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Technical Information

Hydraulic Components

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Safety instructions

General

When working on hydraulic systems or pieces of equipment, the manufacturer information concerning knowledge and training, as well as commissioning and servicing, is to be observed.

Danger!
Working on the electrical equipment of the system
Possible consequences: death or very serious injuries
Work on the electrical equipment of the system may only be carried out by trained, skilled electricians or under the instruction of a trained, skilled electrician.

Warning!
Modifying/converting the hydraulic equipment
Possible consequences: death, serious injuries, machine damage.
Modifications to the machine/system are only allowed after consulting with Caterpillar. Modification without approval will lead to the termination of the operating license.

If, after consulting with Caterpillar, modifications are made to the hydraulic equipment, it is mandatory that these changes be included in the machine documentation.

☞ Note that a modification of the hydraulic equipment might require additional safety measures!

Important!
Spare parts must meet the Caterpillar specifications. This means that all parts to be installed have to satisfy the maximum working pressures and must be suitable for the hydraulic fluid used in the system.

Terms

maximum working pressure — The highest pressure at which the system or parts of the system may be operated under uniform (steady) conditions.

impermissible pressure — The application of impermissibly high pressure to the hydraulic components.

contamination — The permissible contamination (non-dissolved foreign particles in the hydraulic fluid) is based on the most contamination-sensitive component of the hydraulic system. The specified purity class is the maximum permissible value which must not be exceeded under the aspect of operational safety (e.g. clogging of gaps, panels) and the service life.

Operator obligations

protective measures — The operator must take protective measures for work on hydraulic systems. This includes, for example, work instructions for how to work with the hydraulic systems.

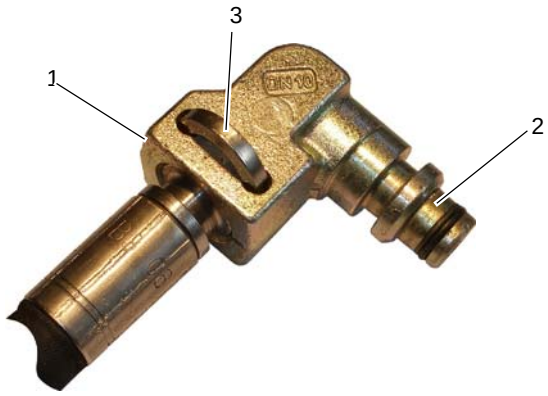
work instructions — Based on this technical information, supplemented with operator-specific instructions, these work instructions should contain information on the following subjects:

SteckO hose connection

SteckO system

The SteckO system is a socket/nipple plugging system which is connected using a staple. SteckO hydraulic connections are used universally in mining.

Fig. 8: Example of a SteckO fitting



1 socket
2 plug nipple
3 staple

Application

Mounting staples

To establish a reliable connection between a hose line and a connector, the nipple is pushed into the socket and is then secured with a staple. The staple must not be deformed under any circumstances.

☞ Place the staple on the socket.

☞ Pound the staple in with a suitable tool without deforming it.

Fig. 9: Press the staple together to align the ends with the holes and pound it in

☞ Check the firm fit of the staple by feel.

Notice!
Check the staple projection on the rear side of the socket.
Make sure there is sufficient projection on the rear side.

Valve does not switch

☞ Try to fix the problem by actuating the function on the control unit/electrohydraulic control unit several times in a row.

Internal leakage

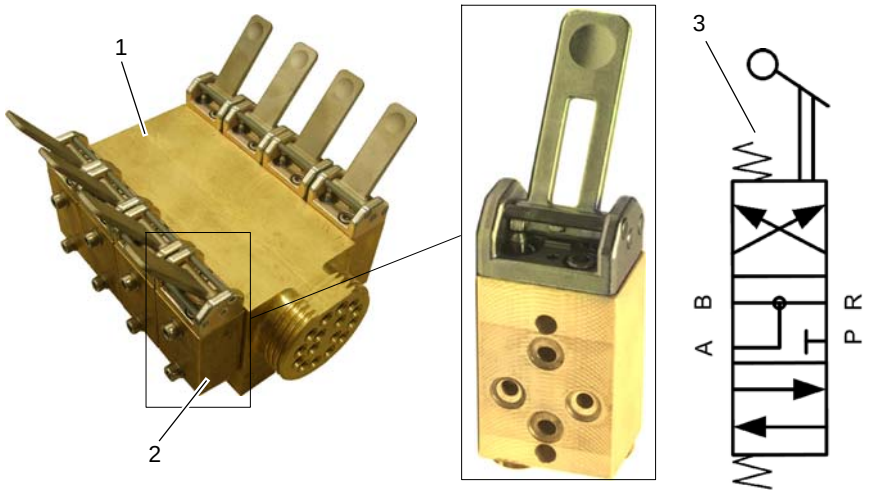
☞ Internal leakage is indicated by hissing noises. Localize the faulty valve by actuating the function individually in sequence. If the noise stops while a function is actuated, that valve is faulty.
You may have to press the button for the faulty function for several seconds before the noise ceases.

Important!
Make sure you observe the separate operating manual for the control unit.

4/3-way hand-lever valve

The 4/3-way valve is a pilot valve, which is for actuating valves of a larger nominal width. As opposed to the above-mentioned 3/2-way pilot valve, it is actuated mechanically by hand. The valve is suitable for block setup and can be fastened accordingly. It can be actuated with or without a holding function. When the lever is engaged, the function is executed until the lever is disengaged.

Fig. 22: 4/3-way valve (example of Multimatic control unit)



1 control unit
2 4/3-way valve
3 circuit diagram

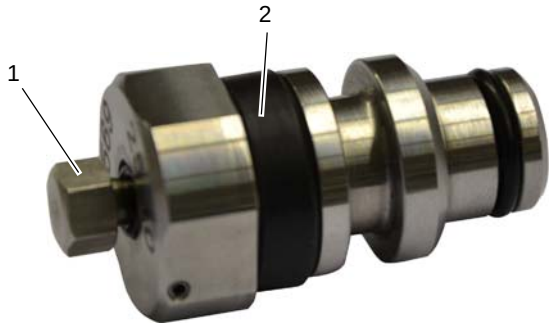
Danger!
Manipulation of the hand lever by locking in place
Possible consequences: death or very serious injuries due to uncontrollable shield movement
Never mechanically lock the hand lever of the 4/3-way valve in place, e.g. by wedging it. The lever must be able to swivel in both directions at all times.

Pressure relief valve / plug

Pressure relief valves are mainly installed in closed hydraulic systems for maintenance purposes. The system pressure can be relieved by opening a set screw.

This is necessary, for example, when the connections of the supply line are short-circuited for the purpose of transport, and when an elevated pressure has built up in the return line during installation. By relieving pressure, any pressure in the return line is relieved.

Fig. 36: Plug with pressure relief valve



1 set screw 2 sealing ring

Important!
Check the sealing ring regularly to see if it has become porous. Just to make sure, you can cover the ring with a rag to prevent hydraulic fluid from spraying out.

Mode of operation

In order to relieve pressure in the system, the set screw is screwed into the valve.

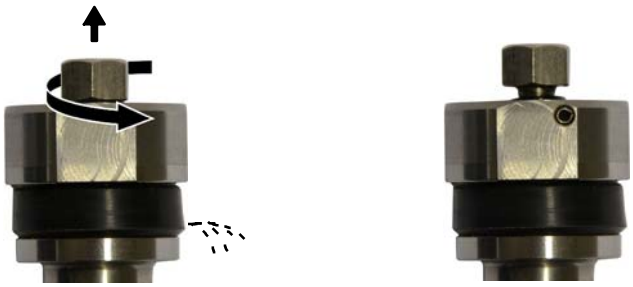
Fig. 37: Open for pressure relief

Screw in the screw **System open, pressure relieved**

To seal the system pressure-tightly again, the set screw is screwed out.

Fig. 38: Pressure relief closed

Screw out screw **System closed**



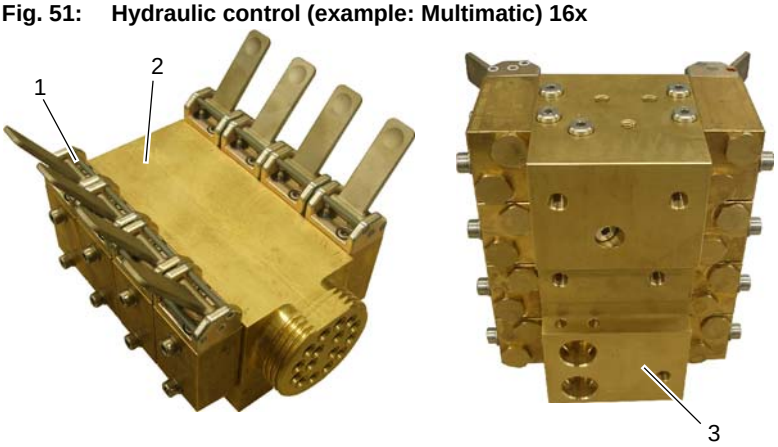
Controls

Hydraulic controls

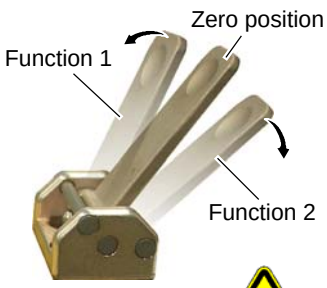
Hydraulic controls are used for controlling hydraulically operated machines and devices. This kind of control is mainly used in underground hydraulic shield supports. Hydraulic controls can execute up to 20 functions which are activated via corresponding pilot valves.

Notice!
In this context, the control may only be used for setting up a neighboring control system. The control unit, therefore, may not act on the support in which it itself is located, but must always be switched so that it only can act on the two directly adjacent supports.

Fig. 51: Hydraulic control (example: Multimatic) 16x



1 pilot valve with switch
2 distributor block
3 hydraulic connections, rear side



Operation

The functions are operated directly on the pilot valves. The pilot valves are usually designed as dual 3/2-way valves. Each pilot valve can be used to actuate two functions. If you actuate the operating lever of the pilot valve, the corresponding working valve is directly actuated. The operating levers of the pilot valve are designed as switches, with or without a catch.

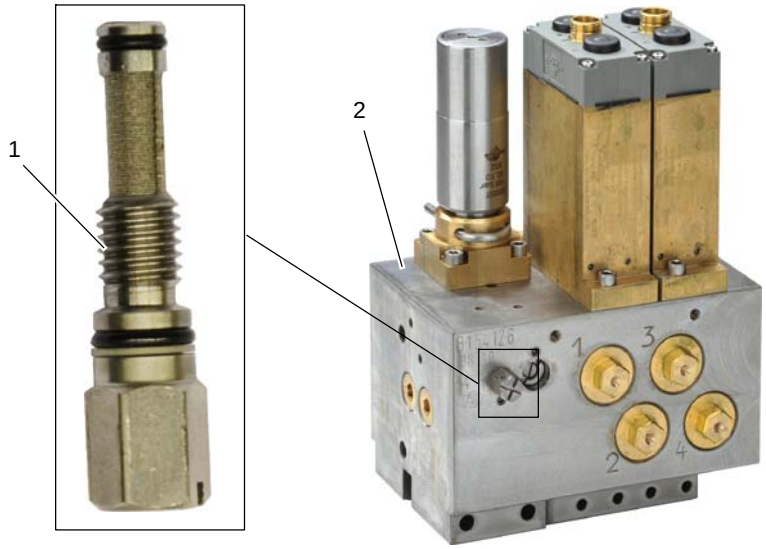
Danger!
Manipulation of the operating levers
Possible consequences: death or very serious injuries due to shield movements which cannot be stopped.
Never lock an operating lever in place!

Filter cartridges

A filter cartridge is located in the distributor block of the control unit. It protects the control unit's valves from damage caused by impurities in the hydraulic fluid.

The filter cartridges on the electrohydraulic control unit of the shield control system protect the downstream hydraulic components against damage caused by contaminants in the hydraulic medium.

Fig. 61: Filter cartridge example



1 filter cartridge

2 electrohydraulic control unit

Maintenance / servicing

Maintenance and servicing information can be found in the “Testing and maintenance” chapter.

Dismantling / disposal

Filter systems and/or used filter elements must be disposed of according to the national environmental protection regulations and/or the regulations of your mine.

Hydraulic fluids

General

Hydraulic fluids are used for transferring energy in hydraulic systems. They must be selected so that they withstand the occurring stresses, particularly the mechanical, chemical and thermal types, and are compatible with the materials used in the hydraulic system. Hydraulic fluids must meet the specifications of the manufacturer of the hydraulic system.

Prerequisites for using hydraulic fluid (suitability test)

The starting point for a functioning hydraulic system is clean hydraulic fluid. If difficulties arise in the preparation of hydraulic fluids, which would compromise their properties, all of the liquid in the hydraulic system must be replaced as a precaution. We recommend creating a maintenance plan for hydraulic fluids to minimize accumulation in the hydraulic components, such as filters.

Important!
Only use hydraulic fluids for which you have a valid certificate in accordance with EWN 8350 or a special permit issued by Caterpillar. Otherwise, there is a risk that the hydraulic system could be seriously damaged and result in the loss of warranty claims.

The composition of hydraulic fluids depends on the quality of the process water (tab. 5). Before Caterpillar issues a corresponding certificate (permit), the customer (operator) must send in a sample of his process water and the concentrate manufacturer must send in a sample of his concentrate for a suitability test.

This suitability test refers to the technological properties of the hydraulic fluid and does not allow any conclusions to be drawn with respect to its properties regarding health, safety and environmental protection.

Fig. 72: Certificate

It is carried out by an independent testing institute authorized by Caterpillar in accordance with EWN 8350. A supplementary “chemical fingerprint” of the concentrate will be made to rule out/verify any changes in the concentrate composition.

If the suitability test shows that the hydraulic fluid meets the requirements, the operator will receive a corresponding certificate from Caterpillar.

The certificate is valid for a period of one year and, after a simplified test, can each be extended for an additional year.

The certificate loses its validity when one or more properties of the process water and/or concentrate no longer meet the requirements. Changes in the mixing ratio will also make the certificate void.

Important!
Changes in the composition of the water will lead to the loss of the certificate even if they are within the limit values mentioned.

If system parts from different manufacturers should be used in a mine, a special permit can be issued for operating all hydraulic components with the same hydraulic fluid after consulting with Caterpillar.

Pressure relief valves (spring-loaded)

Pressure relief valves must be subjected to a functional test at the latest after one year of operation, or when the equipment is moved to another face.

If this deadline cannot be complied with, it is up to the operator to make an exception to extend it.

Possible errors:

Leaky pressure relief valves can usually be detected by the escaping hydraulic fluid or by a pressure drop on the pressure gauge indicator (if there is one). If fluid is already discharged at working pressure, the pressure relief valve is defective or the discharge pressure setting of the pressure relief valve used is too low.

☞ Check the pressure specifications of the pressure relief valves based on the hydraulic circuit diagrams and exchange the damaged valves.

Pressure relief valves (gas-filled)

Pressure relief valves which are pre-tensioned with gas pressure must be additionally random-checked at regular intervals to make sure they can still work. We recommend random inspections at quarterly intervals.

If this deadline cannot be complied with, it is up to the operator to extend it after a corresponding risk analysis.

Test criteria for accumulator cartridges

Accumulator cartridges in hydraulic systems should be checked regularly.

If not otherwise required by the manufacturer, we recommended that approx. 20% of the installed accumulator cartridges be randomly checked every year.

After 2 years of use, all accumulator cartridges of a hydraulic system should be removed and checked.

Important!
When installing accumulator cartridges, always exchange the used sealing rings for new ones, too.

Warning!
Setting/testing the gas filling pressure
Possible consequences: destruction of the hydraulic accumulator, bodily injury due to accumulator bursting
Setting, testing and filling work may only be carried out by Caterpillar Service personnel.

☞ When checking the gas filling pressure, the permissible pressure of the hydraulic accumulator must not be exceeded.

☞ No gas may flow out after each test or setting.

Caution!
Maintenance and filling of accumulator cartridges
Possible consequences: destruction of the accumulator cartridge
Maintaining and filling accumulator cartridges may only be done by Caterpillar Service personnel!