

**02 - 05.4**

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**Control valves, starting  
G 92 ...**



## Kv coefficient calculation

Calculation itself is carried out with respect to conditions of regulating circuit and operating medium according to equations mentioned below. Control valve must be designed to be able to regulate maximal flow quantity at given operating conditions. At the same time it is necessary to check whether minimal flow quantity can be even regulated or not.

Because of eventual minus tolerance 10% of  $Kv_{100}$  against Kvs and requirement for possible regulation within range of maximal flow (decrement and increase of flow), producer recommends to select Kvs value higher than maximal operating Kv value:

$$Kvs = 1.2 \div 1.3 Kv$$

It is necessary to take into account to which extent  $Q_{max}$  involve "precautionary additions" that could result in valve oversizing.

## Relations of Kv calculation

		Pressure drop $p_2 > p_1/2$ $\Delta p < p_1/2$	Pressure drop $\Delta p \geq p_1/2$ $p_2 \leq p_1/2$
Kv =	Liquid	$\frac{Q}{100} \sqrt{\frac{\rho_1}{\Delta p}}$	
	Gas	$\frac{Q_n}{5141} \sqrt{\frac{\rho_n \cdot T_1}{\Delta p \cdot p_2}}$	$\frac{2 \cdot Q_m}{5141 \cdot p_1} \sqrt{\rho_n \cdot T_1}$
	Superh. steam	$\frac{Q_m}{100} \sqrt{\frac{v_2}{\Delta p}}$	$\frac{Q_m}{100} \sqrt{\frac{2v}{p_1}}$
	Sat. steam	$\frac{Q_m}{100} \sqrt{\frac{v_2 \cdot x}{\Delta p}}$	$\frac{Q_m}{100} \sqrt{\frac{2v \cdot x}{p_1}}$

## Above critical flow of vapours and gases

When pressure ratio is above critical ( $p_1/p_2 < 0.54$ ), speed of flow reaches acoustic velocity at the narrowest section. This event can cause higher level of noisiness.

## Dimensions and units

Marking	Unit	Name of dimension
Kv	m <sup>3</sup> /hour	Flow coefficient under conditions of units of flow
$Kv_{100}$	m <sup>3</sup> /hour	Flow coefficient at nominal stroke
Kvs	m <sup>3</sup> /hour	Valve nominal flow coefficient
Q	m <sup>3</sup> /hour	Flow rate in operating conditions ( $T_1, p_1$ )
$Q_n$	Nm <sup>3</sup> /hour	Flow rate in normal conditions (0°C, 0.101 MPa)
$Q_m$	kg/hour	Flow rate in operating conditions ( $T_1, p_1$ )
$p_1$	MPa	Upstream absolute pressure
$p_2$	MPa	Downstream absolute pressure
$p_s$	MPa	Absolute pressure of saturated steam at given temperature ( $T_1$ )
$\Delta p$	MPa	Valve differential pressure ( $\Delta p = p_1 - p_2$ )
$\rho_1$	kg/m <sup>3</sup>	Process medium density in operating conditions ( $T_1, p_1$ )
$\rho_n$	kg/Nm <sup>3</sup>	Gas density in normal conditions (0°C, 0.101 MPa)
$v_2$	m <sup>3</sup> /kg	Specific volume of steam when temperature $T_1$ and pressure $p_2$
$v$	m <sup>3</sup> /kg	Specific volume of steam when temperature $T_1$ and pressure $p_1/2$
$T_1$	K	Absolute temperature at valve inlet ( $T_1 = 273 + t_1$ )
x	1	Proportionate weight volume of saturated steam in wet steam

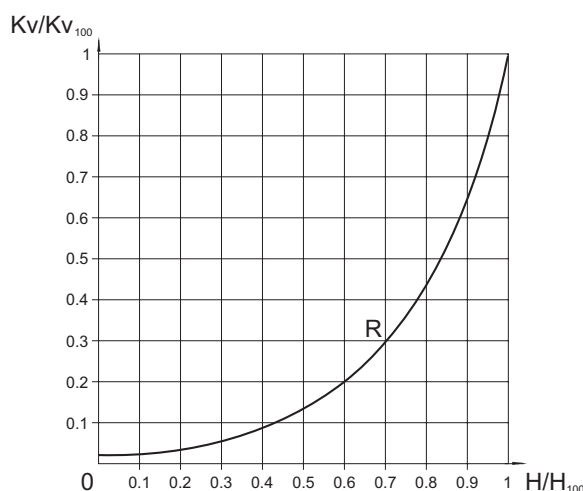
## Cavitation

Cavitation is a phenomenon when there are steam bubbles creating and vanishing in shocks - generally at the narrowest section of flowing due to local pressure drop. This event expressively cuts down service life of inner parts and can result in creation of unpleasant vibrations and noisiness. In control valves it can happen on condition that

$$(p_1 - p_2) \geq 0.6 (p_1 - p_s)$$

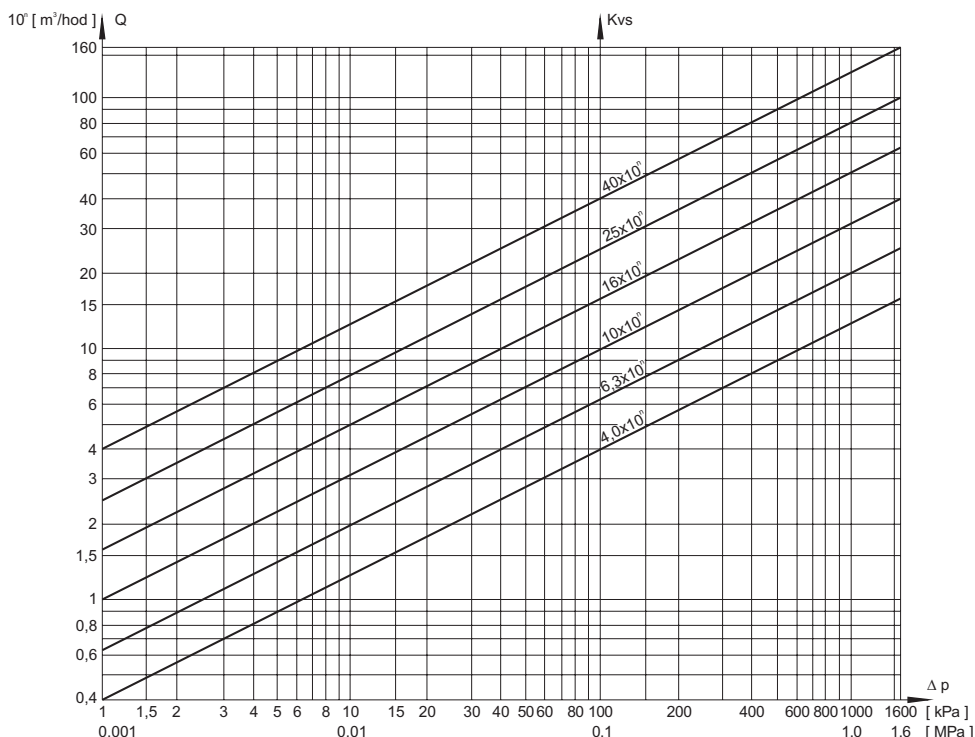
Valve differential pressure should be set the way so that neither any undesired pressure drop causing cavitation can occur, nor liquid-steam(wet steam) mixture can create. Otherwise it must be taken into account when calculating Kv value.

## Valve flow characteristic



R - equal-percentage characteristic (4-percentage)  
 $Kv/Kv_{100} = 0.0183 \cdot e^{(4 \cdot H/H_{100})}$

## Diagram for the valve Kvs value specification according to the required flow rate of water Q and the valve differential pressure $\Delta p$



The diagram serves to specify the valve Kvs value regarding to the required flow rate of water at a given differential pressure. It can be also used for finding out the differential pressure value of the existing valve in behaviour with the flow rate. The diagram applies to water with the density of 1000 kg/m<sup>3</sup>.

For the value  $Q = q \cdot 10^n$ , it is necessary to calculate with  $Kvs = k \cdot 10^n$ . Example: water flow rate of  $16 \cdot 10^{-1} = 1,6 \text{ m}^3/\text{hour}$  corresponds to  $Kv = 2,5 = 25 \cdot 10$  when differential pressure 40kPa.

### Valve complete specification No. for ordering G 92

		X XX	X X X	- X XXX	/ XXX	- XXX
1. Valve	Control valve	G				
2. Series	Control valve, starting	92				
3. Flow direction	Angle		2			
4. Connection	Weld ends		2			
5. Actuating	Adjusted for remote control		5			
6. Material	Alloy steel 1.7357			2		
7. Nominal pressure PN	Acc. to the valve execution				XXX	
8. Max. operating temp.°C	Acc. to the valve execution					XXX
9. Nominal size DN	Acc. to the valve execution					XXX

### Maximal permissible pressures acc. to EN 12 516-1 [MPa]

Material	PN	Temperature [ °C ]							
		200	250	300	350	400	450	500	550
Alloy steel 1.7357	400	37.4	35.7	33.3	30.9	28.9	26.7	22.3	8.8



# G 92 225 2400

## Control valve, starting DN 150, PN 400

### Description

The valve is single-seated, designed to be actuated with an electric rotating actuator. The piston type plug moves in a special control cage with holes and cross section grooves that, when the valve opens, gradually enlarge which provides a smooth regulation.

The valves are supplied with the actuators of the following producer: ZPA Pečky - Modact MO. On the basis of the customer's requirements, it is possible to supply the valve with the connection acc. to ISO 5210 with the actuators such as AUMA, Schiebel and so on. The actuator is mounted to the valve with the aid of adapter ZPA Pečky.

### Application

The valves serves as a control valve applicable to where it is necessary to change the flow water pressure from its maximum value to minimum or vice versa. The max. operating pressures correspond to EN 12 516-1 see page 3 of this catalogue. The possible use for higher temperature must be agreed upon with the producer.

### Process media

The valve is designed to control the flow and pressure of water and steam. The valve max. differential pressure is 20,0 MPa with respect to the concrete conditions of operation (ratio  $p_1 / p_2$ , creation of cavitation, above critical flow etc.)

### Installation

The valve can be installed only in a vertical position with the nut for the connection to the actuator being positioned up above the valve body. The valve should be piped the way so that the medium flow coincides with the arrows indicated on the valve body. With regard to the valve's dismantling, it is recommended to leave a clear space of up to 500 mm above the valve for easy approach. For safe operation, it is necessary so that there would be no bends or elbows piped at least 2000 mm behind the valve.

### Technical data

Series	G 92 225 2400
Type of valve	Control valve (starting), weld ends, angle
Nominal size	150
Nominal pressure	400
Body material	Alloy steel 1.7357
Weld ends material	Alloy steel 1.7335
Process media temp. range	-20 to 550°C
Connection *	ČSN 13 1070
Type of trim	Special cage - piston type plug
Flow characteristic	Equal-percentage acc. to ČSN 13 4509-1
Flow area $F_s$ [cm <sup>2</sup> ]	63
Kvs value	191
Leakage rate	Class II acc. to ČSN EN 1349 (5/2001)

\*) After the agreement with the producer, it is possible to make the connection acc. to the valid ČSN 13 1075 (3/1991) or ČSN EN 12 627 (8/2000)





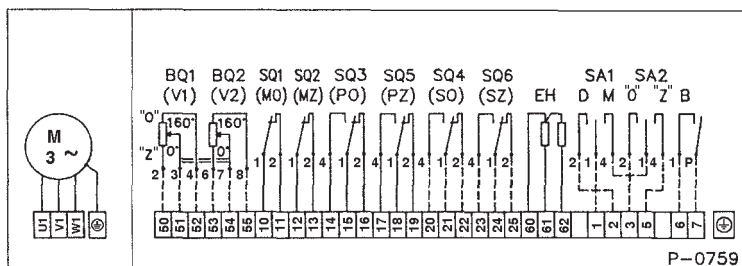
## Electric actuators Modact MO ZPA Pečky

### Technical data

Type	Modact MO
Voltage	3 x 230 V / 400 V (3 x 220 V / 380 V)
Frequency	50 Hz
Motor power	See specification table
Control	3 - position control
Torque range	320 to 630 Nm
Running speed	See specification table
Enclosure	IP 55
Process medium max. temperature	Acc. to used valve
Ambient temperature range	-25 to 55 °C
Ambient humidity range	5 - 100 % with condensation
Weight	max. 128 kg

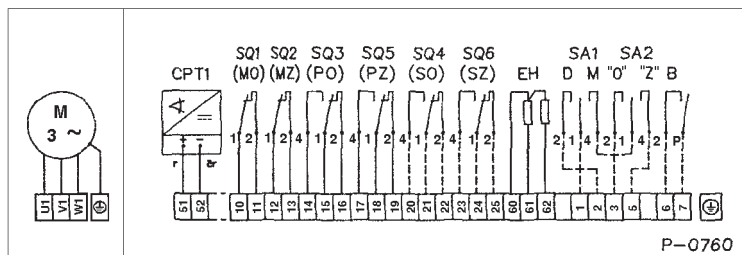
### Wiring diagram of actuator Modact MO

Execution of terminal board  
Position transmitter : resistance 2 x 100 Ω or is not built in



- SQ1 (MO) torque switch in "opening" direction
- SQ2 (MZ) torque switch in "closing" direction
- SQ3 (PO) limit switch in "opening" direction
- SQ5 (PZ) limit switch in "closing" direction
- SQ4 (SO) signalisation switch in "opening" direction
- SQ6 (SZ) signalisation switch in "closing" direction
- EH heaters 2 x TR 551 10k/A
- CPT1 capacity position transmitter CPT1/A4 - 20 mA
- B flasher
- BQ1, BQ2 position transmitter 2 x 100 Ω
- SA1 switch "local - remote control"
- SA2 switch "opening - closing"

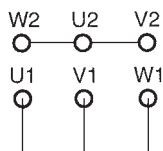
Position transmitter: capacity CPT 1/A 4-20 mA



Electromotor

Control case

Local control



lead in  
Electromotor terminal connectors connection  
for voltage of 3 x 380 V

## Specification of actuator Modact MO

Basic equipment : 2 limit switches PO, PZ 1 electromotor (brake electromotor on special request)  
2 torque switches MO, MZ 2 heaters

Basic technical data :

Type	Torgue [Nm]		Running time [1/min]	Travel range [ot]	Electromotor				Weight [ kg ]		Specification No.	
	Tripping	Engaging torgue			Motor power [W]	Speed rpm	In (380V) [A]	l <sub>z</sub> / In	Cast execution	Aluminium execution	Basic	Additional
MO 63/110-16	320-630	1100	16	2-240	1,1	680	3,2	3,0	112	81	52 034	XX6X
MO 63/110-25			25		1,5	935	4,0	4,4	110	79		XX7X
MO 63/110-40			40		2,2	950	5,4	4,5	120	88		XX1X
MO 63/110-63			63		3,0	1420	6,7	5,2	116	84		XX2X
MO 63/110-100			100		4,0	1440	8,7	6,5	128	96		XX3X
MO 63/110-125			125		5,5	2910	11,1	7,5	129	97		XX4X

Dimensions, electric connection and protection to environment :

Normal execution N 22, output drive type C	Via terminal board	2XXX
	With connector KBSN	CXXX
Tropical execution T 22, output drive type C	Via terminal board	7XXX
	With connector KBSN	HXXX

Local control, position indicator and position transmitter (a figure in the 2nd place of the spec. No. stands for resist. pos. transmitter of 2x100W)

Without local control and position indicator	X1XX	XBXX
Local position indicator	X2XX	
Local control via local control unit <sup>4)</sup>	X3XX	XDXX
Local control via unblock switch <sup>4)</sup>	X4XX	XEXX
Local position indicator and control via local control unit <sup>4)</sup>	X5XX	
Local position indicator and unlock switch <sup>4)</sup>	X6XX	

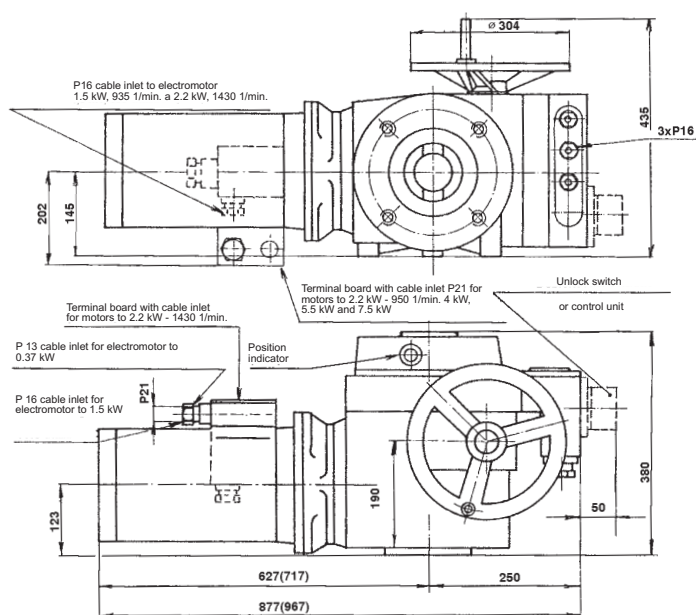
Signalisation, position transmitter, flasher

Without signalisation, position transmitter and flasher	XXX0
Position transmitter	XXX1
Signalisation transmitters	XXX2
Signalisation transmitters and position transmitter	XXX3
Flasher	XXX4
Position transmitter, flasher	XXX5
Signalisation transmitters and flasher	XXX6
Signalisation transmitters, position transmitter and flasher	XXX7

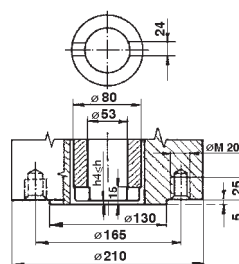
Tripping torgues, running times and other technical parametres are specified together with their specification No. in above-mentioned table. This place is reserved for a figure or a letter specifying the actuator's required parametres

<sup>4)</sup> The actuators with terminal board are supplied with local control switch that substitutes both local control unit and unlock switch. They are supplied with the following executions: x4xx; x6xx; xExx

## Dimensions of Modact MO actuator



Connection dimenstions - Output drive type C



Dimensions in parentheses apply to the version with brake motor



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