Operating Manual

DBT - Shield
1219/2692-2x4877-2058

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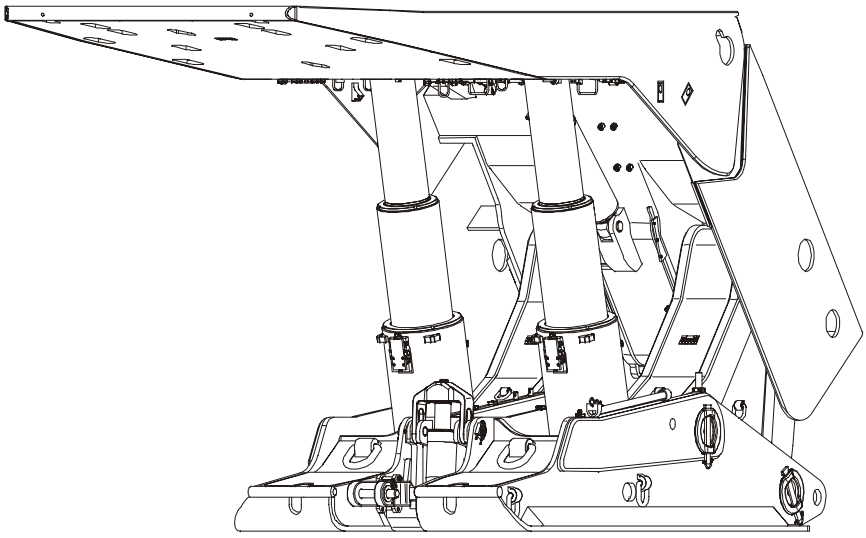

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Characters and symbols used

The following characters and symbols are used for safety instructions and important information in the operating manual.

Try to memorize the symbols and their meanings.

DANGER!
Points in the text marked with this symbol draw your attention to immediately impending danger. Possible consequences are: very serious injury or even death.

WARNING!
These points contain information on dangerous situations. Possible consequences are: very serious injury or even death.

CAUTION!
This symbol draws attention to dangerous situations. Possible consequences are: light to moderately serious injuries and machine damage.

NOTICE!
Points in the text marked with this symbol draw attention to harmful situations. Possible consequences are: damage to the shield or damage in the immediate vicinity.

IMPORTANT!
Points in the text marked with this symbol contain useful tips and information intended to facilitate work for you. They do not warn about harmful or dangerous situations.

■ Items in lists are marked with black squares.

– Points in sub-lists are marked with a long dash at the start of the line.

☞ The symbol of the hand asks you to do something. Several successive paragraphs marked with the symbol of the hand represent a string of actions which must be executed in the order specified. Follow the respective instructions step-by-step to perform the work safely and efficiently.

Operation

shield control

Check to determine whether all protective devices on the shield are present and functional.

Operate the shield control system only if you have a profound knowledge of the control elements and their functions. It is necessary that you have been task trained on the respective control system and know the contents of the respective operating manual. Carefully read the instructions for operating the control system used.

Do not stay in the shield whose functions you are to operate. Always operate the shield only from the adjacent shield.

Make sure that no persons are present in the area of the shield being actuated.

Observe the entire zone of motion of the shield, in order to recognize and avoid hazards in due time.

Set the shield until full setting pressure has been reached since a good support of the roof can only be ensured in this manner.

Extend the flipper towards the coal face as far as possible to prevent coal or surrounding rock from falling into the travelway.

Clean the control equipment at regular intervals. Ensure that the operating symbols are clearly recognizable. This measure avoids faulty operation and resulting accidents.

Keep the floor free from debris. This way you will be able to extend the shifting unit without hindrance and to advance the conveyor without problems.

Ensure that the water spray system responds during advancement.

inclined faces

Secure the conveyor by anchorages. This measure is required to prevent displacement of the conveyor with respect to the shield and the shifting unit jamming in the base skid.

Hydraulic anchorages must always be supplied with the specified working pressure since only thus a sufficient anchorage between shield and conveyor is ensured.

When pulling up the shields, always observe the specified sequence of steps to prevent the shields from colliding with the anchorage cylinders.

On inclined faces, always advance the shields from the bottom to the top. This gives you a better view of your working area.

CAUTION!
Do not exceed permissible canopy angle!
Observe value for minimum residual stroke.

NOTICE!
It is important that the control symbols are legible to avoid the risk of operating errors and resultant accidents.

IMPORTANT!
Both cases require knowledge of the flow plan and skilled personnel. The safety guidelines contained in this manual must strictly be observed.

Chapter 6: Technical data

WARNING!
Risk of getting squeezed between moving parts of the shifting unit and the shield.
Keep away from advancing shield units or such which are going to be advanced.

WARNING!
During normal operating mode the push buttons at the pilot valves of the control blocks must not be used for operating the functions. Failure to observe this warning can result in unexpected and hazardous situations, for example if functional links become invalid. The push buttons of the pilot valves are only allowed to be operated in specified exceptional circumstances, for example for repair or maintenance purposes. In these cases it is imperative to observe the applicable special safety regulations.

WARNING!
Risk of serious bodily injuries due to pressure fluid suddenly escaping at high pressure and bursting hydraulic hose lines caused by dangerous overpressure.
Never close the lowering ports of double-acting props pressure-tight! If you do, a pressure might build up in the annulus when extending the prop which is a multiple of the setting pressure.

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CAUTION!
To prevent overloading of the stabilizing cylinder when the canopy is set in a cavity, care must be taken to ensure that the max. angle of inclination of the canopy (angle main canopy - caving shield) will not be exceeded.

CAUTION!
The pressure setting must not be changed.

Installation

This chapter contains information on the installation of the shield units. Please pay particular attention to the warnings and tips.

WARNING!
When performing any work, observe the safety instructions given in this manual and also the special safety instructions and operating manuals provided by the mine management. Failure to comply can lead to most serious accidents which might even result in death.

CAUTION!
Prior to assembly, sockets and nipples of the plug-type connectors must be treated with lubricating paste B3 to EWN 7068 which does not contain molybdenum disulfide. See chapter 6, section ”Recommended lubricating greases and pastes”.

CAUTION!
Prior to assembly, the sliding surfaces of the transport units of the steel structure must be coated with lubricating paste B6 to EWN 7068 which does not contain molybdenum disulfide. See chapter 6, section ”Recommended lubricating greases and pastes”.

Pre-assembly of the shield units

The shields are delivered as completely pre-assembled units. hence, no further pre-assembly is required for the mechanical and hydraulic systems of the shields.

Installation of the shield units

CAUTION!
For transport underground only the attachment points detailed in chapter 3 ”Transport” are allowed to be used. Further information is given in chapter 3 ”Transport”. Failure to comply may lead to personal injury and damage to property.

installation plan

The shields are installed in the longwall face in correspondence with the installation plan of the mine.

IMPORTANT!
When installing the shields in the face, be sure to observe the shield numbers. Since the individual shields might be provided with different functions they must be arranged in the specified order.

identification for installation in the face

To facilitate identification for assembly and installation in the face the shields or the transport units should be provided with consecutive numbers. This numbering should, for example, correspond to the order in which the shields are to be arranged in the face. The numbers should be written on the surface of the components with a clearly visible color.

The sign plate with the shield number is placed at the base. The shield units are numbered consecutively, see following table.

Operation and maintenance

This chapter provides general information on the operation and maintenance of the shields. This information is to be regarded as preparation of or addition to hands-on training. Reading of this chapter is recommended in addition to the training measures, but it in no way release the operator from participating in the training.

DANGER!
You are only allowed to operate the shield control if you have a profound knowledge of the control elements and of the way the control system works. You must have been task-trained on the present control system and should have practiced to deepen your knowledge. Should this not be the case you are not allowed to operate the control. Inform your superior immediately and ask for the required training.

WARNING!
Ignoring the safety regulations will cause accidents and may result in serious bodily injuries or death.
The regulations about safe working of your mine must be followed strictly. Apply the following instructions analogously in addition and in accordance with the individual safety regulations of the mine.

Basic requirements

Conditions for operation

face crew

The face crew must be informed about possible danger situations. The safety measures to be taken must be laid down in writing and must be made known to the face crew.

The face crew must be instructed to stop the face conveyor immediately in case large layers of coal and rock have fallen onto the conveyor. This also applies in case of accumulation of debris.

face equipment

The face must be illuminated sufficiently.

To warn the face crew and for communication of the crew, intercommunication systems must be provided.

The face conveyor must be equipped with a pre-start warning system and a shut-down and lock-out device.

conveyor overload

Large layers of coal and rock must be broken up to prevent spillage and jamming under shield canopies. Compressed-air picks have to be kept on hand for this purpose. The face conveyor must be at a standstill during the process of breaking up the layers of rock and coal.

In case large layers of rock and coal cannot be broken up as required they may only be transported when it is ensured that nobody will be put in danger. Any work on the face must be stopped until the transport of the rock and coal layers has been finished.

Safe working

For safety of the operator the shields are provided with adjacent controls; i.e. each shield is operated using the controls located in the shield to the left or to the right of the unit to be advanced, or by automated remote batch control.

WARNING!
Always stay clear of a shield which is being moved. Circumstances which are not always obvious may lead to unexpected movements of the shield unit which could result in severe injuries or even death.
For example, the shield canopy may jerk free during lowering if it was stuck between the canopies of the adjacent shields.

CAUTION!
Take care not to damage the push-buttons of the pilot valves. Jammed push-buttons will cause malfunctions of the valves which may result in accidents.

Always observe these safety rules :

Keep all parts of your body under the canopy of a set shield and away from the shield in motion or about to be advanced.

When groups of shields are advanced automatically, nobody is allowed to stay in the area between the operator and the shield to be moved.

Follow these steps if a shield has failed to advance :

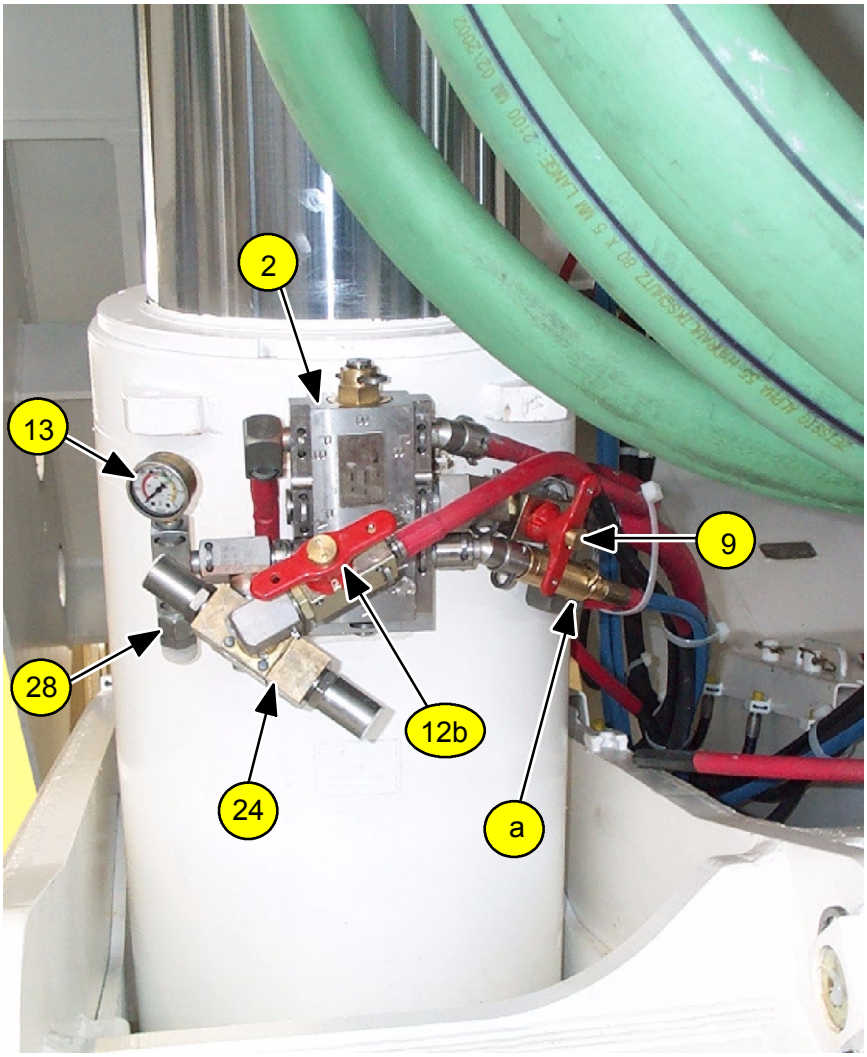
1. Determine reason for failure to advance, there may be:

- Malfunctioning of electronic controls
- External obstructions:
  - shield wedged in between adjacent shields
  - canopy has tip lodged in roof
  - floor step or excessive debris in front of base tip

2. In case of malfunction of the automated batch cycles, advance the shield manually in single step mode by use of the control unit of the adjacent shield unit. See separate manual of the electronic control.

3. In case of external obstructions utilize adjacent manual control to overcome the obstruction(s).

Fig. 29: View on the R.H. prop from faceside, cover removed



2 prop check valve

9 block ball valve,
isolates the prop piston chamber from pressure supply, open as shown

12b block ball valve
isolates the hose line between compensating valve (24) and stabilizing cylinder piston chamber; open as shown

13 pressure gauge

24 compensating valve

28 auxiliary port for pressure gauge

Trouble shooting

Fault finding on shield hydraulic system

The hydraulic circuits of the shields contain a number of modules and components, identified in the schematic drawings. See ”operating the shield hydraulics” in this chapter or the spare parts catalog.

Faults can occur on any of the components. The main cause on hydraulic valves is a by-pass which in most cases is audible to the operator.

The following information will assist you in the detection and elimination of faults.

WARNING!
Trouble shooting on hydraulic systems entails an increased accident hazard. Particularly by malfunctions of the hydraulic system and hydraulic medium escaping at high pressure severe injuries could be caused.
Therefore you are required to be very cautious and wear the specified protective equipment. Failure to comply with these instructions could cause severe injuries.

Fault localization

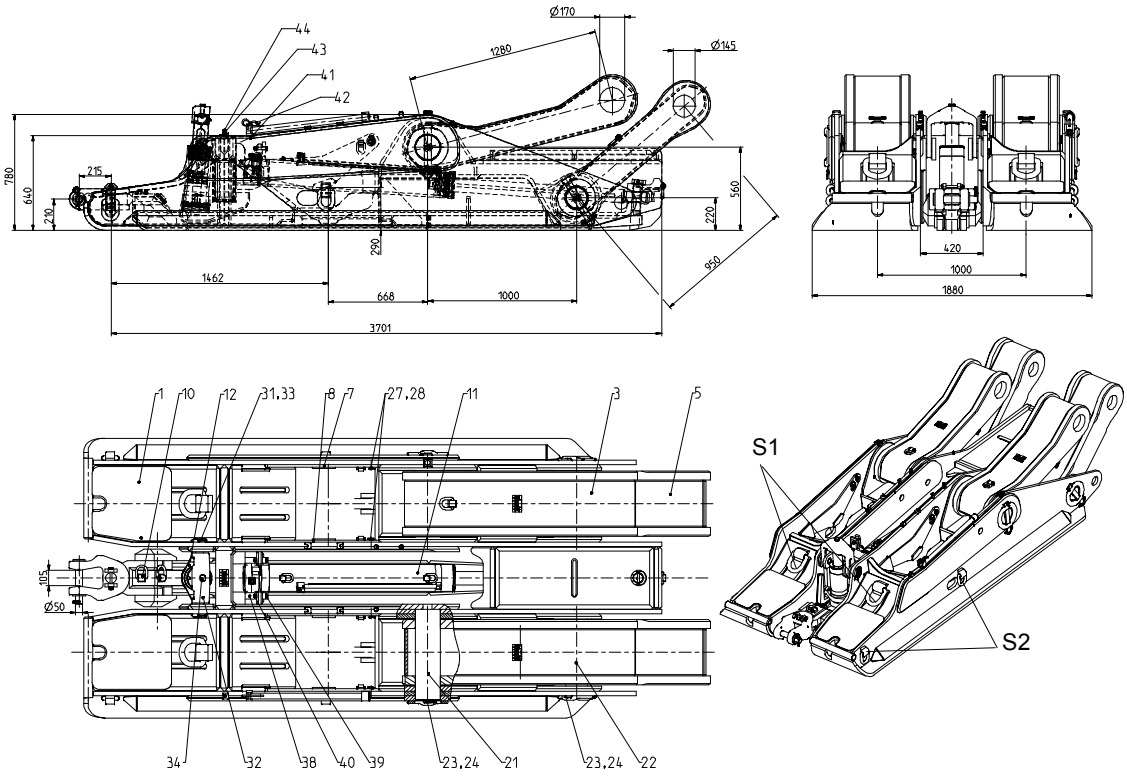
failure to lower the shield

Possible cause	Check required
The shut-off valve for pressure supply at the manifold pipe of the shield is closed.	Open shut-off valve. Feed line must be open to allow pressure to the shield hydraulics.
Shut-off valve in feed line to prop piston chamber is closed.	Open shut-off valve. Lines to piston chamber and annulus of prop must be open.
Canopy is trapped by adjacent shields.	Check the shield is not ‘iron-bound’ and if necessary, operate or lower adjacent shields to free.
Pilot piston in the POCV valve is not operating.	Check if there is enough pressure to operate the piston (minimum 80 bar). POCV may be faulty.
Damaged or trapped hoses	Check for damaged or kinked hoses in prop circuit.
Props are damaged.	Check prop for damage (if damaged, replace prop).
Lack of fluid from control valves	Disconnect the hose to prop and check for adequate flow, if none, remove hose from control valve and check port for flow, and if still no flow, check feed lines to control unit.

POCV = pilot operated check valve

Base with lemniscatic links and central shifting unit

Fig. 36: Base



1 base subassembly
3 lemniscatic link, front
5 lemniscatic link, rear
7 prop retainer R.H.
8 prop retainer L.H.
10 shifting unit
11 shifting cylinder ZE-150/90-1130-SC-W-CR
12 lift cylinder ZE-135/90-240-Li-CR
21 lemniscatic pin, front
22 lemniscatic pin, rear
23, 24 securing elements for item 21, 22
27, 28 securing elements for item 7, 8
32 lift cylinder bearing
38 locking plate
S1 attaching eye, load-bearing capacity: 15000 kg
S2 attaching eye, load-bearing capacity: 8000 kg
others: fastening and securing elements, see spare parts catalog

The solid base transmits the shield load of the hydraulic props into the floor. The props are supported in an articulated manner in ball sockets welded to the base and secured by bolted prop retainers. The links of the lemniscate system are hinge-connected with the base by pins.
The type of base described is characterized by having the shifting unit and its guiding device arranged between the skids. The shifting unit is reverse-mounted with the force of the cylinder being transmitted to the conveyor via the relay bar. With a reverse-mounted shifting unit, the force of the piston surface area is utilized to advance the shield and the smaller force of the ring surface area to advance the pan line. The connection to the conveyor is provided via a universal joint.
A baselift cylinder serves for raising the base out of a soft floor during shield advance.

Hydraulic cylinder, double and single acting

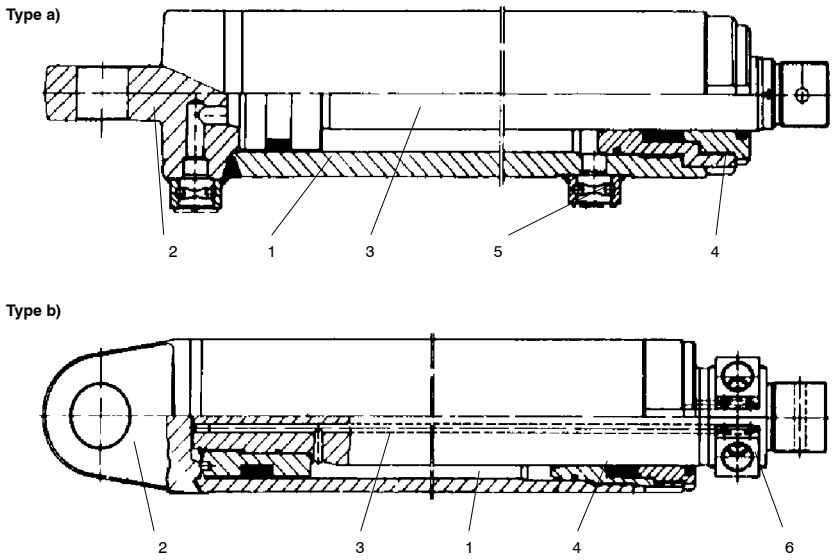
design

The following figure shows the main components of a hydraulic cylinder. The cylinders differ mainly by the arrangement of the connections. They can be roughly divided into two groups:

a) arrangement of connections at the outer cylinder

b) arrangement of connections at the piston rod

Fig. 43: Hydraulic cylinder, typical example



Type a): Connection at the outer cylinder
Type b): Connection at the piston rod

1 outer cylinder
2 cylinder bottom
3 piston rod
4 guide bush
5 connection
6 connection

NOTICE!
The technical data of the cylinders are given in the section “Technical data” of the shield used.

WARNING!
Risk of serious bodily injuries due to pressure fluid suddenly escaping at high pressure and bursting hydraulic hose lines caused by dangerous overpressure.
Never close the lowering ports of double-acting props pressure-tight! If you do, a pressure might build up in the annulus when extending the prop which is a multiple of the setting pressure.

The end of the piston rod can either be attached directly or it is designed in such a way that the means of attachment - e.g. rod head or fork head - can be screwed on and secured against working loose by clamping screws or a spring dowel sleeve.

The pressure fluid is either fed through the connections at the outer cylinder (type a) or through the connections at the piston rod (type b).

If a double-acting cylinder is to be used as single-acting cylinder only, the annulus connection must be provided with a screw with filter element to avoid contamination by dirt. If the cylinder is used without the seals which seal off the annulus, the grooves for the seals have to be filled with lubricating grease.

Quality of the process water

The quality of the process water is a critical factor for the functional reliability of the emulsion. The water must not contain any solid or liquid impurities and must satisfy the bacteriological requirements for drinking water (DIN 2000).

The figures quoted for the concentration of the hydraulic fluids were obtained from trials with test water samples.
The chemical composition of the test water samples used are shown in the table below for your orientation.

Tab. 8: Chemical composition of the test water samples used

	type X test water (NCB 18 to Luxembourg Report)	**type Y test water** (DIN 24320 resp. Luxembourg Report)	**type Z test water** (NCB 19 to Luxembourg Report)
pH value	6.5 - 8.5	6.5 - 8.5	6.5 - 8.5
hardness mmol/l	2.5 (=14°d)**	3.58 (= 20°d)**	7.5 (= 42°d)**
chloride	200 mg/l	200 mg/l	200 mg/l
sulfate	240 mg/l	150 mg/l	720 mg/l
nitrate	0 mg/l	20 mg/l	0 mg/l
magnesium	30 mg/l	50 mg/l	90 mg/l
sodium	130 mg/l	115 mg/l	130 mg/l
calcium	50 mg/l	61 mg/l	150 mg/l
iron, max.	0.3 mg/l*	0.3 mg/l*	0.3 mg/l*

* These values deviate from the quoted standard or from the Luxembourg Report.

** °d = degree German hardness (is no longer permissible in accordance with the applicable legal regulations. The information given is intended only for orientation.)

If the process water available does not have the demanded quality, the special approval of DBT must be obtained before use.

Emulsion values

pH value: 7.5 - 9.5

Permissible bacteria in the emulsion: $\leq 10^5$ Kol/ml

The maximum permissible temperature is 55° C; normally 45° C, should not be exceeded. A higher working temperature will reduce the consistency of the emulsion and shorten the service life of the seal material.

Checking of the emulsion values

At least once per week, check:

- the pH value
- the concentration
  test method: by agreement with the concentrate manufacturer
- the microbial load
  test method: dip slides

IMPORTANT!
Further information is contained in DIN 24320.