Service Manual

Track excavator

28Z3

Machine model	28Z3
Edition	2.0
Language	en
Article number	1000178347

WACKER NEUSON

Documentation

Description	Language	Order no.
Operator's Manual	en	1000177367
Service manual	en	1000178347
Spare parts list	de/en/fr	1000177410
Spare parts list	de/it/es	1000177471

Legend

Edition	Issued
1.0	5/2008
2.0	12/2011

The cover features the machine with possible optional equipment.

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Order no.: 1000178347
Edition: 2.0

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1 Operation

1.1 Notices on this service manual

This service manual contains important information on how to work safely, correctly and economically with the machine. Therefore, it aims not only at new staff, but it also serves as a reference for experienced staff. It helps to avoid dangerous situations and reduce repair costs and downtimes.
Furthermore, the reliability and the service life of the machine will be increased by following the instructions in the Operator's Manual.

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

Operational safety and readiness of the machine do not only depend on your skill, but also on maintenance and servicing of the machine. This is why regular maintenance and service work is absolutely necessary.

Extensive maintenance and repair work must always be carried out by a Wacker Neuson workshop. Use only original spare parts for repairs. This ensures operational safety and readiness of your machine, and maintains its value.

- We reserve the right to improve the technical standard of our machines without adapting the service manual.
- Modifying Wacker Neuson products and fitting them with additional equipment and attachments not included in our delivery program requires Wacker Neuson's written authorisation, otherwise warranty and product liability for possible damage caused by these modifications shall not be applicable.
- Subject to modifications and printing errors.

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

Abbreviations/symbols

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

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

➥ Description of the effects or results of an activity

n. s. = not shown

A combination of digits, or a combination of digits and letters, e.g. 40/**18** or 40/**A** used for identifying the control elements, means:

Figure no. 40/control element no. 18 or position **A** in figure no. 40

Figures carry no numbers if they are placed to the left of the text.

1.2 Identification of warnings and dangers

Important indications regarding the safety of the staff and the machine are identified in this Service Manual with the following terms and symbols:

Danger!

Failure to observe the instructions identified by this symbol can result in personal injury or death for the operator or other persons.

☞ *Measures for avoiding danger*

Caution!

Failure to observe the instructions identified by this symbol can result in damage to the machine.

☞ *Measures for avoiding danger for the machine*

Notice!

This symbol identifies instructions for a more efficient and economical use of the machine.

Environment!

Failure to observe the instructions identified by this symbol can result in damage to the environment. The environment is in danger if environmentally hazardous material (e.g. waste oil) is not subject to proper use or disposal.

1.3 Designated use and exemption from liability

- The machine is intended for:
  - Moving earth, gravel or rubble, and for hammer operation
  - See chapter 1.4 “Fields of application, attachments” in the Operator's Manual for more information on the use of attachments.
  - Every other application is regarded as not designated for the use of the machine. Wacker Neuson will not be liable for damage resulting from use other than mentioned above. The user alone will bear the risk.
  - Designated use also includes observing the instructions set forth in the Operator's Manual and observing the maintenance and service conditions.
- The safety of the machine can be negatively affected by carrying out machine modifications without proper authority and by using spare parts, equipment, attachments and optional equipment which have not been checked and released by Wacker Neuson GmbH. Wacker Neuson GmbH will not be liable for damage resulting from this.
- Wacker Neuson Linz GmbH shall not be liable for personal injury and/or damage to property caused by failure to observe the safety instructions and the Operator's Manual, and by the negligence of the duty to exercise due care when:
  - handling
  - Operation
  - servicing and carrying out maintenance work and
  - repairing the machine. This is also applicable in those cases in which special attention has not been drawn to the duty to exercise due care, in the safety instructions, the Operator's Manuals and maintenance manuals (machine/engine).
  - Read and understand the Operator's Manual before starting up, servicing or repairing the machine. Observe all safety instructions!
- The machine may not be used for transport jobs on public roads!
- Do not use the machine in areas with danger of falling objects from above or the front.
- The quickhitch is only used for locking an attachment.
- Hammer operation is only allowed in specified areas.

1.4 Type labels and component numbers

Fig. 1: Type label: location

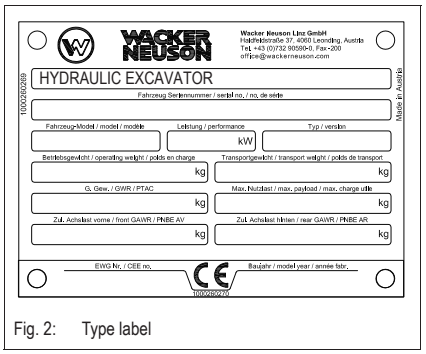


Fig. 2: Type label

Serial number

The serial number is stamped on the machine chassis. It is also located on the type label. The type label is located at the front left on the machine chassis, under the control stand.

Type label information

Field below Wacker Neuson logo:	HYDRAULIC EXCAVATOR
Fahrzeug Seriennummer/serial no./no. de série:	Serial number of machine
Fahrzeug Modell/model/modèle:	Machine designation
Leistung/performance:	Engine output
Typ/version:	Machine type
Betriebsgewicht/operating weight/poids en charge:	Operating weight
Transportgewicht/transport weight/poids en transport:	Transport weight
G. Gew./GWR/PTAC:	Gross weight rating (admissible)
Max. Nutzlast/max. payload/max. charge utile:	Maximum payload
Zul. Achslast vorne/front GAWR/PNBE AV:	Front gross axle weight rating
Zul. Achslast hinten/rear GAWR/PNBE AR:	Rear gross axle weight rating

Option

EWG Nr./CEE no.:	EEC check number
Baujahr/model year/année fabr.:	Year of construction

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

Fig. 3: Cab type label

Cab number

The type label (arrow) is located on the chassis of the cab, at the upper left beside the door.

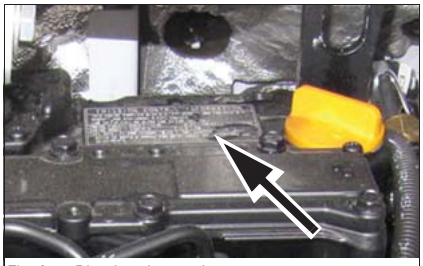


Fig. 4: Diesel engine number

Engine number

The type label (arrow) is located on the valve cover (engine).

Fig. 5: Hydraulic pump type label

Hydraulic pump number

The type label is located on the hydraulic pump housing.

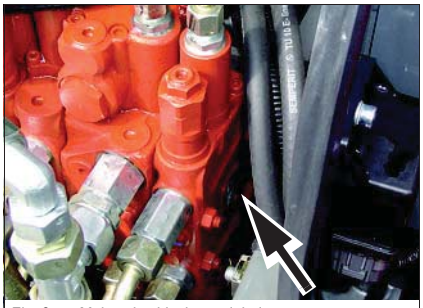


Fig. 6: Main valve block type label

Main valve block number

The type label (arrow) is located on the lower side of the main valve block.

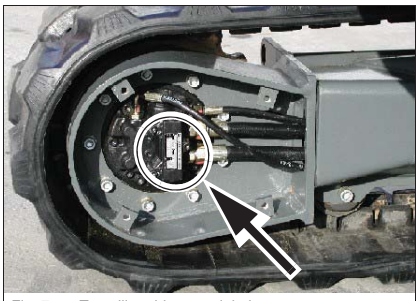


Fig. 7: Travelling drive type label

Travelling drive number

The type label (arrow) is located on the travelling drive.

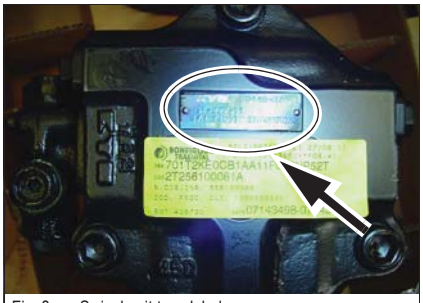


Fig. 8: Swivel unit type label

Swivel unit number

The type label (arrow) is located on top of the gear motor.

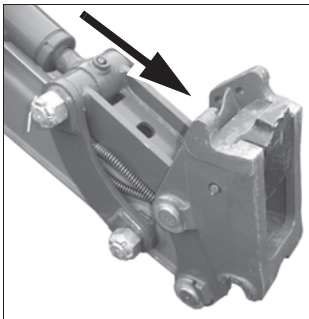


Fig. 9: Hydraulic quickhitch type label

Hydraulic quickhitch

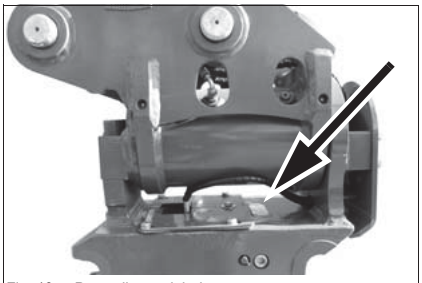


Fig. 10: Powertilt type label

Powertilt with hydraulic quickhitch

The serial number of the Powertilt is stamped in the housing near the hydraulic connections.

The serial number of the hydraulic quickhitch is located on the type label.

The type label is located at the rear on the hydraulic quickhitch fork.

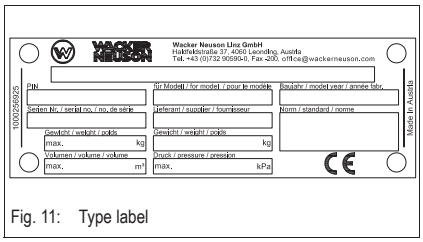


Fig. 11: Type label

Type label information (example):

Field below the Wacker Neuson logo:	description of components
PIN:	part number
Serien Nr./serial no./no. de série:	serial number
Gewicht/weight/poids:	max. authorised weight
Volumen/volume/volume:	max. capacity
für Modell/for model/pour le modèle:	for equipment model
Lieferant/supplier/fournisseur:	supplier's SAP number
Gewicht/weight/poids:	weight of this component
Druck/pressure/pression:	max. authorised pressure
Baujahr/model year/année fabr.:	year of construction
Norm/standard/norme:	standards the component complies with

Not all components require all fields to filled with data.

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

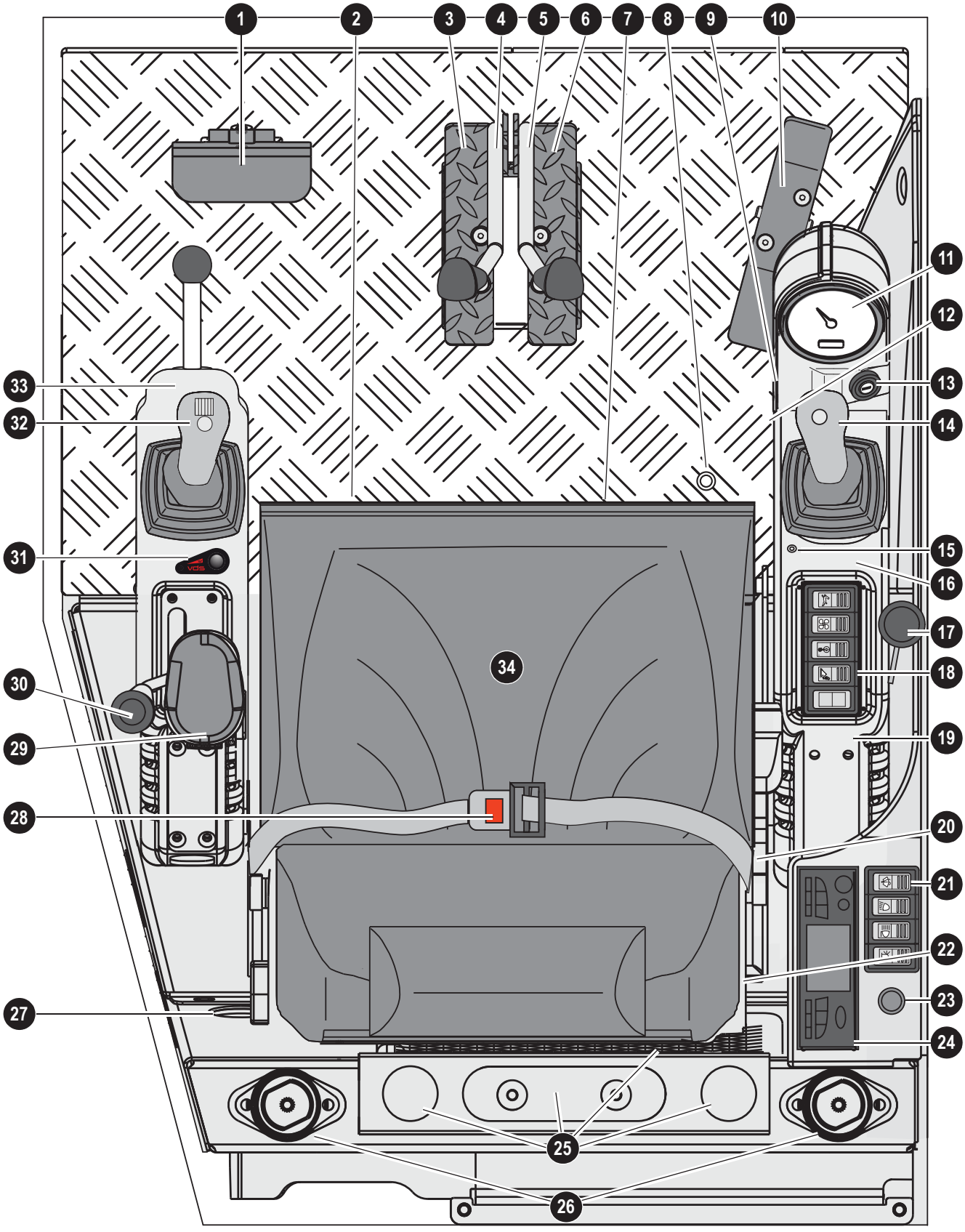
1.5 Machine overview

1	Working light
2	Boom
3	Auxiliary hydraulics
4	Stick
5	Handle
6	Stabiliser blade
7	Eye hook for loading/tying down the machine
8	Undercarriage
9	Exhaust pipe

10	Engine cover
11	Rotating beacon
12	Boom light
13	Canopy (standard)/cab (option)
14	Tank filler inlet
15	Valve cover
16	Rubber tracks
17	Lubrication point for track tension

Fig. 12: Machine outside views

1.6 Cab overview

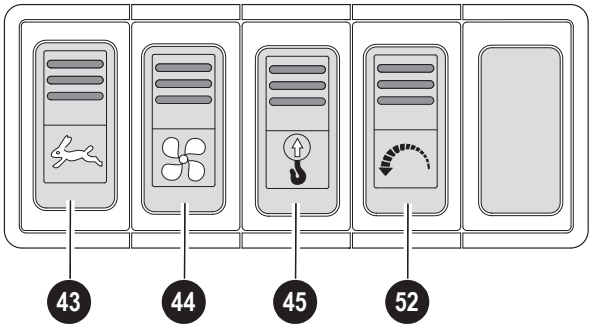


1.7 Cab (legend)

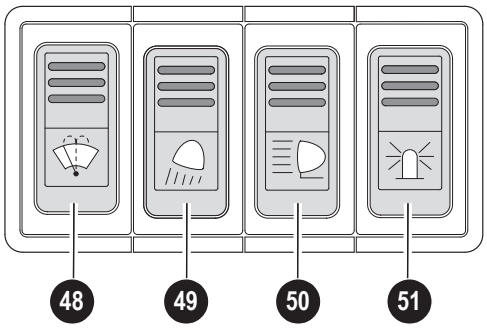
Pos.	Designation
1	Pedal – swivel boom
2	Horizontal seat adjustment
3	Drive pedal (left)
4	Drive lever (left)
5	Drive lever (right)
6	Drive pedal (right)
7	Document storage (underneath the seat console)
8	Hydraulic quickhitch pedal (option)
9	Drive interlock emitter/receiver unit (from serial number AG00699)
10	Auxiliary hydraulics pedal
11	Round display element
12	Heating
13	Preheating start switch
14	Control lever (right)
15	Drive interlock status indicator (option) (up to serial number AG00698)
16	Control lever base (right)
17	Stabiliser blade lever
18	Console switch panel
19	Armrest on the right (not shown)
20	Seat (backrest adjustment)
21	Cab switch panel
22	Seat (weight adjustment)
23	Cigarette lighter
24	Radio (option)
25	Drinks/cup holder/storage net
26	Cab bearing
27	Changeover valve for SAE/ISO controls (option)
28	Seat belt (lock)
29	Armrest (left)
30	Throttle
31	Vertical Digging System (VDS) (option)
32	Control lever (left)
33	Control lever base (left)
34	Seat

1.8 Instrument panel overview

Control element on control console

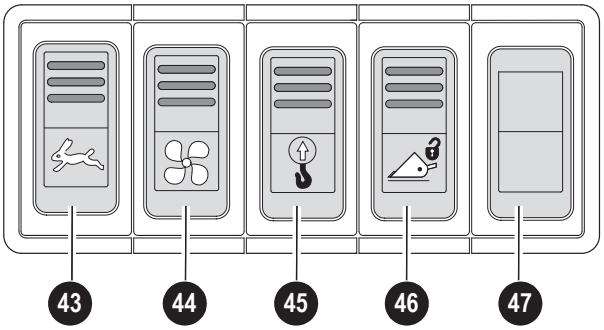


Control element on cab wall

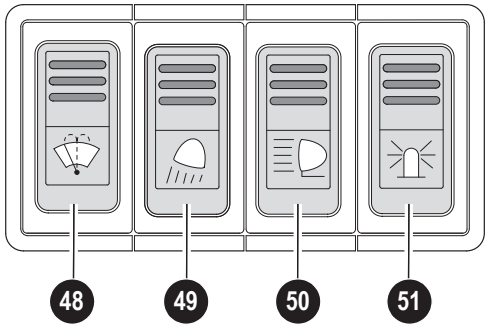


Control elements for proportional controls version (option):

Control element on control console



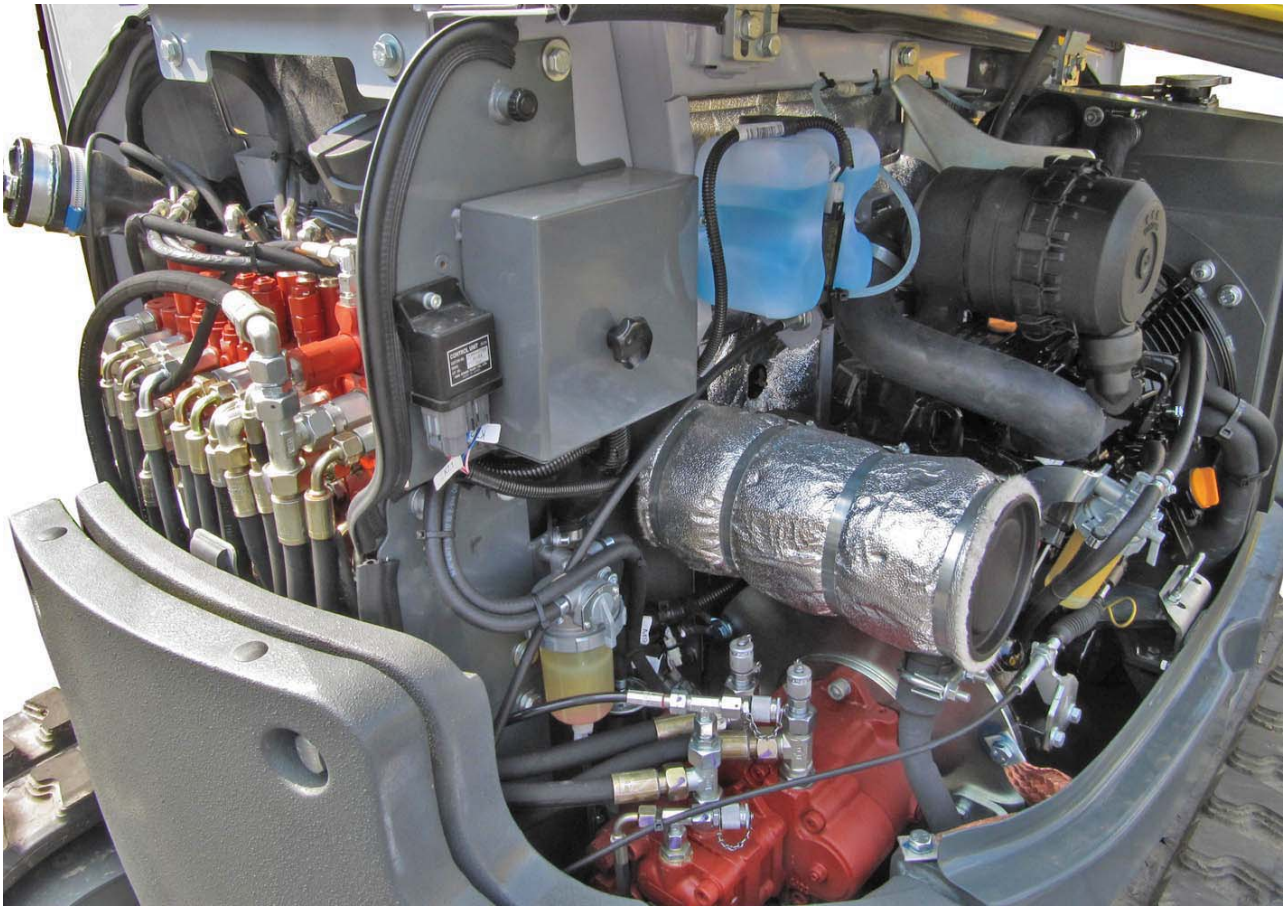
Control element on cab wall



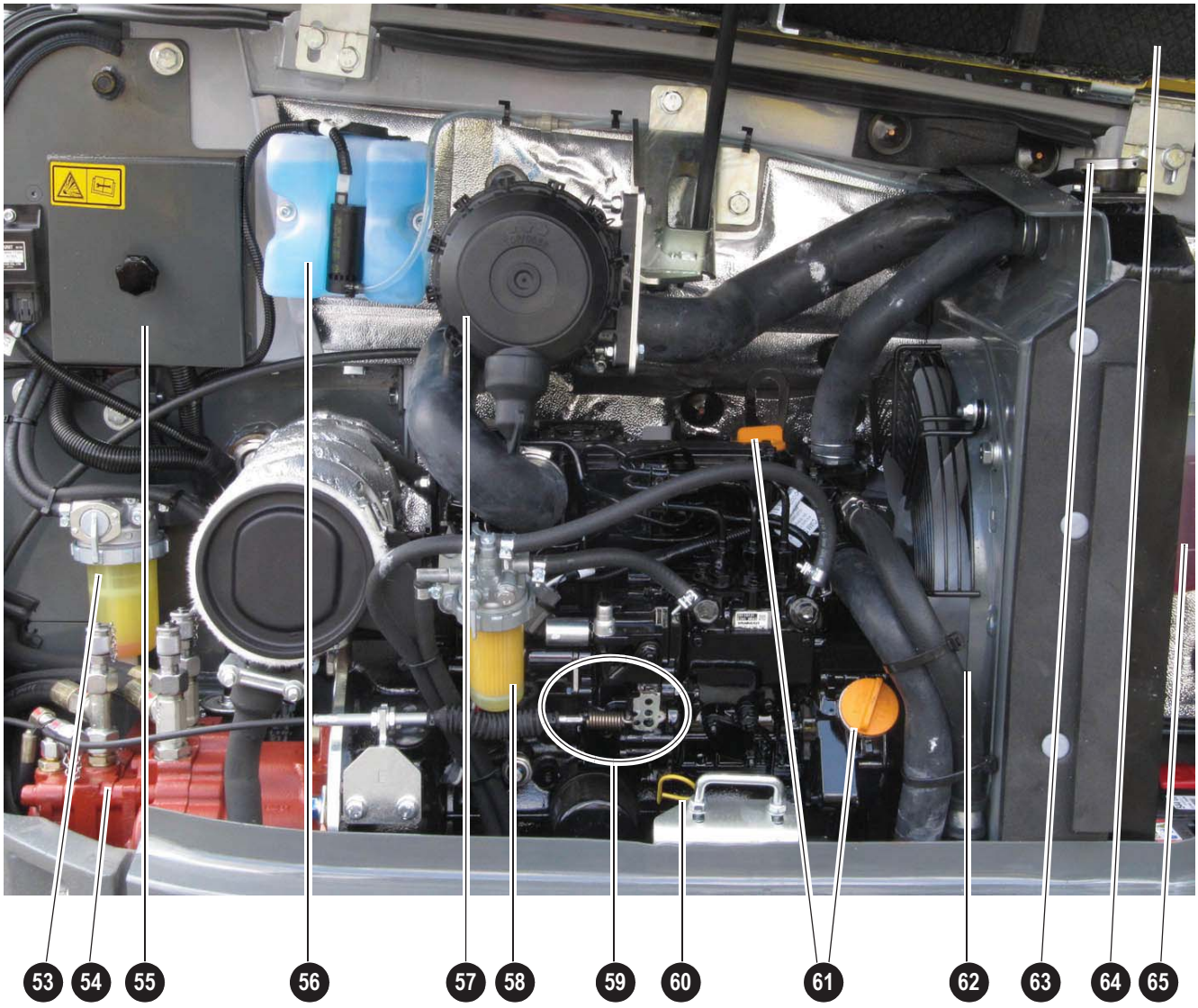
1.9 Instrument panel legend

Pos.	Designation
35	Cold starter indicator light (yellow)
36	Hydraulic oil filter indicator light (red)
37	Alternator charge function indicator light (red)
38	Engine oil pressure indicator light (red)
39	Coolant temperature indicator light (red)
40	Safe load indicator (option) light (red)
41	Fuel level indicator
42	Hour meter
43	High speed
44	Ventilation
45	Safe load indicator (option)
46	Hydraulic quickhitch switch (option)
47	Proportional controls status indicator (option)
48	Washer system
49	Working light
50	Roof lights (option)
51	Rotating beacon (option)
52	Automatic engine speed setting (option)

1.10 Overview of open engine and valve compartment

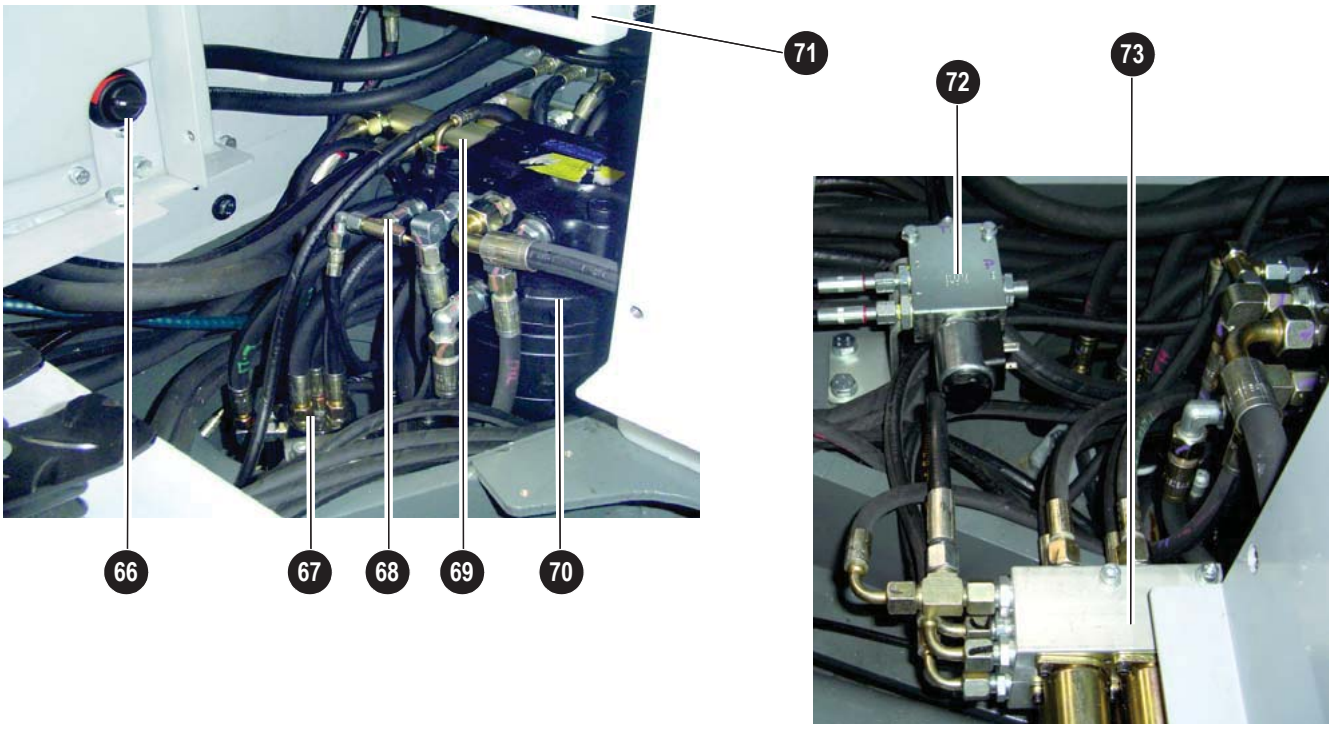


1.11 Engine compartment: overview



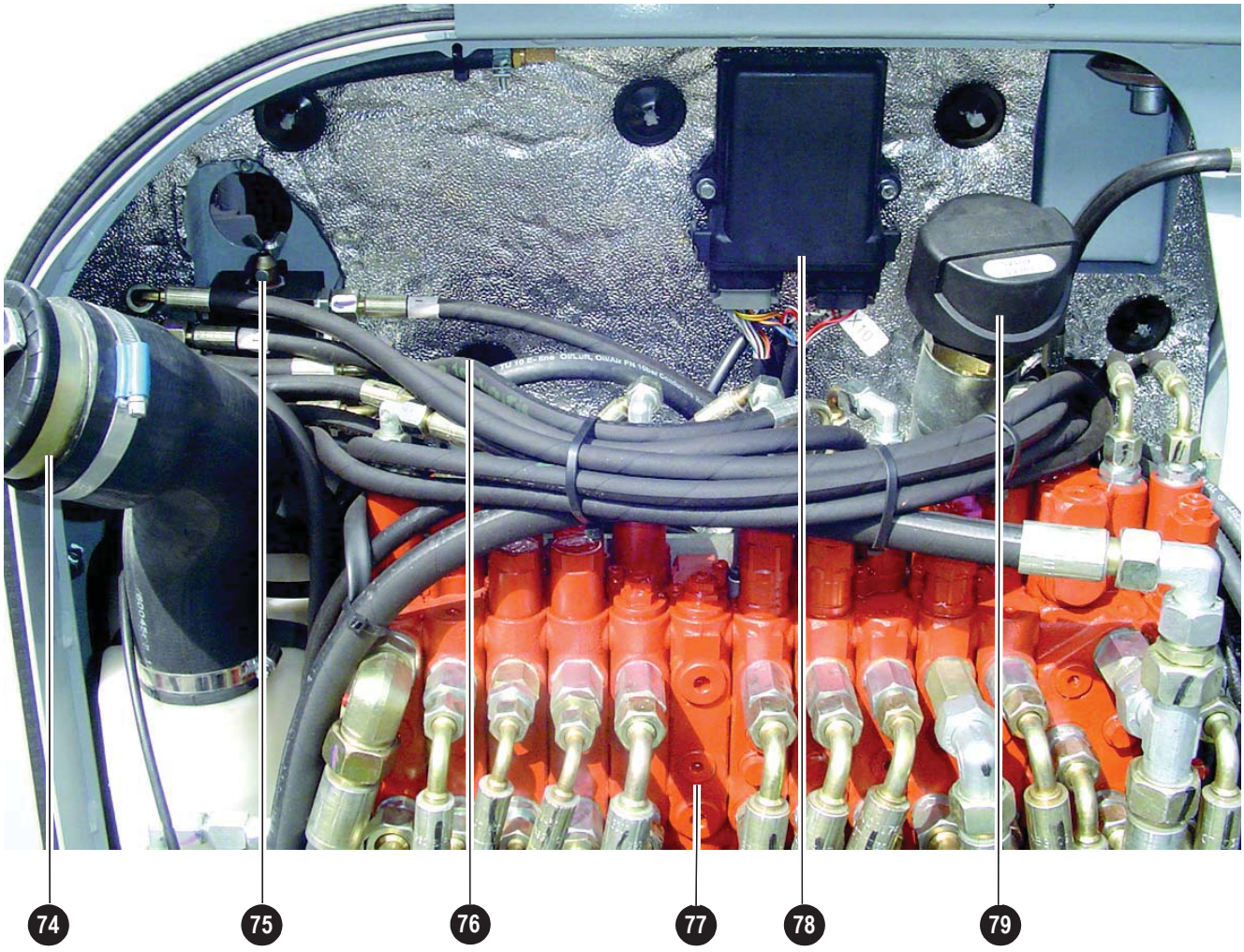
Pos.	Designation	For more information see page
53	Water separator	3-15
54	Hydraulic pump	5-2
55	Fuse box	2-5
56	Washer system tank	
57	Air filter	3-24
58	Fuel filter	3-16
59	Throttle cable	
60	Oil dipstick	3-17
61	Oil filler opening	3-18
62	Radiator	3-22
63	Radiator cap	3-22
64	Engine cover	
65	Expansion tank	3-22

1.12 Chassis overview



Pos.	Designation	For more information see page
66	Heating control	3-63
67	Swivel joint	5-27
68	Shuttle valve	
69	Manifold	
70	Swivel unit	5-24
71	Heating	3-63
72	4/2 way solenoid valve (option)	
73	Proportional valve (option)	5-32

1.13 Valve compartment



Pos.	Designation	For more information see page
74	Fuel filler inlet	*3-13*
75	Changeover valve for SAE/ISO controls (option)	*5-32*
76	Return filter	*3-46*
77	Main valve block	*5-6*
78	Control valve for proportional controls (option)	*7-27*
79	Hydraulic tank cap	*3-43*

1.14 Stop and park the machine

Caution!

Never stop the engine under full load, otherwise it can be damaged due to overheating.

☞ *Let the engine run at idling speed with no load for at least 5 minutes before you switch it off.*

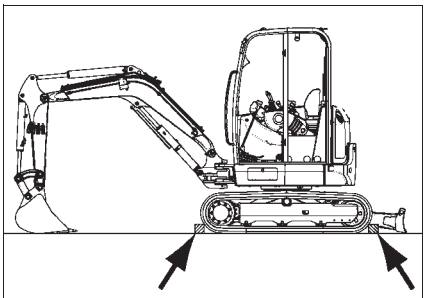


Fig. 13: Parking the machine

- Stop the machine on firm, level and horizontal ground.
- Position the boom straight ahead at the centre of the machine.
- Lower the stabiliser blade to the ground.
- Stop the engine.
- Operate the joystick repeatedly to release the pressure in the hydraulic system.
- Remove the ignition key and carry it with you.
- Fold the control lever base up.
- Close the windows and the door.
- Leave the cab.
- Close and lock all covers.
- Secure the tracks accordingly (e.g. chocks, etc.).

Parking the machine on slopes

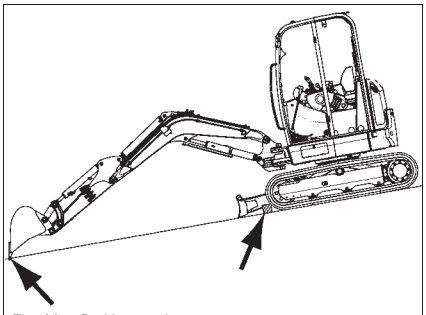


Fig. 14: Parking on slopes

- Lower the bucket *into* the ground on the downhill side of the machine.
- Place the stabiliser blade downhill and lower it to the ground.
- Secure the tracks accordingly (e.g. chocks, etc.) so the machine cannot move.

Specifications

2 Specifications

2.1 Chassis

Sturdy steel sheet chassis, rubber-mounted engine

2.2 Engine

Engine	Model 28Z3
Product	Yanmar diesel engine
Type	3TNV76-NNS
Design	Water-cooled 4 stroke diesel engine
No. of cylinders	3
Fuel injection system	Indirect injection
Aspiration	Natural aspiration
Cooling system	Water-cooled/aspirating fan
Lubrication system	Force-feed lubrication with trochoidal pump
Displacement	1116 cm³ (68 cu. in.)
Nominal bore and stroke	76 x 82 mm (3 x 3.2”)
Output	15.2 kW (20.7 hp) at 2500 rpm
Max. torque	66.1 Nm (48.8 lbs/ft) at 1800 rpm
Max. engine speed without load	2675 +/- 25 rpm
Idling speed	1300 +/- 25 rpm
Valve clearance (intake = outlet)	0.15 – 0.25 mm/(0.006 – 0.01”) cold
Compression	23,5 +/- 1 bar (340.8 +/- 14.5 psi) at 250 rpm
Engine oil pressure (at rated speed)	2.9 – 4.4 bar (42 – 64 psi)
Pressure switch for engine oil pump	0.5 +/- 0.1 bar (7.25 +/- 1.45 psi)
Thermostat opening temperature	70 – 73 °C (158 – 163 °F)
Thermal switch	107 – 113 °C (225 – 235 °F)
Firing order	1 – 3 – 2
Direction of rotation	Counterclockwise (as seen from the flywheel)
Starting aid	Glow plug (preheating time 4 seconds)
Max. inclined position (engine no longer supplied with oil):	25° permanent hill climbing ability in all directions 30° hill climbing ability no longer than 3 minutes Pay attention to the machine's tilting limit!
Specific fuel consumption	< 279 g/kWh at rated output
Exhaust values according to	EPA – Tier 4
Average engine droop	About 60 rpm, warm engine boom, stick and backhoe bucket to the limit

Fuel injection pump

Type	YPES-3ML
Design	In-line pump
Injection pressure	118 – 128 bar (1711 – 1856 psi)
Engine speed control	Mechanical
Lubrication system	Engine oil lubrication

Engine capacities

Capacities	Model 28Z3
Fuel tank	36 l (9.5 gal)
Engine oil	3.4 l (0.9 gal) (up to max. mark) 1.8 l (0.48 gal) (up to min. mark)
Coolant (without radiator)	0.9 l (0.24 gal) (engine only)
Radiator	4.5 l (1.19 gal)
Expansion tank	0.5 l (0.13 gal)

Engine tightening torques

Tightening torques	Model 28Z3
Cylinder-head bolt[1]	54 – 58 Nm (M9x1.25) (40 – 43 lbs/ft)
Connecting rod bearing screw[1]	22.6 – 27.5 Nm (M7x1.0) (16.6 – 20.3 lbs/ft)
Main bearing screw	75.5 – 81.5 Nm (M10x1.25) (55.7 – 60 lbs/ft)
Flywheel screw	80.4 – 86.4 Nm (M10x1.25) (59.3 – 63.7 lbs/ft)

1. Screw must be oiled

2.3 Hydraulic system

Hydraulics	Model 28Z3
Pump	Double variable displacement + twin gear pump 11.5 + 11.5 + 8 + 2.7 cm³ (0.70 + 0.70 + 0.48 + 0.16 cu. in.)
Flow rate	30.80 + 30.80 + 21.40 + 7.2 l/min at 2500 rpm 8.1 + 8.1 + 5.7 + 1.9 gal/min at 2376 rpm
Operating pressure for work and drive hydraulics	225 bar (3263 psi)
Swivel unit operating pressure	206 bar (2987 psi)
Hydraulic oil radiator	Standard
Hydraulic oil tank capacity	30 l (7.9 gal)
Hydraulic oil quantity (system fill)	42 l (11 gal)

Work hydraulics

Work hydraulics	Model 28Z3
Max. operating pressure	$225^{+/-3}$ bar ($3263^{+/-43.5}$ psi)
Main pressure limiting valve for boom/bucket/stick	$225^{+/-3}$ bar ($3263^{+/-43.5}$ psi)
Main pressure limiting valve for stabiliser blade	$206^{-4/+2}$ bar ($2988^{-58/+29}$ psi)
Main pressure restriction for pilot control pressure	$30^{-0/+4}$ bar ($435^{-0/+58}$ psi)
Main pressure restriction for swivel drive (hydraulic motor pressure restriction)	$200^{-4/+2}$ bar ($2901^{-58/+29}$ psi)
Filter	Return filter

Auxiliary hydraulics oil flow 28Z3

Pressure	P2 + P3	P2
15 bar (218 psi)	52.2 l/min (13.79 gal/min)	30.5 l/min (8.06 gal/min)
40 bar (580 psi)	50.6 l/min (13.37 gal/min)	29.5 l/min (7.79 gal/min)
60 bar (870 psi)	48.0 l/min (12.68 gal/min)	29.5 l/min (7.79 gal/min)
90 bar (1305 psi)	43.5 l/min (11.49 gal/min)	28.5 l/min (7.53 gal/min)
120 bar (1740 psi)	39.0 l/min (10.30 gal/min)	27.0 l/min (7.13 gal/min)
150 bar (2175 psi)	33.5 l/min (8.85 gal/min)	25.5 l/min (6.74 gal/min)
180 bar (2611 psi)	27.0 l/min (7.13 gal/min)	21.5 l/min (5.68 gal/min)
200 bar (2901 psi)	12.0 l/min (3.17 gal/min)	19.0 l/min (5.02 gal/min)

Notice!

Output indications for auxiliary hydraulics with unpressurised hammer return line.

2.4 Undercarriage and swivel unit

Undercarriage/swivel unit	Model 28Z3
2 drive speeds	2.1/3.8 kph (1.3/2.4 mph)
Hill climbing ability (briefly)	30°/58%
Track width	300 mm (11.8”)
No. of track rollers on either side	3
Ground clearance	277 mm (10.9”)
Ground pressure	0.27 kg/cm² (3.8 psi))
Upper carriage swivel speed	10.25 rpm

2.5 Stabiliser blade

Stabiliser blade	Model 28Z3
Width/height	1570/290 mm (5'2”/11.4”)
Max. lift over/under subgrade	380/419 mm (1'3”/1'4”)

2.6 Electrical system

Electrical system	Model 28Z3
Alternator	12 V 40 A
Starter	12 V 1.1 kW (1.5 hp)
Battery	12 V 44 Ah
Socket	E.g. for cigarette lighter; 15 A max.

2.7 Noise levels

Sound power level	Model 28Z3
Sound power level (L_{WA})[1]	93 dB (A)
Driver-perceived sound pressure level (L_{PA})[2]	78 dB (A)
Uncertainty (K_{PA})[3]	0.9 (A)

1. According to EN ISO 6395
2. According to EN ISO 6396
3. According to EN ISO 4871

Notice!

Measurement of sound power level according to EC Directive 2000/14 EC. Driver-perceived noise level measured according to EC Directives 84/532/EEC, 89/514/EEC and 95/27/EEC.
Measurements carried out on asphalted surface.

2.8 Vibration

Vibration	Trigger value
Effective acceleration value for the upper extremities of the body[1]	< 2.5 $\frac{m}{s^2}$
Effective acceleration value for the body[1]	< 0.5 $\frac{m}{s^2}$

1. Measurements as per 2002/44/EC, ISO EN 20643 and ISO/TR 25398 (excavating, driving and hammering with a Wacker Neuson hammer). Machine and attachment operation and maintenance as per Operator's Manual.
Uncertainty of measurement: measurements as per EN 12096:1997

2.9 Coolant compound table

Outside temperature	Coolant			
	Water	Anticorrosion agent		Antifreeze agent
Up to °C (°F)	% by volume	cm³/l / (cu. in./gal)	% by volume	% by volume
-37 (-34.6)	50	10 (2.6)	1	50

Use the 1:1 concentration for warm outside temperatures, too:

- Protection against corrosion, cavitation and deposits

Do not mix the coolant with other coolants.
Machine filled at the factory with Eurolub SF D12 coolant (ethylene glycol basis).

2.10 Powertilt

Powertilt	
Model size	6
Piston stroke	525 cm³ (32 cu. in.)
Required oil flow	3 – 6 l/min (0.8 – 1.6 gal/min)
Connections	1/4"
Slewing range	180°[1]
Weight	65 kg (143.3 lbs.)

Drive torque – at 210 bar (3045 psi)	2990 Nm (2205 lbs/ft)
Holding torque – at 225 bar (3263 psi)	7270 Nm (5362 lbs/ft)
Minimum hose/pipe size	10 mm (0.4”)
Connecting hose size	6 mm (0.23”)

1. The actual angle can vary slightly from the indication made here.

2.11 Model-specific tightening torques

Model 28Z3	Thread	Tightening torque Nm (lbs/ft)
Live ring	M12 10.9	120 (88.5) *
Track roller	M14 10.9	120 (88.5) *
Drive pinion	M12 10.9	120 (88.5) *
Travelling drive	M12 10.9	120 (88.5) *
Gear motor	M12 10.9	120 (88.5) *
Angled engine bracket	M10 8.8	45 (33.2)
Engine bearing	M10 8.8	45 (33.2)
Pump base	M10 10.9	45 (33.2)
Pump	M12 10.9	110 (81.1)
Swivel joint	M10 10.9	100 (73.8)*
Counterweight/additional counterweight	M20 8.8	290 (213.9)*

*) All connections with an * must be glued with Loctite S2420 or VaryBond 12-43.

2.12 General tightening torques

Tightening torques for hydraulic screw connections (dry assembly)

Metric hose fittings for hydraulic applications (light execution, DKOL)				
Nominal Ø	Outer Ø	Thread	Wrench size	Tightening torque Nm (lbs/ft)
05	6L	M12X1.5	WS 14	15 (11)
06	8L	M14X1.5	WS 17	20 (14.7)
08	10L	M16X1.5	WS 19	40 (29.5)
10	12L	M18X1.5	WS 22	50 (36.8)
12	15L	M22X1.5	WS 27	75 (55.3)
16	18L	M26X1.5	WS 32	85 (62.7)
20	22L	M30X2	WS 36	100 (73.75)
25	28L	M36X2	WS 41	180 (132.7)
32	35L	M45X2	WS 55	220 (162.3)

Galvanised and dry surface (O-ring slightly oiled). Torque tolerance: -10 %

Values determined empirically and to be applied as approximate figures.

Metric hose fittings for hydraulic applications (heavy execution, DKOL)				
Nominal Ø	Outer Ø	Thread	Wrench size	Tightening torque
				Nm (lbs/ft)
05	8S	M16X1.5	WS 19	40 (29.5)
06	10S	M18X1.5	WS 22	50 (36.8)
08	12S	M20X1.5	WS 24	60 (44.3)
10	14S	M22X1.5	WS 27	75 (55.3)
12	16S	M24X1.5	WS 30	90 (66.4)
16	20S	M30X2	WS 36	100 (73.8)
20	25S	M36X2	WS 41	180 (132.8)
25	30S	M42X2	WS 50	270 (199.1)
32	38S	M52X2	WS 60	400 (295)

Galvanised and dry surface (O-ring slightly oiled). Torque tolerance: -10 %
Values determined empirically and to be applied as approximate figures.

Screw connections with various seals for hydraulic applications (light execution)					
Thread	Straight pipe fitting with thread and screwed plug			Non-return valve with elastic seal	Identification aid outside Ø
	Sealing washer	Elastic seal	O-ring		
	Nm (lbs/ft)	Nm (lbs/ft)	Nm (lbs/ft)	Nm (lbs/ft)	mm (")
M10X1.0	9 (7)	18 (13)	15 (11)	18 (13)	10 (0.4)
M12X1.5	20 (15)	25 (18)	25 (18)	25 (18)	12 (0.5)
M14X1.5	35 (26)	45 (33)	35 (26)	35 (26)	14 (0.55)
M16X1.5	45 (33)	55 (41)	40 (30)	50 (37)	16 (0.6)
M18X1.5	55 (41)	70 (52)	45 (33)	70 (52)	18 (0.7)
M22X1.5	65 (48)	125 (92)	60 (44)	125 (92)	22 (0.9)
M27X2.0	90 (66)	180 (133)	100 (74)	145 (107)	27 (1.0)
M33X2.0	150 (111)	310 (229)	160 (118)	210 (155)	33 (1.3)
M42X2.0	240 (177)	450 (332)	210 (155)	360 (266)	42 (1.7)
M48X2.0	290 (214)	540 (398)	260 (192)	540 (398)	48 (1.9)
G1/8A	9 (7)	18 (13)	15 (11)	18 (13)	9.73 (0.38)
G1/4A	35 (26)	35 (26)	30 (22)	35 (26)	13.16 (0.52)
G3/8A	45 (33)	70 (52)	45 (33)	50 (37)	16.66 (0.66)
G1/2A	65 (48)	90 (66)	55 (41)	65 (48)	20.96 (0.83)
G3/4A	90 (66)	180 (133)	100(74)	140 (103)	26.44 (1.04)
G1A	150 (111)	310 (229)	160 (118)	190 (140)	33.25 (1.31)
G1 1/4A	240 (177)	450 (332)	210 (155)	360 (266)	41.91 (1.65)
G1 1/2A	290 (214)	540 (398)	260 (192)	540 (398)	47.80 (1.88)

Torque tolerance: – 10 %; countermaterial: steel/aluminium

Screw connections with various seals for hydraulic applications (heavy execution)					
Thread	Straight pipe fitting with thread and screwed plug			Non-return valve with elastic seal	Identification aid outside Ø
	Sealing washer	Elastic seal	O-ring		
	Nm (lbs/ft)	Nm (lbs/ft)	Nm (lbs/ft)	Nm (lbs/ft)	mm (")
M12X1.5	20 (15)	35 (26)	35 (26)	35 (26)	12 (0.5)
M14X1.5	35 (26)	55 (41)	45 (33)	45 (33)	14 (0.55)
M16X1.5	45 (33)	70 (52)	55 (41)	55 (41)	16 (0.6)
M18X1.5	55 (41)	90 (66)	70 (52)	70 (52)	18 (0.7)
M20X1.5	55 (41)	125 (92)	80 (59)	100 (74)	22 (0.9)
M22X1.5	65 (48)	135 (100)	100 (74)	125 (92)	27 (1.0)
M27X2.0	90 (66)	180 (133)	170 (126)	135 (100)	12 (0.5)
M33X2.0	150 (111)	310 (229)	310 (229)	210 (155)	33 (1.3)
M42X2.0	240 (177)	450 (332)	330 (243)	360 (266)	42 (1.7)
M48X2.0	290 (214)	540 (398)	420 (310)	540 (398)	48 (1.9)
G1/8A	35 (26)	55 (41)	45 (33)	45 (33)	13.16 (0.52)
G1/4A	45 (33)	80 (59)	60 (44)	60 (44)	16.66 (0.66)
G3/8A	65 (48)	115 (85)	75 (55)	100 (74)	20.96 (0.83)
G1/2A	90 (66)	180 (133)	170 (125)	145 (107)	26.44 (1.04)
G3/4A	150 (111)	310 (229)	310 (229)	260 (192)	33.25 (1.31)
G1A	240 (177)	450 (332)	330 (243)	360 (266)	41.91 (1.65)
G1 1/4A	290 (214)	540 (398)	420 (310)	540 (398)	47.80 (1.88)

Torque tolerance: – 10 %; countermaterial: steel/aluminium

Tightening torques for high-resistance screw connections

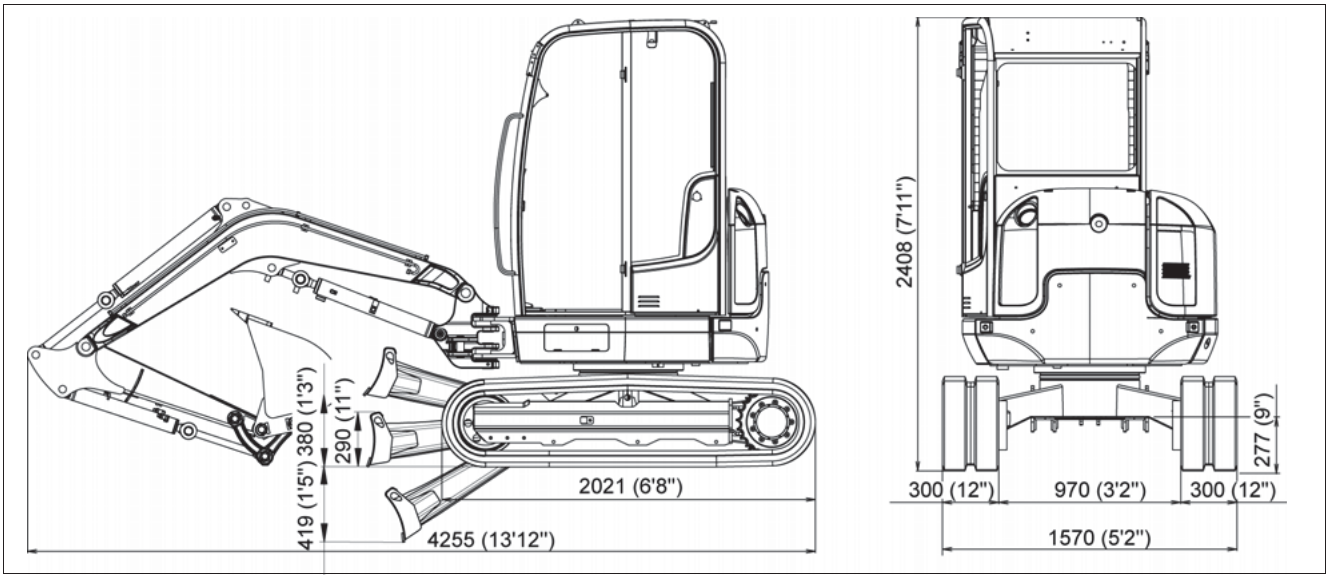
With coarse-pitch thread					
Thread	Screws according to DIN 912, DIN 931, DIN 933 etc.			Screws according to DIN 7984	
	8.8	**10.9**	**12.9**	**8.8**	**10.9**
	Nm (lbs/ft)	Nm (lbs/ft)	Nm (lbs/ft)	Nm (lbs/ft)	Nm (lbs/ft)
M5	5.5 (4)	8 (6)	10 (7)	5 (4)	7 (5)
M6	10 (7)	14 (10)	17 (13)	8.5 (6)	12 (9)
M8	25 (18)	35 (26)	42 (31)	20 (15)	30 (22)
M10	45 (33)	65 (48)	80 (59)	40 (30)	59 (44)
M12	87 (64)	110 (81)	147 (108)	69 (51)	100 (74)
M14	135 (100)	180 (133)	230 (170)	110 (81)	160 (118)
M16	210 (155)	275 (203)	350 (258)	170 (125)	250 (184)
M18	280 (207)	410 (302)	480 (354)	245 (181)	345 (254)
M20	410 (302)	570 (420)	690 (509)	340 (251)	490 (361)
M22	550 (406)	780 (575)	930 (686)	460 (339)	660 (487)
M24	710 (524)	1000 (738)	1190 (878)	590 (435)	840 (620)
M27	1040 (767)	1480 (1092)	1770 (1305)	870 (642)	1250 (922)
M30	1420 (1047)	2010 (1482)	2400 (1770)	1200 (885)	1700 (1254)

DIN 912 – hexagon socket head cap screw; DIN 931/DIN 933 – hexagon head screw with/without shaft;
DIN 7984 – hexagon socket head cap screw with short head
All values subject to a friction coefficient of μ = 0.12 and are to be used as approximate figures.

With fine-pitch thread					
Thread	Screws according to DIN 912, DIN 931, DIN 933 etc.			Screws according to DIN 7984	
	8.8	**10.9**	**12.9**	**8.8**	**10.9**
	Nm (lbs/ft)	Nm (lbs/ft)	Nm (lbs/ft)	Nm (lbs/ft)	Nm (lbs/ft)
M8X1.0	25 (18)	37 (28)	43 (32)	22 (16)	32 (24)
M10X1.0	50 (37)	75 (55)	88 (65)	43 (32)	65 (48)
M10X1.25	49 (36)	71 (52)	83 (61)	42 (31)	62 (46)
M12X1.25	87 (64)	130 (96)	150 (111)	75 (55)	110 (81)
M12X1.5	83 (61)	125 (92)	145 (107)	72 (53)	105 (77)
M14X1.5	135 (100)	200 (148)	235 (173)	120 (89)	175 (129)
M16X1.5	210 (155)	310 (229)	360 (266)	180 (133)	265 (195)
M18X1.5	315 (232)	450 (332)	530 (391)	270 (199)	385 (284)
M20X1.5	440 (325)	630 (465)	730 (538)	375 (277)	530 (391)
M22X1.5	590 (435)	840 (620)	980 (723)	500 (369)	710 (524)
M24X2.0	740 (546)	1070 (789)	1250 (922)	630 (465)	900 (664)
M27X2.0	1100 (811)	1550 (1143)	1800 (1328)	920 (679)	1300 (959)
M30X2.0	1500 (1106)	2150 (1586)	2500 (1844)	1300 (959)	1850 (1364)

DIN 912 – hexagon socket head cap screw; DIN 931/DIN 933 – hexagon head screw with/without shaft;
DIN 7984 – hexagon socket head cap screw with short head
All values subject to a friction coefficient of $\mu = 0.12$ and are to be used as approximate figures.

2.13 Dimensions model 28Z3



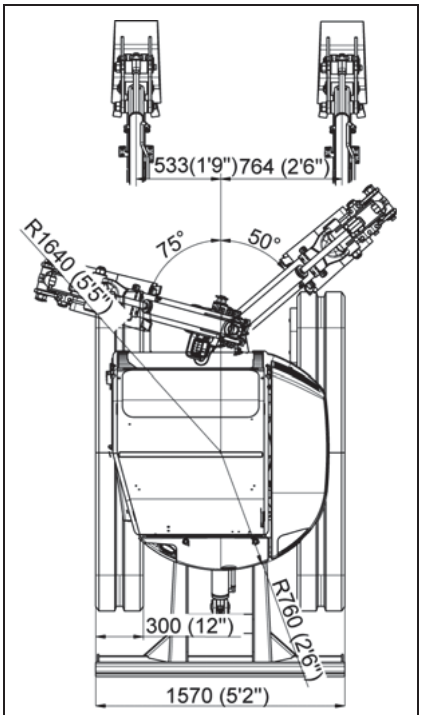


Fig. 1: Machine dimensions

Main data	Model 28Z3
Service weight with cab/canopy	2830/2737 kg (6239/6034 lbs.)
Transport weight with cab/canopy	2670/2577 kg (5886/5681 lbs.)
Height	2408 mm (7'11")
Width	1570 mm (5'2")
Transport length (short/long stick)	4255 mm (13'12")/4272 mm (14')
Max. digging depth (short/long stick)	2544 mm (8'4")/2744 mm (9')
Standard stick length (short stick)	1050 mm (3'5")
Long stick length (long stick)	1250 mm (4'1")
Max. vertical digging depth (short/long stick)	1962 mm (6'5")/2152 mm (7'1")
Max. digging height (short stick)	4170 mm (13'8")
Max. digging height (long stick)	4300 mm (14'1")
Max. dump height (short stick)	2840 mm (9'4")
Max. dump height (long stick)	2970 mm (9'9")
Max. digging radius (short stick)	4613 mm (15'2")
Max. digging radius (long stick)	4805 mm (15'9")
Max. reach at ground level (short stick)	4481 mm (14'8")
Max. reach at ground level (long stick)	4681 mm (15'4")
Max. breakout force at bucket tooth	22.5 kN (5058 lbs/ft)
Max. tearout force (short stick)	13.6 kN (3057 lbs/ft)
Max. tearout force (long stick)	21.9 kN (4923 lbs/ft)
Min. tail end slewing radius	760 mm (2'6")
Max. tail end lateral projection (90° rotation of upper carriage)	0 mm (0'0")
Max. boom displacement to bucket centre (right-hand side)	533 mm (1'9")
Max. boom displacement to bucket centre (left-hand side)	764 mm (2'6")

2.14 Dimensions model 28Z3 VDS

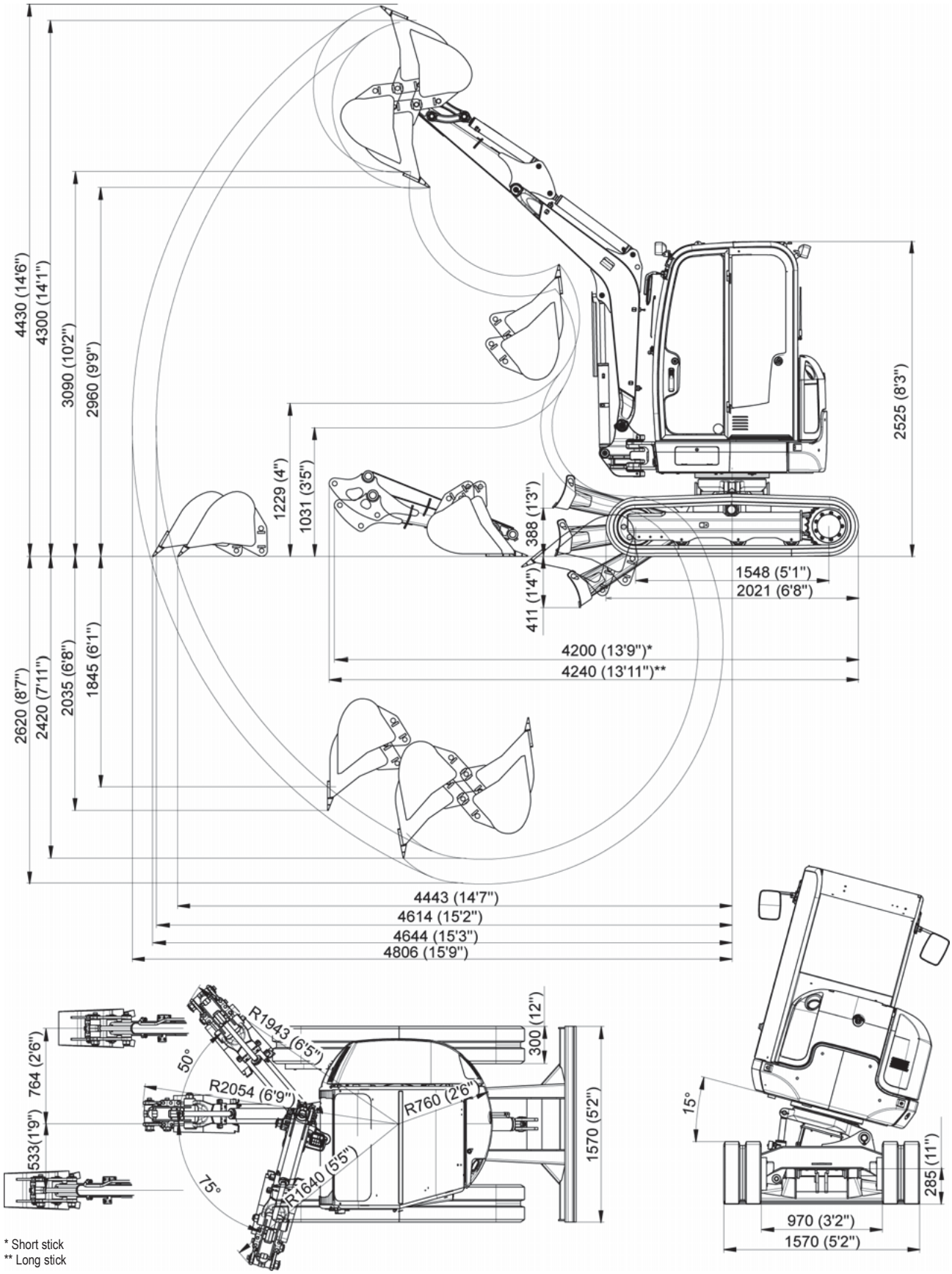


Fig. 2: Machine dimensions (model 28Z3)

Main data	Model 28Z3 VDS
Service weight with cab/canopy	3070/2977 kg (6768/6563 lbs.)
Transport weight with cab/canopy	2910/2817 kg (6415/6210 lbs.)
Height	2525 mm (8'3")
Width	1570 mm (5'2")
Transport length (short/long stick)	4200 mm (13'9")/4240 mm (13'11")
Max. digging depth (short/long stick)	2420 mm (7'11")/2620 mm (8'7")
Standard stick length (short stick)	1050 mm (3'5")
Long stick length (long stick)	1250 mm (4'1")
Max. vertical digging depth (short/long stick)	1845 mm (6'1")/2035 mm (6'8")
Max. digging height (short stick)	4300 mm (14'1")
Max. digging height (long stick)	4430 mm (14'6")
Max. dump height (short stick)	2960 mm (9'9")
Max. dump height (long stick)	3090 mm (10'2")
Max. digging radius (short stick)	4614 mm (15'2")
Max. digging radius (long stick)	4815 mm (15'10")
Max. reach at ground level (short stick)	4443 mm (14'7")
Max. reach at ground level (long stick)	4644 mm (15'3")
Max. breakout force at bucket tooth	22.5 kN (5058 lbs/ft)
Max. tearout force (short stick)	13.6 kN (3057 lbs/ft)
Max. tearout force (long stick)	21.9 kN (4923 lbs/ft)
Min. tail end slewing radius	760 mm (2'6")
Max. tail end lateral projection (90° rotation of upper carriage)	0 mm (0'0")
Max. boom displacement to bucket centre (right-hand side)	533 mm (1'9")
Max. boom displacement to bucket centre (left-hand side)	764 mm (2'6")
Max. tilt angle for VDS	15°

2.15 Lift capacity table 28Z3 (short stick)

	max		3.5 m (11.5 ft)		3.0 m (9.8 ft)		2.5 m (8.2 ft)	
A / B	Lowered blade		Lowered blade		Lowered blade		Lowered blade	
3.0 m (9.8 ft)	508* (1121*)	387 (854)			492* (1085*)	426 (939)		
2.0 m (6.6 ft)	489* (1078*)	280 (617)	492* (1084*)	319 (703)	525* (1157*)	414 (914)	588* (1297*)	559* (1233*)
1.0 m (3.3 ft)	494* (1088*)	249 (548)	554* (1222*)	301 (664)	663* (1463*)	380 (838)	872* (1923*)	495 (1091)
0.0 m (0.0 ft)	504* (1110*)	257 (566)	581* (1282*)	287 (633)	731* (1611*)	357 (787)	967* (2132*)	463 (1020)
-1.0 m (-3.3 ft)	498* (1098*)	324 (714)			605* (1335*)	359 (792)	805* (1774*)	467 (1029)

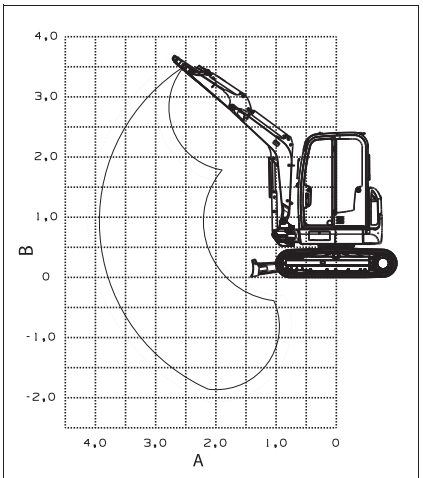


Fig. 3: Lift capacity table (model 28Z3)

max	Admissible load on extended stick
A	Reach from live ring centre
B	Load hook height
*	Lift capacity limited by hydraulic system

All table indications in kg (lbs.) and horizontal position on firm ground without bucket.

	With the stabiliser blade in driving direction
	Without the stabiliser blade, 90° to driving direction

If equipped with a bucket or other attachments, lift capacity or tilt load is reduced by bucket or attachment dead weight.

Calculation basis: according to ISO 10567

The machine's lift capacity is restricted by the settings of the pressure limiting valves and the hydraulic system's stabilising features.

Neither 75 % of the static tilt load nor 87 % of the hydraulic lift capacity is exceeded.

2.16 Lift capacity table 28Z3 long stick (option)

A / B	max		3.5 m (11.5 ft)		3.0 m (9.8 ft)		2.5 m (8.2 ft)	
	Lowered blade		Lowered blade		Lowered blade		Lowered blade	
3.0 m (9.8 ft)	458* (1009*)	339 (747)			423* (933*)	423* (933*)		
2.0 m (6.6 ft)	447* (985*)	253 (558)	450* (993*)	320 (705)	473* (1044*)	417 (919)		
1.0 m (3.3 ft)	453* (1000*)	226 (499)	526* (1161*)	299 (659)	625* (1378*)	380 (837)	811* (1788*)	499 (1101)
0.0 m (0.0 ft)	465* (1026*)	232 (512)	575* (1269*)	282 (621)	720* (1588*)	352 (776)	960* (2116*)	458 (1009)
-1.0 m (-3.3 ft)	468* (1033*)	284 (626)			646* (1425*)	349 (769)	852* (1879*)	455 (1004)

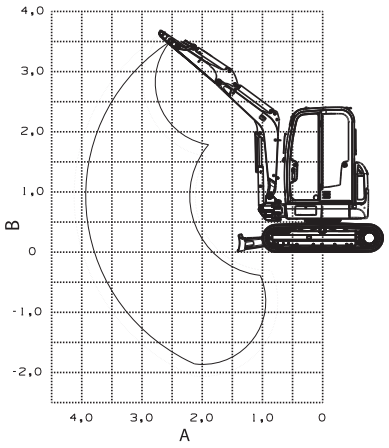
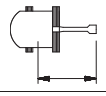


Fig. 4: Lift capacity table (model 28Z3)

max	Admissible load on extended stick
A	Reach from live ring centre
B	Load hook height
*	Lift capacity limited by hydraulic system

All table indications in kg (lbs.) and horizontal position on firm ground without bucket.

	With the stabiliser blade in driving direction
	Without the stabiliser blade, 90° to driving direction

If equipped with a bucket or other attachments, lift capacity or tilt load is reduced by bucket or attachment dead weight.

Calculation basis: according to ISO 10567

The machine's lift capacity is restricted by the settings of the pressure limiting valves and the hydraulic system's stabilising features.

Neither 75 % of the static tilt load nor 87 % of the hydraulic lift capacity is exceeded.

2.17 Lift capacity table 28Z3 short stick and extra weight (option)

A / B	max	3.5 m (11.5 ft)		3.0 m (9.8 ft)		2.5 m (8.2 ft)	
	Lowered blade		Lowered blade		Lowered blade		Lowered blade	
3.0 m (9.8 ft)	508* (1121*)	427 (941)			492* (1085*)	483* (1085*)		
2.0 m (6.6 ft)	489* (1078*)	320 (706)	492* (1084*)	366 (808)	525* (1157*)	472 (1041)	588* (1297*)	588* (1297*)
1.0 m (3.3 ft)	494* (1088*)	290 (640)	554* (1222*)	348 (768)	663* (1463*)	437 (965)	872* (1923*)	568 (1253)
0.0 m (0.0 ft)	504* (1110*)	304 (670)	581* (1282*)	335 (738)	731* (1611*)	414 (914)	967* (2132*)	536 (1182)
-1.0 m (-3.3 ft)	498* (1098*)	391 (863)			605* (1335*)	417 (919)	805* (1774*)	540 (1191)

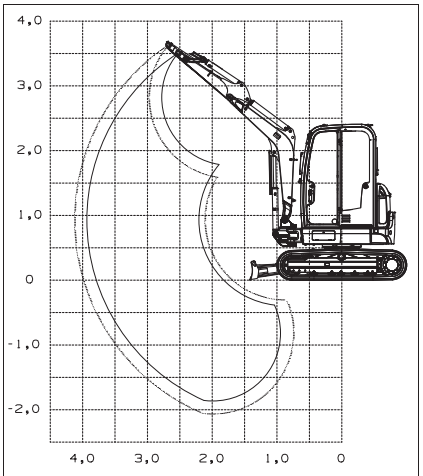
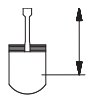


Fig. 5: Lift capacity table (model 28Z3)

max.	Admissible load on extended stick
A	Reach from live ring centre
B	Load hook height
*	Lift capacity limited by hydraulic system

All table indications in kg (lbs.) and horizontal position on firm ground without bucket.

	With the stabiliser blade in driving direction
	Without the stabiliser blade, 90° to driving direction

If equipped with a bucket or other attachments, lift capacity or tilt load is reduced by bucket or attachment dead weight.

Calculation basis: according to ISO 10567

The machine's lift capacity is restricted by the settings of the pressure limiting valves and the hydraulic system's stabilising features.

Neither 75 % of the static tilt load nor 87 % of the hydraulic lift capacity is exceeded.

2.18 Lift capacity table 28Z3 long stick (option) and extra weight (option)

A / B	max		3.5 m (11.5 ft)		3.0 m (9.8 ft)		2.5 m (8.2 ft)	
	Lowered blade		Lowered blade		Lowered blade		Lowered blade	
3.0 m (9.8 ft)	458* (1009*)	377 (832)			423* (933*)	423* (933*)		
2.0 m (6.6 ft)	447* (985*)	292 (643)	450* (993*)	367 (809)	473* (1044*)	473* (1044*)		
1.0 m (3.3 ft)	453* (1000*)	266 (586)	526* (1161*)	346 (764)	625* (1378*)	437 (964)	811* (1788*)	573 (1263)
0.0 m (0.0 ft)	465* (1026*)	276 (609)	575* (1269*)	329 (725)	720* (1588*)	409 (903)	960* (2116*)	531 (1171)
-1.0 m (-3.3 ft)	468* (1033*)	343 (756)			646* (1425*)	406 (896)	852* (1879*)	529 (1166)

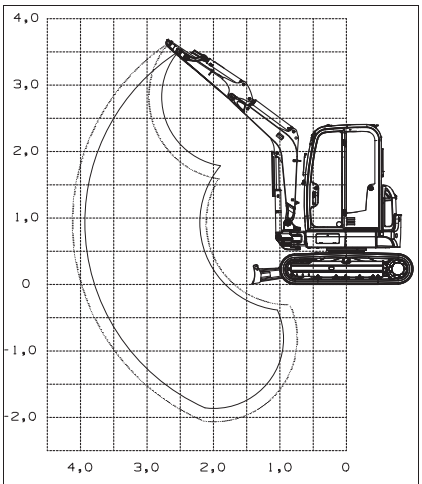


Fig. 6: Lift capacity table (model 28Z3)

max.	Admissible load on extended stick
A	Reach from live ring centre
B	Load hook height
*	Lift capacity limited by hydraulic system

All table indications in kg (lbs.) and horizontal position on firm ground without bucket.

	With the stabiliser blade in driving direction
	Without the stabiliser blade, 90° to driving direction

If equipped with a bucket or other attachments, lift capacity or tilt load is reduced by bucket or attachment dead weight.

Calculation basis: according to ISO 10567

The machine's lift capacity is restricted by the settings of the pressure limiting valves and the hydraulic system's stabilising features.

Neither 75 % of the static tilt load nor 87 % of the hydraulic lift capacity is exceeded.

2.19 Lift capacity table 28Z3 VDS (short stick)

	max			3.5 m (11'6")			3.0 m (9'10")			2.5 m (8'2")			2.0 m (6'7")		
B\A	Lowered blade		Raised blade	Lowered blade		Raised blade	Lowered blade		Raised blade	Lowered blade		Raised blade	Lowered blade		Raised blade
3.0 m (9'10")	516* (1138*)	403 (889)	444 (979)				495* (1091*)	464 (1023)	495* (1091*)						
2.0 m (6'7")	501* (1105*)	303 (668)	333 (655)	508* (1120*)	348 (767)	382 (842)	549* (1235*)	448 (988)	494 (1089)	628* (1385*)	599* (1321*)	628* (1385*)			
1.0 m (3'3")	507* (1118*)	275 (606)	303 (668)	573* (1263*)	329 (725)	363 (800)	690* (1521*)	413 (911)	458 (1010)	912* (2011*)	536 (1182)	601 (1325)			
0.0 m (0'0")	517* (1140*)	289 (637)	319 (703)	589* (1299*)	317 (699)	351 (774)	743* (1638*)	392 (864)	437 (963)	979* (2158*)	509 (1122)	572 (1261)	1366* (3012*)	715 (1576)	821 (1810)
-1.0 m (-3'3")	506* (1116*)	375 (827)	416 (917)				579* (1276*)	399 (880)	444 (979)	783* (1726*)	516 (1138)	580 (1297)	1044* (2302*)	731 (1612)	838 (1848)

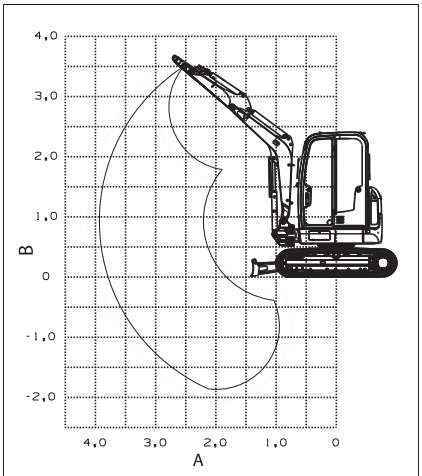


Fig. 7: Lift capacity table (model 28Z3)

max	Admissible load on extended stick
A	Reach from live ring centre
B	Load hook height
*	Lift capacity limited by hydraulic system

All table indications in kg (lbs.) and horizontal position on firm ground without bucket.

	With the stabiliser blade in driving direction
	Without the stabiliser blade, 90° to driving direction

If equipped with a bucket or other attachments, lift capacity or tilt load is reduced by bucket or attachment dead weight.

Calculation basis: according to ISO 10567

The machine's lift capacity is restricted by the settings of the pressure limiting valves and the hydraulic system's stabilising features.

Neither 75 % of the static tilt load nor 87 % of the hydraulic lift capacity is exceeded.

2.20 Lift capacity table 28Z3 long stick VDS (option)

	max			3.5 m (11'6")			3.0 m (9'10")			2.5 m (8'2")			2.0 m (6'7")		
B\A	Lowered blade		Raised blade	Lowered blade		Raised blade	Lowered blade		Raised blade	Lowered blade		Raised blade	Lowered blade		Raised blade
3.0 m (9'10")	466* (1027*)	356 (785)	391 (862)				430* (948*)	430 (948)	430 (948)						
2.0 m (6'7")	458* (1010*)	275 (606)	303 (668)	468* (1032*)	348 (767)	383 (844)	498* (1098*)	450 (992)	497 (1096)						
1.0 m (3'3")	466* (1027*)	251 (553)	277 (611)	547* (1206*)	327 (721)	361 (796)	654* (1442*)	412 (908)	458 (1010)	855* (1885*)	539 (188)	605 (1334)			
0.0 m (0'0")	478* (1054*)	262 (577)	289 (637)	587* (1294*)	311 (686)	344 (758)	736* (1622*)	387 (853)	431 (950)	977* (2154*)	503 (1109)	566 (1248)	1410* (3109*)	705 (1554)	810 (1785)
-1.0 m (-3'3")	479* (1056*)	328 (723)	363 (800)				635* (1400*)	387 (853)	431 (950)	840* (1852*)	504 (1111)	567 (1250)	1145* (2524*)	715 (1576)	821 (1810)

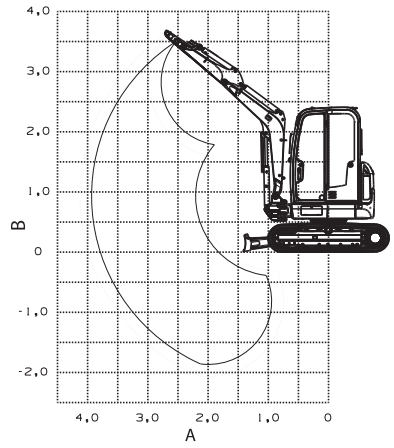


Fig. 8: Lift capacity table (model 28Z3)

max	Admissible load on extended stick
A	Reach from live ring centre
B	Load hook height
*	Lift capacity limited by hydraulic system

All table indications in kg (lbs.) and horizontal position on firm ground without bucket.

	With the stabiliser blade in driving direction
	Without the stabiliser blade, 90° to driving direction

If equipped with a bucket or other attachments, lift capacity or tilt load is reduced by bucket or attachment dead weight.

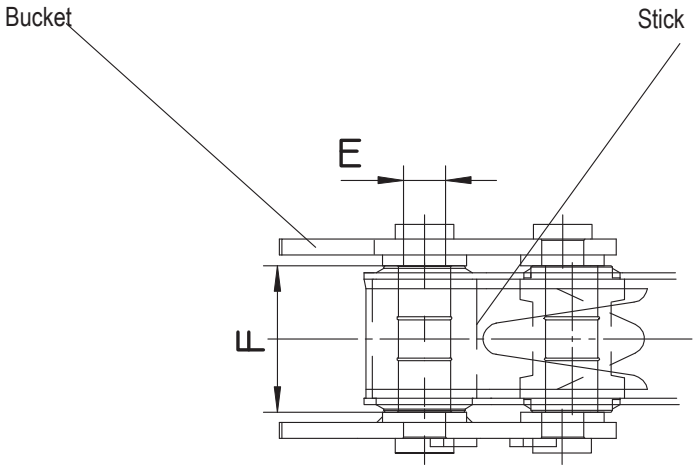
Calculation basis: according to ISO 10567

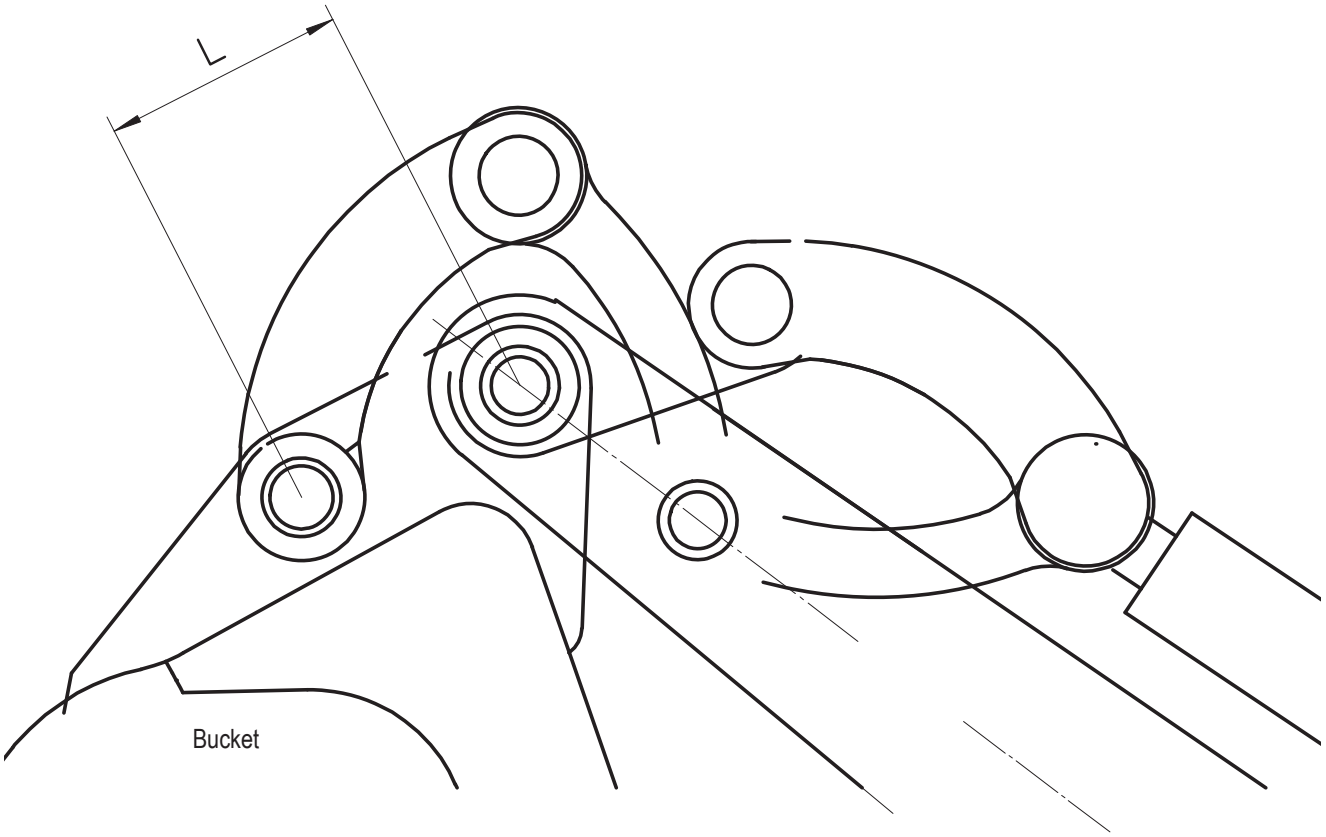
The machine's lift capacity is restricted by the settings of the pressure limiting valves and the hydraulic system's stabilising features.

Neither 75 % of the static tilt load nor 87 % of the hydraulic lift capacity is exceeded.

2.21 Kinematics

E	Pin diameter	40 mm (1.57”)
F	Stick width	140 mm (5.51”)
L	Pin distance from bucket mount	180 mm (7.09”)





Maintenance

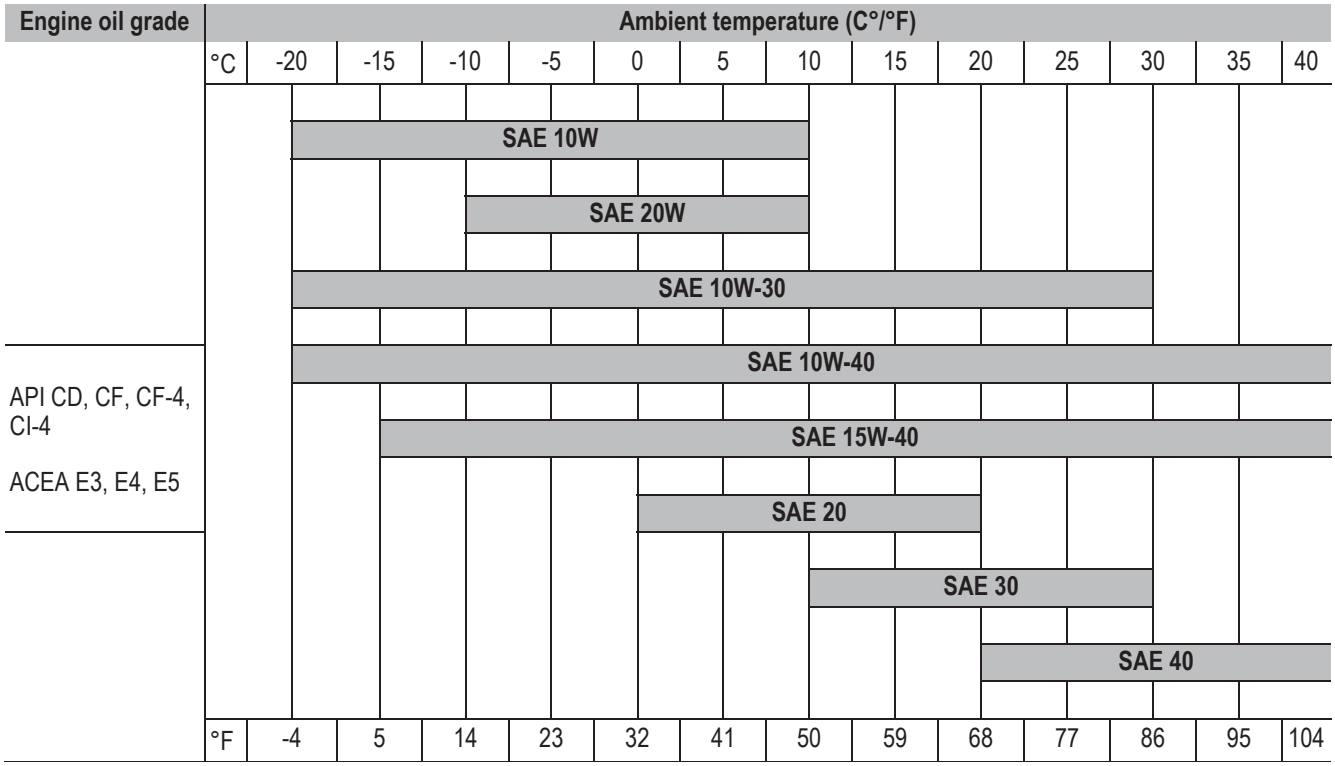
3 Maintenance

3.1 Fluids and lubricants

Component/application	Engine/machine fluid	Specification	Season/temperature	Capacities [1]
Diesel engine	Engine oil[2]	SAE10W-40	-20 °C (-4 °F) +40 °C (104 °F)	About 3.4 l (0.9 gal)
Travelling drive	Gearbox oil	API GL-5	Year-round	About 0.6 l (0.16 gal) each
		SAE 80W-90		
Hydraulic oil tank	Hydraulic oil [3]	HVLP46	Year-round[4]	30 l (7.9 gal)
	Biodegradable oil[5]	PANOLIN HLP Synth 46		
		FINA BIOHYDRAN SE 46		
		BP BIOHYD SE-46		
Grease	Roller and friction bearings	KPF2 K-20[6]	Year-round	As required
	Live ring: ball bearings		Year-round	As required
	Live ring gears			
	Grease nipples			
Grease nipples	Multipurpose grease [7]	FINA Energrease L21 M	Year-round	As required
Battery terminals	Acid-proof grease [8]	FINA Marson L2	Year-round	As required
Fuel tank	Diesel fuel	2-D ASTM D975 – 94 (USA)		About 36 l (9.5 gal)
		1-D ASTM D975 – 94 (USA)		
		EN 590:96 (EU)		
		BS 2869 – A2 (GB)	Depending on outside temperatures Summer or winter diesel fuel	
Radiator	Coolant	Soft water + antifreeze ASTM D4985	Year-round	About 4.5 l (1.2 gal)
		Distilled water + antifreeze ASTM D4985		
Washer system	Cleaning agent	Water + antifreeze	Year-round	1.2 l (0.3 gal)

1. The capacities indicated are approximate values; the oil level check alone is relevant for the correct oil level
   Capacities indicated are no system fills
2. According to DIN 51502; API CD, CF, CF-4, CI-4, ACEA E3, E4, E5
3. According to DIN 51524 section 3
4. Depending on local conditions – *see Hydraulics oil grade* on page 3-4
5. Biodegradable hydraulic oil based on saturated synthetic esters with an iodine value of < 10 g/mg, according to DIN 51524, section 3, HVLP, HEES
6. KPF2K-20 according to DIN 51502/DIN ISO 6743-9 lithium-saponified grease
7. KF2K-25 according to DIN 51502 multipurpose lithium grease with MoS^2 additive
8. Standard acid-proof grease

Oil grades for the diesel engine, depending on temperature



Additional oil change and filter replacement (hydraulic system)

Caution!

An additional oil change and filter replacement can be required depending on how the machine is used. Failure to observe these replacement intervals can cause damage to hydraulic components.

☞ *Observe the following intervals*

Application		Hydraulic oil	Hydraulic oil filter insert
Normal work (excavation work)		Every 1000 s/h	Replace the first time after 50 s/h, then every 1000 s/h
Percentage of hammer work	20 %	Every 800 s/h	300 s/h
	40 %	Every 400 s/h	
	60 %	Every 300 s/h	100 s/h
	Over 80 %	Every 200 s/h	

Notice!

Please refer to the maintenance plan on page 3-7 for additional maintenance work.

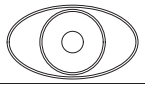
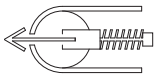
Oil grades for the hydraulic system, depending on temperature

Hydraulics oil grade	Ambient temperature (C°/°F)														
	°C	-20	-15	-10	-5	0	5	10	15	20	25	30	35	40	50
HVLP[1]		ISO VG32													
					ISO VG46										
							ISO VG68								
	°F	-4	5	14	23	32	41	50	59	68	77	86	95	104	122

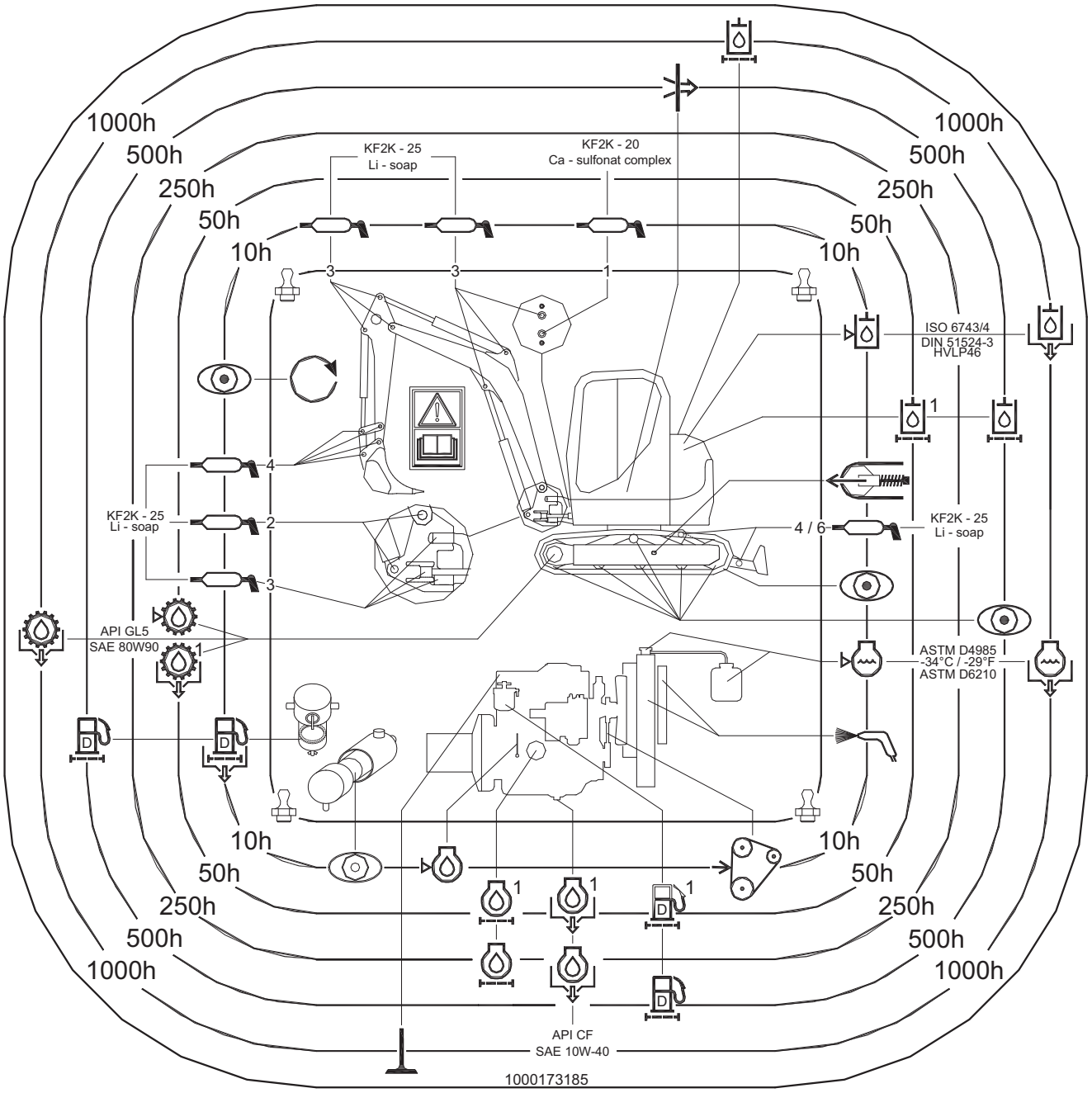
1. According to DIN 51524 section 3

3.2 Maintenance label

Explanation of symbols on the maintenance label

Symbol	Assembly	Explanation
	General	Visual check
	General	Grease instructions
	Fuel system	Drain condensation water
	Fuel system	Replace the fuel filter, clean the fuel prefilter
	Radiator	Check the coolant level
	Radiator	Drain and fill in new coolant
	Engine	Check valve clearance. Adjust if necessary
	Engine	Check the engine oil level
	Engine	Change engine oil
	Engine	Replace the oil filter
	Engine	Check V-belt tension
	Travelling drive	Change oil
	Travelling drive	Check oil level
	Undercarriage	Check track tension
	Hydraulic system	Check oil level
	Hydraulic system	Change hydraulic oil
	Hydraulic system	Replace the hydraulic oil filter, replace the breather filter

Symbol	Assembly	Explanation
	Radiator fins	Clean
	Heating, air conditioning	Replace the air filter



3.3 Maintenance plan (overview)

Work description	Maintenance plan/service hours (s/h)								
For service and maintenance work on the attachment, please refer to the operation and maintenance manual of the attachment manufacturer as well.	Service work (daily)	Every 50 s/h	Every 250 s/h	Every 500 s/h	Every 1000 s/h once a year	Every 1500 s/h	Every 2000 s/h	Customer	Authorised workshop
Fluid and filter changes ( ):									
Carry out the following oil and filter changes (check oil levels after test run):									
• Engine oil[1]			●						●
• Engine oil filter[2]			●						●
• Fuel filter[3]				●					●
• Air filter element – maintenance display on filter[4]					●			●	
• Coolant					●				●
• Hydraulic oil filter insert [5]				●					●
• Hydraulic oil[6]					●				●
• Hydraulic oil tank breather					●				●
• Cab air filter of heating system					●			●	
• Drain condensation water from hydraulic oil tank				●					●
• Drive gearbox oil [7]					●				●
Inspection work ( ):									
Check the following material. Refill if necessary:									
• Engine oil	●							●	
• Engine coolant	●							●	
• Hydraulic oil	●							●	
• Fuel	●							●	
• Drive gearbox oil			●						●
Clean water ducts [8]					●				●
Check pedal function	●							●	
Check radiator for engine and hydraulic oil for dirt. Clean if necessary	●							●	
Check cooling systems, heating and hoses for leaks and pressure (visual check)	●							●	
Check the pilot control filter on the main valve block for dirt, clean it if necessary					●				●
Clean the cab air filter of the heating system				●				●	
Air filter (damage)	●							●	
Remove dust from dust valve	●							●	
Prefilter with water separator: drain water	●							●	
• Clean				●					●

3.3 Maintenance plan (overview)

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)								
	Service work (daily)	Every 50 s/h	Every 250 s/h	Every 500 s/h	Every 1000 s/h once a year	Every 1500 s/h	Every 2000 s/h	Customer	Authorised workshop
Check V-belt condition and tension	●							●	
Check exhaust system for damage and condition	●							●	
Check valve clearance. Adjust if necessary					●				●
Lap the intake and exhaust valves							●		●
Check and adjust the injection pressure of the injection nozzles, clean the injection needles/nozzles						●			●
Empty the fuel tank and check for dirt				●					●
Check battery electrolyte. Fill up with distilled water if necessary		●		●				●	
Check electric connections, bearing play and function of alternator and starter				●					●
Check preheating system and electric connections				●					●
Check correct function of air filter contamination gauge				●					●
Pressure check of primary pressure limiting valves[9]				●					●
Check tracks for cracks and cuts	●							●	
Check track tension. Retighten if necessary	●							●	
Check bearing play of tread rollers, track carrier rollers, front idlers				●					●
Check piston rods for damage	●							●	
Check the screw connections of the safety devices (e.g. cab, etc.) for tightness	●							●	
Check screws for tightness				●					●
Check pin lock	●							●	
Check line fixtures	●							●	
Check indicator lights for correct function	●							●	
Couplings, dirt pile-up on hydraulic system dust caps	●							●	
Check insulating mats in the engine compartment for damage/condition		●						●	
Check labels and Operator's Manual for completeness and condition		●						●	
Adjust the mirrors (option) correctly, clean them and check them for damage and correct function	●							●	
Check all fastening screws on the mirrors (option) and tighten them if necessary		●						●	
Check hydraulic quickhitch for damage	●							●	
Lights and acoustic warning system[10]	●							●	
Check gearing of swivel unit pinion					●				●
Check the Powertilt for damage	●							●	

3.3 Maintenance plan (overview)

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)								
	Service work (daily)	Every 50 s/h	Every 250 s/h	Every 500 s/h	Every 1000 s/h once a year	Every 1500 s/h	Every 2000 s/h	Customer	Authorised workshop
Check Powertilt for axial play (must not be over 0.38 mm/0.015".)			●						●
Actuate Powertilt swivel device in final position for 1 minute[11]	●[12]							●	
Lubrication service ( ):									
Lubricate the following assemblies/components – *see Wartungsaufkleber* on page 5-45:									
• Stabiliser blade	●							●	
• Swivelling console	●							●	
• Boom	●							●	
• Stick	●							●	
• Attachments	●							●	
• Tilt mechanism of upper carriage (VDS)	●							●	
• Hydraulic quickhitch system (option) – *see Hydraulic quickhitch (Easy Lock)* on page 7-20	●[13]							●	
• Powertilt with Easy Lock	●[14]							●	
• Grease strip on chassis – *see Wartungsaufkleber* on page 5-45	●							●	
• Ball bearing race and teeth of live ring		●						●	
Functional check ( ):									
Check the function of the following assemblies/components. Rectify if necessary:									
• Lights, signalling system, acoustic warning system	●							●	
• Heating function		●						●	
• Hydraulic quickhitch (lock)	●							●	
• Check pedal function	●							●	
• Check the Powertilt	●							●	
Leakage check ( ):									
Check for tightness, leaks and chafing: pipes, flexible lines and screw connections of the following assemblies and components. Rectify if necessary:									
• Visual check	●							●	
☞ Engine, hydraulic system and hydraulic components	●							●	
☞ Cooling and heating circuit	●							●	
☞ Travelling drive	●							●	
☞ Hydraulic quickhitch system (hoses, valve)	●							●	

1. Drain engine oil the first time after 50 s/h, then every 250 s/h
2. Replace the engine oil filter the first time after 50 s/h, then every 250 s/h
3. Replace the fuel filter the first time after 50 s/h, then every 500 s/h
4. According to the fouling indicator, every 1000 s/h or once a year at the latest. (Replace after 50 s/h when in extensive use in environments with acidic air, such as acid production facilities, steel and aluminium mills, chemical plants and other nonferrous-metal plants)
5. Replace the hydraulic oil filter insert the first time after 50 s/h, then every 500 s/h
6. Drain the hydraulic oil the first time after 500 s/h, then every 1000 s/h
7. Drain the gearbox oil the first time after 50 s/h, then every 1000 s/h
8. Clean the water ducts every other 1000 s/h servicing
9. Check the first time after 50 s/h, then every 500 s/h
10. Check once a week
11. Rinse the system to remove dirt. Repeat the procedure in the opposite flow direction.
12. Check once a week
13. Switch on once every week
14. Switch on once every week

3.4 Service package

The article numbers for the 2 service packages (50 and 500 service hours) are specified in the 28Z3 spare parts list.

3.5 Introduction

Operational readiness and the service life of machines are heavily dependent on maintenance.

It is therefore in the interest of the machine owner to carry out the prescribed maintenance work

Bear in mind the following points before carrying out service and maintenance work:

- Chapter 2 “SAFETY INSTRUCTIONS” of this Operator's Manual
- The Operator's Manuals of the attachments.

Carry out the prescribed inspections and rectify any disorders immediately before putting the machine into operation, or have them rectified by a Wacker Neuson workshop.

Secure the open engine cover and other open covers appropriately. Do not open the engine cover and other covers on slopes or in strong wind.

When using compressed air, dirt and debris can be blown into your face. Therefore, wear protective goggles, masks and clothing when using compressed air.

3.6 Safety-relevant parts

Service and maintenance work must be carried out by a specifically trained person.

All other maintenance work that is not indicated in this Operator's Manual must be carried out only by the trained and qualified staff of a Wacker Neuson workshop.

The following maintenance plans indicate the maintenance work to be carried out.

This is necessary to ensure optimal functioning.

– *see Maintenance plan (overview)* on page 3-7.

Immediately repair or replace parts that are already damaged or not working properly before they are due for replacement.

Notice!

Safety-relevant parts may only be repaired or replaced by a Wacker Neuson dealer or a Wacker Neuson workshop.

Parts	Interval
Hydraulic hoses	Replace hydraulic hoses every 6 years from the date of manufacture, even if they do not seem to be damaged.
Bladder type accumulator	Must be checked by a Wacker Neuson dealer every 2 years.
Seat belt	No replacement necessary. Replace the seat belt after an accident.

3.7 Fuel system

Danger!

All work involving fuel carries an increased

Danger of fire and poisoning!

- ☞ *Never carry out work on the fuel system in the vicinity of naked flames or sparks!*
- ☞ *Do not refuel in closed rooms!*
- ☞ *No smoking, no fire!*
- ☞ *Do not smoke when working on the fuel system or when refuelling!*
- ☞ *Wipe away fuel spills immediately!*
- ☞ *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!*

Notice!

Do not run the fuel tank completely dry. Otherwise, air is drawn into the fuel system. This requires bleeding the fuel system
– *see Bleeding the fuel system* on page 3-14.

Notice!

Fill up the tank with the correct fuel type at the end of each working day. This prevents condensation water from forming in the fuel tank over night. Do not fill the tank completely but leave some space for the fuel to expand.

Caution!

Bear in mind the following important points when refuelling:

- ☞ *Avoid refuelling with cans in order to avoid dirt in the fuel!*
- ☞ *When refuelling the machine without a fuel-filling pump, use safety-oriented ladders and work platforms.*
- ☞ *Never use machine parts or attachments/superstructures as a climbing aid!*

Refuelling

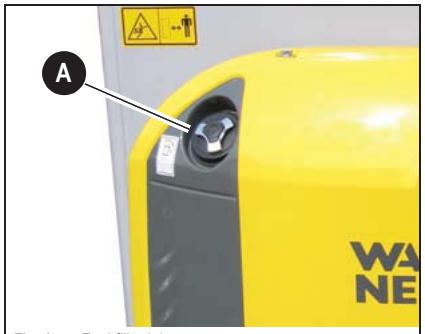


Fig. 1: Fuel filler inlet

Filler inlet **A** for the fuel tank is located behind the cab, on the left in driving direction.

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*

☞ *No smoking, no fire!*

Environment!

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

Notice!

Do not run the fuel tank completely dry. Otherwise, air is drawn into the fuel system. This requires bleeding the fuel system
– *see Bleeding the fuel system* on page 3-14.

Notice!

Fill up the tank with the correct fuel type at the end of each working day. This prevents condensation water from forming in the fuel tank over night. Do not fill the tank completely but leave some space for the fuel to expand.

Emptying the fuel tank

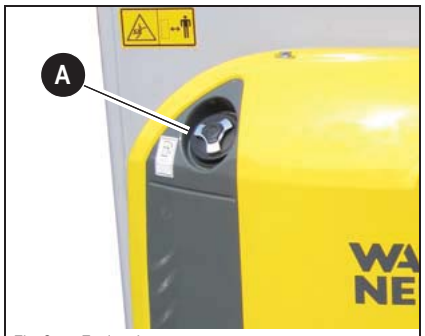


Fig. 2: Fuel tank

Filler inlet **A** for the fuel tank is located in the valve compartment, on the left in driving direction.

Proceed as follows:

Danger!

All work involving fuel carries an increased

Danger of fire and poisoning!

☞ *Do not work in closed rooms*

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

☞ *No smoking, no fire!*

Environment!

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

Filler inlet **A** for the fuel tank is located in the valve compartment, on the left in driving direction.

Proceed as follows:

☞ Open filler inlet **A**

☞ Pump out the fuel with a suitable pump

➥ Collect the fuel in a suitable container

Stationary fuel pumps

General

Only refuel from stationary fuel pumps. Fuel from barrels or cans is usually dirty.

Even the smallest particles of dirt can cause

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

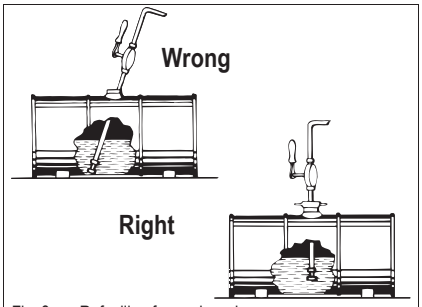


Fig. 3: Refuelling from a barrel

Refuelling from barrels

If refuelling from barrels cannot be avoided, note the following points (see fig. *Fig. 3*):

- Barrels must neither be rolled nor tilted before refuelling
- Protect the suction pipe opening of the barrel pump with a fine-mesh screen
- Immerse it down to a max. 15 cm (5.9”) 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

Diesel fuel specification

Use only high-grade fuels – *see chapter 3.1 Fluids and lubricants* on page 3-2

Bleeding the fuel system

Danger!

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

Danger of burns!

☞ *Work on the fuel system may be carried out only in an absolutely clean environment!*

☞ *Bleed the fuel system only if the engine is cold!*

☞ *Filter elements and drained fuel must be disposed of correctly.*

☞ *Always wear protective equipment and safety glasses when working with fuel.*

Danger!

Danger of injury due to rotating parts!

☞ *Before starting the engine, ensure that no-one is within danger area of the engine/the machine!*

☞ *Start the engine only if the engine cover is closed!*

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:*

- Fold the control lever base up
- Remove the ignition key
- Fill the fuel tank
- Turn the ignition key to the first position
- Wait about 5 minutes while the fuel system bleeds itself automatically
- Start the engine

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

- Stop the engine
- Fold the control lever base up
- Remove the ignition key
- Bleed the fuel system again as described above
- Check for leaks after starting the engine

Water separator

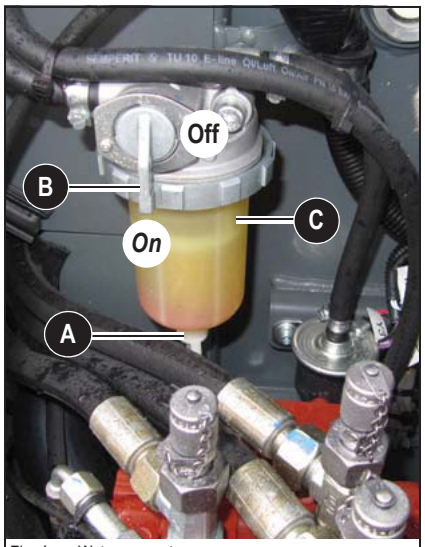


Fig. 4: Water separator

Check the water separator as follows:

☞ *Collect the fuel/water mixture in a suitable container.*

☞ *Stop the engine*

☞ *Switch off ignition*

☞ *Remove the key*

☞ *If the red indicator ring rises to position **C***

☞ *Unscrew thread **A***

➥ The water drains

➥ Wait until the indicator ring returns to the bottom of the water separator

☞ *Screw thread **A** back on again*

Interrupt the fuel supply as follows:

☞ *Turn ball-type cock **B** to the **OFF** mark*

➥ Fuel supply is interrupted

☞ *Turn ball-type cock **B** to the **ON** mark*

➥ Fuel supply is open again

Environment!

Thread **A** is fitted with a hose. Collect the water as it drains with a suitable container and dispose of it in an environmentally friendly manner.

Replacing the fuel filter

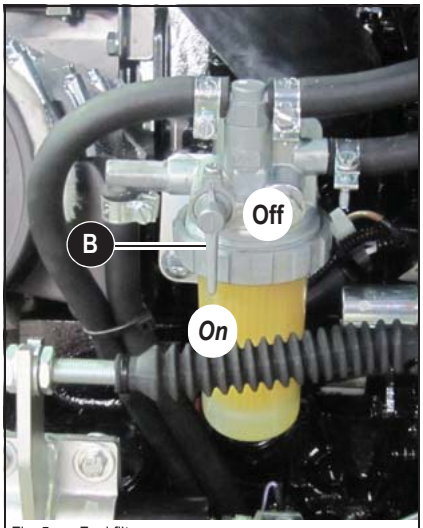


Fig. 5: Fuel filter

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 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!

☞ *Open the engine cover*
☞ *Close stop cock **B** (OFF – horizontal)*
☞ *Unscrew the union nut*
☞ *Remove the transparent housing*
☞ *Remove the old filter insert*
☞ *Put the new filter insert in place*
☞ *Fit the housing back on again (apply a thin coat of oil or diesel fuel to the sealing surface)*
☞ *Open stop cock **B** (ON – vertical)*
☞ *Bleed the fuel system*
– see Bleeding the fuel system on page 3-14
☞ *Check the filter for tightness after a short test run.*
☞ *Dispose of the old filter insert in an environmentally friendly manner*

Tank for washer system


Fig. 6: Tank for washer system

The tank's filler inlet is located in the engine compartment.

Notice!

Fill with clean tap water only!
Add a suitable cleaning agent if required.
In winter:
add antifreeze for washer systems to the clean tap water.
Refer to the antifreeze instructions for further information on concentrations.
The rubber diaphragm in the non-return valve in the housing conglutinates **if stored in a dry condition over a longer period of time**. In order to restore this valve's function, moisten this non-return valve, dip it briefly in water and then blow air through it.

3.8 Engine lubrication system

Caution!

If the engine oil level is too high or too low, if the wrong oil is used or if an oil change is overdue, this can cause

Loss of output and engine damage!

☞ *Oil change – see Maintenance plan (overview) on page 3-7*

Checking the oil level

Notice!

Check the oil level once a day.
We recommend checking it before starting the engine. After stopping a warm engine, wait at least 5 minutes before checking.

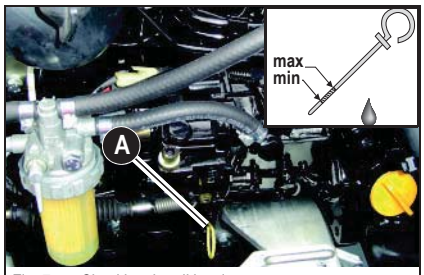


Fig. 7: Checking the oil level

- Park the machine on level and horizontal ground
- Stop the engine
- Fold the control lever base up
- Switch off ignition
- Remove the ignition key and carry it with you
- Let the engine cool down
- Open the engine cover
- Clean the area around the oil dipstick with a lint-free cloth
- Pull out oil dipstick **A**
- Wipe it with a lint-free cloth
- Push it back in as far as possible
- Withdraw it and read off the oil level
- Close and lock the engine cover

Notice!

The oil level must be between the MAX and MIN marks. However if necessary, fill up oil at the latest when the oil reaches the MIN mark on the oil dipstick **A**.

Filling up engine oil

Caution!

Too much or incorrect engine oil can result in engine damage! For this reason:

☞ *Do not add engine oil above the MAX mark of oil dipstick 8/**A***

☞ *Do not fill in engine oil below the MIN mark of oil dipstick 8/**A***

☞ *Use only the specified engine oil*
– see chapter 3.1 Fluids and lubricants on page 3-2

Environment!

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

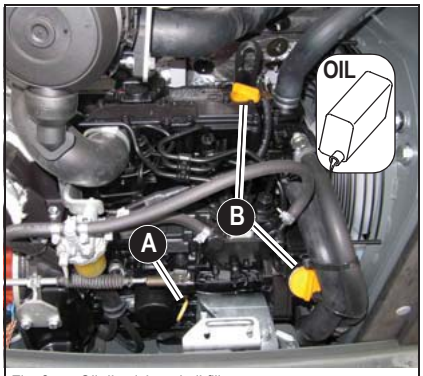


Fig. 8: Oil dipstick and oil filler cap

- Clean the area around oil filler cap **B** with a lint-free cloth
- Open filler cap **B**
- Raise oil dipstick **A** slightly to allow any trapped air to escape
- Fill in engine oil
- Wait about 3 minutes until all the oil has run into the oil sump
- Check the oil level *– see Checking the oil level* on page 3-17
- Fill up if necessary and check the oil level again
- Close filler cap **B**
- Push oil dipstick **A** back in as far as possible
- Completely remove all oil spills from the engine
- Close and lock the engine cover

Caution!

Filling in the engine oil too fast via filler inlet **B** in the valve cover can cause engine damage.

☞ *Fill in the engine oil slowly so it can go down without entering the intake system.*

Changing engine oil

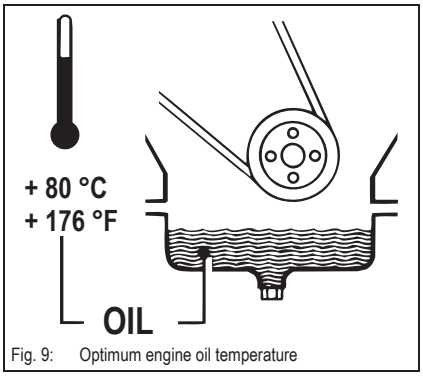


Fig. 9: Optimum engine oil temperature

Danger!

Hot coolant –

Danger of burns!

☞ *Always use appropriate protective equipment, e.g. protective gloves!*

☞ *No smoking, no fire!*

Environment!

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

- Park the machine on level ground
- Let the engine run until it reaches its operating temperature (oil temperature about 80 °C/176 °F)
- Stop the engine
- Switch off ignition and remove the ignition key
- Fold the control lever base up
- Place a container under the opening to collect the oil as it drains
- Unscrew the oil drain plug
- Completely drain the oil
- Fill in engine oil
  – *see chapter Filling up engine oil* on page 3-18
- Screw the oil drain plug back on again
- Start the engine and let it run briefly at low revs
- Stop the engine
- Wait about 3 minutes until all the oil has run into the oil sump
- Check the oil level again
- Fill up if necessary and check again
- Completely remove all oil spills from the engine

Replacing the engine oil filter cartridge

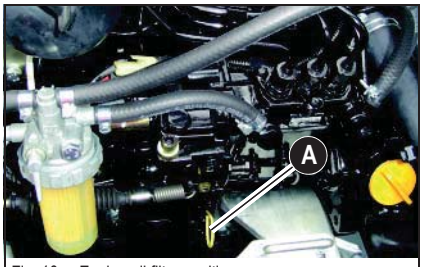


Fig. 10: Engine oil filter position

Danger!

Caution when draining 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!

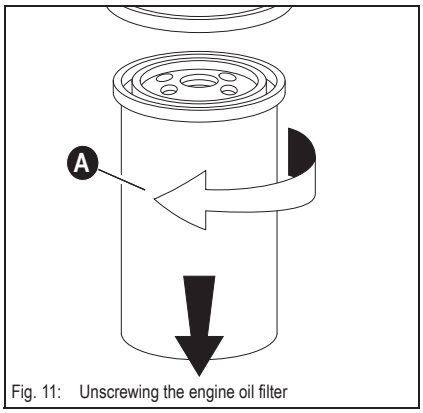


Fig. 11: Unscrewing the engine oil filter

- Stop the engine
- Place a suitable container underneath the oil filter to collect the oil as it drains
- Slowly slacken oil filter cartridge **A** using a commercially available tool
- Let the oil drain into the container
- Remove the filter cartridge once the oil is completely drained
- Ensure that the thread adapter is correctly placed in the filter head

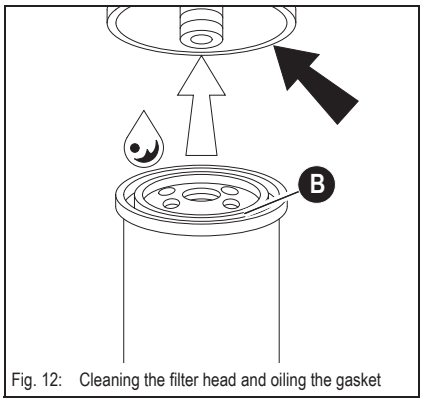


Fig. 12: Cleaning the filter head and oiling the gasket

- Clean the inside of the filter head
- Apply a thin coat of fresh engine oil to rubber seal **B** of the new oil filter cartridge
- Tighten the new filter cartridge by hand until the gasket makes contact

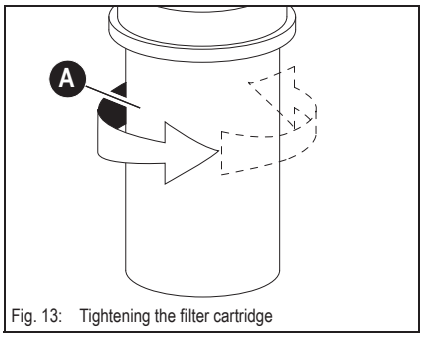


Fig. 13: Tightening the filter cartridge

- Tighten oil filter cartridge **A** by hand by about half a revolution
- Ensure that the oil level is correct!
- Let the engine run briefly
- Stop the engine
- Check the seal of oil filter cartridge **A** and retighten by hand
- Check the oil level and fill in engine oil if necessary
- Completely remove all oil spills from the engine
- Dispose of the used oil filter in an environmentally friendly manner

3.9 Engine and hydraulics cooling system

The oil/water radiator is located in the engine compartment, on the right side of the engine. It cools the diesel engine, and the hydraulic oil of the drive and work hydraulics.

The expansion tank for the coolant is also located in the engine compartment, beside the radiator.

Specific safety instructions

- Dirt on the radiator fins reduces the radiator's heat dissipation capacity! To avoid this:
  - ☞ Clean the outside of the radiator at regular intervals. Use oil-free compressed air (2 bar/29 psi max.) to clean. Maintain a certain distance from the radiator to avoid damage to the radiator fins. Refer to the maintenance plans in the appendix for the cleaning intervals
  - ☞ In dusty or dirty work conditions, clean more frequently than indicated in the maintenance plans
- An insufficient coolant level reduces the heat dissipation capacity as well and can lead to engine damage! Therefore:
  - ☞ Check the coolant level at regular intervals. Refer to the maintenance plans in the appendix for the intervals
  - ☞ If coolant must be added frequently, check the cooling system for leaks and/or contact your dealer!
  - ☞ Never fill in cold water/coolant if the engine is warm!
  - ☞ After filling the expansion tank, make a test run with the engine and check the coolant level again after stopping the engine
- The use of the wrong coolant can destroy the engine and the radiator. Therefore:
  - ☞ Add enough antifreeze compound to the coolant – but never more than 50 %. If possible use brand-name antifreeze compounds with anticorrosion additives
  - ☞ Observe the coolant compound table – *see Coolant compound table* on page 2-5
  - ☞ Do not use radiator cleaning compounds if an antifreeze compound has been added to the coolant – otherwise this causes sludge to form that can damage the engine.
- Once you have filled the expansion tank:
  - ☞ Test run the engine
  - ☞ Stop the engine
  - ☞ Let the engine cool down
  - ☞ Check the coolant level again

Environment!

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

Checking/filling up coolant

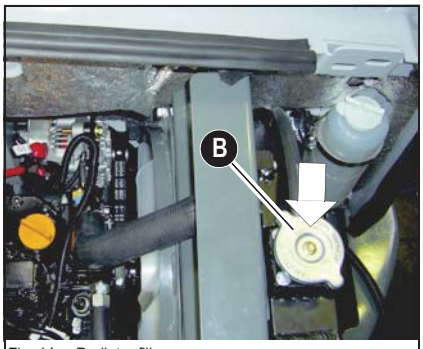


Fig. 14: Radiator filler cap

Danger!

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

–

Danger of burns!

☞ *Wait at least 15 minutes after stopping the engine!*

☞ *Wear protective gloves and clothing*

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

☞ *Ensure that the coolant temperature is sufficiently low so you can touch the radiator plug with your hands*

Danger!

Antifreeze is flammable and poisonous –

Danger of accidents!

☞ *Keep away from flames*

☞ *Avoid eye contact with antifreeze*

- If antifreeze comes into contact with the eyes

➥ Immediately rinse with clean water and seek medical assistance

Checking the coolant level

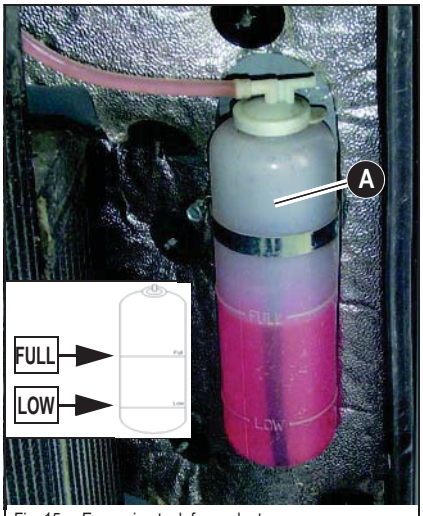


Fig. 15: Expansion tank for coolant

- Park the machine on level ground
- Stop the engine!
- Fold the control lever base up
- Remove the ignition key and carry it with you
- Let the engine and the coolant cool down
- Open the engine cover
- Check the coolant level on the transparent coolant tank **A** and on the radiator **B**

☞ If the coolant level is below the **LOW** seam or if there is no coolant at the radiator's filler inlet:

- Fill up coolant

Notice!

Check the coolant level once a day.
We recommend checking it before starting the engine.

Filling up coolant

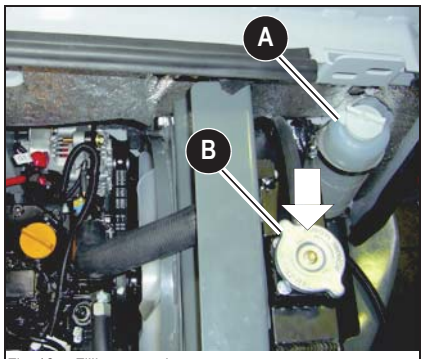


Fig. 16: Filling up coolant

After the engine has cooled down:

☞ *Release overpressure in the radiator*

☞ *Carefully open the cap to the first notch and fully release the pressure*

☞ *Open filler cap **B***

☞ *Fill in coolant up to the lower edge of the filler inlet (radiator)*

☞ *Close filler cap **B***

☞ *Start the engine and let it warm up for about 5 – 10 minutes.*

☞ *Stop the engine*

☞ *Remove the ignition key and carry it with you*

☞ *Let the engine cool down*

☞ *Check the coolant level again*

➥ The coolant level must be between the **LOW** and **FULL** tank seams (*Fig. 15*)

☞ *If necessary, fill up coolant and repeat the procedure until the coolant level remains constant*

☞ *Close and lock the engine cover*

Caution!

Do not mix the coolant with other coolants.

☞ *Only use the coolant recommended by Wacker Neuson – see chapter 2.9 Coolant compound table on page 2-5.*

Notice!

Check the antifreeze every year before the cold season sets in!

Draining coolant

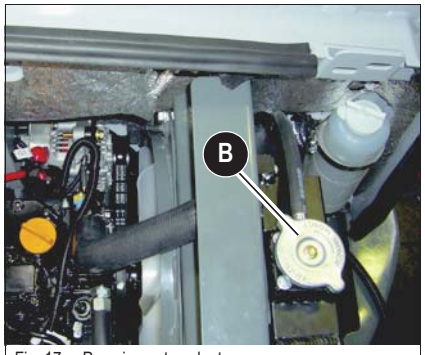


Fig. 17: Pumping out coolant

Danger!

Hot coolant –

Danger of burns!

☞ *Always use appropriate protective equipment, e.g. protective gloves!*

☞ *No smoking, no fire!*

Environment!

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

☞ Stop the engine

☞ Let the coolant cool down

☞ Unscrew filler inlet **B**

☞ Pump out the coolant with a suitable pump

➥ Collect the coolant in a suitable container

3.10 Air filter

Caution!

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

☞ *Do not clean the air filter element.*

☞ *Replace the air filter element according to the indicator or maintenance plan.*

☞ *Never reuse damaged air filter elements.*

☞ *Ensure cleanliness when replacing the air filter element!*

The air filter elements must be replaced:

- If “Service” (red mark) is displayed on fouling indicator **A**
- According to the maintenance plan

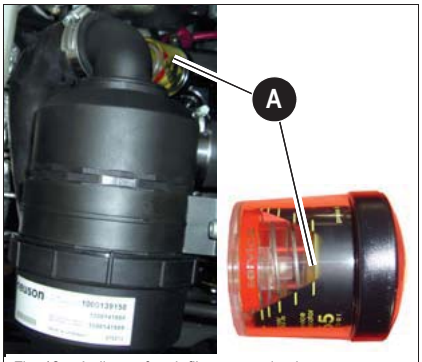


Fig. 18: Indicator for air filter contamination

Caution!

Air filter elements 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

☞ *Check air filter elements every 50 service hours at the latest, and replace it if necessary!*

General instructions for maintenance of the air filter element:

- Store filters in their original packaging and in a dry place
- Do not knock the air filter element against other objects as you install it
- Check air filter attachments, air intake hoses and the air filter element for damage, and immediately repair or replace if necessary
- Check the screws at the induction manifold and the clamps for tightness
- Check the function of the discharge slot of the dust valve, clean it and replace it if necessary

  ☞ Squeeze the end of the valve with your hand.
- Close and lock the engine cover

Replacing air filter elements

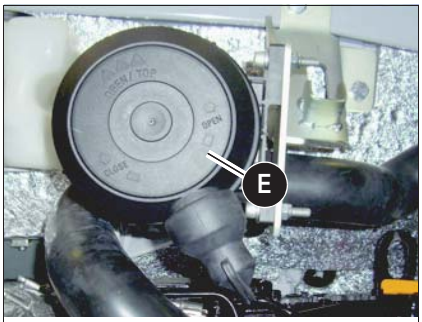


Fig. 19: Removing the housing section (up to serial number AG03215)

Replace the outside air filter element B as follows:

☞ *Stop the engine*

☞ *Fold the control lever base up*

☞ *Remove the ignition key and carry it with you*

☞ *Let the engine cool down*

☞ *Open the engine cover*

☞ *Remove dirt and dust from the air filter element and the area around the air filter*

☞ *Turn the lower housing section* **E** *to the left (up to serial number AG03215)*

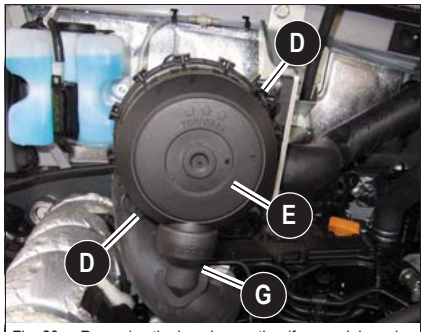


Fig. 20: Removing the housing section (from serial number AG03216)

☞ *Open bow clips* **D** *on housing section* **E** *(from serial number AG03216)*

☞ *Remove lower housing section* **E**

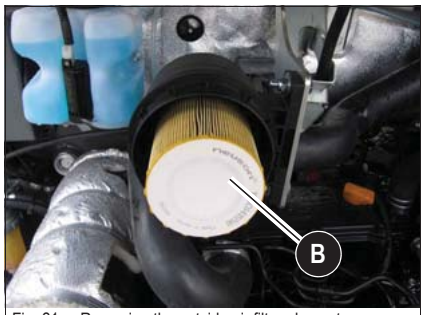


Fig. 21: Removing the outside air filter element

☞ *Carefully remove air filter element* **B** *with slightly turning movements*

☞ **Ensure that** *all dirt (dust) inside the upper and lower housing sections (***F** *and* **E***), including dust valve* ***G****, has been removed*

☞ Clean the parts with a clean lint-free cloth, do not use compressed air

☞ *Check the air filter element for damage, only install intact filters*

☞ *Check the new air filter element* **B** *for damage and carefully insert it in the housing section (install only intact air filter elements)*

☞ *Position housing section* **E** *(ensure that it is properly seated)*

☞ *Turn housing section* **E** *to the right (up to serial number AG03215)*

☞ *Close bow clips* **D** *on housing section* **E** *(from serial number AG03216)*

☞ *Press the button at the front to reset dirt indicator* ***A***

☞ *Close and lock the engine cover*

Notice!

Ensure that dust valve **G** shows downwards once it is installed!

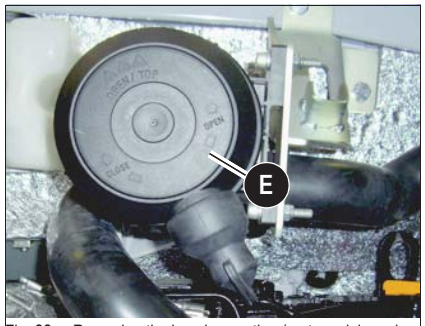


Fig. 22: Removing the housing section (up to serial number AG03215)

Replace the inside air filter element C as follows:

☞ *Stop the engine*

☞ *Fold the control lever base up*

☞ *Remove the ignition key and carry it with you*

☞ *Let the engine cool down*

☞ *Open the engine cover*

☞ *Remove dirt and dust from the air filter and the area around the air filter*

☞ *Turn the lower housing section* **E** *to the left (up to serial number AG03215)*

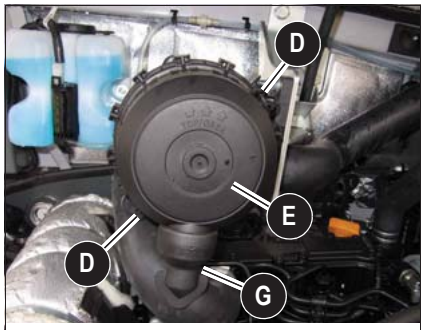


Fig. 23: Removing the housing section (from serial number AG03216)

☞ *Open bow clips* **D** *on housing section* **E** *(from serial number AG03216)*

☞ *Remove lower housing section* **E**

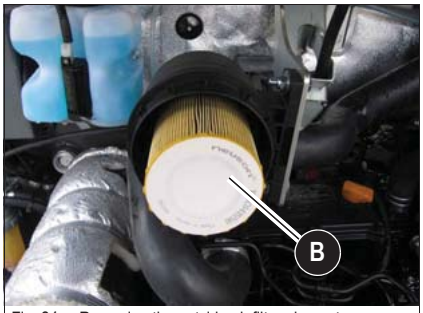


Fig. 24: Removing the outside air filter element

☞ *Carefully remove outside air filter* **B** *with slightly turning movements*

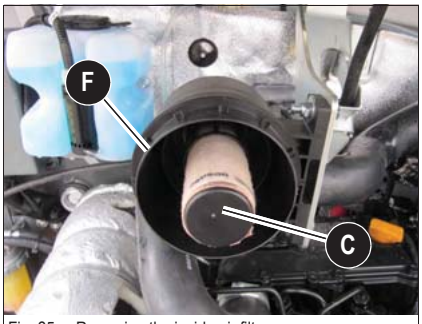


Fig. 25: Removing the inside air filter

☞ *Carefully pull out inside air filter* **A** *with slightly turning movements*

☞ Cover the air supply at the end of the filter with a clean lint-free cloth to prevent dust from entering the engine

☞ **Ensure that** *all dirt (dust) inside the upper and lower housing sections (***F** *and* **E***), including dust valve* ***G****, has been removed*

☞ Clean the parts with a clean lint-free cloth, do not use compressed air

☞ Remove the cloth from the air supply

☞ *Check the new inside air filter* **C** *for damage and carefully insert it in the housing section (install only intact air filter elements)*

☞ *Carefully insert the new inside air filter* **C** *in the inside housing section* **F**

☞ *Carefully insert the outside air filter* **B** *in the upper housing section* **F**

☞ *Position lower housing section* **E** *(ensure that it is properly seated)*

☞ *Turn the lower housing section* **E** *to the right (up to serial number AG03215)*

☞ *Close bow clips* **D** *on housing section* **E** *(from serial number AG03216)*

☞ *Press the button at the front to reset dirt indicator* ***A***

☞ *Close and lock the engine cover*

Notice!

Ensure that dust valve **G** shows downwards once it is installed!

Air intake

Fig. 26: Engine air intake

Danger!

When crossing water fords or similar, ensure that the engine air intake openings are always above water level, otherwise the engine is damaged!

Danger of engine damage!

☞ *Check once a day for cleaniness before putting the machine into operation!*

3.11 Change cab air filter

Caution!

The filter elements will be damaged if they are washed or brushed out!

☞ *Never reuse damaged filter elements.*

☞ *Ensure cleanliness when replacing the filter elements!*

Caution!

Clean the filter elements only with compressed air, bearing in mind the following:

☞ *Wear goggles and protective clothing*

☞ *Carefully clean the filter with compressed air*

☞ *Do not aim the compressed air at the skin or at other people*

☞ *Do not use compressed air for cleaning your clothing*

The machine is equipped with a cab filter located under the seat.

Clean the cab filter every 500 service hours, and replace it every 1000 service hours.

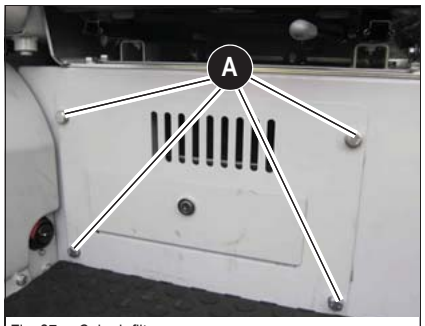


Fig. 27: Cab air filter cover

☞ *Stop the engine*

☞ *Remove the ignition key and carry it with you*

☞ *Fold the control lever base up*

☞ *Remove screws **A** and the cover*

☞ *Remove the filter and clean or replace it*

☞ *Install the filter*

☞ *Mount screws **A** and the cover*

3.12 V-belt

Danger!

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

Danger of personal injury!

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

☞ *Disconnect the battery*

☞ *Let the engine cool down*

Caution!

Cracked and stretched V-belts cause engine damage

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.

Checking V-belt tension

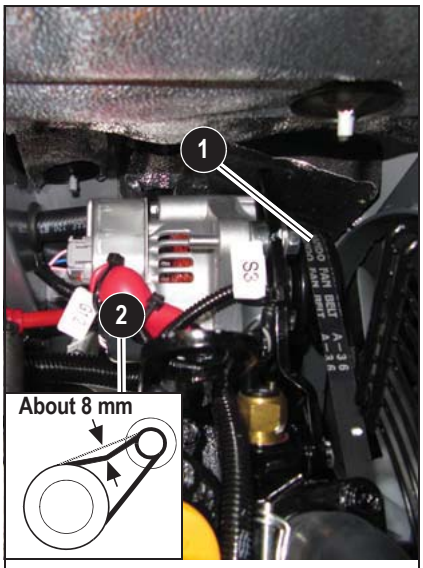


Fig. 28: Checking V-belt tension

☞ Stop the engine

☞ Fold the control lever base up

☞ Remove the ignition key and carry it with you

☞ Disconnect the battery or the battery master switch

☞ Let the engine cool down

☞ Open the engine cover

☞ Carefully check V-belt **1** for damage, cracks or cuts

➥ Replace the V-belt if it touches the base of the V-belt groove or if the pulleys are damaged.

- If the V-belt is damaged:

☞ Press with your thumb about 100 N (22.5 lbs/ft) to check the deflection of the V-belt between both pulleys.
The deflection of a new belt should be 6 to 8 mm (0.24 – 0.31”).
Otherwise, deflection should be 7 to 9 mm (0.27 to 0.35”) after about 5 minutes running time (see *Fig. 28*/2).

☞ Retighten the V-belt if necessary

☞ Close and lock the engine cover

Caution!

Overtightening the V-belt can damage the V-belt, the V-belt guide, the alternator bearing and the water pump bearing.
Avoid contact of oil, grease or similar substances with the V-belt.

☞ *Replace V-belts with damage, cracks, cuts etc.*

☞ *Avoid contact of oil, grease or similar substances with the V-belt*

Retightening the V-belt

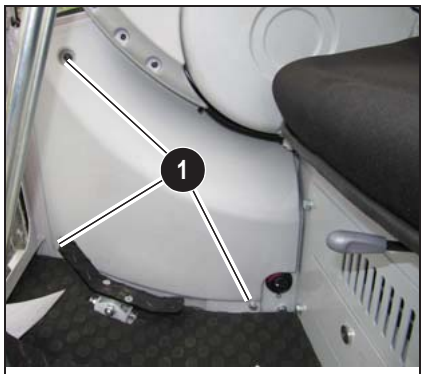


Fig. 29: Removing the covers

☞ Stop the engine
☞ Fold the control lever base up
☞ Remove the ignition key and carry it with you
☞ Disconnect the battery
☞ Let the engine cool down
☞ Raise the upper front window
☞ Remove the lower front window
☞ Slacken fastening screws **1**

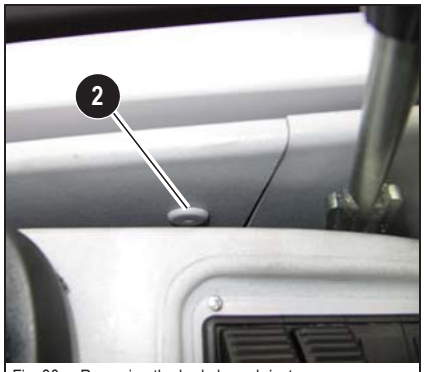


Fig. 30: Removing the body-bound rivet

☞ Remove the body-bound rivet **2** next to the right-hand control lever base
☞ Remove the side trim

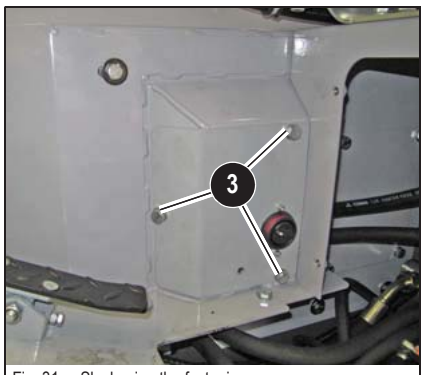


Fig. 31: Slackening the fastening screws

☞ Slacken fastening screws **3**

Fig. 32: Removing the cover

☞ Remove cover **4**
- Take care not to bend the hose

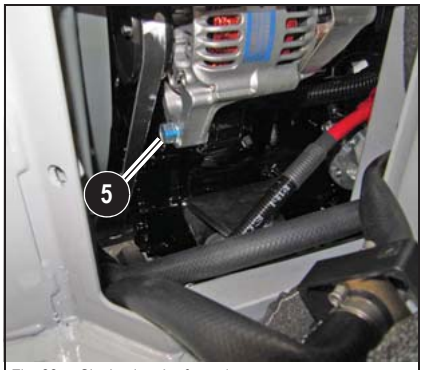


Fig. 33: Slackening the fastening screws

☞ Slacken fastening screw **5**

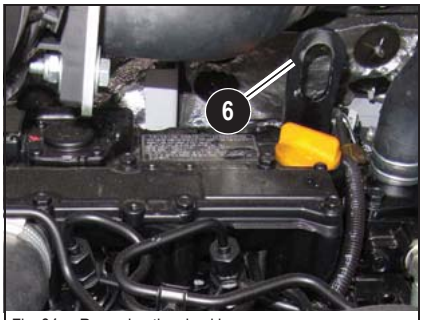


Fig. 34: Removing the shackle

☞ Remove shackle **6**

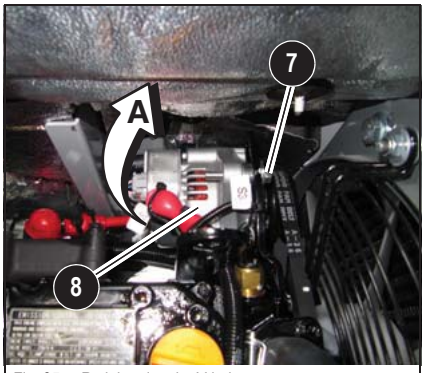


Fig. 35: Retightening the V-belt

☞ Slacken fastening screw **7** of alternator **8**

☞ Use a suitable tool to push the alternator in the direction of arrow **A** until reaching the correct V-belt tension
– *see Checking V-belt tension* on page 3-28

☞ Keep the alternator in this position, and at the same time retighten fastening screw **7**

☞ Check V-belt tension again and adjust it if necessary

☞ Mount the trims and covers back on that have been removed

☞ Connect the battery

☞ Close the engine cover

3.13 Pressure check

General

- Run the machine warm before checking the pressure! Hydraulic oil temperature: 50 °C min. (operating temperature)
- Pressure drop is checked by reducing revs from maximum to idling speed at constant load
- Set the primary pressure limiting valves (PPLV) at maximum engine speed.
- The pressure settings are listed in chapter “Specifications”
  – *see Hydraulic system* on page 2-3
- **Ensure utmost cleanliness of all measuring points and ports, micro measuring lines and pressure gauges that are connected for checking pressure => even the slightest traces of dirt, e.g. a grain of sand, can impair tightness and cause leaks**

Overview of measuring ports (up to serial number AG02712)

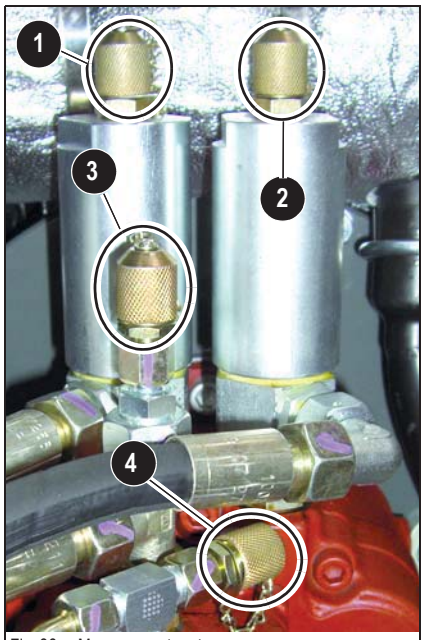


Fig. 36: Measurement ports

Pos.	Designation	
1	Pump 1 measuring port	MP 1
2	Pump 2 measuring port	MP 2
3	Pump 3 measuring port	MP 3
4	Pilot oil supply unit measuring port	MP 4

Notice!

Measuring ports *Fig. 36* and *Fig. 37* differ in design only. The pressure check is carried out in the same way.

Overview of measuring ports (from serial number AG02713)

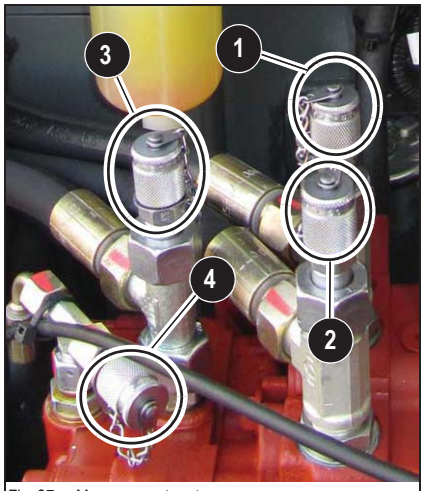


Fig. 37: Measurement ports

Pos.	Designation	
1	Pump 1 measuring port	MP 1
2	Pump 2 measuring port	MP 2
3	Pump 3 measuring port	MP 3
4	Pilot oil supply unit measuring port	MP 4

Checking pilot control pressure

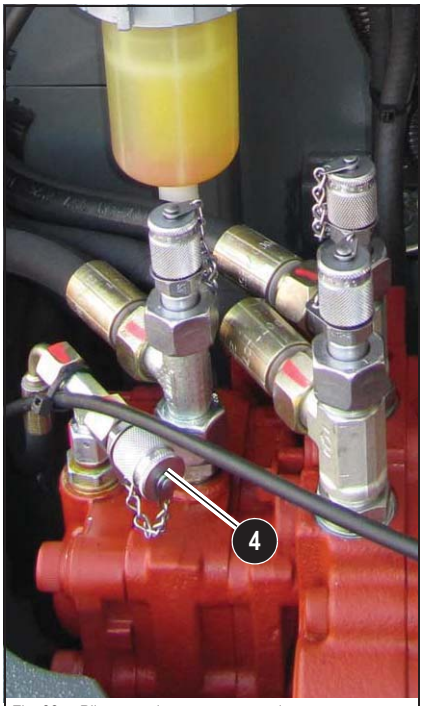


Fig. 38: Pilot control pressure measuring port

Checking pilot control pressure

☞ *Connect a pressure gauge to measuring port MP 4* ***38/4***

☞ *Move the control lever base (safety switch) to work position*

☞ *Check and make a note of the pressure value.*

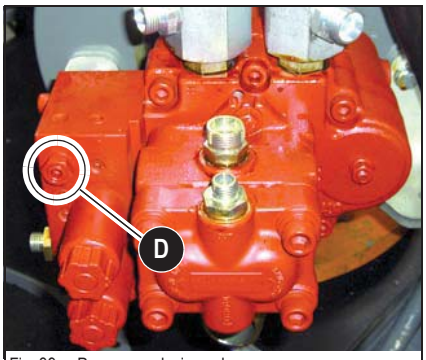


Fig. 39: Pressure reducing valve

Adjusting pressure reducing valve 4 (PRV 4)

☞ Adjust the pressure at the pressure reducing valve 4 (PLV4) **39/D** at the pilot oil supply unit

☞ Check the pilot control pressure again once adjustment is over

Pressure check of variable displacement pump P1

Hydraulic supply for boom, bucket and right-hand side drive functions

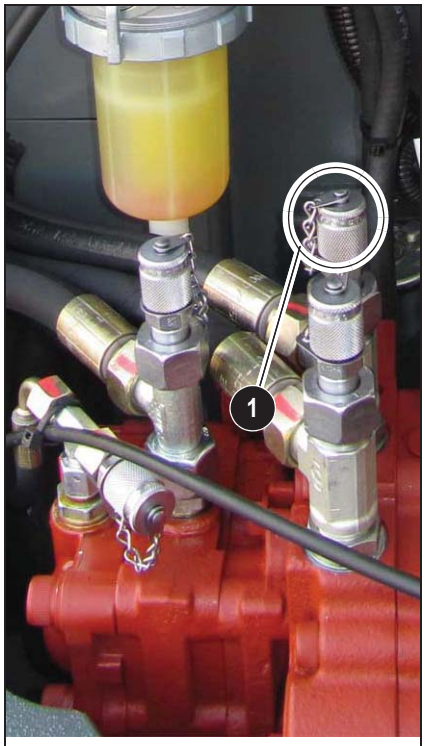


Fig. 40: Measuring port P1

Checking primary pressure limiting valve 1 (PPLV 1)

☞ *Connect a pressure gauge to measuring port MP 1* ***40/1***

☞ *Retract the boom ram or the bucket ram as far as it will go at maximum engine speed*

☞ *Check and make a note of the pressure value.*

Checking pressure drop

☞ *Retract the boom ram or the bucket ram as far as it will go at maximum engine speed*

☞ *Swiftly reduce engine speed from maximum to minimum -> pressure drop*

☞ *Check and make a note of the pressure value.*

➥ Pressure drop should not be more than 10 % of the specified value

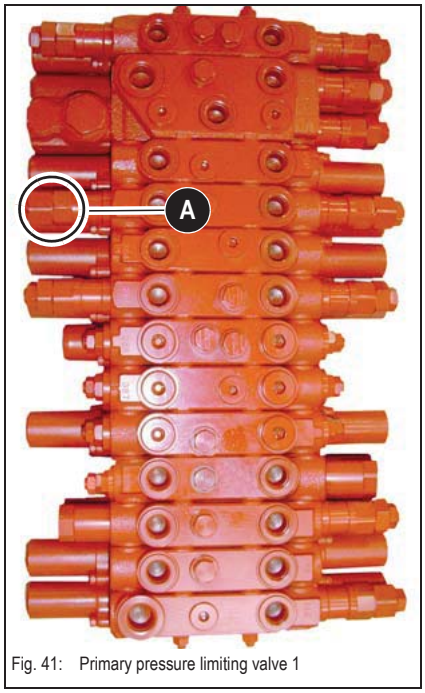


Fig. 41: Primary pressure limiting valve 1

Setting primary pressure limiting valve 1 (PPLV 1)

☞ *Adjust the pressure at the primary pressure limiting valve (PPLV 1)* ***41/A*** *on the main valve block*

☞ Slacken the locknut of the pressure limiting valve

☞ Unscrew the pressure limiting valve until you can read off a pressure drop on the pressure gauge

➥ The valve seat may be stuck and must be slackened first

☞ Adjust the pressure limiting valve and tighten the locknut

☞ *Check the primary pressure limiting valve 1 and the pressure drop once adjustment is over*

Also check with the extend boom, the extend/retract bucket and with the right-hand side forwards/reverse drive functions!

Pressure check of variable displacement pump P2

Hydraulic supply of stick, left-hand side drive and auxiliary hydraulics functions

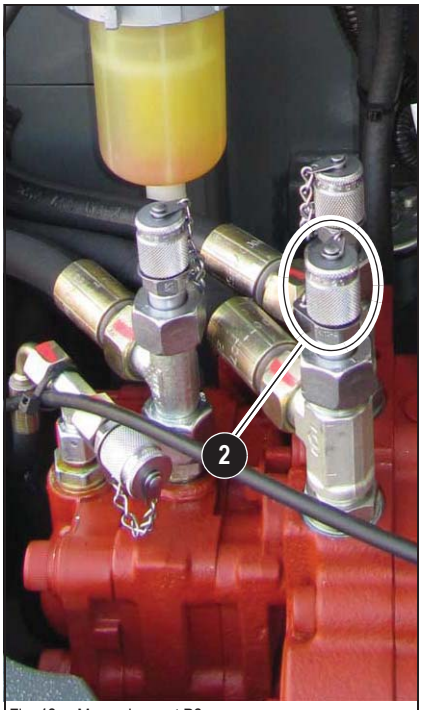


Fig. 42: Measuring port P2

Checking primary pressure limiting valve 2 (PPLV 2)

☞ *Connect a pressure gauge to measuring port MP 2* ***42/2***

☞ *Extend the stick ram as far as it will go at maximum engine speed*

☞ *Check and make a note of the pressure value.*

Checking pressure drop

☞ *Extend the stick ram as far as it will go at maximum engine speed*

☞ *Swiftly reduce engine speed from maximum to minimum -> pressure drop*

☞ *Check and make a note of the pressure value.*

➥ Pressure drop should not be more than 10 % of the specified value

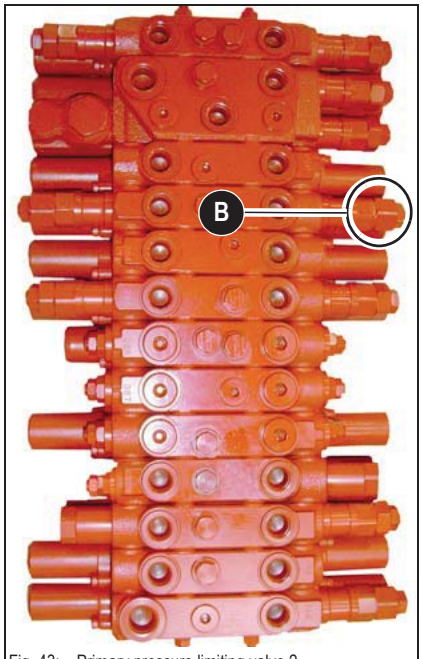


Fig. 43: Primary pressure limiting valve 2

Setting primary pressure limiting valve 2 (PPLV 2)

☞ *Adjust the pressure at the primary pressure limiting valve (PPLV 2)* ***43/B*** *on the main valve block*

☞ Slacken the locknut of the pressure limiting valve

☞ Unscrew the pressure limiting valve until you can read off a pressure drop on the pressure gauge

➥ The valve seat may be stuck and must be slackened first

☞ Adjust the pressure limiting valve and tighten the locknut

☞ *Check the primary pressure limiting valve 2 and the pressure drop once adjustment is over*

Also check with the retract stick and the left-hand side forwards/reverse drive functions!

Checking the auxiliary hydraulics pressure

Notice!

Factory indications for auxiliary hydraulics secondary valves are possibly invalid – adapt these values to the attachment!

Pressure check of gear pump P3

Hydraulic supply for stabiliser blade, auxiliary hydraulics, boom swivel, upper carriage rotation, optional 3rd control circuit

Fig. 44: Measuring port P3

Checking primary pressure limiting valve 3 (PPLV 3)

☞ *Connect a pressure gauge to measuring port MP 3* ***44/3***

☞ *Extend the stabiliser blade ram as far as it will go at maximum engine speed*

☞ *Check and make a note of the pressure value.*

Checking pressure drop

☞ *Extend the stabiliser blade ram as far as it will go at maximum engine speed*

☞ *Swiftly reduce engine speed from maximum to minimum -> pressure drop*

☞ *Check and make a note of the pressure value.*

➥ Pressure drop should not be more than 10 % of the specified value

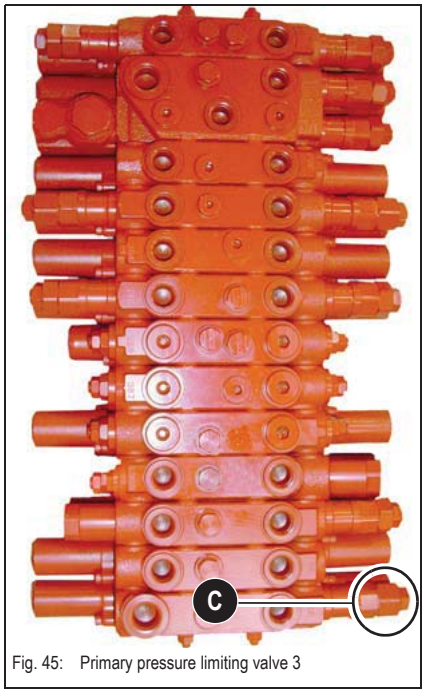


Fig. 45: Primary pressure limiting valve 3

Setting primary pressure limiting valve 3 (PPLV 3)

☞ *Adjust the pressure at the primary pressure limiting valve (PPLV 3)* ***45/C*** *on the main valve block*

☞ Slacken the locknut of the pressure limiting valve

☞ Unscrew the pressure limiting valve until you can read off a pressure drop on the pressure gauge

➥ The valve seat may be stuck and must be slackened first

☞ Adjust the pressure limiting valve and tighten the locknut

☞ *Check the primary pressure limiting valve 3 and the pressure drop once adjustment is over*

Also check with the retract stabiliser blade, boom swivel and upper carriage rotation functions

Checking the auxiliary hydraulics pressure

Notice!

Factory indications for auxiliary hydraulics secondary valves are possibly invalid – adapt these values to the attachment!

Secondary pressure limiting valve of the gear motor

Fig. 46: Secondary pressure limiting valve

Check (at idling speed)

☞ *Connect a pressure gauge to measuring port MP 3*

☞ *Place the bucket or the boom against the ground or the stabiliser blade, or drive against hydraulic resistance*

☞ *Check and make a note of the pressure value.*

Adjusting the secondary pressure limiting valve on the gear motor (at idling speed)

☞ *Adjust the pressure at the secondary pressure limiting valve on the gear motor*

☞ Slacken the locknut of the pressure limiting valve

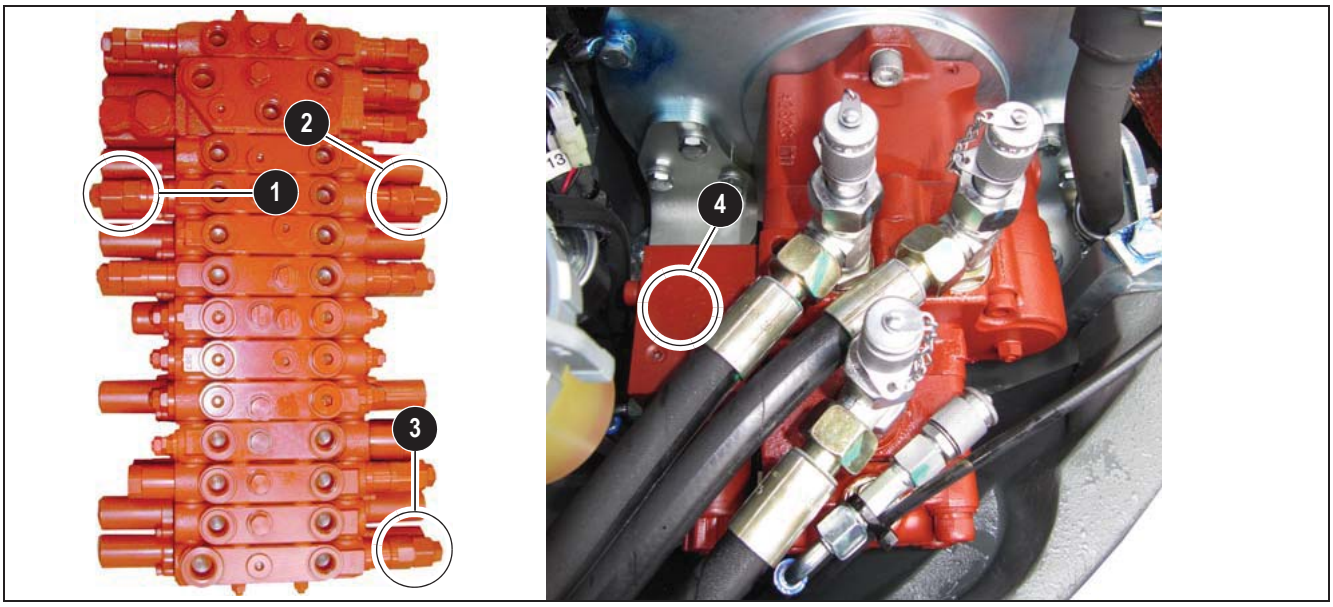
☞ Unscrew the pressure limiting valve until you can read off a pressure drop on the pressure gauge

➥ The valve seat may be stuck and must be slackened first

☞ Adjust the pressure limiting valve and tighten the locknut

☞ *Check the secondary pressure limiting valve again once adjustment is over*

Primary pressure limiting valves



Pos.	Designation	
1	Pump primary pressure limiting valve 1	PPLV 1
2	Pump primary pressure limiting valve 2	PPLV 2
3	Pump primary pressure limiting valve 3	PPLV 3
4	Pressure reducing valve of pilot oil supply unit	PRV 4

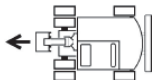
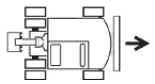
3.14 Test report

Pilot control

Function	Movement	Symbol	Measuring port	Pressure limiting valve	Specified values		1st measurement	2nd measurement
					Engine speed	Pressure in bar (psi)		
Joystick	ANY		Measuring port MP 4 (pump)	Pressure limiting valve PLV 4 (pilot oil supply unit)	Rated value	$30^{-0/+4}(435^{-0/+58})$		

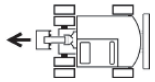
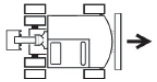
3.14 Test report

Pump 1

Function	Movement	Symbol	Measuring port	Pressure limiting valve	Specified values		1st measurement	2nd measurement
					Engine speed	Pressure in bar (psi)		
Boom	UP		Measuring port MP 1 (pump)	Primary pressure limiting valve PPLV 1 (main valve block)	max.	$225^{\pm 3}(3263^{\pm 43.5})$		
					min.	$202^{\pm 3}(2930^{\pm 43.5})$		
	DOWN				max.	$225^{\pm 3}(3263^{\pm 43.5})$		
					min.	$202^{\pm 3}(2930^{\pm 43.5})$		
Bucket	DUMP OUT				max.	$225^{\pm 3}(3263^{\pm 43.5})$		
					min.	$202^{\pm 3}(2930^{\pm 43.5})$		
	DUMP IN				max.	$225^{\pm 3}(3263^{\pm 43.5})$		
					min.	$202^{\pm 3}(2930^{\pm 43.5})$		
Left-hand drive	Forwards				max.	$225^{\pm 3}(3263^{\pm 43.5})$		
					min.	$202^{\pm 3}(2930^{\pm 43.5})$		
	Reverse				max.	$225^{\pm 3}(3263^{\pm 43.5})$		
					min.	$202^{\pm 3}(2930^{\pm 43.5})$		
VDS	UP				max.	$225^{\pm 3}(3263^{\pm 43.5})$		
					min.	$202^{\pm 3}(2930^{\pm 43.5})$		
	DOWN				max.	$225^{\pm 3}(3263^{\pm 43.5})$		
					min.	$202^{\pm 3}(2930^{\pm 43.5})$		

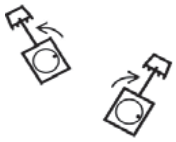
3.14 Test report

Pump 2

Function	Movement	Symbol	Measuring port	Pressure limiting valve	Specified values		1st measurement	2nd measurement
					Engine speed	Pressure in bar (psi)		
Stick	EXTEND		Measuring port MP 2 (pump)	Primary pressure limiting valve PPLV 2 (MVB)	max.	$225^{\pm 3}(3263^{\pm 43.5})$		
					min.	$202^{\pm 3}(2930^{\pm 43.5})$		
	RETRACT				max.	$225^{\pm 3}(3263^{\pm 43.5})$		
					min.	$202^{\pm 3}(2930^{\pm 43.5})$		
Right-hand drive	Forwards		Measuring port MP 2 (pump)	Primary pressure limiting valve PPLV 2 (MVB)	max.	$225^{\pm 3}(3263^{\pm 43.5})$		
					min.	$202^{\pm 3}(2930^{\pm 43.5})$		
	Reverse				max.	$225^{\pm 3}(3263^{\pm 43.5})$		
					min.	$202^{\pm 3}(2930^{\pm 43.5})$		
Auxiliary hydraulics	A				max.	$225^{\pm 3}(3263^{\pm 43.5})$		
					min.	$202^{\pm 3}(2930^{\pm 43.5})$		
	B				max.	$225^{\pm 3}(3263^{\pm 43.5})$		
					min.	$202^{\pm 3}(2930^{\pm 43.5})$		

3.14 Test report

Pump 3

Function	Movement	Symbol	Measuring port	Pressure limiting valve	Specified values		1st measurement	2nd measurement
					Engine speed	Pressure in bar (psi)		
Stabiliser blade	UP		Measuring port MP 3 (pump)	Primary pressure limiting valve PPLV 3 (main valve block)	max.	$206^{-4/+2}(2988^{-58/+29})$		
					min.	$185^{-4/+2}(2683^{-58/+29})$		
	DOWN				max.	$206^{-4/+2}(2988^{-58/+29})$		
					min.	$185^{-4/+2}(2683^{-58/+29})$		
Auxiliary hydraulics	A (2)				max.	$206^{-4/+2}(2988^{-58/+29})$		
					min.	$185^{-4/+2}(2683^{-58/+29})$		
	B (2)				max.	$206^{-4/+2}(2988^{-58/+29})$		
					min.	$185^{-4/+2}(2683^{-58/+29})$		
Swivel boom	Left				max.	$206^{-4/+2}(2988^{-58/+29})$		
					min.	$185^{-4/+2}(2683^{-58/+29})$		
	Right				max.	$206^{-4/+2}(2988^{-58/+29})$		
					min.	$185^{-4/+2}(2683^{-58/+29})$		
3rd control circuit (option)	Left		Measuring port MP 3 (pump)	Primary pressure limiting valve PPLV 3 (main valve block)	max.	$206^{-4/+2}(2988^{-58/+29})$		
					min.	$185^{-4/+2}(2683^{-58/+29})$		
	Right				max.	$206^{-4/+2}(2988^{-58/+29})$		
					min.	$185^{-4/+2}(2683^{-58/+29})$		
Upper carriage rotation	Left		Measuring port MP 3	Secondary pressure limiting valve SPLV (gear motor)	max.	$200^{-4/+2}(2900^{-58/+29})$		
					min.	$180^{-4/+2}(2611^{-58/+29})$		
	Right				max.	$200^{-4/+2}(2900^{-58/+29})$		
					min.	$180^{-4/+2}(2611^{-58/+29})$		

3.15 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 the boom or the attachment to the ground.
  - Move all control levers of the hydraulic control valves several times.
- Fold the control lever base up.
- Hydraulic oil escaping under high pressure can penetrate the skin and cause serious injuries. Therefore always consult a doctor immediately, even in the case of minor wounds – 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.
- Oil or fuel flowing out of high pressure lines can cause fire or malfunctions, and severe injuries or damage to property. Interrupt work immediately if slack nuts or damaged hoses and lines are detected.

  ☞ Contact a Wacker Neuson dealer immediately.
- Have the flexible line replaced if one of the following problems is detected:

  ☞ Damaged or leaky hydraulic seals

  ☞ Worn or torn shells or uncovered reinforcement branches

  ☞ Expanded shells in several positions

  ☞ Entangled or crushed movable parts

  ☞ Foreign bodies jammed or stuck in protective layers

Caution!

Dirty 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 3-2*

☞ *Always fill up hydraulic oil before the level gets too low – see Filling up hydraulic oil on page 3-43*

☞ *If the hydraulic system is filled with biodegradable oil, then only use biodegradable oil of the same type – 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.

Checking the hydraulic oil level

Caution!

Do not fill up oil if the oil level is above the **FULL** mark, otherwise the hydraulic system can be damaged and escaping oil can cause serious injuries.

☞ *Check the hydraulic oil level each time the machine is put into operation or once a day*

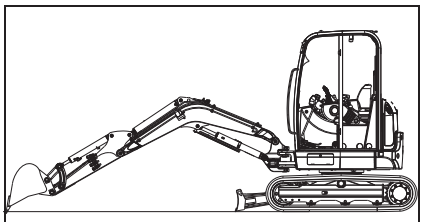


Fig. 47: Parking the machine

- Park the machine on level ground
- Position the boom straight ahead.
- Lower the boom and the attachment to the ground.
- Extend the stabiliser blade ram. Lower the stabiliser blade to the ground
- Stop the engine
- Fold the control lever base up
- Remove the key and carry it with you
- Let the engine cool down
- Unlock and fold up the engine cover
- Sight glass **B** is located at the rear left of the machine under the engine cover.
- Check the oil level on sight glass **B**
- The oil level must be about 1 cm (0.39”) over the centre, between positions **MIN** and **MAX**, as shown by the arrows in fig. 48.

➥ The **MIN** level is marked by the lower joint

➥ The **MAX** level is marked by the upper joint

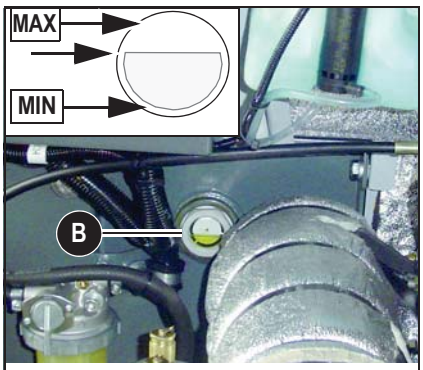


Fig. 48: Oil level indicator on the hydraulic oil tank

If the oil level is lower

- Fill up hydraulic oil
- Close and lock the engine cover

The oil level varies according to the machine's operating temperature:

Machine condition	Temperature	Oil level
Before putting into operation	Between 10 and 30 °C (between 50 and 86 °F)	**MIN** mark
Normal operation	Between 50 and 90 °C (between 122 and 194 °F)	**MAX** mark

Notice!

Measure the oil level of the hydraulic system only after the machine reaches its operating temperature.

Filling up hydraulic oil

Danger!

Removing the filler plug can cause oil to escape –

Danger of accidents!

☞ *Open the breather filter carefully to slowly release the pressure inside the tank.*

Caution!

Do not fill up the hydraulic oil unless the engine is stopped. Otherwise, hydraulic oil will overflow at the filler opening on the hydraulic tank.

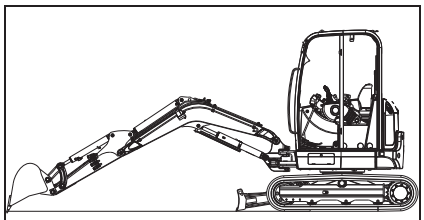


Fig. 49: Parking the machine

- Park the machine on level ground
- Position the boom straight ahead.
- Lower the boom and the attachment to the ground.
- Extend the stabiliser blade ram. Lower the stabiliser blade to the ground
- Stop the engine
- Fold the control lever base up
- Remove the key and carry it with you
- Let the engine cool down
- Remove the tank cover
- Slowly open cap **C** of the hydraulic tank
- Fill up hydraulic oil
- Check the hydraulic oil level on sight glass **B**
- Fill up if necessary and check again
- Close cap **C** of the hydraulic tank hand tight again
- Install the tank cover

Fig. 50: Hydraulic tank cap

Changing hydraulic oil

Notice!

Only change the hydraulic oil if it is warm (about 50 °C/122 °F). Retract all hydraulic rams before changing the oil.

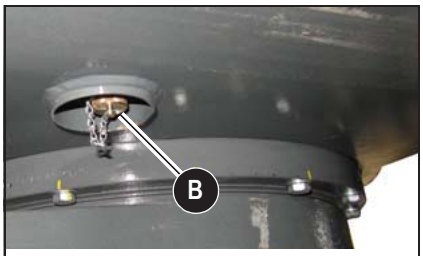


Fig. 51: Hydraulic oil drain plug

☞ *Open the breather filter to release pressure*

☞ *Open drain plug **51/B** and let the oil drain into a container*

☞ *Check the hydraulic oil tank for contamination and clean if necessary*

☞ *Replace the filter according to the maintenance specifications*

☞ *Screw the drain plug back in correctly*

☞ *Fill in clean hydraulic oil through the screen*
– see Filling up hydraulic oil on page 3-43

☞ *Close the hydraulic oil tank correctly*

☞ *Let the machine run at idling speed without load for some minutes*

Monitoring the hydraulic oil return filter

Fig. 52: Hydraulic oil filter indicator light

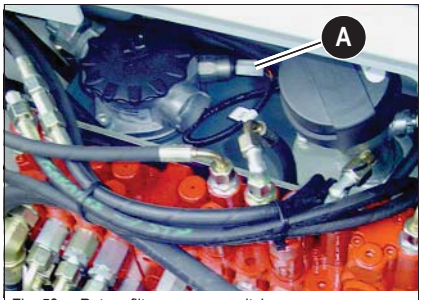


Fig. 53: Return filter pressure switch

Pressure switch **A** activates the red indicator light in the instrument panel which monitors the return filter.

The control pressure is set at 2.5 bar (36 psi) and cannot be modified.

The filter element must be replaced by an authorised workshop:

- If the indicator light comes on when the hydraulic oil is at operating temperature
- At the latest after 1000 service hours (once every year)

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

☞ *Set engine speed so that indicator light **33** goes out*

Replacing the hydraulic oil filter

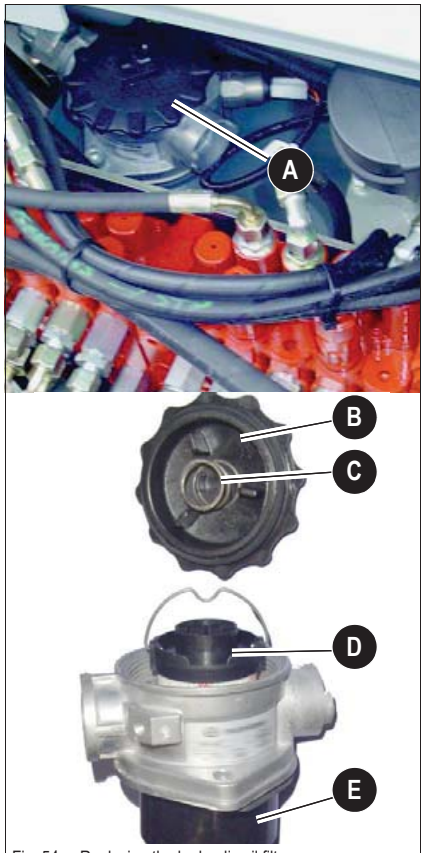


Fig. 54: Replacing the hydraulic oil filter

Replacing the hydraulic oil filter (return filter)

☞ *Opening the tank cover*

☞ *Thoroughly clean the outside of return filter **A***

☞ *Place a suitable container under the filter*

☞ *Unscrew cover **B***

☞ Collect the hydraulic oil as it drains

☞ *Remove spring **C** if it is not seated on cover **B***

☞ *Remove the old filter element **D** by means of the bracket and replace with a new element*

☞ Check the surface of the element for dirt residues and coarse particles

➥ These can be a sign of damage to the components

➥ Clean the drip and dirt collector **E**

☞ *Carefully place a new filter element **D** onto the mount in the filter housing*

☞ *Remove dirt from the housing and the sealing surface of cover **B** if necessary*

☞ *Screw on cover **B** with spring **C** and tighten by hand*

☞ *Make a test run – and check for tightness!*

☞ *Close the tank cover*

Dispose of the replaced return filter in an environmentally friendly manner

Draining condensation water from the hydraulic oil tank

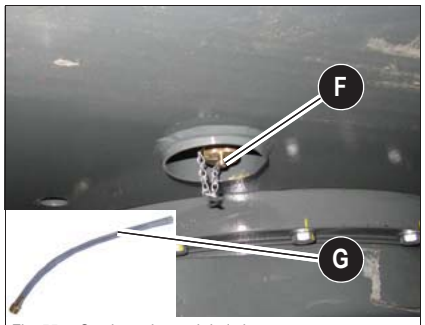


Fig. 55: Service valve and drain hose

Check the hydraulic oil tank after a longer standstill or every 500 service hours. Drain the condensation water if there is any.

The hydraulic oil replacement interval must be shortened if the condensation water is not drained regularly!

Draining the condensation water from the hydraulic oil tank:

☞ *Open breather filter **54/A** to release pressure*

☞ *Take drain hose **G** out of the machine*

➥ Drain hose **G** is located in the tool compartment under the seat

☞ *Connect the drain hose to service valve **F***

☞ *Drain the condensation water (mixed with hydraulic oil) into a container*

➥ Until only pure hydraulic oil comes out

☞ *Close the service valve again*

☞ *Close the drain hose correctly again and store it*

☞ *Replace the filter according to the maintenance specifications*

☞ *Check the hydraulic oil level – see Checking the hydraulic oil level on page 3-42*

☞ *Fill in clean hydraulic oil – see Filling up hydraulic oil on page 3-43*

Close the hydraulic oil tank correctly

Important information for the use of biodegradable oil

- Use only the biodegradable hydraulic fluids which have been tested and approved by Wacker Neuson. Always contact Wacker Neuson 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!
  The joint use of two different biodegradable oils can severely affect the quality of one of the oil types. Therefore when using a different kind of biodegradable oil, ensure that the remaining amount of initial biodegradable oil does not exceed the indications of the manufacturer of biodegradable oil.
- 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 chapter 3.3 Maintenance plan (overview)* on page 3-7.
- Always have the condensation water in the hydraulic oil tank drained by an authorised workshop before the cold season. The water content may not exceed 0.1 % by weight.
- The instructions in this service 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 a Wacker Neuson workshop or your Wacker Neuson dealer.

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 hands.
- 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 20 066.

The article number is marked on the clamping section, and the date of manufacture is indicated on the hose of each hose connection.

3.16 Pilot valve

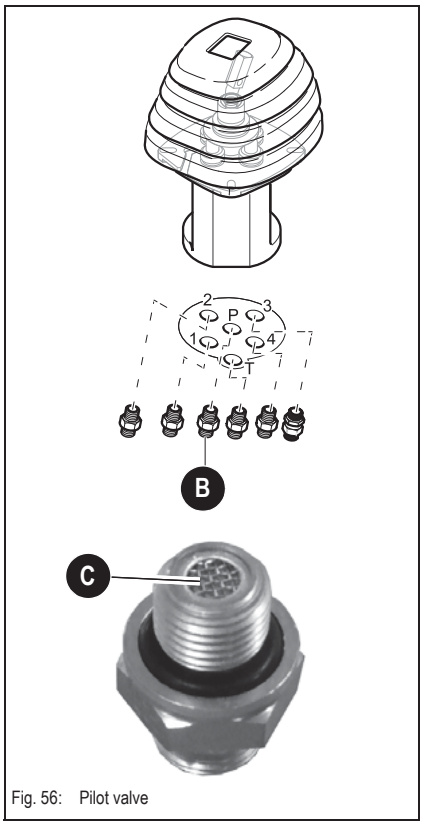


Fig. 56: Pilot valve

Caution!

In order to protect the control spools in the pilot valves from damage due to dirt in the oil, check the pilot control filter every 1000 s/h and clean it if necessary!

Check the pilot valve as follows:

☞ *Park the machine on level ground*

☞ *Retract the bucket and boom rams, lower the boom and the bucket teeth to the ground*

☞ *Lower the stabiliser blade to the ground*

☞ *Set the boom straight*

☞ *Stop the engine*

☞ *Move the control levers in all directions repeatedly*

☞ *Switch off ignition and remove the ignition key*

☞ *Fold up the control lever base*

☞ *Let the engine cool down*

☞ *Slowly open the breather filter*

➥ Release the pressure

☞ *Install the vacuum pump*

☞ Switch on the pump before routing the hoses

☞ Remove the joystick

☞ *Remove the pilot control hose from the joystick*

☞ *Remove pilot control filter **B** from the joystick*

☞ *Check pilot control filter screen **C** for dirt and clean it if necessary. Replace it by a new filter if it is damaged!*

Assemble in the reverse order.

3.17 Travelling drive

Danger!

Immediately after stopping the engine, the engine's components and the oil are very hot. This can cause burns.
If the inside of the drive gear is under pressure, the oil or the plug can be squeezed out.

Danger of injury and scalding!

☞ *Wait until the engine has cooled down before taking up work.*

☞ *Slowly open the plug to release the pressure.*

Checking the oil level and filling up oil

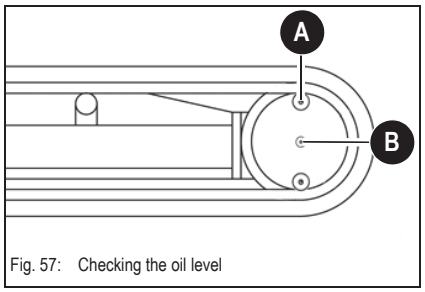


Fig. 57: Checking the oil level

☞ *Stop the machine on firm, level and horizontal ground*

☞ *Place the machine so that filler plug **A** is at the top*

☞ *Stop the engine*

☞ *Let the engine cool down*

☞ *Fold the control lever base up*

☞ *Unscrew screws **A** and **B (LEVEL)** with a suitable tool*

☞ *A small quantity of oil must flow out of opening **B (LEVEL)***

➥ If the oil does not flow out of opening **B (*LEVEL*)**, fill up oil:

☞ Fill in oil through opening **A**,

➥ until a small quantity of oil flows out of opening **B *(LEVEL)***

☞ *Screw screws **A** and **B (LEVEL)** back in again*

☞ *Move the machine a few metres*

☞ *Check the oil level again*

➥ If the oil level is not correct:

☞ Repeat the procedure

Draining oil

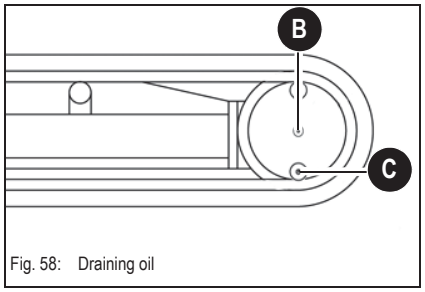


Fig. 58: Draining oil

☞ *Park the machine on level ground*

☞ *Place the machine so that drain plug **C (DRAIN)** is at the bottom*

☞ *Stop the engine*

☞ *Let the engine cool down*

☞ *Fold the control lever base up*

☞ *Remove the ignition key and carry it with you*

☞ *Unscrew screws **B (LEVEL)** and **C (DRAIN)** with a suitable tool*

➥ The oil now flows out of opening **C (DRAIN)**

☞ Use a suitable container to collect the oil as it drains

Environment!

Collect the oil with a suitable container and dispose of it in an environmentally friendly manner.

3.18 Tracks

- Track wear can vary according to work and ground conditions.

☞ We recommend checking track wear and tension once a day.

☞ Park the machine on firm and level ground to check and carry out maintenance.

Checking track tension

Danger!

Working under the machine is extremely dangerous if the tracks are off the ground and if the machine is only supported by the attachment.

Caution, danger!

☞ *Ensure that no-one is in the danger area!*

☞ *Support the machine so as to allow the tracks to sag freely.*

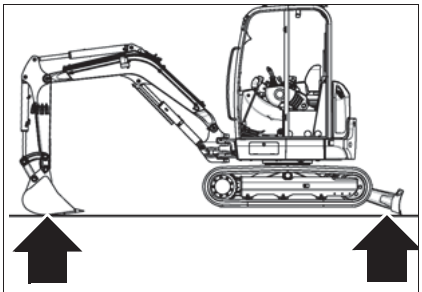


Fig. 59: Raising the machine

☞ *Stop the machine on firm, level and horizontal ground*

☞ *Raise the machine evenly and horizontally*

☞ *Raise the machine by means of the boom and the stabiliser blade*

☞ *Slowly and carefully actuate the control levers*

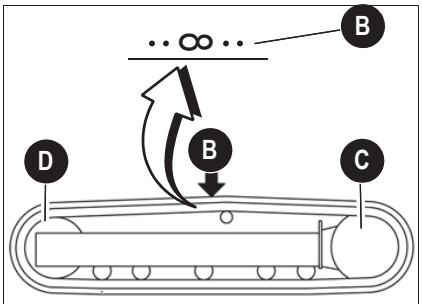


Fig. 60: Rubber track mark

☞ *The rubber track has a mark B as shown in Fig. 60*

☞ *Place the machine so that mark **B** of the rubber track is between the drive pinion **C** and the track tension roller **D***

☞ *Stop the engine*

☞ *Fold the control lever base up*

☞ *Remove the ignition key and carry it with you*

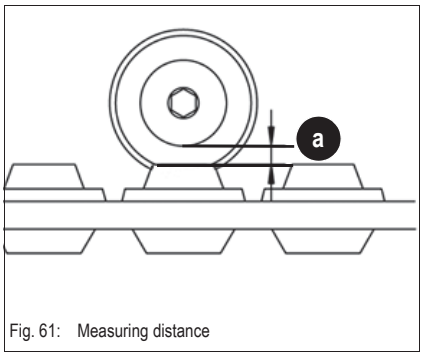


Fig. 61: Measuring distance

- The play **a** between the sliding block's shoulder and the contact area of the second support roller of the drive pinion is 20 – 25 mm (0.78 – 0.98”).

☞ If the tension of the steel or rubber track is not in accordance with the rated value, adjust the tension as follows.

Adjusting track tension

Danger!

The lubricating valve can be squeezed out due to the high grease pressure in the hydraulic ram.

Danger of personal injury!

☞ *Open the lubricating valve only very carefully and do not unscrew it more than a revolution.*

☞ *Slacken no other component except the lubricating valve.*

☞ *Keep your face away from the lubricating valve connection.*

➥ Contact your Wacker Neuson dealer if this does not reduce track tension.

☞ *Release grease only as described below.*

➥ *Observe the safety instructions!*

Caution!

Excessive tension of the tracks causes severe damage to the ram and the track.

☞ *Tighten the tracks only up to the prescribed measuring distance*

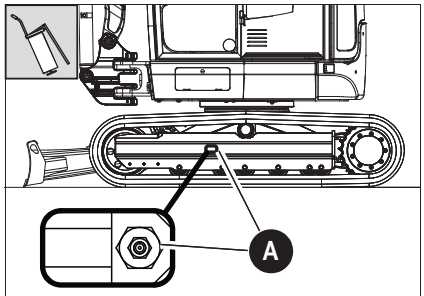


Fig. 62: Tightening the tracks

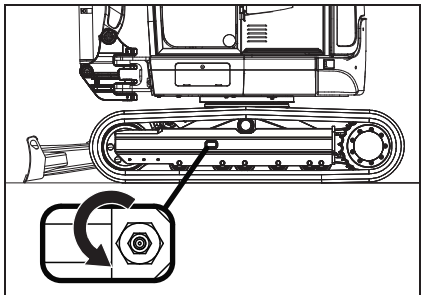


Fig. 63: Draining grease

Tightening the tracks

☞ *Inject grease with the pump through lubricating valve **A***

☞ *Check the tension is correct by starting the engine, letting it run at idling speed and slowly moving the machine forwards and reverse and switching it off again*

☞ *Check the tension of the tracks again*

➥ If it is not correct:

☞ Adjust again

☞ *Should the track still be slack after injecting more grease, replace the track or the seal in the ram.*

Reducing tension

☞ *Place a suitable container underneath to collect the grease.*

☞ *Slowly turn lubricating valve **A** one revolution counterclockwise to release the grease.*

➥ The grease flows out of the groove of the lubricating valve.

☞ *Retighten the lubricating valve **A**.*

☞ *Check the tension is correct by lowering the machine to the ground, starting the engine, letting it run at idling speed without any load and slowly moving the machine forwards and reverse and switching it off again. Raise the machine again with the boom.*

☞ *Check the tension of the tracks again*

➥ If it is not correct:

☞ Adjust again

Environment!

Use a suitable container to collect the grease as it flows out and dispose of it in an environmentally friendly manner.

3.19 Maintenance of attachments

Notice!

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

3.20 Lubrication points

Parking the machine

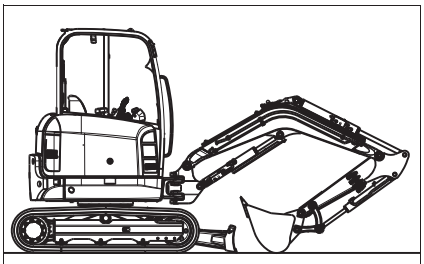


Fig. 64: Transport position

☞ Stop the machine on firm, level and horizontal ground.
☞ Lower the boom.
☞ Lower the stabiliser blade to the ground.
☞ Stop the engine.
☞ Remove the key and carry it with you.
☞ Move control levers **1** and **2** in all directions repeatedly.
☞ Fold the control lever base up.
☞ Do not allow anyone to stay in the cab, and close the doors and the engine cover.
☞ Perform maintenance work.

Notice!

Keep the lubrication points clean and remove ejected grease.

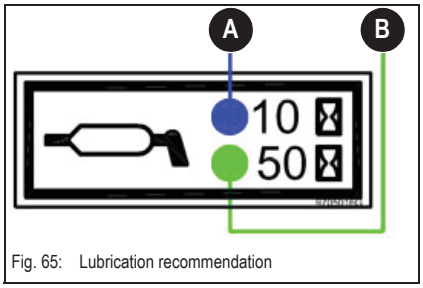


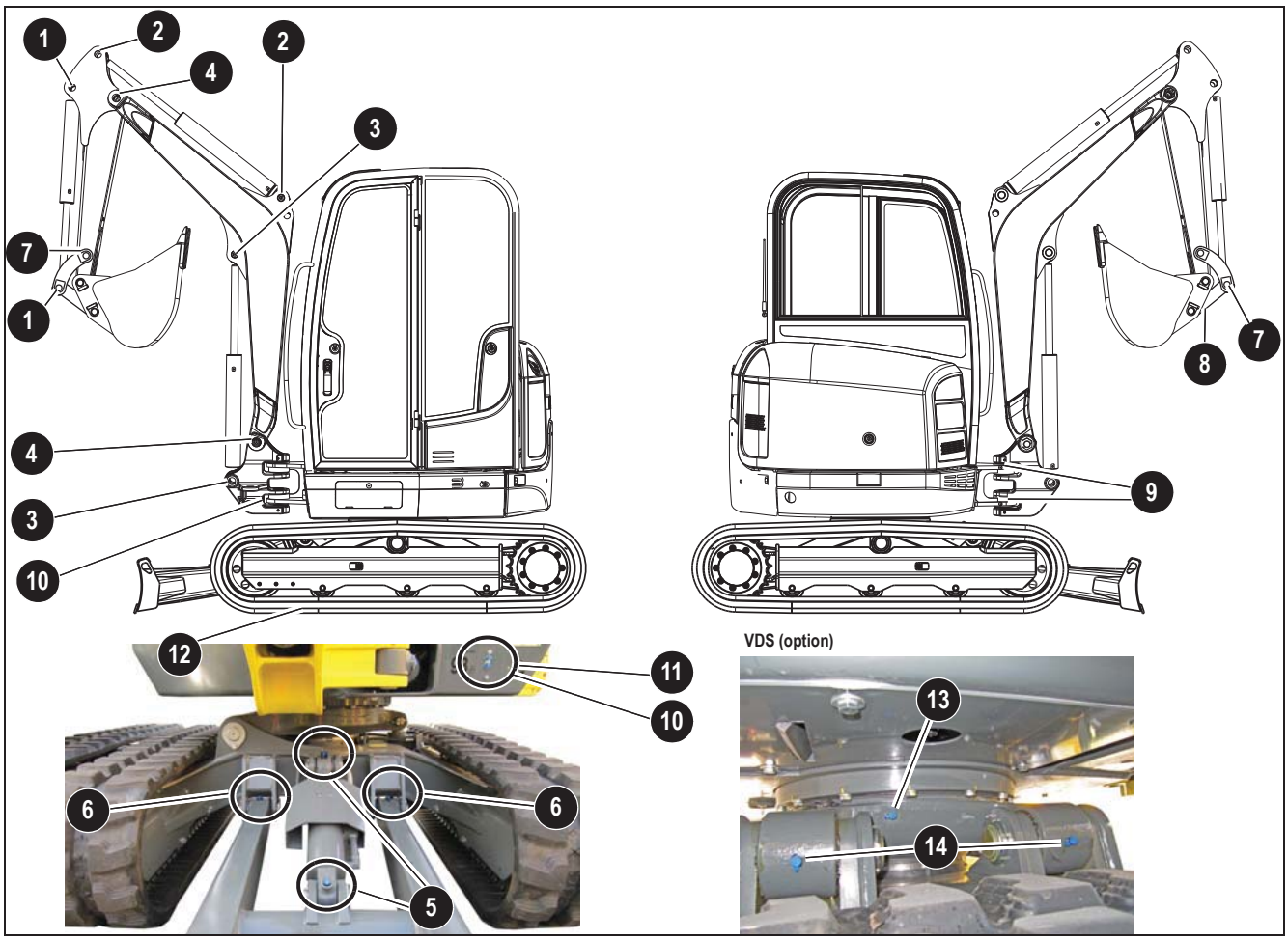
Fig. 65: Lubrication recommendation

A grease type listed in the specifications must be applied to all lubrication points listed – *see chapter 3.1 Fluids and lubricants* on page 3-2.

- Lubrication points **A** with blue caps
  ☞ Apply grease daily
- Lubrication points **B** with green caps
  ☞ Apply grease once a week

Lubricate all mechanical pivots on the machine (such as door hinges, joints) and fittings (such as door arresters) at regular intervals even if they are not listed in the lubrication plan.

3.21 Overview of lubrication points



Pos.	Lubrication point	Interval	No
1	Bucket ram *Fig. 70*/**G** and *Fig. 71*/**G**	Daily	2
2	Stick ram *Fig. 71*/**E** and *Fig. 73*/**E**	Daily	2
3	Boom ram *Fig. 70*/**F** and *Fig. 72*/**F**	Daily	2
4	Boom *Fig. 74*/**H** and *Fig. 75*/**H**	Daily	2
5	Stabiliser blade ram *Fig. 66*/**A**	Daily	2
6	Stabiliser blade *Fig. 66*/**B**	Daily	2
7	Stick *Fig. 76*/**I** and *Fig. 77*/**I**	Daily	2
8	Joint rod *Fig. 78*/**J**	Daily	1
9	Swivelling console *Fig. 69*/**D**	Daily	2
10	Offset ram *Fig. 67*/**C** and *Fig. 79*/**M**	Daily	2
11	Ball bearing race of live ring	– *see Lubrication point on ball bearing race of live ring* on page 3-57	1
12	Teeth of live ring (standard)	– *see Lubrication point of live ring teeth* on page 3-57	1
13	Teeth of live ring (VDS)	– *see Lubrication point of VDS live ring teeth* on page 3-58	1
14	Vertical Digging System (VDS) (option)	– *see VDS lubrication points (option)* on page 3-59	2
15	Powertilt (option)	– *see Powertilt lubrication points (option)* on page 3-59	4
16	Hydraulic quickhitch (option)	– *see Lubrication points of hydraulic quickhitch (option)* on page 3-60	2
17	Quickhitch option	– *see Lubrication points of mechanical quickhitch (option)* on page 3-60	2

Lubrication points on the stabiliser blade and stabiliser blade ram

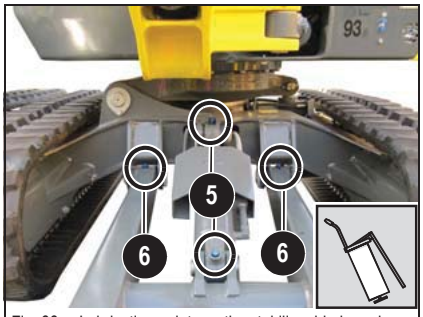


Fig. 66: Lubrication points on the stabiliser blade and ram

☞ *Apply grease to lubrication points **5** on the stabiliser blade ram*

☞ *Apply grease to lubrication points **6** (on either side) on the stabiliser blade*

Lubrication points on the swivelling console and slewing ram

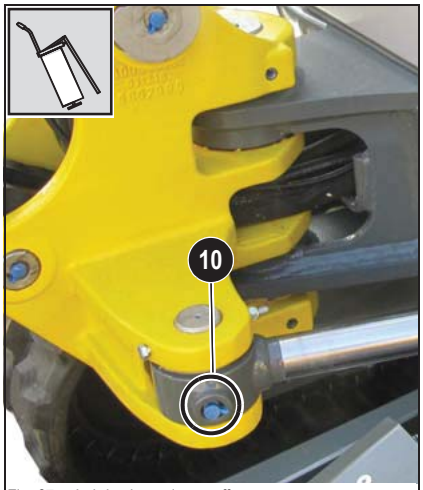


Fig. 67: Lubrication point on offset ram

☞ *Apply grease to lubrication points **10** on the offset ram*

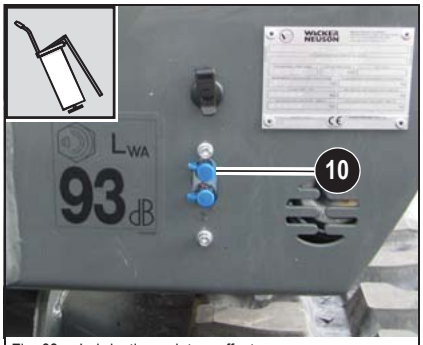


Fig. 68: Lubrication point on offset ram

☞ *Apply grease to lubrication points **10** of the offset ram*

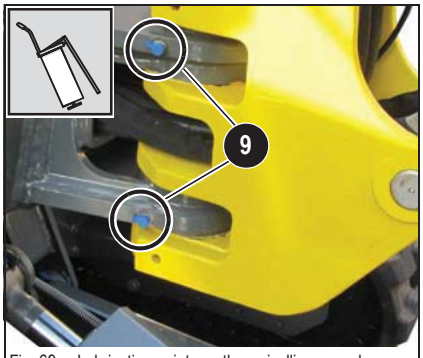


Fig. 69: Lubrication points on the swivelling console

☞ *Apply grease to lubrication points **9** of the swivelling console*

Lubrication points on the boom, bucket and stick rams

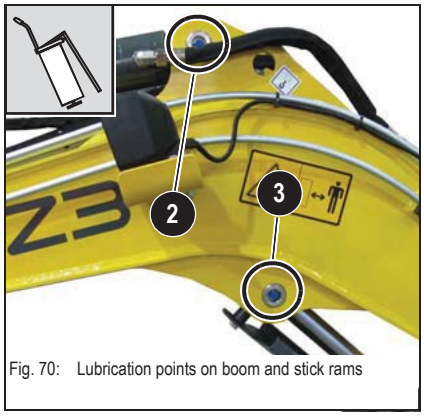


Fig. 70: Lubrication points on boom and stick rams

☞ *Apply grease to lubrication points **2** on the stick ram*

☞ *Apply grease to lubrication points **3** on the boom ram*

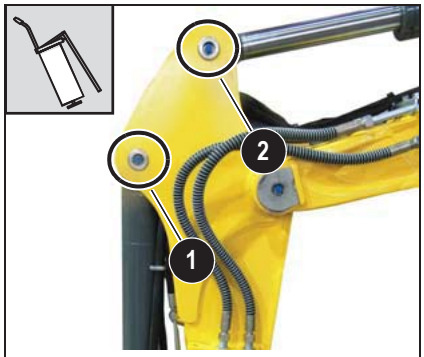


Fig. 71: Lubrication points on bucket and stick rams

☞ *Apply grease to lubrication points **2** on the stick ram*

☞ *Apply grease to lubrication points **1** on the bucket ram*

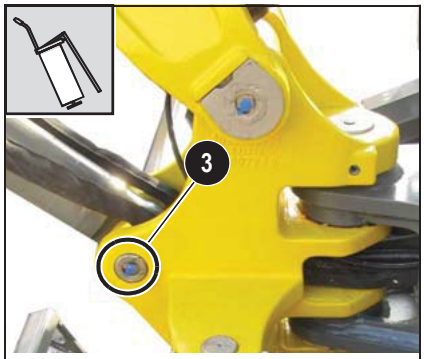


Fig. 72: Lubrication points on the boom ram

☞ *Apply grease to lubrication points **3** on the boom ram*

Fig. 73: Lubrication points on the bucket ram

☞ *Apply grease to lubrication points **1** on the bucket ram*

Lubrication points on the boom and stick

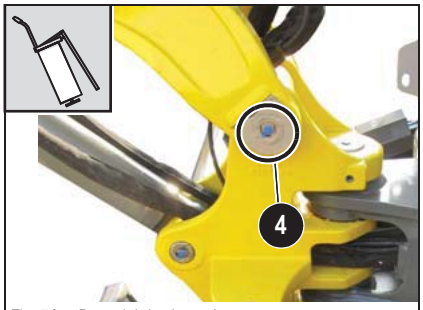


Fig. 74: Boom lubrication points

☞ *Apply grease to lubrication points **4** on the boom*

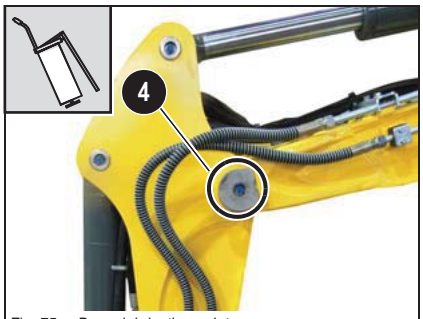


Fig. 75: Boom lubrication points

☞ *Apply grease to lubrication points **4** on the boom*

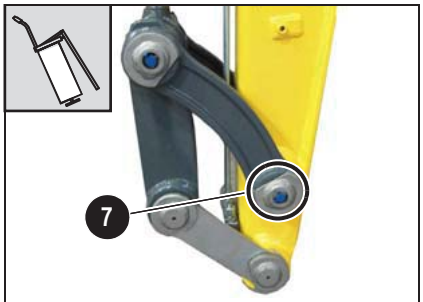


Fig. 76: Lubrication points on the stick

☞ *Apply grease to lubrication points **7** on the stick*

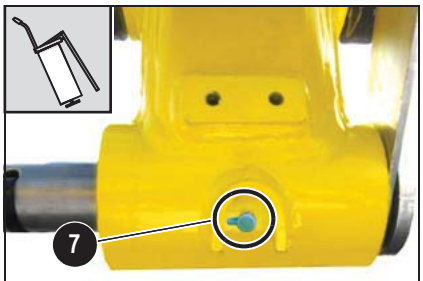


Fig. 77: Lubrication points on the stick

☞ *Apply grease to lubrication points **7** on the stick*

Lubrication point on the joint rod

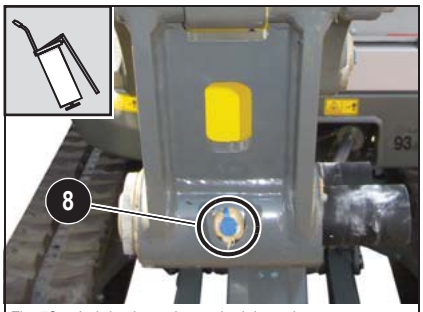


Fig. 78: Lubrication point on the joint rod

☞ *Apply grease to lubrication point **8** on the joint rod*

Lubrication point on ball bearing race of live ring

Danger!

Do not rotate the machine during lubrication!

Danger of severe crushing that can cause death or severe injury!

☞ – *see chapter Parking the machine on page 3-52*

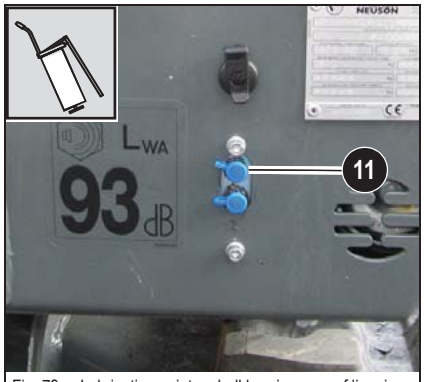


Fig. 79: Lubrication point on ball bearing race of live ring

☞ Stop and park the machine.

☞ Apply grease to lubrication points **11** with one stroke of the grease gun.

☞ Remove ejected grease.

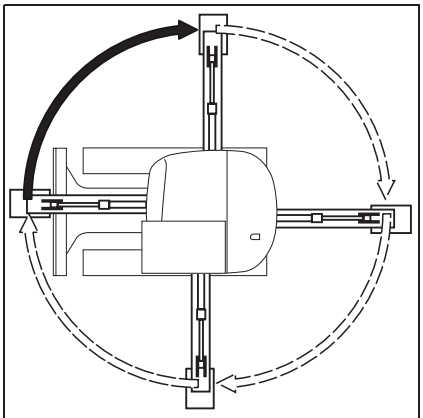


Fig. 80: Turn the machine 90° at a time

☞ Turn the machine 90° at a time.

☞ Stop and park the machine.

☞ Apply grease to each of lubrication points **11** with one stroke of the grease gun.

☞ Remove ejected grease.

☞ Turn the machine 360° a few times.

Lubrication point of live ring teeth

Danger!

Do not rotate the machine during lubrication!

Danger of severe crushing that can cause death or severe injury!

☞ – *see chapter Parking the machine on page 3-52*

Caution!

Lubrication can be carried out over a pit only.

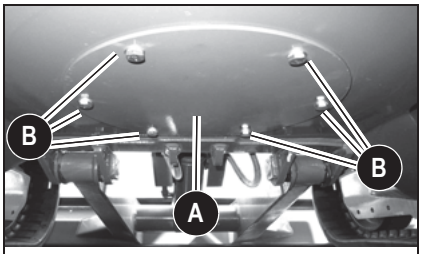


Fig. 81: Remove the cover

☞ Drive and stop the machine over a pit.
☞ The lubrication point is located on the lower side of the undercarriage.
☞ Remove cover **A** by means of six screws **B** on the lower side.

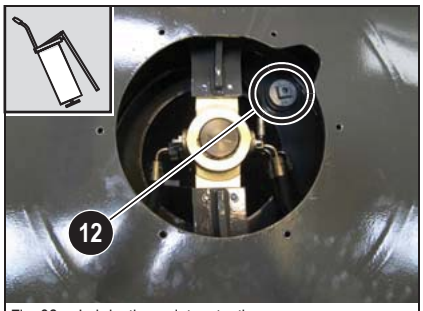


Fig. 82: Lubrication point on teeth

☞ Apply grease to lubrication point **12** with five strokes of the grease gun.
☞ Remove ejected grease.
☞ Install the cover.

Lubrication point of VDS live ring teeth

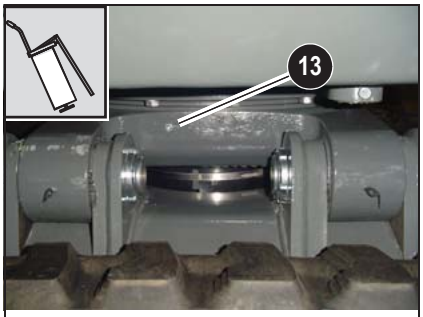


Fig. 83: Lubrication point of VDS live ring teeth

☞ Drive and stop the machine over a pit.
☞ The lubrication point is located on the right-hand side of the undercarriage.
☞ Apply grease to lubrication point **13** with five strokes of the grease gun.
☞ Remove ejected grease.

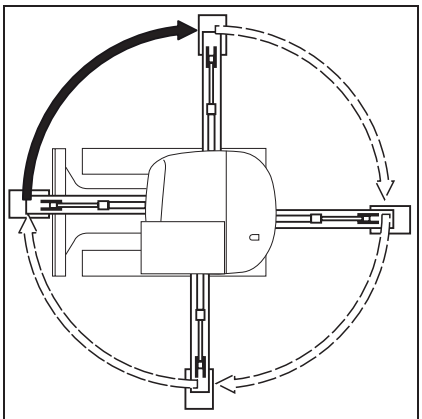


Fig. 84: Turn the machine 90° at a time

☞ Turn the machine 90° at a time and apply grease to lubrication point **13** with five strokes of the grease gun in the following three positions.
☞ Remove ejected grease.
☞ Turn the machine 360° twice.

VDS lubrication points (option)

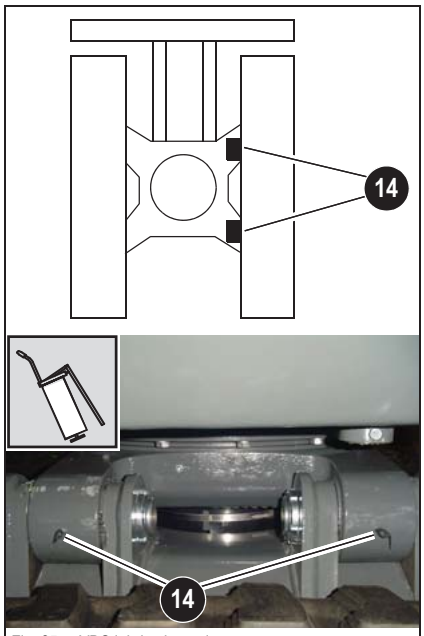


Fig. 85: VDS lubrication points

Apply grease to lubrication points **14** once a week.

Powertilt lubrication points (option)

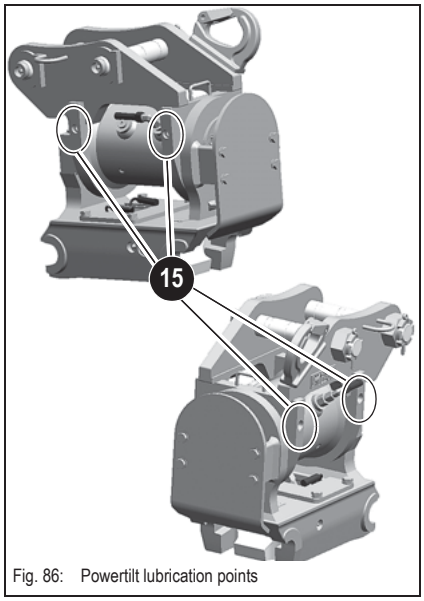


Fig. 86: Powertilt lubrication points

Carry out maintenance of the Powertilt unit once a day with the other maintenance work for the machine.

Carry out visual checks for possible defects, damage or cracks.

Remove all dirt on and around moving parts.

Apply grease by means of grease nipples **15**.

– *see PowerTilt PTS06* on page 8-1

Lubrication points of hydraulic quickhitch (option)

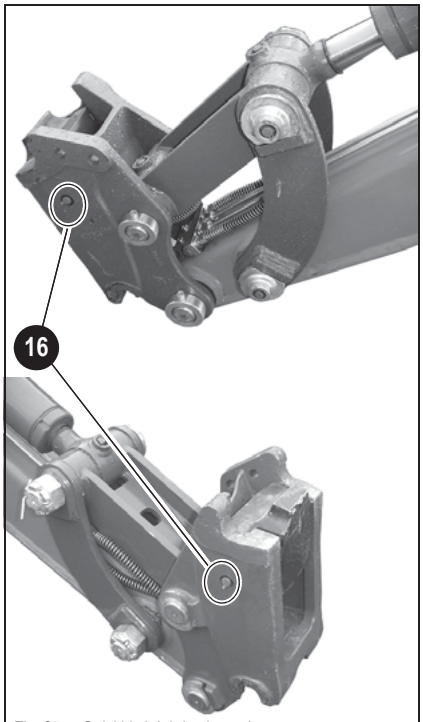


Fig. 87: Quickhitch lubrication points

Notice!

Before picking up an attachment, the driver must ensure that it can be hitched correctly by removing all dirt on either claw of the quickhitch.
Carry out maintenance on the quickhitch once a day with the other maintenance work for the machine.

Carry out visual checks for possible defects, damage or cracks.

Remove all dirt on and around moving parts.

The claws must be clean and slightly greased.

Apply grease to the friction surfaces of the lock mechanism via 2 grease nipples **16** on either side of the quickhitch (see *Fig. 87*).

Before starting work, check the acoustic signal. You must be able to hear the acoustic signal as you actuate the switch.

Lubrication points of mechanical quickhitch (option)

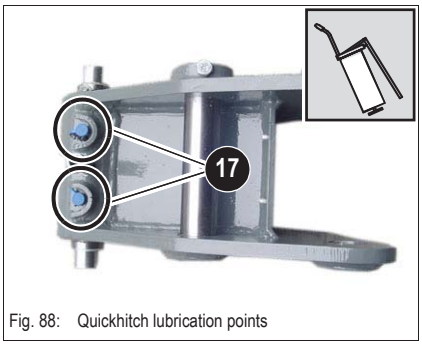


Fig. 88: Quickhitch lubrication points

☞ *Apply grease to lubrication points **17** on the quickhitch (option)*

3.22 Cab

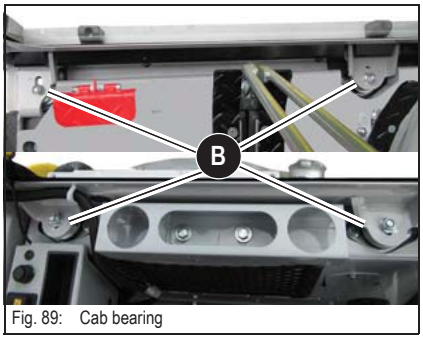


Fig. 89: Cab bearing

☞ *Check cab bearings **B** for damage*

Notice!

Check the cab fastening screws for tightness, retighten with a suitable tool if necessary – *see Tightening torques for high-resistance screw connections* on page 2-8

3.23 Electrical system

Service and maintenance work at regular intervals

Checks before driving the machine or when changing drivers

- Is the light system OK?
- Do the lights and the signalling and warning system work?
- Adjust the mirrors correctly, clean them and check them for damage and correct function.

Every week

- Electric fuses – *see chapter 6.7 Fuse box* on page 6-4
- Cable and earth connections
- Battery charge condition – *see Battery* on page 3-62
- Condition of battery terminals

Instructions concerning specific components

Cables, lamps and fuses

Always observe the following instructions:

- Defective components of the electrical system must always be replaced by an authorised expert. Lamps and fuses may be replaced by the customer.
- 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 6.7 Fuse box* on page 6-4

Alternator

Always observe the following instructions:

- Start the engine only if the battery is connected.
- When connecting the battery, ensure that the poles (+/–) are not inverted.
- Always disconnect the battery before carrying out welding work or connecting a quick battery charger.
- Replace defective charge indicator lights immediately
  – *see Alternator charge function indicator light (red)* on page 1-12

Battery

Danger!

Battery acid is highly caustic!

Danger of caustic injury!

Therefore when recharging and/or working near the battery:

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

If acid is spilt:

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

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

Especially when charging batteries, as well as during normal operation of batteries, an oxyhydrogen mixture is formed in the battery cells –

Danger of explosion!

The battery contains sulphuric acid! This acid must not be allowed to come into contact with the skin, the eyes, clothing or the machine.

☞ *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!*

- Replace the battery immediately

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

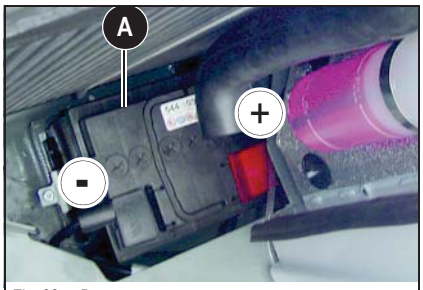


Fig. 90: Battery

Battery **A** is located on the right in the engine compartment. The battery is “maintenance-free”. However check the battery at regular intervals to ensure that the electrolyte level is between the MIN and MAX marks.

The battery must be removed before it can be checked.

Always follow the specific battery safety instructions!

Notice!

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

Danger!

Do not disconnect the battery while the engine is running!

3.24 General maintenance work

Cleaning

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. It is therefore essential to observe the following instructions.

General instructions for all areas of the machine

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:
  - Electric components such as the alternator etc.
  - Control devices and seals
  - Air intake filters etc.

Cleaning with volatile and easily flammable anticorrosion agents and sprays:

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

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:

- Damp cloth
- Brush
- Water with mild soap solution

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!

Exterior of the machine

The following articles are generally suitable:

- High-pressure cleaner
- Steam jet

Engine compartment

Danger!

Clean the engine at engine standstill only –

Danger of personal injury!

☞ *Stop the engine before cleaning*

Caution!

When cleaning the engine with a water or steam jet

☞ *The engine must be cold*

☞ *and do not point the jet directly at electric sensors such as the oil pressure switch.*

The humidity penetrating any such sensors causes them to fail and leads to engine damage!

Shatter protection

Clean the window only with water and a mild soap solution.

Do not use aggressive detergents!

Do not use brushes, steel wool or similar abrasive means. Never wipe dust in a dry state.

Screw connections and attachments

All screw connections must be checked regularly for tightness, even if they are not listed in the maintenance schedules.

Retighten loose connections immediately. Contact an authorised workshop if necessary.

Pivots and hinges

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.

3.25 Preparatory work before taking out of service

The measures indicated below refer to putting the machine out of operation for 30 days or longer.

- Park the machine
  – *see Parking the machine* on page 3-52.
- Check whether oil or other fluids leak from the machine.
- Clean the engine with a high-pressure cleaner in a suitable place
  – *see General maintenance work* on page 3-63.
- Carefully clean and dry the entire machine.
- Spray an anticorrosion agent onto bare metal parts of the machine (e.g. piston rods of hydraulic rams).
- Apply grease to all lubrication points.
- Change engine oil.
- Check and if necessary fill up engine oil, hydraulic oil and coolant
- Store the machine indoors if possible.
- If the machine is stored outdoors, place it on a wooden base and cover it with a watertight tarpaulin to protect it against humidity.
- Fill up the fuel tank to the maximum level.
- Remove the earthing strap from the battery, or remove the battery and store it in a safe place. Charge the battery and carry out battery maintenance at regular intervals.
- Switch off the fuel filter on the upper carriage and the fuel filter on the engine (turn to OFF).
- Close the exhaust pipe and the air intake opening of the air filter system.

3.26 Maintenance if the machine is out of service for a longer period of time

The following measures must be taken if the machine is out of service for more than 30 days.

Putting into operation again

- Remove anticorrosion agent from the piston rods.
- Charge, install and connect the battery.
- Remove the seals from the exhaust pipe and the air filter intake.
- Check the condition of the air filter element and replace the element if necessary.
- Check the dust valve.
- Switch on the fuel filters on the upper carriage and the engine (turn to ON).
- Turn the ignition to position 1 for 2 minutes (to supply the engine with fuel).
- Check whether oil or other fluids leak from the machine.
- Lubricate the machine according to the lubrication plan.
- Check and if necessary fill up engine oil, hydraulic oil, coolant and fuel in the units and tanks
- If the machine was out of service for over 6 months, change the oil in the gearbox, engine, etc. and the hydraulic oil tank.
- Also replace hydraulic oil filters (return and breather filters) if the machine has been out of service for over 6 months.
- Remove the ignition key, remove fuse F2 on the right-hand cover.
- Let the engine run 15 seconds.
- Wait 15 seconds.
- Let the engine run 15 seconds again.
- Remove the ignition key, put fuse F2 back in.
- Start the diesel engine.
- Let the engine run at idling speed at least 15 minutes without load.
- Check the oil levels in all units and fill up oil if necessary.

Start the machine and ensure that each function and all warnings work correctly before putting the machine back into operation.

3.27 Fire extinguisher

Fig. 91: Fire extinguisher in cab

A fire extinguisher is neither included in the machine's standard equipment nor is it available as an option from Wacker Neuson.

☞ *Retrofitting a fire extinguisher according to DIN-EN 3 must be carried out by an authorised workshop.*

Installation in cab:

➥ On the cab framework behind the seat (see *Fig. 91*)

➥ Drill 2 holes with the correct diameter through the trim and frame of the cab

➥ Remove the trims

➥ Cut 2 threads with the correct diameter in the drilled holes

➥ Install the trim

➥ Fasten a retaining bracket you have made yourself with corresponding screws and washers

➥ Fasten the fire extinguisher onto the retaining bracket according to the manufacturer's indications

Notice!

Check the fire extinguisher at regular intervals, also ensure that it is safely mounted.

Fig. 92: Fire extinguisher in canopy

Installation in canopy:

➥ On the canopy framework behind the seat (see *Fig. 92*)

➥ Fasten the fire extinguisher according to the manufacturer's indications

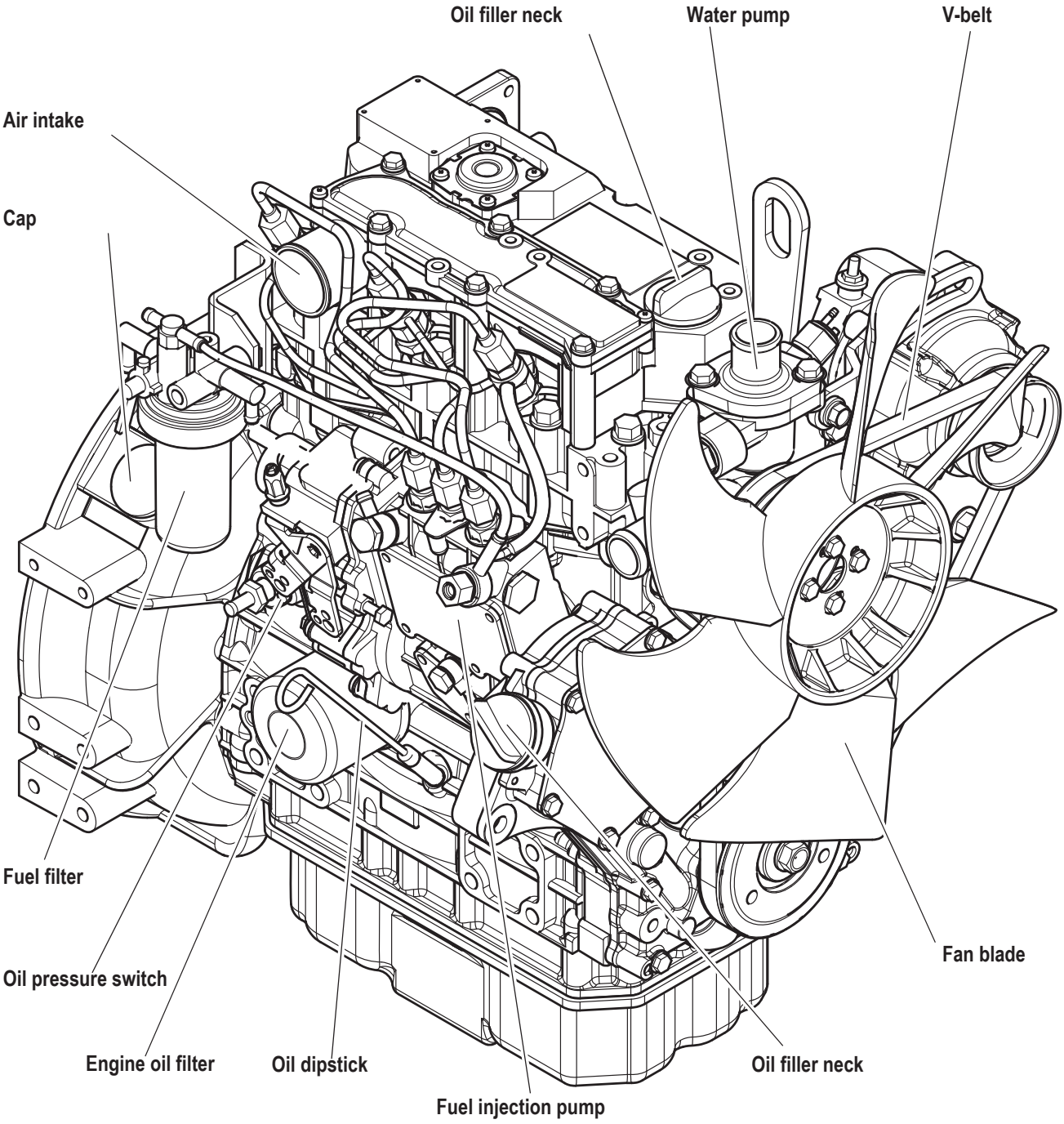
Notice!

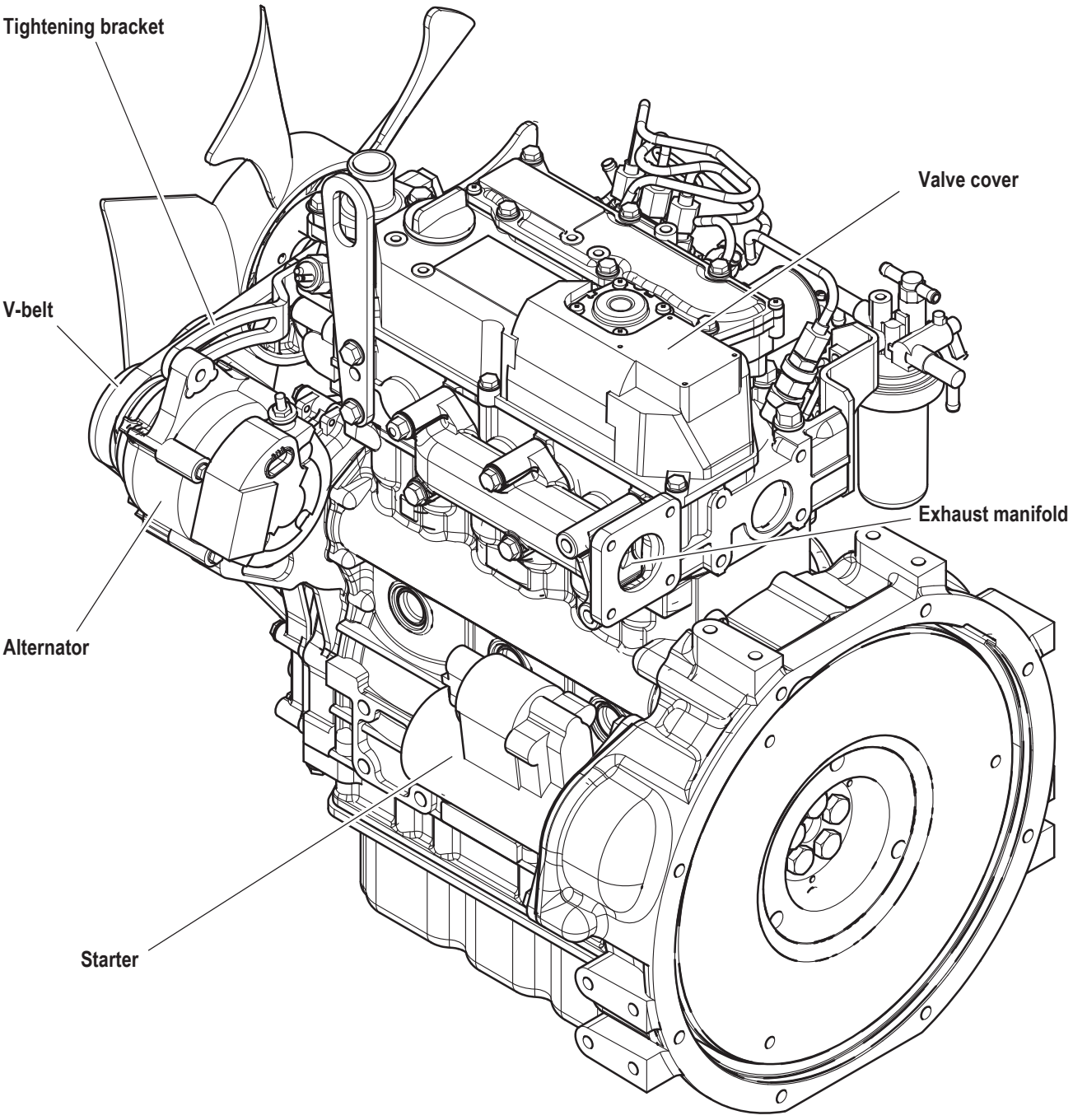
Check the fire extinguisher at regular intervals, also ensure that it is safely mounted.

Engine

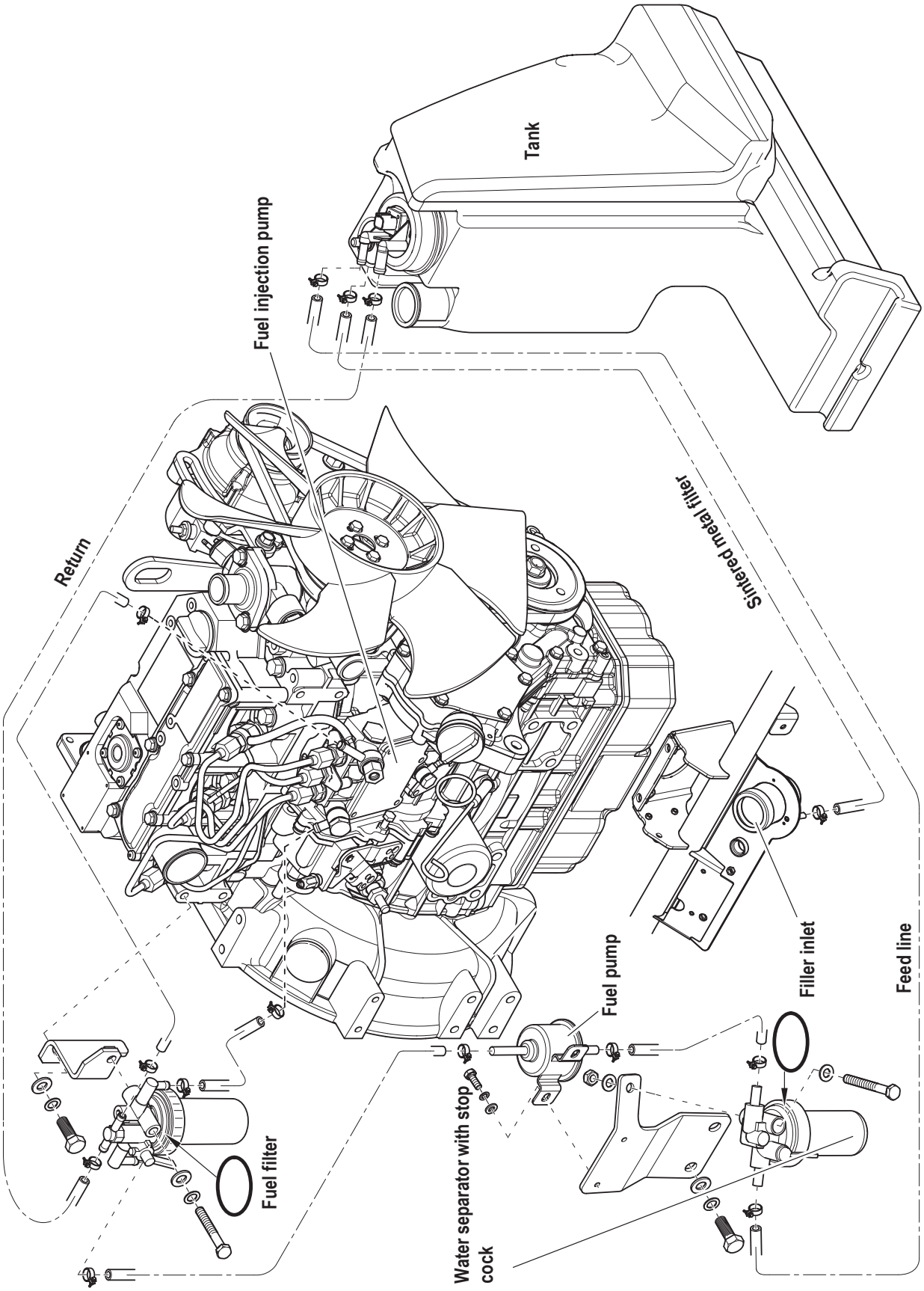
4 Engine

4.1 3TNV76-NNS engine overview

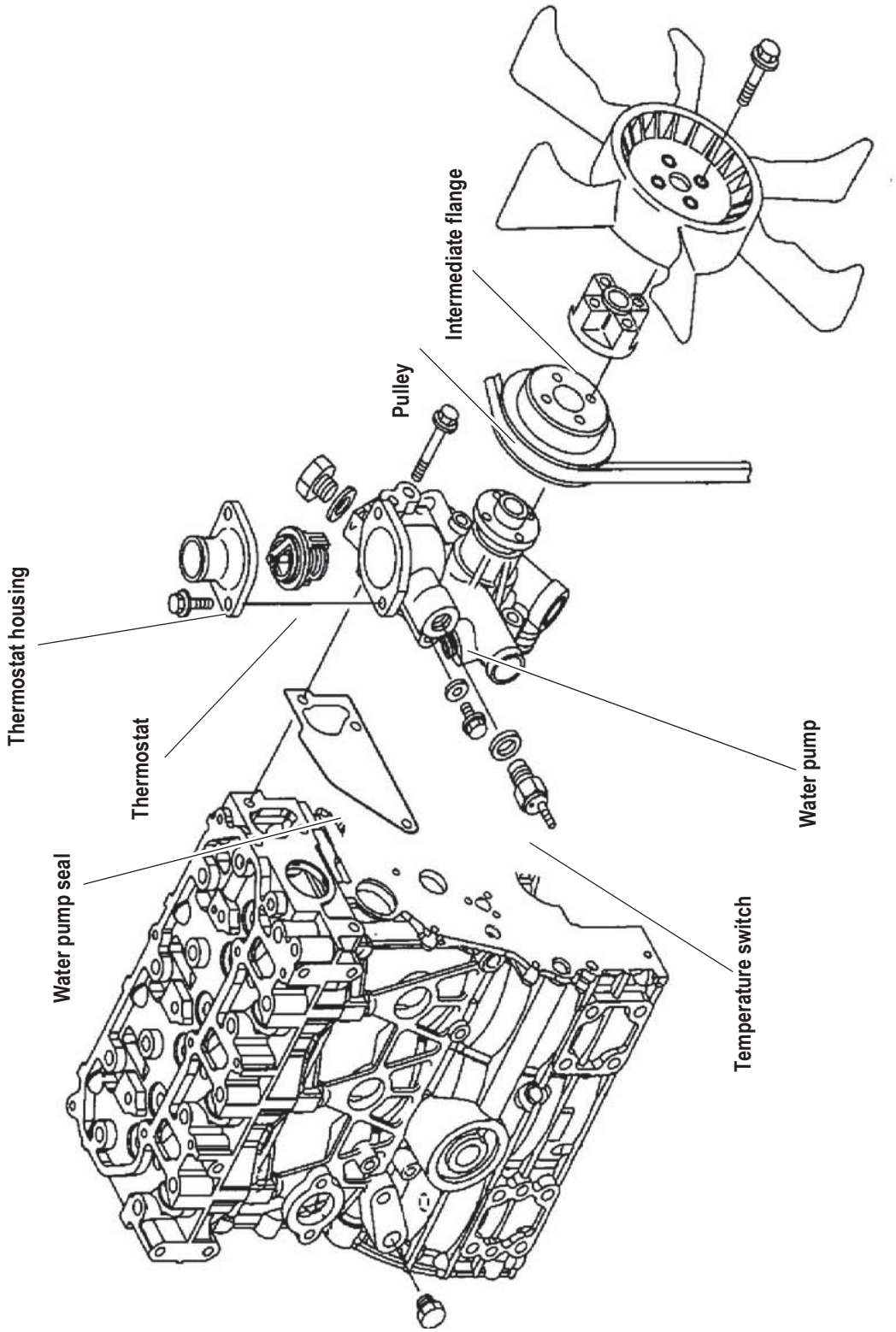



Tightening bracket
Valve cover
V-belt
Exhaust manifold
Alternator
Starter

4.2 Fuel system



4.3 Cooling system



4.4 Checking and adjusting valve clearance

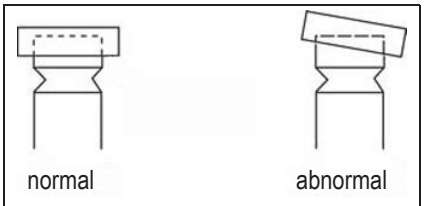


Fig. 1: Valve cap wear

☞ *The standard valve clearance setting is carried out on a cold engine:*

➥ The firing order is 1 – 3 – 2, ignition at the 240 ° position of the crankshaft rotation.

Notice!

The first cylinder is located on the pump side at the flywheel end opposite the radiator.

Checking valve clearance

☞ *Remove the valve cover*

☞ *Turn the ring gear on the flywheel clockwise until the cylinder reaches top dead centre of the compression cycle.*

➥ Both rocker arms are accessible.

➥ The intake and exhaust valves can be set in this position.

➥ The top dead centre mark (indentation) can be seen on the flywheel.

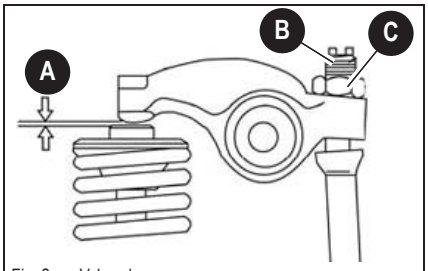


Fig. 2: Valve clearance

☞ *Check the valve cap for abnormal wear – see Fig. 1.*

☞ *Check valve clearance with feeler gauge **A**.*

➥ Valve clearance: 0.15 – 0.25 mm (0.0059 – 0.0098").

☞ *Adjust the valve clearance if it varies.*

To reduce the number of necessary rotations of the crankshaft for checking the valve clearance, the setting of various valves can be adjusted in parallel in accordance with the following table:

Cylinder number	1		2		3	
Valve	Inlet	Exhaust	Inlet	Exhaust	Inlet	Exhaust
Cylinder 1 at top dead centre (compression)	●	●	●			●
Cylinder 1 at top dead centre (exhaust open)				●	●	

Example:

- Turn cylinder 1 to top dead centre (both valves closed – compression).

  ➥ The valves in the upper row of the table can be set in this manner.

- Then turn the crankshaft to top dead centre of the exhaust valve (only the exhaust valve is open).

  ➥ Both other valves in the lower row of the table can be adjusted.

Setting valve clearance

☞ *Check the valve setting as described in the "Valve clearance" section.*

☞ *Slacken locknut **C** and set screw **B** on the rocker arm.*

☞ *Check the valve cap for abnormal wear – see Fig. 1.*

☞ *For the correct valve clearance insert feeler gauge **A**.*

☞ *Adjust the valve clearance by turning set screw **B**.*

➥ The feeler gauge must slip between the valve cap and rocker arm with slight resistance.

➥ Valve clearance: 0.15 – 0.25 mm (0.0059 – 0.0098")

☞ *Tighten locknut **C** while holding set screw **B***

➥ Lightly oil the surface between the valve tappet and the set screw

Notice!

The valve clearance tends to decrease slightly when the locknut ***C*** is tightened – pay attention to this during adjustment

☞ *Check the valve clearance again*

☞ *Repeat the procedure for each valve*

☞ *Place the valve cover gasket*

☞ *Mount the valve cover again*

Lapping the intake and exhaust valves

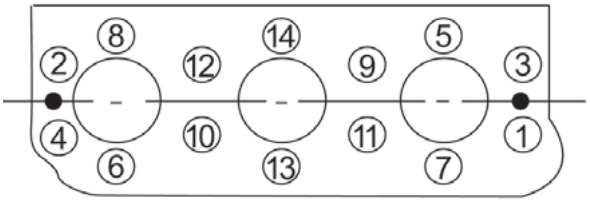
To ensure an exact clearance, the intake and exhaust valves must be lapped every 2000 service hours

4.5 Tightening order for cylinder head bolts

Notice!

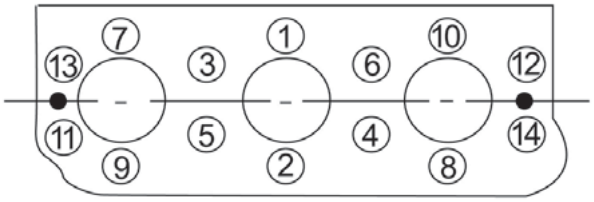
Always carry out work on the cylinder head on a cold engine!

Order for removing the cylinder-head bolts:



V-belt side

Order for mounting the cylinder-head bolts:



V-belt side

Tightening torques for cylinder-head bolts		
1st position	26.9 – 28.9 Nm	19.8 – 21.3 lbs/ft
2nd position	53.9 – 57.9 Nm	39.8 – 42.7 lbs/ft

Notice!

Apply a thin coat of oil to the threads and contact surfaces before mounting.

Caution!

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

4.6 Checking the injection nozzles

Pressure check

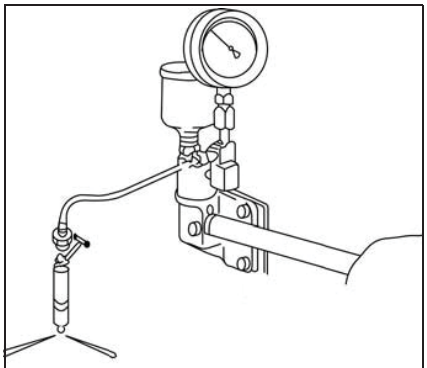


Fig. 3: Nozzle tester

☞ *Ball-type cock on fuel filter in the "OFF" position*

☞ *Clean the area around the nozzles*

☞ *Remove the injection line and the injection nozzle*

☞ *Connect the injection nozzle with the high pressure line of the nozzle tester*

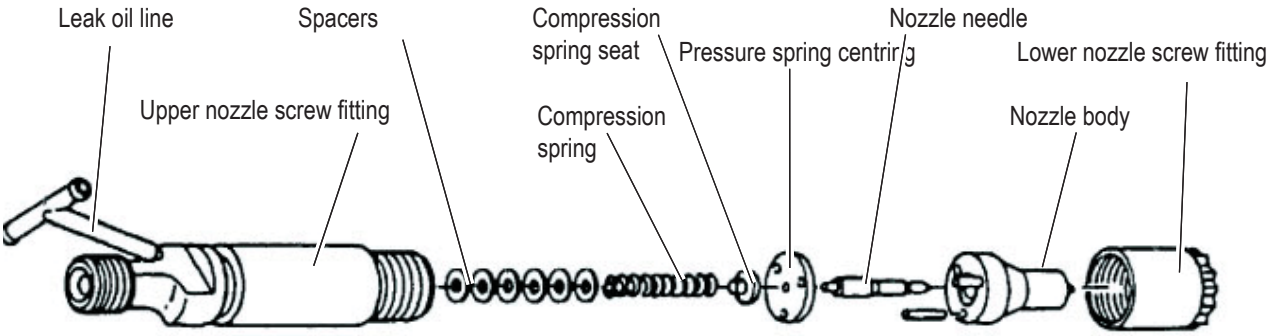
☞ *Slowly increase pressure until the nozzle ejects fuel and read the pressure off the pressure gauge*

☞ *If the injection pressure is too low, replace the spacer in the nozzle by a thicker one. If the pressure is too high, replace the spacer by a thinner one.*

➥ Injection pressure: **118 – 128 bar (1713 – 1858 psi)**

- Spacer thickness of 0.1 mm (0.004") corresponds to modification by 6.9 – 9.8 bar (100 – 142 psi)
- Check the pressure again
- Check the injection nozzle for drips after it has ejected fuel

  ☞ Create a pressure of about 20 bar (290 psi) below injection pressure and check whether fuel drips from the nozzle
- Install the nozzle
- Open the ball-type cock on the fuel filter again



4.7 Checking the nozzle jet

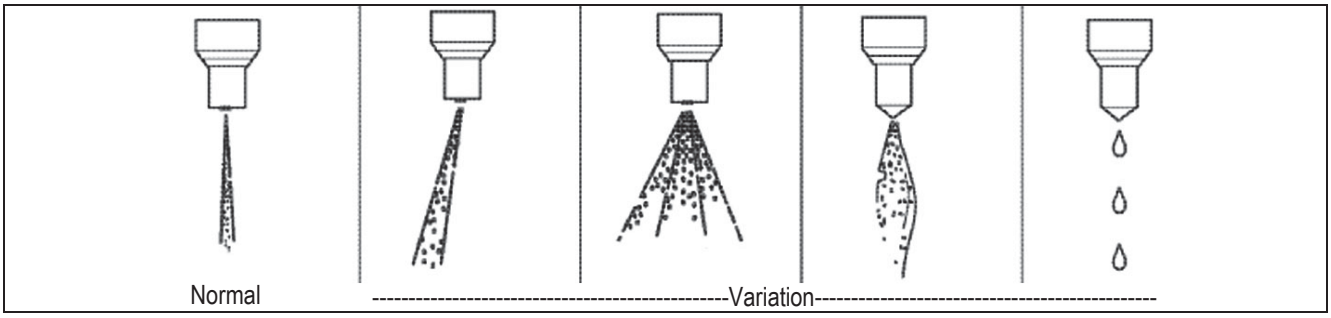
☞ *Remove the injection lines and the injection nozzles*

☞ *Connect the injection nozzle with the high pressure line of the nozzle tester*

☞ *Quickly create pressure until the nozzle ejects fuel (ejection 3 – 4 times)*

☞ *Hold a white sheet of paper about 30 cm (12”) away from the nozzle and let the nozzle eject fuel*

☞ *The nozzle jet must create a shape on the paper as shown below*



4.8 Injection time

Checking injection time

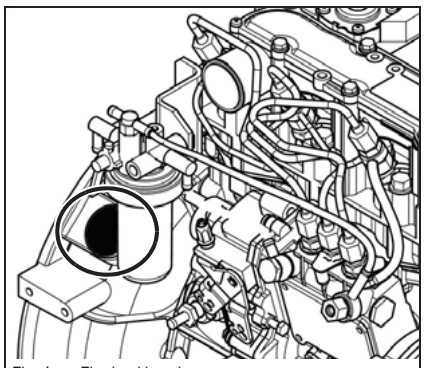


Fig. 4: Flywheel housing cap

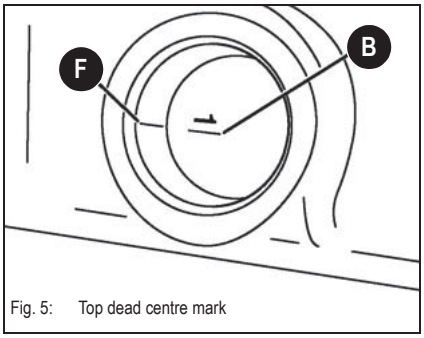


Fig. 5: Top dead centre mark

Preparatory work:

- The fuel system must be filled and bled
- Clean the injection pump and keep it clean

☞ *Checking cylinder 1 is basically sufficient and serves the purpose, but all other cylinders can also be checked*

☞ *Apply current to the cutoff solenoid, or remove the cutoff solenoid and the O-ring from the injection pump*

➥ Fuel supply is enabled

☞ *Set the throttle to the maximum speed*

☞ *Remove the cap on the flywheel housing, see Fig. 4*

➥ The view to the ring gear is opened

☞ *Position a spanner on the screw of the pulley (on the crankshaft) and turn clockwise*

➥ Or turn the ring gear on the flywheel with a screwdriver

☞ *Turn until top dead centre marks **B** on the ring gear for cylinder 1 are visible and at the same level as mark **5/F** on the flywheel housing*

➥ There are several marks on the ring gear depending on the number of cylinders of the diesel engine; each individual mark can be used with the corresponding cylinder for testing purposes

➥ Top dead centre can be assigned to the correct cylinder with the number **B** stamped next to it

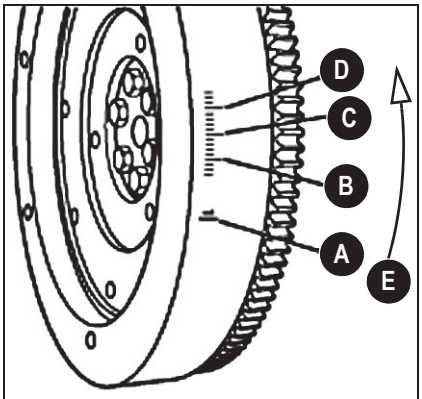


Fig. 6: Marks on flywheel

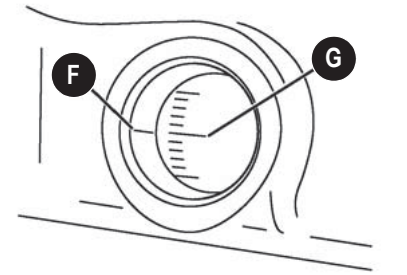


Fig. 7: Mark before top dead centre

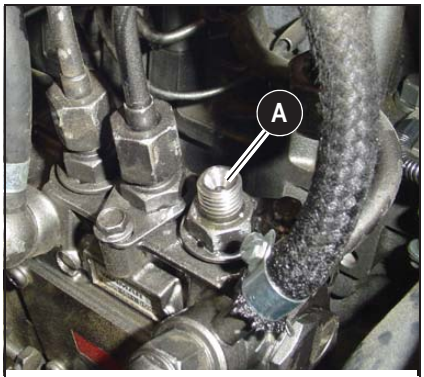


Fig. 8: Opening on fuel pump

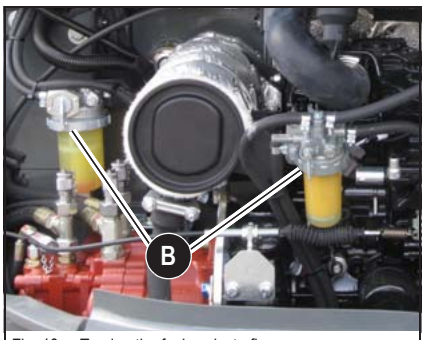


Fig. 10: Turning the fuel cocks to flow

Marks (standard specification) on the flywheel:

- **6/A** top dead centre with corresponding cylinder number
- **6/B** 15° before top dead centre
- **6/C** 20° before top dead centre
- **6/D** 25° before top dead centre
- **6/E** direction of rotation

☞ *Turn until mark **7/G** on the ring gear for cylinder 1 is visible and at the same level as mark **7/F** on the flywheel housing*

➥ Rated injection point 16° before top dead centre (+/- 1°)

☞ *Mark the (rated) injection point on the flywheel housing and ring gear*

Measurement:

☞ *Slacken the high-pressure fuel injection lines of cylinder 1 and push to one side*

➥ The opening of injection pump **A** must be visible

☞ *Open all fuel cocks **B**, see Fig. 10*

Notice!

Fuel is pumped to the cylinder only every second turn of the crankshaft; for this reason it may be necessary to turn the crankshaft twice.

☞ *An auxiliary means (fuel injection line with a transparent pipe) can be mounted on the fuel injection line for precise observation – see Fig. 10*

➥ This auxiliary means is not essential

☞ *Position a spanner on the screw of the pulley (on the crankshaft)*

➥ Or turn the ring gear on the flywheel with a screwdriver

☞ *Slowly turn clockwise until fuel is discharged from the opening of injection pump **A***

Fig. 11: Measuring equipment

☞ *Then slowly turn back approximately two more rotations until about 20° before top dead centre.*

☞ *Remove any bubbles at the opening of the injection pump with your finger so that the opening of the injection pump is about half full with fuel*

☞ *Slowly keep turning the crankshaft clockwise until the fuel level rises to the opening of injection pump **A***

☞ *Stop the rotary motion immediately*

☞ *Read the degrees before top dead centre by means of the indentation on the flywheel*

➥ Rated value: 16° +/- 1° before top dead centre – *see Marks on flywheel* on page 4-10

☞ *Measure the injection time two to three times*

➥ If the specified value is reached, the injection time is correct

☞ *Refit the fuel injection line, cutoff solenoid and cap*

☞ *Check the fuel system for leaks*

➥ If the value varies from the specified value, the injection time must be adjusted

Notice!

Bend the injection lines as you mount them so they are not subject to tension once they are mounted. Bleed the injection lines once they are installed.

Setting injection time

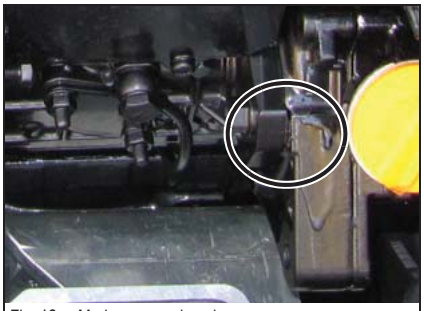


Fig. 12: Mark on pump housing

Variations of the injection time outside the tolerance range can be corrected by turning the fuel injection pump.

➥ The injection time must be measured to determine whether it is premature or too late – *see Marks on flywheel* on page 4-10

☞ *Mark the original position of the injection pump on the pump and gear casing – see Fig. 12*

☞ *Remove all injection lines on the fuel injection pump and slacken the 4 flange screws by about ½ a revolution (do not unscrew completely)*

☞ *Swivel the pump in the required direction and retighten the screws*

➥ Rotated away from the engine: earlier injection time

➥ Rotated towards the engine: later injection time

☞ *Bend each of the injection lines before you mount them so they are not subject to tension once they are mounted*

☞ *Check the injection time again – see Checking injection time on page 4-9*

Notice!

Bend the injection lines as you mount them so they are not subject to tension once they are mounted. Bleed the injection lines once they are installed.

4.9 Removing and installing the injection pump

Removing the injection pump

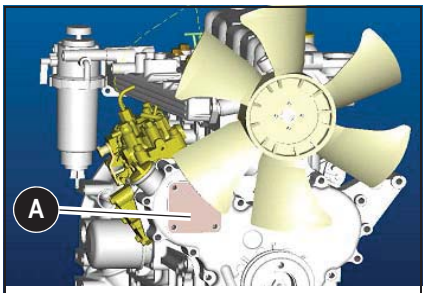


Fig. 13: Gear casing cover

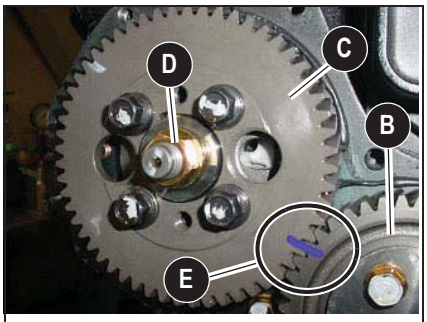


Fig. 14: Gear casing mark

☞ *Mark the original position of the injection pump on the pump and gear casing – see Mark on pump housing on page 4-11*

☞ *Shut off the fuel supply (fuel cock), clean the area of the injection pump and have a container ready to collect any leaked fuel*

☞ *Remove the fuel injection lines, fuel and leak oil lines*

➥ Close any open connections to prevent soiling and to minimise leakage

☞ *Unhook the Bowden cable on the injection pump and remove the cutoff solenoid*

*Remove cover **A** of the injection pump on the gear casing*

➥ Cover **A** is mounted with sealant, therefore separate the cover from the gear casing with a scraper

☞ *Mark position **E** of injection pump gear **C** in relation to gear position **B***

☞ *After marking, do not turn the crankshaft*

➥ Tighten the screw of the pulley with a long spanner to fix the crankshaft in place

☞ *Slacken lock nut **D** of gear **C** and unscrew until the shaft end of the injection pump*

☞ *Use an extractor to pull off/slacken gear **C** on the conical shaft*

☞ *Loosen lock nut **D** completely and remove it from the gear casing with the spring washer and gear **C***

Notice!

Gear **C** of the injection pump can be removed from the gear casing. We recommend, however, leaving gear **C** meshed with the gear **B** in the gear casing.

Notice!

Do not slacken screws ***F*** of the gear of the injection pump, as these specify the precision setting of the fuel injection pump set by the manufacturer!

➥ It is very difficult or even impossible to subsequently set the correct injection time

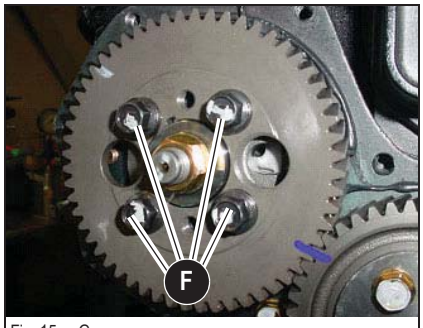


Fig. 15: Gear screws

☞ *Remove the fuel injection pump*

➥ To this purpose unscrew the three fastening screws of the injection pump

Notice!

After removing the injection pump, do not turn the crankshaft anymore

Fitting the injection pump

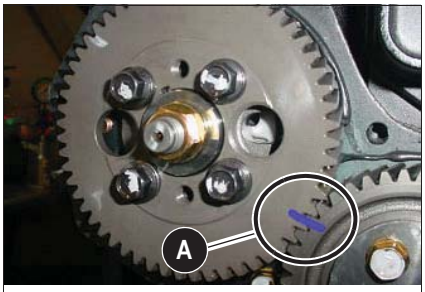


Fig. 16: Gear casing mark

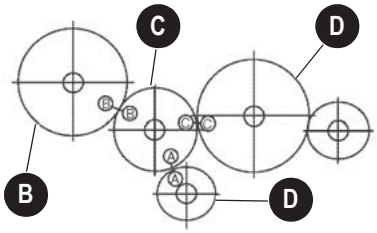


Fig. 17: Overview of mark

☞ *Check the position of the gears by means of mark **A** made during removal*

☞ *Fit a new O-ring on the flange of the injection pump with grease*

☞ *Ensure that the shaft of the injection pump is clean and dry*

☞ *The feather key on the shaft of the injection pump must be aligned with the groove in the hub and gear*

☞ *Fit the injection pump and tighten the securing screws hand tight*

If the injection pump is installed in a diesel engine in which the gear casing was also removed, alignment is possible by means of the marks on the gears of the injection pump, camshaft, crankshaft and idler gear

➥ Ensure that all three marks (A, B, C) are aligned

- **B** injection pump gear
- **C** idler gear
- **D** camshaft gear
- **E** crankshaft gear

☞ *Mount the lock nut with spring washer and tighten to the correct torque*

➥ Never use oil or grease for assembly

➥ Tighten the screw of the pulley with a long spanner to fix the crankshaft in place

☞ *Set the injection pump to the original position by means of the marks on the gear casing and injection pump housing made during removal – see Fig. 12*

Notice!

If a new injection pump is fitted, the mark on the injection pump housing made at the factory is used and must align with the mark on the gear casing.

☞ *Tighten the fastening screws of the injection pump to the correct torque*

☞ *Fit the fuel lines back on again*

☞ *Hook up the Bowden cable again and fit the cutoff solenoid*

☞ *If a new or newly calibrated injection pump is fitted, the injection time must be checked before all components have been fitted*

➥ It is not absolutely necessary to check the original injection pump, but this is recommended – *see Checking injection time* on page 4-9

☞ *Fit the cover of the injection pump on the gear casing and tighten the screws*

➥ Apply sealing compound to the sealing surface

☞ *Fit the fuel injection lines back on again*

Notice!

If a new or newly calibrated injection pump is fitted, at least 0.15 – 0.20 l (0.04 – 0.05 gal) of new, clean engine oil must be filled through the top rear plug of the governor

☞ *Bleeding the fuel system*

☞ *Start the engine and check for any fuel or engine oil leaks*

4.10 Measuring and adjusting the engine speed

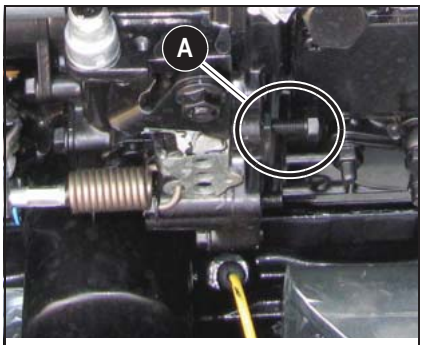


Fig. 18: Adjusting engine speed

Measuring the engine speed

The engine speed can be quickly and simply determined with a tachometer

☞ *Measurement on the crankshaft disc or on the ring gear*

☞ *A manual tachometer Fig. 18 can be obtained from a Wacker Neuson workshop*

Notice!

The maximum engine speed is set and sealed by the manufacturer without the pump and may not be modified!

Fig. 19: Manual tachometer

Adjusting engine speed

Only the idling speed can be adjusted

☞ *Adjust engine speed without load!*

☞ *Run the diesel engine until it reaches operating temperature*

☞ *Check idling speed and maximum engine speed with all attachment functions in neutral*

➥ Idling speed: 1300 +/- 25 rpm

➥ Max. engine speed: 2375 +/- 25 rpm

☞ *In the event of deviation, correct the idling speed by means of the idling speed set screw **A***

4.11 Compression

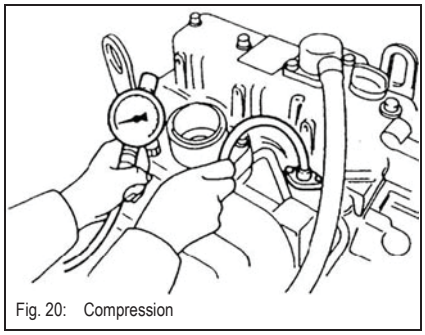


Fig. 20: Compression

☞ *Clean the engine*

☞ *Run the diesel engine until it reaches operating temperature*

☞ *Remove the injection lines and the injection nozzles*

☞ *Set the injection pump to zero delivery*

➥ Remove the connector for the cutoff solenoid

☞ *Turn the engine before attaching the compression gauge*

➥ The remaining fuel is ejected

☞ *Attach the compression gauge to the respective cylinder with a sealing ring*

☞ *Turn the diesel engine with the starter and read off the pressure on the pressure gauge, repeat until the reading is stable*

➥ Specified value: **34.3 +/- 1 bar (498 psi +/- 15) at 250 rpm**

➥ Threshold value: **27.5 +/- 1 bar (399 psi +/- 15) at 250 rpm**

4.12 Checking the coolant thermostat

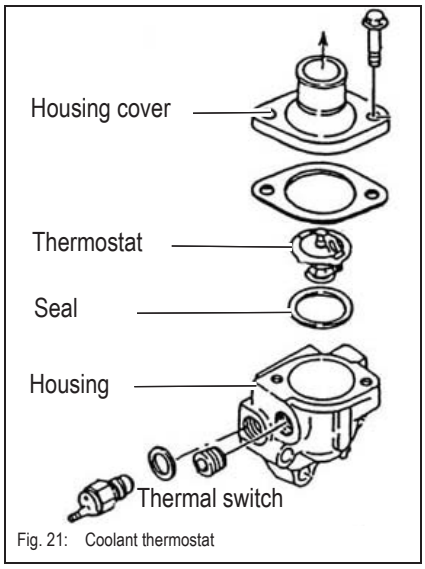


Fig. 21: Coolant thermostat

☞ The thermostat is located on the water pump – *see Cooling system on page 4-5*

☞ *Remove the thermostat*

☞ Drain the coolant

☞ Remove the coolant hose

☞ Unscrew the housing cover from the thermostat

➥ Remove the thermostat

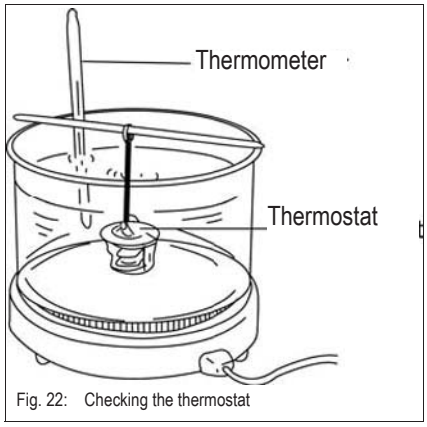


Fig. 22: Checking the thermostat

☞ *Warm up the thermostat in a container with water*

☞ *Check whether the thermostat opens at the specified temperature (check with a temperature gauge)*

➥ Thermostat opening temperature: **70 – 73 °C (158 – 163 °F)**

4.13 Checking the thermal switch

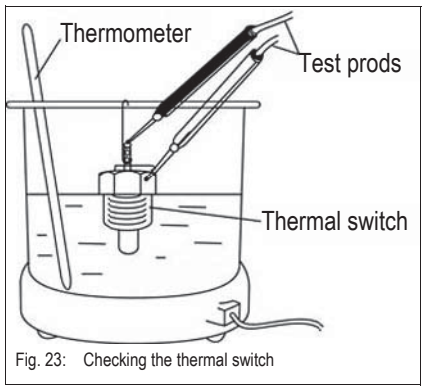


Fig. 23: Checking the thermal switch

☞ *Drain the coolant*

☞ *Remove the thermal switch*

☞ *Warm up the thermal switch in a container with antifreeze*

☞ *Measure the resistance of the thermal switch as shown by means of an ohmmeter.*

➥ The switch must allow the coolant to pass at a temperature of 107 – 113 °C (225 – 235 °F)

4.14 Oil pressure switch

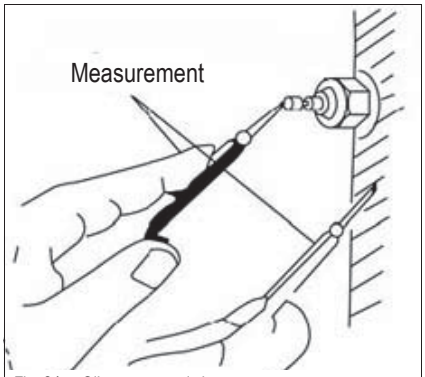


Fig. 24: Oil pressure switch

☞ *Remove the cable connection from the oil pressure switch (in the area of the cutoff solenoid)*

☞ *Start the engine, check for correct idling speed*

☞ *Measure the resistance of the oil pressure switch as shown by means of an ohmmeter.*

➥ Oil pressure switch OK: infinite resistance

➥ The oil pressure switch is defective if the oil can pass

The oil pressure can also be measured with a mechanical dial gauge

☞ *Remove the oil pressure switch and replace with the dial gauge*

☞ *Start the diesel engine and measure the oil pressure*

➥ Replace the oil pressure switch if defective or determine the cause for insufficient oil pressure

4.15 Checking the coolant circuit

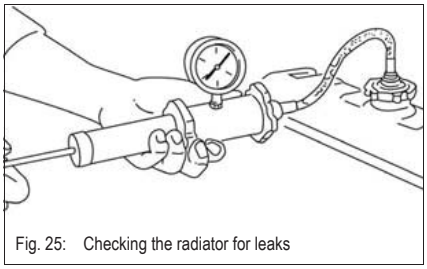


Fig. 25: Checking the radiator for leaks

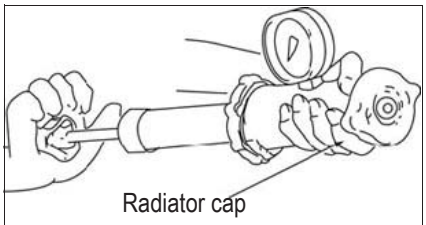


Fig. 26: Checking the radiator cap

Leakage check

☞ *Fill up the radiator completely*

☞ *Mount an adapter on the radiator as shown*

☞ *Increase the pressure in the cooling system by means of a hand pump to about **1 bar (15 psi)***

➥ Check the lines and the connections for leaks if the pressure drops at the pressure gauge

Checking the radiator cap

☞ *Remove the radiator cap and mount it onto the adapter as shown*

☞ *Increase the pressure to about **1 bar (15 psi)** (stamped onto the radiator cap) with the hand pump*

➥ The radiator cap must open within this pressure range

4.16 Cleaning the cooling water channels

☞ *Drain the coolant – see chapter Draining coolant on page 3-23*

☞ *Fill the cooling circuit with water*

☞ *Let the engine run at idling speed for about 5 – 10 minutes*

☞ *Drain the water from the cooling circuit again*

☞ *Refill the coolant – see chapter Checking/filling up coolant on page 3-22*

4.17 Coolant and fuel hoses

☞ *Check the coolant and fuel hoses regularly to ensure that they are not kinked, cracked or damaged*

➥ Renew coolant and fuel hoses every 2 years

4.18 Crankcase vent

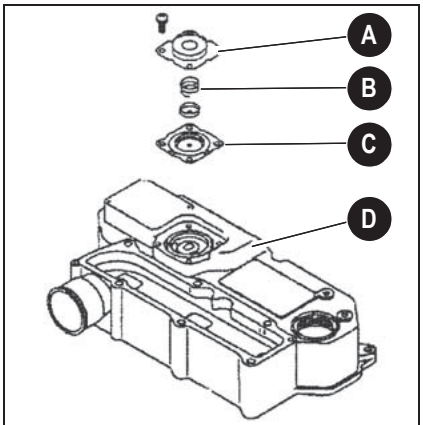


Fig. 27: Diaphragm valve cover

Venting system by means of a spring-loaded diaphragm **C** on the valve cover **D**

➥ If the specified value is exceeded, a connection is opened between the crankcase and the intake manifold

☞ *Unscrew the fastening screws of the cover*

☞ *Remove cover **A**, spring **B** and diaphragm **C***

☞ *Check diaphragm **C** for cracks and spring **B** for deformation*

➥ If necessary, replace the parts

➥ Defective parts result in inadequate monitoring of the crankcase pressure and possible damage

☞ *Install the parts in reverse order*

4.19 Replacing the glow plugs

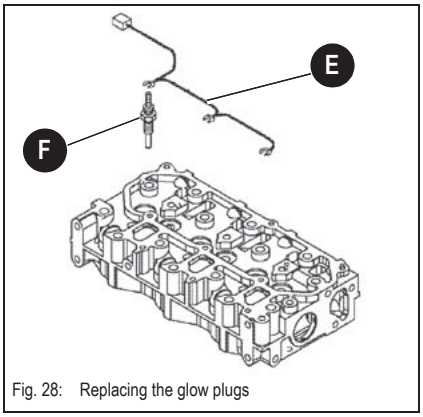


Fig. 28: Replacing the glow plugs

Removing the glow plugs

☞ *Unscrew the fastening screws of valve cover **D**, see Fig. 27*

☞ *Remove the valve cover and the gasket*

☞ *Remove wiring harness **E** from the glow plugs*

➥ To this purpose slacken the nuts on glow plugs **F**

☞ *Unscrew glow plugs **F** from the cylinder head*

Installing the glow plugs

☞ *Screw the glow plugs into the cylinder head*

➥ Tightening torque: 14.7 – 19.6 Nm (11 – 15 lbs/ft)

☞ *Refit the wiring harness and tighten the nuts*

☞ *Lightly grease and fit the new valve cover gasket*

☞ *Fit the valve cover and tighten the fastening screws*

4.20 Engine trouble

Problem	Possible causes
Engine does not start or is not easy to start	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
	Defective starting relay
	Defective glow plug
	Defective solenoid switch
	Defective fuse
	Dirty fuel filter
	Very dirty air filter
	Cutoff solenoid does not attract
	High pressure created immediately in the hydraulic system
	Air in fuel system
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
	Dirty fuel filter
	Air in fuel system
Engine overheats. Temperature warning system responds	Lube oil level too low
	Lube oil level too high
	Dirty air filter
	Dirty radiator fins
	Defective fan, torn or loose V-belt
	Resistance in cooling system too high, flow capacity too low
	Defective fuel injector
	Not enough coolant
	Defective coolant pump
	Cooling system leaks

Problem		Possible causes
Insufficient engine output		Lube oil level too high
		Fuel grade does not comply with specifications
		Dirty fuel filter
		Dirty air filter
		Defective air filter maintenance switch or gauge
		Wrong valve clearance
		Injection line leaks
		Defective fuel injector
		Air in fuel system
Engine does not run on all cylinders		Injection line leaks
		Defective fuel injector/injection pump
Insufficient or no engine oil pressure		Lube oil level too low
		Machine inclination too high
		Wrong SAE grade of engine lubrication oil
Engine oil consumption too high		Lube oil level too high
		Machine inclination too high
		Wrong SAE grade of engine lubrication oil
		Worn oil scraper rings
Engine smoke	Blue	Lube oil level too high
		Machine inclination too high
		Engine oil combustion (defective cylinder-head gasket)
		Wrong SAE grade of engine lubrication oil
		Worn oil scraper rings
	White	Engine starting temperature too low
		Fuel grade does not comply with specifications
		Defective fuel injector
		Exteme misalignment of injection time
		Coolant combustion (defective cylinder-head gasket)
	Black	Dirty air filter
		Defective air filter maintenance switch or gauge
		Defective fuel injector (drips)
		Wrong fuel injection pump setting
		Wrong valve clearance
		Dirty injection nozzle

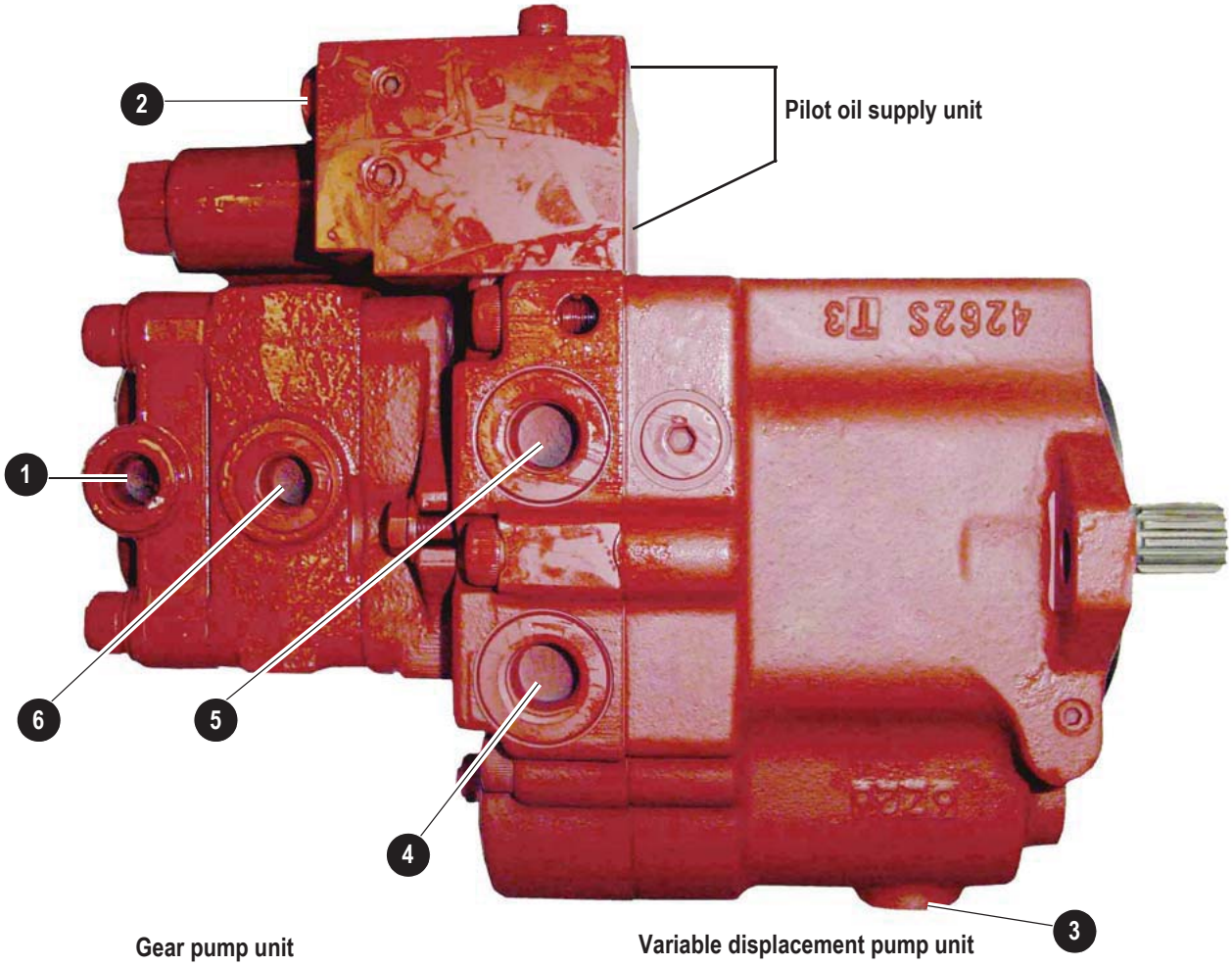
Hydraulic system

5 Hydraulic system

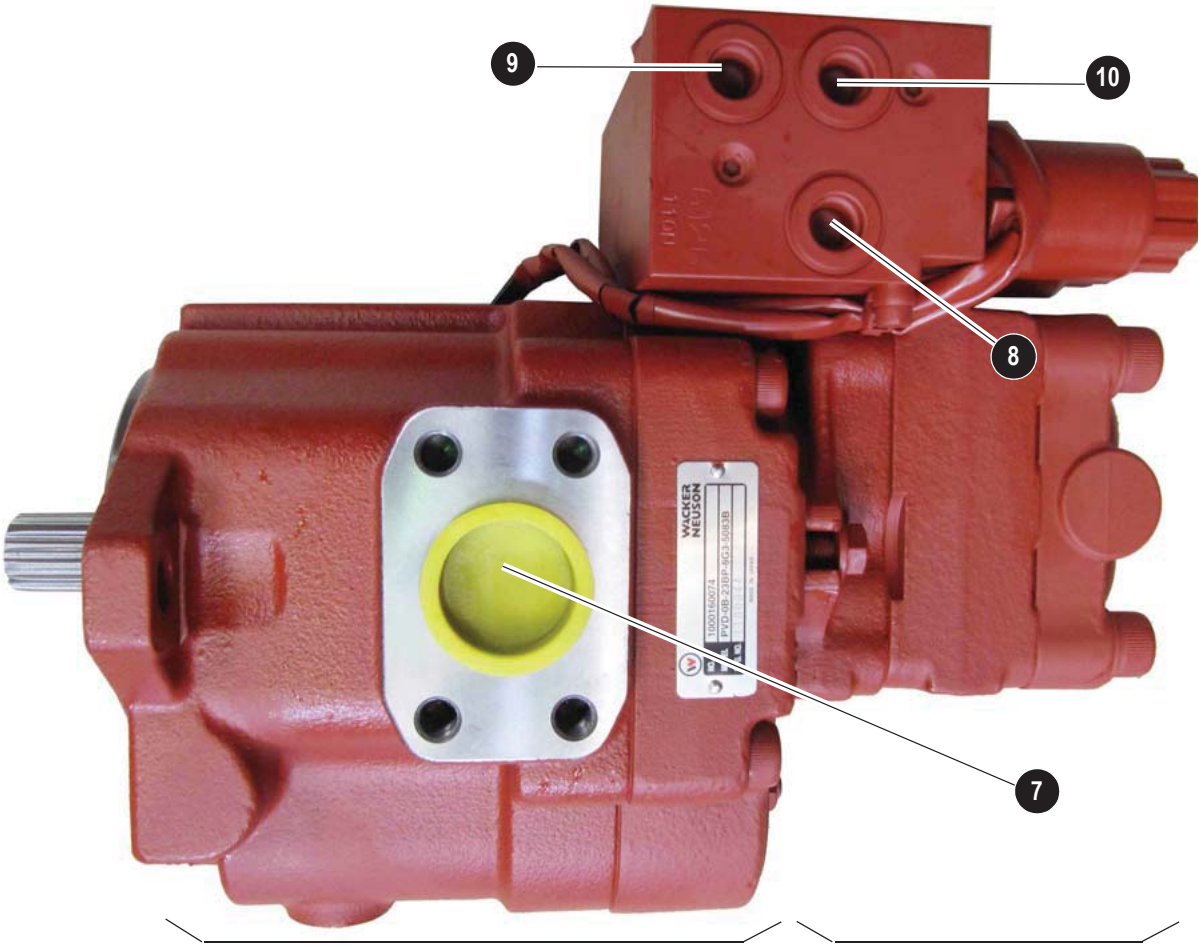
The hydraulic system is governed by a throttle

5.1 Hydraulic pump PVD-0B-23BP-8G3-5083A

Double variable displacement pump + 2 gear pumps

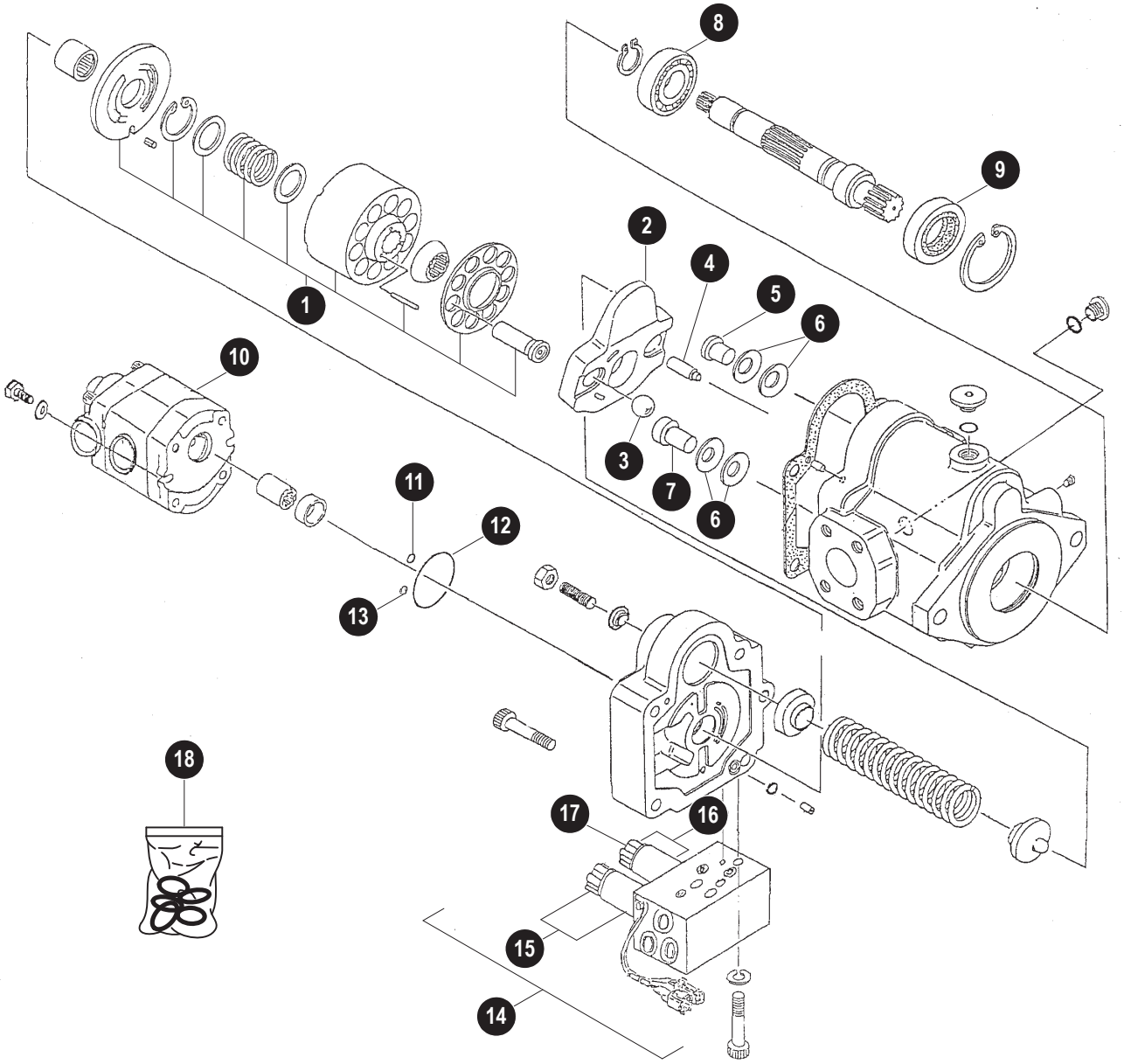


Pos.	Designation
1	Port P4
2	Pressure reducing valve
3	Bleed screw
4	Port P2
5	Port P1
6	Port P3



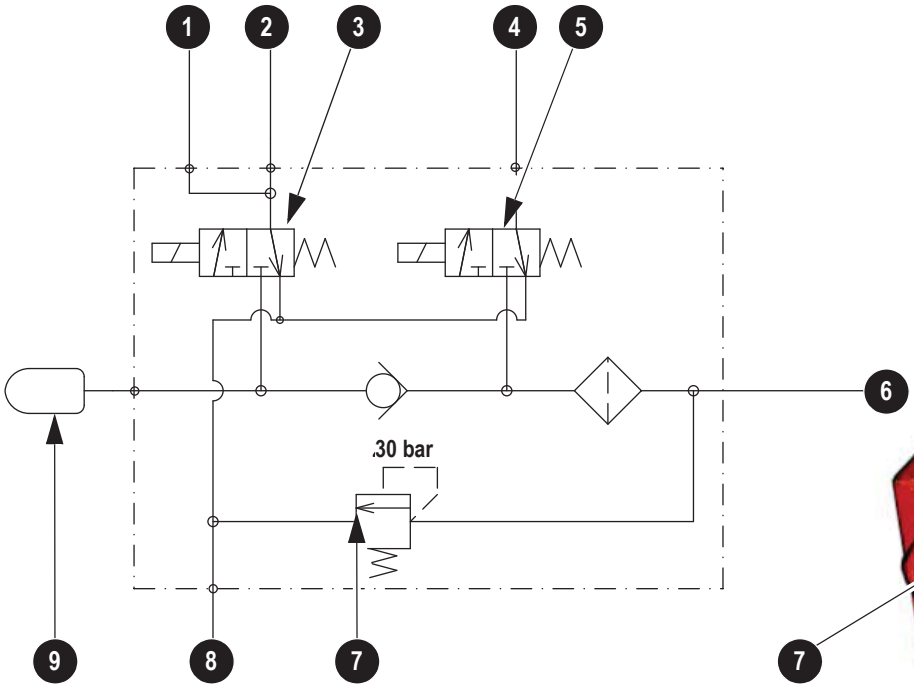
Pos.	Designation
7	Suction line Port
8	Port PB1 (gear motor supply)
9	Port PA (2nd speed range)
10	Port PB2 (pilot valve supply)

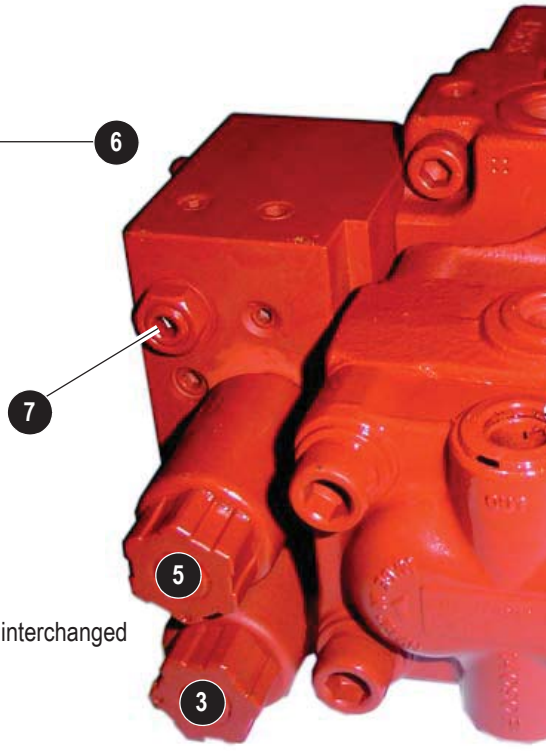
Pump unit: exploded view



Pos.	Designation	Pos.	Designation
1	Drive unit	11	O-ring
2	Swash plate	12	O-ring
3	Ball	13	O-ring
4	Stop stud	14	Pilot oil supply unit
5	Stop pin	15	Solenoid switch
6	Spring	16	Solenoid switch
7	Stop pin	17	Fastening screw
8	Grooved ball bearing	18	Variable displacement pump sealing kit
9	Rotary shaft lip seal		
10	Gear pump		

Pilot oil supply unit





Both valves can be interchanged

Pos.	Designation	Port
1	Gear motor supply	PB1
2	Pilot valve supply	PB2
3	Solenoid valve for safety valve	
4	Drives/2nd speed range supply	PA
5	2nd speed range solenoid valve	
6	Pump 4 supply	Internal to P4
7	Pressure reducing valve	
8	Tank line	
9	Accumulator	

Dismantling the hydraulic pump

It is assumed that the hydraulic pump is only dismantled by staff who understand its internal construction.

Notice!

The seals and O-rings are probably damaged during dismantling and are therefore unusable. Ensure that spare parts are ready for installation.

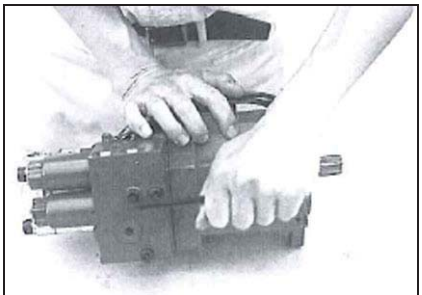


Fig. 1: Removing the pilot oil supply unit

☞ *Drain the oil, clean the pump and place on a clean rubber mat on a work bench*

☞ *Unscrew the hexagon socket screws (3 x) and remove the pilot oil supply unit*

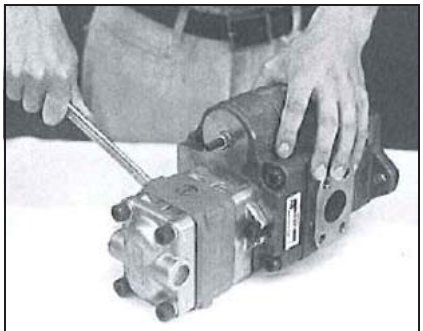


Fig. 2: Removing the gear pump

☞ *Unscrew the hexagon head screws (2 x) and remove the gear pump and coupling with the ring*

➥ The coupling and ring are located either on the gear pump or variable displacement pump

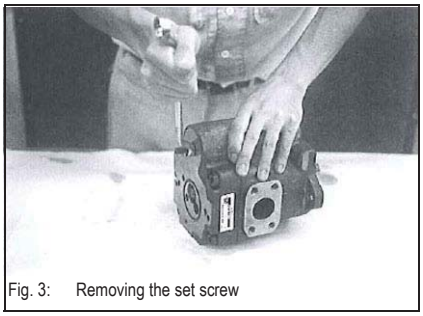


Fig. 3: Removing the set screw

☞ *Mark or measure the setting of the set screw and note*

➥ Makes it easier to restore the correct pump setting

☞ *Slacken the locknut and unscrew the set screw with an Allen key*

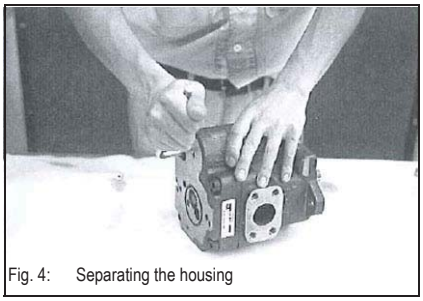


Fig. 4: Separating the housing

☞ *Unscrew the hexagon socket screws (5 x) and separate the pump housing*

➥ The housing can be separated more easily by tapping the housing with the inside spring lightly by means of a rubber hammer

☞ *Remove the intermediate seal*

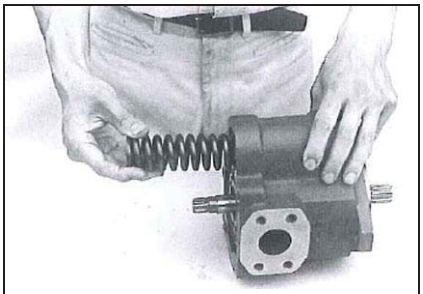


Fig. 5: Remove the spring

☞ *Remove the spring and the underlying spring centring mechanism*

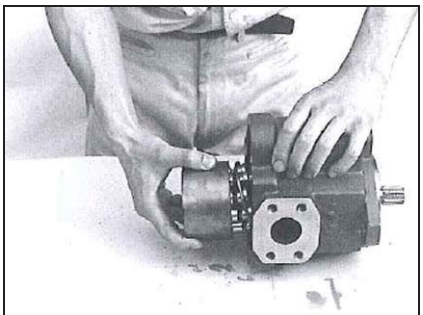


Fig. 6: Pulling out the drive unit

☞ *Pull the drive unit out of the pump*

➥ Hold the mounting plate with the pistons

☞ *Remove the underlying cradle from the pump*

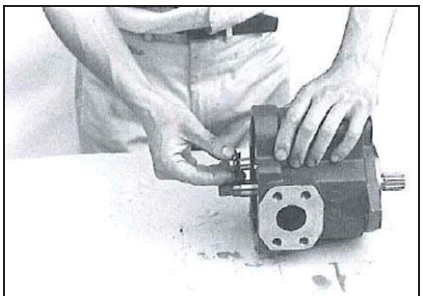


Fig. 7: Removing the stop stud

☞ *Remove the piston and stop studs with the spring seats from the pump*

➥ The length of the stop studs varies, note the correct position

➥ Also note the number and position of the spring seats

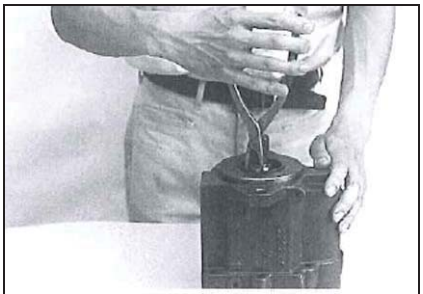


Fig. 8: Removing the circlip

☞ *Remove the circlip with circlip pliers*

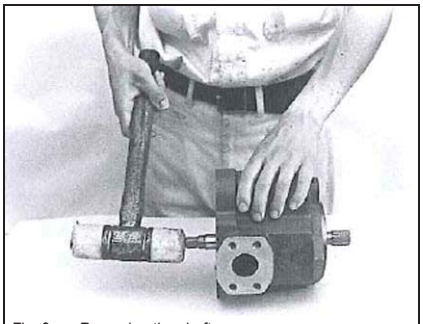


Fig. 9: Removing the shaft

☞ *Knock the shaft out of the housing by tapping lightly with a rubber hammer*

➥ The rotary shaft lip seal and the grooved ball bearing are also loosened at the same time and can be removed

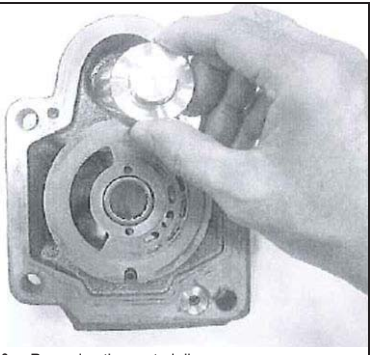


Fig. 10: Removing the control disc

☞ *Remove the guide of the spring and the control disc from the housing*

Fig. 11: Dismantling the drive unit

☞ *Pull the mounting plate with the piston shoes and cylinders out of the cylinder housing*

Fig. 12: Dismantling the drive unit

☞ *Remove the centring mechanism and pins one after another*

☞ *Remove the circlip, thrust washers and spring from the cylinder housing*

Assembling the hydraulic pump

Before assembly thoroughly clean the parts with clean oil to prevent dirt and water from accumulating in the parts and to provide lubrication during assembly.

Apply a thin layer of grease to the O-ring surface to secure it in the grooves provided.

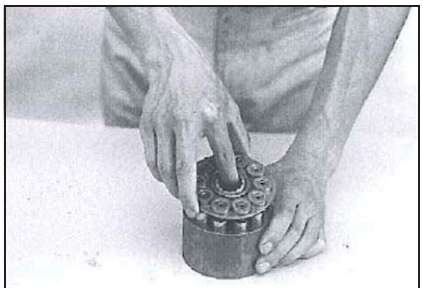


Fig. 13: Assembling the drive unit

☞ *Assemble the pump in the reverse order of dismantling*

☞ *Insert the thrust washers and spring into the cylinder housing and secure in place in the housing with the circlip*

☞ *Insert the pins into the cylinder housing on the opposite side, see Fig. 12 and place the centring mechanism on it*

☞ *Insert the mounting plate with the piston shoes and cylinders into the cylinder housing*

Fig. 14: Fitting the shaft

☞ *Fit the shaft, grooved ball bearing, rotary shaft lip seal and circlip into the housing in this order*

➥ Use a new rotary shaft lip seal and apply a thin layer of lubricant to the surface of the sealing lips before assembly

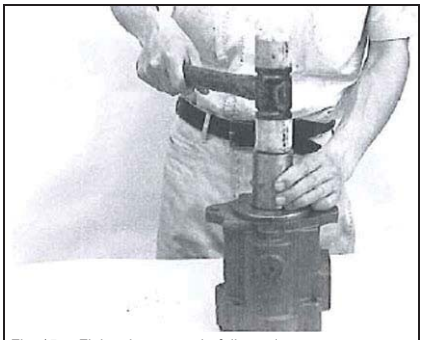


Fig. 15: Fitting the rotary shaft lip seal

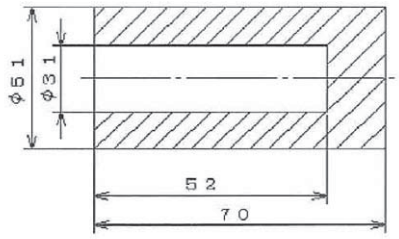


Fig. 16: Auxiliary tool

☞ *Fit with auxiliary tool Fig. 16 while tapping lightly with a rubber hammer*

➥ For easier installation place the housing on the counterpart

☞ *Secure the shaft with the circlip*

☞ *Assemble the stop studs and spring seats (2 x) and then insert them into the pump housing*

➥ Ensure that the stop studs and spring seats are correctly positioned

➥ The stop studs have various lengths and must be fitted in the original position, otherwise the tilting angle is changed.

➥ Insufficient output and engine droop would result

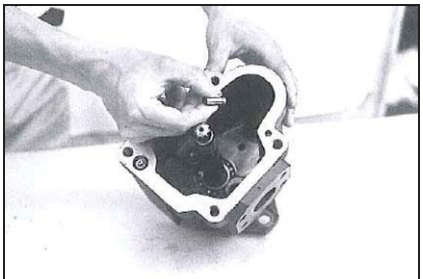


Fig. 17: Inserting the piston

☞ *Insert the piston into the housing*

➥ Ensure the correct installation position

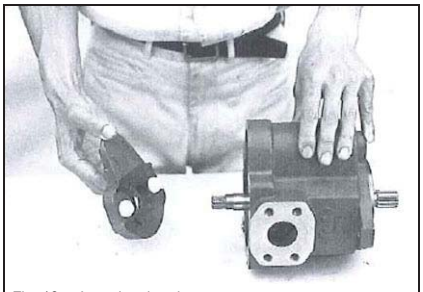


Fig. 18: Inserting the piston

☞ *Place the balls into the corresponding holes in the cradle*

➥ Use grease if the balls do not remain in position in the cradle

☞ *Insert the cradle with the two balls into the pump housing*

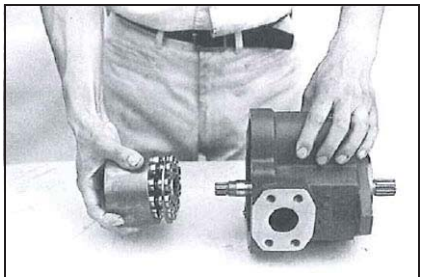


Fig. 19: Fitting the drive unit

☞ *Fit the complete drive unit into the pump housing*

☞ *Insert the spring centring mechanism and spring into the opening provided in the cradle in the pump housing*

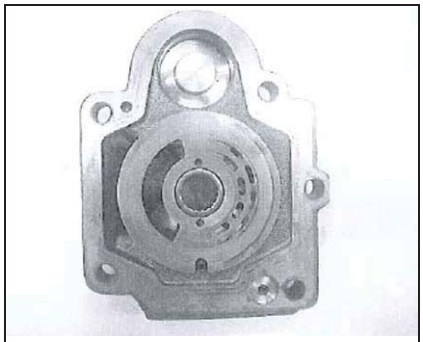


Fig. 20: Fitting the control disc

☞ *Insert the spring guide into the housing*

☞ *Carefully insert the control disc into the housing and centre in the housing with the straight pin*

➥ Ensure the correct installation position

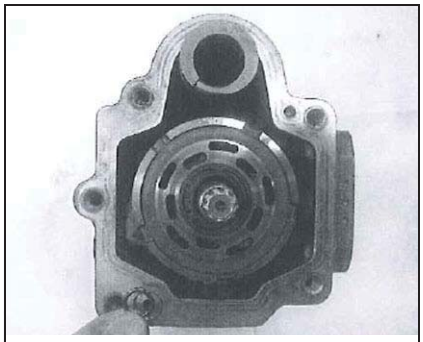


Fig. 21: Inserting the O-ring

☞ *Insert the O-rings on both housing sections*

➥ Use new O-rings

☞ *Position the guides correctly*

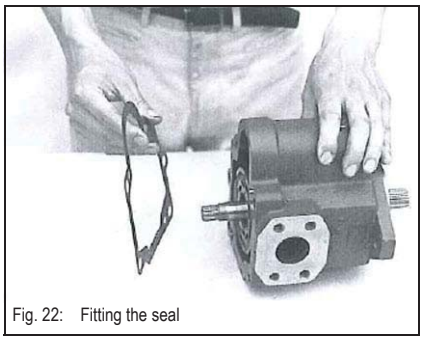


Fig. 22: Fitting the seal

☞ *Fit the seal and align with the parallel pin of the housing*

➥ Use a new seal

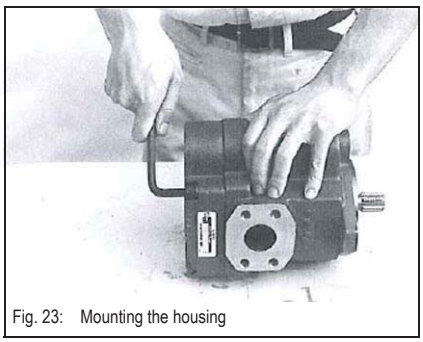


Fig. 23: Mounting the housing

☞ *Place both housing sections together*

☞ *Insert two screws (M10x65) on the top side and tighten until a 5 – 10 mm (0.2 – 0.4”) space is left between both housing sections*

☞ *Fit three screws into the other threaded holes and screw tight*

☞ *Replace the two upper screws (M10x65) with the two remaining original screws and tighten*

➥ Tightening torque 51.0 – 64.7 Nm (37.6 – 47.7 lbs/ft)

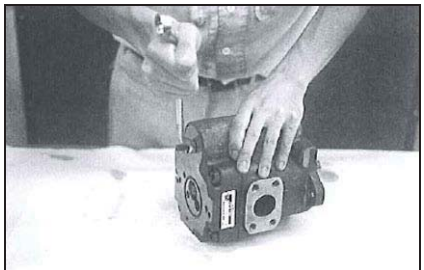


Fig. 24: Fitting the set screw

☞ *Fit the set screw and sealing washer with an Allen key*

➥ Use a new sealing washer

☞ *Restore the original setting of the set screw in accordance with the mark made during dismantling*

➥ Non-compliance with the original setting results in engine droop

☞ *Then secure the set screw with the locknut*

➥ Tightening torque 14.7 – 19.6 Nm (10.8 – 14.5 lbs/ft)

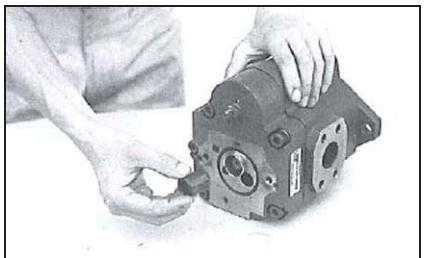


Fig. 25: Mounting the coupling

☞ *Fit the O-rings on the housing on the gear pump side*

➥ Use new O-rings

☞ *Fit the coupling and ring into the housing*

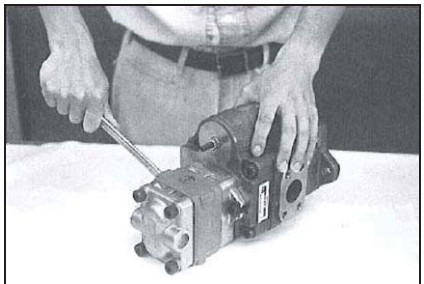


Fig. 26: Mounting the gear pump

☞ *Fit the gear pump and screw tight with the two fastening screws and washers*

➥ Tightening torque 19.6 – 23.5 Nm (14.5 – 17.3 lbs/ft)

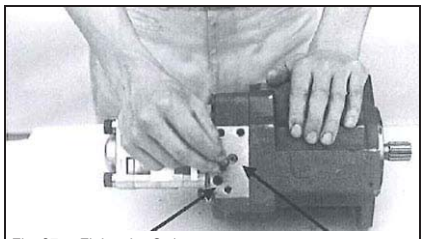


Fig. 27: Fitting the O-rings

☞ *Fit the O-rings on the housing on the pilot oil supply unit side*

➥ Use new O-rings

Fig. 28: Fitting the pilot oil supply unit

☞ *Fit the pilot oil supply unit and screw tight with the three fastening screws and washers*

➥ Tightening torque 20.6 – 25.5 Nm (15.2 – 18.8 lbs/ft)

After completing assembly, ensure that the shaft of the hydraulic pump can be turned smoothly by hand.

Troubleshooting on the hydraulic pump

Problem	Possible causes
Diesel engine overload	Pressure setting is higher than the specification
	Incorrect setting of pump
	Damaged parts in the pump
Insufficient flow or pressure	Speed of the diesel engine too low
	Damaged parts in the pump
	Wrong coupling was fitted
Abnormal noises or vibrations	Air in the hydraulic oil
	Water in the hydraulic oil
	Intake line restricted or obstructed
	Defective piston shoe
	Wrong coupling was fitted
Oil leakage	Damaged O-ring or seal
	Plug or screw connection loose
	Leaking rotary shaft lip seal

5.2 Main valve block

Ports

Bucket

Boom

Right-hand drive

Input P1 P2

Left-hand drive

Stick

Auxiliary hydraulics

Auxiliary hydraulics flow rate adjustment segment

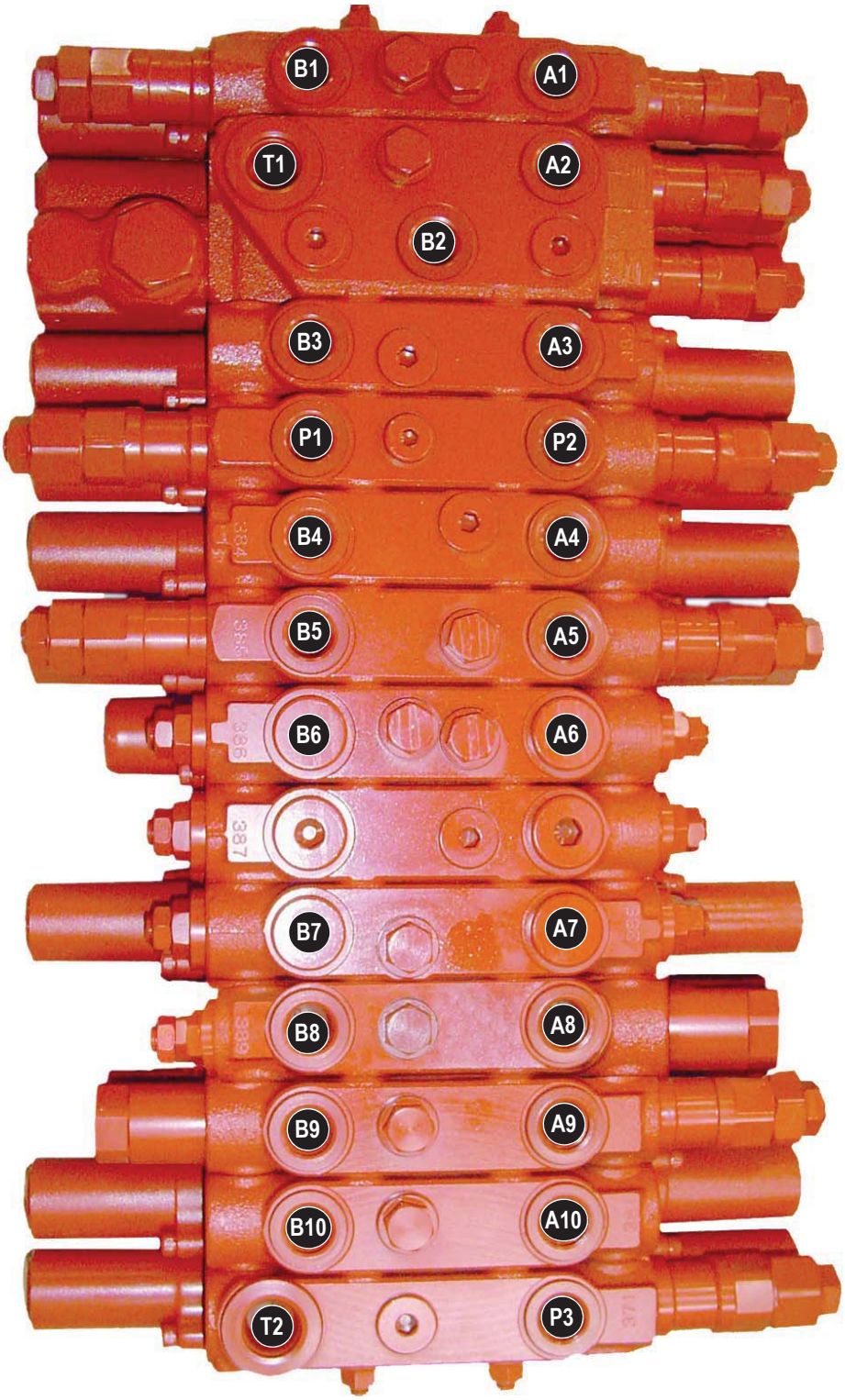
3rd control circuit (option)

Swivel boom

Stabiliser blade

Upper carriage rotation

Straight-ahead/drive counter-balancing system



Main control lines (legend)

Port	Legend
A1, B1	Bucket ram
A2, B2	Boom ram
A3, B3	Drive (right) via swivel joint
A4, B4	Drive (left) via swivel joint
A5, B5	Stick ram
A6, B6	Auxiliary hydraulics
A7, B7	3rd control circuit (option)
A8, B8	Swivel boom
A9, B9	Stabiliser blade
A10, B10	Upper carriage rotation
T2 , P3	Straight-ahead/drive counterbalancing system

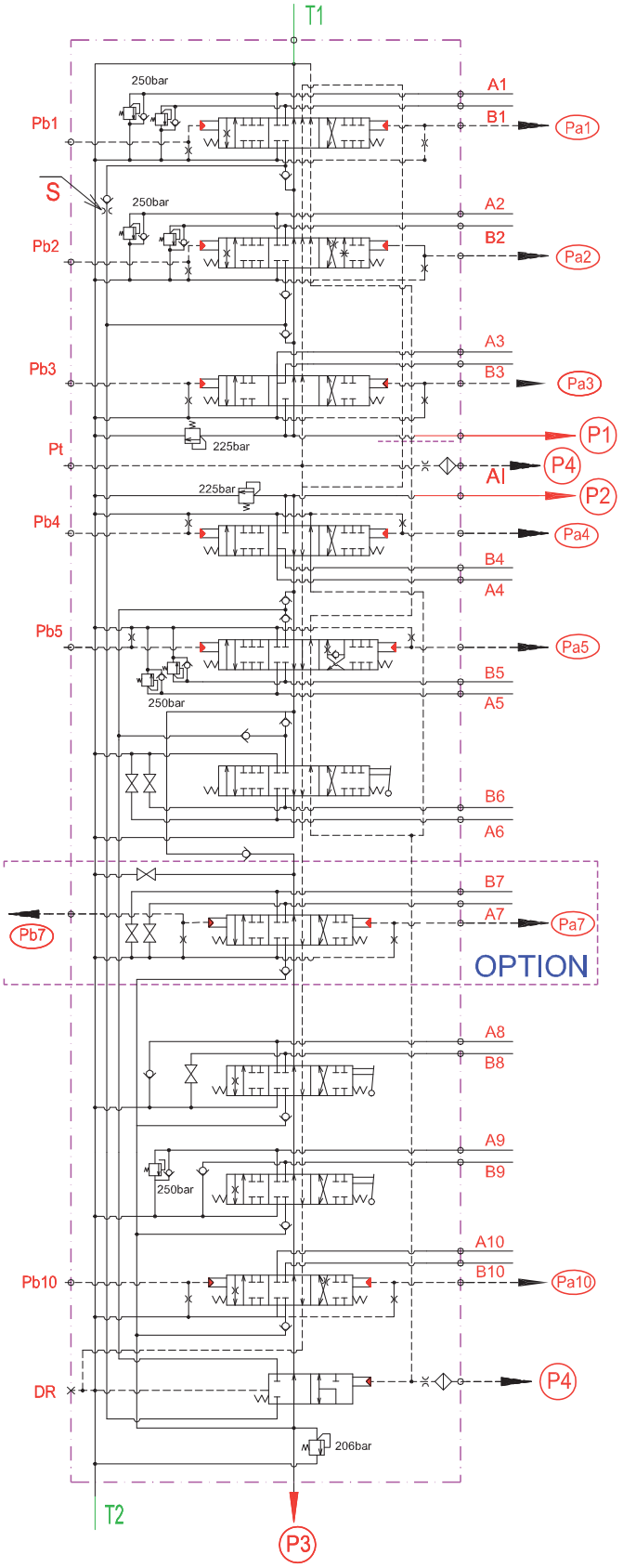
Pump/tank lines

Port	Legend
P1	Pump 1 port
P2	Pump 2 port
P3	Pump 3 port
T1	Tank line via non-return valve and filter in tank
T2	Tank line via oil cooler and filter in tank

S: bucket pre-tension

– *see Bucket pre-tension* on page 5-19

Main valve block diagram



Bucket

Boom

Right-hand drive

Input P1

Input P2

Left-hand drive

Stick

Auxiliary hydraulics

3rd control circuit

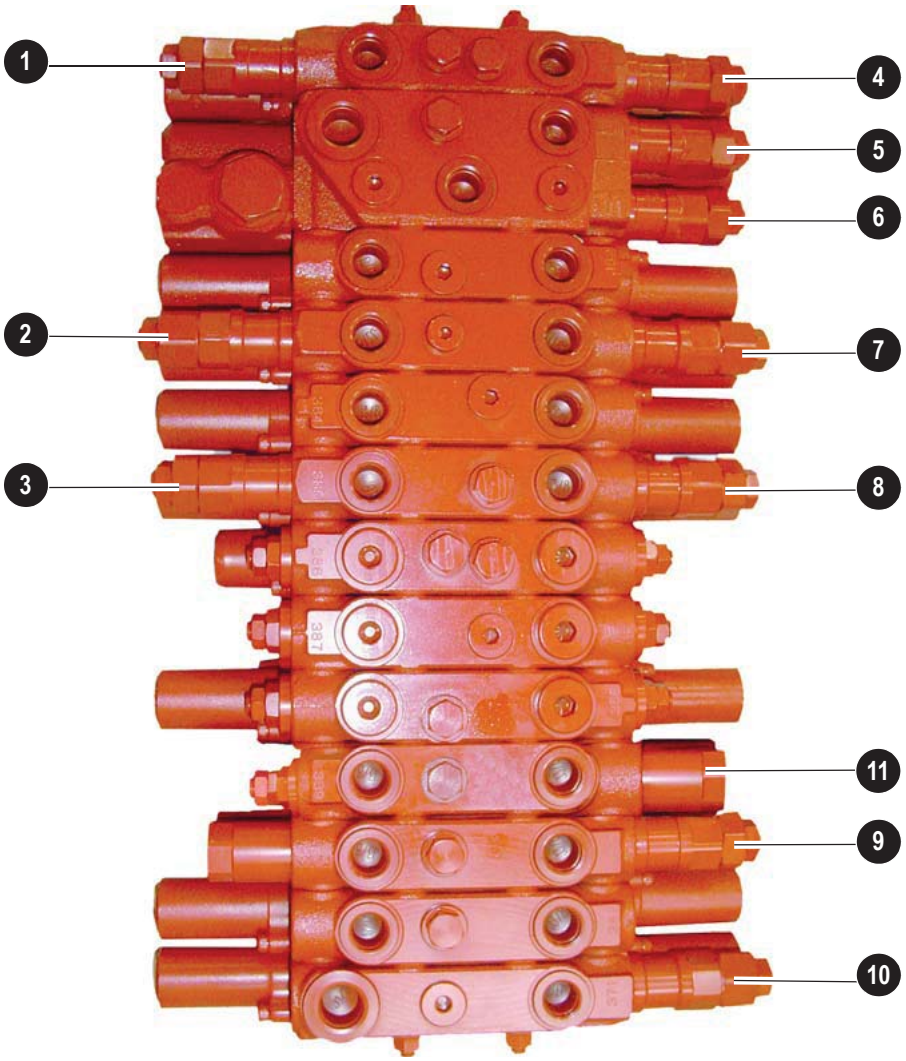
Boom swivel

Stabiliser blade

Upper carriage rotation

Drive counterbalancing system P3

Pressure limiting valves



Pos.	Designation
1	Secondary pressure limiting valve (bucket base side)
2	Primary pressure limiting valve P1
3	Secondary pressure limiting valve (stick rod side)
4	Secondary pressure limiting valve (bucket rod side)
5	Secondary pressure limiting valve (boom rod side)
6	Secondary pressure limiting valve (boom base side)
7	Primary pressure limiting valve P2
8	Secondary pressure limiting valve (stick base side)
9	Secondary pressure limiting valve (stabiliser blade base side)
10	Primary pressure limiting valve P3
11	Anticavitation valve

Pump assignment

Hydraulic supply by pump 1

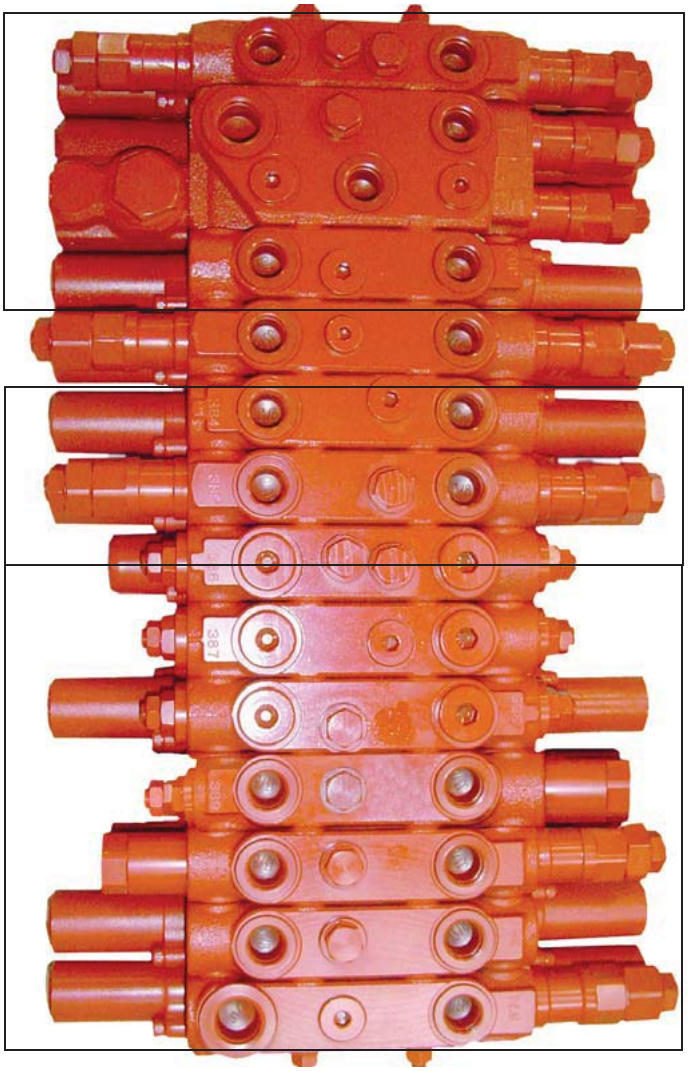
- Bucket section
- Boom section
- Right-hand drive section

Hydraulic supply by pump 2

- Left-hand drive section
- Stick section
- Auxiliary hydraulics section

Hydraulic supply by pump 3

- Auxiliary hydraulics section
- Auxiliary hydraulics flow rate adjustment segment
- 3rd control circuit (option)
- Boom swivel
- Stabiliser blade section
- Upper carriage rotation section
- Drive counterbalancing system section



5.3 Drive counterbalancing system

Without drive counterbalancing system

Actuating the boom as you drive causes the machine to leave its track!

(P1, P2 each supply a drive, and the boom function is also governed by P1 or P2)

With drive counterbalancing system

If the boom is actuated as you drive straight ahead, the machine stays in its track, but drive speed does not remain constant.

The drive counterbalancing system is activated with the left-hand side drive and a boom function (bucket, boom, stick or auxiliary hydraulics).

Function

☞ *The drive counterbalancing system is enabled by means of an increased banking-up pressure if both piston valves for driving and a boom function are activated.*

➥ P3 takes over all boom functions

Pump assignment for drive counterbalancing

Hydraulic supply by pump 1

- Right-hand drive section

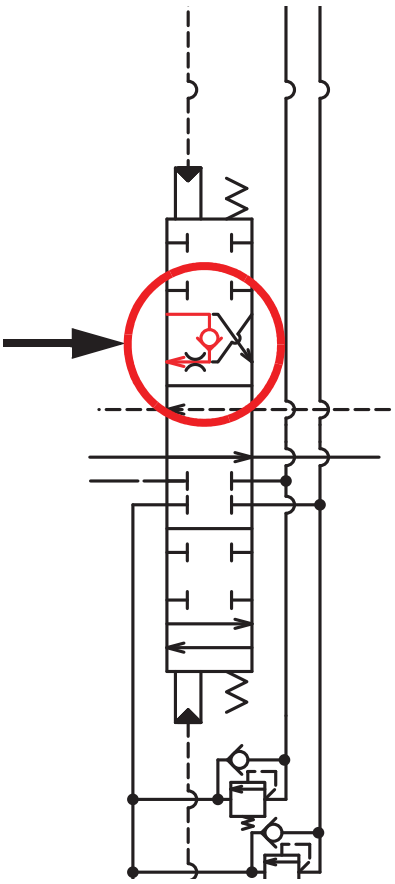
Hydraulic supply by pump 2

- Left-hand drive section

Hydraulic supply by pump 3

- Bucket section
- Boom section
- Stick section
- Auxiliary hydraulics section
- Auxiliary hydraulics flow rate adjustment segment
- 3rd control circuit section (option)
- Boom swivel
- Stabiliser blade section
- Swivel unit section
- Drive counterbalancing system section

5.4 Regeneration – stick section



Problem

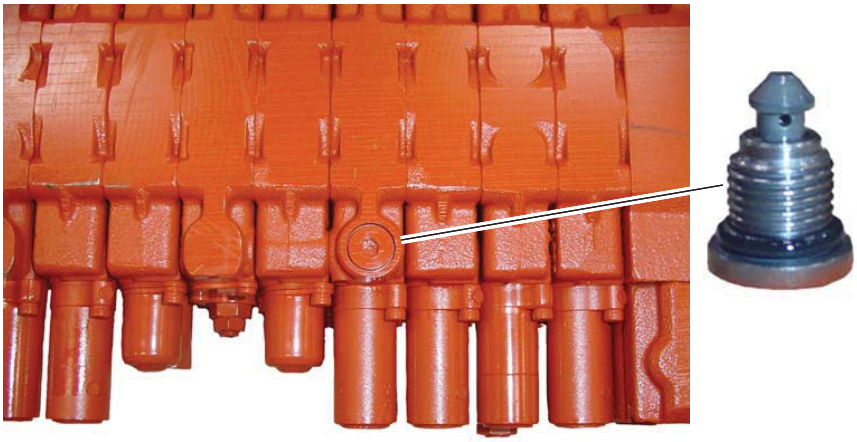
High loads on the stick can cause the stick ram to be “emptied” on the base side, which can cause the stick to stop in vertical position.

Solution

A non-return valve is integrated in the stick segment so the rod-side oil can flow to the base side.

Location

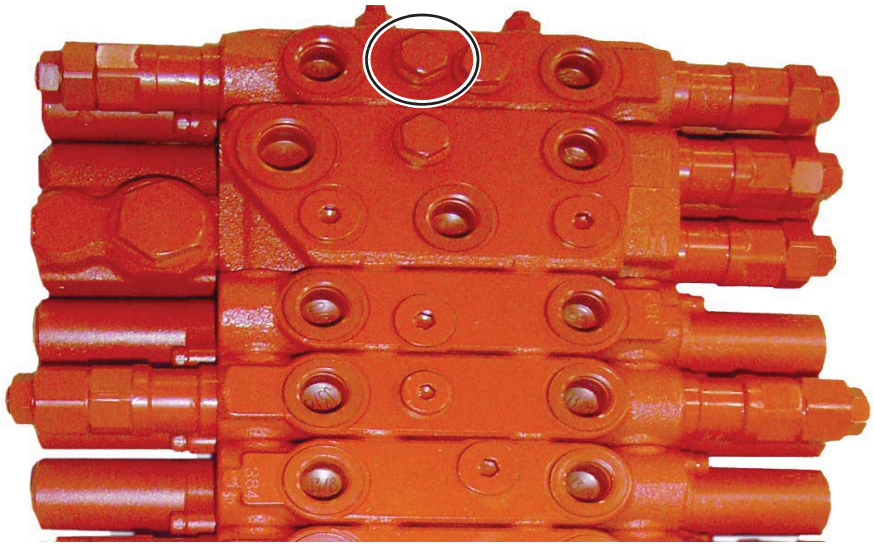
The regeneration valve is located in the stick segment on the lower side.



5.5 Bucket pre-tension

A nozzle is integrated in the pressure line of the bucket segment. If the bucket and the boom (both supplied with oil by the same pump) are actuated at the same time, both move simultaneously, and not the bucket (with its smaller mass) first, and then the boom with its larger mass
– *see* *Main valve block diagram* on page 5-15.

Location:



5.6 Auxiliary hydraulics flow rate adjustment

The available oil quantity at the auxiliary hydraulics ports can be modified by means of set screws A or B on the main valve block.

Set screw – *see Pressure limiting valves* on page 5-16

Notice!

Open both set screws to achieve the effect described below.

There are two possible positions:

Set screw "against hydraulic resistance"

The valve seat is closed in this position

- P2 + P3 supply the auxiliary hydraulics section with oil
- Factory setting

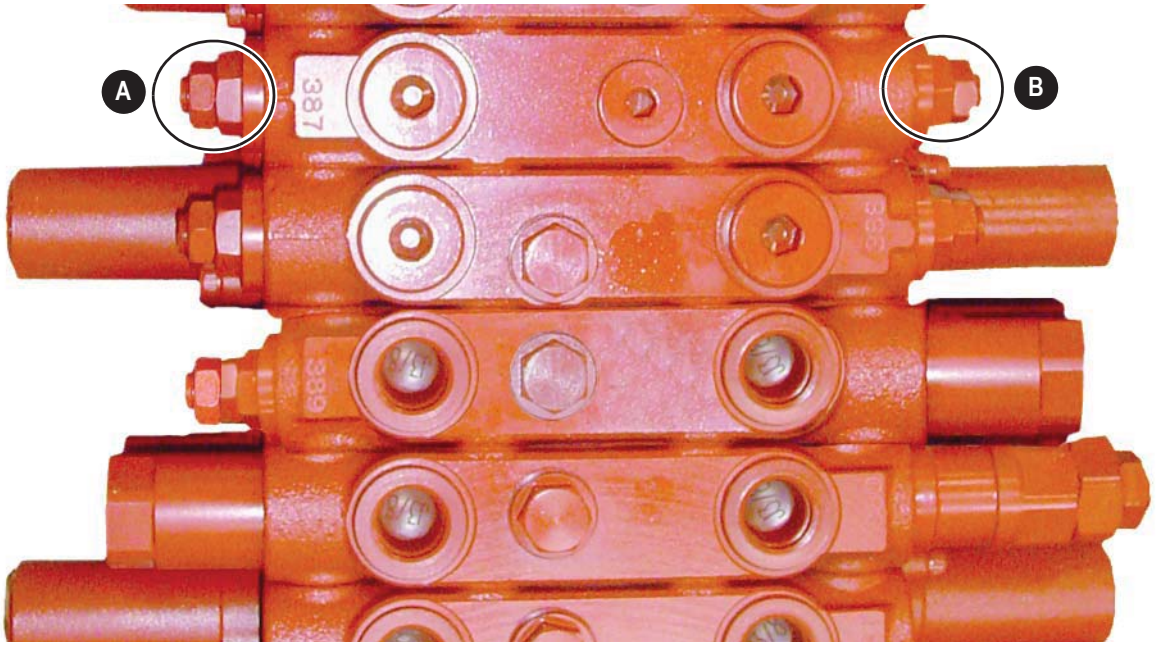
"Open" set screw

Unscrew the valve seat by at least 2 revolutions, but no more than 3, to open the valve seat completely.

- P2 supplies the auxiliary hydraulics section with oil
- The oil supplied by P3 flows to the tank via the open valve seat.

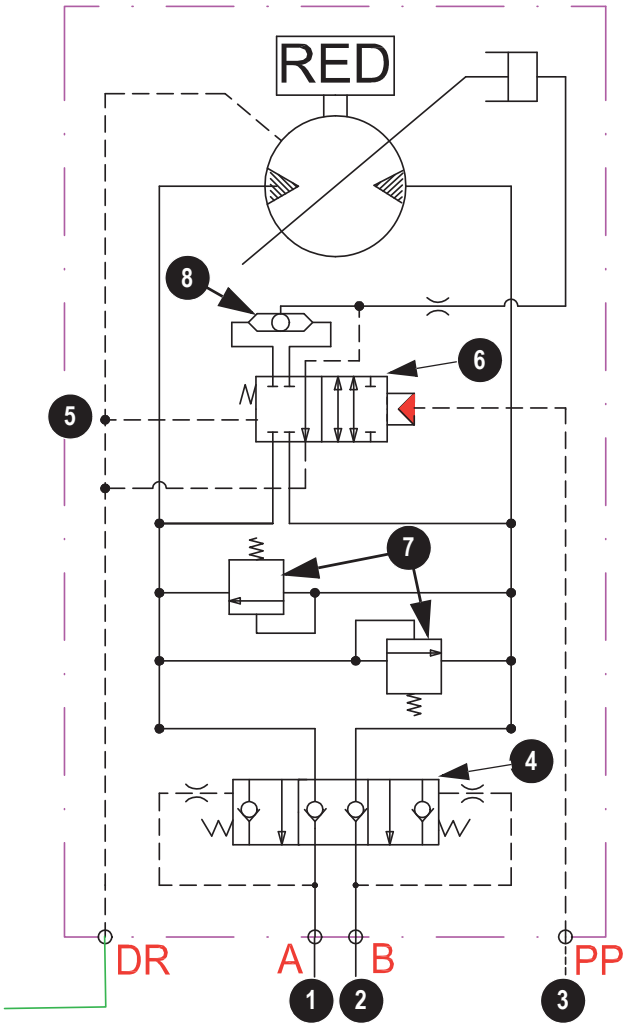
Notice!

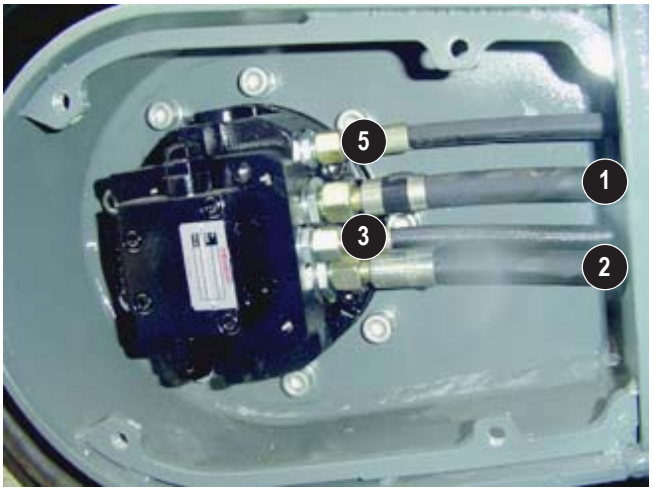
Intermediate positions of the set screws cause the hydraulic oil to warm up – danger of overheating!



5.7 Travelling drive

- Swash-plate piston motor
- The drive has 2 speed ranges switched via 2 capacity positions





Pos.	Designation
1	Drive port (-> swivel joint right 4/left 3)
2	Drive port (-> swivel joint right 2/left 5)
3	2nd speed range port (-> swivel joint 8)
4	Directional valve forwards/reverse = brake piston
5	Leak oil port (-> swivel joint 1)
6	2nd drive speed valve
7	Pressure limiting valves
8	Shuttle valve

Function

Driving:

If high pressure is applied to a drive, the brake piston is slowly actuated via the throttle orifice. Brake piston control causes high pressure to be applied to the motor, which starts turning. There is no pressure on the return line.

Stopping:

The oil flows from both ports to the tank upon releasing the joystick. The brake piston slowly returns to its base position via the throttle. The slow return of the brake piston prevents the hydraulic motor from coming to an abrupt standstill. With the brake piston in neutral position, the ports are no longer connected to the motor, which can no longer turn.

2 speed range functions

Speed range 1

- "High speed" switch switched off

The solenoid valve on the pilot oil supply unit is de-energised, and the oil flows through the control line to the tank. The swash plate of the hydraulic motor is fully swivelled in this position, i.e. the motor is at maximum capacity.

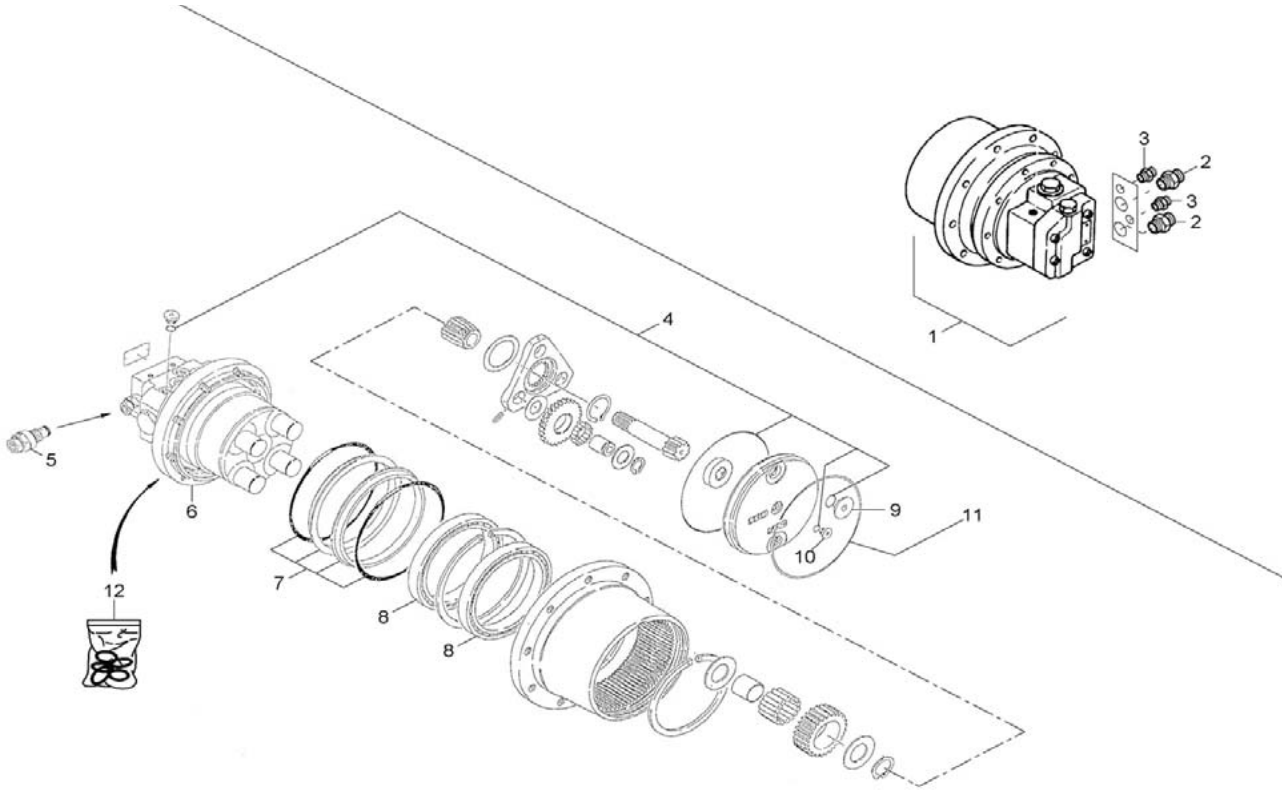
➥ The engine runs at slow speed but at maximum tractive power.

Speed range 2

- "High speed" switch switched on

The solenoid valve is energised, and the swash plate of the hydraulic motor returns to base position, i.e. the motor is at minimum capacity.

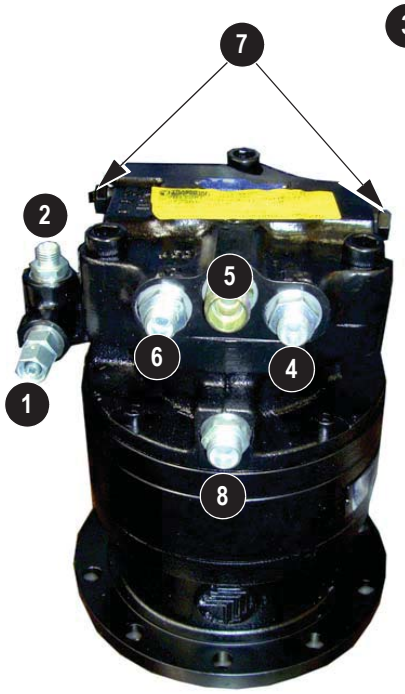
➥ The engine runs at high speed but at low tractive power.

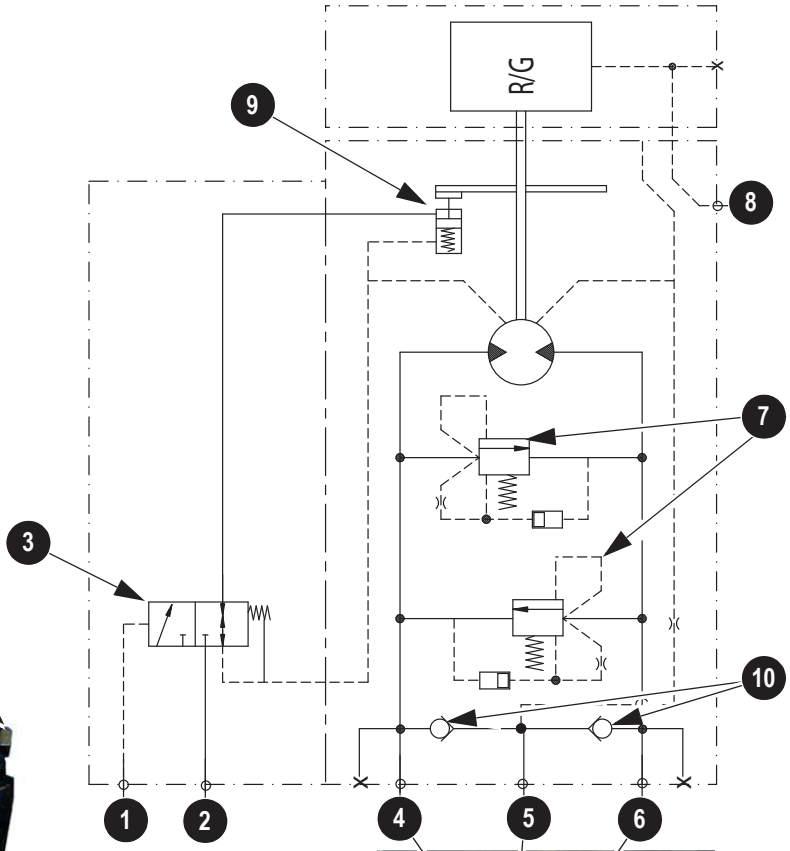


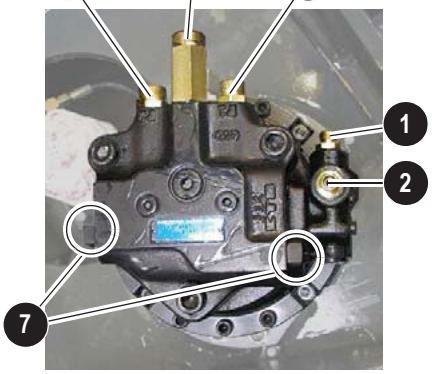
Pos.	Designation
1	Travelling drive
2	Screw connection
3	Screw connection
4	O-ring set
5	Brake cartridge
6	Hydraulic motor
7	Lifetime seal
8	Bearing
9	Plug
10	Plug
11	Snap ring
12	Hydraulic motor sealing kit

5.8 Swivel unit

Hydraulically controlled swash-plate piston motor with maintenance-free swivel gearbox and mechanical motor brake.
The shock anticavitation valves are dampened for smooth braking.







Pos.	Designation
1	SH brake release port (-> shuttle valve)
2	Pilot control pressure port (-> pilot oil supply unit)
3	Brake release valve
4	Right-hand rotation port (-> main valve block)
5	Anticavitation line port (-> main valve block/tank)
6	Left-hand rotation port (-> main valve block)
7	Pressure limiting valves
8	Leak oil port (-> tank)
9	Brake piston
10	Shock anticavitation valves

Swivel unit brake

Hydraulic swivel unit brake:

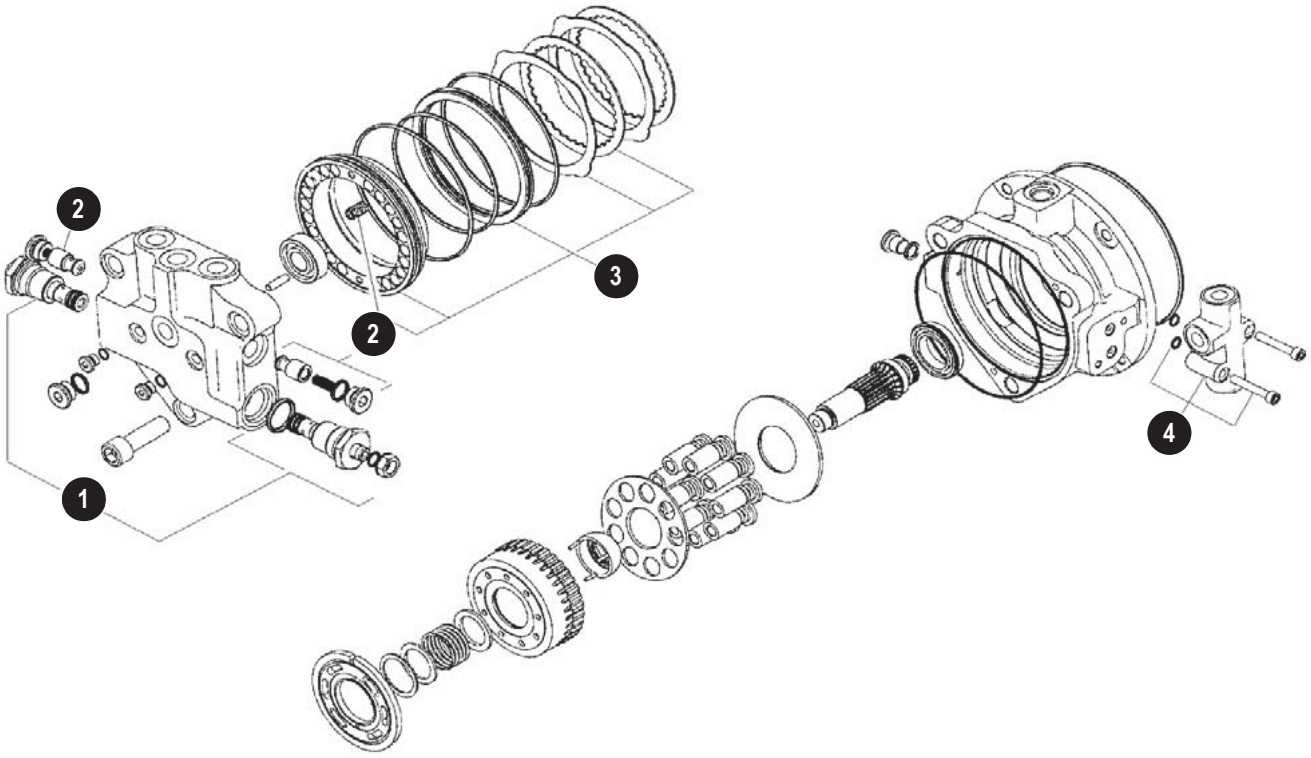
The upper carriage's rotation is sufficiently braked by moving control lever 29 back to initial position. Moving the control lever in the opposite direction (counteraction) brakes the upper carriage with maximum hydraulic output.

Mechanical stop brake:

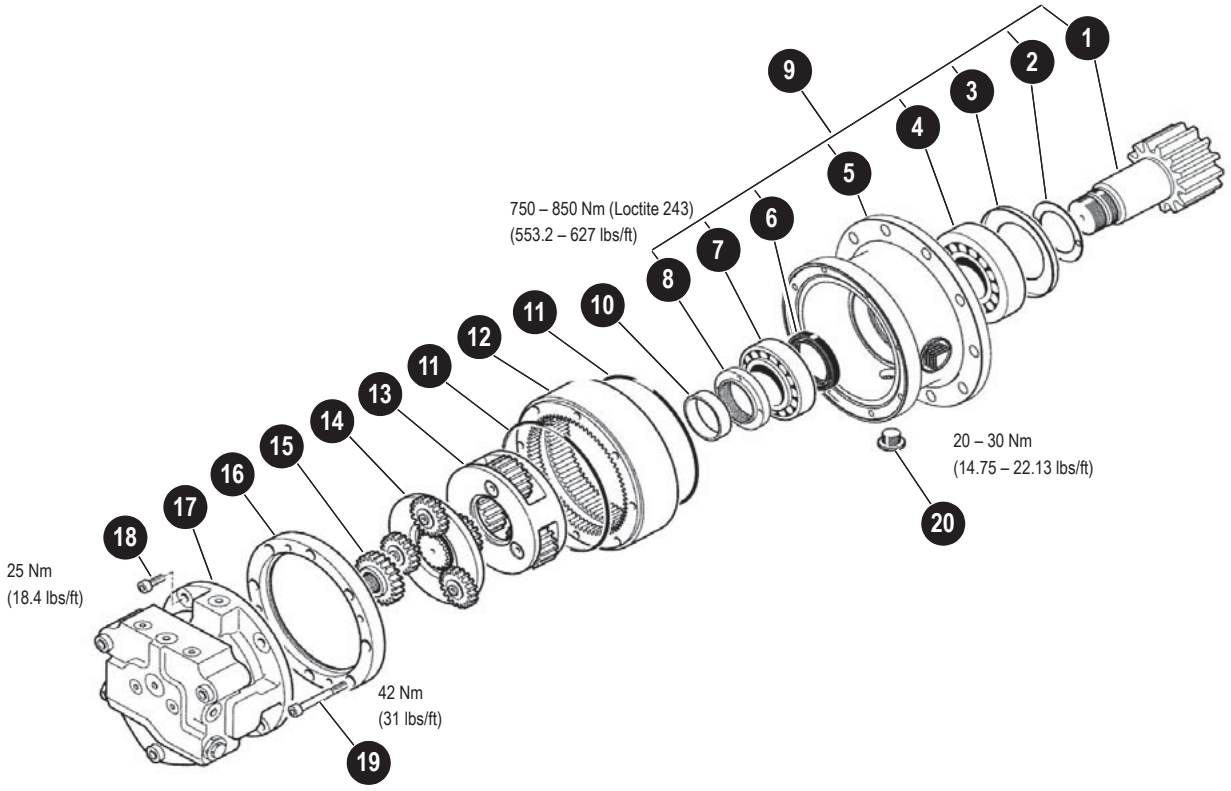
A multidisc brake integrated in the rotation drive has an additional mechanical brake effect with time delay. This negative-effect brake is used as a stop brake and parking brake for the swivel unit. The upper carriage can be stopped in any position.

Notice!

Do not use the brake as a service brake but only as a stop brake and parking brake for the swivel unit.



Pos.	Designation
1	Shock valve
2	Gear motor valve set
3	Engine brake set
4	Timer valve



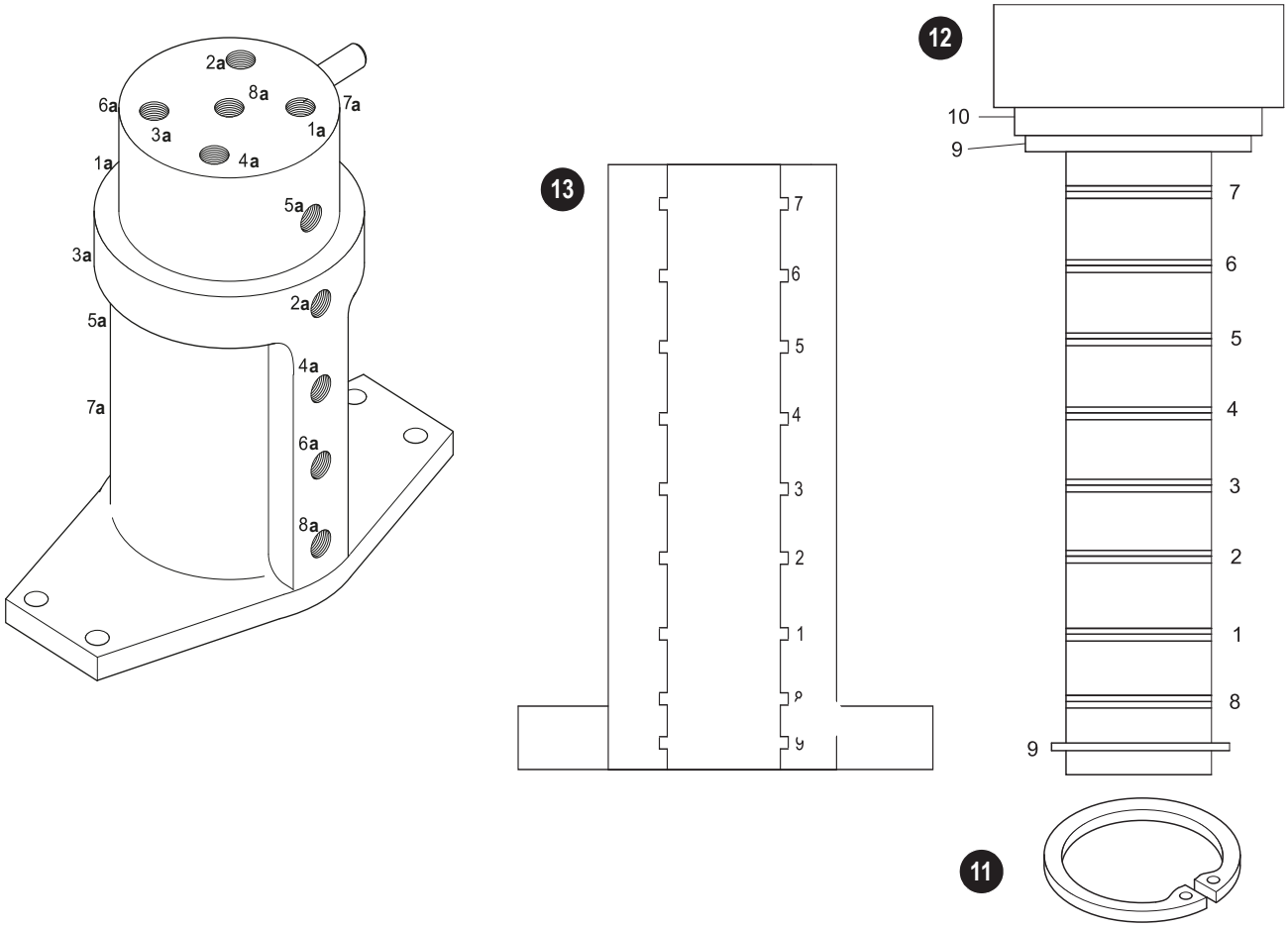
Pos.	Designation
1	Pinion shaft
2	Spacer washer
3	Bearing seal ring
4	Bearing
5	Gear housing
6	Sealing ring
7	Bearing
8	Round nut
9	Complete drive
10	Spacer washer

Pos.	Designation
11	O-ring
12	Ring gear
13	Gear reduction
14	Gear reduction
15	Sun gear
16	Motor flange
17	Hydraulic motor
18	Screw
19	Screw
20	Plug

5.9 Swivel joint

8-port swivel joint

The swivel joint ensures the oil flow between the upper carriage and the undercarriage.



Pos.	Port
1a	Pilot control pressure (PV) pilot oil supply unit
2a and 4a	Right-hand drive
3a and 5a	Left-hand drive
6a and 7a	Stabiliser blade
8a	Travelling drive tank line

Pos.	Designation
1-8	Sealing rings
9	PU prop ring
10	V sealing ring
11	Circlip
12	Inside part
13	Outside part

Replace the sealing rings

☞ *Slacken circlip **11** on the lower side*

☞ *Pull the swivel joint apart*

☞ *Replace the sealing rings*

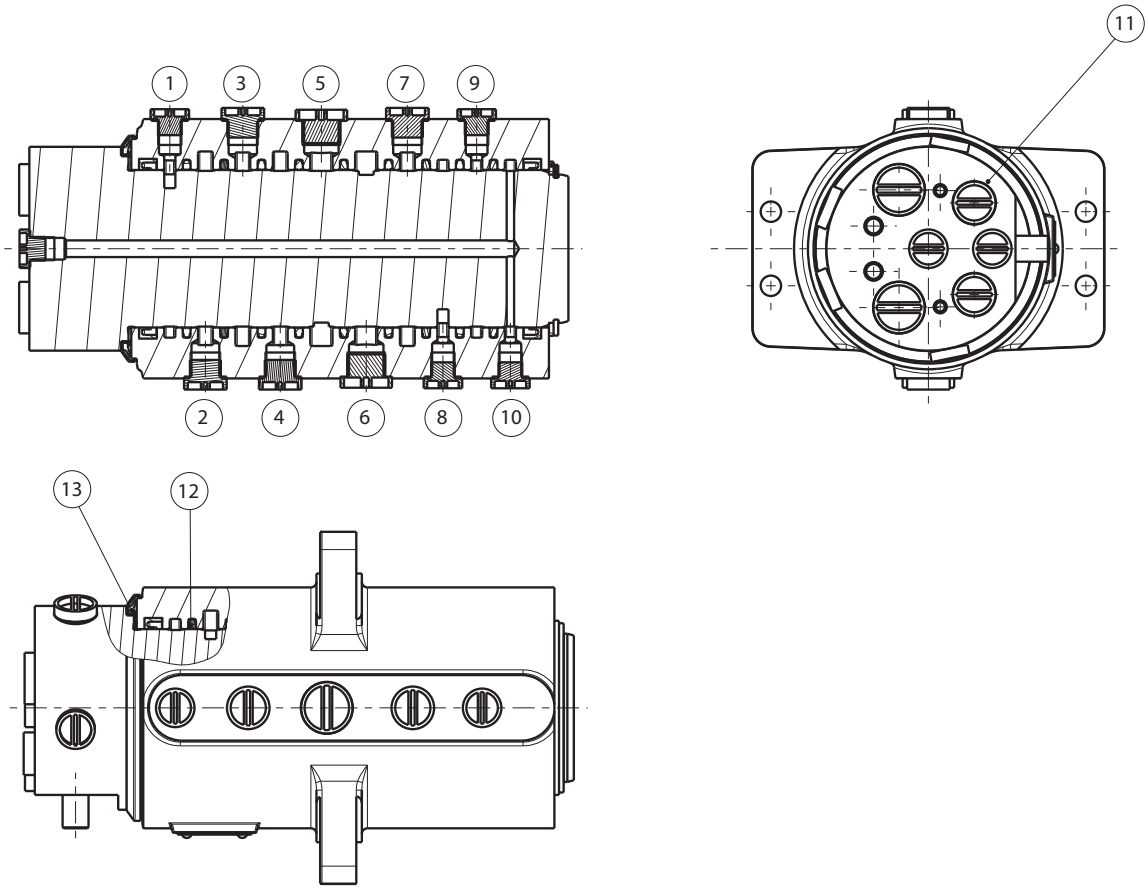
☞ *Push the swivel joint together again*

☞ *Insert circlip **11** again*

5.10 Swivel joint VDS (option)

10-port swivel joint

The swivel joint ensures the oil flow between the upper carriage and the undercarriage.



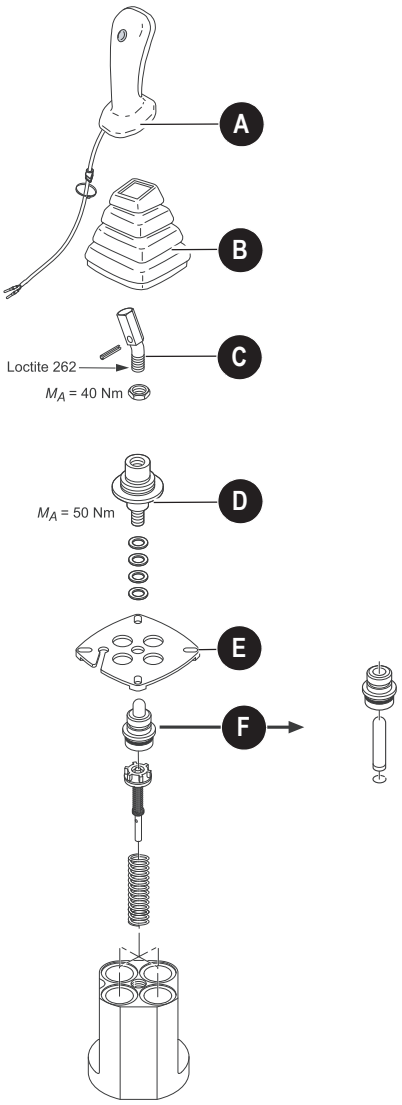
Pos.	Port
1	High speed
2	Stabiliser blade ram
3	Stabiliser blade ram
4	Driving
5	Driving
6	Driving
7	Driving

Pos.	Designation
8	Tilt ram
9	Tilt ram
10	Leak oil
11	Rod seal
12	Rotor seal
13	V-ring

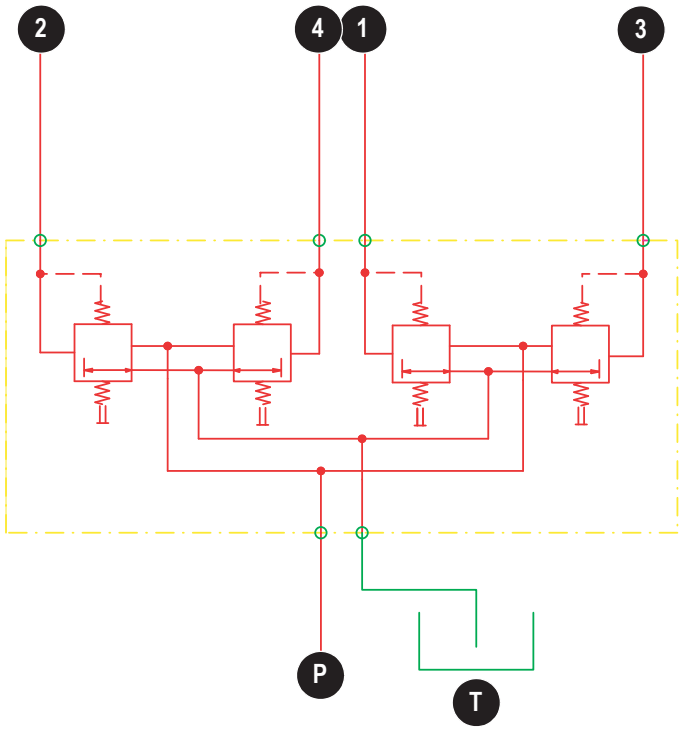
5.11 Pilot valves

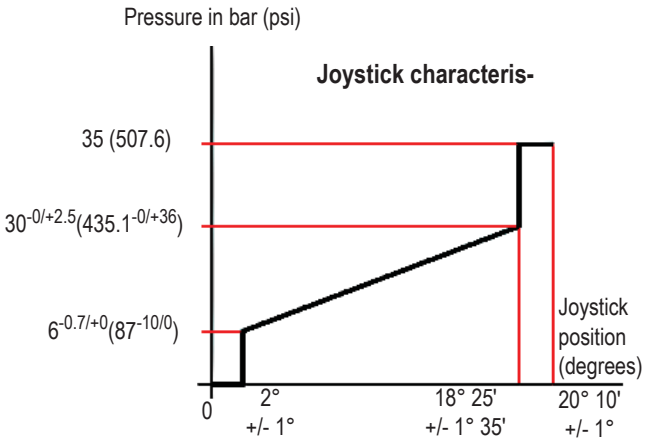
Joystick

- Pilot valve for bucket, boom, stick and upper carriage rotation
- Consists of a lever and four pressure reducing valves



Numbering for right-hand joystick.
Lef-hand side joystick 3 – 1 – 4 – 2



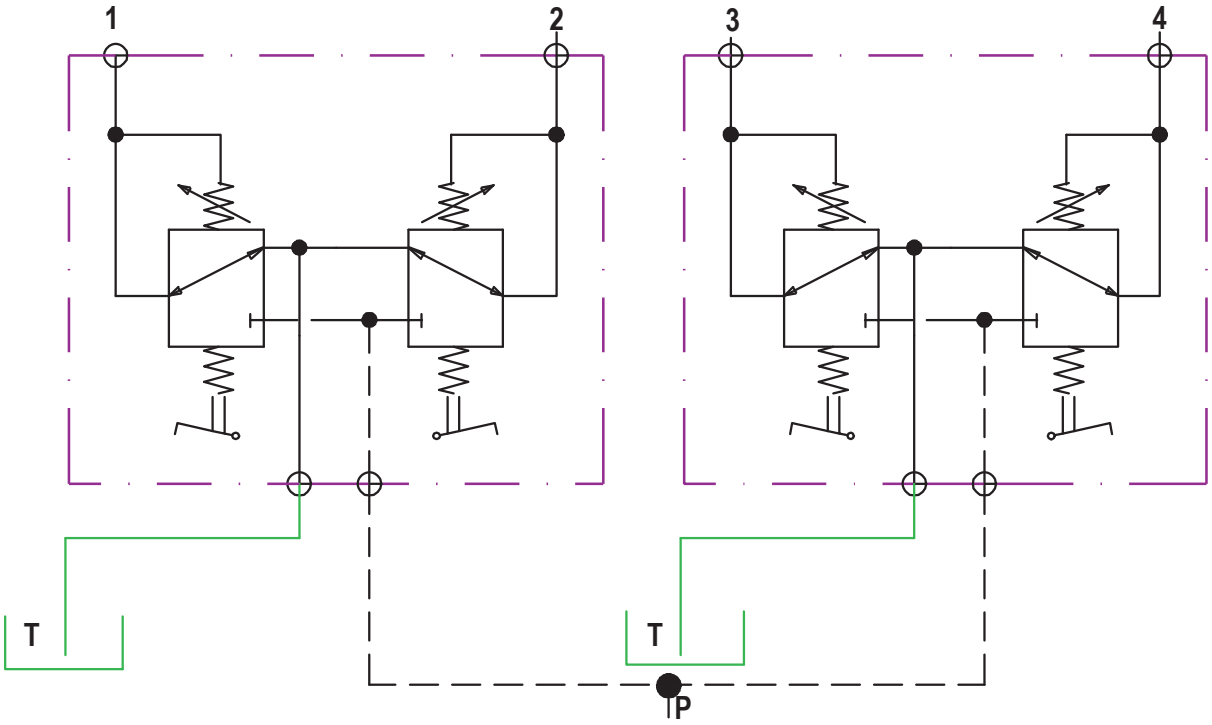


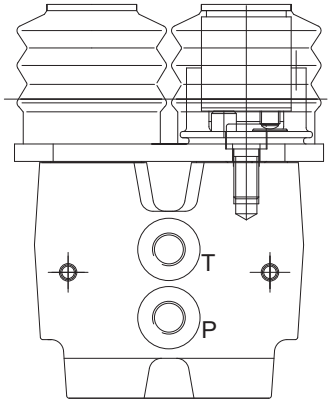
Pos.	Designation
A	Control lever
B	Rubber collar
C	Linkage
D	Universal joint
E	Guide plate
F	Tappet

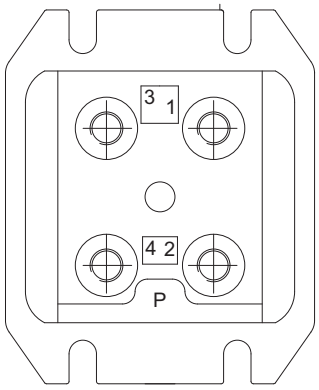
Pos.	Description (left-hand joystick)	Description (right-hand joystick)
1	Stick extension control	Boom ram extension control
2	Left-hand rotation control	Bucket ram extension control
3	Stick retraction control	Boom ram retraction control
4	Right-hand rotation control	Bucket ram retraction control
P	Supply from pilot oil supply unit	Supply from pilot oil supply unit
T	Tank line	Tank line

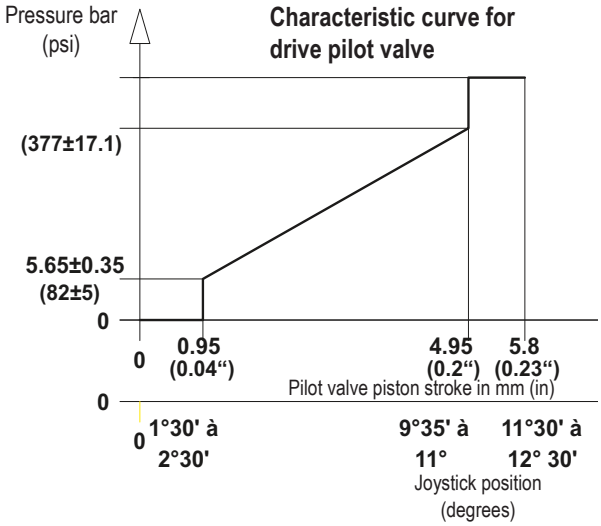
Pilot valve (driving)

- Pedal with hydraulic damping
- Consists of two pedals and four pressure reducing valves

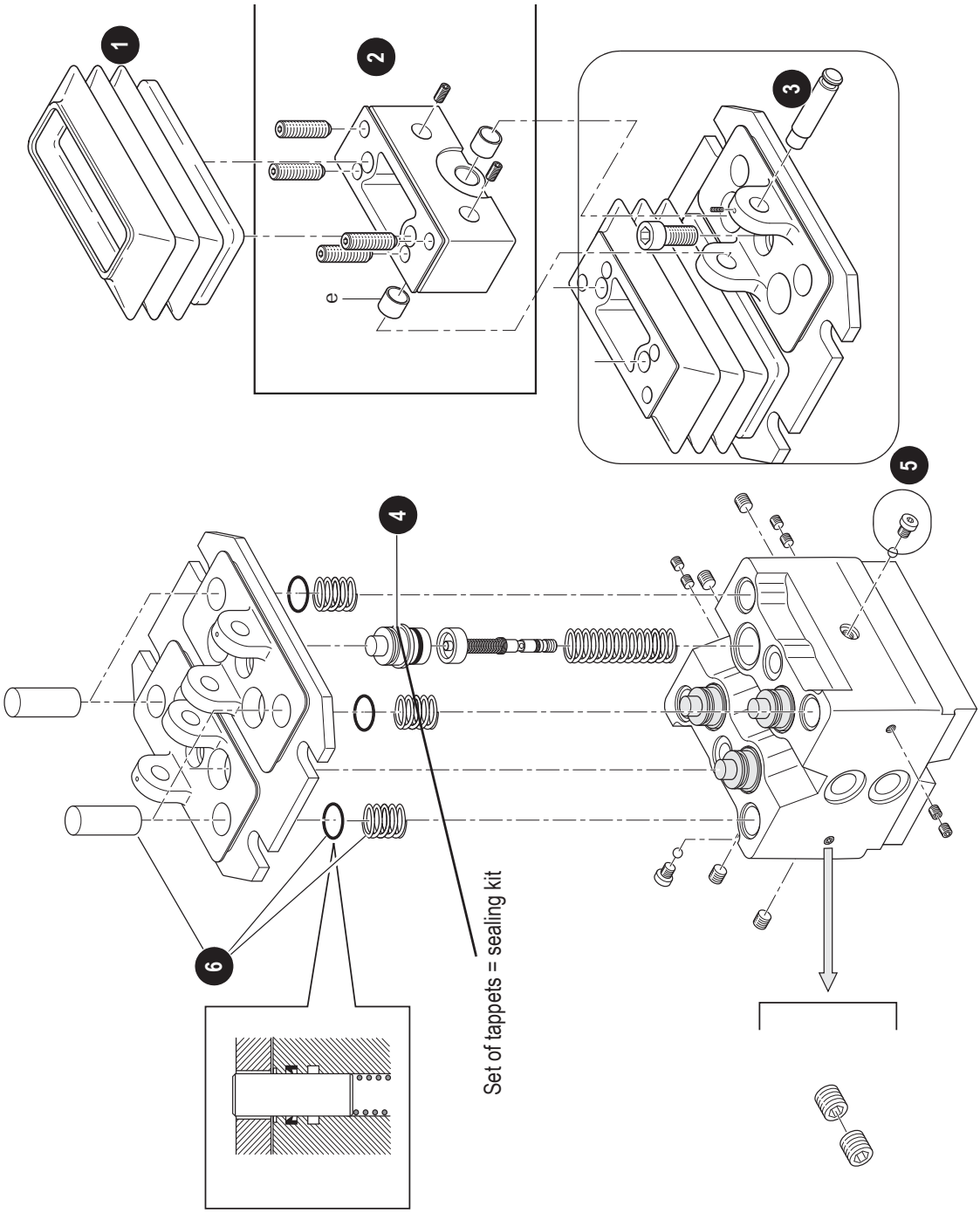








Pos.	Designation
1	Right-hand drive segment control
2	Right-hand drive segment control
3	Left-hand drive segment control
4	Left-hand drive segment control
P	Pilot control pressure
T	Tank line



Pos.	Designation
1	Bellows
2	Shift unit
3	Plates
4	Tappet
5	Non-return valve (also used for bleeding pedal damping)
6	Damping

5.12 Changeover valve for SAE/ISO controls (option)

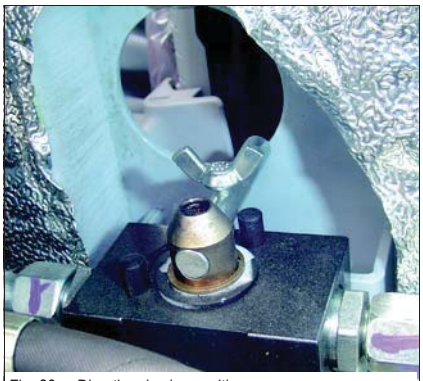


Fig. 29: Directional valve position

The directional valve is located at the left behind the seat.

Danger!

Changing the directional valve over modifies the controls (control levers) –

Danger of accidents!

☞ *Ensure that you know which control mode has been selected before starting work*

☞ *Always secure wing nut **J** on the changeover lever of the directional valve*

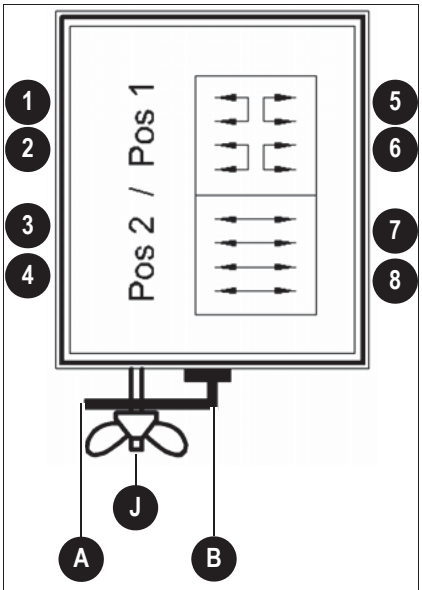


Fig. 30: Directional valve

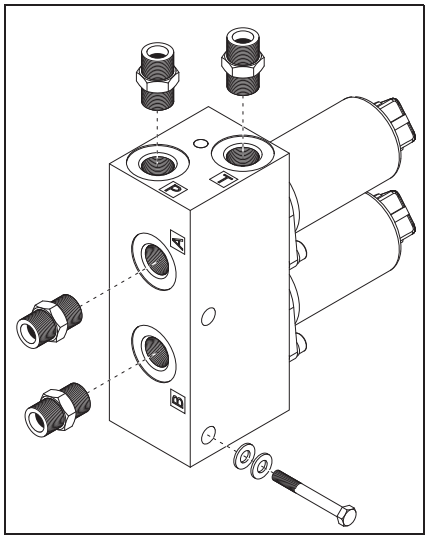
Switch-over carried out via ISO and SAE controls, and vice versa, with the directional valve.

Position	Function
A	ISO controls
B	SAE controls

☞ *Tighten wing nut **J** after changing the control mode.*

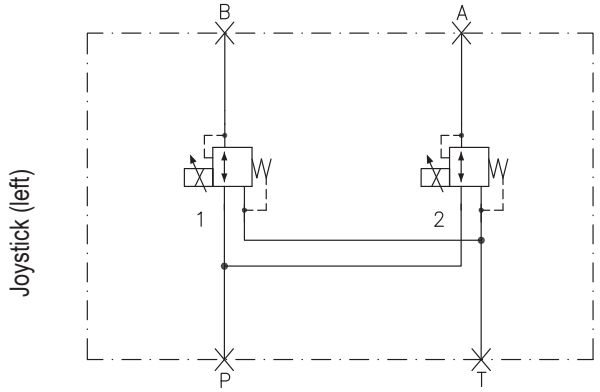
Directional valve ports	
1	Joystick (right) port 1
2	Boom ram retraction control
3	Joystick (right) port 3
4	Main valve block, boom ram extension control
5	Main valve block, stick ram extension control
6	Joystick (left) port 1
7	Main valve block, stick ram retraction control
8	Joystick (left) port 3

5.13 Proportional valve (option)



A **proportional valve** ensures a modifiable control signal (an electric signal) is steplessly transformed into a proportional output signal.

Function and settings in the Operator's Manual.



5.14 Changeover valve VDS (option)

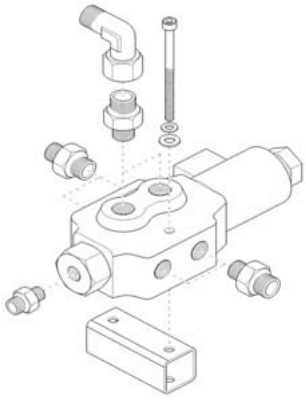


Fig. 31: Changeover valve VDS

The changeover valve VDS is located in the undercarriage next to the swivel unit.

It is actuated with the tip switch on the joystick (bucket/VDS control changeover).

5.15 3/2 directional valve (option)

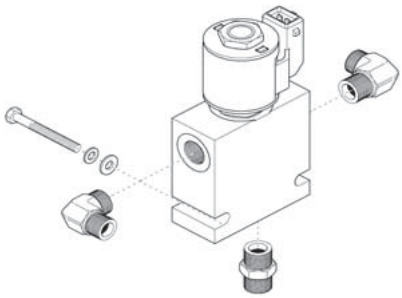


Fig. 32: 3/2 directional valve

The 3/2 directional valve controls the automatic engine speed setting (option) and is installed on the main valve block in the valve compartment at the rear of the machine.

See also *Chapter 7.3 "Automatic engine speed setting"*

5.16 Easy Lock valve (option)

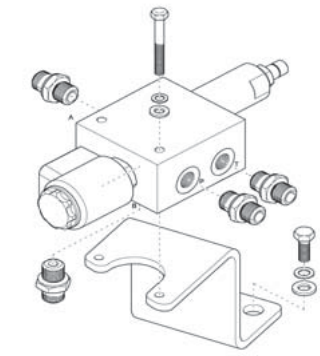


Fig. 33: Easy Lock valve

The working pressures are set with the Easy Lock valve.

Operating pressure: P max = 350 bar (5076 psi)

Volumetric flow: Q max = 15 l/min (3.9 gal/min)

Refer to the Operator's Manual of the component for more information, or see chapter "7.11 Hydraulic Quickhitch (Easy Lock)" on page 7-20.

5.17 Hydraulic oil tank service valve (option)

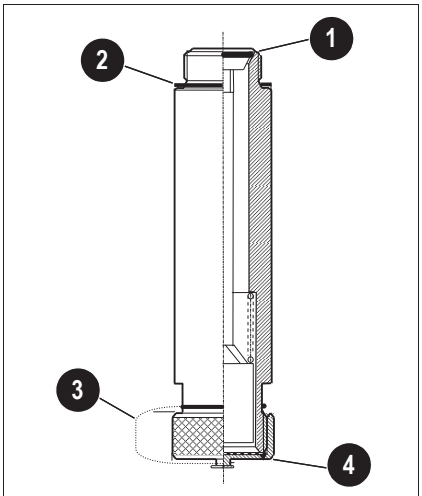


Fig. 34: Hydraulic oil tank service valve

Pos.	Description
1	O-ring
2	Copper seal
3	Chain
4	Washer

5.18 Breather filter

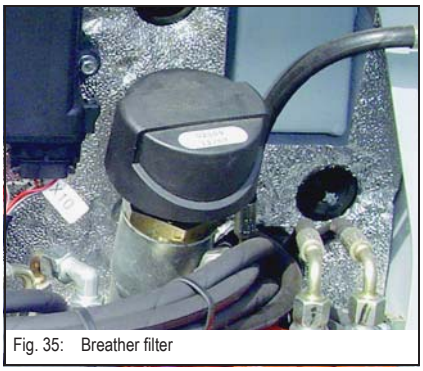


Fig. 35: Breather filter

The breather filter is in charge of:

- Air intake and outlet for pressure compensation in the hydraulic oil tank (varying oil level) – prevents the oil tank from inflating.
- Pre-tension of the oil tank to the specified overpressure -> supports the variable displacement pump's suction
- Filtering the intake air
- Opens at 0.4 bar (5.8 psi)

The breather filter is located in the machine at the rear right.

Replace the filter as indicated in the maintenance plan!

– *see Maintenance plan (overview)* on page 3-7

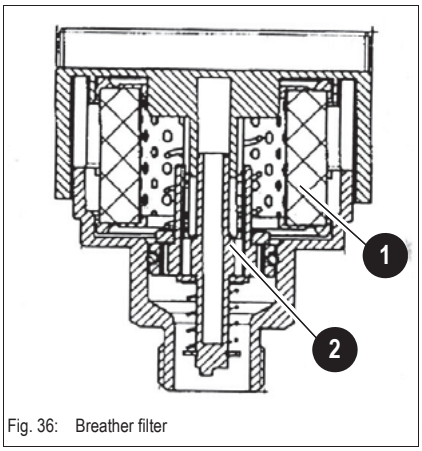


Fig. 36: Breather filter

Pos.	Designation
1	Filter fabric
2	Bleeder valve

5.19 Auxiliary hydraulics connections

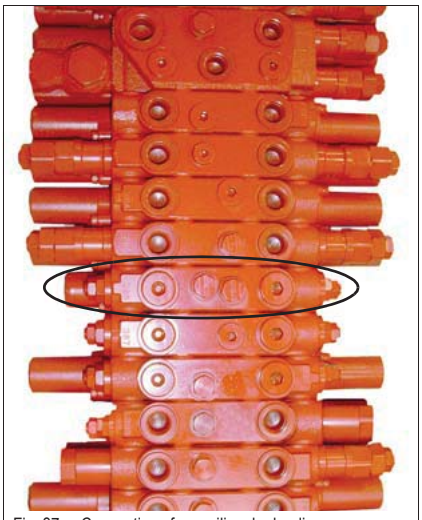


Fig. 37: Connections for auxiliary hydraulics

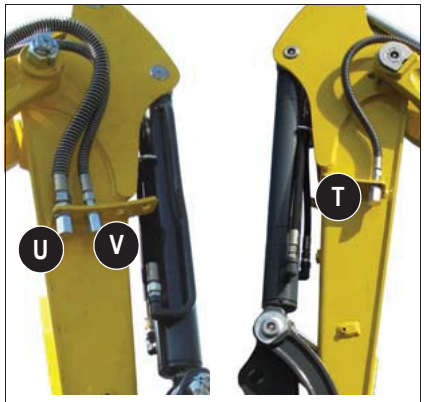


Fig. 38: Connections for auxiliary hydraulics

Notice!

Follow the instructions in the Operator's Manual of the attachment manufacturer for connecting the auxiliary hydraulics to attachments.

Standard ports:

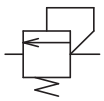
Port	Stick (left)	Stick (right)
T	Pressure line	
V		Pressure line
U		Large return line

5.20 Troubleshooting in the hydraulic system

Problem	Possible causes
Hydraulic system without function	Defective safety switch on control lever base
	Wrong setting of safety switch on control lever base
	Defective solenoid valve on pilot oil supply unit
	Contaminated solenoid valve on pilot oil supply unit
	Hydraulic oil level too low
	Defective valve fuses
	Defective/interrupted plug and socket connection towards solenoid valve
Hydraulic hammer does not work correctly	Quickhitch couplings not connected correctly
	Hydraulic oil quantity too high/too low
	Hydraulic oil pressure too high/too low
	Check the nitrogen fill
Machine runs in 1st speed only	Defective switch for 2nd speed range
	Defective solenoid valve on pilot oil supply unit
	Contaminated solenoid valve on pilot oil supply unit
	Defective valve fuses
	Defective/interrupted plug and socket connection towards solenoid valve
	Counterpressure in travelling drive does not drop below control pressure

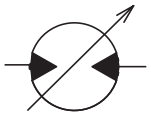
Übersicht der Hydraulikplä

Pos.	Bezeichnung
22	Ölkühler
23	Rücklauffilter
24	Be- / Entlüftungsfilter
25	Hydrauliköltank
26	Minimessanschlüsse
27	Proportionalventil
28	Schnellverschlusskupplung Option Greifer
29	Schlauchbruchventil Option Überlast
30	Lasthalteventil
31	Schockpatrone 3. Steuerkreis
32	Schockpatrone Zusatzhydraulik
33	SAE-Ventil
34	3/2 Wegeventil VDS
35	Zylinder Drehzahlregelung
36	Entsperrbares Rückschlagventil
37	Kippzylinder
38	7/2 Wegeventil VDS
39	Schnellverschlusskupplung Greifer
40	Kugelhahn Greifer
41	Druckschalter

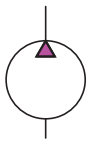


Druckbegrenzungs-
ventil

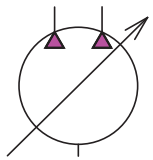
Konstantmotor



Verstellmotor



Konstantpumpe



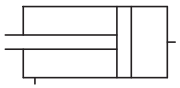
Doppelverstell-
pumpe

il Rückschlagventil

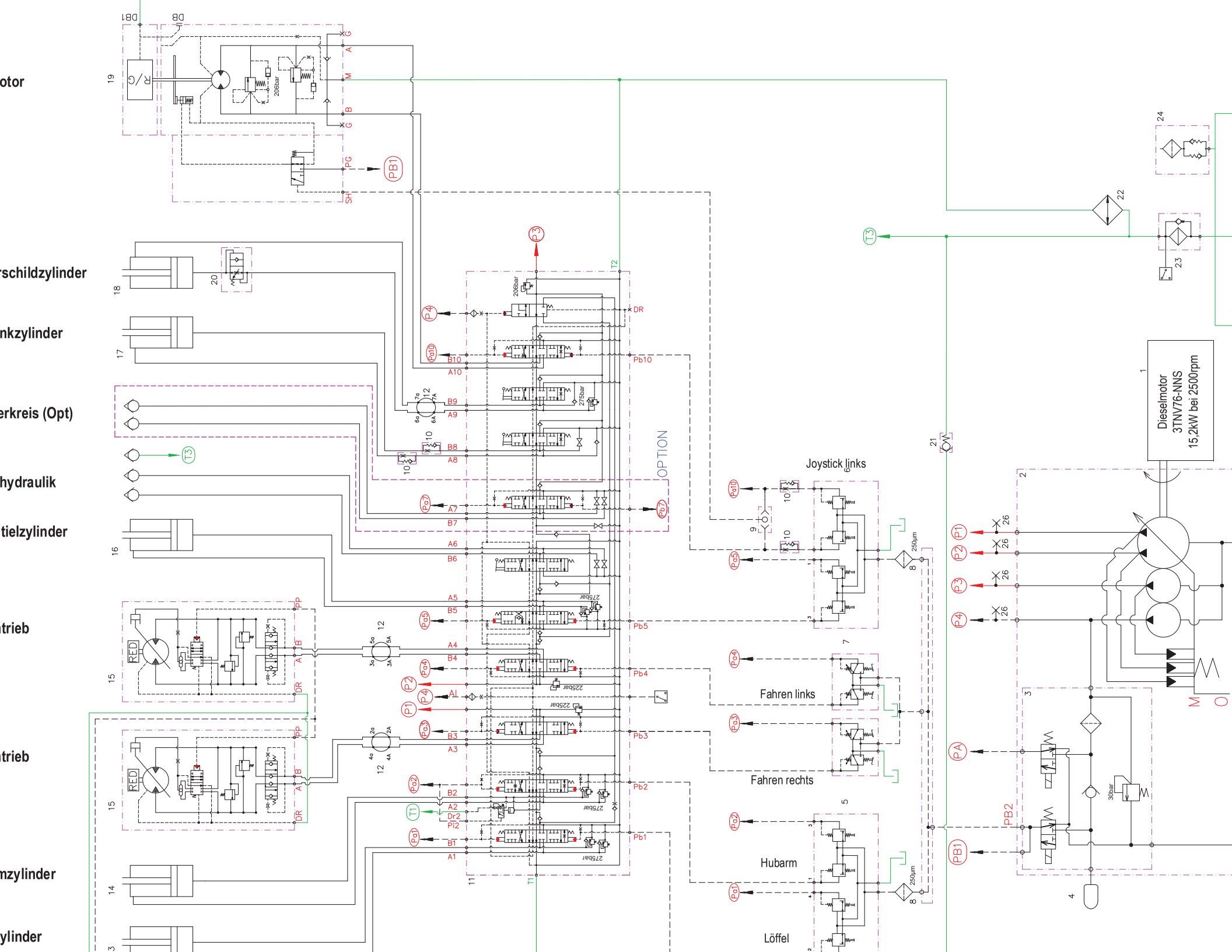
Drossel

Ölkühler

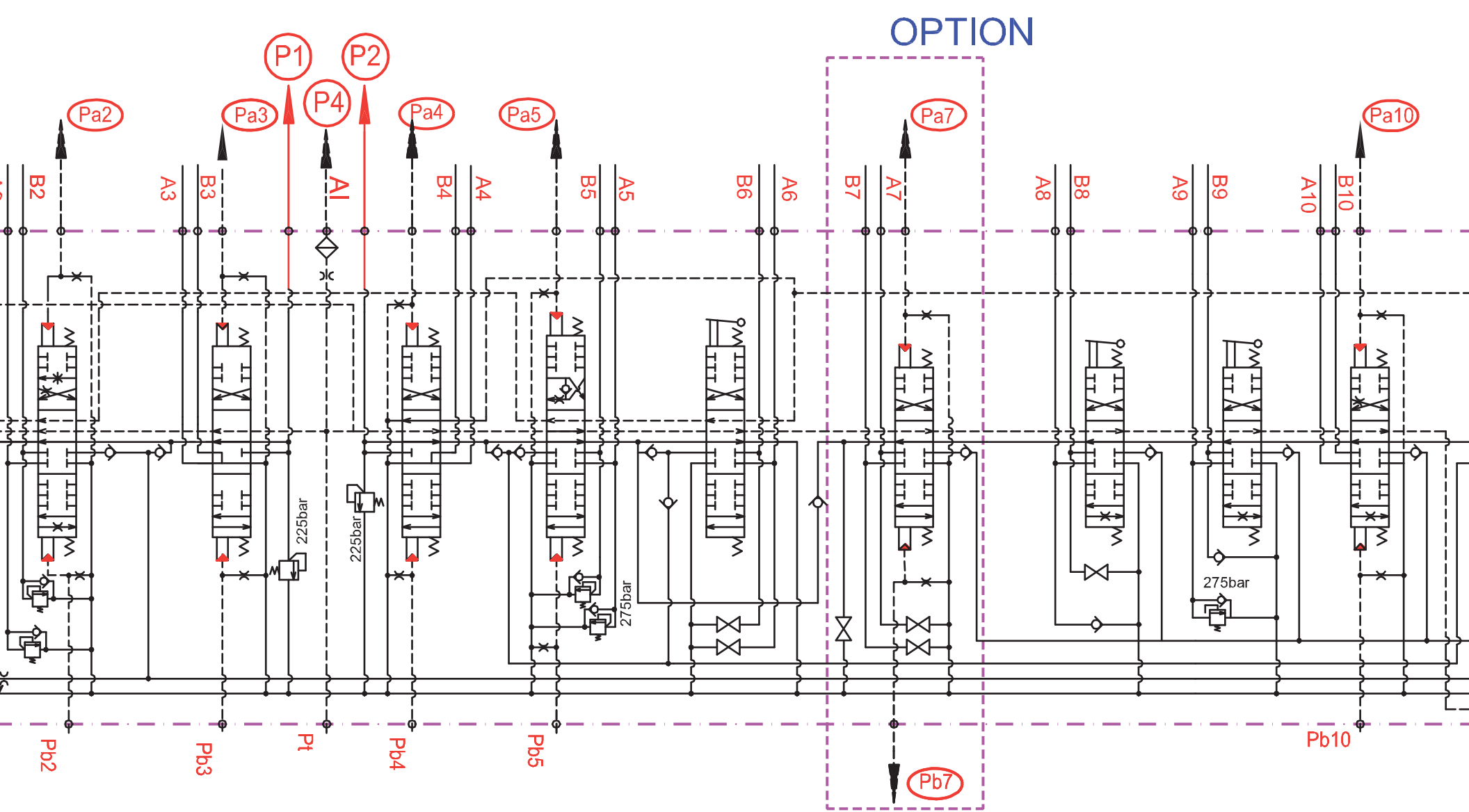
Filter



Doppeltwirkender
Zylinder


Dieselmotor
3TNV76-NNS
15,2kW bei 2500rpm
Joystick links
Fahren links
Fahren rechts
Hubarm
Löffel
OPTION
RED
206bar
275bar
225bar
250µm
30bar

VDS
Schockpatrone 3. Steuerkreis
Drehzahlregelung
Überlastwarneinrichtung FR
Planierschild
Löffelstiel
Hubarm
Schockpatrone ZH
Überlastwarneinrichtung DE
Powertilt
Greifer
Löffel
Zusatzhydraulik
linker Joystick
rechter Joystick
OPTION



	Versorgt von
ffel	rechter Joystick
barm	rechter Joystick
hren rechts	Fahrpedal rechts
hren links	Fahrpedal links
ffelstiel	linker Joystick
satzhydraulik	Schalter am Joystick
Steuerkreis (Opt)	Schalter am Joystick
barmschwenken	Hammerpedal

Hauptsteuerleitungen

Anschluss	Legende
A1, B1	Löffelzylinder
A2, B2	Hubarmzylinder
A3, B3	Fahreinheit rechts über Drehdurchführung
A4, B4	Fahreinheit links über Drehdurchführung
A5, B5	Löffelstielzylinder
A6, B6	Zusatzhydraulik
A7, B7	3.Steuerkreis
A8, B8	Schwenkzylinder

Pumpen-/Tankleitungen

Anschluss	Legende
P1	Anschluss Pumpe 1
P2	Anschluss Pumpe 2
P3	Anschluss Pumpe 3
P4	Anschluss Pumpe 4
T1	Tankleitung über Rückschlagventil
T2	Tankleitung über Ölkühler und Filte

Electrical system

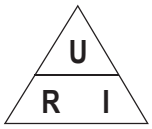
6 Electrical system

6.1 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 (ΩW)

Mnemonic:



Output
Power "P" – Watt (W)

$P = U \times I = R \times I^2 = U^2/R$

6.2 Measuring equipment, measuring methods

Multifunction measuring device

- Measurements of values (U, R, I, f)
- Continuity test
- Diode test

Calculate the 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).

Test lamp

The test lamp is used to test lines and functions with the ignition switched on.

- Line test (testing voltage):

Connect test lamp between test point (live cable) and machine earth or between test point (earth line) and a live cable.

- Functional check (testing current):

Connect test lamp between a connection on the consumer to be tested and the connection line.

6.3 Cable colour coding

Colour	Code
Black	blk
Brown	brn
Red	red
Orange	org
Yellow	yel
Green	grn
Blue	blu
Violet	vio
Grey	gry
White	wht
Pink	pnk

6.4 Relays

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 microelectronics or microswitches (e.g. touchpad keyboards, sensors). The switch contacts can be make-contact, break-contact or changeover switches. These undertake the actual switching function.

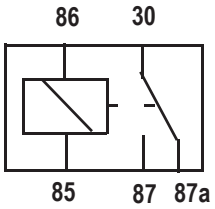


Fig. 1: Terminal description on relay

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)

6.5 Socket

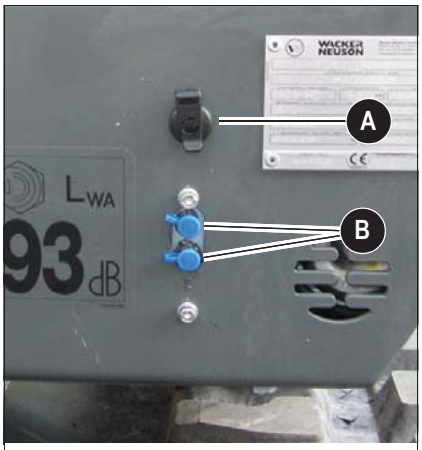


Fig. 2: Socket on the chassis

Socket **A** is located at the front of the machine next to the type label above lubrication strip **B**.

6.6 Electric units

Units	
Alternator	12 V 40 A
Starter	12 V 1.1 kW (1.47 hp)
Battery	12 V 44 Ah
Socket	E.g. for cigarette lighter; 15 A max.

6.7 Fuse box

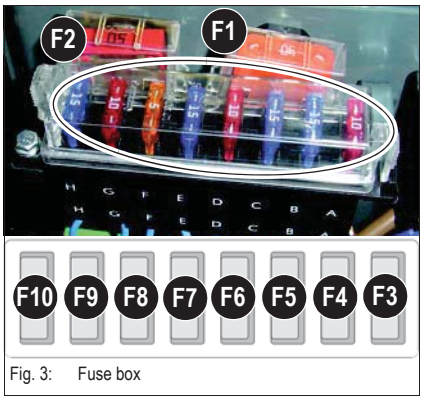


Fig. 3: Fuse box

The fuse box is located on the left in the engine compartment.

Fuse no.	Rated current (A)	Protected circuit
F1	40 A	Start, preheat, cutoff solenoid
F2	50 A	Ignition lock

Fuse no.	Rated current (A)	Protected circuit
F3	10 A	Indicators, cutoff solenoid, relays
F4	15 A	Boom working light, heating
F5	15 A	Valves, horn
F6	10 A	Cab working light
F7	15 A	Wiper, interior light
F8	5 A	Proportional controls
F9	10 A	Rotating beacon, radio
F10	15 A	Socket, cigarette lighter

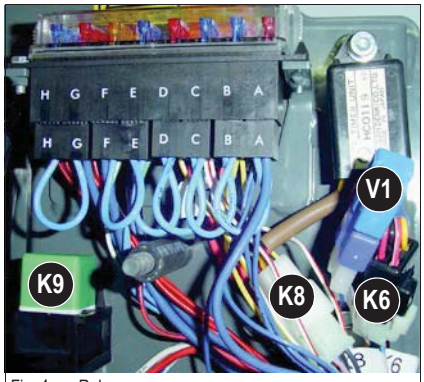


Fig. 4: Relays

Fig. 5: Starting relay

Relay no.	Protected circuit
V1	Blocking diode
K6	Preheating time lag relay
K7	Starting relay
K8	Cutoff solenoid time lag relay
K9	Pick-up contact cutoff solenoid relay

6.8 Alternator

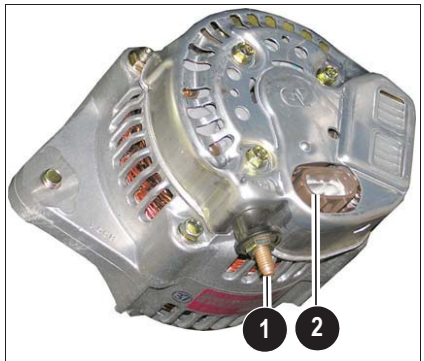


Fig. 6: Alternator

The alternator charges the battery and supplies direct current to electric consumers.

Pos.	Description
1	Connection B (battery)
2	Connection P starting relay
	Connection IG indicator light (12 V)
	Port L indicator light (during service 12 V, otherwise earth)

6.9 Starter

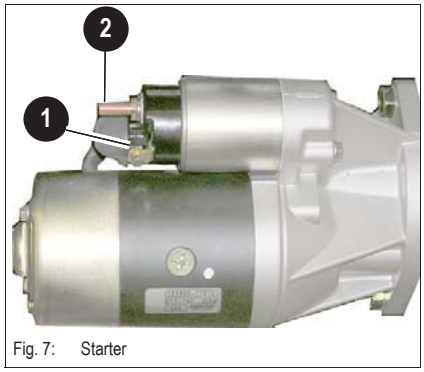
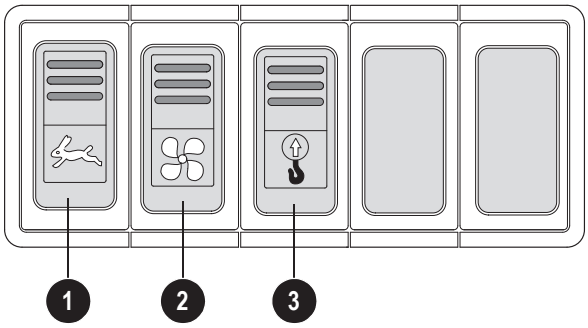


Fig. 7: Starter

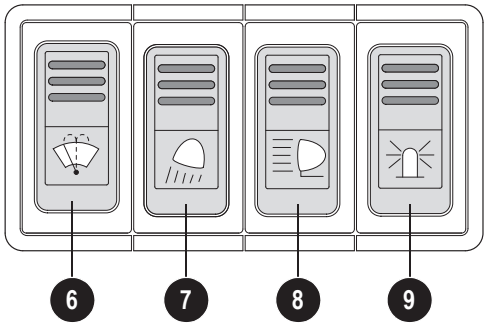
Pos.	Description
1	Connection S starting relay
2	Connection B battery

6.10 Switches: overview

Control element on control console

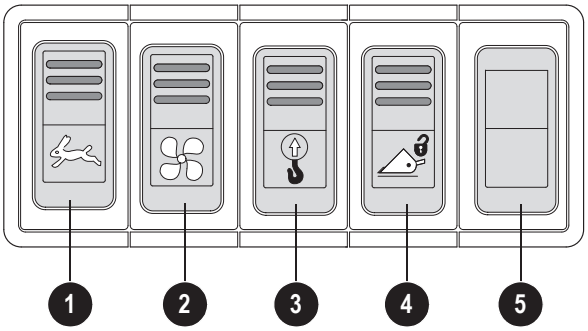


Control element on cab wall

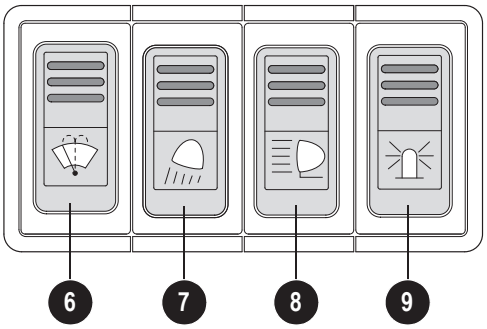


Control elements for proportional controls version (option):

Control element on control console



Control element on cab wall



Switch legend

Pos.	Designation
1	High speed
2	Ventilation
3	Safe load indicator (option)
4	Hydraulic quickhitch switch (option)
5	Proportional controls status indicator (option)
6	Washer system
7	Working light
8	Roof lights (option)
9	Rotating beacon (option)

6.11 Cigarette lighter

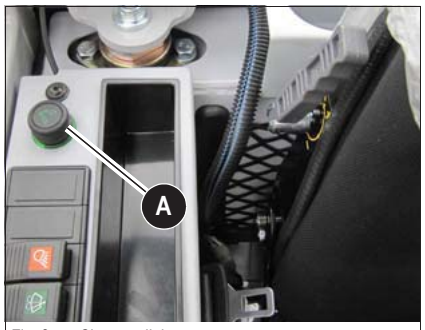


Fig. 8: Cigarette lighter

Cigarette lighter **A** is located on the right-hand control lever base behind the armrest.

6.12 Radio and mounting/wiring for radio installation (option)

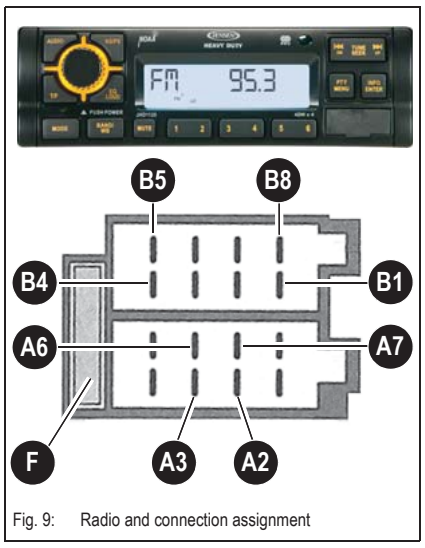


Fig. 9: Radio and connection assignment

The radio is installed in the storage compartment at the right behind the seat.

Connection assignment

Pin	Designation	Pin	Designation
A2	Front right loudspeaker (+)	B4	Not assigned
A3	Front left loudspeaker (+)	B5	Earth connection (-)
A6	Front left loudspeaker (-)	B6	Not assigned
A7	Front right loudspeaker (-)	B7	Connection + 12 V ACC switched
B1	Not assigned	B8	Not assigned
B2	Not assigned	F	15 A fuse
B3	Not assigned		

Mounting/wiring for radio installation (option)

The loudspeakers and the aerial, but not the radio, are installed at the factory with this option.

Notice!

The cab is prewired up to these components at the factory as a standard

6.13 Front working light

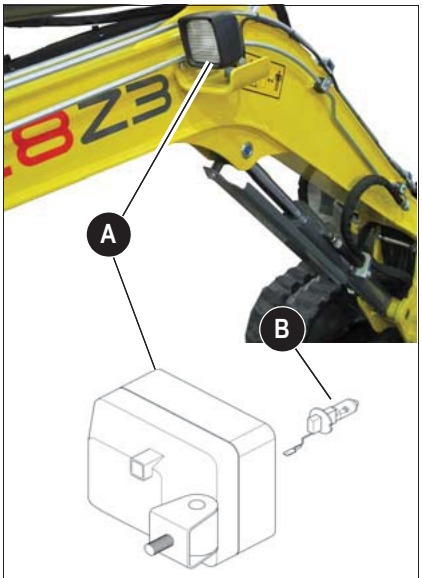


Fig. 10: Front working light

Pos.	Description
A	Front working light
B	Halogen lamp 12 V 55 W H3

6.14 Cab lights (option)

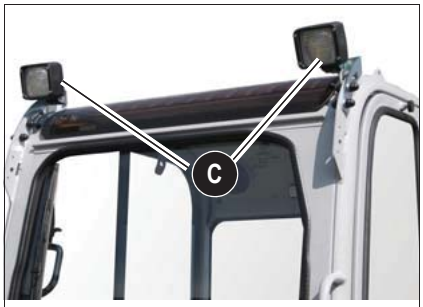


Fig. 11: Front cab lights

Front cab lights

Pos.	Description
C	Front cab lights

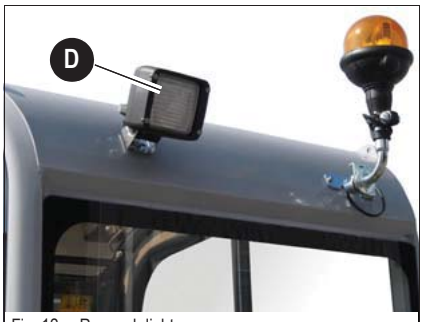


Fig. 12: Rear cab light

Rear cab light

Pos.	Description
D	Rear cab light

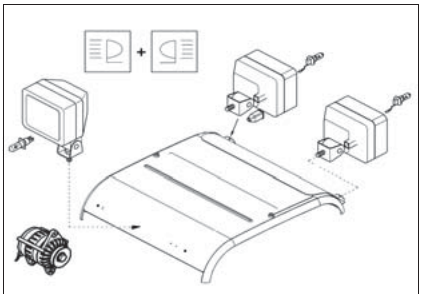


Fig. 13: Front/rear cab lights

Front and rear cab lights

This option includes front cab lights and one rear cab light, see *Fig. 11*, *Fig. 12* and *Fig. 13*.

6.15 Rotating beacon (option)

Fig. 14: Rotating beacon

The rotating beacon is installed at the top rear of the cab.

Pos.	Description
E	Rotating beacon

6.16 Driving signal (option)

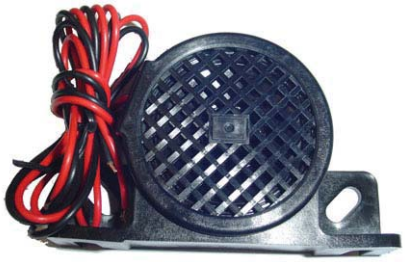


Fig. 15: Driving signal

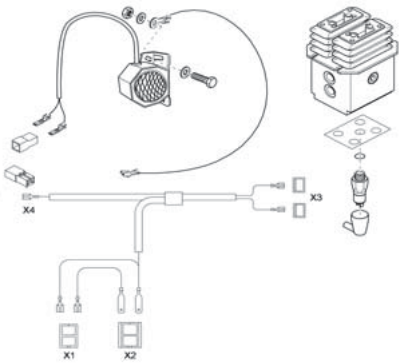


Fig. 16: Driving signal wiring harness

The driving signal is mounted at the rear right of the engine compartment.
The pressure switch for the driving signal is located directly on the underside of the drive valve.

Driving signal wiring harness

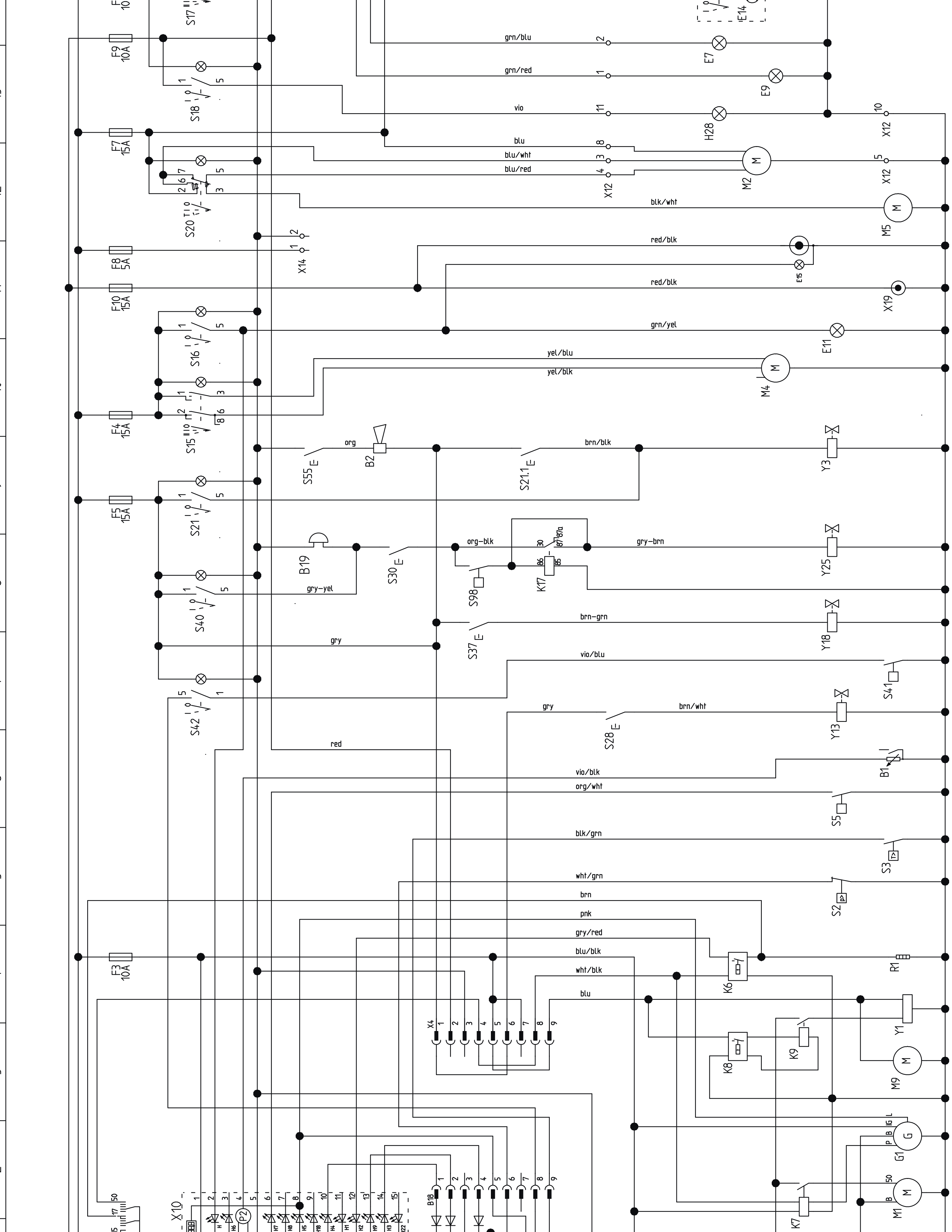
Plug	Description
X1	Wiring harness connector
X2	S21 high-speed cable (not equipped)
X3	Pressure switch connector
X4	Driving signal connector

Die Stromlaufpläne und Ka
Optionen.

nung	Abschnitt	
	C14/15	Opt
	F6	
	C9	
	E15	Opt
	E15	Opt
	C2	
ellwechselsystem)	B8	
hten	E13/14	Opt
rne	E13	Opt
	E11	
	E14	
	E11	
ten, Vorglühen,	E1	
dschloss	E1	
, Abstellmagnet,	A4	
Hubarm, Heizung	A10	
	A9	
Kabine	A14	
enbeleuchtung	A13	
enbeleuchtung	A11	
Radio	A14	
hanzünder	A11	
	F2	
	F1	
ung	B1	
	C1	
eratur	C1	
k	B1	
defunktion	B1	
schmutzung	B1	
ilterverschmutzung	B1	
rneinrichtung	C1	Opt
	E13	Opt

Nr.	Bezeichnung	Abschnitt	
K8	Zeitrelais Abstellmagnet	E3	
K9	Relais Abstellmagnet Ziehkontakt	E3	
K17	Relais SWS	D8	
M1	Starter	F2	
M2	Scheibenwischer	E12	Opt
M4	Heizungslüfter	M10	Opt
M5	Scheibenwaschpumpe	F12	Opt
M9	Dieselförderpumpe	F3	
P1	Betriebsstundenzähler	B1	
P2	Kraftstoffanzeige	B1/2	
R1	Vorglühanlage	F4	
S1	Startschloss	A1	
S2	Druckschalter Motoröl	E/F5	
S3	Temperaturschalter Motor	F5	
S5	Druckschalter Hydrauliköl	E/F6	
S16	Schalter Arbeitsscheinwerfer Hubarm	B11	
S17	Schalter Arbeitsscheinwerfer Kabine	B14	Opt
S18	Schalter Rundumkennleuchte	B13	Opt
S15	Schalter Heizung	B10	
S20	Schalter Scheibenwischer / -waschanlage	B12	Opt
S21	Schalter Schnellfahren	B9	
S21.1	Taster Schnellfahren	D9	Opt
S28	Sicherheitsschalter	D7	
S30	Fußtaster SWS	C8	
S37	Taster VDS	C8	
S40	Schalter SWS (Schnellwechselsystem)	B8	Opt
S41	Druckschalter Überlastwarneinrichtung	F8	Opt
S42	Schalter Überlastwarneinrichtung	B7	Opt
S55	Taster Hupe	B9	
S98	Druckschalter SWS	C8	
V1	Freilaufdiode	E1	
X4	Wegfahrsperre	C3	
X10	Stecker Anzeigeinstrument	B/C1/2	
X12	Stecker Kabine	F12/13/D12	

Nr.	Bezeichnung
Y1	Abstellmagnet
Y3	Ventil Schnellfahren
Y13	Sicherheitsventil
Y18	Ventil VDS
Y25	Ventil SWS (Schnellwechselsyste



F9 10A
F7 15A
F8 5A
F10 15A
F4 15A
F5 15A
F3 10A
S17
S18
S20
S16
S15
S21
S40
S42
S55
S21.1
S30
S98
K17
S37
S28
B2
B19
X14
X12
X4
X10
X19
E7
E9
E11
E14
E15
H28
M2
M4
M5
M9
M1
G1
Y3
Y25
Y18
Y13
Y1
S41
B1
S5
S3
S2
R1
K6
K8
K9
K7
B18
grn/blu
grn/red
vio
blu
blu/wht
blu/red
blk/wht
red/blk
grn/yel
yel/blu
yel/blk
org
brn/blk
org-blk
gry-brn
gry-yel
brn-grn
gry
vio/blu
brn/wht
red
vio/blk
org/wht
blk/grn
wht/grn
brn
pnk
gry/red
blu/blk
wht/blk

Wiring harnesses: overview

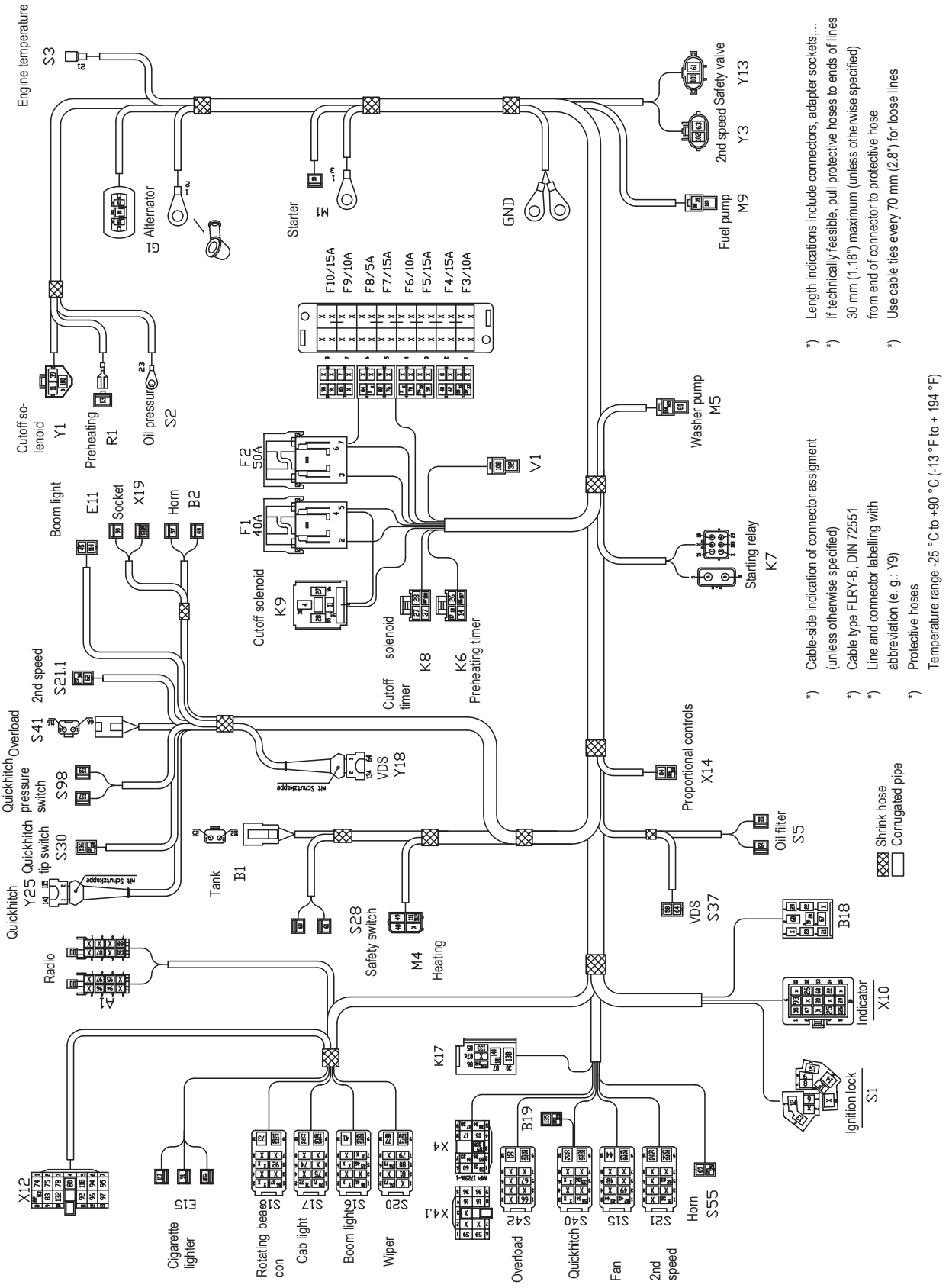
6.19 Engine/chassis wiring harness (legend)

No.	Up to	To	Colour	mm²
1	G1 + 12 V/30	M1	red	10
2	G1 + 12 V/30	F1	red	6
3	M1 + 12 V/30	F2	red	6
4	F1 + 12 V/30	K9/30	red	4
5	F1 + 12 V/30	K7/A	red	4
6	F2 + 12 V/30 ignition lock	S1/1	red	6
7	F2 + 12 V/30	F9/G	red	4
8	S1/5 12 V/15 ignition lock	F4/B	blu	4
9	S1/6 12 V/15 ignition lock	F7/E	blu	4
10	K7/B starter 50	M1	wht-red	2.5
11	K9/87 pick-up contact cutoff solenoid	Y1/1	wht	2.5
12	S1/3 preheating	S1/9	brn	4
13	S1/4 preheating	R1	brn	4
14	S1/8 preheating	K6	brn	1
15	S1/7 starter 50a	X4/4	wht-blk	
16	X4.1/8 starter 50a	X4.1/4	wht-blk	1
17	X4/8 starter 50a	K6	wht-blk	1
18	K7/3 starter 50a	K6	wht-blk	1
19	G1/1 alternator charge indicator light	B18/5	pnk	1
20	X10/8 alternator charge indicator light	B18/5	pnk	1
21	S3 engine temperature switch	B18/9	blk-grn	1
22	X10/14 engine temperature switch	B18/4	blk-grn	1
23	S2 engine oil pressure	B18/6	wht-grn	1
24	X10/10 engine oil pressure	B18/1	wht-gm	1
25	B1/1 fuel tank sensor	X10/4	vio-blk	1
26	K6 preheating indicator light	X10/12	gry-red	1
27	K8 cutoff solenoid relay	K9/86	blu-blk	1
28	K8 cutoff solenoid relay	K9/85	pnk-blk	1
29	G1/3 revs signal	K7/6	blk-blu	1
30	F3/1 12 V/15 indicating instrument, relay	G1/2	blu	1
31	F3/1 12 V/15 indicating instrument, relay	K7/1	blu	1
32	F3/1 12 V/15 indicating instrument, relay	V1	blu	1
33	F3/1 12 V/15 indicating instrument, relay	X4/5	blu	1
34	X4/7 12 V/15 indicating instrument, relay	X4/5	blu	1
35	X4/7 12 V/15 indicating instrument, relay	X10/1	blu	1
36	X4.1/5 12 V/15 indicating instrument, relay	X4.1/9	blu	1
37	X4/9 12 V/15 cutoff solenoid	K8	blu-blk	1
38	X4/9 12 V/15 cutoff solenoid	M9	blu-blk	1
39	Y1/2 12 V/15 cutoff solenoid	M9	blu-blk	1
40	F4/2 12 V lights, fan	S16/1	yel	1
41	S16/10 12 V lights, fan	S16/1	yel	1
42	F4/2 12 V lights, fan	S15/1	yel	1
43	S15/2 12 V lights, fan	S15/1	yel	1
44	S15/2 12 V lights, fan	S15/10	yel	1
45	S16/5 boom working light	E11/1	yel-grn	1

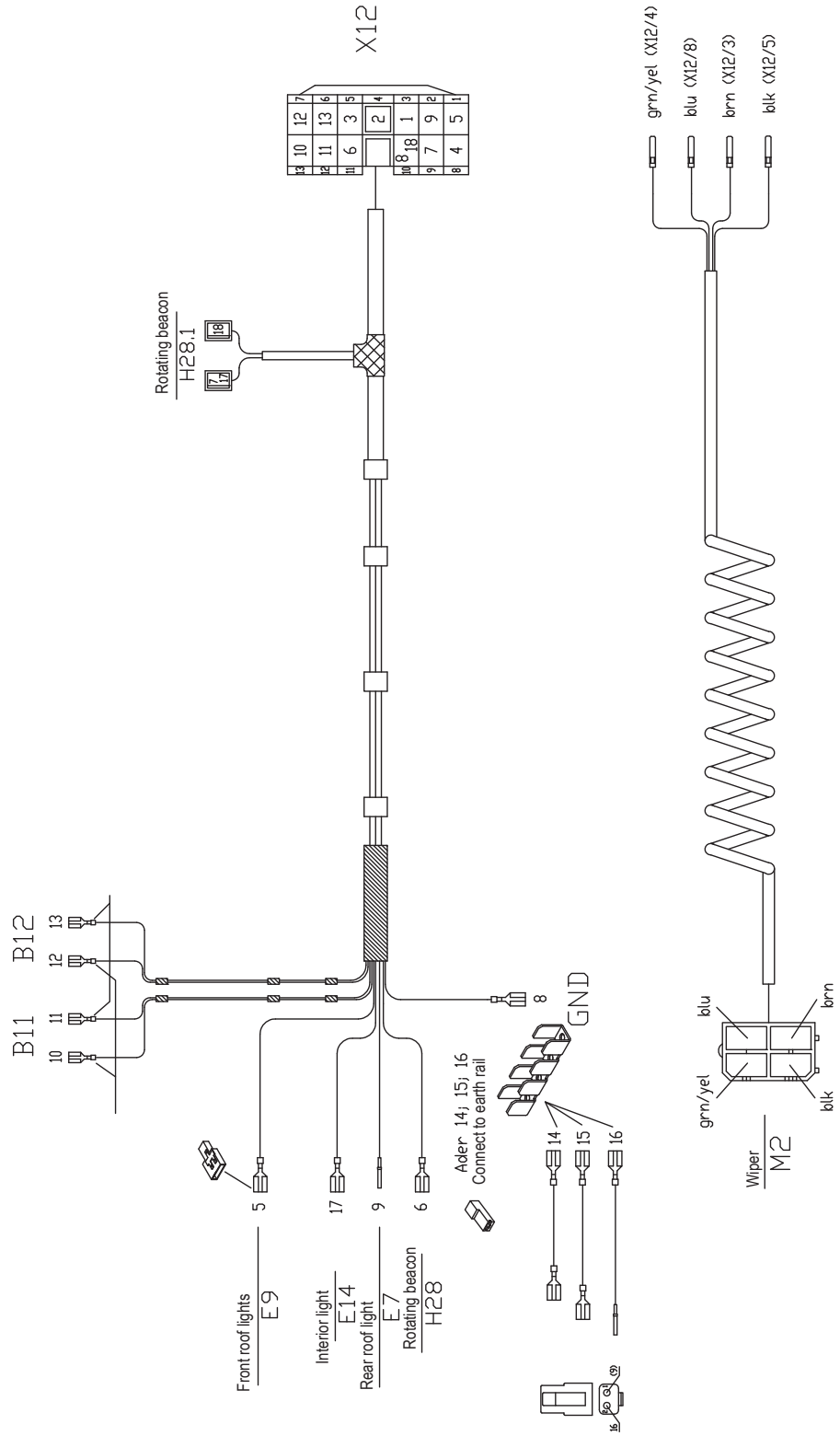
No.	Up to	To	Colour	mm²
46	S16/5 instrument panel lights	E15	yel-grn	1
47	X10/2 instrument panel lights	E15	yel-grn	1
48	S15/6 heating I	M4/1	yel-blk	1
49	S15/3 heating II	M4/3	yel-blu	1
50	F5/3 + 12 V valves/horn	X4/1	gry	1
51	S21/1 + 12 V valves/horn	X4/1	gry	1
52	S21/1 + 12 V valves/horn	S21/10	gry	1
53	S40/1 + 12 V valves/horn	S21/10	gry	1
54	S40/1 + 12 V valves/horn	S40/10	gry	1
55	S42/10 + 12 V valves/horn	S40/10	gry	1
56	F5/3 + 12 V valves/horn	S21.1/1	gry	1
57	B2 + 12 V valves/horn	S21.1/1	gry	1
59	X4.1/1 + 12 V valves/horn	X4.1/6	gry	1
60	X4/6 + 12 V valves/horn	S28	gry	1
61	S28 safety valve	Y13	bm-wht	1
62	S21.1/2 high speed	S21/5	brn-blk	1
63	Y3 high speed	S21/5	brn-blk	1
64	S40/5 quickhitch (quickhitch system)	Y25/1	gry-yel	1
65	S40/5 quickhitch	B19	gry-yel	1
66	S41/1 overload	S42/1	vio-blu	1
67	B18/8 overload	S42/5	vio-blu	1
68	B18/2 overload	X10/13	vio-blu	1
69	S55/1 horn	B2	org	1
70	F6/4 12 V roof lights	S17/1	grn	1
71	S17/2 12 V roof lights	S17/1	grn	1
72	S17/2 12 V roof lights	S17/10	grn	1
73	S18/10 12 V roof lights	S17/10	grn	1
74	S17/6 front roof light	X12/1	gm-red	1
75	S17/3 rear roof light	X12/2	grn-blu	1
76	F7/5 12 V wiper	S20/2	lblu	1
77	S20/10 12 V wiper	S20/2	lblu	1
78	S20/6 wiper	X12/3	blu-wht	1
79	S20/6 wiper	S20/7	blu-wht	1
80	S20/5 wiper reset	X12/4	blu-red	1
81	S20/3 washer pump	M5	blk-wht	1
82	F7/5 12 V wiper	X12/8	lblu	1
83	X12/9 12 V wiper	X12/8	lblu	1
84	F8/6 proportional controls	X14/1	gry-grn	1
85	F9/7 12 V drive interlock, rotating beacon	X4/2	red	1
86	S18/1 12 V drive interlock, rotating beacon	X4/2	red	1
87	S18/1 12 V/30 radio	A1/7	red	1
88	S20/10 12 V/15 radio	A1/4	lblu	1
90	F10/8 socket	X19	red/blk	1.5
91	F10/8 cigarette lighter	E15	red/blk	1.5
92	S18/5 rotating beacon	X12/11	vio	1

No.	Up to	To	Colour	
93	S5 oil filter	X10/6	org-wht	1
94	A1.1/6 right-hand side loudspeaker	X12/6	gm-blk	1
95	A1.1/5 right-hand side loudspeaker	X12/7	grn	1
96	A1.1/4 left-hand side loudspeaker	X12/12	gry	1
97	A1.1/3 left-hand side loudspeaker	X12/13	gry-blk	1
100	Y1/3 earth	GND	blk	1
101	Y13 earth	GND	blk	1
102	Y3 earth	GND	blk	1
103	M9 earth	GND	blk	1
104	M5 earth	GND	blk	1
105	M5 earth	K7/5	blk	1
106	K6 earth	GND	blk	1
107	K6 earth	K8	blk	1
108	V1 earth	K8	blk	1
109	X14/2 earth	GND	blk	1
110	X14/2 earth	S5	blk	1
111	M4/2 earth	GND	blk	1
112	M4/2 earth	B1/2	blk	1
113	X19 earth	GND	blk	1
114	X19 earth	E11/2	blk	1
115	Y25/2 earth	GND	blk	1
116	S41/2 earth	GND	blk	1
117	E15 earth	GND	blk	1
118	X12/5 earth	GND	blk	2.5
119	X4/3 earth	GND	blk	1
120	X4/3 earth	S42/9	blk	1
121	S40/9 earth	S42/9	blk	1
122	S40/9 earth	B19/2	blk	1
123	S15/9 earth	B19/2	blk	1
124	S15/9 earth	S21/9	blk	1
125	S55/2 earth	S21/9	blk	1
126	S55/2 earth	X10/5	blk	1
127	S20/9 earth	GND	blk	1
128	S20/9 earth	S16/9	blk	1
129	S17/9 earth	S16/9	blk	1
130	S17/9 earth	S18/9	blk	1
131	A1/8 earth	S18/9	blk	1
132	X12/10 earth	GND	blk	1.5

6.20 Chassis/engine wiring harness



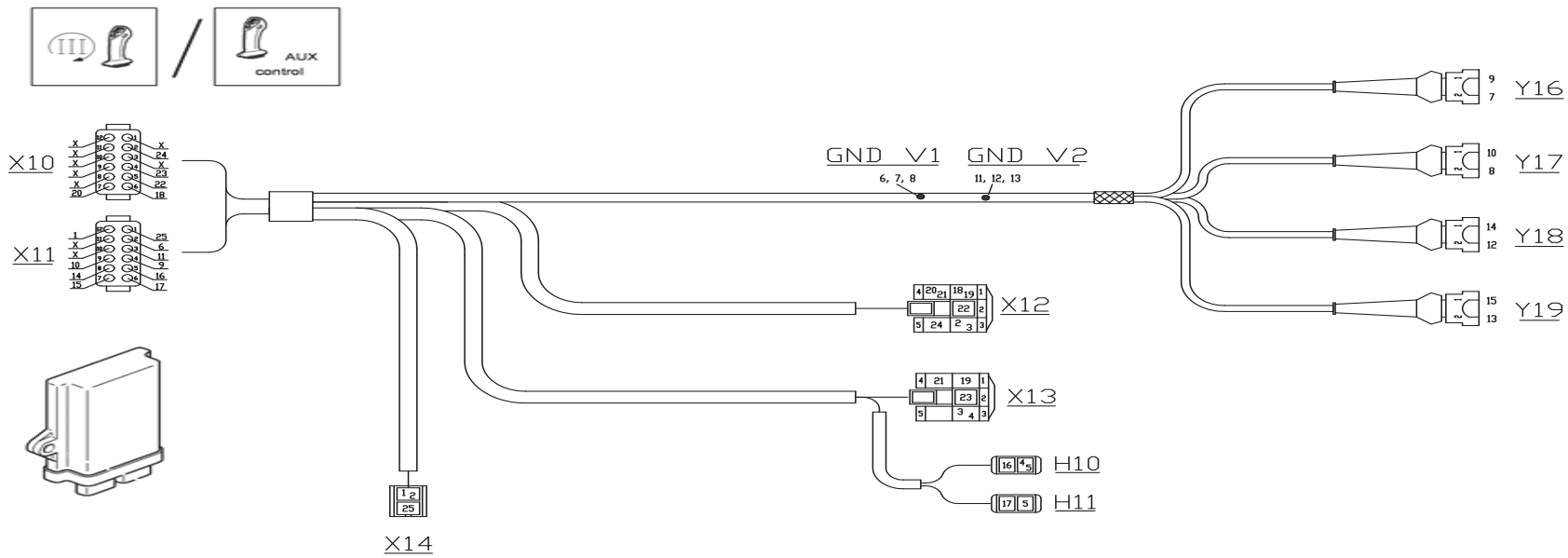
6.21 Cab wiring harness



Strand	From	Up to	mm²	Colour
5	X12/1	E9	1	grn/red
6	X12/11	H28	1	vio
7	X12/9	H28.1	1	blu
8	X12/10	GND	2.5	blk
9	X12/2	E7	1	grn/blu
10	X12/13	B11	1	wht/blk
11	X12/12	B11	1	wht

Strand	From	Up to	mm²	Colour
12	X12/7	B12	0.5	wht/blk
13	X12/6	B12	0.5	wht
14			1	blk
15			1	blk
16			1	blk
17	H28.1	E14	1	vio
18	H28.1	X12/10	1	blk

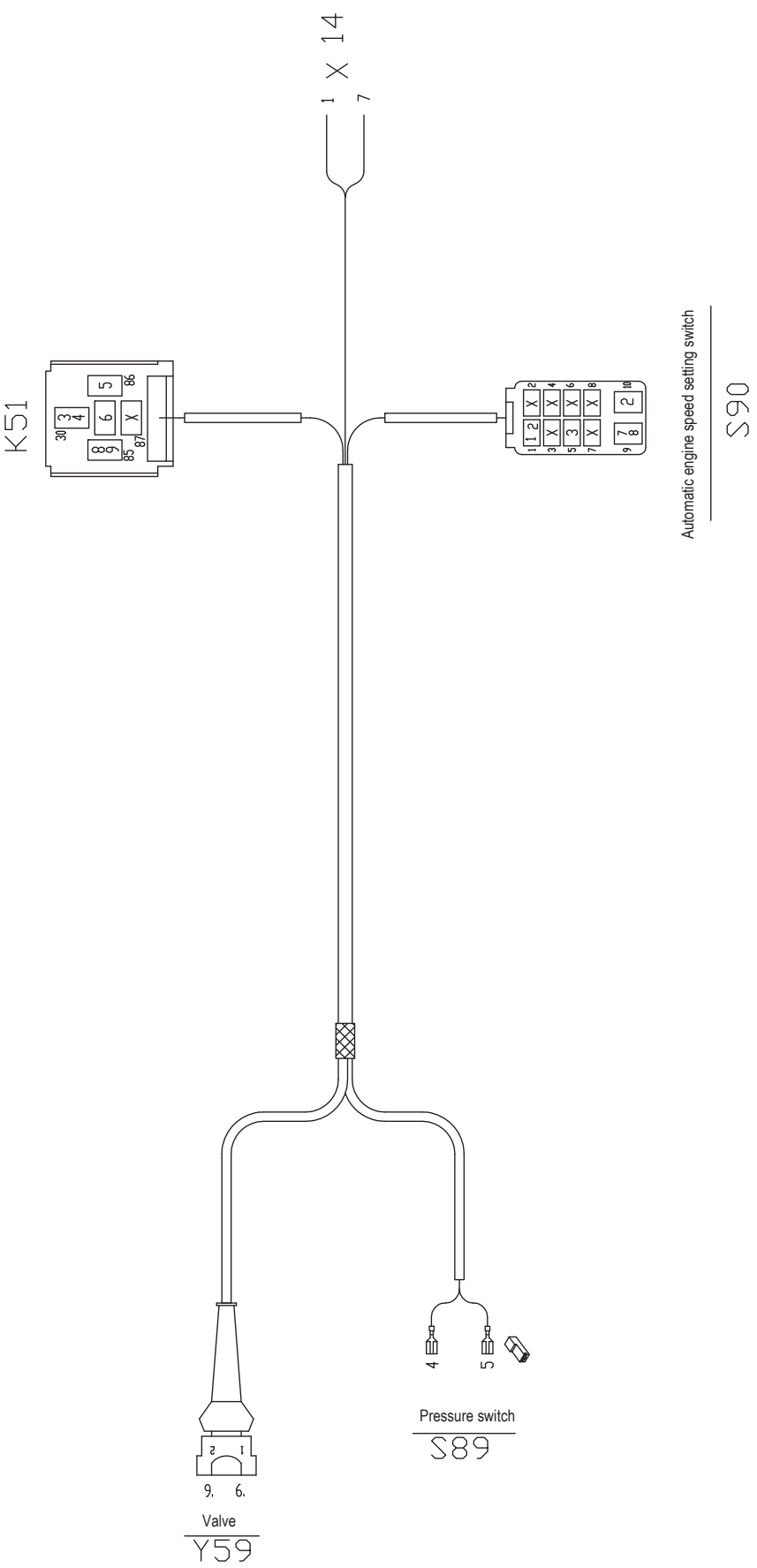
6.22 Proportional controls wiring harness (option)



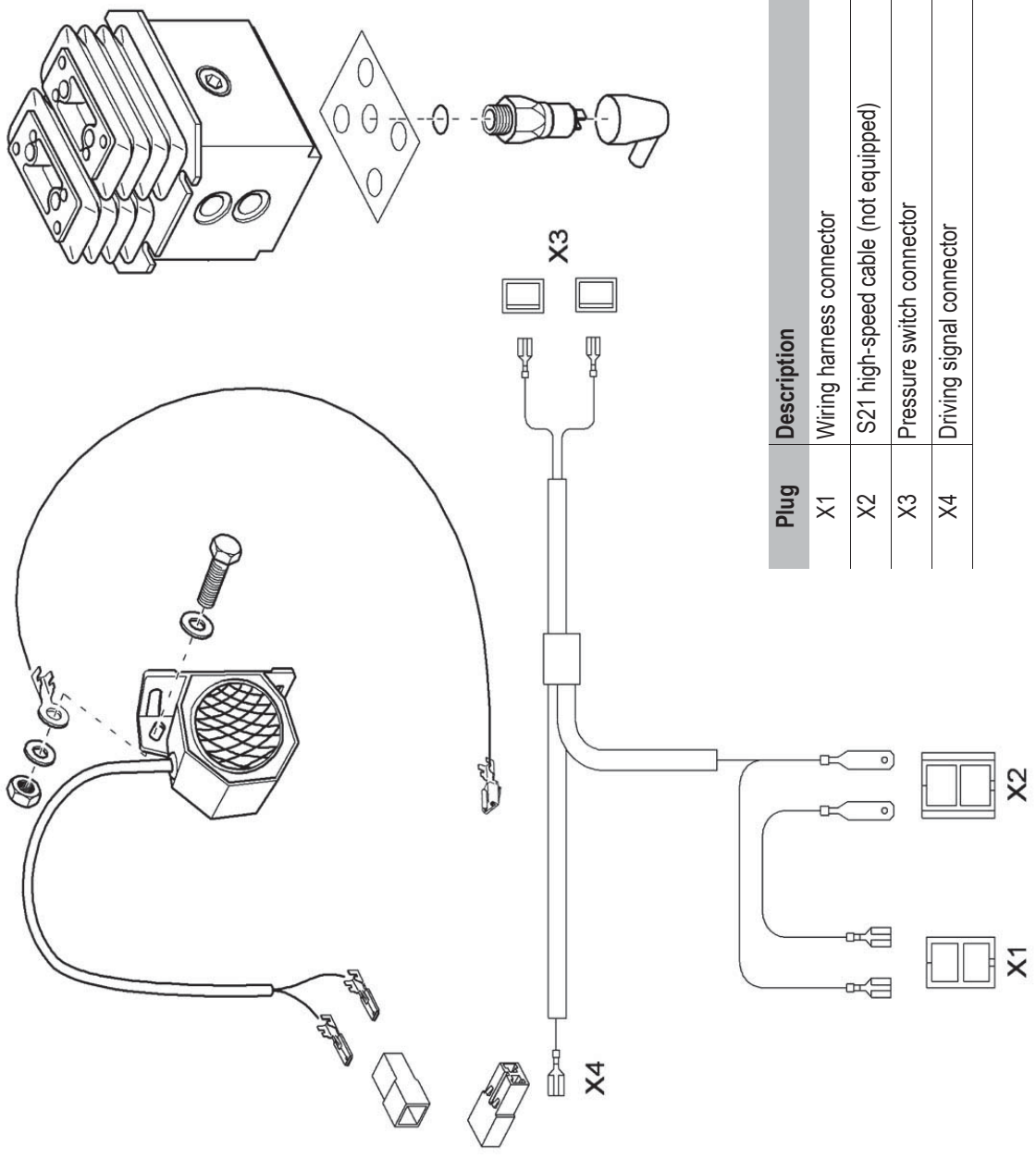
No.	Up to	To	Colour		No.	Up to	To	Colour	
1	X14/1 12 V	X11/12	blu	1	14	X11/8 valve 3	Y18/1	gry/red	1
2	X14/1 12 V	X12/3	blu	1	15	X11/7 valve 4	Y19/1	gry/blu	1
3	X13/3 12 V	X12/3	blu	1	16	X11/5 indicator light	H10/2	yel/red	1
4	H10/1 12 V	X14/3	blu	1	17	X11/6 indicator light	H11/2	yel/blk	1
5	H10/1 12 V	H11/1	blu	1	18	X10/6 5 V joystick	X12/1	red	1
6	X11/2 valve earth	GND V1	brn	1	19	X13/1 5 V joystick	X12/1	red	1
7	Y16/2 valve earth	GND V1	brn	1	20	X10/7 joystick earth	X12/4	blk/wht	1
8	Y17/2 valve earth	GND V1	brn	1	21	X13/4 joystick earth	X12/4	blk/wht	1
9	X11/4 valve 1	Y16/1	gry/blk	1	22	X10/5 joystick signal	X12/2	wht	1
10	X11/9 valve 2	Y17/1	gry/blk	1	23	X10/4 joystick signal	X13/2	wht/blk	1
11	X11/3 valve earth	GND V2	brn/blk	1	24	X10/2 hammer tip switch	X12/5	grn/red	1
12	Y18/2 valve earth	GND V2	brn/blk	1	25	X11/1 earth	X14/2	blk	1
13	Y19/2 valve earth	GND V2	brn/blk	1					

6.23 Engine speed control wiring harness (option)

No.	Up to	To	Colour		No.	Up to	To	Colour	
1	X14	S90/1	blu	1	6	Y59/1	K51/87a	grn	1
2	S90/10	S90/1	blu	1	7	X14	S88/9	blk	1
3	S90/5	K51/30	gry	1	8	K51/85	S88/9	blk	1
4	S89	K51/30	gry	1	9	K51/85	Y59/2	blk	1
5	S89	K51/86	yel	1					

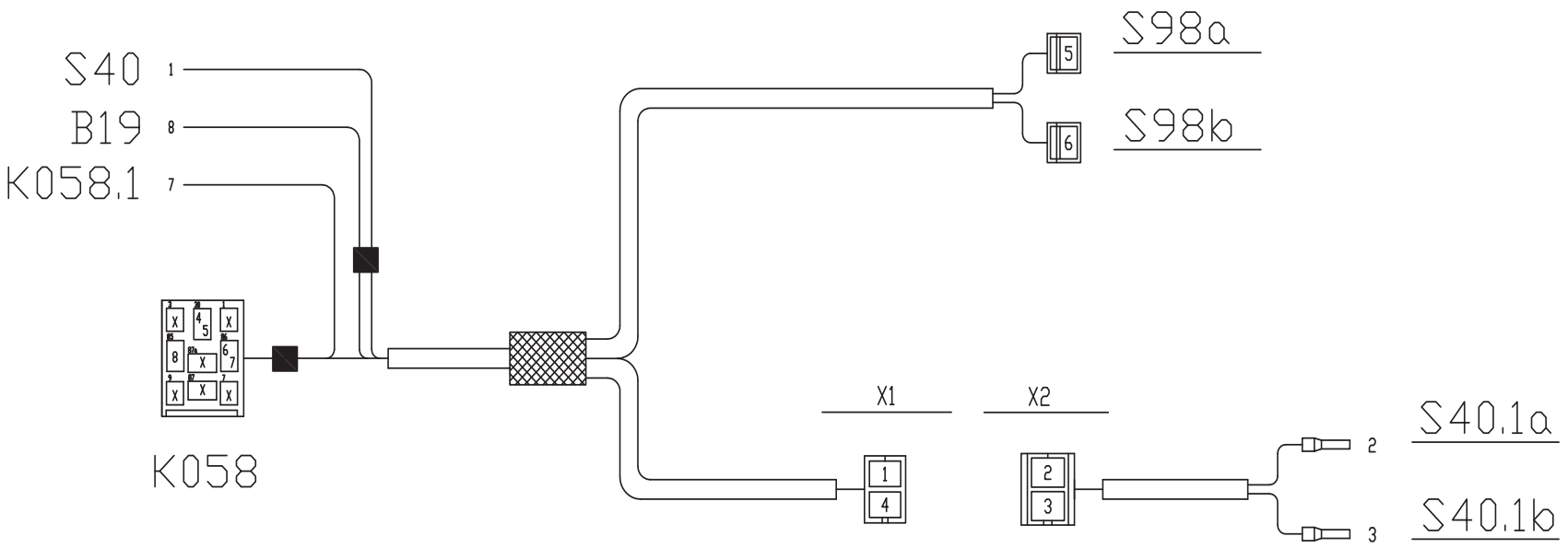


6.24 Driving signal wiring harness (option)



Plug	Description
X1	Wiring harness connector
X2	S21 high-speed cable (not equipped)
X3	Pressure switch connector
X4	Driving signal connector

6.25 Hydraulic quickhitch wiring harness (option)



Tie-wrap

Soft PVC DIN 40621

Shrink hose

*) Cable-side indication of connector assigment (unless otherwise specified)

*) Cable type FLRY-B, DIN 72551

*) Line and connector labelling with abbreviation (e. g.: Y9)

*) Protective hoses
Temperature range -25 °C to +90 °C (-13 °F to + 194 °F)

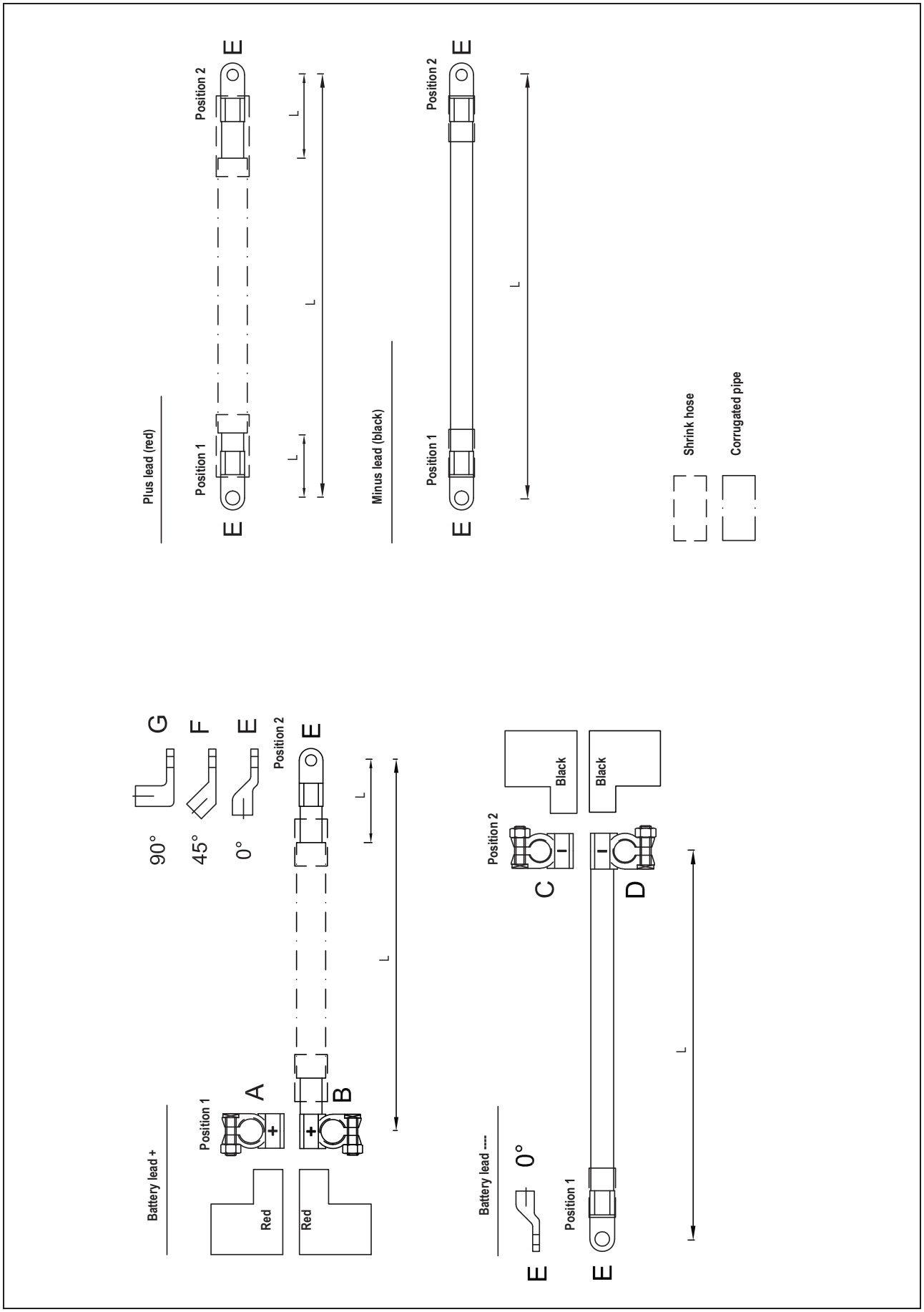
*) Length indications include connectors, adapter sockets,...

*) If technically feasible, pull protective hoses to ends of lines 30 mm (1.18") maximum (unless otherwise specified) from end of connector to protective hose

*) Use cable ties every 70 mm (2.8") for loose lines

Strand	From	Up to	mm²	Colour	Function
1	S40a	X1/1	1	red	+12 V
2	X2/1	S40.1a	1	red	Foot-operated tip switch
3	S40.1b	X2/2	1	brn	Foot-operated tip switch
4	X1/2	K058/30	1	brn	Foot-operated tip switch
5	K058/30	S98a	1	grn	Pressure switch
6	S98b	K058/86	1	blu	Pressure switch
7	K058/86	K058.1	1	gry/yel	Quickhitch valve
8	K058/85	B19	1	blk	Earth

6.26 Battery lead



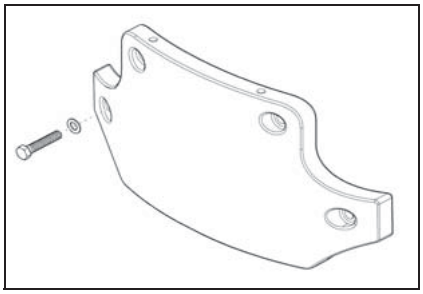
Options

7 Options

- Article numbers for options and retrofit kits: please refer to the 28Z3 spare parts list.

7.1 Counterweight

Specifications



Lock the screw connection with Loctite S2420 or VaryBond 12-43

Counterweight	
Weight	112 kg (246.9 lbs.)
Tightening torque for screws	290 Nm (214 lbs/ft)
Max. tail end lateral projection over tracks	34 mm (1.33”)

Notice!

Bear in mind the lift capacity table when using a counterweight!

7.2 Long stick

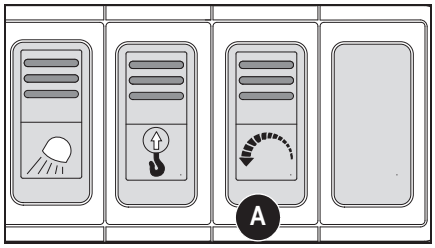
Specifications

Long stick	
Short stick	1050 mm (41”)
Long stick	1250 mm (49”)

Notice!

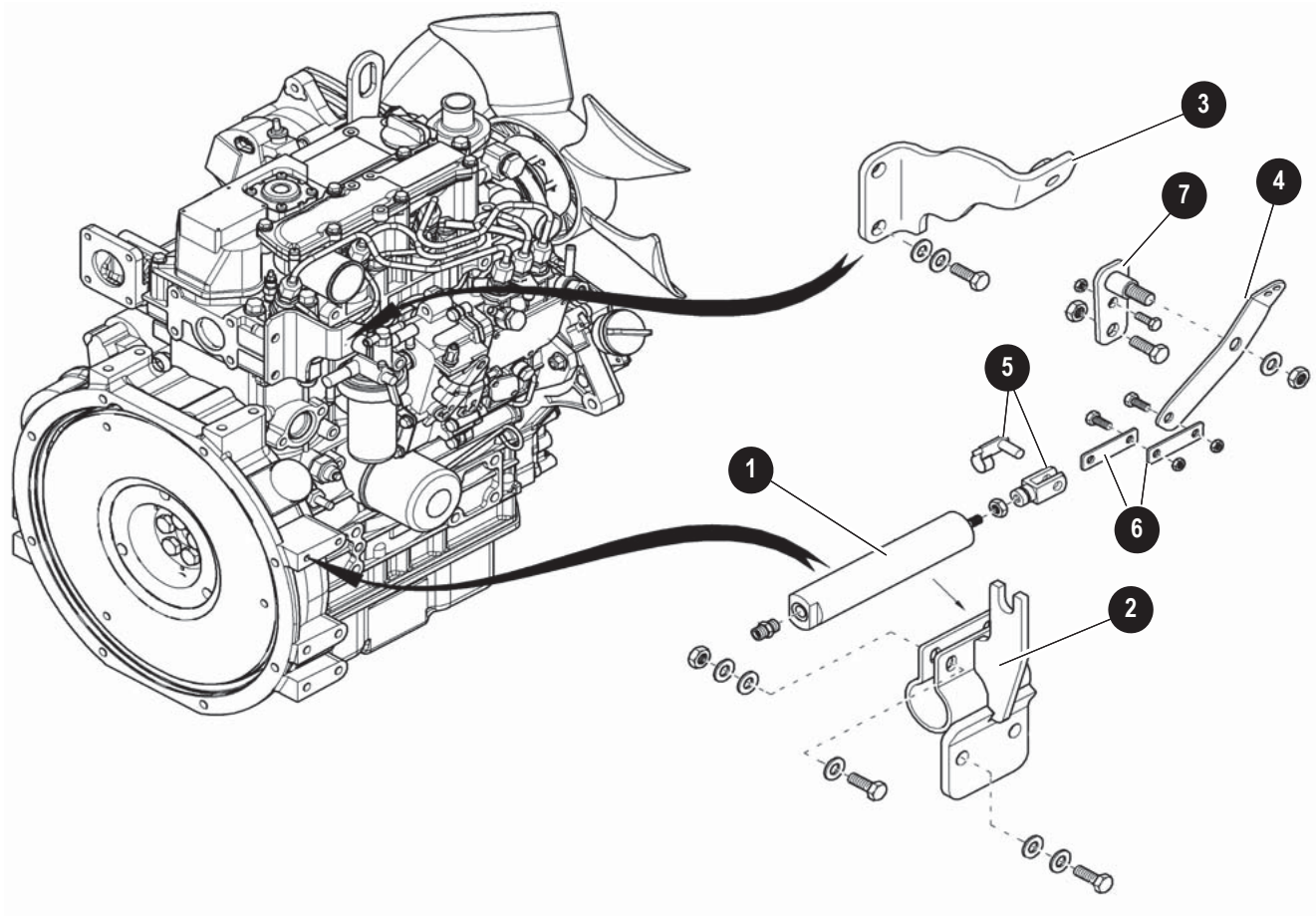
Bear in mind the lift capacity table when using a long stick!

7.3 Automatic engine speed setting



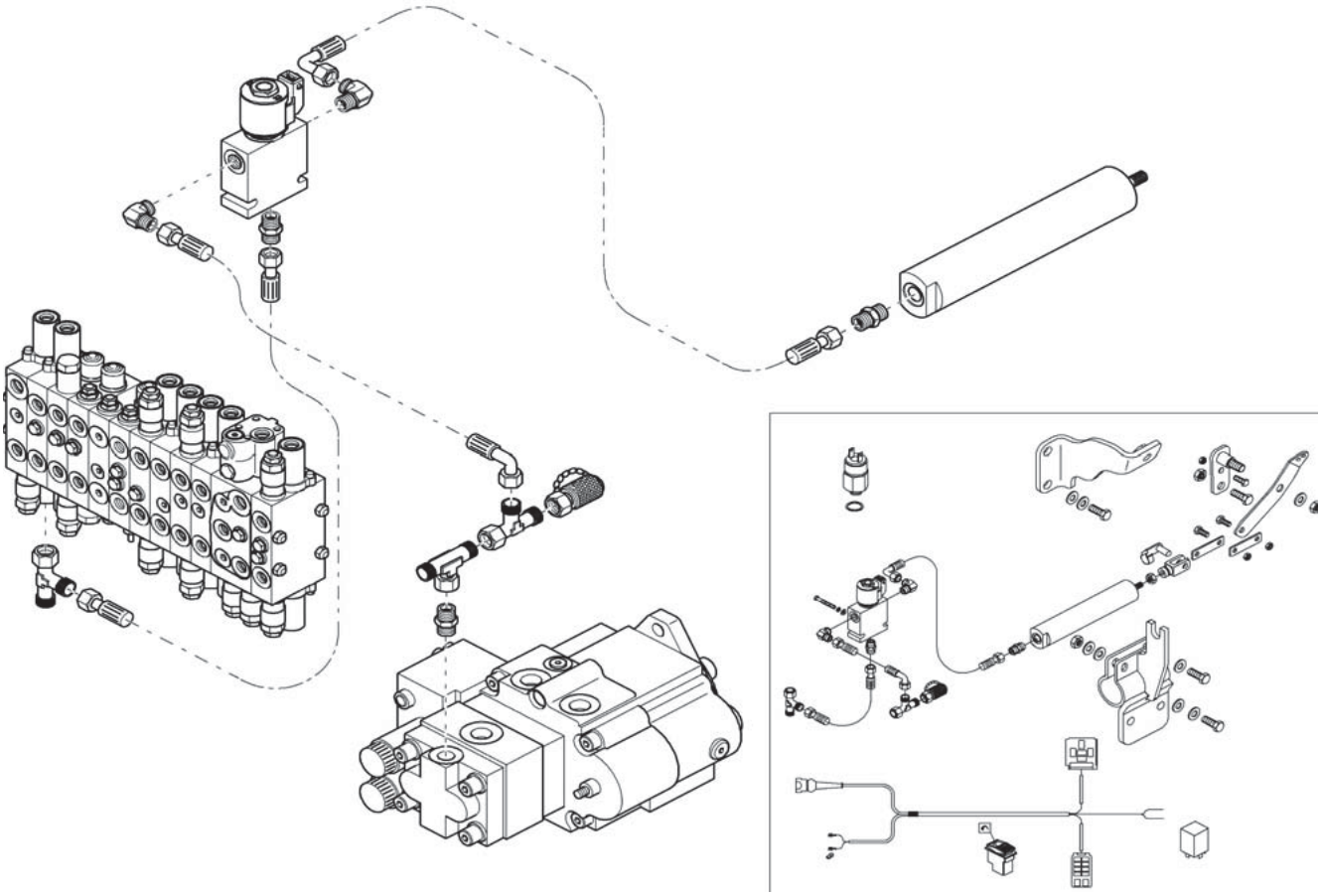
Diesel engine speed is automatically reduced to idling after 5 seconds if no hydraulic functions are carried out and if the automatic engine speed setting (switch **A**) is enabled.

As soon as a hydraulic function is carried out with the control levers, diesel engine speed is automatically increased again to the engine speed adjusted with the throttle.



Pos.	Designation
1	Cylinder
2	Bracket
3	Fuel filter bracket
4	Shackle
5	Fork head
6	Plate
7	Pin

Installation



7.4 Grab pipework

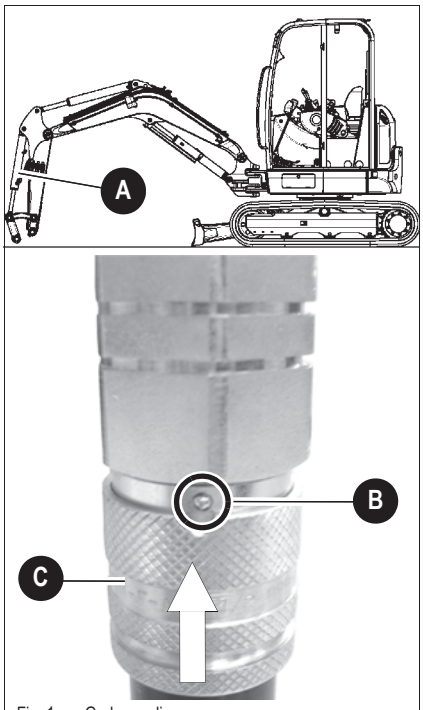


Fig. 1: Grab couplings

Connect and disconnect the grab couplings as follows:

Removing the coupling:

☞ *Park the machine on level ground*

☞ *Extend stick ram **A** halfway through*

☞ *Stop the engine*

☞ *Turn the ignition key to position "**1**"*

☞ *Release the pressure on the stick ram **A** by moving the right-hand control lever to the left and right*

☞ *Fold the control lever base up*

☞ *Turn lock sleeve **C** towards lock ball **B***

☞ *Pull lock sleeve **C** upwards*

☞ The coupling opens

Connecting the coupling:

☞ *Connect the coupling onto the stick ram connection making sure it is straight*

☞ Wait until you hear a hissing sound of the connection

☞ Fully connect the coupling on the connection

☞ *Turn back the lock again (away from lock ball **B**)*

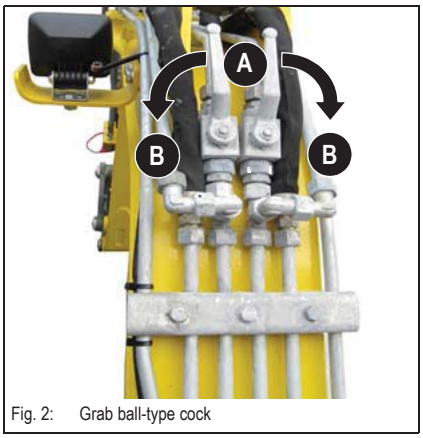


Fig. 2: Grab ball-type cock

Changing over the ball-type cock:

Bucket operation:

☞ *Set the ball-type cocks to position **A***

Grab operation:

☞ *Set the ball-type cocks to position **B***

Attachments

Notice!

Please refer to the Operator's and maintenance manual of the attachment manufacturer for using and carrying out maintenance on attachments such as hammers, grabs etc.

7.5 3rd control circuit/PowerTilt ports

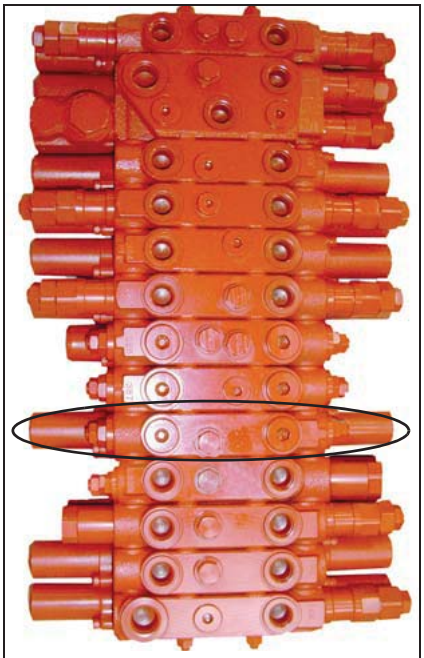


Fig. 3: 3rd control circuit/PowerTilt ports

Standard ports:

Port	Bushing
Standard	Bulkhead coupling 1/2”
Quick coupler option	Quick coupler ISO De 12.5 1/2”

Couplings cannot be coupled under pressure!

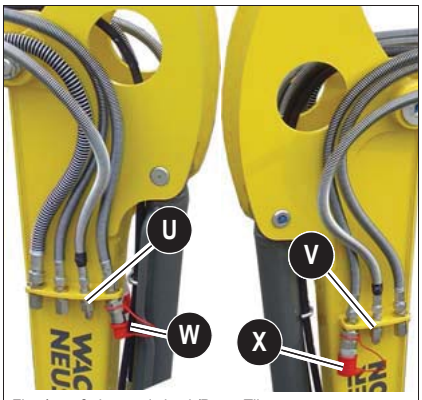


Fig. 4: 3rd control circuit/PowerTilt ports

Notice!

Follow the instructions in the Operator's Manual of the attachment manufacturer for connecting the 3rd control circuit to attachments.

Standard ports:

Port	Stick (left)	Stick (right)
V	3rd control circuit/PowerTilt	
U		3rd control circuit/PowerTilt
W		Grab
X	Grab	

7.6 Safe load indicator

Danger!

Safe load indicator not switched on or adjusted incorrectly –

Danger of accidents!

☞ *Always switch on the safe load indicator!*

☞ *Adjust the safe load indicator if the setting is incorrect (i.e. if it responds too early or too late) – see Setting the pressure switch on page 7-11*

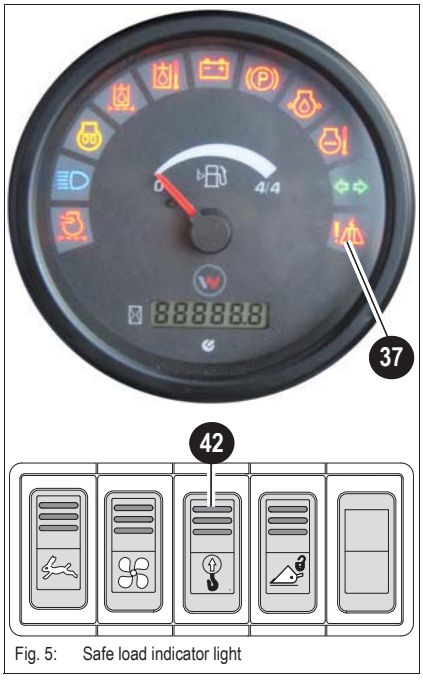


Fig. 5: Safe load indicator light

Switch on the safe load indicator as follows:

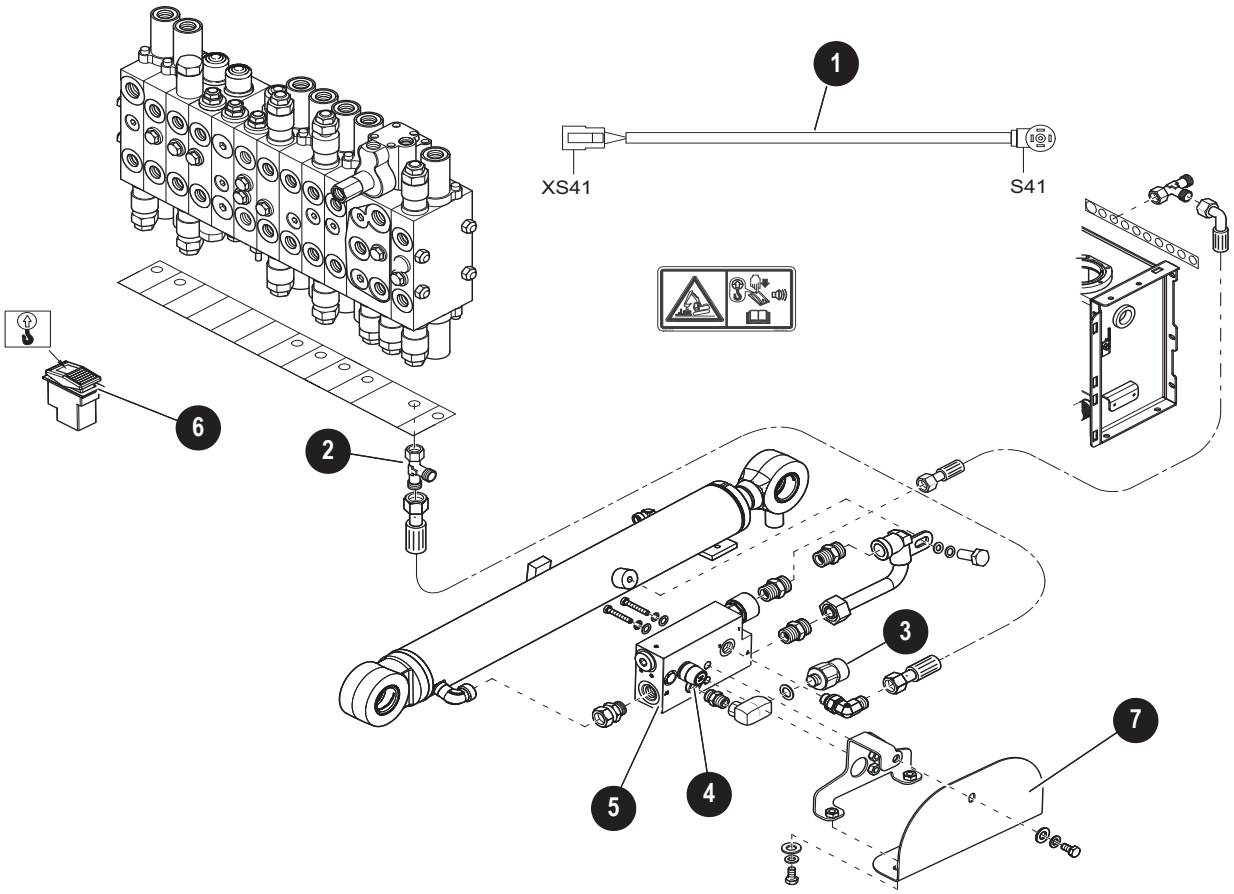
☞ *Press switch* **42** *on the instrument panel*

➥ Indicator light **37** on the round indicating instrument comes on in case of overload

The safe load indicator light comes on, and an acoustic warning is given, to warn the driver he has reached the maximum admissible load. Any further increase of the load moment can cause the machine to overturn in this situation. Therefore the driver must immediately reduce the load moment as follows:

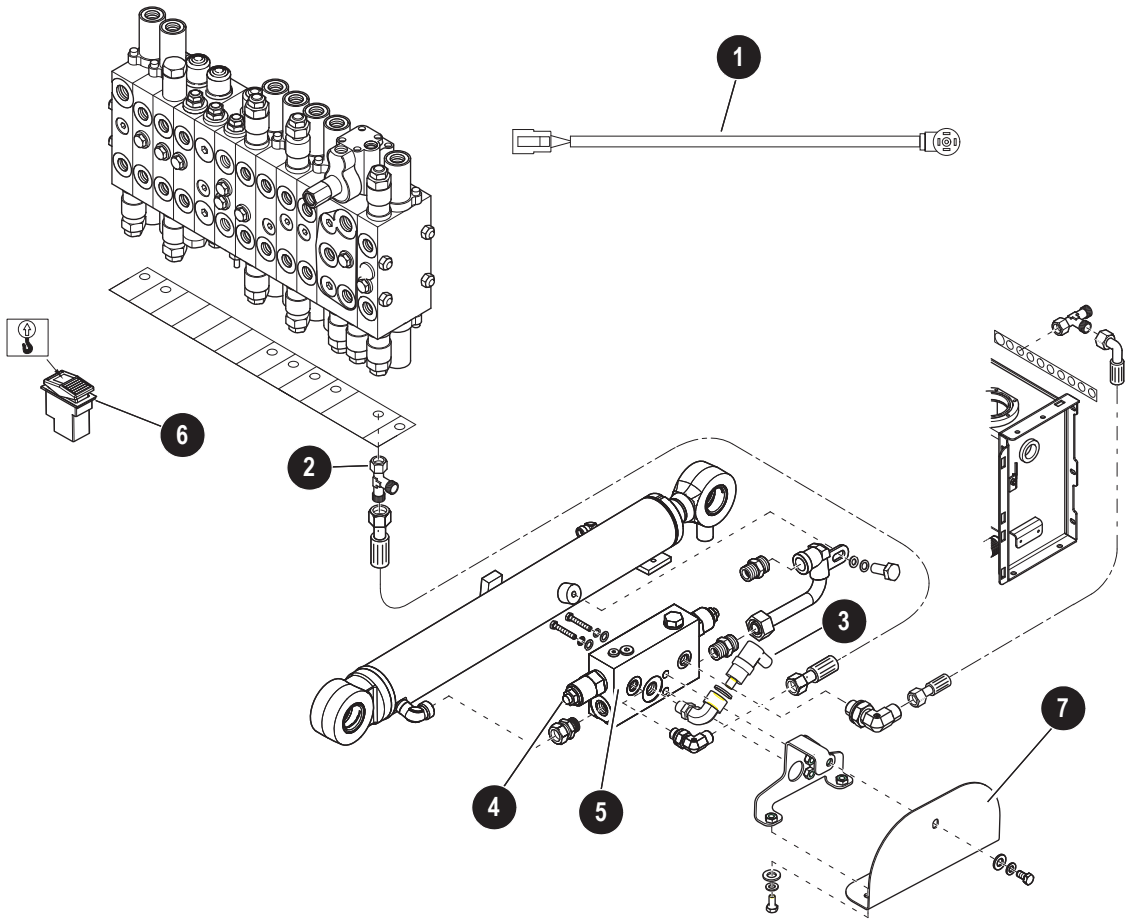
☞ *Reduce reach until both the acoustic signal and the indicator light in the round display element go out*

7.7 Safe load indicator DE (from serial no. AG04828) (safety valves for boom)



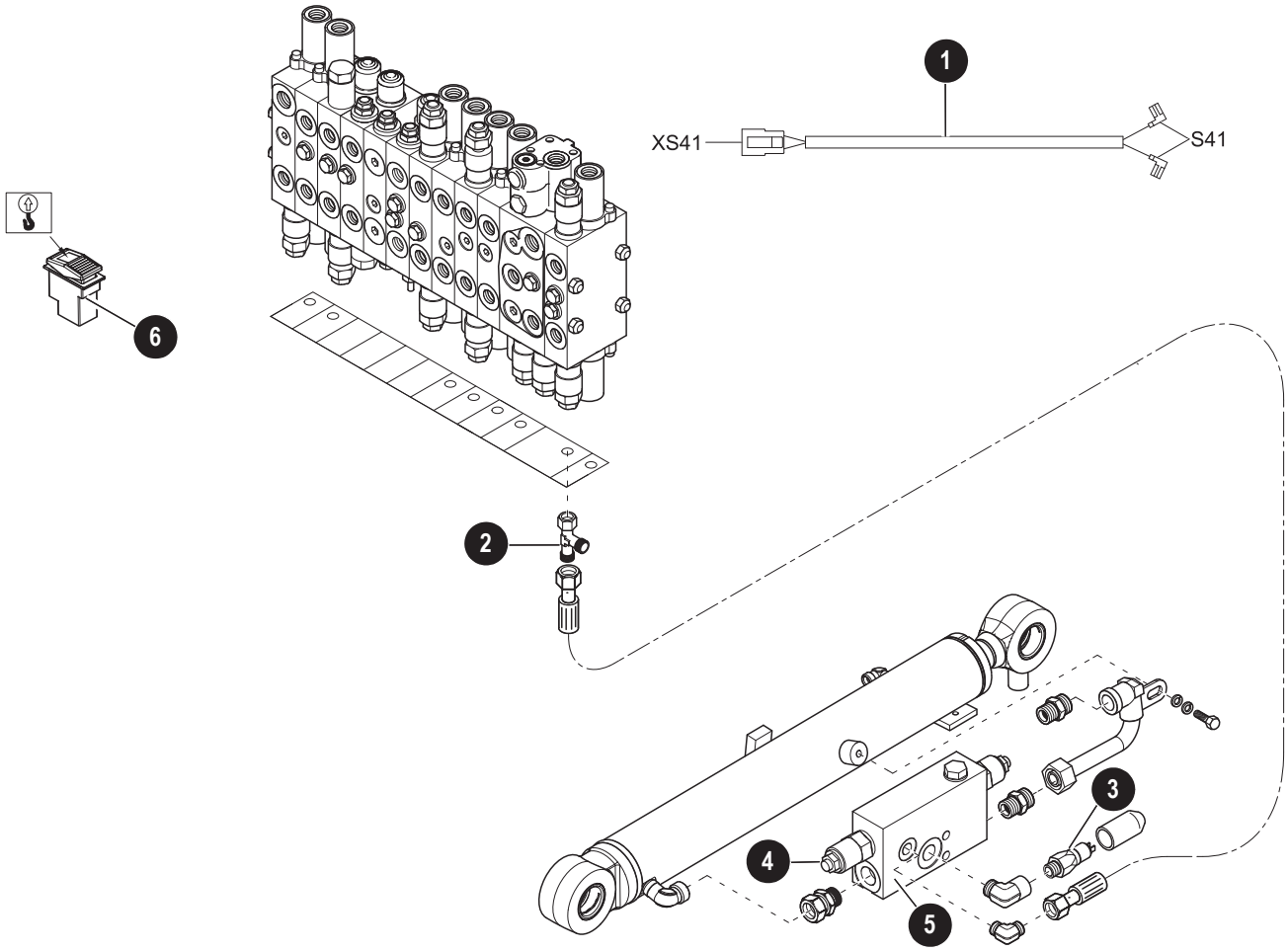
Pos.	Designation
1	Safe load indicator cable
2	Pilot control segment port
3	Pressure switch
4	Directional valve
5	Hose burst valve
6	Switch
7	Protective plate

Safe load indicator DE (serial nos. AG02444 to AG04827) (safety valves for boom)



Pos.	Designation
1	Safe load indicator cable
2	Pilot control segment port
3	Pressure switch
4	Set screw
5	Hose burst valve
6	Switch
7	Protective plate (from serial number AG03069)

Safe load indicator DE (up to serial no. AG02443)



Pos.	Designation
1	Safe load indicator cable
2	Pilot control segment port
3	Pressure switch
4	Set screw
5	Hose burst valve
6	Switch

Function

The hose burst valve is mounted direct on the base-side port of the boom ram.

Extending the boom ram

- The ram can be extended as usual (always “free flow” towards the ram).

In the event of a hose rupture, the load is safely held in base position by means of the non-return valve.

Retracting the boom ram

- Pilot control pressure moves valve (**2**) to work position (free oil return from the base side).
- The valve moves back to home position if the pilot control pressure drops.

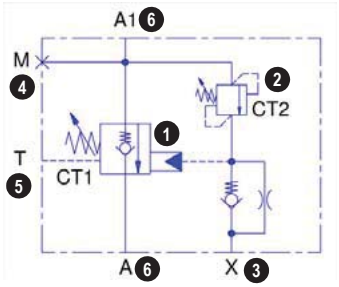
In addition, a safety valve (**1**) protects the hydraulic rams from overload. Overload actuates pressure switch (**4**), the warning device comes on and the buzzer sounds.

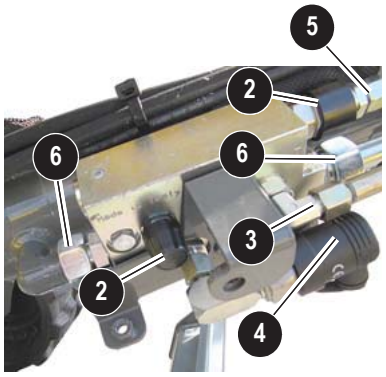
Notice!

The valve settings are sealed, no modifications for legal reasons!

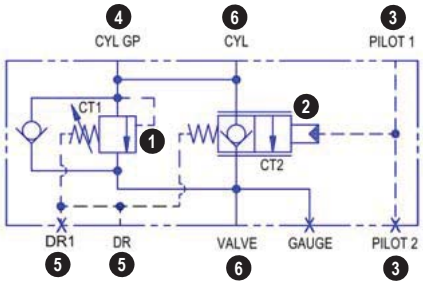
Wiring diagram

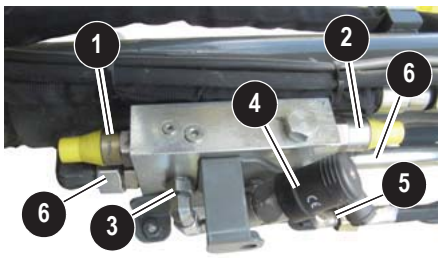
Boom from serial number AG04828



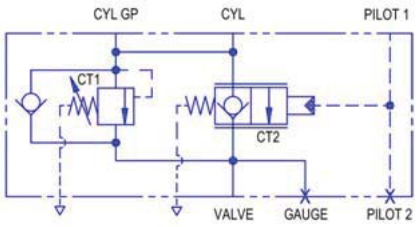


Boom serial numbers AG02444 – AG04827





Boom up to serial number AG02443

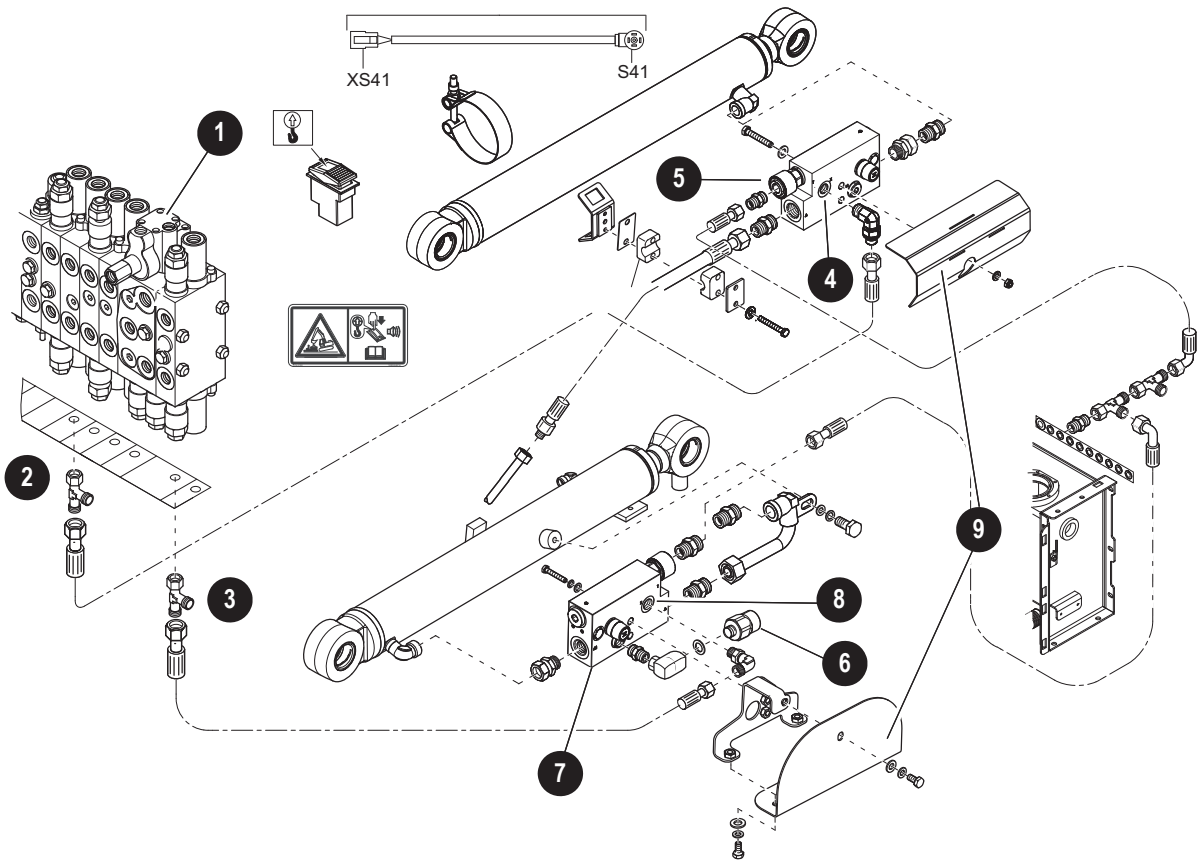


Pos.	Designation	Port	Pos.	Designation	Port
1	Safety valve	CT1	5	Tank line	DR
2	Directional valve	CT2	6	Raise/lower boom	V
3	Pilot control port	PILOT			
4	Pressure switch	GP			

Setting the pressure switch

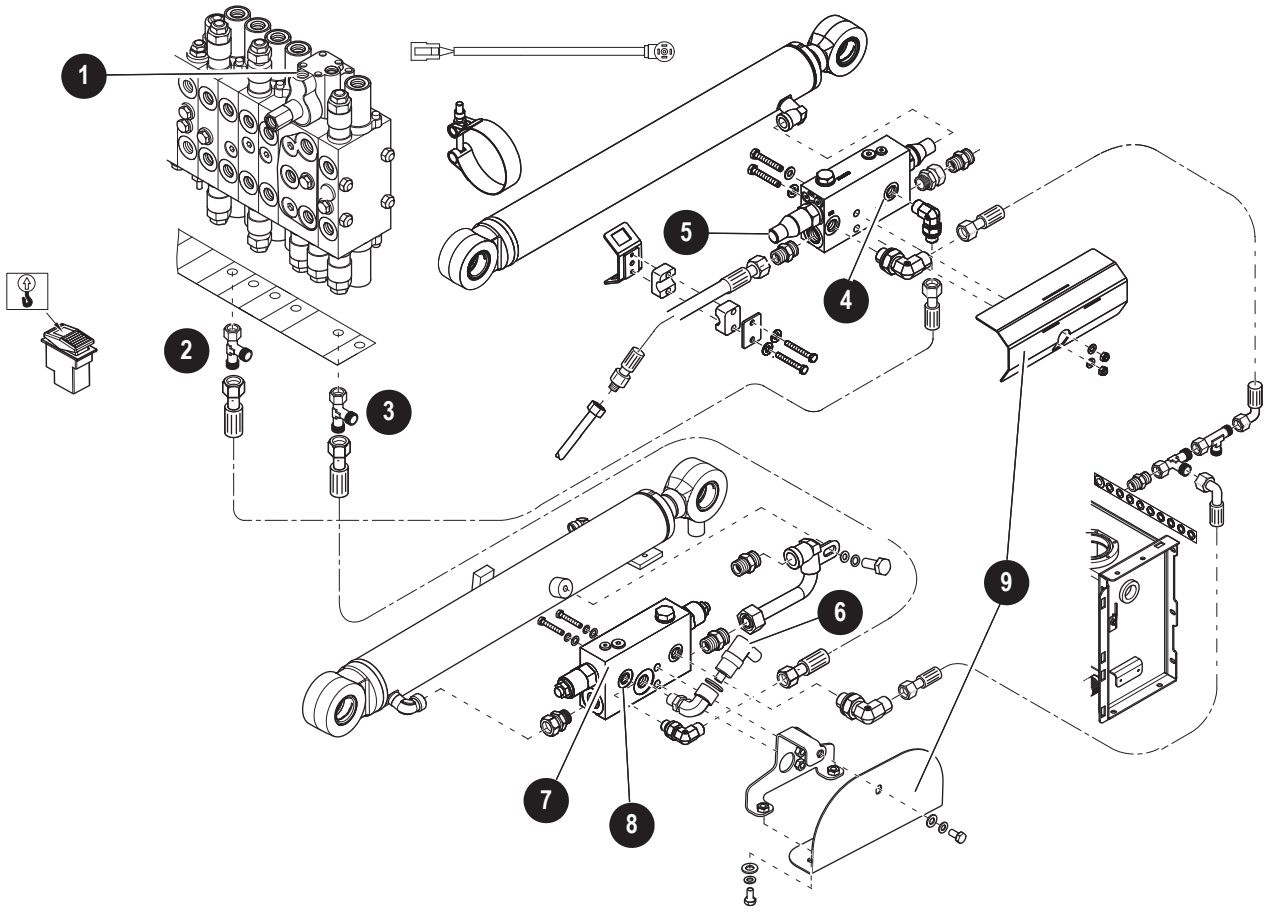
Adjust the pressure switch – *see Setting the pressure switch* on page 7-17

7.8 Safe load indicator FR (from serial no. AG04828) (safety valves for boom, stick and stabiliser blade)



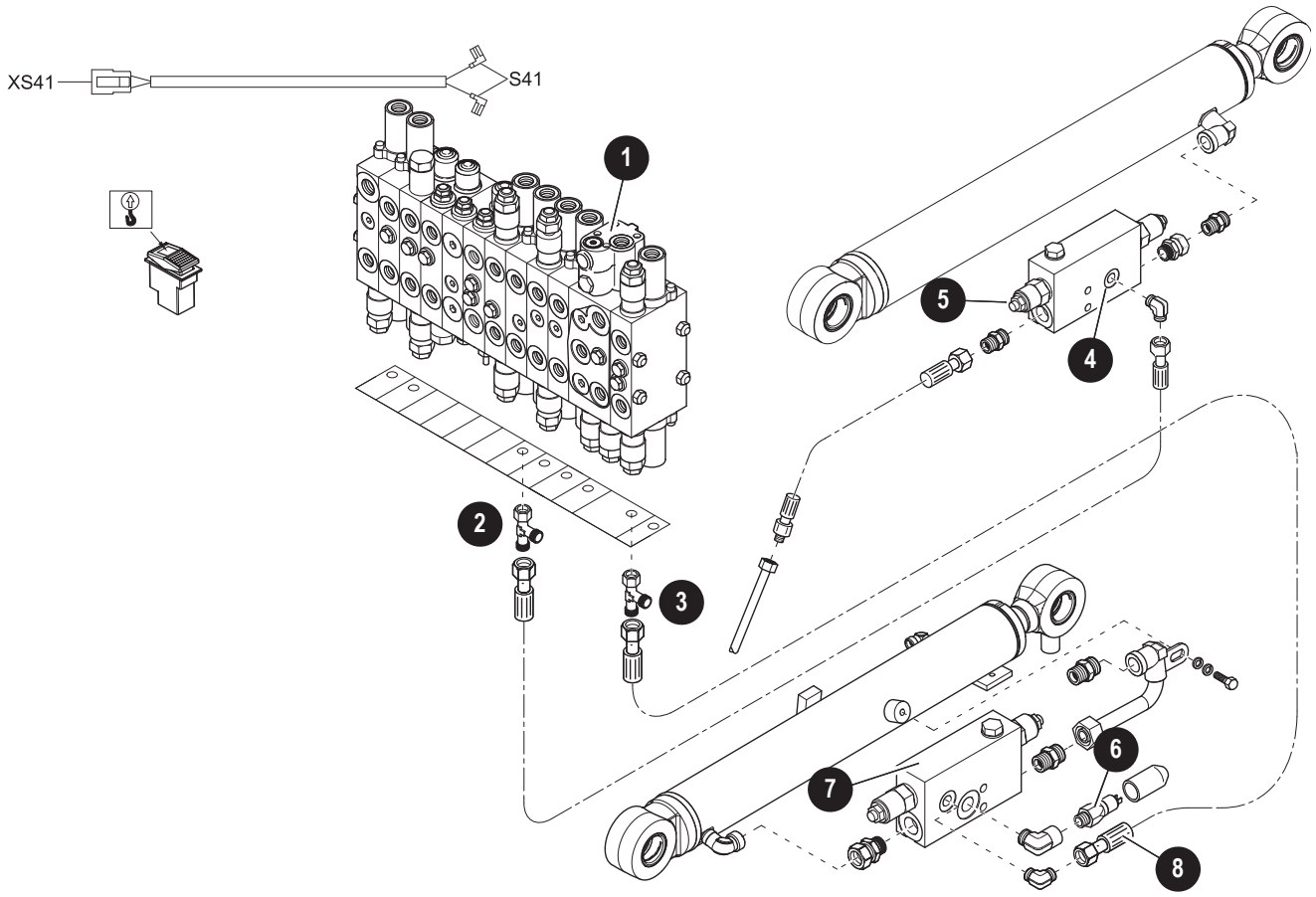
Pos.	Designation
1	Boom segment pilot control port
2	Joystick stick port
3	Joystick boom port
4	Stick pressure line port
5	Leak oil strip port
6	Pressure switch
7	Hose burst valve
8	Boom pressure line port
9	Protective plate

Safe load indicator FR (serial nos. AG02444 to AG04827) (safety valves for boom, stick and stabiliser blade)



Pos.	Designation
1	Boom segment pilot control port
2	Joystick stick port
3	Joystick boom port
4	Stick pressure line port
5	Leak oil strip port
6	Pressure switch
7	Hose burst valve
8	Boom pressure line port
9	Protective plate (from serial number AG03069)

Safe load indicator FR (up to serial no. AG02443)



Pos.	Designation
1	Boom segment pilot control port
2	Joystick stick port
3	Joystick boom port
4	Stick pressure line port
5	Leak oil strip port
6	Pressure switch
7	Hose burst valve
8	Boom pressure line port

Function

A hose burst valve is mounted directly on the base-side port of the boom ram, the other valve is mounted on the rod-side port of the stick ram.

Extending the boom ram

- The ram can be extended as usual (always “free flow” towards the ram).

In the event of a hose rupture, the load is safely held in base position by means of the non-return valve.

Retracting the boom ram

- Pilot control pressure moves valve (**2**) to work position (free oil return from the base side).
- The valve moves back to home position if the pilot control pressure drops.

Retracting the stick ram

- The ram can be retracted as usual (always “free flow” towards the ram).

The built-in non-return valve safely holds the load in rest position.

Extending the stick ram

- Pilot control pressure moves valve (**2**) to work position (free oil flow to the base side).
- The valve moves back to home position if the pilot control pressure drops.

In addition, safety valve (**1**) protects the hydraulic rams from overload. Overload actuates pressure switch (**4**), the warning device comes on and the buzzer sounds.

Notice!

The valve settings are sealed, no modifications for legal reasons!

Extending the stabiliser blade ram

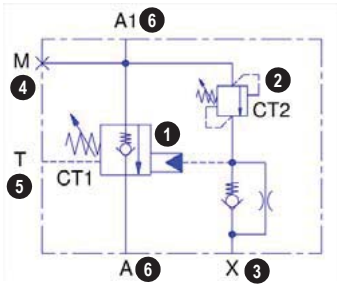
The ram can be extended as usual (always “free flow” from the ram).

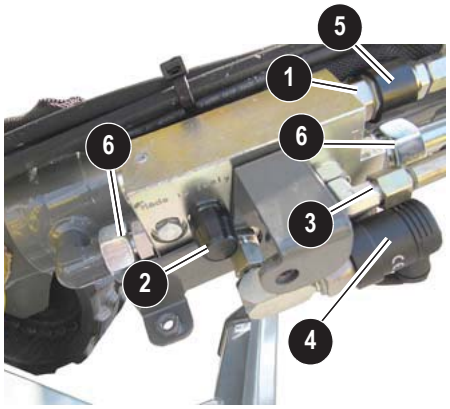
Retracting the stabiliser blade ram

Check valve (**8**) is controlled in parallel by the operating pressure (free oil flow to the base side).

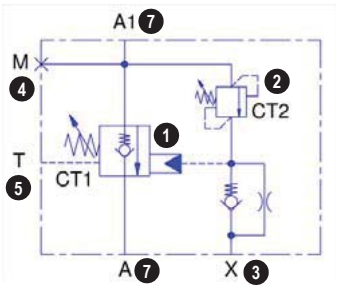
Diagram (from serial no. AG04828)

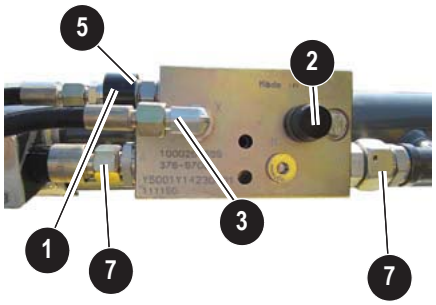
Boom





Stick





Stabiliser blade

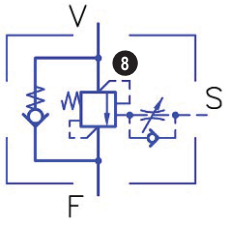
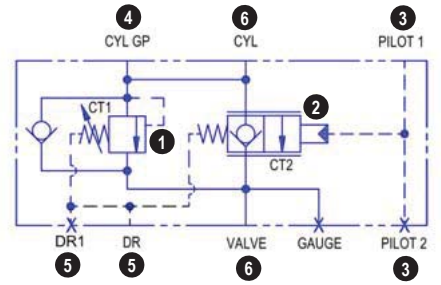
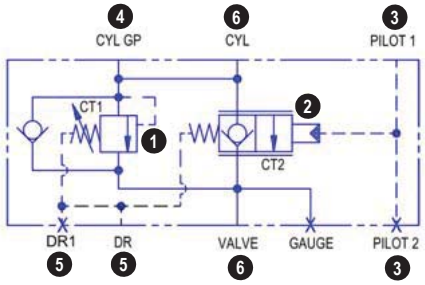


Diagram (serial nos. AG02444 to AG04827)

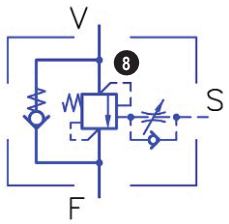
Boom

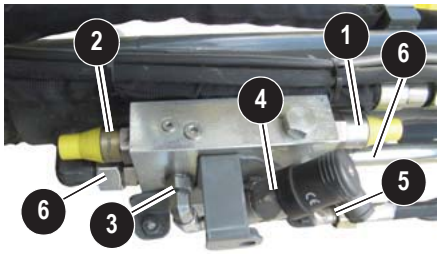


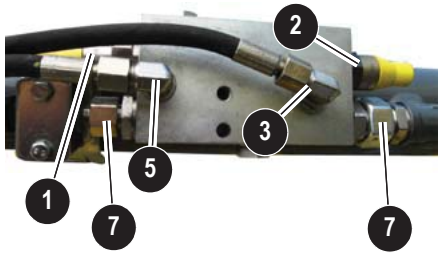
Stick



Stabiliser blade







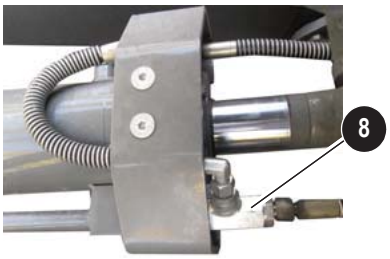
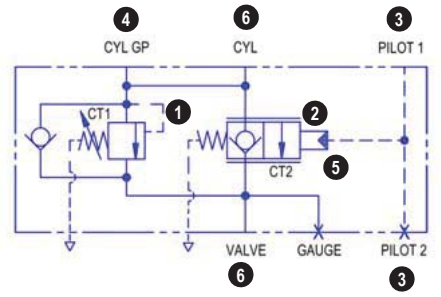
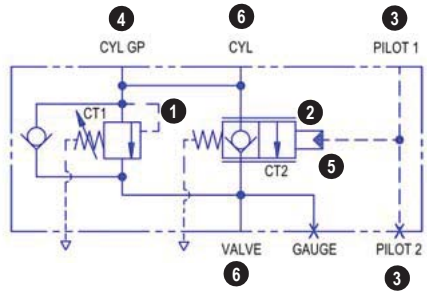


Diagram (up to serial no. AG02443)

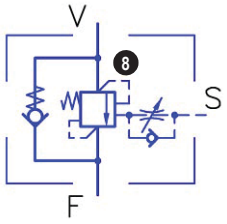
Boom



Stick



Stabiliser blade



Pos.	Designation	Port	Pos.	Designation	Port
1	Safety valve	CT1	5	Tank line	DR
2	Directional valve	CT2	6	Raise/lower boom	V
3	Pilot control port	PILOT	7	Extend/retract stick	V
4	Pressure switch	GP	8	Non-return valve	

Setting the pressure switch

Fig. 6: Pressure switch with cable connector

☞ *Install a test weight according to the lift capacity table (for instance 387 kg/854 lbs) turned 90° with regard to the driving direction – see chapter 2.15 Lift capacity table 28Z3 (short stick) on page 2-13.*

☞ *Set the boom to the values indicated in the lift capacity table for reach and load hook height.*

☞ *Remove connector **A** of cable **1**.*

☞ *Pressure switch **3** is located under connector **A**.*

☞ *Set screw **4** is located on the upper side of pressure switch **3**.*

☞ *Adjust pressure switch **3** so that the warning does not barely sound.*

☞ Adjust pressure switch **3** with set screw **4** and a screwdriver.

➥ Unscrew the screw = earlier response

➥ Tighten the screw = later response

☞ *Check again and reconnect the connector.*

7.9 Hose burst valve safety feature

Notice!

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

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 itself immediately repaired and checked by technical staff with suitable training!*

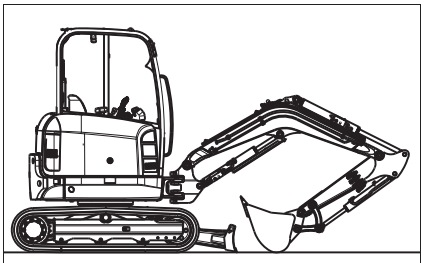


Fig. 7: Transport position

☞ *Proceed as follows in case of damage:*

- Immediately stop the machine
- Move the boom to transport position
- Fold up the left-hand control lever base
- Stop the engine
- Remove the ignition key and lock the cab
- Lock 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

7.10 Mechanical quickhitch

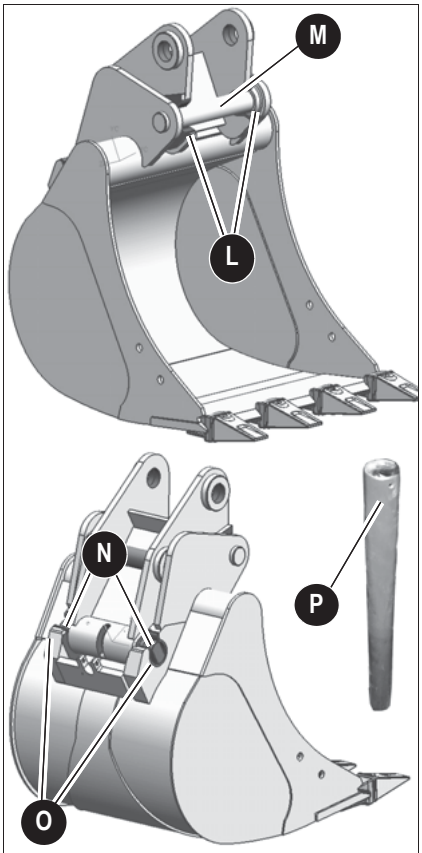


Fig. 8: Bucket with quickhitch

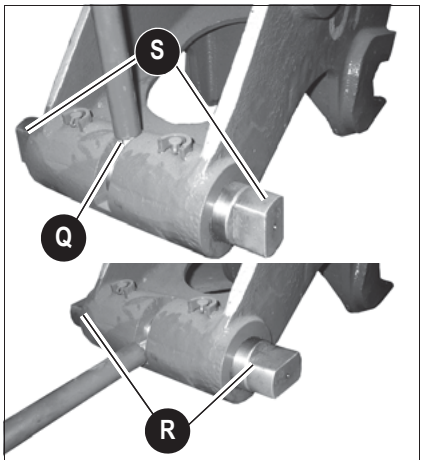


Fig. 9: Bucket with quickhitch

Danger!

The attachment must always be safely locked onto the quickhitch –

Danger of accidents!

☞ *Before starting work, ensure that the attachment is securely locked onto the quickhitch by means of the lock mechanism. You must be able to see the lock on either side of the mounting bore of the attachment.*

☞ *Re-equip as follows:*

- Approach the machine to the attachment
- Pick up the bucket with coupling bar **M** and coupling claws **L** of the quickhitch
- Engage lock mechanism **N** into mounting bore **O**
- Place the bucket on level ground

☞ *Lock as follows:*

- Stop the engine
- Insert tube **P** (included in scope of delivery) in clamping sleeve **Q**
- Press the tube downwards
- The lock pins must be in position **R**

☞ *Unlock as follows:*

- Stop the engine
- Insert tube **P** (included in scope of delivery) in clamping sleeve **Q**
- Press the tube upwards
- The lock pins must be in position **S**

7.11 Hydraulic quickhitch (Easy Lock)

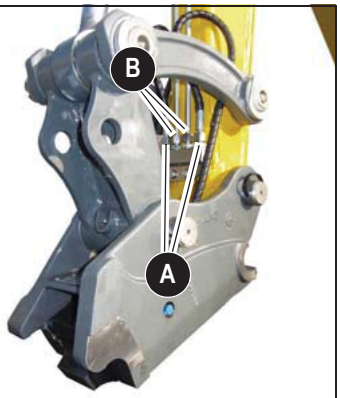


Fig. 10: Hydraulic Easy Lock quickhitch connections

Hydraulic quickhitch connections

- Connections **A** for hydraulic quickhitch
- Supply via pipe line **B**

Opening and closing pressure of hydraulic quickhitch

- Closing pressure 50 bar (725 psi) when a function is activated
  ➥ Otherwise a circulation pressure of about 15 bar (218 psi)
- Opening pressure 206 bar (2990 psi)

Danger!

For system-specific reasons, the hydraulic quickhitch opens and closes with the functions “Stabiliser blade”, “Auxiliary hydraulics”, “Boom swivel” and “Rotate upper carriage”

For reasons of safety, only use the function “Raise stabiliser blade” to open or close!

7.12 3rd control circuit

Function

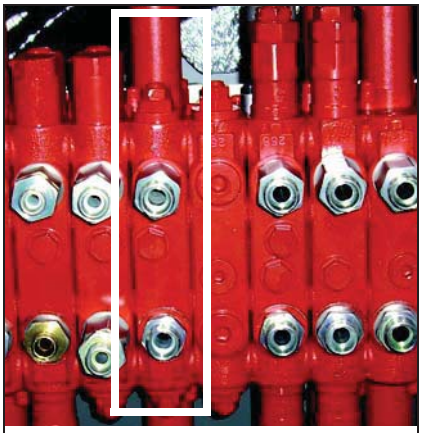


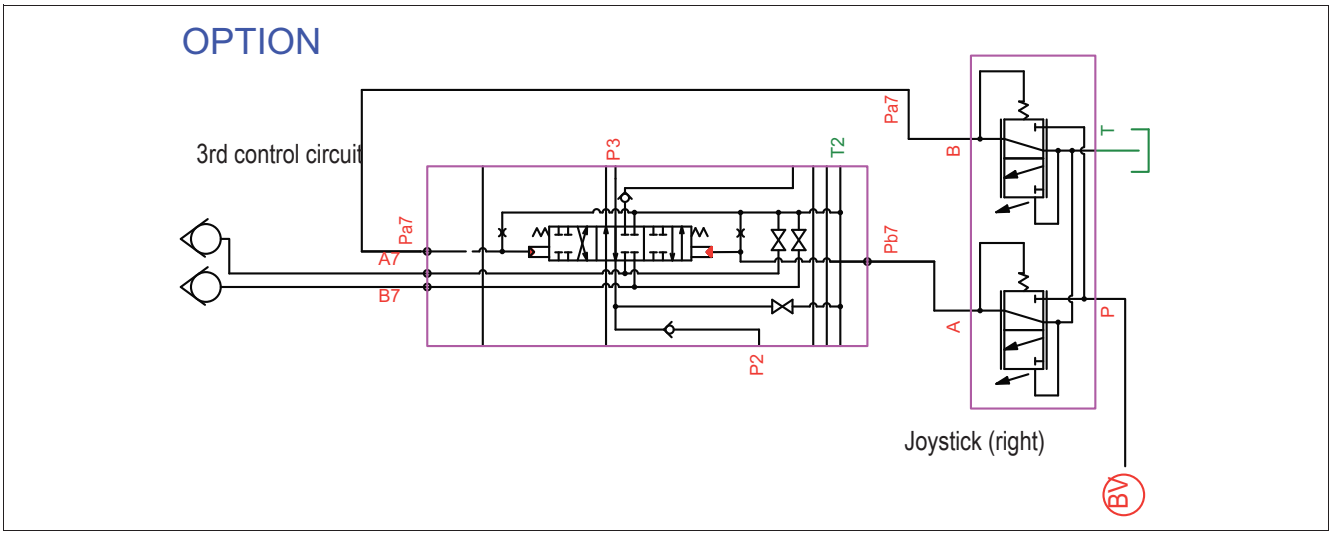
Fig. 11: 3rd control circuit

The 3rd control circuit allows you to operate a range of attachments with up to 3 hydraulic circuits.

- The 3rd control circuit is actuated proportionally via the slide switch on the left-hand side joystick

➥ If the machine is equipped with a 3rd control circuit option, a control valve with an additional segment for the 3rd control circuit is installed

Diagram



7.13 Drive interlock (antitheft protection)

Position

Fig. 12: Drive interlock

Pos.	Designation
1	Transponder receiver surface
2	Red LED

Disabling the drive interlock

☞ *Approach the transponder to 2 cm (0.8") from the* transponder receiver surface

➥ The red LED goes out

☞ *Insert the ignition key into the ignition lock within 30 seconds and turn it at least to position 1*

➥ The drive interlock remains disabled

Enabling the drive interlock

☞ *Remove or turn the ignition key to position 0*

➥ The drive interlock is enabled after 30 seconds

➥ The blinking red LED indicates the drive interlock is enabled

Programming

Coding transponder keys

The so-called main or master key is required for coding a new or uncoded ignition key, or an ignition key with different coding, for the drive interlock.

☞ *Disable the drive interlock with the master key and in addition, keep it close to the transponder receiver surface for 30 – 45 seconds – see Disabling the drive interlock on page 7-21*

➥ The LED changes to a steady green light

➥ The system is in programming mode now (coding mode)!

☞ *Remove the master key from the* transponder receiver *surface*

➥ The LED changes to a rapidly blinking green light

☞ *Hold the ignition key to be programmed against the* transponder receiver *surface*

➥ The ignition key is coded once the LED comes on slowly three times

☞ *Hold further keys next to the transmitter/receiver surface to code them as mentioned above*

The drive interlock is enabled as soon as there is no ignition key contact for 30 seconds.

➥ Blinking red light

Deleting programming/coding

☞ *Disable the drive interlock with the master key and in addition, keep it close to the transponder receiver surface for 30 – 45 seconds – see Disabling the drive interlock on page 7-21*

➥ The LED changes to a steady green light

➥ The system is in programming mode now (coding mode)!

☞ *Hold the master key against the transponder receiver surface* for a further 30 seconds

➥ The LED changes to a steady red light

➥ The system is in delete mode now (coding mode)!

☞ *Remove the master key*

➥ The LED changes to a rapidly blinking red light

☞ *You have 30 seconds to hold the master key again to the* transponder receiver surface to confirm deletion.

➥ The system is deleted once the LED comes on slowly three times

Caution!

Deletion deletes all “normal“ transponders and the master!

- *Reason: once an ignition key is lost, you can no longer delete it!*
- *Therefore, the entire system is deleted for safety reasons and can be completely recoded with the remaining (or newly ordered) ignition keys.*

Configuration of the deleted system

Once deletion is over, the system recognises any TREBE transponder key, i.e. the system can be disabled with any ignition key.

The first transponder key to be recoded for the system is automatically the new master and can be used for coding the “normal” transponder keys – *see Programming* on page 7-21.

Notice!

The following applies both to the coding and programming mode: the system leaves the coding and programming modes and is disabled as soon as the ignition key is inserted in the ignition lock and turned to the first position.

7.14 Proportional controls

Notice!

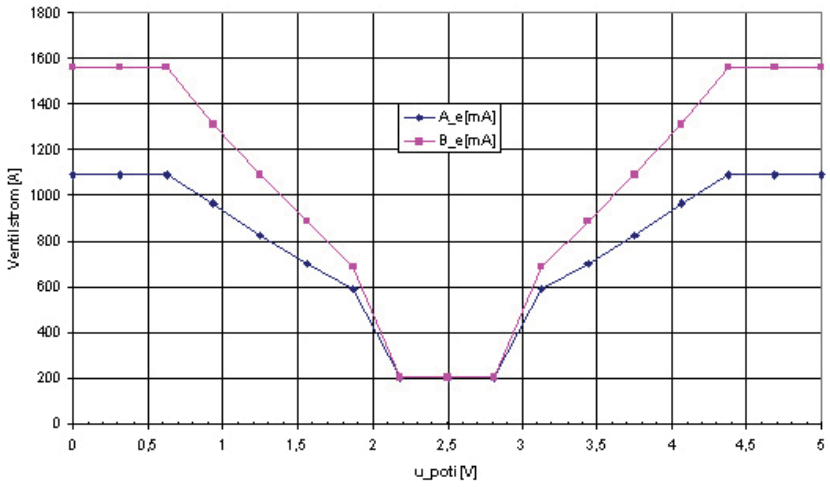
Fast actuation of the control lever for the attachment moves the attachment fast. Slow actuation of the control lever moves the attachment slowly.

Function

This control mode offers proportional operation of the auxiliary hydraulics circuit depending on the position of switch B on the left-hand side joystick (*Fig. 13*).

You can also modify the properties of the characteristic curve. Precision work, for instance with the offset bucket, does not require the full throughput of the auxiliary hydraulics. Therefore we recommend setting the controls to the low characteristic curve 1 (slow movements) *– see Adjusting control response* on page 7-26.

The slide switch is not pressed fully in this position and you can move the machine more smoothly (flat characteristic curve).



If you require the full throughput then characteristic curve 2 will be the choice to make (slide switch pressed as far as it will go).

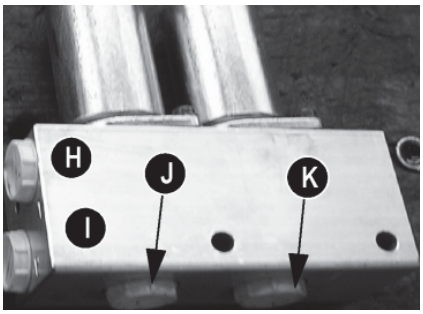
Caution!

Always use button **C** (see *Fig. 13*) on the left-hand joystick for hammer operation.

☞ *Do not use characteristic curve 1 for hammer operation since as described above, oil throughput is not set to maximum in this case and therefore the hydraulic output is not fully available for hammer operation.*

Pressing button **C** ensures full throughput irrespective of the characteristic curve that has been selected!

Ports



Ports	Hose designation
H	T line
I	P line
J	Auxiliary hydraulics (left)
K	Auxiliary hydraulics (right)

Measures to be taken in case of malfunctions

Caution!

The system still works correctly if only one component breaks down. However, if more than one component breaks down, the pressure regulating valves possibly run uncontrollably!

Caution!

System breakdowns can never be excluded, therefore:

- ☞ *Disconnect the electric controls from the power supply before carrying out repair work or maintenance on the hydraulic system!*
- ☞ *Stay clear of areas with danger of crushing!*
- ☞ *Stay clear of areas between moving hydraulic components and fixed obstacles! Danger of crushing!*
- ☞ *The operator of the machine or hydraulic system must be aware of possible machine or system errors.*

Left-hand control lever

Danger!

Unintentional operation of control lever **29** when driving on public roads –

Danger of accidents!

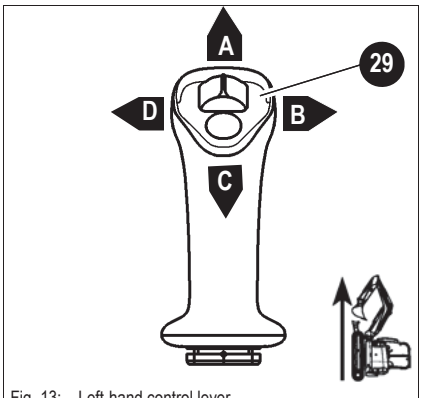


Fig. 13: Left-hand control lever

Position	Lever	Function
A	Forwards	Stick is extended
B	To the right	Upper carriage rotates to the right
C	Backwards	Stick is retracted
D	To the left	Upper carriage rotates to the left

Notice!

Always carry out smooth control movements.

Boom swivel controls

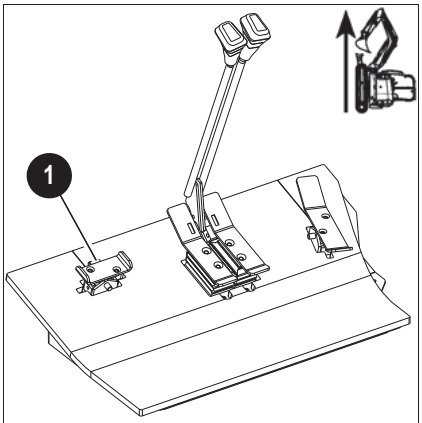


Fig. 14: Swivel controls

Swivelling the boom to the left:

☞ *Move pedal* **1** *to the left*

Swivelling the boom to the right:

☞ *Move pedal* **1** *to the right*

Auxiliary hydraulics

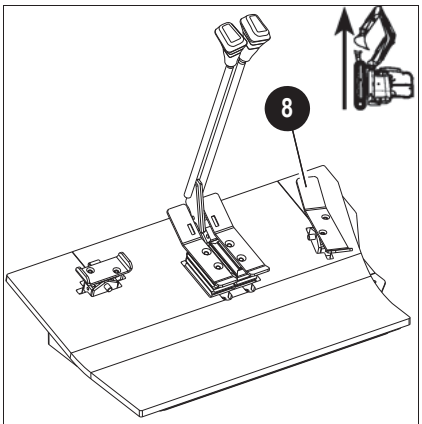


Fig. 15: Auxiliary hydraulics

Actuating the auxiliary hydraulics:

Oil flow in 1st direction:

☞ *Move hammer pedal* **8** *to the left*

Oil flow in 2nd direction:

☞ *Move hammer pedal* **8** *to the right*

Hammer operation

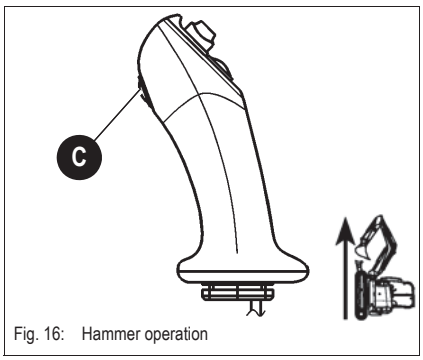


Fig. 16: Hammer operation

Switching on hammer operation:

☞ *Press and hold button* ***C*** *on the control lever*

Switching off hammer operation:

☞ *Release button* ***C*** *on the control lever*

Adjusting control response

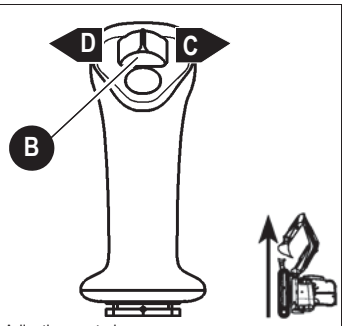


Fig. 17: Adjusting control response

Characteristic curve 1 (slow movements):

☞ *Switch off ignition*

☞ *Then move slide switch **B** to the left **D***

☞ *Hold slide switch **B** to the left **D** and switch on ignition at the same time*

☞ *Then release slide switch **B***

Status indicator ***44*** acknowledges by flashing once

Characteristic curve 2 (fast movements – maximum throughput):

☞ *Switch off ignition*

☞ *Then move slide switch **B** to the right **C***

☞ *Hold slide switch **B** to the right **C** and switch on ignition at the same time*

☞ *Then release slide switch **B***

➥ Status indicator ***44*** acknowledges by flashing twice

Characteristic curves – status indicator

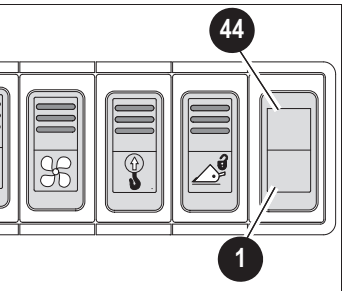


Fig. 18: Characteristic curves – status indicator

Displays the characteristic curve that has been selected for the control valve.

Characteristic curve 1 (slow movements):

*Indicator light **1** in status indicator **44** flashes once after switching on ignition*

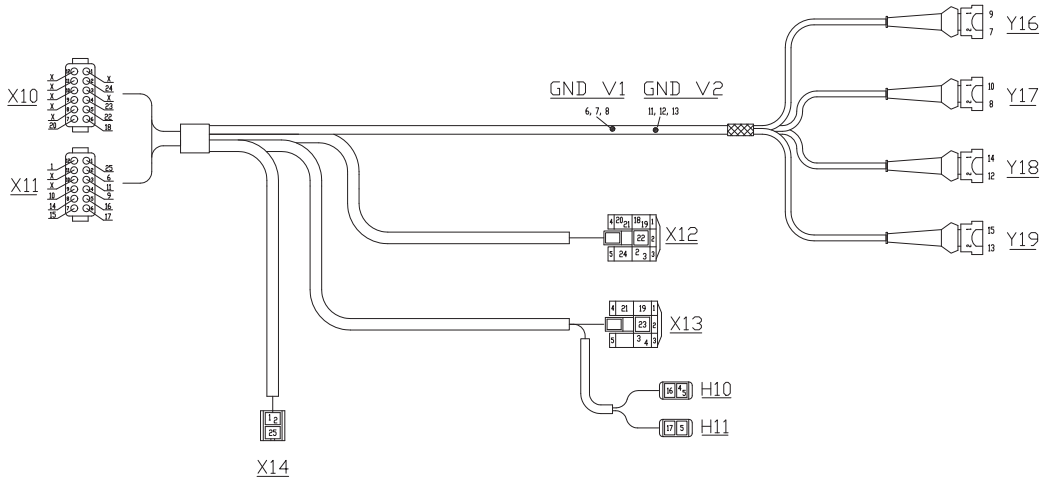
Characteristic curve 2 (fast movements – maximum throughput):

☞ *Indicator light **1** in status indicator **2** flashes twice after switching on ignition*

Notice!

The characteristic curve that has been set last is active after the machine is started again.

Wiring harness



Ports	Hose designation
X10	Connector 1 control unit
X11	Connector 2 control unit
X12	Joystick (left)
X13	Joystick (right)
X14	Proportional controls port
H10	Proportional circuit 1 indicator light
H11	Proportional circuit 1 indicator light
Y16	Auxiliary hydraulics solenoid valve
Y17	Auxiliary hydraulics solenoid valve
Y18	Connector 1 proportional circuit 2
Y19	Connector 2 proportional circuit 2

Control unit connector assignment

Fig. 19: Control unit

X10 digital/analog inputs

PIN	Designation	Connections
1	TX	Serial interface
2	SW2	Hammer operation
3	SW4	Power
4	A_POT2	Joystick signal channel 2
5	A_POT1	Joystick signal channel 1
6	U-analog	Analogous supply +5 V
7	R_POT1	GND joystick
8	R_POT2	GND potentiometer
9	A_POT3	Potentiometer signal
10	SW3	Auto
11	SW1	Pressure switch
12	RX	Serial interface

Fig. 20: Control unit position

X11 supply outputs

PIN	Designation	Connections
1	M_ECU	Earth
2	MVH1	+ channel 1
3	MVH2	+ channel 2
4	MVL1A	Pulse modulation channel 1/magnet 1
5	LSW2	Indicator light
6	LSW3	Indicator light
7	MVL2A	Pulse modulation channel 2/magnet 1
8	MVL2B	Pulse modulation channel 2/magnet 2
9	MVL1B	Pulse modulation M channel 1/magnet 2
10	MOT2	Engine
11	MOT1	Engine
12	U_ECU	+12 V supply

Measures to be taken in case of malfunctions

Caution!

System breakdowns can never be excluded, therefore:

- Disconnect the electronic controls from the power supply before carrying out repair work or maintenance on the hydraulic system.
- Stay clear of areas and parts with danger of crushing.
- Stay clear of areas between moving hydraulic components and fixed obstacles! DANGER OF CRUSHING!
- The operator of the machine or hydraulic system must be aware of possible machine or system errors

Diagnosis display

The control valve status is displayed to the user by means of a flashing code. The following errors are identified by the number of flash pulses:

No.	Pin no.	Designation	Error	Troubleshooting	Critical error
0	-	-	No error	-	-
1	B 5	Channel 1 input (left)	Defective input voltage	Check voltage, home position: 2.5 V deflected: 0.7 V – 4.3 V	-
2	A4, A9	Channel 1 output; Y16/Y17	Overload or overheating (output stage)	Check magnet on valve	-
3	A4, A9	Channel 1 output; Y16/Y17	Short circuit on earth or operating voltage	Check wiring	x
4	B4	Channel 2 input (right)	Defective input voltage	Check voltage, home position: 2.5 V deflected: 0.7 V – 4.3 V	-
5	A7, A8	Channel 2 output; Y18/Y19	Overload or overheating (output stage)	Check magnet on valve	-
6	A7, A8	Channel 2 output; Y18/Y19	Short circuit on earth or operating voltage	Check wiring	x
7	-		System start	-	x
8	A10, A11	Motor output	Overheating (output stage)	Check motor	x
9	-	-	EEProm data error	-	x
10	B6	+5 V joystick	Defective 5 V supply	-	x

The system switches off automatically if a critical error is detected. Activating the control unit is only possible by repeatedly switching on the supply voltage.

Only the error occurring last is issued if several errors occur at the same time. We therefore recommend troubleshooting one error after another until the diagnosis indicator light no longer flashes.

7.15 Engine oil service valve

Function

The service valve replaces the conventional oil drain plug by a quick coupler for draining the engine oil more easily.

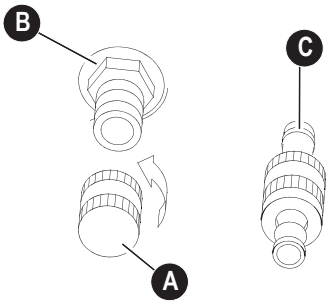


Fig. 21: Drain coupling with hose

- Park the machine on level ground
- Let the engine run until it reaches its operating temperature (oil temperature about 80 °C/176 °F)
- Stop the engine
- Place a container under the opening to collect the oil as it drains
- Unscrew cap **A** of oil drain valve **B**
- Screw in the drain coupling with a sufficiently long hose **D**, ensuring that the end of the hose is in oil drip tray **E**

  ➥ Oil drain valve **B** opens and the engine oil drains

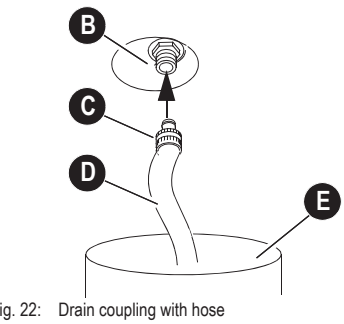


Fig. 22: Drain coupling with hose

- Completely drain the oil
- Unscrew drain coupling **C**
- Screw on cap **A** of the oil drain valve
- Fill in engine oil – *see Filling up engine oil* on page 3-18
- Start the engine and let it run briefly at low revs
- Stop the engine
- Wait a moment until all the oil has run into the oil sump
- Check the oil level again
- Fill up if necessary and check again
- Completely remove all oil spills from the engine

PowerTilt PTS06

8 PowerTilt PTS06

8.1 General instructions

Notice!

This description of the PowerTilt swivel device applies to model PTS06.

General safety instructions

Caution!

To prevent injury to staff and damage to the machine:

- *Read the maintenance and repair manual to ensure correct assembly and maintenance and repair work.*
- *Secure the PowerTilt swivel device.*
- *The PowerTilt and/or attachment must not touch the boom, boom ram and/or work range of the user, especially when is completely swivelled in.*
- *No staff should be in the slewing range of the attachment. The PowerTilt swivel device increases the slewing radius of buckets and attachments.*
- *Never use the PowerTilt or the quickhitch for raising or moving loads. The PowerTilt may be used only for its intended purpose.*

Danger!

Danger of crushing:

Moving parts can cause serious injury.

☞ *While working always keep your hands away from moving parts.*

Caution!

To prevent damage to seals and other internal parts:

☞ *Never perform any welding work on the PowerTilt when it is fully mounted. Any modifications can result in loss of the product guarantee.*

Danger!

Risk of spraying:

Pressurised contents.

☞ *Always wear a suitable mask. Always take care when removing plugs and screw connections.*

Notice!

Keep the work area clean to avoid dirt on assembled parts.

Checking the product

☞ *Clean the PowerTilt swivel device thoroughly before dismantling it. Clean all parts in a washing container and dry them with compressed air. Inspect the PowerTilt swivel device for corrosion damage before dismantling it.*

Notice!

If corrosion is clearly visible, apply penetrant oil to the screws several hours before dismantling.

Internal decompression valve

Notice!

Remove and replace the internal decompression valve only if there is reason to suspect leakage.

Caution!

If the excavator applies too much pressure against an obstacle, this can build up pressure in the Powertilt swivel device.

☞ The internal decompression valve is activated and the PowerTilt does not retain its position.

Testing the hydraulic system of the machine

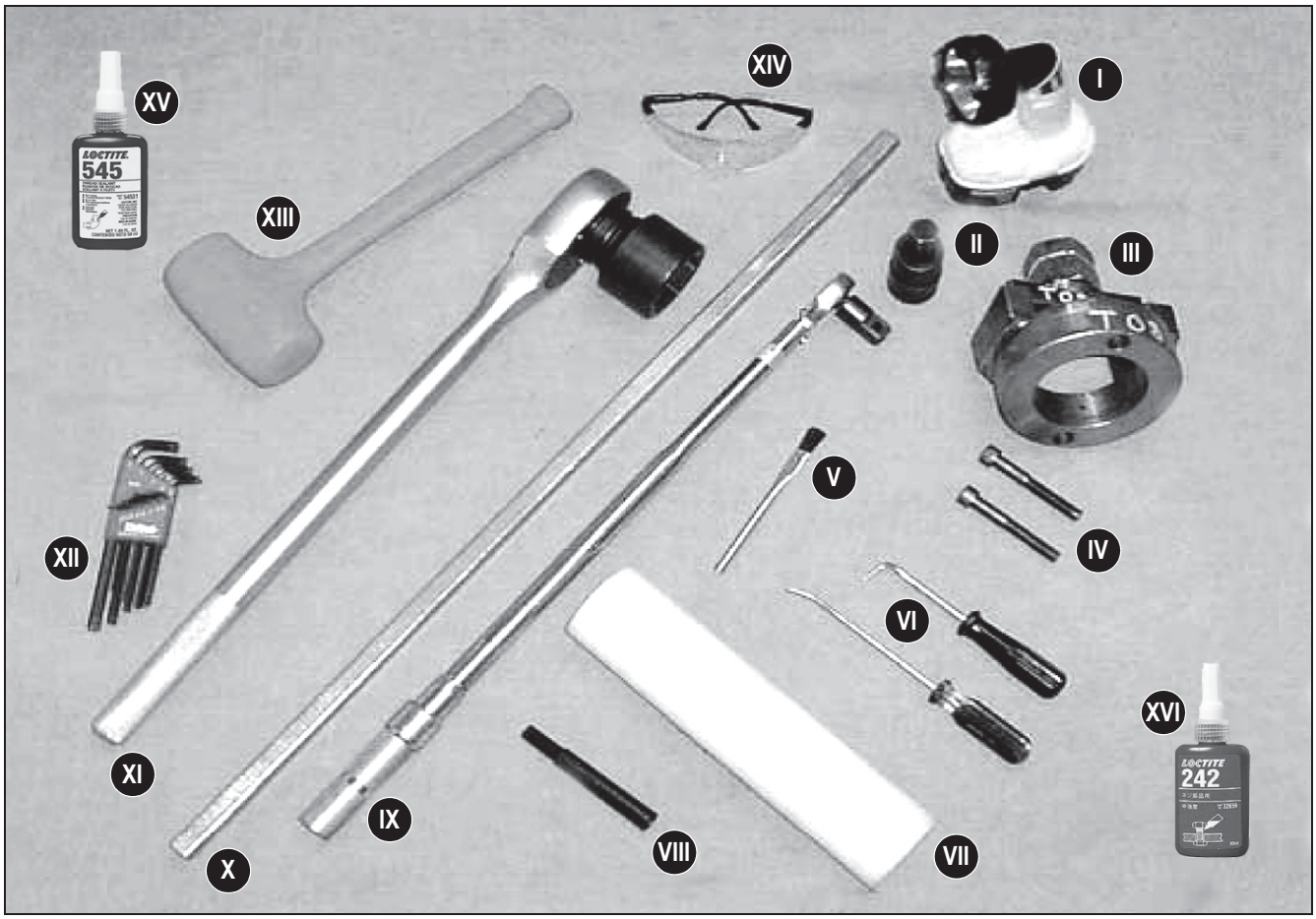
☞ *The maintenance technician is responsible for ensuring that the machine and hydraulic system are in correct working order. Since the hydraulic system of the machine supplies the PowerTilt swivel device with oil, checking the system for correct function is essential.*

Specifications/requirements

Model size			PTS06
Weight of the PowerTilt[1]		kg (lbs)	65 (143)
Total swivel angle		Degrees	180[2]
Drive torque at 210 bar (3046 psi)		Nm (lbs/ft)	2990 (2205)
Holding torque at 225 bar (3263 psi)		Nm (lbs/ft)	7270 (5362)
Piston stroke		cm³ (cu. in.)	525 (207)
Required oil flow		l/min (gal/min)	3-6 (0.8 – 1.6)
Connections[3]		BSPP	1/4
Hydraulic system	Minimum hose/pipe size	mm (in)	10 (0.4)
	Connecting hose size	mm (in)	6 (0.23)
Hydraulic pressures	Pressure range	bar (psi)	150 – 250 (2175 – 3626)
	Pressure on the internal decompression valve[4]	bar (psi)	220 – 230 (3191 – 3336)
	Pipe pressure	bar (psi)	250 – 260 (3626 – 3771)
	Pipe backup (max.)	bar (psi)	40 (580)

1. Average weight
2. The actual angle can vary slightly
3. Most PowerTilt models have four hydraulic connections: 2 connections with the designation “P1” and 2 with the designation “P2”. Most PowerTilt swivel device supplied in the USA have SAE connections. Customers outside North America are normally supplied with BSPP connections.
4. PowerTilt swivel devices are equipped with external decompression valves at the factory.

8.2 Tools



List of required tools

No.	Designation	Qty
I	Torch (may be required)	1
II	Spanner	1
III	Special PTS06 tool for end cap (article number 1000255603)	1
IV	Threaded bolts PTS06 (M12x45)	2
V	Brush	1
VI	Tools for removing seals – *see chapter Making a tool VI for removing the seals* on page 8-6	1-2
VII	Plastic pusher	1
VIII	Permanent marker pen	1
IX	Torque wrench	1
X	Mounting lever or similar	1
XI	Large socket spanner	1
XII	Allen keys	1 set
XIII	Rubber or plastic hammer	1
XIV	Protective goggles	1
XV	Loctite 242	
XVI	Loctite 545	

Making a tool VI for removing the seals

Fig. 1: Tool for removing seals

This tool is only a slightly modified standard screwdriver for flat-headed screws.

1 Heat the flat end with a gas burner until it starts to glow.
2 Secure the heated end of the screwdriver in a vice and bend slightly.
3 Polish the sharp edges of the heated point until it is round. The tool can be modified as required.

Caution!

To prevent injury:

☞ *Wait until the screwdriver has cooled fully.*

8.3 Separating the bucket or equipment from the PowerTilt swivel device

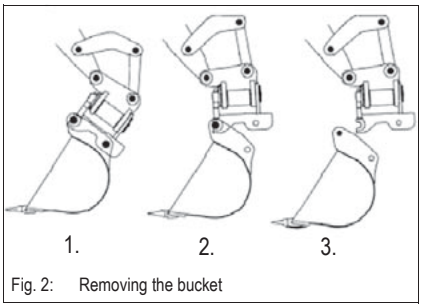


Fig. 2: Removing the bucket

1 Gently lower the bucket or equipment onto the ground and position it so that it cannot move or tip over.
2 Remove the coupling pin.
3 Move the PowerTilt swivel device away from the bucket or equipment to separate both elements. Use the bucket ram for assistance.

Caution!

When removing the bucket or equipment:

☞ Do not damage the PowerTilt hook!

8.4 Separating the PowerTilt swivel device from the machine

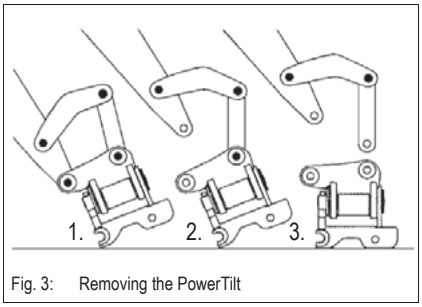
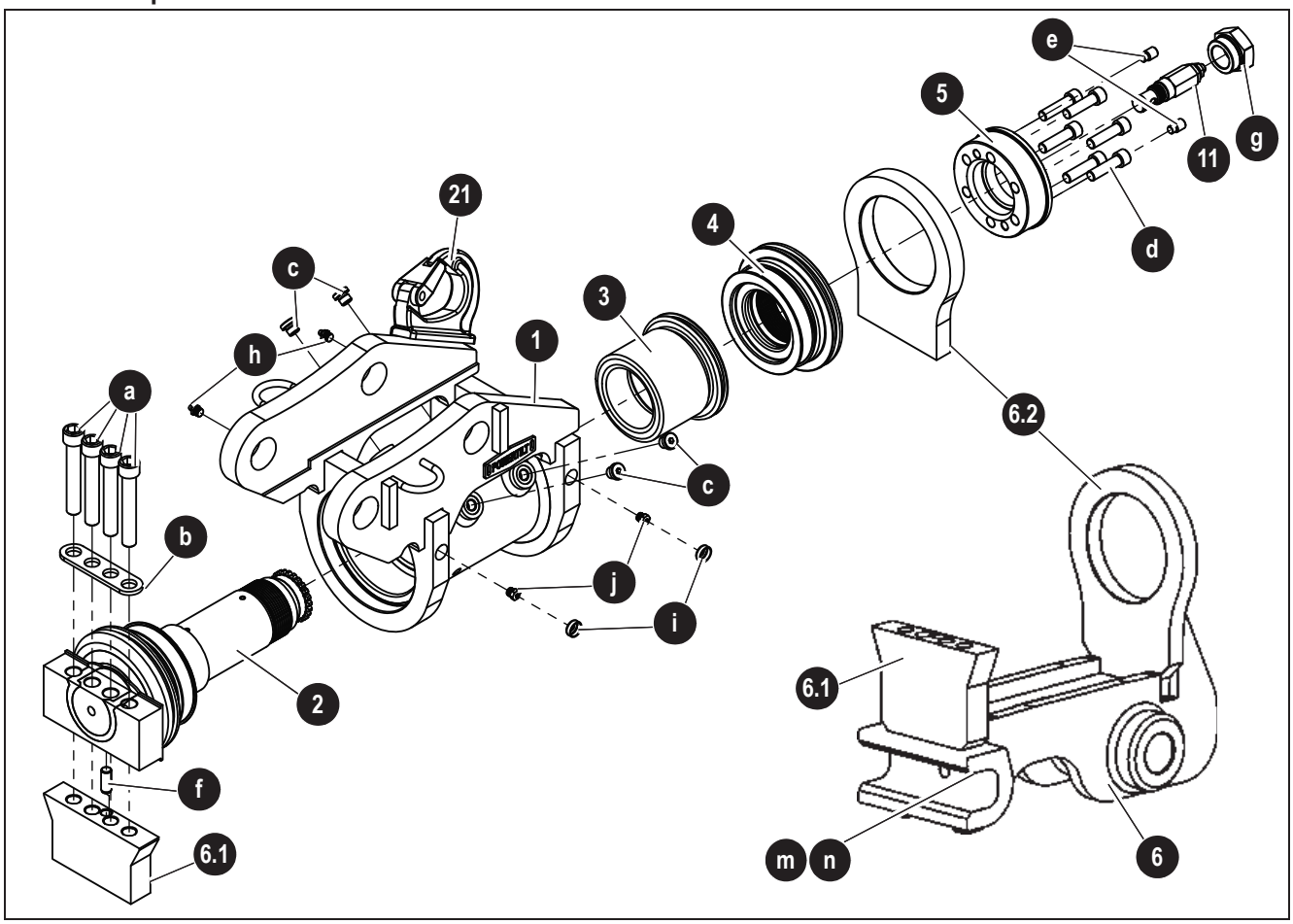


Fig. 3: Removing the PowerTilt

1 Carefully lower the PowerTilt swivel device to the ground.
2 Remove the necessary securing parts and pins from the bucket.
3 Remove the pivot pins.

8.5 Exploded views PTS06

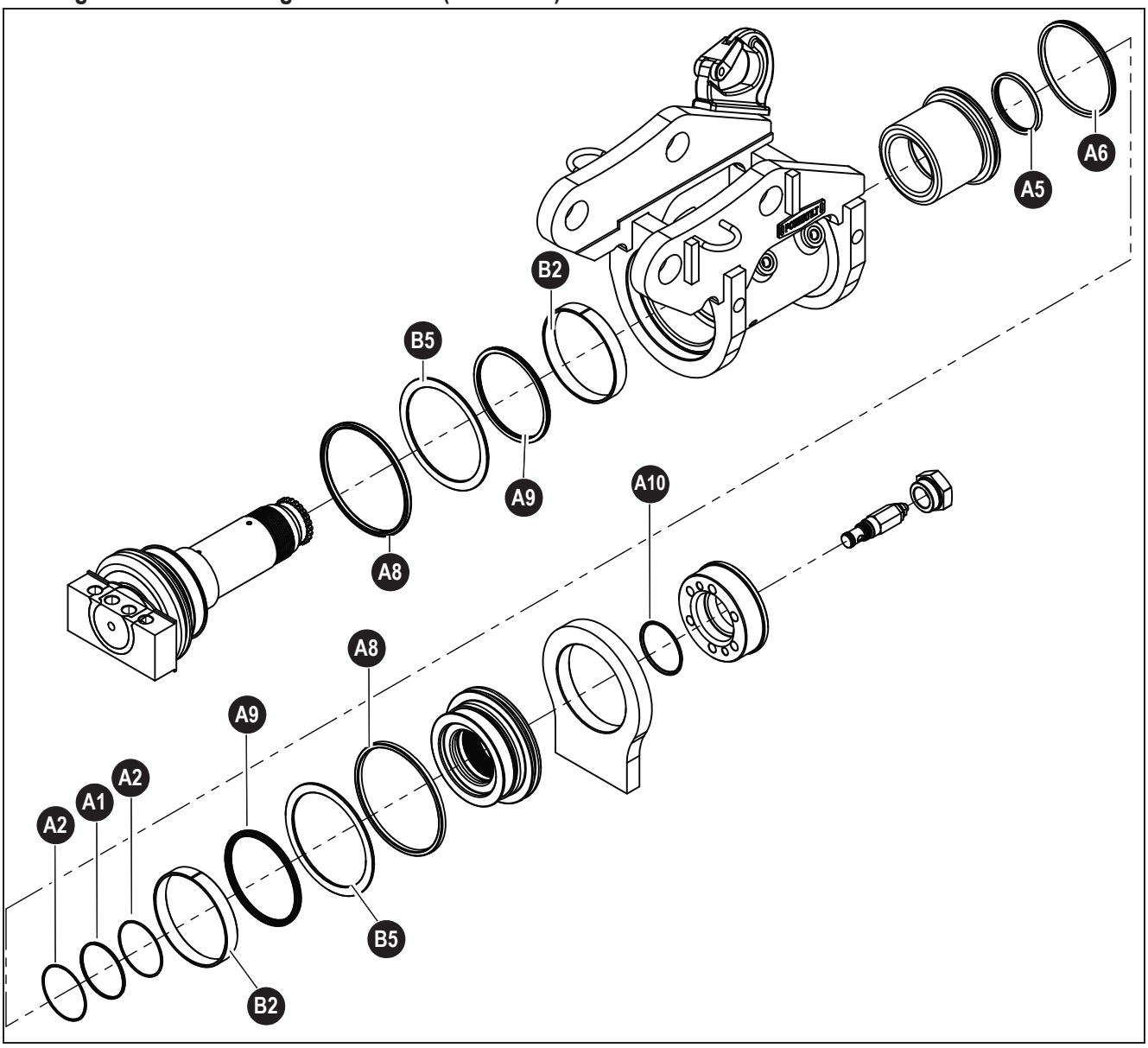
PTS06 components



List of components

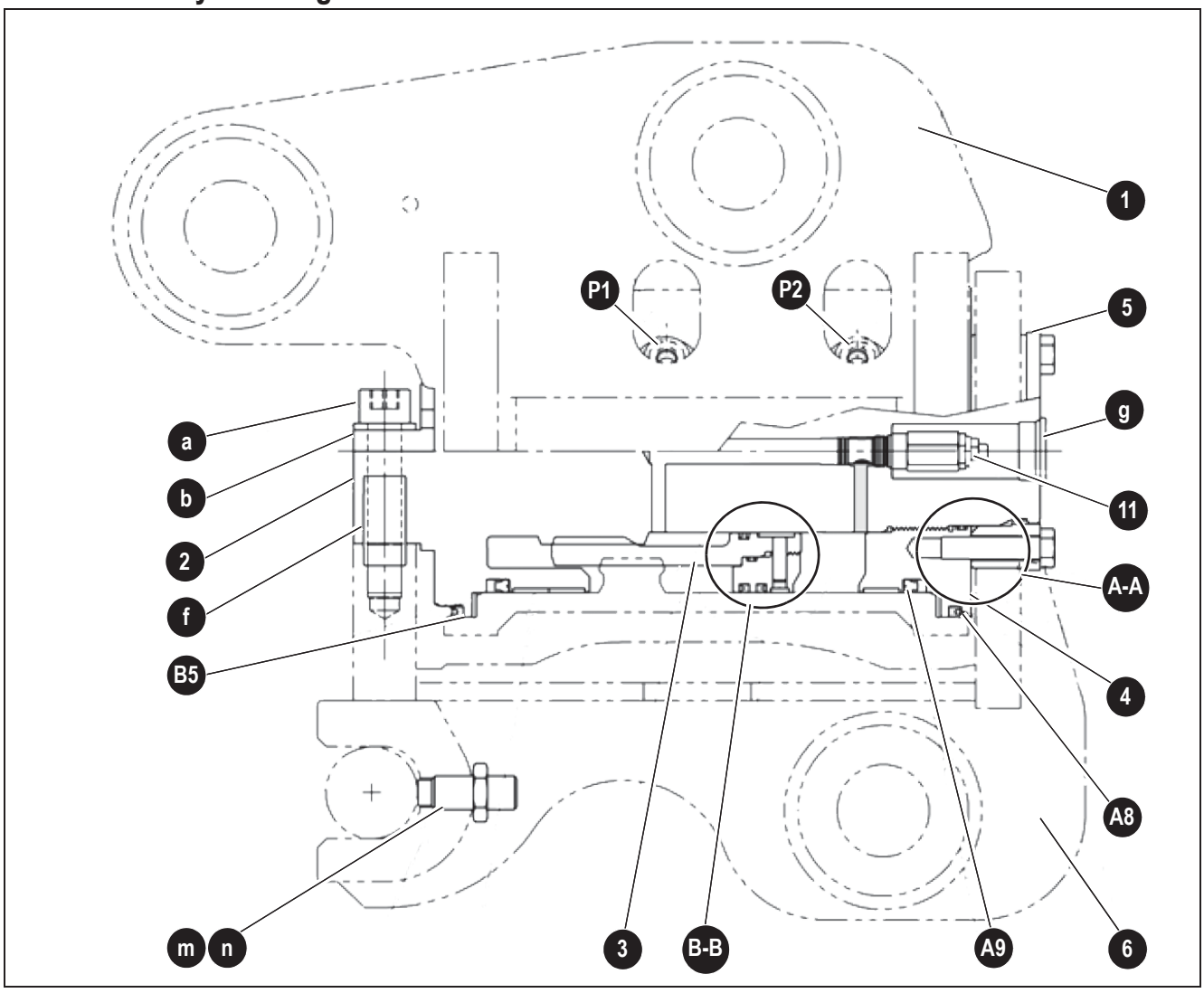
No.	Description	Qty	No.	Description	Qty
1	Housing with integrated ring gear (1.1)	1	a	Shaft fastening screw	4
2	Shaft	1	b	Plate washer	1
3	Piston tube body	1	c	Connecting plug	4
4	End cap	1	d	Screw for securing ring	6
5	Circlip	1	e	Set screw for securing ring	2
6	Standard journal coupling	1	f	Shaft parallel pin	1
6.1	Base block on drive shaft side	Integrated	g	Connecting plug (shaft)	1
6.2	Base block on end cap side	Integrated	h	Grease nipples	2
11	Internal decompression valve	1	i	Cover of grease decompression valve	2
21	Load hook (option)	1	j	Lubrication system decompression valve	2
P1	Hydraulic connection P1	2			
P2	Hydraulic connection P2	2			
			m	Pressure screw (coupling)	1
			n	Lock nut (coupling)	1

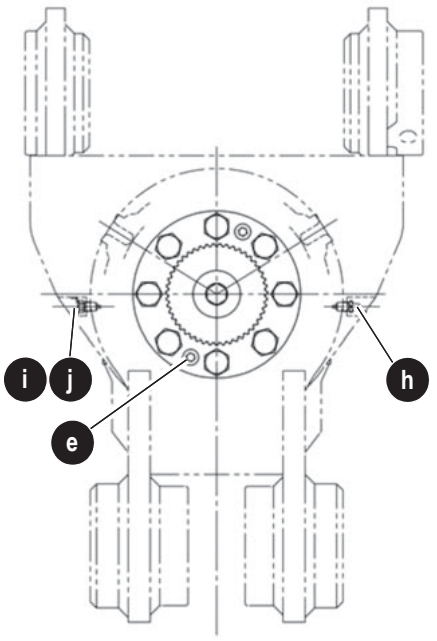
Sealing kit A and bearing kit B PTS06 (overview)

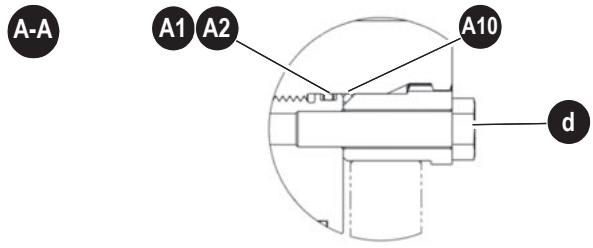


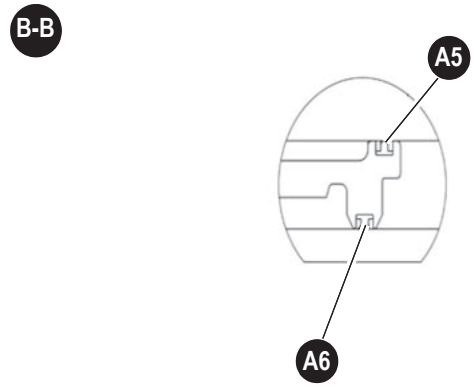
Parts list SEALING KIT A			Parts list BEARING KIT B		
No.	**Description**	**Qty**	**No.**	**Description**	**Qty**
A1	End cap O-ring	1			
A2	Additional ring for end cap	2	B2	Shaft bearing	2
A4	Additional ring for piston	0	B4	Piston bearing	0
A5	Piston seal	1	B5	Pressure disc	2
A6	Piston seal (PTS06 – PTS08)	1			
A8	Plug seal	2			
A9	Pressure seal	2			
A10	O-ring for securing ring	1			

8.6 Assembly drawing









8.7 Removing the standard journal coupling

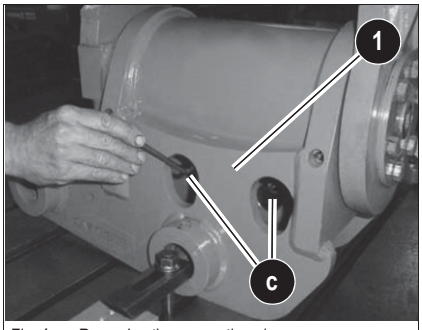


Fig. 4: Removing the connecting plug

☞ *Remove all 4 connecting plugs **c** (on left and right) from the housing and drain the oil into a container.*

☞ *When the oil has been drained, fit the connecting plug back on again.*

Torque specifications for the connecting plug	
Plug size	**Torque values Nm (lbs/ft)**
BSPP G1/4	31 +/- 1 (22.9 +/- 0.7)

Notice!

Check the oil for signs of contamination (water) and metal particles.

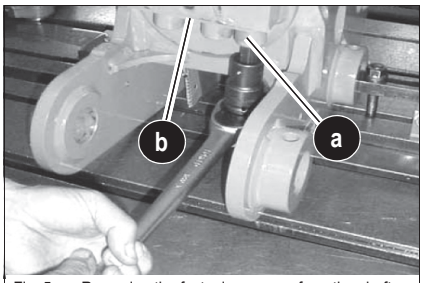
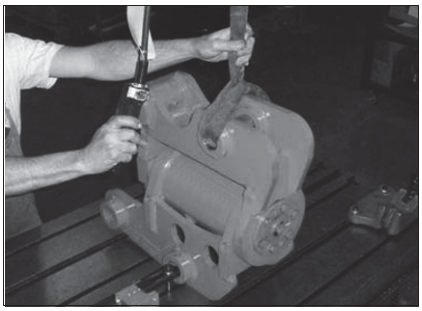


Fig. 5: Removing the fastening screws from the shaft

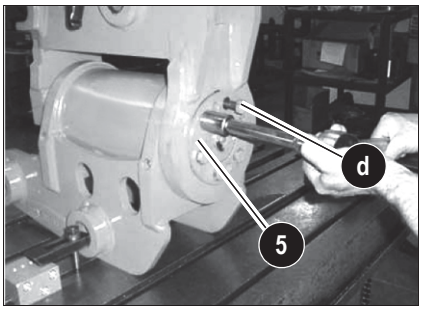
☞ *Slacken the 4 fastening screws of shaft **a** and remove them with plate washer **b** from standard journal coupling **6** or from the drive-side **6.1** and end-cap side **6.2** base block.*



Caution!

In order to avoid personal injury and damage to the equipment:

☞ *Before removing the screws from securing ring **d**, secure the standard journal coupling with lifting gear or similar equipment.*



☞ *Remove screws **d** of securing ring **5**.*

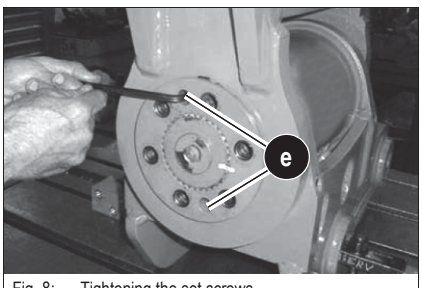


Fig. 8: Tightening the set screws

☞ *Tighten both set screws **e** on securing ring **5**. Turn the screws alternately to remove the securing ring from end cap **4** and base block **6.2** on the end-cap side.*

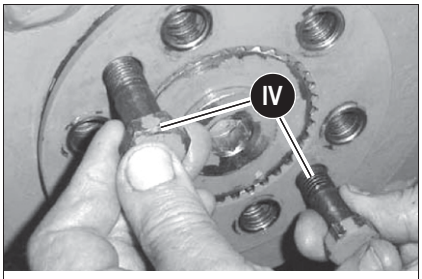


Fig. 9: Removing the securing ring

☞ *Screw threaded bolts **IV** in securing ring **5** and tighten the securing ring.*

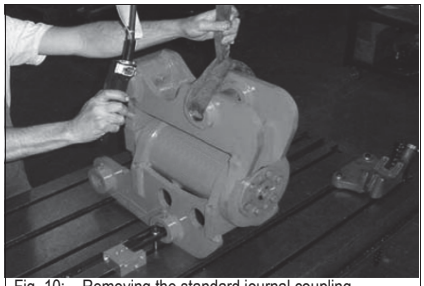


Fig. 10: Removing the standard journal coupling

☞ *With lifting gear or similar equipment, raise the standard journal coupling **6** or the base blocks **6.1, 6.2**.*

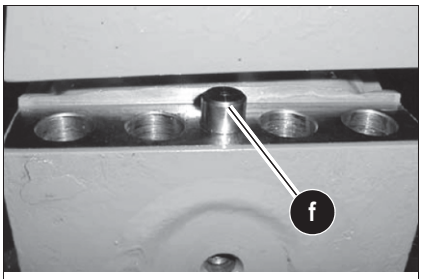


Fig. 11: Shaft parallel pin

Notice!

Parallel pin **f** between the shaft and the drive-side base block **6.1** prevents the components from shifting.

8.8 Removing the end cap, securing ring and internal decompression valve

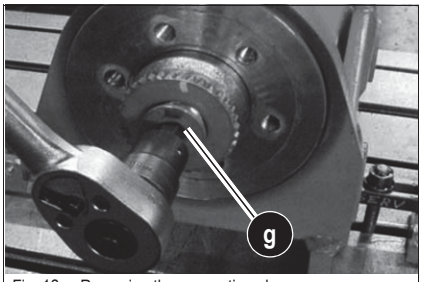


Fig. 12: Removing the connecting plug

☞ *Remove connecting plug **g** from the end of the shaft*

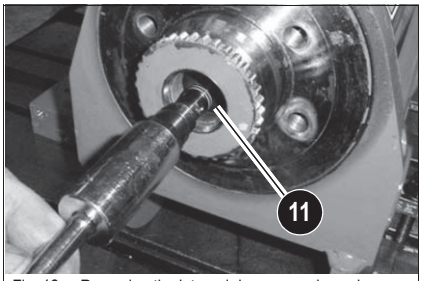


Fig. 13: Removing the internal decompression valve

☞ *Remove the internal decompression valve **11**.*

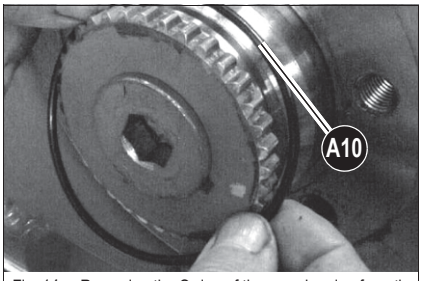


Fig. 14: Removing the O-ring of the securing ring from the shaft

☞ *Remove the O-ring of securing ring **A10** from shaft **2**.*

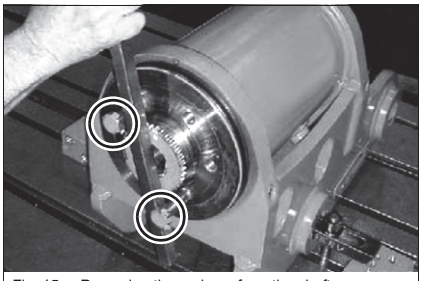


Fig. 15: Removing the end cap from the shaft

☞ *Remove end cap **4** with two pins and a long mounting lever from the shaft.*

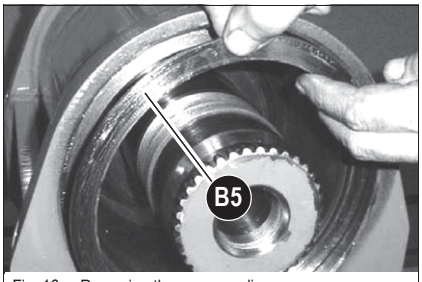


Fig. 16: Removing the pressure disc

☞ *Remove pressure disc **B5** from end cap **4** or the housing collar.*

8.9 Removing the shaft

Notice!

Do not remove shaft **2** yet. The teeth of the component flanks are aligned accordingly to ensure correct synchronisation. Correct synchronisation is particularly important to ensure the correct functioning of the PowerTilt swivel device.

☞ *Turn the shaft clockwise once more and then slowly back counterclockwise.*

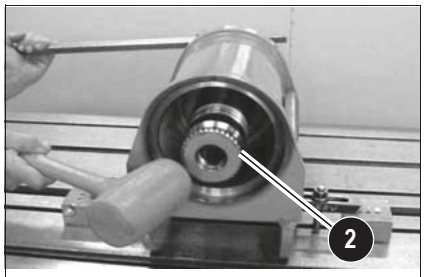
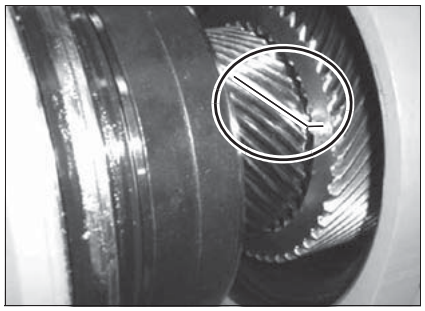


Fig. 17: Removing the shaft with a hammer

Notice!

To pull shaft **2** more easily out of piston tube **3**, tap the threaded end of the shaft lightly with a plastic or rubber hammer until the shaft thread is visible.

☞ *The ring gear of housing **1**, piston tube body **3** and shaft **2** has dead centre marks. As a rule, there are small marks at the front of the teeth and on the ring gear. The dead centre marks of the shaft are possibly at the very bottom next to the spiral gear. The dead centre marks of the piston tube can best be seen if the piston tube teeth are flush with the ring gear in the housing.*



☞ *If the dead centre marks made at the factory cannot be found, mark the alignment between the housing ring gear, the shaft and the piston tube body with a paint stick or a permanent marker pen.*

☞ *Turn the shaft to release the teeth of the shaft from the teeth of the piston tube.*

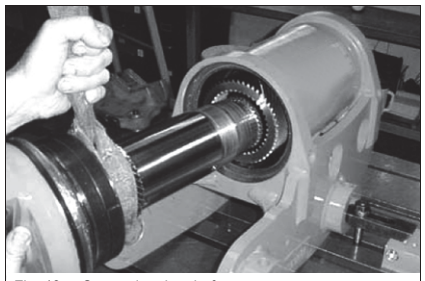


Fig. 19: Supporting the shaft

Caution!

Secure the shaft (heavy)!

☞ *Avoid damage to the teeth.*

8.10 Removing the piston tube body

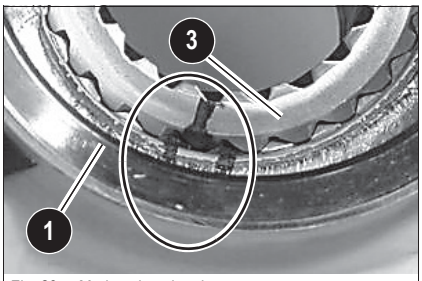


Fig. 20: Mark on housing ring gear

☞ *Check the dead centre marks of housing ring gear **1** and piston tube body **3**.*

☞ *Carefully push the piston tube out of the housing until the gearing is released from the ring gear of the housing.*

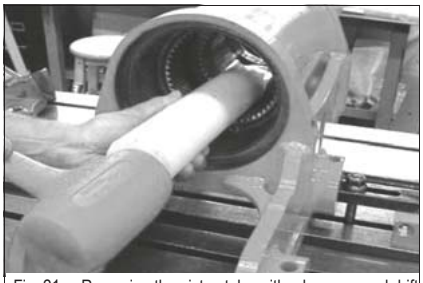


Fig. 21: Removing the piston tube with a hammer and drift

Notice!

The piston tube is pulled out of the housing more easily with a plastic/rubber hammer and a plastic drift. The outer gearing is then released from the teeth of the ring gear in the housing bore.

Caution!

Remove the piston tube carefully!

☞ *Avoid damage to the teeth.*

8.11 Removing the seals (kit A), shaft bearings and pressure discs (kit B)

Fig. 23: Removing the seals and bearings

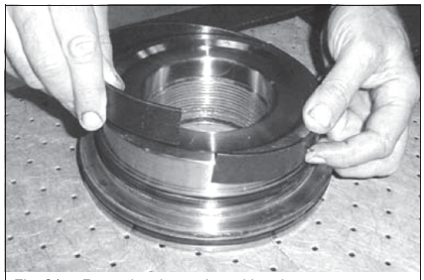


Fig. 24: Removing the seals and bearings

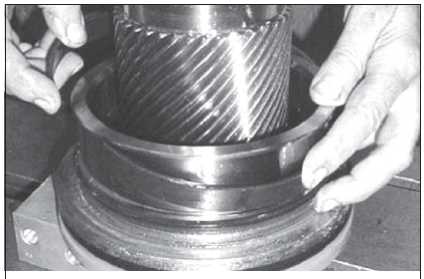


Fig. 25: Removing the seals and bearings

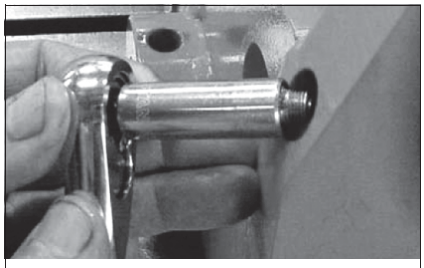


Fig. 26: Removing the grease nipple, etc.

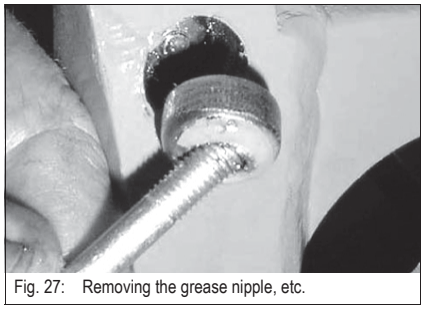


Fig. 27: Removing the grease nipple, etc.

☞ *Use appropriate tools to remove all seals, wear indicators and pressure discs **B5** from piston tube body **3** and end cap **4**.*

Caution!

In order to avoid damage to parts:

☞ *Use only tools with rounded edges to remove seals.*

Notice!

Some models may possibly not have wear indicators on the inside and outside diameters of the piston tube body.

☞ Remove grease nipple **h**, grease decompression valve covers **i** and grease decompression valves **j**.

8.12 Checking components and dead centre marks

☞ *Clean all parts in a washing container and dry them with compressed air.*

Notice!

Check all important areas for signs of wear, corrosion or other damage: sealing grooves, wear indicator grooves, pressure disc surfaces, shaft surfaces, housing bores and gear teeth.

☞ *Search for the dead centre marks on shaft **2**, piston tube body **3** and housing ring gear **1** and if necessary, draw them again with a permanent marker or a paint stick.*

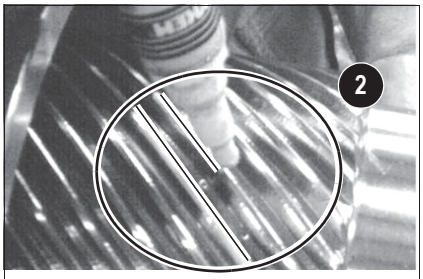


Fig. 28: Retightening the dead centre marks of the shaft

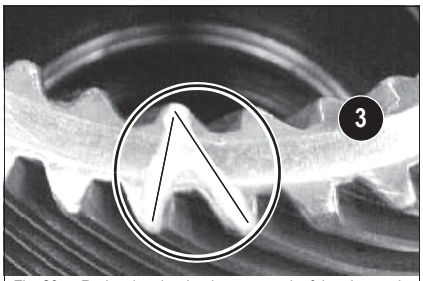


Fig. 29: Redrawing the dead centre mark of the piston tube

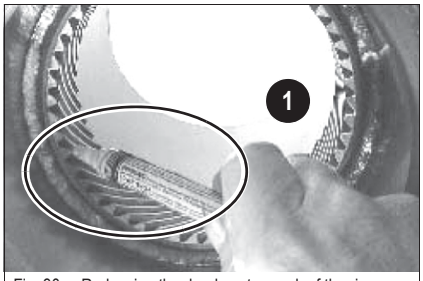


Fig. 30: Redrawing the dead centre mark of the ring gear

8.13 Trial assembly

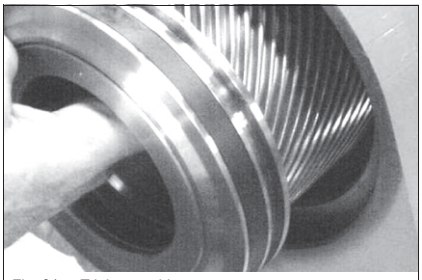


Fig. 31: Trial assembly

Notice!

In some cases a so-called trial assembly may be helpful if the repair technician is not familiar with the actual assembly, in order to find out how to align the teeth correctly. As a rule, seals are not installed during a trial assembly. However, wear indicators and pressure discs must be installed.

8.14 Installing the seals (kit A), shaft bearings and pressure discs (kit B)

Fig. 32: Coat the seals and surfaces with oil

Caution!

Bear the following in mind when installing the new components!

- *Coat the seals and treated surfaces with high-quality hydraulic oil (in accordance with* DIN51524/T3 (HVLP)) *before installation.*

Notice!

The exact position and number of seals or bearings depends on the PowerTilt model.

Installing the end-cap seals and bearings

☞ *In order to install the end-cap seals and bearings according to the order indicated in the following, place end cap **4** on a table so that the inside shows upwards. Before installing, bear in mind the orientation of the seals in the technical drawings.*

☞ *Install the outer seal.*

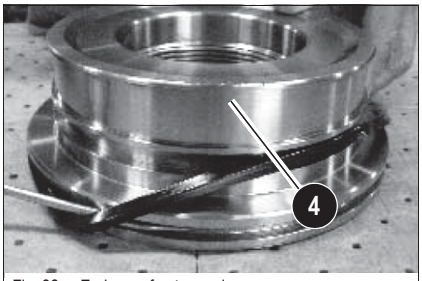


Fig. 33: End cap of outer seal

☞ *Apply a little lithium grease to either side of pressure disc **B5**, and place the pressure disc on the pressure surfaces of end cap **4**.*

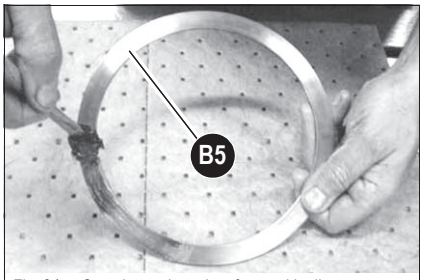


Fig. 34: Coat the seals and surfaces with oil

☞ *Install the first pressure seal **A9** with the lip showing inside.*

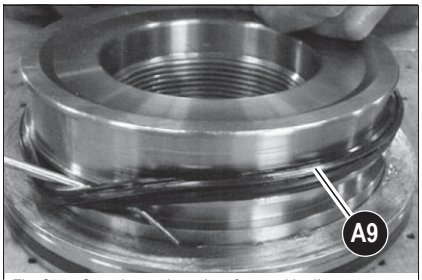


Fig. 35: Coat the seals and surfaces with oil

☞ *Wear indicator **B2** in the wide groove of the end cap.*

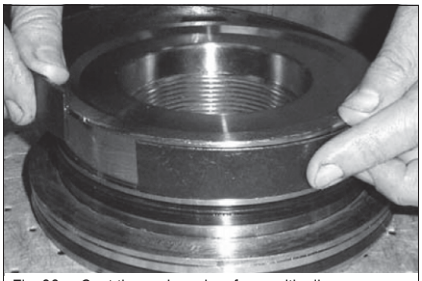


Fig. 36: Coat the seals and surfaces with oil

☞ *Place O-ring **A1** and additional ring **A2** in the groove of the inside seal on the end cap.*

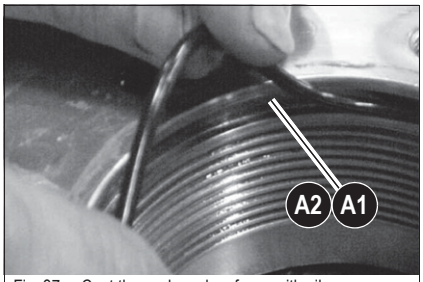


Fig. 37: Coat the seals and surfaces with oil

Installing the piston seals and bearings

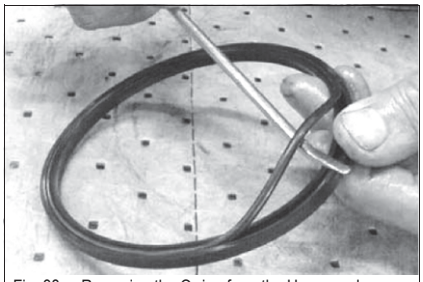


Fig. 38: Removing the O-ring from the U-cup seal

☞ *On some PowerTilt models, remove the O-ring of the outside and inside seals before fitting the U-cup seals, and install this O-ring on the piston gearing.*

Caution!

If these instructions are not followed:

☞ *The seal can wear out prematurely and there is a risk of pressure building up that cannot escape.*

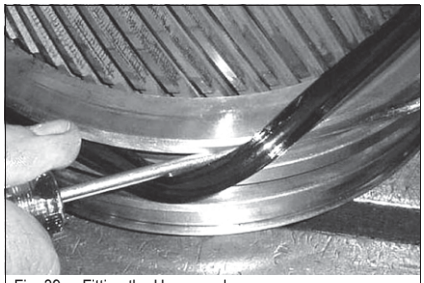


Fig. 39: Fitting the U-cup seals

☞ *On models with so-called U-cup or T seals, fit the seals on the outside and inside diameters **A5, A6** of the piston tube body. On models with U-cup seals, the lips show away from each other.*

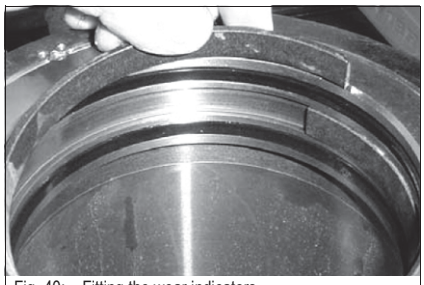


Fig. 40: Fitting the wear indicators

☞ *If wear indicators are used, install them on the outside and/or inside diameters **B4**.*

Fitting the shaft seal and the bearing

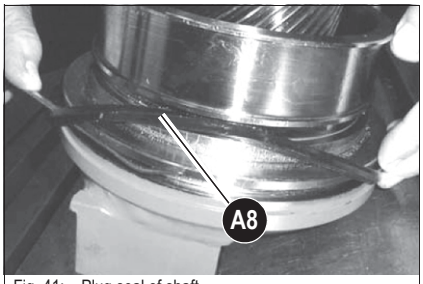


Fig. 41: Plug seal of shaft

☞ *Fit plug seal **A8** on the shaft.*

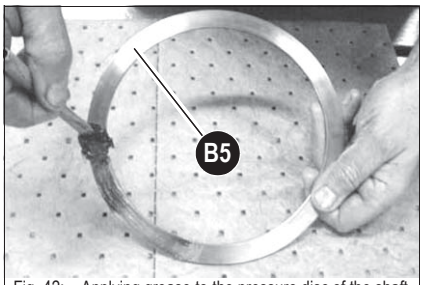


Fig. 42: Applying grease to the pressure disc of the shaft

☞ *Apply a little lithium grease to either side of pressure disc **B5**, and place the pressure disc on shaft **2**.*

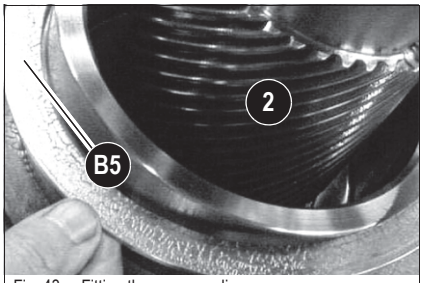


Fig. 43: Fitting the pressure disc

☞ *Install the second pressure seal **A9** with the lip showing inside.*

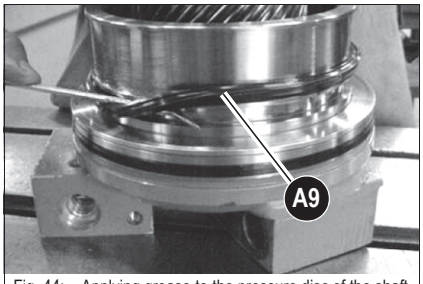


Fig. 44: Applying grease to the pressure disc of the shaft

☞ *Install wear indicator **B2**.*

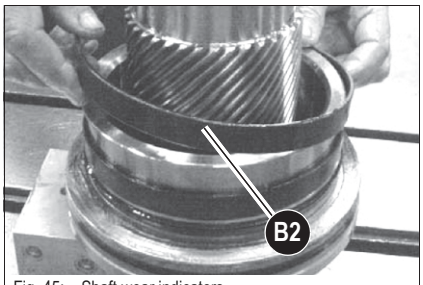


Fig. 45: Shaft wear indicators

8.15 Installing the piston tube

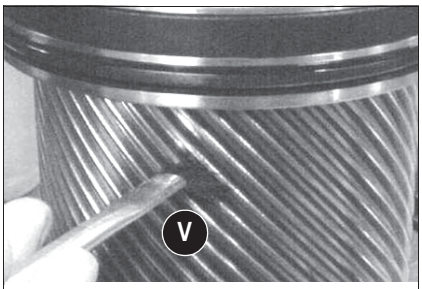


Fig. 46: Hydraulic oil on piston tube

☞ *Apply a high-grade hydraulic oil to the piston and the housing bore with brush **V**.*

Caution!

If this is not observed:

☞ *Damage to seal*

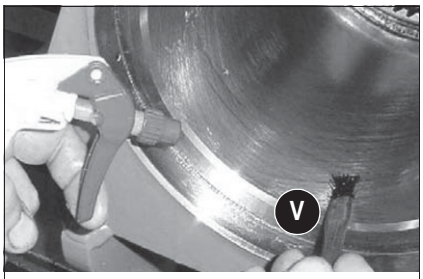


Fig. 47: Hydraulic oil on the housing bore

Fig. 48: Fitting the piston tube

☞ *Carefully push the piston tube into the housing until it makes contact with the ring gear.*

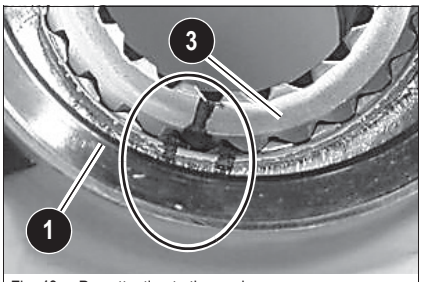


Fig. 49: Pay attention to the marks

☞ *Turn the piston body until the dead centre marks of the piston and the housing are aligned.*

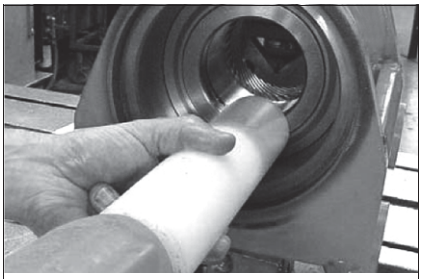


Fig. 50: Fitting the piston tube

☞ *With a plastic/rubber hammer and plastic drift, put the teeth of the piston in the ring gear.*

8.16 Installing the shaft

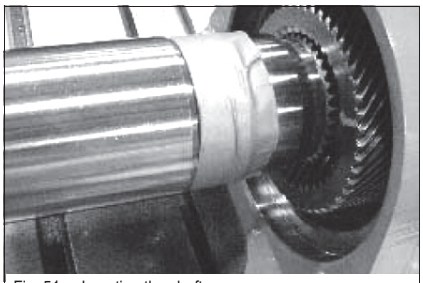


Fig. 51: Inserting the shaft

☞ *Apply high-grade hydraulic oil to shaft **2**.*

Notice!

To prevent seal damage, temporarily cover the shaft thread with tape. After shaft installation, remove the tape.

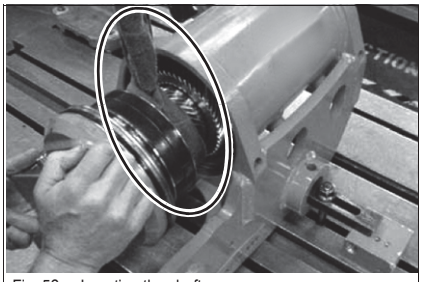
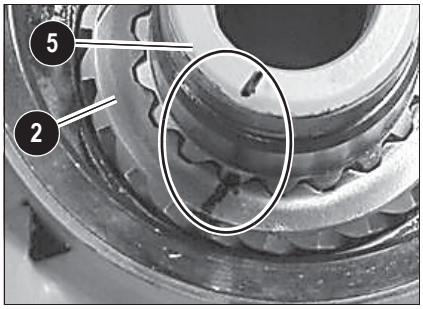


Fig. 52: Inserting the shaft

☞ *Secure the shaft in lifting gear and fit it in the piston tube body **3**.*

Caution!

Ensure that the thread of the shaft does not damage the inside seal **A6** of the piston.



Caution!

Ensure correct alignment of the dead centre marks on shaft **2** and piston tube **3**.
Do not separate the piston tube from the gearbox!

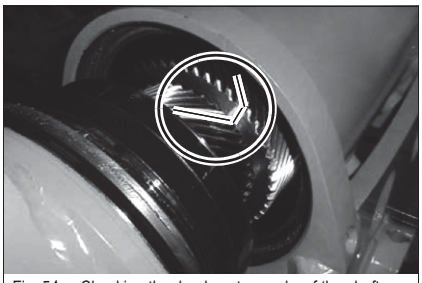


Fig. 54: Checking the dead centre marks of the shaft

☞ *Check the dead centre marks and turn the shaft to the rear until pressure seal touches the housing.*

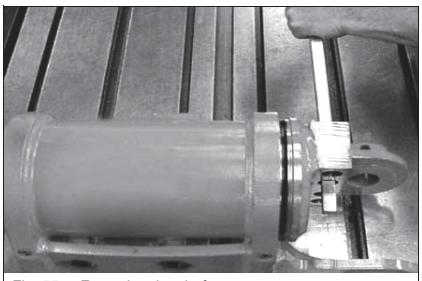


Fig. 55: Fastening the shaft

☞ *Ensure the firm seating of the seal with slight blows and turn the shaft into the housing with a mounting lever.*

8.17 Installing the end cap and the securing ring

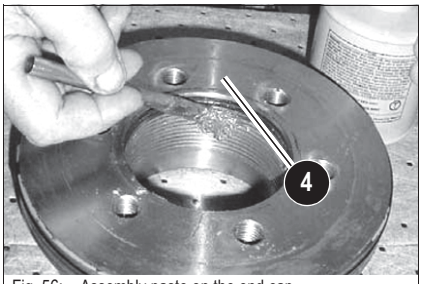


Fig. 56: Assembly paste on the end cap

☞ *Screw on end cap **4** using assembly paste.*

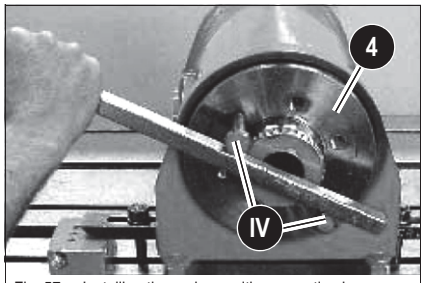


Fig. 57: Installing the end cap with a mounting lever

☞ *Screw in threaded bolts **IV** and tighten end cap **4** by means of a mounting lever until pressure disc **B5** touches housing collar **1**.*

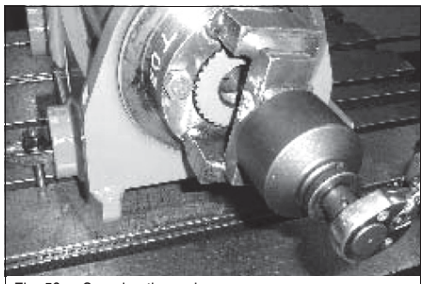


Fig. 58: Securing the end cap

☞ *Remove both bolts and tighten end cap **4** with a torque wrench and an appropriate tool.*

Torque values of end cap	
Model	**Torque values Nm (lbs/ft)**
PTS06	475 – 680 (350 – 502)

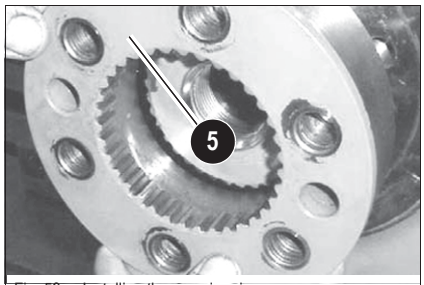


Fig. 59: Installing the securing ring

Notice!

When installing securing ring **5**, ensure that the teeth of the securing ring and the openings of end cap **4** have the best possible alignment by trying out different positions. If the openings cannot be aligned, turn the end cap by a maximum one tooth to align it with the openings.

Fig. 60: Mark on shaft and securing ring

☞ *Before removing the securing ring, mark the orientation of the teeth of the securing ring and the shaft.*

8.18 Installing the internal decompression valve

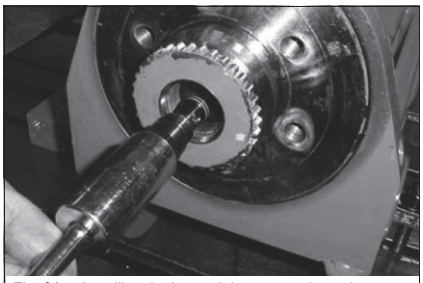


Fig. 61: Installing the internal decompression valve

☞ *Tighten the internal decompression valve to 60 Nm (44 lbs/ft).*

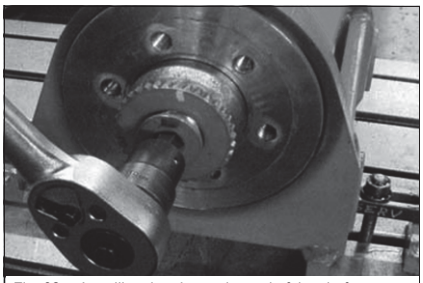


Fig. 62: Installing the plug at the end of the shaft

☞ *Apply Loctite 242* ***XV*** *to the plug thread and tighten the plug to 305 Nm (225 lbs/ft).*

8.19 Installing the standard journal coupling

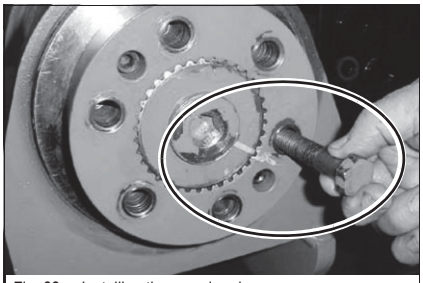


Fig. 63: Installing the securing ring

☞ *Fit securing ring* ***5*** *again. Align the dead centre marks of the securing ring and the shaft. Turn and tighten both screws on the securing ring. Fasten end cap* ***4*** *on shaft* ***2****.*

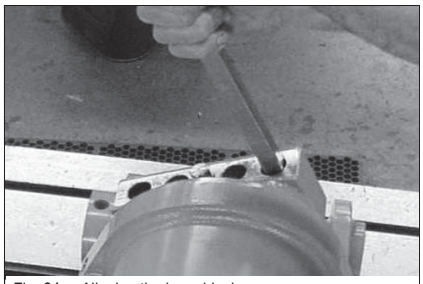


Fig. 64: Aligning the base block

☞ *Turn the shaft with a mounting lever until the mounting surface of base block* ***6.1*** *on the drive-shaft side is horizontal.*

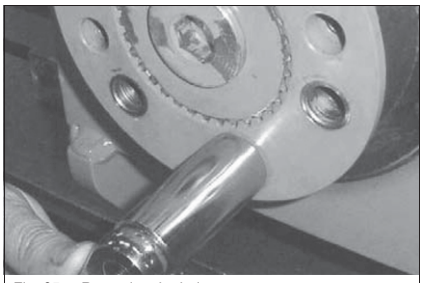


Fig. 65: Removing the bolts

☞ *Remove threaded bolts* ***IV****.*

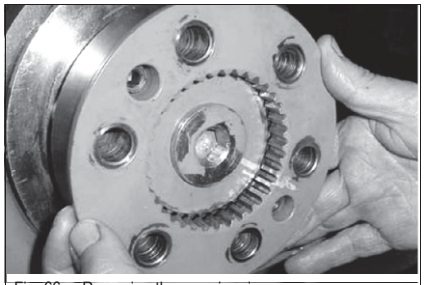


Fig. 66: Removing the securing ring

☞ *Remove the securing ring*

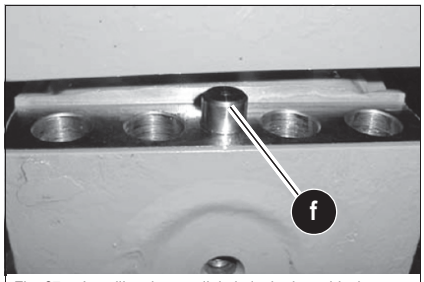


Fig. 67: Installing the parallel pin in the base block

☞ *If not already fitted, fit parallel pin **f** for the alignment in base block **6.1** on the drive-shaft side.*

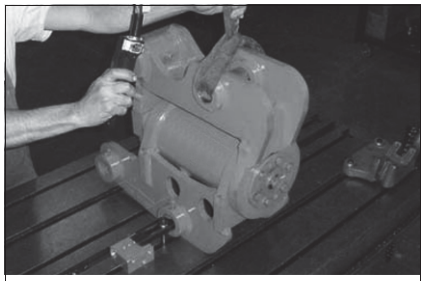


Fig. 68: Fitting the standard journal coupling on the shaft

☞ *Fit the standard journal coupling **6** on shaft **2** with suitable lifting gear. Align the parallel pin of the shaft with the base block **6.1** on the drive-shaft side.*

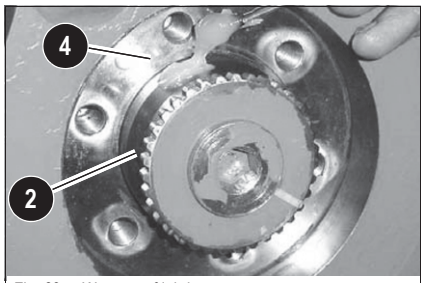


Fig. 69: Waterproof lubricant

☞ *Apply a waterproof lubricant to the end of shaft **2**, securing ring **5** and the outside surfaces of end cap **4**.*

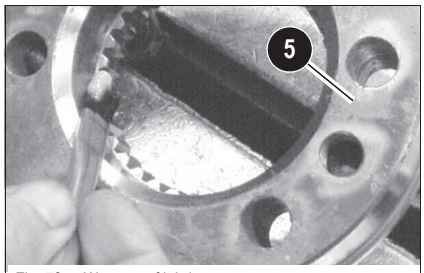


Fig. 70: Waterproof lubricant

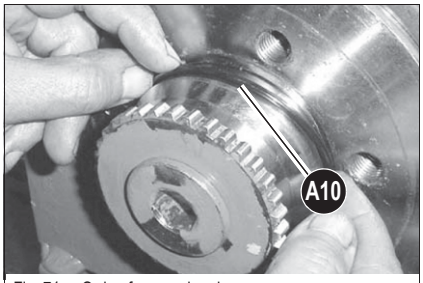


Fig. 71: O-ring for securing ring

☞ *Install the O-ring of circlip **A10** on the shaft.*

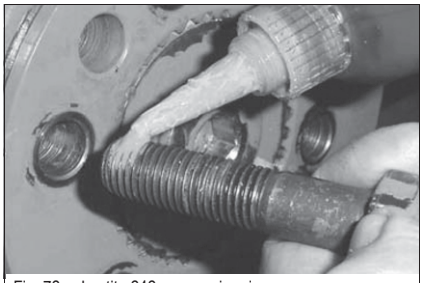


Fig. 72: Loctite 242 on securing ring screws

☞ *Apply Loctite 242 **XV** to the screws of securing ring **d** and tighten them after fitting the securing ring.*

Torque specifications for securing ring screws in Nm (lbs/ft)			
Model	**Size**	**No**	**Hexagon head screw**
PTS06	M12 x 1.75	6	75 +/- 4 (55.3 +/- 3)

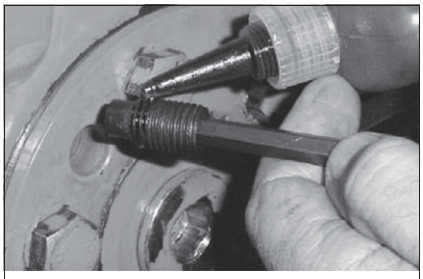


Fig. 73: Loctite 545 on set screws

☞ *Apply Loctite 545 **XVI** to both set screws of securing ring **e** and tighten them to 41 Nm (30 lbs/ft).*

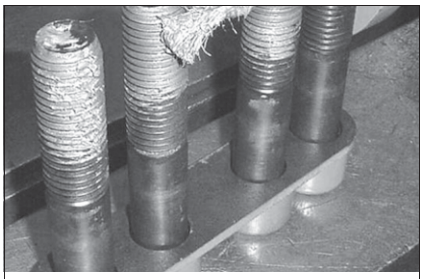


Fig. 74: Fastening screws of shaft

☞ *Apply Loctite 242 **XV** to the threads of the fastening screws of shaft **a**, and tighten the screws.*

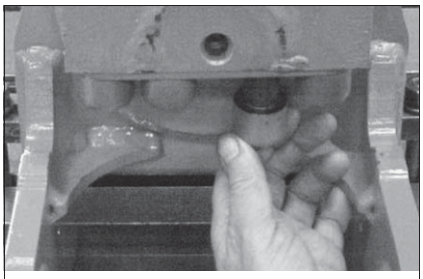


Fig. 75: Fastening the shaft screws

Torque specifications for fastening screws in Nm (lbs/ft)			
Model	**Size**	**No**	**Hexagon socket screw**
PTS06	M16 x 2.00	4	258 +/- 7 (190 +/- 5)

8.20 Lubrication and tests

☞ *For purposes of lubrication or testing, connect the PowerTilt swivel device either to a hydraulics test bench or to a portable pump.*

☞ *Fasten the PowerTilt swivel device firmly in order to avoid any movement.*

Lubrication

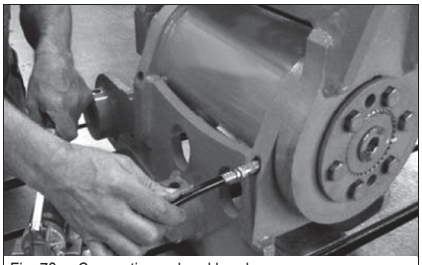


Fig. 76: Connecting rod and head screws

☞ *Fit the grease nipples, grease decompression valves and covers.*

☞ *Before putting the PowerTilt swivel device into operation, apply lithium grease to the plug seals and pressure discs.*

Fig. 77: Lubricant

☞ *Use a grease gun to lubricate the seals and pressure discs at grease nipples **h** or the lubrication connection at the base of the PowerTilt swivel device until grease escapes from the grease decompression valves **j**.*

☞ *Slowly put the PowerTilt swivel device into operation and lubricate again as required. Let the device carry out 20 – 30 cycles during the test, to test the machine for leaks and correct rotation.*

Test for internal leaks

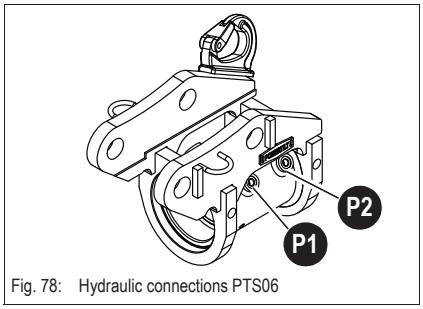


Fig. 78: Hydraulic connections PTS06

☞ *Connect a 350 bar (5076 psi) pressure gauge to the hydraulic line to **P1**. Create pressure at **P1** until the rotating shaft touches the internal or external limits.*

Notice!

Otherwise hydraulic oil escapes at **P2** in very little time.

☞ *Remove and close the hydraulic line at **P2**. Create a pressure of 175 bar (2538 psi) at **P1**. Check for leaks at **P2** and near the main shaft and end-cap seals.*

Notice!

Leaks are a sign of incorrectly installed parts.

☞ *Connect a hydraulic line to **P2** and create pressure as in step 1.*

☞ *Check for leaks at **P1** and near the main shaft and end-cap seals (see step 2).*

Testing the internal decompression valve

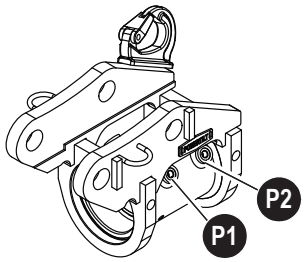


Fig. 79: Hydraulic connections PTS06

Notice!

The internal decompression valve releases hydraulic oil at 210 – 230 bar (3046 – 3336 psi) around the internal piston tube body of the PowerTilt swivel device.

☞ *Connect a 350 bar (5076 psi) pressure gauge to the hydraulic line to **P1**. Create pressure until the shaft reaches the bottom dead centre externally, i. e. until the shaft bracket or the base block on the drive-shaft side touches the housing or the bracket.*

☞ *Remove the hydraulic hose from port **P2** and close it (port side to excavator).*

☞ *Connect the other hydraulic hose to **P2** temporarily and place the open end of the hose in a container.*

Notice!

The internal decompression valve is set at the factory and cannot be adjusted.

☞ *Slowly create the pressure at **P1**. Check the pressure value at which oil escapes at **P2**. Oil escapes at 210 – 230 bar* (3046 – 3336 psi).

☞ *Check **P2** in the same way.*

☞ *Replace the valve if the test pressure does not correspond to the specifications.*

8.21 Securing the PowerTilt swivel device on the machine

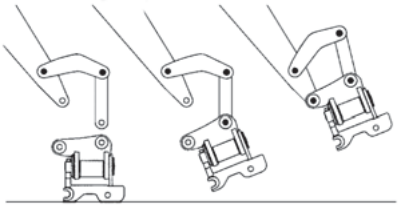


Fig. 80: PowerTilt installation

☞ *Lower the bucket to about 50 – 75 mm (2 – 3") above the PowerTilt swivel device.*

☞ *Align the joint rods with the PowerTilt swivel device and insert the pivot pins.*

☞ *Slowly move the PowerTilt swivel device with the bucket and boom rams to a safe height.*

☞ *Retract the bucket ram until the bucket and the PowerTilt swivel device can be connected with the pins. If necessary turn the pins and fit the required securing parts.*

8.22 Fitting a bucket or equipment onto the PowerTilt swivel device

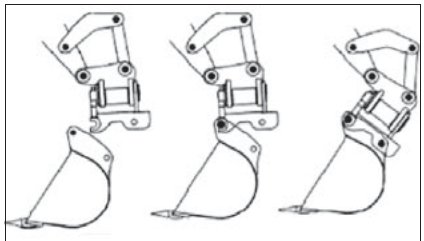


Fig. 81: Bucket or equipment installation

Notice!

Fit a bucket or equipment onto the PowerTilt swivel device only when the hydraulic circuit is installed and functions correctly.

☞ *Fit the bucket mount onto the bucket or equipment.*

☞ *Pick up the bucket pin with the PowerTilt hook.*

Caution!

Align the hook correctly!

☞ *Prevent damage to the hook.*

☞ *Attach and secure the second pin.*

☞ *After fitting the bucket for the first time, adjust the set screw(s) at the back of the hook.*

☞ Slacken the lock nut and turn the screw until it touches the pin.

☞ Secure the screw by tightening the locknut.

Notice!

The mounting pins can be aligned more easily by adjusting correctly when the bucket is replaced.

8.23 Troubleshooting

Problem	Possible cause	Troubleshooting
PowerTilt does not maintain its position.	Oil escapes from the control valve.	Test the component and repair or replace if necessary.
	Defective decompression valve	Remove the internal decompression valve and check for visible damage or dirt. Check the pressure values of the internal decompression valve (220 – 230 bar) (3190 – 3336 psi).
	Oil escapes from the seals.	Test the seals and replace if necessary.
PowerTilt turns only in one direction	A one-way valve has been installed.	Replace by a two-way directional valve.
	Defective internal decompression valve.	Test the component and replace it if necessary.
	Both lines are connected to either the P1 or P2 ports of the Powertilt swivel device.	Pay attention to the correct positions of the ports – *see chapter 8.5 Exploded views PTS06* on page 8-7.
Inexact lateral PowerTilt movements	Air in PowerTilt swivel device or hydraulic system.	Bleed the air from the hydraulic system and determine the cause.
	Hose/pipe diameter/length is larger/longer than recommended.	Install new pipe/flexible lines with the recommended diameter.
		Install the remote-controlled check valve in the lines as close as possible to the PowerTilt swivel device.
Reverse and forwards movement of shaft in housing (axial play of shaft)	Worn or missing pressure discs.	Tighten the end cap according to table *Torque values of end cap* on page 8-23. Replace or install pressure discs as required.
Lateral movement of the bucket	A little play due to necessary spacing between teeth is normal.	Axial play on the shaft < 0.5 mm (0.02”). Readjust the play if it is greater. Axial play occurs due to wear of the axial bearings (discs). If the axial play can no longer be eliminated, the axial bearings are badly worn and must be replaced – *see chapter 8.24 Adjusting the play on the PowerTilt* on page 8-31.
PowerTilt does not take in any lubricant through the grease nipples	Defective grease decompression valve of lubrication system, or grease decompression valve has been replaced by a grease nipple or plug.	Clean or replace the grease decompression valves of the lubrication system.

8.24 Adjusting the play on the PowerTilt

Checking the circumferential play

☞ *Switch off the machine*

☞ *Fit and raise a bucket*

☞ *Apply load to one side of the bucket (have one person press it down)*

☞ *Mark the position on the housing and the shaft*

☞ *Apply load to the other side of the bucket and mark again.*

☞ *Circumferential play (1.5°) as torsion between shaft and housing in mm (in)*

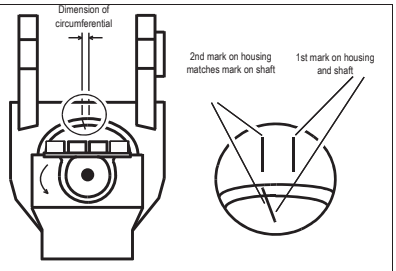


Fig. 82: Dimension of circumferential play

Circumferential play	
Model	**Dim.**
PTS06	2.0 mm (0.08”)

Possibility 1: Air inclusions in the hydraulic system (PowerTilt and hydraulic lines) can cause excessive play on a new PowerTilt. Bleed the PowerTilt via the hydraulic connections on the housing. Repeat this procedure several times if necessary.

☞ *Bearing wear can cause the shaft to have axial play in the housing.*

Possibility 2: axial play > 0.5 mm (0.02”) -> adjust the PowerTilt. If adjusting requires more than half a revolution, or if play cannot be remedied with the adjustment, replace the internal bearings.

Caution!

If bearings are not replaced:

☞ *Damage to the end cap, shaft and housing*

☞ *Slacken and remove the screws of the securing ring.*

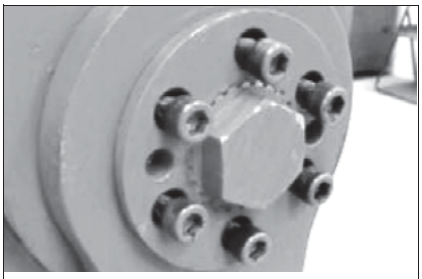


Fig. 83: Slackening the screws of the securing ring

☞ *Press the securing screw out of the oscillating-flange clearance by screwing in the set screws.*

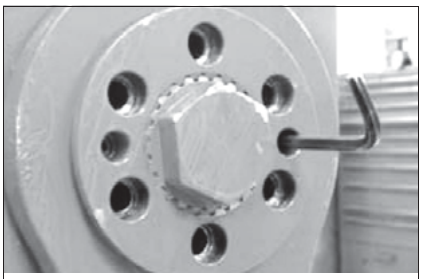


Fig. 84: Adjusting the set screws

Notice!

To remove/mount the securing ring, slacken the fastening screws of the shaft on the other side.

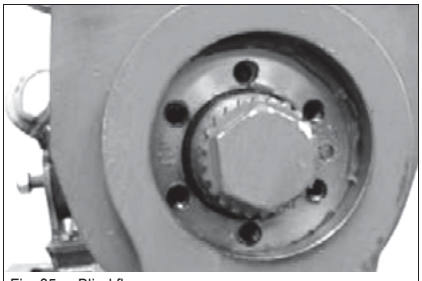


Fig. 85: Blind flange

Fig. 86: Tightening the blind flange

☞ *The end cap and the threaded bores are visible.*

☞ *Fit an adjusting tool and tighten the end cap with a torque wrench.*

Torque values of end cap	
Model	**Torque values Nm (lbs/ft)**
PTS06	475 – 680 (350 – 502)

Caution!

Fit the securing ring before operating the PowerTilt again!

☞ *The shaft turns against the blind flange and the adjusted torque is modified.*

Wacker Neuson Linz GmbH keep abreast of the latest technical developments and constantly improve their products. For this reason, we may from time to time need to make changes to diagrams and descriptions in this documentation which do not reflect products which have already been delivered and which will not be implemented on these machines.

Technical data, dimensions and weights are given as an indication only. Responsibility for errors or omissions not accepted.

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