

Neles™ BH 3-lever butterfly valve

Series BH

Installation, maintenance and
operating instructions

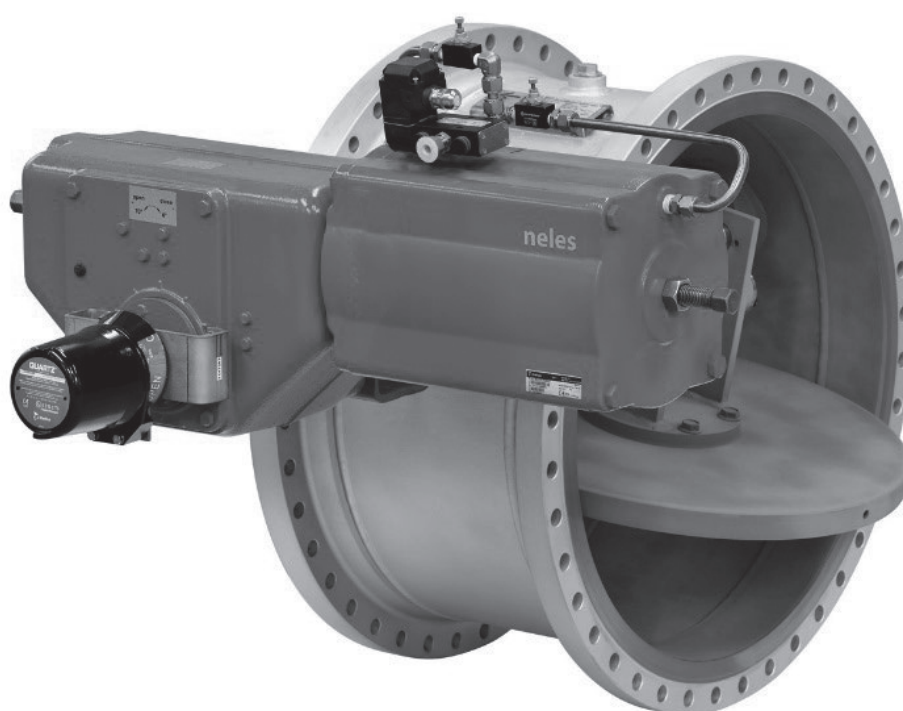


Table of contents

GENERAL	3	EXPLODED VIEW	13
Safety precautions	3	BH 3-lever-valve – wafer type	13
Welding notes	3	BH 3-lever-valve – double flange type	14
Warnings and safety notes	4	TROUBLESHOOTING	15
General disclaimers	4	BH 3-lever-valve does not close seal-tight	15
PRODUCT & FUNCTION DESCRIPTION	4	Leakage of gas	15
Intended use	4	High torque or no correct switching time	15
TRANSPORTATION, RECEPTION AND STORAGE	4	Welding notes	15
Scope of delivery	4	MAINTENANCE	15
Reception	4	Cleaning and maintenance intervals	15
Lifting	5	Preliminary	16
Visual inspection	5	Removing valve from the pipeline	16
Marking and identification	6	ASSEMBLY OF THE VALVE	16
Atex and CE marking	6	Stopper adjustment	18
Contact	6	Replacing the gland packing	18
INSTALLATION	6	VALVES IN OXYGEN SERVICE	19
Installation planning	6	Maintenance / Repair work	19
Preliminary	7	Minimum requirements for oxygen application valves	19
Installation	7	General HSE Requirements	
Bolt sizes and lengths	8	(Health Safety Environment):	20
DETACHING AND MOUNTING ACTUATOR	9	Cleaning during and after service:	20
General	9	Tightening torques of valve screws	20
Detaching preparation	9	EU DECLARATION OF CONFORMITY FOR ATEX APPROVED VALVES	21
Detaching	9	HOW TO ORDER – TYPE CODE	22
Mounting actuator	9	GENERAL DISCLAIMER	23
ORDERING SPARE PARTS	9	Lifting	23
DIMENSIONS AND WEIGHTS	10	Work activities on the valve	23
BH 3-lever valve - dimensions	10	Receive, handle and unpacking.	23
BH 3-lever valve – weights	12	Operating	23
		Maintenance	24

Subject to change without notice.

All trademarks are property of their respective owners.

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

- These instructions provide the customer/operator with important information in addition to the customer/operator's normal operation and maintenance procedures. Since operation and maintenance philosophies vary, Valmet does not attempt to dictate specific procedures, but to provide basic limitations and requirements created by the type of equipment provided.
- These instructions assume that operators already have a general understanding of the requirements for safe operation of mechanical and electrical equipment in potentially hazardous environments. Therefore, these instructions should be interpreted as applied in conjunction with the safety rules and regulations applicable at the site and the particular requirements for operation of other equipment at the site.
- These instructions do not intend to cover all details or variations in equipment nor to provide for every possible contingency to be met in connection with installation, operation, or maintenance. Should further information be desired, or should particular problems arise which are not covered sufficiently for the customer/operator's purposes the matter should be referred to Valmet.
- The rights, obligations and liabilities of Valmet and the customer/operator are strictly limited to those expressly provided in the contract relating to the supply of the equipment. No additional representations or warranties by Valmet regarding the equipment or its use are given or implied by the issue of these instructions.
- These instructions contain proprietary information of Valmet and are furnished to the customer/operator solely to assist in the installation, testing, operation and/or maintenance of the equipment described. This document shall not be reproduced in whole or in part nor shall its contents be disclosed to any third party without the written approval of Valmet.

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 Neles Nelprof™ computer program.

Please follow the occupational safety regulations applicable to noise emissions.

CAUTION:

If you lift the valve or valve unit 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!

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.

1.2 Welding notes

WARNING:

Welding and/or grinding stainless steel and other alloys containing chromium metal may cause the release of hexavalent chromium. Hexavalent chromium (VI) or Cr(VI), is known to cause cancer. Be sure to use all appropriate personal protective equipment (PPE) when welding metals containing chromium.

NOTE:

A qualified welder must do the installation welding. The welder and welding procedure should be qualified in accordance with ASME Boiler and Pressure Vessel Code Section IX or other appropriate regulation.

CAUTION:

To prevent damage to the seat and seals, do not allow the temperature of the seat and body seal area to exceed 94°C (200°F) It is recommended that thermal chalks be used to check the temperature in these areas during welding.

CAUTION:

Ensure that any weld splatter does not fall onto the valve closing members e.g., ball, disc, or seats. This may damage critical seating surfaces and cause leaks.

1.3 Warnings and safety notes

NOTE:

Each chapter of the following IMO contains individual warnings, notes and safety instructions which are highlighted by that must be followed and respected without exception.



1.4 General disclaimers

NOTE:

Please read and follow the instructions and notes on the general disclaimers of liability for the receipt of goods, storage, handling, operation, and maintenance of the valve at the end of this IMO.

2. 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 \leq 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.

2.1 Intended use

The purpose of BH 3-lever-valves is to shut off gas flow. They have a intrinsically safe operation as 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 $+280^{\circ}\text{C}$. 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.

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

Use original spare parts only.

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

3. TRANSPORTATION, RECEPTION AND STORAGE

3.1 Scope of delivery

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

3.2 Reception

Prior to leaving Valmet 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.

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 must be handled, transported, shipped and stored always with the shaft in horizontal orientation

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).

Further storage instruction can be found in M-1147-En.

3.3 Lifting

Depending on the size and weight of the valve, you will require a suitable lifting equipment. The valve is equipped with special lifting points .

Consider the weight of the entire unit (valve and actuator). Lifting must only be carried out by trained and authorized personnel.

In horizontal transport position, always secure the round sling to the body (see Figure 1+2). The shaft may be damaged if you secure the slings to the actuator. Caution: Twisting hazard!

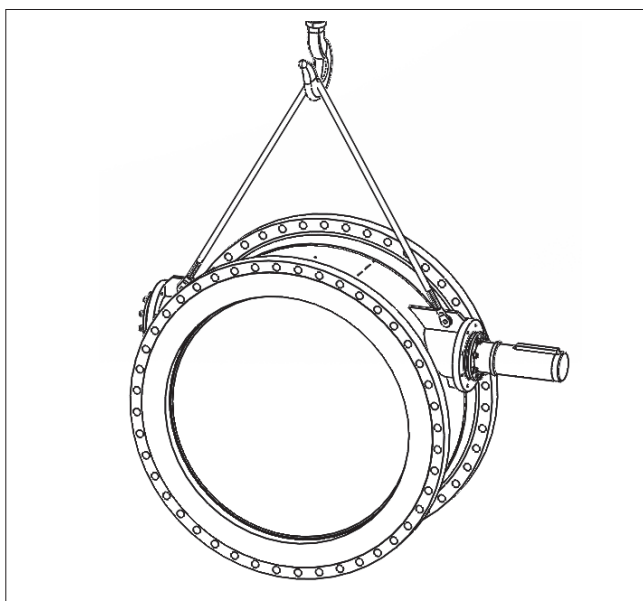


Fig. 1

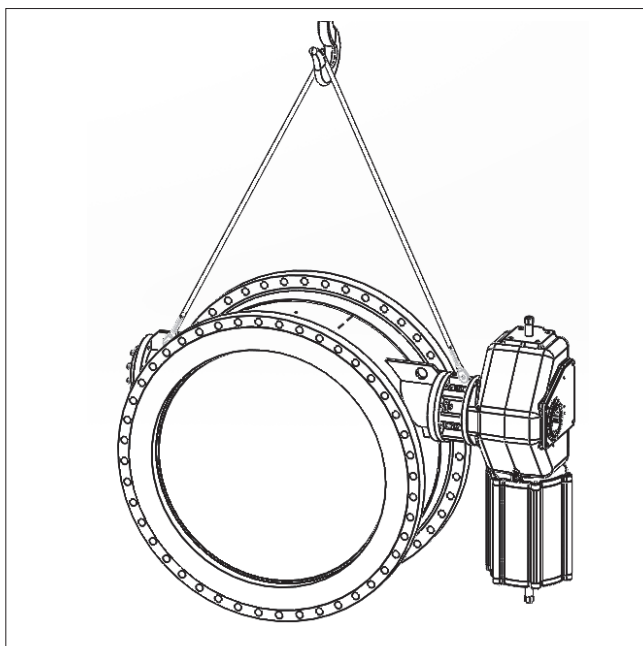


Fig. 2

3.4 Visual inspection

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

Visual inspection – are all screws properly tightened?

Visual inspection for damage to following components:

- Disc
- Drive shaft
- Lever system
- 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.



During operation of the valve: do to grasp into the valve und any circumstances. There is a high risk of serious hand and finger injuries.



- Connect the power supply now. Re-assure yourself that the actuator opens into the correct direction of flow.
- The valve must be operated only with horizontal orientated shaft!
- 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 $\leq \text{NPS16}$ is 20...30 sec, $> \text{NPS16}$ is 30...60sec. A 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.

3.5 Marking and identification

The valve data are shown on the identification 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.

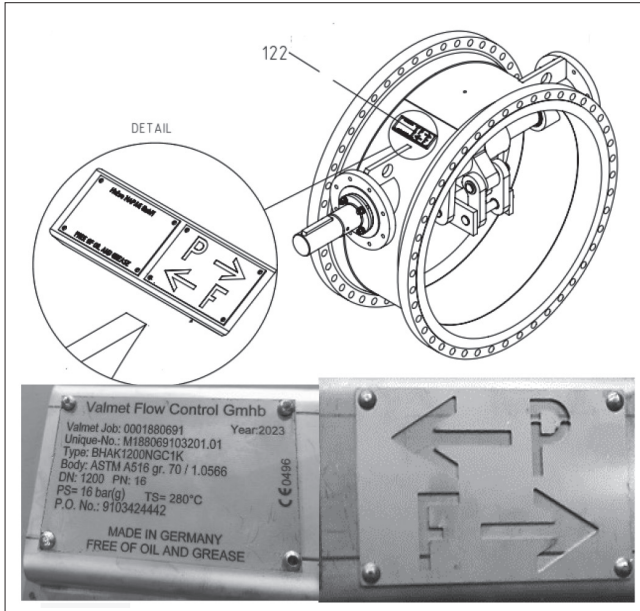


Fig. 3 Identification plate and pressure/flow direction

Further information:

Job no.	=	job number at Valmet 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
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 oxygen applications

3.6 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: identification plate).

3.7 Contact

Please contact your local Valmet partner.

You will find the contact information on the internet at:

www.valmet.com/flowcontrol/valves/

4. INSTALLATION

Assembly work at the BH 3-lever- valve shall only be carried out by qualified and Valmet certificated personnel!



4.1 Installation planning

Consider following aspects before assembly:

- Valve must be installed to allow free access to the actuator at any time.
- The BH 3-lever valve must be installed that shaft is always in horizontal position.
- The valve must never be operated with vertical shaft orientation!
- Actuators must 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.

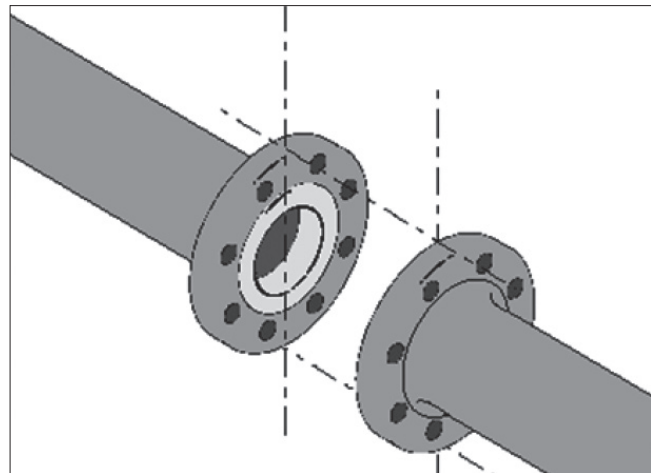


Fig. 4 Alignment of the flanged pipes

- The pipeline must be suitably supported to safely support the weight of the valve and actuator and to avoid vibration during operation.

Do not correct pipeline misalignment or wrong installation space with flange bolts.



Always use correct gaskets and fasteners to secure the valve to the pipeline as per pipe code and flange rating.



4.2 Preliminary

Prior to installation, ensure that the pipelines are free from any contamination and debris. 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.

4.3 Installation

Proceed as follows for installing the valve:

- Ensure that the pipeline is clean and without debris.
- 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 needs always to be in horizontal position for the BH 3-lever valve.
- 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.
- Center the flange gaskets carefully on both sides of the valve.
- Both gaskets are not part of the standard delivery. Valmet delivers the required gaskets seals at your request.
- Keep correct bolts and nuts in place.
- Use the dimensions of the stud bolts itemized in for assembly. (par. 3.4)
- Turn the flange screws or bolts facing one another crosswise and tighten uniformly using a torque wrench according to operator's specification (see Figure 5).
- Finally connect the energy supply.

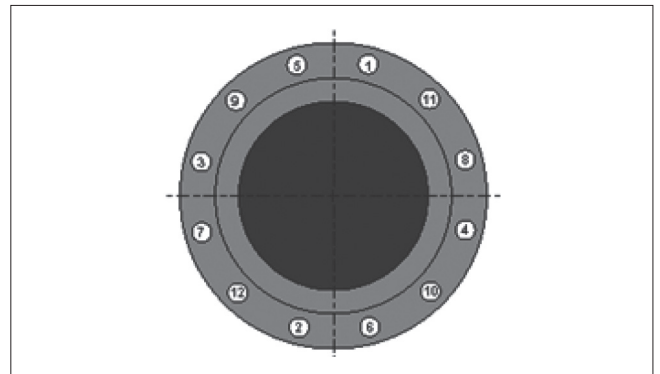


Fig. 5 Crosswise tightening flange bolts

- Final check of proper installed valve and pipeline support in place and fixed.

4.4 Bolt sizes and lengths

ASME class 150

Table 1 Bolting lengths for Class 150

ASME B16.5 / B16.47 series B CL. 150						
size	øK	L1		L		
NPS	thread bolt	QTY bolts	length	QTY bolts	length	QTY nuts
8	3/4"-10UNC	4	90	6	310	16
10	7/8"-9UNC	4	100	10	330	24
12	7/8"-9UNC	4	110	10	370	24
16	1"-8UN	8	120	12	390	32
20	1 1/8"-8UN	-	-	40	180	80
24	1 1/4"-8UN	-	-	40	200	80
28	3/4"-10UNC	-	-	80	140	160
32	3/4"-10UNC	-	-	96	150	192
36	7/8"-9UNC	-	-	88	180	176
40	1 1/8"-8UN	-	-	88	190	176
48	1 1/4"-8UN	-	-	88	220	176
56	1 1/4"-8UN	-	-	120	240	240
64	2"-8UN	-	-	80	350	160

EN1092 – PN10

Table 2 Bolting lengths for PN 10

EN 1092 PN10						
size	øK	L1		L		
DN	thread bolt	QTY bolts	length	QTY bolts	length	QTY nuts
00	M20	4	90	6	320	16
250	M20	4	100	10	320	24
300	M20	4	100	10	360	24
400	M24	8	110	12	380	32
500	M24	-	-	40	150	80
600	M27	-	-	40	170	80
700	M27	-	-	48	170	96
800	M30	-	-	48	180	96
900	M30	-	-	56	190	112
1000	M33	-	-	56	210	112
1200	M36	-	-	64	240	128
1400	M39	-	-	72	260	144
1600	M45	-	-	80	290	160

Table 6 Bolting lengths for PN 25

	NPS	CL	STANDARD DIMENSIONS					FLANGE CONNECTION CL.300 - ASME B16.5							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
WAF	12	300	240	250	290	80	141	450,8	1 1/8"-8UN	16	381	410	310	40	80	450	315	140	43	50	110	B1CU9/25
	16	300	240	315	355	100	135	571,5	1 1/4"-8UN	20	469,9	490	389	35	80	450	315	140	43	50	110	B1CU9/25
DF	20	300	457	350	390	120	217	685,8	35	24	584,2	775	500	64	120	640	445	190	65	65	175	B1C13/55
	24	300	508	390	430	140	254	812,5	42	24	692	915	600	75	120	785	555	222	78	70	215	B1CU17/55

EN1092 – PN16

Table 3 Bolting lengths for PN 16

EN 1092 PN16						
size	øK	L1		L		
DN	thread bolt	QTY bolts	length	QTY bolts	length	QTY nuts
0	M20	8	90	8	320	24
250	M24	4	110	10	330	24
300	M24	4	110	10	380	24
400	M27	8	120	12	390	32
500	M30	-	-	40	180	80
600	M33	-	-	40	200	80
700	M33	-	-	48	190	96
800	M36	-	-	48	200	96
900	M36	-	-	56	220	112
1000	M39	-	-	56	240	112
1200	M45	-	-	64	290	128
1400	M45	-	-	72	300	144
1600	M52	-	-	80	350	160

EN1092 – PN25

Table 4 Bolting lengths for PN 25

EN 1092 PN25						
size	øK	L1		L		
DN	thread bolt	QTY bolts	length	QTY bolts	length	QTY nuts
200	M24	8	110	8	330	24
600	M36	-	-	40	220	80

EN1092 – PN40

Table 5 Bolting lengths for PN 40

EN 1092 PN40						
size	øK	L1		L		
DN	thread bolt	QTY bolts	length	QTY bolts	length	QTY nuts
250	M30	4	130	10	370	24
300	M30	8	130	12	400	32
400	M36	8	140	12	450	32
500	M39	-	-	40	250	80
600	M45	-	-	40	270	80
700	M45	-	-	48	300	96

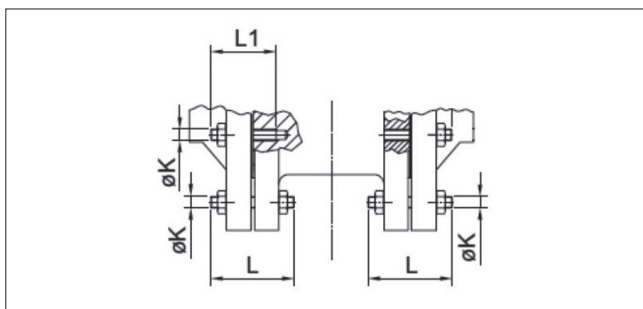


Fig. 6 Bolt dimensions for double flange

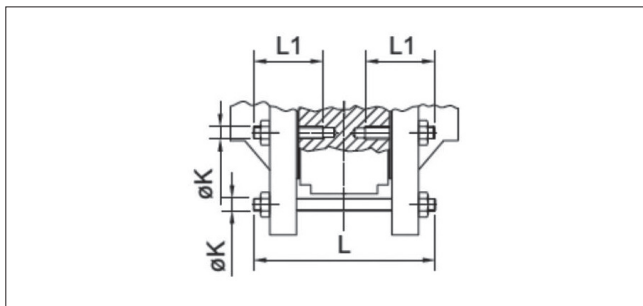


Fig. 7 Bolt dimensions for wafer

5. DETACHING AND MOUNTING ACTUATOR

5.1 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 detaching 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, to allow free access to it any time. This especially applies also to a possible "emergency stop" operation by hand.

5.2 Detaching preparation

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

5.3 Detaching

- Proceed in the following sequence for detaching the actuator:
- When replacing the installed actuator on the piping, make sure that:
- No pressure is applied to the piping and the target valve is removed from the process.
- Ensure that the valve is in closed position.
- Manually mark the position of the stem to the stuffing box with a waterproof 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.

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).



5.4 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.
- Finally connect the energy supply.

6. ORDERING SPARE PARTS

For ordering spare parts, the following information is necessary:

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

7. DIMENSIONS AND WEIGHTS

7.1 BH 3-lever valve - dimensions

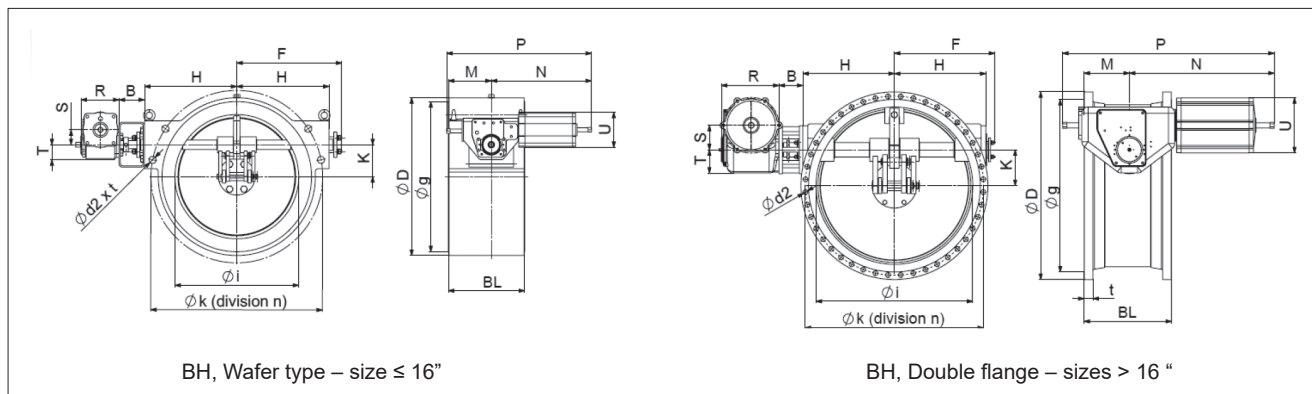


Table 7 BH 3-lever valve dimensions

	NPS	CL	STANDARD DIMENSIONS					cl. 150 ASME B16.5							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"-8UN	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 cl.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
	64	150	790	935	985	260	442	1820	56	40	1750	1930	1596	102	200	2060	1390	541	242	195	610	B1CU50/120

	NPS	CL	STANDARD DIMENSIONS					FLANGE CONNECTION CL.300 - ASME B16.5							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	
WAF	12	300	240	250	290	80	141	450,8	1 1/8"-8UN	16	381	410	310	40	80	450	315	140	43	50	110	B1CU9/25	
	16	300	240	315	355	100	135	571,5	1 1/4"-8UN	20	469,9	490	389	35	80	450	315	140	43	50	110	B1CU9/25	
DF	20	300	457	350	390	120	217	685,8	35	24	584,2	775	500	64	120	640	445	190	65	65	175	B1C13/55	
	24	300	508	390	430	140	254	812,5	42	24	692	915	600	75	120	785	555	222	78	70	215	B1CU17/55	

	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
WAVER	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
	1600	10	790	935	985	260	442	1820	48	40	1750	1930	1596	102	200	2060	1390	541	242	195	610	B1CU50/120

	DN	PN	STANDARD DIMENSIONS					FLANGE CONNECTION PN16 - 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
	1600	16	790	935	985	260	442	1820	56	40	1750	1930	1596	102	200	2060	1390	541	242	195	610	B1CU50/120

	DN	PN	STANDARD DIMENSIONS					FLANGE CONNECTION PN40 - 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	457	350	390	120	217	670	42	20	615	755	500	64	120	640	445	190	65	65	175	B1C13/55
	600	40	508	390	430	140	254	795	48	20	735	890	600	75	120	785	555	222	78	70	215	B1CU17/55
	700	40	610	460	510	160	275	900	48	24	840	995	700	90	120	785	555	222	78	70	215	B1CU25/95

	DN	PN	STANDARD DIMENSIONS					FLANGE CONNECTION PN25 - 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	25	200	175	215	70	105	310	M24	12	278	280	210	36	80	395	270	138	36	46	90	B1CU6/20
DF	413	390	430	140	206	770	206	770	39	20	720	845	600	73	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.

7.2 BH 3-lever valve – weights

Table 8 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_C64	64	150	3810		B1CU50/120	830	4640

	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_J1600	1600	10	3810		B1CU50/120	830	4640

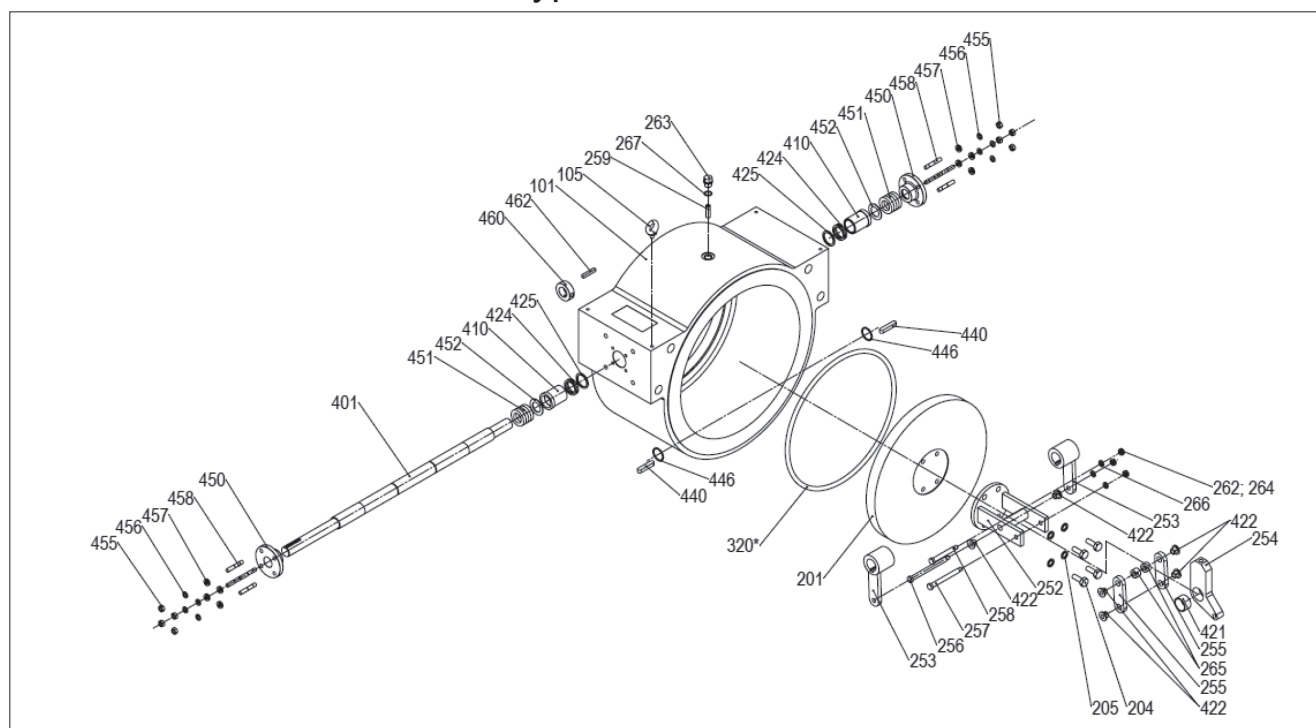
	BH	NPS	CL	weight		ACTUATOR	weight	total weight
	Type			[kg]		Type	[kg]	[kg]
WAFER	BH_K200	200	16	90		B1CU6/20	5	95
	BH_K250	250	16	95		B1CU6/20	5	100
	BH_K300	300	16	160		B1CU9/25	10	170
	BH_K400	400	16	210		B1CU9/25	10	220
DOUBLE FLANGE	BH_K500	500	16	290		B1C13/55	30	320
	BH_K600	600	16	375		B1CU17/55	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_K1600	1600	16	3810		B1CU50/120	830	4640

	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
	BH_N700	700	40	980		B1CU25/95	130	1110

Actuator weights for dp=0,15bar linked to BH valve sizes. For other actuators take weights for relevant actuator type

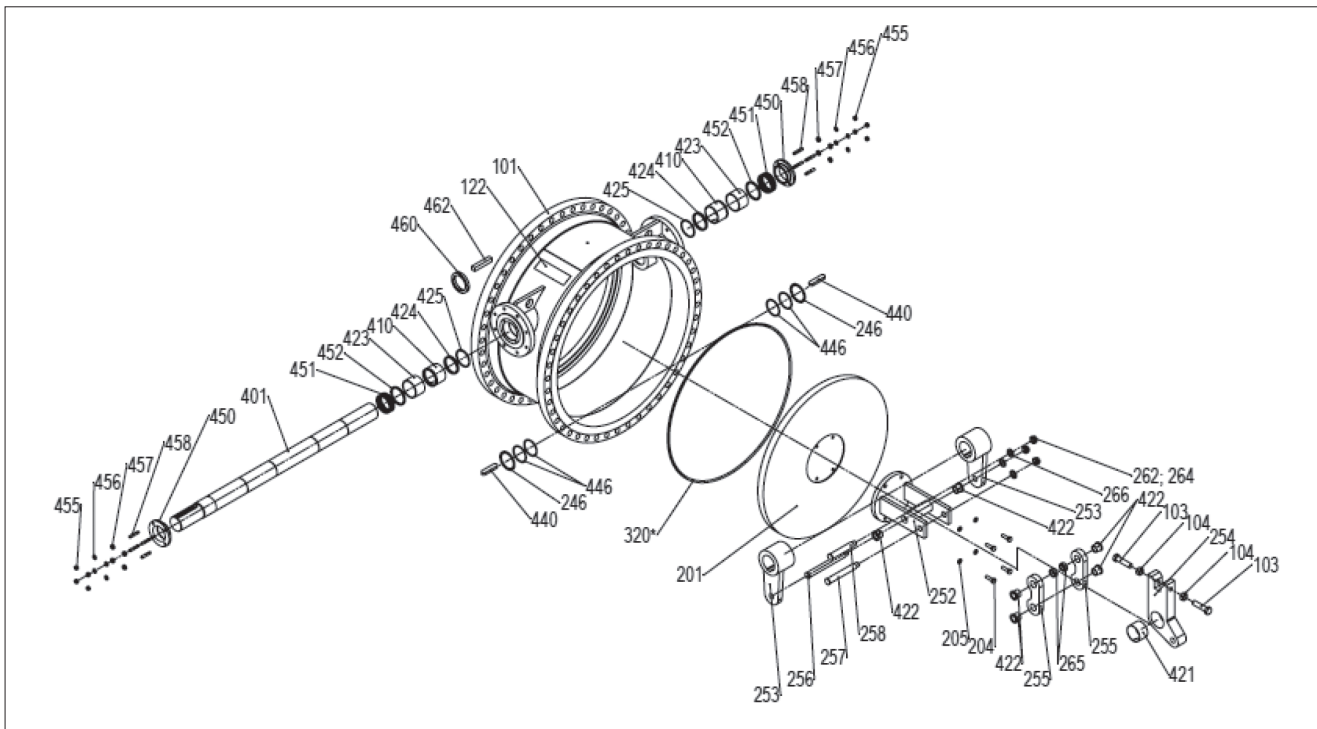
8. EXPLODED VIEW

8.1 BH 3-lever-valve – wafer type



Pos	QTY	Description	Materials
101	1	BODY	Carbon steel casted or flame cut
105	4	LIFTING EYE	DIN 17210
201	1	DISC	Stainless steel
204	4	HEXAGON	Stainless steel
205	4	LOCK WASHER	Stainless steel
252	1	DISC LEVER	Stainless steel
253	2	LEVER 1	Stainless steel
254	1	SUPPORTING ARM	Stainless steel
255	2	LEVER 2	Stainless steel
256	1	PIN	Stainless steel
257	1	PIN	Stainless steel
258	1	PIN	Stainless steel
259	1	PIN	Stainless steel
262	3	CASTLE NUT	Stainless steel
263	1	PLUG SCREW	Carbon steel+ZINC
264	3	SPLINT	Stainless steel
265	2	SPACER RING	Stainless steel
266	3	WASHER	Stainless steel
267	1	O-RING	FKM
320	1	SEALING ELEMENT	FKM
401	1	SHAFT	Stainless martensitic steel
410	2	BEARING SLEEVE	Stainless steel + BRONZE+PTFE
421	1	BEARING SLEEVE	BRONZE+PTFE
422	6	BEARING SLEEVE	BRONZE+GRAPHITE
424	4	PACKING RING	PTFE
425	2	BOTTOM RING	Stainless steel
440	2	FEATHER KEY	Stainless steel
446	2	RETAINING RING	Stainless steel
450	2	GLAND	Stainless steel
451	8	PACKING RING	PTFE
452	2 T	THRUST WASHER	BRONZE+PTFE
455	8	HEXAGON NUT	Stainless steel
456	8	WASHER	Stainless steel
457	32	DISC SPRING	Stainless steel
458	8	THREADED PIN	Stainless steel
460	1	POSITION MARK	Stainless steel
462	1	KEY	Stainless steel

8.2 BH 3-lever-valve – double flange type



Pos	QTY	Description	Materials
101	1	BODY	Carbon steel welded
103	2	HEXAGON SCREW	Stainless steel
104	2	HEXAGON NUT	Stainless steel
122	1	PLANE OF ID-PLATE	Stainless steel
201	1	DISC	Carbon steel plate
204	4	HEXAGON SCREW	Stainless steel
205	4	LOCK WASHER	Stainless steel
246	2	THRUST WASHER	BRONZE+PTFE
252	1	DISC LEVER	Carbon steel
253	2	LEVER 1	Carbon steel
254	1	SUPPORTING ARM	Carbon steel
255	2	LEVER 2	Carbon steel
256	1	PIN	Stainless steel
257	1	PIN	Stainless steel
258	1	PIN	Stainless steel
262	3	CASTLE NUT	Stainless steel
264	3	SPLINT	Stainless steel
265	2	SPACER RING	Stainless steel
266	3	WASHER	Stainless steel
320*	1	SEALING ELEMENT	FKM
401	1	SHAFT	Stainless martensitic steel
410	2	BEARING SLEEVE	1.4301 + BRONZE+PTFE
421	1	BEARING SLEEVE	BRONZE+PTFE
422	6	BEARING SLEEVE	BRONZE+GRAPHITE
423	2	PIPE	Stainless steel
424	4	PACKING RING	PTFE
425	2	BOTTOM RING	Stainless steel
440	2	FEATHER KEY	Stainless steel
446	4	RETAINING RING	Stainless steel
450	2	GLAND	Stainless steel
451	8	PACKING RING	PTFE
452	2	BOTTOM RING	Stainless steel
455	8	HEXAGON NUT	Stainless steel
456	8	WASHER	Stainless steel
457	32	DISC SPRING	Stainless steel
458	8	STUD	Stainless steel
460	1	POSITION MARK	Stainless steel
462	1	KEY	Stainless steel

9. TROUBLESHOOTING

9.1 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.

9.2 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.

9.3 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 0,5 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 must be maintained. Check if valve shows any internal damages, corrosion, 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 10 of this IMO.

9.4 Welding notes

WARNING:

Welding and/or grinding stainless steel and other alloys containing chromium metal may cause the release of hexavalent chromium. Hexavalent chromium (VI) or Cr(VI), is known to cause cancer. Be sure to use all appropriate personal protective equipment (PPE) when welding metals containing chromium.

NOTE:

A qualified welder must do the installation welding. The welder and welding procedure should be qualified in accordance with ASME Boiler and Pressure Vessel Code Section IX or other appropriate regulation.

CAUTION:

To prevent damage to the seat and seals, do not allow the temperature of the seat and body seal area to exceed 94°C (200°F). It is recommended that thermal chocks be used to check the temperature in these areas during welding.

CAUTION:

Ensure that any weld splatter does not fall onto the valve closing members e.g., ball, disc or seats. This may damage critical seating surfaces and cause leaks.

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. Valmet 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 5.2), 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 5ff of this IMO for that.
- Secure the valve carefully using lifting ropes. Handle the valve with actuator or the bar-shaft valve as described in chapter 3.3. 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

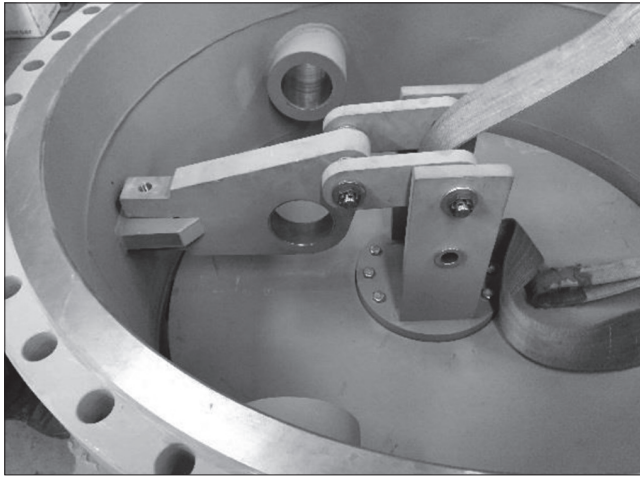
Maintenance at BH 3-lever-valve should only be executed by authorized and trained Valmet personnel.

- 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.



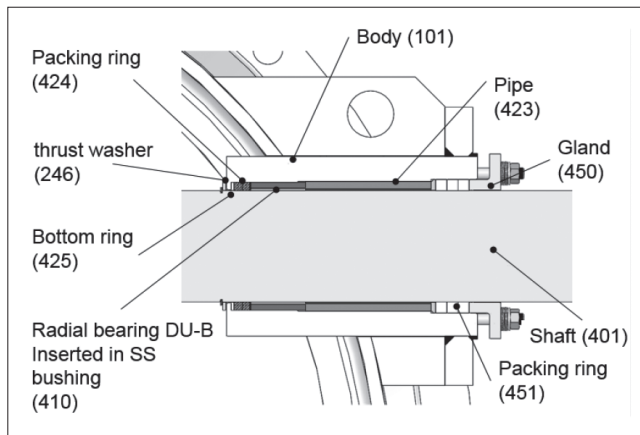
BH disc with disc lever and lever 2

- 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.



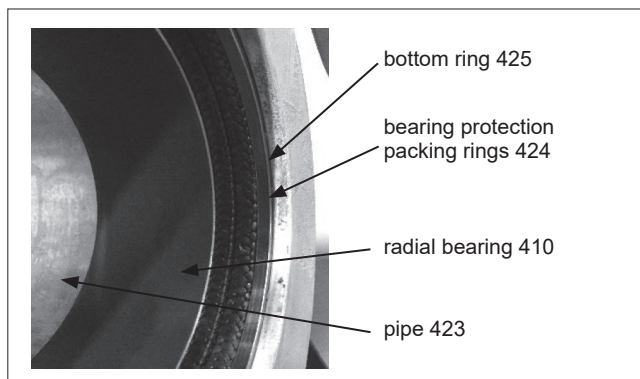
Assembly of support arm

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



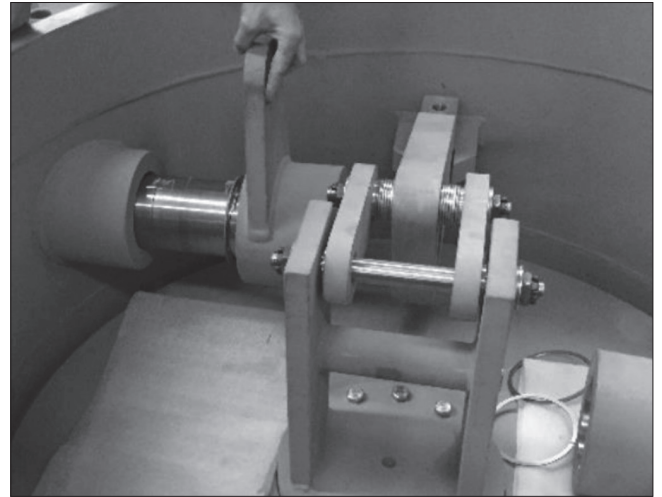
BH 3-lever valve shaft bearing with bearing protection

- 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.



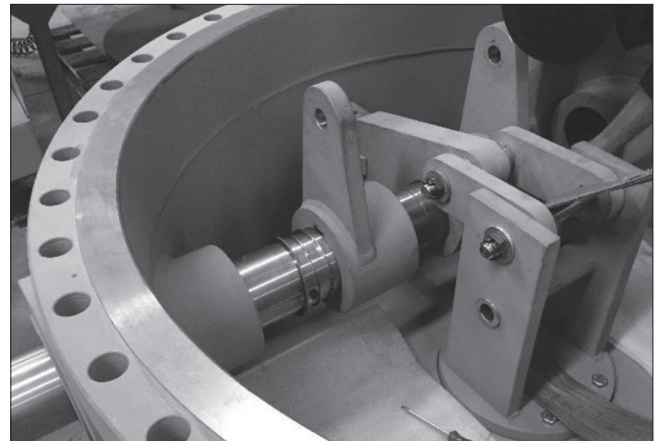
Bearing protection

- 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.

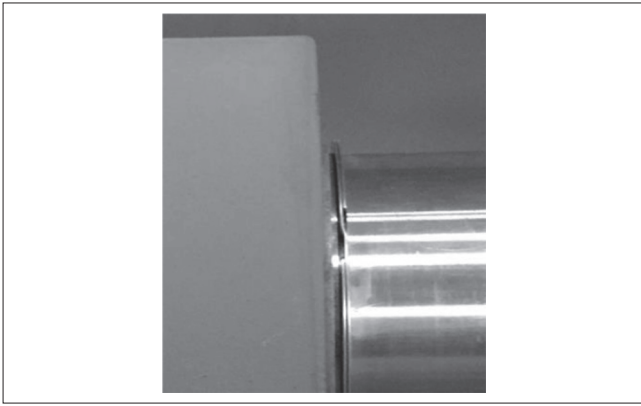


Shaft assembly

- 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

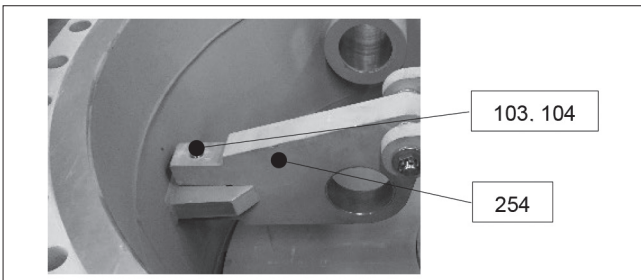


Assembled retaining ring

- For disassembly, the retaining ring can be simply lifted with a screwdriver 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 a 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 sand 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) on 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 5.4).
- Check correct function of the valve:
- Tightness
- Valve must not open when inside pressure is higher then specified opening differential pressure of the valve.

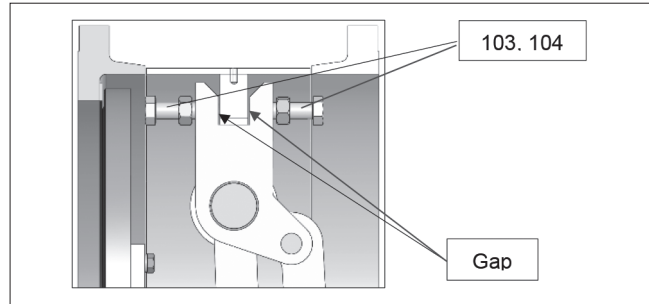
11.1 Stoper adjustment

- The disc closing position of the BH 2-lever valve can be adjusted by the support arm (254) and with the screws and nuts (103, 104)

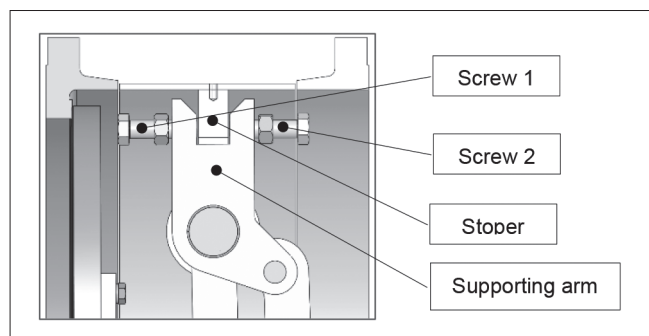


- If an actuator is attached to the BH 3-lever valve, open the actuator stop screw for closing position.

- 6BC71en (neles.com)



- Loosen the hexagon nuts (104) at both sides on the valve.
- Loosen the screws (103) at both sides but not completely from support arm. Only so that you have a gap between body and support arm.
- Close the disc, preferably using the actuator. Use air supply pressure mentioned in the nameplate.



- Turn screw 1 slightly until it touches the stoper.
- Now turn screw 2 until it has contact to the stoper.
- Lock the screws with the nut ant tighten the nuts.
- Tighten the actuator stopper screw.
- If there is a misalignment of the supporting arm, this can lead to a gap between disc and body and cause leakage!

11.2 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.

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 are completely compressed to block.
- 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.
- Re-tighten the nuts with the wrench. Tighten the nuts until the disc springs are compressed to block. Then release the nut by turning a ½ turn backwards.

Table 9 Gland packing BH 3-lever valve.

NPS/DIN	packing diameter	No. of packing rings	spring set diameter	Thread	No. of studs
8/200	20	4	16	M8	4
10/250	20	4	16	M8	4
12/300	25	4	16	M8	4
16/400	25	4	16	M8	4
20/500	45	4	20	M10	4
24/600	60	4	20	M12	4
28/700	65	4	25	M12	4
32/800	80	4	25	M12	4
36/900	90	4	25	M12	4
40/1000	90	4	25	M12	8
48/1200	120	4	25	M12	8
56/1400	120	4	25	M12	8
64/1600	120	4	25	M12	8

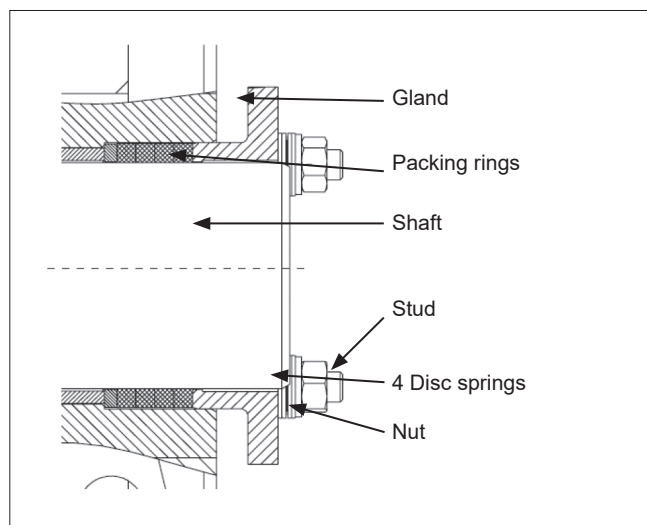


Fig. 8 Gland packing BH 3-lever valve

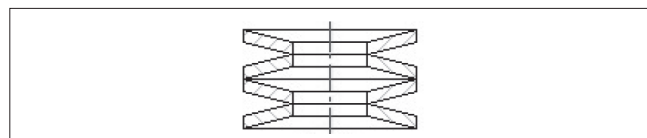


Fig. 9 Disc spring stack for BH 3-lever valve

12. VALVES IN OXYGEN SERVICE

12.1 Maintenance / Repair work

ATTENTION

Oxygen application 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.

Valmet 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.

Due to this

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



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

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

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 need, then only grease which has as minimum an oxygen compatibility approval based on the worst case process conditions.
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 this 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 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 10 Tightening torques for valve screws

Ø	Stressed cross section	Load ¹⁾ Force a the screw		Pre-stressing force	Tightening torque
		AS [mm²]	Rp0.2 [N]		
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. EU DECLARATION OF CONFORMITY FOR ATEX APPROVED VALVES



EU DECLARATION OF CONFORMITY

for ATEX approved valves



Manufacturer:
Valmet Flow Control GmbH
Von-Holzapfel-Straße
86497 Horgau
Germany

EU Authorised Representative: Valmet Flow Control Oy, Vanha Porvoontie 229, 01380 Vantaa, Finland. Contact details: [+358 10 417 5000](tel:+358104175000)

This declaration of conformity is issued under the sole responsibility of the manufacturer.

Product:	Neles Butterfly Valves
Type:	B-series (BA, BD, BE, BH, BK, BM, BN, BO, BW)
ATEX group and category:	II 2 GD, II 3 GD
Ex GAS:	Ex h IIC 85°C...Tmax Gb
Ex DUST:	Ex h IIIC T85°C...T(Tmax) Db

Tmax= valve max. temperature in name plate

Manufacturer's certificates:

Standard / Directive	Notified Body and NoBo number	Certificate No.
ISO 9001:2015	LRQA (Certification body)	10531829
PED 2014/68/EU Module H	DNV Business Assurance Italy S.r.l. 0496	142306-2013-CE-FIN-ACCREDIA
ATEX 2014/34/EU Annex IV	DNV Product Assurance AS Norway 2460	Presafe 18 ATEX 91983Q Issue 6

ATEX 2014/34/EU Annex VIII technical files are archived by Notified Body number 0537

The object of the declaration described above is in conformity with the relevant Union harmonisation legislation:

PED 2014/68/EU	Valve
ATEX 2014/34/EU	Non-electrical equipment

Main components:

Valve:
The valve is suitable for service up to PED Cat III
Valve design standard: ASME B16.34

Installation, Maintenance and Operating instructions manual (IMO) must be followed before installation in order to ensure proper and safe mounting and usage of equipment.

The product above is manufactured in compliance with the applicable European directives and technical specifications/standards (EN10204). The product is in conformity with the customer order.

Instrumentation and accessories having equal protection concept, level and performance specification with the original can be presumed to be in conformity with this Declaration of Conformity.

Protection from e.g. static electricity caused by the process or connected equipment must be considered by the user (EN 60079-14 § 6). EN 60079-19 applies for modifications.

Non-electrical equipment is according EN 80079-37:2016 and EN 80079-36:2016. The actual surface temperature of non-electrical equipment is depended on the process and ambient conditions (EN 80079-36:2016 § 6.2.5 and 6.2.7). The protection from high or low temperature must be considered by the end user before put into service.

The product does not possess any residual risk according to hazard analysis conducted under the applicable directives providing that the procedures stated by the IMO are followed and the product is used under conditions mentioned in the technical specifications.

Documents with digital and/or e-signature conveyed by Valmet Flow Control conform to the Regulation (EU) No 910/2014 as well as the national code on e-signatures. In order to secure the integrity of the document, the authenticity of the sender, and indisputableness of the dispatch the identification is covered by individual ID codes, passwords, and by regularly changing passwords. The authorization to sign documents is based on organizational position and/or is task related. The impartial third party in the company bestows the access right with predefined authorities to particular databases.

Horgau

10.9.2024

Juha Virolainen, Global Quality Director

14. 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 0.15 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 \geq 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
M	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 \leq DN400 / NPS 16 body design always wafer size \geq 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 BH valve \leq 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 Only for \geq DN500 / NPS20
G	With Corrosion protection \leq DN400 / NPS 16 = Stainless steel \geq 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) \leq DN400 / NPS 16 = Stainless steel \geq 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 / 2Cr13 martensitic stainless steel
C1	Metal seated. Tmax 280 °C Live loaded gland packing PTFE Bronze-PTFE bearings Bearing protection Shaft material 1.4021 / 2Cr13 martensitic stainless steel
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)
L	Square end profile at one side
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

15. GENERAL DISCLAIMER

15.1 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. Valves may be equipped with lifting threads on the body or on the flanges. These are which 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.
6. Never lift an assembly by the instrumentation (solenoid, positioner, limit switch, etc.) or by the instrumentation piping. Straps and lifting devices should be fitted to prevent damage to instrumentation and instrumentation piping. Failure to follow the lifting guidance provided may result in damage and personal injury from falling objects.

15.2 Work activities on the valve

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. Make sure that there is a LOTOTO (Lock Out / Tag Out / Try Out) procedure in place for the system in which the valve is installed and strictly follow it.
5. Always make sure that the pipeline is depressurized and in ambient temperature condition before maintenance work is started.
6. 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.
7. Beware of Disc & Ball movement even when the valve is disassembled. Discs and balls may move simply due to the weight of the part or change in position of the valve. Keep hands or other body parts away from locations where they may be injured by movement of the ball or disc. Do not leave objects near or in the valve port which may fall in and need to be retrieved.

15.3 Receive, handle and unpacking.

1. Respect the safety warnings above!
2. Valves are critical components for pipelines to control high pressure fluids and must therefore be handled with care.
3. Store valves 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 valve as long as possible to avoid environmental contamination by dust, water, dirt, etc.
6. Remove the valve endcaps just before mounting into the pipeline.
7. FOR YOUR SAFETY IT IS IMPORTANT THE FOLLOWING PRECAUTIONS BE TAKEN PRIOR TO REMOVAL OF THE VALVE FROM THE PIPELINE OR BEFORE ANY DISASSEMBLY:
 - Be sure you know what fluid is in the pipeline. If there is any doubt, confirm with the proper supervisor.
 - Wear any personal protective equipment (PPE) required for working with the fluid involved in addition to any other PPE normally required.
 - Depressurize the pipeline, bring to ambient temperature, and drain the pipeline fluid.
 - Cycle the valve to relieve any residual pressure in the body cavity.
 - After removal but before disassembly, cycle the valve again until no evidence of trapped pressure remains.
 - The butterfly valve's offset shaft creates greater disc area on one side of the shaft. This will cause the valve to open when pressurized from the preferred direction without a locking handle or an actuator installed.
 - **WARNING: DO NOT PRESSURIZE THE BUTTERFLY VALVE WITHOUT A HANDLE OR AN ACTUATOR MOUNTED ON IT!**
 - **WARNING: DO NOT REMOVE A HANDLE OR AN ACTUATOR FROM A BUTTERFLY VALVE UNDERPRESSURE!**
 - Before you install the butterfly valve in or remove it from the pipeline, cycle the valve closed. Butterfly valves must be in the closed position to bring the disc within the face to face of the valve. Failure to follow these instructions will cause damage to the valve and may result in personal injury.

15.4 Operating

8. The identification plate (ID-plate, type plate, nameplate, or engraved markings) on the valve gives the information of max. process conditions to the valve.
9. (For soft seats) The practical and safe use of this product is determined by both the temperature and pressure ratings of the seat and body. Read the identification plate and check both ratings. This product is available with a variety of seat materials. Some seat materials have pressure ratings that are lower than the body ratings. All body and seat ratings are dependent on the valve type, size and material of the body and seat. Never exceed the marked rating.
10. Temperatures and pressures must never exceed values marked on the valve. Exceeding these values may cause uncontrolled release of pressure and process fluid. Damage or personal injury may result.

11. The operating torque of the valve may rise over time due to wear, particles, or other damage the seat. Never exceed the actuator torque preset values (air supply, position). Application of excessive torque may cause damage to the valve.
12. Valmet valves typically are designed to be used in atmospheric conditions. Do not use valves under external pressurized conditions unless specifically designed and explicitly marked for this service.
13. Avoid Pressure shocks or water hammer. Systems with high pressure valves should be equipped with a bypass to reduce the differential pressure before opening the valve to avoid pressure shock.
14. Avoid thermal shock. High temperature, Low temperature and cryogenic valves should be operated in a way that limits the rate of increase or decrease in temperature. The valve should be thermally stabilized before being pressurized.
15. Materials of the valve are carefully selected for the process conditions. Changes to the process media can have a major impact on function and safety of the valve. Always confirm the materials are suitable for the service prior to installation.
16. As the use of the valve is application specific, a number of factors should be taken into account when selecting a valve for a given application. Therefore, some situations in which the valves are used are outside the scope of this manual.
17. It is the end user's responsibility to confirm compatibility of the valve materials with the intended service, however if you have questions concerning the use, application, or compatibility of the valve for the intended service, contact Valmet for more information.
18. Never use a valve with enriched or pure oxygen if the valve is not explicitly designed and cleaned for oxygen. Selected materials and design have a major impact on the safety to operate the valve with oxygen.
19. Valves intended for use in or with explosive atmospheres must be equipped with a grounding device and marked according ATEX (or equivalent international standards).
20. Manual handles are available for specific butterfly valve sizes and maximum line pressures. Do not operate a valve with a handle or wrench outside the size and pressure limits stated in the IMO. High line pressure may create a large enough force to pull the handle from the operator's hands. Damage or personal injury may result.
27. All pressure containing parts must be inspected visually for damage or corrosion. Damaged parts must be replaced.
28. Valve pressure bearing parts and all internals must be inspected for corrosion or erosion which may result in reduced wall thickness on pressure bearing parts. Damaged pressure bearing parts must be replaced with original equipment manufacturers (OEM) replacement parts or repaired to factory specifications by an authorized Valmet service partner in order to maintain the warrantee.
29. Do not use sharp tools, grinding machines, or files to work on functional surfaces such as sealing, seating or bearing surfaces as this can damage these surfaces.
30. Check the condition of sealing surfaces on the seats, closure device (disc, ball, cage, plug, etc.), body and body cap. Replace parts if there are significant wear, scratches, or damage.
31. Check the wear of bearings and bearing contact surfaces on the shaft and replace damaged parts if necessary.
32. Do not weld on pressure bearing parts without an ASME and PED qualified procedure and personnel.
33. Pressure bearing parts of valves in high temperature applications must be carefully examined for the effects of material creep and fatigue.
34. Make sure that the valve is positioned in the correct flow direction into the pipeline.
35. If the valves are marked to be suitable for explosive atmospheres, the correct function of the discharging device must be tested before returning to service.
36. Always work in a clean environment. Avoid getting particles inside the valve due to machining, grinding, or welding nearby.
37. Never store a maintained valve without flow port protection.
38. When pressure testing valve seats, never exceed the maximum operating pressure of the system or the maximum shut-off pressure marked on the valve identification plate.
39. 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.
40. The valve should be installed between flanges using appropriate gaskets and fasteners that are compatible with the application, and in compliance with applicable piping codes and standards. Center the gaskets carefully when fitting the valve between the flanges. Do not attempt to correct pipeline misalignment by means of the flange bolting.

15.5 Maintenance

21. Respect the safety warnings above!
22. Plan service and maintenance actions, that spare parts, lifting devices and service personnel is available.
23. Maintain the valve within the recommended minimum maintenance intervals or within the recommended maximum operating cycles.
24. Always make sure that the valve and the pipeline is depressurized before starting any kind of maintenance work at a valve.
25. Always check the position of the valve 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 stem position.
 - Consider that the positioner may give the wrong signals.
26. Sealing materials (soft sealing parts) should be changed when the valve is maintained. Always use original equipment manufacturers (OEM) spare parts to ensure proper performance of the repaired valve.

41. Repairs on valves for special service like Oxygen, Chlorine, and Peroxide, have special requirements.
- Parts must be cleaned appropriate to the service and protected from contamination prior to assembly.
 - Assembly areas and tools must be clean and dry to prevent contamination of the parts during assembly.
 - Test equipment must be clean and dry to prevent contamination during testing. This includes the test equipment internals that may allow particles or other contamination into the test fluid during the test.
 - Lubrication shall be used only if specifically required in the instructions. Where lubrication is required, the lubricant must be approved for the service by the end user.

Valmet Flow Control Oy

Vanha Porvoontie 229, 01380 Vantaa, Finland.

Tel. +358 10 417 5000.

www.valmet.com/flowcontrol

Subject to change without prior notice.

Neles, Neles Easyflow, Jamesbury, Stonel, Valvcon and Flowrox, and certain other trademarks, are either registered trademarks or trademarks of Valmet Oyj or its subsidiaries in the United States and/or in other countries.

