Butterfly valves DKR

Technical Information · GB
3.1.6.8 Edition 12.10

- For hot air and flue gas
- Low leakage rates ensure high product quality
- Suitable for high burner capacities due to large nominal diameters
- Simple installation thanks to clamping between standard flanges
- Low-maintenance operation
- Robust design for a long service life

Contents

= To be continued

Butterfly valve DKR..F for hot air and flue gas

Butterfly valve DKR..H with lever

1 Application

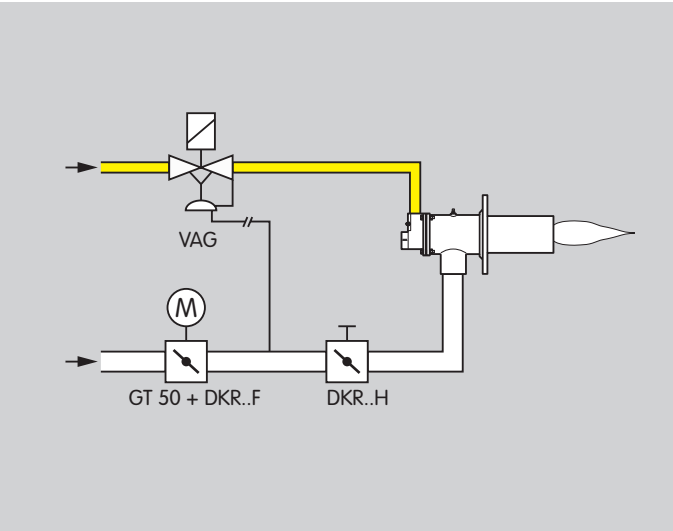
Butterfly valve DKR is designed to adjust volumes of hot air and flue gas on various appliances and flue gas lines. It is designed for control ratios up to 1:10, and with the mounted gear motor GT 50 it is suitable for regulating flow rates for modulating or stage-controlled combustion processes.

On butterfly valve DKR..H, flow rates can be set and fixed using a lever, for example to limit the high-fire rate on the burner. A scale indicates the set angle of opening.

Butterfly valve DKR..F with gear motor GT 50

Roller hearth kiln in the ceramics industry

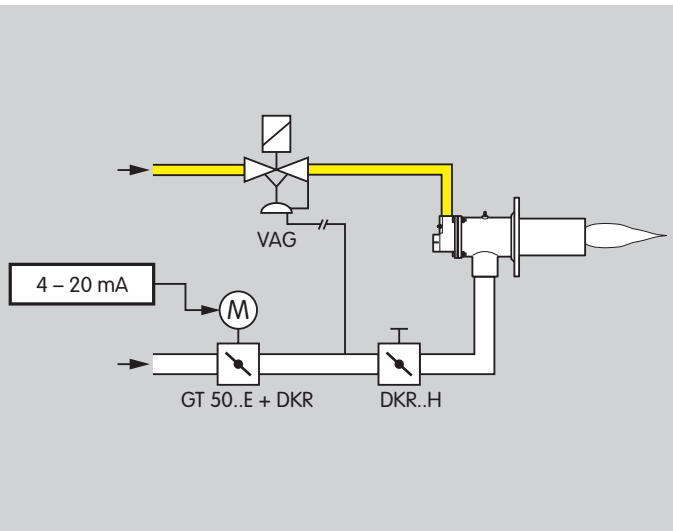
Forging furnace



1.1 Examples of application

1.1.1 Adjusting the high-fire rate

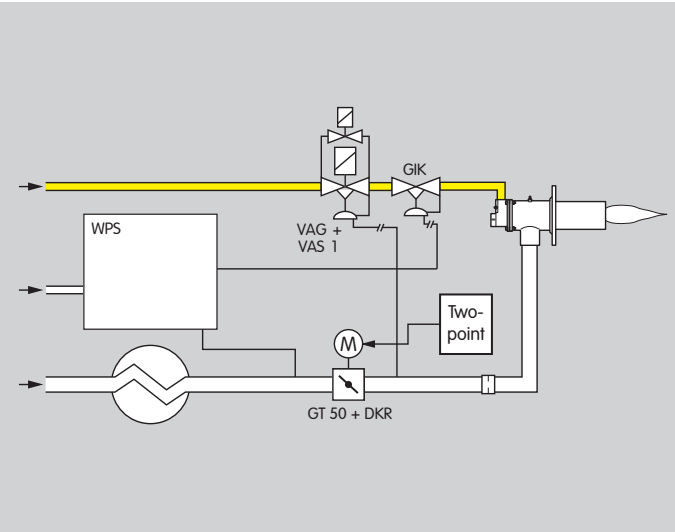
Butterfly valve DKR..H with manual adjustment is used to adjust the high-fire rate.



1.1.2 Adusting the burner output

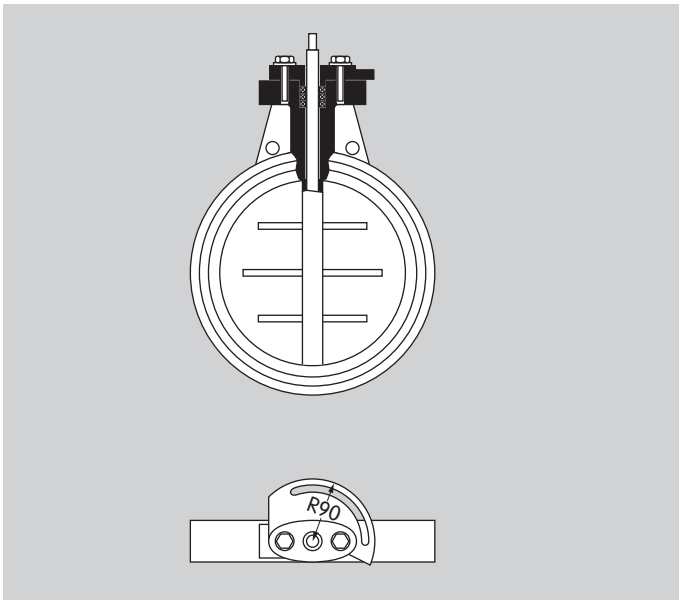
In pneumatic ratio control systems the butterfly valve with mounted gear motor GT 50..E determines the air volume for the required burner output.

Butterfly valve DKR..H with manual adjustment is used to adjust the high-fire rate.



1.1.3 Hot air compensation

Butterfly valve DKR is used on burners that are operated with preheated combustion air at temperatures of up to 650°C.

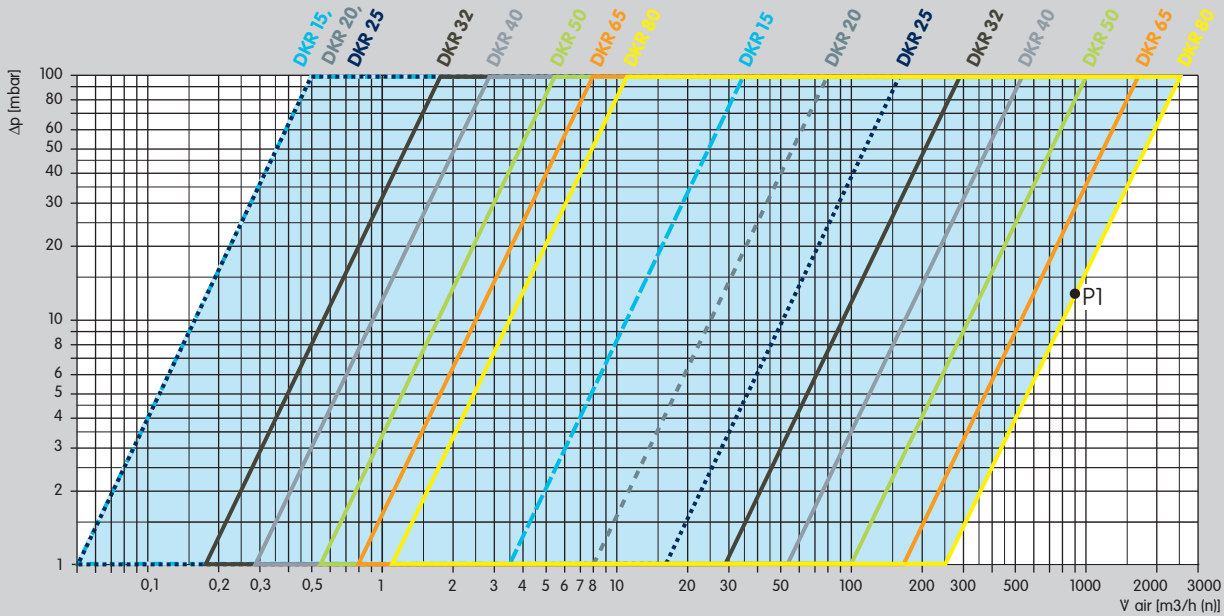


2 Function

The butterfly valve is designed on the basis of the free-flow principle (no deflection of the flow). It releases a cross-section for the flowing medium, depending on a rotary movement between 0 and 90°.

Butterfly valve DKR..D is with disc clearance; butterfly valve DKR..A is equipped with a mechanical stop bar.

3 Flow rate



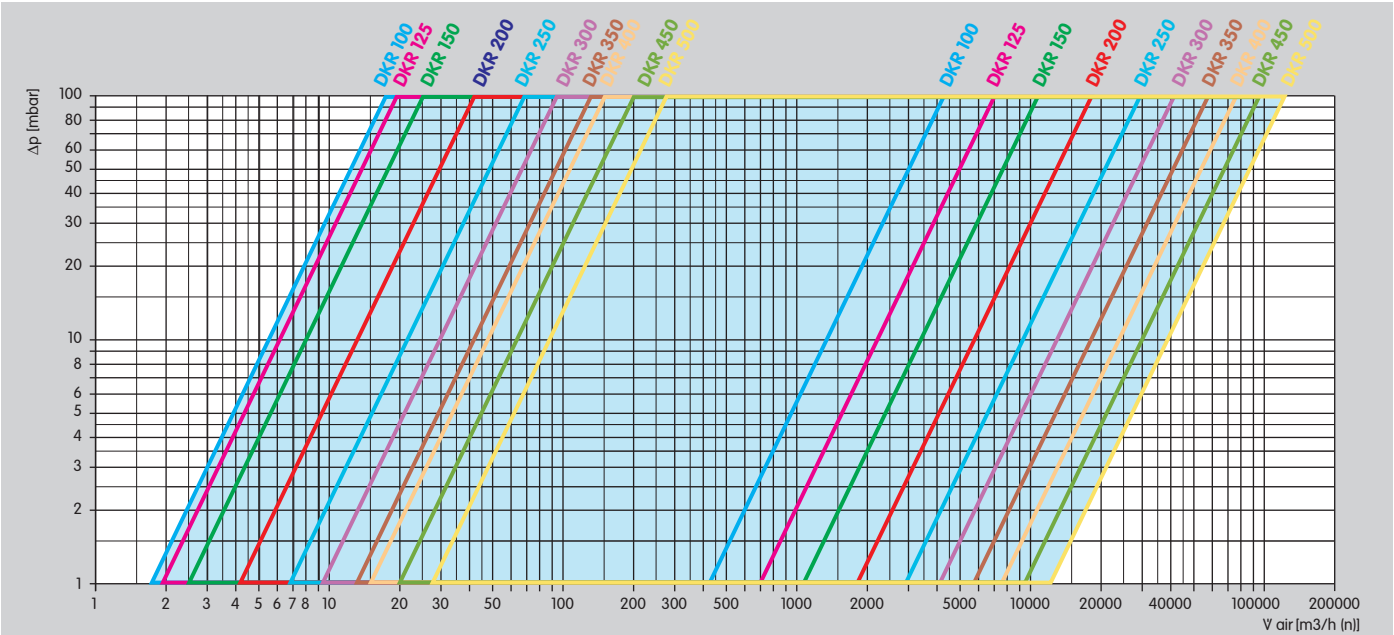
3.1 DKR 15 – 80

The characteristic curves are measured at 15°C with a measurement set-up in accordance with the standards EN 13611/EN 161.

This involves measuring the pressure 5 x DN upstream and downstream of the unit under test. The pressure drop of the pipe is also measured but is not compensated for.

Left curve:
Leakage volume at a 0° opening angle.

Right curve:
Max. flow rate at a 90° opening angle.



3.2 DKR 100 – 500

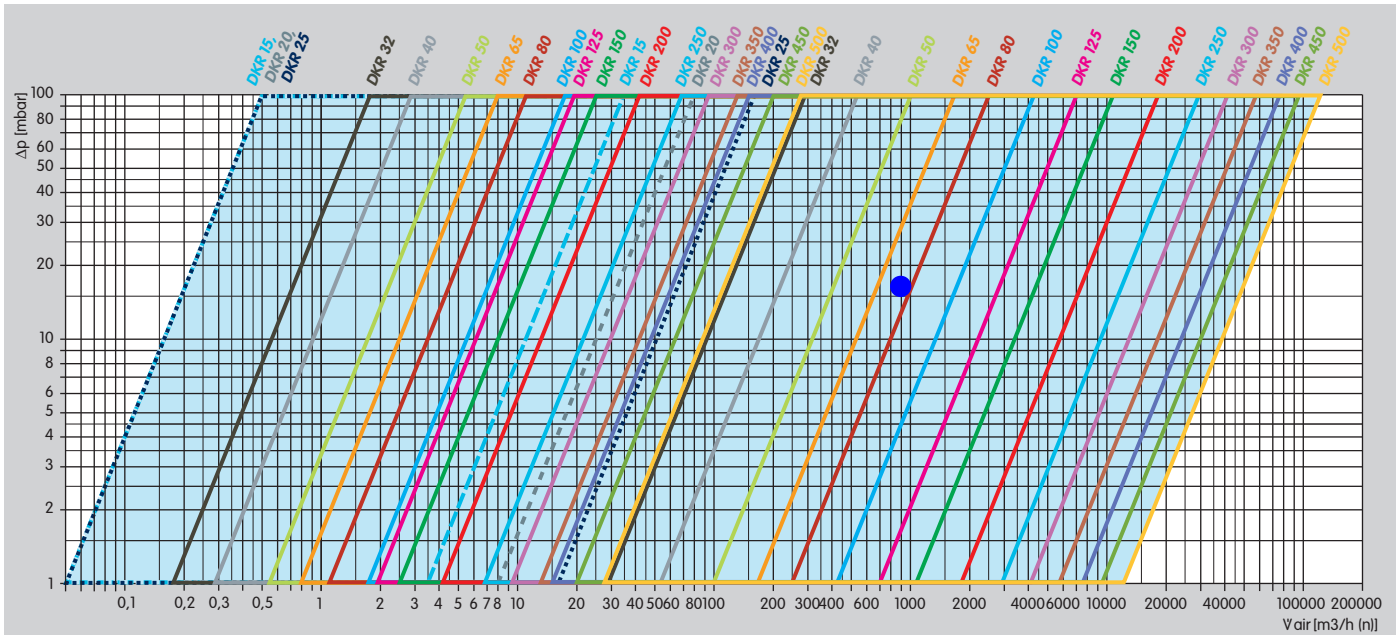
The characteristic curves are measured at 15°C with a measurement set-up in accordance with the standards EN 13611/EN 161.

This involves measuring the pressure 5 x DN upstream and downstream of the unit under test. The pressure drop of the pipe is also measured but is not compensated for.

Left curve:
Leakage volume at a 0° opening angle.

Right curve:
Max. flow rate at a 90° opening angle.

3.3 Interactive calculation of the nominal size



Air	1,29	kg/m3
Flow rate V̇ (standard)	900	m3/h
Outlet pressure p_a	30,0	mbar
$\Delta p_{max.}$	20,0	mbar
Medium temperature	15,0	°C
Flow rate V̇ (operation)	%,3.0f	m3/h

The pipe upstream and downstream of the butterfly valve must be enlarged as the flow velocity exceeds 30 m/s.

Product	Δp [mbar]	α	v [m/s]
DKR 80	16.4	0.4	53
DKR 100	5.5	0.2	32
DKR 125	2.1	0.1	21

3.4 Determining the nominal size

Determining the size of a butterfly valve using the valve authority a for normal operation, see – [Glossary – p. 28].

A valve authority of a = 0.3 provides good control properties.

Select the required nominal size from the flow rate diagram on the basis of the desired flow rate $\dot{V}$ and the calculated Δp.

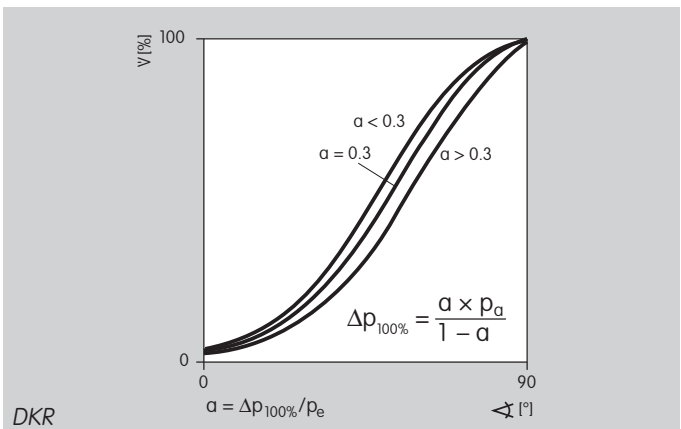
Example

We want to find the nominal size of the butterfly valve DKR for air to be used for modulating control of a gas burner:

Outlet pressure: p_a = 30 mbar

Air flow rate: $\dot{V}$ = 900 $m^3/h_{(n)}$

Valve authority: a = 0.3



$$\Delta p_{100\%} = \frac{0.3 \times 30\ \text{mbar}}{1 - 0.3} = 12.9\ \text{mbar} = 13\ \text{mbar}$$

The flow velocity in the pipes exercises a considerable influence on the pressure loss and the noise development. When designing the butterfly valve, it is recommended that the flow velocity of 30 m/s is not exceeded. A flow rate $\dot{V}$ = 900 $m^3/h_{(n)}$ results in a pipe of DN 100, see – [Flow velocities in pipes – p. 17].

In order to obtain the pressure loss Δp = 13 mbar that has been calculated using the valve authority, valve DKR 80 is selected from the flow rate diagram, see **P1** – [DKR 15 – 80 – p. 8]

If pipe fittings (reducing fittings) are installed in the pipework, the additional pressure loss must be taken into account.

3.5 Determining the nominal size for operation with preheated air

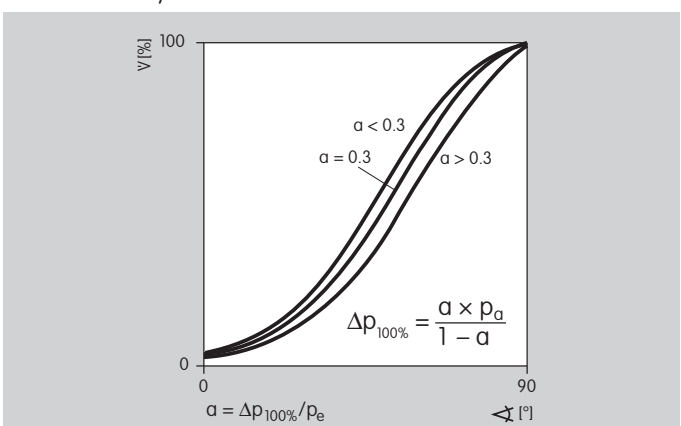
We want to find the nominal size of the butterfly valve DKR to be used for modulating control of a gas burner using preheated air. Once the required pressure loss has been calculated, the butterfly valve will be designed using the k_V value.

Example

Outlet pressure: p_a = 60 mbar
Air flow rate: $\dot{V}$ = 1200 m³/h

Air temperature: 500°C

Valve authority: a = 0.3



The required pressure loss is

$$\Delta p_{100\%} = \frac{0.3 \times 60\ \text{mbar}}{1 - 0.3} = 26\ \text{mbar}$$

The required k_V value is

$$k_V = \frac{\dot{V}_{(n)}}{514} \cdot \sqrt{\frac{\rho_{(n)} \cdot T}{(\Delta p_{Gr} \cdot p_{a\,Gr})}}$$

$$k_V = \frac{1200}{514} \cdot \sqrt{\frac{1.29 \cdot (500 + 273)}{0.026 \cdot (1.013 + 0.06)}}$$

$$k_V = 441$$

Select the DKR with the next largest k_V value from the k_V value table – see [kV values – p. 14]. In this case, select the DKR 100 with a k_V value of 494 m³/h.

With butterfly valve DKR 100, there is an actual pressure loss of

$$\Delta p = \frac{\rho_{(n)} \times T}{p_a} \times \left(\frac{\dot{V}}{k_V \times 514}\right)^2$$

$$\Delta p = \frac{129 \times (500 + 273)}{(1.013 + 0.06)} \times \left(\frac{1200}{494 \times 514}\right)^2$$

$$\Delta p = 21\ \text{mbar}$$

3.6 Calculation formulae

k_V value

$$k_V = \frac{\dot{V}_{(n)}}{514} \cdot \sqrt{\frac{\rho_{(n)} \cdot T}{(\Delta p \cdot p_a)}}$$

Flow rate

$$\dot{V}_{(n)} = k_V \cdot 514 \cdot \sqrt{\frac{(\Delta p \cdot p_a)}{\rho_{(n)} \cdot T}}$$

Pressure loss

$$\Delta p = \frac{\rho_{(n)} \times T}{p_a} \times \left(\frac{\dot{V}}{k_V \times 514}\right)^2$$

Valve authority

$$a = \frac{\Delta p_{100\%}}{p_e}$$

Legend		
$\dot{V}_{(n)}$	[m^3/h]	Standard volumetric flow rate
$\rho_{(n)}$	[kg/m^3]	Gas density in standard state
Δp	[bar]	Pressure loss via control element
p_a	[bar]	Absolute pressure downstream of the control element
p_e	[bar]	Inlet pressure
T	[K]	Absolute temperature of the medium
a	–	Valve authority

3.7 k_V values

	Opening angle	
	0°	90°
DKR 15	0.11	4.0
DKR 20	0.11	9.2
DKR 25	0.11	12.6
DKR 32	0.18	32
DKR 40	0.32	62
DKR 50	0.63	115
DKR 65	0.92	195
DKR 80	1.3	287
DKR 100	2	494
DKR 125	2.3	804
DKR 150	2.8	1260
DKR 200	5	2060
DKR 250	8	3450
DKR 300	11	4820
DKR 350	15	6420
DKR 400	20	8600
DKR 450	24	10800
DKR 500	31	13700

4 Selection

	15	20	25	32	40	50	65	80	100	125	150	200	250	300	350	400	450	500	Z	03	H	F	100	350	450	650	D	A
DKR	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	○

Order example

DKR 250Z03F650D

● = *standard*, ○ = *available*

4.1 Type code

Code	Description
DKR	Butterfly valve for air and flue gas
15–500	Nominal diameter
Z	For fitting between two DIN flanges
03	p_e max. 300 mbar
H	With manual adjustment
F	With free shaft end
	Max. medium temperature [°C]:
100	100
350	350
450	450
650	650
D	With disc clearance
A	With stop bar

5 Project planning information

5.1 Installation

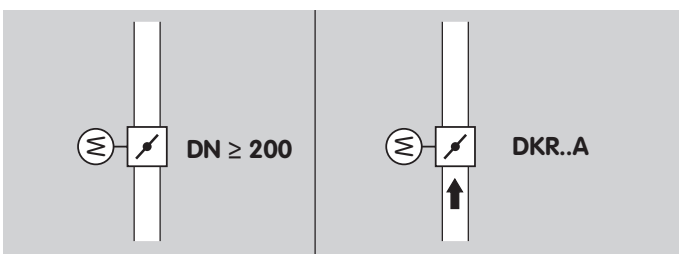
The butterfly valve must be installed in-between two flanges in accordance with EN 1092, PN 16.

The length of the inlet and outlet section should be 5 x DN.

For the design of the pipe, it is advisable not to exceed a flow velocity of 30 m/s, see – [Flow velocities in pipes – p. 17].

Installation position

The unit can be installed in any position.

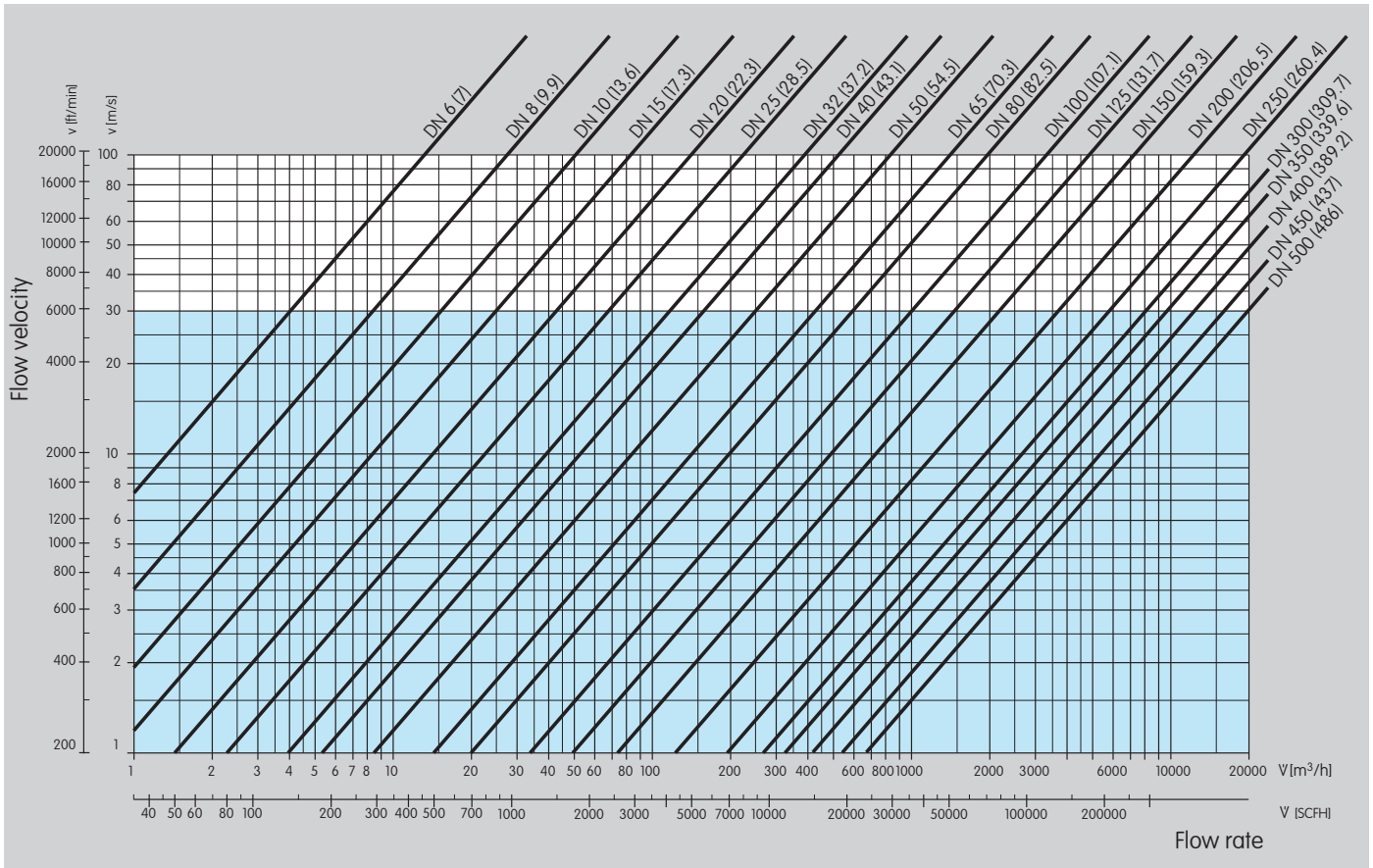


For butterfly valves DKR with a nominal size of DN ≥ 200, we recommend installing the acutator in a vertical pipe. For butterfly valves with stop bars (DKR..A), we recommend installing them in a vertical pipe and selecting the direction of flow from bottom to top in order to prevent dirt accumulating on the stop bar and to ensure that the valve closes tightly.

If the valve is used with hot air, the pipe should be adequately insulated so as to reduce the ambient temperature. The flanges and the butterfly valve DKR must be kept free of insulating material. Install the butterfly valve in such a way that rising hot air does not circulate around the actuator, using the optional attachment set with heat deflector, if required, see – [Heat deflector – p. 23].

In conjunction with the butterfly valve DKR, the actuator can be used for hot air of up to 250°C. When using the attachment set with heat deflector, the actuator can be used in temperatures of up to 650°C.

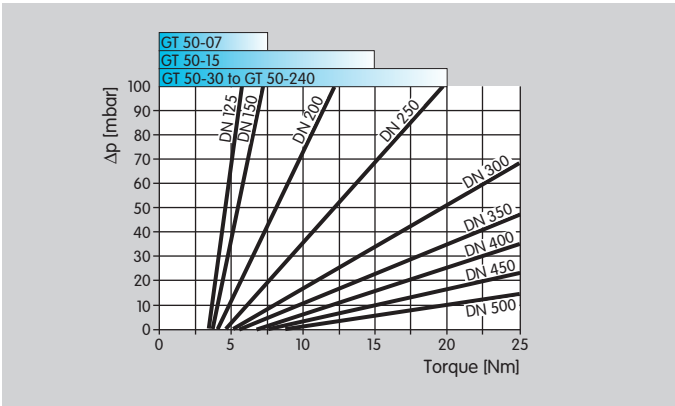
Butterfly valve DKR and gear motor GT 50 are supplied separately or assembled.



5.2 Flow velocities in pipes

It is recommended that flow velocities of 30 m/s are not exceeded when using the valve on thermoprocessing equipment.

The details on the internal diameter correspond to the conventional dimensions for gas pipes as stipulated in the standard EN 10220. Different cross-sections will result in flow velocities that differ correspondingly.



5.3 Actuator running time

Butterfly valve DKR is controlled by gear motor GT 50. The shortest actuator running time per 90° depends on the required torque.

The characteristic curves relate to the maximum torque produced by the flow rate. In general, maximum torque is reached at approx. 70°.

Example:
For butterfly valves DKR 125 or DKR 150, any running time could be used.

The running time is reduced by a factor of 0.83 at a frequency of 60 Hz on the actuator.

6 Accessories

6.1 Attachment set with linkage

With linkage

With linkage, for fitting a gear motor GT 50 to a butterfly valve DKR..D. Fitted or enclosed as an additional item on delivery.

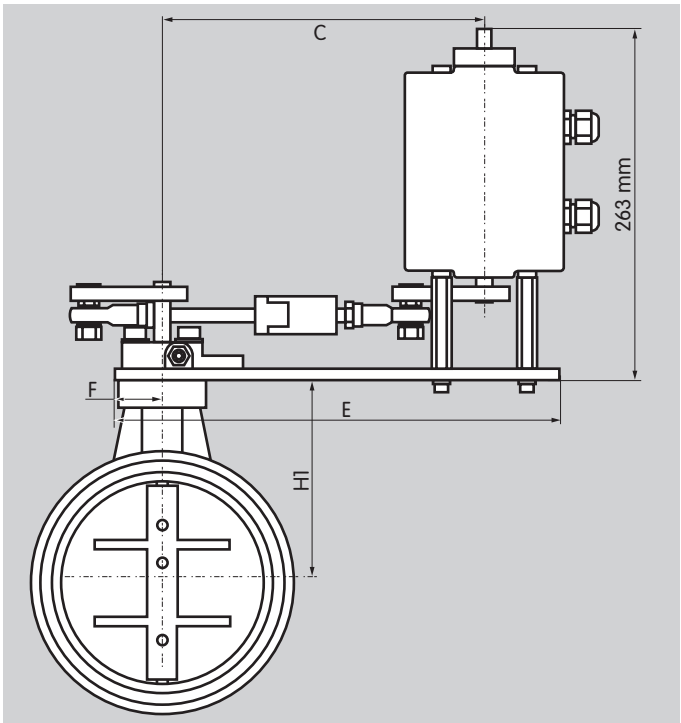
For nominal sizes	Order No.		Weight [kg]
	Enclosed	Fitted	
DN 15 – 20	26501300	26502000	1.5
DN 25 – 50	26501310	26502010	1.6
DN 65 – 100	26501320	26502020	1.7
DN 125	26501330	26502030	1.9
DN 150 – 200	26501340	26502040	1.9
DN 250	26501350	26502050	2.2
DN 300	26501360	26502060	2.2
DN 350	26501370	26502070	2.4
DN 400	26501380	26502080	2.5
DN 450 – 500	26501390	26502090	2.6

With linkage and shock suppressor

With linkage and shock suppressor, for fitting a gear motor GT 50 to a butterfly valve DKR..A. Fitted or enclosed as an additional item on delivery.

For nominal sizes	Order No.		Weight [kg]
	Enclosed	Fitted	
DN 15 – 20	26502350	26501400	1.6
DN 25 – 50	26502360	26501410	1.8
DN 65 – 100	26502370	26501420	1.9
DN 125	26502380	26501430	2.1
DN 150 – 200	26502390	26501440	2.1
DN 250	26502400	26501450	2.4
DN 300	26502410	26501460	2.4
DN 350	26502420	26501470	2.6
DN 400	26502430	26501480	2.7
DN 450 – 500	26502440	26501490	2.8

6.1.1 Dimensions



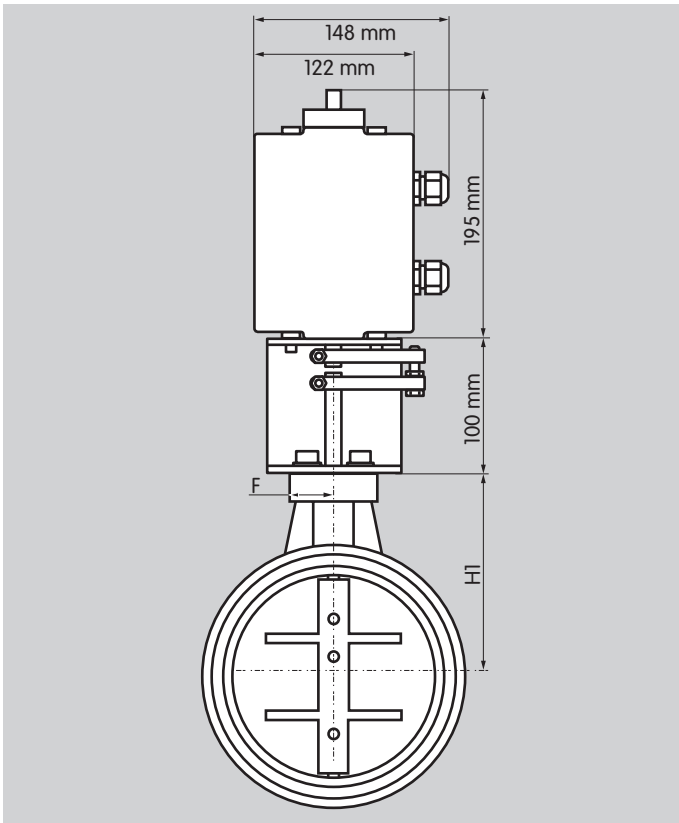
DKR nominal size	Dimensions [mm]			
	C	E	F	H1
DN 15, DN 20	194	285	35	60
DN 25	194	285	35	75
DN 32	194	285	35	80
DN 40	194	285	35	83
DN 50	194	285	35	85
DN 65	194	285	35	95
DN 80	194	285	35	105
DN 100	194	285	35	115
DN 125	239	330	35	135
DN 150	239	330	35	150
DN 200	239	330	35	175
DN 250	294	395	45	220
DN 300	294	395	45	240
DN 350	319	435	60	290
DN 400	350	465	60	335
DN 450	380	495	60	360
DN 500	380	495	60	400

6.2 Attachment set for axial actuator

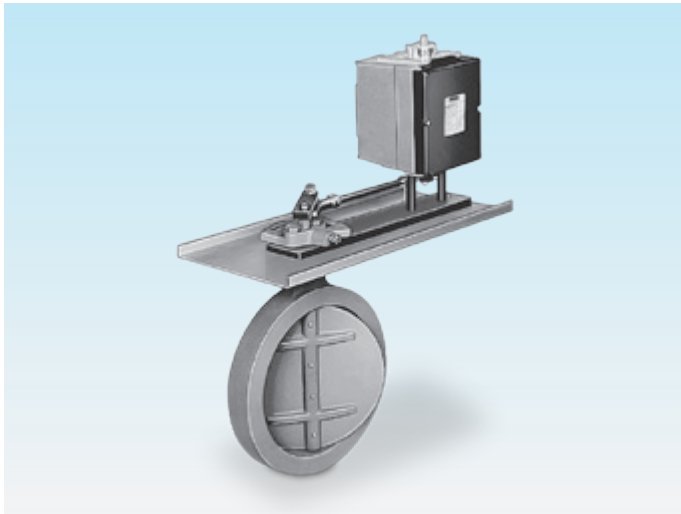
For axial attachment of a gear motor GT 50 to a butterfly valve DKR. Fitted or enclosed as an additional item on delivery.

For nominal sizes	Order No.		Weight [kg]
	Enclosed	Fitted	
DN 15 – 20	26502150	26502600	1.3
DN 25 – 50	26502160	26502610	1.3
DN 65 – 100	26502170	26502620	1.3
DN 125	26502180	26502630	1.3
DN 150 – 200	26502190	26502640	1.3
DN 250	26502200	26502650	1.3
DN 300	26502210	26502660	1.4
DN 350	26502220	26502670	1.4
DN 400	26502230	26502680	1.4
DN 450 – 500	26502240	26502690	1.4

6.2.1 Dimensions



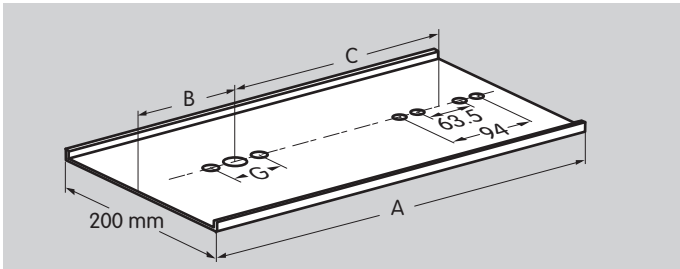
DKR nominal size	Dimensions	
	F	H1
DN 15, DN 20	35	60
DN 25	35	75
DN 32	35	80
DN 40	35	83
DN 50	35	85
DN 65	35	95
DN 80	35	105
DN 100	35	115
DN 125	35	135
DN 150	35	150
DN 200	35	175
DN 250	45	220
DN 300	45	240
DN 350	60	290
DN 400	60	335
DN 450	60	360
DN 500	60	400



Heat deflector on DKR with attachment set and gear motor GT 50

6.3 Heat deflector

Recommended for operation with hot air ≥ 250°C in conjunction with the attachment set with linkage to protect the gear motor GT 50. The ambient temperature on the gear motor must not exceed 60°C.



DKR nominal size	Dimensions [mm]	
	A	B
DN 15 – DN 100	366	70
DN 125 – DN 200	459	127
DN 250, DN 300	566	180
DN 350	619	207
DN 400	673	230
DN 450, DN 500	758	285

Order number: 74921670

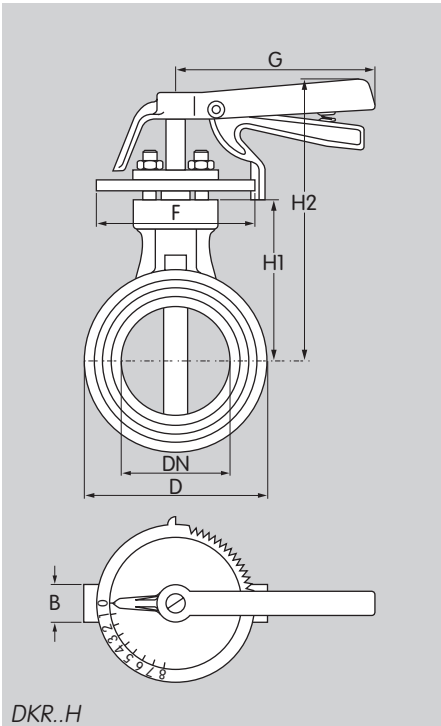
7 Technical data

Gas type: air, flue gas.

Housing material: cast steel, heat-resistant cast iron,
valve disc: steel, cast steel, heat-resistant cast iron,
drive shaft: stainless steel,
seals: free of asbestos.

Inlet pressure p_e: max. 300 mbar.

Medium temperature: -20 to +100°C, +350°C, +450°C, +650°C,
ambient temperature: -20 to +60°C.

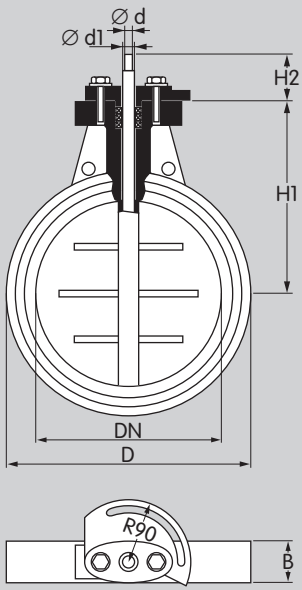


DKR..H

7.1 Dimensions

7.1.1 DKR..H

Type	DN	H1 mm	H2 mm	D mm	B mm	G mm	F mm	Weight kg
DKR 15..H	15	60	125	44	25	105	100	1.14
DKR 20..H	20	60	125	44	25	105	100	1.14
DKR 25..H	25	75	140	60	25	105	100	1.14
DKR 32..H	32	80	145	67	25	105	100	1.4
DKR 40..H	40	83	148	75	25	105	100	1.5
DKR 50..H	50	85	150	85	25	105	100	1.6
DKR 65..H	65	95	160	105	25	120	100	2.2
DKR 80..H	80	105	170	120	30	120	100	2.5
DKR 100..H	100	115	180	140	30	120	100	2.8
DKR 125..H	125	135	205	170	35	150	115	5.0
DKR 150..H	150	150	220	195	40	150	115	6.3
DKR 200..H	200	175	245	255	40	150	115	9.3
DKR 250..H	250	220	305	310	40	150	115	13.9
DKR 300..H	300	240	325	360	45	220	160	22.6
DKR 350..H	350	290	410	415	45	220	160	27
DKR 400..H	400	335	455	465	50	220	160	39
DKR 450..H	450	360	480	520	50	220	160	45
DKR 500..H	500	400	520	620	55	220	160	56



DKR..F

7.1.2 DKR..F

Type	DN	H1 mm	H2 mm	D mm	B mm	d mm	d1 mm	Weight kg
DKR 15..F	15	60	75	44	25	8	8	1.14
DKR 20..F	20	60	75	44	25	8	8	1.14
DKR 25..F	25	75	75	60	25	8	10	1.14
DKR 32..F	32	80	75	67	25	8	10	1.4
DKR 40..F	40	83	75	75	25	8	10	1.5
DKR 50..F	50	85	75	85	25	8	10	1.6
DKR 65..F	65	95	75	105	25	12	12	2.2
DKR 80..F	80	105	75	120	30	12	12	2.5
DKR 100..F	100	115	75	140	30	12	12	2.8
DKR 125..F	125	135	75	170	35	12	12	5.0
DKR 150..F	150	150	75	195	40	12	12	6.3
DKR 200..F	200	175	75	255	40	12	15	9.3
DKR 250..F	250	220	75	310	40	12	15	14
DKR 300..F	300	240	75	360	45	12	20	23
DKR 350..F	350	290	75	415	45	12	25	27
DKR 400..F	400	335	75	465	50	12	30	39
DKR 450..F	450	360	75	520	50	12	30	45
DKR 500..F	500	400	75	620	55	12	30	56

8 Maintenance cycles

Butterfly valve DKR requires little servicing.

We recommend a function check once a year.

9 Glossary

Control characteristic, valve authority

In order for the butterfly valve to be able to influence the flow rate, a proportion of the pressure loss Δp from the entire system has to be caused by the butterfly valve. Since the overall pressure loss Δp should be kept to a minimum, a valve authority a = 0.3 is recommended for the butterfly valve. This means that of the overall pressure loss Δp there is a 30% drop on the fully open butterfly valve.

Hot air compensation

The volume of air increases with the addition of hot air. The oxygen content contained in the air decreases with every m^3. In order to maintain a constant oxygen content, additional air has to be added to the combustion gas.

Feedback

Finally, we are offering you the opportunity to assess this "Technical Information (TI)" and to give us your opinion, so that we can improve our documents further and suit them to your needs.

Clarity

- ○ Found information quickly
- ○ Searched for a long time
- ○ Didn't find information

  What is missing?
- ○ No answer

Comprehension

- ○ Coherent
- ○ Too complicated
- ○ No answer

Scope

- ○ Too little
- ○ Sufficient
- ○ Too wide
- ○ No answer

Use

- ☐ To get to know the product
- ☐ To choose a product
- ☐ Planning
- ☐ To look for information

Navigation

- ○ I can find my way around
- ○ I got "lost"
- ○ No answer

My scope of functions

- ○ Technical department
- ○ Sales
- ○ No answer

Remarks

(Adobe Reader 7 or higher required)

Contact

Elster GmbH
Postfach 2809 · 49018 Osnabrück
Strotheweg 1 · 49504 Lotte (Büren)
Germany
T +49 541 1214-0
F +49 541 1214-370
info@kromschroeder.com
www.kromschroeder.com
www.elster.com

The current addresses of our international agents are available on the Internet:
www.kromschroeder.com → Sales

Kromschröder, a product brand of the Elster Group

03250551