

## Diaphragm Competence

**Bürkert Fluid Control Systems**  
Christian-Bürkert-Straße 13-17  
74653 Ingelfingen  
Germany  
Tel.: +49 (0) 7940/10-0  
Fax: +49 (0) 7940/10-91 204  
info@burkert.com  
www.burkert.com



**bürkert**  
FLUID CONTROL SYSTEMS

## From development through implementation – Quality from Bürkert

As the name implies, the diaphragm is the most important part of the diaphragm valve. It is the sensitive point in this valve type. It ensures that different media are not mixed during the process, it protects the process from external influences and – in some cases also vice versa – it protects the environment from the influences of the process.

All the more reason not to make any compromises in quality concerning this crucial component. With Bürkert diaphragms and diaphragm valves you are on the safe side in every respect.

You benefit for example from the fact that all materials used in our diaphragms are one-hundred percent traceable. This gives you the certainty that only the “best ingredients” are used for your diaphragm. Also, you can choose from a broad assortment of materials and therefore diaphragm types, for maximum flexibility to suit your process task. Different diaphragms from our product range are ideal for CIP (Cleaning in Place) and SIP (Sterilization in Place) and, of course, are internationally certified for use in hygienic processing.

This brochure will give you an overview of the different diaphragm types and help you choose the right solution for your specific application. The brochure is intended only to supplement, and not to substitute, personal support by one of our employees. If you have any questions, please do not hesitate to contact us! We will be glad to assist you; we look forward to your call.

*Raw material in store.*

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# Product overview – The right diaphragm for every need

Our spectrum of diaphragms comprises the following four basic types, with different properties that optimally meet the requirements of different applications.

EPDM diaphragms	Very flexible diaphragms made of ethylene-propylene-diene rubber suitable for use in hygienic processing applications.
FKM diaphragms	Diaphragms of fluoro rubber, especially suitable for use in water treatment applications.
PTFE diaphragms	Polytetrafluorethylene is the material from which these diaphragms are made, which due to their chemical inertness and low reactivity are excellent for hygienic and chemical applications.
Advanced PTFE diaphragms (two-part)	These diaphragms, made of polytetrafluorethylene, the second generation of PTFE with improved mechanical properties, are ideal for applications with high changes in temperature.

Please note: Our diaphragms are optimised and approved for use only in connection with Bürkert diaphragm valves. The use of diaphragms from other manufacturers in Bürkert valves is not recommended, since we cannot guarantee the correct performance and traceability of the diaphragm.

*Diaphragm after vulcanisation, prior to trimming.*

# EPDM diaphragms

Ethylene-propylene-diene rubber is a synthetic rubber or elastomer that can be used in a broad range of applications. The main reason for this is its very high resistance to the influences of temperature and ozone, as well as its general weather-proofness. These diaphragms also feature good resistance to polar substances and steam.

## Properties

EPDM is highly compatible with hot and cold water, alkaline media and non-concentrated acids. Diaphragms made of this material are therefore ideal for hygienic processing applications, which require steam sterilization and oxidizing media.

We do not recommend using these diaphragms in connection with media such as mineral and vegetable oils, plant and animal fats, aromatic or aliphatic hydrocarbons, halogenated solvents or concentrated acids, since they can damage the structure of the diaphragm, causing leaks. For additional information please refer to our "Resistance table" brochure.

## Temperature range

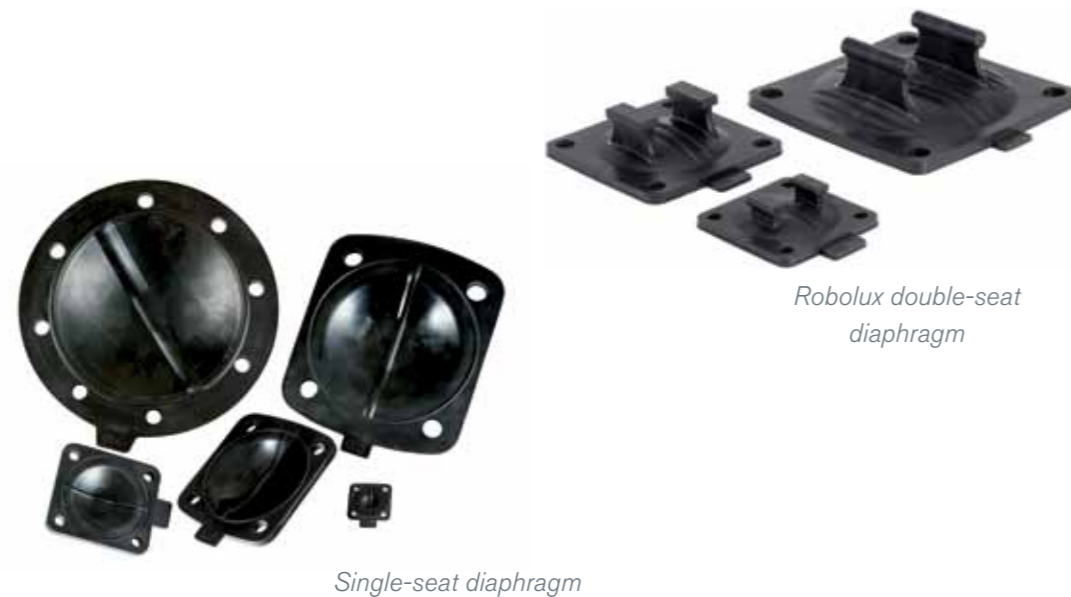
-10 to +130 °C in continuous operation – +140 °C for 60 min (Code AB)  
-5 to +143 °C in continuous operation – +150 °C for 60 min (Code AD)

## Diameter range

DN08 (1/4 inch) to DN100 (4 inch)

## Certifications

FDA: 21CFR177.2600  
USP35, Chapter <87>, Chapter <88>, Class VI, 121 °C



Single-seat diaphragm

Robolux double-seat diaphragm

# FKM diaphragms

FKM is the abbreviation for fluoro rubber in accordance with DIN ISO 1629 and ASTM D1418. All types of fluoro rubber contain vinylidene (di)fluoride (VDF) as one of their monomers. Fluoro rubber is of a higher quality and therefore more expensive than neoprene or nitrile rubber, among other things due to its higher resistance to heat and chemicals. The high chemical resistance of fluoro rubber expands the areas of application for FKM diaphragms in comparison with EPDM diaphragms.

## Properties

FKM diaphragms are resistant to numerous solvents and chemicals. For example, they feature excellent resistance to hydrocarbon aliphates, as well as aromatic and chlorinated chemicals and good resistance to acids and caustic solutions with oxidants. They are not suitable for use with ether and alkaline solutions. FKM diaphragms are therefore pre-destined for use in water treatment, although we do not recommend their use in applications with steam sterilization. For additional information please refer to our "Resistance table" brochure.

## Temperature range

0 to +130 °C in continuous operation

## Diameter range

DN08 (1/4 inch) to DN100 (4 inch)

## Certifications

KTW certificate for diaphragm Type 2036

# PTFE diaphragms

Polytetrafluorethylene is a synthetic fluoropolymer consisting of tetrafluorethylene, which can be used for a broad spectrum of applications due to its outstanding properties. Since it consists of carbon and fluorine, which bond with a high molecular weight, PTFE is a solid. Due to the strong carbon-fluorine bonds it is especially inert, since other substances cannot break this bond. For this reason, PTFE is frequently used in tanks and pipelines for reactive and corrosive chemicals.

## Properties

Due to its outstanding chemical and thermal resistance, its good compatibility with hot and cold water and with caustic solutions and concentrated acids, PTFE diaphragms are ideal for hygienic applications. The chemical inertness of PTFE prevents it from becoming cross-linked, so that it has no "memory", which means that it cannot return to its original form, as is the case with elastomers. The material tends to creep and deform under tension, a phenomenon also known as "cold flow". If the PTFE is excessively deformed from temperatures above 130 °C and high temperature fluctuations (heating / cooling), this can damage the sealing bead, resulting in leaks.

We do not recommend using PTFE diaphragms in applications with temperature fluctuations and a high number of sterilization cycles.

## Temperature range

-10 to +130 °C for continuous operation

## Diameter range

DN08 (1/4 inch) to DN150 (6 inch)

## Certifications

FDA: 21 CFR 177.1550  
FDA: 21CFR177.2600 (support diaphragm)  
USP35, Chapter <87>, Chapter <88>,  
Class VI, 121 °C



# Diaphragms made of Advanced PTFE

Polytetrafluorethylene is a synthetic fluoropolymer consisting of tetrafluorethylene, which can be used for a broad spectrum of applications due to its outstanding properties. Like conventional PTFE, Advanced PTFE consists of carbon and fluorine. In addition to the time-tested properties of conventional PTFE, it offers other substantial benefits. Even under higher loads, the advanced version exhibits a much lower degree of deformation; in comparison with conventional PTFE, the material reacts less strongly to the influence of high temperatures and temperature fluctuations. The compact polymer structure, which reduces the permeation of the diaphragm, improves the process quality.

## Properties

Due to its outstanding chemical and thermal resistance, its good compatibility with hot and cold water and with caustic solutions and concentrated acids, Advanced PTFE diaphragms, just like PTFE diaphragms, are ideal for hygienic applications.

What makes Advanced PTFE diaphragms different from the classic PTFE diaphragms, however, is their behaviour with respect to cold flow. The effects of cold flow, measured as deformation under tension, are significantly lower in Advanced PTFE diaphragms than in conventional PTFE diaphragms. This substantial difference in cold flow behaviour is especially evident after repeated loads and at increased temperatures. Therefore, we can recommend the use of Advanced PTFE diaphragms also in applications with temperature fluctuations and a high number of sterilization cycles.

In Advanced PTFE the service life and stability of the materials has been significantly improved through reinforced EPDM (with polyamide fabric). The "G" marking refers to this reinforcement.



# Diaphragms made of Advanced PTFE

## Temperature range

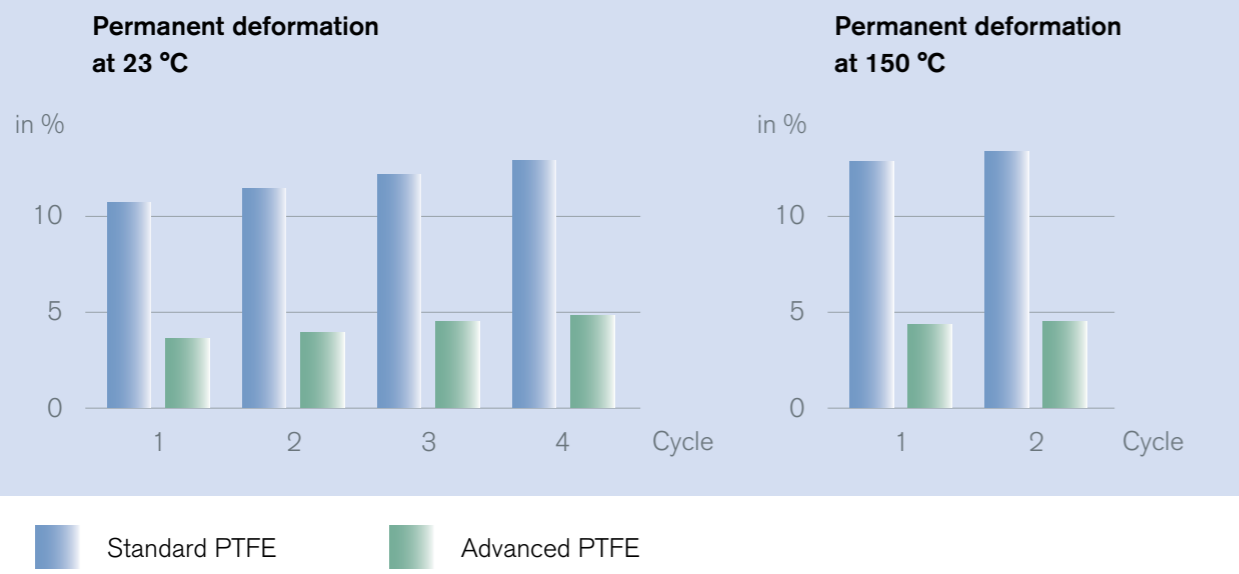
- 10 to +130 °C for continuous operation
- 10 to +140 °C for uninterrupted operation
- 10 to +90 °C for Multiport valves Robolux Type 2036

## Diameter range

DN08 (1/4 inch) to DN100 (4 inch)

## Certifications

- FDA: 21 CFR 177.1550
- FDA: 21CFR177.2600 (support diaphragm)
- USP35, Chapter <87>, Chapter <88>, Class VI, 121 °C



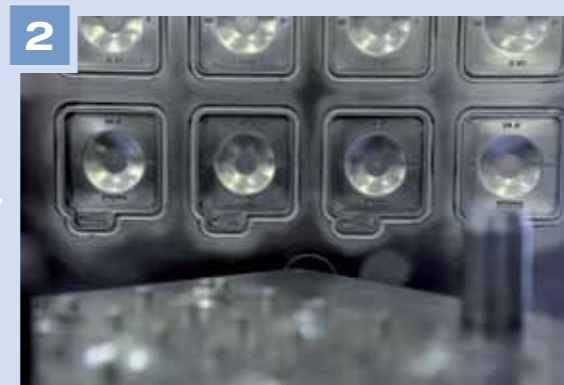
# Production – From raw rubber to a precision manufactured high-tech diaphragm

Quality is at the focus of our diaphragm production, because as described at the outset, the diaphragm is the core component of the diaphragm valve. The performance of the process depends entirely on the quality of the diaphragm. Minimal faults can easily have major effects so our experts pay close attention to every step of the manufacturing process.

## Overview of the production process



1 The raw material is stored in an air conditioned warehouse that is protected against light. This enables less alteration of the material.



2 One vulcanisation tool produces multiple diaphragms simultaneously.



3 EPDM raw material prepared for vulcanisation – between two EPDM sheets there is a layer of re-enforcement material.



4 The vulcanisation tool on the press – the EPDM blanks are placed in the moulds.



7 Completed high-tech diaphragm. The final product is a fully-compliant and traceable diaphragm made to exacting Bürkert specifications.



6 After completion of the vulcanisation process the completed diaphragms can be removed from the tool.



5 During the vulcanisation process the specific manufacturing parameters (for example: time, temperature, pressure, etc.) are monitored and recorded for future reference.

Besides experience in processing the different materials, a crucial role in diaphragm production is also high-precision production in accordance with the high standards of the Bürkert engineers. For this reason, we work together only with audited and qualified production partners who are capable of meeting our high quality standards, also in the production process.

# Design – Form follows function

The material composition must not only comply with industry minimum standards such as 21CFR177 and USP 87/88, it also must be able to withstand standard manufacturing processes such as vulcanisation and peroxide curing.

The selected material must also have optimal process compatibility, taking into account variables such as the chemical composition of the process, expected cycle life, risk factor, expected temperature limits and particle size.

During the exacting design process, all materials that pass these two initial evaluation stages are then individually tested in our research facilities. Pressure limits, chemical exposure and mechanical cycling on fully functional systems are just a few of the critical design points that are fully tested in our facilities. At this final stage, if all the tests are satisfactory, the material is then made available for our clients in our standard product portfolio.



advanced PTFE in white

backing cushion diaphragm (black)

2-pieces PTFE/EPDM diaphragm

The diaphragm is made in 2 pieces. One PTFE or advanced PTFE is directly in contact with the medium and the EPDM gives flexibility to the diaphragm.



EPDM diaphragm for Type 2036-3236 Robolux version.

The unique double-seat diaphragm valve solution is based on one diaphragm with two connections, which enables sealing of two parallel seats.

## Connection types

### Button



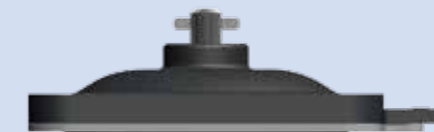
Elastomer knob for integration in the actuator (manual or pneumatic).

### Thread



Threaded pin; the pin is screwed into the actuator.

### Bayonet



Pin fastened in the actuator by a 1/4 turn for very easy trouble-free connection. For PTFE and Advanced PTFE.

### Robolux

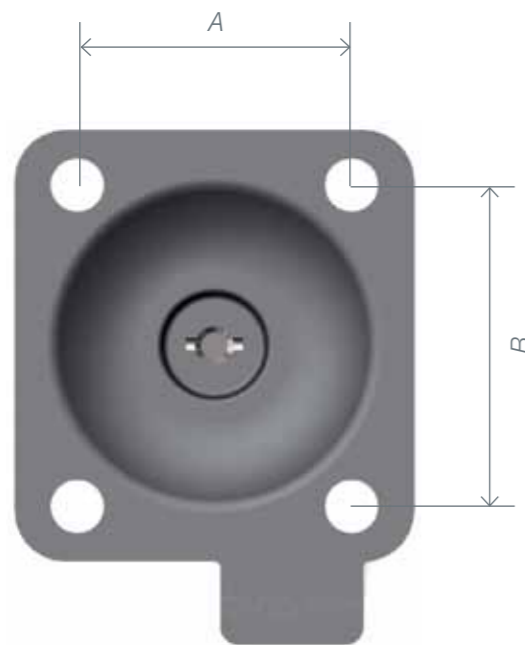


Double-seat diaphragm valve solution, with two connections.

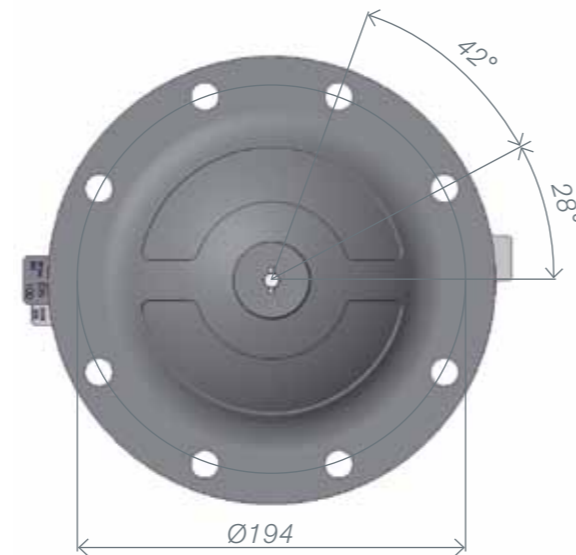


## Dimensions – Finding the right size

The diaphragm dimensions below will help you determine the right size for your installation.



Installation size for diaphragm DN08 to DN80



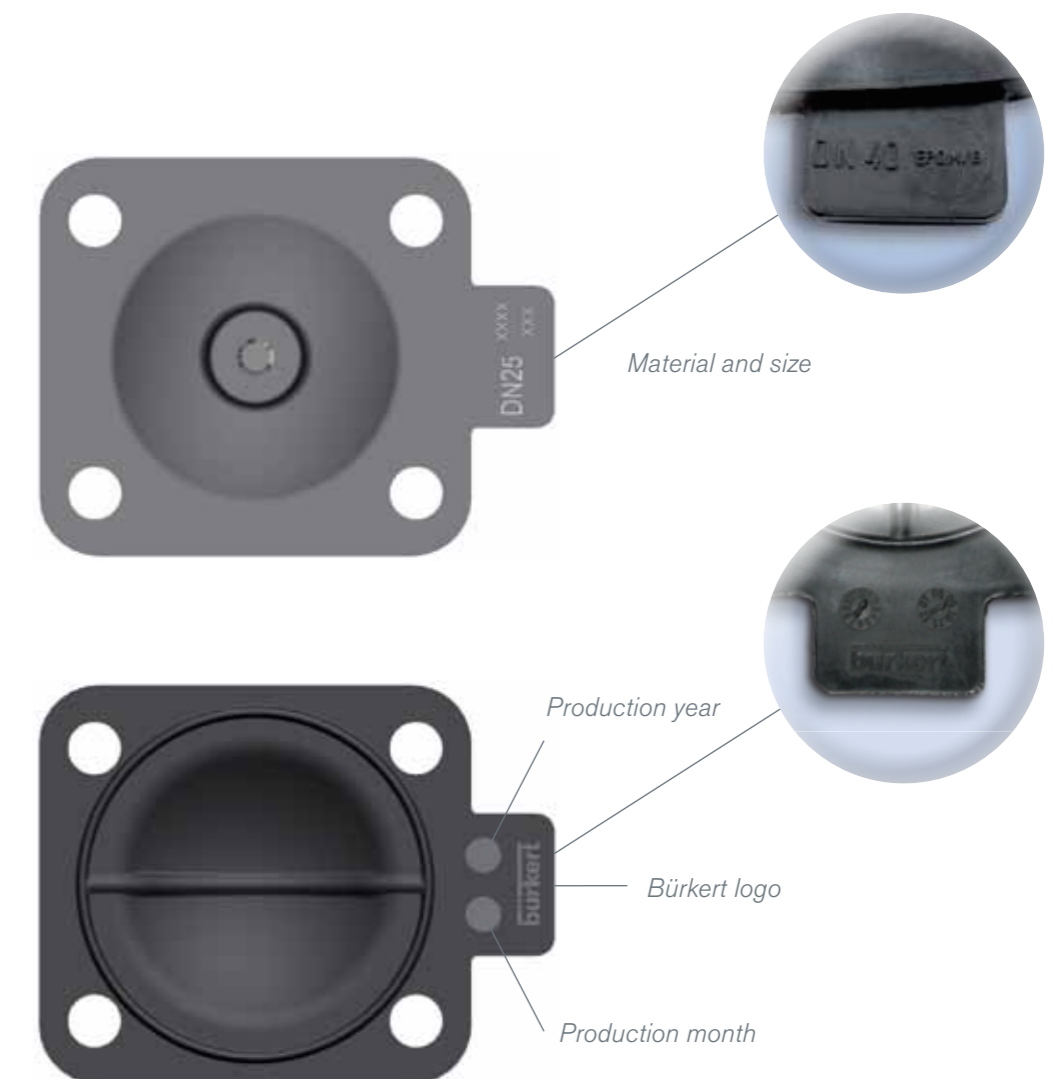
Installation size for diaphragm DN100

Seat size	A	B
08	24.75	24.75
15	33	37
20	40	44
25	46	54
40	65	70
50	78	83
65	95	102
80	114	127

## Traceability – An essential part of your process

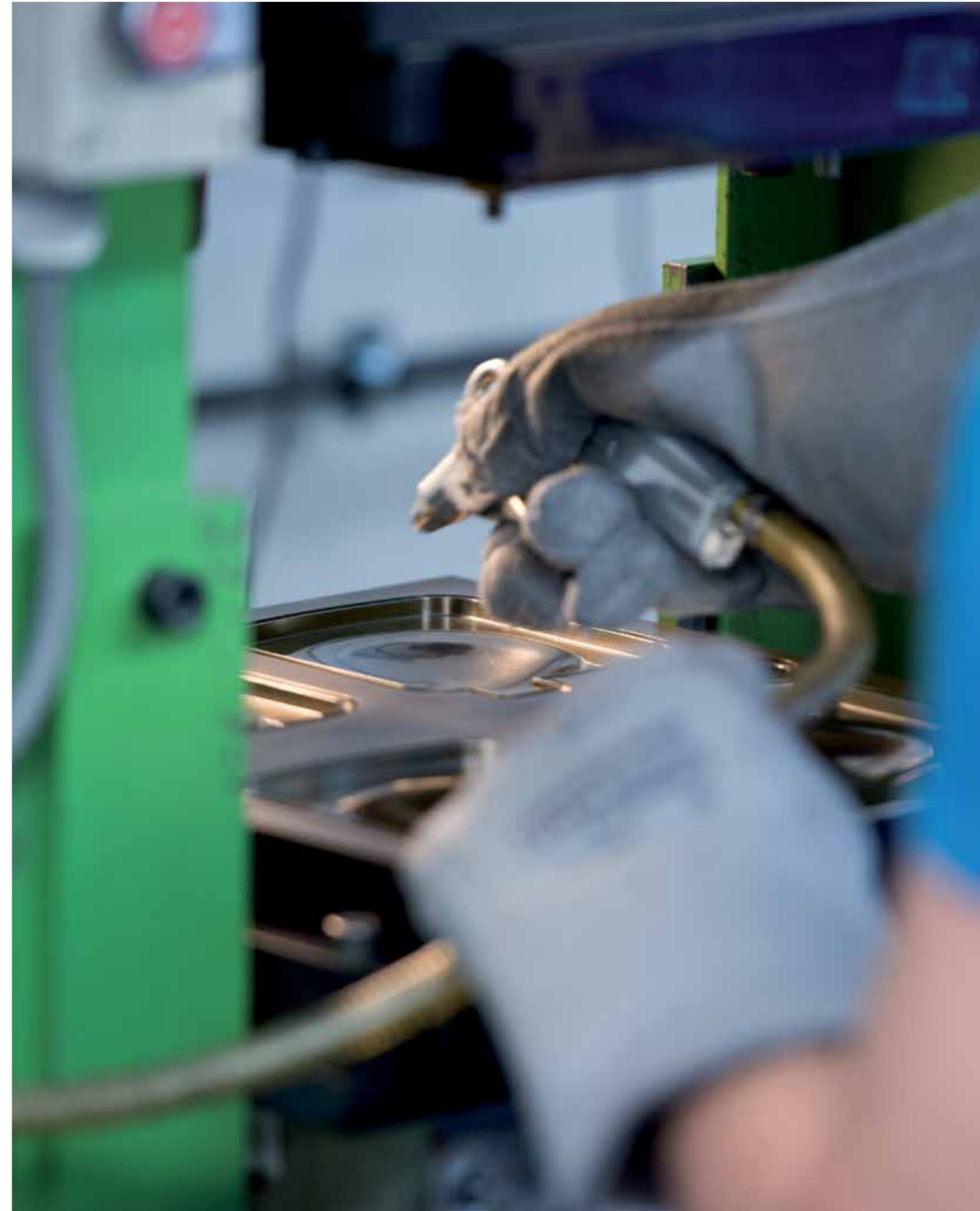
Traceability in a pharmaceuticals plant is essential for ensuring that all materials have the required certificate and for documenting the production period and the production type of the completed product for later quality assurance processes. Traceability is required both in the GMP (Good Manufacturing Practices) guidelines and in the ASME BPE guidelines.

The production date is not to be used as the basis for an expiration date, since the life cycle of the diaphragms differs depending on the application and intensiveness of use. If you need assistance with elastomer selection for your process, our experienced engineering team would be glad to assist you.



# Certificates – Prerequisite for successful process validation

Process validation is an essential quality control for process reliability. Its purpose is to document that a process or system fulfils the specified requirements, in a repeatable and permanent manner. To ensure this reproducibility of desired results in your process cycle, it is important that you use traceable components of high quality. With Bürkert diaphragms and diaphragm valves you can be certain of this, because our products have been extensively tested and certified.



## Bürkert diaphragms – Choosing the right component

To help you decide which diaphragm optimally fulfils the requirements of your process, the following table lists our extensive product range in a detailed and transparent manner. If you need assistance in choosing the right component, just call us. We will be glad to help you select a diaphragm that is optimized for your process.

Material	Bürkert code	Diameter	Min. continuous temperature	Max. continuous temperature	Steam sterilisation	Special certification	SIP cycle
EPDM	AB	8–100	-10 °C	130 °C	140 °C – 60 min.	FDA – USP Class VI USP 381 – EU Phr 3.2.9	Yes
EPDM	AD	8–100	-5 °C	143 °C	150 °C – 60 min.	FDA – USP Class VI	Yes
FKM	FF	8–100	0 °C	130 °C			No
PTFE/EPDM	EA	8–100	-10 °C	130 °C	140 °C – 60 min.	FDA – USP Class VI	No
Advanced PTFE/EPDM	EU	8–100	-10 °C	130 °C	140 °C – 60 min.	FDA – USP Class VI USP 381 – EU Phr 3.2.9	Yes
Advanced PTFE vulcanised on EPDM (Type 2036)	EK	8–50	-10 °C	90 °C	No	FDA/USP Class VI	No

## Service and maintenance – Optimisation of the diaphragm life

The life of the diaphragm depends on the following factors:

- the material of which the diaphragm is made
- the medium with which the diaphragm comes into contact
- the pressure exerted on the diaphragm by the medium
- the temperature of the medium
- the choice of the spring forces required for sealing
- the control pressure for double-acting actuator and normally open actuators

How you can extend the service life of the diaphragm seal:

For NC valves (normally closed) you can adapt the actuator size (spring force) to the pressure of the medium, to set the process in motion. If necessary, select the actuator with reduced spring force (EC04 option). Limiting the stroke length of the diaphragm will restrict the forces which stress the diaphragm and result in premature failure.

For NO (normally open) and double-acting valves, the control pressure should not be higher than necessary to achieve the seal with the pressure of the medium.

If maintenance is necessary, proceed as described in the operating manual. Also comply with the screw torque specified in the operating manual, since an incorrect torque can cause the valve to leak or can reduce the life of the diaphragm. This will help you to improve your process.

If you have any questions, our employees will be glad to assist you.

## Spare parts with ID number

To provide you with optimal support in the repair and maintenance of your diaphragm valves, we have a broad assortment of spare parts, stocked at your local Bürkert office.

		EPDM spare parts code AB	EPDM spare parts code AD
Diameter	Connection	ID number	ID number
DN 08	Button	677663	688421
DN 15		677664	688422
DN 20		677665	688423
DN 25	Thread	677667	688424
DN 32		677668	688425
DN 40		677669	688426
DN 50		677670	688427
DN 65		677671	688428
DN 80		677672	688429
DN 100		677673	688430
DN 150		672447	-

		PTFE spare parts code EA	Advanced PTFE spare parts code EU
Diameter	Connection	ID number	ID number
DN 08	Button	677674	679540
DN 15	Bayonet	677675	679541
DN 20		677676	679542
DN 25		677677	679543
DN 32		677678	679544
DN 40		677679	679545
DN 50		677680	679546
DN 80		677682	679744
DN 100		677683	679745
DN 150	672448	-	

## Bürkert – Close to You

For up-to-date addresses please visit us at [www.burkert.com](http://www.burkert.com).



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