

6.0.1 Work Hydraulics

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6.0.1 Working hydraulics

Safety regulations

- **Hydraulic systems are under high pressure!**



High-pressure fluids (fuel, hydraulic oil) issuing under high pressure can penetrate the skin and cause severe injuries. Therefore, even with the smallest wounds, consult a doctor since otherwise severe infections can arise!

- **Use suitable aids when tracing leaks because of the risk of injury!**
- **Before working on the hydraulic system, absolutely relieve this of pressure and lower attached tools!**

In work on the hydraulic system absolutely switch off the engine and secure the vehicle against rolling away (parking brake, wedge)!

- **Ensure the specified connection of the hydraulic hoses when connecting hydraulic cylinders and motors!**
- **If the connections are swapped, reversed functions (e.g. raise/lower) – risk of accidents!**

Check hydraulic hoses regularly and replace them if damaged or aged!

The replacement hoses must comply with the technical requirements of the tool manufacturer!



Dispose of oils, fuel and filters correctly!

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Basics of troubleshooting on hydraulic systems

A good work plan for diagnosing hydraulic systems must have 7 points:

1. Knowing the system and understanding the functions:

This means understanding the operation of the hydraulic system with the aid of the training documents, the hydraulic circuit diagram and the hydraulic function circuit diagrams.

2. Ask the driver or operator. Only the driver or operator can reliably describe the details of the fault or malfunction.

- Which fault or malfunction occurs?
- When did the fault occur?
- Under what conditions did the fault occur?
- After how many operating hours did the fault occur the first time?
- After how much time in use did the fault occur (e.g. after 30 minutes working time, at which hydraulic oil temperature did the problem occur, etc.)?
- Was maintenance or repair work done on the system before the fault occurred?

3. Put the hydraulic system into operation.

4. Check all functions of the hydraulic system, if possible start up the working hydraulics and duplicate the fault.

5. Make a list of the possible causes (hydraulic problem, electrical problem, engine problem, mechanical problem).

6. Draw your conclusions.

7. Check these conclusions.

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Basics of troubleshooting on hydraulic systems

To be able to help you in problem cases, we absolutely require the results of the 7 points of the fault diagnosis. Please send us your results by telephone or email in the order of point 1 to point 7.

Re point 1: Did you use the technical documents, training documents, hydraulic circuit diagrams, hydraulic function circuit diagrams and the electrical circuit diagrams?

Re point 2: Could you reconstruct the fault that was described by the customer?

Re point 3: Did you put the hydraulic system into operation?

Re point 4: Could you duplicate the fault described by the customer (driver/operator) yourself when starting up and testing the system?

Re point 5: What possible causes have you detected?

Re point 6: What conclusions (fault causes) have you drawn?

Re point 7: Which tests have you performed (electrical, hydraulic), how are the measured values that you have determined with the pressure gauge or flow meter?

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Basics of troubleshooting on hydraulic systems

Check before starting all work:

- That the hydraulic system is sufficiently filled with hydraulic oil, top up with hydraulic oil if necessary!
- The hydraulic oil filters are clean. Check the hydraulic oil filters for chips or metallic parts. Immediately replace soiled hydraulic oil filters.

The function of the component to be tested must be safely recognised before the tests are started. It is essential to use the hydraulic circuit diagram and the hydraulic function circuit diagrams for this!

Perform the further tests in the following order:

- Always first check the electrical system in the case of electrically actuated components (e.g. solenoid valves)!
- It is essential to use the electrical circuit diagram and the electrical function circuit diagram for this.
- Operate the solenoid valves mechanically in the case of functions that are controlled by solenoid valves.
Push in the pin in the centre of the solenoid valve with the aid of a screwdriver or another suitable tool to do this.
- Check the hydraulic oil pressure with a suitable pressure gauge.
- In the case of hydraulic functions operated with a double acting hydraulic cylinder (example: steering, raise/lower dirt hopper), always test the hydraulic cylinders for internal leaks.

Note: It is essential that suitable pressure gauges (e.g. hydraulic measuring case; Hako spare part number 0350 183) are available for testing hydraulic systems. A flow meter (measuring turbine) (e.g. hydr. flow meter set, Hako spare part number 03501840) is necessary for measuring flow rates.

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Cause of damage to hydraulic systems on mobile hydraulics

1. Contaminated hydraulic oil!

The main cause of faults in hydraulic systems is **contaminated hydraulic oil**. Dirt particles lead to malfunctioning of valves and diaphragms. Dirt particles in the hydraulic oil increase the wear of components such as hydraulic pumps, hydraulic motors and other components. The life of the hydraulic components drops to 50 % of the normal life!

How do dirt particles get into the hydraulic system?

- Due to defective maintenance, the hydraulic oil and the hydraulic oil filters are not changed or not changed on time.
- Due to dirt in the hydraulic oil casks.
- Due to refilling hydraulic oil with dirty oil cans and funnels.
- Due to repairs in which sufficient attention was not paid to cleanliness.
- Due to damage to components and valves.

Remedy:

- Maintenance intervals for changing hydraulic oil and filters must be complied with imperatively.
- Check the hydraulic oil filters for cleanliness in the case of faults . Check hydraulic oil filters for chips or metallic parts. Replace dirty hydraulic oil filters immediately.
- Pay attention without fail to cleanliness when filling or refilling hydraulic systems. Use no dirty containers, oil cans or funnels!
- Pay attention without fail to cleanliness when repairing hydraulic systems!
- Use the portable filter unit (Hako spare part number 03502040) and the associated filter element (Hako spare part number 01081470).

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Cause of damage to hydraulic systems on mobile hydraulics

2. Mixing different hydraulic oils or engine oil!

A further cause of faults in hydraulic systems is mixing different hydraulic oils, above all mixing plant-based hydraulic oils with mineral hydraulic oils or mixing with engine oil.

How do other oils get into the hydraulic system?

By refilling with unsuitable hydraulic oil or refilling with engine oil!

Foaming of the hydraulic oil in the hydraulic oil tank occurs frequently in hydraulic systems in which oil mixing has occurred due to refilling with the wrong hydraulic oil. Increased noise in the hydraulic system is frequently found as a further factor.

Remedy:

Completely drain off mixed hydraulic oil. Replace the hydraulic oil filter. Fill the machine with the correct specified hydraulic oil (see operating instructions and technical documentation).

Drive the machine and operate all work functions. The process should last at least 30 minutes.

Then completely drain off and refill the hydraulic oil. Replace the hydraulic oil filter. Fill the machine with the correct specified hydraulic oil. Drive the machine and start up all work functions. If faults now no longer occur, the machine can be put back into normal service.

Important: The process must be performed two times as described, since if the hydraulic oil is replaced once only, a high proportion of mixtures is still in the hydraulic system.

Later failures of hydraulic pumps and hydraulic motors cannot be excluded in hydraulic systems that have been operated for a long time with mixed hydraulic oil, even if the hydraulic oil and the hydraulic oil filter have been replaced two times as described.

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Cause of damage to hydraulic systems in mobile hydraulics

3. Overheating of the hydraulic system!

A further cause of faults is overheating of the hydraulic system. Hydraulic systems in mobile hydraulics should not be operated permanently above 75 °C.

Oil losses at hydraulic pumps, hydraulic motors, valve blocks and O-ring connections occur frequently in hydraulic systems that have been overheated, since the O-rings become hard due to the high temperatures and can no longer seal correctly.

Remedy:

Clean the hydraulic oil radiator. Check the fan speed, tension V-belt of the radiator fan. Replace leaking seals (O-rings, gaskets). Replace the hydraulic oil and hydraulic oil filters since the hydraulic oil is damaged by the thermal stresses.

Later failures of hydraulic pumps and hydraulic motors and valve blocks cannot be excluded in hydraulic systems that have been operated for a longer time at too high a temperature.

If there is suspicion of contaminated hydraulic oil, mixed hydraulic oil, too much water in the hydraulic oil or overheated hydraulic systems, oil samples of the hydraulic oil should be taken without fail before and after the repairs.

Send these oil samples to a laboratory for evaluation. Such examinations are performed by Oil Check in Brannenburg, for instance.

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Cause of damage to hydraulic systems in mobile hydraulics

4. Too much water in the hydraulic oil!

How does water get into the hydraulic oil?

Circulating air gets into the hydraulic oil tank through the ventilation and de-airing filter according to temperature. The circulating air has an amount of water that is absorbed by the hydraulic oil. This effect is intensified when a water hose or high-pressure cleaner is held directly on the ventilation and de-airing filter when the machine is washed.

Hydraulic oils with too much water can be detected frequently by the milky colour of the hydraulic oil.

Remedy:

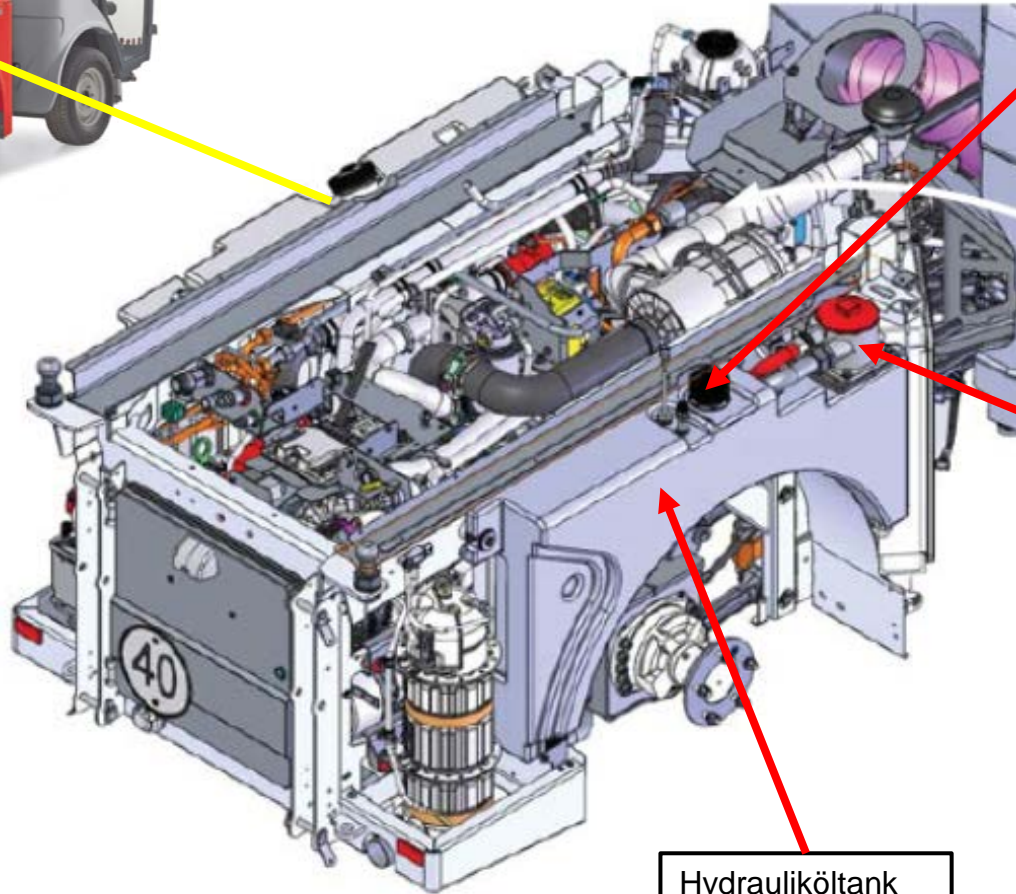
Change the hydraulic oil and the hydraulic oil filters.

Later failures of hydraulic pumps and hydraulic motors and valve blocks cannot be excluded in hydraulic systems that have been operated for a long time with too much water in the hydraulic oil.

If there is suspicion of contaminated hydraulic oil, mixed hydraulic oil, too much water in the hydraulic oil or overheated hydraulic systems, oil samples of the hydraulic oil should be taken without fail before and after the repairs.

Send these oil samples to a laboratory for evaluation. Such examinations are performed by Oil Check in Brannenburg, for instance.

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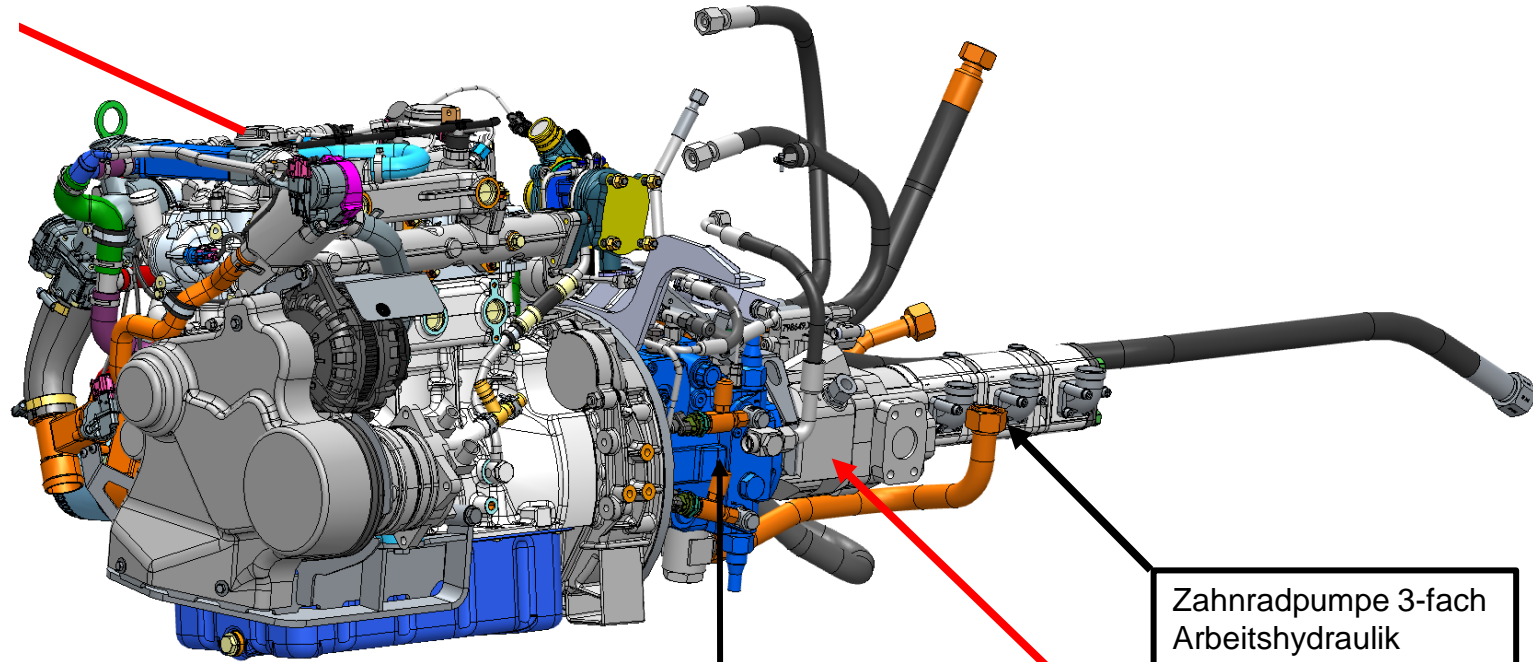
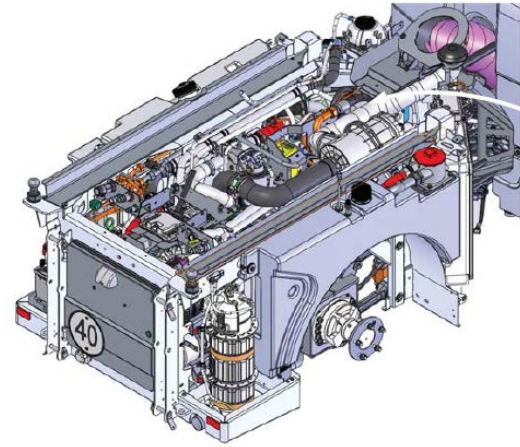


Einfüllfilter und
Belüftungsfilter Hydrauliköltank
Intake and venting filter
hydraulic oil tank

Rücklauf- Saugfilter
Suction and return filter

Hydrauliköltank
Hydraulic Oil tank

6.0.1 Work Hydraulics

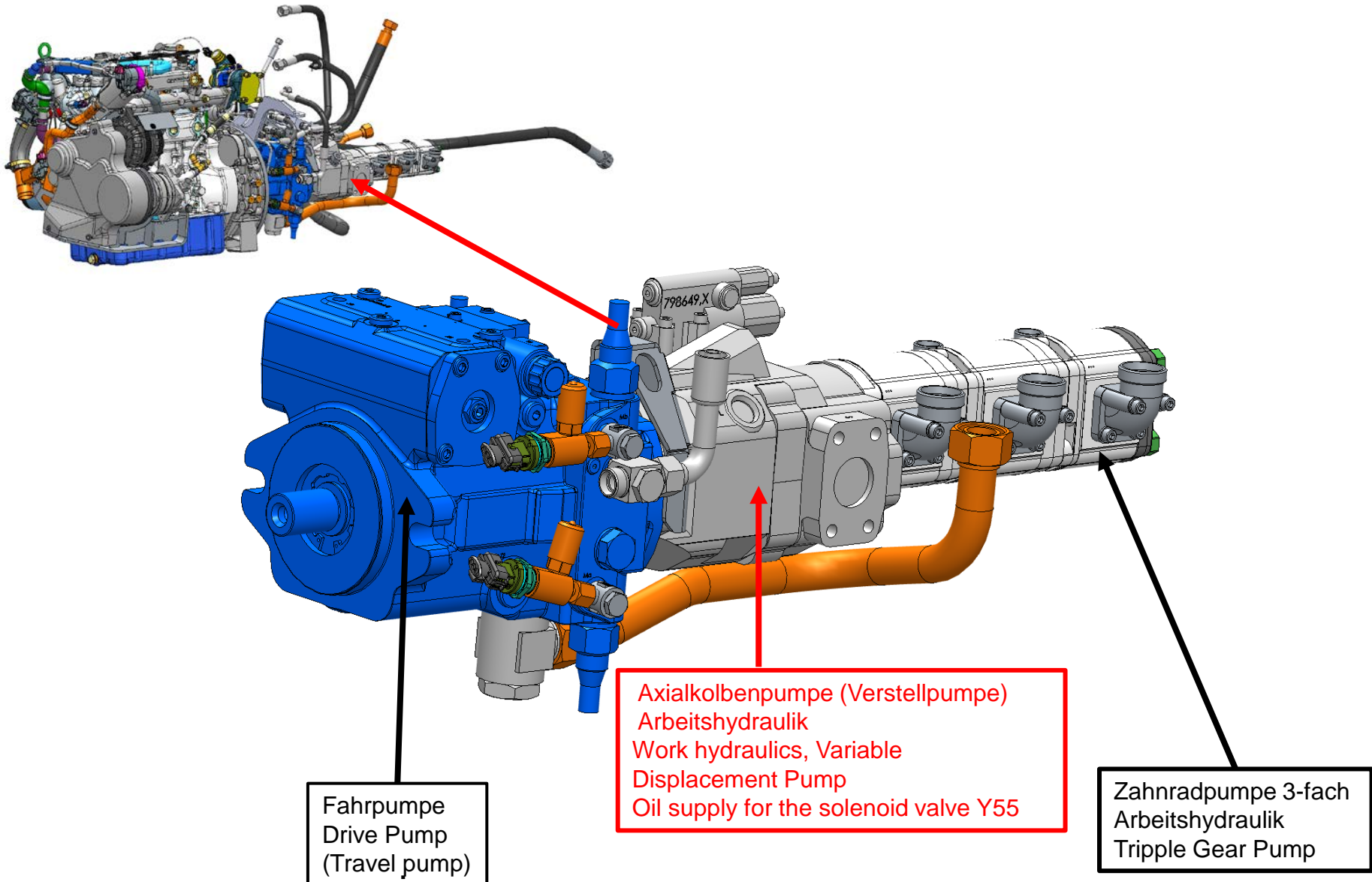


Zahnradpumpe 3-fach
Arbeitshydraulik
Tripple Gear Pump

Fahrpumpe
Drive Pump
(Travel pump)

Axialkolbenpumpe (Verstellpumpe)
Arbeitshydraulik
Work hydraulics, Variable
Displacement Pump
Oil supply for the solenoid valve Y55
proportional solenoid valve front
attachments

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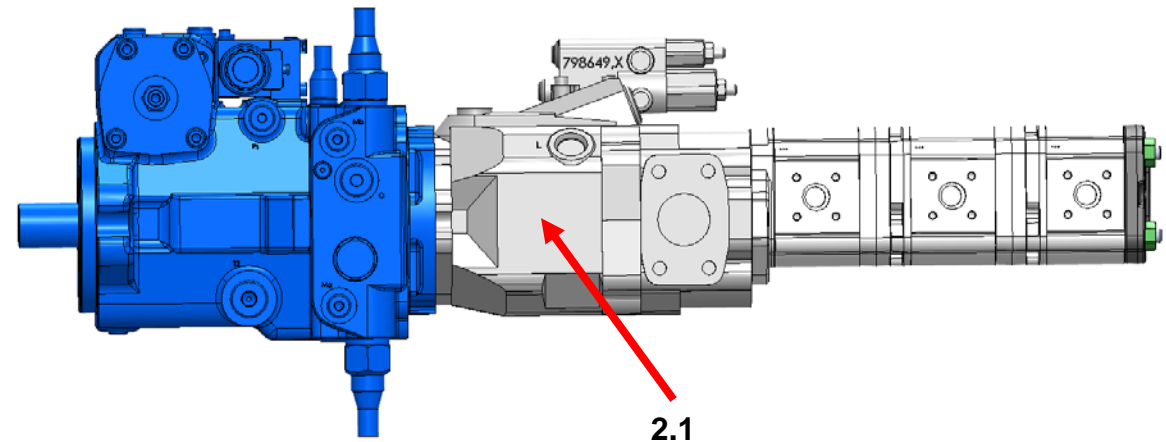
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Hydraulic pumps in the rear wagon of the CM 1650 with triple gear pump

Hydraulics axial piston pump 2.1
(variable displacement pump)

Oil supply for the solenoid valve Y55 proportional
solenoid valve front attachment.

The oil supply for further front attachments:
brooms, mower,
front sweeping roller, scrubbing deck,
snow blower, etc.



Technische Daten	
Typ	AL A10VO 45 DFR/52R-VRC12K52-SO4378
Bosch-Rexroth Teile-Nummer	R902538096
Ausführung nach Bosch-Rexroth Datenblatt	RD 92703
Gewicht ca.	25 kg
Max. geom. Verdrängungsvolumen	37,0 cm ³
max. Antriebsdrehzahl bei max. Hubvolumen	2600 1/min
Druck (Druckabscheidung) max. ca.	225,0 bar
Drehrichtung (bei Blick auf Antriebswelle)	rechts
Durchtrieb 82-2 (A) mit Nabe für Zahnwelle 3/4 in 11T 16/32DP	
Pumpen-Regler	
Druckförderstromregler DFR mit LS-Entlastung	
DFR-Einstellung LS-Differenzdruck	18 bar
UMBAU des REGLERS: DFR mit RÜCKLAUFDÜSE 1,0	

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Output setting for hydraulic circuit I

The maximum delivery of hydraulic circuit I is determined by the coding plugs on the attachment. Two selectable oil flows with a maximum flow of 50 l/min (Fig. 64-A) or 70 l/min (Fig. 64-B) are available for attachments without coding plugs. The adjustment is made on the configuration menu, see page 43.

In the working menu, the hydraulic circuit I Fig. 64-A is activated and set to the required value with the turn-push knob Fig. 64-69. Setting range: OFF/ON or 0 to 100 % In the setting to 70 l/min the adjustment process stops initially at 70 % (corresponds to 50 l/min setting), but can be continued by renewed turning of Fig. 64-69 up to 100 % (70 l/min).



Danger

Risk of injury! Make sure that the attachments are suitable for the set oil volume. An oil volume set too high can lead to injuries due to a defect of the attachment! As a reminder, the setting process is interrupted briefly at 70 %.



Note

The hydraulic circuit I is switched off if the driver leaves the driver's seat. The driver switches the hydraulic circuit I back on with Fig. 64-69 after returning to the driver's seat. In connection with the sweeping unit and the universal hopper, the brush is restarted by pushing the left joystick to the front!

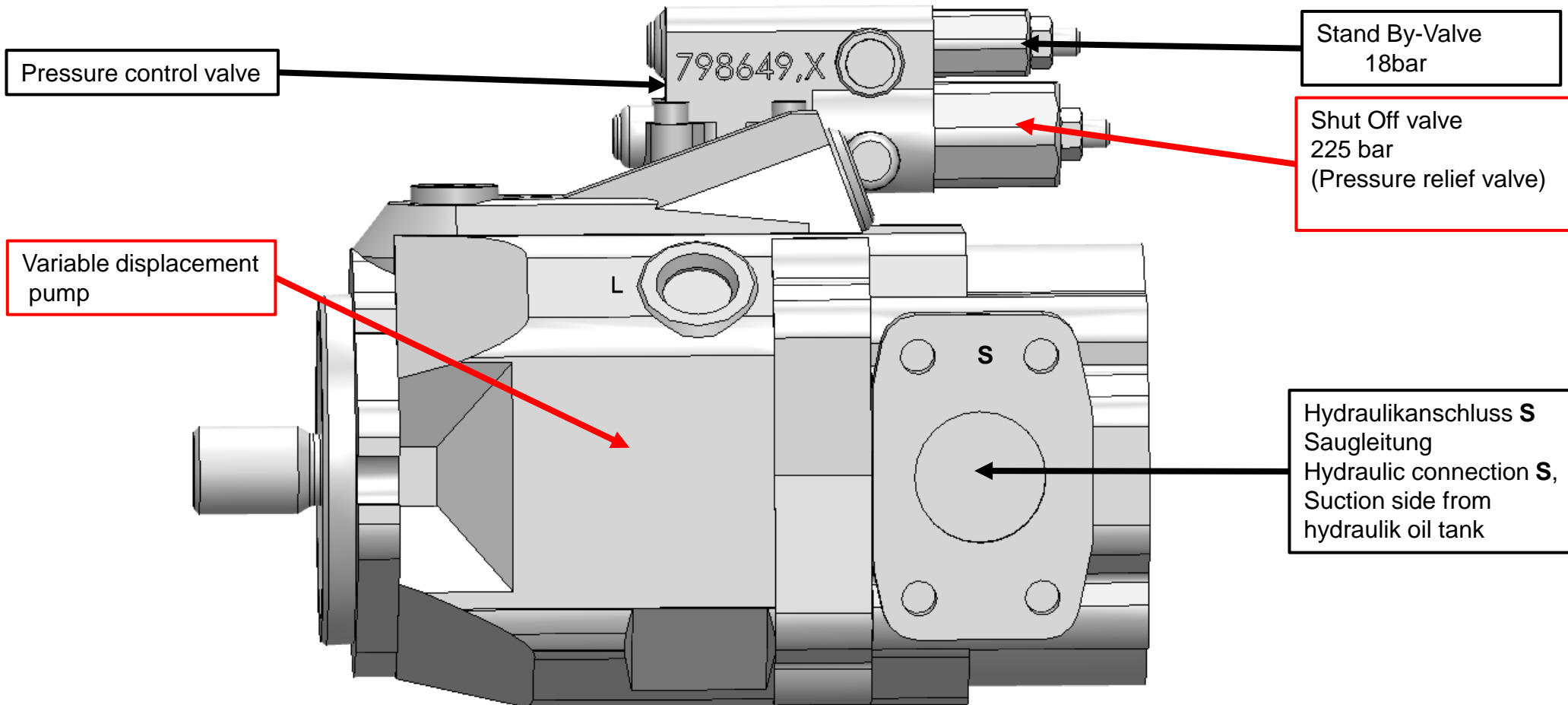


Note

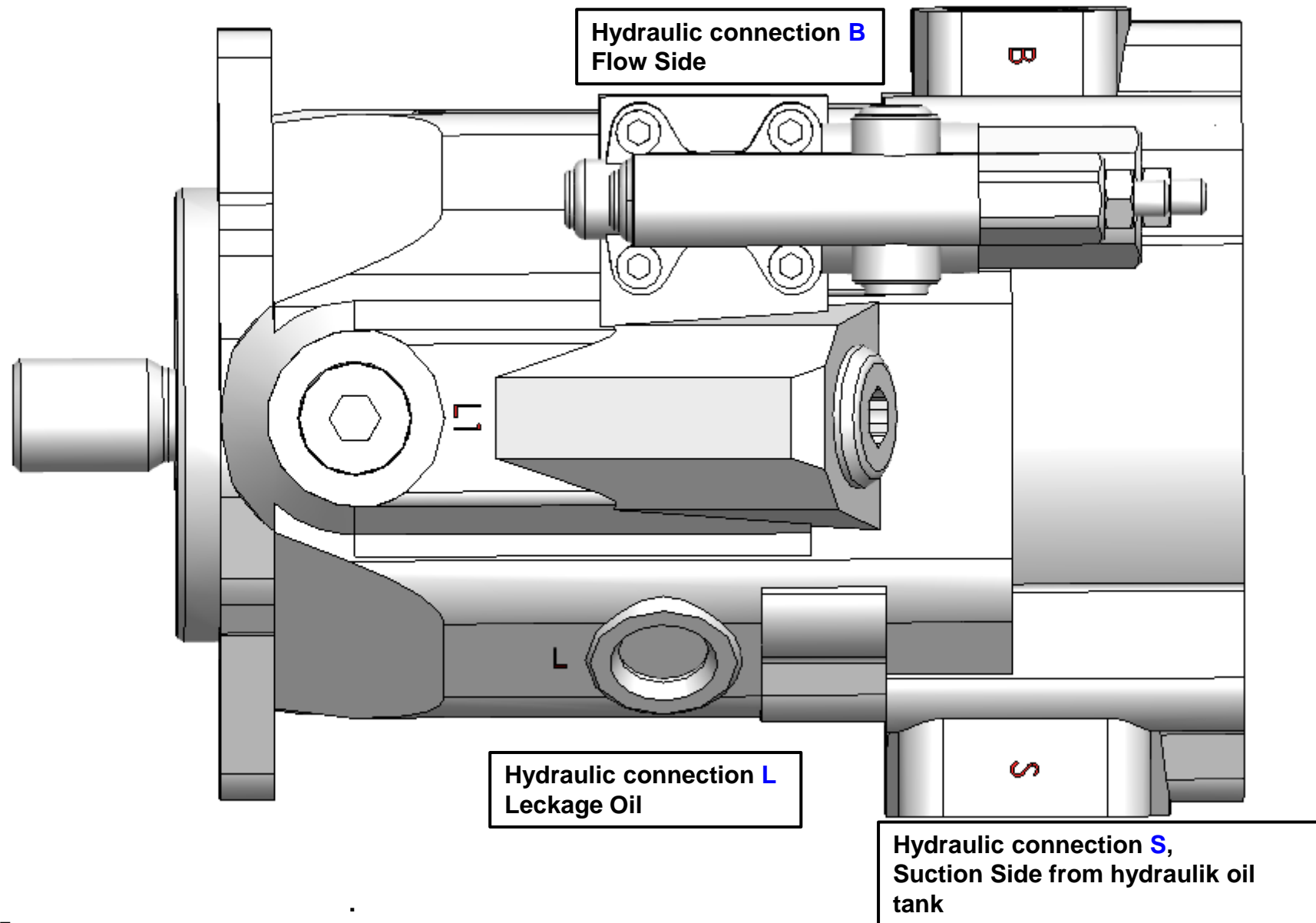
The delivery of hydraulic circuit I depends to a large extent on the engine speed set on the tip switch Fig. 64-63. Select the ECO mode as often as possible in the sense of the most energy-saving operation of the vehicle. If the oil flow requested by Fig. 64-69 does not reach the set value, then the warning Fig. 64-C appears in the multifunctional display. Cancel the adjustment or increase the engine speed until the warning symbol goes out. Also increase the engine speed if you require additional power for driving (e.g. driving uphill or propulsion work in winter service). If the additional power requirement is no longer required, reduce the power step by step.

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Axial Piston Pump 2.1 (Variable Displacement Pump)

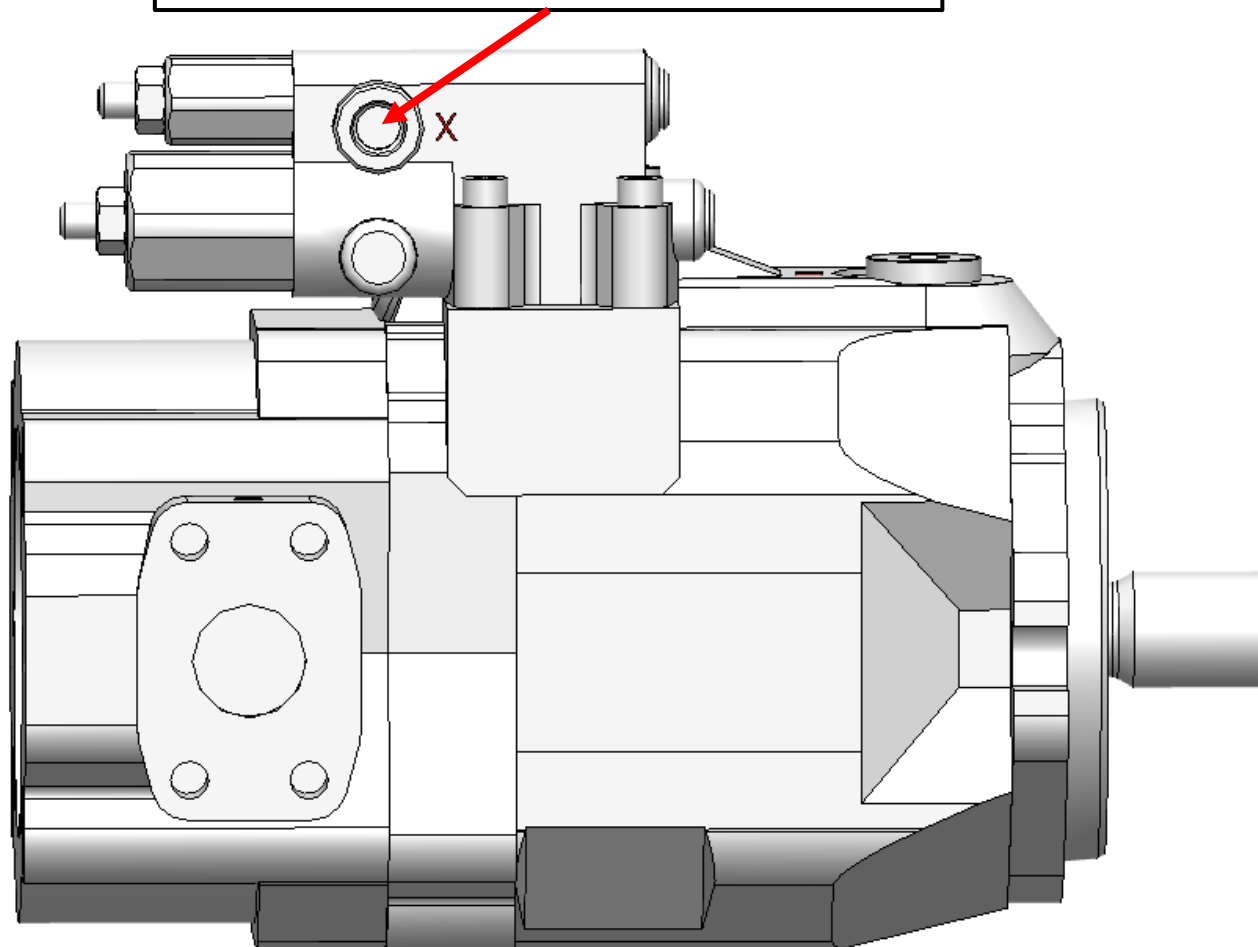


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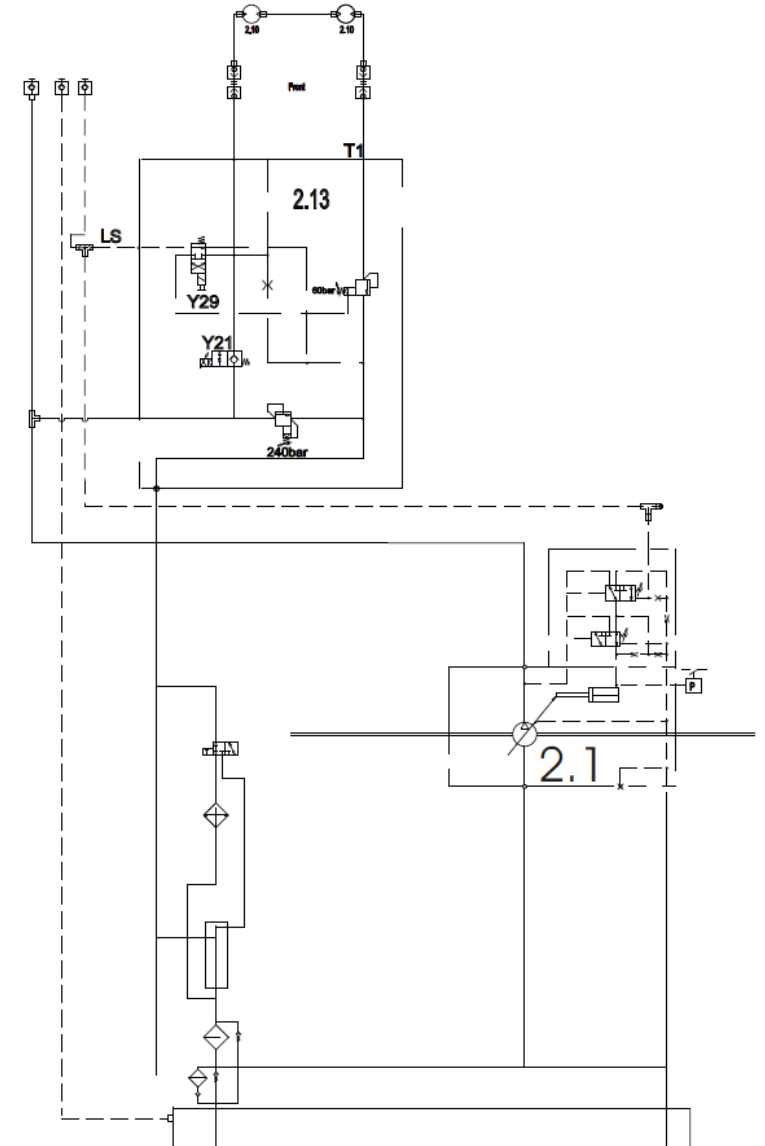
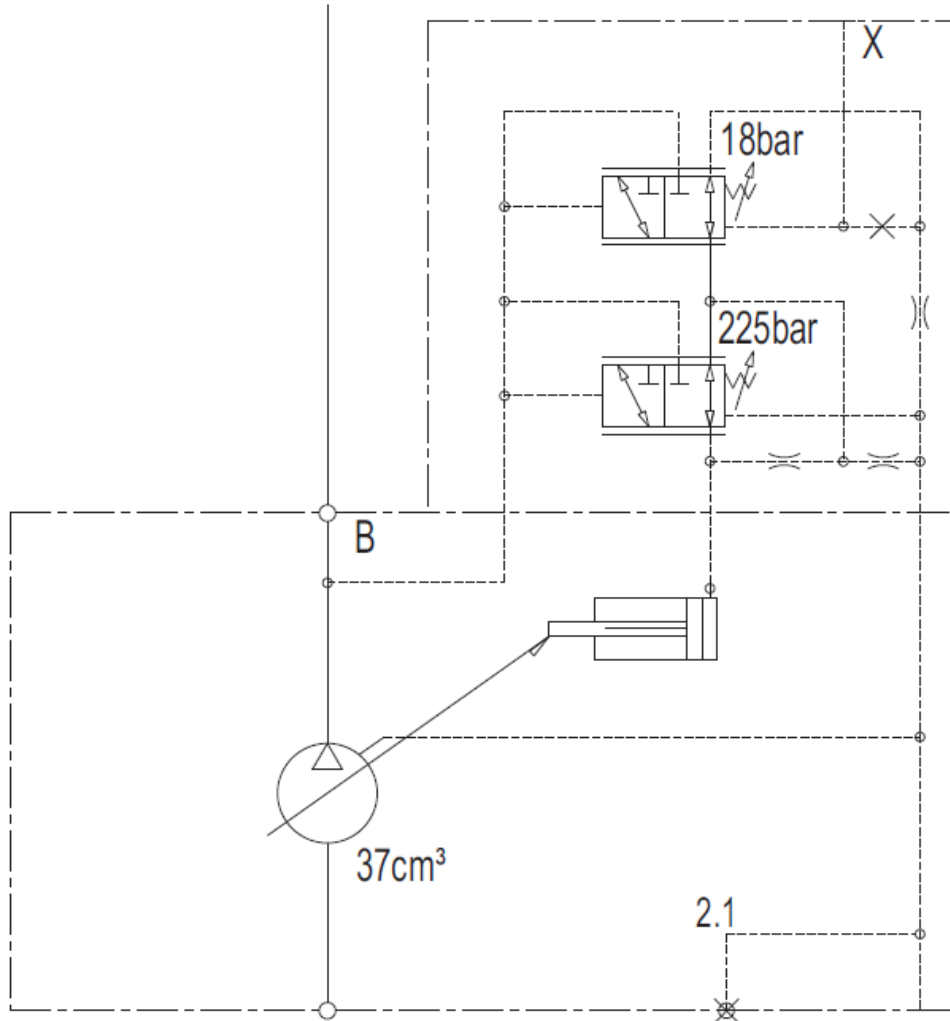


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Hydraulic connection X, Load sensing signal (LS)



6.0.1 Work Hydraulics



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Solenoid valves Y21 + Y29, hydraulic block (2.13) in the front wagon CM 1650 (PN 01501330)

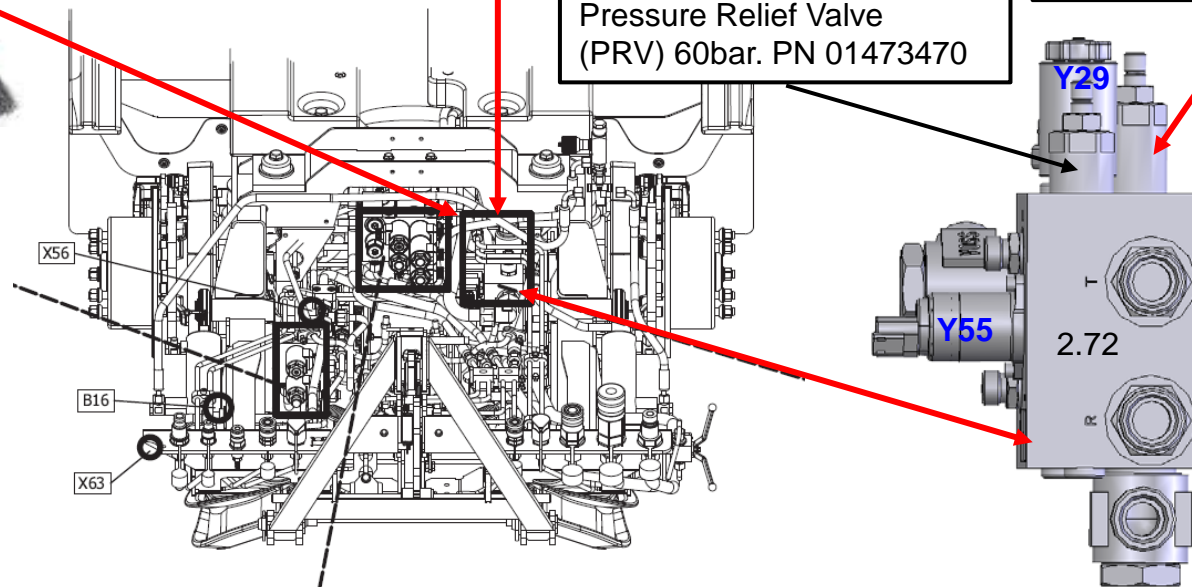
Hydraulic block (2.13, PN 01501330)
With Solenoid valves:

Y55 Proportional- Solenoid Valve broom speed or oil supply for front attachment e.g front mower, snow blower: 0 to 70l/min. PN 01501610.

Y29 Solonoid valve Stop Function Front attachment. PN 01501590.

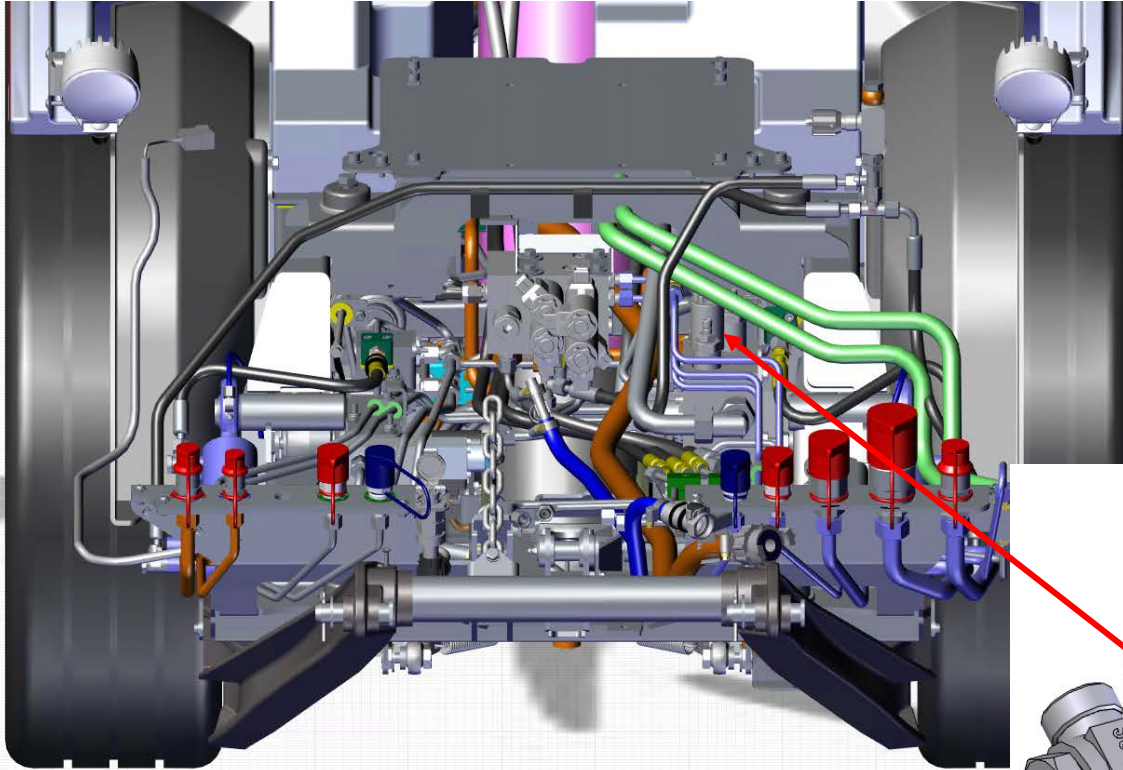
Pressure Relief Valve
(PRV) 60bar. PN 01473470

Pressure Relief Valve
(PRV) 250bar. PN 01492620



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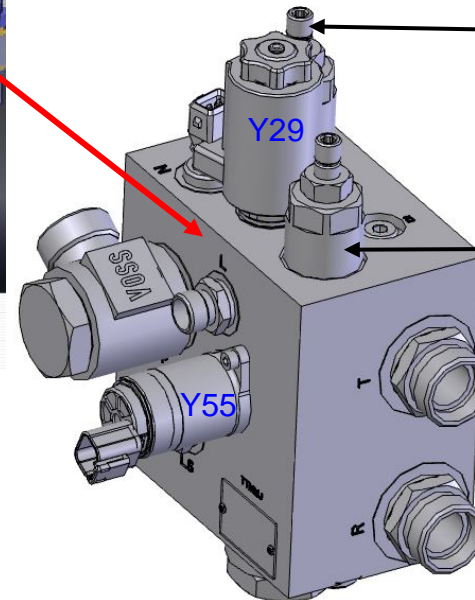
Solenoid valves Y21 + Y29, hydraulic block (2.13) in the front wagon CM 1650 (PN 01501330)



Hydraulic block (2.13, PN 01501330)
With Solenoid valves:

Y55 Proportional- Solenoid Valve broom speed or oil supply for front attachment e.g front mower, snow blower: 0 to 70l/min. PN 01501610.

Y29 Solonoid valve Stop Function Front Attachment. PN 01501590.

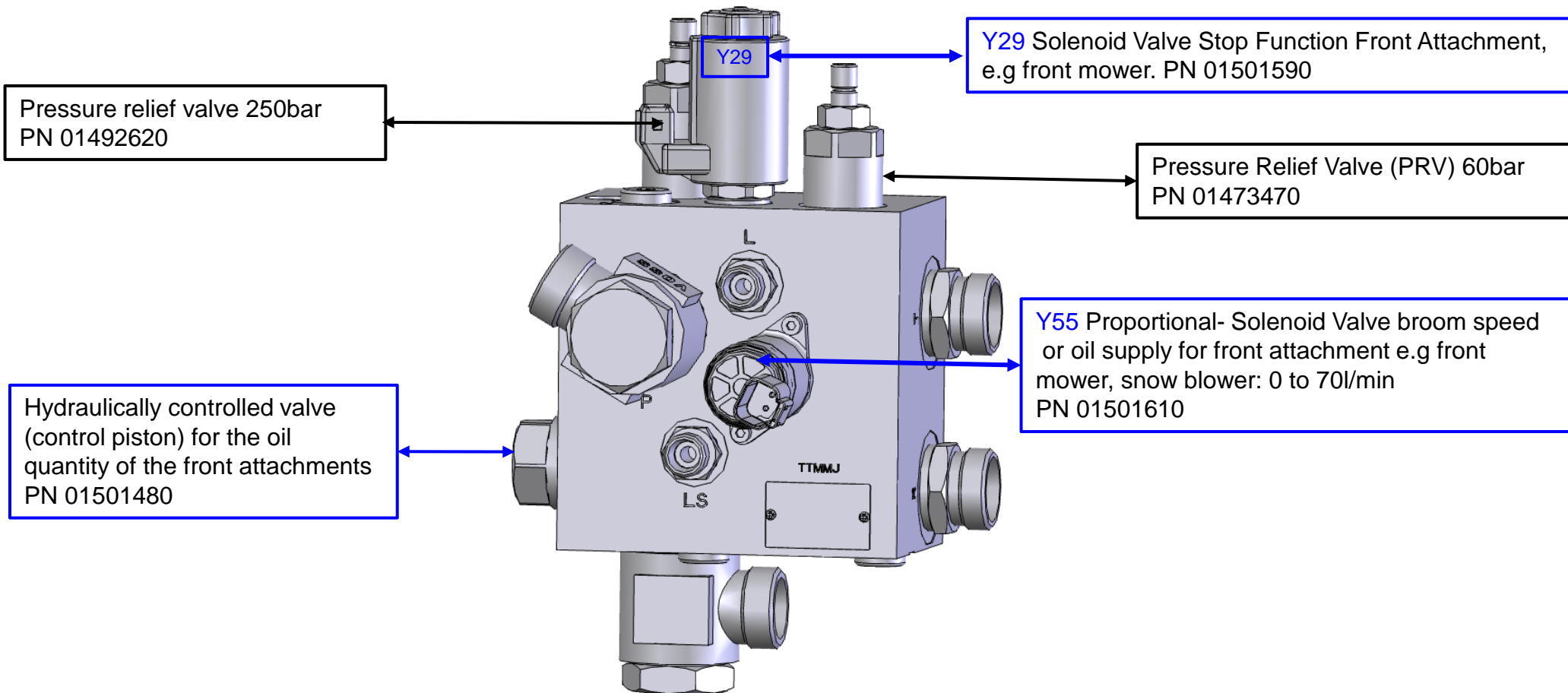


Pressure Relief Valve
(PRV) 250bar. PN 01492620

Pressure Relief Valve
(PRV) 60bar. PN 01473470

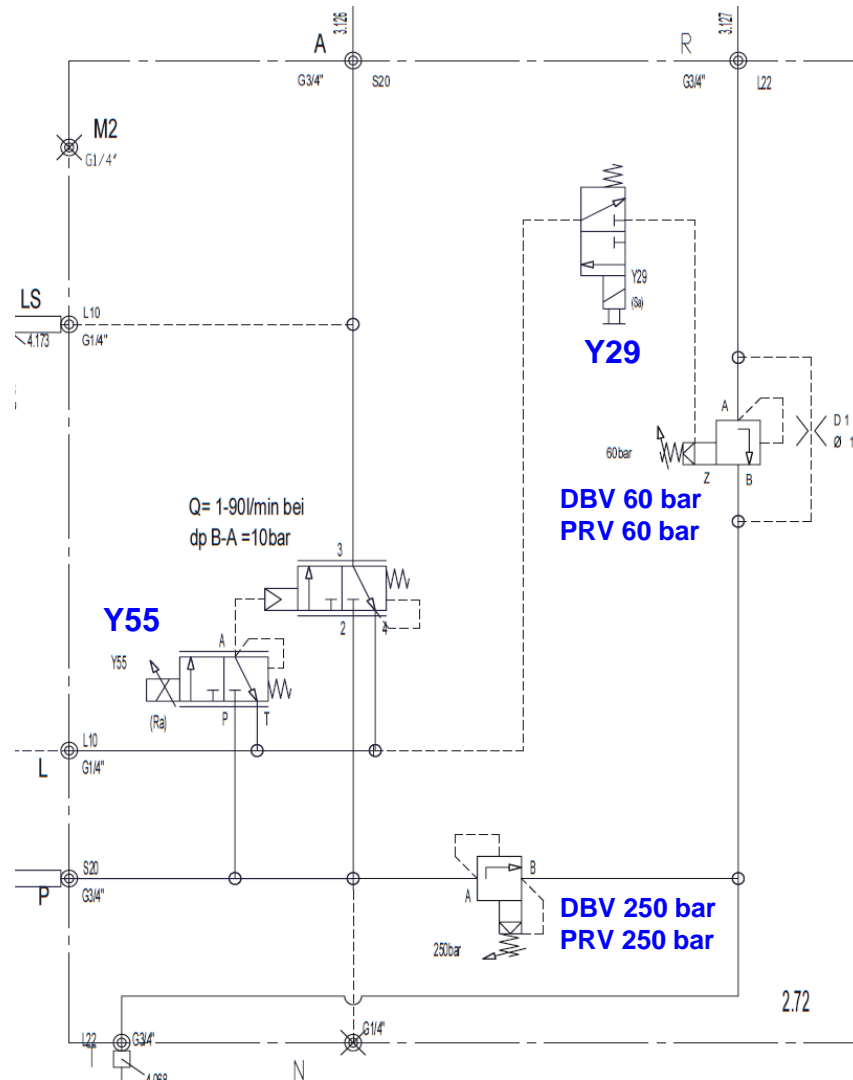
6.0.1 Work Hydraulics

Measured values of solenoid valves hydraulic block (2.72) in the front wagon CM 1650 (View from rear side)



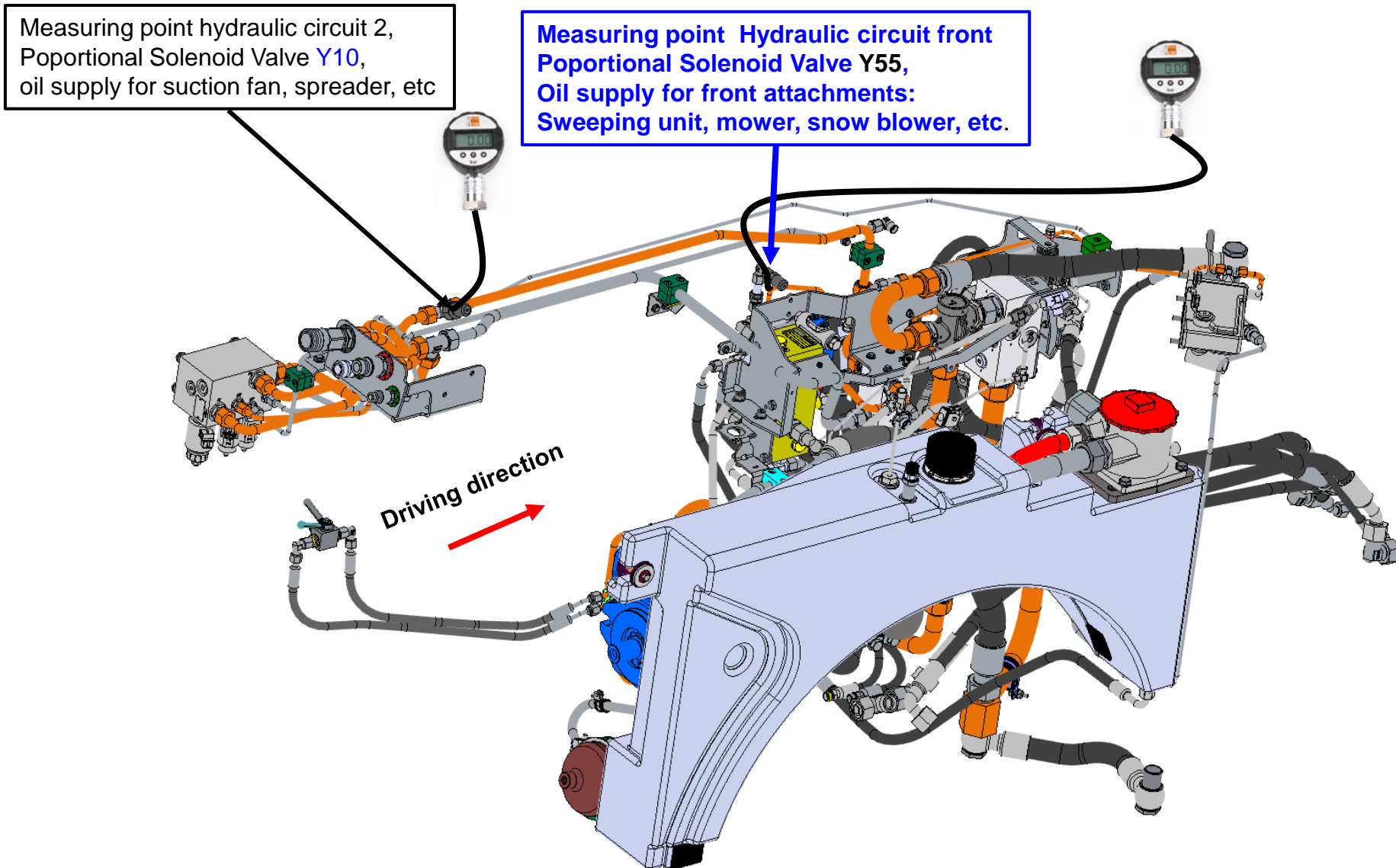
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Hydraulic block (2.72) in the front waggon CM 1650 (PN 01501330)



6.0.1 Work Hydraulics

Hydraulic- Measuring- Connections work hydraulics CM 1650



6.0.1 Work Hydraulics

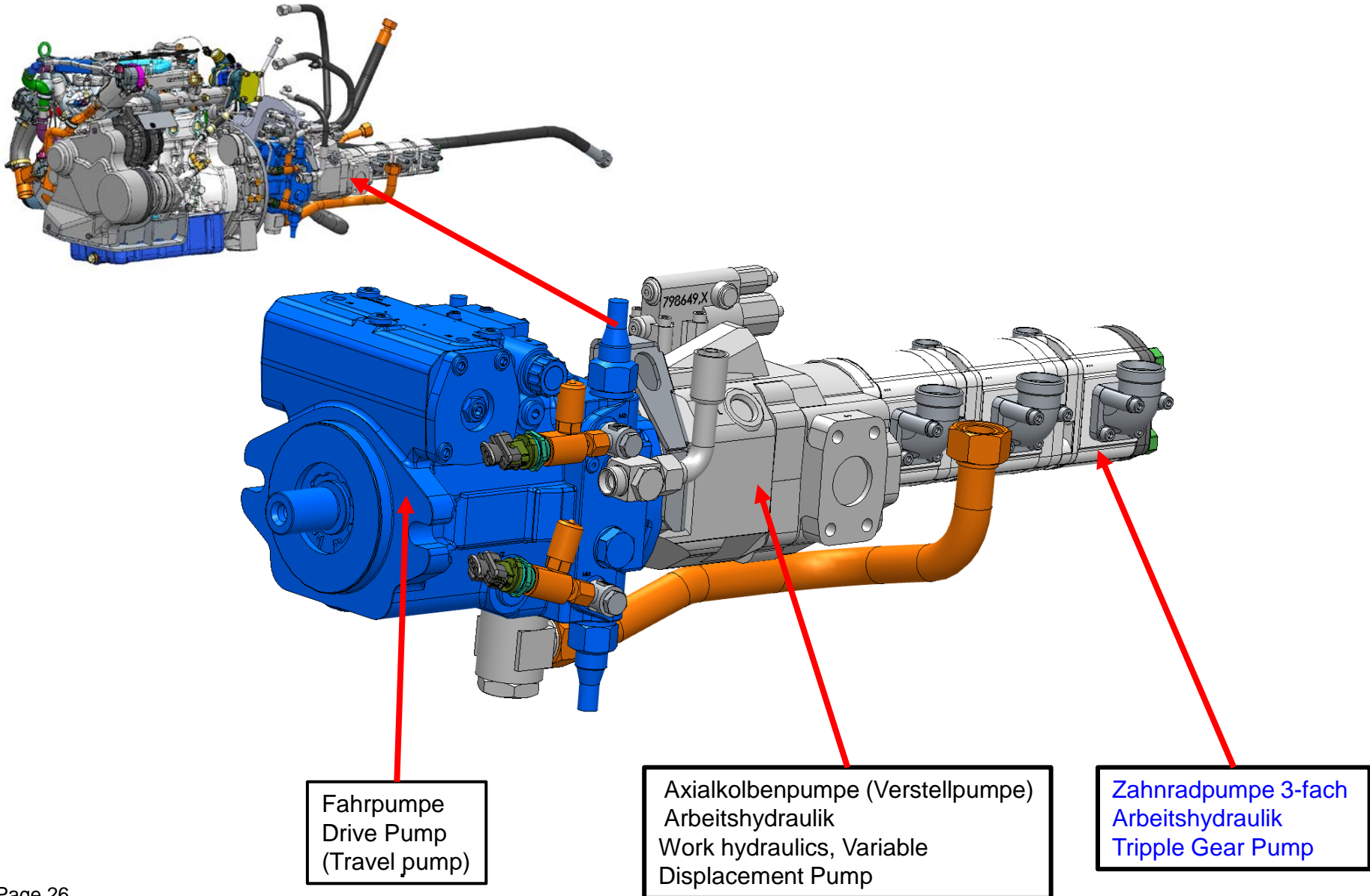
Messwerte der Magnetventile Y55 und Y29 für den Hydraulikblock 2.72
Measured values of solenoid valves Y55 and Y29 for the hydraulic control block 2.72

	Beschreibung- Description MV= Magnetventil- SV= Solenoid Valve	Spannung Voltage (V)	Stromstärke (A) Current Flow (A)	Widerstand der Spule Resistance Coil (Ω)
Y55	MV Y55 Funktion: Ölversorgung Kehreinheit, Frontmäherwerk 2,75m, Schneefräse usw. Proportional- Ventil Y55 und Y29. Max. 70 L/min bei 2400 1/min Function: Oil supply sweeping unit, front mower 2.75m, snow blower Proportional- Solonoid valve Y55 and Y29. Max. 70 L/min bei 2000 1/min	0 - 8,3V	0- 1480mA	5,6Ω (Ohm)
Y29	MV Abbremsfunktion Frontanbaugeräte SV Y29 Stop Function Front Attachment	12V	2000mA	6,0Ω (Ohm)

Achtung: Eine Messtoleranz von +/- 20% durch unterschiedliche Meßgeräte ist möglich!
Caution: A measuring tolerance of +/- 20% due to different measuring devices!

6.0.1 Work Hydraulics

Hydraulic pumps in the rear wagon of the CM 1650 with triple gear pump



6.0.1 Work Hydraulics

Working hydraulic pumps in the rear section of the CM 1650 triple gear pump

Triple gear pump (2.2) working hydraulics

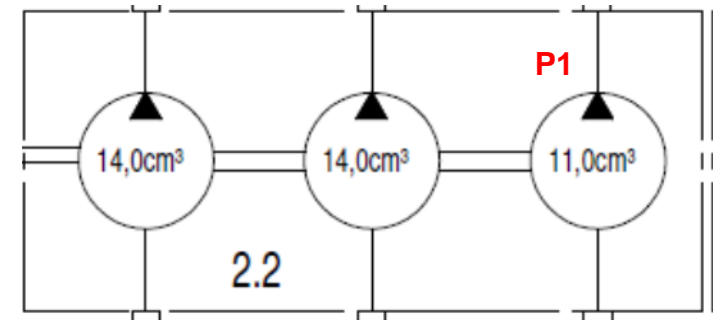
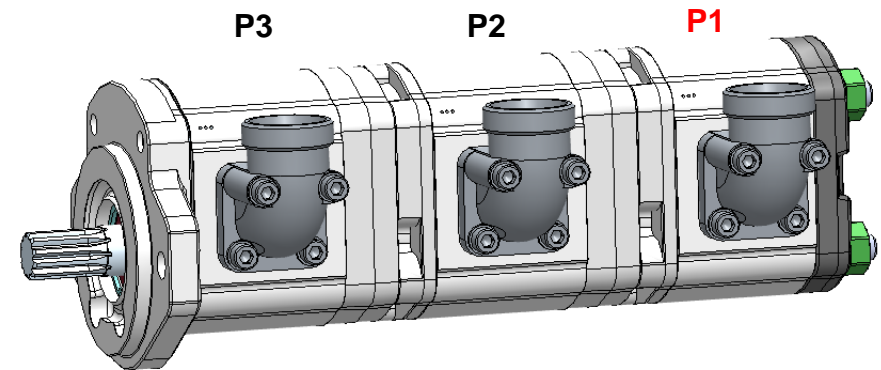
Gear pump **P1** work hydraulics
Output 11.0 ccm per revolution

Delivery rate: approx. 16 L/min at 1600 engine rpm
Delivery rate: approx. 20 L/min at 2000 engine rpm
Delivery rate: Approx. 26 L/min at 2400 engine rpm

Oil supply for the front control block (2.11)
steering (10 l/min) and the solenoid valves:

Y12 circulation off / working hydraulics on
Y13 lower front tool carrier (floating position)
Y14 raise front tool carrier (suction hose)
Y15 swivel out rotating brush R-H
Y16 swivel in rotating brush R-H
Y19 swivel out rotating brush L-H (swivel snow blade)
Y20 swivel in rotating brush L-H (swivel snow blade)

As well as
Y17 raise hopper (in the hydraulic control block 2.12)
Y18 lower hopper (in the hydraulic control block 2.12)



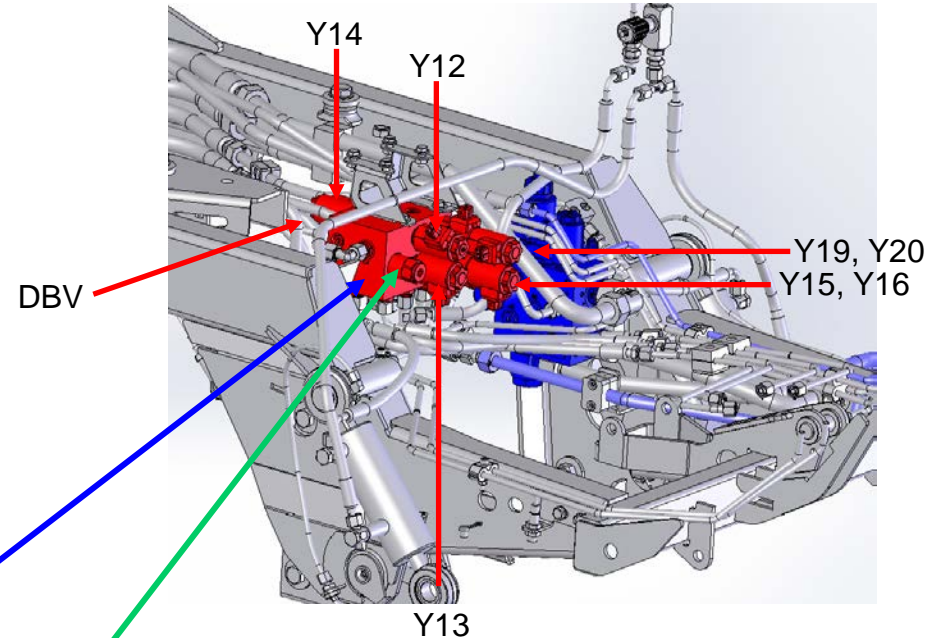
6.0.1 Work Hydraulics

Hydraulic block (2.11) front attachment, solenoid valves, Y12, Y13, Y14, Y15 + Y16, Y19 + Y20

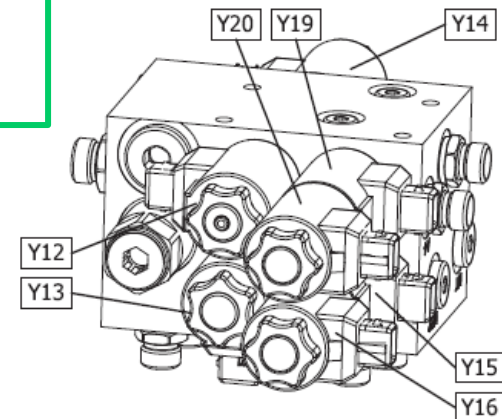
Front wagon hydraulic control block (2.11)
Hako spare part number 01493420, oil supply from gear pump 1

with the solenoid valves:

- Y12 circulation off / working hydraulics on
- Y13 lower front tool carrier (floating position)
- Y14 raise front tool carrier (suction hose)
- Y15 swivel out rotating brush R-H
- Y16 swivel in rotating brush R-H
- Y19 swivel out rotating brush L-H (swivel snow blade)
- Y20 swivel in rotating brush L-H (swivel snow blade)
- DBV (Pressure relief valve) 180 Bar**

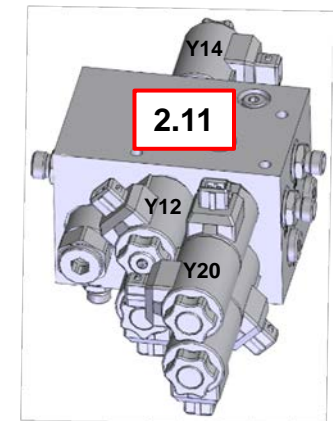
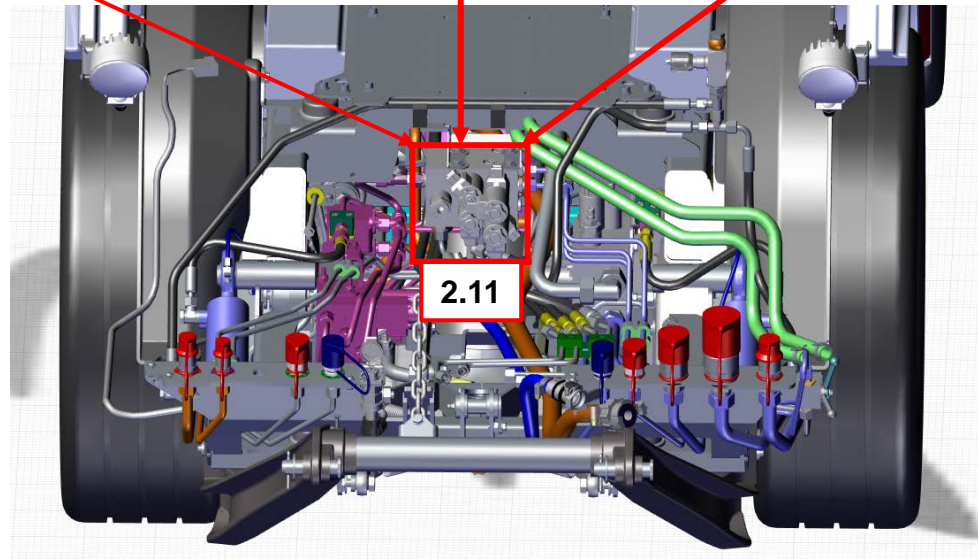
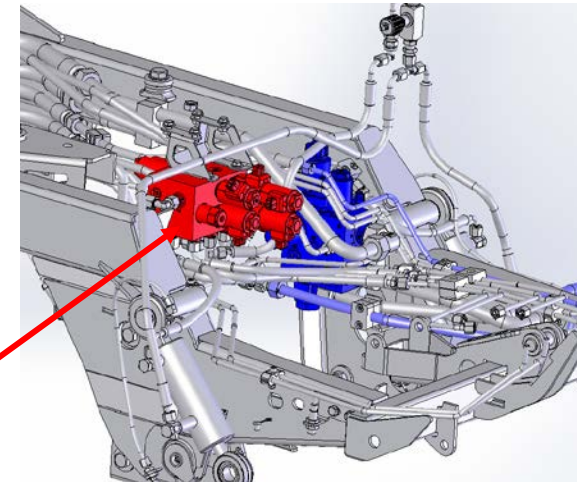
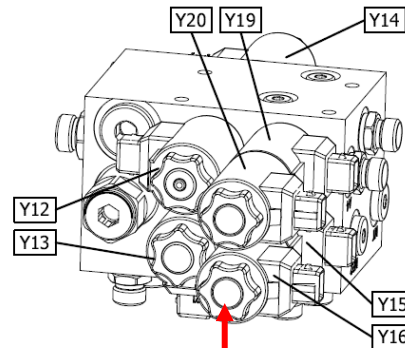


Flow divider valve for steering.
Constant flow rate
9 liter/minute



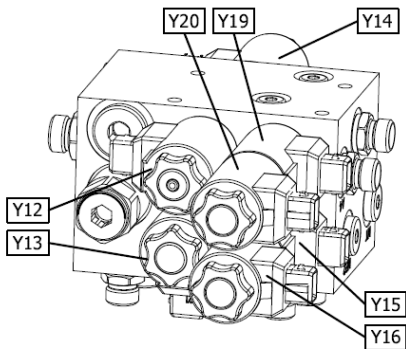
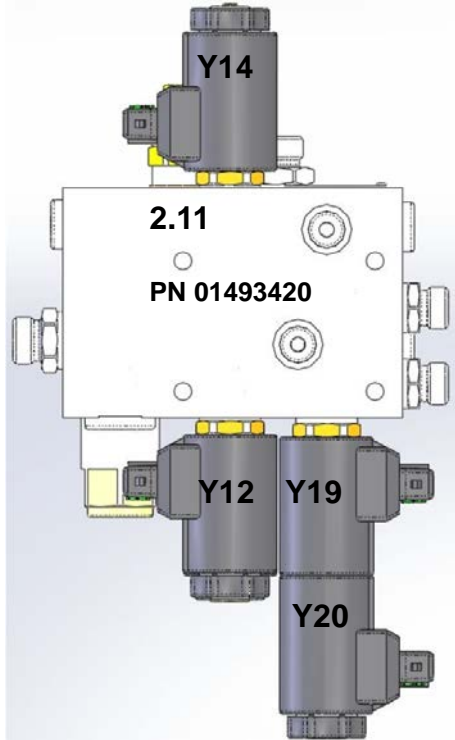
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Hydraulic block (2.11) front attachment, solenoid valves, Y12, Y13, Y14, Y15 + Y16, Y19 + Y20



6.0.1 Work Hydraulics

Hydraulic block (2.11) front attachment, solenoid valves, Y12, Y13, Y14, Y15 + Y16, Y19 + Y20



Hydraulic block front (2.11) with the solenoid valves:

Y12 circulation off / working hydraulics on

Y13 lower front tool carrier (floating position)

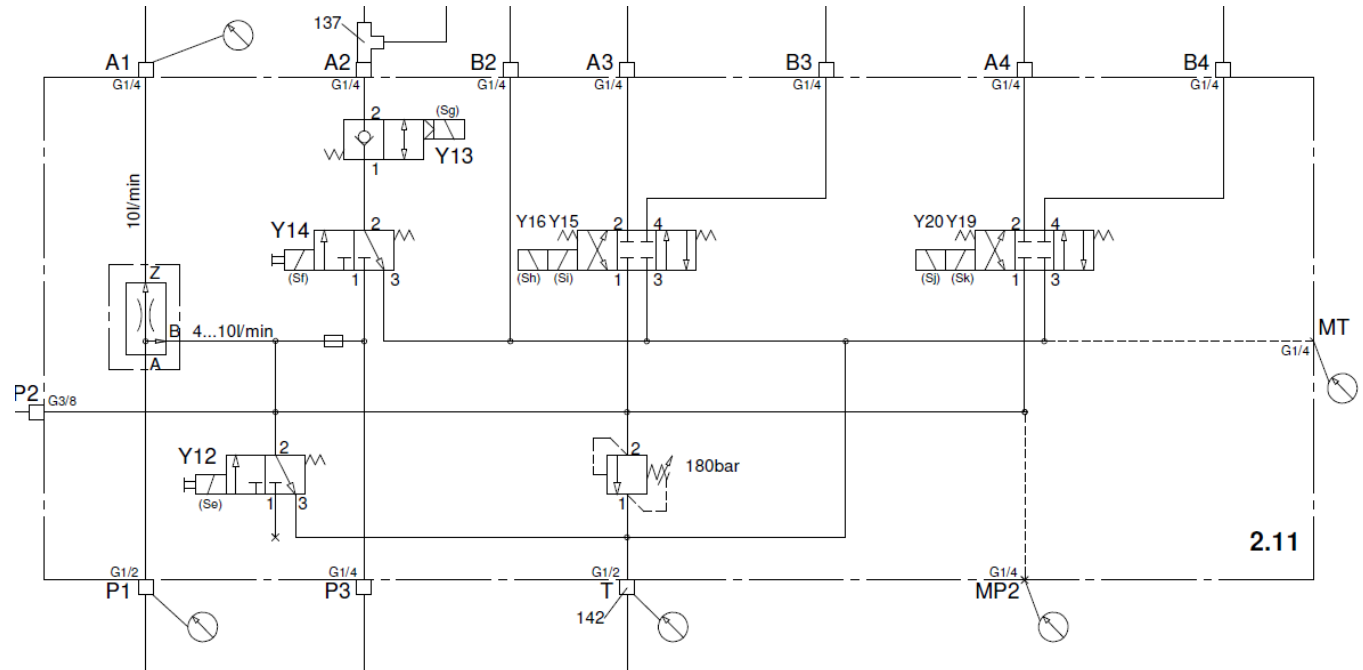
Y14 raise front tool carrier (suction hose)

Y15 swivel out rotating brush R-H

Y16 swivel in rotating brush R-H

Y19 swivel out rotating brush L-H (swivel snow blade out)

Y20 swivel in rotating brush L-H (swivel snow blade in)



6.0.1 Work Hydraulics

Triple gear pump (2.2) working hydraulics

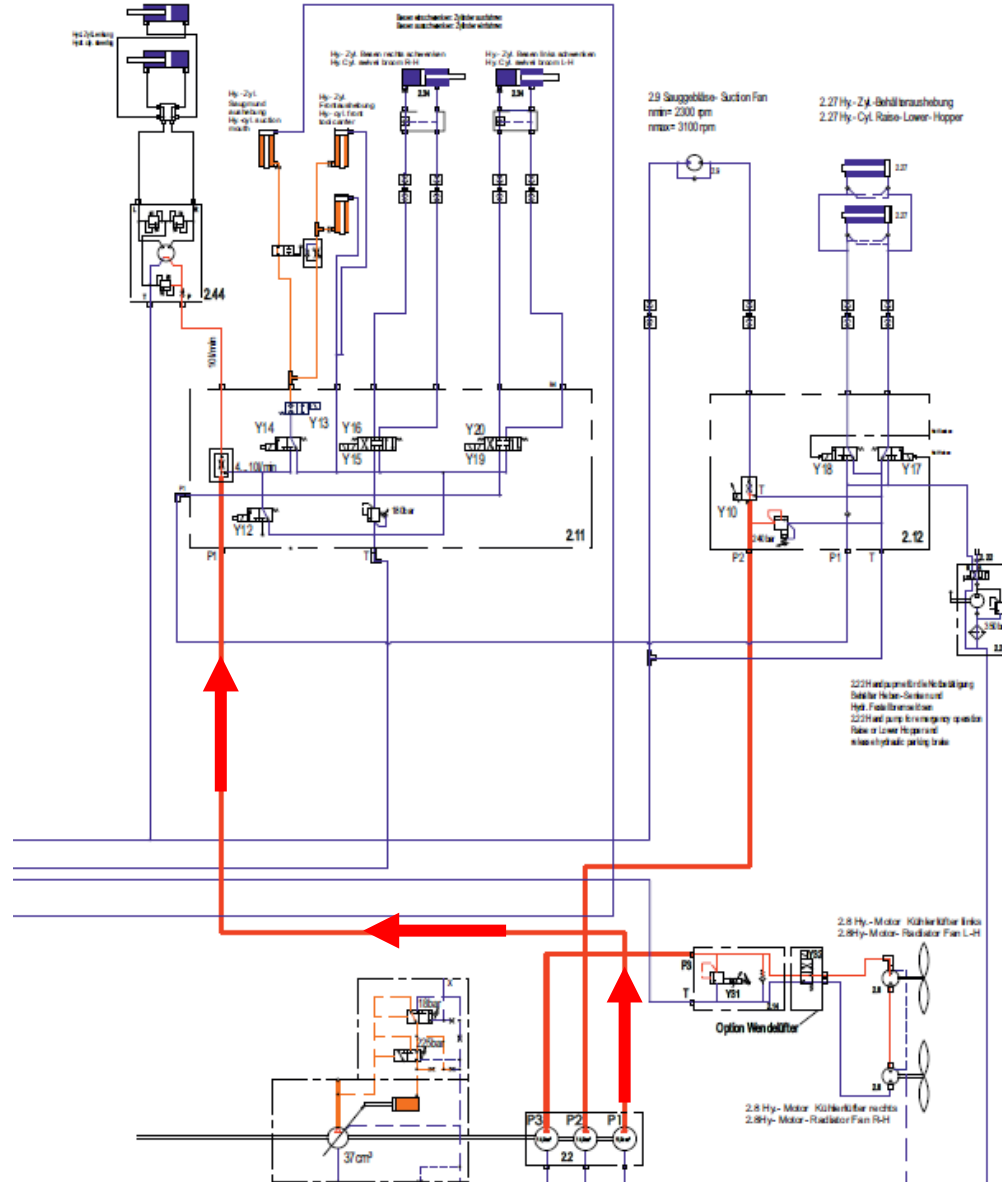
Gear pump 3 working hydraulics

Oil supply for the front control block (2.11)
steering (10 l/min) and the solenoid valves:

- Y12 circulation off / working hydraulics on
- Y13 lower front tool carrier (floating position)
- Y14 raise front tool carrier (suction hose)
- Y15 swivel out rotating brush to the right
- Y16 swivel in rotating brush to the right
- Y19 swivel out rotating brush to the left (swivel snow blade out)
- Y20 swivel in rotating brush to the left (swivel snow blade in)

As well as

- Y17 raise hopper (in the hydraulic control block 2.12)
- Y18 lower hopper (in the hydraulic control block 2.12)



6.0.1 Work Hydraulics

Messwerte der Magnetventile für die Arbeitshydraulik Steuerblock 2.11
Measured values of the solenoid valves for the work hydraulics hydraulic control block 2.11

	Beschreibung- Description MV= Magnetventil- SV= Solenoid Valve	Spannung Voltage (V)	Stromstärke (A) Current Flow (A)	Widerstand der Spule Resistance Coil (Ω)
	<p>Funktion: Frontgeräteträger (FGT). Senken- Schwimmstellung. MV- Y13 bestromt- an.</p> <p>Function: Lower front tool carrier (FTC), floating position FTC. SV- Y13 energized- on</p>			
Y13	<p>MV Geräteträger (FGT) senken; FGT Schwimmstellung.</p>	12V	1350 mA	9,0Ω (Ohm)
<p>Achtung: Eine Messtoleranz von +/- 20% durch unterschiedliche Meßgeräte ist möglich! Caution: A measuring tolerance of +/- 20% due to different measuring devices!</p>				

6.0.1 Work Hydraulics

Messwerte der Magnetventile für die Arbeitshydraulik Steuerblock 2.11

Measured values of the solenoid valves for the work hydraulics hydraulic control block 2.11

	Beschreibung- Description MV= Magnetventil- SV= Solenoid Valve	Spannung Voltage (V)	Stromstärke (A) Current Flow (A)	Widerstand der Spule Resistance Coil (Ω)
	<p>Funktion: Frontgeräteträger (FGT) heben mit Option 1459.31. MV- Y12, Y13, Y14 und Y35 bestromt- an.</p> <p>Funtion: Raise front tool carrier with option 1459.31 SV- Y12, Y13, Y14, Y35 energized- on.</p>			
Y12	<p>MV Umlauf Geräteträger- Arbeitshydraulik ein. SV front tool carrier circulation-work hydraulics on.</p>	12V	2000mA	6,0Ω (Ohm)
Y13	<p>MV Geräteträger (FGT) senken; FGT Schwimmstellung. SV lower front tool carrier (FTC), FTC floating position.</p>	12V	1350 mA	9,0Ω (Ohm)
Y14	<p>MV Frontgeräteträger heben (FGT heben) SV valve raise front tool carrier (FTC up)</p>	12V	2000mA	6,0Ω (Ohm)

Achtung: Eine Messtoleranz von +/- 20% durch unterschiedliche Meßgeräte ist möglich!
Caution: A measuring tolerance of +/- 20% due to different measuring devices!

6.0.1 Work Hydraulics

Messwerte der Magnetventile für die Arbeitshydraulik Steuerblock 2.11

Measured values of the solenoid valves for the work hydraulics hydraulic control block 2.11

	Beschreibung- Description MV= Magnetventil- SV= Solenoid Valve	Spannung Voltage (V)	Stromstärke (A) Current Flow (A)	Widerstand der Spule Resistance Coil (Ω)
	Funktion: Tellerbesen rechts einschwenken: MV- Y12 + Y16 bestromt- ein. Function: Broom R- H narrow (broom in): SV- Y12 + Y16 energized- on.			
Y12	MV Umlauf Gerätetäger- Arbeitshydraulik ein. SV front tool carrier circulation- work hydraulics on.	12V	2000mA	6,0Ω (Ohm)
Y16	MV Tellerbesen rechts einschwenken. SV broom R- H narrow (broom in)	12V	2000mA	6,0Ω (Ohm)

Achtung: Eine Messtoleranz von +/- 20% durch unterschiedliche Messgeräte ist möglich!
Caution: A measuring tolerance of +/- 20% due to different measuring devices!

6.0.1 Work Hydraulics

Messwerte der Magnetventile für die Arbeitshydraulik Steuerblock 2.11

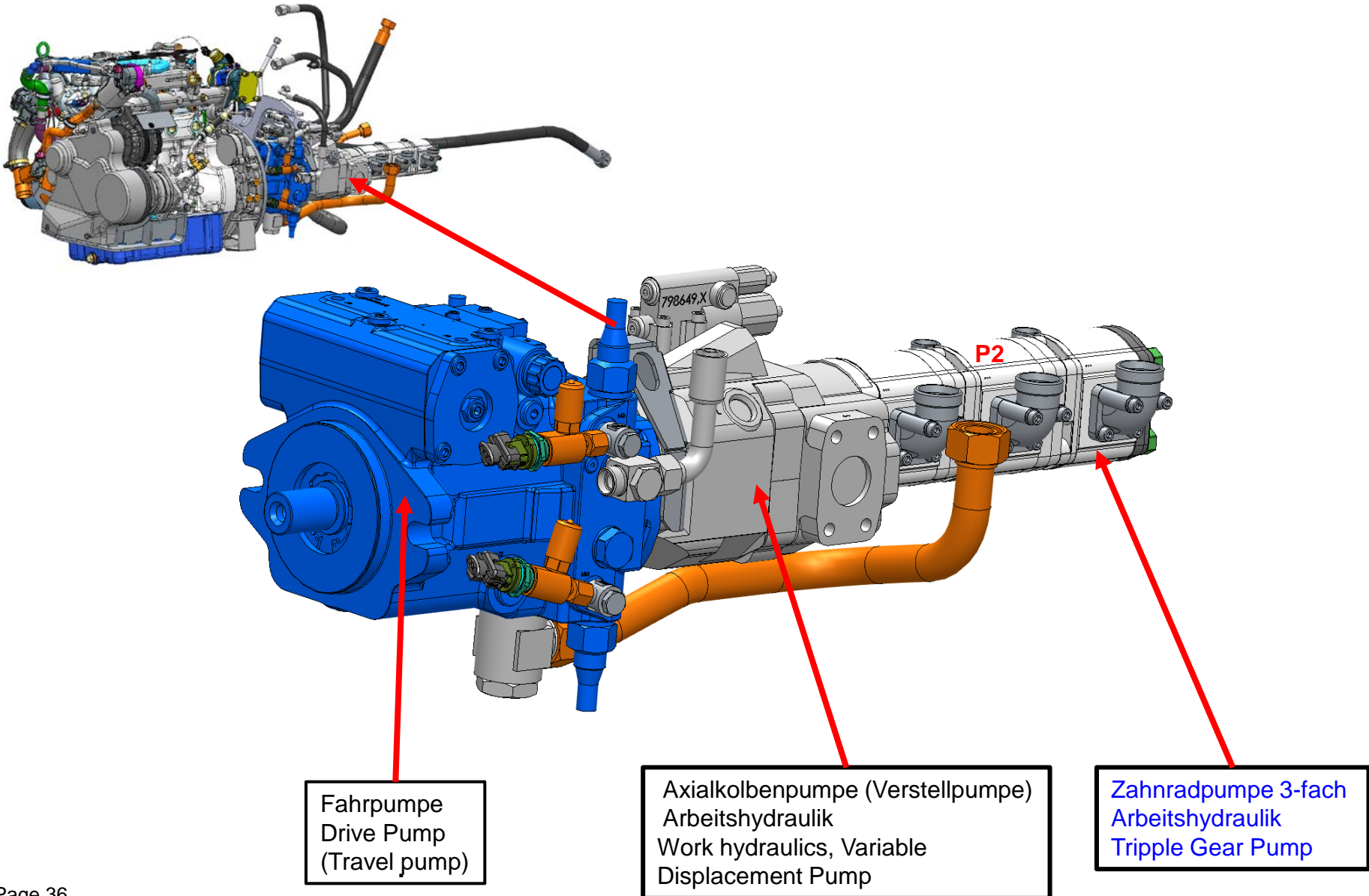
Measured values of the solenoid valves for the work hydraulics hydraulic control block 2.11

	Beschreibung- Description MV= Magnetventil- SV= Solenoid Valve	Spannung Voltage (V)	Stromstärke (A) Current Flow (A)	Widerstand der Spule Resistance Coil (Ω)
	Funktion: Tellerbesen rechts einschwenken: MV- Y12 + Y16 bestromt- ein. Function: Broom R- H narrow (broom in): SV- Y12 + Y16 energized- on.			
Y12	MV Umlauf Gerätetäger- Arbeitshydraulik ein. SV front tool carrier circulation- work hydraulics on.	12V	2000mA	6,0Ω (Ohm)
Y16	MV Tellerbesen rechts einschwenken. SV broom R- H narrow (broom in)	12V	2000mA	6,0Ω (Ohm)

Achtung: Eine Messtoleranz von +/- 20% durch unterschiedliche Messgeräte ist möglich!
Caution: A measuring tolerance of +/- 20% due to different measuring devices!

6.0.1 Work Hydraulics

Hydraulic pumps in the rear wagon of the CM 1650 with triple gear pump



6.0.1 Work Hydraulics

Working hydraulic pumps in the rear wagon of the CM 1650 triple gear pump

Triple gear pump (2.2) work hydraulics

Gear pump **P2** working hydraulics

Output 14.0 ccm per revolution

Delivery rate: approx. 21 L/min at 1600 engine rpm

Delivery rate: approx. 26 L/min at 2000 engine rpm

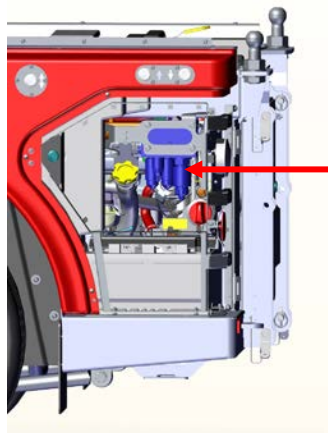
Delivery rate: Approx. 28 L/min at 2400 engine rpm

Oil supply for the blower/bin control block (2.12)
with the solenoid valves:

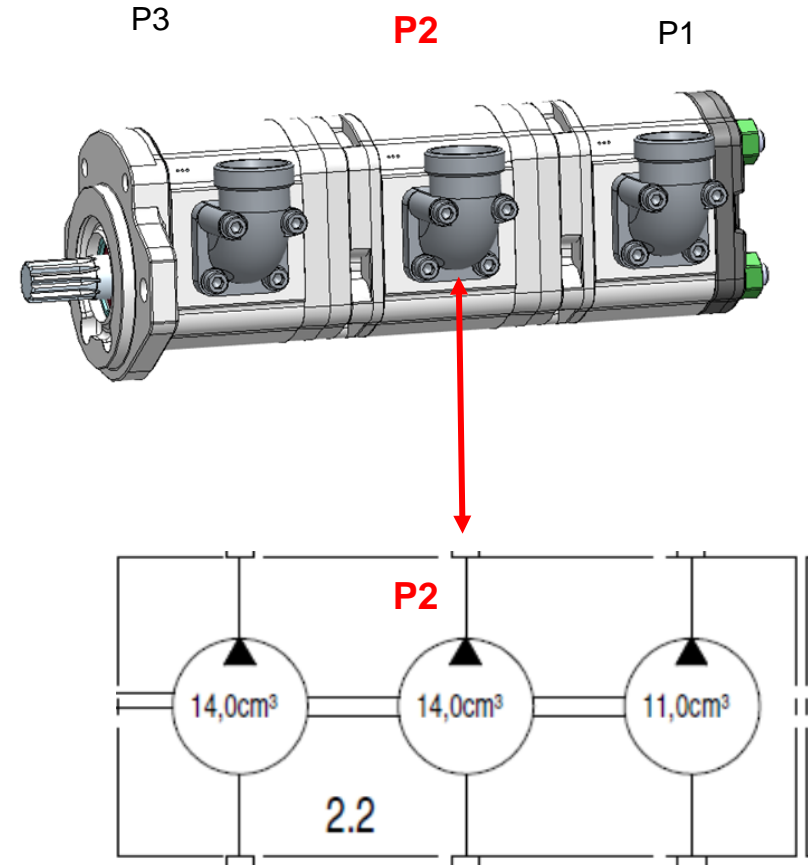
Y10 proportional solenoid valve suction blower (suction blower drive)

Installation location:

Rear wagon in the tail, on the left in driving direction

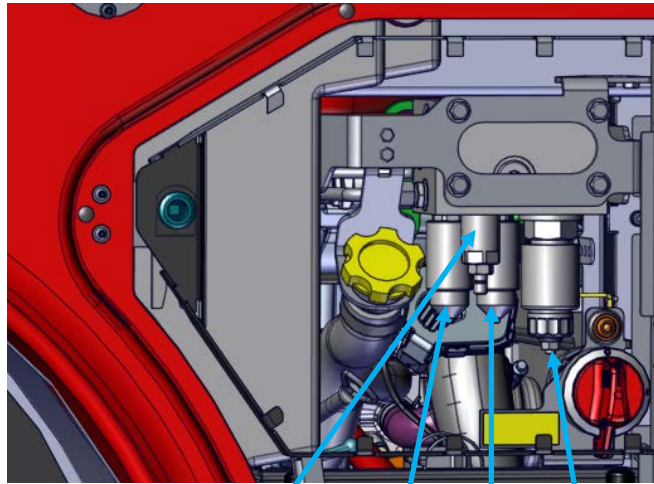


control block (2.12)

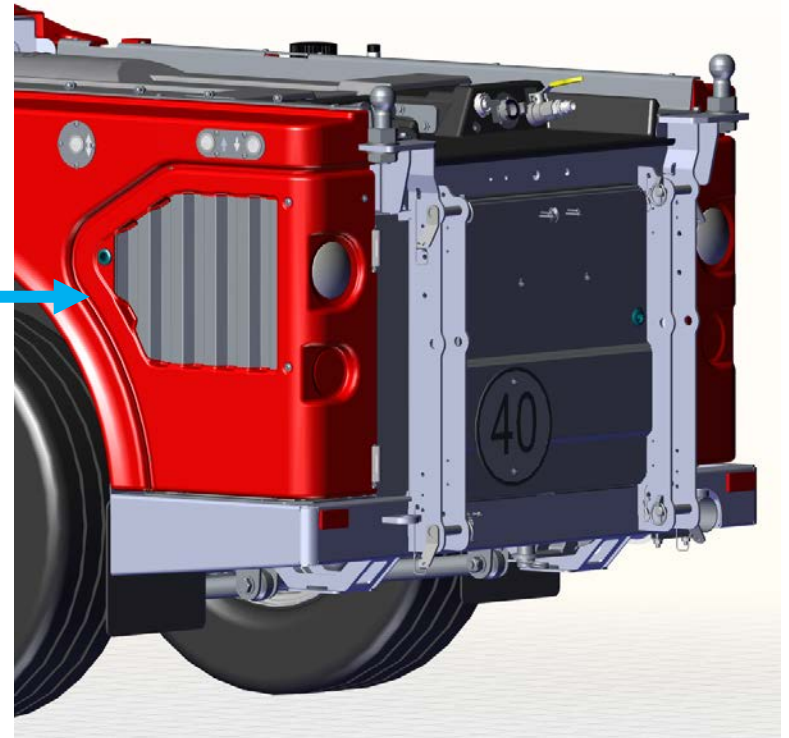


6.0.1 Work Hydraulics

Hydraulic valve block 2.12 blower/hopper in the rear wagon of the CM 1650



DBV Y17 Y18 Y10



Hydraulic block 2.12 blower/hopper in the rear wagon with the solenoid valves:

Y10 Y10 suction fan (hydraulic motor suction fan) / spreader on/off

Y17 raise dirt hopper

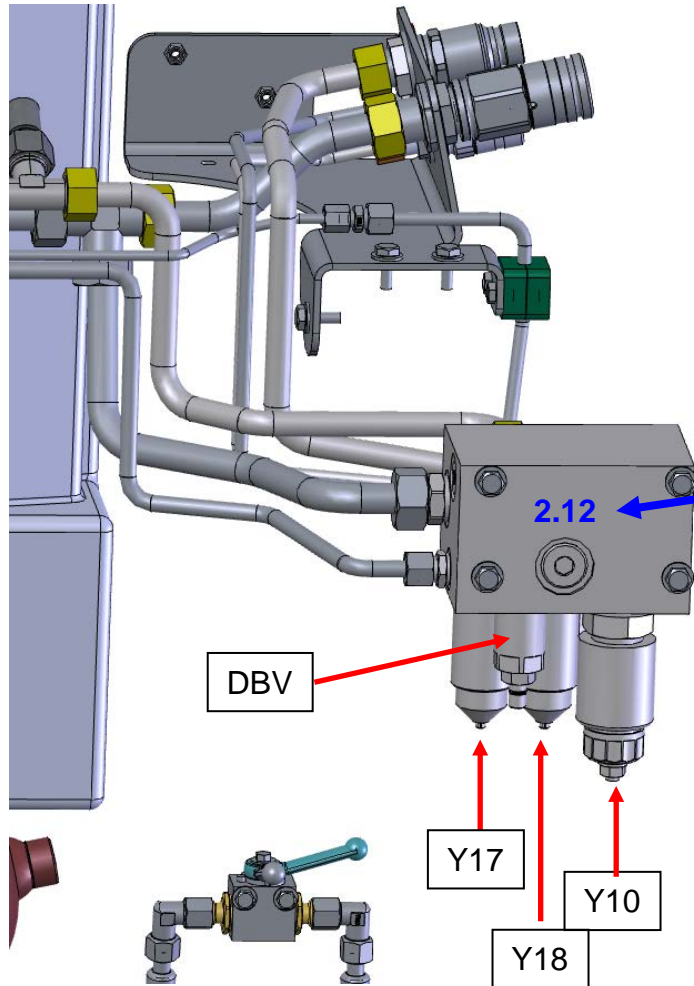
Y18 lower dirt hopper

Installation location:

Rear wagon in the tail, on the left in driving direction

6.0.1 Work Hydraulics

Hydraulic valve block 2.12 blower/hopper solenoid valver Y10, Y17, Y18 in the rear wagon of the CM 1650

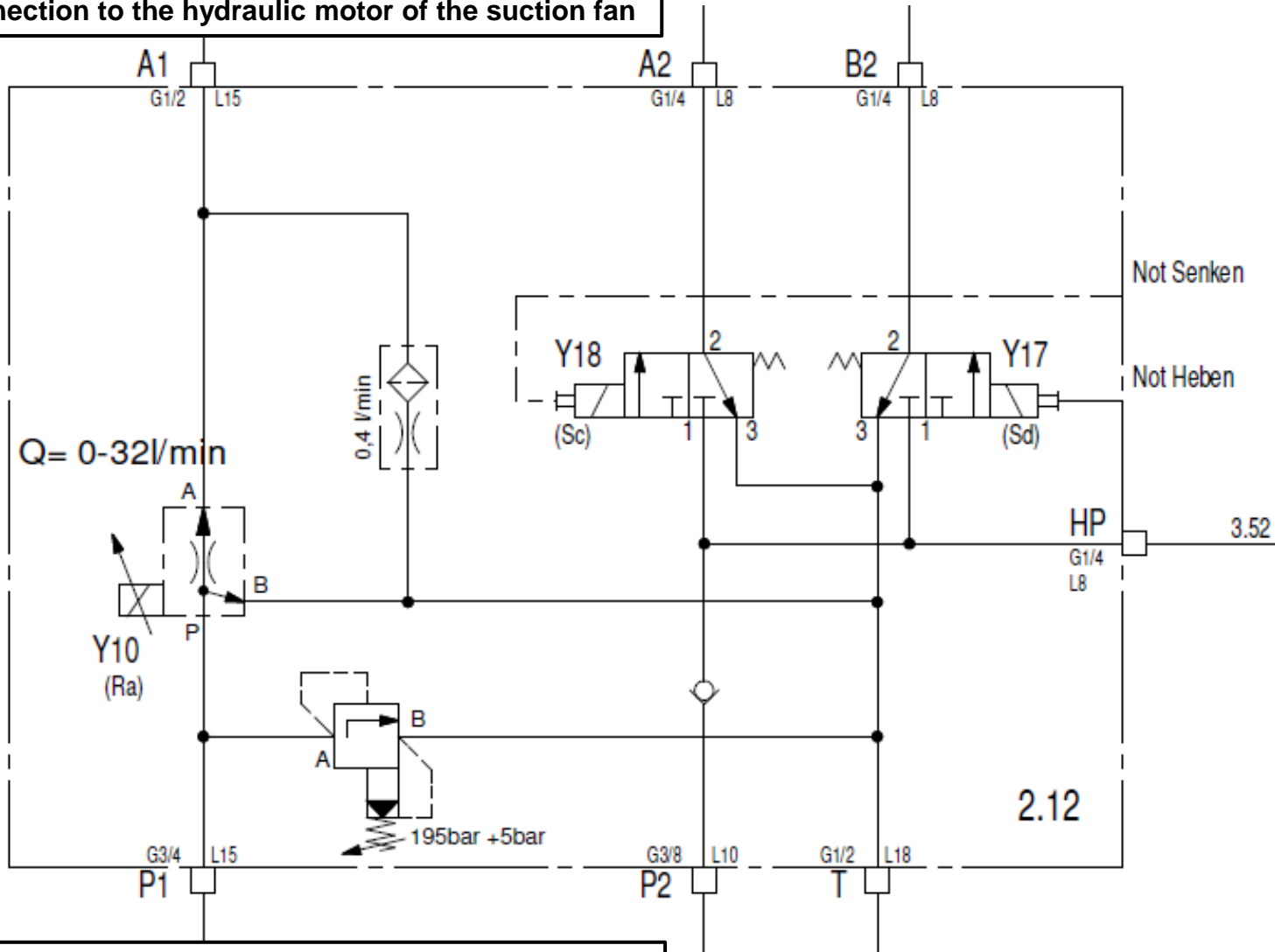


Hydraulic block 2.12 blower/hopper in the rear wagon with the solenoid valves:
Y10 suction fan (hydraulic motor suction fan) / spreader on/off
Y17 raise dirt hopper
Y18 lower dirt hopper
Installation location:
Rear wagon in the tail, on the left in driving direction

6.0.1 Work Hydraulics

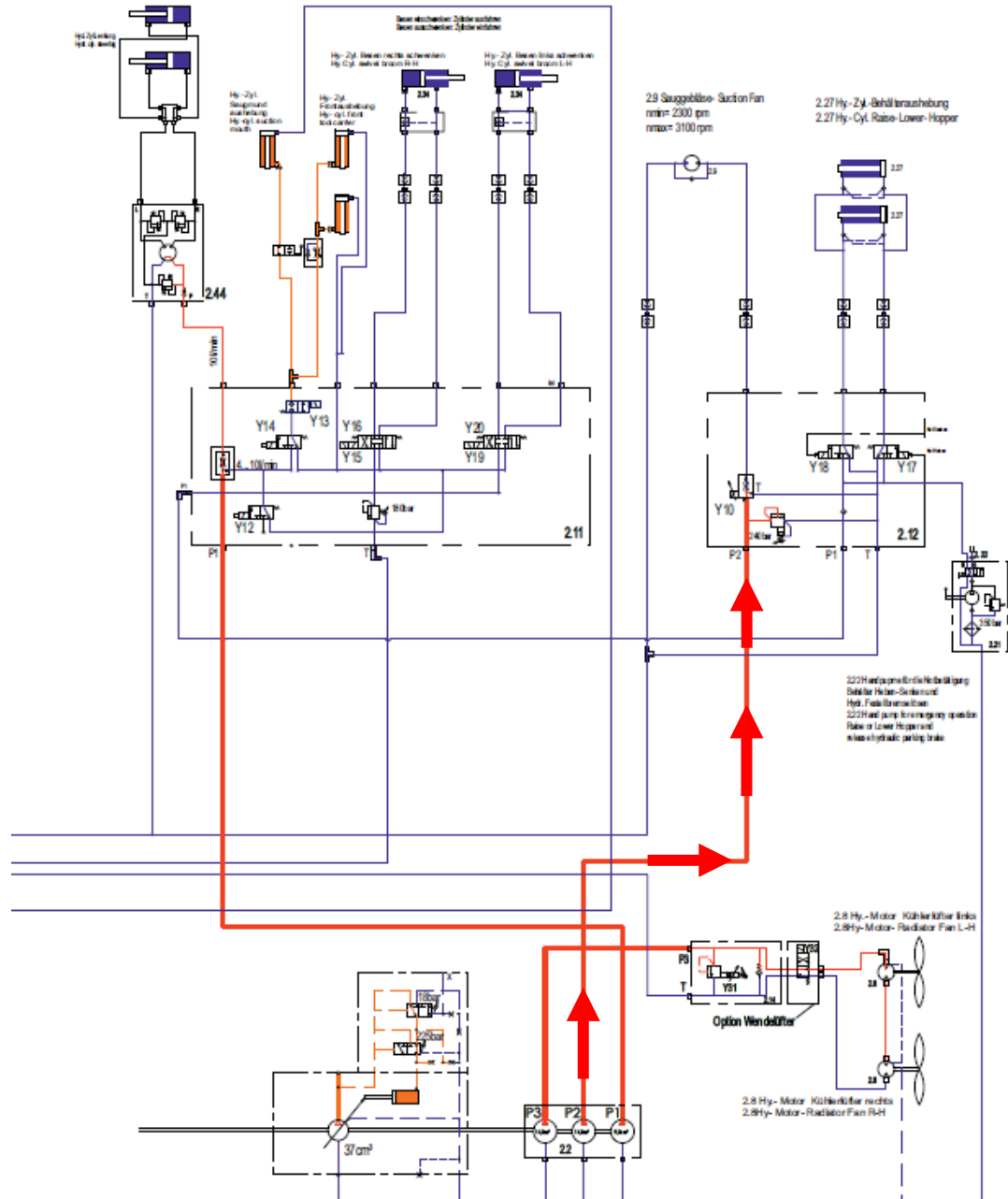
Hydraulic valve block 2.12 blower/hopper solenoid valve Y10, Y17, Y18 in the rear wagon of the CM 1650

A1- Hydraulic- Connection to the hydraulic motor of the suction fan



P1- Hydraulic Connection Oil supply from gear pump 2

6.0.1 Work Hydraulics

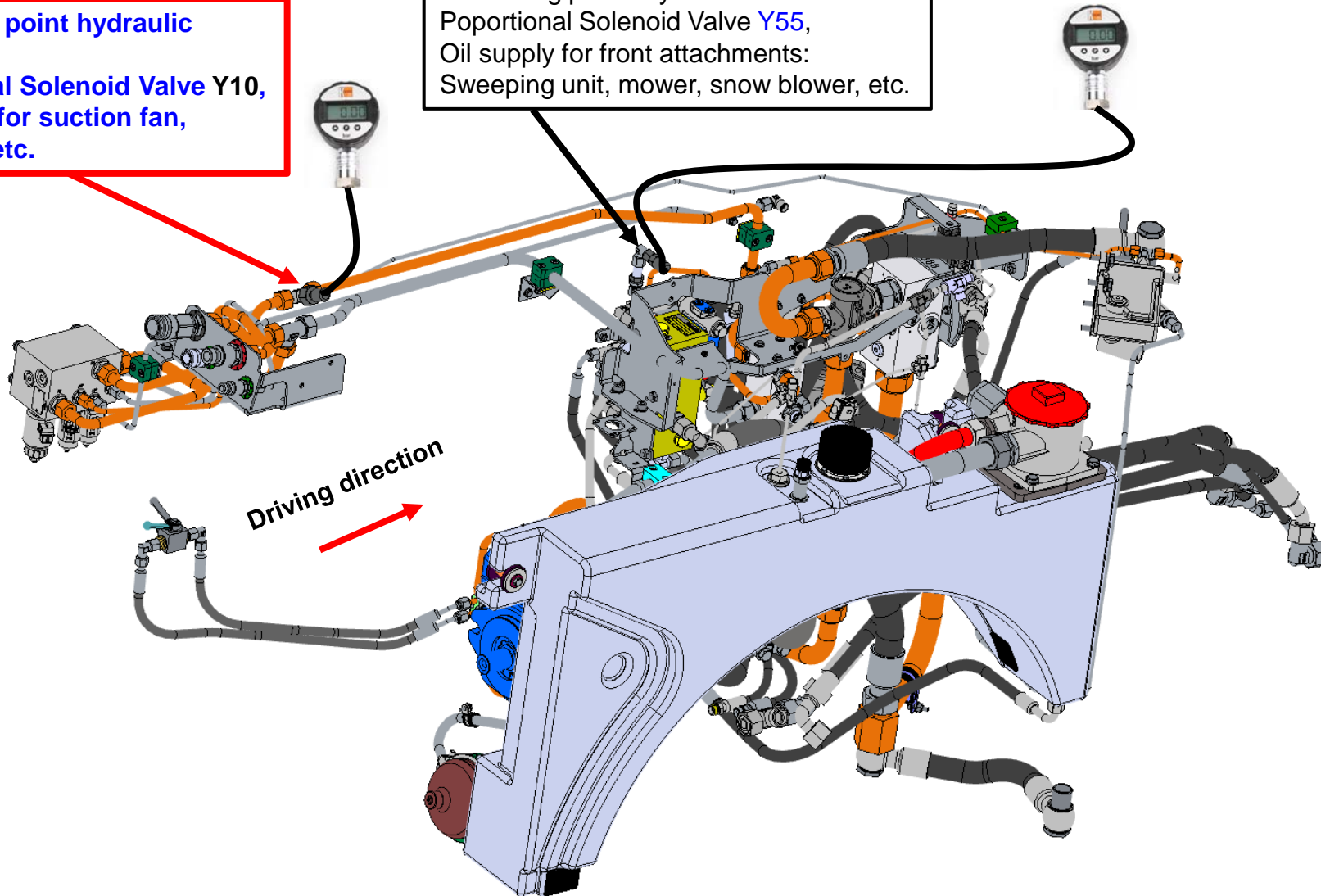


6.0.1 Work Hydraulics

Hydraulic- Measuring- Connections work hydraulics CM 1650

Measuring point hydraulic circuit 2, Proportional Solenoid Valve Y10, oil supply for suction fan, spreader, etc.

Measuring point Hydraulic circuit front Proportional Solenoid Valve Y55, Oil supply for front attachments: Sweeping unit, mower, snow blower, etc.



6.0.1 Work Hydraulics

Messwerte der Magnetventile für die Arbeitshydraulik Steuerblock 2.12
Measured values of the solenoid valves for the work hydraulics hydraulic control block 2.12

	Beschreibung- Description MV= Magnetventil- SV= Solenoid Valve	Spannung Voltage (V)	Stromstärke (A) Current Flow (A)	Widerstand der Spule Resistance Coil (Ω)
	<p>Funktion: Ölversorgung für das Sauggebläse, Sand oder Salzstreuer. MV- Y10 bestromt- ein.</p> <p>Function: Oil supply for the suction fan, sand or salt spreader. SV- Y10 energized- on..</p>			
Y10	<p>Proportionalventil Sauggebläse / Streuer ein.</p> <p>Prop.- Solenoid valve suction fan/ spreader on</p>	0- 6.0V	0- 2000mA	3.0Ω (Ohm)

Achtung: Eine Messtoleranz von +/- 20% durch unterschiedliche Meßgeräte ist möglich!
Caution: A measuring tolerance of +/- 20% due to different measuring devices!

6.0.1 Work Hydraulics

Messwerte der Magnetventile für die Arbeitshydraulik Steuerblock 2.12
Measured values of the solenoid valves for the work hydraulics hydraulic control block 2.12

	Beschreibung- Description MV= Magnetventil- SV= Solenoid Valve	Spannung Voltage (V)	Stromstärke (A) Current Flow (A)	Widerstand der Spule Resistance Coil (Ω)
	Funktion: Kehrgutbehälter heben: MV- Y12 + Y17 bestromt ein. Function: Raise hopper: SV- Y12 + Y17 energized- on.			
Y12	MV Umlauf Geräteträger- Arbeitshydraulik ein. SV front tool carrier circulation- work hydraulics on.	12V	2000mA	6,0Ω (Ohm)
Y17	MV Kehrgutbehälter heben. SV raise hopper (hopper up)	12V	2000mA	6,0Ω (Ohm)
<p>Achtung: Eine Messtoleranz von +/- 20% durch unterschiedliche Meßgeräte ist möglich! Caution: A measuring tolerance of +/- 20% due to different measuring devices!</p>				

6.0.1 Work Hydraulics

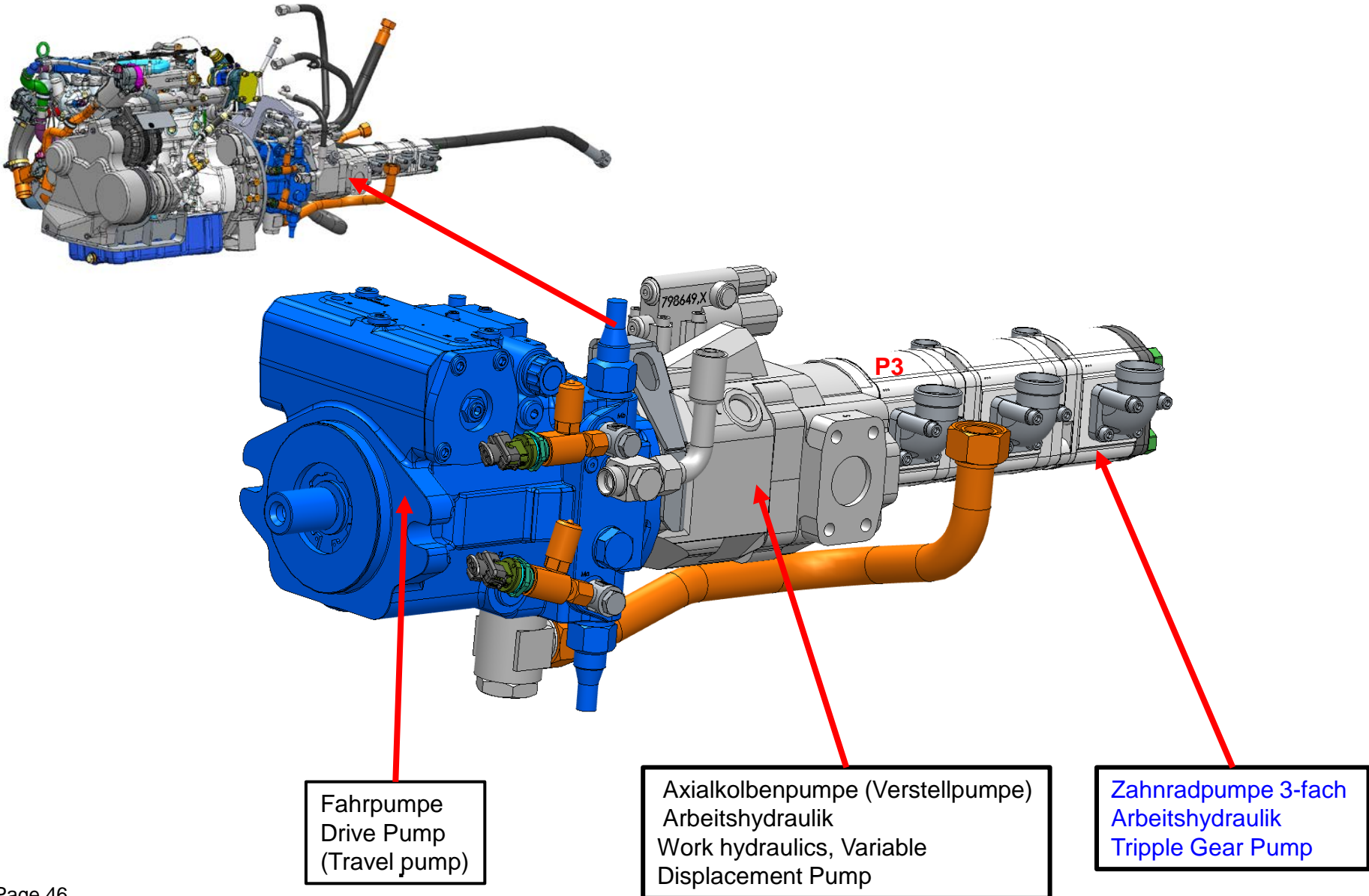
Messwerte der Magnetventile für die Arbeitshydraulik Steuerblock 2.12
Measured values of the solenoid valves for the work hydraulics hydraulic control block 2.12

	Beschreibung- Description MV= Magnetventil- SV= Solenoid Valve	Spannung Voltage (V)	Stromstärke (A) Current Flow (A)	Widerstand der Spule Resistance Coil (Ω)
	<p>Funktion: Kehrgutbehälter senken: MV- Y12 + Y18 bestromt- ein.</p> <p>Function: Lower hopper: SV- Y12 + Y18 energized- on.</p>			
Y12	<p>MV Umlauf Geräteträger- Arbeitshydraulik ein.</p> <p>SV front tool carrier circulation- work hydraulics</p>	12V	2000mA	6,0Ω (Ohm)
Y18	<p>Magnetventil Kehrgutbehälter senken.</p> <p>SV lower hopper.</p>	12V	2000mA	6,0Ω (Ohm)

Achtung: Eine Messtoleranz von +/- 20% durch unterschiedliche Meßgeräte ist möglich!
Caution: A measuring tolerance of +/- 20% due to different measuring devices!

6.0.1 Work Hydraulics

Hydraulic pumps in the rear wagon of the CM 1650 with triple gear pump



6.0.1 Work Hydraulics

Hydraulic pumps in the rear wagon of the CM 1650 with triple gear pump Gear pump (P3) for radiator fan drive (engine cooling, charge air cooling, hydraulic oil cooling)

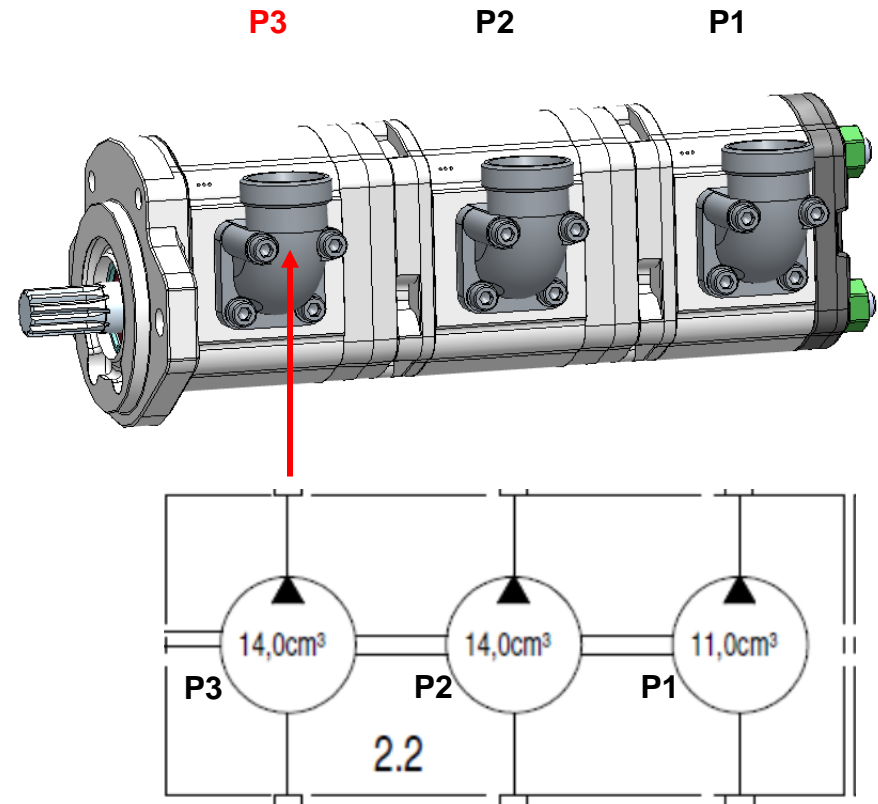
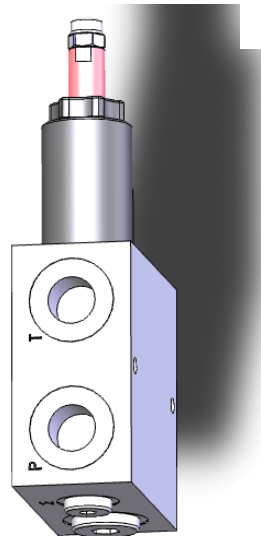
Triple gear pump (2.2) work hydraulics

Gear pump P3 work hydraulics
Output 14.0 ccm per revolution

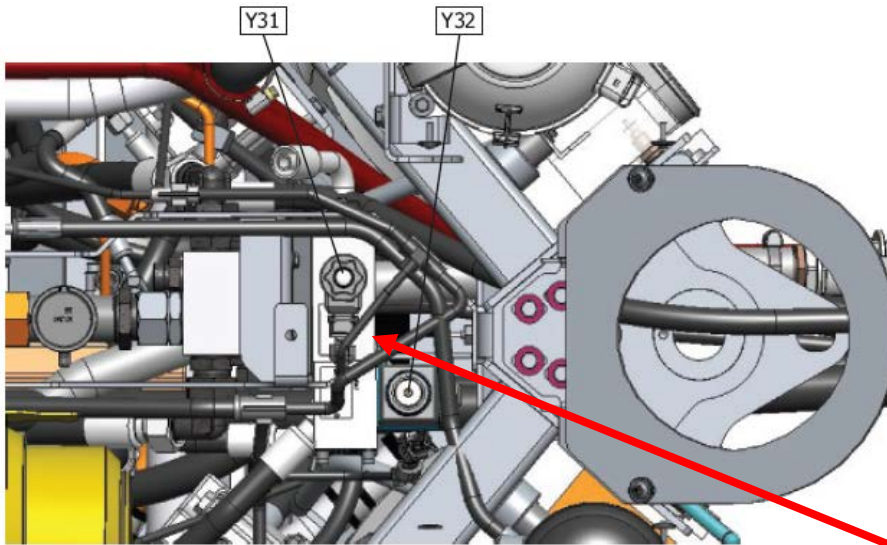
Delivery rate: approx. 21 L/min at 1600 engine rpm
Delivery rate: approx. 26 L/min at 2000 engine rpm
Delivery rate: Approx. 28 L/min at 2400 engine rpm

Oil supply for the hydraulic motors of the radiator fan

Solenoid valve:
Y31 proportional solenoid valve radiator fan s
Y32 reversing fan (option)



6.0.1 Work Hydraulics

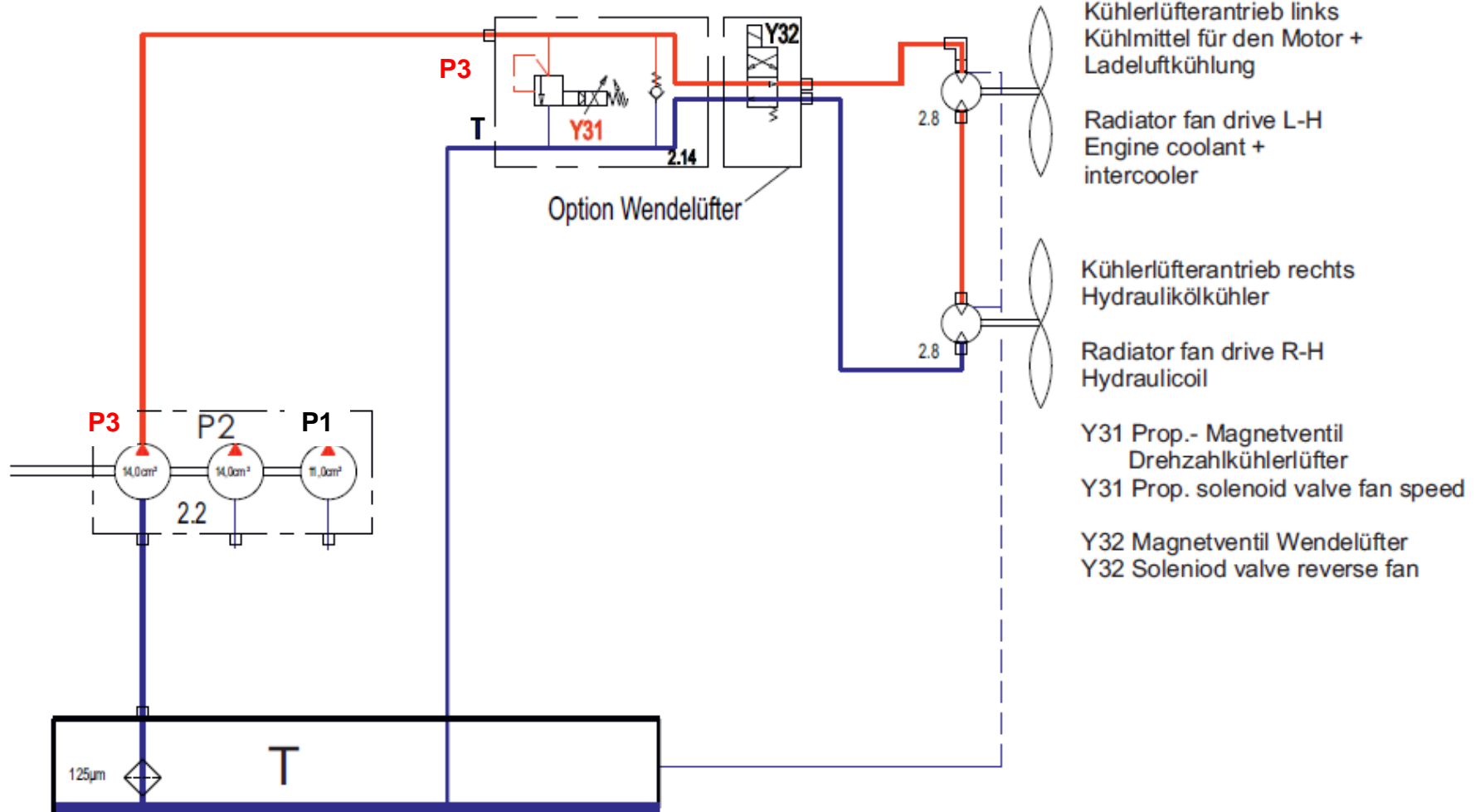


Y31 Proportional solenoid valve radiator fan speed
Y32 Solenoid valve reversing fan (option)

Installation location:
Rear of the car behind the joint
View of the rear of the vehicle from above

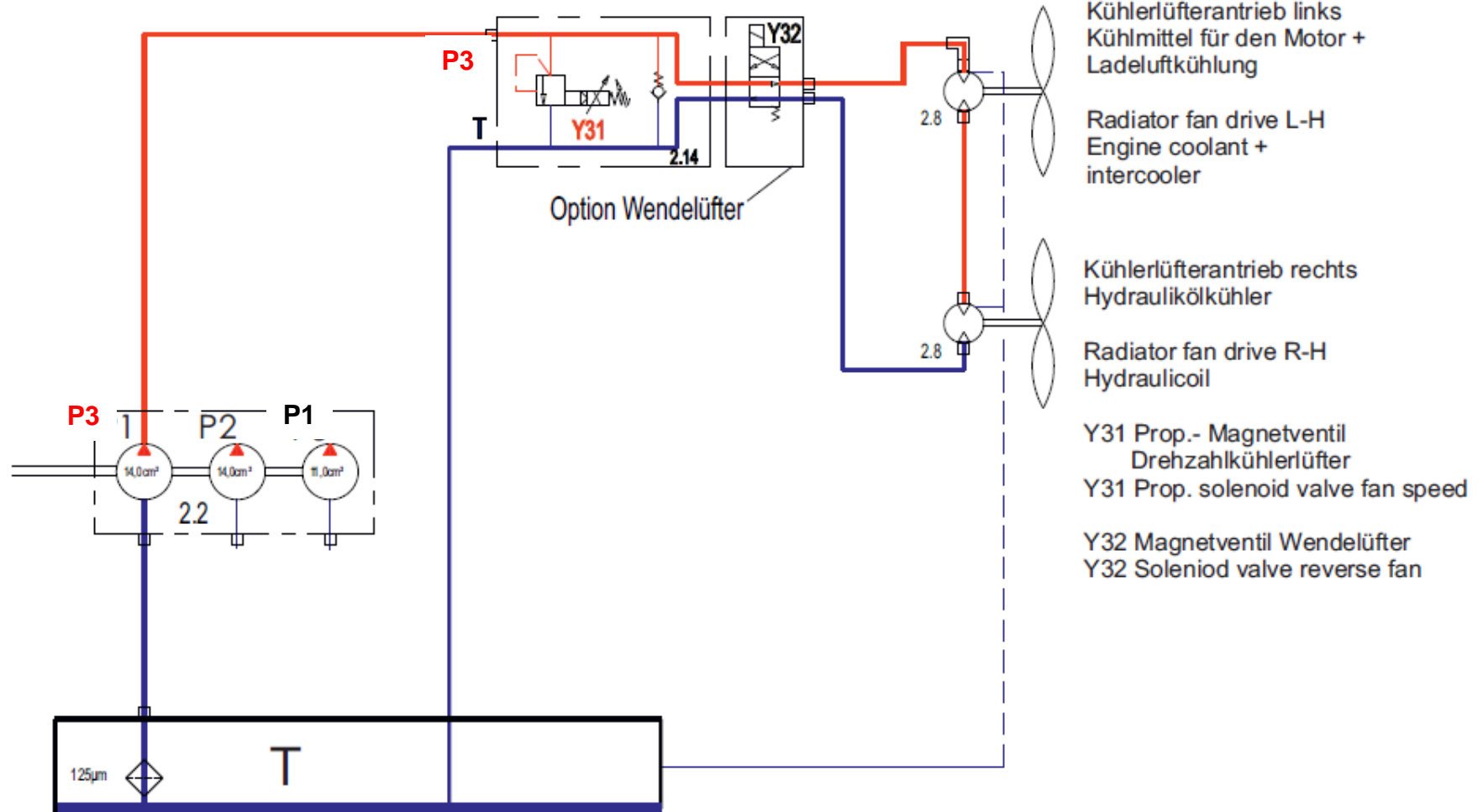
6.0.1 Work Hydraulics

Gear pump (P3) for radiator fan drive (engine cooling, charge air cooling, hydraulic oil cooling)



6.0.1 Work Hydraulics

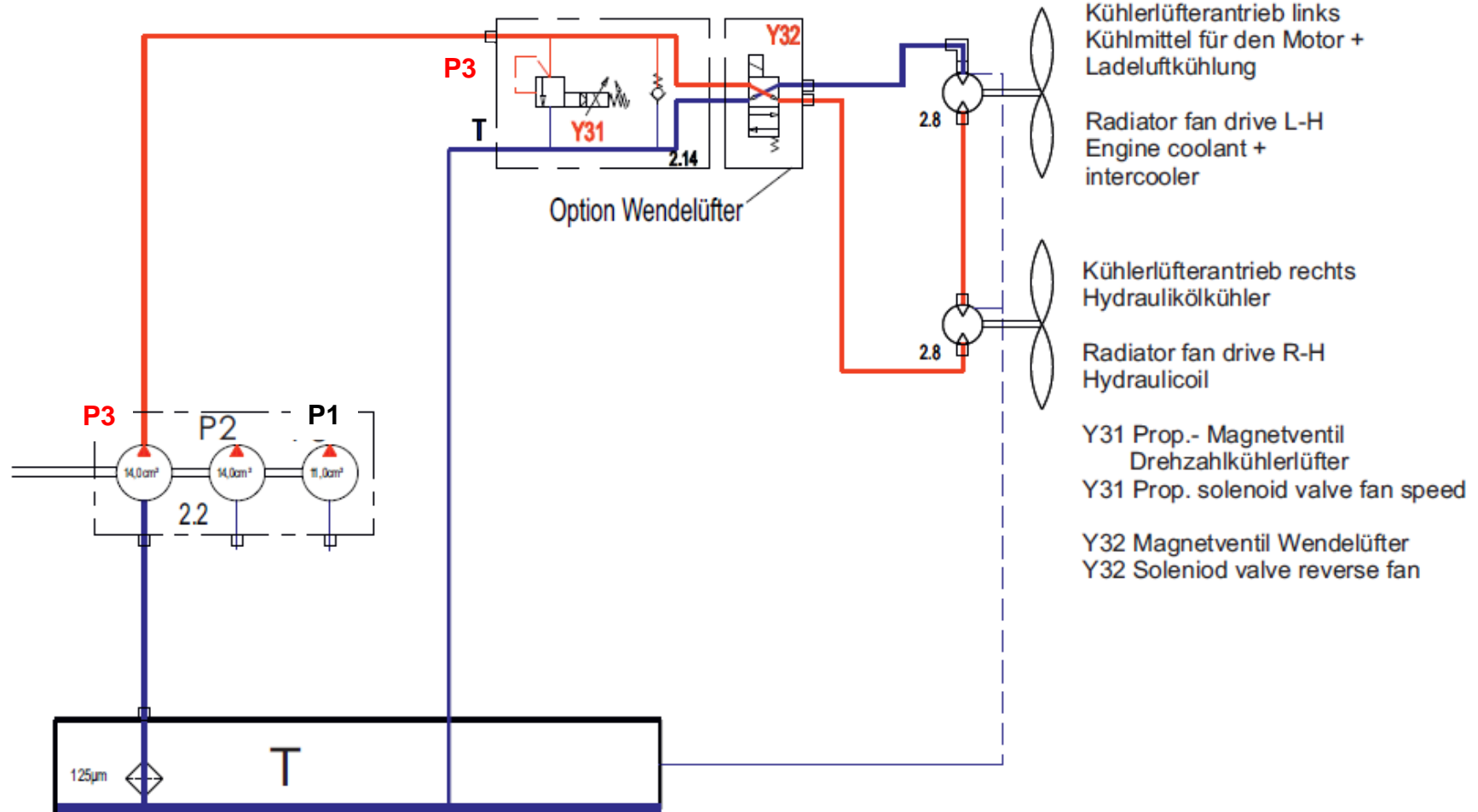
Radiator fan drive with option reverse fan



6.0.1 Work Hydraulics

Radiator fan drive with option reverse fan

Wendelüfter eingeschaltet, Y32 bestromt (12V)



6.0.1 Work Hydraulics

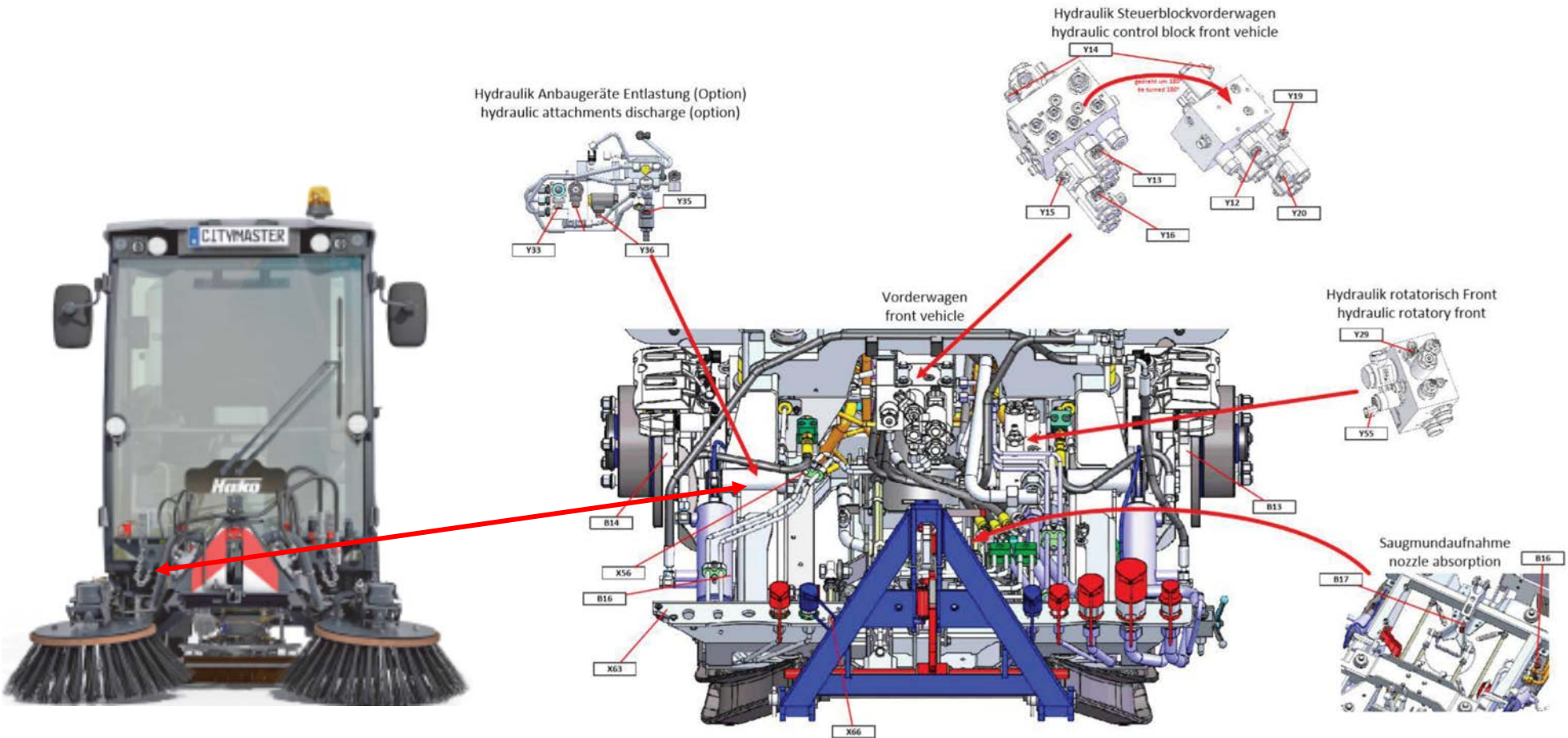
Messwerte der Magnetventile Y31 und Y32 für den Antrieb der Hydraulikmotoren der Kühlerlüfter
Measured values of solenoid valves Y31 and Y32 for driving the hydraulic motors of the cooling fans

	Beschreibung- Description MV= Magnetventil- SV= Solenoid Valve	Spannung Voltage (V)	Stromstärke (A) Current Flow (A)	Widerstand der Spule Resistance Coil (Ω)
	Lüftersteuerung			
Y31	Proportionalventil Lüftermotore (Proportionalventil Kühlerlüfterdrehzahl) Proportional valve fan motors (Proportional solenoid valve radiator fan speed)	7,8 – 3,8V	1300 - 630mA	6,0Ω (Ohm)
Y32	Magnetventil Umschaltung Drehrichtung der Lüftermotoren (Option) Solenoid valve reversing fan (option)	12V	2000mA	6,0Ω (Ohm)

Achtung: Eine Messtoleranz von +/- 20% durch unterschiedliche Messgeräte ist möglich!
Caution: A measuring tolerance of +/- 20% due to different measuring devices!

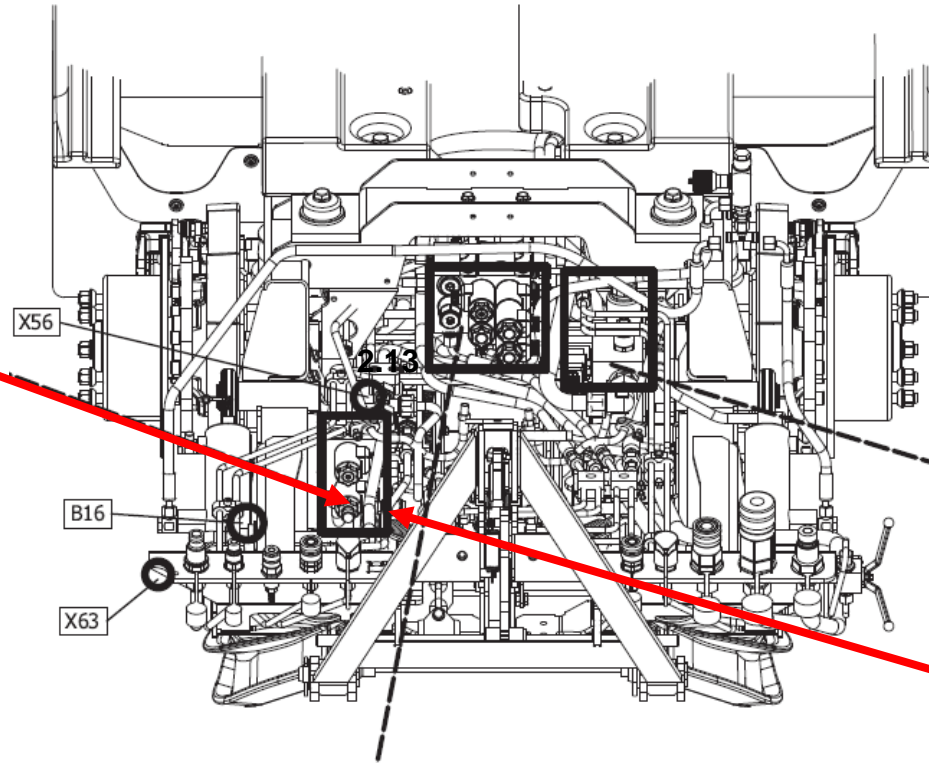
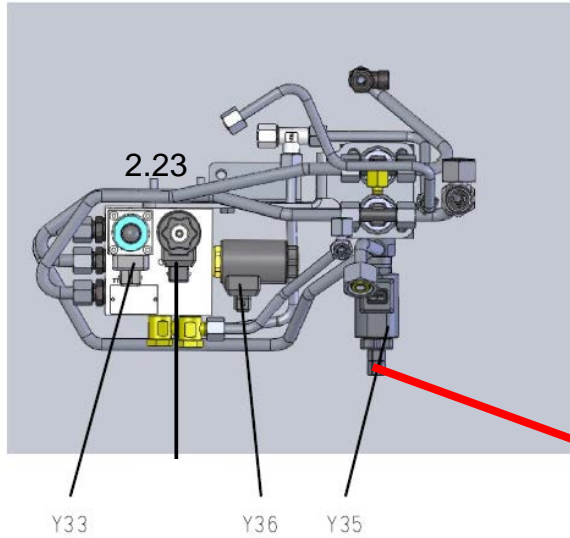
6.0.1 Work Hydraulics

Option 1459.30 Pressure control front tool carrier, solenoid valves Y33, Y34, Y35, Y36, hydraulic valve block 2.23 in the front wagon CM 1650



6.0.1 Work Hydraulics

Option 1459.30 Pressure control front tool carrier, solenoid valves Y33, Y34, Y35, Y36, hydraulic valve block 2.23 in the front wagon CM 1650



Option 1459.31

Pressure control
Front Tool Carrier (FTC)
Hydraulic block (2.23)
Solenoid valves:

Y33 proportional solenoid valve
release front tool carrier

Y34 **not used at the CM 1650!**

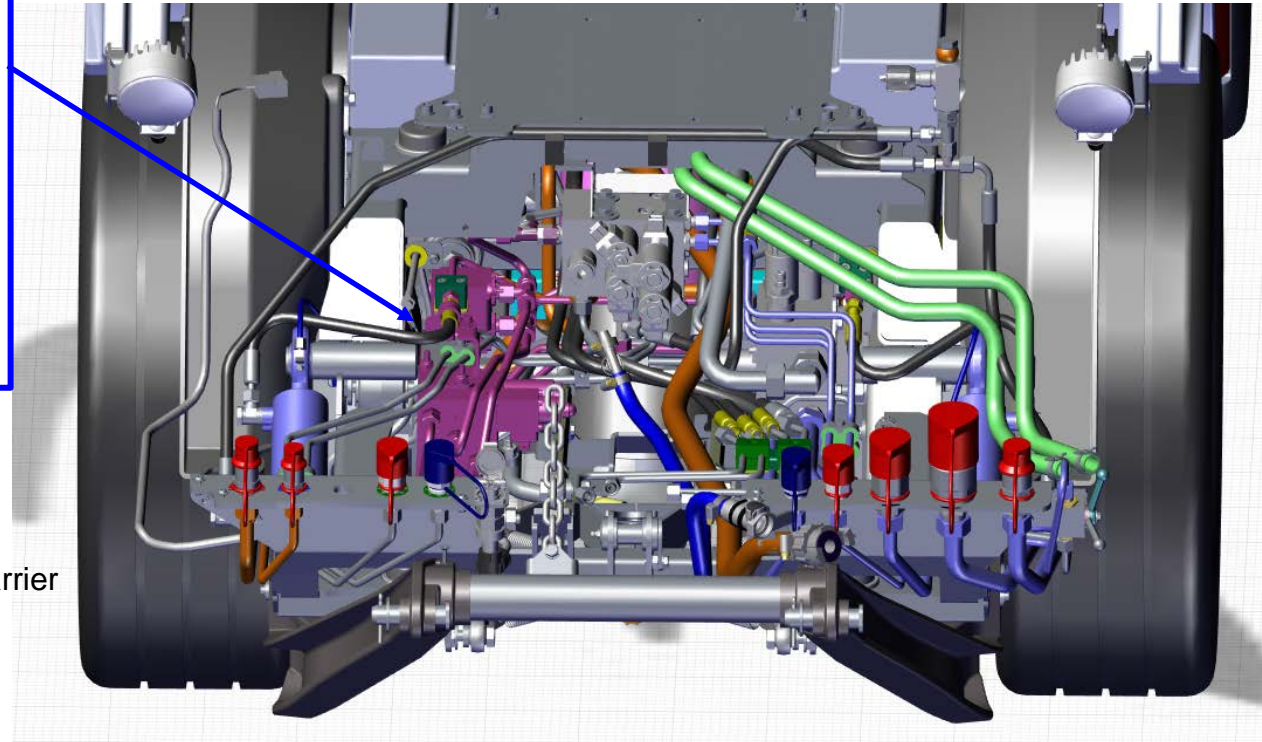
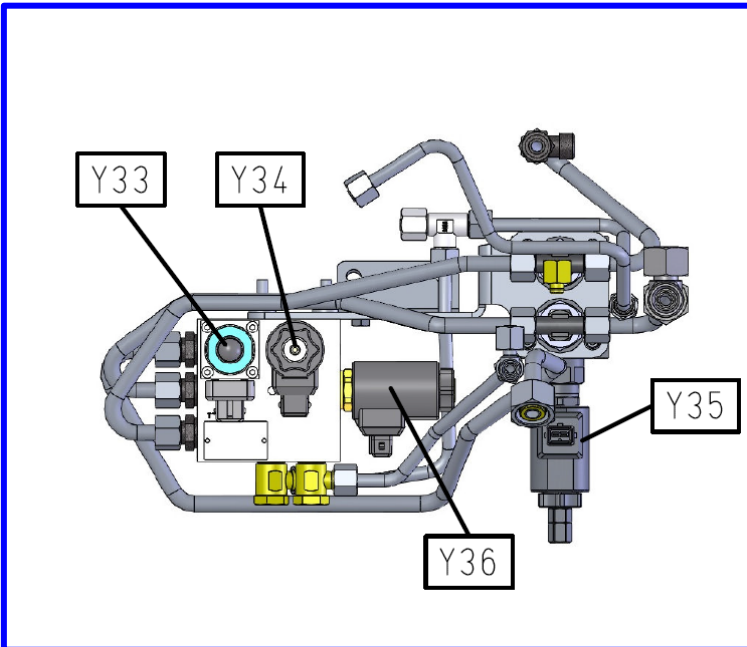
Y35 pressure relief valve 50 or 200 bar

Hako spare part number 01493130

Y36 solenoid valve floating position

6.0.1 Work Hydraulics

Option 1459.30 Pressure control front tool carrier, solenoid valves Y33, Y34, Y35, Y36, hydraulic valve block 2.23 in the front wagon CM 1650



Option 1459.31

Pressure control Front Tool Carrier (FTC)

Hydraulic block (2.23)

Solenoid valves:

Y33 proportional solenoid valve release front tool carrier

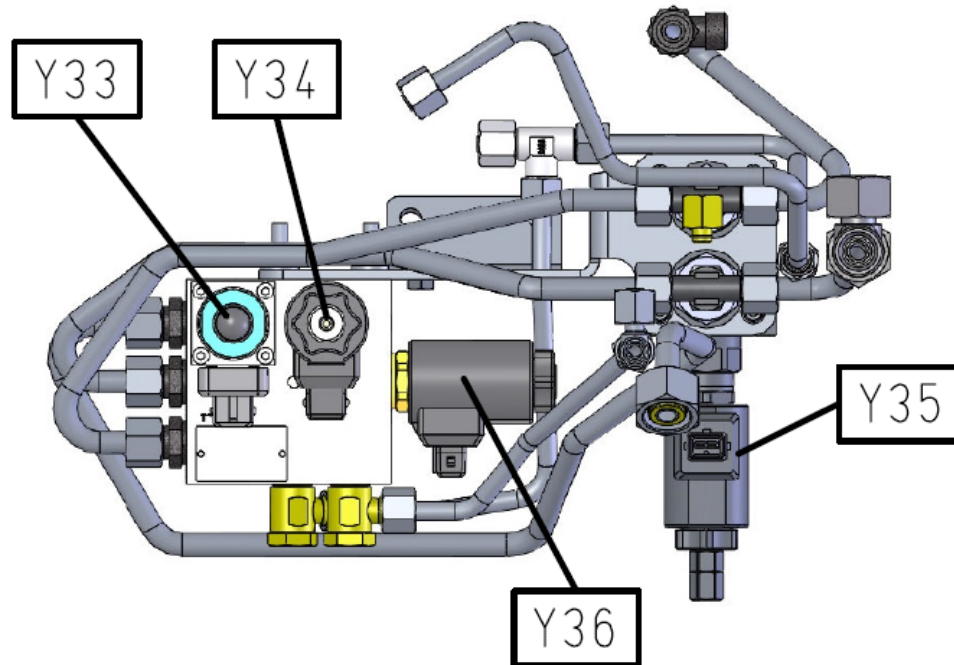
Y34 **not used in CM 1650!**

Y35 pressure relief valve 50 or 200 bar

Y36 solenoid valve floating position

6.0.1 Work Hydraulics

Hydraulic control block (2.23) option pressure control front tool carrier (Option 1459.31)



Option 1459.31

Pressure control
Front Tool Carrier (FTC)

Hydraulic block (2.23)

Solenoid valves:

Y33 proportional solenoid valve
release front tool carrier

Y34 not used at the CM 1650!

Y35 pressure relief valve 50 or 200 bar
Hako spare part number 01493130

Y36 solenoid valve floating position

Function:

Y12 On- energized, Y33 On- energized,
Y35 Off- not energized:

Max.- Pressure Function
„Release Front Tool Carrier (FTC) 50 bar!“

Y12 On- energized, Y33 On- energized,
Y35 On- energized:

Max.- Pressure Function

„ Raise Front Tool Carrier (FTC) 200 bar!“

6.0.1 Work Hydraulics

Messwerte der Magnetventile für die Arbeitshydraulik: Option Anpressdruckverstellung Frontgeräteträger 1459.31
Measured values of the solenoid valves for the work hydraulics: Option pressure control front tool carrier 1459.31

	Beschreibung- Description MV= Magnetventil- SV= Solenoid Valve	Spannung Voltage (V)	Stromstärke (A) Current Flow (A)	Widerstand der Spule Resistance Coil (Ω)
	<p>Funktion: Frontgeräteträger (FGT) heben mit Option 1459.31. MV- Y12, Y13, Y14 und Y35 bestromt- an.</p> <p>Funtion: Raise front tool carrier with option 1459.31 SV- Y12, Y13, Y14, Y35 energized- on.</p>			
Y12	MV Umlauf Geräteträger- Arbeitshydraulik ein. SV front tool carrier circulation- work hydraulics on.	12V	2000mA	6,0Ω (Ohm)
Y13	MV Geräteträger (FGT) senken; FGT Schwimmstellung. SV lower front tool carrier (FTC), FTC floating position.	12V	1350 mA	9,0Ω (Ohm)
Y14	MV Frontgeräteträger heben (FGT heben) SV valve raise front tool carrier (FTC up)	12V	2000mA	6,0Ω (Ohm)
Y35	MV Druckzuschaltung auf 200 bar SV Pressure switchover to 200 bar	12V	2000mA	6,0Ω (Ohm)

Achtung: Eine Messtoleranz von +/- 20% durch unterschiedliche Meßgeräte ist möglich!
Caution: A measuring tolerance of +/- 20% due to different measuring devices!

6.0.1 Work Hydraulics

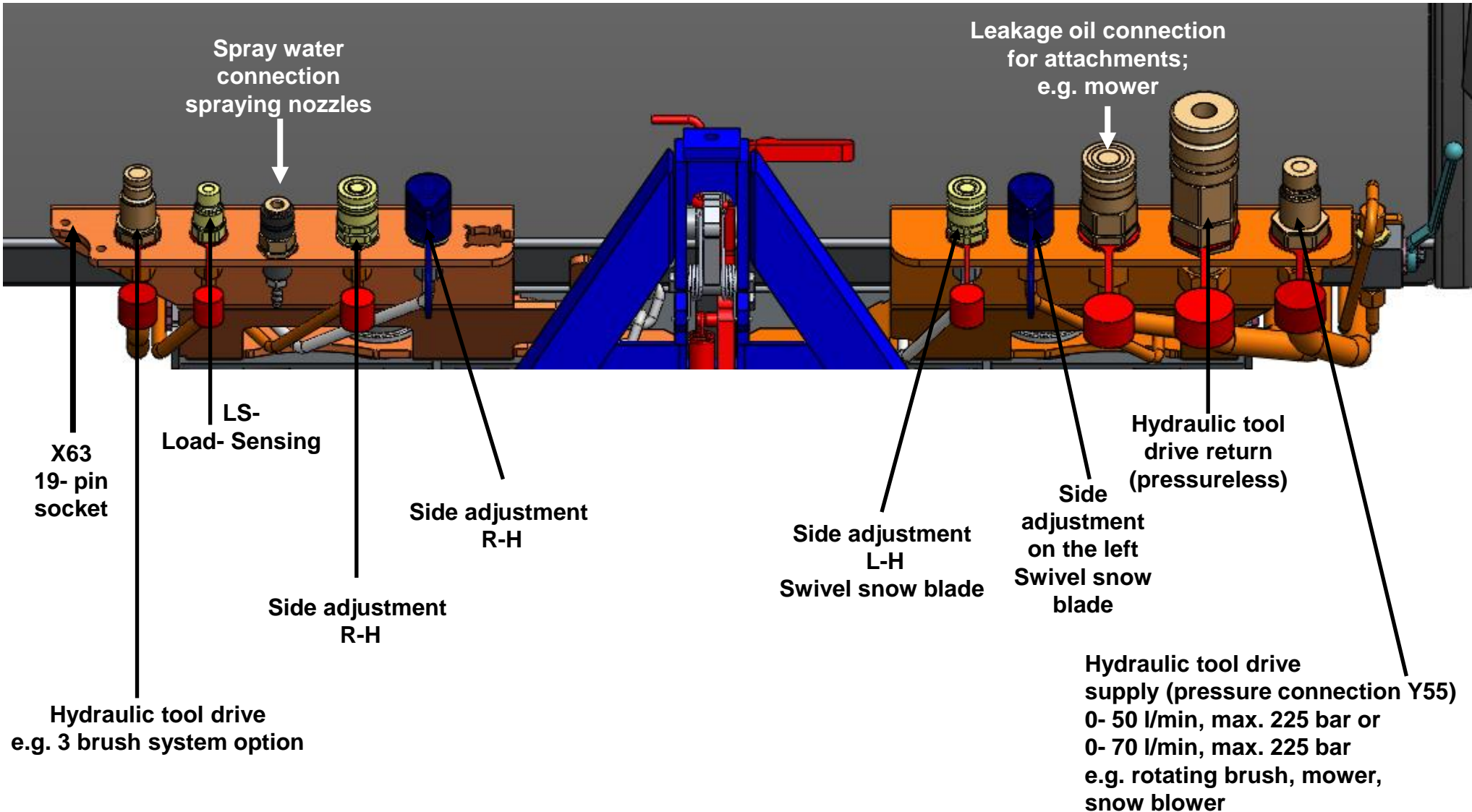
Messwerte der Magnetventile für die Arbeitshydraulik: Option Anpressdruckverstellung Frontgeräteträger 1459.31
Measured values of the solenoid valves for the work hydraulics: Option pressure control front tool carrier 1459.31

	Beschreibung- Description MV= Magnetventil- SV= Solenoid Valve	Spannung Voltage (V)	Stromstärke (A) Current Flow (A)	Widerstand der Spule Resistance Coil (Ω)
	<p>Funktion: Frontgeräteträger (FGT) heben mit Option 1459.31. MV- Y12, Y13, Y14 und Y35 bestromt- an.</p> <p>Funtion: Raise front tool carrier with option 1459.31 SV- Y12, Y13, Y14, Y35 energized- on.</p>			
Y12	MV Umlauf Geräteträger- Arbeitshydraulik ein. SV front tool carrier circulation- work hydraulics on.	12V	2000mA	6,0Ω (Ohm)
Y13	MV Geräteträger (FGT) senken; FGT Schwimmstellung. SV lower front tool carrier (FTC), FTC floating position.	12V	1350 mA	9,0Ω (Ohm)
Y14	MV Frontgeräteträger heben (FGT heben) SV valve raise front tool carrier (FTC up)	12V	2000mA	6,0Ω (Ohm)
Y35	MV Druckzuschaltung auf 200 bar SV Pressure switchover to 200 bar	12V	2000mA	6,0Ω (Ohm)

Achtung: Eine Messtoleranz von +/- 20% durch unterschiedliche Meßgeräte ist möglich!
Caution: A measuring tolerance of +/- 20% due to different measuring devices!

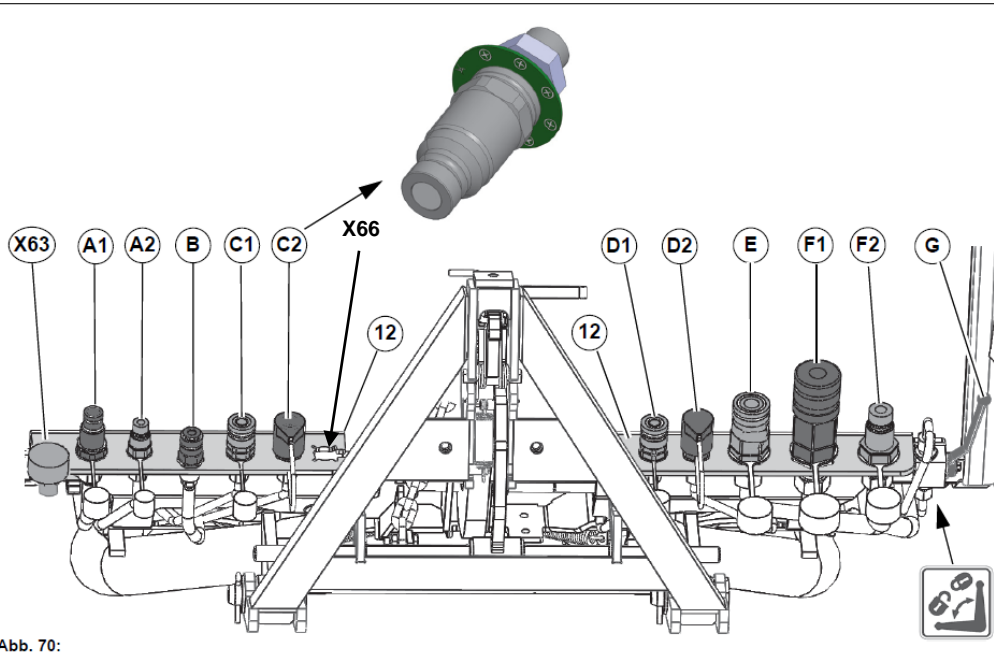
6.0.1 Work Hydraulics

Hydraulic connections (hydraulic couplings) for front attachments



6.0.1 Work Hydraulics

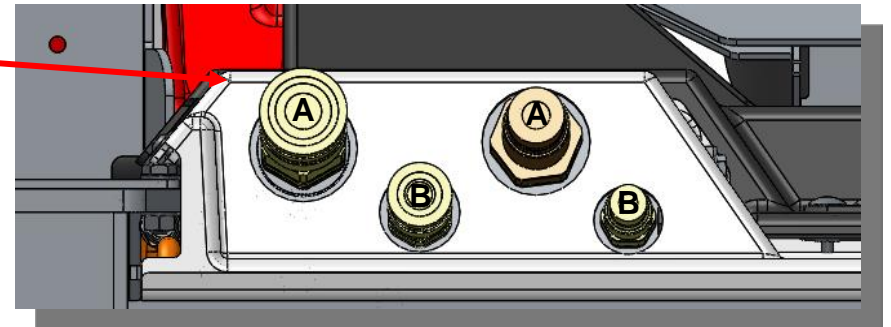
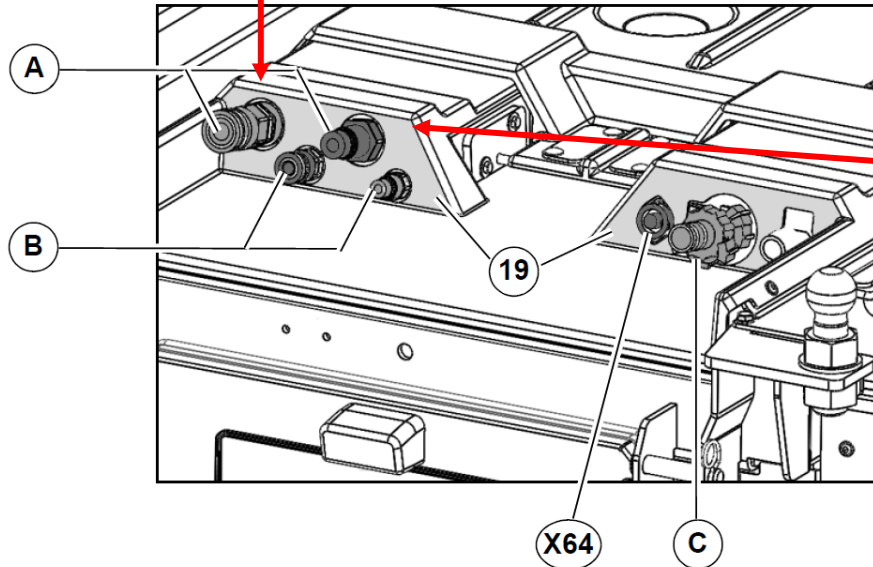
Hydraulic connections (hydraulic couplings) for front attachments



- **A** = Supply for optional 3-brush system (red/P)
- **A2** = Load sensing for option 3-brush system (blue/LS)
- **B** = water connection for sweeping unit spray nozzles
- **C1** = Return of right-hand actuator (green/-)
- **C2** = Supply for right-hand actuator (green/+)
- **D1** = Return of left-hand actuator (red/-)
- **D2** = Supply for left-hand actuator (red/+)
- **E** = Return of leakage oil pipe (e.g. for front mower) (black/L)
- **F1** = Return maximum 70 litres/min (hydraulic circuit I) (black/T!)
Setting the output, see page 78.
- **F2** = Supply maximum 70 litres/min (hydraulic circuit I) (blue/P)
Setting the output, see page 78.
- **G** = ball cock for the suction mouth lift system
- **X63** = 19-pin socket for front attachments
- **X66** = 9-pin socket for 3-brush system

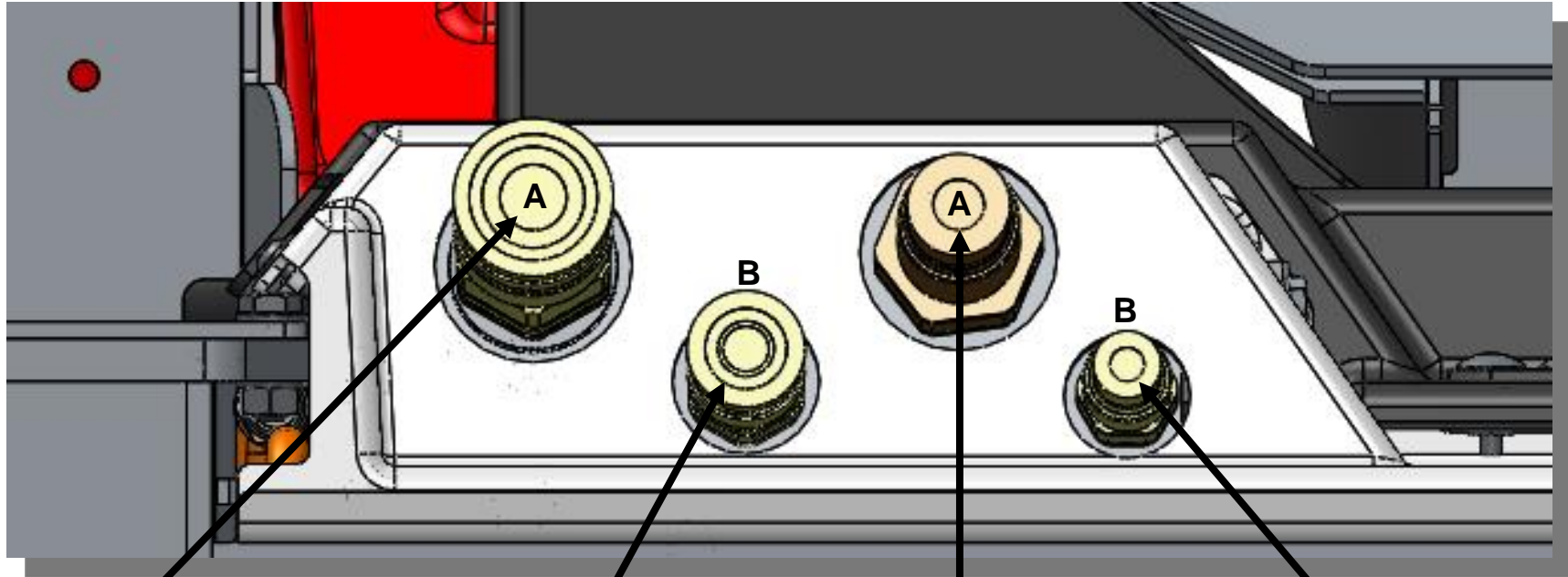
6.0.1 Work Hydraulics

Hydraulic connections (hydraulic couplings) for rear attachments



6.0.1 Work Hydraulics

Hydraulic connections (hydraulic couplings) for rear attachments



A- hydraulic tool drive return, e.g. spreader

B- hopper lift system

A- hydraulic tool drive supply, pressure side, e.g. spreader

B- hopper lift system

6.0.1 Work Hydraulics

Hydraulic connections (hydraulic couplings) for rear attachments

The following devices can be operated with the connections for the rear attachments **Fig. 59-19**:

- **X64** = 7-pin socket for rear attachments
- **A** = supply/return maximum 35 litres/min (hydraulic circuit II)
Setting the output, see page 68.
- **B** = supply/return for lift system hydraulic cylinder
- **C** = dirt hopper circulating water
- **D** = fresh water for high-pressure cleaner (optional)
- **X65** = 7-pin socket for lights
- **X68** = 7-pin socket for spreader control cable
- **X67** = 7-pin socket for spreader control cable

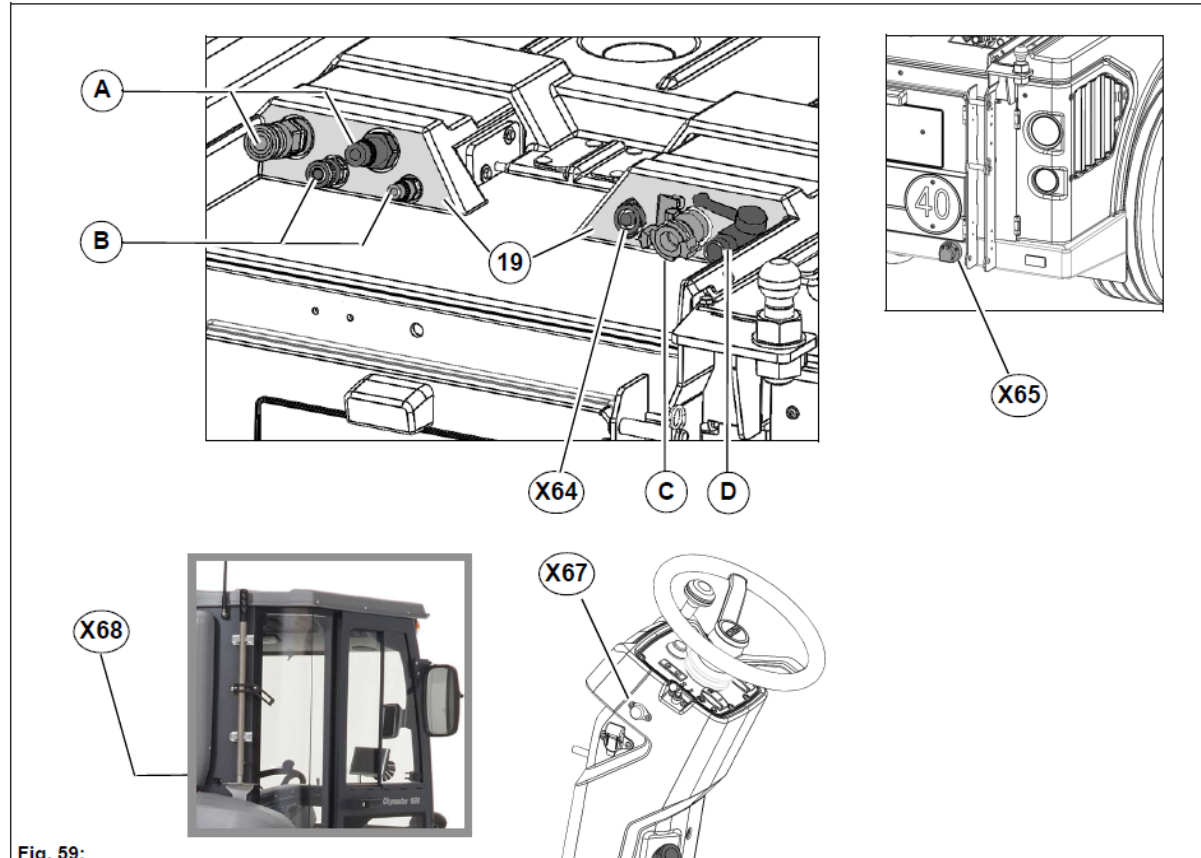


Fig. 59:

Lifting of hopper when engine is not running

The hydraulic hand pump is used to lift or lower the dirt hopper if the engine or working hydraulic is out of function

Dirt hopper lifting:

Keep lever A of hand pump in position II (down).

Keep Lever B from cock in position I (open)

Turn set screw at solenoid valve Y17 (hopper lift) totally in.

Apply the hand pump with the auxillary tool (pipe) at C till the hopper is lifted enough to work at engine etc..

Dirt hopper lowering:

Turn set screw at solenoid valve Y17 (hopper lift) totally out.

Turn set screw at solenoid valve Y18 (hopper lower) totally in.

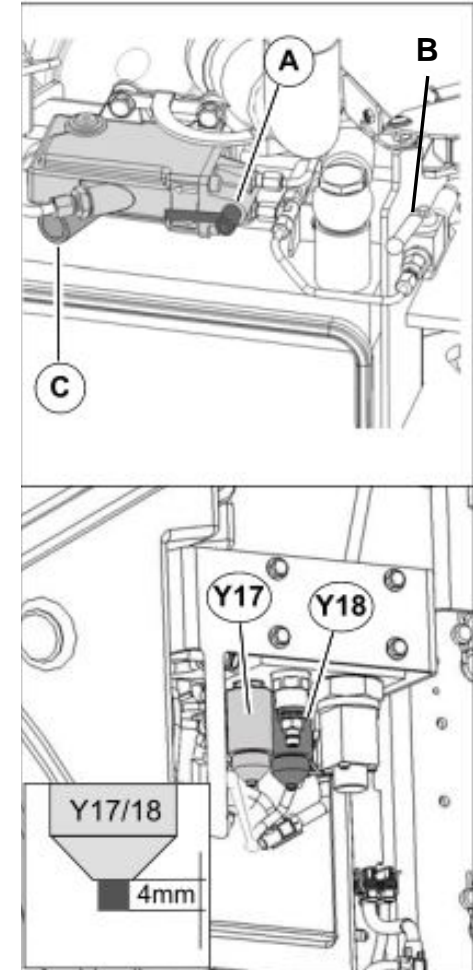
Apply the hand pump with the auxillary tool (pipe) at C till the hopper is lowered totally down.

Turn set screw at solenoid valve Y18 (hopper lower) totally out.

Indicationm:

The set screws of the solenoid valves Y17 + Y18 should be never turned in together

Under normal work both set screws must be turned out totally



6.0.1 Work Hydraulics

You will find further information about the CM 1600 working hydraulics in the sections:

6.0.2 CM 1650 working hydraulics functional circuit diagram

6.0.3 CM 1650 front tool carrier additional pressure adjustment (option) functional circuit diagram

6.0.4 CM 1650 hydraulics circuit diagram (complete)

6.0.5 Adjustment and venting of solenoid valve Y55

6.0.6 Adjustment of solenoid valve Y10

6.0.7 Assembly of the working hydraulics gear pumps

6.0.8 Assembly of the working hydraulics variable displacement pump

6.0.9 Documentation (photos) hydraulic hose layout

6.0.10 3-broom-system

6.0.11 Hydraulic circuit 3-broom-system

6.0.12 Adjustment of 3-broom-system

6.0.13 Graphic symbols in hydraulic diagrams