GESTRA Steam Systems

Product Range A4

Control Valve with Radial Stage Nozzle
ZK 29
PN 160
DN 25, 50, 80, 100, 150 mm (1, 2, 3, 4, 6")

ZK 29

Description

Control valve for operation at high differential pressures.

Application, for example, in industrial plants and power stations as

- Injection-cooling valve
- Warm-up valve
- Drain valve
- Continuous blowdown valve
- Feedwater control valve
- Leak-off valve
- Steam control valve

The pressure drop is decreased in the radial stage nozzle in several stages, so that the flow velocity is reduced leading to a considerable reduction in wear and noise (sound level 80 dB (A)).

Straight-through valve with yoke, spindle with plug and radial stage nozzle. On request also available as angle valve.

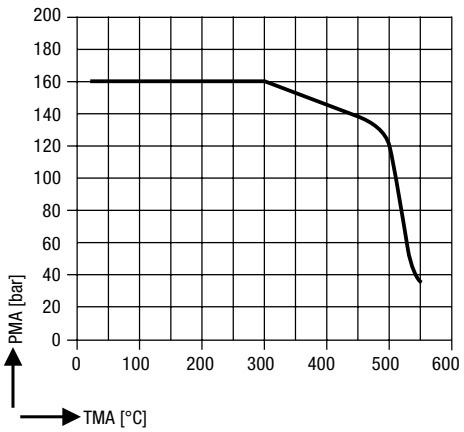
Internals (incl. seat) completely exchangeable. Leak rates in accordance with DIN 3230 BO 1.

Optional items:

- Inlet of sealing fluid
- Self-tightening stuffing box
- Adjustable lift limitation in the closing direction
- Sample valve

Pressure / Temperature Rating				
PMA (Maximum allowable pressure)	[barg]	160	100	62
	[psig]	2320	1450	900
TMA (Maximum allowable temperature)	[°C]	300	510	530
	[°F]	572	950	985
∆ PMX (Maximum differential pressure)	[bar]	100		
	[psi]	1450		

Differential pressure = **inlet** pressure minus **outlet** pressure



Materials	
Body DN 25, 50	forged alloy steel 13 CrMo 4 4 (DIN No.1.7335)
Body DN 80, 100, 150	cast steel GS-17 CrMo 5 5 (1.7357)
Spindle	stainless steel X 35 CrMo 17 (1.4122)
Valve plug and seat	stainless steel X 90 CrMoV 18, tempered (1.4112)

On request, at extra cost butt-weld ends of other materials and dimensions by welding of pipe ends.

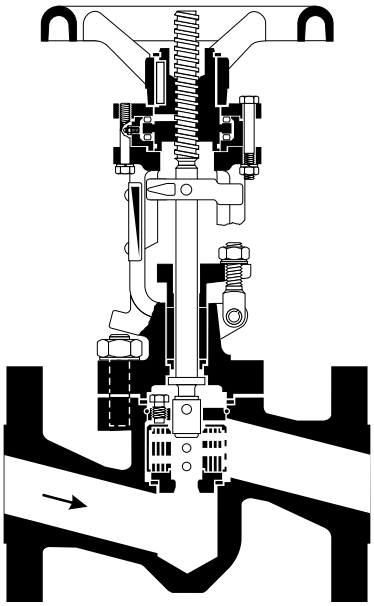
The control valve is suited for the following actuators:

1. ZK 29/01
   Manual operation, not convertible
   (only DN 25 – 80)
2. ZK 29/13
   Electric linear actuator
3. ZK 29/14 **(Standard)**
   Design with insert bush for fitting an electric rotary actuator or a handwheel
4. ZK 29/20
   Pneumatic diaphragm actuator
5. ZK 29/30
   Lever without quarter-turn actuator fitted
6. ZK 29/31
   Lever for fitting a quarter-turn actuator

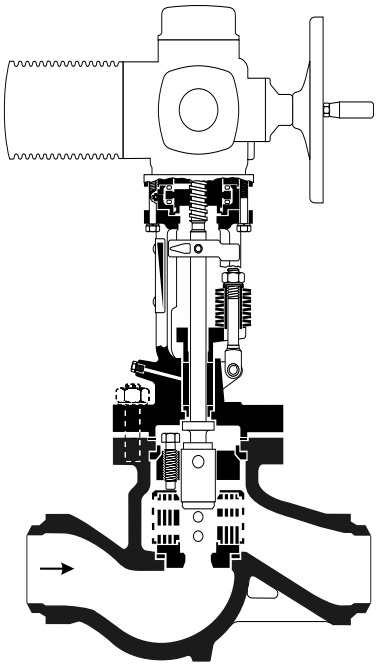
Connections

Butt-weld ends **(Standard)**
Flanges to DIN, PN 160 (BS 4504, table 160); on request flanges with dimensions to PN 40, 63 or 100, overall length, however ≙ PN 160.

Special connections on request.

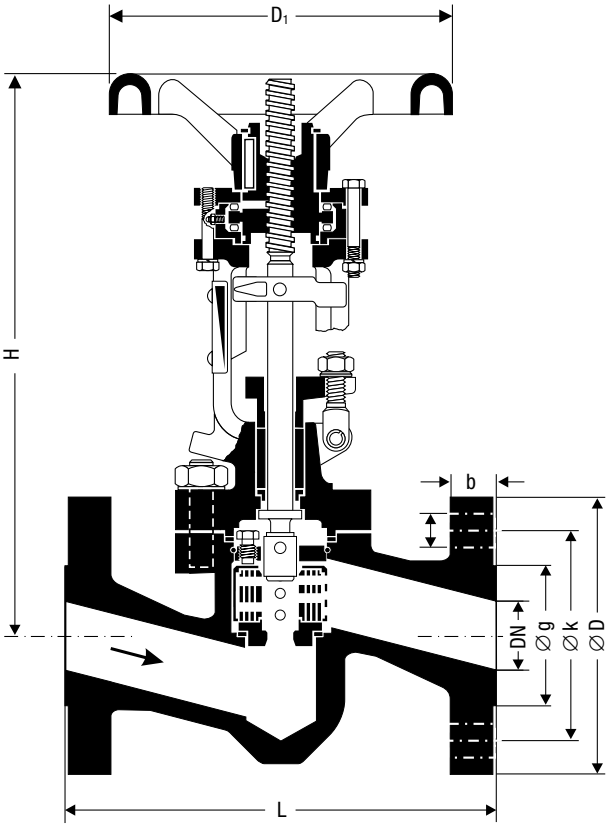


ZK 29/14, DN 25 mm (1")
with flanged ends

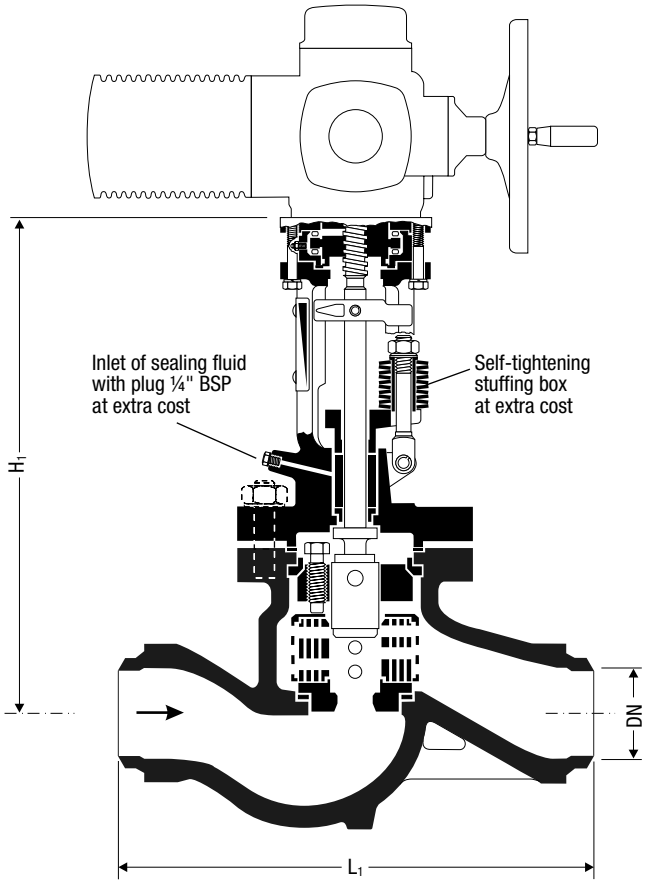


ZK 29/14, DN 80 mm (3")
with butt-weld ends and lift restriction

Dimensions

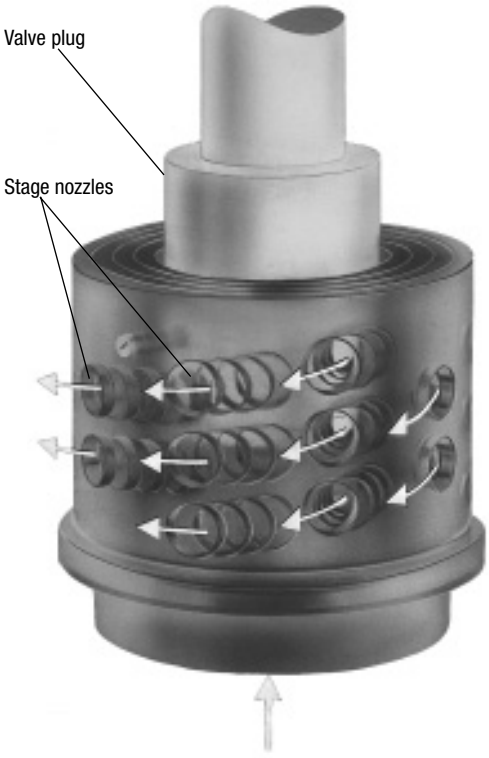


ZK 29/14, with handwheel
DN 50 mm (2")



ZK 29/14, with electric rotary actuator
DN 80 mm (3")

DN		[mm]	25	50	80	100	150
		[in]	1	2	3	4	6
Dimensions in mm		L	230	300	380	430	550
		H	325	390	480	630	740
		H_1	270	320	405	540	660
		D_1	125	200	200	320	500
Flange measurements im mm (PN 160)		D	140	195	230	265	355
		b	24	30	36	40	50
		k	100	145	180	210	290
		g	68	102	138	162	218
		l	18	26	26	30	33
Number of bolts			4	4	8	8	12
Butt-weld ends for pipe (DIN 3239-R4)			33.7x3.2	60.3x4	88.9x6.3	114.3x8	168.3x12.5
Approx. weight ZK 29/14	flanges	[kg]	16.5	33.5	63	120	215
	butt-weld ends	[kg]	12.5	25.5	50	100	180
	handwheel	[kg]	0.5	1.6	1.6	6	15

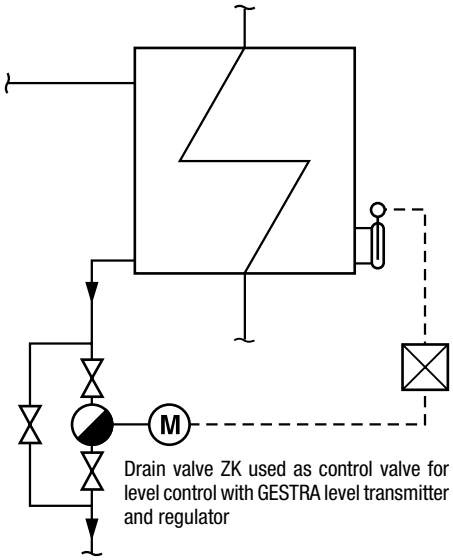


Radial stage nozzle as control unit

k_{vs} values
Selection of Actuator

DN	Characteristic	K_{vs} [m³/h]			Valve stroke [mm]	Revolutions for full stroke of valve	Max. admiss. torque for opening/closing [Nm]	Type/size of actuator DIN ISO 5210
25 (1")	linear	0.7	1.4	2.1	16	4	20	B1 – F10
25 (1")	equal-percentage	0.7	1.4	2.1	16	4	20	B1 – F10
50 (2")	linear	3	6	9	33	8.3	60	B1 – F10
50 (2")	equal-percentage	3	5.5	8	33	8.3	60	B1 – F10
80 (3")	linear	14	21	28	45	11.3	60	B1 – F10
80 (3")	equal-percentage	9	15	21	45	11.3	60	B1 – F10
100 (4")	linear	20	33	46	60	12	95	B1 – F10
100 (4")	equal-percentage	15	25	35	60	12	95	B1 – F10
150 (6")	linear	70	100	130	90	15	215	B1 – F14
150 (6")	equal-percentage	60	85	110	90	15	215	B1 – F14

Example of Application



Drain valve ZK used as control valve for level control with GESTRA level transmitter and regulator

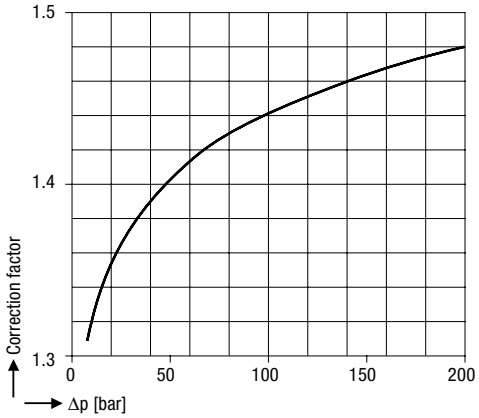
Calculation of required k_v value*)

1. For water flowrates within temperature ranges where flashing because of pressure drop is not to be expected (e. g. leak-off and injection-cooling valves) the calculated k_v value has to be multiplied by a correction factor taken from the chart below due to the successive expansion. The chart includes a safety factor of 1.2.
2. If, due to the pressure drop, flashing is to be expected, the formulae below should not be used to calculate the k_v value. In this case see overleaf for hot water capacity charts. If $p_2/p_1 > 0.5$ multiply the chart reading by the correction factor K taken from the backpressure chart below. The safety factor of 1.2 must always be taken into consideration.
3. For steam the calculated k_v value has to be multiplied by a safety factor of 1.2.

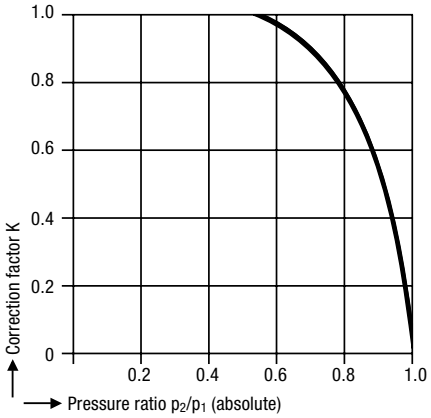
Pressure drop	k_v	for liquids		for gas, temperature-corrected	for vapours	for saturated and wet steam
$\Delta p < \frac{p_1}{2}$ $\left(p_2 > \frac{p_1}{2}\right)$	k_v	$= \frac{\dot{V}}{31.6}\sqrt{\frac{\rho_1}{\Delta p}}$	$= \frac{\dot{m}}{31.6\sqrt{\rho_1 \cdot \Delta p}}$	$= \frac{\dot{V}_N}{514}\sqrt{\frac{\rho_N \cdot T_1}{\Delta p \cdot p_2}}$	$= \frac{\dot{m}}{31.6}\sqrt{\frac{v}{\Delta p}}$	$= \frac{\dot{m}}{31.6}\sqrt{\frac{v \cdot x}{\Delta p}}$
$\Delta p > \frac{p_1}{2}$ $\left(p_2 < \frac{p_1}{2}\right)$	k_v			$= \frac{2\,\dot{V}_N}{514 \cdot p_1}\sqrt{\rho_N \cdot T_1}$	$= \frac{\dot{m}}{31.6}\sqrt{\frac{2\,v}{p_1}}$	$= \frac{\dot{m}}{31.6}\sqrt{\frac{v \cdot x \cdot 2}{p_1}}$

***) Conversion Factors:** C_v (U.S.) = 1.17 · k_v
C_v (U.K.) = 0.98 · k_v

Correction factor for water flowrates (without flashing)



Back pressure chart



Nomenclature:

k_v	Valve flow coefficient for fully open valve within control range	[m³/h]
$\dot{V}$	Flowrate	[m³/h]
$\dot{m}$	Flowrate	[kg/h]
$\dot{V}_N$	Volume flowrate for gases at standard state (0 °C, 1013 mbar)	[m³/h]
p_1	upstream pressure	[bar a]
p_2	downstream pressure	[bar a]
Δp	pressure drop $p_1 - p_2$	[bar]
ρ_1	density of fluid with operating condition at T_1 and p_2	[kg/m³]
ρ_N	density of gases at standard state (0 °C, 1013 mbar)	[kg/m³]
V	specific steam volume at T_1 and p_2 or – if $\Delta p > \frac{p_1}{2}$ – at $\frac{p_1}{2}$	[m³/kg]
T_1	absolute inlet temperature of fluid	[K]
x	Content of dry saturated steam in wet steam	$(0 < x \leq 1)$

Control Valve with Radial Stage Nozzle

ZK 29
PN 160; DN 25, 50, 80, 100, 150 mm (1, 2, 3, 4, 6")

Capacity Charts

The charts indicate the maximum capacities of hot and cold water (condensate) the valve can discharge in continuous operation with the spindle in the utmost control position and linear characteristic.
Within their control range the valves (in all sizes) have a linear characteristic. For special operating conditions the adjustment of the radial stage nozzle can be modified to obtain different k_{vs} values and consequently flowrates varying from those indicated in the charts opposite. The linear characteristic is, however, maintained.
It is also possible the change the lift-flowrate characteristic from linear to equal-percentage by repositioning nozzle rings.

Order and Enquiry Specifications

GESTRA Control valve with radial stage nozzle ZK 29

Design data: p = . . . bar t = . . . °C

Operational data: Load Conditions

	1	2	3
p_1 [bar]			
t_1 [°C]			
p_2 [bar]			
Δp [bar]			
$\dot{m}$ [t/h]			

(Please enter data)

Fluid: .....

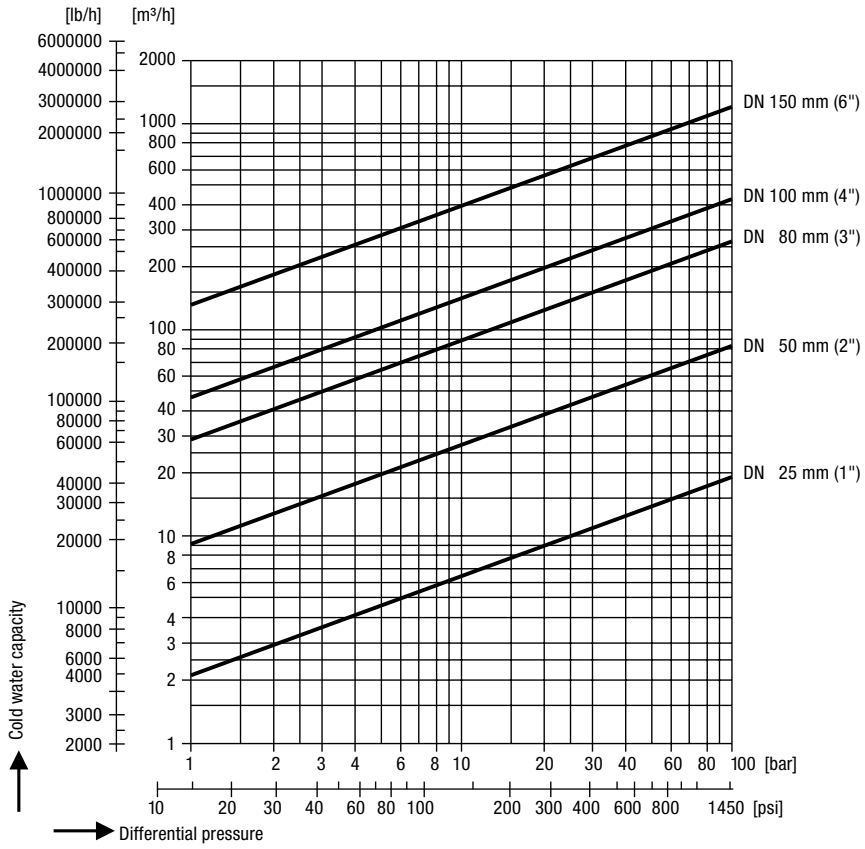
Actuators: Electric (make)
on-off or modulating control
Voltage/Hz
Control voltage/Hz

Pneumatic (make)
Spring to open ☐
Spring to close ☐
Handwheel yes/no
Positioner yes/no

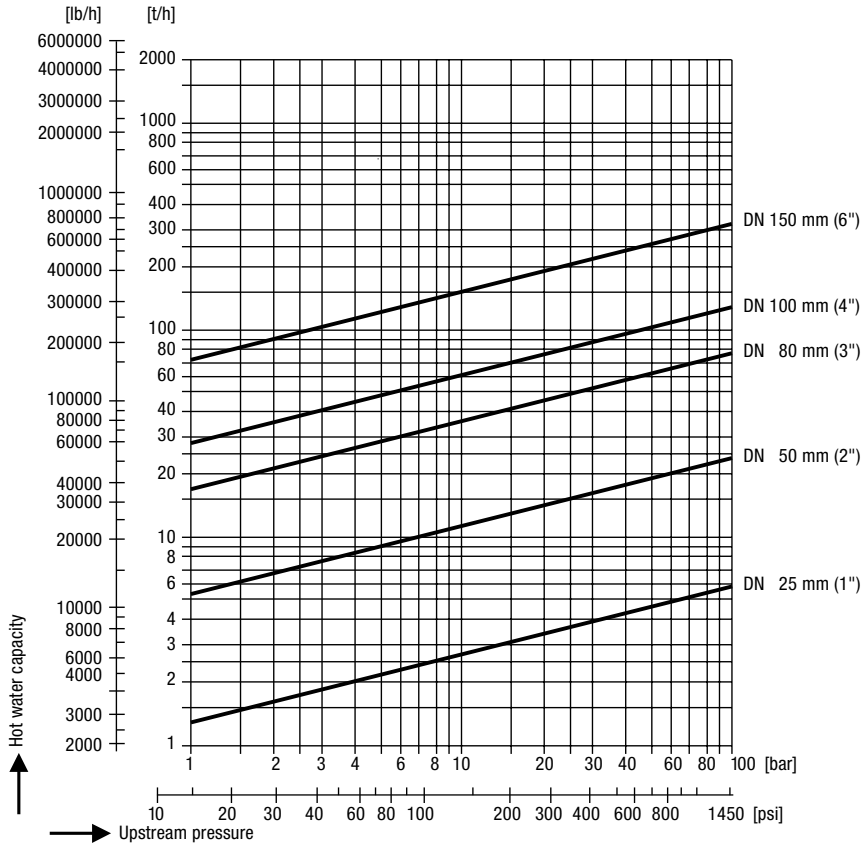
The following test certificates can be issued on request, at extra cost:
In accordance with EN 10204-2.1, -2.2, -3.1A, -3.1B and -3.1C.
All inspection requirements have to be stated with the order. After supply of the equipment certificates can no longer be established. Charges and extent of the above mentioned certificates as well as the different tests confirmed therein are listed in our leaflet “Test and Inspection Charges for Standard Equipment”. For other tests and inspections than those listed above, please consult us.

Supply in accordance with our general terms of business.

Cold water



Hot water
t_s – 5 K



GESTRA AG
P. O. Box 10 54 60, D-28054 Bremen
Münchener Str. 77, D-28215 Bremen
Telephone +49 (0) 421 35 03 - 0, Fax +49 (0) 421 35 03 - 393
E-Mail gestra.ag@flowserve.com, Internet www.gestra.de

FLOWSERVE GESTRA

810514-03/505c · © 1999 GESTRA AG · Bremen · Printed in Germany