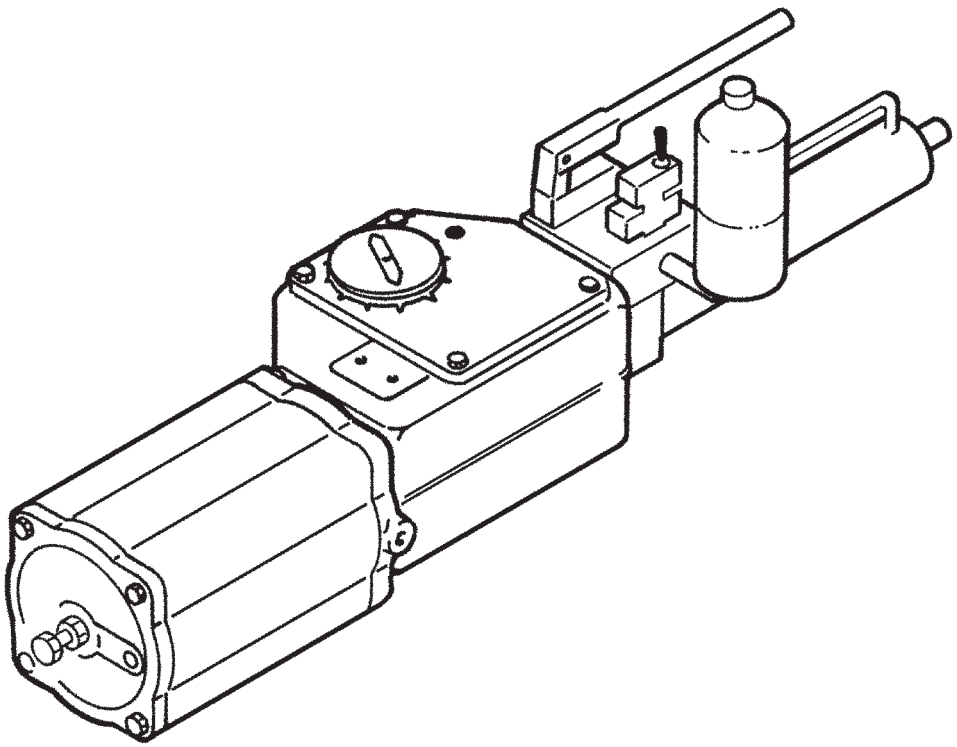
Pneumatic cylinder actuators

Series B1CH

Installation, maintenance and operating instructions



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READ THESE INSTRUCTIONS FIRST!

These instructions provide information about safe handling and operation of the valve.

If you require additional assistance, please contact the manufacturer or manufacturer’s representative.

SAVE THESE INSTRUCTIONS!

Addresses and phone numbers are printed on the back cover.

1. GENERAL

1.1 Scope of the manual

These instructions contain the main information needed by users of Neles B1CH and BCH series actuators. Additional information on valves, positioners and other fittings are available from the instructions on installation, operation and maintenance of the model in question.

1.2 Structure and operation of the actuator

B1CH-series actuators are pneumatic, double-acting cylinder actuators with hydraulic manual override.

B1CH-series are based on same design platform as B1C-series.

The robust heavy-duty construction effectively protects actuator and hydraulic override against vibrations and ambient dust and humidity.

The attachment dimensions used for of B1CH actuators meet the ISO 5211 standard; those for the older generation BCH actuator are in accordance with the manufacturer's standard.

The double-acting pneumatic cylinder is fitted with a double-acting, manually operated hydraulic cylinder at the other end of the piston rod. The linkage converts the linear motion of the cylinders into rotation of the outgoing shaft (90°), see Fig. 1.

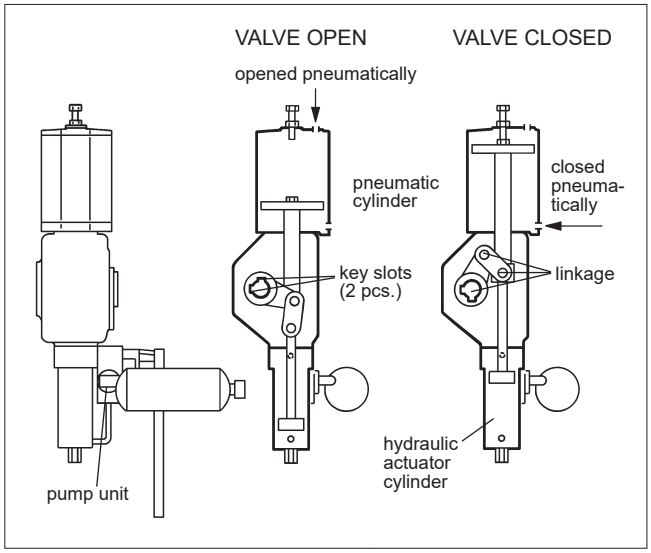


Fig. 1 Operating principle of the B1CH and BCH actuators

The actuator generates maximum torque when for example a ball or butterfly valve is closed, and the need for torque is greatest. Another peak is achieved at 60-80°, when the need for torque on a butterfly valve caused by the dynamic forces of for example pipe flows reaches a maximum. The relationship of the turning angle and the torque is shown in Fig. 5.

The rotation angle of the actuator shaft can be limited by the screws that regulate the length of the piston stroke. These are located in the upper end of the pneumatic cylinder and in the lower end of the hydraulic cylinder (under a protective cap).

The operating principle of the B1CH502 and BCH502 actuators is similar to that of the B1CH and BCH actuators, but the former are fitted with two pneumatic cylinders and two hydraulic actuator cylinders controlled by a single manual hydraulic pump unit (see Fig. 2).

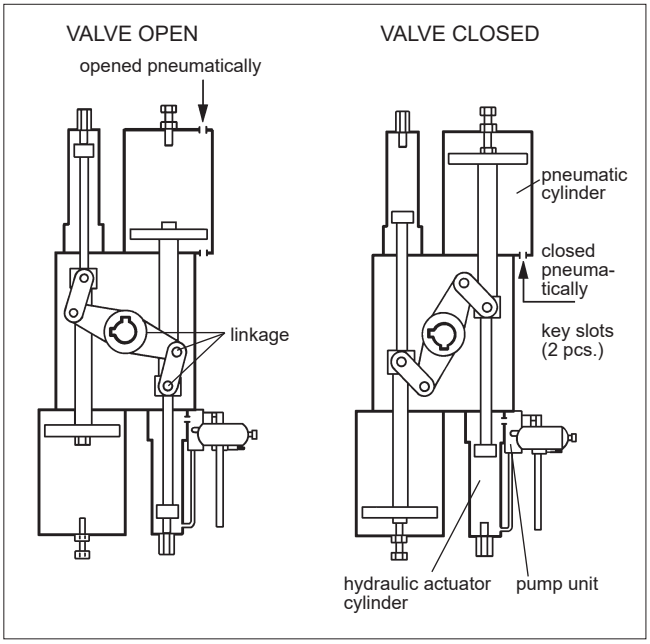


Fig. 2 Operating principle of the B1CH502 and BCH502 actuators as seen from the valve side

1.3 Actuator markings

An identification plate containing the following information is attached to the housing end of the pneumatic cylinder (Fig. 3):

1. Type
2. Manufacturing site, date, successive no. (bar code)
3. SO number or ID number (bar code)
4. Checked by
5. Max. supply pressure

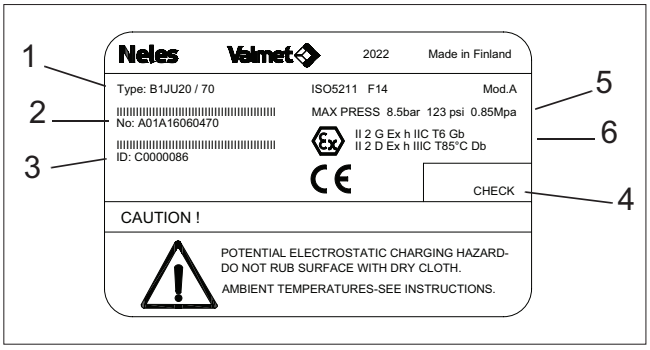


Fig. 3 Information on identification plate.

An identification plate containing the following information is attached to top of the hydraulic pump unit (Fig. 4):

1. Type
2. Serial number

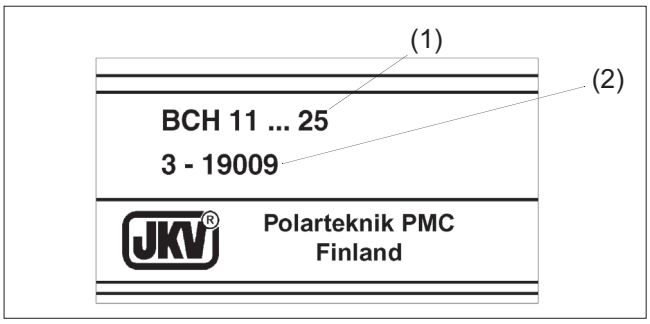


Fig. 4 Information on pump unit identification plate

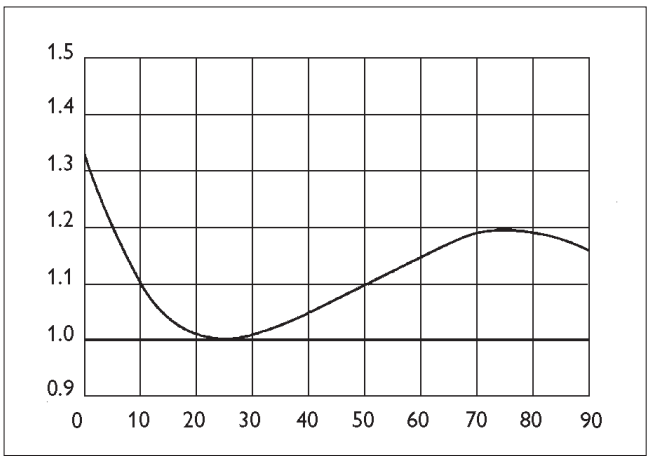


Fig. 5 Output torque as a function of turning angle

Table 1 Stroke volume, supply pressure and nominal torque

Actuator	Stroke volume of pneumatic cylinder, dm^3	Maximum pneumatic supply pressure bar	Nominal torque (Mn) on maximum pneumatic supply pressure Nm
B1CH11 B1CH13	1.1 2.3	8.5 8.5	460 950
B1CH17 B1CH20	4.3 5.4	8.5 10	1 800 2 700
B1CH25 B1CH32 B1CH40	10.5 21 43	10 10 10	5 300 11 000 22 000
B1CH50 B1CH502 B1CH602 B1CH752	84 196 282 441	10 10 8.5 5	43 000 90 000 115 000 110 000

Note:
Nominal torque Mn is the lowest output torque of the actuator on maximum input pressure. The torque changes according to supply pressure

Table 2 Operating pressure, oil volume and number of pump strokes

Actuator	Maximum operating pressure of hydraulic pump unit bar	Total volume of hydraulic oil dm^3	Number of pump strokes (up + down) of hydraulic manual override	
			valve closed	valve open
B1CH11 B1CH13	70 110	2.2 2.3	14 17	11 13
B1CH17 B1CH20	160 80	2.3 2.5	21 66	16 50
B1CH25 B1CH32 B1CH40	130 90 130	2.8 6 7	83 254 333	62 190 250
B1CH50 B1CH502 B1CH602 B1CH752	130 130 160 150	14 25 25 25	660 1320 1543 1543	495 990 1158 1158

1.4 Technical data

Operating temperature:

standard structure	-20...+70 °C
low temperature structure	-40...+70 °C
high temperature structure	-20...+120 °C

1.5 Recycling and disposal

Most actuator parts can be recycled if sorted according to material. Most parts have material marking. A material list is supplied with the actuator. In addition, separate recycling and disposal instructions are available from the manufacturer. An actuator can also be returned to the manufacturer for recycling and disposal against a fee.

1.6 Safety precautions

CAUTION:
Don't exceed the permitted values!
Exceeding the permitted pressure value marked on the actuator may cause damage and lead to uncontrolled pressure release in the worst case. Damage to the equipment and personal injury may result.

CAUTION:
Don't dismantle a pressurized actuator!
Dismantling a pressurized actuator leads to uncontrolled pressure release. Shut off the supply pressure and release pressure from the cylinder before dismantling the actuator.
Otherwise, personal injury and damage to equipment may result.

CAUTION:
Beware of the cutting movement of the valve!
Hands, other parts of the body, tools or other objects must not be pushed into the valve's flow port while it is open. Also prevent foreign objects from entering the pipes. The valves function like a cutter while operating. Shut off and detach the supply of compressed air to the actuator during maintenance.
Otherwise, personal injury or damage to the equipment may result.

CAUTION:
Take the weight of the actuator or valve combination into account when handling it!
Do not lift the valve combination from the actuator, positioner, limit switch or their piping. Lift the actuator as shown in Section 2, lifting ropes for a valve combination should be fastened around it. The weights are shown in Section 10. Dropping may result in personal injury or damage to the equipment.

CAUTION:
Incorrect use of the manual control lever may damage the valve or prevent operation of the manual override!
When operating the actuator pneumatically, do not at the same time close or open the manual control lever of the hydraulic pump unit improperly. Should this happen, the valve will stop or race and get damaged, or operation of the hydraulic pump will be prevented. Also, beware of the fast cutting movement of the valve.

CAUTION:
Install the air filter provided in the package on the top of the reservoir before operating the valve to prevent damage to the hydraulic pump unit!
To prevent oil leaks, the reservoir has been closed with a plug for transport.

2. TRANSPORTATION, RECEPTION AND STORAGE

Check the actuator and the accompanying devices for any damage that may have occurred during transport. Store the actuator carefully before installation, preferably indoors in a dry place. Do not take the actuator to the intended location and do not remove protection plugs from the pipe connections until the actuator is installed.

Lift the actuator according to Figure 6:
Horizontally from the stop screws, vertically from a lifting eye-bolt which has been fitted instead of the stop screw. Do not use eye-bolts for double cylinder actuators. See Section 10 for weights.

Larger actuators have lifting hooks. Do not lift the valve-actuator assembly from actuator.

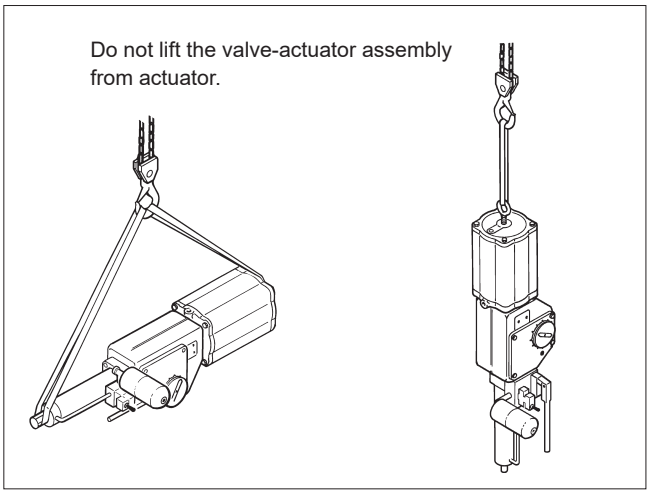


Fig. 6 Lifting the actuator

3. MOUNTING AND DEMOUNTING

3.1 Actuator gas supply

Dry compressed air or sweet natural gas can be used in double-acting cylinder actuators; an oil spray is not needed, nor recommended. Clean, dry and oil-free compressed air must be used in cylinder actuators equipped with a positioner. The air inlets are B1CH11, 13 3/8 NPT; B1CH17, 20, 25 1/2 NPT; B1CH32, 40 3/4 NPT and B1CH50, 502, 602, 752 1 NPT. The maximum permitted supply pressure is indicated on the identification plate. See also Section 1.4 'Technical data'.

3.2 Mounting the actuator on the valve

CAUTION:
Take the weight of the actuator or valve combination into account when handling it!

CAUTION:
Beware of the cutting movement of the valve!

CAUTION:
Install the air filter provided in the package on the top of the reservoir before operating the valve to prevent damage to the hydraulic pump unit!
To prevent oil leaks, the reservoir has been closed with a plug for transport. If the plug places the air filter and then operating with pressure air quickly, the swingle bounces powerfully up. Otherwise, personal injury or damage to the equipment may result.

The valve is installed directly into the shaft bore of the actuator. If the shaft bore is larger than the shaft diameter, a bushing is used. There are two key slots in the shaft bore of the actuator; the angle between them is 90°. They permit changes in the installation position of the actuator with respect to the valve. Neles valves have a bevel at the end of their shafts to facilitate installation.

The installation position can be chosen freely, but Neles recommends one in which the cylinder is horizontal. The hydraulic oil reservoir must always be positioned upright above the manual hydraulic override.

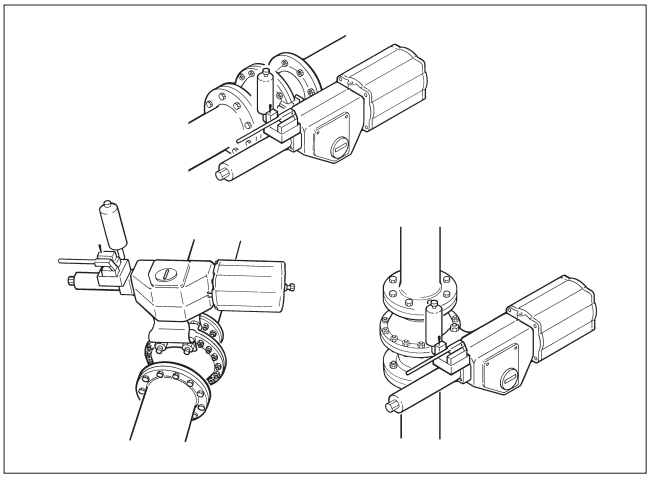


Fig. 7 Ways to install the actuator

When you change the position of the actuator make certain the indicator arrow has been turned to a position corresponding to that of the valve. Modification of the installation position of the manual hydraulic override is described in Section 3.3.

The shaft bore and the bushing can be lubricated before mounting with anti-corrosive, for example Cortec VCI 369, to prevent them from rusting together.

The actuator must not touch the pipeline, because pipeline vibration may damage it or interfere with its operation.

In some cases, for instance when the actuator is exceptionally large, the valve has an extended stem or when there is lot of piping vibration, it may be advisable to support the actuator. Contact Valmet Flow Control for more instructions.

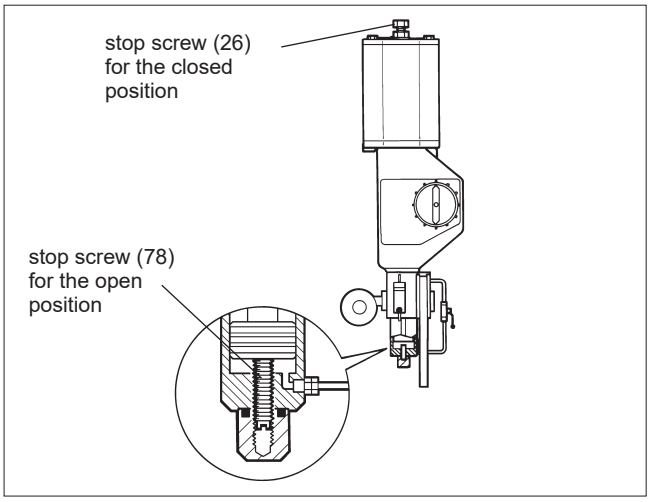


Fig. 8 Ways to install the actuator

There are two adjustable stop screws in the actuator; these stop the movement of the secondary shaft in the extreme positions. The actuator generates a torque of approximately 1.3 times the nominal torque when the piston is at the upper end of the cylinder, see also Fig. 5. Some equipment require a greater torque at one extreme position than in the intermediate position, for example when a ball valve is being opened. The actuator must therefore be installed so that the screw in the end of the cylinder limits the movement of the shaft in which the greatest torque is required. Use non-hardening locking sealant, for example Loctite 225. The setting of the open position is adjusted with the limit screw (78) located within the box nut at the end of the hydraulic cylinder. Also see instructions for individual valves.

If the actuator is used with devices other than Neles valve, any additional parts attached to the actuator must be properly protected.

3.3 Changing the installation position of the hydraulic pump unit

The operating position of the hydraulic pump unit can be varied according to the installation position of the valve, but not all positions are possible. The reservoir of the hydraulic pump unit must always be upright above the manual hydraulic override. Feasible installation positions are shown in Section 10.1.

The pump unit can be turned in place to achieve the required position in relation to the actuator housing. The unit is attached by four screws (90). The standard installation position is shown at the top of drawing in Section 10.1, and from this position the pump unit can be turned in place to positions A-HL and A-HR in relation to the actuator housing (other positions in parentheses).

Installation positions F-L1 and G-L1 require the reservoir to be detached and mounted in a new position. First, however, the hydraulic pump unit must be drained of oil, see Section 5.2, and after the modification filled up again and bled, see Sections 5.6, 5.7 and 5.8. The reservoir has two pipe adapters. In installation position G-L1, the reservoir is attached to the flange of the straight pipe. The unused branch is closed by the blanking end (24) with an O-ring (11), seal (18) and O-ring (12) underneath. The reservoir is attached with four screws (27) and two flanges (20) and sealed with an O-ring (12). See Sections 9.5, 9.6 and 9.7.

In installation position F-L1, the reservoir must be attached to the port on the other side of the frame plate (14). The port is covered by a flange (19) attached with four screws (26) and sealed with an O-ring (12). All changes can thus be made using existing parts.

Changing the installation position of the hydraulic pump unit and its pump rod in B1CH502–752

The dimensional drawing in Section 10 shows that the actuator can be assembled into two basic positions: I, which is the standard position, and II.

If, for example, position I is to be changed to position II, the steel piping between the two hydraulic cylinders must be completely changed.

The manufacturer has a separate modification instruction, D309573, for this or the opposite modification (available on request).

3.4 Hydraulic fluid

A suitable hydraulic fluid is Esso Univis HVI26 or Shell S-9603 mineral oil. The oil volumes are indicated in Table 2.

Checking the oil

Check that the hydraulic cylinder piston is at the limit screw end of the hydraulic cylinder. The process valve is then open.

Detach the air filter (3) at the top of the reservoir (2), see Sections 9.5, 9.6 and 9.7. The fluid level should be about 70 mm from the top edge of the aperture. Add oil as necessary. Attach the air filter (3).

3.5 Demounting the actuator from the valve

CAUTION:
Take the weight of the actuator or valve combination into account when handling it!

CAUTION:
Beware of the cutting movement of the valve!

CAUTION:
When detaching actuator from valve, sudden release may take place due to friction on valve shaft - actuator bore connection.

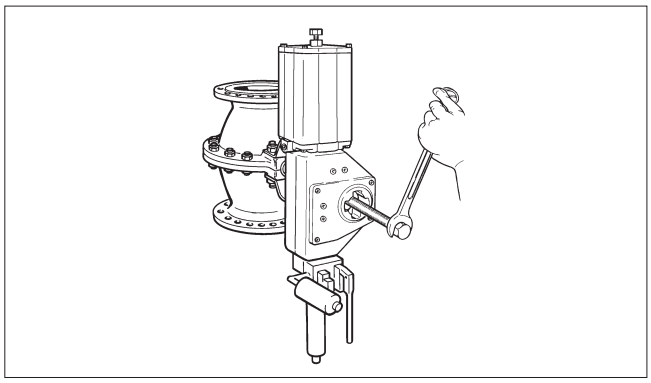


Fig. 9 Removing the actuator with the extractor

Open the screws on the actuator side of the bracket and remove the actuator from the valve shaft. Use the special tool shown in Figure 9, see also Section 7 ’Tools’.

Make certain that the positioning of the valve and actuator vis a vis each other remains the same when you remount the actuator. This maintains the previous direction of operation.

4. OPERATION

4.1 Remote control, valve to close

The valve is operated pneumatically through remote control, and the hydraulic oil is in idle circulation. Operation is automatic.

The actuator is fitted with an instructions plate as shown in Fig. 10. The actions required to close a valve in the open position behind the actuator by pneumatic remote control are illustrated on the left-hand side (A) of the plate.

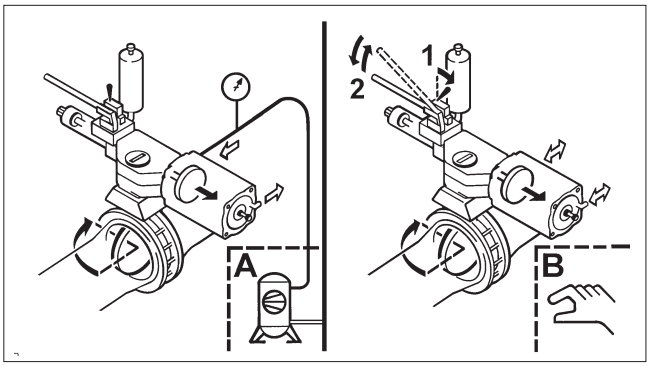


Fig. 10 Operating instructions plate, closing the valve

Fig. 11 shows the schematic operating principle of the hydraulic pump unit on remote control.

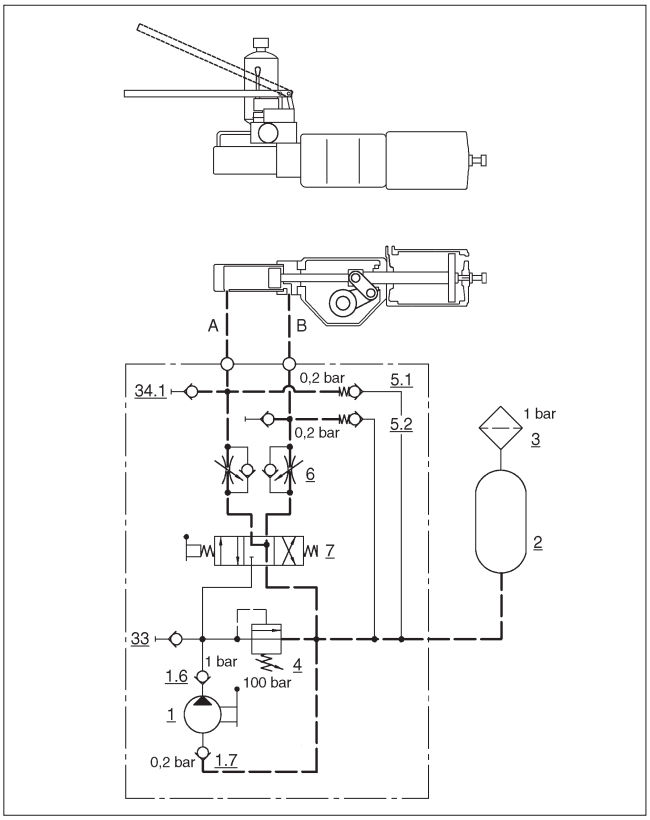


Fig. 11 Operating principle of the hydraulic pump unit on remote control

When the control lever of the 4/3-control valve is in the centre position (self-centring), the actuator can be operated pneumatically.

WARNING:
Do not lock the 4/3-control valve to non-centre position.

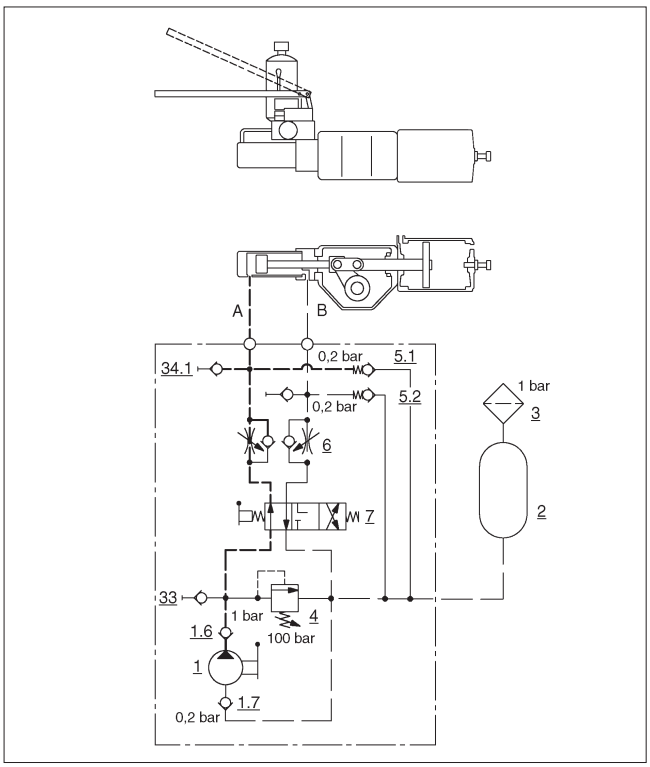


Fig. 12 Operating principle of the hydraulic pump unit on manual control, operating to closed position

NOTE:
If the actuator cylinder of the hydraulic pump unit is fitted with a by-pass valve, see Section 4.5, this must be in the open position, i.e. the manual lever of the by-pass valve must be parallel with the by-pass pipe.

4.2 Manual control, valve to close

The actions required for manual control are illustrated on the right-hand (B) side of the instructions plate shown in Fig. 10.

NOTE:
Make sure that pressure has been released from the actuator cylinder and ports are not closed. If there is an air pressure reservoir in the system, it must be separated.

Air replacement must be allowed into the lower part of the cylinder since the piston moves up when operated, and if the air pipes at the end of the cylinder are closed, harmful overpressure will be created above the piston.

NOTE:
If the actuator cylinder of the hydraulic pump unit is fitted with a by-pass valve, see Section 4.5, this must be in the closed position, i.e. the manual lever of the by-pass valve must be crosswise to the by-pass pipe.

To operate the valve to close, push the control lever of the 4/3-control valve (7) (see Fig. 12) towards the pneumatic cylinder (in the “closed” position shown on the plate) while pumping back and forth with the hydraulic pump (1) until the valve is closed. The control lever can now be released, and it will return to the centre position. (In this position, it can be operated pneumatically provided that the by-pass valve is open.)

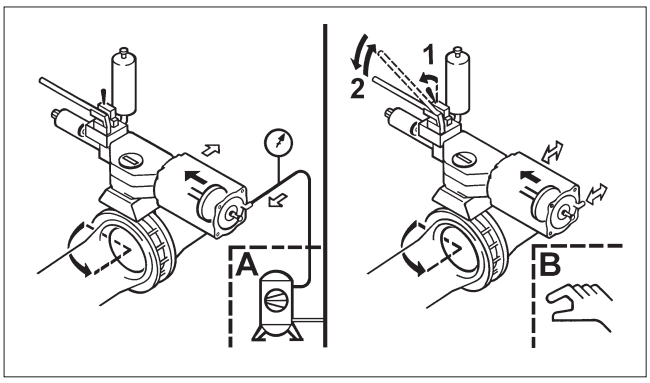


Fig. 13 Operating instructions plate, opening the valve

When the pump is operated, oil flows from the reservoir (2) through the pump (1), the 4/3-control valve (7) (position “closed”) and the velocity restrictor valve (6) to the hydraulic cylinder (A). From the opposite side (B) of the piston, the oil returns through the restrictor valve (6) to the 4/3-control valve (7) and on to the pump (1).

When the 4/3-control valve lever is released, the pressure created by the hydraulic pump is lost and the torque turning the valve drops to zero.

The maximum pressure of each actuator is set at the factory with the pressure relief valve (4), see Table 1, and the pressure can be measured from the take-off point (33), R 1/4, see Fig. 12 and Sections 9.5, 9.6 and 9.7.

The reservoir (2) is provided with an air filter (3) through which the volume of air in the top of the reservoir can compensate for changes in oil volume in the hydraulic system.

NOTE:
The air filter must always be topmost.

4.3 Remote control, valve to open

The actuator is fitted with an instructions plate as shown in Fig. 13. The actions required to open a valve in the closed position behind the actuator pneumatically by remote control are shown on the left-hand side (A) of the plate. The operation is automatic.

NOTE:
If the actuator cylinder of the hydraulic pump unit is fitted with a by-pass valve, see Section 4.5, this must be in the open position, i.e. the manual lever of the by-pass valve must be parallel to the by-pass pipe.

When the lever of the 4/3-control valve (7) (see Fig. 11) of the hydraulic pump unit automatically centres to its “idle” position, the hydraulic oil can circulate freely to the other side of the actuator cylinder piston. The device is now ready to be pneumatically operated.

4.4 Manual control, valve to open

The actions required for manual control are illustrated on the right-hand (B) side of the instructions plate shown in Fig. 13.

NOTE:
Make sure that pressure has been released from the actuator cylinder and ports are not closed. If there is an air pressure reservoir in the system, it must be separated.

Air replacement must be allowed into the upper part of the cylinder since the piston moves down when operated, and if the air pipes at the cylinder base are closed, harmful overpressure will be created below the piston.

NOTE:
If the actuator cylinder of the hydraulic pump unit is fitted with a by-pass valve, see Section 4.5, this must be in the closed position, i.e. the manual lever of the by-pass valve must be crosswise to the by-pass pipe.

Push the control lever of the 4/3-control valve towards the end of the hydraulic actuator cylinder (in the “open” position shown on the plate) and hold it there while pumping back and forth with the hydraulic pump until the valve is open. The control lever can now be released. It will centre automatically, and the unit can now be operated pneumatically provided that the by-pass valve, if there is one, is open.

4.5 Operating the by-pass valve

Should very fast operating times be required of the valve being operated on remote control, the hydraulic actuator cylinder is provided with a pipe by-passing the piston (see Fig. 14) to allow the hydraulic oil to flow fast enough to the other side of the hydraulic piston.

When using manual control, see that the by-pass pipe is closed with the by-pass valve provided, i.e. the lever of the by-pass valve must be crosswise to the by-pass pipe.

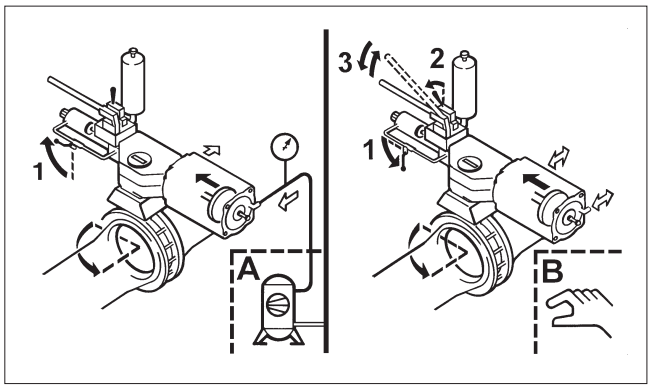


Fig. 14 Operating instructions plate, opening the valve and operating the by-pass valve

4.6 Difference in operation of B1CH502–752 and B1CH11–50

The operation of B1CH502–752 from that of B1CH11–50 only in that the 502–752 actuators have two pneumatic and hydraulic cylinders and one pump unit. The pneumatic and hydraulic piping is therefore branched to two cylinders (see Fig. 2). While operating, remember that two by-pass valves must be used simultaneously, see Fig. 15.

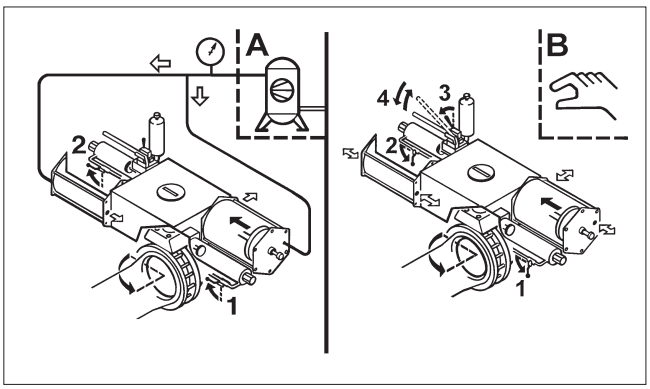


Fig. 15 Operating instructions plate for BCH502, opening the valve

5. MAINTENANCE

5.1 General

CAUTION:
Note the precautions in Section 1.6 before begin-ning work!

In normal conditions, the B1CH actuators require no regular servicing except for the oil level check. Maintenance that can easily be performed by the end user is presented below.

The part numbers in the text refer to the exploded view and to the parts list in Section 9, unless otherwise stated.

The linkage inside the housing should be lubricated at six-month intervals under severely corrosive conditions. Use for example an anti-corrosive like Cortec VCI 369.

Remember to adjust the limits after lubricating if you have loosened the limit screw!

NOTE:
In order to ensure safe and intended performance, remember to re-assemble all parts (e.g. 3a, 4a) as per original construction.

NOTE:
Repair and maintain actuator in a safe environment.

NOTE:
Before using chemicals, read Material Safety Data Sheet.

5.2 Removing oil from the hydraulic pump unit

Oil must be removed from the actuating cylinder and pump unit before servicing.

Connect pneumatic supply through adjustable (0.2-5 bar) relief valve to end of cylinder (/cylinder base).

Adjust operating speed approximately as follows:

B1CH11–17	ca. 20-35 sec
B1CH 20–32	ca. 40-60 sec
B1CH 45–50	ca. 75-90 sec
B1CH502	ca. 90-100 sec

- Remove air filter at top of upright reservoir.
- Remove vent plug (89) and connect adjusted pneumatic supply to end of cylinder to force oil out slowly. (If there is a by-pass valve, close it first, i.e. turn valve lever crosswise to pipe.)
- Remove plug (99) and connect pneumatic supply to cylinder base to force oil out slowly.

5.3 Replacing of piston seals

Pneumatic cylinder

CAUTION:
Don't dismantle a pressurized actuator!

If the piston rings of the hydraulic cylinder are to be replaced at the same time, first remove the oil as described in Section 5.2.

Replacement of all seals and soft bearings is recommended when the actuator has been disassembled for maintenance.

- Remove the actuator from the valve.
- Feed compressed air to end of cylinder to get piston to stop at about 30° before open position. Release pressure from cylinder.
- Remove housing cover (2).
- Turn hydraulic cylinder piston rod (75) off bearing unit and detach cylinder mounting screws (31) from cylinder base (6) side. If the piston (9) turns along with the piston rod (75), remove cylinder end (44) and prevent turning with the piston attachment screw (28), see Fig. 16.

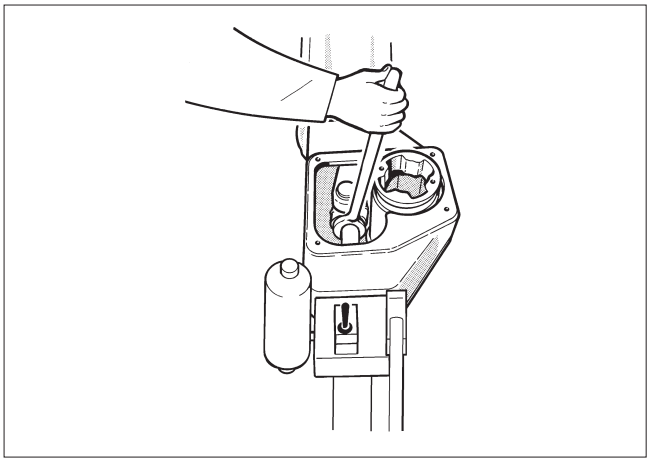


Fig. 16 Removing hydraulic cylinder piston rod

- Remove the cylinder and the piston, including the rod.
- Remove the old seals and the O-ring (24, 18, 19).
- Remove the O-rings (16, 16a) and the bearing (22). Clean the seal space.
- Lubricate the seal space and the new O-rings (16, 16a) with Unisilikon L250L or Molykote III. Install the new bearing (22) and O-rings (16, 16a). See Fig. 17.

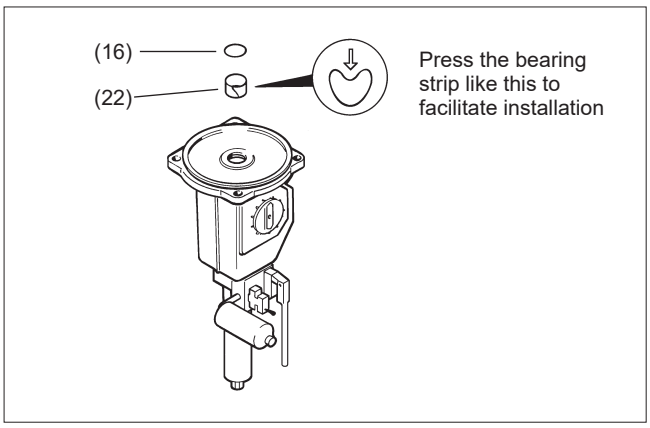


Fig. 17 Mounting the piston rod bearing and seal

- Clean the piston seal groove and lubricate with a thin layer of Cortec VCI 369.
- Place the O-ring (18) under the piston seals.
- Locate the seals (24) around the piston so that the ends of the strips come on opposite sides. Tighten the strips with the tie ring as shown in Figure 18. The strips marked with an asterisk (*) may be cut 1,5-3 mm shorter to facilitate assembly.

NOTE:
The inside surface of the cylinder must be free of grease!

- Knock or press the piston through the tie ring with a press, Fig. 19.
- Mount the O-ring (19) and the cylinder and piston. Note the location of the air inlet: use the air inlet of the cylinder base as a guide. Tighten the screws (31). See Table 3 for torques.

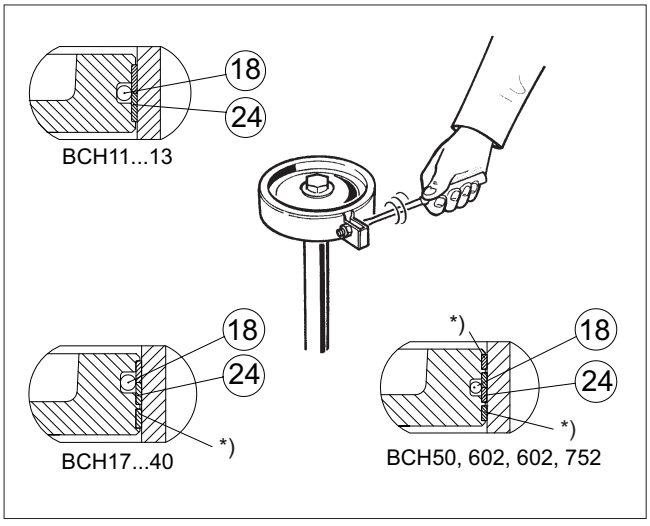


Fig. 18 Tightening the piston seals with a tie ring

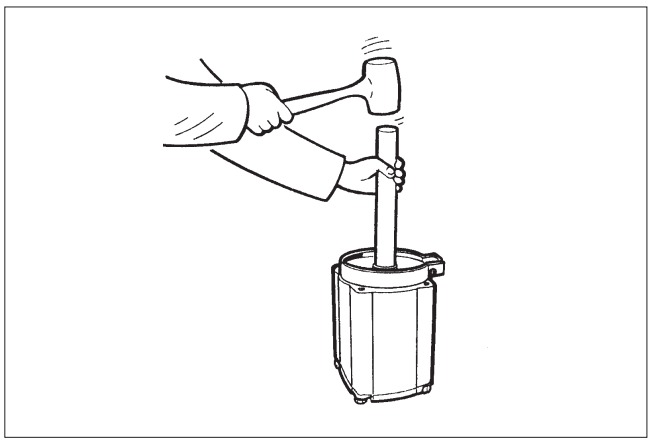


Fig. 19 Placing the piston in the cylinder

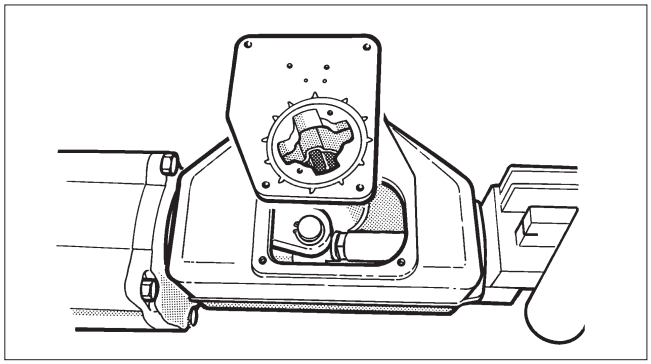


Fig. 20 Mounting the cover on the housing

- Apply sealant, e.g. Loctite 225, to hydraulic cylinder piston rod (75) thread and tighten this through bearing unit (5) to pneumatic cylinder piston rod (10) to the torque indicated in Table 3.
- Fasten the housing cover temporarily so that the linkage bearings (3) function, but the linkage is still visible, see Fig. 20.

CAUTION:
Keep your fingers, tools or other items out of the housing while operating the actuator with the cover open!

Check the assembly of the cylinder to the cylinder base and end. Connect the supply air to the cylinder temporarely via a shut-off valve.

- Operate the actuator and check the function of the cylinder. Also check that the linkage bearings function properly. Remove the air supply and release pressure from the cylinder.
- Lubricate the linkage, inside surface of housing and cover throughout with Cortec VCI 369 anti-corrosive.
- Clean housing and cover contact area. Apply proper amount (min. 3 mm diameter continuous path) of sealant (e.g. Loctite 573, with sizes B1CH40 up use silicone sealant) on the surfaces between the housing and the cover. Fasten the cover. See Table 3 for torques.
- Install new pressure outlet valve (58) on to housing cover.
- Mount the actuator to the valve and adjust the limits.

If you wish to remove the cylinder base, you will need a special tool to open the lock nut (35), see the 'Tools' section.

The nut must be secured with e.g. Loctite 225 when remounted.

5.4 Replacement of linkage bearings and O-rings

CAUTION:
Do not dismantle a pressurized actuator!

- Remove the actuator from the valve.
- Feed compressed air to cylinder end to get piston to stop at about 30° before open position. Then release the pressure.
- Remove housing cover (2).
- Turn open the hydraulic cylinder piston rod (75) holding the bearing unit (5), see Fig. 16.
- Turn the lever (3) so that the bearing unit is detached from the piston rod (10). Lift the entire lever system out of the housing, Figure 21.
- If you require more clearance for the operation, adjust the stop screws correspondingly.

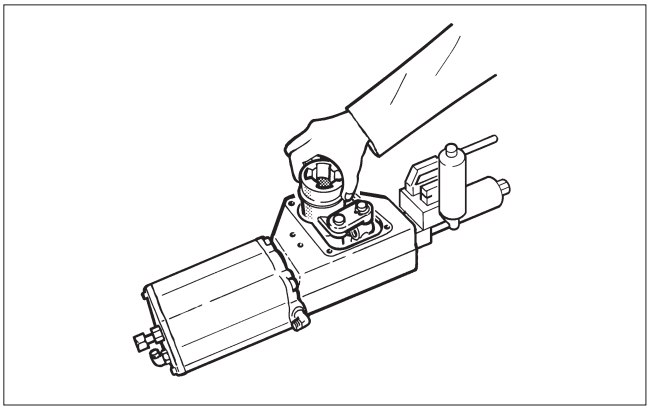


Fig. 21 Removing the linkage from the housing

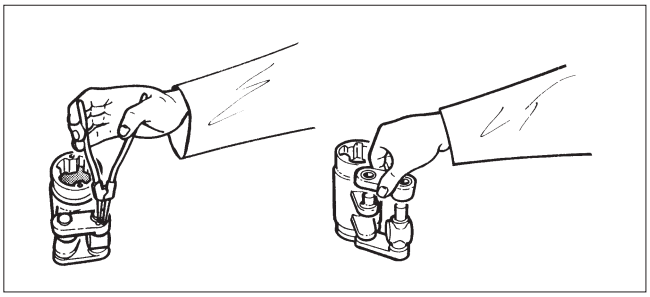


Fig. 22 Dismantling the linkage

- Remove the lock rings (36) and the support rings (37), see Fig. 22.
- Loosen the connection arms (4), clean them and check the condition of the bearings (20, 21).

The bearings (20,21) of the connection arm (4) of B1CH11–25 actuators are fastened with a press-on fit so that the entire connection arm assembly is replaced instead of the bearings.

The bearings in actuators B1CH32–752 are removable.

- Remove the lever bearings (23) and the O-rings (17).
- Clean the parts of the levers and lubricate the bearing and seal surfaces with Cortec VCI 369.
- Install the lever bearings (23) and the O-rings (17).
- Assemble the levers. Place them in the housing, see Figure 21 for the correct position.

- Apply sealant, e.g. Loctite 225, to hydraulic cylinder piston rod (75) thread and tighten this through bearing unit (5) to pneumatic cylinder piston rod (10) to the torque indicated in Table 3.
- Lubricate the linkage, inside surface of housing and cover throughout with Cortec VCI 369 anti-corrosive.
- Clean housing and cover contact area. Apply proper amount (min. 3 mm diameter continuous path) of sealant (e.g. Loctite 573, with sizes B1CH40 up use silicone sealant) on the surfaces between the housing and the cover. Fasten the cover, Fig. 20. See Table 3 for torques.
- Install new pressure outlet valve (58) on to housing cover.
- Operate the actuator and check that it moves correctly.
- Install the actuator on the valve and adjust the stop screws.

Cortec VCI 369 must be applied at six-month intervals in damp conditions where corrosion is likely. Grease filling the housing should also be considered.

5.5 Replacing hydraulic cylinder seals

- Drain system of oil as in Section 5.2.
- Feed compressed air to cylinder end to get piston to stop at about 30° before open position. Release cylinder pressure.
- Remove housing cover (2), see assembly drawings in Section 9.
- Loosen adapter (88) and remove middle nut of elbow pipe (212).
- Detach pump unit by removing screws (85).
- Turn piston rod (75) off, see additional instructions in Section 5.3.1.
- Detach cylinder end (71) from the housing (1) by removing screws (90).
- Remove cylinder end (71) and piston (74) with rod (75) from cylinder (70) by removing screws (97).
- Replace piston and piston rod lip rings (81, 83). Lubricate rings before installing. No special tool is needed for installation. Also replace cylinder O-ring (77) if it is damaged.
- Replace piston rod bearing (80) and piston bearing (82).
- Insert piston (74) with rod (75) in cylinder (70) taking care not to damage lip rings (83).
- Apply sealant, e.g. Loctite 225, to piston rod (75) thread and protect thread with a plastic sleeve to prevent damage to lip rings (81).
- Attach retaining flange (72) to cylinder end (71) with screws (97); use sealant, e.g. Loctite 225. The tightening torque is given in Table 3. Make sure that the O-ring (77) and retaining ring halves (73) are in place.
- Mount cylinder end (71) at the same time attaching piston rod (75) through bearing unit (5) to piston rod (10). Make sure that Loctite 225 is applied to the thread. Tighten screws (90) to torque given in Table 3.
- Attach pump unit with screws (85), apply Loctite 225 and tighten to torque given in Table 3. Check that pump unit O-ring (13) is in place.
- Tighten pipe (87) adapters (212, 88). Both thread and progressive ring must be lubricated. Start the tightening by hand so that you can feel the resistance and then give about half a turn with a key.

Table 3 Tightening torques for screws

	Torque, Nm									
Part	**28**	**30**	**31**	**35**	**75**		**79**	**85**	**90**	**97**
Actuator B1CH11	170	8	18	180	90		90	35	20	10
B1CH 12	170	12	18	200	170	19 *	90	35	20	10
B1CH 13	300	12	40	200	170		90	35	20	10
B1CH 16	300	12	40	250	300		90	35	20	10
B1CH 17	700	12	80	250	700		90	35	20	10
B1CH 20	700	20	80	400	700	30	400	35	90	10
B1CH 25	1100	30	80	800	1100		400	35	90	10
B1CH32	2000	70	80	1500	2000	50	1300	35	300	20
B1CH40	2000	70	200	2000	2000		1300	35	300	20
B1CH 50	3400	150	250	3000	3400	60	2100	35	800	20
B1CH502	3400	150	250	3000	3400		2100	35	800	20

*) Key size

Changing the hydraulic pump unit seals

Normally, the pump unit requires no servicing except for the oil level check (see Section 3.4.1).

Oil must always be removed before the unit is serviced (see Section 5.2); only the oil pump piston seals can be changed without oil removal.

The parts of B1CH11–25 pump units are shown in Section 9.5.
The parts of B1CH32–50 pump units are shown in Section 9.6.
The parts of B1CH502–752 pump units are shown in Section 9.7.

1. **Replacing pump piston seals (1.10, 1.12 and 1.13)**

   Remove air filter (3). Detach screws (28). Remove joint pin (1.5) and piston and replace seals. Lubricate seals and piston before replacing piston. Press piston against pump and attach screws (28) and pin (1.5). Oil may be in the pump during the operation, but make sure that air is bled as follows:

   - Open bleed screw (34.1) for about 1/2 turn, push control valve (7) lever to “closed” position and pump a couple of times. If there is air in the system it will come out from the bleed screw. Close bleed screw (34.1) and release control valve lever.
   - open bleed screw (34.2) for about 1/2 turn, push control valve (7) lever to “open” position and pump a couple of times. If there is air in the system it will come out from the bleed screw. Close bleed screw (34.2) and release control valve lever.

   Add oil when necessary (see Section 3.4.1) and attach filter (3).

2. **Replacing pressure relief valve seals (4.2, 4.3, 4.5)**

   Detach cover (4), clean valve carefully and replace seal rings. Oil seals before installation.

3. **Replacing check valve seals (5.1 and 5.2)**

   Remove blanking end (21) and reducing adapter (15) (in the actuator assembly drawing, this is part 88) and replace seals.

4. **Replacing restrictor and 4/3-control control valve seals (6.2 and 7.2)**

   Remove screws (29) and valves (6, 7) Remove valve covers and replace seals.

5.6 Filling and bleeding the B1CH11–25 hydraulic system

If the hydraulic system contains excessive air, the hand pump will not work but will behave like a soft rubber ball when squeezed. The presence of air will impair pump output.

First make sure that all adapters and plugs of the hydraulic system are tight.

Bleeding instructions for standard installation position E-L1

This installation position is illustrated in Section 10.1.

- Operate actuator to open position (pneumatic supply to end of cylinder).

NOTE:
Release pneumatic pressure from the actuator!

- Open bleed screw (34.2) about 20-30°. The screw is located between the attachment screws (85) of the pump unit.
- If the hydraulic cylinder is fitted with a by-pass valve (200), open this by turning lever parallel to pipe.
- Fill reservoir with Esso Univis HVI26 or Shell S-9603 oil to about 70 mm from top edge of aperture.
- Push 4/3-control valve (7) manual control lever towards closed position while pumping with hand pump to get pressurized oil to flow via pipe (87) to limit screw end of the actuator cylinder.
- Pump the hydraulic cylinder provided with a by-pass valve at least 10 times back and forth to fill the by-pass pipe with oil. Close the by-pass valve by turning the lever crosswise to the by-pass pipe.
- Continue pumping (with manual control lever in closed position). Make sure there is always sufficient oil in reservoir. The manual control lever can be returned during operation. The oil level must be above the suction pipe at the bottom of the reservoir during pumping. At the end, i.e. in closed position, it must be about 5 cm above the pipe. Add oil when necessary.
- Close bleed screw (34.2) and open the other one (34.1) 20-30°. The bleed screw (34.1) is above the adapter (88) of the pipe (87). The by-pass valve, if there is one, must be closed.
- Push manual control valve to open position and pump. This will make the actuator cylinder piston (74) travel towards the open position, displacing into the reservoir an amount of oil corresponding to the piston rod volume.
- With piston in open position against the limit screw, release manual lever and close bleed screw (34.1).
- Push manual lever to open position once more and pump. This will cause the pumping force requirement to rise to the maximum pressure set for the pressure outlet valve.

If no heavy resistance can be felt in the pump after one or two pump strokes, there is still too much air in the system. Excessive air can also be removed by raising the pressure with the pump and then quickly releasing the manual control lever to the idle position. Some of the pressurized air will then burst into the reservoir.

It is also advisable to check whether more air comes out from the bleed screw (34.1) by opening the screw while maintaining high pressure with the pump.

- Add oil to reservoir to about 70 mm from top edge of aperture.
- Open bleed screw (34.2) with other bleed screw (34.1) closed.
- Push manual control lever to closed position and raise pressure by pumping. If no heavy resistance can be felt in pump after two or three pump strokes, there is still too much air in the system.

NOTE:
The volume of pressurized oil is higher in this closed position than in the open position. Thus there is also more air.

- Excessive air can also be removed by raising the pressure with the pump and then quickly releasing the manual control lever to the idle position. Check whether more air comes out from the bleed screw (34.2) by opening the screw while maintaining high pressure with the pump.

The amount of air can be reduced by repeating the pumping in the open direction as described above and opening the bleed screw (34.1).

- Finally, check the amount of oil (about 70 mm) in the open position and fix air filter (3).

Bleeding instructions for installation positions F-L1 and G-L1

The installation position is shown in Section 10.1.

These positions differ from the standard installation position, E-L1, in that the oil pump piston is placed horizontally. That way the bleed screws (34.1 and 34.2) are in places where air does not accumulate.

In this case the bleed screw (34.1) is replaced by a vent plug + bleed screw (89) at the highest point of the cylinder end (71).

The function of the bleed screw (34.1) is replaced by a vent plug + bleed screw (89) at the highest point of the cylinder pipe (70) end.

Actuators in installation positions F-L1 and G-L1 are bled in exactly the same way as actuators in the standard E-L1 position, except that the vent plugs (89) mentioned above are used.

5.7 Filling up and bleeding the B1CH32–50 hydraulic system

These larger actuators can be bled more rapidly by operating the hydraulic cylinder actuating stroke pneumatically and not by pumping.

- First make sure that all adapters and plugs of the hydraulic system are tight.
- The actuator is bled exactly as described in Section 5.6.1 except that pumping is replaced by pneumatic operation. Attach box spanners and transparent plastic hoses to bleed screws (34.1, 34.2) and immerse the other end of the hoses into oil right down to the bottom of the reservoir (2).
- Connect pressure outlet valve (0,2-5 bar) to pneumatic cylinder and set operating speed to slow as in Section 5.2.
- Connect set pressure to cylinder end to open valve.
- Open bleed screw (34.2).
- Open by-pass valve, if there is one.
- Fill reservoir to about 70 mm from top edge.

- Connect pneumatic supply to cylinder base (operates in closed direction), after operating for 1/3 of the travel close by-pass valve, if there is one. See that there is enough oil throughout operation.
- Close bleed screw (34.2) and open the other one (34.1).
- Connect air supply to pneumatic cylinder end (operates in the open direction).
- Close bleed screw (34.1).
- Test amount of air: open manual control lever and pump. If resistance is heavy after two or three pump strokes, the amount of air is acceptable.
- Operate manual control lever to open, pump pressure high and release manual lever. Repeat once more.
- Add oil to about 70 mm from top edge.
- Open bleed screw (34.2).
- Connect pneumatic supply air to cylinder base (operates in closed direction).
- Test amount of air: turn manual control lever to closed position and pump. If resistance is heavy after two or three pump strokes, the amount of air is acceptable.
- Close manual control lever, pump pressure high and release manual lever. Repeat once more.
- Connect compressed air to cylinder end (operates in open direction).
- Check amount of air. If there is too much air, continue bleeding.
- Finally, check amount of oil (about 70 mm) in open position and fix air filter (3).

Bleeding instructions for installation positions F-L1 and G-L1

The installation position is shown in Section 10.1.

In these positions, the functions of the bleed screws are replaced as described in Section 5.6.2. Otherwise, proceed as described in Section 5.7.

5.8 Filling up and bleeding the B1CH502–752 hydraulic system

The B1CH502–752 series actuator differs from that of the B1CH11–50 series in that the former is fitted with two pneumatic and hydraulic cylinders and one hydraulic pump unit.

The pneumatic and hydraulic piping is branched to two cylinders, and so two cylinders are bled simultaneously.

The B1CH502–752 series actuators are assembled in two different installation positions. This description refers to valves with the operating shaft positioned upright.In the other position,the shaft is horizontal. In bleeding, the only difference is that the bleed screws are located differently on top of the cylinder.

If the actuator is not connected to a valve, it can be operated slowly (about 1.5 min) by feeding 1 bar pressure into one cylinder.

If one cylinder is not powerful enough to operate the valve, two cylinders must be used through a T-branch; the pressure is connected as shown in Figs. 23 and 24.

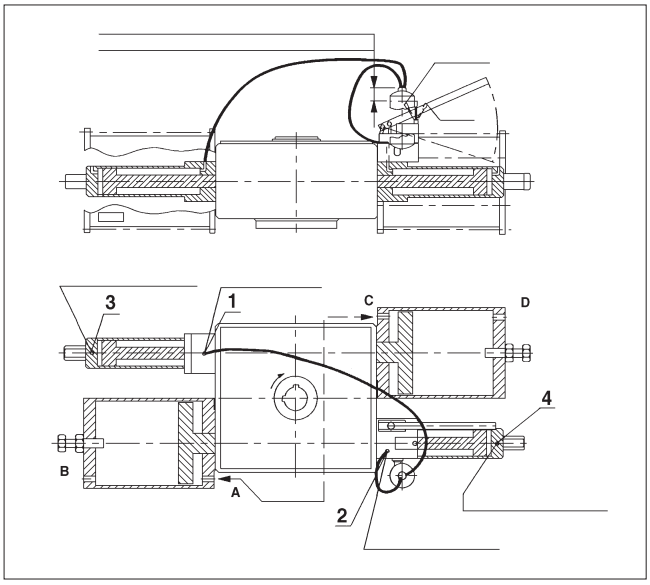


Fig. 23 Valve is open, operation to closed position

- Adjust operating speed to about 1.5 min with the pressure relief valve (1-8.5 bar).
- Operate actuator to open position; pneumatic supply as shown in Fig. 24.
- If actuator is fitted with two by-pass valves (200), open these (lever parallel with pipe).

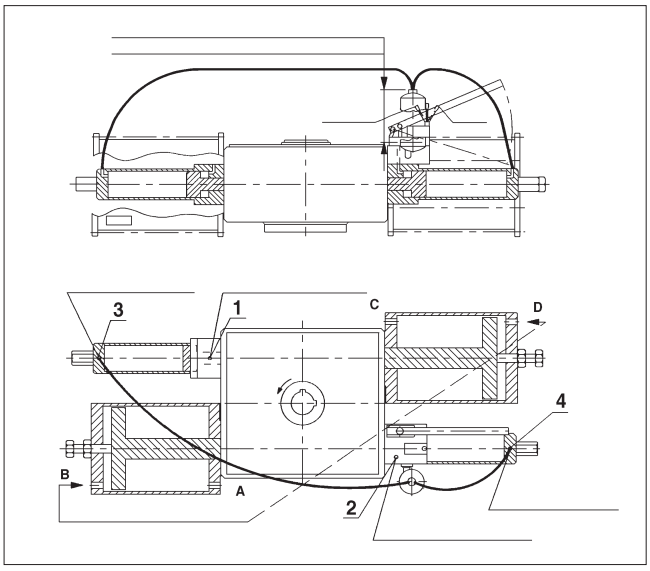


Fig. 24 Valve is closed, operation to open direction

- Remove oil reservoir air filter (3) and fill reservoir with Esso Univis HVI26 or Shell S-9603 oil.The maximum oil volume of the entire system is 25 litres, the stroke volume of the actuator shaft plus movement (valve to close) is 8.6 litres and that of the minus movement (valve to open) 6.5 litres. The volume of the reservoir is about 7.2 litres.
- Connect pneumatic supply as in Fig. 23 (valve closes). This will cause oil to enter the actuator cylinder. Stop after 60-70° shaft turn and add oil to fill reservoir.Operate the valve to closed position.
- Connect bleed hoses (Ø8/5 mm) shown in Fig. 23 from bleed screws 3 and 4 to reservoir and open screws about 20-30°. The hoses must be at the bottom of the reservoir below the oil surface.

- Connect pneumatic supply as in Fig. 23. Operate valve in open direction about 60-70° and fill reservoir with oil. Continue operating the valve to open position.
- Close bleed screws 3 and 4,connect bleed hoses to points 1 and 2 as in Fig. 23 (or connect four hoses to the reservoir) and open these bleed screws (1 and 2) about 20-30°.
- Connect pneumatic supply as in Fig. 23, stop at about 60-70° and add oil. Operate the valve to closed position.
- Close bleed screws 1 and 2,connect bleed hoses to points 3 and 4 as in Fig. 24 and open these bleed screws (3 and 4) about 20-30°.
- Add oil to reservoir.
- Close any by-pass valves (two) by turning lever crosswise to pipe.
- Connect pneumatic supply as in Fig. 24 to operate valve to open direction. Watch oil level; it must remain over the suction pipe at the bottom. Add oil, there should still be room for about one litre. Operate valve fully open.
- Close bleed screws (3 and 4).
- Push 4/3-control valve lever to closed position. Hold it there and pump (max. 30 strokes). The required pumping force will be increased up to the maximum pressure set for the pressure outlet valve. Release control lever quickly.
- Connect bleed hoses to points 1 and 2 as in Fig. 23 and open screws about 20-30°.
- as in Fig. 23 (or connect four hoses to the reservoir) and open these bleed screws (1 and 2) about 20-30°.
- Connect pneumatic supply as in Fig. 23, stop at about 60-70° and add oil. Operate the valve to closed position.
- Close bleed screws 1 and 2,connect bleed hoses to points 3 and 4 as in Fig. 24 and open these bleed screws (3 and 4) about 20-30°.
- Add oil to reservoir.
- Close any by-pass valves (two) by turning lever crosswise to pipe.
- Connect pneumatic supply as in Fig. 24 to operate valve to open direction. Watch oil level; it must remain over the suction pipe at the bottom. Add oil, there should still be room for about one litre. Operate valve fully open.
- Close bleed screws (3 and 4).
- Push 4/3-control valve lever to closed position. Hold it there and pump (max. 30 strokes). The required pumping force will be increased up to the maximum pressure set for the pressure outlet valve. Release control lever quickly.
- Connect bleed hoses to points 1 and 2 as in Fig. 23 and open screws about 20-30°.
- If by-pass valves are provided, open these.
- Connect pneumatic hose as in Fig. 23 to operate valve to closed position. Add oil to raise oil level to about 50-70 mm from top of reservoir.
- Close any by-pass valves provided. The hand pump will not work if the by-pass valves are open.
- Turn control valve lever to closed position and pump simultaneously (max. 30 strokes) until you feel the resistance. Release lever quickly.
- Connect bleed hoses to points 1 and 2 as in Fig. 23 and open screws about 20-30°.
- Open by-pass valves.
- Connect pneumatic hoses as in Fig. 23 to operate valve to closed position. Add oil to raise oil level to about 50-70 mm from top of reservoir.
- Close by-pass valves.
- Close bleed screws at points 1 and 2 and move bleed hoses over to points 3 and 4.
- Turn control valve lever to closed position and pump simultaneously (max. 30 strokes) until you feel the resistance. Maintain pressure with pump and open bleed screw under pressure at point 3.
  This is an efficient way of getting small amounts of air out of the actuator cylinder.
  Repeat procedure several times, the aim being to bring the number of pump strokes to below ten, preferably to a few only.
  Close bleed screw at point 3 and repeat procedure at point 4.
- Open by-pass valves.
- Open bleed screws at points 3 and 4 and hoses from there to reservoir.
- Connect pneumatic hoses as in Fig. 23 to operate actuator to open position.
- Close by-pass valves.
- Close bleed screws at points 3 and 4 and move bleed hoses over to points 1 and 2.
- Turn control valve lever to open position and pump simultaneously until you feel the resistance. Maintain pressure with pump and open bleed screw under pressure at point 1.
  Repeat procedure until pump resistance is felt after a few pump strokes.
  Repeat procedure at bleed screw point 2.
- If not enough air was bled, repeat bleeding procedure.
- Check for any oil leaks under pressure. Make sure that when valve is closed, the oil level is about 50-70 mm from top of reservoir.
- Attach reservoir air filter (3).

5.9 Servicing the B1CH502–752 actuators

The structure of the B1CH502–752 series actuators is in principle the same as that of the normal B1CH11–50 actuator. To acquire a high operating torque, the device is provided with two pneumatic and hydraulic cylinders and one pump unit. The cylinders are interconnected by a linkage system.

Follow the maintenance instructions given in Sections 5.1-5.8. Exceptions are mentioned separately in the appropriate sections.

6. MALFUNCTIONS

Table 4 presents the malfunctions that sometimes result from long-term use and external factors.

Table 4 Malfunctions

Manifestation	Possible cause	Action
Operation jerky or slow	Supply pressure too low	Check that the supply pressure meets the valve's minimum torque requirement. Check that the supply air pipes are large enough.
	Positioner malfunction	Check the operation of the positioner.
	Valve malfunction	Check that the valve works properly without the actuator
	Wrong size actuator	Contact the manufacturer for checking the size.
	Leakage in piston seal or piston rod seal	Replace seals, see Section 5.3.
	Cylinder damage due to possible impurities	Note the installation position recommendation. Cylinder damage always requires replacement.
	Worn actuator bearings	Check condition of bearings in accordance with Section 5.3. Replace the bearings if necessary. If the frequency of operation is high, the bearings and piston seals should be replaced at regular intervals.
	Linkage rusted in difficult damp conditions	Clean the linkage and replace the bearings. Lubricate the housing regularly and apply grease as in Section 5.1. If water collects in the housing, bore a hole in the lower part of the housing (ø 5 mm).
	The fastening screw in the bearing unit is loose	Tighten screw. Lock with Loctite 225.
	Play in the joint between actuator and valve	Replace necessary parts.

6.1 Disturbances caused by improper use of the hydraulic manual override

1. When operating pneumatically in the open direction and simultaneously pushing the control lever to the closed position, so the valve will stop, but when the pneumatic cylinder pressure rises and the control lever is released quickly, the valve will race and may get damaged. Racing can be avoided by releasing the lever slowly.
2. A similar situation will arise when operating pneumatically in the closed direction and simultaneously pushing the control lever to the open position. When after a moment the lever is released quickly, the valve will race and may get damaged.
3. When operating pneumatically in the open direction and simultaneously pushing the control lever to the open position, oil may burst out of the reservoir filter if the operation is very fast. This makes pumping with manual override difficult, because gas bubbles are formed within the underpressured oil. The system should be bled.
4. A situation described in point 3 occurs even more easily when the actuator is operated pneumatically in the close direction and the control lever is simultaneously turned to the closed position.
5. The hydraulic manual override does not function at all if the by-pass valve in the hydraulic cylinder has been left open (lever parallel with by-pass pipe). Note that there are two by-pass valves in B1CH502–752.
6. If an actuator fitted with a by-pass valve is operated pneumatically and the by-pass valve is closed (lever crosswise to hydraulic pipe), gas bubbles will be formed in the underpressured oil, pumping becomes difficult and the system should be bled. Note that there are two by-pass valves in B1CH502–752.

7. TOOLS

Actuator maintenance requires both conventional and special tools. The following tools can be ordered from the manufacturer:

- Removing the actuator:
  - extractor
- Mounting pistons seals:
  - tie ring
- Removing the cylinder base:
  - lock nut wrench

8. ORDERING SPARE PARTS

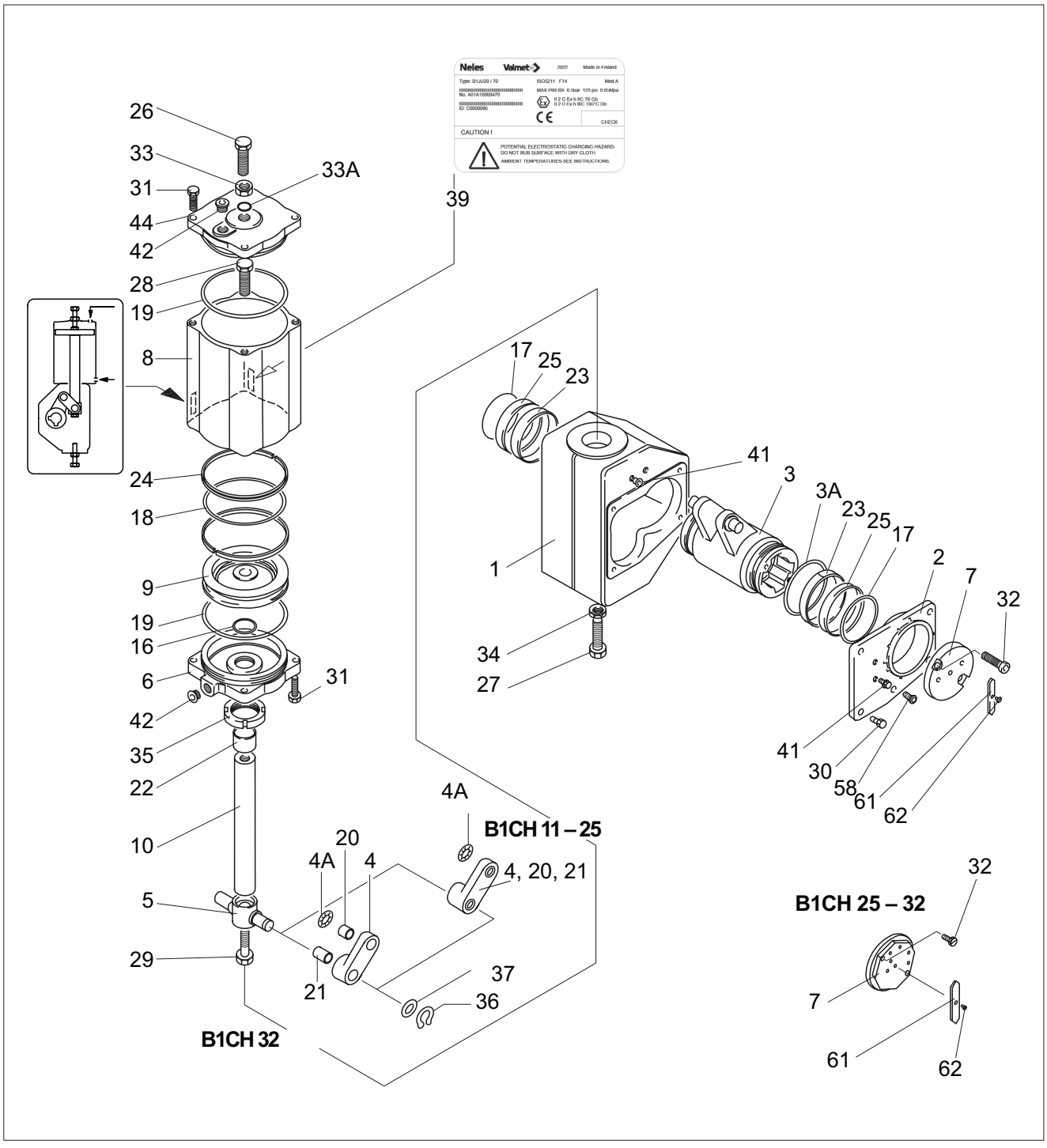
NOTE:
Use only original spare parts. This ensures proper functioning of the actuator.

Give the following information:

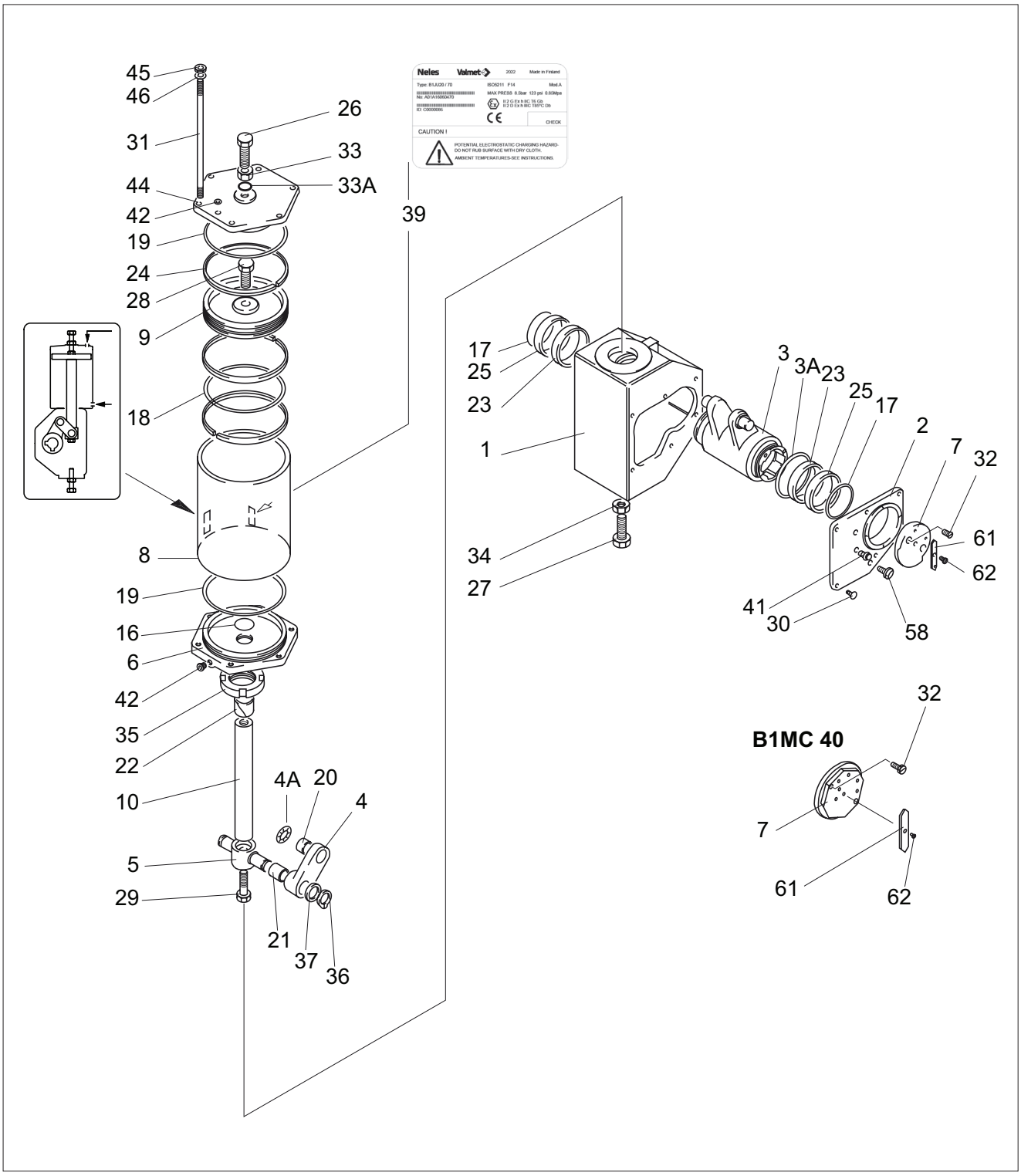
- Type marking indicated on the identification plate and in the relevant documents
- number of parts list, part number, name and quantity, or
- the number of these instructions, part number, name and quantity
- serial number if the type designation contains the letter Y

9. DRAWINGS AND PARTS LISTS

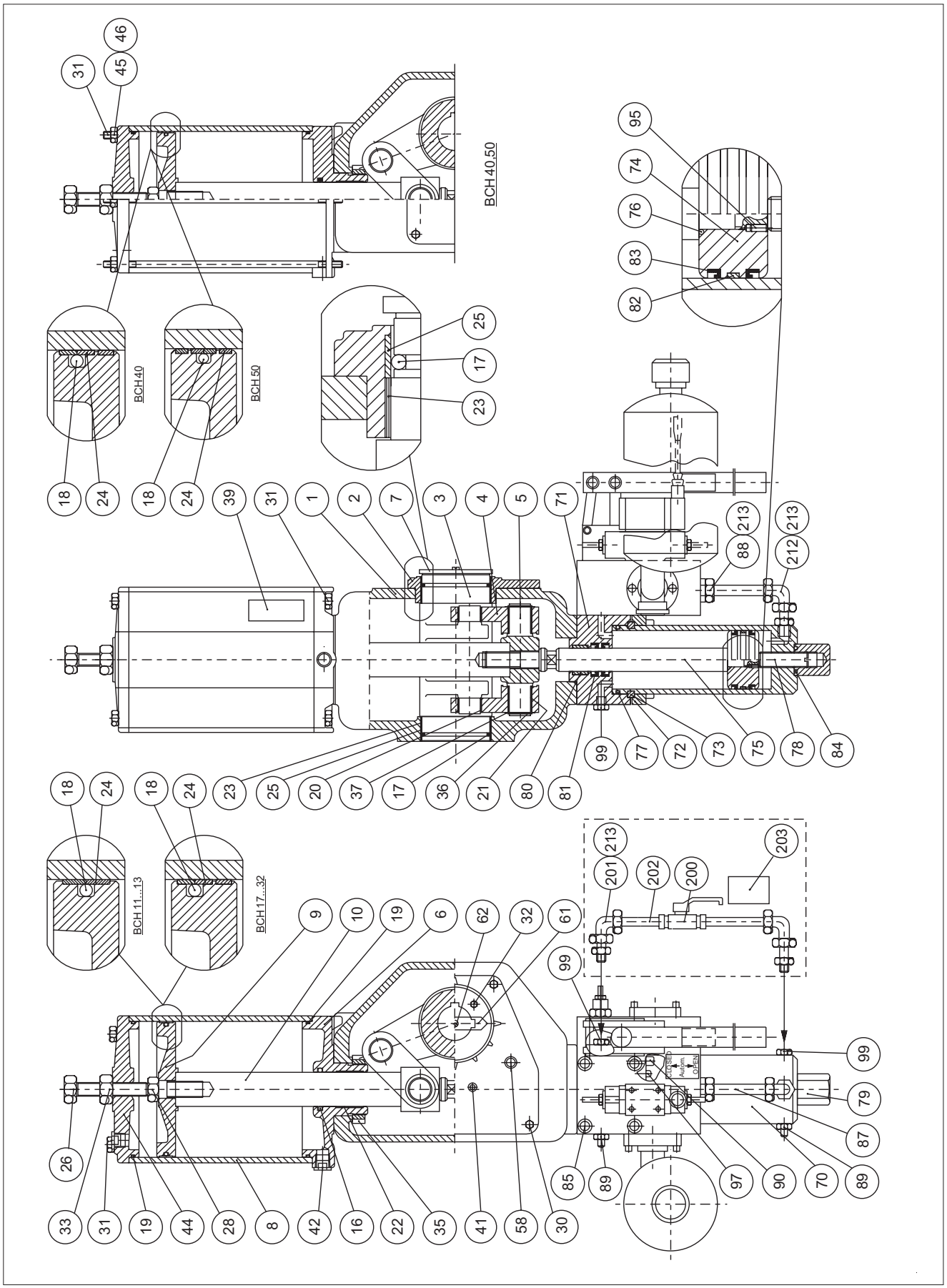
9.1 Actuators B1CH/BCH11–32, exploded view



9.2 Actuators B1CH/BCH 40–50, exploded view



9.3 Actuators B1CH/BCH 11–50, assembly drawing



Actuators B1CH/BCH 11–50, parts list.
Drawings in Sections 9.1, 9.2 and 9.3.

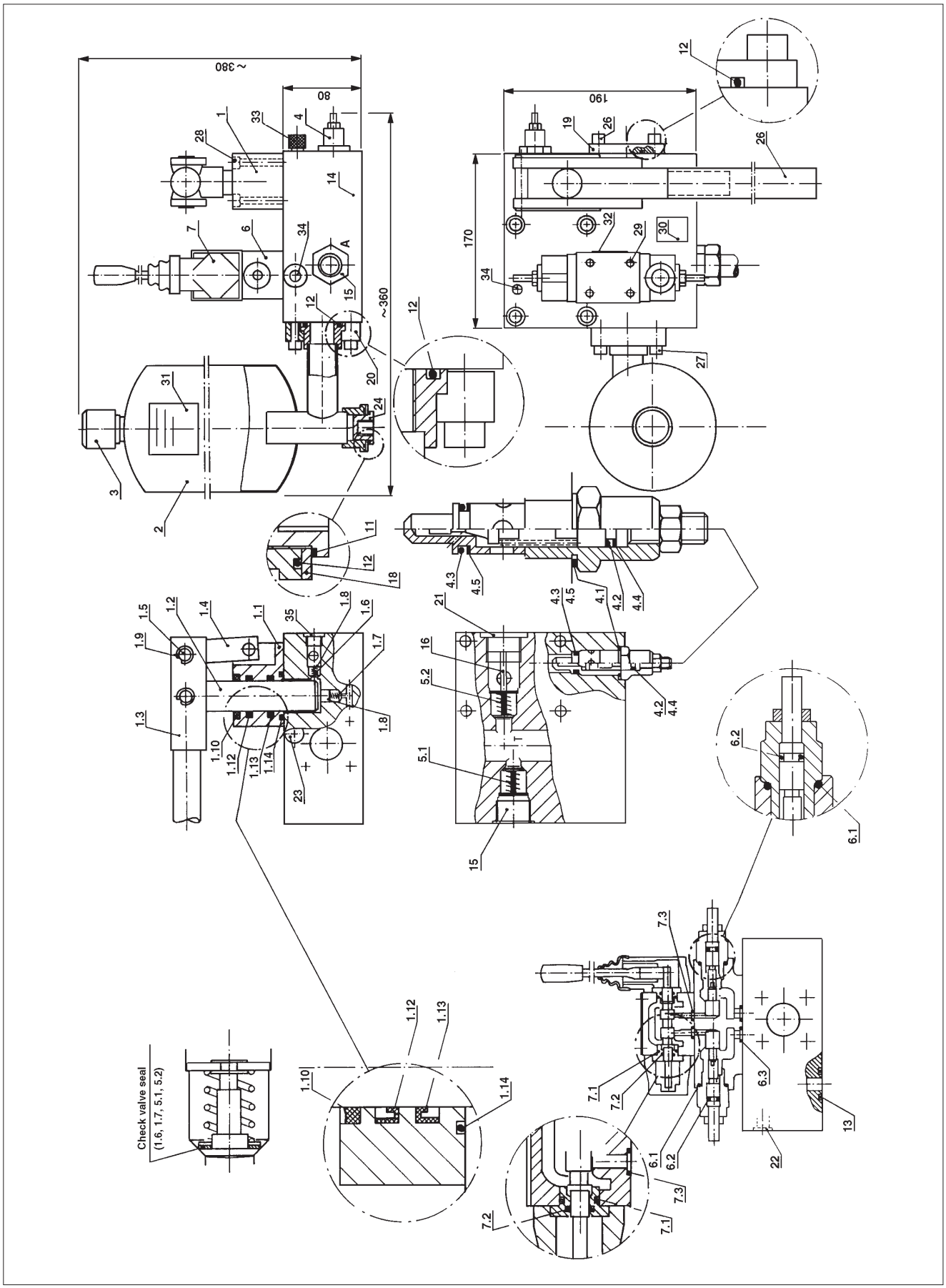
Item	Qty	Description	
1	1	Housing	
1	1	Cover	
3	1	Lever arm	
3A	1	Antistatic ring	
4	2	Connection arm and bearing	
4A	1	Antistatic ring	
5	1	Bearing unit	
6	1	Cylinder base	
7	1	Pointer cover	
8	1	Cylinder	
9	1	Piston	
10	1	Piston rod	
16	1	O-ring	x
17	2	O-ring	x
18	1	O-ring	x
19	2	O-ring	x
20	2	Bearing	x
21	2	Bearing	x
22	1 (2)	Bearing	x
23	2	Bearing	x
24	2 (3,4)	Piston seal	x
25	2	Bushing	
26	1	Hexagon head stop screw	
28	1	Hexagon screw	
30	4 (6)	Hexagon socket screw	
31	8 (12,6)	Hexagon screw/Stud	
32	2	Slotted cheese head screw/Hexagon screw	
33	1	Hexagon nut	
35	1	Lock nut	
36	2	Lock ring	
37	2	Support ring	
39	1	Identification plate	
41		Plug	
42		Plug	
44	1	Cylinder end	

Item	Qty	Description	
45	6	Hexagon nut	
46	6	Washer	
58	1	Pressure outlet valve	x
61	1	Direction arrow	
62	1	Slotted cheese head screw	
70	1	Cylinder	
71	1	Cylinder end	
72	1	Retaining flange	
73	2	Retaining ring	
74	1	Piston	
75	1	Piston rod	
76	1	O-ring	
77	1	O-ring	
78	1	Grub screw	
79	1	Cap	
80	1 (2)	Bearing	x
81	2	Lip ring	x
82	1	Bearing	x
83	2	Lip ring	x
84	1	O-ring	
85	4	Hexagon socket screw	
87	1	Pipe	
88	1	Adapter	
89	2	Vent plug	
90	4	Hexagon socket screw	
95	1	Spring pin	
97	2 (4)	Hexagon socket screw	
99	3 (1)	Hexagon plug	
200	1	Ball valve	
201	2	Elbow pipe	
202	2	Pipe	
203	1	Identification plate	
212	1	Elbow pipe	
213	1	Gasket	

x = Recommended spare parts

NOTE:
For full list of spare part categories of actuator unit, see B1C-series IMO 6BC71en

9.4 Actuators B1CH/BCH 502–752 assembly drawing



Actuators B1CH/BCH 502–752, parts list.
Drawing in Section 9.4

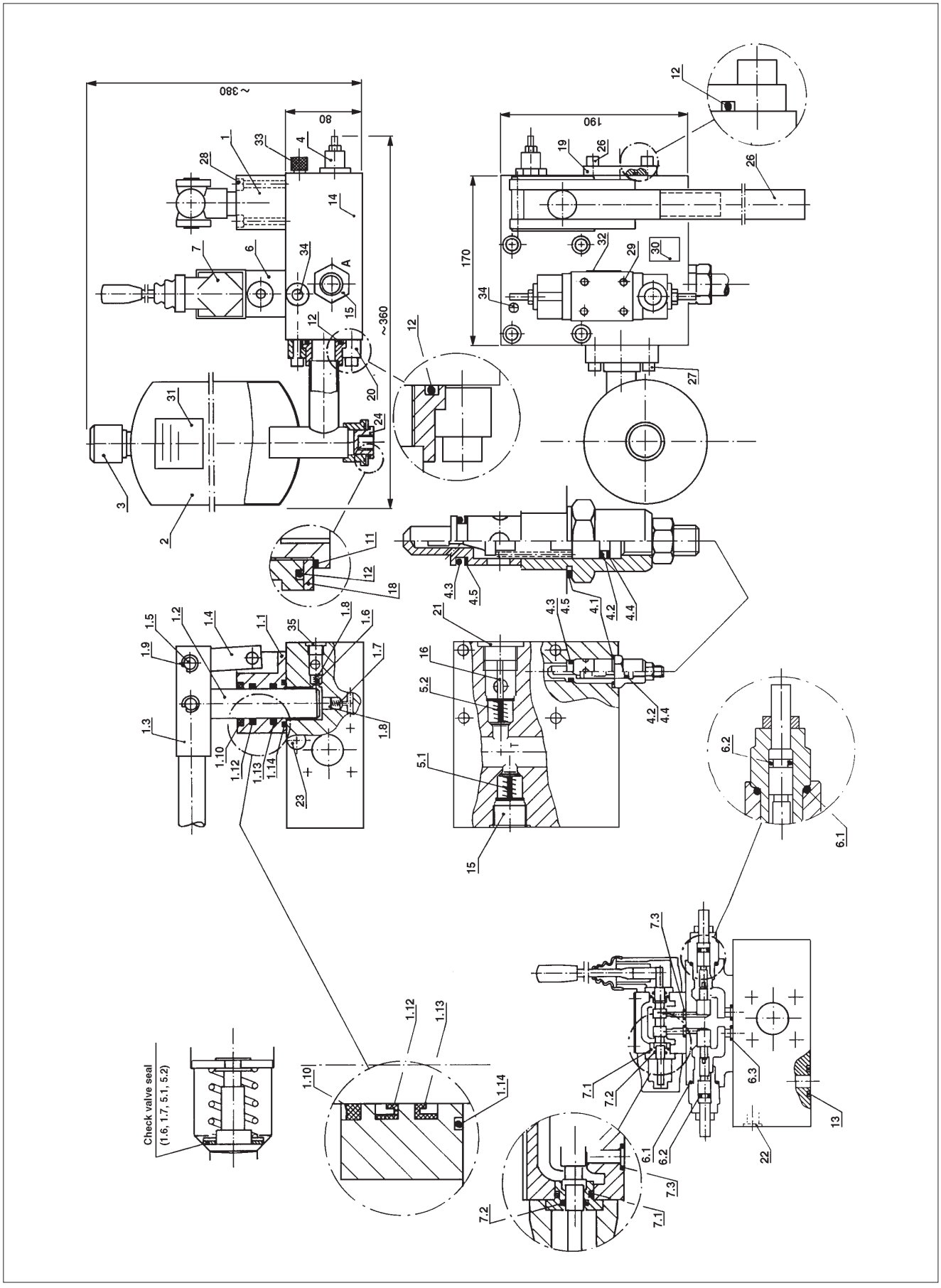
Item	Qty	Description	
1	1	Housing	
1	1	Cover	
3	1	Lever arm	
3A	2	Antistatic ring	
4	4	Connection arm and bearings	
4A	2	Antistatic ring	
5	2	Bearing unit	
6	2	Cylinder base	
7	1	Pointer cover	
8	2	Cylinder	
9	2	Piston	
10	2	Piston rod	
16	2	O-ring	x
17	2	O-ring	x
18	2	O-ring	x
19	4	O-ring	x
20	4	Bearing	x
21	4	Bearing	x
22	4	Bearing	x
23	2	Bearing	x
24	8	Piston seal	x
25	2	Bushing	
26	2	Hexagon head stop screw	
28	2	Hexagon screw	
30	20	Hexagon socket screw	
31	12	Stud	
32	4	Hexagon screw	
33	2	Hexagon nut	
35	2	Lock nut	
36	4	Lock ring	
37	4	Support ring	
39	1	Identification plate	
41		Plug	
42		Plug	
44	2	Cylinder end	
45	12	Hexagon nut	
46	12	Washer	
58	1	Pressure outlet valve	x
61	1	Direction arrow	
62	1	Slotted cheese head screw	
63	2	Spring pin	
65	2	Spring pin	
70	2	Cylinder	
71	2	Cylinder end	

Item	Qty	Description	
72	2	Retaining flange	
73	4	Retaining ring	
74	2	Piston	
75	2	Piston rod	
76	2	O-ring	
77	2	O-ring	
78	2	Grub screw	
79	2	Cap	
80	4	Bearing	x
81	4	Lip ring	x
82	2	Bearing	x
83	4	Lip ring	x
84	2	O-ring	
85	4	Hexagon socket screw	
87	1	Pipe	
88	3	Adapter	
89	3	Vent plug	
90	8	Hexagon socket screw	
92	1	Pipe	
93	2	Spring pin	
97	8	Hexagon socket screw	
99	4 *)	Hexagon plug	
189	1	Reducing bush	
190	1	Pipe	
191	1	Pipe	
192	1	Pipe	
193	1 **)	Reducing bush	
194	4	Hexagon socket screw	
195	4	Sleeve	
196	2	Clamp	
197	1	Gasket	
198	1	Gasket	x
199	1	Elbow pipe	
200	1 **)	Ball valve	
201	2 **)	Elbow pipe	
202	2 **)	Pipe	
203	1 **)	Identification plate	
212	5	Elbow pipe	
213	10	Gasket	
217	2	Adapter	
219	1	Check valve	

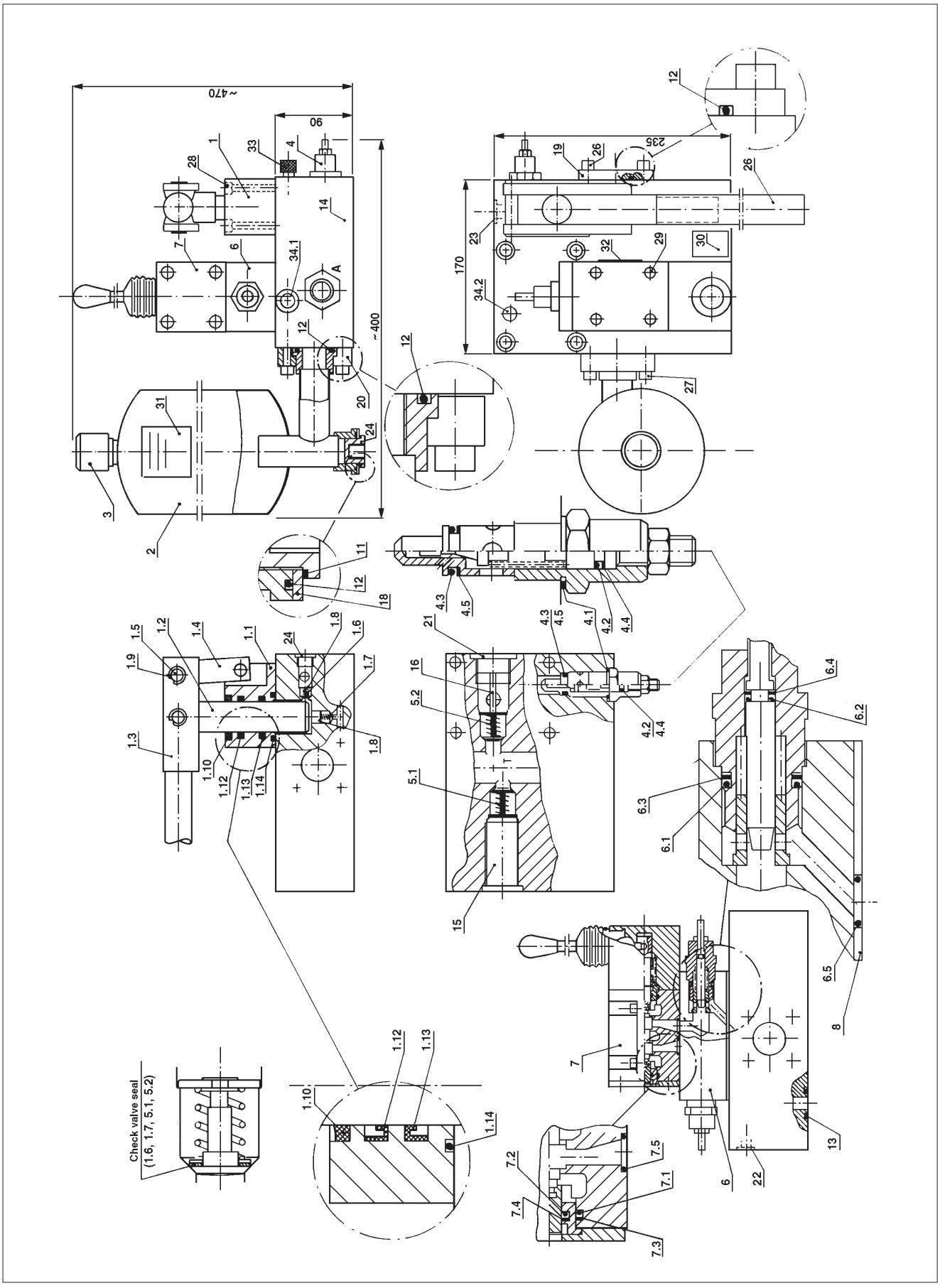
x = Recommended spare parts
*) = Not used with By-Pass system
**) = Only in case with By-Pass system

NOTE:
For full list of spare part categories of actuator unit, see B1C-series IMO 6BC71en

9.5 Hydraulic pump units B1CH/BCH 11–25, assembly drawing



9.6 Hydraulic pump units B1CH/BCH 32–50, assembly drawing



Hydraulic pump units B1CH/BCH 11–25, parts list. Drawing in Section 9.5.

Item	Qty	Description	
1	1	Hand pump	
1.1	1	Body	
1.2	1	Piston	
1.3	1	Lever	
1.4	1	Joint	
1.5	3	Joint pin	
1.6	1	Check valve	x
1.7	1	Check valve	x
1.8	2	Lock ring	
1.9	6	Lock ring	
1.10	1	Wiper seal	x
1.12	1	Piston seal	x
1.13	1	Piston seal	x
1.14	1	O-ring	
2	1	Reservoir	
3	1	Air filter	
4	1	Pressure relief valve	
4.1	1	USIT-ring	
4.2	1	O-ring	x
4.3	1	O-ring	x
4.4	1	Back-up ring	x
4.5	1	Back-up ring	x
5	2	Check valve	x
6	1	Restrictor valve	
6.1	2	O-ring	
6.2	2	O-ring	x
6.3	4	O-ring	
7	1	4/3-control valve	
7.1	2	O-ring	
7.2	2	O-ring	x
7.3	4	O-ring	
11	1	Seal	
12	3	O-ring	
13	1	O-ring	
14	1	Plate	
15	1	Reducing adaptor	
16	1	Spring leaf retainer	
18	1	Washer	
19	1	Flange	
20	2	Flange	
21	1	Blanking end	
22	3	Blanking end	
23	3	Blanking end	
24	1	Blanking end	
25	1	Tube	
26	4	Hexagon socket screw	
27	4	Hexagon socket screw	
28	4	Hexagon socket screw	
29	4	Hexagon socket screw	
30	1	Type plate	
31	1	Instructions plate	
32	1	Function plate	
33	1	Take-off point	
34	2	Bleed screw	
35	1	Blanking end	

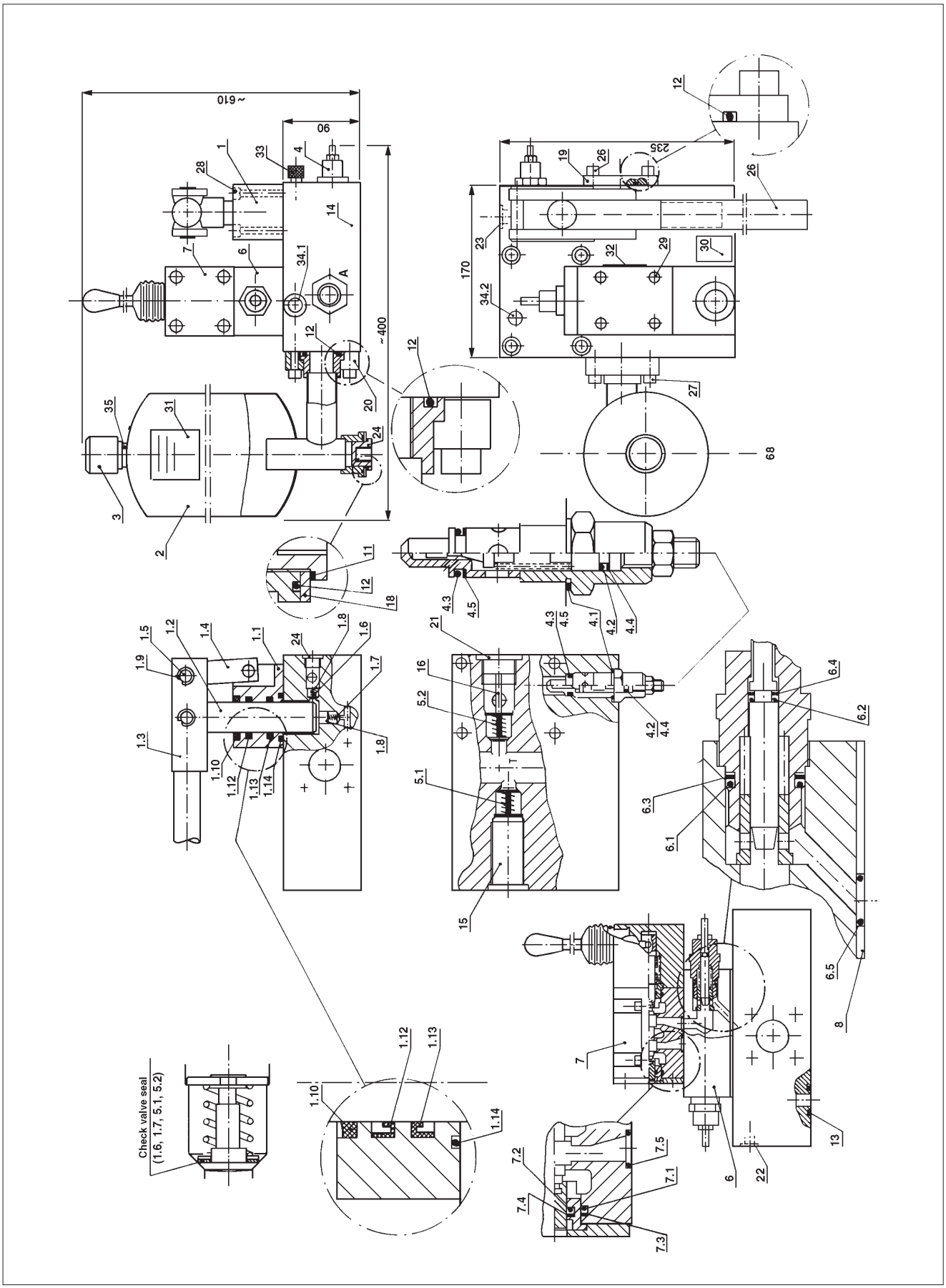
x = Recommended spare part

Hydraulic pump units B1CH/BCH 32–50, parts list. Drawing in Section 9.6.

Item	Qty	Description	
1	1	Hand pump	
1.1	1	Body	
1.2	1	Piston	
1.3	1	Lever	
1.4	1	Joint	
1.5	3	Joint pin	
1.6	1	Check valve	x
1.7	1	Check valve	x
1.8	2	Lock ring	
1.9	6	Lock ring	
1.10	1	Wiper seal	x
1.12	1	Piston seal	x
1.13	1	Piston seal	x
1.14	1	O-ring	
2	1	Reservoir	
3	1	Air filter	
4	1	Pressure relief valve	
4.1	1	USIT-ring	
4.2	1	O-ring	x
4.3	1	O-ring x	
4.4	1	Back-up ring	x
4.5	1	Back-up ring	x
5	2	Check valve	x
6	1	Restrictor valve	
6.1	2	O-ring	x
6.2	2	O-ring	x
6.3	2	Back-up ring	
6.4	2	Back-up ring	
6.5	4	O-ring	
7	1	4/3-control valve	
7.1	2	O-ring	x
7.2	2	O-ring	x
7.3	2	Back-up ring	
7.4	2	Back-up ring	
7.5	4	O-ring	
8	1	Plate	
11	1	Seal	
12	3	O-ring	
13	1	O-ring	
14	1	Plate	
15	1	Reducing adaptor	
16	1	Spring leaf retainer	
18	1	Washer	
19	1	Flange	
20	2	Flange	
21	1	Blanking end	
22	4	Blanking end	
23	3	Blanking end	
24	1	Blanking end	
25	1	Tube	
26	4	Hexagon socket screw	
27	4	Hexagon socket screw	
28	4	Hexagon socket screw	
29	4	Hexagon socket screw	
30	1	Type plate	
31	1	Instructions plate	
32	1	Function plate	
33	1	Take-off point	
34	2	Bleed screw	

x = Recommended spare part

9.7 Hydraulic pump units B1CH/BCH502–752, assembly drawing



Hydraulic pump units B1CH/BCH502–752, parts list.
Drawing in Section 9.7.

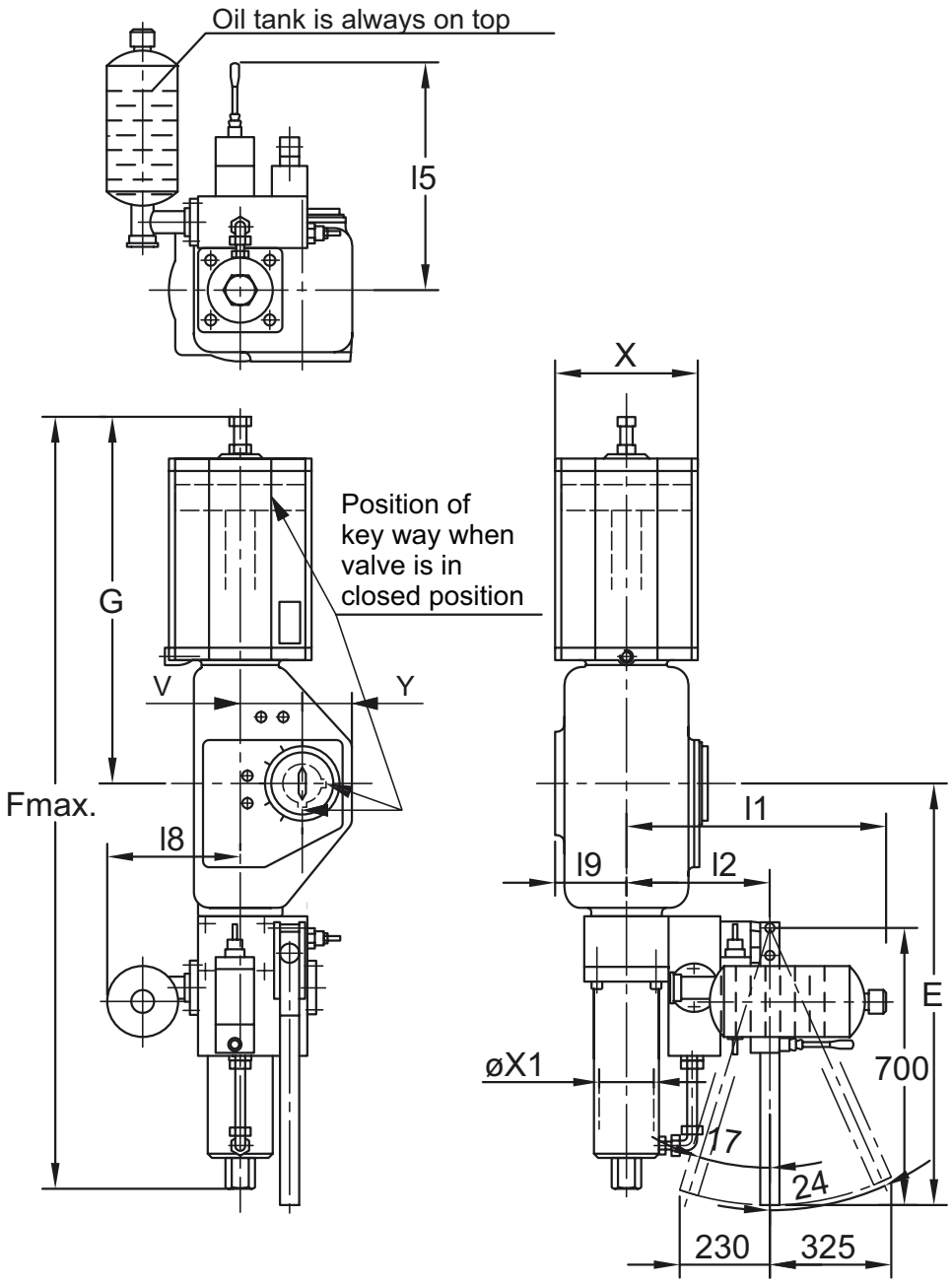
Item	Qty	Description	
1	1	Hand pump	
1.1	1	Body	
1.2	1	Piston	
1.3	1	Lever	
1.4	1	Joint	
1.5	3	Joint pin	
1.6	1	Check valve	x
1.7	1	Check valve	x
1.8	2	Lock ring	
1.9	6	Lock ring	
1.10	1	Wiper seal	x
1.12	1	Piston seal	x
1.13	1	Piston seal	x
1.14	1	O-ring	
2	1	Reservoir	
3	1	Air filter	
4	1	Pressure relief valve	
4.1	1	USIT-ring	
4.2	1	O-ring	x
4.3	1	O-ring	x
4.4	1	Back-up ring	x
4.5	1	Back-up ring	x
5	2	Check valve	x
6	1	Restrictor valve	
6.1	2	O-ring	x
6.2	2	O-ring	x
6.3	2	Back-up ring	
6.4	2	Back-up ring	
6.5	4	O-ring	
7	1	4/3-control valve	

Item	Qty	Description	
7.1	2	O-ring	x
7.2	2	O-ring	x
7.3	2	Back-up ring	
7.4	2	Back-up ring	
7.5	4	O-ring	
8	1	Plate	
11	1	Seal	
12	3	O-ring	
13	1	O-ring	
14	1	Plate	
15	1	Reducing adaptor	
16	1	Spring leaf retainer	
18	1	Washer	
19	1	Flange	
20	2	Flange	
21	1	Blanking end	
22	4	Blanking end	
23	3	Blanking end	
24	1	Blanking end	
25	1	Tube	
26	4	Hexagon socket screw	
27	4	Hexagon socket screw	
28	4	Hexagon socket screw	
29	4	Hexagon socket screw	
30	1	Type plate	
31	1	Instructions plate	
32	1	Function plate	
33	1	Take-off point	
34	2	Bleed screw	
35	1	Blanking end	

x = Recommended spare part

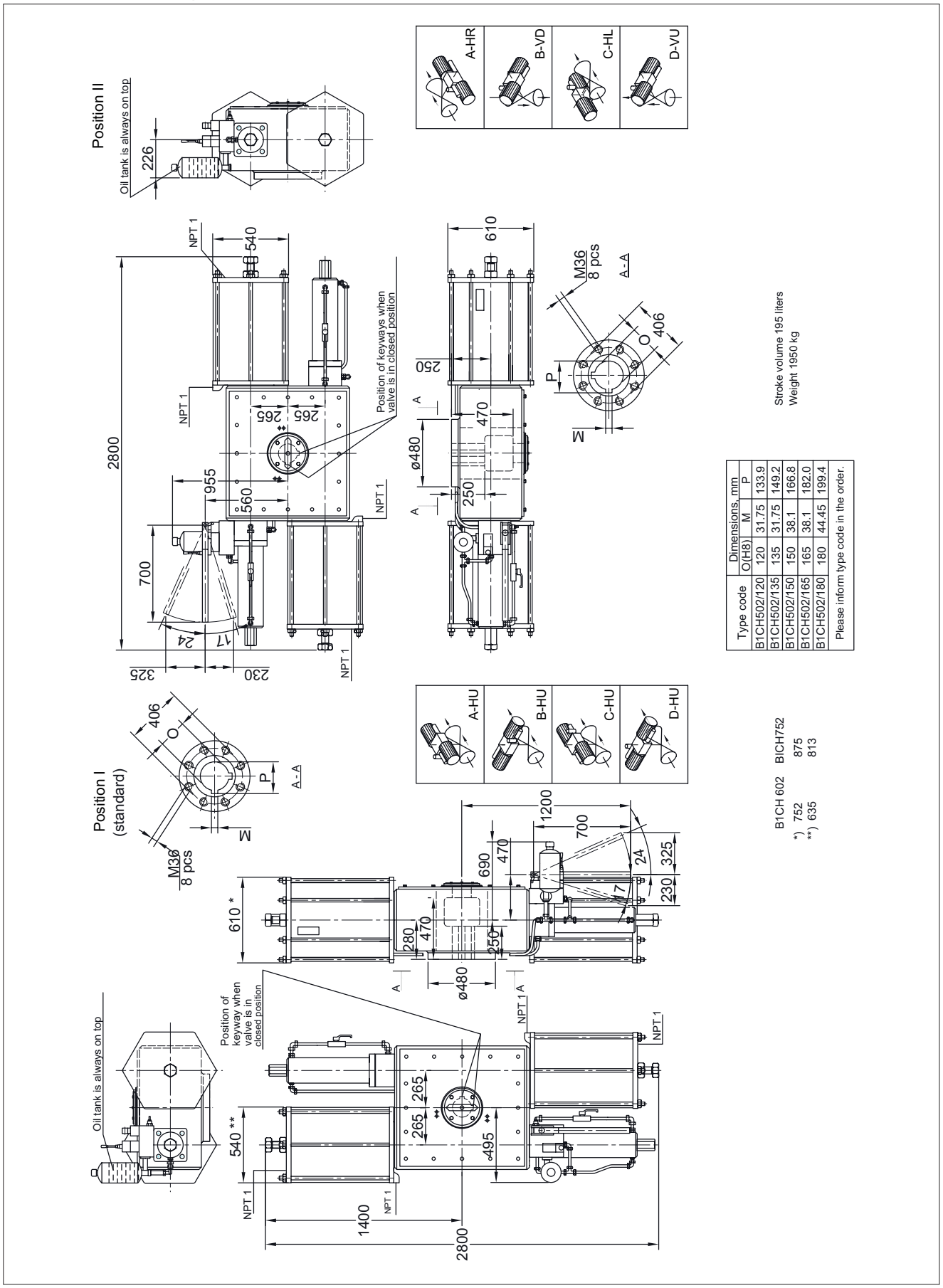
10. DIMENSIONS AND WEIGHTS

B1CH/BCH11–50



Actuator	Dimensions, mm														Weight kg
	X	G	F	V	Y	øX1	I1	I2	I5	I6	I7	I8	I9	E	
B1CH 11	135	375	785	51	50	50	410	211	370	490	430	226	65	828	60
B1CH 13	175	445	875	65	65	50	410	211	370	490	430	226	81	856	75
B1CH 17	215	545	980	78	70	50	410	211	370	490	430	226	96	885	100
B1CH 20	215	575	1245	97	80	80	435	238	395	490	430	226	115	921	126
B1CH 25	265	710	1430	121	110	80	435	238	395	490	430	226	138	970	172
B1CH 32	395	910	1890	153	120	125	540	273	430	565	505	226	175	1036	350
B1CH 40	505	1150	2200	194	185	125	540	273	430	565	505	226	225	1098	550
B1CH 50	610	1350	2710	242	195	160	690	296	455	700	640	226	275	1191	1000

B1CH/BCH502–752, positions I and II



Type code	Dimensions, mm		
	O(H8)	M	P
B1CH502/120	120	31.75	133.9
B1CH502/135	135	31.75	149.2
B1CH502/150	150	38.1	166.8
B1CH502/165	165	38.1	182.0
B1CH502/180	180	44.45	199.4

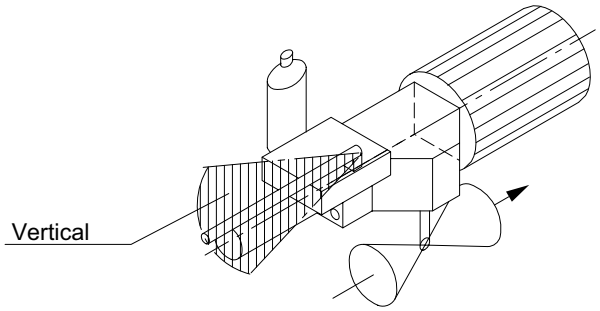
Please inform type code in the order.

Stroke volume 195 liters
Weight 1950 kg

B1CH 602	BICH752
*) 752	875
**) 635	813

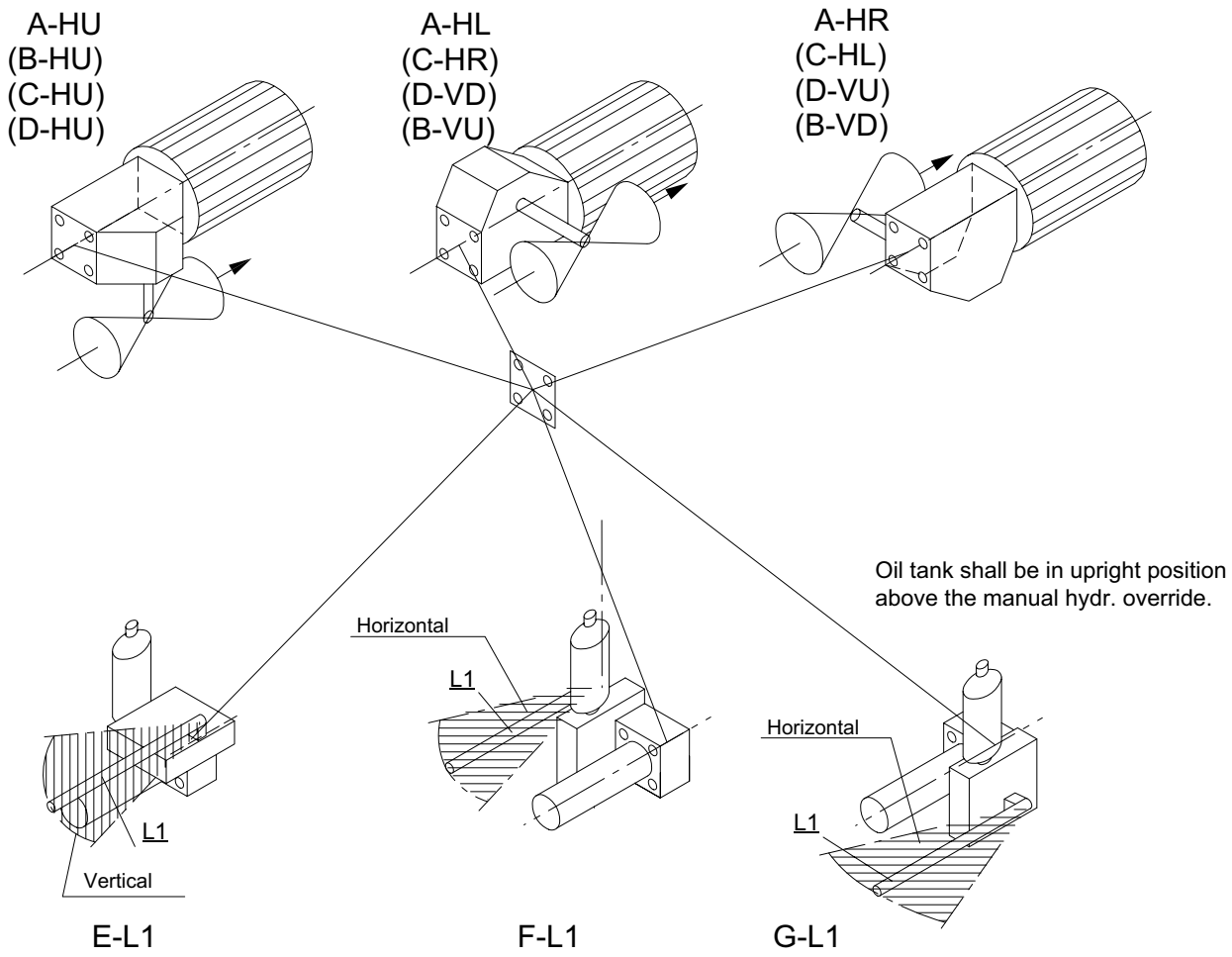
10.1 Mounting positions

If mounting position is not specified, the manual hydraulic override is mounted to standard mounting position A-HU-E-L1

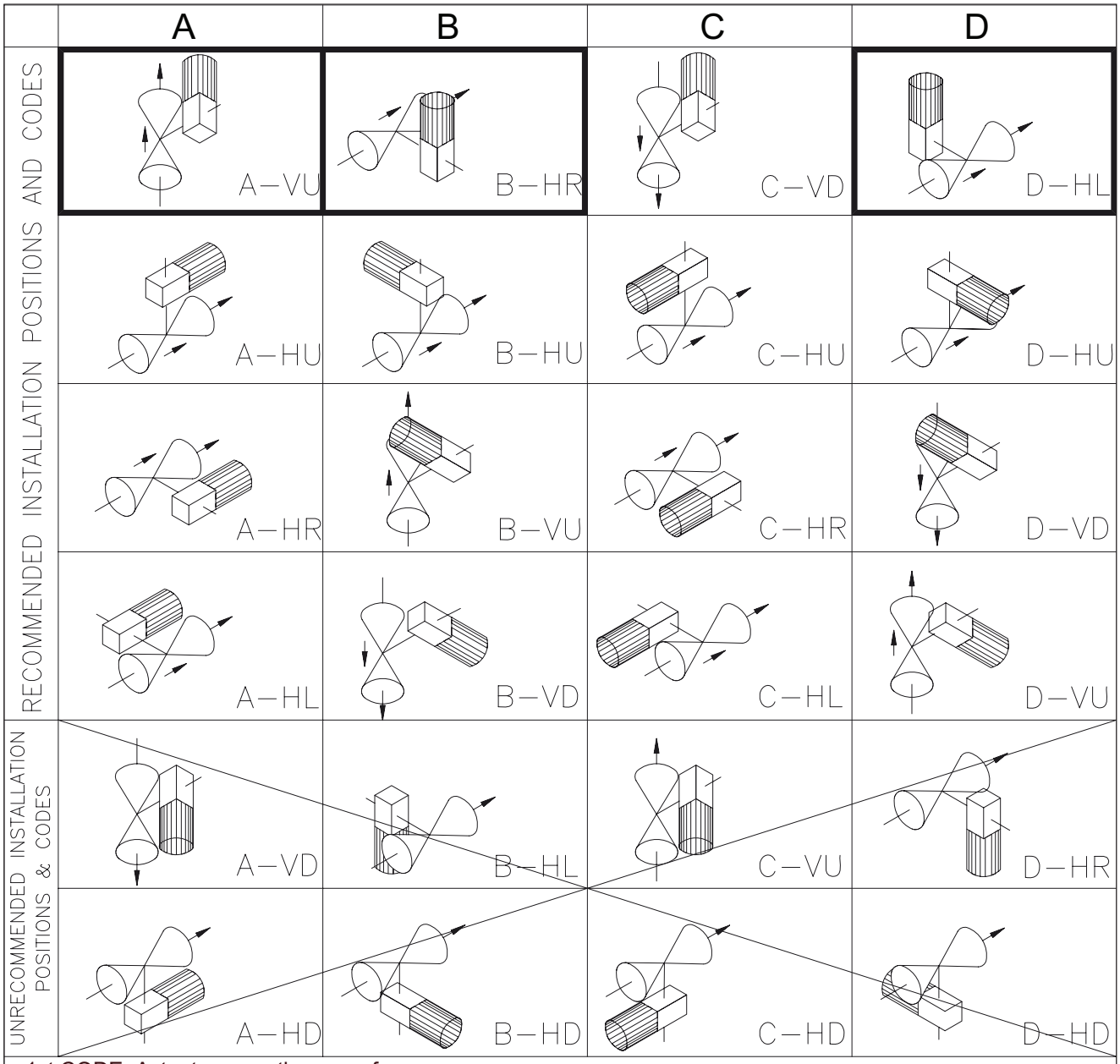


Code:
A-HU- E-L1

- E-L1 — Position of lever
- E- — Position of manual hydr. override
- A-HU- — "Valve-actuator" mounting position, see next page



Pumping movement of lever

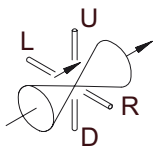


1st CODE: Actuator mounting seen from the upstream side (in unidirectional valves). In bidirectional valves seen from the upstream side in the piping dwg.

A = Cylinder parallel to pipe line on downstream side
B = Cylinder crosswise to the left
C = Cylinder parallel to pipe line on upstream side
D = Cylinder crosswise to the right

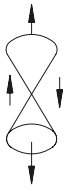
2nd and 3rd CODES: Stem direction when horizontal pipe.

H = Horizontal pipe
R = Stem to right
U = Stem upwards
L = Stem to left
D = Stem downwards

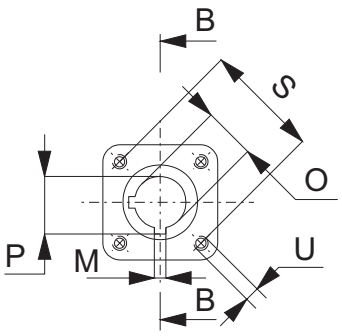


2nd and 3rd CODES when vertical pipe

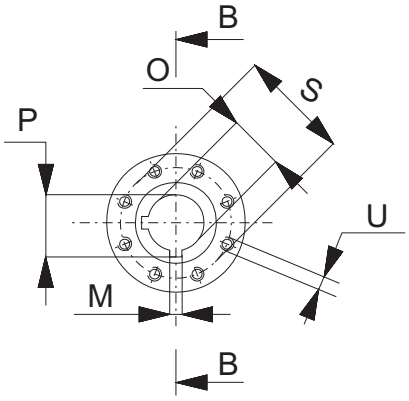
V = Vertical pipe
D = Flow downwards
U = Flow upwards



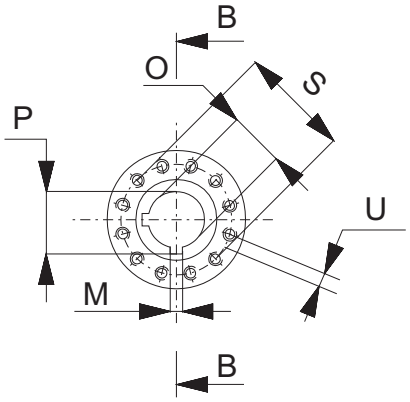
10.2 Attachment dimensions



B1CH11–32; BCH11–25



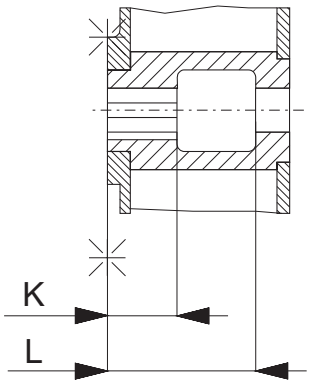
B1CH40, 50; B1CH32–50, 502



B1CH502

Actuator	B1CH, BCH					BCH			B1CH			
B1CH	O (H8)	M	P	K (keyway)	L	S	U (UNC)	N	S	U	N	Mounting face
11	20 25 35 40	4.76 6.35 9.52 9.52	22.3 27.9 39.3 44.4	60	105	80	1/2-13	4	102	M10	4	F10
13	55	12.7	60.8	75	130	120	5/8-11	4	125	M12	4	F12
17	55	12.7	60.8	80	120	120	5/8-11	4	140	M16	4	F14
20	70	19.0	78.3	105	195	145	3/4-10	4	140	M16	4	F14
25	95	22.22	105.5	140	235	180	1-8	4	165	M16	4	F16

Actuator	B1CH, BCH					BCH			B1CH			
B1CH	O (H8)	M	P	K (keyway)	L	S	U	N	S	U (UNC)	N	Mounting face
32	105	25.4	116.3	155	280	210	11/4-7	4	254	M16	8	F25
40	95 105 120	22.22 25.4 31.75	105.0 116.3 133.9	180	340	260	11/4-7	8	298	M20	8	F30
50	120 135	31.75 31.75	133.9 149.2	200	430	290	11/2-6	8	356	M30	8	F35
502	120 135 150 165 180	31.75 31.75 31.75 38.1 44.45	133.9 149.2 166.8 182.0 199.4	250	470	400	11/2-6	12	406	M36	8	F40



11. TYPE CODE

Pneumatic, double-acting cylinder actuator, BCH									
1.	**2.**	**3.**	**4.**	**5.**	**6.**	**7.**	**8.**	**9.**	**10.**
B	C	H	S	Y	U	50/120	H	E	X

1.	**Product group**
B	Cylinder actuator with attachment dimensions acc. to internal standard (D301691)
B1	Cylinder actuator with attachment dimensions acc. ISO 5211

2.	**Series**
C	Double acting, pneumatic

3.	**Construction**
H	Manual hydraulic override

4.	**Cylinder and housing materials**
-	Aluminium cylinder and GG-20 housing, standard materials, without sign
S	Steel cylinder and GG-20 housing
B	Aluminium cylinder and GGG-40 housing and piston
X	Carbon steel cylinder and GGG-40 housing and piston

5.	**Special construction**
-	Standard construction without sign
Y	Special, to be specified, e.g. special material or stop screw

6.	**VDI / VDE**
U	Attachment dimensions according to VDI/VDE

7.	**Actuator size**
	E.g. 50/120 = actuator size / shaft bore diameter

8.	**Materials of seals and bearings (all versions ATEX II 2 G/D h and ATEX II 3 G/D h)**
-	For temperatures -20...+70 °C, standard without sign O-rings: Nitrile (NBR) Bearings and piston seals: PE-HD DU-bearings in sizes 11...25 SS net + PTFE bearings with anti-static ring in sizes 32...752
H	For temperatures -20...+120 °C Dynamic O-rings: Fluorocarbon rubber (Viton). Bearings and piston seals: PTFE+C25
C	For temperatures -40...+70 °C Dynamic O-rings: Epiclohydrin rubber (ECO). Bearings and piston seals: PTFE+C25

9.	**Screw material**
-	Stainless steel (standard) without sign for sizes 11 through 32. Steel, zinc coated and passivated (standard) without sign for sizes 40 and bigger
E	Stainless steel for sizes 40 and bigger with aluminium cylinder. Stainless steel for all sizes with steel cylinder.

10.	**Non-standard operation range**
-	Standard, X=0, Z=90
X	Valve closed position is limited. **X can be any value between 0-90º.** For example, when closed position is limited to 30 º then **X = 30** (never fully closed).
Z	Valve open position is limited. **Z can be any value between 90-0º.** For example, when open position is limited to 70 º then **Z = 70** (never fully open).

APPENDIX 1:

General safety warnings

Lifting

1. Always use a lifting plan created by a qualified person to lift this equipment. Lifting guidance is provided in this IMO (Installation, Maintenance and Operation manual) to assist in lifting plan development. Think about the center of gravity (CG) of the equipment being lifted. Make sure the CG is always under the central lifting point.
2. Actuators may be equipped with lifting threads/lugs on the body or cylinder end caps. These are intended for use with the lifting plan.
3. Use only correct and approved lifting devices. Ensure that lifting devices and straps are securely attached to the equipment prior to lifting.
4. Check, that lifting devices are not damaged and in good condition with a valid check stamp prior to use.
5. Workers must be trained for lifting and handling valves.

Work activities on the actuator

1. Wear your personal safety equipment. Personal safety equipment includes but is not limited to protective shoes, protective clothing, safety glasses, helmet, hearing protection and working gloves.
2. Always follow the local safety instructions in addition to the Valmet instructions. If Valmet instructions conflict with local safety instructions, stop work and contact Valmet for more information.
3. Before beginning service on the equipment make sure that the actuator is disconnected from any kind of power source (pneumatic, hydraulic, and/or electric), and no stored energy is applied on the actuator (compressed spring, compressed air volumes, etc.). Do not attempt to remove a spring return actuator unless the stop screw is carrying the spring force.
4. Always make sure that the pipeline / valve pressure or temperature don't result in any risk when maintenance work is starting or being executed.
5. Keep hands and other body parts out of the flow port when the valve is being serviced and the actuator is connected to the valve. There is a high risk of serious injury to hands and/ or fingers due to malfunction if the valve suddenly starts to operate.
6. When the actuator is being serviced and the actuator is connected to the valve, never touch the inside of the valve. There is a high risk of serious injury to hands and/or fingers if the valve suddenly starts to operate due to malfunction.

General disclaimers

Receiving, handling and unpacking.

1. Respect the safety warnings above!
2. Actuators are critical components for pipelines to control valves with high pressure fluids and must therefore be handled with care.
3. Store actuators and equipment in a dry and protected area until the equipment is installed.
4. Do not exceed the maximum storage temperatures given in the IMO (installation, maintenance, and operating instructions).
5. Keep the original packaging on the actuator as long as possible to avoid environmental contamination by dust, water, dirt, etc.
6. Remove the actuator or related accessories pneumatic supply port transportation protective caps just before connecting into plant supply network.

Operating

7. The identification plate (nameplate, or engraved markings) on the actuator gives the information of max. operating and ambient conditions.
8. Temperatures and pressures must never exceed values marked on the actuator identification plate. Exceeding these values may cause damage or personal injury.
9. Never exceed the actuator torque preset values (air supply, position). Application of excessive torque may cause damage to the valve.
10. Valmet actuators typically are designed to be used in atmospheric conditions. Do not use actuators under external pressurized conditions unless specifically designed and explicitly marked for this service.
11. As the use of the actuator is application specific, a number of factors should be taken into account when selecting an actuator for a given application. Therefore, some situations in which the actuators are used are outside the scope of this manual.
12. It is the end user's responsibility to confirm compatibility of the actuator materials with the intended service, however if you have questions concerning the use, application, or compatibility of the actuator for the intended service, contact Valmet for more information.
13. Never use enriched or pure oxygen as actuator supply medium.
14. Actuators intended for use in or with explosive atmospheres must be equipped with a grounding device and marked according ATEX (or equivalent international standards).
15. Extremely fast actuator operating strokes should be avoided especially if repeating cycles. Stroke speed should be limited by restrictor valves in such cases.

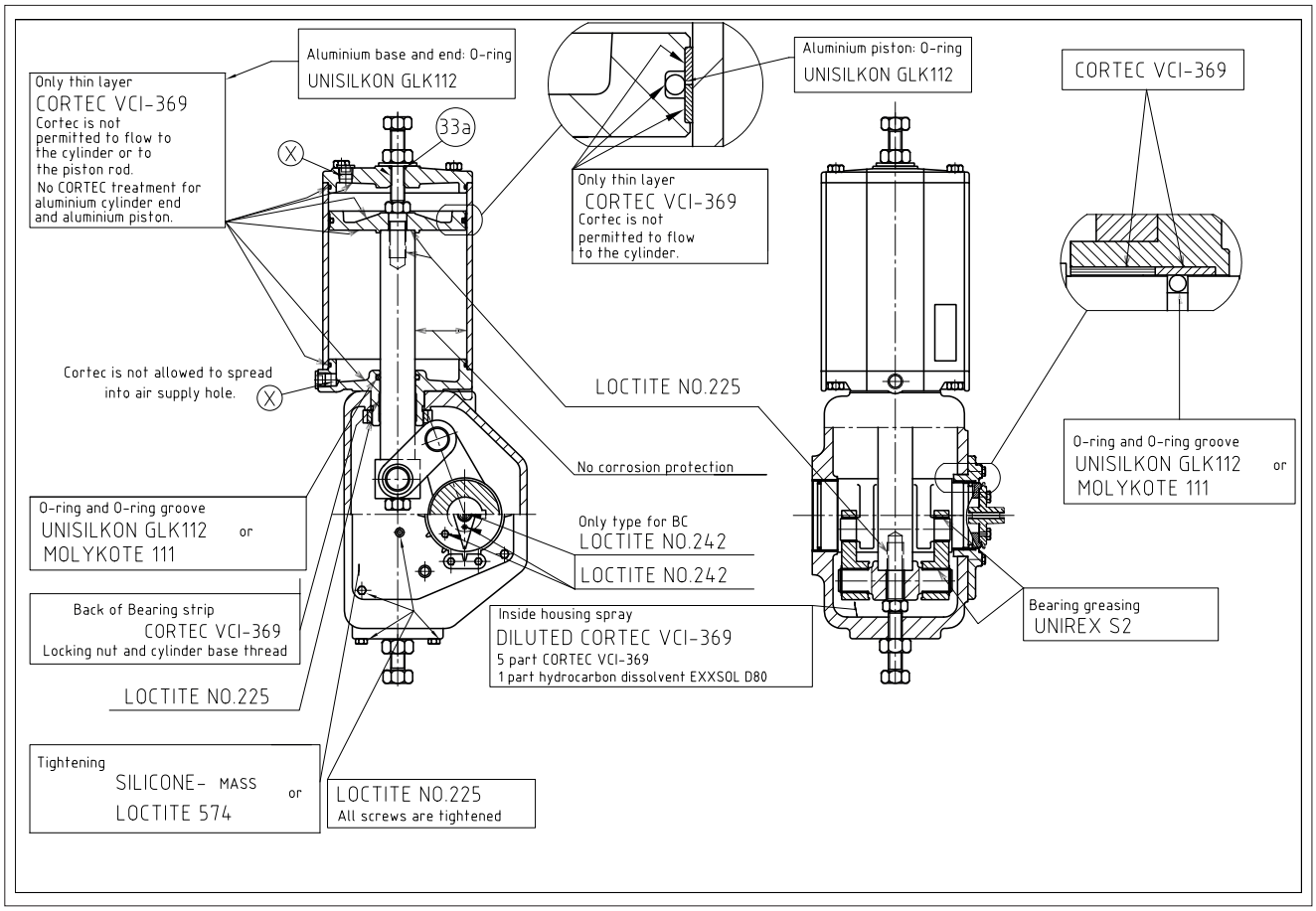
Maintenance

16. Respect the safety warnings above!
17. Plan service and maintenance actions, that spare parts, lifting devices and service personnel is available.
18. Maintain the actuator within the recommended minimum maintenance intervals or within the recommended maximum operating cycles.
19. Always make sure that the actuator is depressurized before starting any kind of maintenance work at a actuator.
20. Always check the position of the (valve) actuator before starting maintenance work. Follow the Lock out /tag out (LOTO) rules at the site before starting any maintenance activity.
    - See IMO for the correct actuator yoke/driver arm/lever arm keyway position.
    - Consider that the positioner may give wrong signals.
21. Sealing and bearing materials (soft parts) should be changed when the actuator is in maintenance. Always use original equipment manufacturers (OEM) spare parts to ensure proper performance of the repaired actuator.
22. Do not use sharp tools, grinding machines, or files to work on functional surfaces such as sealing or bearing surfaces as this can damage these surfaces.

23. All pressure containing parts must be inspected visually for damage or corrosion. Damaged parts must be replaced.
24. Check the condition of the hard bearings and counter surfaces. Replace parts if there are significant wear, scratches, or damage.
25. Make sure that the actuator and its accessories is positioned in the correct planned orientation into the pipeline.
26. If the actuators are marked to be suitable for explosive atmospheres the correct function of the discharging device must be tested before returning to service.
27. Always work in a clean environment. Avoid getting particles inside the actuator due to machining, grinding, or welding nearby.
28. Never store an actuator in maintenance without pneumatic supply port protection.
29. Actuator mounting and unmounting:
    - Before installing the actuator on to the valve, be sure the actuator is properly indicating the valve position. Failure to assemble these to indicate correct valve position may result in damage or personal injury.
    - When installing or removing a linkage kit, best practice is to remove the entire linkage assembly, including couplings which may fall off the valve during lifting or when position changes.
    - Mounting sets have been designed to support the weight of the Valmet actuator and recommended accessories. Use of the linkage to support additional equipment or additional weight such as people, ladders, etc. may result in equipment damage or personal injury.

APPENDIX 2:

B1C series lubrication instruction



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