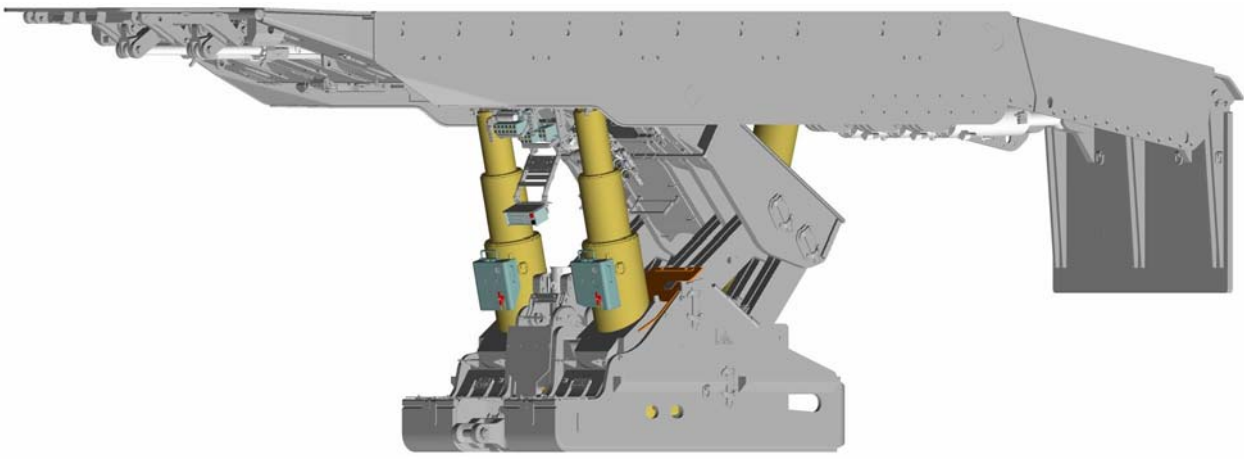
Operating manual

Shield support 2400/4300-3x5330-2050

Doc. No.: 7420 245 000 BA 00

Translation of the original operating manual



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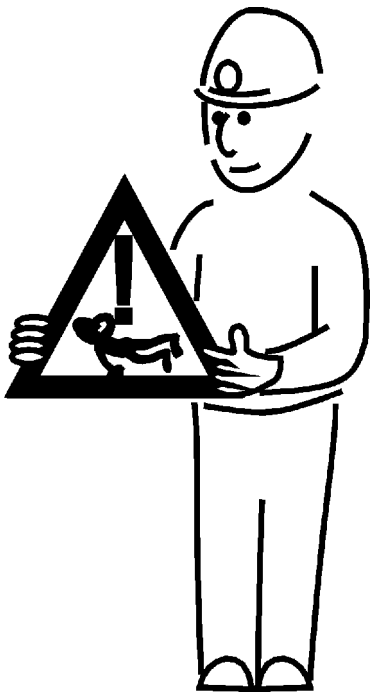
2 Your safety



For raising the conveyor, use only the following::

- High-strength, undamaged chain slings.
- The lifting points provided for the purpose.
  Check that the lifting points are undamaged before attaching the load.
- Lifting gear of adequate load-carrying capacity.

Maintenance

Make sure that all safety and protective equipment of the shield units is complete and in working order. If the safety and protective equipment is included in the Caterpillar scope of delivery, refer to chapter 6, “Technical data”, for its location.

Be sure to observe the intervals specified for maintenance and inspection. See chapter 5, section “Maintenance”.

Check the shield at least once every shift for externally visible damage.

Inform the supervisory personnel and the face crew about maintenance and repair work. Provide them with information on the intended work and its probable duration.

Cordon off your working area over a wide range to avoid endangering other persons.

Immediately replace damaged components relevant for safety. Shut down the affected shield immediately if component damage creates a hazard and immediate repair is not possible. If there is a safety hazard, secure this area and notify the entire face crew and responsible superiors without delay.

Use only spare parts which comply with the specified technical requirements. This is best ensured by using original Caterpillar spare parts.
Please refer to the spare parts catalogue provided for the equipment for the order numbers for the required spare parts.

Do not make any modifications or changes which might impair the safety of the shield. Caterpillar must be informed of all changes and modifications to check whether they have any effect on the approval or whether it is necessary to apply for a revised approval. Any modifications carried out without authorization invalidate the Caterpillar declaration of conformity and a new conformity test will be required.

During work on the relay bar assembly, cordon off the working area for the mining equipment.

Transport

Load units, dimensions and weights

Make sure to pay attention to the transport sheet. It includes information on:

- dimensions
- weight
- lifting points
- centers of gravity.

The load units are provided with suitable lifting points for transport and installation as far as technically possible.

Warning!
Only use load handling devices which comply with the technical and legal regulations for transporting loads.
Falling components can cause serious injury and death.
Only use suitable load handling devices.

Before transport

temperatures below freezing

Before transporting the equipment at temperatures below freezing, all hydraulic components that are operated with emulsion (HFAE or HFAS) must be completely drained and filled with a corrosion inhibitor (e.g. CV 50).

It is only permitted to transport equipment at temperatures of -21°C to -40°C if certain requirements for these conditions have been taken into account during the design and production of the equipment. Nevertheless, the individual parts and devices of this equipment must not be subjected to sudden loads at such low temperatures and may only be loaded statically or quasi-statically.

During transport of this equipment with mobile handling systems at such low temperatures, measures must also be taken to ensure that the parts and devices are not subjected to sudden impact loads.
At very low temperatures and on roads in bad condition, the transport vehicle's speed must therefore be limited to a maximum of 25 km/h for truck transport.

electrical and electronic components

Electrical and electronic components must be removed for overseas transport or prolonged storage outdoors,
unless these components or the entire equipment are protected against harmful environmental influences by suitable packaging.
The electrical cables remain in the equipment. They must be protected carefully from transport damage and the connectors must be protected from dirt.

Installation

In this chapter, you will be given information about installing the shield units. Please pay special attention to the warnings and tips.

Warning!
In addition to the safety instructions given in this manual, also make sure you observe the special safety instructions and operation instructions which apply to the operation of the mine. Failure to do so can lead to extremely serious accidents which may be fatal.

Caution!
Before the hydraulic lines are connected with one another, the sockets and nipples of the plug-in connections must be treated with the molybdenum disulfide-free B3 lubricating paste in accordance with EWN 7068. See chapter 6, section “Grease and lubricating pastes”.

Caution!
All slide surfaces must be treated with the molybdenum disulfide-free B6 lubricating paste in accordance with EWN 7068 before the transport units of the steel structure are connected with one another. See chapter 6, section “Grease and lubricating pastes”.

Preassembly of the shield units

The shield units are delivered completely preassembled. Accordingly, no further pre-assembly is required on the mechanical and hydraulic systems of the shield units.

Installation of the shield units

Caution!
For underground transportation, only those lifting points may be used which are described in detail in chapter 3 “Transport”. Failure to comply can lead to personal injury and damage to property.

Further information about this can be found in chapter 3 “Transport”.

installation plan

The shield units are installed in the face according to the installation plan of the mine.

Important!
When installing the shields in the face, be sure to pay attention to the shield numbers. Since some shield units may be equipped with different functions, their setup on the face is not arbitrary!

identification for installation in the face

In order to identify the shield units or their transport units more easily for the purpose of assembling and installing them in the face, they should be labeled with a consecutive number. The numbers should correspond to the order in which the shield units are to be arranged in the face, for example. The numbers should be written in color so that they are clearly visible on the surface of the parts.

- Hydraulic system:

☞ Check the entire hydraulic system for leaks. Seal any leaky connections immediately.

☞ In particular, check whether the hinges and hoses can be damaged due to movements of the shields.

Danger!
Damaged hoses can burst and hydraulic fluid can escape under high pressure.
As a result, you or others could be seriously injured or even killed.
Make sure that hydraulic hoses cannot be damaged by movements of the shield.
Lay the hydraulic hoses correctly behind the brackets provided for them.

☞ Check the hydraulic supply pressure.

☞ Check the load-carrying function of the legs. The current pressure under the piston of a leg can be queried on the PMC®-R control unit. Here, you can query the pressure for a neighboring support or the support in which you are currently located. The pressure gauge on the leg control valve of the leg indicates the pressure directly.

☞ Check all operating elements to make sure they are working properly. Test whether the function is correctly executed when the corresponding operating element is activated.

- Signaling and lighting systems, information signs:

Important!
For further information, please see the corresponding separate operating manual of the respective manufacturer.

☞ Check all signaling devices.

☞ Make sure that the face lighting is sufficient.

☞ Check whether the face area, especially the travel way, is sufficiently marked with signs. It is imperative that you observe the regulations of the responsible mines inspectorate.

- EMERGENCY STOP systems:

☞ Check that all EMERGENCY STOP systems are working properly.

- Mining and conveying:

☞ Before commissioning, check all functions of the face system.

☞ Test to make sure the entire face system (mining equipment, conveying system, supports) is working perfectly.

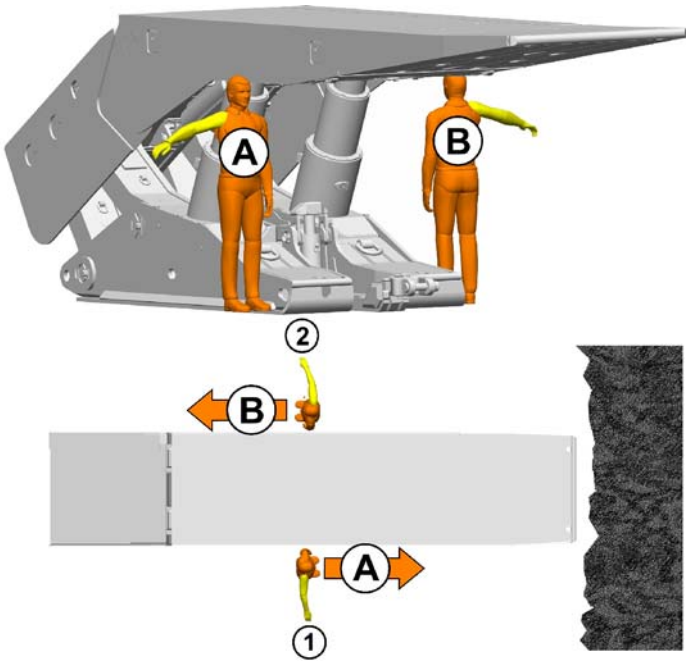
Warning!
Bent support canopies must not project into the mining area.

Operation of the shield support

definition of viewing direction

In the following figure, the sides are defined on a support shield. If the right or left side is named in the following document, the view toward the coal face is considered to be standard.

Fig. 22: Definition of viewing direction, schematic diagram



A looking toward coal face
B looking toward gob
1 right side, face side
2 right side, gob side

general

Well-trained operating personnel, knowledge of and compliance with the safety regulations, as well as the operating instructions listed below largely prevent dangerous situations from arising, and are good preconditions for the fail-safe interaction of the support and mining within the face system.

If the support is equipped with an electrohydraulic shield control, it is imperative that the operator is familiar with the separate operating manual for this control system.

The shield units must always be set until the setting pressure has been reached in order to achieve good roof support and to ensure sufficient bracing between the roof and the floor for shield units with special functions, such as an anchor for anchoring devices.

In general, the supports should be advanced to support the exposed roof surface as quickly as possible.

The shield units must be aligned at right angles to the conveyor.

shield canopy position

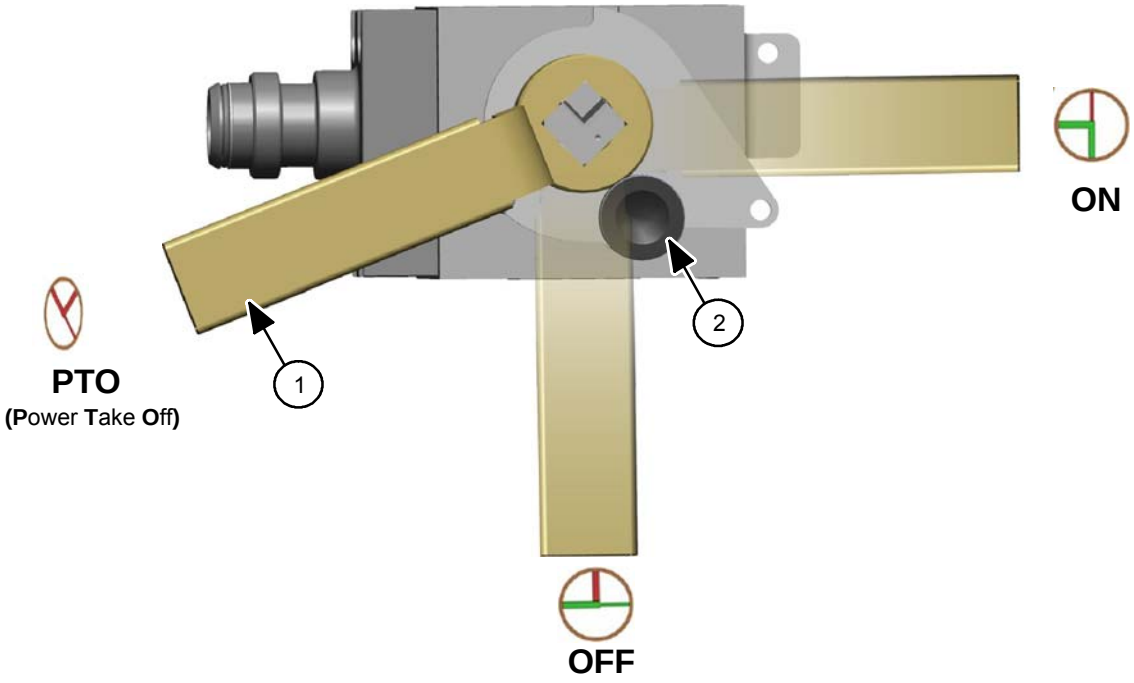
The shield units should always be set so that the shield canopy and base frame are aligned as parallel to each other as possible. In the context of the maximum inclination and swivel angles specified on the technical data sheet, however, steps on the roof can be underpinned and steps on the floor can be overcome by bending the shield canopy accordingly, if required by geological or operational conditions.

5/3-way ball valve

The 5/3-way ball valve has three switching or lever positions.

The 5/3-way ball valve is installed on the intershield manifold and is for shutting off the pressure supply line during maintenance work or repairs.
In the PTO (Power Take Off) lever position, the pressure supply line and the pressure relief are shut off.

Fig. 29: 5/3-way ball valve, with three lever positions



PTO depressurized
(pressure and pressure relief shut off)
medium flow stopped

OFF depressurized
(pressure relief for output side to the tank)
medium flow stopped

ON working position
(pressure open)
medium flow open

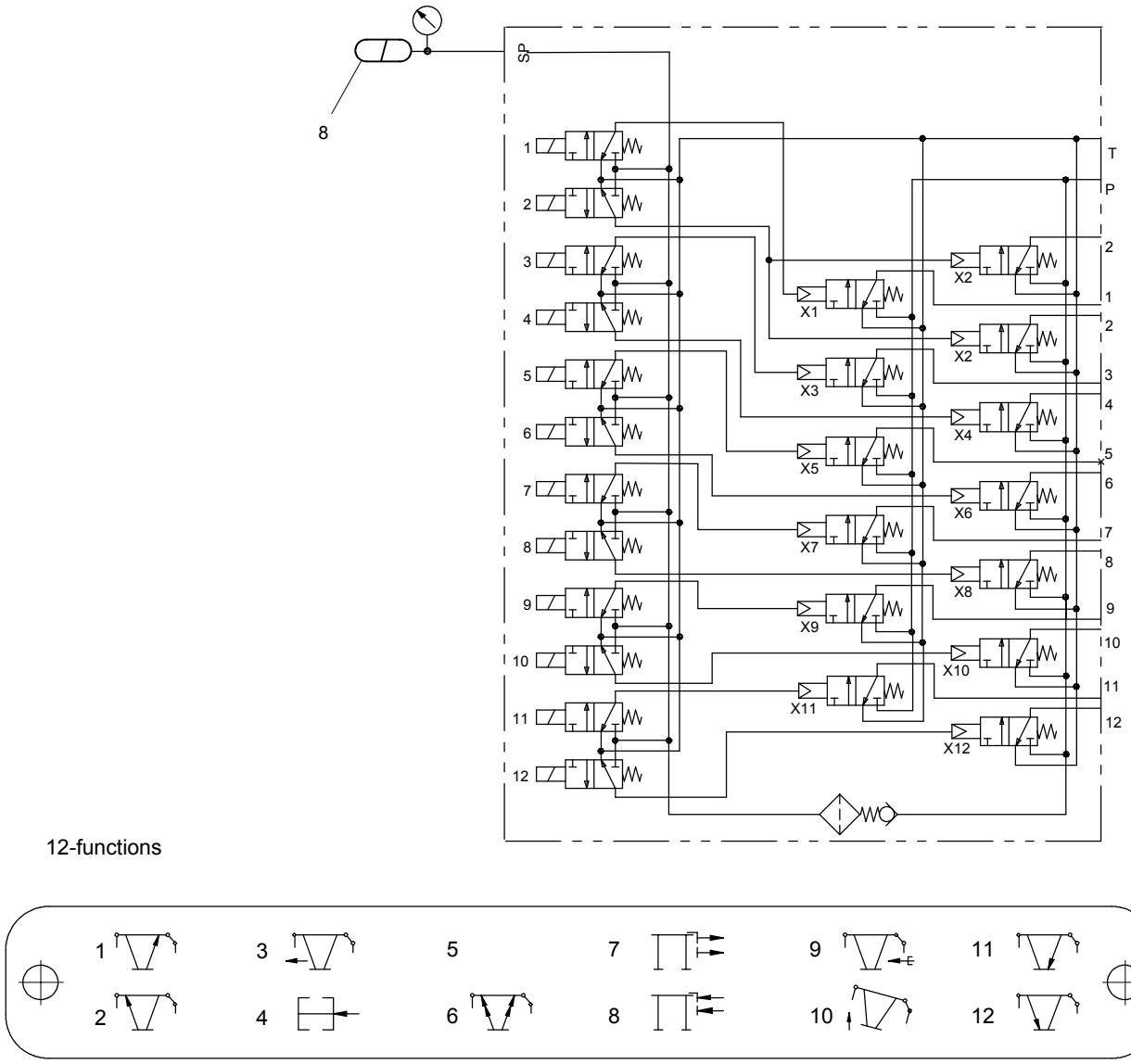
1 lever

2 engagement pin

☞ Change the lever position by

1. pulling the engagement pin (2),
2. turning the hand lever (1) in the respective position until the lever engages.

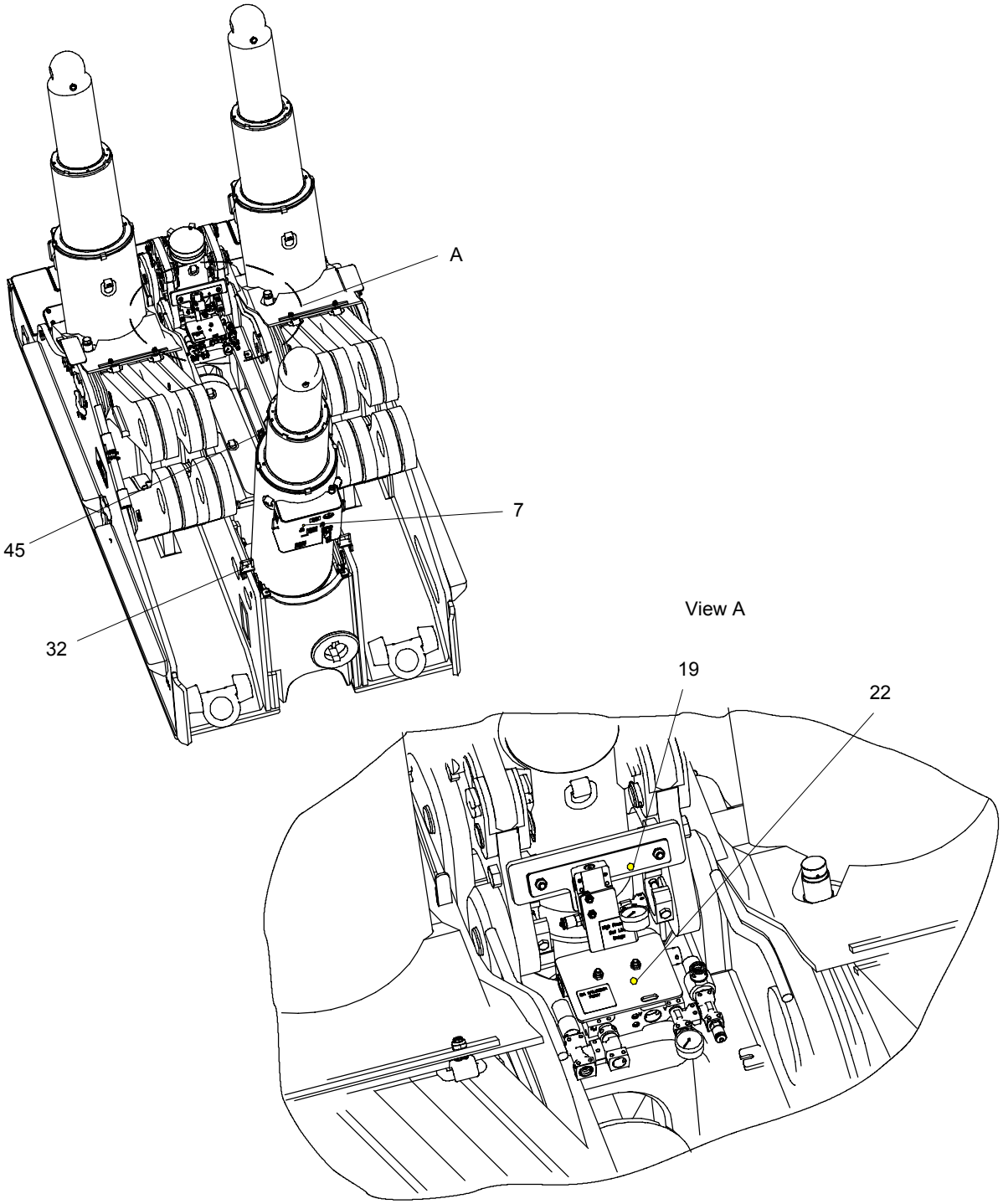
Fig. 36: Functions of the electrohydraulic control unit, 12-function, symbol plate



Tab. 8: Electrohydraulic control unit with 12-functions, assignment of functions

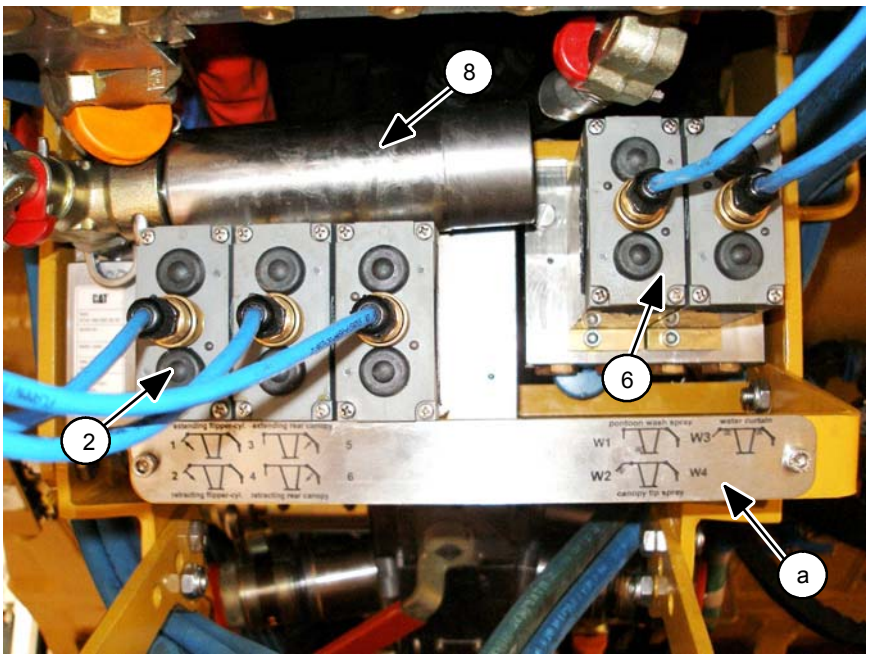
Function, designation	Function no.
Set rear leg	1
Set front leg	2
Advance shield	3
Push conveyor	4
- - - - - - - - -	5
Set high pressure	6
Extend side seal cylinder	7
Retract side seal cylinder	8
Pull up rear conveyor	9
Extend base lifting cylinder	10
Retract rear leg	11
Retract front leg	12

Fig. 45: Shield hydraulics, brackets and accessories, for both gate end shields



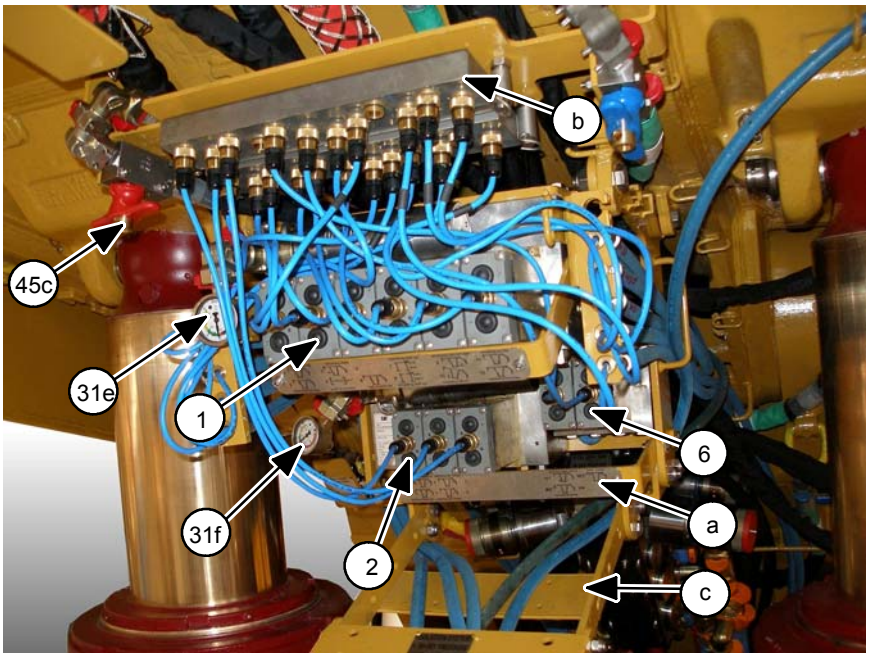
7 cover
19 bracket for manifold
22 bracket, shifting ram
32 hose guide
45 bracket for nozzle head

Fig. 61: Electrohydraulic control unit, 6-function, and water valve



2 electrohydraul. control unit, 6-function
6 water valve unit, 4-function
8 accumulator cartridge DN 20-SS
a symbol bar

Fig. 62: Electrohydraulic control units and water valve with brackets



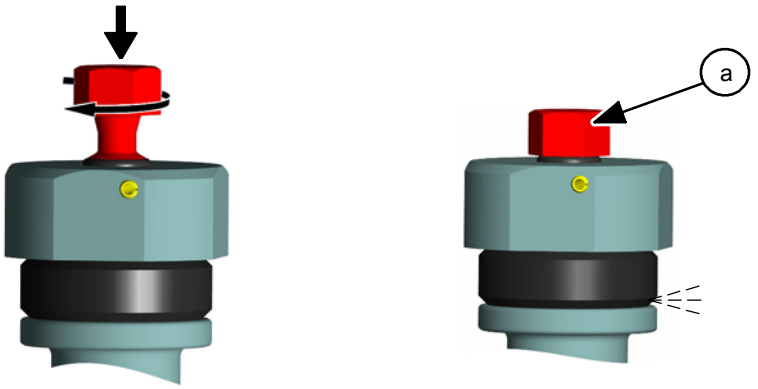
1 electrohydraul. control unit, 12-function
2 electrohydraul. control unit, 6-function
6 water valve unit, 4-function
31e pressure gauge
31f pressure gauge
45c HP ball valve DN 10
a symbol bar
b solenoid driver module
c brackets

Plug with pressure relief

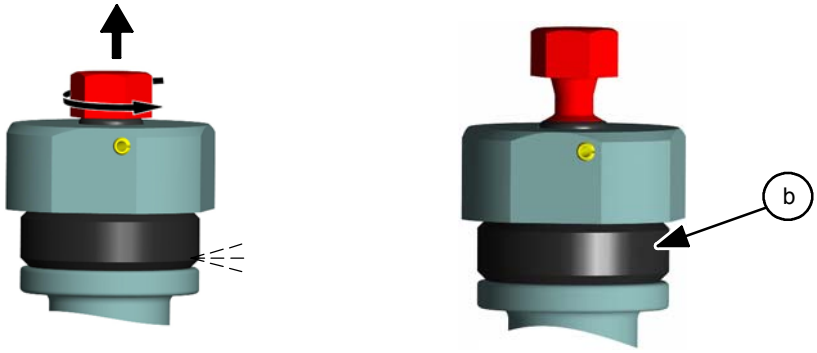
Via a pressure relief valve, the enclosed pressure can be relieved by **screwing in** the vented cap screw.
After releasing the pressure, this screw must be screwed all the way out again.

Fig. 77: Plug DN 10 with pressure relief

To open pressure relief:
Screw in screw.



To close pressure relief:
Screw out screw.



a hex. head screw M 6x16-A 2-70 b sealing ring

Important!
Regularly check the sealing ring (b) to see if it has become porous. For safety, cover the ring with a rag to prevent hydraulic fluid from spraying out.

The shield is equipped with two plugs DN 10 with vented cap screw.

The plugs (29) positioned on a through sleeve with pressure relief are used to relieve any potential pressure in the return line. This can be necessary, e.g. when the supply line connections have been closed off for transport and increased pressure has built up in the return line during installation.

Maintenance

Warning!
If operational safety is endangered, damaged components must be replaced immediately. If this is not possible, you must immediately shut down the shield and secure it. Immediately notify the entire face crew and your superiors.

electronic control system

Refer to the separate operating manual for the PMC®-R control unit.

hydraulic control system

Special measures

Caution!
Filter cartridges on electrohydraulic shield control systems must be replaced immediately after commissioning or restart (e.g. after changing to another face or working on the hydraulic system).

After working on a hydraulic system, you can assume that dirt has penetrated the hydraulic system. Depending on the degree of contamination, this can clog the filters in the system. As a result, functions are slowed down, performed incorrectly, or not performed at all.

filter cartridges

The filter cartridges on the intershield manifold and on the electrohydraulic control unit of the shield control system protect the downstream hydraulic components from damage caused by contaminants in the hydraulic medium. They only have to be regularly replaced if the filtering system of the face supply unit is inadequate. Therefore, it is very important to ensure the required hydraulic medium quality!
If problems occur during preparation of the medium, there will be an increased risk of malfunctions due to clogged filters.

replacing filters

The intervals between mandatory filter replacements depend on the degree of contamination in the water and/or of the emulsion (HFA fluid) used and must therefore be determined on a case-by-case basis. Clogged filters may be the reason that functions start to slow down or even reach a point where they can no longer be carried out.

We recommend:

emulsion filters

- Replace the emulsion filters directly.

piston rods

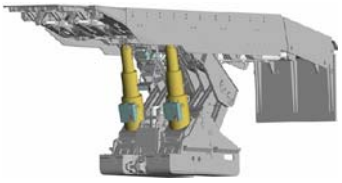
On all shields which are equipped with a water spraying system, the piston rods of cylinders that are usually only rarely extended and retracted completely, for example legs and stabilizing cylinders, must be thoroughly cleaned about every 6 months and then treated with a suitable preservative.

Technical data

This chapter contains the technical description of the support and its main subassemblies as well as the technical data for the described subassemblies.

Description

Model 2400/4300-3x5330-2050



The three-legged shield mainly consists of the following main subassemblies:

- base frame with lemniscatic links and relay bar assembly,
- canopy with flipper,
- caving canopy and flap,
- side seals,
- caving shield,
- hydraulic legs,
- hydraulic equipment with hose lines and control.

Tab. 12: Shield support variants, dimensions and weight

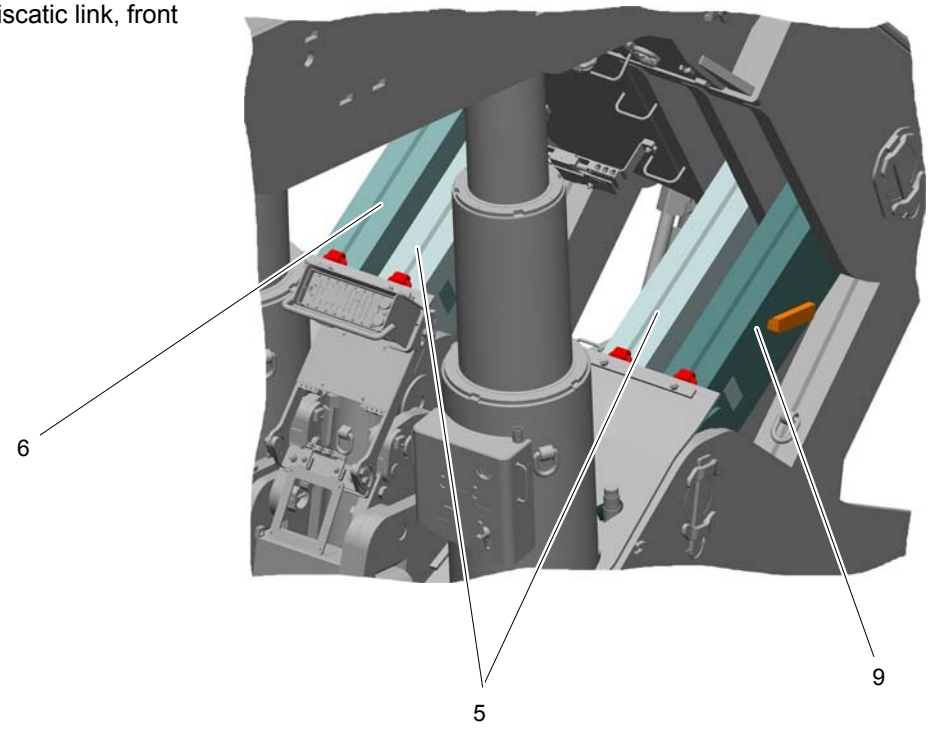
Use	Device number	**Dimensions**, L x H x W **max. / min. in mm**	**Approxim. weight in kg**
Gate end shield	7420 245 000 00 01	13 202 x 4 300 x 1 950 10 666 x 2 400 x 1 950	68 500
Gate end shield	7420 245 000 00 02	13 202 x 4 300 x 1 950 10 636 x 2 400 x 1 950	68 500

Tab. 13: Shield support, numbering

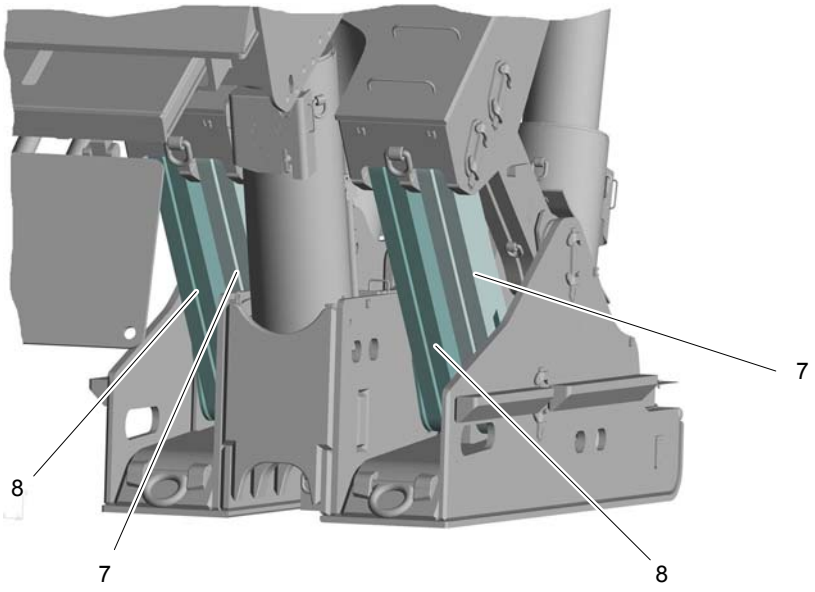
Device number	Shield number	Special design
7420 245 000 00 01	003 to 004 GS001 to GS002	Antitopple device 1 canopy/canopy Dr. no. 7427 115 000 00 00 Antitopple device 2 canopy/canopy Dr. no. 7427 116 000 00 00
	147 to 149 GS005 to GS007	Anchoring device, canopy/canopy Dr. no. 7427 111 000 00 00 End shield steering device Dr. no. 7427 113 000 00 00
7420 245 000 00 02	145 GS003 146 GS004	Anchoring device, canopy/canopy Dr. no. 7427 111 000 00 00

Fig. 94: Lemniscatic links on shield

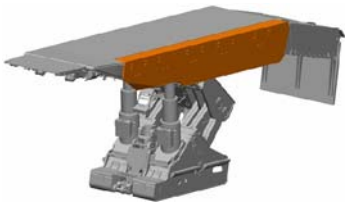
Lemniscatic link, front



Lemniscatic link, rear



5 lemniscatic link, front
6 lemniscatic link, front
7 lemniscatic link, rear right
8 lemniscatic link, rear left
9 lemniscatic link, front



Side seal, canopy 7420 245 710 ....

... is included in:

- variant 01 - 7420 245 000 00 01

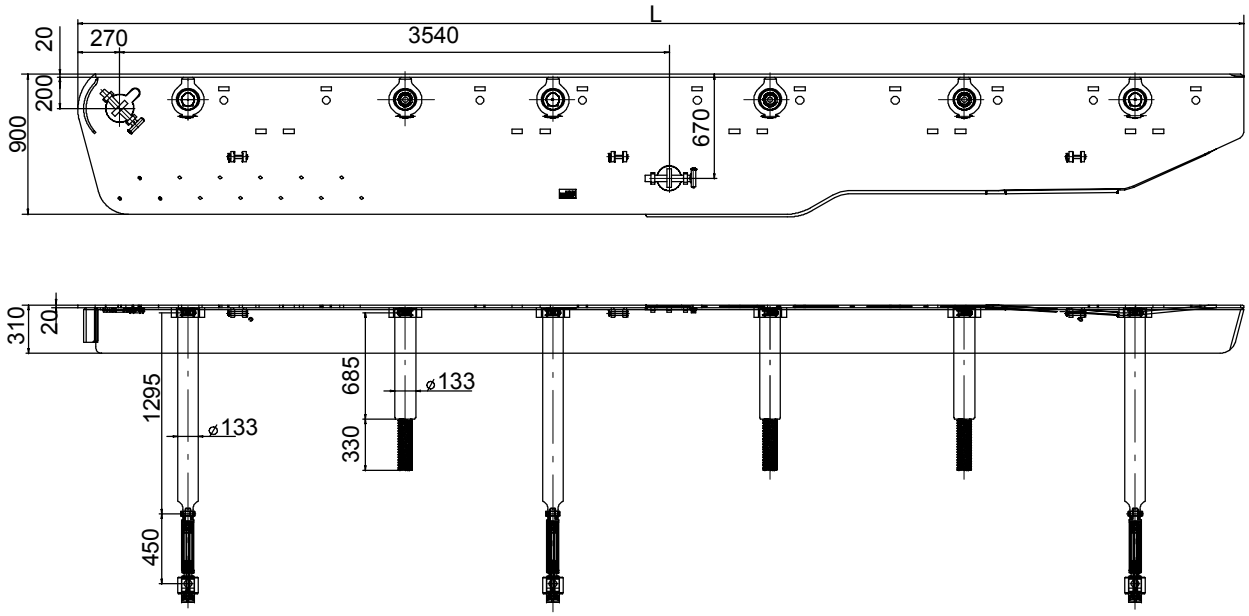
Side seal, canopy 7420 245 720 ....

... is included in:

- variant 02 - 7420 245 000 00 02

The side seals vary in length:
the side seal of shield variant 01 is 200 mm longer.

Fig. 104: Side seal, canopy, dimensions



Side seal variant	L	Note
7420 245 710 00 00	7510	* for shield variant 01
7420 245 720 00 00	7310	* for shield variant 02

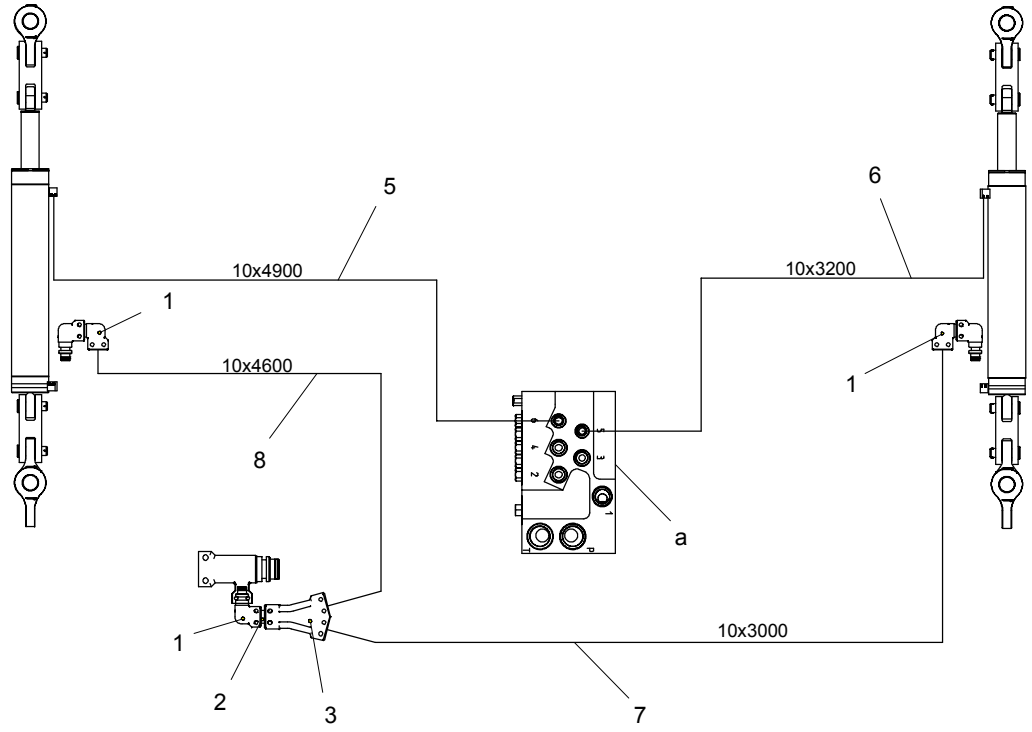
Notice!
Apply lubricant B6 as per EWN 7068*) to all connecting points and slide surfaces.

*) EWN = works standard

Warning!
Make sure that the offset between shield 1 and shield 2 does not exceed the maximum permissible dimension.
Otherwise the alignment cylinders or their brackets can be seriously damaged. You could be seriously injured or even killed by falling parts.
The offset may never exceed 200 mm!

By pressing the button on the electrohydraulic control unit, the corresponding alignment cylinder is retracted and the shield is aligned.

Fig. 113: Hydraulic control for antitopple device 1 “canopy/canopy”



1 plug-in elbow socket DN 10
2 double nipple DN 10
3 Y-manifold socket DN 10
5 SHL-LTG 4SP-DN10x4900-ST
6 SHL-LTG 4SP-DN10x3200-ST
7 SHL-LTG 4SP-DN10x3000-ST
8 SHL-LTG 4SP-DN10x4600-ST
a electrohydraulic control unit, 6-function

Fig. 124: Outrigger ram, position

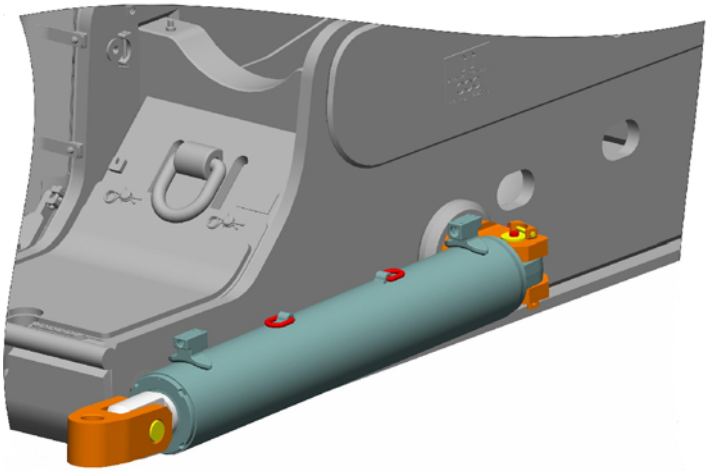
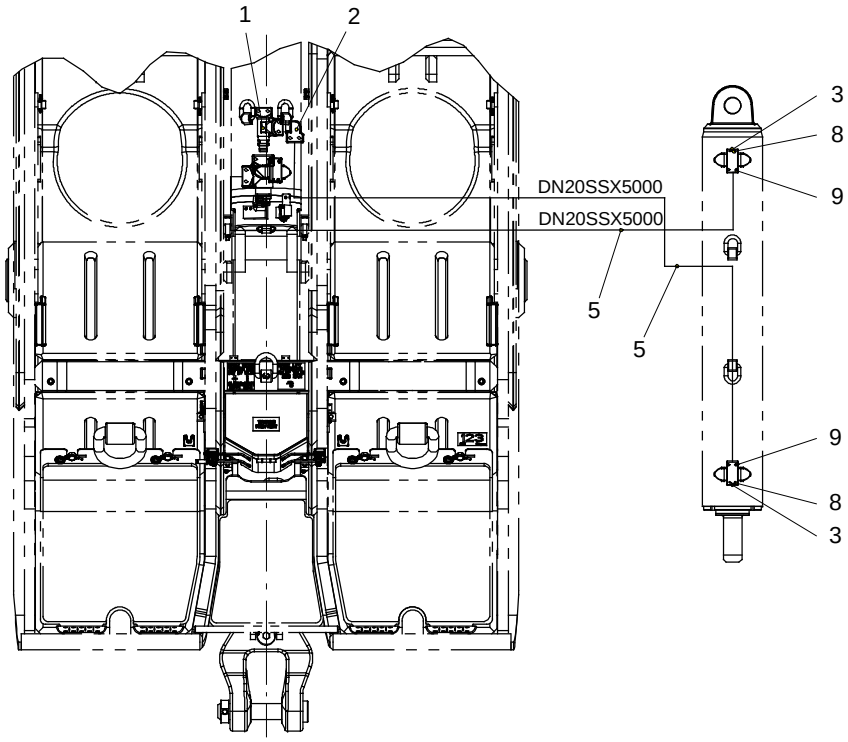


Fig. 125: Hydraulic system for outrigger ram



1 plug-in L-socket DN 20
2 plug-in elbow socket DN 20
3 plug
5 SHL-LTG-4SH-DN20x5000
8 staple DN 10
9 staple DN 20

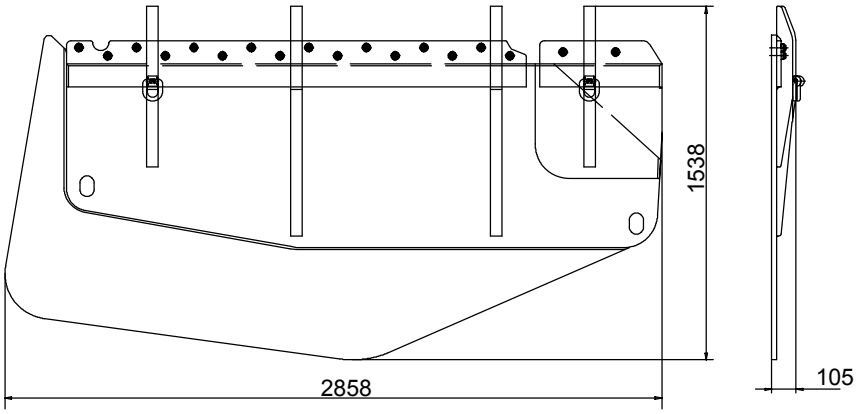
Tab. 21: Overview of antitopple devices and anchoring devices

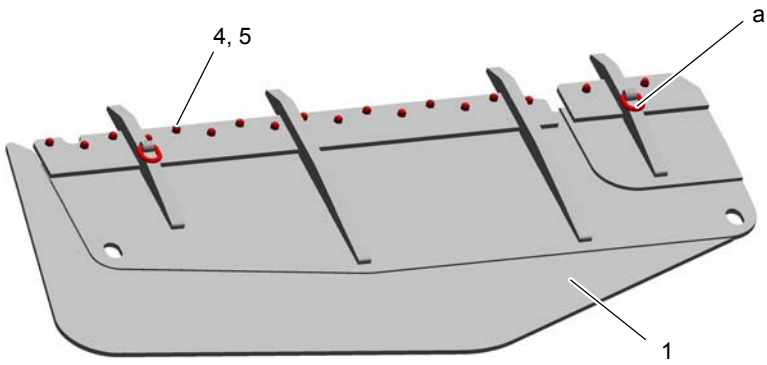
Description	Var. 1	Var. 2	ID No.	Hydraulic system drawing	Note
Antitopple device 1, canopy/ canopy	x	-	7427 115 000 00 00	8112 374 082 00 00	Gate end shield 003 (GS001) and gate end shield 004 (GS002)
Antitopple device 2, canopy/ canopy	x	-	7427 116 000 00 00	8112 374 083 00 00	Gate end shield 003 (GS001) and segment shield 002 (BS002)
Anchoring device, canopy/ canopy	x	x	7427 111 000 00 00	8112 374 081 00 00	Gate end shield 146 (GS004) var. 02 Gate end shield 147 (GS005) var. 01 Gate end shield 148 (GS006) var. 01 Gate end shield 149 (GS007) var. 01
Outrigger ram	x	-	7427 113 000 00 00	8112 374 040 00 00	Gate end shield 003 (GS001)

Side plate, left

The side plate is attached on the left side to shield 145 on the tail gate.

Fig. 135: Side plate, left





1 side plate
4 countersunk screw M 20x60-8.8
5 hex. nut M 20-A 2-70

a load ring,
load capacity: 3000 kg

Notice!
Apply lubricant B6 as per EWN 7068 to all connecting points and slide surfaces.

normal and exceptional operation

Hydraulic system

The following section provides an overview of the parts of the shield hydraulics. Supplemental information can be found in the replacement parts catalogue for the shield support or the hydraulic components listed in chapter 5.

During normal operation, the shield functions may only be operated via the PMC®-R control unit.

Shield hydraulics

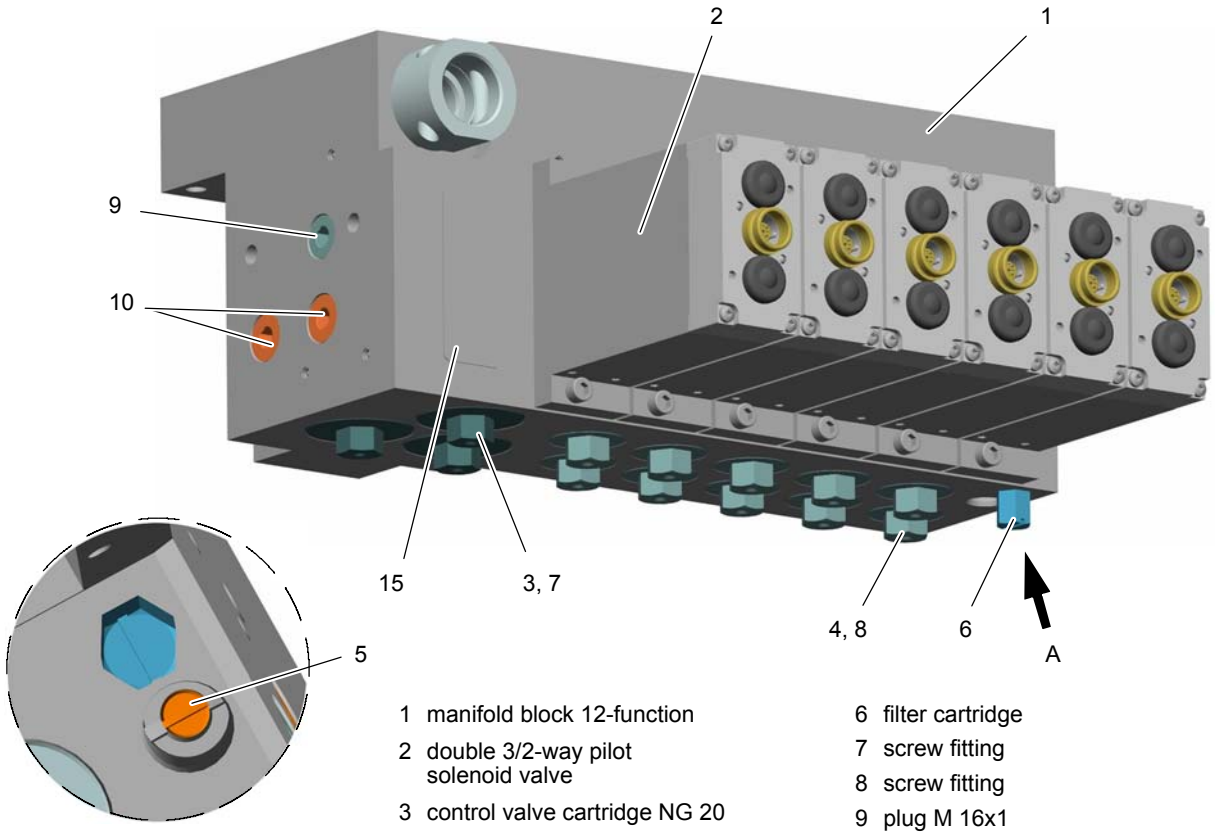
Electrohydraulic control unit

The pilot valves of the electrohydraulic control unit are equipped with buttons which allow the shield functions to be actuated manually. A symbol plate allows for the function/button allocation.

The shields 7420 245 000 0x are each provided with two electrohydraulic control units:

- 8154 182 000 00 00 has 12 functions,
- 8154 180 000 00 00 has 6 functions.

Fig. 147: Electrohydraulic control unit, 12-function



1 manifold block 12-function
2 double 3/2-way pilot solenoid valve
3 control valve cartridge NG 20
4 control valve cartridge NG 13
5 check valve NG2
6 filter cartridge
7 screw fitting
8 screw fitting
9 plug M 16x1
10 plug M 18x1
15 name plate

Technical data, hydraulic cylinders

telescopic leg Z1
double acting, 2-stage

Type SD-7150-450-1625/3875 Device no. 8250 210 000 00 00

Leg length a) retracted	mm	1465
b) extended	mm	3285
Stroke, hydraulic	mm	1820
Piston diameter.	mm	380 / 270
Piston rod diameter.	mm	350 / 250
Piston surface	cm^2	1134.1 / 573
Annular surface	cm^2	172 / 82
Leg force at setting pressure, 350 bar	kN	3969
Setting pressure, 470 bar	kN	5330
Retracting force at 350 bar	kN	602

shifting ram Z2
double acting, reverse mounted

Type ZE-200/100-1080 Device no. 8241 535 000 00 00
version with reed rod

Cylinder stroke	mm	1080
Piston diameter	mm	240
Piston rod diameter	mm	100
Piston surface	cm^2	452.4
Annular surface	cm^2	373.9
Thrust force at 320 / 180 bar	kN	1448/ 814
Pulling force at 320 bar / 380 bar	kN	1196 / 1 421

side seal cylinder Z4
double acting

Type ZE-63/50-215 Device no. 8241 352 000 00 00

Cylinder stroke	mm	215
Piston diameter	mm	63
Piston rod diameter	mm	50
Piston surface	cm^2	31.2
Annular surface	cm^2	11.5
Thrust force at 320 / --- bar	kN	100 / ---
Pulling force at 320 / 380 bar	kN	37 / 43.7