

# Neles™ high performance butterfly valves

## Series BWX

Installation, maintenance and  
operating instructions



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## **READ THESE INSTRUCTIONS FIRST!**

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

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

## **SAVE THESE INSTRUCTIONS!**

Addresses and phone numbers are printed on the back cover.

# 1. GENERAL

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.

## 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 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!

See Figure 2 and Figure 3

## 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 chucks 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 eg. 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.

### Product & function description

The BWX valve type is a metal seated double eccentric valve with a free floating metallic seat in a monolithic body without clamp ring. With high quality CrNi steel and cryo extension the BWX valve type is ready to use in cryogenic applications. With other material combinations it can be used in many other industrial applications.

Body types:

- Type BWX\_3: double flange short, FtF according API 609
- Type BWX\_4: Lug, FtF according API 609
- Type BWX\_6: wafer, FtF according API 609
- Other body types are available on request.

Nominal sizes:

- NPS 4 ... NPS24 / class 150 ... class 900
- DN80 ... DN600 / PN10 ... PN 150

Operating Temperature range:

- Cryogenic; operating temp.: -273 °C ... +200 °C
- Standard. operating temp : -40 °C ... +600 °C
- Long term storage temperature: 20 °C ... +80 °C
- Environment temperature: -40 °C ... +80 °C

Functional description:

The rotatable mounted disc is moved by shaft mounted between the disc and an actuator. The butterfly valve is closed if the disc at a right-angle to the direction of flow.

The metal seated BWX valve type is equipped with a robust U-type metal seat. The seat is located in a protected area in the body with lowest tear and wear.

Butterfly valves of type BWX are preferably pneumatically driven. Other actuators solutions such as manual, electric or hydraulic actuators are possible in general. The angular shift between opening and closing is 90°. The limitation of the angular shift occurs in the drive.

The closed position of the disc can be roughly indicated by a red marking on the shaft. (see Figure 1) The valve is in "closed position" when the red mark is in line with mark on extension (orientated in flow direction).

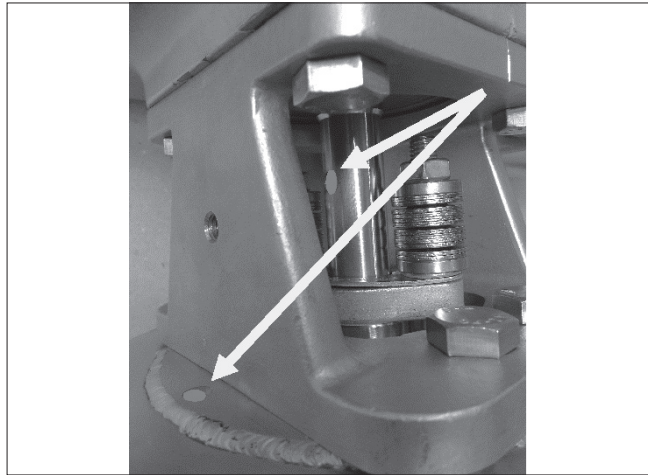


Fig. 1

## 1.5 Intended use

The delivered metal seated valve type BWX was designed specifically to meet the requirements that are specified in the job related documentation. This applies especially to the operating parameters, namely pressure, temperature and medium. The inadvertent occurrence of an incorrect medium, a higher pressure or a higher or lower temperature at the pipeline may lead to the destruction of the entire valve. The defective parts must be replaced immediately.

The pipeline and the used medium must always be free from any solid contamination. Otherwise, the tightness of the metal seated valve could be affected.

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 service personnel.

### Scope of delivery

The BWX valve type typically is delivered completely along with either a manual gear or a pneumatic actuator, equipped with positioner and instrumentation. In special cases also a bare shaft valve can be delivered e.g. as entire spare valve.

### Visual inspection

Prior to leaving Valmet factory, the BWX valve type 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 BWX valve type 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.

The lower blind flange is equipped with a thread to insert a eye bolt for lifting devices.

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

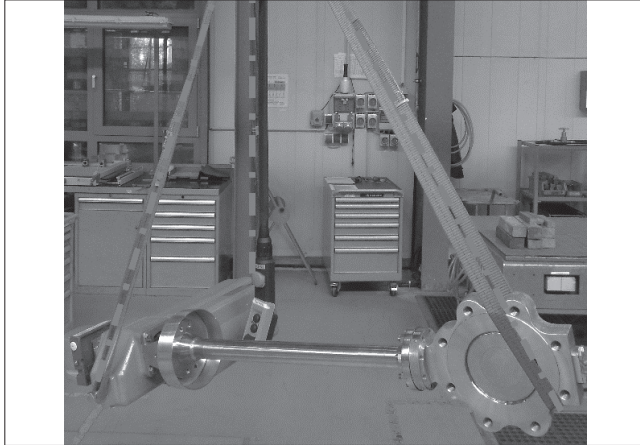


Fig. 2

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.

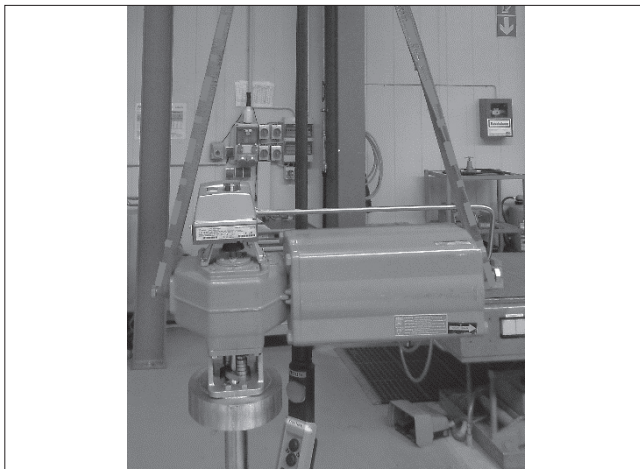


Fig. 3

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
- Metal seat
- Flange surfaces of the valve

Place the valve in a vertical position.

The BWX butterfly 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.

The following applies in general:

For top view of the drive shaft to the valve:  
OPEN= Left-handed rotation (counterclockwise)  
CLOSE= Right-handed rotation (clockwise).  
(see Figure 4)



Opening and closing is similar to a water tap. (Viewed from the actuator top side)

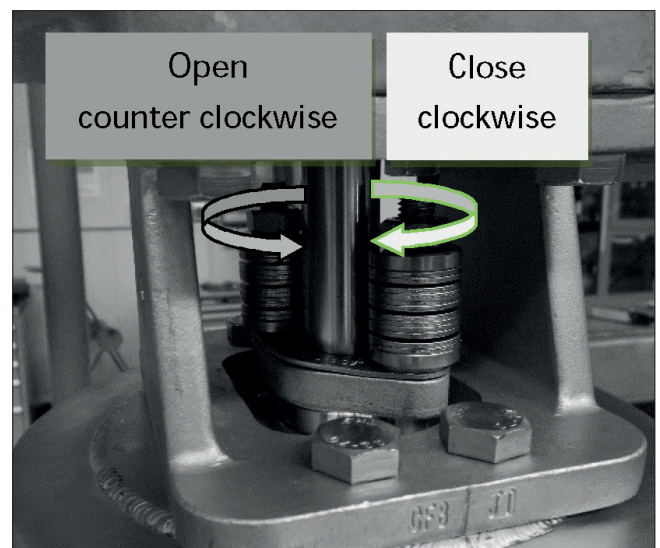


Fig. 4 Open / close direction

- 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.
- 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

## 1.6 Marking and identification

The valve data are shown on the type plate attached to the valve body neck. (see Figure 5)

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.

Further information:



Fig. 5 Example of identification plate series BWX

Job no.	=	job number at Valmet
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 O2 applications

## 1.7 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 5: type plate).

## 1.8 Contact

Please contact your local Valmet partner.

You will find the contact information in the internet at: [www.valmet.com/flowcontrol/valves/](http://www.valmet.com/flowcontrol/valves/)

## 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.

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 BWX butterfly valve shall only be made by qualified and Valmet certificated personnel!



### 3.1 Installation planning

Consider following aspects before assembly:

- You must install the valve, so as to allow free access to the actuator at any time.
- For installation of the valve in cryogenic applications, the extension should be typically in vertical position. Inclinations up to maximum horizontal position is possible. Depending on extension length and actuator size a weight compensation is necessary. (see 4.2)
- Actuators that are operated using electric, pneumatic or hydraulic energy 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.

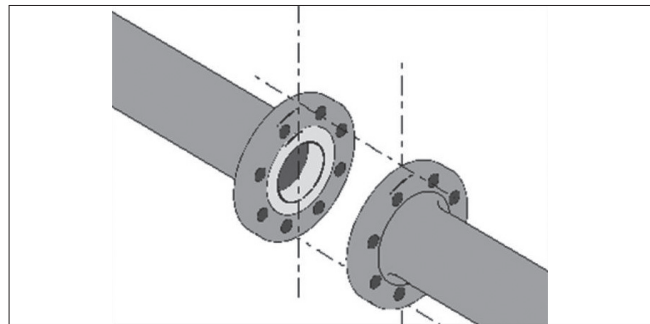


Fig. 6 Alignment of the flanged pipes

### 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.



Exercise caution while installing valves with the failsafe position "spring to open".



If the disc extends beyond the installation length of the valve, then the valve must be closed before installation (pneumatic, hydraulic etc.). It is mandatory to ensure that the energy supply lines are secured and not damaged or ruptured during installation under any circumstances.

If the power supply is interrupted suddenly, the valve opens abruptly due to the pre-stressed spring assembly. This can lead to serious injury and to material damage.

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:

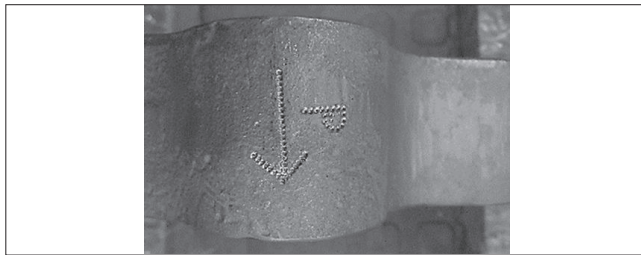


Fig. 7 Pressure direction

- 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 7)

- Close the valve for the assembly. In the open position, the sealing surface of the disc can protrude out of the body and be damaged during installation.
- 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. Valmet delivers the required gaskets seals at your request.
- Use the dimensions of the stud bolts itemized in Table 1 to Table 3 on page 7 for assembly.
- Turn the flange screws or bolts facing one another crosswise and tighten uniformly using a torque wrench according to operator's specification (see Figure 8).
- Finally connect the energy supply.

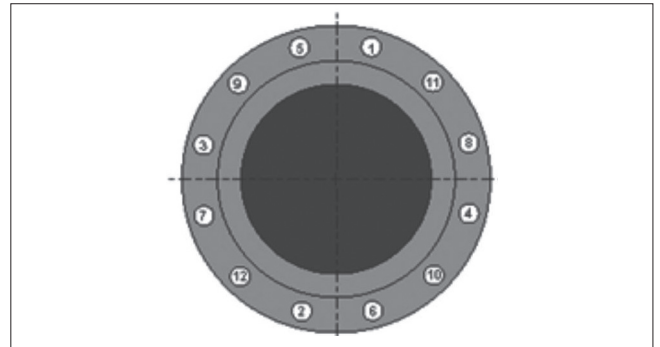


Fig. 8 Crosswise tightening flange bolts

### 3.4 Bolt sizes and lengths:

#### ASME class 150 / PN10 / PN16

Table 1 Bolting lengths for Class 150, PN10, PN16

ASME B16.5 cl.150									
size		wafer				lug		double flange	
		L1		L		L1		L1	
NPS	thread	quantity	length	quantity	length	quantity	length	quantity	length
4	5/8"-11UNC	8	80	4	150	16	80	16	90
6	3/4-10UNC	8	80	4	160	16	80	16	100
8	3/4-10UNC	8	90	4	170	16	90	16	100
10	7/8-9UNC	8	100	8	200	24	100	24	120
12	7/8-9UNC	8	100	8	210	24	100	24	120
14	1-8UN	8	120	8	240	24	120	24	140
16	1-8UN	8	120	12	250	32	120	32	140
18	1 1/8-8UN	8	130	12	280	32	130	32	160
20	1 1/8-8UN	8	130	16	300	40	130	40	160
24	1 1/4-8UN	8	150	16	340	40	150	40	180

EN 1092-PN10									
size		wafer				lug		double flange	
		L1		L		L1		L1	
NPS	thread	quantity	length	quantity	length	quantity	length	quantity	length
100	M16	8	70	4	150	16	70	16	90
150	M20	8	90	4	170	16	90	16	100
200	M20	8	90	4	180	16	90	24	110
250	M20	8	90	8	190	24	90	24	110
300	M20	8	90	8	200	24	90	24	110
350	M20	8	90	12	210	32	90	32	110
400	M24	8	100	12	230	32	100	32	120
450	M24	8	110	16	250	40	110	40	130
500	M24	8	110	16	260	40	110	40	130
600	M27	8	120	16	300	40	120	40	140

EN 1092-PN16									
size		wafer				lug		double flange	
		L1		L		L1		L1	
NPS	thread	quantity	length	quantity	length	quantity	length	quantity	length
100	M16	8	70	4	150	16	70	16	90
150	M20	8	90	4	170	16	90	16	100
200	M20	8	90	8	180	24	90	24	110
250	M24	8	100	8	200	24	100	24	120
300	M24	8	110	8	210	24	110	24	130
350	M24	8	110	12	230	32	110	32	130
400	M27	8	120	12	250	32	120	32	140
450	M27	8	120	16	260	40	120	40	150
500	M30	8	130	16	290	40	130	40	160
600	M33	8	150	16	330	40	150	40	170



# ASME class 300 / PN25 / PN40

Table 2 Bolting lengths for Class 300, PN40, PN25

ASME B16.5 cl.300									
size	thread	wafer				lug		double flange	
		L1		L		L1		L1	
NPS	thread	quantity	length	quantity	length	quantity	length	quantity	length
4	3/4-10UNC	8	90	4	170	16	90	16	110
6	3/4-10UNC	8	90	8	180	24	90	24	120
8	7/8-9UNC	8	110	8	220	24	110	24	140
10	1-8UN	8	130	12	250	32	130	32	170
12	1 1/8-8UN	8	140	12	280	32	140	32	180
14	1 1/8-8UN	8	140	16	310	40	140	40	190
16	1 1/4-8UN	8	160	16	340	40	160	40	200
18	1 1/4-8UN	8	160	20	360	48	160	48	210
20	1 1/4-8UN	8	160	20	380	48	160	48	210
24	1 1/2-8UN	8	190	20	430	48	190	48	240

EN 1092-PN25									
size	thread	wafer				lug		double flange	
		L1		L		L1		L1	
NPS	thread	quantity	length	quantity	length	quantity	length	quantity	length
100	M20	8	90	4	170	16	90	16	110
150	M24	8	110	4	190	16	110	16	130
200	M24	8	110	8	210	24	110	24	130
250	M27	8	120	8	230	24	120	24	140
300	M27	8	120	12	240	32	120	32	150
350	M30	8	130	12	280	32	130	32	160
400	M33	8	150	12	310	32	150	32	170
450	M33	8	150	16	340	40	150	40	190
500	M33	8	150	16	350	40	150	40	190
600	M36	8	160	16	380	40	160	40	200

EN 1092-PN40									
size	thread	wafer				lug		double flange	
		L1		L		L1		L1	
NPS	thread	quantity	length	quantity	length	quantity	length	quantity	length
100	M20	8	90	4	170	16	90	16	110
150	M24	8	110	4	190	16	110	16	130
200	M27	8	120	8	220	24	120	24	150
250	M30	8	130	8	250	24	130	24	160
300	M30	8	140	12	270	32	140	32	170
350	M33	8	150	12	310	32	150	32	190
400	M36	8	160	12	340	32	160	32	200
450	M36	8	170	16	370	40	170	40	220
500	M39	8	180	16	390	40	180	40	220
600	M45	8	210	16	450	40	210	40	270

# ASME class 600 / PN63 / PN100

Table 3 Bolting lengths for Class 600, PN63, PN100

ASME B16.5 cl.600									
size	thread	wafer				lug		double flange	
		L1		L		L1		L1	
NPS	thread	quantity	length	quantity	length	quantity	length	quantity	length
4	7/8-9UNC	8	110	4	210	16	110	16	140
6	8UN	8	130	8	250	24	130	24	170
8	1 1/8-8UN	8	150	8	300	24	150	24	190
10	1 1/4-8UN	8	160	12	340	32	160	32	220
12	1 1/4-8UN	8	170	16	370	40	170	40	220
14	1 3/8-8UN	8	180	16	400	40	180	40	240
16	1 1/2-8UN	8	200	16	440	40	200	40	260
18	1 5/8-8UN	8	220	16	500	40	220	40	290
20	1 5/8-8UN	8	220	20	520	48	220	48	300
24	1 7/8-8UN	8	260	20	580	48	260	48	350

EN 1092-PN63									
size	thread	wafer				lug		double flange	
		L1		L		L1		L1	
NPS	thread	quantity	length	quantity	length	quantity	length	quantity	length
100	M24	8	110	4	200	16	110	16	130
150	M30	8	130	4	240	16	130	16	160
200	M33	8	150	8	280	24	150	24	180
250	M33	8	150	8	310	24	150	24	190
300	M33	8	160	12	340	32	160	32	200
350	M36	8	170	12	370	32	170	32	210
400	M39	8	180	12	410	32	180	32	230
450									
500									
600									

EN 1092-PN100									
size	thread	wafer				lug		double flange	
		L1		L		L1		L1	
NPS	thread	quantity	length	quantity	length	quantity	length	quantity	length
100	M27	8	120	4	220	16	120	16	150
150	M30	8	140	8	260	24	140	24	170
200	M33	8	160	8	300	24	160	24	200
250	M36	8	170	8	340	24	170	24	220
300	M39	8	190	12	390	32	190	32	250
350	M45	8	210	12	430	32	210	32	270
400									
450									
500									
600									

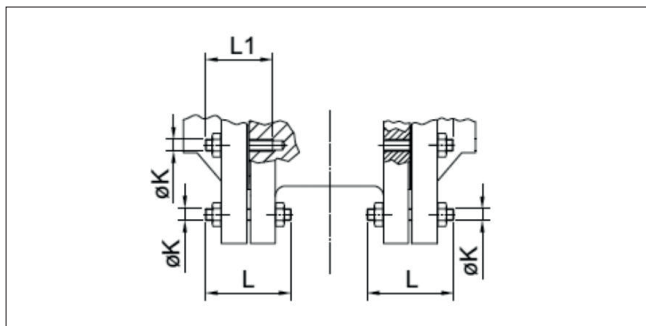


Fig. 9 Bolt dimensions for double flange

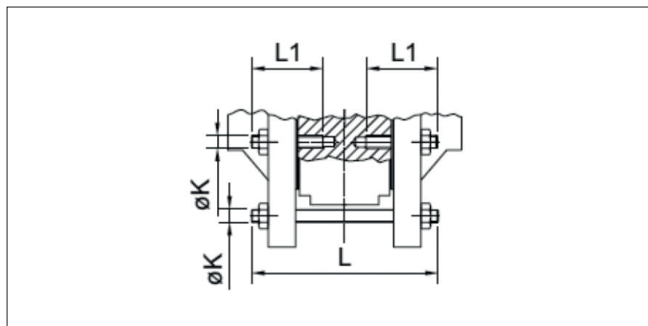


Fig. 10 Bolt dimensions for wafer / lug

## 4. DETACHING AND MOUNTING ACTUATOR

### 4.1 General

**CAUTION:**

**Note the weight of the valve or the entire servo 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!

Do not dismantle any actuator with spring retainer without securing the spring with a stop screw!

**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 Weight compensation of actuator

The actuator of the BWX valve has to be weight compensated. This is depending on the valve size, extension length, actuator type (weight) and inclination of the extension out of the horizontal position (0° = horizontal, 90° = vertical). Valves with manual gear boxes do not need a weight compensation. Other actuator types then specified must be checked.

Table 4 Necessary weight compensation

	weight compensation necessary from [degree of extension / extension length / pressure class/actuator]							
	0° (horizontal) ... 30°				30° ... 60°			
	extension lengths				extension lengths			
	860	1060	1260	1460	860	1060	1260	1460
ASME CL150 PN 10 / PN 16			B1J12/55					
			B1J16/55					B1J16/55
			B1J25/95					B1J25/95
			B1J32/105					B1J32/105
ASME CL300 PN25/PN40		B1J12/55						
		B1J16/55						B1J12/55
		B1J25/95						B1J16/55
		B1J322 o BJ132/105						B1J25/95
ASME CL600 PN63 / PN100		B1J12/55						B1J322 o BJ132/105
		B1J16/55						B1J12/55
		B1J25/95						B1J16/55
			B1J32/105					B1J25/95
			B1J322					B1J32/105
							B1J322	

A weight compensation kit is available.

### 4.3 Detaching preparation

If the actuator is mounted on a valve in a pipeline, following requirements must be check 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 assembler 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.

### 4.4 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 pressureless 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. (see Figure 11)
- 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 BWX valve type.
- 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).



## 4.5 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.

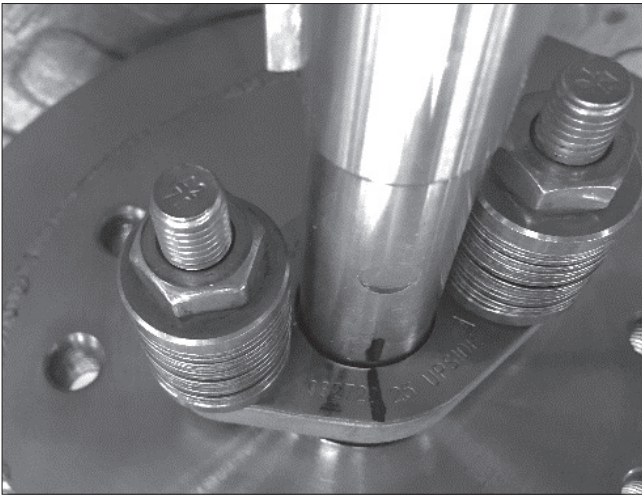


Fig. 11 Marking of shaft position to gland

- 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.

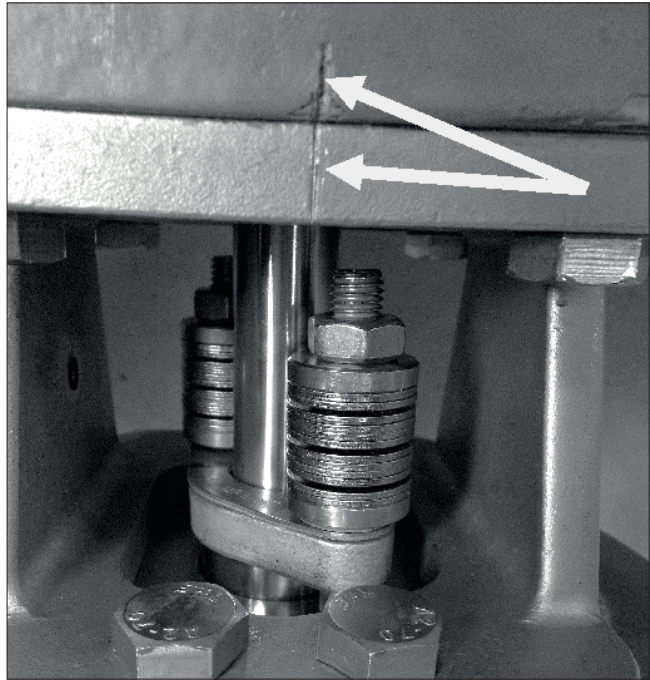


Fig. 12 Marking actuator position

- Secure the actuator to the bracket using the screws and tighten them on their cross tips.
- 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 5)
- 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

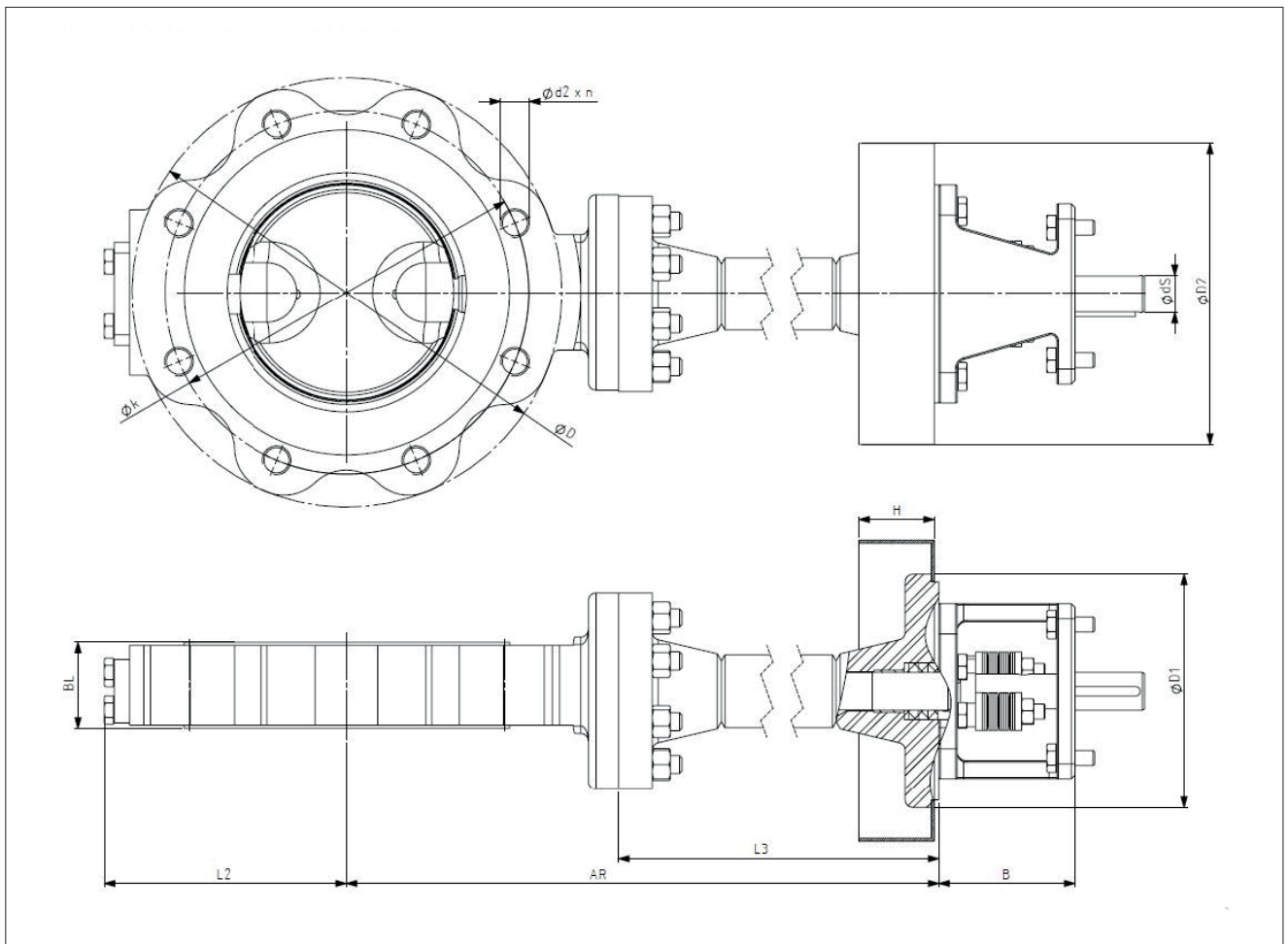


Fig. 13 Main dimensions BWX

Table 5 Standard dimensions – Class150, PN10, PN16

CL150 - PN10 - PN16																			
Standard dimensions [mm]											flange dimensions								
											ASME B16.5 cl.150			EN 1092-PN10			EN 1092-PN16		
NPS/DIN	AR *)	D2 / H	BL	L2	L3 *)	B	D1	dS	D	weight	k	d2	n	k	d2	n	k	d2	n
4/100	860	200/50	54	136	680	90	155	25	230	30 kg	190.5	5/8"-11UNC	8	180	M16	8	180	M16	8
6/150	860	200/50	57	161	680	90	155	25	285	35 kg	241.3	3/4-10UNC	8	240	M20	8	240	M20	8
8/200	860	200/50	64	187	650	90	155	25	345	49 kg	298.5	3/4-10UNC	8	295	M20	8	295	M20	12
10/250	860	200/50	71	247	600	110	165	30	405	70 kg	362	7/8-9UNC	12	350	M20	12	355	M24	12
12/300	1060	200/50	81	272	760	110	165	30	485	102 kg	431.8	7/8-9UNC	12	400	M20	12	410	M24	12
14/350	1060	260/50	92	300	710	120	210	40	535	137 kg	476.3	1-8UN	12	460	M20	16	470	M24	16
16/400	1060	260/50	102	328	710	120	210	40	595	188 kg	539.8	1-8UN	16	515	M24	16	525	M27	16
18/450	1060	260/50	114	375	630	120	210	50	635	240 kg	577.9	1 1/8-8UN	16	565	M24	20	585	M27	20
20/500	1060	260/50	127	423	630	140	210	50	715	305 kg	635	1 1/8-8UN	20	620	M24	20	650	M30	20
24/600	1060	300/50	154	498	580	180	290	70	840	519 kg	749.3	1 1/4-8UN	20	725	M27	20	770	M33	20

\*) Option: +200 mm / +400 mm

Table 6 Standard dimensions – Class300, PN25, PN40

CL300- PN25 - PN40																			
Standard dimensions [mm]											flange dimensions								
											ASME B16.5 cl.300			EN 1092-PN25			EN 1092-PN40		
NPS/DIN	AR *)	D2 / H	BL	L2	L3 *)	B	D1	dS	D	weight	k	d2	n	k	d2	n	k	d2	n
4/100	860	200/50	54	136	680	90	155	25	255	31 kg	200	3/4-10UNC	8	190	M20	8	190	M20	8
6/150	860	200/50	59	187	650	90	155	25	320	46 kg	269.9	3/4-10UNC	12	250	M24	8	250	M24	8
8/200	860	200/50	73	224	600	110	165	30	380	73 kg	330.2	7/8-9UNC	12	310	M24	12	320	M27	12
10/250	860	260/50	83	258	600	120	210	40	445	123 kg	387.4	1-8UN	16	370	M27	12	385	M30	12
12/300	1060	260/50	92	283	710	120	210	40	520	161 kg	450.8	1 1/8-8UN	16	430	M27	16	450	M30	16
14/350	1060	260/50	117	341	710	140	210	50	585	235 kg	514.4	1 1/8-8UN	20	490	M30	16	510	M33	16
16/400	1060	260/50	133	399	630	140	210	50	650	319 kg	571.5	1 1/4-8UN	20	550	M33	16	585	M36	16
18/450	1060	300/50	149	429	580	180	290	70	710	422 kg	628.6	1 1/4-8UN	24	600	M33	20	610	M36	20
20/500	1060	300/50	159	458	580	180	290	70	775	547 kg	685.8	1 1/4-8UN	24	660	M33	20	670	M39	20
24/600	1060	360/50	181	567	510	180	350	85	915	874 kg	812.8	1 1/2-8UN	24	770	M36	20	795	M45	20

\*) Option: +200 mm / +400 mm

Table 7 Standard dimensions – Class600, PN63

CL600- PN63																	
Standard dimensions [mm]											flange dimensions						
											ASME B16.5 cl.600			EN 1092-PN63			
NPS/DIN	AR *)	D2 / H	BL	L2	L3 *)	B	D1	dS	D	weight	k	d2	n	k	d2	n	
4/100	860	200/50	64	165	680	90	155	25	275	39 kg	215.9	7/8-9UNC	8	200	M24	8	
6/150	860	200/50	78	201	600	110	165	30	355	77 kg	292.1	1 8UN	12	280	M30	8	
8/200	860	260/50	102	238	600	120	210	40	420	134 kg	349.2	1 1/8-8UN	12	345	M33	12	
10/250	860	260/50	117	323	560	180	210	50	510	208 kg	431.8	1 1/4-8UN	16	400	M33	12	
12/300	1060	300/50	140	323	660	180	290	70	560	340 kg	489	1 1/4-8UN	20	460	M33	16	

## 6.1 Torque

Table 8 Maximal ETC and BTO torques for BWX cryo version with extension, soft bearings and PTFE packing under delta pressure. Torque values given in [Nm]

NPS DN	CI 150 PN10/16						CI 300 PN25/40						CI 600 PN63							
	delta p [bar]																			
	ETC	0	5	10	16	20	ETC	0	10	20	30	40	50	ETC	0	20	40	60	80	100
4 100	220	161 ±17%	171 ±15%	181 ±12%	192 ±11%	200 ±10%	299	161 ±20%	189 ±16%	218 ±15%	246 ±13%	275 ±11%	303 ±9%	330	233 ±20%	268 ±12%	304 ±11%	339 ±11%	375 ±10%	410 ±10%
6 150	223	170 ±17%	192 ±15%	213 ±12%	239 ±12%	256 ±11%	399	176 ±25%	240 ±16%	305 ±15%	369 ±12%	434 ±8%	498 ±7%	550	360 ±28%	450 ±20%	540 ±13%	585 ±8%	720 ±8%	810 ±7%
8 200	344	254 ±16%	304 ±15%	353 ±12%	415 ±11%	452 ±10%	541	303 ±25%	413 ±16%	522 ±14%	632 ±12%	741 ±8%	851 ±7%	810	570 ±21%	766 ±17%	962 ±10%	1158 ±8%	1354 ±7%	1550 ±6%
10 250	398	328 ±15%	394 ±13%	460 ±10%	539 ±9%	592 ±8%	540	380 ±24%	518 ±16%	656 ±14%	794 ±13%	932 ±10%	1070 ±8%	1490	870 ±16%	1202 ±10%	1534 ±6%	1866 ±6%	2198 ±4%	2530 ±4%
12 300	404	340 ±15%	428 ±12%	515 ±10%	620 ±8%	690 ±7%	600	430 ±21%	622 ±13%	814 ±11%	1006 ±8%	1198 ±6%	1390 ±4%	2540	1640 ±12%	2142 ±9%	2644 ±6%	3146 ±5%	3648 ±4%	4150 ±3%
14 350	441	400 ±13%	533 ±11%	665 ±9%	824 ±7%	930 ±6%	740	630 ±14%	904 ±8%	1178 ±7%	1452 ±6%	1726 ±5%	2000 ±3%							
16 400	456	430 ±14%	600 ±10%	770 ±9%	974 ±7%	1110 ±5%	850	660 ±14%	1030 ±9%	1400 ±7%	1770 ±5%	2140 ±5%	2510 ±4%							
18 450	1030	890 ±11%	1113 ±10%	1335 ±8%	1602 ±6%	1780 ±5%	3290	2630 ±8%	3148 ±6%	3666 ±5%	4184 ±5%	4702 ±4%	5220 ±3%							
20 500	1170	1000 ±11%	1300 ±10%	1600 ±8%	1960 ±6%	2200 ±5%	3620	2800 ±8%	3488 ±5%	4176 ±5%	4864 ±5%	5552 ±3%	6240 ±3%							
24 600	1676	1370 ±11%	1823 ±9%	2275 ±8%	2818 ±6%	3180 ±5%	5640	4020 ±8%	4564 ±5%	6196 ±5%	7284 ±5%	8372 ±3%	9460 ±3%							

The torque values can vary. The given values represent the standard torques and additionally the range in [%] where the value can vary. This percentage range is an approximate value.

Table 9 Maximal ETC and BTO torques for BWX warm version no extension, metal bearings and graphite packing under delta pressure. Torque values given in [Nm]

NPS DN	CI 150 PN10/16						CI 300 PN25/40						CI 600 PN63							
	delta p [bar]																			
	ETC	0	5	10	16	20	ETC	0	10	20	30	40	50	ETC	0	20	40	60	80	100
4 100	227	148 ±17%	162 ±15%	176 ±12%	193 ±11%	205 ±10%	305	222 ±22%	240 ±17%	257 ±13%	275 ±12%	292 ±11%	310 ±10%	384	237 ±19%	282 ±16%	328 ±12%	373 ±11%	419 ±10%	464 ±9%
6 150	200	137 ±17%	160 ±15%	184 ±12%	211 ±12%	230 ±11%	328	200 ±25%	249 ±18%	299 ±13%	348 ±11%	398 ±10%	447 ±7%	680	370 ±19%	482 ±15%	594 ±12%	706 ±8%	818 ±8%	930 ±5%
8 200	342	227 16%	283 ±15%	338 ±12%	405 ±11%	449 ±10%	513	306 ±25%	414 ±16%	522 ±13%	630 ±11%	738 ±8%	846 ±7%	1220	890 ±17%	856 ±14%	1122 ±10%	1388 ±8%	1654 ±5%	1920 ±4%
10 250	483	359 ±15%	449 ±13%	539 ±10%	647 ±9%	719 ±8%	760	370 ±24%	556 ±18%	742 ±13%	928 ±12%	1114 ±10%	1300 ±8%	1950	810 ±14%	1246 ±10%	1682 ±8%	2118 ±3%	2554 ±3%	2990 ±3%
12 300	564	427 ±15%	561 ±12%	695 ±10%	856 ±8%	963 ±7%	1150	410 ±20%	1150 ±13%	1720 ±7%	2290 ±7%	2860 ±5%	3430 ±5%	3380	1690 ±8%	2350 ±8%	3010 ±5%	3670 ±2%	4330 ±2%	4990 ±2%
14 350	756	617 ±13%	862 ±11%	1106 ±9%	1399 ±7%	1595 ±6%	2160	580 ±14%	904 ±9%	1178 ±7%	1452 ±6%	1726 ±5%	2000 ±3%	4860	1960 ±8%	2812 ±7%	3934 ±5%	5056 ±2%	6178 ±2%	7300 ±1%
16 400	656	557 ±14%	817 ±10%	1077 ±9%	1388 ±7%	1596 ±5%	1950	590 ±14%	1194 ±9%	1798 ±5%	2402 ±6%	3006 ±4%	3610 ±4%	7280	3060 ±8%	4522 ±6%	5984 ±4%	7446 ±2%	8908 ±2%	10370 ±1%
18 450	1225	953 ±11%	1244 ±10%	1535 ±8%	1885 ±6%	2118 ±5%	4270	1570 ±8%	2498 ±6%	3426 ±5%	4354 ±5%	5282 ±4%	6210 ±3%	8700	3120 ±7%	5002 ±5%	6884 ±4%	8766 ±2%	10648 ±2%	12530 ±1%
20 500	1722	1324 ±11%	1802 ±10%	2280 ±8%	2854 ±6%	3237 ±5%	6550	1770 ±7%	3252 ±6%	4734 ±5%	6216 ±5%	7698 ±3%	9180 ±3%	15470	6660 ±7%	9430 ±4%	12200 ±3%	14970 ±2%	17740 ±2%	20510 ±1%
24 600	2924	2151 ±11%	3000 ±9%	3849 ±8%	4867 ±6%	5547 ±5%	12670	2860 ±6%	5588 ±5%	8316 ±4%	11044 ±4%	13772 ±2%	16500 ±2%	23200	6900 ±7%	11640 ±3%	16380 ±3%	21120 ±2%	25860 ±2%	30600 ±1%

## 7. TROUBLESHOOTING

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

### 7.1 The metal seated valve does not close seal-tight

- Never close the metal seated 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 ring 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 (see Figure 1).
- If closing position is not reached it can be any blocking inside of the valve (between disc and seat) or inside the actuator.
- Check the torques of the BWX valve on the basis of the torque table. (see Table 8). Due to several tolerance effects the values can vary deviate from the values given in the table of ± 10 %...20 %.
- Check the sealing surface of the disc and the sealing elements for possible damage. Dismantle the valve. Test whether any foreign objects are present between the disc and the sealing elements. Remove the foreign objects or deposits, if necessary.
- There must be no scratches or damages at the surface from the disc (201), seat (321) and seat contact area in the body (101).
- Replace damaged parts, if necessary.

### 7.2 Leakage of fluid or gas

- Check if disc spring set (495) from the live loaded gland packing are proper and equal pre-stressed.
- 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.
- In case of leakage between body and extension or between body and bottom blind flange, the graphite seals are either not assembled correctly and are damaged, they need to be replaced by new sealings. (107, 470).
- Check if flange from extension (102) and bottom blind flange (402) are firmly tightened. There must be no gap between this parts and the body (101).

### 7.3 High torque or no correct switching time

- Check if actuator is equipped with correct supply air
- Check if solenoid valve is operating well.
- 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 bearings and sealing element, and replace, if necessary.

For disassembly, please read the maintenance section of this IMO at chapter 9ff of this IMO.

## 7.4 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 BWX 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 of the high-performance valve upon supply of energy. Therefore, ensure that the valve does not move or tip over during the functional test under any circumstances.
4. Exercise caution while installing valves in the failsafe position "spring opens" If the disc extends beyond the installation length of the valve, then the valve must be closed before installation (pneumatic, hydraulic etc.). It is mandatory to ensure that the energy supply lines are secured and not damaged or ruptured during installation under any circumstances. If the energy supply is interrupted suddenly, the valve opens abruptly. This can lead to serious injury and to material damage.
5. 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.
6. Make sure that cleaning agents do not cause any unwanted chemical reactions upon contact with possible residues in the high-performance valve.
7. 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.

## 8. MAINTENANCE

### 8.1 Cleaning and maintenance intervals

Butterfly valves of the BWX series are mostly maintenance-free.

Check the valve regularly for its tightness. Valmet recommends replacement of the metallic sealing element (321) and the packing rings (451) on demand or in critical applications after a period of two years at most. In non-critical applications a maintenance period of 5 years are recommended.

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.

Inspected 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. 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 has to be handed over to the responsible service person always.

### 8.2 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 BWX 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 BWX valve, the BWX valve must be closed to exclude any incidental damage.

### 8.3 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 9), 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 9 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 4. See especially Figure 2 and Figure 3).
- 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.

## 9. ASSEMBLY OF THE VALVE

**Maintenance at BWX valve should only be executed by authorized and trained Valmet personnel.**

### Before you start:

If the valve is operating in an oxygen service, all parts must be absolutely free of any oil and grease. See the cleaning procedure at chapter 11. Spare parts for oxygen valves are marked and special cleaned. Handle those with additional care!

Take care that the assembly area is clean and free from oil and grease and wear white and lint free working gloves. Avoid to touch the wetted parts of the valve bare-handed.

Handle seat, seat surface at disc and body with special care. Any scratch or damage degrades valve performance.

### 9.1 Insert radial Bearings

- The BWX valve is equipped with 3 radial DUB soft bearings in the body, disc and extension (Pos 420, 424, 425). It is not necessary to change the bearings when there is no or less wear.
- Before new DUB bearings will be inserted the used ones have to be removed from body, extension and disc. Avoid damages at this parts, especially at the disc surface.
- The axial bearing (405) has to be inserted in the disc bore with the bronze back side first. (Slide surface towards trunnion!).

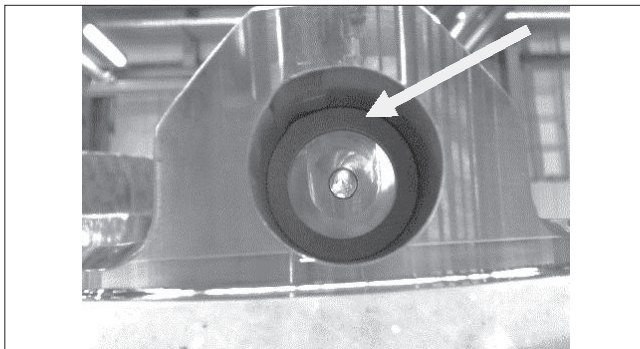


Fig. 14 Inserted axial bearing

- Insert the DUB bearings with a thorn in order to guide the bearing carefully in the bore. Slightly hammer down the bearings to its final position.

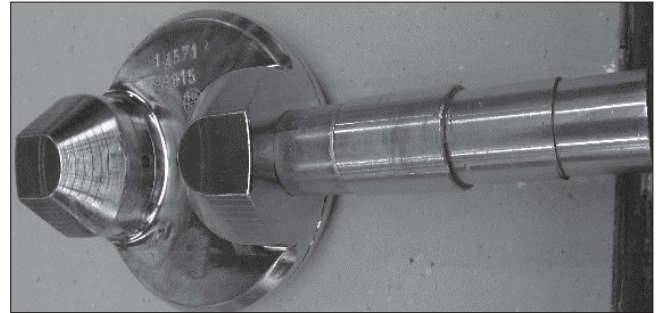


Fig. 15 DUB bearing inserted in disc

- Repeat this procedure in same way with body (101) and extension (102) and push down the DUB bearing to its final position.

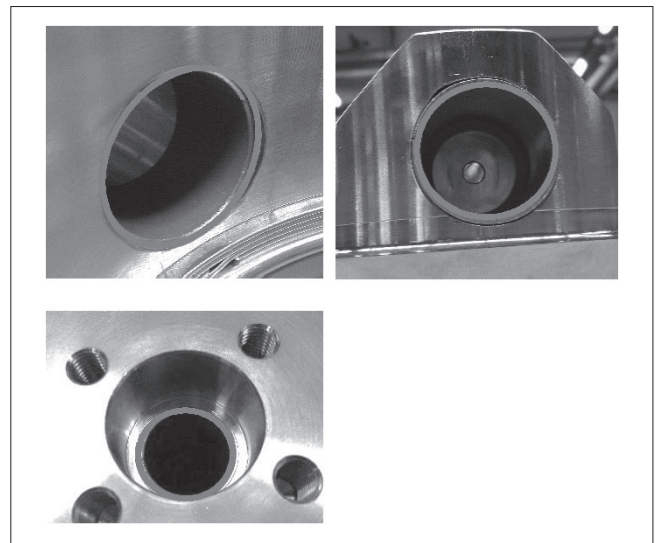


Fig. 16 Inserted radial DUB bearings in body and disc and extension

### 9.2 Insert axial bearing

- The axial bearing (404) of the BWX valve is located between body neck and flange of the extension.
- The axial washer (407) is press fitted to the shaft (401) and cannot be removed.
- Move the axial bearing from the top of the shaft to its final position in the body neck.

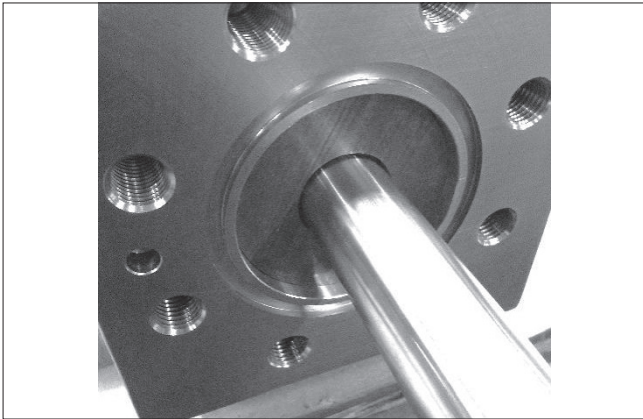


Fig. 17 Axial bearing, bronze back is visible

- Take care that the sliding surface towards to the body!  
(The bronze back is now visible! See Figure 17)

### 9.3 Seat

Handle the seat with care. Do not use any sharp tool!

- The BWX valve has a silver coated metal U-type seat (321), inserted in the body. It can free float in radial direction and should be movable in the body by hand force.
- Carefully check the surface inside the body where the seat is inserted. There must be no scratches or damages at all. The surface in the body must also be free from any particles, fibers, dust or any other parts.
- Check also the seat, especially also at the U-flanks and the round seat surface. There must be no scratches or damages at all. The silver coating must be without any damages.
- Carefully insert the U-seat in the body (101). The U-seat is symmetrically and can be used with both U-flanks towards the body. If doubts, use the better surface towards the body sealing surface.

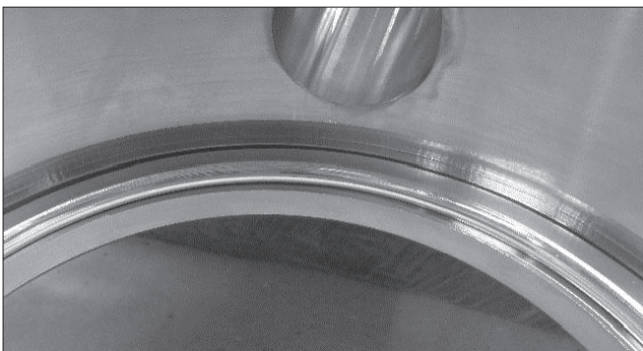


Fig. 18 U-type metallic seat inserted in body

- The U-seat is fixed with a spiral formed retaining ring (310). Depending on size and pressure class there may be also 2 retaining ring used.



Fig. 19 Insert spiral shape retaining ring

- Extend the spiral ring and start to insert one ring end into the groove above the U-seat. See Figure 20

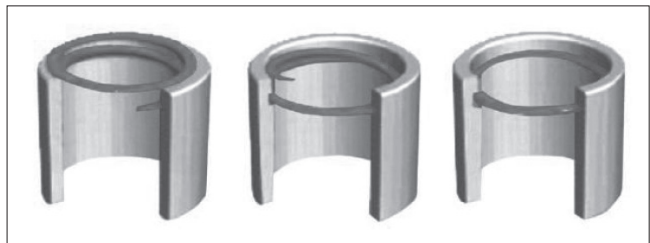


Fig. 20 Install spiral retaining ring

- Slide the remaining part of the retaining ring by pushing it spirally into the groove until it snaps in place. Do not use sharp tools. Usually it works only by hand force.
- Check that the retaining ring has snapped in place at the complete circumference. It is recommended to put the start/end position of the spiral retaining ring at about 45° angle from shaft line (~ between 1 and 2 o'clock) in the body.



Fig 21a Insert retainer

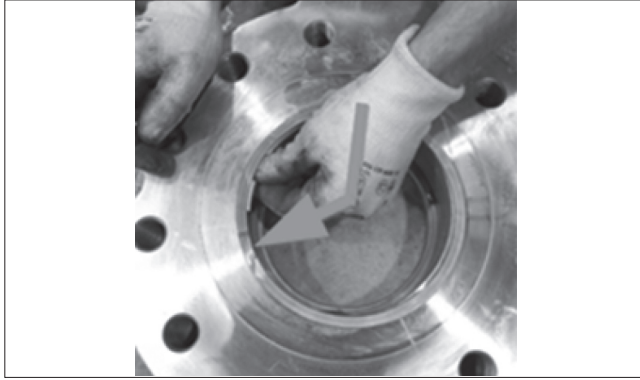


Fig 21b Insert 2nd retainer

- If 2 retaining rings are used, insert the 2nd retaining ring in the same way.
- Place the start/end position of the 2nd spiral retaining ring (if used depending from size and pressure range) at about 180° in opposite direction of the first one (~ between 7 and 8 o'clock) in the body.
- **Note:** the start/end position of two retaining rings should not be placed up on each other. It is recommended to avoid 12-, 3-, 6- and 9 o'clock position of the start/end section of the retaining ring.
- Check if seat (321) can be moved in each radial direction smoothly with hand force. The axial clearance of the seat (321) should be around 0.05mm (0,1mm max. value) at the entire circumference. Check this by using a slip gauge between seat (321) and retaining ring (310).

### Remove seat

- Disassemble the BWX valve unless the disc (201) is out of the body (101).
- To exchange the seat (321), the spiral retaining ring (310) has to be taken out of the body (101).
- Disassembly of the retaining rings with the help of a flat-bladed screwdriver. The screwdriver is inserted into the disassembly notch and rotated slightly so that one ring end of the retaining ring slides out of the groove.
- The ring will be removed spirally from the groove. Caution: do not over stress the retaining ring by bending or stretching.

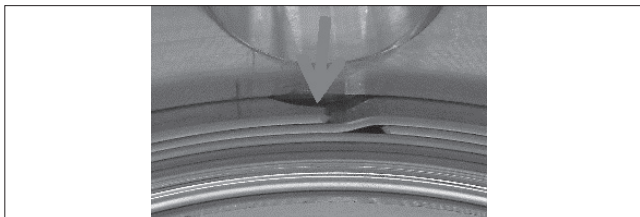


Fig. 22 Disassembly of retaining ring

- Continue to pull the retaining ring out of the groove over the circumference and pull it out of the body.
- Finally the seat (321) can be taken out of the body (101).

## 9.4 Disc assembly

- The seat (321) and spiral retaining rings (310) must be inserted according previous description (see 10.3)
- The radial bearings (Pos 420, 424, 425) must be in good condition and inserted in body (101), extension (102) and disc (201). (see also 10.1).
- The radial bearing (405) in the disc (201) must be in place and in good condition. (see 10.1)
- Put the disc (201) with on a (wooden) support with shaft connection eyes on top. Place body (101) with seat on top over the disc and level both items that shaft connection in the disc and shaft bores in body are approximately aligning.
- Make sure that bearing (425) in disc (201) is on 6 o'clock position while polygon profile of the disc (201) is on 12 o'clock position in the body (101).

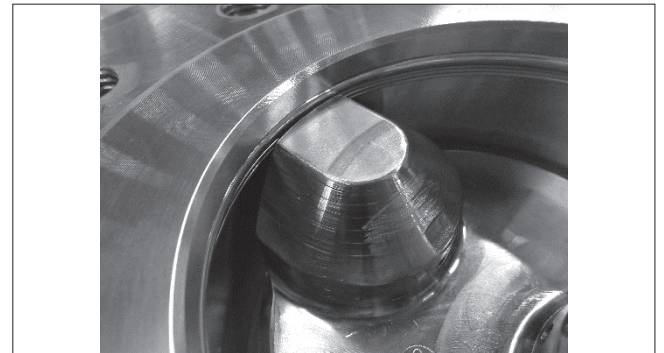


Fig. 23 Insert disc

- Always use new sealings (470, 107) when assembly the valve.
- Insert trunnion (402) in body. Check the correct position of sealing (470) between body (101) and trunnion (402) when trunnion is pushed completely in body and in disc (201).
- Take drive shaft (401), and place red dot downwards. Push drive shaft through the body and with the polygon inside the disc.

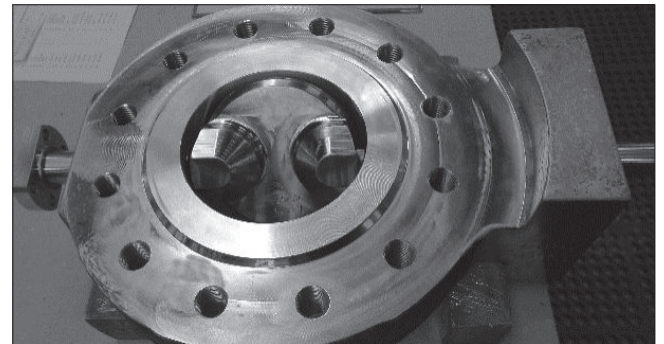


Fig. 24 Insert trunnion and shaft

- Carefully turn the disc with the driveshaft and check the correct positioning of the shaft to the disc.
- Insert screws (432) in trunnion (402) and tighten it.
- Insert axial bearing (404) in the body (101). (see 10.2).
- Put sealing (107) to its place in the groove at body neck and check correct position.
- Push extension (102) over the shaft (401), and fit the worm screw into the remaining hole at the body neck flange. Finally tighten the nuts (104) at the inserted stud bolts (103).
- Check that trunnion flange and extension flange have metal to metal contact to the body.

## 9.5 Replacing the gland packing

The gland packing (451) must be changed if leakage occurs even after the hex nuts (494) have been tightened as recommended.

### BWX\_C, BWX\_D BWX\_J, BWX\_K, BWX\_L, BWX\_M

- This valve types (pressure classes) are equipped with 2 stud bolts at the gland.
- Make sure the valve is not pressurized.
- Unfasten the nuts (494) and remove the disc spring kits (495), the retaining plates (476) 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 retaining plates with the text UPSIDE on top (see Figure 25).
- Mount the disc spring kits.
- Place the nuts on the studs.
- Pre-compress the gland packing by tightening the nuts with a tool until the disc springs have value of compression (h1-h2) as in Table 9 and Table 10
- 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 the disc springs and use these values as a basis when defining the final height of the springs (as compressed condition).

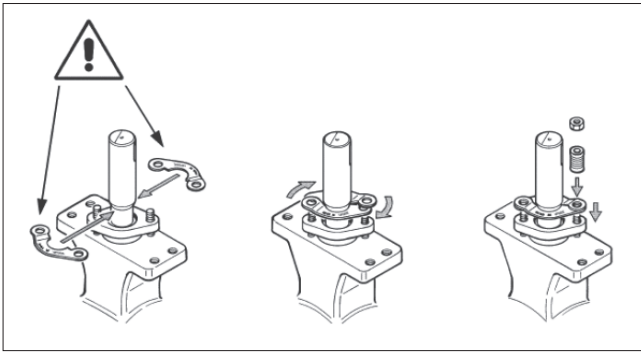


Fig. 25 Mounting the retaining plates

- Re-install the disc springs and tighten the nuts with the tool. Tighten the nuts until the set value of compression (h1-h2) of disc springs is achieved, see Table 9 and Table 10 depending on size and pressure class.

Table 10 Tightening of gland packing BWXC, ~J, ~K, ~L

size	BWXC, BWXJ; BWXK, BWXL							
	NPS/DIN	packing diameter	spring set diameter	Thread	no of studs	Compression (h1-h2)		
						Graphite	Graphite +PTFE	PTFE
4/100	25	25	M10	2	1.6	1.5	1.4	
6/150	25	25	M10		1.6	1.5	1.4	
8/200	25	25	M10		1.6	1.5	1.4	
10/250	30	25	M10		1.6	1.5	1.4	
12/300	30	25	M10		1.6	1.5	1.4	
14/350	40	25	M10		1.6	1.5	1.4	
16/400	40	25	M10		1.6	1.5	1.4	
18/450	50	35.5	M14		2.3	2.2	2.0	
20/500	50	35.5	M14		2.3	2.2	2.0	
24/600	70	40	M16		2.6	2.4	2.2	

Table 11 Tightening of gland packing BWXD, ~L, ~M

size	BWXD, BWXL, BWXM							
	NPS/DIN	packing diameter	spring set diameter	Thread	no of studs	Compression (h1-h2)		
						Graphite	Graphite +PTFE	PTFE
4/100	25	25	M10	2	2.2	2.0	1.9	
6/150	25	25	M10		2.2	2.0	1.9	
8/200	30	25	M10		2.2	2.0	1.9	
10/250	40	25	M10		2.2	2.0	1.9	
12/300	40	25	M10		2.2	2.0	1.9	
14/350	50	35.5	M14		3.2	2.9	2.7	
16/400	50	35.5	M14		3.2	2.9	2.7	
18/450	70	40	M16		3.6	3.2	3.0	
20/500	70	40	M16		3.6	3.2	3.0	
24/600	85	40	M16		3.6	3.2	3.0	

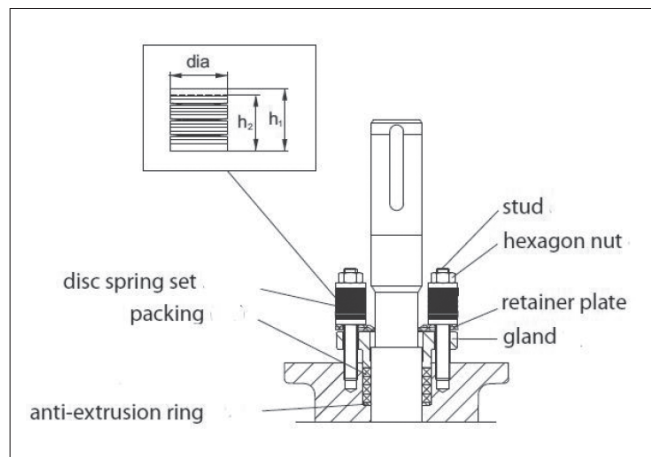


Fig. 26 Gland packing BWXC, ~J, ~K, ~L, ~D, ~L

- If the leakage still occurs when the valve is pressurized, re-tighten the nuts but don't exceed the values in the Tables 7 and 8 by 50 % or do not fully compress the disc springs.

## BWX\_F, BWX\_N, BWX\_P

- This valve types (pressure classes) are equipped with 4 stud bolts at the gland.
- Make sure the valve is not pressurized.
- Unfasten the nuts (496) and remove the disc spring kits (495), the gland (450), the retainer ring (452) and the compression ring (492). See Figure 27.

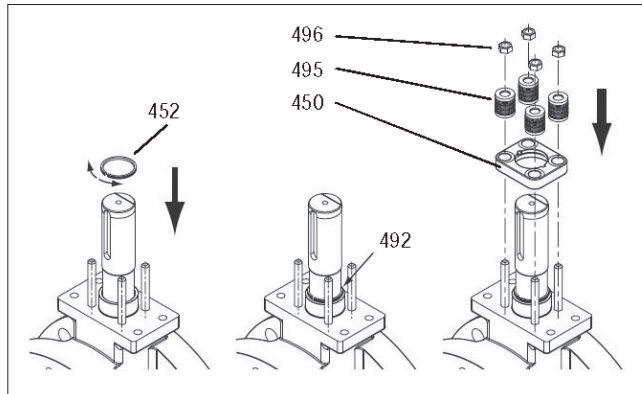


Fig. 27 Gland packing system BWXF, ~N, ~P

- Remove old packing rings (451). Do not damage the surfaces of the packing ring counterbore and shaft.
- Clean the gland and packing ring counterbore.
- 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. Position the cut ends of the graphite rings at a 90° angle to each other.
- Mount the compression ring.
- Slip the retainer ring on the shaft and push it against the compression ring.
- Install the gland.
- Mount the disc spring kits.
- Place the nuts on the studs.
- Pre-compress the gland packing by tightening the nuts with a tool until the disc springs have value of compression (h1-h2) as in Table 11.
- 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 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 tool. Tighten the nuts until the set value of compression (h1-h2) of disc springs is achieved, see Table 9.
- If the leakage still occurs when the valve is pressurized, re-tighten the nuts but don't exceed the value in the Table 11 by 50 % or do not fully compress the disc springs.

Table 12 Tightening of gland packing BWXF, ~N, ~P

size	BWXD, BWXL, BWXM							
	NPS/DIN	packing diameter	spring set diameter	Thread	no of studs	Compression (h1-h2)		
						Graphite	Graphite +PTFE	PTFE
4/100	25	25	M10	4	2.3	2.1	2.0	
6/150	30	31.5	M12		3.0	2.6	2.5	
8/200	40	35.5	M14		3.4	3.0	2.9	
10/250	50	40	M16		3.8	3.4	3.2	
12/300	70	50	M20		4.7	4.1	4.0	
	70							
	85							
	85							
	95							
	105							

## 10. VALVES IN OXYGEN SERVICE

### 10.1 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.

## 10.2 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. 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!!**

## 10.3 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.

## 10.4 Cleaning during and after service:

We just will highlight once more, that as minimum the shown Minimum requirements for oxygen application valves (chapter 11.2) 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 11.1.2 on this page!

## 10.5 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 Rp0.2, friction coefficient 0.16.

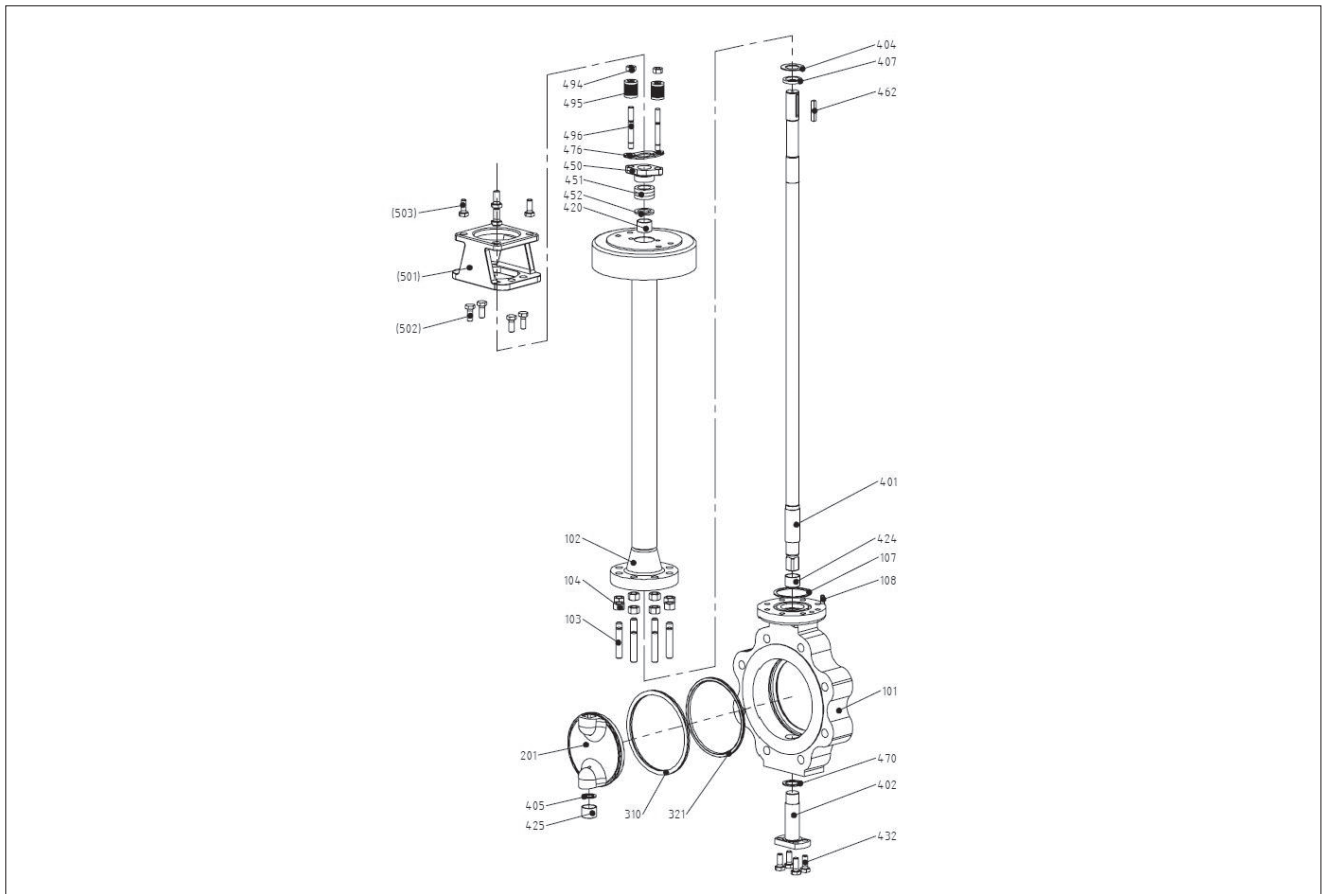
Table 13 Tightening torques for valve screws

Ø	Stressed cross section AS [mm <sup>2</sup> ]	Load <sup>1)</sup> Force a the screw		Pre-stressing force N	Tightening torque Nm
		Rp0.2 [N]	Rm [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

# 11. BWX – METAL SEATED

## 11.1 Bill of material



Part nr.	Qty.	Description	Material
101	1	BODY	ASTM A351 gr. CF8M
102	1	EXTENSION	AISI 316
103	8	THREADED PIN	Stainless steel
104	8	HEXAGON NUT	Stainless steel
107	1	SEALING	Graphite
108	1	WORM SCREW	Stainless steel
117	1	SIGN CLOSED	Aluminium
201	1	DISC	ASTM A351 gr. CF8M
321	1	SEALING ELEMENT	UNS N07718
310	2	RETAINING RING	1.4571
401	1	DRIVE SHAFT	ASTM A479 gr. XM-19-H
424	1	BEARING SLEEVE	Bronze+PTFE
420	1	BEARING SLEEVE	Bronze+PTFE
404	1	THRUST BEARING	Bronze+PTFE
407	1	THRUST WASHER	ASTM A479 gr. XM-19-H
462	1	KEY	1.4460
402	1	SHAFT	ASTM A479 gr. XM-19-H
424	1	BEARING SLEEVE	Bronze+PTFE
425	1	BEARING SLEEVE	Bronze+PTFE
405	1	THRUST WASHER	Bronze+PTFE
432	4	HEXAGON SCREW	Stainless steel
470	1	SEALING	Graphite
450	1	GLAND	A351 gr. CF8M/1.4408
451	4	PACKING RING	PTFE
452	1	ANTI EXTRUSION RING	AISI 316
495	2	DISC SPRING SET	Spring steel
476	2	RETAINER PLATE	316L/1.4435
496	2	STUD	Stainless steel
494	2	HEXAGON NUT	Stainless steel

## 12. HOW TO ORDER – TYPE CODE

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.
BWX	4	C	1	A	X	2	08	A	A	N	D	G1		

BWX cryogenic valve type for O2 service, API lugged, cl 150 full rated, metallic seat, soft bearings, oxygen service, extension: AR=1060, NPS 8, body CF8M, disc CF8M, shafts XM19, seat Inconel, live loaded packing for oxygen service

1. sign	PRODUCT SERIES / DESIGN
BWX	Cryogenic temperature butterfly valve, free floating metal seated, 3 bearings, stub shaft design with full bore, and cryogenic extension. Standard FtF design acc. API 609

2. sign	BODY CONSTRUCTION
2	Flanged, long pattern (without threaded holes)
3	Flanged, short pattern (with threaded holes)
4	Lug type
6	Wafer type
Y	Special, to be specified

3. sign Body	BODY PRESSURE RATING
C	ASME class 150
D	ASME class 300
F	ASME class 600
J	PN 10
K	PN 16
L	PN 25
M	PN 40
N	PN 63
P	PN 100

4. sign	SEAT DESIGN
1	U-Type metal seat with coating Standard tightness in preferred direction: FCI 70.2 cl V, EN12266 C Optional tightness in preferred direction: FCI 70.2 cl VI, EN12266 B Max tightness in non-preferred direction: FCI 70.2 cl IV (Air), EN12266 D
6	Shoulder (Step seat) for control application: FCI 70.2 class III
7	No seat for control application: FCI 70.2 class II

5. sign	BEARINGS / BODY
A	Soft bearings, PTFE or eq. on sinter metal. Back material is bronze.
B	Metal bearings for high temperature. Tmax = 600 °C

6. sign	APPLICATION
-	Standard, without sign
N	All wetted parts acc. <b>NACE</b>
Z	Oxygen Service for <b>GOX/LOX</b> applications all internal non-metallic parts have valid test report from notified body (BAM, WHA, etc)

7. sign	EXTENSION	
	Standard (without cryo extension)	
0	300	Extension length "AR" [mm]
1	860	
2	1060	
3	1260	
4	1460	
5	1660	
Y	Special construction, extension length defined in dimension drawings	

8. sign	SIZE (ASME rating = inch / PN rating = metric)
	Inch: 04, 06, 08, 10, 12, 14, 16, 18, 20, 24
	Metric: 100, 150, 200, 250, 300, 350, 400, 450, 500, 600

9. sign	BODY MATERIAL	10. sign	DISC MATERIAL	11. sign	SHAFT MATERIAL
A	ASTM A351 CF8M / 1.4408	A	ASTM A351 CF8M eq. AISI 316 / 1.4408	N	XM-19 (Nitronic 50 HS)
P	ASTM A216 WCB / A.0619	N2	ASTM A487 CA6NM (similar to 1.4317)	N2	1.4021 equal SS410

10. sign	TRIM MATERIAL
A	ASTM A351 CF8M / 1.4408
P	ASTM A487 CA6NM / 1.4317

11. sign	SHAFT MATERIAL
N	ASTM A479 XM-19
C	ASTM SA564 Gr. 630 Condition 1150D

12. sign	SEAT MATERIAL
D	U-type metallic seat, UNS 07718 + silver coated (disc: ENP coated 30 microns or equal) T = -200 °C ...+850 °C
E	U-type metallic seat, 1.4021 + silver coated (disc: ENP coated 30 microns or equal) T = -20 °C ...+400 °C
Z	Step seat. Seat = body material
X	No seat; swing through

13. sign	PACKING CONSTRUCTION
T3	Live loaded PTFE packing. For emission certificate please contact factory
G1	Live loaded graphite packing, compatible to <b>GOX/LOX</b>
G3	Live loaded graphite packing, <b>Fire safe</b> for emission certification, please contact factory
Y	Special, to be specified



14. sign	SPECIAL FLANGE FACING TYPES/FORMS
-	Ra 3.2 - 6.3, standard, without sign covers: <ul style="list-style-type: none"> <li>• EN 1092-1 Type B1 (Ra 3.2 - 12.5)</li> <li>• ASME B16.5, Ra 3.2 - 6.3 (125 - 250 µin)</li> <li>• DIN 2526 Form E (Ra 4)</li> </ul>
05	Ring Joint
Y	Special, to be specified

15. sign	FLANGE
-	without sign according to valve body pressure rating <u>PN-rating</u> <ul style="list-style-type: none"> <li>• EN1092-1</li> </ul> <u>ASME-rating</u> <ul style="list-style-type: none"> <li>• ASME B 16.5 #150-#1500 size 4 - 24, #2500 size max 12"</li> <li>• ASME B 16.47 Series B #150 - 600 size 26" -60". #900 size max 48" <ul style="list-style-type: none"> <li>- Bigger flange drilling has to be agreed with the factory.</li> </ul> </li> <li>• Butt weld ends acc. ASME B16.25, Pipe diameter and pipe class to be defined</li> </ul>
Y	Special, to be specified

## 13. GENERAL DISCLAIMER

### 13.1 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.

### 13.2 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.

### 13.3 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.

### 13.4 Operating

8. The 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 type 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.
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.
  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.

## 13.5 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.
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

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