SUMMARY

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SAFETY INSTRUCTIONS

Personal safety instructions

Observe the safety instructions



- **Read carefully through all safety instructions attached to the machine and observe them; read all safety instructions in this manual in addition.**
- **Safety instruction stickers/plates must be affixed, maintained and replaced when necessary.**
- **If a safety instruction sticker/plate or this manual is damaged or missing, obtain a replacement from your dealer. The procedure is the same as when ordering spare parts (it is essential to quote the machine type and the serial number).**
- **Familiarize yourself with the correct, safety-oriented procedure for operating the machine and its control elements.**
- **Allow only trained, qualified and authorized persons to operate the machine.**
- **Keep the machine in good working order.**
- **Unauthorized modifications to the machine may affect its efficiency and/or safety and reduce its service life.**
- **The instructions given in this Safety Instructions section are designed to show the fundamental safety procedures for the machine. However, they cannot cover all hazardous situations with which you may be confronted. If in doubt, consult your immediate superior before operating the machine or carrying out servicing work.**

Protection from noise



Sustained effects of noise may lead to impaired hearing or deafness.

Wear appropriate ear protectors such as earplugs or muffs for protection from disturbing or intolerable noise.

Preparing for emergencies



Be prepared for the event of a fire breaking out or an accident occurring.

Keep the first-aid box and the fire extinguisher readily accessible at all times.

Read the instructions for operating the fire extinguisher and learn how to use it properly.

Stipulate emergency procedures for the event of fire or accidents.

Keep the emergency numbers of doctors, emergency services, hospitals and the fire service in the immediate vicinity of the phone.

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Data sheet for MH6.6 cylinders

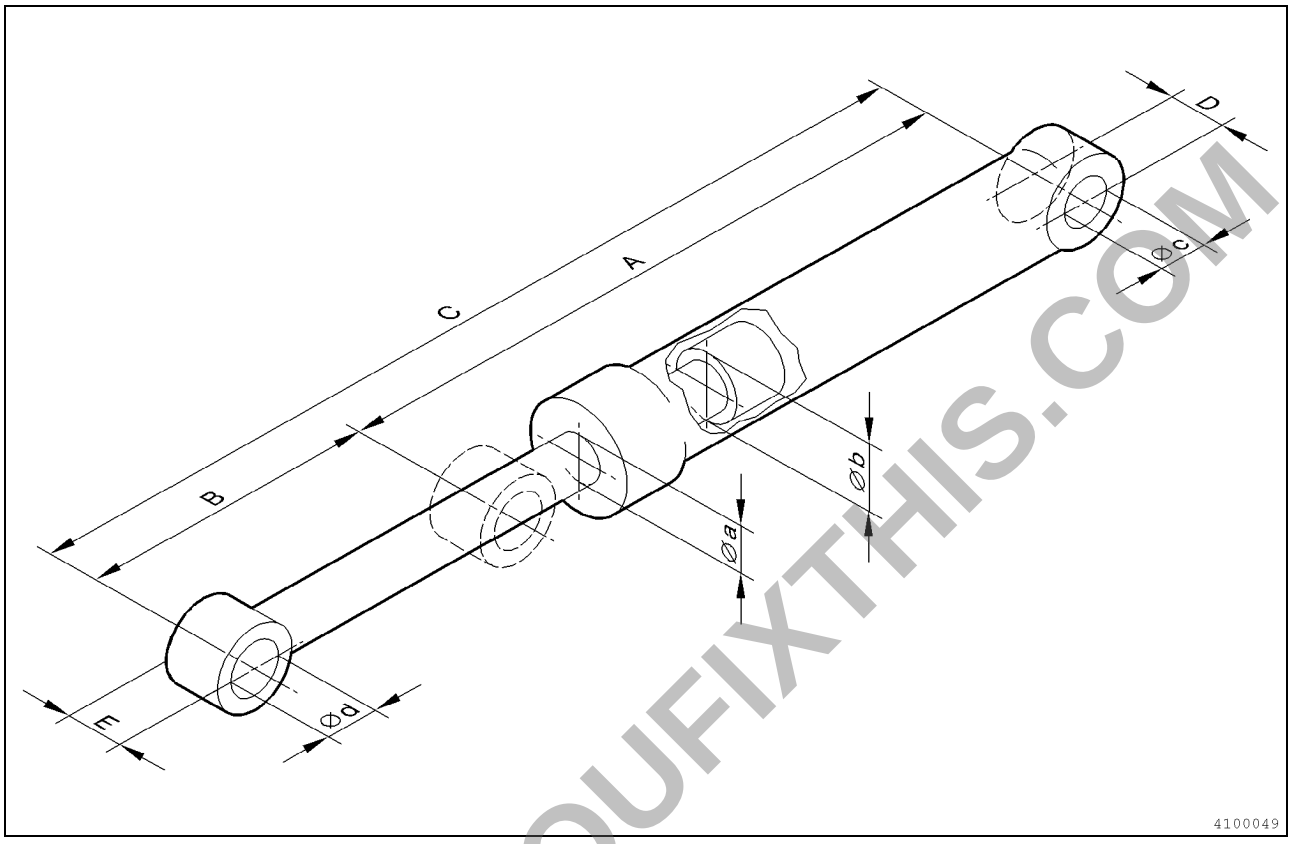


Fig. 1

MH6.6	P/N	Piston	Piston rod	Length	Stroke	Length	Cylinder barrel		Piston rod	
							Eye	Width	Eye	Width
		∅ b	∅ a	A	B	C	∅ c	D	∅ d	E
Monoblock boom	72113778	135	85	1630±1.8	1050±1.8	2680±3.6	$90^{+0.25}_{+0.05}$	$116^{0}_{-0.5}$	$100^{+0.25}_{+0.05}$	$106^{0}_{-0.5}$
Boom adjusting	72104531	135	85	1565±1.8	985±1.8	2550±3.6	$90^{+0.25}_{+0.05}$	$116^{0}_{-0.5}$	$100^{+0.25}_{+0.05}$	$106^{0}_{-0.5}$
Stick cylinder	72104546	135	95	1975±1.8	1400±1.8	3375±3.6	80	$116^{0}_{-0.5}$	80	$116^{0}_{-0.5}$
Bucket cylinder	72113790	115	80	1660±1.8	1075±1.8	2735±3.6	$70^{+0.25}_{+0.05}$	$96^{0}_{-0.5}$	$80^{+0.25}_{+0.05}$	$96^{0}_{-0.5}$
Adjusting cylinder	3327103	180	100	1360	745	2105	$110^{+0.457}_{+0.370}$	126±1.2	$110^{+0.457}_{+0.370}$	$126^{0}_{-0.5}$

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Power supply / engine starter

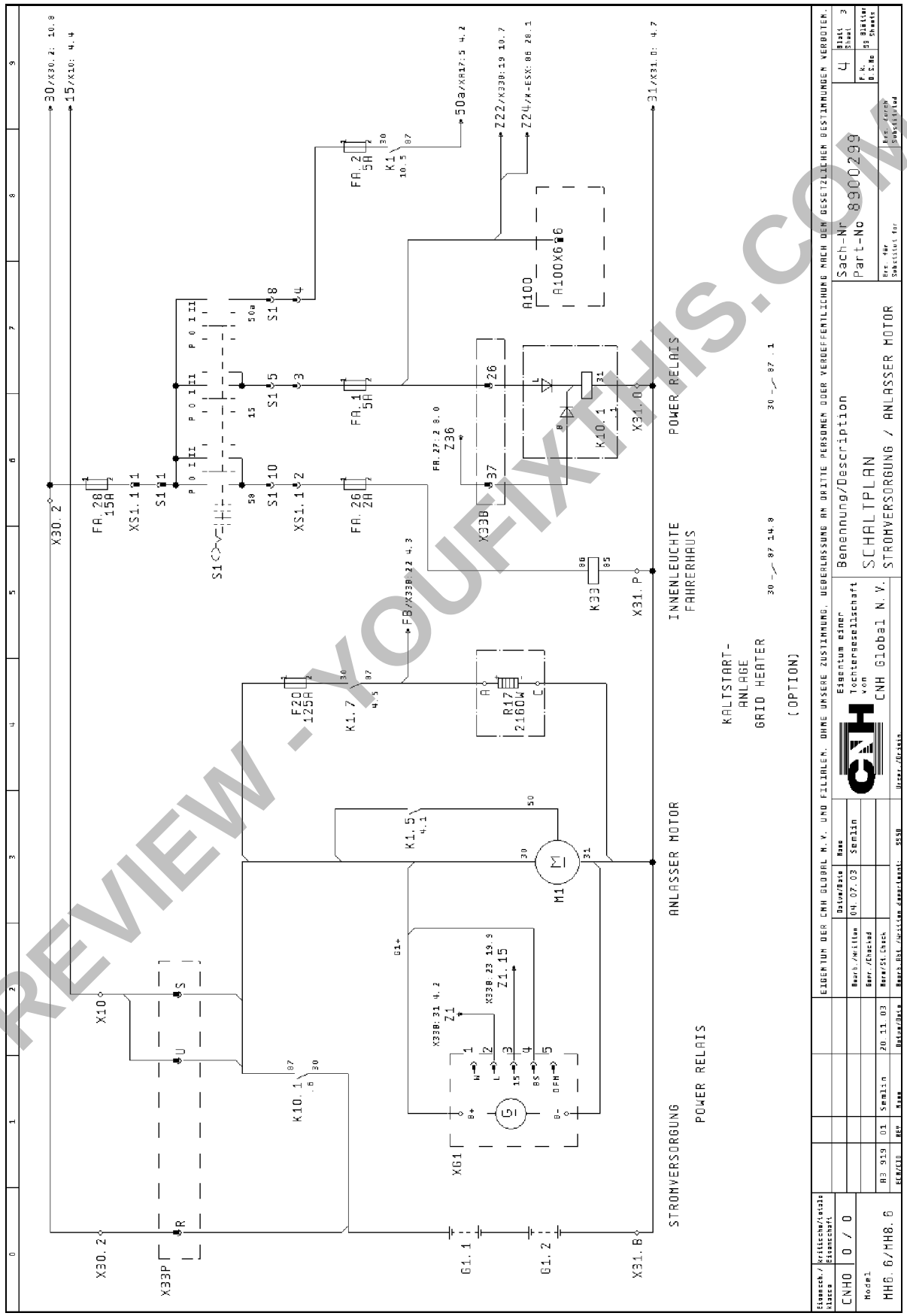


Fig. 3

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Pin assignment ESX controller

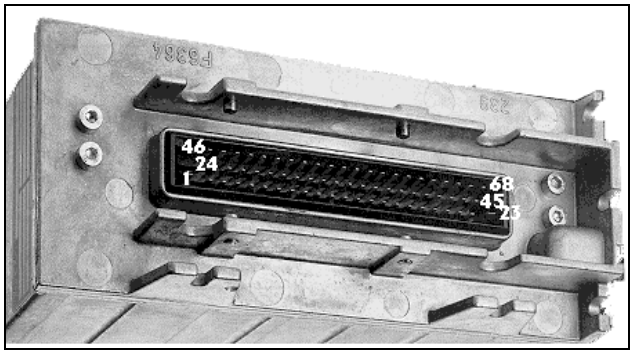


Fig. 7



Fig. 8

Pin	Function
1	Ground, analog
2	Digital/PWM output 10, (2,5 A)
3	Digital/PWM output 12, (2,5 A)
4	Serial interface, RxD
5	Serial interface, TxD
6	Analog input 1
7	Analog input 3
8	Analog input 5
9	Analog input 7
10	Baby-Board, slot 2/6
11	Baby-Board, slot 2/2
12	Digital speed input 2
13	Digital speed input 4
14	Digital speed input 6
15	Digital speed input 8
16	Digital speed input 10
17	Digital speed input 12
18	Digital speed input 14
19	Digital speed input 16
20	Baby-Board, slot 1/2
21	Baby-Board, slot 1/4
22	Baby-Board, slot 1/6
23	8,5 V out
24	Digital/PWM output 9, (2,5 A)
25	Digital/PWM output 11, (2,5 A)
26	1st CAN-Bus, dominant lower, W-
27	1st CAN-Bus, dominant higher, W+
28	D+ input
29	Analog input 2
30	Analog input 4
31	Analog input 6
32	Analog input 8
33	2nd CAN-Bus, dominant lower, W-
34	Digital speed input 1

Pin	Function
35	Digital speed input 3
36	Digital speed input 5
37	Digital speed input 7
38	Digital speed input 9
39	Digital speed input 11
40	Digital speed input 13
41	Digital speed input 15
42	Baby-Board, slot 1/1
43	Baby-Board, slot 1/3
44	Baby-Board, slot 1/5
45	Baby-Board, slot 2/1
46	Digital/PWM output 1, (4 A with current measuring)
47	Digital/PWM output 2, (4 A with current measuring)
48	Digital/PWM output 3, (4 A with current measuring)
49	Digital/PWM output 4, (4 A with current measuring)
50	Baby-Board, slot 2/3
51	Baby-Board, slot 2/4
52	Baby-Board, slot 2/5
53	2nd CAN-Bus, dominant higher, W+
54	Power supply 12 V (24 V), U_E
55	Electrical ground, digital
56	Power supply 12 V (24 V), U_B
57	Power supply 12 V (24 V), U_B
58	Power supply 12 V (24 V), U_B
59	Power supply 12 V (24 V), U_B
60	Power supply 12 V (24 V), U_B
61	Digital/PWM output 6, (4 A)
62	Digital/PWM output 7, (4 A)
63	Digital/PWM output 8, (4 A)
64	Digital/PWM output 5, (4 A with current measuring)
65	Ground for Babyboard 1
66	Ground for Babyboard 1
67	Ground for Babyboard 2
68	Ground for Babyboard 2

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Electronic control diagram

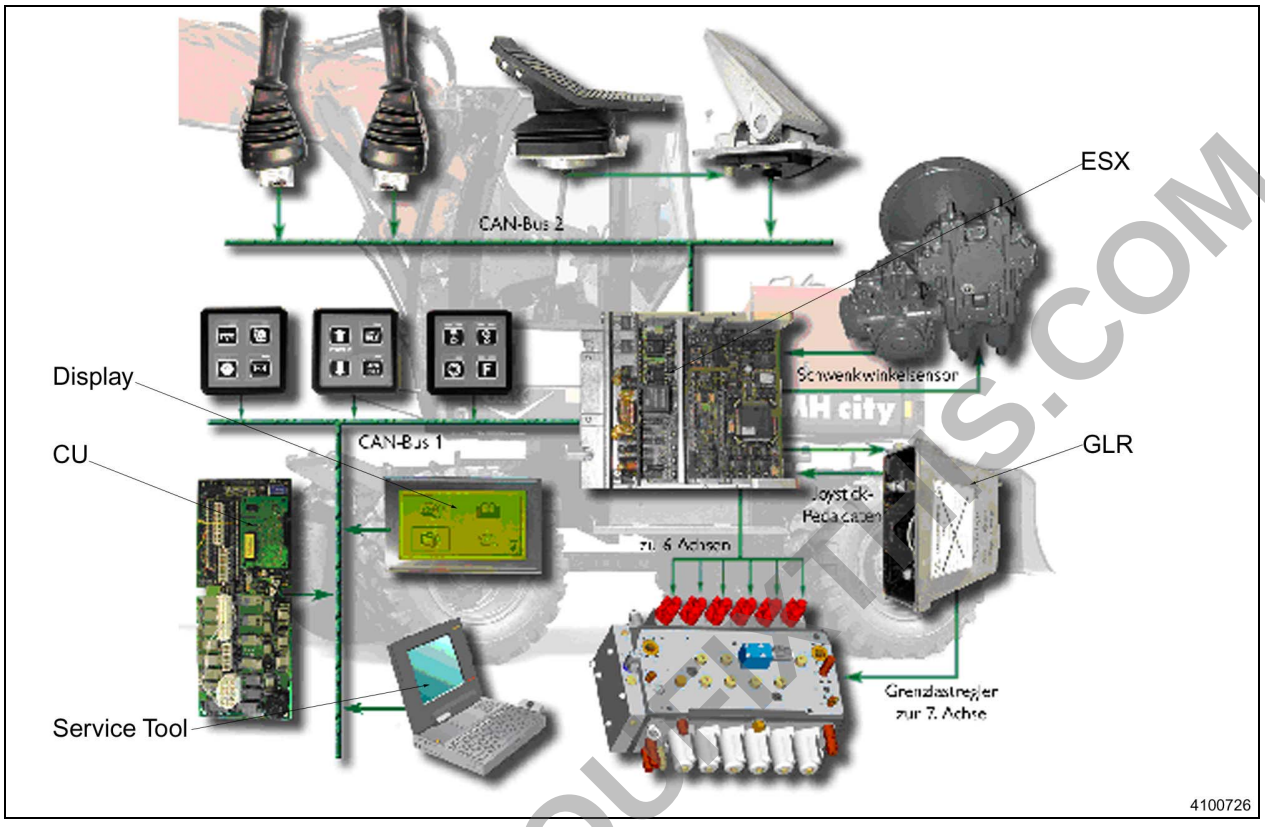


Fig. 1

Description

The diagram shows the interlinking of the electronic and hydraulic components.

The modules responsible for the operation and control of the electrical system of the vehicle, e.g. display (C4), central electronic unit CU **(C**entral **U**nit A100), keyboard module (C5.1, C5.2, C5.3) and PMS/PCS with load limit regulator (GLR A10), and ESX (A7.3) are connected to CAN bus 1.

CAN bus 1 has the diagnostic sockets.

The electronic modules of the electrohydraulic servo control, e.g. joystick on right (A56) and left (A57), as well as the driving pedal (A61) and the double pedal (A61.1) are connected with the ESX via CAN bus 2.

The two BUS systems are interlinked via the ESX.

The ESX controls the pump control, the control valve adjustment, and the slewing pump control systems.

In addition, the ESX issues current values via CAN bus 1 at the load limit regulator to the hammer/shears control.

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WORKING, SLEWING AND PILOT-CONTROL CIRCUITS IN THE SUPERSTRUCTURE

Schematic diagram

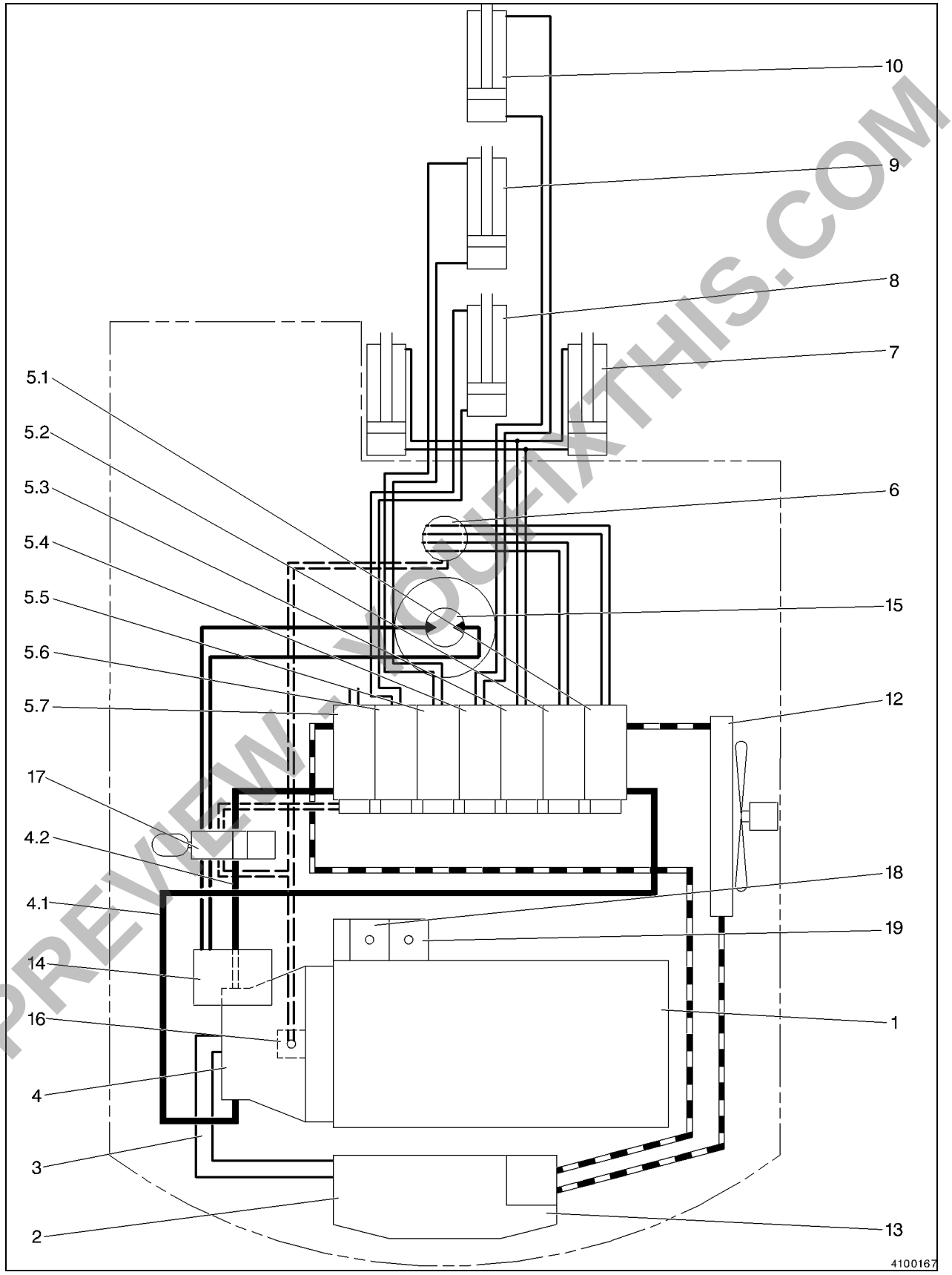


Fig. 1

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Rigid axle, gearbox housing

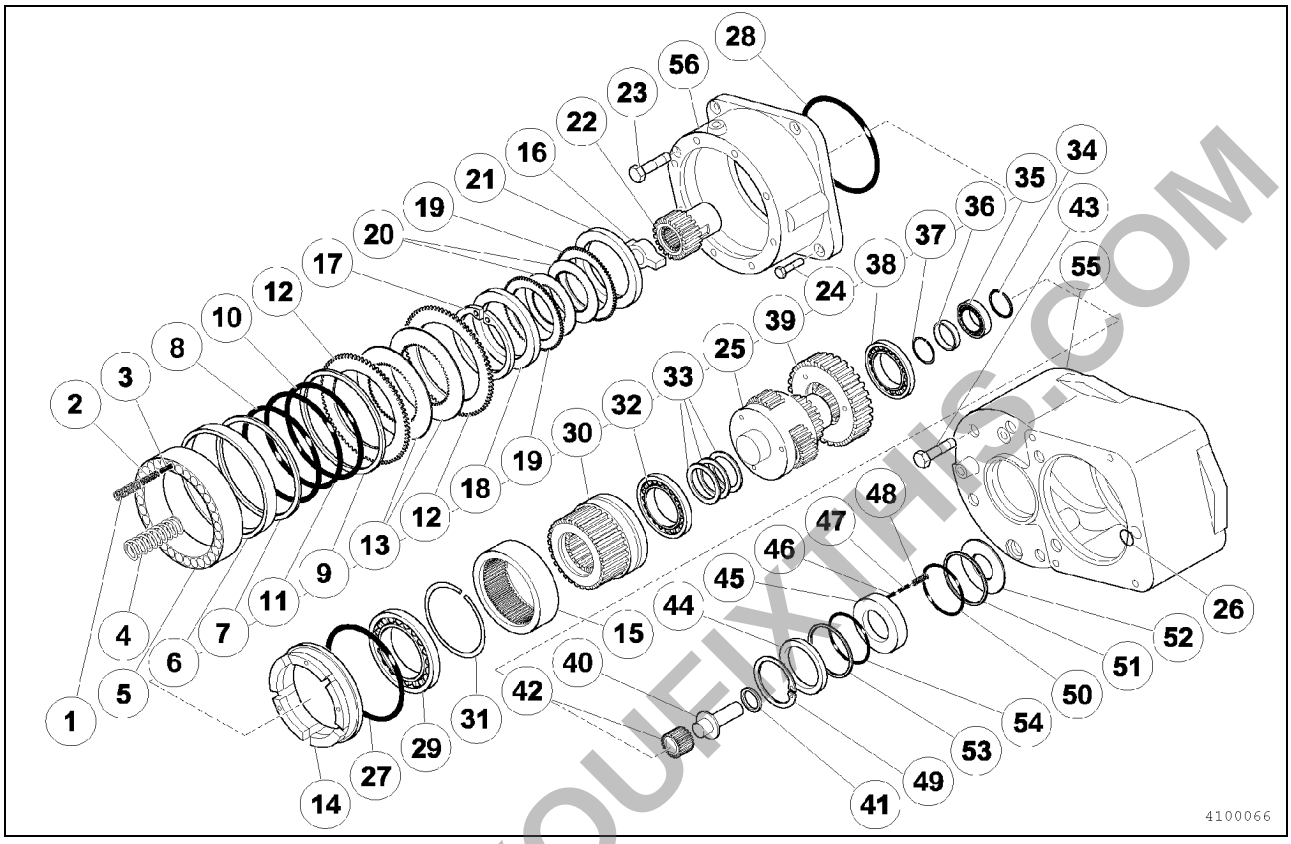


Fig. 1

Removing and fitting the gearbox housing

Removal and fitting of the gearbox housing are described in the axle manual.

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Replacing the buffers under the cab baseplate

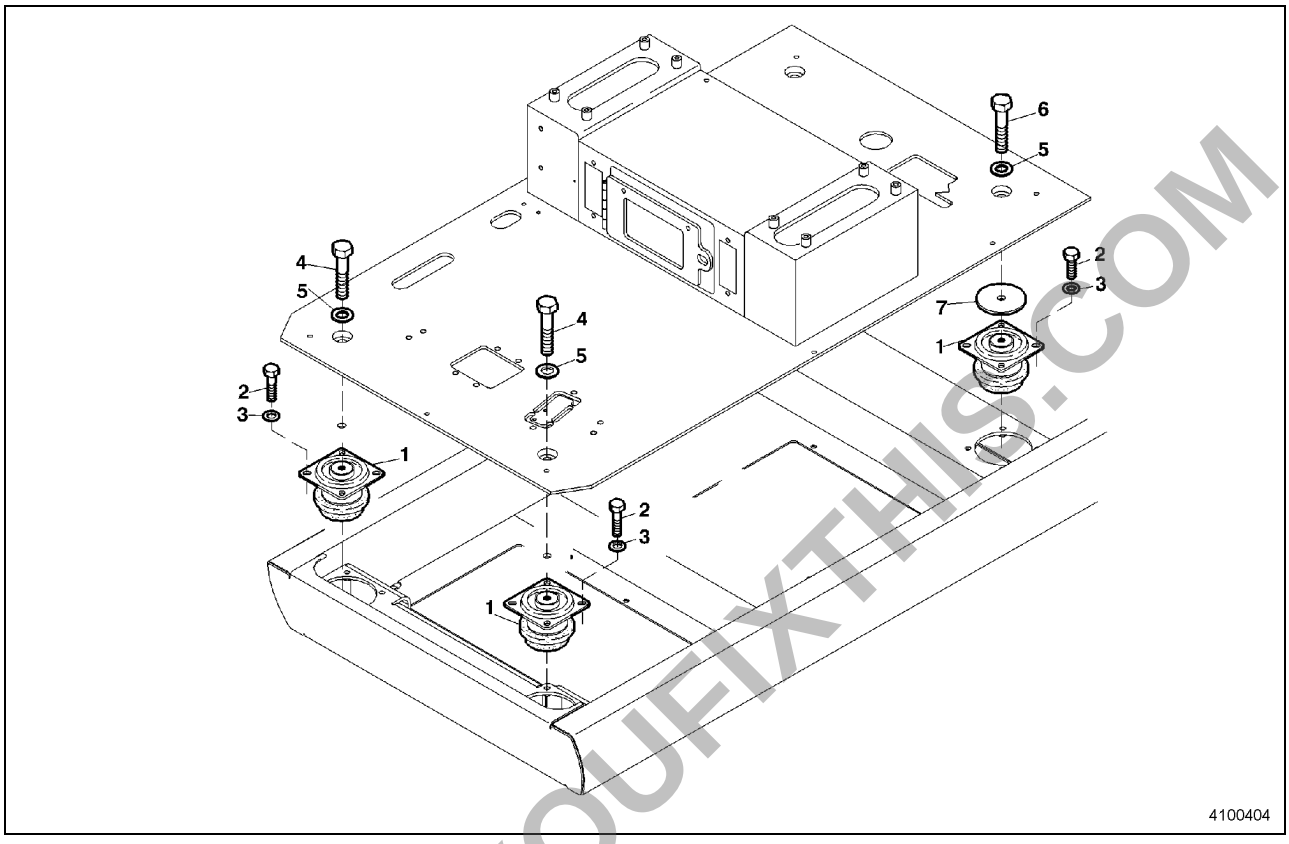


Fig. 1

Key

No.	Q.ty	Designation
1	4	Buffer
2	16	Screw
3	16	Disk
4	2	Screw
5	4	Disk
6	2	Screw
7	2	Disk

Preparations

- Secure the machine as described under 'Securing the machine'.

Front buffers

- Remove the rubber mats over the screws to be loosened.
- Loosen and remove the front screws (4).
- Loosen the rear screws (6), but without removing them.
- Raise the front part of the cab with the baseplate slightly so that the screws of the buffers can be removed.

Place a timber beam between the baseplate and the frame to ensure that the fitting space does not narrow: risk of crushing.

- Loosen and remove the screws (2) and the disks (3) retaining the buffers.
- Lift the buffer out of its housing and replace.
- Fasten the buffer with the screws (2) and the disks (3), remove the safety timber and lower the cab cautiously.
- Fasten the baseplate with the cab using the screws (4) and (5).

Rear buffers

- To replace the rear buffers, observe the same working steps as described for the front buffers.

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Bolts with standard thread DIN 13 – 13

Thread nominal Ø	Material quality	Tightening torques M_A in Nm		
		total 0.10 [1]	total 0.12 [2]	total 0.16 (L) [3]
M 5	8.8 10.9 12.9	4.9 7.3 8.5	5.5 8.1 9.5	6.5 9.5 11.2
M 6	8.8 10.9 12.9	8.5 12.5 14.5	9.5 14 16.5	11.2 16.5 19.5
M 8	8.8 10.9 12.9	20.5 30 35	23 34 40	27 40 47
M 10	8.8 10.9 12.9	41 60 71	46 68 79	55 80 94
M 12	8.8 10.9 12.9	71 104 195	79 117 215	94 140 260
M 16	8.8 10.9 12.9	170 250 300	195 280 330	230 340 400
M 20	8.8 10.9 12.9	350 490 580	390 560 650	470 670 780
M 24	8.8 10.9 12.9	600 850 1000	670 960 1120	800 1140 1350
M 30	8.8 10.9 12.9	1190 1700 2000	1350 1900 2250	1600 2300 2700
M 36	8.8 10.9 12.9	2100 3000 3500	2350 3300 3900	2800 4000 4700

[1] Screw and/or nut electro-galvanized.

[2] Screw black-plated or phosphatized, thread oiled.

[3] Screws with liquid screw fixer, e.g. Loctite 242, 243.

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Fault codes

9000 (German)
9011 ESX checksum fault
9012 ESX cutoff fault
9013 SPI communication of ESX defective
9014 SPI bus of ESX reserved
9015 Checksum fault on initialization of ESX system monitoring
9016 Plausibility fault on initialization of ESX system monitoring
9017 ESX reset through user watchdog
9018 ESX reset through system watchdog
9019 ESX hardware fault
9020 Checksum fault during readout of ESX fault memory
9021 Fault in reading of ESX fault memory
9022 ESX value outside valid range
9023 Supply voltage of ESX operation amplifier and multiplexer defective
9024 ESX temperature outside permitted range
9025 Processor configuration faulty due to ESX hardware
9026 Multiplexer or ESX A/D converter defective.
9027 Threshold voltage of ESX inputs faulty
9028 ESX frame potential faulty
9029 Supply voltage of ESX watchdog module defective
9030 Frame potential at BTS module of ESX faulty
9031 ESX relay defective
9032 ESX watchdog module cannot switch off relay
9033 ESX watchdog module defective
9034 CPU of ESX defective
9035 ESX flags cannot be set
9036 ESX flags cannot be scanned
9037 ESX arithmetic unit defective
9038 ESX multiplier defective
9039 Fault in CPU test sequence of ESX
9040 External RAM or ROM of ESX defective
9041 Shadow memory module of ESX defective
9042 Net current measurement on start of ESX faulty
9043 Cyclic net current measurement of ESX faulty
9044 Internal RAM defective on start of ESX
9045 Cyclic internal RAM test of ESX defective
9046 Ignition lock input status of ESX faulty
9047 Cyclic diagnosis of ESX faulty

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FAULT CODES

General information on fault codes

The following units of the machine are permanently monitored:

- Central Unit (CU)
- Power-Control-System (PCS)
- Electro-Hydraulic Controller (ESX)

In the event of a fault, a **fault code** (e.g. N°7004) is diplayed in the upper half of the multi-function display (108, Fig. 1) in combination with two **coloured warning lights** (112 yellow and 113 red, Fig. 1) which will light up individually or together, depending on the type of fault. Depending on the severity of the fault, a special tone signal will be heard in addition.

Meaning of signals:

RED **+** **CONTINUOUS TONE**	**Severe fault** The safety of persons and/or the functioning of essential units of the machine is at risk.

	**Severe faults must be rectified immediately.** **Shut off the machine at once.**

YELLOW **+** **SINGLE BEEP**	The fault signalled is not relevant to the safety of persons or to the functioning of the machine. These faults must be rectified as fast as possible. In most of the cases, however, the machine remains fully functional.

(see also "Multi-function display")

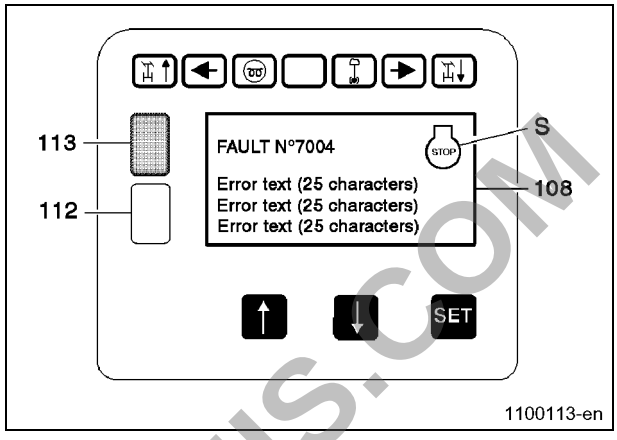


Fig. 1

In addition to the fault code, the lower half of the multi-function display (108, Fig. 1) gives an explanation of the fault code (error text).

In individual cases there is the possibility of several faults occurring at the same time.

The corresponding error codes are then displayed one after another in alternation with the normal display contents.

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Display, Service, Calibration (engine ON)

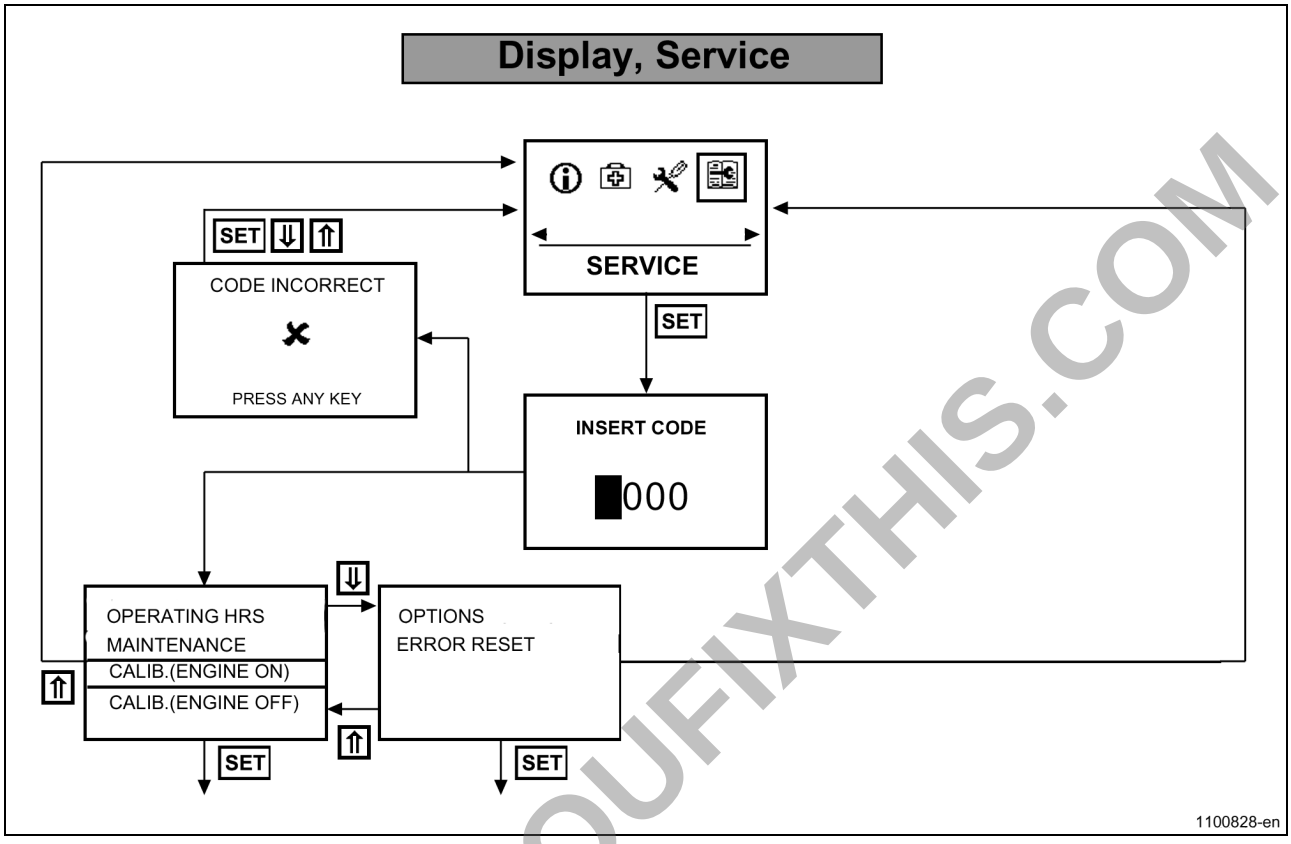


Fig. 1

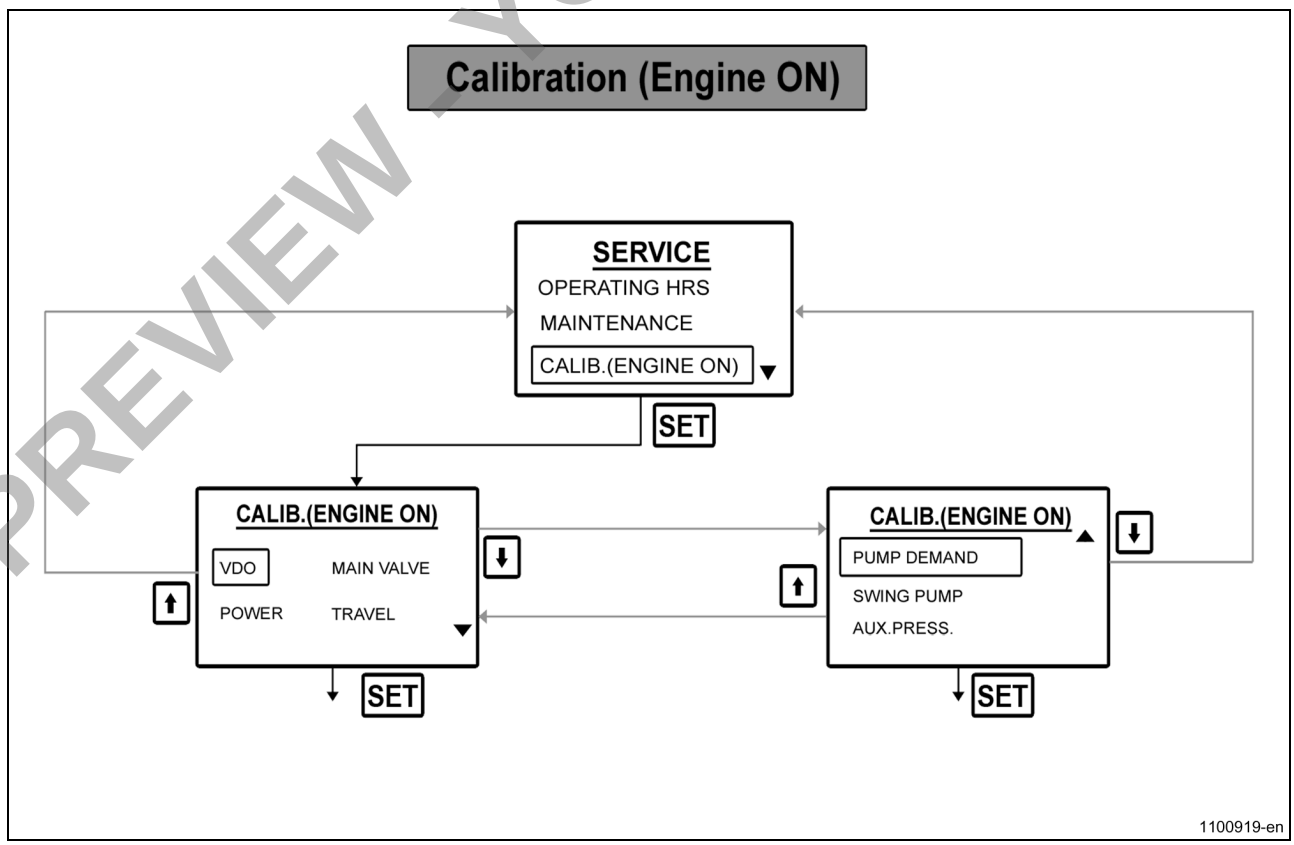


Fig. 2

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Warnings and symbols

The following signs are used in the Workshop Manual to designate exceptionally important information:



Precautionary rules and measures designed to protect the operator and other persons from life-threatening hazards or injury and to prevent extensive damage to property.



Information and precautionary measures designed to prevent damage to the machine and other property.

Risks resulting from failure to observe the safety instructions



This hydraulic excavator has been built in accordance with state-of-the-art standards and recognized safety regulations.

Nevertheless, its use may constitute a risk if it continues to be operated despite damage being suspected or having occurred, or if it is inexpertly repaired.

There is then a risk of

- **life-threatening injury**
- **irreparable damage to the machine and other assets.**

The hydraulic excavator must be stopped immediately if suspected damage or damage that has occurred affects the safety of the operator, other persons at the excavator deployment site, or other assets. All components are carefully coordinated. Trouble-free operation and a long service life are assured only if original spare parts are used.

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Conversion from foot and inch to metric mesures

1 in = 25.4 mm (exact)	1 ft = 12 in = 304.8 mm	Example: 4ft 2in = 1.27m

ft	in											
	+0	+1	+2	+3	+4	+5	+6	+7	+8	+9	+10	+11
	m	m	m	m	m	m	m	m	m	m	m	m
0		0.0254	0.0508	0.0762	0.1016	0.1270	0.1524	0.1778	0.2032	0.2286	0.2540	0.2794
1	0.3048	0.3302	0.3556	0.3810	0.4064	0.4318	0.4572	0.4826	0.5080	0.5334	0.5588	0.5842
2	0.6096	0.6350	0.6604	0.6858	0.7112	0.7366	0.7620	0.7874	0.8128	0.8382	0.8636	0.8890
3	0.9144	0.9398	0.9652	0.9906	1.0160	1.0414	1.0668	1.0922	1.1176	1.1430	1.1684	1.1938
4	1.2192	1.2446	1.2700	1.2954	1.3208	1.3462	1.3716	1.3970	1.4224	1.4478	1.4732	1.4986
5	1.5240	1.5494	1.5748	1.6002	1.6256	1.6510	1.6764	1.7018	1.7272	1.7526	1.7780	1.8034
6	1.8288	1.8542	1.8796	1.9050	1.9304	1.9558	1.9812	2.0066	2.0320	2.0574	2.0828	2.1082
7	2.1336	2.1590	2.1844	2.2098	2.2352	2.2606	2.2860	2.3114	2.3368	2.3622	2.3876	2.4130
8	2.4384	2.4638	2.4892	2.5146	2.5400	2.5654	2.5908	2.6162	2.6416	2.6670	2.6924	2.7178
9	2.7432	2.7686	2.7940	2.8194	2.8448	2.8702	2.8956	2.9210	2.9464	2.9718	2.9972	3.0226
10	3.0480	3.0734	3.0988	3.1242	3.1496	3.1750	3.2004	3.2258	3.2512	3.2766	3.3020	3.3274
11	3.3528	3.3782	3.4036	3.4290	3.4544	3.4798	3.5052	3.5306	3.5560	3.5814	3.6068	3.6322
12	3.6576	3.6830	3.7000	3.7338	3.7592	3.7846	3.8100	3.8354	3.8608	3.8862	3.9116	3.9370

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Control elements (Fig. 1)

No.	Designation		Function
60	**Steering column and steering wheel**		Transfer of steering movement to steered axle
61	**Pedal**	**Travelling**	Control of machine travel
62	**Pedal**	**Service brake**	Braking of travelling movements. The locking lever blocks the service brake in braked position and, at the same time, the floating axle. Unblocking the brake pedal automatically unblocks the floating axle.
63	**Pushbutton**	**Grab rotation / Adjustable boom upper section (optional)**	Selects sense of grab rotation: **right** (with option "Upper boom section shift operation": **slew to the right**
64	**Pushbutton**	**Signalhorn**	Acoustic warning signal
65	**Pushbutton**	**Travel direction**	Selects **forward** travel (No. 101 lit up)
66	**Pushbutton**	**Travel direction**	Selects **reverse** travel (No. 107 lit up)
67	**Pushbutton**	**Travel direction**	Selects **neutral** travel
68	**Locking bolt**	**Oberwagen-Verriegelung**	Locks up the superstructure and the undercarriage
69	**Control lever**	**Boom**	forward - lowering the boom backward - raising the boom
		Bucket	to the right - emptying the bucket to the left - fillng the bucket
		Grab	With grab option: to the right - opening the grab to the left - closing the grab
70	**Steuerhebel**	**Slewing**	to the right - superstructure slewing to the right to the left- superstructure slewing to the left
		Stick **Levelling blade / stabilizers**	forward - stretching out stick - lowering the levelling blade / the stabilizers backwards - retracting the stick - raising the levelling blade / the stabilizers. (see also Nos. 22 - 25)
71	**Pushbutton**	**Levelling**	Supplementary activation of the "levelling" mode (see: "Switching over to "levelling")

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Hammer / Shears / Frequency (option)

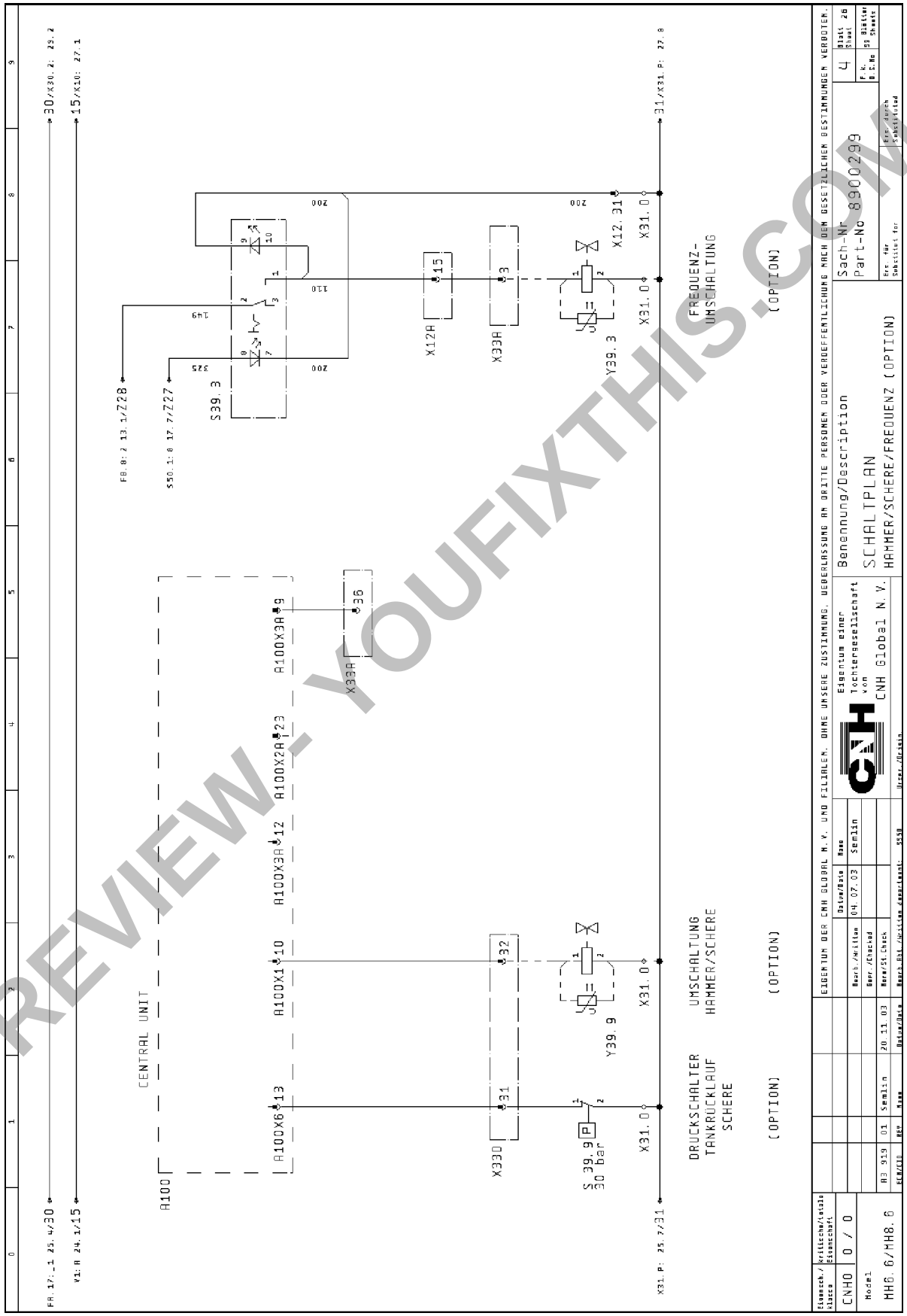


Fig. 26

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POWER SUPPLY

Electrical circuit diagram CAN-bus power supply

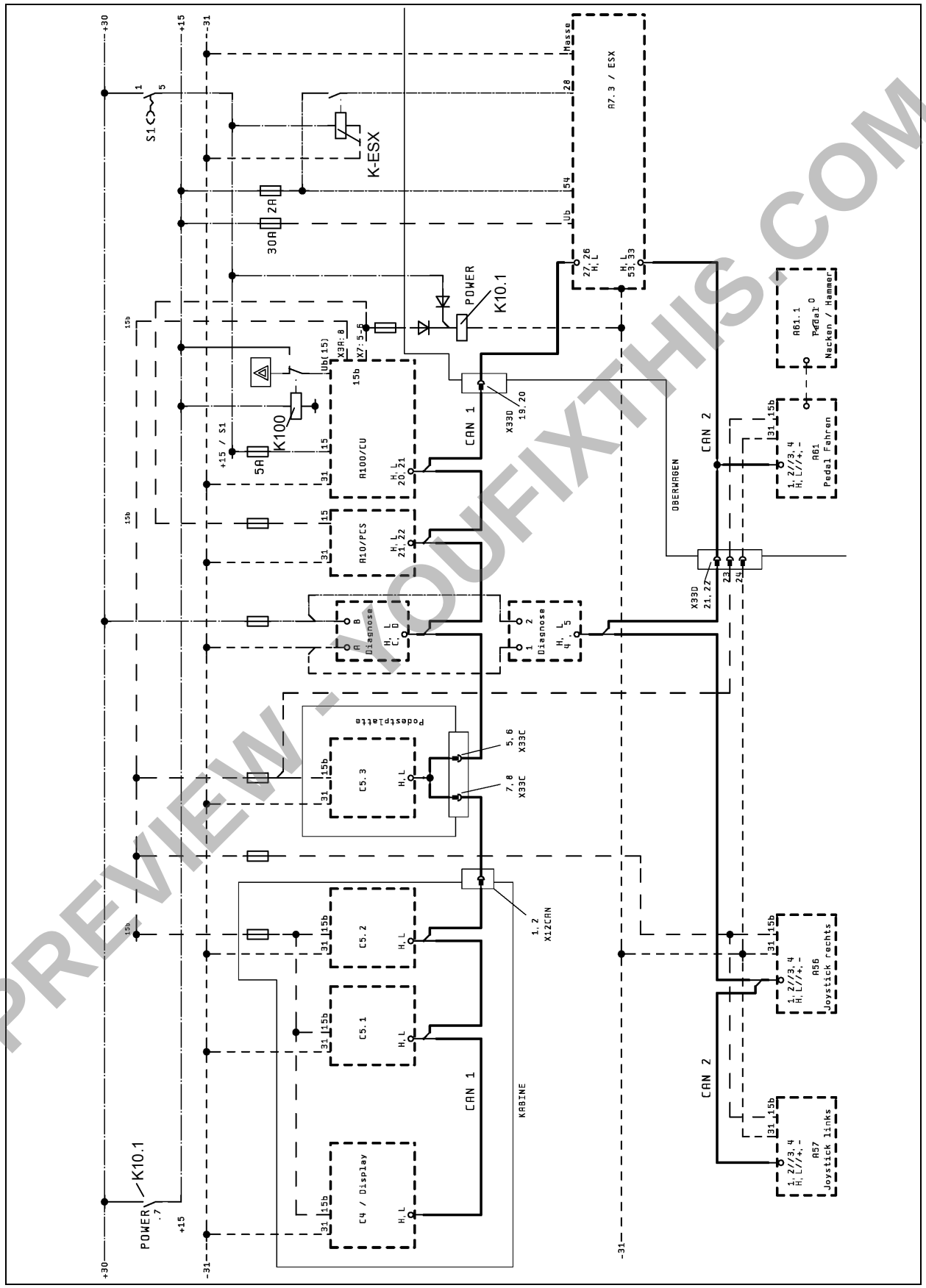


Fig. 1

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Description

The travel circuit is driven only by the oil from pump 1. After entering the control block, the oil is admitted to the pressure measuring point, the pressure sensor B211 (58) and the primary valve.

Neutral

In neutral position of the travelling spool, the flushing oil volume of pump 1 flows past the control spool into channel C1 and then past the other control spools into the tank channel.

The circulating pressure of pump 1 opens the load holding valve (1) and the oil flow reaches the P channel.

The pressure generated by the tank channel precharging valves is admitted to the travel oil motor via the two replenishing non-return valves (3+4) to avoid cavitation.

The pilot-control pressure is available at undercarriage control block (105) and controls the solenoids Y16 for the parking brake, Y62 for the floating-axle support and Y21.2 for the creep-speed function.

Before travelling

After releasing of the parking brake, the gear preselected at solenoid valve Y21.4 is engaged.

Pressure switch S16.1 opens and the hand-brake pilot lamp is off.

When solenoid valve Y62 is energized, the pilot-control pressure unblocks the floating-axle cylinders (111).

The travel oil motor is in Vgmin position when solenoid Y21.2 is deenergized.

The travel oil motor can be regulated depending on high pressure.

Forward travel

The selection of the travel direction and the precision movements of the travel pedal are sensed by the ESX which opens a virtual pressure switch DSF before the travel movement starts. The ESX then activates solenoid valve Y290 in the pilot-control unit (60) and the pilot pressure oil flows through the inlet filter in port PF to proportional valves Y201a and Y201b. The ESX also energizes proportional valve Y241 so that pump 1 is controlled by load-sensing pressure.

Proportional valve Y201a is energized by the ESX depending on pedal excursion.

In proportion to pedal excursion, pilot-pressure oil is admitted through solenoid valve Y201a to the upper cap and the travel spool is displaced downwards against the springs. Channel C1 is blocked off and the oil from pump 1 flows via load-holding valve (1) into the pump channel and past the open control edge to port A1 and then through rotor (75) to travel oil motor (102). The load pressure thus generated passes through the transverse duct and the center bore in the control spool into channel M and acts on pressure sensor B10. The output signal from pressure sensor B10 and the speed signal from sensor B7 at the speed-change gearbox (101) are evaluated by the ESX for automatic gear change purposes. The oil returning from the travel oil motor must flow through the travel brake valve and the rotor back into the control block and then via the tank channel preloading valves into the return circuit.

Reverse travel

During reverse travel, proportional valve Y201b is active and lets pilot pressure oil in proportion to the pedal excursion flow into the lower pilot cap so that the travel spool is displaced upwards against the springs. The oil from pump 1 now flows from the pump channel to control block port B1 and through the rotor into the travel oil motor.

Setting off on slopes

For precision initiation of the driving movement on slopes at low engine speeds, the load-holding valve (1) is of importance. During this phase, the load pressure is retained by the load-holding valve until pump 1 has built up a high pressure flow which is greater than the load pressure, whereafter the machine starts travelling. The load-holding valve prevents the machine from rolling backwards.

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Bucket cylinder control spool

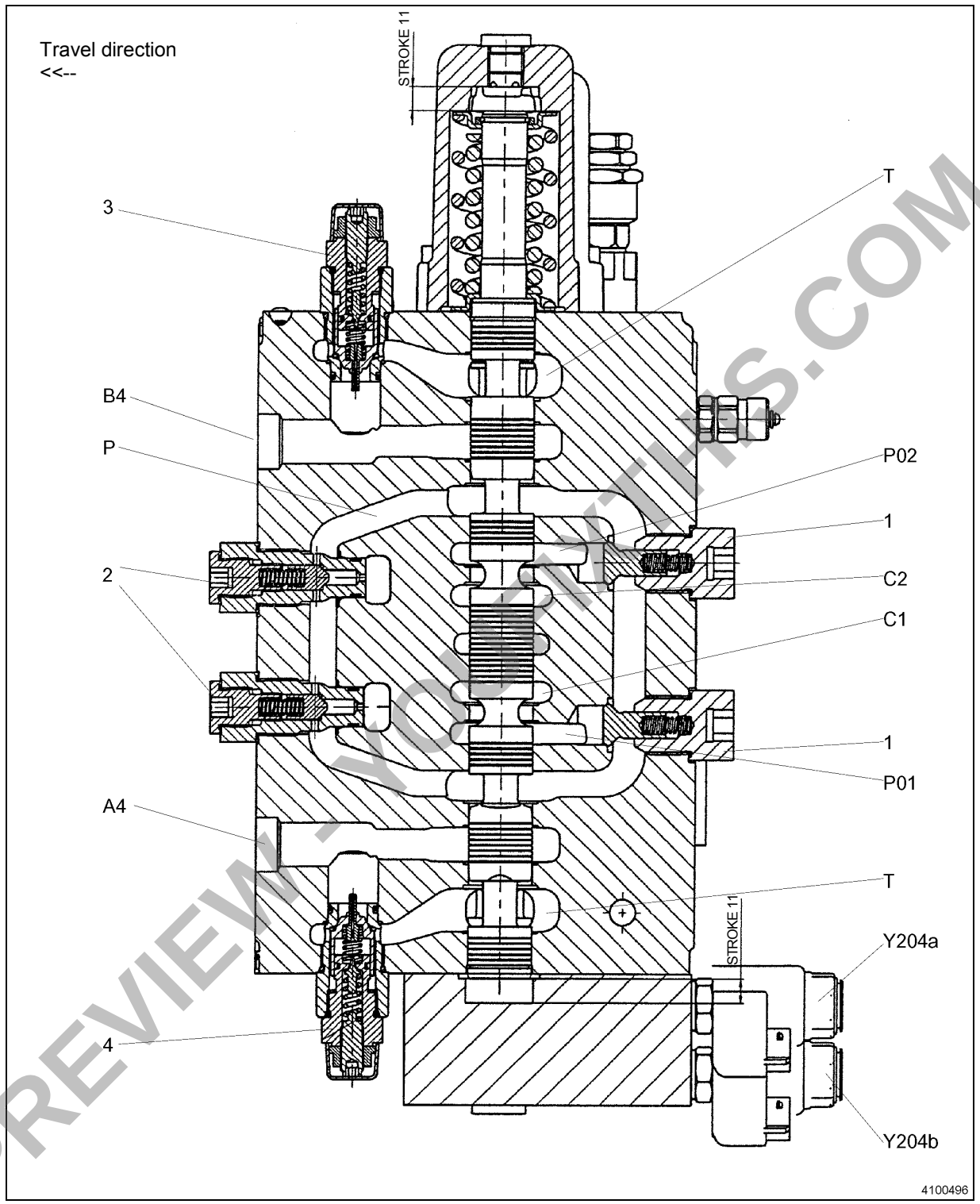


Fig. 2

Key

P1	Pressure channel of pump 1	A4	Bucket cylinder piston side
P01	Pressure channel of pump 1	B4	Bucket cylinder rod side
C1	Connecting channel for pump 1	1	Load-holding valves
P2	Pressure channel of 2	2	Bucket parallel connections
P02	Pressure channel of 2	3	Secondary valve rod side
C2	Connecting channel for pump 2	4	Secondary valve piston side
P	P channel (bridging channel)	T	Preloaded tank channel

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Slewing pump A 4 VG (No. 4)

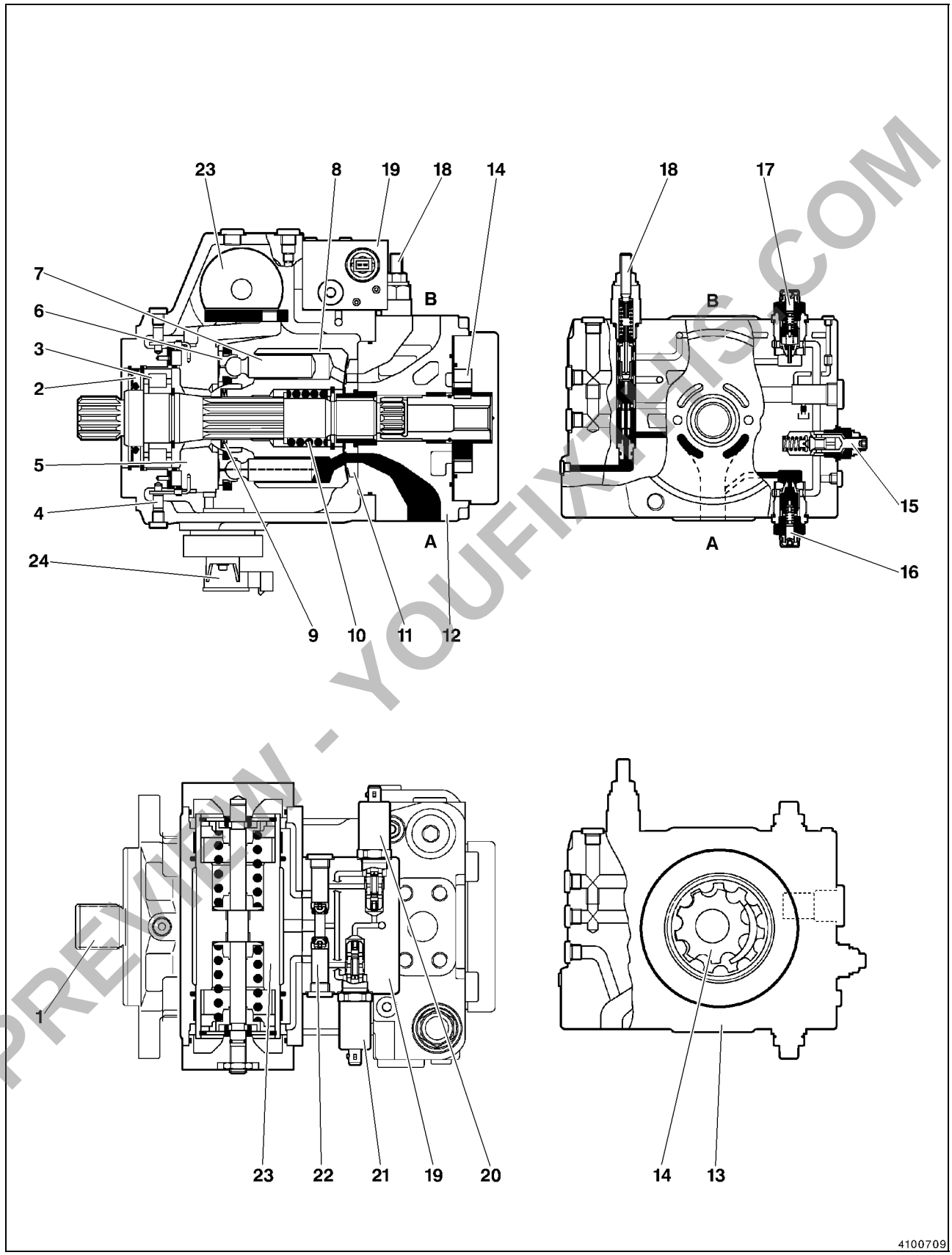


Fig. 1

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Combined radiator

To remove the combined radiator, it is necessary to detach the panelling sheets at the battery box to ensure sufficient room for working. The panelling sheets must not be removed completely, though. It is sufficient to loosen and to shift them aside.

To shift the panelling sheets, it is necessary to remove the cover of the battery box, the battery itself and the flap of the fan.

Preparations

- Secure the machine as described under 'Securing the machine'.
- Shut off the engine and the ignition.
- Depressurize the hydraulic system.

Removing the combined radiator

- Remove the above-mentioned components.

see: battery box
fan flap
battery box panelling sheets

Collect escaping oil in a suitable recipient and discard without polluting the environment.

- Detach and remove the hosepipes.

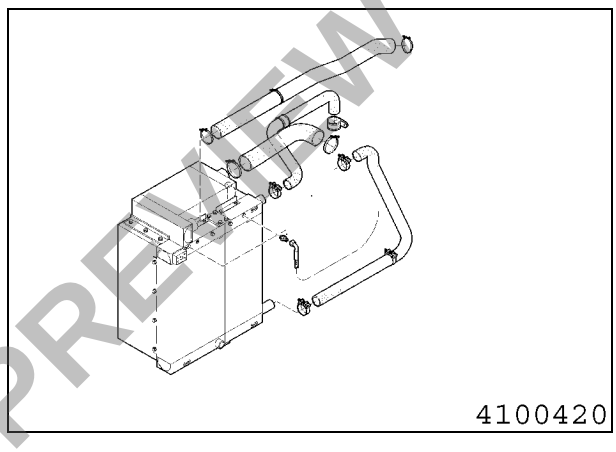


Fig. 1

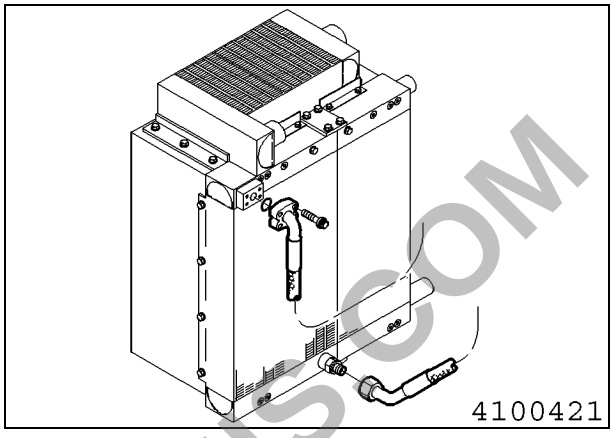


Fig. 2

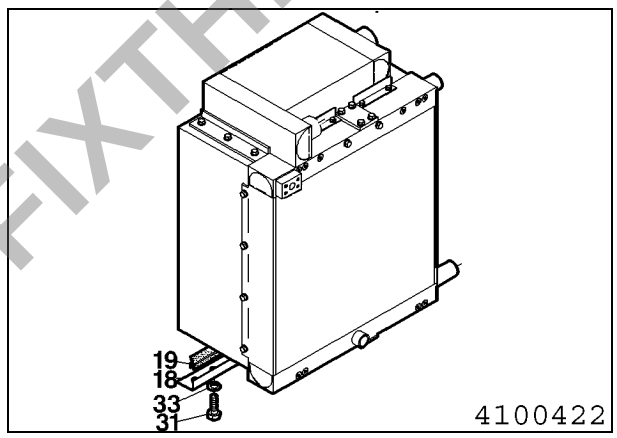


Fig. 3

- Loosen the screws (31) fixing the radiator to the frame.
- Attach the radiator by means of eye-bolts to a crane and lift it slightly.
- Push the combined radiator slightly forwards to disengage the connecting pieces.
- Lift the combined radiator out of the frame and slew it aside.

Refitting the combined radiator

- Position the combined radiator with the crane inside the frame and fasten it with the screws (31) and the washers (33).
- Make sure insulating element (19) is in the correct position.
- Refit all hoses.
- Refill and bleed the hydraulic system.

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Outriggers

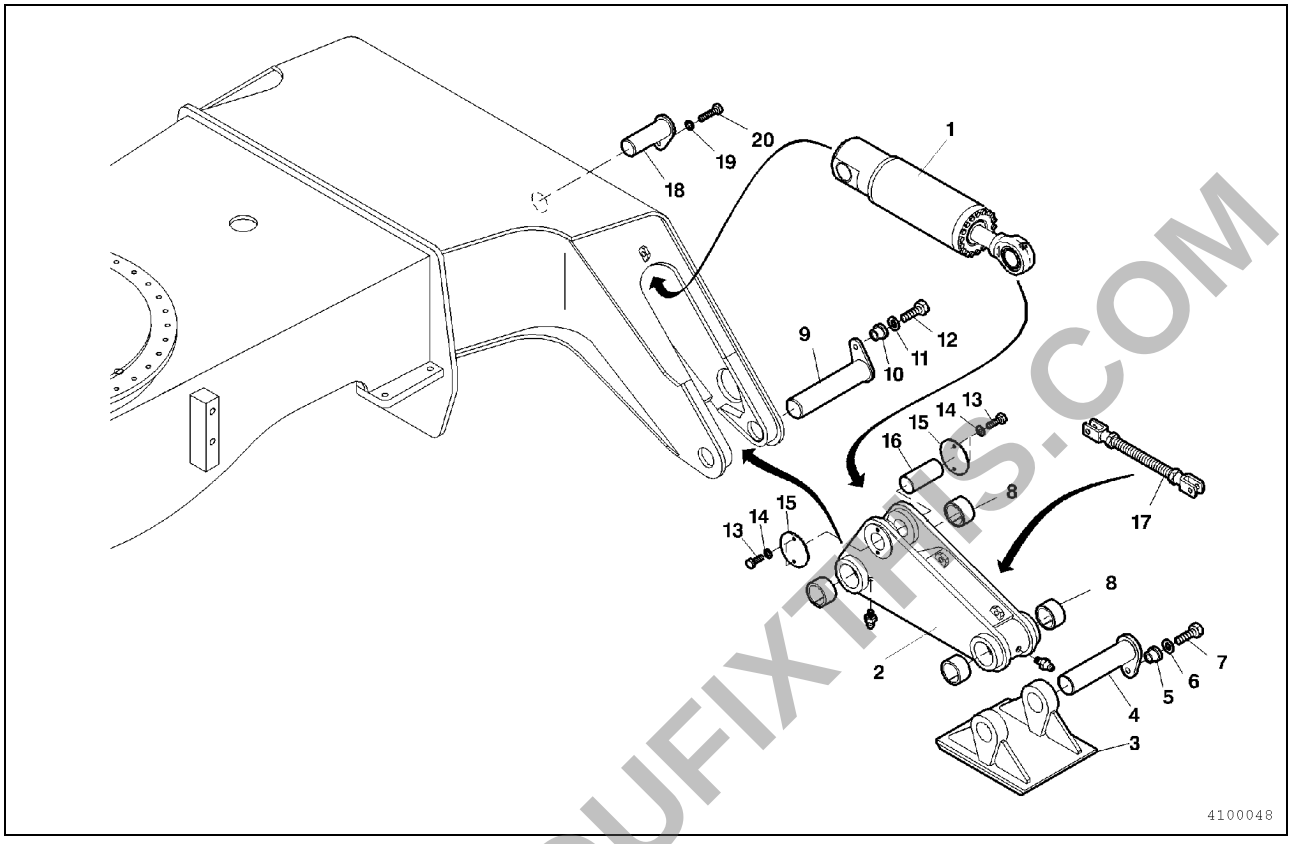


Fig. 1

Key

No.	Q.ty	Designation
1	2	Outrigger cylinder
2	2	Outrigger arm
3	2	Baseplate
4	2	Pin
5	2	Washer
6	2	Washer
7	2	Hex screw
8	4	Bearing bush
9	2	Pin
10	2	Washer

No.	Q.ty	Designation
11	2	Washer
12	2	Hex screw
13	8	Hex screw
14	8	Washer
15	4	Disk
16	2	Pin
17	2	Rod
18	2	Pin
19	2	Pin
20	2	Hex screw

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