https://truckmanualshub.com/

1. Brochure.....

2. Service .....

3. Hydraulic .....

4. Components .....

5. Electric / Electronics .....

6. Engine .....

https://truckmanualshub.com/

Standard equipment. Optional extras.

Standard equipment

- Engine Control Unit (ECU)
- Patented Menzi Multi-Joystick
- Automatic parking brake
- Additional diesel tank in chassis
- 2 hydraulic circuits on boom
- Hydraulic return line
- Configured for the use of various attachments

John Deere 4-cylindre engine	*104 kW / 140 hp*
Displacement	*4'500 ccm / 275 cm/inch*
Max. swivelling speed	*10 rpm*
Swivel force	*46'000 Nm*
Ripping force	*69'784 N / 15'688 lbf*
Breakout force	*73'600 N / 16'546 lbf*
Lifting force max.	*6'000 kg / 13'227 lb*

Menzi Muck A91 Mobil
Two-wheel drive. The two largest wheels are driven.
Max. roadspeed up to 15 km/h / 9,4 mph.



Menzi Muck A91 Mobil 4x4
All-wheel drive. Steered wheels with variable track width for narrow and wide drive settings.
Max. roadspeed up to 10 km/h / 6,25 mph.



Menzi Muck A91 Mobil 4x4 Plus
The all-wheel drive system delivers power to 4 wheels of the same size. Compact axle leg steering on the front wheels.
Max. roadspeed up to 10 km/h / 6,25 mph.



Options

- Hydraulic telescopic feet (A91 Mobil)
- Air-conditioning
- Bio-degradable hydraulic oil
- Automatic central lubrication system
- Particulate filter
- Customer-specific paintwork
- On-road equipment
- High-speed version for roadspeeds of up to 15 km/h / 9,4 mph
- Hydraulic freewheel engagement of drive wheels
- Hydraulic rescue mountings (A91 4x4 Plus)
- Luxury seat with air suspension
- Winch preparation, including mounting
- Special adaptations



Engine-Control-Unit

Electronically controlled fuel injection system. The NOMINAL speed is compared continuously against the ACTUAL speed. The resultant feedback control compensates for any additional engine compression and delivers up to 10 % more power in the process.

Perfect handling – high levels of safety

The ergonomically shaped Multi-Joysticks make work both safe and pleasurable. All chassis movements are controlled via the top-mounted microswitches. Once the operator has taken hold of the joysticks, he can keep his hands on them all the time. Virtually the entire excavator can be controlled using the logically placed switches. Each switch to command its action without using change over buttons. Additional integrated switches for complex accessories.



d:\daten\prospekte\kt\kt-a91-0620-e-gb.pub



MENZI MUCK AG Maschinenfabrik
CH-9443 Widnau / Switzerland

Telefon + +41 (0)71 727 12 12
Fax + +41 (0)71 727 12 13
info@menzimuck.com
www.menzimuck.com

menzi muck

The king's class of mobile walking excavators

https://truckmanualshub.com/

Menzi Muck A91
Strong. Fast. Comfortable.

More than 35 years experience as Number 1 make a difference. The new Menzi Muck A91 is based on a thoroughly researched concept employing tried and tested technology. Make your decision in favor of power, mobility and maximum performance.

The A91 will satisfy all your wishes with a fully comprehensive range of features. Mind you, despite all this technological attributes, we still view the operator as the center point around whom the concept has been created. Every detail in the operators cab is based on functionality, safety and comfort. All the way from the luxurious seat on its adjustable suspension to the air-conditioning system and to the exclusive patented Menzi Multi-Joystick control system.

Make your decision in favor of power
4-cylinder John Deere turbo-diesel engine. Max. rating 104 kW (140 bhp). Exhaust standard 9768 Level 2.













Drive circuit with parking brake
Hydrostatic wheel motors with locking differentials. Automatic parking brake, no manual handbrake required.

Fast, responsive hydraulic system
State-of-the-art LUDV load-sensing hydraulic system with a total displacement of 99 gpm and an operating pressure of 4061 psi.







High level of lifting capability
Robust booms with powerful cylinders enable the vehicle to contend with high lifting torques. The massive pins guarantee a long service life.

No need to sweat – no need to freeze
The temperature controlled air-conditioning system (optional) is standard equipment and ensures a consistent pleasant working environment.





Ease of maintenance
The tilting operator's cab and the large rear and side covers provide an excellent access for maintenance.

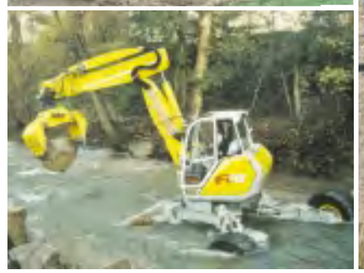
Relaxed seating
The operators seat (optional) delivers maximum levels of comfort. The seat, the armrests, the joystick and the footpedals are all individually adjustable.

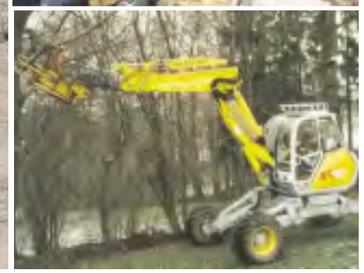




Extended service life
The latest chassis design provides optimal stability. All load bearing components feature high quality steel castings for strength.

Safety cab
This comfortable full-view safety cab has passed all inspections and tests: ROPS, FOPS and OPS test as defined in DIN ISO 34171.





New robust retaining system
Steel pads with three positions which rotate to provide clearance for rubber pad installation.

https://truckmanualshub.com/

Basic Data Menzi Muck A91

John Deere 4-cylindre engine	kW / HP	104 / 140
Governed to 1900 rpm	kW / HP	93 / 125
Max. engine speed	rpm	1900
Displacement	ccm / cm/inch	4500 / 275
Starter	kW / HP	4.5 / 9.8
Diesel fuel tank capacity	litre	326 (126/200)
	US-gall.	86.1 (33.3 / 52,8)
Hydraulic system capacity	litre / US-gall.	230 / 61
Max. swivelling speed	rpm	10
Swivel force	Nm. / lbf	46000 / 33928
Operation across slope	%	70
Operation along slope	%	100
Climbing ability on road up to	%	50
Ripping force T1,8	N / lbf	69784 / 15688
Ripping force T2	N / lbf	76762 / 17256
Breakout force	N / lbf	73600 / 16546
Lifting force max.	kg / lb	6000 / 13227

Version: Menzi Muck A91 Mobile

Weight without bucket	kg / lb	9600 / 21164
Speed standard	km/h / mph	up to max. 8 / 5
Speed (2 gradates) optional	km/h / mph	up to max. 15 / 9,4
Turning circle diameter less than	m / ft	18 / 59
Standard front tyre 300-15	mm / inch	800 x 300 / 2'7''x1'
Optional front tyre size 400/60-15.5	mm / inch	70 x 400 / 2'1''x1'5''
Standard tyre size hub drive 550/80-23	mm / inch	1350 x 550 / 4'5''x1'9''
Optional tyre size hub drive 49x19.0-20	mm / inch	1280 x 510 / 4'2''x1'8''
Optional tyre size hub drive 18R/22.5 XF	mm / inch	1170x450 / 3'10''x1'6''
Optional tyre size hub drive 600/55-26.5, T421	mm / inch	1350x600 / 4'5''x2'

Version: Menzi Muck A91 4x4

Weight without bucket	kg / lb	9900 / 21825
Speed (2 gradates)	km/h / mph	up to max. 10 / 6,25
Turning circle diameter less than	m / ft	18 / 59
Standard front tyre 400/60-15.5	mm / inch	70 x 400 / 2'1'' x 1'5''
Standard tyre size hub drive 550/80-23	mm / inch	1350 x 550 / 4'5'' x 1'9''
Optional tyre size hub drive 49x19.0-20	mm / inch	1280 x 510 / 4'1'' x 1'7''
Optional tyre size hub drive 600/55-26.5, 16pr, T421	mm / inch	1350 x 600 / 4'5'' x 2'

Version: Menzi Muck A91 4x4 Plus

Weight without bucket	kg / lb	10500 / 23148
Speed (2 gradates)	km/h / mph	up to max. 10 / 6,25
Turning circle diameter less than	m / ft	14,5 / 47,5
Standard tyre size hub drive 550/80-23	mm / inch	1350 x 550 / 4'5'' x 1'9''
Optional tyre size hub drive 49x19.0-20	mm / inch	1280 x 510 / 4'1'' x 1'7''
Optional tyre size hub drive 600/55-26.5, 16pr, T421	mm / inch	1350 x 600 / 4'5'' x 2''
Optional tyre size hub drive 600/55-22.5	mm / inch	1100 x 600 / 3'8'' x 2''

Menzi Muck AG
Maschinenfabrik
CH-9443 Widnau
info@menzimuck.com
www.menzimuck.com

Verwaltung:
Tel. +41 071 7271212
Fax +41 071 7271213

Service:
Tel. +41 071 7271200
Fax +41 071 7271201

d:\daten\prospekt\mba91-v2-0803.pmd - Technische Änderungen vorbehalten

Engine

John Deere 4-cylinder diesel engine. Type 4045HF275. In accordance with exhaust standard 9768 gradates 2 and Tier-2 emission certification CARB. 4500 ccm/275 cm/inch. 104 KW (140 hp) at 2,400 rpm, governed to 1,900 rpm: 93 KW (125 hp). Gross power guaranteed at SAE J1995 and ISO 3046. Turbocharged with air / air charge cooling system and direct injection.

Engine control Unit

The original John Deere control unit ECU controls the fuel injection system. The set point speed is permanently compared electronically with the actual engine speed; the engine pressure is compensated for by means of automatic adjustment. In this way, the hydraulic performance is constantly maintained. The standard ECS provides the excavator with an increased output of 10%. The engine speed is variable.

Hydraulic system

Load-sensing hydraulics (LIFD: load-independent flow division). The latest generation of load-independent flow division. The system works using a performance-regulated tilting plate axial piston pump. Working pressure: 280 bar. The controller is very sensitive. Total capacity: 375 l/min. / 99 US-gall. (Working operation 240 l/min / 63.4 US-gall., travel operation 130 l/min / 35.6 US-gall). The power unit is activated in closed circuit by a separate tilting plate axial piston pump.

Hydraulic cylinders

The hydraulic cylinders on the boom have end-position damping which allows for gentle braking in the end position. All hydraulic cylinders on the chassis are equipped with ball joints and have double safety-check valves (hose fracture protection) so that the machine maintains its position in the event of a fault occurring.

Control

Multi-Joystick: with 19 functions in series. The recently developed ergonomically designed joystick guarantees even more flexibility. The boom, chassis, steering and attachment connection are all controlled using the joystick.
Pedals: there are 4 pedals for controlling the telescopic boom, attachment connection, winch and travel. The height and angle of the pedal bank can be adjusted individually by the operator.

Instrument panel

Clear and ergonomically designed instrument panel. Large LCD display showing the most important indicators and individual language choice: engine speed, operating hour meter, trip meter, fuel gauge, air-filter impurity indicator, hydraulic oil temperature indicator, water temperature indicator, battery-charge condition indicator, engine oil pressure indicator, pressure return filter indicator, alarm, service indicator, engine shut-off indicator etc. There are various controls operated by means of rocker switches; there is also a clock, a cigarette lighter and an air-conditioning regulation. Engine and instrument panel are connected by a CAN-bus.

Electrical equipment

24 volts, 125 Ah battery, 45 amp alternator, 7.2 kW starter motor. Electrical wattage rating: 1,080 watts. There are two front and two rear work headlamps, horn, parallel windscreen wipers with windscreen washers, emergency shut-off and a radio with a cassette deck which has two speakers installed in the rear top left and rear top right of the cab.

Swing

The swing assembly is operated using torque control. An axial piston motor with an automatic multi-disc brake runs using planetary gearing stop on the inner gear teeth of the enlarged slewing gear. Slew range: 360° (endless), slewing speed: up to 10 rpm.

Safety cab

Comfortable crash-proof cab has all-round view, rollover resistance (ROPS and FOPS tested, according to DIN ISO 3471), is TBG-tested, vibration-free and quiet. The cab can be hydraulically tilted. The front side window, the right-hand side window and the roof window are all hinged. There is efficient air conditioning with a temperature selector. The freely adjustable air-sprung luxury seat, and armrests that can be adjusted for height and angle, offer optimum seat positioning. The operator can automatically switch off the primary control unit on leaving the cab by raising the left-hand control lever (unless the lever is inaccurately manipulated).

Power unit

This has a closed circuit with a separate pump. The unit works by means of hydrostatic wheel-hub drives with hydraulic differential lock. The wheel-hub drives are equipped with automatic parking brakes. The steering is operated by means of a joystick. Switch from boom operation to steering operation using the rocker switch, or at short notice by using a switch on the joystick.

Menzi Muck A91 mobile
The drive is via the two large wheels (2-wheel drive). The steered wheels on the front stabilisers are easily removed manually. Speed: 0 - 5 mph (0 - 8 km/h), optional faster version with two speeds depending on the tyres, up to 0 - 10 mph (0 - 15 km/h).

Menzi Muck A91 4x4
All-wheel drive. The steered wheels on the front stabilisers have variable track adjustment with 4 different positions from a minimum of 2,360 mm to a maximum of 3,660 mm. Standard 2-speed power unit: 1st speed: 0 - 2.5 mph (0 - 4 km/h), 2nd speed: 0 - 6.25 mph (0 - 10 km/h) (varies depending on which tyres are mounted)

Menzi Muck A91 4x4 Plus
Version with 4 wheels of the same size. Front wheels with additional steering swivel to give optimum manoeuvrability. Turning-circle diameter: 14.5 m. Standard 2-speed power unit: 1st speed: 0 - 2.5 mph (0 - 4 km/h), 2nd speed: 0 - 6.25 mph (0 - 10 km/h) (varies depending on which tyres are fitted). Optionally hydraulic rescue mountings including steel pads.

Standard equipment

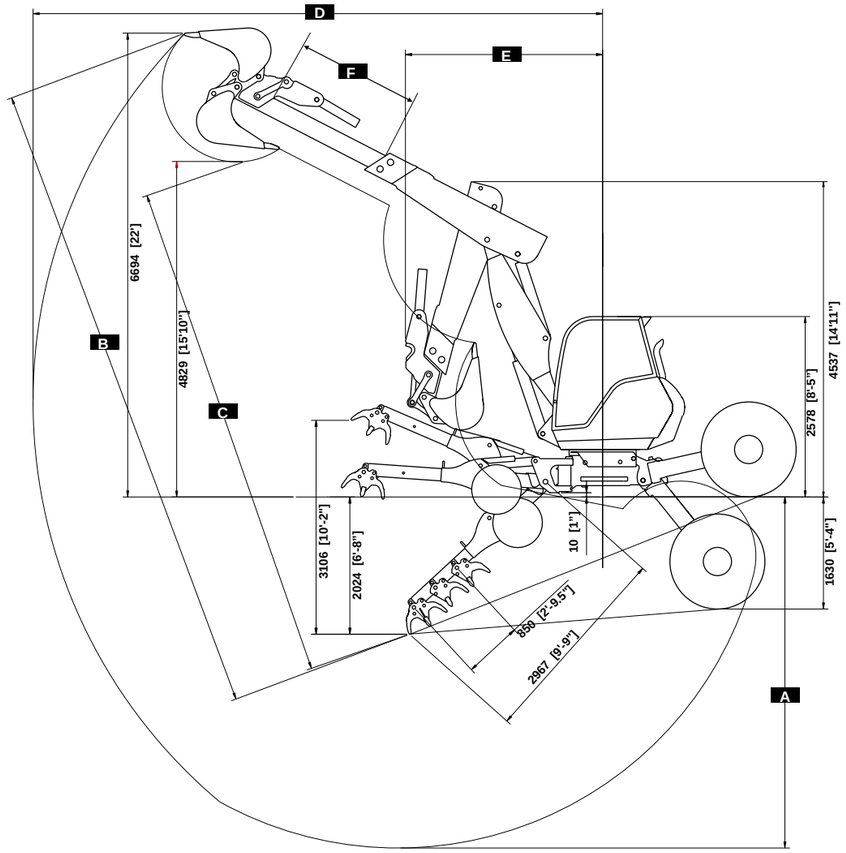
- Engine control unit (ECU)
- Multi-Joystick
- Reserve fuel tank in the chassis 200 litres
- 2 steel pads (except on the 4x4 plus)

Options

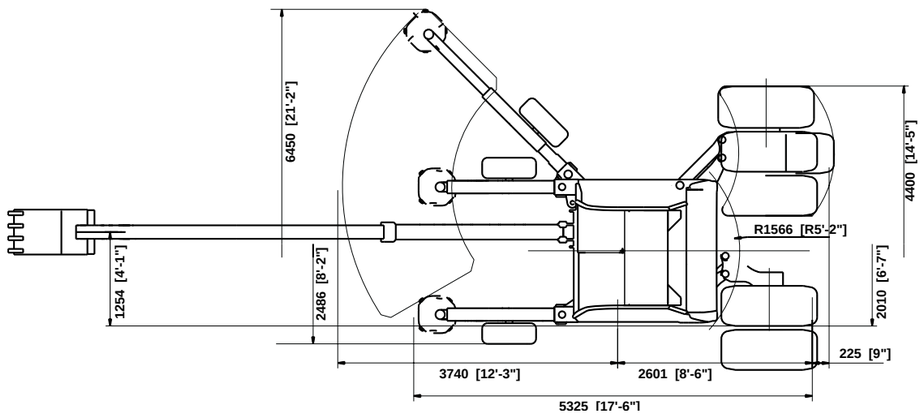
- Equipment for the hoist attachment (load hook, overload warning fittings, hose fracture protection on the boom cylinder)
- Air conditioning
- Hydraulic telescopic front stabilisers (except on the 4x4 Plus)
- Biodegradable hydraulic fluid
- Automatic central lubricating system
- Customer-specified paintwork
- Fast version (A91 mobile)
- Hydraulic free-wheel shifting of the drive wheels (A91 mobile)
- Revolving lamp
- Custom-made devices
- Shut down
- Luxury seat with air suspension
- Special types of tyres
- Winch preparation, including mounting

https://truckmanualshub.com/

Menzi Muck A91 Mobile / Menzi Muck A91 4x4

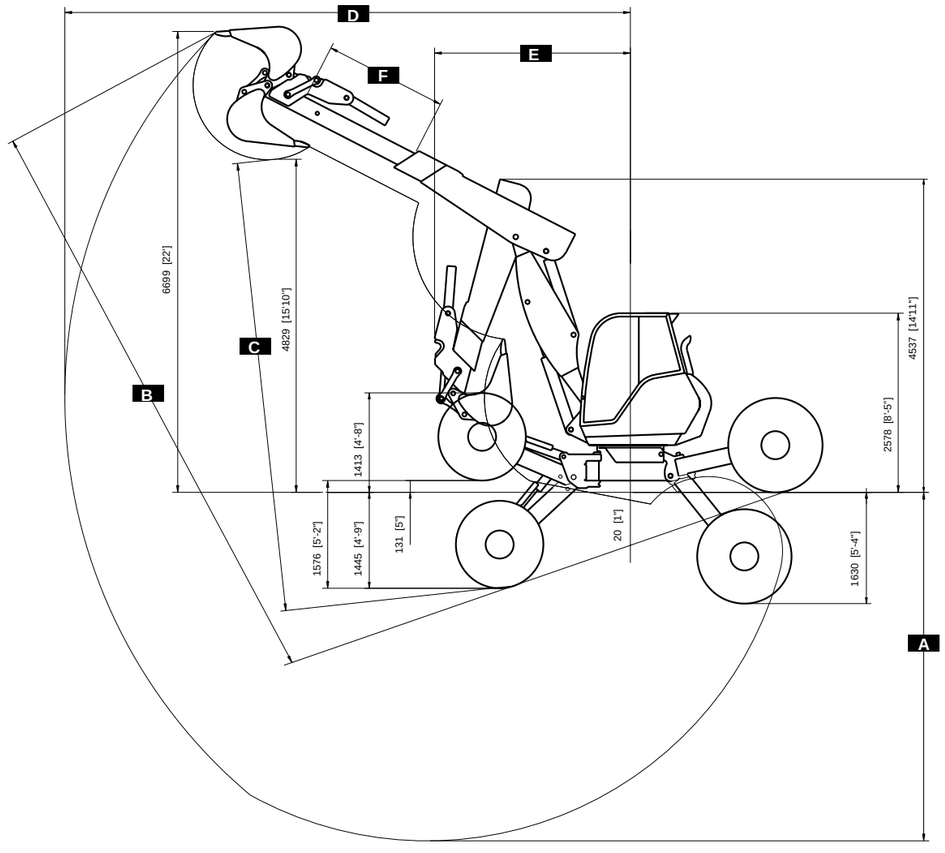


Excavation depth	A mm / ft	5139 / 16'10"
Excavation height	B mm / ft	9308 / 30'6"
Discharge height	C mm / ft	7237 / 23'9"
Jib Range	D mm / ft	8274 / 27'2''
Smallest swivelling radius	E mm / ft	2864 / 9'5''
Dipper length	F mm / ft	1800 / 5'11''

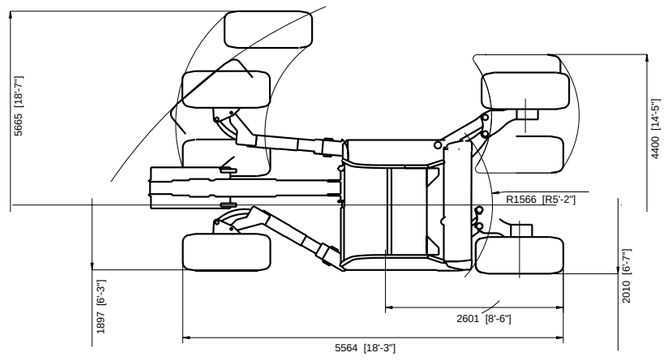


Minimum and maximum measurements depend on type of tyre.

Menzi Muck A91 4x4 Plus



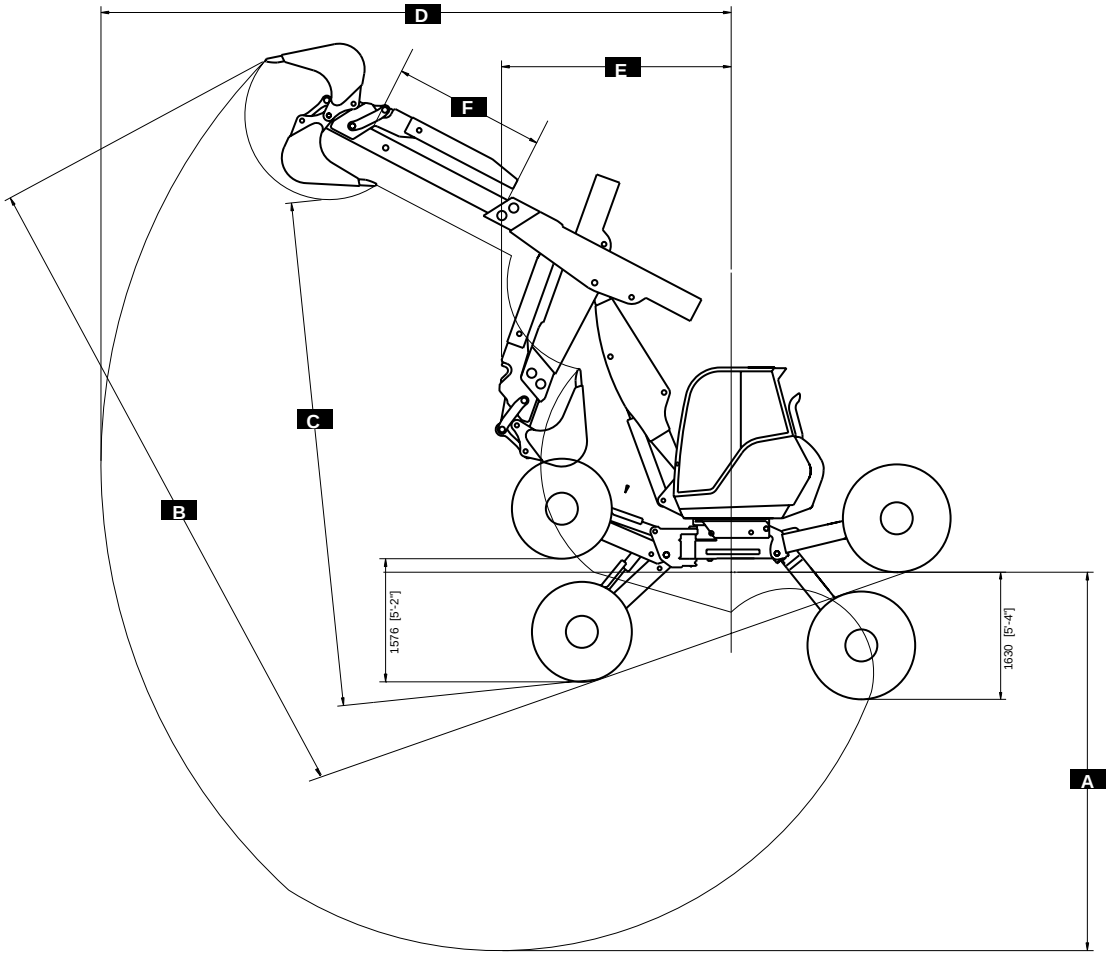
Excavation depth	A mm / ft	5139 / 16'10"
Excavation height	B mm / ft	9100 / 29'10"
Discharge height	C mm / ft	7057 / 23'2''
Jib Range	D mm / ft	8274 / 27'2''
Smallest swivelling radius	E mm / ft	2864 / 9'5''
Dipper length	F mm / ft	1800 / 5'11''



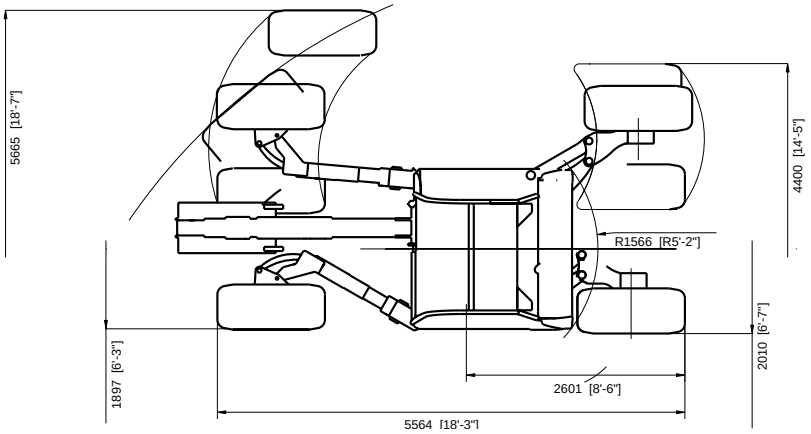
Minimum and maximum measurements depend on type of tyre.

https://truckmanualshub.com/

Menzi Muck A91 Mobile / Menzi Muck A91 4x4 with 2m telescope

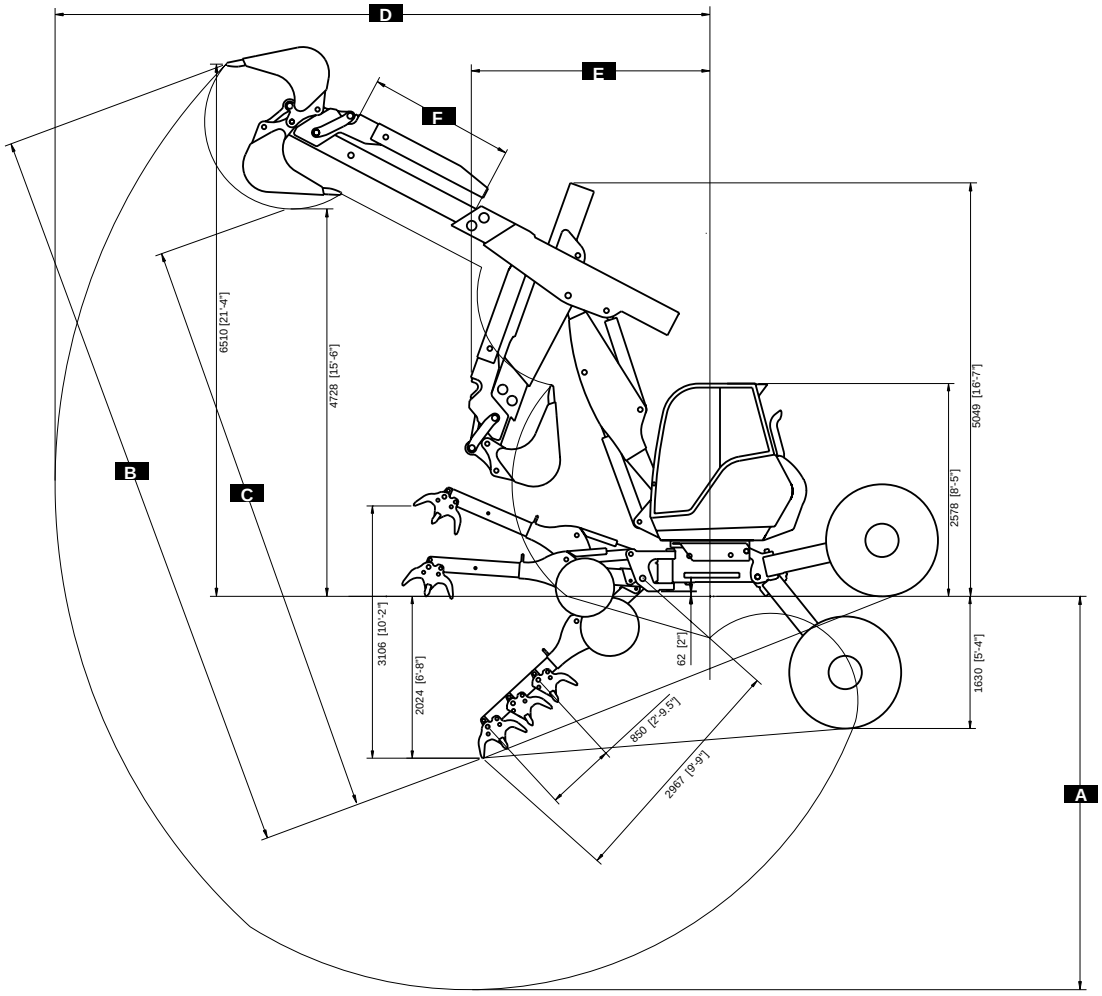


Excavation depth	A mm	4885 / 16’
Excavation height	B mm	8908 / 29’3”
Discharge height	C mm	6913 / 22’8”
Jib Range	D mm	8075 / 26’6”
Smallest swivelling radius	E mm	2943 / 9’8”
Dipper length	F mm	1955 / 6’5”

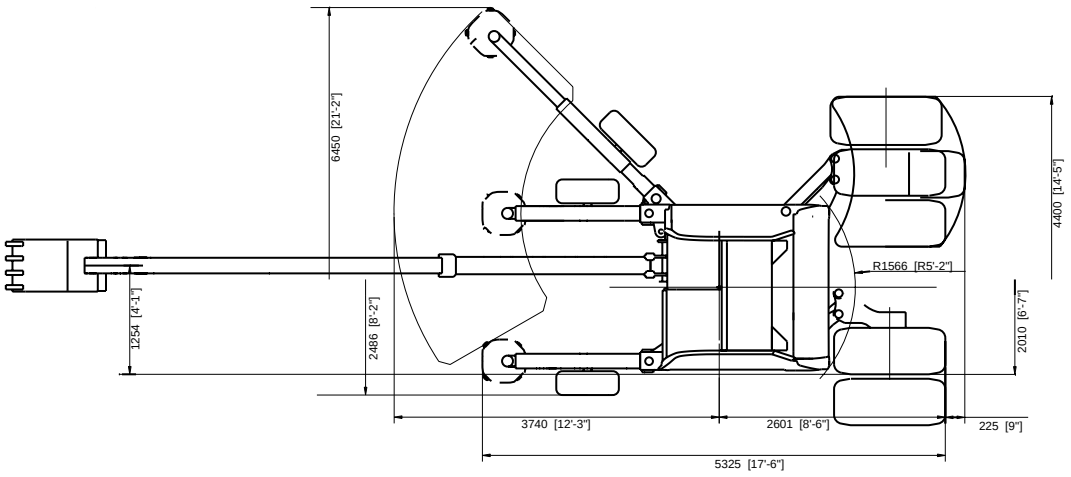


https://truckmanualshub.com/

Menzi Muck A91 4x4 Plus with 2m telescope



Excavation depth	A mm	4885 / 16'
Excavation height	B mm	9101 / 29' 10''
Discharge height	C mm	7092 / 23'3''
Jib Range	D mm	8075 / 26'6''
Smallest swivelling radius	E mm	2943 / 9'8''
Dipper length	F mm	1955 / 6'5''



https://truckmanualshub.com/

50 hours Service A91V2 Mobil

Engine

- Check the cooling water level
- Check the automatic belt tensioner and check belt wear
- Drain condensed water from the fuel filter
- Change the engine oil
- Change the engine oil filter
- Change the fuel filter
- Change the air filter, clean the case
- Clean water cooler
- Check revolutions 1900 - 1950 rpm, upper idle 900 +/- 50 rpm, lower idle
- Check the function of the electrical system. (Display/ Steering)
- Check that the clamp bolts for the engine mounting and any attached aggregates are tight.
- At operating temperature, check smoke development under maximum load.
- Check function of air filter control
- Check engine and heater water hoses for leakage
- Check antifreeze

Refer also to the operating manual for the John Deere engine.

Attention:
No adjustment of engine valve play!

Hydraulics

The hydraulic oil must be at operating temperature of approx. 50°C before adjusting the pressure of the hydraulic system.

- Change return filter
- Change transmission oil
- Check operating pressures
- Check for leakage at the spool valve and the secondary pressure control valve (lowering the hydraulic cylinder)
- Check stabiliser cylinder for decrease (safety for hydraulic hose break)
- Check hydraulic oil level
- Check entire hydraulic system for leaks
- Check fastening and placement of hydraulic hoses and pipes
- Clean the hydraulic oil cooler
- Check the function of the hydraulic tank fill cap (while pressurised)

General

- With the aid of the machine operator, grease the entire excavator. Observe grease distribution
- Check the grease coat on the pinion and ring gear, and replenish as necessary
- Check the tightness of the ring gear bolt and tighten if necessary (285 Nm)
- Check the tightness of the transmission bolt and tighten if necessary (285 Nm)
- Adjust the play of the telescopic arm
- Retighten any loose bolt connections
- Check the function of the heating
- Check the entire excavator for cracks
- Tighten the wheel nuts

Mobile version

Additional tasks for the A91 Mobile:

- Check the pressure
- Check the flow rate of the pump with the machine in operating mode
- Change the oil of the wheel hubs
- Check the wheel bolts on the drive wheels and tighten if necessary (340 Nm)
- Check the function of the wheel hub brake

https://truckmanualshub.com/

Client

Name _____

Adress _____

_____

_____

Telephone _____

E-Mail _____

Machine

Type _____

Chassis-No. _____

Engine-No. _____

Operating hours _____

Service

done by _____

Date _____

Bestätigung

Service correctly done _____

Comment _____

_____

_____

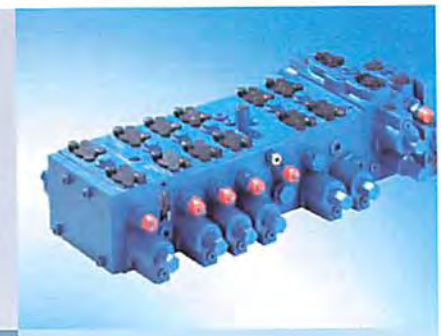
Sign of client _____

Menzi Muck AG Maschinenfabrik
CH-9443 Widnau / Switzerland

Tel. ++41(0)71 727 12 12
Fax ++41(0)71 727 12 13
www.menzimuck.com
info@menzimuck.com

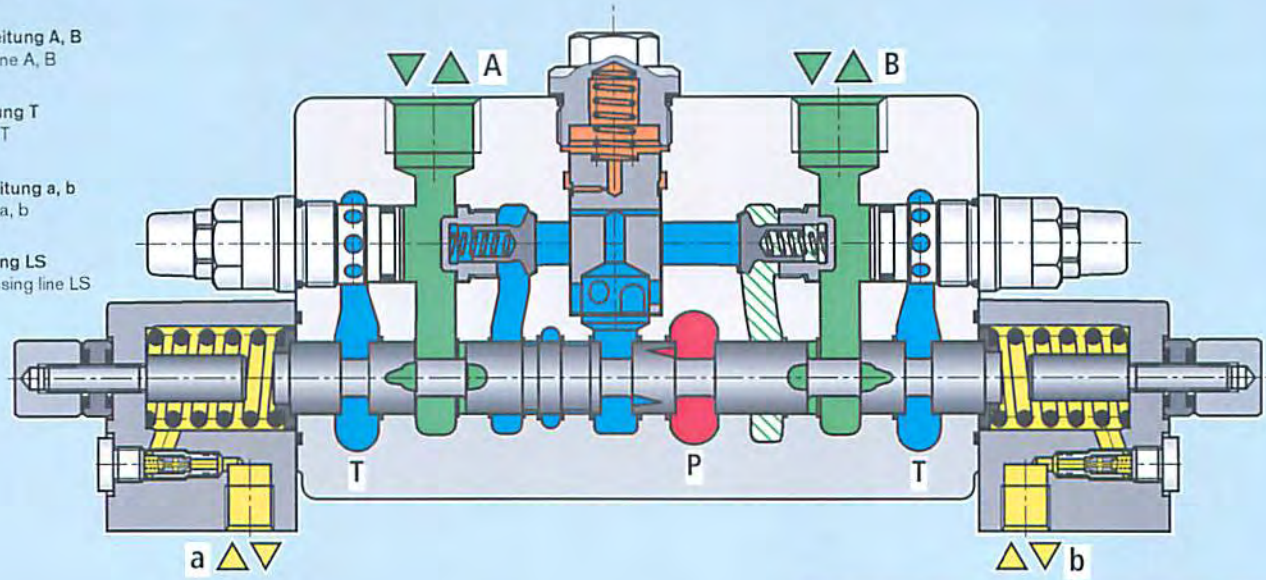
https://truckmanualshub.com/

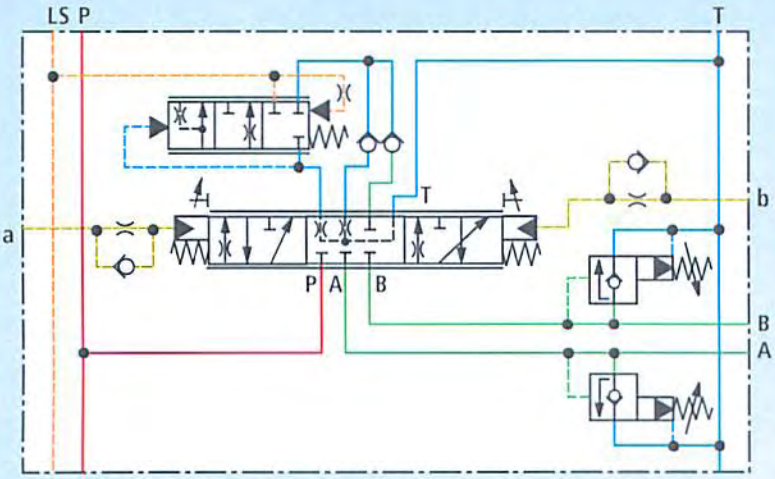
Hochdruck LUDV Steuerblock
High Pressure LUDV Flow Sharing Control Block



M7-20/22

- Pumpenleitung P / Pump line P
- Arbeitsleitung A, B / Service line A, B
- Tankleitung T / Tank line T
- Steuerleitung a, b / Pilot line a, b
- LS-Leitung LS / Load sensing line LS





Anwendungen
Bagger, Krane, Bohrgeräte

Technische Daten
- Max. Betriebsdruck 420 bar
- Max. Volumenstrom 240 L/min (M7-20)
  400 L/min (M7-22)
- LUDV Steuerung
- Monoblock- und Scheibenbauweise (max. 9 Wegeventilelemente)
- Hydraulisch oder elektro-hydraulisch betätigt

Applications
Excavators, Cranes, Drilling riggs

Technical Data
- *Max. pressure 420 bar*
- *Max. flow 240 L/min (M7-20)*
  400 L/min (M7-22)
- *LUDV system (Flow sharing)*
- *Monoblock and sandwich design (max. 9 valve sections)*
- *Hydraulic or electro-hydraulic operated*

Nachdruck verboten – Änderungen vorbehalten
All rights reserved – Subject to revision

RDE 64295-W/01.04
Ersetzt/Replaces: 64278-W

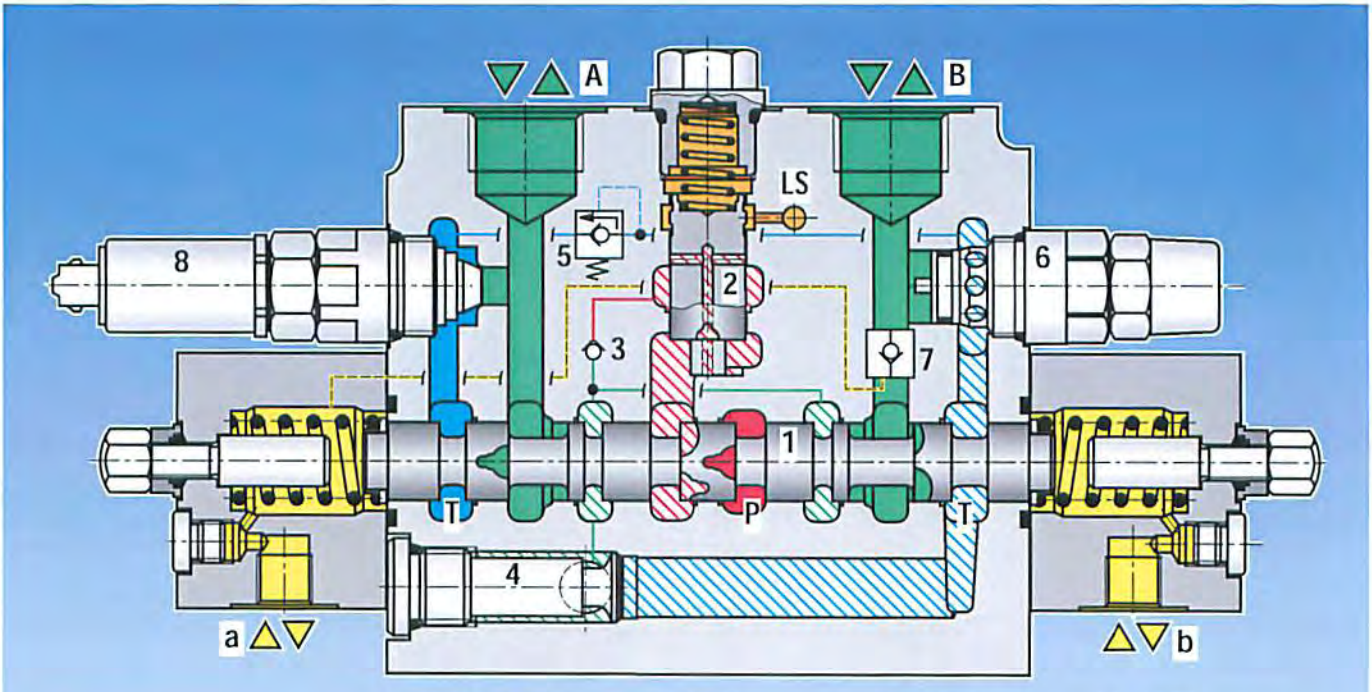
https://truckmanualshub.com/

Hochdruck Load-Sensing Steuerblock

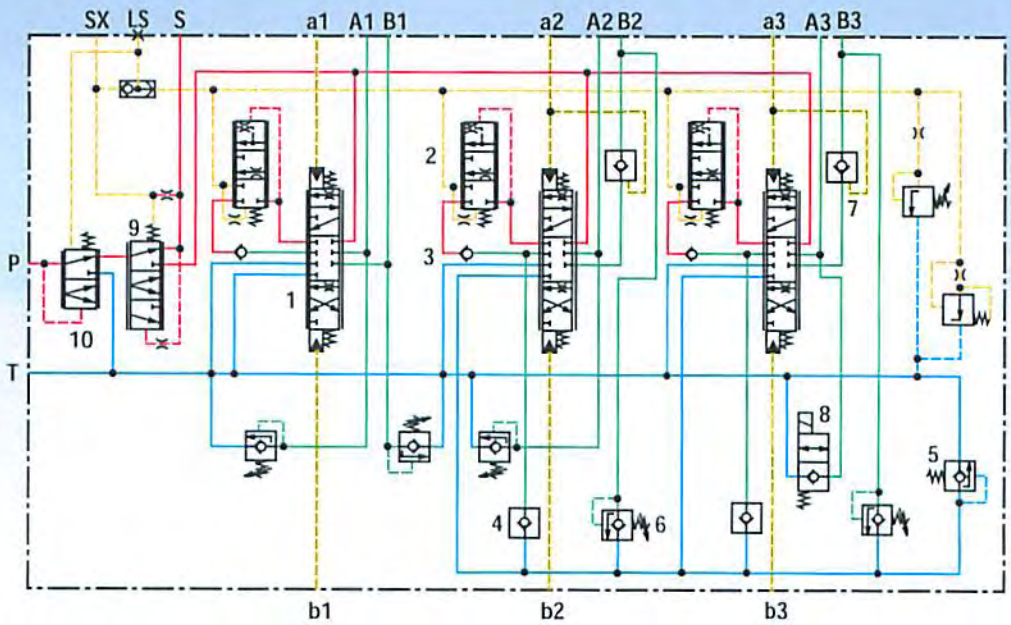
High Pressure Load Sensing Control Block

M6-15

engineering mannesmann Rexroth



- Pumpenleitung P *Pump line P*
- Arbeitsleitung A, B *Service line A, B*
- Tankleitung T *Tank line T*
- Steuerleitung a, b *Pilot line a, b*
- LS-Leitung LS *Load sensing line LS*





Anwendung: Lader, Telestapler

Technische Daten:

- Open Center, Eingang
- Closed Center, Eingang
- Max. Betriebsdruck 350/420 bar
- Max. Volumenstrom – Eingang 200 L/min
  – Sektion 150 L/min
- LUDV-Steuerung, Monoblockbauweise
- Hydraulisch oder elektrohydraulisch betätigt

Application: *Loader, Telehandler*

Technical data:

- *Open center, inlet*
- *Closed center, inlet*
- *Max. pressure 350/420 bar*
- *Max. flow – inlet 200 L/min*
  – section 150 L/min
- *LUDV control, monoblock design*
- *Hydraulic or electro-hydraulic operated*

RDE 64 284-W/05.99

Rexroth Hydraulics

https://truckmanualshub.com/

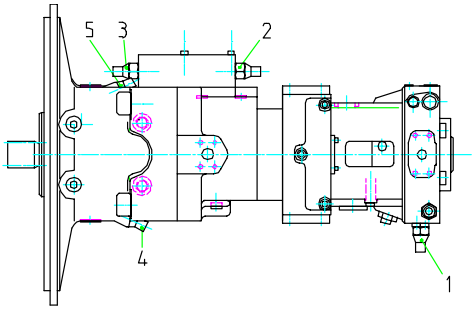
Basic setting instructions for Menzi Muck A91V2 / M7/ M6

Change the settings when the hydraulic oil temperatures are at approximately 40 - 50°C and the diesel motor is at operating temperature.

1. Diesel motor

- Idle 850 - 900 rpm
- Maximum speed (electronically controlled) 1900 – 1950 rpm
- Emergency gas 1500 - 1550 rpm with emergency gas plug
- Overspeed trip unit at low temperatures 1500 – 1550 rpm

2. Hydraulic pump



Pump:

Set the controller (1) of the pump mechanism so that the raised wheels begin to turn at a motor speed of approx. 1250 - 1300 rpm.

Working pump:

Do not adjust the controller (2) of the working pump, as it is set ex-works. As the control measurement, the free thread length of the thread end projection (2) must be 16.0 mm.

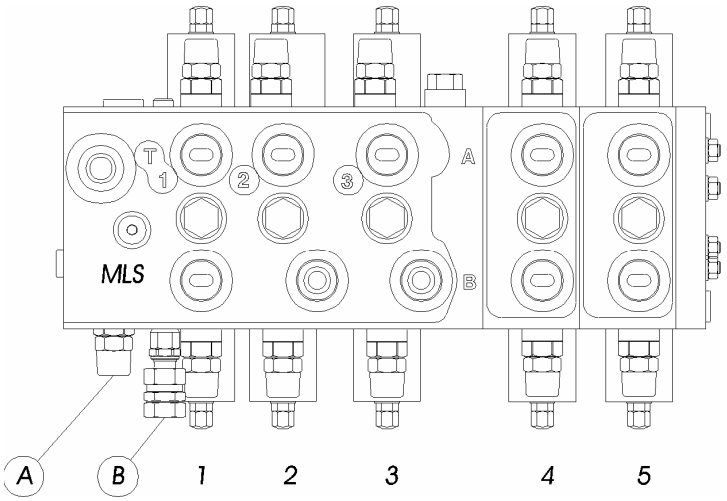
https://truckmanualshub.com/

4. Secondary pressures M6 / M7

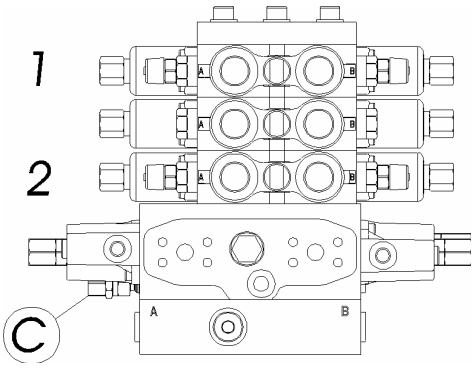
- Screw in the LS pressure control valve until it stops (B)
- Screw in the primary pressure control valve until it stops (A)
- Set the secondary pressures according to the table

M6	**B**	**A**
1) Small auxiliary connection line	310^{+10} bar	310^{+10} bar
2) Handle	310^{+10} bar	310^{+10} bar
3) Shovel	310^{+10} bar	450^{+10} bar
4) Large auxiliary connection line	310^{+10} bar	310^{+10} bar
5) Telescope	310^{+10} bar	320^{+10} bar
M7		
1) Extension arm	350^{+10} bar	310^{+10} bar
2) Cable winch	310^{+10} bar	310^{+10} bar

M6



M7



5. Slewing secondary pressures

- Secondary pressure of 280 bar (at the slewing motor) must be corrected using the shims.

  Attention: The pressure control valve screws must **not** be adjusted

6. Main pressure M6

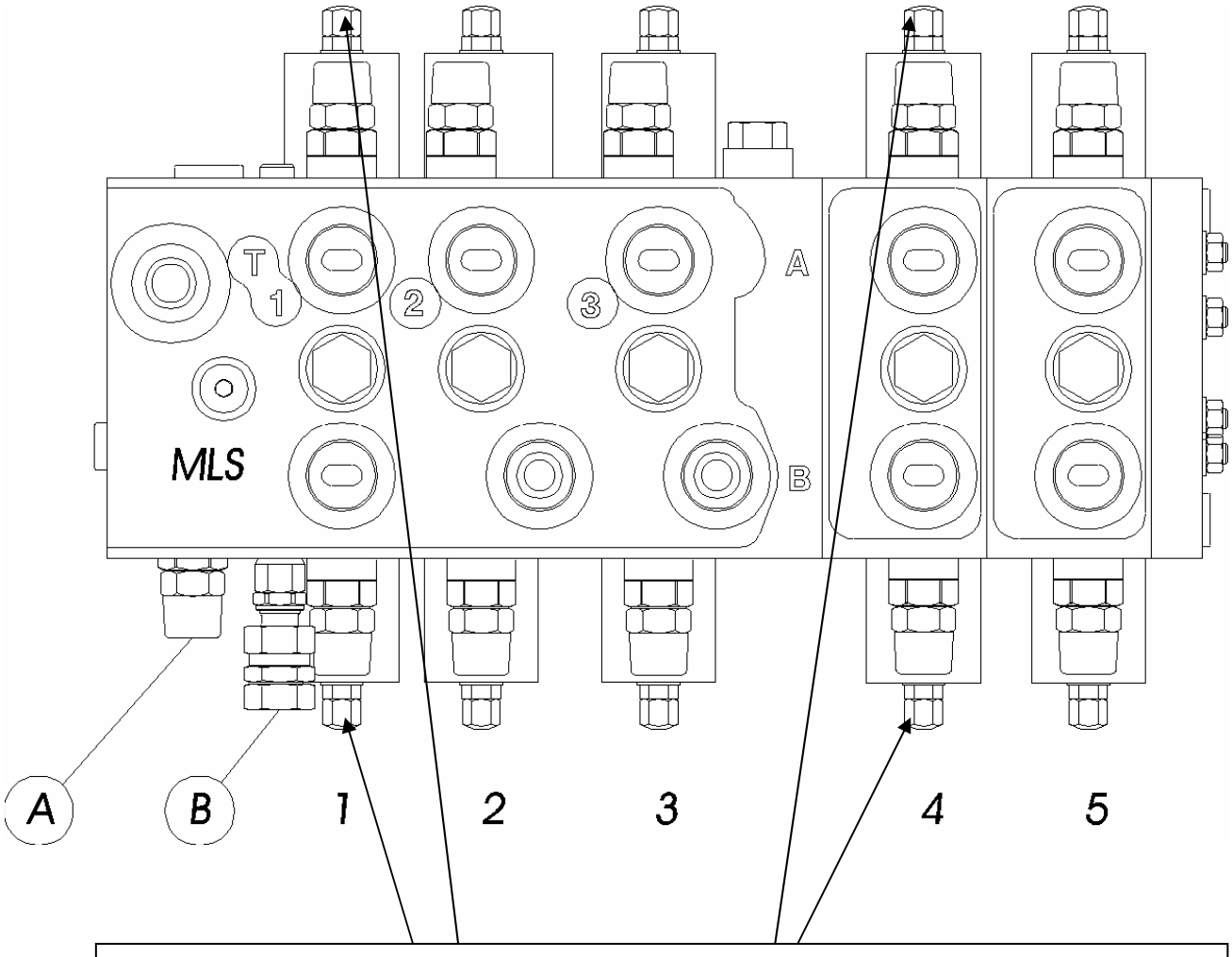
- Primary pressure control valve (A) 360 bar
- LS pressure control valve (B) 290 bar

https://truckmanualshub.com/

7. Setting instructions for Menzi Muck A91 volume of auxiliary line

M6
1) Small auxiliary connection line
2) Dipper
3) Bucket
4) Large auxiliary connection line
5) Telescope

M6



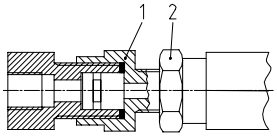
The maximum oil- volume can be set with the bolt on the pilot cap of the main valve. Srewing in means less volume.

Attention: The maximum volume is given by the shape of the spool! (80l/min for the small line, 160l/min for the big line)

https://truckmanualshub.com/

8. Slewing pressure M7

Pressure intensifier (C)



- Drive the swivel out and as far as it will go with the upper structure.
- Set the pressure intensifier (C) to 270 bars. Unscrew the lock nut (2) and screw in the valve (1).

9. Setting cable winch / hydraulic connection

- Schlang & Reichart maximum 70 l/min.
- Kyburz maximum 100 l/min.
- Hydraulic connection 120 – 140 l/min. or according to customer specifications

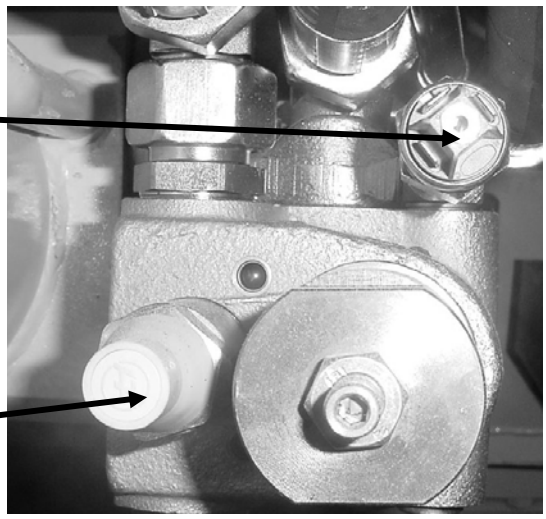
10. Upper structure speed

- max. 9 rpm
- The maximum speed is set at the stroke limiter of the M7.
  Unscrew the stroke limiter until it stops, then screw it back in 1 ¼ turns.

11. Lifting gear use

Overload signal:

- A91 230 bar



12. Hydraulic burst hose protection

- Secondary pressure (1) 310 bar

https://truckmanualshub.com/

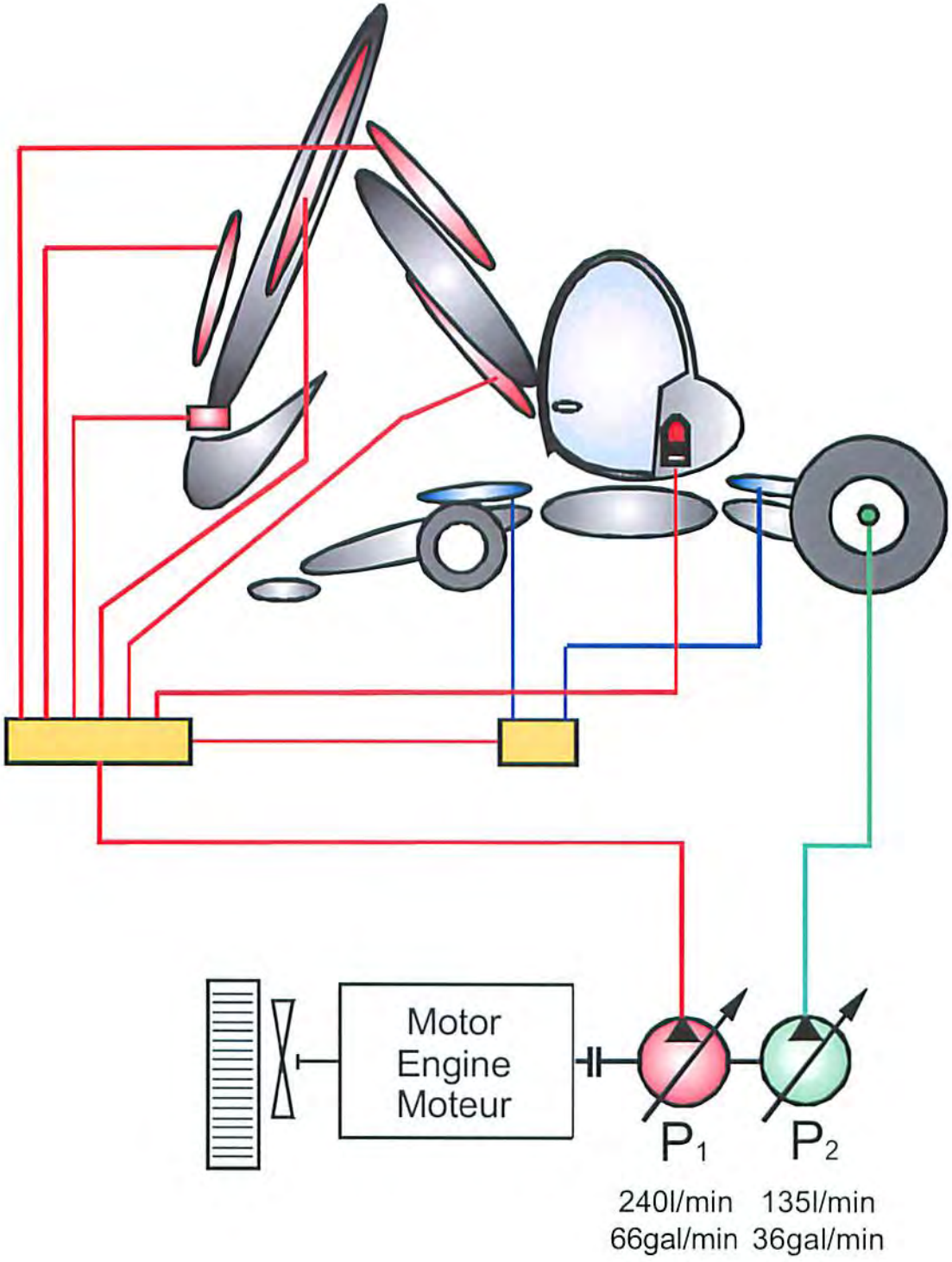
13. Final inspection

While driving the excavator, extend the telescope and also activate another consuming device. The diesel motor should not be driven too hard under this load. If it is driven too hard, screw in the control screw (1) of the pump mechanism a little.

29.04.2003 R. Geiger

https://truckmanualshub.com/

A91V2



https://truckmanualshub.com/

Drehwerk / Swing

Zusatzverbraucher klein
Small Port

Stiel
Dipper

Löffel
Bucket

Zusatzverbraucher gross
Big Port

Teleskop
Telescop

Ausleger
Boom

Lenkung
Steering

Winde
Winch

Seilwinde Chassis
Winch Chassis

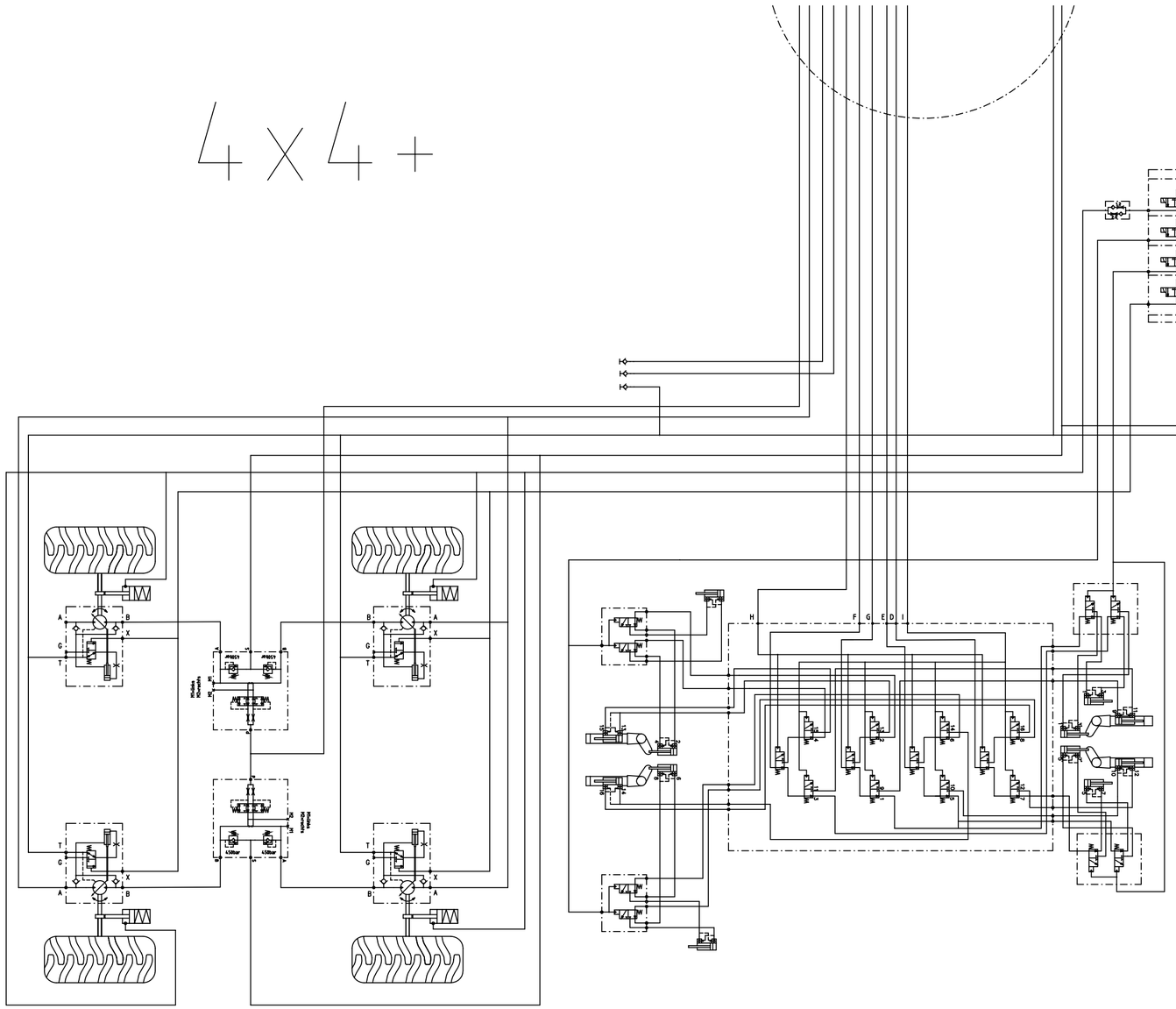
Schaltdruck Fahren schnell / Second speed

Hammer

Schutzvermerk nach DIN 34 beachten!				DIN7168 ~~fein~~ mittel ~~grob~~		Oberfläche	Maßstab 1:1.5	Position — Menge —
							— —
							— —
					Datum	Name	Hydr.Schema A91 Version "D"
				Bearb.	23.09.02	rge	
				Gepr.			
				Norm			
4	Aktualisiert	18.04.06	RGe				
3	Aktualisiert	01.06.05	RGe	Menzi Muck AG CH-9443 Widnau			219325
2	Aktualisiert	19.05.04	RGe				Blatt A2
1	Aktualisiert	02.10.03	RGe				BI
Zust.	Änderung	Datum	Name	EDV Nr.			02.06.05

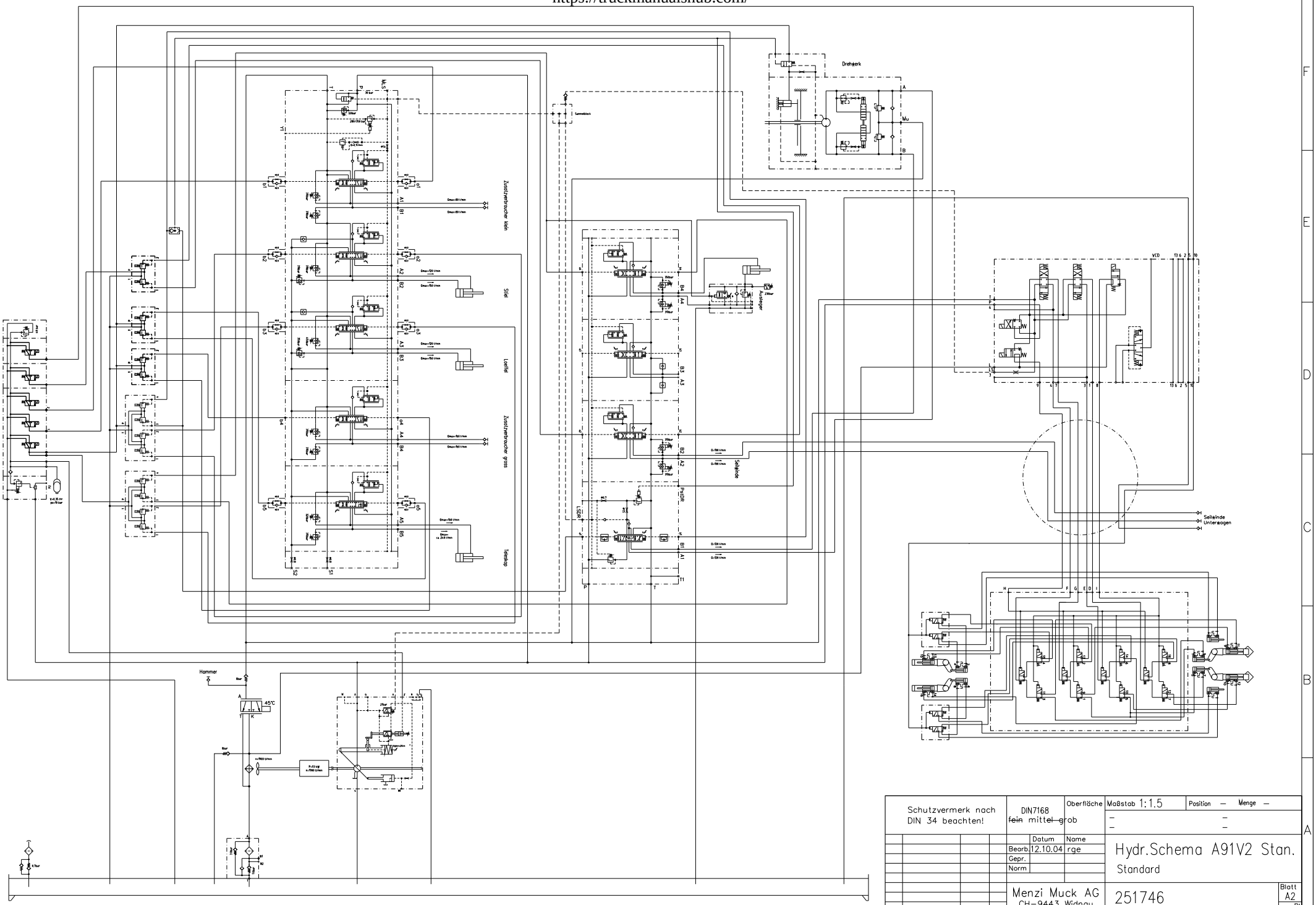
https://truckmanualshub.com/

4 X 4 +



Schutzvermerk nach DIN 34 beachten!				DIN7168 ~~fein~~ mittel ~~grob~~		Oberfläche	Maßstab 1:1.5	Position –	Menge –
							–	–	
					Datum	Name	–	–	
				Bearb.	09.02.06	rge	Hydr. Schema A91		
				Gepr.			Version "D"		
				Norm					
							Menzi Muck AG CH–9443 Widnau	219325	Blatt A2
4	Aktualisiert	18.04.06	RGe						Bl
Zust.	Änderung	Datum	Name	EDV Nr.					03.05.02

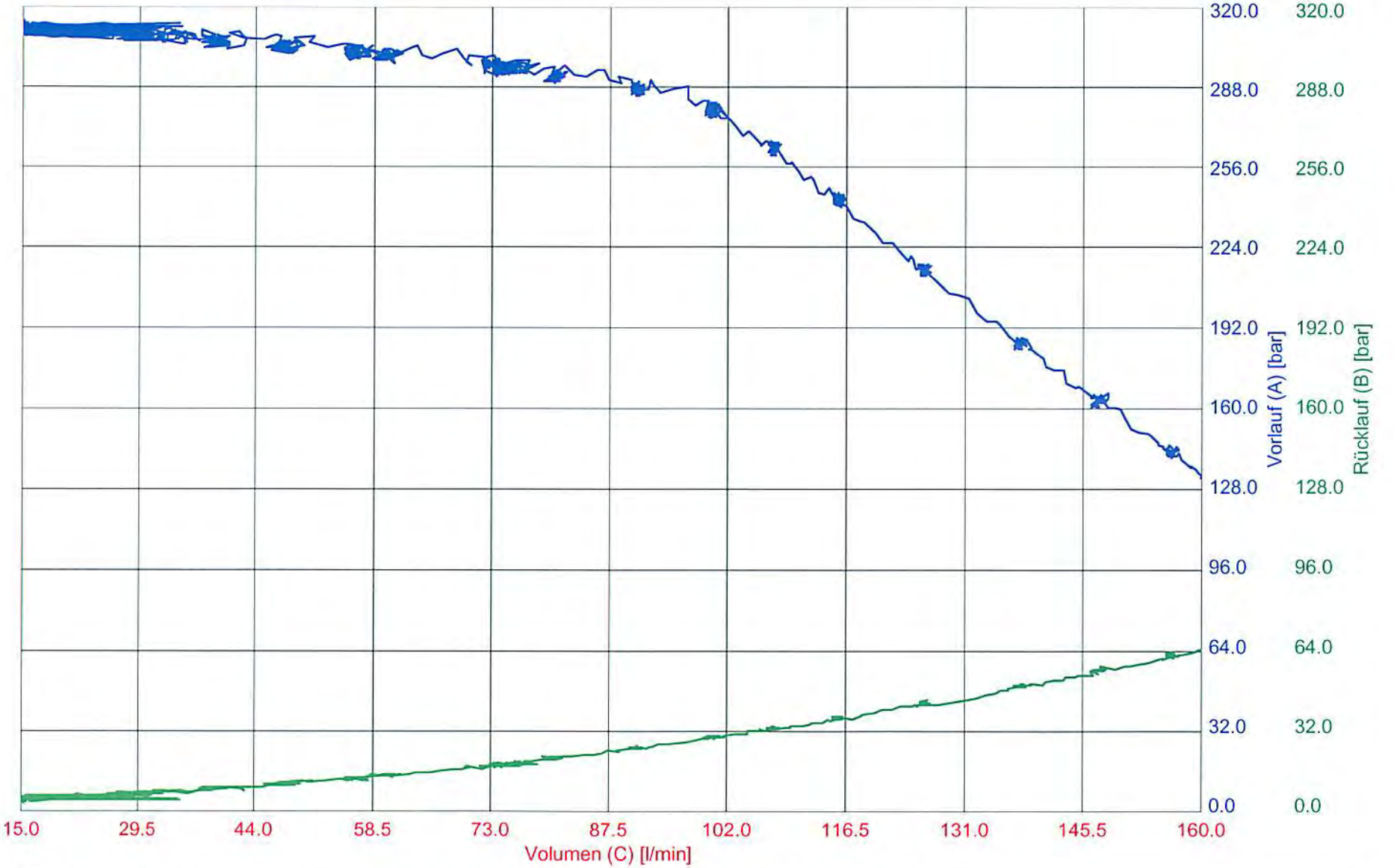
https://truckmanualshub.com/



Schutzvermerk nach DIN 34 beachten!	DIN7168 ~~fein~~ mittel ~~grob~~	Oberfläche	Maßstab 1:1.5	Position –	Menge –
			–	–	
		Datum	Name	Hydr.Schema A91V2 Stan.	
		Bearb. 12.10.04	rge	Standard	
		Gepr.			
		Norm			
	Menzi Muck AG CH-9443 Widnau			251746	Blatt A2
Zust. Änderung	Datum	Name	EDV Nr.		03.05.02

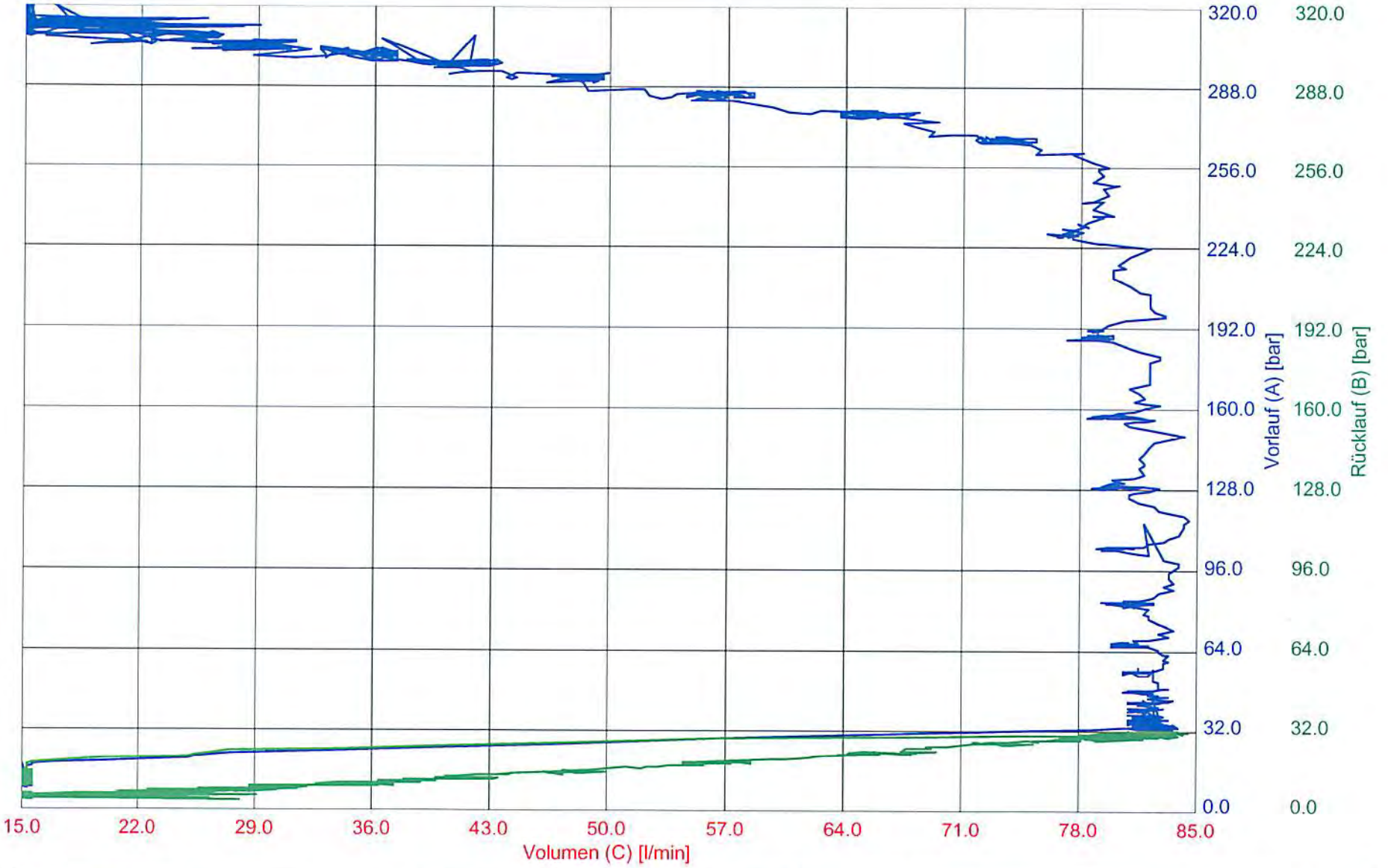
https://truckmanualshub.com/

A91 Big port



https://truckmanualshub.com/

A91 Small port

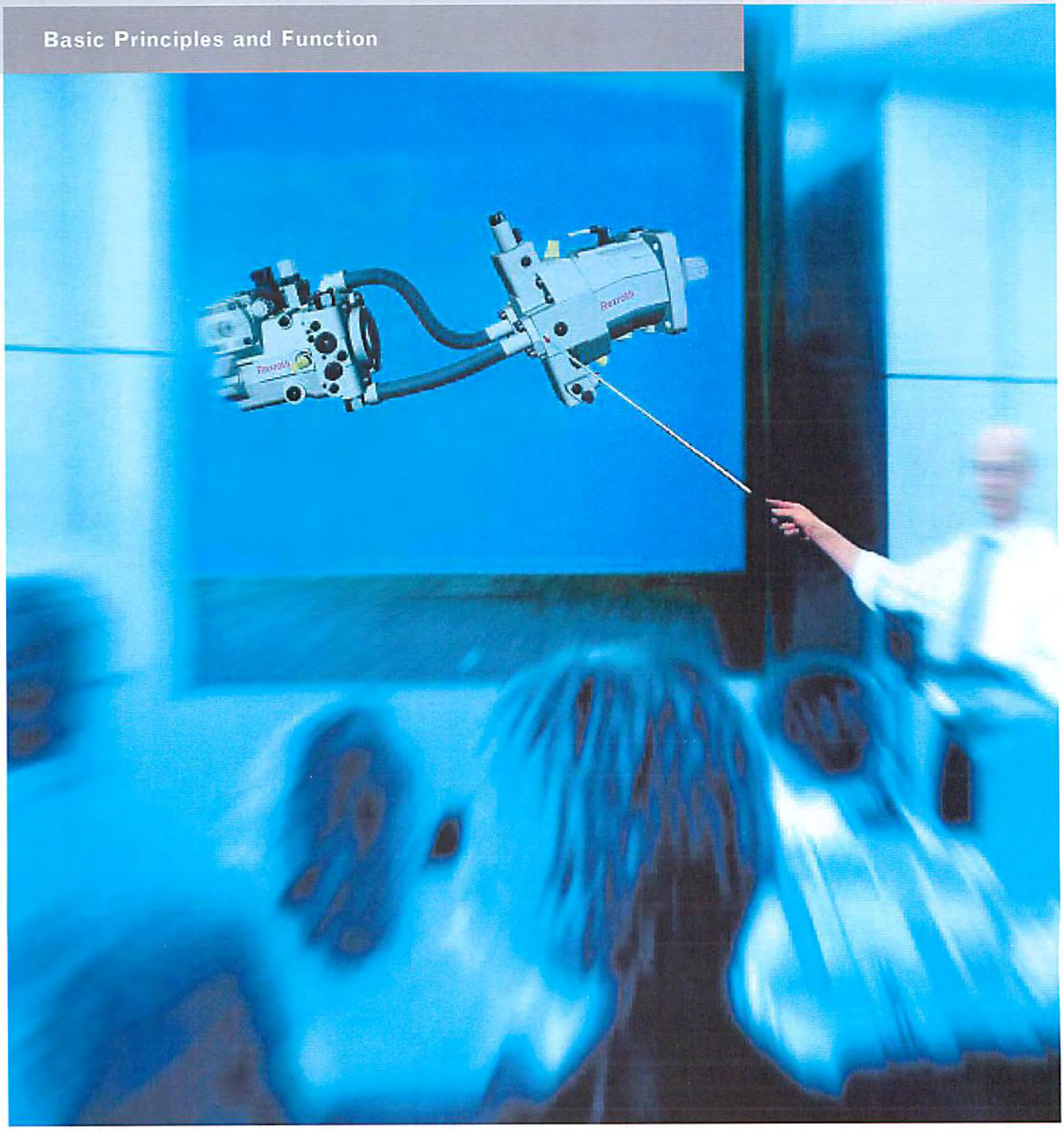


https://truckmanualshub.com/

Rexroth
Bosch Group

Training Mobile Hydraulic Axial Piston Units

Basic Principles and Function



https://truckmanualshub.com/

1 Basic Principles

Page

1.1 Types of Hydraulic Circuit 4-5
1.1.1 Open Circuit
1.1.2 Closed Circuit

2 Principles of Function

2.1 Bent-Axis 6-11
2.1.1 Bent-Axis Principle
2.1.2 Description of Function
2.1.3 Principles of Calculation
2.1.4 Rotary Group Forces
2.1.5 40° -Tapered Piston, Bent-Axis Rotary Group
2.1.6 Examples of Types
2.1.7 Symbols

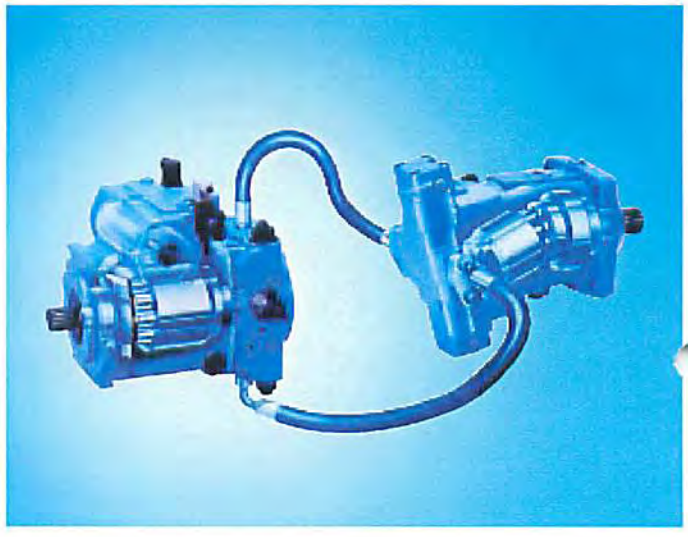
2.2 Swashplate 12-17
2.2.1 Swashplate Principle
2.2.2 Description of Function
2.2.3 Principles of Calculation
2.2.4 Rotary Group Forces
2.2.5 Swashplate Rotary Group
2.2.6 Examples of Types
2.2.7 Symbols

3 Components

A Selection of Typical Models from the indivdual Product Groups 18-31

3.1 to 3.10 Standard Models of Bent-Axis and Swashplate Design

3.11 Summary of Control Devices







https://truckmanualshub.com/



1 Basic Principles

1.1 Types of Hydraulic Circuit

For the hydraulic engineer, there are three basic types of circuit to consider:

Open circuit / Closed circuit / Semi-closed circuit

In the following we look at open and closed circuits in some details. The semi-closed circuit is a mixture of these two types of circuit and is used in applications where volume compensation via prefill valves is necessary.
(e.g. when using a single rod cylinder)

1.1.1 Open Circuit

Open circuit normally means the case where the pump suction line leads below a fluid level whose surface is **open** to atmospheric pressure. Maintenance of a pressure balance between the air in the hydaulic tank and the air in the atmosphere guarantees good *pump suction characteristics*. There must be no resistance in the inlet line which might cause pressure to drop below the so-called *suction head/suction limit*.

Axial piston units are *self-priming*; in certain special cases, however, a low pressure is applied to the suction side.

In **open** circuit hydraulic fluid is fed to the user via directional control valves and returned to the tank in the same way.

Typical features of the **open** circuit are:

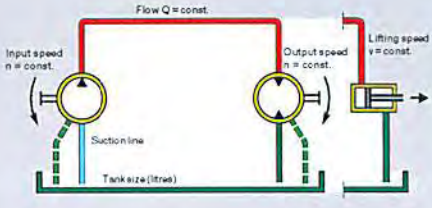
- Suction lines - short length, large diameter
- Directional control valves - flow-related sizes
- Filter / cooler - flow-related sizes
- Tank size - a multiple of the max. pump flow in litres
- Pump arrangement - adjacent to or below the tank
- Drive speeds - limited by the suction head
- Load maintained in return by valves

The **open** circuit is standard in many industrial and mobile applications - from machine tools, through press drives to winches and mobile transmissions.

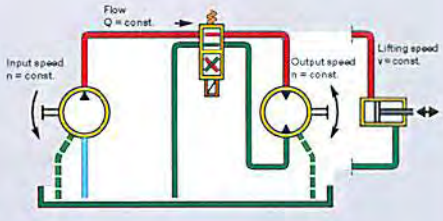
Open Circuit
The way to the complete Hydraulic-System:

(Explanation of symbols, see page 5)

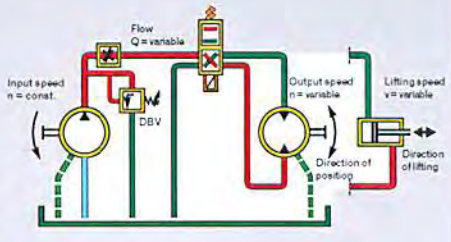
Basic system with hydraulic pump and hydraulic motor (or cylinder).
Single direction of input, output and lift.



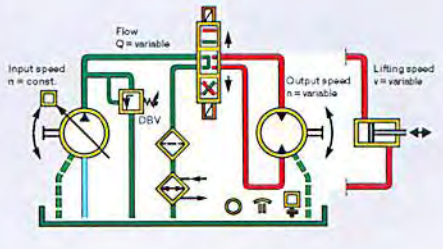
The directional control valve allows **reversal** of the direction of rotation or of movement at the user.



Variable output speed is achieved by installation of a flow controller for variable flow.
The pressure relief valve (DBV) protects the system from overload.



Here, the fixed pump and flow controller have been replaced by a variable pump. Further valve functions have been added, e.g. free-wheeling of the user. Filter, cooler and other accessories are also fitted.



https://truckmanualshub.com/



1.1.2 Closed Circuit

A hydraulic system is described as **closed** when the hydraulic fluid is returned from the user direct to the pump.

There is a high pressure and a low pressure side, depending on the direction of load (take-off torque at the user).

The high pressure side is protected by pressure relief valves which unload to the low pressure side. The hydraulic fluid remains in the circuit.

Only the continuous leakage from pump and motor (dependent on operating data) must be replaced.

This fluid is normally replenished by an auxiliary pump flanged direct onto the main pump which delivers a continuous, adequate supply of fluid (boost fluid) from a small tank via a check valve into the low pressure side of the **closed** circuit. Any surplus flow of the boost pump, which operates in *open* circuit, is returned via a boost-pressure relief valve to the tank. The boosting of the low pressure side enhances the pump-operating characteristics.

Typical features of the **closed** circuit for axial piston units are:

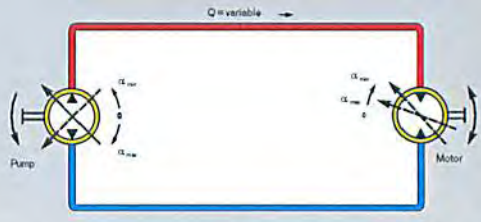
- Directional control valves - small sizes for pilot operation
- Filter/cooler - small sizes
- Tank size - small, dimensioned to suit boost pump flow and volume of system
- Speed - high limiting values through boost
- Arrangement/mounting - position-flexible/optional
- Drive - completely reversible through centre position
- Load maintained - via the drive motor
- Feedback of braking power

red		(High) pressure line
blue		(Low, boost) pressure line
blue		Suction line
green		Return line (tank, bypass pressure)
green		Leakage line
yellow		Hydraulic components (pump, motor, cylinder, valves, accessories)
orange		Control element (solenoids, spring)

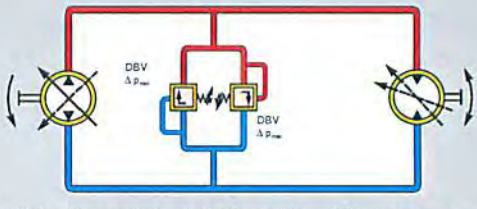
Explanation of Symbols / Colour Code for Open and Closed Circuits

Closed Circuit
A Step-by-Step Guide:

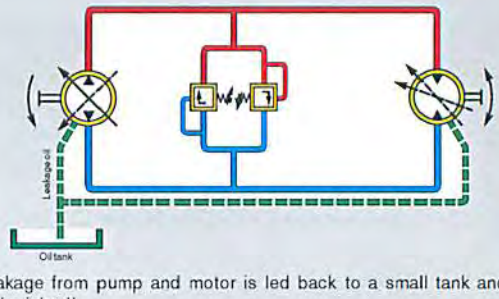
(Explanation of symbols, see below left)



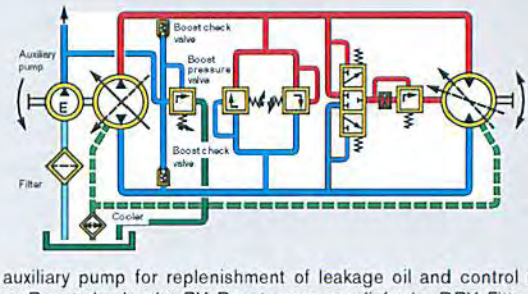
Basic system with variable pump and variable motor. **Single** pump input drive direction. Motor power take-off in **both** directions. The pump can be swivelled smoothly over centre, i.e. the direction of flow is reversible.



Pressure relief valves, one each for the high and low pressure sides, prevent the maximum permissible pressure from being exceeded.



The leakage from pump and motor is led back to a small tank and must be replenished!



An auxiliary pump for replenishment of leakage oil and control of the pump. Boost check valve RV. Boost pressure relief valve DBV. Fitted filter, cooler and accessories.

https://truckmanualshub.com/

2 Principles of Function

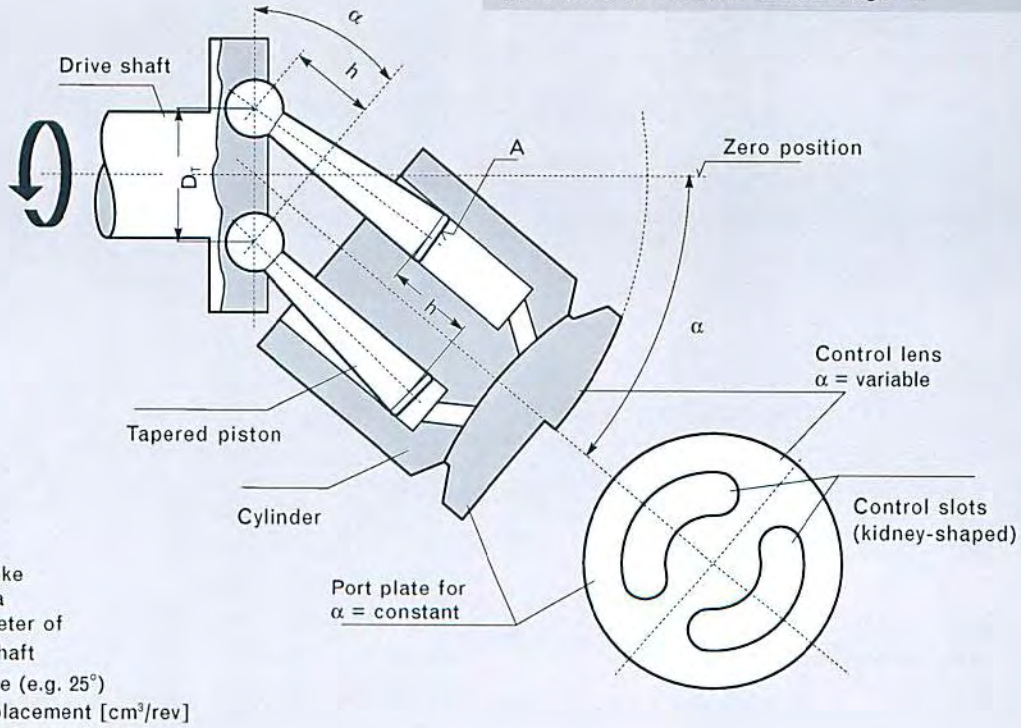
2.1 Bent-Axis

The bent-axis mechanism is a displacement unit, the displacement pistons of which are arranged at *an angle* to the drive shaft axis.



Fixed Displacement Unit
with tapered piston rotary group

Schematic Diagram of a Bent-Axis Unit
with fixed or variable swivel angle α



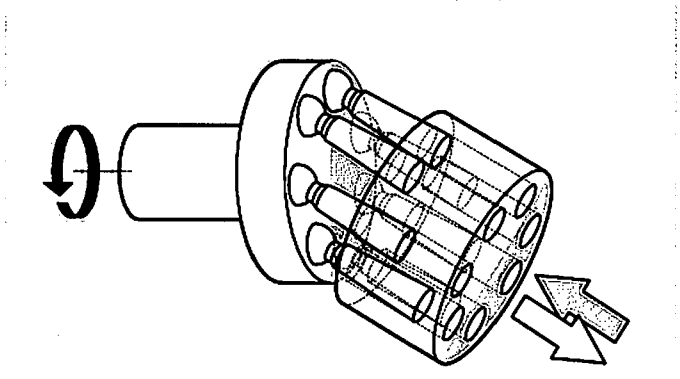
h = Piston stroke
A = Piston area
D_T = Pitch diameter of the drive shaft
α = Swivel angle (e.g. 25°)
V_g = Geom. displacement [cm^3/rev]
x = Number of pistons (e.g. 7)

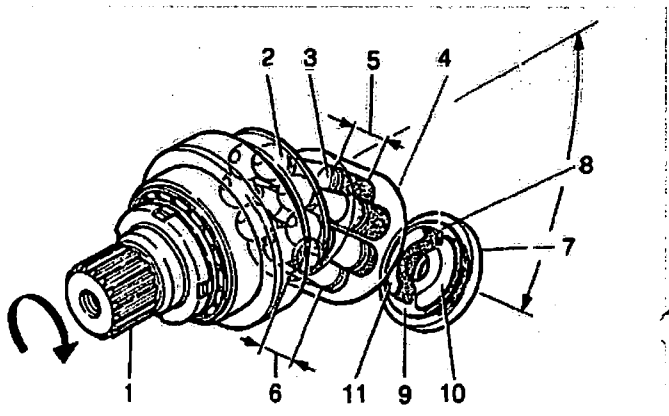
$h = D_T \cdot \sin \alpha$

$V_g = x \cdot A \cdot h$

$V_g = x \cdot A \cdot D_T \cdot \sin \alpha$

https://truckmanualshub.com/





1 = Drive shaft
2 = Piston
3 = Piston area
4 = Cylinder
5 = Pressure stroke
6 = Suction stroke
7 = Port plate
8 = Upper dead point OT
9 = Lower dead point UT
10 = Control slot, pressure side (for direction of rotation shown)
11 = Control slot, suction side (for direction of rotation shown)

2.1.1 Bent-Axis Principle

Pump Function:

Through the flexible piston/piston rod arrangement, rotation of the drive shaft also causes the cylinder to rotate without the need for a Cardan coupling. The pistons execute a stroke within the cylinder bores dependent on the angle of inclination of the *bent axis*. The hydraulic medium is fed to the low pressure (inlet) side of the pump and pumped out by the pistons on the high pressure (outlet) side into the system.

Motor Function:

In motor operation, the process is reversed and pressure oil is fed to the inlet side of the unit. The pistons perform a stroke which is converted via the flexible piston mounting on the drive flange into a rotary movement. The cylinder rotates with the pistons, generating an output torque on the drive shaft. Oil exiting on the outlet side flows back into the system.

Swivel Angle:

The tilt/swivel angle of the fixed displacement unit is determined by the housing and is therefore fixed. On a variable unit, this angle is infinitely variable within specific limits. Changing the swivel angle changes the piston stroke, thus allowing variable displacement.

2.1.2 Description of Function

Example : Fixed Displacement Unit

The axial piston units of bent-axis design with fixed or variable displacement can operate as hydraulic pumps or hydraulic motors.

When used as a pump, the flow is proportional to the input speed and the swivel angle. If the unit is used as a motor, the output speed is proportional to the flow through the unit. The input (pump) or output (motor) torque increases with the pressure drop between the high and low pressure sides. In pump operation, mechanical energy is converted into hydrostatic power, while in motor operation, inversely, hydrostatic power is converted into mechanical energy. By adjusting the swive angle of a variable pump or motor it is possible to vary the displacement and thus the flow.

Function

. . . as a pump in open circuit:

On rotation of the drive shaft, the cylinder is caused to rotate by seven pistons flexibly mounted in a circular arrangement on the drive shaft. The cylinder slides on the spherical port plate which has two kidney-shaped control slots. As the cylinder rotates, each of the seven pistons moves from the upper dead point OT to the lower dead point UT and back, thereby executing a stroke dependent on the swivel angle. The piston movement from the lower to the upper dead point in the cylinder bore produces the suction stroke, whereby a quantity of oil relative to the piston area and piston stroke is sucked in through the control slot on the suction side.

https://truckmanualshub.com/

On further rotation of the drive shaft, as the pistons move from the upper to the lower dead point, oil is pushed out through the other control slot (pressure side). The pistons are held against the drive shaft by hydraulic pressure.

. . . as a motor:

The motor function is the reverse of the pump function. In this case, hydraulic oil is fed via the connection plate through a control slot to the cylinder bores. 3 or 4 cylinder bores are located over the pressure side control slot, 4 or 3 over the return-line side, with one bore possibly being covered by part of the port plate directly at the dead point. The force generated as a product of pressure and piston area acts on the drive shaft to produce the output torque.

Control Function: (with control devices fitted)

The swivel angle of the bent axis can be changed, for example, mechanically via an adjusting spindle or hydraulically via an adjusting piston. The hydraulic section of the rotary group cylinder complete with control lens (port plate) is swivelled out and, depending on the type of circuit and function, is held in the zero or starting position by either mechanical or hydraulic means. Increasing the swivel angle increases displacement and torque; decreasing the angle gives a corresponding reduction in these values. If the swivel angle is zero, the displacement is also zero.

Mechanical or hydraulic control devices are normally fitted, which can themselves be controlled and regulated by mechanical, hydraulic or electrical means. Well-known types of control are: handwheel control, electro-proportional control, constant horsepower control.

General

Because of the bent-axis design, in both pump and motor operation, the torque is generated direct at the drive shaft. The radial loading of the pistons on the cylinder is very low, giving low wear, high efficiency and good starting torque. The spherical design of the port plate means a torque-free cylinder bearing since all forces acting on the cylinder pass through one point. Axial movement caused by elastic deformation does not increase the leakage losses between cylinder and port plate. When idling and during the start-up process, the cylinder is held against the port plate by the built-in cup springs. As pressure increases, hydraulic forces balance the cylinder so that, even with high loading on the control face between cylinder and port plate, a permanent oil film is maintained and leakage is kept to a minimum. Mounted on the drive shaft is the bearing set which absorbs axial and radial forces. External sealing of the rotary group is by means of radial seal and O-rings. A retaining ring holds the complete rotary group in the housing.

2.1.3 Principles of Calculation

Calculating Pump Size

	Fixed displacement bent-axis pump	Variable displacement bent-axis pump
Flow	$Q_t = \frac{V_g \cdot n \cdot \eta_{vol}}{1000}$ (l/min)	$Q_t = \frac{V_{g\,max} \cdot n \cdot \sin\alpha \cdot \eta_{vol}}{1000 \cdot \sin\alpha_{max}}$ (l/min)
Drive speed	$n = \frac{Q_t \cdot 1000}{V_g \cdot \eta_{vol}}$ (min^{-1})	$n = \frac{Q_t \cdot 1000 \cdot \sin\alpha_{max}}{V_{g\,max} \cdot \sin\alpha \cdot \eta_{vol}}$ (min^{-1})
Drive torque	$M_t = \frac{V_g \cdot \Delta p}{20\pi \cdot \eta_{mh}} = \frac{1{,}59 \cdot V_g \cdot \Delta p}{100 \cdot \eta_{mh}}$ (Nm)	$M_t = \frac{V_{g\,max} \cdot \Delta p \cdot \sin\alpha}{20\pi \cdot \eta_{mh} \cdot \sin\alpha_{max}} = \frac{1{,}59 \cdot V_{g\,max} \cdot \Delta p \cdot \sin\alpha}{100 \cdot \eta_{mh} \cdot \sin\alpha_{max}}$ (Nm)
Drive power	$P_t = \frac{2\pi \cdot M_t \cdot n}{60000} = \frac{M_t \cdot n}{9549}$ (kW) $P_t = \frac{Q_t \cdot \Delta p}{600 \cdot \eta_{vol} \cdot \eta_{mh}} = \frac{Q_t \cdot \Delta p}{600 \cdot \eta_t}$ (kW)	$P_t = \frac{2\pi \cdot M_t \cdot n}{60000} = \frac{M_t \cdot n}{9549}$ (kW) $P_t = \frac{Q_t \cdot \Delta p}{600 \cdot \eta_{vol} \cdot \eta_{mh}} = \frac{Q_t \cdot \Delta p}{600 \cdot \eta_t}$ (kW)

https://truckmanualshub.com/

Calculating Motor Size

	Fixed displacement bent-axis motor	Variable displacement bent-axis motor
Consumption (flow)	$Q_2 = \frac{V_g \cdot n}{1000 \cdot \eta_{vol}}$ (l/min)	$Q_2 = \frac{V_{g\,max} \cdot n \cdot \sin\alpha}{1000 \cdot \sin\alpha_{max} \cdot \eta_{vol}}$ (l/min)
Output speed	$n = \frac{Q_2 \cdot 1000 \cdot \eta_{vol}}{V_g}$ (min^{-1})	$n = \frac{Q_2 \cdot 1000 \cdot \sin\alpha_{max} \cdot \eta_{vol}}{V_{g\,max} \cdot \sin\alpha}$ (min^{-1})
Output torque	$M_2 = \frac{V_g \cdot \Delta p \cdot \eta_{mh}}{20\,\pi} = \frac{1{,}59 \cdot V_g \cdot \Delta p \cdot \eta_{mh}}{100}$ (Nm)	$M_2 = \frac{V_{g\,max} \cdot \Delta p \cdot \sin\alpha \cdot \eta_{mh}}{20\,\pi \cdot \sin\alpha_{max}} = \frac{1{,}59 \cdot V_{g\,max} \cdot \Delta p \cdot \sin\alpha \cdot \eta_{mh}}{100 \cdot \sin\alpha_{max}}$ (Nm)
Output power	$P_2 = \frac{2\,\pi \cdot M_2 \cdot n}{60\,000} = \frac{M_2 \cdot n}{9549}$ (kW) $P_2 = \frac{Q_2 \cdot \Delta p}{600} \cdot \eta_{vol} \cdot \eta_{mh} = \frac{Q_2 \cdot \Delta p \cdot \eta_t}{600}$ (kW)	$P_2 = \frac{2\,\pi \cdot M_2 \cdot n}{60\,000} = \frac{M_2 \cdot n}{9549}$ (kW) $P_2 = \frac{Q_2 \cdot \Delta p}{600} \cdot \eta_{vol} \cdot \eta_{mh} = \frac{Q_2 \cdot \Delta p \cdot \eta_t}{600}$ (kW)

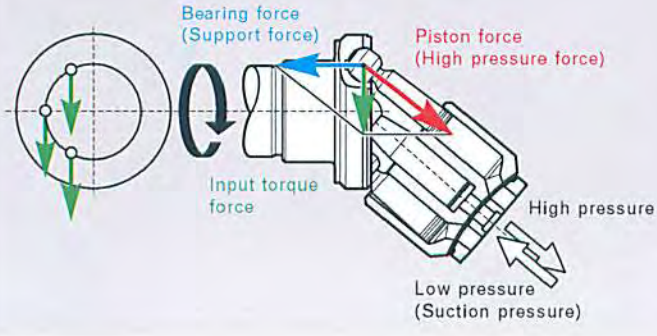
Where:

Q_1	= flow	(l/min)	α_{max}	= max. swivel angle (various depending on type)	
Q_2	= consumption (flow)	(l/min)	α	= set swivel angle (may be between 0 and α_{max})	
M_1	= drive torque	(Nm)	η_{vol}	= volumetric efficiency	
M_2	= output torque	(Nm)	η_{mh}	= mechanical-hydraulic efficiency	
P_1	= drive power	(kW)	η	= total efficiency ($\eta_t = \eta_{vol} \cdot \eta_{mh}$)	
P_2	= output power	(kW)	Δp	= differential pressure (bar)	
V_g	= geometric stroke volume per revolution	(cm^3)			
$V_{g\,max}$	= max. geom. stroke volume per revolution	(cm^3)			
n	= speed	(min^{-1})			

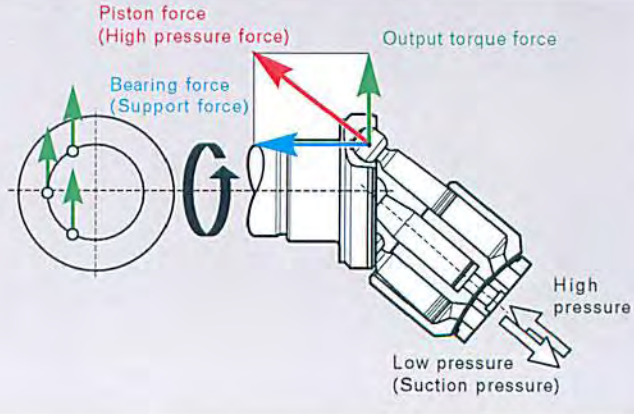
2.1.4 Rotary Group Forces

Parallelogram illustrating forces in a Fixed Displacement Unit. The resolution of forces takes place on the drive flange, i.e. direct on the drive shaft. This conversion from torque into piston force in the pump, and in reverse in the motor, guarantees the best possible efficiency. A *single* resolution means a *single* efficiency loss!

Resolution of Forces on Pump Drive Flange

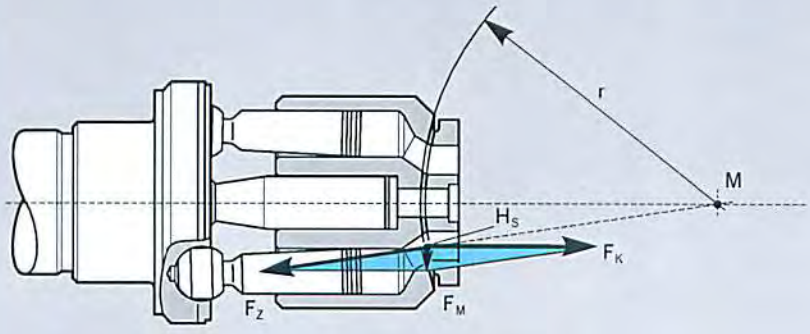


Resolution of Forces on Motor Drive Flange



https://truckmanualshub.com/

Resolution of Forces on Port Plate with Spherical Control Face



M = centre of assumed (theoretical) sphere
r = radius of this sphere
H_S = focal point of hydrostatic bearing pressure field
F_K = sum of the force of 3 or 4 pistons
F_Z = force of hydrostatic pressure field of cylinder
F_M = resulting force on centre pin

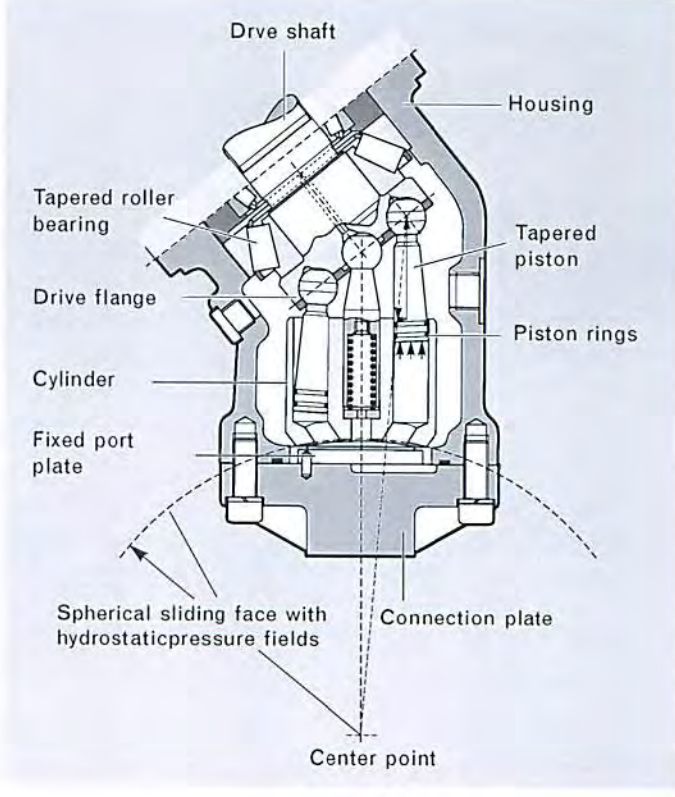
For this torque illustration, a segment of the hydraulic rotary group has been cut out and shown in simplified form in pure *static* condition with swivel angle 0°.

In practice, when the rotary group is swivelled out, *dynamic* loading is present since 3 or 4 of the piston areas are always under high pressure.

2.1.5 40° Tapered Piston, Bent-Axis Rotary Group

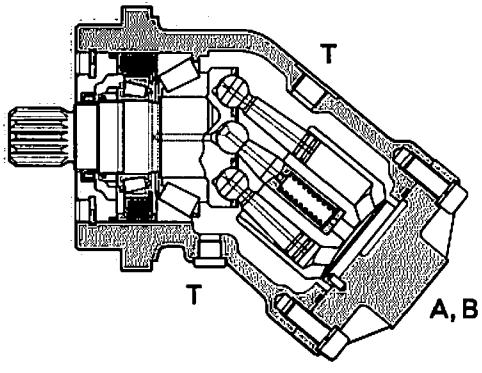
Shown here in housing with fixed swivel angle

- Central swivel point
- Cardanless cylinder drive
- Torque-free cylinder bearing
- Self-centring rotary group
- Spherical port plate
- Tapered roller bearings
- One-piece tapered piston with 2 piston rings
- Automatic bearing lubrication
- Piston-force resolution direct on drive flange

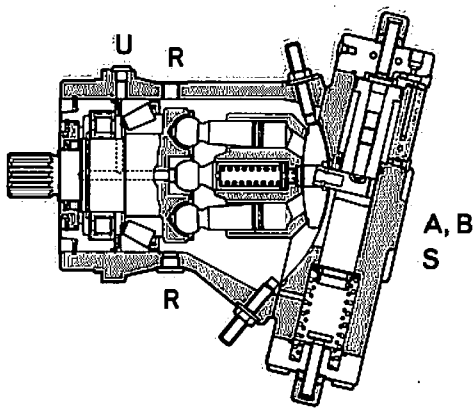


https://truckmanualshub.com/

2.1.6 Examples of Types



Fixed Displacement Unit A2F (fixed swivel angle)
For operation as pump or motor in open or closed circuit.

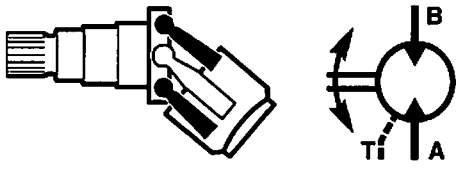


Variable Displacement UnitA7VO (variable swi. angle)
For operation as a pump with infinitely adjustable displacement in open circuit.

2.1.7 Symbols (Symbolic illustration of the best-known types))

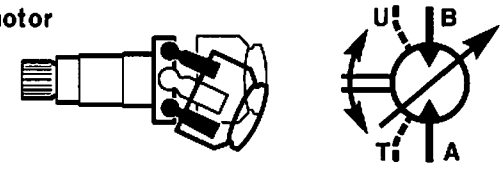
A,B Pressure ports **S** Suction ports
T,R Case drain ports **U** Flushing ports

Fixed motor
A2FM



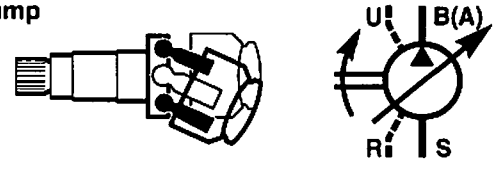
Fixed displacement motor for open or closed circuits; fixed swivel angle; both directions of rotation of power take-off.

Variable motor
A6VM



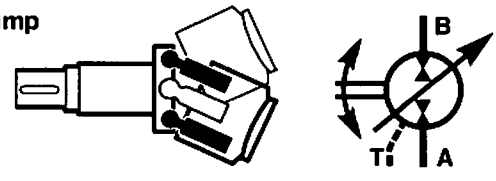
Variable displacement motor for open and closed circuits, swivel to one side only; infinitely variable swivel angle; both directions of rotation of power take-off.

Variable pump
A7VO



Variable displacement pump for open circuits, swivel to one side only; infinitely variable swivel angle; single direction of rotation of drive.

Variable pump
A2V



Variable displacement pump for closed circuits, swivel to both sides; swivel angle infinitely variable over centre; both directions of rotation of drive.

https://truckmanualshub.com/

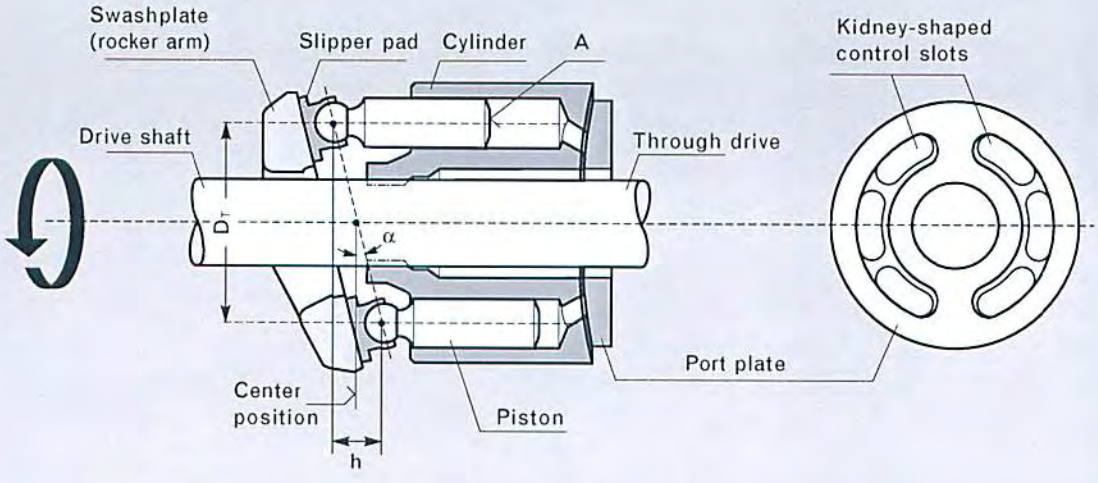
2.2 Swashplate

Das *Schrägscheiben*-Triebwerk ist eine Verdrängermaschine, deren Verdrängerkolben axial zur Triebwelle angeordnet sind. Sie stützen sich dabei auf einer *schrägen Scheibe* ab.



Variable Displacement Pump with electro-hydraulic control, speed-related closed loop control and built-on auxiliary pump

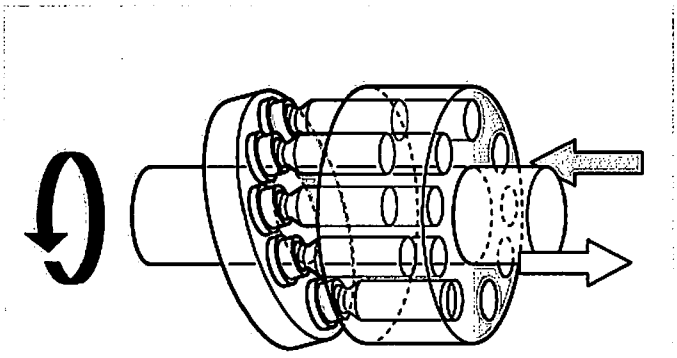
Schematic Diagram of a Swashplate (with parallel-axis pistons)
with fixed or variable swivel angle α

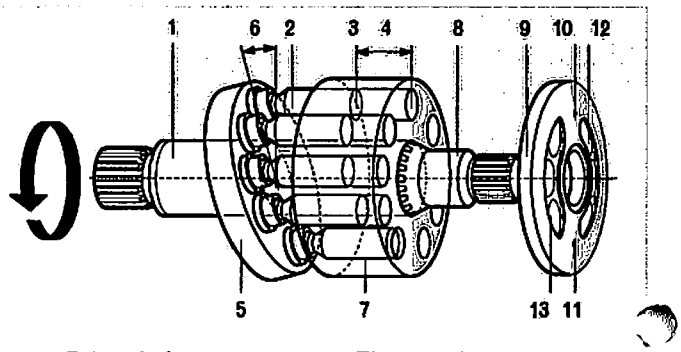


h = Piston stroke
A = Piston area
D_T = Pitch diameter when α = 0
α = Swivel angle (e.g. 20°)

V_g = Geom. displacement [cm³/rev]
x = Number of pistons (e.g. 9)
$h = D_T \cdot \tan \alpha$
$V_g = x \cdot A \cdot h$
$V_g = x \cdot A \cdot D_T \cdot \tan \alpha$

https://truckmanualshub.com/





1	=	Drive shaft	8	=	Through drive
2	=	Piston	9	=	Port plate
3	=	Piston area	10	=	Upper dead point OT
4	=	Piston stroke	11	=	Lower dead point UT
5	=	Swash plate	12	=	Control slot, pressure side (for direction of rotation shown)
6	=	Angle of adjustment	13	=	Control slot, suction side (for direction of rotation shown)
7	=	Cylinder			

2.2.1 Swashplate Principle

Pump Function:

Through the gearing, rotation of the drive shaft also causes the cylinder to rotate. The pistons execute a stroke within the cylinder bores dependent on the tilt angle of the *swashplate.* The hydraulic medium is fed to the low pressure (inlet) side of the pump and pumped out by the pistons on the high pressure (outlet) side into the system.

Motor Function:

In motor operation, the process is reversed and pressure oil is fed to the inlet side of the unit. The pistons perform a stroke, taking the cylinder with them. Via the gearing, this, in turn, causes the drive shaft to rotate. Oil exits on the low pressure (outlet) side and flows back into the system.

Swivel Angle:

In the fixed displacement unit, the angle of the swashplate is fixed within the housing. In the variable unit, this angle is infinitely variable within specific limits. Changing the swashplate angle changes the piston stroke, thus varying the displacement.

2.2.2 Description of Function

Example: Variable Displacement Pump

The axial piston units of swashplate design, with fixed or variable displacement, can operate as hydraulic pumps or motors. When used as a pump, the flow is proportional to the input speed and the swashplate angle. If the unit is used as a motor, the output speed is proportional to the flow through the unit. The input (pump) or output (motor) torque increases with the pressure drop between the high and low pressure sides.

In pump operation, mechanical energy is converted into hydrostatic power while in motor operation, inversely, hydrostatic power is converted into mechanical energy.
By adjusting the swashplate angle of a variable pump or motor it is possible to *vary* the displacement and thus the flow.

Function

. . . as a pump

Driven by the prime mover, (e.g. diesel or electric motor), the drive shaft rotates and, via the gearing, also causes the cylinder to rotate, taking with it the nine pistons. The pistons are held against the sliding surface of the swashplate by the slipper pads and carry out a stroke. The slipper pads are held against the sliding surface and guided by means of a return device. As the cylinder rotates, each piston moves through the lower or upper dead point and back to its starting position. A movement from one dead point to the other (where the direction of movement is reversed) constitutes one complete stroke during which a volume of hydraulic fluid, corresponding to the piston area and the stroke, is either *sucked in* or *pumped out* via the two control slots in the portplate.

During the *suction* stroke, the hydraulic fluid is sucked - in reality *compressed* - by atmospheric pressure in open circuits, and by the boost pressure in closed circuits, into the piston area as it increases in size. During the *pressure stroke*, fluid is pushed out through the piston bores on the opposite side into the hydraulic system.

https://truckmanualshub.com/

. . . as a motor

The motor function is the reverse of the pump function. In this case, hydraulic fluid is fed from the system to the hydraulic motor. Oil flows via the connection plate through a control slot to the cylinder bores. 4 or 5 cylinder bores are located over the pressure side control slot. The remaining cylinder bores are located over the other control slot and are either connected with the return-line side, or may be closed when directly above the connecting strip between the two control slots. Application of pressure to the piston causes it to slide down the swashplate, taking the cylinder with it. The cylinder and the nine connected pistons rotate with the drive shaft and the pistons carry out a stroke. Hydraulic pressure generates a torque at the cylinder and thus the rotation of the drive shaft. The output speed is determined by the volume of flow into the motor.

Control Function: (with control devices fitted)

The angle of the swashplate can be changed, for example, mechanically via a pivot pin or hydraulically via an adjusting piston. The swashplate/rocker arm is mounted on roller or plain bearings and the zero position is spring-centred. Increasing the swivel angle increases displacement and torque, decreasing the angle gives a corresponding reduction in these values. If the swivel angle is zero, the displacement is also zero. Mechanical or hydraulic control devices are normally fitted, which can themselves be controlled and regulated by mechanical, hydraulic or electrical means. Well-known types of control are: electro-proportional control, constant pressure control (zero stroke control), constant horsepower control.

General

Swashplate-type pumps and motors are suitable for application in open and closed circuits. Because of their design, they are used predominantly as pumps in closed circuits. The possibility of mounting auxiliary or secondary pumps on the through drive and of making use of the integrated design of controls and valves offers a number of advantages. Through this compact and lightweight arrangement, longer service life may be expected since the slipper pads are mounted on *hydrostatic* bearings (plain bearings). The resolution of forces (piston forces/torque) takes place on the swashplate via the slipper pad. Forces within the hydraulic section of the rotary group, ie. cylinder with pistons and port plate, are balanced. The drive shaft bearings allow external forces to be absorbed. The principle of the spherical control area, its lubrication, the pre-tensioning of the cylinder via cup springs, etc., are similar to that of the bent-axis rotary group.

2.1.3 Principles of Calculation

Calculating Pump Size

	Fixed displacement swashplate pump	Variable displacement swashplate pump
Flow	$Q_t = \frac{V_g \cdot n \cdot \eta_{vol}}{1000}$ (l/min)	$Q_t = \frac{V_{g\,max} \cdot n \cdot \tan\alpha \cdot \eta_{vol}}{1000 \cdot \tan \alpha_{max}}$ (l/min)
Drive speed	$n = \frac{Q_t \cdot 1000}{V_g \cdot \eta_{vol}}$ (min^{-1})	$n = \frac{Q_t \cdot 1000 \cdot \tan \alpha_{max}}{V_{g\,max} \cdot \tan\alpha \cdot \eta_{vol}}$ (min^{-1})
Drive torque	$M_t = \frac{V_g \cdot \Delta p}{20\pi \cdot \eta_{mh}} = \frac{1{,}59 \cdot V_g \cdot \Delta p}{100 \cdot \eta_{mh}}$ (Nm)	$M_t = \frac{V_{g\,max} \cdot \Delta p \cdot \tan\alpha}{20\pi \cdot \eta_{mh} \cdot \tan \alpha_{max}} = \frac{1{,}59 \cdot V_{g\,max} \cdot \Delta p \cdot \tan\alpha}{100 \cdot \eta_{mh} \cdot \tan \alpha_{max}}$ (Nm)
Drive power	$P_t = \frac{2\pi \cdot M_t \cdot n}{60\,000} = \frac{M_t \cdot n}{9549}$ (kW) $P_t = \frac{Q_t \cdot \Delta p}{600 \cdot \eta_{vol} \cdot \eta_{mh}} = \frac{Q_t \cdot \Delta p}{600 \cdot \eta_t}$ (kW)	$P_t = \frac{2\pi \cdot M_t \cdot n}{60\,000} = \frac{M_t \cdot n}{9549}$ (kW) $P_t = \frac{Q_t \cdot \Delta p}{600 \cdot \eta_{vol} \cdot \eta_{mh}} = \frac{Q_t \cdot \Delta p}{600 \cdot \eta_t}$ (kW)

https://truckmanualshub.com/

Calculating Motor Size

	Fixed displacement swashplate motor	Variable displacement swashplate motor
Consumption (Flow)	$Q_2 = \frac{V_g \cdot n}{1000 \cdot \eta_{vol}}$ (l/min)	$Q_2 = \frac{V_{g\,max} \cdot n \cdot \tan\alpha}{1000 \cdot \tan\alpha_{max} \cdot \eta_{vol}}$ (l/min)
Output speed	$n = \frac{Q_2 \cdot 1000 \cdot \eta_{vol}}{V_g}$ (min^{-1})	$n = \frac{Q_2 \cdot 1000 \cdot \tan\alpha_{max} \cdot \eta_{vol}}{V_{g\,max} \cdot \tan\alpha}$ (min^{-1})
Output torque	$M_2 = \frac{V_g \cdot \Delta p \cdot \eta_{mh}}{20\pi} = \frac{1{,}59 \cdot V_g \cdot \Delta p \cdot \eta_{mh}}{100}$ (Nm)	$M_2 = \frac{V_{g\,max} \cdot \Delta p \cdot \tan\alpha \cdot \eta_{mh}}{20\pi \cdot \tan\alpha_{max}} = \frac{1{,}59 \cdot V_{g\,max} \cdot \Delta p \cdot \tan\alpha \cdot \eta_{mh}}{100 \cdot \tan\alpha_{max}}$ (Nm)
Output power	$P_2 = \frac{2\pi \cdot M_2 \cdot n}{60\,000} = \frac{M_2 \cdot n}{9549}$ (kW) $P_2 = \frac{Q_2 \cdot \Delta p}{600} \cdot \eta_{vol} \cdot \eta_{mh} = \frac{Q_2 \cdot \Delta p \cdot \eta_t}{600}$ (kW)	$P_2 = \frac{2\pi \cdot M_2 \cdot n}{60\,000} = \frac{M_2 \cdot n}{9549}$ (kW) $P_2 = \frac{Q_2 \cdot \Delta p}{600} \cdot \eta_{vol} \cdot \eta_{mh} = \frac{Q_2 \cdot \Delta p \cdot \eta_t}{600}$ (kW)

Es ist hierbei:

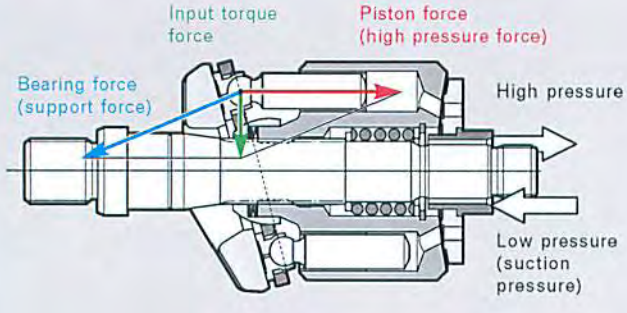
Q_1	= flow	(l/min)	α_{max}	= max. swivel angle (various depending on type)	
Q_2	= consumption (flow)	(l/min)	α	= set swivel angle (may be between 0 and α_{max})	
M_1	= drive torque	(Nm)	η_{vol}	= volumetric efficiency	
M_2	= output torque	(Nm)	η_{mh}	= mechanical-hydraulic efficiency	
P_1	= drive power	(kW)	η_t	= total efficiency ($\eta_t = \eta_{vol} \cdot \eta_{mh}$)	
P_2	= output power	(kW)	Δp	= differential pressure (bar)	
V_g	= geometric stroke volume per revolution	(cm^3)			
$V_{g\,max}$	= max. geom. stroke volume per revolution	(cm^3)			
n	= speed	(min^{-1})			

2.2.4 Rotary Group Forces

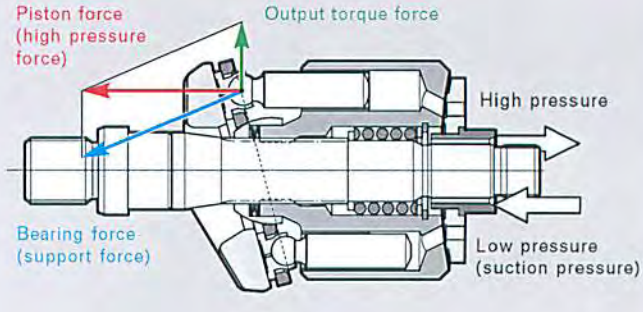
The resolution of forces takes place on the swashplate in the slipper pads and the cylinder.

The piston slipper pads are on hydrostatic bearings, and guarantee long service life of the rotary groups.

Resolution of Forces on the Pump Swashplate



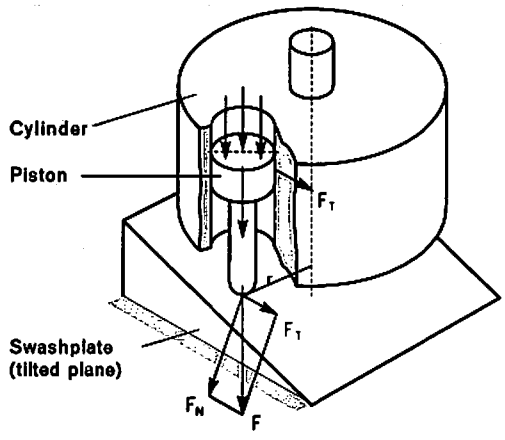
Resolution of Forces on the Motor Swashplate



https://truckmanualshub.com/

2.2.5 Swashplate Rotary Group

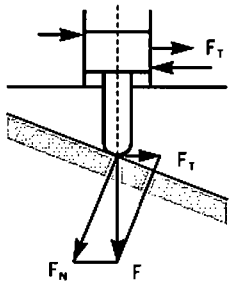
Simplified illustration



The basic components of a swashplate rotary group are: Cylinder - Piston - Swashplate

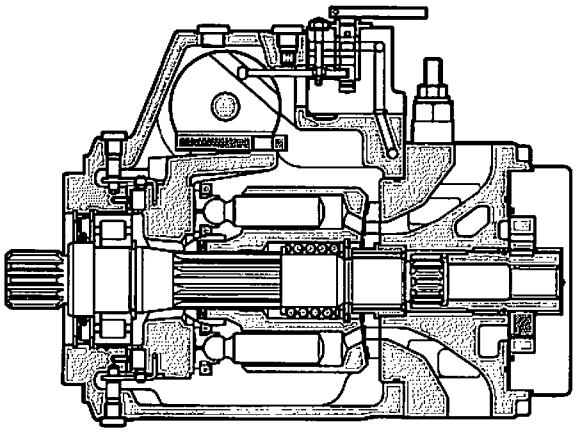
e.g. as a motor:

As explained in the Description of Function, the piston is pressurised by oil from the pump and pressed against the tilted plate.

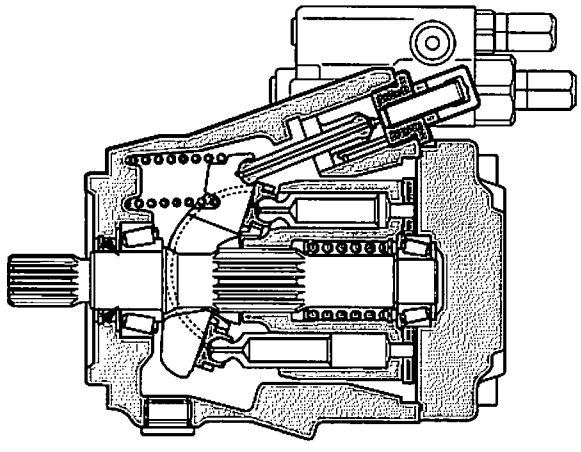


The resolution of the piston forces at the point of contact (plain bearing) with the tilted plate produces a bearing-force and a torque-force component (F_N and F_T). The piston slides down the tilted plate and carries out a stroke, taking with it the cylinder and drive shaft. However, because of the movement allowed by the piston tolerance within the cylinder bore, at the point of break-away (start-up), a greater frictional resistance occurs (static friction) than during a normal stroke (sliding friction). This 2-fold resolution of forces is the reason for the slightly lower starting efficiency of the *swashplate* unit as compared to the single resolution of forces in the case of the *bent-axis* unit. In practice, this can be important in motor operation, but is of little significance in pump operation.

2.2.6 Examples of Types



Variable Pump for Closed Circuits A4VG
High pressure range up to 450 bar



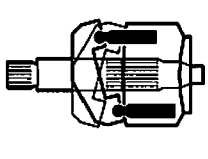
Variable Pump for Open Circuits A10VO
Medium pressure range up to 315 bar

https://truckmanualshub.com/

2.2.7 Symbols
(Symbolic illustration of the best known types)

A,B Pressure ports **S** Suction port
T,R,L Case drain ports **U** Flushing port

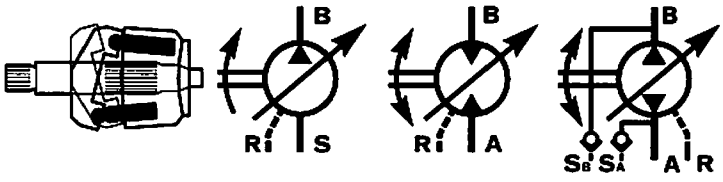
Variable pump
A4VG





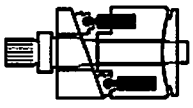
Variable displacement pump for closed circuits, swivel to both sides; swivel angle infinitely variable over centre; both directions of rotation of drive; tandem version possible by mounting additional pump at the through drive.

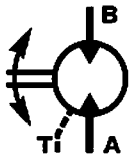
Variable pump
A4VSO/G/H



Variable displacement pump for open, closed or semi-closed circuits; swivel angle infinitely variable; single or both directions of rotation of drive and flow direction, depending on the type of circuit; auxiliary pump may be mounted at the through drive.

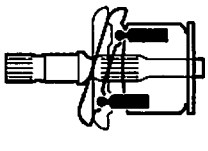
Fixed motor
A4FM

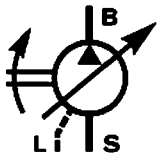




Fixed displacement motor for open or closed circuits; fixed swivel angle; both directions of rotation of power take-off; possibility of through drive for mounting brake.

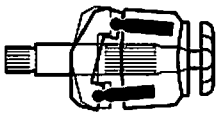
Variable pump
A10VO

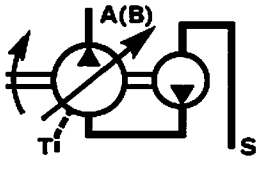




Variable displacement pump for open circuits, swivel to one side only; infinitely variable swivel angle; single direction of rotation of drive.

Variable pump
A11VLO





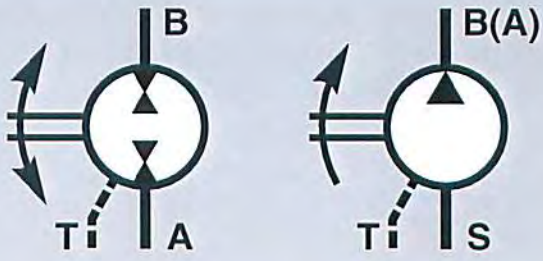
Variable displacement pump for open circuits, swivel to one side only; infinitely variable swivel angle; single direction of rotation of drive; with built-on charging pump at through drive.

https://truckmanualshub.com/

3 Components

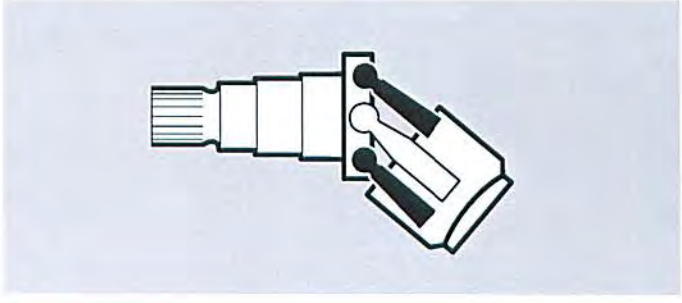
3.1 Fixed displacement motors and pumps of bent axis design

With high performance, modern axial-tapered piston rotary groups, series 6



Important Features:

- Cardanless cylinder drive via tapered pistons
- Tapered pistons with piston ring seals
- Robust tapered roller bearings with long service life
- Flange and shaft end to ISO or SAE standards
- Two drain ports and flushing port for bearings as standard
- Direct mounting of brake valve possible
- Models available for special applications
- Nominal pressure up to 400 bar / peak pressure up to 450 bar



3.1.1 Fixed motor

Operation as a motor in open and closed circuits; used in mobile and industrial applications, wherever a constant displacement is required for hydrostatic power transmission.



A2FM 400/450 bar

3.1.2 Fixed pump

With a suitable connection plate fitted, the A2FM motor becomes the A2FO pump (not illustrated) which is suitable for open circuits and is noted for its robustness, reliability, long service life and quiet operation.

3.1.3 Fixed pump for Trucks

Pump with special characteristics and dimensions for applications in mobile trucks; it is designed for a pressure range of 250/350 bar. If it is necessary to change the direction of rotation (e.g. with change of gearbox), this is simply carried out on the open-circuit pump by rotating the connection plate.



KFA 300/350 bar

https://truckmanualshub.com/

3.2 Variable Motor of Bent-Axis Design for Open and Closed Circuits

Important Features:

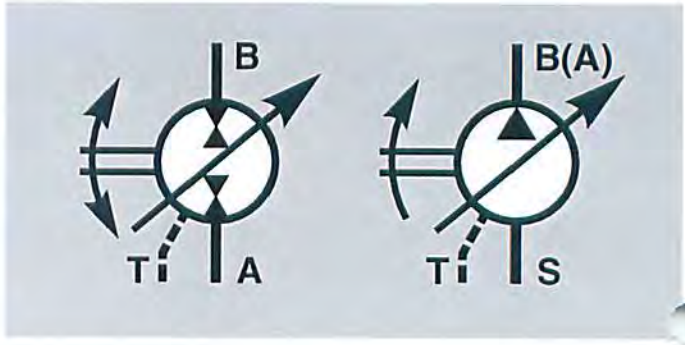
- Gives greater control range for hydrostatic transmissions
- Fulfils the requirement for high speed and high torque
- Cost-saving through elimination of gearbox, and possibility of using smaller pumps
- Low unit power
- Good starting characteristics
- Various control and regulating devices
- Swivel to one side only
- nominal pressure 400 bar / peak pressure 450 bar

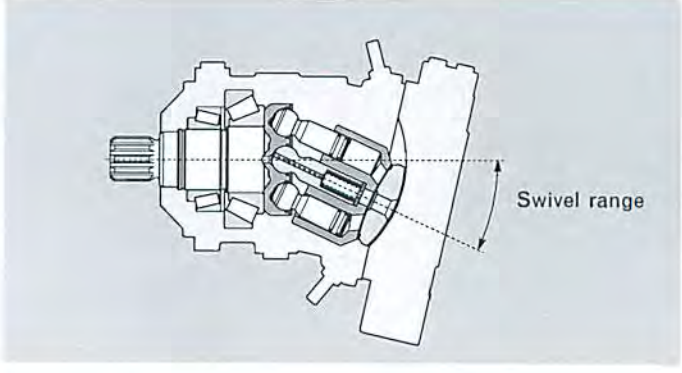
3.2.1 Automatic control, High-Pressure-related

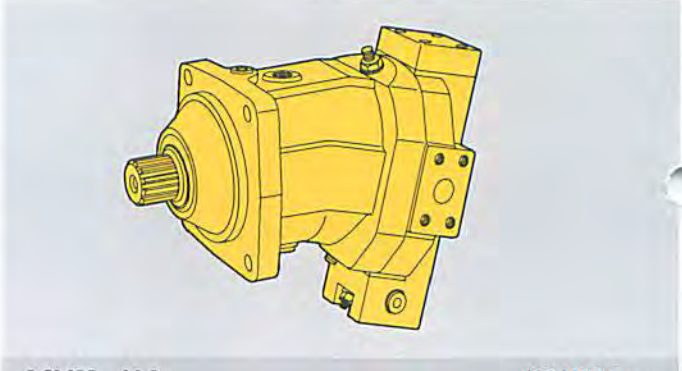
The A6VM variable motor has a bent-axis rotary group. The torque is therefore generated direct on the drive shaft and the cylinder is driven without a Cardan coupling directly by the tapered pistons. The swivel angle of the rotary group may be changed by moving the control lens along a spherical surface by means of the adjusting piston. Provided that the pump flow and high pressure remain constant, then

- reducing the angle gives higher speed and lower torque
- increasing the angle gives higher torque and lower speed.

The code ... HA refers to the high-pressure-related control of this motor. The displacement is set automatically dependent on operating pressure. When the operating pressure set with the regulating valve - measured internally via A or B - is reached, the motor is swivelled from $V_{g\,min}$ to $V_{g\,max}$. Below this pressure, the motor remains at minimum swivel angle.

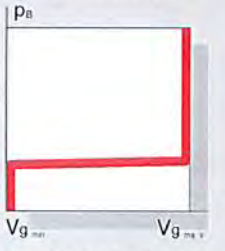




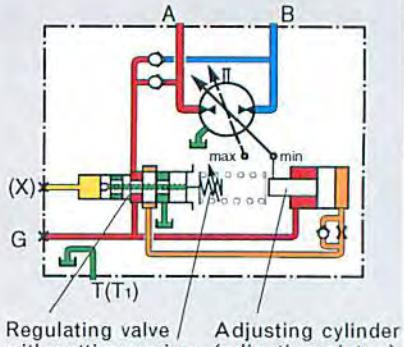


A6VM...HA **400/450 bar**

HA-Curve
Automatic control
high-pressure-related



p_B = Operating press.
V_g = Displacement



Regulating valve with setting spring

Adjusting cylinder (adjusting piston)

https://truckmanualshub.com/

3.3 Variable Pump of Bent-Axis Design for Open Circuits

Important Features:

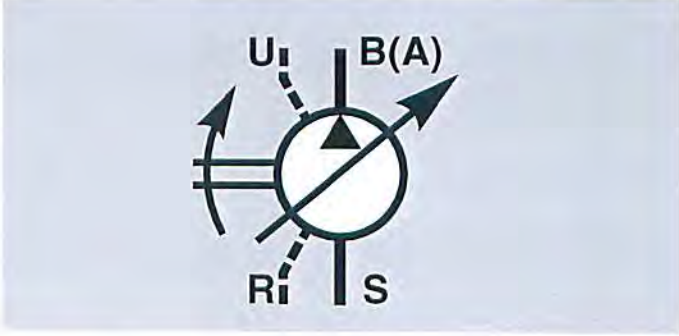
- Axial-tapered piston rotary group
- Cardanless cylinder drive via tapered pistons
- Robust bearings with long service life
- Displacement variable between V_{g0} and $V_{g\,max}$
- Constant horsepower control with exact hyperbolic curve
- Constant pressure control, hydraulic and electric control devices, load-sensing operation possible
- High pressure range up to 350/400 bar
- For use in mobile and industrial applications

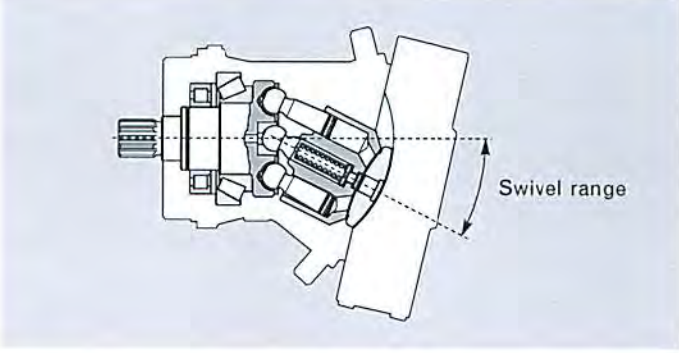
3.3.1 High Pressure Applications

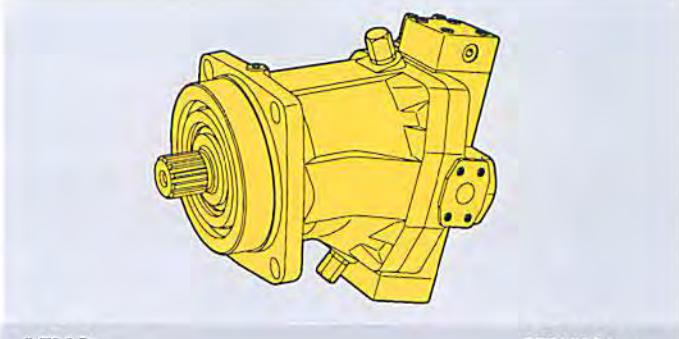
The A7VO is a variable pump with internal drain for open hydraulic circuits. The bent-axis rotary group is characterised by its robustness and good self-priming properties. The drive shaft bearings also allow external forces to be absorbed. For particularly demanding requirements in terms of force absorption and running time, type A7VLO has a rotary group with specially strengthened bearings.

The swivel angle of the rotary group is changed by moving the control lens along a spherical surface by means of an adjusting piston. Increasing the angle increases the pump flow and the required drive torque.

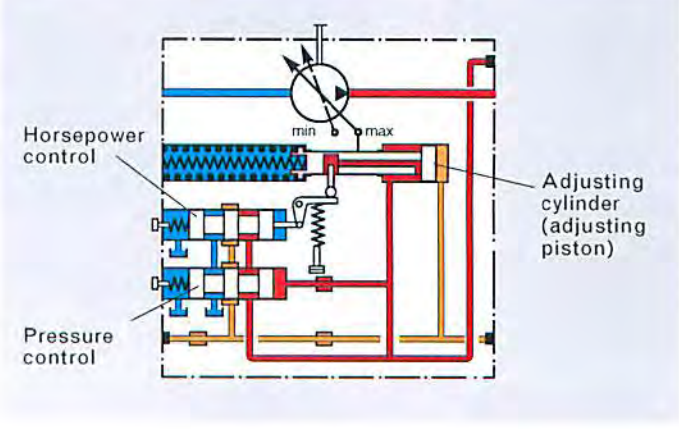
Reducing the angle reduces the pump flow and the required drive torque. The maximum angle is e.g. 25° or 26,5°. The minimum 0°. The pump is controlled as a function of the operating pressure, and adjusted by means of external control signals. The necessary control pressure is taken from the pressure side via a check valve.







A7VO **350/400 bar**
with fitted constant horsepower control in the port plate



https://truckmanualshub.com/

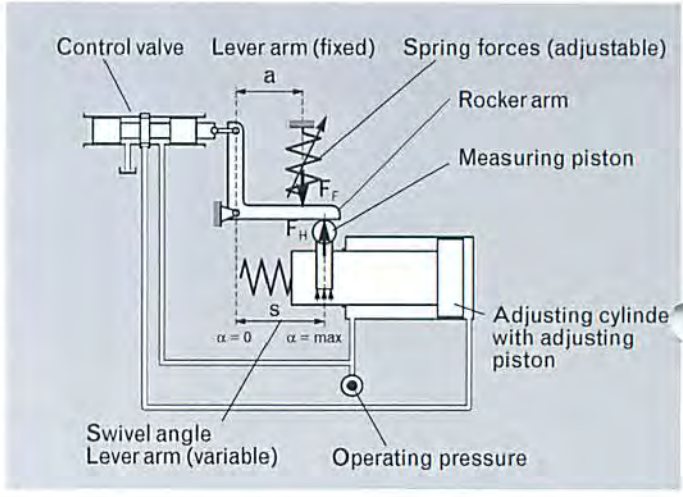
3.3.2 Constant Horsepower Control LR

(see Spring-Loaded Control / Hyperbolic Control)

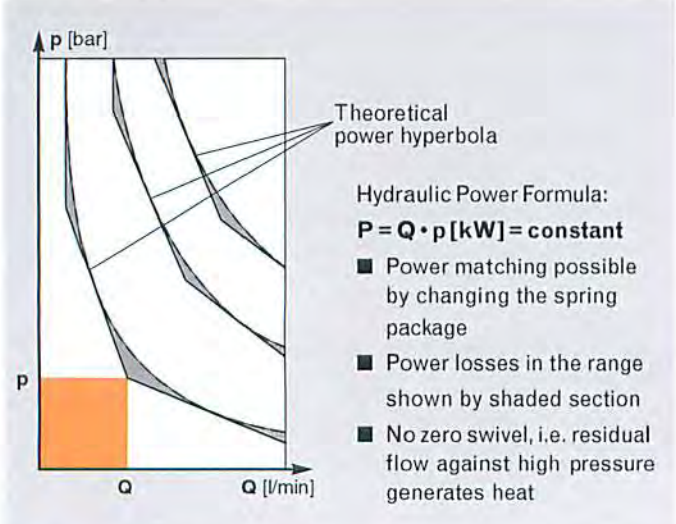
The control holds the pump input torque M [Nm] constant. The constant horsepower control is a function of this constant torque in combination with a constant input speed n [1 /min]. On one side we have the input mechanical drive power P = M • n [kW], on the other the hydraulic output power P = Q • p [kW]. While operating pressure p [bar] is dependent on load, flow Q [l/min] can be varied by changing the swivel angle.

Similar to a computer, the control continuously multiplies pressure and flow, and compares the result with the set value. Any upward drift is corrected by reducing the swivel angle and, inversely, by increasing the swivel angle. The control is adjustable (screwing in the setting screw increases the set value).

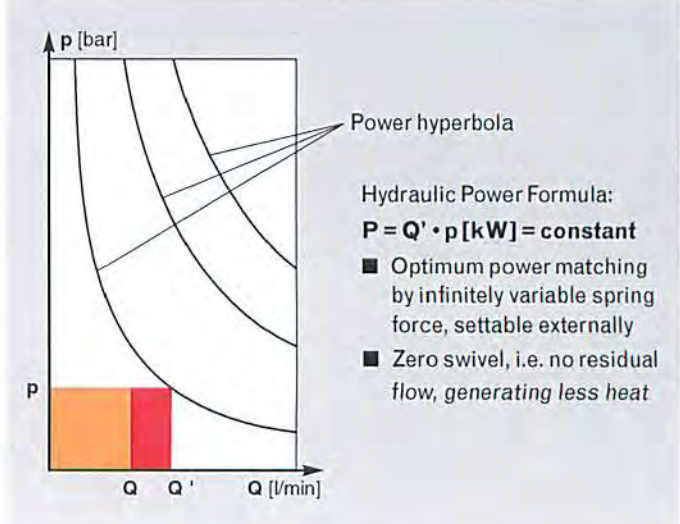
Start of control is at max. swivel angle. The position at end of control is dependent on the maximum pressure. Alternatively, both end values can be limited by the stop screws. Warning: if the maximum set angle is increased there is a danger of cavitation in the pump and of over-speeding of the hydraulic motor! Increasing the minimum set angle can lead to overloading of the prime mover in the high pressure range.



Operating pressure acts via a measuring piston in the adjusting piston on a rocker arm. The opposed spring force, externally adjustable, determines the power setting. If operating pressure p exceeds the permissible value, calculated from the formula P = Q • p [kW], the rocker arm actuates the control valve and the pump is destroked. The pump flow is reduced until the product of Q • p once again corresponds to the available power. The ideal power hyperbola is achieved, the drive is not overloaded, because of the "constant HP control". Inversely, the pump flow can, depending on operating pressure and supported by a return spring, be increased up to its maximum value.



Spring-loaded Control withapproximated curve



Hyperbolic control with ideal hyperbolic curve

https://truckmanualshub.com/

3.3.3 Variable Double Pump with 2 parallel Bent-Axis Rotary Groups

Two variable pumps - one drive. An advantageous combination of two individual pumps with integral distributor gear.

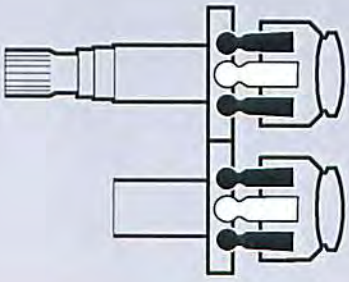
Models with secondary drive and/or auxiliary pump for the supply of additional hydraulic circuits are today standard, particularly in mobile applications.

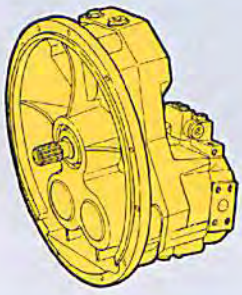
As an extension of the constant horsepower control for a single pump (A7VO..LR - see pages 18/19), the double pump A8VO..SR with *summated horsepower control* is used, for example, for two parallel hydraulic circuits where the total drive power is split between the two circuits proportional to the pressures in both circuits.

The high pressure signal is averaged in the summation valve and used as the reference value. The ideal hyperbolic power curve is achieved when the torque forces acting on the rocker arm of the constant horsepower control are in balance.
The max. hydraulic torque, which is the product of high pressure force F_H and swivel stroke **s**, may not exceed the mechanical torque occurring as a product of the adjustable spring force F_F and the fixed lever arm **a**.

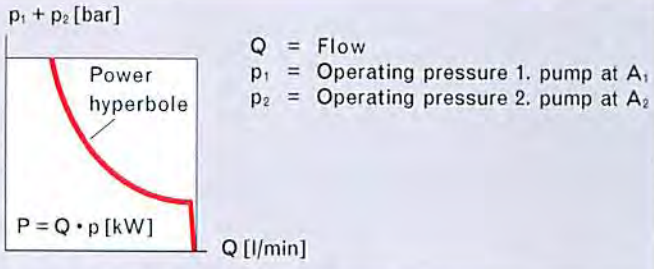
Since the operating pressure **p** is predetermined by the hydraulic system and the pump can only change its flow Q, if the max. allowable power is exceeded, the pump is automatically swivelled back to a smaller angle. Swivel stroke s is reduced until the resulting hydraulic torque is once again equal to the given mechanical torque.

In practice, both individual or combined controls find application. Common variations are load-limit control, three-circuit control, load sensing, etc.

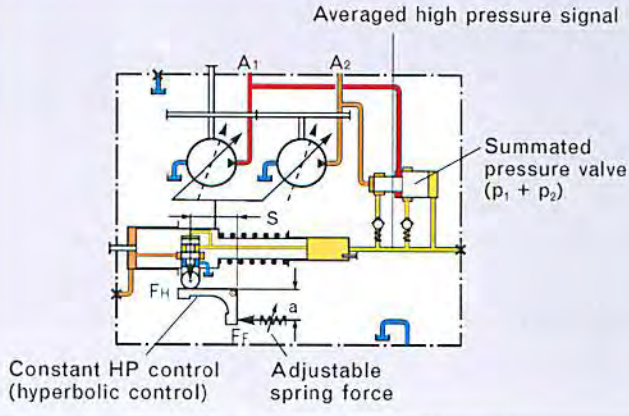




A8VO...SR 350/400 bar



Hyperbolic Control *summated HP control curve*



Double pump with *summated HP control*

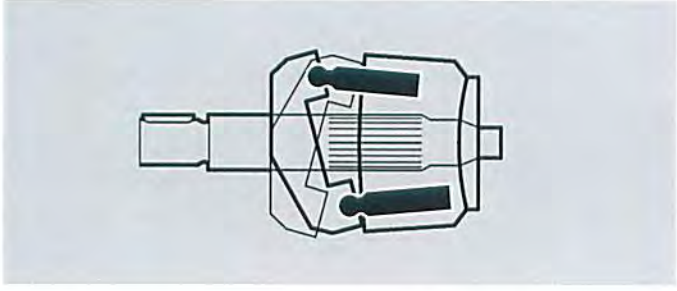
https://truckmanualshub.com/



3.4 Variable Pump of Swashplate Design

for universal industrial applications

O = Open circuit
G = Closed circuit
H = Semi-closed circuit



The A4VS.. variable pump is universally suitable for use in the various types of circuit (O-C-S). A wide range of controls and pump models are available.
For industrial applications the A4VS..G pump e.g. (operating in closed circuit) can be extended by the addition of relevant adjusting devices and built-on valve block, auxiliary pumps at the through drive, tank and cooler to form a complete hydraulic drive unit.
A semi-closed circuit **..H..** may also be extended by the use of anti-cavitation check valves. This will compensate e.g. for differences in volume when operating single rod cylinders.

3.4.1 Pump Control Devices

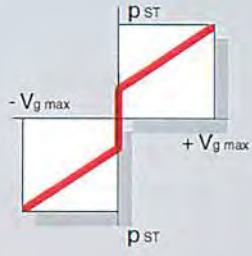
of modular design for a variety of control and regulating functions

In addition to the recognised advantages of swashplate design the A4VSO pump, developed specially for use in industrial applications, also offers an extremely long bearing service life. Load-sensing control and mooring operation, as well as secondary control, can be achieved with this pump.
The system of closed loop secondary speed control, in combination with a pressure-controlled pump and a secondary-controlled motor, guarantees high control dynamics, accurate speed control, minimal power loss and energy recuperation.

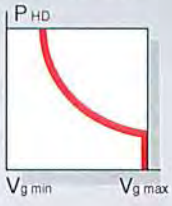
Speed control DS1 regulates the variable unit to produce the necessary torque for the required speed. This torque (in the power supply with impressed pressure) is proportional to the displacement and thus also proportional to the swivel angle. The swivel angle (adjusting distance) is recorded by means of an inductive positional transducer, and the speed is recorded by a tachogenerator.

Examples:

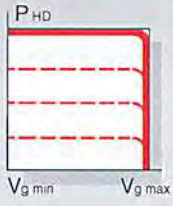
HD
Hydraulic control
pressure-regulated



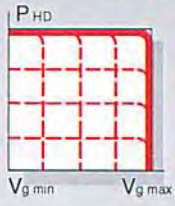
LR
Const. horse-power control



DR
Const. pressure control

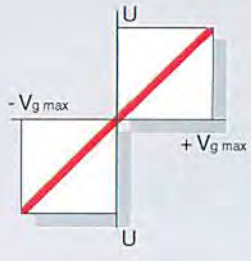


DFR
Const. pressure and flow control



EO1
Hydraulic displacement control
(proportional valve)

HS
Hydraulic displacement control
(servo valve)



P_{HD} = High pressure
V_g = Displacement
P_{ST} = Pilot pressure
U = Control voltage

https://truckmanualshub.com/



A10V(S)O Medium High Press. Range 280 / 350 bar

3.5 Variable Pump of Swashplate Design

for medium pressure range in open circuits

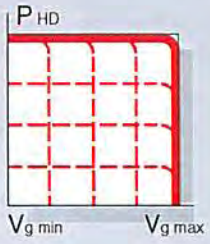
Axial piston pump A10V.O is suitable for use in mobile and industrial applications at pressures of up to 280/350 bar. Compared to fixed pump systems it saves energy, e.g. through automatic matching to force (pressure) and speed (flow requirements) by means of a combined constant pressure and flow control.

Besides its compact build, other advantages of the swashplate design are its low unit power, long service life and quiet operation. The through-drive option for mounting of additional pumps is a particularly useful feature.

As a fixed unit at an operating pressure of 280 bar, this is a real alternative to fixed displacement gear or vane type pumps.

DFR
Constant pressure and flow control

P_{HD} = Operating pressure
V_g = Flow



3.6 Variable Pump of Swashplate Design

for simple mobile applications in closed circuit

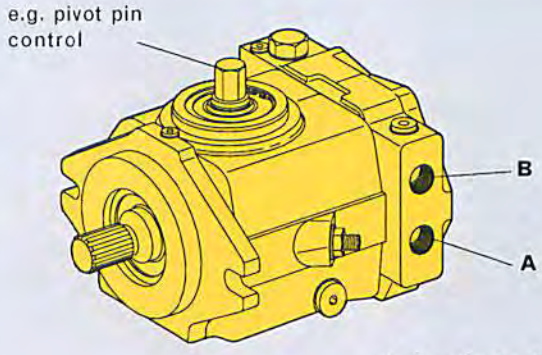
The A10VG is a variable pump of swashplate design for hydrostatic transmissions in a closed circuit. All necessary valves and an auxiliary pump are integrated. The pump design is such that it can easily be extended to a multiple pump.

The swivel angle of the rotary group is changed, e.g. directly by *turning* the *pivot pin* manually.

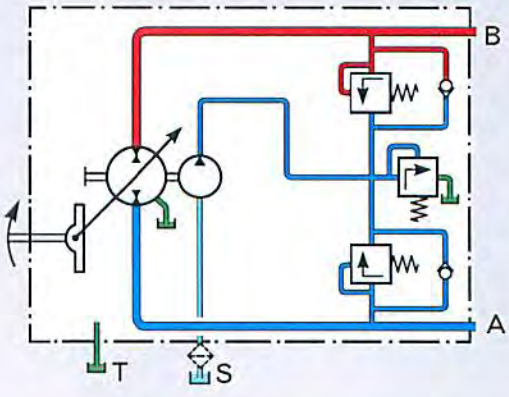
If the swivel angle is zero, the pump flow is also zero. Swivelling the pump over centre smoothly reverses the direction of flow.

With the manual pivot pin control, the pin is connected direct to the rocker arm of the rotary group. The angle of rotation of the pin corresponds to the pump swivel angle. The necessary adjustment torque, usually applied by hand or foot force, is influenced by the high pressure and the swivel angle. Limiting of the stroke, or angle of the stroke, or angle of the control mechanism, or possible zero-centring, must be carried out within the control mechanism itself.

In addition to the manual pivot-pin control, hydraulic controls can also be fitted to this pump.



A, B = Service lines
T = Tank
S = Suction line



A10VG Medium High Press. Range 300 / 350 bar

https://truckmanualshub.com/



A11VO High Pressure Range 350 / 400 bar

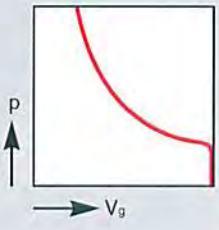
3.7 Variable Pump of Swashplate Design

for mobile applications in open circuit

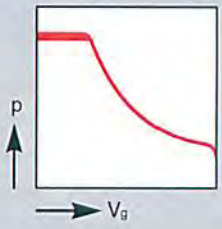
The control functions of the A11VLO illustrated here can be operated either super-imposed or as individual functions:

- Constant horsepower control with hyperbolic curve
- Constant pressure control via sequence valve
- Load-sensing control via Δp-control of load-pressure signal

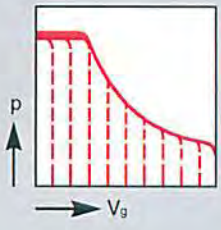
LR
The constant horsepower control regulates the pump displacement in relation to the operating pressure so that a given drive power at constant drive speed is not exceeded.



DR
The constant pressure control causes the pump to swivel back towards V_g=0, once the maxi-mum operating pressure has been reached. This function is super-imposed on the constant horsepower control.



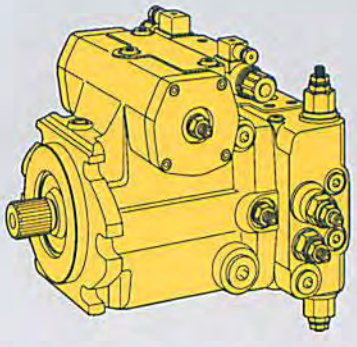
LRDS
The load-sensing control operates as a load-pressure dependent flow controller and matches the pump displacement to the flow requirement indicated by the operator. Pump flow is dependent on the opening cross-section the directional valves, but is not affected by the load pressure in the range below the power curve. The constant power and pressure controls are super-imposed on the load-sensingfunction.

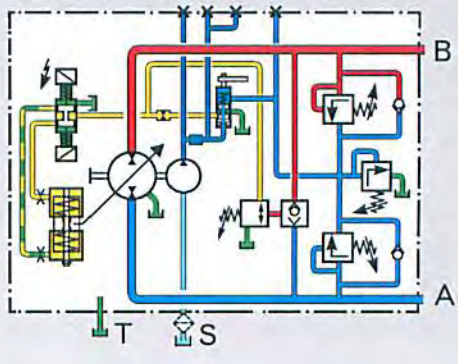


3.8 Variable Pump of Swashplate Design

for high-pressure mobile transmissions in closed circuit

We have here in the A4VG DA pump a power pack, complete with all components for closed circuit operation, similar to that described in 3.6. Through hydraulic control with various control devices, we have the typical "*mobile pump*". This is combined with a fixed or variable motor to give the automatic "*mobile transmission*".
Illustrated here is the "*speed-related automotive control*". The pump is controlled by means of the drive speed, operating pressure and, electrically, via 2 switching solenoids. The control energy is taken from the boost circuit. The pump control time is retarded by means of throttles.
The DA control is designed for mobile transmissions with combustion engines. It takes account of the fact that in combustion engines the torque increases with the speed, and that with loads around the max. torque limit a loss of speed occurs. The power capacity of a combustion engine can, therefore, more or less be equated with its current speed. Through corresponding adjustments on the hydraulic side, optimum automotive control is achieved.





A4VG High Pressure Range 400 / 450 bar

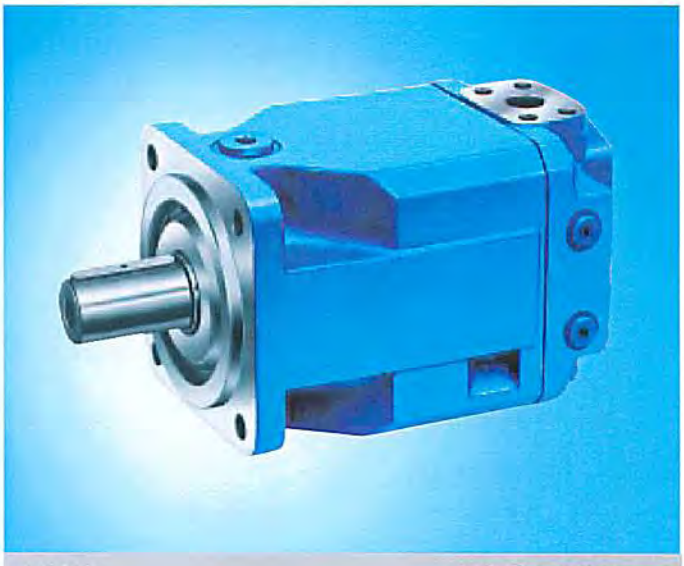
https://truckmanualshub.com/

3.9 Fixed Motor of Swashplate Design

The A4FM is of compact, space-saving design, offering the following technical advantages with:

Connection in series (summated pressure)
Mounting of brake possible
Insensitive to oscillations

This fixed motor for high pressures (350 / 400 bar) is suitable for connection in series.
The axial pressure compensation of the hydrostatic bearing on the slipper pads ensures high loading capability and a long service life.



A4FM 350 / 400 / 450 bar

3.10 Variable Motor of Swashplate Design

The A10VM is a switching motor in swashplate design that can be switched between two positions.
It operates in the medium pressure range (250 / 315 bar) in open or closed circuits.

Variable motor/switching motor
Hydraulic or electrical two-point adjustment with mounted switching valve

Adjustment range 1 : 2,5

Mechanical holding brake can be built on

Also available as a small compact plug-in motor



A10VM 280 / 350 bar

https://truckmanualshub.com/

3.11 Summary

of the most common control options on pumps and motors

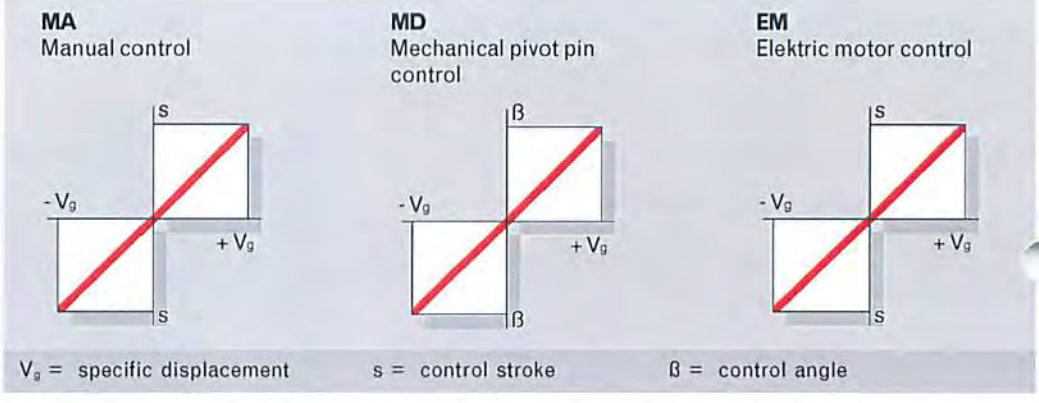
The electronic components (amplifiers), used to amplify the signals, are not listed here.

Different features of the controls are:

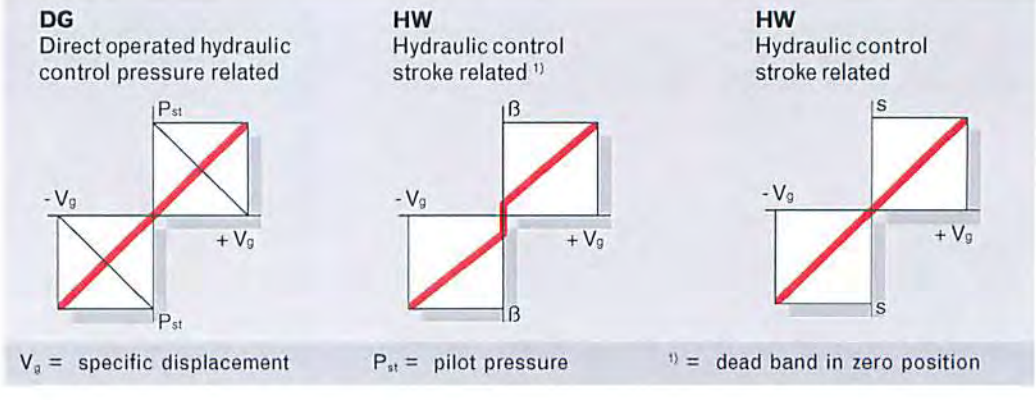
- Type of circuit
- Force transfer (hydraulic or mechanical)
- Operation of control (direct or pilot operation)
- Curve (position and adjustability)
- Open loop control (without feedback)
  - mechanical/manual
  - mechanical/electrical
  - hydraulic/mechanical
  - hydraulic/electrical
  - hydraulic/hydraulic
- Closed loop control (with feedback)
  - hydraulic/mechanical
  - hydraulic/electrical

3.11.1 Pump Controls

- Mechanical - manual, proportional to:
  MA - control stroke **s**, or
- **MD** - control angle ß for pumps in reversible operation
- Mechanical/electrical, with
  EM - electric gear motor



- Hydraulic - mechanical, proportional to:
  DG - pilot pressure p_{St}
  HW - control angle ß or control stroke **s** for pumps in reversible operation



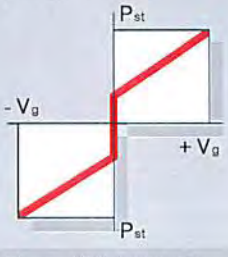
https://truckmanualshub.com/

■ Hydraulic - hydraulic:
HD - proportional to pilot pressure p_{St} for pumps in open circuit or reversible operation

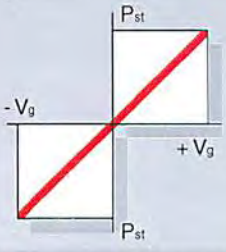
HD
Hydraulic control pressure related



HD
Hydraulic control pressure related [1]



HD
Hydraulic control pressure related



V_g = specific displacement | P_{St} = pilot pressure | [1] = dead band in zero position

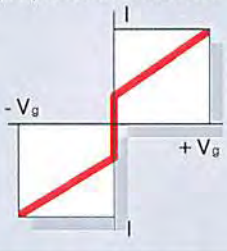
■ Hydraulic - electrical:
EZ - with switching solenoids (not illust.)

EP - with proportional solenoids, proportional to control current I in open or closed circuit

EP
Elektric control with proportional solenoid



EP
Elektric control with proportional solenoid

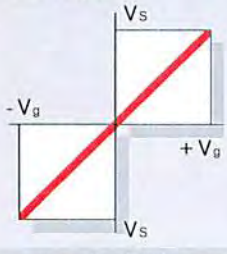


V_g = specific displacement | I = control current

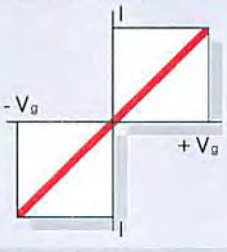
■ Hydraulic, flow-related:
HM - proportional to pilot oil flow V_S, in reversible operation

HS - electrical/hydraulic with built-on servo valve, proportional to control current I

HM
Hydraulic control flow-related



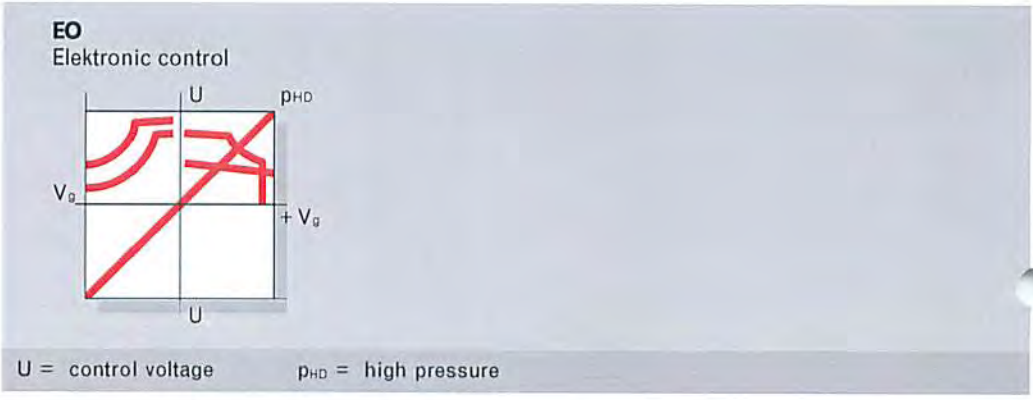
HS
Hydraulic control with servovalve



V_g = specific displacement | V_S = pilot oil flow

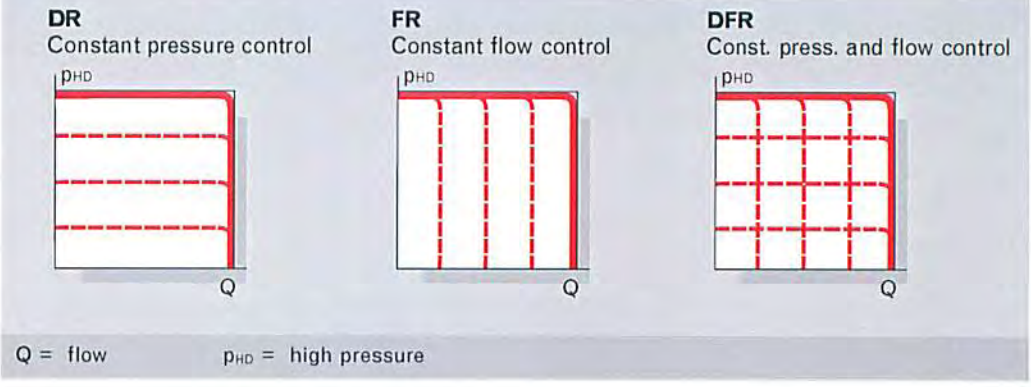
https://truckmanualshub.com/

■ Hydraulic, flow-related:
EO - with built-on proportional valve in reversible operation; with electronic amplifier; closed loop control possible.



3.11.2 Closed-Loop Pump Controls

■ Hydraulic:
DR - constant system pressure through suitable adjustment of pump flow
FR - constant pump flow with variable drive speed and/or flow variation to meet changing user requirement
DFR - a combination of both the above controls; the constant flow control is super-imposed on a mechanically settable constant pressure control

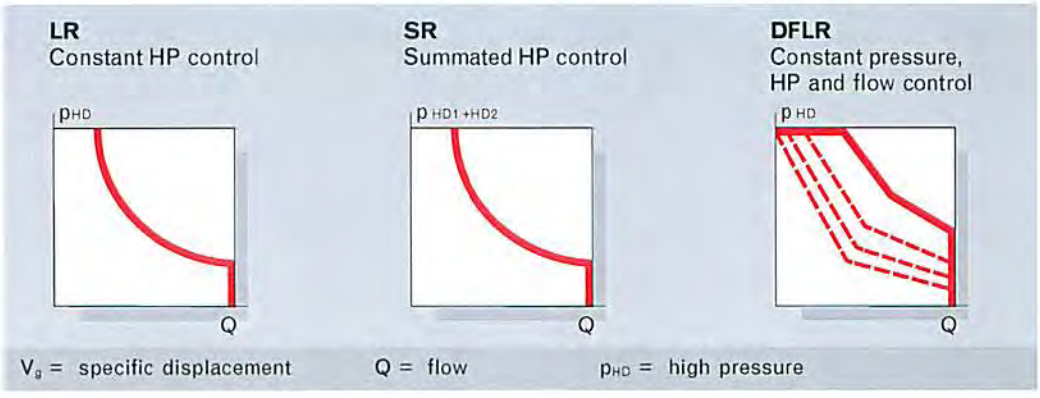


https://truckmanualshub.com/

LR - constant drive torque control; power = torque x speed, P = M x n = constant.

SR - for parallel operation of two pumps from one prime mover; automatic power distribution by summation of pressure

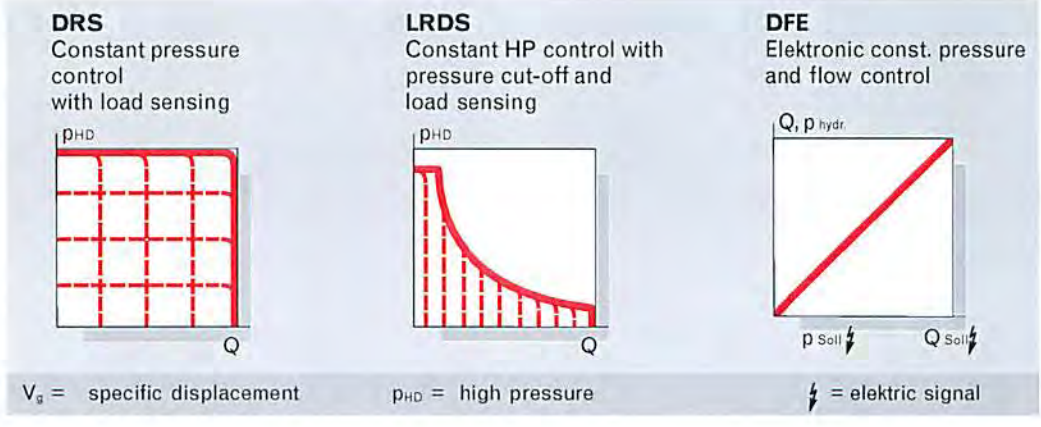
DFLR - combined constant pressure/flow control with super-imposed constant horse-power control



DRS - flow variation ac-cording to user require-ment (load sensing) with super-imposed constant pressure control; pump is swivelled dependent on load pressure

LRDS - drive torque is limited on max. by addition of constant horsepower control; pump flow is varied according to user requirement

■ Elektronic:
DFE - alternative electro-nic version of combined control DFR.



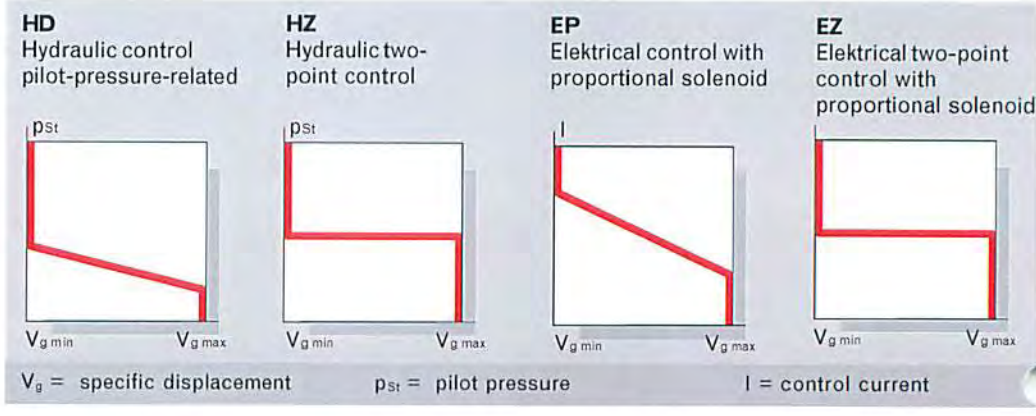
https://truckmanualshub.com/

■ Electrical - hydraulic control current related
DE - with pressure reducing valve built-on in reversible operation; electronic amplifier and sensoric for control function practicable



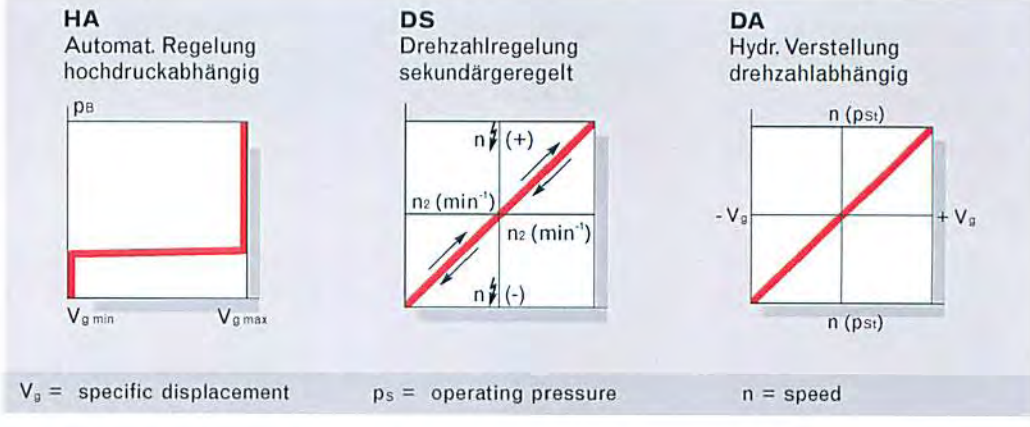
3.11.3 Motor Controls

■ Hydraulic - hydraulic:
HD - proportional to pilot pressure p_{ST}.
HZ - hydraulic/hydraulic, two-point control
EP - hydraulic/electric, with proportional solenoid
EZ - with switching solenoid, two-point control.



3.11.4 Closed-Loop Motor Controls

■ Hydraulic:
HA - automatic high-pressure-related control; automatic adjustment to current torque requirement
DS - pumps with DS control are used as motors for *"secondary control"*
DA - speed-related hydraulic control is the basis for "mobile transmission" with *"automotive control"*.



https://truckmanualshub.com/

Rexroth
Bosch Group

Bosch Rexroth AG
Mobile Hydraulics
Glockeraustraße 2
89275 Elchingen, Germany
Telefon +49 (0) 7308 8170-1
Telefax +49 (0) 7308 82 2683
info.brm@boschrexroth.de
training.elchingen@boschrexroth.de
www.boschrexroth.com/brm

Printed in Germany
RE 90 600 / 01.04

https://truckmanualshub.com/

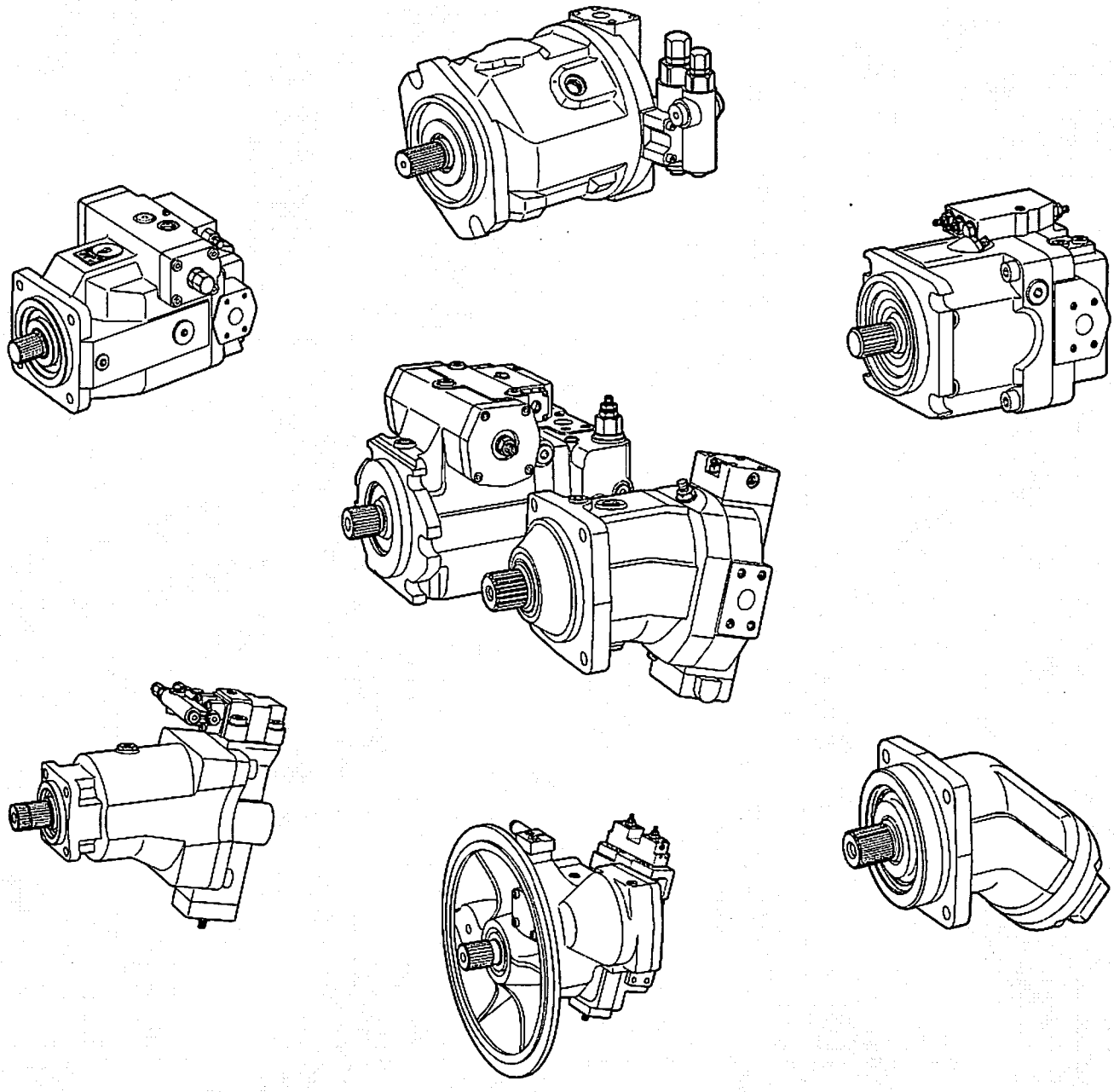
Rexroth
Bosch Group

General Operating Instructions for Axial Piston Units

General Operating Instructions

RE 90 300-B/05.05
Replaces RE 90 300-B/08.92
and RE 90 301-B/09.87

B



https://truckmanualshub.com/

Manufacturer

Bosch Rexroth AG
Hydraulics
Product Segment Axial Piston Units
Elchingen plant
Glockeraustrasse 2
89275 Elchingen, Germany

Telephone +49 (0) 73 08 82-0
Fax +49 (0) 73 08 72 74

Bosch Rexroth AG
Hydraulics
Product Segment Axial Piston Units
Horb plant
An den Kelterwiesen 14
72160 Horb am Neckar, Germany

Telephone +49 (0)74 51 - 92 0
Fax +49 (0)74 51 - 82 21

info.brm-ak@boschrexroth.de

www.boschrexroth.com/addresses

This website also provides information about contact persons in other countries.

Manufacturer details are available on the axial piston unit name plate.

Contents

1 About these instructions ... 3
1.1 Structure and requirements ... 3
1.2 Staff requirements ... 5
1.3 Hazard markings and pictograms ... 6

2 Safety ... 7
2.1 Basic safety instructions ... 7
2.2 Operating company's and operator's obligations to exercise due care ... 9
2.3 Responsibility of machine or system manufacturer ... 10

3 Product description ... 11
3.1 Identification of axial piston unit ... 11
3.2 Functional description ... 12
3.3 Scope of supply ... 12
3.4 Technical data ... 12
3.5 Conventional use ... 13

4 Installation ... 15
4.1 General installation instructions ... 16
4.2 Unpacking instructions ... 17
4.3 Preparing axial piston unit for assembly ... 17
4.4 Transporting the axial piston unit to the installation location ... 18
4.5 Assembling axial piston unit ... 19
4.6 Connecting lines ... 21
4.7 Connecting electric controller ... 22
4.8 Disassembling axial piston unit ... 23
4.9 Preparing axial piston unit for storage ... 23
4.10 Disposing of axial piston unit ... 24

5 Commissioning ... 25
5.1 Preparations ... 26
5.2 Filling axial piston unit ... 26
5.3 Testing the direction of rotation of the engine ... 28
5.4 Testing hydraulic fluid supply ... 28
5.5 Performing functional test ... 29
5.6 Performing flushing cycle ... 29

6 Fault diagnosis ... 31

7 Servicing ... 35
7.1 Maintenance ... 35
7.2 Inspection ... 35
7.3 Repair ... 36

Appendix A: Project planning notes ... 37
Selection of hydraulic fluid ... 37
Tank design ... 38
Filter design ... 39
Cooler ... 39
Hose lines and piping ... 40

Index ... 41

https://truckmanualshub.com/

Avoiding hazards

⚠ DANGER!

To ensure reliable operation and to avoid damage when performing an installation, commissioning or repair work, study these operating instructions carefully and thoroughly!

Bosch Rexroth AG can not be held liable for any personal injuries or machine damage arising from non-adherence to these operating instructions. In case of damage induced by disregard of these operating instructions, any warranty provided by Bosch Rexroth AG will be rendered null and void and liability placed with the operator.

1 About these instructions

1.1 Structure and requirements

Documents

Operating instructions for Rexroth axial piston units consist of three part documents:

- General operating instructions for axial piston units

  These general operating instructions for axial piston units will assist you during installation, commissioning and operation of Rexroth axial piston units. These include axial piston pumps and motors for use in open or closed hydraulic circuits.

  Unless stated differently, the information in these operating instructions applies to all Rexroth axial piston units. Information, which only applies to specific pumps or motors or hydraulic concepts, is marked in the text accordingly.

- Product-specific operating instructions

  The product-specific operating instructions for the individual Rexroth axial piston units contain additional, specific information on installation, commissioning and operation. Not every Rexroth axial piston unit is supplied with its own product-specific operating instructions.

  Always observe both the details in the product-specific operating instructions and the details in the general operating instructions RE 90 300-B/05.05.

- Technical data sheet

  The technical data sheets for the individual Rexroth axial piston units contain the complete technical data.

Please contact Rexroth to request the missing parts of the documentation, if you are not in possession of the whole set of documents. Safe operation of Rexroth axial piston units can only be guaranteed if you observe the details in all the part documents.

General operating instructions

These general operating instructions will assist you during installation, commissioning and operation of Rexroth axial piston units. You will require the individual chapters of these instructions for the different phases of working with the axial piston unit:

- "2 Safety" on page 7 explains how the instructions in this document are to be understood and contains several basic safety instructions on handling axial piston units.
- "3 Product description" on page 11 provides you with information on the identification of axial piston units as well as its proper and intended use.
- "4 Installation" on page15 provides you with information on the installation, and on the disassembly and storage of axial piston units.
- "5 Commissioning" on page 25 explains what you have to observe during the commissioning of the axial piston unit and machine or the system.
- The overview in "6 Troubleshooting" on page 31 assists you in searching and tracing faults on the axial piston unit and the general machine or system.

https://truckmanualshub.com/

- "7 Servicing" on page 35 provides you with information on maintenance, inspection and repairs to the axial piston unit.
- The Annex starting on page 37 contains project-planning notes for selection of the hydraulic fluid, and design of the tank, filter and heat exchanger as well as the correct piping of the hydraulic system.

Area of validity for these instructions

These operating instructions are valid for Rexroth axial piston units for operation with permissible hydraulic fluids. Information on permissible hydraulic fluids is available in the technical data sheet.

These operating instructions are for the:

- machine or system manufacturer,
- operating company,
- operator.

Each particular installation drawing, technical data sheet and order confirmation of the Bosch Rexroth AG is also binding for the machine or system manufacturer.

Important documents

Before starting with the tasks described in this instruction manual, make sure that the following documents are already available:

- **Product-specific operating instructions**
  The product-specific operating instructions contain special information valid for each particular axial piston unit. Please ask Rexroth if there is a product-specific instruction manual for your axial piston unit.
- **Order confirmation**
  The order confirmation contains the preset technical data. The axial piston unit may only be operated using the values and conditions specified in the order confirmation.
- **Installation drawing**
  The installation drawing for the axial piston unit contains the outer dimensions, all connections and the hydraulic plan for the axial piston unit.
- **Technical data sheet**
  The technical data sheet contains among other things the permissible technical data for the axial piston unit.
- **General connection plan of the machine or system**
  The hydraulic and electrical connection plan of the machine or system contain the information of the hydraulic or electrical connections. You need this data to work with the axial piston unit as part of the machine or system. You will get the documentation from the machine or system manufacturer.

The following Rexroth publications give further information about installation and operation of the axial piston unit:

- **RE 90 220: Mineral-oil based hydraulic fluids**
  Describes the requirements on a mineral-oil based hydraulic fluid for the operation of a Rexroth axial piston unit and assists you in selecting a hydraulic fluid for your system.
- **RE 90 221: Environmentally acceptable hydraulic fluids HEES, HEPG, HETG for axial piston units**
  Describes the requirements on an environmentally acceptable hydraulic fluid for the operation of a Rexroth axial piston unit and assists you in selecting a hydraulic fluid for your system.
- **RE 90 223: Axial piston unit for the operation with HF hydraulic fluids**
  Contains additional information on the use of Rexroth axial piston units with HF hydraulic fluids.
- **RE 90 300-03-B: Information on using hydraulic drives at low temperatures**
  Contains additional information on the use of Rexroth axial piston units at low temperatures.

https://truckmanualshub.com/

1.2 Staff requirements

General requirements, qualification

Axial piston units may only be installed and operated by qualified personnel.

Qualified personnel is someone who is able to evaluate his tasks, to recognize dangers, and to take necessary measures to provide risks of accidents on the basis of his professional education, his knowledge and experience as well as the knowledge of relevant regulations.

Persons who are currently being instructed, trainees, or supervised persons under 18 may not work on Rexroth hydraulic products.

This does not apply for adolescents with a minimum age of 16, if

- the work with Rexroth hydraulic products is necessary for reaching the training goal,
- the protection of the adolescent is guaranteed by an experienced supervisior and if they use only work equipment, tools and protection means which exlude injuries.

Persons, who are alcoholized, or under the influence of drugs or medicaments, which affect the reactivity may generally not operate or maintain Rexroth hydraulic products.

Requirements on maintenance staff

Maintenance measures can be necessary to obtain the operability of the axial piston unit. Details are available in chapter "7 Servicing" (page 35).

Maintenance measures include inspection, service and maintenance of hydraulic and electrical components. For these different activities different levels of minimum qualifications of the staff are required.

To perform **inspections** on the outermost parts of the axial piston unit the staff has to fulfill the following requirements:

- he/she has to be instructed in the task.

To perform **service** tasks on hydraulic parts of the axial piston unit personnel must fulfill the following requirements:

- he/she has to introduced in the task,
- he/she has have specific hydraulic knowledge,
- he/she has be able of reading and fully understanding hydraulic plans,
- he/she has fully understand the relations regarding the installed security devices and,
- he/she has fully understand the function and configuration of the hydraulic components.

Repair work on axial piston units may only be made by repair shops who are authorized by Rexroth. Rexroth offers a complete range of services for the repair of Rexroth axial piston units.

For electric work generally applies the following:

- Work on electric equipment may only be done by an authorized and trained electrician or by instructed persons under the direction and supervision of an authorized trained electrician according to the electro-technical regulations.

https://truckmanualshub.com/

1.3 Hazard markings and pictograms

This instruction differentiate between categories of hazards as per ISO Guide 37:

⚠ DANGER!	This hazard marking warns of high risk, lethal dangers and severe injuries.
⚠ WARNING	This hazard marking warns of medium risk, injuries and severe property damage.
⚠ CAUTION	This hazard marking warns of low risk and property damage.
Note	This marking refers to information, which helps to better understand the machine processes, or which refers to special or important circumstances.
Tip	This marking refers to information which helps to work more efficient.
	This symbol refers to information on disposal of components and operating materials.

https://truckmanualshub.com/

2 Safety

Read this chapter carefully before starting to work with the axial piston unit.

Rexroth axial piston units are to be installed as components in machines or systems. The safety regulations in this instruction relate to axial piston units only. Please note additionally the manufacturer's safety regulations for the machine or system.

2.1 Basic safety instructions

Please observe strictly the following safety instructions as well as the safety instructions of the machine or system manufacturer, to avoid any injuries and health damages as well as material damage and environmental pollution.

⚠ DANGER! **Danger of life**

Working on operational machines or systems forms a danger to life or physical condition.

The works described in this document may only be performed on disconnected **machines or systems**. Before starting to work please ensure that:

- the engine cannot be switched on.
- all power transmitting components and connections (electric, pneumatic, hydraulic) are switched off according to the manufacturers instructions and cannot be switched on again. If possible, remove the main fuse on the machine or system.
- the machine or system is completely hydraulically relieved (depressurized). Please follow the instructions of the machine or system manufacturer.

⚠ WARNING **Risk of injury**

To avoid any injuries, please observe the following recommendations regarding **safety wear**:

- While working on the machine or system always wear safety shoes with steel caps.
- While working with dangerous substances (for example hydraulic fluids) always wear safety gloves, safety glasses and suitable working clothes.

⚠ DANGER! **Risk of toxication and injury**

Contact with hydraulic fluids may damage your health (e.g. eye injuries, skin and tissue damage, toxication at inhalation).

- Please check the lines for wear or damage before each inital operation.
- Please wear thereby protective gloves, safety glasses and suitable working clothes.
- If however hydraulic fluid contacts the eyes or penetrates your skin please consult a doctor immediately.
- When dealing with hydraulic fluids absolutely observe the safety instructions of the hydraulic fluid manufacturer.

https://truckmanualshub.com/

⚠ WARNING

Risk of burns!

The axial piston unit heats up during operation. Also the solenoids on the axial piston unit heat up during operation. Fingers and hands can suffer severe burn injuries touching the axial piston unit or solenoids.

- Always allow the axial piston unit to cool down before touching it.
- Protect yourself by wearing heat-resistant gloves and protective clothing.

⚠ DANGER!

Risk of toxication and injury

While searching for leakages escaping hydraulic fluid can penetrate the skin and cause severe poisoning and injuries.

- Only search for leakages when the machine is switched off and depressurized.

⚠ WARNING

Risk of injury and damage

Incorrectly connected components can cause severe malfunctions.

- Ensure that pipes are connected according to the connection plan.
- Perform component-oriented functional tests.

⚠ DANGER!

Fire hazard

Hydraulic pressure fluid is flammable.

- Please obstruct a naked flame from the axial piston unit.

⚠ WARNING

Hearing damage

The noise emission of axial piston units depends on speed, operating pressure and installation conditions. You can count on the fact that the sound pressure level rises above 70 dBA on normal operating conditions. This may cause hearing damage.

- Always wear hearing protection while working next to the operating axial piston.

https://truckmanualshub.com/

WARNING

Environmental pollution

Hydraulic fluids are water-endangering fluids. Leaking hydraulic fluid can cause toxication of the groundwater and ground contamination.

- Place a collector vessel under the axial piston unit.
- Remedy the leakage immediately.
- National laws and regulations must be observed at all times. In Germany hydraulic machines or systems are classified as "systems for handling water-polluting substances for the purpose of the Federal Water Act (WHG)". In this context please note especially §1 and §19 of the WHG (§19g, 19i, 19l).
- Further information is available in the Rexroth publications "Mineral-oil based hydraulic fluids", RE 90 220. "Environmentally acceptable, rapid biologically degradable hydraulic fluids HEPG, HEES for axial piston units", RE 90 221 and "Axial piston units for operation with HF hydraulic fluids, RE 90 223.

2.2 Due diligence of the operating company and the operator

The operating company and the operator has to ensure that

- the axial piston unit is only used conventionally (see "3.5 conventional use" on page 13).
- the axial piston unit is stored, operated and repaired according to the operating and environmental conditions defined in the technical data, and especially that the limits given in the technical data will not be exceeded.
- the axial piston unit after being repaired may only be operated if in proper and fully functional condition.
- required personal protective equipment is available to the staff and that it will be worn.
- while working on the axial piston unit the engine has been securely switched off and the system has to be depressurized.
- the operating instructions (general and product-specific) are always available in a legible and complete status at the location of the axial piston unit.
- only qualified and authorized staff will be deployed for the maintenance of the axial piston unit.

Note

For storing, installation, commissioning or operation of the axial piston unit at low temperatures (lower than –25 °C) the instructions in the Rexroth publication "Instructions on using hydrostatic drives at low temperatures", RE 90 300-03-B must be observed.

Note

In addition to the instruction manual please observe generally valid, statutory and other binding regulations of the national legislation for accident prevention and environmental protection.

https://truckmanualshub.com/

2.3 Responsibility of the machine or system manufacturer

Rexroth axial piston units are components for the purpose of the Machine Directive 98/37/EG (sub units), which are used for the installation in a machine or a system. Rexroth axial piston units are no ready-to-use machines for the purpose of the EU Machine Directive.

Bosch Rexroth AG indicates that the scope of supply is exclusively intended for the installation in a machine or system or to be connected with other components to a whole new machine or system.

This instruction serves as a basis for the general system instructions to be issued by the machine or system manufacturer.

Commissioning is prohibited until it is secured that the machine or system, in which these products are installed, comply with the regulation of the EU Directives and all other guidelines regarding the machine or system.

In addition to the machine guidelines, additional guidelines such as, e.g. pressure vessel directive and explosion protection directive, are also valid. The interaction of the hydraulic product with the machine or system, in which the hydraulic product is installed, can cause various dangers. For this reason make sure that the hydraulic product is unreservedly applicable for its intended use at its installation point.

The interfaces to the general machine and the operating conditions are of major significance. We recommend that the result of the danger analysis (risk assessment) for the general machine has also to be involved in the planning for the hydraulic product.

Note

For storing, installation, commissioning or operation of the axial piston unit at low temperatures (lower than –25 °C) the instructions in the Rexroth publication "Instructions on using hydrostatic drives at low temperatures", RE 90 300-03-B must be observed.

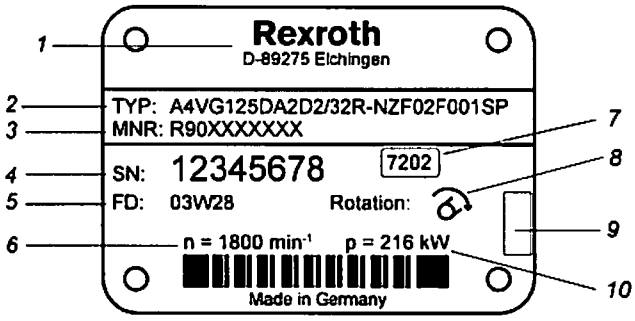
https://truckmanualshub.com/

3 Product description

This chapter explains how to identify an axial piston unit using the name plate. In addition you will get information how to use the axial piston unit properly.

3.1 Identification of the axial piston unit

The axial piston unit can be identified with the name plate. The following example shows the name plate of a variable displacement pump A4VG:



The name plate contains the following information:

1 Manufacturer

2 Ordering code

3 Material number of axial piston unit

4 Serial number

5 Production date

6 Speed [1])

7 Internal plant designation

8 Direction of rotation (looking on to shaft)

9 Designated area for test stamp

10 Power [1])

[1]): Positions 6 and 10 vary depending on the product.

https://truckmanualshub.com/

3.2 Functional description

The product spectrum of Rexroth axial piston units covers the following categories:

- Type of function: pump or motor
- Type of circuit: open or closed hydraulic circuit
- Design: bent axis or swashplate
- Displacement: fixed or variable

The pressure range of Rexroth axial piston unit is available in the technical data sheet.

Axial piston **pumps** are designed and built for the generation, the control and the regulation of a hydraulic flow and are product-specific in the open or closed circuit. Thereby they are powered by an "engine".

Note

In these operating instructions the term "engine" is used as a generic term for diesel, petrol, gas and electric engines.

Axial piston **units** are designed and built to convert the hydraulic flow into rotation and torque.

Axial piston units are used to build hydrostatic transmissions for the insertion in static or mobile operation. Such transmissions are suitable for the transmission of outputs for moving, turning, lifting and for all kinds of motion involving large forces.

A detailed functional description is available in the product-specific operating instructions for your axial piston unit.

3.3 Scope of supply

The following components are part of scope of supply of axial piston units:

- Axial piston unit with transport protection
- Protective caps
- Flange covers
- Label with commissioning information

3.4 Technical data

Details on technical data of your axial piston unit are available in the technical data sheet.

The set technical data of your axial piston unit are available in the order confirmation.

https://truckmanualshub.com/

3.5 Conventional use

Observe the following while operating the axial piston unit:

- The axial piston unit may only be stored in a dry and dust-free atmosphere, which is free of corrosives and vapors.

  The factory corrosion protection is sufficient when stored under the specified conditions, unless condensate or leakage water penetrates the axial piston unit.

- The axial piston unit may only be operated using the following hydraulic fluids:
  - Mineral oils according to the "Mineral-oil based hydraulic fluids" data sheet (RE 90 220)
  - Environmentally acceptable hydraulic fluids according to the "Environmentally acceptable hydraulic fluids HEES, HEPG, HETG for axial piston units" data sheet (RE 90 221)
  - Fire resistant HF hydraulic fluids according to the "Axial piston units for operation with HF hydraulic fluids" data sheet (RE 90 223)

  You can get information about using the product combined with other hydraulic fluids on request.

  When using non mineral-oil based hydraulic fluids observe the restrictions in the "Environmentally acceptable hydraulic fluids HEES, HEPG, HETG for axial piston units" (RE 90 221) and "Axial piston units for operation with HF hydraulic fluids" (RE 90 223).

- The axial piston unit may only be operated under the specified operating conditions.

  The axial piston unit may only be operated when technically in perfect working order and further it may only be stored, operated and repaired according to the technical data, operating and environmental conditions mentioned in the order confirmation. Particularly the limits specified in the technical data may not be exceeded.

  For storing, installation, commissioning or operation of the axial piston unit at low temperatures (lower than −25 °C) the instructions in the Rexroth publication "Instructions on using hydrostatic drives at low temperatures", RE 90 300-03-B must be observed.

- The axial piston unit may only be operated with the specified output data.

  The operation with other connection, application or output data, than those specified in the general and product-specific operating instructions and the technical data sheet, is only permitted with a written agreement of Bosch Rexroth AG. Additionally, the technical details specified in the respective order confirmation of Bosch Rexroth AG apply related to a system. The order confirmation is available for the machine or system manufacturer and is binding.

- The axial piston unit may only be used for the specified purpose.

  The axial piston unit may not be used for other purposes than the specified one, unless Bosch Rexroth AG agreed the other purpose in written form. The operating instructions of the machine or system manufacturer and if necessary any technical data must be strictly observed.

- The axial piston unit may not be used in explosive environments.

  Ignition sources are not allowed in immediate vicinity of the axial piston unit, because hydraulic fluid escaping may be flammable or even explosive.

- General use and predictable fault usage has to be considered (Device and Product Safety Act GPSG, Product Liability Act PHG).

Note

Any deviations from the intended usage or specifications contained in these instructions, technical modifications and conversions of the axial piston unit, and the operation of individual parts or the installation of individual parts into other products will affect the safety and exclude any warranty.

https://truckmanualshub.com/

https://truckmanualshub.com/

4 Installation

This chapter describes the essential, generally valid steps for the installation of Rexroth axial piston units. Read this chapter if you:

- wish to install an axial piston unit into a static or mobile hydraulic system or
- wish to disassemble or dispose an axial piston unit.

Also observe the details of the installation in the product-specific operating instructions of your axial piston unit.

Note

Observe the underlying safety instructions on page 7 of these operating instructions for all work performed for installation of the axial piston unit.

You will find all information about the selection of the hydraulic fluid and the design of the tank, the filter and the heat exchanger as well as for correct piping of the hydraulic system in the Annex as from page 37.

Structure of chapter

This chapter is structured as follows:

- "4.1 General installation instructions" on page 16 contains information that must be observed before and after the installation.
- Information on unpacking the axial piston unit is available on page 17.
- As from "4.3 Preparing axial piston unit for assembly" on page 17 you will be informed about the steps for the installation.
  The following sections describe the necessary steps.
  - Unpacking of the axial piston unit.
  - Assembly of the axial piston unit at the scheduled installation location.
  - Connection of the hydraulic lines.
  - Connection of an electrical controller (optional).
- "4.8 Disassembling the axial piston unit" on page 23 and the following sections contain information about disassembling, storing or disposing the axial piston unit.

https://truckmanualshub.com/

4.1 General installation instructions

The installation location and position for an axial piston unit essentially determine the process of installation and commissioning (as when filling the axial piston unit).

Information about permitted installation locations and positions is available in the product-specific operating instructions or in the technical data sheet.

Note

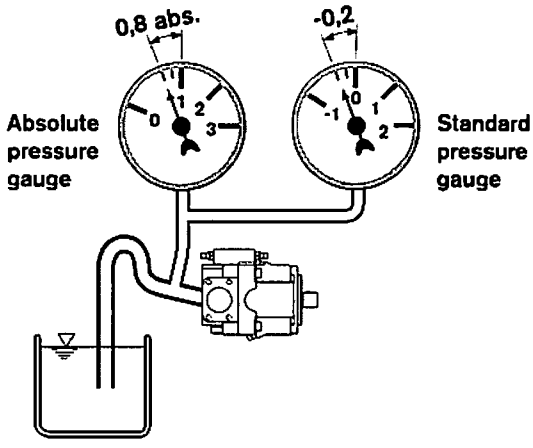
Please count on an influence of the control device while operating with variable axial piston units which are assemblied in certain installation locations. Because of gravity, dead weight and housing internal pressure minor curve displacements and actuating time changes may occur.

Valid for all installation positions:

- The housing of the axial piston unit must be filled and remain filled with hydraulic fluid at commissioning and during operation.
- To achieve favorable noise values, decouple all connecting lines (suction, pressure and leakage fluid connections) from the tank using flexible elements.

Suction pressure for pumps

Generally in all installation positions and locations a **minimum suction pressure** at connection "S" is prescribed for all pumps : Minimum suction pressure ≥ 0.8 bar abs (additional values see technical data sheet).



CAUTION

Risk of damage for to axial piston unit

The axial piston unit must always be filled with hydraulic fluid.

- During commissioning make sure that the axial piston unit is supplied with sufficient hydraulic fluid.
- Ensure that the entire hydraulic system is tight.
- In the case of unusual noise or vibration development switch off the machine or system immediately and check whether the axial piston unit has been filled with hydraulic fluid.

Cleanliness

Cleanliness must be observed:

- Absolute cleanliness is required. The axial piston unit must be installed in a clean condition. Contamination in the hydraulic fluid may severely impair the service life of the axial piston unit.
- Do not use any cotton waste or fibrous cloths for cleaning. Use suitable fluid cleaning agents to remove lubricants and other major contamination. Cleaning agent must not penetrate the hydraulic system.
- Do not use hemp or mastic to lute.

https://truckmanualshub.com/

4.2 Unpacking instructions

While unpacking the axial piston unit please observe the following instructions:

CAUTION

Risk of parts falling down

If the packaging is not opened correctly parts may fall out and damage the parts or result in injury.

- Place the packaging on a flat and sustainable underground.
- Open the packaging from the top only.

The axial piston unit will be delivered in a corrosion protection film. The film can be disposed of with other polyethylene materials.

When disposing of the packaging always observe the local regulations.

4.3 Preparing axial piston unit for assembly

To prepare the axial piston unit for assembly:

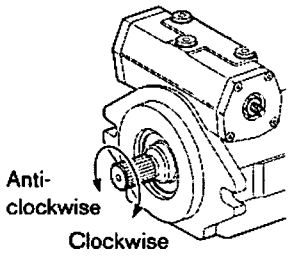
1 Remove the packaging material and dispose it according to the valid regulations.

2 Check the scope of supply regarding transportation damages.

3 Compare the material number and designation (ordering code) with the details in the order confirmation.

If the material number for the axial piston unit does not correspond with the one in the order confirmation. Please contact the Rexroth-Service for clarification.

4 Check the rotational direction of the axial piston unit (on the name plate) and make sure that this corresponds to the directional rotation of the engine or power take-off drive.



Note

Please note that the direction of rotation as specified on the name plate determines the direction of rotation of the axial piston unit with regard to the drive shaft. The engine direction of rotation is described in the engine manufacturer's operating instructions.

https://truckmanualshub.com/

4.4 Transporting the axial piston unit to the installation location

Depending on size and local conditions axial piston units can be transported – e.g. using a fork lift truck or hoisting gear.

The drive shaft **can** be used to transport the axial piston unit as long as only outward axial forces occur. Thus you can hook the axial piston unit onto the drive shaft.

Therefore turn an eyebolt into the drive shaft. Make sure that each eyebolt can bear the total weight of the axial piston unit plus approx. 20 %.

CAUTION

Risk of damage

Prompt or impulsive forces on the drive shaft can damage the axial piston unit.

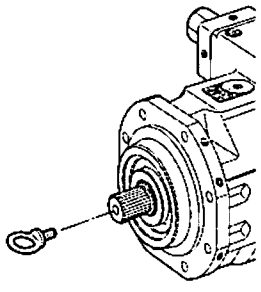
While transporting make sure that the axial piston unit's drive shaft is not subjected to prompt or impulsive forces. That means precisely:

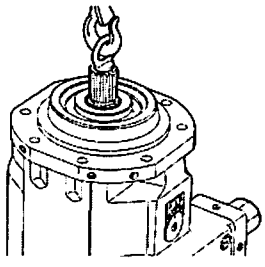
- Do not hit the coupling or drive shaft of the axial piston unit.
- Do not set/place the axial piston unit on the drive shaft.
- Details about the permissible axial and radial loading are available in the technical data sheet.

To transport the axial piston unit to the installation location:

1 Turn the eyebolt into the drive shaft as shown. The size of the thread is stated in the installation drawing.

You can hoist the axial piston unit as shown using the eyebolt screwed into the drive shaft without any risk of damaging it.





https://truckmanualshub.com/

4.5 Assembling the axial piston unit

How to assemble the axial piston unit depends on the connecting elements to the drive or the output side. The following descriptions explain the installation of the axial piston unit:

- via coupling
- via a gearbox
- via a cardan shaft

General information

During assembly (and disassembly) of the axial piston unit observe the following general instructions:

- The axial piston unit has to be fixed so that the expected forces and torques can be transferred without any danger.
- The permissible axial and radial loading of the drive shaft, the permissible torsional vibrations, optimum direction of load force, as well as the limit speeds are available in the respective technical data sheet.
- When driving a pump or the output of a motor with the aid of a **cardan shaft** vibrations may occur, which may result in temporary leaks on the shaft seal ring of the axial piston unit depending on the frequency and temperature.
- After a short running time **toothed belts** lose a major portion of their pre-tension and thus cause fluctuations in speed or torsional vibrations.

  Torsional vibrations may result in leakages on the shaft sealing ring of the driven axial piston unit. Particularly at risk are diesel drives with a small number of cylinders and low flywheel mass.

  Rexroth recommends to avoid this type of toothed belt drive or to equip it with an automatic tensioning device.
- **V-belt drives** without automatic tensioning device are also critical in terms of speed fluctuations or torsional vibrations. These can also lead to leakages on the shaft sealing ring.

  An automatic tensioning device can lessen the speed fluctuations and vibrations and thus avoid consequential damage.

  Rexroth recommends the use of V-belt drives only with an automatic tensioning device.
- In both types of **belt drive** the permissible radial loading on the shaft must be observed. If necessary, the belt pulley can be separately mounted.
- The drive and output elements are to be assembled by pulling it onto the drive shaft with the aid of the threaded hole in the drive shaft end.

⚠ CAUTION

Risk of damage

Prompt or impulsive forces on the drive shaft can damage the axial piston unit.

During installation make sure that the axial piston unit's drive shaft is not subjected to prompt or impulsive forces. That means precisely:

- Do not hit the coupler or drive shaft of the axial piston unit.
- Do not set/place the axial piston unit on the drive shaft.
- Details about the permissible axial and radial loading are available in the technical data sheet.

https://truckmanualshub.com/

Coupling

To assemble the axial piston unit with a coupling:

1 Assemble the specified coupling half to the drive or output shaft of the axial piston unit according to the coupling manufacturer's specifications.

The shaft of the axial piston unit is equipped with a threaded hole. The size of thread is stated in the installation drawing. This threaded hole can be used for assembling the coupling.

2 Make sure that the installation location is clean and free from contaminants.

3 Brace the coupling hub onto the drive shaft or ensure a permanent lubrication of the drive shaft. This avoids any formation of frictional corrosion and thus the attendant wear.

4 Transport the axial piston unit to the installation location and assemble the coupling onto the drive or output according to the coupling manufacturer's specifications.

Please note that the axial piston unit should not be tightened until the coupling has been correctly assemblied.

5 Fix the axial piston unit at the installation location. If necessary, details on the tools required and tightening torques for the fixing screws can be procured from the machine or system manufacturer.

a) For **installation of the bell housing** check the axial play of the coupling through the bell window according to the manufacturer's specifications.

b) For **installation of the flange** align the axial piston unit carrier to the drive or output.

Note

Please note the following:

- Frictional corrosion on the coupling parts is to be avoided either by clamping the coupling hub onto the drive shaft or through constant lubrication.
- When using flexible couplings and after completing the installation check the drive has to be free of resonance.

Installation on a gearbox

Drive shaft connections are to be protected against frictional corrosion (constant lubrication).

The concealed installation means that it is not longer possible to inspect whether the axial piston unit's centering diameter actually centers the axial piston unit (observe tolerances), or whether axial or acts on the drive shaft of the axial piston unit (installation length). The control must therefore take place during the assembly procedure.

Completing the assembly

To complete the assembly:

1 Remove any assemblied eyebolts.

2 Remove transport protection.

The axial piston unit is delivered with protective caps and plastic plugs. They have to be removed before the connection. Which actual transport protection has to be removed at your axial piston unit can be read in the product-specific operating instructions.

Generally the caps and plugs can be removed by hand. If necessary a gripper can also be used.

The protective caps of the adjustment screws may not be removed.

https://truckmanualshub.com/

Note

Sealing rings and surfaces may be damaged if the transport protection is not removed correctly.

Please note the following:

- Do not damage the sealing surfaces!
- All ports must have pipes or hoses connected according to the hydraulic connection plan or the ports must be sealed with screw plugs.
- The operating and function connections are designed exclusively for connecting hydraulic lines (see under "4.6 Connecting lines").

3 For axial piston pumps with drive-through:
If a drive through element is used (auxiliary pump, PTO), remove the flange cover and assemble the auxiliary pump as shown in the pump manufacturer's instructions.

4.6 Connecting lines

The machine or system manufacturer is responsible to dimension the lines. The axial piston unit must be connected in line with the hydraulic connection plan of the machine or system manufacturer to the remaining hydraulic system.

Observe the following safety instructions.

CAUTION

Risk of damage

Hydraulic lines and hoses that are installed under tension, generate additional mechanical forces during operation and thus reduce the service life of the axial piston unit and the overall system.

- Install all lines and hoses free of tension.

CAUTION

Risk of damage

Generally a minimum permissible suction pressure at port "S" is prescribed for axial piston pumps in all installation locations. If the pressure at port "S" drops under the specified values, damage may occur, which may lead to destruction of the pump.

- Make sure that the required suction pressure is reached by using corresponding piping (suction cross-section, pipe diameter, tank position) and appropriate viscosity .

Note

The operating and function connections are designed exclusively for connecting hydraulic lines.

https://truckmanualshub.com/

Notes on routing lines

Observe the following instructions when routing the suction, pressure and leakage fluid lines. Observe also the project planning instructions in the Annex (see page 37).

The **suction line** (pipe or hose) must be as short and straight as possible.

The line cross section is to be measured so that the minimum permitted pressure at the suction port is not dropped below and the maximum permitted pressure is not exceeded. Observe the air tightness of the junctions and the pressure strength of the hose compared with the external air pressure.

Sufficient burst resistance of the pipes, hoses and connecting elements must be observed for **pressure lines**.

Route **leakage fluid lines** so that the housing is constantly filled with hydraulic fluid and to ensure that no air gets through the shaft sealing ring even for extended down times. The housing internal pressure may not exceed the limits listed for the axial piston unit in the technical data sheet under any operating conditions. The junction of the leakage fluid line must always be mounted under the minimum fluid level in the tank.

Procedure

To connect the axial piston unit to the hydraulic system:

1 Remove the transport protection (if not already removed).

2 Clean the lines.
Contamination in the hydraulic fluid may severely impair the service life of the axial piston unit. The lines must be cleaned before being installed.

3 Brace the lines according to the fitting manufacturer's specifications.
All ports must be connected either to pipes or hoses according to the installation drawing and machine or system connection plan or the ports sealed using suitable screw plugs.
Note the manufacturer specifications on the permissible tightening torques for the fittings used. For fastening screws as under DIN 13/ISO 68 we recommend checking the tightening torque in individual cases as per VDI 2230 Status 2003.

4 Make sure:
- that the union nuts are correctly tightened on the screwed connections and flanges (Observe tightening torques!). Mark all checked screwed connections using, e.g. a permanent marker.
- that pipe and hose lines and any combination of connecting pieces, couplings or connecting points with hoses or pipes are checked by an expert to ensure that they are safe to operate.

4.7 Connecting electric controller

For electrically controlled axial piston units the electric controller must be connected according to the electric connection plan of the machine or system manufacturer.

⚠ DANGER!

Risk of electric shock

When connecting the electric controller there is a risk of experiencing an electric shock.

- Before proceeding with the connection process make sure that the entire machine is switched off and secured against being switched on (e.g., by removing main fuse). Information about how to securely shutdown the machine is available in the machine or system manufacturer's specifications.

https://truckmanualshub.com/

4.8 Disassembling the axial piston unit

⚠ DANGER!

Danger to life

Working on an axial piston unit with switched on the engine forms a danger to life and physical condition.

- Switch off the machine or system and unload it (depressurize), before disassembling the axial piston unit. The procedure on how to shut down and relieve the machine is available in the specifications of the machine or system manufacturer. The switched-off machine must be secured against being switched on again.

To disassemble the axial piston unit proceed as follows:

1 Switch the machine or system off.

2 Relieve the hydraulic system according to the machine and system manufacturer's specifications. Make sure that the hydraulic system is depressurized.

3 Allow the axial piston unit to cool down. Check whether the axial piston unit has cooled down far enough so that it can be dismantled without any problems.

4 Place a fluid collector under the axial piston unit, to collect any fluid that may escape.

5 Disconnect the axial piston unit using a suitable tool from the pipelines, so that any escaping fluid drops can be collected in the provided collector.

6 Empty the axial piston unit.

7 Seal all openings.

8 If necessary, prepare the axial piston unit for storage as described on the following pages.

4.9 Preparing axial piston unit for storage

The axial piston unit is provided ex-factory with a corrosion protection packaging (corrosion protection film).

The active substance which leaks from the corrosion protection film into the interior drops onto the metal surface and forms a separating layer between the material and electrolyte (water).

Note

When storing Rexroth axial piston units, do not remove the corrosion protection film before no independent corrosion protection is provided.

If the film is damaged or opened the active substance enters the immediate environment; the corrosion protection capability has then been destroyed. For this reason seal any openings in the film immediately.

The film is solely approved for corrosion protection of the axial piston unit.

If the axial piston unit is to be stored for an extended period or removed from the machine or system and not built in again straight away, it must be conserved against corrosion for the duration of storage.

The storage areas must be free from corrosive material and vapor. The professional storage of the axial piston unit must be inspected occasionally.

The following instructions only refer to units which are operated with a mineral-oil based hydraulic fluid. Other hydraulic fluids require conservation methods that are specifically designed for them. In such a case contact Rexroth.

https://truckmanualshub.com/

When storing axial piston units the following instructions must be adhered considering the external and internal corrosion protective measures. The axial piston unit may not be stored under conditions that are less favorable than those stated in the table.

Prepare the axial piston unit for storage according to the following specifications:

Storage conditions	Storage period	
	Up to 12 months	12 to 24 months
	Protective method	
Solid, dry, constantly temperate room	Discharge the axial piston unit and seal all connections airproof. Pack the axial piston unit airproof in a corrosion protection film. (Standard protection method)	Discharge the axial piston unit and fill with approx. 10 to 20 ml of the corrosion protection VCI 329. Seal all connections airproof. Pack the axial piston unit airproof in a corrosion protection film.
Dry room, maximum temperature difference <10 °C	Discharge the axial piston unit and fill with approx. 10 to 20 ml of the corrosion protection VCI 329. Seal all connections airproof. Pack the axial piston unit airproof in corrosion protection film and additionally in a wooden crate.	

Note The corrosion protection VCI 329 is only compatible with mineral oil.

4.10 Disposing the axial piston unit

Note the following points in case of scrappage:

- Drain all hydraulic fluid from the axial piston unit
- Professional disposal of fluid residue according to the manufacturer's specifications and valid laws
- Professional disassembly and separation according to cast parts, steel, nonferrous metals, electronic waste, seals and delivery for recycling at a **specialist company**

The axial piston unit does not contain any pollutants.

Disposal

When disposing of the axial piston unit always observe the local regulations.

https://truckmanualshub.com/

5 Commissioning

This chapter explains how to startup the axial piston unit. Follow the instructions in this chapter if:

- you are starting operation of the axial piston unit for the first time,
- you are going to operate the axial piston unit again after having had it repaired,
- you are going to operate the axial piston unit after a standstill with an empty suction line, or
- you are going to operate the axial piston unit again following an extended idle period (> 6 months).

Note: The axial piston unit is a component within the meaning of Machine Directive 98/37/EG, which is used for installation in a machine or system. Commissioning is **prohibited** unti it is determined that the machine or system, in which this product is installed, complies with the regulations of the EU directives and all other relevant guidelines.

Observe the following safety instructions for commissioning:

⚠ DANGER!

Danger to life

Working in the danger zone of a machine or system represents a danger for life and physical condition.

- Eliminate all potential sources of dangers on the machine or system.
- Nobody may stand in the machine's or system's danger zone.
- The emergency stop button for the machine or system must be within reach.
- Always follow the instructions of the machine or system manufacturer for commissioning.

⚠ CAUTION

Risk of damage

Contamination of the hydraulic fluid may lead to increased wear and malfunctions. In particular solid contaminants in the suction line such as, e.g. welding beads and metal shavings may damage the axial piston unit.

- Pay attention to utmost cleanliness when performing commissioning.

⚠ CAUTION

Risk of damage

An commissioning or a restart without or with insufficient hydraulic fluid filling in the housing area will lead to damage or immediately destroy the power unit.

- Make sure that during commissioning or restarting of a machine or system the entire housing area of the axial piston unit and the suction and working lines are filled with hydraulic fluid and remain filled throughout the operation.

Note

When performing commissioning of the axial piston unit, observe

- the basic safety instructions on page 7 of these operating instructions,
- the details for commissioning in the product-specific operating instructions for your axial piston unit (where available),
- the VDI-guidelines for commissioning and maintenance of hydraulic systems VDI-3027 as well as the CETOP proposals.

https://truckmanualshub.com/

5.1 Preparations

Before commissioning of the axial piston unit, you should take all necessary precautions and have all required equipment ready.

Tool required

You will require the following tool:

The installation drawing contains the dimensions for all connections on the axial piston unit. Please observe also the instructions of the manufacturers for the other hydraulic components when selecting the required tool.

Pressure fluid required

You will require an authorized hydraulic fluid:

The machine or system manufacturer can provide you with precise details on the hydraulic fluid. Details on minimum requirements on mineral-oil based hydraulic fluids, environmentally compatible hydraulic fluids or HF hydraulic fluids for the axial piston unit are available in the Rexroth publications RE 90 220, RE 90 221 or RE 90 223.

5.2 Filling of the axial piston unit

Before you can operate the axial piston unit, it must be completely filled with hydraulic fluid. Therefore we recommend the use of a charging unit.

To ensure the functional reliability of the axial piston unit, the purity class 20/18/15 according to ISO 4406 at least is necessary for the hydraulic fluid. At very high hydraulic fluid temperatures (+90 °C to maximum +115 °C) the purity class 19/17/14 according to ISO 4406 is at least necessary. If these classes cannot be adhered please contact Rexroth. Regarding permissible temperatures, see technical data sheet.

When filling the axial piston unity observe the following safety instructions:

⚠ DANGER!

Risk of toxication and injury

Contact with hydraulic fluids may damage your health (e.g. eye injuries, skin and tissue damage, toxications when inhaling).

- Check the lines for signs of wear or damage before each commissioning.
- Wear protective gloves, safety glasses and suitable working clothes.
- If however hydraulic fluid does enter the eyes or penetrates your skin consult a doctor immediately.
- When dealing with hydraulic fluids always observe the safety instructions issued by the hydraulic fluid manufacturer.

⚠ DANGER!

Fire hazard

Hydraulic pressure fluid is flammable.

- Do not subject the axial piston unit to naked flame.

⚠ CAUTION

Risk of damage

The axial piston unit must be filled with hydraulic fluid during operation and at standstill.

- During initial start-up make sure that the axial piston unit is supplied with sufficient hydraulic fluid. In the event of unusual noise or vibration development switch off the machine or system immediately and check whether the axial piston unit is filled with hydraulic fluid.

https://truckmanualshub.com/

Note

When filling the hydraulic system note the following:

- the axial piston unit may not be operated when it is being filled,
- the lines must also be filled,
- information on the optimum filling position of your axial piston unit is available in the product-specific operating instructions.

Procedure

Proceed as follows when filling the axial piston unit with hydraulic fluid:

1 Bleed using the highest port.

2 Make sure that all other ports are connected with pipes or sealed according to the general connection plan.

3 Fill the axial piston unit with hydraulic fluid.

4 Seal the port again.

https://truckmanualshub.com/

5.3 Testing the direction of rotation of the engine

Make sure that direction of rotation of the axial piston unit matches the details on the name plate (see also "4.3 Preparing axial piston unit for assembly" on page 17). To do so rotate the engine briefly at lowest rotational speed (jog).

5.4 Testing hydraulic fluid supply

The axial piston unit must always have a sufficient supply of hydraulic fluid. For this reason, it is not essential that the hydraulic fluid supply is given at initial start-up.

If you test the hydraulic fluid supply, perform a constant check on the noise development and check for any leakage oil discharge. If the axial piston unit gets louder (cavitation) or the leakage fluid is discharged with bubbles, it will indicate that the axial piston unit is not being supplied with sufficient hydraulic fluid. Instructions on troubleshooting are available on page 31.

To test the hydraulic fluid supply:

1 Allow the engine to run at the lowest rotational speed for roughly one minute.
The axial piston unit must be operated without load.
Pay attention to leakage and noise.

2 Check the axial piston unit's leakage fluid line here.
The leakage fluid should not contain any bubbles.

3 Check the suction pressure at port "S" of the axial piston unit.
The permissible values are available in the technical data sheet.

https://truckmanualshub.com/

5.5 Performing functional test

Once you have tested the hydraulic fluid supply, you must perform a functional test on the system. The functional test should be performed according to the details of the machine or system manufacturer. Pay attention to noise development and leakage fluid. Please note that brief changes in noise development are perfectly normal.

The axial piston unit is checked for functional capability before delivery according to the technical details. During commissioning it must be ensured that the axial piston unit was installed into the system on schedule.

⚠ DANGER!

Danger in case of incorrectly connected machine or system

Any change of the connections will lead to contrary functions (e.g. lift instead of lower) and thus represents a corresponding danger to persons and equipment.

- When connecting hydraulic cylinders, pumps, motors and valves check the specified hydraulic piping.

⚠ DANGER!

Hot surfaces

The axial piston unit heats up during operation. The solenoids in the pump also heat up during operation. Touching the axial piston unit or the solenoids may lead to severe burn injuries.

- Allow the axial piston unit to cool down and protect yourself against burn injuries by wearing heat-resistant gloves and protective clothing.

5.6 Performing flushing cycle

Rexroth recommends a flushing cycle for the general machine or system. This serves to remove any contaminants from the machine or system.

The flushing cycle can, e.g. by using an additional flushing unit.

Note

The axial piston unit must be operated without load during the flushing cycle.

Note

To ensure that the hydraulic fluid has the correct purity class note the following instructions:

- The finer the filtration the better the cleanliness class of hydraulic fluid reached, the longer the life of the axial piston machine.
- To ensure the functional reliability of the axial piston unit, the purity class 20/18/15 according to ISO 4406 at least is necessary for the hydraulic fluid.
- At very high hydraulic fluid temperatures (+90 °C to maximum +115 °C) the purity class 19/17/14 according to ISO 4406 at least is necessary.
- If these classes cannot be adhered please contact Rexroth.

https://truckmanualshub.com/

https://truckmanualshub.com/

6 Fault diagnosis

The following table may assist you diagnosing a fault. The table does not claim to be complete.

The typical features and faults form the columns in the table and the potentially affected parts on the axial piston unit and machine or the system form the rows. The individual table cells describe the cause and remedy for each respective fault (column) on each part (row).

Specific instructions on troubleshooting your axial piston unit are available in the product-specific operating instructions.

Practically, problems that are not considered here may also occur.

https://truckmanualshub.com/

Components	Irregular noise	No or insufficient flow
Output elements	Mechanical parts faulty on output side (coupling seat, misalignment etc.)	Speed transfer or travel transfer faulty
Hydraulic cylinder/ hydraulic motor	Insufficient rotation or speed, overhauling processes (hydraulic motors is driven by a machine to a pump), braking noise, faulty inner seal, damage on the power unit	Internal losses, leaking boots, dirt-specific wear
Flow control valves	Air inclusions, differential pressure too small, vibrations	Control cover clogged up, throttle-type check valve adjusted
Pressure valves/ post-suction valves (secondary)	Vibration or rattling indicates air inclusions or faulty damping, wrong pressure setting, insufficient post suction, opening pressure of post-suction valves too high, cavitation on oil motor	Adjustment too low, valve seat damaged, jammed through contamination
Directional-control valves	Actuation faulty, configuration fault (nominal width), throttling points	Wrong or inaccurate slide position, negative overlap, control pressure too low - fails to interconnect
Pressure valves (primary)	Vibration or rattling indicates air inclusions or faulty damping, wrong pressure setting	Adjustment too low, valve seat damaged, jammed through contamination
Hydraulic accumulator	Accumulator bubble faulty, nitrogen filling penetrates hydraulic circuit, faulty seals, inflow or discharge rates too high Accumulator in connection with throttle losses could provoke vibration-capable systems	Nitrogen filling pressure too low
Return lines	Line does not end below the oil, turbulence towards suction side, no separation, mechanical vibrations, insufficient fastening	-
Filter	Insufficient fastening, mechanic vibrations	For high-pressure filters: The insert is contaminated, bypass valve is jammed
Cooler	Air-oil cooler-valve noise, mechanic vibrations	-
Pressure lines	Inapropriate fastening, impact sound, pipe cross section too small	Screw connection leaky, cross section too small, increase of the throttling point pressure
Engine	Wrong rotating direction, rotation speed too high, bearing play, bearing damage	Rotation speed too low
Coupling	Coupling seat faulty, misalignment, flexible elements defective	Rotation speed transfer faulty
Variable displacement pump	Rotation speed too high, air intake, cavitation, mechanic damage	Power comparison of the engine pump (do outputs match each other?), pump fails to swivel out, inner leakage, dirt-specific wear (stroke limitation on a too small swivel angle)
Overflow-oil line	Insufficient fastening	-
Suction conditions	Insufficient suction cross-section, suction height too high, diversions, cross-section constrictions, suction line leakage, air bubbles, tank stop valve not open, resistance at filter	Suction behavior interrupted, insufficient suction cross section, suction height too high, diversions, cross section constrictions, suction line leaky
Container hydraulic fluid	Oil level too low, oil foaming, water in oil, cold operating material, viscosity too high, ineffective tank ventilation	Oil level too low, ineffective tank ventilation

https://truckmanualshub.com/

Components	No or insufficient pressure	Pressure / flow fluctuation
Output elements	Torque transfer faulty	Output elements defective
Hydraulic cylinder/ hydraulic motor	Inner or external leakage, dirt-specific wear, power unit damage	No or insufficient ventilation, faulty boots, stick-slip effect, alternating load directions, hydraulic motor absorption quantity too small or too large
Flow control valves	-	Air inclusions, differential pressure too small, flow control valve contaminated, check valve faulty
Pressure valves/ post-suction valves (secondary)	Adjustment too low, valve seat damaged, spring rupture, foreign matter in valve seat	Alternating back pressure, pressure valve set too small, valve seat damage
Directional-control valves	Wrong position, mechanicaly jammed, reset spring fracture, leakage dummy plugs separated	Flow forces influence the slider activity and opening paths, positioning fault, unstable position, control pressure fluctuations
Pressure valves (primary)	Adjustment too low, valve seat damaged, spring rupture, foreign matter in valve seat	Alternating back pressure, pressure valve set too small, valve seat damage
Hydraulic accumulator	Nitrogen filling pressure too low or too high: Stored output insufficient	Vibration-capable system between hydraulic accumulator, pressure and flow-control valves and pumps
Return lines	-	-
Filter	For high-pressure filters: The insert is contaminated, bypass valve is jammed	-
Cooler	-	-
Pressure lines	Line breakage, screw connections not tight, display or testers faulty	Incorrectly ventilated, display or tester faulty, wrong display
Engine	Wrong rotating direction, drive output too low, electric motor incorrectly connected.	Engine irregularity too large, for diesel motors idling speed too low, frequency fluctuations for electric motors
Coupling	Torque transfer faulty	-
Variable displacement pump	Power comparison of engine pump (do outputs match?), pump fails to swivel out, inner leakage, dirt-specific wear power-unit damage (stroke limitation on a too small swivel angle),	Air suction, inner leakage, dirt-specific wear, power-unit damage, controller unstable. For motor compression or for temporary overload interrupted control behavior as consequence of dirt jamming. Motor compression through excess output consumption on power take-off, controller fluctuates
Overflow-oil line	-	-
Suction conditions	Suction behavior interrupted, insufficient suction cross section, suction height too high, diversions, cross section constrictions, suction line leakage, air inclusions	Suction behavior interrupted, insufficient suction cross section, suction height too high, diversions, cross section constrictions, suction line leakage, air inclusions
Container hydraulic fluid	Oil level too low, viscosity hydraulic fluid too low, thus causing high leakages, gap leakages	Air bubbles, turbulence from return to suction, wrong tank design, no sealing between return and suction chamber

https://truckmanualshub.com/

Components	Pressure fluid temperature too high
Output elements	–
Hydraulic cylinder/ hydraulic motor	Inner Leakage, gap leakages, wear damages, hydraulic motor and cylinder configuration too small
Flow control valves	Wear, gap leakages
Pressure valves/post-suction valves (secondary)	Setting too high: Increase in gap leakages in all components, increased leakage oil attack. Load rhythm by machine too high. Setting too low: Output drop, thermal attack, cone valve jams when opened
Directional-control valves	Wrong position, throttle losses, measurement too short, cross section too small, wear
Pressure valves (primary)	Setting too high: Increase in gap leakages in all components, increased leakage oil attack. Load rhythm by machine too high. Setting too low: Output drop, thermal attack, cone valve jams when opened
Hydraulic accumulator	–
Return lines	Cross section too narrow
Filter	Bypass valve opening pressure too high
Cooler	Measurement too small, cooling effect too low, room or ambient temperature too high, external ventilation or water supply interrupted, surface contaminated, bypass valve open
Pressure lines	Cross section too narrow, throttling through insufficient bending radii
Drive motor	Rotation speed too high
Coupling	–
Variable displacement pump	Inner leakage, wear-related damage
Overflow-oil line	High temperature as consequence of greater leakage indicates expected breakdown in a component
Suction conditions	–
Container hydraulic fluid	Wrong viscosity, oil filling too low, tank too small. In event of major local heating lubricity, pressure load and aging resistance of pressure fluid is impaired. Component wear, gap leakages, heating

https://truckmanualshub.com/

7 Servicing

Regular cleaning is necessary to maintain the axial piston unit. Visible coarse dirt must be removed. In particular, sensitive and important components such as solenoids, valves and displays must be kept clean.

CAUTION

Risk of damage

When cleaning, sealings may be destroyed and water may penetrate into the air bores.

- Do not point the high-pressure cleaner at sensitive components such as, e.g. shaft sealing ring, electrical connections and electrical components.
- Do not use any corrosive substances for cleaning.

7.1 Maintenance

Usually axial piston units are maintenance-free units. However the service life of axial piston units depends also on the quality of the hydraulic fluid. For this reason Rexroth recommends that the hydraulic fluid has to be changed at least once a year or every 2000 operating hours or that it has to be analyzed by a laboratory.

The service life of the hydraulic fluid is depends essentially on the machine or system. Thus, the machine or system manufacturer is responsible for defining the maintenance periods.

Changes in the leakage flow indicate wear in the axial piston unit. For this reason Rexroth recommends that the leakage fluid quantity has to be measured and documented at regular intervals. This will enable unscheduled wear in the axial piston unit to be detected at an early stage and thus enable the cause to be rectified quickly.

7.2 Inspection

To enable the axial piston unit to run for a long time and reliably, Rexroth recommends a regular inspection of the hydraulic system and that the following operating conditions have to be documented:

- Operating temperature at a comparable charge state (weekly)
- Hydraulic fluid status (daily)
- Hydraulic fluid quality (after 2000 operating hours)

The axial piston unit itself should be checked regularly for:

- Leakages (daily)

  Early recognition of losses in hydraulic fluid can help to find faults on the machine or system and to clear them. For this reason Rexroth recommends that the axial piston unit and machine or system has always to be kept in a clean condition.
- Unusual noise development (daily)

  Unusual noise development may have various reasons. The "6 Fault diagnosis" chapter on page 31 will help you in searching for possible fault causes.
- Loosened fixing elements (monthly)

  All fixing elements have to be checked when the system is switched off, depressurized and cooled down.

Systematic documentation of the operating conditions (such as, e.g. increasing operating temperatures) will enable you to detect increased wear at an early stage and to implement the necessary countermeasures.

https://truckmanualshub.com/

⚠ WARNING **Risk of damage**

The axial piston unit may only be operated with the technical data as listed in the order confirmation.

- If the axial piston unit deviates from the permissible operating parameters, shutdown the system and implement measures for adjustment.

7.3 Repair:

Repairs of the axial piston unit may only be performed by authorized, skilled and instructed staff. Rexroth offers a comprehensive range of services for the repair of Rexroth axial piston units.

Only original Rexroth service parts may be used for repairs of Rexroth axial piston units.

Tested parts and pre-assembled original Rexroth modules enable successful repairs with the minimal expenditure of time.

The list of service parts for axial piston units are order specific. When ordering service parts please quote the material and serial number of the axial piston unit as well as the material numbers of the service parts.

Repair contact

Please address all requests on repair work to the Service department at the axial piston unit's manufacturing plant. Details on the manufacturing plant are available on the axial piston unit's rating label.

Bosch Rexroth AG
Hydraulics
Product Segment Axial Piston Units
Elchingen plant
Glockeraustrasse 2
89275 Elchingen, Germany

Telephone +49 (0) 73 08 82-0
Fax +49 (0) 73 08 72 74

service.elchingen@boschrexroth.de

Bosch Rexroth AG
Hydraulics
Product Segment Axial Piston Unit
Horb plant
An den Kelterwiesen 14
72160 Horb am Neckar, Germany

Telephone +49 (0)74 51 - 92 0
Fax +49 (0)74 51 - 82 21

service.horb@boschrexroth.de

Information on contacts in the various countries is available at the following Internet address.

www.boschrexroth.com/addresses

https://truckmanualshub.com/

Appendix A: Project planning information

This annex contains instructions of additional components that are required to complete the hydraulics system. Select these components together with the respective manufacturers. Only some conventional instructions are listed below. Rexroth is not responsible of correctness and completeness in individual cases.

Project planning instructions are available for the following topics:

- Selection of hydraulic fluid
- Tank design
- Filter design
- Cooler
- Hose lines and piping

Selection of hydraulic fluid

The hydraulic fluid in the hydraulic circuit must be chosen very carefully already at project planning the drive to ensure failure-free and efficient operation. Often not all hydraulic fluid requirements can be fulfilled constantly. Therefore, a concrete consideration, which should be performed together with the hydraulic fluid supplier, is advisable.

Please note also the specifications in the "Mineral-oil based hydraulic fluids" (RE 90 220), "Environmentally-compatible hydraulic fluids HEES, HEPG, HETG for axial piston units" (RE 90 221) and "Axial piston units for operation with HF hydraulic fluids" (RE 90 223).

The viscosity or viscosity temperature characteristics are of primary importance, whereas the density and pour point must be noted, too.

Mineral-oil based fluid grades are suitable for the usage with axial piston pumps and motors. Their suitability is also dependent on the following factors:

- Wear properties
- Viscosity temperature characteristics
- Oxidation and corrosion protection
- Material compatibility
- Air separation properties (LAV)
- Water separation properties (WAV)

Wear properties and viscosity

Details on wear properties and the viscosity of hydraulic fluids are available in the "Mineral-oil based hydraulic fluids" (RE 90 220), "Environmentally-compatible hydraulic fluids HEES, HEPG, HETG for axial piston units" (RE 90 221) and "Axial piston units for operation with HF hydraulic fluids" (RE 90 223).

https://truckmanualshub.com/

Tank design

Due to the heat balance the tank has to be large enough.

The following applies for an initial estimate of the tank volume V (in l):

- for mobile installations:
  $V = 0.25...0.4 \cdot Q + EZ$, whereas
  - Q is the counter value of the pump suction volume (in l/min) and
  - EZ is the sum of the filling volumes of all cylinders (in l).
- for static installations:
  $V = 3...5 \cdot Q$

You should also consider an air space of 10 to 15 % of the hydraulic fluid volume.

Note

Attach a sign at an easily visible point on the tank, which identifies the tank as a hydraulic fluid tank. The specification, volume and hydraulic fluid change intervals should also be specified. Add a reference to the filter change intervals and the designation of the interchangeable filter cartridges.

Make sure that the tank filling process can only be performed using a permanently fixed filter. Usually, new hydraulic fluid from new barrels is contaminated.

Ground clearance

Make sure that the ground clearance is at least 15 cm, to ensure that a good heat dissipation is given.

Drainage options

Due to temperature fluctuations condensation water will be formed in the tank. It has to be possible to collect this water and contamination at the lowest point of the tank. Therefore, incline the base and provide a drainage option at the lowest point.

Stabilizer plates

Provide stabilization plates, which serve to avoid turbulent flows in the tank and which promote dirt depositing and air separation.

Air filters

Make sure that the planned air filters have at least the same filter purity as the installation filters.

Hydraulic fluid level control

Make sure that a hydraulic fluid level control is assemblied at an easily visible position. Hydraulic fluid, which escapes through a leaking component, is always contaminated and may not be returned to the tank. Perform a corresponding augmentation in good time so that the lowest hydraulic fluid level is never reached.

Suction line

Suction lines should be routed so that they are in a position of approx. 5 cm over the base of the tank or in case of a lateral exit be this far away from the base of the tank.

The entry diameter should be enlarged by an inclined gate and an alignment to the oil-stabilized side should be made.

A suction line that ends too close to the surface may enable air to be aspirated. Therefore note that there is also a temporary removal of hydraulic fluid by cylinders as well as a possible inclined position of the machine when determining the lowest hydraulic fluid level.

The negative pressure may not drop below 0.8 bar (abs.) (see also the respective data sheet).

Leakage fluid line

Route the junction of the leakage fluid in the tank below the minimum hydraulic fluid level. Pay attention to a sufficient cross-section while integrating several leakage fluid lines into a collecting pipe.

https://truckmanualshub.com/

Filter design

The purity of the hydraulic fluid and the service life of the hydraulic system are directly associated. Constant filtering of the hydraulic fluid and additional measures (e.g. flushing circuit during commissioning or after assembly work on the system) are therefore particularly important.

The filter manufacturer has to account for the filter function and the compliance with the required purity level.

Required purity level

Temperature range	< 90 °C	90 °C to 115 °C
DIN ISO 4406	20/18/15	19/17/14

Accessibility

Make sure that the filters can be accessed ideally to ease the maintenance work.

Equip the filter where possible with a contamination display and a pressure-resistant filter element.

Cooler

Usually, air-oil or water-oil cooling is sufficient in the leakage fluid lines. The cooling load conforms with the load and speed of the hydraulic components. Thereby, load rhythm and the radiating surface are very important. Check the temperature balance by measuring the temperature during commissioning.

Arrange the air-oil heat exchanger so that they are not in the area of the hot exhaust air of the main engine or the working machine.

Provide a cooler bypass for the protection of the oil cooler during cold starts. This can be realized by installing a check valve or a therm-bypass-valve.

Please attend especially to a regular dedusting of the fins of air-oil heat exchangers.

https://truckmanualshub.com/

Hose lines and piping

Hose lines are used in hydraulics systems to connect tie-in points that move relative to each other. Hose lines also serve to dampen the transmission of structure-borne sound.

We would like to point out that the installation or unit manufacturer is responsible for ensuring that the design and installation of hose lines and piping is conducted conform to standards. In particular, the installation or unit manufacturer must ensure that the hose lines and fittings are designed to match the maximum dynamic pressures of the pumps and motors, which are specified in the order confirmation, evident from dynamic measurements or which may occur at the operator.

In this context we would like to refer to the EN norms for hoses and hose lines according to DIN EN 853–857 and their installation according to the safety regulations of the BIA in ZH 1/74.

Furthermore, the following information apply for the connections:

- To achieve favorable noise values decouple all connecting lines (suction, pressure, leakage fluid connections) from the tank using flexible elements.
- Route any leakage fluid back to the tank so that as little leakage fluid pressure (= case pressure) as possible is generated.

https://truckmanualshub.com/

Index

A

About these instructions 3

C

Caution
- Electrostatic discharge of proportional solenoids 35
- Impact or shock-type forces on drive shaft 18
- Installing lines and hoses free of tension 21
- Minimum permissible suction pressure 21
- Hydraulic fluid 16, 27
- When cleaning 35

Commissioning 25
- Before starting 26
- Performing functional test 29
- Performing purging run 29
- Hydraulic fluid required 26
- Testing engine direction of rotation 28
- Testing hydraulic fluid supply 28
- Tool required 26

Cooler 39

D

Danger
- Avoiding hazards 3
- Contact with hydraulic fluids 26
- Electric shock 22
- Fire 27
- Hazard zones on machine or system 25
- Hot surfaces 29
- Improperly connected machine or system 29
- Shutting down machine or system 23

Disassembling axial piston unit 23
Direction of rotation 17
Disposal 24

F

Fault diagnosis 31
Filling axial piston unit 26
Filter design 39

H

Hose lines 40
Hydraulic fluid
- Additional documents 4
- Selection 37

I

Important documents 4
- Installation drawing 4

Inspection 35
Installation
- Assembling axial piston unit 19
- Completing assembly 20
- Disassembling axial piston unit 23
- Disposing of axial piston unit 24
- Installation on gearbox 20
- Installation with flexible coupling 19, 20
- Notes on unpacking 17
- on gearbox 20
- Preparing axial piston unit for assembly 17
- Storage preparation 23
- with coupling 20

Installation drawing 4

M

Maintenance 35
- Inspection 35
- Repair 36
- Service 35

N

Note
- Commissioning of a component 26, 27, 29
- Connections 21
- Corrosion protection 23
- Corrosion protection VCI 329 24
- Project planning 37
- Sealing rings and sealing areas 21
- Unpacking 17

O

Oil selection 37

P

Piping 40
Hydraulic fluid
- Filling axial piston unit 26

Problem solution 31
Project planning notes 37
Purging run 29

Q

Qualification 5

R

Recycling 24
Repair 24, 36
Requirements
- General 5
- Maintenance personnel 5

https://truckmanualshub.com/

S

Safety
Hazard markings 6
Pictograms 6
Scrappage 24
Service 35
Storage
Preparing axial piston unit 23
Suction pressure 16

T

Tank design 38
Troubleshooting 31

U

Unpacking 17

W

Warning
Do not leave permissible operating area 36
Environmental pollution through hydraulic fluids 9

https://truckmanualshub.com/

https://truckmanualshub.com/

Rexroth
Bosch Group

Bosch Rexroth AG
Hydraulics
Product Segment
Axial Piston Units
Elchingen plant
Glockeraustrasse 2
89275 Elchingen, Germany
Telephone +49 (0) 73 08 82-0
Fax +49 (0) 73 08 72 74
info.brm-ak@boschrexroth.de
www.boschrexroth.com/brm

Bosch Rexroth AG
Hydraulics
Product Segment
Axial Piston Units
Horb plant
An den Kelterwiesen 14
72160 Horb, Germany
Telephone +49 (0) 74 51 92-0
Fax +49 (0) 74 51 82 21
info.brm-ak@boschrexroth.de
www.boschrexroth.com/brm

© All rights reserved by
Bosch Rexroth AG, also for the event of registration of industrial property rights. All powers of disposition, such as reproduction and forwarding rights with us.

The data specified above only serves to describe the product. The information we have provided cannot be used as evidence of a particular aspect or of suitability for a particular purpose. This information does not release the user from his/her responsibility to perform his/her own assessments and tests. Please note that our products are subject to the natural processes of aging and wear.

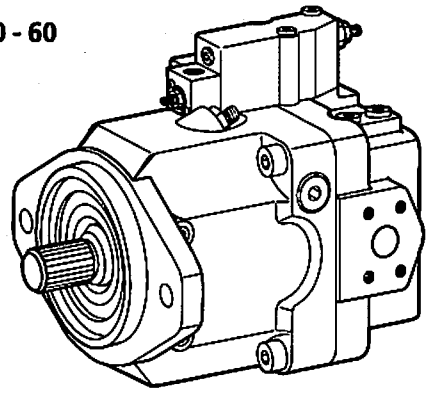
Subject to change.

Printed in Germany
RE 90 300-B/05.05

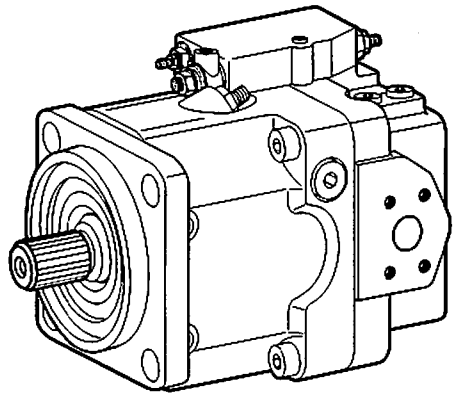
https://truckmanualshub.com/

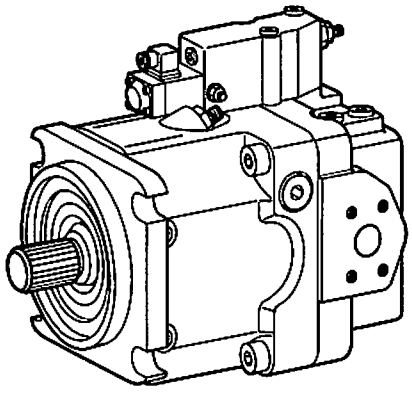
engineering
mannesmann
Rexroth

NG / Size 40 - 60



NG / Size 75 - 95





NG / Size 130

R

RDE 92500-02-R / 03.01
ersetzt / replaces 09.96

Reparaturanleitung - A11VO 40 - 130 Baureihe 10

Repair instructions - A11VO 40 - 130 Series 10

Brueninghaus
Hydromatik

https://truckmanualshub.com/

HINWEIS

Bezeichnungen, Beschreibungen und Darstellungen entsprechen dem Informationsstand zum Zeitpunkt der Drucklegung dieser Unterlage.

Änderungen können den Service am Produkt beeinflussen, Verpflichtungen entstehen uns daraus nicht.

Methoden und Vorrichtungen sind Empfehlungen, für deren Resultat wir keine Haftung übernehmen können.

BRUENINGHAUS HYDROMATIK- Baugruppen, mit Angabe der Fabrik-Nr. bestellt, sind die Basis guter Reparaturen.

Einstell- und Prüfarbeiten sind bei Betriebstemperatur auf dem Teststand vorzunehmen.

Schutz von Personen und Eigentum ist durch Vorkehrungen sicherzustellen.

Sachkenntnis, die Voraussetzung für jede Service-arbeit, vermitteln wir in unseren Schulungskursen.

NOTICE

Specifications, descriptions and illustrative material shown herein were as accurate as known at the time this publication was approved for printing.

BRUENINGHAUS HYDROMATIK reserves the right to discontinue models or options at any time or to change speci-fications, materials, or design without notice and with-out incurring obligation.

Optional equipment and accessories may add cost to the basic unit, and some options are available only in combination with certain models or other options.

For the available combinations refer to the relevant data sheet for the basic unit and the desired option.

Adjustment and tests have to be carried out on the test bench under operating temperatures.

Protection of personnel and property has to be guar-anteed by appropriate measures.

Expert knowledge, the precondition of any service work, can be obtained in our training courses.

INHALT

Seite/ Page

A11VO

Schnittbild	3-5
Allgemeine Reparaturhinweise	6
Dichtsätze und Baugruppen	7-8
Triebwelle abdichten	9
Reglergehäuse abdichten	10-11
Anschlußplatte,Regler demontieren	12-14
Regler	15-17
Triebwerk ausbauen	18-20
Überprüfungshinweise	21-23
Pumpe montieren	24-28
Montagehinweise für Anziehdrehmomente	29-32
Prüfanweisung A11VO 40-130 LRDS / LRDH	33-43

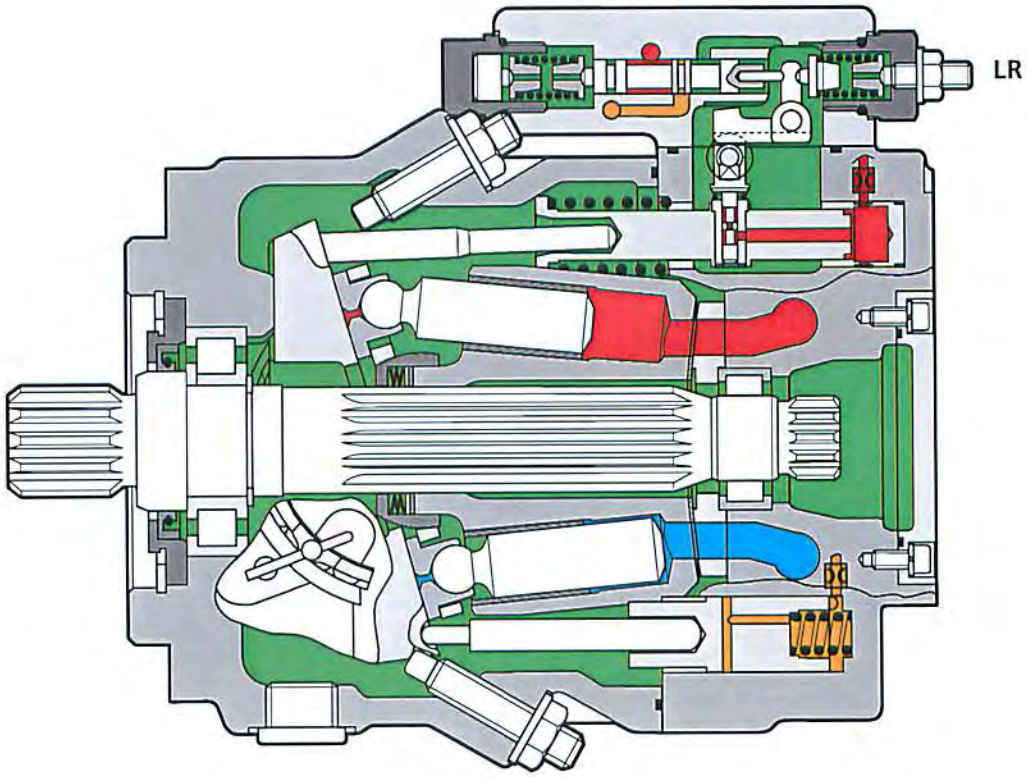
CONTENTS

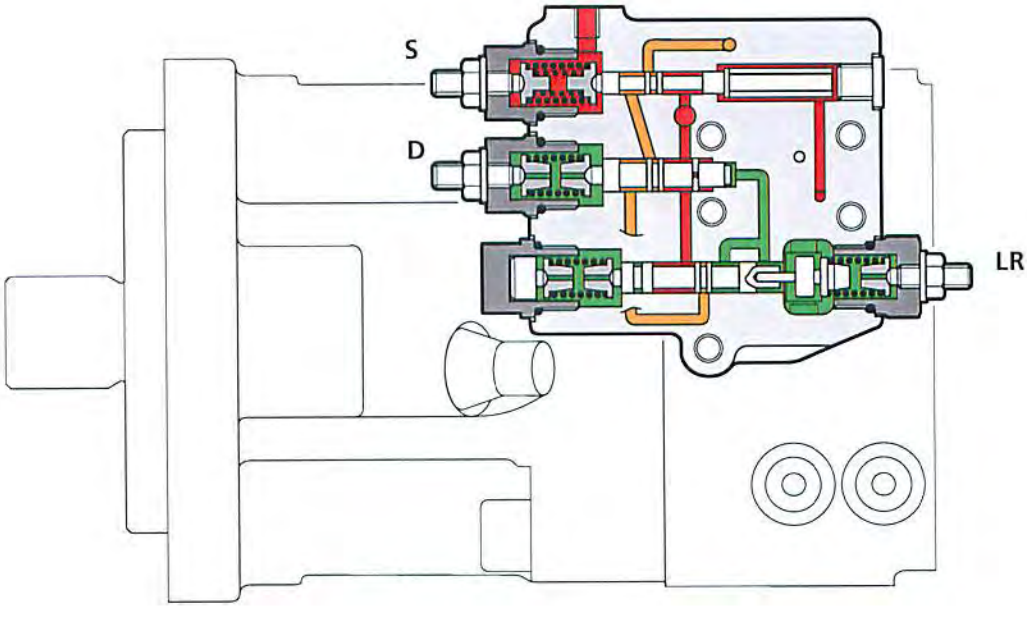
A11VO

Sectional view	3-5
General repair instructions	6
Seal kits and sub-assemblies	7-8
Sealing of the drive shaft	9
Sealing of the regulator housing	10-11
Remove port plate, regulator	12-14
Regulators	15-17
Remove rotary group	18-20
Inspection hints	21-23
Pump assembly	24-28
Assembly guidelines for tightening torques	29-32
Test instruction A11VO 40-130 LRDS / LRDH	33-43

https://truckmanualshub.com/

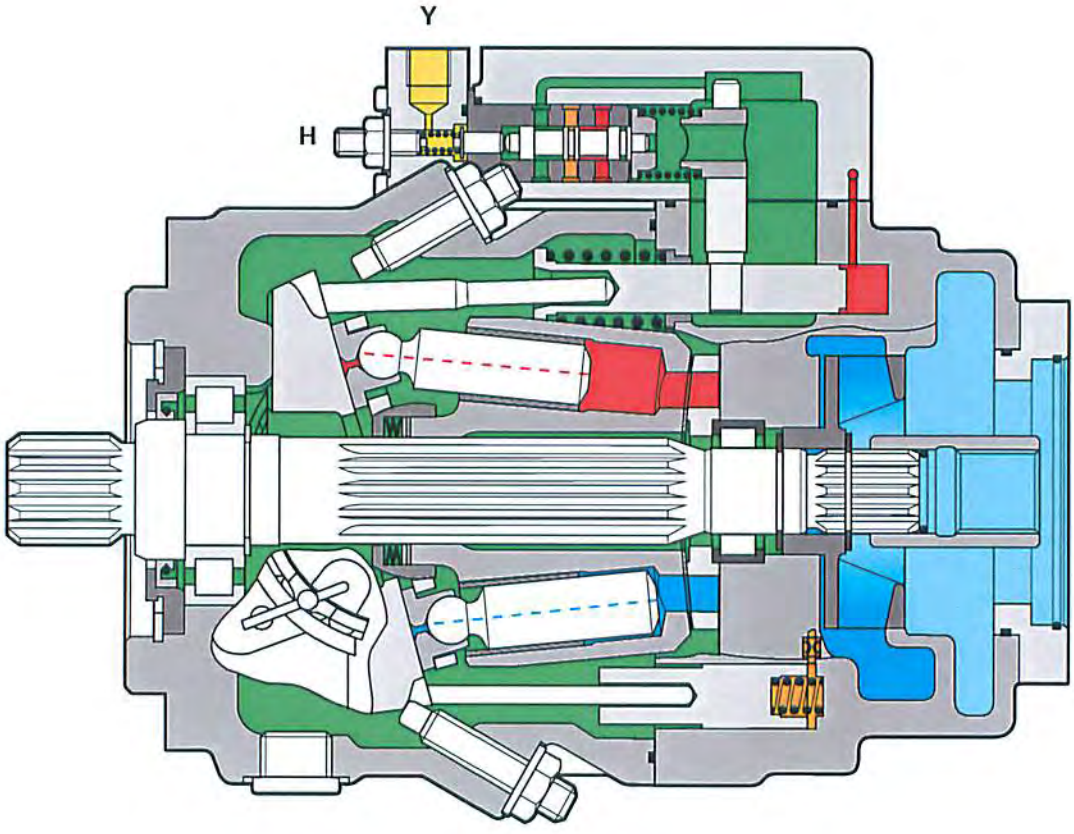
A11VO...LRDS

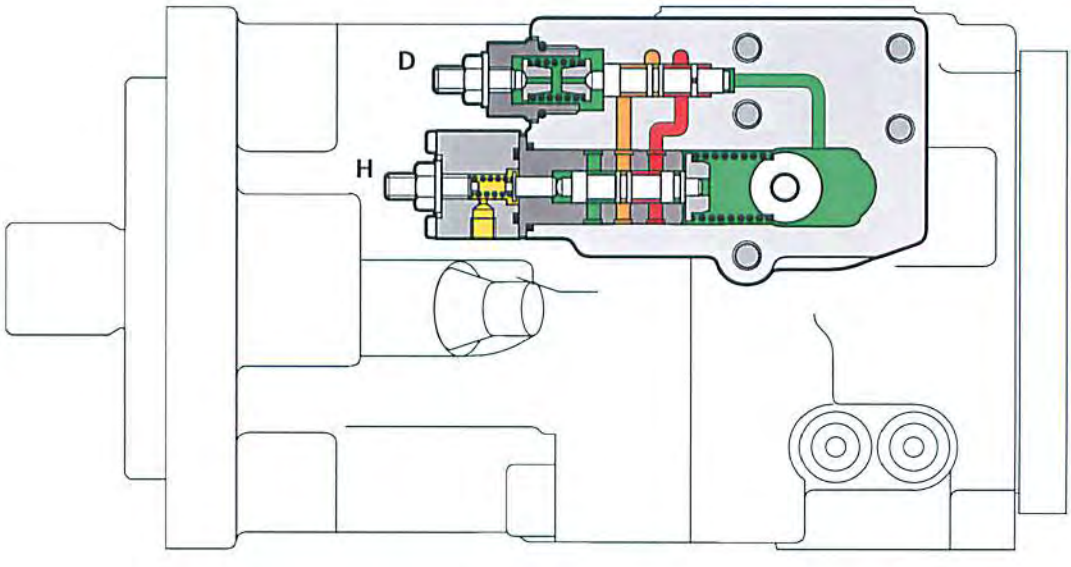




https://truckmanualshub.com/

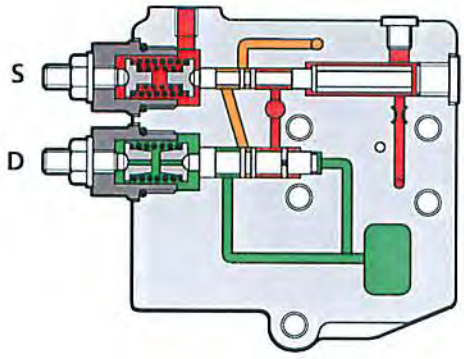
A11VO 130 HD2D
(mit Impeller / with impeller)



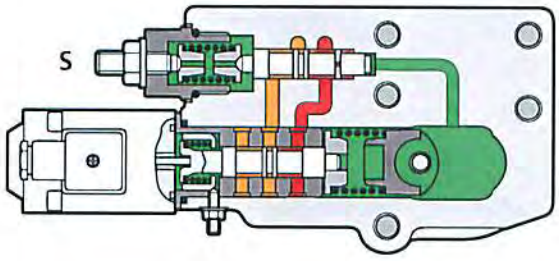


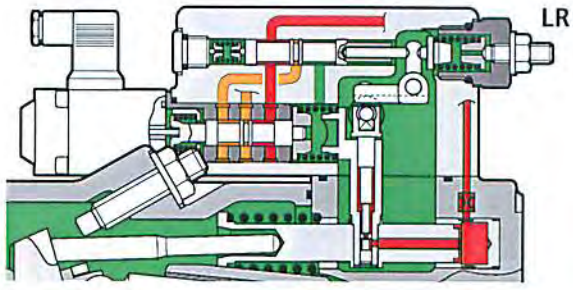
https://truckmanualshub.com/

DRS

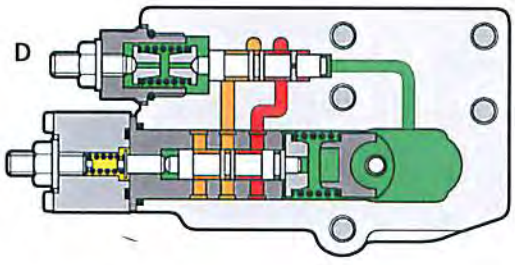


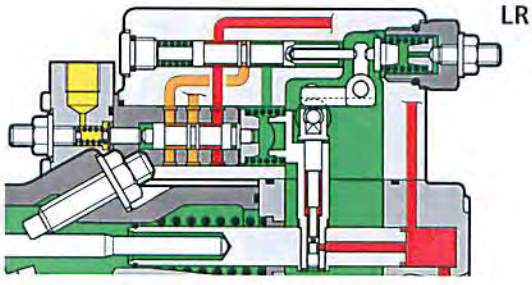
LRDU2



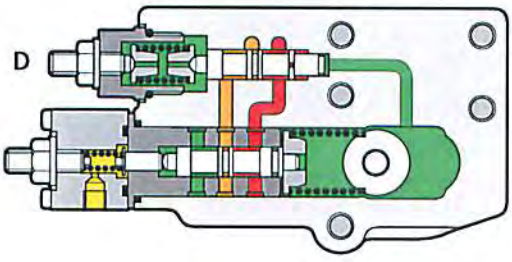


LRDH





EP2D (HD2D)

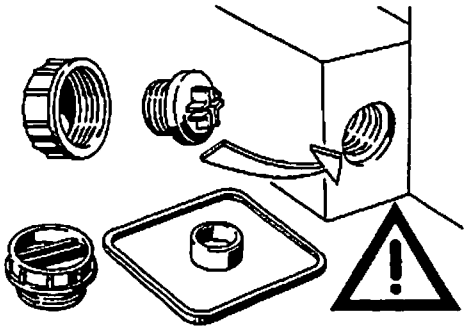


https://truckmanualshub.com/



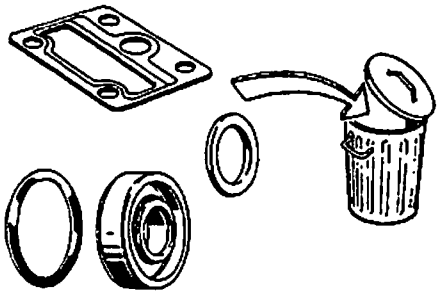
Achtung!
Nachfolgende Hinweise bei allen Reparaturarbeiten an Hydraulikaggregaten beachten!

Attention!
Observe the following notices when carrying out repair work at hydraulic aggregates!



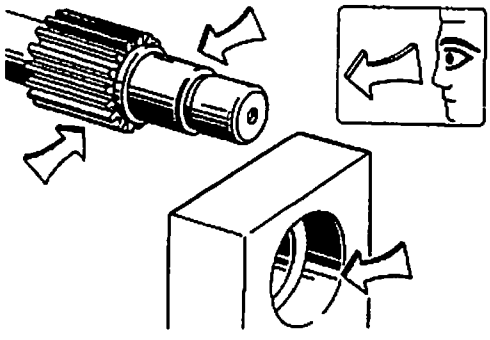
Alle Öffnungen der Hydraulikaggregate verschließen.

Close all ports of the hydraulic aggregates.



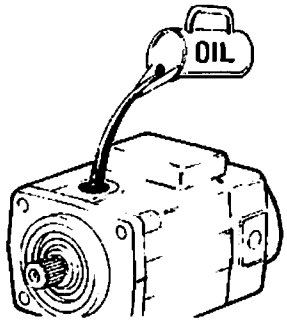
Alle Dichtungen erneuern.
Nur original BRUENINGHAUS HYDROMATIK - Ersatzteile verwenden!

Replace all seals.
Use only original BRUENINGHAUS HYDROMATIK spare parts!



Alle Dicht- und Gleitflächen auf Verschleiß prüfen.
Achtung: Nacharbeiten an Dichtflächen z.B. durch Schleifpapier kann die Oberfläche beschädigen.

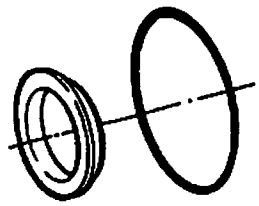
Check all seal and sliding surfaces for wear.
Attention: Rework of sealing area f. ex. with abrasive paper can damage surface.



Hydraulikaggregate vor Inbetriebnahme mit Hydrauliköl befüllen.

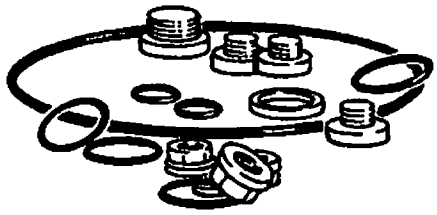
Fill up hydraulic aggregates with hydraulic oil before start-up.

https://truckmanualshub.com/



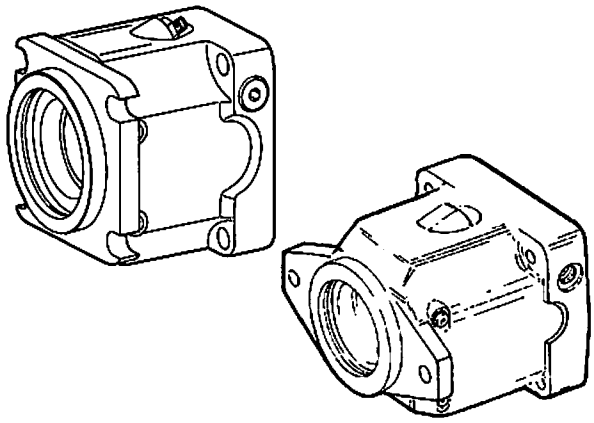
Dichtsatz für Triebwelle.

Seal kit for drive shaft.



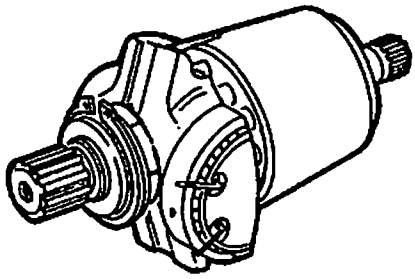
Äußerer Dichtsatz.

External seal kit.



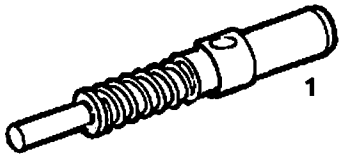
Gehäuse

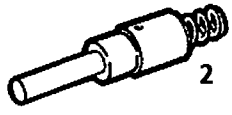
Housing



Triebwerk, komplett.

Complete rotary group.

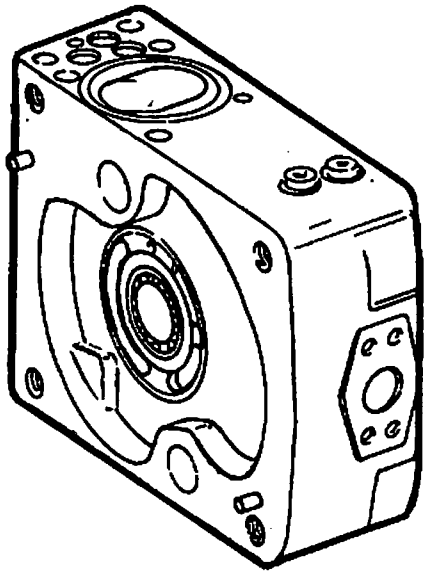




1. Verstellung, klein.
2. Verstellung, groß.

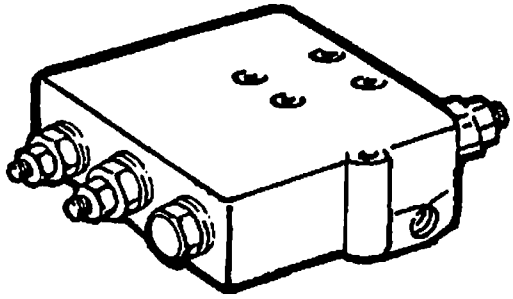
1. Hydraulic control, small size.
2. Hydraulic control, big size.

https://truckmanualshub.com/



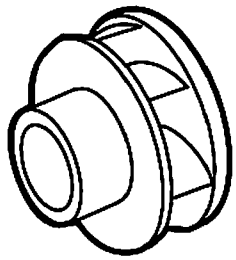
Anschlußplatte

Port plate



Regler, komplett.

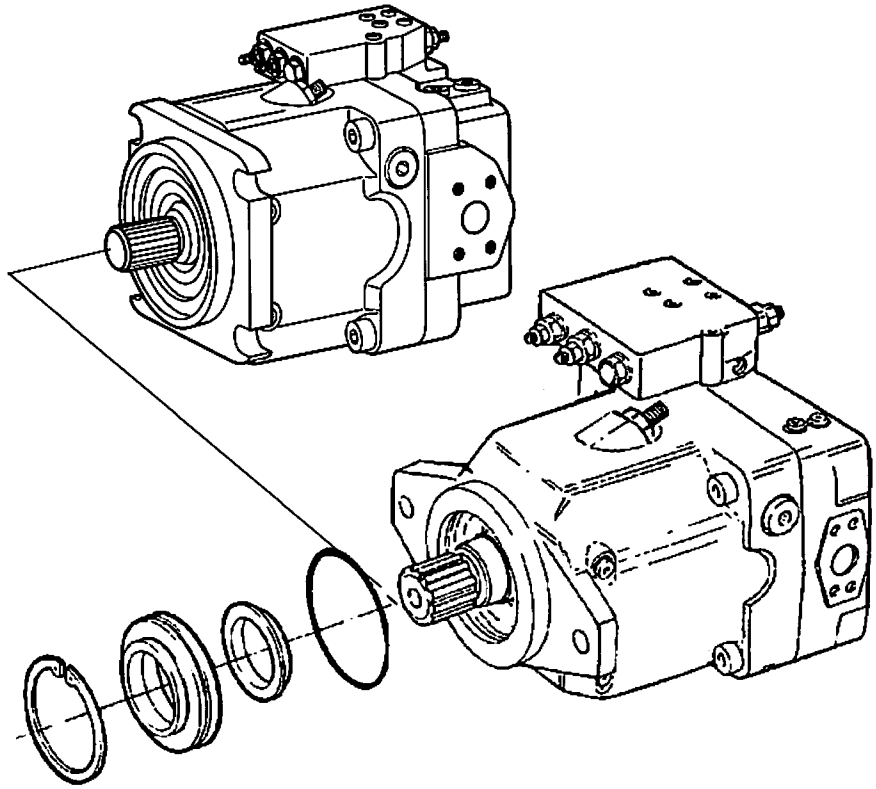
Complete regulator



Impeller

Impeller

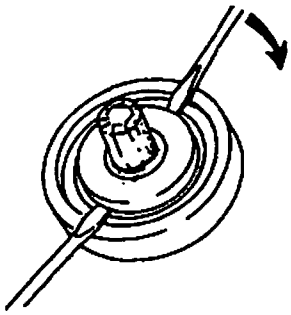
https://truckmanualshub.com/





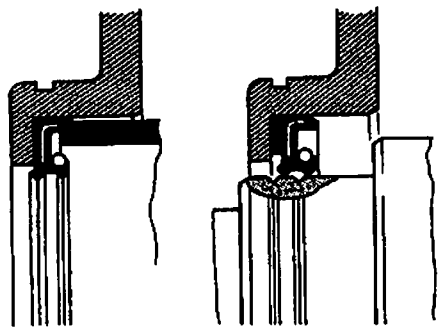
Triebwelle abkleben.

Protect the drive shaft.



Sicherungsring lösen und ausbauen.
Verschlußring abdrücken.

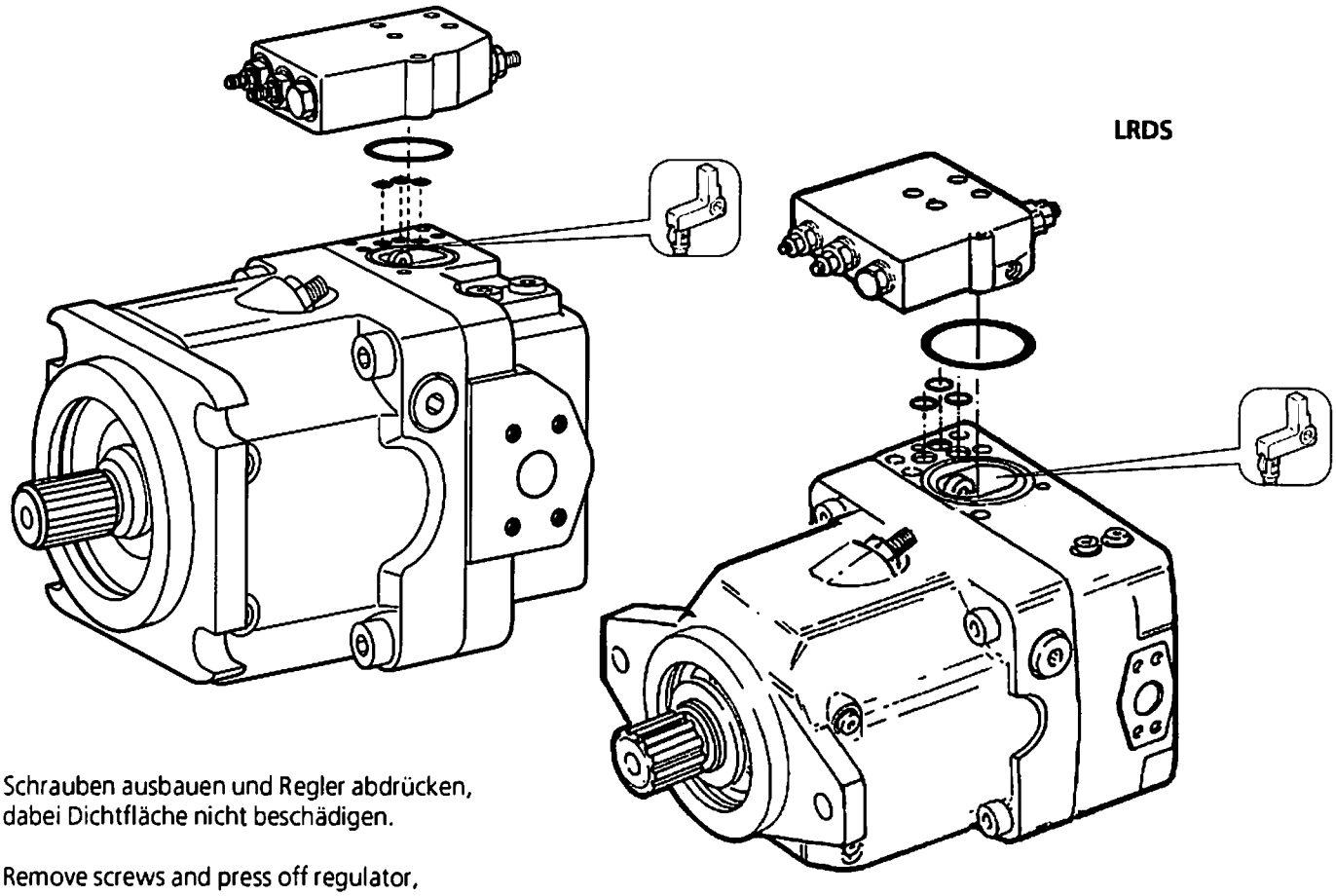
Loosen retaining ring and remove it,
press away front cover.



1. Neuen Wellendichtring lagerichtig mit passender Büchse einpressen.
2. Bei tiefer Laufrille Scheibe vor den Wellendichtring einlegen.

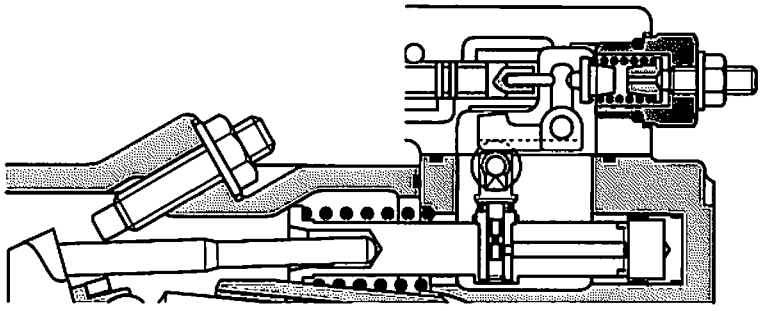
1. Press in the shaft seal ring to the correct position with a suitable sleeve.
2. If the shaft is deeply grooved, insert shim behind seal.

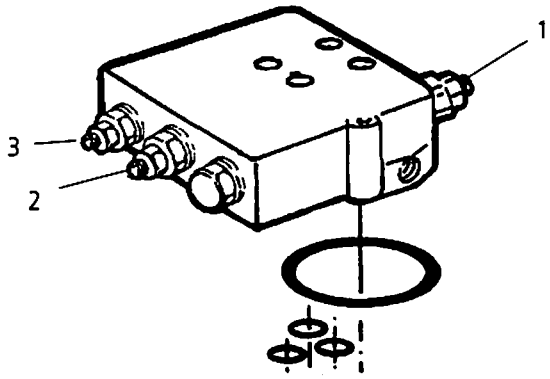
https://truckmanualshub.com/



Schrauben ausbauen und Regler abdrücken, dabei Dichtfläche nicht beschädigen.

Remove screws and press off regulator, thereby make sure that sealing surface is not damaged.





1. Leistungsregler
2. Druckregler
3. Load-Sensing-Regler

Achtung!
Einstellschrauben nicht verändern. Gewindehülse komplett mit Einstellschrauben ausbauen.

1. Power control
2. Constant pressure control
3. Load-Sensing-valve

Note:
Do not change position of adjustment screws. Remove complete set of threaded bush with adjustment screws.

https://truckmanualshub.com/

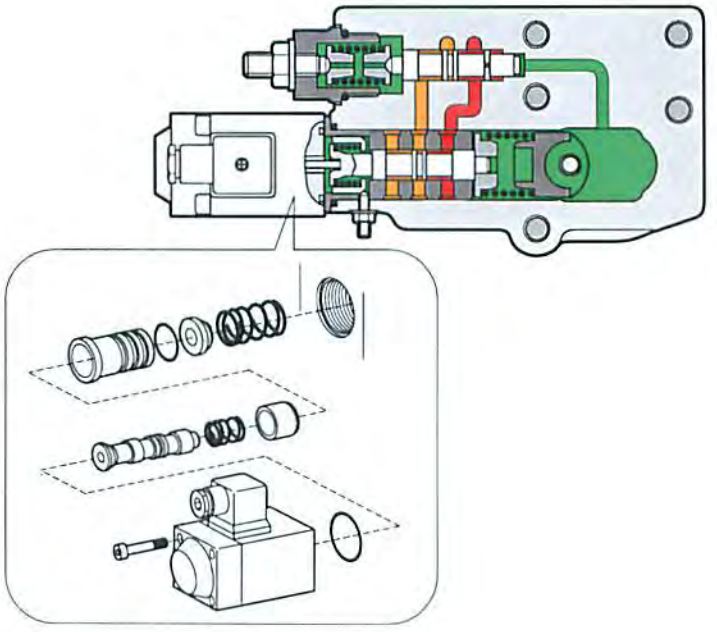
⚠ Achtung!

Bei Regler mit Meßfeder: z.B. HD2D, LRDU2, LRDH, EP2D

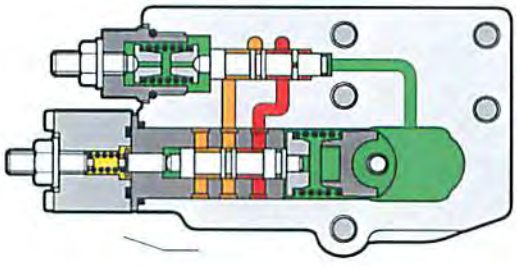
Zuerst Steuerbuchse mit Meßfeder ausbauen,
dann Reglergehäuse abbauen!

⚠ Attention!

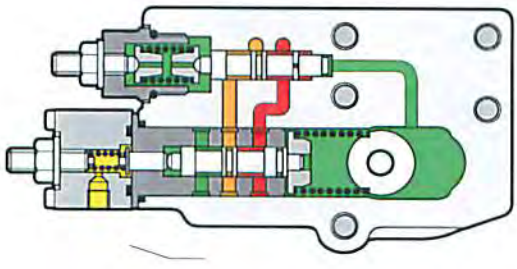
For control with measuring spring, for example HD2D, LRDU2, LRDH, EP2D
At first remove control bush with measuring spring,
than remove regulator housing!



LRDU2

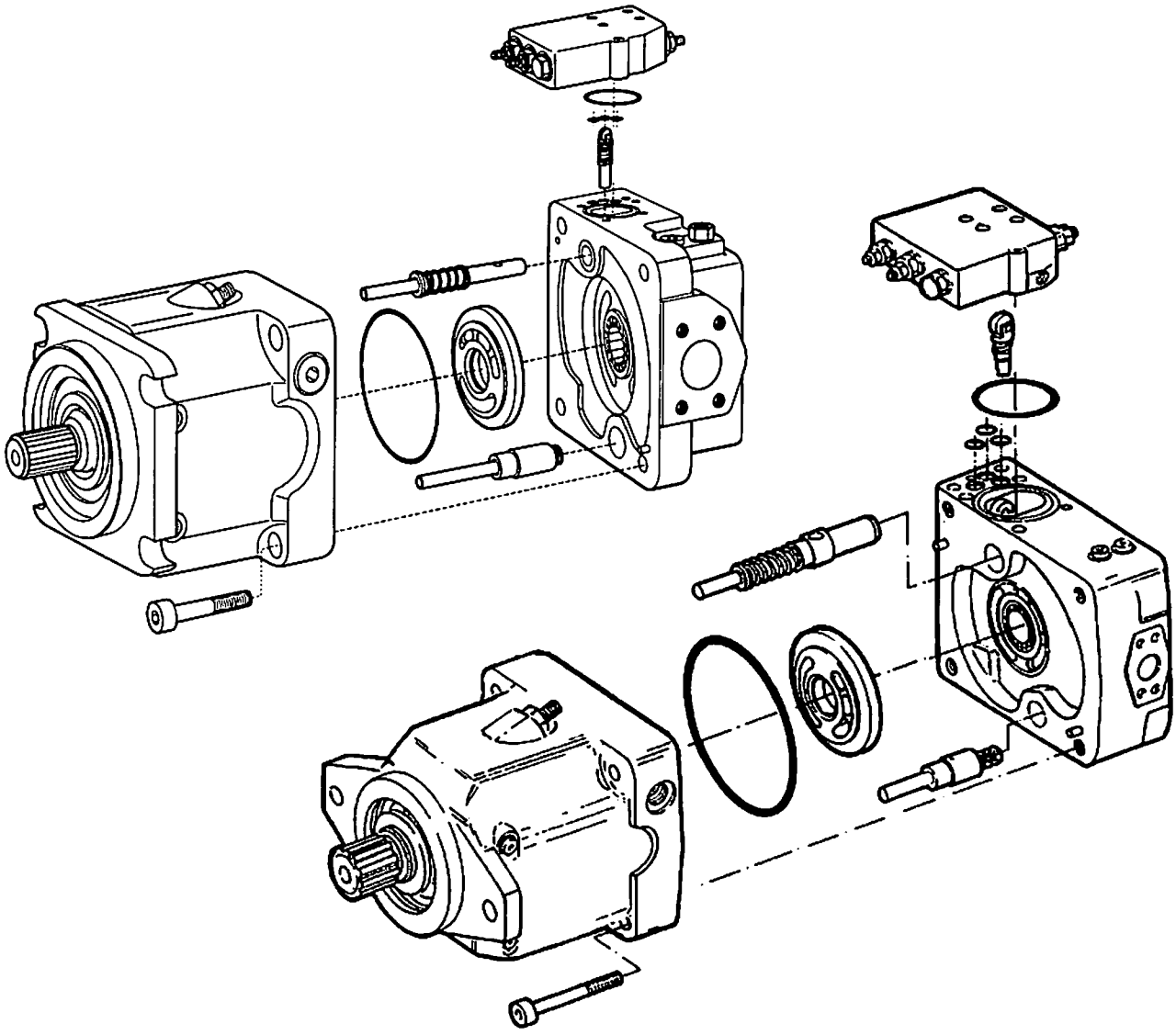


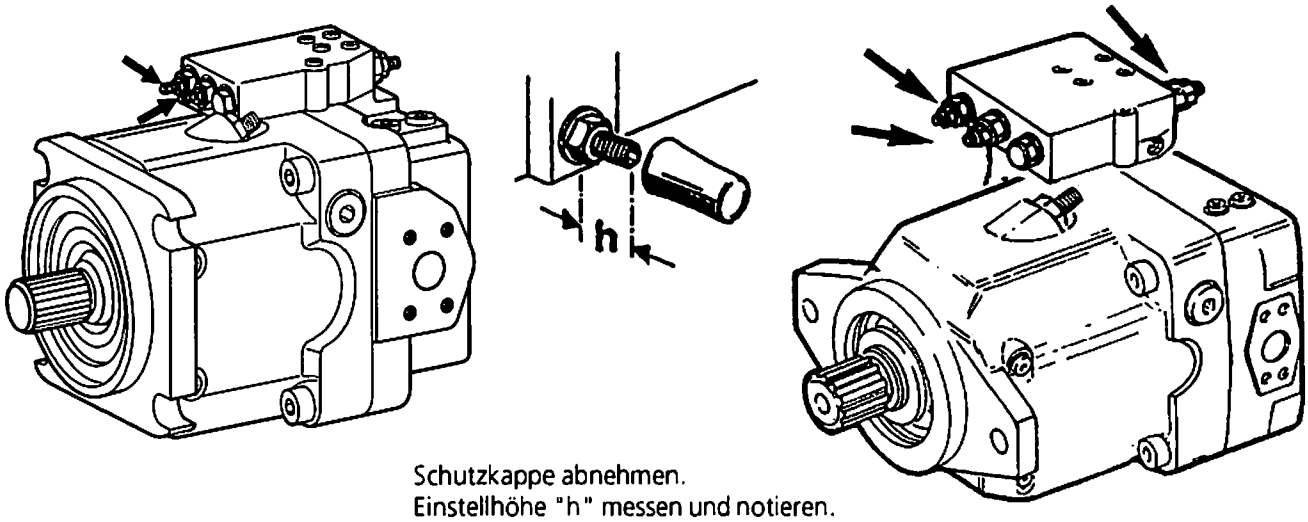
LRDH



HD2D

https://truckmanualshub.com/

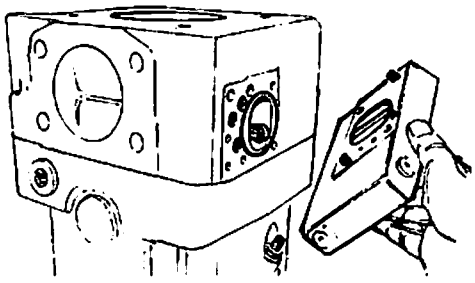




Schutzkappe abnehmen.
Einstellhöhe "h" messen und notieren.

Remove protection cover.
Measure and note adjustment heigth "h".

https://truckmanualshub.com/

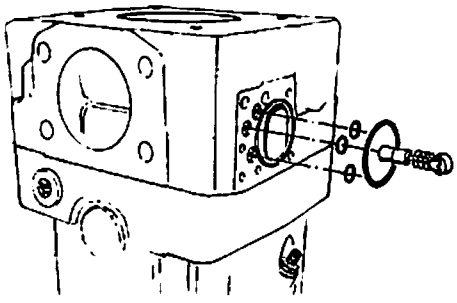


Reglergehäuse abbauen.

⚠ Bei Regler mit Meßfeder z.B. DRL, EP, LRDH - zuerst Steuerbuchse mit Meßfeder ausbauen, dann Reglergehäuse abbauen.

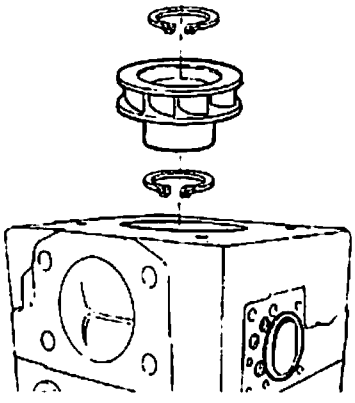
Remove regulator housing.

⚠ For control with measuring spring for instance: DRL, EP, LRDH - at first remove control bush with measuring spring, than remove regulator housing.



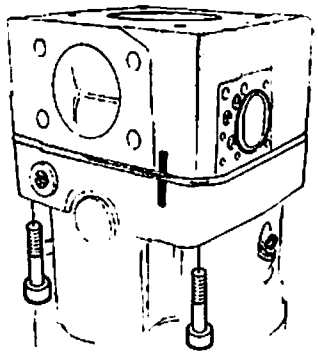
O-Ringe, Meßkolben mit Büchse und Feder ausbauen.

Remove O-ring, measuring piston with bush and spring.



⚠ Ausführung mit Impeller!
Zuerst Impeller ausbauen.

⚠ Design with impeller!
At first remove impeller.

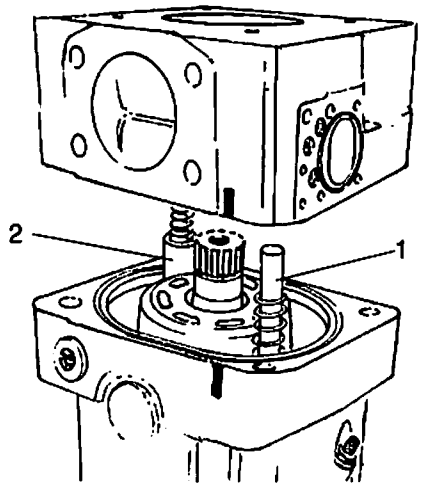


Lage der Anschlußplatte markieren.
Anschlußplattenbefestigung lösen.

Mark position of the connection plate.
Loosen connection plate fixation.

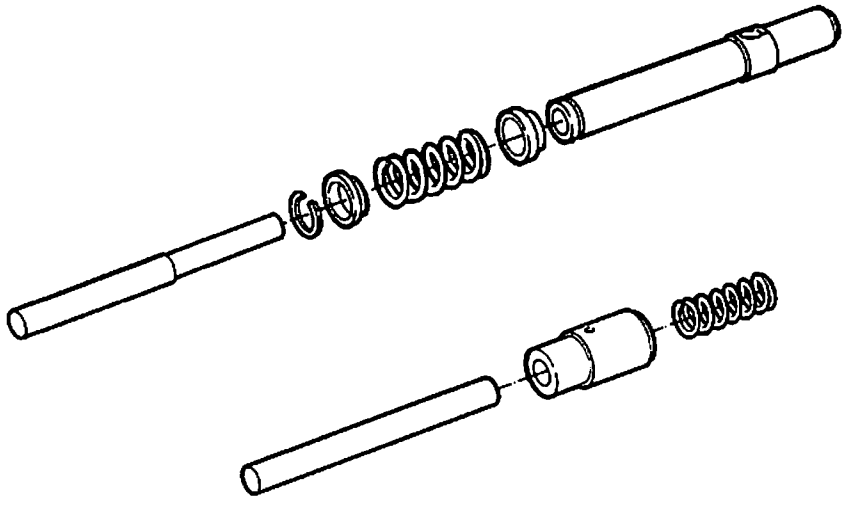
https://truckmanualshub.com/

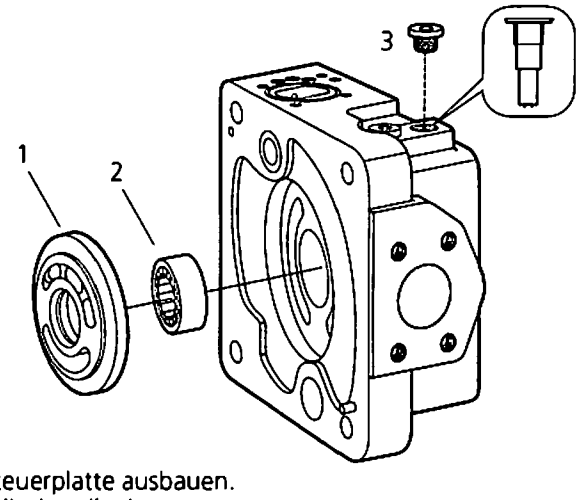
Anschlußplatte, Regler demontieren
Remove port plate, regulator



Anschlußplatte mit Steuerplatte abheben.
Verstellung ausbauen.
1. Hydr. -klein
2. Hydr. -groß

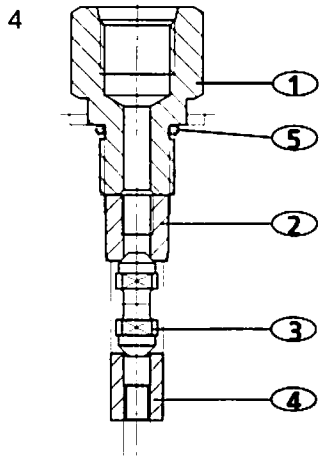
Remove port plate with control plate.
Disassemble regulator.
1. Hydr. -small
2. Hydr. -large





1. Steuerplatte ausbauen.
2. Zylinderrollenlager
3. Anschluß "G" **ohne** Wechselventil
4. **mit** Wechselventil.

1. Remove control plate.
2. Cylinder roller bearing.
3. Port "G" **without** valve
4. Alternatively **with** valve



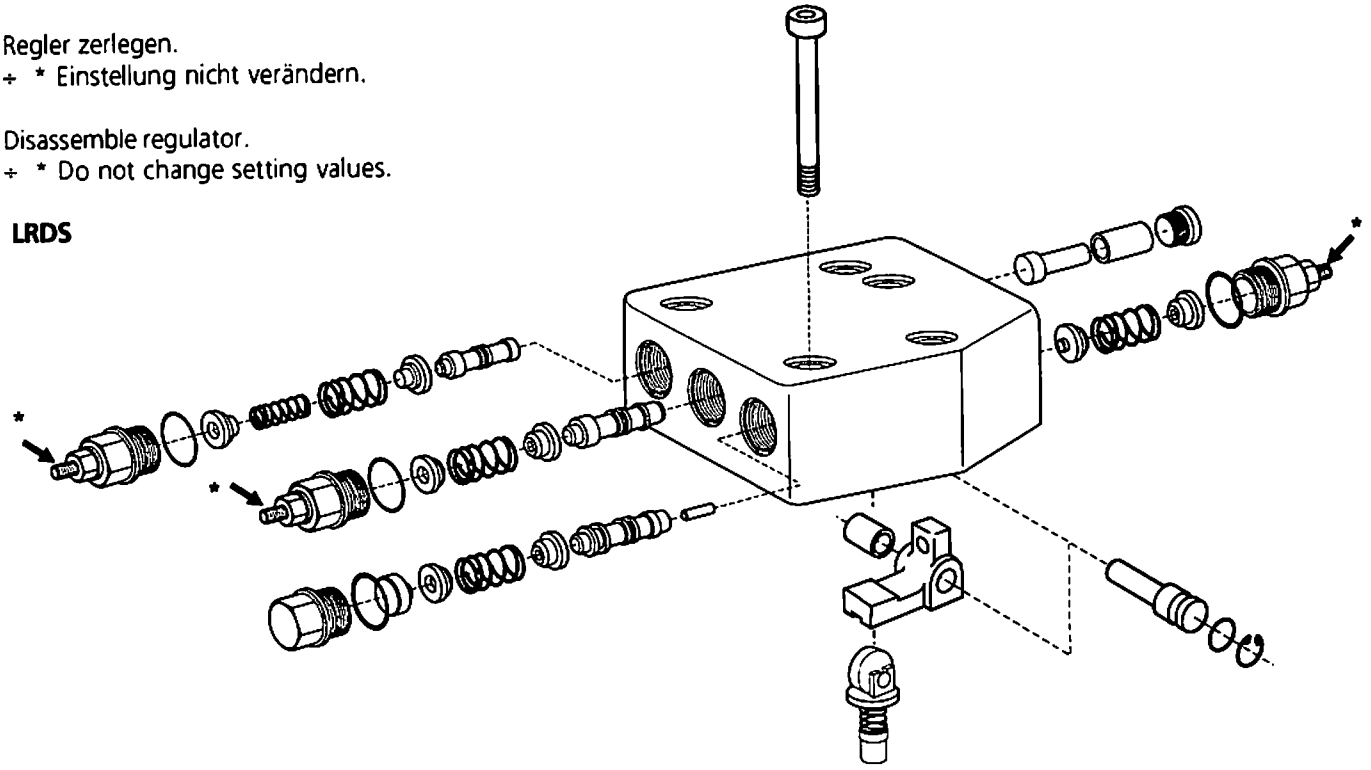
① Anschlußstück / Connection plate
② Buchse / Sleeve
③ Ventilkegel / Valve poppet
④ Ventilbuchse / Valve sleeve
⑤ Dichtring / Seal ring

https://truckmanualshub.com/

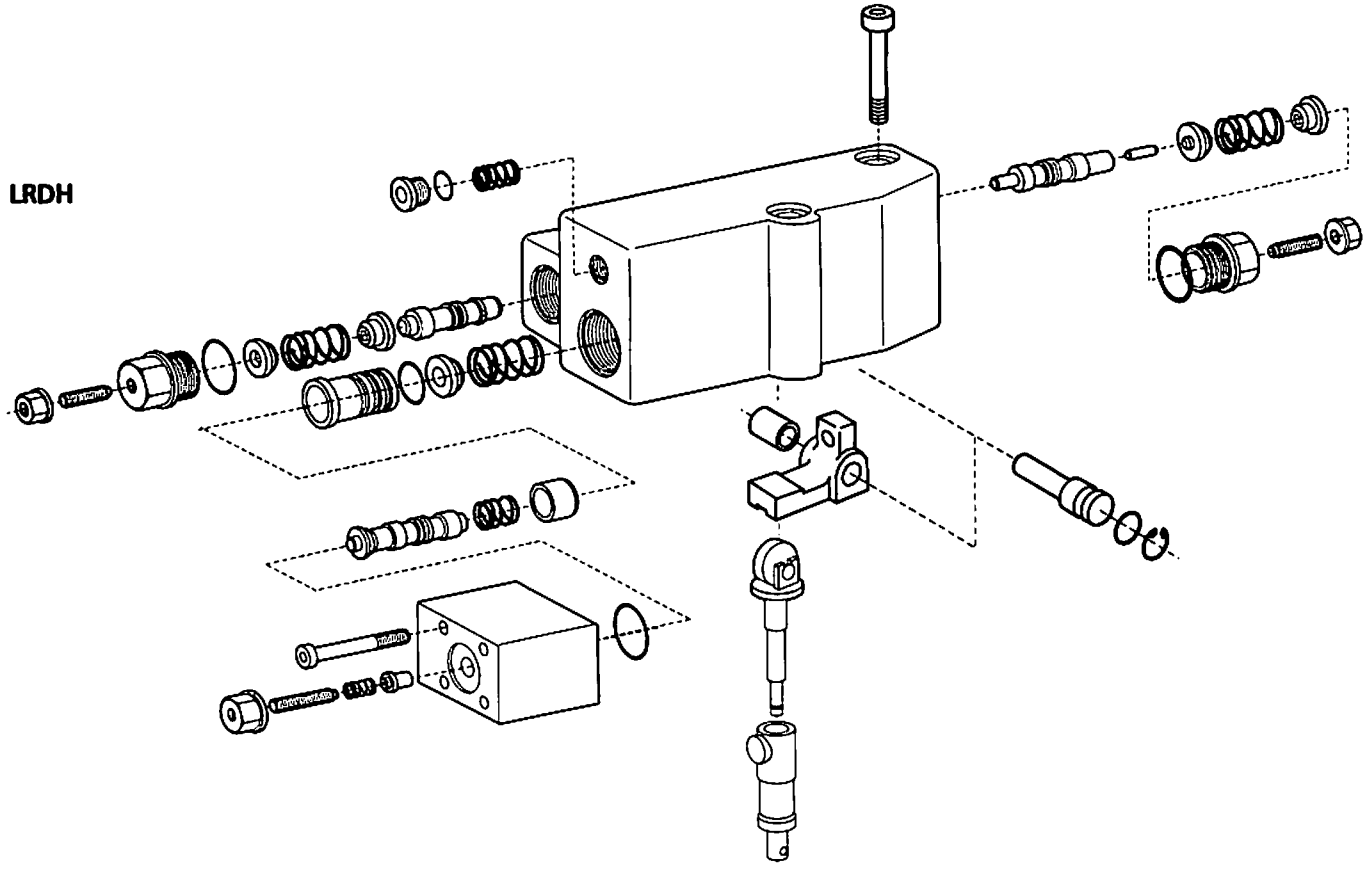
Regler zerlegen.
÷ * Einstellung nicht verändern.

Disassemble regulator.
÷ * Do not change setting values.

LRDS

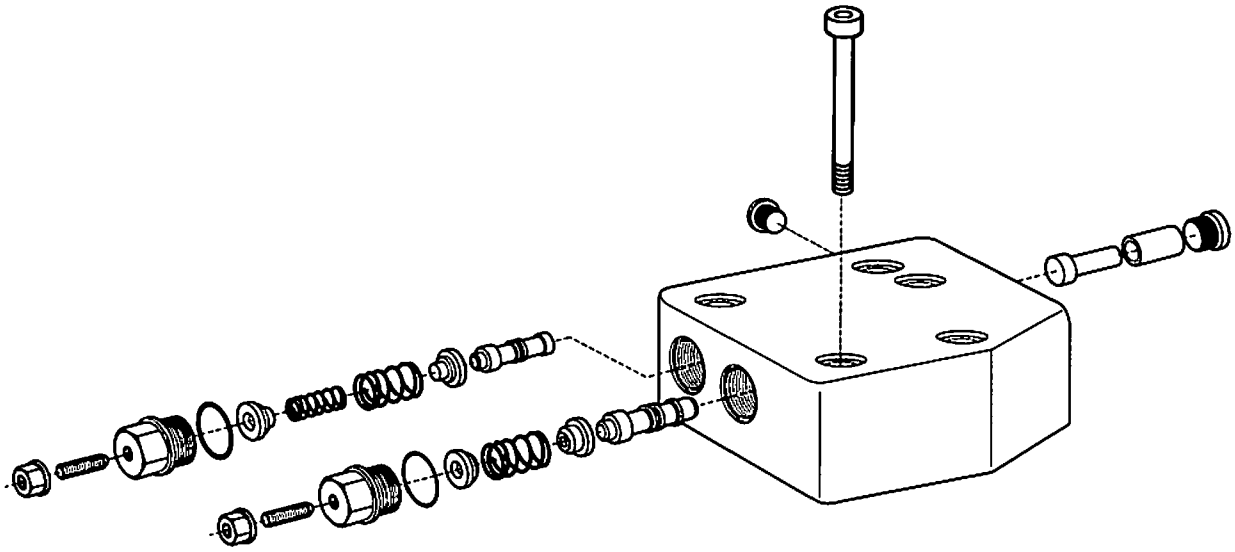


LRDH

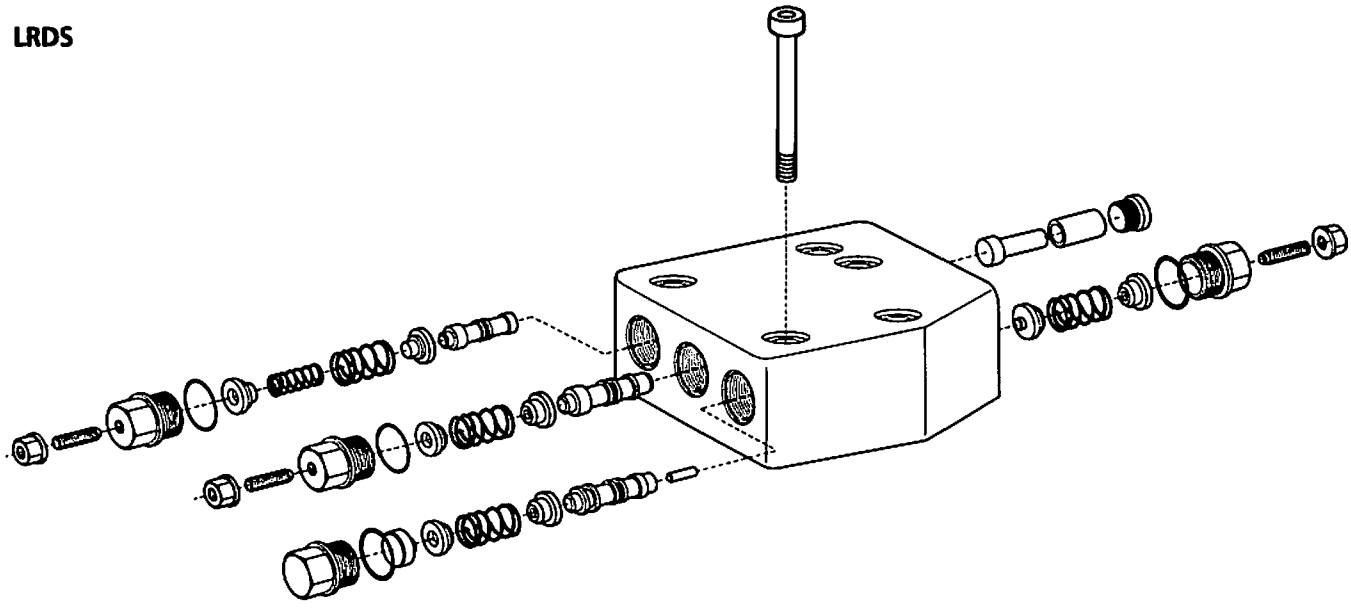


https://truckmanualshub.com/

DRS

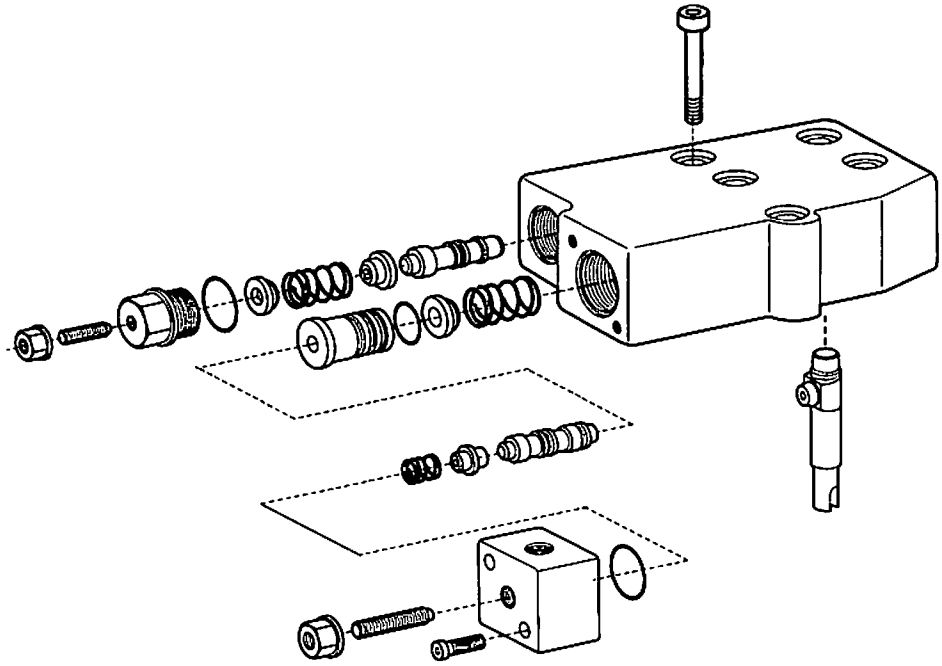


LRDS

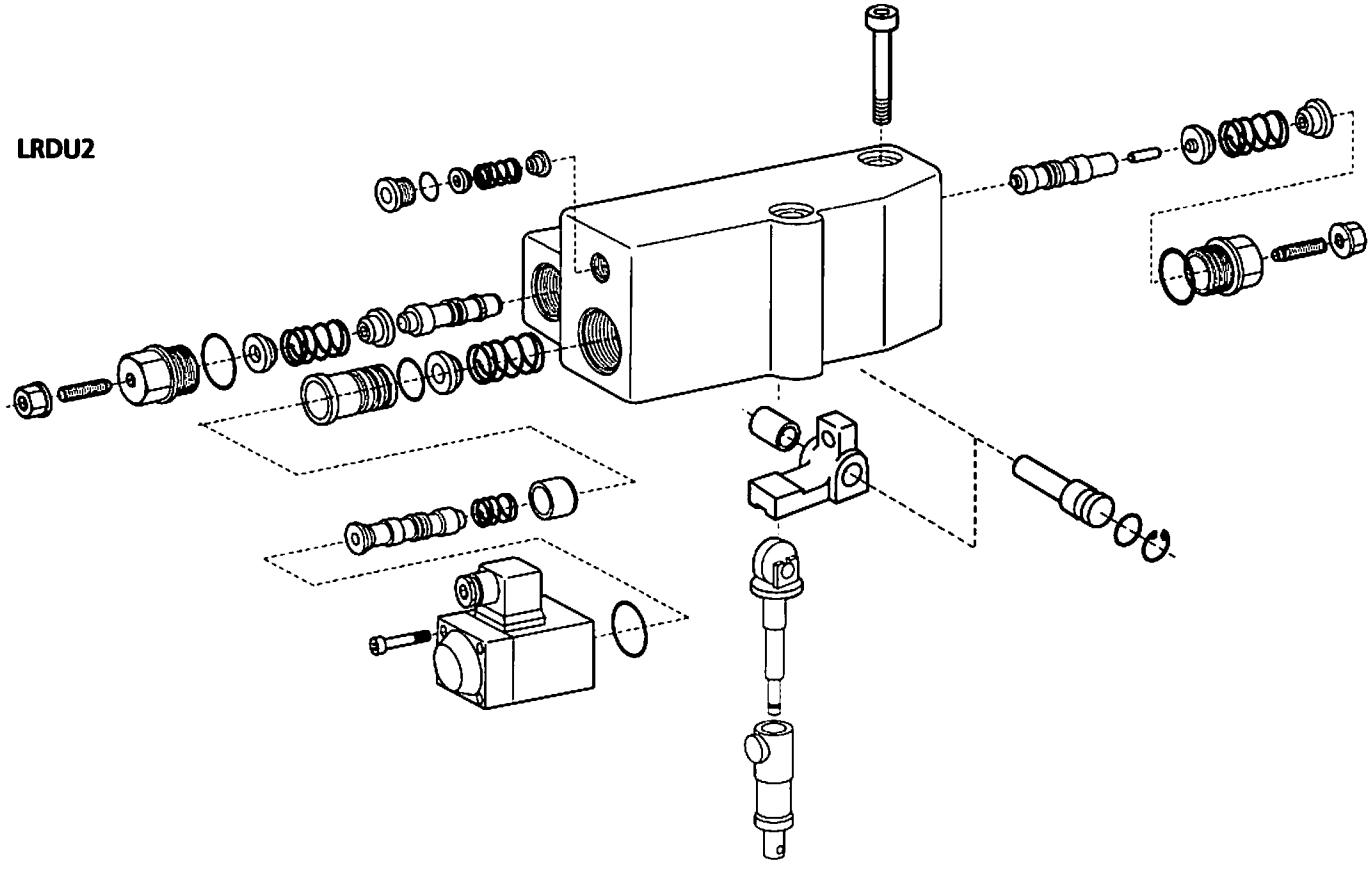


https://truckmanualshub.com/

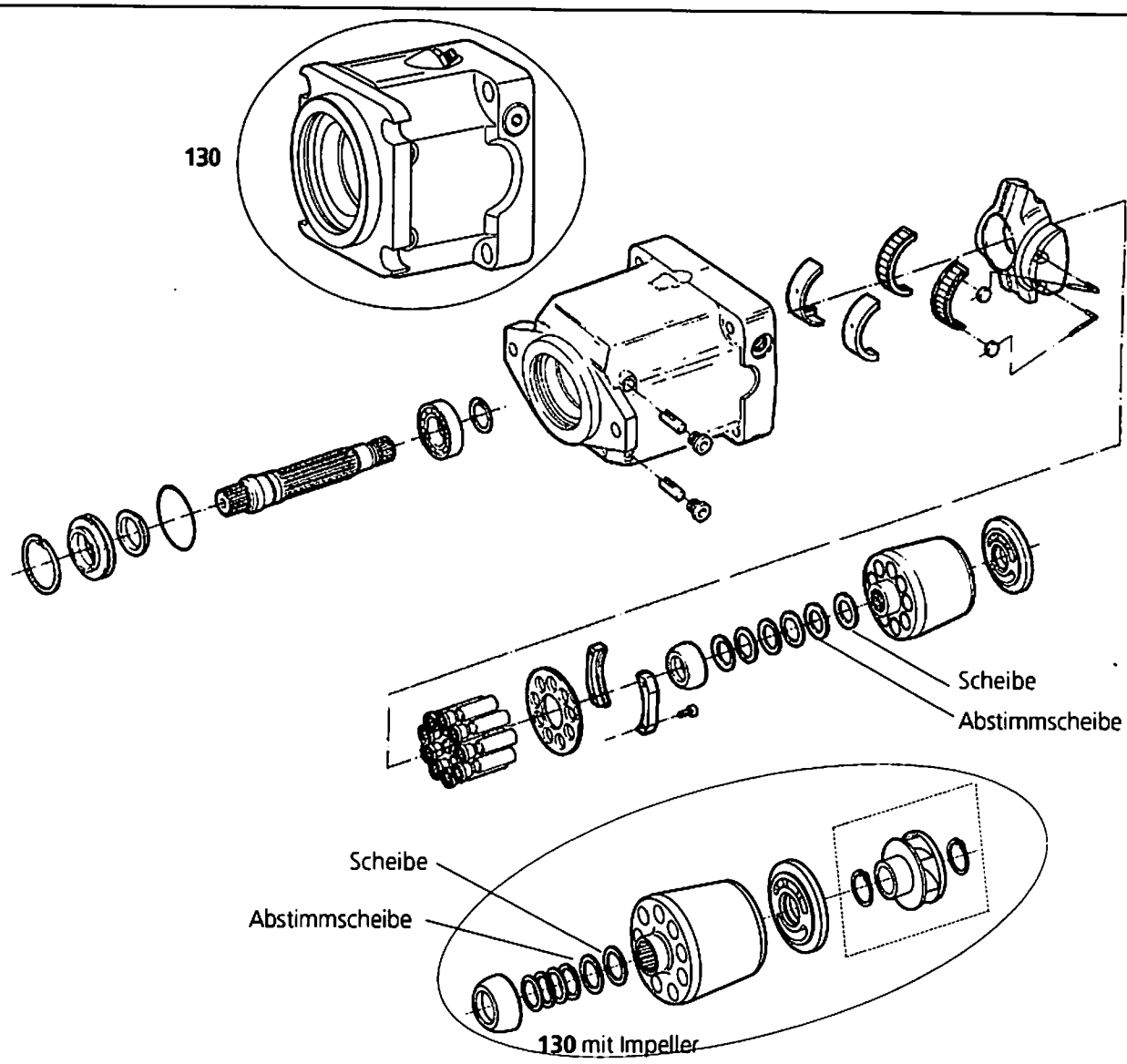
HD2D

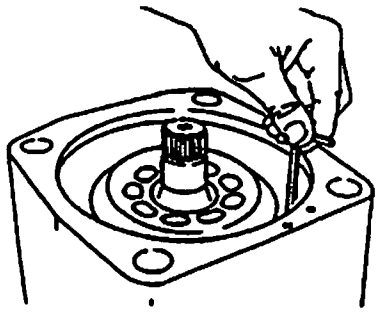


LRDU2



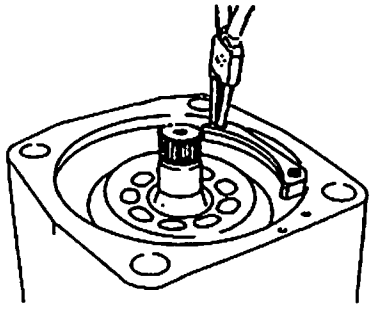
https://truckmanualshub.com/





Haltesegment lösen.

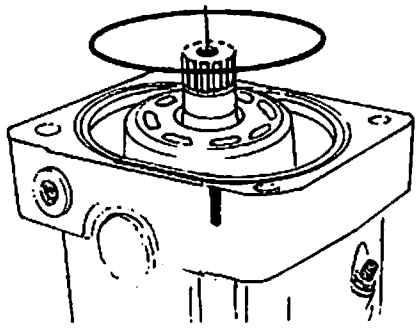
Loosen fixing of the retaining segments.



Haltesegment mit Schrauben ausbauen.

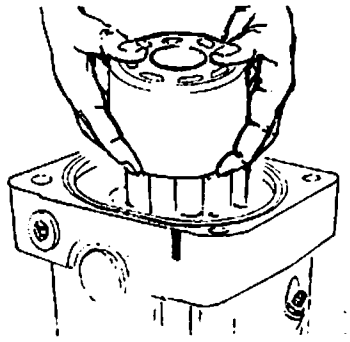
Remove retaining segments with screws.

https://truckmanualshub.com/



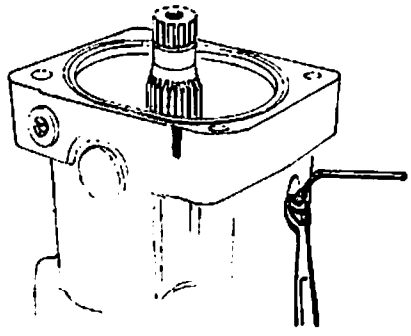
O-Ring ausbauen.

Remove O-ring.



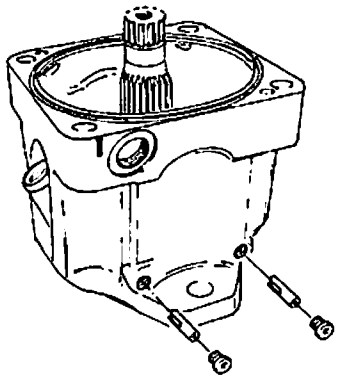
Zylinder mit Kolben ausbauen.

Remove cylinder with pistons.



Q-min-, Q-max-Einstellschrauben lösen.
Maß "X" festhalten.

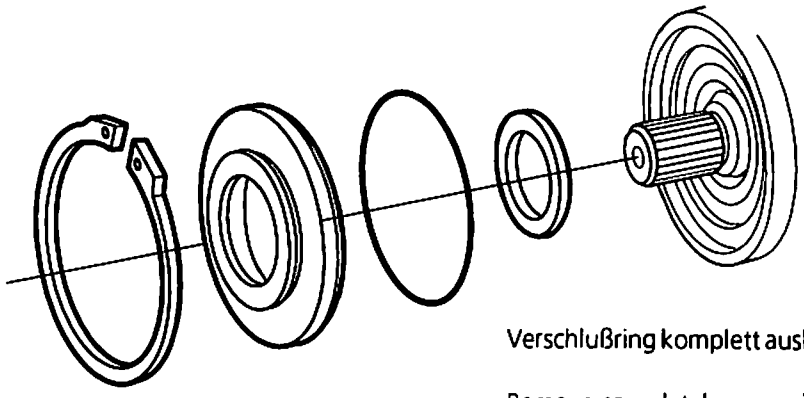
Remove Q-min and Q-max screws after noting down adjustment dimension.



Gelenkstifte für Schwenklager ausbauen.

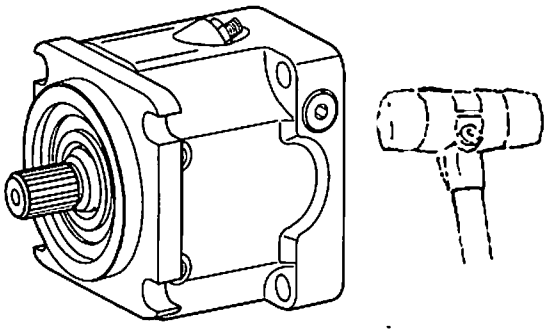
Remove joint pin for swivel cradle.

https://truckmanualshub.com/



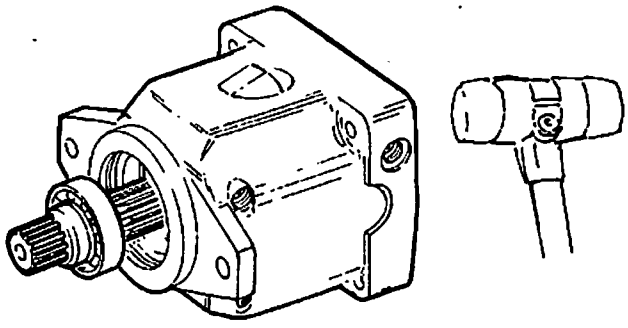
Verschlußring komplett ausbauen.

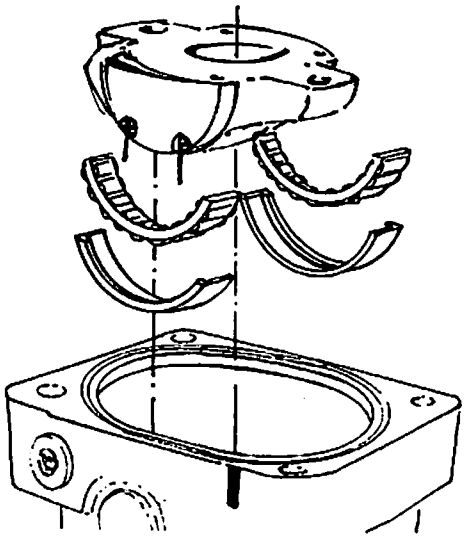
Remove completely cover ring.



Triebwelle auspressen.

Press out drive shaft.

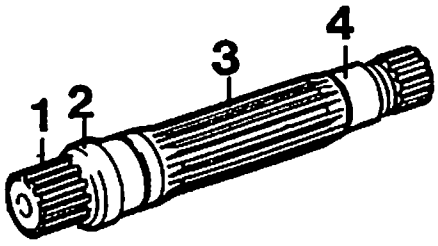




Schwenkwiege mit Lager und Lagerschalen ausbauen.

Remove swivel cradle with bearing as well as bearing case.

https://truckmanualshub.com/

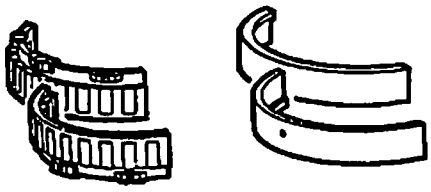


Kontrolle!
Verzahnung (1); Lauffläche WDR (2); Verzahnung (3); Lagersitz (4).

Check!
Gears (1); Contact area shaft seal (2); Gears (3); Bearing seat (4).
Sliding surface (1) free of scoring.

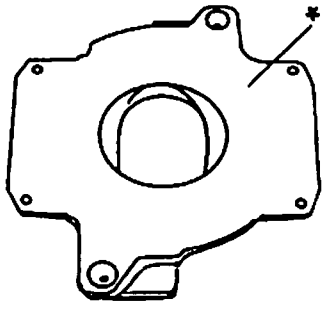
1 Lager
Bearing

2 Lagerschalen
Bearing cup



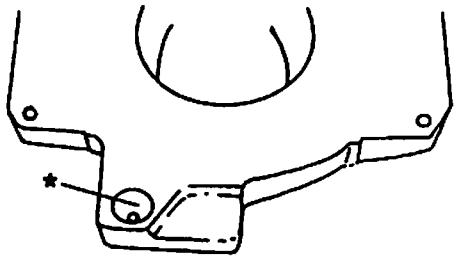
Kontrolle!
Käfig-Paar (1);
Lagerschalenpaar (2).

Check!
Cage set (1);
Bearing cup set (2).



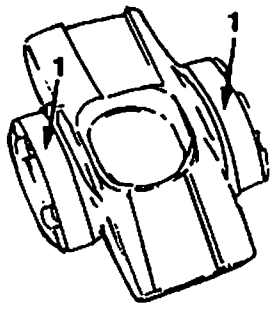
Kontrolle!
Gleitfläche (*).

Check!
Contact area (*).



Kontrolle!
Kalotte für Regler (*).

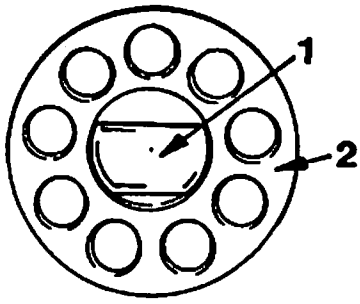
Check!Socket for regulator (*).



Kontrolle!
Lagerbahn (1).

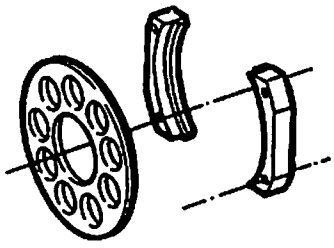
Check!
Contact area of bearing (1).

https://truckmanualshub.com/



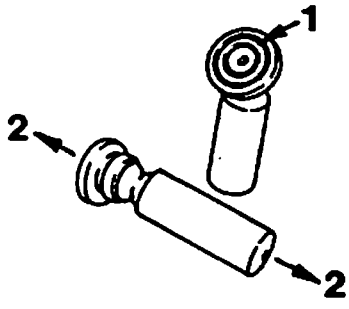
Kontrolle!
Rückzugkugel (1)
Rückzugplatte (2).

Inspection!
Retaining ball (1)
Retaining plate (2).



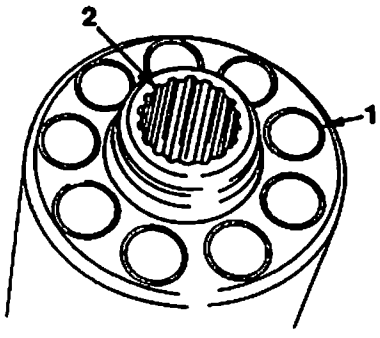
Kontrolle!
Haltesegmente

Inspection!
Fixing segments



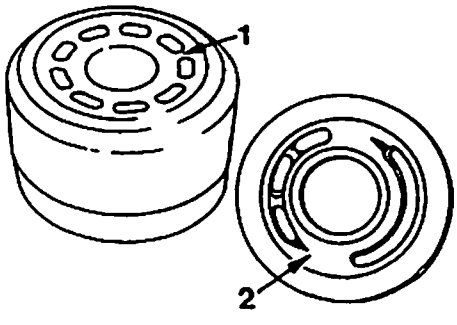
Kontrolle!
Gleitschuhe (1),
Axialspiel (2).

Inspection!
Slipperpads (1),
Axial backslash (2).



Kontrolle!
Zylinderbohrungen (1),
Verzahnung (2).

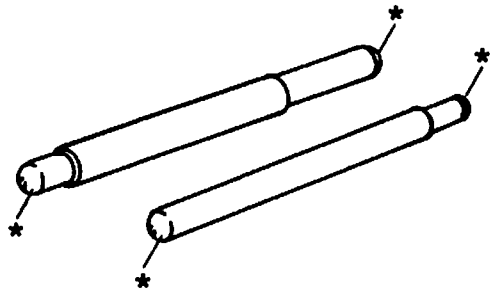
Inspection!
Cylinder boring (1),
Gears (2).



Kontrolle!
Zylindergleitfläche (1),
Gleitfläche Steuerplatte (2).

Inspection!
Cylinder contact area (1),
Contact area control plate (2).

https://truckmanualshub.com/

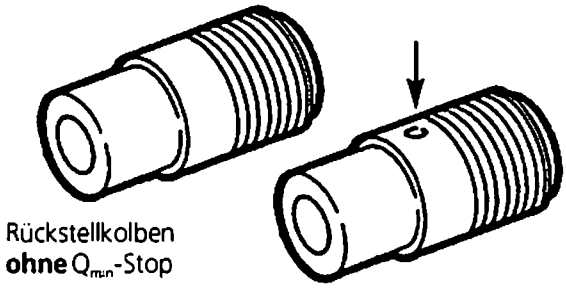


Kontrolle!
Kugelköpfe

⚠ Geschliffene Seite zur Wiege einbauen!

Inspection!
Fixing segments

⚠ Assemble the grinded side to the cradle!

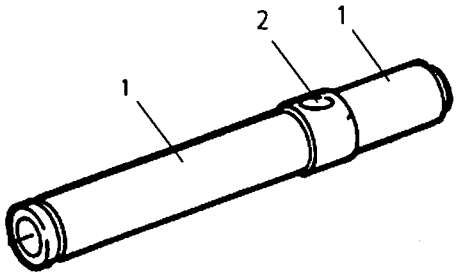


Rückstellkolben
ohne Q_{min}-Stop

Rückstellkolben
mit Q_{min}-Stop

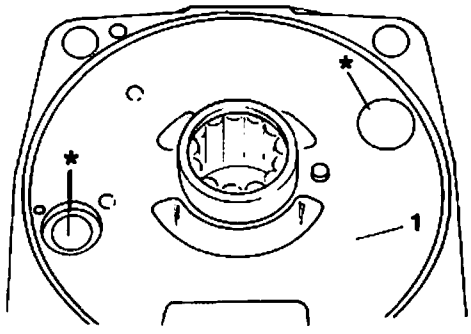
Kontrolle!
Rückstellkolben (*)
⚠ Abstimmumg über Rückstellstange.

Inspection!
Piston (*)
⚠ Adjustment ..



Kontrolle!
Stellkolben (1),
Bohrung - Stellbüchse (2).

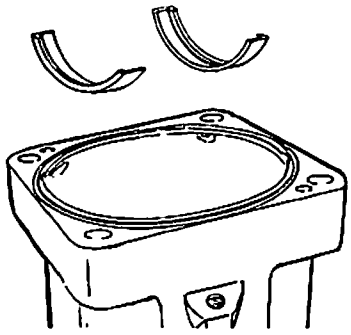
Inspection!
Positioning piston (1),
Boring - control bush (2).



Kontrolle!
Bohrung (*),
Auflagefläche - Steuerplatte (1).

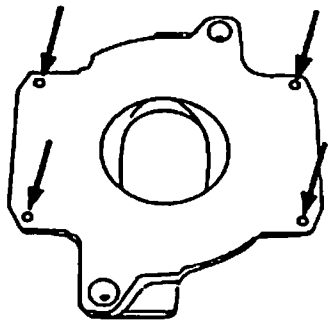
Inspection!
Boring (*),
Contact area control plate (1).

https://truckmanualshub.com/



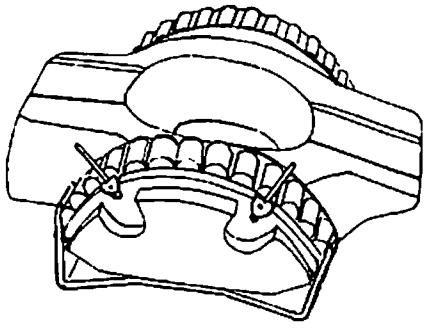
Lagerschalen einsetzen.

Insert bearing bell.



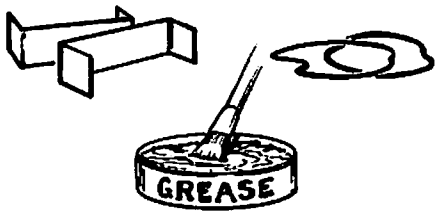
Gewindebohrungen reinigen.

Clean threaded borings.



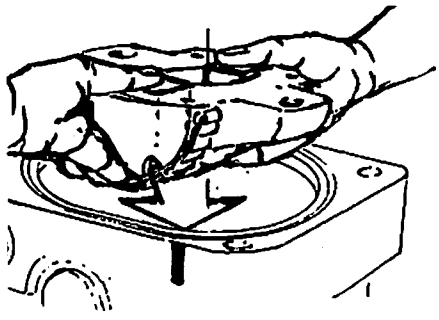
Lager mit Drahtführung auf Schwenkwiege montieren.
Mit Hilfsmittel festhalten.

Install bearings with wire guide on swivel cradle.
Fixing with auxiliary device.



Hilfsmittel z.B.
- Klammer
- Gummiringe
- Fett

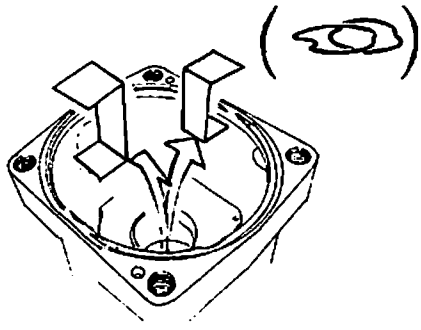
Auxiliary devices e. g.
- clamp
- rubber rings
- grease



Schwenkwiege mit Lager in Lagerschalen einsetzen.
Achtung! Einbaulage.

Place swivel cradle with bearing into bearing shell.
Attention! Installation position.

https://truckmanualshub.com/

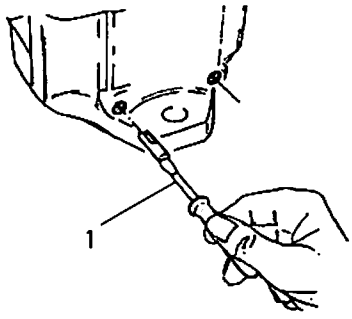


Hilfsmittel ausbauen.

⚠ Lagersitzkontrolle.

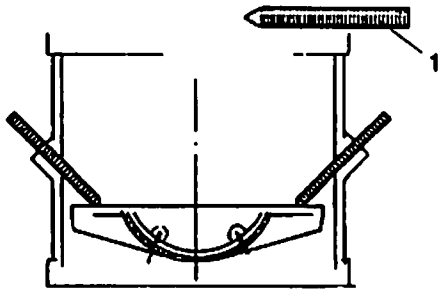
Remove auxiliary devices.

⚠ Check bearing seats.



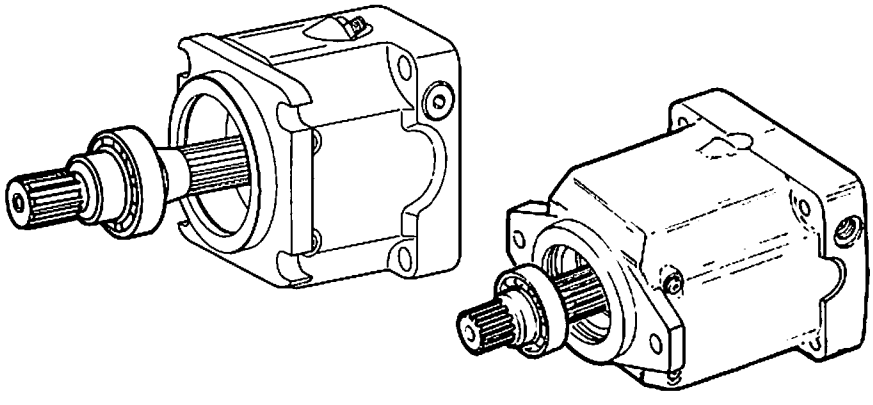
Führungsdraht ausrichten. Gelenkstifte einsetzen.
Verschlußschrauben einbauen.
1. Hilfsmittel Schraubendreher

Adjust guide wire. Install joint pins.
Install locking screws.
1. Auxiliary device screw driver



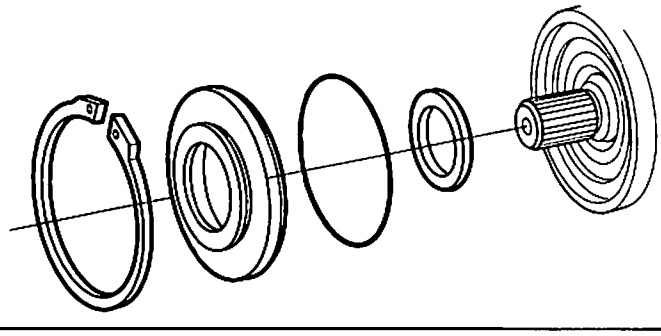
Schwenkwiege mit Gewindestift in Nullage fixieren.
1. Hilfsmittel (Gewindestift 2x).

Fit swivel cradle with threaded pin in zero position.
1. Auxiliary device (threaded pins 2x).



Triebwelle einsetzen.

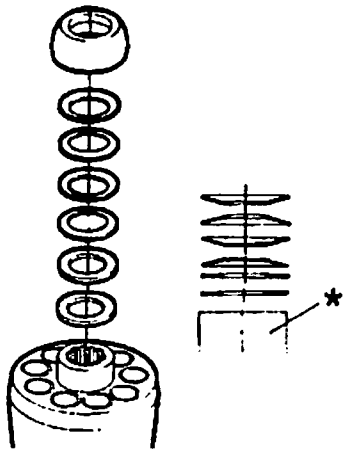
Install drive shaft.



Verschlußring montieren.

Mount cover ring.

https://truckmanualshub.com/

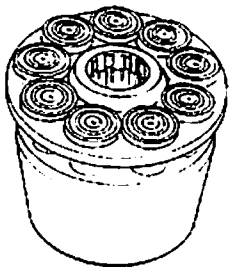


Abstimmscheibe, Federn und Rückzugkugel montieren.
Hinweis: Richtige Einbaulage beachten*.

⚠ Triebwerksabstimmung siehe Service Info.

Mount shims, springs and retaining ball.
Note: Observe correct mounting position*.

⚠ Rotary group adjustment see Service information.

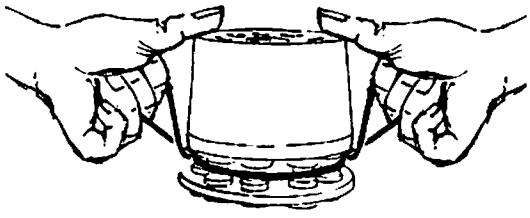


Rückzugeinrichtung mit Kolben in Zylinder montieren.

⚠ Verzahnung Rückzugkugel / Zylinder ausrichten.

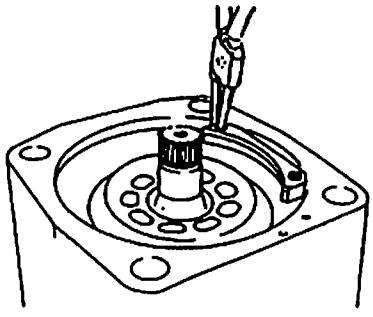
Place retaining plate with piston into cylinder.

⚠ Align gearing of retaining ball / cylinder.



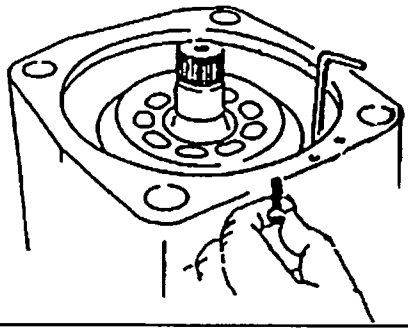
Montagehilfe:
Mit O-Ring über Kolben Rückzugeinrichtung festhalten.

Assembly hint:
Fix with O-ring via piston retaining assembly.



Haltesegment einsetzen.

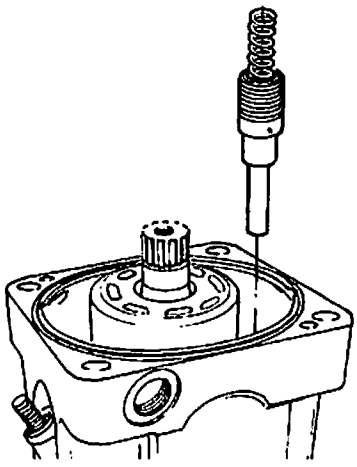
Insert fixing segments.



Schrauben mit Precote-Beschichtung verwenden.
⚠ Achtung!
Aushärtezeit beachten!
Schrauben nach Drehmoment anziehen.

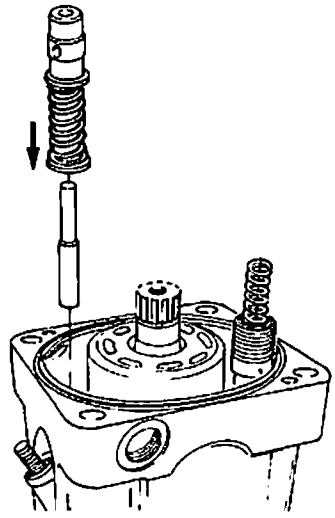
Install screws with Precote.
⚠ Attention!
Pay attention with hardening time!
Tight screws with torque value.

https://truckmanualshub.com/



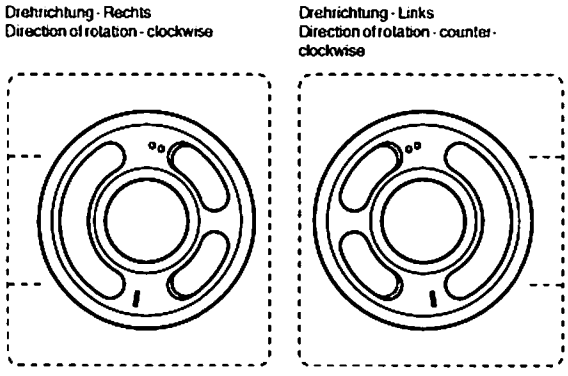
Hydraulische Verstellung - groß.

Hydraulic control rod - big size.

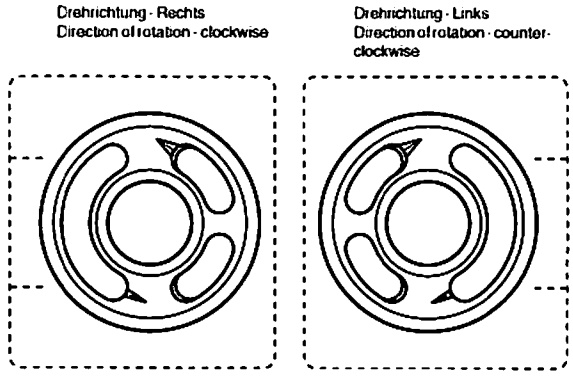


Hydraulische Verstellung - klein.

Hydraulic control rod - small size.



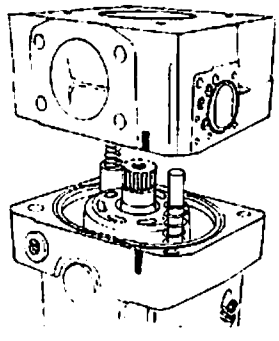
Standardausführung / Standart type



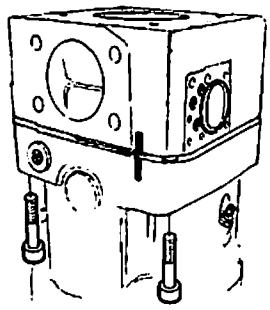
Sonderausführung / Special type

Steuerplatte einsetzen.
Achtung!
Einbaulage (Drehrichtung).

Install control plate.
Attention!
Installation position (Direction of rotation).

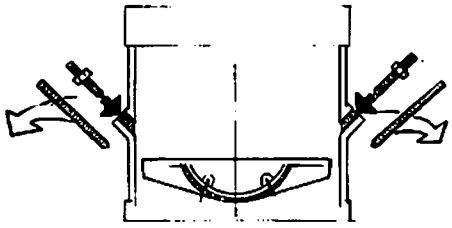


https://truckmanualshub.com/



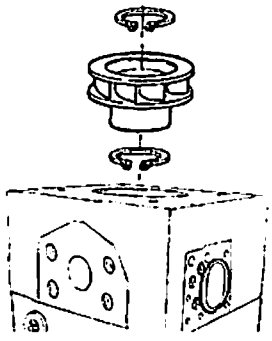
Anschlußplatte anbauen und mit Schrauben befestigen.
Achtung! Drehmoment - Schrauben (siehe Seite 29).

Fix port plate, assembly with screws.
Attention! Torque - screws (see page 29).



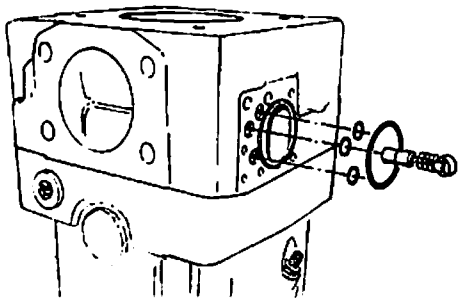
Gewindestift ausbauen.
Q-min, Q-max- Schrauben einbauen.
Achtung!
Einstellmaß

Remove threaded pins.
Install Q-min, Q-max- screws.
Adjustment measure



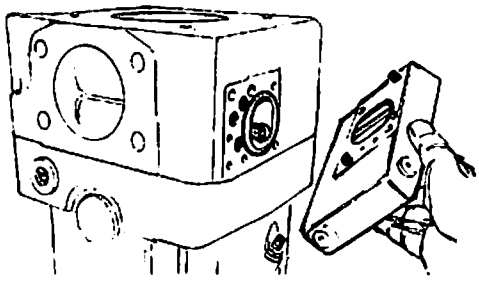
⚠ Ausführung mit Impeller!
Impeller montieren.

⚠ Design with impeller!
Assemble impeller.



Meßkolben mit O-Ringen einbauen.

Install measuring piston with O-rings.



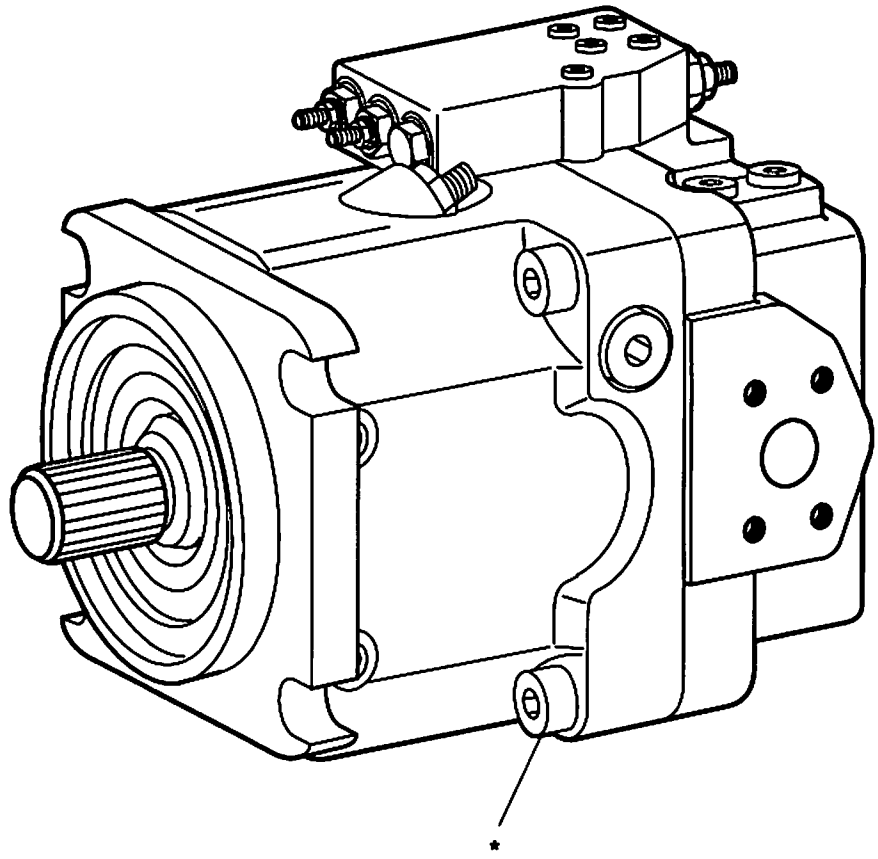
Regler anbauen.

Place regulator.

https://truckmanualshub.com/

A11VO - Gruppe Drehmoment
A11VO Tightening torques

Drehmoment für Schrauben 10.9 * / **Gehäuse - Anschlußplatte**
Tightening torques for shaft bolts 10.9 * / **Housing - port plate**



NG / Size	Schraubengröße / Screw dimension	Anziehdrehmoment Zyl. Schr. Anschlußplatte Tightening torques shaft bolts port plate
40	M14	205 Nm
60	M16	260 Nm
75	M16	260 Nm
95	M18	400 Nm
130	M18	400 Nm
160	M20	580 Nm
190	M20	580 Nm
200	M20	580 Nm
250	M24	1000 Nm
260	M22	780 Nm

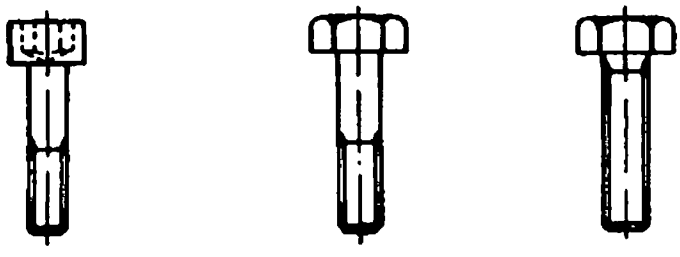
https://truckmanualshub.com/

1. Schaftschrauben (nach N 08.001)

Die Werte gelten für Schaftschrauben mit metrischem ISO-Gewinde nach DIN 13 Teil 13, sowie Kopfauflagemaßen nach DIN 912 Zylinderschrauben, DIN 931 Sechskantschrauben mit Schaft bzw. DIN 933 Sechskantschrauben mit Gewinde bis Kopf.

1. Bolts (to N 08.001)

The values stated are valid for bolts with metric ISO threads to DIN 13 part 13, as well as head areas to DIN 912 socked head cap screws, DIN 931 hexagon bolt or DIN 933 hexagon bolts with threads up to the head.

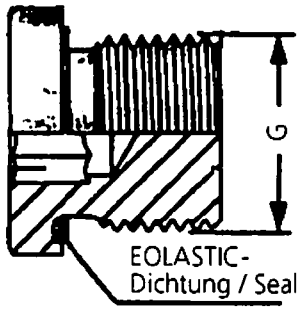


Gewinde / Thread	Festigkeitsklassen / Tensile strength class		
	8.8	10.9	12.9
	Anziehdrehmoment / Tightening torque M_A in Nm		
M 3	1,1	1,6	1,9
M 4	3,1	4,5	5,3
M 5	6,1	8,9	10,4
M 6	10,4	15,5	18
M 8	25	37	43
M 10	51	75	87
M 12	87	130	150
M 14	140	205	240
M 16	215	310	370
M 18	300	430	510
M 20	430	620	720
M 22	580	830	970
M 24	740	1060	1240

https://truckmanualshub.com/

2. **Verschlußschrauben** mit Innensechskant und Profildichtring (nach N 02.009).

2. **Plugs** with internal hexagon and profile seal ring (to N 02.009).

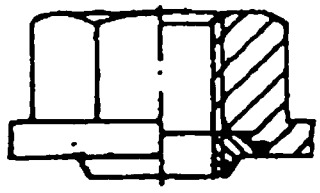


Gewinde / Thread	Anziehdrehmoment / Tightening torque M_A in Nm	Gewinde / Thread	Anziehdrehmoment Tightening torque M_A in Nm
M8 x 1	5	G 1/8 A	10
M10 x 1	10	G 1/4 A	30
M12 x 1,5	20	G 3/8 A	35
M14 x 1,5	30	G 1/2 A	60
M16 x 1,5	35	G 3/4 A	90
M18 x 1,5	40	G 1 A	140
M20 x 1,5	50	G 1 1/4 A	240
M22 x 1,5	60	G 1 1/2 A	300
M26 x 1,5	70		
M27 x 2	90		
M30 x 1,5	100		
M33 x 2	140		
M42 x 2	240		
M48 x 2	300		

https://truckmanualshub.com/

6. SEAL-LOCK-Dichtmuttern (nach N 02.100)

6. SEAL-LOCK - sealing nuts (to N 02.100)



Gewinde / Thread	Anziehdrehmoment M_A in Nm Tightening torque M_A in Nm
M6	10
M6 x 0,5	11
M8	22
M8 x 1	24
M10	40
M10 x 1	44
M12	69
M12 x 1,5	72
M14	110
M14 x 1,5	120
M16	170
M16 x 1,5	180

https://truckmanualshub.com/

1. Vorbereiten Funktionsprüfung

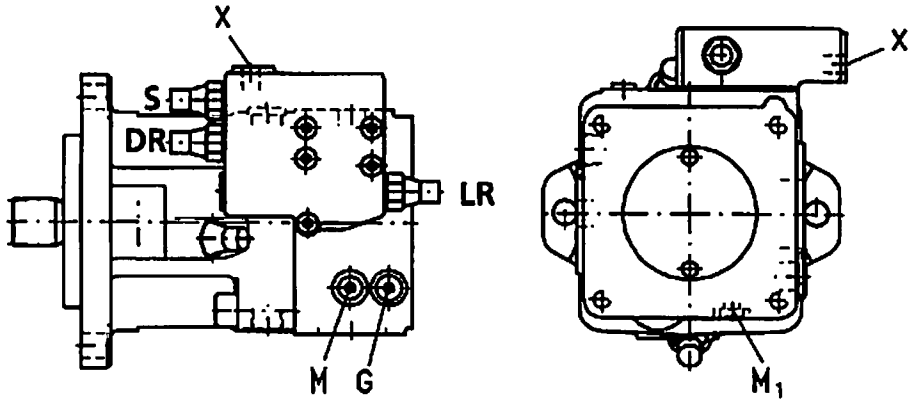
1.1 Leistungsdiagramm anfordern
1.2 Einbauen, befestigen und Gehäuse füllen
1.3 Drehrichtung festlegen

1. Preparation for functional testing

1.1 Requisition of power curve diagram
1.2 Install, fix and fill the housing
1.3 Check the direction of rotation

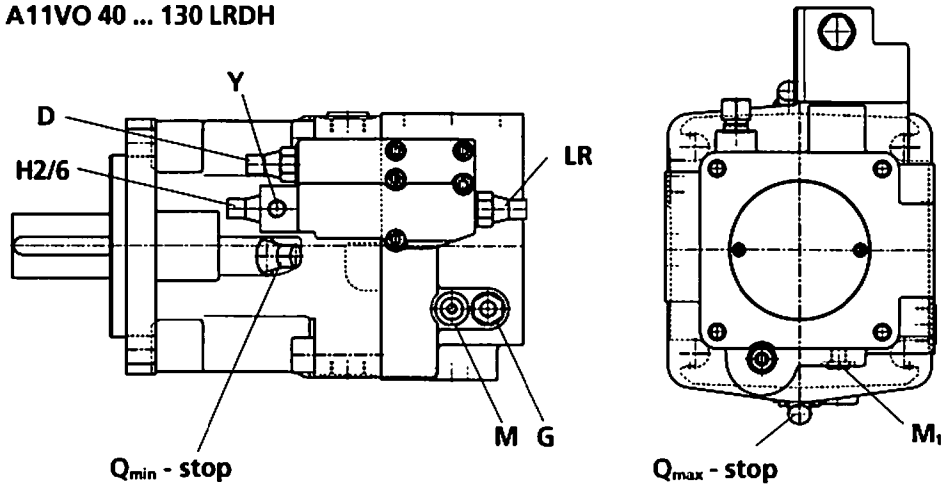
Anschlüsse / ports

A11VO 40 ... 130 LRDS



M: Meßstelle, Arbeitsanschluß / Test ports, pressure port
M_1: Meßstelle, Stellkammer / Test port
LR: Leistungsregler / HP-control
DR: Druckabschneidung / Pressure cut-off
X: Anschluß für ΔP-Regler / Port for ΔP-control
G: Anschluß für Stelldruck / Port for positioning pressure
S: Load-Sensing-regler / Load-sensing control

A11VO 40 ... 130 LRDH



M: Meßstelle, Arbeitsanschluß Test point, pressure port
M_1: Meßstelle, Stellkammer Test point, adjustment chamber
G: Anschluß für Stelldruck Port for adjustment pressure
LR: Leistungdregler HP-control
D: Druckabschneidung Pressure cut-off
H2/6: Hydraulische Hubbegrenzung $V_{g\,min}$ - $V_{g\,max}$ Hydraulic stroke limiter

2. Einstellvorgang

2.1 Auf Prüftemperatur fahren
2.2 Antriebsdrehzahl
2.3 Q_{min}- Anschlag ausschrauben

2. Setting process

2.1 Drive to temperature
2.2 Input speed
2.3 Screw-out Q_{min}- stop

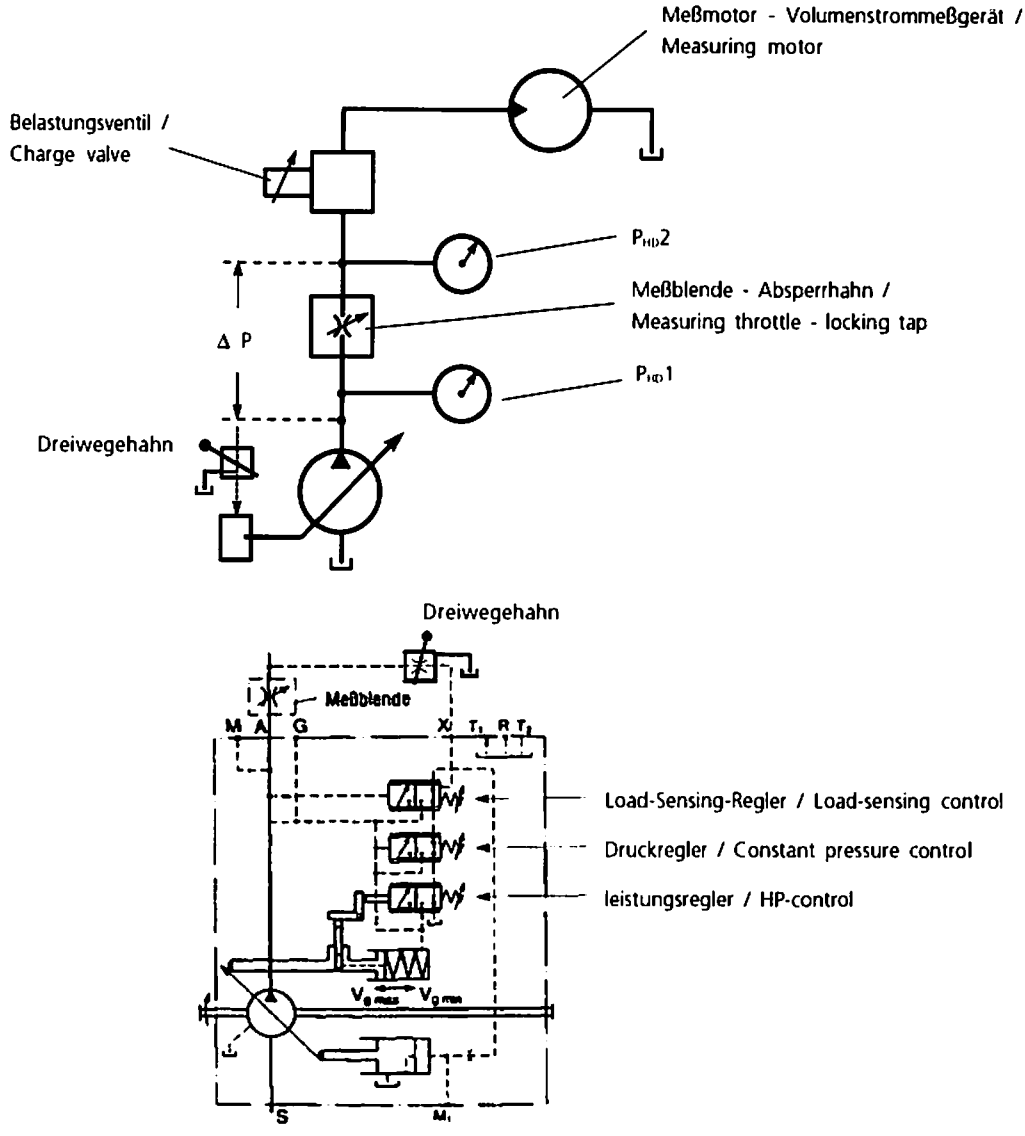
https://truckmanualshub.com/

2.4 Einstellen Load-Sensing-Regler(s)

Prüfstandaufbau

2.4 Setting of Load-sensing control (s)

Test installation



2.5 Meßblende / Absperrhahn vorsichtig schließen bis $Q_{max}/2$ (halber Volumenstrom).
Hochdruck 100 bar ($P_{HD}2$) nach der Meßblende (Belastungsventil) einstellen.

2.6 ΔP am LS-Regler einstellen und kontern.
zum Beispiel: 18 bar ΔP
$P_{HD}2$ = 100 bar ΔP 18 bar
$P_{HD}1$ = 118 bar

2.7 Dreiwegehahn in der X-Leitung vorsichtig schließen.

2.8 Q_{min}-Schraube anlegen, 1/2 Umdrehung wieder herausdrehen und kontern.

2.5 Measuring orifice / close carefully locking tap up to $Q_{max}/2$ (half volume).
Set high pressure 100 bar ($P_{HD}2$) behind the measuring orifice (charge valve).

2.6 Set ΔP at the HP-control and jam the screw.
for example: 18 bar ΔP
$P_{HD}2$ = 100 bar ΔP 18 bar
$P_{HD}1$ = 118 bar

2.7 Measuring orifice / close entirely locking tap

2.8 Place Q_{min}-screw, screw-out again and jam the screw.

https://truckmanualshub.com/

2.4 Einstellen

H - Kennlinie $V_{g\,min}$ - $V_{g\,max}$ (positive control)

Zur Verstellung ist ein Druck von 30 bar notwendig. Das erforderliche Stellöl wird dem Hochdruck oder dem Anschluß G anliegenden Fremdstelldruck (30 bar) entnommen.

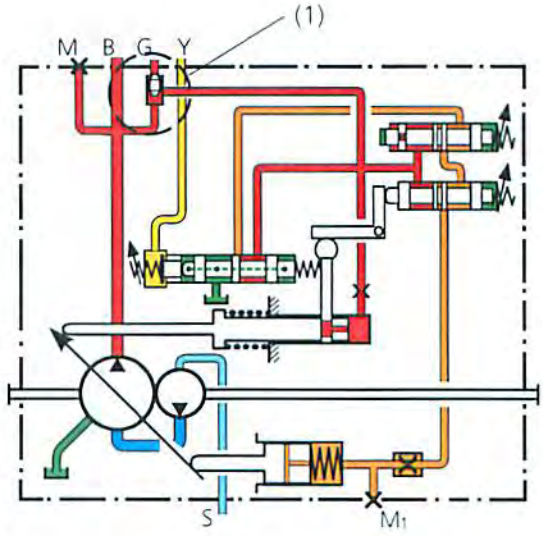
Ist der Betriebsdruck 30 bar und $V_{g\,min} > 0$, so ist kein Fremdstelldruck erforderlich. In diesem Fall muß das Wechselventil (1) vor Inbetriebnahme aus der Pumpe entfernt werden. Sonst Gefahr von Fehlfunktion.

Ausgangslage im drucklosen Zustand ist: $V_{g\,max}$
Bei Betriebsdruck > 30 bar schwenkt die Pumpe von $V_{g\,max}$ nach $V_{g\,min}$.

Steuerbeginn (bei $V_{g\,min}$),
einstellbar _____ von 4 - 10 bar

H2 ♦ Steuerdruckanstieg
($V_{g\,min}$ - $V_{g\,max}$) _____ Δp = 25 bar

H6 ♦ Steuerdruckanstieg
($V_{g\,min}$ - $V_{g\,max}$) _____ Δp = 10 bar



Leistungsregler mit Druckabschneidung und hydr. Hubbegrenzung, **LRDH2**, **LRDH6**
(Funktion: $V_{g\,min}$ nach $V_{g\,max}$)

2.4 Einstellen

H - Kennlinie $V_{g\,max}$ - $V_{g\,min}$ (negative control)

Zur Verstellung ist ein Druck von 30 bar notwendig. Das erforderliche Stellöl wird dem Hochdruck oder dem Anschluß G anliegenden Fremdstelldruck (30 bar) entnommen.

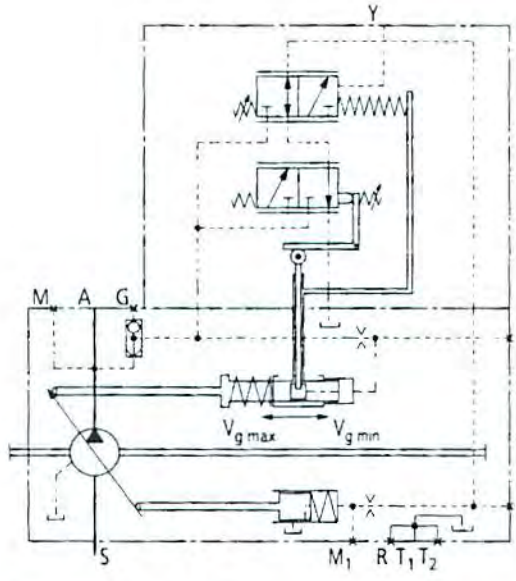
Ist der Betriebsdruck 30 bar, so ist kein Fremdstelldruck erforderlich. In diesem Fall muß das Wechselventil (1) vor Inbetriebnahme aus der Pumpe entfernt werden. Sonst Gefahr von Fehlfunktion.

Ausgangslage im drucklosen Zustand ist: $V_{g\,max}$
Vertellung von $V_{g\,max}$ nach $V_{g\,min}$.
Mit steigendem Steuerdruck schwenkt die Pumpe auf kleineres Verdrängungsvolumen.

Verstellbeginn (bei $V_{g\,max}$),
einstellbar _____ von 4 - 10 bar

Kennlinie **H1** ♦ Steuerdruckanstieg
($V_{g\,max}$ - $V_{g\,min}$) _____ Δp = 25 bar

Kennlinie **H5** ♦ Steuerdruckanstieg
($V_{g\,max}$ - $V_{g\,min}$) _____ Δp = 10 bar



Schaltplan **LRH1**, **LRH5**

https://truckmanualshub.com/

2.4 Setting the H - characteristic curve $V_{g\,min}$ - $V_{g\,max}$ (positive control)

A pressure of 30 bar is required for the adjustment. The required control oil is obtained from the high pressure or from the remote adjustment pressure (30 bar) being applied to port G.

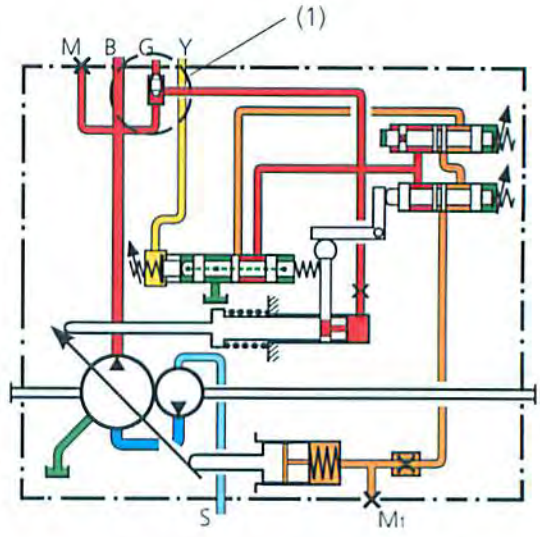
If the working pressure is 30 bar and $V_{g\,min} > 0$, no remote adjustment pressure is required. In this case the shuttle valve (1) must be removed from the pump before commissioning. Otherwise incorrect functions may occure.

Initial condition in a depressurised condition: $V_{g\,max}$ with a working pressure of > 30 bar, the pump swivels from $V_{g\,max}$ to $V_{g\,min}$.

Start of control (at $V_{g\,min}$),
Adjustable ——— from 4 - 10 bar

H2 ♦ Increase in control pressure
($V_{g\,min}$ - $V_{g\,max}$) ——— Δp = 25 bar

H6 ♦ Increase in control pressure
($V_{g\,min}$ - $V_{g\,max}$) ——— Δp = 10 bar



Power controller with pressure cut-offand hydraulic stroke limiter, **LRDH2, LRDH6**
(Function: $V_{g\,min}$ to $V_{g\,max}$)

2.4 Setting the H - characteristic curve $V_{g\,max}$ - $V_{g\,min}$ (negative control)

A pressure of 30 bar is required for the adjustment. The required control oil is obtained from the high pressure or from the remote adjustment pressure (30 bar) being applied to port G.

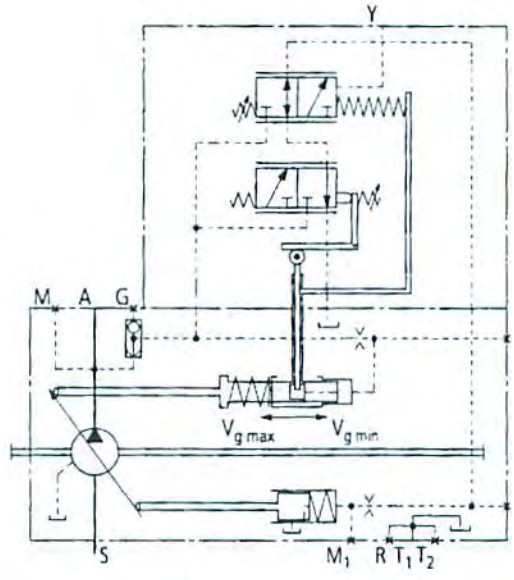
If the working pressure is 30 bar, no remote adjustment pressure is required. In this case the shuttle valve (1) must be removed from the pump before commissioning. Otherwise incorrect functions may occure.

Initial condition in a depressurised condition: $V_{g\,max}$
Adjustment from $V_{g\,max}$ to $V_{g\,min}$.
Mit steigendem Steuerdruck schwenkt die Pumpe auf kleineres Verdrängungsvolumen.

Start of control (at $V_{g\,max}$),
Adjustable——— from 4 - 10 bar

H1 ♦ Increase in control pressure
($V_{g\,max}$ - $V_{g\,min}$) ——— Δp = 25 bar

H5 ♦ Increase in control pressure
($V_{g\,max}$ - $V_{g\,min}$) ——— Δp = 10 bar



Schaltplan **LRH1, LRH5**

https://truckmanualshub.com/

Einstellmöglichkeit 1
z. B. H-Kennlinie $V_{g\,min}$ - $V_{g\,max}$ (positive control)

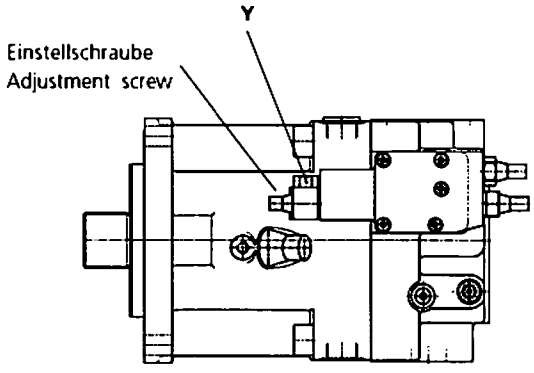
Einstellung Regelbeginn
über mehrere Punkte nach Leistungs-diagramm. (Steuerdruck - Volumenstrom)

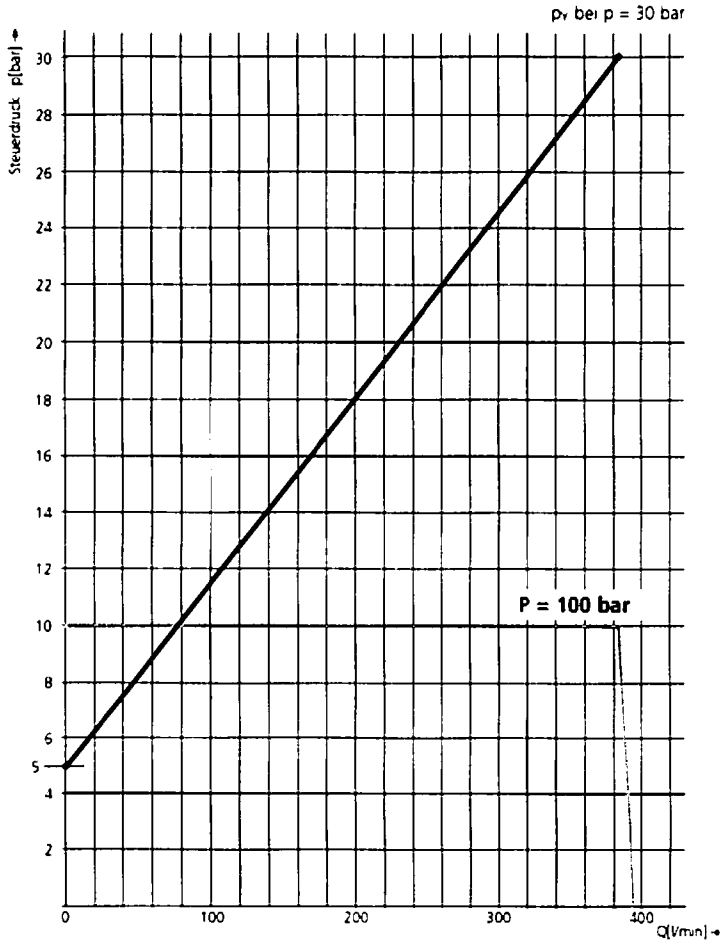
	Beispiel
• $P_{A/B}$ unterhalb Regelbeginn Leistungsregler	100 bar
$P_{Steuerdruck}$: **Y** • Regelbeginn: gemäß Auftrag	5 ± 0,6 bar
$P_{Steuerdruck}$: **Y** • Regelende: gemäß Auftrag	30 ± 1 bar
• Prüfen der Hysterese und Stetigkeit im gesamten Regelbereich	

Adjustable possibilty 1

Adjusting the start of control
Via more than one point on the power diagram (control pressure - flow)

	Example
• $P_{A/B}$ Below the start of control Power controller	100 bar
$P_{control\ pressure}$: **Y** • Start of control: as per order	5 ± 0,6 bar
$P_{control\ pressure}$: **Y** • End of control: as per order	30 ± 1 bar
• Checking the hysteresis and continuance over the entire control range	





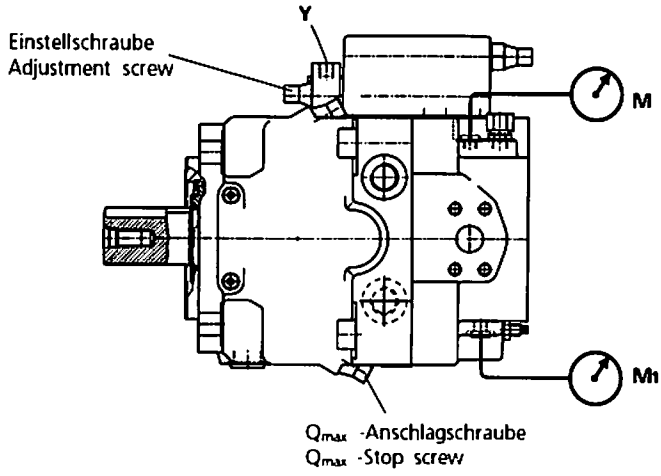
https://truckmanualshub.com/

Einstellmöglichkeit 2

Einstellung Regelbeginn
Kontrolle Stelldruck an M_1
⚠ Diese Einstellung ist ungenau (Toleranz).

Adjustment possibility 2

Setting the start of control by
checking the adjustment pressure at M_1
⚠ This setting is not exact (tolerance).



Beispiel: **H2 positive control $V_{g\,min}$ - $V_{g\,max}$**

		Manometer	
• $P_{A/B}$ • $P_{Steuerdruck}$ Y	100 bar 0 bar	M = 100 bar	M_1 = ~100 bar
• $P_{Steuerdruck}$ Y Regelbeginn gemäß Auftrag	5 ± 0,6 bar	M = 100 bar	M_1 = 1/3 von M = ~33 bar Einstellung an Einstellschraube
• $P_{Steuerdruck}$ Y Regelende gemäß Auftrag	30 ± 1 bar	M = 100 bar	M_1 = 0 bar bzw. Gehäusedruck

- Förderstrom Q_{max} überprüfen / einstellen.

Example: **H2 positive control $V_{g\,min}$ - $V_{g\,max}$**

		Pressure gauge	
• $P_{A/B}$ • $P_{control\ pressure}$ Y	100 bar 0 bar	M = 100 bar	M_1 = ~100 bar
• $P_{control\ pressure}$ Y Start of control as per order	5 ± 0,6 bar	M = 100 bar	M_1 = 1/3 of M = ~33 bar Set via the adjustment screw
• $P_{control\ pressure}$ Y End of control as per order	30 ± 1 bar	M = 100 bar	M_1 = 0 bar or housing pressure

- Flow Q_{max} check / adjust.

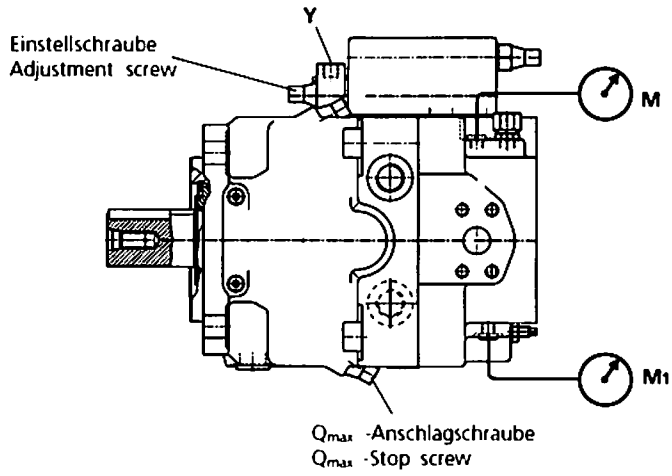
https://truckmanualshub.com/

Einstellmöglichkeit 2

Einstellung Regelbeginn
Kontrolle Stelldruck an M_1
⚠ Diese Einstellung ist ungenau (Toleranz).

Adjustment possibility 2

Setting the start of control by
checking the adjustment pressure at M_1
⚠ This setting is not exact (tolerance).



Beispiel: **H1 negative control $V_{g\,max}$ - $V_{g\,min}$**

		Manometer	
• $P_{A/B}$ • $P_{Steuerdruck}$ Y	100 bar 0 bar	M = 100 bar	M_1 = 0 bar bzw. Gehäusedruck
• $P_{Steuerdruck}$ Y Regelbeginn gemäß Auftrag	5 ± 0,6 bar	M = 100 bar	M_1 = 1/3 von M = **~33 bar** Einstellung an Einstellschraube
• $P_{Steuerdruck}$ Y Regelende gemäß Auftrag	30 ± 1 bar	M = 100 bar	M_1 = ~ 100 bar

- Förderstrom Q_{max} überprüfen / einstellen.

Example: **H1 negative control $V_{g\,max}$ - $V_{g\,min}$**

		Pressure gauge	
• $P_{A/B}$ • $P_{control\ pressure}$ Y	100 bar 0 bar	M = 100 bar	M_1 = 0 bar or housing
• $P_{control\ pressure}$ Y Start of control as per order	5 ± 0,6 bar	M = 100 bar	M_1 = 1/3 of M = **~33 bar** Set via the adjustment screw
• $P_{control\ pressure}$ Y End of control as per order	30 ± 1 bar	M = 100 bar	M_1 = ~100 bar pressure

- Flow Q_{max} check / adjust.

https://truckmanualshub.com/

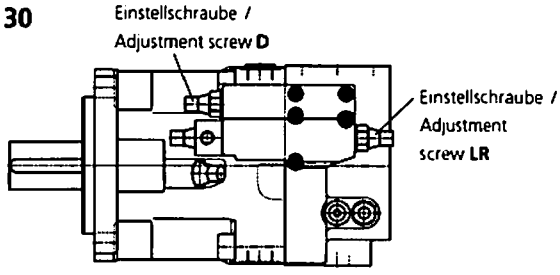
2.5 Einstellen Leistungsregler LRD(H2)

- Druckregler blockieren (eindrehen).
  H_{max} Steuerdruck auf Y ♦ Pumpe in Q_{max}
- Leistungsregler nach Leistungsdiagramm (LD) einstellen.

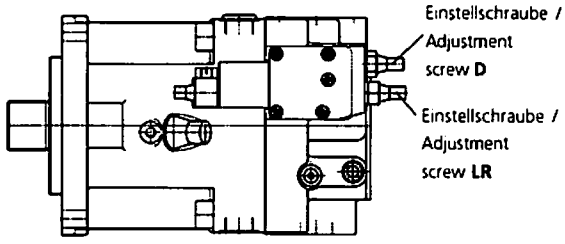
Einstellmöglichkeit / Adjustment possibility 1

Einstellung Regelbeginn nach Eingangsdrehmoment
Setting the start of control via the input torque

40 ... 130



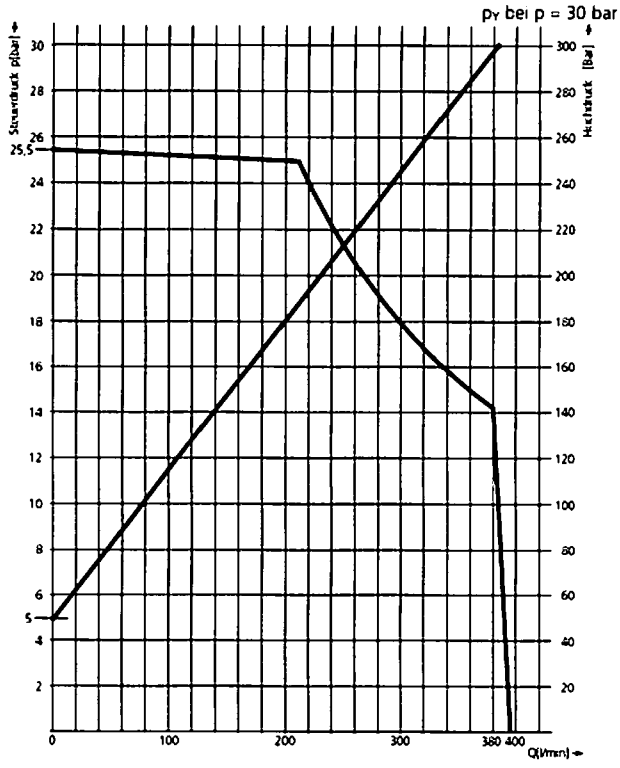
190 ... 260

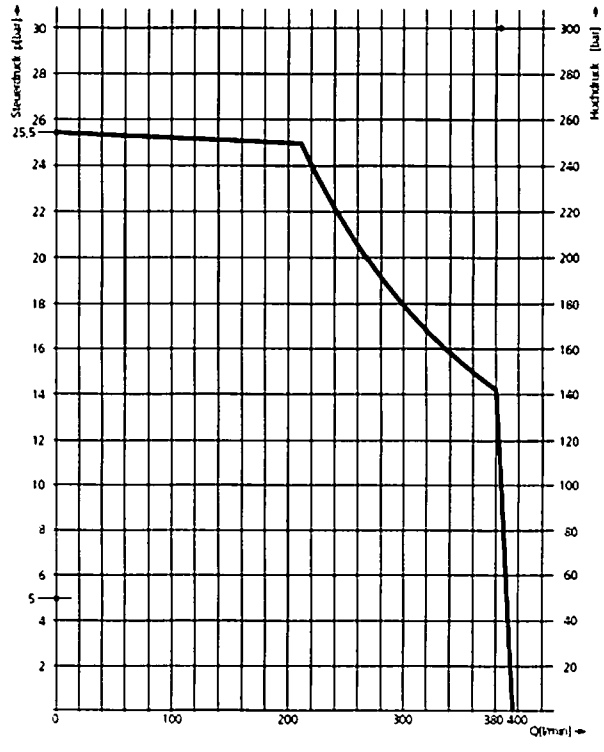


A11VLO 260 LRDH2 = 1551 min^{1} 102,5 KW 631 Nm

2.5 Setting the power controller LRD(H2)

- Lock the power controller (screw in).
  H_{max} control pressure on Y ♦ pump to Q_{max}
- Set the power controller to the power diagram (LD).





2.5 Einstellen Leistungsregler LRD(H1)

- Druckregler blockieren (eindrehen).
  Steuerdruck an Y - 0 bar ♦ Pumpe in Q_{max}
- Leistungsregler nach Leistungsdiagramm (LD) einstellen.

2.5 Setting the power controller LRD(H1)

- Lock the power controller (screw in).
  Control pressure on Y - 0 bar ♦ pump to Q_{max}
- Set the power controller to the power diagram (LD).

https://truckmanualshub.com/

2.9 Einstellen Leistungsregler LRDS

2.10 Druckregler blockieren (eindrehen).
2.11 Leistungsregler nach Leistungsdiagramm (LD) einstellen.
2.12 Meßblende, Absperrhahn öffnen
Förderstrom Q_{max} einstellen (Q_{max}-Schraube)

2.9 Setting of the HP-control LRDS

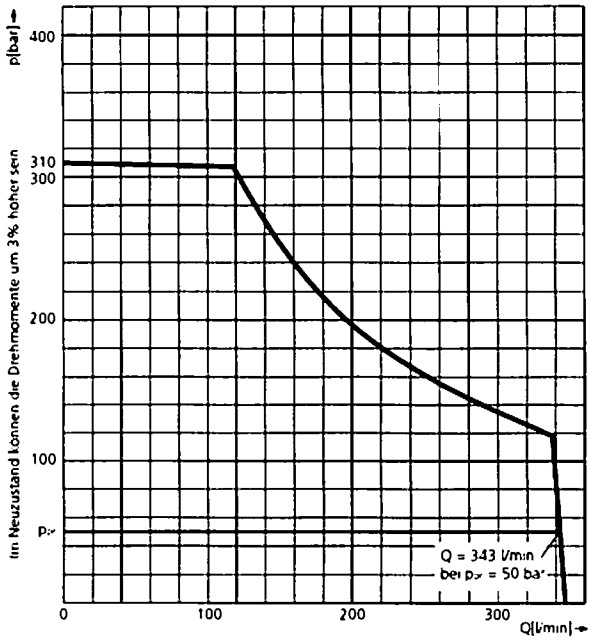
2.10 Block constant pressure control (screw-in).
2.11 Setting of HP control as to HP diagram.
2.12 Measuring orifice, open locking tap
Set flow Q_{max} (Q_{max}-screw)

Beispiel 1

Einstellung Regelbeginn
nach Eingangsdrehmoment

Example 1

Setting of begin of regulation
as to input torque



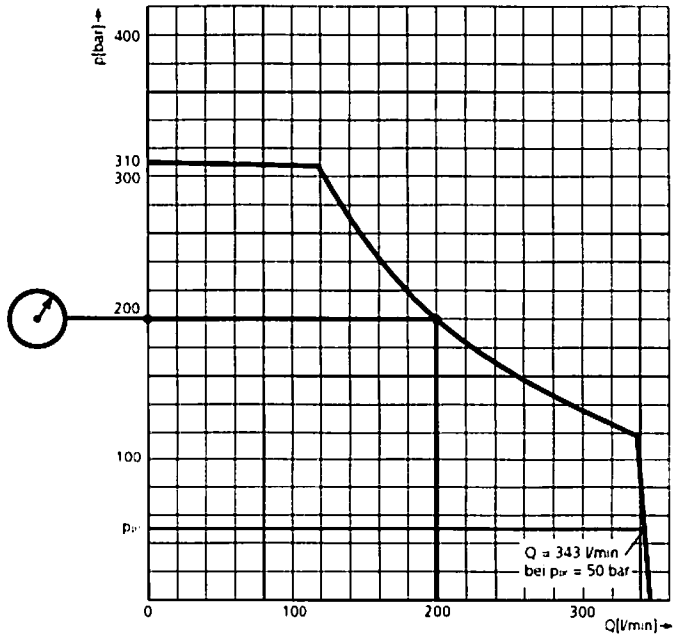
A11VLO 200 LRDS = 1775 min^{1} 75,0 KW 404 Nm

Beispiel 2

Einstellung Regelbeginn
über einen Punkt auf der
Leistungskennlinie nach
Druck und Volumen

Example 2

Setting of begin of regulation
at a point of the horse power
diagram (pressure / flow)



https://truckmanualshub.com/

LR

Beispiel 3

Einstellung Regelbeginn
Druck mit Kontrolle
Stelldruck an $\mathbf{M_1}$

⚠ Diese Einstellung ist "ungenau" (Toleranz)

Beispiel:
Regelbeginn = 120 bar
Betriebsdruck langsam erhöhen bis Manometer an **M** = 120 bar anzeigt, dabei darf der Stelldruck an $\mathbf{M_1}$ ~ 1/3 vom Betriebsdruck ~ 40 bar betragen.

Das ist Regelbeginn

Beispiel:
Druck an **M** = 120 bar
Druck an $\mathbf{M_1}$ = 20 bar
Regelbeginn zu spät
Leistungsüberschreitung
Einstellschraube herausdrehen bis ~ 40 bar erreicht werden.

Example 3

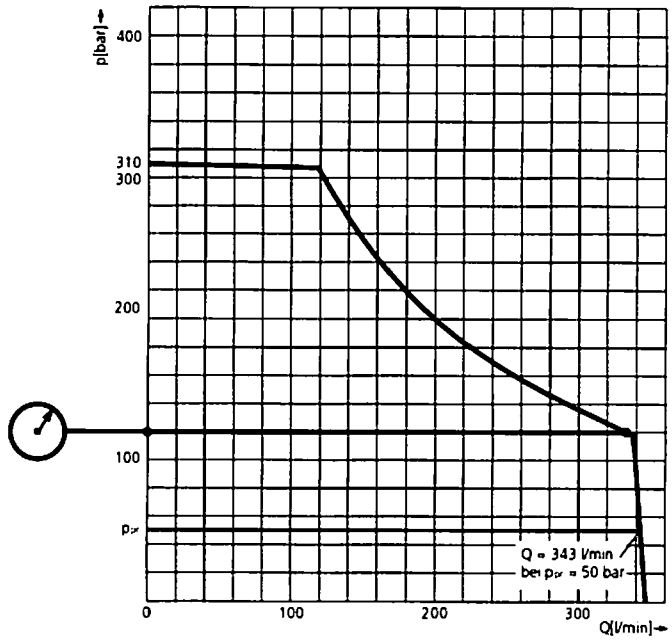
Setting of begin of regulation
Pressure with control
Setting pressure at $\mathbf{M_1}$

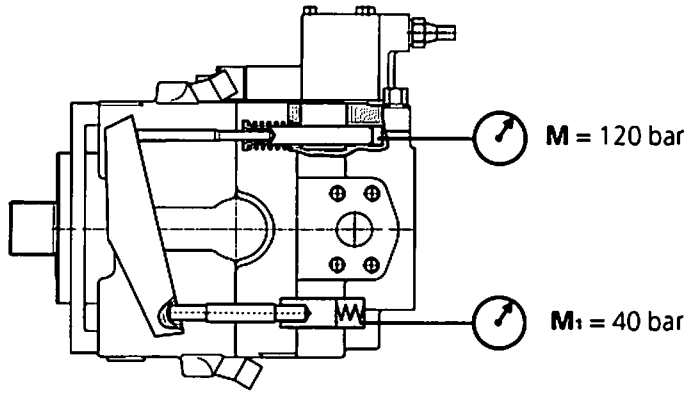
⚠ This setting is "unprecise" (Tolerance)

Example:
Begin of regulation = 120 bar
Slowly increase operation pressure up to pressure gauge at **M** = 120 bar.
The positioning pressure may be at $\mathbf{M_1}$ ~ 1/3 of the operation presure ~ 40 bar.

This is begin of regulation

Example:
Pressure at **M** = 120 bar
Pressure at $\mathbf{M_1}$ = 20 bar
Begin of regulation too late - power excess.
Unscrew setting screw until ~ 40 bar are reached.





https://truckmanualshub.com/

D

2.13 Einstellen Druckregler

2.14 Mit Belastungsventil Druckregler nach Leistungsdiagramm einstellen.

Beispiel 4

Druckreglereinstellung = 310 bar
Betriebsdruck mit Belastungsventil auf ~ 350 bar erhöhen.

Blockierten Druckregler vorsichtig herausdrehen bis 310 bar erreicht wird.
Einstellschraube kontern.

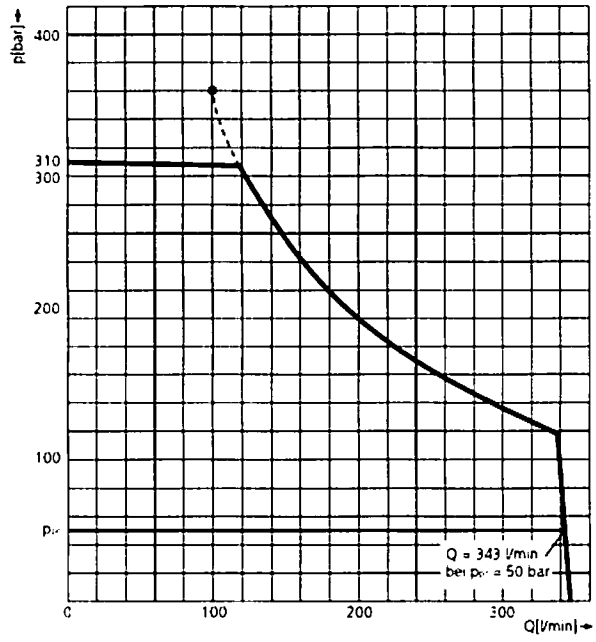
2.13 Setting of constant pressure

2.14 Setting with help of the charge valve the constant pressure control as to HP diagram.

Example 4

Setting of constant pressure control = 310 bar
Increase operation pressure with help of charge valve ~ to 350 bar.

Unscrew carefully blocked constant pressure control up to 310 bar.
Jam setting screw.



https://truckmanualshub.com/

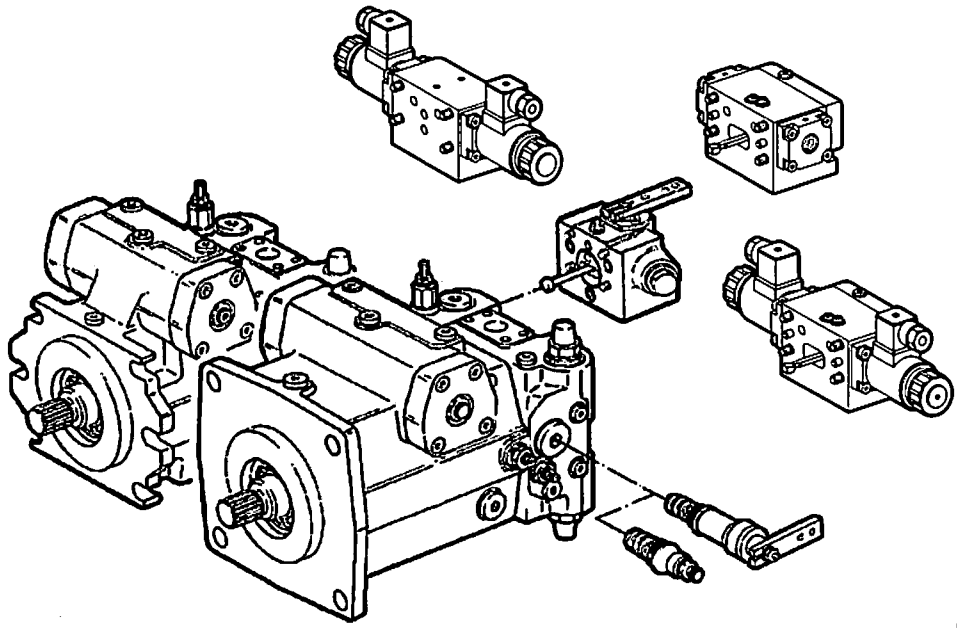
Brueninghaus Hydromatik GmbH, Werk Elchingen, Glockeraustraße 2, D-89275 Elchingen, Tel. (07308) 820, Fax (07308) 7274, E-Mail: service.elchingen@bru-hyd.com
Brueninghaus Hydromatik GmbH, Werk Horb, An den Kelterwiesen 14, D-72160 Horb, Tel. (07451) 920, Fax (07451) 8221, E-Mail: service.horb@bru-hyd.com

https://truckmanualshub.com/

Rexroth
Bosch Group

Reparaturanleitung / Repair instructions

A4VG 71 - 180 Baureihe/Series 32



R

RDE 92003-02-R/01.02
ersetzt/replaces 05.99

Mobile Hydraulics

https://truckmanualshub.com/

HINWEIS

Bezeichnungen, Beschreibungen und Darstellungen entsprechen dem Informationsstand zum Zeitpunkt der Drucklegung dieser Unterlage.

Änderungen können den Service am Produkt beeinflussen, Verpflichtungen entstehen uns daraus nicht.

Methoden und Vorrichtungen sind Empfehlungen, für deren Resultat wir keine Haftung übernehmen können.

BRUENINGHAUS HYDROMATIK- Baugruppen, mit Angabe der Fabrik-Nr. bestellt, sind die Basis guter Reparaturen.

Einstell- und Prüfarbeiten sind bei Betriebstemperatur auf dem Teststand vorzunehmen.

Schutz von Personen und Eigentum ist durch Vorkehrungen sicherzustellen.

Sachkenntnis, die Voraussetzung für jede Service-arbeit, vermitteln wir in unseren Schulungskursen.

NOTICE

Specifications, descriptions and illustrative material shown herein were as accurate as known at the time this publication was approved for printing.

BRUENINGHAUS HYDROMATIK reserves the right to discontinue models or options at any time or to change speci-fications, materials, or design without notice and with-out incurring obligation.

Optional equipment and accessories may add cost to the basic unit, and some options are available only in combination with certain models or other options.

For the available combinations refer to the relevant data sheet for the basic unit and the desired option.

Adjustment and tests have to be carried out on the test bench under operating temperatures.

Protection of personnel and property has to be guaranteed by appropriate measures.

Expert knowledge, the precondition of any service work, can be obtained in our training courses.

INHALT

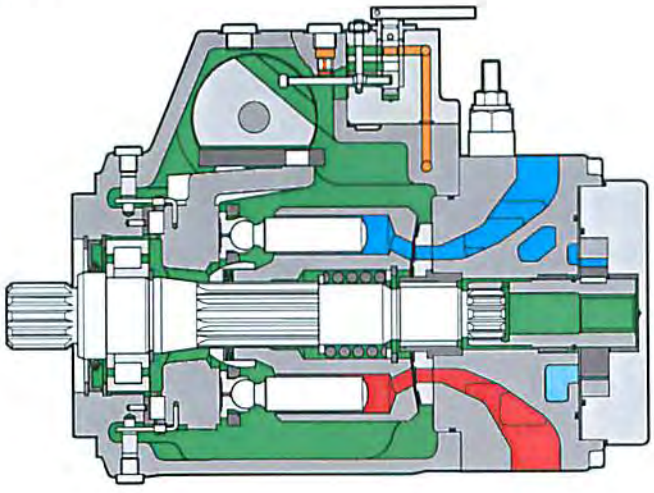
	Seite/ Page
A4VG	
Schnittbild	3-4
Allgemeine Reparaturhinweise	5
Dichtsätze und Baugruppen	6-9
Triebwelle abdichten	10
Hilfspumpe abdichten	11
Stellkolbendeckel abdichten	12-13
Speisedruckventil abdichten	14
Druckbegrenzungsventil abdichten	15
Druckabschneidung abdichten	16
Ansteuergerät abdichten	17
Ansteuergerät HW	18
Ansteuergeräte EP - HD	19-22
Ansteuergerät DA	23
Regelventil abdichten / überprüfen	24
Pumpe demontieren	25-29
Verstellung demontieren	30-31
Zylinder demontieren	32
Überprüfungshinweise	33-34
Stellkolben, Triebwerk montieren	35-37
Triebwerk einbauen	38-41
Pumpe montieren	42-44
Montageanweisung für Anziehdrehmomente	45-48
Sicherheitsbestimmungen	49-50
Einstellhinweise	51-57

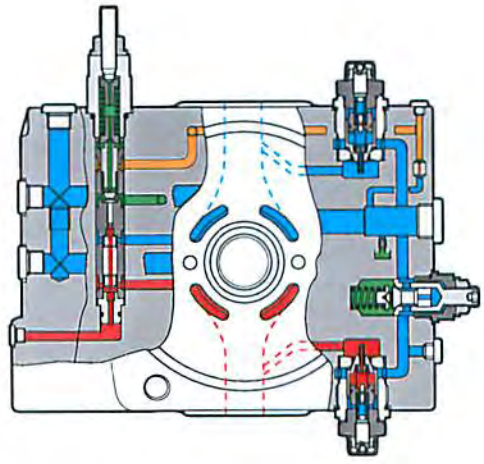
CONTENTS

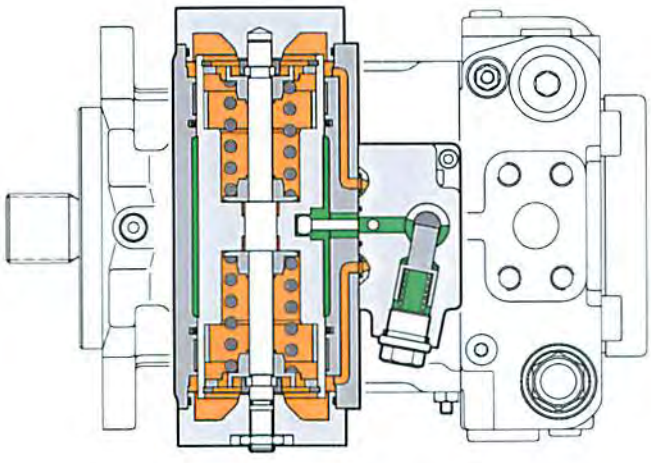
A4VG
Sectional view
General repair instructions
Seal kits and sub assembly groups
Sealing of the drive shaft
Sealing of the boost pump
Sealing of the control piston cover
Sealing of the boost pressure valve
Sealing of the pressure relief valve HD
Sealing of the pressure cut-off valve
Sealing of the control device
Control device HW
Control devices EP - HD
Control device DA
Sealing of the regulator valve
Pump disassembly
Dismantling of the control
Dismantling of the cylinder
Inspection notes
Positioning piston, rotary group assembly
Installation of the rotary group
Assembly of the pump
Assembly guidelines for tightening torques
Safety regulations
Adjustment instructions

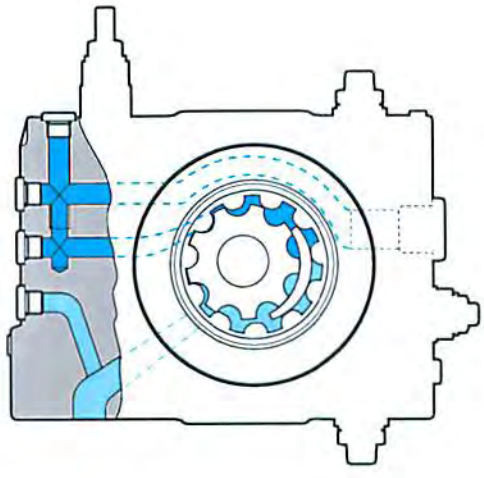
https://truckmanualshub.com/

HW/D

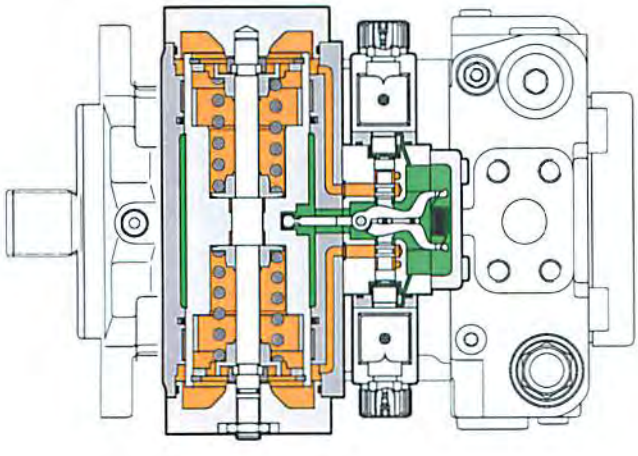




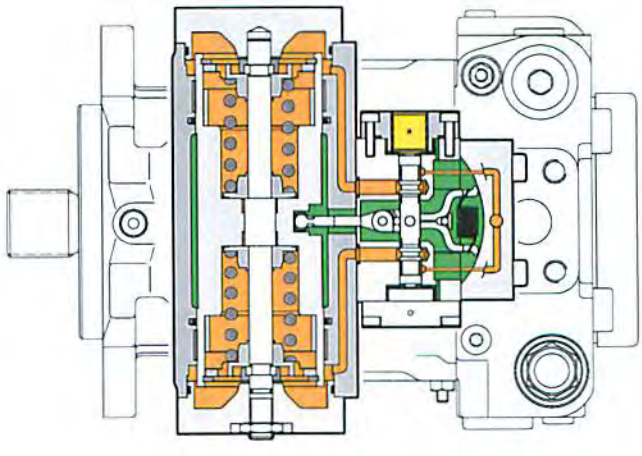




EP/D

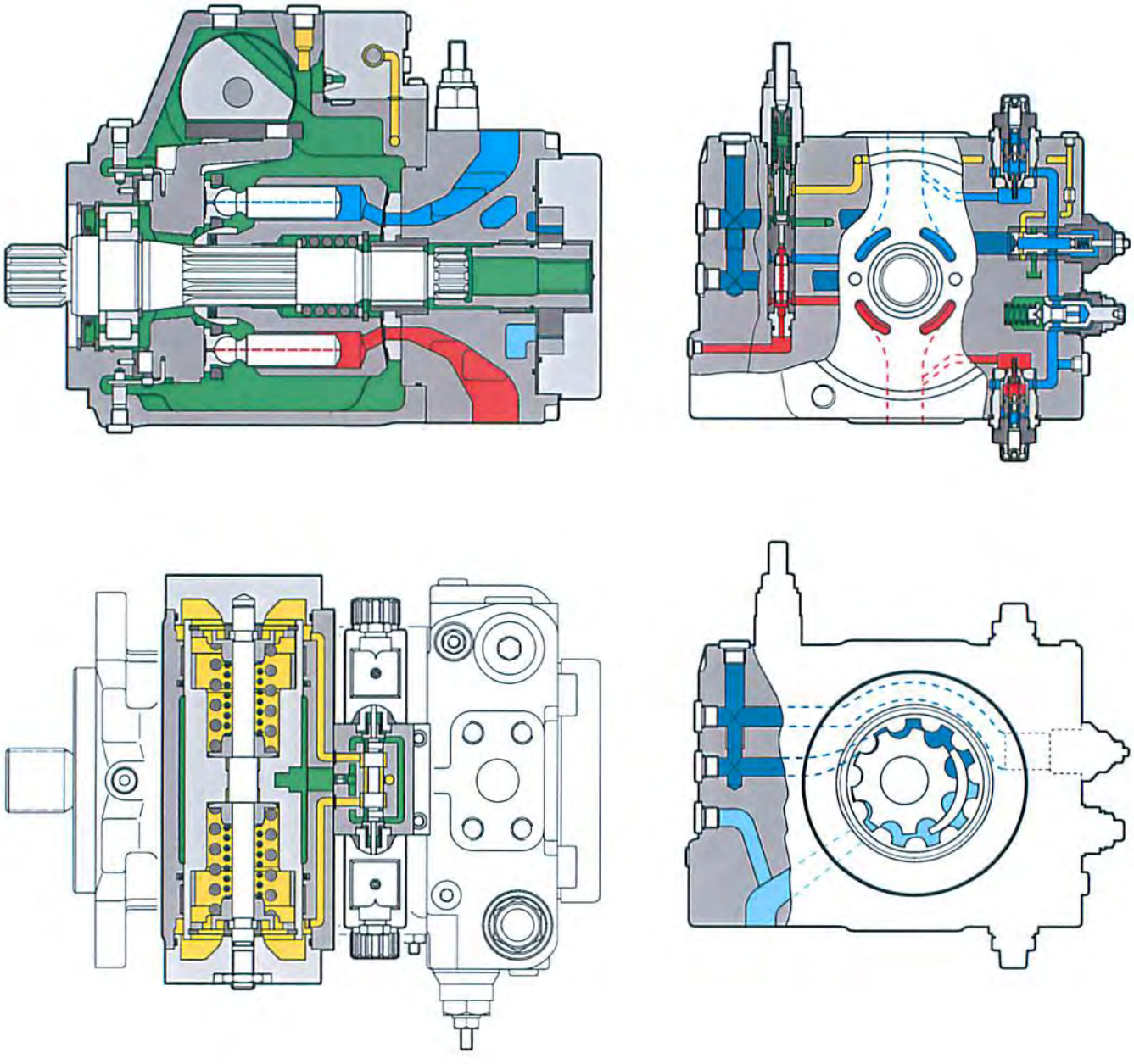


HD/D



https://truckmanualshub.com/

DA/D

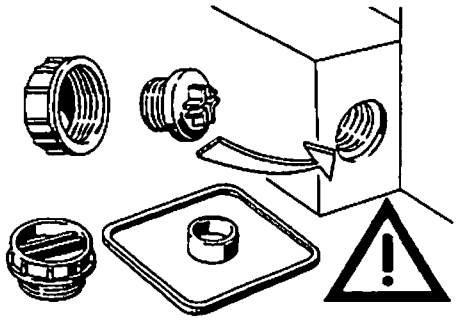


https://truckmanualshub.com/



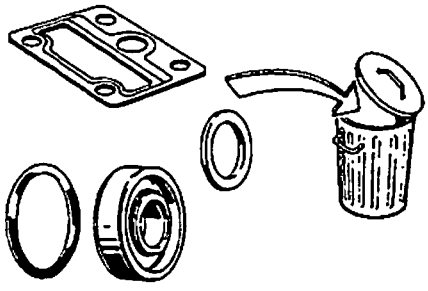
Achtung!
Nachfolgend Hinweise bei allen Reparaturarbeiten an Hydraulikaggregaten beachten!

Attention!
Observe the following notices when carrying out repair work at hydraulic aggregates!



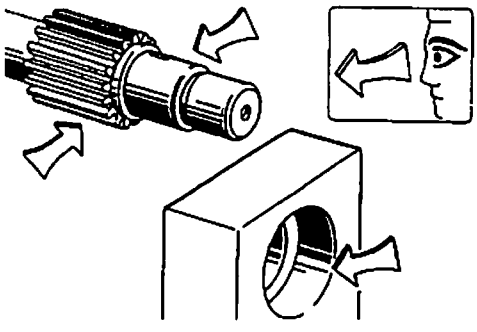
Alle Öffnungen der Hydraulikaggregate verschließen.

Close all ports of the hydraulic aggregates.



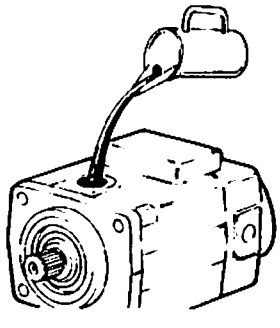
Alle Dichtungen erneuern.
Nur original HYDROMATIK-Ersatzteile verwenden.

Replace all seals.
Use only original HYDROMATIK spare parts.



Alle Dicht- und Gleitflächen auf Verschleiß prüfen.
Achtung: Nacharbeiten an Dichtflächen z.B. durch Schleifpapier kann die Oberfläche beschädigen.

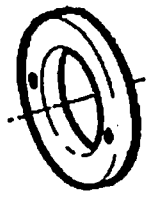
Check all seal and sliding surfaces for wear.
Attention: Rework of sealing area f. ex. with abrasive paper can damage surface.



Hydraulikaggregate vor Inbetriebnahme mit Betriebsmedium befüllen.

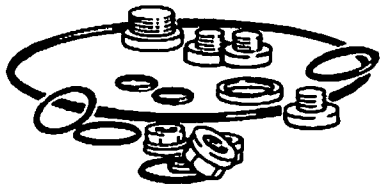
Fill up hydraulic aggregates with medium before start- up.

https://truckmanualshub.com/



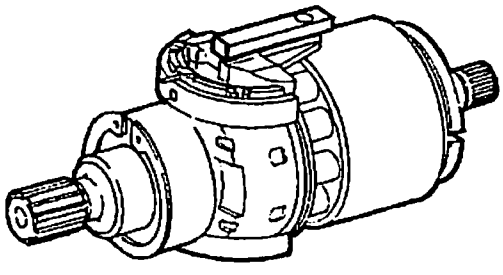
Dichtsatz für Triebwelle.

Seal kit for drive shaft.



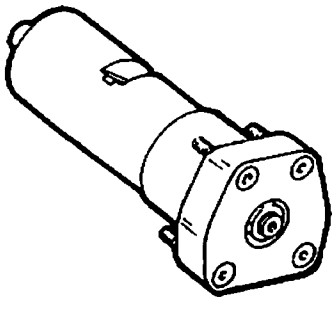
Äußerer Dichtsatz.

External seal kit.



Triebwerk komplett.

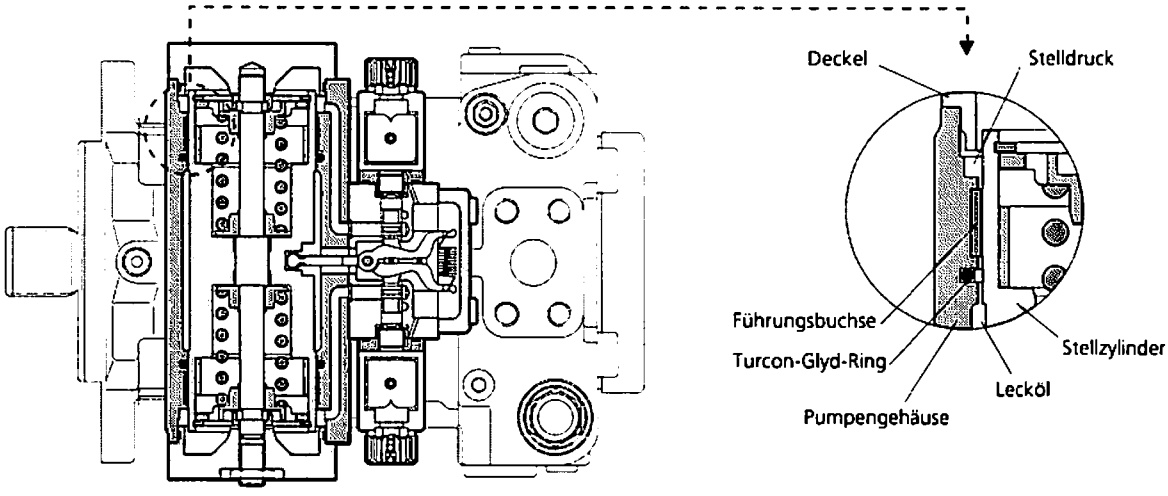
Complete rotary group.



Stellkolben

Positioning piston

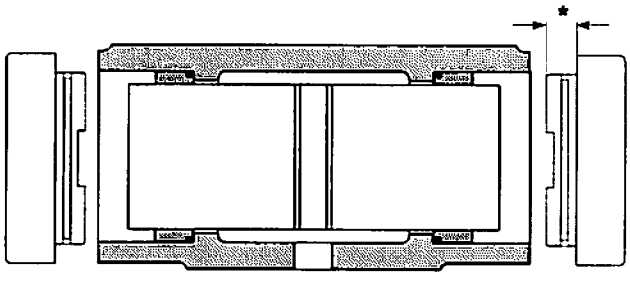
https://truckmanualshub.com/



Bei den Verstellpumpen A4VG erfolgt zur Zeit die Umstellung der Verstellung auf Turcon-Dichtungen.
Die Stückliste der kompletten Einheit erhält dabei eine neue Ident.- Nummer.
Typenschlüssel, Typnummer und Außenabmeßungen bleiben dabei unverändert. (Pumpengehäuse ändert sich nur im Bereich vom Stellkolben. Stellkolben ändert sich in eine angefaste Ausführung).

⚠ Alten Stellkolben nicht bei Turcon-Dichtung verwenden (scharfkantig - Dichtungen werden beschädigt).

Pumpengehäuse / Pump housing
mit Lagerbuchse / with bush **ALT / OLD**



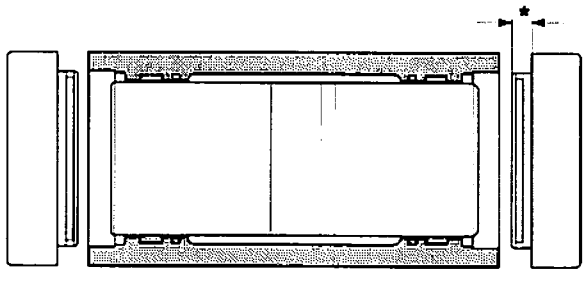
⚠ Die Umstellung der Verstellung auf Turcon-Dichtung ist im allgemeinen mit einer Funktionsverbesserung verbunden (DA-Verhalten, geringerer Temperatureinfluß auf Stellzeiten).

⚠ Bei gleicher Düsenbestückung können sich die Stellzeiten geringfügig verändern.

At present the change of the control into Turcon seal is made for A4VG.
The parts list of the complete unit will receive a new identification number.
Type reference and outside dimensions remain unchanged (pump housing will change at the area of the positioning piston. Positioning piston will change into chamfering design).

⚠ Do not use old positioning piston with Turcon seal (sharp edged - seal will be damaged)

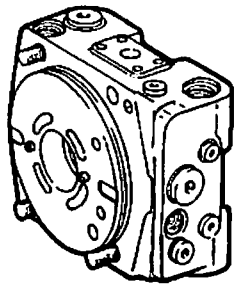
Pumpengehäuse / Pump housing
mit Turcon-Dichtung / with Turcon seal **NEU / NEW**



⚠ The change of the control into Turcon seal design improves in general the function (DA-behaviour, lower temperature-influence on control times).

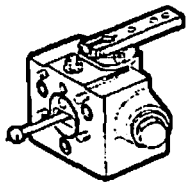
⚠ The control times will slightly change with the same throttle sections. Therefore our customers have to be informed about this change.

https://truckmanualshub.com/



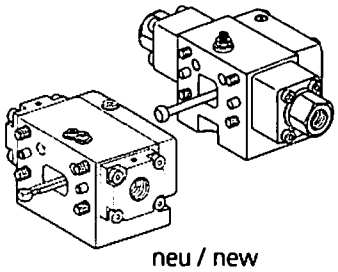
Anschlußplatte

Valve plate



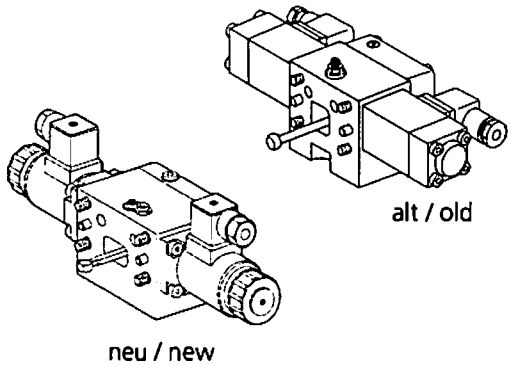
Ansteuergerät **HW**
Hinweis:
NG 71 wie NG 40 - 56 mit Flachdichtung.

Control device **HW**
Note:
Size 71 control device as size 40 - 56 with flat seal.



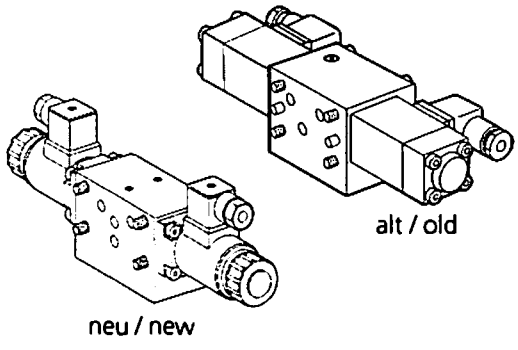
Ansteuergerät **HD**
Hinweis:
NG 71 wie NG 40 - 56 mit Flachdichtung.

Control device **HD**
Note:
Size 71 control device as size 40 - 56 with flat seal.



Ansteuergerät **EP**
Hinweis:
NG 71 wie NG 40 - 56 mit Flachdichtung.

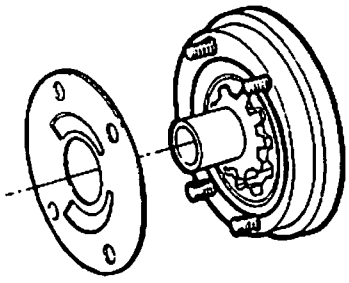
Control device **EP**
Note:
Size 71 control device as size 40 - 56 with flat seal.



Ansteuergerät **DA**
Hinweis:
NG 71 wie NG 40 - 56 mit Flachdichtung.

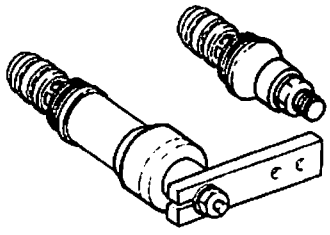
Control device **DA**
Note:
Size 71 control device as size 40 - 56 with flat seal.

https://truckmanualshub.com/



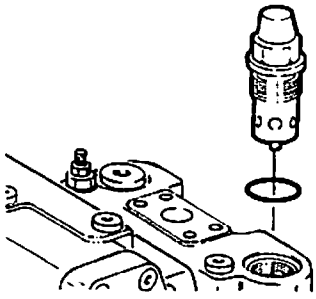
Hilfspumpe

Boost pump



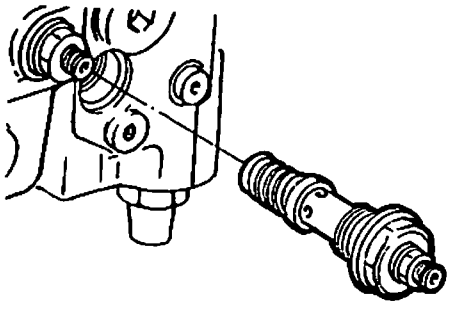
Regelventil

Control valve



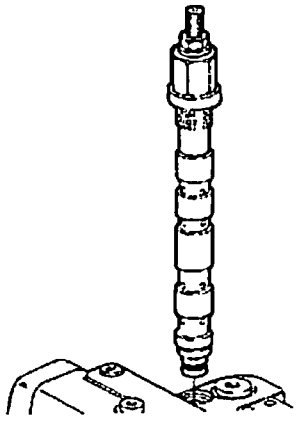
HD - Ventil

High pressure valve



ND - Ventil

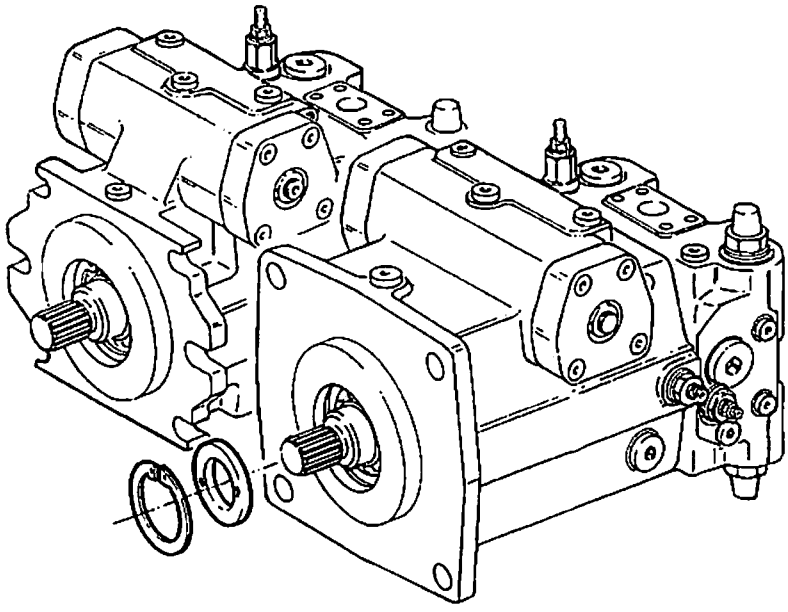
Low pressure valve

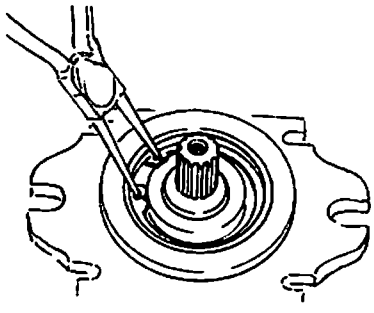


Druckabschneidung

Pressure cut-off

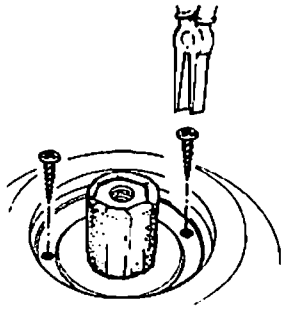
https://truckmanualshub.com/





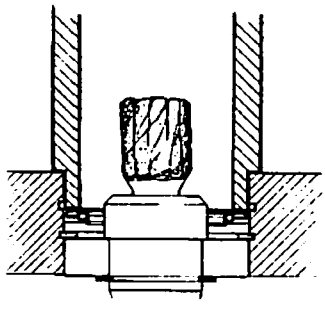
Triebwelle abkleben.
Sicherungsring ausbauen.

Protecting the drive shaft.
Remove retaining ring.



Blechschraube in die mit Gummi gefüllten Löcher eindrehen.
Mit Zange WDR herausziehen.

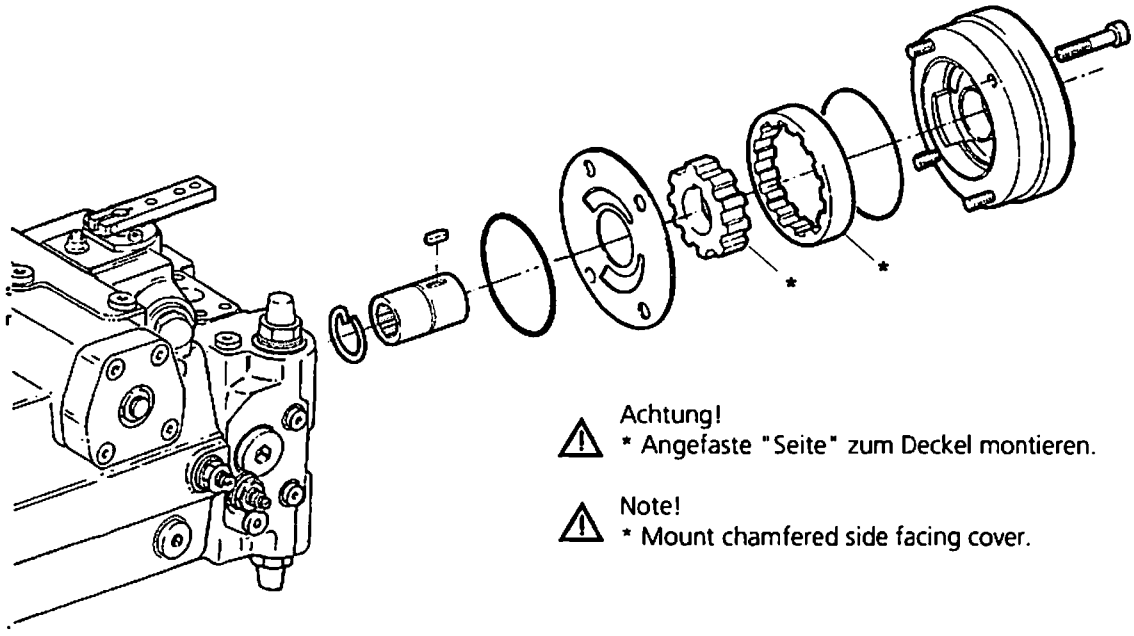
Screw in sheet metal screw into the holes fitted with rubber.
Pull out shaft seal with pliers.



Wellendichtring mit Buchse auf Anschlag einpressen.
Sicherungsring einbauen.
⚠ Dicht- und Staublippe, Wellendichtring leicht einfetten.

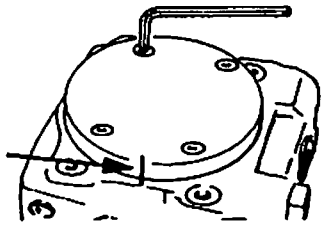
Press-in shaft seal with bush to stop.
Assemble retaining ring.
⚠ Lightly grease the seal, dust lips and shaft seal ring.

https://truckmanualshub.com/



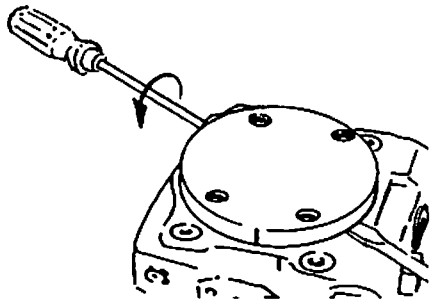
⚠ Achtung!
* Angefaste "Seite" zum Deckel montieren.

⚠ Note!
* Mount chamfered side facing cover.



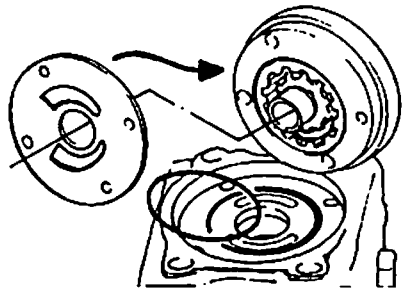
Lage kennzeichnen,
Befestigungsschrauben ausbauen.

Mark position,
remove fixing screws.



Deckel abdrücken.

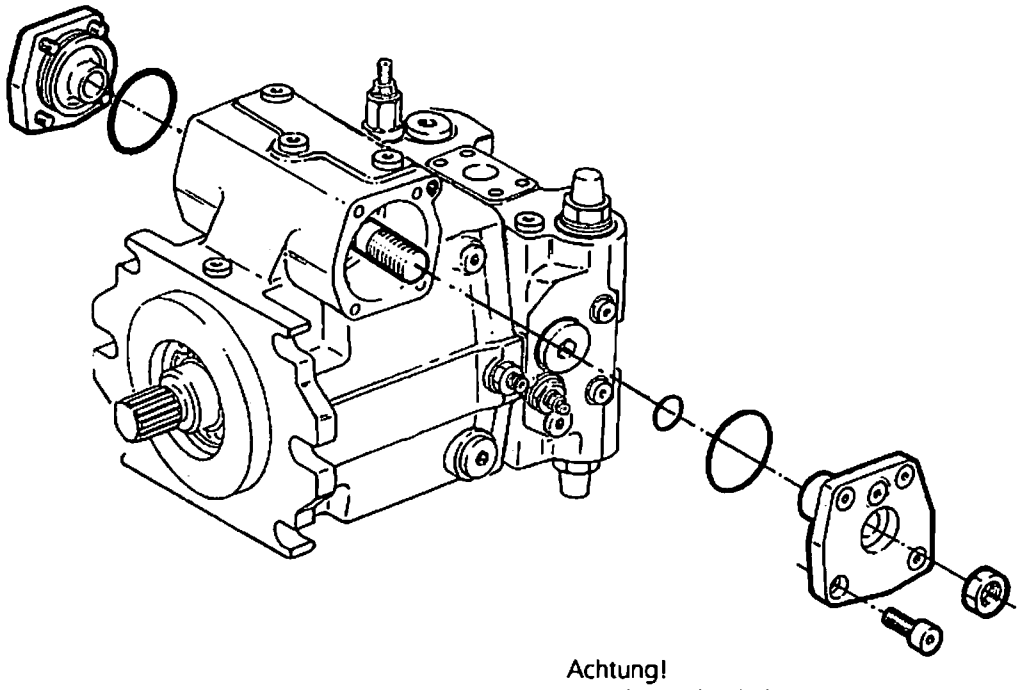
Pry-off cover.



Kontrolle:
O-Ring, Nut,
Lauffläche, Anschlußplatte.

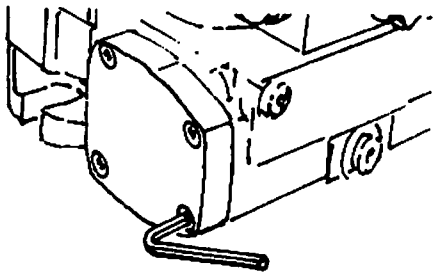
Check:
O-ring, groove,
gliding surface, connection plate.

https://truckmanualshub.com/



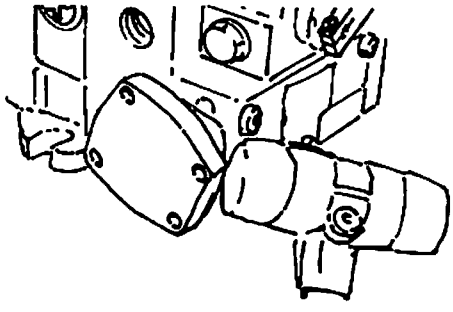
Achtung!
Korrekt mechanische 0-Lageneinstellung überprüfen

Attention!
Check correct mechanical 0-position.



Lage kennzeichnen.

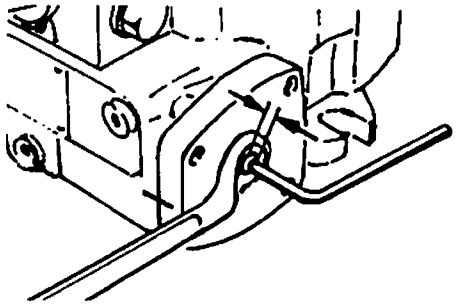
Mark position.



Deckel verdrehen und mit leichten Hammerschlägen lösen.

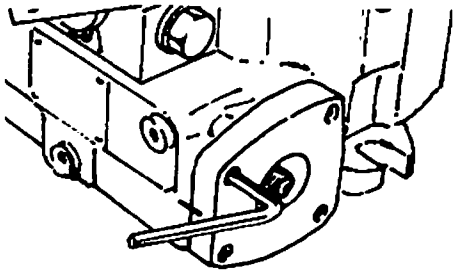
Rotate cover and release by tapping gently with hammer.

https://truckmanualshub.com/



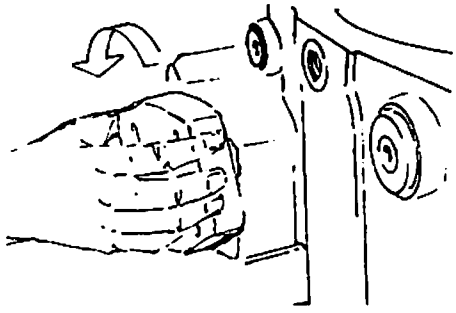
Deckel kennzeichnen. Maß festhalten, Kontermutter lösen, Stellschraube gegenhalten.

Mark cover. Must be fixed, loosen counter nut, hold adjustment screw.



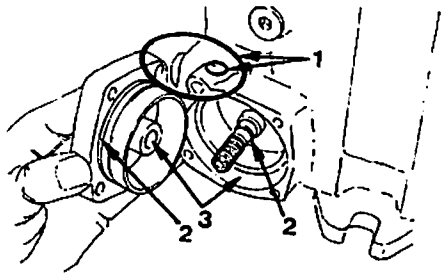
Deckel demontieren.

Remove cover.



Deckel von Stellschraube "abschrauben".

Lift off by turning the setting screw.



Kontrolle!
O-Ring (1), Nut (2), Gehäuse (3).

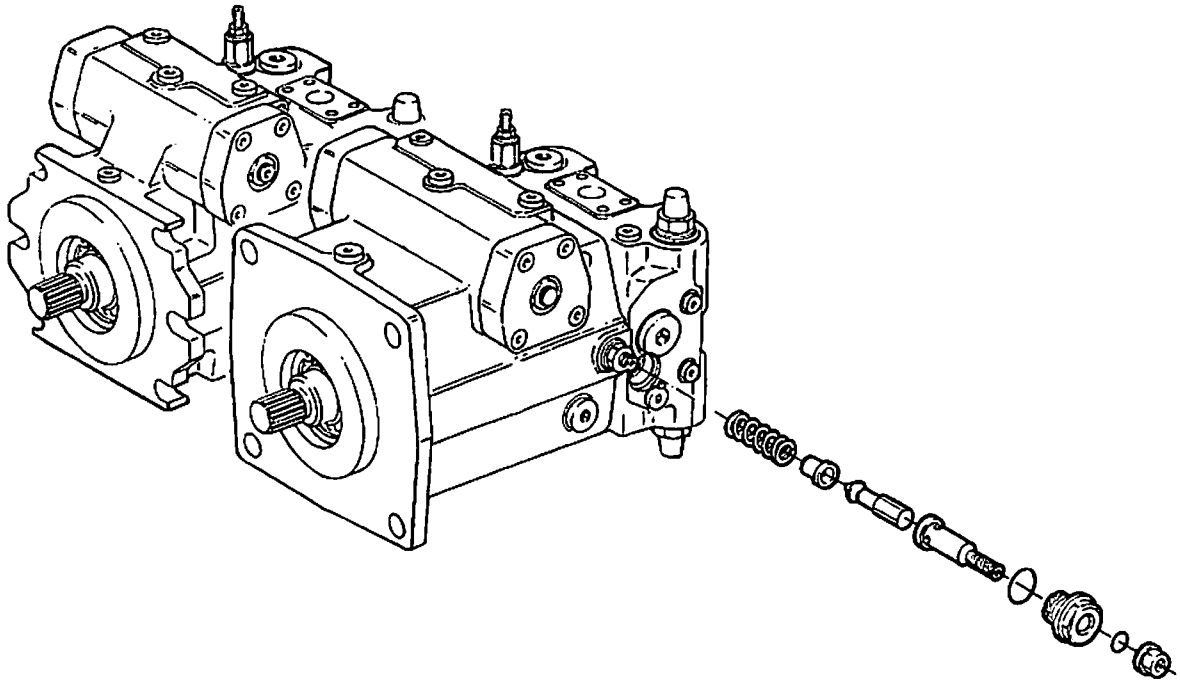
Check!
O-ring (1), groove (2), housing (3).

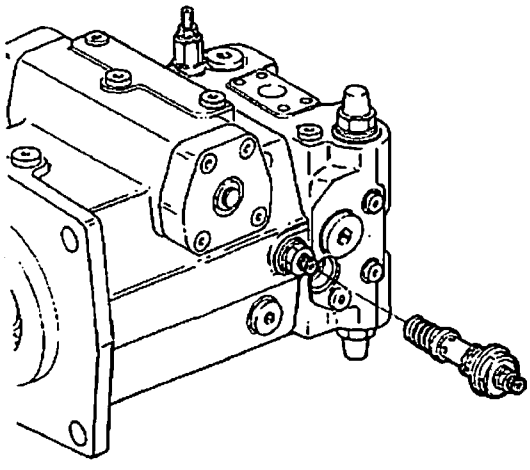


Achtung!
Korrekte mechanische Nullageneinstellung muß nach Einbau im Gerät bzw. Prüfstand erfolgen.

Attention!
Adjustment of the correct zero position to be carried out after installation into the machine or on the test bench.

https://truckmanualshub.com/

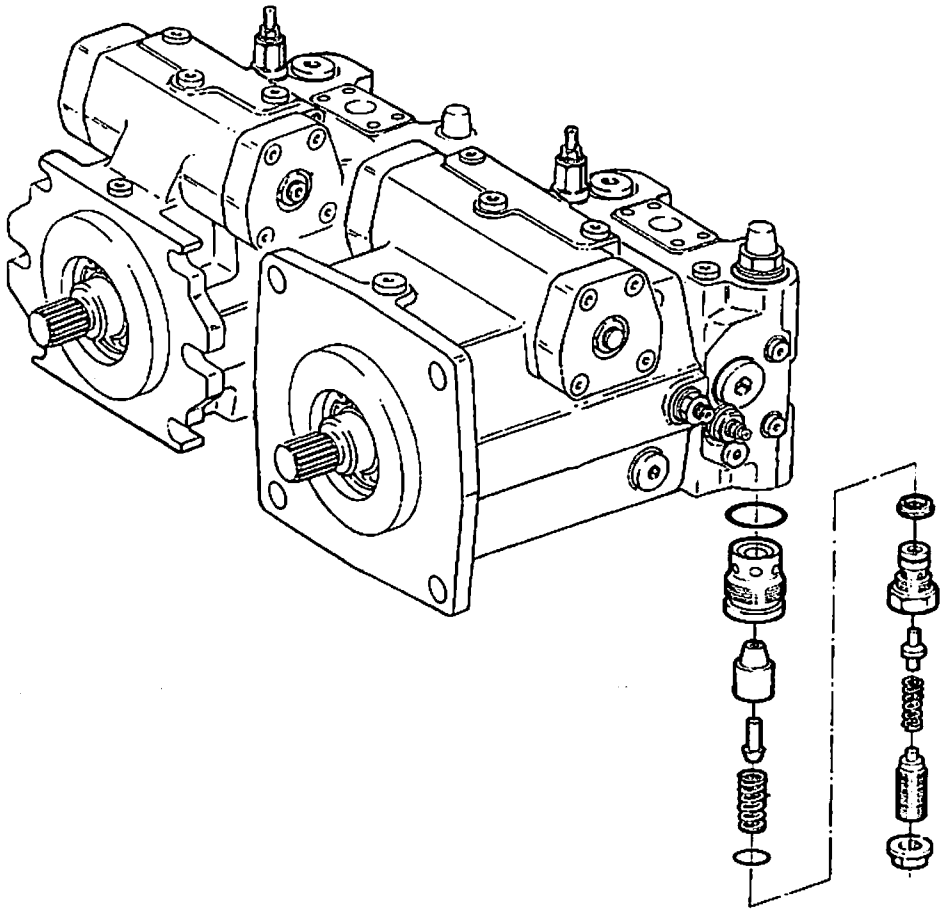


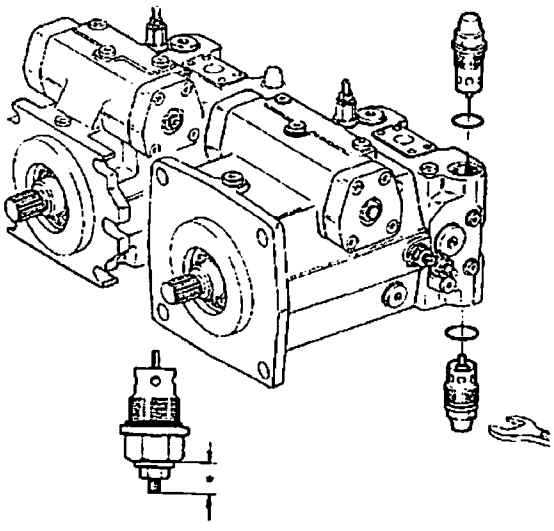


Ventil komplett ausbauen.
Hinweis:
Einstellschraube nicht verändern.
Achtung!
Nach Einbau Ventileinstellung überprüfen!

Remove valve completely:
Note:
Do not change adjustment screw.
Attention!
Check valve setting after installation.

https://truckmanualshub.com/

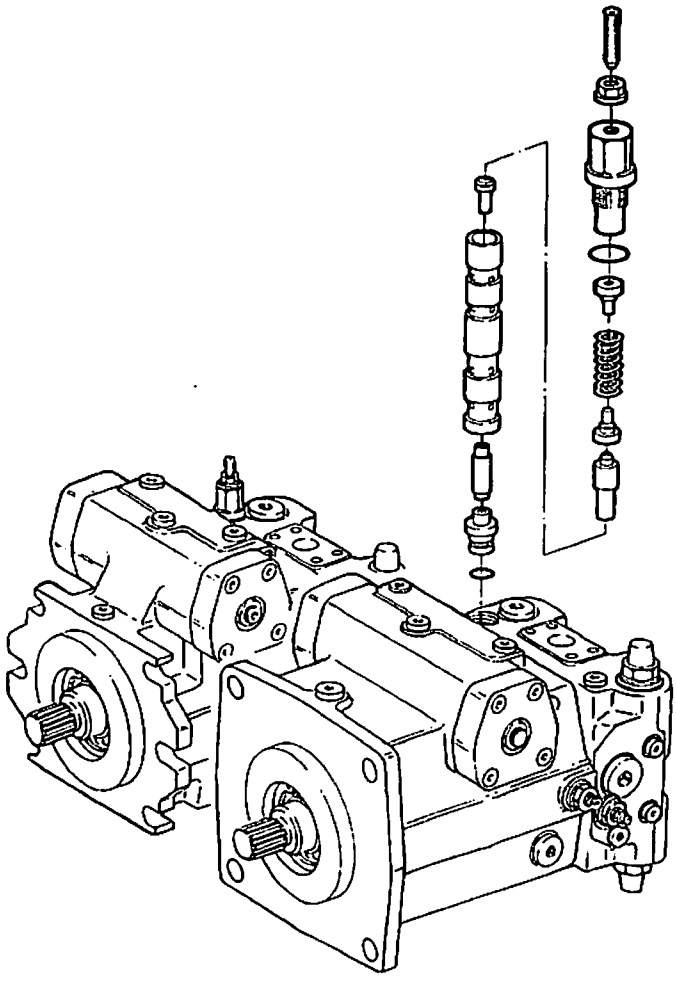


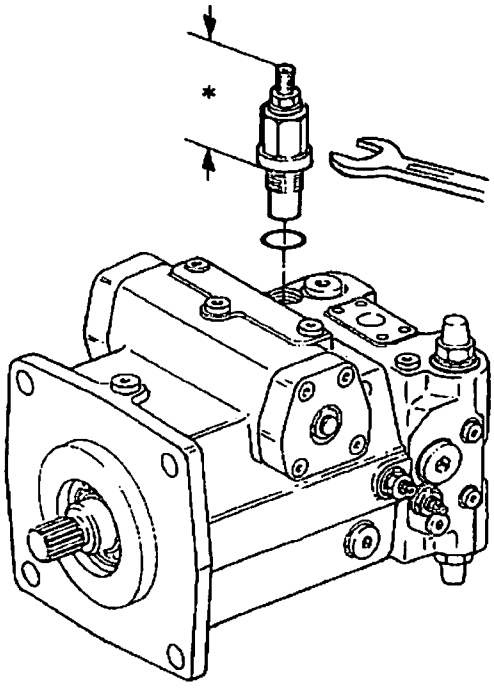


Ventil komplett ausbauen.
Kontrolle: O-Ring, Gehäuse.
Wechsel der Dichtmutter - Einstellmaß (*) festhalten.
Achtung!
Nach Einbau "Ventileinstellung" überprüfen.

Remove valve completely.
Control: O-ring, housing.
Replacement of the tightening nut, record measure (*).
Attention!
After assembly check "valve setting".

https://truckmanualshub.com/

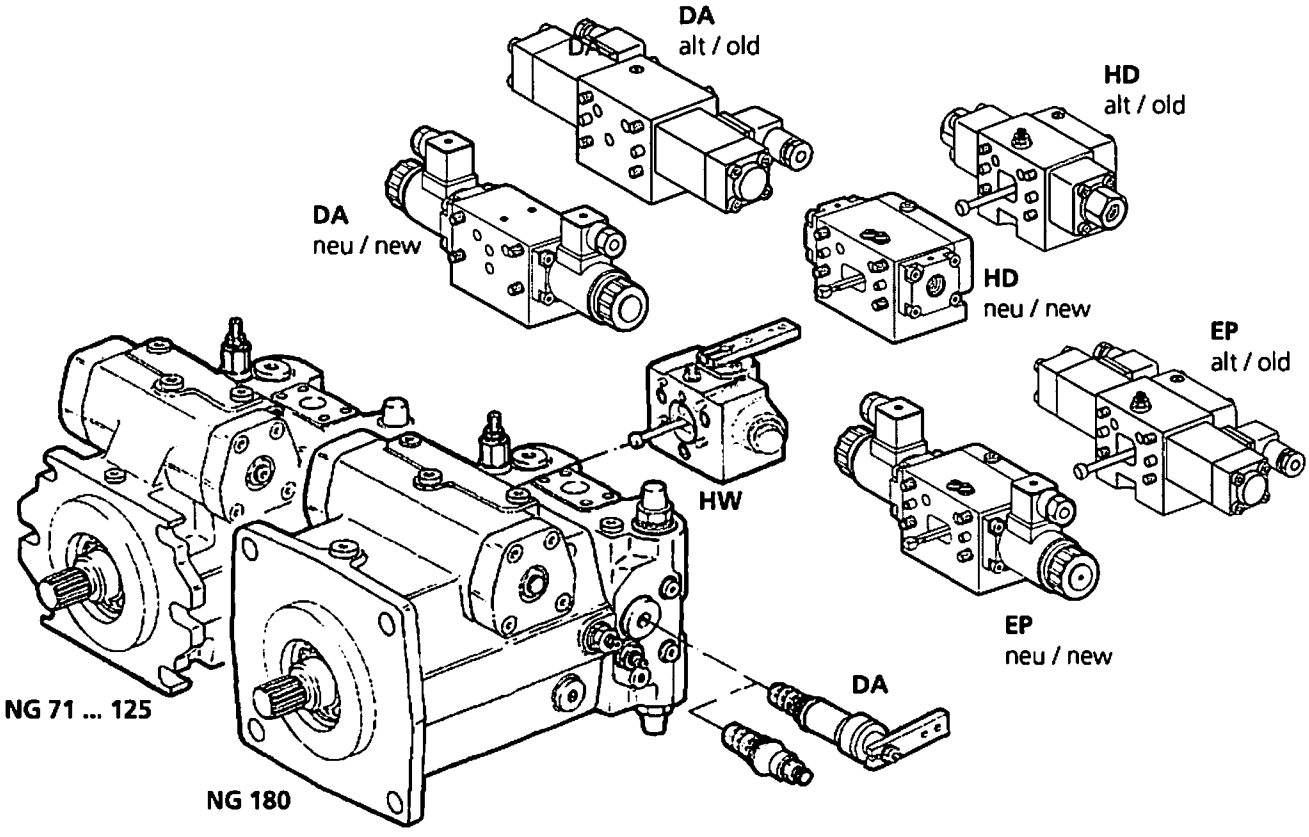




Einstellteil komplett ausschrauben.
Kontrolle: O-Ring, Gehäuse.
Wechsel der Dichtmutter - Einstellmaß (*) festhalten.
Achtung!
Nach Einbau "Ventileinstellung" überprüfen.

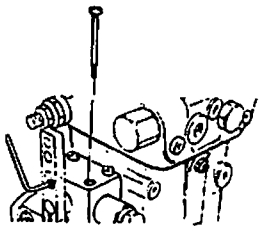
Unscrew setting cartridge completely.
Control: O-ring, housing.
Replacement of the tightening nut, record measure (*).
Attention!
After assembly check "valve setting".

https://truckmanualshub.com/



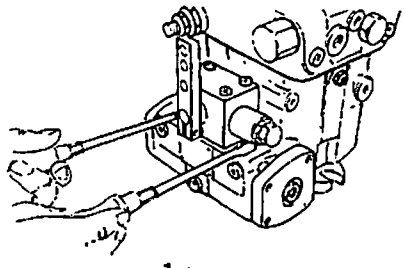
Ansteuergerät abbauen.
Hinweis:
NG 71: Abdichtung der Ansteuergeräte wie NG 40 - 56 mit Flachdichtung.
Achtung!
Korrekte hydraulische Nullageneinstellung überprüfen.

Remove control device.
Note:
Size 71: Sealing of control device as size 40 - 56 with flat seal.
Attention!
Check correct hydraulic 0-position.



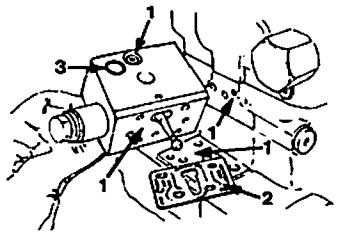
* Befestigungsschrauben demontieren.

* Remove fixing screws.



Ansteuergerät abdrücken.

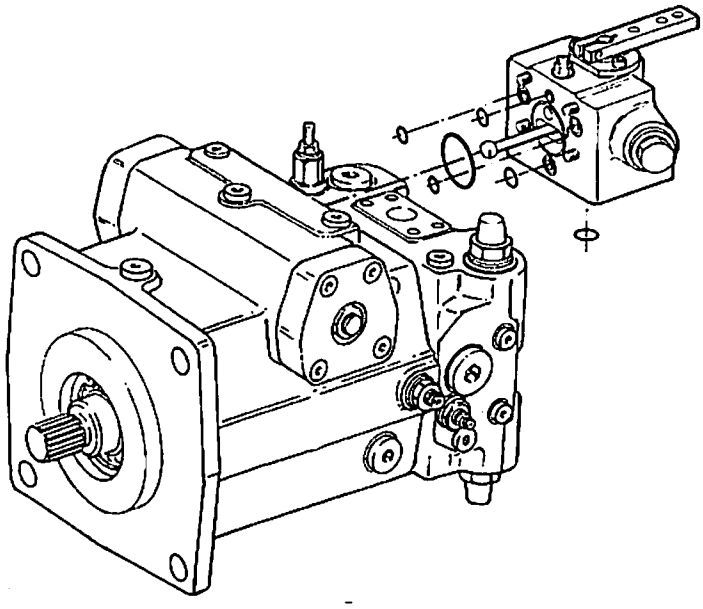
Pry-off the control unit.

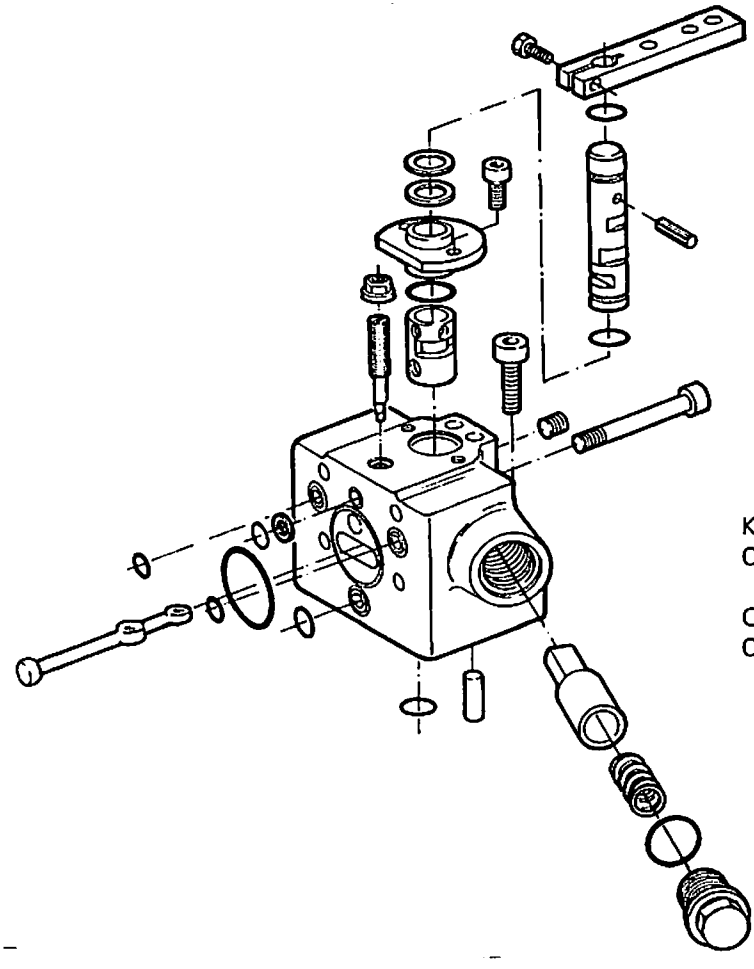


Kontrolle
Dichtfläche (1), Flachdichtung (2), O-Ringe (3).

Check
Sealing surface (1), gasket (2), O-rings (3).

https://truckmanualshub.com/



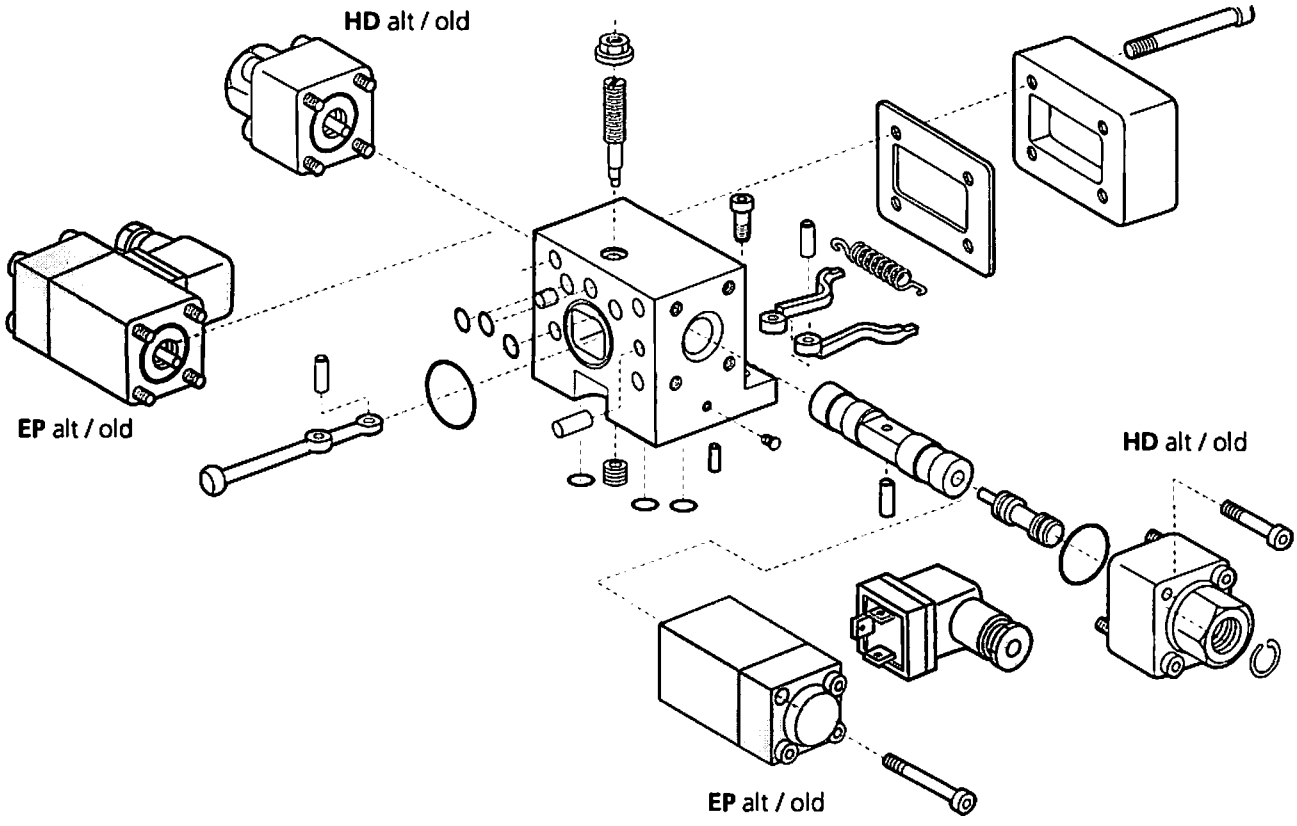


Kontrolle:
O-Ringe und Dichtung.

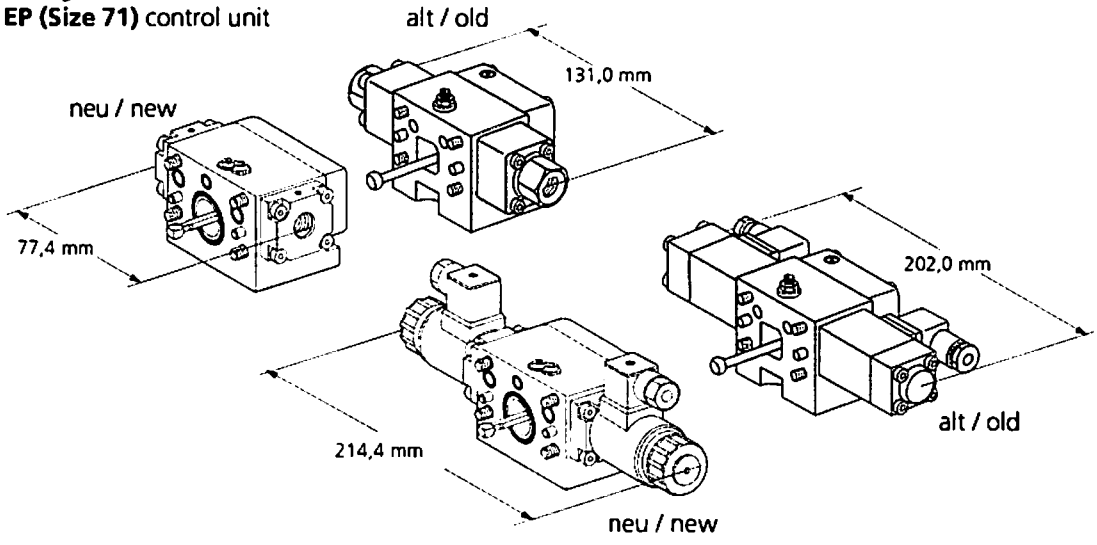
Check:
O-rings, gasket.

https://truckmanualshub.com/

Ansteuergerät **HD - EP** alt **(NG 90 - 180)**
HD - EP (Size 90 - 180) control unit old

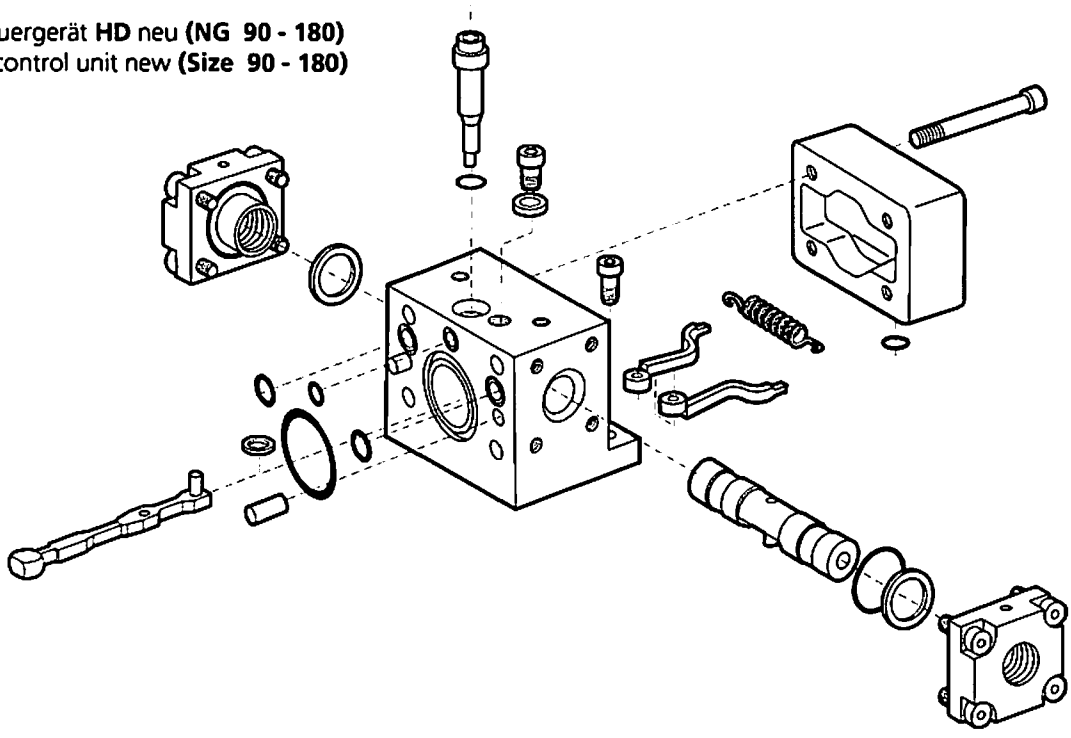


Neues Ansteuergerät **HD - EP (NG 71)**
New **HD - EP (Size 71)** control unit

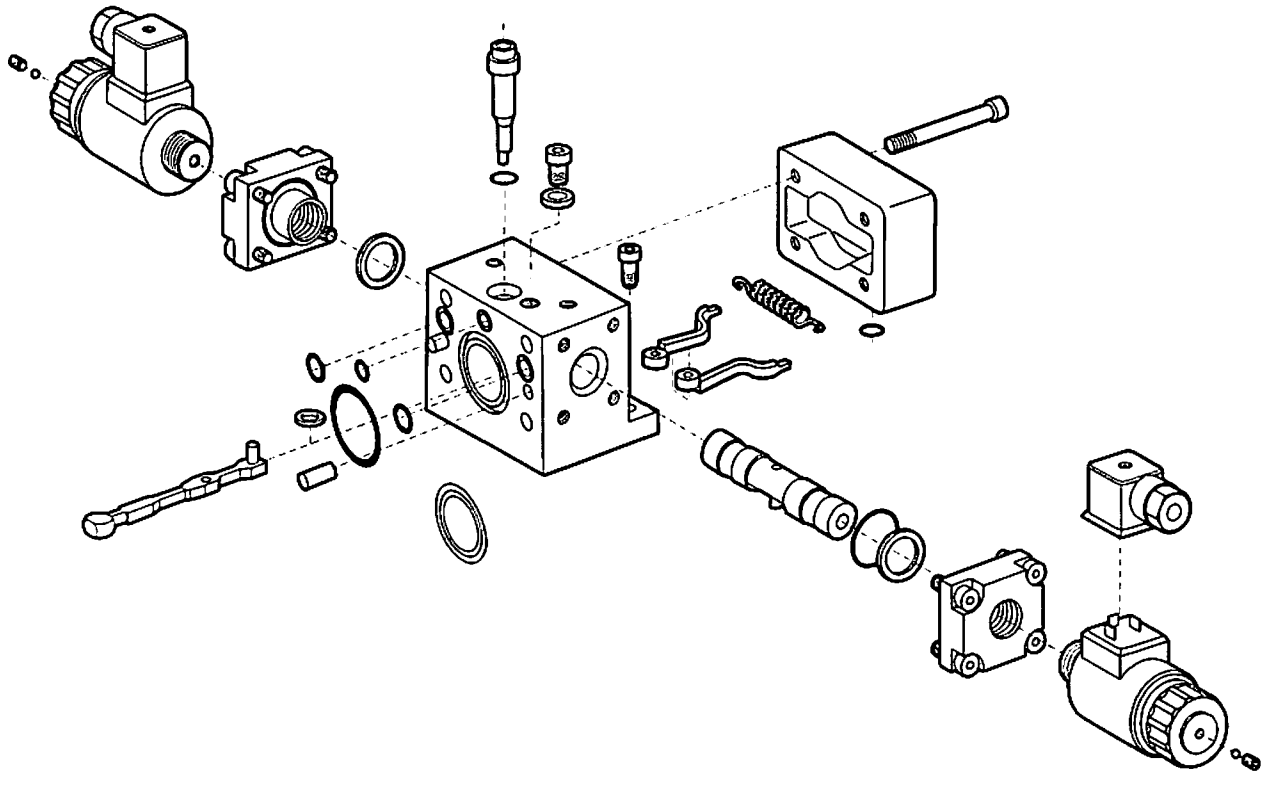


https://truckmanualshub.com/

Ansteuergerät **HD** neu **(NG 90 - 180)**
HD - control unit new **(Size 90 - 180)**

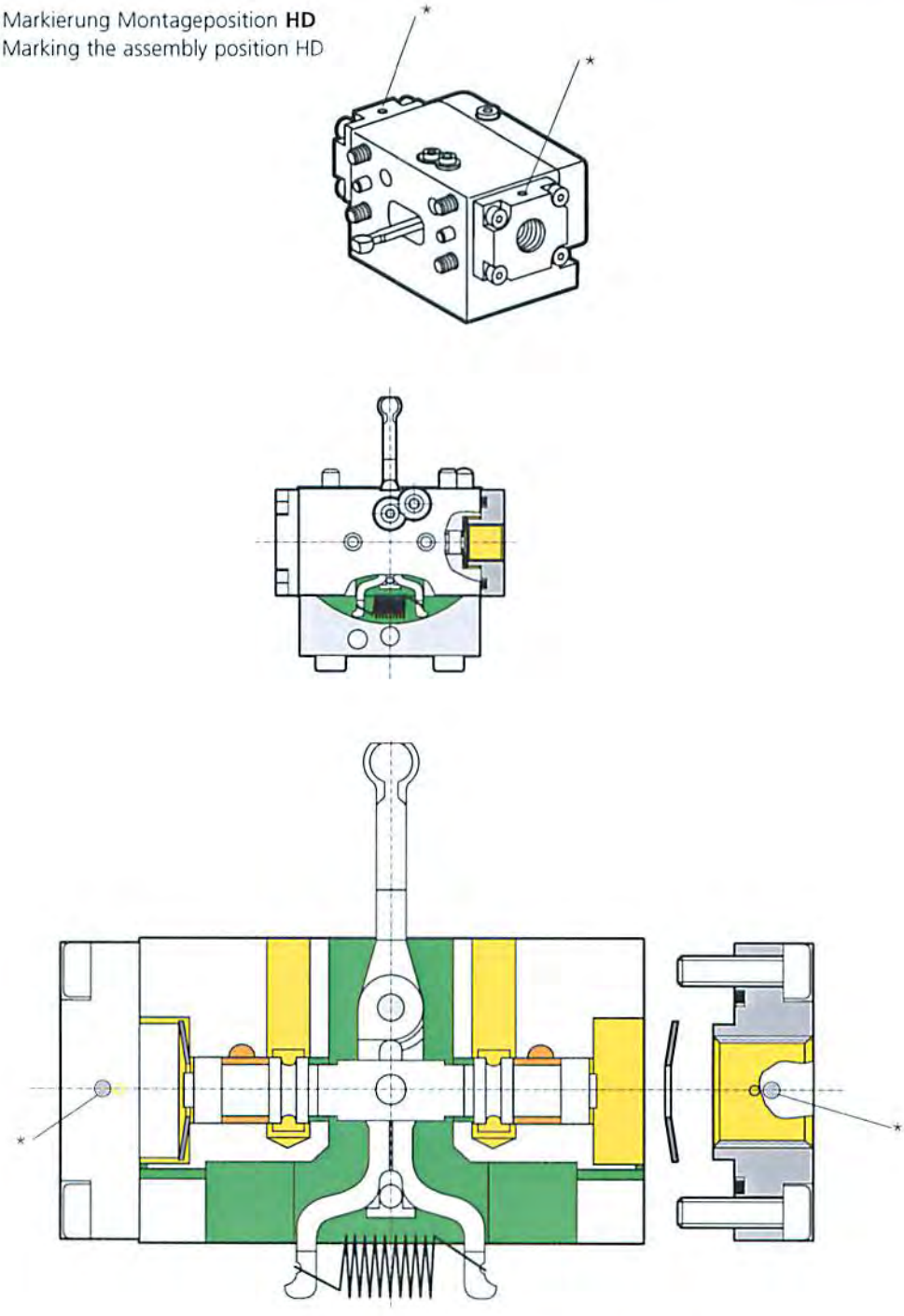


Ansteuergerät **EP** neu **(NG 90 - 180)**
EP - control unit new **(Size 90 - 180)**



https://truckmanualshub.com/

* Markierung Montageposition **HD**
* Marking the assembly position HD



* Markierung
Montageposition **HD**

* Assembly position marker **HD**

Wird von EP- auf HD-Ausführung umgebaut - Deckelposition beachten siehe Markierung

- Leckölkanal offen wird geschlossen.

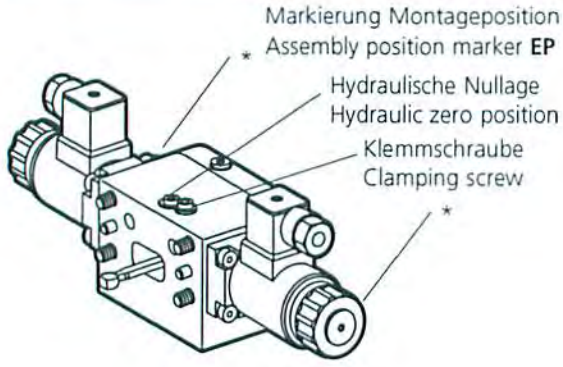
⚠ Zugfeder tauschen!

Is converted from EP into the HD version - take note of the cover position, see marker

- The open leakage port is plugged

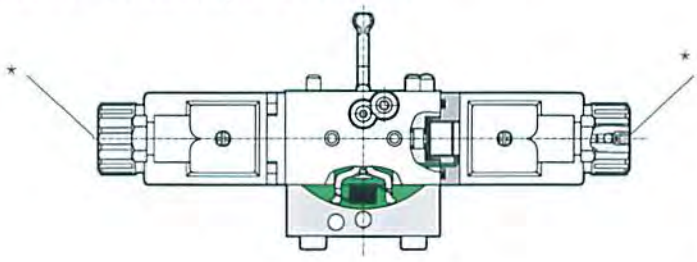
⚠ Exchange the tension spring!

https://truckmanualshub.com/

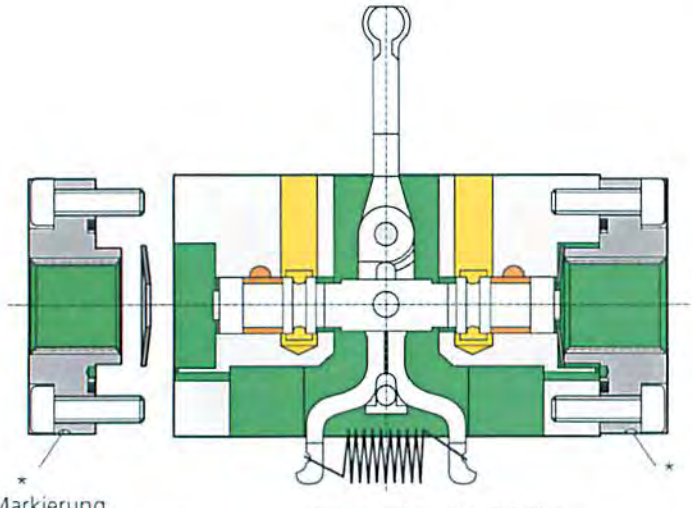


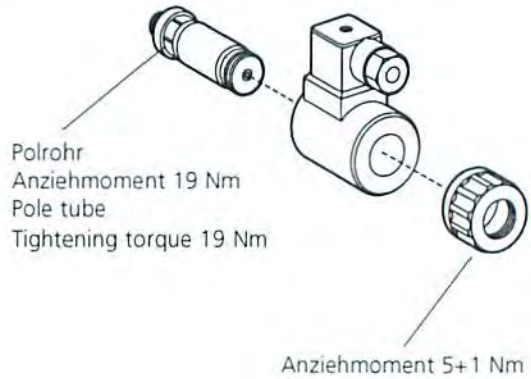
Die neuen Proportionalmagnete müssen bei der Inbetriebnahme entlüftet werden. Wird die Luft nicht aus dem Ankerraum entfernt, kann es zum Schwingen der Ansteuerung kommen.
Zum Entlüften ist am Ende des Magneten, im Messingteil, ein kleiner Gewindestift M4, SW 2 vorhanden. Dieser Gewindestift ist max. 2 Umdrehungen herauszudrehen und nach dem Entlüften mit 1 Nm wieder festzuziehen.
Bei der Ausführung mit Nothand mit Federrückzug muß zum Entlüften die Kunststoffmutter mit Gummibalg entfernt und nach dem Entlüften mit 5+1 Nm wieder angeschraubt werden.

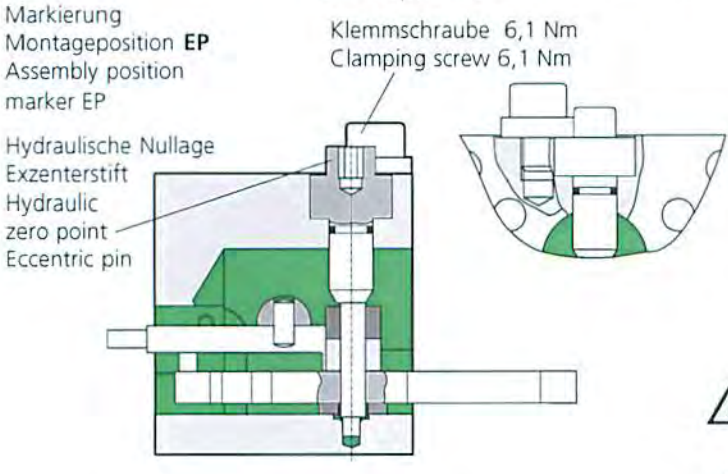
Entlüftungsschraube * max. 2 Umdrehungen herausdrehen.
Bleed screw *. Unscrew by a max. of 2 turns



The new proportional solenoids must be bled during commissioning. If the air is not removed from the armature chamber oscillations at the control can occur.
For bleeding purposes there is, on the end of the solenoid, in the brass component a small set screw M4, 2A/F. This can be unscrewed by a maximum of 2 turns and then after completion of the bleeding tightened to a maximum of 2 Nm.
For the version with hand override and spring return the plastic nut with rubber coating has to be removed for bleeding. After bleeding it has to be replaced and tightened with 5+1 Nm.





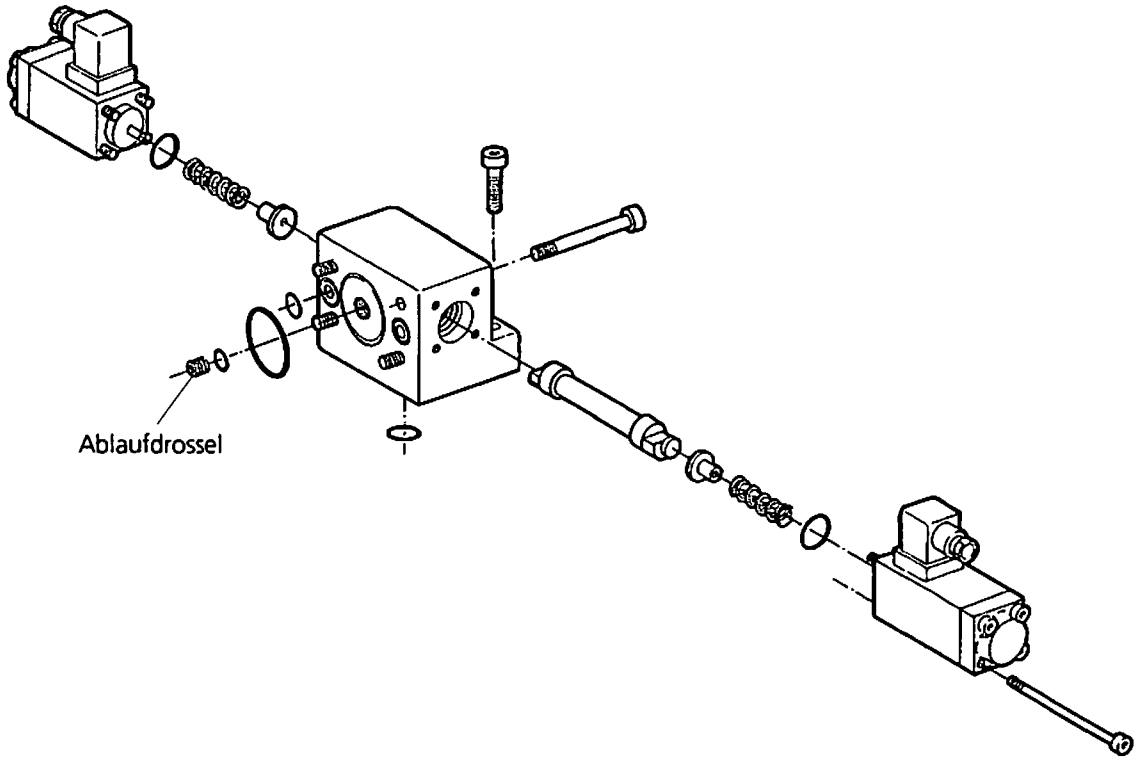


⚠ Beim Lösen der Klemmschraube
Exzenterstift - Hydraulische Nullage festhalten.

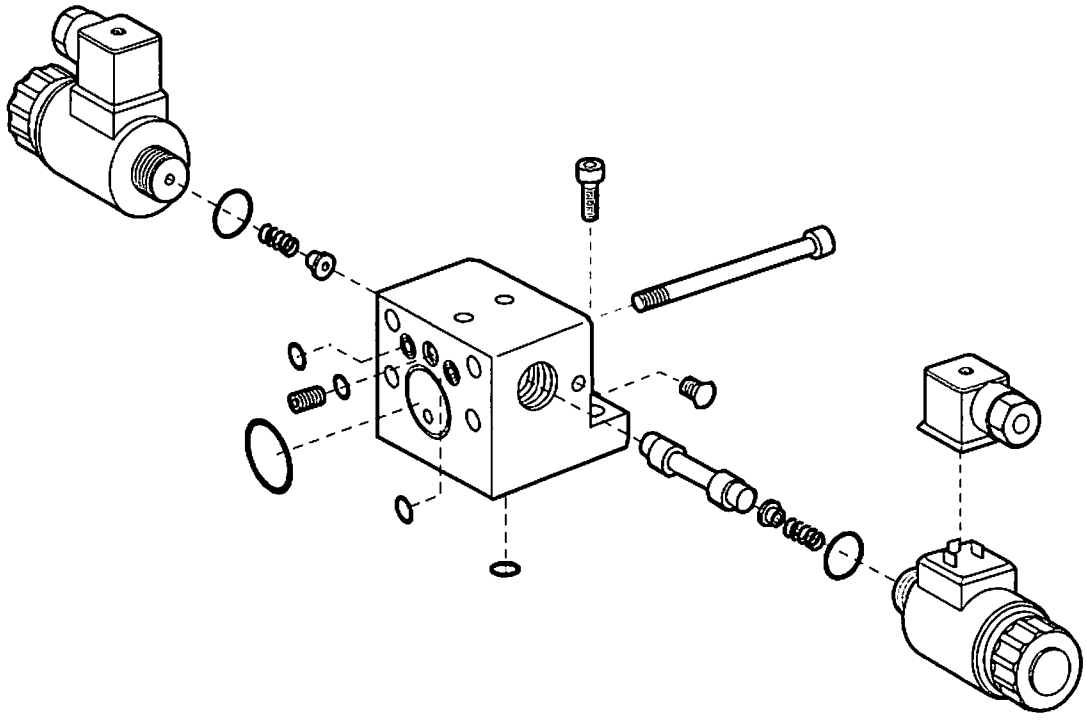
⚠ When loosening the clamping screw
Hold the eccentric pin - hydraulic zero point

https://truckmanualshub.com/

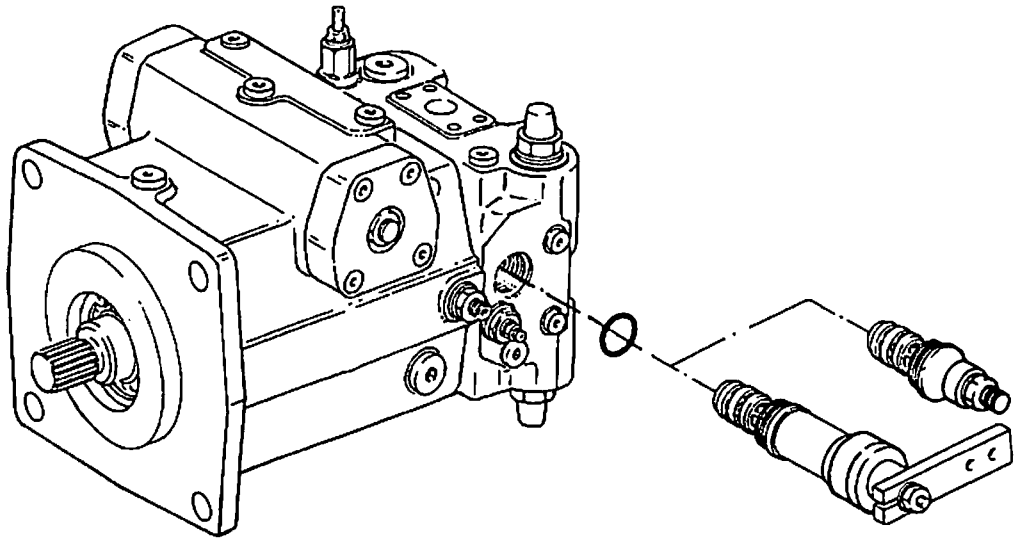
Ansteuergerät **DA** alt **(NG 90 - 180)**
DA - control unit old **(Size 90 - 180)**

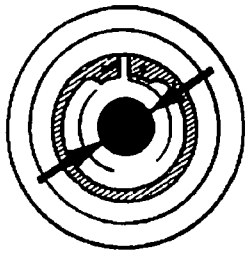


Ansteuergerät **DA** neu **(NG 90 - 180)**
DA - control unit new **(Size 90 - 180)**



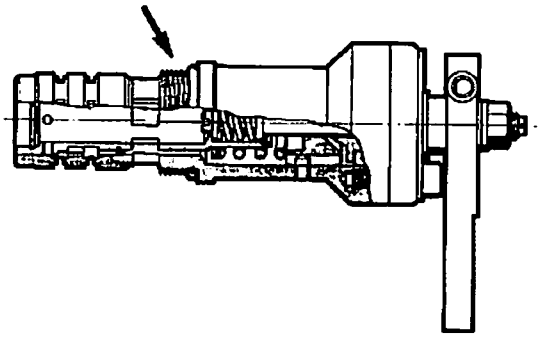
https://truckmanualshub.com/





Blende überprüfen.
Keine Beschädigung.

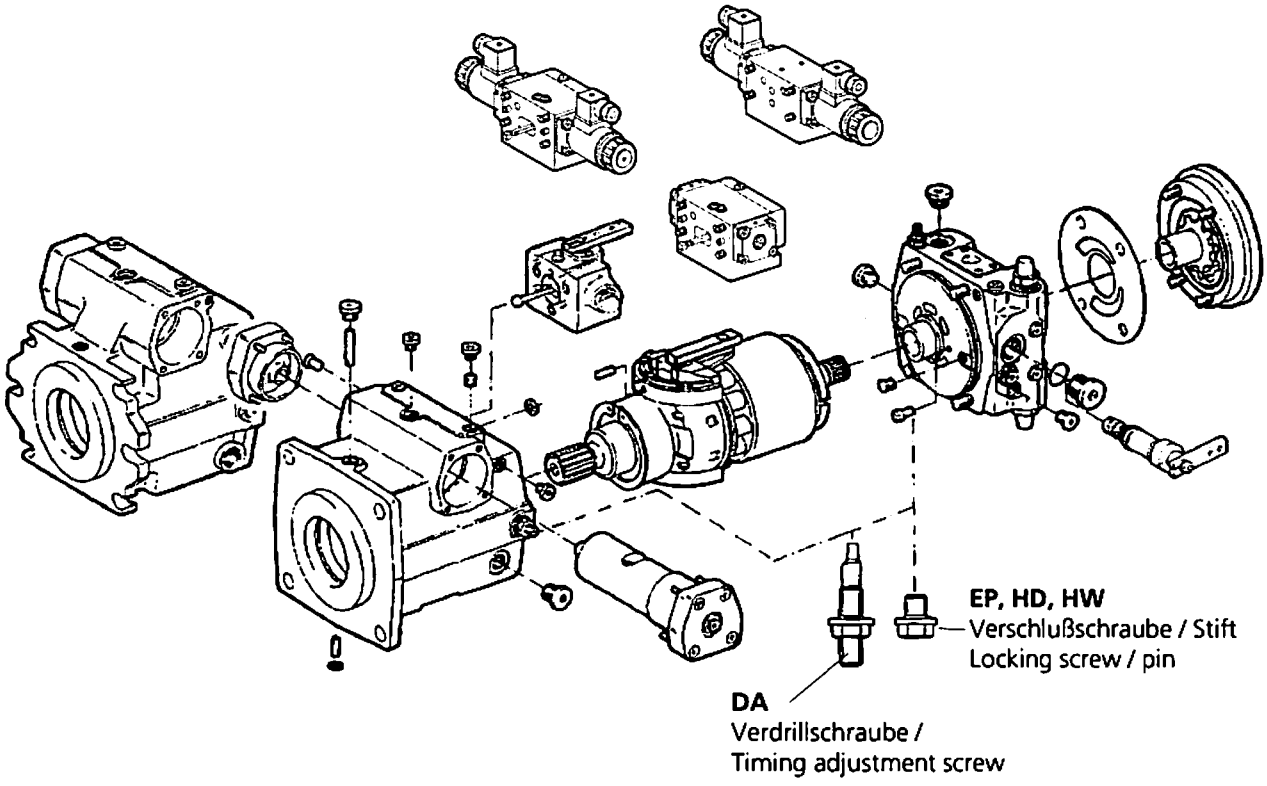
Inspect orifice.
No damage.

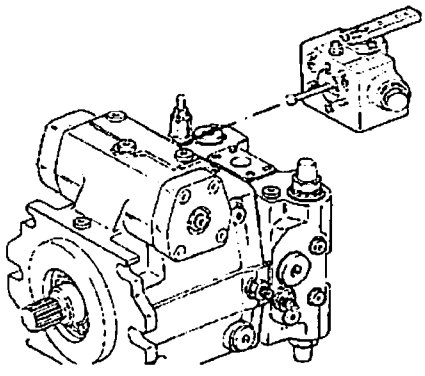


Gewinde abkleben.
O-Ring einsetzen.

Cover threads.
Insert O-ring.

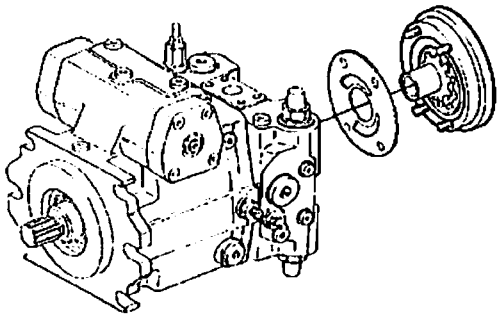
https://truckmanualshub.com/





Ansteuergerät abbauen.

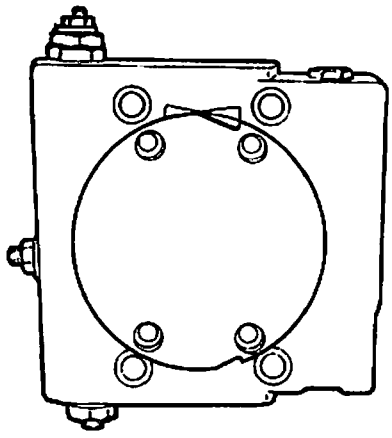
Remove control device.



Hilfspumpe ausbauen.
Hinweis:
Einbaulage kennzeichnen.

Remove auxiliary pump.
Note:
Mark assembly position previously.

https://truckmanualshub.com/



z.B. Drehrichtung "Rechts"

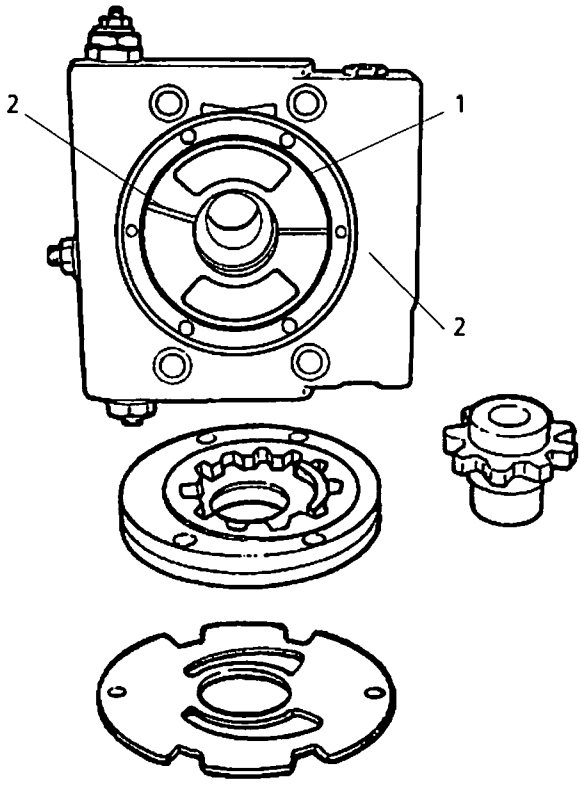
e.g. "clockwise" direction of rotation

Anschlußplatte mit Hilfspumpe

⚠ Achtung: Drehrichtung wird immer mit Blick auf die Triebwelle angegeben.

Port plate with auxiliary pump

⚠ Attention: Direction of rotation is always indicated with view on the drive shaft.



Drehrichtung "rechts"

Breite Seite zur Sichel "rechts".

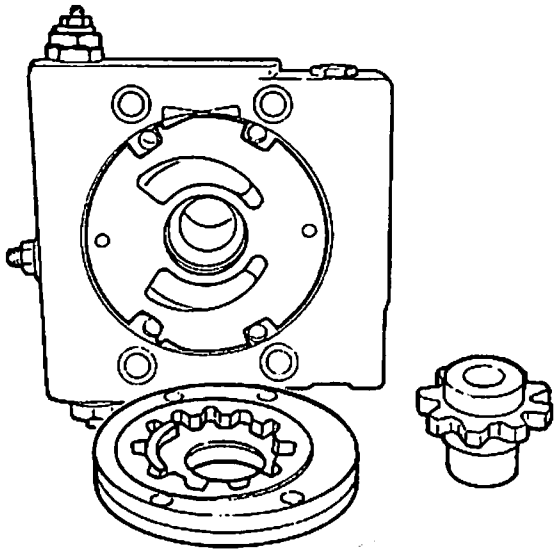
1. O-Ring,
2. Entlastungskanal

Direction of rotation "clockwise"

Broadside to the crescent "clockwise"

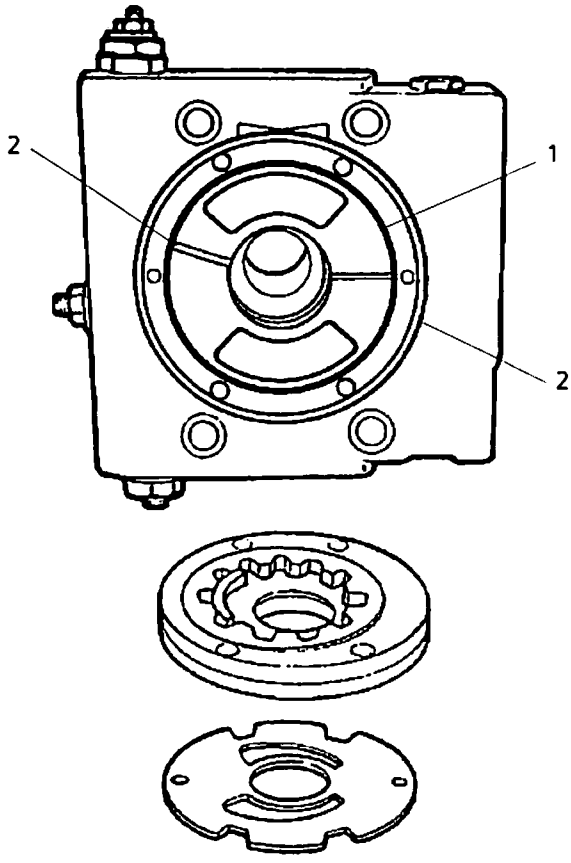
1. O-ring
2. Discharge channel

https://truckmanualshub.com/



Drehrichtung "links"

"Counterclockwise" direction of rotation



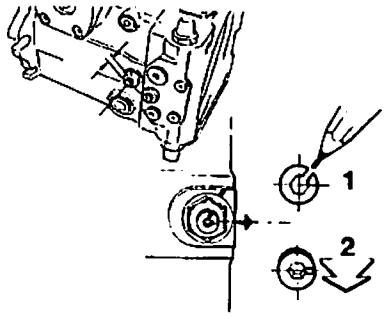
1. O-Ring,
2. Entlastungskanal

1. O-ring
2. Discharge channel

Verschleißplatte 71 - 180

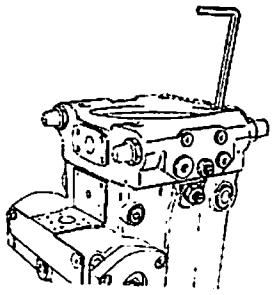
Wear plate 71 - 180

https://truckmanualshub.com/



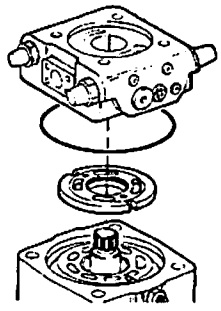
Lage der Verdrillschraube markieren (1).
Einstellmaß festhalten.
Verdrillschraube auf Demontageposition stellen (2).

Mark the position of the indexing screw (1).
Record setting measure.
Set the indexing screw to disassembly position (2).



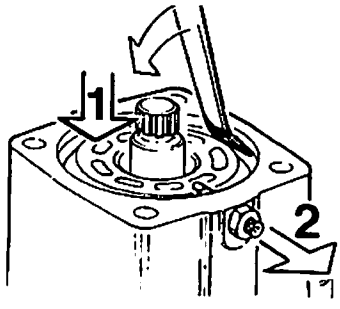
Lage der Hilfspumpe und Anschlußplatte markieren.
Anschlußplattenbefestigung lösen.

Mark position of the connection plate.
Loosen connection plate fixation.



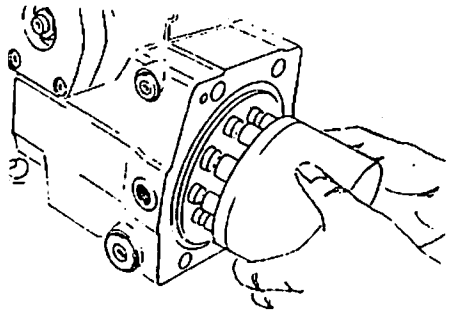
Anschlußplatte und Steuerplatte abheben.

Lift off port plate and control plate.



1. Zylinder nach unten drücken.
2. Verdrillschraube herausdrehen.

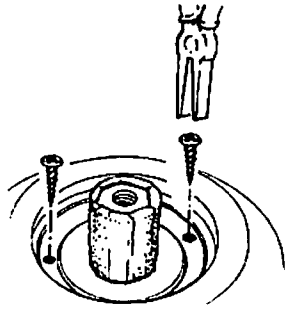
1. Press the cylinder to the bottom.
2. Remove fixing indexing screw.



Zylinder komplett mit Kolben und
Rückzugeinrichtung ausbauen.

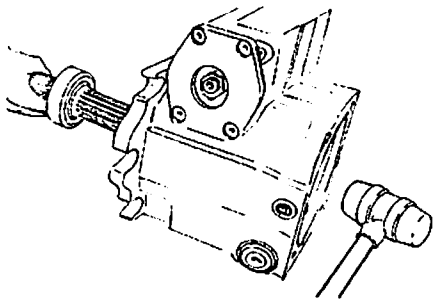
Push off hydraulic section of rotary group.

https://truckmanualshub.com/



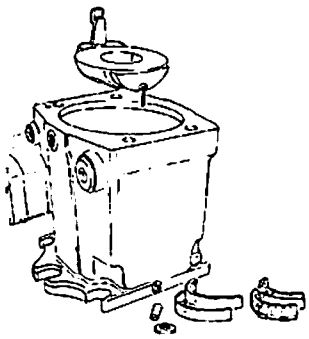
Seegerring / WDR ausbauen.

Remove retaining ring and radial seal ring.



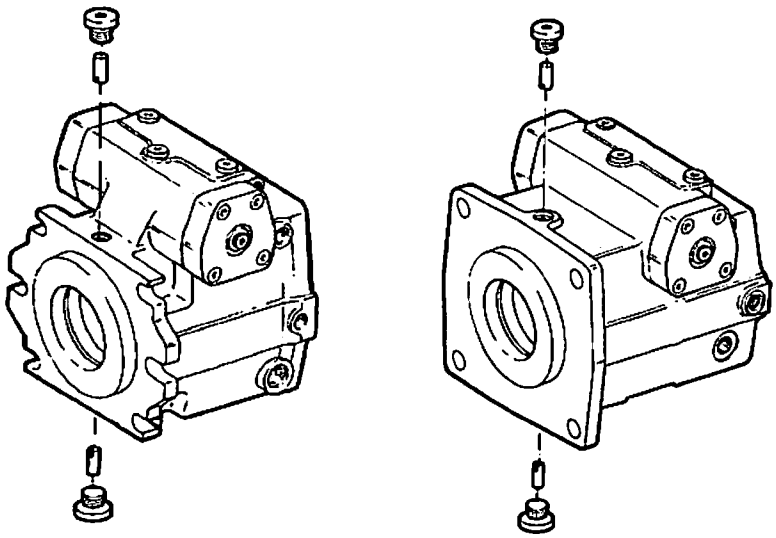
Triebwelle mit leichten Hammerschlägen austreiben.

Remove drive shaft with slide hammer strokes.



Schwenkwiege / Lager komplett ausbauen.

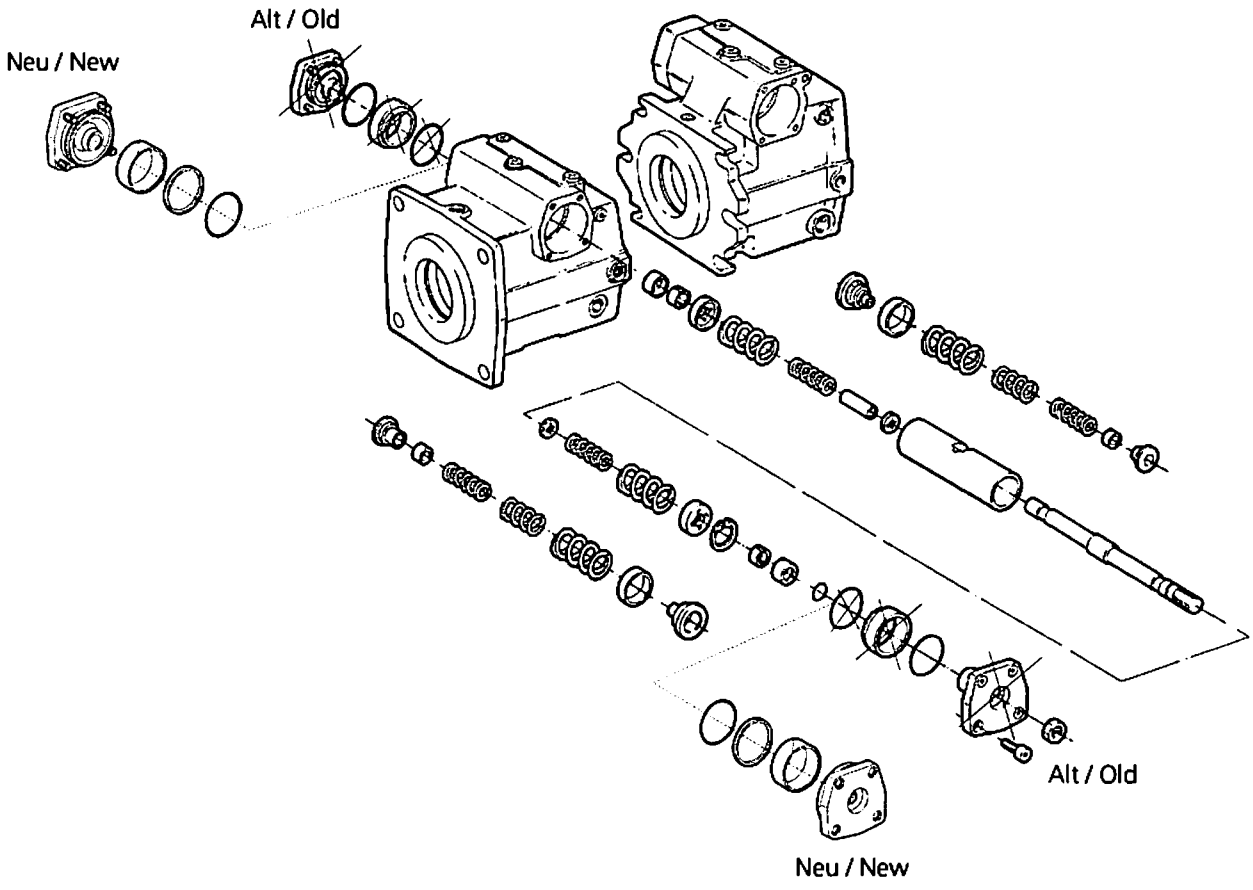
Remove swash plate / bearing cups.

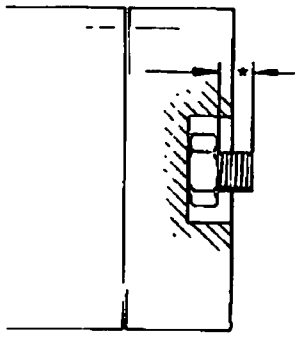


Gelenkstift ausbauen.

Remove joint pin.

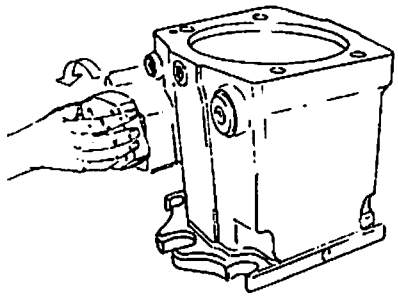
https://truckmanualshub.com/





Lage vom Deckel markieren, Maß "Nullage" festhalten, Mutter lösen.

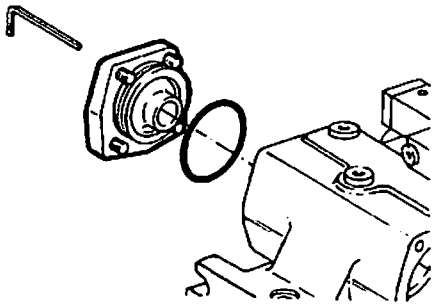
Mark position of the cover, note measure of "zero position". Loosen nut.



Deckel abdrehen.

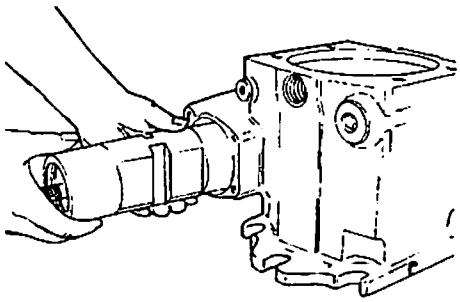
Remove cover.

https://truckmanualshub.com/



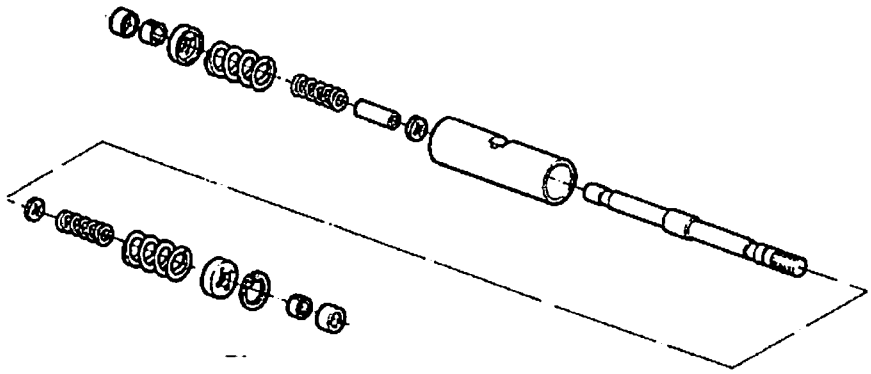
61 Lage des Deckels markieren.
Befestigungsschrauben lösen, abbauen.

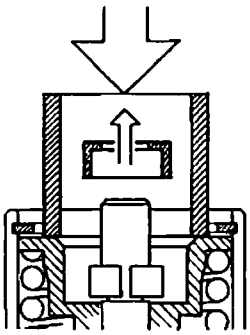
Mark position of the cover.
Loosen locking screw, remove cover.



62 Stellzylinder ausbauen.

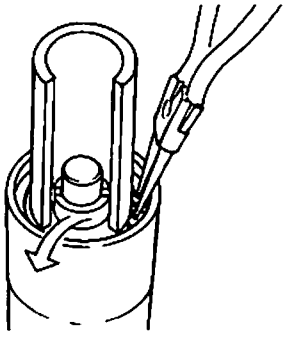
Remove positioning ring.





Vorrichtung aufsetzen und Feder vorspannen.
Aufnahmering ausbauen.

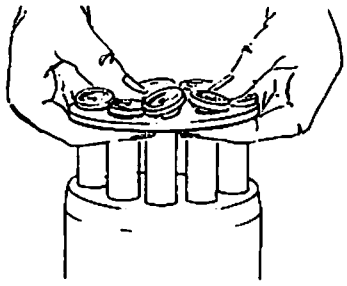
Fit tool device and preload spring.
Remove take-off ring.



Ringe ausbauen.
Sicherungsring ausbauen.
Achtung: Teile stehen unter Federvorspannung.

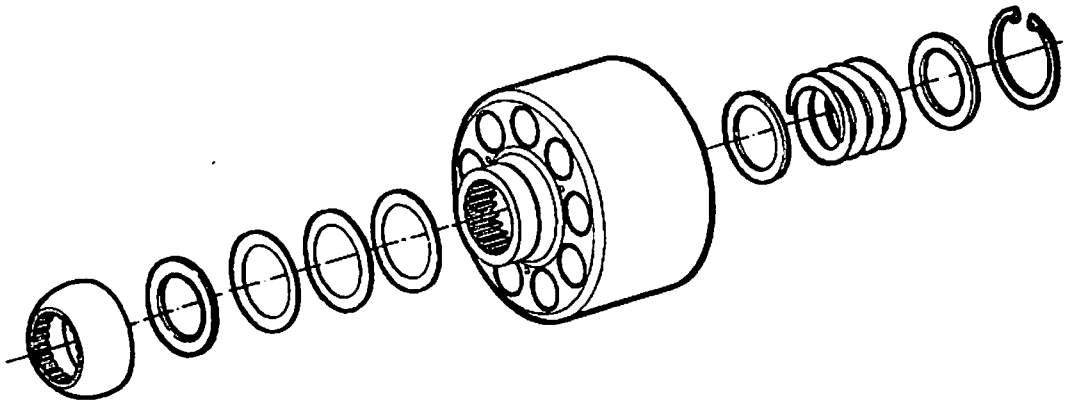
Remove rings.
Remove safety ring.
Attention: Parts are under spring load.

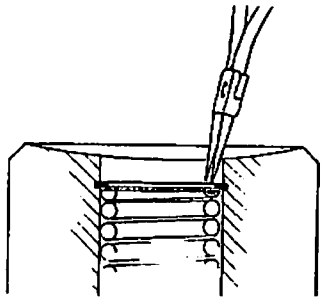
https://truckmanualshub.com/



Kolben mit Rückzugeinrichtung ausbauen.
Tragkugel mit Tellerfedersäule abheben.

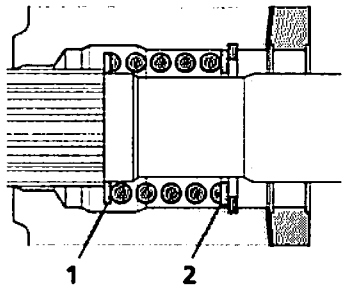
Remove piston with retaining plate.
Remove retaining ball with spring cup assembly.





Sicherungsring ausbauen.

Remove safety ring.

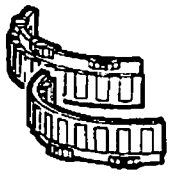


Scheibe 1, 2

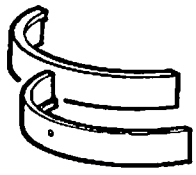
Disc 1, 2

https://truckmanualshub.com/

Lager
Bearing

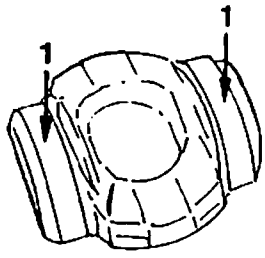


Lagerschalen
Bearing cup



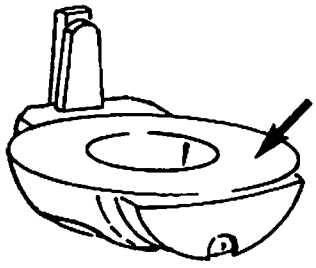
Kontrolle!
Käfig-Paar (1),
Lagerschalenpaar (2).

Check!
Cage set (1),
Bearing cup set (2).



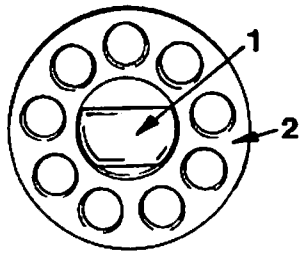
Kontrolle!
Lagerbahnen (1)

Check!
Bearing surfaces (1)



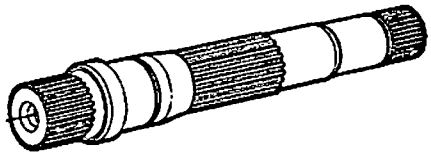
Kontrolle!
Gleitfläche riefenfrei.

Check!
Sliding surface free from scoring.



Kontrolle!
Rückzugeinrichtung riefenfrei.

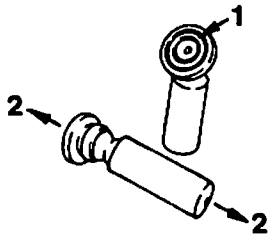
Check!
Check that return device is free of scoring.



Kontrolle!
1. Verzahnung "ausgeschlagen", Passungsrost.
2. Laufflächen.
3. Lauffläche - Wellendichtring.

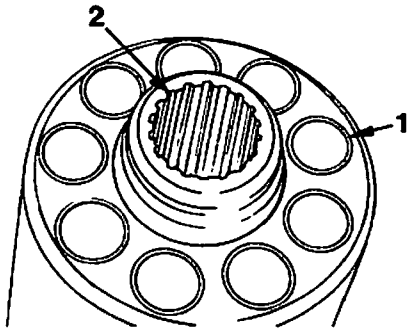
Check!
1. Splines for damage or fretting.
2. Running surfaces.
3. Groove cut by shaft seal.

https://truckmanualshub.com/



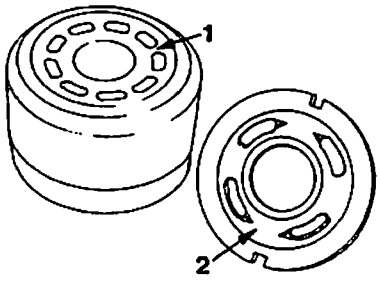
Kontrolle!
Lauffläche (1) keine Kratzer, keine Metalleinlagerungen, kein Axialspiel (2), (Kolben nur satzweise tauschen).

Check!
Check that there are no scratches or metal deposits on sliding surface (1), and there is no axial play (2), (otherwise: pistons must be replaced in sets).



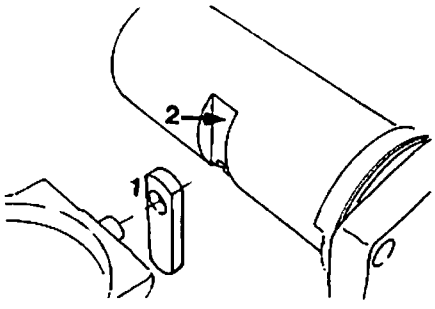
Kontrolle!
Zylinderbohrungen (1), Verzahnungen (2).

Check!
Cylinder bores (1), splines (2).



Kontrolle!
Zylindergleitfläche (1) riefenfrei.
Steuerplatte (2) nicht riefig.

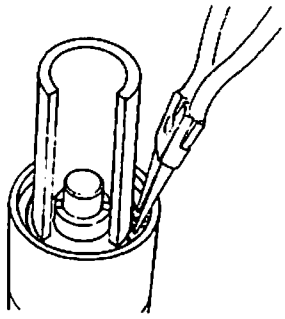
Check!
Cylinder surface (1) free of scoring.
Control plate (2) without scoring.



Kontrolle!
Stellkolben - Schwenkwiegenverbindung
Gleitstein (1), Nut im Stellkolben (2), Stellkolben.

Check!
Positioning piston - cradle linkage
Gliding stone (1), groove at the positioning piston (2).
Positioning piston.

https://truckmanualshub.com/



Stellkolben montieren.
Hinweis:
Auf korrekten Sitz der geteilten Ringe "achten".

Assemble positioning piston.
Instruction:
Observe correct fit of the divided rings.

Gehäuse - Turcon-Glyd-Ring montieren / Assemble housing - Turcon-Glyd-ring

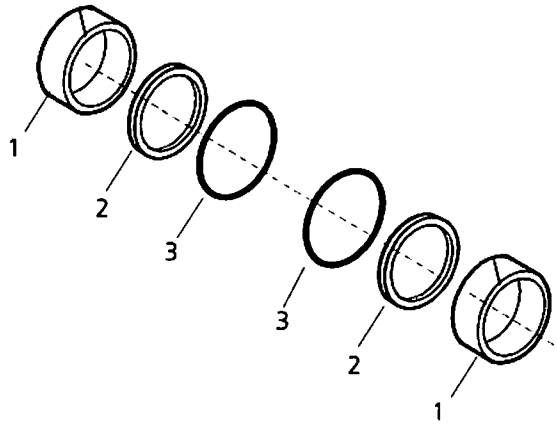
Hilfswerkzeuge / Auxiliary tools:

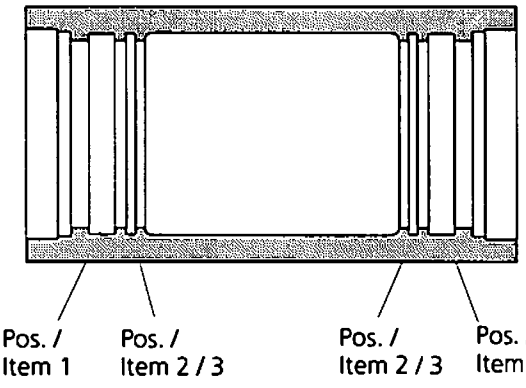
Montagezange / Assembly pliers: B+S x M22

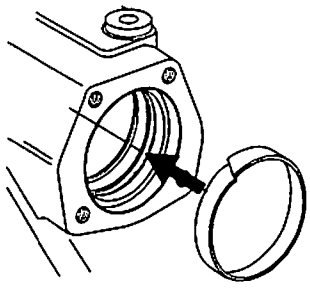
Führungsdorn / Guide thorn:

A4VG28	I: 277 4 347
A4VG40	I: 277 4 049
A4VG56	I: 277 4 050
A4VG71	I: 277 4 051
A4VG90	I: 277 4 052
A4VG125	I: 277 4 053
A4VG180	I: 277 4 054
A4VG250	I: 277 4 072

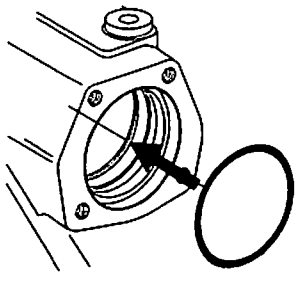
Montage / Assembly A4VG







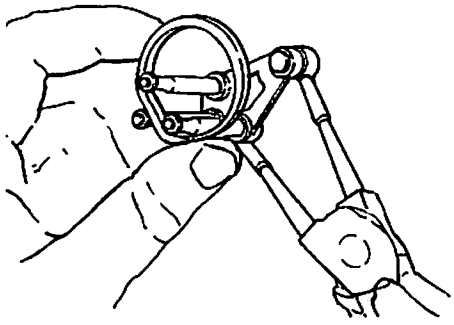
Pos. / Item 1: Stangenführungsring montieren.
Install barguide ring.



Pos. / Item 3: O-Ring montieren.
Install O-ring.

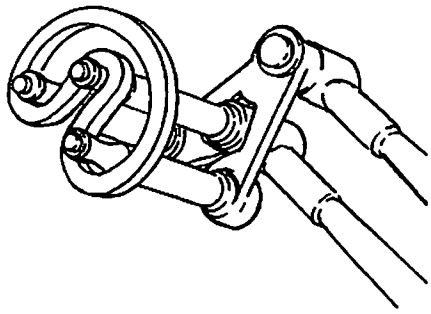
https://truckmanualshub.com/

Gehäuse - Turcon-Glyd-Ring montieren / Assemble housing - Turcon-Glyd-ring



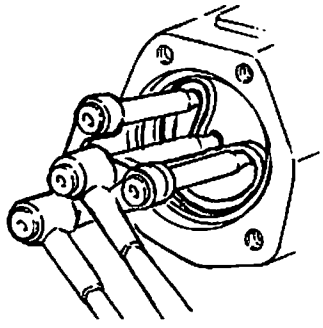
Dichtring (Pos. 2) in die Montagezange einlegen.

Fit the seal ring (Item 2) into the assembly tool.



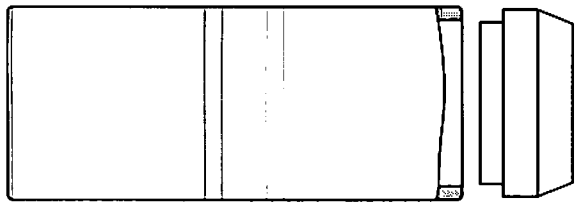
Dichtring mit Zangenschenkel nierenförmig zusammendrücken. Die Verformung von Turcon-Dichtungen ist sorgfältig vorzunehmen, damit die Dichtkanten nicht beschädigt werden.

Press the seal ring into the kidney shape using the assembly tool. The deformation of the Turcon seal has to be done with care so as not to damage the sealing edges.



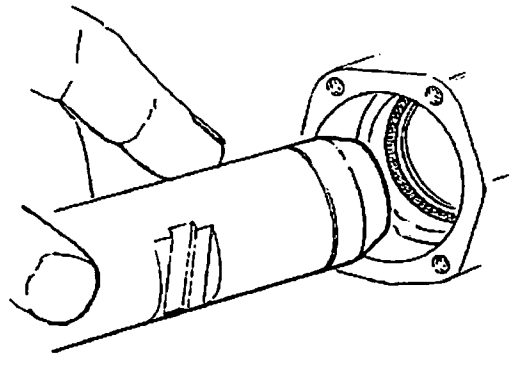
Dichtring ins Gehäuse einführen und in der Aufnahmenut plazieren. Dann Spannung lösen und Montagezange heraus ziehen. Lage des Dichtringes prüfen - eventuell mit dem Finger egalisieren.

Position the seal ring into the housing and place it into the groove. Release the tension and withdraw the assembly tool. Check the position of the seal ring if necessary straighten using a finger.



Führungsdorn in Stellkolben einbauen.

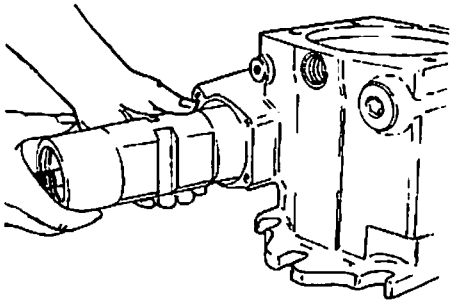
Insert guide thorn into the positioning piston.



Führungsdorn leicht einfetten.
Stellkolben mit Führungsdorn einbauen.

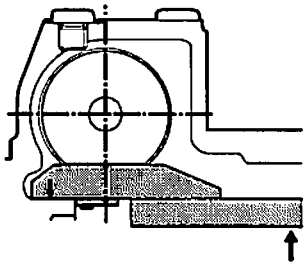
Grease slightly guide thorn.
Install positioning piston with guide thorn.

https://truckmanualshub.com/



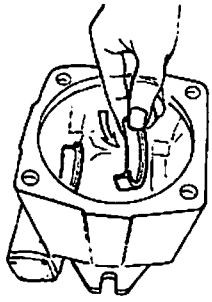
Stellkolben ins Gehäuse einsetzen.
Hinweis:
Stellkolben vor Einbau einölen.

Insert positioning piston into the housing.
Instruction:
Oil positioning piston before assembly.



Stellkolben mit Hebel (Id.Nr. 2774491) ausrichten.
* Führung für Gleitstein - Schwenkwiege

Position stroke piston with lever (Id.No. 2774491).
* Sliding stone guidance in the piston.

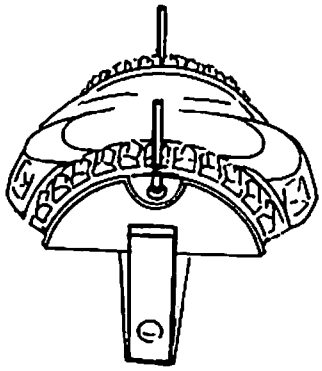


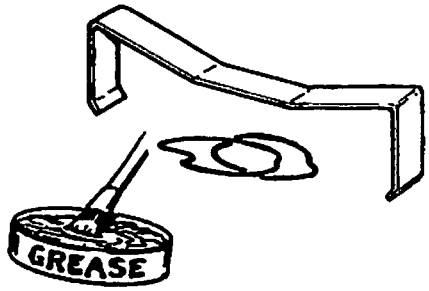
Lagerschalenpaar einsetzen.

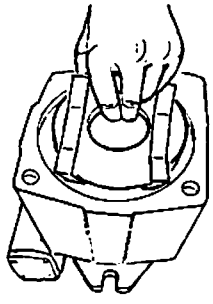
Insert bearing cup set.

Lager, Draht, Gleitstein und Gelenkstift montieren.
Montagehilfe: z.B. - Klammer / Gummiringe / Fett

Assemble bearing, wire, gliding stone and articulating pin.
Assistance: Devices e.g. - Clamp / rubber rings / grease







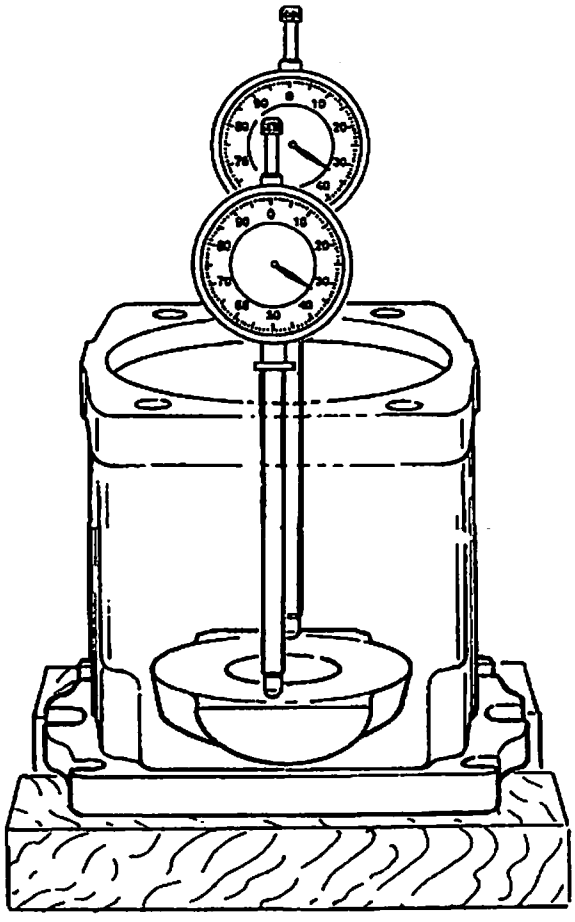
Schwenkwiege komplett ins Gehäuse einsetzen.
Auf korrekten Sitz der Schwenklager im Gehäuse "achten".

⚠ Montagehilfe ausbauen.

Insert completely swivel cradle into the housing.
Pay attention for correct seat of the swivel cradle in the housing.

⚠ Remove auxiliary device.

https://truckmanualshub.com/

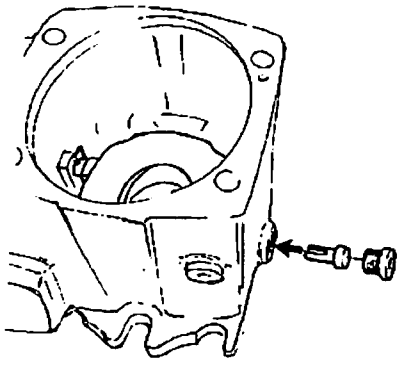


⚠ Kontrolle: Sitz der Schwenklager in der Lagerbahn.

Schwenkwiege mittig stellen mit Meßvorrichtung (Uhr oder Tiefenmaß)
Punkt 1 und 2 kontrollieren - gleiches Maß.

⚠ Check: Location of the swivel-bearing in the bearing.

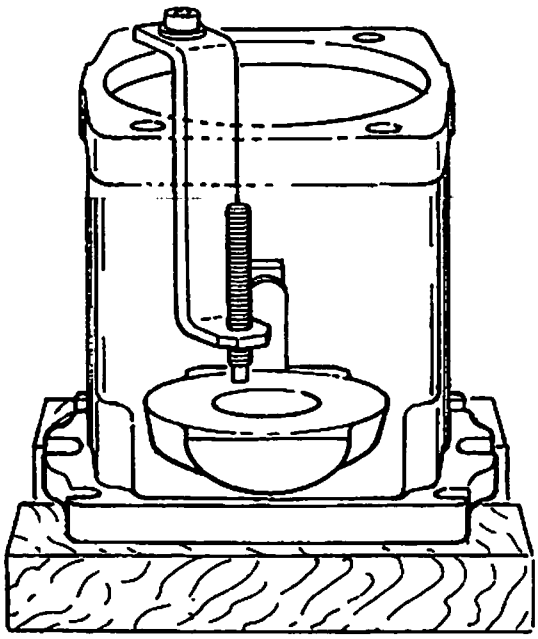
Centralise the swivel by using a measuring device (dial gauge or depth measurement).
Check points 1 and 2 - they should have the same dimension.



Gelenkstift montieren.

Fit joint pin.

https://truckmanualshub.com/



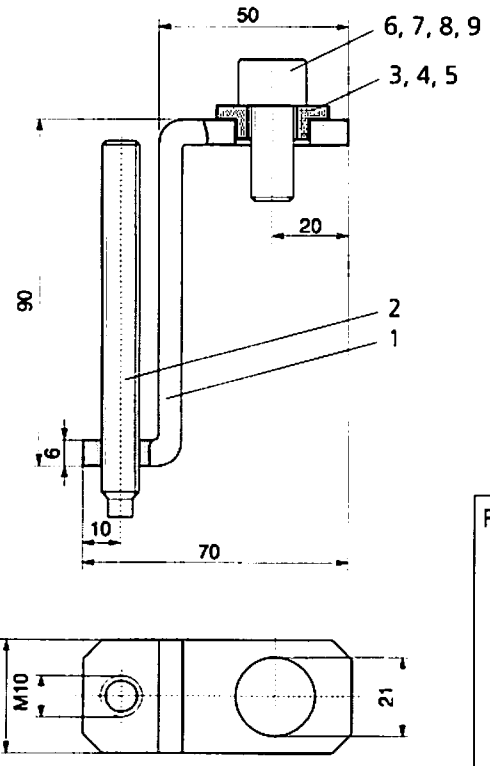
Haltevorrichtung montieren.
Mit Gewindestift Schwenkwiege festhalten.

⚠ Keine Gewaltanwendung.

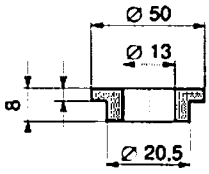
Fit holding device.
Hold swash plate in position utilising the set screw.

⚠ Do not use force.

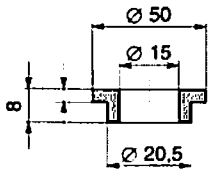
Haltevorrichtung "Schwenkwiege" A4V
Holding device "swivel cradle" A4V



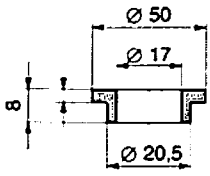
Teil/Part 3



Teil/Part 4

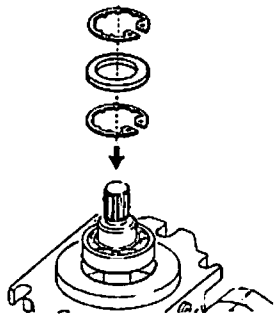


Teil/Part 5



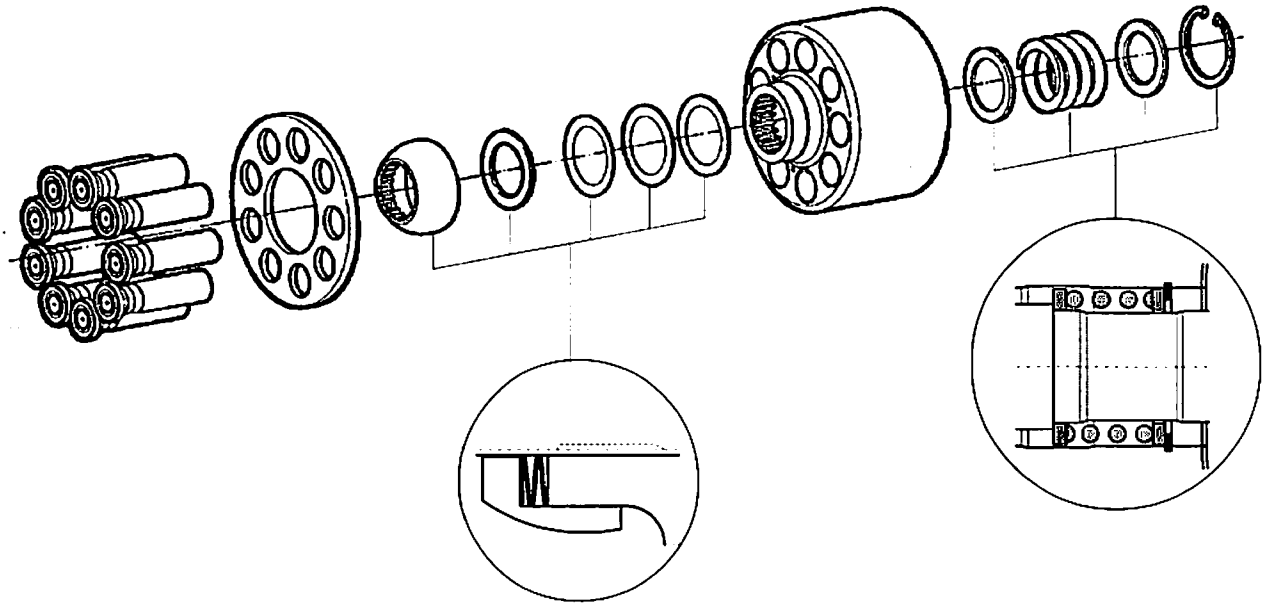
Pos./Item	Benennung/Designation	Stck./Qty.
1	Winkel/Angle	2
2	Gewindestift/Threaded pin	2
3	Scheibe/Shim	2
4	Scheibe/Shim	2
5	Scheibe/Shim	2
6	Zyl. Schraube/Cyl. screw M12 x 25 DIN 912	2
7	Zyl. Schraube/Cyl. screw M14 x 25 DIN 912	2
8	Zyl. Schraube/Cyl. screw M16 x 30 DIN 912	2
9	Zyl. Schraube/Cyl. screw M20 x 35 DIN 912	2

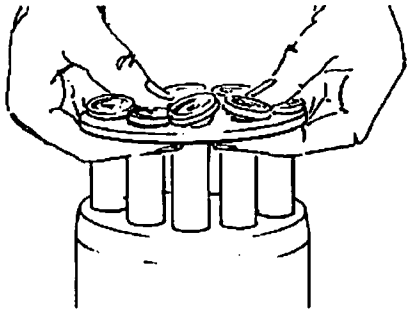
https://truckmanualshub.com/



Neue Montageposition!
Triebwelle mit Lager und Wellendichtring einbauen.

Assemble drive shaft with bearings and radial seal rings.

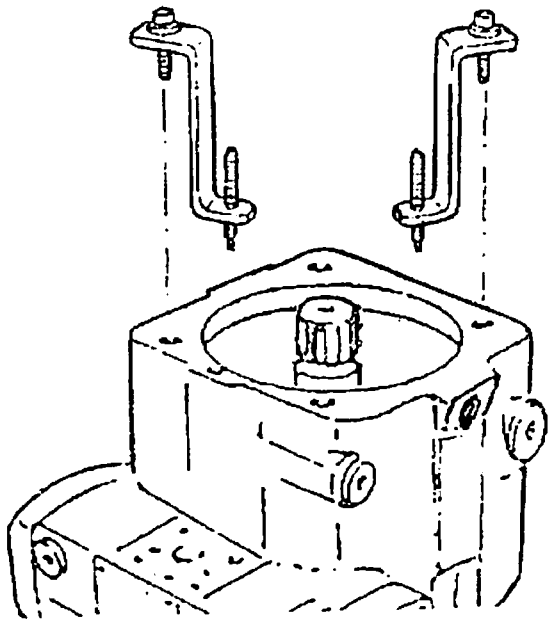




Kolben mit Rückzugeinrichtung montieren.
Hinweis:
Kolben, Gleitschuhe einölen.

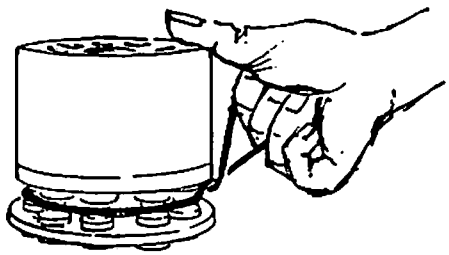
Assemble piston with retaining plate.
Note:
Oil piston and piston pad.

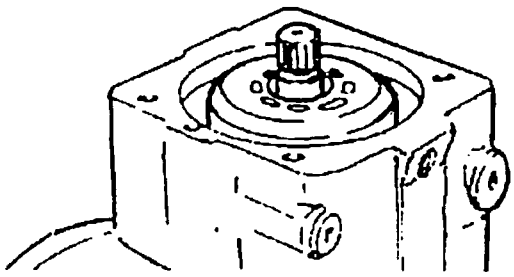
https://truckmanualshub.com/



Vorrichtung ausbauen.
Zylinder mit Kolben und Rückzugeinrichtung einbauen.

Remove holding device.
Fit cylinder complete with pistons and retaining device.

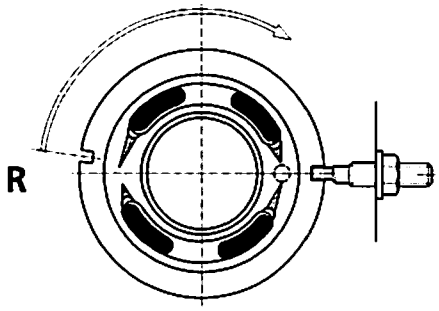




Montagehilfe:
Mit O-Ring Kolben festhalten.

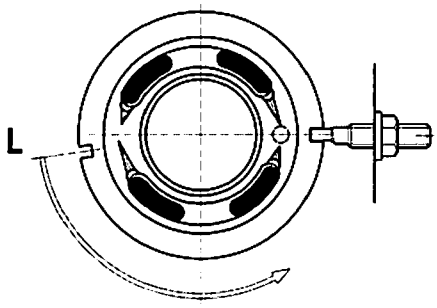
Assembly aid:
Hold the pistons by using an O-ring.

https://truckmanualshub.com/



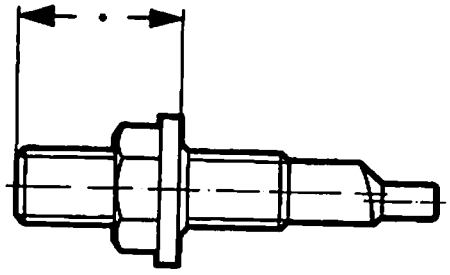
Steuerplatte Rechtslauf - in Drehrichtung verdreht.
Achtung!
Geräuschkerben sind drehrichtungsbezogen eingeschliffen.

Control plate clockwise rotation - indexed in the direction of rotation.
Note!
Noise grooves are machined - in based on direction of rotation.



Steuerplatte Linkslauf - in Drehrichtung verdreht.
Achtung!
Geräuschkerben sind drehrichtungsbezogen eingeschliffen.

Control plate counter clockwise rotation - indexed in the direction of rotation.
Note!
Noise grooves are machined - in based on direction of rotation.



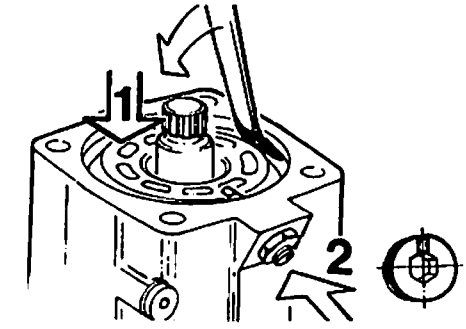
Grundeinstellung - Verdrillschraube /
Basic setting - indexing screw

A4VG...71 * = 28 ± 0,75 mm

A4VG...90 * = 29 ± 0,75 mm

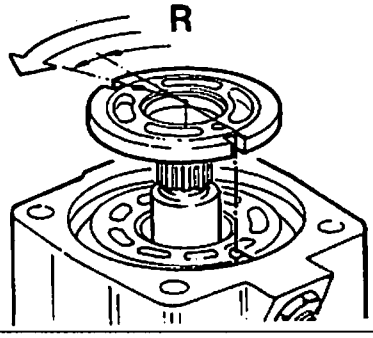
A4VG...125 * = 20 ± 0,75 mm

A4VG...180 * = 22 ± 0,75 mm



Zylinder nach unten drücken (1).
Verdrillschraube einbauen (2).
Kerbe in Montageposition.

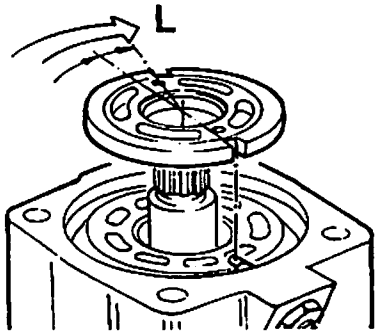
Press the cylinder to the bottom (1).
Screw in the indexing screw (2).
Groove in mounting position.



Steuerplatte einsetzen - Rechtslauf.

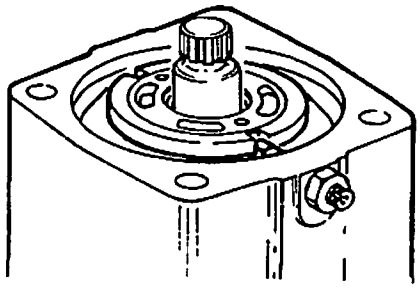
Insert the control plate - clockwise rotation.

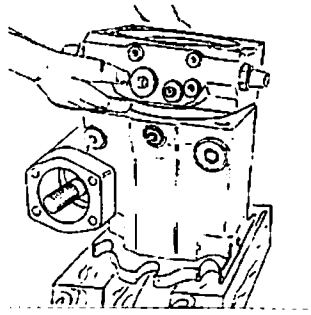
https://truckmanualshub.com/



Steuerplatte einsetzen - Linkslauf.

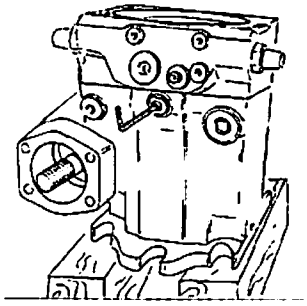
Insert the control plate - Counter- clockwise rotation.





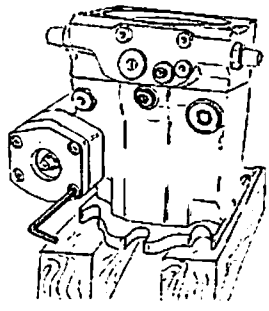
Anschlußplatte aufbauen.
Achtung! Federvorspannung!
Mit zwei Befestigungsschrauben überkreuz Anschlußplatte in Gehäuseführung einsetzen - Fertigmontage!

Assemble connection plate.
Attention! Spring preloaded!
Insert control plate into housing, guidance with two locking screws crossing over -Finish assembly!



Verdrillschraube - Nach Markierung ausrichten.

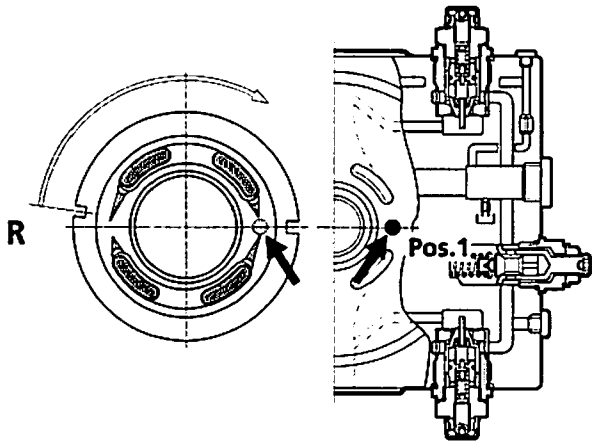
Locking screw - Observe adjusting measure.



1. Deckel montieren.
2. Nullage nach Maß einstellen.

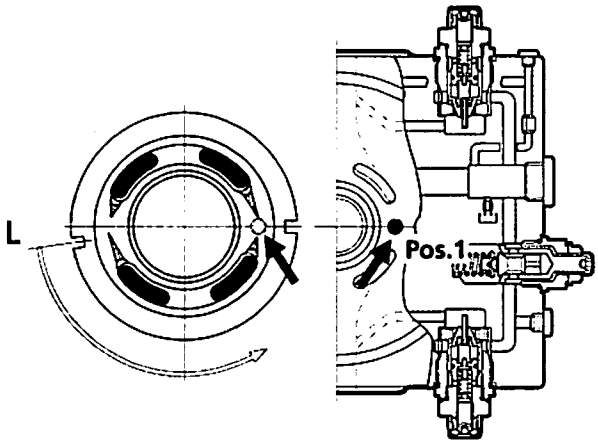
1. Assemble cover
2. Adjust zero position according to measure.

https://truckmanualshub.com/



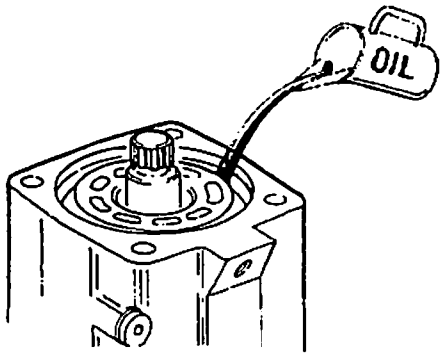
Steuerplatte Rechtslauf - in Drehrichtung verdreht.
Achtung!
Pos.1 Fixierstift
Geräuschkerben sind drehrichtungsbezogen eingeschliffen.

Control plate clockwise rotation - indexed in the direction of rotation.
Note!
Pos.1 Fixing pin
Noise grooves are machined - in based on direction of rotation.



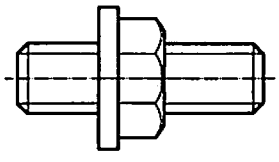
Steuerplatte Linkslauf - in Drehrichtung verdreht.
Achtung!
Pos.1 Fixierstift
Geräuschkerben sind drehrichtungsbezogen eingeschliffen.

Control plate counter clockwise rotation - indexed in the direction of rotation.
Note!
Pos.1 Fixing pin
Noise grooves are machined - in based on direction of rotation.



Zylinderflächen und DU-Lager einölen, neue O-Ringe mit Fett einreiben und einsetzen.

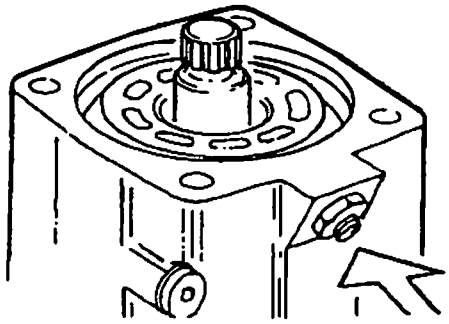
Oil the running surfaces of the cylinder barrel and the DU- bearing. Grease the O-rings and insert in grooves.



Verschlußschraube

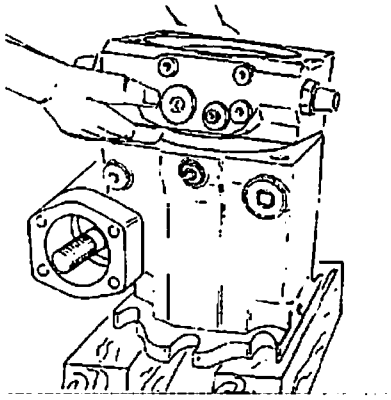
Plug

https://truckmanualshub.com/



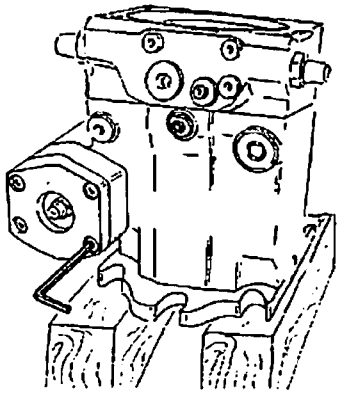
Verschlußschraube einbauen.

Screw in the plug.



Anschlußplatte mit Steuerplatte lagerichtig aufsetzen.
Hinweis:
EP, HD, HW -Steuerplatte mit Fett einsetzen.

Place port block with control plate in correct position.
Note:
EP, HD, HW - Put control plate with grease.



1. Deckel montieren.
2. Nullage nach Maß einstellen.

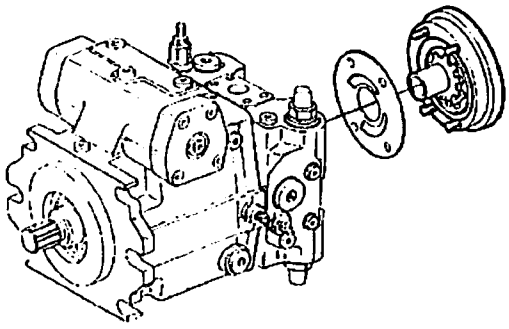
1. Assemble cover
2. Adjust zero position according to measure.

https://truckmanualshub.com/



Achtung!
Korrekte mechanische Nullageneinstellung muß nach Einbau im Gerät bzw. Prüfstand erfolgen.

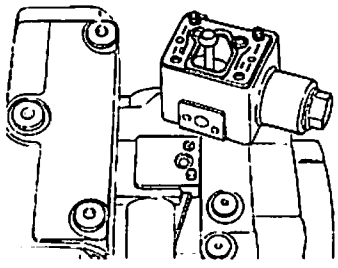
Attention!
Adjustments of the correct zero position to be carried out after installation into the machine or on the bench test.



Hilfspumpe montieren.
Hinweis: Drehrichtung beachten. (Siehe Seite 26, 27)

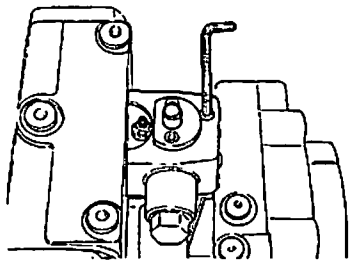
Assemble auxiliary pump.
Note: Take care of direction of rotation. (See page 26, 27)

NG 71



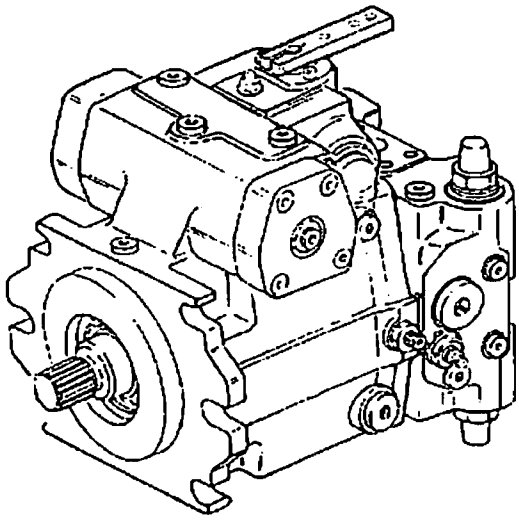
Dichtung mit zwei Befestigungschrauben zentrieren und Ansteuergerät einbauen.
Alle vier Schrauben mit halbem Drehmoment anziehen.

Centre the seal using two fixing screws and fit the control unit.
Tighten all four screws to half of specified torque.



Fünfte Schraube einsetzen und mit Drehmoment = 10,4 Nm festziehen.
Restliche vier Schrauben nach Drehmoment festziehen.

Fit the fifth screw and tighten to a torque of 10,4 Nm.
Then tighten the other four screws to there correct torque.



Ansteuergerät montieren.

Assemble control device.

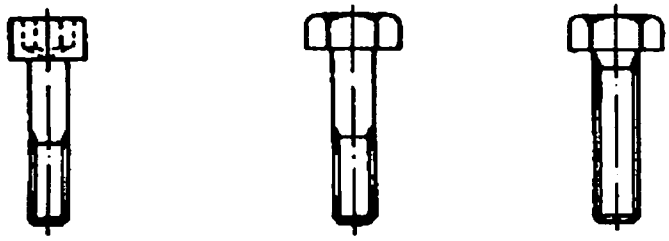
https://truckmanualshub.com/

1. Schaftschrauben (nach N 08.001)

Die Werte gelten für Schaftschrauben mit metrischem ISO-Gewinde nach DIN 13 Teil 13, sowie Kopfauflagemaßen nach DIN 912 Zylinderschrauben, DIN 931 Sechskantschrauben mit Schaft bzw. DIN 933 Sechskantschrauben mit Gewinde bis Kopf.

1. Bolts (to N 08.001)

The values stated are valid for bolts with metric ISO threads to DIN 13 part 13, as well as head areas to DIN 912 socked head cap screws, DIN 931 hexagon bolt or DIN 933 hexagon bolts with threads up to the head.

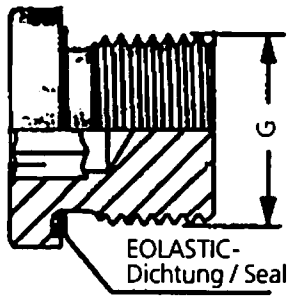


Gewinde / Thread	Festigkeitsklassen / Tensile strength class		
	8.8	10.9	12.9
	Anziehdrehmoment / Tightening torque M_A in Nm		
M 3	1,1	1,6	1,9
M 4	3,1	4,5	5,3
M 5	6,1	8,9	10,4
M 6	10,4	15,5	18
M 8	25	37	43
M 10	51	75	87
M 12	87	130	150
M 14	140	205	240
M 16	215	310	370
M 18	300	430	510
M 20	430	620	720
M 22	580	830	970
M 24	740	1060	1240

https://truckmanualshub.com/

2. **Verschlußschrauben** mit Innensechskant und Profildichtring (nach N 02.009).

2. **Plugs** with internal hexagon and profile seal ring (to N 02.009).

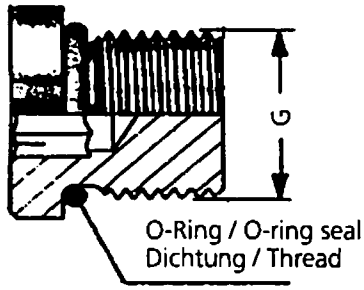


Gewinde / Thread	Anziehdrehmoment / Tightening torque M_A in Nm	Gewinde / Thread	Anziehdrehmoment Tightening torque M_A in Nm
M8 x 1	5	G 1/8 A	10
M10 x 1	10	G 1/4 A	30
M12 x 1,5	20	G 3/8 A	35
M14 x 1,5	30	G 1/2 A	60
M16 x 1,5	35	G 3/4 A	90
M18 x 1,5	40	G 1 A	140
M20 x 1,5	50	G 1 1/4 A	240
M22 x 1,5	60	G 1 1/2 A	300
M26 x 1,5	70		
M27 x 2	90		
M30 x 1,5	100		
M33 x 2	140		
M42 x 2	240		
M48 x 2	300		

https://truckmanualshub.com/

5. **Verschlußschrauben** mit Innensechskant, O-Ring und UNF-, UN-Gewinde nach SAE J 514 (nach N 02.106)

5. **Plugs** with internal hexagon, O-ring and UNF-, UN- threads to SAE J 514 (nach N 02.106)

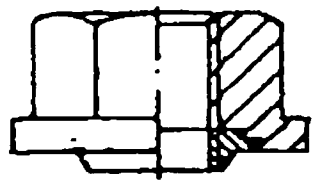


Gewinde / Thread	Anziehdrehmoment M_A in Nm Tightening torque M_A in Nm	Gewinde / Thread	Anziehdrehmoment M_A in Nm Tightening torque M_A in Nm
7/16 - 20 UNF	15	M12 x 1,5	20
1/2 - 20 UNF	20	M14 x 1,5	30
9/16 - 18 UNF	25	M27 x 1,5	90
3/4 - 16 UNF	72		
7/8 - 14 UN	127		
1 1/16 - 12 UN	147		
1 3/16 - 12 UN	173		
1 5/16 - 12 UN	198		
1 5/8 - 12 UN	320		
1 7/8 - 12 UN	390		

6. **SEAL-LOCK-Dichtmuttern** (nach N 02.100)

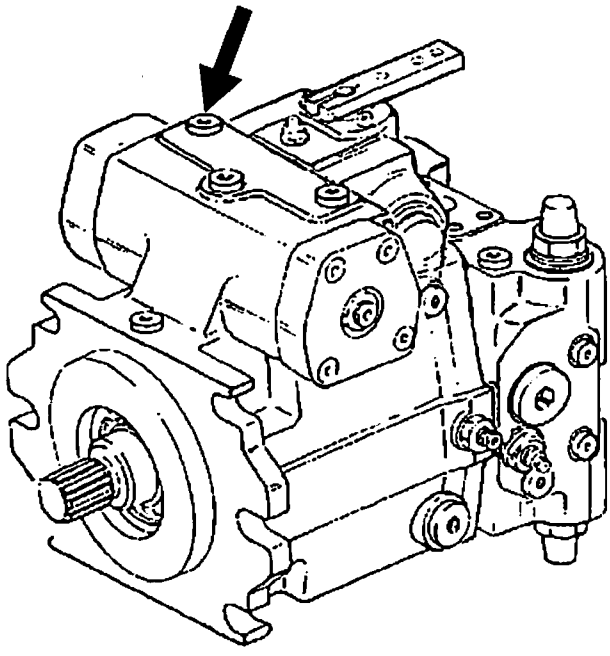
6. **SEAL-LOCK - sealing nuts** (to N 02.100)

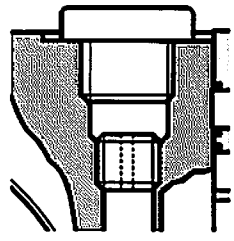
Gewinde / Thread	Anziehdrehmoment M_A in Nm Tightening torque M_A in Nm
M6	10
M6 x 0,5	11
M8	22
M8 x 1	24
M10	40
M10 x 1	44
M12	69
M12 x 1,5	72
M14	110
M14 x 1,5	120
M16	170
M16 x 1,5	180

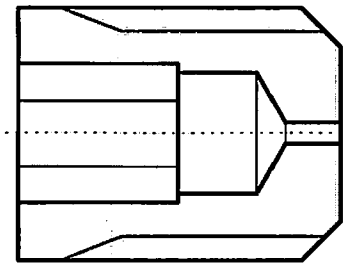


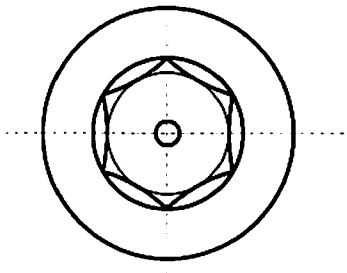
https://truckmanualshub.com/

A10V - Düsen / orifices









Gewinde / Thread	Anziehdremomente Nm / Tightening torques Nm	
	bisher / up to	**neu / new**
M6	6,5	**3**
M10	28	**12**

https://truckmanualshub.com/

Allgemein

- Machen Sie sich mit der Ausstattung der Maschine vertraut.
- Fahren Sie die Maschine nur, wenn Sie sich völlig mit den Bedien- und Steuerelementen sowie der Arbeitsweise der Maschine vertraut gemacht haben.
- Benutzen Sie Ihre Schutzausrüstung wie Schutzhelm, Sicherheitsschuhe und Gehörschutz.
- Machen Sie sich mit Ihrem Arbeitsgebiet vertraut.
- Benutzen Sie die Maschine nur für den ihr zugedachten Zweck.

Beachten Sie bitte die Richtlinien der Berufsgenossenschaft und des Maschinenherstellers

General advice

- Make yourself familiar with the equipment of the machine.
- Only operate the machine if your are completely familiar with the operating and control elements as well as the functioning of the machine.
- Use your safety equipment like helmet, safety shoes and hearing protection.
- Make yourself familiar with your working field.
- Only operate the machine for its intended purpose.

Please observe the guidelines of the Professional Association and the machine manufacturer.





Vor dem Start

- Beachten Sie die Bedienungshinweise vor dem Starten.
- Prüfen Sie die Maschine auf auffällige Fehler.
- Fahren Sie die Maschine nicht mit defekten Instrumenten, Kontrolleuchten oder Steuerorganen.
- Alle Schutzvorrichtungen müssen fest auf ihrem Platz sein.
- Nehmen Sie keine losen Gegenstände mit bzw. befestigen Sie diese an der Maschine.
- Halten Sie die Maschine von öligem und zündfähigem Material frei.
- Prüfen Sie vor dem Besteigen der Maschine, ob sich Personen oder Hindernisse neben oder unter der Maschine befinden.
- Vorsicht beim Besteigen der Maschine, benützen Sie Treppen und Griffe.
- Stellen Sie vor dem Start Ihren Sitz ein.

Before starting

- Observe the operating instructions before starting.
- Check the machine for obvious faults.
- Do not operate the machine with defective instruments, warning lights or control elements.
- All safety devices must be in a secure position.
- Do not carry with you movable objects or secure them to the machine.
- Keep oily and inflammable material away from the machine.
- Before entering thc driver's cabin, check if persons or obstacles are beside or beneath the machine.
- Be careful when entering the driver's cabin, use stairs and handles.
- Adjust your seat before starting.

https://truckmanualshub.com/

Starten

- Beim Starten müssen alle Bedienhebel in "Neutralstellung" stehen.
- Die Maschine nur vom Fahrersitz aus Starten.
- Prüfen Sie die Anzeigeinstrumente nach dem Start, um sicher zu gehen, daß alles ordnungsgemäß funktioniert.
- Lassen Sie die Maschine nicht unbewacht, während der Motor läuft.
- Beim Start mit Batterieverbindungskabeln verbinden Sie Plus mit Plus und Minus mit Minus. Massekabel (Minus) immer zuletzt anschliesen und zuerst abtrennen.

Start

- When starting all operating levers must be in "neutral position".
- Only start the machine from the driver's seat
- Check the indicating instruments after start to assure that all functions are in order.
- Do not leave the machine unobserved when the motor is running.
- When starting with battery connection cables connect plus with plus and minus with minus. Always connect negative (-) cable last and disconnect negative cable first.

Vorsicht

- Auspuffgase sind lebensgefährlich. Bei Start in geschlossenen Räumen für ausreichende Luftzufuhr sorgen!

Attention

- Exhaust gas is dangerous. Assure sufficient fresh air when starting in closed rooms!

Hydraulikanlage

1. Hydraulikanlage steht unter hohem Druck!

⚠ Unter hohem Druck austretende Hochdruck-Flüssigkeiten (Kraftstoff, Hydrauliköl) können die Haut durchdringen und schwere Verletzungen verursachen. Daher sofort einen Arzt aufsuchen, da anderenfalls schwere Infektionen entstehen können!

2. Bei der Suche nach Leckstellen wegen Ver letzungsgefahr geeignete Hilfsmittel verwenden!
3. Vor Arbeiten an der Hydraulikanlage diese unbedingt drucklos machen und angebaute Geräte absenken!
4. Bei Arbeiten an der Hydraulikanlage unbedingt Motor abstellen und Maschine gegen Wegrollen sichern (Feststellbremse, Unterlegkeil)!
5. Beim Anschließen von Hydraulikzylindern und -motoren ist auf vorgeschriebenen Anschluß der Hydraulikschläuche zu achten!
6. Bei Vertauschen der Anschlüsse umgekehrte Funktionen (z.B. Heben/Senken) - Unfallgefahr!
7. Hydraulikschlauchleitungen regelmäßig kontrollieren und bei Beschädigung und Alterung austauschen! Die Austauschschlauchleitungen müssen den technischen Anforderungen des Geräteherstellers entsprechen!

⚠ Öle, Kraftstoffe und Filter ordnungsgemäß entsorgen!

Hydraulic equipment

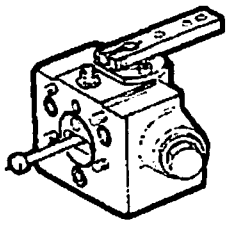
1. Hydraulic equipment is standing under high pressure.

⚠ High pressure fluids (fuel, hydraulic oil) which escape under high pressure can penetrate the skin and cause heavy injuries. Therefore immediately consult a doctor as otherwise heavy infections can be caused.

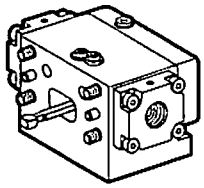
2. When searching leakages use appropriate auxiliary devices because of the danger of accidents.
3. Before working at the hydraulic equipment, lower pressure to zero and lower working arms of the rnachine.
4. When working at the hydraulic equipment, absolutely stop motor and secure machine against rolling away (parking brake, shim)!
5. When connecting hydraulic cylinders and motor pay attention to correct connection of hydraulic flexible hoses.
6. In case of exchanging the ports, the tunctions are vice versa (f. ex. lift-up/lower) - danger of accidents!
7. Check hydraulic flexible hoses regularly and replace them in case of dammage or wear! The new hose pipes must comply with the technical requirements of the machine manufacturer!

⚠ Orderly disposal or recycling of oil, fuel and filters!

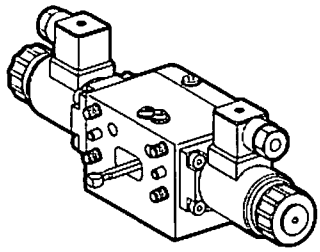
https://truckmanualshub.com/



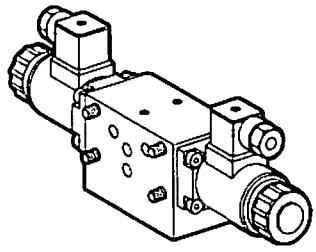
HW



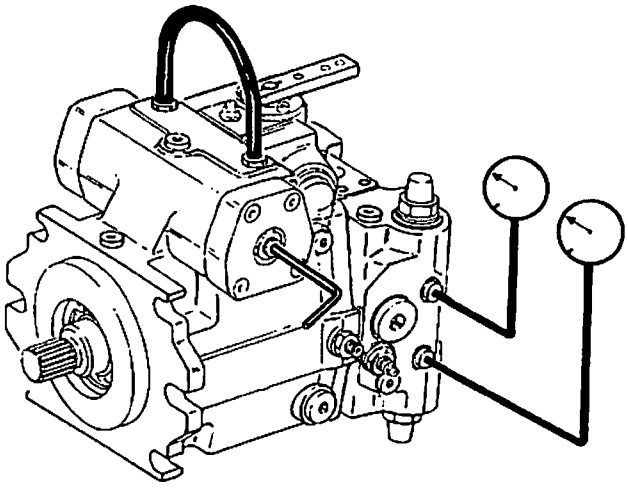
HD



EP



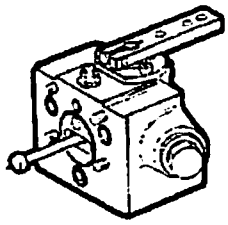
DA



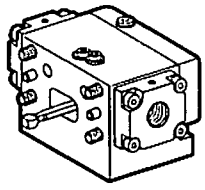
Achtung!
Sicherheitsbestimmungen beachten!
Mit Schlauch NW6 beide Stellkammern verbinden. Vermeidung von Restsignal aus hydraulischer Nullage.
Manometer an M_A und M_B anschließen.
Nullage so einstellen, daß bei blockiertem Antrieb beide Manometer auf gleichem Druckwert stehen.
Hinweis:
Totband der Nullage - vermitteln.

Attention!
Observe safety regulations!
Connect both control chambers with hose NW6. Avoidance of rest signal from hydraulic zero position.
Connect manometer to M_A and M_B. Adjust zero position so that at blocked drive both manometer indicate the same pressure valve.
Note:
Adjust death line of zero position.

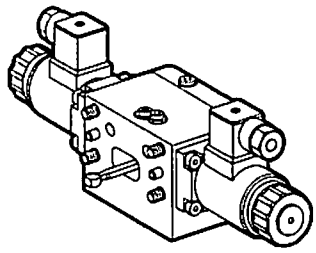
https://truckmanualshub.com/



HW



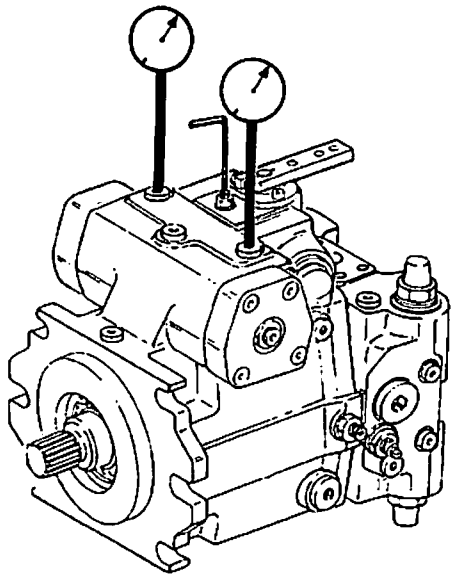
HD



EP

Achtung!
Sicherheitsbestimmungen beachten!

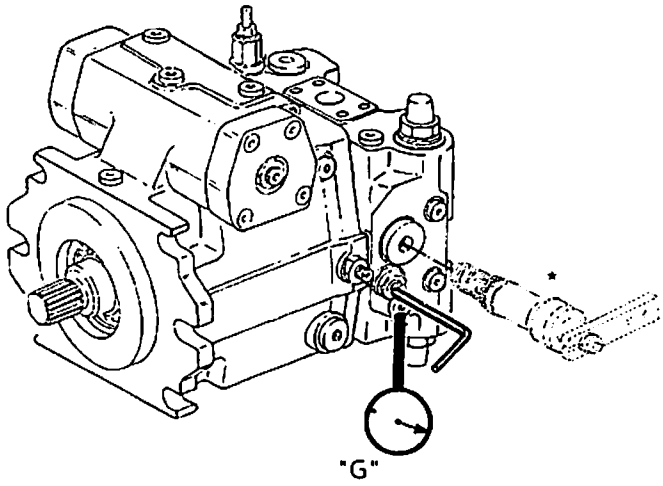
Attention!
Observe safety regulations!



Manometer an X_1 und X_2 anschließen.
Nullage so einstellen, daß bei blockiertem Antrieb beide Manometer auf gleichem Druckwert stehen.
Hinweis:
Excenterjustierung
- nicht über ±90° verdrehen.

Connect manometer to X_1 and X_2.
Adjust zero position so that at blocked drive both manometer indicate the same pressure value.
Note:
Eccentric adjusting
- Do not turn over ±90°.

https://truckmanualshub.com/



Achtung!
Sicherheitsbestimmungen beachten!

Hinweis:
Nachjustierung nur bei Betriebstemperatur.

Manometer an "G" anschließen.

Achtung!
* Speisedruckeinstellung!
Nenndruck p_H - 18 bar
Höchstdruck p_H - 40 bar
Bei Max.-Drehzahl.

Hinweis:
Einstelldaten nach Werksauftrag.

* bei DA-Ausführung

Attention!
Observe safety regulations!

Note:
Readjusting only at operating temperature.

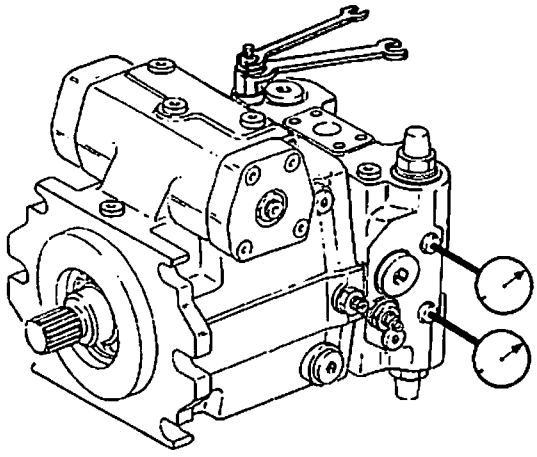
Connect manometer to "G".

Attention!
* Boost pressure setting!
Nominal pressure p_H - 18 bar
Peak pressure p_H - 40 bar
at max. speed.

Note:
Adjusting data according to order.

https://truckmanualshub.com/

Druckabschneidung
Pressure cut-off



Achtung!
Sicherheitsbestimmungen beachten!

HD-Ventil ohne Bypass

1 . HD- Ventile sind immer 10% höher eingestellt als die Druckabschneidung.
Bei Veränderung eines Einsteilwertes immer beide kontrollieren.
2. Nachjustierung nur bei Betriebstemperatur

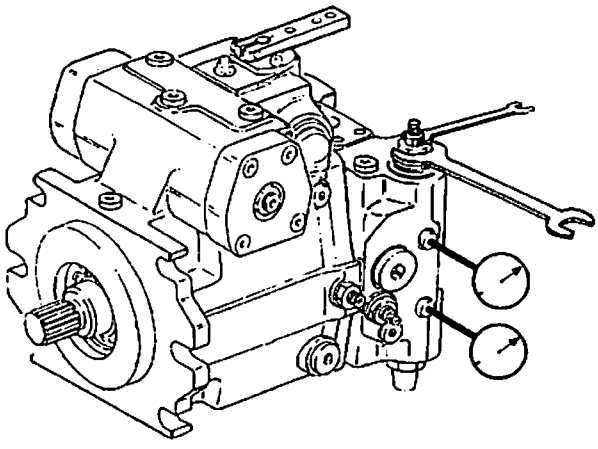
Manometer an M_A und M_B anschließen.
Druckabschneidung: Maß X Einstellschrauben notieren!
Einstellschraube auf Block drehen.

HD- Ventile: Mit geringer Pumpenmenge über Ventile fahren. Einstellwert kontrollieren.
(Nur kurzzeitig "Temperatur".)

Drucklos "Einstellwert" verändern - Kontrolle

Druckabschneidung:
Einstellschraube auf Maß (*) zurückdrehen.
Druckwert kontrollieren bzw. nachjustieren.
Achtung! Differenz von 10% HD- Ventile und Druckabschneidung beachten!
Hinweis: Einstelldaten nach Werksauftrag.

HD- Ventile
HP- valves



Attention!
Observe safety regulations.

HP valve without bypass-function

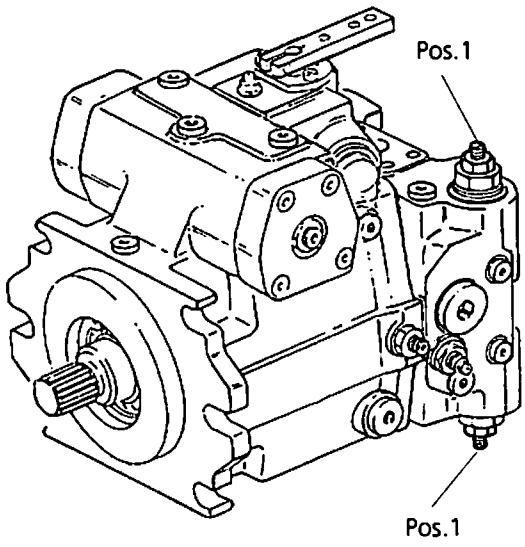
1 . HP valves are always adjusted 10% higher than the pressure cut-off.
If one setting value is changed, always check both values.
2. Readjusting only at operating temperature.

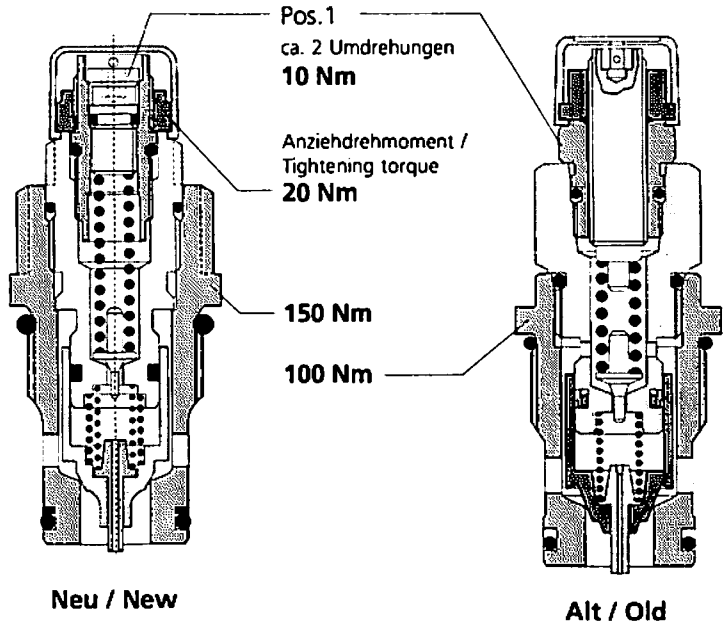
Connect manometer M_A and M_B.
Pressure cut-off: Note measure X setting screw! Turn setting screw on block.
HP valves: Operate valves with small pump flow volume.
Check setting value. ("temperature" only for a short time).
Change "setting value" - check.

Pressure cut-off:
Turn back setting screw to measure (*).
Check pressure value and readjust.
Attention! Observe 10% pressure difference HP valves and pressure cut-off!

https://truckmanualshub.com/

A4VG 71 - 90





Fahrzeuge mit rein-hydrostatischem Fahrantrieb bzw. mit hydrostatischem Fahrantrieb und Schaltgetriebe ohne Leerlaufstellung (Freilauf).

Hydrostatischer Antrieb / Bypaß-Schaltung

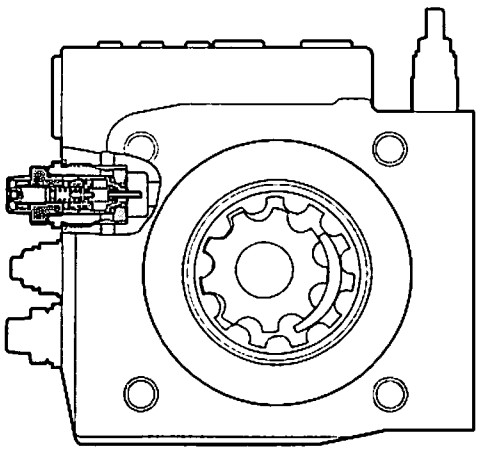
In diesem Fall wird der Fahrantrieb auf freien Umlauf geschaltet. Zu diesem Zweck haben die in der Verstellpumpe integrierten Hochdruckbegrenzungsventile eine sogenannte Bypaß-Funktion. D.h. durch Drehen der entsprechenden Schraube (Pos.1) wird der Ventil-Einsatz so entspannt, daß ein freier Öl-Umlauf möglich ist.

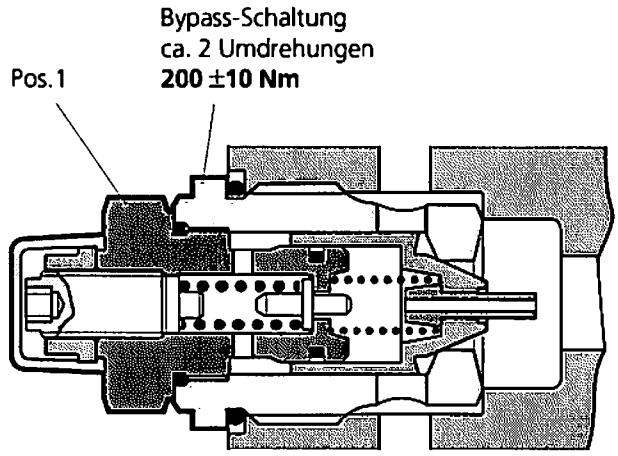
Vehicle with hydrostatic transmission and gear shift without idling setting position (free wheeling).

Hydrostatic transmission / Bypass-switching

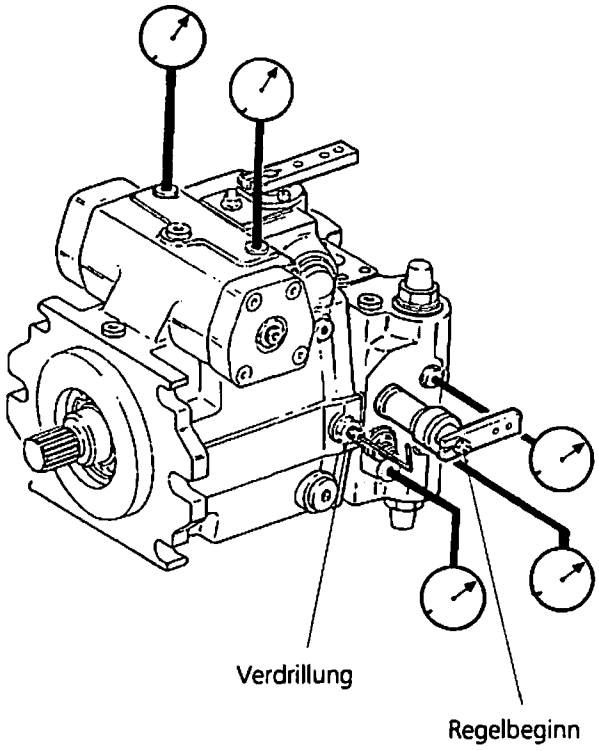
In this case the travel transmission is switched on to free wheeling.For this purpose the variable displacement pump has incorporated high pressure relief valves with bypass function.
The screw (item 1) is unscrewed to such an extent, that the valve cartridge is released and free oil circulation is possible.

A4VG 125 - 250





https://truckmanualshub.com/



Achtung!
Sicherheitsbestimmungen beachten!

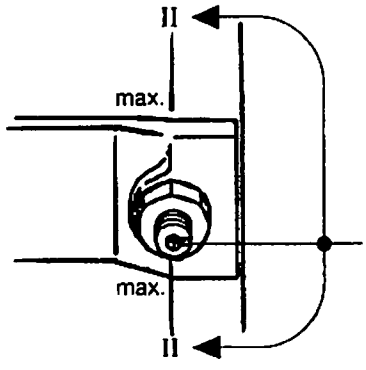
Überprüfung der Einstelldaten
Betriebstemperatur soll während des Überprüfungsvorgangs weitgehend konstant gehalten werden.
Antriebsmotor starten, Leerlaufdrehzahl

Blockzustand
Fahrtrichtungsschalter **"0"**
Motordrehzahl langsam steigern bis zur max. Motordrehzahl, dabei Meßgeräte beobachten.
Speisedruck:
Leerlaufdrehzahl
Psp = ca. 15-20 bar
max. Motordrehzahl
Psp = ... bar*

Blockzustand
Fahrtrichtungsschalter - vorwärts
(Straßengang und Festgebremst)

Einstelldaten Pumpe A4V/DA überprüfen
Regelbeginn
HD 40 - 50 bar
Motordrehzahl . min.^{1} * Psp . . . . . bar*
HD . . . . . bar
Nachjustierung - Regelbeginnschraube

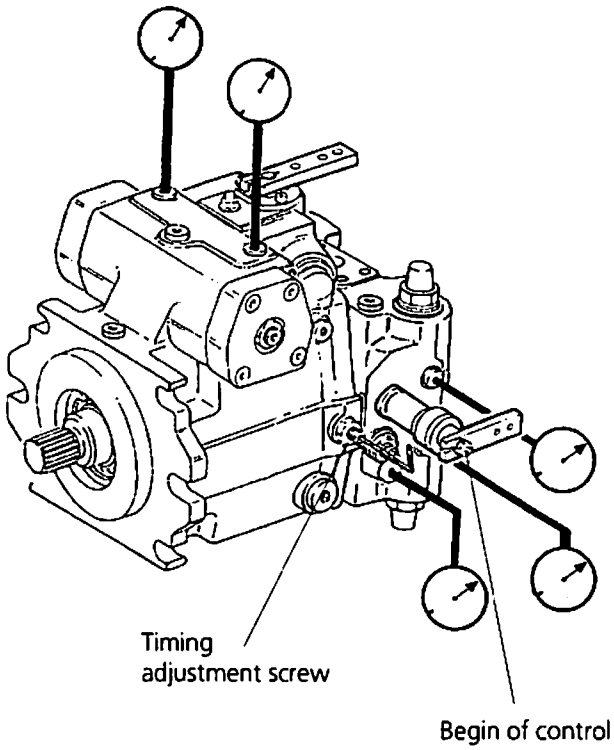
Regelende
HD . . . . . bar*
Motordrehzahl . . . . . min.^{1} * Psp . . . . . bar*
Nachjustierung - Verdrillschraube



Hinweis:
Excenterjustierung - Drehrichtung beachten

Hinweis: * Einstelldaten nach Werksauftrag!

https://truckmanualshub.com/



Attention!
Observe safety regulations!

Check setting data.
Operating temperature should be kept largely constant during the check procedure.
Start prime mover, idle speed.

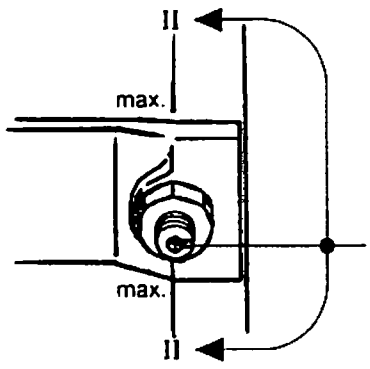
Block position
Drive direction switch - **"0"**.
Slowly increase motor speed up to the max. motor speed and thereby observe measuring instruments.

Boost pressure:
Idle speed of prime mover
Psp = approx. 15 - 20 bar
max. motor speed
Psp = ... bar*

Block position
Drive direction switch - **forward**
(Road gear and fully applied brake)

Check setting data pump A4VIDA
Begin of control:
HD 40 - 50 bar
Motor speed . . . . . rpm* Psp . . . . . bar*
HD . . . . . bar*
Readjusting - control start screw

End of control
HD . . . . . bar
Motor speed . . . . . rpm* Psp . . . . . bar*
Readjusting timing adjustment screw



Note:
Eccentric adjusting - observe direction of rotation

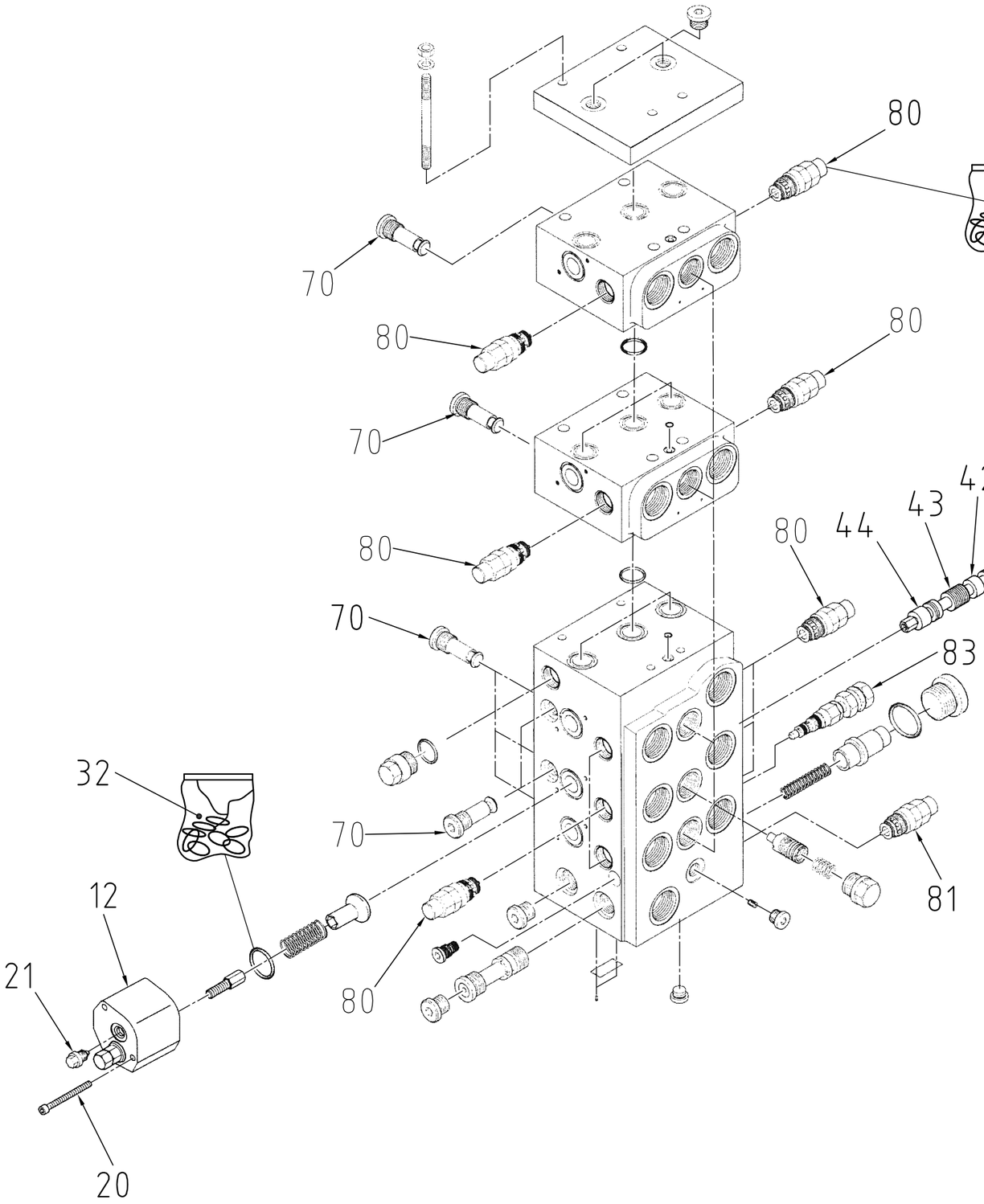
* Setting data according to order!

https://truckmanualshub.com/

Brueninghaus Hydromatik GmbH, Werk Elchingen, Glockeraustraße 2, D-89275 Elchingen, Tel. (07308) 820, Fax (07308) 7274, E-Mail: service.elchingen@bru-hyd.com

Brueninghaus Hydromatik GmbH, Werk Horb, An den Kelterwiesen 14, D-72160 Horb, Tel. (07451) 920, Fax (07451) 8221, E-Mail: service.horb@bru-hyd.com

https://truckmanualshub.com/



100		10	Dichtsatz kpl. Ventil SP12		860568
② 83		1	Druckbegrenzungsventil		198633
81		1	Druckbegrenzungsventil		860755
80		10	Begrenzungsventil SP12		860559
70		7	Rueckschlagventil		860767
44		10	Kolben M6 Teleskop		860753
43		10	Kolben M6 Zusatz gross		860752
42		10	Kolben M6 Loeffel		860751
41		10	Kolben M6 Stiel		860750
40		10	Kolben M6 Zusatz klein		860749
32		10	Dichtsatz zu 860746		860748
21		8	Drosselrueckschlagventil		860747
20		20	Isk.Schraube M05x055 verz.	DIN912	801183
12		10	Deckel		860746
Pos.	Stücklisten-Name	Menge	Beschreibung 1	Norm/Lieferant 1	Material 1
			Beschreibung 2	Norm/Lieferant 2	Material 2
			Identnummer	Preis	Gewicht

Schutzvermerk nach DIN 34 beachten!

DIN7168 ~~fein~~ mittel ~~grob~~

Oberfläche

Maßstab 1:1 | Position – | Menge –

– –

– –

	Datum	Name
Bearb.	28.10.2003	mbe
Gepr.		
Norm		

Steuerventil M6 A91 Euro2

Zust.	Änderung	Datum	Name
2	Pos.83 neu	26.10.04	SO
1	Pos.70 hinzu	24.08.04	SO

Menzi Muck AG
CH–9443 Widnau

860718

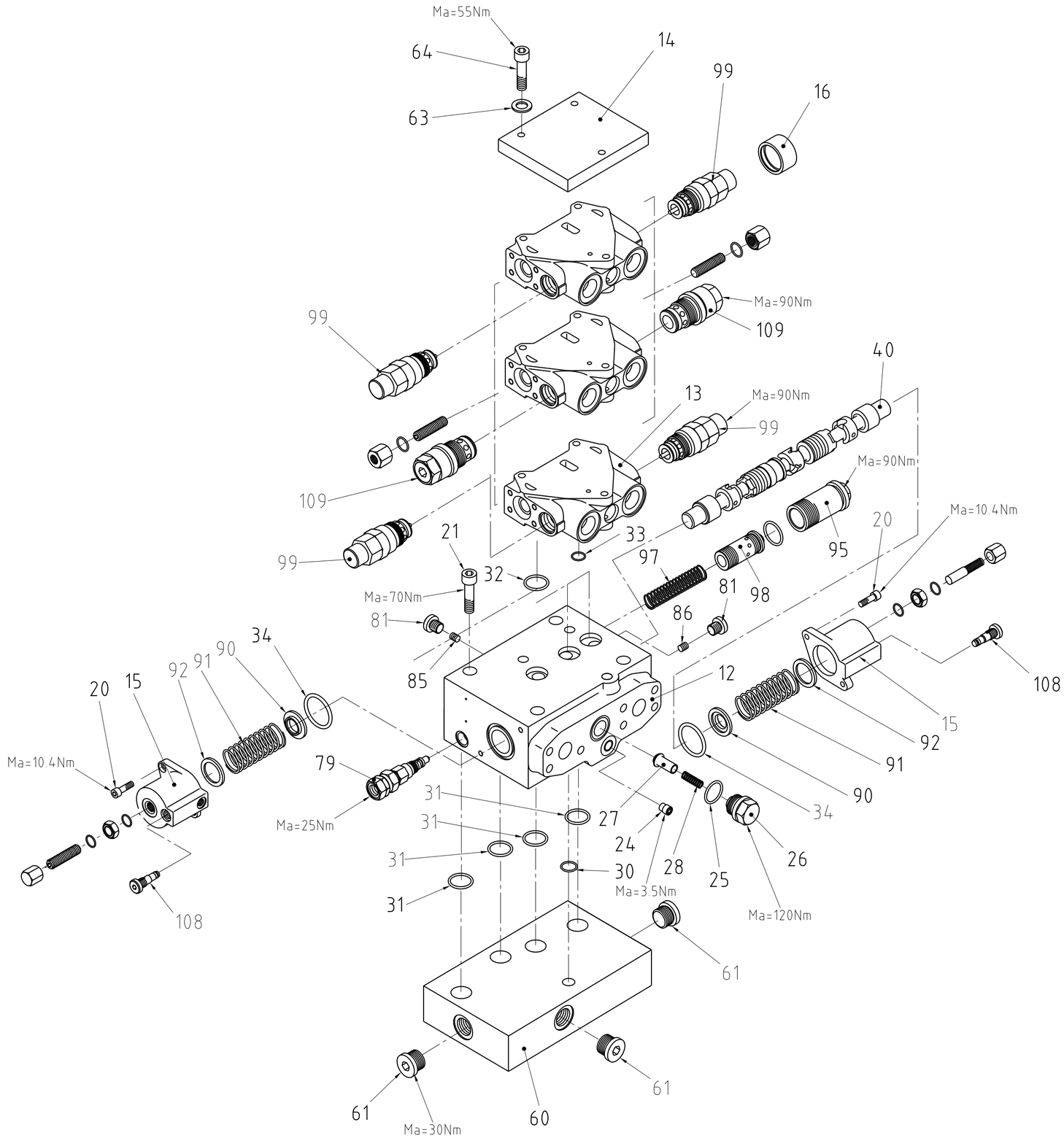
Blatt A3

Bl

EDV Nr.

26.10.2004

https://truckmanualshub.com/



109		2	Nachsaugventil		860745
108		2	Drosselventil		860694
99		4	Druckbegrenzungsventil MHDBN 16		860559
98		1	Kolben		860692
97		1	Druckfeder		860691
(5) 95		1	Reduzierstueck		860828
92		2	Scheibe 25/35x1	DIN 988	860688
91		2	Druckfeder 29.2/5.3x49.9/3.3		860687
90		2	Federteller 22.5/36.0x7/3-18		860686
86		1	Duese 0.7 M6		860685
85		1	Duese 1.5 M6		860684
81		2	Verschlussschraube G1/4		860683
79		1	Druckbegrenzungsventil		860680
64		3	Isk.Schraube M12x130	DIN 912/12.9	801087
63		3	Scheibe 13x24x2.5 verz	DIN 125A	800210
61		3	Verschlussschraube M22x1.5		860677
60		1	Platte		860676
40		1	Kolben		860675
34		2	O-Ring 40.94x2.62		860674
(5) 33		4	O-Ring 10.77x2.62		860764
(5) 32		12	O-Ring 29.82x2.62		860763
31		4	O-Ring 25.00x3.53		860673
30		1	O-Ring 12.37x2.62		860672
28		1	Druckfeder		860671
27		1	Kegel		860670
26		1	Verschlussschraube		860669
25		1	O-Ring 20.29x2.62		860668
24		1	Rueckschlagventil RVE-04-0.2		860667
21		4	Isk.Schraube M10x085	DIN 912/12.9	801086
20		4	Isk.Schraube M06x016 verz	DIN 912/8.8	800205
16		6	Deckel		860664
15		2	Deckel		860663
14		1	Platte		860662
(5) 13		1	Gehaeuse SX14H2X/EA100-100H230		860661
12		1	Gehaeuse		860660
Pos.	Stucklisten-Name	Menge	Beschreibung 1	Norm/Lieferant 1	Material 1
			Beschreibung 2	Norm/Lieferant 2	Material 2
			Identnummer	Preis	Gewicht

Schutzvermerk nach DIN 34 beachten!

DIN7168 ~~fein~~ mittel ~~grob~~

Oberflaeche

Maßstab 1:1 | Position – | Menge –

					Datum	Name
				Bearb.	10.04.2003	MBe
				Gepr.		
5	Anpassungen	21.03.07	SO	Norm		
4	Pos.63 neu	21.07.06	MRu			
3	Pos.20 neu	02.12.05	SO			
2	Pos.99 neu	28.10.03	mbe			
1	Pos.109 neu	20.10.03	mbe			
Zust.	Anderung	Datum	Name	EDV Nr.		

Steuerventil M7 A91

Menzi Muck AG
CH-9443 Widnau

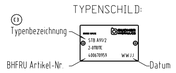
860706

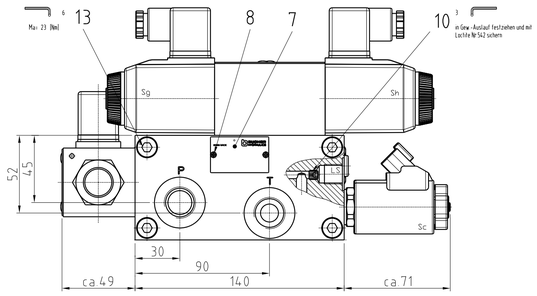
Blatt A3 Bl

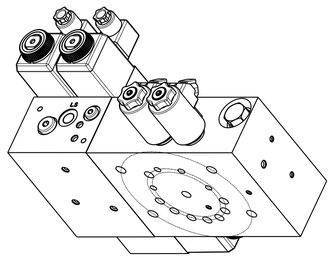
21.03.2007

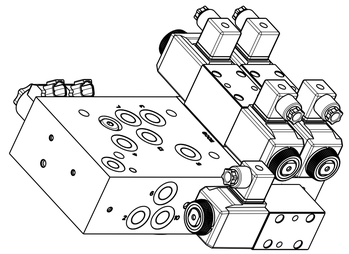
https://truckmanualshub.com/

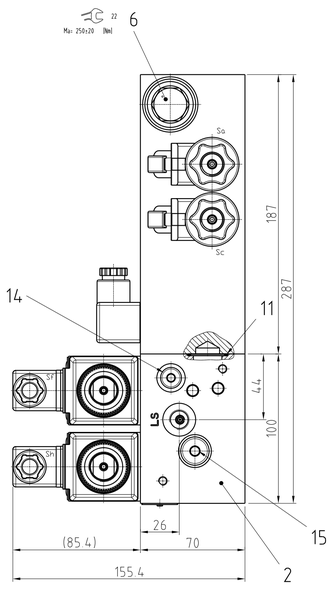
TYPENSCHILD:

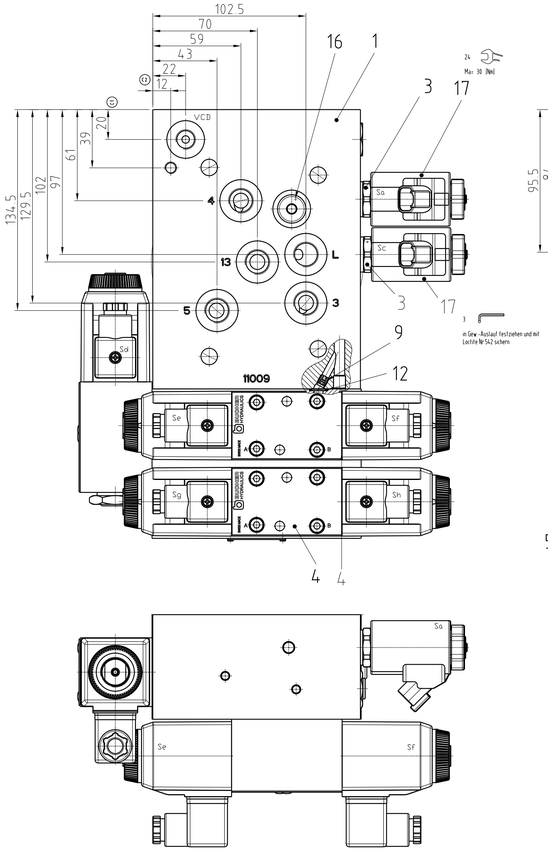


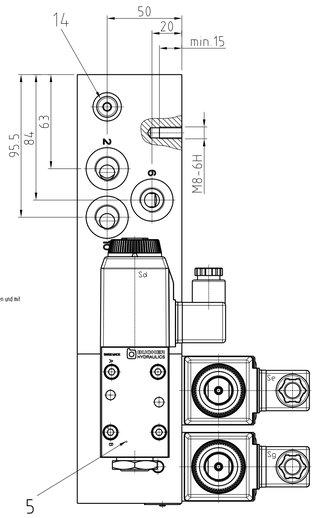


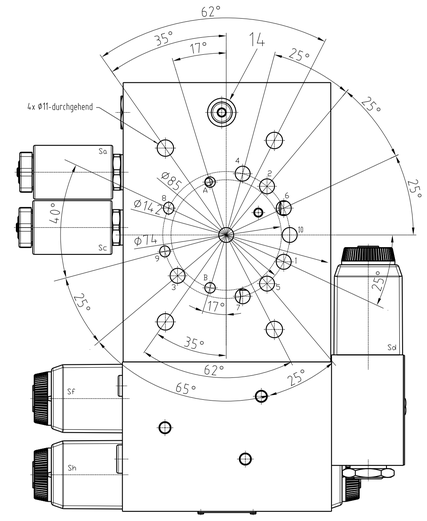


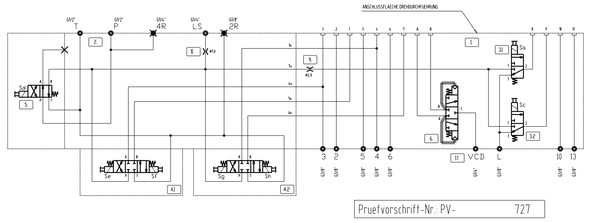












ANSCHLUESSE BLOCK	
T und P	G 1/2"
2, 3, 4, 5, 6, 10, 13 und L	G 3/8"
LS, VCD	G 1/4"

Anzugsmoment - VSTI - Verschlussschrauben		
G 1/8" , i-6kt SW 5 , Ma=10[Nm]	Pos.	15
G 1/4" , i-6kt SW 6 , Ma=30[Nm]	Pos.	16

17		2	Magnetspule 24V	ERSATZTEIL	198539
16		1	Verschlussstopfen G3/8"		197725
15		3	Verschlussstopfen G1/4"		197759
② 14		3	Verschlussstopfen G1/8"		197760
13		4	Isk Schraube M08x120 verz	DIN 912/8.8	800832
12		5	O-Ring NR 012 9.25x1.78 N90		197757
11		1	O-Ring NR 021 23.52x1.78 N90		197758
10		1	Duese G M6 D1.0		198346
9		2	Duese G M6 D2.0		197752
8		2	Taptit M2.5x5.3 verz	DIN 7500C	197727
7		1	Typenschild Bucher	39x24x0.8	198158
6		1	Spuelventil	G916.101.430.020	198860
② 5		1	Wegeventil WEDO-42-A-6-V-1	24V	199705
4		2	Wegeventil WEDO-43-D-6-V-1	24V	198157
3		2	Magnetventil 3/2 24V		198155
2		1	Ventilblock 2 K3-8491		197753
1		1	Ventilblock 1	70x139x187	199454
Pos.	Stuckliste-Name	Menge	Beschreibung 1	Norm/Lieferant 1	Material 1
			Beschreibung 2	Norm/Lieferant 2	Material 2
			Identnummer	Preis	Gewicht

Schutzvermerk nach DIN 34 beachten!

DIN7168 ~~fein~~ mittel ~~grob~~

Oberflache

Massstab 1:2 | Position – | Menge –

	Datum	Name
Bearb.	14.01.2003	SO
Gepr.		
Norm		

Zust.	Anderung	Datum	Name
2	Pos.5,14 neu	23.05.05	SO
1	Pos.1 neu	21.06.04	SO

Menzi Muck AG
CH-9443 Widnau

EDV Nr.

Abstuetzventil A91 Euro2

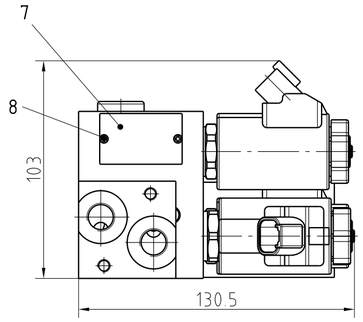
STB A91/2 2-011011

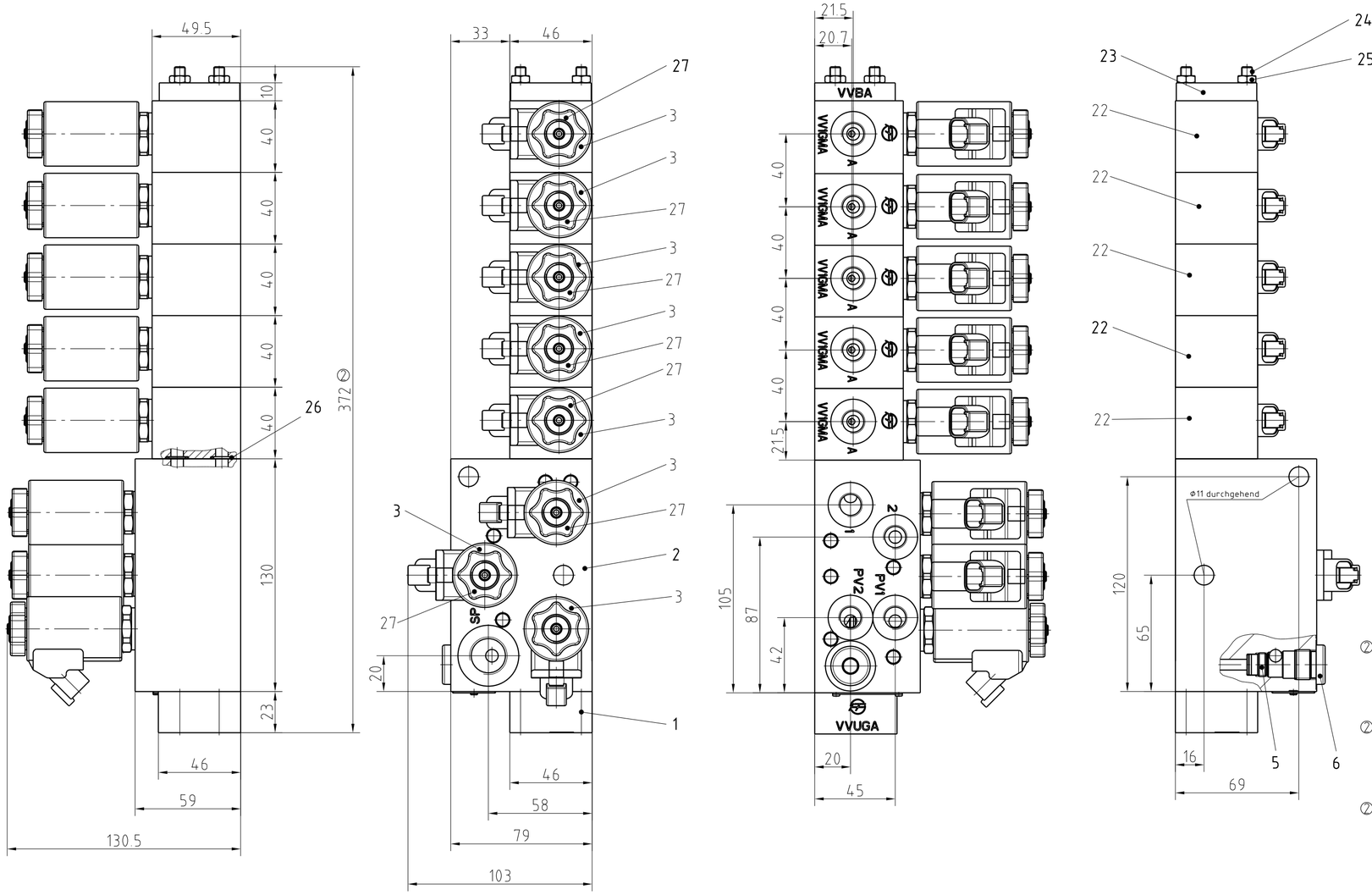
198563

Blatt A1 Bl

23.05.2005

https://truckmanualshub.com/





②	27		7	Magnetspule 24V	ERSATZTEIL	198539
	26		14	O-Ring 9.25x1.78		197749
	25		1	Skt Mutter M06	DIN 9434/10	801100
	24		2	Stehbolzen		198069
	23		1	VV-Koerper VVBA		197746
②	22		5	VV-Koerper VV1GMA		197745
	8		2	Taptite M2.5x5.3		197727
	7		1	Typenschild Bucher		198158
	6		1	Verschlussstopfen G3/8"		197725
	5		1	RKVE-06-Z4		198178
②	3		8	Magnetventil 3/2 24V		198155
	2		1	STB Vorsteuereinheit		197721
	1		1	VV-Koerper VVUA		197720
Pos.		Stücklisten-Name	Menge	Beschreibung 1	Norm/Lieferant 1	Material 1
				Beschreibung 2	Norm/Lieferant 2	Material 2
				Identnummer	Preis	Gewicht

Schutzvermerk nach DIN 34 beachten!

DIN7168 ~~fein~~ mittel ~~grob~~

Oberfläche

Maßstab 1:2 | Position – | Menge –

					Datum	Name
				Bearb.	27.02.98	FL
				Gepr.		
				Norm		

2	Anpassungen	25.04.05	SO
1	Pos.3 und 4	20.09.04	SO
Zust.	Änderung	Datum	Name

Menzi Muck AG
CH-9443 Widnau

EDV Nr.

Vorsteuerventil A91

400-2-010026

198139

Blatt A1

Bl

25.04.2005

https://truckmanualshub.com/

TOSHIBA MACHINE PRODUCT INFORMATION



Options

Planetary reduction gear unit for swing drive

Hydraulic timer for mechanical brake release

Reducing valve for swing reverse motion

Free swing function

Super shockless relief valve

Features

1. Light weight, compact design

Various components such as the motor housing and reduction gear cover, and the cylinder and shaft have been combined and integrated into a single type construction for decreased weight and size.

2. Highly reliable and long life

Supported by the cylinder block, the cylinder block is rigidly constructed for virtually no effects from external vibration and hydraulic pressure fluctuations.

3. Quiet operation

Virtually noise free operation due to highly rigid-type cylinder block and shaft.

4. Highly efficient operation with outstanding self-priming capability

Enlarged oil path and reduced stress between the piston and the shoe due to optimum oil path in the valve plate.

5. Improved operability

Virtually leak-proof with improved fine-movement operations

Excavator Use	Pressure	Flow Rate	motor
 Mini-shovel	24.5 MPa(250 kgf/cm²)	40-60 ℓ/min	 MFC20
 Small-sized	34.3 MPa(350 kgf/cm²)	70-160 ℓ/min	 MFC40 MFC65 MFC80

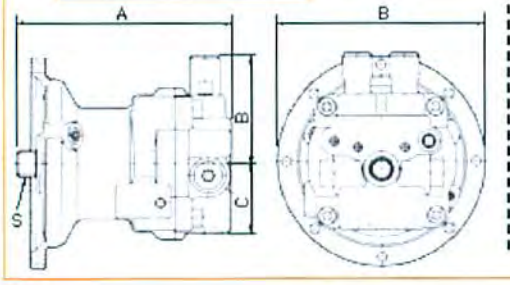
https://truckmanualshub.com/

 Medium-sized	34.3 MPa(350 kgf/cm²)	200-260ℓ/min	 MFC160 MFC200
 Large-sized	34.3 MPa(350 kgf/cm²)	300-500ℓ/min	 MFC250

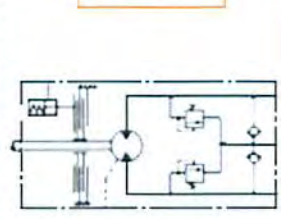
Specifications

Model	MFC20	MFC40	MFC65	MFC80	MFC160	MFC200	MFC250
Displacement (cm^3/rev)	22	43	65	79	151	186	250
Maximum working pressure (bar)	206	275	343				
Maximum speed (rpm)	3,000	2,500	2,150	2,000	1,600	1,500	1,350
Theoretical torque (Nm)	96	188	284	345	660	813	1,093
Maximum mechanical brake torque for parking (Nm)	96	188	284	345	660	813	1,093
Weight (Kg)	15	20	26	33	45	58	77

Configuration



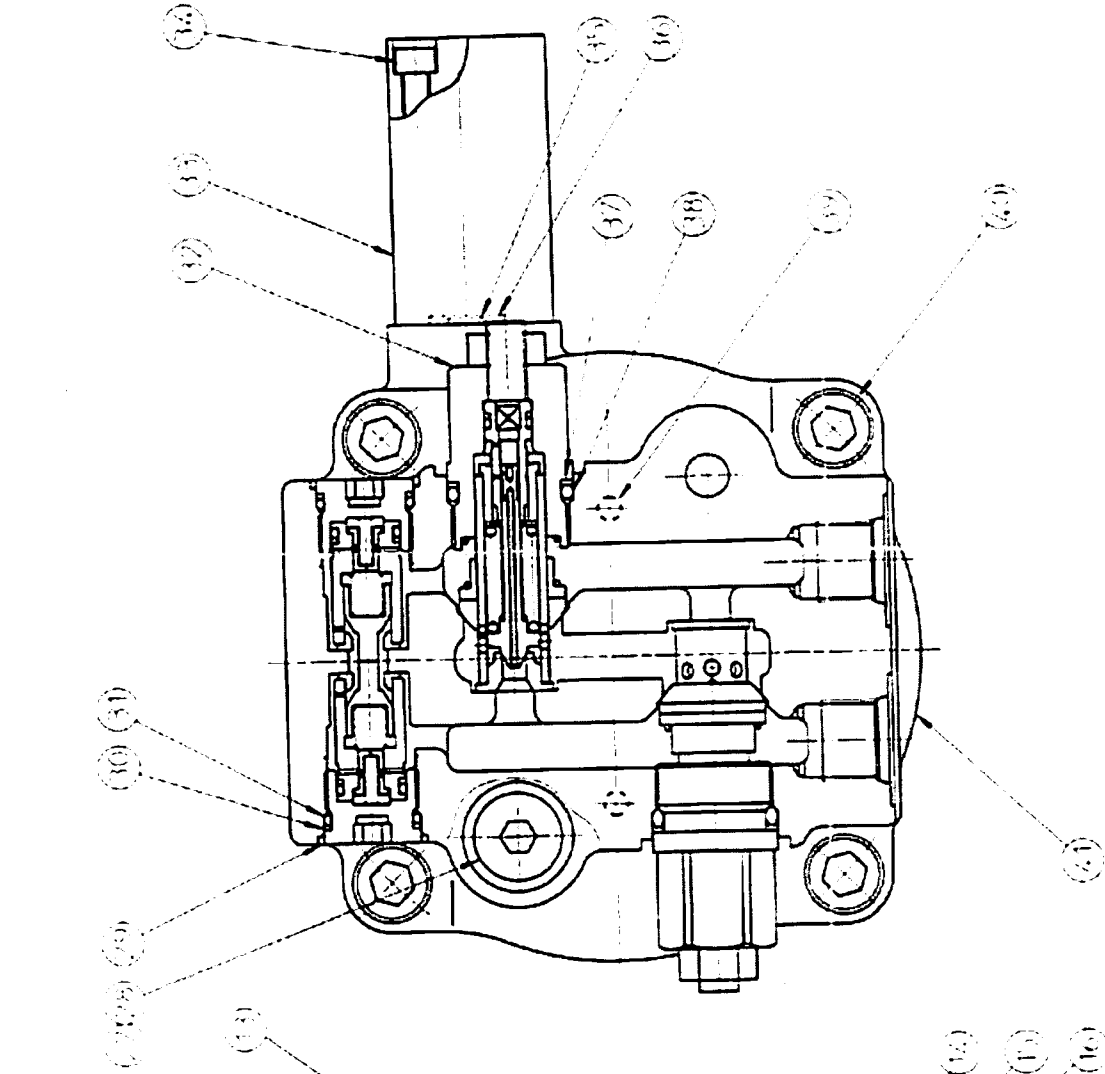
Circuit

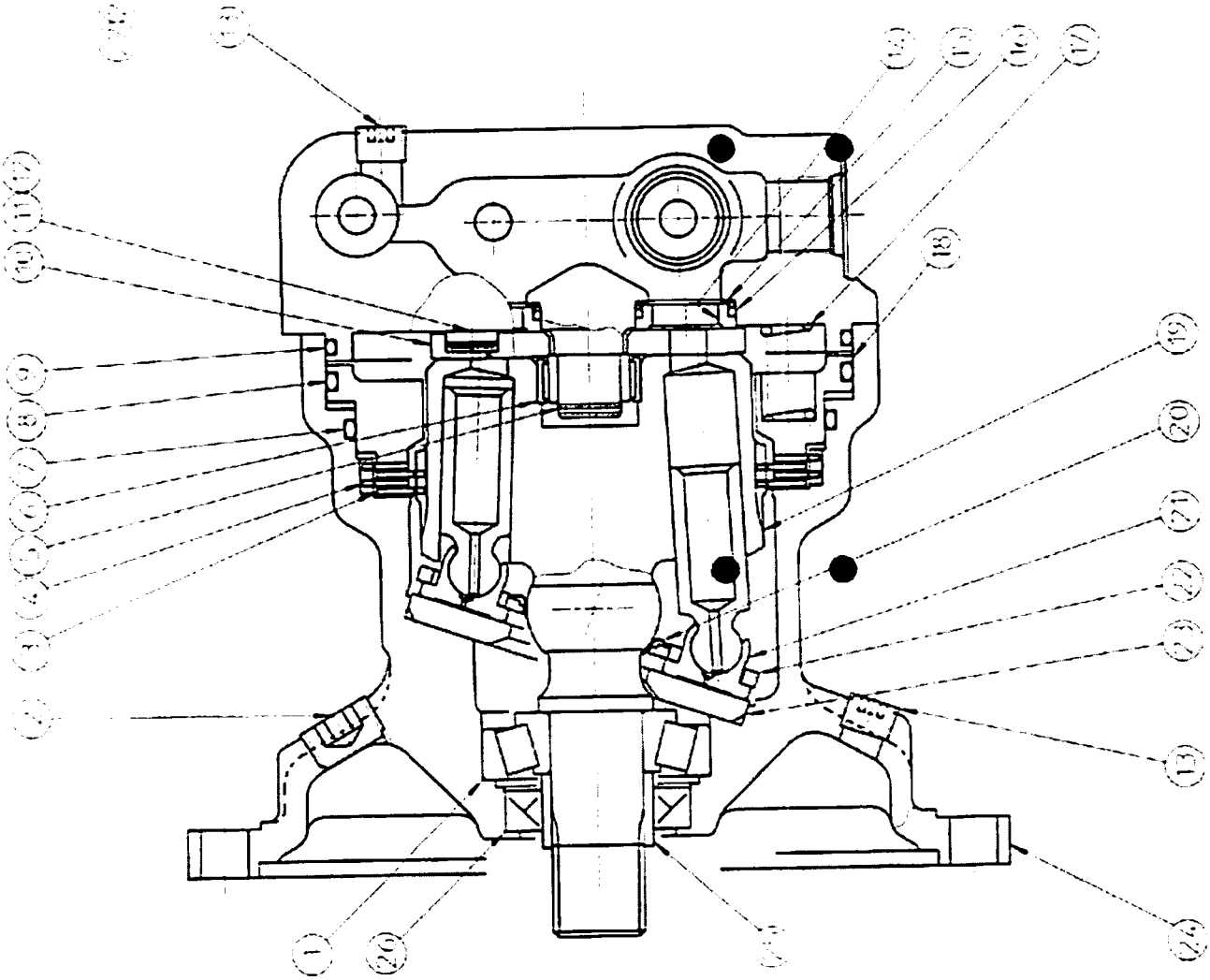


(mm)

Model		MFC40	MFC65	MFC80	MFC160	MFC200	MFC250
A		238	248	266	319	332	383
B		115	137	135	140	168	185
C		80	87	87	107	110	143
D		217	264	264	307	370	284
S (JIS)	m	1.667	1.667	-	-	-	2.5
	z	13	16	-	-	-	20
S (SAE)	DP	-	-	12/24	8/16	8/16	-
	z	-	-	14	13	13	-

https://truckmanualshub.com/



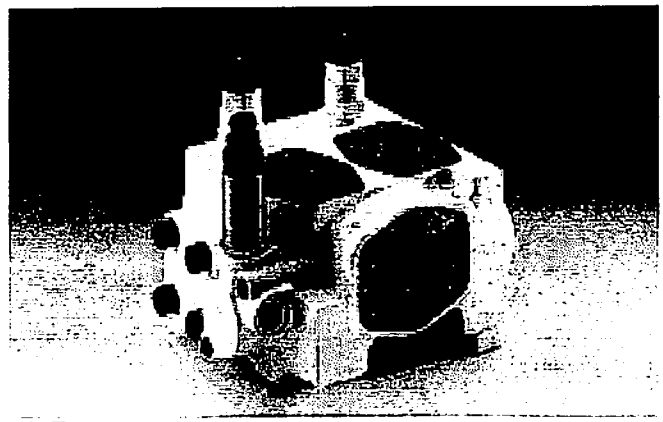


https://truckmanualshub.com/

MANNESMANN REXROTH	Flow Divider Type MH2FA, Series 4X (Differential lock)			RE 64 582/02.98 Replaces: 03.96
	Size 12 to 32	up to 420 bar	up to 300 L/min	

Characteristics:

- Double-acting (dividing and summating) flow divider
- Fixed division ratio
- Suitable for open and closed circuit
- Type of connection:
  - Threaded connection (size 12)
  - SAE-flange connection (size18 to 32)
- 7 standard division ratios
- Optionally with or without free wheel operation
- Flow division function: hydraulic or electrically selectable
- Optionally integrated pressure supply valves
- Wet pin DC solenoid



H/A 2574
Type MH2FAER 32..4X/1H...

⚠ **Attention !**
The selection and release of the type MH2FA flow divider can only be authorised by Rexroth Hydraulics, Mobile hydraulics product group.

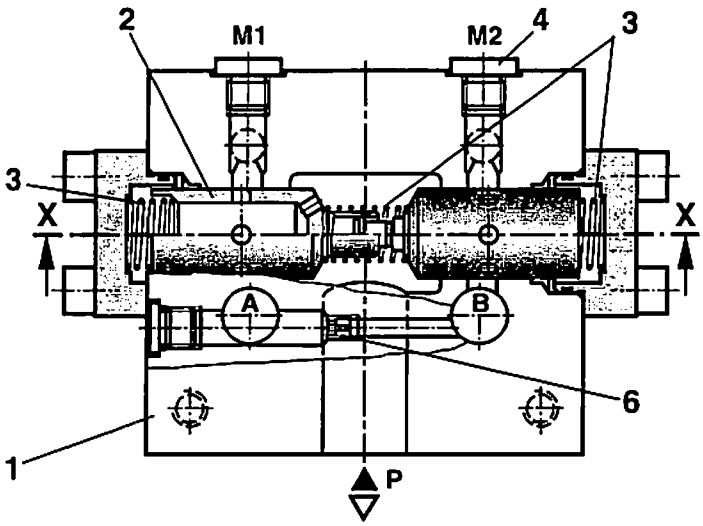
Function description, section

Flow dividers type MH2FA without or with free wheeling operation are primarily used as a differential lock on hydrostatic drives with parallel switched hydraulic motors.

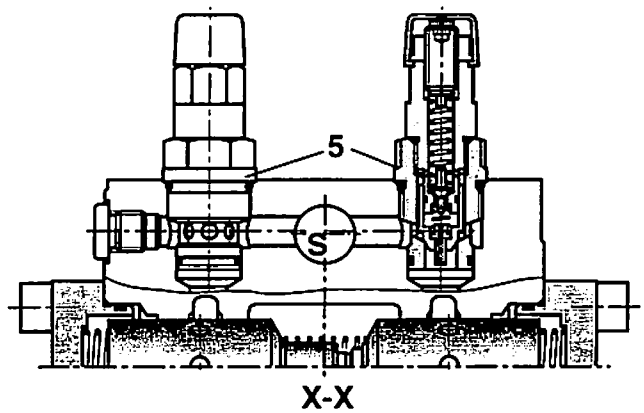
Flow divider without free wheel operation
The valves mainly consist of housing (1), control spool (2) and three centering springs (3) at the control spool. The main flow from channel P which can be variable to a certain degree is divided into two partial flows (volume flow partial function). The centering springs as well as the partial flows flowing to both outlets keep the control spool in medium position with their pressure. Caused by an imbalanced volume flow consumption of the pressurised actuators (e.g. hydraulic motor) a pressure difference occurs. This controls the control spool in such a way that the flow to both outlets remains within the partial accuracy.

The division is largely independent from the pressure of the two individual flows and the viscosity.

The return flow - pressure fluid flows from A/B to P (summating function) - is summated with the flow divider valve.
The actuator pressures can be taken directly at the measuring points (4). With flow dividers with unequal division the larger partial flow is in channel A as standard. When the valve is in operation as a flow divider cavitation may occur in one outlet due the driving around a corner (for example) or pressure peaks may occur in the system due to rapid changes in direction. For this reason pressure supply valves (5) are optionally integrated into the actuator ports. Through an orifice (6) between A and B volume balancing is possible where it is necessary.
With integrated pressure supply valves port "S" of the flow divider must be connected with the feed pump (port "G" of main pump).
It is recommended to accurately check a circuit with a flow divider for danger of supply deficiency and pressure peaks.



Type MH2FAN..



additionally with integrated pressure supply valves

https://truckmanualshub.com/

Function description, section

Flow divider with free wheel option (can be switched on)

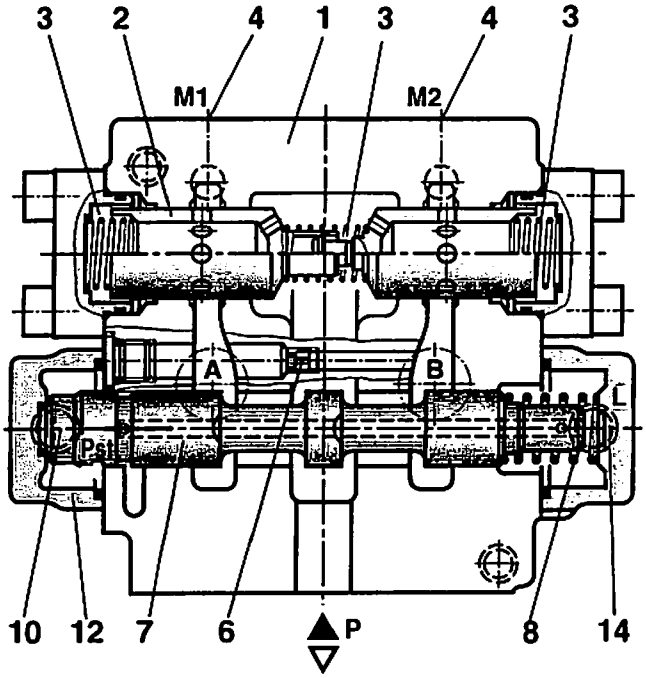
The function of this flow divider is in principle the same as the function of the flow divider without free wheel option. The valve is, however, additionally equipped with a control spool (7) and a return spring (8) for the return of the control spool.

The control spool (7) is kept in the starting position by a return spring (8). The main flow from channel P bypasses the control spool (2) and flows directly to ports A and B.

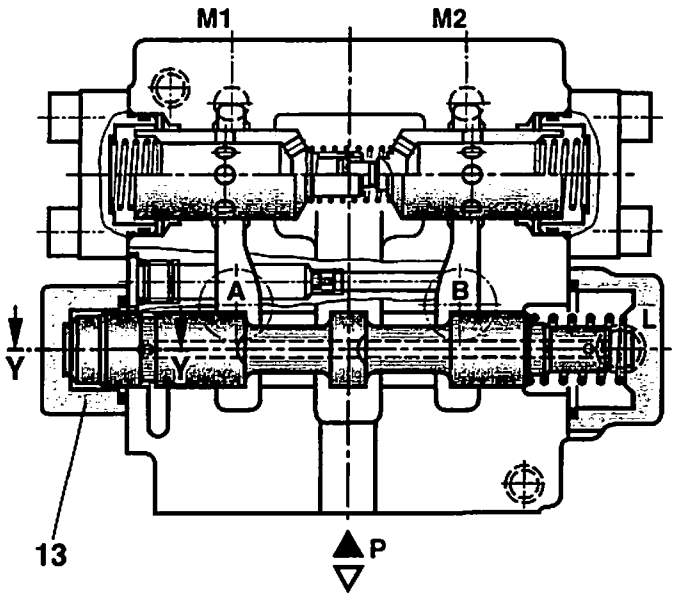
The operation of the control spool (7) is carried out optionally hydraulic via port Pst (10) or with electrical operation via a directional valve (9) or a solenoid (11).

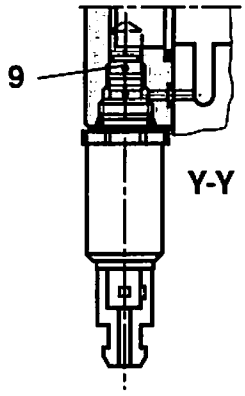
The control pressure in the cover (12;13) must not exceed 30 bar. When switching off the solenoid the control spool returns to the starting position. The control fluid in the cover (13) is pushed towards port L (14) via the boring in the control spool (7).

For operating examples and symbols see pages 3 and 4.

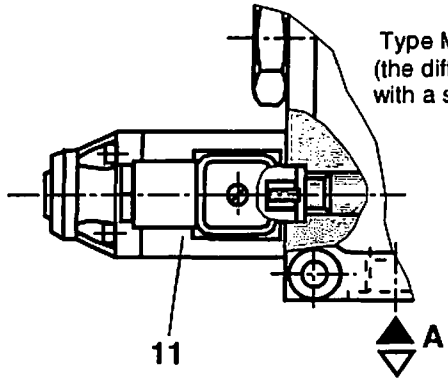


Type MH2FAH... (hydraulic operated)





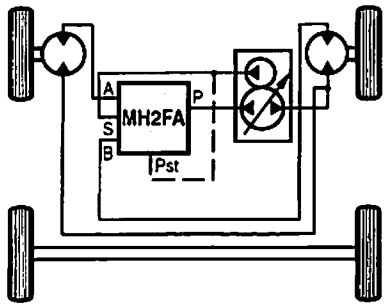
Type MH2FAE..., size 18 to 32
(electro-hydraulic operated)



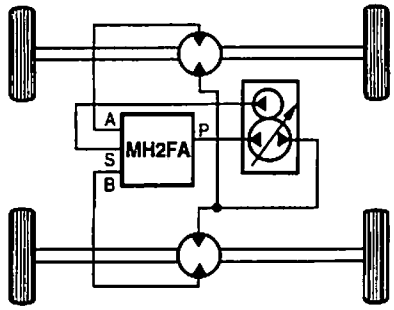
Type MH2FAE..., size 12
(the differential lock is directly operated with a solenoid)

https://truckmanualshub.com/

Circuit examples for transmissions (Flow divider with integrated pressure supply valves)



Flow divider as operated wheel separater(Pst) with integrated pressure supply valves "Model ...H.." and supply port (S).



Flow divider as axis separater with integrated pressure supply valves "Model ...H.." and supply port (S).

Note: If a flushing valve is necessary in a closed circuit with flow divider it must always be installed between pump and flow divider. If necessary please consult us.

Ordering code

MH2FA		R		D		4X/	1				V		*

Further details in clear text

Model

W/o free wheeling	= N
Flow divider hydraulic operated	= H
Flow divider electrically operated	= E
Mechanically operated on request	

Size 12 q_v = 70 L/min	= 12
Size 18 q_v = 140 L/min	= 18
Size 22 q_v = 220 L/min	= 22
Size 32 q_v = 300 L/min	= 32

Double-acting = D

Division ratio [1])

A : B	A : B	A : B
50 : 50 = **A**	75 : 25 = **C**	65 : 35 = **E**
60 : 40 = **B**	70 : 30 = **D**	85 : 15 = **F**
		55 : 45 = **G**

Series 40 to 49 = 4X
(40 to 49: unchanged installation and connection dimensions)

Standard = 1

Type of connection

01 = 11 = 16 = [3]) see table below

V = FPM seals, suitable for Mineral oil (HL, HLP) to DIN 51 524 and Phosphate-ester (HFD-R)

Orifice in connection boring between A and B

A00 =	with locking screw
A06 =	Orifices-Ø 0,6 mm
A08 =	Orifices-Ø 0,8 mm
A10 =	Orifices-Ø 1,0 mm
A12 =	Orifices-Ø 1,2 mm
A15 =	Orifices-Ø 1,5 mm

[2])	Size	Direct voltage
G12Z4 =	12	12 V
G24Z4 =	12	24 V
G12C4 =	18 to 32	12 V
G24C4 =	18 to 32	24 V

w/o code = w/o pressure supply valves in ports A, B
H = with pressure supply valves in ports A, B
(Standard-pressure setting to A, B 420 bar – please indicate other pressure settings in clear text).

[1]) With uneven divisions the greater partial flow - unless stated otherwise - is always in channel A (standard).
A : B (actuator port)
Example: Division ratio "**B**" = 60 : 40
On request the larger partial flow may be in port "B" (Example: division ratio "**B1**"= 40 : 60)

[2]) only with electrical model "MH2FA**E**".

[3]) **Types of connection** (further connection types on request)

Size	Type of connection	P	A, B	L, M1, M2, Pst	S
12	**01**	3/4" BSP	1/2" BSP	1/4" BSP	3/8" BSP
18	**11** [4])	SAE 3/4"	SAE 3/4"	1/4" BSP	1/2" BSP
	16 [5])	SAE 3/4"	SAE 3/4"	9/16-18 UNF	7/8-14 UNF
22	**11** [4])	SAE 1"	SAE 3/4"	1/4" BSP	1/2" BSP
	16 [5])	SAE 1"	SAE 1"	9/16-18 UNF	7/8-14 UNF
32	**11** [4])	SAE 1 1/4"	SAE 1"	1/4" BSP	1/2" BSP
	16 [5])	SAE 1 1/4"	SAE 1"	9/16-18 UNF	7/8-14 UNF

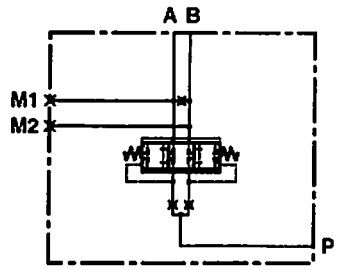
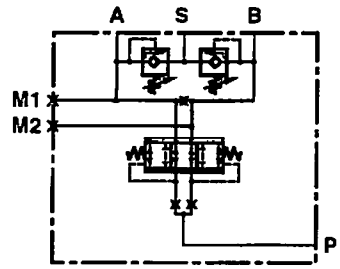
[4]) for SAE-flanges pressure stage 6000 PSI (fixing screws – metric thread)

[5]) for SAE-flanges pressure stage 6000 PSI (fixing screws – UNC thread)
Ports L, M1, M2 and Pst to SAE J-475

Pipe thread "BSP" to ISO 228/1

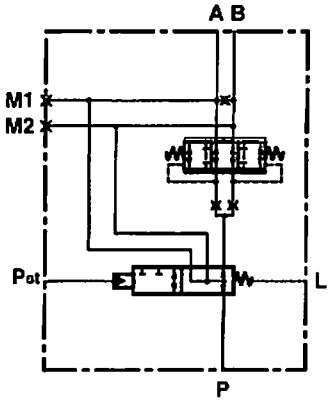
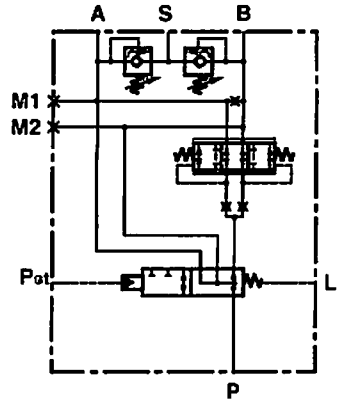
https://truckmanualshub.com/

Symbols for flow divider without free wheel circuit

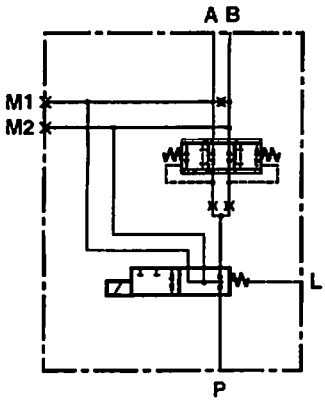
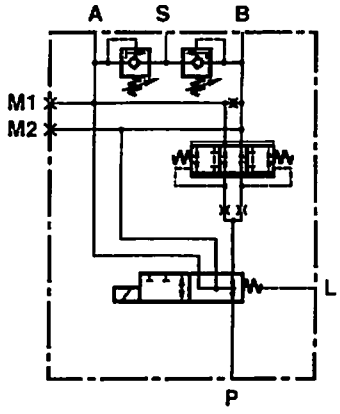
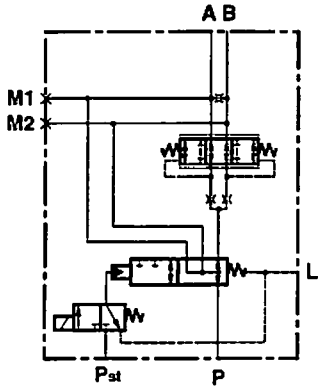
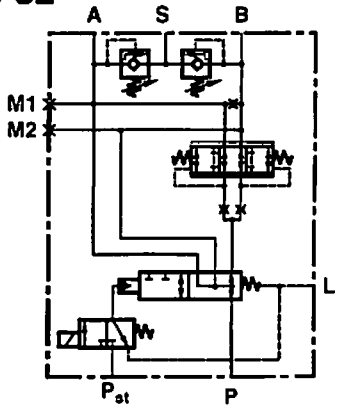
Without pressure feed valves	With pressure feed valves in ports A, B
	

Symbols of flow divider with free wheel circuit, added operation

Hydraulic operation

Without pressure feed valves	With pressure feed valves in ports A, B
	

Electrical operation

Without pressure feed valves	With pressure feed valves in ports A, B
Size 12 	**Size 12** 
Size 18 to 32 	**Size 18 to 32** 

https://truckmanualshub.com/

Technical Data (For application outside these parameters please consult us!)

General

Model			Flow divider			
Type description			MH2FA...			
Mounting type			Surface mounting			
Type of connection			Threaded connection (size 12); SAE-flange connection (size 18 to 32)			
Installation position			horizontal			
Size	size		12		18 to 32	
Volume flow	q_v	L/min	70		300	
Division accuracy		%	< ±5			
Weight			without / with pressure supply valves in A and B (ordering code "H")			
			without	with	without	with
without free wheeling	m	kg	5	6,3	12,0	12,0
Hydraulic operation	m	kg	8,5	9,0	15,0	15,5
Electrical operation	m	kg	9,0	9,5	17,0	17,5

Hydraulic

Operating pressure				
Port P, A, B, M1, M2,	p	bar	up to 420	
Port L	p	bar	unpressurized to tank	
Port Pst, S	p	bar	max.30	
Pressure difference	Δp	bar	up to 30	
Model	size		12	18 to 32
Pilot pressure "E"	p	bar	–	11 to max.30
Switch pressure "H"	p	bar	8 to max. 30	11 to max.30
Pressure fluid	p	bar	Mineral oil (HL, HLP) to DIN 51 524, phosphate ester (HFD-R)	
Pressure fluid temperature range	T	°C	–20 to +80	
Viscosity range	v	mm²/s	10 to 380	
Fluid cleanliness			Max. permissible degree of contamination to NAS 1638 Class 9. We therefore recommend a filter with a minimum retention rate $\beta_{10} \geq 75$.	

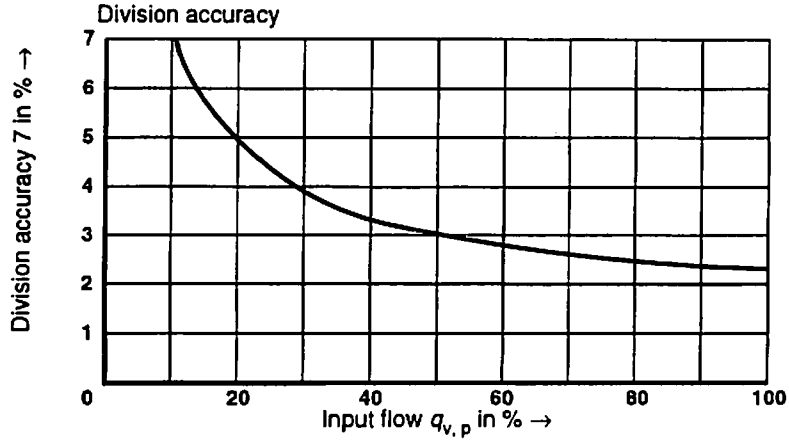
Electrical (for electrically operated flow divider, ordering code "E")

Voltage type	U	V	12 and 24 direct voltage (further voltages on request)	
Size	size		12	18 to 32
Power consumption with direct current	P	W	30	26
Duty cycle	ED	%	100	100
Ambient temperature	T	°C	up to 50	up to 50
Insulation to DIN 40 050			IP65	IP65
Replacement solenoid, type			GH44-4-A	Solenoid **not** available separately, complete valve see RE 58 007

https://truckmanualshub.com/

Operating Curves (measured at ν = 41 mm²/s and t = 50°C)

Division accuracy

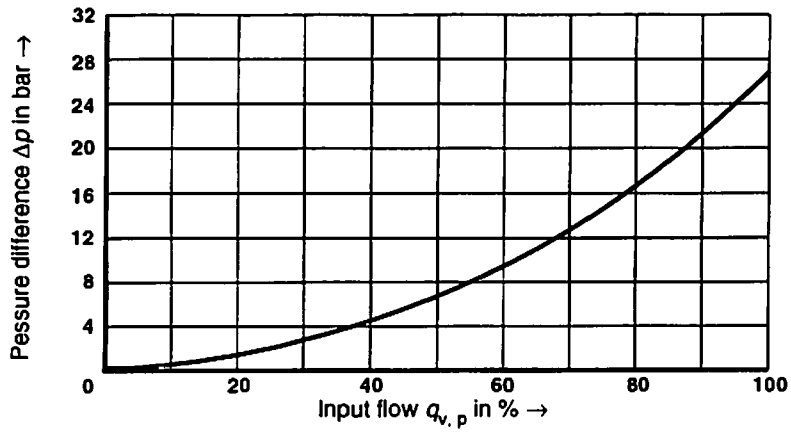


T = Deviation of an actuator from theoretical operating curve with a pressure difference of 150 bar between A and B dependent on input volume flow $q_{v,p}$.
Minimum input flow

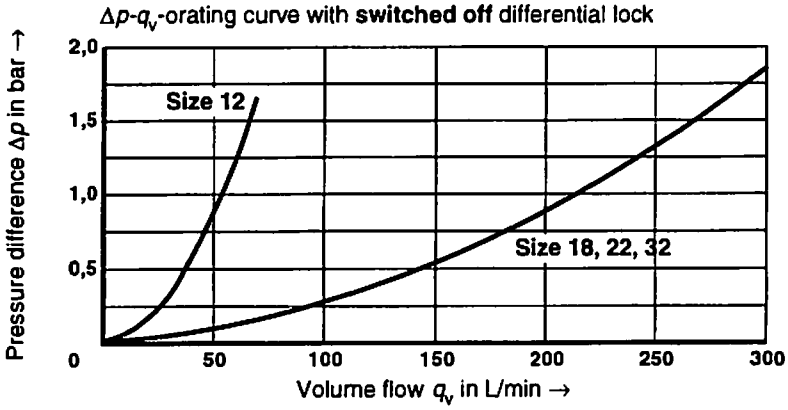
(Start of control) $q_{v,p\,min} = \frac{q_{v,p\,max}}{30}$

without orifice between A and B

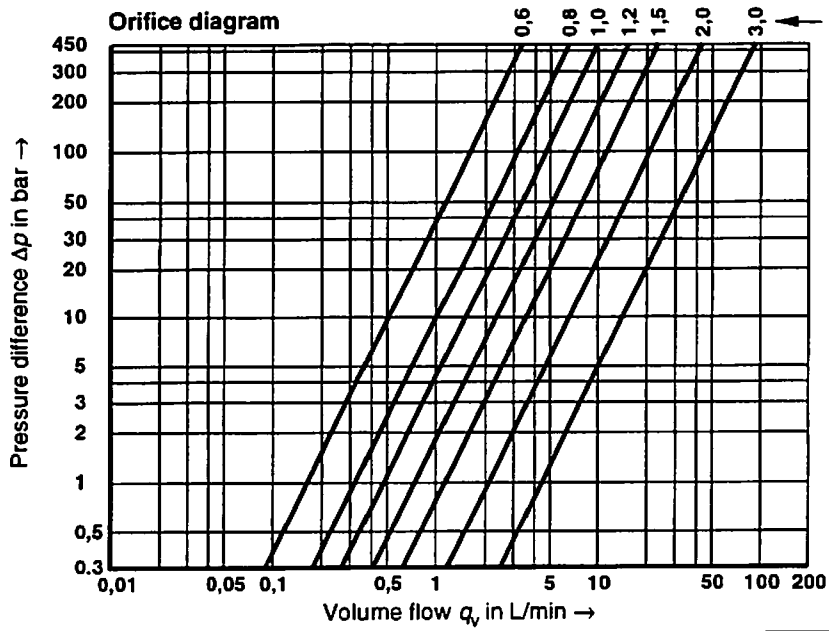
Δp-q_v-operating curve with **switched-on** differential lock



Δp-q_v-orating curve with **switched off** differential lock



Orifice diagram

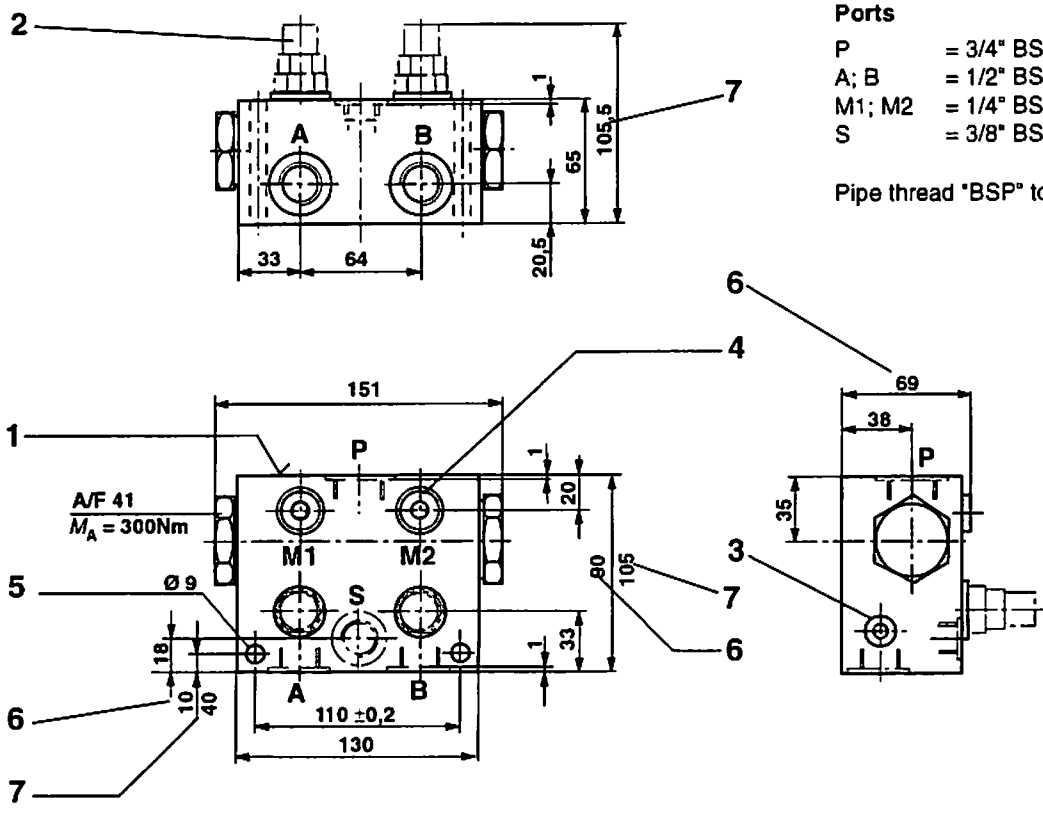


Warning!
The operating curves in the orifice diagram are purely calculated value and therefore for guidance purposes only.

https://truckmanualshub.com/

Flow divider without free wheel operation (Dimensions in mm)

Size 12



Ports

P	= 3/4" BSP
A; B	= 1/2" BSP
M1; M2	= 1/4" BSP
S	= 3/8" BSP

Pipe thread "BSP" to ISO 228/1

1 Type description
(Flow divider number)

2 Pressure feed valve (ordering code "H")
Type MHDBN 16 K2-1X/420V
Order no. **417037**
(further details see RE 64 642)
Key width of hexagonal nut A/F 24,
Tightening torque M_A = 90 ± 10 Nm

3 Locking screw for compensating orifice

4 Locking screw for measuring port

5 Valve fixing holes

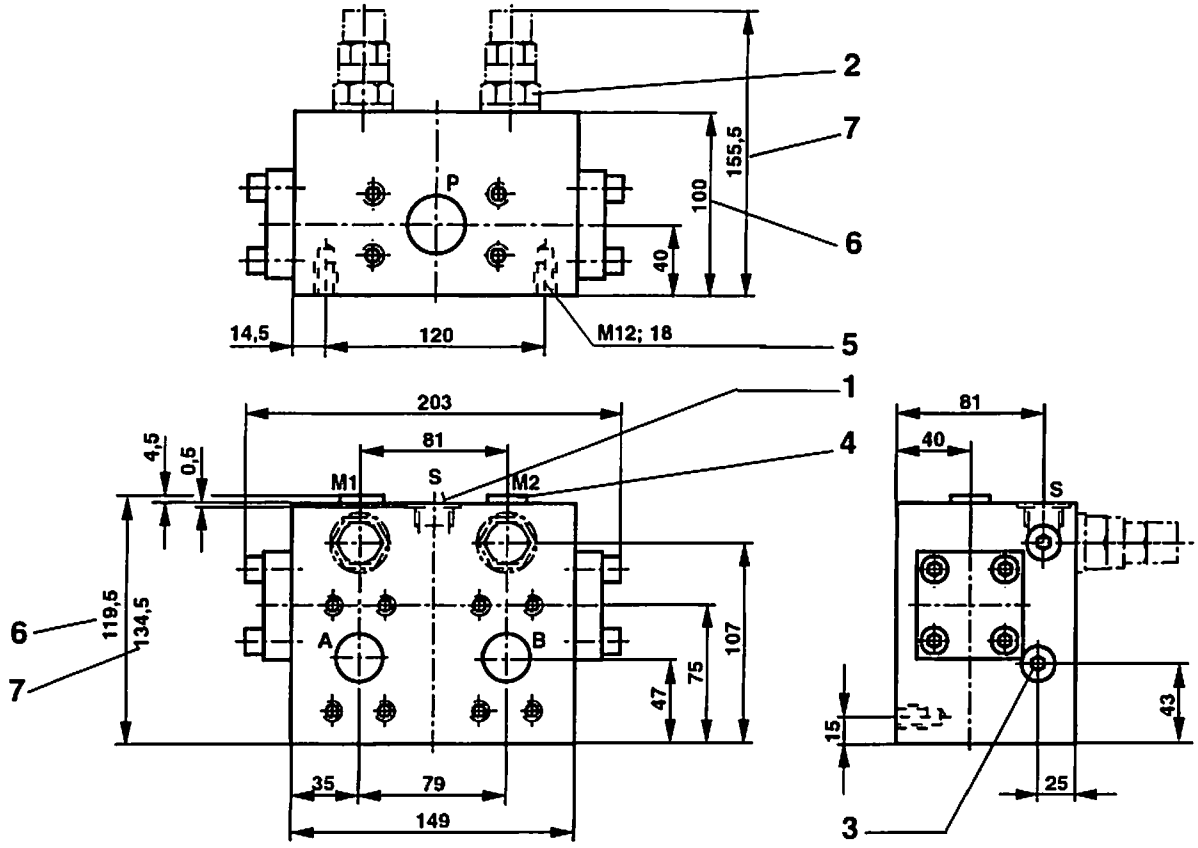
6 Measure for type "**without** pressure feed valves"

7 Measure for type with
pressure feed valve (ordering codes "**H**")

https://truckmanualshub.com/

Flow divider without free wheel operation (Dimensions in mm)

Size 18, 22, 32



1 Type description
(Flow divider number)

2 Pressure feed valve (ordering code"H")
Type MHDBN 16 K2-1X/420VFC
Order no. **593925**
Key width of hexagonal nuts A/F 27,
Tightening torque M_A = 100 ± 10 Nm

3 Locking screw for compensating orifice

4 Locking screw for measuring port

5 Valve fixing holes

6 Measure for model "**without** pressure feed valves"

7 Measure for model with pressure feed valves (ordering code "H")

Ports

Size	Type of connection	P	A, B	M1, M2	S
18	**11** [1]	SAE 3/4"	SAE 3/4"	1/4" BSP	1/2" BSP
	16 [2]	SAE 3/4"	SAE 3/4"	9/16-18 UNF	7/8-14 UNF
22	**11** [1]	SAE 1"	SAE 3/4"	1/4" BSP	1/2" BSP
	16 [2]	SAE 1"	SAE 1"	9/16-18 UNF	7/8-14 UNF
32	**11** [1]	SAE 1 1/4"	SAE 1"	1/4" BSP	1/2" BSP
	16 [2]	SAE 1 1/4"	SAE 1"	9/16-18 UNF	7/8-14 UNF

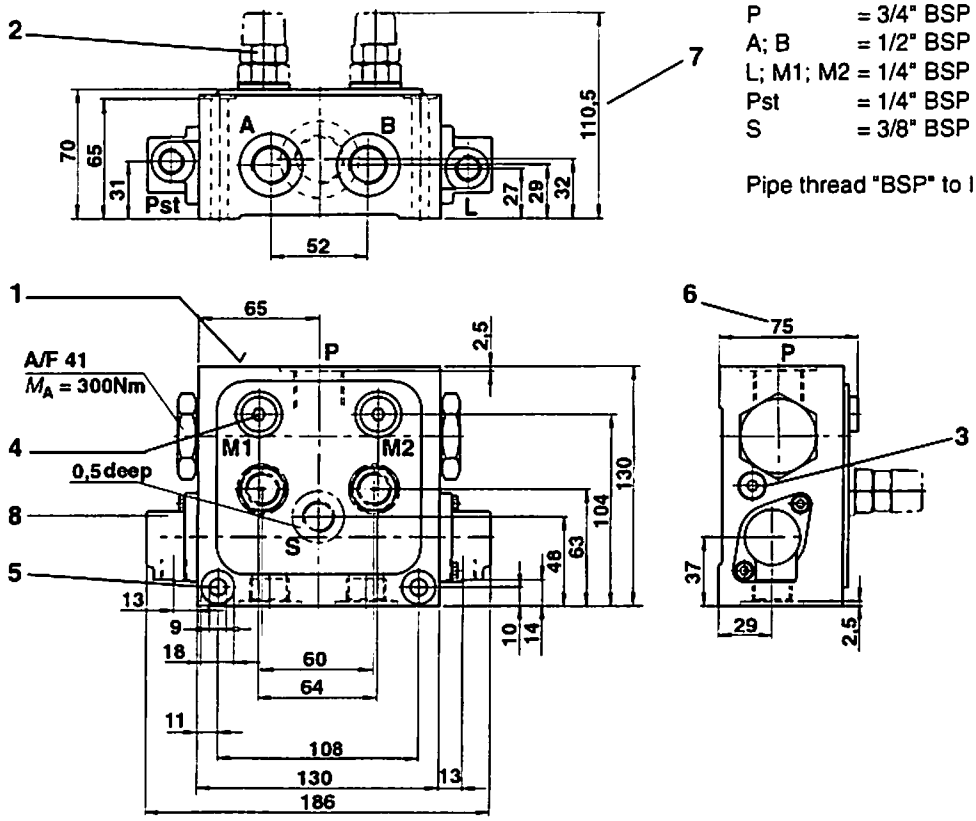
[1] for SAE-flanges pressure rating 6000 PSI (fixing screws – metric thread)
[2] for SAE-flanges pressure rating 6000 PSI (fixing screws – UNC thread)
Ports M1 and M2 to SAE J-475

Pipe thread "BSP" to ISO 228/1

https://truckmanualshub.com/

Flow divider for hydraulic operation (Dimensions in mm)

Size 12



Ports

P	= 3/4" BSP
A; B	= 1/2" BSP
L; M1; M2	= 1/4" BSP
Pst	= 1/4" BSP
S	= 3/8" BSP

Pipe thread "BSP" to ISO 228/1

1 Type description
(Flow divider no.)

2 Pressure feed valve (ordering code"**H**")
Type MHDBN 16 K2-1X/420V
Order no. **417037**
(further details see RE 64 642)
Key width of hexagonal nuts A/F 24,
Tightening torque M_A = 90 ± 10 Nm

3 Locking screw for compensating orifice

4 Locking screw for measuring port

5 Valve fixing holes

6 Measure for model "without pressure feed valves"

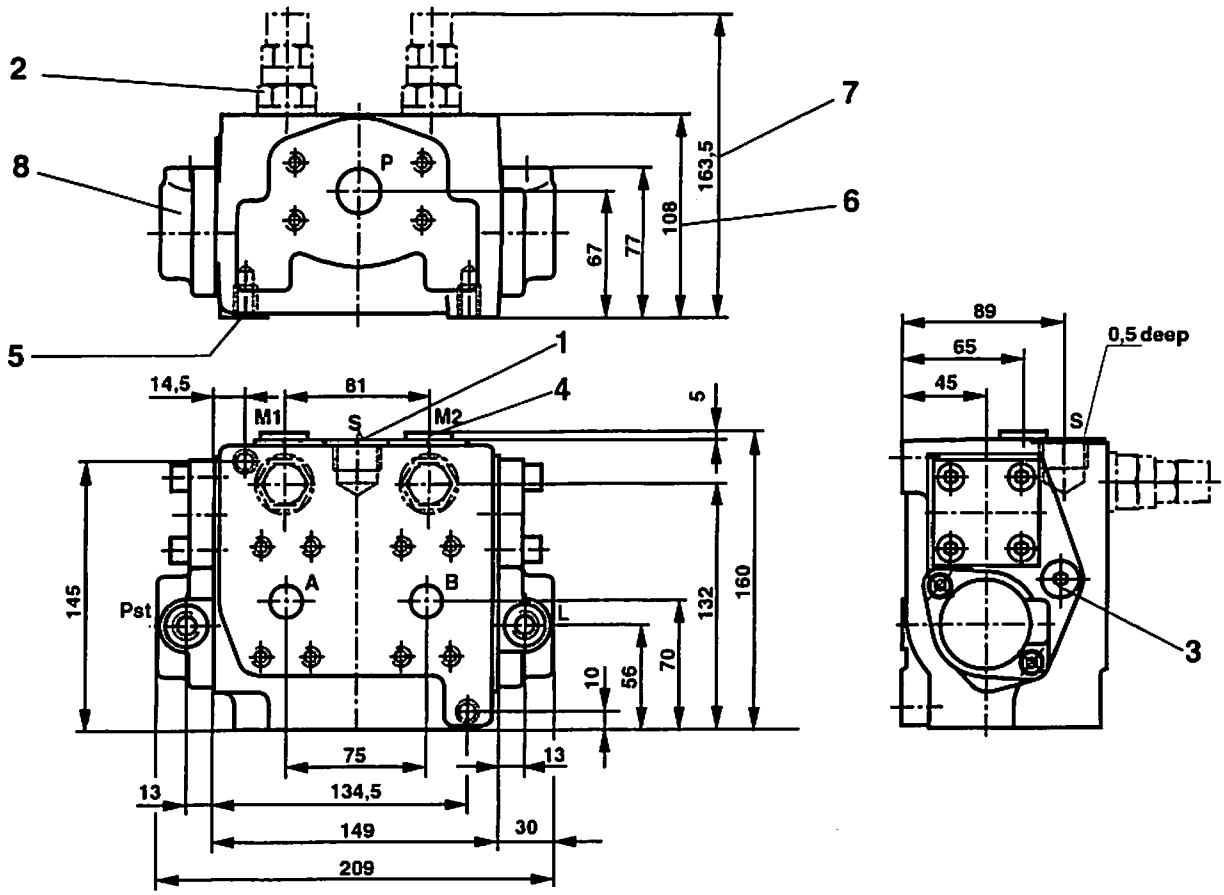
7 Measure for model "with pressure feed valves (ordering code "**H**")

8 Cover for control spool

https://truckmanualshub.com/

Flow divider with hydraulic operation (Dimensions in mm)

Size 18, 22, 32



1 Type description
(Flow divider no.)

2 Pressure feed valve (ordering code."**H**")
Type MHDBN 16 K2-1X/420VFC
Order no. **593925**
Key width of hexagonal nuts F/A 24,
Tightening torque M_A = 90 ± 10 Nm

3 Locking screw for compensating orifice

4 Locking screw for measuring port

5 Valve fixing thread at
port "11" → M12; 17 deep, at
port "16" → 1/2-13UNC-2B/0,67"

6 Dimensions for model "**without** pressure supply valves"

7 Dimension for model with pressure supply valves (ordering code "**H**")

8 Cover for control spool

Ports

Size	Type of connection	P	A, B	L, M1, M2, Pst	S
18	**11** [1])	SAE 3/4"	SAE 3/4"	1/4" BSP	1/2" BSP
	16 [2])	SAE 3/4"	SAE 3/4"	9/16-18 UNF	7/8-14 UNF
22	**11** [1])	SAE 1"	SAE 3/4"	1/4" BSP	1/2" BSP
	16 [2])	SAE 1"	SAE 1"	9/16-18 UNF	7/8-14 UNF
32	**11** [1])	SAE 1 1/4"	SAE 1"	1/4" BSP	1/2" BSP
	16 [2])	SAE 1 1/4"	SAE 1"	9/16-18 UNF	7/8-14 UNF

[1]) for SAE-flanges pressure rating 6000 PSI (fixing screws – metric thread)
[2]) for SAE-flanges pressure rating 6000 PSI (fixing screws – UNC thread)
ports M1 and M2 to SAE J-475

Pipe thread "BSP" to ISO 228/1

https://truckmanualshub.com/

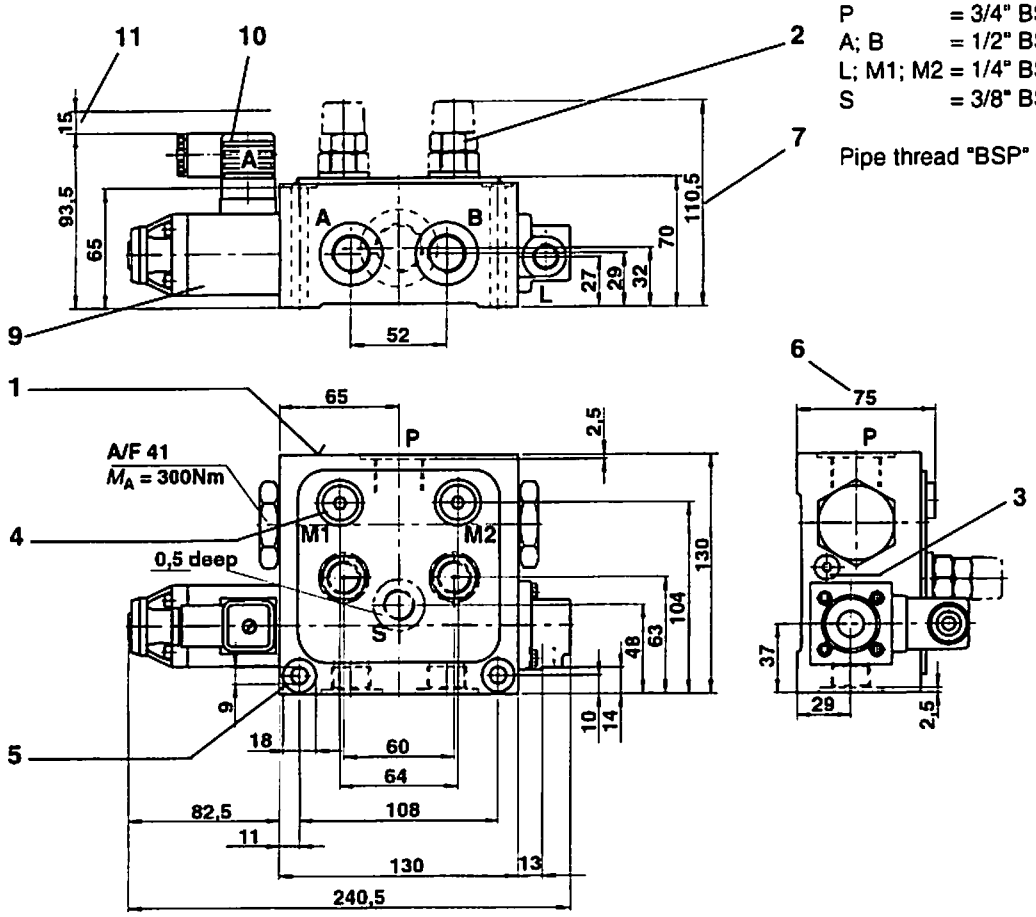
Flow divider for electrical operation (Dimensions in mm)

Size 12

Ports

P	= 3/4" BSP
A; B	= 1/2" BSP
L; M1; M2	= 1/4" BSP
S	= 3/8" BSP

Pipe thread "BSP" to ISO 228/1



1 Type description (Flow divider no.)

2 Pressure feed valve (ordering code."H")
Type MHDBN 16 K2-1X/420V
Order no. **417037**
(further details see RE 64 642)
Key width of hexagonal nuts A/F 24,
Tightening torque M_A = 90 ± 10 Nm

3 Locking screw for compensating orifice

4 Locking screw for measuring port

5 Valve fixing holes

6 Dimensions for model "**without** pressure feed valves"

7 Dimension for model with pressure feed valves (Ordering codes "**H**")

9 Direct operation solenoid GH-44-4-A

10 Plug "Z4", grey

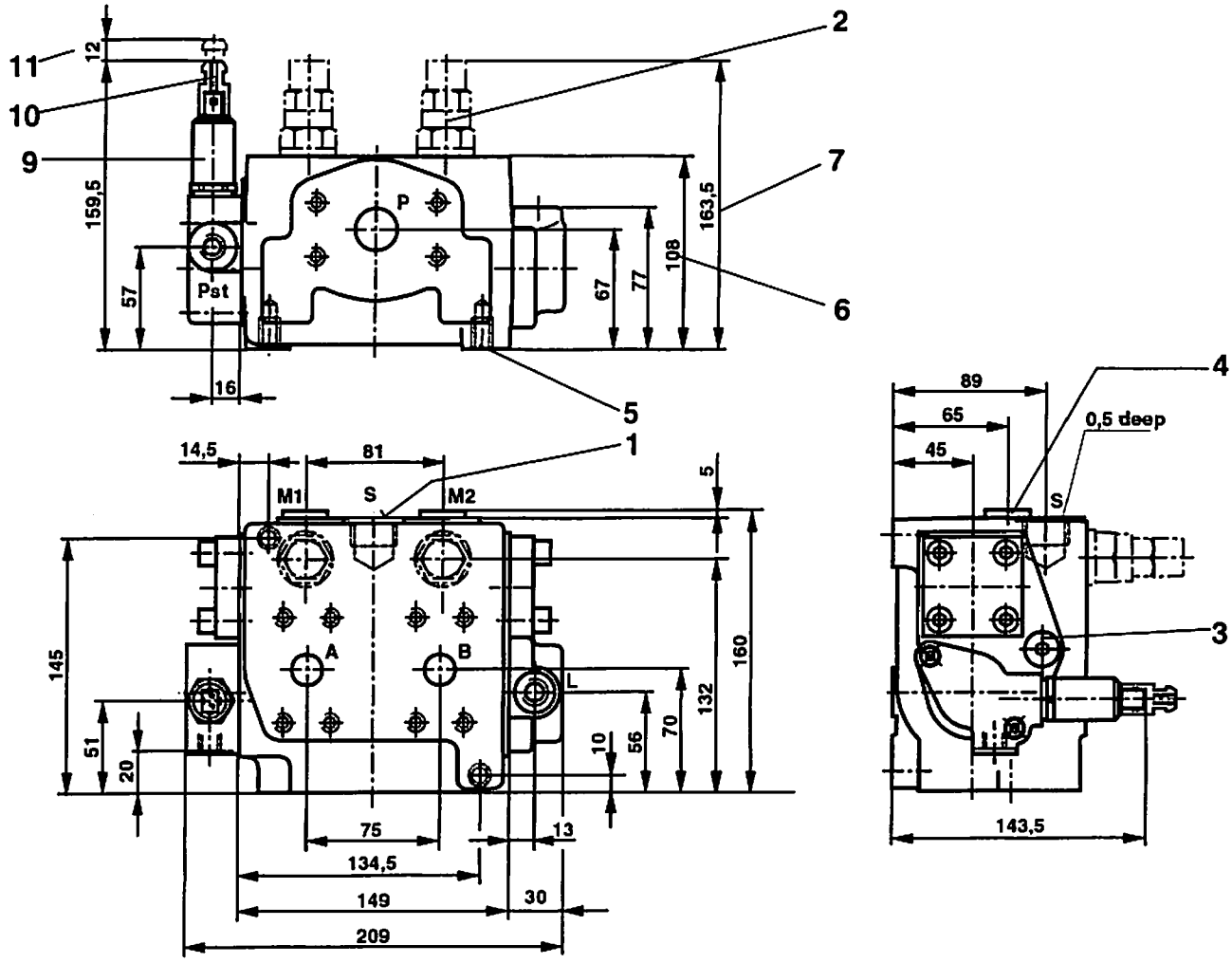
11 Space requirement for removal of plug

https://truckmanualshub.com/

Flow divider for electrical operation

(Dimensions in mm)

Size 18, 22, 32



1 Type description (flow divider no.)

2 Pressure feed valve
(Ordering codes "H")
Type MHDBN 16 K2-1X/420VFC
Order no. **593925**
Key width of hexagonal nuts A/F 27,
Tightening torque $M_A = 90 \pm 10$ Nm

3 Locking screw for compensating orifice

4 Locking screw for measuring port

5 Valve fixing thread at
port "11" → M12; 17 deep, at
port "16" → 1/2-13UNC-2B/0,67"

6 Dimension for model "**without**" pressure feed valves

7 Dimension for model with pressure feed valves (ordering code "H")

9 Directional valve with wet pin DC solenoid
(see RE 58 007)

10 Plug, 2-pin Junior Timer type C and contacts (AMP)

11 Space requirement for removal of plug

Ports

Size	Type of connection	P	A, B	L, M1, M2, Pst	S
18	11 [1]	SAE 3/4"	SAE 3/4"	1/4" BSP	1/2" BSP
	16 [2]	SAE 3/4"	SAE 3/4"	9/16-18 UNF	7/8-14 UNF
22	11 [1]	SAE 1"	SAE 3/4"	1/4" BSP	1/2" BSP
	16 [2]	SAE 1"	SAE 1"	9/16-18 UNF	7/8-14 UNF
32	11 [1]	SAE 1 1/4"	SAE 1"	1/4" BSP	1/2" BSP
	16 [2]	SAE 1 1/4"	SAE 1"	9/16-18 UNF	7/8-14 UNF

[1] for SAE-flanges pressure rating 6000 PSI (fixing screws – metric thread)
[2] for SAE-flanges pressure rating 6000 PSI (fixing screws – UNC thread)
ports M1 and M2 to SAE J-475

Pipe thread "BSP" to ISO 228/1

Mannesmann Rexroth AG
Rexroth Hydraulics
D-97813 Lohr am Main
Jahnstraße 3-5 • D-97816 Lohr am Main
Telefon 0 93 52 / 18-0 • Telefax 0 93 52 / 18-10 40

Mannesmann Rexroth Limited
Cromwell Road, St. Neots,
Huntingdon, Cambs. PE19 2ES
Tel: (01480) 476041
Fax: (01480) 219052

The specified data is for product description purposes only and may not be deemed to be guaranteed unless expressly confirmed in the contract. All rights reserved – Subject to revision

https://truckmanualshub.com/

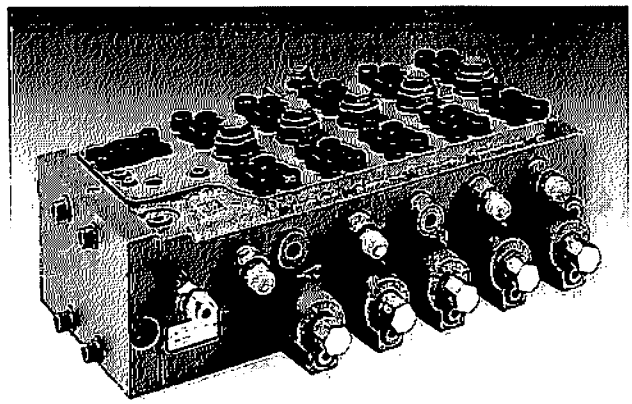
RE 64 295/07.02

Replaces: 11.01

LUDV control block of mono and sandwich plate design Type M7-22

Nominal size 22
Series 3X
Nominal pressure
- Pump side, max.: 380 bar
- Actuator side: 420 bar

Nominal flow: 400 L/min
Section: 400 L/min
Inlet: 400 L/min



HAD 6169

Control block type 5M7-22 (5-fold mono block)

Overview of contents

Contents	Page		
Features	1	Name plate explanation	6
Function, section	2	Ordering details, ordering examples	6 to 10
Technical data	3	Circuit (example)	11
Characteristic curves	4	Other elements	12, 13
Combination possibilites	5	Unit dimensions	14, 15

Features

System
- Load pressure independent flow distribution (LUDV)
  - Closed centre for variable displacement pumps
  - Integrated load holding valve
  - Integrated tank back pressure
    - 3-fold block (K internal, T fitted)
    - 5-fold block (K and T internal)
  - Unloading function
    - Better response characteristics
    - Reduction of switch off peaks
    - Flushing and cooling
    - Low cavitation risk

Design
- Mono block / sandwich plate design
  - Inlet element: Basic block 3 or 5 axes
  - Expandable via sandwich plates (max. 4)
  - End plates
- M7-20 LS sandwich plates can be fitted (see page 13)
- Actuator types
  - Hydraulic
  - Electro-hydraulic

Flow
- Load compensated
- High repeatability accuracy
- Low hysteresis
- Adjustable via stroke limiters

Pressure
- Primary and secondary pressure safety
  - Pilot operated, compact cartridge valves of a large nominal size with combined anti-cavitation function
- LS pressure limitation
  - For the complete control block

Areas of application
- Excavators
- Drag-line excavators / tracked cranes
- Cranes
- Material handling

© 2002
by Bosch Rexroth AG, Industrial Hydraulics, D-97813 Lohr am Main

All rights reserved. No part of this document may be reproduced or stored, processed, duplicated or circulated using electronic systems, in any form or by any means, without the prior written authorisation of Bosch Rexroth AG.
In the event of contravention of the above provisions, the contravening party is obliged to pay compensation.

This document was prepared with the greatest of care, and all statements have been examined for correctness.
This document is subject to alterations for reason of the continuing further developments of products.
No liability can be accepted for any incorrect or incomplete statements.

https://truckmanualshub.com/

Section, function

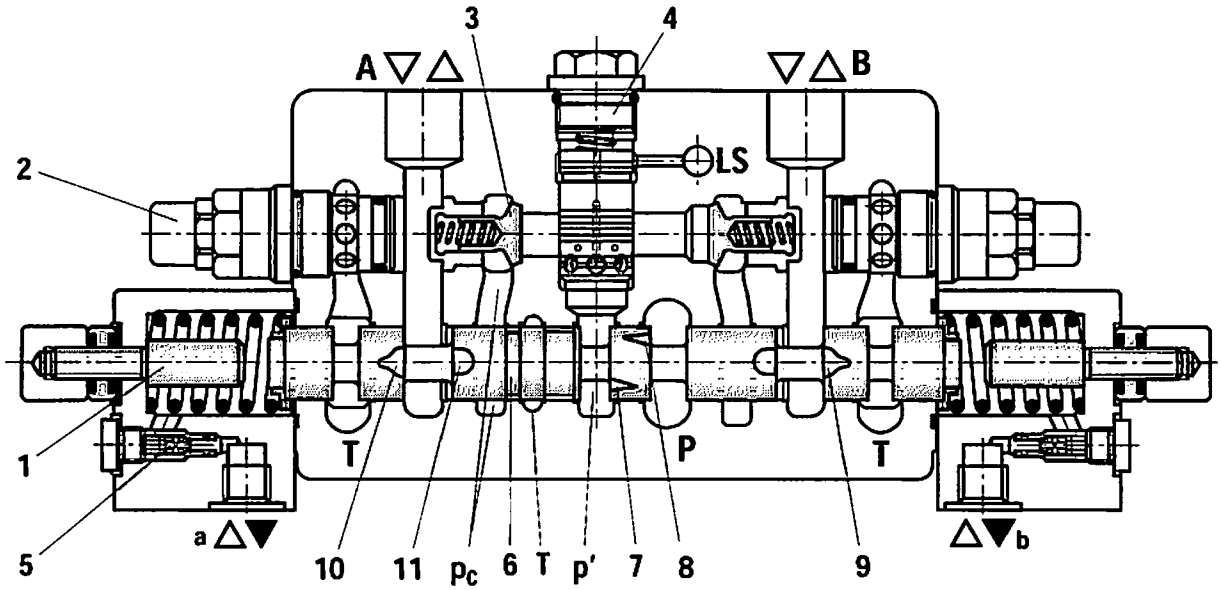
LUDV control

LUDV stands for „Load independent flow distribution". All of the LUDV pressure compensators are applied with the highest pressure. If within the LUDV system there is insufficient flow, i.e. the pump can not provide enough flow, to operate all of the actuators at the required speeds then all of the functions are proportionally reduced in speed. A big advantage of the LUDV system is that no actuator stops if there is an insufficient supply of oil.

With the main spool in its neutral position (no pilot pressure at ports a or b) the connection from the pump to the P'channel is interrupted by the main spool. The load holding valves and the pressure compensators are closed. The actuator connections are closed via the control spool overlap within the housing. The LUDV pressure compensator comprises of a control spool and a compression spring which defines the initial position.

The main spool (6) is proportionally pushed against the spring force by the pilot pressure which is being applied via the pilot control unit. The meter-in measurement orifice (7) of the control spool opens the connection from the pump connection P' to the P channel. The pressure in this area opens the pressure compensator (4) and is applied as far as the load holding valves (3).

The actuator pressure p_c of port A holds the left hand load holding valve (3) closed via the passages within the control spool (11). With an increase in p' over p_c then the check valve opens. The connection from the pump to the actuator is opened and movement commences. The oil from the actuator flows from B via the meter-out orifice (9) back to tank. The secondary pressure relief valves (2) remain closed as long as the pressure in the actuator connection lies below the pressure setting. The main cone of the combined pressure/anti-cavitation valve (2) in the feed (side A) opens, during cavitation, in the actuator connection and enables the supply from the pre-loaded tank line within the block.



1 Stroke limitier
2 Secondary-pressure/anti-cavitation valve
3 Load holding valve
4 LUDV pressure compensator
5 Pilot pressure shuttle
6 Main spool
7 Meter-in measurement orifice P –> P' –> A
8 Meter-in measurement orifice P –> P' –> B
9 Meter-out orifice B –> T
10 Meter-out orifice A –> T
11 Ring channel P –> A (adequate P –> B)

https://truckmanualshub.com/

Technical data (for applications outside these parameters, please consult us!)

General

Design			Mixed design (mono block/sandwich plates)
Installation			Optional
Connection type			Pipe thread (standard)
Weight	3-fold mono block	kg	64
	5-fold monoblock	kg	90
	Sandwich plate M7-20	kg	12
	Sandwich plate M7-22	kg	19.5
	End plate	kg	3.7

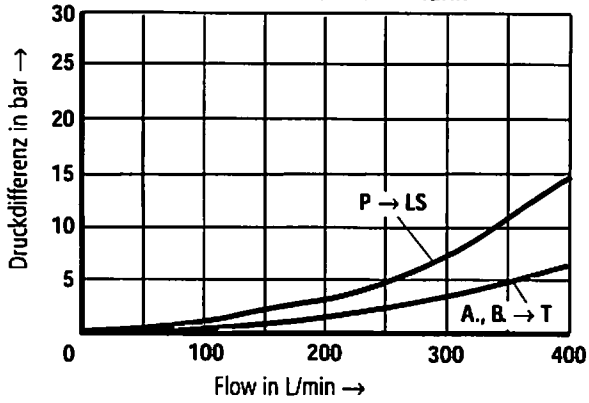
Hydraulic

Nominal flow	Port P	$q_{V,\,max}$	L/min	500
	Port A, B	$q_{V,\,max}$	L/min	400 (at Δp block inlet P –> LS = 19 bar)
Nominal pressure		p_{nom}	bar	380
	LS	p	bar	380
operating pressure	P	p	bar	380
at port:	A, B	p	bar	420
	T	p	bar	30
	Y	p	bar	At zero pressure at tank
Pilot oil supply, max.	X	p	bar	35
Pilot pressure	a, b	p	bar	35
Pilot pressure range	Hydraulic	p	bar	See page 4
	Electro-hydraulic	p	bar	See page 4
Electrical pilot valves				FTWE 4 K...; see RE 58 008 FTDRE 4 K...; see RE 58 038] With plug tpye Junior Timer (AMP) or a free cable end with a Deutsch plug
Recommended hydraulic pilot control units				4TH 6...; characteristic curve 70; see RE 64 555 2TH 6 R; characteristic curve 70; see RE 64 552
Pressure fluid				Mineral oil (HL,HLP) to DIN 51 524 pressure fluids HEES (Synthetic Ester) to VDMA 24568 as well as the pressure fluids specified within RE 90 221.
Pressure fluid temperature range		ϑ	°C	– 20 to 80
Viscosity range		ν	mm²/s	10 to 380
Degree of contamination				Maximum permissible degree of contamination of the pressure fluid is to NAS 1638 class 9. We therefore recommend a filter with a minimum retention rate of $\beta_{10} \geq 75$.

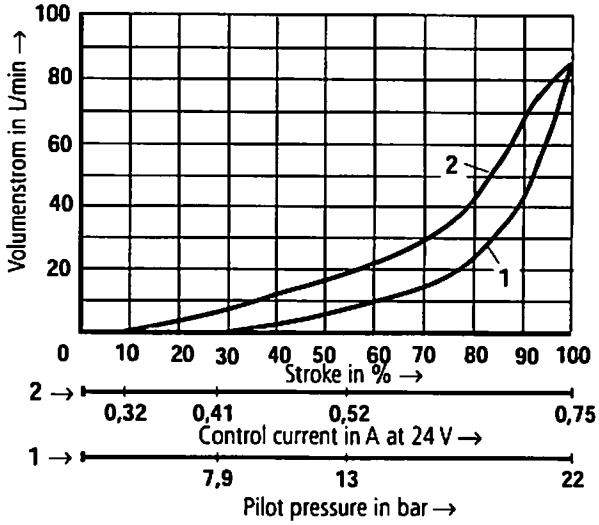
https://truckmanualshub.com/

Characteristic curves

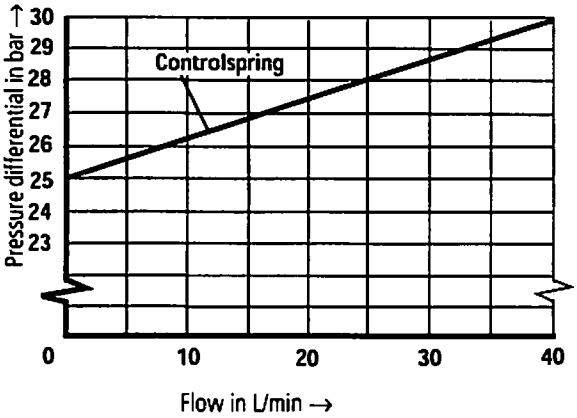
Flow characteristic curves Pump → LS
Actuator → Tank



P→ A, B



Flow resistance **Unloading valve**

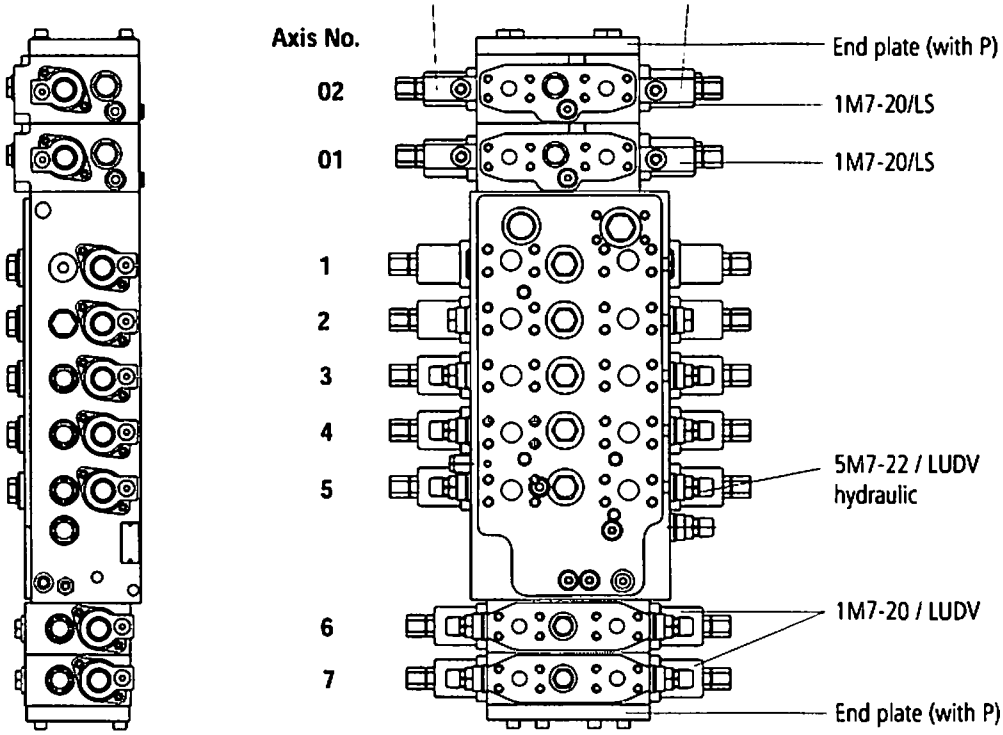


1 Hydraulic actuator
2 Electro-hydraulic actuator

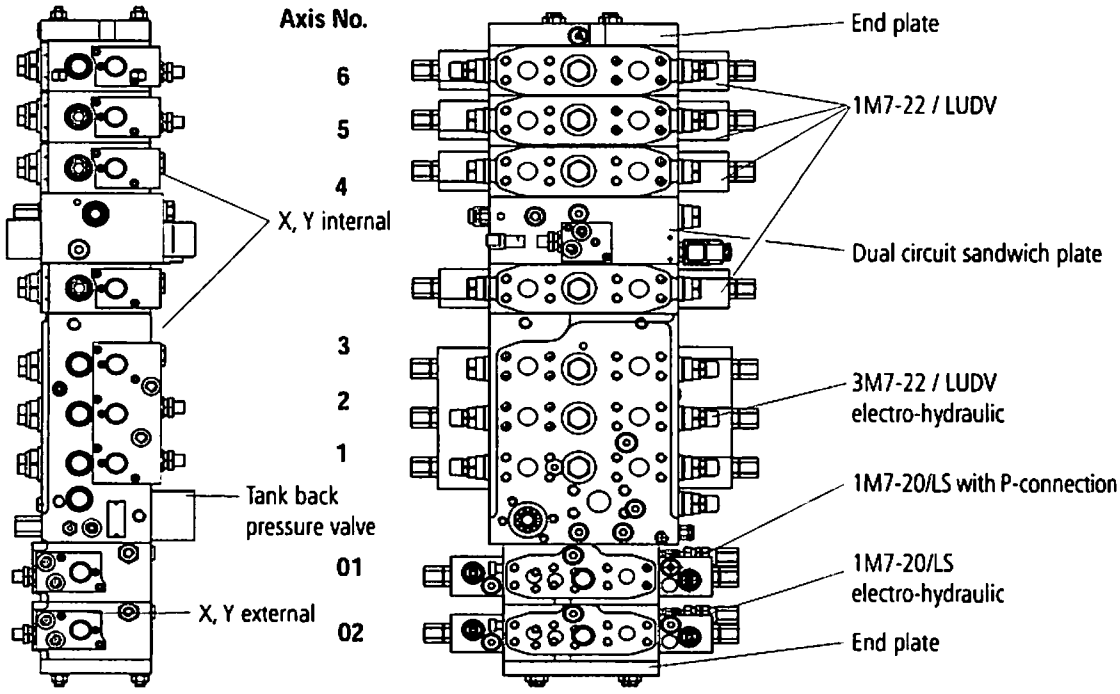
https://truckmanualshub.com/

Combination possibilities

1.)



2.)



https://truckmanualshub.com/

Explanation of the M7 - 22 type key

The type key documents the function features that are available as standard for this modular design valve series. They comprise of a 3- or 5-fold mono block with LUDV functions, on the front face of which a group of up to 4 LUDV plates with or without sandwich plates and appropriate end plates can be mounted. On the opposite face up to 3 LUDV plates, with end plate, can be mounted. The number of axis that the block comprises of results from the addition of the quantity of spools contained within the mono block and the number of LUDV and LS plates fitted.

The first part of the type codes "key features" contains details concerning the block configuration, without details regarding the set values and details regarding the individual spool axis, are defined. This code is also to be found on the block name plate.

In the second part the detailed features and set values for the block are stated.

Subsequently for each of the blocks spool axis (LUDV mono block, LUDV and LS plates) the appropriate features have to be selected.

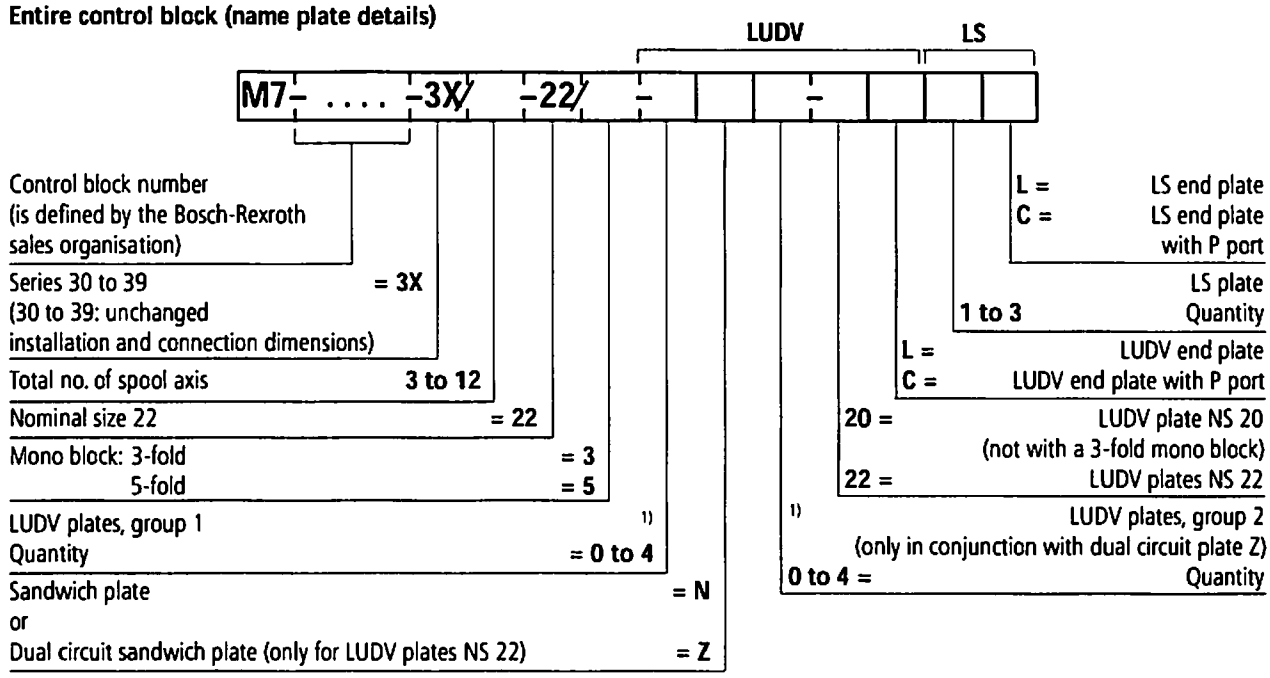
Full details covering all of the features are a prerequiste for fast and accurate order processing. If you have any questions please contact our application specialist in our technical sales organisation.

Engineering guidelines

The M7-LUDV system control block is the core component of the hydraulic control of a mobile machine. It can therefore only be specified in conjunction with a hydrualic circuit that covers the entire machine.

Ordering details

Entire control block (name plate details)



1) the sum of both is maximum 4

Ordering example:

Main features

Entire block:

- Low consecutive control block number (defined by Bosch-Rexroth sales)
- 5 axes in total
- 3-fold mono block
- 1 LUDV plate (group 1)
- 1 LS plate
- End plate with P port (LUDV plate), without function (LS plate)

Ordering detail	M7– .... –3X/	5	–22/	3	–	1	N	0	–22	C	1	L

https://truckmanualshub.com/

Ordering details

Detailmerkmale / Einstellwerte

			–						V	11

Applications
Excavators = 1
Drag-line excavators/ tracked cranes = 2
Cranes = 3
Materials handling equip. = 4
Others = 5

Primary pressure relief
Plug = Q
With primary pressure relief valve = A...
(pressure details in bar, 3-figure)

LS pressure relief
Plug = Q
With primary pressure relief valve = A
Version A with sequencing stage = Z

For version Q = 000
Adjustment value for LS pressure relief valve = . . .
(pressure details in bar, 3-figure)

Adjustment value for the sequencing stage
For versions Q and A = 000
With sequencing stage = . . .
(pressure details in bar, 3-figure)

LS Shuttle
With = J
Without = N

Tank back pressure [1]
0 = Without
1 = With 0.5 bar
2 = With 2.0 bar
3 = With 3.5 bar
5 = With 5.5 bar
7 = With 7.0 bar

Cooler back pressure [1]
0 = Without
1 = With 0.5 bar
2 = With 2.0 bar
3 = With 3.5 bar
4 = With 5.5 bar
5 = With 7.0 bar

J = Cooler back pressure electrically unloaded
N = Cooler back pressure **not** electrically unloaded

q_{Vmin} circuit (unloading function)
Q = Plug
A = With q_{Vmin} circuit

Attention! The compatitibility of the seals and pressure fluid has to be taken into account!
V = FKM seals

11 = Standard connections see pages 14 and 15

[1] **Note:**
When defining the back pressure values the cooling requirements of the machine have to be taken into account!

Ordering example:

Set values
Entire block:

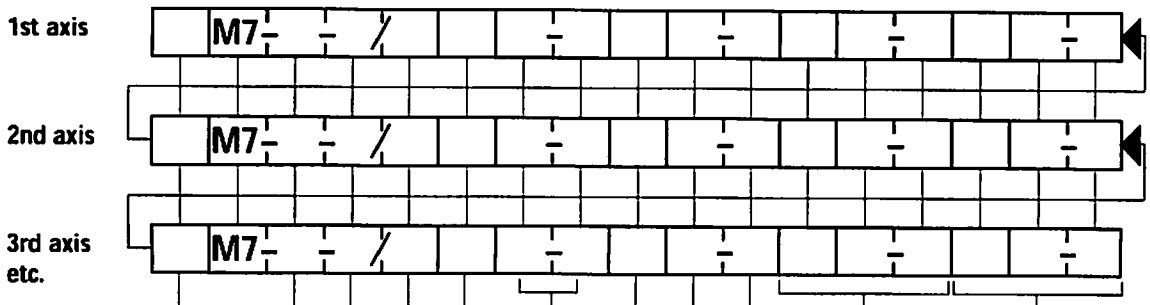
- Cranes
- Primary pressure relief set to 360 bar
- Load sensing pressure, set to 330 bar
- With LS shuttle
- With tank back pressure set to 5.5 bar
- With cooler back pressure set to 2.0 bar, electrically unloaded
- With q_{Vmin} circuit
- FKM seals

Ordering detail

3	A360	A330	–	000	J	5	J	2	A	V	11

https://truckmanualshub.com/

Ordering details: directional valve axis LUDV (see combination possibilities on page 5)



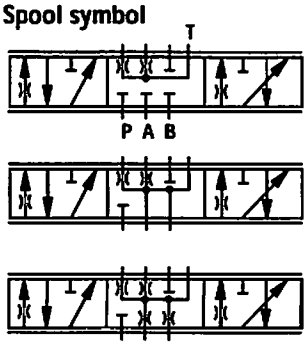
Number of axis = **1 to 4** (see page 5)

Nom. size 20, series 2X = **20** (not suitable for a 3-fold mono block)
Nom. size 22, series 3X = **22**

Series 20 to 29 = **2X** (20 to 29: unchanged installation and connection dimensions)
Series 30 to 39 = **3X** (30 to 39: unchanged installation and connection dimensions)

Load holding valve
Without = **0**
Both sides = **1**

Spool symbol



= **E**
= **J**
= **Q**

(Standard 5 mm² residual cross-section)
Specal spool (in clear text) = **S**

Actuator connections A and B
Flow details in L/min, 3 figures = . . .–. . .

Operator type
Hydraulic proportional = **H93**
Electro-hydraulic proportional 12 V = **W23**
Electro-hydraulic proportional 24 V = **W21**
Electro-hydraulic on/off 12 V = **W43**
Electro-hydraulic on/off 24 V = **W41**

Verbraucheranschluss „A"
Verbraucheranschluss „B"

Secondary valves
Q000-000 = Plug
E000-000 = Anti-cavitation valve
H.[1]. .-000 = Pressure/anti-cavitation valve
N.[1]. .-. . .[2]. . . = Pressure/anti-cavitation valve with switching function

[1] Preferred values, pressure function:
.200 = 200 bar
.240 = 240 bar
.280 = 280 bar
.320 = 320 bar
.380 = 380 bar
.420 = 420 bar

[2] Set values, switching function pressure details in bar, 3 figures

Dampling shuttle
00 = Without (standard for W)
06 = With Ø 0.6 mm
07 = With Ø 0.7 mm
08 = With Ø 0.8 mm
10 = With Ø 1.0 mm
12 = With Ø 1.2 mm
14 = With Ø 1.4 mm

Electric plugs
(Details only required with electro-hydraulic operation)
C4 = Junior Timer 2-pin (AMP)
K4003 = Free cable end with Deutsch plug

https://truckmanualshub.com/

Ordering details: directional valve axis LUDV (see combination possibilities see page 5)

Ordering example:

Directional valve elements:

LUDV axes:

Monoblock

1st spool axis:

- With load holding valve
- Spool symbol: E
- Flow: In A and B 230 L/min
- Operator type: Hydraulic proportional
- With damping shuttle Ø 1.0 mm
- Secondary valve: Pressure/anti-cavitation valves, actuator connections A and B 380 bar

Ordering detail

1	M7-22-3X/ 1	E	230 - 230	H93 - 10	H380-000	H380-000

2nd spool axis: As 1st spool axis but with spool symbol: J

Ordering detail

1	M7-22-3X/ 1	J	230 - 230	H93 - 10	H380-000	H380-000

3rd spool axis: As 1st spool axis but without dampling shuttle

Ordering detail

1	M7-22-3X/ 1	E	230 - 230	H93 - 00	H380-000	H380-000

4th spool axis: As 1st spool axis but with spool symbol: J

Ordering detail

1	M7-22-3X/ 1	J	230 - 230	H93 - 10	H380-000	H380-000

https://truckmanualshub.com/

Ordering details: directional valve axis LS (see combination possibilities on page 5)

1st axis
2nd axis
3rd axis etc.

M7-20-2X/ _ _ _ _ _ _

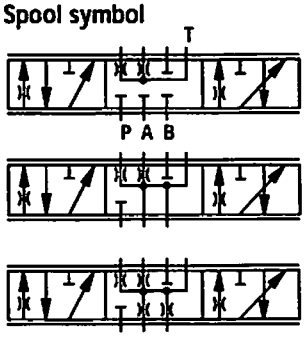
Number of axis = 1 to 3 (see page 5)

Nom. size 20 = 20

Series 20 to 29 = 2X
(20 to 29: unchanged installation and connection dimensions)

Load holding valve
Without = 0
With = 1

Spool symbol



= E

= J

= Q

(Standard 5 mm² residual cross-section)

Special spool (in clear text) = S

Actuator connections A and B
Flow details in L/min, 3 figures = . . .-. . .

Operator type

Hydraulic proportional	= H93
Electro-hydraulic proportional 12 V	= W23
Electro-hydraulic proportional 24 V	= W21
Electro-hydraulic on/off 12 V	= W43
Electro-hydraulic on/off 24 V	= W41

LS pressure relief

Q000-000 =	Plug
E000-. . . =	LS pressure valve
H. . .-. . . =	LS pressure valve with switching function
T000-. . . =	Proportional torque control valve

Dampling shuttle

00 =	Without (standard for W)
06 =	With Ø 0.6 mm
07 =	With Ø 0.7 mm
08 =	With Ø 0.8 mm
10 =	With Ø 1.0 mm
12 =	With Ø 1.2 mm
14 =	With Ø 1.4 mm

Electric plugs
(Details only required with electro-hydraulic operation)

C4 =	Junior Timer 2-pin (AMP)
K4003 =	Free cable end with Deutsch plug

Ordering example:

LS sandwich:
- With load holding valve

1st spool axis:
- Spool symbol: E
- Flow: In A and B 230 L/min
- Operator type: Hydraulic proportional
- With dampling shuttle Ø 1.0 mm
- With torque control valve 280 bar

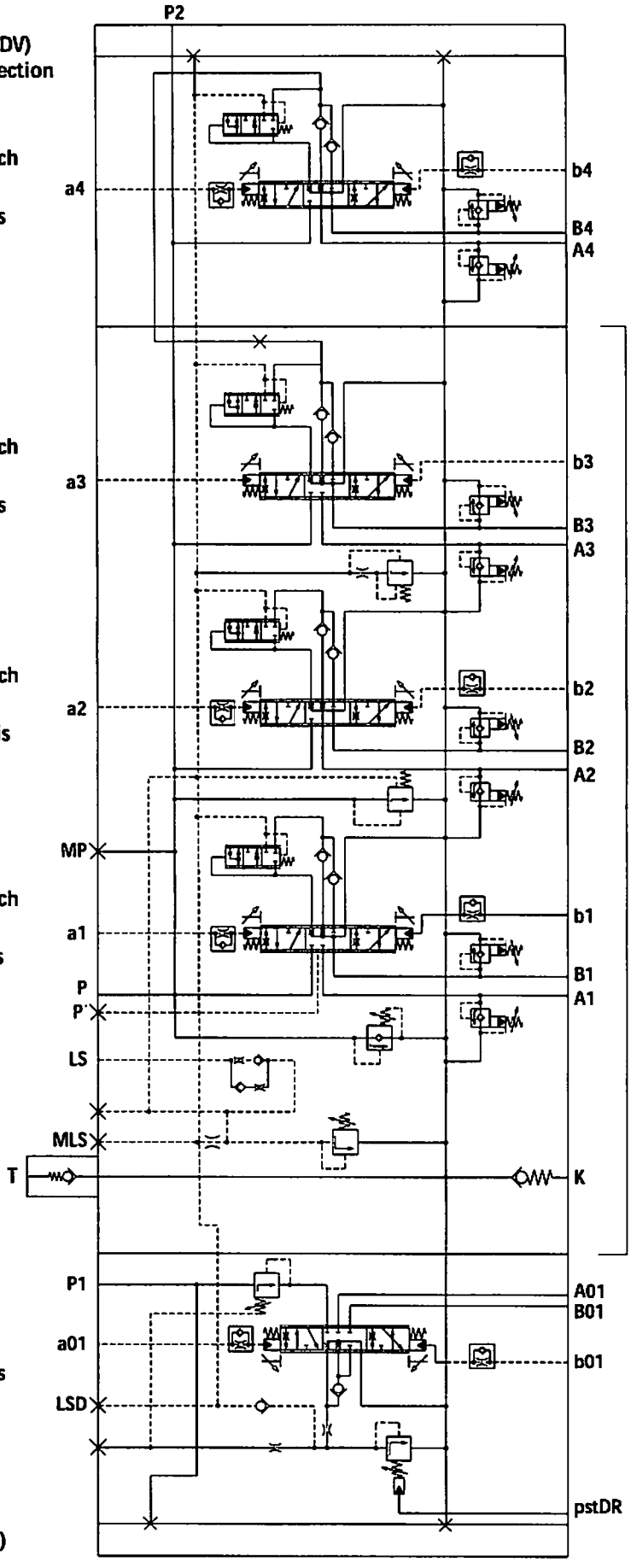
Ordering detail

1	M7-20-2X/1E	230-230	H93-10	T000 - 280

https://truckmanualshub.com/

Ordering example

Circuit



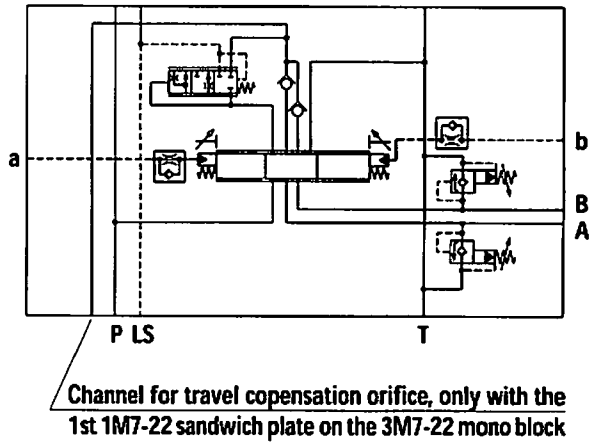
https://truckmanualshub.com/

Other elements

1-fold M7-20 and M7-22 hydraulic

Short description

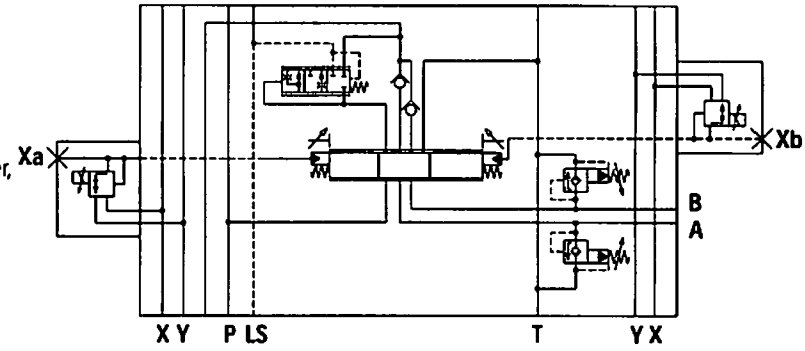
- LUDV sandwich plate
- Hydraulic pilot operation
  (switching speed of the main spool can be adjusted; stroke stops for exact flow adjustment are available)
- Pressure/anti-cavitation valves
- Load holding valves



1-fold M7-22 electro-hydraulic pilot operation

Short description

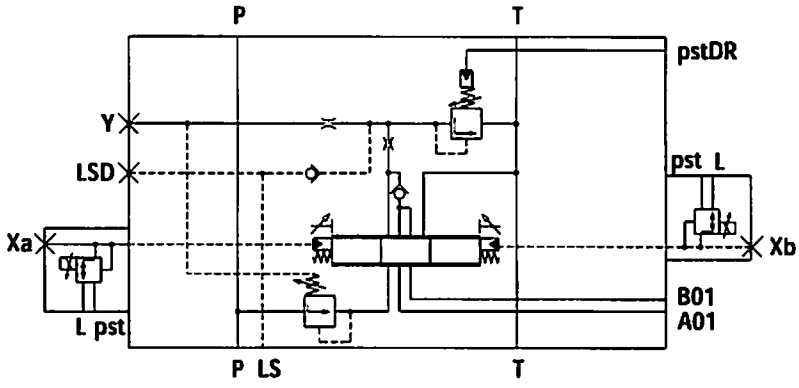
- LUDV sandwich plate
- Electro-hydraulic pilot operation
  (additional pst sensing Xa; Xb on the control cover, X, Y internal)
- Pressure/anti-cavitation valves
- Load holding valves



1-fold M7-20 electro-hydraulic

Short description

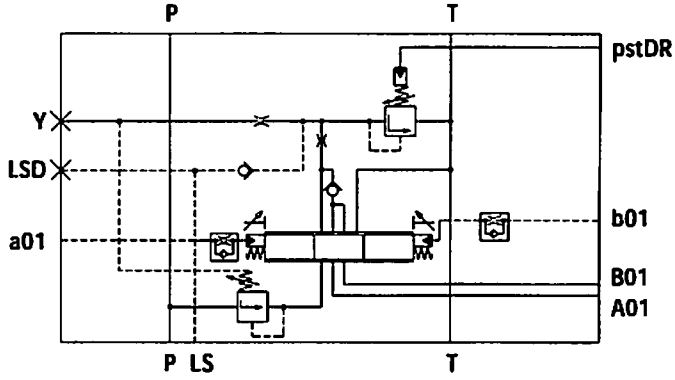
- LS sandwich plate
- LS pressure relief
- Electro-hydraulic pilot operation
- Load holding valves
- No secondary safety is possible



1-fold M7-20/LS hydraulic

Short description

- LS sandwich plate (e.g. for actuators: slew drive, gripper); LS section pressure relief (can also be used as torque control)
- Hydraulic pilot operation
  (switching speed of the main spool can be adjusted; stroke stops for exact flow adjustment are available)
- Load holding valves
- No secondary safety is possible



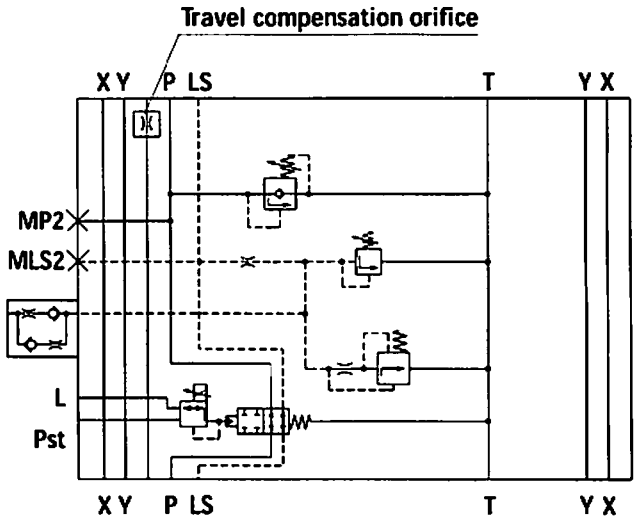
https://truckmanualshub.com/

Other elements

Dual circuit sandwich plate M7-22

Short description

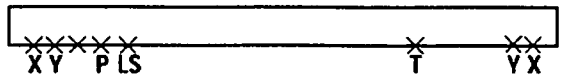
- Dual circuit valve –> separation of P1 and P2 (LS1 and LS2) can be proportional or on/off
- Primary pressure relief, LS pressure relief and LS unloading for the 2nd circuit is integrated.
- Integrated travel compensation orifice (can also be switched off), standard with tracked vehicles



End plate M7-22/LUDV

Short description

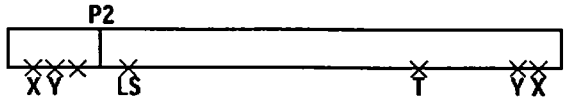
- End plate



End plate M7-22/LUDV/P2

Short description

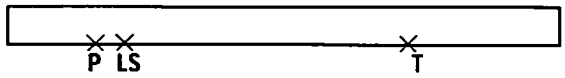
- End plate with P2 connection (inlet)



nd plate M7-20/LS and LUDV

Short description

- End plate



End plate M7-20/LS/P2

Short description

- End plate with P2 connection (inlet)

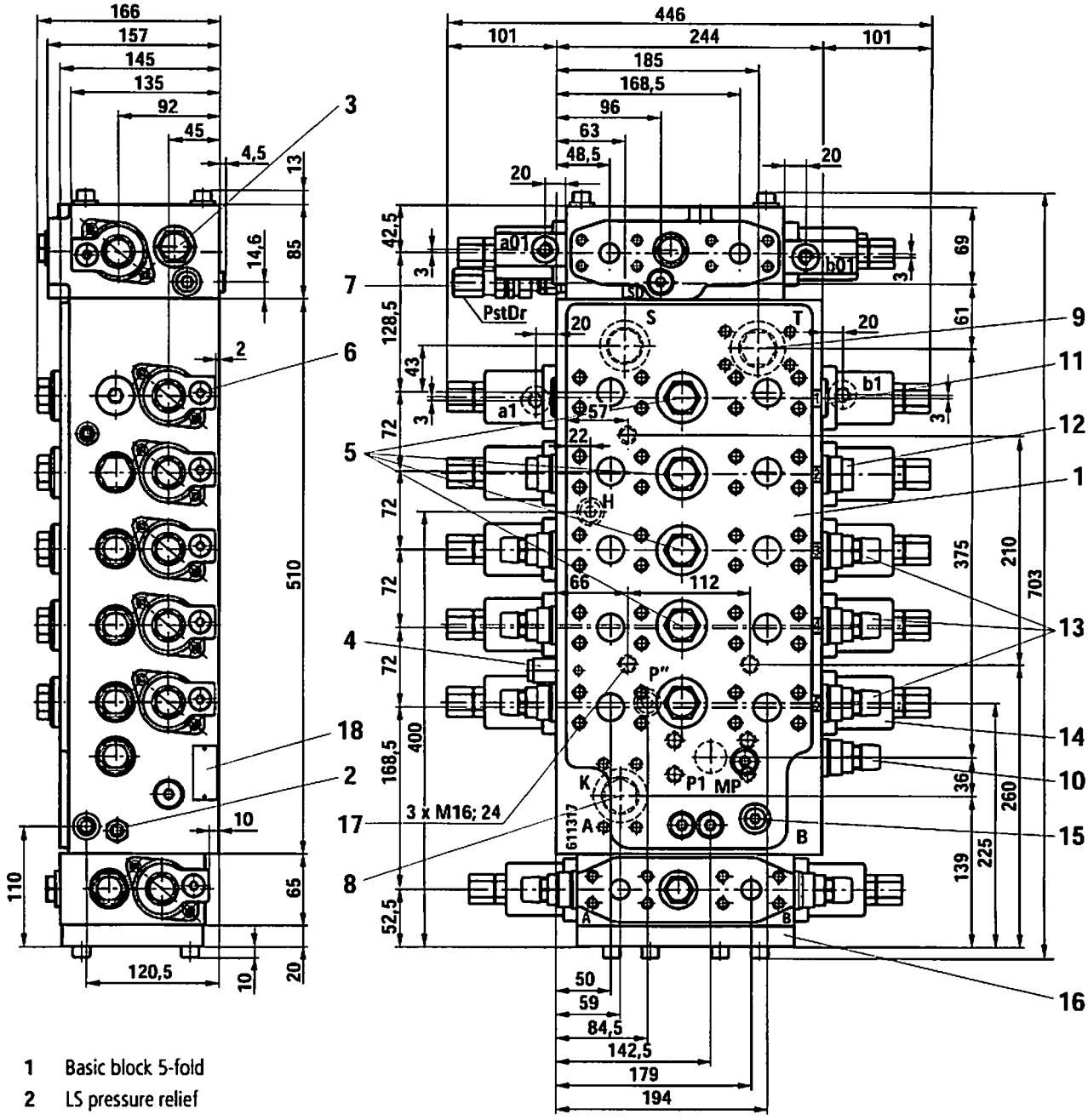


https://truckmanualshub.com/

Unit dimensions

(Dimensions in mm)

Hydraulic operation



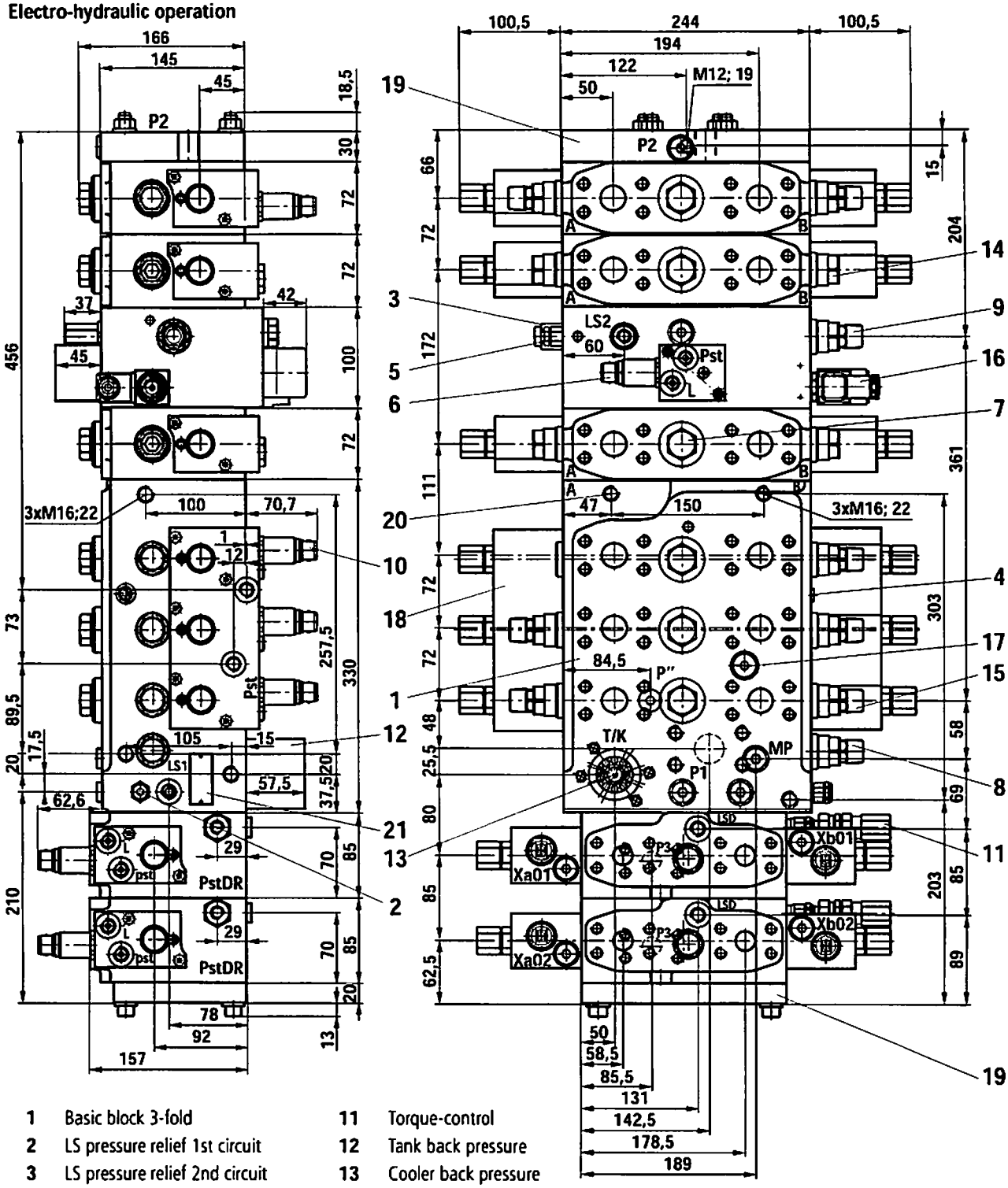
1	Basic block 5-fold			**Pipe connections**	
2	LS pressure relief			P1	= SAE 1 1/4" 6000 PSI
3	LS pressure compensation			T, K	= SAE 1 1/4" 3000 PSI
4	LS unloading			A1- B5	= SAE 1" 6000 PSI
5	LUDV pressure compensator			A01, B01, A6, B6	= SAE 3/4" 6000 PSI
6	pst shuttle			a01, b01, a1-b6	= G 1/4
7	Torque-control valve			LS, MP	= G 1/4
8	Cooler back pressure			PstDR, LSD, P'	= G 1/4
9	Tank back pressure			S	= M33 x 2
10	Primary pressure relief valve				
11	Plug	15	q_{Vmin} circuit		
12	Anti-cavitation valve	16	End plate M7-20		
13	Secondary pressure relief valve	17	Fixing thread		
14	Control cover with stroke limiter	18	Name plate		

https://truckmanualshub.com/

Unit dimensions

(Dimensions in mm)

Electro-hydraulic operation



1	Basic block 3-fold	**11**	Torque-control		
2	LS pressure relief 1st circuit	**12**	Tank back pressure		
3	LS pressure relief 2nd circuit	**13**	Cooler back pressure		
4	LS unloading 1st circuit	**14**	Anti-cavitation valve		
5	LS unloading 2nd circuit	**15**	Secondary pressure relief valve		
6	1st circuit/2nd circuit switching	**16**	Switchable compensation orifice		
7	LUDV pressure compensator	**17**	q_{Vmin} circuit		
8	Primary pressure relief valve 1st circuit	**18**	Control cover with stroke limitation		
9	Primary pressure relief valve 2nd circuit	**19**	End plate		
10	Electrical switching or proportional valve	**20**	Fixing thread		
		21	Name plate		

Pipe connections

P1	= SAE 1 1/4" 6000 PSI
T, K	= SAE 1 1/4" 3000 PSI
A1- B6, P2	= SAE 1" 6000 PSI
A01-B02, P3	= SAE 3/4" 6000 PSI
Xa1, Xb6, Xa01-Xb02	= G 1/4
Pst, L	= G 1/4
LS1, LS2, MP	= G 1/4
PstDR, LSD, P'	= G 1/4

https://truckmanualshub.com/

Notes

Bosch Rexroth AG
Industrial Hydraulics
D-97813 Lohr am Main
Zum Eisengießer 1 • D-97816 Lohr am Main
Telefon 0 93 52 / 18-0
Telefax 0 93 52 / 18-23 58 • Telex 6 89 418-0
eMail documentation@boschrexroth.de
Internet www.boschrexroth.de

Bosch Rexroth Limited

Cromwell Road, St Neots,
Cambs, PE19 2ES
Tel: 0 14 80/22 32 56
Fax: 0 14 80/21 90 52
E-mail: info@boschrexroth.co.uk

The data specified above only serve to describe the product. No statements concerning a certain condition or suitability for a certain application can be derived from our information. It must be remembered that our products are subject to a natural process of wear and ageing.

https://truckmanualshub.com/

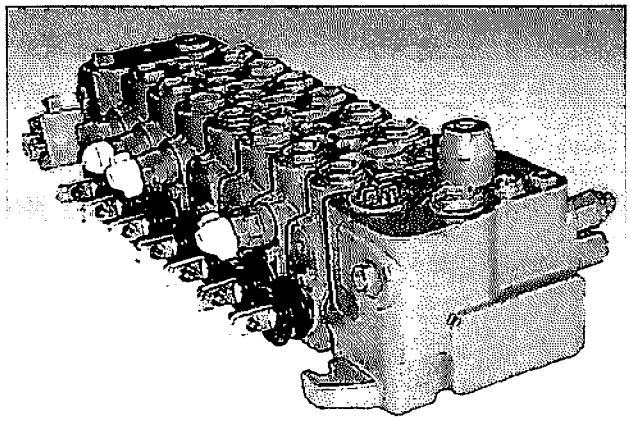
RE 64 125-S/10.05

Maintenance instructions for limited distribution

Replaces : **11.03**

Directional control block with flow distribution independent of the pressure and available flow

Type SX 14, series 2X



Type SX 14

Contents

1 Introduction
1.1 Foreword 1
1.2 Safety instructions 1
2 Troubleshooting 2-3
3 Fondamental rules 4
3.1 General information concerning control block connection 4
4 Removal / installation of SX 14 control block 4
4.1 General recommendations 4
4.2 Removal of the SX 14 control block 4
4.3 Installation of the SX 14 control block 4
4.4 Starting, maximal pressure set up 4
5 Inlet and outlet elements repair procedure 5
5.1 LS pressure relief valve replacement 5
5.2 Flow regulator replacement 5
5.3 Flow divider replacement 6
5.4 Removal of the flushing valve for "closed center" 7
5.5 "Closed center" removal 8
5.6 "Open center"removal 9
5.7 Removal of the outlet element flushing valve 10
5.8 Solenoid valve, "clamps" and shuttle valve removal 11
6 Distribution element repair procedure 12
6.1 Secondary valves replacement 12
6.2 Spool stroke measurement (3 positions) 12
6.3 Removal of spool with spring return 13-14
6.4 Hydraulic operation removal 15
6.5 Removal of mechanical detent system 16
6.6 Removal of electrical detent system (spool pushed) 17
6.7 Removal of electrical detent system (spool pulled) 18
6.8 Electrical controlled spool removal 19
6.9 Control block disassembly / assembly 20-21
7 Precautions when replacing the spool lip seal 22

1 Introduction

1.1 Foreword

This manual deals with the instructions relative to servicing and maintenance operations for the SX 14 control block. For the inspections and servicing operations associated with the hydraulic system of the machine to which the block is connected, please consult the maintenance manual supplied by the equipment manufacturer.

It is recommended that only qualified personnel perform the installation, connection and maintenance of this device, and that all operations be carried out in compliance with the technical standards in force and the cleanliness regulations specific to this type of installation.

To ensure maximum performance and safety during maintenance operations we advise you to

READ THIS MANUAL THOROUGHLY

All information, illustrations, instructions and characteristics contained in this document are based on the latest product information available at the time of publication. In its attempts to maintain a high-quality product, BOSCH REXROTH reserves the right to make design or technical modifications at any time and without prior notification.

1.2 Safety instructions

Please pay a particular attention to the signals of the safety alerts and special instructions in this manual. They are indicated in the following manner:

⚠ **Indicates information or instructions which must be followed to guarantee your safety during operations.**

CAUTION WARNING AGAINST POSSIBLE EQUIPMENT DAMAGE.

NOTE : Useful information.

© 2003
by Bosch Rexroth AG, Mobile Hydraulics, D-89275 Elchingen

All rights reserved. No part of this document may be reproduced or stored, processed, duplicated or circulated using electronic systems, in any form or by any means, without the prior written authorisation of Bosch Rexroth AG, Mobile Hydraulics. In the event of contravention of the above provisions, the contravening party is obliged to pay compensation.

https://truckmanualshub.com/

2 Troubleshooting

CAUTION

BEFORE STARTING ANY PROCEDURES OF TROUBLE SHOOTING OR REMOVING THE CONTROL BLOCK, INSPECT THE GLOBAL MACHINE'S HYDRAULIC SYSTEM TO ELIMINATE ALL POSSIBLE MALFUNCTIONS NOT RELATED TO THE SX 14 CONTROL BLOCK.

Abnormal operation of the actuators connected to the control block

Malfunction	Probable Cause	Additional Checks	Remedy
Lack of strength at all actuators	1 - LS pressure relief valve defective	Take a pressure measurement (see block specifications)	Replace LS pressure relief valve (see § 5.1)
	2 - LS pressure relief valve out of adjustment		Make necessary adjustments (see § 4.4)
Lack of force on one actuator only	1 - Secondary pressure relief valve out of adjustment		Reset to original pressure (refer to block specifications)
	2 - Secondary pressure relief valve blocked "open" (return to tank)		Replace secondary pressure relief valve (see § 6.1)
Lack of speed in the performance of a movement or all movements	SX 14 with "open center" on the inlet element (if so equipped) - Piston if the "open center" blockedinpositionPtowardT		Replace housing + piston assembly (see § 6.9 and 5.6)
Movement performance slow	1 - Spool stroke incorrect	Manual control: measure spool stroke (see § 6.2) Direct electrical control: - check solenoid resistance (R : 2,5 Ω at 25 °C)	If stroke is incorrect: replace housing + spool assembly (see § 6.9 and 6.3) If resistance is incorrect: replace solenoid (see § 6.8)
	2 - Hydraulic operator adjustable stopnut out of adjustment		Make necessary adjustments (see § 6.4)
	3 - Individual compensator pressure blocked		Replace housing + pressure compensator assembly (see § 6.9)
Lack of load hold	1 - Load hold check valve failure		Replace housing + valve assembly (see § 6.9)
	2 - Excessive clearance between the housing and the spool		Replace housing + spool assembly (see § 6.9)
Steering abnormally hard	1 - Flow divider adjustment problem	1 - Adjustment piston sliding freely	Replace control sub-system (see § 5.3)
		2 - Adjustment piston blocked	Replace housing + control system assembly (see § 6.9 et 5.3)
Steering response time abnormally long	Filter of the check piston's flow divider is clogged		Replace the filter (see § 5.3)
Clamp operation malfunction (SX 14 installed on backhoe loader)	1 - Solenoid on the outlet element defective	Check solenoid resistance (R : 7,6 Ω at 20 °C)	If resistance is incorrect: replace the solenoid (see § 5.8)
	2 - Shuttle valve malfunction on the outlet element		Replace shuttle valve (see § 5.8)
	3 - 2-way valve defective		Replace 2-way valve (see § 5.8)
Simultaneous movement malfunction	1 - Blockage of the individual compensator orifice		Remove and clean individual compensator (see § 6.9)
	2 - Individual pressure compensator blocked		Replace the housing + pressure compensator assembly (see § 6.9)
	3 - LS line leakage		Replace LS flow regulator (see § 5.2)

https://truckmanualshub.com/

Abnormal machine operation

Malfunction	Probable Cause	Additional Checks	Remedy
Engine remains under load after spools are returned to neutral	1- Flow regulator blocked		Replace flow regulator (see § 5.2)
	2- Flow regulator filter clogged		Replace the filter (see § 5.2)

Abnormal control block operation

Malfunction	Probable Cause	Additional Checks	Remedy
Detent malfunction	1- Mechanism defective		Replace mechanical detent (see § 6.5)
	2- Solenoid defective	Check solenoid resistance (for electrical detent) (R: 16,5 Ω at 20 °C)	If resistance is incorrect: Replace solenoid (see § 6.6 or 6.7)
Increase of force on controls or spool return defective	Control block assembly tie rods too tight	Check tightening torque	Loosen and tighten to 42 ± 10% N.m. **CAUTION** REMOVE CONTROL BLOCK FROM ITS FIXATION POINTS
	Spool seals obsolete		Replace spool seals (see § 6.3)

Visual defects

Malfunction	Probable Cause	Additional Checks	Remedy
Spool leaking oil	Spool seals defective		Replace spool seals (see § 6.3) Check the rubber boot condition
Oil leakage at pressure relief valves and plugs	Seals defective		Remove pressure relief valve or plug and replace seals (see § 6.1)
Oil leakage between elements	Seals between elements defective		Remove working sections and replace seals (see § 6.9)
Oil leaking from hydraulic operator housing	1- Seal between housing and body defective		Replace seal (see § 6.4)
	2- Seal of adjustable stop nut defective		Replace seal (see § 6.4)
Tongue control boot damaged			Replace boot (see § 6.3)

https://truckmanualshub.com/

3 Fundamental rules

3.1 General information concerning control block connection

When removing the block, all openings must be plugged immediately to prevent any contamination of the hydraulic system.

When replacing the block, remove the plastic plugs from the openings and lines just before making the connections.

Do not tighten connectors to a torque greater than that specified in the assembly instructions.

Check the hydraulic installation's oil quality and filtration capacity during all servicing/maintenance operations.

The use of Teflon tape, hemp and joint filler is prohibited.

Hydraulic lines and connections must not be under any strain whatsoever.

4 Removal / installation of the SX 14 control block

4.1 General recommendations

CAUTION

BEFORE REMOVING THE SX 14 CONTROL BLOCK FROM THE MACHINE, THE BLOCK AND ITS SURROUNDINGS MUST BE THOROUGHLY CLEANED (DO NOT DIRECT THE JET OF A PRESSURE WASHING UNIT DIRECTLY AT THE UNIT).

NO IMPURITIES MUST ENTER THE HYDRAULIC SYSTEM. PLASTIC PLUGS ARE TO BE FITTED ON LINES AND ORIFICES IMMEDIATELY FOLLOWING THEIR REMOVAL.



Wear protective clothing and use suitable equipment to prevent accidents, particularly concerning the hydraulic fluid.

Use the lifting eyes and suitable handling equipment.

Set all actuators connected to the machine in neutral position (on the ground, at lower limit ...) to avoid accidents which could result from uncontrolled movements of the equipment when the hydraulic system is disconnected.

With the machine off, release the pressure remaining in the system by manipulating all of the distribution spools. This is performed by moving the handle in all directions.

4.2 Removal of the SX 14 control block

Install a vacuum pump on the tank to limit oil leakage when connections are removed.

After disconnecting the lines from the block, immediately fit the sealing plugs. Make sure to collect any possible oil leakage in a suitable receptacle.

Unscrew the mounting screws and remove the control block.

4.3 Installation of the SX 14 control block

Contact faces must be perfectly clean.

Check the evenness of support area on the machine (Tolerance: 0.5 mm).

Check the condition of line connector seals.

Clean the block if it has been in storage for a long period of time.

Correctly place and secure the control block onto the machine with the mounting screws.

Connect the lines to the block as per the connecting diagram and tighten to the torque specification (refer to the table in the Data sheet).

Ensure that hoses are not twisted or rub.

Once correctly installed, the unit can be placed into operation.

4.4 Starting, maximal pressure set up

- Decalibrate the LS pressure relief valve (19 mm open end spanner on counternut) before starting the machine,
- Maintain one of the control block spool valve in action before the linked hydraulic receiver is at the end of stroke .

CAUTION

ON THE SPOOL VALVE, THE VALUE OF THE SECONDARY VALVE PRESSURE MUST BE GREATER THAN THAT OF THE LS PRESSURE RELIEF VALVE TO ADJUST.

- Adjust the maximum pressure measured in M using the LS pressure relief valve (6 mm socket wrench).
- Tighten the counternut of the adjusting screw to the torque : 20 ± 10% N.m.

https://truckmanualshub.com/

5 Inlet and outlet elements repair procedure

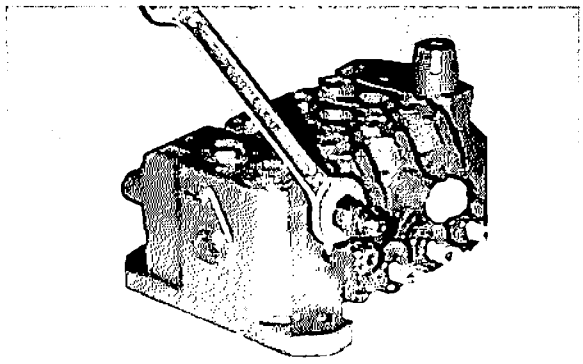
5.1 LS pressure relief valve replacement

NOTE : The control block does not need to be removed from the machine to perform this operation.

Machine off:
- **place all of the machine's actuators connected to the control block in neutral position,**
- **release stored pressure by operating all the spools.**

NOTE : Install a vacuum pump on the tank to limit oil leakage during this operation.

Collect possible leaks with a suitable receptacle.



On the inlet element, unscrew the LS pressure relief valve (24 mm open end spanner).

Reassembly:
- *install the LS pressure relief valve on the inlet element, torque : 45 ± 10% N.m.*
- *set the LS pressure relief valve to the specified value (see § 4.4)*
- *fit a new appropriate locking cover.*

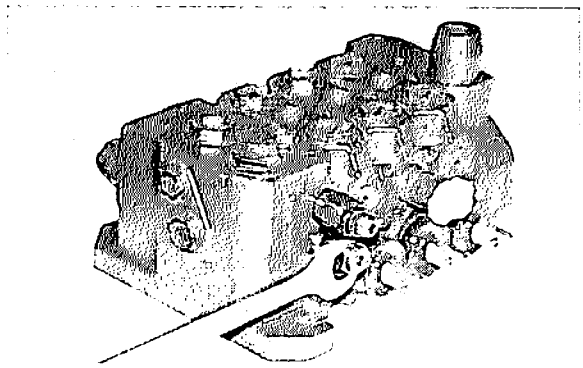
5.2 Flow regulator replacement

NOTE : The control block does not need to be removed from the machine to perform this operation.

Machine off:
- **place all of the machine's actuators connected to the control block in neutral position,**
- **release stored pressure by operating all the spools.**

NOTE : Install a vacuum pump on the tank to limit oil leakage during this operation.

Collect possible leaks with a suitable receptacle.

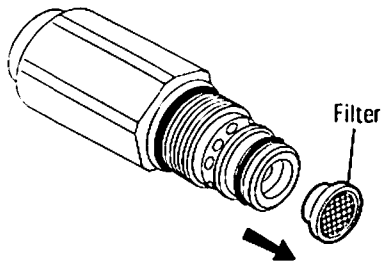


On the inlet or outlet element:
- unscrew the LS pressure relief valve (see § 5.1)
- unscrew the flow regulator (22 mm open end spanner).

Reassembly :
- *install the flow regulator on the inlet or outlet element,*
- *torque : 20 ± 10% N.m.*

Flow regulator filter replacement

Using pliers, extract the filter from the end of the flow regulator. Be careful not to damage the seal and the end of the flow regulator.



Reassemble parts in reverse order.

https://truckmanualshub.com/

5.3 Flow divider replacement

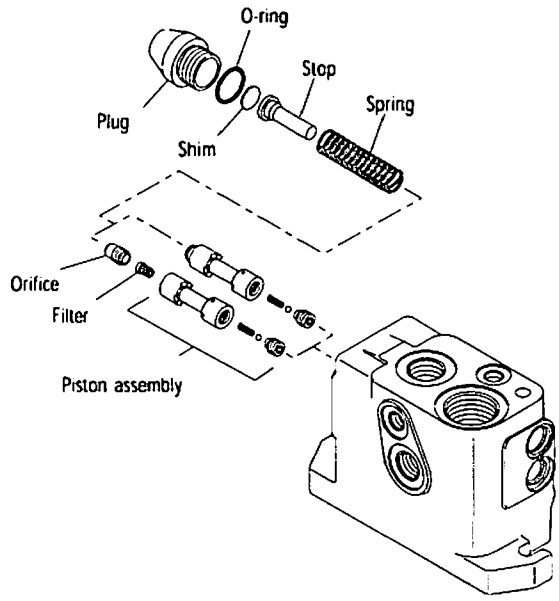
NOTE : The control block does not need to be removed from the machine to perform this operation.

Machine off:

- **place all of the machine's actuators connected to the control block in neutral position,**
- **release stored pressure by manipulating all the spools.**

NOTE : Install a vacuum pump on the tank to limit oil leakage during this operation.

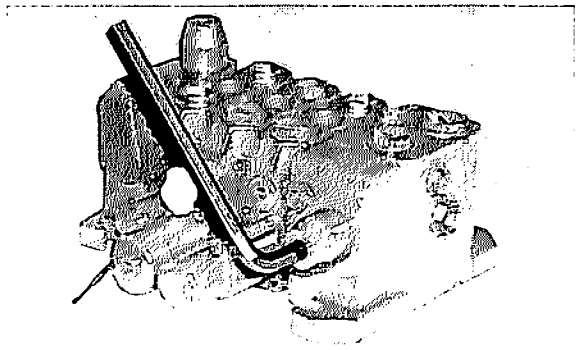
Collect possible leaks with a suitable receptacle.



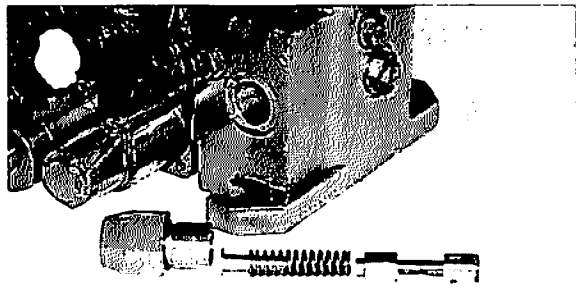
On the inlet element, unscrew the plug (12 mm socket wrench).

Reassembly :

- *replace the plug O-ring,*
- *torque : 100 ± 10% N.m.*



Remove : - shim,
- stop,
- spring,
- the piston assembly.



Replace defective parts.

Reassemble parts in reverse order.

https://truckmanualshub.com/

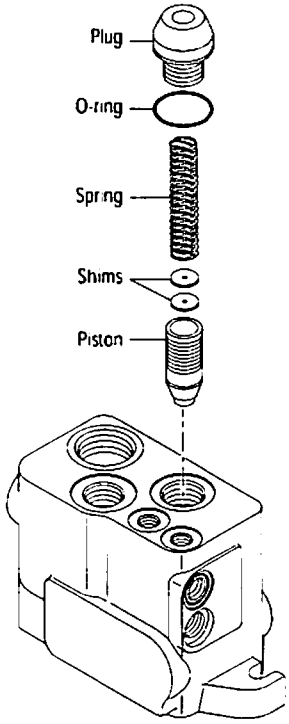
5.4 Removal of the flushing valve for "closed center"

NOTE : The control block does not need to be removed from the machine to perform this operation.

Machine off:
- **place all of the machine's actuators connected to the control block in neutral position,**
- **release stored pressure by manipulating all the spools.**

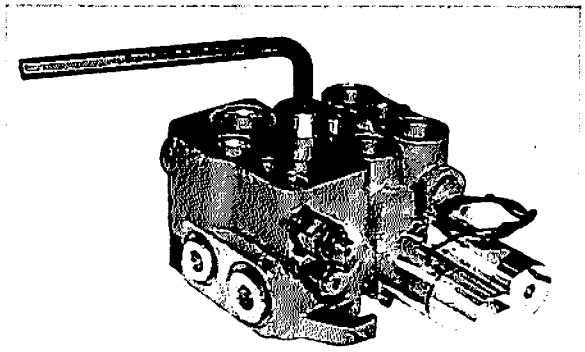
NOTE : Install a vacuum pump on the tank to limit oil leakage during this operation.

Collect possible leaks with a suitable receptacle.



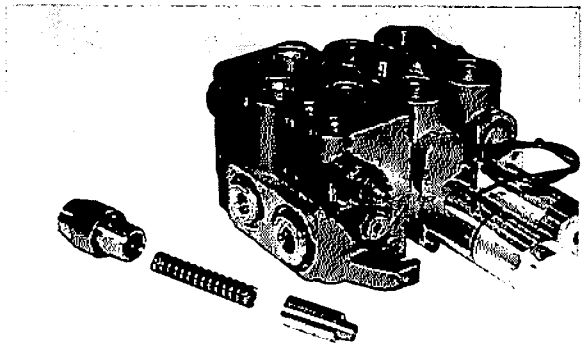
On the inlet element, unscrew the flushing valve plug (12 mm socket wrench).

Reassembly :
- *replace the plug O-ring,*
- *torque: 100 ± 10% N.m.*



Remove : - spring,
- shims,
- piston.

Reassemble parts in reverse order.



https://truckmanualshub.com/

5.5 "Closed center" removal

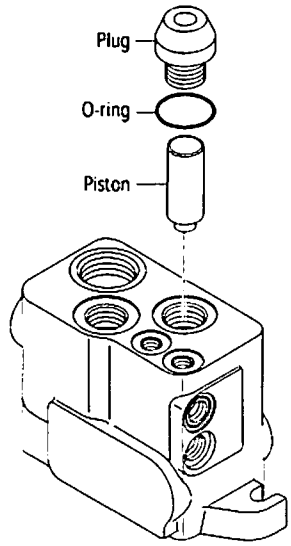
NOTE : The control block does not need to be removed from the machine to perform this operation

Machine off:

- **place all of the machine's actuators connected to the control block in neutral position,**
- **release stored pressure by manipulating all the spools.**

NOTE : Install a vacuum pump on the tank to limit oil leakage during this operation.

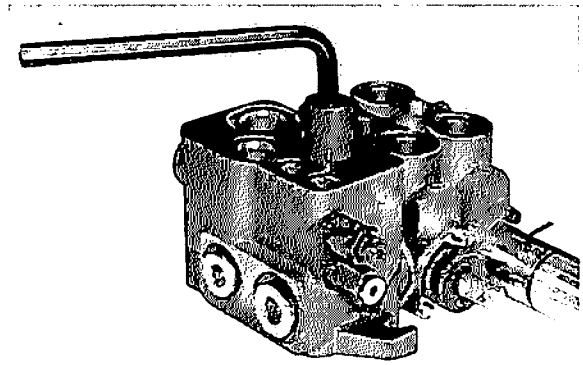
Collect possible leaks with a suitable receptacle.



On the inlet element, unscrew the plug from the "closed center" (12 mm socket wrench).

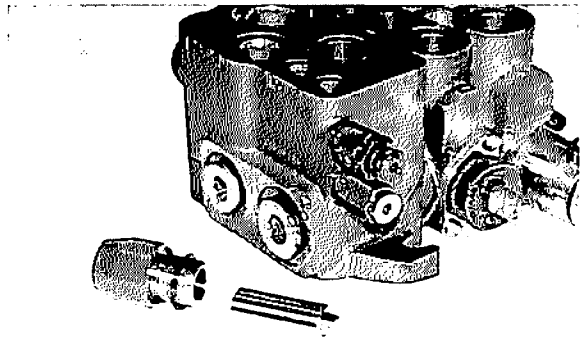
Reassembly :

- *replace the plug O-ring,*
- *torque: 100 ± 10% N.m.*



Remove the piston.

Reassemble parts in reverse order.



https://truckmanualshub.com/

5.6 "Open center" removal

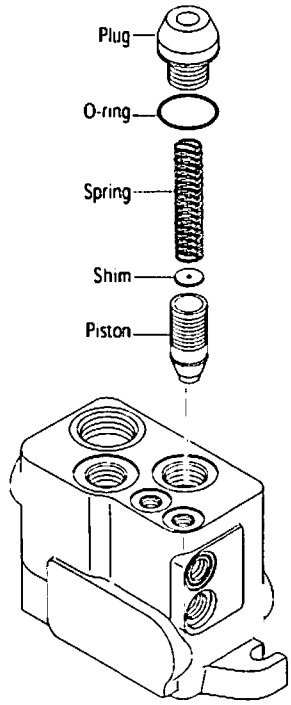
NOTE : The control block does not need to be removed from the machine to perform this operation.

Machine off:

- **place all of the machine's actuators connected to the control block in neutral position,**
- **release stored pressure by manipulating all the spools.**

NOTE : Install a vacuum pump on the tank to limit oil leakage during this operation.

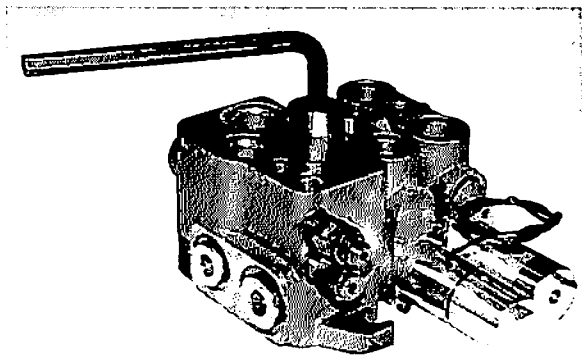
Collect possible leaks with a suitable receptacle.



On the inlet element, remove the "open center" plug (12 mm socket wrench).

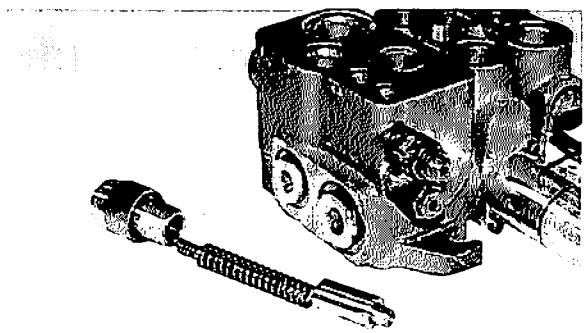
Reassembly :

- *replace the plug O-ring,*
- *torque: 100 ± 10% N.m.*



Remove: - spring,
- shim,
- piston.

Reassemble parts in reverse order.



https://truckmanualshub.com/

5.7 Removal of the outlet element flushing valve

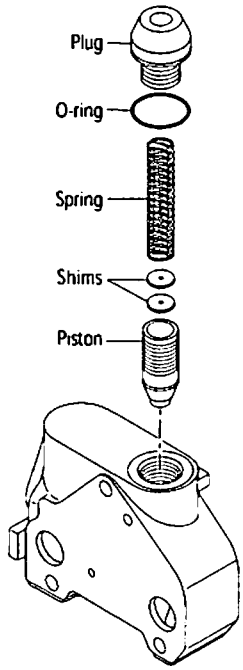
NOTE : The control block does not need to be removed from the machine to perform this operation.

Machine off:

- **place all of the machine's actuators connected to the control block in neutral position,**
- **release stored pressure by manipulating all the spools.**

NOTE : Install a vacuum pump on the tank to limit oil leakage during this operation.

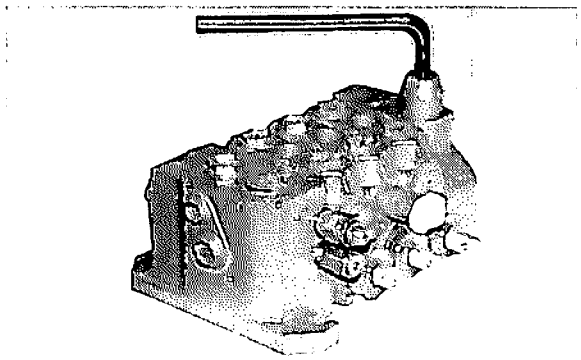
Collect possible leaks with a suitable receptacle.



On the outlet element, unscrew the flushing valve plug. (12 mm socket wrench).

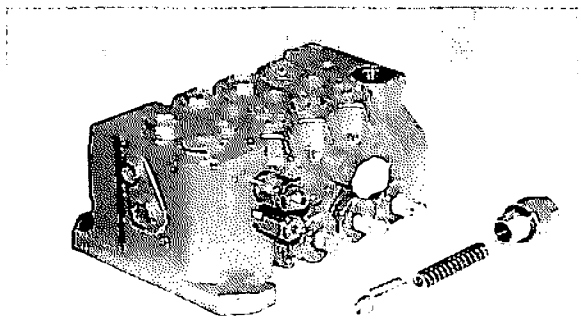
Reassembly :

- *replace the plug O-ring,*
- *torque: 100 ± 10% N.m.*



Remove : - spring,
- shims,
- piston.

Reassemble parts in reverse order.



https://truckmanualshub.com/

5.8 Solenoid valve, "clamps" and shuttle valve removal (installed on backhoe loader)

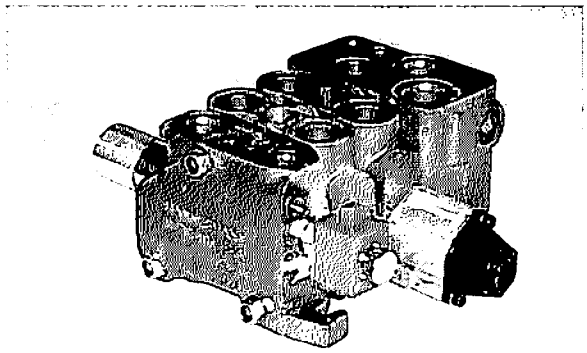
NOTE : The control block does not need to be removed from the machine to perform this operation.

Machine off:
- **place all of the machine's actuators connected to the control block in neutral position,**
- **release stored pressure by manipulating all the spools.**

NOTE : Install a vacuum pump on the tank to limit oil leakage during this operation.

Collect possible leaks with a suitable receptacle.

Solenoid replacement



On the outlet element, unscrew the knurled knob from the solenoid.

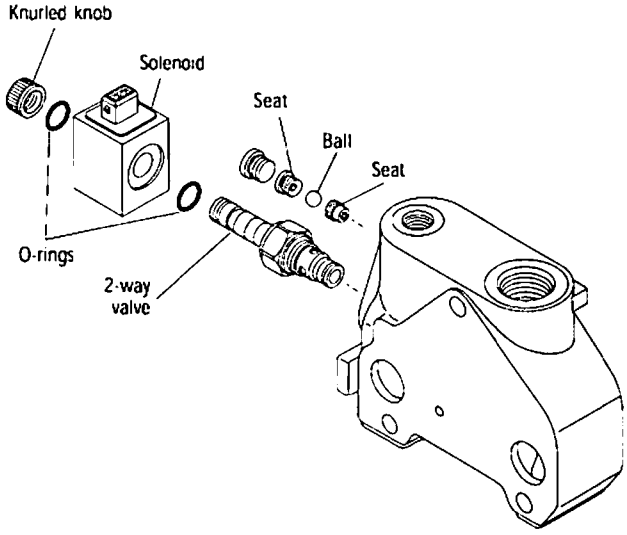
Pull the solenoid off the stem of the 2-ways valve.

Reassembly :
- *replace the 2 seals of the solenoid,*
- *torque : 3,5 ± 10% N.m.*

2-ways valve replacement

Unscrew the 2-ways valve (24 mm wrench).

Reassembly : torque : 45 ± 10% N.m.



Shuttle valve or selector removal

On the outlet element, unscrew the upper seat (4 mm socket wrench).

Reassembly : torque : 20 ± 10% N.m.

Remove the ball using a magnet.

Unscrew the lower seat (4 mm socket wrench).

Reassembly : torque : 20 ± 10% N.m.

Replace shuttle valve parts.

Apply a droplet of **Loctite 542 pneumatic/hydraulic sealant** on the seats thread.

CAUTION DO NOT PUT LOCTITE ON THE BALL.

Reassemble parts in reverse order.

https://truckmanualshub.com/

6 Distribution element repair procedure

6.1 Secondary valves replacement

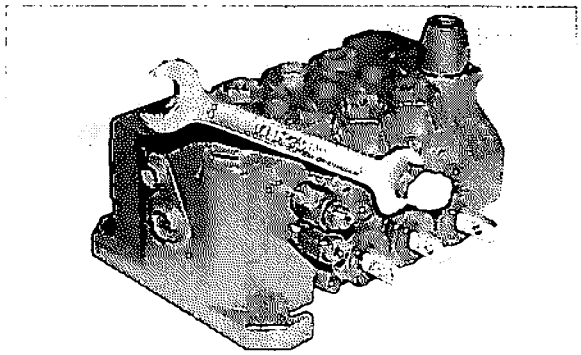
NOTE : The control block does not need to be removed from the machine to perform this operation.

Machine off:
- **place all of the machine's actuators connected to the control block in neutral position,**
- **release stored pressure by manipulating all the spools.**

NOTE : Install a vacuum pump on the tank to limit oil leakage during this operation.

Collect possible leaks with a suitable receptacle.

Pressure relief valve replacement



On the distribution element in question, unscrew the secondary pressure relief valve (24 mm open end spanner).

Reassembly :
- *set the pressure relief valve to the specified value,*
- *install the secondary pressure relief valve on the distribution element,*
- *torque : 70 ± 10% N.m.*
- *fit a new appropriate locking cover.*

Replace valve seals or pressure relief valve.

Plug replacement

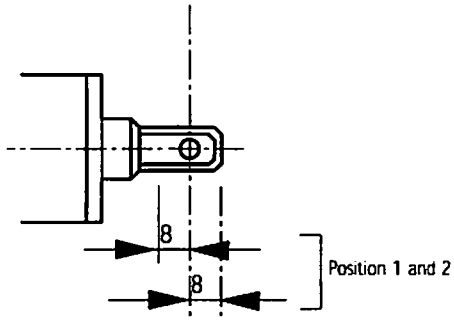
On the distribution element in question, unscrew the plug (8 mm socket wrench).

Reassembly : *torque : 70 ± 10% N.m.*

Replace plug seals or plug.

6.2 Spool stroke measurement (3 positions)

Move the control lever of the element in question in all possible positions, and measure the corresponding spool stroke values at the tongue.



https://truckmanualshub.com/

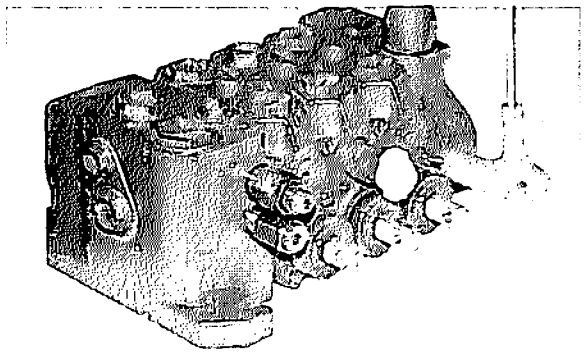
6.3 Removal of spool with spring return

NOTE : The control block does not need to be removed from the machine to perform this operation.

Machine off:
- **place all of the machine's actuators connected to the control block in neutral position,**
- **release stored pressure by manipulating all the spools.**

NOTE : Install a vacuum pump on the tank to limit oil leakage during this operation.

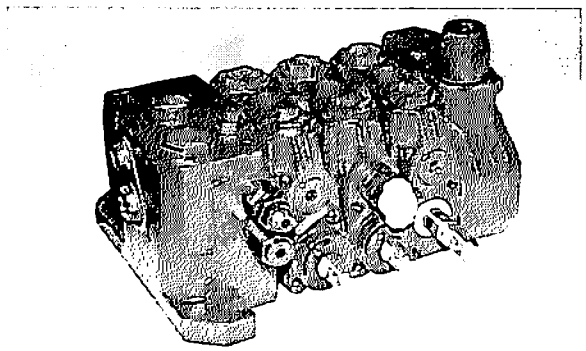
Collect possible leaks with a suitable receptacle.



Tongue side

Remove : - mounting screws (L=12 mm) (screwdriver Torx Tx30),
- the boot and its plate,
- plate.

Reassembly :
- *replace the lip seal, or replace the old spool seals (wiper ring + O-ring) by a lip seal*
- *torque : 10 ± 10% N.m.*

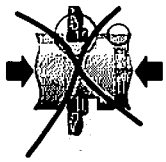


CAUTION

POSITION THE METALLIC PART OF THE LIP SEAL ON THE OUTSIDE.

THE LIP SEAL MUST BE FITTED ON THE END OF THE SPOOL SO THAT IT IS NOT DAMAGED ON THE SPOOL GROOVES AND ITS TIGHTNESS PROPERTY DOES NOT DETERIORATE. (see § 7)

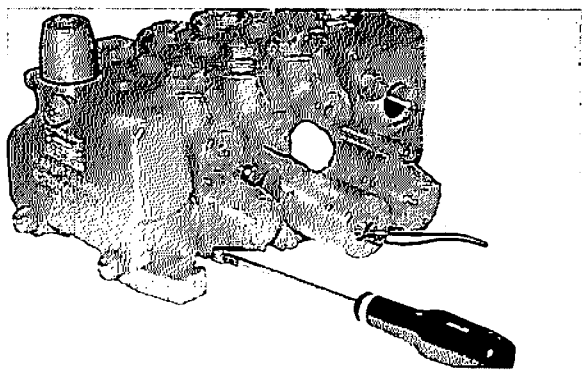
SLIDE THE LIP SEAL PERPENDICULARLY ONTO THE SPOOL.



Cover side

Remove the mounting screws (L=16 mm) and the cover (screwdriver Torx Tx30).

Reassembly :
- *replace the lip seal, or replace the old spool seals (wiper ring + O-ring) by a lip seal*
- *torque : 10 ± 10% N.m.*



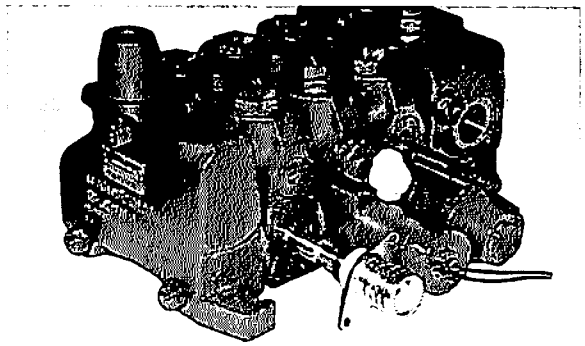
CAUTION

POSITION THE METALLIC PART OF THE LIP SEAL ON THE OUTSIDE.

THE LIP SEAL MUST BE FITTED ON THE END OF THE SPOOL SO THAT IT IS NOT DAMAGED ON THE SPOOL GROOVES AND ITS TIGHTNESS PROPERTY DOES NOT DETERIORATE. (see § 7)

SLIDE THE LIP SEAL PERPENDICULARLY ONTO THE SPOOL.





Spool fitted with a mechanical detent system: see § 6.5
Spool fitted with an electrical detent system: see § 6.6 & 6.7

Remove the spool from the working section.

Reassemble parts in reverse order.

https://truckmanualshub.com/

Return system removal for spool seal(s) replacement

NOTE : Use the spool clamp (DSI.-No: 08 103 002) and a vice to secure the spool.

CAUTION

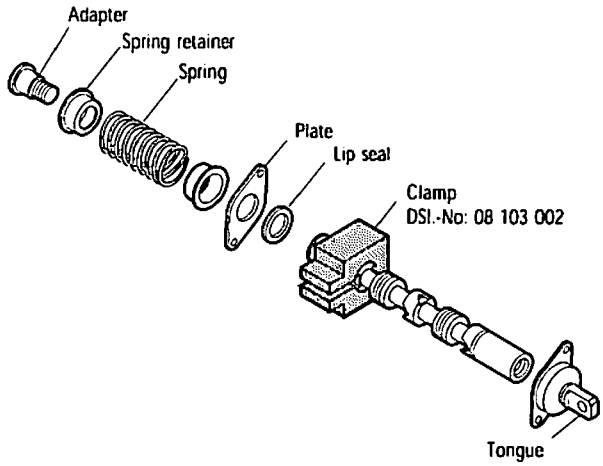
IN ORDER TO AVOID BREAKING THE CLAMP, PLACE IT APPROXIMATELY 15 MM FROM THE END OF THE SPOOL (NEVER IN THE CENTRE).

Beforehand, heat the spool to 200° C in an oven or, failing that, with a heat gun.

Wear thick protective gloves when handling the hot spool.

Remove the adapter (5 mm socket wrench).

Remove: - 2 spring retainers,
- spring,
- plate,
- lip seal or old spool seals (wiper ring + O-ring).



Reassembly :

- *replace the lip seal, or replace the old spool seals (wiper ring + O-ring) by a lip seal*

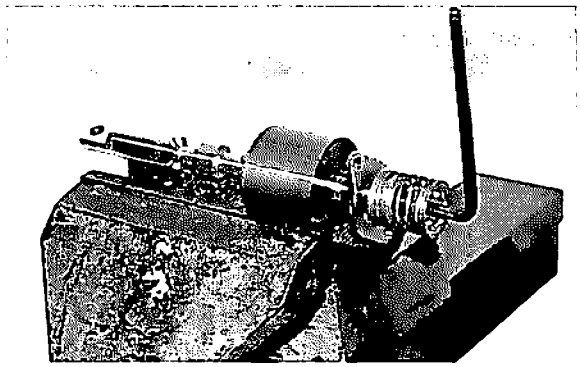
CAUTION

POSITION THE METALLIC PART OF THE LIP SEAL ON THE OUTSIDE.

THE LIP SEAL MUST BE FITTED ON THE END OF THE SPOOL SO THAT IT IS NOT DAMAGED ON THE SPOOL GROOVES AND ITS TIGHTNESS PROPERTY DOES NOT DETERIORATE. (see § 7)



SLIDE THE LIP SEAL PERPENDICULARLY ONTO THE SPOOL.



- *grease the spring,*
- *apply a droplet of loctite 262 on the end of the spool internal thread,*
- *reassemble the return system parts in reverse order,*
- *torque : 10 ± 10% N.m.*

CAUTION

WAIT FOR 8 HOURS BEFORE USING THE MACHINE TO LET THE LOCTITE 262 DRY COMPLETELY.

Tongue replacement (if necessary)

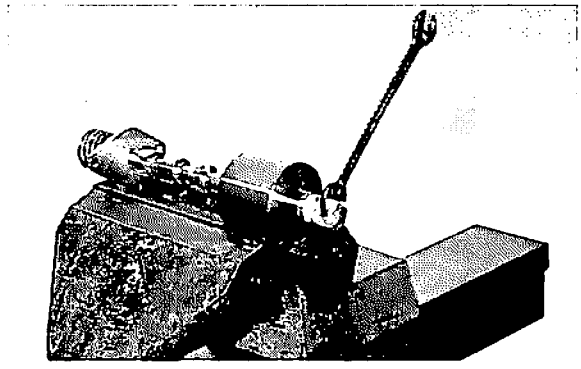
Beforehand, heat the spool to 200° C in an oven or, failing that, with a heat gun.

Wear thick protective gloves when handling the hot spool.

CAUTION

DO NOT USE A WELDING TORCH TO HEAT THE TONGUE AS SPOOL DEFORMATION MAY RESULT.

Loosen the tongue with an open end spanner (8 mm open end spanner).



Reassembly :

- *apply a droplet of loctite 262 on the end of the tongue thread,*
- *torque : 10 ± 10% N.m.*

CAUTION

WAIT FOR 8 HOURS BEFORE USING THE MACHINE TO LET THE LOCTITE 262 DRY COMPLETELY.

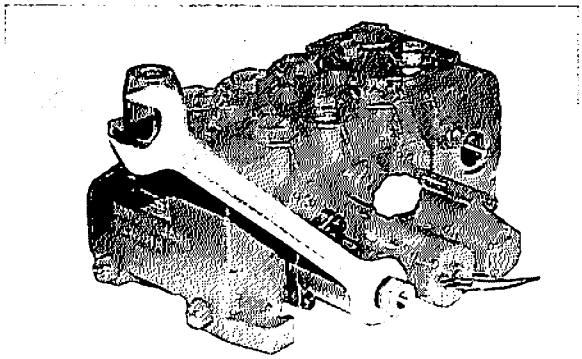
https://truckmanualshub.com/

6.4 Hydraulic operation removal

NOTE : The control block does not need to be removed from the machine to perform this operation.

Machine off:

- **place all of the machine's actuators connected to the control block in neutral position,**
- **release stored pressure by manipulating all the spools,**
- **do not modify the (adjustable) stop screw setting.**

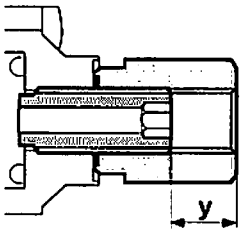


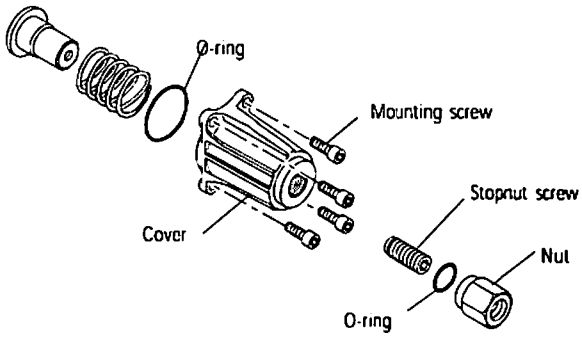
NOTE : Install a vacuum pump on the reservoir to limit oil leakage during this operation.

Collect possible leaks with a suitable receptacle.

Adjustable stop nut seal replacement

NOTE : Using a vernier, measure before replacement the dimension **y** between the stopnut screw and the nut tip (see diagram below).
This value **y** is to be thoroughly respected when reassembling to ensure an identical flow adjustment.





Remove the nut :

- Gaz (22 mm open end spanner)
- UNF (27 mm open end spanner)

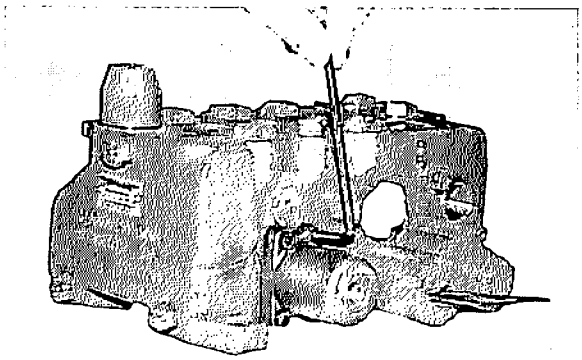
Reassembly :

- *replace the nut O-ring or replace the nut + stopnut screw assembly,*
- *torque : 40 ± 10% N.m.*

CAUTION

WHILE TIGHTNING THE NUT, BLOCK THE STOPNUT SCREW USING A 6 MM SOCKET WRENCH.

Hydraulic control housing removal



Remove the 4 mounting screws (screwdriver Torx Tx30 for Torx screws or 5 mm socket wrench for CHc screws).

Reassembly :

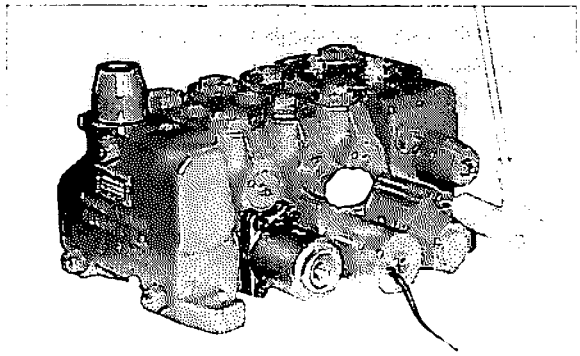
- *replace the O-ring on the body,*
- *torque : 10 ± 10% N.m.*

Reassemble parts in reverse order.

https://truckmanualshub.com/

6.5 Removal of mechanical detent system (pull function only)

NOTE : The control block does not need to be removed from the machine to perform this operation.

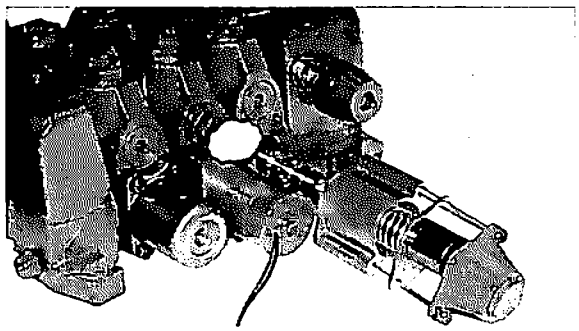


Machine off:

- **place all of the machine's actuators connected to the control block in neutral position,**
- **release stored pressure by manipulating all the spools.**

NOTE : Install a vacuum pump on the reservoir to limit oil leakage during this operation.

Collect possible leaks with a suitable receptacle.



Tongue side : see § 6.3

Cover side

Remove the 2 mounting screws and the cover (screwdriver Torx Tx30).

Remove the spool from the working section.

Reassembly:

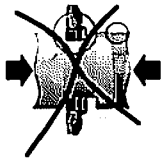
- *replace the O-ring on the spacer,*
- *replace the lip seal, or replace the old spool seals (wiper ring + O-ring) by a lip seal on the spacer side and tongue side (see § 6.3),*
- *torque : 10 ± 10% N.m.*

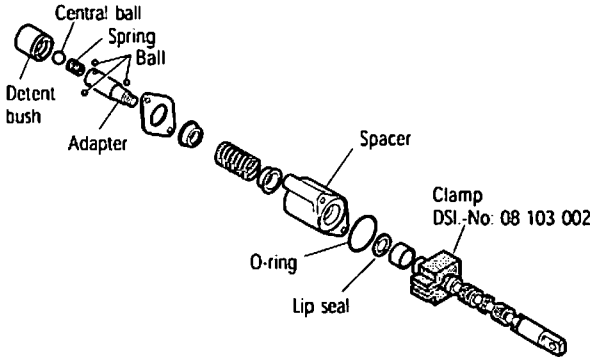
CAUTION

POSITION THE METALLIC PART OF THE LIP SEAL ON THE OUTSIDE.

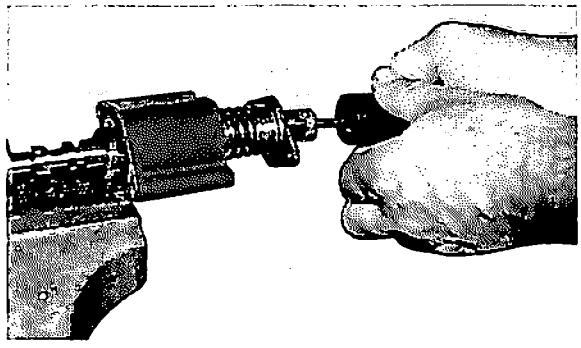
THE LIP SEAL MUST BE FITTED ON THE END OF THE SPOOL SO THAT IT IS NOT DAMAGED ON THE SPOOL GROOVES AND ITS TIGHTNESS PROPERTY DOES NOT DETERIORATE. (see § 7)

SLIDE THE LIP SEAL PERPENDICULARLY ONTO THE SPOOL.





NOTE : Use the spool clamp (DSI.-No: 08 103 002) and a vice to secure the spool.



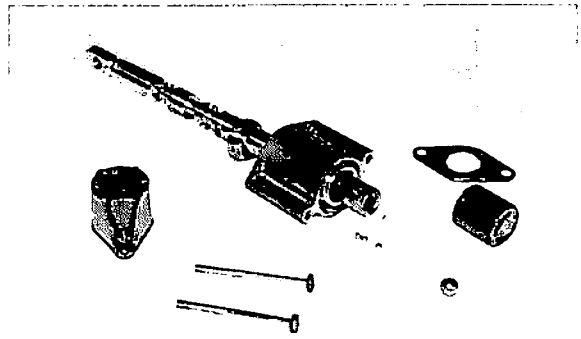
CAUTION

IN ORDER TO AVOID BREAKING THE CLAMP, PLACE IT APPROXIMATELY 15 MM FROM THE END OF THE SPOOL (NEVER IN THE CENTRE).

Using a metal rod (min. length = 80 mm, Ø 6), push the central ball while extracting the detent bush.

Mark the orientation of the detent bush for the reassembly.

Remove the balls and the spring.



Reassembly :

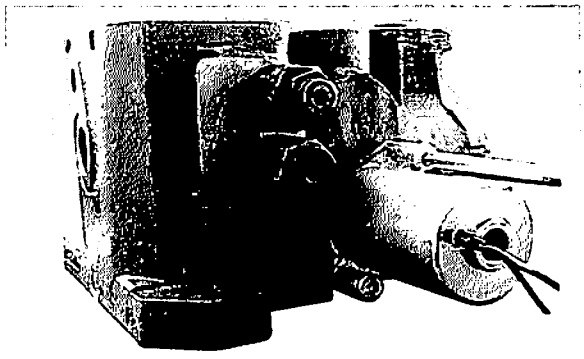
- *introduce the spring into the adapter,*
- *place the 3 balls into the radial holes of the adapter and hold them with a small amount of grease,*
- *position the central ball against with the spring,*
- *slip the detent bush onto a metal rod,*
- *using the rod, press the central ball into the adapter, then slide the detent bush onto the adapter, making sure that the 3 balls are still in place,*

NOTE : The orientation of the detent bush must be respected.

- *remove the metal rod, assembly is complete.*

https://truckmanualshub.com/

6.6 Removal of electrical detent system (spool pushed)



Spool removal for seal replacement

NOTE : This operation can be performed independently of the solenoid replacement operation.

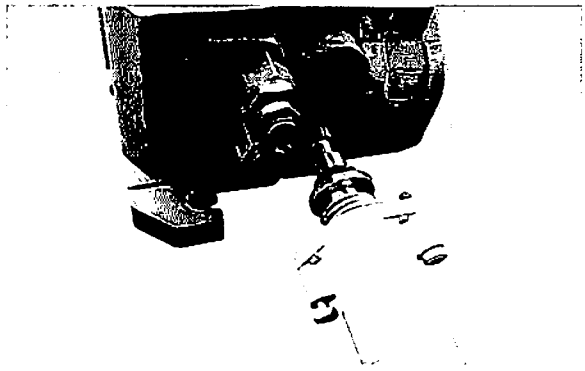
Remove the control block from the machine for this operation, if necessary.

Machine off:

- **place all of the machine's actuators connected to the control block in neutral position,**
- **release stored pressure by manipulating all the spools.**

NOTE : Install a vacuum pump on the tank to limit oil leakage during this operation.

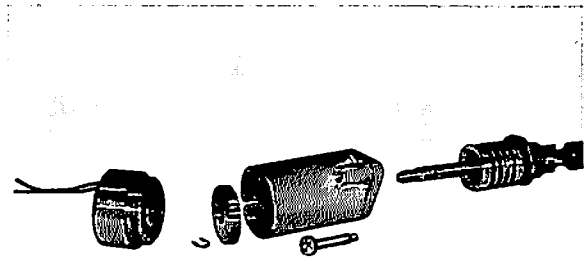
Collect possible leaks with a suitable receptacle.



Tongue side : see § 6.3

Control side

- remove the 2 mounting screws (screwdriver Torx Tx30)
  Reassembly : torque : 10 ± 10% N.m.
- remove the detent system.
- remove the spool from the distribution element.



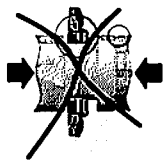
Reassembly :

- *replace the detent system O-ring,*
- *replace the lip seal, or replace the old spool seals (wiper ring + O-ring) by a lip seal on tongue side (see § 6.3).*

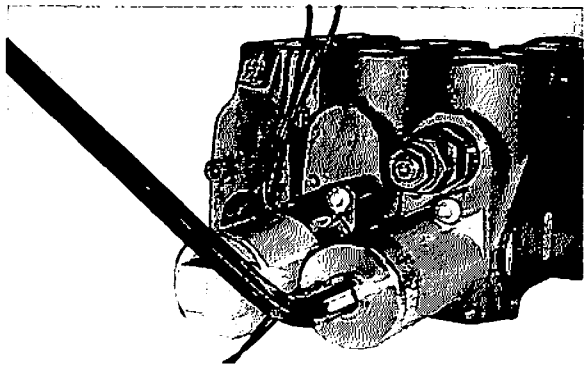
CAUTION

POSITION THE METALLIC PART OF THE LIP SEAL ON THE OUTSIDE.

THE LIP SEAL MUST BE FITTED ON THE END OF THE SPOOL SO THAT IT IS NOT DAMAGED ON THE SPOOL GROOVES AND ITS TIGHTNESS PROPERTY DOES NOT DETERIORATE. (see § 7)



SLIDE THE LIP SEAL PERPENDICULARLY ONTO THE SPOOL.

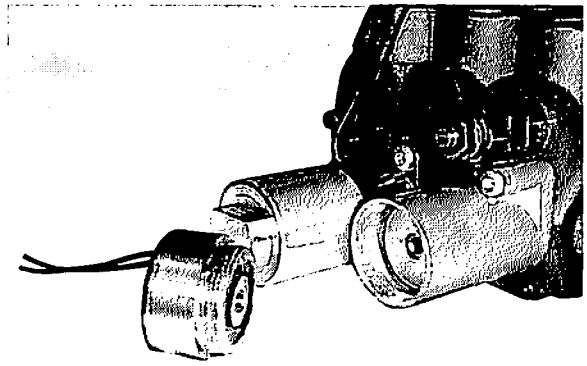


Solenoid Replacement

NOTE : The control block does not need to be removed from the machine to perform this operation.

Unscrew the solenoid from the housing (10 mm socket wrench).

Reassembly : torque : 20 ± 10% N.m.



Install a new solenoid.

https://truckmanualshub.com/

6.7 Removal of electrical detent system (spool pulled)

Spool removal for seal replacement

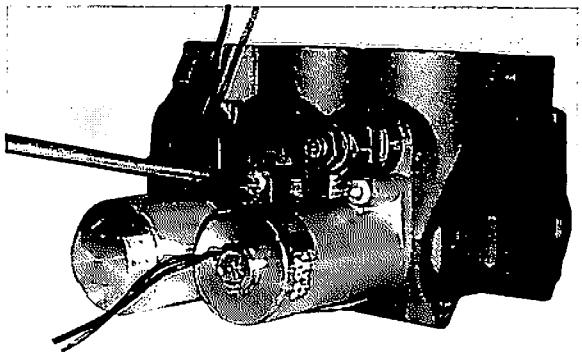
NOTE : This operation can be performed independently of the solenoid replacement operation.

Remove the control block from the machine for this operation, if necessary.

Machine off:
- **place all of the machine's actuators connected to the control block in neutral position,**
- **release stored pressure by manipulating all the spools.**

NOTE : Install a vacuum pump on the tank to limit oil leakage during this operation.

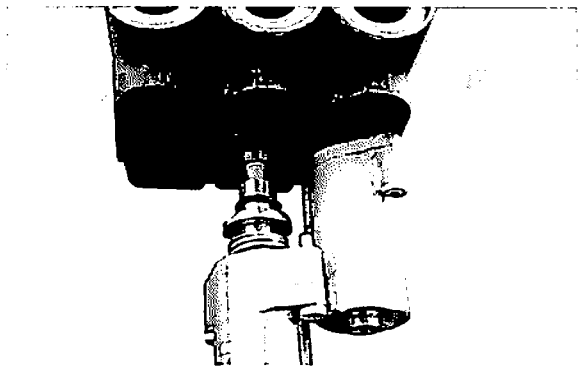
Collect possible leaks with a suitable receptacle.



Tongue side : see § 6.3

Control side

- Remove the 2 mounting screws (screwdriver Torx Tx30)
  Reassembly : torque : 10 ± 10% N.m.
- remove the detent system.
- remove the spool from the distribution element.



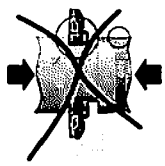
Reassembly:
- *replace the detent system O-ring,*
- *replace the lip seal, or replace the old spool seals (wiper ring + O-ring) by a lip seal on tongue side (see § 6.3).*

CAUTION

POSITION THE METALLIC PART OF THE LIP SEAL ON THE OUTSIDE.

THE LIP SEAL MUST BE FITTED ON THE END OF THE SPOOL SO THAT IT IS NOT DAMAGED ON THE SPOOL GROOVES AND ITS TIGHTNESS PROPERTY DOES NOT DETERIORATE. (see § 7)

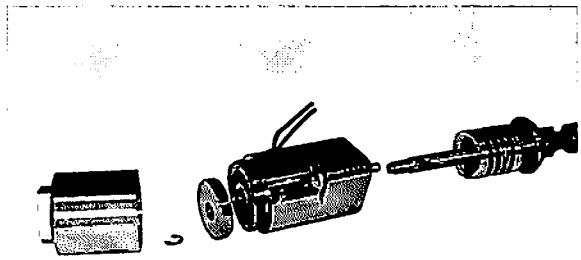
SLIDE THE LIP SEAL PERPENDICULARLY ONTO THE SPOOL.



Solenoid replacement

NOTE : The control block does not need to be removed from the machine to perform this operation.

Collect possible leaks with a suitable receptacle.



Remove the 2 mounting screws (screwdriver Torx Tx30) and the detent system.
Reassembly : torque : 10 ± 10% N.m.

Unscrew the rear housing (19 mm open-end spanner).
Reassembly : torque : 20 ± 10% N.m.

Remove the circlip, spring and armature.
Install the new solenoid.

Reassemble parts in reverse order.

https://truckmanualshub.com/

6.8 Electrical controlled spool removal

NOTE : The control block does not need to be removed from the machine to perform this operation.

Machine off:
- **place all of the machine's actuators connected to the control block in neutral position,**
- **release stored pressure by manipulating all the spools.**

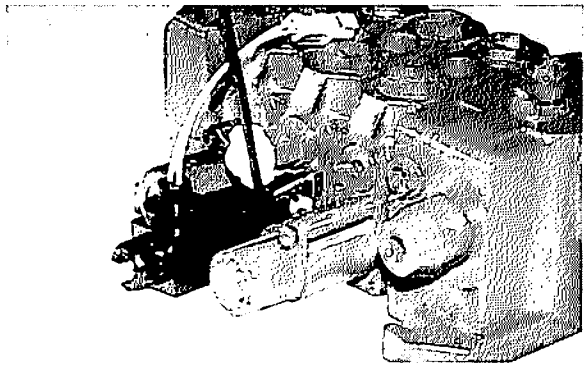
NOTE : Install a vacuum pump on the tank to limit oil leakage during this operation.

Collect possible leaks with a suitable receptacle.

Solenoid control replacement

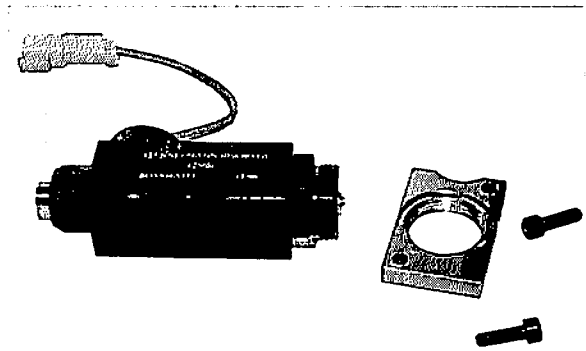
Remove the 2 mounting screws and the solenoid control (5 mm socket wrench).

Reassembly : torque : 10 ± 10% N.m.



Unscrew the mounting plate from the solenoid control.

Reassembly :
- *replace the O-rings on the solenoid control and mounting plate.*
- *torque : 10 ± 10% N.m.*



Repeat the operation on the other side of the distribution element.

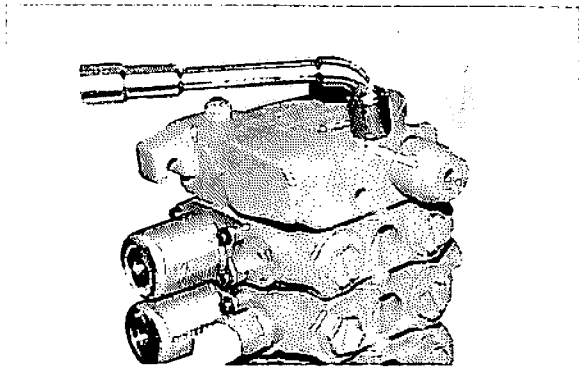
Reassemble parts in reverse order.

https://truckmanualshub.com/

6.9 Control block Disassembly / Assembly

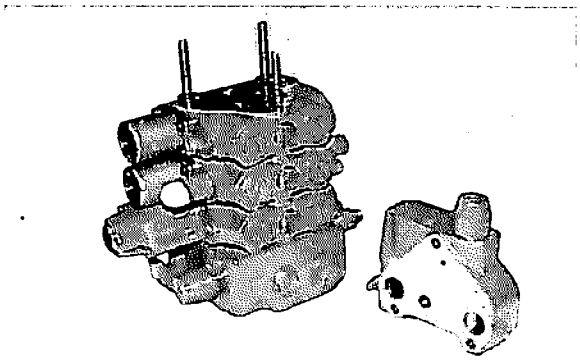
Preliminary operations

Remove the control block from the machine (see § 4).

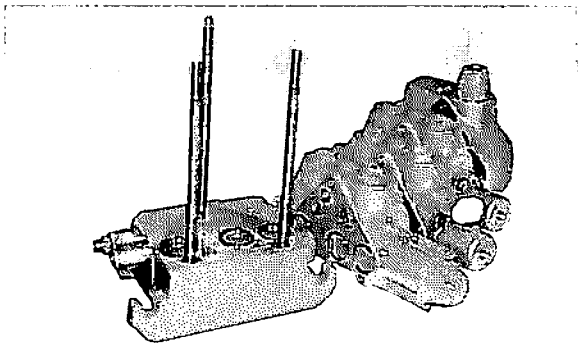


Remove the 3 nuts (16 mm or 17 mm ring wrench)
Reassembly : torque : 42 ± 10% N.m.

Remove the outlet element.



Separate the working sections from the inlet element.
Reassembly :
- *replace the O-rings located between the working sections, the inlet element and the outlet element.*
- *check the cleanliness of the element faces.*
- *place the control block horizontally on an even support area to tight the nuts.*



If the inlet element is to be replaced, remove the tie rods.
Reassembly :
- *make sure that the tie rods are tightened to the specified torque.*

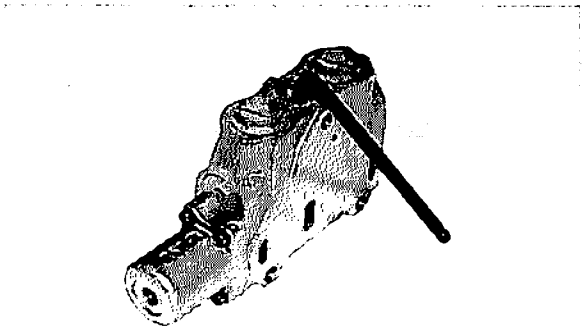
Reassemble parts in reverse order.

https://truckmanualshub.com/

Individual pressure compensator removal

Unscrew the compensator plug (8 mm socket wrench).

Reassembly :
- replace the plug O-ring,
- torque : 60 ± 10% N.m.

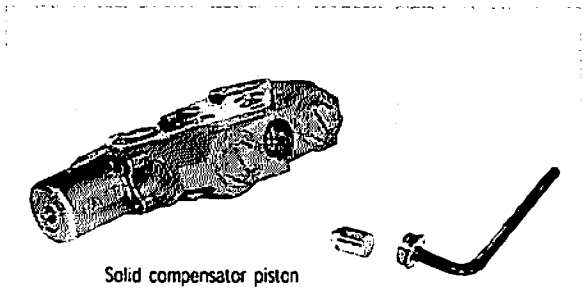


Remove the compensator piston using a magnet to extract it from its bore.

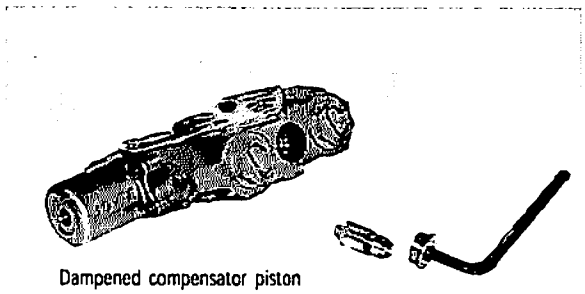
Clean the piston's nozzle with compressed air to remove all traces of pollution.

Check the condition of the bore in the distribution element body.

Reassemble parts in reverse order.



Solid compensator piston

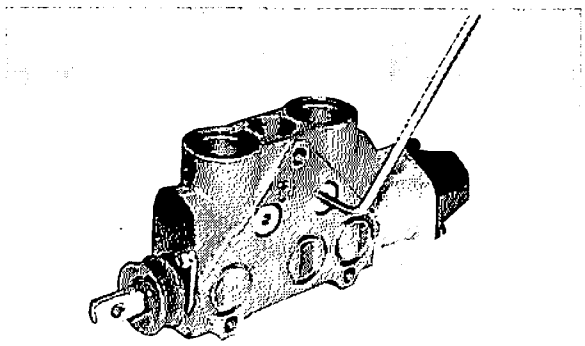


Dampened compensator piston

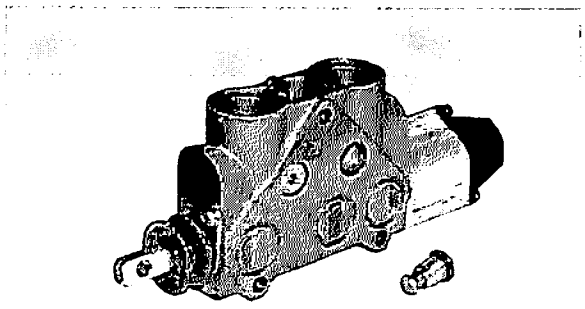
Check valve removal

Unscrew the check valve plug (5 mm socket wrench).

Reassembly :
- replace the plug O-ring.
- torque : 30 ± 10% N.m.



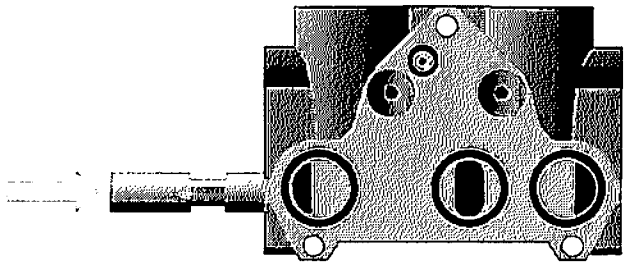
Visually check the condition of parts :
- replace the assembly if necessary.



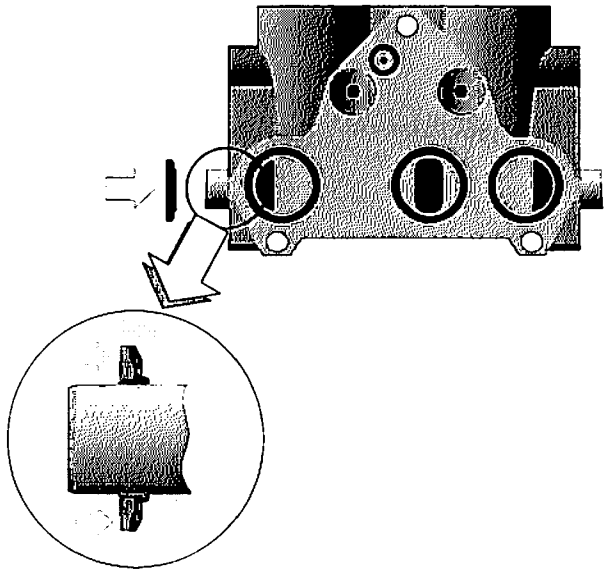
https://truckmanualshub.com/

7 Precaution when replacing the spool lip seal

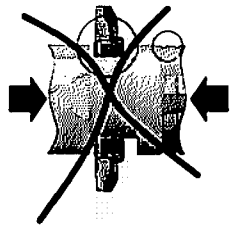
Place the spool in the working section.



Slide the lip seal perpendicularly onto the spool, positioning the metallic part of the lip seal on the outside.



NOTE : The lip seal must be fitted on the end of the spool so that it is not damaged on the spool grooves and its tightness property does not deteriorate.



Bosch Rexroth AG
Hydraulics
Productsegment Axialkolbenmaschinen
Werk Elchingen
Glockeraustraße 2
89275 Elchingen, Germany
Tel. +49 (0) 73 08 82-0
Fax. +49 (0) 73 08 72 74
info.brm-ak@boschrexroth.de
www.boschrexroth.com/brm

Bosch Rexroth DSI S.A.S.
BP 101
91, bd Irène Joliot-Curie
69634 Vénissieux cédex, France
Tel. +33 (0) 4 78 78 52 52
Fax. +33 (0) 4 78 78 52 26
Internet www.boschrexroth.fr

The data specified above only serve to describe the product. No statements concerning a certain condition or suitability for a certain application can be derived from our information.
The details stated do not release you from the responsibility for carrying out your own assessment and verification. It must be remembered that our products are subject to a natural process of wear and ageing.

https://truckmanualshub.com/

Notes

Bosch Rexroth AG
Hydraulics
Productsegment Axialkolbenmaschinen
Werk Elchingen
Glockeraustraße 2
89275 Elchingen, Germany
Tel. +49 (0) 73 08 82-0
Fax. +49 (0) 73 08 72 74
info.brm-ak@boschrexroth.de
www.boschrexroth.com/brm

Bosch Rexroth DSI S.A.S.
BP 101
91, bd Irène Joliot-Curie
69634 Vénissieux cédex, France
Tel. +33 (0) 4 78 78 52 52
Fax. +33 (0) 4 78 78 52 26
Internet www.boschrexroth.fr

The data specified above only serve to describe the product. No statements concerning a certain condition or suitability for a certain application can be derived from our information.
The details stated do not release you from the responsibility for carrying out your own assessment and verification. It must be remembered that our products are subject to a natural process of wear and ageing.

https://truckmanualshub.com/

Notes

Bosch Rexroth AG
Hydraulics
Productsegment Axialkolbenmaschinen
Werk Elchingen
Glockeraustraße 2
89275 Elchingen, Germany
Tel. +49 (0) 73 08 82-0
Fax. +49 (0) 73 08 72 74
info.brm-ak@boschrexroth.de
www.boschrexroth.com/brm

Bosch Rexroth DSI S.A.S.
BP 101
91, bd Irène Joliot-Curie
69634 Vénissieux cédex, France
Tel. +33 (0) 4 78 78 52 52
Fax. +33 (0) 4 78 78 52 26
Internet www.boschrexroth.fr

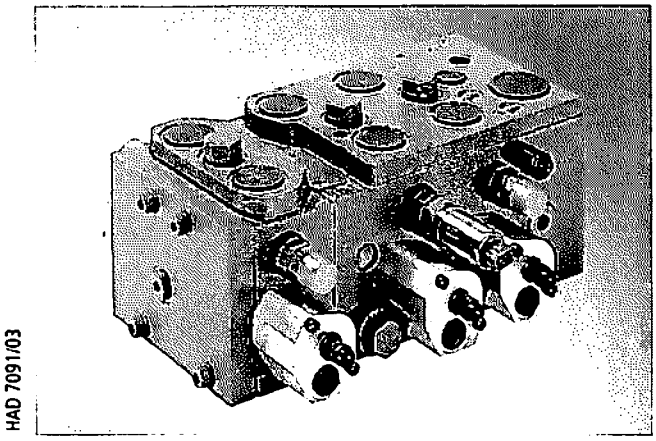
The data specified above only serve to describe the product. No statements concerning a certain condition or suitability for a certain application can be derived from our information.
The details stated do not release you from the responsibility for carrying out your own assessment and verification. It must be remembered that our products are subject to a natural process of wear and ageing.

https://truckmanualshub.com/

RE 64 284/07.03
Replaces: 06.00

High pressure LUDV load-sensing control block of monoblock/sandwich plate design Type M6-15

Nominal size 15
Series 1X
Nominal pressure
– Pump side: 350 bar
– Actuator side: 420 bar
Max. flow
– Pump side: 200 L/min
– Actuator side: 160 L/min



Control block type 3M6-15

Overview of contents

Contents	Page
Features	1
Section, function	2
Characteristic curves	3
Technical data	3
Ordering details	4
Engineering guidelines	5
Unit dimensions	6, 7

Features

System
- Load pressure independent flow distribution LUDV
  - Closed centre version for variable displacement pumps
  - Open centre version for fixed displacement pumps
  - Priority function in the inlet
  - Regenerative function
  - Hydraulically pilot operated check valves (low leakage)
  - Float position function (electrically switchable)
  - Integrated pilot oil supply

Design
- Monoblock/sandwich plate design
  - Inlet element: Basic block 2 axes
  - Expandable via sandwich plates
  - End plate
- Actuator types
  - Hydraulic
  - Electro-hydraulic

Flow
- Load pressure compensated
- High repeatability accuracy
- Low hysteresis
- Adjustable via stroke limiter

Pressure
- Secondary safety
  - Pilot operated, large nominal size compact cartridge valves with combined anti-cavitation function
- LS pressure limitation
  - For the entire block

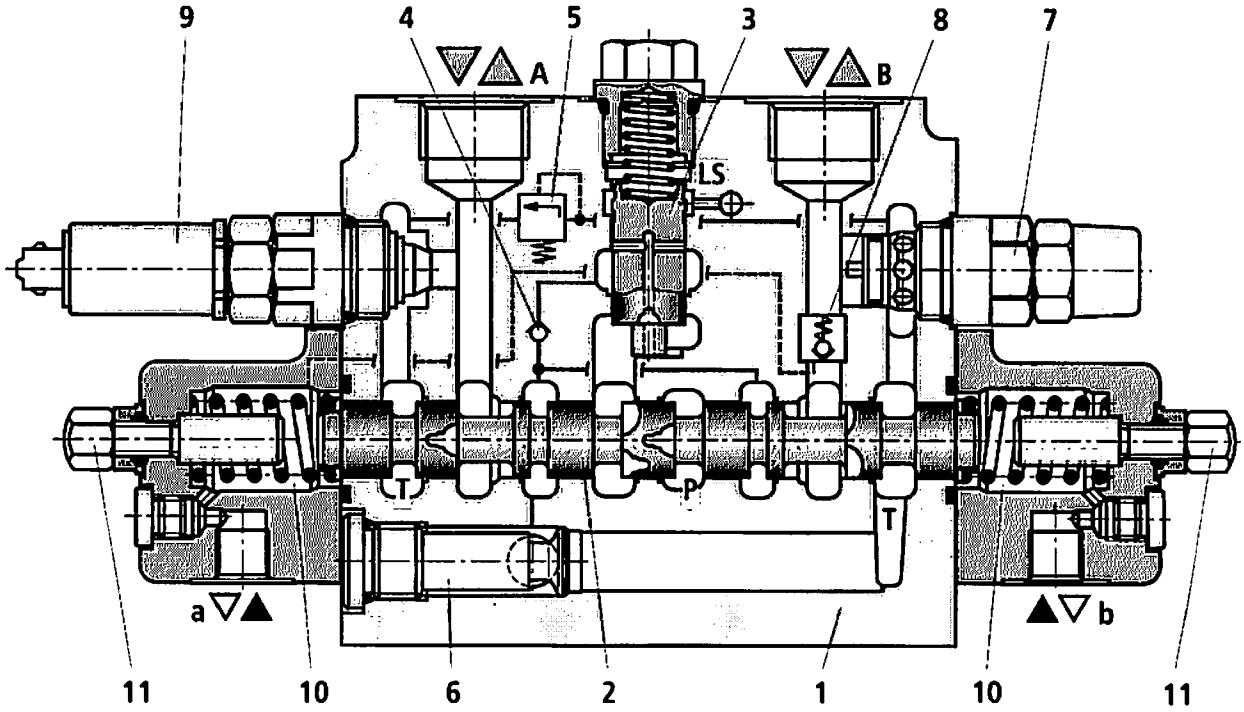
Application areas
- Wheeled loaders
- Tracked graders
- Tracked loaders

© 2003
by Bosch Rexroth AG, Mobile Hydraulics, D-97813 Lohr am Main

All rights reserved. No part of this document may be reproduced or stored, processed, duplicated or circulated using electronic systems, in any form or by means, without the prior written authorisation of Bosch Rexroth AG. In the event of contravention of the above provisions, the contravening party is obliged to pay compensation.

https://truckmanualshub.com/

Section, function



1 Housing
2 Main spool
3 Pressure compensator
4 Load holding valve
5 Regeneration back pressure valve
6 Regeneration feed valve
7 Pressure/anti-cavitation valve
8 Pilot operated check valve
9 Float position valve
10 Spring chamber
11 Stroke limiter

Control block M6-15
Proportional directional valve to the LUDV principle (Lastdruck-unabhänige-Durchfluss-Verteilung / Load pressure-Independent-Flow-Distribution).

Actuator control
At the main spool (2) the direction and volume of flow is determined that flows to the actuator connections (A or B).
The spring chambers (10) are supplied with pilot pressure either via the pilot connections „a" and „b" (hydraulic control) or internally via the integrated pressure reducing valves or switching valves (electro-hydraulic control). The value of the pilot pressure within the spring chamber (10) determines the stroke of the main spool (2).
The pressure compensator (3) controls the pressure differential at the main spool (2) and therefore, the flow to the actuators (A, B).

Load pressure compensation, LUDV
The M6-15 control block works to the LUDV principle. In this load-sensing version the pressure compensators (3) are located between the main spool (2) and the actuator connections (A, B).
The highest load pressure of all of the actuators involved is applied to all of the pressure compensators. In parallel it is also applied to the pump.
Opposite to conventional LS versions with the LUDV there are no unwanted waiting times at individual actuators, if the pump flow is insufficient for all of the functions then all work movements are reduced in speed by the same ratio.

Load holding
Within each function axis a load holding valve is fitted between the pressure compensator (3) and the actuator connections (4).

Leak-free isolation
There are pilot operated check valves (8) integrated into the connections B1 and B2. These are leak-free and prevent the load from dropping even over long periods of time. The check valves are opened via pilot pressure from „a".

Flow limitation
The maximum flow can be individually adjusted via the stroke limiter (11).

Pressure safety, actuator connections
Large nominal size pressure control valves with combined anti-cavitation functions (7) protect the actuators from overloads and cavitation.

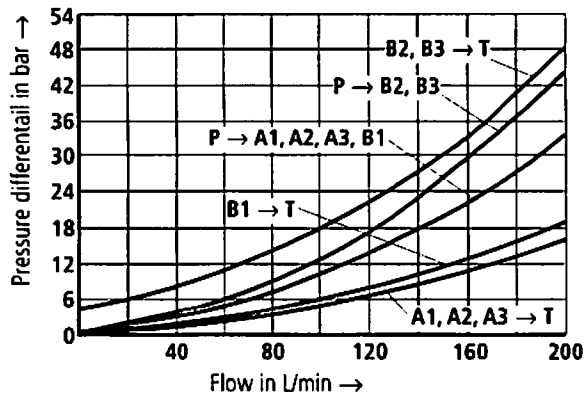
Float position
The float position is obtained by means of a 4-position spool.
Another possibility is the electrically switchable float position valve (9). The float position is switched by actuating and simultaneous operation of the directional spool (2) in the „lowering direction".

Regeneration
To prevent cavitation, with negative loads (e. g. tipping or lowering), the tank port is pre-loaded via valve (5) and is fed with oil via the check valve (6) downstream of the pressure compensator.

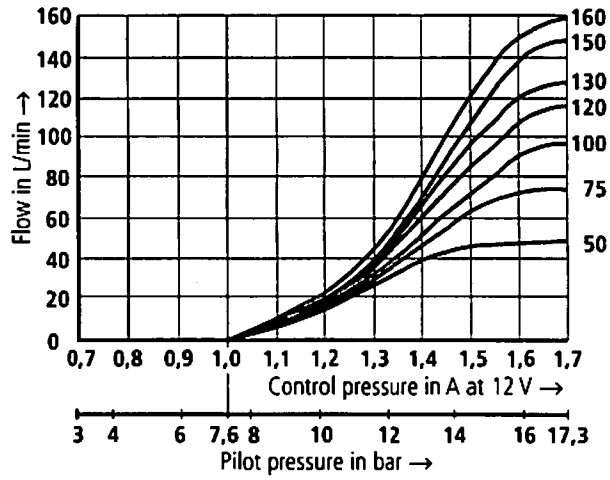
https://truckmanualshub.com/

Characteristic curves

Flow resistance **Pump → actuator**
Actuator → tank



P→ A, B



Technical data (for applications outside these parameters, please consult us!)

General

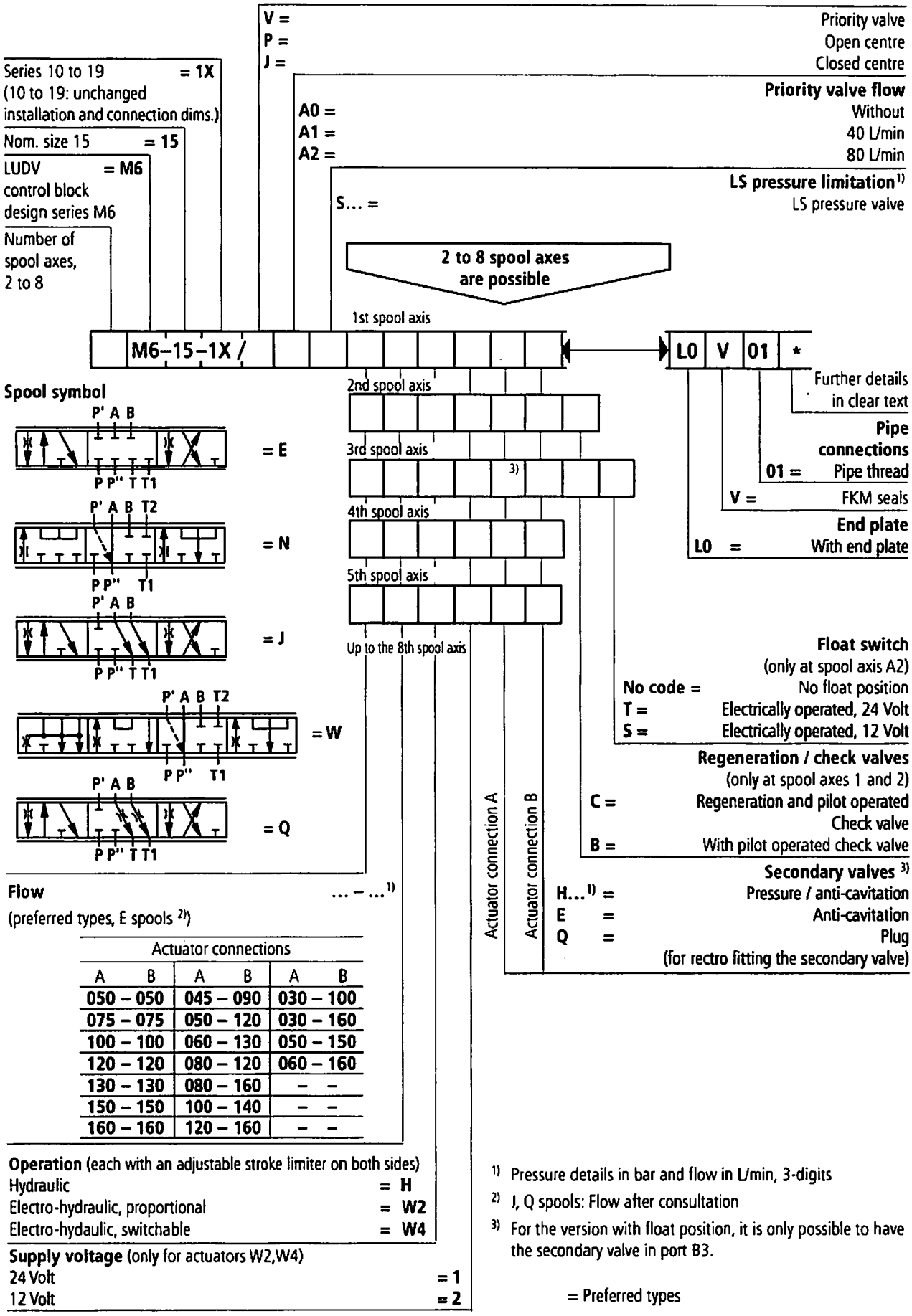
Design			Mixed (monoblock/sanwich plates)		
Installation			Optional		
Connection type			Pipe thread (standard)		
Weight	Description		2-sect. monoblock	Directional valve element	End plate
		kg	32.9	8.5	3.0

Hydraulic

Flow	Port P	$q_{V,\,max}$	L/min	200
	Ports A, B	$q_{V,\,max}$	L/min	160 (load compensated Δp = 16 bar)
Nominal pressure		p_{nom}	bar	350
Max. operating	P	p	bar	350
pressure at port:	A / B / LS	p	bar	420
	T	p	bar	30
	Y	p	bar	At zero pressure to tank
Max. pilot pressure	X	p	bar	35
at port:	a, b	p	bar	35
Pilot pressure range	Hydraulic	p	bar	5.8 to 17.3
	Electro-hydraulic	p	bar	6.0 to 17.3
Pressure fluid				Mineral oil (HL,HLP) to DIN 51 524 Pressure fluids HEES (synthetic ester) to VDMA 24568 as well as pressure fluids as specified within RE 90 221.
Pressure fluid temperature range		ϑ	°C	– 20 to 80
Viscosity range		ν	mm²/s	10 to 380
Degree of contamination (max. permissible)				ISO 4406 (C) class 20/18/15
Electrical pilot control valves				FTWE 2 K...; see RE 58 007 FTDRE 2 K...; see RE 58 032] With plug type Junior Timer (AMP)
Recommended hydraulic pilot control units				4THF 6...; control curve 06, see RE 64 553 2TH 6...; control curve 06, see RE 64 552 4TH 6...; control curve 06, see RE 64 555
Recommended amplifiers (further control possiblities on request)				MHVA2A1X/G..F..; 1 axis, see RE 29 875 MHVA6..12B1X/G..F..; 3 to 6 axes, see RE 29 883 VT11 550..; 1 axis, see RE 29 870 MHVD9-3..A1X/..FF.., see RE 29 873

https://truckmanualshub.com/

Ordering details



Actuator connections					
A	B	A	B	A	B
050	050	045	090	030	100
075	075	050	120	030	160
100	100	060	130	050	150
120	120	080	120	060	160
130	130	080	160	–	–
150	150	100	140	–	–
160	160	120	160	–	–

1) Pressure details in bar and flow in L/min, 3-digits

2) J, Q spools: Flow after consultation

3) For the version with float position, it is only possible to have the secondary valve in port B3.

= Preferred types

https://truckmanualshub.com/

Engineering guidelines

Application (component): .....

Kinematics	Parallel	
	Z	
	Others	

Pump used (type)	
Controller used (designation)	

Open-Centre	
Closed-Centre	

Primary valve, pressure in bar	Yes	
Primary valve	No	
LS - pressure limitation, pressure in bar		

Pilot oil generation	Internal	
Pilot oil generation	External	

No. of actuators	

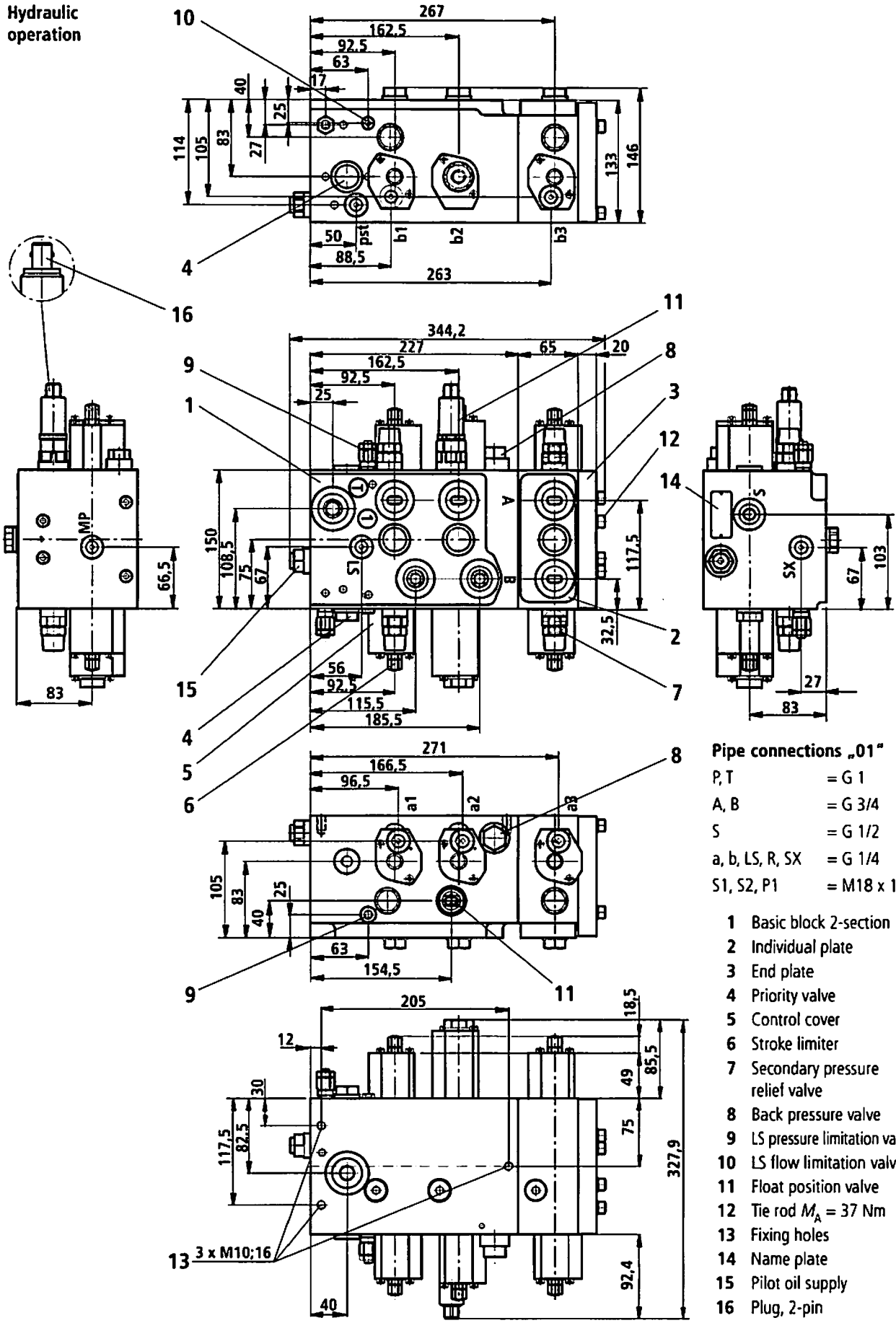
			Axis 1	Axis 2	Axis 3	Axis 4
Spool symbol e.g. "E", "W", "R"						
Flow q_V in L/min	Actuator A					
Flow q_V in L/min	Actuator B					
Secondary valve p in bar	Actuator A					
Secondary valve p in bar	Actuator B					
Feed valve	Actuator A					
Feed valve	Actuator B					
Plug	A side (secondary side)					
Plug	B side (secondary side)					
Hydraulic operation						
Electro-hydraulic operation, proportional						
Electro-hydraulic operation, switchable						
Supply voltage	24 Volt					
Supply voltage	12 Volt					
Pilot operated check valve (only on B1, B2)						
4-position spool (only on axis 2)						
Float position valve, electrical operation	24 Volt					
Float position valve, electrical operation	12 Volt					

Other details in clear text	

https://truckmanualshub.com/

Unit dimensions (dimensions in mm)

Hydraulic operation



Pipe connections „01"

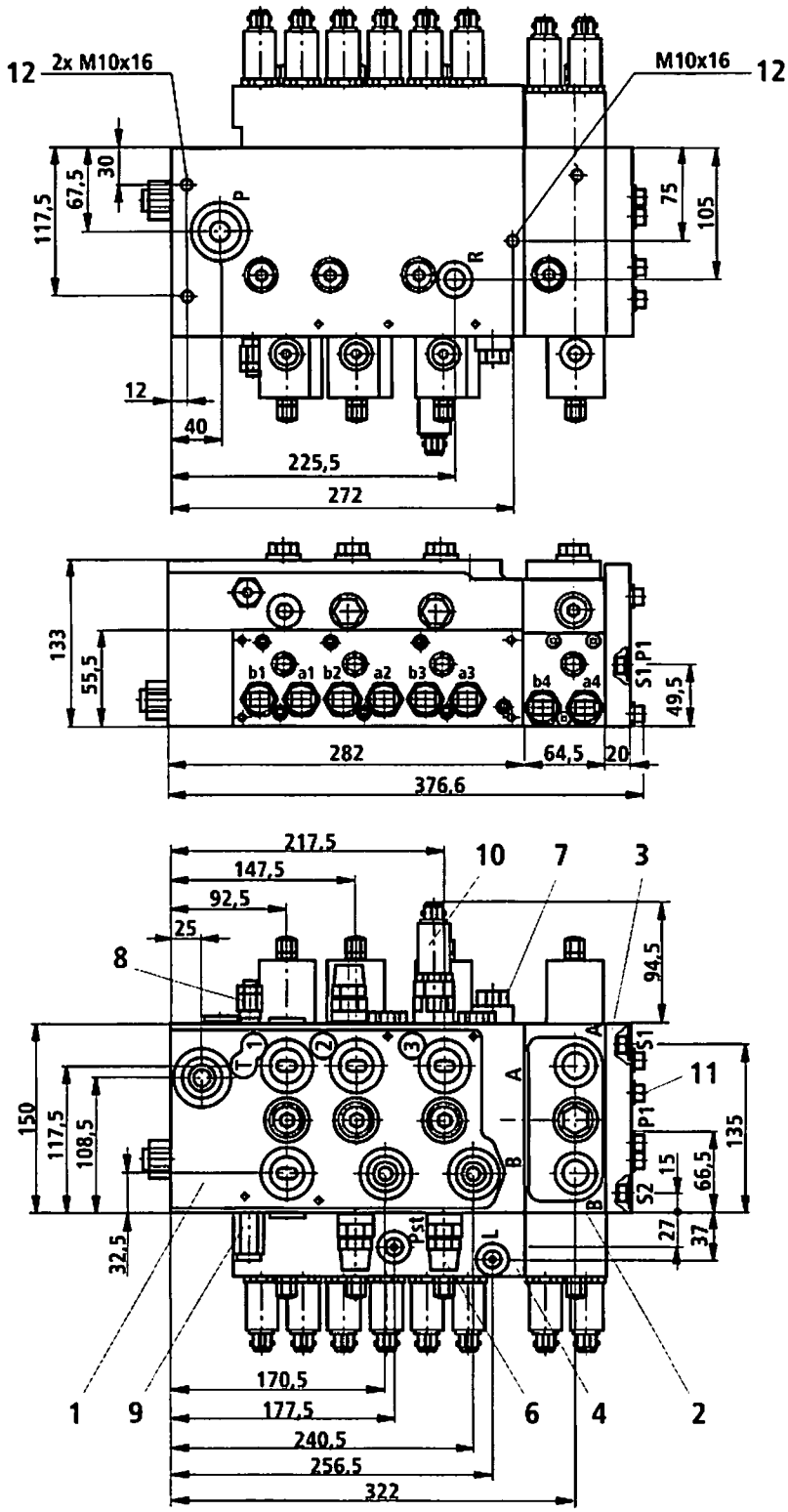
P, T	= G 1
A, B	= G 3/4
S	= G 1/2
a, b, LS, R, SX	= G 1/4
S1, S2, P1	= M18 x 1.5

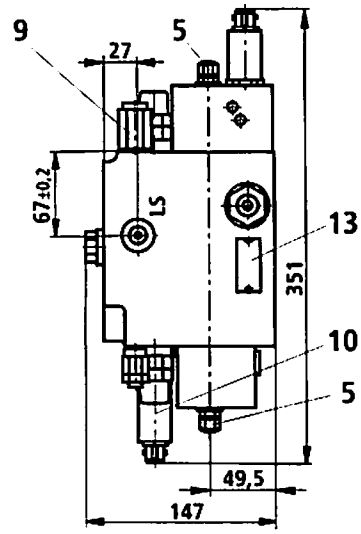
1 Basic block 2-section
2 Individual plate
3 End plate
4 Priority valve
5 Control cover
6 Stroke limiter
7 Secondary pressure relief valve
8 Back pressure valve
9 LS pressure limitation valve
10 LS flow limitation valve
11 Float position valve
12 Tie rod M_A = 37 Nm
13 Fixing holes
14 Name plate
15 Pilot oil supply
16 Plug, 2-pin

https://truckmanualshub.com/

Unit dimensions (dimensions in mm)

Electro-hydraulic operation





Pipe connections „01"

P, T	= G 1
A, B	= G 3/4
L, LS, Pst, R	= G 1/4
S1, S2, P1	= M18 x 1.5

1	Basic block 3-section
2	Directional valve element
3	End plate
4	Control cover
5	Stroke limiter
6	Secondary pressure relief valve
7	Back pressure valve
8	LS pressure limitation valve
9	LS flow limitation valve
10	Float position valve
11	Tie rod M_A = 37 Nm
12	Fixing holes
13	Name plate

https://truckmanualshub.com/

Notes

Bosch Rexroth AG
Mobile Hydraulics
Produktbereich Mobile Controls
D-97813 Lohr am Main
Zum Eisengießer 1 • D-97816 Lohr am Main
Telefon 0 93 52 / 18-0
Telefax 0 93 522 / 18-23 58 • Telex 6 89 418-0
eMail info.brm-mc@boschrexroth.de
Internet www.boschrexroth.com/brm

The data specified above only serves to describe the product. No statements concerning a certain condition or suitability for a certain application can be derived from our information. The details stated do not release you from the responsibility for carrying out your own assessment and verification. It must be remembered that our products are subject to a natural process of wear and ageing.

https://truckmanualshub.com/

Trainingscourse Electric

A91 V2
A81

https://truckmanualshub.com/

Index

1. Cable harness 3

2. DIGSY Connector 8
Compact E I/O Stecker 8
Compact E CPU Connector 9
CGM 10 Pin Connector 10
CGM 6 Pin Connector 10
CGM Status-LEDs 10
CGM (display) 13
DCE (DIGSY Compact E) 13

3. Stored variables 13
CGM (Display) 13
Compact E 13
ECU (engine) 14

4. Replacing electronic control system 15
Replacement of display unit ONLY (CGM) 15
Replacement of Compact E ONLY (DCE) 16
Replacement of DCE AND CGM 16
Modifications when replacing the ECU 17
After replacing the complete engine 17

5. Calculating the operating hours 18
Operating hours menue 18
Calculating the operating hours 19

6. Protecting engine by speed reduction 20
Coolant temperature 20
Oil pressure 20
Intake air temperature 20
Diesel temperature 20

7. Error detection sensors and switches 21
Indication on display 21
Effect on machine 22
Measured values 22

8. Error detection Sensors / Engine 23

9. Error detection Sensors /
Air-condition unit 24

10. Service entry in CGM 25

11. Recall data with CGM 26
How does it work 28
Stored coolant temperature 30
Stored hydraulic temperature 31

12. Informationen about CGM 32
unchanging engine hours 32
fuel lever alarm 32
pleas contact service 33

13. Cable harness on JD engine (incl. ECU) 34

14. Errordiagnostics CAN bus 39

15. Programming CGM and DCE
with bootlaoder 41

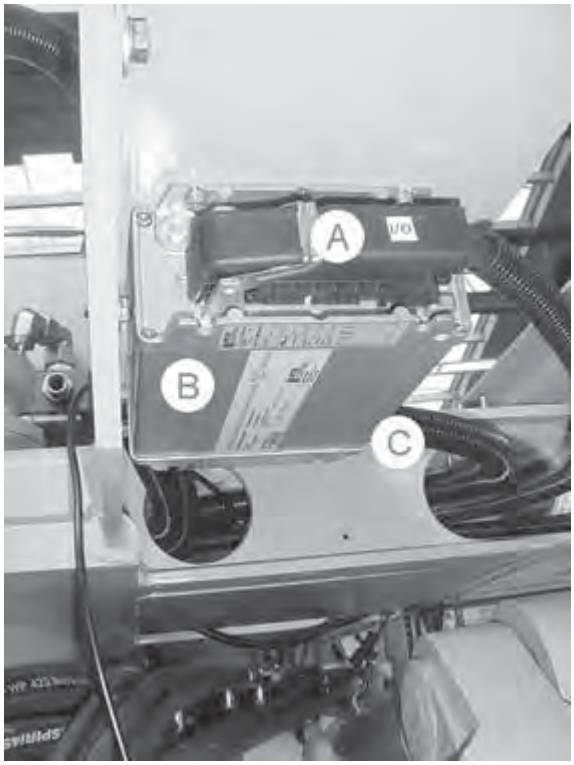
16. Additional information 47
Elektrics 47
Engine and ECU elektrics 47
Service documentation 47

17. Changes 48

https://truckmanualshub.com/

1. Cable harness

The photographs in this document show where the sensors and connectors are located in the machine.

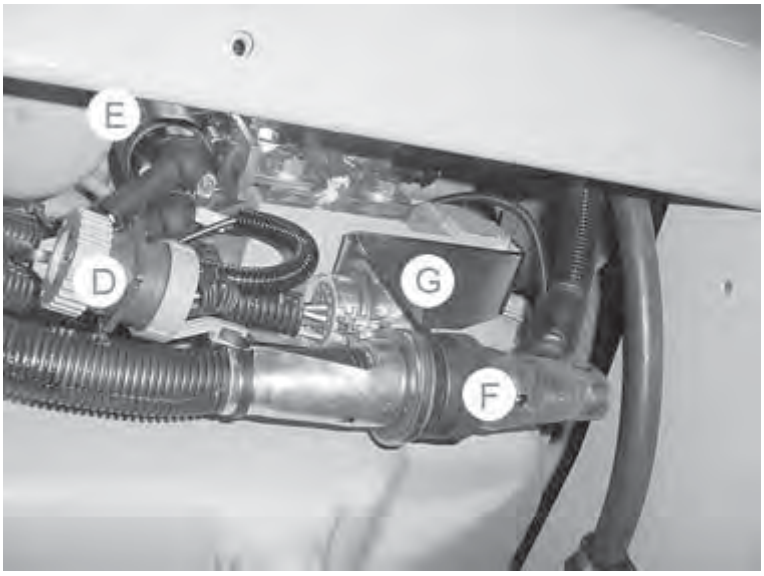


A = DIGSY COMPACT E I/O connector

B = DIGSY COMPACT E

C = DIGSY COMPACT E CPU connector

https://truckmanualshub.com/

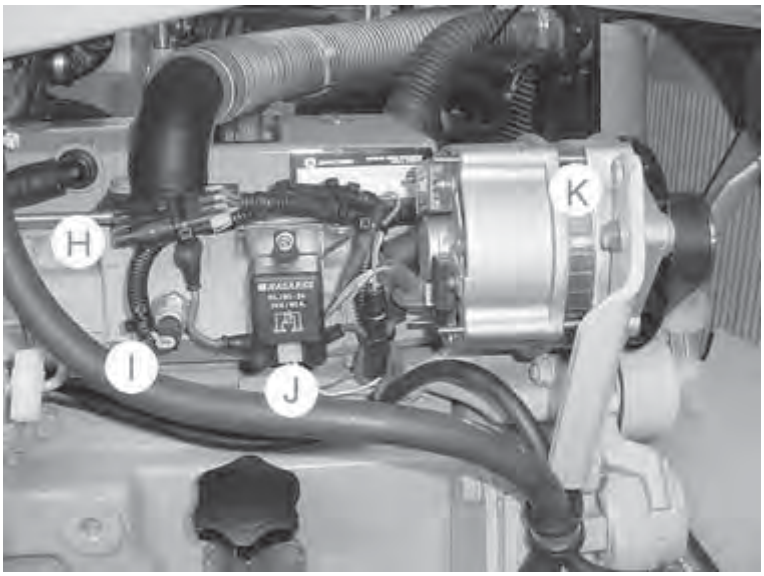


D = This connector will be used for ECU-diagnose. Diagnose can be made by laptop (DST Software) or handheld (Murphy Gauge.

E = Starter relay (The picture shows the old type, actual the relais is the same type as the air heater relais)

F = Interface between engine cable harness and machine cable harness (DIGSY, ignition, etc.)

G = Interface for engine auxiliary functions (not assigned)



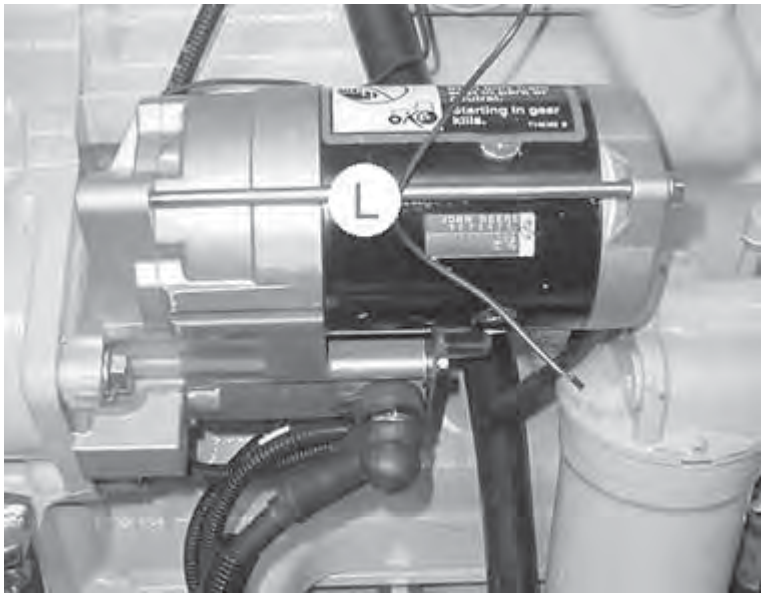
H = Air heater

I = Intake air temperature sensor

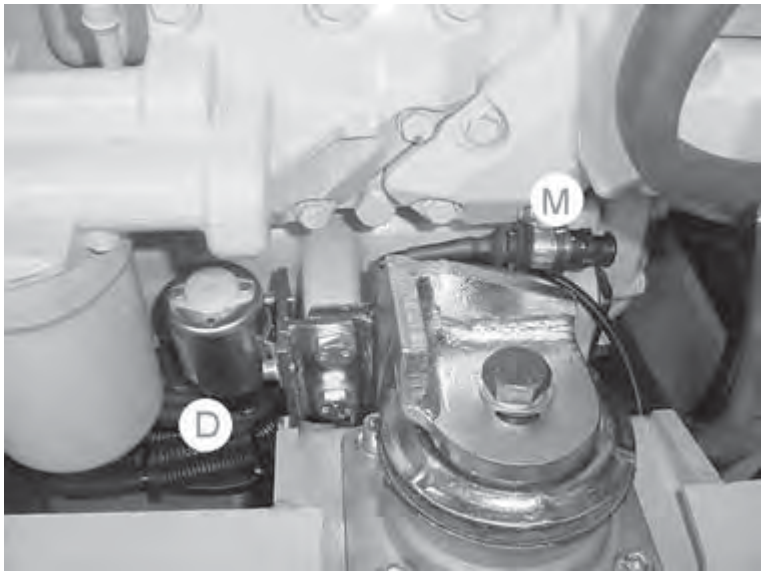
J = Air heater relay

K = Alternator

https://truckmanualshub.com/



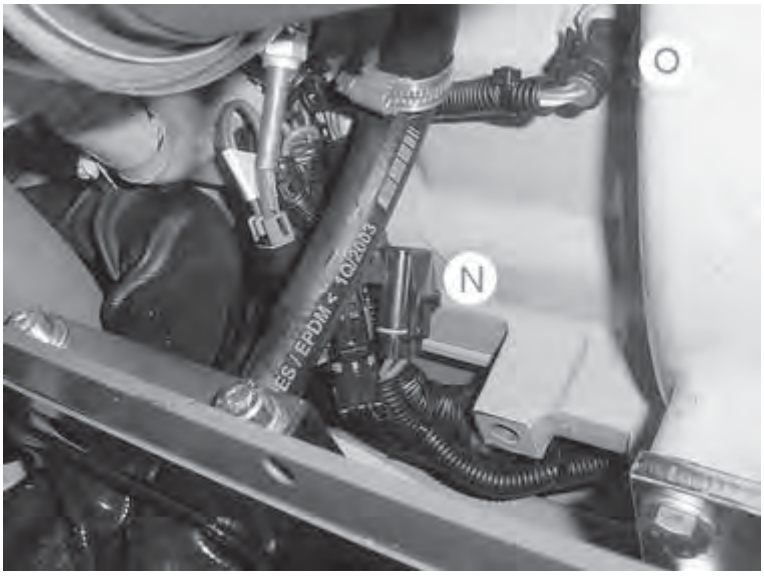
L = Starter



D = Starter relay

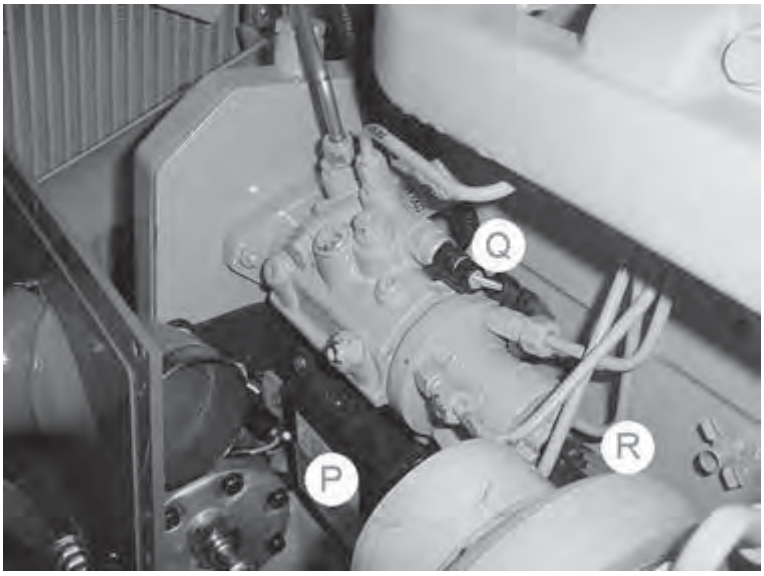
M = Socket for emergency throttle

https://truckmanualshub.com/



N = Connector (with tab) with 10 A fuse to protect the steady plus on the ECU

O = Oil pressure sensor



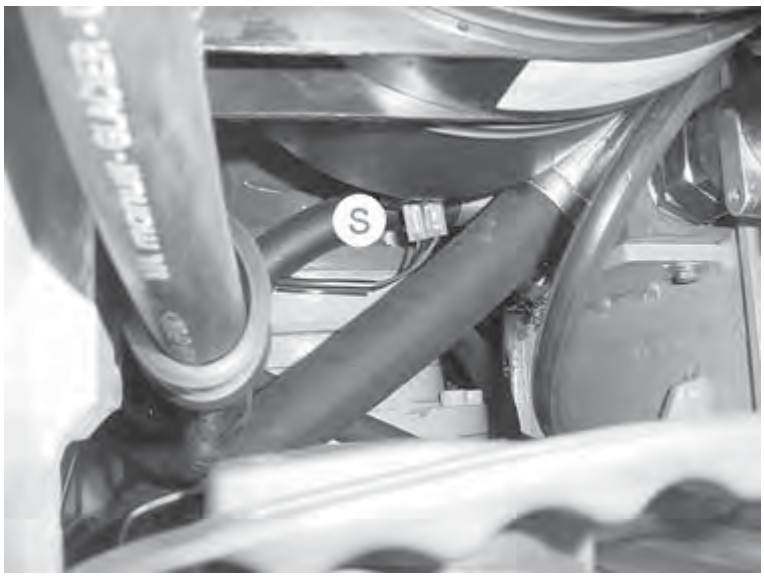
P = ECU

Q = fuel temperature sensor

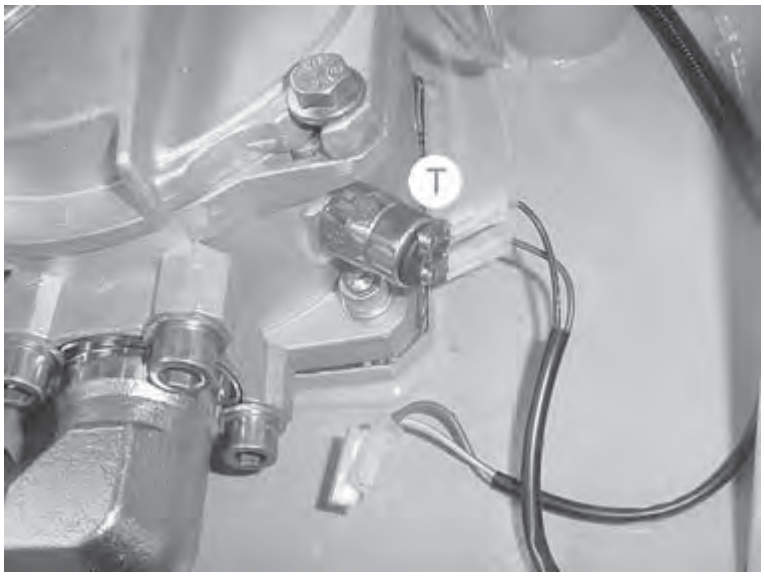
R = fuel control solenoid connector

Not shown on photo:
The coolant temperature sensor is located on the thermostat housing.

https://truckmanualshub.com/



S = Switch, diesel engine's air intake filter soiled



T = Switch, Hydraulic return filter soiled

https://truckmanualshub.com/

2. DIGSY Connector



Compact E I/O Connector

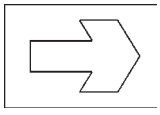
Pin	Colour	A	Signal
1	yellow	1.0	Terminal 15 24 V power supply
4	no. 1	0.75	Fuel indicator signal (with bridge to pin 15)
5	no. 3	0.75	Hydraulic oil temperature (with bridge to pin 16)
8	no. 4	0.75	Hydraulic oil temperature ground
11	brown	1.0	Ground
12	brown	0.34	CAN low: A91B/C: Bus cable to engine A81/A91D: Bus cable to CGM
13	white	0.34	CAN high: A91B/C: Bus cable to engine A81/A91D: Bus cable to CGM
14	shield		CAN bus shield: A91B/C: Bus cable to engine A81/A91D: Bus cable to CGM
15			Fuel gauge sensor power supply (with bridge to pin 4)
16			Hydraulic oil temperature power supply (with bridge to pin 5)
29	brown	1.0	Ground
31			CAN termination (with bridge to pin 32)
32			CAN termination (with bridge to pin 31)
37	no. 2	0.75	Fuel gauge sensor ground
39	black/white	0.75	Indicator signal left
40	black/green	0.75	Indicator signal right
41	white/blue	1.5	Floodlight signal
42	no. 12	0.75	2nd gear signal
43	blue/red	0.75	Automatic idle system signal
44	white	0.5	Fixed speed 1 (cable ws connected to relevant pin)
45	white	0.5	Fixed speed 2 (cable ws connected to relevant pin)
46	white	0.5	Fixed speed 3 (cable ws connected to relevant pin)
47	brown	1	Ground

https://truckmanualshub.com/

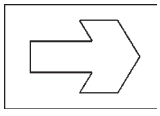


Compact E CPU Connector

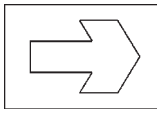
Pin	Colour	A	Signal
1	yellow	1.0	Switched battery +24 V power supply
4	grey	0.5	Tap potentiometer gas (0.5 V)
9	purple/yellow		Central lubrication signal status display
10	green/black	0.75	Central lubrication signal level check
11	brown	1.0	Ground
12	brown	0.34	CAN low: A91B/C: Bus cable to CGM A81/A91D: Bus cable to engine
13	white	0.34	CAN high: A91B/C: Bus cable to CGM A81/A91D: Bus cable to engine
14	shield		CAN bus shield: A91B/C: Bus cable to CGM A81/A91D: Bus cable to engine
18	white	0.25	RS-232 interface receive connection to pin 3 D-Sub (9-pin)
20	red	1.0	Unswitched battery 30 +24 V
28			Break monitoring
29	brown	1.0	Ground
31			CAN termination (with bridge to pin 32)
32			CAN termination (with bridge to pin 31)
36	brown	0.25	RS-232 interface send (connection to pin 2 D-Sub (9-pin))
37	shield		RS-232 interface ground(connection to pin 5 D-Sub (9-pin))
38	blue/green	1.0	Switched battery (signal ignition on/off)
39	no. 5	0.75	Diesel engine's air intake filter soiled Signal
40	no. 6	0.75	Hydraulic return filter soiled Signal
41	green	0.75	Overload sensor signal
42	no. 7	0.75	Level signal coolant
43	blue/white	0.75	Air heater check signal
47	brown	1.0	Ground
48	red/white	0.75	Alarm buzzer
49			Break valve



If pin 1 on I/O connector (=VIQ2) is not connected to power supply all analog outputs and digital in- and outputs will not work.

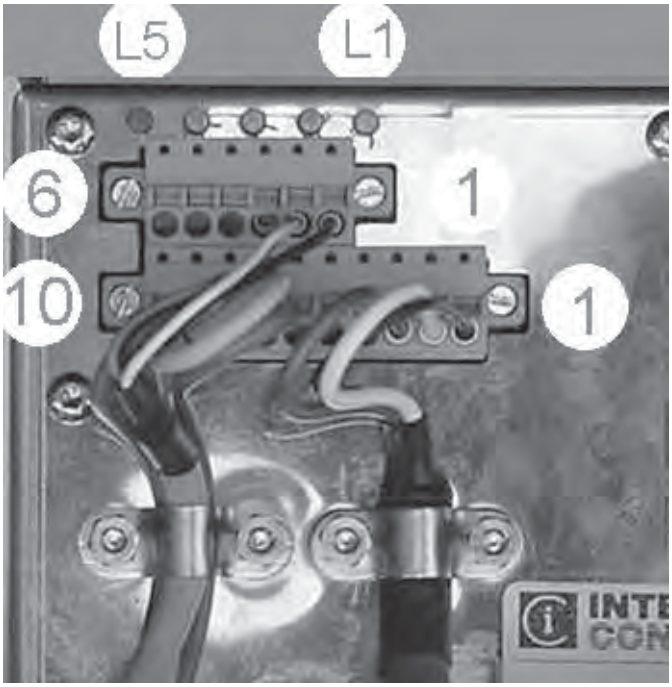


All not used cables have to be pull out the connector. Do not cut them because the accrue short cable receive the radiation of mobile phones. This causes troubles.



Do not mount a recovery doide on a PWM output beacuse this causes false measurements. Because there is already mount a recovery diode inside the device.

https://truckmanualshub.com/



CGM 10 Pin Connector

Pin	Colour	A	Signal
1	shield		Bus cable to Compact (CAN bus shield)
2	white	0.34	Bus cable to Compact (CAN low)
3	brown	0.34	Bus cable to Compact (CAN high)
7	brown	0.75	Ground
9	yellow	0.75	Switched battery 24 V (ignition on/off)
10	red	0.75	Unswitched battery 24 V (steady plus)

CGM 6 Pin Connector

Pin	Colour	A	Signal
1	shield		RS-232 shield connection to pin 5 D-Sub (9-pin)
2	white	0.25	RS-232 output send connection to pin 2 D-Sub (9-pin)
3	brown	0.25	RS-232 input receive connection to pin 3 D-Sub (9-pin)
6	-	-	Only Optional: Power supply for time and date

CGM Status-LEDs

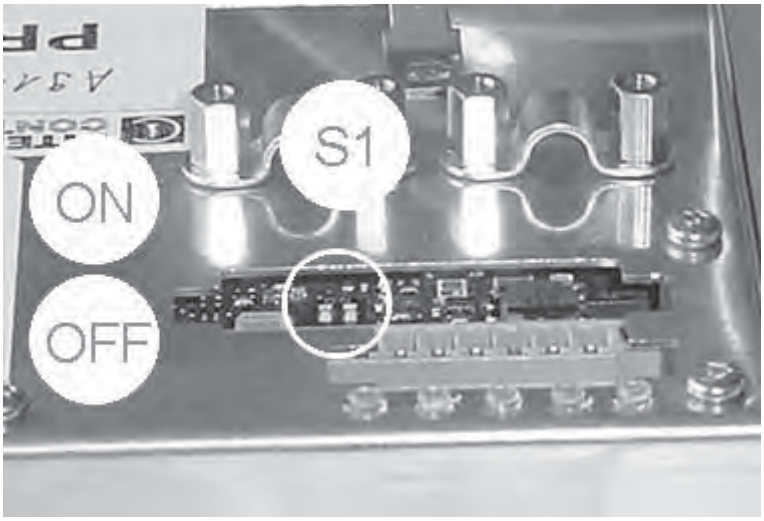
LED	Designation	LED no.	Description
L1	VIM LED	D16	+24 V power supply to processor PCB
L2	5V LED	D7	Status of logic voltage
L3	DIAG LED	D9	CGM sequence status
L4	CAN LED	D10	Status of CAN bus
L5		D11	Not fitted

https://truckmanualshub.com/

VIM LED	5V LED	DIAG LED	CGM status	Diagnosis/Remedy
off	off	off	CGM not running	No power supply
off	on	on		VIM LED faulty
orange	green	—	5 V voltage OK	
orange	red	red/orange	CGM not running	Internal voltage < 4.65 V Check external power supply (if VIM LED glowing), may need to be sent back to manufacturer for testing.
orange orange	off off	off red, yellow, orange	CGM not running 5 V LED faulty	No internal power supply, may need to be sent back to manufacturer for testing
orange	red/green flashing or transient red	red/green flashing or transient red	Mains failure or watchdog Note: Once it has flashed 5 times, the LED will turn red and stay red (permanent RESET error)	Overwrite/deletion of AWP due to primary system error, send control system back to manufacturer unchanged with detailed description of error
orange	green	permanent red (usually red during start-up)	System error due to permanent RESET Checksum error firmware Checksum error software Checksum error graphics data RAM error	Reload of AWP or graphics module or primary system error, send control system back to manufacturer unchanged with detailed description of error
orange	green	green	AWP loaded/started	All OK
orange	green	orange	Download active	All OK

CAN LED	Bus status	CAN status	Diagnosis/Remedy
off	Bus OFF	No CAN configuration block or currently no reception via CAN	Check configuration or check plug-in connectors
green (flashing)	active	CAN bus active receiving and sending messages	
orange (flashing)	Start-up or not operational	CGM in CAN start-up or preoperational	If LED does not turn green: You may need to check node states or bus
red	Passive error BUS OFF	Error	Check configuration, emergencies, hardware connections

https://truckmanualshub.com/



CGM terminating resistor

The switch for the terminating resistor located inside the housing is not directly visible. However, this switch becomes visible and can be activated once the 10-pin connector has been unplugged.

Push the switches back to activate the terminating resistor. If the switches are in the forward position, the terminating resistor is not active.

If the terminating resistor is not active, errors and error messages will be generated sporadically because the CAN bus is not in a stable state.

https://truckmanualshub.com/

3. Stored variables (from Vers. 02-00)

CGM (display)

- Error memory
- Value memory with stored max. temperatures and extreme values for battery voltage
- Average diesel consumption
- Languages

The following values are written to the CGM on shutdown:

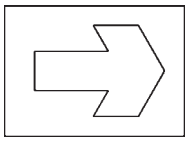
- Service interval
- Next service in (= hours until next service)
- Old engine hours
- Offset

DCE (DIGSY Compact E)

- Low idle speed
- Speed limiting
- Fixed speed
- Engine speed control

Once the engine has been running for 5 seconds, the following values are written to the DCE by the CGM on shutdown:

- Service interval
- Next service in (= hours until next service)
- Old engine hours
- Offset

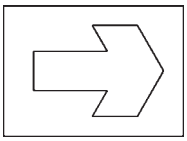


The sensors are connected either directly to the Compact E or to the ECU.
If they are connected to the ECU, the sensor signals are sent to the DIGSY Compact as data packets via the CAN bus.
The alarm device is connected to the Compact E.

https://truckmanualshub.com/

ECU (engine)

- Engine hours
- Serial number
- Error codes
- Other data that can only be read out by JD



The operating hours are not the same as the engine hours (see Chapter 4).
The display functions in the same way as a drag indicator. This means that even in the event of the total failure of an ECU, the operating hours meter can be read for the purpose of reprogramming.

https://truckmanualshub.com/

4. Replacing electronic control system

As the simplification of the way in which operating hours are calculated has increased the risk of operating hours being manipulated, all major changes (ECU replacement or engine change) must be recorded in the machine log. This means that even in the event of a total loss of data on the CGM or DCE, the actual operating hours can still be calculated.

Replacement of display unit ONLY (CGM)

1. Make a note of the operating hours and hours until the next service.
2. Switch off the ignition.
3. Change the CGM (new or reprogrammed CGM).
4. Switch on the ignition and wait for the control system to start up completely.
5. In the Service menu, press and hold down F3 whilst pressing F2 at the same time (a corresponding symbol does not appear on the screen) in order to write the values from the DCE to the CGM.
6. Switch off the ignition and wait for 5 seconds once the screen goes out (whilst the values are saved).



The engine must NOT be started at this point.

7. Switch on the ignition and wait for the control system to start up completely.
8. Start the engine and let it turn over for 5 seconds.
9. Switch off the ignition and wait for 5 seconds once the screen goes out.
10. Switch on the ignition and check the operating hours and hours until the next service.
11. Switch off the ignition.

If the hours until the next service displayed do not tally with the actual hours until the next service, the hours until the next service can be corrected by entering the service code repeatedly.

The values from the values memory and the two error memories must be recorded in the machine log. This data can also be read out once the CGM has been disassembled at Menzi Muck.

https://truckmanualshub.com/

Replacement of Compact E ONLY (DCE)

1. Make a note of the operating hours and hours until the next service.
2. Switch off the ignition.
3. Change the DCE (new or reprogrammed DCE).
4. Switch on the ignition and wait for the control system to start up completely.
5. Start the engine and let it turn over for 5 seconds.
6. Switch off the ignition and wait for 5 seconds once the screen goes out (whilst the values are saved).
7. Switch on the ignition and wait for the control system to start up completely.
8. In the Service menu, press and hold down F3 whilst pressing F2 at the same time (a corresponding symbol does not appear on the screen) in order to write the values from the DCE to the CGM for checking.
9. Switch off the ignition and wait for 5 seconds once the screen goes out.
10. Switch on the ignition and check the operating hours and hours until the next service.
11. Switch off the ignition.



If the hours until the next service displayed do not tally with the actual hours until the next service, the hours until the next service can be corrected by entering the service code repeatedly.

Replacement of DCE AND CGM at the same time

If the control systems are already running software version 91-02-00 or later, the DCE can be replaced first, then the procedure described above followed and finally the CGM can be replaced and the procedure described above followed.

If this is not possible, all values stored in the DCE and CGM must be written off (see Chapter 3).

https://truckmanualshub.com/

Modifications when replacing the ECU

1. Switch on the ignition.
2. Make a note of the operating hours.
3. Switch off the ignition.
4. Change the ECU (new ECU with 0h or old ECU with x hours).
5. Switch on and wait for start-up to complete.
6. Open the Operating Hours menu.
7. Press F3.
8. Modify the offset to reflect the difference between the old and new ECU.
9. Check that the operating hours tally with the current value.
10. Switch off the ignition (whilst the values are saved).
11. Start the engine and wait for 5 seconds.
12. Switch off the ignition and wait for 5 seconds once the screen goes out.
13. Switch on the ignition and wait for the control system to start up completely.
14. In the Service menu, press and hold down F3 whilst pressing F2 at the same time (a corresponding symbol does not appear on the screen) in order to write the values from the DCE to the CGM for checking.
15. Switch off the ignition and wait for 5 seconds once the screen goes out.
16. Switch on the ignition and check the operating hours and hours until the next service.
16. Switch off the ignition.



If the hours until the next service displayed do not tally with the actual hours until the next service, the hours until the next service can be corrected by entering the service code repeatedly.

Modifications when replacing the complete engine

1. Switch on the ignition.
2. Make a note of the operating hours.
3. Switch off the ignition.
4. Change the engine (ECU or old ECU with x hours).
5. Switch on and wait for start-up to complete.
6. Open the Operating Hours menu and press F2.
8. Check that the operating hours tally with the current value.
   If the values are not correct, they can be corrected with the offset.
9. Switch off the ignition (whilst the values are saved).
10. Switch on the ignition and wait for the control system to start up completely.
11. Start the engine and wait for 5 seconds.
12. Switch off the ignition and wait for 5 seconds once the screen goes out.
13. Switch on the ignition and wait for the control system to start up completely.
14. In the Service menu, press and hold down F3 whilst pressing F2 at the same time (a corresponding symbol does not appear on the screen) in order to write the values from the DCE to the CGM for checking.
15. Switch off the ignition and wait for 5 seconds once the screen goes out.
16. Switch on the ignition and check the operating hours and hours until the next service.
17. Switch off the ignition.

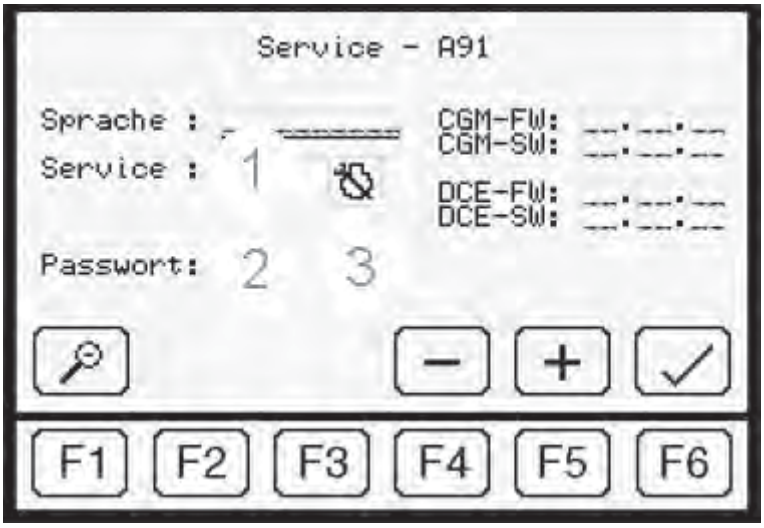
https://truckmanualshub.com/

5. Calculating the operating hours

Operating Hours menu (for Menzi service personnel only)

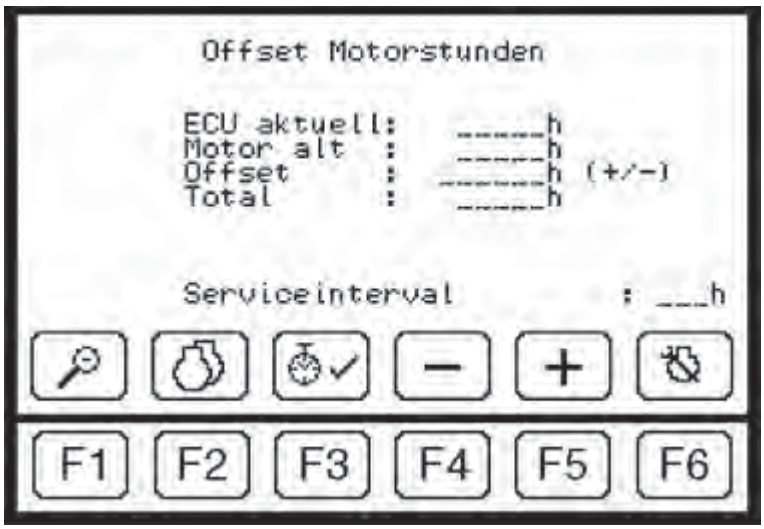
The Operating Hours menu can be accessed by entering a password under Item 3 in the Service menu. Press F6 repeatedly until the pointer points to the last group of four.

However, the operating hours code is stored solely in the engineering in order to prevent tampering. This code must not be issued and, in the event that ECU or engine is replaced outside Germany or, a display can be substituted in order that the code remains confidential.



Not for the costumer

https://truckmanualshub.com/



Calculating the operating hours

ECU actuel	Hours sent by the ECU
Motor old	Engine hours of old engine. Calculated automatically when F2 is pressed
Offset	Correction factor
Total	Calculated operating hours for machine
Service interval	Service interval in hours
F1	Back to Service menu
F2	Key pressed AFTER engine has been replaced. „Total“ value is written to „Old engine“ and offset deleted.
F3	Recalculate „Total“ using current ECU hours. (reset drag indicator)
F4	Reduce offset
F5	Increase offset
F6	Modify service interval between 50 hours and 500 hours

Not for the costumer

https://truckmanualshub.com/

6. Protecting the engine via speed reduction

Coolant temperature

108°C	5% power reduction
113°C	40% power reduction
118°C	60% power reduction

Oil pressure

Low speed	High speed	
165 kPa	350 kPa	40% power reduction
135 kPa	280 kPa	60% power reduction

Intake air temperature

With charge cooler (downstream of charge cooler):

100°C	20% power reduction

Without charge cooler:

150°C	20% power reduction

Diesel temperature

120°C	20% power reduction

https://truckmanualshub.com/

7. Error detection sensors and switches

Indication on display

Sensor/Switch	Cable break	Short circuit
Hydraulics temperature	-20°C	0°C
Hydraulicfilter pressure	No symbol	„Return filter soiled“
Fuel indicator sensor	Tank empty	Tank full
Battery voltage	No display	No display
Intake air diesel engine	No symbol	„Intake filter soiled“
1st/2nd gear	No symbol	Fuse blows = No signal
Coolant level	„Level tool low“	No symbol
Indicator	No symbol	Fuse blows = No signal
Overload warning	No signal	Constant signal
Light	No symbol	Floodlight fuse blows = No signal
Central lubrication active	No symbol	Fuse blows = No signal
Central lubrication level	No symbol	Fuse blows = No signal
CAN bus to display	„CAN“	„CAN“
CAN bus to engine (with emergency gas resistor)	Speed = 0 rpm Coolant = -40°C No engine oil pressure (as n=0 rpm)	Speed = 0 rpm Coolant = -40°C No engine oil pressure (as n=0 rpm)
Terminating resistor in CGM switched off	Sporadic appearance of „CAN“ error message	Sporadic appearance of „CAN“ error message

https://truckmanualshub.com/

Effect on machine

Sensor/Switch	Cable break	Short circuit
Hydraulics temperature	Speed limited to 1500 rpm as temp. <10°C	Speed limited to 1500 rpm as temp. <10°C
CAN bus to motor (with emergency gas resistor)	Speed = 0 rpm Coolant temperature = -40°C No engine oil pressure (as n=0 rpm) n engine = approx. 1600 rpm	Speed = 0 rpm Coolant temperature = -40°C No engine oil pressure (as n=0 rpm) n engine = approx. 1600 rpm
CAN bus to motor (no emergency gas resistor)	Speed = 0 rpm Coolant temperature = -40°C No engine oil pressure (as n=0 rpm) n engine = approx. 900 rpm	Speed = 0 rpm Coolant temperature = -40°C No engine oil pressure (as n=0 rpm) n engine = approx. 900 rpm

Measured values

Hydraulics temperature	-20°C = 5 Kohm +60°C = 134 ohm	+20°C = 677 ohm +90°C = 51.2 ohm ± 4.3 ohm
Hydraulicfilter pressure	Soiled = Switch closed	Clean = Switch open
Fuel indicaotr sensor	Tank full 1.5 ohm ± 0.4 ohm	Tank empty 80.6 ohm ± 1.8 ohm
Intake air filter Diesel engine	Soiled = Switch closed	Clean= Switch open
1st/2nd gear	2nd gear = Switch closed	1st gear = Switch open
Coolant level	Level OK = Switch closed	Level too low = Switch open
Overload warning	Overload = Switch closed	No overload = Switch open
Central lubrication active	Lubrication active = Voltage at pin 9	Lubrication not active = No voltage at pin 9
Central lubrication level	Level too low = Voltage at pin 10	Level OK = No voltage at pin 10

https://truckmanualshub.com/

8. Error detection Sensors Engine

	During operation	
	Cable break	Short circuit
Engine oil pressure	- Error code stored in ECU - No derating	Short circuit to ground: - Error code stored in ECU - No derating Short circuit to 5 V: - Error code stored in ECU - No derating Short circuit to 24 V: - Sensor damaged beyond repair
Engine crank sensor Coolant temperature	- No error code stored in ECU - Machine does not start - Error code stored in ECU - No derating	- No error code stored in ECU - Machine does not start Short circuit to ground: - Error code stored in ECU - No derating

The best troubleshooting tools are the Murphy gauge and the CTM 334 manual.
The Murphy gauge indicates the SPN and FMI code.
The page on which the description of how to remove the relevant error appears can be located in the keyword register under Diagnostics.

Once errors have been corrected, the SPN and FMI code should be recorded in the machine log and deleted with the Murphy gauge. This will make troubleshooting in the future easier as no errors that have been rectified will appear in the memory.



The enginecrank sensor does not send an error code to the Murphy gauge or laptop! It can only be checked by testing the resistance when the engine is stationary. The value is approximately 3 Kohm.

https://truckmanualshub.com/

9. Errors Air-condition unit AUTOCLIMA

Error code on display:

E1 Cable break on exterior temperature sensor cable
E2 Short circuit on exterior temperature sensor cable

E3 Cable break on interior temperature sensor cable
E4 Short circuit for interior temperature sensor cable

E5 Cable break for mixed air temperature sensor cable
E6 Short circuit for mixed air temperature sensor cable

Error without error code

Error: Temperature oscillating dramatically around air outlet nozzles. These oscillations can lead to individual heat intervals in cooling mode.

Solution: This error indicates that the sensor connections for mixed air temperature and interior air temperature have been mixed up.
As a consequence, the interior temperature measured by the control during cooling is very low and the control will attempt to correct this by inducing warm air. As soon as this warm air flows past the (incorrectly connected) interior air sensor, the control will attempt to compensate this heat by means of intense cooling.

https://truckmanualshub.com/

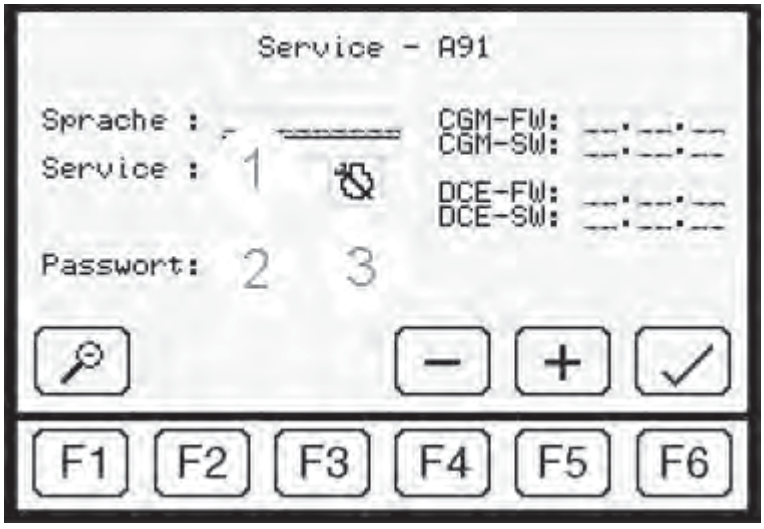
10. Service entry in CGM

In order to reset the service, the service code must be entered in the Service menu (Item 1).

Service code: 5183

Confirm the entry by pressing F6 five times in order to move the „_“ through all entry fields in the password.

Once the service code has been entered, it may not be entered again for 30 operating hours.



Not for the costumer

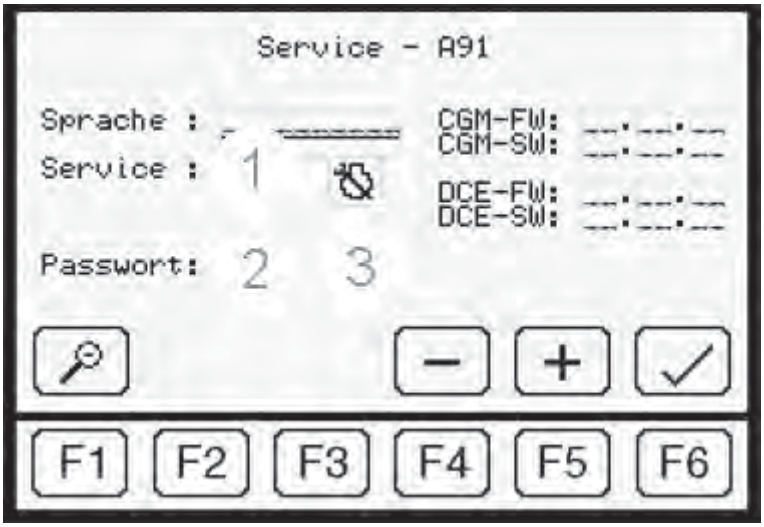
https://truckmanualshub.com/

11. Recall data with CGM

In the exended servicemenu can recalled informations about machines operating conditions.

In the servicemenu can entered (2) the code.

Exended code (ONLY FOR MENZI MUCK SERVICE) 9724

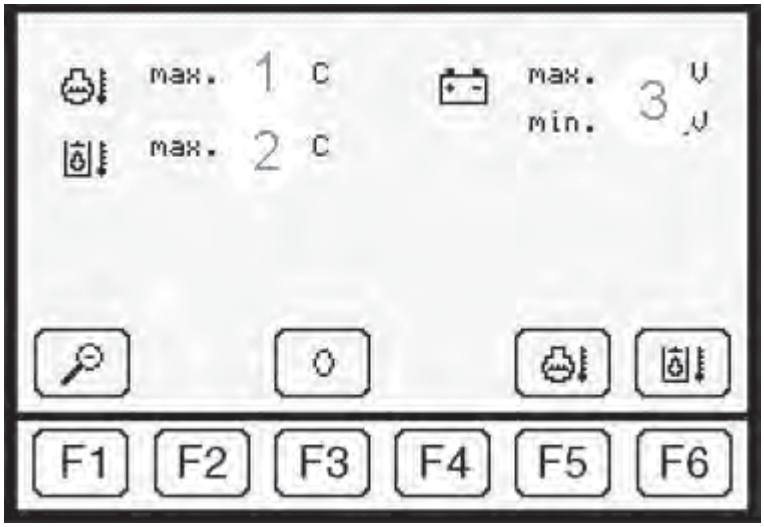


The display cange into the datastorage menu.

Not for the costumer

https://truckmanualshub.com/

Datastorage



In this Window you can see the extreme values since the last resert of those datas.

1 Maximum coolanttempertature

2 Maximum hydaulictemperature

3 Minimum und maximum battery voltage during working display.

Reset the value by pushing the F3 button.
Please note those values in the machine card first.

The battery voltage can only be stored between 8V and 32V.
Outside this range the CGM will not work.

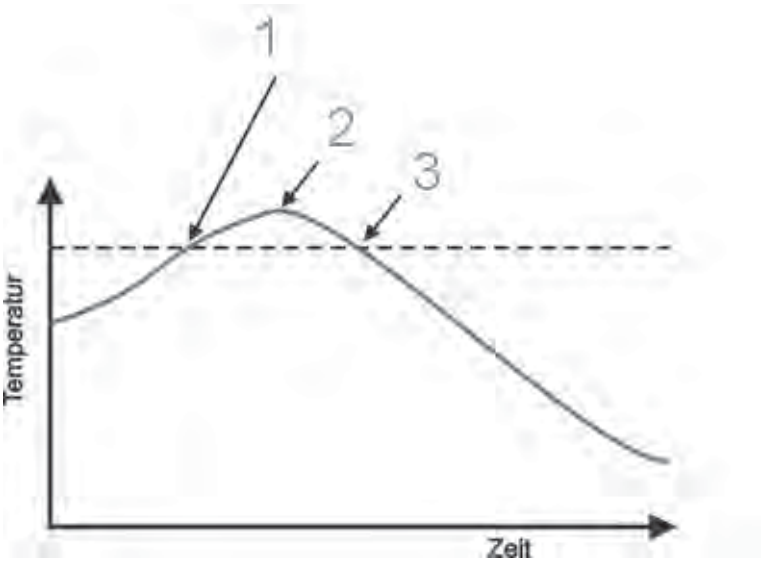
By pushing the F3 button only the minimum ans maximum will be reseted.
The stored coolant and hydraulic temperature will stay in the CGM.

Not for the costumer

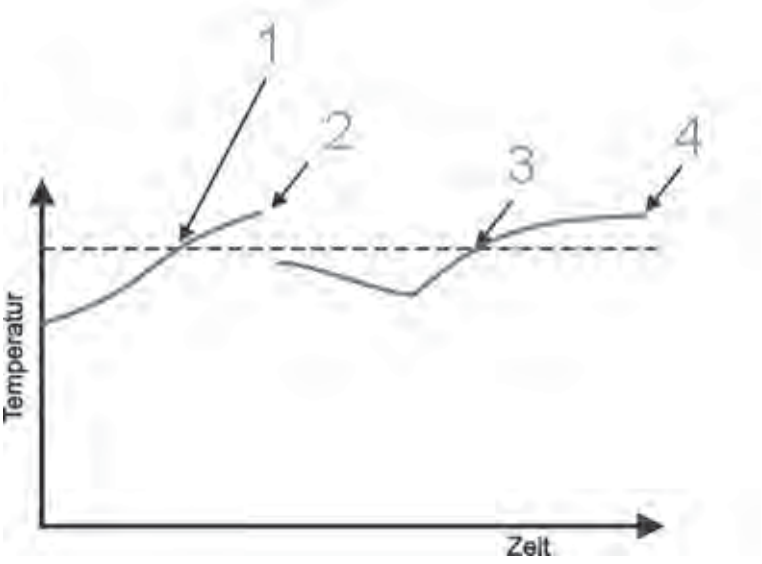
https://truckmanualshub.com/

How does it work

This desciption is based the data storage from the version A91-01-04 and A81-02-00.
The older version have a similar but not so extend version.
The data storage store informations on each pass of the alarm limit.
It will store 20 events for coolant temperature and 20 events for hydraulic temperature.
For a reduction of the memory use it will not store a continuous gradient.



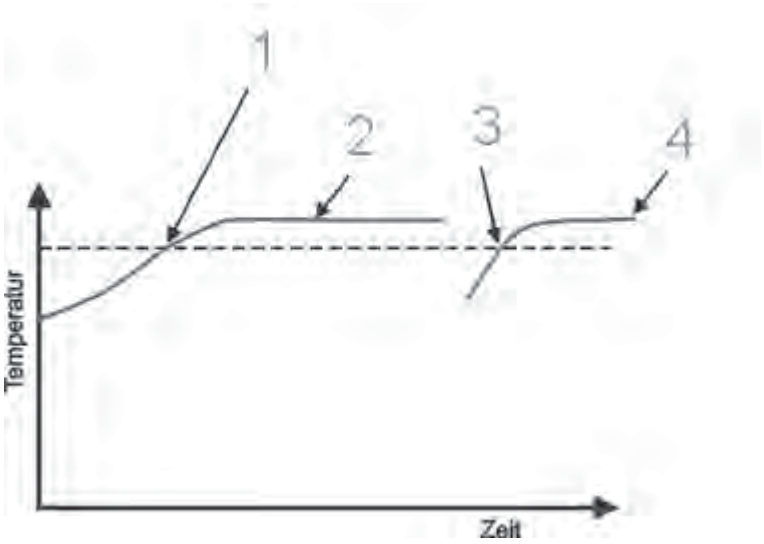
Case 1:
The temperature of the medium rises over the alarm limit (1) and cause an alarm.
The temperature rises till a maximum (2) and falls after a time under the limit.
The data storage stores the event 1 and the event 2.



Case 2:
The temperature of the medium rises over the alarm limit (1) and cause an alarm.
The temperature rises till a maximum (2) the driver stops of the maschine.
The temperature of the medium rises over the alarm limit (3) and cause an alarm.
The temperature rises till a maximum (4) the driver stops of the maschine again.
The data storage stores the event 1 and the event 3.

Not for the costumer

https://truckmanualshub.com/



Case 3:
The temperature of the medium rises over the alarm limit (1) and cause an alarm.
The temperature rises till a maximum (2) the driver stops of the maschine.
The temperature of the medium rises over the alarm limit (3) and cause an alarm.
The temperature rises till a maximum (4) the driver stops of the maschine again.
The data storage stores the event 1 and the event 3.

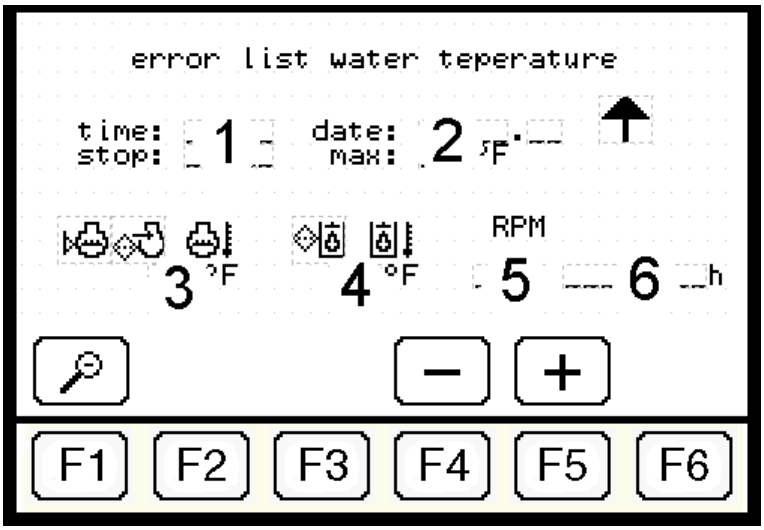
You can make differences between case 1,2 or 3 by have a look a the maschine hours or the other event the data storage will show to you for exemple Coolant niveau or filter pollution.

Not for the costumer

https://truckmanualshub.com/

Stored coolant temperature

This desciption is based the data storage from the version A91-01-04 and A81-02-00.
By pushing button F5 the display change into the stored coolant temperatures.



In this data storage for each event will stored those informations:

1 Time when the event begins
Time when the event ends

2 Date when the event happend
maximum temperature during the event

3 Actual coolant temperature when the event begins or ends

4 Actual hydraulic temperature when the event begins or ends

5 Enginespeed when the event begins

6 Machinehours when the event begins

Additional following informations will be stored:
- Coolant niveau
- Airfilter pollution
- Hydraulicfilter pollution

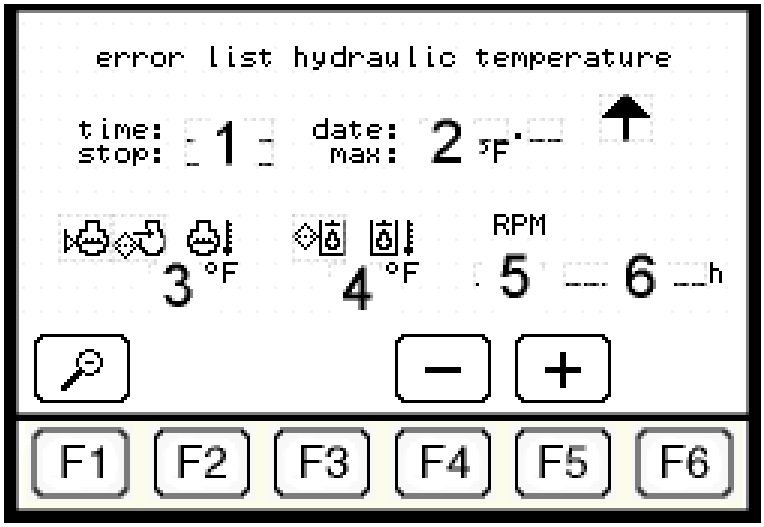
By pushing button F1 the display change into the datastorage menu.

Not for the costumer

https://truckmanualshub.com/

Stored hydraulic temperature

This desciption is based the data storage from the version A91-01-04 and A81-02-00.
By pushing button F5 the display change into the stored hydraulic temperatures.



In this data storage for each event will stored those informations:

1 Time when the event begins
Time when the event ends

2 Date when the event happend
maximum temperature during the event

3 Actual coolant temperature when the event begins or ends

4 Actual hydraulic temperature when the event begins or ends

5 Enginespeed when the event begins

6 Machinehours when the event begins

Additional following informations will be stored:
- Coolant niveau
- Airfilter pollution
- Hydraulicfilter pollution

By pushing button F1 the display change into the datastorage menu.

Not for the costumer

https://truckmanualshub.com/

12. Informationen to the CGM

Hour counter is frozen, daily hour counter continues to increment

ECU has been replaced and sends an hour count which is lower than the current hour count.
The hour count remains frozen at the old value until the ECU sends a value greater than this.
This is because the hour counter is programmed like a drag indicator.
Solution:

1. Order an ECU with the current engine hour value from John Deere via dealer.
2. Connect the laptop to the Sub-D connector in the fuse box.
3. Enter the old ECU hour count in the „Old engine“ field. The current ECU value will be added to the old value.

Diesel level alarm

An alarm is output if the value measured by the fuel indicator sensor remains below the alarm value consistently for 10 seconds. However, if it rises above this value even once during the 10 seconds, the time will start to count back down from 10 seconds the next time the value falls below this level.

If an alarm is output, the tank symbol on the display will flash and an „R“ will appear instead of the content of the tank. The error message „Please refuel“ also appears and the alarm device sounds.
If the driver acknowledges this error by pressing F6, the alarm message will continue to appear although the alarm device will not sound.

Exception to the rule:
If the ignition remains switched off for so long that the display switches itself off (approx. 10 s), the next time the engine starts up, the error message will appear and the alarm device will sound.
This setting has been made in order that an audible reminder is output if a different driver takes the wheel or if the engine is not restarted until the next day.

Software note: In the software, the „diesel_low“ variable represents the alarm value.

https://truckmanualshub.com/

please contact service

This window will be shon, when within 10 enginehours one of those errors will be shown
- watertemp. too high
- hydr.temp too high

1st example:
Within 10 enginehours the dispaly shows 10 times the "watertemp. too high"
The display shows the window "please contact service"

2nd example:
Within 10 enginehours the dispaly shows 10 times the "hydr.temp. too high"
The display shows the window "please contact service"

3rd example:
Within 10 enginehours the dispaly shows 5 times the "hydr.temp. too high" and 5 times "watertemp. too high
The display shows the window "please contact service"

https://truckmanualshub.com/

13. Cable harness on John Deere engine (incl. ECU)

Connectors on the cable harness and how they work

Number on JD diagram/Number on Menzi circuit diagram



X3/X15 engine connector (21-pin)

Connection between machine and engine cable harnesses.



X6/X16 auxiliary connector (23-pin)

Although we do not use this connector, it must be connected watertight in order to prevent engine speed faults as there is a second analogue gas input on one pin.
Additional options can be activated.



X10/X17b terminating resistor

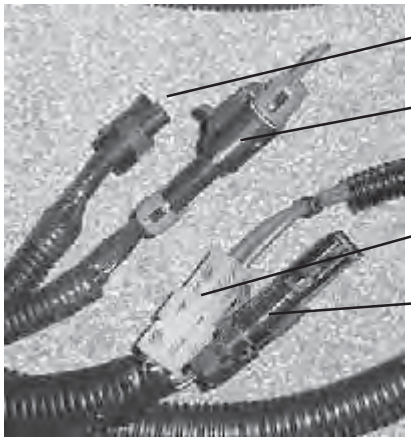
CAN bus 120 ohm terminating resistor. Used to prevent reflections at the ends of the cables. These echoes would distort the signals.



X7/X18 Diagnostic connector

Connection between Murphy gauge (hand-held device) or MagiKey (laptop) for diagnostics.

https://truckmanualshub.com/

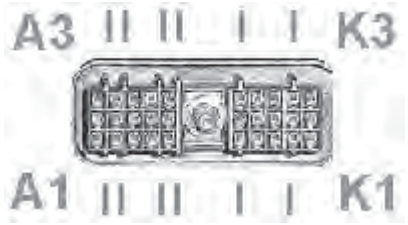


B1/- Connector for engine oil pressure sensor

X5/X19 Remote on/off. If this bridge is removed or damaged, this will have the same effect as a faulty fuse.

-/- Fuse extension connector

N1/- Z-diode pre-exciter diode



A1/A1 ECU connector. The pin assignment is marked on the connector. The pins are marked in the photograph (pay attention to the bars on the side).



Y1/- Fuel control solenoid



F1/0 10 A fuse for protect unswitched battery



Identical connector in terms of construction (be aware of the risk of connectors being mixed up) for:
B2/R2 Fuel temperature
B3/R3 Coolant temperature
B4/R4 Intake air temperature
B5/L1 Engine crank sensor (twisted cable)
Resistance when engine is stationary = 3 Kohm



X02/- Alternator pre-excitation

https://truckmanualshub.com/



SE4 /- Fuel heating (John Deere option)

Emergency gas plug

The following connections can be made in the emergency gas plug. The resistance is 5 Kohm and the speed is set by adjusting the resistance.

ECU connector A1/A1	Engine connector (21-pin) X3/X15	Machine
Pin D3	Pin C	Sensor ground (# ground!!)
Pin E2	Pin M	Incoming voltage (+5 V)
Pin G2	Pin A	

Minimum cable harness to start an engine

The following cable connections must be made:

ECU connector A1/A1	Connected to:
Pin A2	Switched battery (15)
Pin J2	Ground (31)
Pin K1	Unwitched battery (30)
Pin B2	Engine crank sensor B5/L1-pin A
Pin D2	Engine crank sensor B5/L1-pin B
Pin A3	Fuel control soleniod Y1/—pin B
Pin K2	Fuel control soleniod Y1/—pin A

If the cable harness is extended by adding a potentiometer or fixed resistor, the hydraulics can also be operated at and above approx. 1600 rpm.
This type of cable harness could be manufactured for emergency applications, in order to set the machine in motion following unsuccessful troubleshooting, for example.

https://truckmanualshub.com/

Minimum cable harness for diagnostics

The following cable connections must be made:

ECU connector A1/A1	Diagnostic connector X7/X18	Terminating resistor	Machine X10/X17b
	Pin A		Ground (30)
	Pin B		Switched plus (15)
Pin G1	Pin C	Pin A	
Pin F1	Pin D	Pin B	
	Pin E	Pin C	Ground(30)

These connections are required in order to make the connection between the ECU and the Murphy gauge.

External derating, shutdown and reduced droop

External derating (e.g. via thermostat):

Auxiliary connector (23-pin) X6/X16	Connected to:
Pin D	Pin B = Switched battery(15)

Shutdown:

Auxiliary connector (23-pin) X6/X16	Connected to:
Pin K	Pin B = Switched battery (15)

Shutdown Override momentary

Engine connector (21-pin) X3/X15	Connected to:
Pin N	Auxiliary connector (23-pin) Pin A = +5V

This can only be achieved via a pushbutton. The override may only last up to approx. 10 seconds.

Instead of 8% droop (standard) for reduced droop 0%::

Auxiliary connector (23-pin) X6/X16	Connected to:
Pin E	Pin B = Switched battery(15)

Then check whether the engine is running with jerk or is unstable.

Note for engine crank sensor



A faulty sensor will not generate an error code in the ECU.



The resistance of the sensor can be measured when the engine is stationary. The resistance should be approx. 3 Kohm.

https://truckmanualshub.com/

Note for preheating

The preheating time is controlled via the fuel temperature (sensor B2/R2).

Reading the John Deere circuit diagram

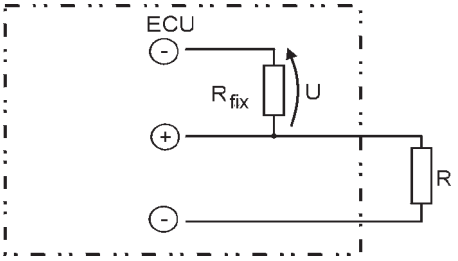
The circuit diagram appears in the CTM manual.

Both the sensor designation and pin designation are indicated.
For the ECU, the pin is identified by a letter and a number.
See the start of this chapter or the connector for the designation.

The best way to determine the function of a cable is to read off the cable number.
The number appears in both the John Deere circuit diagram and the Menzi circuit diagram.

Note in respect of the CTM334 manual

When is a voltage considered to be high or low as defined by the error description?
The ECU features a built-in measuring bridge with a fixed resistance Rfix.



The following scenarios are therefore possible:
1. R = ∞ Ω (cable break)
As the entire current flows via R_{fix}, the voltage U increases —>
Voltage high
2. R = ∞ Ω (short circuit)
As the entire current flows via R, the voltage U decreases —>
Voltage low

Voltage converter for Murphy gauge

If the Murphy gauge is operated at 24 V for a sustained period of time, a voltage transformer should be used in order to avoid damaging the warning LED.

Voltage transformer data
RE 162448
P/N 78-35-0008 X-9
MLVC2412
Input V 14-32 VDC
Output V 12 VDC +/- 0.5V
Maximum current: 750mA

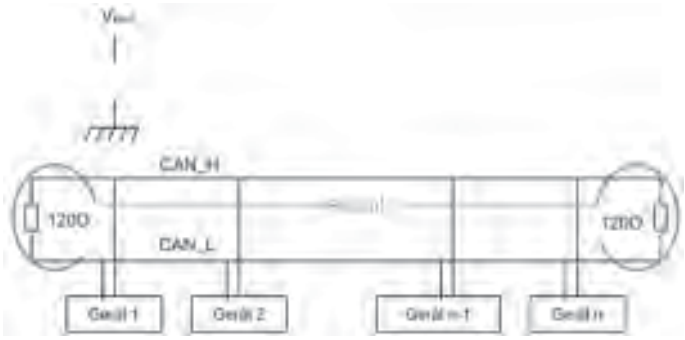
https://truckmanualshub.com/

14. CAN Bus troubleshooting

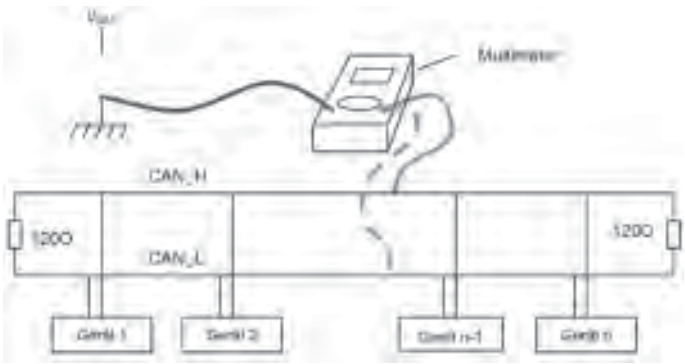
To find out wiring errors, missing terminal resistors, disconnetions or short circuits in the CAN-bus concerning the various applications you should check the components. To do this you have to switch off the component before hand.

1. All spots where CAN-Bus leads are interrupted (e.g. terminal, cable connections, soldering spots, cable transitions, etc.) should be checked visually putting main concentration on solid connection and fixation of the cable ends.

2. On both ends of the CAN-Bus lead check whether the terminal resistors are installed and connected properly. On components with internal terminal resistor check whether the terminal resistors are connected.

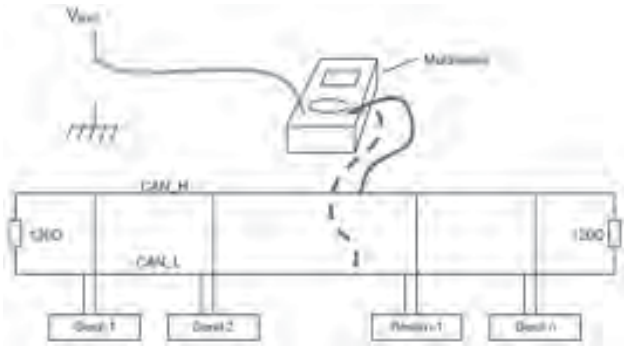


3. Use a mulitmeter set on resistance measurement (100'000 ohm mode) and measure the resistance from CAN hi to ground and from the CAN low to ground. A general expected value can not be given but , if the resistance is less than 10'000 ohms this might be an indication of a high-resistance connection of a Bus-lead to the ground.

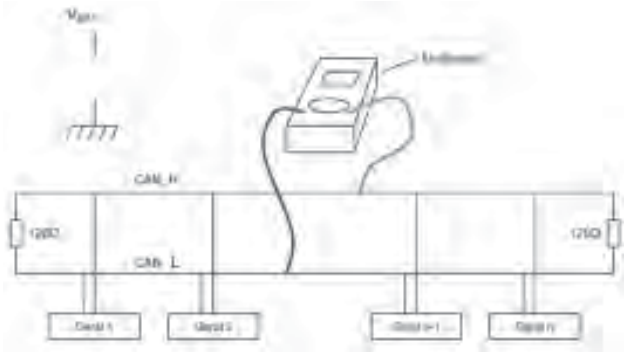


https://truckmanualshub.com/

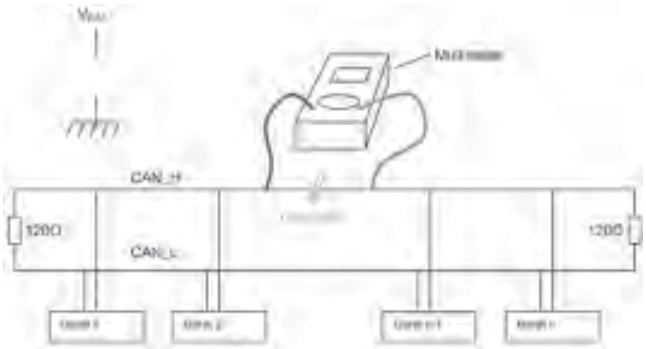
4. Use a mulitmeter set on resistance measurement (100'000 ohm mode) and measure the resistance from CAN hi to supply voltage and from CAN low to the supply voltage. A general expected value can not be given but , if the resistance is less than 10'000 ohms this might be an indication of a high-resistance connection of a Bus-lead to the ground.



5. Use a mulitmeter set on resistance measurement (500 ohm mode) and measure the resistance between CAN hi and CAN low. The resistance has to be between 55 and 70 ohms.
With this method you can check whether the terminal resistors are installed and have got the correct rate. You can also check hereby whether there is an interrupion of a lead or a short circuit.



6. Disconnect CAN hi or CAN low at a plug or something similar.
Use a mulitmeter set on resistance measurement (500 ohm mode) and measure the resistance between those two ends. The resistance has to be between 230 and 260 ohms.
Hereby you measure the resistance of the Bus-circuit, incl. the terminal resistors. This method shows whether the terminal resistors are connected and have got the correct rate. You can also check hereby whether there is an interruption of a lead or a short circuit.



If you perform steps 1 to 6 thoroughly, the possibility of undiscovered Bus-errors is reduced drastically.

https://truckmanualshub.com/

15. Programming CGM and DCE with Bootloader

Vorbereitung

- Labtop with a charged accumulator or a power supply
- Check which version is on the CGM or DCE and compare with the data sheet (DIGSY SW - Versionen A91V2.doc oder DIGSY SW - Versionen A81.doc) if the firm- or software are compatible.
- An programmed device as a backup if something will break down during the programming.

The shield of the programmingcable have to be on pin 5 in the Sub-D 9 plug. You can use our adapter.

Write down the machine hours, time till next service and eventually the stored datas (Capter 11)

Vorsicht

During programming the labtop or the machine should not be switched off.
This can cause problems

Programmierung

1 Switch of the machine
2 Open the fuse box
3 Connect Laptop with a serial cable to the device (CGM or DCE).
CGM = Upper plug
DCE = Lower plug

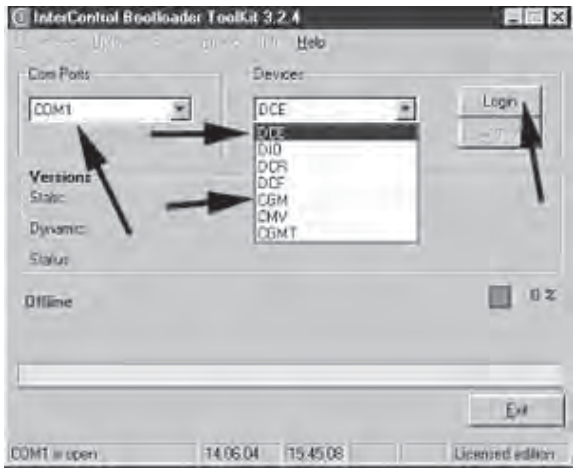


4 Now switch on the machine
5 Open Bootloader



https://truckmanualshub.com/

6 Choose Com Port
Choose Device



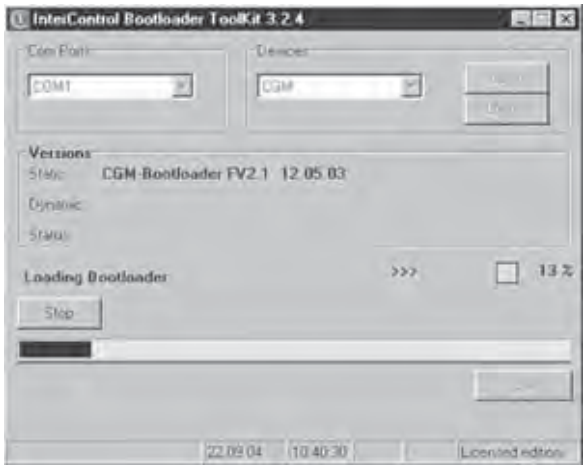
7 Click Login

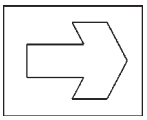
8 Click "OK"



Now remove the fuse Nr. 17 and put it back in (or turn the main switch off and on).

9 Bootloader start to connect to the device

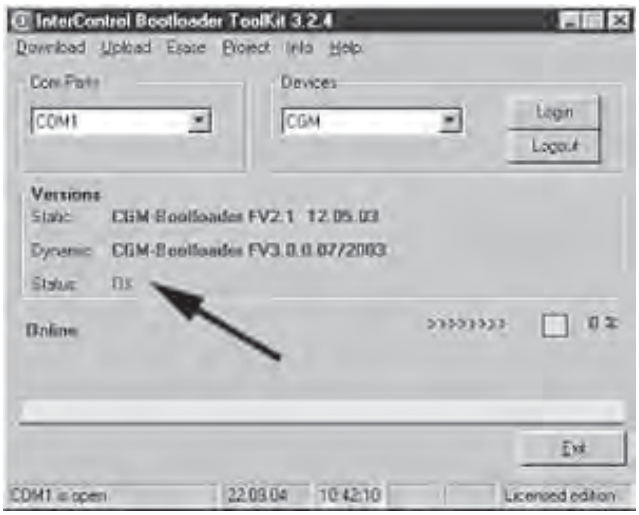




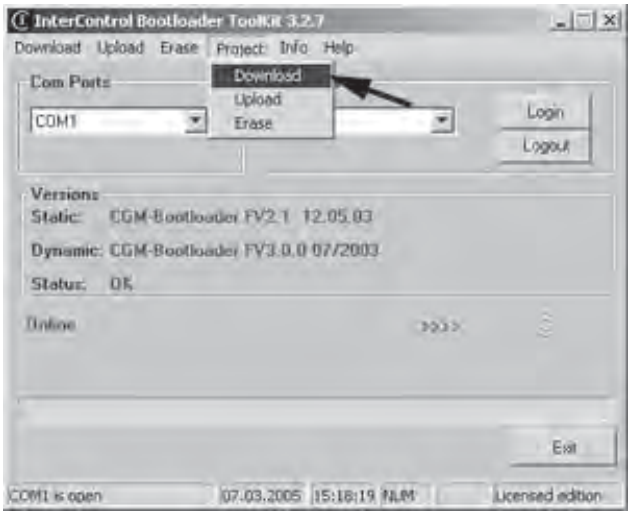
If the is an old device (CGM-FW: 04.XX.XX bzw. DCE-FW: 06.01.XX or older) the Bootloader is trying to open an old Software.Click "No" and change the device. The old device can be updated by MENZI MUCK.

https://truckmanualshub.com/

10 Connection is estabilshed.



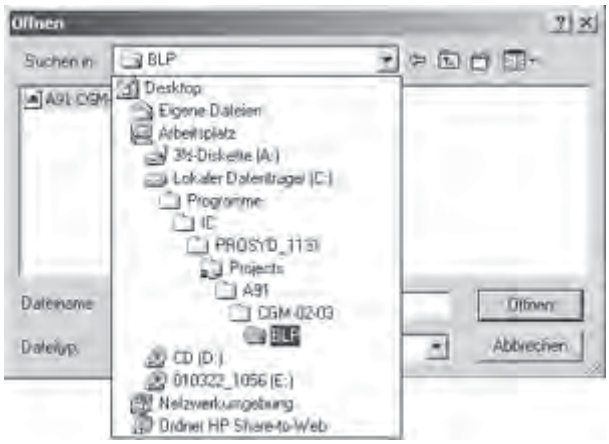
11 In the menu "Project" choose "Download"



https://truckmanualshub.com/

12 (1) Choose desired file





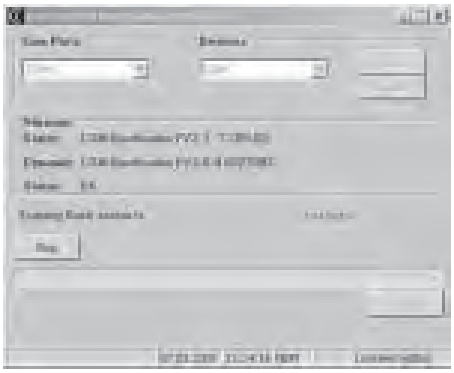
The files are located:
Daten (D:)
Programme
Intercontrol
--> your maschine type

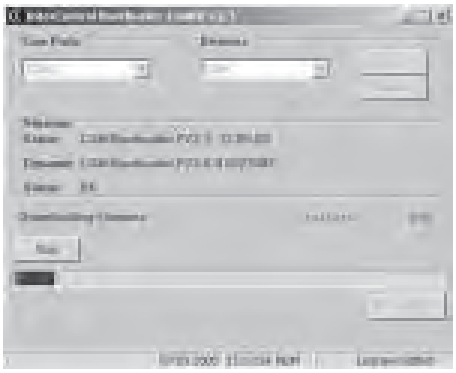
(2) Check if the file is compatible with the device.

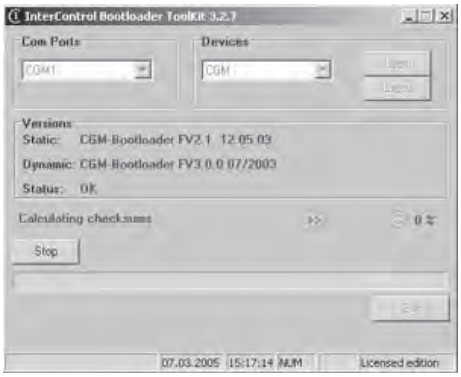
13 Choose the parts of the programm you want to download
(Firmware) --> SHOULD NOT BE ACTIVATED
Application
Retain Data = Variables (Depending on excavator and Application)
Mask Block = Only for CGM these are the pictures for the display
(Depending on excavator and Application)

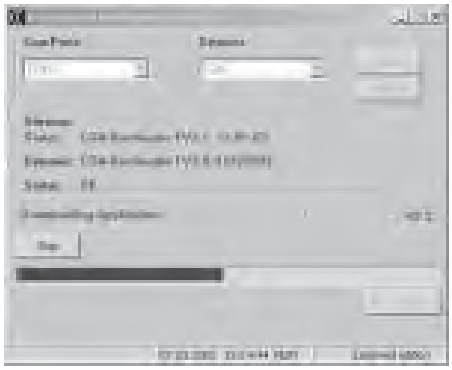
https://truckmanualshub.com/

14 Click on "OK" and the Bootloader starts to send all the choosen programmparts to the device automatically. (takes about 10min)







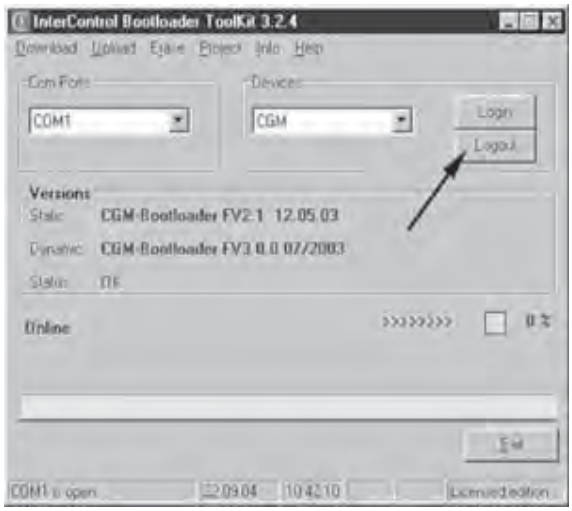


15 Programm confirm if the download was successful



16 Click Logout

https://truckmanualshub.com/



17 Switch of the machine

18 Remove the fuse Nr. 17 and put it back in (or turn the main switch off and on).

Programming is now finished

Test the programming

1 Switch on the machine
Check if everything is working
2 Switch off the machine
3 Switch off the main switch
Wait 5 seconds
4 Switch on the main switch
5 Switch on the machine
Check if everything is working

https://truckmanualshub.com/

16. Additional information

Elektrics

Technical information CGM	04-68253A HB digsycgm Chapter E ProductDescription.pdf
Keyword list, components	Electronics+Electrics A91V2.xls
Circuit diagram A91 AUTOCLIMA	250430.dwg
Circuit diagram A91 SCIROCCO	250493.dwg
Circuit diagram A81	251289.dwg
DIGSY software versions A91V2	DIGSY SW - Versions A91V2.doc
DIGSY software versions A81	DIGSY SW - Versions A81.doc

Engine electrics and engine electronics

For troubleshooting:	CTM33

All 4.5 litre John Deere engines	
Engine cable harness+ECU description	EIB02-29.pdf
Spare parts for engine cable harness	CONNECTOR.pdf
Diagram of engine cable harness	RE507898.pdf
Circuit diagram for engine	RE516162.pdf
	250430.dwg
Technical data + ECU number	EIB02-02-2B - Rev.Tier-2 Engine Ratings 4.5 L and 6.8 L.pdf

A91V2 4045HF275 (104 kW)	
Technical data	4045-T11-140I.pdf
Brochure with dimensions	Brochure 4045HF275.pdf

Service documentation

John Deere engines general:
Technical manual for components POWERTECH 4.5 diesel engines

https://truckmanualshub.com/

17. Changes

Index 1
Translated from German document Index 5

Index 2
Updated to German document Index 6

Index 3
Updated to German document Index 7
New Pages 28-31 about datat sotorage

Index 4
Updated to German document Index 8

Index 5
Updated to German document Index9

Index 6
Better translation in chapter 14

Index 11
Same Indexnumber as the German document.
Updated to German document Index 10 + 11

Index 12
Updated to German document Index 12

https://truckmanualshub.com/

JOHN DEERE

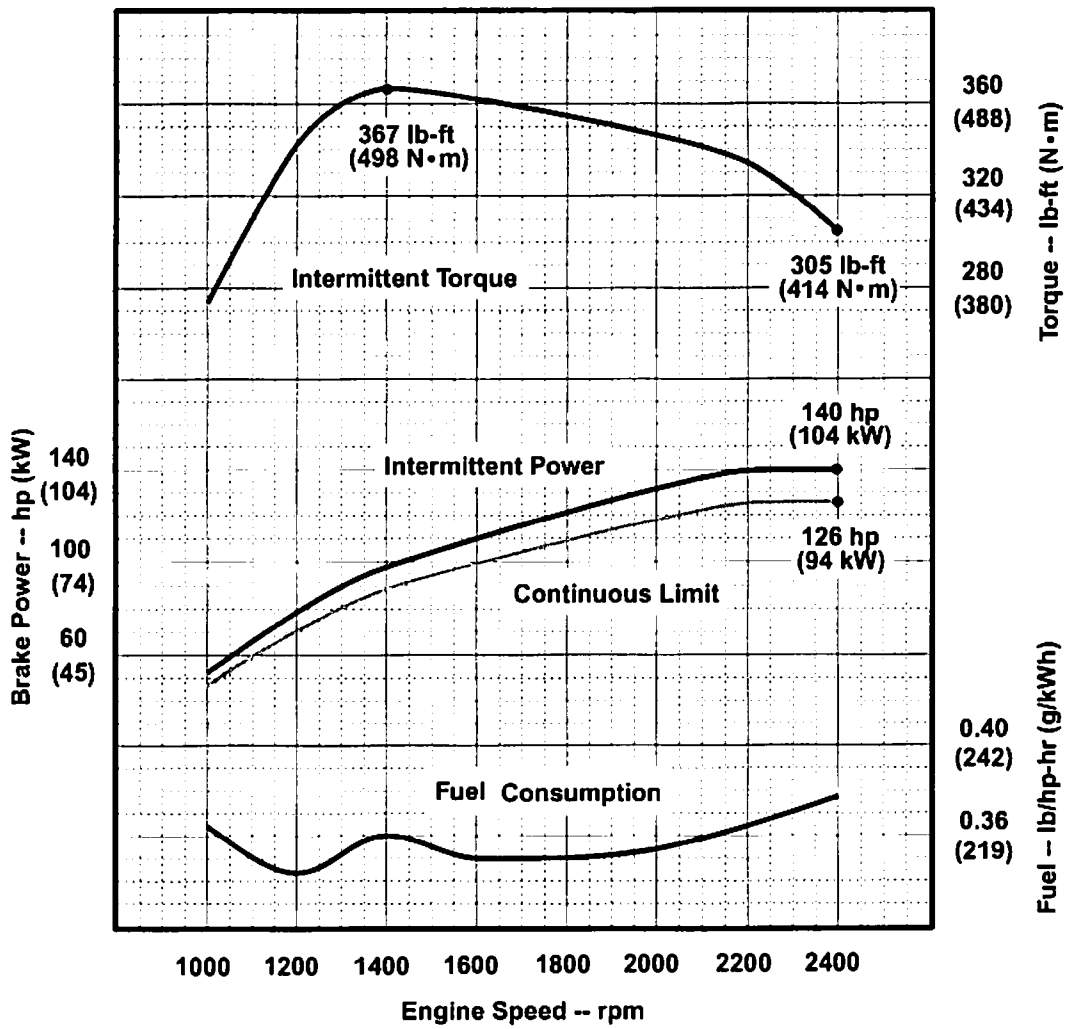
ENGINE PERFORMANCE CURVE

Rating: Gross Power

Application: Industrial
Intermittent / Continuous

POWERTECH 4.5L Engine
Model: 4045HF275

140 hp @ 2400 rpm
104 kW @ 2400 rpm
[Option 16?? / 16??]



Air Intake Restriction ..... 12 in.H_2O (3 kPa)
Exhaust Back Pressure ..... 30 in.H_2O (7.5 kPa)

Gross power guaranteed within + or - 5% at SAE J1995 and ISO 3046 conditions:
- 77 °F (25 °C) air inlet temperature
- 29.31 in.Hg (99 kPa) barometer
- 104 °F (40 °C) fuel inlet temperature
- 0.853 fuel specific gravity @ 60 °F (15.5 °C)

Conversion factors:
- Power: kW = hp x 0.746
- Fuel: 1 gal = 7.1 lb, 1 L = 0.85 kg
- Torque: N•m = lb-ft x 1.356

All values are from currently available data and are subject to change without notice.

Notes:

Tier-2 Emission Certifications:	Certified by:
CARB; EPA; EU Ref: Engine Emission Label	

* Revised Data
Curve: 4045HF275140I ..... Sheet 1 of 2
September 2001

https://truckmanualshub.com/

Common Specifications:

Engine Specification Data

General Data

Model	4045HF275
Number of Cylinders	4
Bore and Stroke--in. (mm)	4.19 x 5.00 (106 x 127)
Displacement--in.^{3} (L)	275 (4.5)
Compression Ratio	17.0:1
Valves per Cylinder--Intake/Exhaust	1/1
Firing Order	1-3-4-2
Combustion System	Direct Injection
Engine Type	In-line, 4-Cycle
Aspiration	Turbocharged
Charge Air Cooling System	Air-to-Air
Engine Crankcase Vent System	Open
Maximum Crankcase Pressure--in. H_2O (kPa)	2 (0.5)

Physical Data

Length--in. (mm)	33.9 (860)
Width--in. (mm)	24.1 (612)
Height--in. (mm)	39.1 (994)
Weight, dry--lb (kg)	993 (451)
(Includes flywheel housing, flywheel & electrics)	
Center of Gravity Location	
From Rear Face of Block (X-axis)--in. (mm)	9.8 (249)
Right of Crankshaft (Y-axis)--in. (mm)	2.17 (55)
Above Crankshaft (Z-axis)--in. (mm)	5.7 (145)
Max. Allow. Static Bending Moment at Rear Face of Flywhl Hsg w/ 5-G Load--lb-ft (N•m)	600 (814)
Thrust Bmg. Load Limit (Forward)--lb (N) [I]	900 (4003)
[C]	500 (2224)

Fuel System

Fuel Injection Pump		Stanadyne DE10
Governor Regulation		7-10 %
Governor Type		Electronic
Fuel Consumption--lb/hr (kg/hr)	[I]	53.0 (24.0)
	[C]	49.0 (22.0)
Fuel Spill Rate--lb/hr (kg/hr)	[I]	145.0 (66.0)
	[C]	145.0 (66.0)
Total Fuel Flow--lb/hr (kg/hr)	[I]	198.0 (90.0)
	[C]	194.0 (88.0)
Maximum Fuel Transfer Pump Suction--ft (m) fuel		3 (0.9)
Fuel Filter Micron Size @ 98% Efficiency		5

[I] = Intermittent Data [C] = Continuous Data
Unless noted, all other values pertain to both.

Lubrication System

Oil Pressure at Rated Speed--psi (kPa)	50 (345)
Oil Pressure at Low Idle-psi (kPa)	15 (105)
In Pan Oil Temperature--°F (°C)	240 (115)
Oil Pan Capacity, High--qt (L)	13 (12.3)
Oil Pan Capacity, Low--qt (L)	11.9 (11.3)
Total Engine Oil Capacity with Filters--qt (L)	14.1 (13.3)
Engine Angularity Limits, Any Direction--Degrees[I]	30
[C]	20

Air System

Maximum Allowable Temp Rise--Ambient Air to Engine Inlet--°F (°C)		15 (8)
Maximum Air Intake Restriction		
Dirty Air Cleaner--in. H_2O (kPa)		25 (6.25)
Clean Air Cleaner--in. H_2O (kPa)		12 (3)
Engine Air Flow--ft^3/min (m^3/min)	[I]	360 (10.2)
	[C]	346 (9.8)
Intake Manifold Pressure--psi (kPa)	[I]	18 (123)
	[C]	16 (112)
Recommended Intake Pipe Diameter--in. (mm)		3 (76.2)
Compressor Discharge Temp--°F (°C)	[I]	298 (148)
	[C]	284 (140)
Max. Press. Drop Through Charge Air Cooler--in.H_2O (kPa)		52 (13)
Max. Temp. Out of Charge Air Cooler @ 77°F (25°C) Ambient Air--°F (°C)		140 (60)

Cooling System

Engine Heat Rejection--BTU/min (kW)	[I]	3032 (53)
	[C]	2731 (48)
Air/Air Exch. Heat Rejection--BTU/min (kW)	[I]	910 (16)
	[C]	797 (14)
Coolant Flow--gal/min (L/min)		54 (204)
Thermostat Start to Open--°F (°C)		180 (82)
Thermostat Fully Open--°F (°C)		201 (94)
Engine Coolant Capacity--qt (L)		9 (8.5)
Recommended Pressure Cap--psi (kPa)		10 (69)
Maximum Top Tank Temp--°F (°C)		221 (105)
Minimum Coolant Fill Rate--gal/min (L/min)		3 (11)
Minimum Air-to-Boil Temperature--°F (°C)		117 (47)

Exhaust System

Exhaust Flow--ft^3/min (m^3/min)	[I]	858 (24.3)
	[C]	805 (22.8)
Exhaust Temperature--°F (°C)	[I]	887 (475)
	[C]	860 (460)
Max. Allowable Back Pressure--in. H_2O (kPa)		30 (7.5)
Rec'd. Exhaust Pipe Diameter--in. (mm)		4.0 (101.6)

Electrical System

Recommended Battery Capacity (CCA)	
12 Volt System--amp	640
24 Volt System--amp	570
Maximum Allowable Starting Circuit Resistance	
12 Volt System--Ohm	0.0012
24 Volt System--Ohm	0.002
Starter Rolling Current--12 Volt System	
At 32 °F (0 °C)--amp	780
At -22 °F (-30 °C)--amp	1000
Starter Rolling Current--24 Volt System	
At 32 °F (0 °C)--amp	600
At -22 °F (-30 °C)--amp	700

Performance Data

Rated Power--hp (kW)	[I]	140 (104)
	[C]	126 (94)
Rated Speed--rpm		2400
Peak Torque--lb-ft (N•m)	[I]	367 (498)
	[C]	330 (448)
Peak Torque Speed--rpm		1400
Low Idle Speed--rpm		800
BMEP--psi (kPa)	[I]	167 (1154)
	[C]	151 (1039)
Friction Power @ Rated Speed--hp (kW)		30 (22)
Altitude Capability -- ft (m)		10,000 (3050)
Ratio--Air : Fuel	[I]	28.8:1
	[C]	30.2:1
Smoke @ Rated Speed--Bosch No.	[I]	< 2
	[C]	< 2
Noise--dB(A) @ 1 m	[I]	N/A
	[C]	N/A

Engine Speed rpm	Contin. Limit hp(kW)	Intermit. Power hp(kW)	Intermit. Torque lb-ft(N•m)	BSFC lb/hp-hr (g/kWh)
2400	126 (94)	140 (104)	305 (414)	0.378 (230)
2200	126 (94)	140 (104)	333 (451)	0.365 (222)
2000	118 (88)	131 (98)	347 (470)	0.353 (215)
1800	109 (81)	121 (90)	354 (480)	0.350 (213)
1600	99 (74)	110 (82)	361 (490)	0.350 (213)
1400	89 (66)	98 (73)	367 (498)	0.360 (219)
1200	70 (52)	78 (58)	342 (464)	0.343 (209)
1000	47 (35)	52 (39)	273 (370)	0.363 (221)

All values at rated speed and power with standard options unless otherwise noted.

* Revised Data
Curve: 4045HF275140I ..... Sheet 2 of 2
September 2001