



GESTRA®
Control Valve
with Radial Stage Nozzle
ZK 210



Issue Date: 6/00

Control Valves
PN 250
DN 25, 50, 80 mm
(1, 2, 3")
ZK 210

A4

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

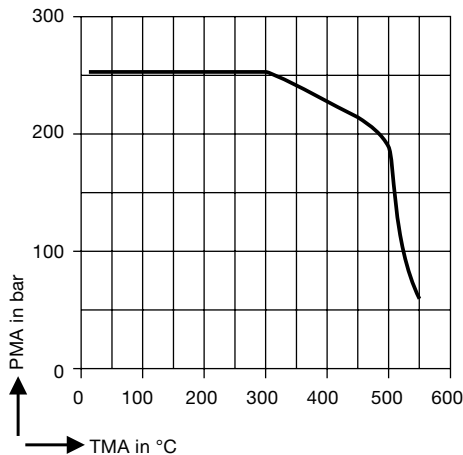
The pressure drop is decreased in the radial stage nozzle in several stages, so that the flow velocity is reduced leading to a considerable reduction in wear and noise (sound level 80 dB (A)).

Straight-through valve (DN 25, 50 mm (1, 2")) or angle valve (DN 80 mm (3")) with yoke, spindle with plug and radial stage nozzle.

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

Pressure/Temperature Rating				
PMA (Maximum allowable pressure)	[barg] [psig]	250 3625	217 3145	54 785
TMA (Maximum allowable temperature)	[°C] [°F]	300 572	450 842	550 1022
ΔPMX (Maximum differential pressure)		3 stages:		
		100 bar (1450 psi)		
		4/5 stages:		
		180 bar (2610 psi)		

Differential pressure = inlet pressure minus outlet pressure



Materials	
Body	forged alloy steel 13 CrMo 4 4 (DIN No. 1.7335*)
Valve seat	3 stages: S.S. X90 CrMoV 18 (1.4112) 4/5 stages: S.S. X35 CrMo 17 (1.4122)
Valve spindle and plug	S.S. X35 CrMo 17 (1.4122)

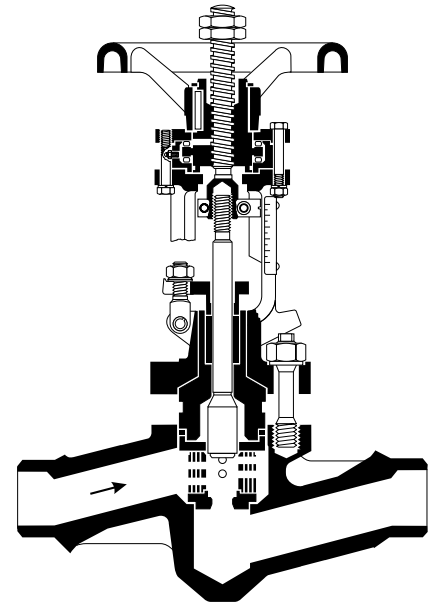
*) On request, at extra cost butt-weld ends of other materials and dimensions by welding of pipe ends.

The following actuators can be fitted to the valve:

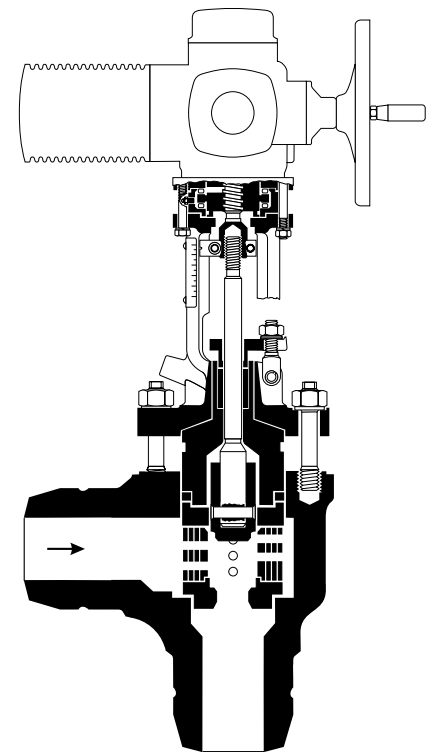
1. ZK 210/01
Manual operation, not convertible for electric rotary actuators (only DN 25 and DN 50)
2. ZK 210/13
Electric linear actuator
3. ZK 210/14 (standard)
Design with insert bush F10-B1 for fitting an electric rotary actuator or a handwheel.
4. ZK 210/20
Pneumatic diaphragm actuator

Connections

Butt-weld ends (standard)
 Special end connections on request.

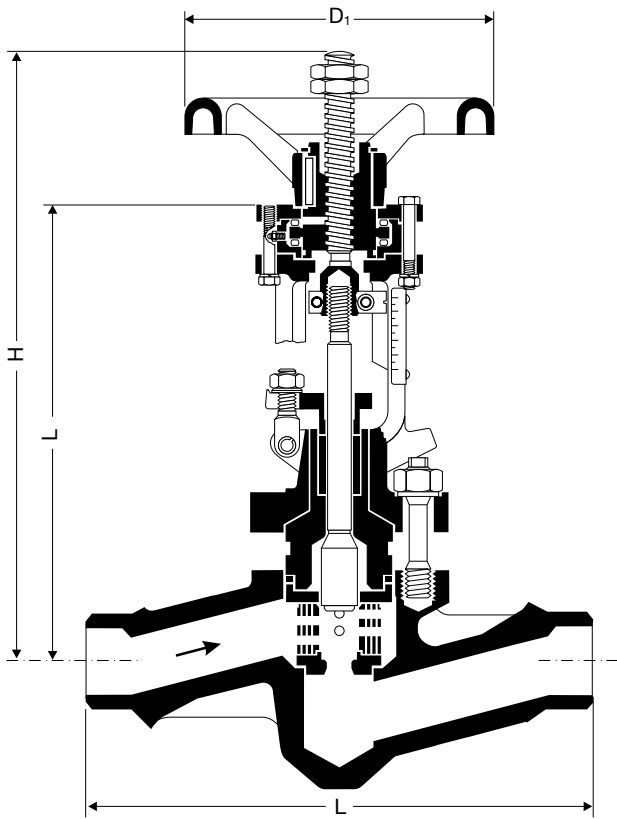


ZK 210/14, DN 50 mm (2")
with butt-weld ends

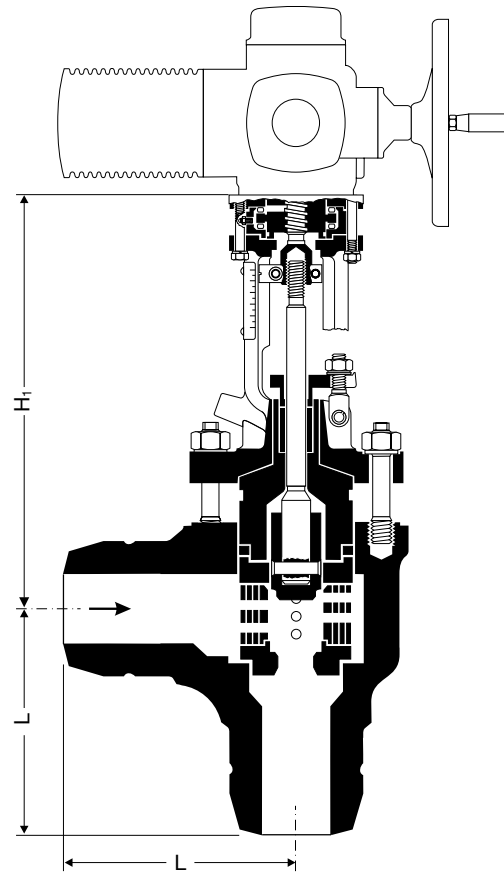


ZK 210/14, DN 80 mm (3")
with butt-weld ends

Dimensions

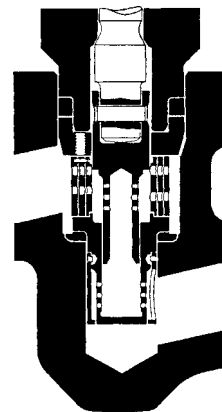


ZK 210/14 with handwheel
DN 25, 50 mm (1, 2")



ZK 210/14,
DN 80 mm (3")
with electric rotary actuator

DN	[mm]	25	50	80
	[in]	1	2	3
Dimensions in mm	L	230	300	225
	H	384	455	535
	H ₁	287	345	375
	D ₁	200	200	320
Butt-weld ends for pipe		33.7x3.6	60.3x6.3	101.6x11
Approx. weight for design ZK 210/14	[kg]	12	25	60
	handwheel [kg]	1.6	1.6	6



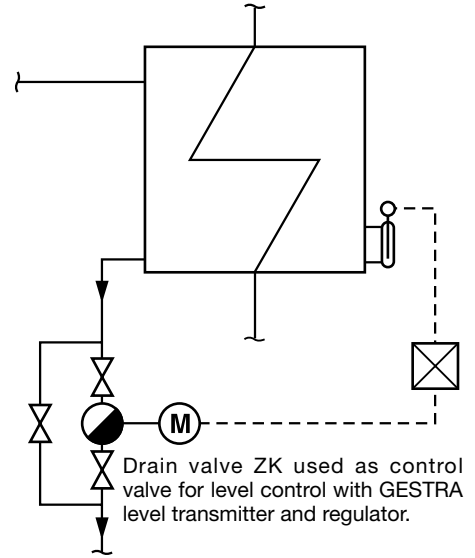
ZK 210, DN 50 mm (2")
5 stages

k_{vs} values
Selection of Actuator

DN	Nozzle*)	Characteristic	K _{vs}			Valve stroke [mm]	Rev./stroke	Max. admis. torque for opening/closing [Nm]	Type/size of actuator DIN ISO 5210
			[m ³ /h]						
25 (1")	3 stages	linear	0.8	1.5	2.3	18	3.6	20/20	B1-F10
25 (1")	3 stages	equal-percentage	0.8	1.5	2.3	18	3.6	20/20	B1-F10
25 (1")	4 stages	linear	0.5			13	2.6	20/20	B1-F10
50 (2")	3 stages	linear	3.3	6.5	10	35	7	30/60	B1-F10
50 (2")	3 stages	equal-percentage	3	6	9	35	7	30/60	B1-F10
50 (2")	5 stages	linear	2			23	4.6	30/60	B1-F10
80 (3")	3 stages	linear	9.5	18	28	50	10	80/120	B1-F10
80 (3")	3 stages	equal-percentage	8.5	18	25	50	10	80/120	B1-F10
80 (3")	5 stages	linear	5			35	7	80/120	B1-F10

*) 3 stages: Δp_{max} = 100 bar (1450 psi) (standard) 4/5 stages: Δp_{max} = 180 bar (2610 psi)

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*)

- 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.
- 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 p₂/p₁ > 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.
- For steam the calculated k_v value has to be multiplied by a safety factor of 1.2.

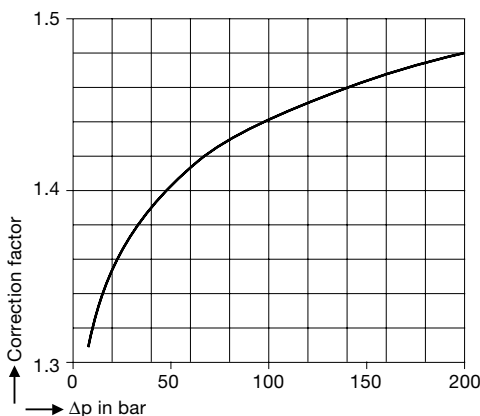
Pressure drop	k _v	for liquids	for gas, temperature-corrected	for vapours	for saturated and wet steam
$\Delta p < \frac{p_1}{2}$ $(p_2 > \frac{p_1}{2})$	k _v	$= \frac{\dot{V}}{31.6} \sqrt{\frac{\rho_1}{\Delta p}}$	$= \frac{\dot{V}_N}{514} \sqrt{\frac{\rho_N \cdot T_1}{\Delta p \cdot p_2}}$	$= \frac{\dot{m}}{31.6}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

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

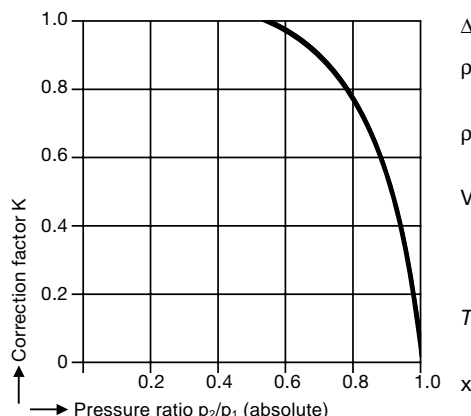
Nomenclature:

- 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]
- p₁ Upstream pressure [bar a]
- p₂ Downstream pressure [bar a]
- Δp Pressure drop p₁ - p₂ [bar]
- ρ₁ Density of fluid with operating condition at T₁ and p₂ [kg/m³]
- ρ_N Density of gases at standard state (0°C, 1013 mbar) [kg/m³]
- V Specific steam volume at T₁ and p₂ or - if Δp > $\frac{p_1}{2}$ - at $\frac{p_1}{2}$ [m³/kg]
- T₁ Absolute inlet temperature of fluid [K]
- x Content of dry saturated steam in wet steam (0 < x ≤ 1)

Correction factor for water flowrates (without flashing)



Backpressure chart



A₄

**Control Valves
PN 250
DN 25, 50, 80 mm
(1, 2, 3")**

ZK 210



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Flow Control Division

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 to 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 210

Design data: $p = \dots \text{bar}$ $t = \dots ^\circ\text{C}$

Operational data: Load Conditions

	Min.	Normal	Max.
	within control range		
p_1 [bar]			
t_1 [°C]			
p_2 [bar]			
Δp [bar]			
\dot{m} [t/h]			

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:

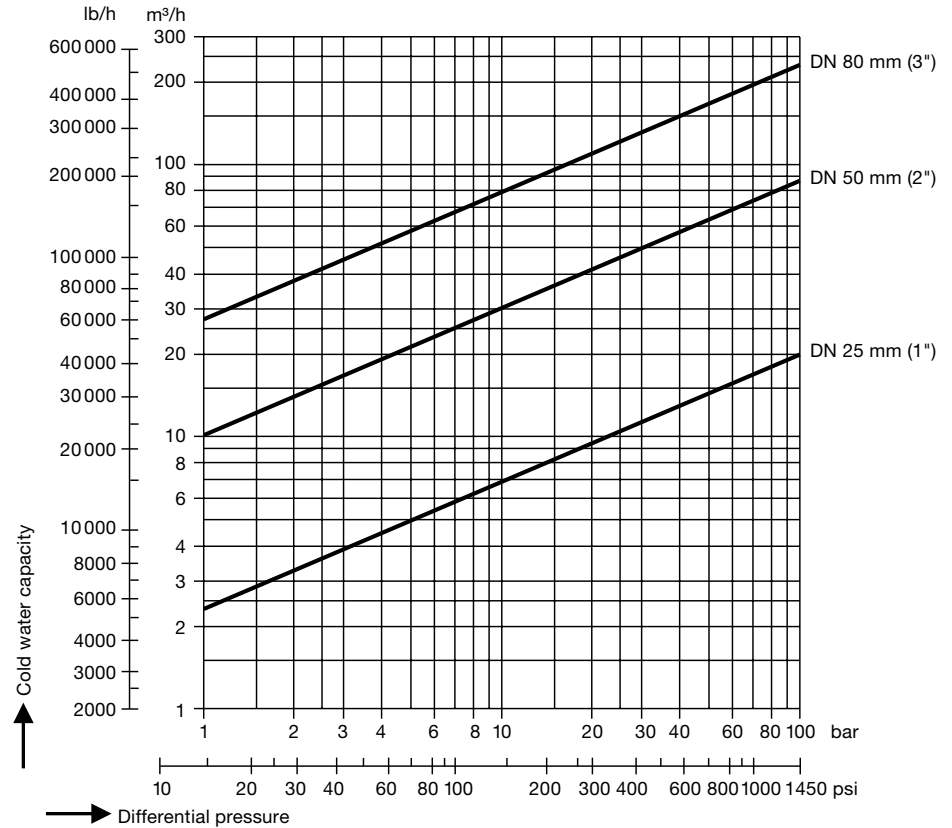
In accordance with EN 10204-2.1, -2.2, -3.1A, -3.1B and -3.1C.

All inspection requirements have to be stated with the order. After supply of the equipment certificates cannot be established. For tests and inspection charges please consult us.

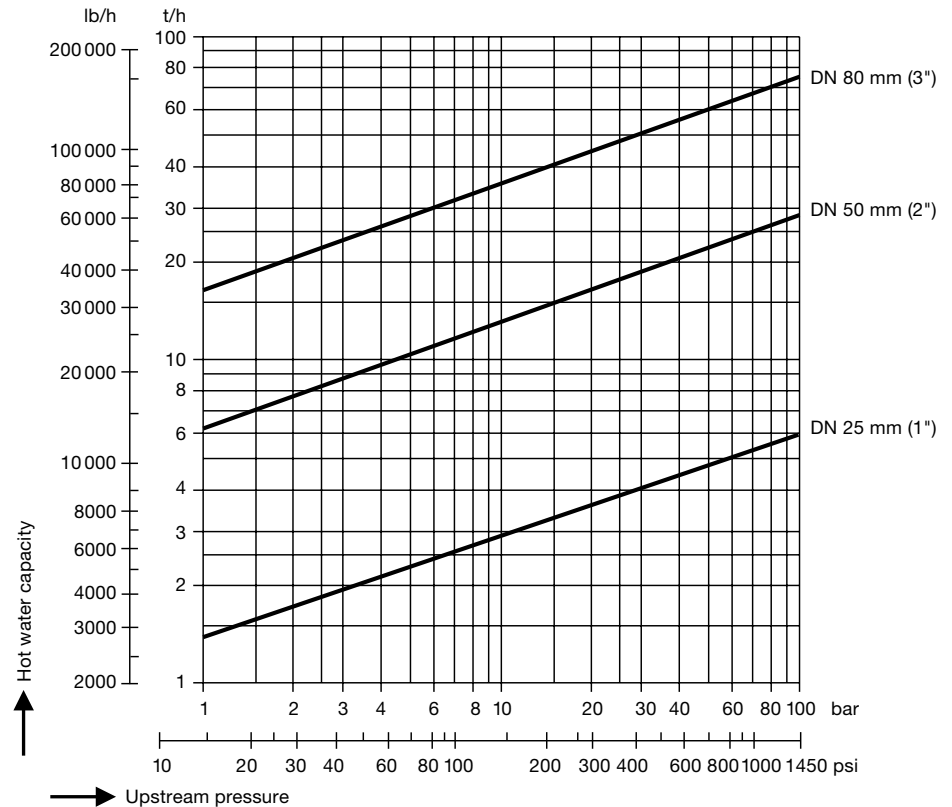
Supply in accordance with our general terms of business.

Technical modifications reserved.

Cold water



Hot water $t_s - 5K$



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