

Shop Manual

PC4000-6

HYDRAULIC MINING SHOVEL SERIAL NUMBERS PC4000-6 8170

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CONVERSION TABLE

METHOD OF USING THE CONVERSION TABLE

The Conversion Table in this section is provided to enable simple conversion of figures. For details of the method of using the Conversion Table, see the example given below.

EXAMPLE

Method of using the Conversion Table to convert from millimeters to inches.

1. Convert 55 mm into inches.

- Locate the number 5 in the vertical column at the left side, take this as (A), then draw a horizontal line from (A).
- Locate the number 5 in the row across the top, take this as (B), then draw a perpendicular line down from (B).
- Take the point where the two lines cross as (C). This point (C) gives the value when converting from millimeters to inches. Therefore, 55 millimeters = 2.165 inches.

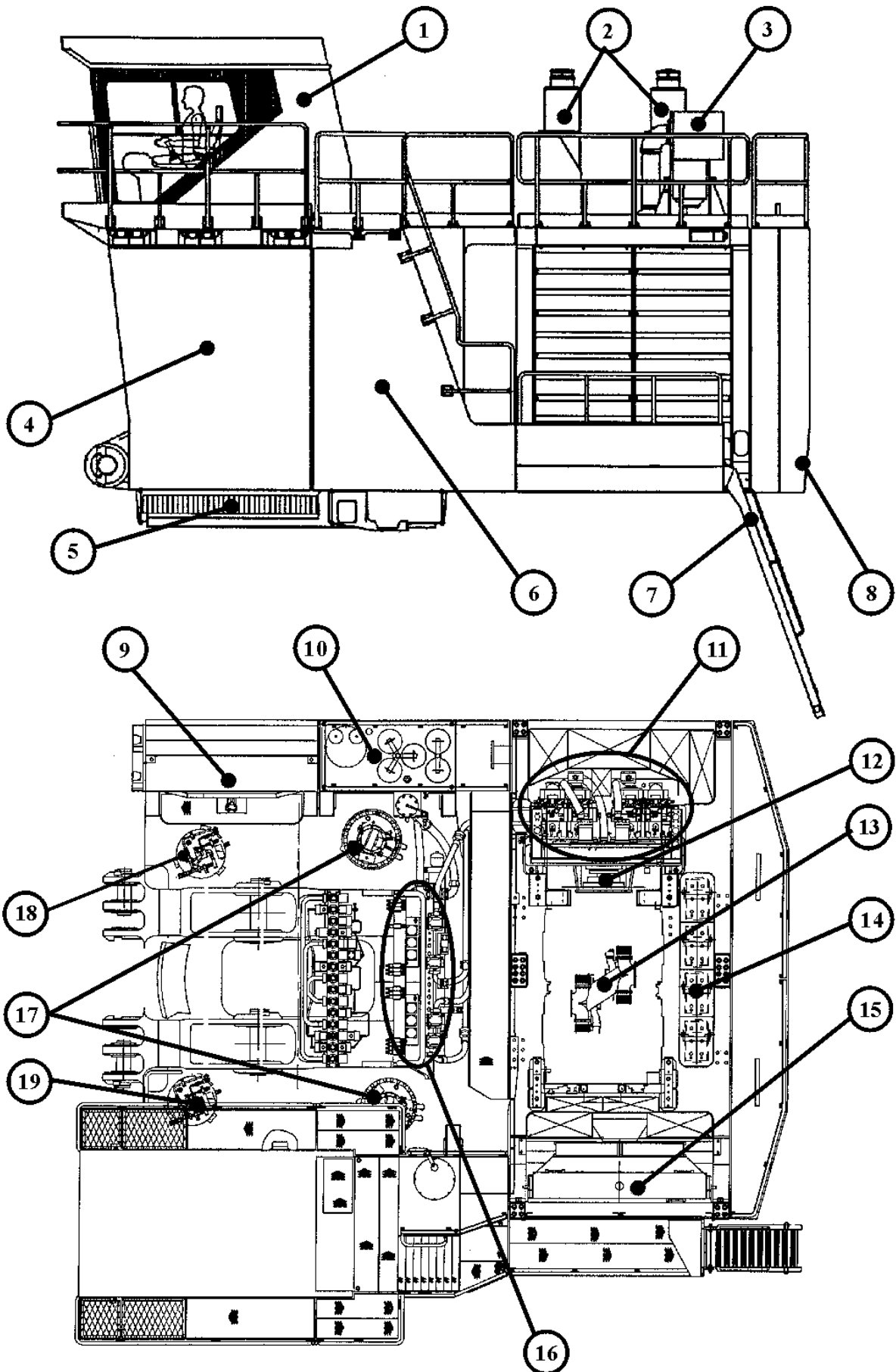
2. Convert 550 mm into inches.

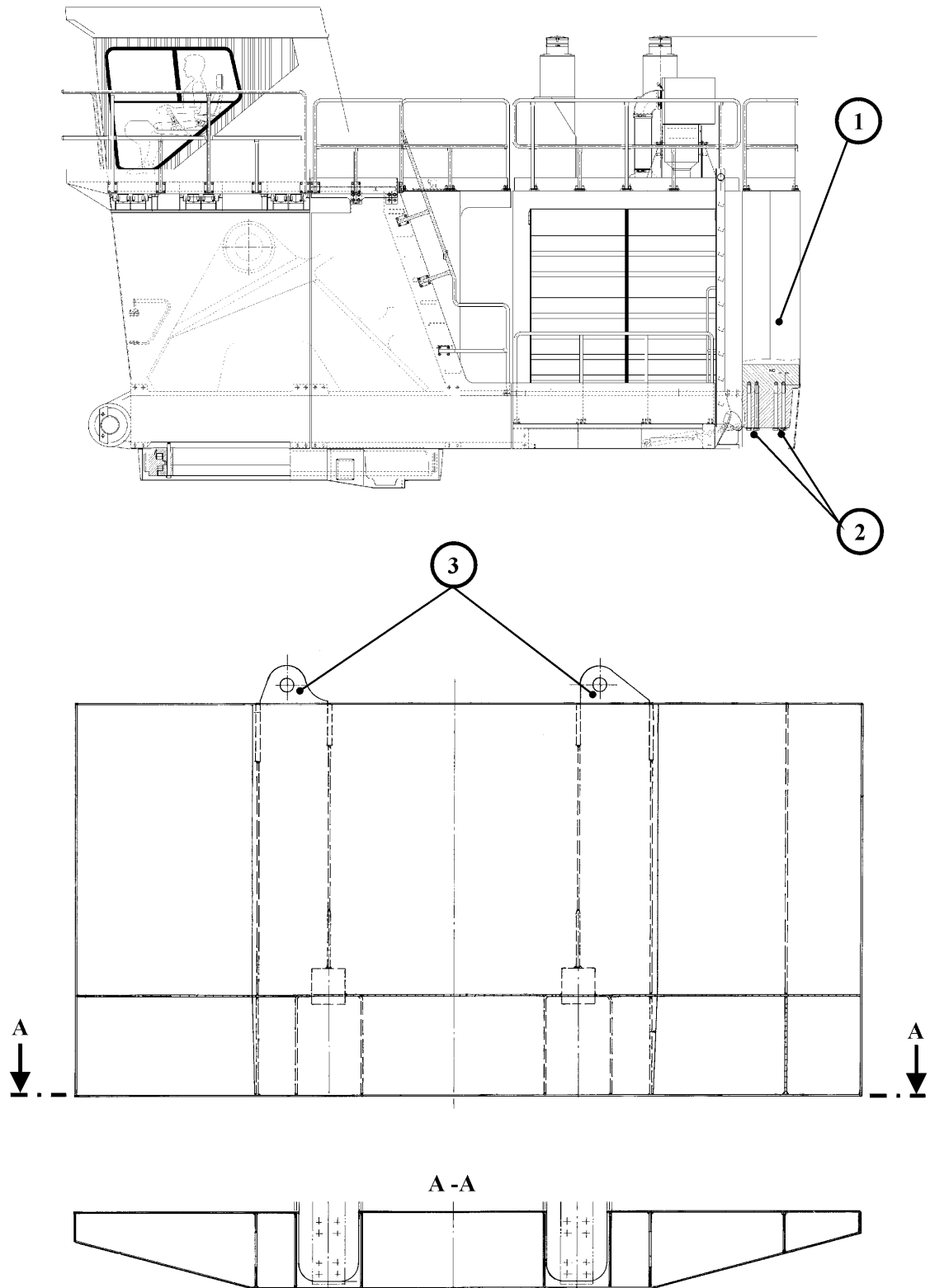
- The number 550 does not appear in the table, so divide by 10 (move the decimal one place to the left) to convert it to 55 mm.
- Carry out the same procedure as above to convert 55 mm to 2.165 inches.
- The original value (550 mm) was divided by 10, so multiply 2.165 inches by 10 (move the decimal one place to the right) to return to the original value. This gives 550 mm = 21.65 inches.

Millimeters to inches

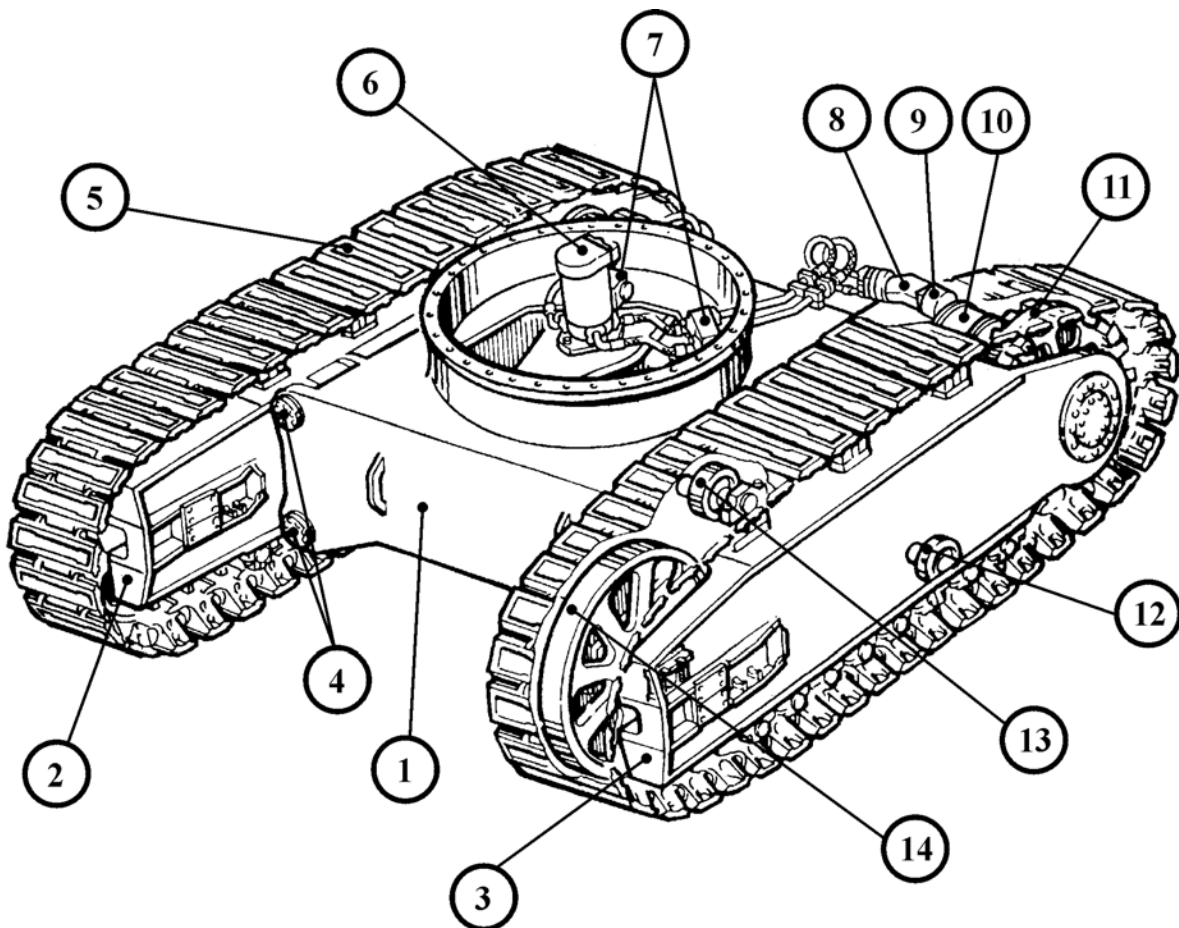
1 mm = 0.03937 in

	0	1	2	3	4	5	6	7	8	9
0	0	0.039	0.079	0.118	0.157	0.197	0.236	0.276	0.315	0.354
10	0.394	0.433	0.472	0.512	0.551	0.591	0.630	0.669	0.709	0.748
20	0.787	0.827	0.866	0.906	0.945	0.984	1.024	1.063	1.102	1.142
30	1.181	1.220	1.260	1.299	1.339	1.378	1.417	1.457	1.496	1.536
40	1.575	1.614	1.654	1.693	1.732	1.772	1.811	1.850	1.890	1.929
50	1.969	2.008	2.047	2.087	2.126	2.165	2.205	2.244	2.283	2.323
60	2.362	2.402	2.441	2.480	2.520	2.559	2.598	2.638	2.677	2.717
70	2.756	2.795	2.835	2.874	2.913	2.953	2.992	3.032	3.071	3.110
80	3.150	3.189	3.228	3.268	3.307	3.346	3.386	3.425	3.465	3.504
90	3.543	3.583	3.622	3.661	3.701	3.740	3.780	3.819	3.858	3.898





Z 21474



Z 21481

2.1 Engine and PTO mounts

Legend for illustration (Z 21601):

(1) Flexible bearing

(2) Bolt with self locking nut

Quantity	Bolt size (mm)	Grade	SW* (mm)	Tightening torque (Nm)
4 per mount	M 10 x35	8.8	17	43

(3) Tie bolt

Quantity	Bolt size (mm)	Grade	SW* (mm)	Tightening torque (Nm)
4	M 24 x400	10.9	36	snugly

(4) Rubber-bounded metal bar

(5) Self locking nut

(6) Bolt M16 with self locking nut

Quantity	Bolt size (mm)	Grade	SW* (mm)	Tightening torque (Nm)
2	M 16x 80	10.9	24	265

(7) Cup springs, seven per bolt

(8) Stop bolt

Quantity	Bolt size (mm)	Grade	SW* (mm)	Tightening torque (Nm)
2	M 36 x250	10.9	55	Not specified

(9) Nut

(10) Bolt

Quantity	Bolt size (mm)	Grade	SW* (mm)	Tightening torque (Nm)
10	M 24 x 200	10.9	36	880

(11) Bolt

Quantity	Bolt size (mm)	Grade	SW* (mm)	Tightening torque (Nm)
16	M 20 x 120	10.9	30	510

(12) Resilient sleeve

(13) Bolt

Quantity	Bolt size (mm)	Grade	SW* (mm)	Tightening torque (Nm)
4	M 30 x 200	10.9	46	1770

(14) Resilient sleeve

* SW = Wrench size

continued

2.4 Fan drive and radiator assembly

Cont'd

Legend for illustration (Z 21605):

- (1) Radiator
- (2) Intake air fan
- (5.2) Axial piston pump (fixed displacement pump, with variable setting)
- (23) Fan motor (Axial piston motor)
- (31.2) Pressure relief valve - Engine radiator fan drive
- (34.2) Pressure filter with pressure differential switch B21
- (41) Main oil reservoir
- (52) Check valve – (Anti cavitation valve for fan drive motor)
- (Y136) Proportional solenoid valve - Engine radiator fan speed (infinitely variable)
- (L) Leak oil (case drain) to tank
- (P) Pressure to motor
- (R) Return oil to tank

Function:

From pump (5.2) flows the oil through the filter (34.2) to the fan motor (23) and then back to the tank.

The check valve (52) act as an anti cavitation valve and is installed, because the fan motor -driven by inertial force- is running for a short period after the engine has been switched off.

The hydraulic circuit "Fan drive" is secured by the pilot controlled pressure relief valve (31.2). This valve works together with the proportional solenoid valve (Y136). The proportional solenoid valve(Y136) operates depending on engine coolant temperature.

The ECM (Electronic Control Module) of the engine controls the proportional solenoid valve (Y136) by sending variable current signals, depending on the engine coolant temperature.

Which in turn changes the fan speed.

With a low current signal to the proportional solenoid the relief valve is functioning and the fans are running with the max. set- speed. With a high current signal to the proportional solenoid the relief valve is not functioning and the fans are running with a very low speed, caused by the flow resistance only.

2.8 PTO Lubrication and cooling

Legend for illustration (Z 21609):

- (1) Line to the cooler (hot oil)
- (2) Return line from the cooler (cooled oil)
- (3) Return line from valve
- (P) Pressure port
- (8.2) Gear pump PTO-gearbox lubrication
- (36) Pressure filter - PTO gear lubrication
- (B27-1) Maintenance switch, 5 bar
- (29) Pressure relief valve, 10 bar
- (M3) Pressure check point
- (B17-1) Pressure switch, 0,5 bar
- (15.1+15.2) Oil cooler, part of hydraulic oil cooler
- (B49-1) Temperature sensor

Function:

Pump (8.2) forces the gear oil from the gear oil pan through filter (20) to pressure relief valve (21). This pressure relief valve acts as a back pressure valve causing that most of the oil passes through the gear oil coolers (17.1+17.2).

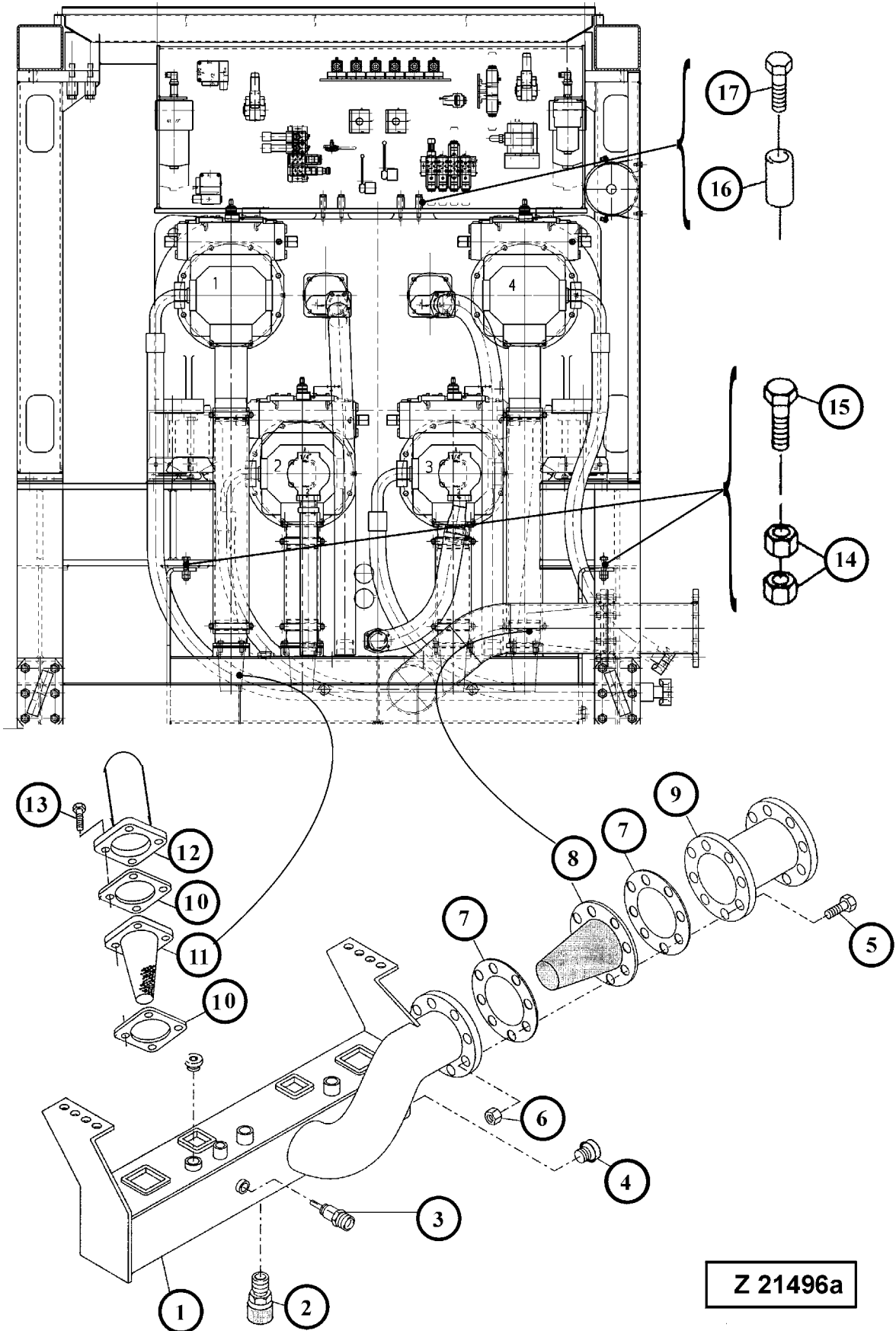
The gear oil coolers are a small part of the hydraulic oil coolers, thus the gear oil gets cooled by the same air stream as the hydraulic oil. From the coolers the oil flows to the port (P) of the gear and internally via a system of pipes to the several spray nozzles.

The spray nozzles in the gear case ensure proper and adequate distribution of the lube oil.

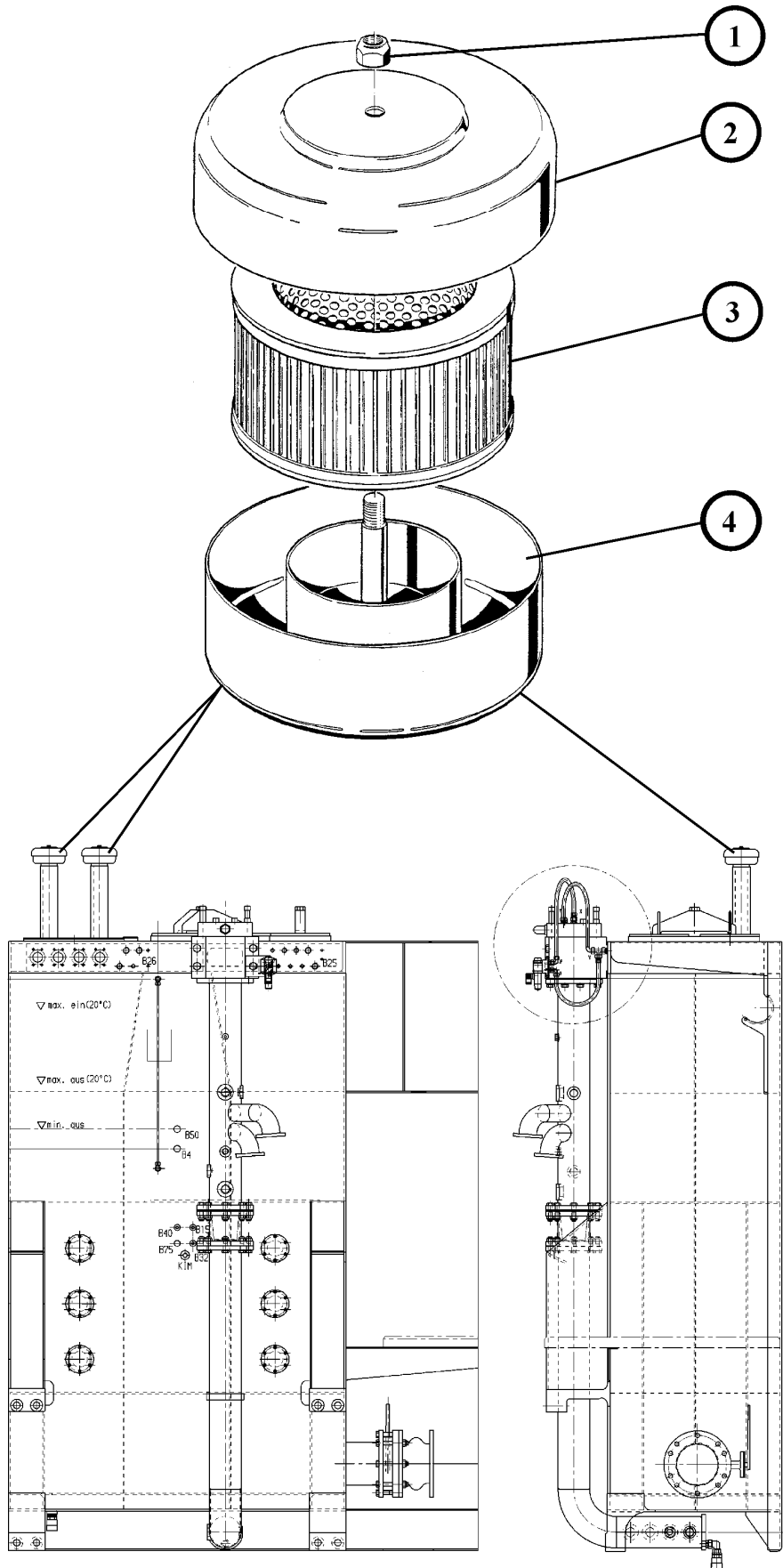
The circuit is monitored by the pressure switches (B17-1). At too low lube oil pressure (0.5 bar), a fault message will be displayed on the monitor at the dash board.

The gear oil temperature is monitored by the sensor unit (B49-1). At too high oil temperature a fault message will be displayed on the monitor at the dash board.

continued



Z 21496a



4.4 Fan drive (Two stage cooler fan RPM control)

Legend for illustration (Z 21597)

- (5.1) Axial piston pump (fixed displacement pump, with variable setting)
- (31.1) Pressure relief valve (maximum fan speed)
- (34.1) Pressure filter with pressure differential switch B28
- (37.1) Fan motor (Axial piston motor)
- (37.2) Fan motor (Axial piston motor)
- (38) Check valve – (Anti cavitation valve for fan drive motor)
- (124) Pressure relief valve (medium fan speed)
- (Y6a/b) Solenoid valve
- (M6) Pressure check point

Function:

From pump (5.1) flows the oil through the filter (34.1) to the fan motors (37.1 + 37.2) and then back to the tank.

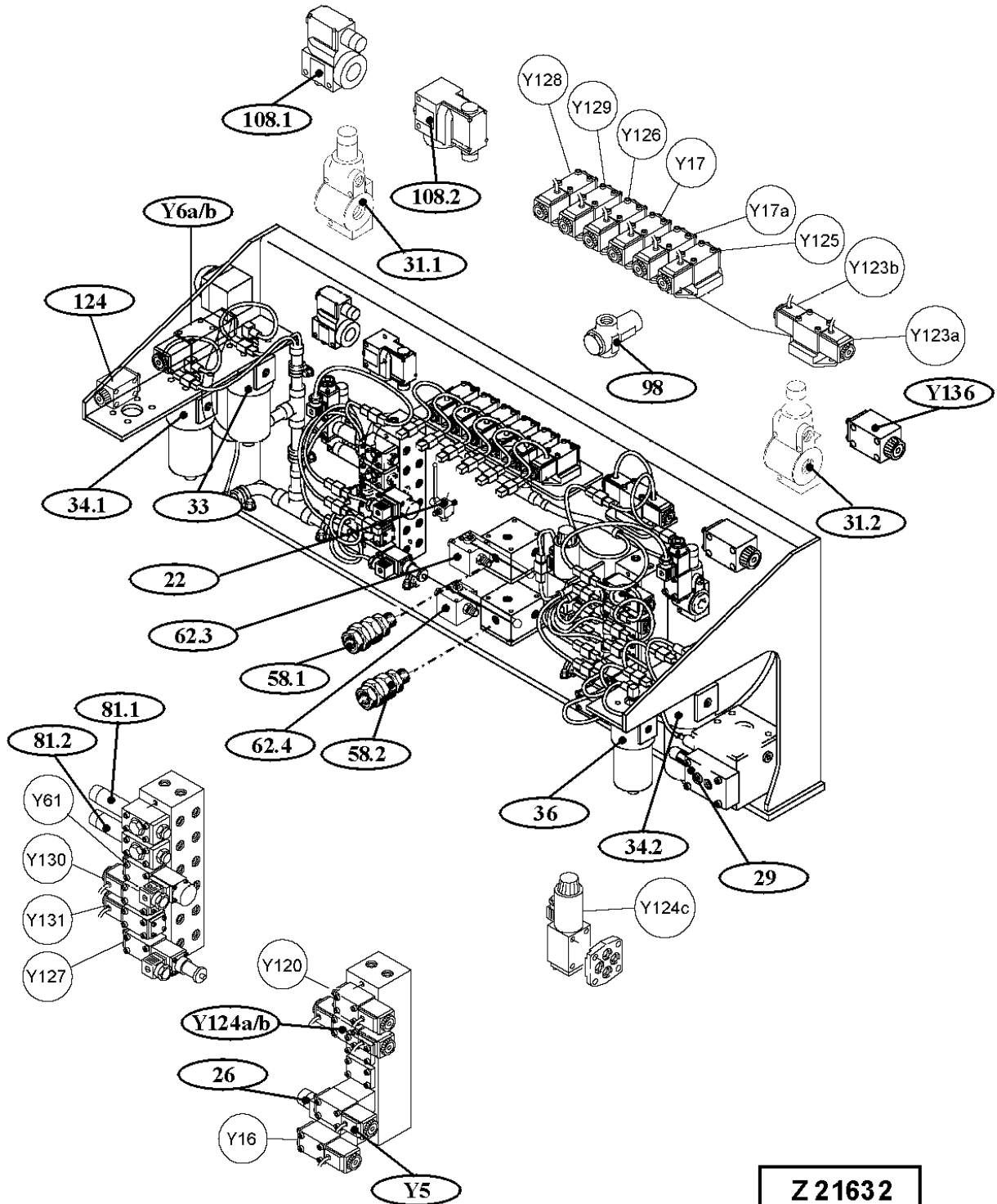
The check valve (38) act as an anti cavitation valve and is installed, because the fan motor -driven by inertial force- is running for a short period after the oil flow is interrupted by solenoid valve (Y6a/b), or if the engine has been switched off.

The hydraulic circuit "Fan drive" is secured by the pilot controlled pressure relief valves (31.1) and (124).

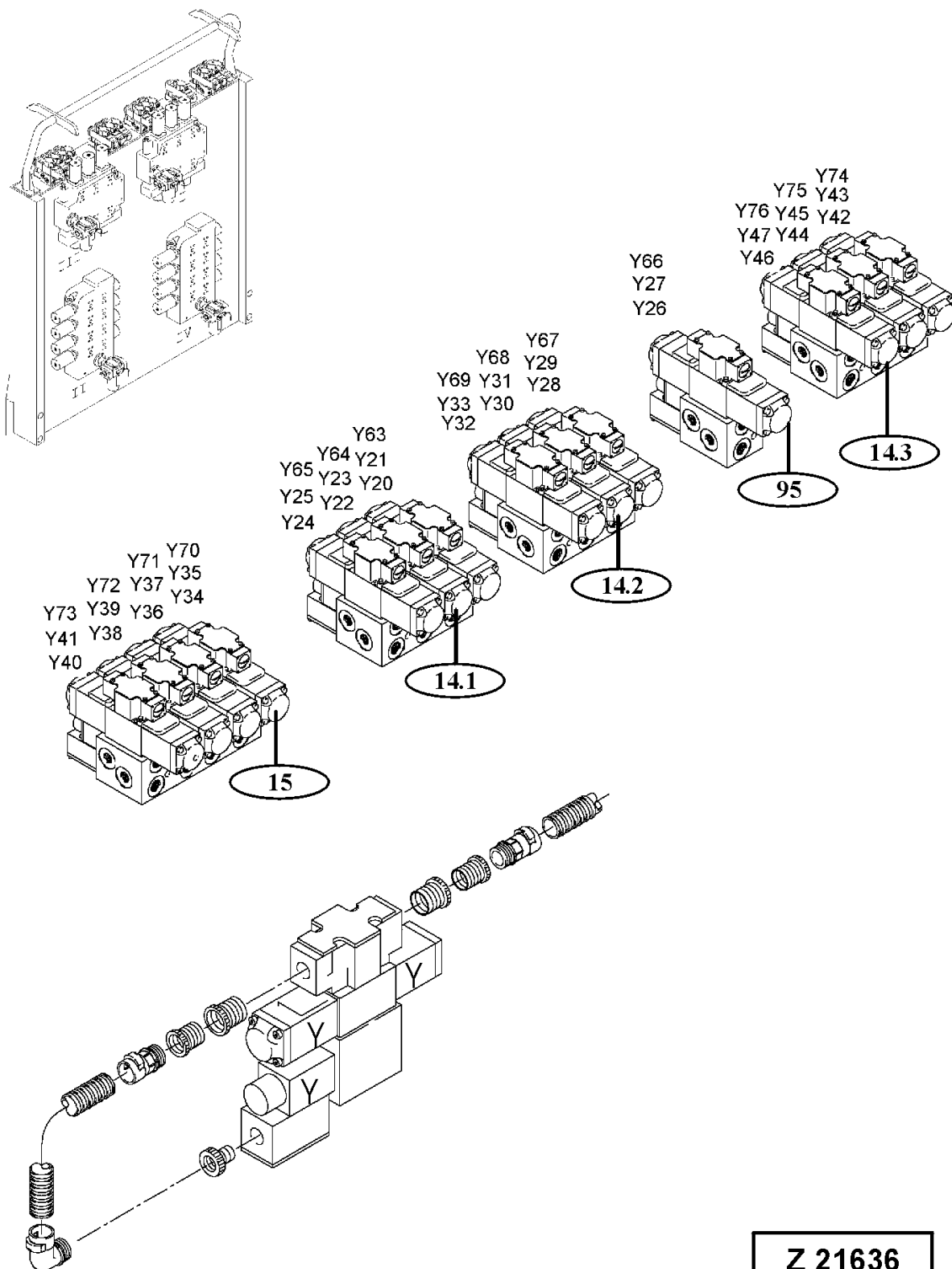
These valves are working together with the solenoid valve (Y6a/b), controlled by the VHMS system, depending on the hydraulic oil temperature:

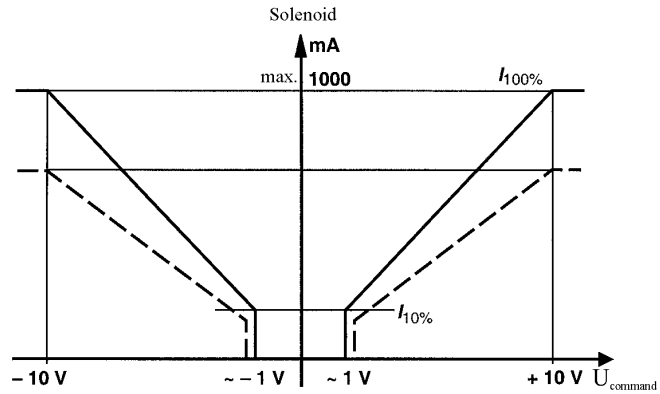
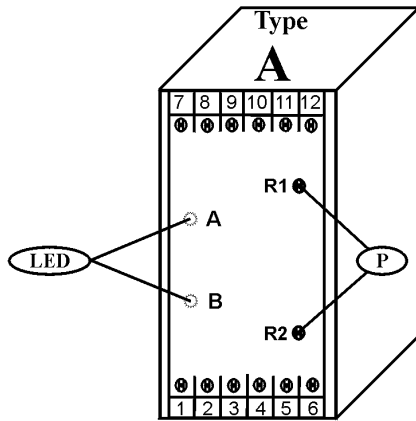
- With **de-energized solenoids Y6a and Y6b** the relief valve (31.1) is functioning and the fans are running with max. adjusted speed (1250 RPM)
- With **solenoid Y6a energized** the relief valve (31.1) is not functioning and the fans are running with a very low speed caused by the flow resistance only.
- With **solenoid Y6b energized** the relief valve (124) is controlling the relief valve (31.1) and the fans are running with 1000 RPM only.

(See also description on next page)



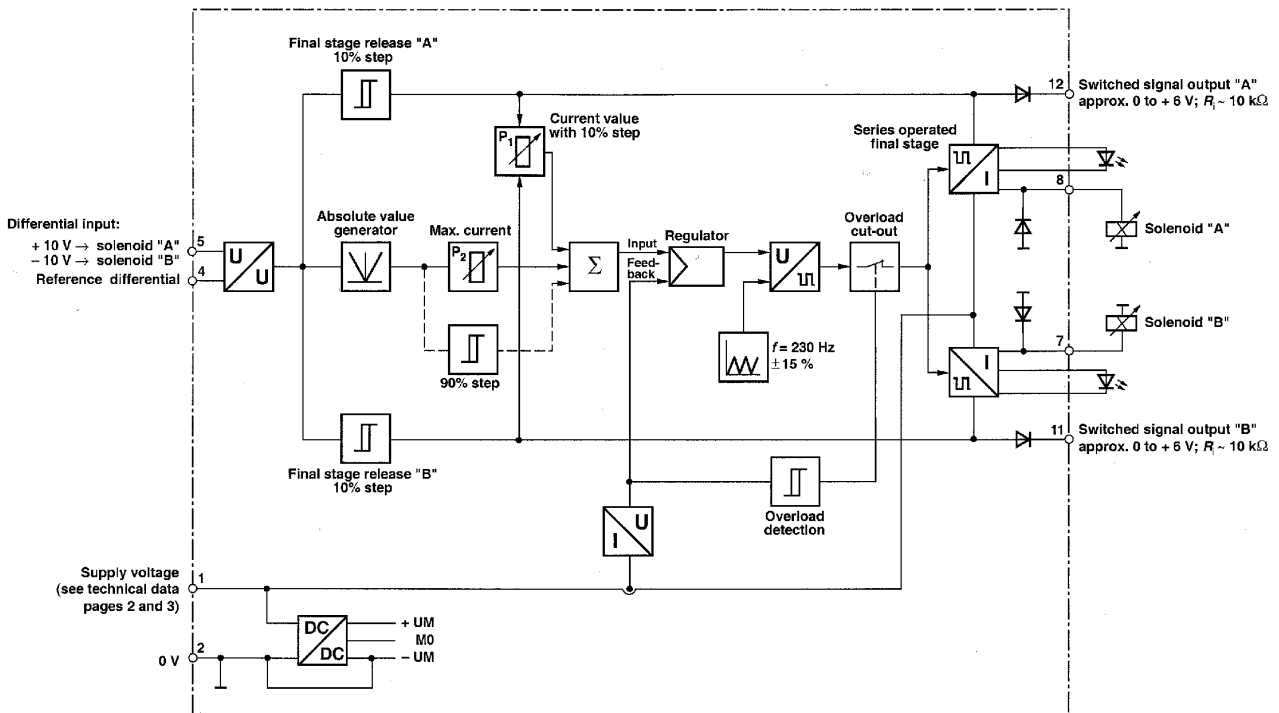
Z 21632



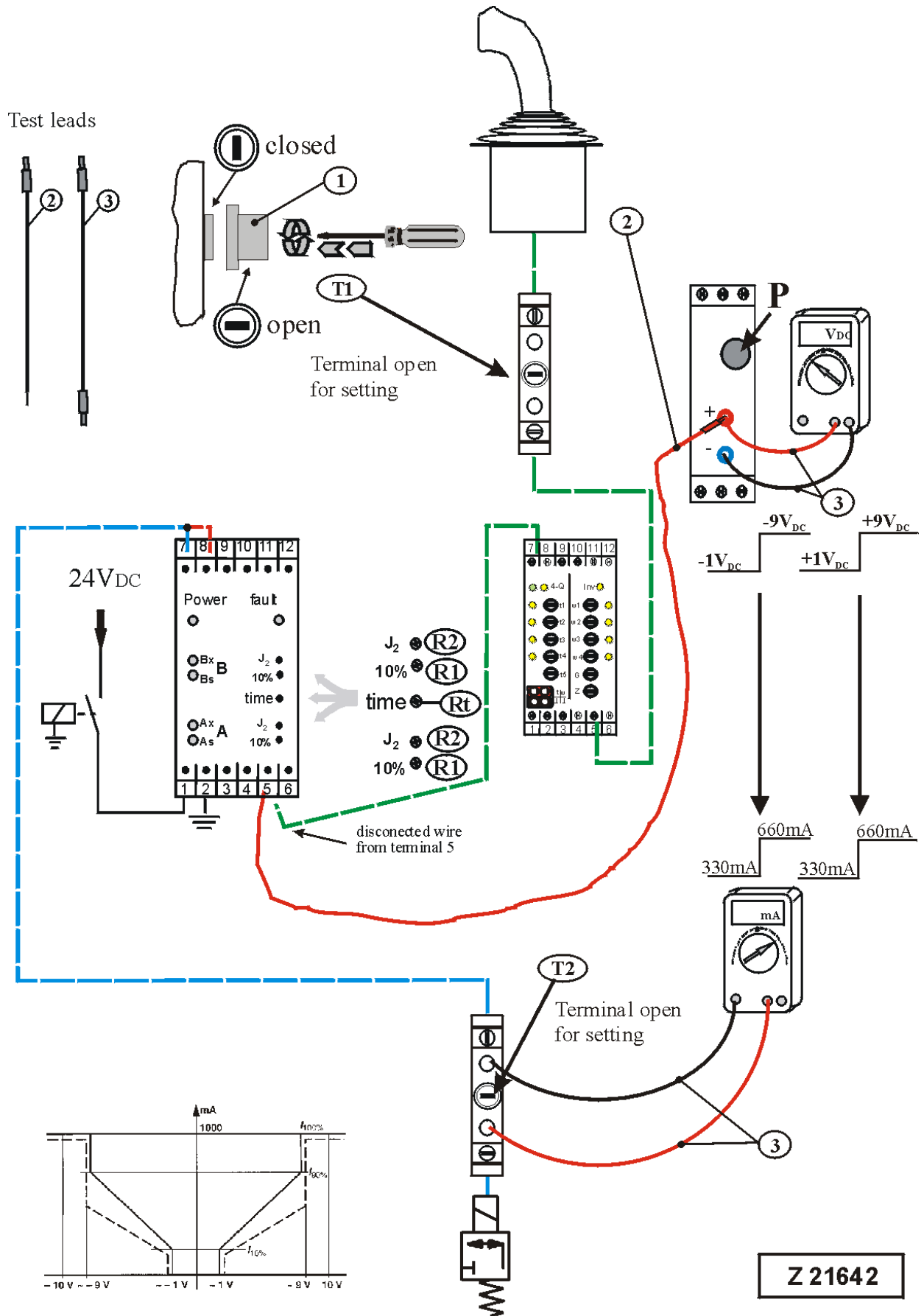


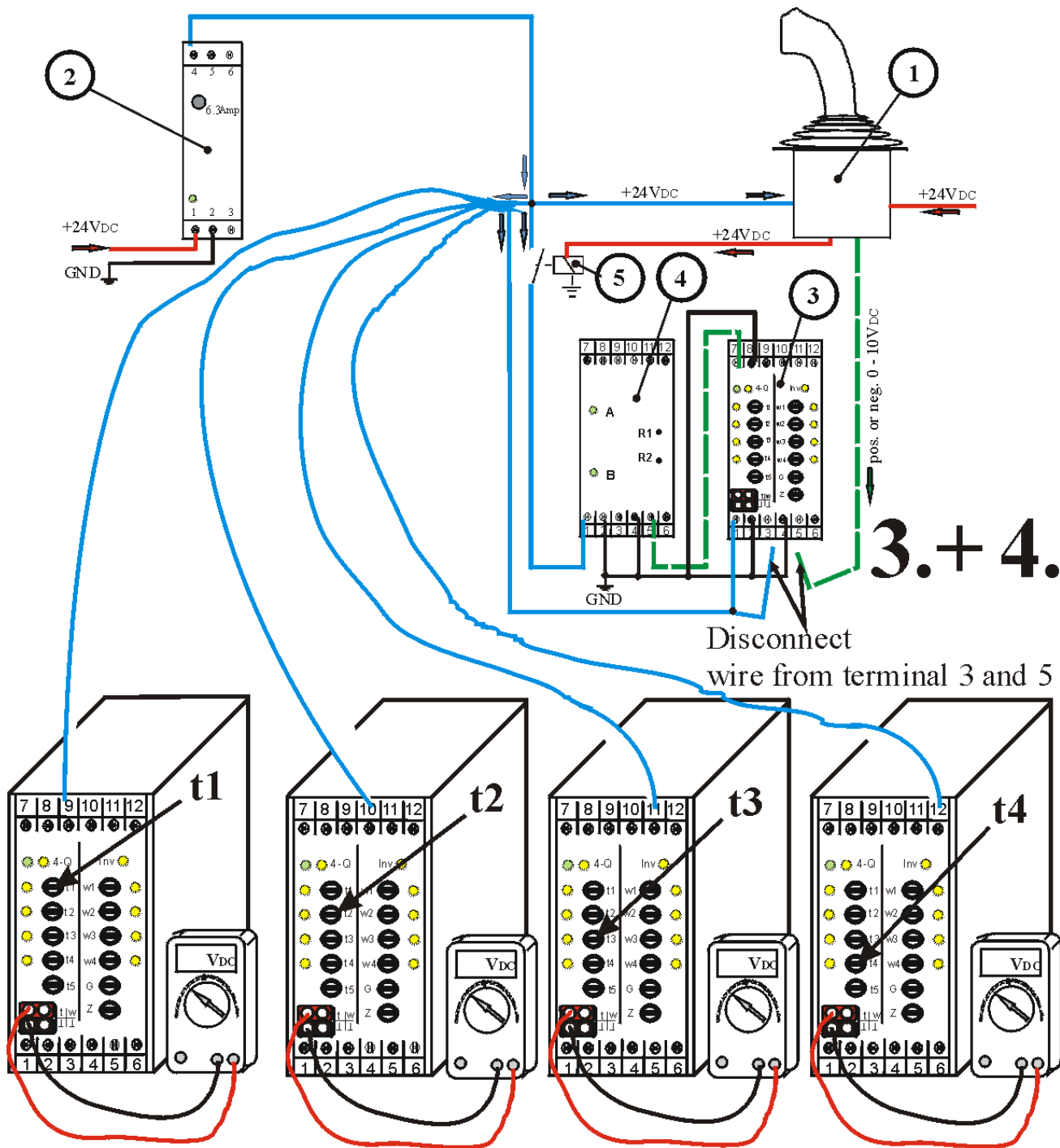
Terminal Wiring

Supply voltage	+ U_B	1	7	Output solenoid "B"
	0 V	2	8	Output solenoid "A"
Differential input	NC	3	9	NC
	Reference differential	4	10	NC
	+ 10 V → solenoid "A"	5	11	to switched signal output "B"
	- 10 V → solenoid "B"	6	12	to switched signal output "A"



Note: – The over current cutout is reset by command input returning to zero !
– No reverse polarity protection in 12 V model !





Note: Measuring and setting the ramp time

		Quick reaction					Slow reaction					
Value at measurement socket „t“	U_t in V	5	3	2	1	0.5	0.3	0.2	0.1	0.05	0.03	0.02
Actual ramp time ($\pm 20\%$)	t in ms	20	33	50	100	200	333	500	1000	2000	3333	5000

The following applies: $t = \frac{100 \text{ Vms}}{U_t}$

Example: measured $U_t = 5 \text{ V}$

results $t = \frac{100 \text{ Vms}}{5 \text{ V}} = 20 \text{ ms}$

Requested ramp time = 2000ms (2,0 seconds)


$U_t = \frac{100 \text{ Vms}}{2000 \text{ ms}} = 0,05 \text{ V}$

5.

Z 21645

6.1.4 Distributor Manifold - Location of restrictor blocks and anti cavitation valves
Backhoe Attachment

Legend for illustration (Z 21832):

- (SL) Synchronization (Equalization) lines
- (SRV) Service-line Relief Valve
-  Pressure check point
- (42) Distributor manifold
- (64.1) ACV Block Section **A**, Boom cylinder rod side
- (70.1+.2) Restrictor blocks Section **B**, Boom cylinder piston side with SRVs and pressure check points **M16.1 + M16.2**
- (70.3) Restrictor block Section **C**, Bucket cylinder piston side with SRV and pressure check point **M17.1**
- (70.4) Restrictor block Section **C**, Bucket cylinder piston side with SRV and pressure check point **M17.2**
- (64.2) ACV Block Section **C**, Bucket cylinder piston side
- (64.3) ACV Block Section **D**, Bucket cylinder rod side
- (70.5) Restrictor block Section **D**, Bucket cylinder rod side with SRV and pressure check point **M18**
- (64.4) ACV Block Section **F**, Stick cylinder piston side
- (70.7) Restrictor block Section **G**, Bucket cylinder rod side with SRV and pressure check point **M20**
- (64.5) ACV Block Section **H**, Stick cylinder piston side
- (70.8+.9) Restrictor blocks Section **J**, Stick cylinder rod side with SRVs and pressure check points **M21.1 + M21.2**
- (70.10) Restrictor block Section **K**, Stick cylinder rod side with SRV and pressure check point **M22**
- (64.6) ACV Block Section **K**, Stick cylinder rod side
- (70.11) Restrictor block Section **L**, Bucket cylinder rod side with SRV and pressure check point **M23**
- (64.8) ACV Block Section **M**, Bucket cylinder piston side
- (70.12) Restrictor block Section **M**, Bucket cylinder piston side with SRV and pressure check point **M24**
- (70.13) Restrictor blocks Section **O**, Boom cylinder piston side with SRV and pressure check point **M26.1**
- (70.14) Restrictor blocks Section **O**, Boom cylinder piston side with SRV and pressure check point **M26.2**
- (64.9) ACV Block Section **P**, Boom cylinder rod side

6.1.9 Directional Solenoid Valves (Three positions / 4-ways)

- **This solenoid operated directional spool valves are installed to control the start, stop and direction of an oil flow.**

Legend for illustration (Z 21839):

- (1) Housing
- (2) Solenoids
- (3) Control spool
- (4) Reset springs
- (5) Plunger
- (6) End cover

Function:

In un-operated condition the control spool (3) is held in the neutral or starting position by the reset springs (4). Operation of the control spool is by means of oil immersed solenoids (2).

The force of the solenoid (2) acts via the plunger (5) on the control spool (3) and pushes it from its resting position into the required end position. This results in the required free flow from P to A and B to T or from P to B and A to T.

When the solenoid (2) is de-energised, the control spool (3) is returned to its original position by the reset springs (4).

6.1.12 Control Blocks and Valves

Legend for illustration (Z 21704):

- (1) Reset springs
- (2) Fine controlling grooves
- (3) Spool

Function:

Reset springs (1) moves the spool (3) in neutral position.

Fine control grooves (2) provide for sensitive controlling, because a motion is started always while the pressure oil and the return oil first passes this fine control grooves before spool (3) is inter connecting the entire groove to the user channel.

In neutral position of spool (3) the pump oil is flowing back via port PU to the tank.

Lower picture:

Example. The spool is moved to left position: Port PU is closed and the connection through the check valve RP1 to the user (port A) is open. Also the connection from the other user side (port B return) is connected to the port T (return line to tank).

Return line of the pressure relief valve MRV is also connected to the port T.

6.1.14 Pressure Reducing Valve



- **Pressure reducing valves are installed to reduce the common 45 bar pilot pressure to a lower pressure for other systems, e.g. the pump regulation system.**

Legend for illustration (Z 21844):

- (1) Set screw
- (2) Spool
- (3) Compression spring
- (4) Threaded sleeve
- (5) Non return valve
- (6) Boring
- (7) Spring chamber
- (8) Control land

Function:

Pressure reducing valves type DR & DP are direct operated valves of 3 way design, e.g. with a pressure relief function on the reduced pressure side.

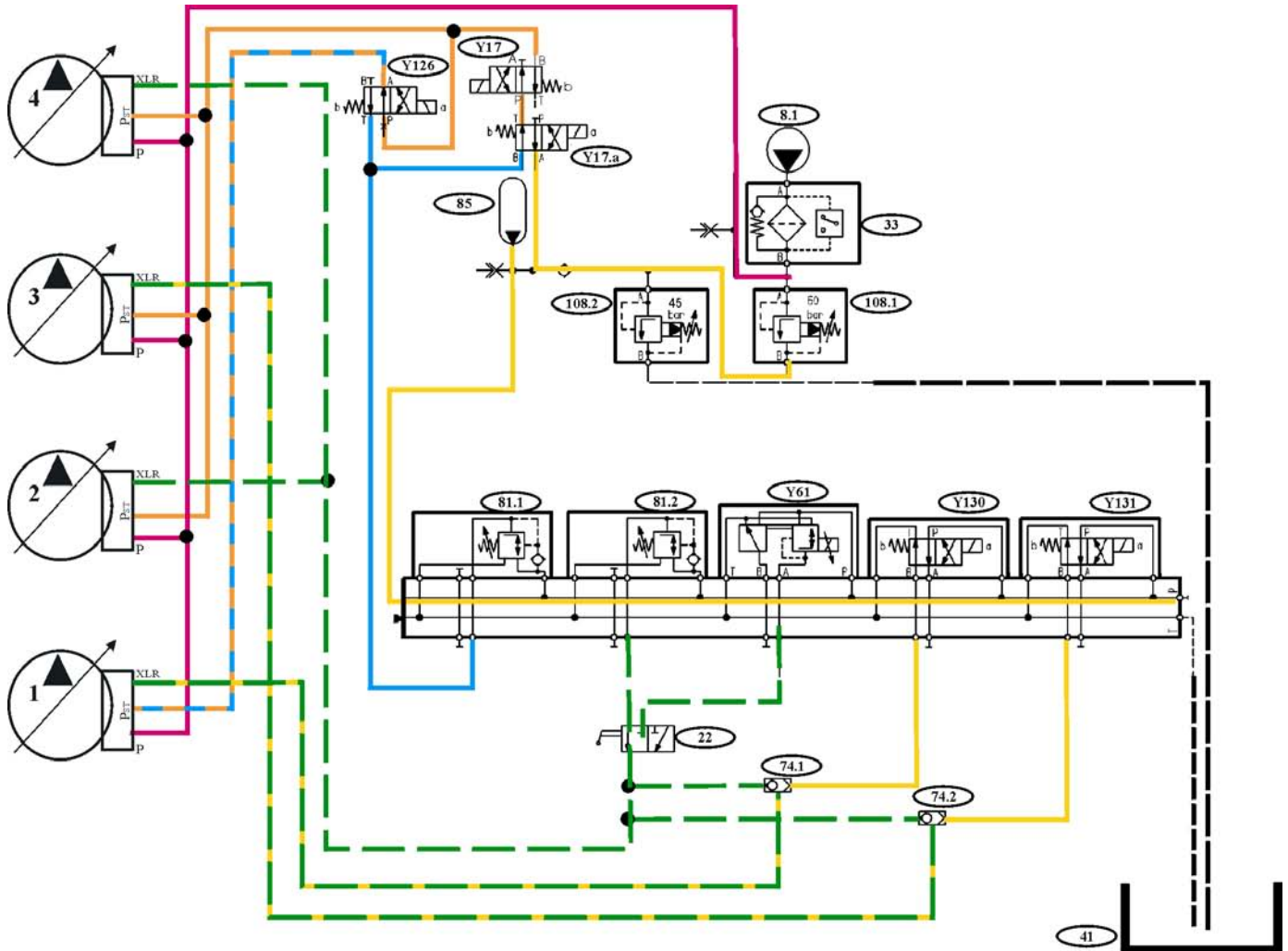
At rest, the valve is normally open, and fluid can flow unhindered from port P to A. Pressure in port A is also present on the end of the spool (2), via control line (6), opposing the compression spring (3). When the pressure in port A reaches the pressure level set at spring (3), spool (2) moves to the control position and holds the pressure in port A constant.

Fluid to control the valve is taken from port A via the boring (6).

If the pressure in port A rises still further due to external forces, the spool (2) is moved still further towards the compression spring (3).

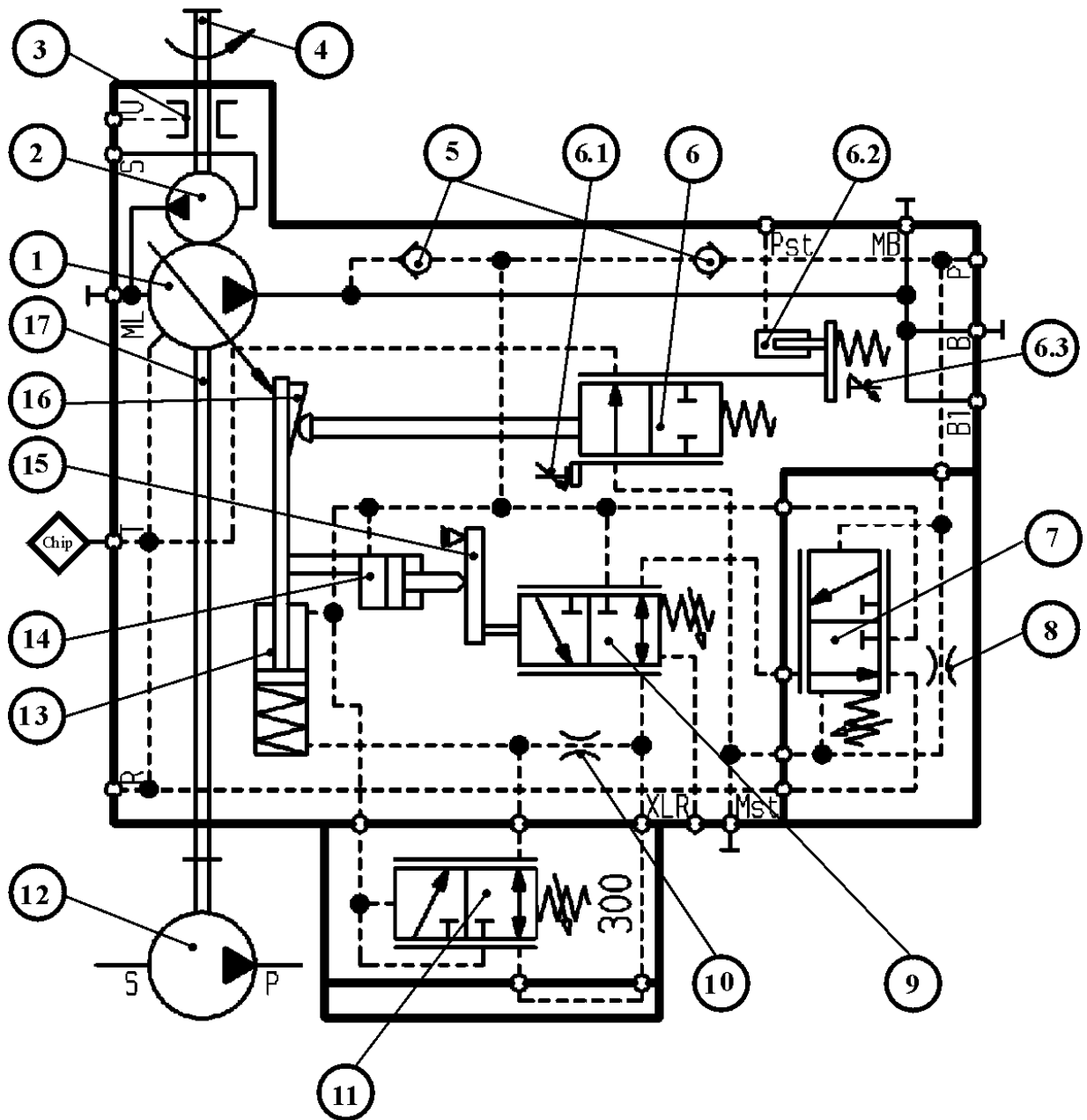
This causes a flow path to be opened over control land (8) in the control spool (2) to tank. Sufficient fluid then flows to tank to prevent any further rise in pressure.

An optional non return valve (5) is available to allow free flow from A to P.

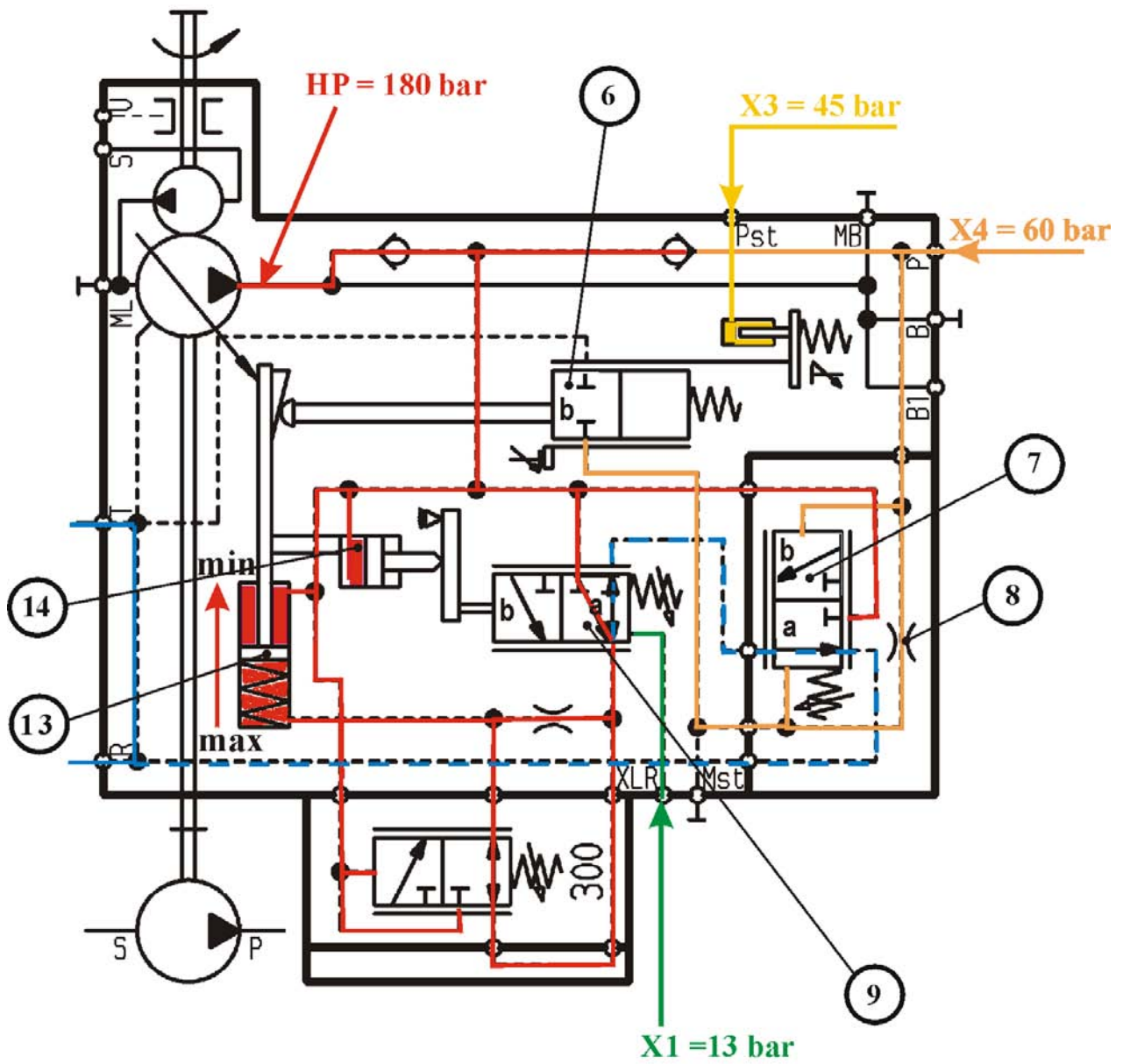


- pilot pressure (X2)
- pump support pressure (X4)
- remote control pressure (X3)
- reduced pilot pressure (X2) for $\frac{1}{2}$ Qmax flow
- remote control pressure (X3) or reduced pilot pressure (X2)
- pump regulation pressure (X1)
- pump regulation pressure (X1) or pilot pressure (X2)
(depending on the position of Y130 respectively Y131)

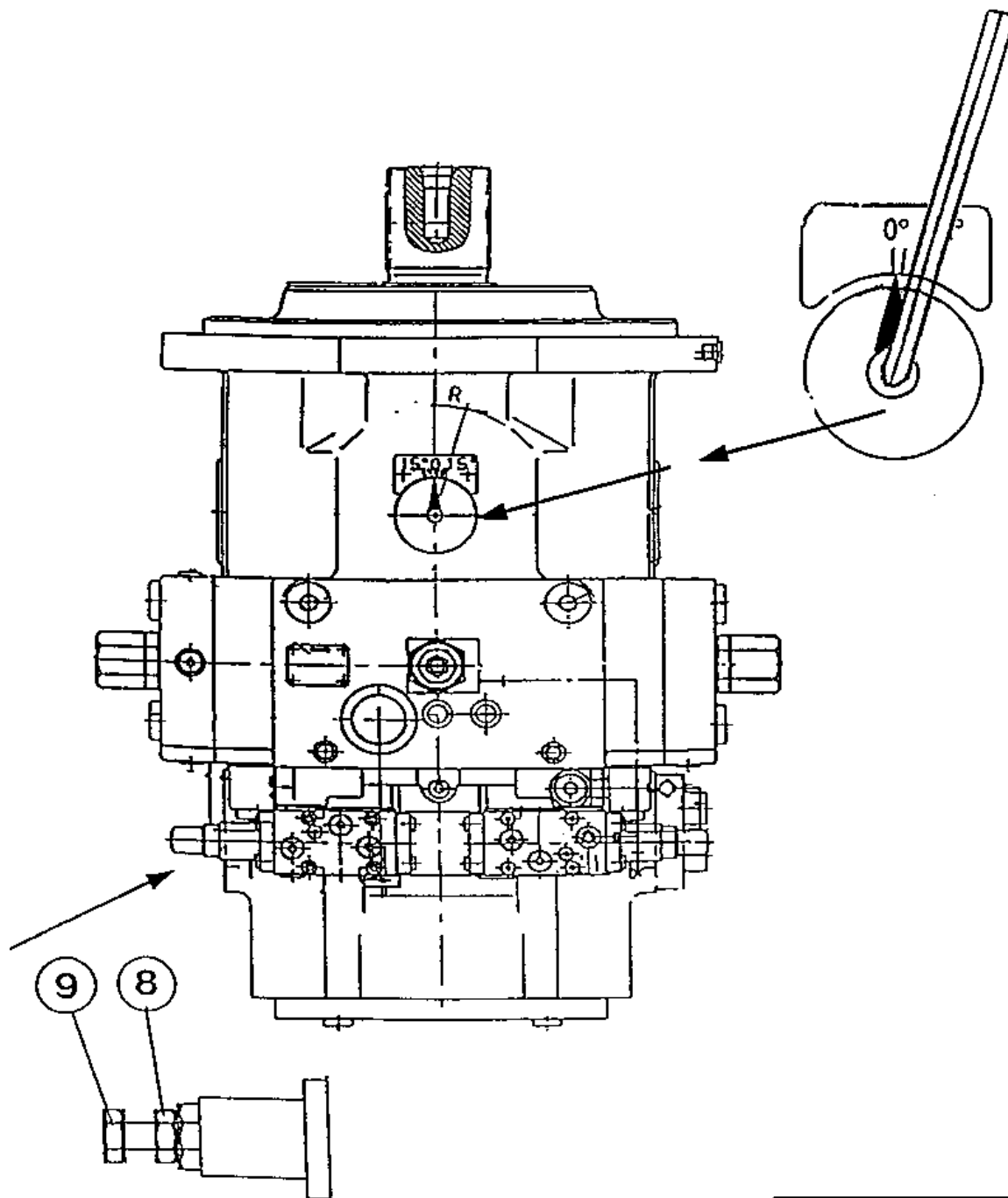
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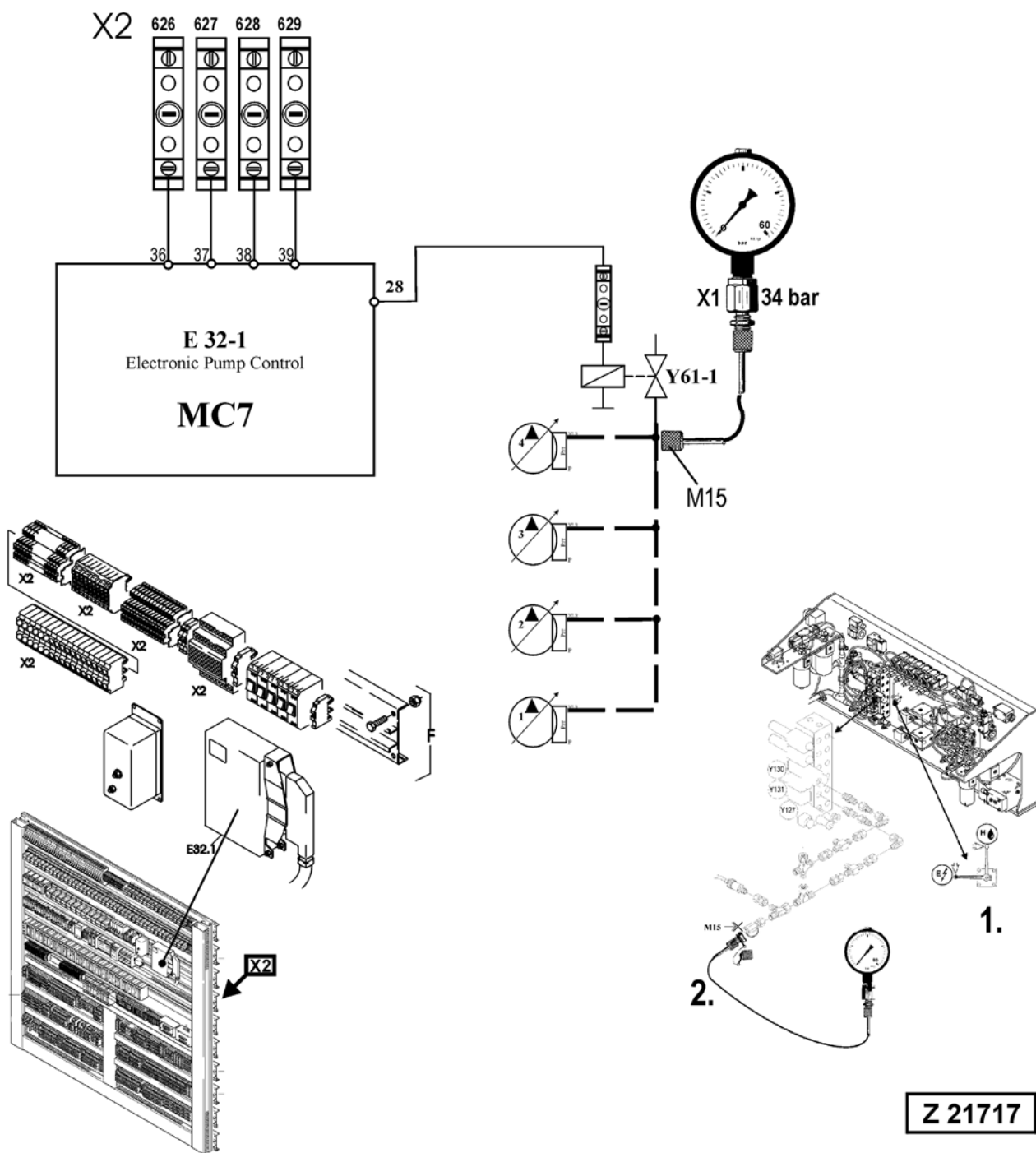
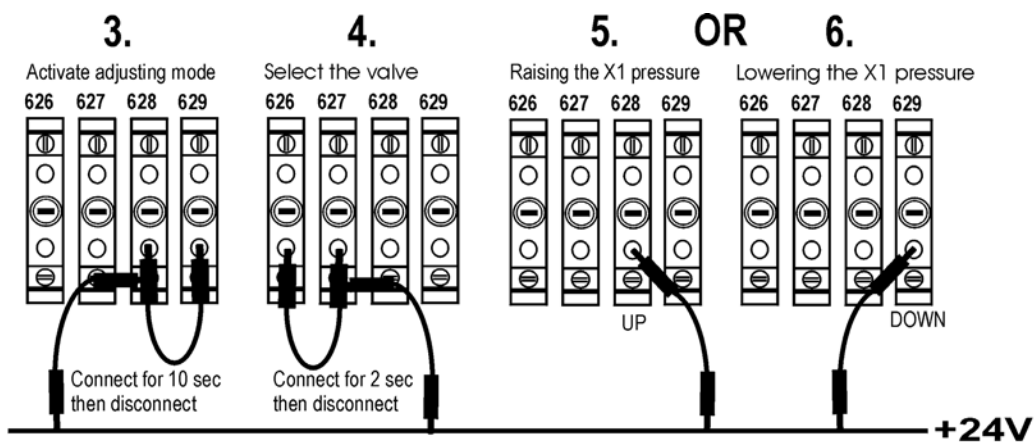
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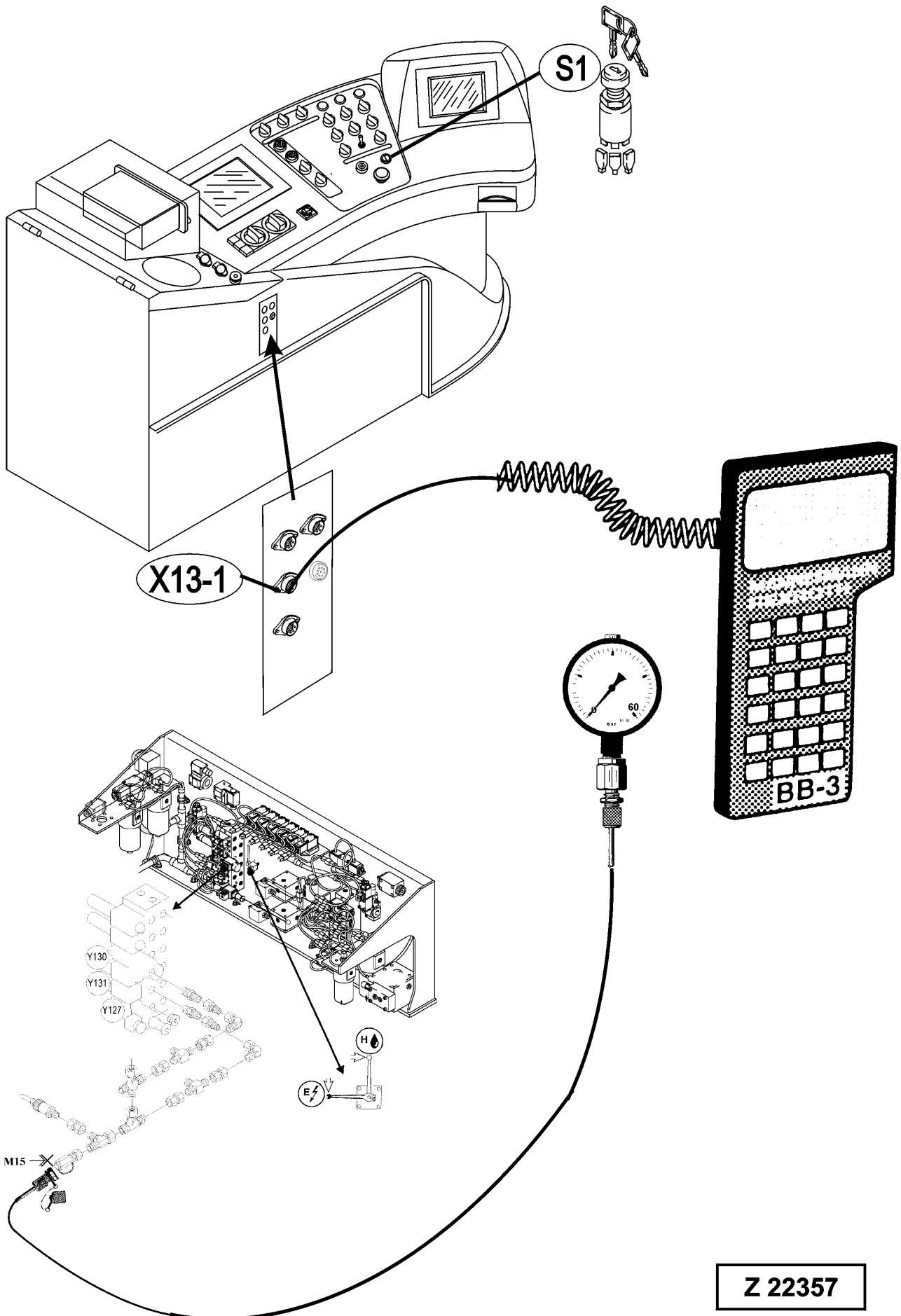


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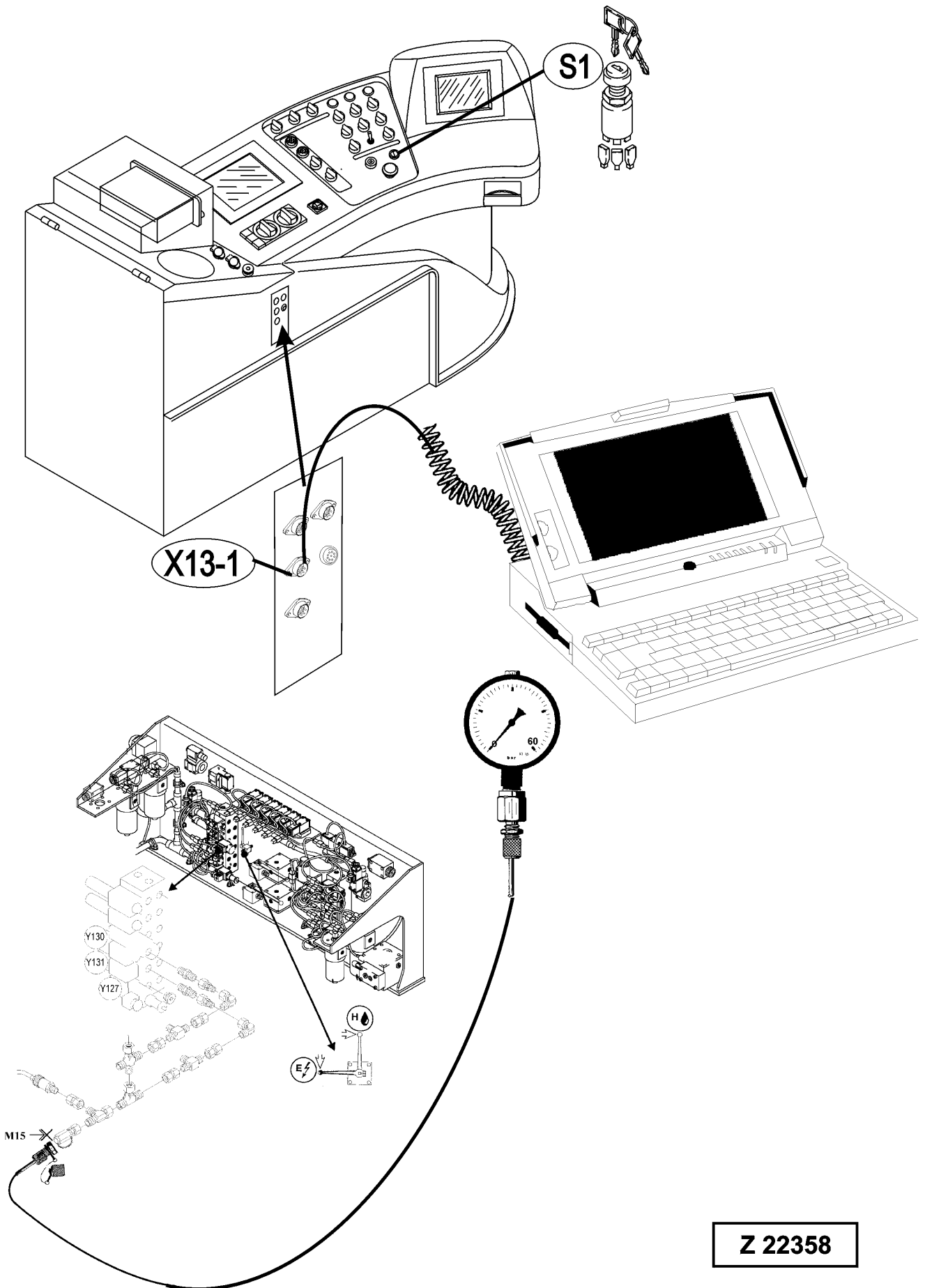


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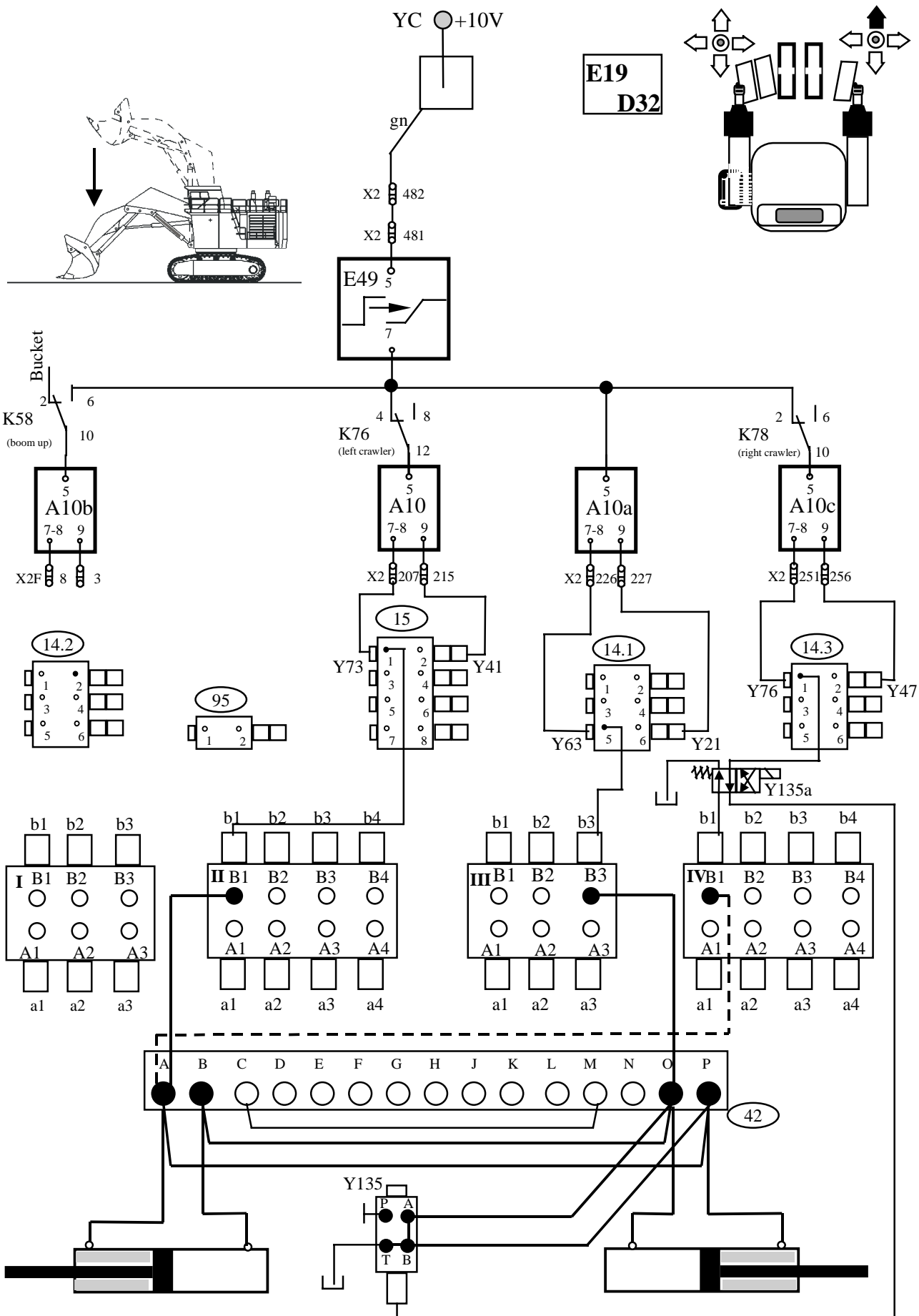
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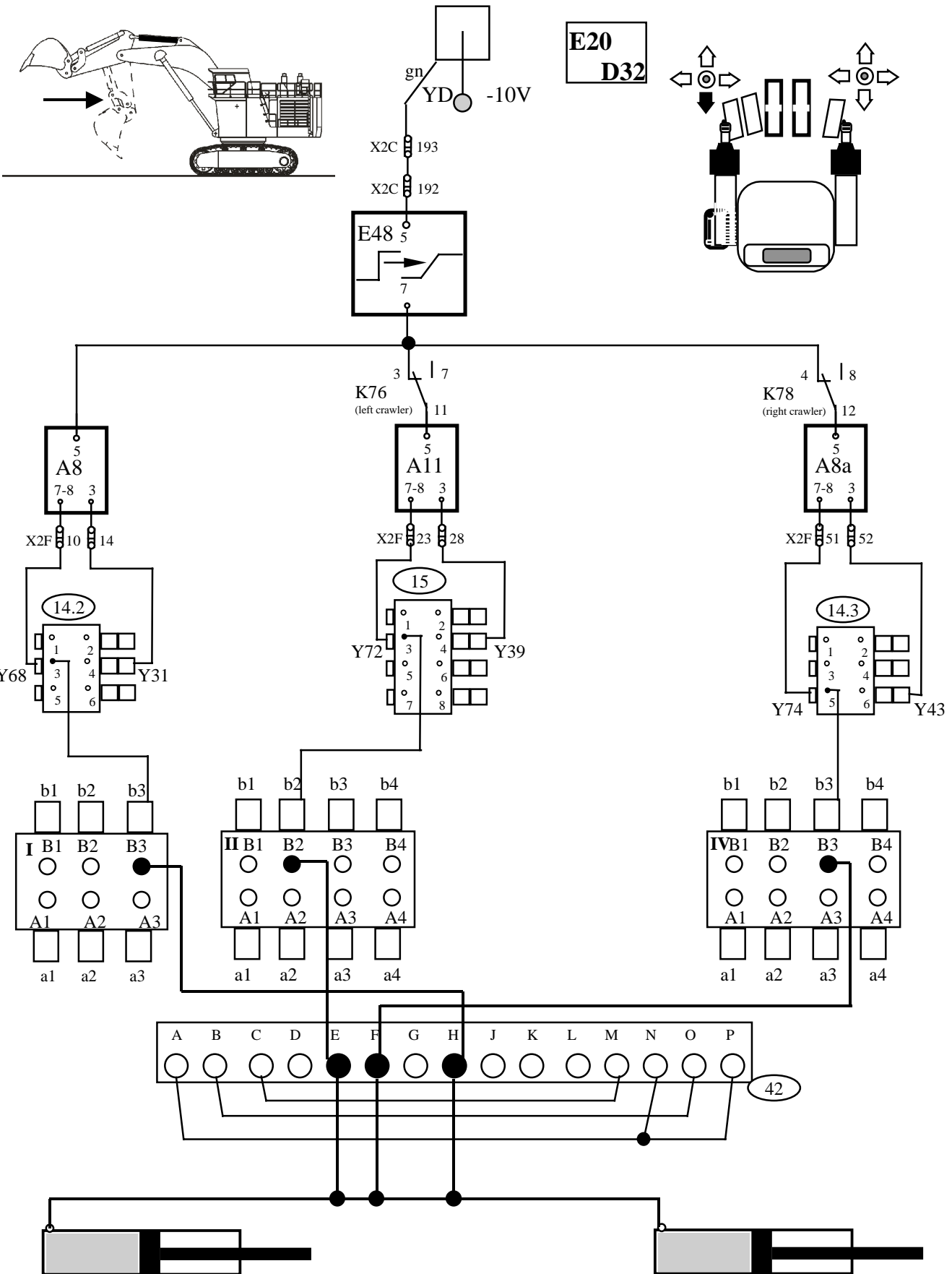


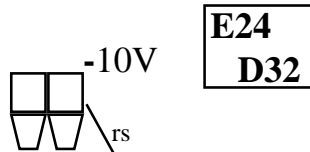
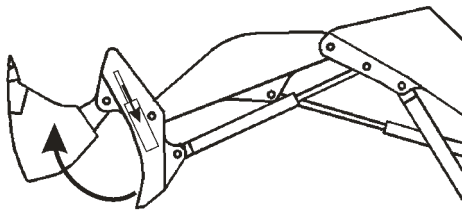
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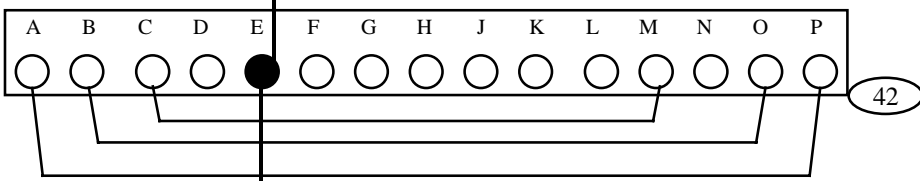
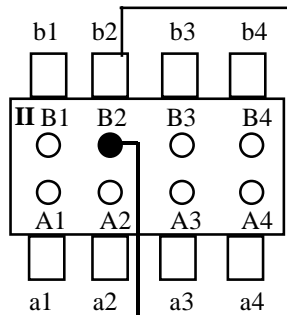
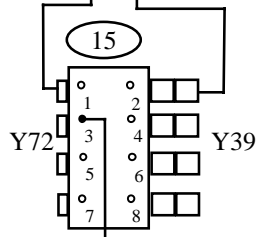
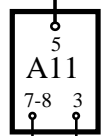
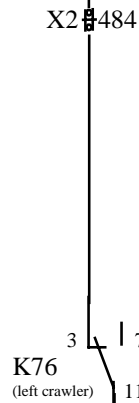
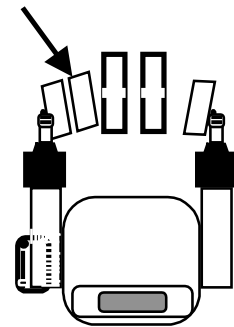
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8.3	Hydraulic for the travel circuit	

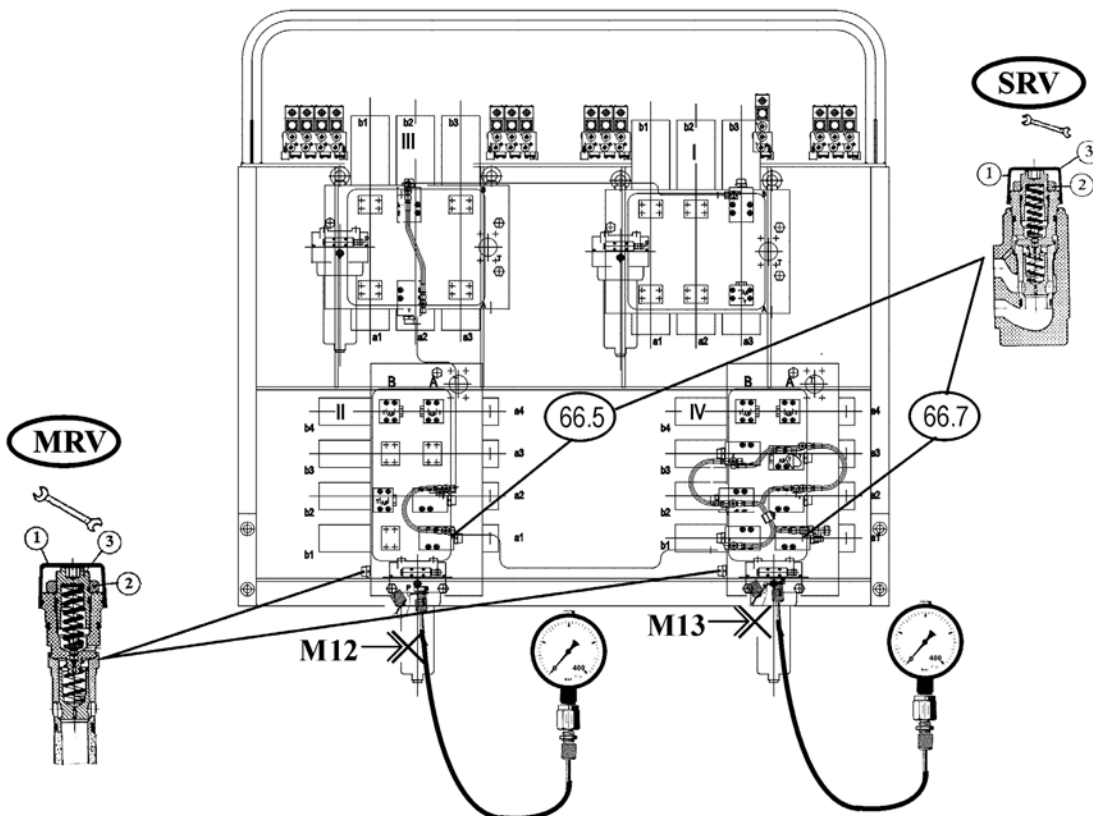
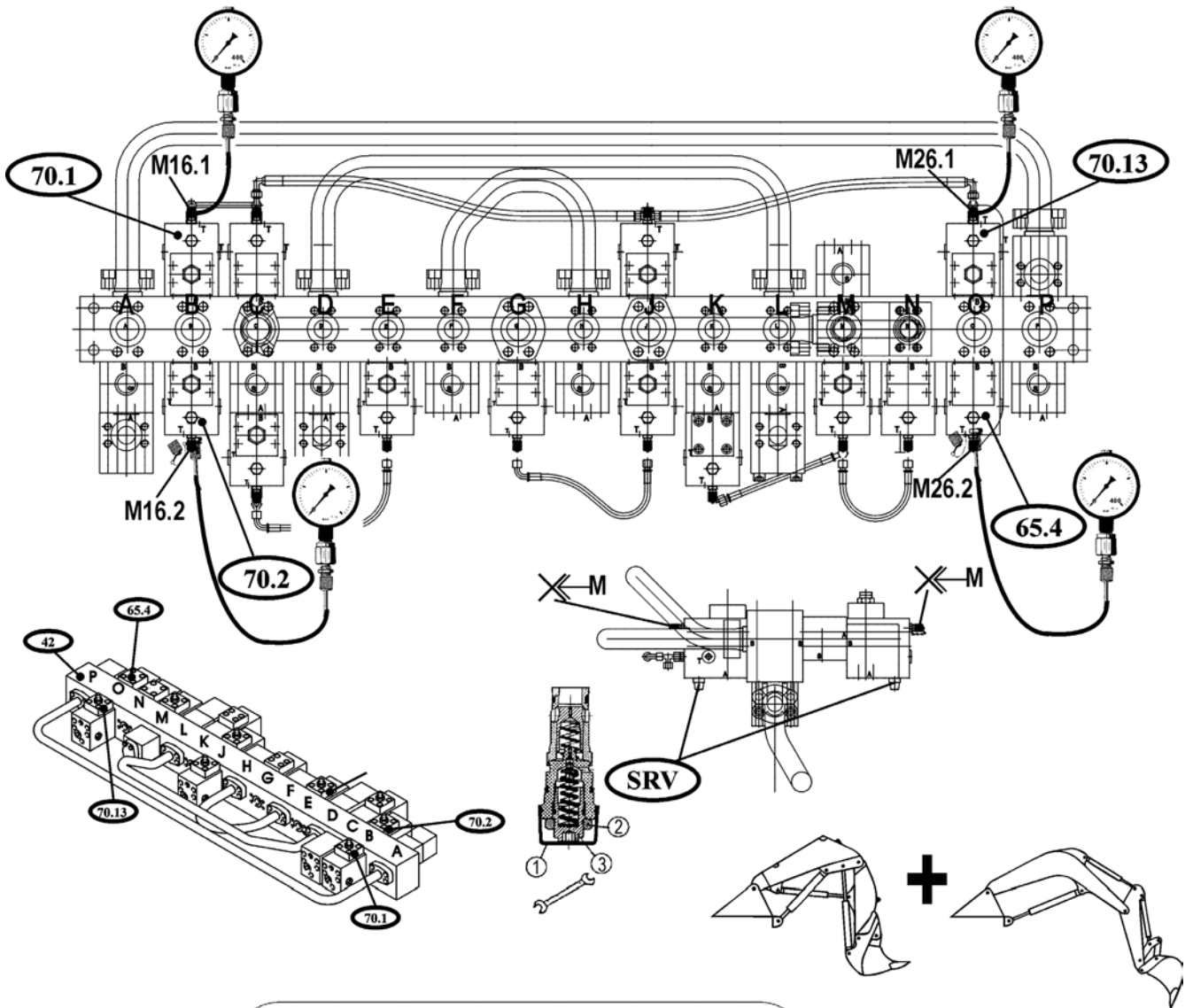


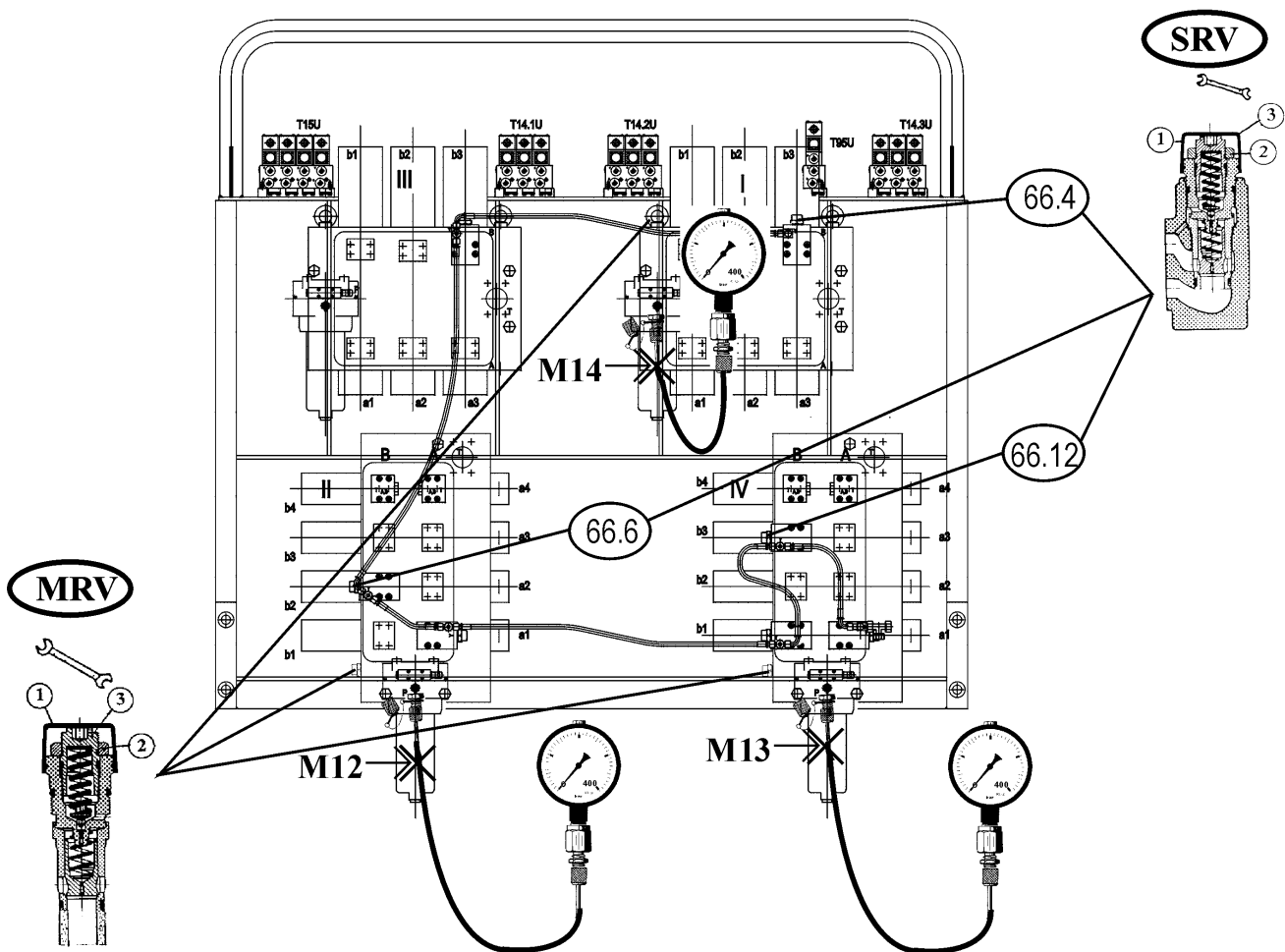
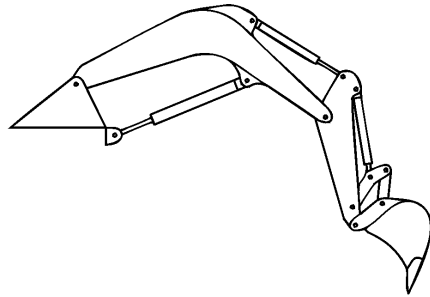


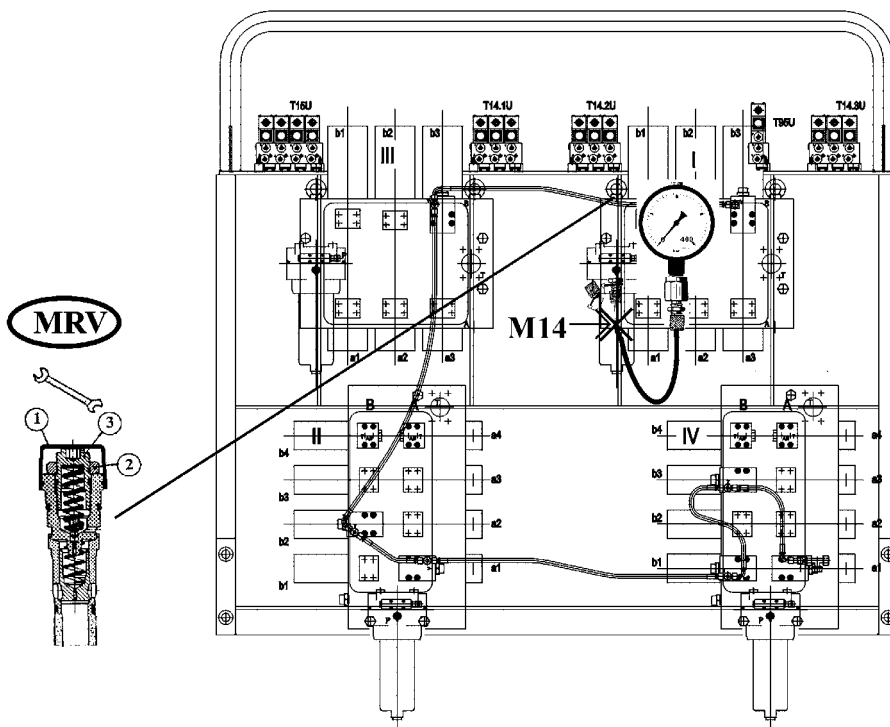
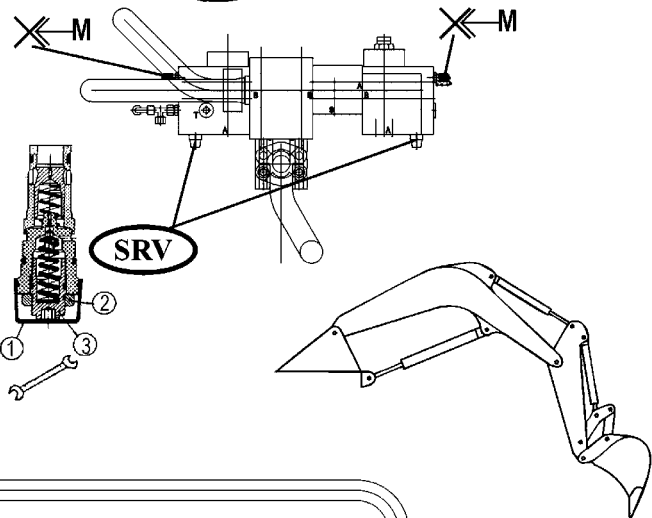
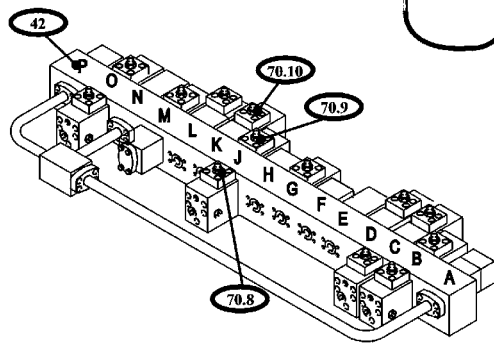
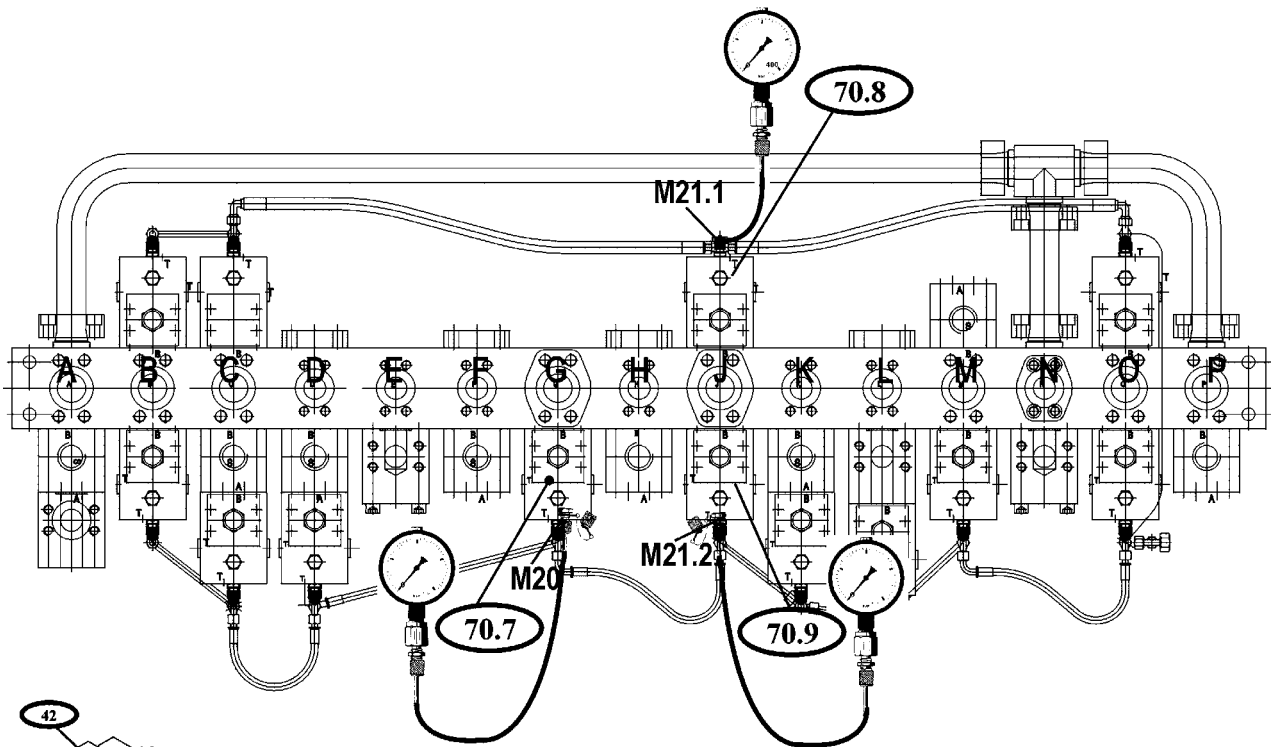


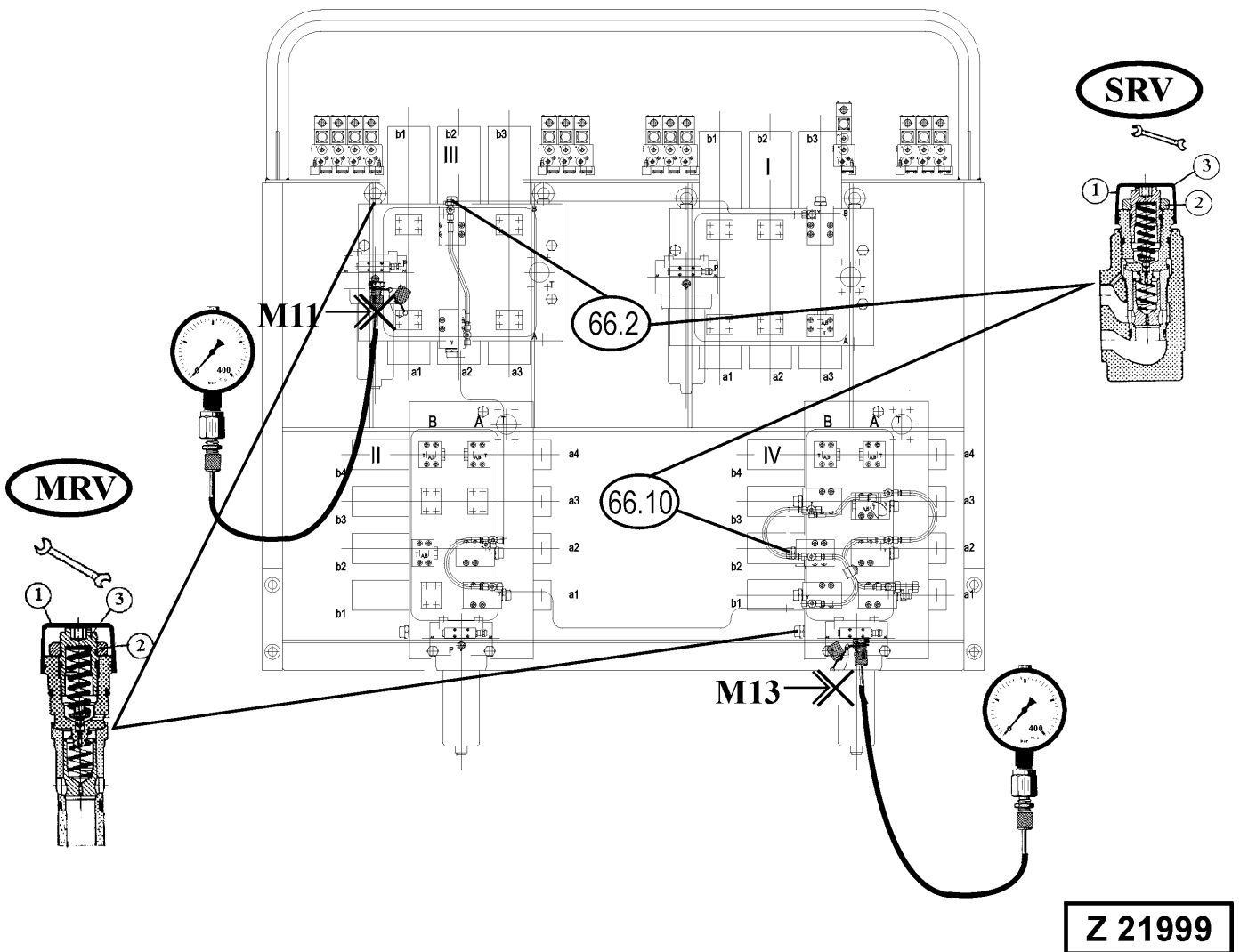
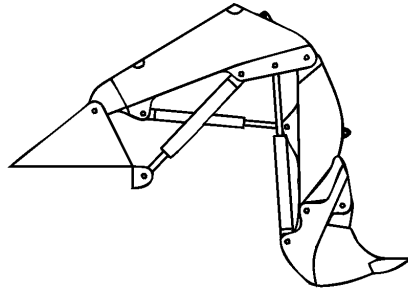
E24
D32

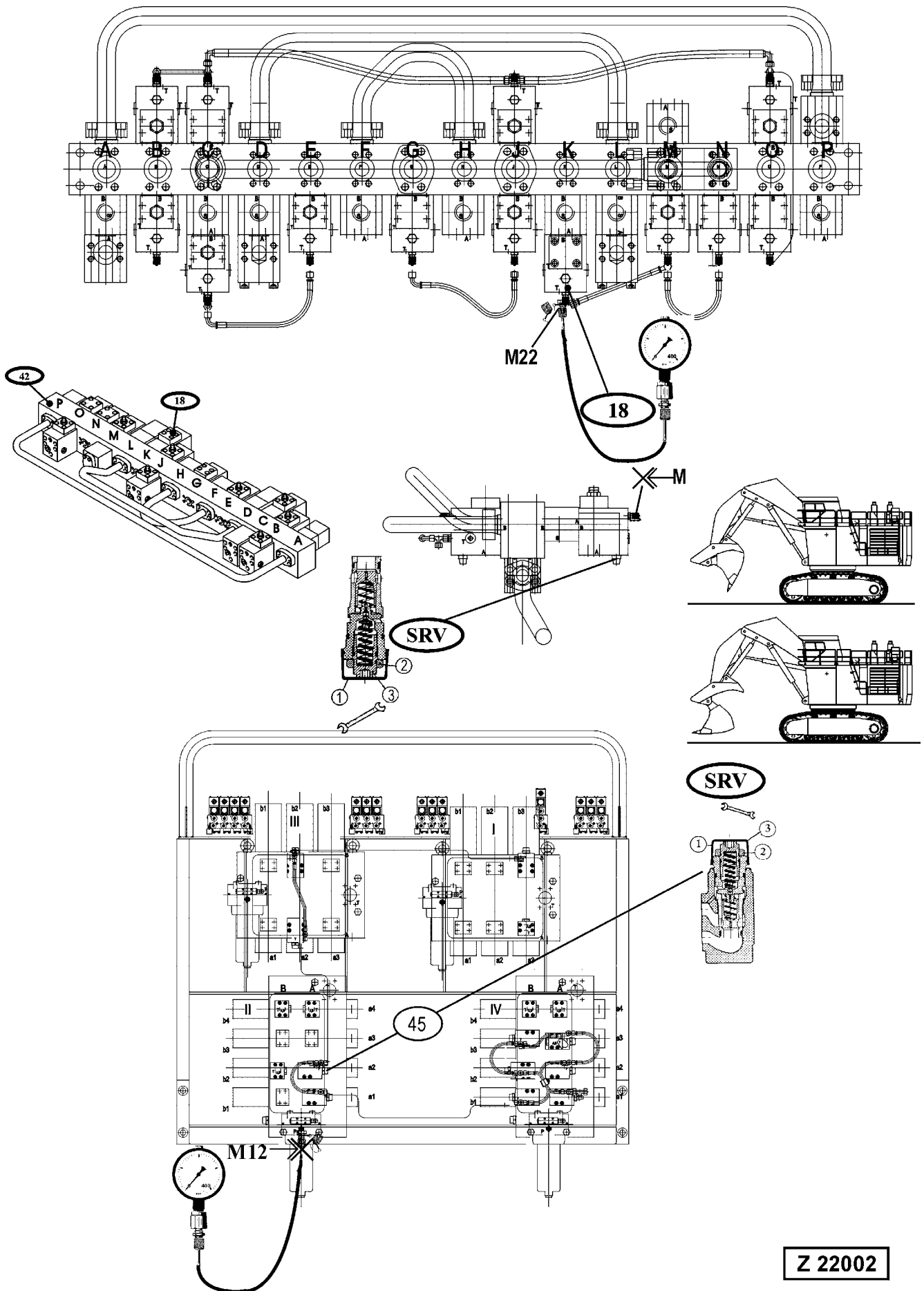


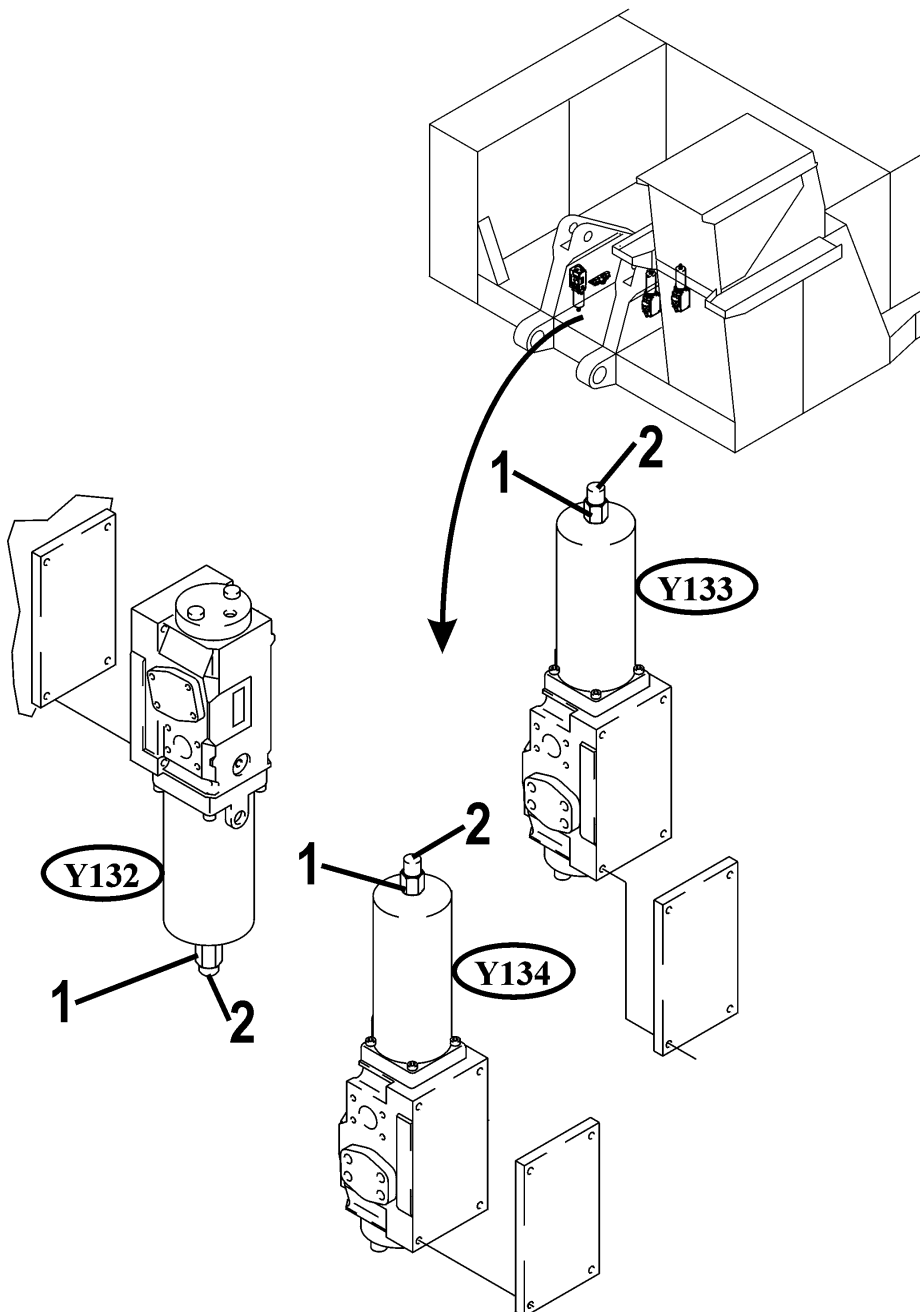
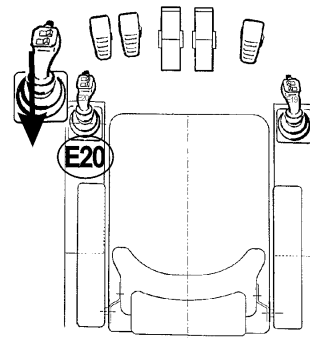
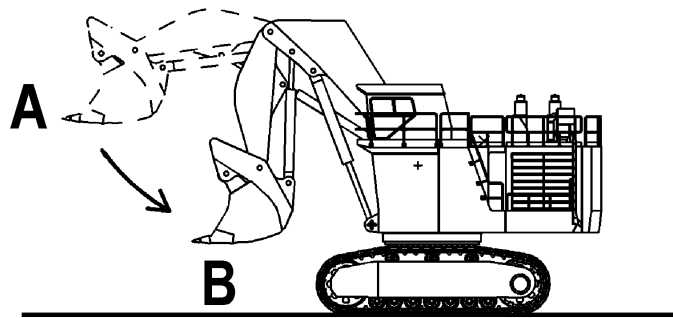


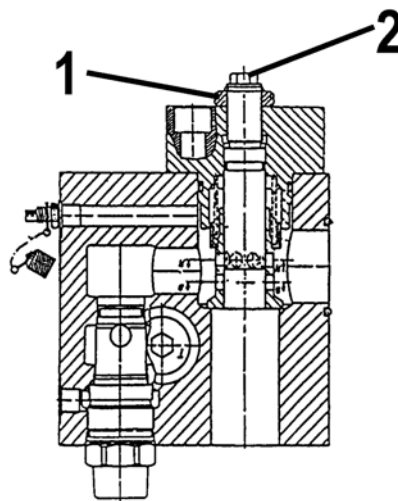
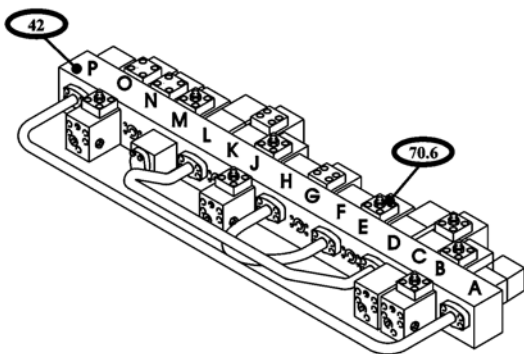
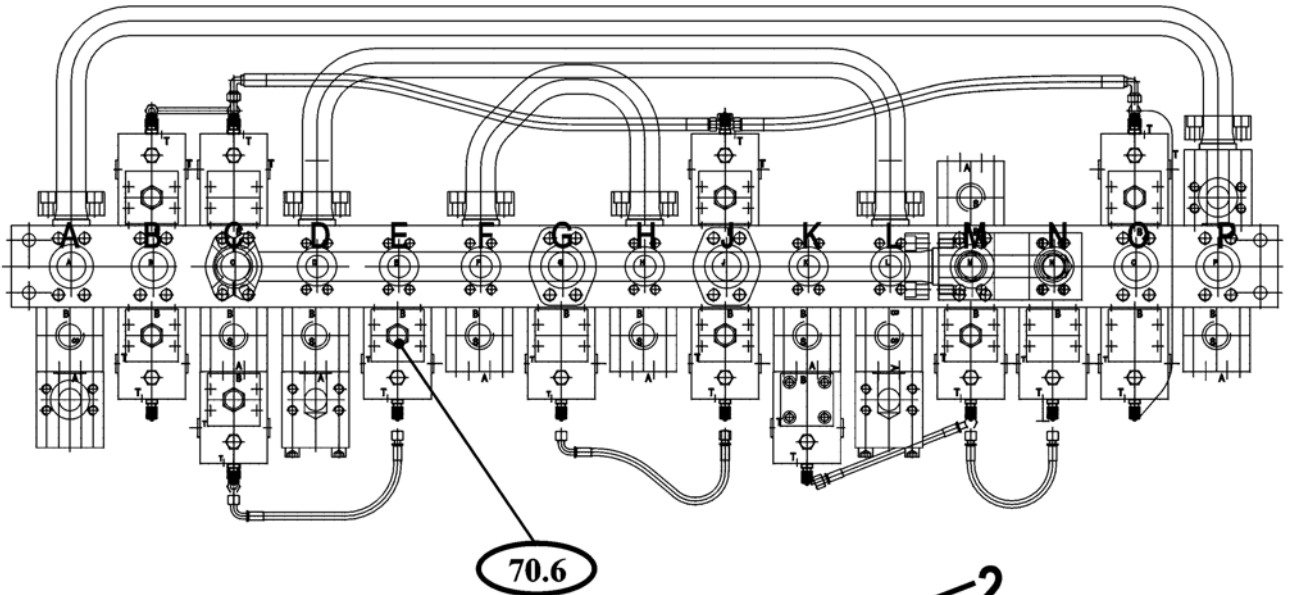
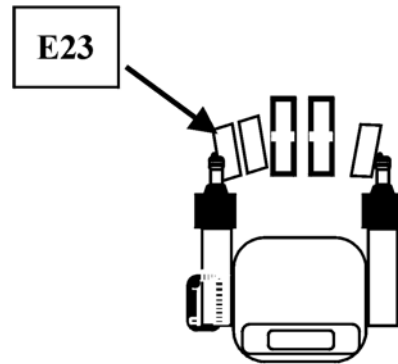
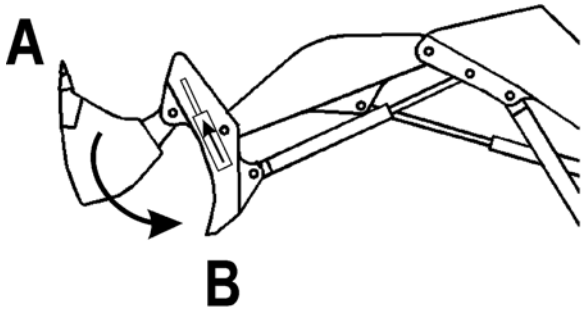












Cont'd.:

8.2.2 Swing Motor

Axial piston motor A2FLM (with SL-bearing)

Function:

The pressure oil inlet (A or B) and consequent oil outlet (B or A) determine the output drive direction of the drive shaft (1).

Direction of rotation:

"Clockwise" = Direction of flow A to B

"Counter-Clockwise" = Direction of flow B to A

with view onto drive shaft!

Via the control lens (8) the oil is directed to the cylinder bores.

The piston (5) is moved from the lower (6b) to the up- per dead point (6a) by means of the force acting on it and causes the drive shaft to rotate. On further rotation of the drive shaft (additional pistons are pressurized) this piston is moved towards the lower dead point again and oil of the cylinder chamber is forced out through the kidney formed openings of the control lens. This oil is fed back to the tank via the return line.

If the supply and return line is changed it changes the output drive direction of the drive shaft.

By means of the angled arrangement of the cylinder (7) (bent axis design), a certain piston stroke is produced which results in a fixed displacement per revolution of the drive shaft. According to the size of the applied flow this produces a specific output speed.

The output torque at the drive shaft is dependent on the size of the motor and the required operating pressure.

8.2.6 Electric / Hydraulic flowchart “Swing Left”

Legend for illustration (Z 21945):

(E20)	Control lever (Joy stick)
(D32)	Time relay – Pilot control: Neutral position monitoring
(XB)	Direction (axis) of joy stick
(-10V)	Signal voltage (Maximum)
(ws/gn)	Colour code of signal voltage cable (Joy stick)
(X2...)	Terminal rail with number
(E50)	Ramp time module
(A7)	Amplifier module – Swing (Y65 + Y24/25 – Block III)
(A7a)	Amplifier module – Swing (Y66 + Y26/27 – Block I)
(K153)	Relay – Pump control swing: Additional oil flow of Pump #1 to the swing if energized (swing speed dependent)
(K154 + K154a)	Relay – Counter prevention if energized
(14.1)	Remote control valve block
(95)	Remote control valve block
(Y65 + Y66)	Proportional solenoid valve
(Y24 + Y26)	Directional solenoid valve
(I + III)	Main control blocks I +III
(16.1)	Distributor manifold
(61.1 + 61.2)	Swing brake valve blocks
(60.1 + 60.2)	Swing motors

Illustration Z21945 shows:

The electrical signal.

Signal voltage of joy stick (E20) arrives via ramp time module (E50) at terminal 5 of the amplifier modules (A7 + A7a) and further to the proportional and directional solenoid valves of the remote control blocks (14.1+ 95).

The hydraulic signal. (pilot pressure)

When the proportional and directional solenoid valves are energized pilot pressure oil flows to the pressure ports of the main control blocks.

The hydraulic oil flow

Now the oil of the main pumps flows through the main control blocks (I + III) and arrives via swing brake valves (61.1 + 61.2) at the swing motors (60.1 + 60.2).

8.2.9 Checks and adjustments for the swing circuit



- It is important that the complete MRV-valve and the Pressure Increasing Valve is firmly (with 300 Nm) tightened. Otherwise, internal leaks could occur which result in: problems of correct adjustment, loud flow noises and high temperatures.
- Whenever pressure checks are carried out, they must be carried out for both, R.H. and L.H. Swing, to make sure the double check valves in the control lines and the check valves in the brake valve blocks are in good condition.
- Because the Swing motors are working hydraulically in combined operation, the pressure gauge shows the pressure of the pressure increasing valve with the lowest setting. Even when the gauge shows the required pressure it is possible that one valve has a higher setting. Therefore lower the pressure on one valve below the required pressure and then increase up to required pressure. Proceed with next valve in the same manner.

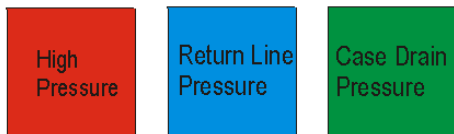
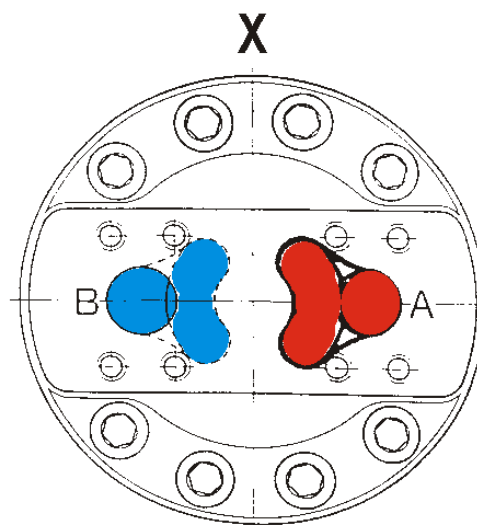
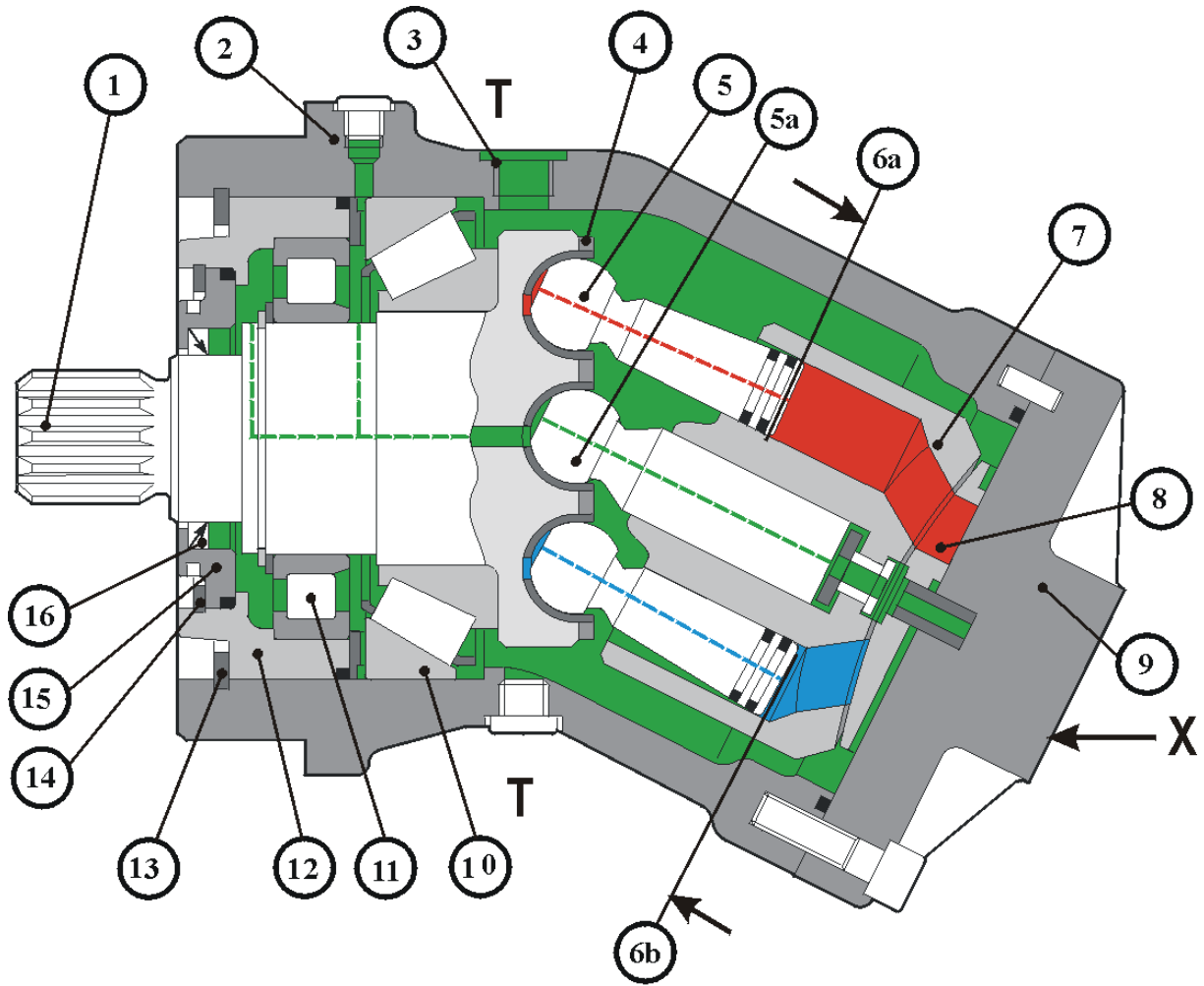
High pressure check / adjustment

1. Connect the gauge to the check point M11 and M14 at the high pressure filter units.
2. Disconnect the pilot pressure lines from the T-unions and close the lines with a suitable plug (P).
3. Loosen lock nut (3) of **both** pressure increasing valves (PIV) and screw in set screw (4) until piston (5) comes to stop.
4. Start engine and let it run with max. speed.
5. Lower attachment to ground and **apply house brake** with switch S29.
6. Actuate either L.H. or R.H. rotation until the hydraulic system stalls and increase * slowly the MRV-pressure while observing the pressure gauge. Gauge value must remain at 330 -5 bar.
7. If the gauge shows a smaller or greater value the pressure increasing valve must be adjusted.

*

Procedure:

- a) remove dust cap (a) and loosen lock nut (b).
- b) Adjust pressure with set screw (c).
- c) Secure adjustment by tightening lock nut (b) and install dust cap (a).
- d) Re-check pressure setting.
- e) Re-set **MRV** to **310 + 5 bar** after the check / adjustment is finished.



Z 22505

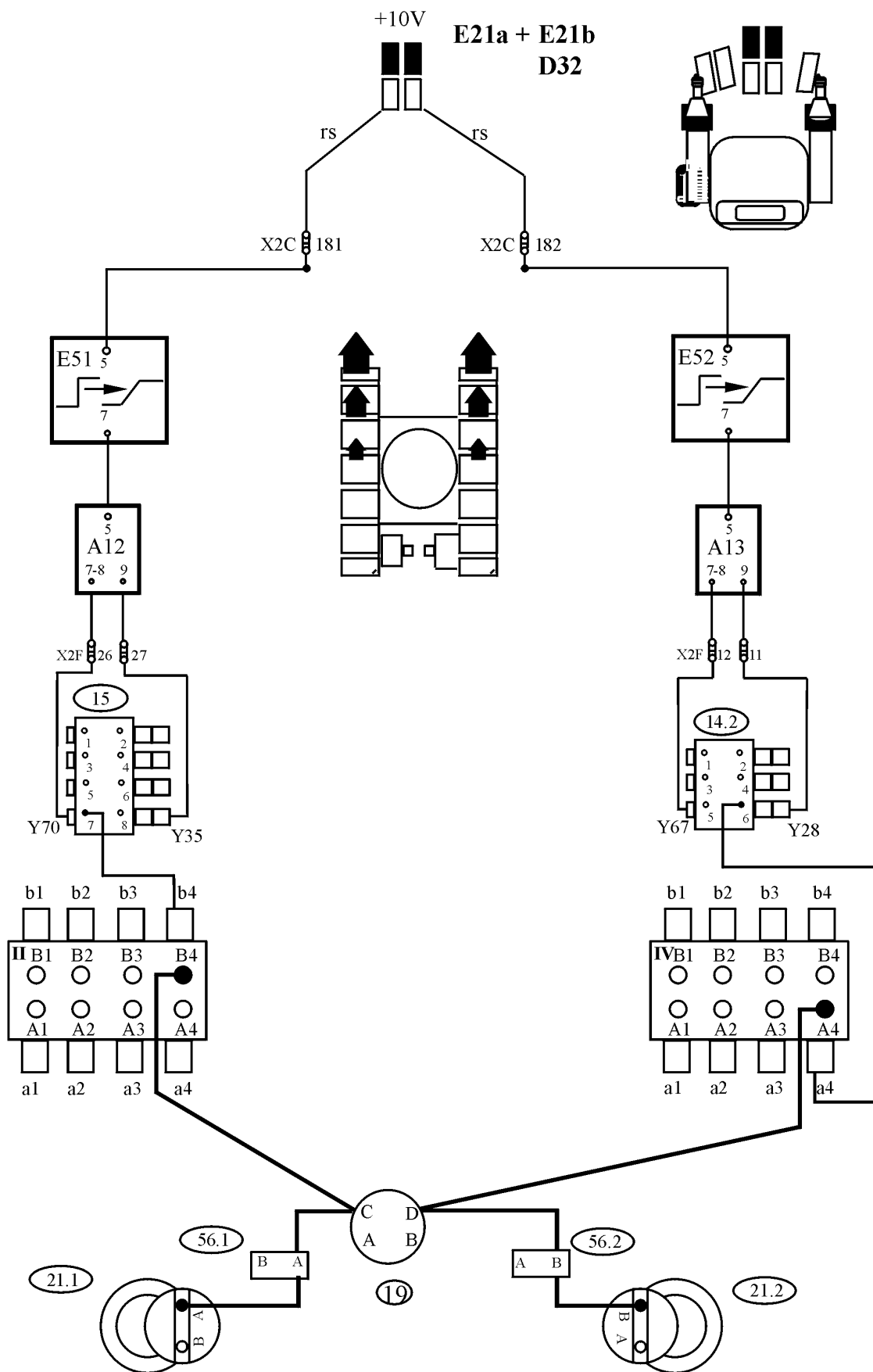
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Z 22517

9.0 General:

Legend for illustration (Z 21926):

- (83.1 – 83.4) Track tensioning cylinders
- (M29.2 + M29.6) Bleeder and hydraulic pressure check points at the R.H.- tensioning cylinders.
- (M29.1 + M29.5) Bleeder and hydraulic pressure check points at the L.H.- tensioning cylinders.
- (M29.3) Bleeder and hydraulic pressure check point at the bladder accumulator (82.1) for the L.H.-side.
- (M29.4) Bleeder and hydraulic pressure check point at the bladder accumulator (82.2) for the R.H.-side.
- (89.1 + 89.2) Membrane accumulator, 1,3 liter (pre-charge pressure 31bar)
- (62.2) Service shut-off cock for the L.H.-side
- (62.3) Service shut-off cock for the R.H.-side
* "O" = open - "C" = closed
- (82.1 + 82.2) Bladder accumulator, 5 liter (pre-charge pressure 150bar)
- (19) Rotary joint
- (L16) Supply line L.H.-side
- (L17) Supply line R.H.-side

The hydraulic track tensioning system ensures automatically the correct track tension.

The pilot pressure pump (8.1, see diagram on page 4) will supply oil to all four tensioning cylinders (83.1-83.4).

The maximum pressure is limited by the pressure increasing valves (58.1) for the L.H.-side and (58.2) for the R.H.-side.

The pressure in the tensioning cylinders transmits the required force to move the guide wheels to the front, until the correct track tension is obtained.

The tension for each crawler (R.H.-side and L.H.-side) is separately controlled and adjusted.

External forces acting at the guide wheels will be absorbed through the pressure accumulators (89.1 + 89.2, first stage) and (82.1 + 82.2, second stage).



- **For information about the preventative track inspection, refer to the Operation and Maintenance Manual.**

Functional description on next page

9.4 Adjustments / Checks

Legend for illustration (Z 21930):

(58.1)	Pressure increasing valve – Track tensioning system L.H.
(58.2)	Pressure increasing valve – Track tensioning system R.H.
(62.3)	Service shut-off cock for the L.H.-side
(62.4)	Service shut-off cock for the R.H.-side
(MRV)	Main relief valve – Operating pressure of main control block III
(M11)	Pressure check point – Operating pressure of main control block III
(M29.3)	Bleeder and hydraulic pressure check point at the bladder accumulator (82.1) for the L.H.-side.
(M29.4)	Bleeder and hydraulic pressure check point at the bladder accumulator (82.2) for the R.H.-side.
(M29.7)	Pressure check point - track tensioning system operating pressure - L.H.
(M29.8)	Pressure check point - track tensioning system operating pressure - R.H.
(Y128)	Solenoid valve – Oil supply to the L.H. - track tensioning system
(Y129)	Solenoid valve – Oil supply to the R.H. - track tensioning system
(1)	Piston
(2)	Lock nut
(3)	Set screw - high pressure 310bar
(4)	Lock nut
(5)	Set screw - low pressure 35 bar

Checking / Setting the pressure increasing valve

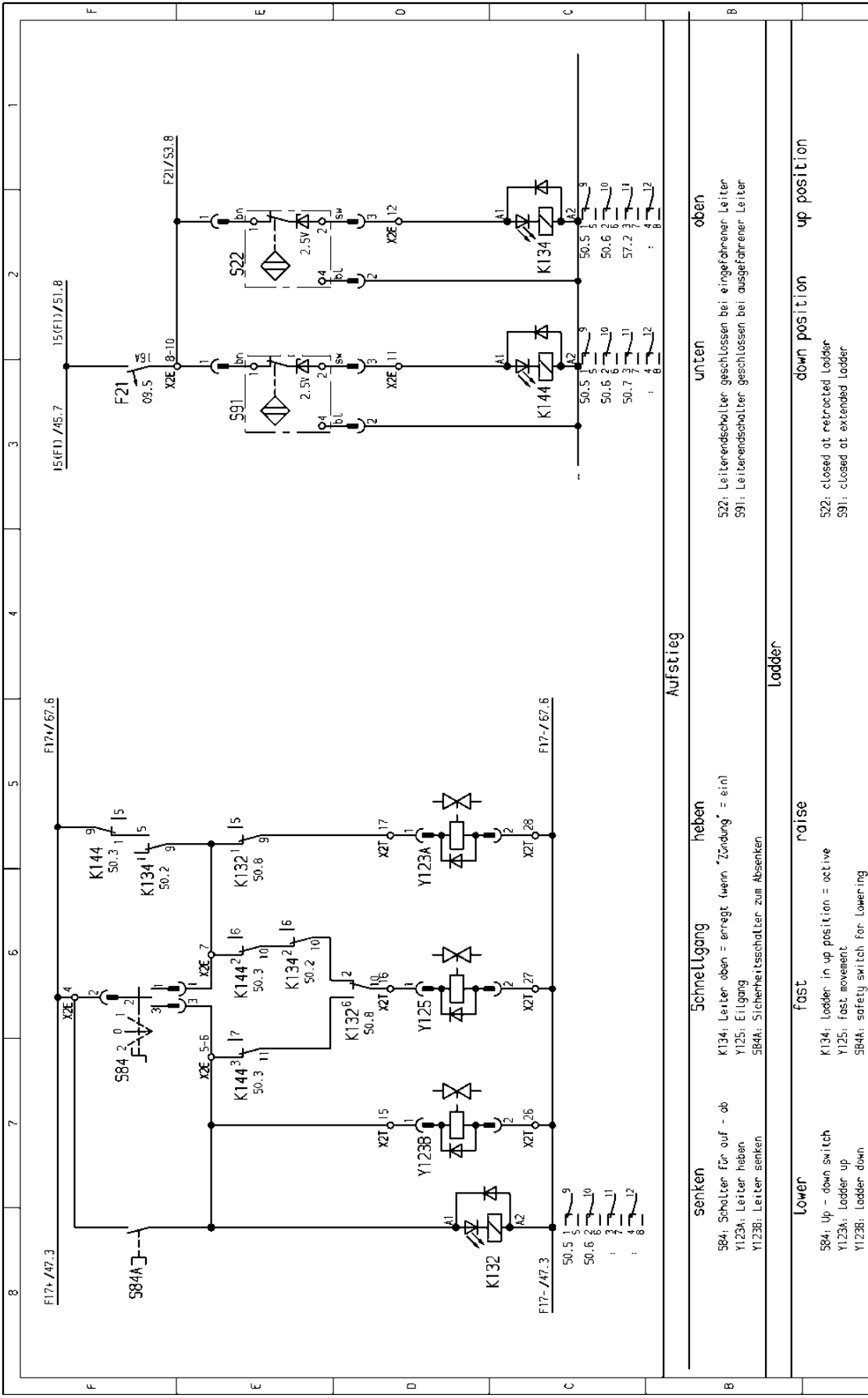
Pre-conditions: Correct MRV, SRV and pilot pressure setting and the system must be free of air.

The description is only for the R.H. track. The same procedure applies also for the L.H. side.

Basic Adjustment:

1. Connect a pressure gauge to check point M11.
2. Start the engine and let it run with max. speed.
3. Increase the MRV-setting (Block III), ~ 330 to 340 bar.
4. Switch OFF the engine, open cock valve (62.4) to allow pressure relieve of the R.H. track, and close it again.

continued



<p>Generalplan</p> <p>Typ: PCS500-6</p> <p>Ident.-Nr.: E5926</p>		<p>Erstverw.:</p> <p>Ident.-Nr.: E5926</p>		<p>Name: E5926</p> <p>F.ÄH-Nr.: E5926</p>	
<p>Bau-Nr.: KOMATSU MINING GERMANY</p> <p>Ident.-Nr.: 897 899 40</p> <p>Format: A3</p>		<p>Ersetzt durch:</p> <p>Ident.-Nr.: 897 899 40</p> <p>Format: A3</p>		<p>Datum: 50/</p>	
<p>Elektroplan</p> <p>Copyright reserved (Schutzvermerk DTR 34 beachten)</p>		<p>Entstanden aus:</p> <p>Ersetzt durch:</p>		<p>Datum: 5</p>	
<p>Wiederholungsverwendung:</p> <p>Typ: Ident.-Nr.: F</p>		<p>Vordruck f. Schaltpläne</p> <p>Computereinstelle Zeichnung (CAD)</p>		<p>Datum: 7</p>	
<p>senken</p> <p>S84: Schalter für auf - ab</p> <p>Y123A: Leiter heben</p> <p>Y123B: Leiter senken</p>		<p>Schnellgang</p> <p>heben</p> <p>K134: Leiter oben = erregt wenn "Zündung" = ein</p> <p>Y125: Erlang</p> <p>S84: Sicherheitsschalter zum Absenken</p>		<p>Aufstieg</p> <p>unten</p> <p>oben</p> <p>S22: Leiterschalter geschlossen bei eingefahrener Leiter</p> <p>S91: Leiterschalter geschlossen bei ausgefahrener Leiter</p>	
<p>lower</p> <p>S84: Up - down switch</p> <p>Y123A: Ladder up</p> <p>Y123B: Ladder down</p>		<p>fast</p> <p>raise</p> <p>K134: Ladder in up position = active</p> <p>Y125: Fast movement</p> <p>S84: safety switch for Lowering</p>		<p>ladder</p> <p>down position</p> <p>up position</p> <p>S22: closed at retracted ladder</p> <p>S91: closed at extended ladder</p>	
<p>Datum: 24-JAN-02</p> <p>Bearb.: Boer</p> <p>Abt.: 8121.4</p> <p>Norm:</p>		<p>Datum: 7</p>		<p>Datum: 5</p>	

Cont'd.:

- (20.1) Orifice - bearing lubrication Main pump I
- (20.2) Orifice - bearing lubrication Main pump II
- (20.3) Orifice - bearing lubrication Main pump III
- (20.4) Orifice - bearing lubrication Main pump IV
- (21.1) Travel gear drive L.H.
Axial piston motor **A2FM 500 /60W-VZH-01**
- (21.2) Travel gear drive R.H.
Axial piston motor **A2FM 500 /60W-VZH-01**
- (22) Change over valve – Electronic pump regulation or hydraulic constant regulation
3/2-directional control valve (manual operated)
- (23) Engine radiator fan drive
Axial piston motor **A2FM 160 /61W-VAB-02**
- (24) Pressure switch B24 – monitors item (92.1) – (92.2)
- (25.1 + 25.2) Check valve
- (26) Pressure relief valve – safety valve to protect the travel parking brakes in case of a defect rotary distributor
- (27.1 – 27.10) Base plate for solenoid valves
- (28.1 – 28.16) Solenoid valves – 4/2-directional control valve
- (29) Pressure relief valve – PTO gear lubrication
- (30) Hydraulic oil level gauge
- (31.1) Pressure relief valve - Hydraulic oil cooler fan drive, with solenoid valve Y6a / Y6b for fan RPM control
- (31.2) Pressure relief valve - Engine radiator fan drive, with proportional solenoid valve Y136 for fan RPM control
- (32.1 – 32.4) Restrictor, shock absorbers for the hydraulic oil cooler
- (33) Pressure filter (B22) – pilot pressure, pump regulation, pump bearing lubrication, track tensioning, grease pumps
- (34.1) Pressure filter (B28)– Hydraulic oil cooler fan drive
- (34.2) Pressure filter (B21) – Engine radiator fan drive
- (35) Control and filter panel
- (36) Pressure filter (B27) - PTO gear lubrication

continued

13.1 Designation of electrical devices

Indicating letter	Kind of component
A	System, subassembly, parts group, trigger boxes, control units
B	Transducer for conversion of non-electrical variables to electrical variables, and vice versa. Speed sensors, pressure sensors, pressure switches, oil-pressure switches, temperature sensors
C	Condenser, capacitor, Condensers and capacitors, general
D	Elements with time lag, memory elements, binary elements
E	Various devices and equipment
F	Protection device Fuses, current protection circuits
G	Power supply, generator Batteries, generators, alternators
H	Monitor, alarm, signaling device Indicator lights, signal lights, headlights, warning buzzers, horn
K	Relay, contactors
L	Inductor Coils, windings
M	Motor
N	Regulators, amplifiers
P	Measuring instrument
Q	High voltage switching units
R	Resistors, heating devices
S	Switches, selectors
T	Transformer
U	Modulator, converter from one electrical in an other electrical value
V	Semiconductor, electron tubes, diodes, rectifiers, zener diodes
W	Transmission path, conductor, antenna
X	Terminal, Plug, Plug and socket connection
Y	Electrically actuated mechanical device Solenoid-operated valves
Z	Compensating units, filters, limiters cable connection

13.4 Reading a Circuit Diagram.

Legend for illustration (Z 21825):



- **Examples are shown by sectional drawings out of the electric circuit diagram 897 844 40 page 08.**

(1) Section F8 / sheet 08

The hint F11/06.1 indicates that the wire from F11 is continued on sheet 06 column 1.

(2) Section C4 / sheet 08

Shown is the relay coil K51-1 only and not its contacts.

The contacts are shown somewhere else in the diagram.

Switching and contact positions are shown below at the foot of that particular circuit in row C-C as shown below.

Example for K51-1:

08.5		opens on sheet 8 section 5 when relay is energized
:		Not used
:		Not used
:		Not used

When diodes are fitted to a relay, they are fitted to allow a current flow in one direction only. An LED* (Light Emitting Diode) indicates a current flow if it lights up.

When diodes ** are fitted anti-parallel to a relay coil, they absorb the high induced voltage caused by making and breaking the current flow through the coil.

This occurs each time we operate a switch supplying current to the coil. The diode effect allows the induced current to circulate within the coil windings and decay when the energy to the coil is cut.

* LED between A1 and coil

** Diode between A1 and A2.

(3) Section F7 / sheet 08

Connectors and Terminals are identified by a letter and number code.

X2 o 23-28 = Terminal box X2 Terminals 23 to 28 are linked with a metal bridge.

continued

Cont'd.: 10.5 Component list

Legend for the circuit diagram: # 897 844 40

Illustration Z 21789

Component Code	Page	Function
E6	12-30	Programmable logic controller (PLC)
E7	28	Monitoring the charge/discharge current
E8-1	28	RPM-converter (converts rpm-pulses into norm signals)
E13	38	cigarette lighter
E19	46	Joy stick right
E20	46	Joy stick left
E21a	46	Pedal travel – left track
E21b	46	Pedal travel – right track
E22	46	Pedal swing brake
E23	46	Pedal bucket closing
E24	46	Pedal bucket opening
E25	33	Radio
E26	36	Air-condition
E26a	36	Air-condition operator panel
E32-1	42	Electronic pump control (MC7)
E41	43	Swing speed switch unit
E42	43	Swing direction monitoring unit
E43	43	Swing speed switch unit
E44	34	Refrigerator
E45-1	55	Pump unit “Reserve” (Automatic engine oil supply system)
E46	30	VHMS controller
E47	32	Colored Graphic Console (CGC)
E48	50	Ramp time module – stick function
E49	49	Ramp time module – boom function
E50	50	Ramp time module – swing function
E51	51	Ramp time module – left crawler
E52	51	Ramp time module – right crawler
E53-1	10	PWM controller – engine radiator fan speed (Y136-1)
E300	37	Engine-independent cab heater
E350	30	ORBComm (Option)
E400	06	Battery charger

Continued

Cont'd.: 10.5 Component list

Legend for the circuit diagram: # 897 844 40

Illustration Z 21794

Component Code	Page	Function
G1	06	Starter battery
G2	06	Starter battery
G3	06	Starter battery
G4	06	Starter battery
G8	06	Battery for stabilized voltage (PLC and VHMS controller)
G9	06	Battery for stabilized voltage (PLC and VHMS controller)

Continued

Cont'd.: 10.5 Component list

Legend for the circuit diagram: # 897 844 40

Illustration Z 21799

Component Code	Page	Function
K62	55	Relay – Hydraulic oil transfer pump (Option)
K67	36	Relay – Cab blower motor (ON if engine n \geq 300RPM)
K71	48	Relay – pilot control (Bucket fill)
K74	50	Relay – pilot control (Stick out)
K76	51	Relay – pilot control (crawler left)
K78	51	Relay – pilot control (crawler right)
K79a	22	Relay – Hydraulic oil overheating: - Warning - Engine derate (reduced engine power)
K80	44	Relay – pump control: energized = Y126 and Y130 activated (If swing speed \geq xxx imp/min and S250 = ON) - Oil flow reduction Pump #1 (Y126) - X1 pressure = 35bar at Pump #1 (Y130)
K82	21	Relay – pump control: energized = Y17a and Y101 activated (warm up period) - 1/2 Q _{max} operation (Y17a) - Reduction pre-load pressure (Y101)
K93-1	21	Relay – Engine shutdown
K100	22	Relay – PLC self holding

Continued

Cont'd.: 10.5 Component list

Legend for the circuit diagram: # 897 844 40

Illustration Z 21804

Component Code	Page	Function
S11	35	Switch "Windshield wiper" (Interval, slow, fast)
S15	38	Switch "Lighting engine compartment "
S15a	38	Switch "Lighting pump compartment "
S16	38	Switch " Interior cab lighting " (Dashboard)
S17	38	Switch " Cab base lighting "
S18	39	Switch " Access area lighting " (Ladder)
S18a	39	Switch " Access area lighting " (Cabin)
S20	39	Switch " Working light " (Dashboard)
S21	36	Switch " Cab heating blower control " (Dashboard)
S22	40	Proximity switch "Access ladder position UP"
S23	41	Proximity switch "Refilling arm position UP"
S24	15	Switch " Manual lubrication CLS " (Dashboard)
S26	15	Switch " Manual lubrication SLS " (Dashboard)
S27	08	Switch " PLC bypass " (Cab base)
S28	45	Switch " Seat operated switch " (in operators seat)
S29	46	Switch " Swing parking brake " (Dashboard)
S30	20	Switch " Engine RPM control - High / Low idle" (in R.H. control lever E19)
S31	14	Proximity switch "Gate valve monitoring"
S33a	08	Switch " Emergency Stop " (Ladder)
S33b	08	Switch " Emergency Stop " (Valve Block)
S33c-1	08	Switch " Emergency Stop " (Control and filter panel)
S35	55	Switch " Hydraulic oil transfer pump " (Option)
S36	19	Switch " Emergency Stop " (Dashboard)
S38	38	Switch " Interior cab lighting " (Cab door)
S40	36	Switch " Cab pressurizing blower " (Dashboard)

Continued

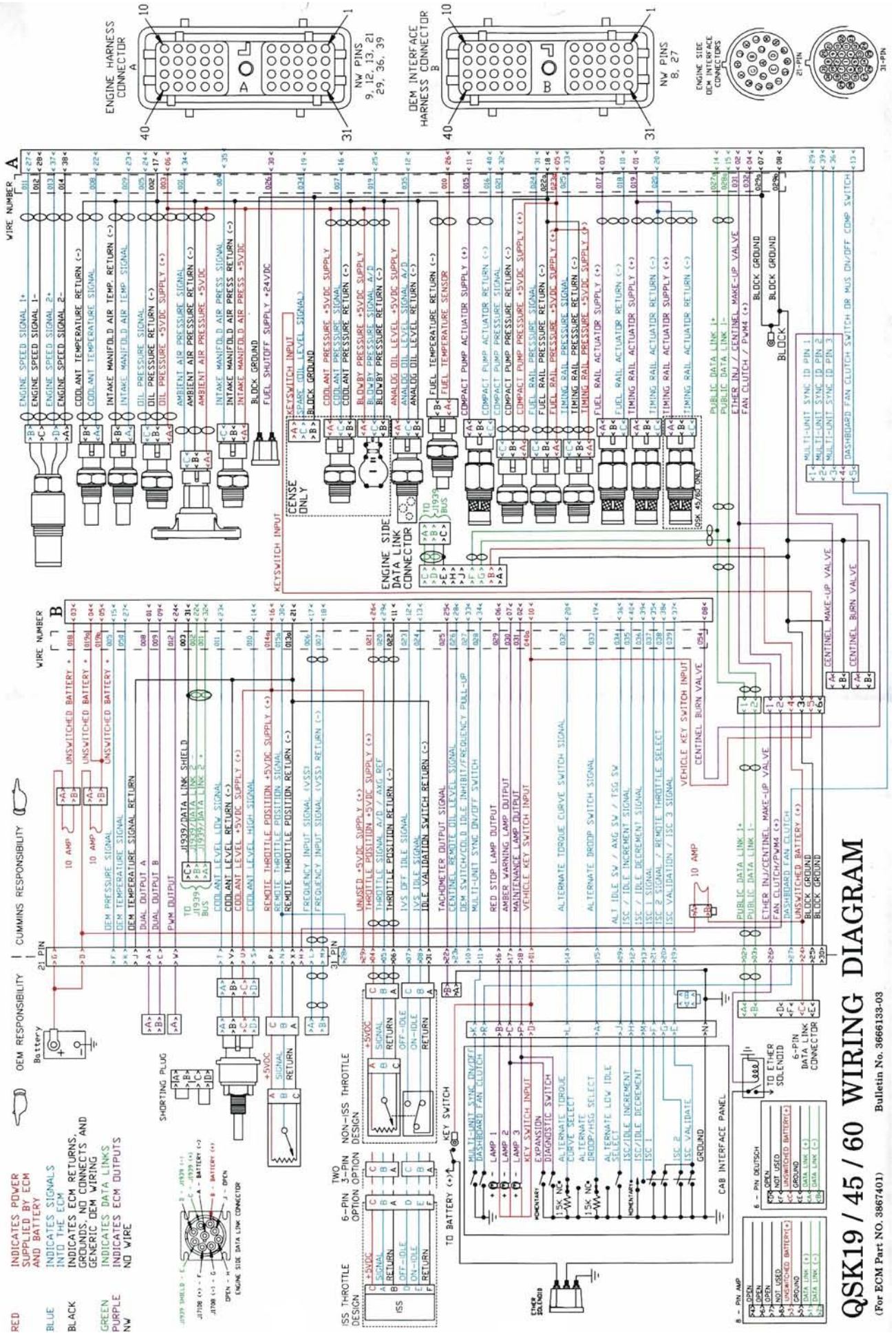
Cont'd.: 10.5 Component list

Legend for the circuit diagram: # 897 844 40

Illustration Z 21812

Component Code	Page	Function
Y99	56	Solenoid valve, shut off valve in fuel supply line
Y101	44	Solenoid valve "Reduction pre-load pressure oil cooler"
Y120	46	Solenoid valve "Hydraulic swing brake " De-energized = Hydraulic swing brake ON
Y123a	40	Solenoid valve "Hydraulic access ladder – up "
Y123b	40	Solenoid valve "Hydraulic access ladder – down "
Y124a	24	Solenoid valve "Refilling arm – up "
Y124b	24	Solenoid valve "Refilling arm – down "
Y124c	24	Solenoid valve "Refilling arm – enable"
Y125	40	Solenoid valve "Hydraulic access ladder – fast movement "
Y126	44	Solenoid valve "Oil flow reduction Pump #1 "
Y127	46	Proportional solenoid valve "Hydraulic swing brake "
Y128	41	Solenoid valve "Track tension left crawler"
Y129	41	Solenoid valve "Track tension right crawler"
Y130	44	Solenoid valve "Fixed pump #1 for swing" X1 = 35bar
Y131	44	Solenoid valve "Fixed pump #3 for swing" X1 = 35bar
Y132a	52	Solenoid valve " Floating stick function"
Y133a	52	Solenoid valve " Floating stick function"
Y135a	52	Solenoid valve " Floating boom function"
Y136-1	10	Proportional solenoid valve "Engine radiator fan speed"
Y300	37	Solenoid valve "Fuel pump, engine-independent cab heater

Continued



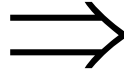
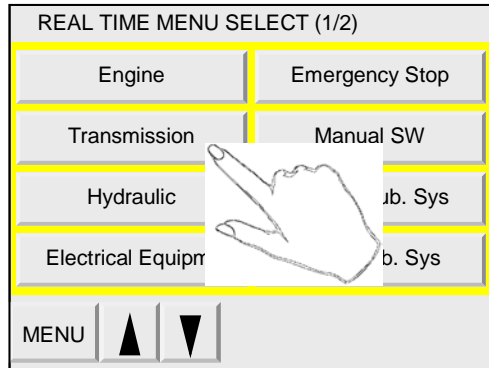
QSK19 / 45 / 60 WIRING DIAGRAM
 (For ECM Part No. 3867401) Bulletin No. 3666138-03

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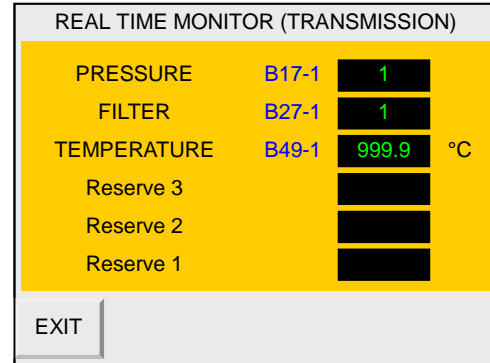
14.2.4 Real Time Menu Select Screen (No. 4.1.1)

4.1.1



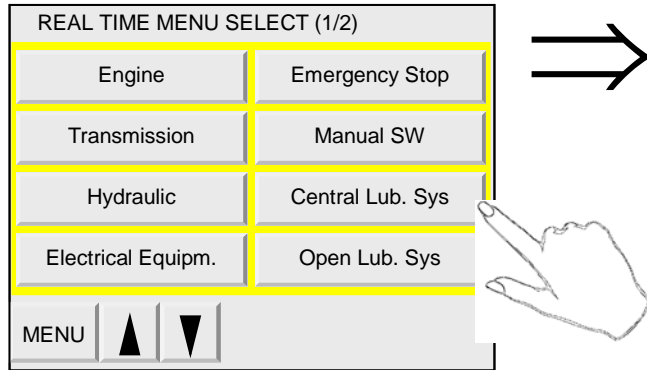
Transmission

5.2.1



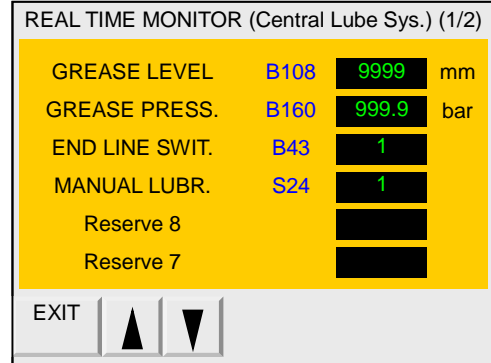
14.2.4 Real Time Menu Select Screen (No. 4.1.1)

4.1.1

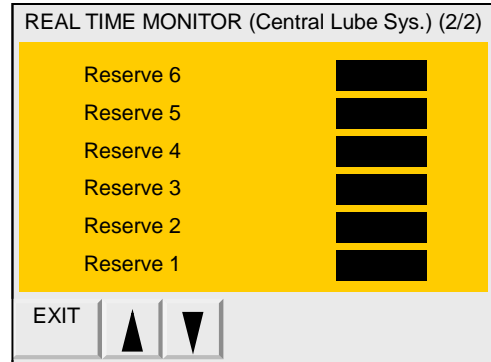


Central Lubrication System

5.7.1



5.7.2



14.2.5 PM-Clinic (No. 4.2.3 – 4.2.5) Power Check

There are 3 Monitors to freeze data under different conditions.

In order to obtain a complete power check, which consists of three different Monitors, the save button should only be pressed after the third monitor No. 4.2.5 “POWER CHECK 3/3 ” has been frozen.

4.2.3 Real Time Data

PM CLINIC (POWER CHECK) 1/3

Speed	1800	rpm
X1	34.0	bar
P1	150.0	bar
P2	150.0	bar
P3	180.0	bar
P4	160.0	bar
P Average		160.0 bar

EXIT ▲ ▼ PAUSE

4.2.3 Frozen Data

PM CLINIC (POWER CHECK) 1/3

Speed	1800	rpm
X1	34.0	bar
P1	150.0	bar
P2	150.0	bar
P3	180.0	bar
P4	160.0	bar
P Average		160.0 bar

SAVE ▲ ▼ RESET

It is possible to store the values of 3 different Power Checks.

To do this Press the ▼ and ▲ buttons to monitor the other Power Check pages.

4.2.4

PM CLINIC (POWER CHECK) 2/3

Speed	1800	rpm
X1	34.0	bar
P1	150.0	bar
P2	150.0	bar
P3	180.0	bar
P4	160.0	bar
P Average		160.0 bar

EXIT ▲ ▼ PAUSE

4.2.4

PM CLINIC (POWER CHECK) 2/3

Speed	1800	rpm
X1	34.0	bar
P1	150.0	bar
P2	150.0	bar
P3	180.0	bar
P4	160.0	bar
P Average		160.0 bar

SAVE ▲ ▼ RESET

4.2.5

PM CLINIC (POWER CHECK) 3/3

Speed	1800	rpm
X1	34.0	bar
P1	150.0	bar
P2	150.0	bar
P3	180.0	bar
P4	160.0	bar
P Average		160.0 bar

EXIT ▲ ▼ PAUSE

4.2.5

PM CLINIC (POWER CHECK) 3/3

Speed	1800	rpm
X1	34.0	bar
P1	150.0	bar
P2	150.0	bar
P3	180.0	bar
P4	160.0	bar
P Average		160.0 bar

SAVE ▲ ▼ RESET

PM-Clinic data

Do you really want to record these PM-Clinic data?

YES NO

4.2.1

PM CLINIC (GENERAL 1)

ENGINE MODEL	QSK60
S/N ENGINE	12345678901
OPERARION HOURS	1257.9 h
OIL VISCOSITY HYDR.	VG100
HYDRAULIC OIL TEMP	65.5 °C
AMBIENT TEMP.	28.7 °C

MENU ▲ ▼ Power Check

Monitor 4.2.1 appears again.

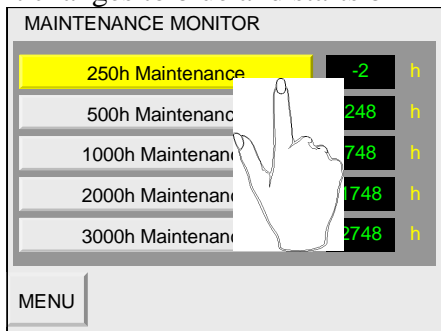
14.2.8 Maintenance Monitor (No. 4.5 – 4.5.1) Maintenance Acknowledgement

Maintenance confirmation through Service Personnel

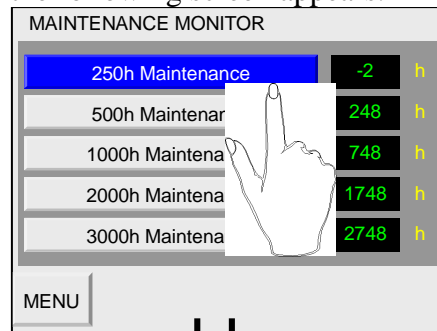
Maintenance indicated with yellow or red background color should be confirmed through Service Personnel in the Service Menu subsequent to the execution of the maintenance. With the confirmation the actual value maintenance number is increased by 1. Thus, the length of the maintenance cycle is added to the display value and the gray color will appear in the maintenance display. The button in the Service Menu used for maintenance confirmation then turns gray instead of yellow and is then without any function. The confirmation of the maintenance is then stored.

Example: 250h Maintenance is required (yellow), service meter reading is 252 Hours.

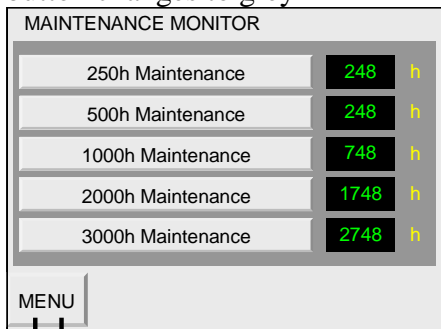
When you select the yellow button, it changes to blue and starts blinking.



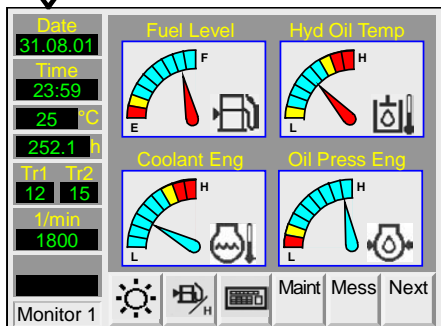
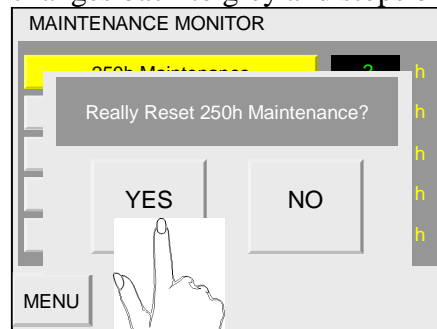
When you press the blinking button again, the following screen appears.



If the display color changes from yellow to grey, also the "MAINT" button changes to grey

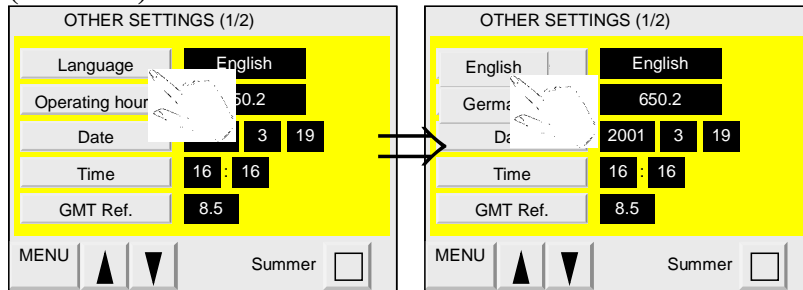


When you press the YES button, the color changes back to grey and stops blinking



14.2.11 Settings (No. 4.8.1 – No. 4.8.10)

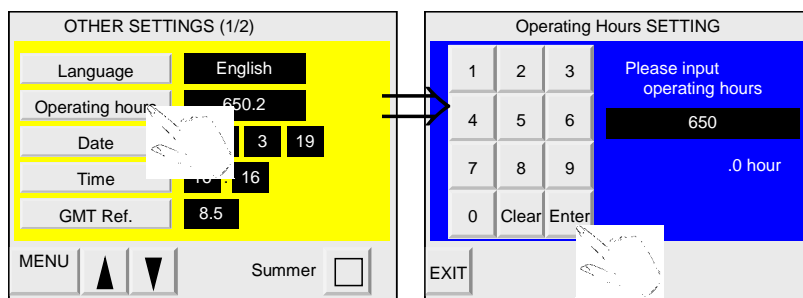
Other Settings 1/2
(No. 4.8.3)



Language selector button:

When the language menu appears, select a desired language.

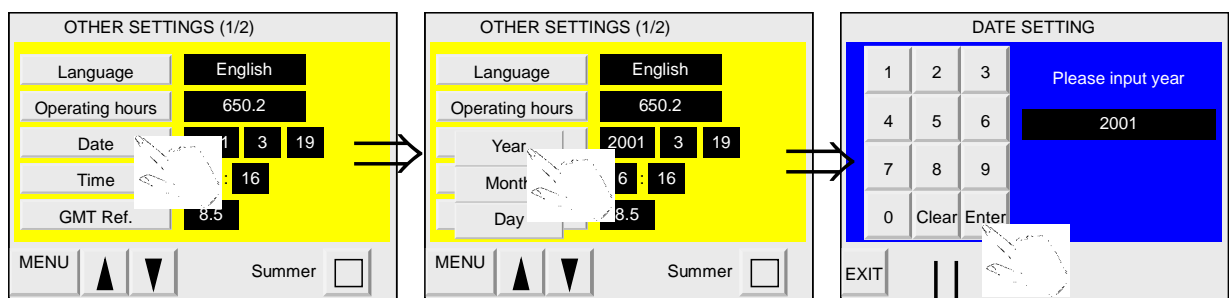
The CGC is reset on a software basis. The screen disappears and then the software is restarted from the opening screen.



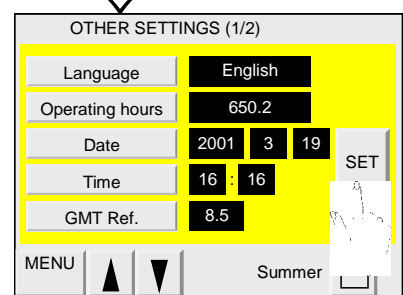
SMR setting button:

Only an integer can be entered as a numerical value. Decimal numbers cannot be entered.

Set the service meter only while the engine is stopped.



For all DATE SETTINGS, i.e. Year Month and Day it is necessary to confirm the new settings by using the SET button.



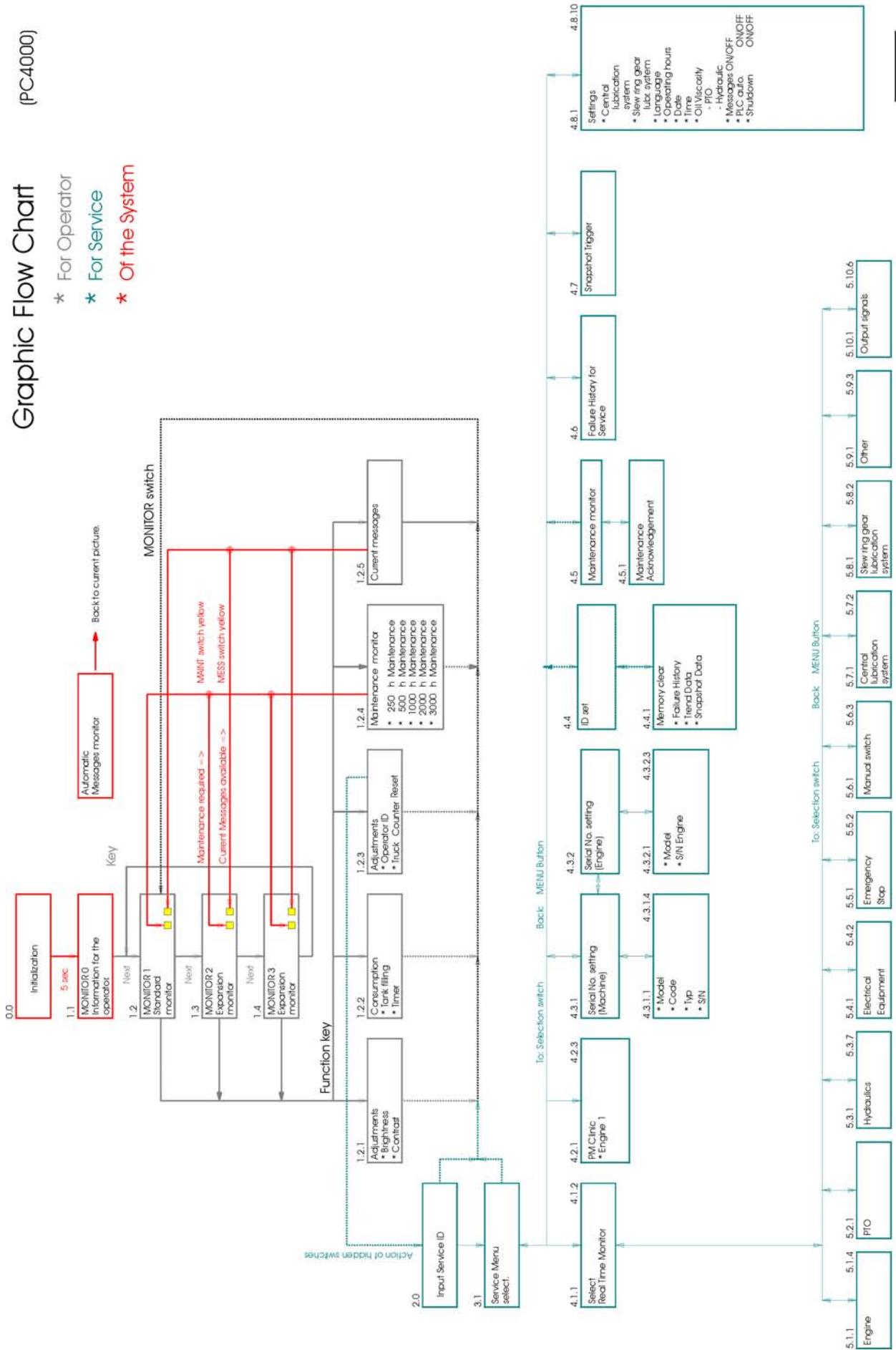
Graphic Flow Chart

(PC4000)

14.1
2

KOMATSU
MINING GERMANY

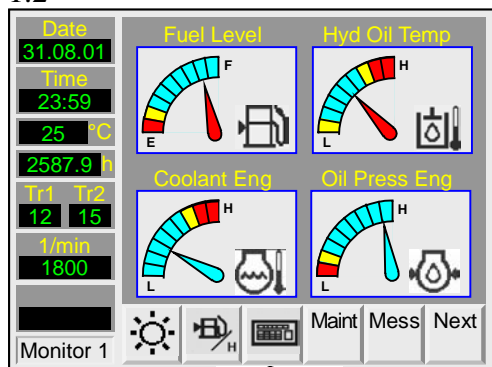
- * For Operator
- * For Service
- * Of the System



Z 21568

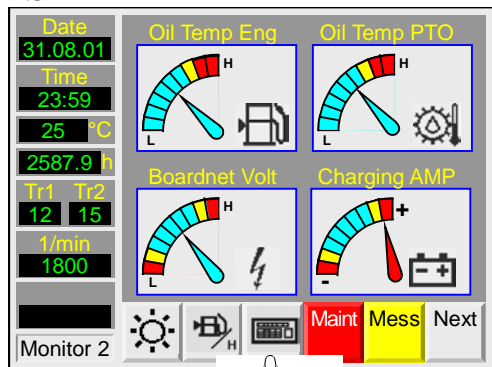
verm. bl. 202

1.2

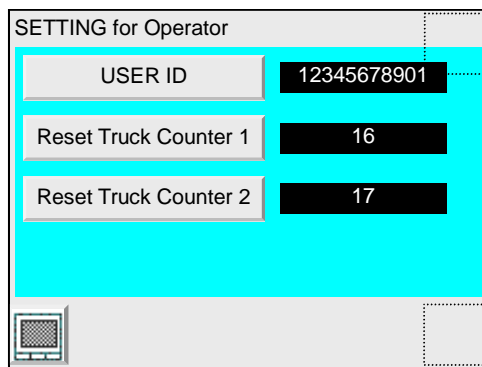


Operator Menu	
0.0	Initialization
1.1	Information
Machine Conditions:	
1.2	Monitor1 Standard monitor
1.3	Monitor2 Expansion monitor
1.4	Monitor3 Expansion monitor
1.2.1	Screen Adjustment
1.2.2	Consumption
1.2.3	Operator ID
1.2.4	Maintenance Monitor
1.2.5	Current Messages

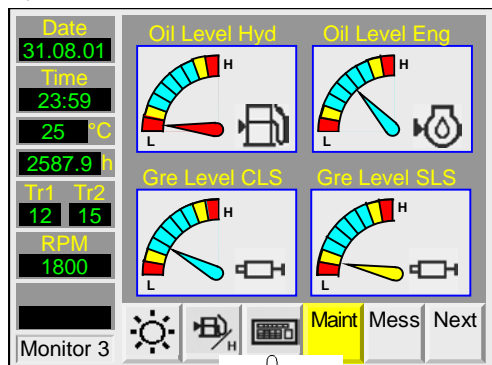
1.3



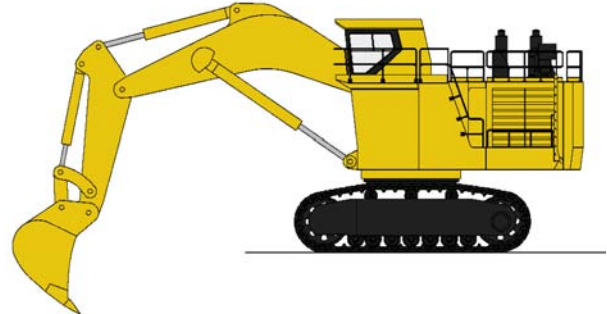
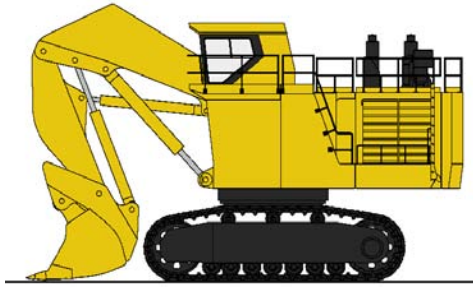
1.2.3



1.4



Komatsu Hydraulic Mining Shovel



PC 4000 Vehicle Health Monitoring System

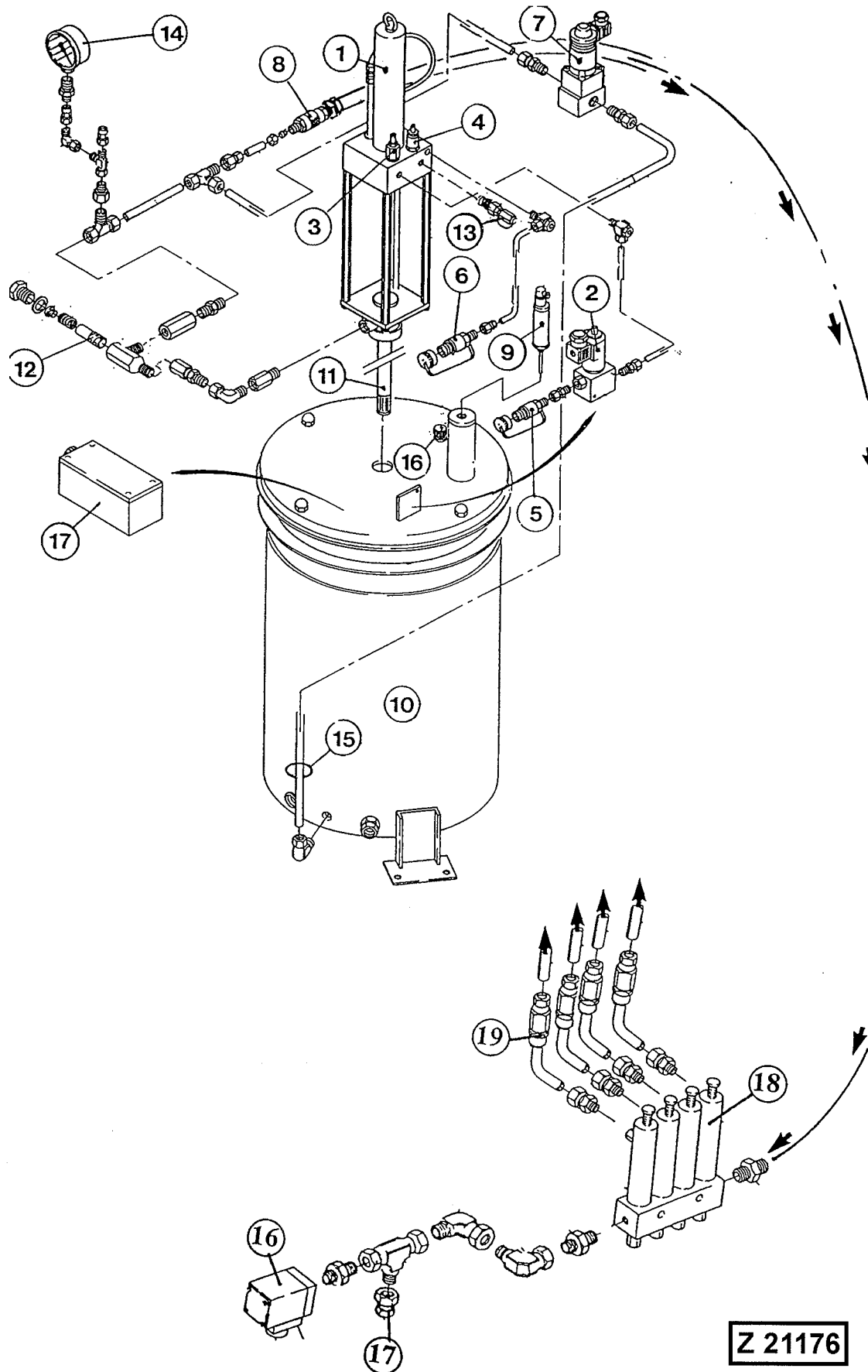


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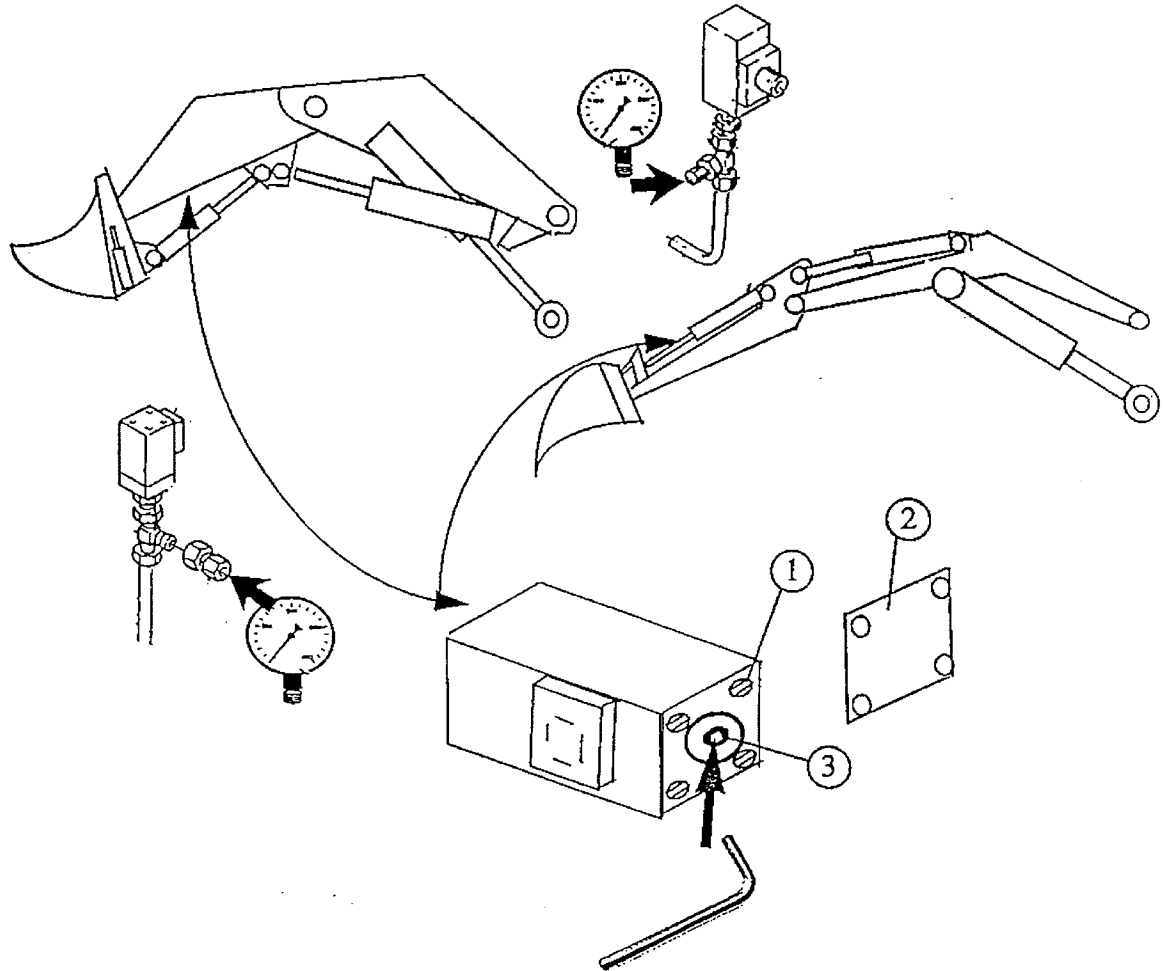
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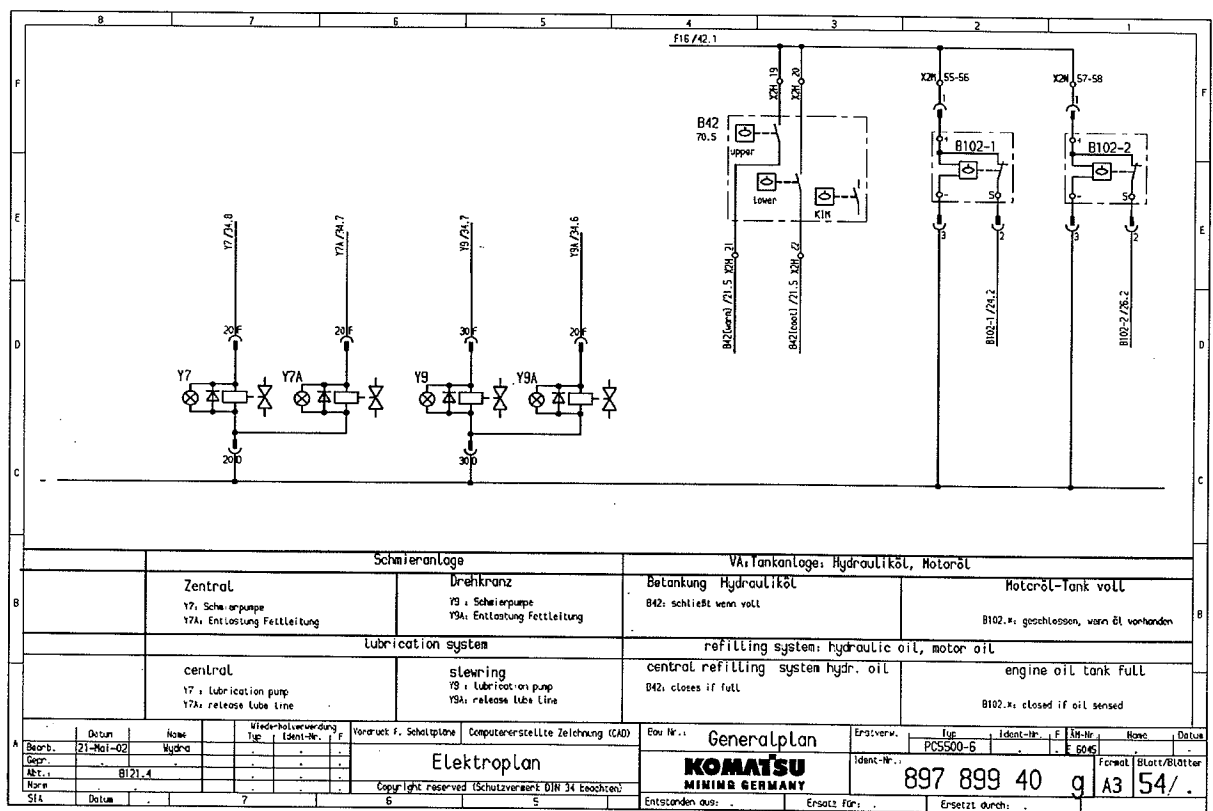
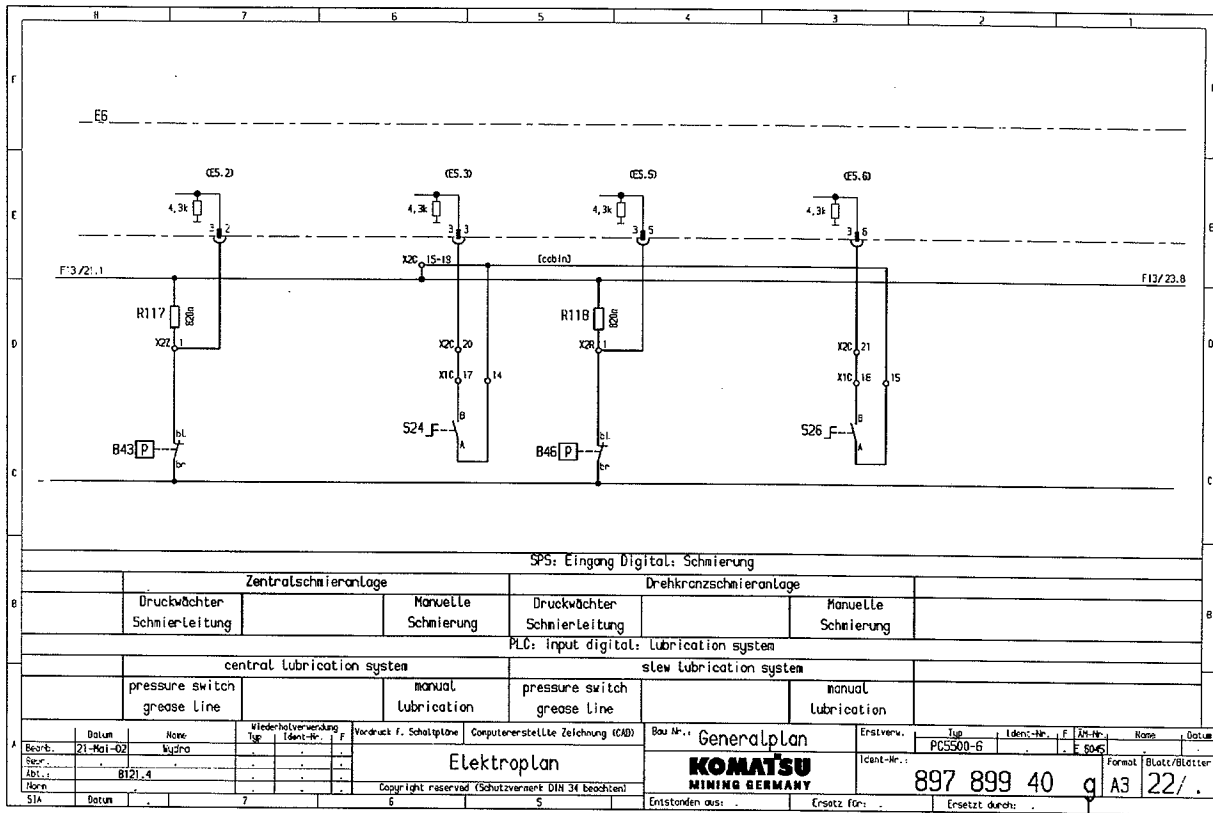
	Page
Function	2 - 4
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Z 21176



Z 21180



Z 21177a

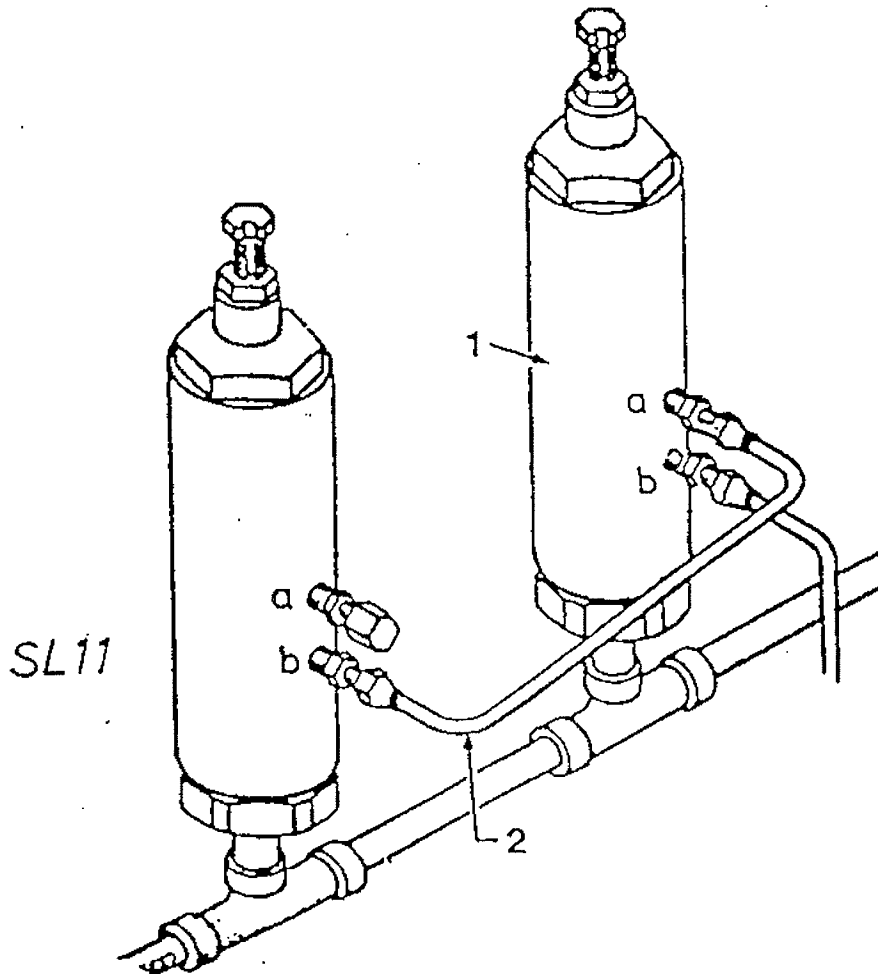
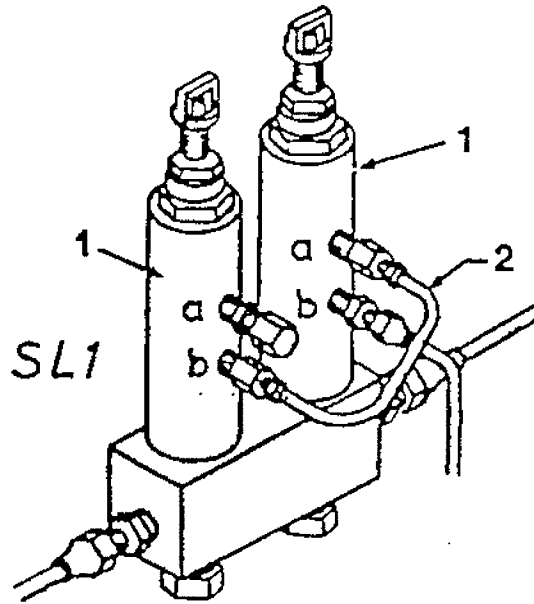


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Application	3
Examples of application	3
Erection and Installation	4
Operating instructions	4
Type identification	5
Troubleshooting	5
Technical Data	5
Dimensions	6

Safety Instructions

Use in conformity with the intended application

- The solenoid valves are exclusively intended for use in centralized lubrication systems and centralized lubricant supply systems.
- The maximum ratings specified in the "Technical Data", particularly the maximum operating pressure, must not be exceeded on no account.
- Any other use is not conform to the intended application.
- The manufacturer is not liable for damage resulting from any other use.

Maintenance and Repairs

- Before maintenance or repair work is carried out on the solenoid valves, observe the content of the Owner's Manual and the Safety Instructions.
- The Owner's Manual must be available on the site where the solenoid valves are in operation.
- Alterations or modifications of the solenoid valves are only authorized if approved by the manufacturer.
- For repairs, use only original spare parts.
- If other parts are used, the manufacturer may be released from its liability for the resulting damage.

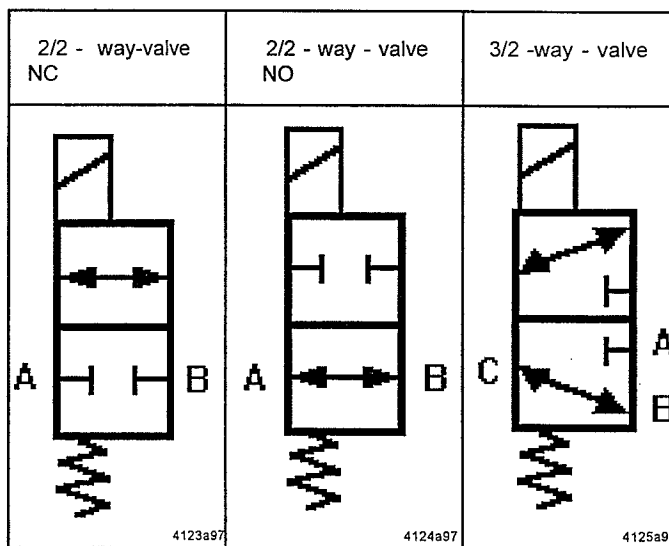
Operation of the Solenoid Valves

- Use the solenoid valves only if they are in good technical condition.
- Defects and faults which impair the safety must be eliminated immediately.
- The function of the solenoid valves is only guaranteed if they are used with clean lubricant.
- If you need more information than is given in this Owner's Manual, please contact our company (refer to the address in the footer).

Structure

- The solenoid valves are ball seat valves equipped with a dry armature solenoid.
- In the 2/2-way design, the passage B -A may be closed or opened, in the 3/2-way design the inlet is connected to either outlet.
- The basic position (solenoid not actuated) is obtained automatically via a return spring, the operating position is maintained as long as voltage is applied to the solenoid.
- The solenoid valves are switchable and can be pressure-loaded in both flow directions.

Available Versions:




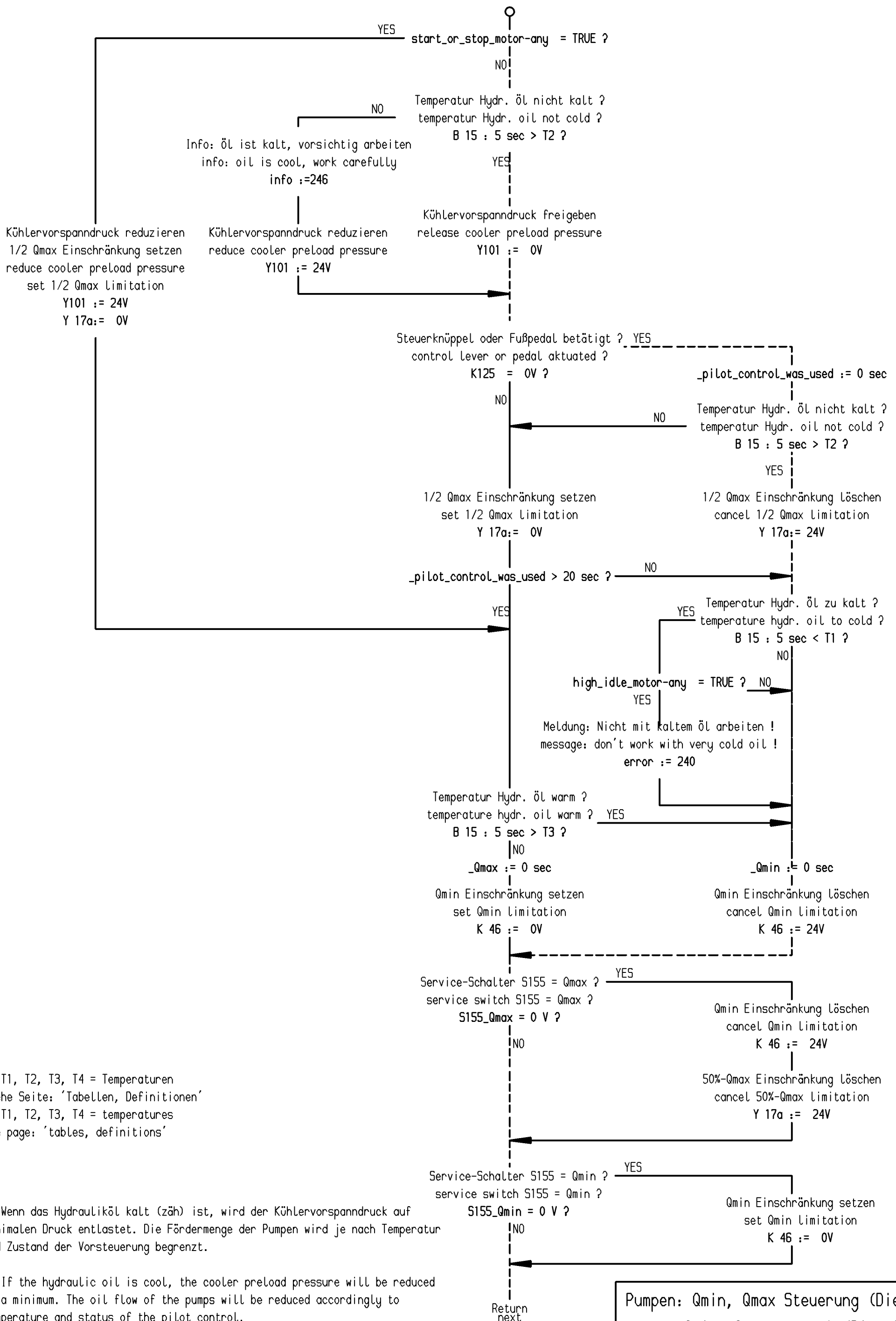
Subject to change without notice

17	S 11.3 = 24V ? (SLOW ON)	41	error := 065	42	info := 005
62	S 23 = 24V ?	64	error := 066	52	info := 012
62	S 23 = 24V ?	59	error := 067	52	info := 013
63	S 23 = 24V ?	65	error := 069	67	info := 091
52	S 24 = 24V ?	65	error := 070	37	info := 092
52	S 26 = 24V ?	51	error := 071	37	info := 093
38	S 27 = 24V ?	46	error := 072	37	info := 094
45	S 28 = 0V ?	46	error := 073	37	info := 095
67	S 28 : 2 sec = 0V ?	46	error := 074	67	info := 096
35	S 30 = 24V ?	46	error := 075	37	info := 100
40	S 31 : 2 sec = 0V ?	46	error := 076	57	info := 207
37	S 33a : 2 sec = 0V ?	46	error := 077	57	info := 208
37	S 33b : 2 sec = 0V ?	46	error := 078	13	info := 242
37	S 33c-1 : 2 sec = 0V ?	46	error := 079	58	info := 243
37	S 36 : 2 sec = 0V ?	46	error := 080	43	info := 247
56	S 41 : 0.5 sec = 0V ?	68	error := 081	64	info := 257
63	S 43 = 24V ?	36	error := 090	34	info := 351
37	S 58 : 2 sec = 0V ?	37	error := 100	34	info := 352
30	S 74 = 24V ?	60	error := 104	10	info := 353
33	S 74 = 24V ?	60	error := 105	70	info := 354
62	S 87 = 0V ?	44	error := 140	33	info :=101
45	S 94 = 0V ?	45	error := 141	30	info :=102
62	S 94 = 0V ?	46	error := 143	33	info :=103
62	S 94 = 0V ?	46	error := 144	14	info :=246
67	S 94 = 0V ?	46	error := 145	15	interval := FALSE
14	S155_Qmax = 0 V ?	46	error := 146	15	interval := TRUE
14	S155_Qmin = 0 V ?	51	error := 147	17	interval = TRUE ?
64	Y 6a-1 := 0V	58	error := 148	62	Last_move_was_downwards = TRUE ?
64	Y 6a-1 := 0V	46	error := 149	62	Last_move_was_downwards := FALSE
64	Y 6a-1 := 24V	49	error := 151	62	Last_move_was_downwards := TRUE
64	Y 6a-1 := 24V	49	error := 153	62	Last_move_was_downwards := TRUE
64	Y 6b-1 := 0V	47	error := 154	11	low_idle_motor-x = TRUE ?
64	Y 6b-1 := 0V	48	error := 155	11	low_idle_motor-x := FALSE
64	Y 6b-1 := 0V	49	error := 157	11	low_idle_motor-x := FALSE
64	Y 6b-1 := 24V	49	error := 158	11	low_idle_motor-x := FALSE
54	Y 7a := 0V	50	error := 159	11	low_idle_motor-x := TRUE
53	Y 7a := 24V	61	error := 160	16	lower_down: 24->0V ?
54	Y 9a := 0V	59	error := 161	70	lube_display_counter-u -> to memory
53	Y 9a := 24V	60	error := 162	54	lube_display_counter-u := lube_counter-u + 1
14	Y 17a := 24V	56	error := 163	10	lube_display_counter-u <- from memory
14	Y 17a := 0V	61	error := 164	53	lube_request-u := lube_request-u - 1
14	Y 17a := 0V	50	error := 165	54	lube_request-u := lube_request-u - 1
14	Y 17a := 24V	49	error := 166	54	manual_lube-u := FALSE
65	Y 53-x := 0V	49	error := 168	52	manual_lube-u := TRUE
65	Y 53-x := 24V	46	error := 169	53	manual_lube-u = TRUE ?
53	Y 7 (K29) := 0V	47	error := 169	54	manual_lube-u = TRUE ?
54	Y 7 (K29) := 0V	48	error := 170	55	manual_lube-u = TRUE ?
53	Y 7 (K29) := 24V	49	error := 171	54	press_decrease-u = TRUE ?
53	Y 9 (K36) := 0V	49	error := 172	54	press_decrease-u := FALSE
54	Y 9 (K36) := 0V	43	error := 173	54	press_decrease-u := FALSE
53	Y 9 (K36) := 24V	43	error := 174	53	press_decrease-u := TRUE
14	Y101 := 0V	43	error := 175	52	press_decrease_too_long-u = TRUE ?
14	Y101 := 24V	59	error := 176	52	press_decrease_too_long-u := FALSE
14	Y101 := 24V	60	error := 177	55	press_decrease_too_long-u := FALSE
62	Y124a := 0V	60	error := 178	54	press_decrease_too_long-u := TRUE
62	Y124a := 0V	44	error := 179	53	press_increase-u = TRUE ?
62	Y124a := 24V	45	error := 180	53	press_increase-u := FALSE
62	Y124b := 0V	45	error := 181	53	press_increase-u := FALSE
62	Y124b := 0V	52	error := 184	55	press_increase-u := TRUE
62	Y124b := 24V	52	error := 185	52	press_increase_too_long-u = TRUE ?
62	arm_is_already_moving = TRUE ?	52	error := 186	52	press_increase_too_long-u := FALSE
62	arm_is_already_moving := FALSE	52	error := 187	55	press_increase_too_long-u := FALSE
62	arm_is_already_moving := TRUE	52	error := 188	53	press_increase_too_long-u := TRUE
68	bucket_off_(oiltemp) = TRUE ?	52	error := 189	12	running_motor-1 = TRUE ?
64	bucket_off_(oiltemp) := FALSE	14	error := 240	64	running_motor-1 = TRUE ?
64	bucket_off_(oiltemp) := TRUE	38	error := 251	67	running_motor-any = TRUE ?
70	controller_setting = TRUE ?	37	error := 252	12	running_motor-any := FALSE
70	controller_setting = TRUE ?	37	error := 253	12	running_motor-any := TRUE
40	error := 001	37	error := 254	11	running_motor-x := FALSE
56	error := 003	37	error := 255	11	running_motor-x := TRUE
41	error := 007	18	first_cycle := TRUE	69	short_circuit_output_group_A1-X := FALSE
39	error := 008	18	first_cycle = FALSE ?	69	short_circuit_output_group_A13-X := FALSE
39	error := 009	63	flag tank_full := FALSE	69	short_circuit_output_group_A3-X := FALSE
39	error := 010	63	flag tank_full := TRUE	69	short_circuit_output_group_A5-X := FALSE
39	error := 011	63	flag tank_full = TRUE ?	69	short_circuit_output_group_A7-X := FALSE
40	error := 020	12	high_idle_motor-1 = TRUE ?	35	shutdown_low_idle_motor-all = TRUE ?
39	error := 021	14	high_idle_motor-any = TRUE ?	13	shutdown_low_idle_motor-all := FALSE
39	error := 022	12	high_idle_motor-any := FALSE	39	shutdown_low_idle_motor-all := TRUE
39	error := 023	12	high_idle_motor-any := TRUE	39	shutdown_motor-1 := TRUE
39	error := 024	11	high_idle_motor-x = TRUE ?	40	shutdown_motor-1 := TRUE
38	error := 060	11	high_idle_motor-x := FALSE	41	shutdown_motor-1 := TRUE
11	error := 061	11	high_idle_motor-x := FALSE	13	shutdown_motor-x = TRUE ?
11	error := 062	11	high_idle_motor-x := FALSE	13	shutdown_motor-x := FALSE
64	error := 063	11	high_idle_motor-x := TRUE	11	shutdown_motor-x := TRUE
41	error := 064	56	info := 002	17	slow_speed_on := FALSE

↑
Seite
page

Querverweisliste
cross reference list

Datum		Computererstellte Zeichnung (CAD)	Bau Nr.:	08170	Typ	Ident-Nr.	F	ÄM-Nr.	Name	Datum
Bearb.	31.05.06	Abel			PC4000-6	.	.	E7753	.	.
Gepr.	-	-			Ident-Nr.:	Format	Blatt/Blätter			
Abt.:	8125				942 107 40	A3	4 / 70			



D: T1, T2, T3, T4 = Temperaturen
siehe Seite: 'Tabellen, Definitionen'
E: T1, T2, T3, T4 = temperatures
see page: 'tables, definitions'

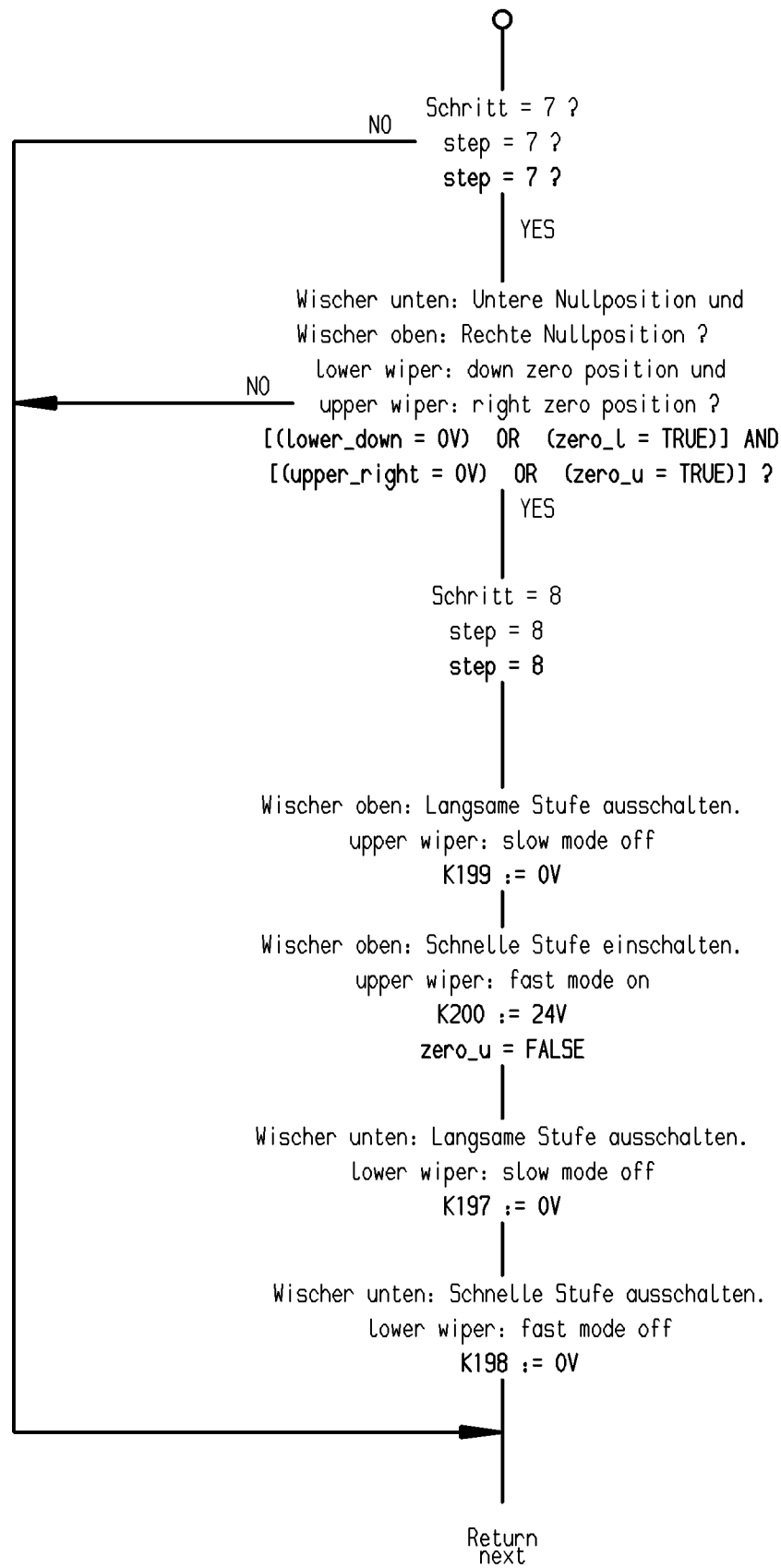
D: Wenn das Hydrauliköl kalt (zäh) ist, wird der Kühlervorspanndruck auf minimalen Druck entlastet. Die Fördermenge der Pumpen wird je nach Temperatur und Zustand der Vorsteuerung begrenzt.

E: If the hydraulic oil is cool, the cooler preload pressure will be reduced to a minimum. The oil flow of the pumps will be reduced accordingly to temperature and status of the pilot control.

Pumpen: Qmin, Qmax Steuerung (Diesel)
pumps: Qmin, Qmax control (Diesel)

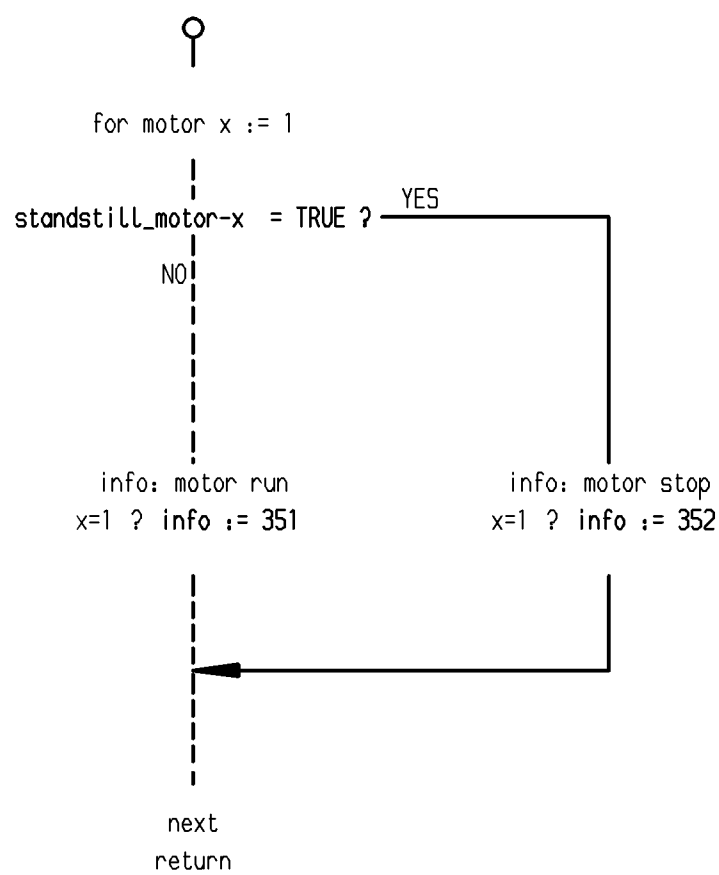
	Datum	Name	Computererstellte Zeichnung (CAD)	Bau Nr.:	08170	Typ	Ident-Nr.	F	ÄM-Nr.	Name	Datum
Bearb.	05-APR-06	Abel	A-Plan Flowchart	KOMATSU MINING GERMANY		PC4000-6	.	.	E7753		
Gepf.					Ident-Nr.:	942 107 40	Format	A3	Blatt/Blätter	14 / 70	
Abt.:	8125										

Oberer Wischer startet.
upper windscreen wiper starts.



Scheibenwischersteuerung (Teil 10)
window wiper control (part 10)

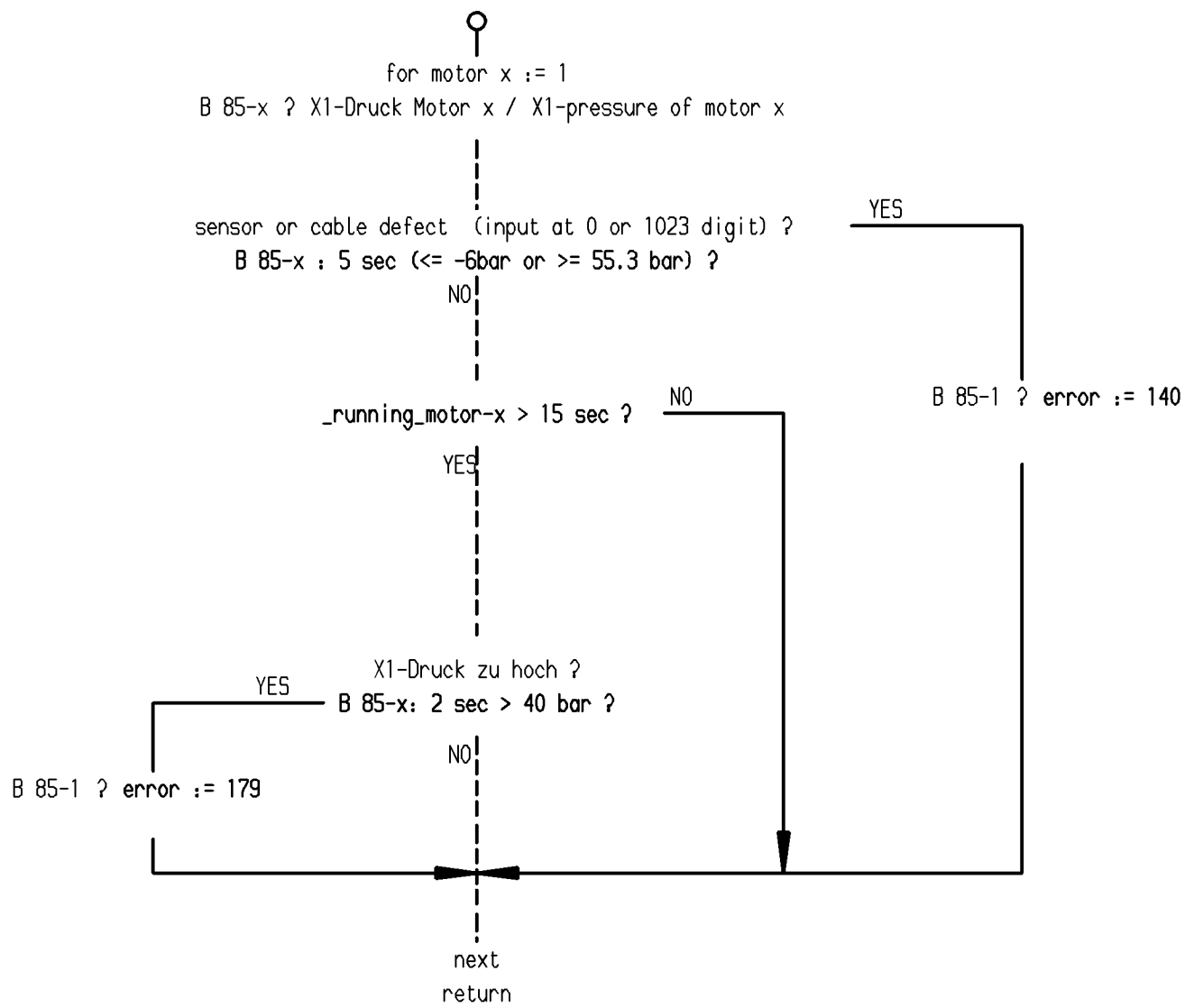
			Computererstellte Zeichnung (CAD)		Bau Nr.: 08170		Typ	Ident-Nr.	F	ÄM-Nr.	Name	Datum
Bearb.	05-APR-06	Abel	A-Plan Flowchart		KOMATSU MINING GERMANY		PC4000-6	.	.	E7753	.	.
Gepr.	-	-					Ident-Nr.:	942 107 40	Format	A3	Blatt/Blätter	24 / 70
Abt.:	8125						Copyright reserved (Schutzvermerk DIN 34 beachten)					



- D: Wenn der Motor stillsteht, wird die Meldung "Motor steht" ausgegeben.
Wenn der Motor läuft, wird die Meldung "Motor läuft" ausgegeben.
- E: When the engine is at standstill, the message "engine stop" is displayed.
When the engine is at running, the message "engine run" is displayed.

Ausgabe der Start/Stop Meldungen
output of start_or_stop messages

Datum		Name		Computererstellte Zeichnung (CAD)		Bau Nr.: 08170		Typ		Ident-Nr.	F	ÄM-Nr.	Name		Datum
05-APR-06		Abel		A-Plan Flowchart				PC4000-6		.	.	E7753			
Gepr.								Ident-Nr.:		Format		Blatt/Blätter			
8125								942 107 40		A3		34 / 70			
Copyright reserved (Schutzvermerk DIN 34 beachten)															



D: Überwachung des X1-Druck (für die Pumpenregelung). Ist der Druck zu hoch erfolgt eine Fehlermeldung. Ein Defekt des Sensors oder der Zuleitungen wird nach Möglichkeit angezeigt.

E: Monitoring the X1 pressure (for pump control). A message will be displayed if the pressure is too high or out of range.

X1-Drücke für Pumpenregelung
X1-pressures for pump control

			Computererstellte Zeichnung (CAD)		Bau Nr.: 08170		Typ	Ident-Nr.	F	ÄM-Nr.	Name	Datum
Bearb.	05-APR-06	Abel	A-Plan Flowchart		KOMATSU MINING GERMANY		PC4000-6	.	.	E7753	.	.
Gepr.	-	-					Ident-Nr.:	942 107 40	Format	A3	Blatt/Blätter	44 / 70
Abt.:	8125											

D: Schmieranlage: (siehe Diagramm auf der nächsten Seite) Nach Einschalten der ECS läuft zuerst die Pausenzeit ab (Entsprechend der Eingabe: `_user_set_pause_time`). Während die Pausenzeit läuft, gilt: `_press_increase = FALSE`, sowie `_press_decrease = FALSE`. Am Ende der Pausenzeit wird `press_increase = TRUE` gesetzt und es erfolgt der Druckaufbau. Ist der Abschalt- druck erreicht, wird `_press_increase = FALSE`, sowie `_press_decrease = TRUE` ge- setzt und die Pumpe wird abgeschaltet. Nach einer Zeitverzögerung "Haltezeit" erfolgt die Druckentlastung der Schmierleitungen. Sind die Leitungen entlastet, wird `_press_decrease = FALSE` gesetzt. Damit beginnt wieder die Pausenzeit.

Dauert der Druckauf-, bzw. Druckabbau zu lange, wird eine Fehlermeldung ausgege- ben und es beginnt wieder die Pausenzeit.

Schmierungen können manuell angefordert werden. Das heißt, je nach Anzahl der Tastendrucke werden entsprechend viele Schmierzyklen durchgeführt.

Wenn das Fettfaß leer ist, wird eine Meldung ausgegeben und Schmierzyklen nicht mehr durchgeführt. Bei 5% Restinhalt wird eine Meldung ausgegeben.

E: Lubrication System: (see diagram on next page) After the ECS is switched on, first the pause time runs (according to: `_user_set_pause_time`). The following settings are valid during the pause time: `_press_increase = FALSE`, and `press_decrease = FALSE`. When the pause time finished `_press_increase` will be set to TRUE and the pressure increase phase follows. When the final pressure is reached, `_press_increase = FALSE` is set and at the same time `_press_decrease = TRUE` will be set and the pump is switched off. After a time delay "holding time" passed by, the pressure relief of the lubrication system starts. Is the pressure low again, `_press_decrease = FALSE` will be set. This means, the pause time starts again.

If the time needed for pressure increase or decrease is too long, an error mes- sage will be displayed and the pause time starts again.

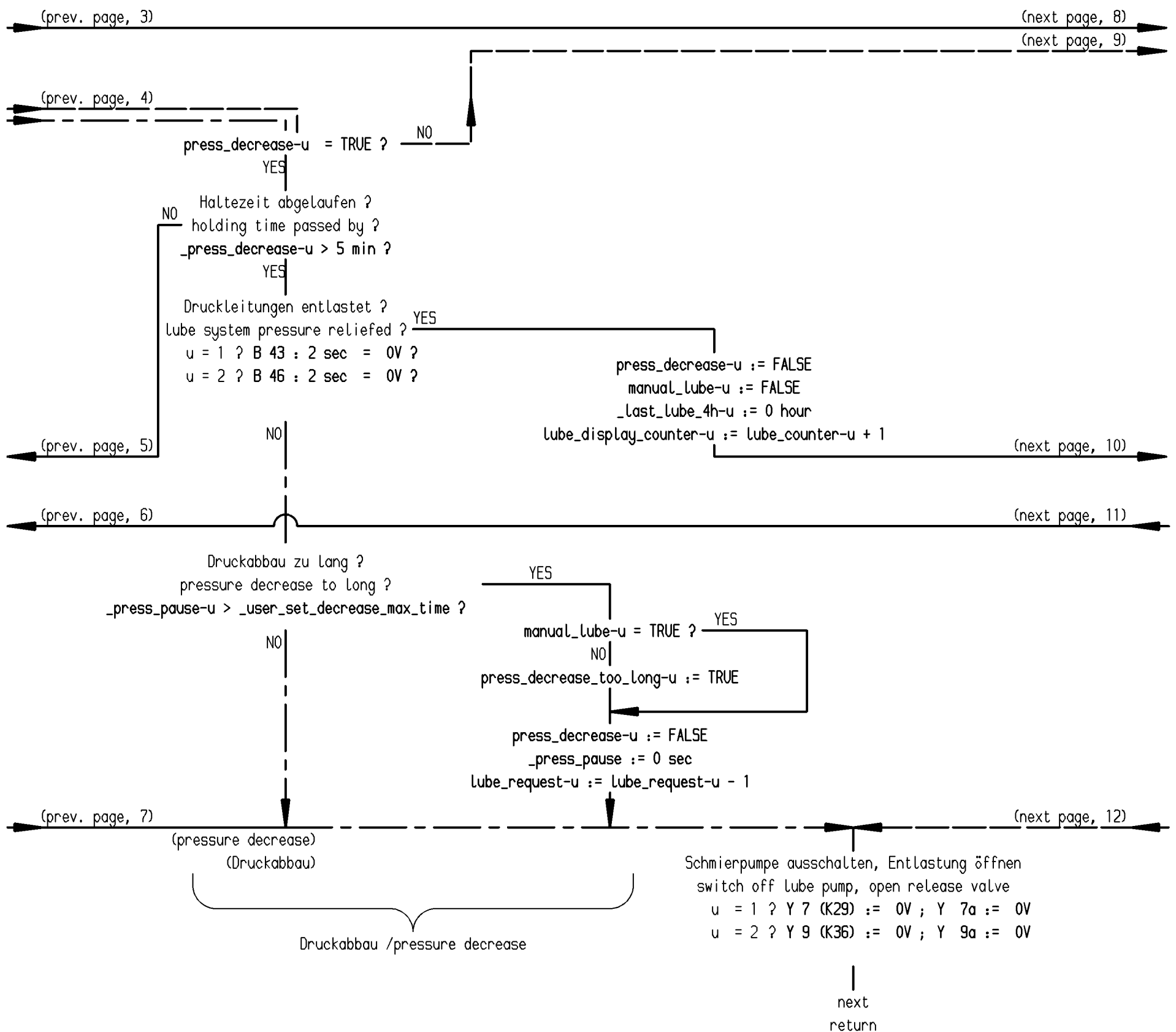
Lubrications may be requested manually. According to the number the switch is pressed, lube cycles will be run.

If the grease barrel is empty, a message will be displayed and no further lube cycles executed. At a level of 5% a message will be displayed.

----- = Druckaufbau / pressure increase
 - - - - - = Druckabbau / pressure decrease
 _____ = Pause / pause

D: Diese Zeiten werden an der ECS eingegeben:
 E: this times are set by user input at ECS:

	min.	max.	default
<code>_user_set_increase_max_time-u</code>	1 min.	20 min.	20 min.
<code>_user_set_decrease_max_time-u</code>	10 min.	15 min.	10 min.
<code>_user_set_pause_time-u1</code>	10 min.	60 min.	40 min.
<code>_user_set_pause_time-u2</code>	10 min.	20 min.	10 min.



Schmierpumpe ausschalten, Entlastung öffnen
 switch off lube pump, open release valve
`u = 1 ? Y 7 (K29) := 0V ; Y 7a := 0V`
`u = 2 ? Y 9 (K36) := 0V ; Y 9a := 0V`

Power-Master Schmieranlage					
Power-Master lube system					
Typ	Ident-Nr.	F	ÄM-Nr.	Name	Datum
PC4000-6	.	.	E7753	.	.
Ident-Nr.:			Format	Blatt/Blätter	
942 107 40			A3	54 / 70	

Datum		Name		Computererstellte Zeichnung (CAD)		Bau Nr.:	
05-APR-06		Abel		A-Plan		08170	
Gep.				Flowchart		KOMATSU	
Abt.: 8125						MINING GERMANY	

40		E12
41		A 6
42	G12	
43. 1		C 2
43. 5		B 7
44. 1	B11	
44. 2	B 9	
45	B10	
46. 1	G10	
46. 2	G 7	
47		F 5
48. 1	H 4	
48. 2	H 3	
51. 1		B 2
51. 2		B 2
52		C 2
53		B 6
54		B 3
55		B 3
56. 2	C 3	
57. 1	B 4	
57. 2	B 3	
59. 1		B 5
59. 2		B 4
59. 3		B 4
59. 4		B 4
60. 1	H 4	
60. 2	H 3	
61. 1	H 4	
61. 2	H 2	
62. 1	B 3	
62. 2	A 4	
62. 3	A 2	
63		E 1
64. 1	G12	
64. 2	G11	
64. 3	G10	
64. 4	G10	
64. 5	G 8	
64. 6	G 8	
64. 7	G 7	
64. 8	G 7	
64. 9	G 5	
65. 1	G11	
65. 2	G 9	
65. 3	G 6	
65. 4	G 5	
66. 1	D11	
66. 2	D11	
66. 4	D 6	
66. 5	B11	
66. 7	B 8	
66. 8	B 8	
66. 9	B 8	
66.10	B 8	
66.11	B 7	
66.12	B 7	
67. 1	F 4	
67. 2		A 5
67. 3		A 3
67. 4		C 1
68. 1	D 6	
68. 2	B10	
68. 3	B10	
68. 4	B 9	
68. 5	B 7	
68. 6	B 7	
68. 7	B 7	

D: Häufig gestellte Fragen:

-- 1. Wie werden Relais dargestellt?

(Bild a): Relais werden getrennt als Spule und Kontakt(e) dargestellt. Zu dem Symbol "Spule" (a1) gehört der Name (a2) "K6" und die Klemmenbezeichnung (a3): "A1" und "A2". Unter der Spule wird gezeigt, welche Kontakte (a4) "1", "5", "9" geschaltet werden und auf welchem Blatt diese verwendet werden (a5) "04.4", also auf Blatt "04" in Spalte "4". Dort werden die Kontakte eingesetzt (a6), ebenfalls mit dem Namen (a7) "K6" und dem Hinweis, auf welchem Blatt die Spule zu finden ist (a8) "04.5": Blatt 4 in der Spalte 5.

-- 2. Was bedeutet die Skizze unter den Zeitrelais?

(Bild b): Sie zeigt, wie die unterschiedlichen Zeitrelais (b1, b2, b3) reagieren. Oben ist das Eingangssignal dargestellt (b4) (wann das Zeitrelais mit (+) verbunden ist), unten das Ausgangssignal (b5) (wann die Kontakte schalten). Beispiel in Bild b: 20 Sekunden (b6) "20s" nachdem das Relais aktiviert wurde (b7) schaltet das Relais seinen Kontakt (b8). Werden die "20s" nicht erreicht (b9), wird der Kontakt nicht geschaltet (b10).

-- 3. Was sind Potenzialverweise?

(Bild c): Wenn Verbindungen über mehrere Blätter verteilt verlaufen, erhalten Sie einen Potenzialverweis. Das Potenzial mit Namen "Lamp" (c1, c2) wird auf Seite 11 (c3) und auf Seite 18 (c4) verwendet. (c5) zeigt: Das Potenzial wird auf Blatt "18.2" weitergeführt. (c6) zeigt: Das Potenzial kommt von Blatt "11.3".

-- 4. Was sind Dioden?

(Bild d): Dioden (d1) lassen Strom nur in einer Richtung passieren: Nur wenn das Dreieck (d2) an Plus und der Strich (d3) an Minus ist. (d4) zeigt den Namen der Diode und (d5) gibt an, daß diese Diode zu einem Bauteil (Diodengatter) gehört, das auf Blatt "17.2" gezeigt wird. Mit zwei Pfeilen (d6) wird eine Leuchtdiode (LED) markiert.

-- 5. Bauteile auf mehreren Blättern?

(Bild e): Geräte können verteilt auf mehrere Blätter dargestellt werden. Das Gerät "E24" ist zum Teil auf Blatt "34" dargestellt, ein anderer Teil ist auf Blatt "39" zu finden. Verweise (e1) "39.8" und (e2) "34.1" zeigen jeweils die zugehörigen anderen Blätter.

-- 6. Kabelquerschnitte und Aufdruck?

(Bild f): Der Querschnitt für ein Kabel (f1) wird bei (f2) angegeben. Eine Kabelbedruckung wird bei (f3) gezeigt: "K73.2". Der Querschnitt gilt für alle nachfolgenden Kabel bis Masse.

-- 7. Farbbezeichnungen:

(Bild e): be: beige, bl: blau, br: braun; ge: gelb, gn: grün, gr: grau, or: orange, rs: rosa, rt: rot, sw: schwarz, vio: violett, ws: weiß.

-- 8. Bezeichnung der Bauteile:

A: Steuergerät, B: Sensor, C: Kondensator, D: Zeitrelais, E: Elektronisches Gerät, F: Sicherung, G: Batterie, Generator, H: Lampen, Hupe, K: Relais, M: Motor, P: Meßgerät, R: Widerstand, S: Schalter, T: Transformator, V: Dioden, X: Klemme, Stecker, Y: Ventil.

-- 8. Bezeichnung der Klemmen:

X1: in der Kabine, X2: im Kabinenuntersatz, X2A: Not-Aus, X2B: Batterie, X2C: Kabine, X2D: Hochdruckfilter / Pumpen, X2E: Zahnkranz / Leiter, X2F: Fernsteuerplatten, X2H: Hydrauliktank, X2K: Betankung, X2L: Beleuchtung / Fahralarm / Fahrerwarnanlage / Temperatur, X2M: Motor-1 / Motoröltank-1, X2N: Motor-2 / Motoröltank-2, X2R: Ritzelschmieranlage, X2S: Steuer+Filterplatte-1, X2T: Steuer+Filterplatte-2, X2V: (Varianten) Feuerlöschanlage, X2Y: Ventile, X2Z: Zentralschmieranlage.

-- 9. Mathematische Zeichen

">" bedeutet "größer als", z. B. "rpm > 300". "<" bedeutet "kleiner als".

(00-03-27.doc)

E: FAQ: Frequently asked questions

-- 1. How are relays represented?

(see illust. a): A relay is shown divided in coil and contact(s). To the symbol coil (a1) belongs the name (a2) "K6" and the terminal designation (a3): "A1" and "A2". Below the coil is shown which contacts (a4) "1", "5", "9" are operated and on which page they are used (a5): "04.4". That means on page "04" in column "4". At that page, the contacts are shown again (a6) with the name (a7) "K6" and a note on which page the coil can be found: (a8) "04.5": Page 4 in column 5.

-- 2. What is the meaning of the sketch below the time relay?

(see illust. b): It shows how the different time relays react. On top a input signal is shown (b4), below the output signal (b5). Example in illust. b: 20 seconds (b6) "20s" after activation of the relay (b7) the relay switches its contact (b8). If the "20s" will not be obtained (b9), the contact will not be switched (b10).

-- 3. What are references?

(see illust. c): If connections are shown divided on several pages then they have a reference mark. The potential with the name "Lamp" (c1, c2) is used on page 11 (c3) and on page 18 (c4). (c5) shows: The potential will be continued on page "18.2". (c6) shows: The potential comes from page "11.3".

-- 4. What are diodes?

(see illust. d): Diodes (d1) let the current flow only in one direction: Only if the triangle (d2) is connected to "Plus" and the line (d3) to "Minus". (d4) indicates the name of the diode and (d5) informs that this diode belongs to a diode array shown on page "17.2". A LED is marked with two arrows (d6).

-- 5. Parts shown on several pages.

(see illust. e) Electrical devices can be represented distributed on several pages. The device "E24" is partially represented on page "34" another part of it you find on page "39". The references (e1) "39.8" and (e2) "34.1" indicate respectively the other pages belonging to.

-- 6. Cable cross section and cable imprints.

(see illust. f) The cross section for a cable (f1) is shown at (f2). A cable imprint is shown at (f3): "K73.2". The cross section applies for all following cables up to ground.

-- 7. Colour code

(see illust. e): be: beige, bl: blue, br: brown, ge: yellow, gn: green, gr: grey, or: orange, rs: pink, rt: red, vio: violet, ws: white

-- 8. Designation of electrical devices

A: Control units, B: sensors, pressure switches, C: capacitor, D: time relays, E: various devices, heating devices, air condition, lights, F: fuses, circuit breaker, G: batteries, alternators, generators, H: indicator lights, alarm, horn, K: Relay, M: motor, P: measuring instrument, R: resistor, S: switch, T: transformer, V: diodes, X: terminal, plug, Y: valve

-- 9. Designation of clips:

X1: inside cab, X2: inside cab-base, X2A: emergency shut-off, X2B: battery, X2C: cab, X2D: high pressure filter / pumps, X2E: rim / ladder, X2F: control plate assy-1, X2H: hydraulic oil tank, X2K: fuel filling, X2L: lighting / movement signal / driver warning / ambient temperature, X2M: engine-1 / engine oil tank-1, X2N: engine-2 / engine oil tank-2, X2R: slew lubrication system, X2S: hydraulic control panel-1, X2T: hydraulic control panel-2, X2V: (options) fire extinguish system, X2Y: valves, X2Z: central lubrication system.

-- 10. Mathematical symbols

">" means "more than", e.g. "rpm > 300", "<" means "less than"

(00-03-27_1.doc)

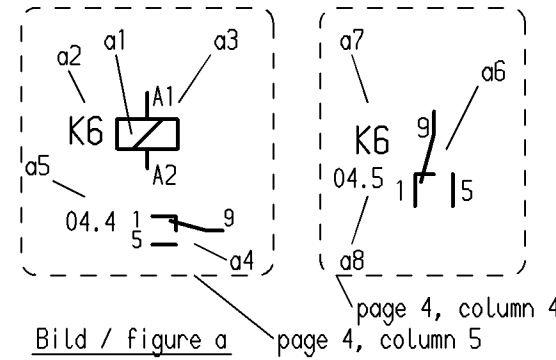


Bild / figure a page 4, column 5

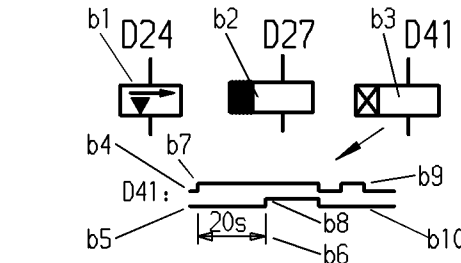


Bild / figure b

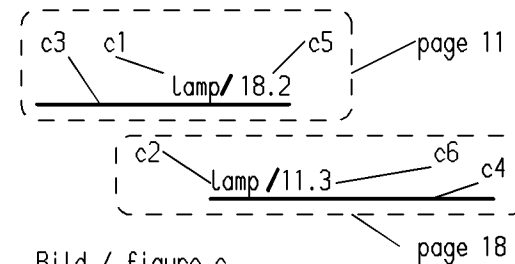


Bild / figure c

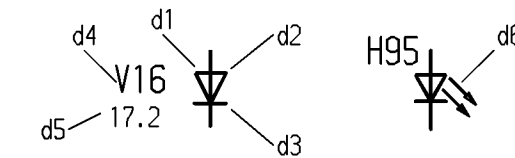


Bild / figure d

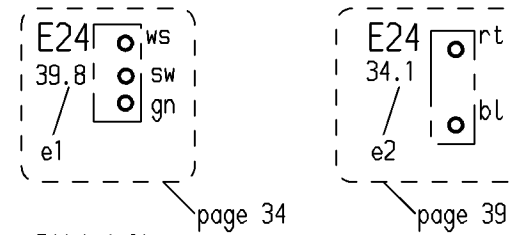


Bild / figure e

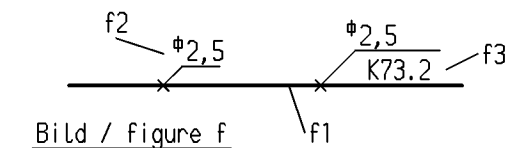


Bild / figure f

A	Datum	Name	Wiederholungsverwendung		Vordruck f. Schaltpläne	Computererstellte Zeichnung (CAD)	Bau Nr.: 08170	Erstverw. Typ	Ident-Nr. F	ÄM-Nr. E7753	Name	Datum
	Bearb.	05-APR-06	Abel	Typ								
	Gepr.	-	.	.		Elektroplan	FAQ: Häufig gestellte Fragen				A3	5 / 73
	Abt.:	8125	.	.		FAQ: frequently asked questions						
	Norm	.	.	.		Copyright reserved (Schutzvermerk DIN 34 beachten)						
	SIA	Datum	.	.	7	6	5	Entstanden aus:	Ersatz für:	Ersetzt durch:		

8

7

6

5

4

3

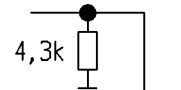
2

1

E6

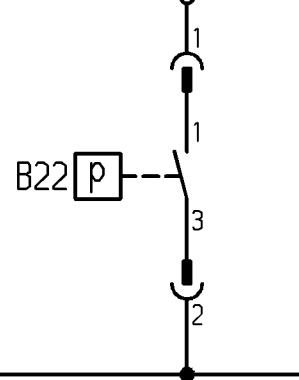
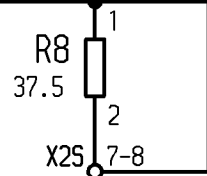
data word:
port name:

(E2.2)
_B22



F13/14.2

F13/16.8



SPS: Eingang Digital: Filter

Filter
Pumpenregelung

Schaltpunkt 5 bar diff.

PLC: input digital: filter

filter
pump control

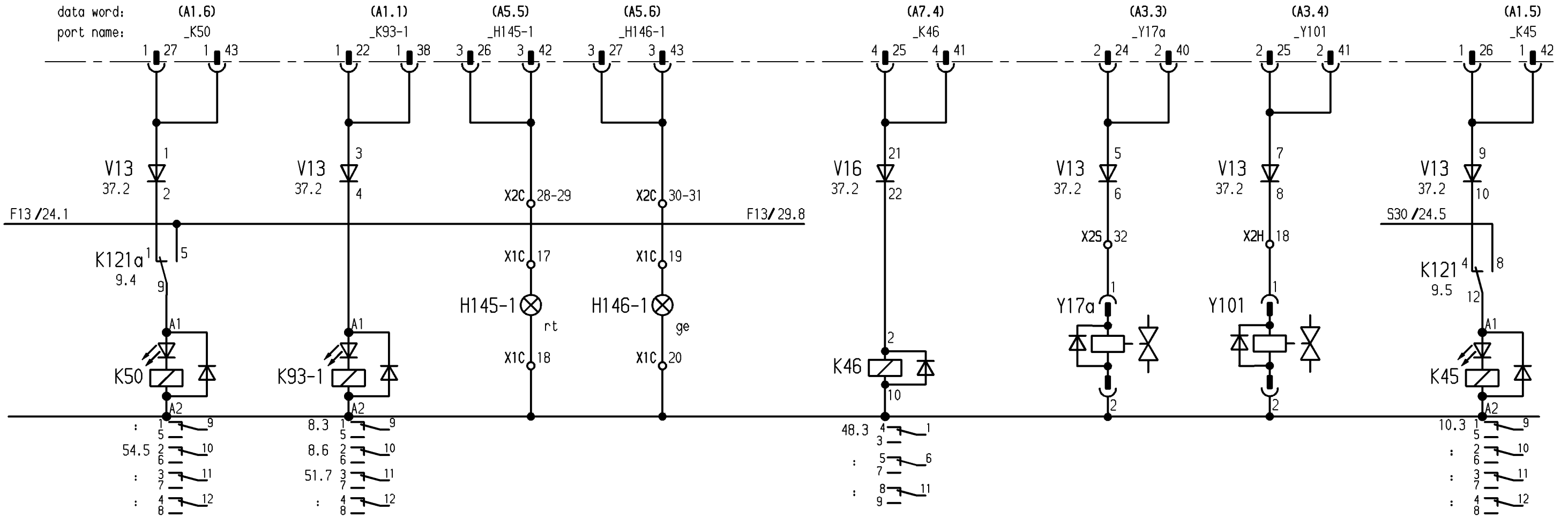
switch point 5 bar diff.

A	Datum	Name	Wiederholverwendung			Vordruck f. Schaltpläne	Computererstellte Zeichnung (CAD)	Bau Nr.: 08170	Erstverw.	Typ	Ident-Nr.	F	ÄM-Nr.	Name	Datum			
	Typ	Ident-Nr.	F	Ident-Nr.	F					ÄM-Nr.	Name	Datum						
Bearb.	05-APR-06	Abel	.	.	.	Elektroplan Copyright reserved (Schutzvermerk DIN 34 beachten)	KOMATSU MINING GERMANY	Ident-Nr.: 942 106 40	Format Blatt/Blätter A3 15/73									
Gepr.	-	-	.	.	.													
Abt.:	8125		.	.	.													
Norm			.	.	.													
SIA	Datum	.	7	6	5	Entstanden aus:	Ersatz für:	Ersetzt durch:										

Tabelle K50 / table K50

Ölsorte nach ISO oil grade acc. to ISO	VG22	VG32	VG46	VG68	VG100	TellLus Arctic 32
Schaltpunkt switching point	58°C	69°C	79°C	85°C	85°C	85°C

E6



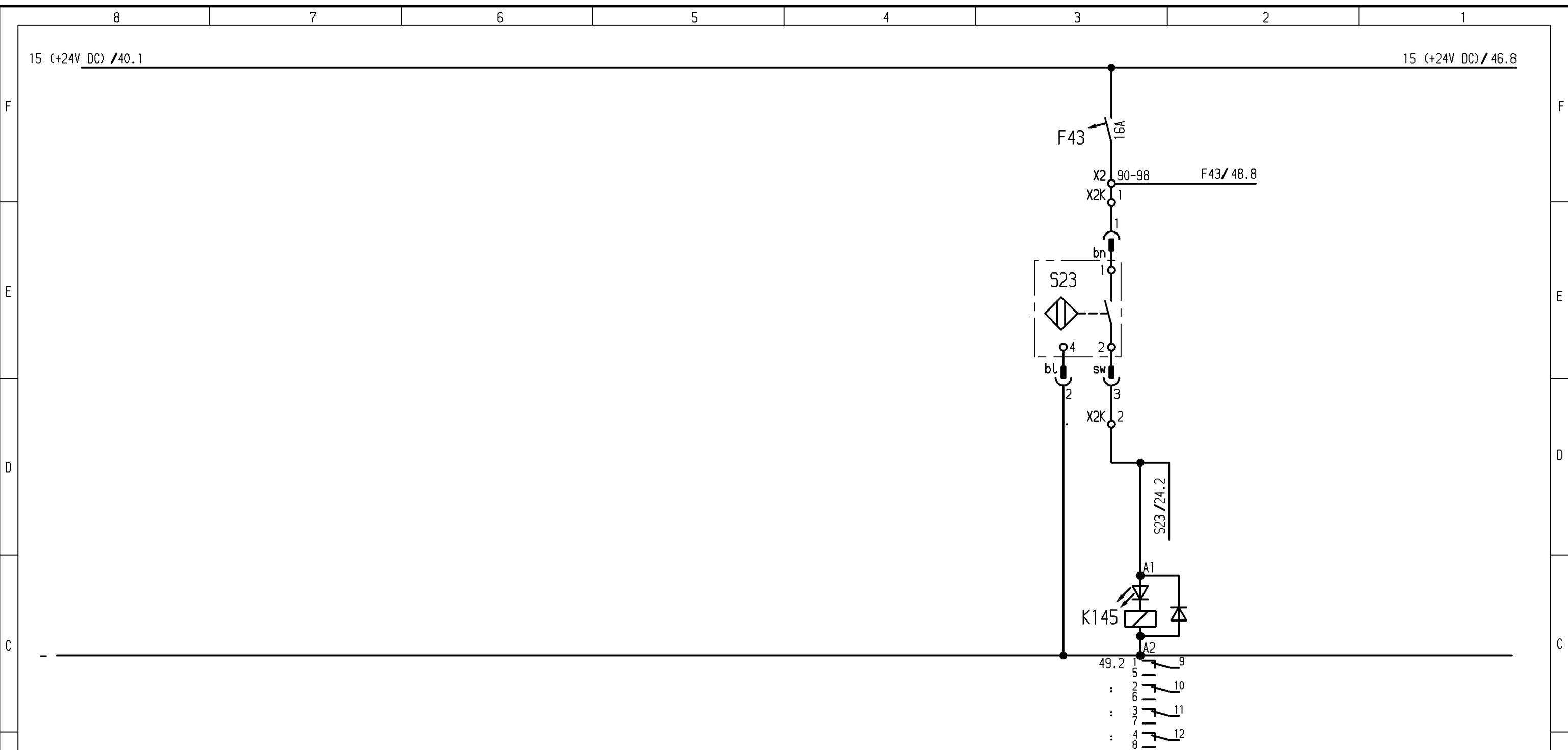
SPS: Ausgang Digital

Löffelabschaltung K50: aktiv = Schaufelbewegung freigeben	Shutdown Relais	H145: VHSM Diagnoselampe in der Kabine (rot) H146: VHSM Diagnoselampe in der Kabine (gelb 1)	Pumpensteuerung Qmin 1/2 Qmax Betrieb Y17a: aktiv = Pumpen: Fördermengeneinschränkung 1/2 Qmax aufheben	Reduzierung Vorspanndr. Y101 erregt = Ölkühlervorspanndruck reduziert	Drehzahlsteuerung
--	-----------------	---	---	--	-------------------

PLC: output digital

bucket shut off K50: active = enable bucket movement	shutdown relay	H145: VHSM diagnostic lamp in the cab (red) H146: VHSM diagnostic lamp in the cab (yellow 1)	pump control Qmin 1/2 Qmax operation Y17a: active = release: pumps from 1/2 Qmax restriction	reduction preload press. Y101 active = oil cooler preload pressure reduced	rpm control
---	----------------	---	--	---	-------------

Datum		Name		Wiederholverwendung		Vordruck f. Schaltpläne		Computererstellte Zeichnung (CAD)		Bau Nr.: 08170		Erstverw.		Typ		Ident-Nr.		F		ÄM-Nr.		Name		Datum	
Bearb.	05-APR-06	Abel		Elektroplan Copyright reserved (Schutzvermerk DIN 34 beachten)				KOMATSU MINING GERMANY		Ident-Nr.: 942 106 40		Format A3		Blatt/Blätter 25/73							
Gepr.	-	-																			
Abt.:	8125																				
Norm																					
SIA	Datum	.	.	7	.	6	.	5	Entstanden aus:		Ersatz für:		Ersetzt durch:												



Tankarm

S23: Endschalter Betankungsarm
geschlossen = oben

refilling arm

S23: Limit switch refilling arm
closed = upper position

A	Wiederholverwendung			Vordruck f. Schaltpläne	Computererstellte Zeichnung (CAD)	Bau Nr.: 08170	Erstverw. Typ	Ident-Nr. F	ÄM-Nr.	Name	Datum
	Typ	Ident-Nr.	F								
Bearb.	Datum	Name					PC4000-6		E7753		
Gepr.	05-APR-06	Abel	.								
Abt.:	8125		.								
Norm			.								
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