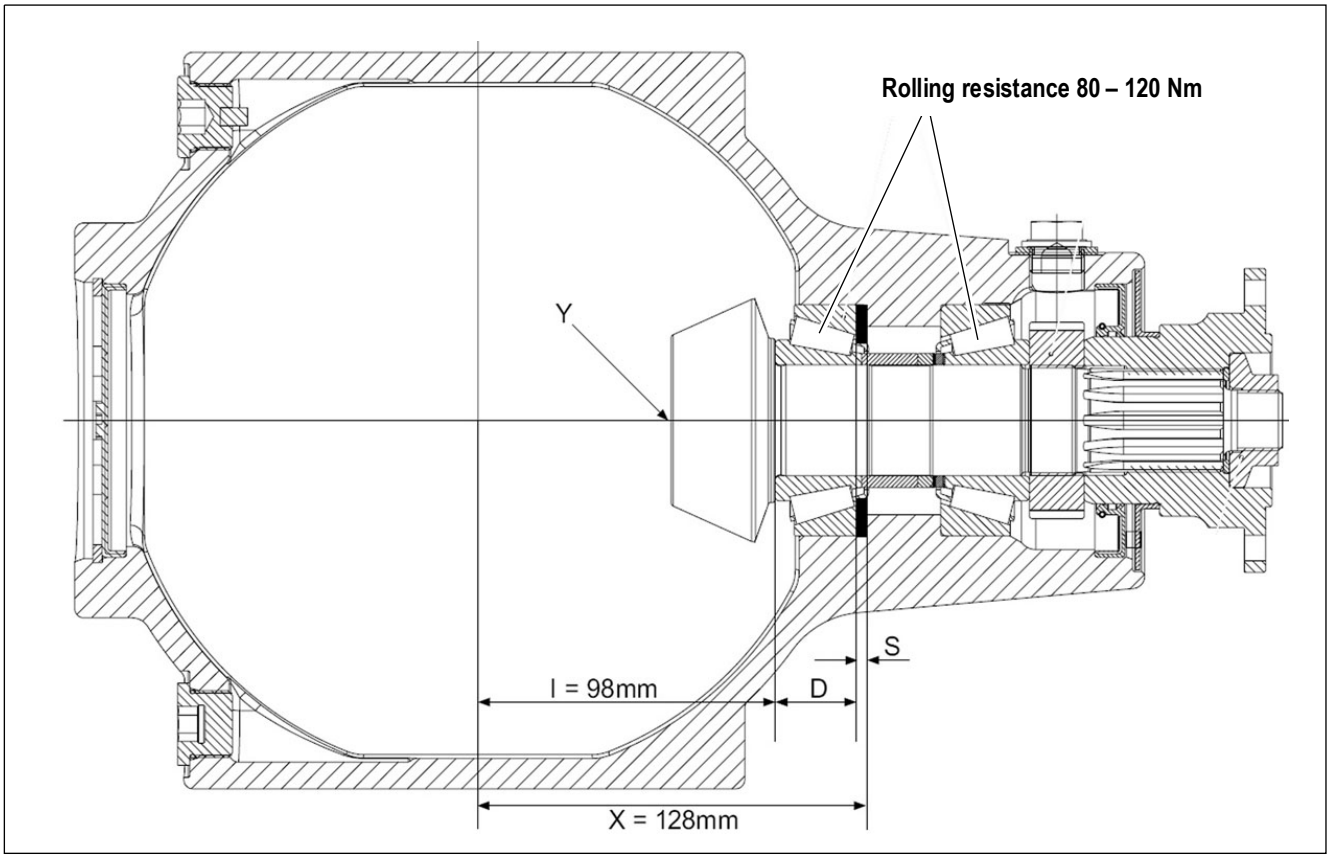


☞ *Mount the variable displacement motor*

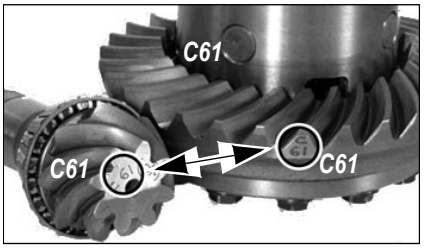


☞ *Fill up gearbox oil*

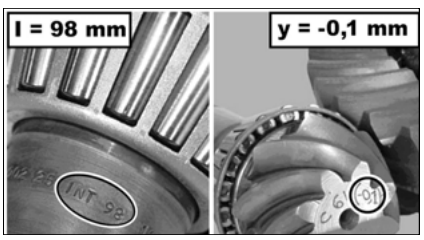
6.6 Setting the gear drive



Dimension **X** = 28 mm basic housing dimension
Dimension **l** = 98 mm basic pinion shaft dimension
Dimension **D** = taper roller bearing dimension
Dimension **S** = shim



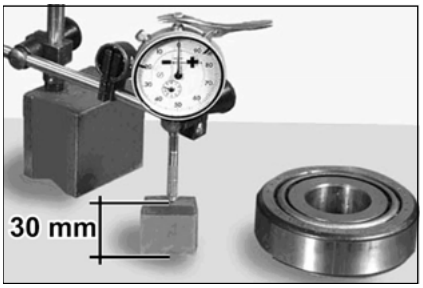
☞ *When installing a new gear drive, make sure the pairs are correct* ***(C61 – C61)***



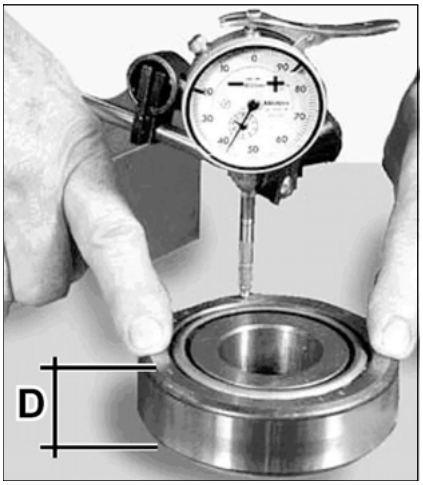
Calculation of dimension *l*

- **INT98** = 98 mm is the basic dimension of the pinion shaft
  ➥ The divergence, e.g. – 0.1 is stamped on the front side of the shaft
- Dimension **l** is calculated for instance as follows:
  98 mm (basic pinion shaft dimension) – 0.1 (divergence) = 97.9 mm

Determining dimension D



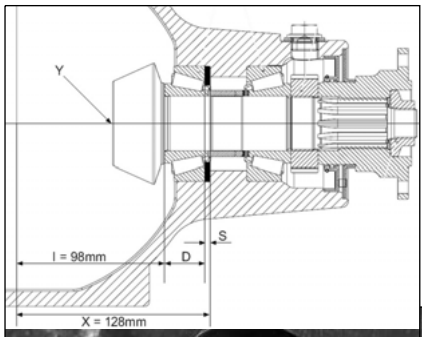
☞ *Set the dial gauge to 30 mm*



☞ *Measure the taper roller bearing by turning several times*

➥ Example: “-55” on the dial gauge results in a bearing thickness of 29.45 = D

Determining dimension S

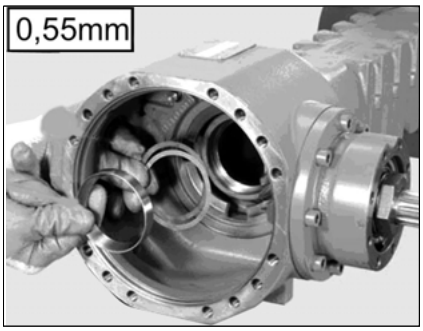




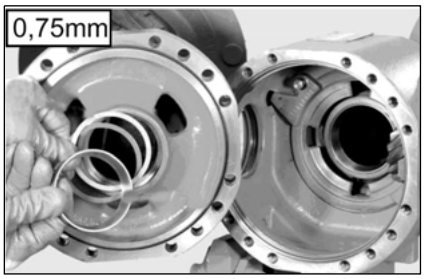
- Dimension X 128.00 mm
- Dimension l - 97.90 mm
- Dimension D - 29.45 mm

- Dimension S 0.65 mm

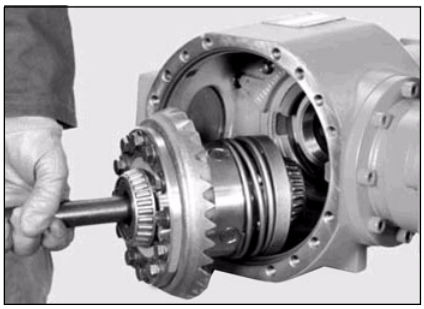
Adjusting the crown wheel axial play



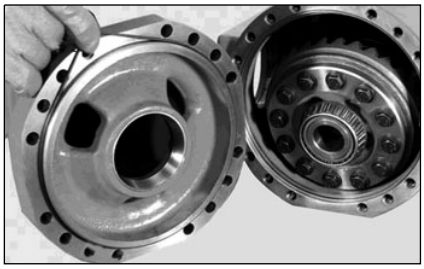
☞ *0.55 mm spacers are placed in the right-hand side axle half (as seen onto the flange)*



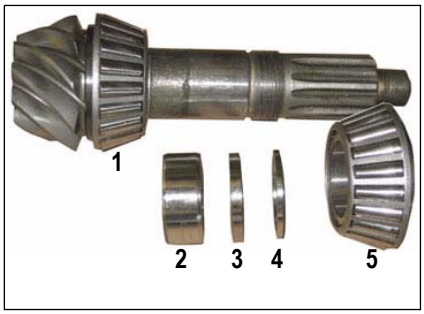
☞ *0.75 mm spacers are placed in the left-hand side axle half (as seen onto the flange)*



☞ *Mount the differential*

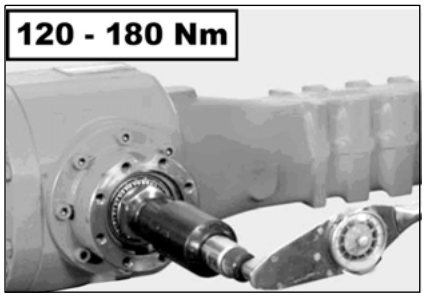


☞ *Mount a new O-ring (apply grease) and mount the axle half*



☞ *Bear in mind the order of assembly*

1 Taper roller bearing
2 Raceway for rotary shaft lip seal
3 Thick spacer
4 Thin spacer
5 Taper roller bearing



☞ *The rolling moment of both the pinion shaft and the differential amounts to 120 – 180 Nm*



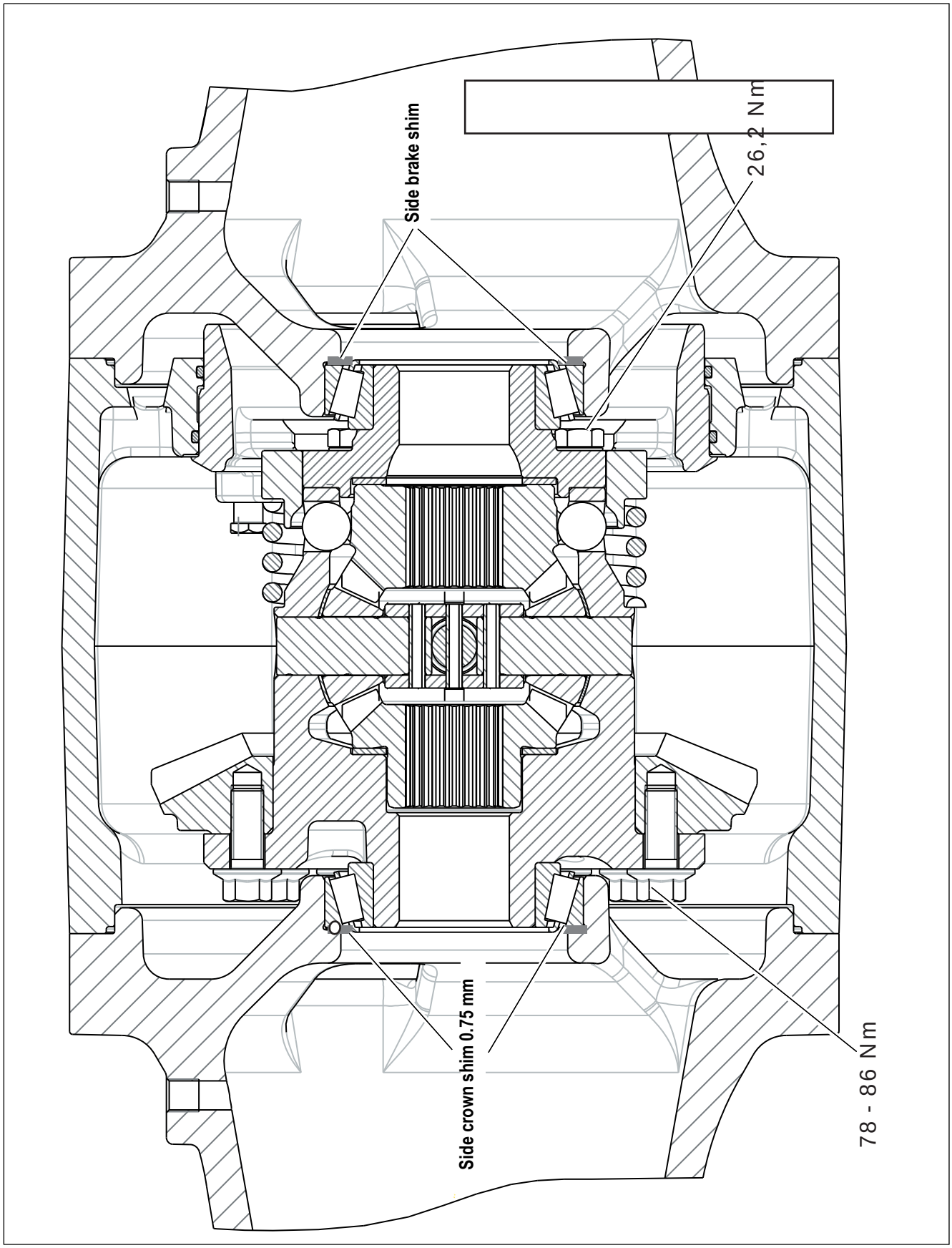
☞ *Check backlash with a dial gauge*

➥0.13 – 0.20 mm backlash between the crown wheel and the pinion shaft

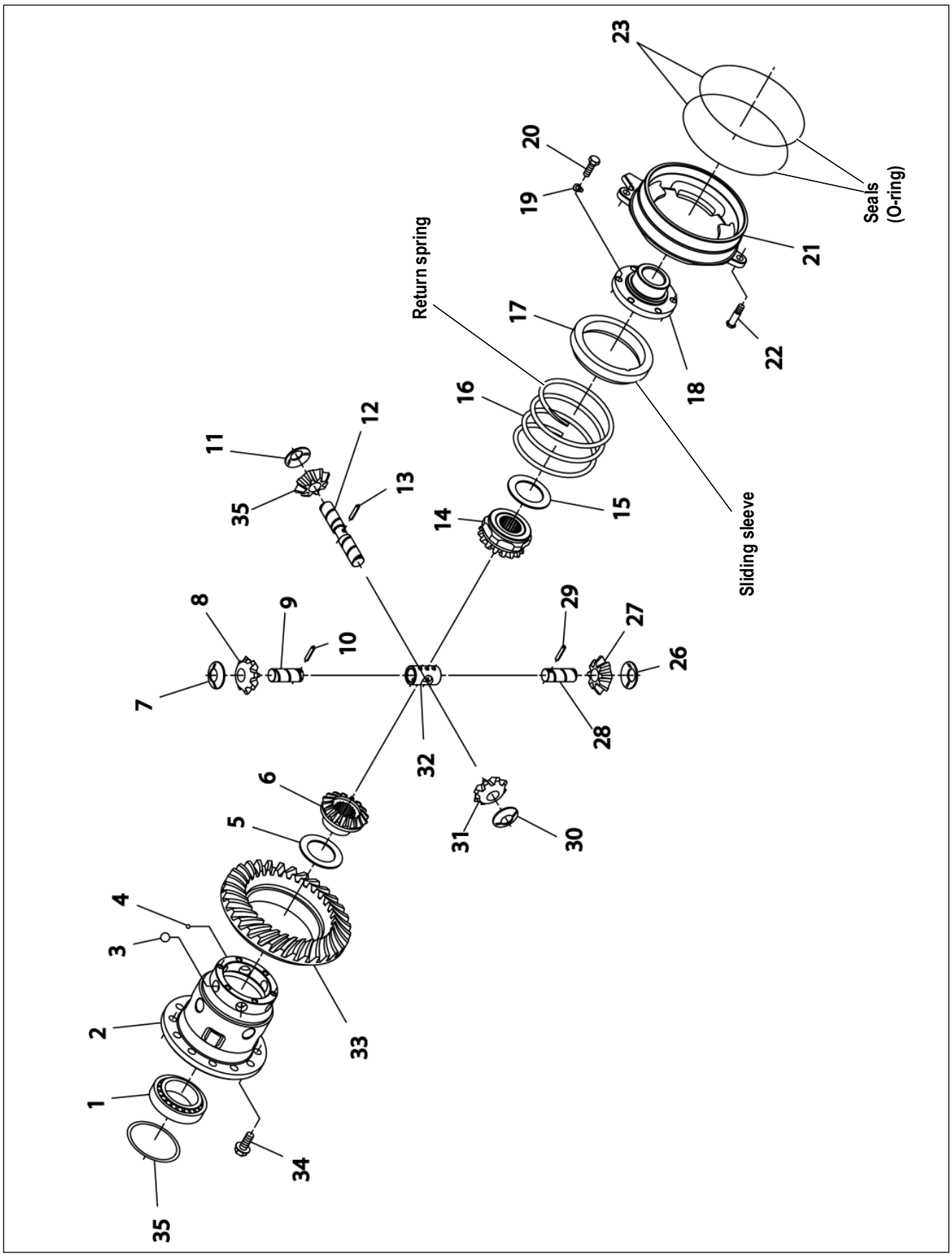
Important!

If the rolling moment or the backlash is not correct, change the spacers in the axle halves.

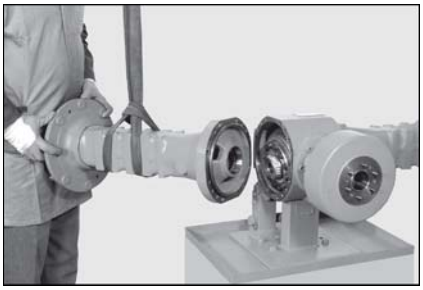
6.7 Differential cage – differential lock screw connections (front axle)



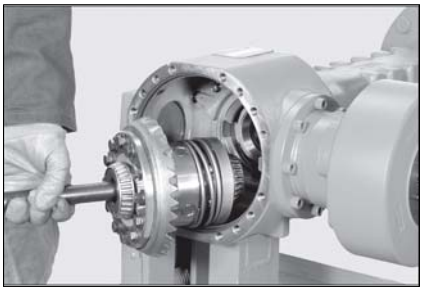
6.8 Differential lock – differential cage (front axle): overview



6.9 Removing the differential cage with the differential lock (front axle)



☞ *Completely remove the axle tube (on the **left** in driving direction)*



☞ *Completely remove the differential cage with the differential lock*



☞ *Remove the taper roller bearing with an extractor*



Caution!

The sliding sleeve can be ejected upwards when slackening the hexagon head screws!

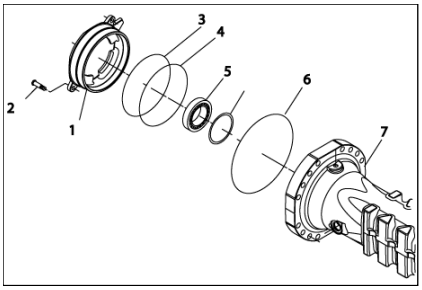
☞ *Press the sliding sleeve downwards and*

☞ *Remove the hexagon head screws*

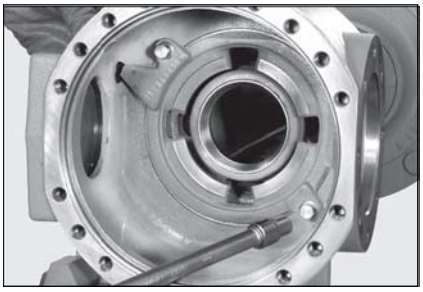


☞ *Remove the sliding sleeve and the spring from the differential cage*

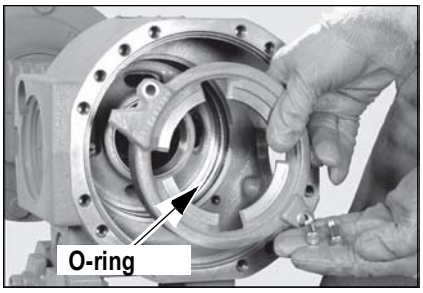
6.10 Removing the front axle differential lock



- Pos. **1**: piston
- Pos. **2**: stop screw
- Pos. **3** + **4**: seals (O-rings)

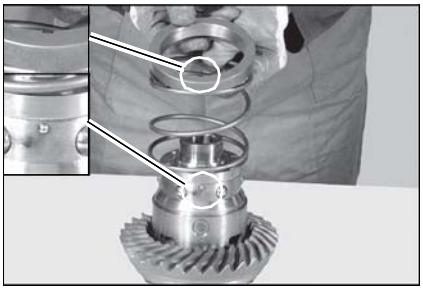


☞ *Remove the fastening screws*



☞ *Remove the piston*

6.11 Assembling the front axle differential lock



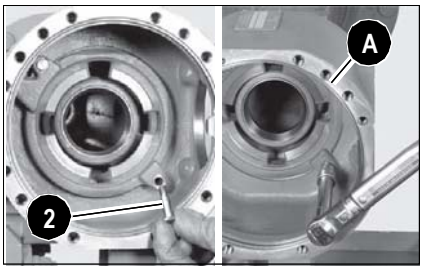
☞ *Guide groove **A** on the sliding sleeve and ball **B** on the differential cage must be aligned during assembly*



☞ *Insert the hexagon head screws of the sliding sleeve with Loctite 242 and*
☞ *tighten them to a **torque of 26.2 Nm***



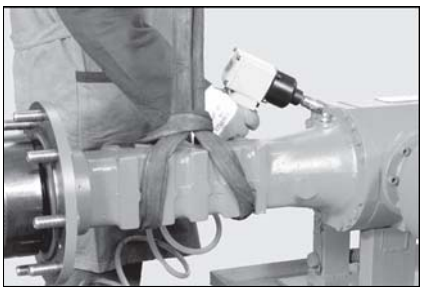
☞ *Preheat the taper roller bearing to **100 °C** and*
☞ *mount it with an adapter*



☞ *Insert the piston of the lock and*
☞ *tighten fastening screws **2** to a torque of **30 Nm***
☞ *Clean the flange surface on the differential housing*

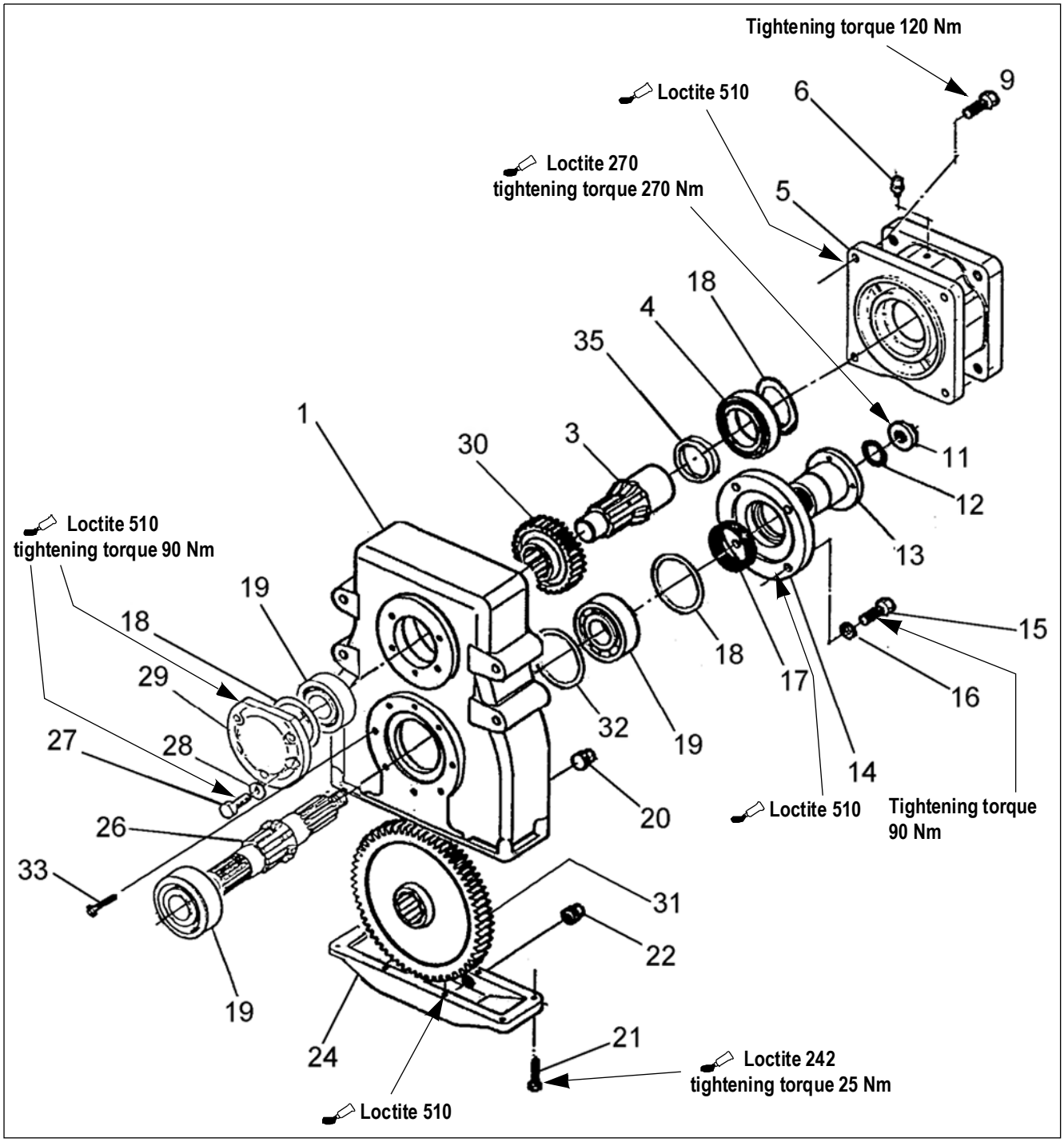


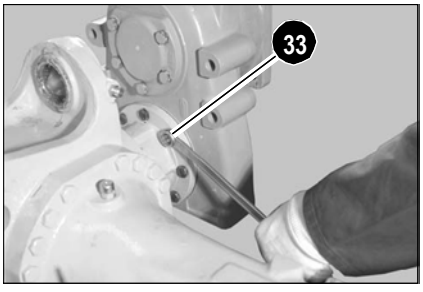
☞ *Carefully insert the differential cage with the lock in the piston*



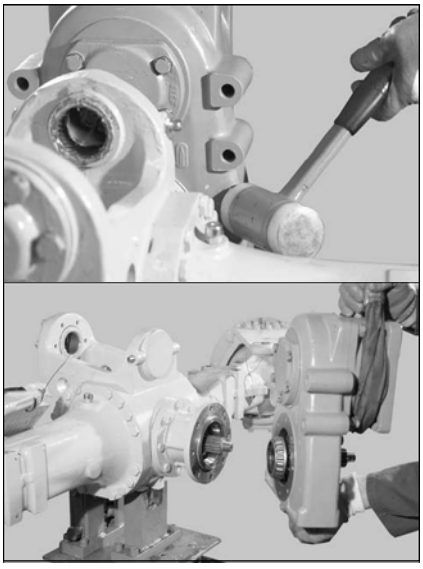
☞ *Clean the flange surface on the axle tube and*
☞ *Mount the complete axle tube*

6.12 Removing the gearbox

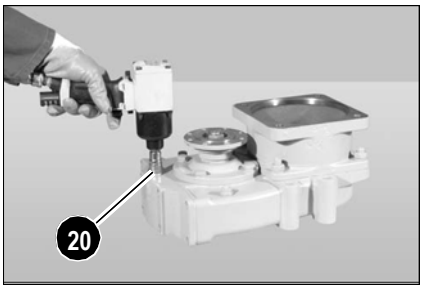




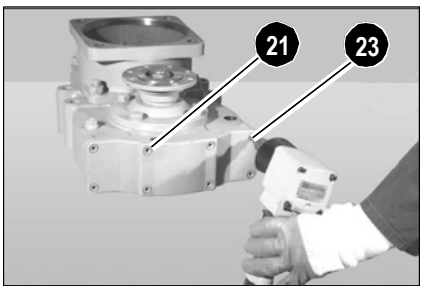
☞ *Remove fastening screws **33** from the gearbox*



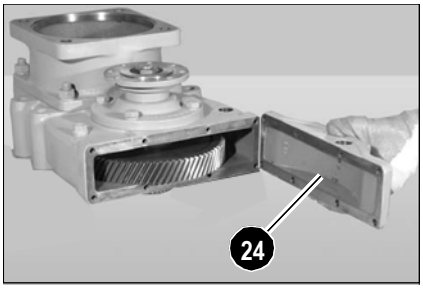
☞ *Remove the gearbox from the axle*



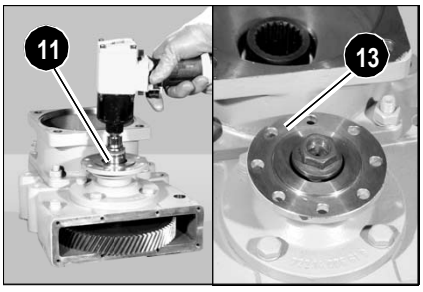
☞ *Unscrew drain plug **20***



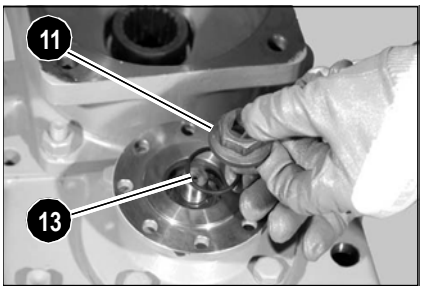
☞ *Unscrew screws **21** and **23** from cover **24***



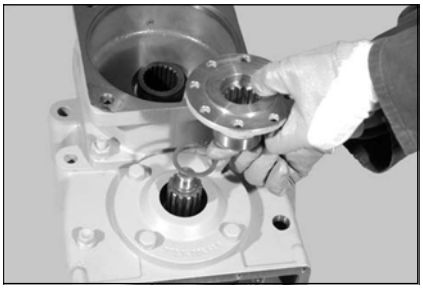
☞ *Remove cover **24***



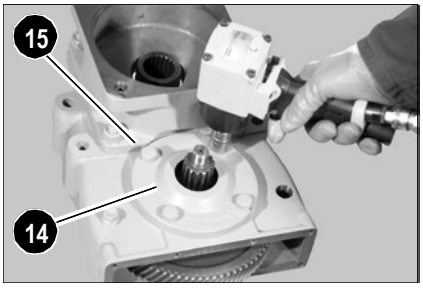
☞ *Remove nut **11** from flange **13***



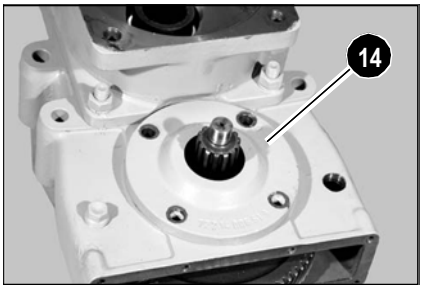
☞ *Remove nut **11** and O-ring **12***



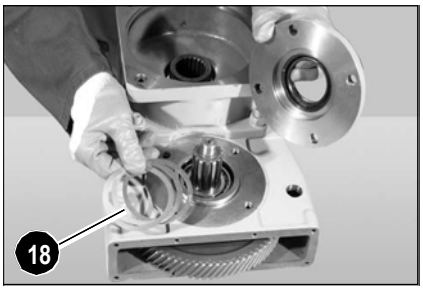
☞ *Remove the flange*



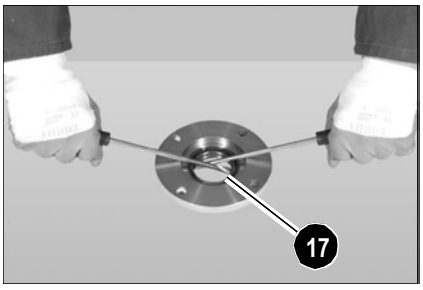
☞ *Remove fastening screws **15** from cover **14***



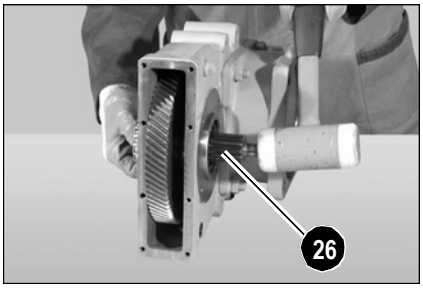
☞ *Remove cover **14***



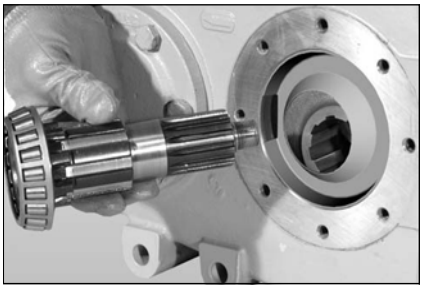
☞ *Remove spacers **18***



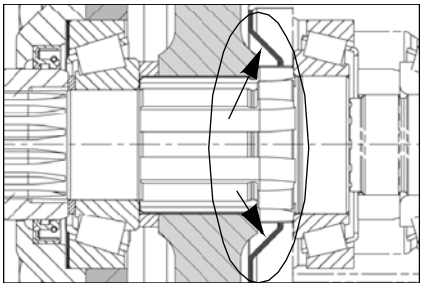
☞ *Remove sealing ring **17***



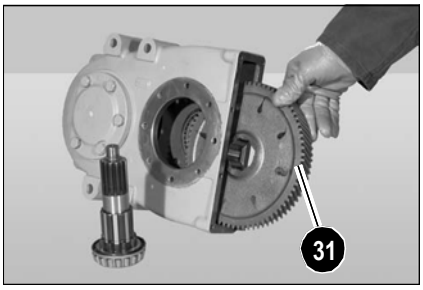
☞ *Remove shaft **26***



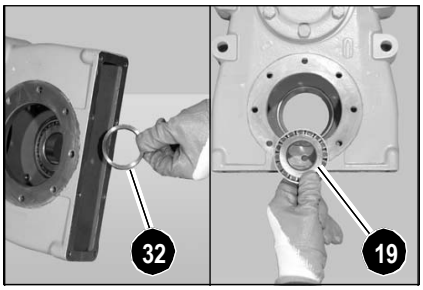
☞ *Remove the oil baffle*



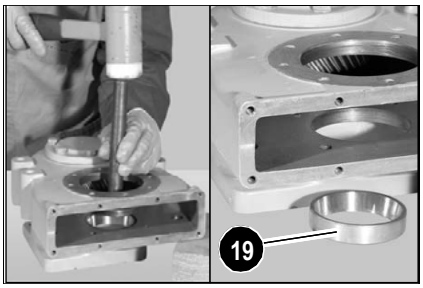
☞ *Oil baffle*



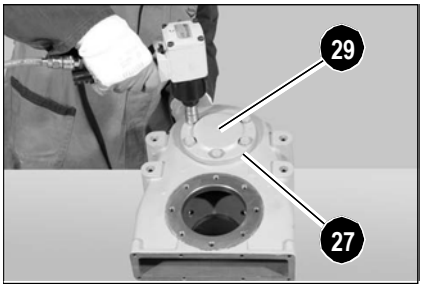
☞ *Remove gear **31***



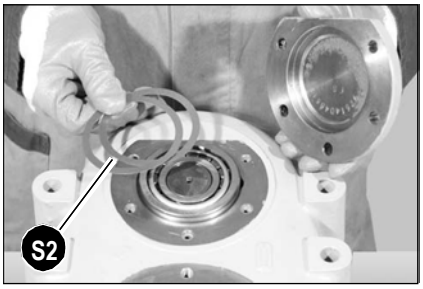
☞ *Remove washer **31** and bearing **19***



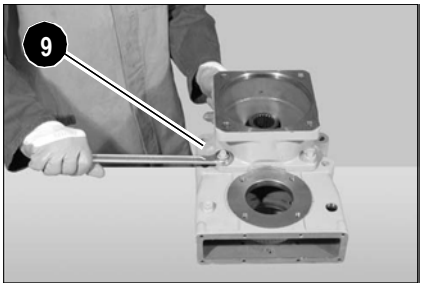
☞ *Remove bearing shell **19***



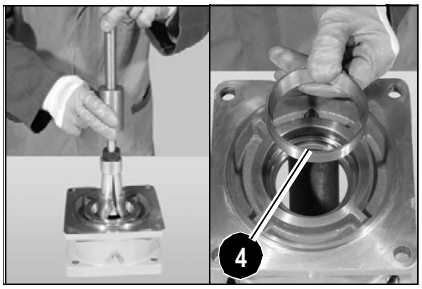
☞ *Unscrew screws **27** from cover **29** and remove the cover*



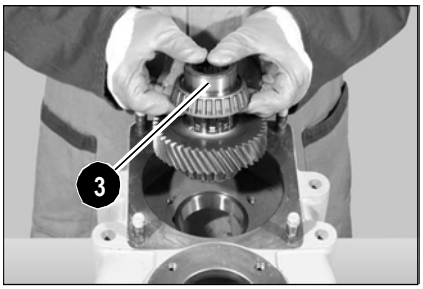
☞ *Remove spacers **S2***



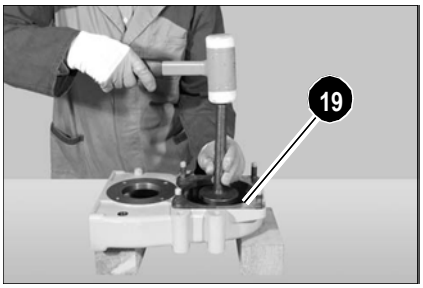
☞ *Unscrew fastening screws **9** from the adapter housing and remove the adapter housing*



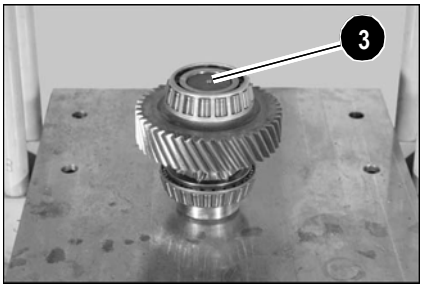
☞ *Extract bearing **4** from the adapter housing with an extractor*



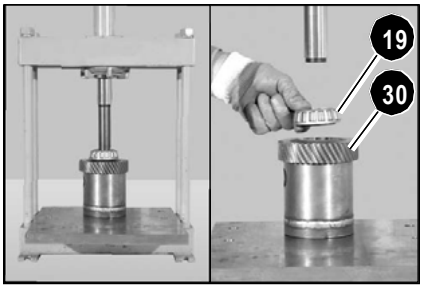
☞ *Remove upper shaft **3***



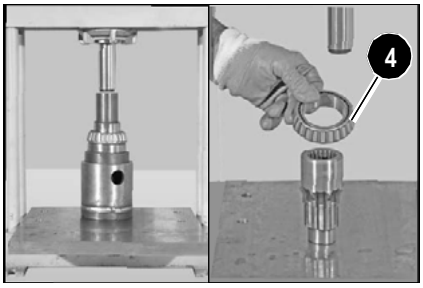
☞ *Remove outer ring **19** of the bearing*



☞ *Remove shaft **3** from the bearing with a press*

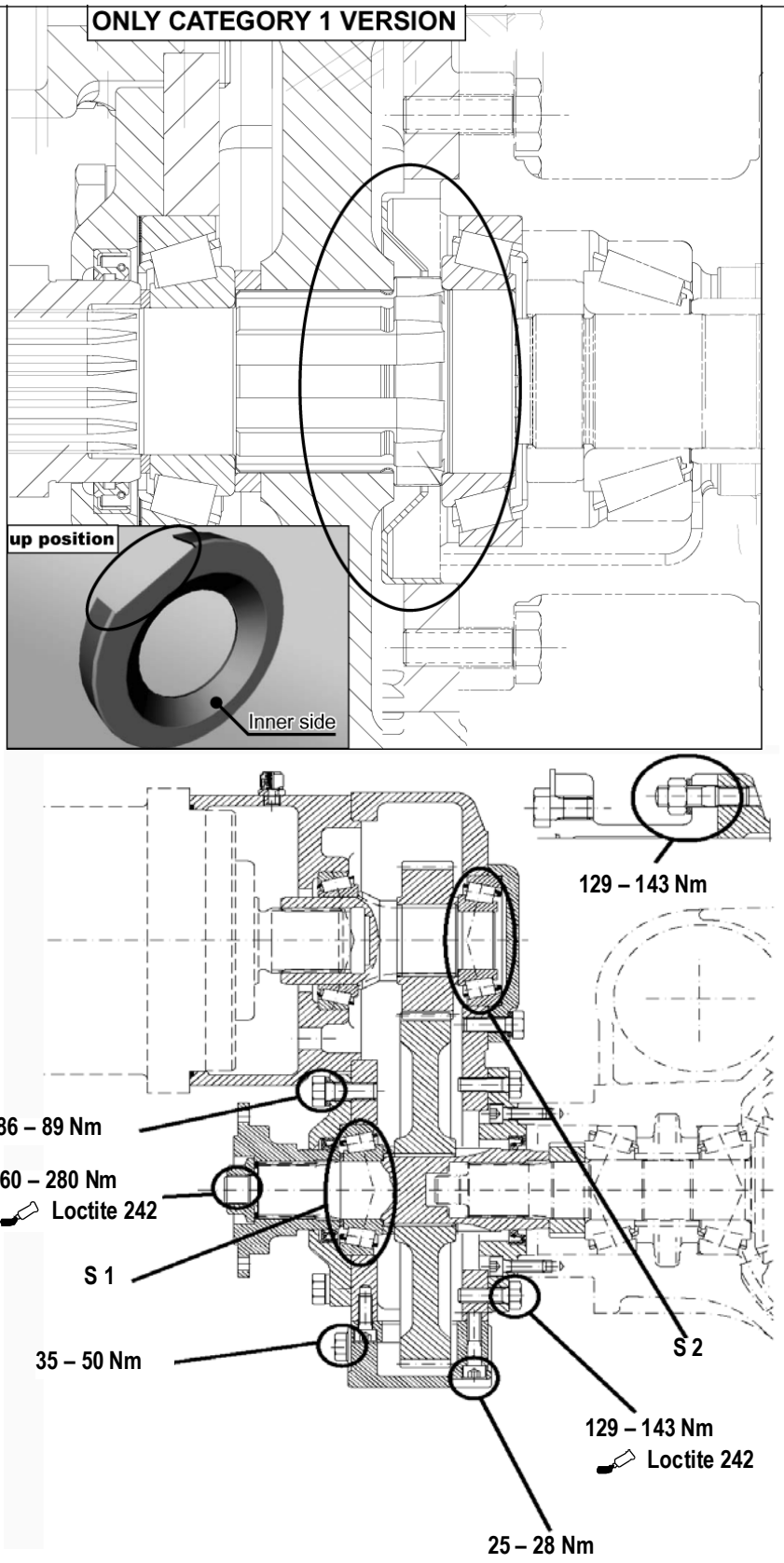


☞ *Remove gear **30** and bearing **19***

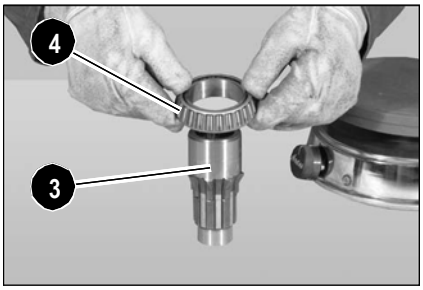


☞ *Remove bearing **4** by applying pressure*

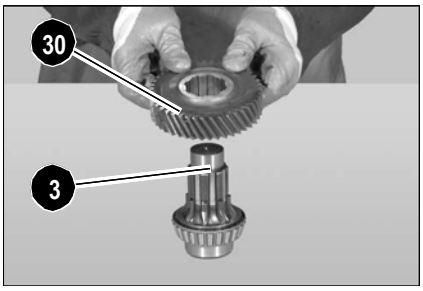
6.13 Input shaft version 1 sealing: overview



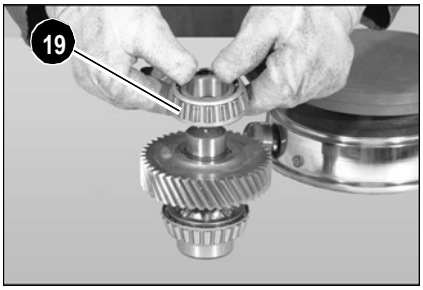
6.14 Assembling the gearbox



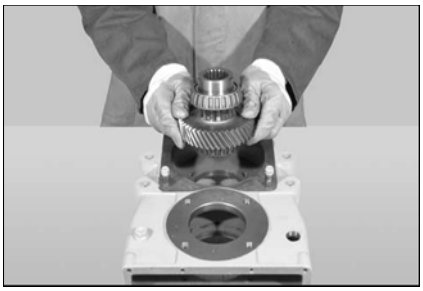
☞ *Mount bearing **4** on shaft **3***



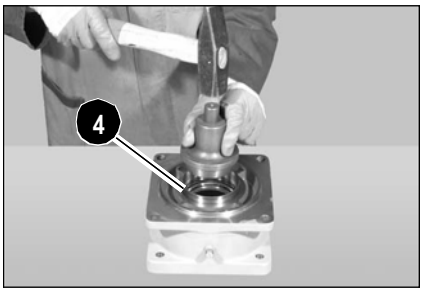
☞ *Mount gear **30** on shaft **3***



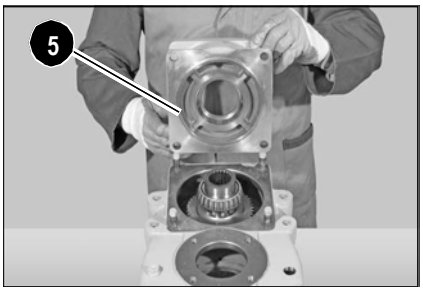
☞ *Mount bearing **19***



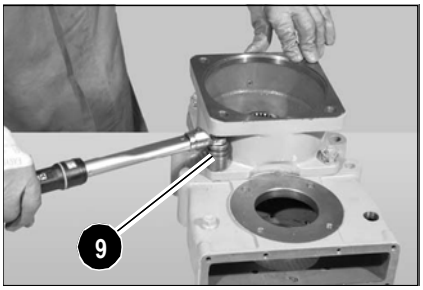
☞ *Mount the complete shaft in the housing*



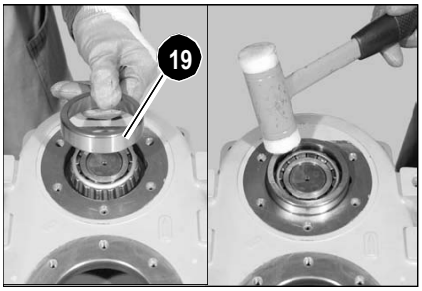
☞ *Press seal **4** into the adapter housing*



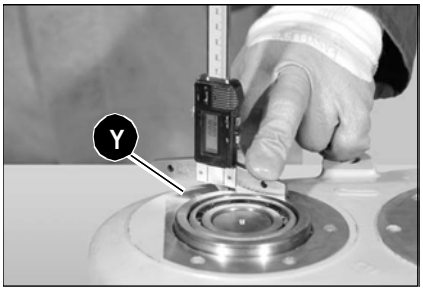
☞ *Mount adapter housing **5***



☞ *Tighten fastening screws **9** to 140 Nm*

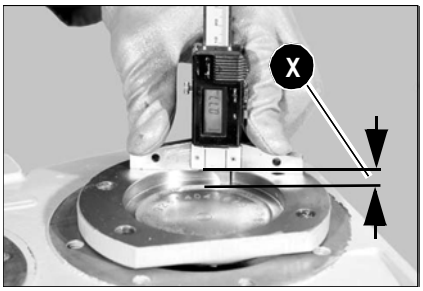


☞ *Mount bearing shell **19***



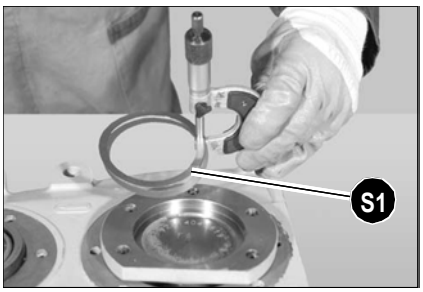
☞ *Determine the bearing projection and make a note of it*

➥ The dimension of the projection is referred to as **Y**



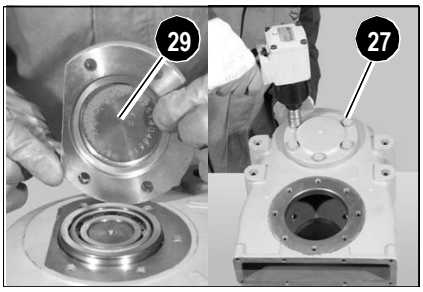
☞ *Determine dimension **X***

➥ Dimension **X** results from the distance between the contact surface and the upper edge of the bearing

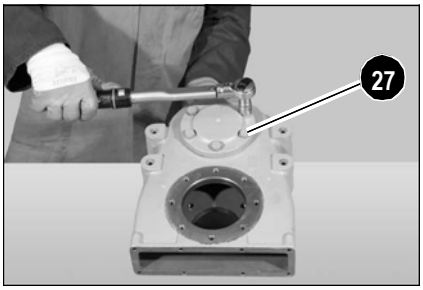


☞ *Measure both dimensions **X** and **Y** to determine the thickness of the spacers*

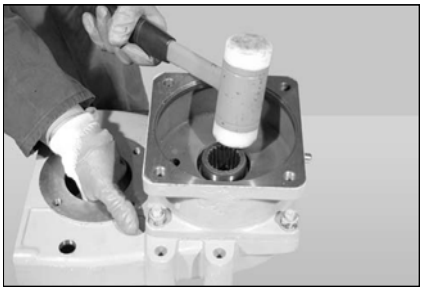
➥ **S1 = X – Y (0.02 +- 0.05) = 0.95 – 0.05 = 0.90 = S**



☞ *Mount cover **29** with screws **27** and Loctite 510*



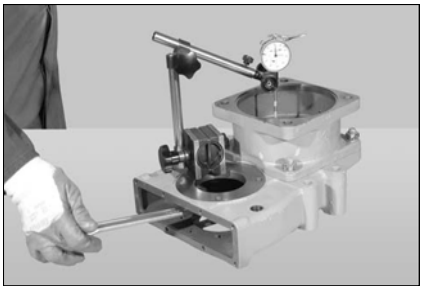
☞ *Tighten screws **27** to 50 Nm*



☞ *Drive in the input shaft as far as it will go*

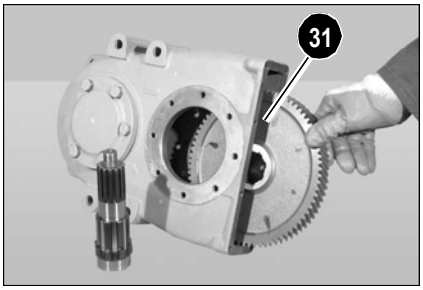


☞ *Place the dial gauge on the housing*

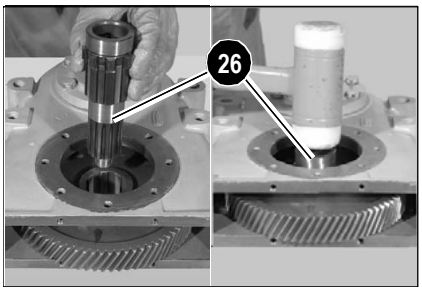


☞ *Measure the bearing play with a mounting lever*

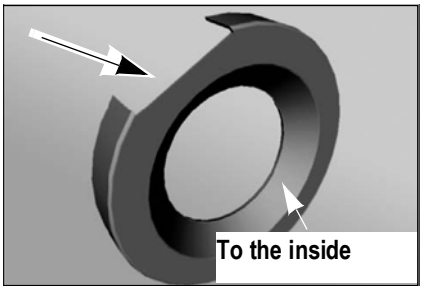
➥ Bearing play 0.02 – 0.05 mm



☞ *Mount gear **31***



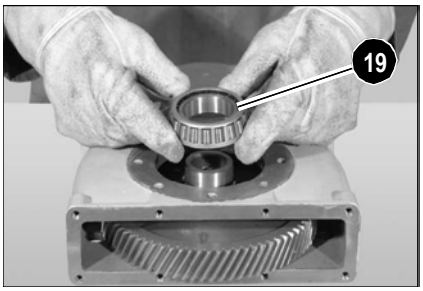
☞ *Mount shaft **26** with a plastic hammer*



☞ *Mount the oil driving ring*

Caution!

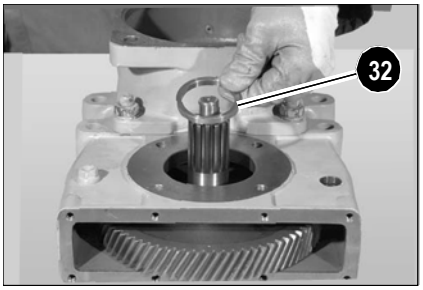
Cut-out side upwards!



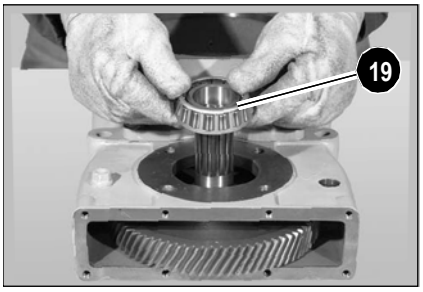
☞ *Mount bearing **19***



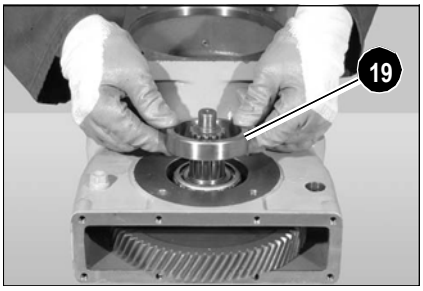
☞ *Mount the bearing with a plastic hammer as far as it will go*



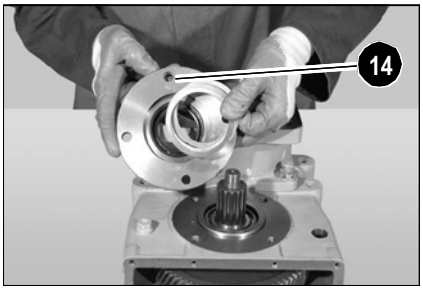
☞ *Mount spacer ring **32***



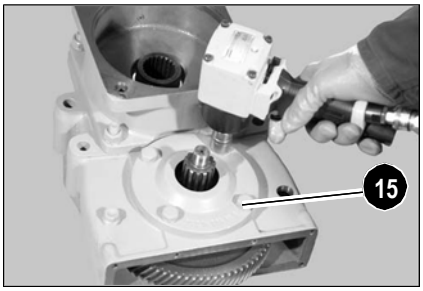
☞ *Mount inner ring **19** on the shaft*



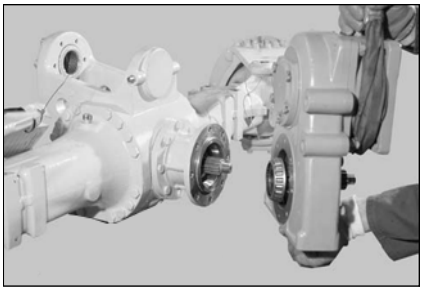
☞ *Mount outer ring*



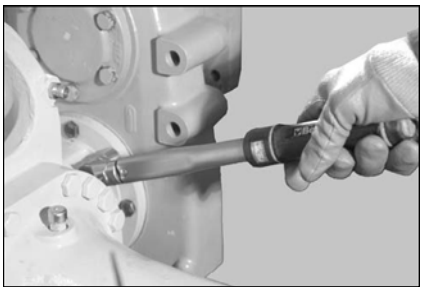
☞ *Mount cover **14** with washers*



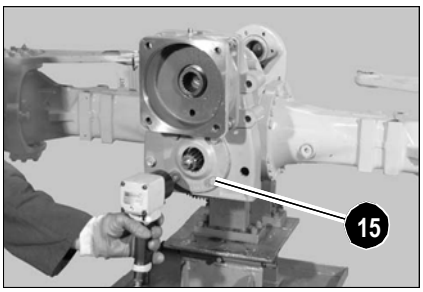
☞ *Tighten screws **15***



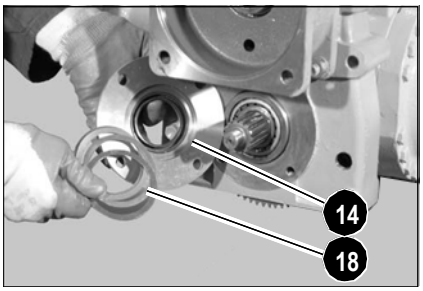
☞ *Mount the gearbox on the axle*



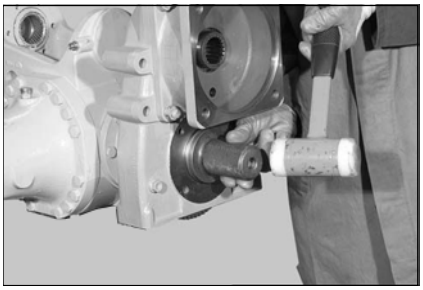
☞ *Tighten fastening screws **33** to 75 Nm*



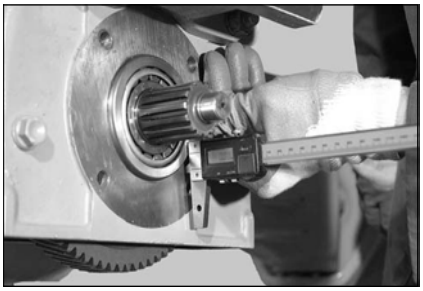
☞ *Unscrew fastening screws **15***



☞ *Remove washers **18** and cover **14***

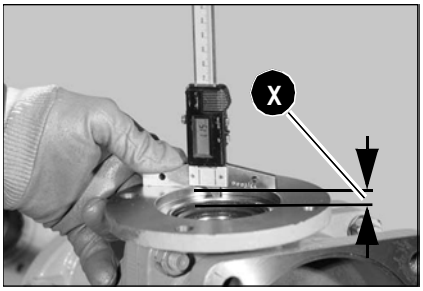


☞ *Drive in the bearing again*



☞ *Determine the bearing projection*

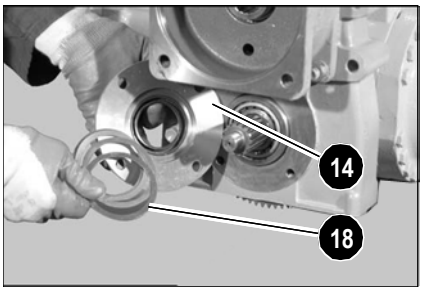
➥ The dimension is referred to as **Y**



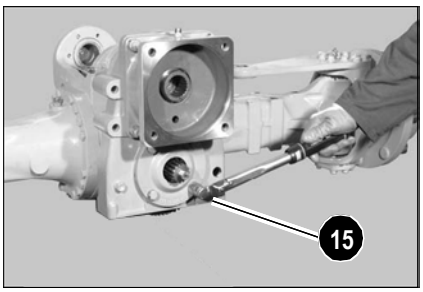
☞ *Measure the dimension on the cover between the contact surface and the upper edge of the bearing*

➥ Determine the spacers

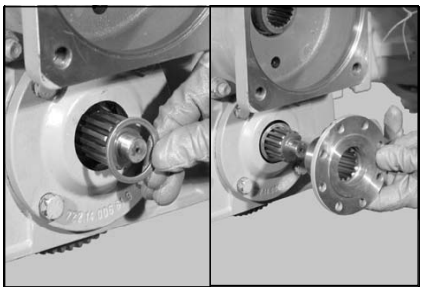
➥ X -Y – 0.05 mm (initial stress) = thickness of spacers



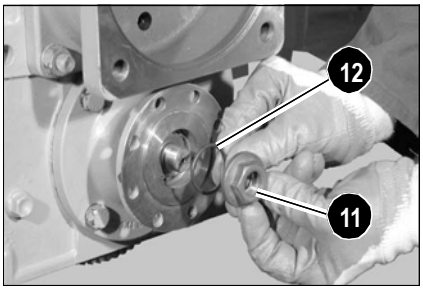
☞ *Mount washers **18** and cover **14***



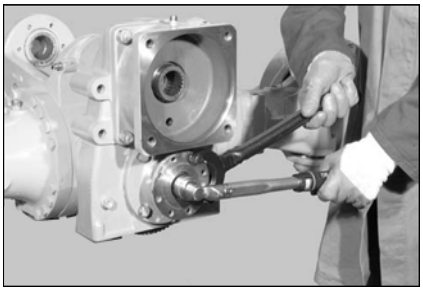
☞ *Tighten screws **15** to 90 Nm*



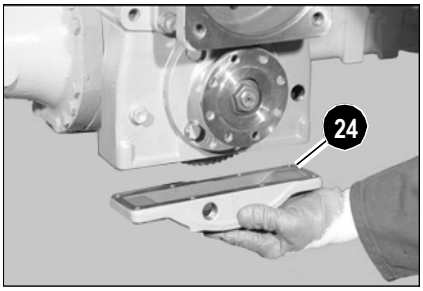
☞ *Mount the spacer washer and the flange*



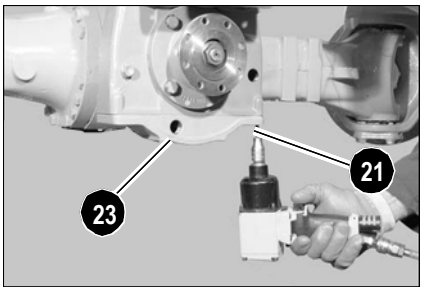
☞ *Mount O-ring **12** and nut **11***



☞ *Tighten the flange to 280 Nm*



☞ *Mount cover **24** with Loctite 510*

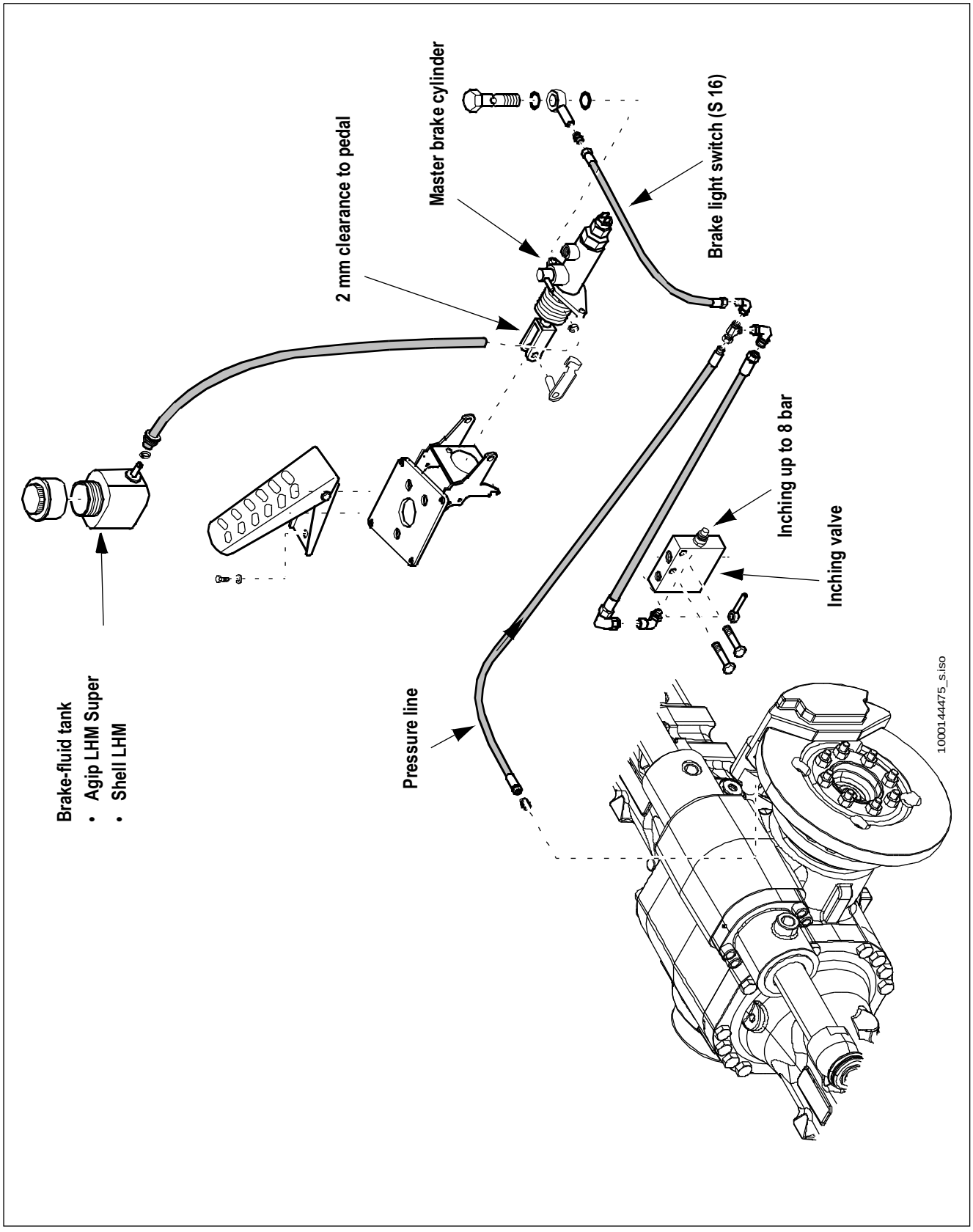


☞ *Tighten fastening screws **21** and **23** to 28 Nm*

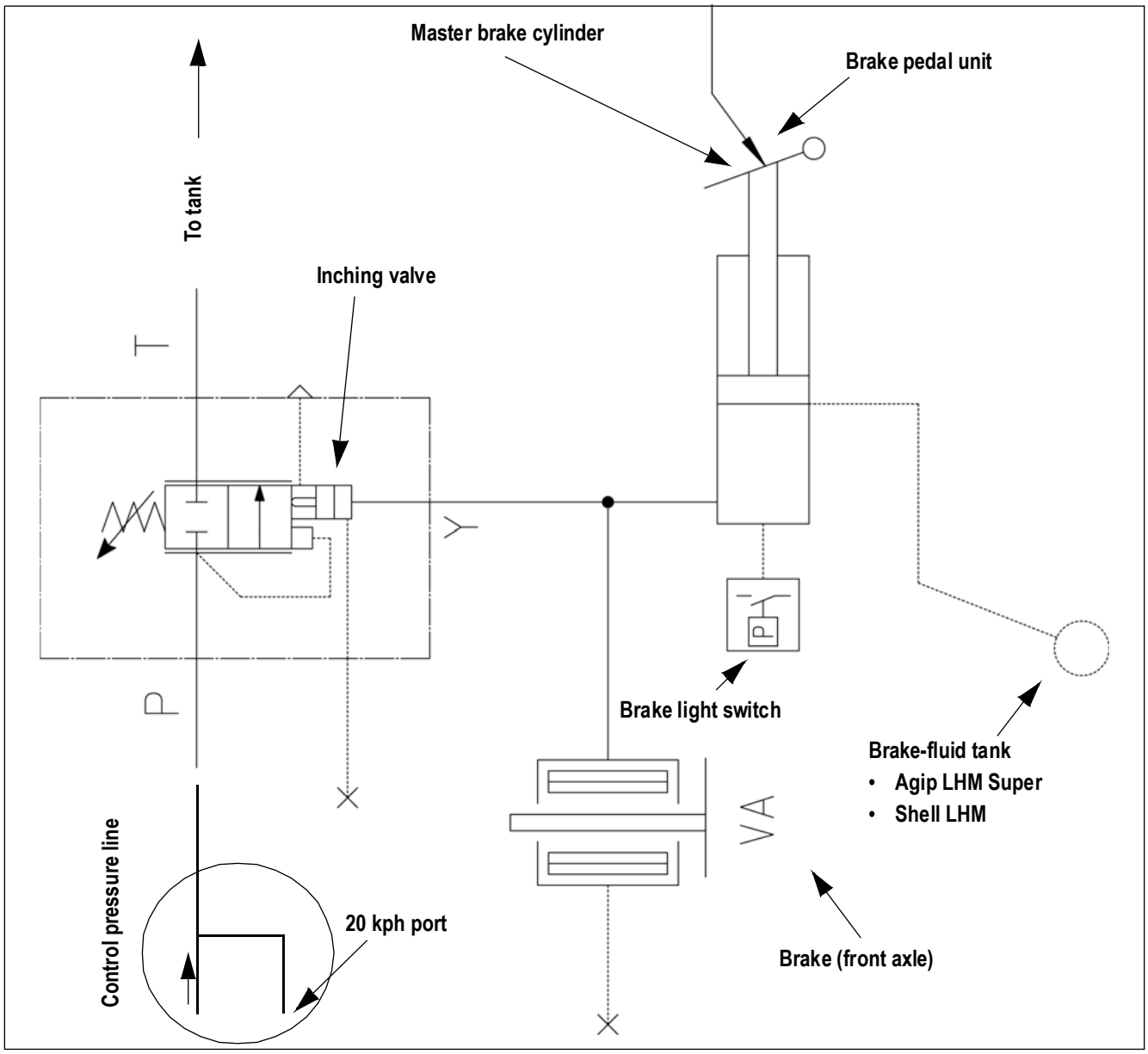
Brakes

7 Brakes

7.1 Brake circuit



7.2 Brake diagram



Service brake/inching valve function

The brake pedal consists of 2 parts

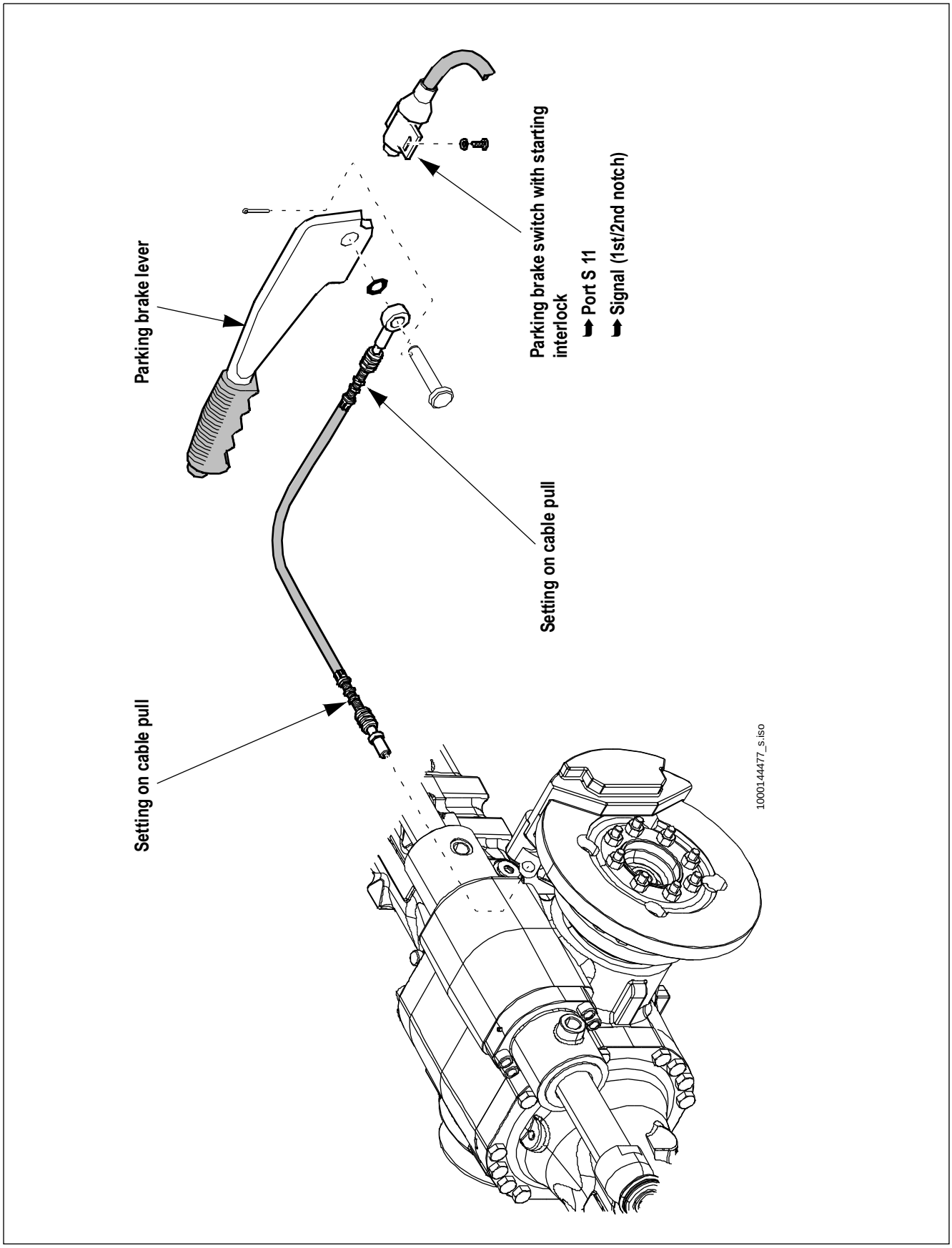
- Pedal
- Displacement piston

A force (F) is applied to the displacement piston with the service brake. The movement of the displacement piston conducts the brake fluid to the front axle multi-disc brake and to the inching valve.

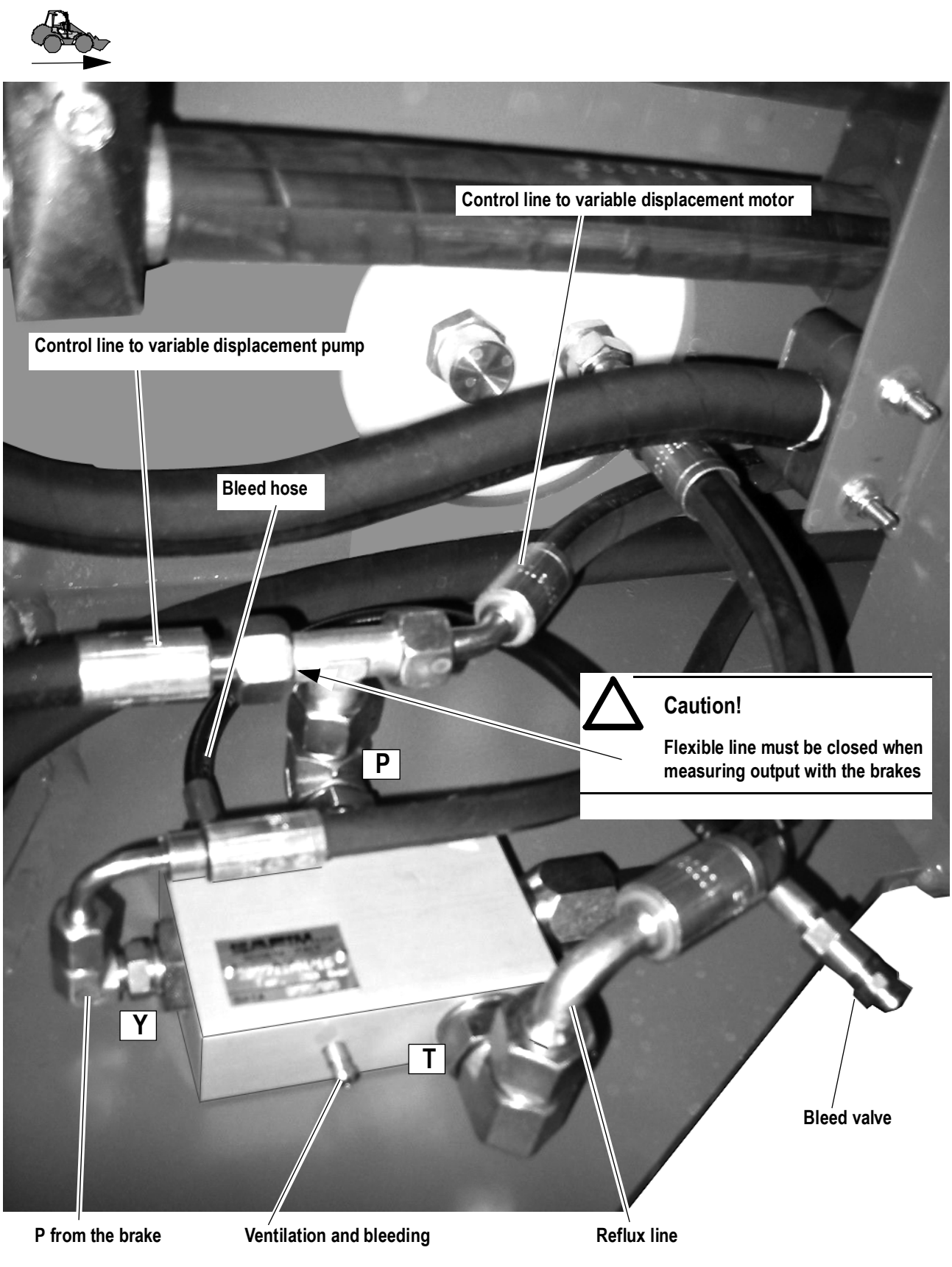
Actuating the master brake cylinder applies brake pressure to port Y of the inching valve, which in turn controls the control spool in the inching valve and establishes a connection between ports P and T.

The control pressure in the servo piston (variable displacement pump) is reduced, and hence the flow rate of the drive hydraulics is reduced.

7.3 Parking brake circuit



7.4 20 kph inching valve circuit



7.5 Service brake

Important information on the brake system

Caution!

For reasons of safety, the brake/inching valve and the brake calliper may be dismantled and repaired by authorised specialist staff only. Otherwise replace the complete unit.
In order to avoid destroying the seals in the brake system, use Agip LHM Super or Shell LHM brake fluid.

☞ *Make sure old brake fluid in the bleed equipment is fully replaced by the brake fluid specified above – no mixtures!*

Brake calliper maintenance

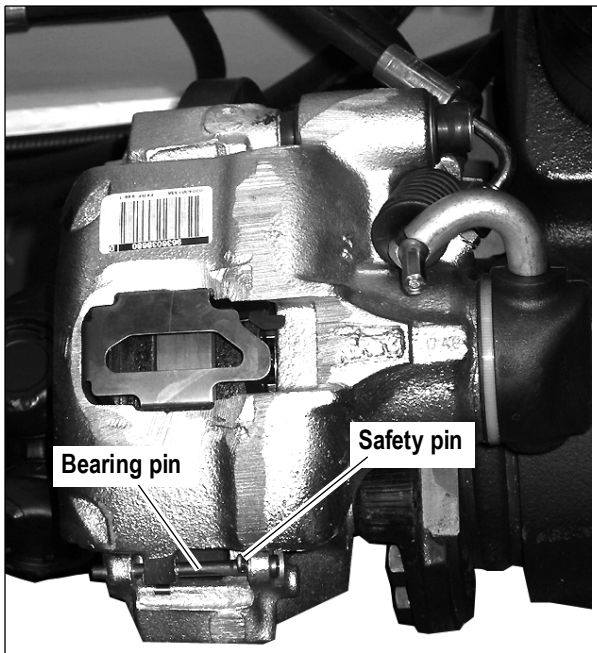
Caution!

Make sure under all circumstances that no grease with metallic components is used for maintenance work (e.g. copper paste)

☞ *Use only PLASTILUBE or similar lubricants*

Important!

In connection with copper and salt water, aluminium-alloy brake callipers turn into galvanic elements producing electric tension. This in turn produces corrosion, and the components “seize”.



Danger!

Do not dismantle the brake piston in the brake calliper.

Danger of accidents!

☞ *Replace the complete brake calliper in case of leaks!*

Replacing the brake linings

☞ *Remove the safety pin*
☞ *Extract the bearing pin*
☞ *Remove the cable pull on the brake calliper*
☞ *Fold the brake calliper up*
☞ *Remove the brake linings*
☞ *Turn the brake cylinder piston to reset it applying pressure*
☞ *Insert new brake linings and mount the brake calliper in the reverse order*

Bleeding the brake system with bleed equipment

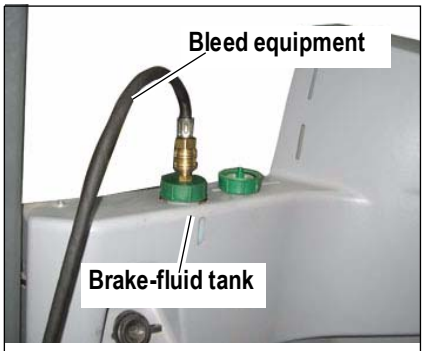


Fig. 127: Brake-fluid tank – bleed

Caution!

Use only Agip LHM Super or Shell LHM brake fluid!

☞ *Connect the bleed equipment to the brake-fluid tank (left-hand side access)*

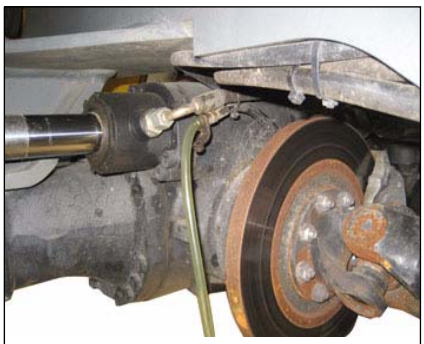


Fig. 128: Bleeding the brakes

☞ *Connect the hose of the receptacle to the breather line of the brake calliper*

☞ *Open the bleed valves*

☞ *Press down the brake pedal*

➥ This supports bleeding

☞ *Bleed the brake system until there is no more air or bubbles in it*

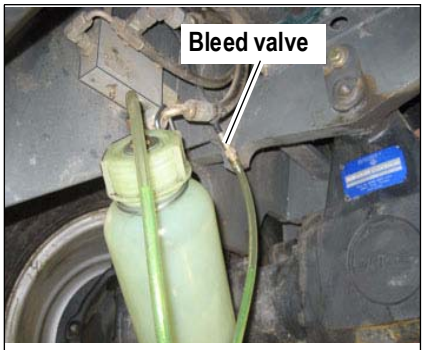


Fig. 129: Bleeding the inching valve

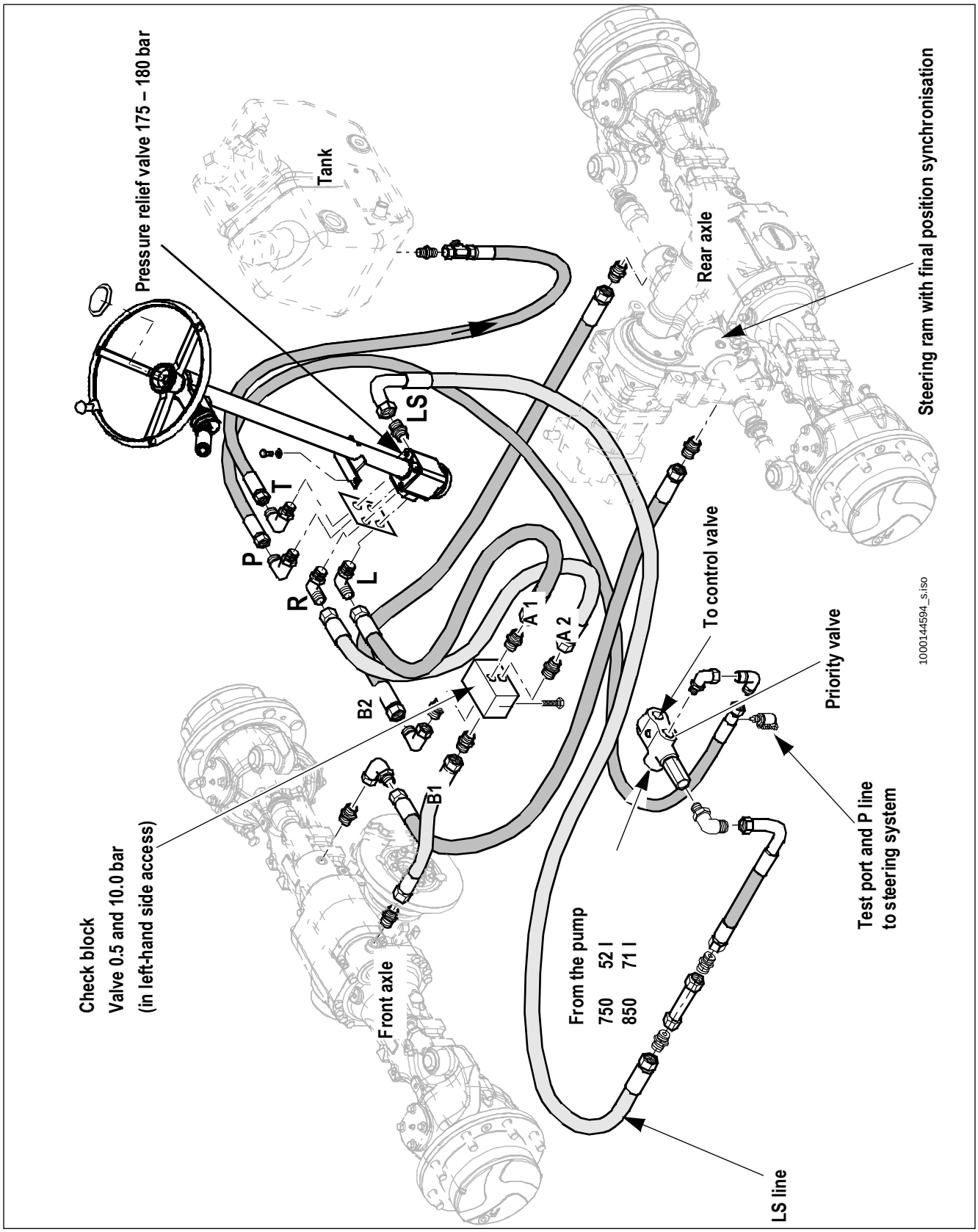
☞ *Bleed the inching valve (at the left behind the rear axle as seen in driving direction)*

Notes:

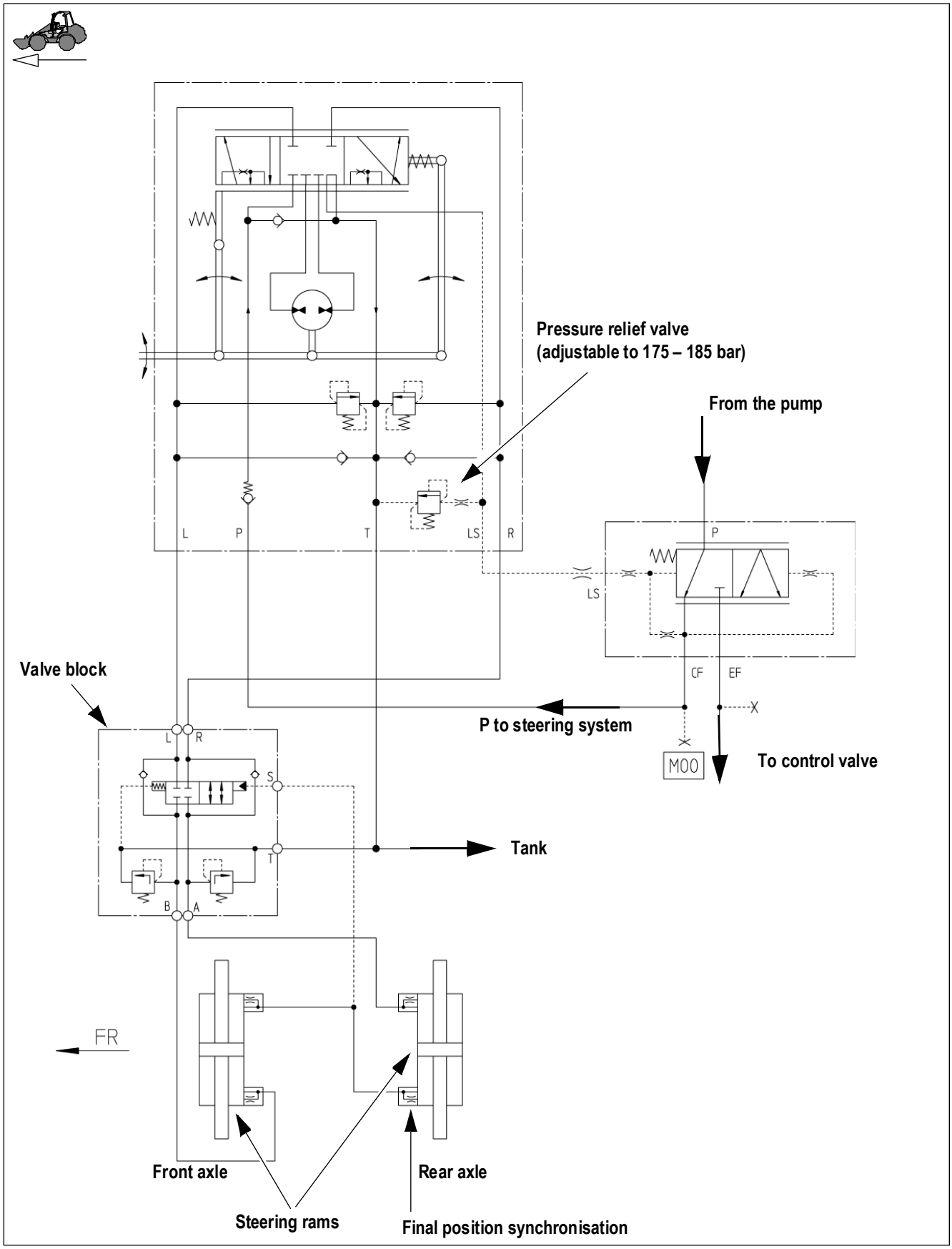
Steering system

8 Steering system

8.1 Steering circuit



8.2 Steering circuit

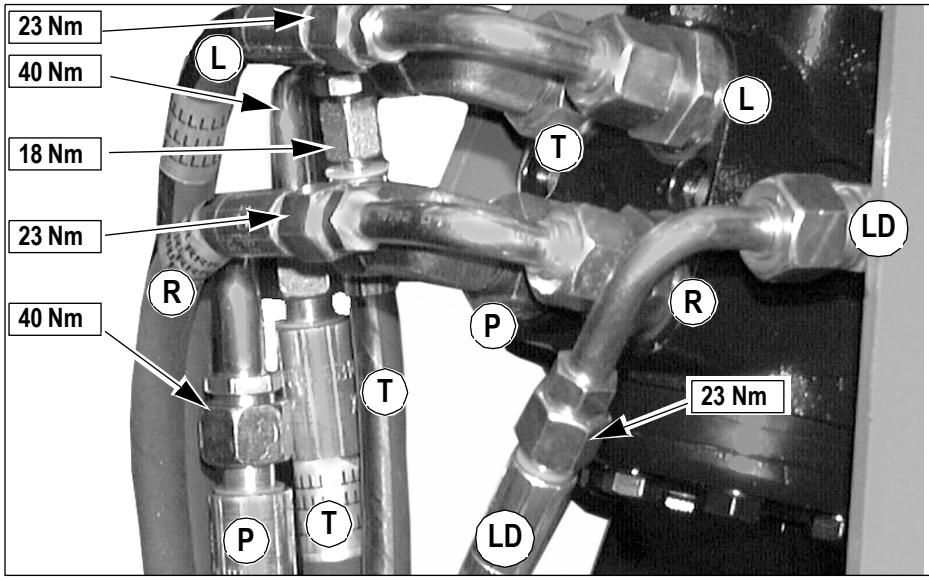


8.3 Steering system adjustment

Function

Steering is carried out by means of 2 steering rams. Both steering rams are connected together on one side of the chamber, the steering valve and the check block are located in between. Each of these components has a certain amount of leakage which means hydraulic oil escapes between the front and rear steering rams. This oil is no longer replenished whilst steering since pressure is applied to only one side of the front or rear steering ram when steering to the left or right. This is why synchronising several times a day is normal, depending on the use the machine is put to.

8.4 Hydraulic ports on servostat



P = hydraulic pump pressure
=>priority valve => servostat

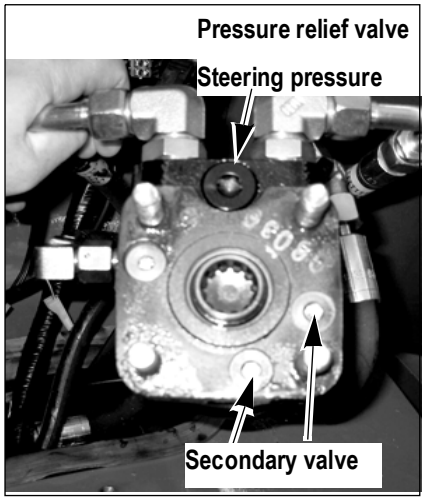
LD = priority valve
=> servostat

L = left servostat
=> rear axle steering ram

R = right servostat
=> front axle steering ram

T = servostat reflux
=> hydraulic oil tank

8.5 Pressure relief valve: adjustment



Proceed as follows:

☞ *Remove the leg room cover*

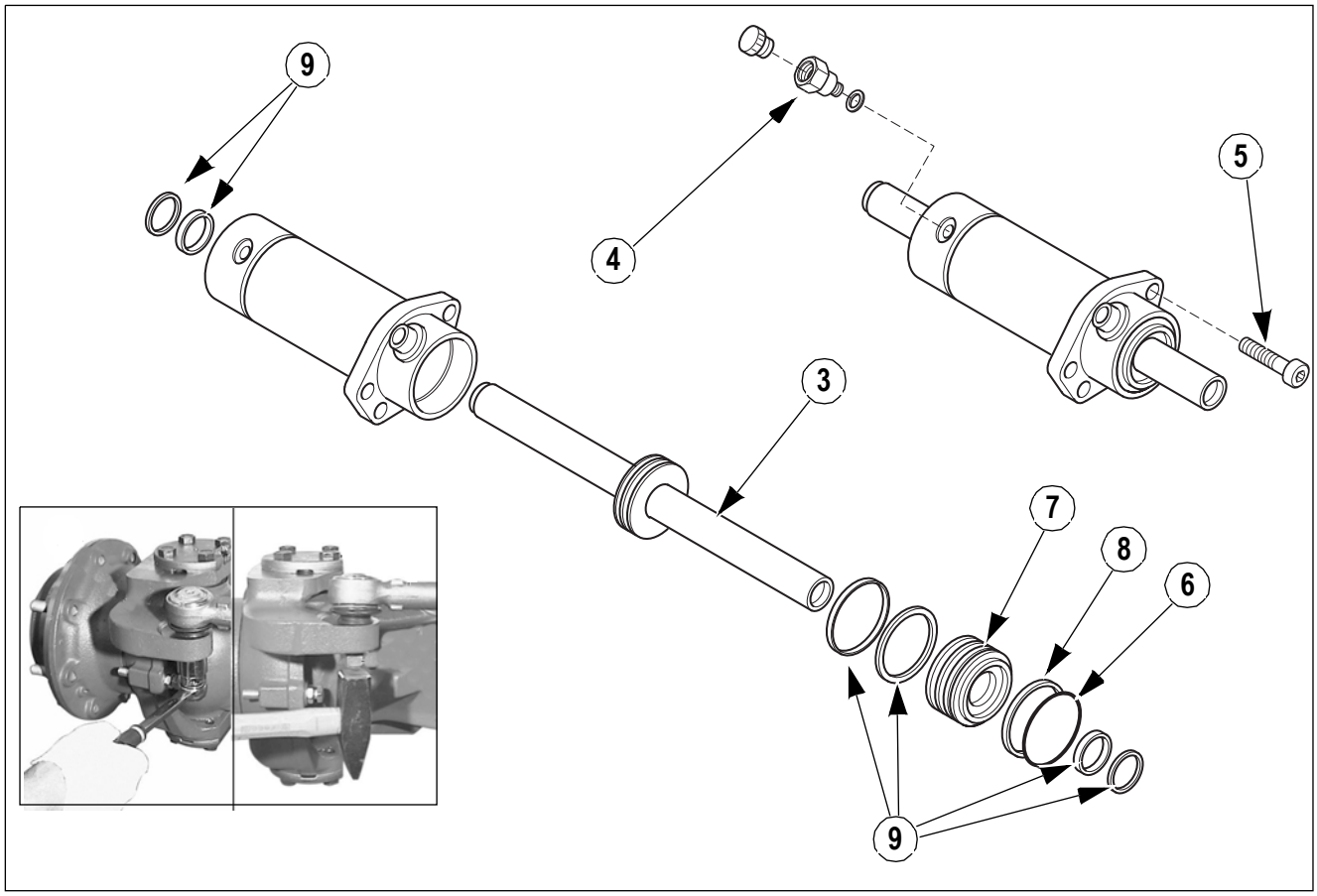
☞ *Remove the side cover on the steering console*

☞ *Slacken the servostat (4 screws M10) and slide downwards*

☞ *Adjust the steering pressure with an allen key*

➥175 bar

8.6 Sealing steering rams



☞ *Proceed as follows:*

- Remove lock nut **1** on track rod joint **2**
- Remove track rod joint **2** from the planetary carrier
- Determine the setting value between the end of the piston rod and the track rod joint

➥ e.g. determine the revolutions as you remove track rod joint **2**

- Remove track rod joint **2** from piston rod **3**
- Remove threaded pipe fitting **4**
- Remove the complete steering ram from the axle carrier

➥ 3 screws **5**

- Fasten the steering ram in a vice with aluminium clamps
- Remove circlip **6**
- Slide guide bushing **7** to the inside
- Remove circlip **8**
- Pull out piston rod **3** with guide bushing **7**
- Replace the seals and cuffs **9**
- Assembly in the reverse order

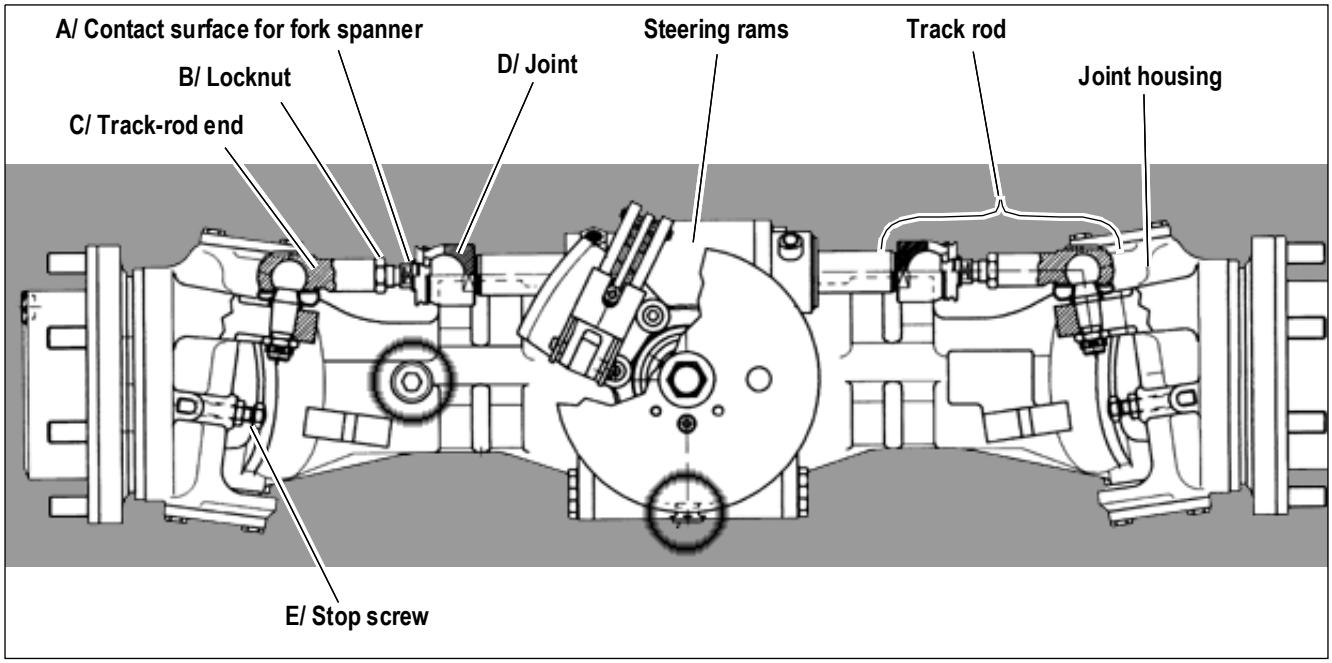
8.7 Checking a steering ram

- Apply pressure to the steering ram in centre position, i.e. block one side with a sleeve.
- Remove the hydraulic lines. The connecting piece to the manual pump must have a micro port and a stop cock
- Raise pressure to 150 bar; pressure is allowed to drop to about 20 bar in 10 minutes
- Then carry out a low-pressure test at 10 bar; no pressure drop in the process!

8.8 Overview of steering ram setting

Readjust the steering system when carrying out repair work on the axles or in case of complaints:

- After replacing/repairing the track rods or the track-rod ends **C**
- After carrying out repair work on the joint housings or stop screws **E**
- After carrying out repair work on the steering ram, e.g. replacing the piston rod or ram cylinder.
  The steering requires no setting in case of sealing work during which locknut **B** on track-rod end **C** has not been slackened.

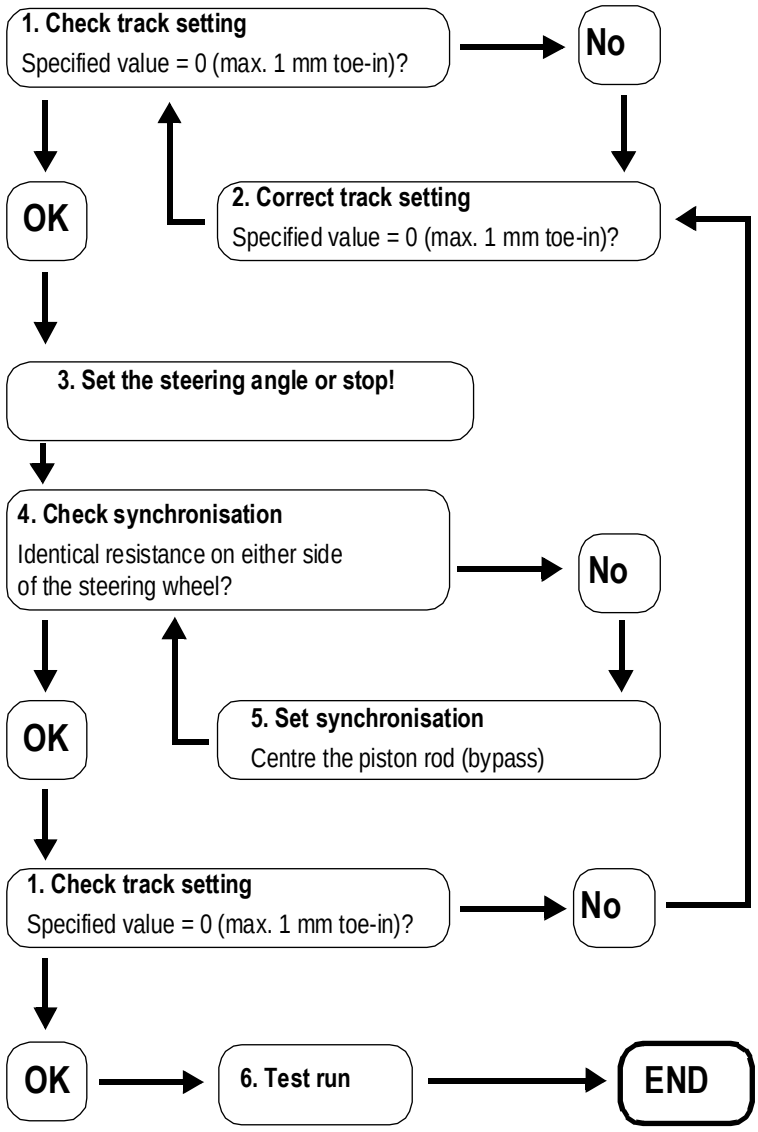


Necessary tools

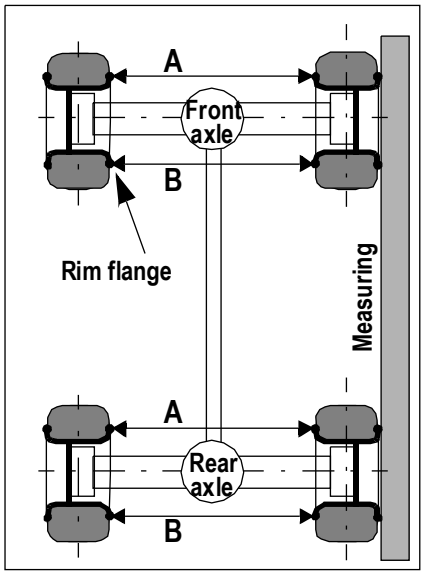
1 measuring staff, about 3 m
1 track measurement rod
1 screw connection G 10-L (order no. 1000020767)
Standard tools

8.9 How to check/set the steering rams

The diagram shows how to follow the separate steps.



8.10 Checking the track setting (1)



Check the track as follows:

☞ *Jack up the machine and prop it safely. Make sure there is enough space for steering at the full steering angles for the front and rear axles.*

☞ *Set the steering to straight ahead. Check with the measuring staff*

☞ *Determine **dimension A** and **dimension B**. To this effect, measure with the track measurement rod on the inside on the rim flange at the centre of the wheel*

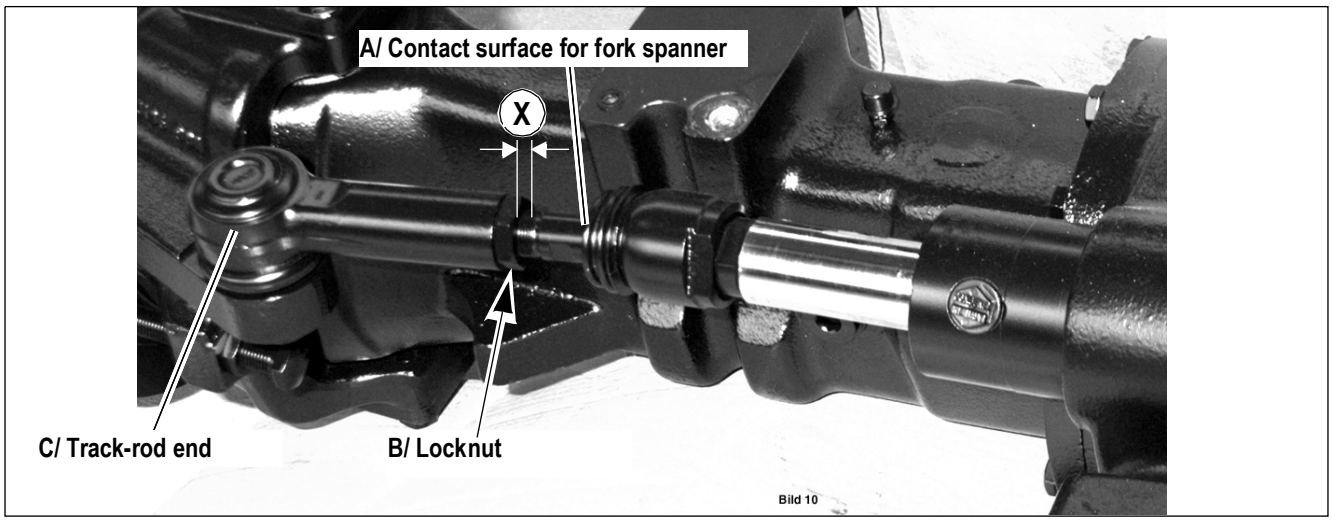
➥ **Rated dimension B – A = 0, max. + 1 mm**

➥ I.e. dimension **A** may be a max. 1 mm smaller than dimension **B** on the same axle

Caution!

Check and set the tracks of front and rear axles separately!
The front and rear axle dimensions can differ slightly due to production tolerances.

8.11 Correcting the track setting (2)



If the track setting does not correspond to the specified value **0 (max. 1 mm toe-in)**, set the track as follows:

☞ *Slacken locknut **B** on either side*

☞ *Slightly and evenly screw in or unscrew the threaded rod in track-rod end **C** on either side.*

➥ Make sure **dimension X** is approximately identical on either side.

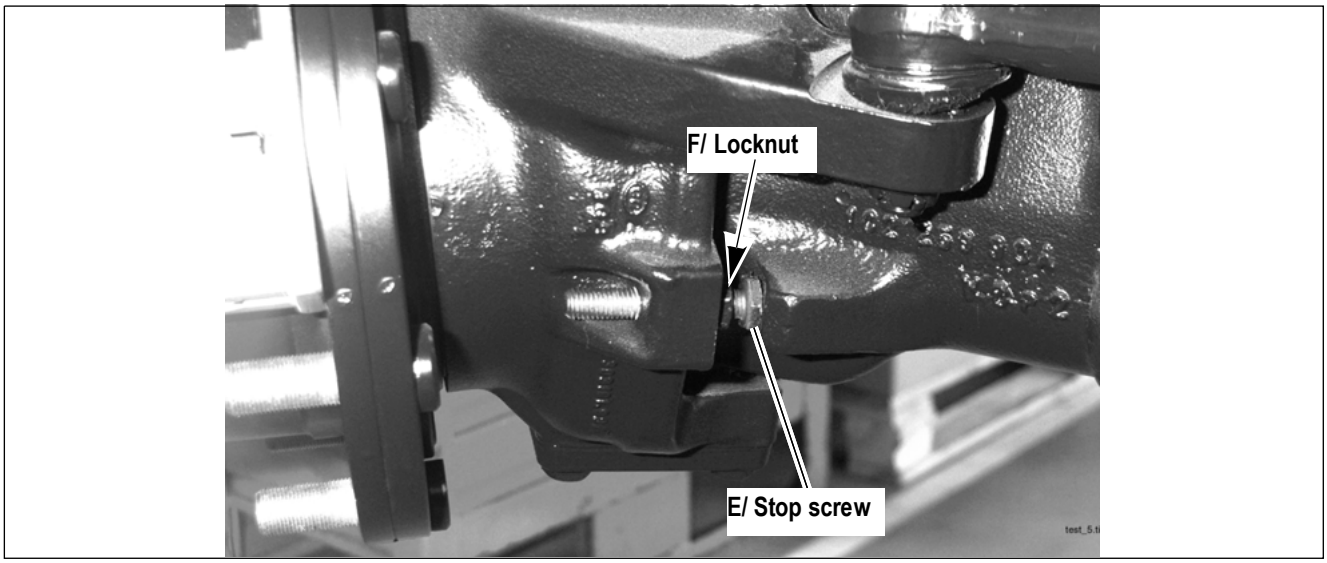
☞ *Check the track setting again*

☞ *Repeat this procedure until the track setting corresponds to the specified value.*

☞ *Counter locknut **B***

☞ *Check **dimension X** again on either side of the steering ram*

8.12 Setting the steering limit (3)



Specified value: steering angle = 40 ° (front and rear axles)

The steering synchronisation will not run correctly unless the steering angles of all wheels are exactly the same.

The exact setting of the steering angles and stops has been carried out in the plant.

Proceed as follows if no measurement equipment is available.

Proceed as follows:

☞ *Slacken locknuts **F** on stop screws **E***

☞ *Fully unscrew all stop screws **E** on either side of the front and rear axles*

☞ *Actuate the steering ram to the **left** as far as it will go*

➥ Stop screw **E** is not allowed to touch the limit stop on the axle

☞ *Turn stop screw **E** against the limit stop by hand, then unscrew it again **1.5 revolutions** and counter it with locknut **F***

☞ *Actuate the steering ram to the **right** as far as it will go*

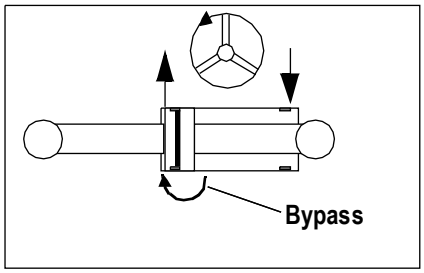
➥ Stop screw **E** is not allowed to touch the limit stop on the axle

☞ *Turn stop screw **E** against the limit stop by hand, then unscrew it again **1.5 revolutions** and counter it with locknut **F***

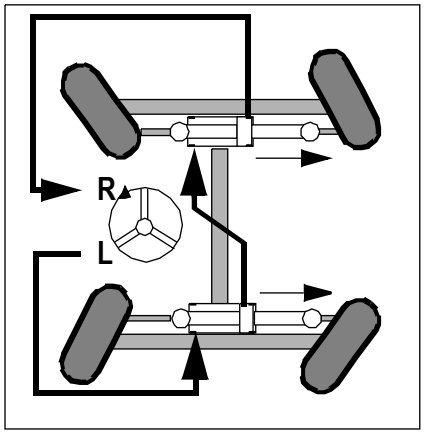
Important!

Carry out these basic settings on both joint housings of the front and rear axles. Limiting the maximum steering angle ensures steering angles of about 40°.

8.13 Checking steering synchronisation (4)



The axles are synchronised by means of a bypass in the final positions of the steering rams. In the final position of the piston, oil flows from one side of the cylinder to the other.



In the axle that reaches the steering limit first, the oil flows through a bypass in the steering ram and on to the other side if the wheels do not run synchronously.

If the steering wheel is turned further, the steering ram of the other axle moves on as far as it will go. The wheels on the inside curve have the same steering angle in this case. The wheels (or the axles) are hence synchronous.

If the steering is set to straight ahead again, the wheels (or the axles) run in the same track.

However, this only works optimally if the bypass position with regard to the left and right of the piston (and with regard to the front and rear axles) is symmetrical in the limit positions.

This is the case if the same resistance can be felt at the steering limits on the left and right when evenly turning the steering wheel at the same speed.

➥ The force required to turn the steering wheel at the limit stops on the left and right must be identical.

The steering rams (or the bypasses) of the front and rear axles must be centred separately as follows to ensure this.

Checking the bypass

When checking the front axle

☞ *Remove both flexible lines from the rear axle steering ram and connect them with an intermediate screw connection G 10-L (order no. 1000020767)*

When checking the rear axle

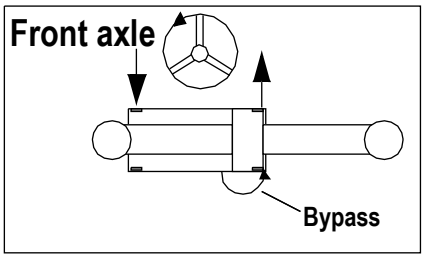
☞ *Remove both flexible lines from the front axle steering ram and connect them with an intermediate screw connection G 10-L (order no. 1000020767)*

Caution!

Make sure there is no air in the steering circuit otherwise synchronisation cannot be checked or set correctly!

☞ *Bleed the steering system after repairing the steering rams – see Bleeding the steering rams on page 8-10!*

Bleeding the steering rams



☞ *Start the engine*

☞ *Turn the steering wheel to the left until a resistance can be felt*

☞ *Continue turning the steering wheel 5 to 10 revolutions until the resistance no longer changes*

☞ *Turn the steering wheel to the right until a resistance can be felt*

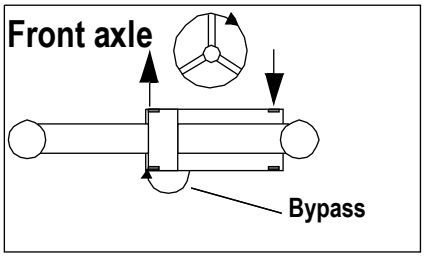
☞ *Continue turning the steering wheel 5 to 10 revolutions until the resistance no longer changes*

If there is no more air in the steering circuit, then ...

☞ *Turn the wheels to the left as far as they will go*

☞ *Continue turning the steering wheel against the limit*

➥ You must be able to feel a certain resistance (oil flows through the bypass)



☞ *Turn the wheels to the right as far as they will go*

☞ *Continue turning the steering wheel against the limit*

➥ You must be able to feel the same resistance here, too, as on the other side

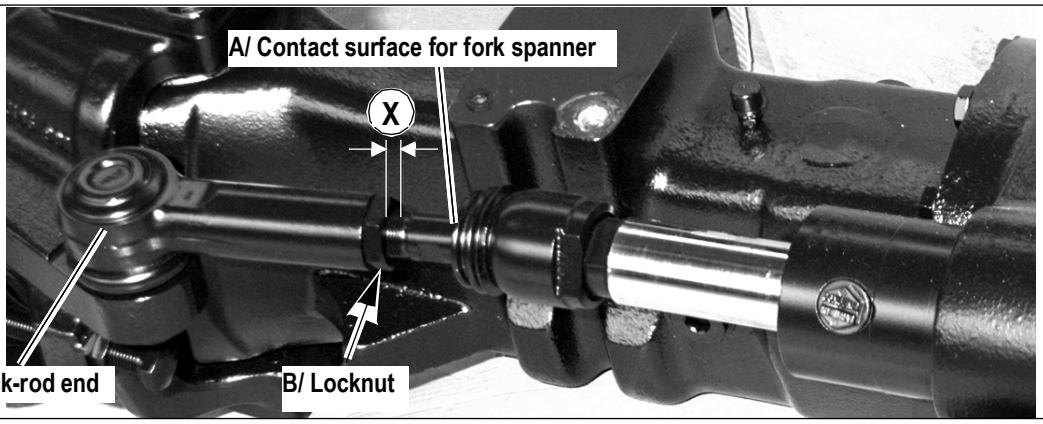
➥ If the resistance is stronger (at the same speed with which the steering wheel is turned), move the piston of the piston rod to the left until reaching the same resistance

☞ *See "Setting steering synchronisation (5)"* *on page 8-11*

Caution!

The steering rams of the front and rear axles are checked in the same way!

8.14 Setting steering synchronisation (5)



Caution!

Basically, always move the piston in the direction with the stronger resistance!

Proceed as follows:

☞ *Set the steering system to straight-ahead position*

☞ *Switch off the engine and the ignition*

☞ *Slacken locknut **B** on either side, counter on contact surface **A** with a fork spanner*

☞ *Move the piston gradually (half revolutions) until the resistance you can feel on the steering wheel is identical. To this effect:*

- ☞ Unscrew the threaded rod half a revolution on track-rod end **C** on the left
- ☞ Screw in the threaded rod the same number of revolutions on track-rod end **C** on the right

☞ *Tighten locknut **B** on either side, counter on contact surface **A** with a fork spanner as you do so*

☞ *Check the track again as soon as the piston rod is centred. **Dimension X** is of no importance now since it is no longer identical on the left and right.*

☞ *Remove the intermediate screw connection G 10-L (order no. 1000020767) between the flexible lines on the steering ram and mount the flexible lines correctly onto the steering ram connections*

Caution!

The steering rams of the front and rear axles are set in the same way!

Final check/test run

☞ *Tighten all flexible lines and screw connections oil-tight*

☞ *Put the machine back onto its wheels*

☞ *Carry out a test run. Turn the steering wheel to the left and right as far as it will go to check the synchronous position of the wheels*

Hydraulic system

9 Hydraulic system

9.1 Test report for model 347-03 (950)

Model:	Serial no.
_____	_____

Test conditions:	Oil temperature (rated): 50 – 60 °C Driving direction (rated):

Test features:	Notes:		Actual value:	
Diesel engine idling speed measured at the crankshaft	Lower pulley Upper pulley	1100 – 1180 2920 – 2970		
Work hydraulics 3rd control circuit	Measured on the hydraulic pump (max. engine speed)	225 – 240 bar		
Work hydraulics Lift ram (secondary)	Min. idling speed	240 bar		
Work hydraulics Tilt ram (dump out) (secondary)		115 – 135 bar		
Work hydraulics Tilt ram (dump in) (secondary)		240 bar		
Load stabiliser	Measured on the hydraulic pump	145 – 155 bar		
Steering pressure	At maximum engine speed	175 – 195		
Loader unit lowering measured at the piston rod	T oil = 50 °C P cylinder = 100 bar/t = 10 min	Lift ram max. 9.5 mm Tilt ram max. 11 mm		

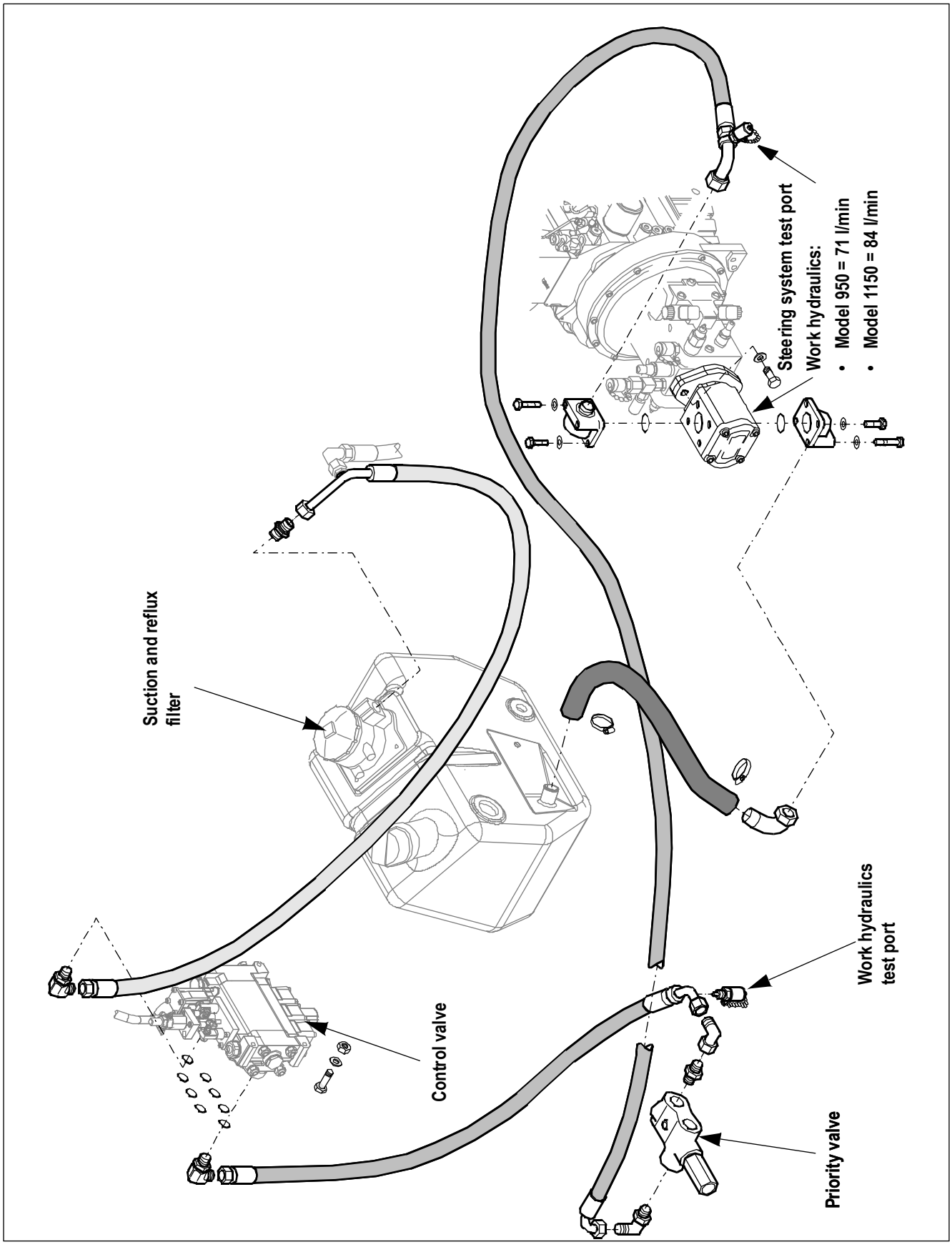
9.2 Test report for model 347-04 (1150)

Model:	Serial no.
_____	_____

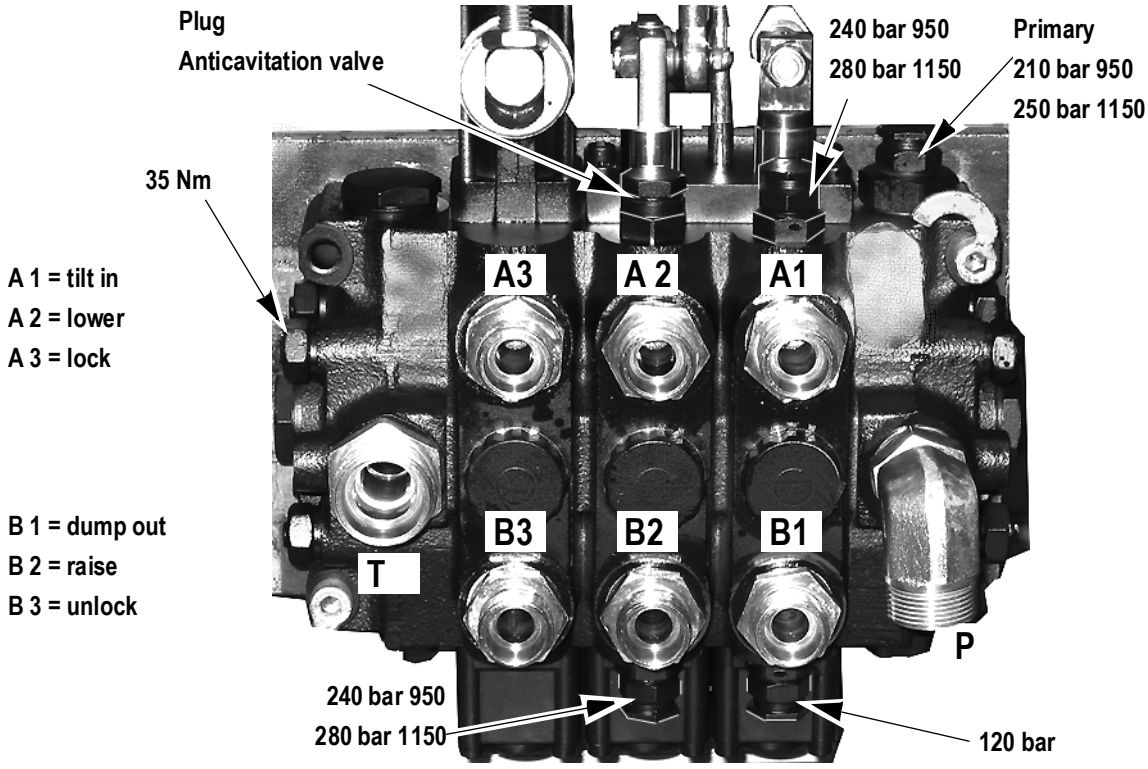
Test conditions:	Oil temperature (rated): 50 – 60 °C Driving direction (rated):

Test features:	Notes:		Actual value:	
Diesel engine idling speed measured at the crankshaft	Lower pulley Upper pulley	1200 – 1260 2920 – 2970		
Work hydraulics 3rd control circuit	Measured on the hydraulic pump (max. engine speed)	255 – 270 bar		
Work hydraulics Lift ram (secondary)	Min. idling speed	240 bar		
Work hydraulics Tilt ram (dump out) (secondary)		115 – 135 bar		
Work hydraulics Tilt ram (dump in) (secondary)		240 bar		
Load stabiliser	Measured on the hydraulic pump	145 – 155 bar		
Steering pressure	At maximum engine speed	175 – 195		
Loader unit lowering measured at the piston rod	T oil = 50 °C P cylinder = 100 bar/t = 10 min	Lift ram max. 9.0 mm Tilt ram max. 11 mm		

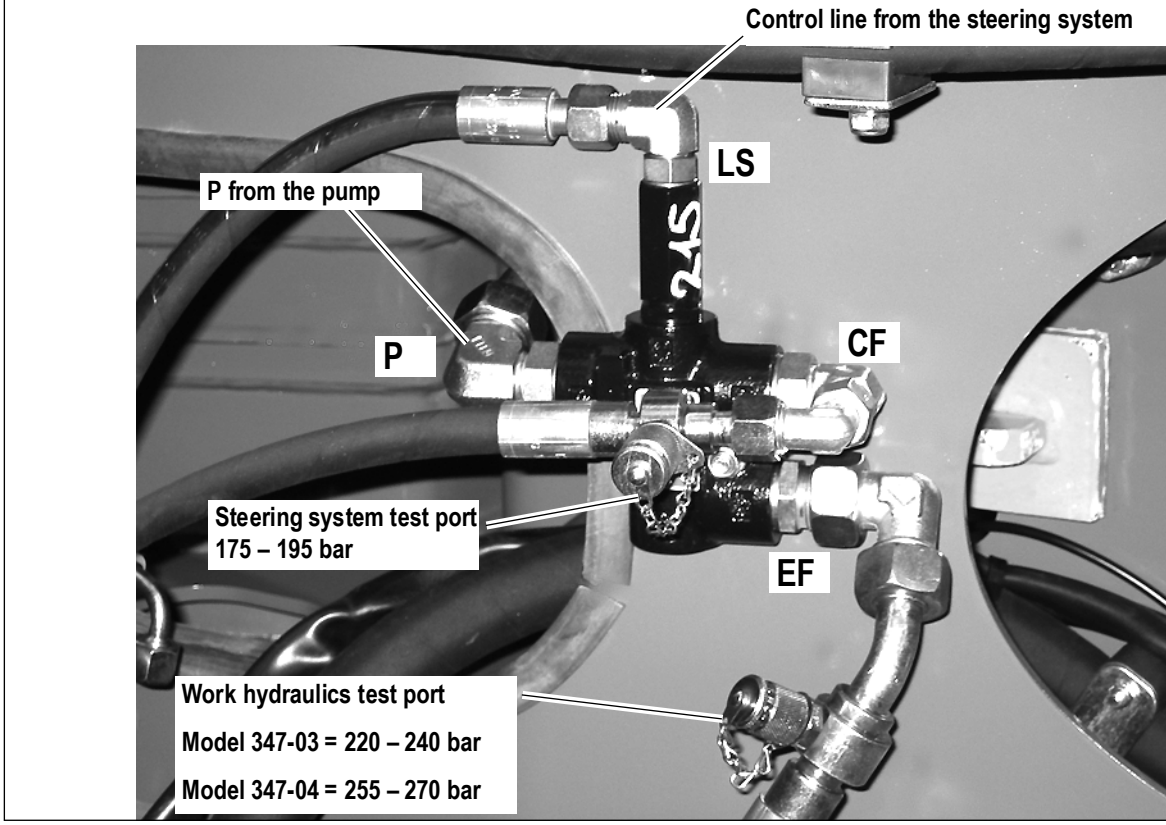
9.3 Work hydraulics oil supply



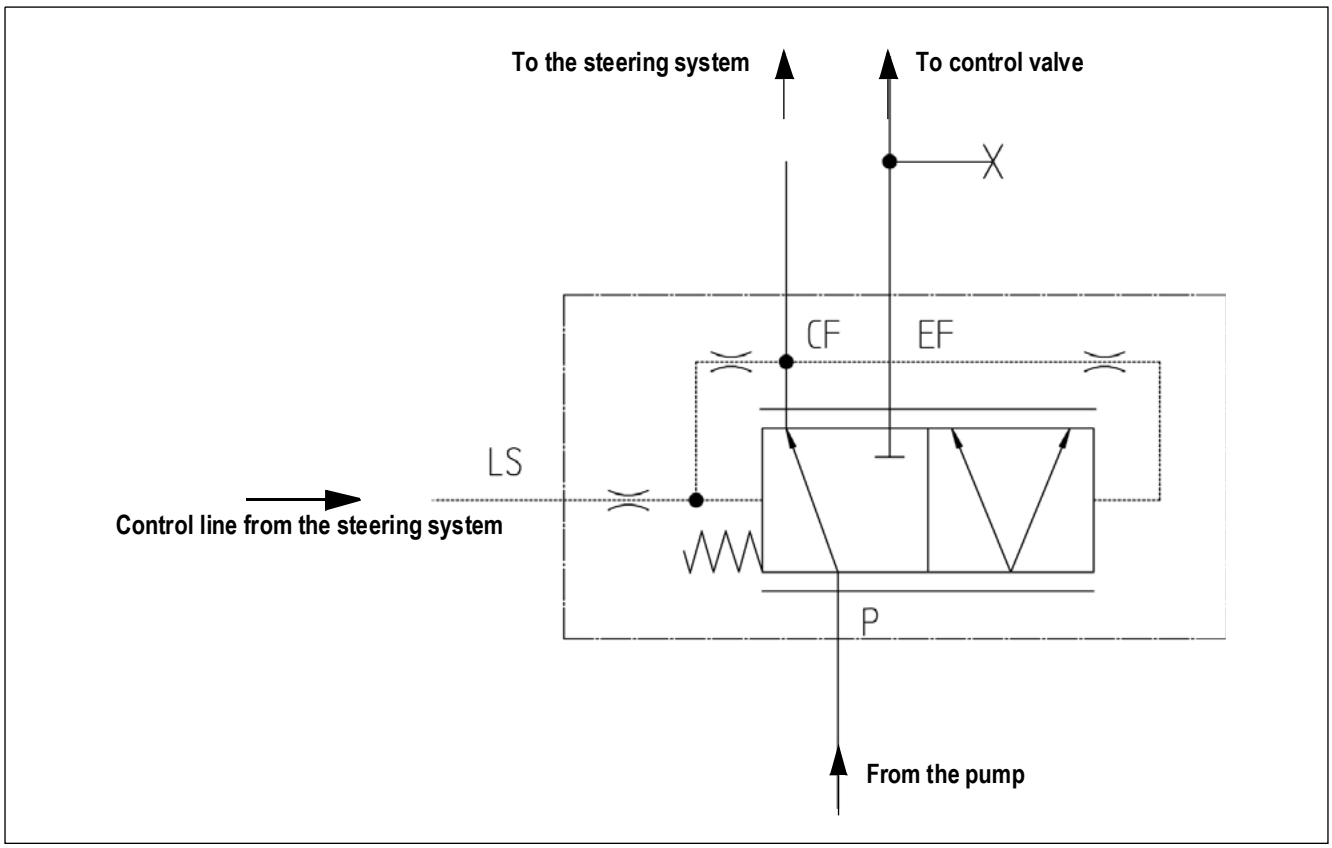
9.4 Control valve ports



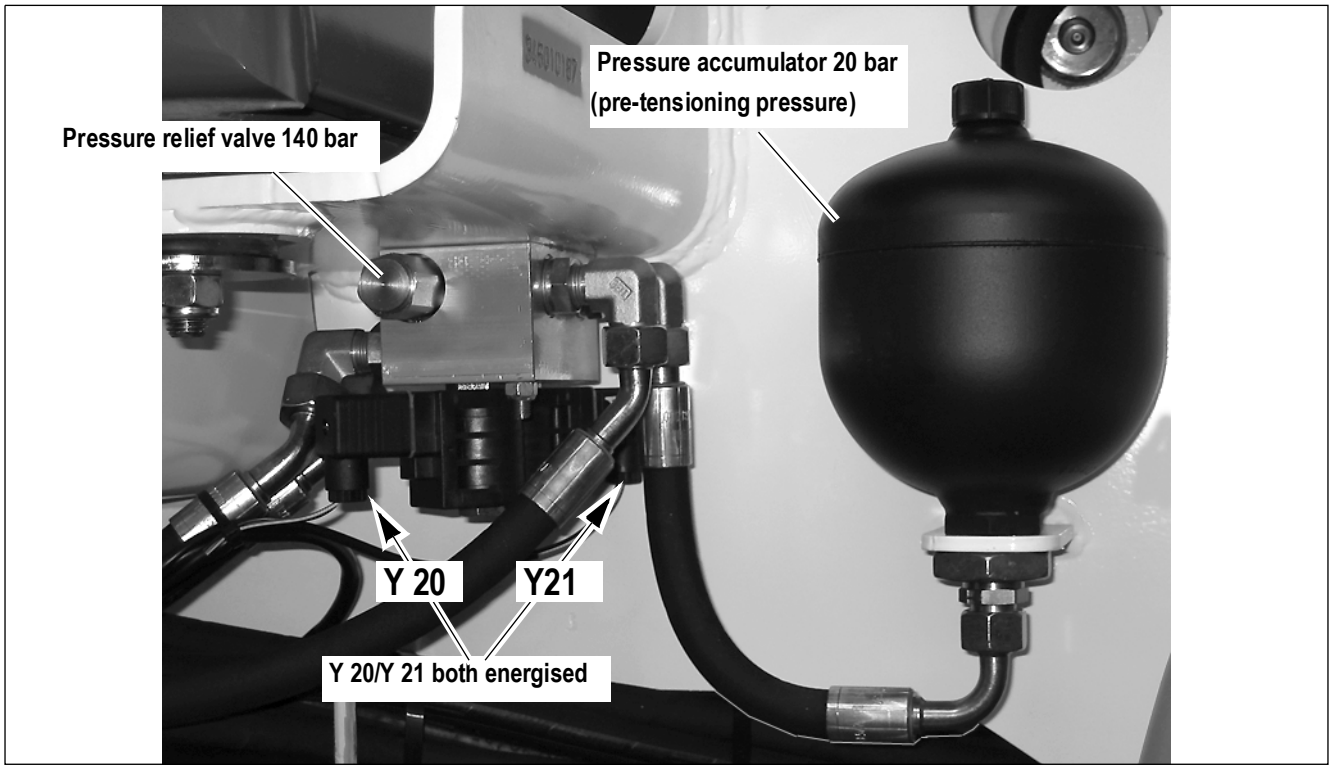
9.5 Priority valve ports



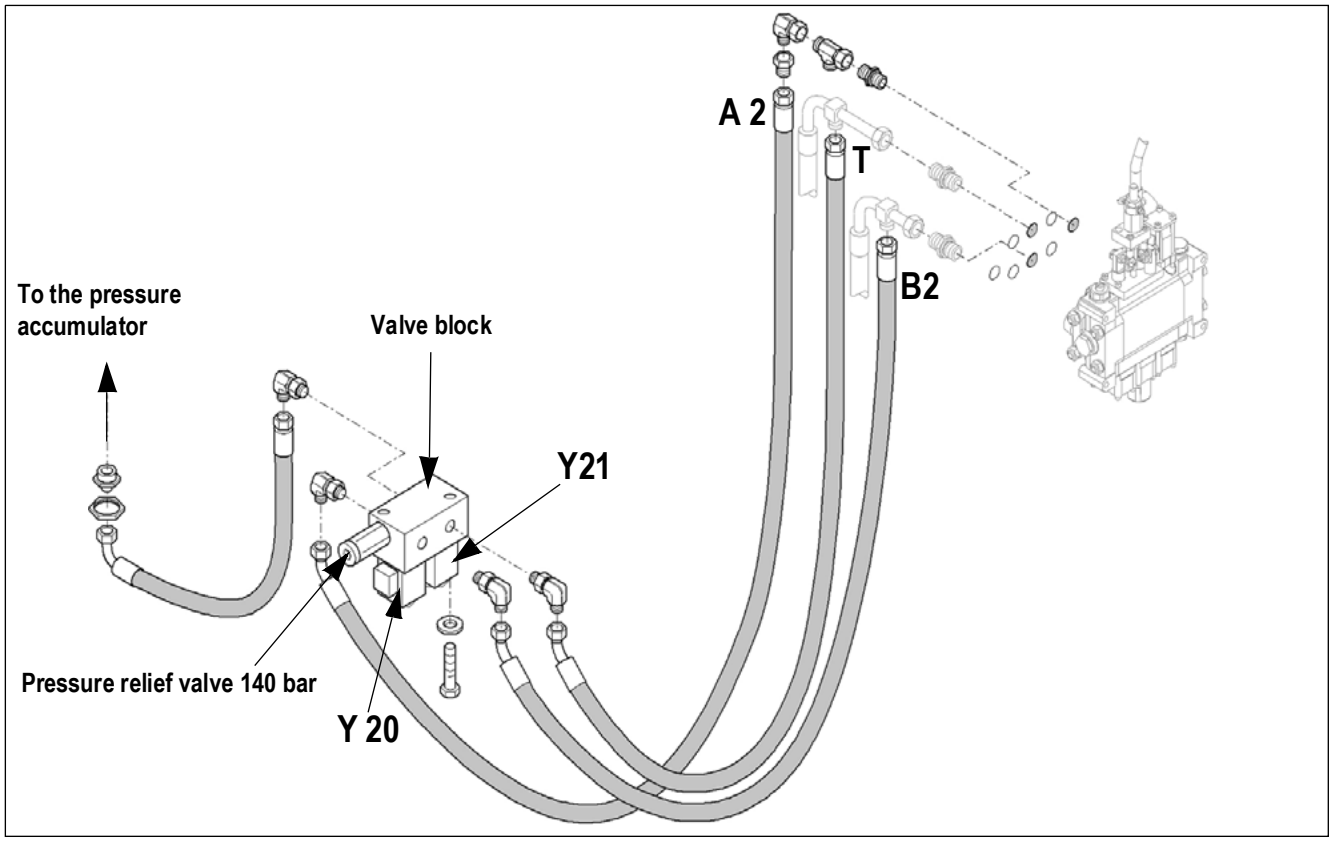
9.6 Priority valve diagram



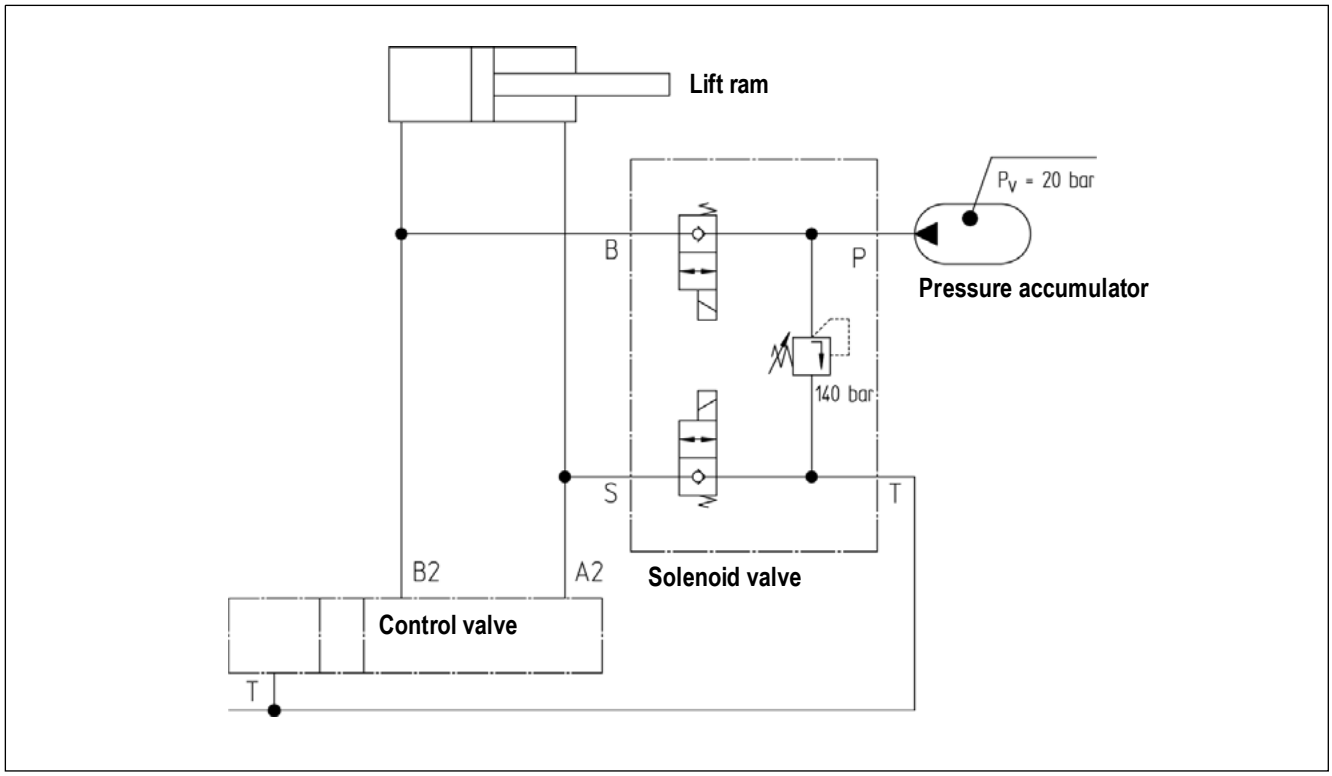
9.7 Load stabiliser ports



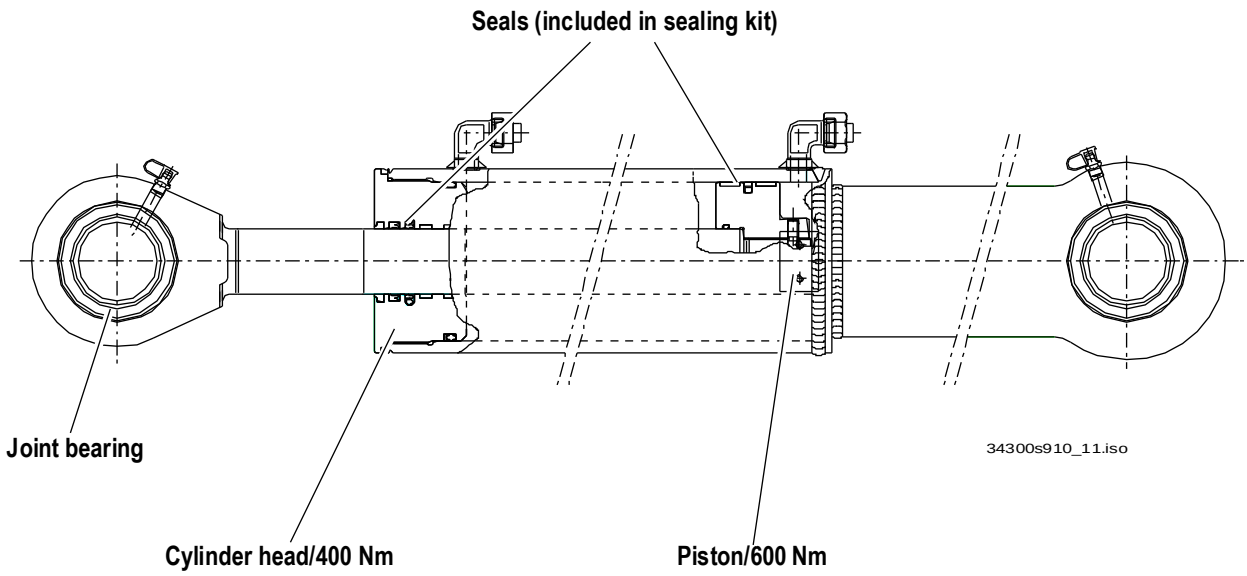
9.8 Load stabiliser circuit



9.9 Load stabiliser diagram



9.10 Lift ram: sealing work



Disassembly/assembly

☞ *Unscrew cylinder head with special key*

☞ *Pull out piston rod*

☞ *Remove threaded pin on piston*

☞ *Unscrew piston from piston rod*

☞ *Replace complete sealing kit*

➥ Sealing kit includes all seals, sleeves and threaded pins

➥ Calibrate the piston seal when replacing it

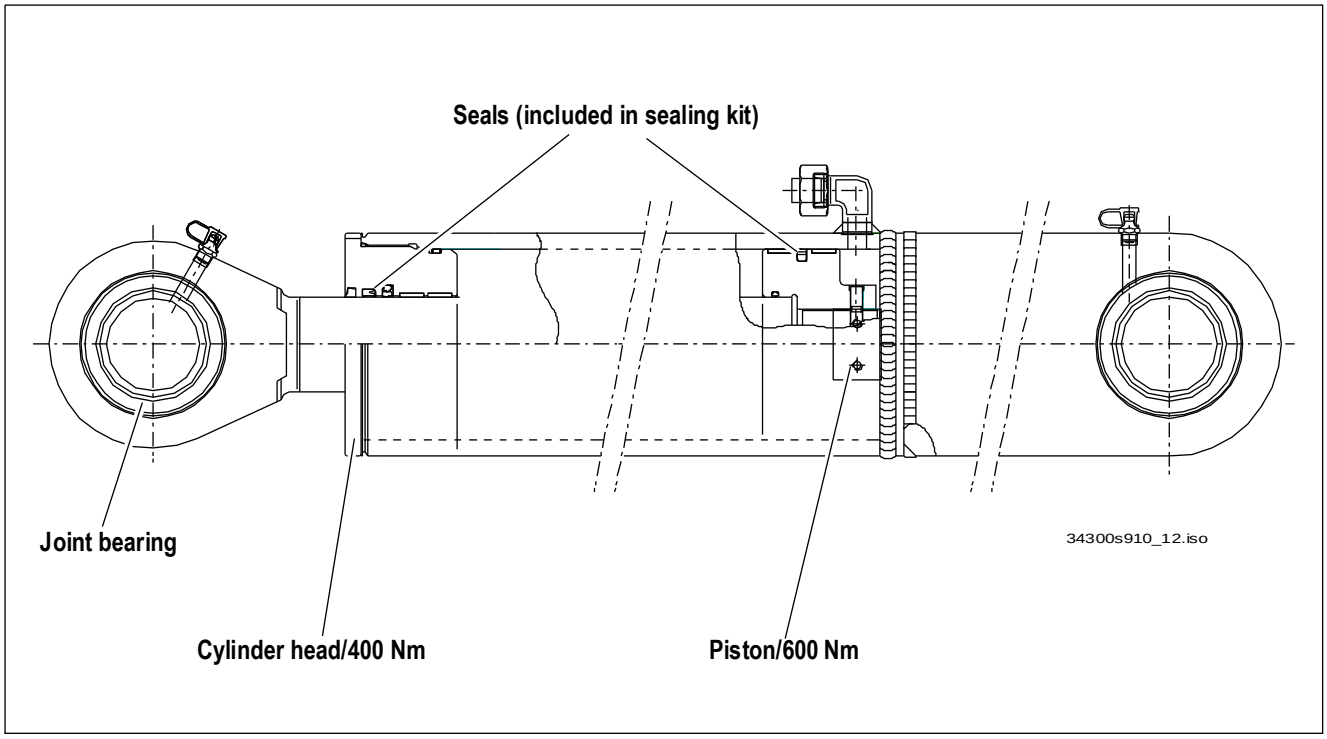
☞ *Assembly in the reverse order*

➥ Bear in mind the tightening torques

Caution!

Special tools required for sealing the ram

9.11 Tilt ram: sealing work



Disassembly/assembly

☞ *Unscrew cylinder head with special key*

☞ *Pull out piston rod*

☞ *Remove threaded pin on piston*

☞ *Unscrew piston from piston rod*

☞ *Replace complete sealing kit*

➥ Sealing kit includes all seals, sleeves and threaded pins

➥ Calibrate the piston seal when replacing it

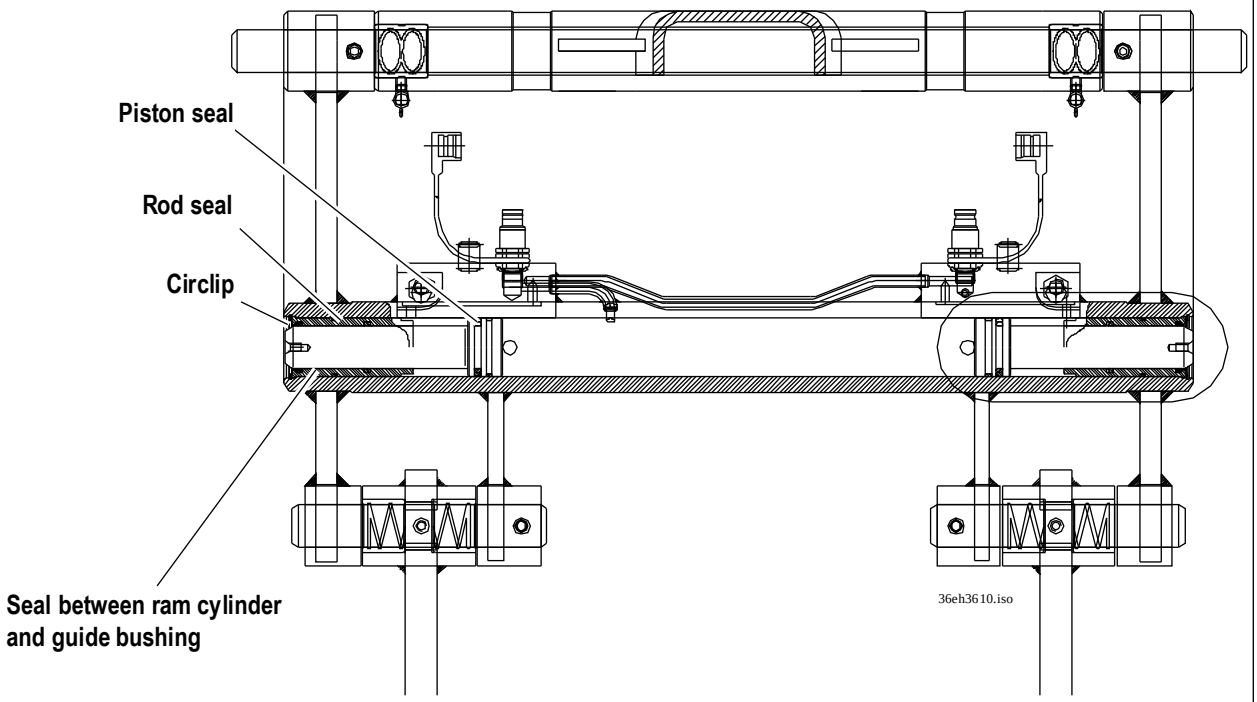
☞ *Assembly in the reverse order*

➥ Bear in mind the tightening torques

Caution!

Special tools required for sealing the ram

9.12 Control ram (quickhitch frame): sealing work



Disassembly/assembly

☞ *Release the pressure in the quickhitch ram control circuit*

☞ *Remove the circlip*

☞ *Drive out the piston with an impact extractor M 8*

☞ *Renew the seal between piston rod and guide bushing*

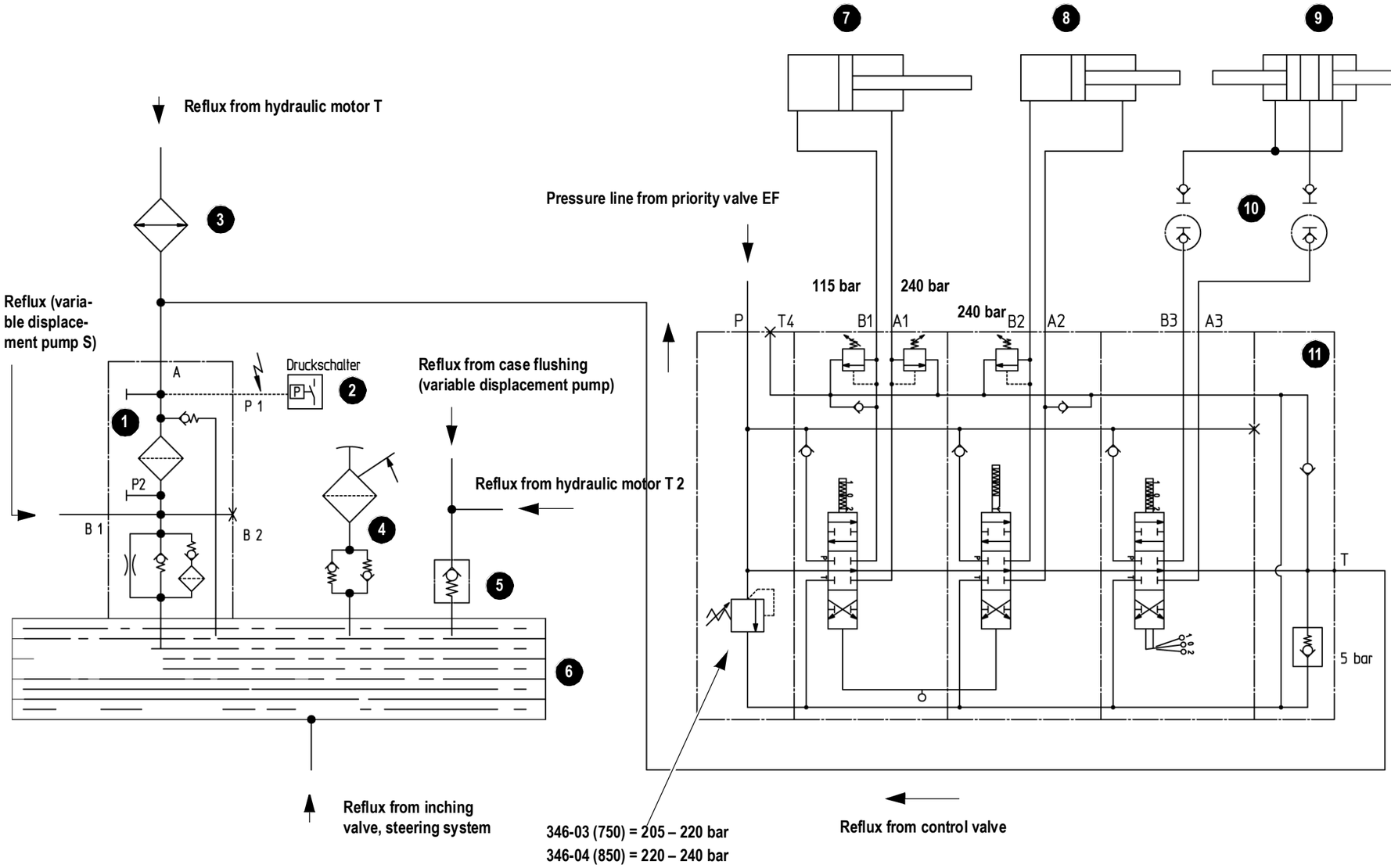
➥ Replace complete sealing kit

☞ *Assembly in the reverse order*

Caution!

Special tools required for sealing the ram

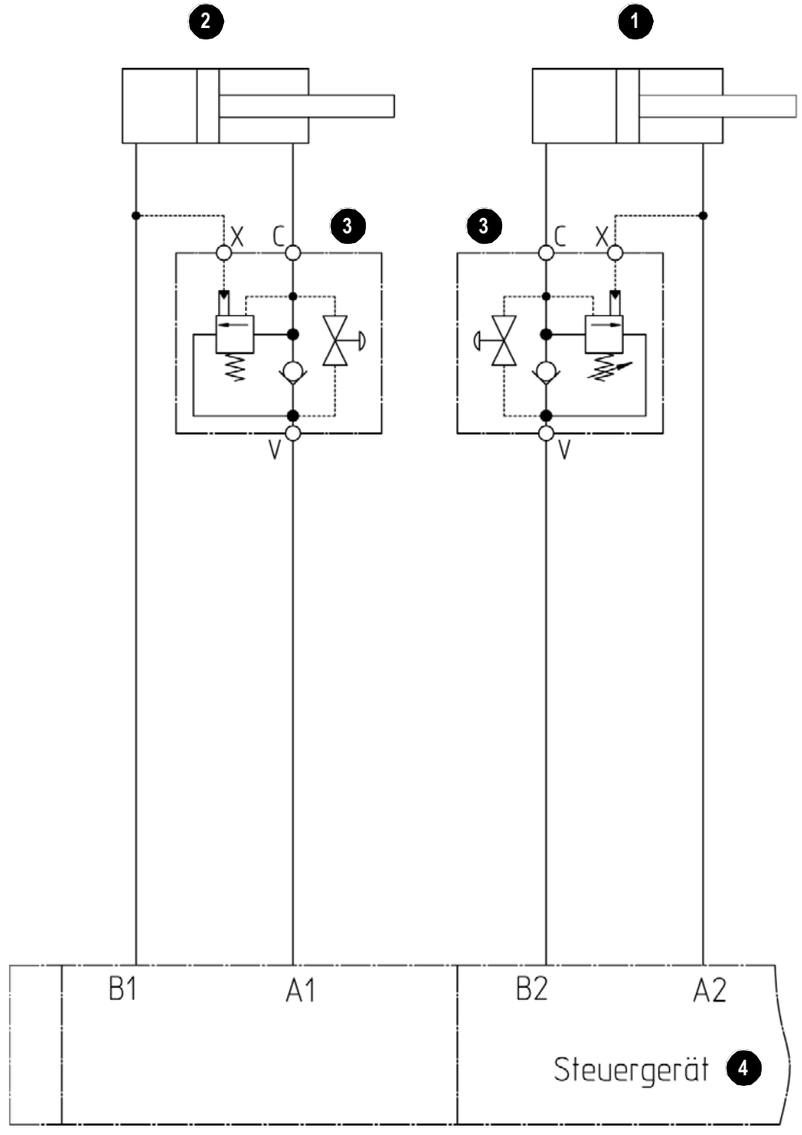
9.13 Work hydraulics diagram



Ref.	
1	Reflux suction filter
2	Pressure switch
3	Oil-to-water-cooler
4	Vent filter
5	Non-return valve 1.5 bar
6	Hydraulic oil tank
7	Tilt ram
8	Lift ram
9	Control ram (3rd control circuit)
10	Quick couplers (3rd control circuit)
11	Control valve (3-fold)

Work hydraulics diagram

9.14 Hose burst valve hydraulics diagram (option)



Ref.	
1	Lift ram
2	Tilt ram
3	Hose burst valve
4	Control valve (3-fold)

Electrical system

10 Electrical system

10.1 Ohm's Law (current, voltage, resistance); power

It describes the interrelation between current, voltage and resistance.

Current "**I**" – Ampere (A)
Voltage "**U**" – Volt (V)
Resistance "**R**" – Ohm (Ω)

! Mnemonic**:**



Output
Power "P" – Watt (W)

$P = U \times I = R \times I^2 = U^2/R$

10.2 Measuring equipment, measuring methods

Multifunction measuring device

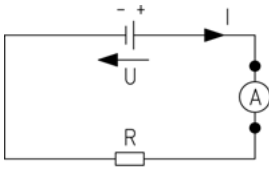
- Measurements of values (U, R, I, f)
- Continuity test
- Diode test

Calculate measuring range using known data (P, U, R, I) and set before measuring!
Observe AC/DC basic setting.
➥ AC = alternating current/voltage;
➥ DC = direct current/voltage

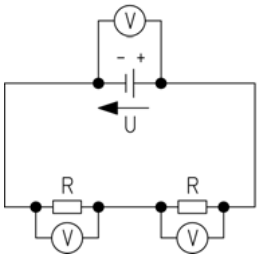
Test device with acoustic and optical signal output

- Continuity test in de-energised machine electrical system and of wiring harnesses

Measuring methods – multifunction measuring device



- Measuring current (ignition switched on):
- Black cable in COM socket (earth),
- red cable in A socket or mA socket; connect in series to consumer.



- Measuring voltage (ignition switched on):
- Black cable in COM socket (earth),
- red cable in V socket;
- connect in parallel to consumer.
- Measuring resistance (ignition switched off):
- Black cable in COM socket (earth),
- red cable in Ω socket;
- connect in parallel to consumer (see measuring voltage).

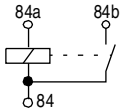
10.3 Terminal description

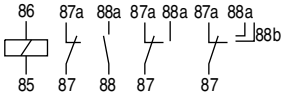
Terminal descriptions and cable descriptions are not identical because equipment with different terminal descriptions can be connected to both ends of a cable.

If there are not enough terminal descriptions (multiple connectors), the terminals are marked with continuous number or letter codes without any standardised function assignment.

Terminal	Meaning
1	**Ignition coil, ignition distributor** Low voltage
1a 1b	Ignition distributor with two separate electrical circuits to ignition contact breaker I to ignition contact breaker II
2	Short-circuit terminal (magneto ignition)
4	Ignition coil, ignition distributor High voltage
4a 4b	Ignition distributor with two separate electrical circuits from ignition coil I, terminal 4 from ignition coil II, terminal 4
15	Switched plus behind battery (output ignition [drive] switch)
15a	Output at dropping resistor to ignition coil and starter
17 19	**Preheating start switch** Start Preheating
30	**Battery** Input from + battery terminal, direct
30a	12/24 V battery changeover relay Input from + terminal of battery II
31	Return line to battery Minus terminal or earth, direct
31b	Return line to battery Minus terminal or earth, via switch or relay (switched negative)
31a 31c	12/24 V battery changeover relay Return line to minus terminal of battery II Return line to minus terminal of battery I
32 33 33a 33b 33f 33g 33h 33L 33R	**Electric motors** Return line[1)] Main terminal connection[1)] Self-parking switch-off Shunt field For second lower speed range For third lower speed range For fourth lower speed range Counterclockwise rotation Clockwise rotation
45	**Starter** Separate starter relay, output; Starter, input (main current)

Terminal	Meaning
45a 45b	Two-starter parallel operation Starting relay for engagement current Output starter I, Input starters I and II Output starter II
48	Terminal on starter and on start-repeating relay (to monitor starting)
49 49a 49b 49c	**Turn indicator unit** (pulse generator) Input Output Output, 2nd turn indicator circuit Output, 3rd turn indicator circuit
50	**Starter** Starter control (direct)
50a	Battery changeover relay Output for starter control
50b	Starter control with parallel operation of 2 starters with sequential control
50c 50d	Starting relay for sequential control of the engagement current during parallel operation of 2 starters Input at starting relay for starter I Input at starting relay for starter II
50e 50f	Start locking relay Input Output
50g 50 h	Start repeat relay Input Output
51 51e	**AC alternator** Direct current voltage at rectifier Direct current voltage at rectifier with choke coil for daytime driving
52	**Trailer signals** Signals from trailer to towing machine
53 53a 53b 53c 53e 53i	**Wiper motor**, input (+) Wiper (+), self-parking switch-off Wiper (shunt winding) Electric window washer pump Wiper (brake winding) Wiper motor with permanent magnet and third brush (for higher speed)
54 54g	**Trailer signal** For lamp combinations and trailer plug connections **Brake lights** Pneumatic valve for additional retarding brake, electromagnetically actuated
55	**Fog lights**
56 56a 56b 56d	Headlight High beam and high beam telltale Low beam Headlight flasher contact

Terminal	Meaning
57 57a 57L 57R	**Side marker light** for motorcycles (also for cars, trucks etc. in other countries) **Parking light** Parking light, left Parking light, right
58 58b 58c 58d 58L 58R	**Side marker, rear, numberplate and instrument panel lights** Rear light changeover for single-axle tractors Trailer plug-and-receptacle assembly for single-conductor rear light cable with fuse in trailer Variable-intensity instrument panel lights, side marker and rear light Left Right, numberplate light
59 59a 59b 59c	**AC alternator** (magneto alternator) Alternating voltage, output, rectifier, input Charging armature, output Rear light armature, output Brake light armature, output
61	**Alternator charge telltale**
71 71a 71b	**Tone sequence control device** Input Output to horns 1 + 2 low Output to horns 1 + 2 high
72	**Alarm switch** (rotating beacon)
75	Radio, cigarette lighter
76	Loudspeaker
77	Door valve control
81 81a 81b 82 82a 82b 82z 82y 83 83a 83b 83L 83R	**Switches (**break contact and changeover switches) Input 1st output, break side 2nd output, break side Make-contact switch Input 1st output 2nd output 1st input 2nd input Multiple position switch Input Output, position 1 Output, position 2 Output, left-hand side position Output, right-hand side position
84 84a 84b	**Current relay** Input, actuator and relay contact Output, actuator Output, relay contact 

Terminal	Meaning
85 86 86a 86b	Switching relay – output, actuator (end of winding negative or earth) Input, actuator Start of winding Start of winding or 1st winding Winding tap or 2nd winding 
87 87a 87b 87c 87z 87y 87x	Relay contact for break and changeover contacts Input 1st output (break side) 2nd output 3rd output 1st input 2nd input 3rd input
88	Relay contact for make-contact Input
88a 88b 88c	Relay point for make-contact and changeover contacts (make side) 1st output 2nd output 3rd output
88z 88y 88x	Relay contact for make-contact 1st input 2nd input 3rd input
Alternator and governor	
B+ B- D+ D- DF DF 1 DF 2	Battery positive Battery negative Dynamo positive Dynamo negative Dynamo field Dynamo field 1 Dynamo field 2
U, V, W	Three-phase alternator – three-phase terminals
Turn indicators (turn indicator unit)	
C C0 C2 C3 L R	First telltale Main terminal connection for separate indicator circuits actuated by the turn indicator switch Second telltale Third telltale (e.g. when towing two trailers) Turn indicators (left) Turn indicators (right)

10.4 Colour coding of electric lines

The cables are colour-coded according to DIN 72551 Part 4. Refer to the 21 pin cab/frame interface or the explanation in the wiring harness drawings for other colours not listed in this DIN standard.

Extract from DIN 72551, sheet 4

Line		Basic colour	Identification colour
From	to		
Ignition coil I	Ignition distributor (low-voltage ignition lead)	Green	-
Ignition coil II	Ignition distributor (low-voltage ignition lead)	Green	Red
Battery	Starter	Black	-
Battery	Earth (if bare earth lead is not used)	Black	-
Starter	Alternator	Red	-
Starter	Control panel (30)	Red	-
Light switch (30)	Ignition switch (30)	Red	-
Control panel (30) or light switch (30)	Fuse	Red	-
Fuse	Hand lamp, radio, clock etc.	Red	-
Control panel (15/54)	Heater plug and starter switch; heater-plug telltale	Black	-
Heater plug and starter switch; heater-plug telltale	Glow plugs	Black	-
Ignition switch (15/54)	Ignition coil	Black	-
Ignition switch or control panel (54/15/61a)	Telltales	Black	-
Control panel or ignition switch (15/54)	Fuse	Black	-
Fuse box	Brake light	Black	Red
Fuse box	Turn indicator switch	Black	White-green
Turn indicator switch	Turn indicators, left	Black	White
Turn indicator switch	Turn indicators, right	Black	Green
Telltale	Turn indicators	Light blue	-
Fuse	Cigarette lighter	Black	-
Fuse	Heated window	Black	Yellow-red
Fuse	1st horn	Black	Yellow
Fuse	2nd and 3rd horn	Black	Yellow-light blue
Horns	1 pole horn pushbutton (earth)	Brown	-
Fuse	Wipers	Black	Purple
Battery charge telltale	Terminal 61 of alternator or reverse current cutout	Light blue	-
Fuse	Main beam telltale	Light blue	White
Oil pressure gauge (indicator)	Oil pressure switch	Light blue	Green
Fuel level indicator	Fuel tank	Light blue	Black
Tyre-pressure warning device	Tyre-pressure drop indicator	Light blue	Yellow
Control panel bzw. Lichtschalter	Low beam switch	White	Black
Low beam switch (a)	Fuse	White	-

Line		Basic colour	Identification colour
From	to		
Fuse	Main headlight, left	White	-
Fuse	Main headlight, right	White	-
Low beam switch (b)	Fuse	Yellow	-
Fuse	Low beam, left	Yellow	-
Fuse	Low beam, right	Yellow	-
Control panel or light switch (58)	Fuse	Grey	-
Fuse	Rear light, side light and side marker lights left	Grey	Black
Fuse	Numberplate light (combined with rear left light)	Grey	Black
Fuse	Rear light, side light and side marker lights, right	Grey	Red
Fuse	Numberplate light (combined with rear right light)	Grey	Red
Fuse	Numberplate light (only if special line is laid)	Grey	-
Fuse	Dome light	Red	-
Control panel (57)	Fuse	Grey	Green
Control panel bzw. Lichtschalter	Instrument panel light	Grey	Red
All consumers except the battery earth lead if the use of bare lines is not possible	Earth	Brown	-
Battery changeover switch (50)/starter pushbutton or heater plug and starter switch	Starter	Black	-

Other colour codes (identical to IEC 757)

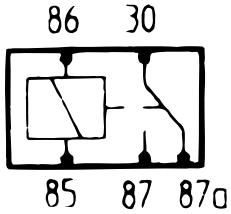
Colour	Abbreviation Old	Abbreviation New
Black	**sw**	**BK**
Brown	**br**	**BN**
Red	**rt**	**RD**
Orange	**or**	**OG**
Yellow	**ge**	**YE**
Green	**gn**	**GN**
Blue	**bl**	**BU**
Violet	**vi**	**VT**
Grey	**gr**	**GY**
White	**ws**	**WH**
Pink	**rs**	**PK**
Gold	**-**	**GD**
Turquoise	**tk**	**TQ**
Silver	**-**	**SR**

10.5 Switching relay function

Use, mode of function

Relays are used for switching electric loads (high currents) whereby the control power of the relay coil is relatively low. Relays can therefore be controlled by micro electronics or micro switches (e.g. touchpad keyboards, sensors). The switch contacts can be make-contact, break-contact or changeover switches. These undertake the actual switching function.

Terminal description on relay



Zero-centre relay

86 = Start of coil (control line)

85 = End of coil (earth)

30 = Input (load line)

87 = Make-contact switch output (load line)

87 a= Break-contact switch output (load line)

10.6 Starter, battery, alternator

Electrical system	
Alternator	12 V 95 A
Starter	12 V 2.3 kW
Battery	12 V 72 Ah

10.7 Fuse box

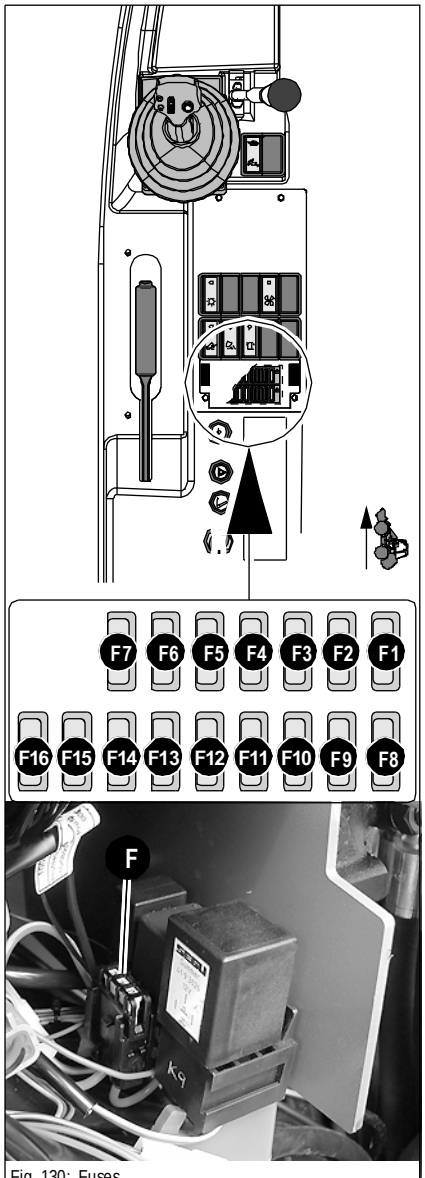


Fig. 130: Fuses

No.	Rated current	Protected circuit
F1	7.5	High beam (left)
F2	7.5	High beam (right)
F3	5	Left side marker and rear lights, front socket
F4	5	**Switch assignment:** 4th control circuit S11, front/rear working light, front attachments (option), rotating beacon (option) **Switch lights:** lights, heating S5, load stabiliser S8, 3rd control circuit, right side marker and rear lights, front socket (option)
F5	7.5	High current relay – preheating and starting, high current relay, interior light, relays – minus compensation, preheating telltale, hazard warning light
F6	25	Cigarette lighter, rotating beacon (option), front/rear working light
F7	25	High beam telltale
F8	7.5	Low beam (left)
F9	7.5	Low beam (right)
F10	5	Switching relay – front attachment (option), instrument panel, cutoff solenoid, sensor (coolant level indication)
F11	15	Washer pump, rear wiper, relays – wiper, front wiper, horn
F12	5	Solenoid valve 1st/2nd speed range, differential lock
F13	7.5	Relays – forwards/reverse, solenoid valve – forwards/reverse, backup warning system
F14	20	Front attachment (option), heater fan
F15	7.5	Relay – turn indicators, brake lights, solenoid valve (exhaust gas recirculation)
F16	5	Radio (option)
F	20	Air conditioning (option) Access: maintenance flap (outside right of cab)

10.8 Main fuse box with relays

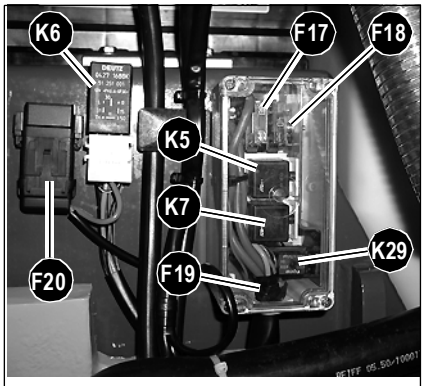


Fig. 131: Main fuse box

The main fuse box with the power relays and the preheating time control unit is located in the engine compartment on the left underneath the battery.

Fuse no.	Rated current (A)	Protected circuit
F17	80 A	Main fuse (machine)
F18	40 A	Preheating (intake-air preheating), starter fuse
F19	10 A	Minus compensation
F20	50 A	Preheating (2nd glow plug, intake-air preheating)

Relay no.	Protected circuit
K5	Preheating: power relay
K6	Preheating time control unit
K7	Start: starter relay
K29	Minus compensation

10.9 Switching relays for differential lock, warning sensor, air conditioning (option)

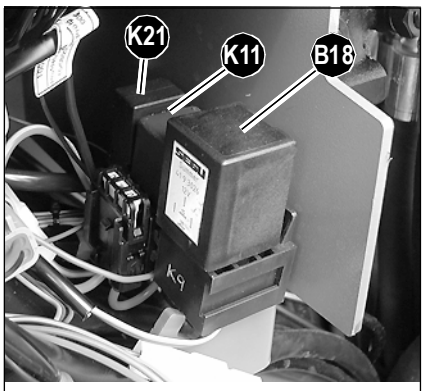


Fig. 132: Differential lock switching relay

The switching relays are located on the control valve bracket.

➥ Access: maintenance flap (outside right of cab).

Switching relay no.	Protected circuit
K21	Differential lock switching relay
K11	Air conditioning (option) switching relay
B18	Diesel engine temperature warning buzzer

10.10 Switching relays

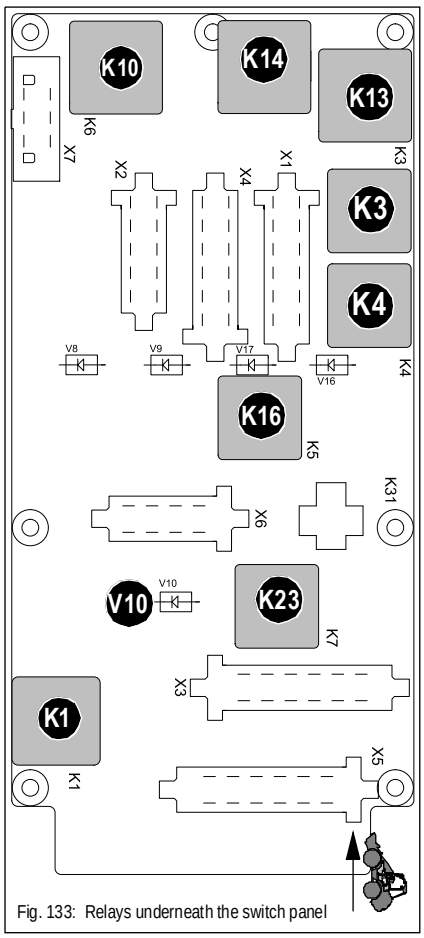


Fig. 133: Relays underneath the switch panel

The switching relays are located underneath the switch panel (side console on the right).
➥ Access: maintenance flap (outside right of cab).

Switching relay no.	Protected circuit
K1	High current relay
K3	Reverse driving switching relay
K4	Forwards driving switching relay
K10	Switching relay – turn indicators
K13	3rd control circuit switching relay
K14	
K16	Switching relay – front socket (option)
K23	Wiper switching relay
V10	Blocking diode

10.11 Description of blocking diodes

Blocking diodes V8, V9

Function

- V9 has no function in the 50 series
- V8 only for the differential lock function (100 % switchable)

Location

- On the board

Blocking diode V10

Function

- V10 has no function in the 50 series

Location

- On the board

Blocking diode V11

Function

- V11 has the function of preventing the engine from starting with the parking brake released.

  ➥ Relay K7 is earthed via the telltale if V11 is defective

Location

- On X1

Blocking diodes V16, V17

Function

- V16/V17 for the lights (S15 switch for fan)

  ➥ Switch S15 is not lit if V16/V17 are defective

Location

- On the board

Blocking diodes V20, V21

Function

- V20, V21 are used for the float position with hose burst valve and load stabiliser
- V20 is used for the load stabiliser

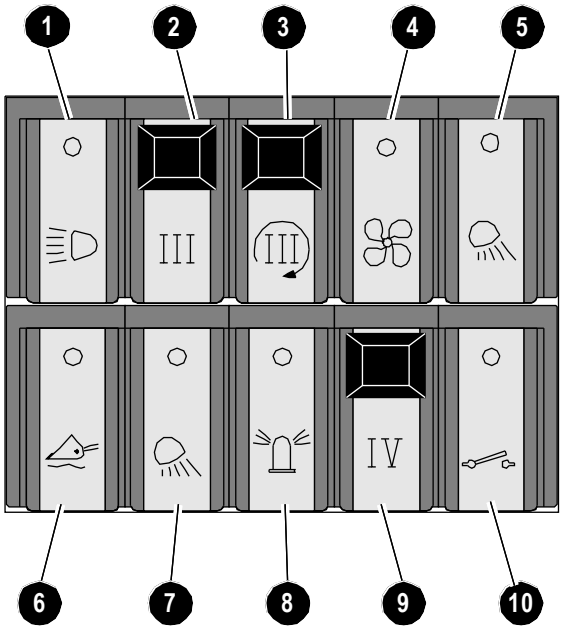
  ➥ The hose burst valve is not switched if V20 is defective
- V21 is used for the float position with hose burst valve

  ➥ The hose burst valve does not open if V21 is defective

Location

- On the board

10.12 Overview of switch assignment



Caution!

Mount the switches as shown and affix symbols on them to avoid damage due to malfunctions!

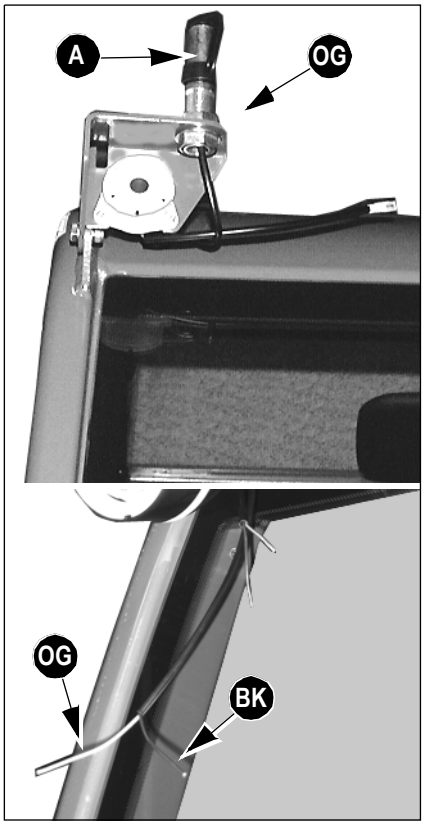
☞ *Remove the dummy cover*

☞ *Insert the switch (tip switch) in the board*

Switch position	1	2	3	4	5
Abbreviation	S 14	S32	S33	S 15	S 17
Switch order no.	1000051958	10001001016	1000116427	1000051967	1000051971
Symbol order no.	1000115420	–	–	1000052358	1000096654
Function	Lights	Electrical 3rd control circuit	Continuous operation of 3rd control circuit	Heating/fan	Only with 2 rear working lights

Switch position	6	7	8	9	10
Abbreviation	S 44	S 16	S 18	S 56	S 27
Switch order no.	1000052377	1000051959	1000051959	1000116428	1000051959
Symbol order no.	1000051962	1000052361	1000052356		1000052354
Function	Load stabiliser	Working light	Rotating beacon	4th control circuit	Front socket

10.13 Retrofitting a rotating beacon



☞ *Mount bracket **A** for the rotating beacon at the rear left of the cab*

☞ *The cable for the rotating beacon is located at the rear left in the cab frame*

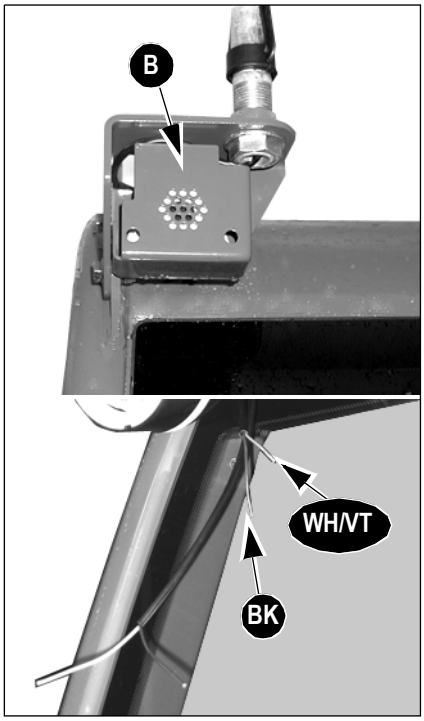
➥ Cable colours **OG** (orange) for power and
BK (black) for earth

☞ *Insert the switch with the symbol in switch console **S 18***

➥ *– see Overview of switch assignment* on page 10-13

☞ *Check the electrical system*

10.14 Retrofitting the backup warning system



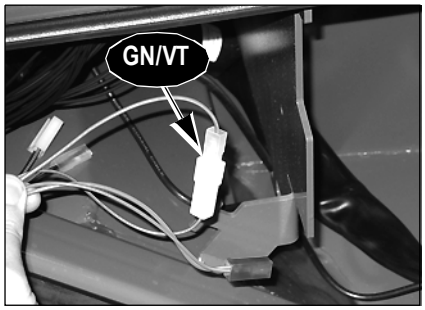
☞ *Mount backup warning system **B** on the bracket at the rear left of the cab*

☞ *The cable for the rotating beacon is located at the rear left in the cab frame*

➥ Cable colours **WH/VT** (white/violet) for power and
BK (black) for earth

☞ *Check the electrical system*

10.15 Retrofitting 2 front working lights



☞ *Mount the working lights on the brackets at the front left and right*

☞ *The cables for the **front working lights** are located in the wiring harnesses at the upper left and right in the cab frame*

➥ **GN/VT** (green/violet) for power and **BK** (black) for earth

☞ *Insert the switch in switch console **S 16***

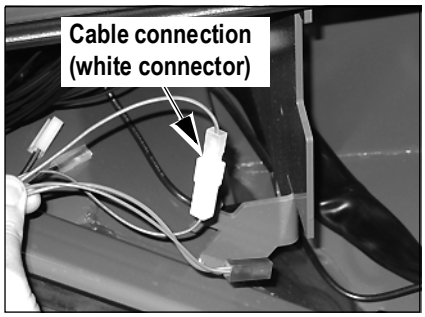
➥ *– see Overview of switch assignment* on page 10-13

☞ *Connect both cables **GN/VT** (green/violet with white connectors)*

➥ *The cables are located underneath the board and are accessed via the outside maintenance flap on the right*

➥ Check the electrical system

10.16 Retrofitting 2 front working lights and 1 rear working light



☞ *Mount the front working lights (see description above)*

☞ *Mount the working light on the bracket at the rear right and connect it with the cable for the rear working light*

➥ The cables for the **rear working light** are located in the wiring harness at the upper right in the cab frame

➥ **GN/VT** (green/violet) for power and **BK** (black) for earth

☞ *Insert the switch in switch console **S 16***

➥ *– see Overview of switch assignment* on page 10-13

☞ *Connect the plug and socket connection (white connector and green/violet cable)*

Caution!

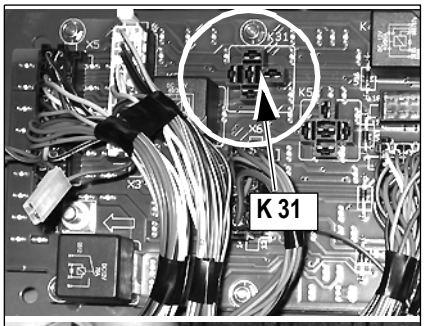
Only 3 additional lights can be operated with switch **S16**

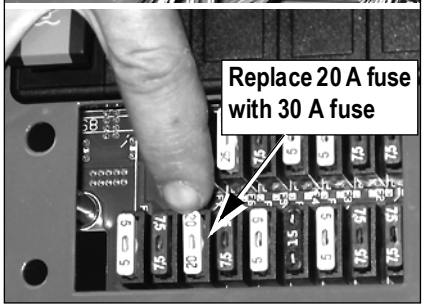
☞ *A new switch is required in the switch panel when mounting a 4th working light*

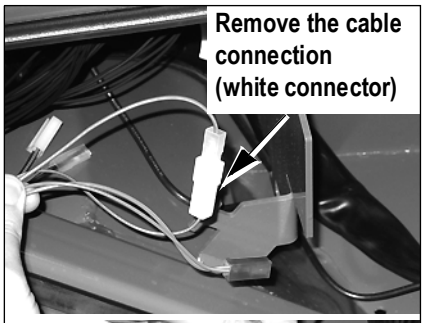
☞ *– see Retrofitting 2 front working lights and 2 rear working lights on page 10-16*

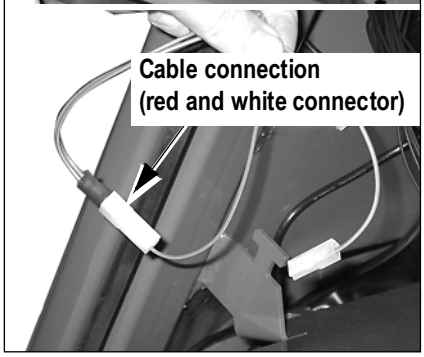
☞ *Check the electrical system*

10.17 Retrofitting 2 front working lights and 2 rear working lights









☞ *Mount the front working lights*

➥ *– see Retrofitting 2 front working lights* on page 10-15

☞ *Mount the working lights on the brackets at the rear left and right, and*

☞ *connect them with the cables for the rear working lights*

☞ *The cables are located:*

➥ at the **upper right** in the cab frame **GN/VT** (green/violet) for power and **BK** (black) for earth

➥ at the **upper left** under the roof lining **GN/VT** (green/violet) for power and **BK** (black) for earth

☞ *Insert tip switch 1000051971 in switch console **S 17***

➥ *– see Overview of switch assignment* on page 10-13

☞ *Insert relay 1000051953 in slot **K 31*** (see figure for board)

☞ *Replace **20 A fuse** with a **30 A fuse***

➥ *– see Fuse box* on page 10-9 (slot F14)

If front working lights are already installed ...

☞ *Remove the plug and socket connection (white connector and green/violet cable), and*

☞ *Connect the cable with the **white connector**, with the cable with the **red connector** (see figure)*

➥ Cable colours: green/violet

If no working lights are installed at the front ...

☞ *Connect the cable with the **white connector**, with the cable with the **red connector** (see figure)*

➥ Cable colours: green/violet

➥ The cables are located underneath the board

➥ Access: via outside maintenance flap on the right

☞ *Check the electrical system*

Additional parts for the 4th working light (rear)

Pos.	Description	Order no.	Qty
1	Tip switch	1000051971	1
2	Symbol	1000096654	1
3	Relays	1000051935	1
4	Working lights	1000051955	1 (2)
5	Flat fuse (30 A)	1000052491	1
6	Screw	1000085390	2
7	Hexagon nut	1000013022	2
8	Washer	1000015431	2

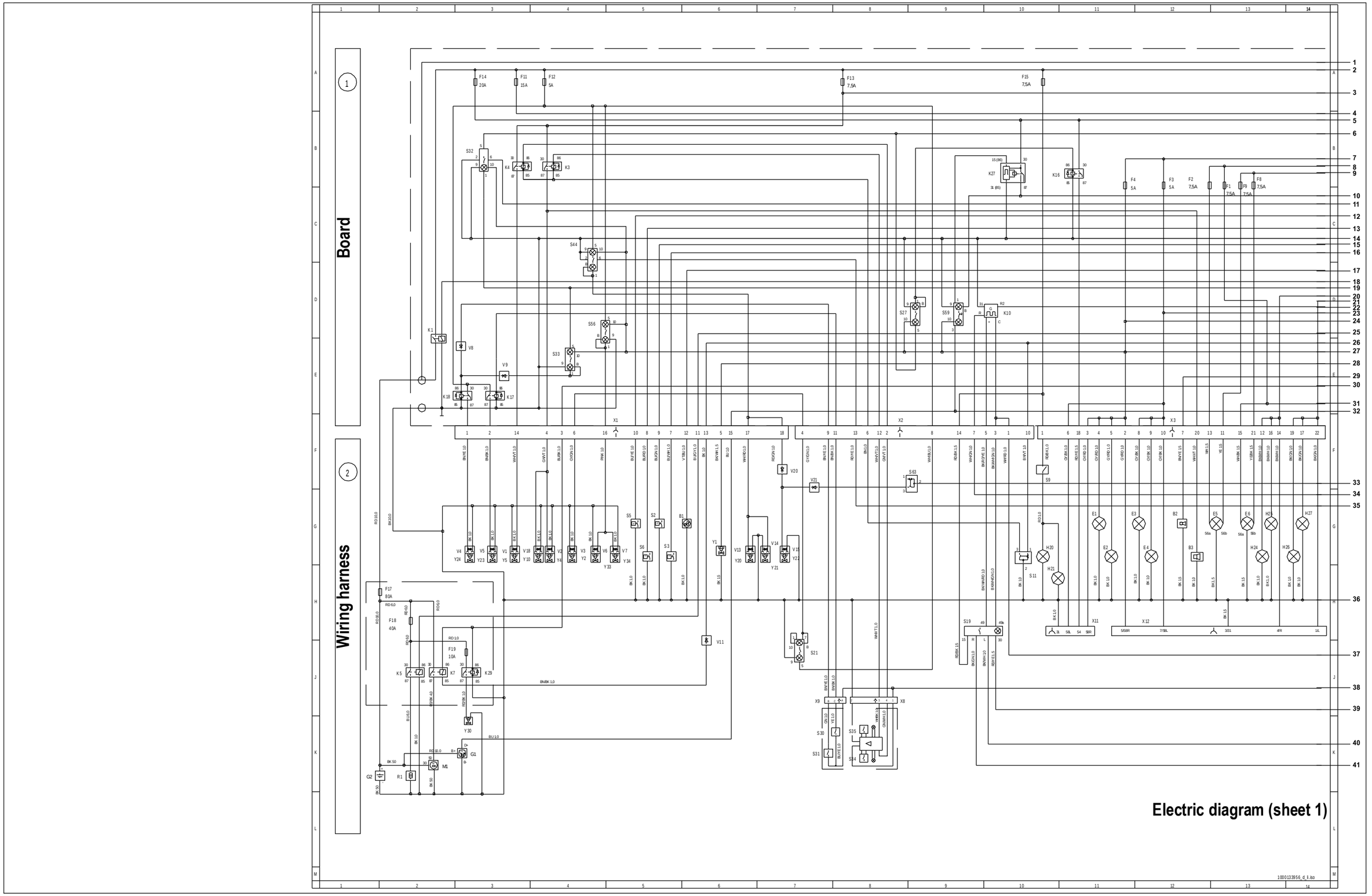
Notes:

10.18 Electric diagram legend

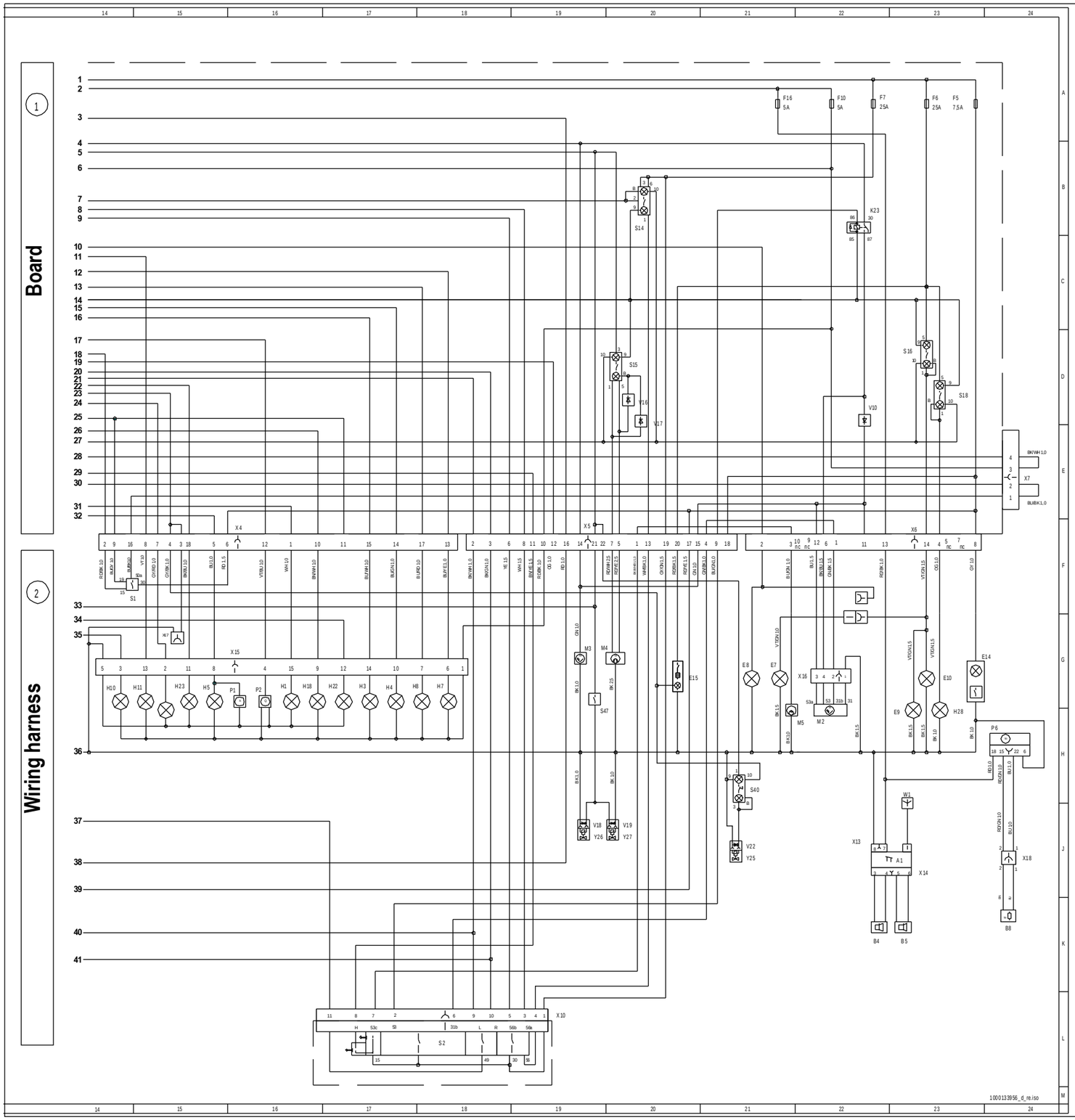
Equipment	Consumer	Location (section)	Remarks
A1	Radio	X6/2	Option
B1	Fuel level sensor	X1/2	
B2	Horn	X3/2	
B3	Backup warning system	X3/2	Option
B8	Safe load indicator sensor	X6/2	
B11	Loudspeaker	X6/2	Option
B12	Loudspeaker	X6/2	Option
E1	Front right side marker light	X3/2	
E2	Rear right light	X3/2	
E3	Front left side marker light	X3/2	
E4	Rear left light	X3/2	
E5	High, low beam (right)	X3/2	
E6	High, low beam (left)	X3/2	
E7	Rear working light	X6/2	Option
E8	Rear working light	X6/2	Option
E9	Front working light	X6/2	Option
E10	Front working light	X6/2	Option
E14	Interior light with switch	X6/2	
E15	Cigarette lighter with light	X5/2	
F1..F16	Fuses		
F17	Main fuse		
F18	Preheating/start fuse		
G1	Alternator	2	
G2	Battery	2	
H1	High beam telltale	X4/2	
H3	Engine temperature telltale	X4/2	
H4	Engine oil pressure telltale	X4/2	
H5	Alternator charge telltale	X4/2	
H7	Hydraulic oil filter telltale	X4/2	
H8	Hydraulic oil temperature telltale	X4/2	
H10	Hose burst valve telltale	X2/2	Option
H11	3rd control circuit telltale	X4/2	
H18	Parking brake telltale	X4/2	
H20	Brake lights	X5/2	
H21	Brake lights	X5/2	
H22	Machine turn indicator telltale	X2/2	
H23	Rear attachment turn indicator telltale	X4/2	
H24	Front right turn indicator	X3/2	
H25	Rear right turn indicator	X3/2	
H26	Front left turn indicator	X3/2	
H27	Rear left turn indicator	X3/2	
H28	Rotating beacon	X6/2	Option
K1	High current relay 70 A	1	
K3	Reverse driving 40/60 A	X1/1	
K4	Forwards driving 40/60 A	X1/1	
K5	High current relay preheating	2	
K7	Start high current relay	2	
K10	Turn indicator relay	X2/1	
K16	Front socket 40/60 A	X3/1	Option
K17	Unlock 40/60 A	X1/1	Option
K18	Lock 40/60 A	X1/1	Option
K23	Wiper speed 1 40/60A	X5/1	
K27	Time lag relay 5 min	X2/1	Option
M1	Starter	2	
M2	Front wiper motor	X6/2	
M3	Rear wiper motor	X6/2	
M4	Engine fan	X5/2	
M5	Washer pump	X6/2	
P1	Hour meter	X4/2	
P2	Fuel level indication	X4/2	
P6	Safe load indicator	X6/2	Tele
R1	Glow plug	2	
R2	Heated rear window	X6/2	Option
S1	Preheating start switch	X4/2	
S2	Engine oil pressure switch	X1/2	
S3	Engine temperature switch	X1/2	
S5	Hydraulic oil pressure switch	X1/2	
S6	Hydraulic oil temperature switch	X1/2	
S9	Brake light switch	X5/2	
S11	Parking brake switch	X2/2	
S12	Steering-column control lever (left)	X2/2	
S14	Light switch	X6/1	
S15	Heating switch	X5/1	
S16	Working light switch	X6/1	Option
S18	Rotating beacon switch	X6/1	Option
S 19	Hazard warning switch	X2/2	
S21	1st/2nd speed switch	X2/2	
S27	Front socket switch	X2/1	Option
S30	“Unlock” tip switch	X2/2	Option
S31	“Lock” tip switch	X2/2	Option
S32	3rd control circuit switch	X1/1	Option
S33	3rd control circuit switch	X1/1	Option
S34	Forwards driving switch	X2/2	
S35	Reverse driving switch	X2/2	
S40	Quickhitch lock tip switch	X5/2	Tele
S44	Load stabiliser switch	X1/1	Option
S47	Tilt ram lock key-operated switch	X5/2	Option
S56	4th control circuit switch	X1/1	Option
S59	Heated rear window switch	X2/1	Option
S63	Float position/hose burst valve switch	X2/2	Option
V1..V7	Suppressor diode	X1/2	
V8,V9	Blocking diode	X1/1	
V10	Blocking diode	X6/1	
V11	Blocking diode	X1/2	
V13.V15	Suppressor diode	X1/2	
V16,V17	Blocking diode	X5/1	
V18,V19	Suppressor diode	X5/2	
V20,V21	Blocking diode	X2/2	Option
V22	Suppressor diode	X5/2	Tele
W1	Radio aerial	X6/2	
X1	Connector engine/valves		(natural coloured)
X2	Drive input connector		
X3	Lights connector		(natural coloured)
X4	Instrument panel connector		
X5	Power supply connector		
X6	Roof connector		
X7	Min. 13 pole drive interlock connector		
X8	Control lever connector (drive)	X2/2	
X9	Control lever connector (auxiliary hydraulics)	X2/2	
X10	12 pole steering column connector (left)		
X11	Front socket	X3/2	Option
X12	Rear socket	X3/2	Option
X13	Radio connection grey	X5/2	
X14	Radio connection brown	X5/2	
X15	Instrument panel connection	X4/2	
X16	Front wiper connection	X6/2	
X17	Clearance lights connection	X4/2	
X18	Safe load indicator sensor connection	X6/2	Tele
Y10	Cutoff solenoid	X1/2	
Y2	1st/2nd speed solenoid valve	X1/2	
Y4	Reverse driving solenoid valve	X1/2	
Y5	Forwards driving solenoid valve	X1/2	
Y10	Driving direction identification solenoid valve	X1/2	
Y20	Load stabiliser solenoid valve	X1/2	Option
Y21	Load stabiliser solenoid valve	X1/2	Option
Y23	“Retract telescopic boom” solenoid valve	X1/2	Tele
Y24	“Extend telescopic boom” solenoid valve	X1/2	Tele
Y22	Hose burst valve solenoid (OFF)	X1/2	Option
Y25	Quickhitch lock solenoid valve	X5/2	Tele
Y26	Tilt ram lock solenoid valve	X5/2	Option
Y27	Tilt ram lock solenoid valve	X5/2	Option
Y30	Minus compensation valve (motor II)	2	
Y33	Solenoid valve 4th control circuit	X1/2	Option
Y34	Solenoid valve 4th control circuit	X1/2	Option

Electric diagram legend

10.19 Electric diagram sheet 1



10.20 Electric diagram sheet 2



Electric diagram (sheet 2)

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