

# Shop Manual

# PC5500-6

## HYDRAULIC MINING SHOVEL SERIAL NUMBERS PC5500-6 15018

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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

## 1.1 Superstructure

Legend for illustration (Z 22386):

- (1) Operators Cab with integrated FOP system
- (2) Exhaust
- (3) Air cleaner
- (4) Cab support (contains the electrical switch board)
- (5) Swing ring connection
- (6) Fuel reservoir
- (7) Hydraulic ladder
- (8) Counter weight
- (9) Hydraulic oil cooler with hydraulic driven fans
- (10) Hydraulic oil reservoir
- (11) Batteries
- (12) Swing Gear
- (13) Grease pump of the **Central Lubrication System**
- (14) Grease pump of the **Swing gear pinion Lubrication System**
- (15) Main Control blocks with high pressure filters
  
- (16) Engine 1
- (17) Flexible coupling, oil filled
- (18) PTO gear with hydraulic pumps
- (19) Main hydraulic pumps 1, 2 and 3
- (20) Radiator for the engine cooling system
  
- (21) Engine 2
- (22) Flexible coupling, oil filled
- (23) PTO gear with hydraulic pumps
- (24) Main hydraulic pumps 4, 5 and 6
- (25) Radiator for the engine cooling system

**1.1 Superstructure**

## 1.1.5 Counter weight

Legend for illustration (Z 21474):

## (1) Counter weight

Total weight
40000 kg

## (2) Mounting bolts

Quantity	Bolt size (mm)	Grade	SW* (mm)	Tightening torque (Nm)
16	M 48 x 380	10.9	75	7500

\* SW = Wrench size

## (3) Lifting points

## 1.2 Under carriage

Legend for illustration (Z 21481):

- (1) Undercarriage center body
- (2) Crawler carrier R.H.-side
- (3) Crawler carrier L.H.-side
- (4) Connecting pins, center body to crawler carriers
- (5) Crawler tracks
- (6) Rotary distributor
- (7) Brake valves
- (8) Travel motors
- (9) Parking brakes, spring loaded disk type brakes
- (10) Travel gear
- (11) Sprocket
- (12) Track rollers
- (13) Carrier rollers
- (14) Guide wheel (Idler)

**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 x420	10.9	36	snugly

(4) Rubber-bounded metal bar

(5) Self locking nut M24

(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 230	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 22399):

- (1) Radiator
- (2) Intake air fan
- (10.1) Axial piston pump Engine 1 (fixed displacement pump, with variable setting)
- (10.3) Axial piston pump Engine 2 (fixed displacement pump, with variable setting)
- (23.1) Fan motor (Axial piston motor)
- (23.2) Fan motor (Axial piston motor)
- (41) Main oil reservoir
- (168.3) Pressure relief valve – Engine 1 radiator fan drive
- (168.4) Pressure relief valve – Engine 2 radiator fan drive
- (68.3) Pressure filter with pressure differential switch B21-1 (Engine 1)
- (68.5) Pressure filter with pressure differential switch B21-2 (Engine 2)
- (103.3) Check valve engine 1– (Anti cavitation valve for fan drive motor)
- (103.4) Check valve engine 2– (Anti cavitation valve for fan drive motor)
- (148.13) 4/3 direction flow valve – Engine 1 radiator fan speed (stop, low and high speed)
- (148.14) 4/3 direction flow valve – Engine 2 radiator fan speed (stop, low and high speed)
- (169.3) pressure reduction valve (low fan speed adjusting) engine 1
- (169.4) pressure reduction valve (low fan speed adjusting) engine 2
- (L) Leak oil (case drain) to tank
- (P) Pressure to motor
- (R) Return oil to tank

### **Function:**

From pump (10.1 / 10.3) flows the oil through the filter (68.3 / 68.5) to the fan motor (23.1 / 23.2) and then back to the tank.

The check valve (103.3 / 103.4) 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 (168.3 / 168.4). This valve works together with the 4/3 direction flow valve

**continued**

## 2.6 Pump distributor gearbox (PTO)

Legend for illustration (Z 22409):

- (1) Oil level gauge
- (2) Oil filler plug
- (3) Breather filter
- (4) Oil collector reservoir for auxiliary pump drive shaft housing
- (5) Breather filter with oil level gauge (drive shaft housing)
- (6) Main pump drive shaft housings
- (7) Oil level plug of main pump drive shaft housing
- (8) Oil filler plug with breather pipe of main pump drive shaft housing
- (9) Oil drain plug of main pump drive shaft housing
- (10) Oil drain plug of PTO gear
- (11) Flange for heater studs
- (12) Gear oil temperature probe mounting bore
- (13) Thermostat switch mounting bore cover plate
- (14) Suction line connection for gear oil cooling
- (15) Return line connection from gear oil cooler
- (D) Drive flange
- (M) Power take off for main pumps
- (R) Power take off for engine radiator fan drive pump
- (C) Power take off for hydraulic oil cooler fan drive pump

### **Description**

The pump distribution gear (PTO gear) is a spur gear design and driven by an diesel engine.

The PTO gear runs in antifriction bearings and has been provided with a splash lubrication system. The oil supply of the bearings and tooth contacts takes place by an injection. The gearwheels are of case-hardened steel.

The hydraulic pumps are directly attached to the gearbox. O-rings included in the supply enable the unit to be reliably sealed statically.

The gearbox housing is a one-piece design and made of grey cast iron.

Gearbox design allows a direct attachment to the engine via connection flange.

The gearbox has been provided with connections for a separate cooling system resp. for heating rods. For more information refer to the REPAIR MANUAL

Description for the lubrication see next pages.

**Table of contents section 4.0**

<b>Section</b>		<b>Page</b>
<b>4.0</b>	<b>Hydraulic oil cooling</b>	
4.1	General	<b>2</b>
4.2	Function of the hydraulic oil cooling circuit	<b>3</b>
4.3	Adjustment of the Back Pressure Valve	<b>4</b>
4.4	Fan drive (Two stage cooler fan RPM control)	<b>5 + 6</b>
4.5	Pressure relief valves and solenoid valve	<b>7 + 8</b>
4.6	Fixed Displacement Pump, with variable setting	<b>9</b>
4.7	Radiator fan drive speed adjustment	<b>10 -12</b>

**Function:**

From pump (10.x) flows the oil through the filter (68.x) to the fan motor (22.x) and then back to the tank.

The check valve (103.x) 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-x/Y6B-x) or if the engine has been switched off. The hydraulic circuit "Fan drive" is secured by the pilot controlled pressure relief valves (168.x) and (169.x).

These valves are working together with the solenoid valve (Y6A-x/Y6B-x), controlled by the PLC, depending on the hydraulic oil temperature:

- With **de-energized solenoids Y6A-x and Y6B-x** the relief valve (168.x) is functioning and the fans are running with max. adjusted speed (1300 RPM)
- With **solenoid Y6A-x energized** the relief valve (168.x) 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 (169.x) is controlling the relief valve (168.x) and the fans are running with 1000 RPM only.

(See also description on next page)

## 2.7 Radiator fan drive speed adjustment

Cont'd

### Basic Adjustment max fan speed

1. Reduce the output flow of the respective pump (P), by adjusting the minimum possible swivel angle, to avoid over speeding the fan:  
To do this, loosen both lock nuts (6.1 + 7.1) and turn **out** bolt (6) and turn **in** bolt (7) up to final stop.  
This is necessary to avoid a loose positioning pin (10), resulting in oscillating of the cylinder barrel.  
Tighten the lock nuts.
2. Remove protection cap (1) from relief valve (168.x), loosen lock nut (2) and turn set screw (3) fully clockwise and then a half turn counter clockwise.
3. Disconnect the plug connectors (Y6A-x and Y6B-x) of the 4/3 direction flow valve, to ensure that the full flow of pump P will be delivered to the fan motor. The valve is in neutral position and all ports are blocked.
4. Connect a pressure gauge to check point (M5-x).
5. Start the respective engine and let it run in high idle.
6. Check the fan speed with a non-contact rev counter  
Required fan speed: **1250 min<sup>-1</sup>**

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- **Be careful not to get caught in the fan or other rotating parts**

7. Increase the output flow of pump **P**, by adjusting the swivel angle, until the fan speed will be 20 min<sup>-1</sup> higher than required:  
To do this, loosen both lock nuts (6.1 + 7.1) and turn **in** bolt (6) and turn **out** bolt (7) the **same length**.  
This is necessary to avoid a loose positioning pin (10), resulting in oscillating of the cylinder barrel.  
Tighten the lock nuts (6.1 + 7.1).

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- **Do not exceed the maximum permissible operating pressure of 230bar.**



- **Note down the lengths "L1" and "L2" as reference measurements.**

**Continued**

## 5.2 Pilot Pressure Supply and Adjustments

### Pilot Pressure Circuit

The pilot pressure oil is used for the following functions.

To move the control block spools, to supply the main pump regulation system, to lubricate the main pump bearings, to release the travel- and swing gear house brakes (spring loaded multi disk brakes), to drive the Lincoln Lubrication pumps, to move the hydraulic operated ladder, to move the hydraulic operated refilling arm and to supply the hydraulic track tensioning system.

Legend for illustration (Z 22498):

- (7.1 / 7.2) Pilot pressure pumps
- (84.1 / 84.2) Check valve (for combined operation)
- (68.1) Filter
- (70.1) Pressure relief valve 60 bar
- (70.2) Pressure relief valve 35 bar
- (85) Pressure accumulator
- (43 + 45.x) Remote control valves
- (M2) 60 bar pressure check point (X4-Pressure)
- (M3) 35 bar pressure check point (X2-Pressure)
- (M40) 35 bar pres. check point (X2-Pressure in front of accumulator)

### Function:

#### Study together with the hydraulic circuit diagram

The pumps (7.1 and 7.2) are delivering the oil through the filter (68.1) to port A of the pressure relief valve (70.1) and the pressure relief valve (70.2) port A. The pressure relief valve (70.1) maintains the adjusted pressure of 60 bar it is called X4-pressure.

- X4 - pressure:**
- Pump support pressure
  - Pump bearing lubrication
  - Actuation of refilling arm and ladder
  - Lubrication system
  - Track tensioning system

continued

#### 5.4 Function principle of the Electro-Hydraulic- Proportional Control

Legend for illustration (Z 21637)

- (1) Pump
- (2) Filter
- (3) Pressure relief valve
- (4) Check valve
- (5) Pressure Accumulator
- (6) Directional Solenoid valve, a side
- (7) Directional Solenoid valve, b side
- (8) Proportional Solenoid valve
- (9) Control valve block
- (10) Battery
- (11) Electronic units with amplifiers etc.
- (12) Control lever

##### **Function:**

The electric-hydraulic control system is used to control the direction and volume of oil flow to the operating cylinders and motors via the control valve blocks.

##### **Hydraulically:**

The oil volume of pump (1) flows through filter (2) into the pilot pressure system. The pressure is limited by the pressure relief valve (3).

With the pressurized oil stored in accumulator (5), a limited number of spool movements can be carried out with the engines at standstill.

When a lever (or pedal) is actuated, proportional solenoid valve (8) and one of the directional solenoid valves (either 6 or 7) are energized, and allows the pilot pressure oil to flow to the spools of the control blocks.

##### **Electrical**

Whenever a lever or a pedal is moved out of its neutral position, an amplifier will create a current between 0 and 1000 mA. (For detailed information refer to page 10 in this section)

Depending on the lever direction, simultaneously one of the directional solenoid valves (either 6 or 7) is energized.

The proportional solenoid valve alters the pilot pressure, proportional to the lever deflection, this results in a spool movement between neutral and full stroke position.

continued

## 5.8 Proportional Amplifier Module, Type B

Legend for illustration (Z 21640)

**Type B** (for Boom, Stick, Bucket, Clam, Swing and Travel)

<p>(LED)</p> <p>AX: Proportional output AX active</p> <p>AS: Switched output AS active</p> <p>BX: Proportional output BX active</p> <p>BS: Switched output BS active</p> <p>Power: Internal supply voltage</p> <p>Fault: Fault indication</p>	<p>(P) Set Potentiometer:</p> <p>- 10% for the lowest current value</p> <p>- J2 for the highest current value</p> <p>(Pt) Set Potentiometer for the „Ramp Time“</p>
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The amplifier module is snapped onto mounting rails inside the X2-box. The amplifier module contains the necessary electronics for the control of two proportional solenoids and two directional solenoids. The outputs for proportional solenoids Ax and Bx and the switched outputs As and Bs are activated by connecting a minimum of approx. 10% signal voltage at the amplifier input.

A positive signal voltage controls outputs A, a negative signal voltage controls output B.

A signal voltage of approx. 10% with respect to +/- 10 V input voltage at the amplifier, produces a stepped output voltage. The height of this 10% jump may be set separately for proportional outputs Ax and Bx via external potentiometer. As the signal voltage rises the solenoid current for the proportional outputs increases linearly.

A further step in output current occurs at approx. 90% signal voltage. The maximum current or the 90% jump may be set separately for outputs Ax and Bx via external potentiometers and hence the gradient of the output curve may be influenced.

LED`s indicate the current output to each proportional and switched output, whereby the brightness is approx. proportional to the solenoid current in Ax and Bx. This function should not be used for setting.

A Ramp Time function is included in the amplifier which may be externally changed by a set potentiometer. The setting range for the ramp time is approx. from 80ms to 1s. The time setting applies to both up and down ramps and to both proportional solenoids.

A fault is indicated by the LED „Fault“.

### 5.12 Adjusting the Amplifiers Type B, illustration (Z 21643)

The amplifiers for the crawler foot pedals are adjustable in the same way as the amplifiers for the joy sticks.(refer to page 17 and 18 in this section)

The amplifier for the swing foot brake is similar.

#### **Procedure for the swing foot brake:**

1. Open\* the respective **separating terminal** (T1) between the pedal unit and the amplifier module to be set.
2. Open\* the respective separating terminal (T2) between the amplifier module to be set and the proportional solenoid valve.
3. Disconnect the wire from terminal five.
4. Connect the positive output of the service module with terminal five of the amplifier module, using test lead (2).
5. Attach a multimeter for voltage reading to the service module, using test lead (3).
6. Attach a multimeter (in series) for Amp reading to the terminal between amplifier module and solenoid valve, using test lead (3).
7. Press the pedal fully down ; or manual override the relay which allows 24 V operating voltage to the amplifier module; thus the amplifier gets 24 V operating voltage.
8. Turn the potentiometer (P) of the **Service-Module** until the multimeter shows **1 VDC** ; the multimeter for the current reading will show a value which should correspond to the value giving in the circuit diagram **e.g. 10 mA**. (10 % value)

**If necessary correct the value with potentiometer (R1).**

\* How to open and close the terminal:

Push the yellow stud (1) down with a screw driver and turn it 90° to the left to open or to the right to close the terminal. A spring pushes then the stud outwards and the contacts are either open or closed.

**continued**

**E51 Left crawler**

24 Volt at	Joy stick Signal		Pot	Value to be measured at socket "t"
Terminal 9	Neutral ⇒ Forward	0V to +10V	t1	<b>0,10 Volt</b> = 1000ms
Terminal 10	Forward ⇒ Neutral	+10V to 0V	t2	<b>0,10 Volt</b> = 1000ms
Terminal 11	Neutral ⇒ Backward	0V to -10V	t3	<b>0,10 Volt</b> = 1000ms
Terminal 12	Backward ⇒ Neutral	-10V to 0V	t4	<b>0,10 Volt</b> = 1000ms

**E52 Right crawler**

24 Volt at	Joy stick Signal		Pot	Value to be measured at socket "t"
Terminal 9	Neutral ⇒ Backward	0V to +10V	t1	<b>0,10 Volt</b> = 1000ms
Terminal 10	Backward ⇒ Neutral	+10V to 0V	t2	<b>0,10 Volt</b> = 1000ms
Terminal 11	Neutral ⇒ Forward	0V to -10V	t3	<b>0,10 Volt</b> = 1000ms
Terminal 12	Forward ⇒ Neutral	-10V to 0V	t4	<b>0,10 Volt</b> = 1000ms

**E59 Bucket (only BHA)**

24 Volt at	Joy stick Signal		Pot	Value to be measured at socket "t"
Terminal 9	Neutral ⇒ Fill	0V to +10V	t1	<b>0,10 Volt</b> = 1000ms
Terminal 10	Fill ⇒ Neutral	+10V to 0V	t2	<b>5,00 Volt</b> = 20ms
Terminal 11	Neutral ⇒ Dump	0V to -10V	t3	<b>0,10 Volt</b> = 1000ms
Terminal 12	Dump ⇒ Neutral	-10V to 0V	t4	<b>5,00 Volt</b> = 20ms

**Cont'd**

**Main Control Blocks and High Pressure Filter BHA**

**Pump circuit No. III**

- (176 / III) Control block (R. H. Travel, Boom, Bucket, Stick)
- (46.2) High pressure filter, Pump 1 and 6
- (31.03) SRV Travel motors right backward
- (32.17) ACV Travel motors right backward
- (31.04) SRV Travel motors right forward
- (32.18) ACV Travel motors right forward
- (32.19) ACV Boom cylinder rod side
- (32.20) ACV Boom cylinder piston side
- (32.21) ACV Bucket cylinder rod side
- (32.22) ACV Bucket cylinder piston side
- (32.23) ACV Stick cylinder rod side
- (32.25) ACV Stick cylinder piston side

**Pump circuit No. IV**

- (13 / IV) Control block **IV** (Single spool for swing)
- (44.1) High pressure filter, Pump 3



- **There is one MRV in each control block.**

### 6.1.7 Remote control valves



- Remote control valves are part of the electric-hydraulic control system

Legend for illustration (Z 21838):

- (1 - 8) Pilot pressure lines to the control block
- (9) Pilot pressure supply port
- (10) Return to tank port
- (11) Manifold block
- (12) Double directional solenoid valve
- (13) Single proportional solenoid valve

**Function:**

The electric-hydraulic control system is used to control the direction and volume of oil flow to the operating cylinders and motors via the main control valve blocks.

When a lever (or pedal) is actuated, a proportional solenoid valve (13) and one of the directional solenoid valves (12 either a or b) are energized, and allows the pilot pressure oil to flow to the spools of the main control blocks. The proportional solenoid valve alters the pilot pressure, proportional to the lever deflection, this results a spool movement between neutral and full stroke position.

### 6.1.11 Control Blocks and Valves

Legend for illustration (Z 22440):

- (1) Main relief valve (MRV)Control block housing
- (2) Load holding valve
- (3) Anti cavitation valve (ACV)
- (4) Service line relief valve (SRV)

#### **Explanation of the schematic drawing of the control block:**

The hydraulic oil flows through the control block from port P to T, if all spools are in neutral position ("pressure-less circuit" or "Free circulation").

#### **(A)** 4 valve block

E.g. the spools moves up when pilot pressure is build up in the control pipe line a1. (Imagine the lower symbol box moves to the center position.)

Now pump oil flows through holding valve (2) to the user port A1 because the free flow circulation to the hydraulic reservoir is closed. The main relief valve (1) limits the maximum operation pressure in this circuit. Via port B1 the return oil from the user is flowing back to the hydraulic reservoir.

During down hill travelling motion and stopping procedure (e.g. travel motors) the anti cavitation valves (3) prevents cavitation on the hydraulic motors. Because during these short periods of time the hydraulic motor needs a higher oil supply than the pump can deliver.

E.g. the spool #4 moves up when pilot pressure is build up in the control pipe a4. Now the user port A4 is connected to the pump pressure line and the free circulation to the tank. There is no high pressure build up only 8 bar from the back pressure valve and line resistance. Via port B4 the return oil from the user is flowing back to the hydraulic reservoir. Service line relief valve (4) is additional installed in this circuit to protect the circuit for extreme pressure. The shortly extreme pressure closes also the holding valve (2) which secures the hydraulic pump from extreme pressure peaks.

The holding valves (2) have also the function of load holding valves because during the fine controlling period all lines are connected together (negative over-lapping). The load pressure is for a moment higher than the pump pressure.

#### **(B)** single valve block

### 6.1.14 Pressure Reducing Valve



- **Pressure reducing valves are installed to reduce the common 35 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.

## 7.0 Main hydraulic pumps and pump regulation system

### Pump regulation system

#### General

Controlled output flow of the main pumps is necessary:

- To utilize the available engine power most efficiently in every operating mode.
- To limit the power consumption of the hydraulic pumps depending of the load of the engine. (Electronic pump regulation with micro-controller MC7)
- For additional functions, such as swing dependent or temperature-dependent flow control.

#### Function:

**X1** – pump regulation pressure (0 – 25 bar):

The power controller of the main pumps can be remotely controlled by applying an external pilot pressure (X1) at port X<sub>LR</sub> to the spring chamber of the power control valve. The start of destroking can be varied in proportion to the applied X1 - pressure.

**X2** – pilot pressure (35 bar):

Constant pilot pressure to regulate the main pumps at special circumstances, e.g. to fix pump 3 in Q-max position activated by the swing control (pump for swinging controlled by Y48) .

**X3** – remote control pressure (0 / 16 / 35bar):

Basic setting Q-min (0 bar), the flow rate increases with the pilot pressure X3 at port P<sub>st</sub>, up to Q-max (35 bar).

The hyperbolic power control is superimposed on the pilot pressure signal and keeps the specified drive power constant. ( $p_x V_g = \text{constant}$ ).

The flow rates are:

Q-min.: X3 = 0 bar

½ Q-max.: X3 = 16 bar

Q-max.: X3 = 35 bar

**X4** – pump support pressure (60 bar):

Constant pilot pressure to support the regulation function at low operating pressure and to lubricate the main pump bearings.

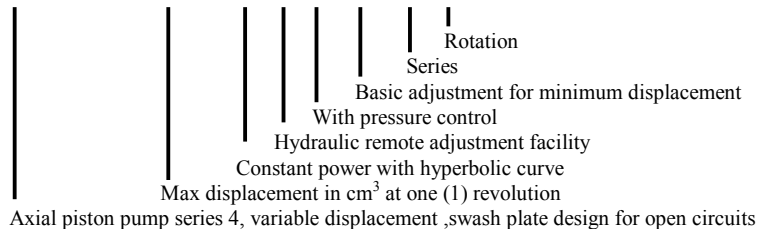
## 7.1 Main Pumps

### 7.1.3 Operating Principles

Main hydraulic pump **A4VSO 500 LR3DN / 30L**

Type code explanation:

**A4VSO 500 LR 3 D N / 30 L**



#### Function and characteristics:

- The A4VSO variable displacement axial piston pump in swash plate design is intended for drives in open circuit operation.
- The flow volume is proportional to the drive speed and the displacement. By adjusting the swash plate an infinitely variable flow adjustment is possible.
- Pumps of the same nominal size can be built onto the trough drive. Combinations with gear pumps are also possible.

Legend for illustration (Z 22446):

The lower illustration shows only a principle pump construction

- (1) Drive shaft
- (2) Cylindrical roller bearing
- (3) Slipper pad
- (4) Swivel angle indicator
- (5) Positioning piston
- (6) Swivel pin
- (7) Cylinder with pistons
- (8) Final connecting plate
- (9) Cylindrical roller bearing
- (10) Splints for the through drive coupling (Aux. pump drive)
- (11) Swivel cradle
- (12) Q-min stop bolt
- (13) Power control valve
- (14) Pressure balance valve
- (15) Power curve correction
- (16) Pressure cut off valve
- (17) Q-max. stop bolt
- (18) Remote control valve

**continued**

## 7.1 Main Pumps

### 7.1.3 Operating Principles, illustration (Z 21554a)

Cont'd:

**½ Q-max position:** (remember Q means volume)

**When does the pumps move into half Q-max position?**

- Engine running
- and** hydraulic oil below normal operating temperature (< T2)
- and** the controls frequently used within 20 sec.  
(or Service switch S151 activated)
- and** a pump pressure **below** start of de-stroking.

Example with the following conditions:

- Engine running (> 1800 min<sup>-1</sup>)
- Pump pressure between 60 bar and 300 bar, present at the slipper pad of piston #14 and the small area side of the positioning piston #13
- X1 = 24 bar (pump regulation pressure)
- X3 = 16 bar (remote control pressure); Y17 energized **and** Y17a **de**-energized for all six pumps.
- X4 = 60 bar (pump support pressure), present at valve #6.

Response of pump control mechanism:

Valve #6 moves to an intermediate position (in-between "a" and "b"), since a certain amount of oil behind nozzle (7) flows through valve #5 (which is also in an intermediate position, due to the 16 bar remote control pressure X3) back to tank.

The large area side of positioning piston #12 is connected, via power control valve (8) position "a" and pressure balance valve (6), to the return oil line.

The pump moves into ½ Q-max position, because the return oil flow through pressure balance valve (6) is restricted (due to its intermediate position), resulting in a pressure at the large area side of the positioning piston (12).

**The pump moves into ½ Q-max position**

**continued**

## 7.1 Main Pumps

### 7.1.4 Checks / Adjustments

Cont'd:

**Start of de-stroking (LR valve)**, illustration (Z21559)

The reason of this check is to make sure, the pump starts de-stroking at an operating pressure of **150 bar** with a pump regulation pressure **X1 = 0 bar**.

1. Connect a 400 bar pressure gauge to the pressure check point at the respective high pressure filter for the pumps being checked.
2. Connect a 25 bar pressure gauge to respective pressure check point M20-1 or M20-2 at the control and filter panel (X1-pressure).
3. Change over the respective three way cock to electronic regulation.
4. Unplug the respective proportional valve Y61.1 / Y61.2.
5. Insert an Allen key into the angle indicator bolt (see illustration) for better visibility of the start of.
6. Start the respective engine, let it run with max. speed. The X1-pressure should be 0 bar.
7. Stall the hydraulic for the pump to be checked and alter the operating pressure with the MRV between 140 and 160 bar. Start of de-stroking should be at an operating pressure of 150 bar, shown at the gauge connected to the high pressure filter.

If readjustment is required proceed as follow:

- a) Adjust with the MRV an operating pressure of 150 bar.
- b) Loosen lock nut #6 (Power control valve).
- c) Turn set bolt #7, so that the pump is still in Q-max. position, but just at the beginning of de-stroking.
- d) Tighten lock nut #6.
8. Re-adjust the operating pressure at the MRV to  $310^{+10}$  bar and plug on the Y61.1 resp. Y61.2  
(For exact values refer to the final test report.)
9. Remove Allen key and gauges.

**continued**

## 7.2 Electronic Pump Regulation System

### 7.2.3 Checks and adjustments

**Microcontroller MC7**, illustration (Z 21714a)

The adjustment of the X1-pressure can be done with three different methods:

- A. With 24V supply to separating terminals at the X2-switch board  
or
- B. With the electronic service tool (EST) BB-3 connected to the serial interface X13-1 (located in the operators cab)  
or
- C. With a laptop, running the BODEM software, connected to the serial interface X13-1 (located in the operators cab)



- **Procedure B and C should only be carried out by authorized personnel. [ Dealer or KMG-factory staff ]**  
**Because it is possible to influence the behavior of the pump regulation system.**  
**On the following pages are only the necessary setups described.**  
**If additional information is required, please contact KMG-Service department.**

**7.2 Electronic Pump Regulation System**

**7.2.3 Checks and adjustments Microcontroller MC7, illustration (Z 22357)**

**Method B**

**Cont'd:**

**Excavator Type selection:**

Press **MENU**. Return to main menu.



Press **TEACH**. Activate storage menu.



Press **1**. Save Params. This menu item permits storage of all edited parameters in the EEPROM of the MC electronics.



Press **ENTER**. Store parameters.



Press **MENU**. Abort.



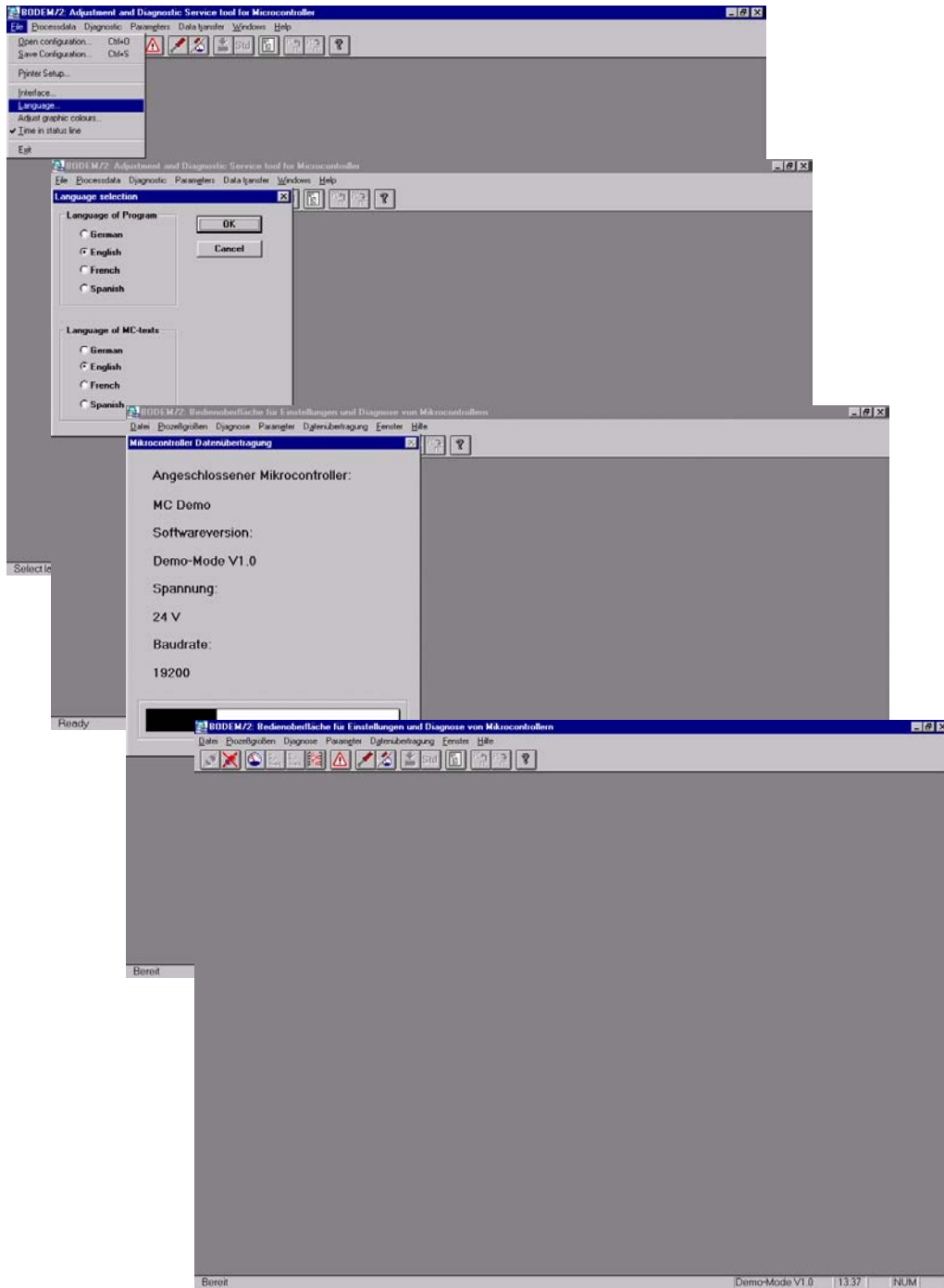
## 7.2 Electronic Pump Regulation System

### 7.2.3 Checks and adjustments Microcontroller MC7, illustration (Z 22358)

#### Method C

#### Language selection

Open menu FILE → Language , select the required language and confirm with OK .



**7.4 Determination of the Peak point (Engine performance) ,illustration (Z 22360a)**

1. Connect pressure gauges to check points (M12.1, M12.2, M12.3 and M12.4) at the high pressure filter.
2. Connect a pressure gauge to the X1.1 and X1.2 pressure check point M20-1 and M20-2.
3. Unplug solenoid valves Y6A-1, Y6B-1, and Y6A-2, Y6B-2, for engine 2, to ensure that the hydraulic oil cooler fans are running with maximum speed.
4. Unplug the solenoid valve Y14A-1, Y14B-1 for engine 1 and Y14A-2, Y14B-2 for engine 2 to ensure that the engine radiator fan is running with maximum speed.
5. Start one engine and let it run with max. speed.
6. Check High Idle speed =  $1900^{+35} \text{ min}^{-1}$ .
7. Set the MRV of main valve block I, II and III individually to approx. 120 bar \*, to prevent the engine from overloading during the test.
8. Shift the three way cock valves (79.1, 79.2) to position “Hydraulic regulation“.
9. Set the X1-pressure at pressure reducing valve (81.2) **> 24 bar \*\***, to ensure that the pumps remaining in Q-max. flow position during the test.
11. Apply max. load to all pumps (e.g. extend the bucket cylinder to the stop position until the hydraulic system stalls), and increase the pressure at the 3 MRV’s \* (block I, II, III) equally until the engine speed is  **$1800 \pm 10 \text{ min}^{-1}$** .  
Record this pressure for other tests. Required: **3 times  $220 \pm 5 \text{ bar}$** .
12. Stop engine and start the other one. Repeat from step 6.



- **If the operating pressure respectively the engine speed is higher than required there is probably not the full volume available.**
- **If the operating pressure respectively the engine speed is lower than required there is probably not the full engine power available.**

**continued**

## 8.0 General

### Cont'd:

#### 8.0.1 Floating function of boom and stick cylinders FSA: illustration (Z 22568):

The Excavator (only front shovel attachment) operates automatically with the float position for boom and stick activated.

That means the lowering movement of boom and stick is always done in the float position.

For **deactivation of the float position**, two push buttons are installed:

- a) **S95** in the **right** joy stick (E19) for the **Boom** function
- b) **S95a** in the **left** joy stick (E20) for the **Stick** function

Press the respective button and keep it depressed as long as the float position shall be deactivated.

When releasing the button the float position is activated again.

#### **Function:**

There are different main valve spools in the three main valve blocks (14, 15 and 16) for boom and stick installed. Only by lowering of the boom or retracting of the stick is the floating function active if the button on the lever is not pushed. The piston and rod side of the respective cylinders are in floating position direct connect to the return line (tank). The pressure free pump circulation is still active there is no pump pressure to the respective cylinders. By external force the cylinder can move up or down with negligible hydraulically resistance.

In floating position of the boom only valve spool 4 of main valve block I and 2 of block III active.

In floating position of the stick only valve spool 2 of Main valve block I and 4 of block III active.

To push down the boom or retract the stick by hydraulically force the respective button on the lever must be activated.

S98 for the Stick cylinders

S95 for the Boom cylinders

In normal operation mode (i.e. float position) the piston side, the rod side and the tank are connected together when lowering the boom or retracting the stick.

If a pressurised lowering of the boom or retracting of the stick cylinders is required the connection of piston side, rod side and tank must be disconnected and the rod side must be connected to the pump pressure. This is done by disconnecting the respective special floating valve spool and activating the respective standard valve spool. Now pressurised pump oil can flow to the cylinder rod side.

### 8.1.2 Electric / Hydraulic flowchart “ Boom lowering ” FSA, Auto Float off

Legend for illustration (Z 22530):

(E19)	Control lever (Joy stick)
(D32)	Time relay – Pilot control: Neutral position monitoring
(+Y)	Direction (axis) of joy stick
(+10V)	Signal voltage (Maximum)
(gn)	Colour code of signal voltage cable ( Joy stick)
(X2...)	Terminal rail with number
(E49)	Ramp time module
(A10)	Amplifier module – Boom
(A10A)	Amplifier module – Boom
(A10B)	Amplifier module – Boom
(K76A)	Relay – pilot control: Contacts 6 / 10 open while extending the stick.
(K79)	Relay – pilot control: Contacts 6 / 10 open while filling the bucket.
(K80)	Relay – pilot control: Contacts 8 / 12 closed while moving the boom up.
(K160)	Relay – pilot control: Contacts 2 / 10 closed and 5 / 9 open while auto floating on.
(K207C)	Relay – pilot control: Contacts 5 / 9 closed while warming up hydraulic oil (S205).
(45.1 – 45.3)	Remote control valves
(Y23, Y26, Y29)	Proportional solenoid valve
(Y23b, Y26b, Y29b)	Directional solenoid valve
(I – III)	Main control blocks I – IV

#### **Electrical signal flow (EURO control).**

The auto float button in the right lever E19 is still engaged this will energize relay K160. Signal voltage of joy stick (E19) arrives via ramp time module (E49) only at terminal 5 of the amplifier modules (A10a and A10b) and further to the proportional and directional solenoid valve of the remote control blocks (45.2 and 45.3).

#### **Hydraulic signal flow. (pilot pressure)**

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

#### **Hydraulic oil flow**

Only the oil of main pump 3 and 4 flows through the main control blocks (II) and arrives via the distributor manifold at the boom hydraulic cylinders piston rod side. Through main valve block III for boom lowering is no pressure oil flow depend on a different valve spool with closed pressure port.

#### 8.1.4 Electric / Hydraulic flowchart “ Stick retracting ” FSA Autor Float off

Legend for illustration (Z 22534):

(E20)	Control lever (Joy stick)
(D32)	Time relay – Pilot control: Neutral position monitoring
(YD)	Direction (axis) of joy stick
(-10V)	Signal voltage (Maximum)
(gn)	Colour code of signal voltage cable ( Joy stick)
(X2...)	Terminal rail with number
(E48)	Ramp time module
(A8)	Amplifier module – Stick
(A8a)	Amplifier module – Stick
(A8b)	Amplifier module – Stick
(K76A)	Relay – pilot control: Contacts 7 / 11 and 8 / 12 open while retracting the stick.
(K80)	Relay – pilot control: Contacts 1 / 9 only open while bucket moving.
(K170)	Relay – pilot control: Contacts 1 / 9 closed and 3 / 11 open while auto floating off.
(K207C)	Relay – pilot control: Contacts 5 / 9 closed while warming up hydraulic oil (S205).
(45.1, 45.2, 45.3)	Remote control valves
(Y23, Y26, Y29)	Proportional solenoid valve
(Y23b, Y26b, Y29b)	Directional solenoid valve
(I + III)	Main control blocks I + III

#### **Electrical signal flow (EURO control).**

Signal voltage of joy stick (E20) arrives via ramp time module (E48) at terminal 5 of the amplifier modules (A8, A8a) and further to the proportional and directional solenoid valves of the remote control blocks (45.1 and 45.2).

#### **Hydraulic signal flow. (pilot pressure)**

When the proportional and directional solenoid valves are energized pilot pressure oil flows to the pilot pressure ports of the control blocks ( I and II ).

#### **Hydraulic oil flow**

Only the oil of main pump 3 and 4 flows through the main control block (II) and arrives via the distributor manifold at the stick hydraulic cylinders piston side. Through main valve block I for stick retracting is no pressure oil flow depend on a different valve spool with closed pressure port.

**8.1.6 Electric / Hydraulic flowchart “ Bucket dump ” FSA**

Legend for illustration (Z 22537):

(E19)	Control lever (Joy stick)
(D32)	Time relay – Pilot control: Neutral position monitoring
(+X)	Direction (axis) of joy stick
(+10V)	Signal voltage (Maximum)
(ws / gn)	Colour code of signal voltage cable ( Joy stick)
(X2...)	Terminal rail with number
(A9)	Amplifier module – Bucket
(A9a)	Amplifier module – Bucket
(A9b)	Amplifier module – Bucket
(K50)	Relay – pilot control: Bucket cut-off Contacts 6 / 10 only closed if the hydraulic oil is in normal operating temperature.
(K78)	Relay – pilot control: Contacts 1 / 9 only open while bucket dump.
(K79)	Relay – pilot control: Contacts 1 / 9 only open while lifting the boom.
(K205)	Relay – pilot control: Contacts 1 / 3 only open while S205 activated (hydraulic oil warming up)
(45., 45.2, 45.3)	Remote control valves
(Y22, Y24, Y30)	Proportional solenoid valve
(Y22A, Y24A, Y30A)	Directional solenoid valve
(I – III)	Main control blocks I – III

**Electrical signal flow (EURO control).**

Signal voltage of joy stick (E19) arrives via relay contacts K50 at terminal 19 of the ELB modules. From ELB modules the signal voltage arrives at terminal 5 of the amplifier modules (A9, A9a, A9b) and further to the proportional and directional solenoid valves of the remote control blocks (45.1, 45.2, 45.3). Only while bucket dump together with boom up K78 and K79 opened the contacts 1 / 9 and deactivate amplifier module A9 (priority to the boom).

**Hydraulic signal flow. (pilot pressure)**

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

**Hydraulic oil flow**

Now the oil of the main pumps flows through the main control blocks (I to III) and arrives via the distributor manifold at the hydraulic cylinders. There is no oil flow through main control block I to the bucket cylinder if bucket dump and boom up is activated.

**8.1.10 Checks and adjustments of the Main Relief Valves (MRV), illustration (Z 22481):**

There are four main relief valves (primary valves) installed, one in each main control block, to limit the maximum pump supply line pressure (operating pressure).

	MRV in control block	Check point	Functions <b>BHA</b>			
			Travel	Stick	Bucket	Boom
Pump circuit I	I	M12.1	Travel	Stick	Bucket	Boom
Pump circuit II	II	M12.3	Bucket	Boom	-	Stick
Pump circuit III	III	M12.4	Travel	Boom	Bucket	Stick
Pump circuit IV	IV	M12.2	Swing, (if no swing active circuit II)			

Each Pump circuit can be checked or adjusted individually by selecting one function of the required pump circuit.

**Checking:**

1. Connect the gauge to the required check point M12.1 – M12.4.
2. Start both engines and let them run in high idle.
3. Extend or retract the cylinder to the stop position for the valve being tested until the hydraulic system stalls.
4. Read the pressure. Required:  $310 \pm 5$  bar

If the pressure is not correct, carry out a comparative measurement with an other function, in order to avoid wrong measuring results caused by wrongly adjusted SRV or other defects in the system.



- **When using the single function “stick in or out”, as indicated in the table (gray shaded), all MRV can be adjusted, because all four pump circuits are engaged.**

**Adjusting:**

1. Remove protective cap (a).
2. Loosen lock nut (b).
3. Turn set screw (c) **-clockwise to increase pressure, Counter-clock wise to decrease pressure.**
5. Tighten lock nut (b) and install cap (a).



- **It is important that the valve body of MRV-valve and the SRV-valve are firmly tightened (with 300 Nm). Otherwise, the internal sealing is not properly which results in loud flow noises and wrong adjustments.**

**8.1.11 Checks and adjustments of the Service Line Relief Valves (SRV),  
illustration (Z 22542):**

**Stick cylinder “piston side” FSA**

There are three service line relief valves (secondary valves) installed, all three at the distributor manifold, to limit the maximum possible pressure peaks in the service line.

Since the opening pressure of the SRV's is higher than the setting of the Main Relief Valves (MRV's) it is necessary to increase the main relief pressure for testing and adjusting purposes.

Valve	Press. check point	Location
SRV 142.5	M27.1	Manifold section F
SRV 142.6		Manifold section F
SRV 142.7		Manifold section J
MRV circuit I	M12.1 (High pressure filter)	Double high pressure filter R.H.
MRV circuit II	M12.3 (High pressure filter)	Single HP filter, control block II
MRV circuit III	M12.4 (High pressure filter)	Double high pressure filter L.H..
MRV circuit IV	M12.2 (High pressure filter)	Single HP filter, control block IV

1. Connect gauges to all above listed check points.
2. Start both engines and let them run in high idle.
3. Extend the stick cylinder to the stop position until the hydraulic system stalls.
4. Increase slowly the pump supply line pressure, by turning in set screws (3) of the MRV in control block IV, while observing the pressure gauges. Stop as soon the pressure does not raise any further. The gauge pointers should remain at 350 bar <sup>+ 5 bar</sup>.



- **Since the piston side of the stick cylinders are protected by several SRV's, the pressure gauges show the pressure of that valve with the lowest setting.**

**Even when the gauges show the required pressure it is possible that one or more valves have a higher setting.**

- **To ensure that only the SRV's open during checks and adjustments it is necessary to further increase the setting of the MRV's.**

5. Remove protective cap (1) of MRV.
6. Loosen lock nut (2).
7. Turn set screw (3) of the MRV ½ turn further in, the gauge pointers will remain at the value shown at item #4 (350 bar <sup>+ 5 bar</sup>).
8. Tighten lock nut (2) and install cap (1).

**continued**

**8.1.11 Checks and adjustments of the Service Line Relief Valves (SRV),  
illustration (Z 22543a):**

**Cont'd:**

**Stick cylinder “piston rod side” FSA**



- **Since the piston rod side of the stick cylinders are protected by several SRV's, the pressure gauges show the pressure of that valve with the lowest setting.**

**Even when the gauges show the required pressure it is possible that one valves have a higher setting**

- **To ensure that only the SRV's open during checks and adjustments it is necessary to further increase the setting of the MRV's.**

7. Turn set screw (3) of both MRV's ½ turn further in, the gauge pointers will remain at the value shown at item #6 (350 bar <sup>+5 bar</sup>).
8. Adjust the SRV's equally, until all gauges show a pressure of 360 bar. Adjust in steps of ¼ turn of set screw (1) (SRV's) in the following sequence : 33.1 ⇒ 33.5
9. Turn set screw (3)-clockwise to increase pressure, Counter-clockwise to decrease pressure.  
Adjust pressure at SRV 33.1 to ~360 bar if the pressure don't increase turn set screw from the last setting max. ¼ turn in (c.w.).
10. Adjust pressure at the SRV 33.5 to ~350 bar.



- **Now all gauges will show the same value of 350 bar, but only SRV-33.1 has the correct setting.**

11. Reduce the pressure, at SRV 33.1 to a value below the required value and then increase up to the required pressure (350bar), while observing all gauges.

**8.1.11 Checks and adjustments of the Service Line Relief Valves (SRV),  
illustration (Z 22544):**

**Cont'd:**

**Bucket cylinder "Piston rod side" FSA**

9. Adjust all three SRV's equally, until all gauges show a pressure of 360 bar.

Adjust in steps of ¼ turn of set screw (3) in the following sequence:

142.1 ⇒ 142.2 ⇒ 142.3

Remove protective cap (1) of SRV's.

Loosen lock nut (2).

Turn set screw (3) **-clockwise to increase pressure, Counter-clockwise to decrease pressure.**

Tighten lock nut (2) and install cap (1).

10. Reduce the pressure, at SRV- 142.1 to a value below the required value, and then increase up to the required pressure (350 bar), while observing all gauges.



- **Now all gauges will show the same value of 350 bar, but only SRV-142.1 has the correct setting.**

11. Proceed with the other valves in the same manner in the following sequence:  
142.2 ⇒ 142.3



- **Strong pulsation of the return line hoses, indicates deviation in opening pressure of SRV's and must be avoided.**

**Repeat the adjusting procedure until the oil returns well-balanced via all six service line relief valves.**

12. Reset the MRV's to 310 bar <sup>+ 5 bar</sup> after the check / adjustment is finished, as follows:

Remove protective cap (1).

Loosen lock nut (2).

Turn set screw (3) **-clockwise to increase pressure, Counter-clockwise to decrease pressure.**

Tighten lock nut (2) and install cap (1).



- **It is important that the valve body of MRV and the SRV are firmly tightened (with 300 Nm). Otherwise, the internal sealing is not properly which results in loud flow noises and wrong adjustments.**

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**8.1.11 Checks and adjustments of the Service Line Relief Valves (SRV),  
illustration (Z 22487):**

**Bucket cylinder “Piston rod side” BHA**

There are three service line relief valves (secondary valves) installed at the distributor manifold, to limit the maximum possible pressure peaks in the service line.

Since the opening pressure of the SRV’s is higher than the setting of the Main Relief Valves (MRV’s) it is necessary to increase the main relief pressure for testing and adjusting purposes.

Valve	Press. check point	Location
SRV 142.8	M34.1	Manifold section L
SRV 142.9	M34.2	Manifold section L
SRV 142.10	M34.3	Manifold section M
MRV circuit I	M12.1 (High pressure filter)	Double high pressure filter R.H.
MRV circuit II	M12.3 (High pressure filter)	Singl high pressure filter, block II
MRV circuit III	M12.4 (High pressure filter)	Double high pressure filter L.H..
MRV circuit IV	M12.2 (High pressure filter)	Singl high pressure filter, block IV

1. Connect gauges to all above listed check points.
2. Start both engines and let it run with max. speed.
3. Retract the Bucket cylinder (Bucket dump) to the stop position until the hydraulic system stalls.
4. Increase slowly the pump supply line pressure, by turning in set screws (3) of MRV’s in control block I, I, III and IV, while observing the pressure gauges. Stop as soon the pressure does not raise any further.  
The gauge pointers should remain at 350 bar <sup>+ 5 bar</sup>.



- **Since the piston rod side of the bucket cylinders are protected by several SRV’s, the pressure gauges show the pressure of that valve with the lowest setting.**

**Even when the gauges show the required pressure it is possible that one or more valves have a higher setting.**

- **To ensure that only the SRV’s open during checks and adjustments it is necessary to further increase the setting of the MRV.**

5. Remove protective cap (1) of MRV.
6. Loosen lock nut (2).
7. Turn set screw (3) of both MRV’s ½ turn further in, the gauge pointers will remain at the value shown at item #4 (350 bar <sup>+ 5 bar</sup>).
8. Tighten lock nut (2) and install cap (1).

**continued**

**8.1.12 Checks and adjustments of the lowering speed,  
illustration (Z 22489):**

**Boom cylinder FSA**

Due to the two different operation modes for lowering the boom, the lowering speed must be adjusted twice:

- I. Float position **activated**
- II. Float position **deactivated**

**Maximum permissible lowering speed for both operation modes:**

	Cylinder retracting time/meter (s /m)	Total time(s)
Boom FSA	1,4	4,3

**Adjustments / Checks:**

**I. Float position activated:**

1. Use a stop watch to measure the cylinder running time.
2. Raise the fully extended attachment with **empty** bucket to the maximum height position (A).
3. Shift both engines to high idle speed.
4. Rapidly move the control lever (E19) to the front end position (start the stop watch) and hold it until the final position (B) is reached.(stop the stop watch).

*m*

- **Lower the boom so, that the bucket stops just above the ground.**

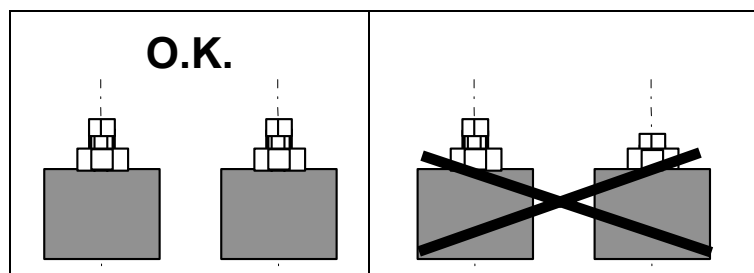
5. If the lowering speed is too high, i.e. the measured time is less than the permissible time, the speed must be reduced by **altering the throttle valves 141.1 (section B) and 141.3 (section N, pointing to the attachment).**

Adjust as follows:

To decrease the lowering speed loosen lock nut (1) and turn the bolt (2) cw.

To increase the lowering speed loosen lock nut (1) and turn the bolt (2) ccw.

**Since there are several valves throttling the return oil flow the valves must be set synchronously. The adjusting screws have to be turned in by the same amount of revolutions.**



6. Check lowering speed again and repeat the adjustment if necessary.
7. If the adjustment is finished tighten lock nut (1).

**continued**

**8.1.12 Checks and adjustments of the lowering speed,  
illustration (Z 22491):**

**Stick cylinder BHA**

**Maximum permissible lowering speed:**

	Cylinder extending time/meter (s /m)	Total time (s)
Stick BHA	0,6	1,5

**Adjustments / Checks:**

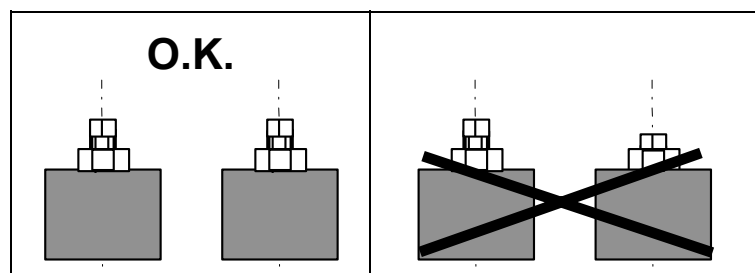
1. Use a stop watch to measure the cylinder running time.
2. Raise the fully extended attachment with **empty** bucket to the maximum height position (A).
3. Shift the engines to high idle speed.
4. Rapidly move the control lever (E20) to the rear end position (start the stop watch) and hold it until the final position (B) is reached.(stop the stop watch).
5. If the lowering speed is too high, i.e. the measured time is less than the permissible time, the speed must be reduced by **altering the throttle valves 142.5, 142.6 and 142.7 at the distributor manifold.**

Adjust as follows:

To decrease the lowering speed loosen the lock nut (1) and turn the bolt (2) cw.

To increase the lowering speed loosen the lock nut (1) and turn the bolt (2) ccw.

**Since there are several valves throttling the return oil flow of the stick cylinder the valves must be set synchronously. The adjusting screws have to be turned in by the same amount of revolutions.**



6. Check lowering speed again and repeat the adjustment if necessary.

If the adjustment is finished tighten lock nut (1).

**Table of contents section 8.2**

<b>Section</b>		<b>Page</b>
<b>8.2</b>	<b>Hydraulic for the swing circuit</b>	
8.2.1	Swing Circuit (Brief description)	<b>2 + 3</b>
8.2.2	Swing Motor	<b>4 - 7</b>
8.2.3	Swing Gear Box	<b>8</b>
8.2.4	Swing Parking Brake (Gear house Brake)	<b>9</b>
8.2.5	Swing Brake Valve	<b>10+12</b>
8.2.6	Electric / Hydraulic flowchart "Swing Left"	<b>13</b>
8.2.7	Electric / Hydraulic flowchart "Swing Right"	<b>14</b>
8.2.8	Swing Monitoring System	<b>15 + 16</b>
8.2.9	Adjustments for the swing circuit	<b>17 - 19</b>

**8.2.2 Hydraulic Motor Axial Piston Motor A6VM355 HD1D**

**Hydraulic control**, illustration Z22431

**Cont'd:**

**Flow from A to B without „X-pressure“ (slow swing speed) :**

The operating pressure opens check valve (1) and closes the opposite valve (2). The same pressure is present at constant pressure control valve (8) and inside the small area side of the positioning piston (4). The large area side is connected via the governor valve (3) to tank (port T2).

**The motor remains in  $V_{gmax}$  position. = max. torque by low speed.**

**Flow from A to B with „X-pressure“ (higher swing speed):**

Operating pressure opens check valve (1) and closes the opposite valve (2). The same pressure is present at constant pressure control valve (8) and inside the small area side of the positioning piston (4).

Because the „X“ pressure shifts governor valve (3) a connection is made to the large area side of positioning piston (4).

Depending on the system pressure (lower than 280 bar), valve (8) starts closing the return line. Same pressure on both sides but different areas causes a greater force at the piston side moving the motor into the  $V_{gmin}$  position.

**The motor is in regulation mode due to 35 bar x-pressure:**

**Displacement between  $V_{gmax}$  position(>280bar) and  $V_{gmin}$  position(<280bar).**

As a result of decreasing operating pressure the motors are reducing their displacement so that the swing speed will increase.

If the operating pressure rises as a result of load torque, to the setting of the constant pressure control valve (280 bar), the motors are swiveled out to a greater angle (higher displacement) and the swing speed will decrease.

**Cont'd.:**

### **8.2.5 Swing Brake Valve**

If after a swing motion the joy stick is released into neutral position without using the foot brake, the superstructure is turned by inertial force and the hydraulic motor acts as a pump because it is driven by the swing gear.

In this period the pressure in the service line is lower than the pressure in the return line, because there is a back pressure valve at the tank, and oil is forced through the anti-cavitation valves into the service line.

#### **Function of the pressure increasing valve.**

When ever a swing motion is carried out or the foot brake is used, pilot pressure arrives the pressure increasing valve (1) at port "X". The pilot pressure pre-loads these valves.

By applying pilot pressure via the external port X to piston (12), the pre-tensioning of the pressure spring (10) is increased by the amount of the piston stroke "S", which results in the actual valve setting.

The system pressure is in front of the main piston (13) and via the jet bore (6) also in the chamber of the spring (7) and via the jet bore (8) at the pressure relief valve poppet (9).

Due to the force balance the piston (13) is kept in its position supported by the spring (7).

Overcomes the system pressure the setting of the valve (9), this valve opens a channel to the dump line port (Y). Due to the drop of force the piston (13) is moved to the right.

The pressure line gets connected with the return line (T).

Damped opening and closing are obtained by the throttled volumetric change that is caused by the jet bores.

**continued**

**8.2.8 Swing Monitoring System, illustration (Z 21947a)**

(Study together with the valid hydraulic and electric circuit diagram for the machine)

**Adjustments - Measurements -Settings**
**a) Distance between Swing ring teeth and the switches B98 and B99**

The sensors B98 and B99 are inductive switches with own electronic. Sensor B98 switches 24V via cable "Sig" to terminal 4 of E42 and Sensor B99 switches 24V via cable "Sig" to terminal 11 of E42 if a tooth comes close to the sensor head.

Simultaneously these signal arrives at E43 terminal 4.

Adjust the distance "C" of the sensors **B98** and **B99** to **5±1 mm**.

**b) E42 for monitoring the slew direction**

E42 is an programmable module which is factory programmed with the parameters are shown in the electric diagram. Therefore no adjustments or settings are required.

The indication light (In1 from B98 / In2 from B99) lights/pulses if a input signal comes up. The indication light (Out1 for swing left / Out2 for swing right) lights if the module indicates a swing direction.

**b) E43 for monitoring the slew direction**

E43 is an programmable module which is factory programmed with the parameters are shown in the electric diagram below.

**Settings:**
**E43 (speed monitor) "counter prevention"**

No	Function	nominal setting
1	Setting the start up delay	Not used set to "0"
2	Fine setting of the preset value (pulses / min.)	12 imp/min (i.e.120)
3	Setting the hysteresis	Not used set to "0"
4	LED: lights when the output relay is energised	---
5	Setting the switching function	Set to "III"
6	Coarse setting of the preset value (pulses / min)	X x 10 imp/min

If necessary increase or decrease the imp/min with set screw no. 2 until a smooth slew operation is possible.

**Travel Circuit**

Legend for illustration (Z 22521):

(1; 2; 5; 6)	Main pumps
(14 / I)	L.H. Control block
(16 / III)	R.H. Control block
(21.1- 21.4)	Travel motors (A2FM 355)
(28.1+28.2)	Travel motors valve blocks
(34)	Rotary distributor
(40)	Suction tank
(46.1+46.2)	Double filter
(52.1 + 52.4)	Travel gear house brakes
(M12.1 + M12.4)	High pressure check points
(M33.1, M33.2)	High pressure check points left travel motors
(M33.3, M33.4)	High pressure check points right travel motors

**Brief description**

(Study together with the machine valid hydraulic and electric circuit diagram).

**Control circuits, not shown**

By the function of the remote control valve (45.1 + 45.3) pilot pressure oil is sent to one side of each control block (14/I + 16/III) when operating the foot pedal for travelling "Forward or Reverse".

### 8.3.4 Travel Gear and Parking Brake

**Function principle ( illustration Z22524):**

The spur gear stage (B) is driven by two hydraulic motors via two drive shafts (A). This in turn causes that by the shaft (C) the first planetary stage (D) is driven; opposite the input drive direction.

The planetary carrier (D) rotates in the same direction because of the planetary gears and the internal geared hollow wheel (G). The planetary gears of the second planetary stage are driven as well. The planetary carrier is connected by splines to the r.h. side frame flange, therefore rotates the hollow wheel (G) (means the complete gear rotates) in same direction as the drive shaft (A).

The drive sprocket is mounted to the hollow wheel flange (3).

For maintenance see MAINTENANCE MANUAL

For more details see PARTS BOOK and REPAIR MANUAL

**Function Check of the Travel Gear House Brake**

Illustration Z 22529

1. Connect pressure gauge to check point (M6) at the filter and valve panel engine 2..
2. Start one engine and let it run with max. speed.
3. Read the pressure. Gauge must show common pilot pressure (norm.  $35 \pm 1$  bar). If not check the pilot pressure. If the pressure is below 24 bar, the text display must show „**Travel gear house brake ON**“.
4. Operate the travel foot pedals, **the machine must travel**.  
In case the machine doesn't travel the text display must show „**Travel gear house brake ON**“
5. Unplug solenoid (Y16) and operate the travel foot pedals, **the machine must not travel**.  
The text display must show „**Travel gear house brake ON**“



- **In a case of malfunctioning check the electrical controlling and the solenoid valve Y16.**

**Function check of the pressure switch (B48)**

1. Connect pressure gauge to check point (M6).
2. Start one engine. Gauge must show common pilot pressure (norm.  $35 + 1$  bar).
3. Set pilot pressure relief valve to 22 bar.
4. Unplug solenoid valve Y16 to allow pressure release from the pressure line of the house brake.
5. Reconnect solenoid valve Y16.  
The text display must show „Travel gear house brake ON“
6. Increase the pilot pressure up to 26 bar  
„Travel gear house brake ON“ must disappear  
If not check the switch B48; in case it is an adjustable switch, adjust the switch point.( If necessary see SB 21-439 latest edition)
7. Reset pilot pressure to 35 bar.

## 9.2 Pressure Increasing Valve



- The pressure increasing valve is a remote controlled pressure relief valve.

Legend for illustration (Z 21846):

- (1) Pilot valve with valve seat
- (2) Valve poppet
- (3) Compression spring
- (4) Main valve with sleeve
- (5) Main piston
- (6) Closing spring
- (7) Set screw - low pressure 35 bar
- (8) Set screw - high pressure 310bar
- (9) Piston
- (10) Pin
- (11+12) Jet bore
- (13+14) Lock nut

### **Function:**

The valve poppet (2) is connected via the jet bores (11) and (12) with the P port.

If static pressure increases above the set pressure value, the valve poppet (2) opens and allows oil to flow freely to tank (T1). This oil generates a pressure drop in the spring chamber of the main spool, the closing force of the spring (6) is cancelled, and the main piston (5) opens to allow the pump flow to flow to tank (T2).

Damped opening and closing is obtained by the throttled volumetric change. By applying external pressure of  $P_{st\ max} = 60\ bar$  to the main spool (9) via port X, the pre-tensioning of the pressure spring (3) is increased by the amount of the piston stroke "S" and system pressure is increased correspondingly. The setting is fixed by means of the setting screw (7) and lock nut (13); 1 turn of the screw  $\sim 150\ bar$ .

**Table of contents section 10.0**

<b>Section</b>		<b>Page</b>
<b>10.0</b>	<b>Access ladder hydraulic operated</b>	
10.0	General	<b>2</b>
10.1	Function of hydraulic operated access ladder	<b>3+4</b>

## 11.0 Hydraulic operated refilling arm

### General

Legend for Illustration Z22496

(A)	Refilling arm
(B)	Control switch (pull switch)
(B)	Hydraulic cylinder
(D)	Limit switch S23
(7.1+7.2)	Pilot Pump
(68.1)	Pilot filter with filter monitoring switch B22
(70.1)	Pressure relieve valve (60 bar)
(70.2)	Pressure relieve valve (35 bar)
(162.1+161.22)	Check valves
Y124A	Solenoid valve: refilling arm up
Y124B	Solenoid valve: refilling arm down
Y125C	Solenoid valve: security valve “refilling arm locking”
(163)	Hydraulic cylinder

The excavator is equipped with a central refilling system for easy service and maintenance. One part of this system is the movable refilling arm. This arm is hydraulic driven by the hydraulic cylinder (C) and mounted below the power frame.

The refilling arm can moved up or down by pull switch S23. For correct operation of the refilling arm see OPERATION MANUAL:



**If the refilling arm swing out of the upper position the pilot control will stop all working functions and activate the swing brake. The text display show a message.**

**13.1 Designation of electrical devices**

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

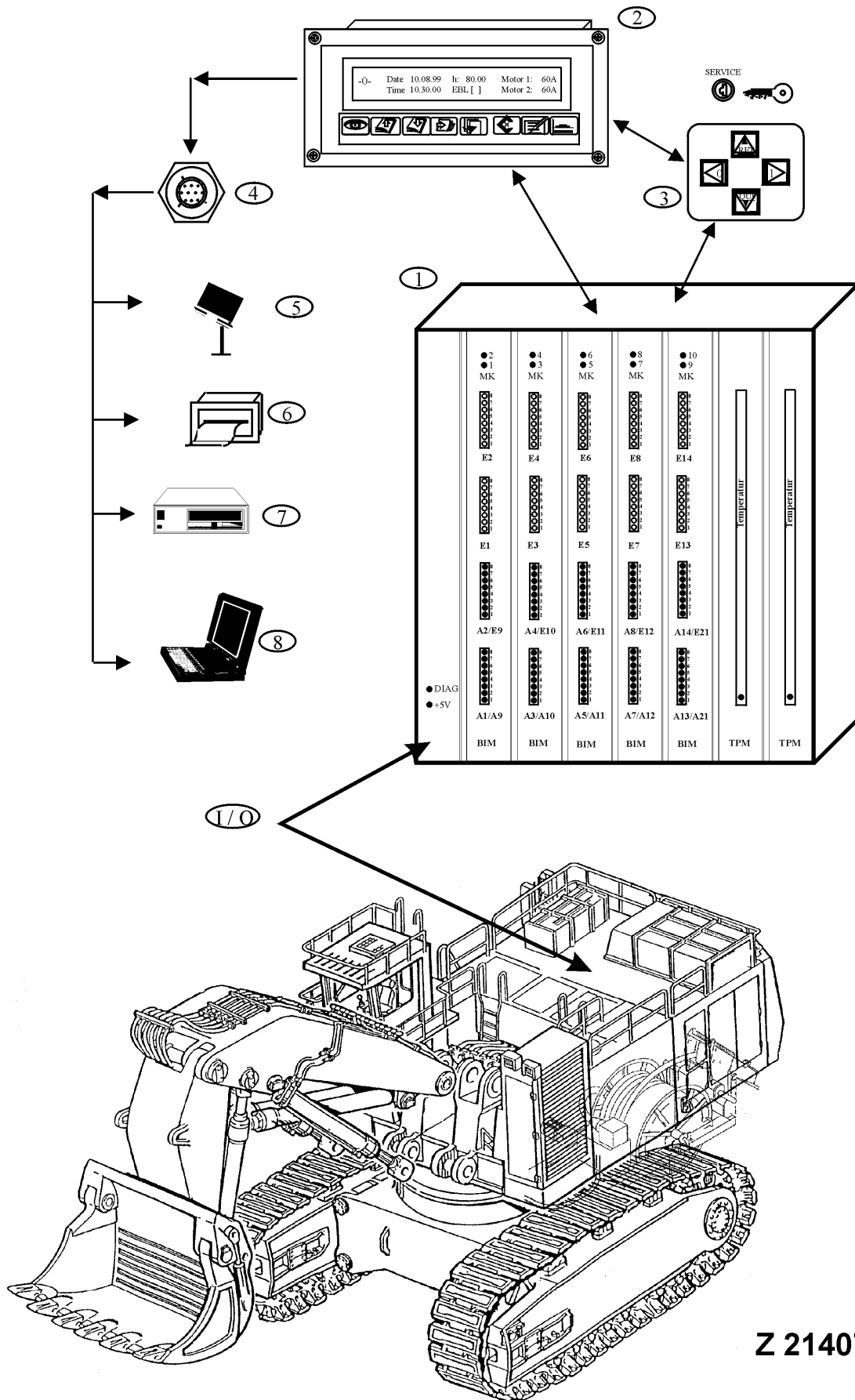
This occurs each time we operate a switch supplying current to the coil. The diode effect allows the induced current to circulate within the coil windings and decay when the energy to the coil is cut.


\* 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



**14.0**  
 **16**

**KOMATSU**  
MINING GERMANY

**14.0**  
 **26**

**KOMATSU**  
MINING GERMANY



**14.0**  
 **46**

**KOMATSU**  
MINING GERMANY

**14.5.5 Temperature – Resistance Chart PT100**  
**Basic Values in Ohm according to DIN 43 76**  
**For Measuring Resistor PT100**

° C	-0	-1	-2	-3	-4	-5	-6	-7	-8	-9
-50	80,31	79,91	79,51	79,11	78,72	78,32	77,92	77,52	77,13	76,73
-40	84,27	83,88	83,48	83,08	82,69	82,29	81,89	81,50	81,10	80,70
-30	88,22	87,83	87,43	87,04	86,64	86,25	85,85	85,46	85,06	84,67
-20	92,16	91,77	91,37	90,98	90,59	90,19	89,80	89,40	89,01	88,62
-10	96,09	95,69	95,30	94,91	94,52	94,12	93,73	93,34	92,95	92,55
0	100,00	99,61	99,22	98,83	98,44	98,04	97,65	97,26	96,87	96,48

° C	0	1	2	3	4	5	6	7	8	9
0	100,00	100,39	100,78	101,17	101,56	101,95	102,34	102,73	103,12	103,51
10	103,90	104,29	104,68	105,07	105,46	105,85	106,24	106,63	107,02	107,40
20	107,79	108,18	108,57	108,96	109,35	109,73	110,12	110,51	110,90	111,28
30	111,67	112,06	112,45	112,83	113,22	113,61	113,99	114,38	114,77	115,15
40	115,54	115,93	116,31	116,70	117,08	117,47	117,85	118,24	118,62	119,01
50	119,40	119,78	120,16	120,55	120,93	121,32	121,70	122,09	122,47	122,86
60	123,24	123,62	124,01	124,39	124,77	125,16	125,54	125,92	126,31	126,69
70	127,07	127,45	127,84	128,22	128,60	128,98	129,37	129,75	130,13	130,51
80	130,89	131,27	131,66	132,04	132,42	132,80	133,18	133,56	133,94	134,32
90	134,70	135,08	135,46	135,84	136,22	136,60	136,98	137,36	137,74	138,12
100	138,50	138,88	139,26	139,64	140,02	140,39	140,77	141,15	141,53	141,91
110	142,29	142,66	143,04	143,42	143,80	144,17	144,55	144,93	145,31	145,68
120	146,06	146,44	146,81	147,19	147,57	147,94	148,32	148,70	149,07	149,45
130	149,82	150,20	150,57	150,95	151,33	151,70	152,08	152,45	152,83	153,20
140	153,58	153,95	154,32	154,70	155,07	155,45	155,82	156,19	156,57	156,94
150	157,31	157,69	158,06	158,43	158,81	159,18	159,55	159,93	160,30	160,67

**Example:**    **84 ° C**            ⇒ 80° + 4° = **132,42 Ω**  
                   **124,4 Ω**            ⇒ 124,4 ≈ 124,39 = 60° + 3° = **63 °C**

**14.0**  
 **66**

**KOMATSU**  
MINING GERMANY

**14.0**  
 **76**

**KOMATSU**  
MINING GERMANY

```

30 error :=1136
30 error :=1142
30 error :=1148
30 error :=1154
30 error :=1160
39 error :=1166
39 error :=1172
39 error :=1178
39 error :=1184
24 error :=1190
25 error :=1196
57 error :=1202
16 error :=1208
16 error :=1214
16 error :=1220
16 error :=1226
18 error :=1232
18 error :=1238
26 error :=1244
40 error :=1250
22 error :=1256
22 error :=1262
26 error :=1268
35 error :=1274
18 error :=1280
11 high_idle_motor-1 = TRUE ?
11 high_idle_motor-2 = TRUE ?
13 high_idle_motor-any = TRUE ?
11 high_idle_motor-any := FALSE
11 high_idle_motor-any := TRUE
10 high_idle_motor-x = TRUE ?
41 high_idle_motor-x = TRUE ?
10 high_idle_motor-x := FALSE
10 high_idle_motor-x := FALSE
10 high_idle_motor-x := FALSE
10 high_idle_motor-x := TRUE
43 info := 1398
43 info := 1402
55 info :=1310
55 info :=1312
55 info :=1314
55 info :=1316
55 info :=1318
13 info :=1320
23 info :=1322
14 info :=1324
14 info :=1326
12 info :=1328
12 info :=1330
14 info :=1334
14 info :=1336
36 info :=1338
17 info :=1340
56 info :=1348 (5 sec)
50 info :=1350
50 info :=1354
18 info :=1358
18 info :=1362
18 info :=1366
18 info :=1370
31 info :=1378
31 info :=1382
48 info :=1386
18 info :=1390
18 info :=1394
10 info :=1426
10 info :=1426
21 info :=1426
22 info :=1426
42 info :=1426
42 info :=1426
54 info :=1450
54 info :=1460
54 info :=1470
54 info :=1480
54 info :=1490
54 info :=1500
54 info :=1510
44 last_move_was_downwards = TRUE ?
44 last_move_was_downwards := FALSE
44 last_move_was_downwards := TRUE
44 last_move_was_downwards := TRUE
10 low_idle_motor-x = TRUE ?
42 low_idle_motor-x = TRUE ?
10 low_idle_motor-x := FALSE

10 low_idle_motor-x := FALSE
10 low_idle_motor-x := FALSE
10 low_idle_motor-x := TRUE
52 lube_display_counter-u -> to memory
33 lube_display_counter-u := lube_counter-u + 1
32 lube_request-u := lube_request-u - 1
33 lube_request-u := lube_request-u - 1
54 m1000 = TRUE ?
55 m1000 := FALSE
53 m1000 := TRUE
53 m1000 := TRUE
54 m1000 := TRUE
54 m2000 = TRUE ?
55 m2000 := FALSE
53 m2000 := TRUE
54 m2000 := TRUE
54 m250 = TRUE ?
55 m250 := FALSE
54 m250 := TRUE
54 m3000 = TRUE ?
55 m3000 := FALSE
53 m3000 := TRUE
53 m3000 := TRUE
54 m3000 := TRUE
54 m500 = TRUE ?
55 m500 := FALSE
53 m500 := TRUE
54 m500 := TRUE
33 manual_lube-u := FALSE
31 manual_lube-u := TRUE
32 manual_lube-u = TRUE ?
33 manual_lube-u = TRUE ?
34 manual_lube-u = TRUE ?
57 motor_overheated_1/2_Qmax = FALSE
57 motor_overheated_1/2_Qmax = TRUE
13 motor_overheated_1/2_Qmax = TRUE ?
33 press_decrease-u = TRUE ?
33 press_decrease-u := FALSE
33 press_decrease-u := FALSE
32 press_decrease-u := TRUE
31 press_decrease_too_long-u = TRUE ?
31 press_decrease_too_long-u := FALSE
34 press_decrease_too_long-u := FALSE
33 press_decrease_too_long-u := TRUE
32 press_increase-u = TRUE ?
32 press_increase-u := FALSE
32 press_increase-u := FALSE
34 press_increase-u := TRUE
31 press_increase_too_long-u = TRUE ?
31 press_increase_too_long-u := FALSE
34 press_increase_too_long-u := FALSE
32 press_increase_too_long-u := TRUE
53 qe1000 = TRUE ?
52 qe1000 -> to memory
55 qe1000 := FALSE
53 qe250 = TRUE ?
52 qe250 -> to memory
55 qe250 := FALSE
11 running_motor-1 = TRUE ?
48 running_motor-1 = TRUE ?
11 running_motor-2 = TRUE ?
48 running_motor-2 = TRUE ?
50 running_motor-any = TRUE ?
11 running_motor-any := FALSE
11 running_motor-any := TRUE
14 running_motor-x = TRUE ?
16 running_motor-x = TRUE ?
10 running_motor-x := FALSE
10 running_motor-x := TRUE
16 serious_error_x = FALSE
16 serious_error_x = TRUE
16 serious_error_x = TRUE ?
51 short_circuit_output_group_A1-X = TRUE ?
51 short_circuit_output_group_A1-X := FALSE
51 short_circuit_output_group_A13-X = TRUE ?
51 short_circuit_output_group_A13-X := FALSE
51 short_circuit_output_group_A3-X = TRUE ?
51 short_circuit_output_group_A3-X := FALSE
51 short_circuit_output_group_A5-X = TRUE ?
51 short_circuit_output_group_A5-X := FALSE
51 short_circuit_output_group_A7-X = TRUE ?
51 short_circuit_output_group_A7-X := FALSE
17 shutdown_low_idle_motor-all = FALSE
17 shutdown_low_idle_motor-all = TRUE ?

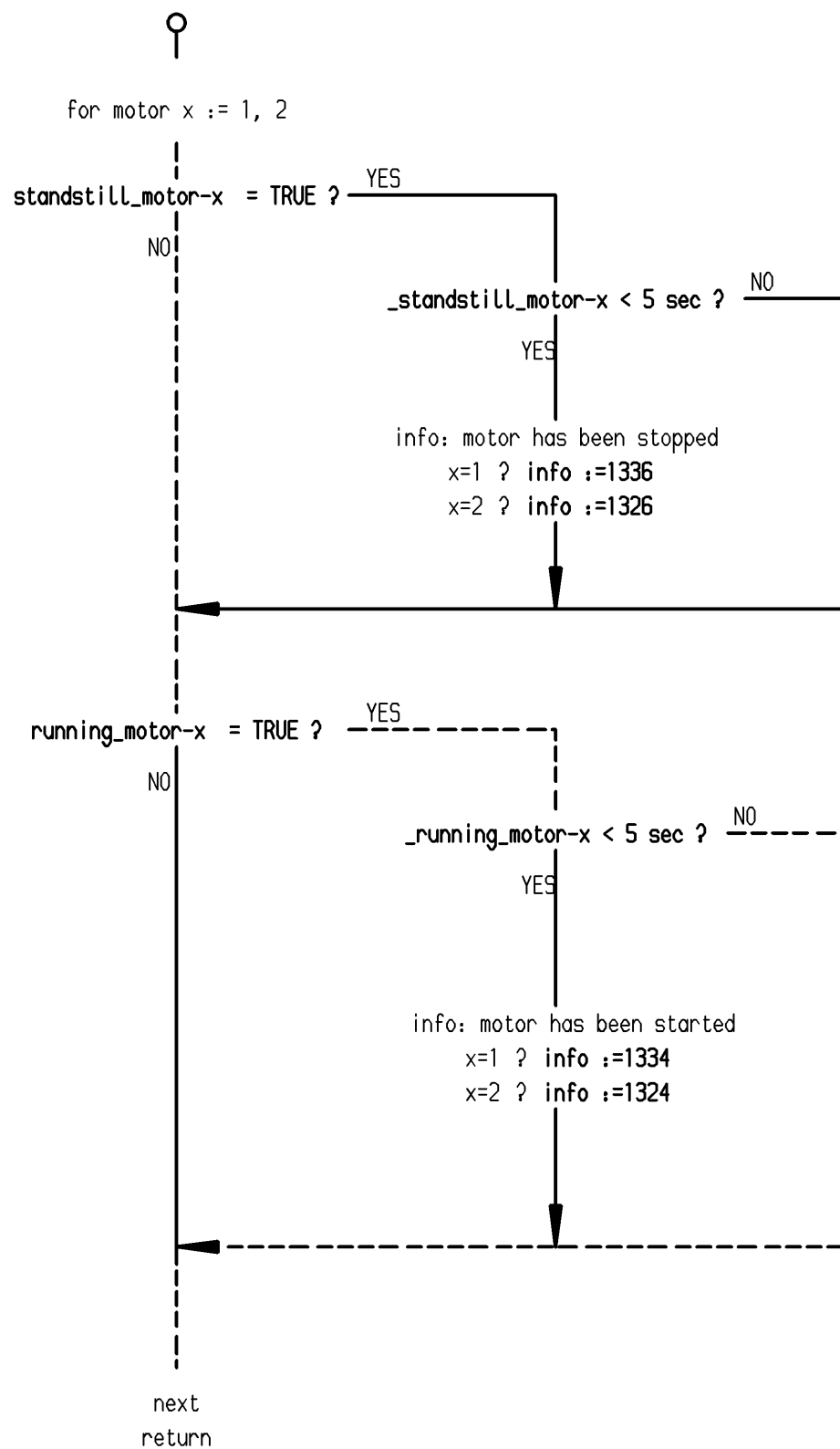
20 shutdown_low_idle_motor-all := TRUE
41 shutdown_low_idle_motor-all := TRUE
57 shutdown_low_idle_motor-all := TRUE
12 shutdown_message := FALSE
12 shutdown_message := FALSE
10 shutdown_message := TRUE
20 shutdown_message := TRUE
21 shutdown_message := TRUE
22 shutdown_message := TRUE
41 shutdown_message := TRUE
42 shutdown_message := TRUE
57 shutdown_message := TRUE
21 shutdown_motor-1 := TRUE
57 shutdown_motor-1 := TRUE
10 shutdown_motor-1_10sec := TRUE
21 shutdown_motor-1_10sec := TRUE
22 shutdown_motor-1_10sec := TRUE
21 shutdown_motor-2 := TRUE
57 shutdown_motor-2 := TRUE
10 shutdown_motor-2_10sec := TRUE
21 shutdown_motor-2_10sec := TRUE
22 shutdown_motor-2_10sec := TRUE
12 shutdown_motor-x = TRUE ?
12 shutdown_motor-x := FALSE
20 shutdown_motor-x := TRUE
41 shutdown_motor-x := TRUE
42 shutdown_motor-x := TRUE
12 shutdown_motor-x_10sec = TRUE ?
12 shutdown_motor-x_10sec := FALSE
42 shutdown_motor-x_10sec := TRUE
16 simple_error_x = FALSE
16 simple_error_x = TRUE
16 simple_error_x = TRUE ?
41 stand_still_motor-x > 70 sec ?
11 standstill_motor-1 = TRUE ?
41 standstill_motor-1 = TRUE ?
57 standstill_motor-1 = TRUE ?
57 standstill_motor-1 = TRUE ?
41 standstill_motor-2 = TRUE ?
57 standstill_motor-2 = TRUE ?
57 standstill_motor-2 = TRUE ?
11 standstill_motor-2 := TRUE ?
16 standstill_motor-all = TRUE ?
18 standstill_motor-all = TRUE ?
21 standstill_motor-all = TRUE ?
29 standstill_motor-all = TRUE ?
31 standstill_motor-all = TRUE ?
52 standstill_motor-all = TRUE ?
11 standstill_motor-all := FALSE
11 standstill_motor-all := TRUE
10 standstill_motor-x = TRUE ?
12 standstill_motor-x = TRUE ?
14 standstill_motor-x = TRUE ?
20 standstill_motor-x = TRUE ?
42 standstill_motor-x = TRUE ?
10 standstill_motor-x := FALSE
10 standstill_motor-x := FALSE
10 standstill_motor-x := TRUE
11 start_or_stop_motor-1 = TRUE ?
57 start_or_stop_motor-1 = TRUE ?
57 start_or_stop_motor-1 = TRUE ?
11 start_or_stop_motor-2 = TRUE ?
57 start_or_stop_motor-2 = TRUE ?
57 start_or_stop_motor-2 = TRUE ?
13 start_or_stop_motor-any = TRUE ?
31 start_or_stop_motor-any = TRUE ?
37 start_or_stop_motor-any = TRUE ?
11 start_or_stop_motor-any := FALSE
11 start_or_stop_motor-any := TRUE
10 start_or_stop_motor-x = TRUE ?
10 start_or_stop_motor-x := FALSE
10 start_or_stop_motor-x := FALSE
10 start_or_stop_motor-x := FALSE
10 start_or_stop_motor-x := TRUE

```

↑  
Seite  
page

Querverweisliste  
cross reference list

Datum		Computererstellte Zeichnung (CAD)		Bau Nr. 15018/-19		Typ	Ident-Nr.	F	ÄM-Nr.	Name	Datum	
Bearb.	11-NOV-05	Huesers		Ablaufdiagramm Flowchart		PC5500-6	.	.	E7544	.	.	
Gepr.	.	.				<b>KOMATSU</b> MINING GERMANY	Ident-Nr.:		Format		Blatt/Blätter	
Abt.:	8125	.					926 502 40	a	A3	04 / .		

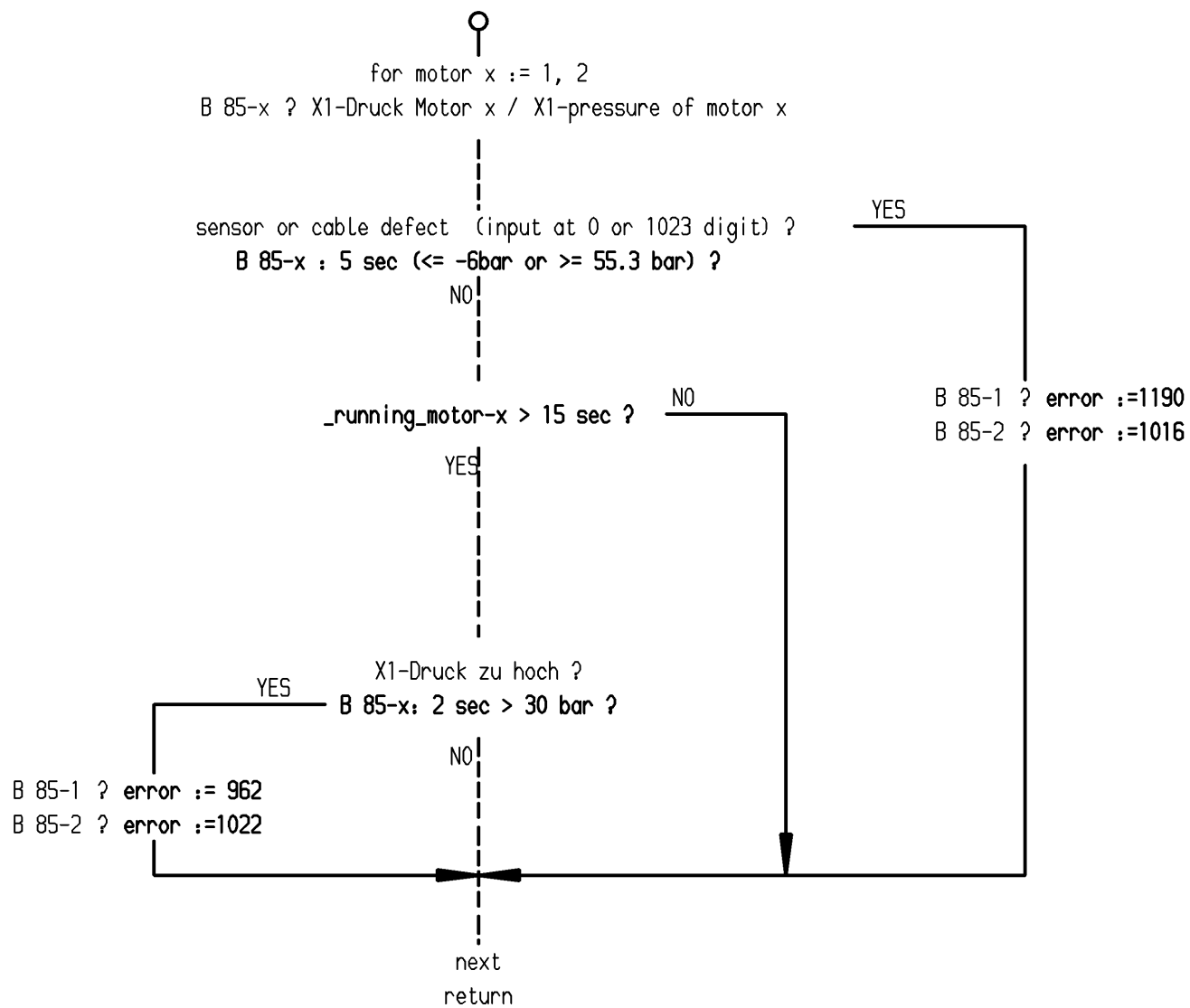


D: Wenn der Motor stillsteht oder läuft, wird jeweils für die ersten 5 Sekunden eine Meldung ausgegeben.

E: When the motor is at standstill or running respectively, a message is displayed (for the first 5 seconds).

Ausgabe der Start/Stop Meldungen  
output of start/stop messages

			Computererstellte Zeichnung (CAD)		Bau Nr. 15018/-19		Typ	Ident-Nr.	F	ÄM-Nr.	Name	Datum
Bearb.	11-NOV-05	Huesers	Ablaufdiagramm Flowchart		<b>KOMATSU</b> MINING GERMANY		PC5500-6	.	.	E7544	.	.
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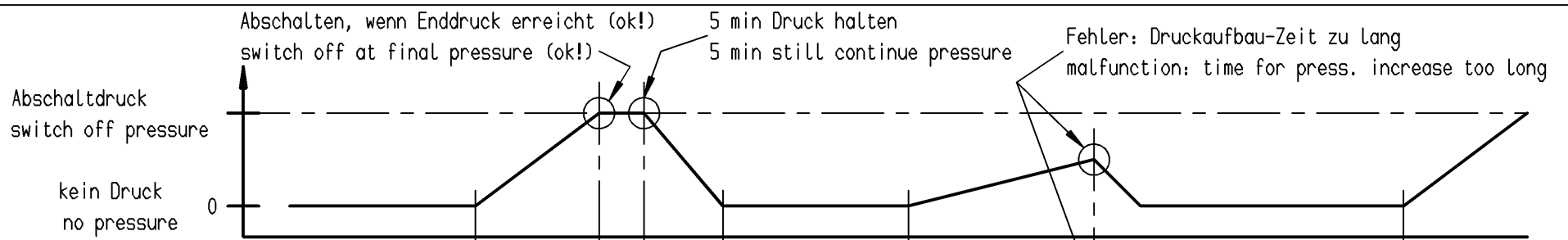


D: Überwachung des X1-Druckes (für die Pumpenregelung). Ist der Druck zu hoch, erfolgt eine Fehlermeldung. Ein Defekt des Sensors oder der Zuleitungen wird nach Möglichkeit angezeigt.

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

X1-Drücke für Pumpenregelung  
X1-pressures for pump control

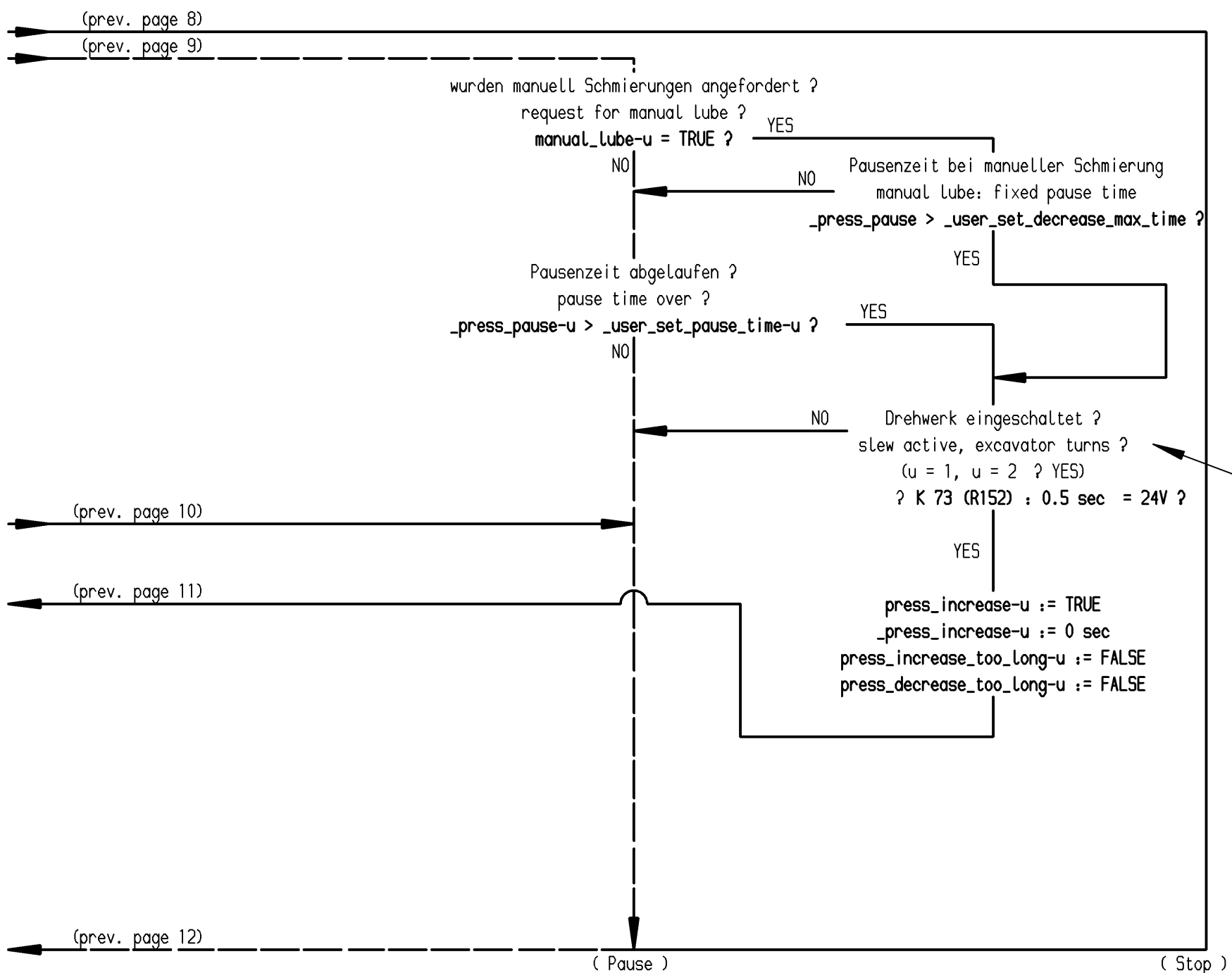
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Bearb.	11-NOV-05	Huesers		Ablaufdiagramm Flowchart		<b>KOMATSU</b> MINING GERMANY		PC5500-6	.	.	E7544	.	.
Gepr.	.	.						Ident-Nr.:	926 502 40 a	Format	A3	Blatt/Blätter	24 / .
Abt.:	8125							Copyright reserved (Schutzvermerk DIN 34 beachten)					



_user_set_increase_max_time								
_press_increase (timer)	FALSE	0s	(TRUE)	FALSE	FALSE	0s	(TRUE)	FALSE
press_increase								
_user_set_pause_time								
_user_set_decrease_max_time								
_press_pause (timer)	FALSE	0s	5min	(TRUE)	FALSE	0s	FALSE	FALSE
press_decrease								
press_increase_too_Long	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	(TRUE)	FALSE
press_decrease_too_Long	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE

Bild: Funktionen der Schmieranlage

figure: functions of lube system



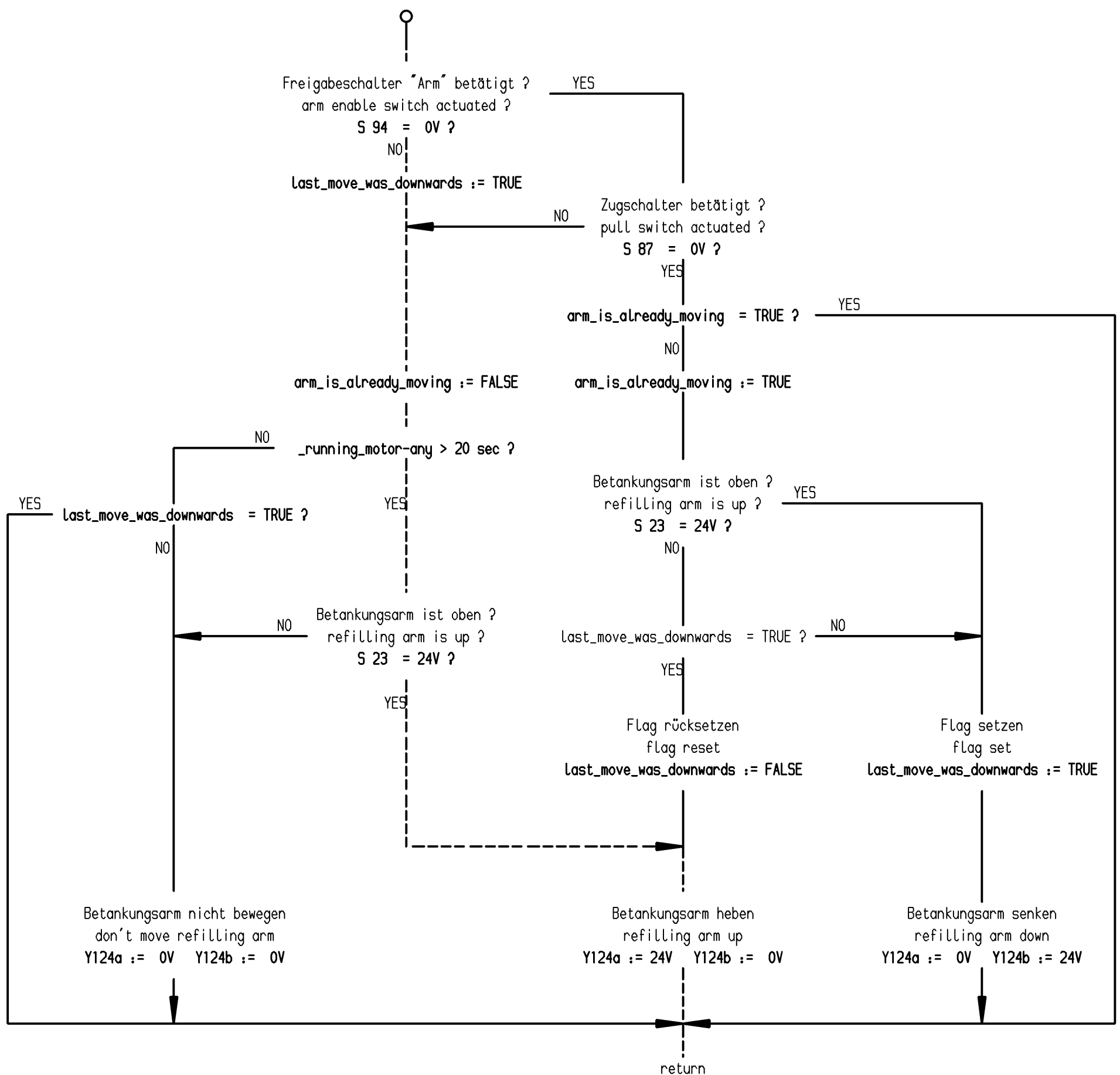
NO nur bei Drehkranz Schmierung möglich, sonst immer YES  
 NO is only available for slew lubrication, otherwise always YES

D: Schmieranlage: Erklärung siehe vorherige Seite  
 E: Lubrication System: Explanation see previous page.

Pausensteuerung / pause control

Power-Master Schmieranlage  
 Power-Master lube system

Datum		Name		Computererstellte Zeichnung (CAD)		Bau Nr. 15018/-19		Typ		Ident-Nr.		F		ÄM-Nr.		Name		Datum	
11-NOV-05		Huesers		Ablaufdiagramm Flowchart		KOMATSU MINING GERMANY		PC5500-6		.		.		E7544		.		.	
8125		.						Ident-Nr.:				Format				Blatt/Blätter			
								926 502 40 a				A3				34 / .			



- D: Für jegliche Armbewegung muß zuerst der Freigabeschalter S94 in der Kabine betätigt sein.
- Bei Stillstand der Hauptmotoren muß der Zugschalter während einer Bewegung dauerhaft gezogen werden.
- Der Arm wechselt bei jedem Loslassen die Bewegungsrichtung.
- Im Betriebszustand 1 kann der Arm durch einmaliges Ziehen am Zugschalter abwechselnd gesenkt oder gestoppt werden.
- Wenn der Arm oben ist, soll er als erstes senken
- bei laufendem Motor wird der Arm, wenn er oben ist, gegen den oberen Anschlag gepresst. (unabhängig vom Freigabeschalter)

- E: for any arm movement, the switch "remote control enable" S94 must be in the enable position. (The switch is located in the cab).
- at standstill of main motors, the pull switch S87 must be pulled as long as the arm shall move.
- After any release of the pull switch, the arm will move in the opposite direction.
- In operation condition 1 the arm may be lowered and stopped repeatedly by a single pull at the pull switch.
- If the arm is in the upper position, it will go down first.
- If the engine is running and the arm is in the upper position, it will be pushed against the upper stop, independently of the "remote control enable" switch.

Betankungsarm refilling arm					
Typ	Ident-Nr.	F	ÄM-Nr.	Name	Datum
PC5500-6	.	.	E7544	.	.
Ident-Nr.:			Format	Blatt/Blätter	
926 502 40 a			A3	44 / .	

Datum	Name	Computererstellte Zeichnung (CAD)	Bau Nr.
11-NOV-05	Huesers	Ablaufdiagramm Flowchart	15018/-19
Gepr.	.		
Abt.:	8125		

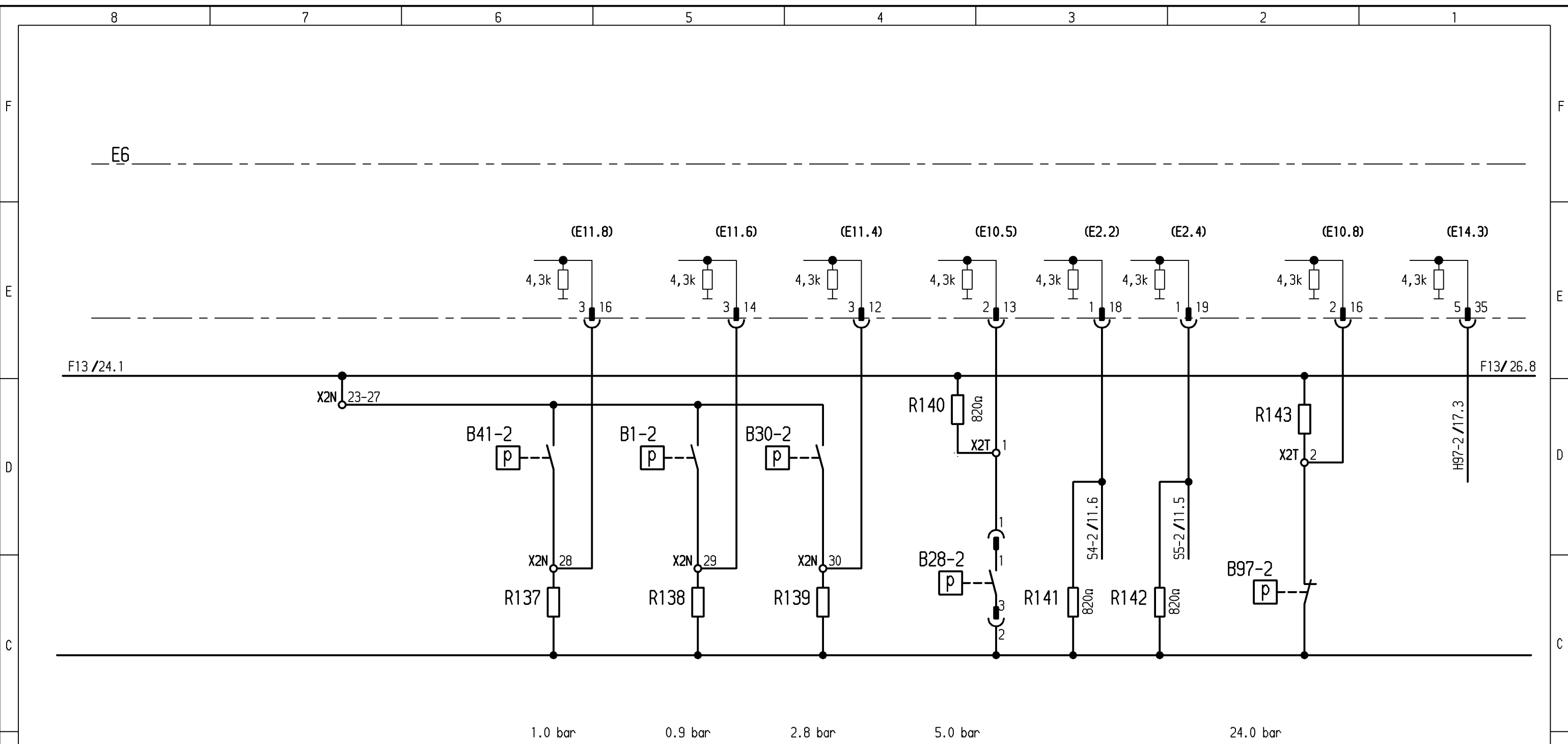


68.05		E 2
69.01		E 8
69.02		E 2
70.01		E 9
70.02		E10
71.01		D 9
71.02		D 3
74.01		E 8
74.02		E 2
78.01		E11
78.02		E11
78.03		E 4
78.04		E 3
78.05		E10
78.06		E 4
78.07		D 1
78.08		B 6
78.11		E 6
78.12		E10
78.14		D 8
78.15		D 1
79.01		E11
79.02		E 4
80.01		E10
80.02		E 4
81.01		E11
81.02		E10
82.01		E 5
82.02		E 3
83		E 5
84.01		F 9
84.02		F 8
85		E 5
89.01		E 8
89.02		E 1
90.01		D 5
90.02		D 4
90.03		E10
90.04		E 4
91		E 5
92.01		H11
92.02		H10
92.03		H 8
92.04		H 5
92.05		H 4
92.06		H 2
C1	F 3	A 5
C2	F 2	A 5
L1	C11	D 5
L2	G 3	D 4
L3	F 1	D 5
L4	H 1	D 3
L5	C11	B 7
L6	F 4	A 5
L7	F 4	A 5
100.01		C 9
100.02		C 2
101.01		C 9
101.02		B 2
101.03		B 9
103.01		B 3
103.02		A 3
103.03		C10
103.04		C 2
105.01		B 4
105.02		B 4
105.03		A 4
105.04		A 4

	8	7	6	5	4	3	2	1
	Seite	Inhalt	Größe	page	contents	size		
F	21	(E 9.7)		18	3E 11-2			
F	21	(E 9.8)		15	3E 14-1			
F	20	(E 10.1)		17	3E 14-2			
F	24	(E 10.2)		53	3E 45-1			
F	26	(E 10.3)		53	3E 45-2			
F	23	(E 10.4)		08	3G 5-1			
F	25	(E 10.5)		08	3G 5-2			
F	23	(E 10.7)		16	3H 10-1			
F	25	(E 10.8)		18	3H 10-2			
F	23	(E 11.3)		07	3K 2a-1			
F	25	(E 11.4)		08	3K 2a-2			
F	23	(E 11.5)		07	3K 2b-1			
F	25	(E 11.6)		08	3K 2b-2			
F	23	(E 11.7)		07	3M 1-1			
F	25	(E 11.8)		08	3M 1-2			
F	21	(E 13.1)		07	3M 2-1			
F	21	(E 13.2)		08	3M 2-2			
F	24	(E 13.3)		15	3Y 39-1			
F	26	(E 13.4)		17	3Y 39-2			
F	24	(E 13.5)						
F	26	(E 13.6)						
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F	21	(E 14.4)						
F	29	(E 14.6)						
F	28	(E 14.7)						
F	37	(E W1.1)						
F	37	(E W1.2)						
F	37	(E W1.3)						
F	37	(E W1.4)						
F	37	(E W2.1)						
F	37	(E W2.2)						
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F	38	(E W3.3)						
F	38	(E W3.4)						
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F	36	(EW15.2)						
F	38	(EW15.3)						
F	38	(EW15.4)						
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F	18	3B 52-2						
F	15	3B 59-1						
F	17	3B 59-2						
F	15	3B 59a-1						
F	17	3B 59a-2						
F	07	3B 93-1						
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	Gepr.	.	.	.	.	.	Elektroplan		KOMATSU		Ident-Nr.:	926 500 40		Format	Blatt/Blätter	
	Abt.:	8125	.	.	.	.	cross reference list		MINING GERMANY		d	A3	05/.	.	.	
Norm	.	.	.	.	.	Copyright reserved (Schutzvermerk DIN 34 beachten)				Erstverw.		Erstverw.		Erstverw.		
SIA	Datum	.	7	6	5			Entstanden aus:		Ersatz für:		Ersetzt durch:				





SPS: Eingang Digital: Motor #2 (und Komponenten "-2")

Kühlwasserdruck	Öldruck		Ölkühler	Anzeige		Pumpenschmierung	Warnung Motorregler
	Hoher Leerlauf	Niedriger Leerlauf	Hoher Leerlauf	Filter Lüfterantrieb schließt > 5bar	Start		

PLC: input digital: motor #2 (components "-2")

coolant pressure	oil pressure		fan oil cooler	Display		pump bearing lubrication	warning engine governor
	high idle	low idle	high idle	fan oil cooler closes > 5 bar	start		

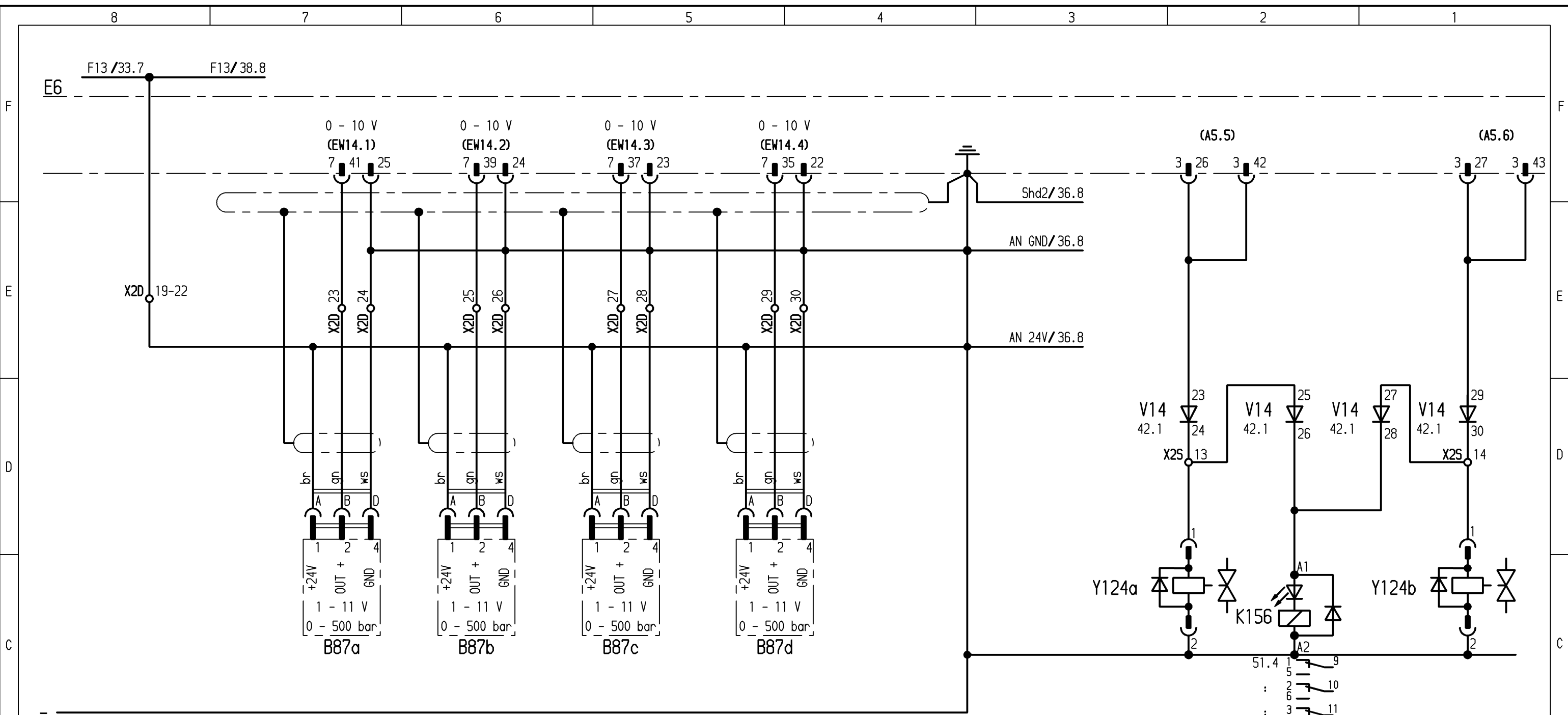
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Abt.:			8125																								
Norm																											
SIA			Datum			7		6		5		Entstanden aus:		Ersatz für:		Ersetzt durch:											

Elektroplan



926 500 40 e A3 25/.

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Abgeschirmte Leitungen vom Sensor bis Eingang SPS

SPS: Eingang Analog: Drücke Pumpen

Drücke				Betankungsarm	
Pumpe 1 + 6	Pumpe 2 + 5	Pumpe 3	Pumpe 4	Y124a: heben	Y124b: senken

PLC: input analog: pressures pumps

pressures				refilling arm	
pump 1 + 6	pump 2 + 5	pump 3	pump 4	Y124a: up	Y124b: down

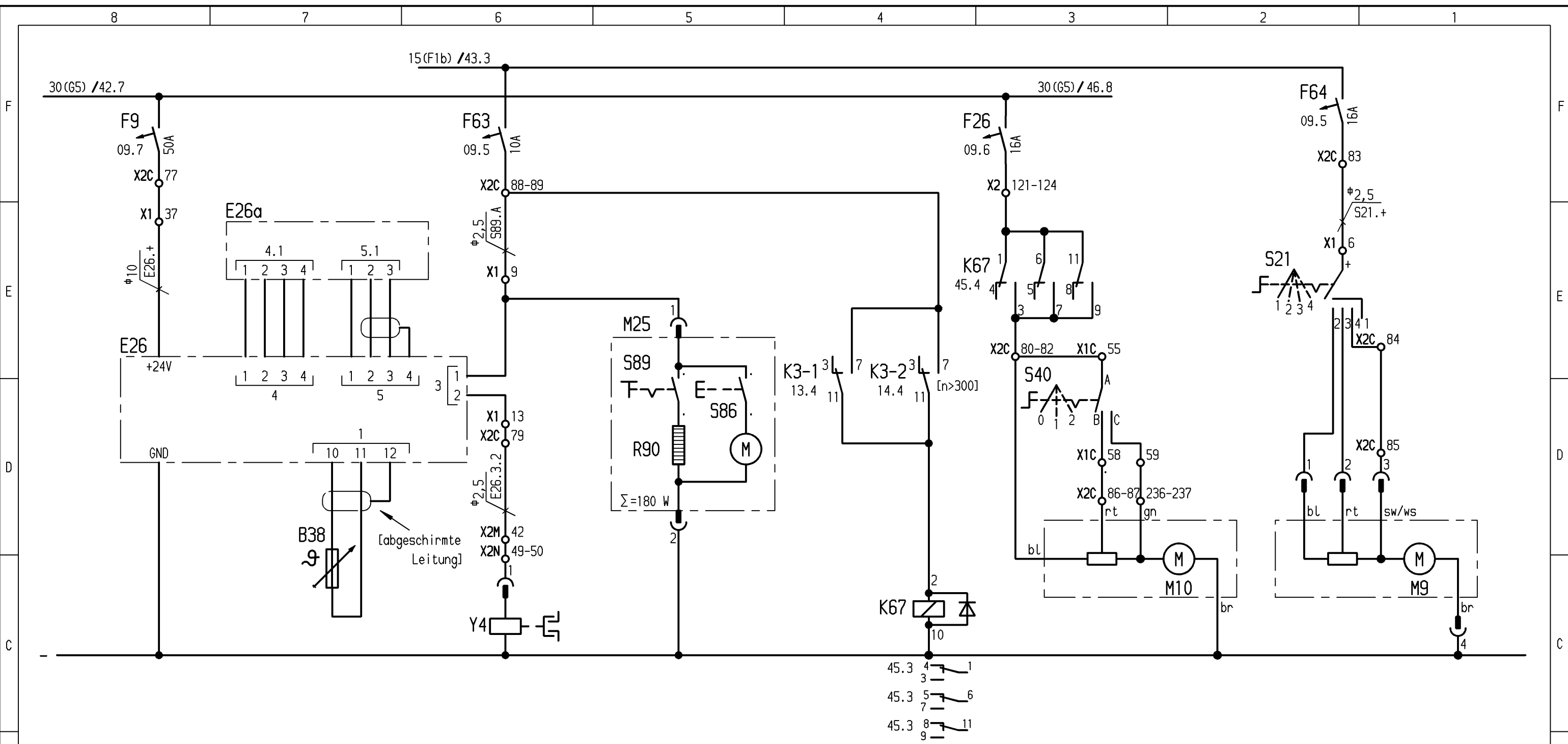
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Elektroplan



Ident-Nr.: 926 500 40 d A3 35/ .

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Kabine: Klimaanlage, Fahrersitz, Heizung

Kabine: Klima

E26 : Klimaanlage  
E26a: Klimaanlage Bedienpult

Fahrersitz

B38 : Kabinenthermostat  
Y4: Magnetkupplung (Kompressor)

Kabine Überdruckgebläse

R85: Sitzheizung  
M25: Kompressor

Kabine Überdruckgebläse

Heizung Kabine

M9: Lüftermotor

cabin: air condition, driver seat, heating

cabin: air condition

E26 : aircondition  
E26a: operator panel

driver's seat

Y4: magnetic clutch (compressor)  
B38 : cab thermostat

driver's seat

R85: seat heating  
M25: air compressor

cab blower

cab heater

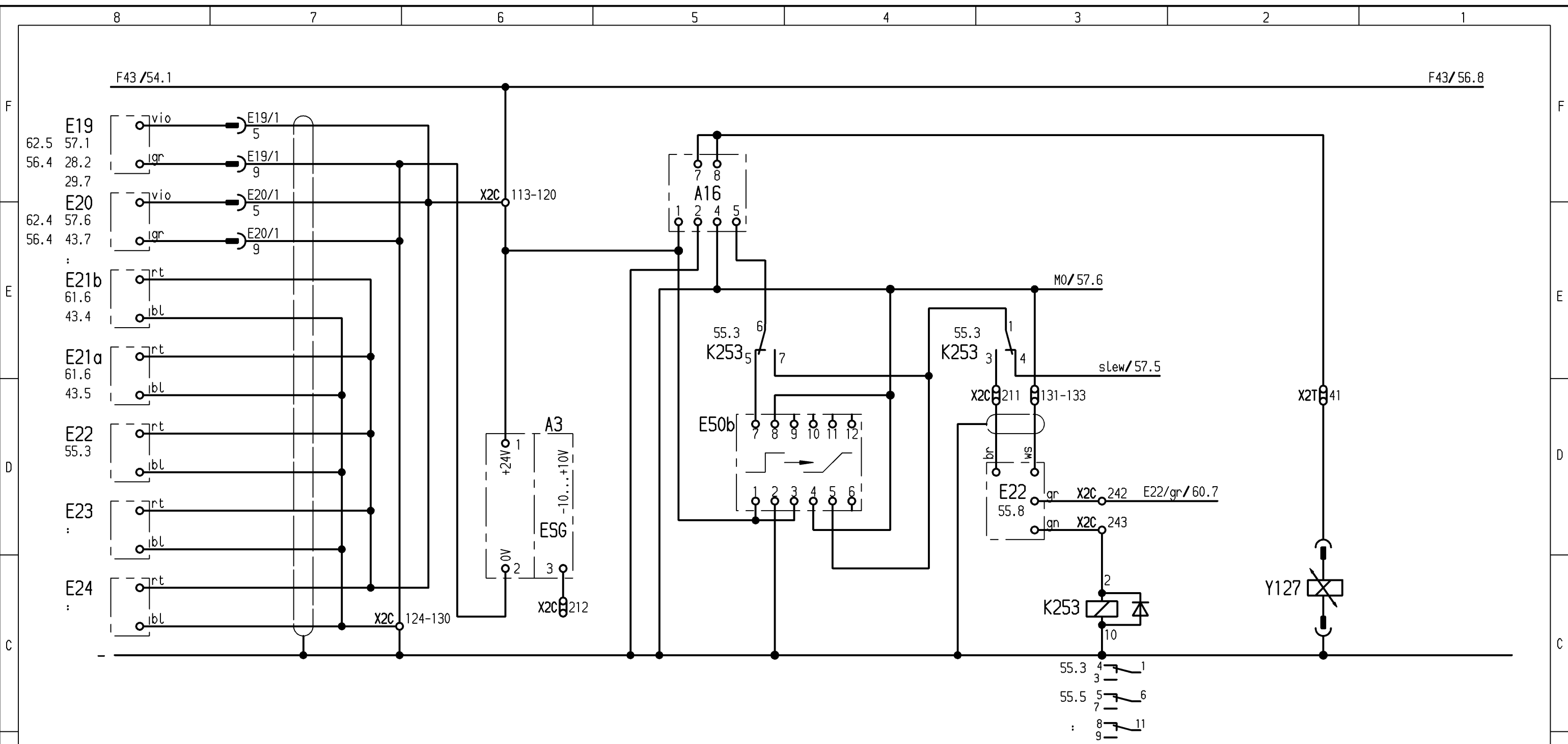
M9: blower drive

A	Bearb.	Datum	Name	Wiederholverwendung Typ Ident-Nr. F	Vordruck f. Schaltpläne	Computererstellte Zeichnung (CAD)	Bau Nr.:	15018/-19	Erstverw.	Typ	Ident-Nr.	F	ÄM-Nr.	Name	Datum
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	Abt.:	8125		.	.	.		Ident-Nr.:	926 500 40	d	A3	45/.			
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Entstanden aus: . Ersatz für: . Ersetzt durch: .



Vorsteuerung: Stromversorgung für Hand- und Fußhebel

Vorsteuerung: Bremse - Drehwerk

Stromversorgung

Drehbremse

Proportional Bremse

E19: Handhebel rechts  
 E20: Handhebel Links  
 E21A, E21B: Fußpedal Fahren

E22: Fußpedal Drehbremse  
 E23: Fußpedal Links  
 E24: Fußpedal rechts

A3: Testmodul -10...+10V

pilot control: power supply for levers and pedals

pilot control: brake - slew

current supply

slew brake

proportional brake

E19: joy stick right  
 E20: joy stick left  
 E21A, E21B: pedal travel

E22: pedal slew brake  
 E23: pedal left  
 E24: pedal right

A3: testing modul -10...+100V

A	Bearb.	Datum	Name	Wiederholverwendung			Vordruck f. Schaltpläne	Computererstellte Zeichnung (CAD)	Bau Nr.:	15018/-19	Erstverw.	Typ	Ident-Nr.	F	ÄM-Nr.	Name	Datum
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	Abt.:	8125					Elektroplan			Ident-Nr.:			926 500 40 d		Format	Blatt/Blätter	
	Norm			Copyright reserved (Schutzvermerk DIN 34 beachten)						Erstverw.:			Ersatz für:		Ersetzt durch:		A3
SIA	Datum			7			6	5	Entstanden aus:		Ersatz für:		Ersetzt durch:				

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