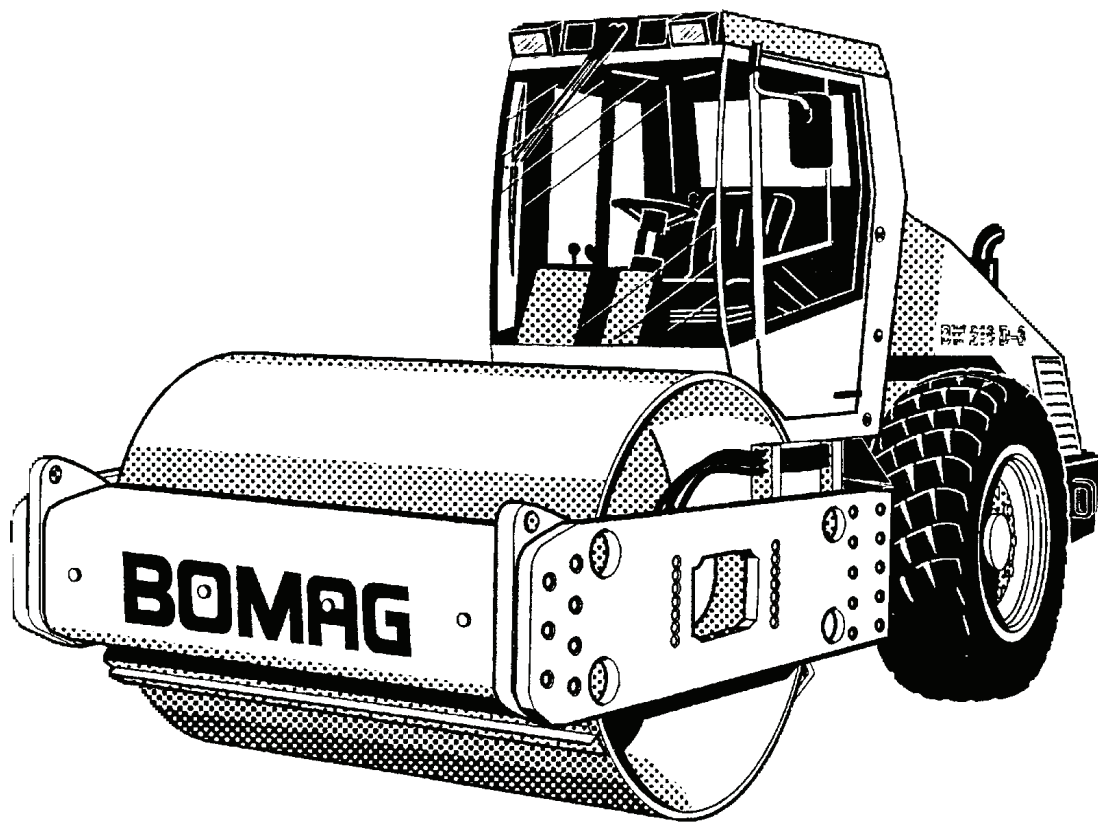


BOMAG

Service Training



Single Drum Rollers

BW 213 D/DH/PDH - 3

BW 214 DH/PDH-3

Deutz 2012C / 1013EC

Foreword

Reliable construction equipment is of greatest advantage for all parties involved in this business:

- for the customer/user it is a basis for an exact calculation of utilization periods and the completion of projects as scheduled.
- in the rental business it means that the equipment can be reliably used and planned without having to stock a large number of stand-by machines.
- for the manufacturer it means that customers are satisfied, provides him with a good image and gives him a feeling of confidence.

It is BOMAG's philosophy to design and produce the machines with highest possible reliability. However, it is the responsibility of the customer to have the daily routine maintenance work performed by his personnel. This aspect of simple and easy maintenance was one of the key issues when developing and designing the machine:

- the location of components in the machine eases maintenance work,
- the high quality standard of BOMAG is the basis for the considerable extension of the service and maintenance intervals,
- the After Sales Service of BOMAG, including excellent operating and maintenance instruction manuals, high quality training courses and on-site machine demonstrations helps the customer to maintain their machines in good condition over a long period of time.

Permanent training of BOMAG's own service personnel as well as the service personnel of BOMAG Profit Centres and dealers is therefore a general prerequisite for BOMAG's excellent world-wide service.

This program of permanent training is only possible with appropriate and up-to-date training material for trainers as well as persons attending the training courses.

This training manual has not only been written as a support for the professional work of the trainer, but also for the trainees attending these training courses.

The different levels of product training demand, that the training performed by BOMAG, its Profit Centres or its dealers reflects the high quality of the training conducted at the Training Centre at BOMAG in Boppard. For this reason we invested a lot of time in the preparation of these materials .

The structure of this training manual enables us to change or up-date individual chapters in case of major alterations to the machine.

Documentation

For the BOMAG machines described in this Service Training book the following documents are additionally available:

Attention!

Please draw the current P/N's of the documents according to the serial number of the machine from the Doclist respectively Central Service page in the BOMAG-Intranet or Extranet (BOMAG Secured Area).

- 1. Operating and maintenance instructions**
- 2. Spare parts catalogue**
- 3. Electric circuit diagram***
- 4. Hydraulic diagram ***
- 5. Repair instructions**
- 6. Service Information**

* The at the date of publication current documents are part of this training manual.

General

Single drum rollers of generation 3 are self-propelled soil compaction machines, which are particularly suitable for heavy-duty compaction applications in earth construction.

The product range of single drum rollers includes also the machines:

- BW 213 (available in different versions)
- BW 214

The machines are available with two different types of drums, whereby the correct selection of the drum depends on the type of material to be compacted.

The smooth drum is particularly suitable for the compaction of mixed soils, sand, gravel and rock, whereas the padfoot drum shows its advantages on cohesive soils. The use of a machine with padfoot drum on sand and gravel is not recommended.

The BW 213 D-3 model 2003 is powered by a water cooled 4-cylinder Deutz engine of series BF4M 2012C.

All other models of the product range BW 213 DH/PDH-3 and BW 214DH/PDH-3 are powered by a water cooled 4-cylinder Deutz engine of series BF4M 1013EC.

Engine driven pumps transfer the output power of the engine via hydrostatic circuits to the drum, the rear wheels and the steering cylinder. These hydrostatic drives guarantee lowest possible power losses and high efficiency.

Front and rear frames are connected by an oscillating articulated joint. The amply dimensioned oscillation angle makes sure that drum and wheels are always in ground contact.

The rear axle is fitted with multi-disc brakes in the planetary drives. These brakes have the function of parking brakes. When starting the diesel engine the brakes are released by the increasing charge pressure. When shutting the engine down they are closed again by spring pressure. The brakes can also be applied while the engine is running. This requires only the actuation of the respective brake control valve. However, this feature should only be used if the machine is to be parked for a short while with the engine running. This parking brake must never be used as a service brake, because the deceleration effect is very high and the brake discs would be damaged.

All machines of this family work with hydraulic travel systems for rear wheels and drum.

The actual compaction tool, the drum, is fitted with a vibrator shaft. This shaft runs in cylinder roller bearings. The vibrator shaft is driven by a hydraulic motor via a Bowex coupling.

Vibration of the drum is generated by the centrifugal forces caused by the revolving eccentric weights on the vibrator shaft.

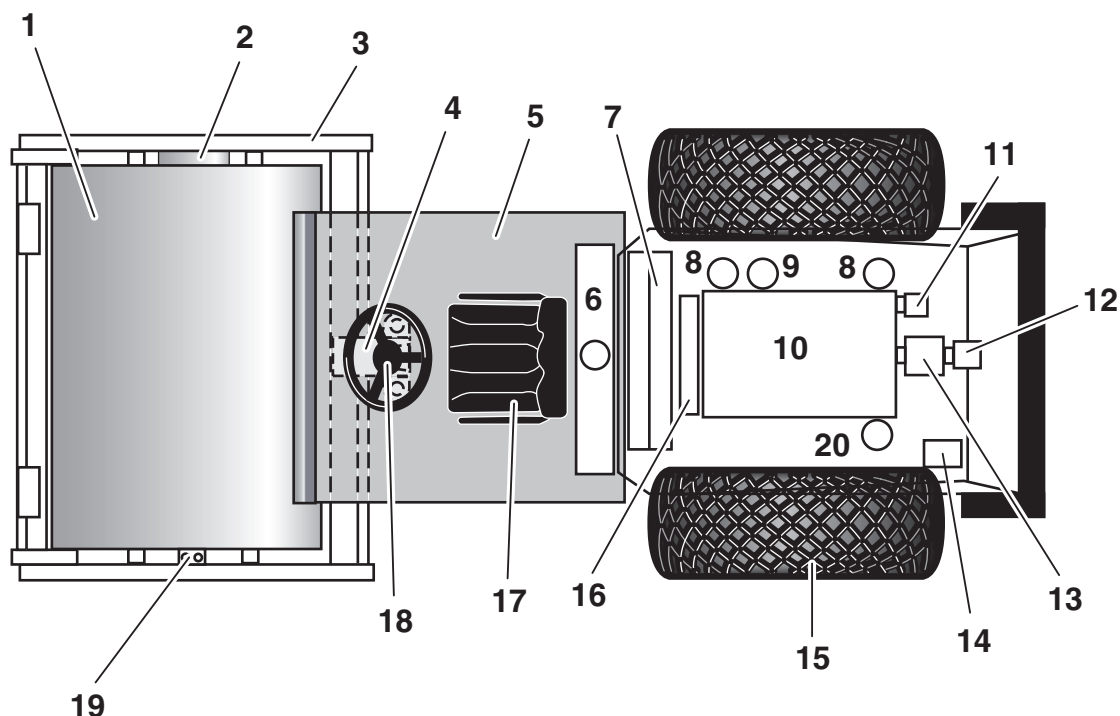
The sense of rotation of the vibrator shaft can be reversed. Changing the sense of rotation changes also the position of the change-over weights inside the eccentric weights on the vibrator shaft. This changes also the centrifugal force and the amplitude. The vibrator shaft speed is different to both directions of rotation. This means, that the vibration frequency will also change.

In combination with the hydraulic vibration circuit the change-over weights inside the eccentric weights are arranged in such a way, that the high amplitude works with low frequency and vice versa.

The combination of high amplitude and low frequency is particularly suitable for compaction applications in heavy earth construction and for pre-compaction work. Low amplitude with high frequency should be used for final compaction during the last passes.

The individual machine functions like travel system, vibration and steering circuit are described in detail in the corresponding chapters.

List of components



Position of the most important maintenance points

- | | | | |
|----|------------------------------|----|---|
| 1 | Drum | 11 | Steering pump |
| 2 | Drum drive motor | 12 | Vibration pump |
| 3 | Front frame | 13 | Travel pump |
| 4 | Articulated joint | 14 | Hand pump for engine hood |
| 5 | Operator's stand | 15 | Wheels (with axle and axle drive motor) |
| 6 | Hydraulic oil cooler | 16 | Cooling blower |
| 7 | Radiator / Charge air cooler | 17 | Driver's seat |
| 8 | Fuel filter | 18 | Steering wheel with steering valve |
| 9 | Lubrication oil filter | 19 | Vibration motor |
| 10 | Diesel engine | 20 | Hydraulic oil filter |

Technical data and adjustment values

The following pages contain technical data valid at the date of printing (see front page of this manual).

Attention!

The currently valid technical data and adjustment values can be taken from the BOMAG Intranet or Extranet (BOMAG Secured Area) in accordance with the serial number of the machine.

BOMAG Central Service - Technical data and adjustment values**Status: 2003-03-10**

Product type:	BW 213 D-3
Type No.:	581 42
Serial numbers from:	101 581 42 1001
Engine:	
Manufacturer:	Deutz
Type:	BF4M2012C
Combustion principle:	4-stroke-Diesel
Cooling:	Water
Number of cylinders:	4
Power acc. to ISO 9249:	98 kW
Power data at nominal speed of:	2300 1/min
Low idle speed:	900+/-200 1/min
High idle speed:	2430+/-50 1/min
Spec. fuel consumption:	225 g/kWh
Valve clearance, inlet:	0,3 mm
Valve clearance, outlet:	0,5 mm
Opening pressure, injection valves:	220 bar
Starter voltage:	12 V
Starter power:	3,1 kW
Travel pump:	
Manufacturer:	Sauer-Danfoss
Type:	90R 075
System:	Axial piston-swash plate
Max. displacement:	75 cm ³ /U
Max. flow ratio:	172,9 l/min
High pressure limitation:	435 +/-15 bar
Charge pressure, high idle:	25+/-1 bar
Travel motor, rear:	
Manufacturer:	Sauer-Danfoss
Type:	51D110
System:	Axial piston-bent axle
Max. displacement (stage 1):	110 cm ³ /U
Min. displacement (stage 2):	65,9 cm ³ /U
Perm. leak oil quantity:	2 l/min
Drum drive:	
Manufacturer:	Poclain
Type:	MSE 18 2CX
System:	Radial piston
Displacement stage 1:	2800 cm ³ /U
Displacement stage 2:	1400 cm ³ /U
Perm. leak oil quantity:	2 l/min
Vibration pump:	
Manufacturer:	Sauer-Danfoss

Type:	42R 041
System:	Axial piston-swash plate
Max. displacement:	41 cm ³ /U
Starting pressure:	350+/-50 bar
Operating pressure, soil dependent:	ca.100 bar

Vibration motor:

Manufacturer:	Hydromatik
Type:	A10FM 45
System:	Axial piston-swash plate
Displacement:	45 cm ³ /U
Frequency:	30/36 Hz
Amplitude:	1,8/0,9 mm

Steering and charge pump:

Manufacturer:	Bosch
Type:	HY/ZFS11/22,5
System:	Gear pump
Displacement:	22,5 cm ³ /U
Max. steering pressure:	190+/-10 bar

Steering valve:

Manufacturer:	Sauer-Danfoss
Type:	OSPC 500 ON
System:	Rotary valve

Rear axle:

Manufacturer:	Dana
Type:	CHC 192/51HD
Differential:	No-Spin
Degree of locking:	100 %
Reduction ratio:	43,72

Filling capacities:

Engine coolant:	16 l (50% Water, 50% Anti-freeze agent on Ethane-diol-basis)
Engine oil:	10 l (SAE 15W-40, API SJ/CF)
Hydraulic oil:	60 l (HVLP 46 VI 150)
Vibration bearing housing:	2x 0,8 l (SAE 15W-40, API SJ/CF)
Rear axle:	11 l (SAE 90 EP, API GL 5)
Rear axle wheel hubs:	2,9 l (SAE 90 EP, API GL 5)
AC refrigerant:	1100 g (R 134a)
Compressor oil (filling the system):	100 ml (PAG Öl)

BOMAG Central Service - Technical data and adjustment values**Status: 2003-03-10**

Product type:	BW 213 DH-3
Type No.:	581 43
Serial numbers from:	101 581 43 1001
Engine:	
Manufacturer:	Deutz
Type:	BF4M1013EC
Combustion principle:	4-stroke-Diesel
Cooling:	Water
Number of cylinders:	4
Power acc. to ISO 9249:	114 kW
Power data at nominal speed of:	2200 1/min
Low idle speed:	900+/-200 1/min
High idle speed:	2430+/-50 1/min
Spec. fuel consumption:	235 g/kWh
Valve clearance, inlet:	0,3 mm
Valve clearance, outlet:	0,5 mm
Opening pressure, injection valves:	275 bar
Starter voltage:	12 V
Starter power:	3,1 kW
Travel pump:	
Manufacturer:	Sauer-Danfoss
Type:	90R 075
System:	Axial piston-swash plate
Max. displacement:	75 cm ³ /U
Max. flow ratio:	172,9 l/min
High pressure limitation:	435 +/-15 bar
Charge pressure, high idle:	25+/-1 bar
Reduction gear, drum:	
Manufacturer:	Sauer-Danfoss
Type:	CR 31
Transmission ratio:	45,6
Travel motor, rear:	
Manufacturer:	Sauer-Danfoss
Type:	51D110
System:	Axial piston-bent axle
Max. displacement (stage 1):	110 cm ³ /U
Min. displacement (stage 2):	31,4 cm ³ /U
Perm. leak oil quantity:	2 l/min
Drum drive:	
Manufacturer:	Sauer-Danfoss
Type:	51C 110
System:	Axial piston-swash plate
Displacement stage 1:	110 cm ³ /U

Displacement stage 2:	31,4 cm ³ /U
Perm. leak oil quantity:	2 l/min

Vibration pump:

Manufacturer:	Sauer-Danfoss
Type:	42R 041
System:	Axial piston-swash plate
Max. displacement:	41 cm ³ /U
Starting pressure:	350+/-50 bar
Operating pressure, soil dependent:	ca.100 bar

Vibration motor:

Manufacturer:	Hydromatik
Type:	A10FM 45
System:	Axial piston-swash plate
Displacement:	45 cm ³ /U
Frequency:	30/36 Hz
Amplitude:	1,8/0,9 mm

Steering and charge pump:

Manufacturer:	Bosch
Type:	HY/ZFS11/22,5
System:	Gear pump
Displacement:	22,5 cm ³ /U
Max. steering pressure:	190+/-10 bar

Steering valve:

Manufacturer:	Sauer-Danfoss
Type:	OSPC 500 ON
System:	Rotary valve

Rear axle:

Manufacturer:	Dana
Type:	CHC 193/66LD
Differential:	No-Spin
Degree of locking:	100 %
Reduction ratio:	65,08

Filling capacities:

Engine coolant:	16 l (50% Water, 50% Anti-freeze agent on Ethane-diol-basis)
Engine oil:	10 l (SAE 15W-40, API SJ/CF)
Hydraulic oil:	60 l (HVLP 46 VI 150)
Vibration bearing housing:	2x 0,8 l (SAE 15W-40, API SJ/CF)
Rear axle:	1,8 l (SAE 90 EP, API GL 5)
Rear axle wheel hubs:	1,85 l (SAE 90 EP, API GL 5)
Rear axle, transmission:	9,5 l (SAE 90 EP, API GL 5)
Reduction gear, drum:	2,8 l (SAE 90 EP, API GL 5)
AC refrigerant:	1100 g (R 134a)
Compressor oil (filling the system):	100 ml (PAG Öl)

BOMAG Central Service - Technical data and adjustment values**Status: 2003-03-10**

Product type:	BW 213 PDH-3
Type No.:	581 44
Serial numbers from:	101 581 44 1001
Engine:	
Manufacturer:	Deutz
Type:	BF4M1013EC
Combustion principle:	4-stroke-Diesel
Cooling:	Water
Number of cylinders:	4
Power acc. to ISO 9249:	114 kW
Power data at nominal speed of:	2200 1/min
Low idle speed:	900+/-200 1/min
High idle speed:	2430+/-50 1/min
Spec. fuel consumption:	235 g/kWh
Valve clearance, inlet:	0,3 mm
Valve clearance, outlet:	0,5 mm
Opening pressure, injection valves:	275 bar
Starter voltage:	12 V
Starter power:	3,1 kW
Travel pump:	
Manufacturer:	Sauer-Danfoss
Type:	90R 075
System:	Axial piston-swash plate
Max. displacement:	75 cm ³ /U
Max. flow ratio:	172,9 l/min
High pressure limitation:	435 +/-15 bar
Charge pressure, high idle:	25+/-1 bar
Reduction gear, drum:	
Manufacturer:	Sauer-Danfoss
Type:	CR 31
Transmission ratio:	45,6
Travel motor, rear:	
Manufacturer:	Sauer-Danfoss
Type:	51D110
System:	Axial piston-bent axle
Max. displacement (stage 1):	110 cm ³ /U
Min. displacement (stage 2):	31,4 cm ³ /U
Perm. leak oil quantity:	2 l/min
Drum drive:	
Manufacturer:	Sauer-Danfoss
Type:	51C 110
System:	Axial piston-swash plate
Displacement stage 1:	110 cm ³ /U

Displacement stage 2:	31,4 cm ³ /U
Perm. leak oil quantity:	2 l/min

Vibration pump:

Manufacturer:	Sauer-Danfoss
Type:	42R 041
System:	Axial piston-swash plate
Max. displacement:	41 cm ³ /U
Starting pressure:	350+/-50 bar
Operating pressure, soil dependent:	ca.100 bar

Vibration motor:

Manufacturer:	Hydromatik
Type:	A10FM 45
System:	Axial piston-swash plate
Displacement:	45 cm ³ /U
Frequency:	30/36 Hz
Amplitude:	1,8/0,9 mm

Steering and charge pump:

Manufacturer:	Bosch
Type:	HY/ZFS11/22,5
System:	Gear pump
Displacement:	22,5 cm ³ /U
Max. steering pressure:	190+/-10 bar

Steering valve:

Manufacturer:	Sauer-Danfoss
Type:	OSPC 500 ON
System:	Rotary valve

Rear axle:

Manufacturer:	Dana
Type:	CHC 193/66LD
Differential:	No-Spin
Degree of locking:	100 %
Reduction ratio:	65,08

Filling capacities:

Engine coolant:	16 l (50% Water, 50% Anti-freeze agent on Ethane-diol-basis)
Engine oil:	10 l (SAE 15W-40, API SJ/CF)
Hydraulic oil:	60 l (HVLP 46 VI 150)
Vibration bearing housing:	2x 0,8 l (SAE 15W-40, API SJ/CF)
Rear axle:	1,8 l (SAE 90 EP, API GL 5)
Rear axle wheel hubs:	1,85 l (SAE 90 EP, API GL 5)
Rear axle, transmission:	9,5 l (SAE 90 EP, API GL 5)
Reduction gear, drum:	2,8 l (SAE 90 EP, API GL 5)
AC refrigerant:	1100 g (R 134a)
Compressor oil (filling the system):	100 ml (PAG Öl)

BOMAG Central Service - Technical data and adjustment values**Status: 2003-03-10**

Product type:	BW 213 DH-3 BVC
Type No.:	581 45
Serial numbers from:	101 581 45 1001
Engine:	
Manufacturer:	Deutz
Type:	BF4M1013EC
Combustion principle:	4-stroke-Diesel
Cooling:	Water
Number of cylinders:	4
Power acc. to ISO 9249:	114 kW
Power data at nominal speed of:	2200 1/min
Low idle speed:	900+/-200 1/min
High idle speed:	2430+/-50 1/min
Spec. fuel consumption:	235 g/kWh
Valve clearance, inlet:	0,3 mm
Valve clearance, outlet:	0,5 mm
Opening pressure, injection valves:	275 bar
Starter voltage:	12 V
Starter power:	3,1 kW
Travel pump:	
Manufacturer:	Sauer-Danfoss
Type:	90R 075
System:	Axial piston-swash plate
Max. displacement:	75 cm ³ /U
Max. flow ratio:	172,9 l/min
High pressure limitation:	435 +/-15 bar
Charge pressure, high idle:	25+/-1 bar
Reduction gear, drum:	
Manufacturer:	Sauer-Danfoss
Type:	CR 31
Transmission ratio:	45,6
Travel motor, rear:	
Manufacturer:	Sauer-Danfoss
Type:	51D110
System:	Axial piston-bent axle
Max. displacement (stage 1):	110 cm ³ /U
Min. displacement (stage 2):	31,4 cm ³ /U
Perm. leak oil quantity:	2 l/min
Drum drive:	
Manufacturer:	Sauer-Danfoss
Type:	51C 110
System:	Axial piston-swash plate
Displacement stage 1:	110 cm ³ /U

Displacement stage 2:	31,4 cm ³ /U
Perm. leak oil quantity:	2 l/min

Vibration pump:

Manufacturer:	Sauer-Danfoss
Type:	42R 041
System:	Axial piston-swash plate
Max. displacement:	41 cm ³ /U
Starting pressure:	350+/-50 bar
Operating pressure, soil dependent:	ca.100 bar

Vibration motor:

Manufacturer:	Hydromatik
Type:	A2FM 45
System:	Axial piston-bent axle
Displacement:	80 cm ³ /U
Frequency:	28 Hz
Amplitude:	2,4 mm

Steering and charge pump:

Manufacturer:	Bosch
Type:	HY/ZFS11/22,5
System:	Gear pump
Displacement:	22,5 cm ³ /U
Max. steering pressure:	190+/-10 bar

Steering valve:

Manufacturer:	Sauer-Danfoss
Type:	OSPC 500 ON
System:	Rotary valve

Swashing motor, VARIO:

Manufacturer:	Pleiger
Type:	STF 1-000-21
System:	piston-gear rack

Rear axle:

Manufacturer:	Dana
Type:	CHC 193/66LD
Differential:	No-Spin
Degree of locking:	100 %
Reduction ratio:	65,08

Filling capacities:

Engine coolant:	16 l (50% Water, 50% Anti-freeze agent on Ethane-diol-basis)
Engine oil:	10 l (SAE 15W-40, API SJ/CF)
Hydraulic oil:	60 l (HVLV 46 VI 150)
Vibration bearing housing:	16,5 l (SAE 15W-40, API SJ/CF)
Drum filling VARIO:	80 l (50% Water, 50% Anti-freeze agent on Ethane-diol-basis)
Gearbox VARIO:	3,6 l (Hight temperature grease AUTOL Top 2000)
Rear axle:	1,8 l (SAE 90 EP, API GL 5)
Rear axle wheel hubs:	1.85 l (SAE 90 EP. API GL 5)

Rear axle, transmission:	9,5 l (SAE 90 EP, API GL 5)
Reduction gear, drum:	2,8 l (SAE 90 EP, API GL 5)
AC refrigerant:	1100 g (R 134a)
Compressor oil (filling the system):	100 ml (PAG Öl)

BOMAG Central Service - Technical data and adjustment values**Status: 2003-03-10**

Product type:	BW 213 DH-3 BVC mit Platten
Type No.:	581 41
Serial numbers from:	101 581 41 1001
Engine:	
Manufacturer:	Deutz
Type:	BF4M1013EC
Combustion principle:	4-stroke-Diesel
Cooling:	Water
Number of cylinders:	4
Power acc. to ISO 9249:	114 kW
Power data at nominal speed of:	2200 1/min
Low idle speed:	900+/-200 1/min
High idle speed:	2430+/-50 1/min
Spec. fuel consumption:	235 g/kWh
Valve clearance, inlet:	0,3 mm
Valve clearance, outlet:	0,5 mm
Opening pressure, injection valves:	275 bar
Starter voltage:	12 V
Starter power:	3,1 kW
Travel pump:	
Manufacturer:	Sauer-Danfoss
Type:	90R 075
System:	Axial piston-swash plate
Max. displacement:	75 cm ³ /U
Max. flow ratio:	172,9 l/min
High pressure limitation:	435 +/-15 bar
Charge pressure, high idle:	25+/-1 bar
Reduction gear, drum:	
Manufacturer:	Sauer-Danfoss
Type:	CR 31
Transmission ratio:	45,6
Travel motor, rear:	
Manufacturer:	Sauer-Danfoss
Type:	51D110
System:	Axial piston-bent axle
Max. displacement (stage 1):	110 cm ³ /U
Min. displacement (stage 2):	31,4 cm ³ /U
Perm. leak oil quantity:	2 l/min
Drum drive:	
Manufacturer:	Sauer-Danfoss
Type:	51C 110
System:	Axial piston-swash plate
Displacement stage 1:	110 cm ³ /U

Displacement stage 2: 27,5 cm³/U
 Perm. leak oil quantity: 2 l/min

Vibration pump:

Manufacturer: Sauer-Danfoss
 Type: 42R 041
 System: Axial piston-swash plate
 Max. displacement: 41 cm³/U
 Starting pressure: 350+/-50 bar
 Operating pressure, soil dependent: ca.100 bar

Vibration motor:

Manufacturer: Hydromatik
 Type: A2FM 45
 System: Axial piston-bent axle
 Displacement: 80 cm³/U
 Frequency: 28 Hz
 Amplitude: 2,4 mm

Vibration motor, plates:

Manufacturer: Hydromatik
 Type: A2FM16
 System: Axial piston-bent axle
 Displacement: 16 cm³/U
 Frequency: 35-65/45-85 Hz

Additional pump, plates:

Manufacturer: Sauer-Danfoss
 Type: 42R 041
 System: Axial piston-swash plate
 Max. displacement: 41 cm³/U
 Starting pressure: 370+/-10 bar
 Charge pressure, high idle: 20+/-2 bar

Steering and charge pump:

Manufacturer: Bosch
 Type: HY/ZFS11/22,5
 System: Gear pump
 Displacement: 22,5 cm³/U
 Max. steering pressure: 190+/-10 bar

Steering valve:

Manufacturer: Sauer-Danfoss
 Type: OSPC 500 ON
 System: Rotary valve

Swashing motor, VARIO:

Manufacturer: Pleiger
 Type: STF 1-000-21
 System: piston-gear rack

Rear axle:

Manufacturer: Dana
 Type: C10 102/51

Type:	CHC 193/31
Differential:	No-Spin
Degree of locking:	100 %
Reduction ratio:	65,08
Filling capacities:	
Engine coolant:	16 l (50% Water, 50% Anti-freeze agent on Ethane-diol-basis)
Engine oil:	10 l (SAE 15W-40, API SJ/CF)
Hydraulic oil:	60 l (HVLP 46 VI 150)
Vibration bearing housing:	16,5 l (SAE 15W-40, API SJ/CF)
Drum filling VARIO:	80 l (50% Water, 50% Anti-freeze agent on Ethane-diol-basis)
Gearbox VARIO:	3,6 l (Hight temperature grease AUTOL Top 2000)
Rear axle:	11 l (SAE 90 EP, API GL 5)
Rear axle wheel hubs:	2,9 l (SAE 90 EP, API GL 5)
Rear axle, transmission:	1,9 l (SAE 90 EP, API GL 5)
Reduction gear, drum:	2,8 l (SAE 90 EP, API GL 5)
AC refrigerant:	1100 g (R 134a)
Compressor oil (filling the system):	100 ml (PAG Öl)

BOMAG Central Service - Technical data and adjustment values**Status: 2003-03-10**

Product type:	BW 214 DH-3
Type No.:	581 46
Serial numbers from:	101 581 46 1001
Engine:	
Manufacturer:	Deutz
Type:	BF4M1013EC
Combustion principle:	4-stroke-Diesel
Cooling:	Water
Number of cylinders:	4
Power acc. to ISO 9249:	114 kW
Power data at nominal speed of:	2200 1/min
Low idle speed:	900+/-200 1/min
High idle speed:	2430+/-50 1/min
Spec. fuel consumption:	235 g/kWh
Valve clearance, inlet:	0,3 mm
Valve clearance, outlet:	0,5 mm
Opening pressure, injection valves:	275 bar
Starter voltage:	12 V
Starter power:	3,1 kW
Travel pump:	
Manufacturer:	Sauer-Danfoss
Type:	90R 075
System:	Axial piston-swash plate
Max. displacement:	75 cm ³ /U
Max. flow ratio:	176,25 l/min
High pressure limitation:	435 +/-15 bar
Charge pressure, high idle:	25+/-1 bar
Reduction gear, drum:	
Manufacturer:	Sauer-Danfoss
Type:	CR 31
Transmission ratio:	45,6
Travel motor, rear:	
Manufacturer:	Sauer-Danfoss
Type:	51D110
System:	Axial piston-bent axle
Max. displacement (stage 1):	110 cm ³ /U
Min. displacement (stage 2):	31,4 cm ³ /U
Perm. leak oil quantity:	2 l/min
Drum drive:	
Manufacturer:	Sauer-Danfoss
Type:	51C 110
System:	Axial piston-swash plate
Displacement stage 1:	110 cm ³ /U

Displacement stage 2:	27,5 cm ³ /U
Perm. leak oil quantity:	2 l/min

Vibration pump:

Manufacturer:	Sauer-Danfoss
Type:	42R 041
System:	Axial piston-swash plate
Max. displacement:	41 cm ³ /U
Starting pressure:	350+/-50 bar
Operating pressure, soil dependent:	ca.100 bar

Vibration motor:

Manufacturer:	Hydromatik
Type:	A10FM 45
System:	Axial piston-swash plate
Displacement:	45 cm ³ /U
Frequency:	30/36 Hz
Amplitude:	1,8/0,9 mm

Steering and charge pump:

Manufacturer:	Bosch
Type:	HY/ZFS11/22,5
System:	Gear pump
Displacement:	22,5 cm ³ /U
Max. steering pressure:	190+/-10 bar

Steering valve:

Manufacturer:	Sauer-Danfoss
Type:	OSPC 500 ON
System:	Rotary valve

Rear axle:

Manufacturer:	Dana
Type:	CHC 193/66LD
Differential:	No-Spin
Degree of locking:	100 %
Reduction ratio:	65,08

Filling capacities:

Engine coolant:	16 l (50% Water, 50% Anti-freeze agent on Ethane-diol-basis)
Engine oil:	10 l (SAE 15W-40, API SJ/CF)
Hydraulic oil:	60 l (HVLP 46 VI 150)
Vibration bearing housing:	2x 0,8 l (SAE 15W-40, API SJ/CF)
Rear axle:	1,8 l (SAE 90 EP, API GL 5)
Rear axle wheel hubs:	1,85 l (SAE 90 EP, API GL 5)
Rear axle, transmission:	9,5 l (SAE 90 EP, API GL 5)
Reduction gear, drum:	2,8 l (SAE 90 EP, API GL 5)
AC refrigerant:	1100 g (R 134a)
Compressor oil (filling the system):	100 ml (PAG Öl)

Maintenance

Single drum rollers are heavy-duty construction machines for extremely difficult tasks in earth construction. To be able to meet these demands these machines must always be ready to be loaded up to their limits. Furthermore, all guards and safety installations must always be fully functional.

Thorough maintenance of the machine is therefore mandatory. This not only guarantees a remarkably higher functional safety, but also prolongs the lifetime of the machine and of important components.

The time required for thorough maintenance is only minor when being compared with the malfunctions and faults that may occur if these instructions are not observed.

The maintenance intervals are given in operating hours. It is quite obvious that with each maintenance interval all the work for shorter preceding intervals must also be performed. During the 2000 hours interval you must also perform the work described for the service intervals after 250, 500 and 1000 hours.

It should also be clear that with the 2500 hour interval only the work for the 10, 250 and 500 hours intervals must be performed.

During maintenance work you must only use the fuels and lubricants mentioned in the table of fuels and lubricants (oils, fuels, grease etc.).

This training manual is handed out together with the presently valid operation and maintenance manual. For the individual maintenance intervals and the description of the maintenance work involved please refer to these maintenance instructions.

Maintenance table

Maintenance work	Remark	Running-in inspect. (50 op. hours)	10 oper. hours	50 oper. hours	250 oper. hours	500 oper. hours	1000 oper. hours	2000 oper. hours	as required
Change the engine oil filter		X							
Change the engine oil		X							
Check, adjust the valve clearance		X							
Tighten all bolted connections on air intake, exhaust, oil sump and engine mounts		X							
Tighten all bolted connections on the machine		X							
Retighten the wheel studs		X							
Change the oil in the axle		X							
Change the oil in the planetary drives		X							
Change the oil in the axle reduction gear	not BW 213 D-3	X							
Change the oil in the drum drive reduction gear	not BW 213 D-3	X							
Change the oil in the vibrator housings drives	see note	X				X	X		
Check the engine oil level	Dipstick mark		X	X	X	X	X	X	
Check the water separator			X	X	X	X	X	X	
Check the fuel level	approx. 340 l		X	X	X	X	X	X	
Check the hydraulic oil level	Inspection glass		X	X	X	X	X	X	
Check the coolant level			X	X	X	X	X	X	
Check the tire pressure	1.1 bar			X	X	X	X	X	
Adjust the scrapers				X	X	X	X	X	

Maintenance work	Remark	Running-in inspect. (50 op. hours)	10 oper. hours	50 oper. hours	250 oper. hours	500 oper. hours	1000 oper. hours	2000 oper. hours	as required
Clean the cooling fins on radiator, charge air cooler and hydraulic oil cooler					X	X	X	X	
Check the oil level in the axle					X	X	X	X	
Check the oil level in the intermediate gear of the axle	not BW 213 D-3				X	X	X	X	
Check the oil level in the planetary drives					X	X	X	X	
Check the oil level in the drum drive reduction gear					X	X	X	X	
Check the oil level in the vibrator housings					X	X	X	X	
Check V-belt and tension, change V-Belt if necessary	not BW 213 D-3				X	X	X	X	
Change engine oil and oil filter	min. 1 x per year					X	X	X	
Darin the sludge from the fuel tank						X	X	X	
Battery maintenance	Grease the poles					X	X	X	
Change the oil in the axle	min. 1 x per year						X	X	
Change the oil in the planetary drives	min. 1 x per year						X	X	
Change the oil in the intermediate gear of the axle	min. 1 x per year, not BW 213 D-3						X	X	
Change the oil in the drum drive reduction gear	not BW 213 D-3						X	X	
Change the fuel filter and prefilter cartridge							X	X	
Change the oil in the vibrator housings drives	1 X year; 0.8 l/side						X	X	
Check the engine mounts							X	X	
Check the fastening of the axle on the frame							X	X	
Tighten the wheel nuts							X	X	
Check the ROPS							X	X	

Maintenance work	Remark	Running-in inspect. (50 op. hours)	10 oper. hours	50 oper. hours	250 oper. hours	500 oper. hours	1000 oper. hours	2000 oper. hours	as required
Check V-belt and tension, change V-Belt if necessary	only BW 213 D-3						X	X	
Checking and adjusting the valve clearance (on cold engine) DEUTZ	Inlet = 0,3 mm exhaust = 0,5 mm						X	X	
Check / Change fuel leakage lines							X	X	
Change hydraulic oil and breather filter	min. every 2 years							X	X
Change the hydraulic oil filter	min. every 2 years and after repairs in the hydraulic system							X	X
Change the coolant	min. every 2 years							X	X
Clean, replace the dry air filter element	min. 1 x year, safety cartridge min. every 2 years								X
Adjust the parking brake									X
Bleed the fuel system									X
Change the tires									X
Change the fresh air filter for the cabin									X
Tighten all bolted connections	Observe the tightening torques!								X
Engine conservation	Before longer periods of standstill								X

Additionally every 12.000 hours: engine service:

- Replace the Injection valves
- Replace the coolant pump
- Replace the pressure retaining valve
- Replace the crankcase ventilation valve

Note:

When changing filters use only the original filters specified in the operating and maintenance instructions for this machine. The installation of incorrect filters (e.g. insufficient pressure resistance) can lead to severe damage on engine or hydraulic components.

The coolant for the water cooled engine must always be mixed with 40 to 50% anti-freeze additive (even under hot environmental conditions) as a preventive measure against corrosion and cavitation. However, the additive proportion must not exceed 60%, since this would have an adverse effect on the cooling ability of the coolant.

Oil change intervals in the vibrator housings: after 50 h, after 500 h, after 1000 h and then every 1000 h.

Deutz diesel engine

Single drum rollers of series BW 213 D-3 are from model 2003 powered by a Deutz diesel engine of product range BF4M 2012 C.

All other Models of series BW 213/214 DH-3/PDH-3 are from model 2003 powered by a Deutz diesel engine of product range BF4M 1013 C.

This automotive engine is characterized by the following features:

- short and compact design,
- low noise level,
- almost vibration-free running,
- low fuel consumption,
- low exhaust emissions (EPA II),
- high power reserves and
- good access to all service points.

Crankcase and cylinders of this engine are made of alloyed cast iron. This provides strength and ensures high wear resistance.

The forged steel conrods are fitted with compensation weights near the conrod bearing seats. These weights compensate manufacturing tolerances with respect to weight and centre of gravity.

The pistons are made of an aluminium alloy. The combustion chamber recess is slightly offset from the middle at its side walls are inclined for 10° towards the inside. All pistons are fitted with three piston rings and a cast iron ring carrier for the first ring. The pistons are lubricated by an oil mist.

The forged crankshaft is equipped with integrated counterweights.

The block-type cylinder head is made of cast steel. Each cylinder is fitted with one intake and one exhaust valve. The valve guides are shrunk into the cylinder head. The valve seat rings are made of high-grade steel and are also shrink fitted.

Service side

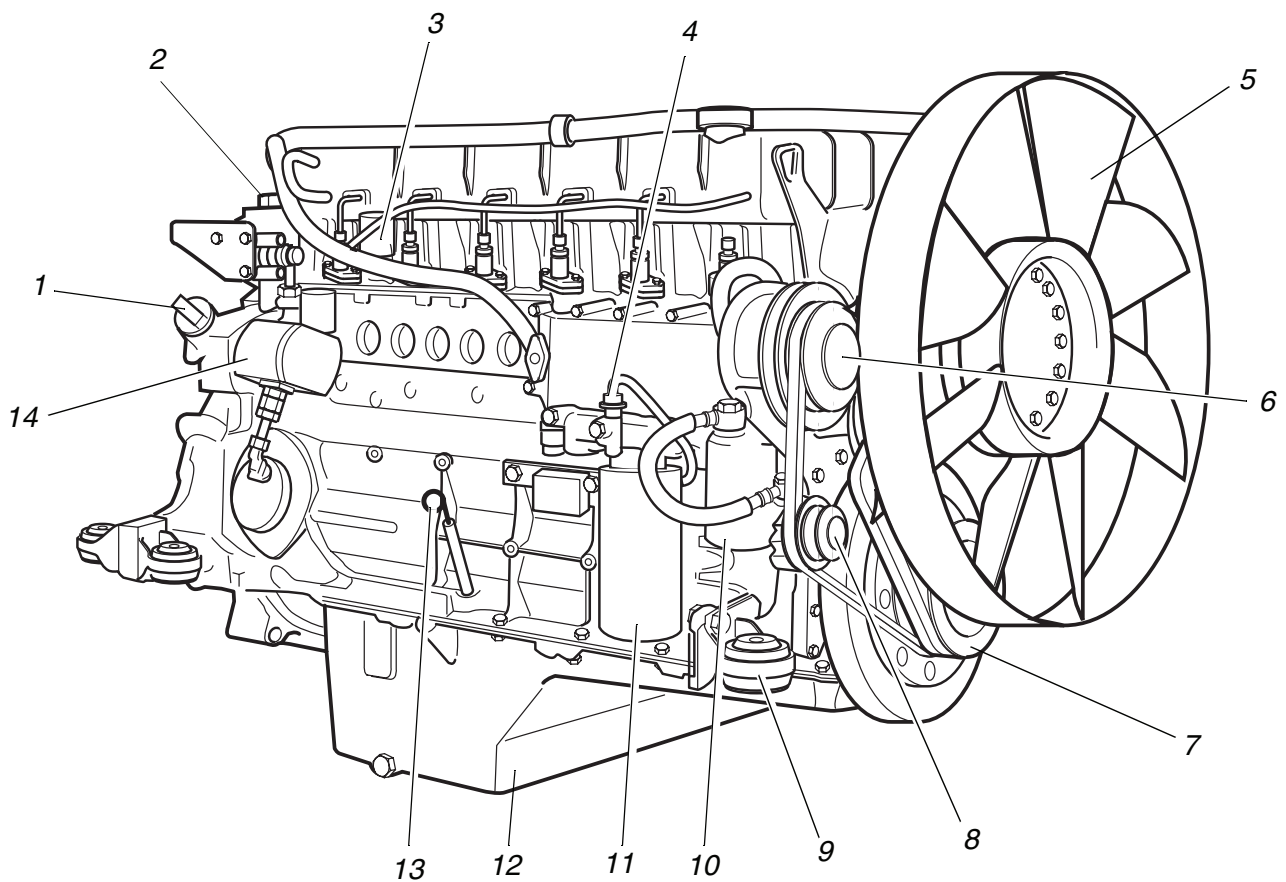


Fig. 1: Service side BFM 2012/1013

- | | | | |
|---|--------------------------------------|----|------------------------|
| 1 | Oil filler neck | 8 | Fuel pump |
| 2 | Valve, boost fuel supply (not BOMAG) | 9 | Engine mounting |
| 3 | Engine solenoid | 10 | Fuel filter |
| 4 | Oil pressure switch | 11 | Lubrication oil filter |
| 5 | Cooling air blower | 12 | Oil sump |
| 6 | Coolant pump | 13 | Dipstick |
| 7 | V-belt pulley | 14 | Steering/charge pump |

Starter side

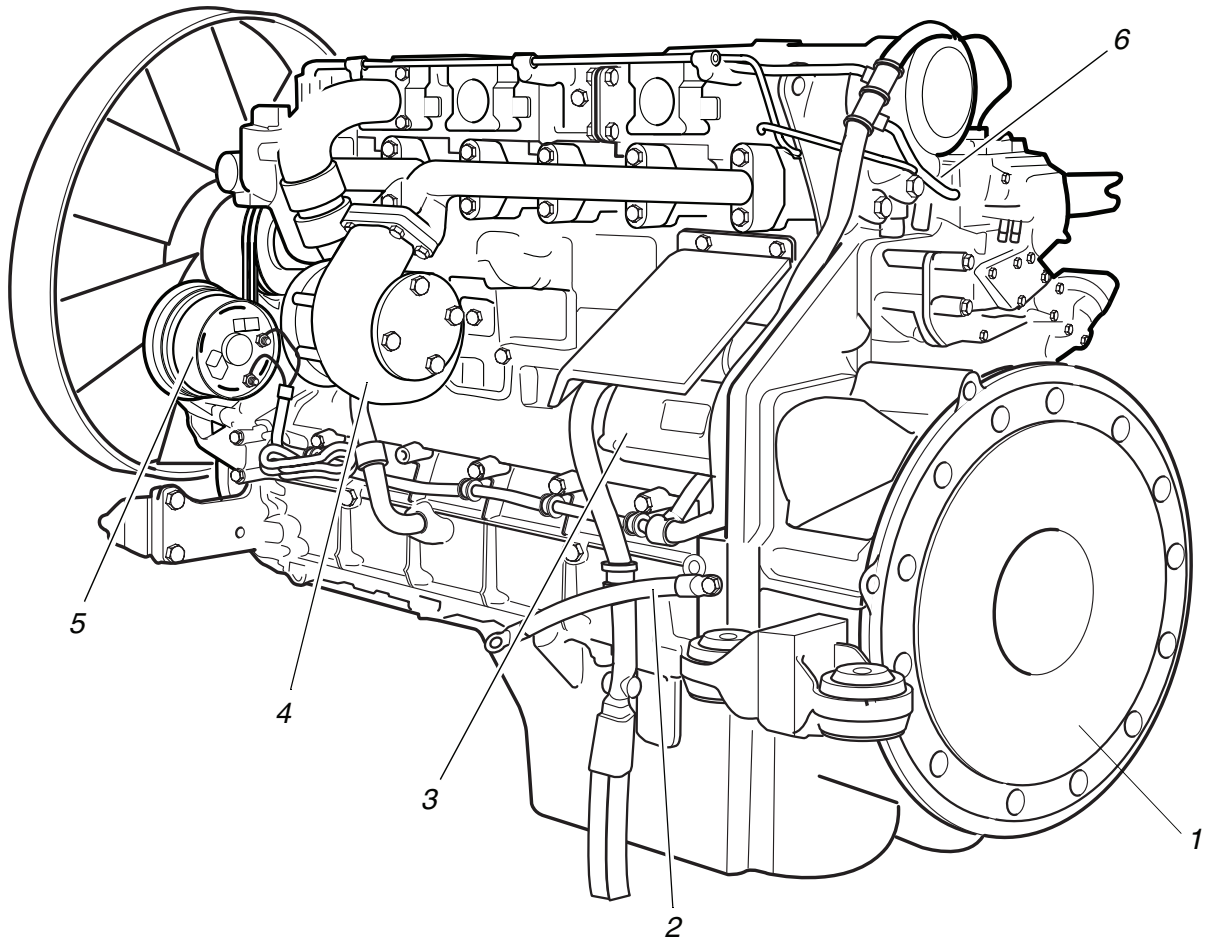


Fig. 2: Starter side

- 1 *Flywheel*
- 2 *Ground cable*
- 3 *Starter*
- 4 *Turbo charger*
- 5 *Generator*
- 6 *Coolant temperature switch*

Lubrication oil circuit

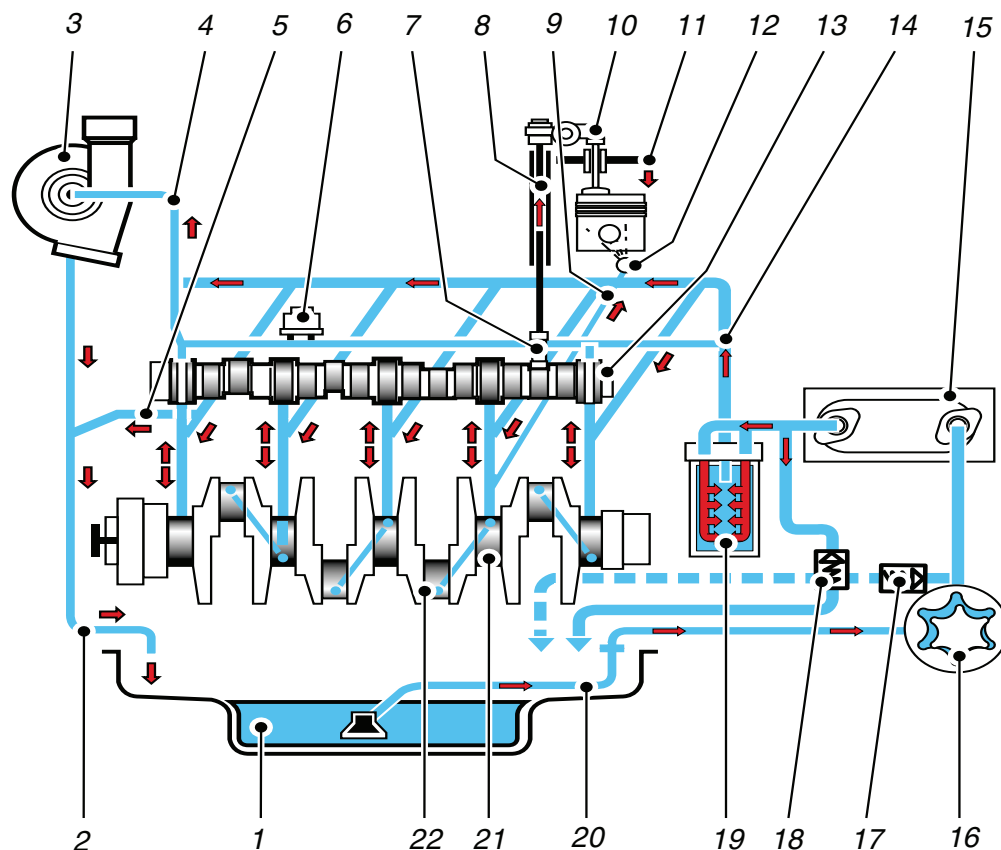


Fig. 3: Lubrication oil circuit

- | | |
|--|---------------------------|
| 1 Oil sump | 12 Piston cooling nozzle |
| 2 Return flow turbo charger to crankcase | 13 Camshaft bearing |
| 3 Turbo charger | 14 Main oil channel |
| 4 Oil line to turbo charger | 15 Lubrication oil cooler |
| 5 Line to mass balance wheel (2 x) | 16 Lubrication oil pump |
| 6 Oil pressure sensor | 17 Pressure relief valve |
| 7 Valve with pulse lubrication | 18 Leak oil return line |
| 8 Push rod, oil supply to rocker arms | 19 Lubrication oil filter |
| 9 Line to spray nozzles | 20 Suction line |
| 10 Rocker arm | 21 Crankshaft bearing |
| 11 Return flow to oil sump | 22 Conrod bearing |

Lubrication oil circuit

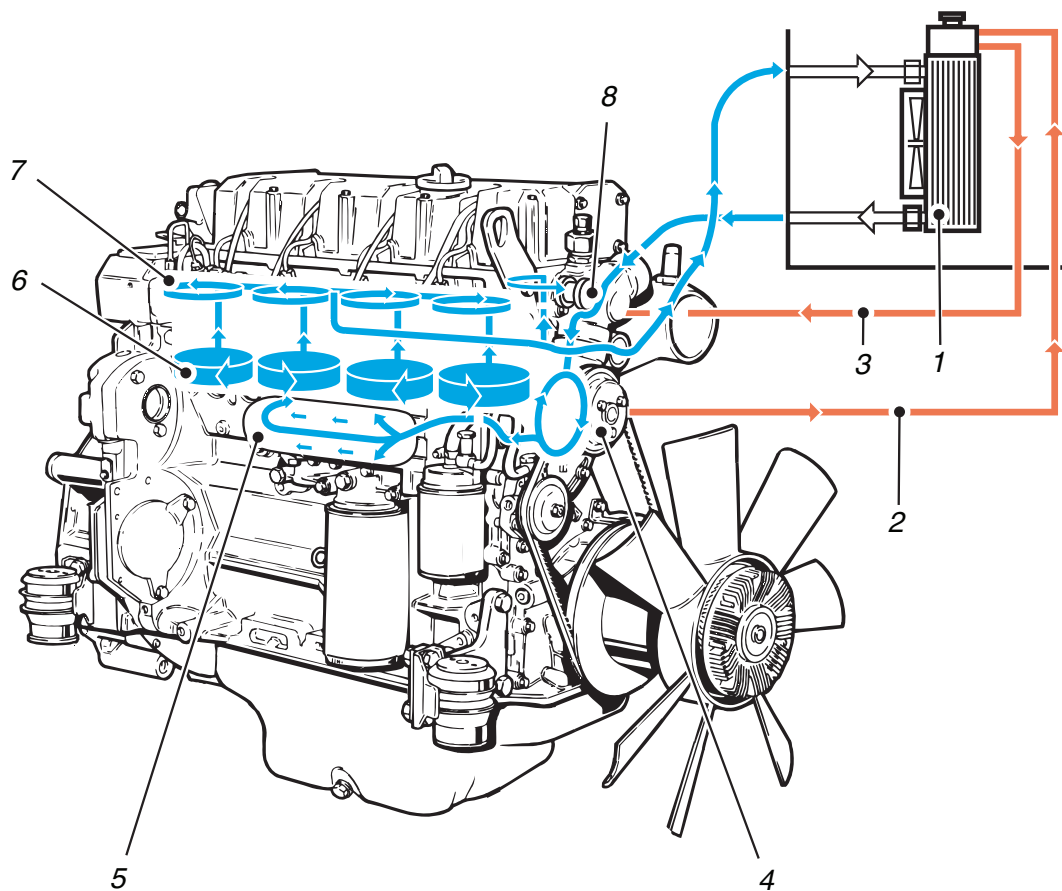


Fig. 4: Lubrication oil circuit

- 1 Cooler
- 2 To cooler
- 3 From cooler
- 4 Coolant pump
- 5 Lubrication oil cooler
- 6 Cylinder cooling
- 7 Cylinder head cooling
- 8 Ventilation connection between cylinder head and heat exchanger

Fuelsystem

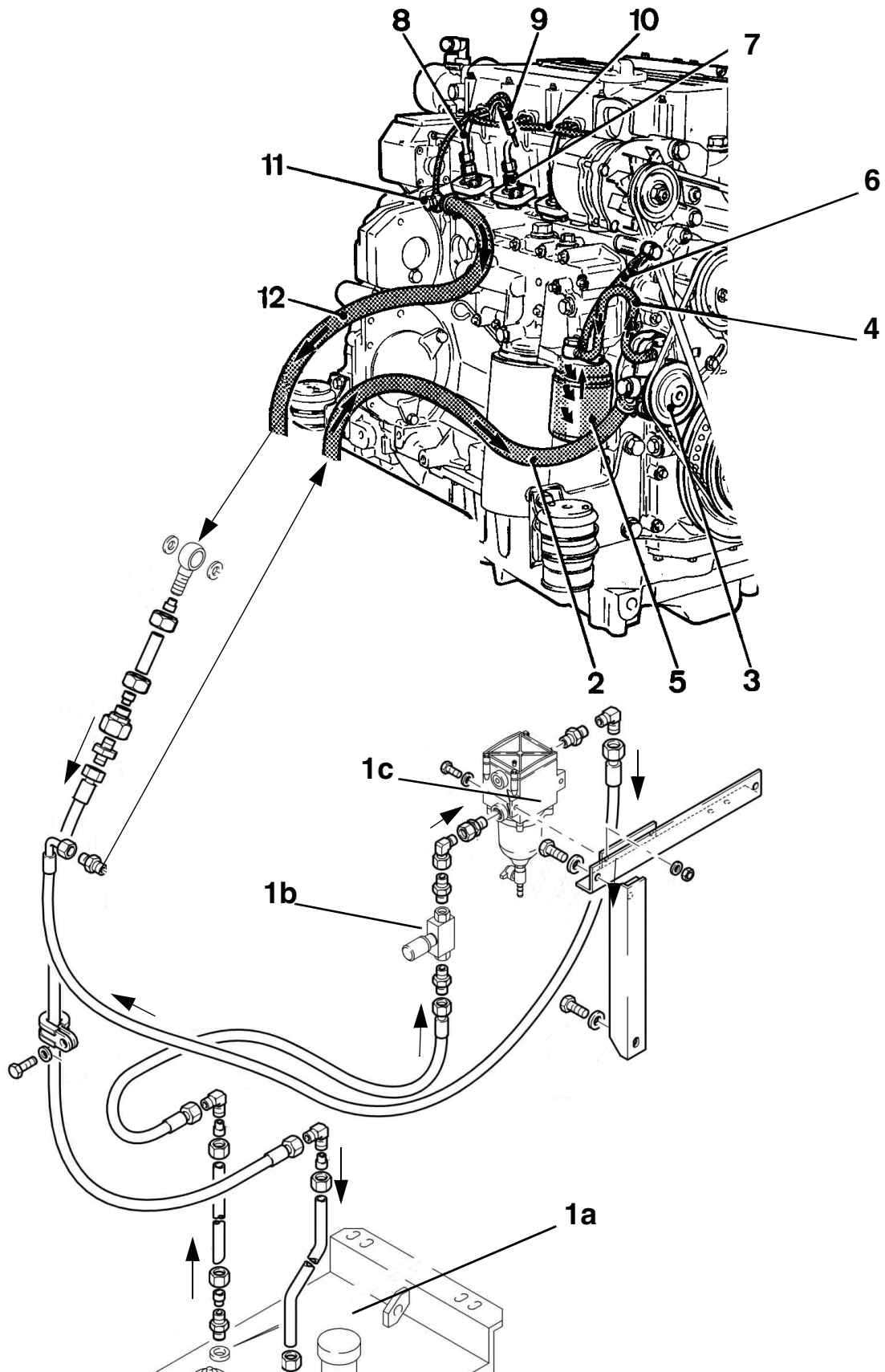


Fig. 5: Fuel system

Legend Fig. 6:

- 1a *Fuel tank*
- 1b *Manual fuel pump with integrated check valve*
- 1c *Fuel pre-filter / water separator*
- 2 *Feed to fuel lift pump*
- 3 *Fuel lift pump*
- 4 *Connecting line lift pump – main filter (**fuel pre-pressure up to 10 bar**)*
- 5 *Main fuel filter (**pressure resistant**)*
- 6 *Connecting line main filter – supply for injection pump*
- 7 *Single injection pump*
- 8 *High pressure line*
- 9 *Injection nozzle*
- 10 *Leakage line*
- 11 *Pressure retaining valve - 5 bar*
- 12 *Return flow to tank*

Fuel pre-filter / water separator (SEPAR-Filter)

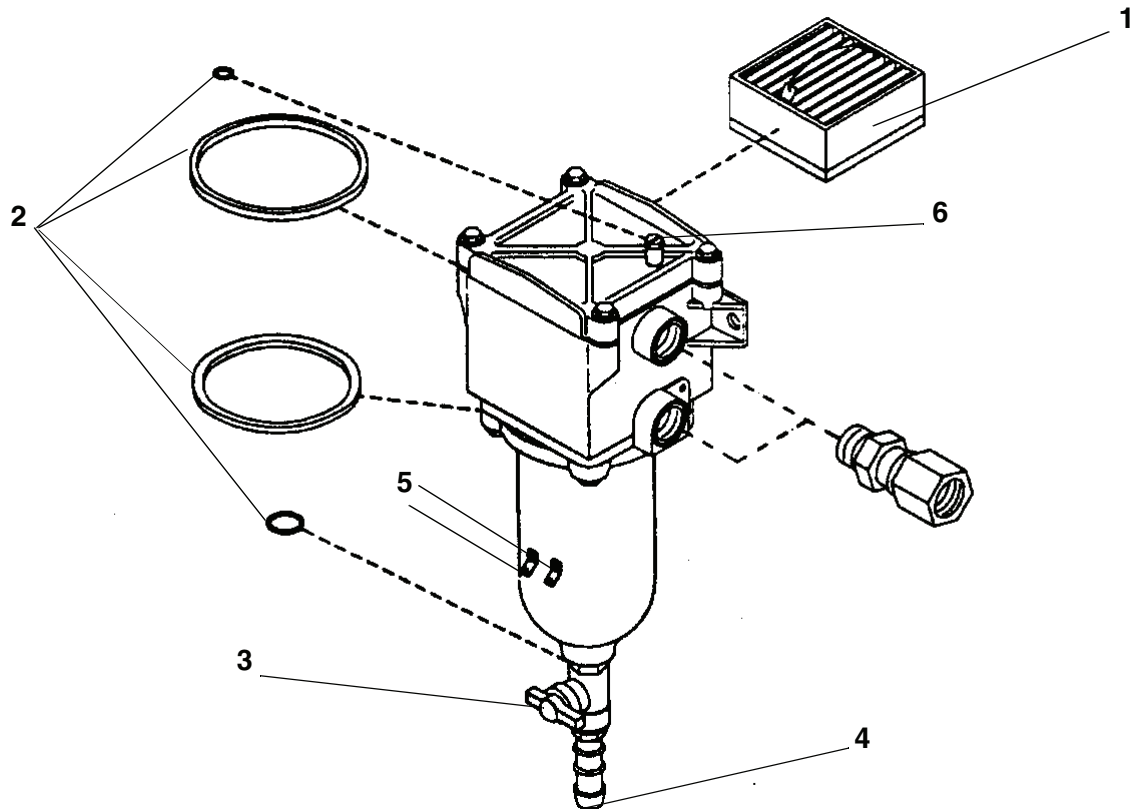


Fig. 6: Fuel filter / water separator

- 1 Filter element
- 2 Seal kit
- 3 Drain valve
- 4 Discharge from drain valve
- 5 Electric connection for water level sensor

The fuel pre-filter / water separator consists mainly of:

- the centrifugal water separator
- the dirt / water sediment bowl with water level warning sensor
- and the filter element

Function:

The fuel is drawn by the fuel lift pump into the filter through inlet port B (Fig.8). Inlet A is closed

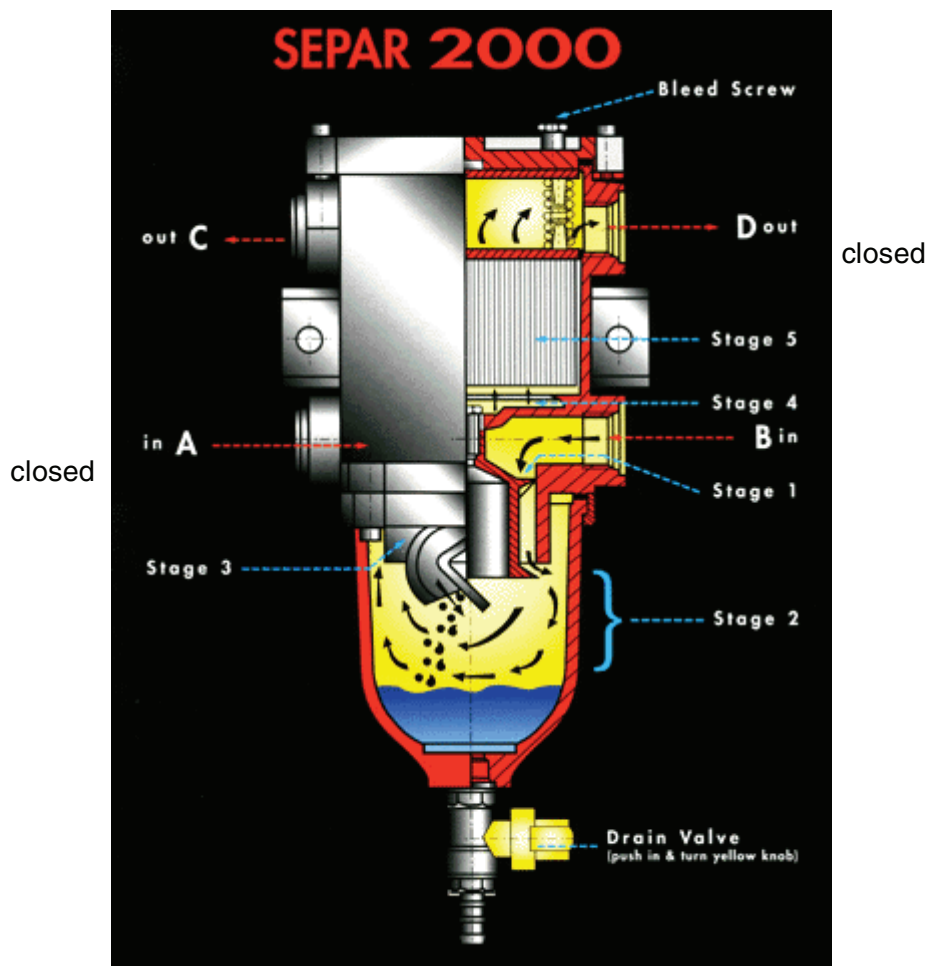


Fig. 7: SEPAR-Filter

Phase1:

The fuel flows from the inlet to the centrifuge. The centrifuge itself does not rotate. Rotation of the fuel is caused by the geometry of the centrifuge.

Phase 2:

The fuel coming out of the centrifuge flows against the outside wall of the collecting vessel. Here the velocity of the fuel is braked. Due to the inertia of the heavier dirt and water particles these are pressed to the outside so that they drop down into the collecting bowl by their gravity.

Phase 3:

Fuel now flow up along the outside of the centrifuge while it is still rotating inside the vessel. In this phase smaller dirt and water particles move to the middle of the vessel, where the water particles accumulate to larger drops. There they are picked up by the middle bigger wing of the centrifuge,

from where they drop down. This is caused by the fact that the lowest pressure in vessel is at the lowest point of the centrifuge.

Phase 4:

Even directly in front of the filter element the fuel is still in rotation. This causes further dirt and water particles to settle and drop down into the vessel.

Phase 5:

The water resistant filter element retains remaining smaller dirt and water particles.

Once the water level reaches the height of the warning connections, the warning light H 70 in the dashboard will light up.

Draining of water/fuel / regeneration of the filter element:

To open the drain valve keep the actuating button depressed and turn it.

If the filter element is clogged before a service is due (indicated by e.g. a power drop), the filter may be regenerated as follows to keep up operation of the engine:

- Open the bleeding screw (this applies atmospheric pressure to the filter element and releases bigger dirt particles from the bottom side of the filter, which will then sink down.
- Open the drain valve and let approx. 0.5 l of fuel run out. The fuel above the filter element presses through the filter element and cleans the underside of the filter element from dirt.
- Close the drain valve.
- Bleed the system with the manual fuel pump and then tighten the bleeding screw.

Main fuel filter

Attention!

The main fuel filter is subjected to approx. 10 bar fuel pre-pressure from the fuel lift pump. This pressure is considerably higher than on other engines. For this reason only original filter elements must be used. Filter elements of similar design or with adequate dimensions are not necessarily pressure resistant!

A filter element of insufficient pressure resistance will be damaged by the high pressure and will disintegrate. This causes severe damage to the injection system!

Checking and adjusting the valve clearance

Excessive or insufficient valve clearance can cause failure of the engine as a result of mechanical and thermal overloads. The valve clearance must therefore be checked and, if necessary, adjusted at the intervals specified in the operating and maintenance instructions.

Note:

The valve clearance must be checked and adjusted when the engine is cold.

Intake valve: = 0.3 mm

Exhaust valve= 0.5 mm

- Turn the crankshaft until both valves on cylinder 1 are overlapping (the exhaust valve is not yet closed, the intake valve starts to open).

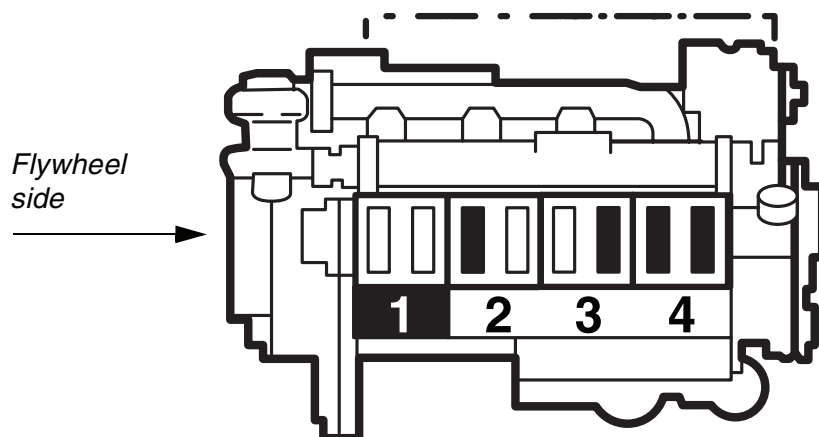


Fig. 8: Crankshaft position 1

- Check and adjust the valve clearance by following the black marking in the adjustment schematics. For control purposes mark the respective rocker arm with chalk.

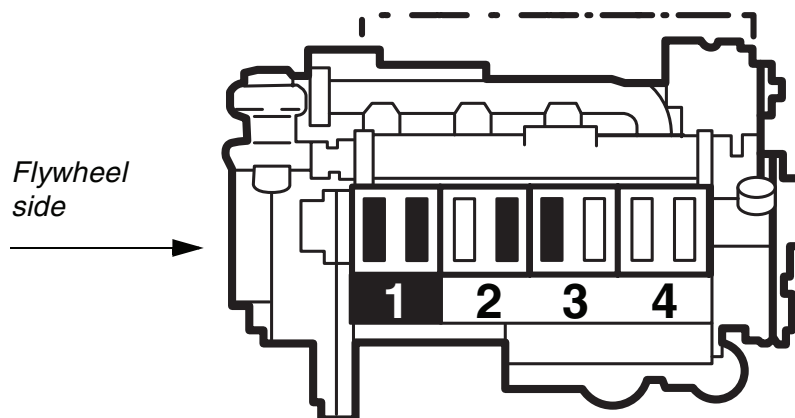


Fig. 9: Crankshaft position 2

- Turn the crankshaft one full turn (360°) further.
- Check and adjust the valve clearance by following the black marking in the adjustment schematics.

Explanation of pictograms

During the following work the following pictograms are used for the reason of simplicity:

	Disassembly of assembly groups		Guard against personal injury Indication of hazard
	Reassembly to form assembly group		Guard against material damage Damage to parts
	Remove obstructing parts		Prop up - Support - Hold
	Reinstall - Remount parts which had obstructed disassembly		Oil
	Attention! Important notice!		Grease
	Check - Adjust e. g. torque dimensions, pressures, etc.		Mark before disassembly, observe marks when reassembling
	Special tool		Balance Eliminate any imbalance
	Note direction of installation		Filling - Topping up - Refilling e. g. oil, cooling water, etc.
	Visual inspection		Drain off e. g. oil, cooling water, etc.
	Possibly still serviceable Renew if necessary		Loosen - Release e. g. loosening a clamping device
	Renew at each reassembly		Tighten - Clamp e. g. tightening a clamping device
	Unlock - Lock e. g. split pin, locking plate, etc.		Vent
	Lock - Adhere e. g. with liquid sealant		Machining process

plug-in injection pump

Deutz diesel engines of product range 2012/1013 are equipped with plug-in injection pumps of series PF 33 from Bosch.

The concept of the plug-in fuel injection pumps enables the realization of high injection pressures in connection with extremely short injection lines, which contributes to a high hydraulic stiffness of the injection system. This in turn provides the prerequisite for low exhaust emission values (soot) in combination with a low fuel consumption.

Plug-in fuel injection pumps have the following plunger dimensions:

- Stroke 12 mm
- Diameter 9 mm

Cavitation in the injection lines and injection overrun, which is normally associated with high pressures, is prevented by a return flow nozzle arranged after the pressure valve
The constant volume relief is 50 mm³.

Assembling the plug-type injection pumps

The adjustment of the injection pump timing (FB) affects:

- the fuel consumption,
- the power
- the exhaust emission

of the engine.

On engines of series 2012/1013 the start of delivery is adjusted without tolerance. The start of delivery is entered in degree of crank angle measured from the top dead centre of the piston and depends on application, power and speed setting of the engine.

The plug-in injection pump is in position of start of delivery when the plunger just closes the fuel supply bore in the plunger sleeve.

On engines with inline injection pumps the engine drive is turned to start of delivery position and closing of the fuel supply bore is determined by means of a high pressure pump. Occurring tolerances are compensated in the coupling of the injection pump drive, whereby the injection pump camshaft is turned to start of delivery position against the fixed engine drive.

The injection pump cams of engine series 2012/1013 are arranged on the camshaft of the engine. For this reason the conventional adjustment method for the start of delivery cannot be used.

The start of delivery of the injection pump must be adjusted using the new method.

For this the conventional adjustment method is subdivided into length measurements of individual engine parts and calculations.

The permissible manufacturing tolerances for the components

- cylinder crankcase,
- camshaft,
- plunger
- plug-in injection pump

are measured and eliminated by the adjustment of the start of delivery.

However, in cases of interest for BOMAG engineers the engine will not be overhauled completely, but individual injection pumps will be replaced.

Crankcase, camshaft and plunger remain unchanged.

This results in a certain installation measurement for the engine drive, which is stamped on the engine type plate.

In column „EP“ it is stamped as „CODE“ for each cylinder.

Note:

If an injection pump and/or nozzle is replaced, the respective high pressure line between pump and nozzle must also be replaced..

1. Remove crankcase ventilation and cylinder head cover.

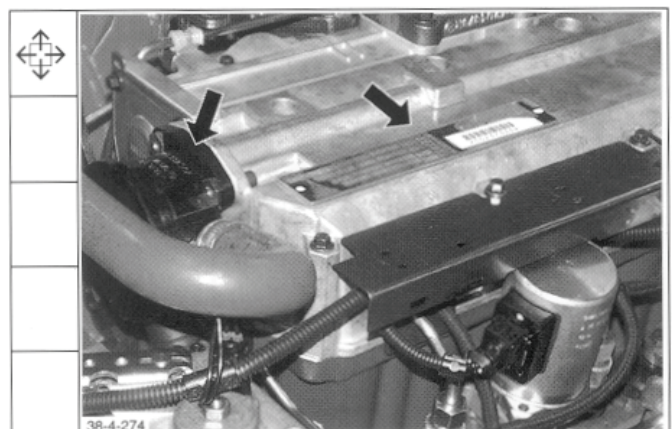


Fig. 10:

2. Remove the engine solenoid

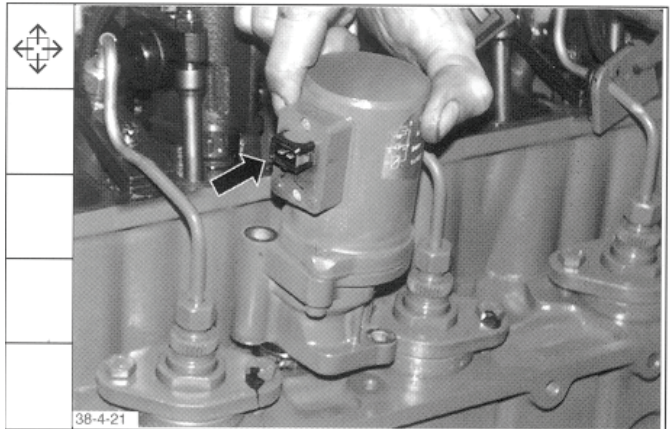


Fig. 11:

3. Insert the pressing device WILBÄR No. 100 830 carefully into the groove of the governor rod and fasten it.

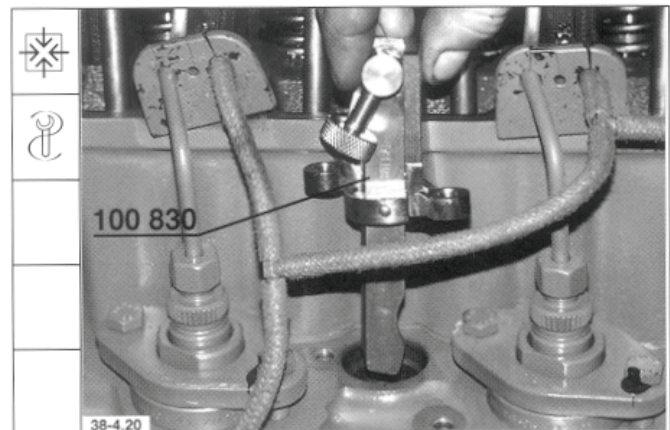


Fig. 12:

4. Turn the knurled fastening screw to press the governor rod to stop position.

Note:

Tighten the knurled fastening screw by hand.

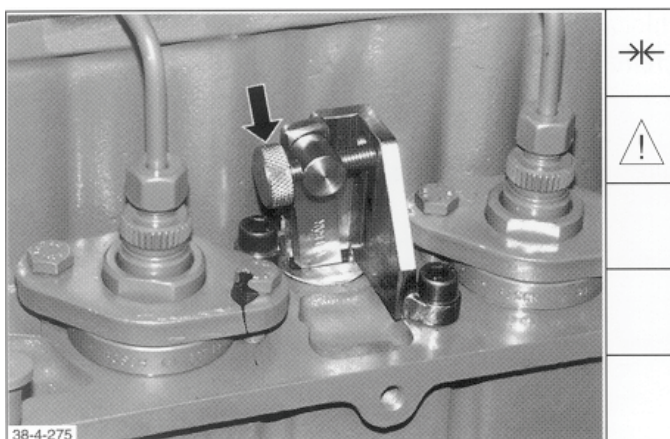


Fig. 13:

- Set the cylinder of the injection pump to be replaced to ignition top dead centre (valves overlapping). Then turn the crankshaft approx. 120° against the sense of rotation.

Note:

View on flywheel

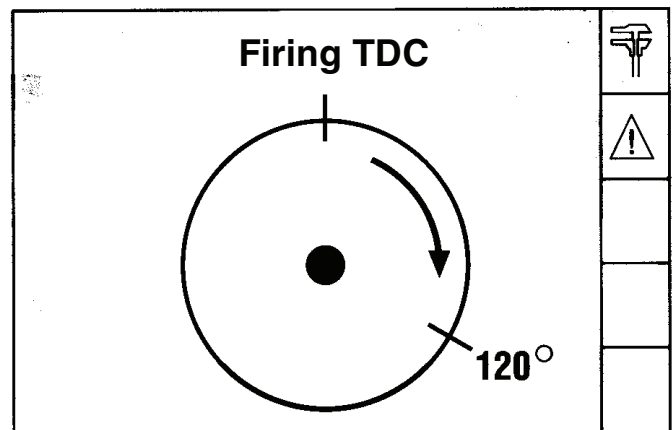


Fig. 14:

- Remove injection line and injection pump.

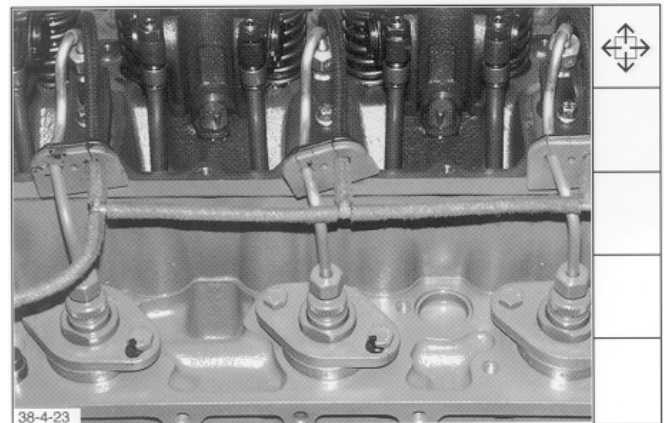


Fig. 15:

- Take the compensation shim carefully out with the rod magnet.

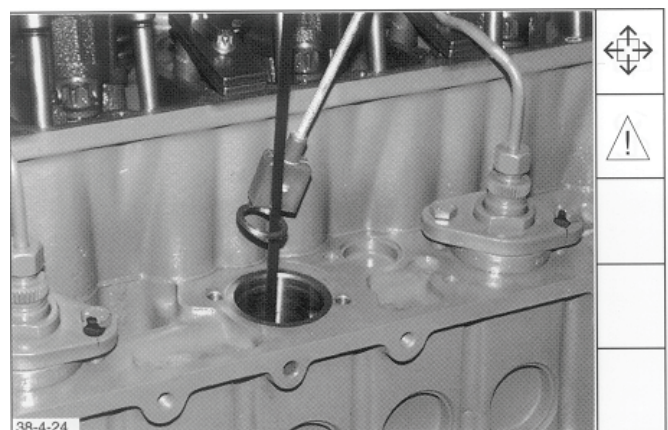


Fig. 16:

Determine the thickness of the new compensation shim:

Determination of the compensation shim thickness when replacing plug-in fuel injection pumps

On the engine type plate column - EP – contains a code for the plug-in fuel injection pump for each cylinder.

Mot. - Typ		Code		Mot. - Nr.		kW(G) red.	EP	K
kW(G)		kW(S)		1/min		kW(S) red.	295	
kW(W)				°C		m		
DEUTZ MOTOR Industriemotoren GmbH		MADE IN GERMANY						



E

Each line represents 1 cylinder
e.g. 1st line = cylinder 1
2. line = cylinder 2 etc.

Fig. 17: Injection pump code BFM 2012/1013

The EP-code is used to determine the installation measurement to be corrected „E_K“ from table 1.

E _K (mm)	EP code	E _K (mm)	EP code	E _K (mm)	EP code	E _K (mm)	EP code
119,250	230	119,850	254	120,450	278	121,050	302
119,275	231	119,875	255	120,475	279	121,075	303
119,300	232	119,900	256	120,500	280	121,100	304
119,325	233	119,925	257	120,525	281	121,125	305
119,350	234	119,950	258	120,550	282	121,150	306
119,375	235	119,975	259	120,575	283	121,175	307
119,400	236	120,000	260	120,600	284	121,200	308
119,425	237	120,025	261	120,625	285	121,225	309
119,450	238	120,050	262	120,650	286	121,250	310
119,475	239	121,075	263	120,675	287	121,275	311
119,500	240	120,100	264	120,700	288	121,300	312
119,525	241	120,125	265	120,725	289	121,325	313
119,550	242	120,150	266	120,750	290	121,350	314
119,575	243	120,175	267	120,775	291	121,375	315
119,600	244	120,200	268	120,800	292		
119,625	245	120,225	269	120,825	293		
119,650	246	120,250	270	120,850	294		
119,675	247	120,275	271	120,875	295		
119,700	248	120,300	272	120,900	296		
119,725	249	120,325	273	120,925	297		
119,750	250	120,350	274	120,950	298		
119,775	251	120,375	275	120,975	299		
119,800	252	120,400	276	121,000	300		
119,825	253	120,425	277	121,025	301		

Fig. 18: Injection pump code table **BFM 2012**

E _K (mm)	EP code	E _K (mm)	EP code	E _K (mm)	EP code	E _K (mm)	EP code
		145.7	349	146.3	373	146.9	397
		145.725	350	146.325	374	146.925	398
		145.75	351	146.35	375	146.95	399
		145.775	352	146.375	376	146.975	400
		145.8	353	146.4	377	147.0	401
		145.825	354	146.425	378	147.025	402
		145.85	355	146.45	379	147.05	403
		145.875	356	146.475	380	147.075	404
145.35	335	145.9	357	146.5	381	147.1	405
		145.925	358	146.525	382	147.125	406
145.375	336	145.95	359	146.55	383	147.15	407
		145.975	360	146.575	384	147.175	408
145.4	337	146.0	361	146.6	385	147.2	409
145.425	338	146.025	362	146.625	386	147.225	410
145.45	339	146.05	363	146.65	387	147.25	411
145.475	340	146.075	364	146.675	388	147.275	412
145.5	341	146.1	365	146.7	389	147.3	413
145.525	342	146.125	366	146.725	390	147.325	414
145.55	343	146.15	367	146.75	391	147.35	415
145.575	344	146.175	368	146.775	392	147.375	416
145.6	345	146.2	369	146.8	393	147.4	417
145.625	346	146.225	370	146.825	394	147.425	418
145.65	347	146.25	371	146.85	395	147.45	419
145.675	348	146.275	372	146.875	396		

Fig. 19: Injection pump code table **BFM 1013**

E_K (mm) = corrected injection pump measurement, determined by EP-code on type plate and from table 1.

During the manufacture of the plug-in fuel injection pump the high pressure method is used to determine the wear in the fuel supply bore. In this position – injection pump plunger in start of fuel delivery position - the distance between pump contact face and plunger foot contact face is measured.

Measurement "A" in 1/100 mm has been written on the pump with an electric marker.

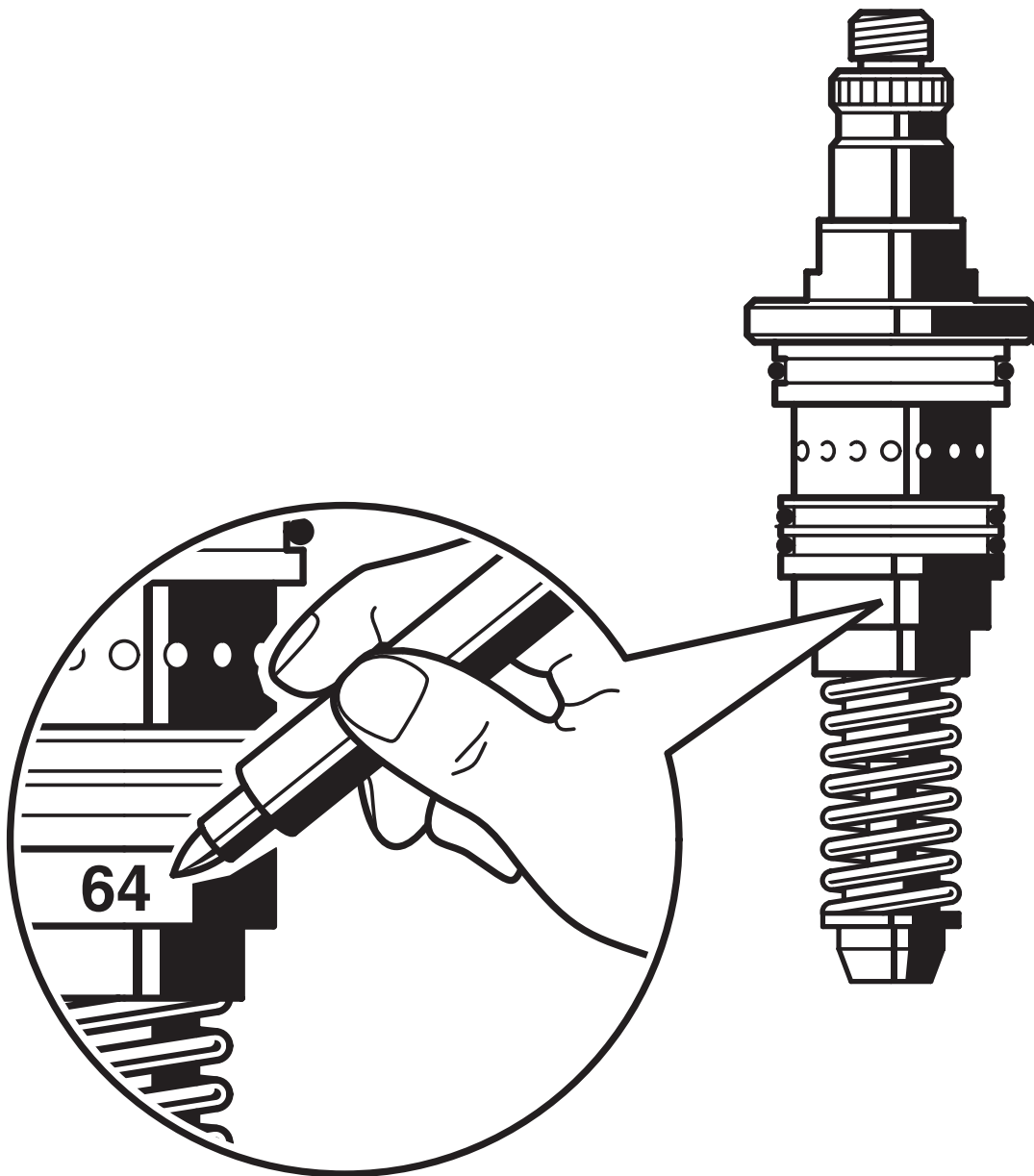


Fig. 20: Plunger code inscription

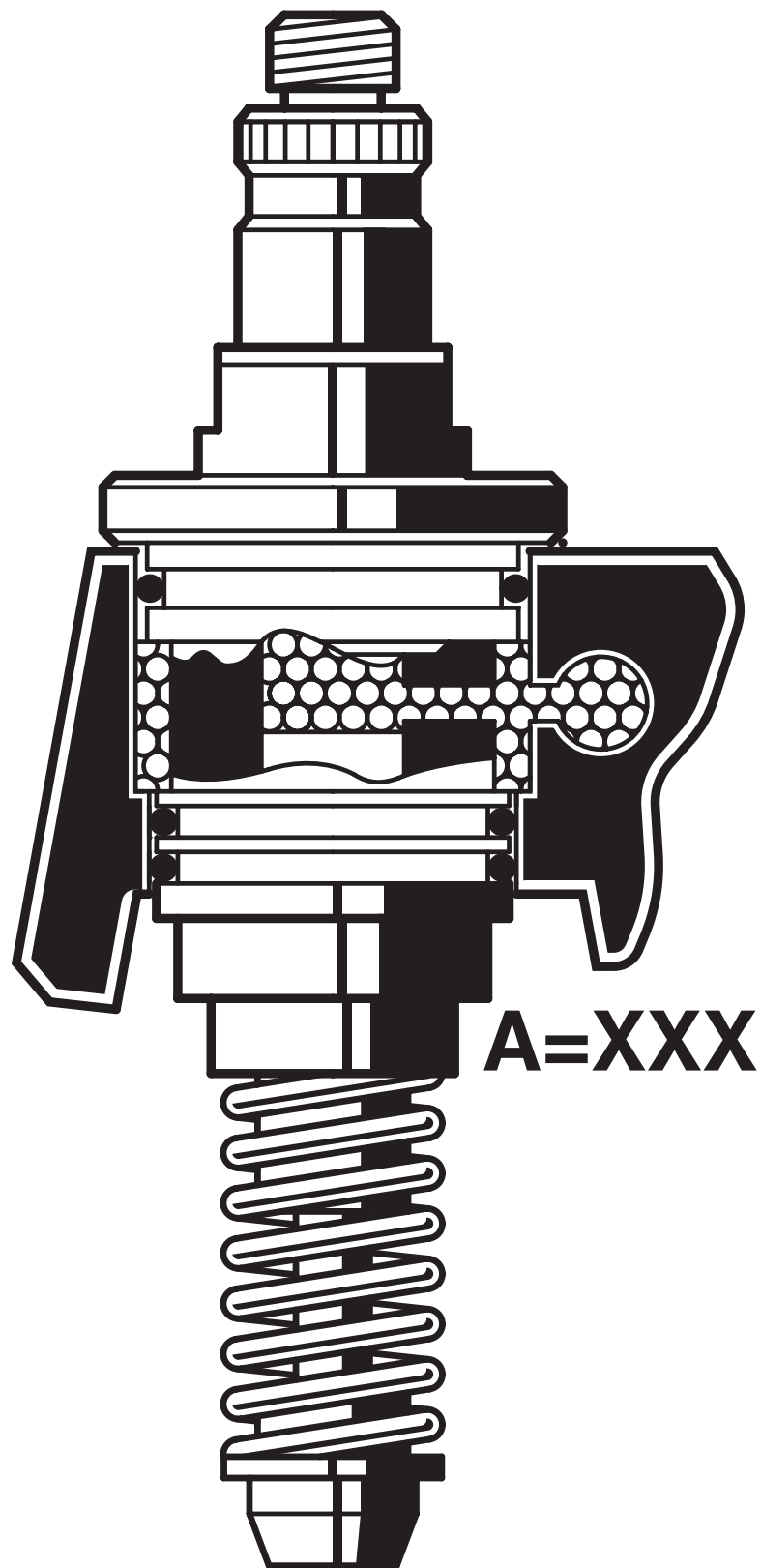


Fig. 21: Individual injection pump

Measurement "A" specifies by how many 1/100 mm the gap between contact area on cylinder crankcase and plunger foot is longer than the hydraulic base measurement L_0 .

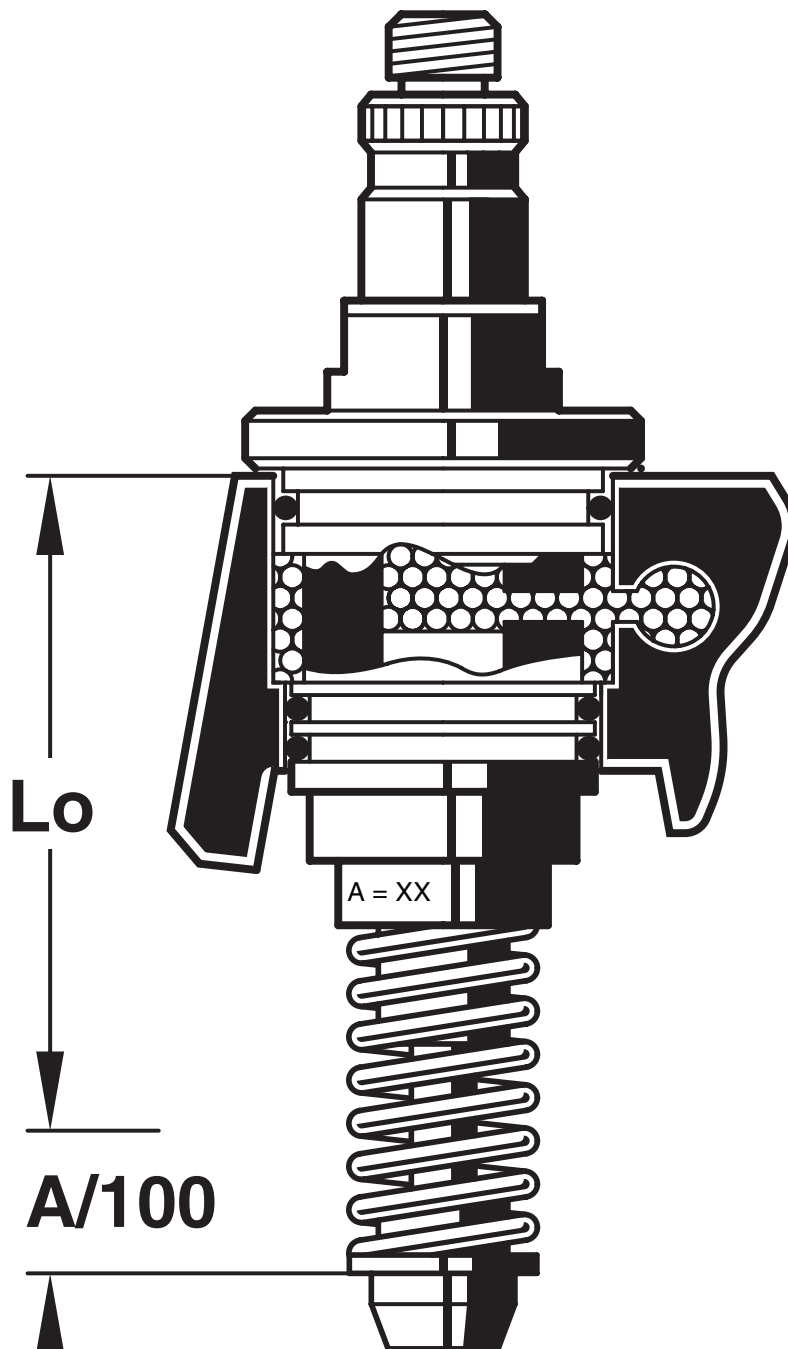


Fig. 22: Presentation of measurement „A“

- $L_0 = 117,5$ mm - BFM 2012
- $L_0 = 143$ mm - BFM 1013

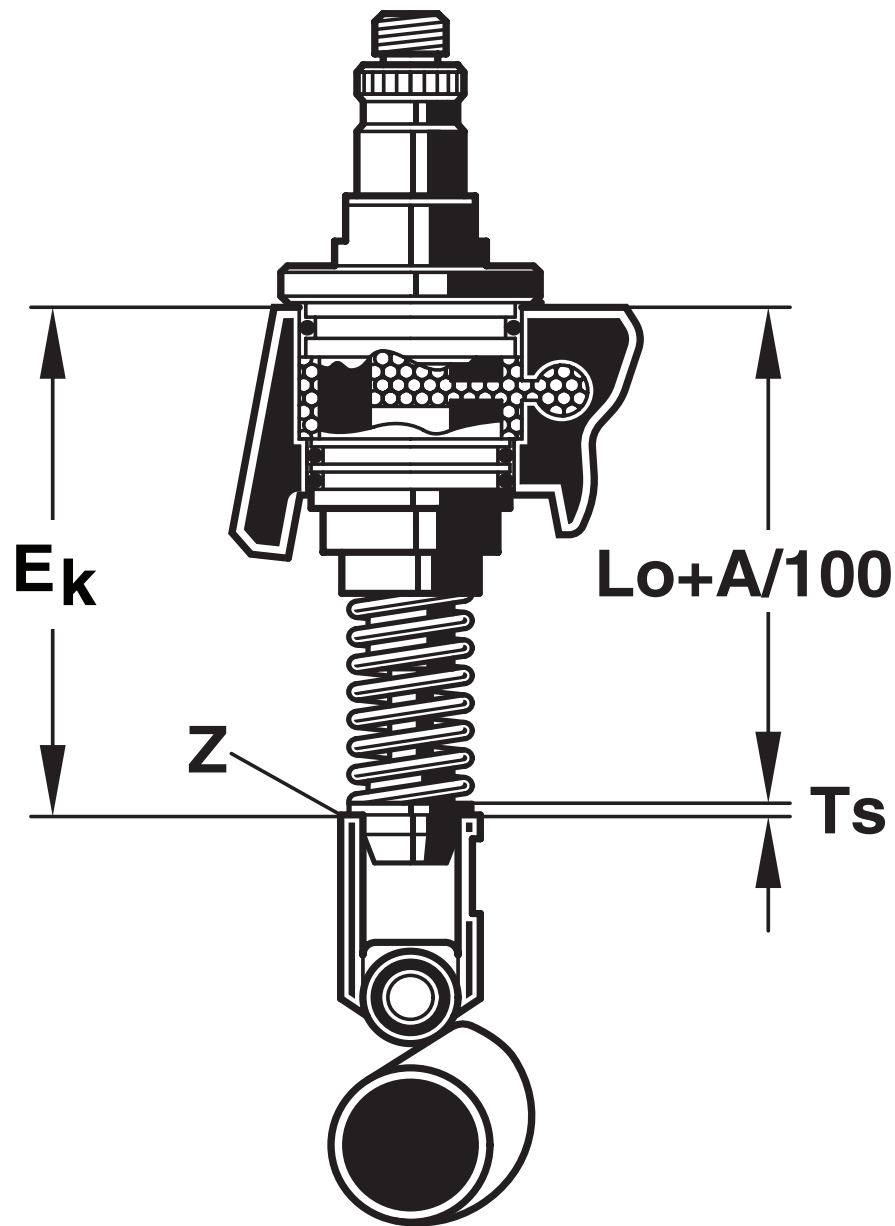


Fig. 23: Drive in start of delivery position after determination of „ T_s “

The plug-in fuel injection pump is now positively connected with the drive, which has been set to start of delivery by inserting a compensation shim "Z" of calibrated thickness..

The illustration explains that according to calculation:

$$(E_k) - (L_o + A/100)$$

there is a gap „ T_s “ between injection pump plunger foot and roller plunger. This gap has to be compensated with a compensation shim "Z" of appropriate (calculated) thickness.

Theoretical thickness „T _s “ (mm)	Compensation shim thickness „S _s “ (mm)	Theoretical thickness „T _s “ (mm)	Compensation shim thickness „S _s “ (mm)
0.95 - 1.049	1.0	2.45 - 2.549	2.5
1.05 - 1.149	1.1	2.55 - 2.649	2.6
1.15 - 1.249	1.2	2.65 - 2.749	2.7
1.25 - 1.349	1.3	2.75 - 2.849	2.8
1.35 - 1.449	1.4	2.85 - 2.949	2.9
1.45 - 1.549	1.5	2.95 - 3.049	3.0
1.55 - 1.649	1.6	3.05 - 3.149	3.1
1.65 - 1.749	1.7	3.15 - 3.249	3.2
1.75 - 1.849	1.8	3.25 - 3.349	3.3
1.85 - 1.949	1.9	3.35 - 3.449	3.4
1.95 - 2.049	2.0	3.45 - 3.549	3.5
2.05 - 2.149	2.1	3.55 - 3.649	3.6
2.15 - 2.249	2.2	3.65 - 3.749	3.7
2.25 - 2.349	2.3	3.75 - 3.850	3.8
2.35 - 2.449	2.4		

Table 1: Shim thicknesses 2012/1013

For the determination of the theoretical shim thickness „T_s“ it is also necessary to determine measurement L₀ + A/100 of the new fuel injection pump, which must then be subtracted from the corrected injection pump measurement E_k.

$$T_s = E_k - (L_0 + A/100) \text{ [mm]}$$

The real compensation shim thickness „S_s“ is determined with the help of table 2.

Exemplary calculation for BFM 2012

EP-code read off engine type plate: 295

- see table 1

corrected injection pump measurement „E_k“: 120,875 mm

L_o = 117,5 mm (fixed measurement)

Value for A/100 read off new injection pump A/100 = 42

- $T_s = E_k - (L_o + A/100)$
 $T_s = 120,875 \text{ mm} - (117,5 + 42/100 \text{ mm})$
 $T_s = 2.995 \text{ mm}$

- see also table 1

$T_s = 3,0 \text{ mm}$

Exemplary calculation for BFM 1013

EP-code read off engine type plate: 397

- see table 1

corrected injection pump measurement „E_k“: 146.9 mm

L_o = 143 mm (fixed measurement)

Value for A/100 read off new injection pump A/100 = 133

- $T_s = E_k - (L_o + A/100)$
 $T_s = 146,9 \text{ mm} - (143 + 133/100 \text{ mm})$
 $T_s = 2.57 \text{ mm}$

- see also table 1

$T_s = 2,6 \text{ mm}$

8. Place the new calculated compensation shim on the roller plunger.

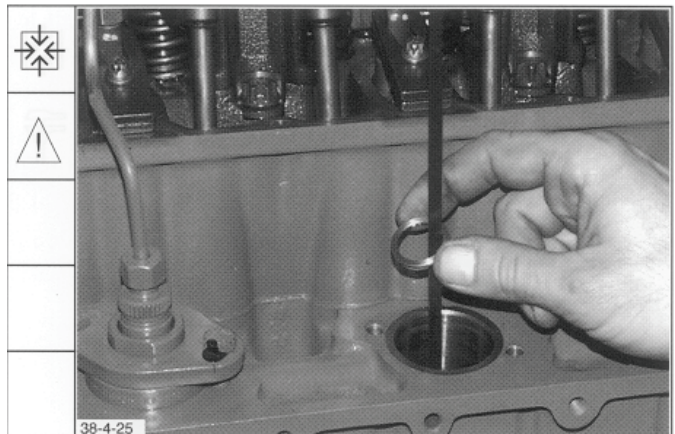


Fig. 24:

9. Turn the injection pump control lever to approx. middle position.

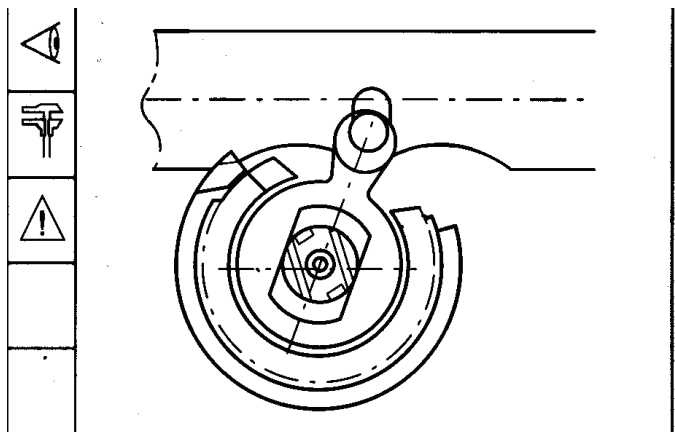


Fig. 25:

10. Apply some oil to the locating bore in the crankcase and the O-rings on the injection pump. Carefully insert the injection pump control lever into the governor rod.



Fig. 26:

11. Attach the flange.

Note:

The chamfer must face towards the injection pump body



Fig. 27:

12. Slightly oil the screws and tighten them evenly with 5Nm.



Fig. 28:

13. Loosen the screws again for 60°.

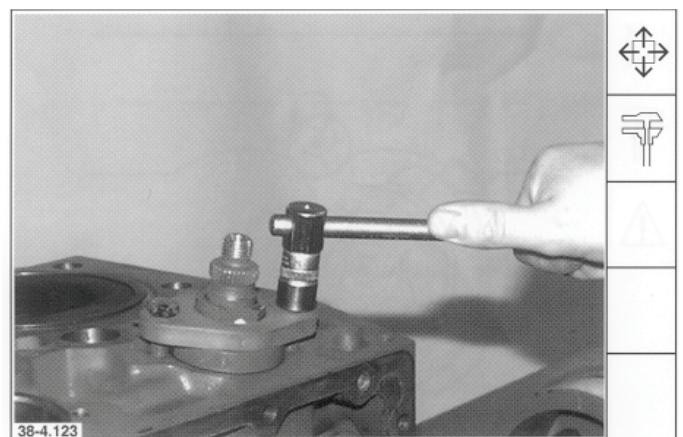


Fig. 29:

14. **Carefully** turn the injection pump with and open end spanner in anti-clockwise direction against the noticeable stop

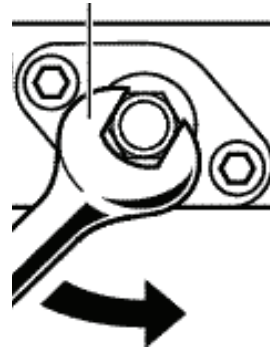


Fig. 30:

15. Tighten the screws again for 60° and continue in stages with tightening torques of **7 Nm, 10 Nm and 30 Nm**.

Note:

Start with the outer screw, viewed from the flywheel. (see arrow).

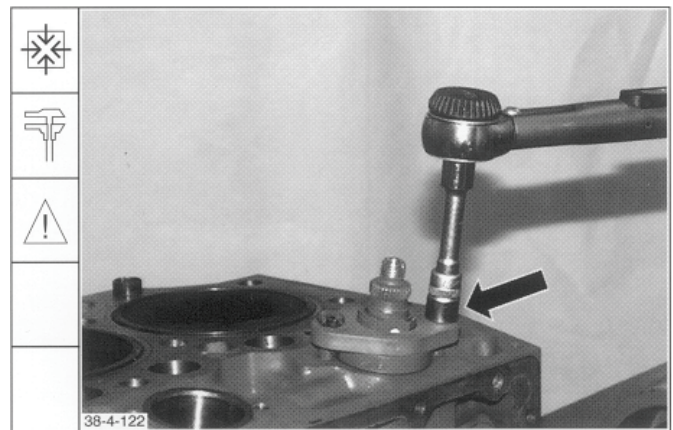


Fig. 31:

16. Back out the knurled screw of the pressing device, remove the pressing device.
17. Reinstall the engine solenoid with a new O-ring.
18. Reinstall the cylinder head cover. Tightening torque: **9 +/- 1 Nm**.

Note:

If necessary replace the gasket.

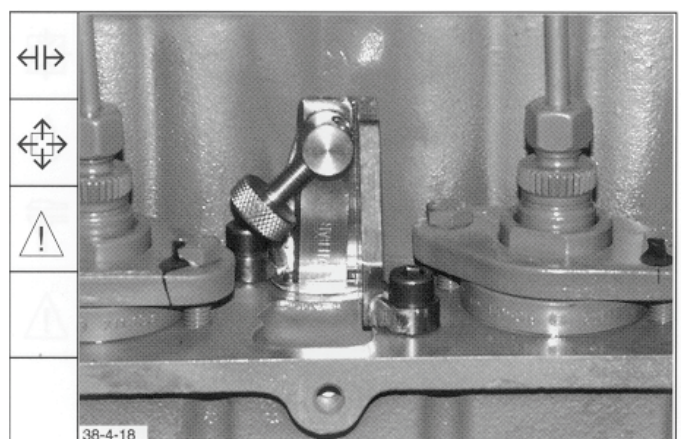


Fig. 32:

19. Slightly oil the O-ring of the crankcase ventilation. Reassemble the crankcase ventilation. Tightening torque **9 +/- 1 Nm**

Note:

If necessary replace the gasket.

Tools

The following tools can be ordered from the respective supplier (in brackets) under the stated part-number.

For tools from Hazet and Bosch you should consult your nearest representative, orders to Wilbär should be addressed to:

Co. Wilbär
P.O. box 140580
D - 42826 Remscheid

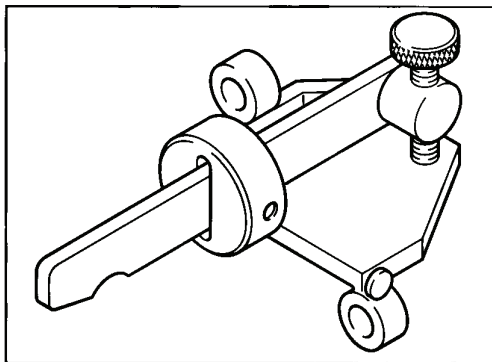


Fig. 33

- Pressing device for governor rod 100 830 (Wilbär)

Electrical components and measuring point on the engine

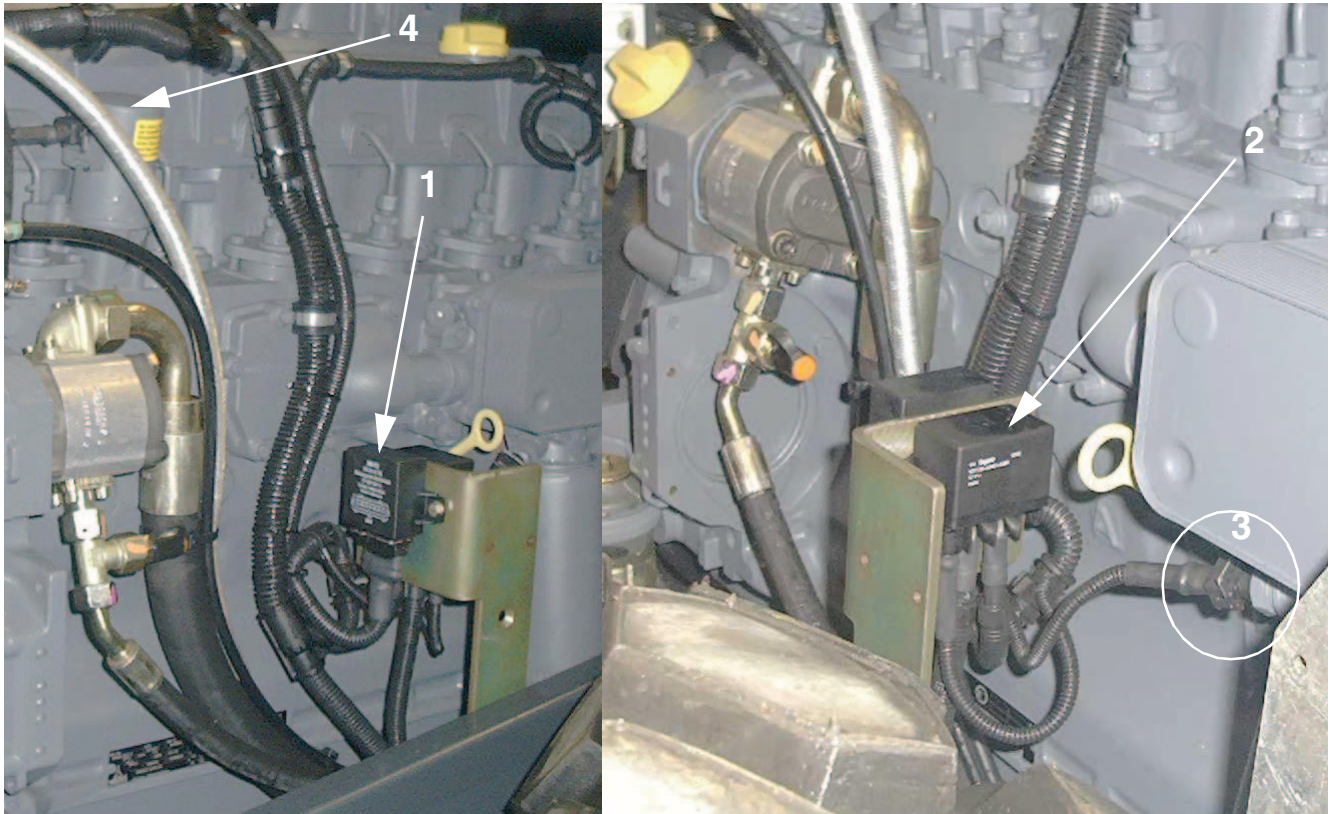


Fig. 34: Diesel engine, right

Pos.	Designation	Pos. in wiring diagram	Pos. in hydraulic diagram	Measuring values
1	Heating flange module	A 13		
2	High current relay for heating flange	K 14		0/12 V
3	Oil pressure switch	B 06		pressureless closed, 0,8 bar
4	Engine solenoid	Y 13		0/12V, approx. 4 Ω

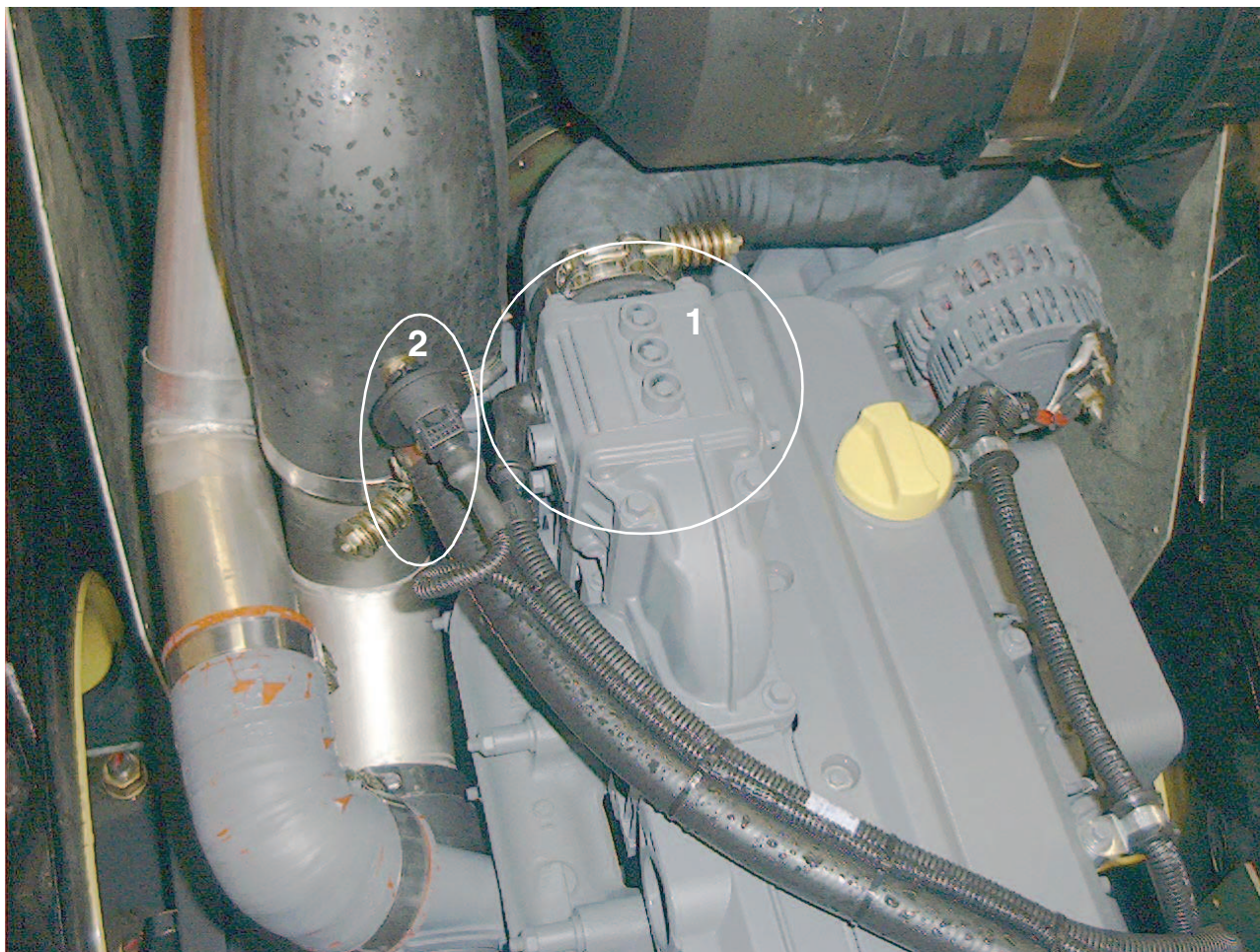


Fig. 35: Top view of diesel engine

Pos.	Designation	Pos. in wiring diagram	Pos. in hydraulic diagram	Measuring values
1	Heating flange	R 19		0/12 V, 167 A, approx. 0,07 Ω
2	Pressure differential switch for air filter	B 03		pressureless open, 50 mbar

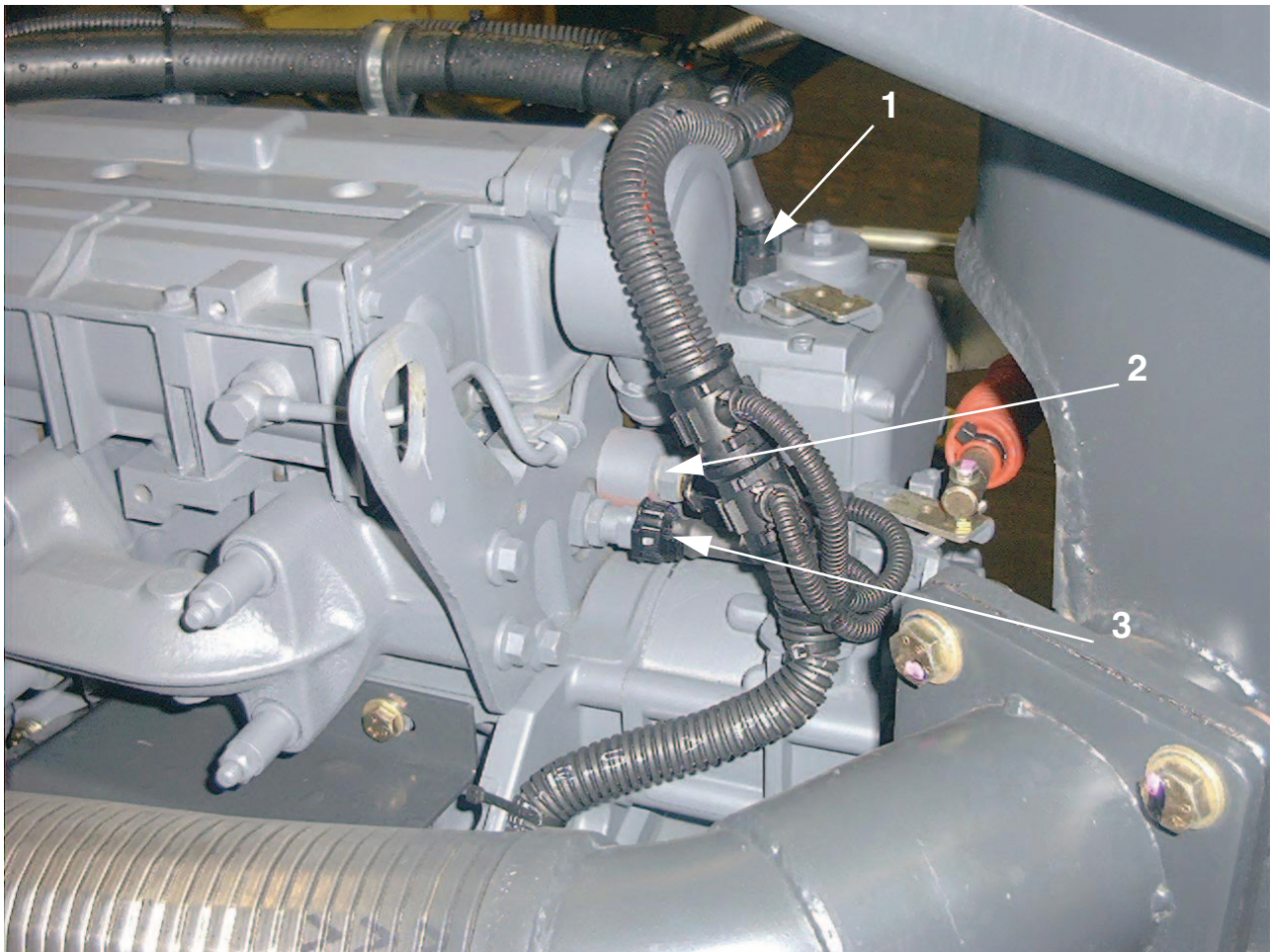


Fig. 36: Rear view of diesel engine

Pos.	Designation	Pos. in wiring diagram	Pos. in hydraulic diagram	Measuring values
1	Boost fuel valve	Y01		0/12 V
2	Coolant temperature switch for warning light	B53		cold open, on ca. 110°C
3	Coolant temperature flange for heating flange	B 113		approx. 2 Ω at 20°C

Travel circuit

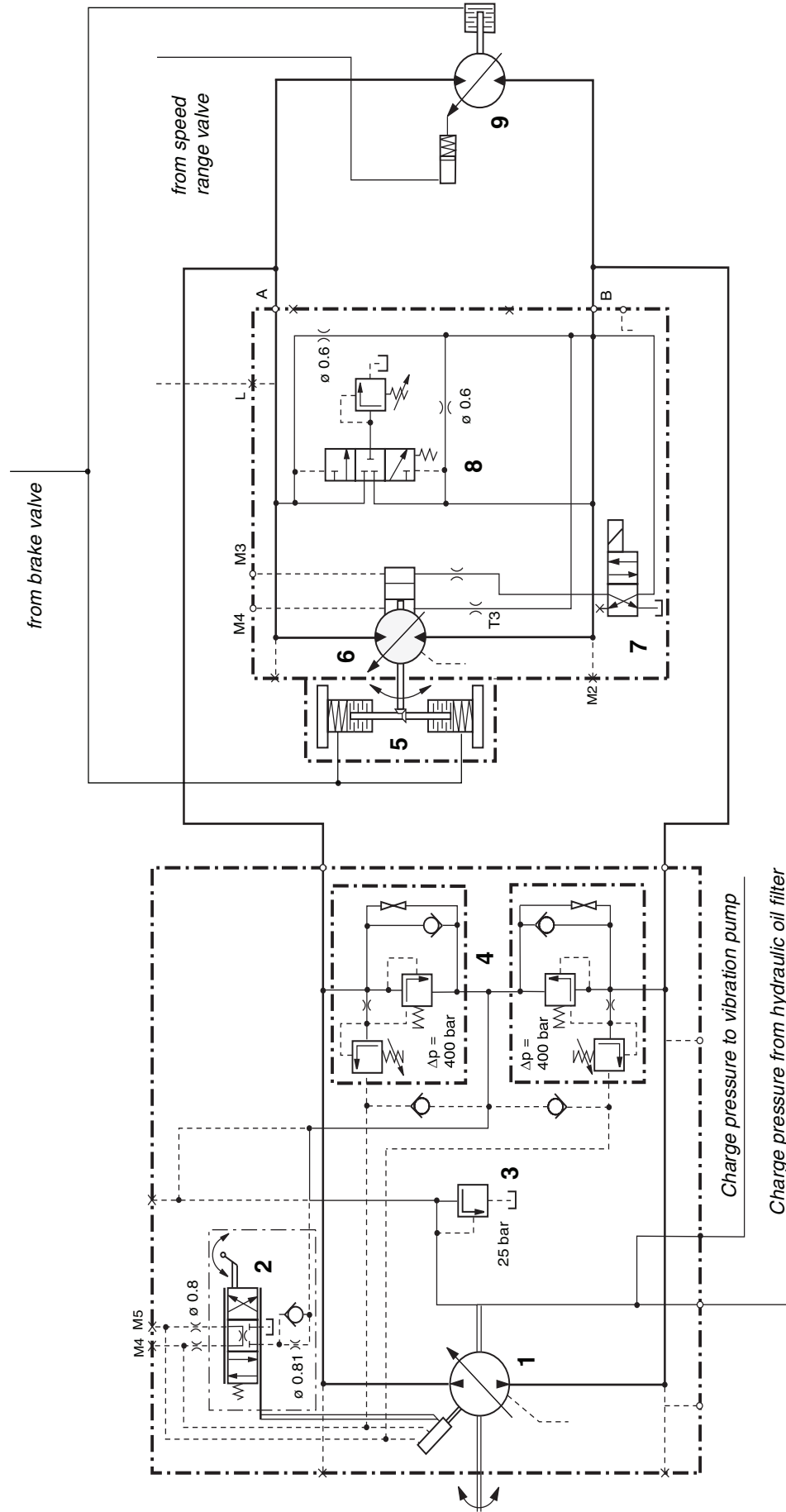


Fig. 1: Hydraulic diagram travel system BW 213 D-3

1	Travel pump Sauer 90 R 075	4	Multi function valve	7	Speed range valve
2	Servo control	5	Rear axle	8	Flushing valve
3	Charge pressure relief valve	6	Axle drive motor Sauer 51 D 110	9	Drum drive motor Poclain MSE 18 2CX

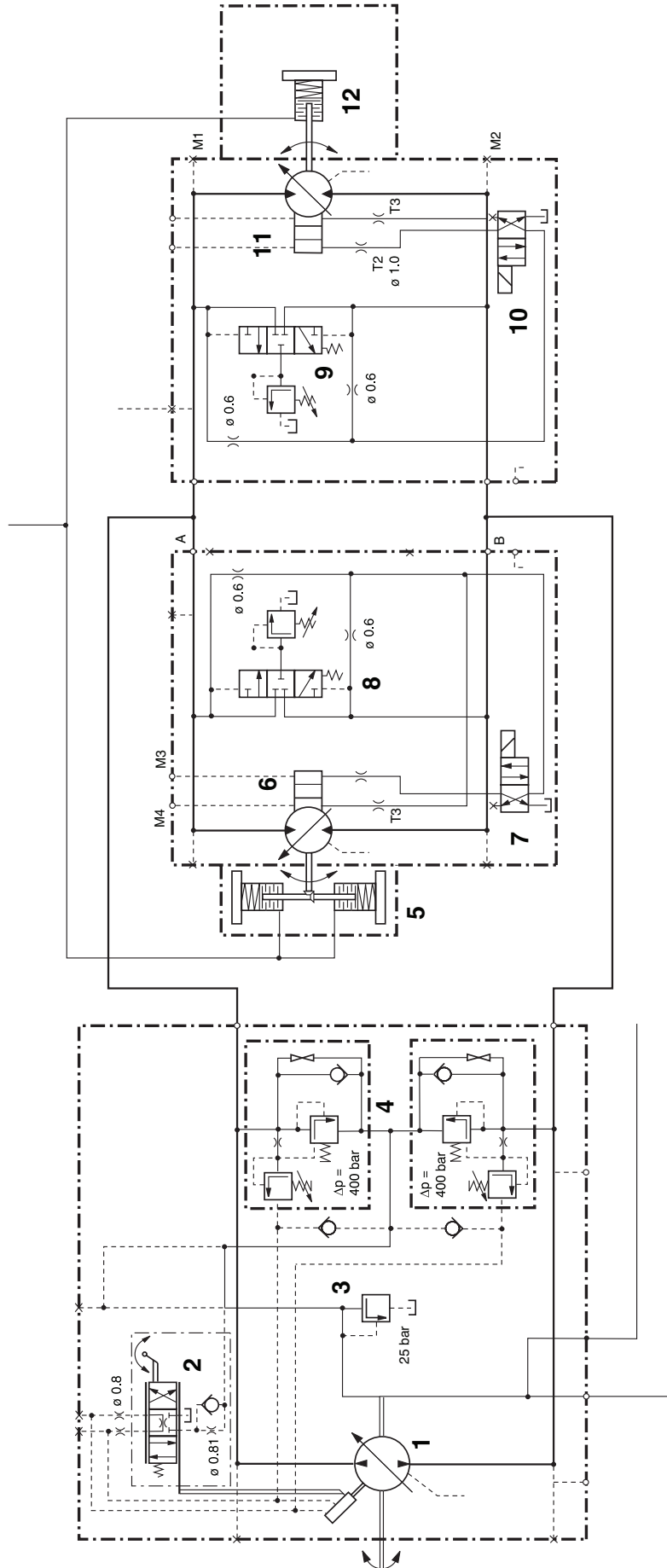


Fig. 2: Hydraulic diagram travel circuit BW 213 DH/PDH-3 / BW 214 DH/PDH-3 / BW 216 DH/PDH-3

- | | | | | | |
|---|------------------------------|---|---------------------------------|----|--------------------------------------|
| 1 | Travel pump Sauer 90 R 075 | 5 | Rear axle | 9 | Flushing valve (drum drive motor) |
| 2 | Servo control | 6 | Axle drive motor Sauer 51 D 110 | 10 | Speed range valve (drum drive motor) |
| 3 | Charge pressure relief valve | 7 | Speed range valve | 11 | Drum drive motor (Sauer 51 C 110) |
| 4 | Multi function valve | 8 | Flushing valve | 12 | Reduction gear Sauer CR 31 |

The travel system of the single drum rollers is a closed hydraulic circuit and consists mainly of:

- travel pump with control and safety elements,
- drum drive motor with integrated multi-disc brake (BW 213 D-3),
- drum drive motor with reduction gear (all DH/PDH-3 versions),
- axle drive motor,
- charge pump (also for vibration circuit),
- hydraulic oil filter (in charge circuit),
- hydraulic oil cooler with thermostat
- hydraulic lines.

Travel pump and vibration pump are connected to a tandem pump unit. The charge pump is an integral part of the vibration pump.

The travel pump is the first pump section, flanged directly to the flywheel side of the diesel engine.

The pump delivers the hydraulic oil to the travel motors for drum and axle drives. The multi-function valves in the pump limit the pressure in the closed circuit to 425 bar ($\Delta p = 400$ bar between low and high pressure sides).

A flushing valve in the axle drive motor (and in the Sauer drum drive motor 51 C 110) flushes a certain oil quantity out of the closed circuit when the machine is driving (Δp between the two sides of the closed circuit).

Leakage in the individual components of the circuit are replaced by the charge circuit through the boost check valves in the travel pump.

The charge pump inside the vibration pump draws hydraulic oil out of the tank and delivers it through the hydraulic oil filter to the boost check valves in travel and vibration pump. The return flow from the steering system flows also through the hydraulic oil filter and is then available for the charge circuit.

The charge circuit provides the oil for the control functions in the closed circuits for travel and vibration drive, as well as to release the parking brakes and to change the travel speed ranges.

Both travel motors are designed with variable displacement. The operator has the possibility to choose from two fixed displacements and thereby from two different travel speed ranges.

Travel pump

The travel pump is a swash plate operated axial piston pump with variable displacement, most suitable for applications in hydrostatic drives with closed circuit.

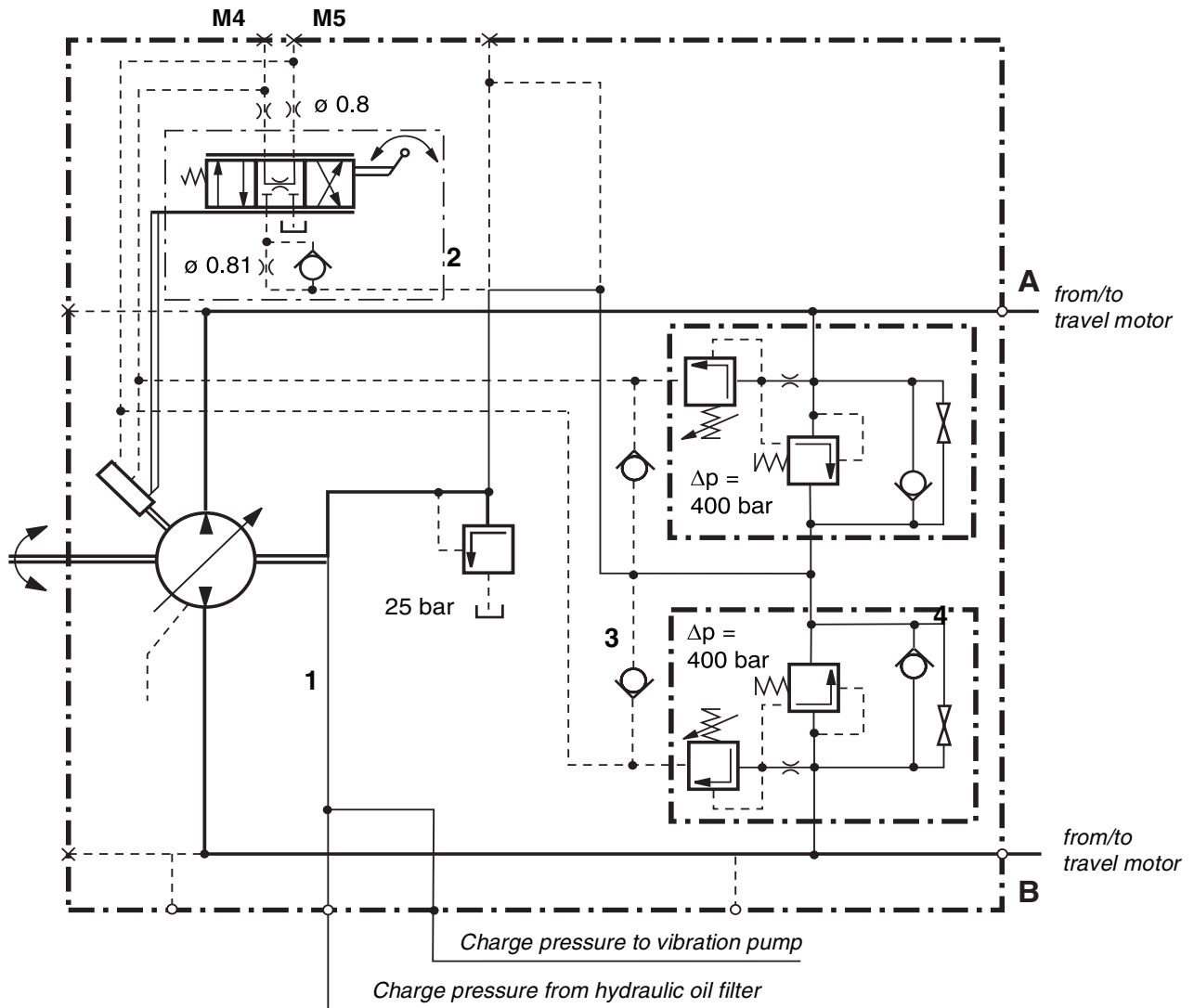


Fig. 3: Hydraulic diagram of travel pump

- | | | | |
|---|---------------|---|------------------------------|
| 1 | Pump drive | 3 | Charge pressure relief valve |
| 2 | Servo control | 4 | Multi-function valves |

The travel pump delivers the hydraulic oil to the motors on rear axle and drum. The pump flow is proportional to the pump speed (output speed of diesel engine) and the actual displacement (swashing angle of swash plate) of the pump.

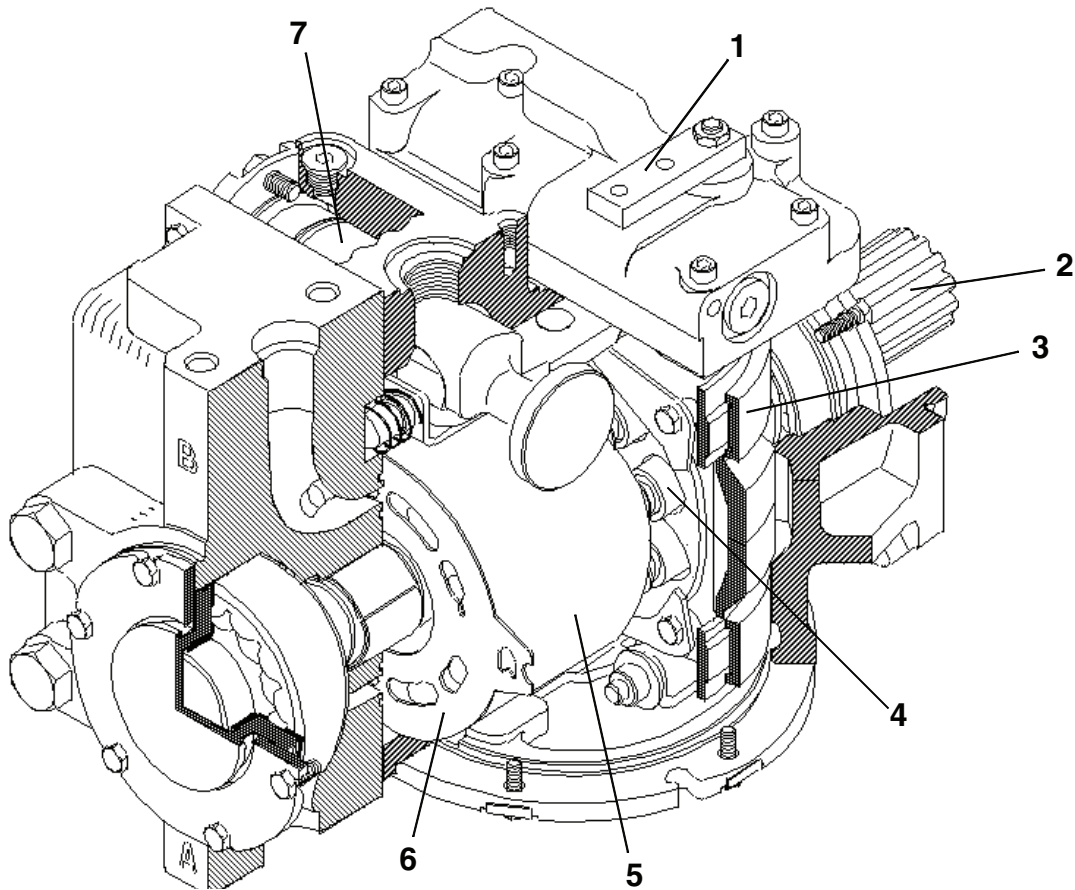


Fig. 4: Travel pump

- | | | | |
|---|---------------------------|---|----------------|
| 1 | Control lever | 5 | Cylinder block |
| 2 | Drive shaft | 6 | Valve plate |
| 3 | Swash plate bearing | 7 | Control piston |
| 4 | Pistons with slipper pads | | |

With the servo control the swashing angle can be infinitely adjusted from neutral position (0) to both maximum displacement positions.

When altering the swash plate position through the neutral position, the oil flow will be reversed and the machine will drive to the opposite direction.

All valves as well as the safety and control elements needed for operation in a closed circuit, are integrated in the pump.

Note:

The charge pump is inside the vibration pump.

Cross-sectional view of travel pump

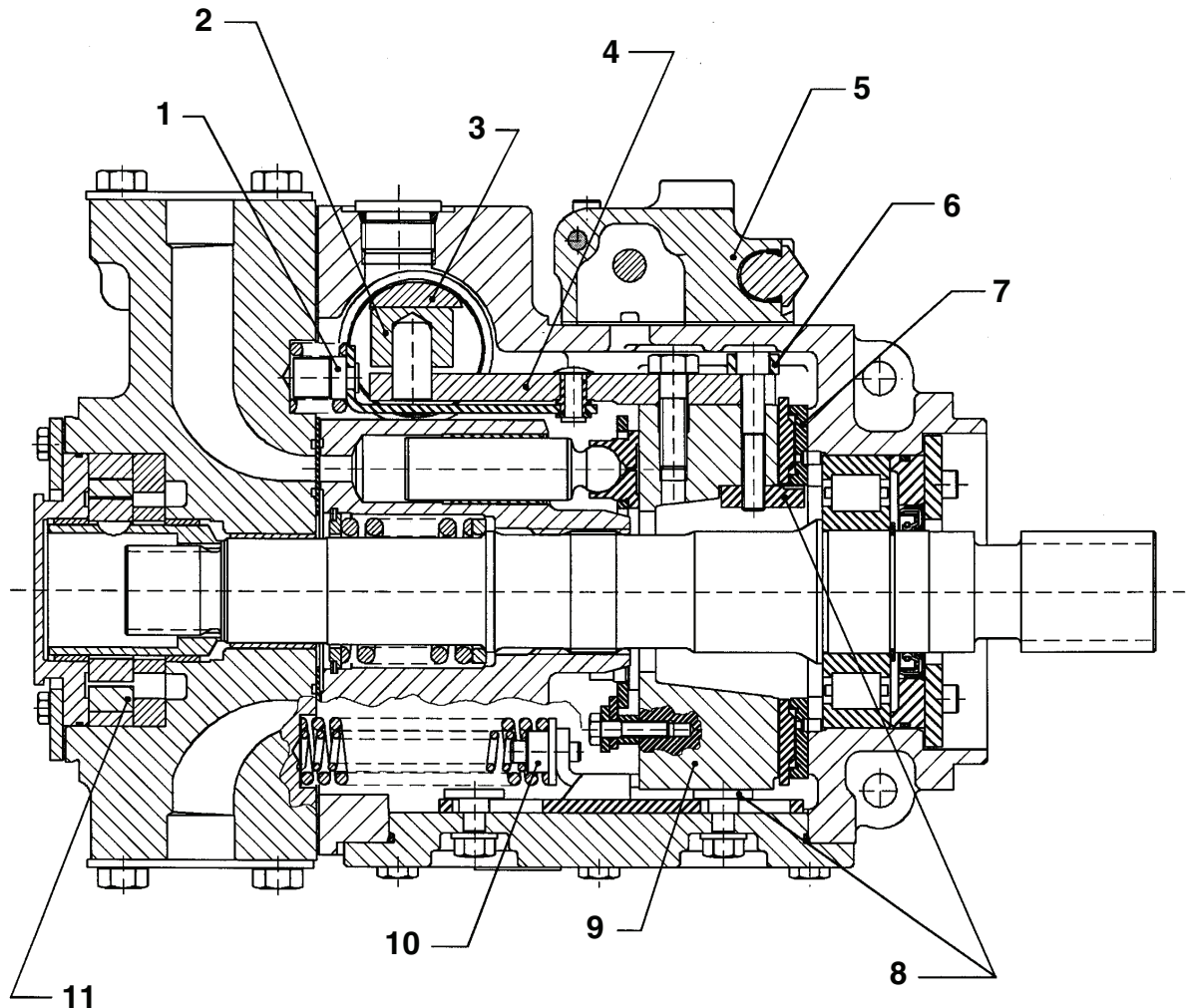


Fig. 5: Cross-sectional view of travel pump

- | | | | |
|---|--------------------------|----|--------------------------------------|
| 1 | Retainer for swash plate | 7 | Swash plate bearing |
| 2 | Sliding block | 8 | Swash plate guide |
| 3 | Control piston | 9 | Swash plate |
| 4 | Servo arm | 10 | Swashing lever |
| 5 | Servo valve | 11 | Charge pump (only in vibration pump) |
| 6 | Feedback device | | |

View of the rotating group

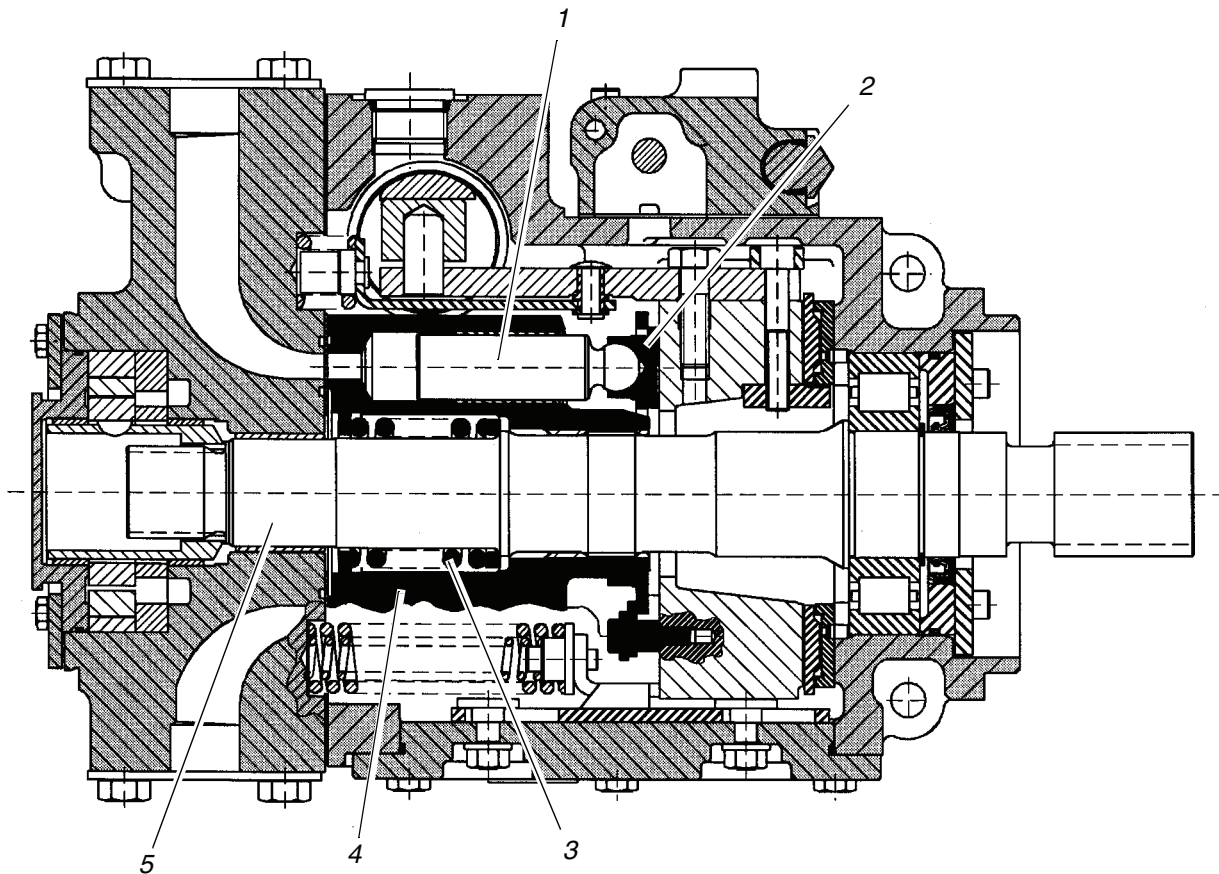


Fig. 6: Travel pump, view of the rotating group

- 1 Working pistons
- 2 Slipper pad
- 3 Pre-tensioning spring
- 4 Cylinder block
- 5 Drive shaft

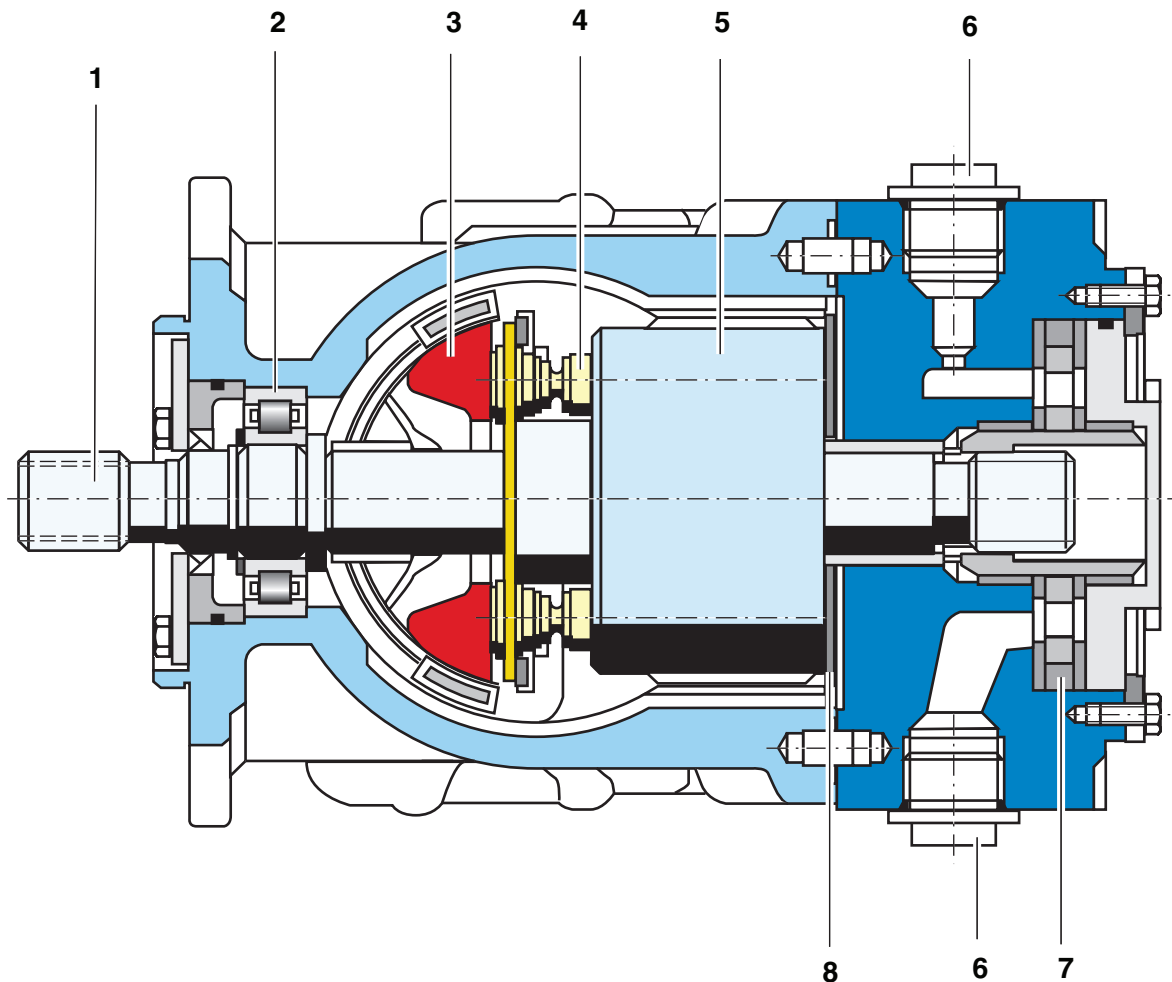
Description of function

Fig. 7: Function of travel pump

- | | | | |
|---|---------------------------|---|--------------------------------------|
| 1 | Drive shaft | 5 | Cylinder block |
| 2 | Drive shaft bearing | 6 | Multi-function valves |
| 3 | Swash plate | 7 | Charge pump (only in vibration pump) |
| 4 | Pistons with slipper pads | 8 | Valve plate |

The drive shaft (1) is directly driven by the diesel engine via an elastic coupling. the shaft turns the tightly connected cylinder block (5).

With the rotation of the drive shaft (1) the cylinder block (5) moves the working pistons (4). The slipper pads of the working pistons abut against the swash plate (3).

When moving the swash plate out of neutral position, the working pistons will perform a stroke movement with every rotation of the cylinder block.

The slipper pads are hydrostatically balanced and are retained on the sliding face of the swashing cradle by a retaining device.

During a full rotation of the cylinder block each working piston will move through the bottom and top dead centre back to the initial position. During this movement each piston performs a complete stroke.

During the piston stroke each piston draws in a certain quantity of oil from the low pressure side of the hydraulic circuit and presses it out into the high pressure side.

Tandem pump, connections and adjustment points

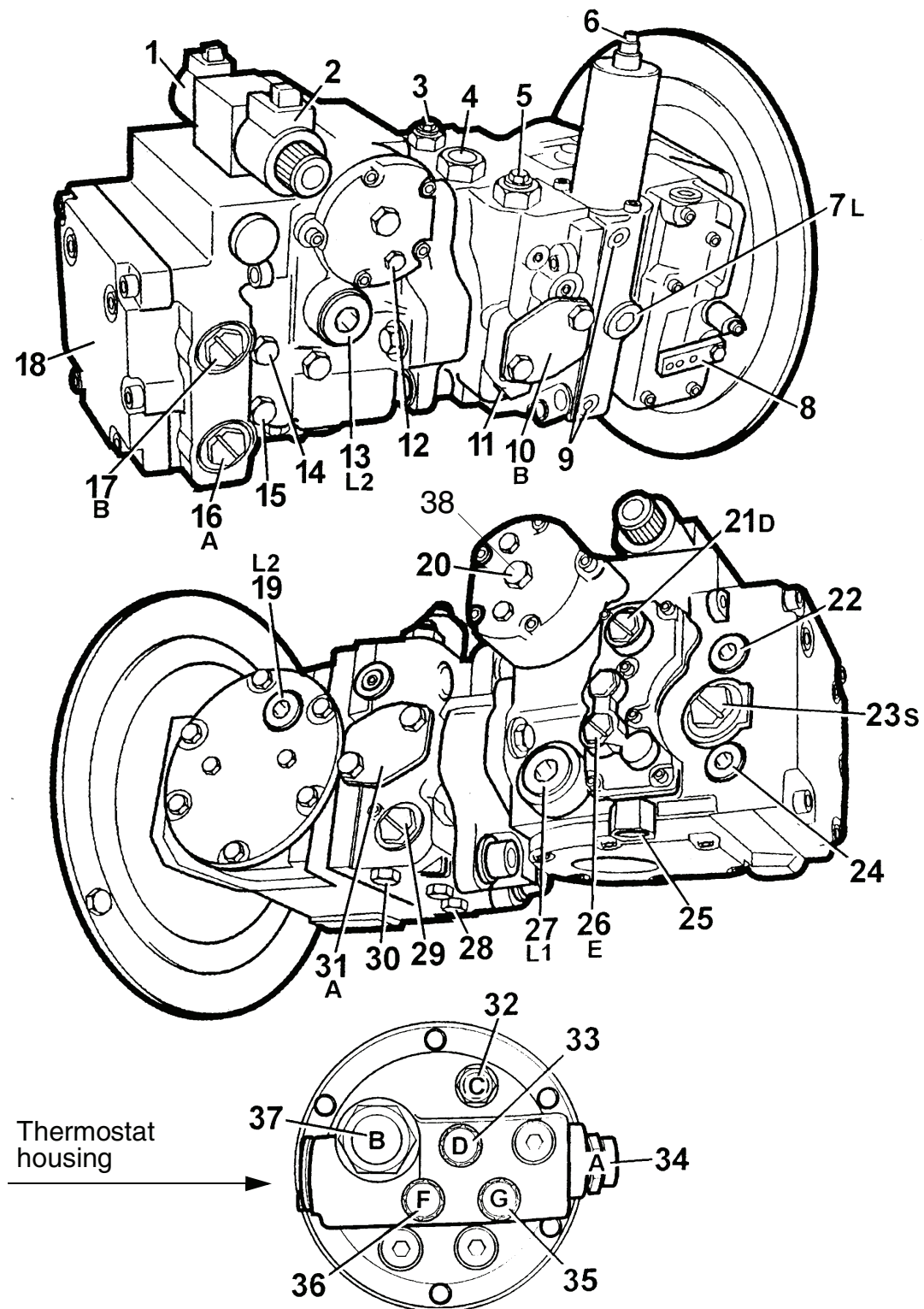


Fig. 8: Connections and adjustment points

- 1 Control solenoid, high frequency (vibration pump)
- 2 Control solenoid, low frequency (vibration pump)
- 3 Multi-function valve 425 bar (charging and pressure limitation), travel system
- 4 Charge pressure to solenoid valve for brakes and speed range selector, charging vibration
- 5 Multi-function valve 425 bar (charging and pressure limitation), travel system
- 6 Adjustment screw, mechanical neutral position
- 7 Port L, leak oil to vibration pump
- 8 Travel lever
- 9 Pressure test port, pilot pressure
- 10 High pressure port B, high pressure reverse
- 11 Charge pressure relief valve, 25 bar
- 12 Adjustment screw, low frequency
- 13 Port L2, leak oil to tank
- 14 Pressure test port MB, high frequency
- 15 Pressure test port MA, low frequency
- 16 High pressure port A, low frequency
- 17 High pressure port B, high frequency
- 18 Charge pump (only in vibration pump)
- 19 Port L2, to drum drive motor 51 C 110 (flushing)
- 20 Adjustment screw, high frequency
- 21 Port D, charge pressure to filter
- 22 Multi-function valve 370 bar (charging and pressure limitation), vibration high frequency
- 23 Port S, suction line between hydraulic oil tank and charge pump
- 24 Multi-function valve 370 bar (charging and pressure limitation), vibration low frequency
- 25 Charge pressure relief valve, vibration pump (blocked)
- 26 Port E, charge oil from travel pump
- 27 Port L1, leak oil port to travel pump
- 28 Pressure test port MB, high pressure reverse
- 29 Charge oil from filter
- 30 Pressure test port MA, high pressure forward
- 31 High pressure port A, high pressure forward
- 32 Port C, from solenoid valve for brake/speed range selection
- 33 Leak oil port D, leak oil from axle drive motor
- 34 Leak oil port A, leak oil from travel pump
- 35 Leak oil port G, leak oil from drum drive motor
- 36 Leak oil port F, leak oil from vibration motor
- 37 Leak oil port B, leak oil to oil cooler
- 38 Adjustment screw for mechanical neutral position, vibration

Servo control

The servo control (mechanical – hydraulic displacement control) converts the mechanical input signal of the pump control lever into a position controlling output signal. This position controlling signal determines the swashing angle of the swash plate (the displacement of the pump), as well as the swashing direction (flow direction of the pressure fluid).

The flow quantity delivered by the variable displacement pump is proportional to the value of the mechanical input signal. A mechanical feedback device ensures the fixed correlation between the mechanical input signal and the swashing angle of the swash plate (displacement of pump).

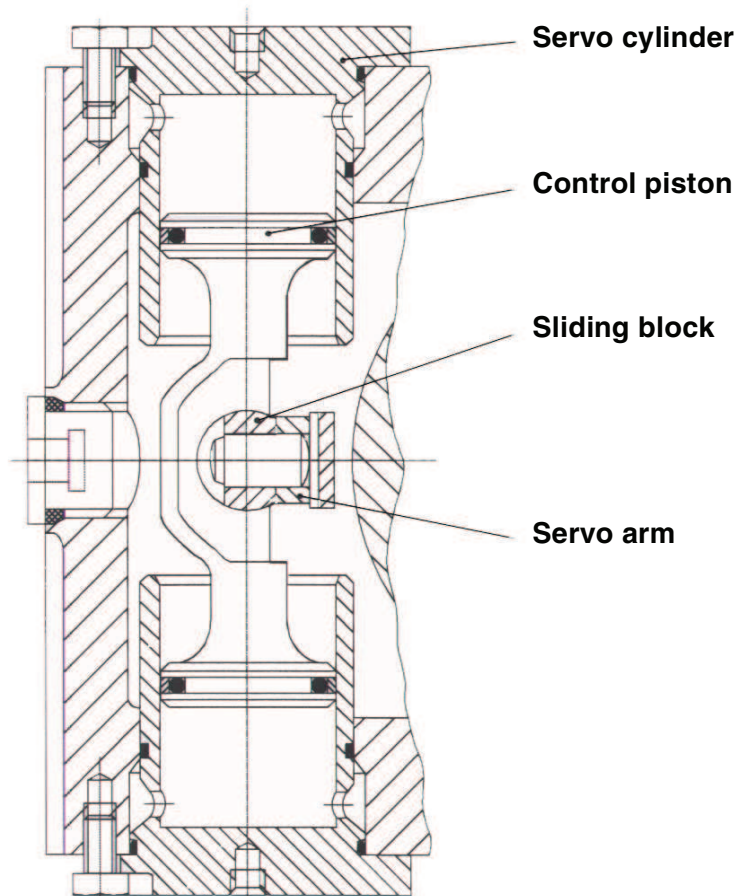


Fig. 9: Control piston

A mechanical safety device (spring) makes sure that a too fast lever movement will not cause any damage to the servo control.

The pump displacement can be adjusted by actuating the pump control lever via travel lever and travel control cable. This requires only very little manual forces and only a slight movement of the lever.

Since the control is spring centred, the swash plate will automatically return to neutral position under the following conditions, thereby interrupting the oil flow and braking the machine:

- when shutting the engine down,
- if the external control cable comes loose,
- if the pressure in the charge circuit drops below a certain value.

Multi-function valves

High pressure limitation

Pumps of series 90 are equipped with a follower valve, which activates a pressure override and a pressure relief valve, one after the other.

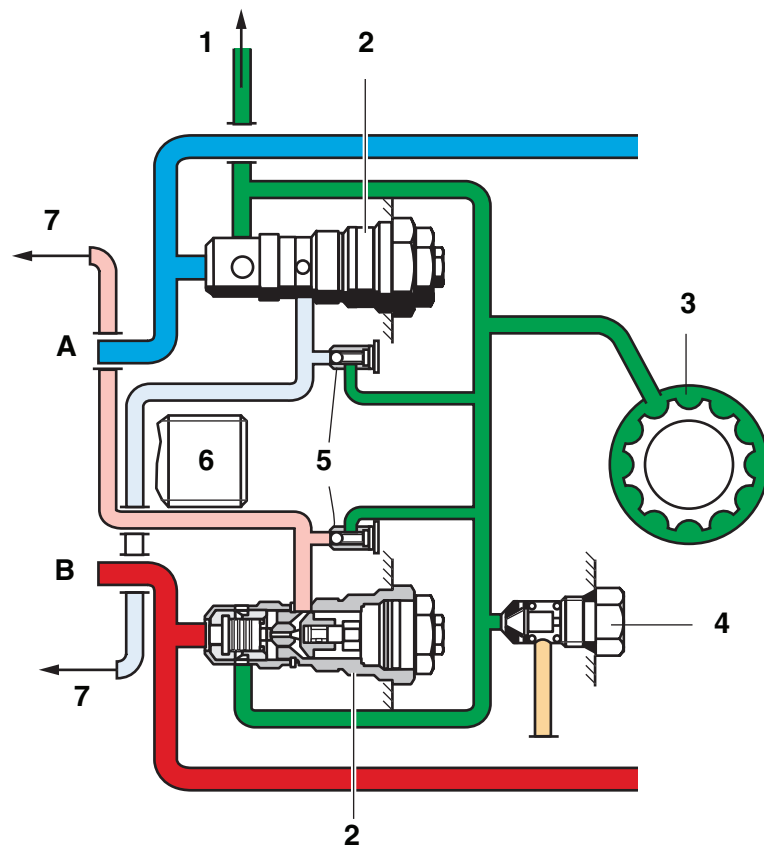


Fig. 10: Multi-function valves

- | | | | |
|---|------------------------------|---|-----------------------|
| 1 | to the control | 6 | Drive shaft |
| 2 | Multi-function valve | 7 | to the control piston |
| 3 | Charge pump | 8 | to the control piston |
| 4 | Charge pressure relief valve | A | Port A |
| 5 | Pilot pressure relief valve | B | Port B |

If the adjusted pressure is reached, the pressure override will move the swash plate quickly back towards neutral position, thereby limiting the system pressure. The average response time is less than 90 ms.

In case of a very quick increase in pressure (pressure peaks) the system utilizes the function of the pressure relief valves as a protection for the hydraulic systems. In such a case the pressure override works as a pre-control unit for the control piston of the pressure relief valve. The pressure level of the high pressure relief valve is higher than the pressure level of the pressure override. The high pressure relief valves will only respond if the pressure override is not able to swash the pump back quick enough in case of sudden pressure peaks.

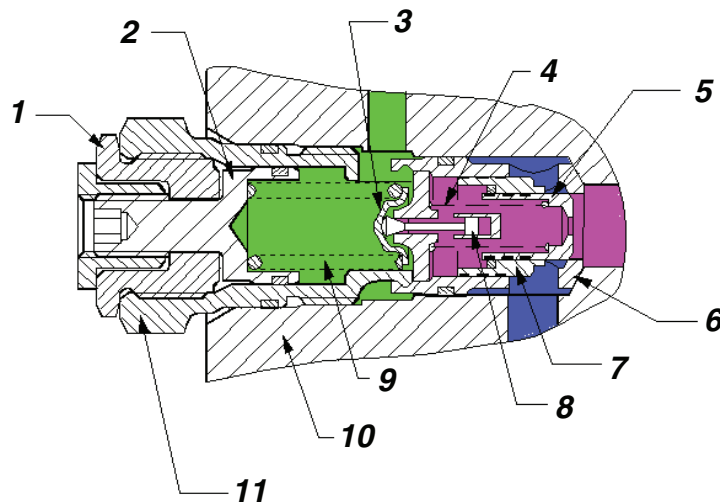


Fig. 11: Multi-function valve, details

- | | | | |
|---|----------------------------|----|---------------------|
| 1 | Reducing fitting | 7 | Check valve |
| 2 | Hydraulic by-pass piston | 8 | Pressure limitation |
| 3 | Spring plate | 9 | Spring |
| 4 | Spring | 10 | By-pass housing |
| 5 | High pressure relief valve | 10 | By-pass sleeve |
| 6 | Valve seat | | |

Pressure override and high pressure relief valve are both parts of the multi-function valve, which is screwed into the pump.

With its possibility to swash the swash plate inside the pump back within a period of 90 ms, the pressure override makes sure that the high pressure relief valves will only respond in exceptional cases. This protects the hydraulic circuit against overheating and reduces the load on the diesel engine.

Note:

The multi function valves must be tightened with a torque of 89 Nm!

Charge pressure relief valve

The charge pressure relief valve is a direct acting valve with fixed adjustment and is part of the safety elements in a closed hydraulic circuit. This valve limits the pressure in the charge circuit to the adjusted value (25 bar).

The charge circuit compensates leaks and flushing quantities in the closed travel and vibration circuits and provides the necessary pressure to control the travel and vibration pumps, the speed range selection and to operate the multi-disc brakes in the travel drives.

Since feeding of cool and filtered oil is only possible in the low pressure side of the closed circuit, the pressure in the low pressure side is almost identical with the pressure in the charge circuit.

When parking the machine on level ground with the engine running, the pressures in both sides of the closed circuit are identical (charge pressure).

Flushing valve

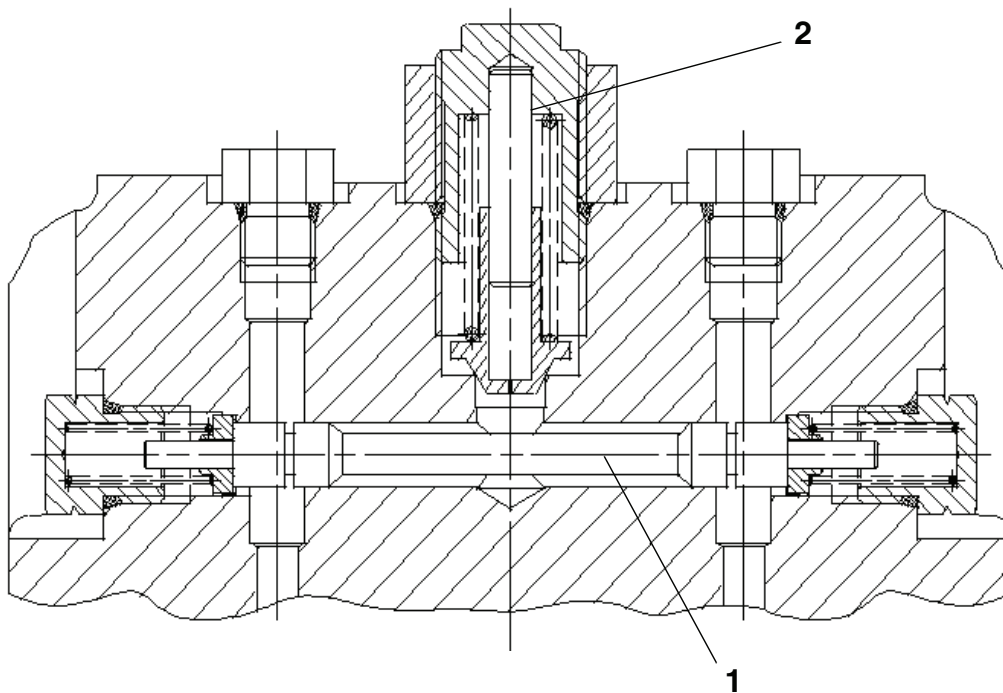


Fig. 12 Cross-section of flushing valve

1 Flushing spool

2 Flushing pressure relief valve

The flushing valves are integrated in the axle drive motor, or on DH/PDH machines, also in the drum drive motor. In case of a pressure increase in one of the two sides of the closed circuit the flushing valves have the function to flush a certain quantity of oil out of the low pressure side.

The valve is operated by the pressure difference between the two sides of the closed circuit (A and B). If the pressure in one side is higher than in the other, this pressure will move the valve out of neutral position against the neutral setting spring. Oil can now flow out of the low pressure side. This oil flows through a thermostat valve back to the tank. The flushed out oil quantity is immediately replaced by oil entering from the charge circuit through the corresponding boost check valve (part of the multi-function valve).

In this way the closed travel circuit is permanently supplied with cool and filtered oil and the temperature household of the hydraulic system is maintained at a permissible level.

Axle drive motor

The axle drive motor is a swash plate controlled Sauer-Sundstrand axial piston motor (series 51 D 110) with variable displacement.

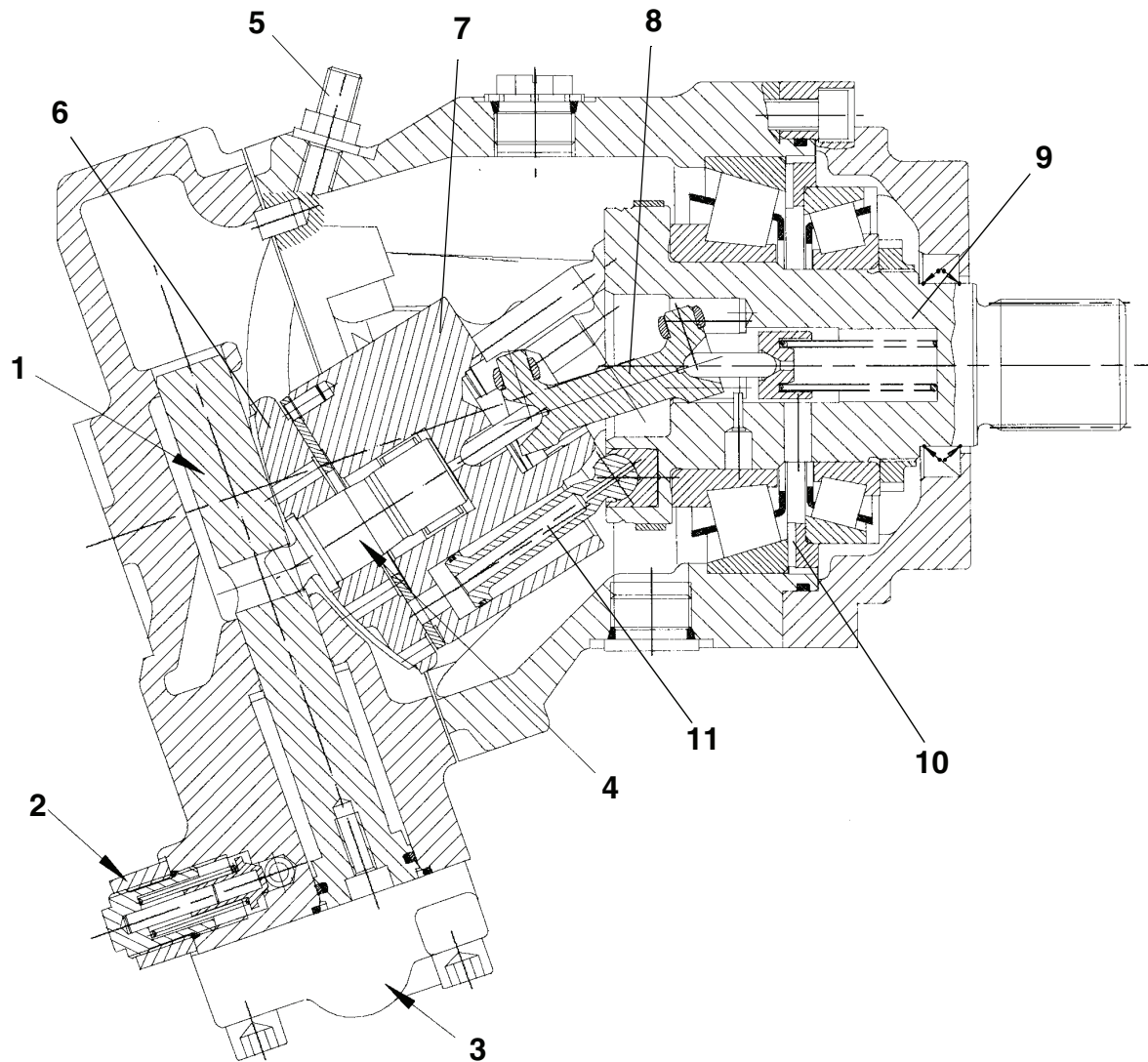


Fig. 13: Axle drive motor,

- | | | | |
|---|-------------------------|----|----------------------|
| 1 | Control piston | 7 | Cylinder block |
| 2 | Flushing valve | 8 | Universal joint |
| 3 | Control | 9 | Output shaft |
| 4 | Spindle with ball | 10 | Output shaft bearing |
| 5 | Q _{min} -screw | 11 | Working piston |
| 6 | Valve plate | | |

The motor can be adjusted to two fixed displacements. This is accomplished by changing the angle between cylinder block and output shaft.

With a large angle position the motor works with maximum displacement, slow speed and high torque.

When changing the swash plate position to minimal angle the motor works with minimum displacement, high speed and low torque.

The displacement is changed by a control piston, which is tightly connected with the valve segment. Changing of the displacement is accomplished by pressurizing the corresponding control piston side with pressure oil from the charge circuit via a 4/2-way solenoid valve.

Function

The motor is connected with the travel pump via the high pressure ports A and B. The hydraulic oil flows under high pressure through the corresponding port to the back of the working pistons. Since the working pistons are arranged under an angle to the output shaft, the pressurized pistons will perform a stroke movement, thereby causing a rotation of the output shaft.

Once the respective piston has passed its dead centre (max. extended position), it will change to the low pressure side. As the rotation progresses, the piston will move back into the cylinder bore. Oil is thereby displaced out of the cylinder chamber through the low pressure side back to the pump.

The synchronizing shaft with roll surfaces ensures uniform rotation of output shaft and cylinder block. The ball joints of the pistons run in journal bearings, which are pressed into the outer shaft. For the connection between output shaft and pistons no other parts are required. The output shaft runs in two tapered roller bearings.

Manual releasing of brake on axle drive

For manual releasing of the brakes on the rear axle you should proceed as follows:

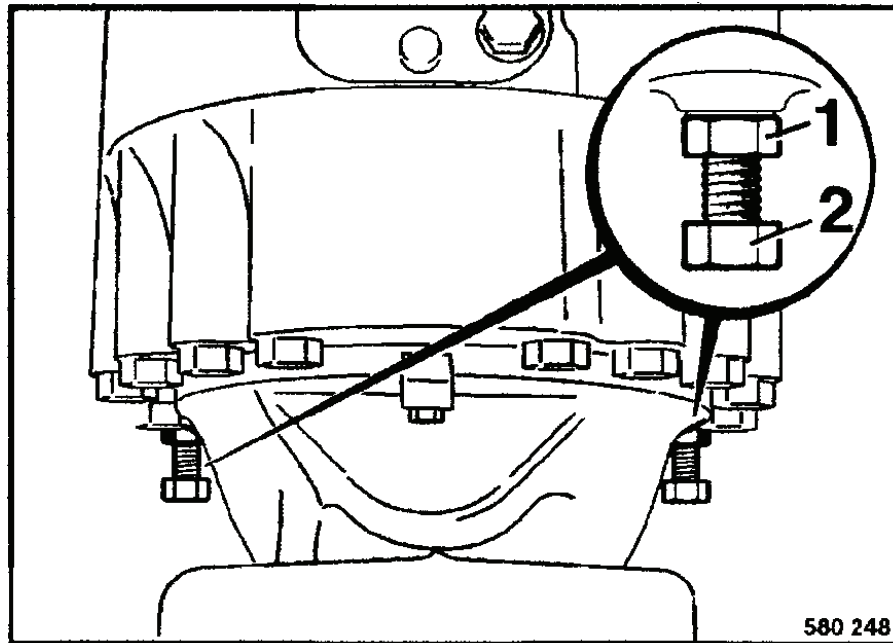


Fig. 14: Manual releasing of rear axle brakes

- Slacken the counter nut (Pos. 1, Fig. 14) and turn the counter nut approx. 8 mm back, until the brake is released.
- Turn the brake releasing screws (Pos.2) completely in against the end stop.
- From this stop turn the screw max. another turn in to release the brake.

Attention!

Turn the screws in evenly on both sides! (alternately 1/4 turn on each side)

- Repeat this measure on the opposite wheel side

Drum drive motor Poclain MSE 18 2 CX

On single drum rollers of series BW 213 D-3 the drum is driven by a hydraulic radial piston motor.

These drum drive motors consist of three housing parts, the flat distributor, the cylinder block with the working pistons and the output shaft.

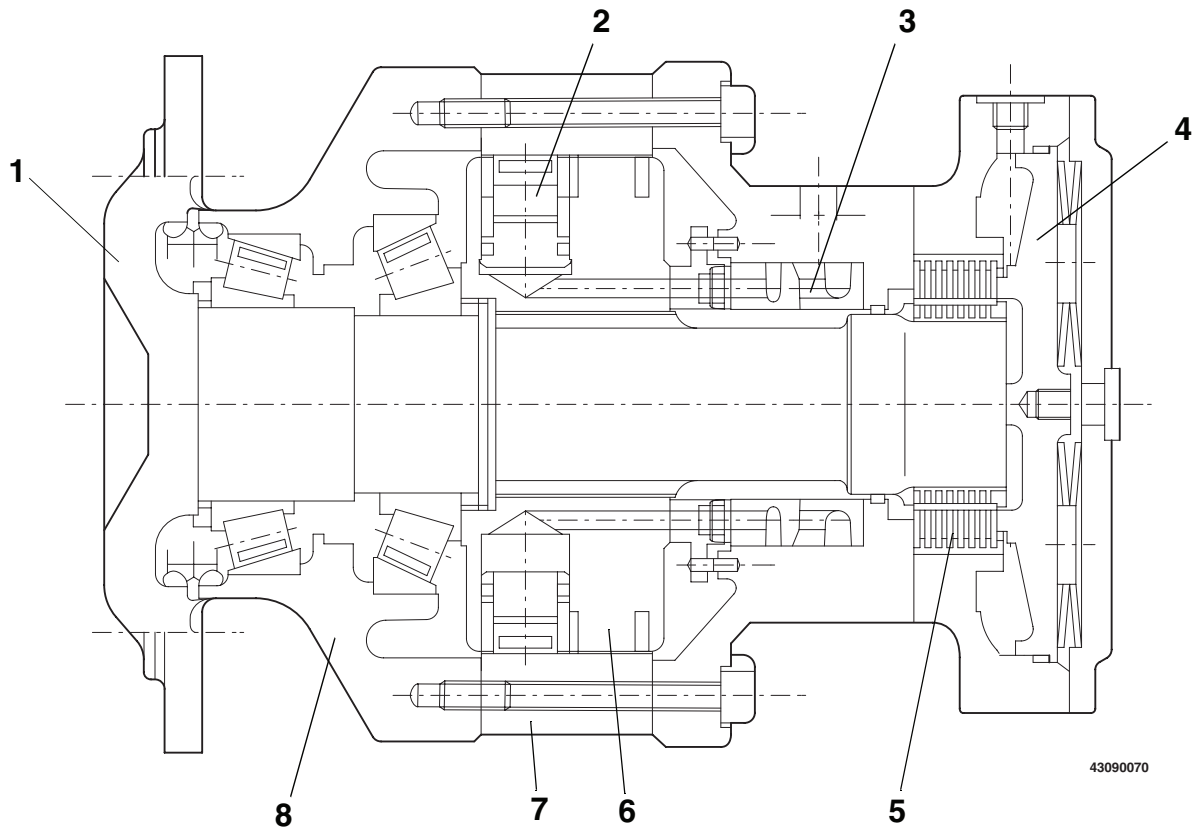


Fig. 15: Drum drive motor

- 1 Drive shaft with output flange
- 2 Piston with roller
- 3 Oil distributor
- 4 Brake piston
- 5 Multi-disc brake
- 6 Cylinder block
- 7 Cam ring
- 8 Bearing plate

The housing consists of:

- bearing section (drive shaft bearings),
- torque section (cam race) and
- oil distributor.

Pressure oil flows through the flat distributor to the working pistons in the cylinder block. This pressure oil presses the working pistons with the rollers against the cam race of the torque section and forces the rollers to roll along the cam race.

This transforms the axial movement of the pistons to a radial movement of the cylinder block. The cylinder block transfers this rotation via a spline connection to the output shaft.

The output shaft runs in two tapered roller bearings. It transfers the rotary movement via the drive disc and the rubber elements to the drum.

The function of the radial piston motor is described hereunder. The piston positions described in this explanation can be seen in the related illustration.

The movement of a piston along the cam race must be examined in several phases during a full rotation:

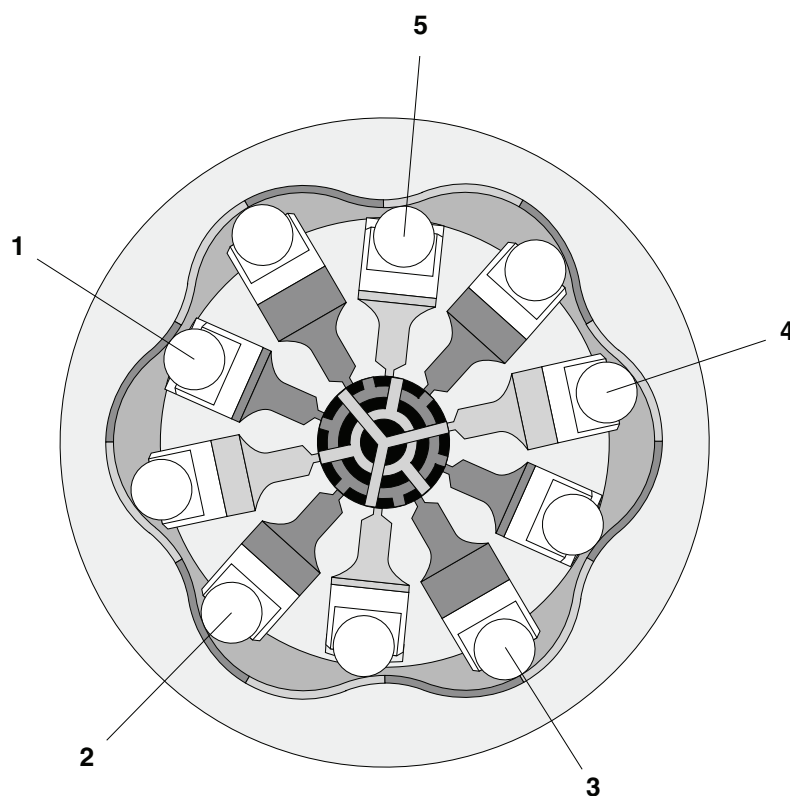


Fig. 16: Function of the radial piston motor

Piston position 1:

The oil enters into the oil distributor under pressure, flows through the distributor and presses against the piston. The rotation starts at this point. The pressure applied to the back of the piston moves the roller along the cam and causes a rotation of the cylinder block.

Piston position 2:

At this point the opening cross-section for the oil flow to the piston has reached its maximum size. The piston continues his travel along the cam race towards the valley between two cams. As the movement continues, the opening cross-section for the oil supply decreases.

Piston position 3:

Once the piston has reached the bottom of the valley, the oil flow to the piston is interrupted. The piston is no longer driven. It has reached its dead centre. Now another piston must be driven to move the first piston out of the dead centre.

Piston position 4:

Other driven pistons now move the first piston out of the dead centre. The oil behind the piston is now connected with the low pressure side and the reverse movement of the piston presses the oil back to the pump.

Piston position 5:

The pumping movement of the motor back to the pump comes to an end, the connecting bore between cylinder chamber and low pressure side closes again. The piston will now reach its second dead centre position. This point is the start of a new working cycle.

Reversing the oil flow reverses also the rotation of the motor.

The output shaft runs in two tapered roller bearings. It transmits the rotary movement via the drive disc and the rubber elements to the drum.

Manual releasing of the brake in the Poclain motor

For manual releasing of the brake in the Poclain motor (drum drive) you should proceed as follows:

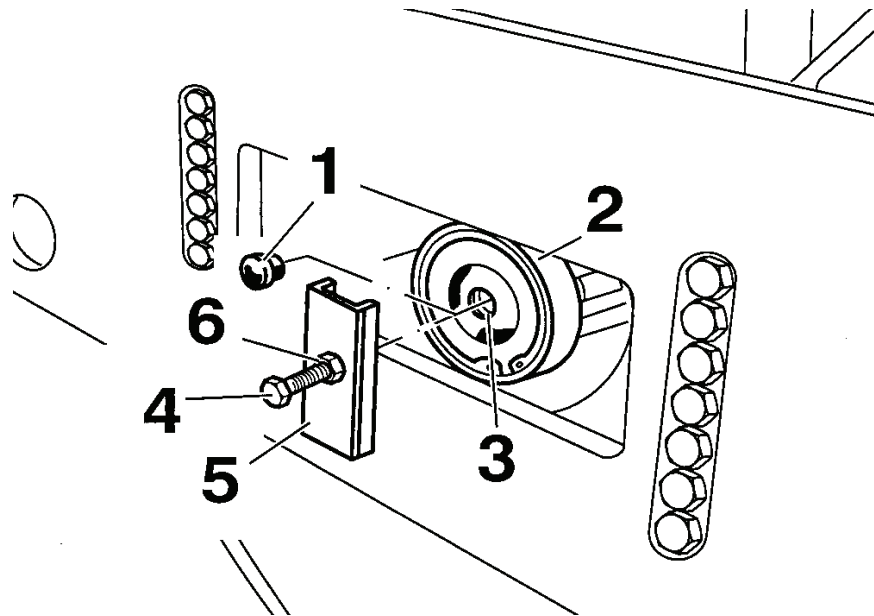


Fig. 17: Manual releasing of the brake in the Poclain motor

- Remove the plug 1 (Fig. 17).
- Lay the U-bar (5) across the brake housing (2) and turn the screw (4) into the tapped bore (3) until it bottoms.
- Turn the nut (6) down and tighten it for approx. one turn. The drum must turn freely.

Drum drive motor 51 C 110 with reduction gear CR 31

The drums on the DH-3 and PDH-3 versions are driven by a swash plate operated Sauer axial piston motor 51 C 110. This motor is almost identical with the rear axle motor. Another detailed description at this point is therefore not necessary.

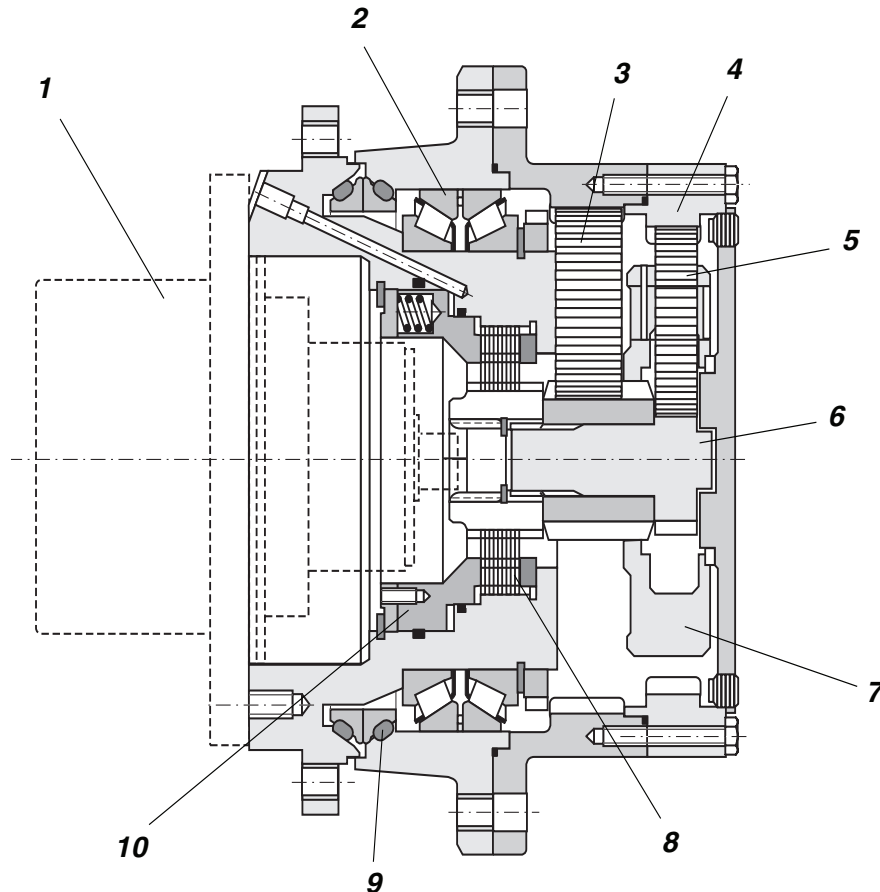


Fig. 18: Reduction gear CR 31

- | | | | |
|---|------------------------|----|-----------------|
| 1 | Travel motor | 6 | Sun gear |
| 2 | Tapered roller bearing | 7 | Planet carrier |
| 3 | Spur wheel | 8 | Brake discs |
| 4 | Hollow wheel | 9 | Mechanical seal |
| 5 | Planet wheel | 10 | Brake piston |

This motor is a fast rotating hydraulic motor. Since the output speed of this motor is much too high to drive the drum, a reduction gear reduces the output speed to the actually required drum drive speed.

Brake control

During operation the closed hydrostatic travel circuit has the function of a service brake. When moving the travel lever from full forward or reverse position towards neutral, the travel pump will follow towards zero position relative to the movement of the travel lever. The oil flow is thereby reduced and the machine is hydraulically braked. When moving the travel lever to neutral position, the pump will also return to neutral, the supply of oil is interrupted and the hydraulic circuit brakes the machine to standstill.

However, since minor leaks cannot be avoided in any hydraulic circuit and such minor leaks will cause creeping of the machine when it is parked on a slope with the engine running, the machine is additionally equipped with multi-disc brakes in drum drive and both wheel drives. When engaging the travel lever in neutral position the multi-disc brakes will close and the machine can be parked on slopes with the engine running and without the risk of creeping.

However, these parking brakes can also be operated via a 3/2-way solenoid valve. In de-energized condition the multi-disc brakes in the travel drives are unloaded. The charge pressure to the brakes is interrupted and the oil from the brake housings flows as leak oil back into the tank.

If the brake solenoid valve is supplied with current while the engine is running and the brake is open, the connection of the brake line to the tank is interrupted and oil from the charge circuit is guided to the brake pistons. The oil pressure works against the spring force of the brake spring and relieves the brake discs.

Manual releasing of the brake in the drum drive reduction gear

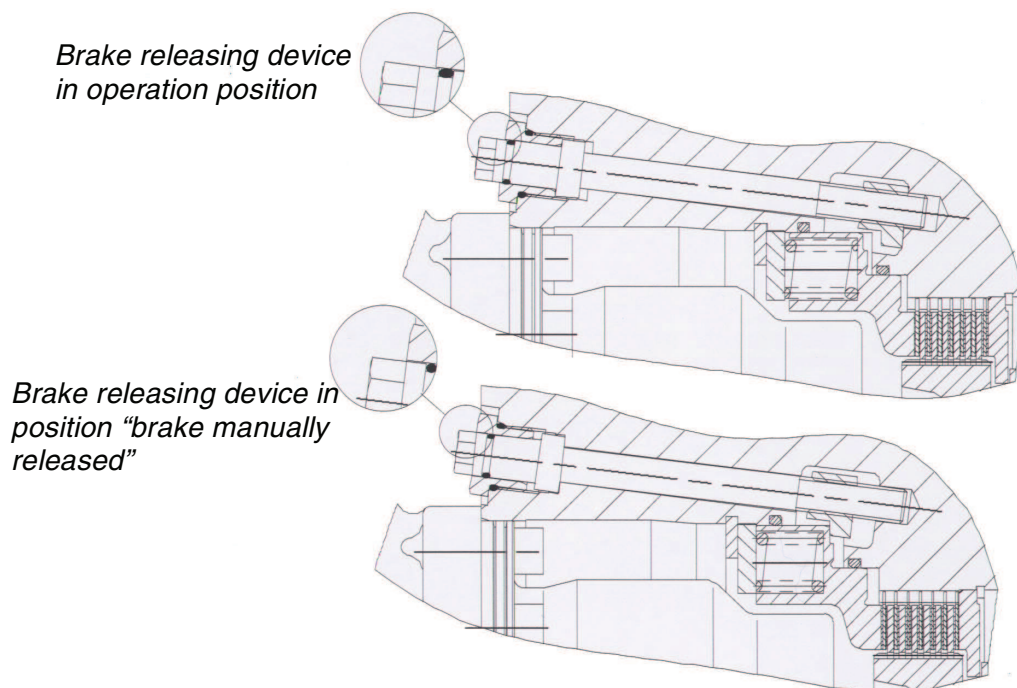


Fig. 19 Manual brake releasing device

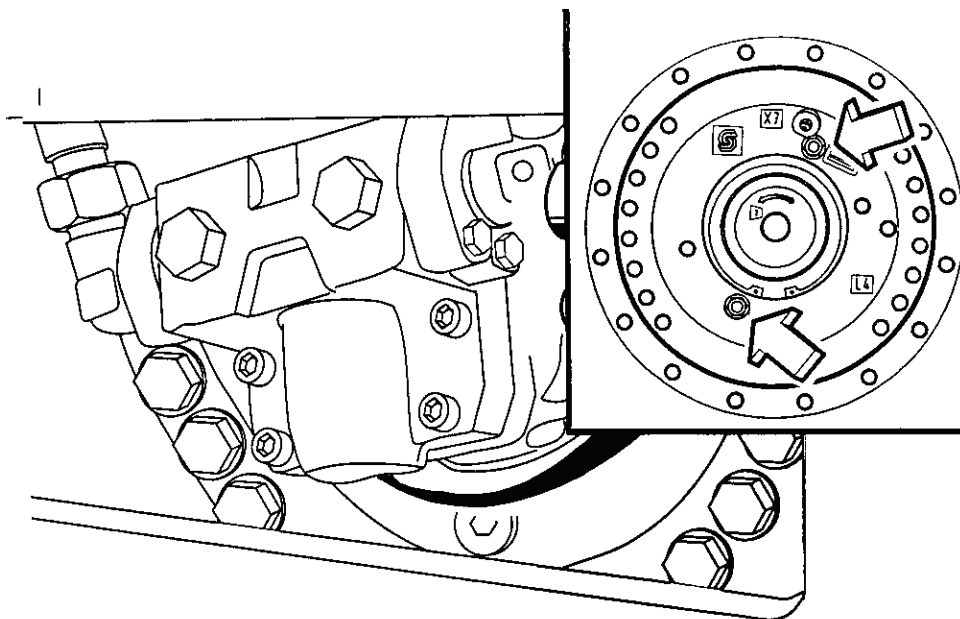


Fig. 20: Manual releasing of the brake in the drum drive CR31

- Turn both screws (Fig. 20) for releasing the brake in the drum drive reduction gear evenly in clockwise direction, until the drum can be turned freely.

Travel circuit with Poclain motor (position of components)

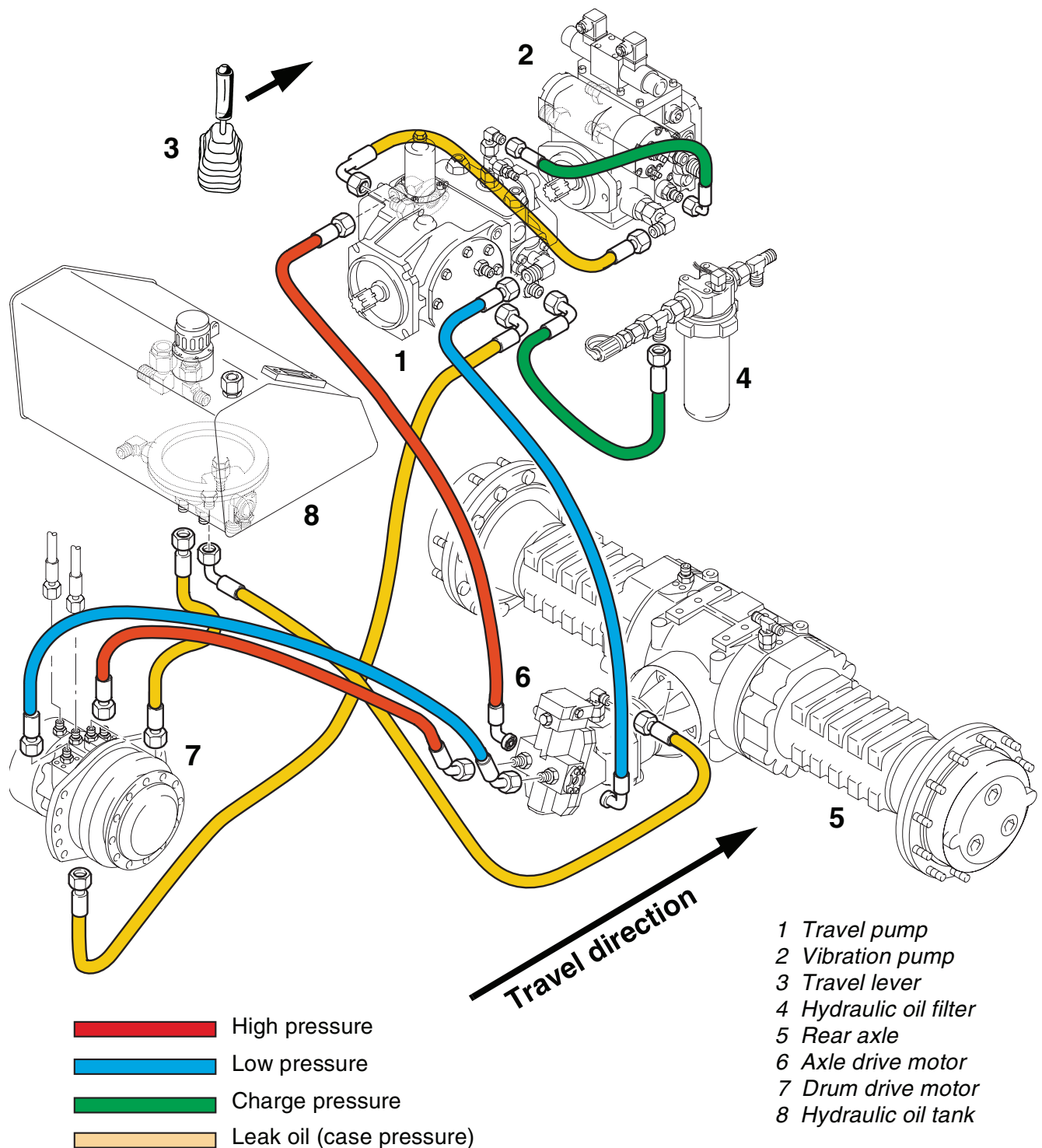


Fig. 21: BW 213 D-3, travel circuit, routing of hoses

Travel circuit with drum drive motor 51 C 110 and CR 31 (position of components)

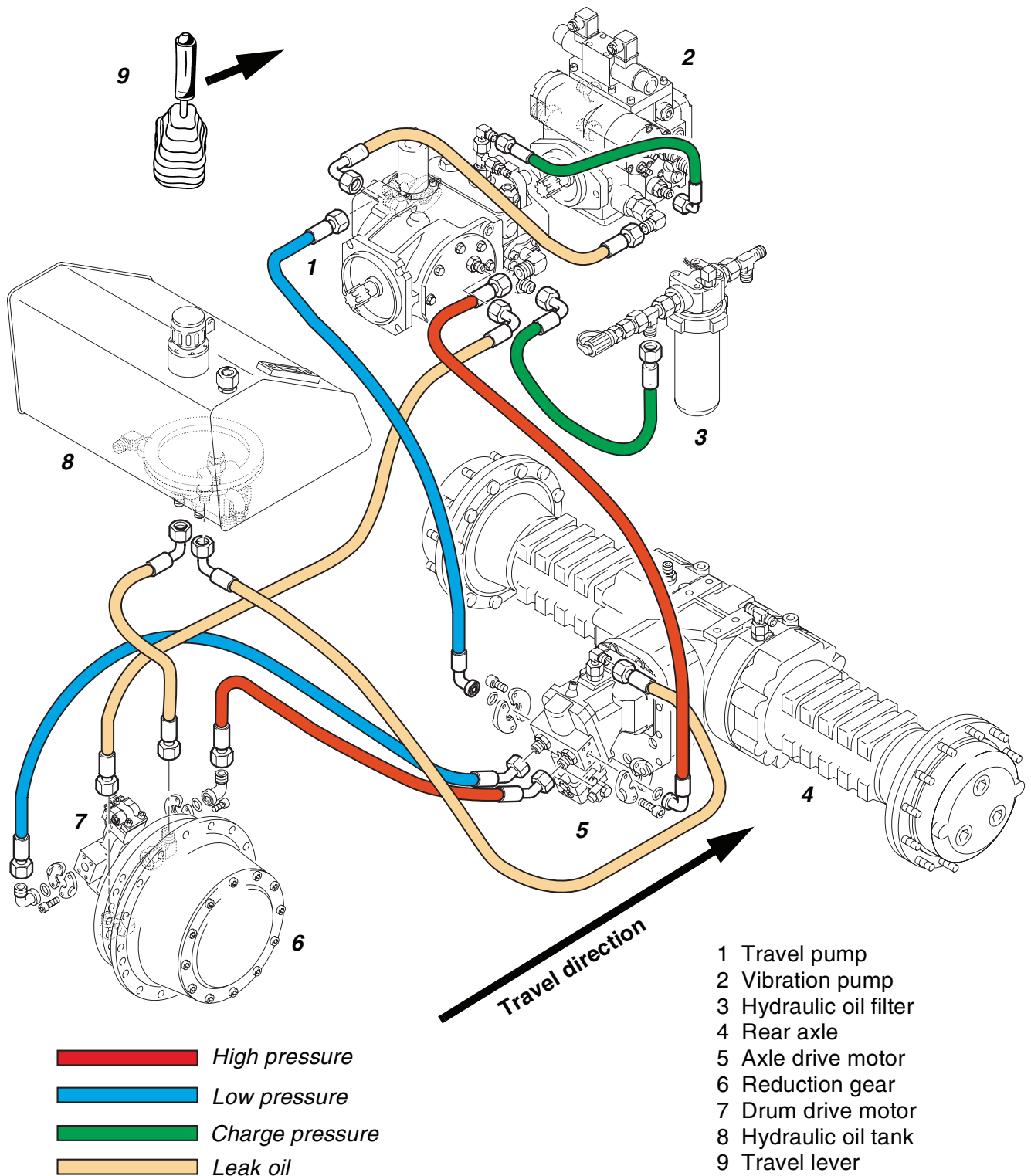


Fig. 22: Travel circuit with 51 C 110 and CR 31

Brake control BW 213 - 3 (with Poclain motor)

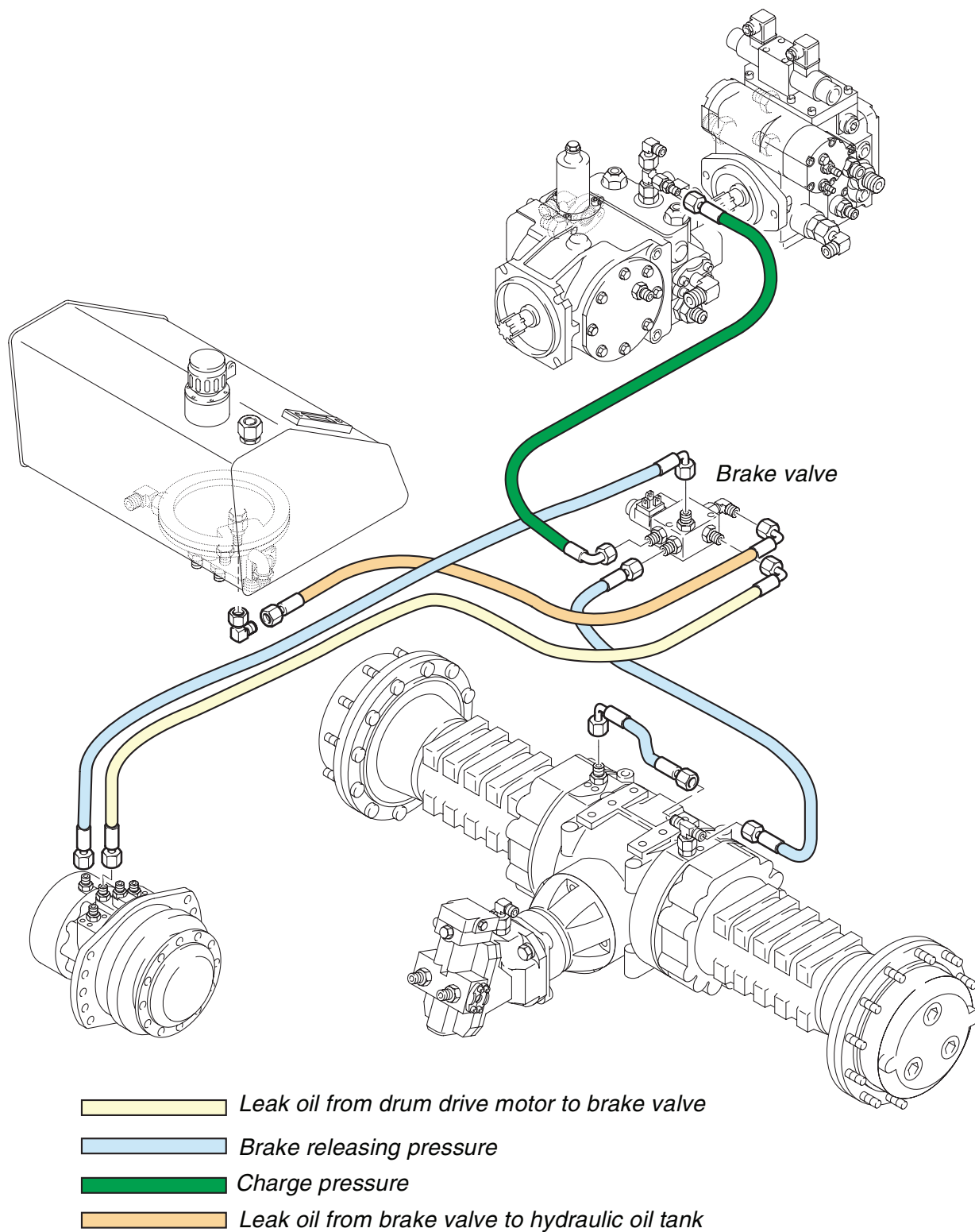


Fig. 23: Brake circuit

Brake control BW 213 - 3 (with Sauer motor 51 C 110 and CR 31)

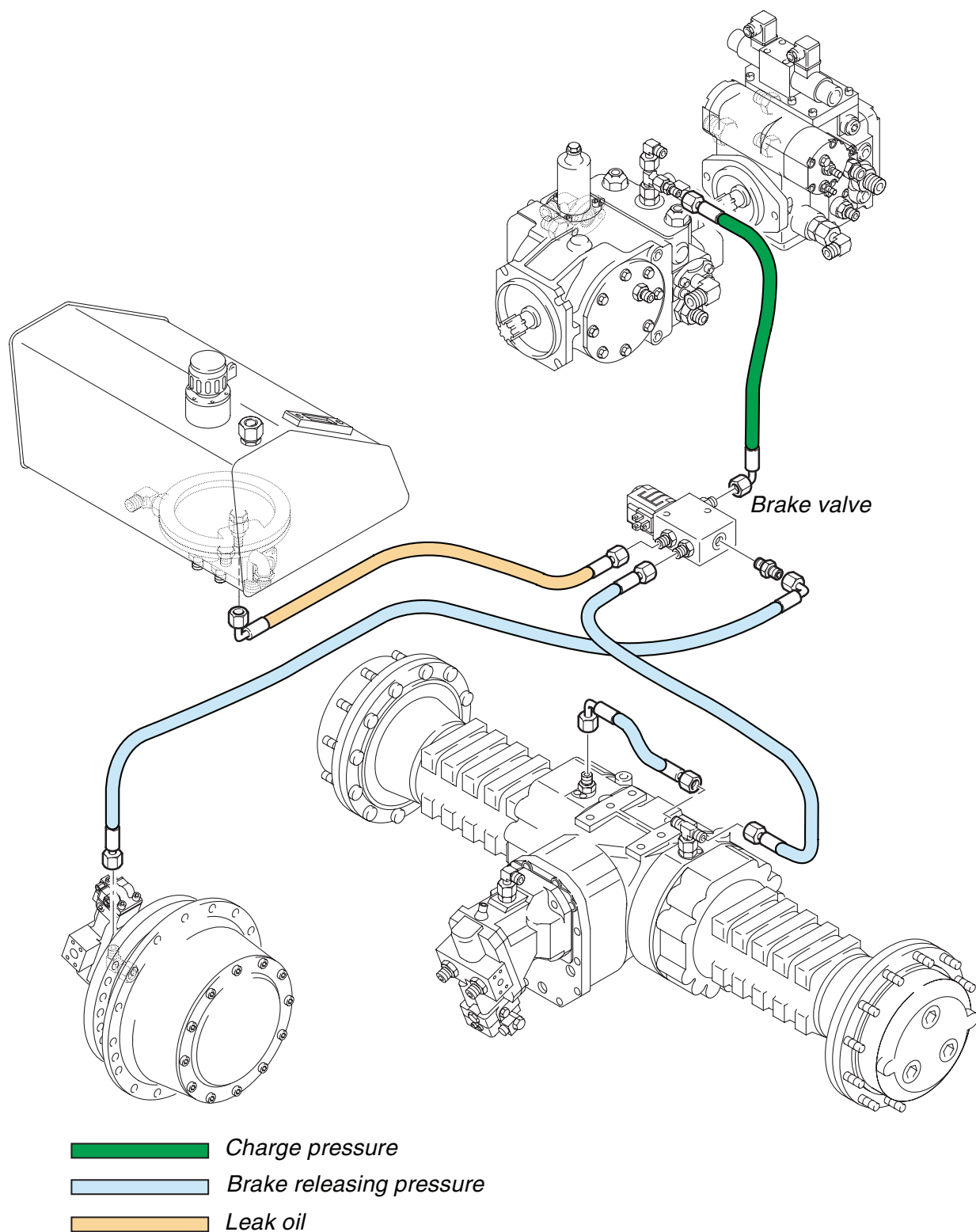


Fig. 24: Brake circuit

Trouble shooting travel circuit

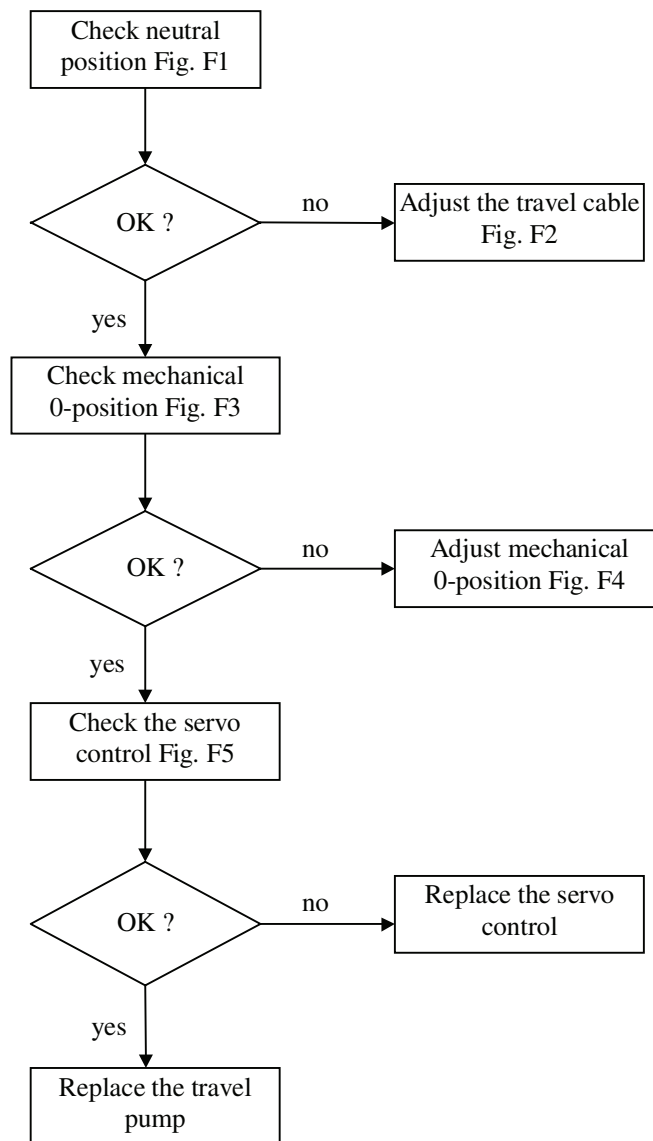
The following description of trouble shooting steps contains a small selection of possible faults, which may occur during operation of the machine. This list is by no means complete, however, the description should help you to become acquainted with a systematic trouble shooting procedure.

The problems and trouble shooting steps described in this training manual are identical with the problems and trouble shooting steps in the operating and maintenance instructions for this machine.

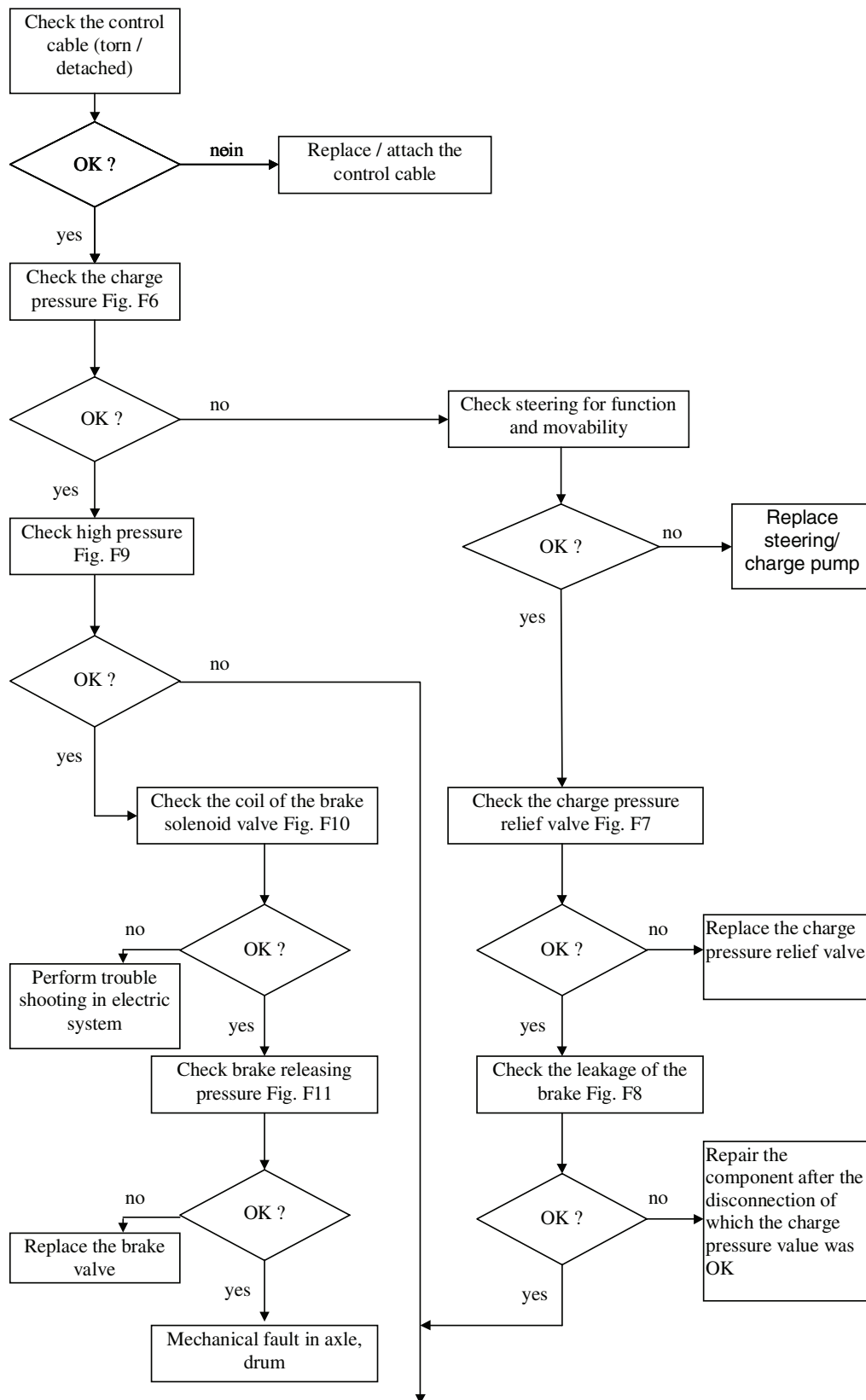
However, in this manual we have tried to describe the individual steps in more detail, in order to explain why certain trouble shooting steps should be applied and why certain preparations must be made before certain tests or measurements can be performed.

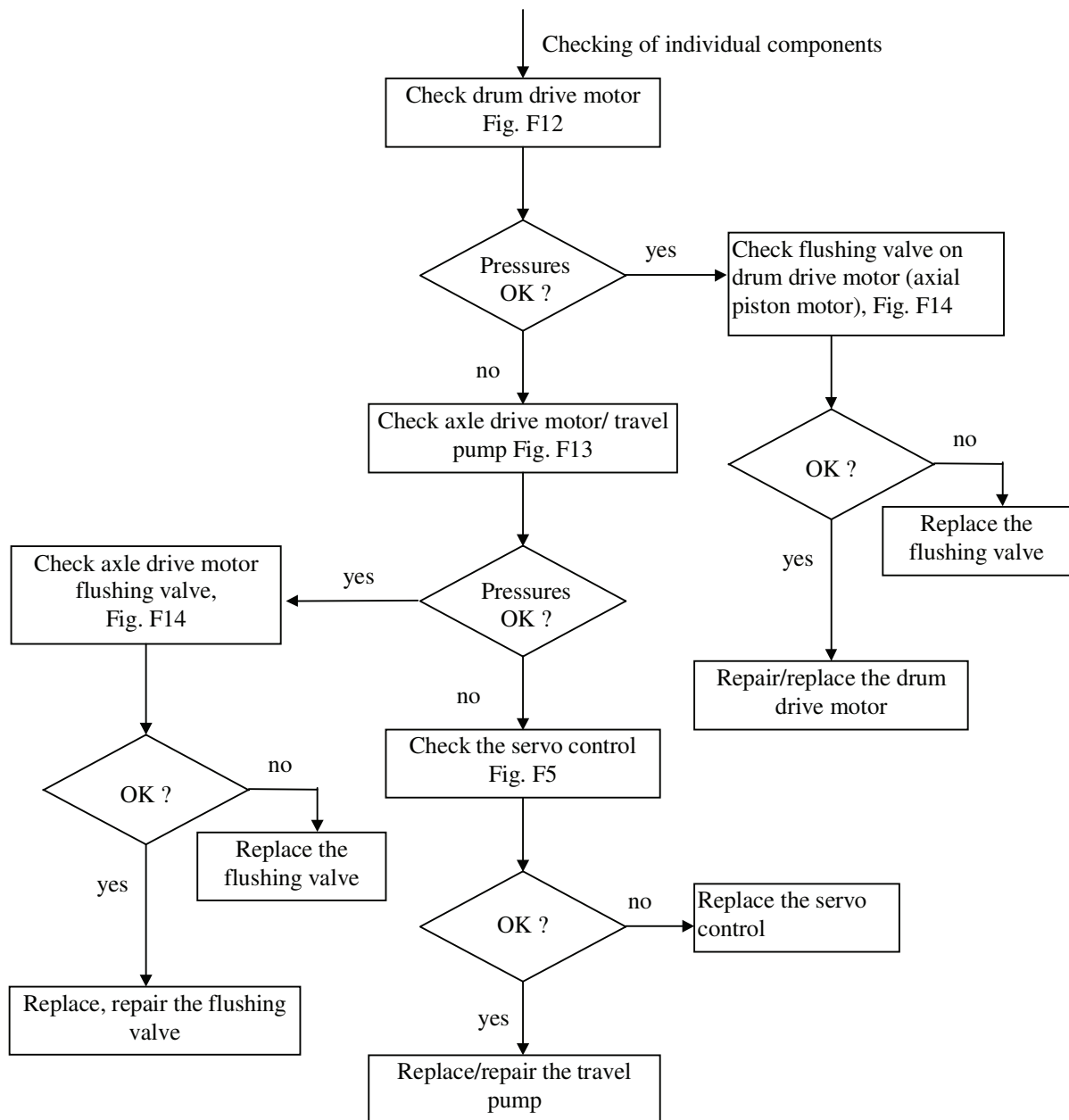
After this training session the persons attending the course should be able to apply the correct trouble shooting steps, even if the actual problem is not described in this manual.

The machine moves with the travel lever in "NEUTRAL"

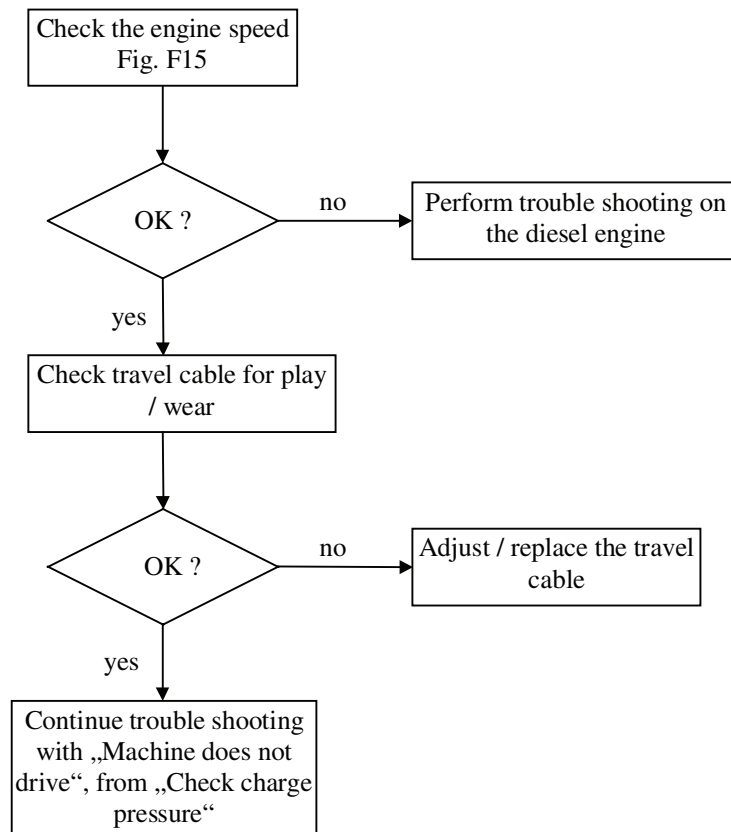


The machine does not drive (to either direction)





Insufficient travel power, max. speed is not reached



Hydraulic oil overheating (> 90 °C)

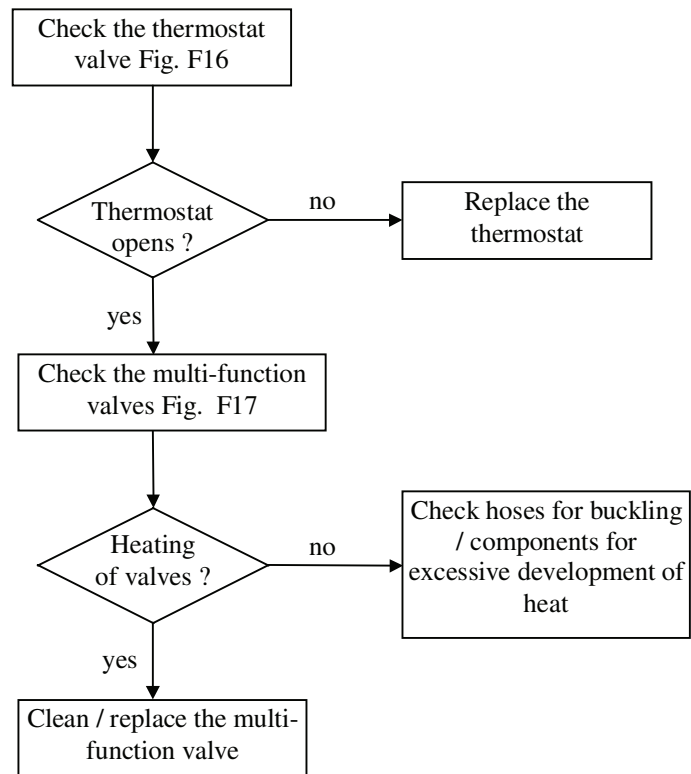


Fig. F1:

Checking the neutral position

With the travel lever in neutral position the machine must not move, even when the engine is running. In this condition the travel pump is centred in neutral position and both sides of the closed circuit have identical pressure (charge pressure).

If the machine moves in this condition on flat ground you should perform trouble shooting by applying the following steps.

- Shift the travel lever to "Neutral" position
- Disconnect the travel cable from the pump
- Start the engine (if the machine is free of faults the machine will now stop)
- Check, whether bores in ball socket and pump control lever are in line

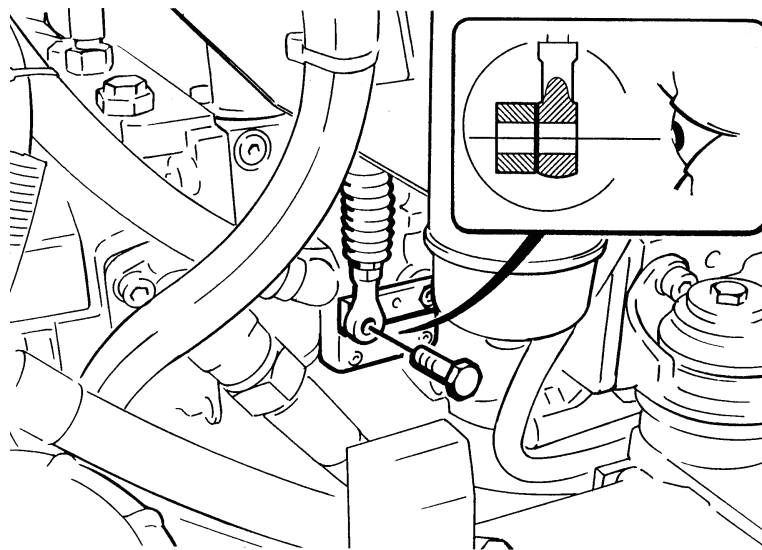


Fig. F2:

Adjusting the travel cable

- Slacken the counter nut on the travel cable bracket to adjust the travel control cable
- Turn the adjustment nut, until the correct neutral position (bores in line) is reached
- Tighten the counter nut again

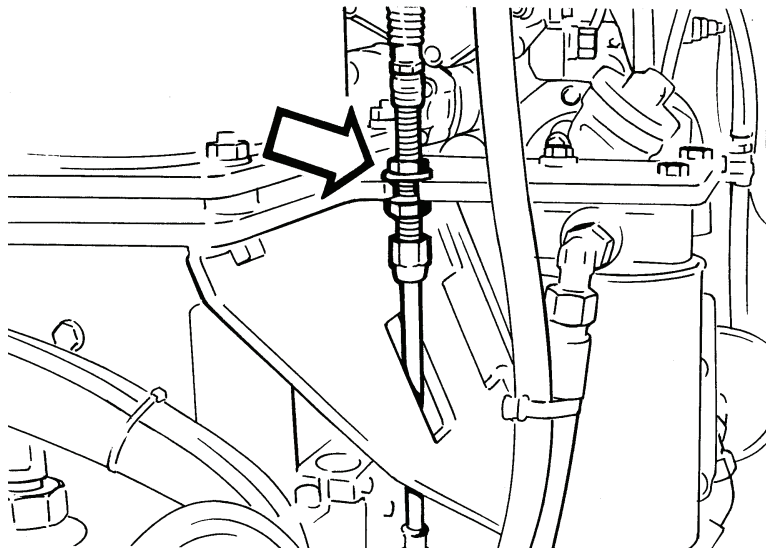


Fig. F3:

Checking the mechanical neutral position

The mechanical neutral position determines the mechanical position of the pump control piston. This piston is connected with the swash plate and its position determines the position of the swash plate. If the piston is out of neutral position the swash plate actuates the working pistons, whereby oil is being pumped to the travel motors.

- Connect both control chambers on the pump control with a suitable hose
- Start the engine
- If the mechanical neutral position is correctly adjusted the machine will not move.

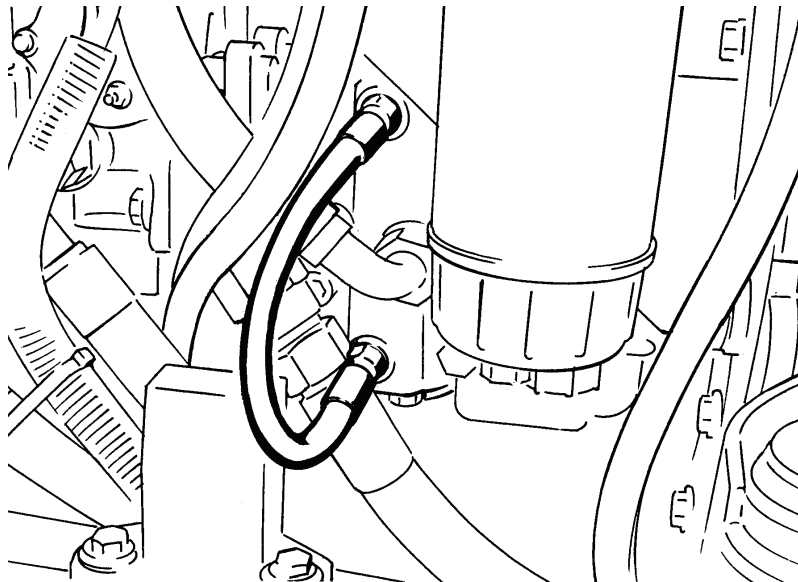


Fig. F4:

Adjusting the mechanical neutral position

If the machine still moves after connecting both control chambers, the mechanical neutral position of the travel pump needs to be adjusted:

- Connect 600 bar pressure gauges to the high pressure test ports
- Pull the plug off the brake solenoid valve and block the drum
- Start the engine and run it with max. speed
- Read the pressure gauges and adjust the mechanical neutral position on the adjustment screw of the spring pack on the control cylinder (see illustration), until identical pressure (charge pressure) is reached on both sides.

For higher accuracy repeat the testing and adjustment procedure with two 60 bar pressure gauges.

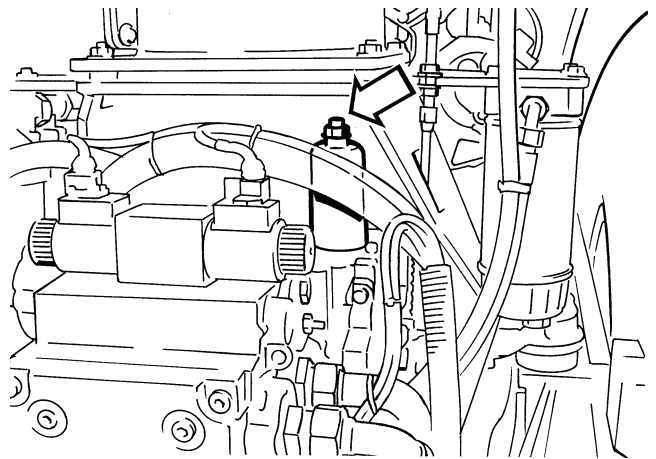
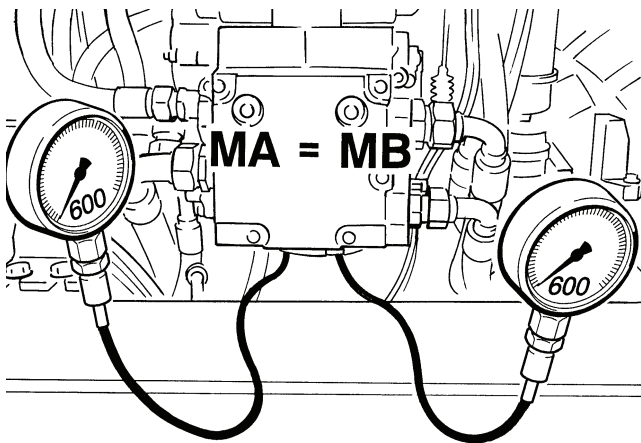


Fig. F5:

Checking the servo control:

- Disassemble the servo control
- Check piston and linkages for moveability and wear
- Check the nozzles, clean if necessary

replace a defective servo control immediately.

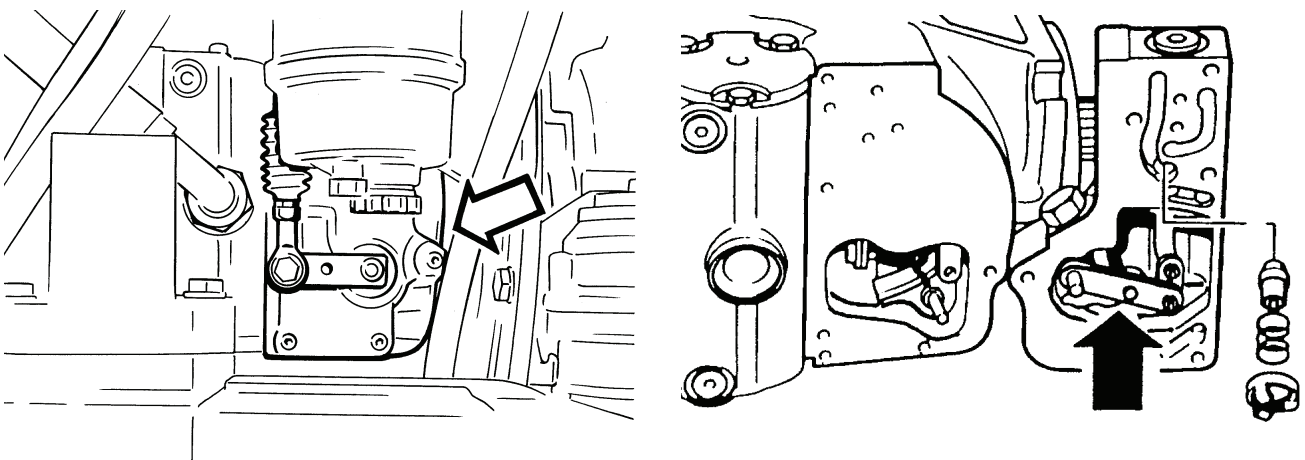


Fig. F6:

Checking the charge pressure

- Connect a 60 bar pressure gauge to the charge pressure test port
- Start the engine and run it with max. speed

Nominal value: 25 +/-1 bar

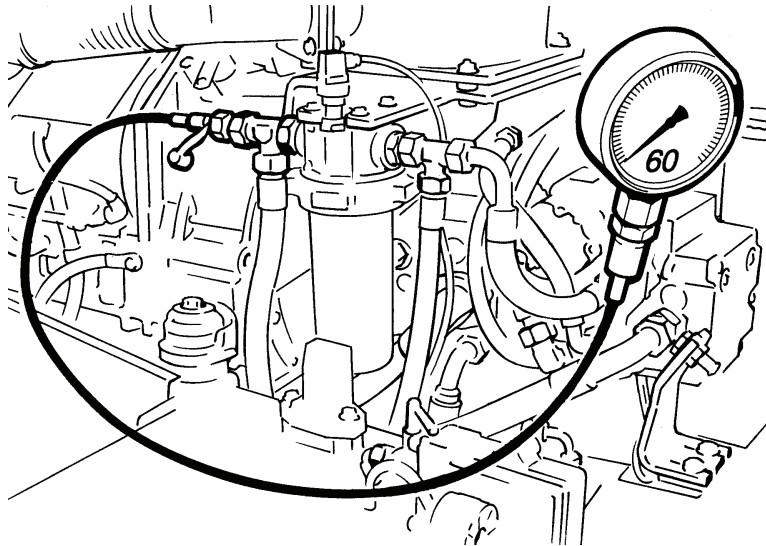


Fig. F7:

Checking the charge pressure relief valve

- Unscrew the valve and check for dirt and damage

Replace a defective charge pressure relief valve immediately.

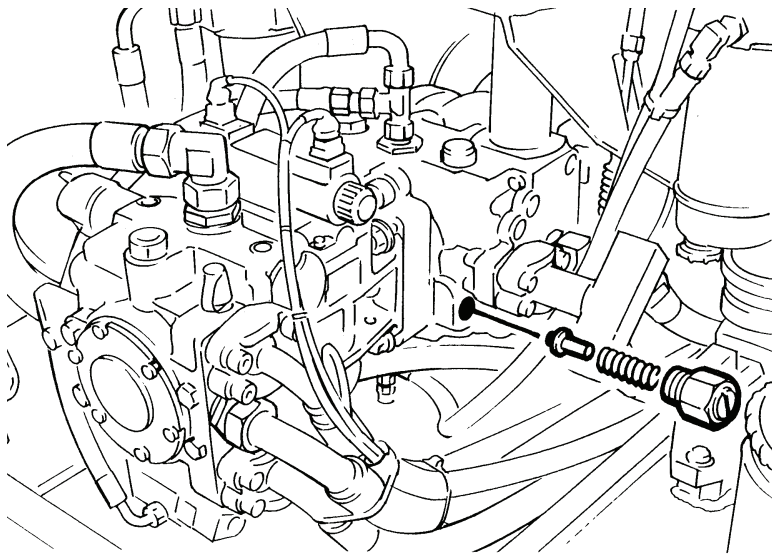


Fig. F8:

Checking the leakage of the brake

A leakage in the brake housings can cause a drop in charge pressure, the brake cannot be released.

- Release the brake by shifting the travel lever out of braking position
- Disconnect the brake lines one after the other from drum drive and wheel drive motor and perform charge pressure tests always after disconnecting a hose

Repair the motor after the disconnection of which the charge pressure was found correct.

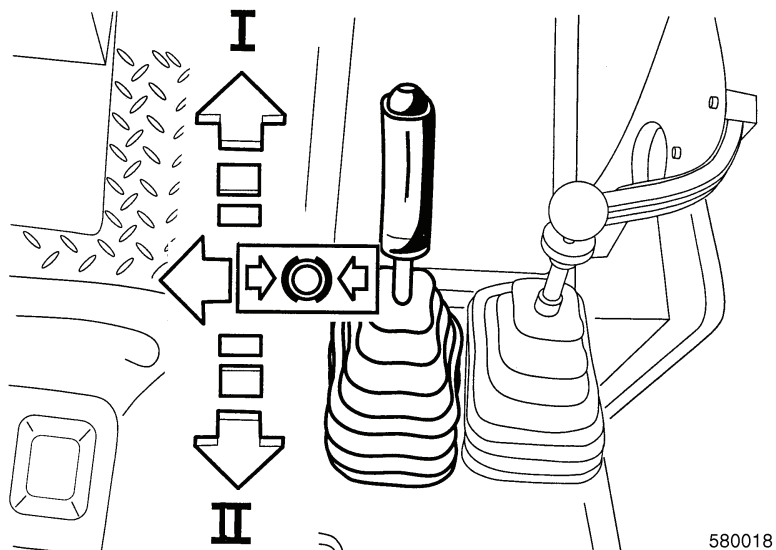


Fig. F9:

Checking high pressure

- Connect 600 bar pressure gauges to the high pressure test ports
- Connect a 60 bar pressure gauge to the charge pressure test port
- Pull the plug off the brake solenoid valve and block the drum
- Start the engine and run it with max. speed
- Drive the machine against the closed brake, for this purpose actuate the travel lever for a moment and read the pressure gauges

Nominal values: High pressure 435 +/-15 bar, charge pressure 25 +/- 1 bar

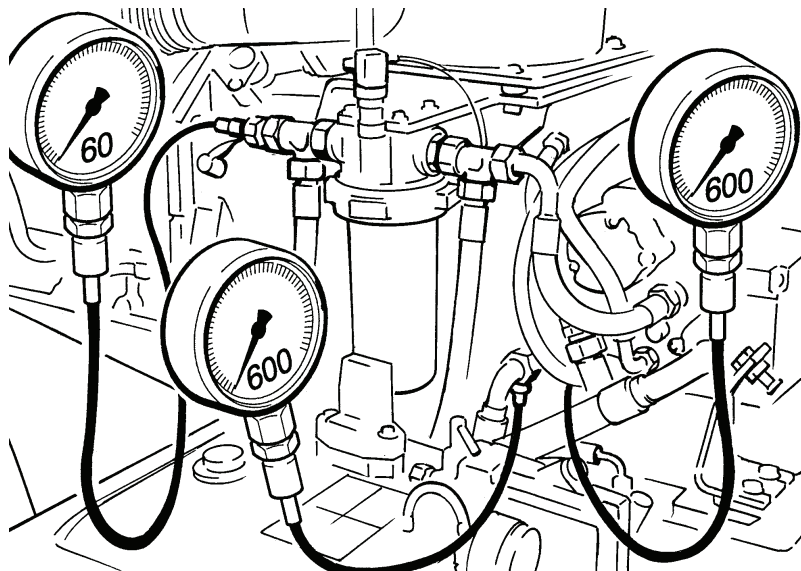


Fig. F10:

Checking the magnetic coil of the brake valve

- Start the engine and release the brake (disengage the travel lever from the braking position)
- use an appropriate meter to measure the voltage and current draw on the magnetic coil of the solenoid valve

**Nominal values: D-versions: 12 V / 1.8 A;
DH/PDH-versions: 12 V / 1.8 A;**

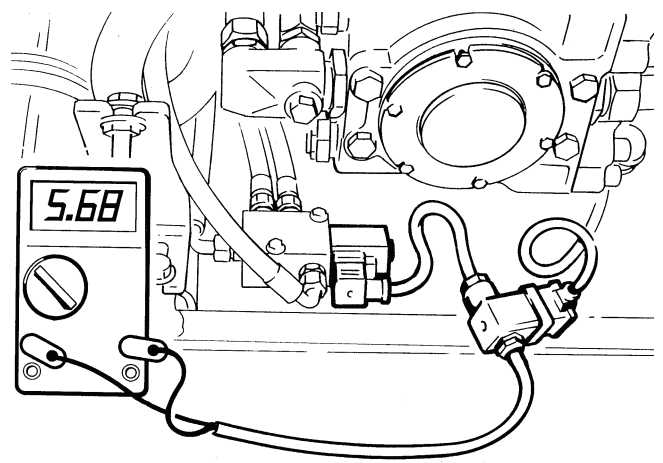
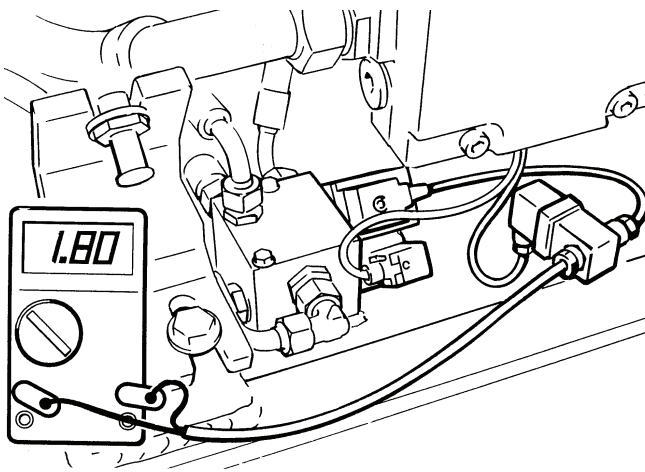


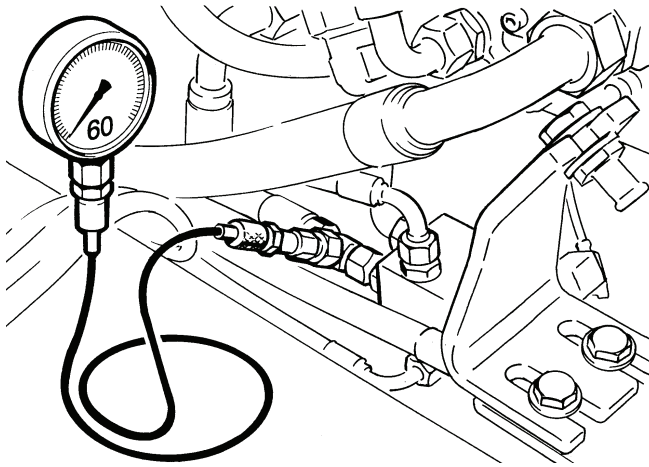
Fig. F11:

Checking the brake releasing pressure

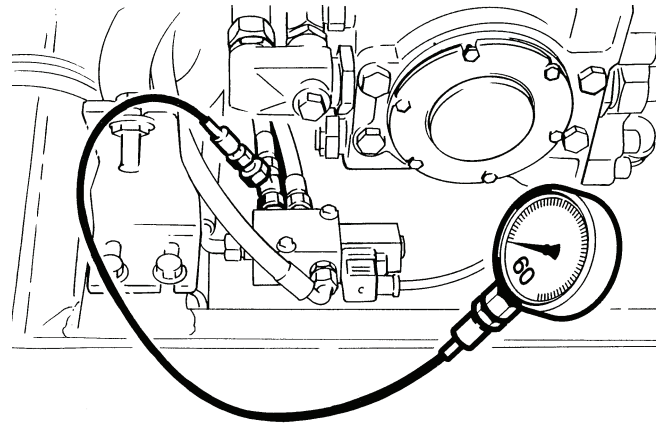
If the brake valve does not open, no oil from the charge circuit will be guided to the brakes and the brake discs cannot open.

- Install a pressure test port with a 60 bar pressure gauge to the brake releasing line
- Start the engine and release the brake (disengage the travel lever from the braking position)
- Read the pressure gauge,

Nominal value: 25 +/- 1 bar (charge pressure)



D - version



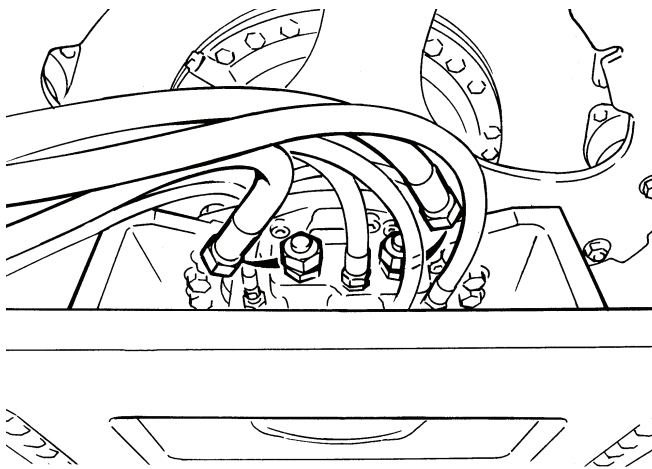
DH-/PDH-versions

Fig. F12:

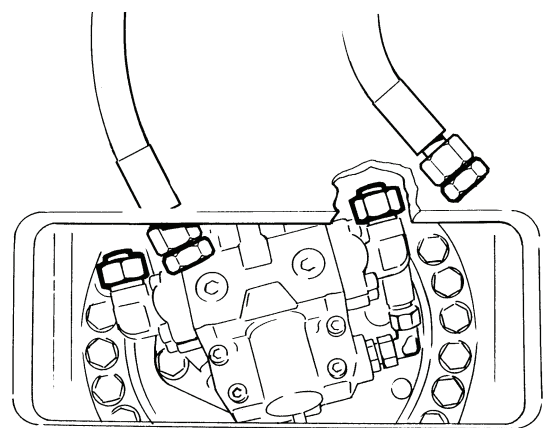
Checking the drum drive motor

- Unscrew the high pressure hoses from the drum drive motor and close them with suitable plugs
- Perform a high pressure test (Fig. F9)

If the specified pressure values are reached after disconnecting the drum drive motor, whereas they have not been reached while the motor was still connected, the drum drive motor is defective. If the specified pressures are not reached, the axle drive motor or the travel pump must be defective



D - version



DH-/PDH-versions

Fig. F13:

Checking axle drive motor / travel pump

- Disconnect the high pressure hoses from the travel pump
- Close the pump port with pressure resistant plugs
- Perform a high pressure test (Fig. F9)

If the specified pressure values are now reached and the drum drive motor is OK, the fault must be in the axle drive motor. If the high pressure values are not reached, the fault must be in the travel pump.

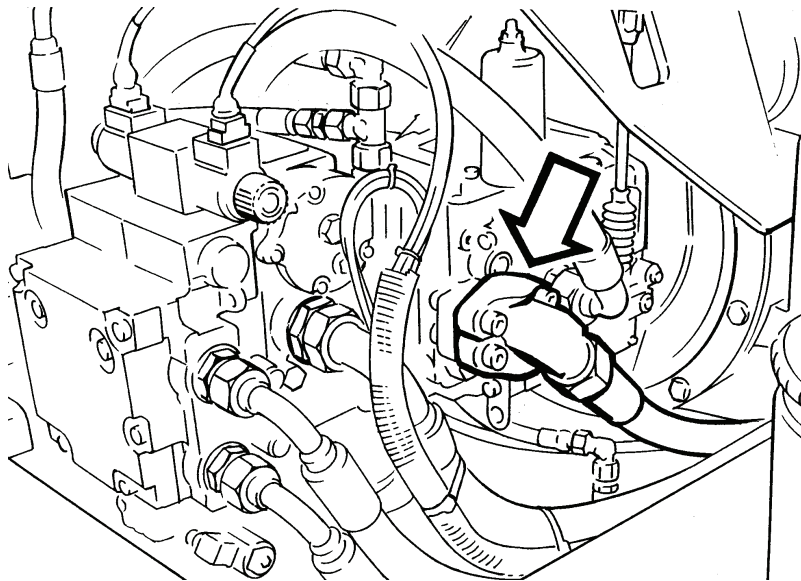


Fig. F14:

Checking the flushing valves on axle drive and drum drive motor (only axial piston motor)

In case of a failure on one of the flushing valves a too high oil quantity may be flushed out and the charge circuit may not be able to replace this quantity. The charge pressure will drop and important machine functions will no longer be available.

- Pull the valve spool out of the flushing valve
- Check for moveability and damage

replace a defective flushing valve.

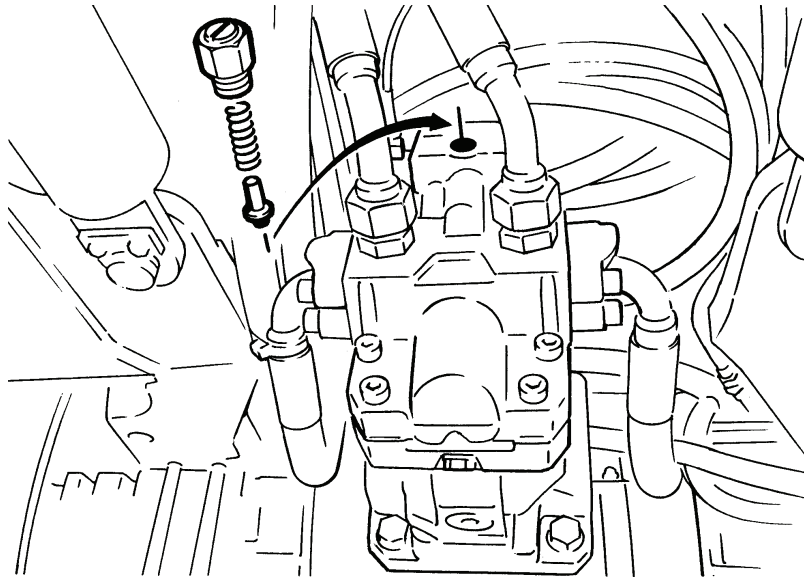


Fig. F15:

Checking the engine speed

- Start the engine and run it with max. speed
- Measure the engine speed with a suitable RPM-meter (e.g. digital optical RPM-meter)

Nominal value: 2300 min⁻¹ (high idle)

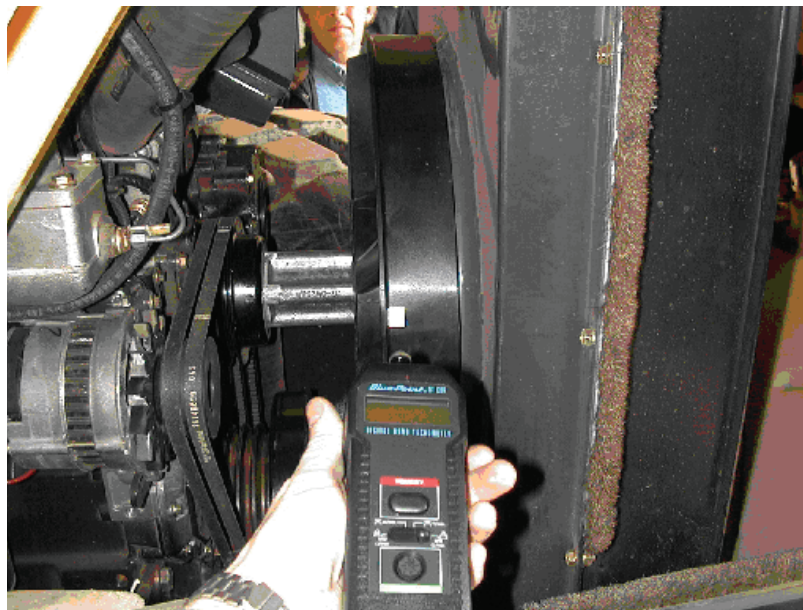


Fig. F16:

Checking the thermostat valve

If the hydraulic oil heats up to a too high temperature it will lose its lubrication properties, which may cause damage to important components in the hydraulic system.

In case of a too high hydraulic oil temperature shut the engine down immediately, let the system cool down and perform trouble shooting. Do not start to operate the machine unless the fault has been corrected.

First check the function of the thermostat valve. Up to a temperature of 60°C all leak oil, flushing and return flow quantities flow directly back into the tank. At 60°C the thermostat valve should start to open and guide the hydraulic oil through the hydraulic oil cooler back to the tank.

- Feel with your hand if the hose to the hydraulic oil cooler starts to become warm after a hydraulic oil temperature of 60°C is reached.
- If the thermostat valve does not open it must be replaced immediately.

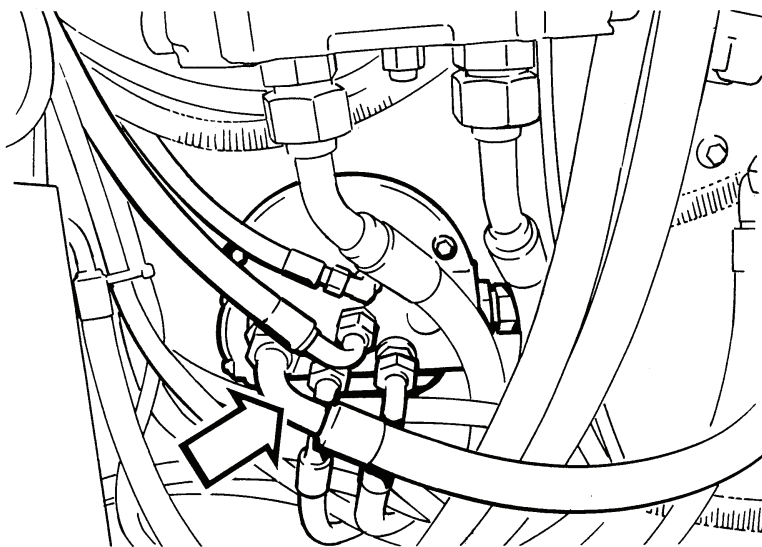


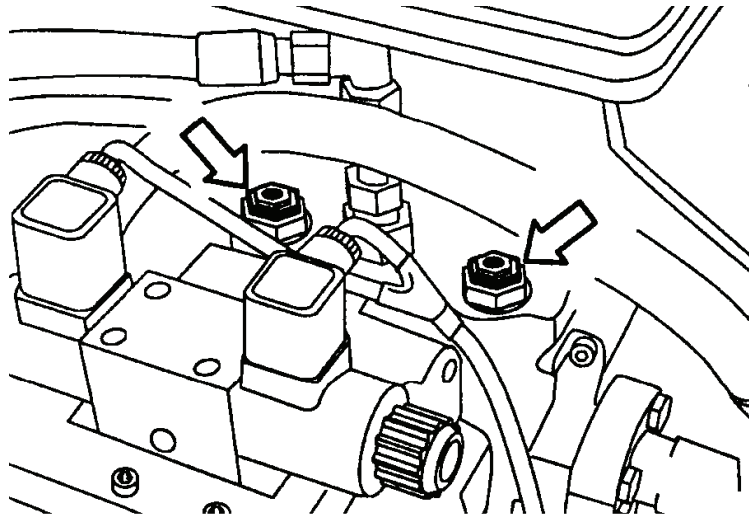
Fig. F17:

Checking the multi-function valves

The opening cross-sections of the high pressure relief valves, which are part of the multi-function valves, are very small. Hydraulic oil escaping from the high pressure side through the high pressure relief valves (e.g. in case of a defective pressure override, which is also part of the multi-function valve) will cause very quick overheating of the hydraulic oil.

- Pull the plug off the brake solenoid valve
- Block drum and wheels with chocks
- Start the engine and run it with max. speed
- Actuate the travel lever to both directions and check the multi function valves for heat development.
- If one of the valves develops excessive heat, it must be immediately replaced

Attention! Tightening torque for multi-function valves 89 Nm



Vibration system

The vibration system of the single drum rollers BW 213 - 214 of generation 3 works with two frequencies and two amplitudes. This enables perfect adaptation of the machine to various types of soil and different applications.

The vibration drive is a closed hydraulic circuit. The circuit consists of:

- the vibration pump,
- the vibration motor and
- the pressure resistant connecting hoses.

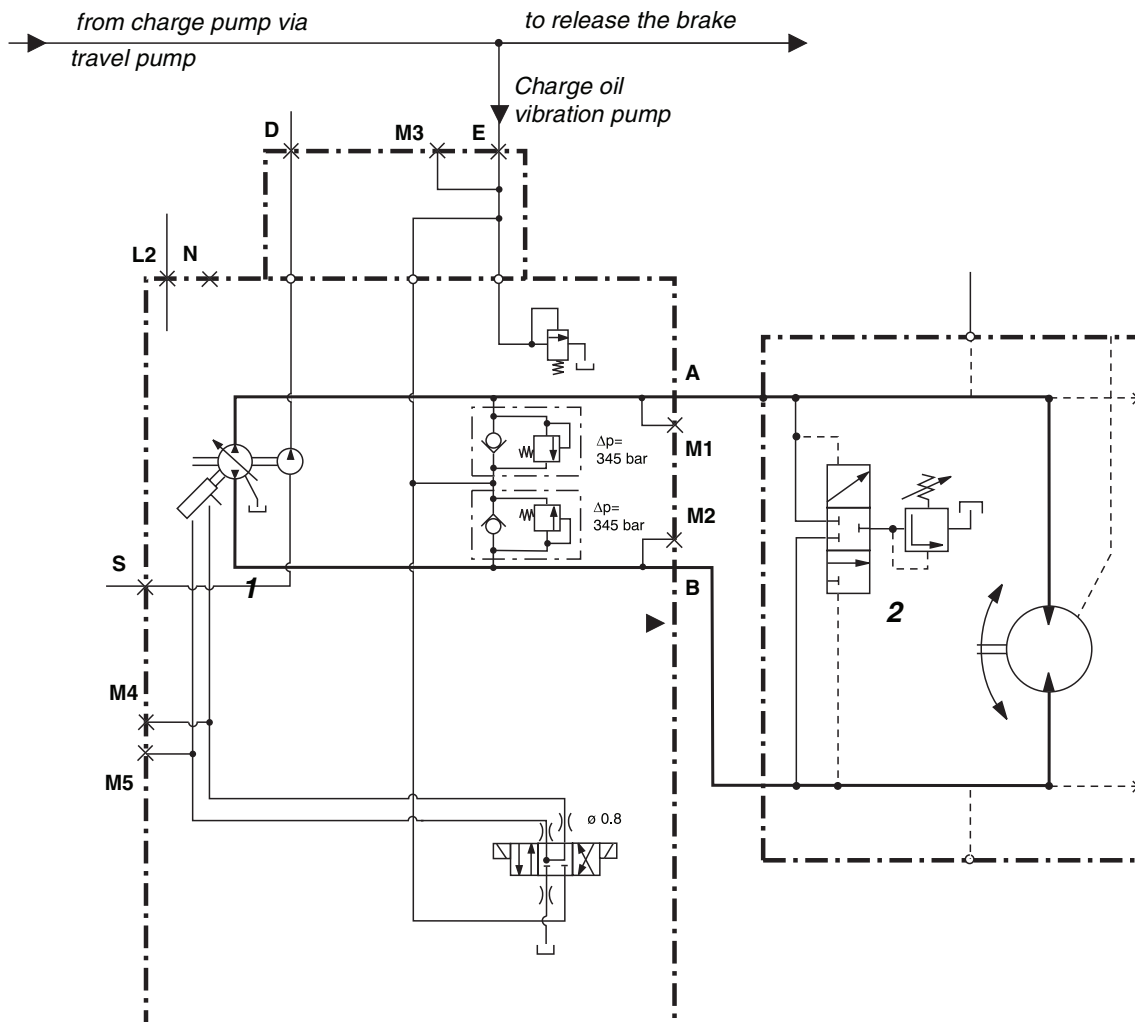


Fig. 1: Vibration circuit

- 1 *Vibration pump*
- 2 *Vibration motor*

Vibration pump and travel pump are joined together to a tandem pump unit. This tandem unit is directly driven by the diesel engine.

When operating a 4/3-way solenoid valve on the pump control the pump is actuated out of neutral position to one of the two possible displacement positions, pilot oil from the charge circuit is guided to one of the two control piston sides. The swash plate inside the pump will swash to the corresponding side and the pump will deliver oil to the vibration motor. The vibration motor starts and rotates the vibrator shaft inside the drum.

When altering the position of the swash plate through the neutral position to the opposite side, the oil flow will change its direction and the vibration motor will change its sense of rotation.

Since the end stops for the swash plate are set to different swashing angles to both directions, the angle for the piston stroke is also different to both sides. This angle influences the length of the piston stroke and thereby the actual displacement of the pump.

- Large angle = high displacement = high vibrator shaft speed (frequency)
- Small angle = low displacement = slow vibrator shaft speed (frequency)

The eccentric weights on the vibrator shaft are fitted with additional change-over weights. Depending on the sense of rotation of the vibrator shaft these change-over weights add to or subtract from the basic weights.

This results in the following constellations:

- Basic weight + change-over weight = high amplitude
- Basic weight - change-over weight = low amplitude

In order to achieve effective compaction results the vibration system is designed in such a way, that high amplitude is coupled with low frequency and low amplitude with high frequency.

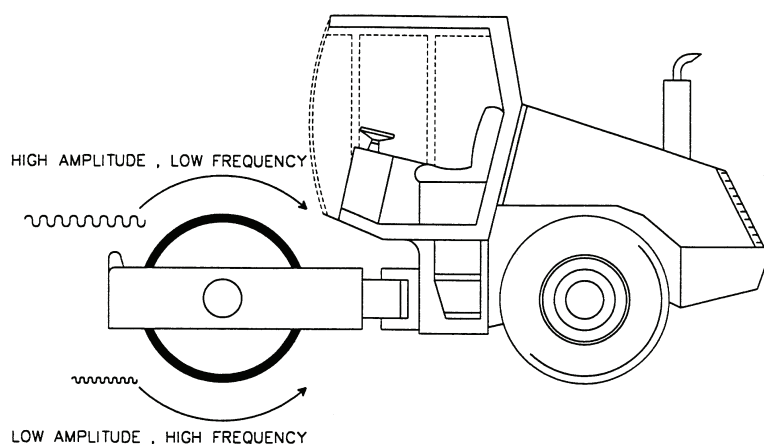


Fig. 2:

Vibration pump

Similar to the travel pump the vibration pump is also a swash plate operated Sauer-Sundstrand axial piston pump with variable displacement for operation in a closed circuit.

The displacement of the pump is proportional to the engine speed and the chosen displacement.

When actuating the swash plate out of neutral position the flow quantity to the chosen direction will increase from "0" to the maximum value. When altering the position of the swash plate through the neutral position to the opposite side, the oil flow will change its direction and the vibration motor will change its sense of rotation. All valves and safety elements for operation in a closed circuit are integrated in the pump.

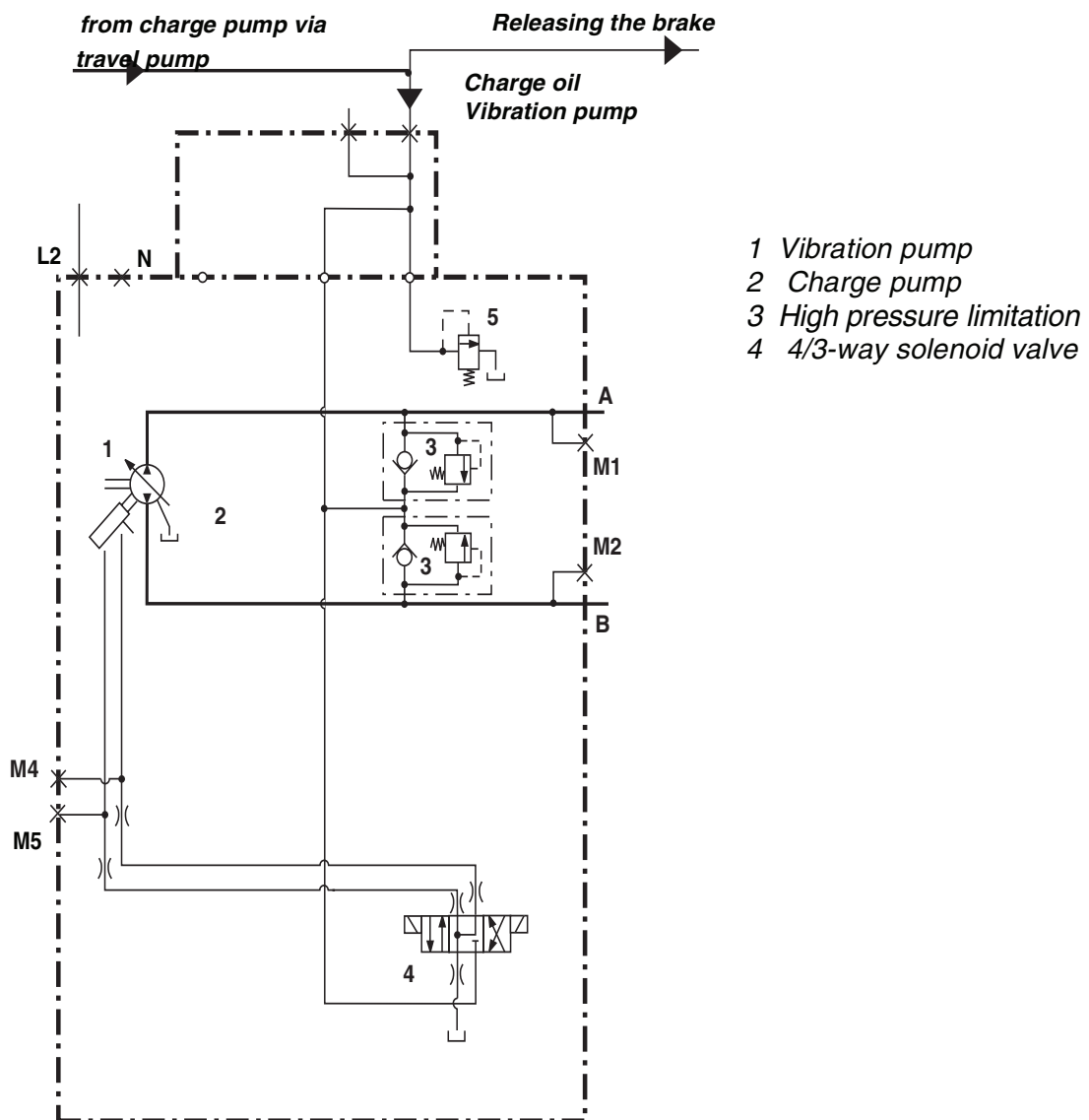


Fig. 3: Hydraulic diagram vibration pump

Function

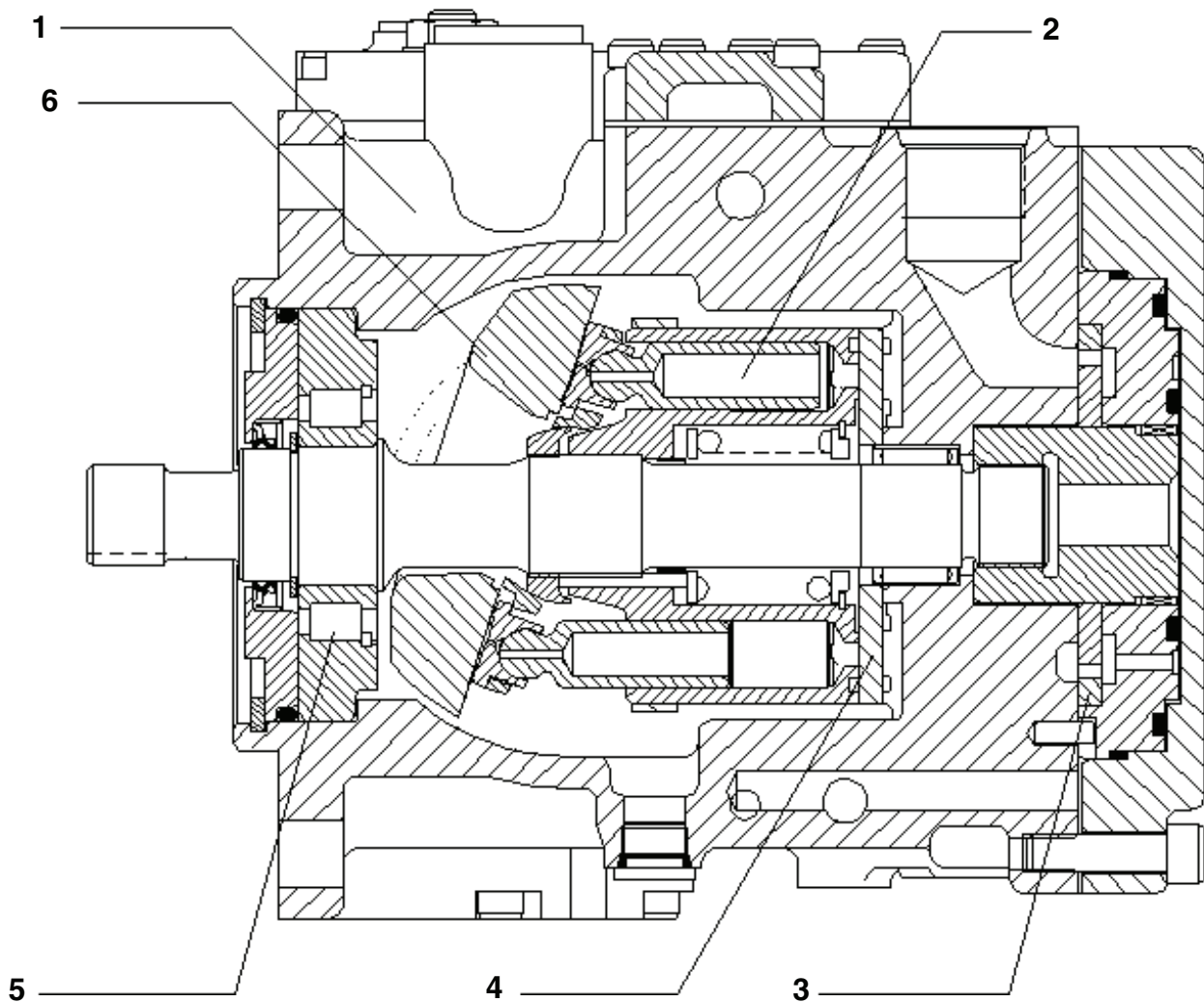


Fig. 4 Cross-section of vibration pump

- 1 *Servo piston*
- 2 *Working pistons*
- 3 *Charge pump*
- 4 *Valve plate*
- 5 *Roller bearing*
- 6 *Swash plate*

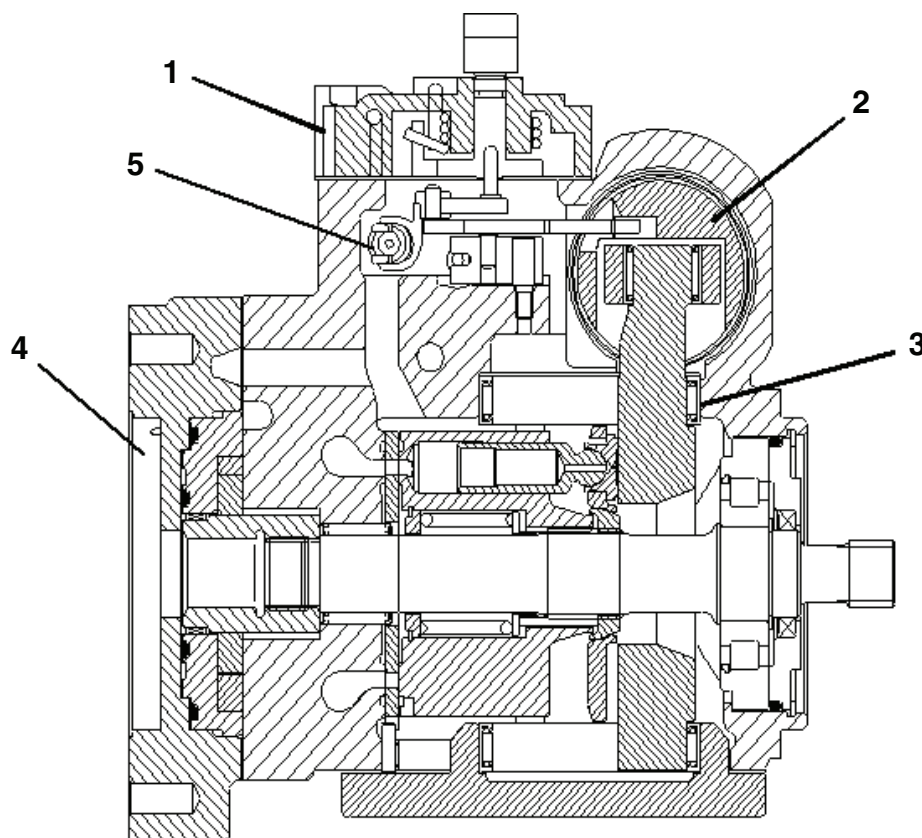


Fig. 5 Cross-section of vibration pump

- 1 Control
- 2 Servo piston
- 3 Friction free swash plate bearing
- 4 Attachment plate
- 5 Spool valve

The engine drives the drive shaft with the cylinder block. The cylinder block carries the working pistons.

The slipper pads rest against the sliding surface of the swash plate and are at the same time held on the sliding surface by a retaining device.

During each rotation the piston pass through their upper and lower dead centre back to their initial position. Between both dead centres each piston performs a full working stroke. During this stroke movement oil is drawn in from the low pressure side of the closed circuit and pressed out through the slots in the valve plate into the high pressure side. The oil quantity depends on the piston area and the length of the working stroke.

During the suction stroke the oil is drawn into the piston chamber, i.e. the charge pressure forces it into the piston chamber. On the opposite side the piston presses the oil out into the high pressure side of the closed circuit.

Control

The electro-hydraulic displacement control (remote control) converts the electric input signal to a load controlling output signal. Since the pump is not equipped with a proportional control, but a 12 Volt solenoid valve, the pump is always actuated to one of the two end stop positions.

High pressure relief valves

As a measure to protect the closed vibration circuit against to high pressures the vibration pump is fitted with pressure relief valves.

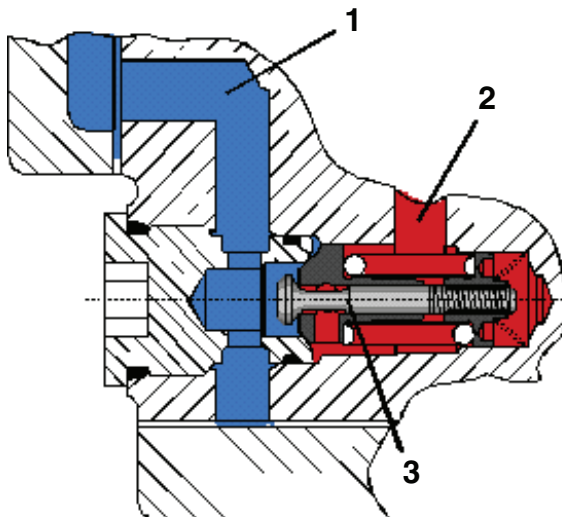


Fig. 6 Pressure relief valve

- 1 From the charge pump*
- 2 Closed circuit*
- 3 High pressure relief valve with integrated boost check valve*

Since the heavy mass of the vibrator shaft must be set into motion during the acceleration of the vibration, very high pressure peaks will occur in the high pressure side of the closed circuit during this phase. The high pressure relief valve reduces these pressure peaks to a value of max. 374 bar (pressure difference between high and low pressure side = 345 bar + charge pressure = 29 bar).

The screw-type cartridges of the high pressure relief valves contain also the boost check valves for the closed vibration circuit. The function of these valves has already been described in the chapter "travel system".

Charge pump

The charge pump for travel circuit and vibration works also as steering pump. The pump is an internal gear pump with fixed displacement.

The oil flow generated by the charge pump is joined together with the return flow from the steering valve before the hydraulic oil filter and flows through the filter to the charge ports on travel pump and vibration pump.

Vibration motor

The vibration motor is a swash plate type axial piston motor with fixed displacement of series A10FM 45 from Bosch-Rexroth (Hydromatik). Since the motor can be subjected to pressure from both sides, it is most suitable for the use in closed hydraulic circuits.

The output speed of the motor depends on the oil quantity supplied by the vibration pump.

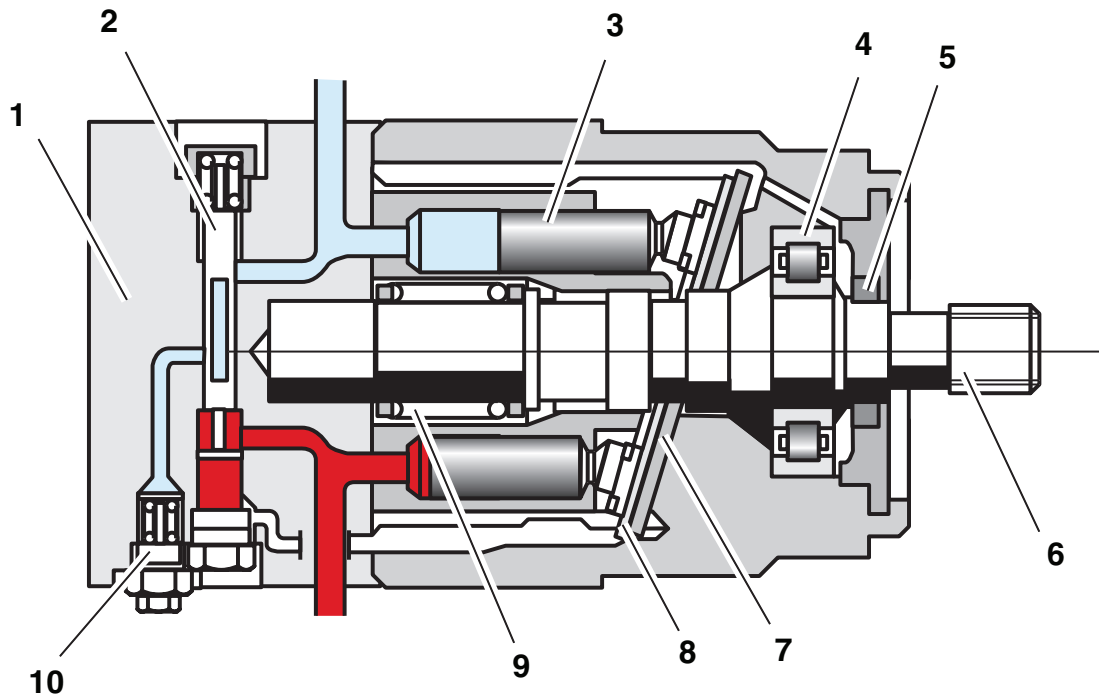


Fig. 7 Cross-section of vibration motor

- 1 Flushing valve block
- 2 Flushing valve
- 3 Working pistons with slipper pads
- 4 Roller bearing for output shaft
- 5 Radial seal
- 6 Output shaft
- 7 swash plate
- 8 Retaining plate
- 9 Pre-tensioning spring
- 10 Flushing pressure relief valve

The output torque raises with increasing pressure difference between low and high pressure side in the closed circuit.

Changing the flow direction of the oil will also change the sense of rotation of the vibration motor.

When switching the vibration on the motor must first start to move the resting vibration shaft. This resistance causes a hydraulic starting pressure, which is limited to 365 bar by the corresponding high pressure relief valve. Once the vibrator shaft has reached its final speed, the pressure will drop to a value between 100 and 150 bar (operating pressure). The value of the operating pressure mainly depends on the condition of the ground (degree of compaction, material etc.).

- Hard ground = High operating pressure
- Loose ground = Low operating pressure

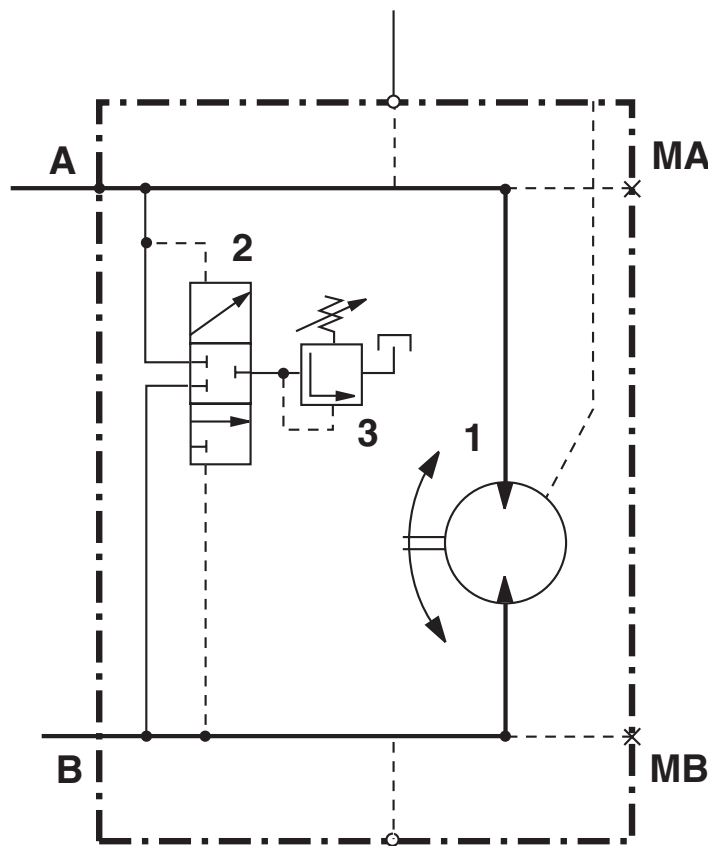


Fig. 8 Circuit diagram of vibration motor

- 1 *Vibration motor*
- 2 *Flushing valve*
- 3 *Flushing pressure relief valve*

The vibration motor is equipped with an integrated flushing valve. When switching the vibration on a pressure difference will appear between the two sides of the closed circuit. The higher pressure moves the valve spool of the flushing valve against the neutral setting spring, so that oil can flow out of the low pressure side.

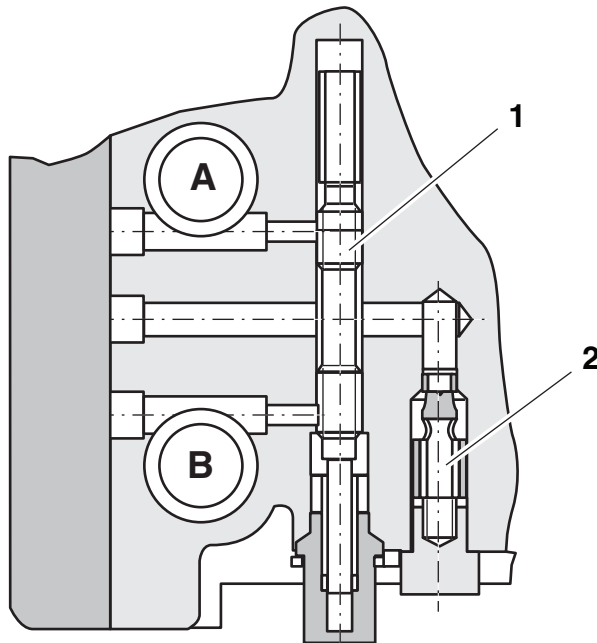


Fig. 9 Flushing valve

- 1 Flushing spool
- 2 Flushing pressure relief valve

The flushing valve is fitted with a downstream 13 bar pressure relief valve. This valve ensures that only a certain quantity of hydraulic oil is flushed out of the low pressure side.

This oil flows via a thermostat valve back to the hydraulic tank. The flushed out oil is immediately replaced with fresh and filtered oil through the corresponding boost check valve.

Drum

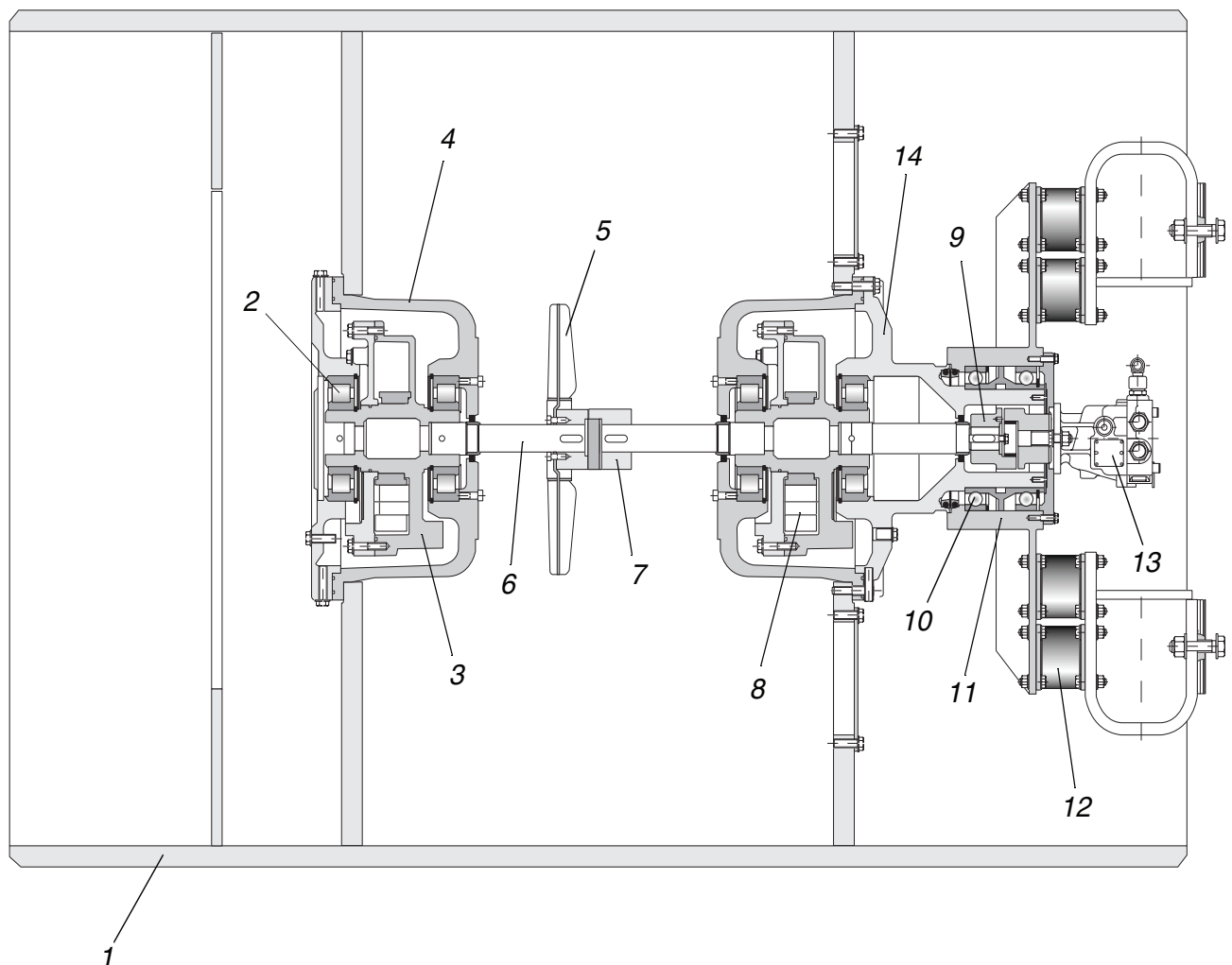


Fig. 10 Cross-section of drum

- | | | | |
|---|---------------------------------|----|---------------------------------------|
| 1 | Drum shell | 8 | Change-over weight |
| 2 | Vibration bearing | 9 | Coupling vibr.-motor – vibrator shaft |
| 3 | Basic weight | 10 | Travel bearing |
| 4 | Vibrator housing | 11 | Travel bearing housing |
| 5 | Cooling fan | 12 | Rubber buffer |
| 6 | Vibrator shaft | 13 | Vibration motor |
| 7 | Elastic coupling between shafts | 14 | Flanged bearing housing |

Trouble shooting vibration circuit

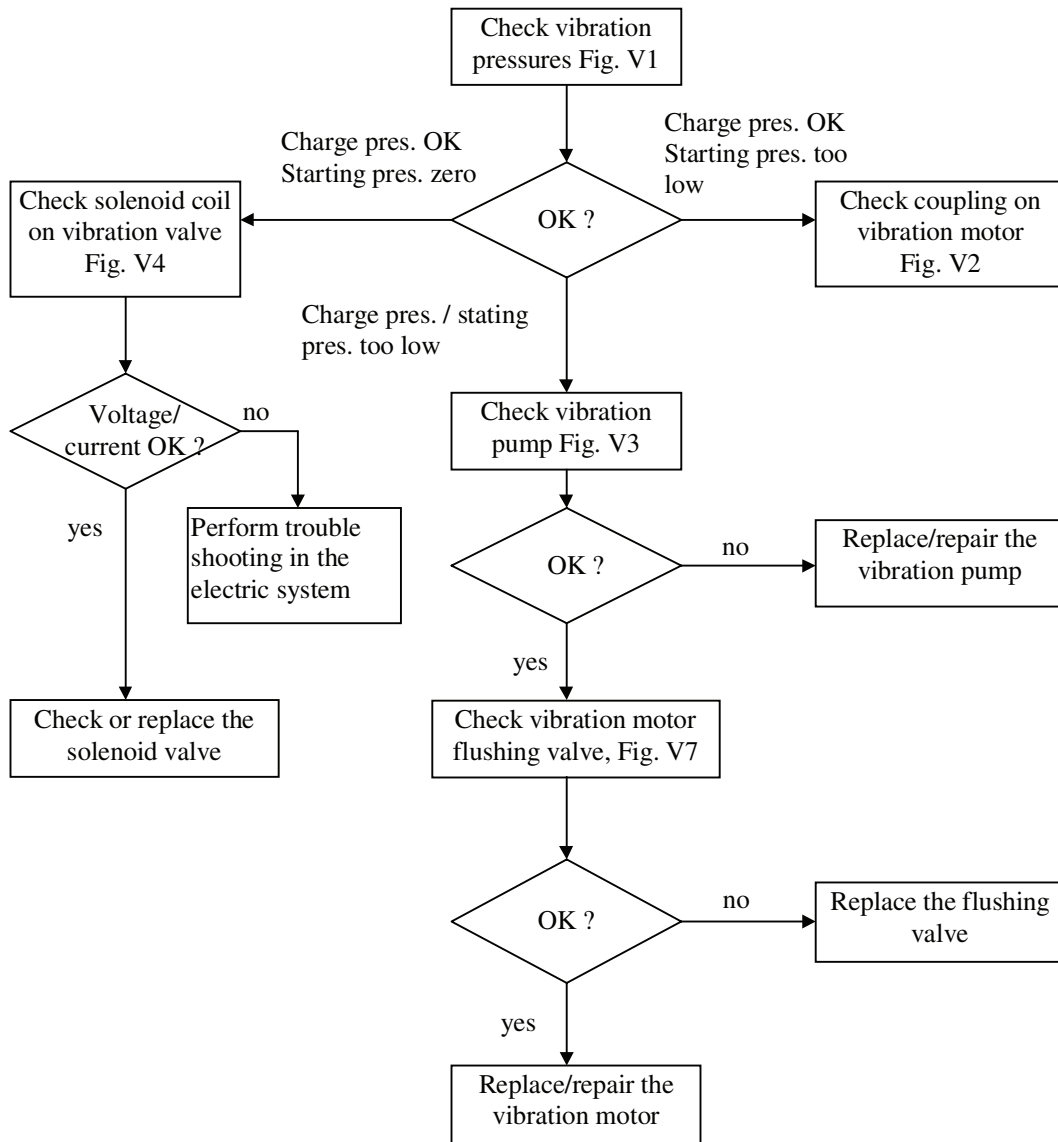
The following description of trouble shooting steps contains a small selection of possible faults, which may occur during operation of the machine. This list is by no means complete, however, the description should help you to become acquainted with a systematic trouble shooting procedure.

The problems and trouble shooting steps described in this training manual are identical with the problems and trouble shooting steps in the operating and maintenance instructions for this machine.

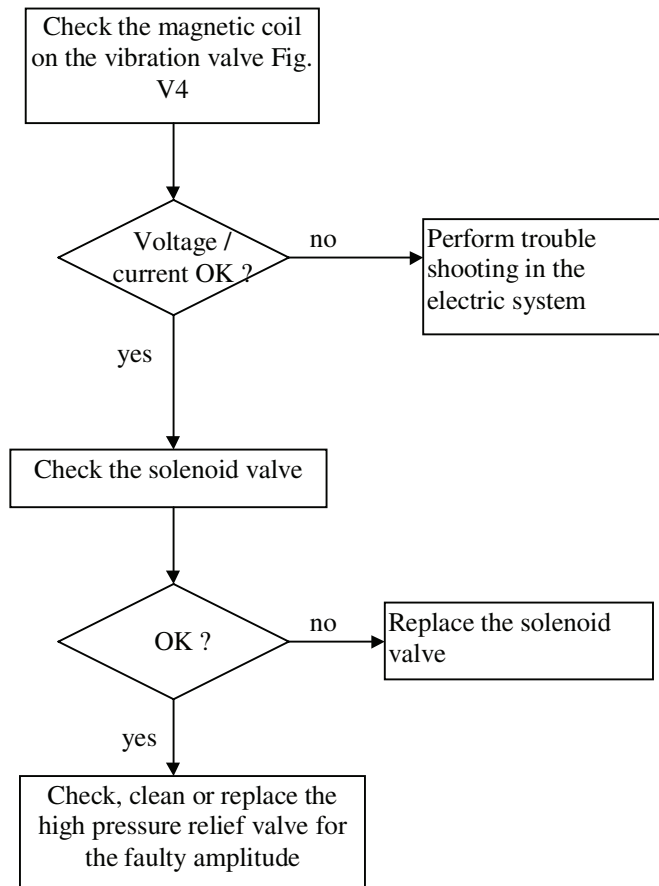
However, in this manual we have tried to describe the individual steps in more detail, in order to explain why certain trouble shooting steps should be applied and why certain preparations must be made before certain tests or measurements can be performed.

After this training session the persons attending the course should be able to apply the correct trouble shooting steps, even if the actual problem is not described in this manual.

No vibration (travel system o.k.)



Vibration works only with high or low amplitude



Too low vibration frequency (travel system o.k.)

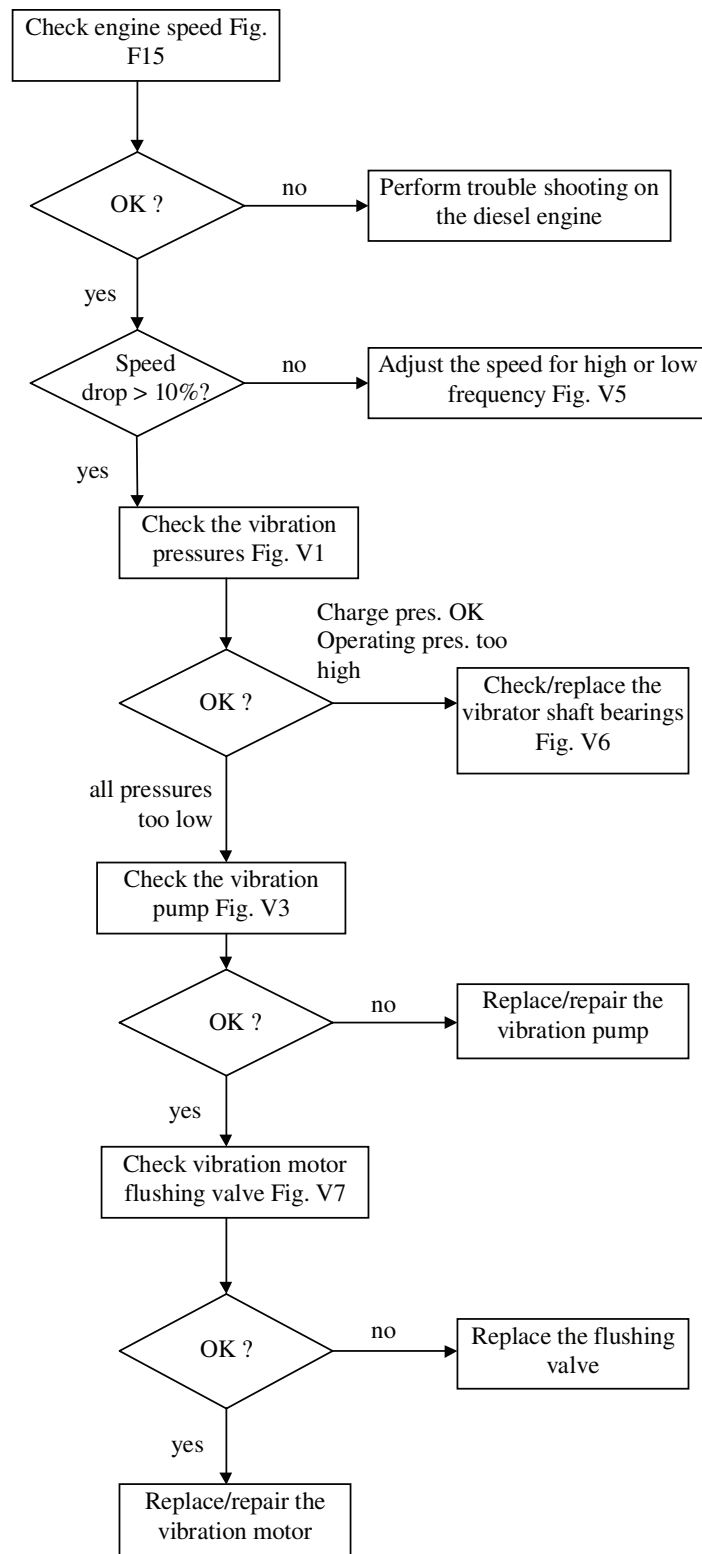


Fig. V1

Checking the vibration pressures

A too low charge pressure is an early indicator for a fault (leakage) in the closed vibration circuit (if travel system is OK). The pump cannot be operated correctly.

A too low starting pressure is an indicator for extreme leaks in the closed circuit or a defective vibration motor coupling.

A too high operating pressure is an indicator for damaged vibration bearings or overfilling of the vibration bearing housing.

- Connect 600 bar pressure gauges to the high pressure test ports
- Connect a 60 bar pressure gauge to the charge pressure test port
- Drive the drum on old rubber tires
- Start the engine and run it with max. speed
- Switch the vibration on and read the pressure gauges

Nominal values: charge pressure 25 +/- 1 bar
starting pressure 350 +/- 50 bar
Operating pressure

low amplitude approx. 90 +/- 15 bar
high amplitude approx. 110 +/- 15 bar

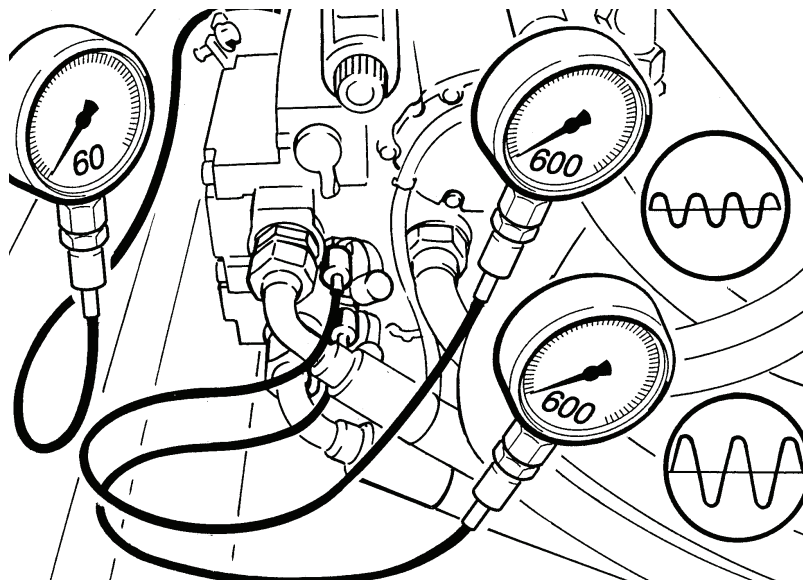


Fig. V2:

Checking the coupling on the vibration motor

- Disassemble the vibration motor
- Check the coupling parts between motor and shaft
- Replace defective parts

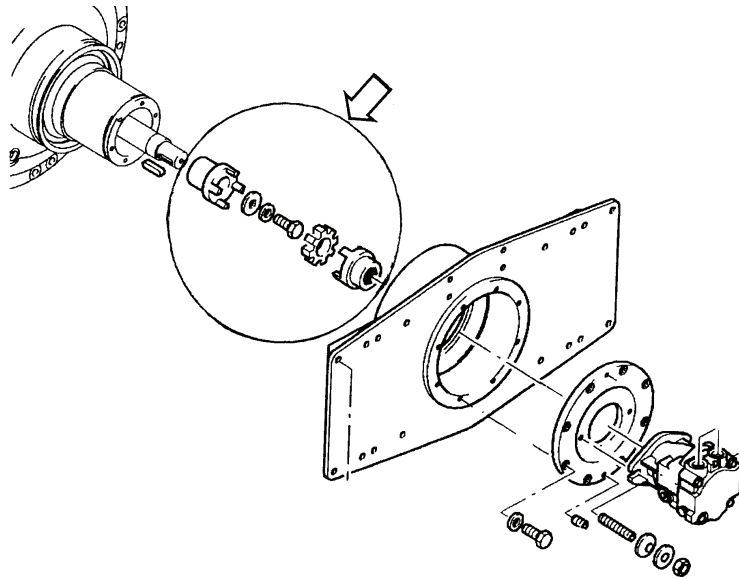


Fig. V3:

Checking the vibration pump

- Close the high pressure ports on the vibration pump with plugs
- Check the vibration pressures, see Fig. V2

If the pressure values are now reached whereas they were not reached while the vibration motor was connected, the vibration motor must be faulty. If the high pressure values are not reached, the fault must be in the pump.

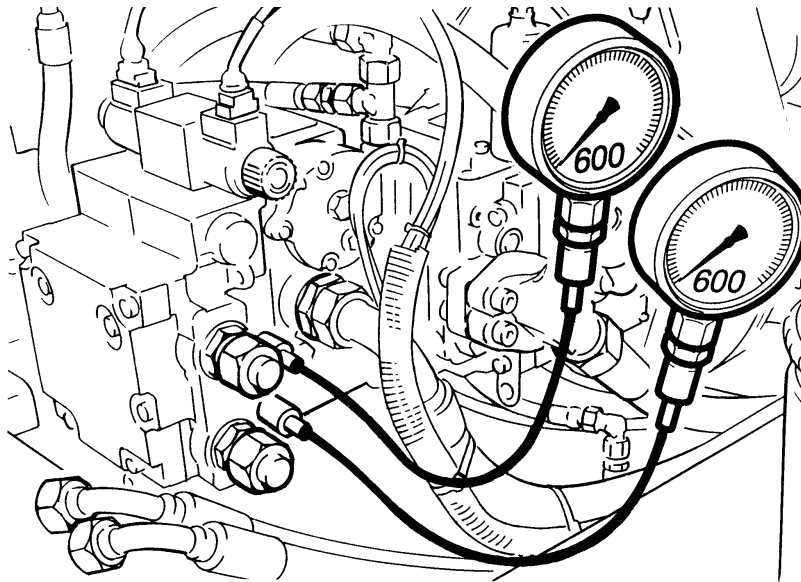


Fig. V4:

Checking the magnetic coil of the vibration valve

- Switch the ignition on
- Switch the vibration on with high or low frequency
- Measure the voltage applied to the magnetic coil and the current draw with an appropriate meter

Nominal values: 12V / 2,5 A

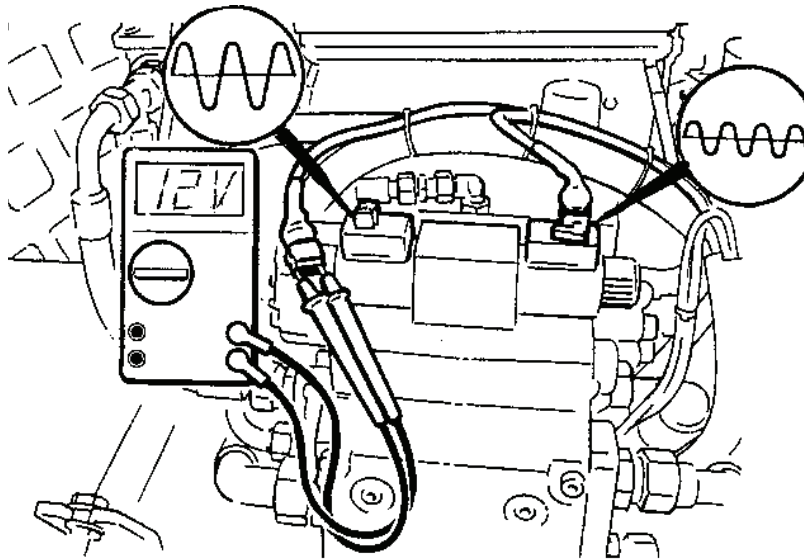


Fig. V5:

Adjusting high and low frequency

If the engine speed is correct and the drop in vibrator shaft speed is less than 10%, the corresponding frequency can be adjusted on the vibration pump.

- Slacken the counter nut on the respective adjustment screw
- Turn the adjustment screw, until the required vibrator shaft speed is reached (the adjustment screw for high amplitude protrudes further than the adjustment screw for low amplitude).
- Retighten the counter nut.

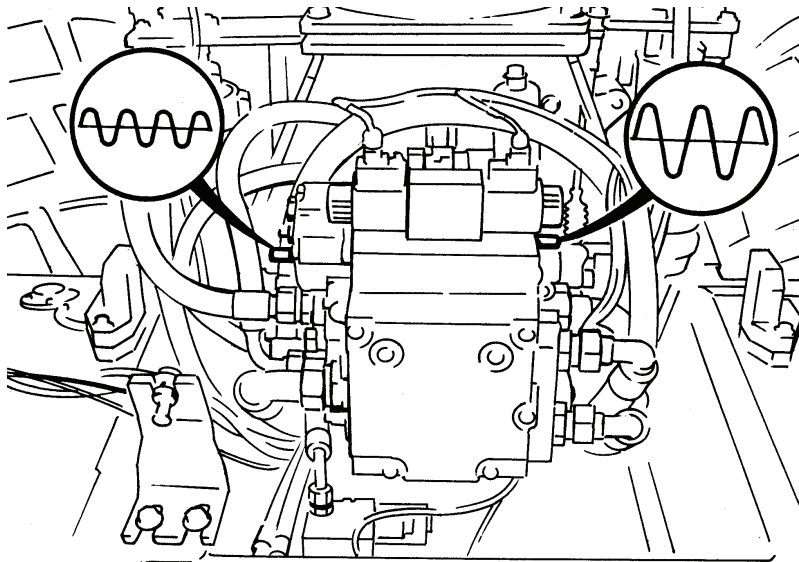


Fig. V6:

Checking the vibrator shaft bearings

- Disassemble the vibration motor
- Check the moveability of the vibration bearings
- Replace defective parts

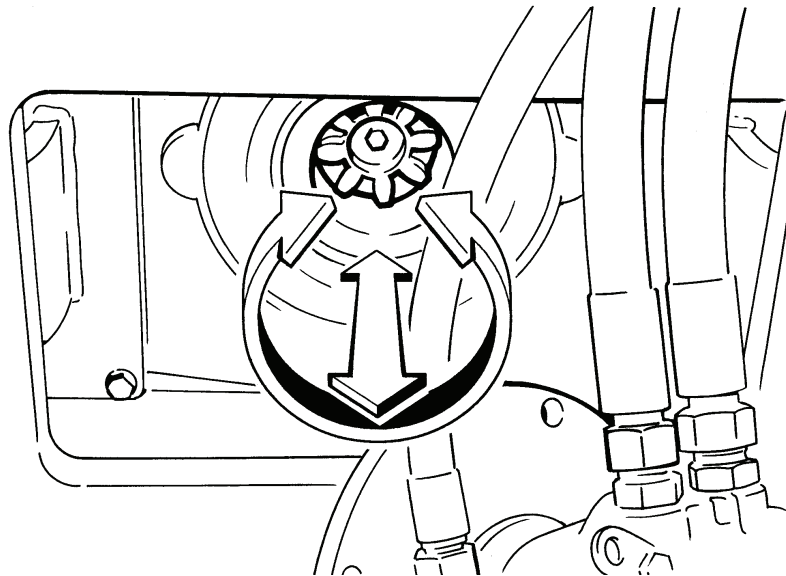
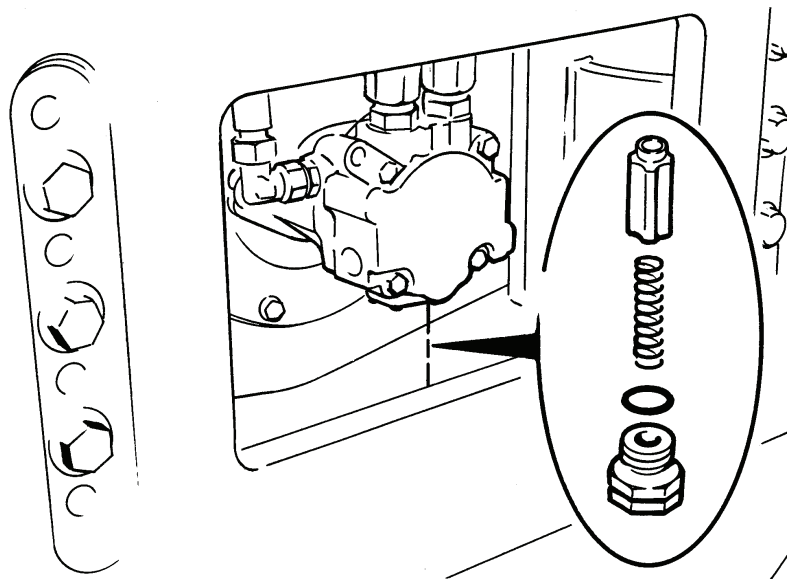


Fig. V7:

Checking the flushing valve on the vibration motor

- Unscrew the flushing valve from the vibration motor
- Check the flushing spool for damage and moveability
- Replace a defective flushing valve



Steering

The single drum rollers BW 213 D-3 / DH/PDH-3 and BW 214 DH/PDH-3 are equipped with a hydraulically operated oscillating articulated steering.

The steering system consists mainly of:

- the steering/charge pump,
- the steering valve,
- the steering cylinders and
- the pressure resistant connecting hoses.

The steering pump delivers the hydraulic oil from the hydraulic oil tank to the steering valve and the connected steering unit. If the steering is not operated, the complete oil flow will flow through a fine filter to the charge ports for the travel and vibration circuits.

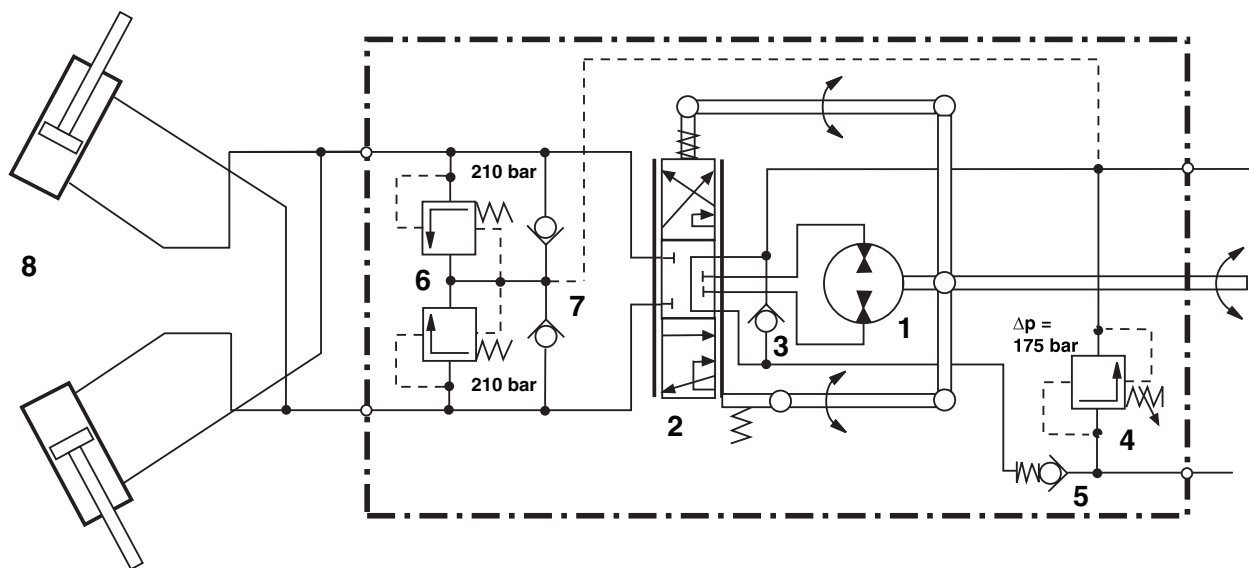


Fig. 1: Hydraulic diagram of steering system

- | | | | |
|---|----------------------------|---|------------------------|
| 1 | Rating pump | 5 | Check valve |
| 2 | Distributor valve | 6 | Shock valves |
| 3 | Anti-cavitation valve | 7 | Anti-cavitation valves |
| 4 | High pressure relief valve | 8 | Steering cylinder |

When turning the steering wheel the distributor valve guides the oil flow to the corresponding steering cylinder sides.

A rating pump inside the steering unit measures the exact oil quantity corresponding with the turning angle of the steering wheel and delivers the oil to the steering cylinders.

The steering cylinders extend or retract and articulate the machine.

The steering valve contains also a pressure relief valve. This valve limits the steering pressure to 175 bar. Since the oil is available for the charge circuit after it as left the steering unit, the charge pressure of 25 bar must be added to this value. The maximum steering pressure is therefore approx. 200 bar.

Steering/charge pump

The steering/charge pump is a gear pump with constant displacement.

It is driven by the auxiliary drive of the diesel engine and draws the hydraulic oil directly out of the oil tank. The oil flows then through the steering valve and the fine filter to the charge ports in the travel and vibration circuits, or, when turning the steering wheel, to the steering cylinders.

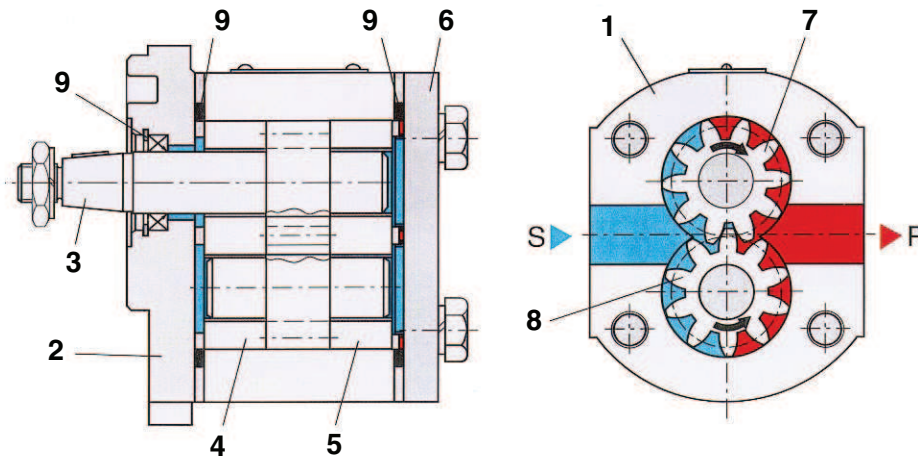


Fig. 2: Steering pump

1	Housing	4, 5	Bearing plates	9	Seals
2	Flange	6	Cover		
3	Shaft	7, 8	Pinions		

Function of the gear pump

The drive gear of the steering pump is connected with the auxiliary drive of the diesel engine via a coupling. Drive gear and driven gear are positioned by a bearing plate in such a way, that the teeth of both gears mesh with minimum clearance when rotating.

The displacement chambers are formed between the tooth flanks, the inside wall of the housing and the faces of the bearing plates. The chambers transport the hydraulic oil from the suction side to the pressure side. This generates a vacuum in the suction line, which draws the hydraulic oil out of the tank. These tooth chambers transport the hydraulic oil along the inside wall of the housing from the suction side to the pressure side, from where it is pressed to the consumers. To ensure a safe function of the pump the tooth chambers must be so tightly sealed that the hydraulic fluid can be transported from the suction side to the pressure side without any losses.

Outer gear pumps are provided with gap seals. This results in pressure level dependent fluid losses from the pressure side to the suction side. An axial pressure field presses the bearing plate on the cover side against the front face of the gears, making sure that only a very little quantity of oil will leak from the pressure side to the suction side when the pressure increases during operation.

The pressure field is always under system pressure.

Steering valve

The steering valve consists mainly of:

- the distributor valve,
- the rating pump,
- the steering pressure relief valve and
- the shock valves.

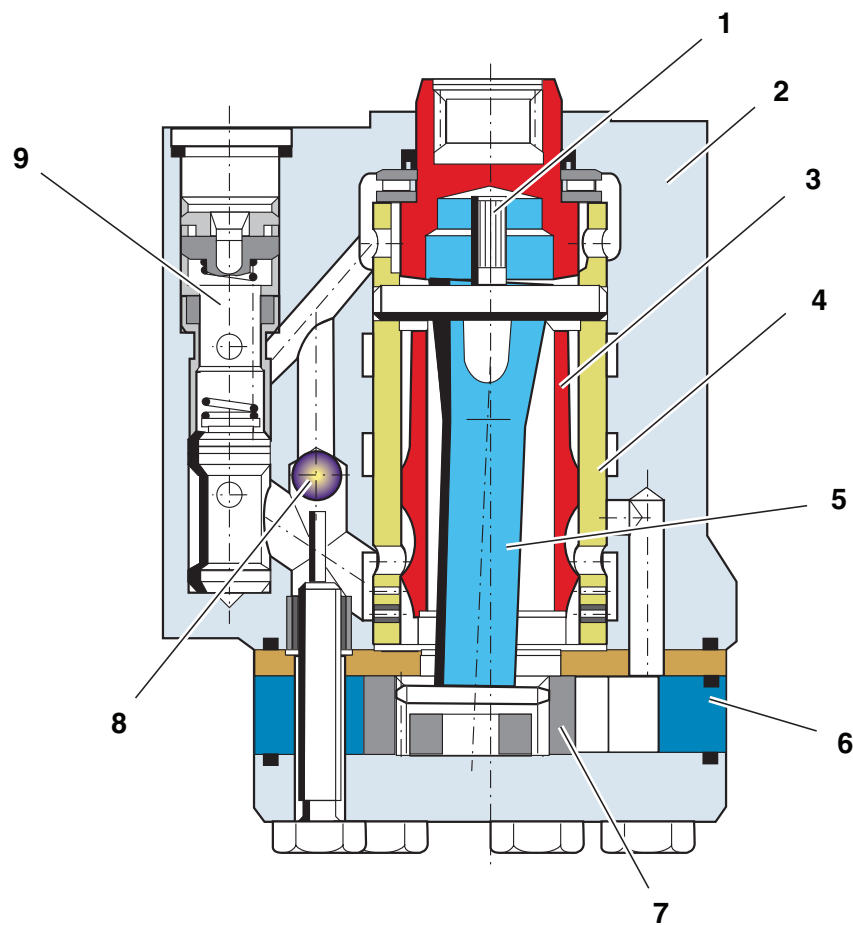


Fig. 3: Steering unit

1	Neutral setting springs	6	Ring gear
2	Housing	7	Gear
3	Inner spool	8	Check valve
4	Outer spool	9	Pressure relief valve
5	Universal shaft		

When turning the steering wheel the oil flow from the pump is guided through the distributor valve to the rating pump and from there to the respective sides of the steering cylinders.

The rating pump determines the exact oil quantity in dependence on the turning angle of the steering wheel.

The high pressure relief valve in the steering unit limits the pressure in the steering system to 175 bar + charge pressure.

The steering unit is equipped with so-called shock valves for both pressure sides to the steering cylinder. These valves are adjusted to 200 bar. They compensate extreme pressure peaks, which can be introduced from outside, e.g. when driving over obstacles. The system is thereby protected against overloads.

Each of these shock valves is fitted with an additional anti-cavitation valve. These anti-cavitation valves protect the system against cavitation which could be caused by the reaction of the shock valves.

A check valve inside the steering unit makes sure that the hydraulic oil cannot flow to the steering pump if forces are introduced from outside. In such a case the steering cylinders would act as pumps and press the oil back to the pump.

Articulated joint

The articulated joint is the connecting link between the front frame with the drum and the rear frame with operator's stand, diesel engine and drive wheels.

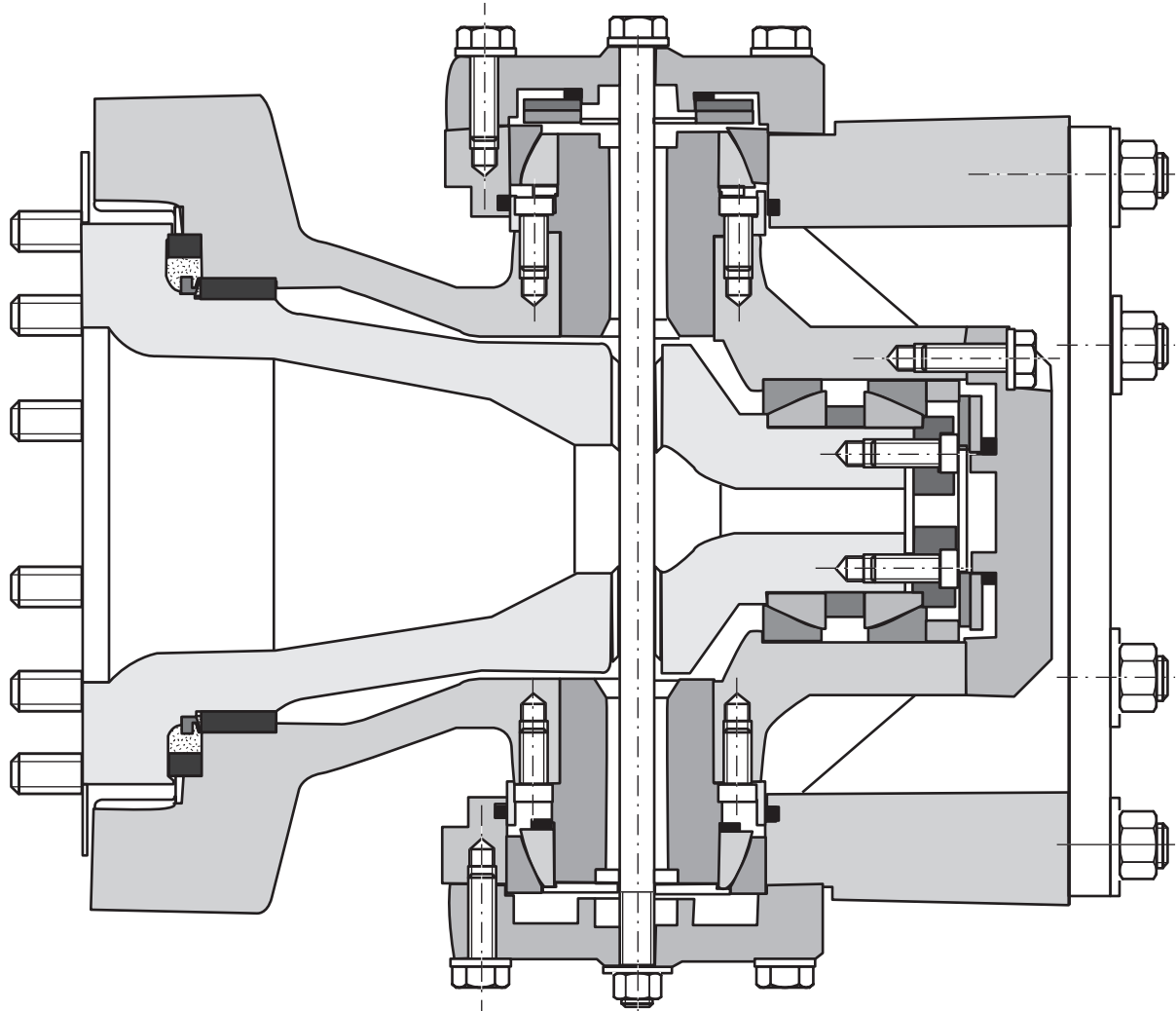


Fig. 4 Articulated joint

The rear console is tightly bolted to the rear frame.

The front console is fastened with screws to the rear cross-member of the front frame. Due to the use of rocker bearings between front and rear console, both frames can oscillate to each other for $\pm 12^\circ$. This ensures that the machine is always in ground contact, even under extremely difficult soil conditions.

The front console is connected with the rear console by two vertical bolts. These bolts are mounted in rocker bearings.

The front console is additionally fitted with the welded on bearings eyelets for the steering cylinders.

When turning the steering wheel the steering will extend or retract. The piston rods swivel the front console around the vertical bolts. The machine articulates and steers.

All bearing points on the articulated joint are maintenance free, lubrication is not required.

Steering circuit, position of components

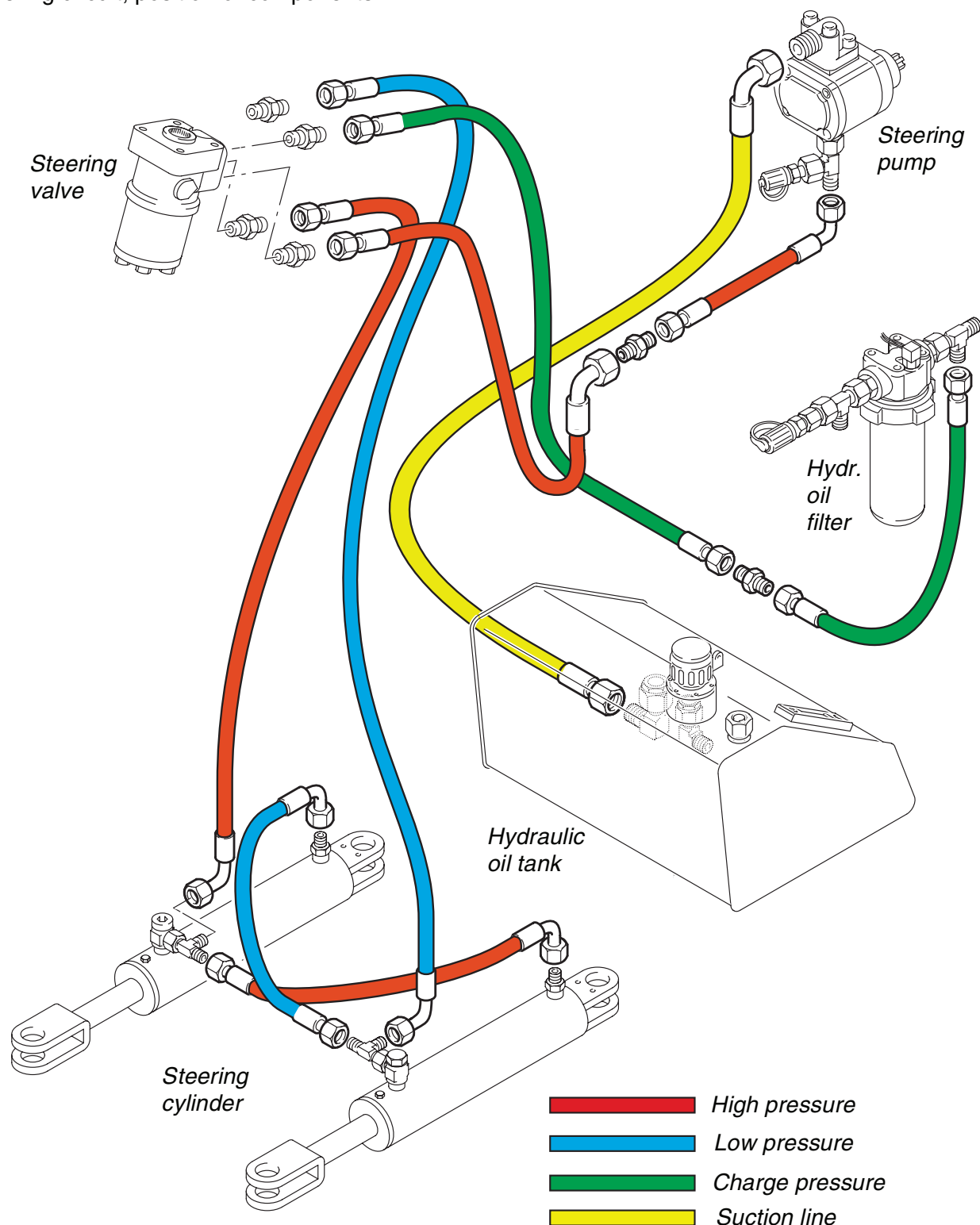


Fig. 5: Steering circuit, position of components

Electrics, single drum rollers of generation 3

The new single drum rollers of generation 3 are fitted with two easy to change logic modules.

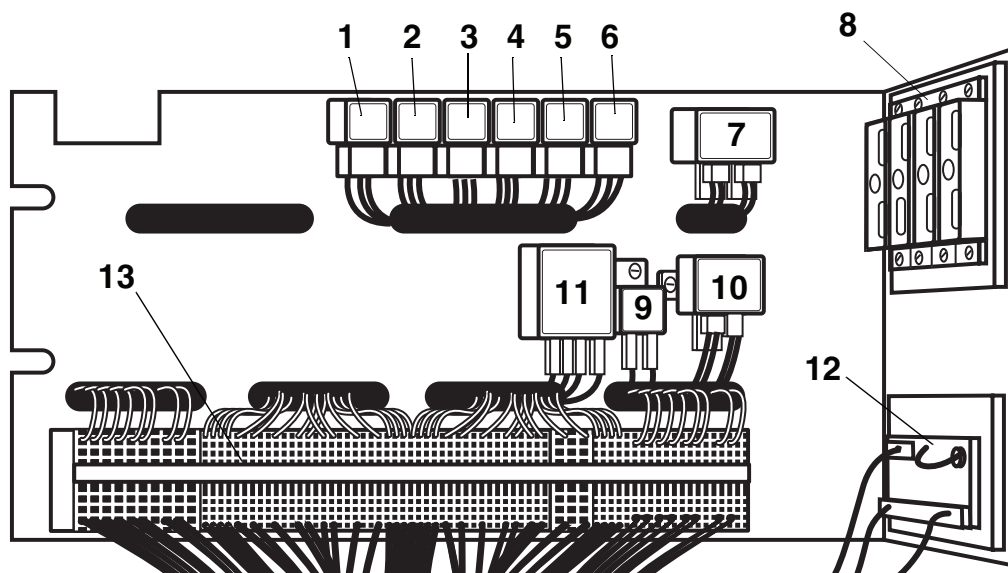


Fig. 1: Electric junction box

- | | | |
|--------------------------------|---------------------------------|-------------------------|
| 1 Relay K06 (rear head lights) | 6 Relay K05 (start current) | 11 Generator module A23 |
| 2 Relay K26n (backup alarm) | 7 Relay K11 (terminal 30 -> 15) | 12 Diode module |
| 3 Relay K22 (engine solenoid) | 8 Fuse box | 13 Terminal strip X1: |
| 4 Relay K48 (travel lever "0") | 9 Relay K04 (vibration) | |
| 5 Relay K36 (brake control) | 10 Relay K32 (cabin) | |

The electric junction box contains the following module:

- Generator module (A23),

Simple trouble shooting by easy bridging of input and output potentials.

The generator module is able to convert the different signals of various generator manufacturers to a D+ signal. This allows to use different engines from various manufacturers without having to change the electric system.

- Diode module

In the speed range selection logic the diode module is used to change to different speed ranges.

The optionally available Anti Spin Control (ASC) provides optimal traction for drum and wheels. This enables safe driving on difficult soil and increases the gradability of the machine.

Power supply (Fig. 2)

Battery

When the engine is stopped the power supply for the vehicle electrics is assured by two parallel connected rechargeable and maintenance free 12 Volt batteries.

The minus pole of the battery (G01:05,11) is connected with vehicle ground (potential 31).

The plus pole of the battery (G01:02,08) is connected with potential 30 via the main fuse (F00:02).

There is a direct connection between battery (+),

- terminal B+ on generator (G02:15),
- starter (M01:05) (Fig. 3) terminal 30.

The minus pole (-) of the battery is connected with potential 31.

Note:

Potentials 30, 31 and B+ are always directly connected with the battery. The current can only be interrupted by fully discharging or disconnecting the battery.

Generator

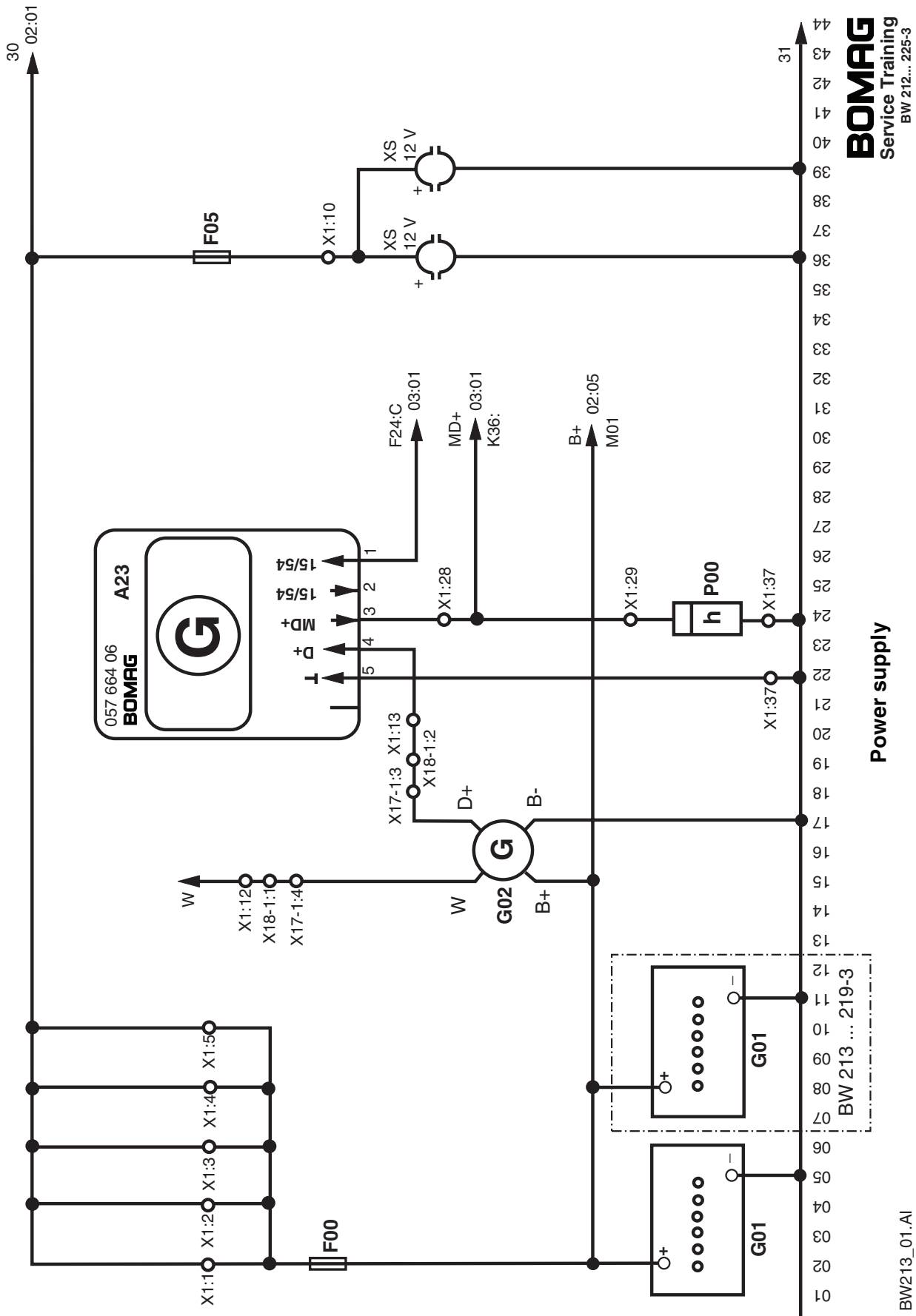
When the engine is running a 14 V generator (G02:16) supplies the vehicle electrics via terminals B+ (to potential 30) and B- (to potential 31) with current.

Terminal D+ supplies the generator module (A23:23) with a (+) or (-) signal. When the engine is not running terminal D+ is negative (ground potential). The charge control light in the monitoring board (A15) (Fig. 3) lights up. Refer also to the chapter "Monitoring board".

Sockets

The machines are equipped with two sockets (XS:36/XS:39). These are connected to potential 30 and secured by fuse (F05).

Fig. 2:



Ignition and starter circuit (Fig. 3)

Ignition switch (S00) in position "0" (ignition off)

The ignition switch (S00:04) is permanently supplied with current from the battery (G01) (Fig. 2) via main fuse (F00) (potential 30) and fuse (F13:05).

In this position the connection to the coil of relay (K11:28) is interrupted and the relay drops off. The solenoid valve (Y58:32) for interrupting the fuel supply or the shut-down solenoid (Y13:37) (depending on type of engine) is no longer supplied with current and the engine will stop.

Ignition switch (S00) in position "1" (ignition on) with the engine at rest

In this position the coil of relay (K11:26) is supplied with current.

Relay (K11) switches potential 30 to potential K11 (15/54). Fault monitoring unit (A15) (Fig. 3) supplies the coil of relay (K22:40) with current, the relay switches. Current flows

- from potential K11,
- via fuse (F14:37),
- the closed emergency stop switch (S01:37),
- the closed contacts of relay (K22:37)
- to the solenoid valve (Y58:32) for interrupting the fuel supply or the engine shut-down solenoid (Y13:37).

The engine is now ready for starting.

Ignition switch (S00) in position "3" (starting)

Note:

Position "2" is not used.

In this switching condition current flows from terminal 50a on ignition switch (S00:06) to the contact of relay (K05:07).

When the travel lever is in "0" - and brake position the contact of proximity switch (B13:15) opens, the coil of relay (K48:15) is no longer excited and the contact switches over.

Current flows

- from potential K11,
- via relay (K48:17),
- to the coil of relay (K05:09).

The contact closes and current can now flow to the starter (M01:05) terminal 50. The magnetic switch of the starter is excited and the starter cranks the diesel engine.

Note:

The starter (M01) is supplied with current directly from potentials B+ and 31.

When releasing the ignition switch it will automatically return to position "1".

During the starting process a 50a signal is transferred to the monitoring board (A15) (Fig. 4).

During the starting process this signal avoids sounding of the warning buzzer and activation of the automatic engine shut-down (see description of the fault monitoring unit).

To repeat the starting process the ignition must first be switched off and on again (start repetition interlock).

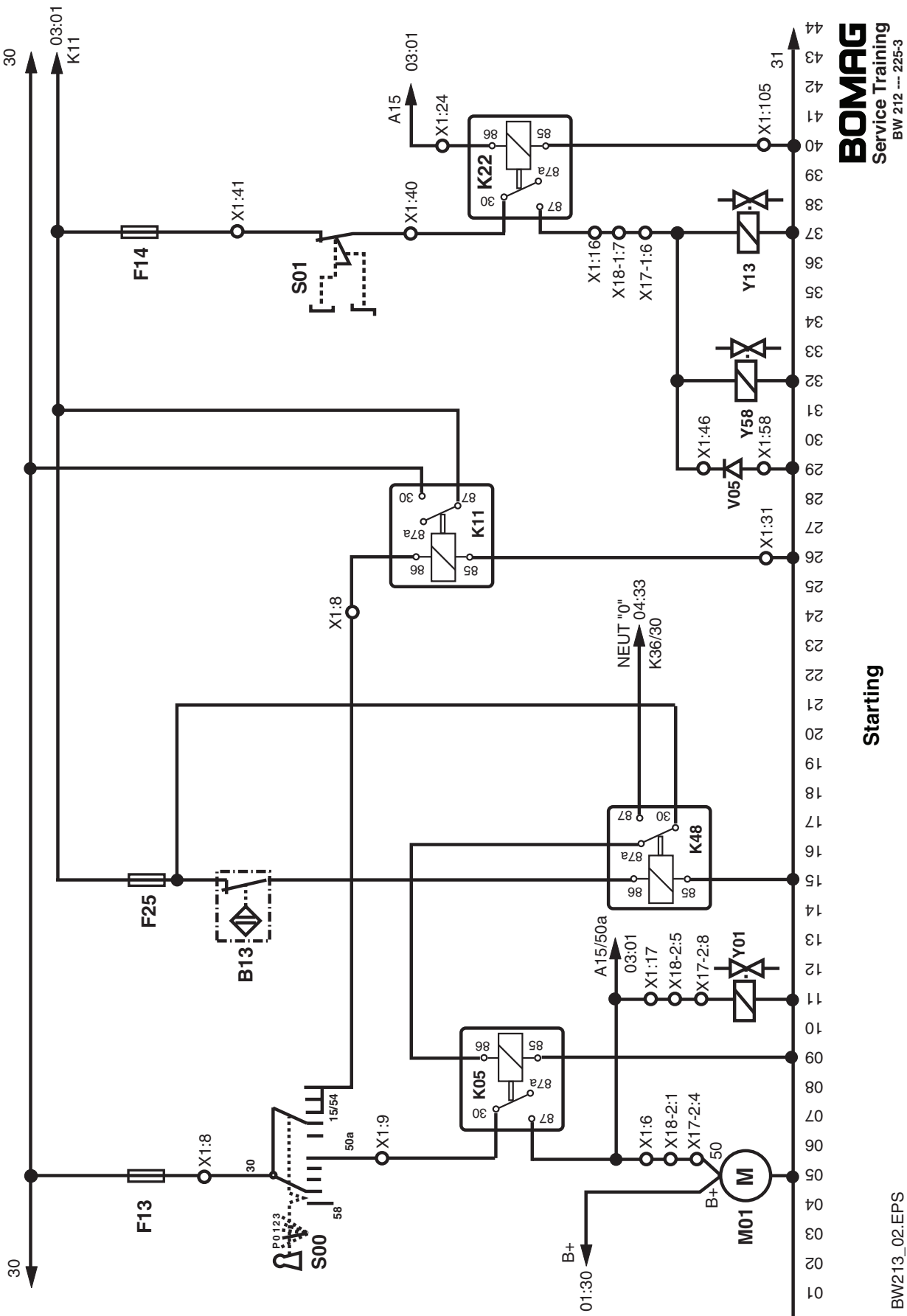
Ignition switch (S00) in position "1" (ignition on) with the engine running

When the engine is running the generator (G02) (Fig. 2) produces electric current. This current flows from terminal D+ to the generator module (A23). The output signal MD+ delivers the voltage for the operating hour meter (P00).

The MD+ signal is additionally fed into the monitoring board (A15) (Fig. 4) and into the brake control relay (K36) (Fig. 6).

The internal logic of the fault monitoring unit switches the charge control light off.

In case of a fault the automatic shut-down system in the monitoring board (A15) is activated and the warning buzzer will sound.



Monitoring board (Fig. 4)

Ignition on, engine not running

When switching the ignition on the program is reset to a defined initial condition.

As a self-test function all warning and control lights light up for a moment.

If a fault is detected already at this point, the corresponding control light will stay on.

Warning buzzer (H07:22) and shut-down relay (K22:40) (Fig. 3) remain deactivated, because the pressure has not yet built up. If the time span between "Ignition On" and "Start" is too long, starting is not possible.

Engine running

The monitoring board is active, warning buzzer and shut-down relay are at stand-by.

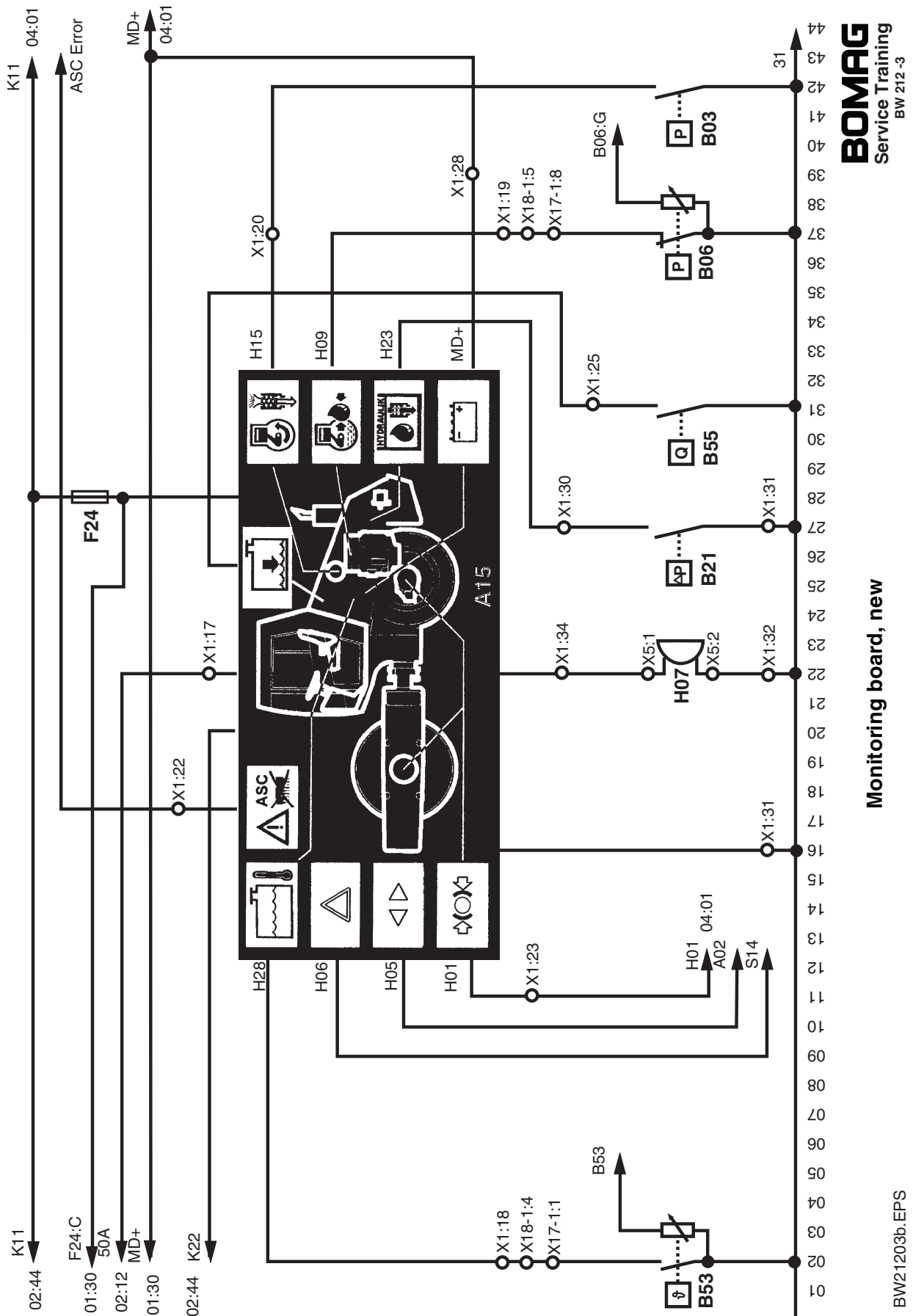
Within a predetermined period of time all sending signals for the corresponding potential must change to "OK". If this is not true, the following control lights will light:

- the signal fields,
- the warning buzzer is activated
- and the shut-off relay is switched after a predetermined time.

Engine stalled, ignition on

The monitoring board remains activated, warning buzzer and shut-down relay will be activated after a predetermined period of time.

In order to achieve a clearly defined initial condition, the ignition must first be switched off for a moment.



Engine shut down by shut-down relay

The fault, that has led to the shut down of the engine, is saved and displayed.

The warning buzzer remains active. Other indicators, that were triggered by the shut down of the engine, are no longer displayed. The operator can rectify the fault.

After this the ignition switch must be switched off to deactivate the shut-down relay, in order to enable a new starting attempt.

Function group	Colour of indication	Shut down time
Hydraulic oil filter (B21)	red	2 minutes
Coolant temperature (B53)	red	2 minutes
Engine oil pressure (B06)	red	10 seconds
Coolant level (B55)	red	10 seconds
Brake applied (H01)	red	-
Charge control (MD+)	yellow	-
Air filter (B03)	yellow	-
Hazard light (H06)	red	-
Indicator on (H05)	green	-
Anti Spin Control ASC	yellow	-

Brakes (Fig. 6)

With the engine at standstill no hydraulic pressure is available, the brake discs cannot be relieved, the brake is automatically closed.

Travel lever in “brake”-position with the engine running

When the engine is running and the generator is fully functional, the generator (G02:15) (Fig. 2) delivers a D+ signal or the generator module (A23:24) (Fig. 2) a MD+ signal to the brake relay (K36:33).

If the travel lever is in “brake”-position, the coil of relay (K48:05) is not supplied with current.

Current flows

- from potential K11,
- via fuse (F25)
- and the contacts of relay (K48:07)
- to the coil of relay (K05:09) (Fig. 3).

Starting is now possible.

Current flows also

- from potential K11,
- via fuse (F25)
- and the contacts of relay (K48:05)
- to the monitoring board (A15:17) (Fig. 4).

The control light “Brake applied” (H01) lights up.

Travel lever operated

When operating the travel lever

- proximity switch (B13:05) will close,
- relay (K48) switches over
- and the current flow to relay (K05:09) (starting) (Fig. 3) is interrupted.

The engine cannot be started.

If the engine is running and the generator is fully functional

- the coil of relay (K36:34) is supplied with current,
- the contact closes.

Current flows

- from potential K11,
- via the contacts of relay (K48:07),
- and the contacts of relay (K36:33)
- to solenoid valve (Y04:34), when the emergency stop switch (S01:34) is closed.

The brake opens.

If the V-belt has snapped, the generator is defective or if the engine has stalled when driving up a gradient and no MD+ signal is present, the coil of relay (K36:34) is no longer supplied with current. Contact (K36) will open and interrupt the current flow to solenoid valve (Y04:34). The brake closes.

To be able to drive the machine for a short while, even with a snapped V-belt or a defective generator, the contacts 30-87 of relay (K36:34) must be bridged to open the brake.



Travel speed range selector (Fig. 7)

Reverse travel

When moving the travel lever to reverse while driving on level ground, the coil of relay (K26:05) is not supplied with current.

Current flows

- from potential K11,
- via fuse (F26:23),
- through the closed contact (K26:07)
- to the back-up alarm buzzer (H14:11).

The back-up alarm will sound.

Forward travel

In this position the proximity switch (B14:05) closes.

Current flows

- from potential K11,
- via fuse (F25:05),
- the closed proximity switch (B14:05),
- to the coil of relay (K26:05).

The relay switches over, the current supply for the warning buzzer (H14:11) is interrupted.

Current flows also

- from potential K11,
- via fuse (F26:23),
- to the travel speed range selector (S42:24).

Travel speed ranges

Depending on the position of the travel speed range (S42:23) the solenoid valves (Y30:19, Y31:29)

- for both travel motors (drum and axle),
- only for the front travel motor (drum),
- only for the rear travel motor (axle),
- or for none of the motors are supplied with current.

This enables the operator to influence the gradability of the machine by changing the displacement of the travel motors. The motor of the slipping axle is switched over to low displacement.

If the travel speed range selector switch (S42:23) is in position 1 "turtle", none of the solenoid valves (Y30:11/Y31:18) is supplied with current. In this switch position all motors for drum and axle work with high displacement. The machine drives with low travel speed range (working speed).

In **switch position 2** current flows

- from potential K11,
- via fuse (F26:23),
- switch (S42:23)
- to solenoid valve (Y30:19).

The drum drive motor switches to low displacement.

The current flow to solenoid valve (Y31:29) is avoided by diode (V02:22).

In **switch position 3** current flows

- from potential K11,
- via fuse (F26:23),
- switch (S42:23)
- to solenoid valve (Y31:29).

The axle drive motor switches to low displacement.

The current flow to solenoid valve (Y30:19) is avoided by diode (V03:27).

If the travel speed range selector switch (S42:23) is in **position 4 "rabbit"** both solenoid valves (Y30:11/Y31:18) are supplied with current. In this switching condition both motors for drum and axle are switched to low displacement. The machine drives with high speed range (transport speed).

In this switch position current flows

- from potential K11,
- via fuse (F26:23),
- switch (S42:23)
- to both diodes (V02:22 and V03:27)
- to both solenoid valves (Y30:19 and Y31:29).

Drum drive motor and axle drive motor change to low displacement.

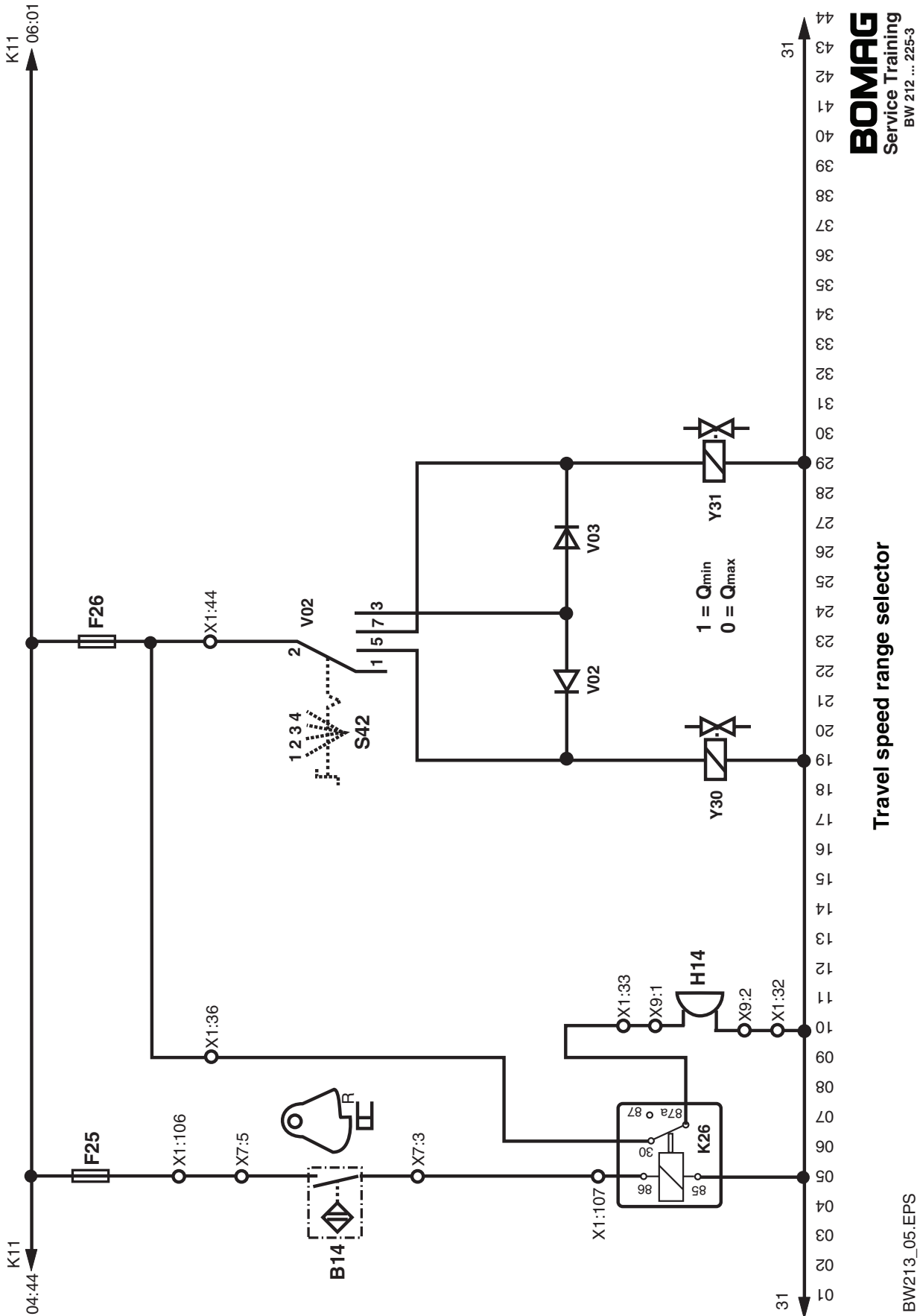


Fig. 6:

Anti Spin Control ASC

On extreme inclinations and on slippery soil the Anti Spin Control (ASC) provides optimal traction and avoids spinning of drum and wheels.

However, if the physical limits are reached, even the ASC cannot improve the traction of the machine any further.

The following machines are generally equipped with the ASC Anti-Spin-Control (Fig. 9):

- BW 213 DH-3/PDH-3
- BW 214 DH-3/PDH-3
- BW 216 DH-3/PDH-3
- BW 219 DH-3/PDH-3
- BW 225 D-3/PD-3

The machines with Anti Spin Control (ASC) in the travel system are equipped with the following sensors:

- analogue inclination sensor (B57)
- analogue travel lever sensor
- sensors for speed and detection of sense of rotation (B59/B60).

For safety reasons the following assembly groups (hardware) are electronically monitored:

- area monitoring of inclination sensor
- area monitoring of travel lever sensor
- fault monitoring of speed sensor
- fault monitoring of solenoid valves
- fault monitoring of internal 5V voltage supply for the sensors.

Additional monitoring of (software):

- checking of signal for sense of rotation
- checking of signal for neutral start position
- checking of version of operating system.

If a fault is found, e.g. cable breakage or short circuit, the ASC-system is deactivated and an error message will be displayed (monitoring board).

Voltage on analogue input of plug (X1:52) on inclination sensor

Inclination	Position of drum	Voltage (V)
-45° (100%)	uphill	0,5
-5,7° (10%)	downhill	2,15
0°	level ground	2,5
+5,7° (10%)	uphill	2,75
+45° (100%)	uphill	4,5

Vibration (Fig. 11)

Switching the vibration on

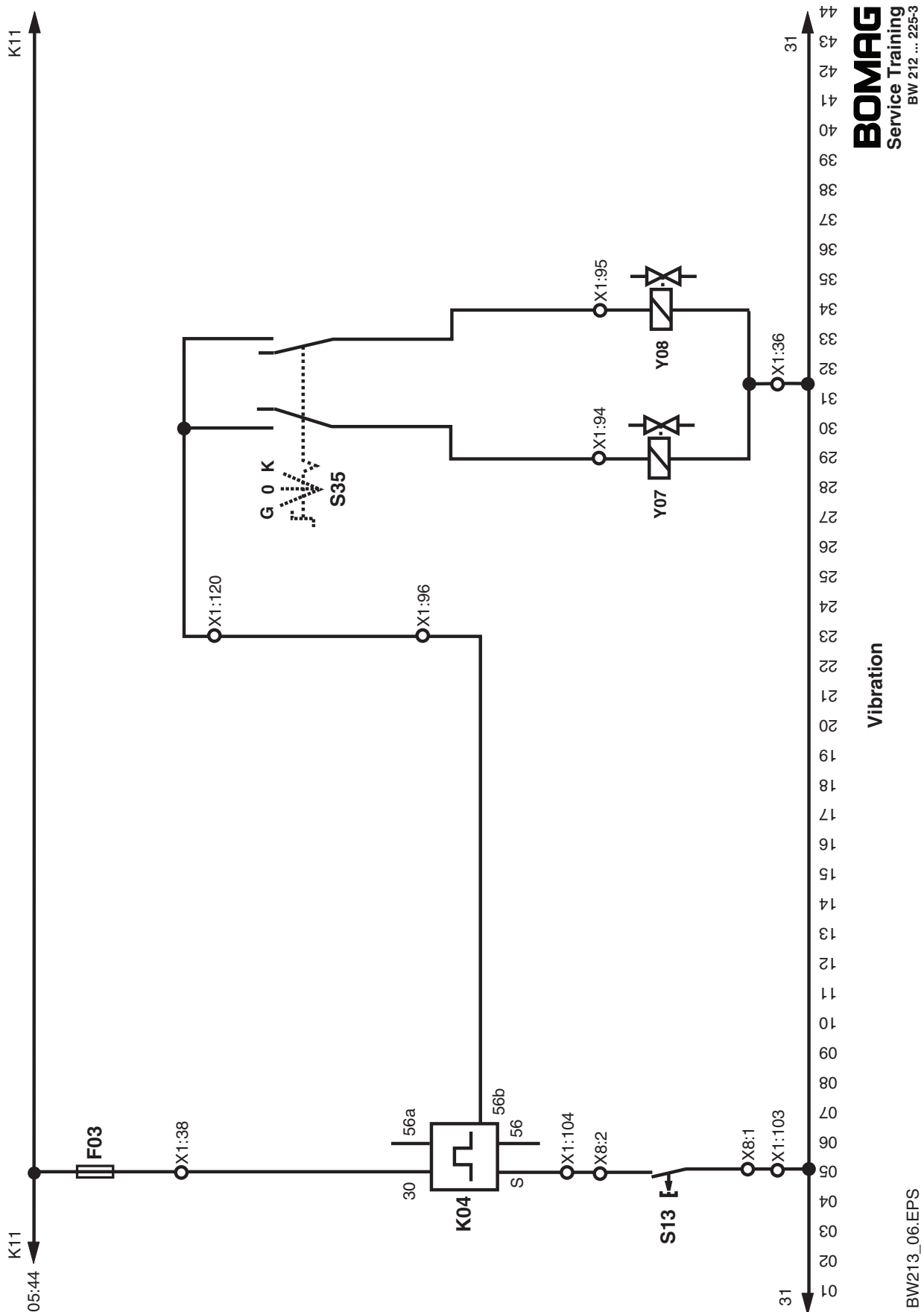
Current flows:

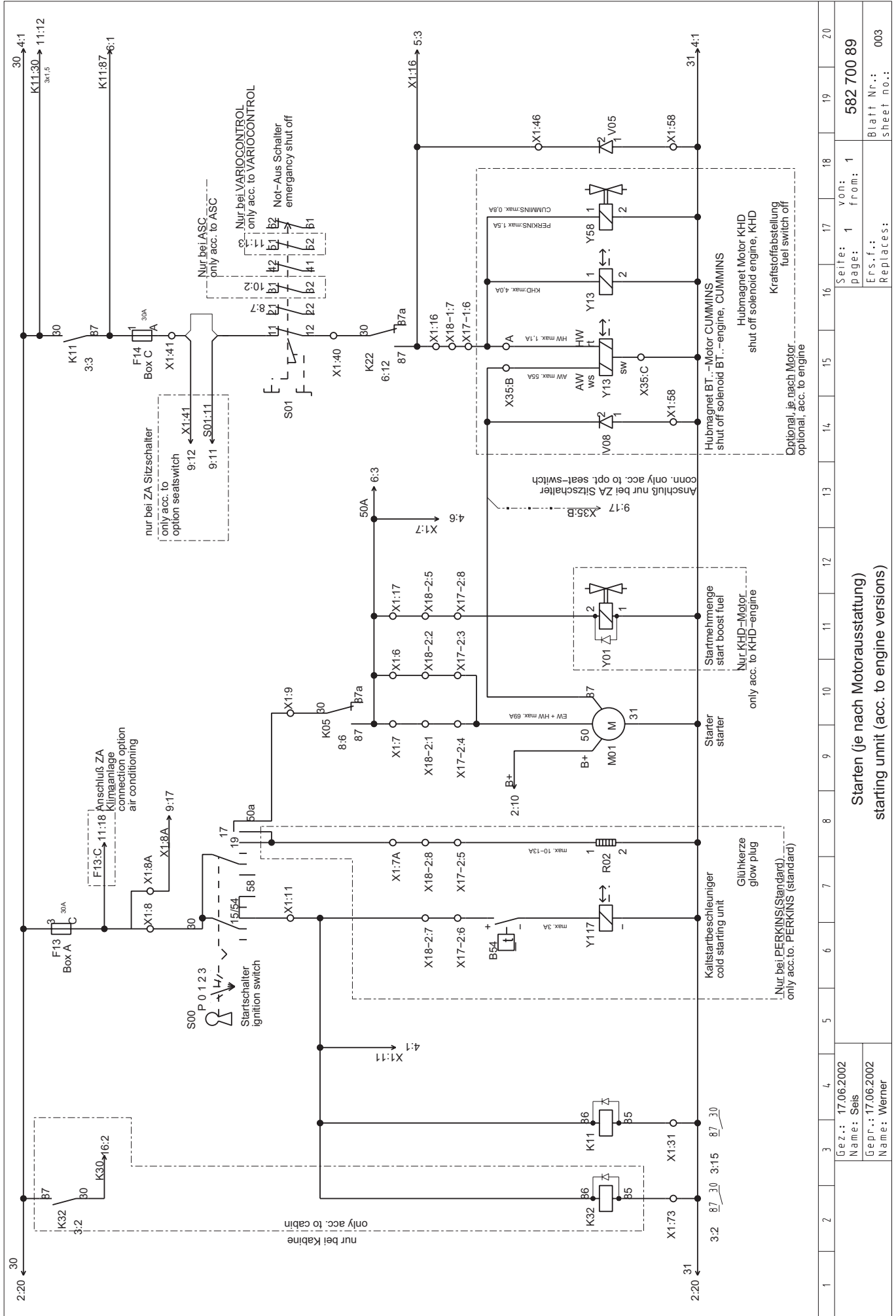
- from potential K11,
- via fuse (F03:05)
- to toggle relay (K04:05).

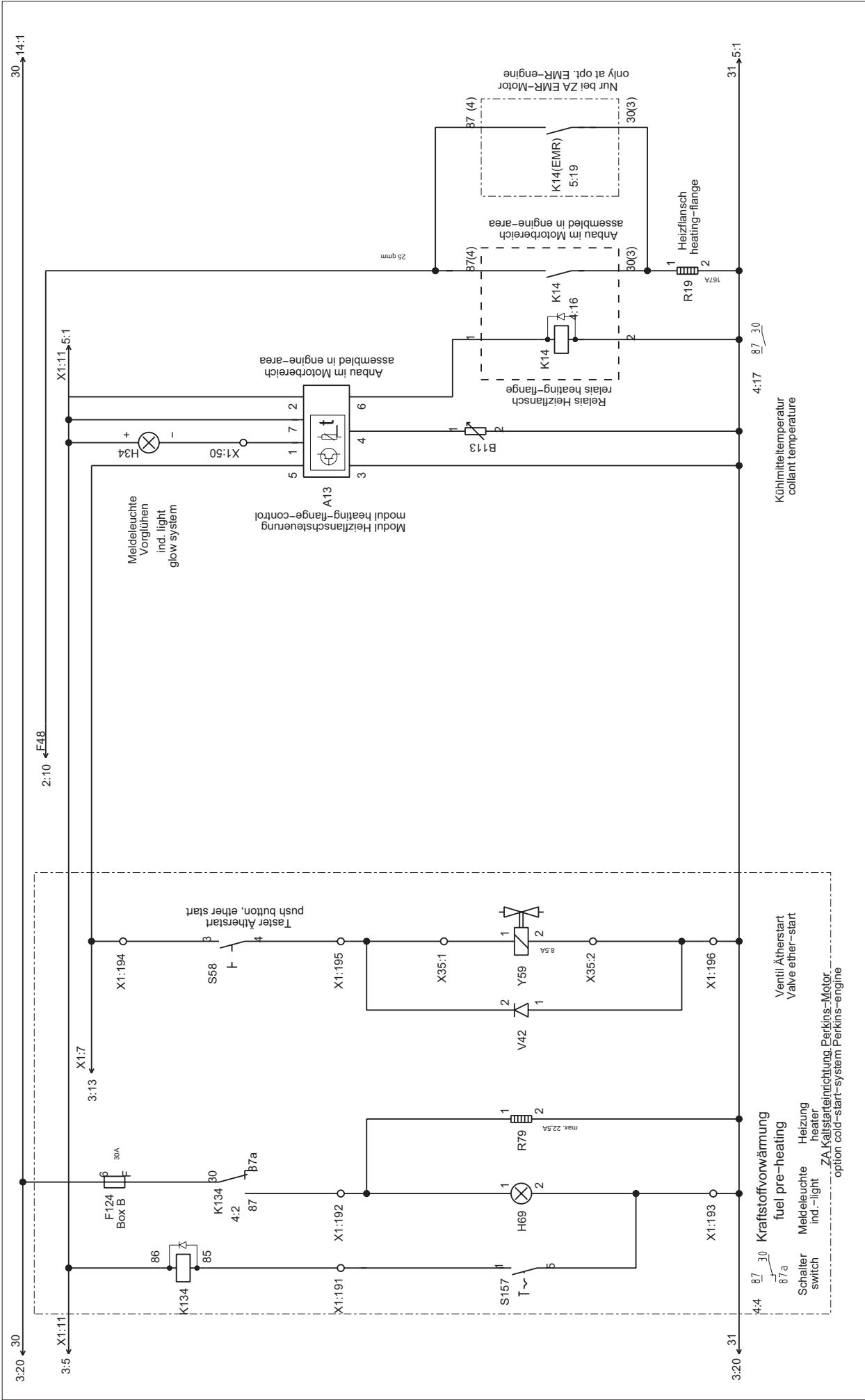
When pressing the push button (S13:05) the toggle relay switches and the contact of toggle relay (K04:05) closes.

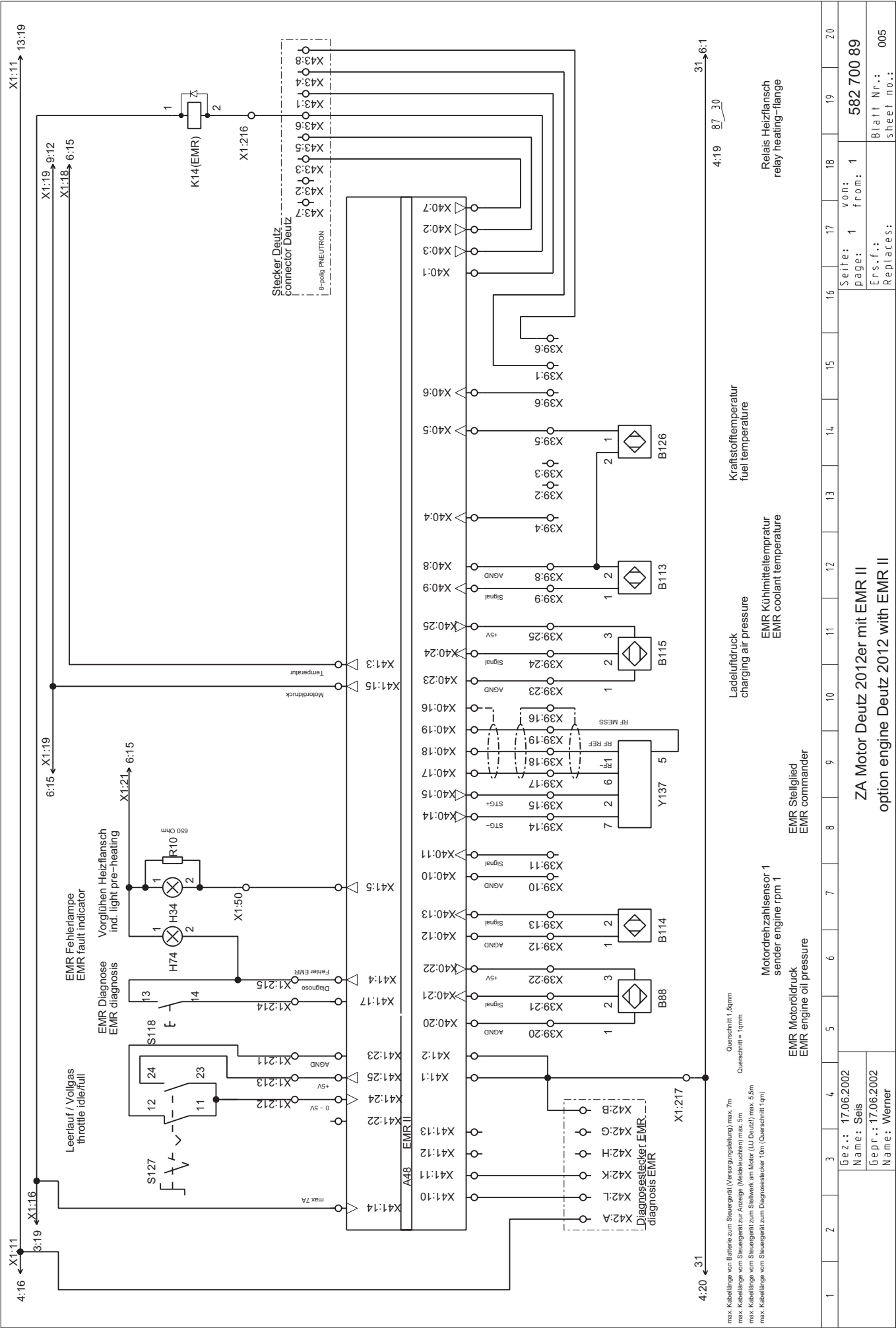
Current flows to the selector switch for high / low amplitude (S35:29).

Depending on the switch position current flows to the solenoid valve (Y07:29) for high amplitude or (Y08:34) for low amplitude. The selected vibration starts.

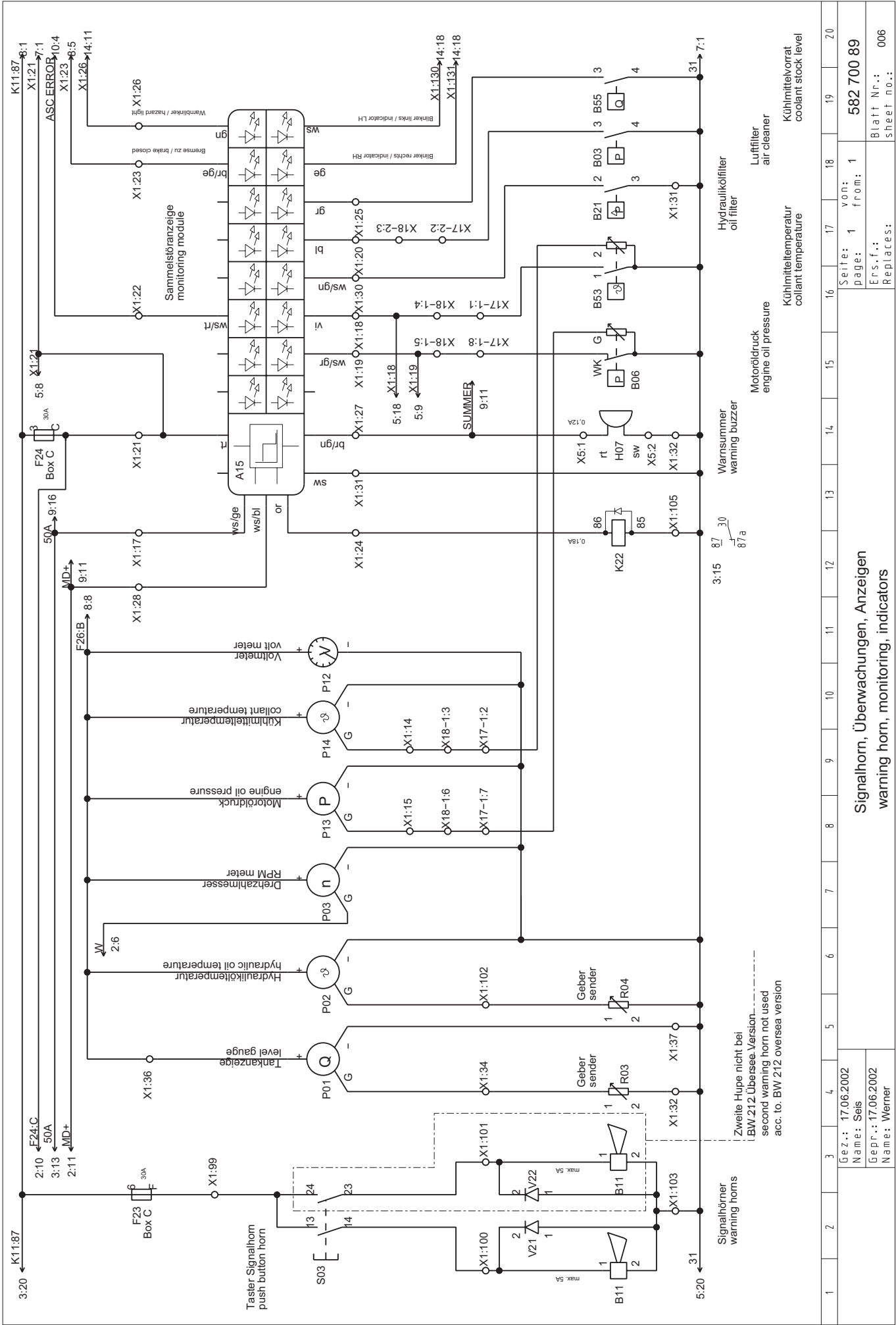


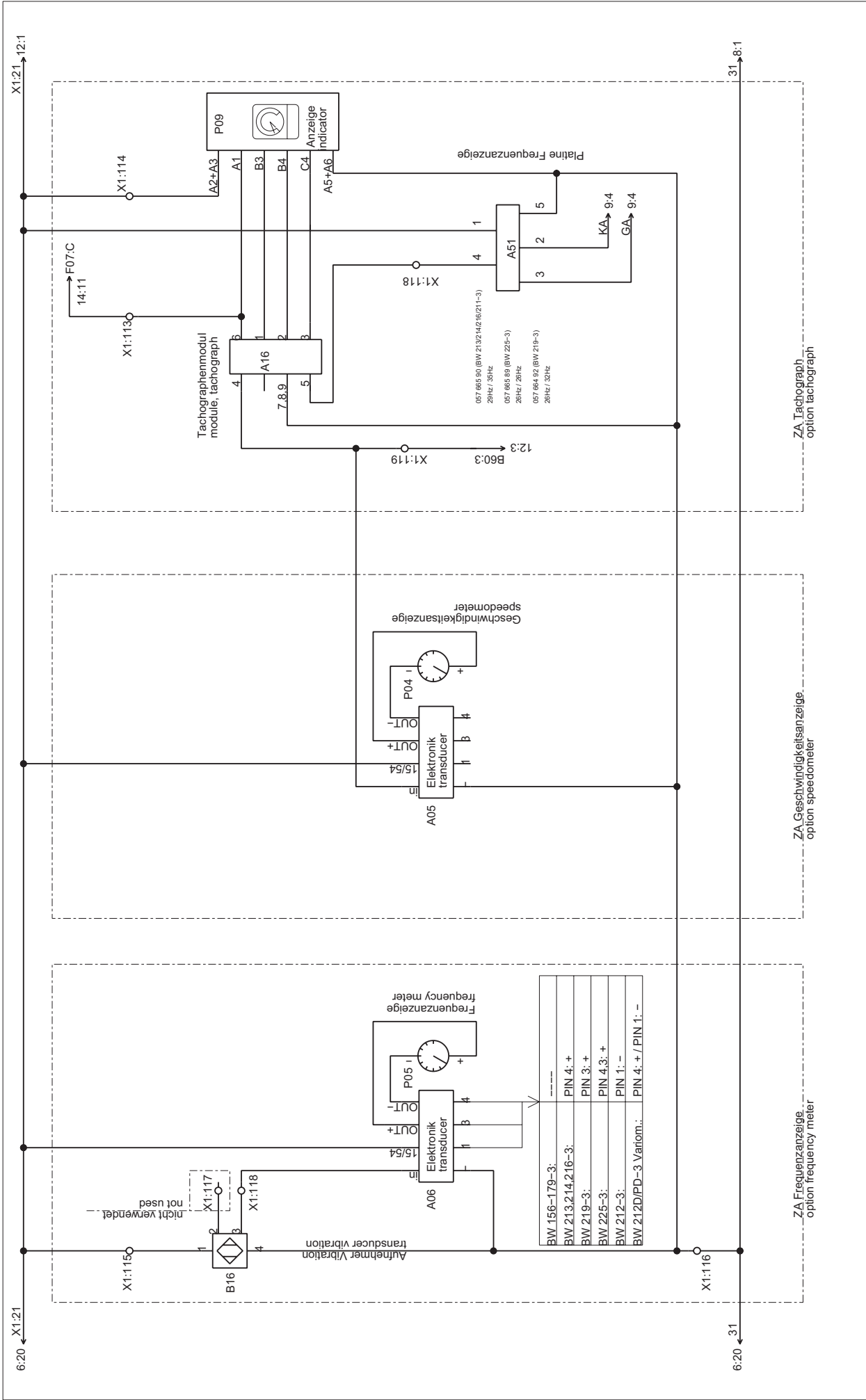


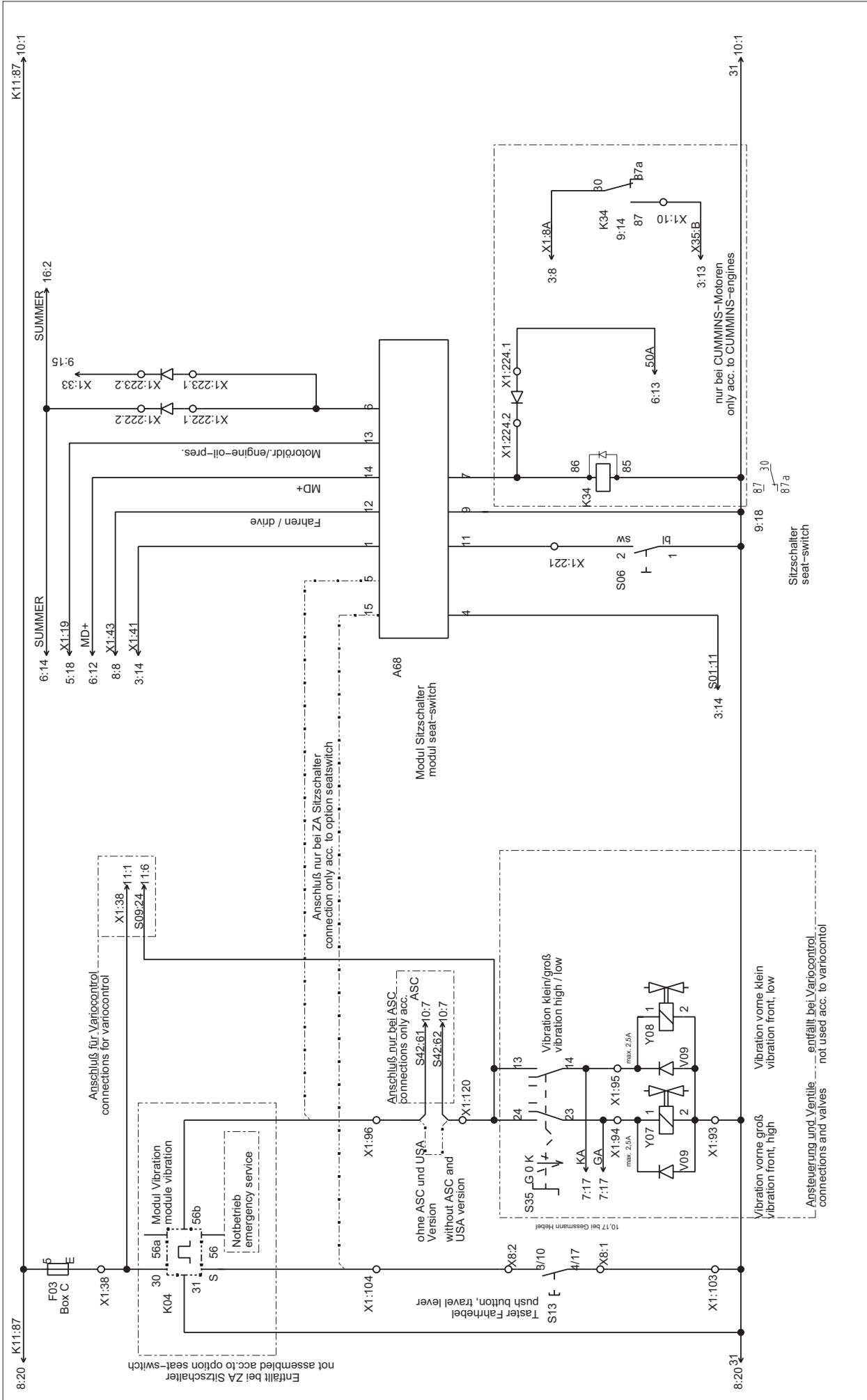


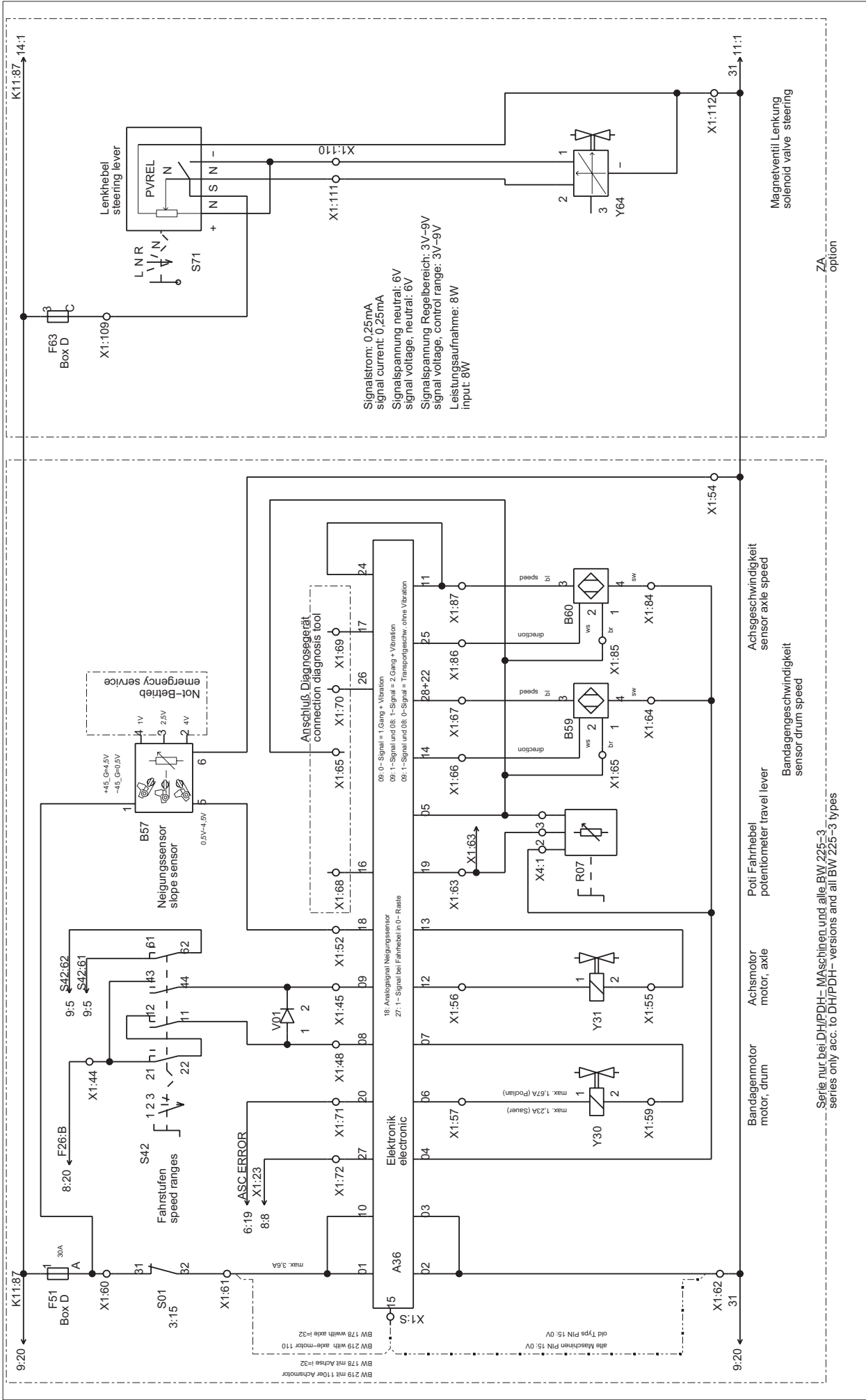


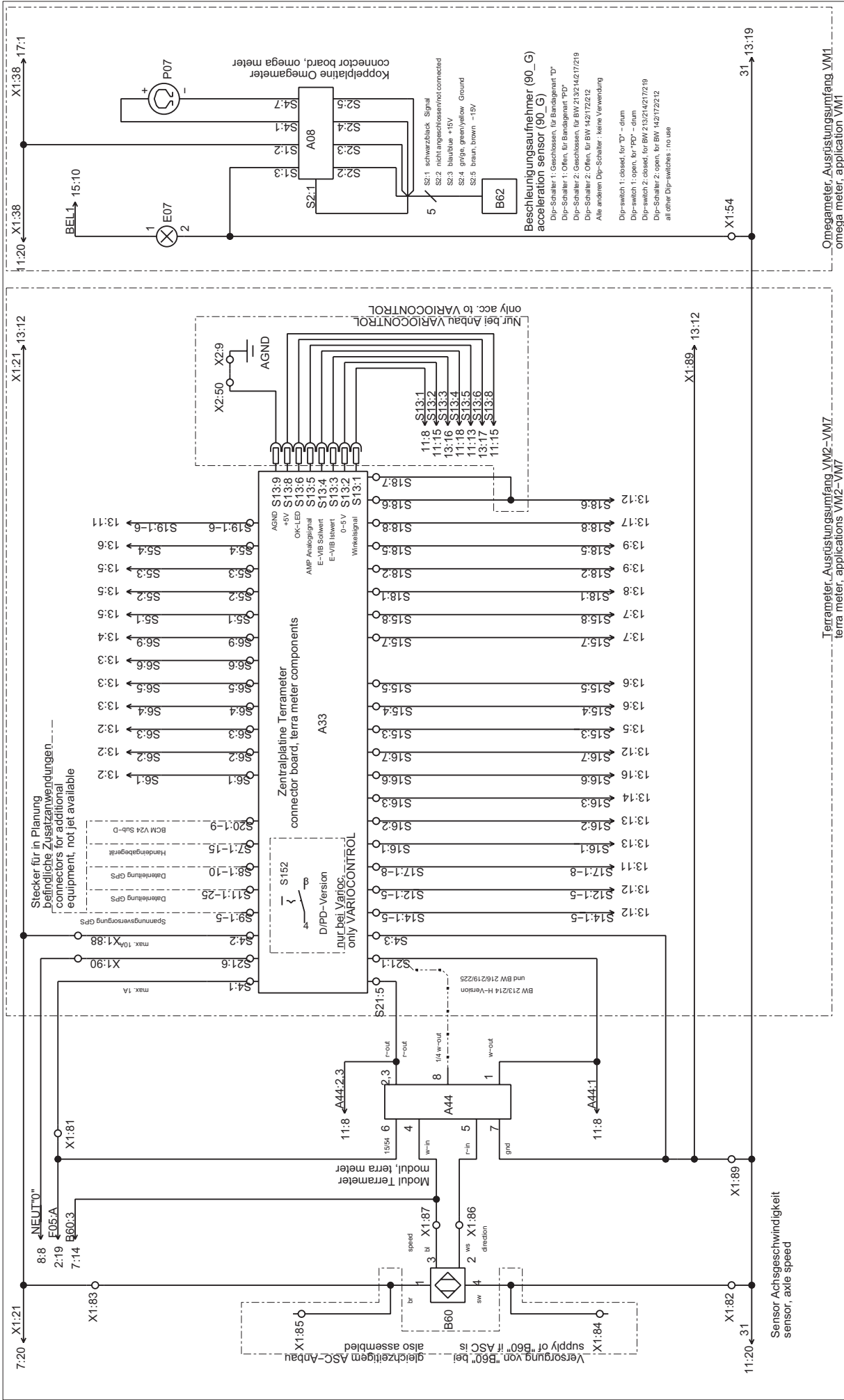
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
max. Kabellänge von Batterie zum Steuergerät (Versorgungsleitung) max. 7m max. Kabellänge vom Steuergerät zur Anzeige (Meldeleuchten) max. 5m max. Kabellänge vom Steuergerät zum Stellwerk am Motor (LU Deutz) max. 5,5m max. Kabellänge vom Steuergerät zum Diagnosestecker 10m (Querschnitt 1qm)				Gez.: 17.06.2002 Name: Seis				ZA Motor Deutz 2012er mit EMR II option engine Deutz 2012 with EMR II				Seite: 1 von: 1 page: 1 from: 1 Ers.f.: Replaces:				582 700 89 Blatt Nr.: sheet no.:			
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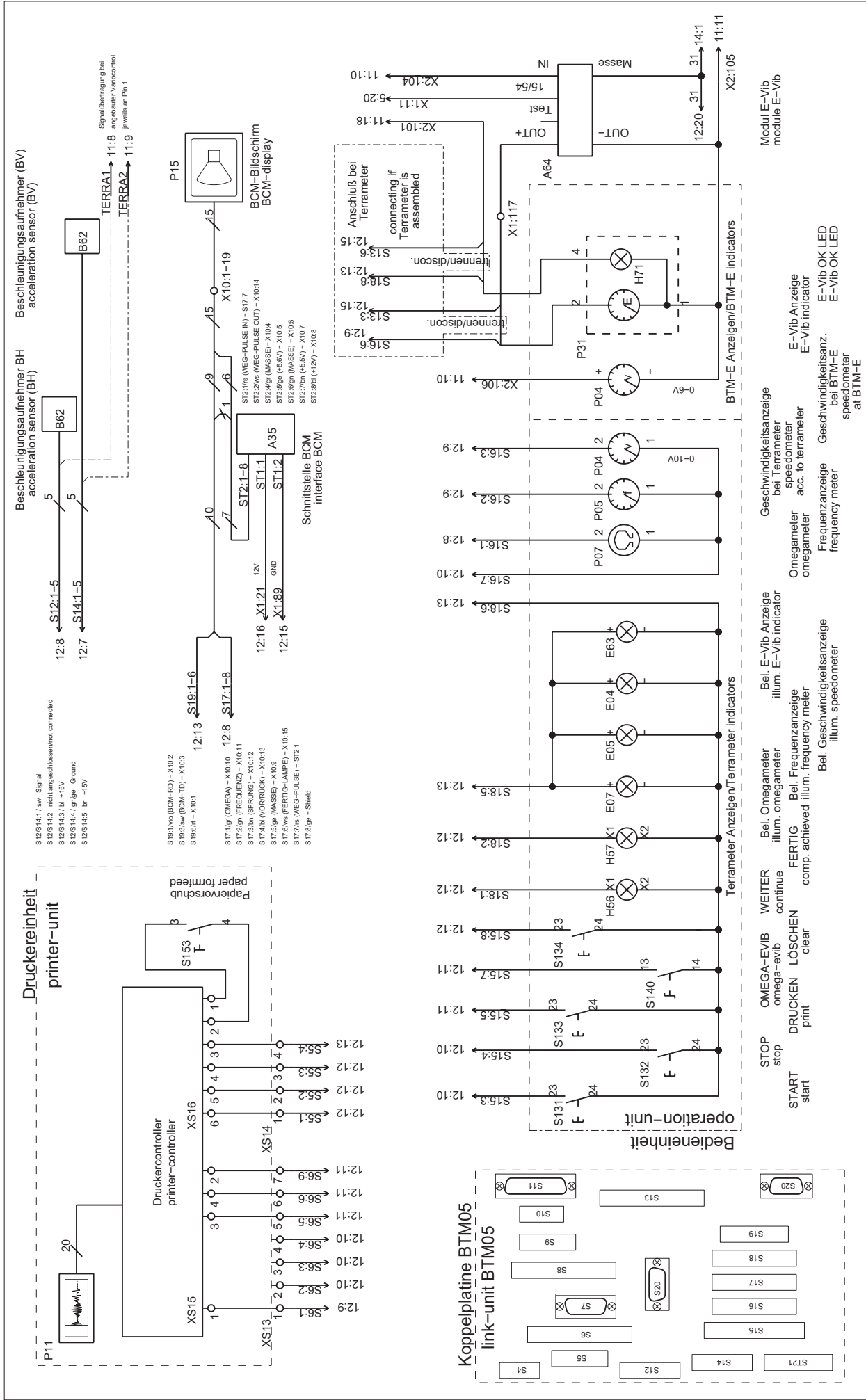


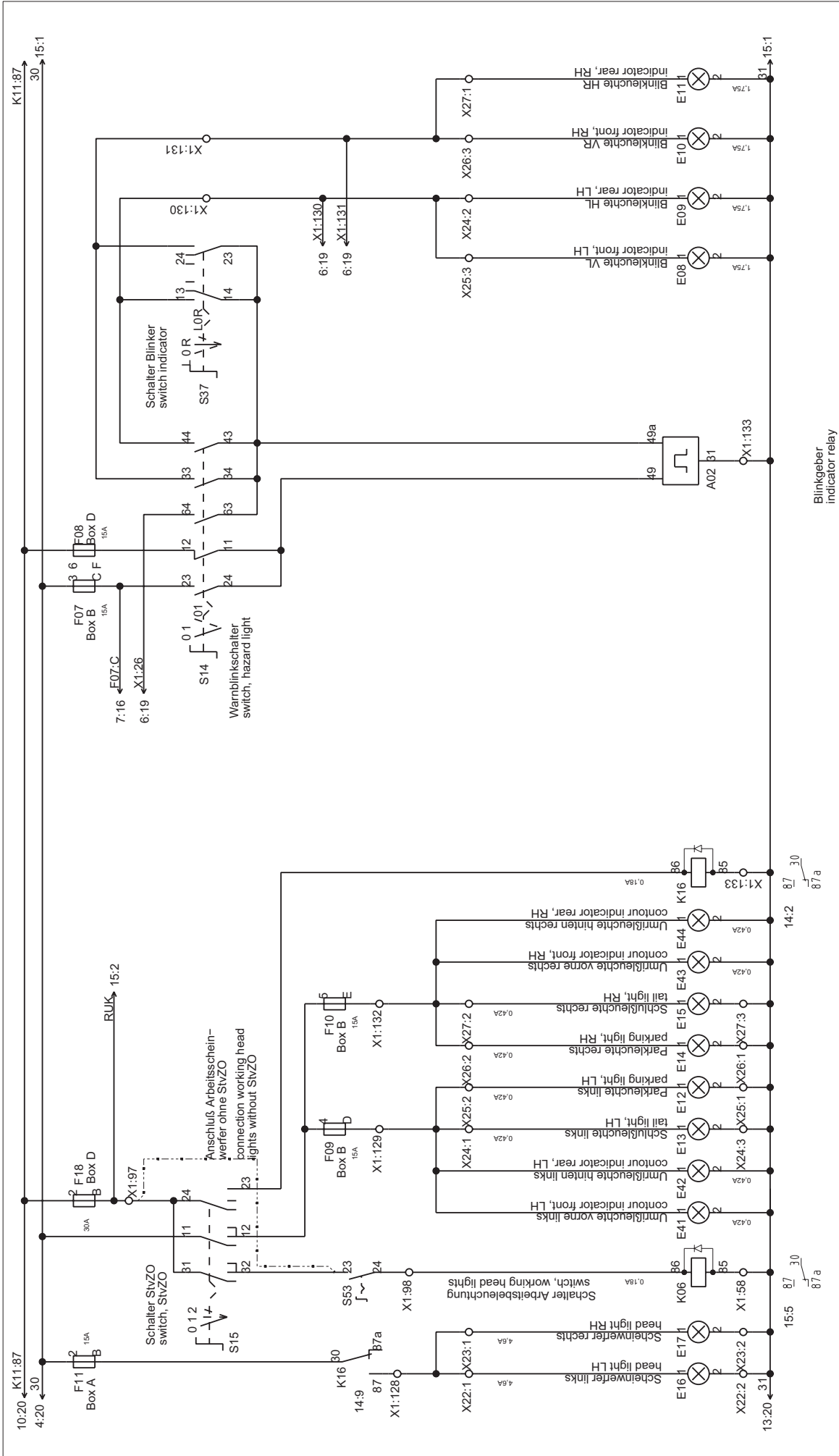


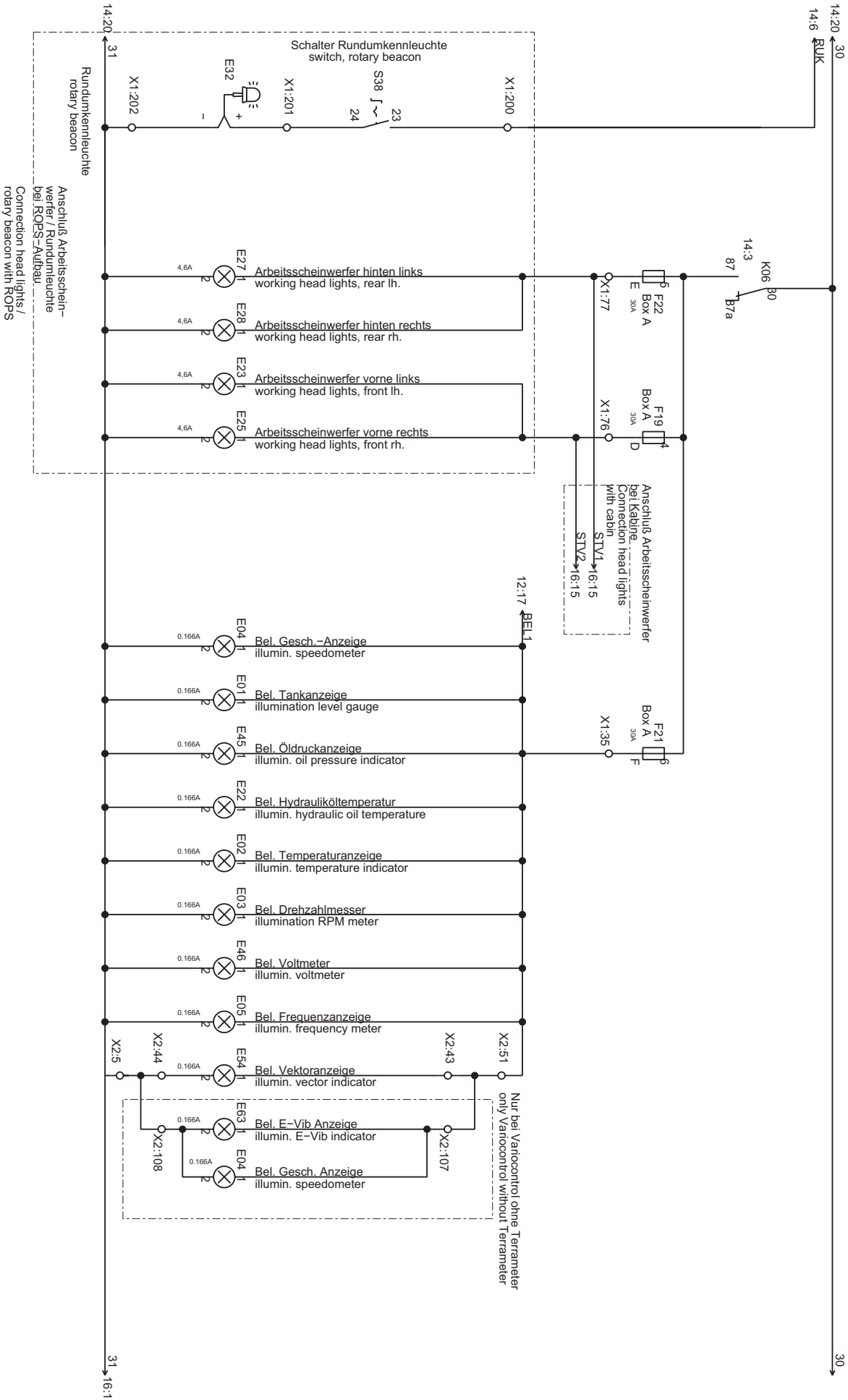








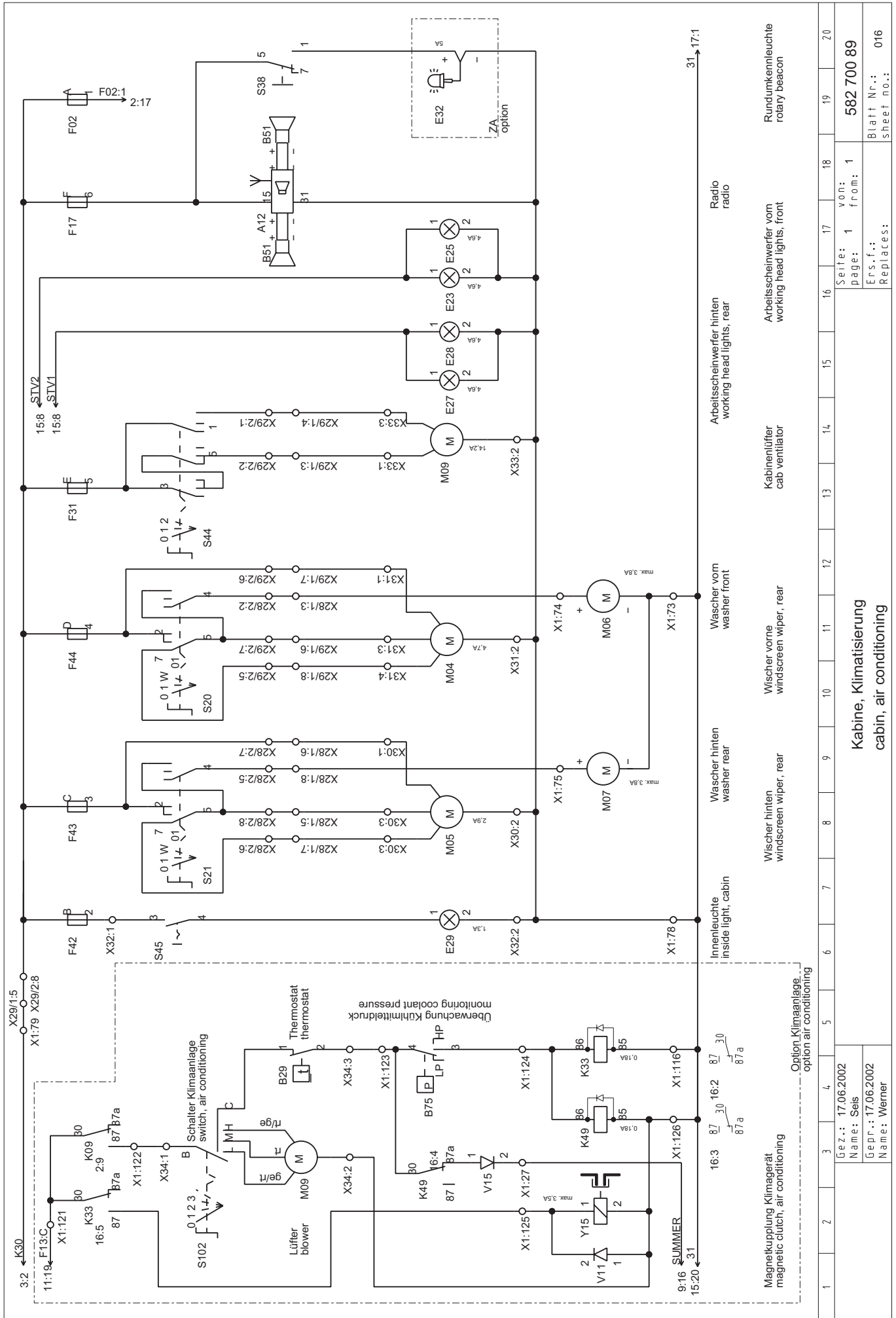


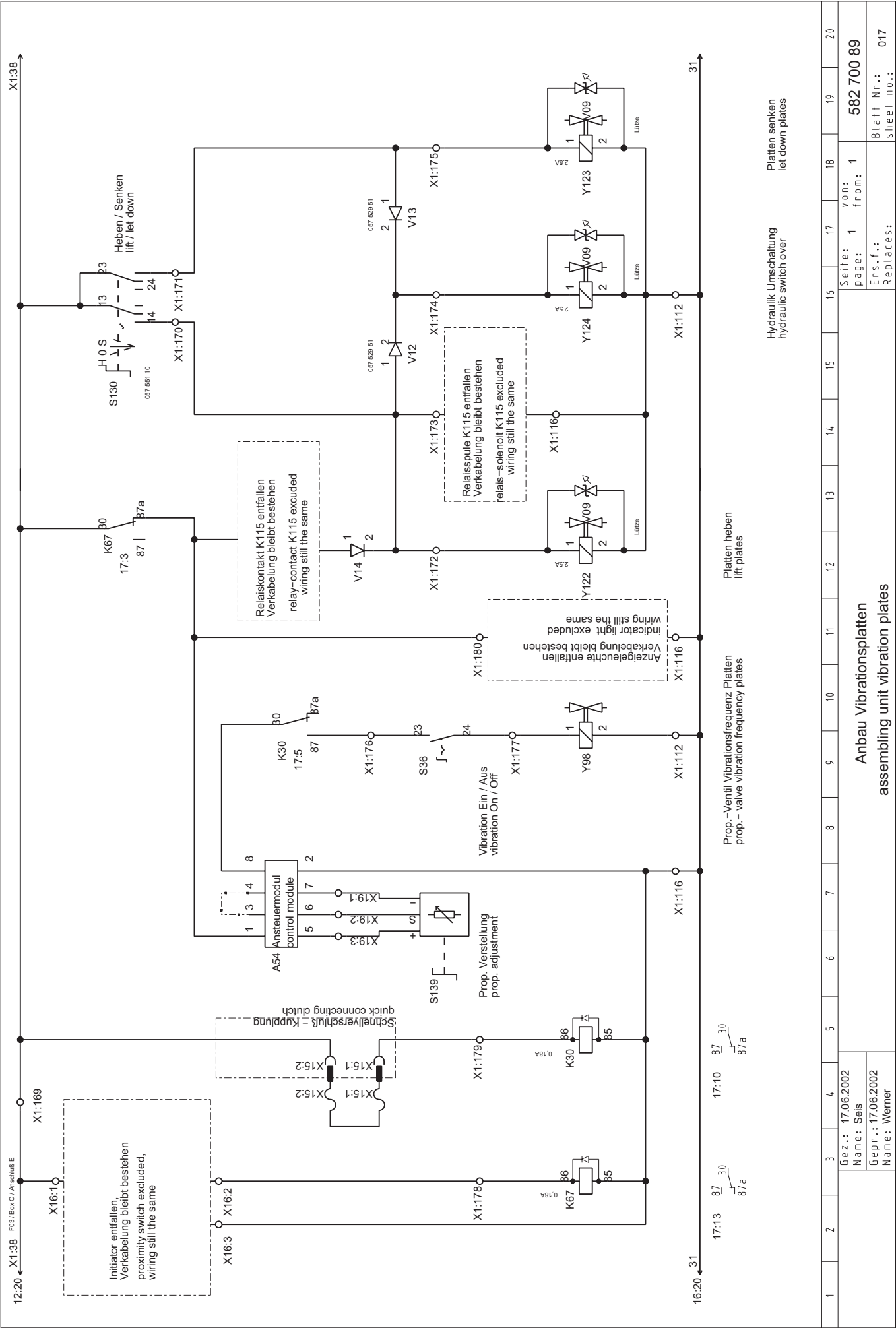


Gez.: 17.06.2002
Name: Seis
Gepr.: 17.06.2002
Name: Werner

Instr. Beleuchtung, Arbeitsbel., Rundumkennleuchte
instr. illumination, working head lights, rotary beacon

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Ers.f.:
Replaces:
Blatt Nr.: 582 700 89
sheet no.: 015





Anbau Vibrationsplatten
assembling unit vibration plates

Gez.: 17.06.2002
Name: Seis
Gepr.: 17.06.2002
Name: Werner

Seite: 1 von: 1
page: 1 from: 1
Ers.f.:
Replaces:

Blatt Nr.: 582 700 89
sheet no.: 017

		Name	Bl.	Pf.	Benennung	title	TYP
1		A02	014	14	Blinkrelais	Indicator relay	
		A05	007	9	Elektronik Geschwindigkeitsanzeige	Electronic system, speedometer	MODUL
		A06	007	4	Elektronik Frequenzanzeige vorne	Electronic system, frequency meter, fr.	MODUL
		A08	012	18	Elektronik Omegameter	Electronic system, Omegameter	
2		A12	016	17	Radio	Radio	
		A13	004	14	Steuergeraet Heizung	Control unit, heating	
		A15	006	13	Platine Ueberwachungsmodul	Printed circuit board, monitoring module	
		A16	007	15	Elektronik Tachograph	Electronic system, tachograph	
3		A23	002	8	Platine Generator	Printed circuit generator	
		A33	012	12	Zentralplatine Kopplung Verdichtungskomponenten	Connection dircuit board, compac. components	
		A35	013	14	Versorgungsplatine	Suppling circuit board	
		A36	010	2	Elektronik Antischlupfregelung	Elektronic antispin control	
4		A37	011	11	Elektronik Variomatic	Elektronic variomatic	
		A44	012	4	Zusatzelektronik	Additional control unit	
		A46	011	2	Modul Variomatik	Modul, variomatik	
		A48	005	3	Elektronische Motorsteuerung	Electronic engine management	
5		A51	007	17	Platine Frequenzanzeige	Circuit board, frequency meter	
		A54	017	6	Modul Pumpenansteuerung	Modul pump control	
		A64	013	18	Modul Steifigkeitsanzeige	Modul stiffnes indicator	
		A68	009	12	Modul Sitzkontakt	Modul seat contact	
6		B03	006	19	Unterdruckschalter Luftfilter	Vacuum switch, air cleaner	
		B06	006	15	Druckschalter Motoroel	Pressure switch, engine oil	
		B11	006	1	Signalhorn	Warning horn	MAX. 5A
		B11	006	3	Signalhorn	Warning horn	MAX. 5A
7		B13	008	2	Naeherungsinitiator Fahrhebel links	Proximity switch, travel lever, lh.	
		B14	008	4	Naeherungsinitiator Fahrhebel rechts	Proximity switch, travel lever, rh.	
		B16	007	3	Aufnehmer Vibrationsfrequenz vorne	Transducer, vibration frequency, front	
		B21	006	18	Differenzdruckschalter Hydr.-Oelfilter	Pressure diff. switch, hydr. oil filter	
8		B29	016	5	Raumthermostat	Room thermostat	
		B51	016	17	Lautsprecher Radio	Speaker radio	
		B51	016	18	Lautsprecher Radio	Speaker radio	
		B53	006	16	Temperaturgeber Kuehlmittel	Temperature switch, collant	
9		B54	003	7	Temperaturgeber Starthilfe	Temperature switch, starting assistance	
		B55	006	19	Kuehlmittelstand Ausgleichsbehaelter	Coolant charge expansion tank	
		B57	010	9	Neigungssensor Stufenumschaltung	Slope sensor, speed range selection	
		B59	010	11	Aufnehmer Bandagengeschwindigkeit	Sensor, drum speed	
10		B60	010	12	Aufnehmer Achsgeschwindigkeit	Sensor, axle speed	
		B60	012	2	Aufnehmer Achsgeschwindigkeit	Sensor, axle speed	
		B61	011	7	Aufnehmer Verstellzylinder	Sensor, ajustable zylinder	
		B62	011	9	Beschleunigungsaufnehmer	Acceleration sensor	
11		B62	011	10	Beschleunigungsaufnehmer	Acceleration sensor	
		B62	012	18	Beschleunigungsaufnehmer	Acceleration sensor	
		B62	013	14	Beschleunigungsaufnehmer	Acceleration sensor	
		B62	013	17	Beschleunigungsaufnehmer	Acceleration sensor	
12		B75	016	5	Kuehlmitteldruck	coolant pressure	
		B88	005	5	Druckgeber Motoroel	Sender, engine oil pressure	
		B113	004	14	EMR Temperaturgeber Kuehlmittel	EMR Temperature switch, collant	
		B113	005	12	EMR Temperaturgeber Kuehlmittel	EMR Temperature switch, collant	
13		B114	005	6	EMR Aufnehmer, Motordrehzahl	EMR Tranducer, engine speed	
		B115	005	10	Geber Ladeluftdruck	Sender, charging air pressure	
		B126	005	14	EMR Temperaturgeber Kraftstoff	EMR fuel temperature sender	
14		E01	015	10	Beleuchtung Tankanzeige	Illumination, level gauge	
		E02	015	13	Beleuchtung Temperaturanzeige	Illumination, temperature gauge	
		E03	015	13	Beleuchtung Drehzahlmesser	Illumination, rpm meter	
		E04	013	11	Beleuchtung Geschwindigkeitsanzeige	Illumination, speedometer	
15		E04	015	10	Beleuchtung Geschwindigkeitsanzeige	Illumination, speedometer	
		E04	015	17	Beleuchtung Geschwindigkeitsanzeige	Illumination, speedometer	
		E05	013	10	Beleuchtung Frequenzanzeige vorne	Illumination, frequency gauge, front	
		E05	015	15	Beleuchtung Frequenzanzeige vorne	Illumination, frequency gauge, front	
16		E07	012	17	Beleuchtung Omegameter	Illumination, Omegameter	
		E07	013	9	Beleuchtung Omegameter	Illumination, Omegameter	
		E08	014	17	Blinkleuchte vorne links	Indicator, front, lh.	MAX. 1,75A
		E09	014	18	Blinkleuchte hinten links	Indicator, rear, lh.	MAX. 1,75A
17		E10	014	19	Blinkleuchte vorne rechts	Indicator, front, rh.	MAX. 1,75A
		E11	014	19	Blinkleuchte hinten rechts	Indicator, rear, rh.	MAX. 1,75A
		E12	014	6	Parkleuchte links	Parking light, lh.	MAX. 0,42A
		E13	014	5	Schlussleuchte links	Tail light, lh.	MAX. 0,42A
18		E14	014	6	Parkleuchte rechts	Parking light, rh.	MAX. 0,42A
		E15	014	7	Schlussleuchte rechts	Tail light, rh.	MAX. 0,42A
		E16	014	2	Scheinwerfer links	Head light, lh.	MAX. 4,6A
		E17	014	2	Scheinwerfer rechts	Head light, rh.	MAX. 4,6A
19		E22	015	12	Beleuchtung Temperaturanzeige Hydr.-oel	Illumination, temp. gauge, hydraulic oil	
		E23	015	6	Arbeitsscheinwerfer vorne links	Working head light, front, lh.	MAX. 4,6A
		E23	016	16	Arbeitsscheinwerfer vorne links	Working head light, front, lh.	4,6A
		E25	015	7	Arbeitsscheinwerfer vorne rechts	Working head light, front, rh.	MAX. 4,6A
20		E25	016	17	Arbeitsscheinwerfer vorne rechts	Working head light, front, rh.	4,6A
		E27	015	5	Arbeitsscheinwerfer hinten links	Working head light, rear, lh.	MAX. 4,6A
		E27	016	15	Arbeitsscheinwerfer hinten links	Working head light, rear, lh.	4,6A
		E28	015	5	Arbeitsscheinwerfer hinten rechts	Working head light, rear, rh.	MAX. 4,6A
21		E28	016	16	Arbeitsscheinwerfer hinten rechts	Working head light, rear, rh.	4,6A
		E29	016	7	Innenleuchte Kabine	Inside light, cabin	1,3A
		E30	002	12	Heizgeraet	Heating unit	MAX.20A/NENN2A
		E32	015	3	Kennleuchte	Warning light	
22		E32	016	20	Kennleuchte	Warning light	5A
		E41	014	4	Umrissleuchte vorne links	Contour illumination front, lh.	MAX. 0,42A
		E42	014	4	Umrissleuchte hinten links	Contour illumination rear, lh.	MAX. 0,42A
		E43	014	7	Umrissleuchte vorne rechts	Contour illumination front, rh.	MAX. 0,42A
23		E44	014	8	Umrissleuchte hinten rechts	Contour illumination rear, rh.	MAX. 0,42A
		E45	015	11	Beleuchtung Oeldruckanzeige	Illumination oil pressure indicator	
		E46	015	14	Beleuchtung Voltmeter	Illumination volt meter	
		E54	015	16	Beleuchtung Vektoranzeige	Illumination vector indicator	
24		E63	013	11	Beleuchtung Steifigkeitsanzeige	Illumination stiffness indicator	
		E63	015	16	Beleuchtung Steifigkeitsanzeige	Illumination stiffness indicator	
25		F00	002	3	Hauptsicherung Batterie	Fuse, main, battery	125A
		F02	016	19	Ersatzsicherung	Fuse, spare	
		F03	009	2	Sicherung Vibration	Fuse, vibration	30A

		Name	Bl.	Pf.	Benennung	title	TYP
1	2	F05	002	19	Sicherung Steckdose	Fuse, socket	30A
		F07	014	12	Sicherung Warnblinker	Fuse, hazard light	15A
		F08	014	13	Sicherung Blinker u. Arbeitsscheinw.	Fuse, indicators a. work, head light	15A
		F09	014	5	Sicherung Park- u. Schlussl. links	Fuse, parking and tail light, lh.	15A
		F10	014	7	Sicherung Park- u. Schlussl. rechts	Fuse, parking and tail light, rh.	15A
		F11	014	2	Sicherung Scheinwerfer links	Fuse, head light, lh.	15A
		F13	003	6	Sicherung Startschalter	Fuse, starter switch	30A
		F14	003	15	Sicherung Hubmagnet Motor	Fuse, shut off solenoid, engine	30A
		F17	016	17	Sicherung Radio	Fuse, radio	
		F18	014	4	Vorsicherung Arbeitsscheinw. vorne	Primary fuse, work, head light, fr.	30A
		F19	015	7	Sicherung Arbeitsscheinw. vorne li.	Fuse, working head light, front, lh.	30A
		F21	015	11	Sicherung Instrumentenbeleuchtung	Fuse, illumination of gauges	30A
		F22	015	5	Sicherung Arbeitsscheinwerfer hinten	Fuse, working head lights, rear	30A
		F23	006	2	Sicherung Signalhorn	Fuse, warning horn	30A
		F24	006	14	Sicherung Ueberwachungsmodul	Fuse, monitoring module	30A
		F25	008	2	Sicherung Magnetv. Fahren u. Bremse	Fuse, sol. valve, travel and brake	30A
		F26	008	14	Sicherung Magnetv. Fahrstufenumsch.	Fuse, sol. valve, speed range sel.	30A
		F31	016	13	Sicherung Kabinenluefter	Fuse, cabin ventilator	
		F40	002	12	Sicherung Kabinenheizung	Fuse, heating unit cab	25A
		F42	016	7	Sicherung Kabineninnenleuchte	Fuse, inside light cab	
3	4	F43	016	8	Sicherung Wischermotor hinten	Fuse, wipermotor rear	
		F44	016	11	Sicherung Wischermotor vorn	Fuse, wipermotor front	
		F48	002	4	Sicherung Gluehanlage	Fuse, glow plug system	125A
		F51	010	2	Sicherung Antischlupfregelung	Fuse, antispin control	30A
		F63	010	16	Sicherung Lenkung	Fuse, steering	30A
		F67	011	12	Sicherung Steuerung (Potential 30)	Fuse, controller (pot.30)	15A
		F84	011	13	Sicherung Steuerung (Klemme 54)	Fuse, controller (Pin 54)	10A
		F124	004	4	Sicherung Kraftstoffvorwärmung	Fuse, fuel pre-heating	30A
		G01	002	3	Batterie	Battery	100 AH
		G02	002	5	Generator	Generator	
		G03	002	4	Batterie	Battery	100 AH
		H04	011	2	Meldeleuchte Betriebsstoerung	Indicator light, breakdown	
		H07	006	14	Warnsummer Betriebsstoerung	Warning buzzer, breakdown	
		H14	008	9	Warnsummer Rueckwaertsfahrt	Back-up alarm buzzer	
		H34	004	14	Meldeleuchte Vorgluehen	Indicator light, glowing	
		H34	005	7	Meldeleuchte Vorgluehen	Indicator light, glowing	VORGLÜHEN
		H56	011	14	Meldeleuchte "Weiter"	Indicator light, "continue"	
		H56	013	8	Meldeleuchte "Weiter"	Indicator light, "continue"	
		H57	011	15	Meldeleuchte "Fertig"	Indicator light, "ready"	
		H57	013	9	Meldeleuchte "Fertig"	Indicator light, "ready"	
		H69	004	3	Meldeleuchte Kraftstoffvorwärmung	Indicator light, fuel pre-heating	
5	6	H71	013	17	Anzeige EVIB OK	Indicator EVIB OK	
		H74	005	6	Meldeleuchte Motordiagnose	Indicator light, eng. diagnostics	EMR FEHLER
		K04	009	2	Schrittrelais Vibration	Toggle relay, vibration	
		K05	008	6	Relais Startstrom	Relay, starting current	BOSCHW
		K06	014	3	Relais Scheinwerfer hinten	Relay, head lights, rear	BOSCHW
		K09	002	9	Relais Klimageraet	Relay, air conditioning	BOSCHW
		K11	003	3	Relais Klemme 30 auf 15	Relay, terminal 30 to 15	BOSCHL
		K14	004	16	Relais Vorgluehen	Relay, glow plug system	BOSCHL
		K16	014	9	Relais Scheinwerfer vorne	Relay, head lights, front	BOSCHW
		K22	006	12	Relais Hubmagnet Motor	Relay, shut off solenoid, engine	BOSCHW
		K26	008	4	Relais Rueckfahrwarneinrichtung	Relay, back up alarm	BOSCHW
		K30	017	5	Relais Ueberlastschutz	Relay, overload protection	BOSCHW
		K32	003	2	Relais Kabine	Relay, cabin	BOSCHL
		K33	016	5	Relais Warnsummer Betriebsstoerung	Relay, warning buzzer, failure indication	BOSCHW
		K34	009	14	Relais Sitzkontaktschalter	Relay, switch, drivers seat	BOSCHW
		K36	002	8	Relais Bremskontrolle	Relay, brake control	BOSCHW
		K48	008	2	Relais Fahrhebel 0-Stellung	Relay, travel lever 0-position	BOSCHW
		K49	016	4	Relais Warnsummer	Relay, warning buzzer	BOSCHW
		K67	017	3	Relais Vibrationsabschaltung	Relay, vibration deactivation	BOSCHW
		K134	004	2	Relais Kraftstoffvorwärmung	Relay, fuel pre-heating	BOSCHW
7	8	K14(EMR)	005	19	Relais Vorgluehen	Relais, glow plugn system	BOSCHL
		M01	003	9	Starter	Starter	
		M04	016	10	Scheibenwischermotor vorne	Windscreen wiper motor, front	4.7A
		M05	016	8	Scheibenwischermotor hinten	Windscreen wiper motor, rear	2.9A
		M06	016	11	Scheibenwaschermotor vorne	Windscreen washer motor, front	MAX. 3.8A
		M07	016	9	Scheibenwaschermotor hinten	Windscreen washer motor, rear	MAX. 3.8A
		M09	016	3	Kabinenluefter	Cabin ventilator	
		M09	016	14	Kabinenluefter	Cabin ventilator	14,2A
		P00	002	10	Betriebsstundenzaehler	Operating hour meter	
		P01	006	5	Tankanzeige	Level gauge	
		P02	006	6	Temperaturanzeige Hydraulikoel	Temperature gauge, hydraulic oil	
		P03	006	7	Drehzahlmesser	Rpm meter	
		P04	007	11	Geschwindigkeitsanzeige	Speedometer	
		P04	013	14	Geschwindigkeitsanzeige	Speedometer	
		P04	013	15	Geschwindigkeitsanzeige	Speedometer	
		P05	007	5	Frequenzanzeige vorne	Frequency meter, front	
		P05	013	13	Frequenzanzeige vorne	Frequency meter, front	
		P07	012	19	Omegameter	Omegameter	
		P07	013	13	Omegameter	Omegameter	
		P09	007	18	Frequenz- und Geschwindigkeitsanzeige	Frequency- and Speedometer	
9	10	P11	011	19	Drucker	Printer	
		P11	013	3	Drucker	Printer	
		P12	006	11	Voltmeter	Volt meter	
		P13	006	8	Anzeige Motoroeldruck	Pressure gauge, engine oil	
		P14	006	10	Anzeige Kuehlmitteltemperatur	Temperature gauge, coolant	
		P15	013	17	BCM 03 Bildschirm	BCM 03 terminal	
		P16	011	19	Fehleranzeige Variomatic	Fault indication, varimatic	
		P26	011	5	Anzeige Amplitude	amplitude indicator	
		P31	013	16	Stiefigkeitsanzeige	Stiffness indicator	
		R02	003	8	Gluehkerze	Glow plug	0,8A
		R03	006	4	Geber Tankanzeige	Sender, level gauge	
		R04	006	5	Geber Hydraulikoeltemperatur	Sender, hydraulic oil temp.	

		Name	Bl.	Pf.	Benennung	title	TYP
1	2	R07	010	8	Potentiometer Geschwindigkeitsk.	Potentiometer speed control	
		R10	005	8	Parallelwiderstand	Parallel resistor	EMR DIAGNOSE
		R19	004	17	Heizflansch	heater flange	
		R23	011	14	Widerstand	Resistor	1KOHM
		R24	011	14	Widerstand	Resistor	1KOHM
		R25	011	14	Widerstand	Resistor	1KOHM
		R26	011	14	Widerstand	Resistor	1KOHM
2	3	R79	004	5	Kraftstoffvorwärmung	fuel pre-heater	
		S00	003	6	Startschalter	Starter switch	
		S01	003	15	Schalter NOT AUS	Switch, emergency off	NOTAUSH
		S03	006	2	Taster Signalhorn	Push button, warning horn	
		S06	009	13	Sitzkontaktschalter links	Switch, seat contact, lh.	
		S09	011	6	Vibrationsschalter vorne	Switch, vibration, front	
		S13	009	2	Vibrationsschalter Fahrhebel rechts	Switch, vibration, travel lever, rh.	
3	4	S14	014	12	Warnblinkschalter	Switch, hazard light	
		S15	014	3	Beleuchtungsschalter StVZO	Switch, lighting StVZO	
		S20	016	11	Schalter Scheibenwischer vorne	Switch, windscreen wiper, front	
		S21	016	8	Schalter Scheibenwischer hinten	Switch, windscreen wiper, rear	
		S35	009	5	Vibrationsschalter klein/gross	Switch, vibration low/high	
		S36	017	9	Vibrationsschalter	Switch, vibration	
		S37	014	16	Schalter Blinker	Switch, indicator	
4	5	S38	015	3	Schalter Kennleuchte	Switch, warning light	
		S38	016	20	Schalter Kennleuchte	Switch, warning light	
		S42	008	11	Stufenumschalter schnell-langsam	Speed range selector, fast-slow	
		S42	008	16	Stufenumschalter schnell-langsam	Speed range selector, fast-slow	
		S42	010	5	Stufenumschalter schnell-langsam	Speed range selector, fast-slow	
		S44	016	13	Schalter Kabinenluefter	Switch, cabin ventilator	
		S45	016	7	Kabineninnenleuchte	Switch, cabin inside light	
5	6	S53	014	3	Schalter Arbeitsbeleuchtung	Switch, working lights	
		S58	004	7	Schalter Aetherstartanlage	Push button, ether starting unit	
		S65	011	2	Schalter Vibration horizontal/vertikal	Switch, vibration horizontal/vertical	
		S71	010	17	Schalter Lenkung	Switch, steering	
		S102	016	3	Schalter Klimaanlage	Switch air conditioning	
		S104	011	15	Schalter man./autom.	Switch man./autom.	
		S106	011	17	Schalter Verdichtungsenergie	Switch, compaction energy	
6	7	S107	011	16	Schalter Amplitudenverstellung	Switch, amplitt. adjustment	
		S118	005	5	Schalter Fehlerdiagnose	Switch, fault diagnosis	EMR DIAGNOSE
		S11:1-25	012	8			TERRAMETER
		S127	005	4	Schalter Motordrehzahl	Switch, engine rpm	
		S12:1-5	012	8			TERRAMETER
		S130	017	16	Schalter Platten Heben / Senken	Switch, plates lift / let down	
		S131	011	16	Schalter Start	Switch, start	
7	8	S131	013	5	Schalter Start	Switch, start	
		S132	011	16	Schalter Stop	Switch, stop	
		S132	013	6	Schalter Stop	Switch, stop	
		S133	011	17	Schalter Drucken	Switch, print	
		S133	013	6	Schalter Drucken	Switch, print	
		S134	011	18	Schalter Loeschen	Switch, erase	
		S134	013	7	Schalter Loeschen	Switch, erase	
8	9	S139	017	6	Schalter Frequenzverstellung	Switch, frequency control	
		S140	013	7	Schalter Test / Normal	Switch, test mode / standard mode	
		S14:1-5	012	7			TERRAMETER
		S152	012	8	Schalter PD-D	Switch, PD-D	DIP-SCHALTER
		S153	013	7	Papiervorschub	Paper formfeed	
		S157	004	2	Schalter Kraftstoffvorwärmung	Switch, fuel pre-heating	
		S15:3	012	10			TERRAMETER
9	10	S15:4	012	10			TERRAMETER
		S15:5	012	11			TERRAMETER
		S15:7	012	11			TERRAMETER
		S15:8	012	12			TERRAMETER
		S16:1	012	8			TERRAMETER
		S16:2	012	9			TERRAMETER
		S16:3	012	9			TERRAMETER
10	11	S16:6	012	9			TERRAMETER
		S16:7	012	10			TERRAMETER
		S17:1-8	012	8			TERRAMETER
		S18:1	012	12			TERRAMETER
		S18:2	012	12			TERRAMETER
		S18:5	012	13			TERRAMETER
		S18:6	012	13			TERRAMETER
11	12	S18:7	012	14			TERRAMETER
		S18:8	012	13			TERRAMETER
		S19:1-6	012	13			TERRAMETER
		S20:1-9	012	9			TERRAMETER
		S21:1	012	7			TERRAMETER
		S21:5	012	6			TERRAMETER
		S21:6	012	7			TERRAMETER
12	13	S4:1	012	6			TERRAMETER
		S4:2	012	7			TERRAMETER
		S4:3	012	7			TERRAMETER
		S5:1	012	12			TERRAMETER
		S5:2	012	12			TERRAMETER
		S5:3	012	12			TERRAMETER
		S5:4	012	13			TERRAMETER
13	14	S6:1	012	9			TERRAMETER
		S6:2	012	10			TERRAMETER
		S6:3	012	10			TERRAMETER
		S6:4	012	10			TERRAMETER
		S6:5	012	11			TERRAMETER
		S6:6	012	11			TERRAMETER
		S6:9	012	11			TERRAMETER
14	15	S7:1-15	012	8			TERRAMETER
		S8:1-10	012	8			TERRAMETER
		S9:1-5	012	7			TERRAMETER
		V01	010	6	Diode	Diode	DIODENMODUL
		V02	008	16	Diode	Diode	DIODENMODUL
		V03	008	17	Diode	Diode	DIODENMODUL

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		Name	Bl.	Pf.	Benennung	title	TYP
1		V05	003	18	Diode	Diode	DIODENMODUL
		V08	003	14	Diode	Diode	DIODENMODUL
		V09	008	8	Diode	Diode	
2		V09	008	12	Diode	Diode	
		V09	008	16	Diode	Diode	
		V09	008	19	Diode	Diode	
3		V09	009	4	Diode	Diode	
		V09	009	5	Diode	Diode	
		V09	011	9	Diode	Diode	VENTIL
4		V09	011	12	Diode	Diode	LÜTZE
		V09	017	13	Diode	Diode	LÜTZE
		V09	017	17	Diode	Diode	LÜTZE
5		V09	017	19	Diode	Diode	LÜTZE
		V11	016	1	Diode	Diode	WAGO, FE5B
		V12	017	15	Diode	Diode	WAGO, FE5B
6		V13	017	18	Diode	Diode	WAGO, FE5B
		V14	017	12	Diode	Diode	WAGO, FE5B
		V15	016	3	Diode	Diode	FE5B
7		V21	006	2	Diode	Diode	FE5B
		V22	006	2	Diode	Diode	FE5B
		V42	004	6	Diode (A2)	Diode (A2)	FE5B/KABEL
8		X1:1	002	1	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:2	002	2	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:3	002	2	WAGO, E-KASTEN	WAGO, E-BOX	
9		X1:4	002	3	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:5	002	3	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:6	003	10	WAGO, E-KASTEN	WAGO, E-BOX	
10		X1:7	003	10	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:8	003	6	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:9	003	10	WAGO, E-KASTEN	WAGO, E-BOX	
11		X1:S	010	2	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:10	002	19	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:10	009	18	WAGO, E-KASTEN	WAGO, E-BOX	
12		X1:11	003	7	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:12	002	6	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:13	002	6	WAGO, E-KASTEN	WAGO, E-BOX	
13		X1:14	006	9	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:15	006	8	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:16	003	15	WAGO, E-KASTEN	WAGO, E-BOX	
14		X1:17	003	11	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:17	006	12	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:18	006	16	WAGO, E-KASTEN	WAGO, E-BOX	
15		X1:19	006	15	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:20	006	17	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:21	006	14	WAGO, E-KASTEN	WAGO, E-BOX	
16		X1:22	006	16	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:23	006	18	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:24	006	12	WAGO, E-KASTEN	WAGO, E-BOX	
17		X1:25	006	17	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:26	006	19	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:27	006	14	WAGO, E-KASTEN	WAGO, E-BOX	
18		X1:27	016	3	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:28	002	8	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:28	006	12	WAGO, E-KASTEN	WAGO, E-BOX	
19		X1:29	002	10	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:30	006	16	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:31	003	3	WAGO, E-KASTEN	WAGO, E-BOX	
20		X1:31	006	13	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:31	006	18	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:31	008	2	WAGO, E-KASTEN	WAGO, E-BOX	
21		X1:32	002	8	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:32	006	4	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:32	006	14	WAGO, E-KASTEN	WAGO, E-BOX	
22		X1:32	008	9	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:33	008	9	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:34	006	4	WAGO, E-KASTEN	WAGO, E-BOX	
23		X1:35	015	11	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:36	006	5	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:36	008	9	WAGO, E-KASTEN	WAGO, E-BOX	
24		X1:37	002	8	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:37	002	10	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:37	006	5	WAGO, E-KASTEN	WAGO, E-BOX	
25		X1:37	008	6	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:38	009	2	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:40	003	15	WAGO, E-KASTEN	WAGO, E-BOX	
26		X1:41	003	15	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:42	008	7	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:43	008	7	WAGO, E-KASTEN	WAGO, E-BOX	
27		X1:44	008	11	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:44	008	16	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:44	010	5	WAGO, E-KASTEN	WAGO, E-BOX	
28		X1:45	010	6	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:46	003	18	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:48	010	6	WAGO, E-KASTEN	WAGO, E-BOX	
29		X1:50	004	14	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:50	005	7	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:51	008	16	WAGO, E-KASTEN	WAGO, E-BOX	
30		X1:52	010	7	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:54	008	4	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:54	008	11	WAGO, E-KASTEN	WAGO, E-BOX	
31		X1:54	008	18	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:54	010	14	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:54	012	17	WAGO, E-KASTEN	WAGO, E-BOX	
32		X1:55	010	6	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:56	008	11	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:56	008	18	WAGO, E-KASTEN	WAGO, E-BOX	
33		X1:56	010	6	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:57	008	15	WAGO, E-KASTEN	WAGO, E-BOX	

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		Name	Bl.	Pf.	Benennung	title	TYP
1		X1:57	010	5	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:58	003	14	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:58	003	18	WAGO, E-KASTEN	WAGO, E-BOX	
2		X1:58	008	15	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:58	014	3	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:59	010	5	WAGO, E-KASTEN	WAGO, E-BOX	
3		X1:60	010	2	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:61	010	2	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:62	010	2	WAGO, E-KASTEN	WAGO, E-BOX	
4		X1:63	010	8	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:64	010	11	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:65	010	10	WAGO, E-KASTEN	WAGO, E-BOX	
5		X1:65	010	10	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:66	010	10	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:67	010	11	WAGO, E-KASTEN	WAGO, E-BOX	
6		X1:68	010	8	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:69	010	11	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:70	010	11	WAGO, E-KASTEN	WAGO, E-BOX	
7		X1:71	010	5	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:72	010	4	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:73	003	2	WAGO, E-KASTEN	WAGO, E-BOX	
8		X1:73	016	11	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:74	016	11	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:75	016	9	WAGO, E-KASTEN	WAGO, E-BOX	
9		X1:76	015	7	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:77	015	5	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:78	002	12	WAGO, E-KASTEN	WAGO, E-BOX	
10		X1:78	016	7	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:79	016	5	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:7A	003	8	WAGO, E-KASTEN	WAGO, E-BOX	
11		X1:80	002	12	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:81	012	4	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:82	012	2	WAGO, E-KASTEN	WAGO, E-BOX	
12		X1:83	012	2	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:84	010	12	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:84	012	2	WAGO, E-KASTEN	WAGO, E-BOX	
13		X1:85	010	11	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:85	012	2	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:86	010	11	WAGO, E-KASTEN	WAGO, E-BOX	
14		X1:86	012	3	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:87	010	12	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:87	012	3	WAGO, E-KASTEN	WAGO, E-BOX	
15		X1:88	012	7	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:89	012	4	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:8A	003	7	WAGO, E-KASTEN	WAGO, E-BOX	
16		X1:90	012	7	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:91	008	7	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:92	008	7	WAGO, E-KASTEN	WAGO, E-BOX	
17		X1:93	009	5	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:94	009	5	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:94	011	6	WAGO, E-KASTEN	WAGO, E-BOX	
18		X1:95	009	5	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:96	009	5	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:97	014	4	WAGO, E-KASTEN	WAGO, E-BOX	
19		X1:98	014	3	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:99	006	2	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:100	006	1	WAGO, E-KASTEN	WAGO, E-BOX	
20		X1:101	006	3	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:102	006	5	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:103	006	2	WAGO, E-KASTEN	WAGO, E-BOX	
21		X1:103	009	2	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:104	009	2	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:105	006	12	WAGO, E-KASTEN	WAGO, E-BOX	
22		X1:105	008	3	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:106	008	2	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:107	008	4	WAGO, E-KASTEN	WAGO, E-BOX	
23		X1:108	008	2	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:109	010	16	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:110	010	18	WAGO, E-KASTEN	WAGO, E-BOX	
24		X1:111	010	18	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:112	010	19	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:112	017	9	WAGO, E-KASTEN	WAGO, E-BOX	
25		X1:112	017	16	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:113	007	16	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:114	007	18	WAGO, E-KASTEN	WAGO, E-BOX	
26		X1:115	007	3	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:116	007	3	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:116	016	5	WAGO, E-KASTEN	WAGO, E-BOX	
27		X1:116	017	7	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:116	017	11	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:116	017	14	WAGO, E-KASTEN	WAGO, E-BOX	
28		X1:117	007	3	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:117	013	18	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:118	007	3	WAGO, E-KASTEN	WAGO, E-BOX	
29		X1:118	007	17	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:119	007	14	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:120	009	5	WAGO, E-KASTEN	WAGO, E-BOX	
30		X1:121	016	2	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:122	016	3	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:123	016	5	WAGO, E-KASTEN	WAGO, E-BOX	
31		X1:124	016	5	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:125	016	2	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:126	002	9	WAGO, E-KASTEN	WAGO, E-BOX	
32		X1:126	016	4	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:128	014	2	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:129	014	5	WAGO, E-KASTEN	WAGO, E-BOX	
33		X1:130	014	18	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:131	014	19	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:132	014	7	WAGO, E-KASTEN	WAGO, E-BOX	

		Name	Bl.	Pf.	Benennung	title	TYP
1		X1:133	014	9	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:133	014	14	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:169	017	4	WAGO, E-KASTEN	WAGO, E-BOX	
2		X1:170	017	16	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:171	017	16	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:172	017	12	WAGO, E-KASTEN	WAGO, E-BOX	
3		X1:173	017	14	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:174	017	16	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:175	017	18	WAGO, E-KASTEN	WAGO, E-BOX	
4		X1:176	017	9	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:177	017	9	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:178	017	3	WAGO, E-KASTEN	WAGO, E-BOX	
5		X1:179	017	5	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:180	017	11	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:191	004	2	WAGO, E-KASTEN	WAGO, E-BOX	
6		X1:192	004	3	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:193	004	3	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:194	004	7	WAGO, E-KASTEN	WAGO, E-BOX	
7		X1:195	004	7	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:196	004	7	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:200	015	3	WAGO, E-KASTEN	WAGO, E-BOX	
8		X1:201	015	3	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:202	015	3	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:211	005	5	WAGO, E-BOX	Wago, E-BOX	
9		X1:212	005	4	WAGO, E-BOX	Wago, E-BOX	
		X1:213	005	4	WAGO, E-BOX	Wago, E-BOX	
		X1:214	005	5	WAGO, E-BOX	Wago, E-BOX	
10		X1:215	005	6	WAGO, E-BOX	Wago, E-BOX	
		X1:216	005	19	WAGO, E-BOX	Wago, E-BOX	
		X1:217	005	4	WAGO, E-BOX	Wago, E-BOX	
11		X1:221	009	13	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:222.1	009	15	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:222.2	009	15	WAGO, E-KASTEN	WAGO, E-BOX	
12		X1:223.1	009	15	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:223.2	009	15	WAGO, E-KASTEN	WAGO, E-BOX	
		X1:224.1	009	15	WAGO, E-KASTEN	WAGO, E-BOX	
13		X1:224.2	009	14	WAGO, E-KASTEN	WAGO, E-BOX	
		X2:3	011	7	VARIOCONTROL	variocontrol	
		X2:4	011	7	VARIOCONTROL	variocontrol	
14		X2:5	011	7	VARIOCONTROL	variocontrol	
		X2:5	011	13	VARIOCONTROL	variocontrol	
		X2:5	015	16	VARIOCONTROL	variocontrol	
15		X2:6	011	2	VARIOCONTROL	variocontrol	
		X2:7	011	2	VARIOCONTROL	variocontrol	
		X2:8	011	11	VARIOCONTROL	variocontrol	
16		X2:9	011	3	VARIOCONTROL	variocontrol	
		X2:9	012	16	VARIOCONTROL	variocontrol	
		X2:10	011	11	VARIOCONTROL	variocontrol	
17		X2:11	011	3	VARIOCONTROL	variocontrol	
		X2:12	011	18	VARIOCONTROL	variocontrol	
		X2:13	011	18	VARIOCONTROL	variocontrol	
18		X2:14	011	17	VARIOCONTROL	variocontrol	
		X2:15	011	18	VARIOCONTROL	variocontrol	
		X2:16	011	17	VARIOCONTROL	variocontrol	
19		X2:17	011	17	VARIOCONTROL	variocontrol	
		X2:1A	011	12	VARIOCONTROL	variocontrol	
		X2:1E	011	12	VARIOCONTROL	variocontrol	
20		X2:20	011	6	VARIOCONTROL	variocontrol	
		X2:21	011	8	VARIOCONTROL	variocontrol	
		X2:22	011	9	VARIOCONTROL	variocontrol	
21		X2:23	011	9	VARIOCONTROL	variocontrol	
		X2:24	011	9	VARIOCONTROL	variocontrol	
		X2:25	011	9	VARIOCONTROL	variocontrol	
22		X2:2A	011	13	VARIOCONTROL	variocontrol	
		X2:2E	011	13	VARIOCONTROL	variocontrol	
		X2:31	011	5	VARIOCONTROL	variocontrol	
23		X2:31	011	14	VARIOCONTROL	variocontrol	
		X2:31	011	17	VARIOCONTROL	variocontrol	
		X2:31	011	17	VARIOCONTROL	variocontrol	
24		X2:32	011	14	VARIOCONTROL	variocontrol	
		X2:32	011	17	VARIOCONTROL	variocontrol	
		X2:32	011	17	VARIOCONTROL	variocontrol	
25		X2:33	011	16	VARIOCONTROL	variocontrol	
		X2:34	011	16	VARIOCONTROL	variocontrol	
		X2:35	011	15	VARIOCONTROL	variocontrol	
26		X2:36	011	16	VARIOCONTROL	variocontrol	
		X2:37	011	16	VARIOCONTROL	variocontrol	
		X2:38	011	2	VARIOCONTROL	variocontrol	
27		X2:39	011	2	VARIOCONTROL	variocontrol	
		X2:40	011	9	VARIOCONTROL	variocontrol	
		X2:41	011	2	VARIOCONTROL	variocontrol	
28		X2:42	011	5	VARIOCONTROL	variocontrol	
		X2:43	015	16	VARIOCONTROL	variocontrol	
		X2:44	015	16	VARIOCONTROL	variocontrol	
29		X2:45	011	12	VARIOCONTROL	variocontrol	
		X2:46	011	13	VARIOCONTROL	variocontrol	
		X2:47	011	2	VARIOCONTROL	variocontrol	
30		X2:48	011	20	VARIOCONTROL	variocontrol	
		X2:49	011	6	VARIOCONTROL	variocontrol	
		X2:50	012	15	VARIOCONTROL	variocontrol	
31		X2:51	015	16	VARIOCONTROL	variocontrol	
		X2:52	011	8	VARIOCONTROL	variocontrol	
		X2:53	011	8	VARIOCONTROL	variocontrol	
32		X2:54	011	7	VARIOCONTROL	variocontrol	
		X2:55	011	16	VARIOCONTROL	variocontrol	
		X2:56	011	16	VARIOCONTROL	variocontrol	
33		X2:57	011	9	VARIOCONTROL	variocontrol	
		X2:58	011	10	VARIOCONTROL	variocontrol	
		X2:59	011	3	VARIOCONTROL	variocontrol	

		Name	Bl.	Pf.	Benennung	title	TYP
1		X2:60	011	4	VARIOCONTROL	variocontrol	
		X2:61	011	5	VARIOCONTROL	variocontrol	
		X2:62	011	5	VARIOCONTROL	variocontrol	
2		X2:63	011	13	VARIOCONTROL	variocontrol	
		X2:64	011	7	VARIOCONTROL	variocontrol	
		X2:66	011	9	VARIOCONTROL	variocontrol	
3		X2:67	011	10	VARIOCONTROL	variocontrol	
		X2:68	011	7	VARIOCONTROL	variocontrol	
		X2:69	011	4	VARIOCONTROL	variocontrol	
4		X2:70	011	4	VARIOCONTROL	variocontrol	
		X2:71	011	7	VARIOCONTROL	variocontrol	
		X2:72	011	6	VARIOCONTROL	variocontrol	
5		X2:72	011	10	VARIOCONTROL	variocontrol	
		X2:73	011	14	VARIOCONTROL	variocontrol	
		X2:74	011	14	VARIOCONTROL	variocontrol	
6		X2:75	011	15	VARIOCONTROL	variocontrol	
		X2:76	011	16	VARIOCONTROL	variocontrol	
		X2:77	011	16	VARIOCONTROL	variocontrol	
7		X2:78	011	17	VARIOCONTROL	variocontrol	
		X2:79	011	19	VARIOCONTROL	variocontrol	
		X2:80	011	19	VARIOCONTROL	variocontrol	
8		X2:81	011	19	VARIOCONTROL	variocontrol	
		X2:82	011	20	VARIOCONTROL	variocontrol	
		X2:83	011	19	VARIOCONTROL	variocontrol	
9		X2:101	011	17	VARIOCONTROL	variocontrol	
		X2:102	011	18	VARIOCONTROL	variocontrol	
		X2:103	011	13	VARIOCONTROL	variocontrol	
10		X2:104	011	10	VARIOCONTROL	variocontrol	
		X2:105	011	11	VARIOCONTROL	variocontrol	
		X2:106	011	10	VARIOCONTROL	variocontrol	
11		X2:107	015	16	VARIOCONTROL	variocontrol	
		X2:108	015	16	VARIOCONTROL	variocontrol	
		X3:1	011	8	WEIDMÜLLER, BANDAGE	Weidmueller drum	
12		X3:2	011	8	WEIDMÜLLER, BANDAGE	Weidmueller drum	
		X3:3	011	8	WEIDMÜLLER, BANDAGE	Weidmueller drum	
		X3:4	011	8	WEIDMÜLLER, BANDAGE	Weidmueller drum	
13		X3:5	011	10	WEIDMÜLLER, BANDAGE	Weidmueller drum	
		X3:6	011	6	WEIDMÜLLER, BANDAGE	Weidmueller drum	
		X3:7	011	9	WEIDMÜLLER, BANDAGE	Weidmueller drum	
14		X3:8	011	10	WEIDMÜLLER, BANDAGE	Weidmueller drum	
		X3:9	011	7	WEIDMÜLLER, BANDAGE	Weidmueller drum	
		X3:11	011	7	WEIDMÜLLER, BANDAGE	Weidmueller drum	
15		X3:12	011	3	WEIDMÜLLER, BANDAGE	Weidmueller drum	
		X3:13	011	4	WEIDMÜLLER, BANDAGE	Weidmueller drum	
		X3:14	011	5	WEIDMÜLLER, BANDAGE	Weidmueller drum	
16		X3:15	011	5	WEIDMÜLLER, BANDAGE	Weidmueller drum	
		X3:16	011	13	WEIDMÜLLER, BANDAGE	Weidmueller drum	
		X3:17	011	3	WEIDMÜLLER, BANDAGE	Weidmueller drum	
17		X3:18	011	5	WEIDMÜLLER, BANDAGE	Weidmueller drum	
		X3:19	011	13	WEIDMÜLLER, BANDAGE	Weidmueller drum	
		X4:1	010	8	AMP, POTI FAHRHEBEL	AMP, poti travel lever	
18		X4:2	010	9	AMP, POTI FAHRHEBEL	AMP, poti travel lever	
		X4:3	010	9	AMP, POTI FAHRHEBEL	AMP, poti travel lever	
		X5:1	006	14	AMP, WARNSUMMER	AMP, buzzer	
19		X5:2	006	14	AMP, WARNSUMMER	AMP, buzzer	
		X6:1	008	1	AMP FAHRHEBEL	AMP, travel lever	
		X6:2	008	2	AMP FAHRHEBEL	AMP, travel lever	
20		X6:3	008	2	AMP FAHRHEBEL	AMP, travel lever	
		X7:1	008	3	AMP FAHRHEBEL	AMP, travel lever	
		X7:2	008	4	AMP FAHRHEBEL	AMP, travel lever	
21		X7:3	008	4	AMP FAHRHEBEL	AMP, travel lever	
		X8:1	009	2	AMP FAHRHEBEL	AMP, travel lever	
		X8:2	009	2	AMP FAHRHEBEL	AMP, travel lever	
22		X9:1	008	9	AMP WARNSUMMER	AMP, buzzer	
		X9:2	008	9	AMP WARNSUMMER	AMP, buzzer	
		XS	002	19	Steckdose	Socket	
23		XS	002	19	Steckdose	Socket	
		X10:1-19	013	16	ANSCHLUßSTECKER BCM	connector BCM	
24		X11:1	011	19	SCHALTBAU DIAGNOSE	Schaltbau diagnosis	
		X11:2	011	18	SCHALTBAU DIAGNOSE	Schaltbau diagnosis	
		X11:3	011	18	SCHALTBAU DIAGNOSE	Schaltbau diagnosis	
25		X11:4	011	19	SCHALTBAU DIAGNOSE	Schaltbau diagnosis	
		X11:5	011	19	SCHALTBAU DIAGNOSE	Schaltbau diagnosis	
		X11:6	011	20	SCHALTBAU DIAGNOSE	Schaltbau diagnosis	
26		X11:7	011	20	SCHALTBAU DIAGNOSE	Schaltbau diagnosis	
		X11:8	011	7	SCHALTBAU DIAGNOSE	Schaltbau diagnosis	
		X11:9	011	9	SCHALTBAU DIAGNOSE	Schaltbau diagnosis	
27		X11:10	011	10	SCHALTBAU DIAGNOSE	Schaltbau diagnosis	
		X11:11	011	17	SCHALTBAU DIAGNOSE	Schaltbau diagnosis	
		X11:12	011	17	SCHALTBAU DIAGNOSE	Schaltbau diagnosis	
28		X11:13	011	18	SCHALTBAU DIAGNOSE	Schaltbau diagnosis	
		X11:14	011	7	SCHALTBAU DIAGNOSE	Schaltbau diagnosis	
		X11:15	011	7	SCHALTBAU DIAGNOSE	Schaltbau diagnosis	
29		X11:16	011	7	SCHALTBAU DIAGNOSE	Schaltbau diagnosis	
		X11:17	011	8	SCHALTBAU DIAGNOSE	Schaltbau diagnosis	
		X11:18	011	8	SCHALTBAU DIAGNOSE	Schaltbau diagnosis	
30		X11:19	011	6	SCHALTBAU DIAGNOSE	Schaltbau diagnosis	
		X12:2	011	14	AMP, SCHALTER	AMP, switch	
		X12:3	011	16	AMP, SCHALTER	AMP, switch	
31		X12:4	011	14	AMP, SCHALTER	AMP, switch	
		X12:5	011	16	AMP, SCHALTER	AMP, switch	
		X12:6	011	16	AMP, SCHALTER	AMP, switch	
32		X15:1	017	4	PLATTEN KUPPLUNG ANBA	plates clutch assembling unit	
		X15:1	017	5	PLATTEN KUPPLUNG MASC	plates clutch, machine	
		X15:2	017	4	PLATTEN KUPPLUNG ANBA	plates clutch assembling unit	
33		X15:2	017	5	PLATTEN KUPPLUNG MASC	plates clutch, machine	
		X16:1	017	3	AMP, SENSOR	AMP, sensor	
		X16:2	017	3	AMP, SENSOR	AMP, sensor	
34		X16:3	017	2	AMP, SENSOR	AMP, sensor	

		Name	Bl.	Pf.	Benennung	title	TYP
1	2	X17-1:1	006	16	MOTORSTECKER MOTOR	engine plug, engine side	
		X17-1:2	006	9	MOTORSTECKER MOTOR	engine plug, engine side	
		X17-1:3	002	6	MOTORSTECKER MOTOR	engine plug, engine side	
		X17-1:4	002	6	MOTORSTECKER MOTOR	engine plug, engine side	
		X17-1:6	003	15	MOTORSTECKER MOTOR	engine plug, engine side	
		X17-1:7	006	8	MOTORSTECKER MOTOR	engine plug, engine side	
		X17-1:8	006	15	MOTORSTECKER MOTOR	engine plug, engine side	
		X17-2:2	006	17	MOTORSTECKER MOTOR	engine plug, engine side	
		X17-2:3	003	10	MOTORSTECKER MOTOR	engine plug, engine side	
		X17-2:4	003	10	MOTORSTECKER MOTOR	engine plug, engine side	
		X17-2:5	003	8	MOTORSTECKER MOTOR	engine plug, engine side	
		X17-2:6	003	7	MOTORSTECKER MOTOR	engine plug, engine side	
		X17-2:8	003	11	MOTORSTECKER MOTOR	engine plug, engine side	
		X18-1:1	002	6	MOTORSTECKER MASCH.	engine plug, machine side	
		X18-1:2	002	6	MOTORSTECKER MASCH.	engine plug, machine side	
		X18-1:3	006	9	MOTORSTECKER MASCH.	engine plug, machine side	
		X18-1:4	006	16	MOTORSTECKER MASCH.	engine plug, machine side	
		X18-1:5	006	15	MOTORSTECKER MASCH.	engine plug, machine side	
		X18-1:6	006	8	MOTORSTECKER MASCH.	engine plug, machine side	
		X18-1:7	003	15	MOTORSTECKER MASCH.	engine plug, machine side	
		X18-2:1	003	10	MOTORSTECKER MASCH.	engine plug, machine side	
3	4	X18-2:2	003	10	MOTORSTECKER MASCH.	engine plug, machine side	
		X18-2:3	006	17	MOTORSTECKER MASCH.	engine plug, machine side	
		X18-2:5	003	11	MOTORSTECKER MASCH.	engine plug, machine side	
		X18-2:7	003	7	MOTORSTECKER MASCH.	engine plug, machine side	
		X18-2:8	003	8	MOTORSTECKER MASCH.	engine plug, machine side	
		X19:1	017	7	AMP POTI PLATTEN	APM poti vibration plates	
		X19:2	017	7	AMP POTI PLATTEN	APM poti vibration plates	
		X19:3	017	6	AMP POTI PLATTEN	APM poti vibration plates	
		X20:1	011	16	AMP POTI S107	AMP poti S107	
		X20:2	011	16	AMP POTI S107	AMP poti S107	
		X20:3	011	16	AMP POTI S107	AMP poti S107	
		X21:1	011	17	AMP POTI S106	AMP poti S106	
		X21:2	011	17	AMP POTI S106	AMP poti S106	
		X21:3	011	17	AMP POTI S106	AMP poti S106	
		X22:1	014	2	STECKER SCHEINW. STVZ	connector head lights StvZO	
		X22:2	014	2	STECKER SCHEINW. STVZ	connector head lights StvZO	
		X23:1	014	2	STECKER SCHEINW. STVZ	connector head lights StvZO	
		X23:2	014	2	STECKER SCHEINW. STVZ	connector head lights StvZO	
		X24:1	014	5	STECKER SCHLUßLEUCHTE	connector tail lights	
		X24:2	014	18	STECKER SCHLUßLEUCHTE	connector tail lights	
5	6	X24:3	014	5	STECKER SCHLUßLEUCHTE	connector tail lights	
		X25:1	014	6	STECKER PARKLEUCHTE	connector parking lights	
		X25:2	014	6	STECKER PARKLEUCHTE	connector parking lights	
		X25:3	014	17	STECKER PARKLEUCHTE	connector parking lights	
		X26:1	014	6	STECKER PARKLEUCHTE	connector parking lights	
		X26:2	014	6	STECKER PARKLEUCHTE	connector parking lights	
		X26:3	014	19	STECKER PARKLEUCHTE	connector parking lights	
		X27:1	014	19	STECKER SCHLUßLEUCHTE	connector tail lights	
		X27:2	014	7	STECKER SCHLUßLEUCHTE	connector tail lights	
		X27:3	014	7	STECKER SCHLUßLEUCHTE	connector tail lights	
		X30:1	016	9	WISCHER HINTEN	connector wiper rear	
		X30:2	016	8	WISCHER HINTEN	connector wiper rear	
		X30:3	016	8	STECKER WISCHER HINTE	connector wiper rear	
		X30:3	016	8	WISCHER HINTEN	connector wiper rear	
		X31:1	016	12	WISCHER VORN	connector wiper front	
		X31:2	016	11	WISCHER VORN	connector wiper front	
		X31:3	016	11	WISCHER VORN	connector wiper front	
		X31:4	016	10	WISCHER VORN	connector wiper front	
		X32:1	016	7	STECKER INNENLEUCHTE	connector inside light, cabin	
		X32:2	016	7	STECKER INNENLEUCHTE	connector inside light, cabin	
7	8	X33:1	016	14	STECKER LÜFTER	connector blower	
		X33:2	016	14	STECKER LÜFTER	connector blower	
		X33:3	016	14	STECKER LÜFTER	connector blower	
		X34:1	016	3	STECKER KLIMAANL. KAB	connector air cond. cabin	
		X34:2	016	3	STECKER KLIMAANL. KAB	connector air cond. cabin	
		X34:3	016	5	STECKER KLIMAANL. KAB	connector air cond. cabin	
		X35:1	004	7	DEUTSCH 2-POL	connector DEUTSCH 2-pol	
		X35:2	004	7	DEUTSCH 2-POL	connector DEUTSCH 2-pol	
		X35:A	003	15	MOTORSTECKER MOTOR	engine plug, engine side	
		X35:B	003	15	HUBMAGNETSTECKER	connector shut-off-solenoid	
		X35:C	003	15	MOTORSTECKER MOTOR	engine plug, engine side	
		X36:2-8	002	16	DIAGNOSESTECKER HEIZU	connector heater-diagnosis	
		X37:1	002	14	STECKER KRAFTSTOFFPUM	connector fuel-pump	
		X37:2	002	14	STECKER KRAFTSTOFFPUM	connector fuel-pump	
		X38:1	011	19	VARIOCONTROL	variocontrol	
		X38:2	011	19	VARIOCONTROL	variocontrol	
		X38:3	011	19	VARIOCONTROL	variocontrol	
		X38:4	011	19	VARIOCONTROL	variocontrol	
		X38:5	011	19	VARIOCONTROL	variocontrol	
		X39:1	005	15	Stecker Motor	connector engine	
9	10	X39:2	005	13	Stecker Motor	connector engine	
		X39:3	005	14	Stecker Motor	connector engine	
		X39:4	005	13	Stecker Motor	connector engine	
		X39:5	005	14	Stecker Motor	connector engine	
		X39:6	005	15	Stecker Motor	connector engine	
		X39:6	005	15	Stecker Motor	connector engine	
		X39:8	005	12	Stecker Motor	connector engine	
		X39:9	005	12	Stecker Motor	connector engine	
		X39:10	005	7	Stecker Motor	connector engine	
		X39:11	005	8	Stecker Motor	connector engine	
		X39:12	005	6	Stecker Motor	connector engine	
		X39:13	005	7	Stecker Motor	connector engine	
		X39:14	005	8	Stecker Motor	connector engine	
		X39:15	005	9	Stecker Motor	connector engine	
		X39:16	005	10	Stecker Motor	connector engine	
		X39:17	005	9	Stecker Motor	connector engine	
		X39:18	005	9	Stecker Motor	connector engine	
		X39:19	005	10	Stecker Motor	connector engine	
		X39:19	005	10	Stecker Motor	connector engine	

component listing

Bauteilliste

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page: 8von: 10
from: 10Blatt Nr.:
sheet no.: 108

582 700 89

			Name	Bl.	Pf.	Benennung	title	TYP
Gez.: 17.06.2002 Name: Seis Gepr.: 17.06.2002 Name: Werner	1	XS16:2	013	6	Druckercontroller	Printer-controller		
		XS16:3	013	6	Druckercontroller	Printer-controller		
		XS16:4	013	5	Druckercontroller	Printer-controller		
		XS16:5	013	5	Druckercontroller	Printer-controller		
		XS16:6	013	5	Druckercontroller	Printer-controller		
	2	Y01	003	11	Magnetventil Startmehrmenge	Solenoid valve, start boost fuel		
		Y04	008	7	Magnetventil Bremse	Solenoid valve, brake	MAX. 1,8A	
		Y07	009	5	Magnetventil Vibration vorne gross	Solenoid valve, vibration, front, high	MAX. 2,5A	
		Y08	009	6	Magnetventil Vibration vorne klein	Solenoid valve, vibration, front, low	MAX. 2,5A	
		Y13	003	15	Hubmagnet Motor	Shut off solenoid, engine	1,1A/55A	
	3	Y13	003	16	Hubmagnet Motor	Shut off solenoid, engine	4A	
		Y14	002	15	Kraftstoffpumpe Heizgeraet	Fuel pump, heating unit		
		Y15	016	2	Magnetkupplung Klimakompressor	Magnetic clutch, air conditioning compr.	3,5A	
		Y22	011	9	Magnetventil Vibration	Solenoid valve, vibration		
		Y30	008	15	Magnetventil Stufenumschaltung vorn	Solenoid valve, speed range sel., front	1,23A/1,67A	
	4	Y30	010	5	Magnetventil Stufenumschaltung vorn	Solenoid valve, speed range sel., front	1,23A/1,67A	
		Y31	008	11	Magnetventil Stufenumschaltung hinten	Solenoid valve, speed range sel., rear	MAX. 1,23A	
		Y31	008	18	Magnetventil Stufenumschaltung hinten	Solenoid valve, speed range sel., rear	MAX. 1,23A	
		Y31	010	6	Magnetventil Stufenumschaltung hinten	Solenoid valve, speed range sel., rear	MAX. 1,23A	
		Y58	003	17	Magnetventil Kraftstoffabschaltung	Solenoid valve, fuel switch off	0,8A	
5	Y59	004	7	Magnetventil Aetherstartanlage	Solenoid valve, ether starting unit			
	Y64	010	18	Magnetventil Lenkung	Solenoid valve, steering	0,33A		
	Y98	017	9	Magnetventil Vibrationsfrequenz, hinten	Solenoid valve, vibrat.freq.,rear			
	Y117	003	7	Kaltstartbeschleuniger	cold starting unit	3A		
	Y119	011	13	Magnetventil Arretierung	Solenoid valve, adjustment			
6	Y122	017	12	Magnetventil Platten heben	Solenoid valve, lift plates	2,5A		
	Y123	017	18	Magnetventil Platten senken	Solenoid valve, let down plates	2,5A		
	Y124	017	16	Magnetventil Hydraulikumschaltung	Solenoid valve, hydraulic switch over	2,5A		
	Y125	011	3	Einlassventil 1	Intake valve 1			
	Y126	011	5	Einlassventil 3	Intake valve 3			
7	Y127	011	5	Auslassventil 2	Exhaust valve 2			
	Y128	011	4	Auslassventil 4	Exhaust valve 4			
	Y137	005	9	EMR Verstellung	EMR adjustment			
8								
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Gez.: 17.06.2002
Name: Seis
Gepr.: 17.06.2002
Name: Werner

Bauteilliste
component listing

Seite: 10 von: 10
Ers.f.:
Replaces:
Blatt Nr.: 582 700 89
Sheet no.: 110

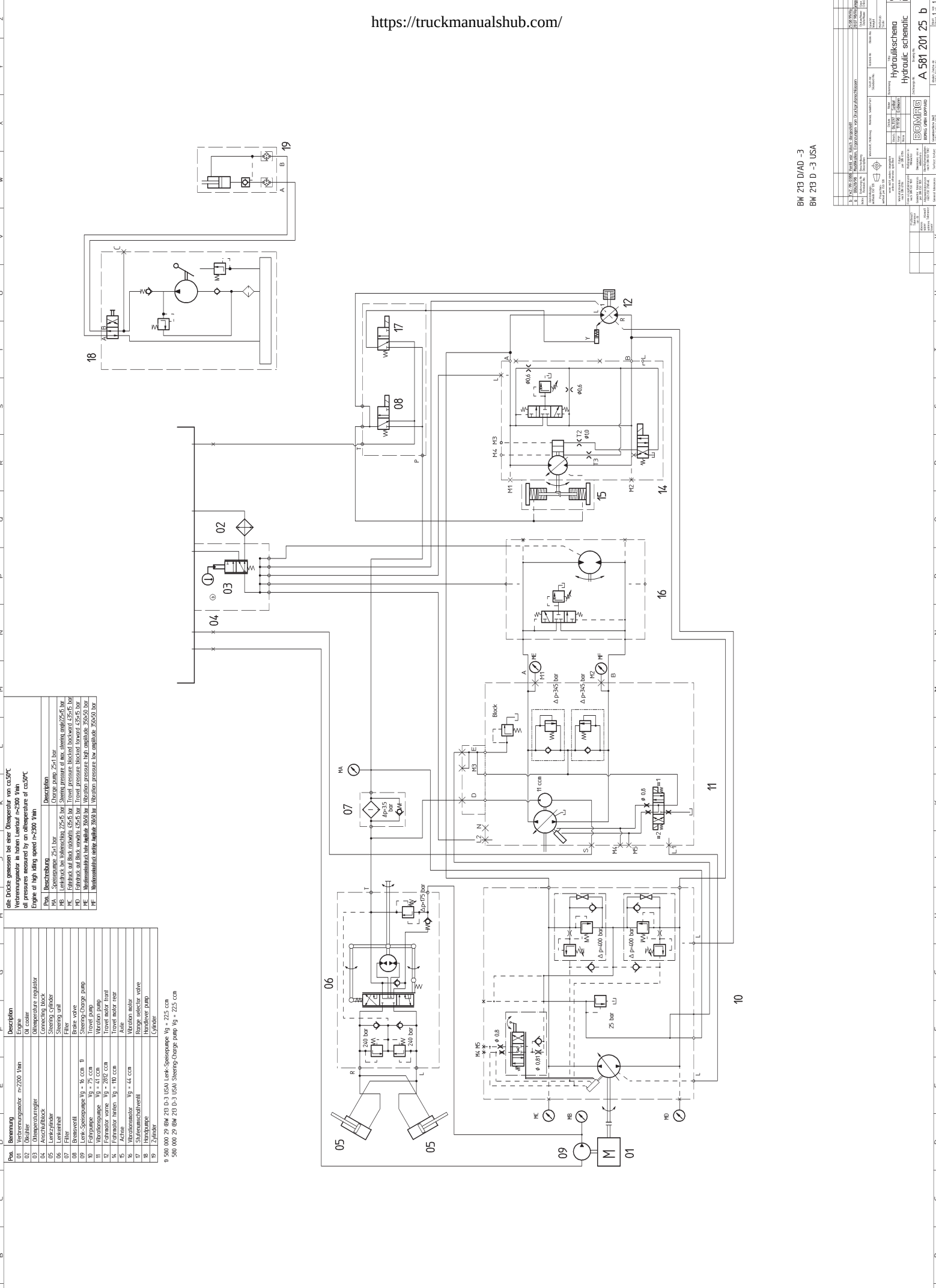


alle Drücke gemessen bei einer Öltemperatur von ca.50°C	
Verdrichtungsdruck in hohen Lasten n=2300 1/min	
all pressures measured by an oil temperature of ca.50°C	
Engine at high idling speed n=2300 1/min	
Pos.	Beschreibung
MA	Speisepumpe 2x1 bar
MB	Leitwerk bei Volllast 25-5 bar
MC	Leitwerk bei Blockade 5-6 bar
MD	Leitwerk bei Volllast 5-6 bar
ME	Leitwerk bei Blockade 5-6 bar
MF	Unterdruck bei Volllast 5-6 bar
MG	Unterdruck bei Blockade 5-6 bar
MH	Unterdruck bei Volllast 5-6 bar
MI	Unterdruck bei Blockade 5-6 bar

Pos.	Beschreibung	Description
01	Verdrichtungsdruck n=2300 1/min	Engine
02	Öltemperatur	Oil cooler
03	Öltemperaturregler	Temperature regulator
04	Anschlußblock	Connecting block
05	Leitwerk	Steering cylinder
06	Leitwerk	Steering cylinder
07	Filter	Filter
08	Brakeventil	Brake valve
09	Leitwerk-Speisepumpe Vg = 16 cm³/min	Steering charge pump
10	Leitwerk-Speisepumpe Vg = 75 cm³/min	Steering pump
11	Leitwerk-Speisepumpe Vg = 285 cm³/min	Steering pump
12	Leitwerk-Speisepumpe Vg = 285 cm³/min	Steering pump
13	Leitwerk-Speisepumpe Vg = 285 cm³/min	Steering pump
14	Leitwerk-Speisepumpe Vg = 285 cm³/min	Steering pump
15	Leitwerk-Speisepumpe Vg = 285 cm³/min	Steering pump
16	Leitwerk-Speisepumpe Vg = 285 cm³/min	Steering pump
17	Leitwerk-Speisepumpe Vg = 285 cm³/min	Steering pump
18	Leitwerk-Speisepumpe Vg = 285 cm³/min	Steering pump
19	Leitwerk-Speisepumpe Vg = 285 cm³/min	Steering pump

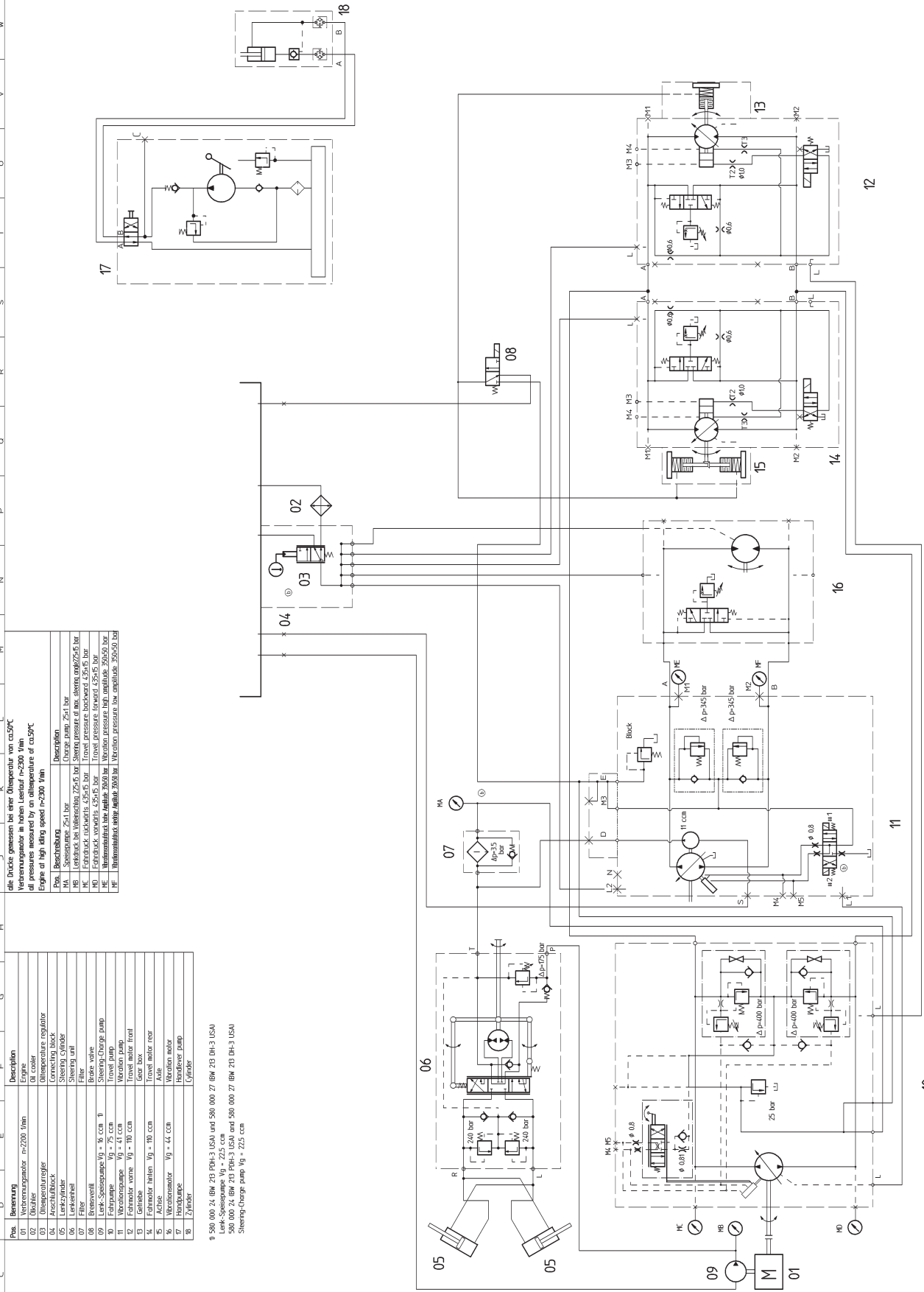
9 580 000 29 BW 213 D-3 USA Steering-Charge pump Vg = 225 cm³/min
580 000 29 BW 213 D-3 USA Steering-Charge pump Vg = 225 cm³/min

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BW 213 D/AD -3
BW 213 D -3 USA

BOMBAH	
Hydraulikschema	
Hydraulic schematic	
A 581 201 25 b	
Date: 1.1.2000	
Author: BOMBAH	
Version: 1.0	
Drawing: 1.0	
Scale: 1:1	
Material: Steel	
Surface: Polished	
Tolerance: ±0.1 mm	
Weight: 1.5 kg	
Price: 1.500,-	
Contact: BOMBAH	
Address: 1.1.2000	
Phone: 1.1.2000	
Fax: 1.1.2000	
E-Mail: 1.1.2000	
Web: 1.1.2000	
1.1.2000	

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BW 213 DH/DPH -3
BW 213 DH/DPH -3 USA
BW 214 DH/DPH -3
BW 216 D/TH/DPH -3

