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")

A4

ZK 210

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

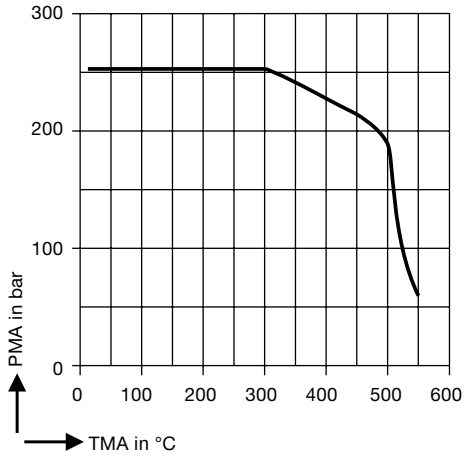
The pressure drop is decreased in the radial stage nozzle in several stages, so that the flow velocity is reduced leading to a considerable reduction in wear and noise (sound level 80 dB (A)).

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 BO1.

Pressure/Temperature Rating			
PMA (Maximum allowable pressure) [barg]	250	217	54
[psig]	3625	3145	785
TMA (Maximum allowable temperature [°C]	300	450	550
[°F]	572	842	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. X 90 CrMoV 18 (1.4112) 4/5 stages: S.S. X 35 CrMo 17 (1.4122)
Valve spindle and plug	S.S. X 35 CrMo 17 (1.4122)

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

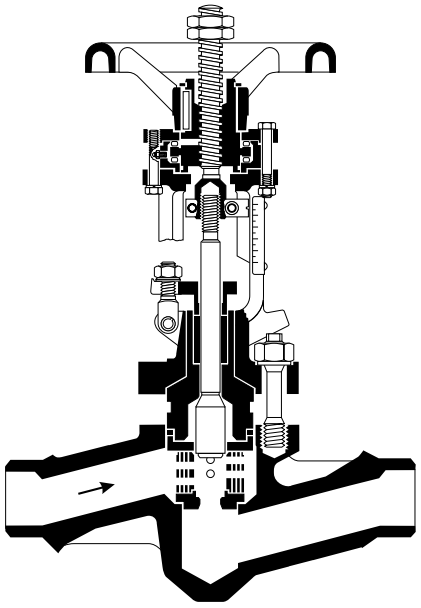
The following actuators can be fitted to the valve:

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

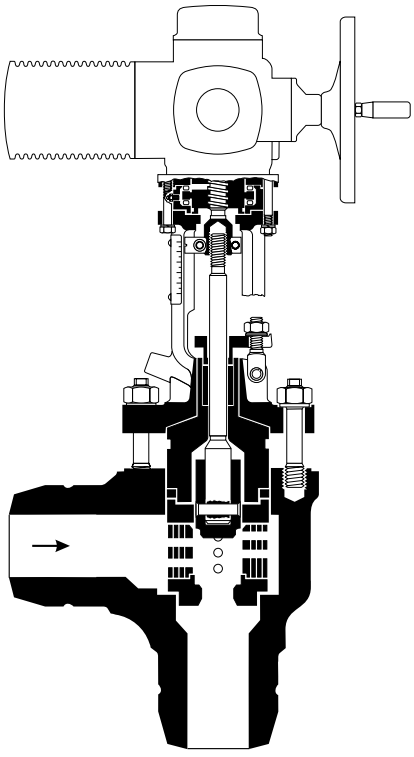
Connections

Butt-weld ends **(standard)**

Special end connections on request.

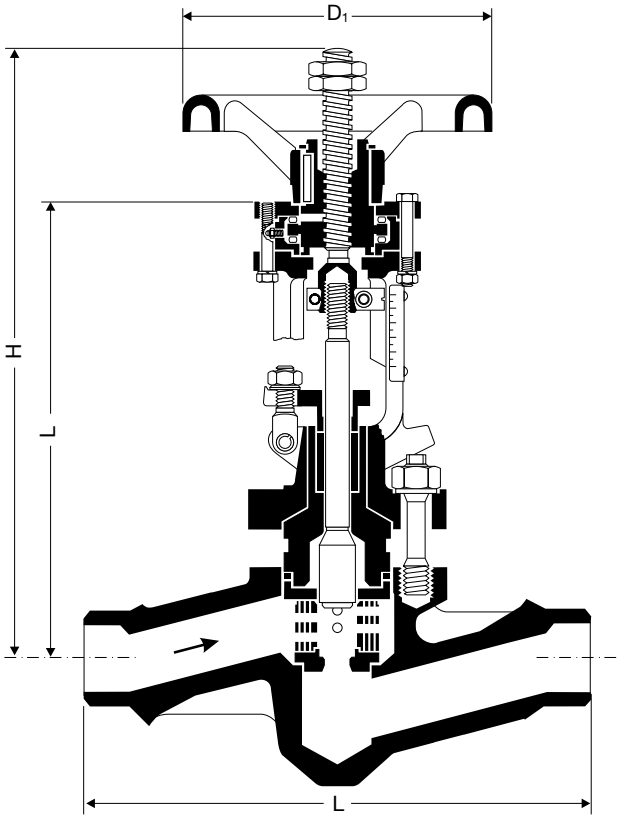


ZK 210/14, DN 50 mm (2") with butt-weld ends

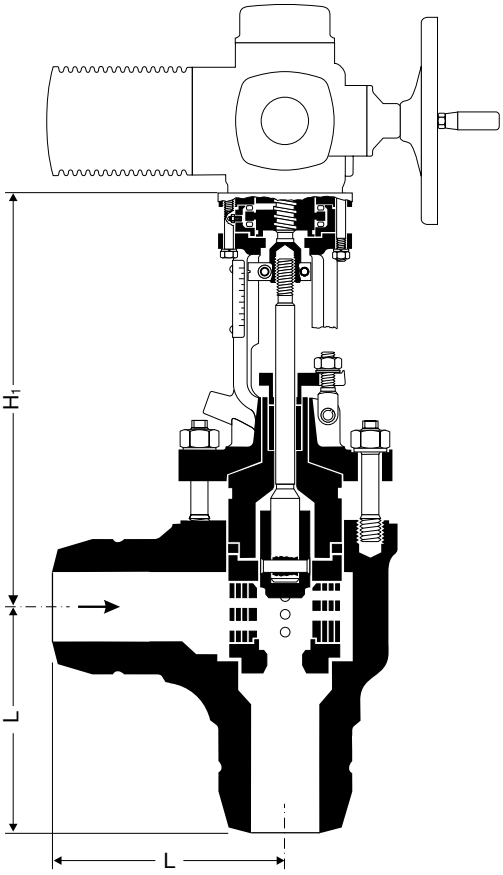


ZK 210/14, DN 80 mm (3") with butt-weld ends

Dimensions

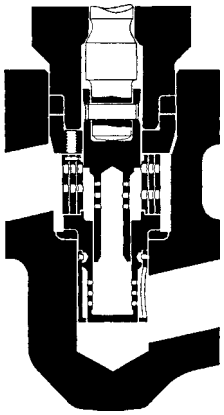


ZK 210/14 with handwheel
DN 25, 50 mm (1, 2")



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

DN	[mm] [in]	25 1	50 2	80 3
Dimensions in mm	L H H_1 D_1	230 384 287 200	300 455 345 200	225 535 375 320
Butt-weld ends for pipe		33.7x3.6	60.3x6.3	101.6x11
Approx. weight for design ZK 210/14	[kg] handwheel [kg]	12 1.6	25 1.6	60 6



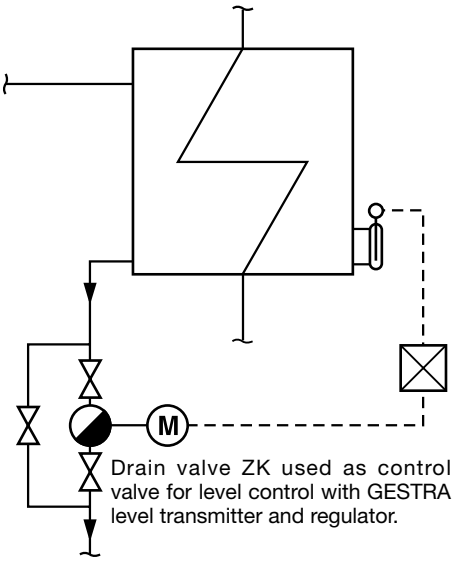
ZK 210, DN 50 mm (2")
5 stages

k_{vs} values
Selection of Actuator

DN	Nozzle*)	Characteristic	K_{vs} [m³/h]			Valve stroke [mm]	Rev./ stroke	Max. admiss. torque for opening/ closing [Nm]	Type/size of actuator DIN ISO 5210
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*)

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.

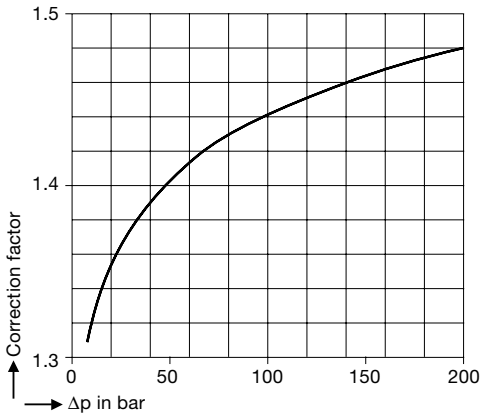
Pressure drop	k_v	for liquids		for gas, temperature-corrected	for vapours	for saturated and wet steam
$\Delta p < \frac{p_1}{2}$ $\left(p_2 > \frac{p_1}{2}\right)$	k_v	$= \frac{\dot{V}}{31.6}\sqrt{\frac{\rho_1}{\Delta p}}$	$= \frac{\dot{m}}{31.6\sqrt{\rho_1 \cdot \Delta p}}$	$= \frac{\dot{V}_N}{514}\sqrt{\frac{\rho_N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

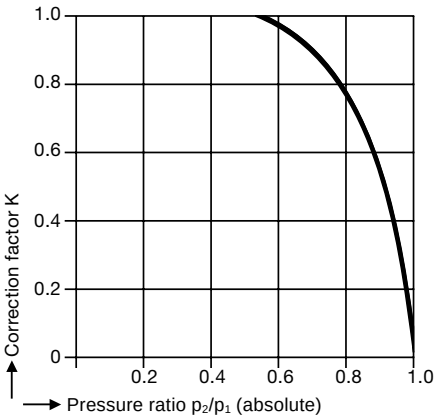
Nomenclature:

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	$(0 < x \leq 1)$

Correction factor for water flowrates (without flashing)



Backpressure chart



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

ZK 210

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FLOWSERVE
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 = . . . bar t = . . . °C

Operational data: Load Conditions

	Min.	Normal within control range	Max.
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

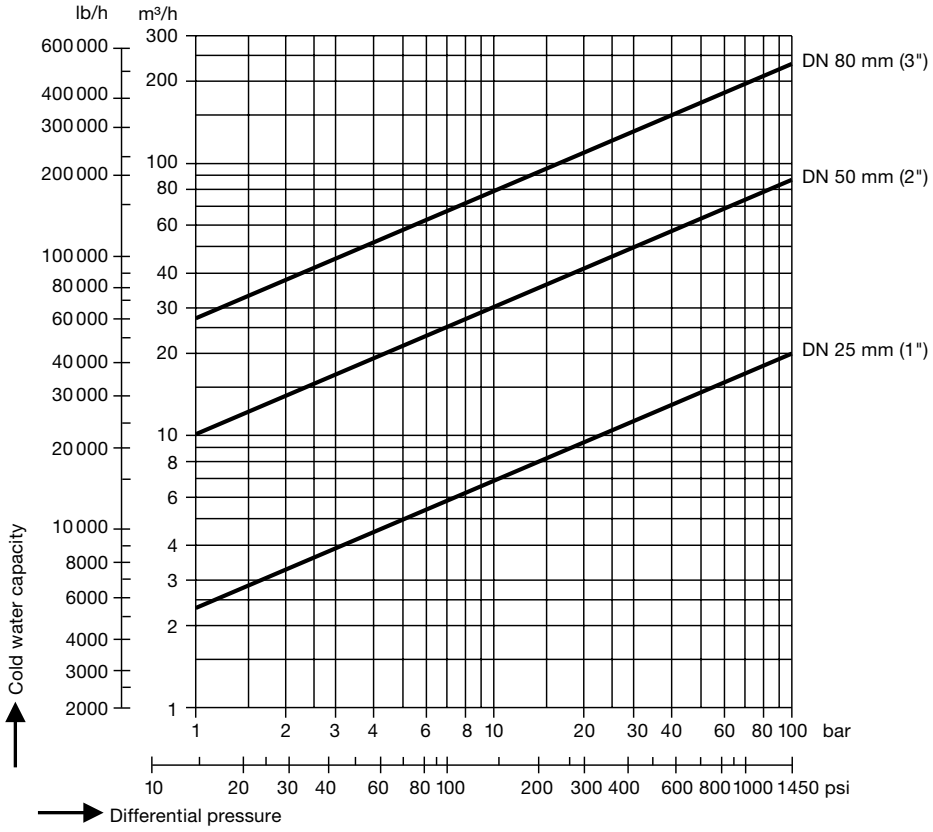
Pneumatic (make)
Spring to open ☐
Spring to close ☐
Handwheel yes/no
Positioner yes/no

The following test certificates can be issued on request, at extra cost:

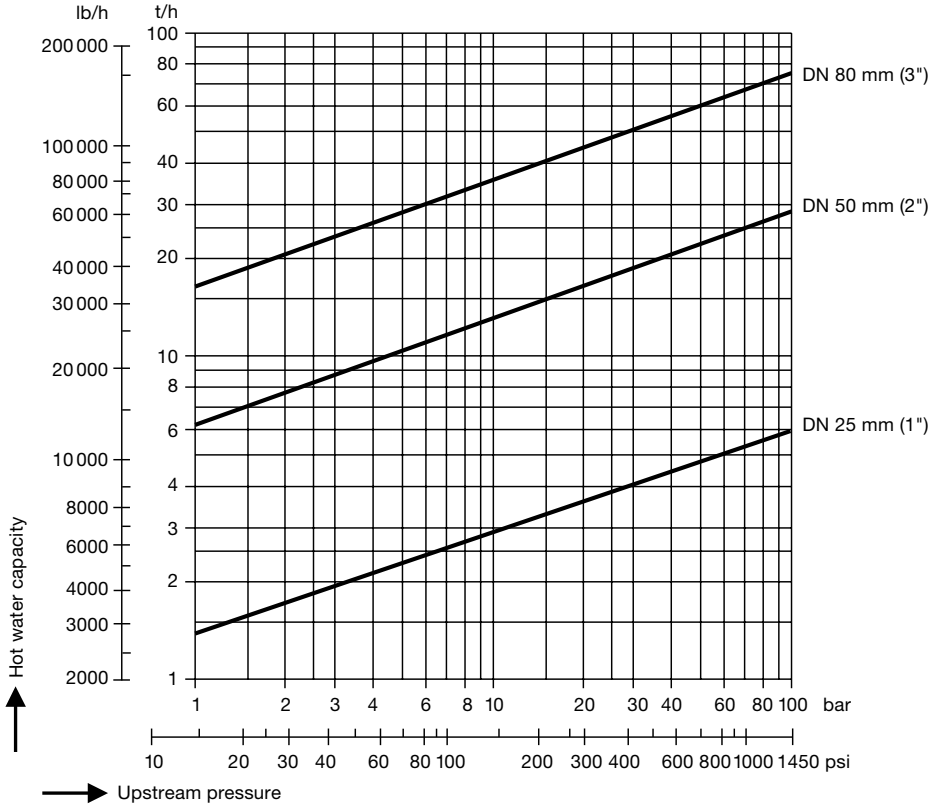
In accordance with EN 10204-2.1, -2.2, -3.1A, -3.1B and -3.1C.

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.

Cold water



Hot water
t_s – 5 K



Supply in accordance with our general terms of business.

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