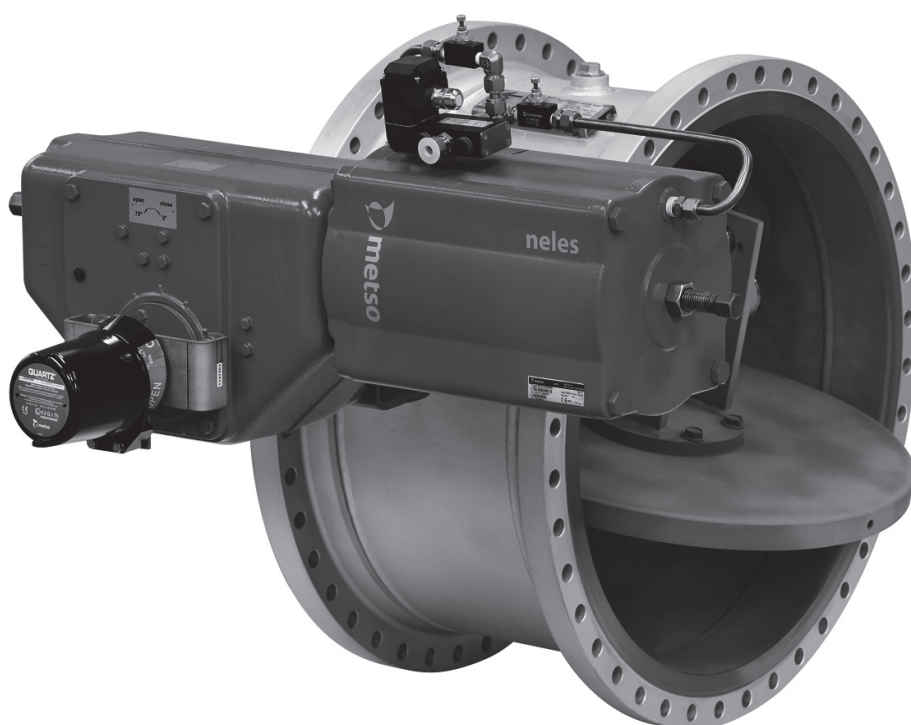


MAPAG Three Lever Valve Type BH

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.

Addresses and phone numbers are printed on the back cover.

SAVE THESE INSTRUCTIONS!

Subject to change without notice.

All trademarks are property of their respective owners.

1 GENERAL

1.1 Safety precautions

CAUTION:

Never exceed the performance limits of the valve!

Exceeding the limits indicated on the Identification plate of the valve may lead to damage and uncontrolled release of pressure.

It may lead to injury to persons and damage to property.

CAUTION:

A valve under pressure may neither be opened nor removed from the pipeline!

Opening or dismantling valve under pressure will inevitably lead to uncontrolled release of pressure.

Before dismantling the valve, the relevant pipeline section should be shut off, the valve made pressure less and the medium removed. Please consider the properties of the existing medium.

People and environment must be protected sufficiently against dangerous and poisonous substances.

Ensure that no medium can get into that pipeline section during maintenance work on the valve.

Errors during these precautionary measures may lead to injury to persons and damage to property.

CAUTION:

Take note of the cutting action of the valve disc!

Keep hands, other parts of the body, tools and other objects far away from the opening.

Do not leave any objects inside the pipeline.

If the valve is actuated, the valve disc acts as a cutting device.

The position of the valve disc can change even when the body is moved.

Before starting work on the valve, the supply air pipes of the actuator must be shut off and released.

Errors here may lead to injury to persons and damage to property.

CAUTION:

Take note of the noise emissions!

The valve can produce noise in the pipeline.

The sound level depends on the type of application.

The sound level can be calculated in advance using Metso Automation Nelprof computer program.

Please follow the occupational safety regulations applicable to noise emissions.

CAUTION:

If you lift the valve or valve unit only in horizontal position and using a crane, consider the weight!

The valve or the valve unit may never be raised at the actuator, positioner, end switch and their piping.

Place the lifting device securely around the valve body.

Falling parts may lead to injuries and damage to property.

Exercise caution while lifting: the valve can rotate!

Product & function description

The BH 3-lever-valve is special valve to shut off gas stream flow. It is mainly installed in air separation units (ASU) before mole sieve stations.

Body types:

- Wafer type for sizes ≤ DN400 / NPS16
- Double flanged for sizes up to DN1600 / NPS64
- Other body types / sizes are available on request.

Nominal sizes:

- NPS 8 ... NPS64
- DN200 ... DN1600
- Flange drillings available for ASME cl.150, PN10, PN16 and up to DN600 PN40

Operating Temperature range:

- Standard. operating temperature: -20 °C ... +280 °C
- Max. limit soft seated valve: + 200 °C
- Long term storage temperature: -20 °C ... +80 °C
- Environment temperature: -20 °C ... +80 °C

Functional description:

The disc is moved by eccentric located shaft with lever arms acting the disc in the middle. The lever 1 is directly fixed on the shaft and moves the disc via disc lever. Due to the lever arrangements, the disc detaches from the sealing parallel and without any friction when opened. This means that the sealing sections are not subjected to any abrasion wear. The result is an extremely low torque level. BH 3-lever valves are operated by pneumatic Neles[®] actuator types B1C. The actuator position can be selected either on left or right side in flow direction.

1.2 Intended use

The purpose of BH 3-lever-valves is to shut off gas flow. They are self-locking for a specified differential pressure. If this pressure setting is exceeded, the valve cannot be operated by male function. This is a mechanical inherent safety function of the valve. Depending on the medium and the configuration of the system, BH 3-lever valves can be used for gases at temperatures between - 20° C and + 280° C. actuator.

The movement of the valve disc and the end positions are indicated by mechanical stoppers at the actuator. Positioners or limit switches can be used as an option.

Proper use of the valve also requires that the operating, assembly and maintenance personnel have read and understood this manual.

Assembly work shall be handled only by qualified personnel.

Metso does not assume any liability for structural modifications that are undertaken without specific approval by Metso.

Use original spare parts only.

These are to be installed by Metso's service personnel.

See Figure 1 and Figure 2

1.3 Scope of delivery

The BH 3-lever-valve typically is delivered completely along with a pneumatic actuator, equipped with positioner/sole-noid valve and instrumentation.

1.4 Visual inspection

Prior to leaving Metso factory, the BH 3-lever-valve has been checked by our quality assurance department for seal-tightness and function and set for operation according to the job-related documents.

Please check the BH 3-lever-valve for possible shipping damage prior to installation. Should parts of the delivery show damage, please report this immediately to our qualified personnel.

Check the valve for its function before installation. Please proceed as follows:

Depending on the size and weight of the valve, you will require a hoisting rope.

In horizontal transport position, always secure the round sling to the body (see Figure 2). The shaft may be damaged if you secure the slings to the actuator. Caution: Twisting hazard!

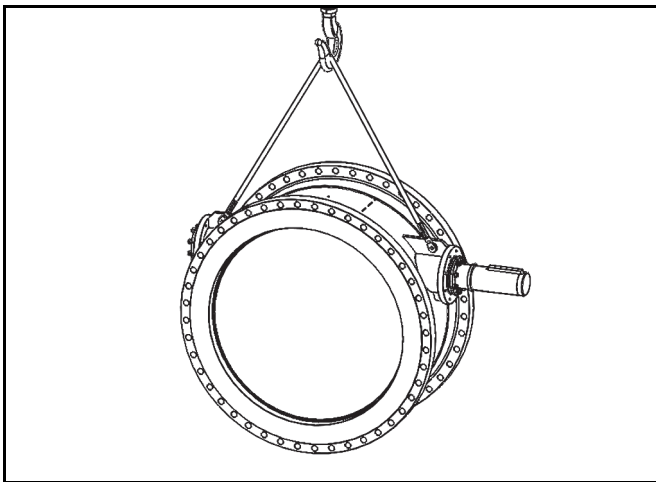


Figure 1

Only in vertical transport position, always secure the round sling to the actuator (see Figure 3). Make sure that instrumentation and piping is not damaged if you secure the slings to the actuator.

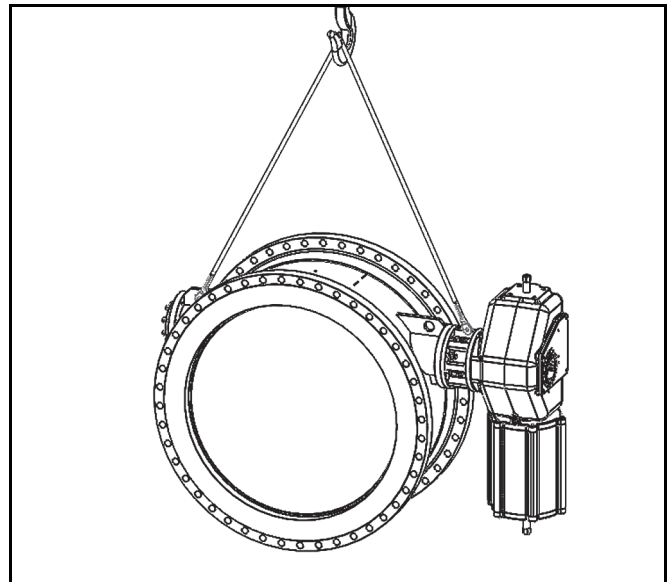


Figure 2

Visual inspection – are all screws properly tightened?

Visual inspection for damage to following components:

- ☐ Disc
- ☐ Drive shaft
- ☐ Actuator and instrumentation
- ☐ Piping and tubing
- ☐ Gland packing
- ☐ Seat and seat surface
- ☐ Flange surfaces of the valve

The BH 3-lever valve may show uncontrolled movements during the functional test. Therefore, ensure that the valve does not move or tip over during functional test under any circumstances.



- ☐ Connect the power supply now. Re-assure yourself that the actuator opens into the correct direction of flow.

- Test the function of the valve. Allow the valve to open and close 2...3 times. The stop of the drive ensures that the disc cannot be turned beyond the factory-set closed position. Factory setting of stroking for ≤ NPS 16 is 20s - 30s; > NPS 16 is 30s - 60s. Faster stroking time is not allowed
- Disconnect the energy supply after the functional test.
- If the valve does not work flawlessly in the functional test, please contact our qualified personnel.

Indications for this may be:

- The valve does not move, moves too slowly or not uniformly
- Unusual running noise can be heard
- The disc does not move completely into the seated position
- The disc does not open completely

1.5 Marking and identification

The valve data are shown on the type plate attached to the valve body neck. (see Figure 3)

In the service case, the factory number (Serial No.) is the one that uniquely designates the valve. This number is also attached to the body in case the identification plate can no longer be found.

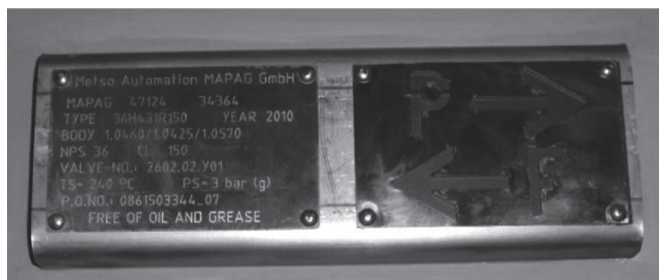


Figure 3 Type plate and pressure/flow direction

Further information:

Job no.	=	job number at Metso Flow Control
Serial-No	=	unique fabrication number
Type	=	Type code of the valve
BODY	=	body material
YEAR	=	Year of manufacture
NPS or DN	=	Size; CL or PN = pressure class Pressure class
PS	=	Operating pressure of the valve
Tag no.	=	Valve and fittings number
TS.	=	Operating temperature range of the valve in °C (medium)
P.O.No.	=	Order number of the customer / consignment number
FREE OF OIL AND GREASE FOR O2		suitable for use in O2 applications

1.6 Atex and CE marking

The valve fulfills the requirements of the European Directive 2014/68/EU regarding pressure-related equipment and is marked according to this directive.

The CE sign is displayed on the identification plate (see Figure 3: type plate).

1.7 Contact

Please contact your local Metso partner.

You will find the contact information in the internet at:

www.metso.com/automation

2 TRANSPORT, RECEPTION AND STORAGE

Check the valve including accessories for shipping damage.

Prior to installation, the valve is to be carefully stored in a dry roofed room.

Storage temperature = -20° to 80 °C Relative humidity 85% max. (Non-condensing)

The valve must be warehoused with the factory-mounted covers.

The valve should be transported on-site only a short while before the installation. The covers on the openings are to be removed for installing the valve.

Avoid any dust, water or other contamination of the valve internals during final assembly at construction site.

The valve is delivered in closed position. A valve with an actuator and a spring retainer is delivered in the position set by the spring (spring opens or closes).

3 INSTALLATION

Assembly work at the BH 3-lever- valve shall only be made by qualified and Metso certificated personnel!



3.1 Installation planning

Consider following aspects before assembly:

- Valve had to be install to allow free access to the actuator at any time.
- Valve had to be install that shaft is always in horizontal position
- Actuators may be connected to the energy supply only after installing the valve.
- The flange holes of both pipeline ends must be exactly aligned axially with each other. The sealing surfaces of the opposite flanges must be parallel to each other. The flange holes may not be distorted from one another, so that the valve is not exposed to any stresses during assembly.

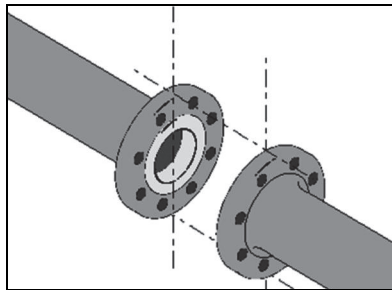


Figure 4 Alignment of the flanged pipes

3.2 Preliminary

Prior to assembly, ensure that the pipelines are free from any contamination. Any contamination, such as welding spots, rust or dirt can impair the seal-tightness of the valve and damage the sealing surface of the disc or the seat.

This applies especially to the assembly of valves in the new installations. Even during operation, the medium may not carry any contamination that can deposit in the seat area.

Valves used in oxygen applications are delivered OIL AND GREASE FREE with very clean wetted surface conditions regarding any kind of hydrocarbons. There must be no use of any oil and grease usage during installation at any part of the valve!

Also do not touch the wetted of the valve without clean and dry gloves.



Lifting gear is required for installing larger valves in the piping. The weight of the valve including the actuator can be found in the job-related documentation.

3.3 Installation

Proceed as follows for installing the valve:

- Turn the valve in such a manner that the arrow (P for pressure) on the body points to the pressure direction of the process. (see Figure 3)
- Close the valve for the assembly
- Shaft need to be in horizontal position
- Note the minimum inner diameter of the pipeline is in accordance with ASME B36.10M, ASME B36.19M and / or DIN EN 10305-2 and DIN EN 10305-5.
- Use a gasket that is suitable for your application on both sides of the valve between the body and the flanges facing each other. Both gaskets are not part of the standard delivery. Metso delivers the required gaskets seals at your request.
- Use the dimensions of the stud bolts itemized in for assembly.

ASME B16.5 / B16.47 cl.150									
size		wafer					double flange		
	ød	L1	L	QTY			QTY	L	
NPS	thread	QTY	length	QTY	length	nut	bolt	nut	bolt
8	3/4"-10UNC	8	90	4	310	24			
10	7/8"-9UNC	8	100	8	330	32			
12	7/8"-9UNC	8	110	8	3	70	32		
16	1"-8UN	8	120	12	390	40			
20	1 1/8"-8UN						40	80	180
24	1 1/4"-8UN						40	80	200
28	3/4"-10UNC						80	160	140
32	3/4"-10UNC						96	192	150
36	7/8"-9UNC						88	176	180
40	1 1/8"-8UN						88	176	190
48	1 1/4"-8UN						88	176	220
56	1 1/4"-8UN						120	240	240

Table 1)

- Turn the flange screws or bolts facing one another cross-wise and tighten uniformly using a torque wrench according to operator's specification (see Figure 5).
- Finally connect the energy supply.

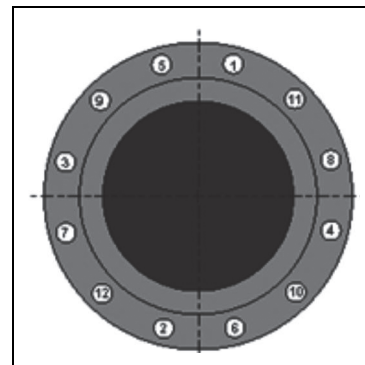


Figure 5 Crosswise tightening flange bolts

3.4 Bolt sizes and lengths:

3.4.1 ASME class 150

ASME B16.5 / B16.47 cl.150									
size		wafer				double flange			
	ød	L1		L		QTY	QTY		L
NPS	thread	QTY	length	QTY	length	nut	bolt	nut	bolt
8	3/4"-10UNC	8	90	4	310	24			
10	7/8"-9UNC	8	100	8	330	32			
12	7/8"-9UNC	8	110	8	370	32			
16	1"-8UN	8	120	12	390	40			
20	1 1/8"-8UN						40	80	180
24	1 1/4"-8UN						40	80	200
28	3/4"-10UNC						80	160	140
32	3/4"-10UNC						96	192	150
36	7/8"-9UNC						88	176	180
40	1 1/8"-8UN						88	176	190
48	1 1/4"-8UN						88	176	220
56	1 1/4"-8UN						120	240	240

Table 1 - bolting lengths for Class 150, PN10, PN16

3.4.2 EN1092 – PN10

ASME B16.5 / B16.47 cl.150									
size		wafer				double flange			
	ød	L1		L		QTY	QTY		L
NPS	thread	QTY	length	QTY	length	nut	bolt	nut	bolt
200	M20	8	90	4	320	24			
250	M20	8	100	8	320	32			
300	M20	8	100	8	360	32			
400	M24	8	110	12	380	40			
500	M24						40	80	150
600	M27						40	80	170
700	M27						48	96	170
800	M30						48	96	180
900	M30						56	112	190
1000	M33						56	112	210
1200	M36						64	128	240
1400	M39						72	144	260

Table 2 - bolting lengths for PN 16

3.4.3 EN1092 – PN16

ASME B16.5 / B16.47 cl.150									
size		wafer				double flange			
	ød	L1		L		QTY	QTY		L
NPS	thread	QTY	length	QTY	length	nut	bolt	nut	bolt
200	M20	8	90	8	320	32			
250	M24	8	110	8	330	32			
300	M24	8	110	8	380	32			
400	M27	8	120	12	390	40			
500	M30						40	80	180
600	M33						40	80	200
700	M33						48	96	190
800	M36						48	96	200
900	M36						56	112	220
1000	M39						56	112	240
1200	M45						64	128	290
1400	M45						72	144	300

3.4.4 EN1092 – PN40

ASME B16.5 / B16.47 cl.150									
size		wafer				double flange			
	ød	L1		L		QTY	QTY		L
NPS	thread	QTY	length	QTY	length	nut	bolt	nut	bolt
200	M27	8	120	8	360	32			
250	M30	8	140	8	360	32			
300	M30	8	150	12	360	40			
400	M36	8	170	12	360	40			
500	M39						40	80	270
600	M45						40	80	320

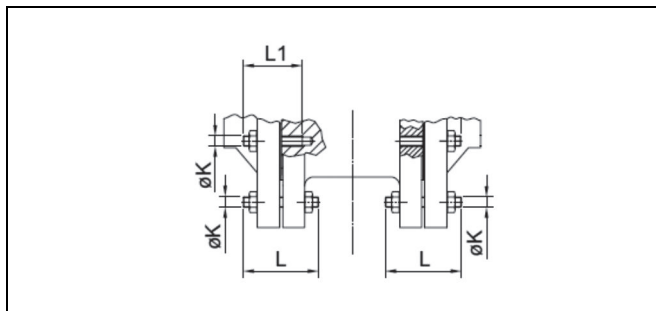


Figure 6 Bolt dimensions for double flange

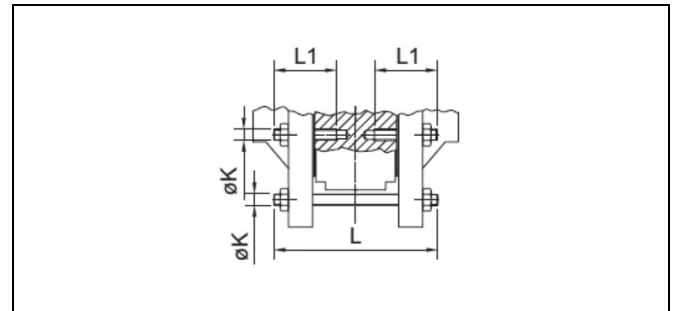


Figure 7 Bolt dimensions for wafer

4 DETACHING AND MOUNTING ACTUATOR

4.1 General

CAUTION:

Note the weight of the valve or the entire actuator unit while handling!

The actuator must not be detached from the valve if the pipeline is under pressure as a consequence of a dynamic torque!

NOTE:

Before dismantling the actuator, note the mounting position and opening angle of the valve with respect to actuator and positioner/ limit switch so that the correct function is maintained in the following assembly.

You must install the actuator, so as to allow free access to it any time. This especially applies also to a possible "emergency stop" operation by hand.

4.2 Detaching preparation

If the actuator is mounted on a valve in a pipeline, following requirements must be checked before attaching the actuator:

- Ensure that errors are not caused due to removing the actuator.
- Test carefully whether a hot medium has flown through the pipeline and whether the actuator is cooled off sufficiently, so as to prevent any hazard due to extreme temperatures.
- Reassure yourself that the worker does not face any risks from the medium that has recently passed through the valve.
- If you do not make the disassembly by yourself, warn the qualified personnel of eventual risks.

4.3 Detaching

Proceed in the following sequence for dismantling the actuator:

If the actuator installed on / in the pipeline is to be changed, ensure that:

- The pipeline is pressure less and the relevant valve is disengaged from the process.
- Ensure that the valve is in closed position.
- Manually mark the position of the stem to the stuffing box with a water proof marker.
- Disconnect the energy supply to the actuator. In addition, press the EMERGENCY STOP switch for energy supply to the actuator or activate the remote control, so that no one can reconnect the energy supply by mistake.

- Secure the actuator using secure ropes.
- Loosen the screws between the bracket and the actuator and then screw them carefully perpendicular to the drive shaft of the BH 3-lever-valve.
- Transport the actuator, so that it does not move during transport and eventually get damaged.

If you control the actuator using a remote control, then you must mount the device at the actuator to interrupt the energy supply for reasons of safety (for example: emergency stop).



4.4 Mounting actuator

Proceed as follows for installing the actuator:

- Before attaching the actuator, set the valve in its defined closed position. Check the mark that it is in line between stem and stuffing box.
- If a new Neles actuator is used, turn stopper screw completely in the actuator to avoid overturn of the disc.
- Push the selector shaft of the actuator carefully onto the valve shaft. Note that the actuator adjoins the bracket exactly and is aligned with it, so that no stresses may occur at the valve shaft.
- Note that the marking on the drive shaft corresponds to the position of the disc. Note that the closed disc may not be in zero position.
- Put actuator on the valve in that way, that the previous marking is accurate leveling position.
- Adjust the actuator that for closed position the marking is exactly in line.
- Secure the actuator to the bracket using the screws and tighten them on their cross tips.
- Limit stop screw of actuator need to be adjusted for open position of valve. 90° opening of disc is ~72° opening of actuator.
- Finally connect the energy supply.

5 ORDERING SPARE PARTS

For ordering spare parts, the following information is necessary:

- Unique / Identification number of the valve (from type plate – see Figure 3)
- Type code of the valve (from type plate) with size and pressure specification.
- If possible, make a photo of the type plate
- Machine name, start-up date.
- ID number and number of "Spare sets" required.

6 DIMENSIONS AND WEIGHTS

6.1 BH 3-lever valve - dimensions

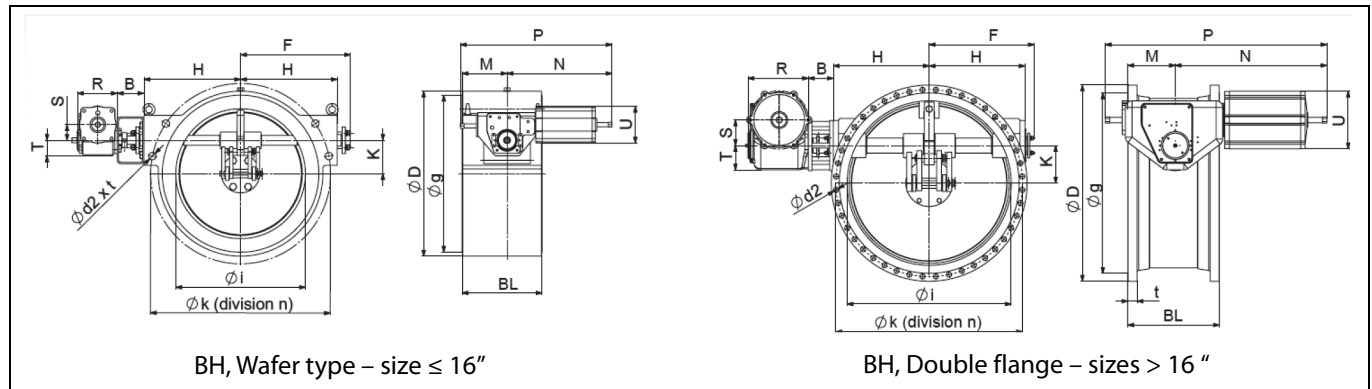


Table 3 – BH 3-lever valve dimensions

	NPS	CL	STANDARD DIMENSIONS					FLANGE CONNECTION PN10 - EN 1092							DIMENSIONS ACTUATOR MOUNTING								ACTUATOR
			BL [mm]	H [mm]	F [mm]	K [mm]	M [mm]	øk [mm]	ød2 [inch/mm]	n	øg [mm]	øD [mm]	øi [mm]	t [mm]	B [mm]	P [mm]	N [mm]	R [mm]	S [mm]	T [mm]	U [mm]	Type	
WAFER	8	150	200	165	205	70	105	298.5	3/4"-10UNC	8	269.9	270	210	30	80	395	270	138	36	46	90	B1CU6/20	
	10	150	200	192.5	232.5	72	105	362	7/8"-9UNC	12	323.8	325	260	35	80	395	270	138	36	46	90	B1CU6/20	
	12	150	240	230	270	80	125	431.8	7/8"-9UNC	12	381	375	310	35	80	450	315	140	43	50	110	B1CU9/25	
	16	150	240	290	330	100	135	539.8	1"-8UNC	16	469.9	494	389	40	80	450	315	140	43	50	110	B1CU9/25	
DOUBLE FLANGE	20	150	350	350	390	120	173	635	32	20	584.2	700	500	43.3	120	640	445	190	65	65	175	B1C13/55	
	24	150	390	390	430	140	201	749.3	35	20	692	815	600	49.7	120	785	555	222	78	70	215	B1CU17/55	
	FLANGE CONNECTION c1.150 - ASME B16.47 SERIE B																						
	28	150	430	460	510	160	223	795.3	23	40	762	835	697	45	120	1075	725	304	121	110	265	B1CU25/95	
	32	150	470	514.5	564.5	180	240	900.1	23	48	864	940	794	46.6	150	1075	725	304	121	110	265	B1CU25/95	
	36	150	510	535	585	200	268	1009.6	26	44	972	1055	892	53	150	1370	920	379	153	146	395	B1CU32/105	
	40	150	550	580	630	225	285	1120.6	30	44	1080	1175	985	56	150	1370	920	379	153	146	395	B1CU32/105	
	48	150	630	697.5	747.5	260	333	1335	32	44	1289	1390	1185	65.6	200	1670	1150	449	194	185	505	B1CU40/120	
	56	150	710	775	825	300	363	1543	32	60	1492	1600	1380	73.6	200	1670	1150	449	194	185	505	B1CU40/120	
	DN	PN	STANDARD DIMENSIONS					FLANGE CONNECTION PN10 - EN 1092							DIMENSIONS ACTUATOR MOUNTING								ACTUATOR
			BL [mm]	H [mm]	F [mm]	K [mm]	M [mm]	øk [mm]	ød2 [inch/mm]	n	øg [mm]	øD [mm]	øi [mm]	t [mm]	B [mm]	P [mm]	N [mm]	R [mm]	S [mm]	T [mm]	U [mm]	Type	
WAFER	200	10	200	165	205	70	105	295	M20	8	268	270	210	30	80	395	270	138	36	46	90	B1CU6/20	
	250	10	200	192.5	232.5	72	105	350	M20	12	324	325	260	30	80	395	270	138	36	46	90	B1CU6/20	
	300	10	240	230	270	80	125	400	M20	12	370	375	310	30	80	450	315	140	43	50	110	B1CU9/25	
	400	10	240	290	330	100	135	515	M24	16	482	485	389	35	80	450	315	140	43	50	110	B1CU9/25	
DOUBLE FLANGE	500	10	350	350	390	120	173	620	26	20	585	670	500	43.3	120	640	445	190	65	65	175	B1C13/55	
	600	10	390	390	430	140	201	725	30	20	685	780	600	49.7	120	785	555	222	78	70	215	B1CU17/55	
	700	10	430	460	510	160	223	840	30	24	800	895	697	45	120	1075	725	304	121	110	265	B1CU25/95	
	800	10	470	514.5	564.5	180	240	950	33	24	905	1015	794	46.6	150	1075	725	304	121	110	265	B1CU25/95	
	900	10	510	535	585	200	268	1050	33	28	1005	1115	892	53	150	1370	920	379	153	146	395	B1CU32/105	
	1000	10	550	580	630	225	285	1160	36	28	1110	1230	985	56	150	1370	920	379	153	146	395	B1CU32/105	
	1200	10	630	697.5	747.5	260	333	1380	39	32	1330	1455	1185	65.6	200	1670	1150	449	194	185	505	B1CU40/120	
	1400	10	710	775	825	300	363	1590	42	36	1535	1675	1380	73.6	200	1670	1150	449	194	185	505	B1CU40/120	
	DN	PN	STANDARD DIMENSIONS					FLANGE CONNECTION PN10 - EN 1092							DIMENSIONS ACTUATOR MOUNTING								ACTUATOR
			BL [mm]	H [mm]	F [mm]	K [mm]	M [mm]	øk [mm]	ød2 [inch/mm]	n	øg [mm]	øD [mm]	øi [mm]	t [mm]	B [mm]	P [mm]	N [mm]	R [mm]	S [mm]	T [mm]	U [mm]	Type	
WAFER	200	16	200	165	205	70	105	295	M20	12	268	270	210	30	80	395	270	138	36	46	90	B1CU6/20	
	250	16	200	192.5	232.5	72	105	355	M24	12	320	325	260	35	80	395	270	138	36	46	90	B1CU6/20	
	300	16	240	230	270	80	125	410	M24	12	378	375	310	35	80	450	315	140	43	50	110	B1CU9/25	
	400	16	240	290	330	100	135	525	M27	16	490	494	389	40	80	450	315	140	43	50	110	B1CU9/25	
DOUBLE FLANGE	500	16	350	350	390	120	173	650	33	20	610	715	500	43.3	120	640	445	190	65	65	175	B1C13/55	
	600	16	390	390	430	140	201	770	36	20	725	840	600	49.7	120	785	555	222	78	70	215	B1CU17/55	
	700	16	430	460	510	160	223	840	36	24	795	910	697	45	120	1075	725	304	121	110	265	B1CU25/95	
	800	16	470	514.5	564.5	180	240	950	39	24	900	1025	794	46.6	150	1075	725	304	121	110	265	B1CU25/95	
	900	16	510	535	585	200	268	1050	39	28	1000	1125	892	53	150	1370	920	379	153	146	395	B1CU32/105	
	1000	16	550	580	630	225	285	1170	42	28	1115	1255	985	56	150	1370	920	379	153	146	395	B1CU32/105	
	1200	16	630	69.5	747.5	260	333	1390	48	32	1330	1485	1185	65.6	200	1670	1150	449	194	185	505	B1CU40/120	
	1400	16	710	775	825	300	363	1590	48	36	1530	1685	1380	73.6	200	1670	1150	449	194	185	505	B1CU40/120	
	DN	PN	STANDARD DIMENSIONS					FLANGE CONNECTION PN10 - EN 1092							DIMENSIONS ACTUATOR MOUNTING								ACTUATOR
			BL [mm]	H [mm]	F [mm]	K [mm]	M [mm]	øk [mm]	ød2 [inch/mm]	n	øg [mm]	øD [mm]	øi [mm]	t [mm]	B [mm]	P [mm]	N [mm]	R [mm]	S [mm]	T [mm]	U [mm]	Type	
WAFER	200	40	200	165	205	70	105	320	M27	12	285	290	210	40	80	395	270	138	36	46	90	B1CU6/20	
	250	40	200	192.5	232.5	72	105	385	M30	12	345	352	260	45	80	395	270	138	36	46	90	B1CU6/20	
	300	40	240	230	270	80	125	450	M30	16	410	417	310	45	80	450	315	140	43	50	110	B1CU9/25	
	400	40	240	290	330	100	135	585	M36	16	535	546	389	54	80	450	315	140	43	50	110	B1CU9/25	
DF	500	40	350	350	390	120	173	615	42	20	610	755	500	57	120	640	445	190	65	65	175	B1C13/55	
	600	40	390	390	430	140	201	735	48	20	725	890	600	72	120	785	555	222	78	70	215	B1CU17/55	

Actuator dimensions for dp=0.15bar linked to BH valve size.

For other actuators take dimensions for relevant actuator type from above rows DIMENSIONS ACTUATOR MOUNTING.

6.2 BH 3-lever valve - weights

Table 4 – BH 3-lever valve & actuator weights

	BH	NPS	CL	weight	ACTUATOR	weight	total weight
	Type			[kg]	Type	[kg]	[kg]
WAFER	BH_C;D8	8	150;300	90	B1CU6/20	5	95
	BH_C;D10	10	150;300	95	B1CU6/20	5	100
	BH_C;D12	12	150;300	160	B1CU9/25	10	170
	BH_C;D16	16	150;300	210	B1CU9/25	10	220
DOUBLE FLANGE	BH_C20	20	150	270	B1C13/55	30	300
	BH_C24	24	150	350	B1CU17/55	55	405
	BH_C28	28	150	455	B1CU25/95	130	585
	BH_C32	32	150	550	B1CU25/95	130	680
	BH_C36	36	150	775	B1CU32/105	255	1030
	BH_C40	40	150	800	B1CU32/105	255	1055
	BH_C48	48	150	1470	B1CU40/120	445	1915
	BH_C56	56	150	2200	B1CU40/120	445	2645

	BH	NPS	CL	weight	ACTUATOR	weight	total weight
	Type			[kg]	Type	[kg]	[kg]
WAFER	BH_J;N200	200	10;40	90	B1CU6/20	5	95
	BH_J;N250	250	10;40	95	B1CU6/20	5	100
	BH_J;N300	300	10;40	160	B1CU9/25	10	170
	BH_J;N400	400	10;40	210	B1CU9/25	10	220
DOUBLE FLANGE	BH_J500	500	10	270	B1C13/55	30	300
	BH_J600	600	10	350	B1CU17/55	55	405
	BH_J700	700	10	455	B1CU25/95	130	585
	BH_J800	800	10	550	B1CU25/95	130	680
	BH_J900	900	10	775	B1CU32/105	255	1030
	BH_J1000	1000	10	800	B1CU32/105	255	1055
	BH_J1200	1200	10	1470	B1CU40/120	445	1915
	BH_J1400	1400	10	2200	B1CU40/120	445	2645

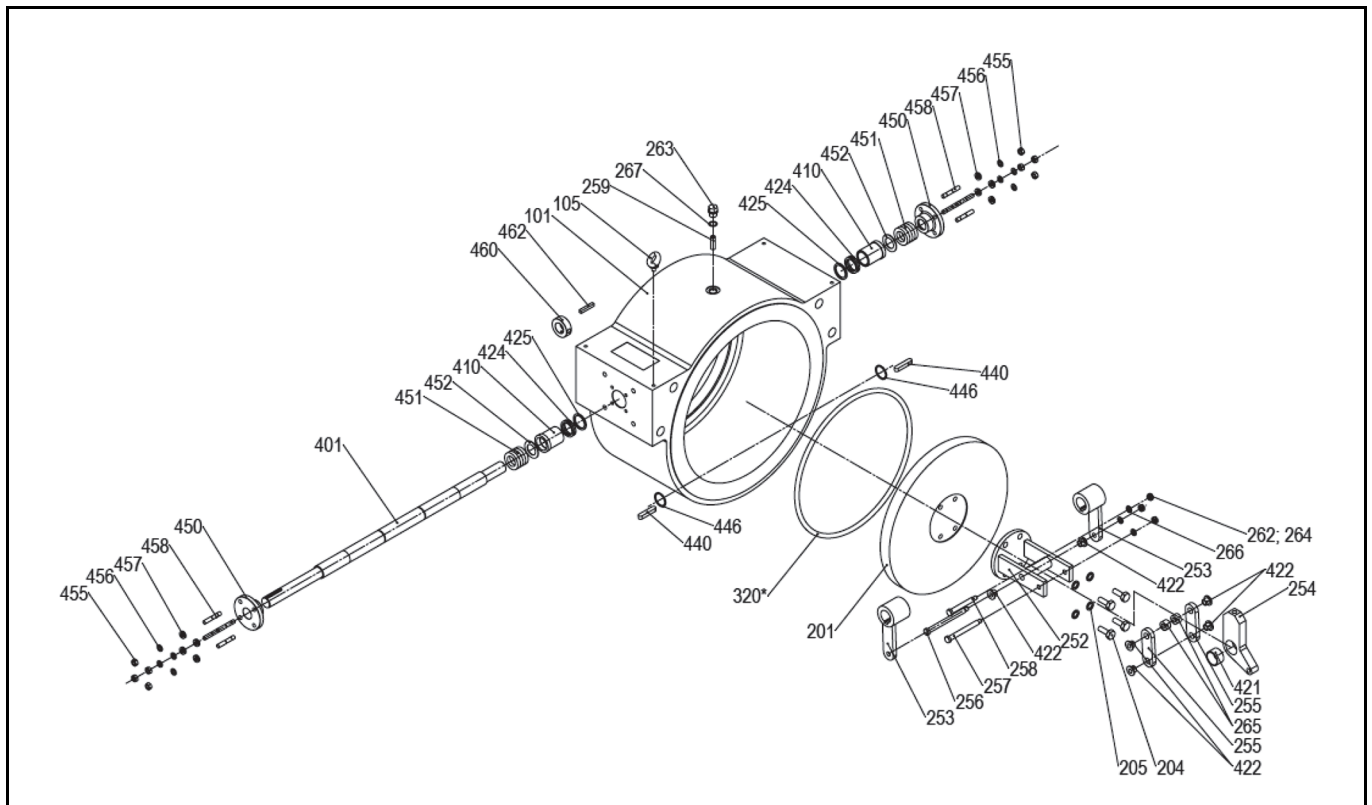
	BH	NPS	CL	weight	ACTUATOR	weight	total weight
	Type			[kg]	Type	[kg]	[kg]
WAFER	BH_K200	200	16	90	B1CU6/20	5	95
	BH_K250	250	16	95	B1CU6/20	5	100
	BH_K300	300	16	160	B1CU9/25	10	170
	BH_K400	400	16	210	B1CU9/25	10	220
DOUBLE FLANGE	BH_K500	500	16	290	B1C13/55	30	320
	BH_K600	600	16	375	B1CU17/55	55	430
	BH_K700	700	16	490	B1CU25/95	130	620
	BH_K800	800	16	590	B1CU25/95	130	720
	BH_K900	900	16	830	B1CU32/105	255	1085
	BH_K1000	1000	16	860	B1CU32/105	255	1115
	BH_K1200	1200	16	1575	B1CU40/120	445	2020
	BH_K1400	1400	16	2355	B1CU40/120	445	2800

	BH	NPS	CL	weight	ACTUATOR	weight	total weight
	Type			[kg]	Type	[kg]	[kg]
WAFER	BH_N200	200	40	90	B1CU6/20	5	95
	BH_N250	250	40	95	B1CU6/20	5	100
	BH_N300	300	40	160	B1CU9/25	10	170
	BH_N400	400	40	210	B1CU9/25	10	220
DF	BH_N500	500	40	350	B1C13/55	30	380
	BH_N600	600	40	450	B1CU17/55	55	505

Actuator weights for dp=0.15bar linked to BH valve sizes. For other actuators take weights for relevant actuator type

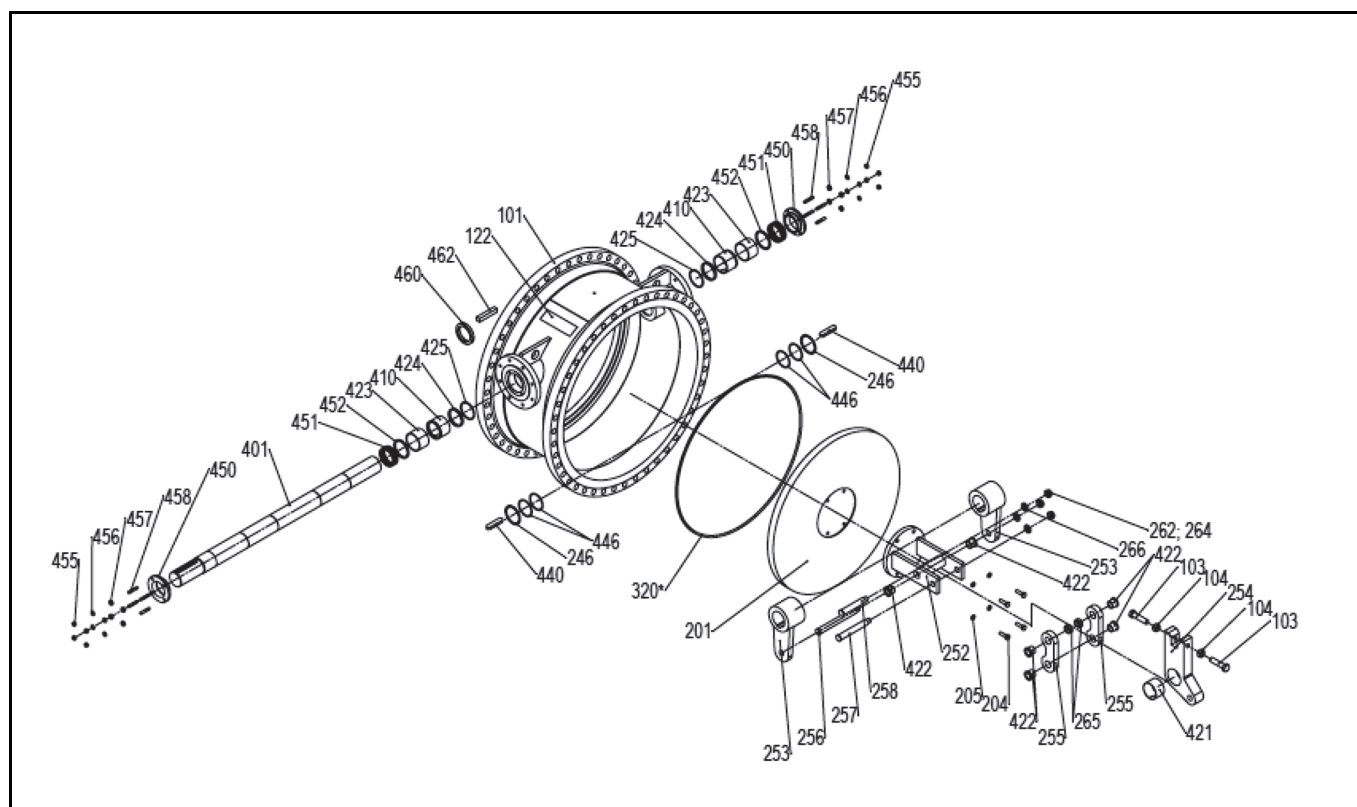
7 EXPLODED VIEW

7.1 BH 3-lever-valve – wafer type



Pos	QTY	Description	Material
101	1	BODY	A516 gr. 70
105	4	LIFTING EYE	DIN 17210-1.0401
201	1	DISC	EN 10028-1.4571
204	4	HEXAGON	SCREW A2-70
205	4	LOCK WASHER	STAINLESS STEEL
252	1	DISC LEVER	1.4571
253	2	LEVER 1	1.4571
254	1	SUPPORTING ARM	1.4571
255	2	LEVER 2	1.4571
256	1	PIN	XM-19
257	1	PIN	XM-19
258	1	PIN	XM-19
259	1	PIN	XM-19
262	3	CASTLE NUT	A2-70
263	1	PLUG SCREW	CARBON STEEL+ZINC
264	3	SPLINT	A2-70
265	2	SPACER RING	1.4571
266	3	WASHER	AISI 316
267	1	O-RING	FKM
320	1	SEALING ELEMENT	FKM
401	1	SHAFT	1.4021
410	2	BEARING SLEEVE	1.4301 + BRONZE+PTFE
421	1	BEARING SLEEVE	BRONZE+PTFE
422	6	BEARING SLEEVE	BRONZE+GRAPHITE
424	4	PACKING RING	PTFE
425	2	BOTTOM RING	1.4301
440	2	FEATHER KEY	1.4057
446	2	RETAINING RING	1.4571
450	2	GLAND	1.4021
451	8	PACKING RING	PTFE
452	2 T	HRUST WASHER	BRONZE+PTFE
455	8	HEXAGON NUT	A2-70
456	8	WASHER	AISI 316
457	32	DISC SPRING	STAINLESS STEEL
458	8	THREADED PIN	A2-70
460	1	POSITION MARK	1.4301
462	1	KEY	1.4460

7.2 BH 3-lever-valve – double flange type



Pos	QTY	Description	Material
101	1	BODY	A516 gr. 70
103	2	HEXAGON SCREW	A2-70
104	2	HEXAGON NUT	A2-70
122	1	PLANE OF ID-PLATE	1.4301
201	1	DISC	1.0570
204	4	HEXAGON SCREW	A2-70
205	4	LOCK WASHER	STAINLESS STEEL
246	2	THRUST WASHER	BRONZE+PTFE
252	1	DISC LEVER	1.0037
253	2	LEVER 1	1.0037
254	1	SUPPORTING ARM	1.0037
255	2	LEVER 2	1.0037
256	1	PIN	XM-19
257	1	PIN	XM-19
258	1	PIN	XM-19
262	3	CASTLE NUT	A2-70
264	3	SPLINT	A2-70
265	2	SPACER RING	1.4571
266	3	WASHER	TAINLESS STEEL
320*	1	SEALING ELEMENT	FKM
401	1	SHAFT	1.4021
410	2	BEARING SLEEVE	1.4301 + BRONZE+PTFE
421	1	BEARING SLEEVE	BRONZE+PTFE
422	6	BEARING SLEEVE	BRONZE+GRAPHITE
423	2	PIPE	1.4301
424	4	PACKING RING	PTFE
425	2	BOTTOM RING	1.4571
440	2	FEATHER KEY	1.4057
446	4	RETAINING RING	1.4571
450	2	GLAND	1.4571
451	8	PACKING RING	PTFE
452	2	BOTTOM RING	1.4571
455	8	HEXAGON NUT	A2-70
456	8	WASHER	AISI 304
457	32	DISC SPRING	STAINLESS STEEL
458	8	STUD	DIN 267 PART 11 A2-70
460	1	POSITION MARK	1.4301
462	1	KEY	1.4460

8 TROUBLESHOOTING

8.1 BH 3-lever-valve does not close seal-tight

- Never close the valve by exerting excess force. This leads to the risk of irreparable damage.
- Test whether the energy supply is connected.
- Test whether the "closed" position of the actuator and the "closed" position of the disc are in alignment.
- Valve leakage is not always caused by a damaged seat or disc. The reason can also be that the disc is not in the correct closed position.
- Check the position of the actuator relative to the valve. The screws may be loose or the bracket damaged.
- Check the adjustment in the closed position
- The marking line parallel to the disc on the valve shaft head shows roughly the closed position of the disc.
- If closing position is not reached it can be any blocking inside of the valve (between disc and seat), anything blocking the lever system or something inside the actuator.
- Check the sealing surface of the disc and body and the sealing element for possible damage. Dismantle the valve. Test whether any foreign objects are present between the disc and seat. Remove the foreign objects or deposits, if necessary.
- There must be no scratches or damages at the surface from the disc (201) and seat contact area in the body (101). For soft seated BH valve, the seat (321) must be without damages.
- Replace damaged parts, if necessary.

In addition, please refer to the information in the "Cleaning and Maintenance" chapter in the Maintenance section of this IMO.

8.2 Leakage of gas

- Check if disc spring set (457) from the life loaded gland packing are proper and equal pre-stressed on both sides of the shaft.
- Check if the actuator is assembled well and valve drive shaft and actuator shaft connection are aligned with each other. Avoid lateral forces to be applied on the drive shaft.

8.3 High torque or no correct switching time

- Check if actuator is equipped with correct supply air
- Check if solenoid valve is operating well.
 - Remember that the actuator of the BH 3-lever valve only opens the valve if the internal differential pressure is significantly below 0.3 bar.
- Check if actuator itself is working properly.
- Check that gland packing is not tightened too strong.

If all pre-checks do not lead to a failure, the valve has to be maintained. Check if valve shows any internal damages, scratches or bumps at moving parts.

Check and substitute all metal parts. Check shaft bearings, lever bearings and sealing element, and replace, if necessary.

For disassembly, please read the maintenance section of this IMO at chapter 10ff of this IMO.

9 SAFETY INSTRUCTIONS

Please follow the below-mentioned safety instructions during installation, maintenance and operation of the high performance valve:

1. For safety reasons, you must not do any modifications to the mode of operation of the BH 3-lever valve or its actuator.
2. Assembly work at the valve must be done only by qualified personnel!
3. A functional test is associated with the risk of sudden uncontrolled movement upon supply of energy. Therefore, ensure that the valve does not move during the functional test under any circumstances.
4. There is a significant risk of injury from accidental operation of the remote control during any maintenance work. If you intend to use a remote control for working with the valve, then an additional emergency stop switch that acts as a locking device is required at the actuator.
5. Make sure that cleaning agents do not cause any unwanted chemical reactions upon contact with possible residues in the high-performance valve.
6. While working in the area of the sealing surface of the disc, secure the disc using wooden wedges to exclude crushing hazard. Pay attention to the fact that you do not damage the sealing surface of the disc as a result.

10 MAINTENANCE

10.1 Cleaning and maintenance intervals

Butterfly valves of the BH 3-lever valve series are mainly maintenance-free. The BH 3-lever valves are designed for a 5-year maintenance free operation.

- Check the valve regularly for its tightness. Metso recommends replacement of the sealing element (320) and the packing rings (451+424) on demand but at latest after 5 years.
- Check and replace shaft bearing and bearing protection of the valve.
- Check movability of lever system. Change bronze bearings (422) and pins (256...258) of the lever system and replace, if necessary.
- If the medium is contaminated with particles that may impair the seal-tightness of the valve, then the sealing surface of the disc must be cleaned regularly. Contamination may damage the sealing surface of the metal seated disc or the sealing element.
- Auxiliaries that may attack the sealing surface. Use water, soapsuds or other liquid solvents and a lint-free rag.
- Inspect all bolts and nuts after cleaning. Evidence of corrosion, cracking, galling, stretching or thread deformation (by thread gauge) or other damage is cause for rejection and replacement with new bolting.

Never use cutting, scraping or grinding tools such as files or sandpaper to clean seat surface. Moreover, do not use any solvent based cleaning agents that may cause unwanted chemical reactions upon contact with residues of the medium or attack the seal.



While assigning cleaning and maintenance work to qualified external firms and / or qualified external personnel, it is mandatory to make them aware of the dangers of the used medium and possibly present residues. The IMO must be handed over to the responsible service person always.

For proper maintenance, the valve must be removed from the pipeline. Follow the instructions in following chapters.

10.2 Preliminary

Suitable spare parts sets should be kept ready and / or provided on time to avoid longer downtimes during maintenance work. Please take into account the delivery and transport times.

Before dismantling the BH 3-lever valve, the following prerequisites must be met:

- Ensure that the pipelines are pressure less and free of process-related gases and fluids.

Check whether the valve has already cooled down or warmed up to the extent that there are no more hazards due to extreme temperatures.

- Inform yourself about the medium that last passed through the valve. Residues may occur in the valve. Make sure that there is no poisoning or acid-burn risk when coming in contact with the residues. Protect yourself using appropriate protective clothing, safety goggles and a breathing mask, where appropriate. It is mandatory to follow the safety instructions for operating personnel.
- If you do not make the disassembly by yourself, instruct the qualified personnel and provide them with protective clothing, if necessary. While assembling, and disassembling the BH 3-lever valve, the BH 3-lever valve must be closed to exclude any incidental damage.

10.3 Removing valve from the pipeline

CAUTION:

Do not dismantle the valve or remove it from the pipeline while the valve is pressurized!

- The pipeline is pressure less and cleaned well.
- The relevant valve must be disengaged from the process and completely depressurized.
- The valve is in a defined position – “closed” in general. It is mandatory to follow the safety instructions of the operator! Proceed in the following sequence for dismantling the valve:
- Close the valve.

It is generally most convenient to detach the actuator and its auxiliary devices (see paragraph 8), before removing the valve from the pipeline. If the valve package is small or difficult to access, it may be more practical to remove the entire package at the same time.

- If the actuator must be removed for dismantling the valve, mark its direction to the bracket and the body with a waterproof felt-tip pen before dismantling the actuator. In this manner, you can correctly reposition the actuator during reinstallation and prevent it from triggering any faulty function.

Disconnect the energy supply to the actuator. In addition, press the EMERGENCY STOP switch for energy supply to the actuator or activate the remote control, so that no one can reconnect the energy supply by mistake.

Dismantle the actuator. Refer to chapter 4ff on page 8 of the IMO for this.

- Secure the valve carefully using lifting ropes. Handle the valve with actuator or the bar-shaft valve as described in chapter 1.2 page 3. See especially Figure 1 and Figure 2).
- Release the valve by loosening the screws opposite to one another or the nuts in a crosswise manner.
- Transport the valve securely, so that they do not move during transport and eventually get damaged.

11 ASSEMBLY OF THE VALVE

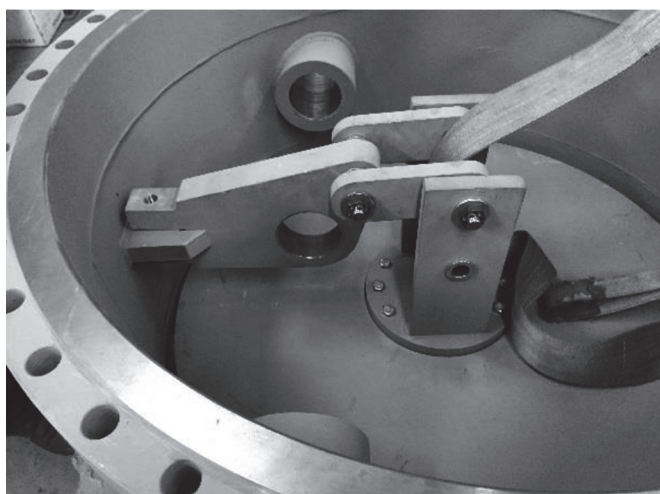
Maintenance at BH 3-lever-valve should only be executed by authorized and trained Metso personnel.

- Place shut off disc (201) with seat groove down on a suitable support.
- Avoid any damages, or scratches to the seat surface of the disc or a damage of the inserted soft seat.
- Place disc lever (252) on the back side of the disc and tighten screws (204) with the Nordlock washers (205) underneath.
- Assemble levers 2 (257) to disc lever.
- The bronze bearings (422) of the lever system need an initial lubrication. Use a thin layer on pin/bearing surface of lever system.
- Use only Klüberalfa YV 93-1202 grease for that



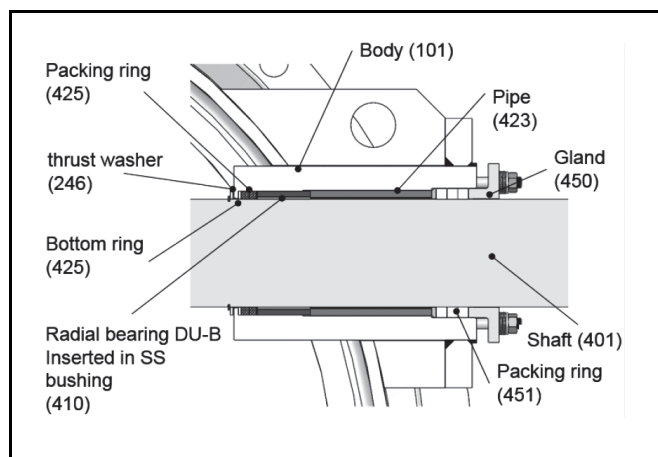
BH disc with disc lever and lever 2

- Check, that seat surface in the valve body is clean without any particles before you place the disc.
- Lift the disc inside the body and place it centered inside the body (101) on the seat surface.



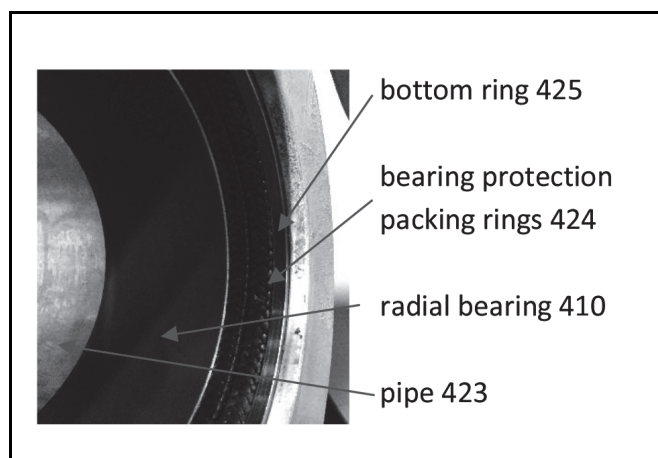
Assembly of support arm

- Insert and assemble support arm (254) with already inserted DU-bearing (421).
- Insert shaft bearing on both sides:



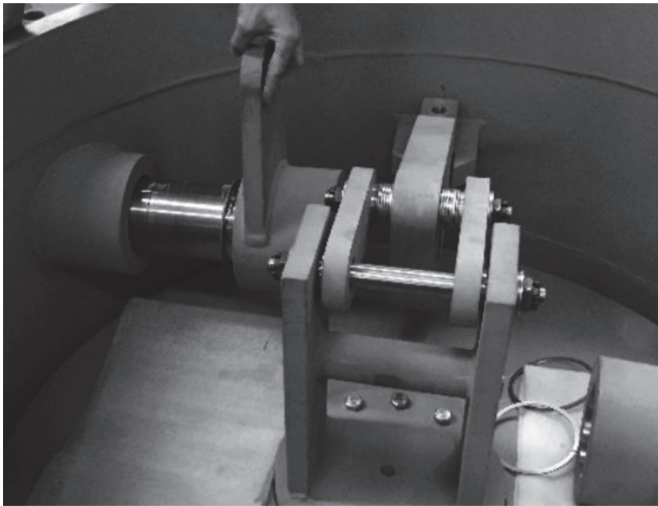
BH 3-lever valve shaft bearing with bearing protection

- insert bottom ring (425)
- Insert packing ring (424) as bearing protection
- Insert radial bearing (410)
- There is no grease necessary at the radial bearings.
- Insert pipe (423)
- At first step it is recommended to insert a PTFE bushing instead of the packing ring (451). Add gland and slightly fix it with bolt and nuts.



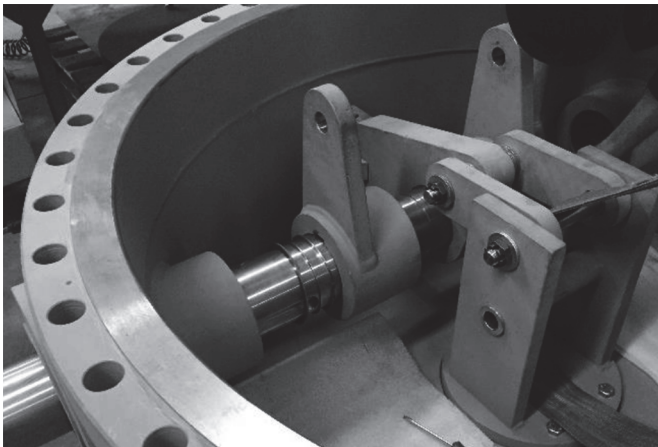
Bearing protection

- Insert shaft (401) in the assembled bearing from one side.



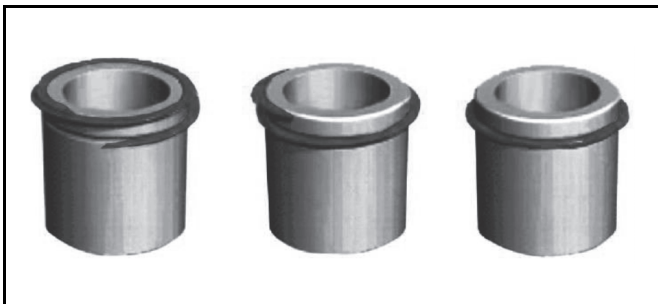
Shaft assembly – lever 1

- Take care, that shaft (401) with the actuator connection is located on the correct side of the body.
- Put thrust washer (246) and then 2 spiral formed lock washers (446) on the shaft.
- Put first lever 1 (253) on the shaft and push shaft through bearing of support arm (254).
- Push shaft further and move all rings to outer site, insert key (440) in shaft and move lever 1 (253) over shaft key.

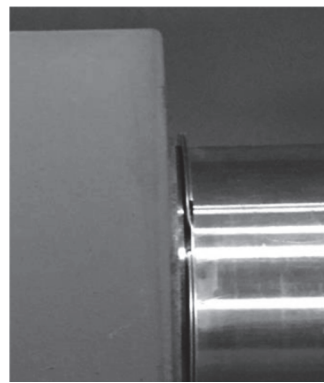


Shaft assembly

- Repeat this in reverse order for the other side
- The shaft is in correct position, when all 4 retaining rings (446) are snapped in their groove.
- The spiral retaining rings (446) can be easily twisted without any tool in the groove unless they snap in.



Retaining ring principle



Assembled retaining ring

- For disassembly, the retaining ring can be simply lifted with a screw driver at one open end and pulled or twisted out of the groove.
- Insert hexagon screws (103) and counter nut (104) to support arm and fix and counter its position
- Turn shaft that bores of lever 1 (253) comes in line with bearings of disc lever (252), insert pin (256), crown nut (266) and lock nut with splint (264).
- The bronze bearings of the lever system need an initial lubrication. Use a thin layer on pin/bearing surface of lever system.
- Use only Klüberalfa YV 93-1202 grease for that.
- Do this for all pin and crown nuts of the lever system and ensure movability of the entire lever system.
- Make final assembly of stuffing box (451) and gland (450) with life loaded disc spring sets (455 ... 457) at both ends.
- Assemble position marker (460) to shaft (401).
- Place valve in upright position that flanges are vertical and shaft is horizontal aligned. Ensure a save support for assembled valve.
- Assemble bracket and actuator to the valve. (see 4.4).
- Check correct function of the valve:
 - Tightness
 - Valve must not open when inside pressure is higher than specified opening differential pressure of the valve.

11.1 Replacing the gland packing

The gland packing (451) must be changed if leakage occurs even after the hex nuts (455) have been tightened as recommended.

11.1.1 Stuffing box BH 3-lever valve

- This BH valve types are equipped with 4 stud bolts at the gland. Sizes bigger the 40 inch / DN1000 have 8 bolts.
- The BH valve shaft (401) has one stuffing box at each side.
- Make sure the valve is not pressurized.
- Unfasten the nuts (444) and remove the disc springs kits (457) and the gland (450).

- Remove old packing rings (451). Do not damage the surfaces of the packing ring counterbore and shaft. It is not necessary to change anti-extrusion ring (452).
- Clean the gland and packing ring counter bore. Install new set of packing rings. Slip the rings onto the shaft. Ensure that there are no burrs in the keyway groove which could damage the packing.
- Install the gland.
- Mount the disc spring kits. There are 4 disc springs at each stud. The disc springs are stacked normal – no parallel stack.
- Place the nuts on the studs.
- Pre-compress the gland packing by tightening the nuts with a wrench until the disc springs have value of compression given in Table 5 and depending from rated pressure of the valve. (compression values for other pipeline pressures in between can be interpolated)
- Carry out 3...5 operation cycles with the valve. Suitable range of movement is about 80 %.
- It is not necessary to fully close or open the valve during the operation.
- Unfasten the nuts and disc springs.
- Measure the height h1 of uncompressed the disc springs and use these values as a basis when defining the final height of the springs (as compressed condition).
- Re-install the disc springs and tighten the nuts with the wrench. Tighten the nuts until the set value of compression (h1–h2) of disc springs is achieved, see Table 5 and Table 6 depending on size and pressure class.

size	BH 3-lever valve						
NPS/DIN	packing diameter	spring set diameter	Thread	no of studs	10 bar spring compression	20bar	40 bar
8/200	20	16	M8		0.7	1.3	2.5
10/250	20	16	M8		0.7	1.3	2.5
12/300	25	16	M8		0.8	1.5	2.9
16/400	25	16	M8		0.8	1.5	2.9
20/500	45	20	M10		1.0	2.0	3.9
24/600	60	20	M12		1.3	2.5	5.0
28/700	65	25	M12		0.8	1.6	
32/800	80	25	M12		1.4	2.7	
36/900	90	25	M12		1.2	2.3	
40/1000	90	25	M12		1.2	2.3	
48/1200	120	25	M12		1.2	2.4	
56/1400	120	25	M12		1.2	2.4	

Table 5– tightening of gland packing BH 3-lever valve

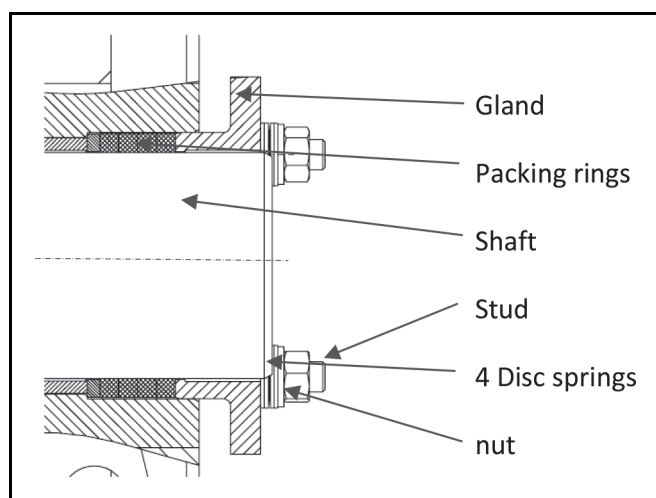


Table 6 –gland packing BH 3-lever valve

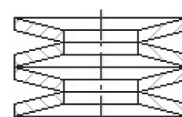


Figure 8 Disc spring stack for BH 3-lever valve

12 VALVES IN OXYGEN SERVICE

12.1 Maintenance / Repair work



12.1.1 ATTENTION:

Oxygen applications are high risky applications and a lot of special precautions have to be considered to avoid all kind of incidents!

If the needed minimum requirements for oxygen application would not carefully and accurately be kept it could cause terrible incidents like explosions or similar.

In the worst case people could get terrible injured or they could get died.

Metso has a lot of experience with valves for oxygen applications. We have special trained people who know, what they have to do and we have special assembly and testing environments for this oxygen cases.



12.1.2 Due to this

Metso highly recommend the customer not to carry out any repair or maintenance themselves on valves for oxygen service.

Just contact the Metso specialists. They will take care about your needs.

In addition, please note that the valve will automatically lose the Metso warranty if it would have been maintained or repaired outside Metso.

On the next page are just some very brief basic information concerning valves for oxygen application.

12.2 Minimum requirements for oxygen application valves



The following four things are just a few of the minimum things which have to be considered during maintenance or repair of a valve for oxygen applications.

1. All installed parts must fulfill the required cleanliness level. This is valid for each single part as well as for the whole assembled valve.
2. All used non-metallic parts must have as minimum an oxygen compatibility approval based on the worst case process conditions.
3. If grease has to be used based on technical needs then only grease, which has as minimum an oxygen compatibility approval based on the worst case process conditions.
4. 4.A final inspection concerning the achieved cleanliness level has to be carried out.

Do never install a valve when you are not sure if all of these 4 things are fulfilled!!

12.3 General HSE Requirements (Health Safety Environment):

Take care that all local and international necessary health, safety and environment laws and instructions are fulfilled before starting any service, maintenance or repair work. Keep these HSE requirements during the whole work until it is finished.

All construction activities shall be carried out with the utmost safety. Related safety procedures shall be verified and approved by the local responsible HSE Management of the plant site before any work would have been started.

12.4 Cleaning during and after service:

We just will highlight once more, that as minimum the shown Minimum requirements for

oxygen application valves (chapter 12.2) have to be fulfilled very carefully and accurately if any kind of maintenance or repair or service job has been carried out.

We will not give any more details here. Please follow strictly to our recommendation given in paragraph 12.1.2 on this page!

12.5 Tightening torques of valve screws

Allowable tightening torques for screws of the steel type A2- 70.2 and A4-70 with metric coarse-pitch thread according to DIN 13. The utilization is 70% of $R_{p0.2}$, friction coefficient 0.16.

Table 7 - tightening torques for valve screws

$\emptyset$	Stressed cross section	Load 1) Force at the screw		Pre-stressing force	Tightening torque
	AS [mm ²]	Rp0.2 [N]	Rm [N]	N	Nm
M4	8.8	3951	6146	2489	2.13
M6	14.2	6390	9940	4026	4.19
M7	20.1	9045	14070	5698	7.3
M8	36.6	16470	25620	10376	17.5
M10	58.0	26100	40600	16443	35.2
M12	84.3	37935	59010	23899	60.3
M14	115.0	51750	80500	32603	95.8
M16	157.0	70650	109900	44510	146.2
M18	192.0	86400	134400	54432	203.1
M20	245.0	110250	171500	69458	285.7
M22	303.0	75750	151500	47723	212.4
M24	353.0	88250	176500	55598	273.9
M27	459.0	114750	229500	72293	405.3
M30	561.0	140250	280500	85358	549.0

1) values correspond to 100% of yield strength

13 HOW TO ORDER – TYPE CODE

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
-	BH	A	C	48	N	G	B1	-	-
BH with max. opening 0.3 bar pressure difference, drillings acc. to CL 150 pressure class, size NPS 48, carbon steel body, carbon steel disc, corrosion protected lever, soft seated with PTFE packing.									
-	BH	B	C	48	N	A	C1	-	-
BH with max. opening 0.15 bar pressure difference, drillings acc. to CL 150 pressure class, size NPS 48, carbon steel body, carbon steel disc, carbon steel lever, metal seated with PTFE packing									
-	BH	A	J	400	N	G	B1	K	-
BH with max. opening 0.3 bar pressure difference, drillings acc. to PN 10 pressure class, size DN 400, carbon steel body, stainless steel disc, stainless steel lever, soft seated with PTFE packing, both side shaft end with key for spare valve.									

1. sign	RESERVED FOR FUTURE USE
-	

2. sign	PRODUCT SERIES / DESIGN
BH	3-lever valve with precise controlled max opening dp. and face-to-face according to EN 558 part 1, basic series 14 for size ≥ NPS 20/DN 500; Special face-to-face for size NPS 8 - NPS 16 / DN 200 - DN 400

3. sign	PRODUCT MAX OPENING PRESSURE DIFFERENCE FOR ACTUATOR
A	dp max= 0.3 bar
B	dp max= 0.15 bar
Y	Special (always check the availability from the factory)

4. sign	PRESSURE RATING AND CONSTRUCTION
C	Body design 16 bar, trim 7,5 bar, body drilling ASME class #150
D	Body design 40 bar, trim 30 bar, body drilling ASME class #300
J	Body design 10 bar, trim 7,5 bar, body drilling acc. EN 1092-1 PN10
K	Body design 16 bar, trim 7,5 bar, body drilling acc. EN 1092-1 PN16
L	Body design 25 bar, trim 12 bar, body drilling acc. EN 1092-1 PN25
N	Body design 40 bar, trim 30 bar, body drilling acc. EN 1092-1 PN40

5. sign	SIZE RANGE (DN or Inch) & BODY DESIGN
	DN 200, 250, 300, 400, 500, 600, 700, 800, 900, 1000, 1200, 1400, 1600 NPS 08, 10, 12, 16, 20, 24, 28, 32, 36, 40, 44, 48, 54, 56, 64 Size ≤ DN400 / NPS 16 body design always wafer size ≥ DN500 / NPS 20 body design always double flanged
Y	Special, to be specified

6. sign	BODY AND DISC DESIGN
N	Neo Design: Corrosion resistant lever system. Body: EN 1.0460 / 1.0425 / 1.0570 (flange / body / neck) Disc: EN 1.0570 or equal - for lever valve ≤ DN400 / NPS 16 = stainless steel disc

7. sign	LEVER DESIGN
A	Carbon steel with zinc primer. Corrosion resisted moving parts (screws, nuts, pins, etc...) Inserted heavy duty bronze lever bearings
G	With Corrosion protection ≤ DN400 / NPS 16 = Stainless steel ≥ DN500 / NPS 20 = Carbon steel with corrosion protection (GEOMET) Corrosion resisted moving parts (screws, nuts, pins, etc...) Inserted heavy duty bronze lever bearings
OPTIONS	
C1	Corrosion protection (Optional design) ≤ DN400 / NPS 16 = Stainless steel ≥ DN500 / NPS 20 = Stainless steel Corrosion resisted moving parts (screws, nuts, pins, etc...) Inserted heavy duty bronze lever bearings

8. sign	SEAT, GLAND PACKING AND SHAFT DESIGN
B1	Soft seated / FKM. Tmax 200 °C Live loaded gland packing PTFE Bronze-PTFE composite bearings Bearing protection Shaft material 1.4021
C1	Metal seated. Tmax 280 °C Live loaded gland packing PTFE Bronze-PTFE bearings Bearing protection Shaft material 1.4021
Y	Special, to be specified

9 sign	SHAFT DESIGN
-	key at one side (Standard)
K	both side shaft end with key (only for spare lever valves)
M	both side shaft end with square end profile (only for spare lever valves)

10. sign	FLANGE FACING
-	Raised Face , Ra 3.2 - 6.3, standard EN 1092-1 Type B1 (all sizes) ASME B16.5 (sizes up to NPS 24) ASME B16.47 Series B (sizes larger than NPS 24)
Y	Special, to be specified

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