

spirax
sarco
M15 ISO

TI-P133-46
CMGT Issue 2

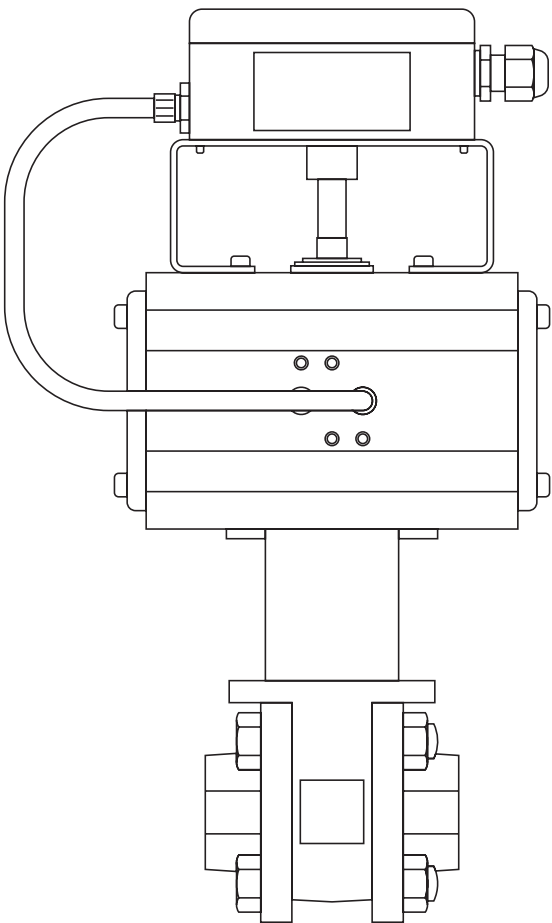
Ball Valve for Control of Fluids
Sizing Sheet

Description

The M15 ISO ball valve is ideal for control applications. Both ball and seat are manufactured in chrome plated metal which ensures a long life, even with applications that constantly modulate the flow of the fluid. The valve is actuated by a double or single acting pneumatic actuator. The actuator is regulated by an electropneumatic positioner that receives a 4 - 20 mA signal from the process.

Advantages:

- Inherent equal percentage flow characteristic with high rangeability (32:1).
- Suitable for fluids that contain solids in suspension.
- Capacity is much higher than a same size globe valve.
- Less maintenance than spindle regulating valves.
- Small, compact and easily maintained.



10.3

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Pipeline ancillaries
Ball valves

Sizing

- 1. Determine the required C_v for the ball valve using the appropriate equation detailed below. With the first approximation for this calculation it is suggested to use a factor $FL = 0.68$, that corresponds to an opening of the valve of 72° .
- 2. Calculate the diameter of the pipe for maximum flow within the limits of velocity and pressure drop for the fluid.
- 3. With the C_v and pipe diameter, use the table overleaf starting with the column that corresponds to the rotation of 72° , that gives $FL = 0.68$.
- 4. In this column, choose the combination of ball valve diameter and pipe diameter that gives a C_v result the same or superior to the one calculated in step 1.
- 5. It is recommended not to use a ball valve with a diameter less than half the pipe diameter, because of excessive tension that can produce vibrations.

Simplified equations for sizing (K_v values = $C_v \times 0.86$)

For liquids		
Where:	Sub-critical flow	Critical flow
ΔP_m = Maximum ΔP for sizing, When $P_2 > P_v$ use $\Delta P_m = F_L^2(P_1 - P_v)$ When $P_2 > P_v$ use $\Delta P_m = P_1 - \left[0.96 - 0.28 \sqrt{\frac{P_v}{P_c}} \right] P_v$ C_v = Flow coefficient of the valve F_L = Pressure recovery factor pr = Density at inlet temperature (water = 1.0 at STP) P_1 = Upstream pressure (bar a) P_2 = Downstream pressure (bar a) P_v = Vapour pressure of the liquid at inlet temperature (bar a) P_c = Thermodynamic critical pressure (bar a) \dot{V} = Flowrate in m^3/h \dot{m} = Flowrate in kg/h	When: $\Delta P < \Delta P_m$ Volumetric flowrate $C_v = 1.16 \dot{V} \sqrt{\frac{pr}{\Delta P}}$ Mass flowrate $C_v = \frac{\dot{m}}{865 \sqrt{\Delta P pr}}$	When: $\Delta P \geq \Delta P_m$ Volumetric flowrate $C_v = \frac{1.16 \dot{V}}{F_L} \sqrt{\frac{pr}{\Delta P_m}}$ Mass flowrate $C_v = \frac{\dot{m}}{865 F_L \sqrt{pr \Delta P_m}}$

Simplified equations for sizing (K_v values = C_v x 0.86)

For steam and gases		
<div>Where:</div> <div>C_v = Flow coeffercient of the valve</div> <div>F_L = Pressure recovery factor</div> <div>pr = Specific density of gas (air = 1)</div> <div>P₁ = Upstream pressure (bar a)</div> <div>P₂ = Downstream presure (bar a)</div> <div>T = Inlet temperature in °K (°C + 273)</div> <div>Ḃ = Flowrate of gas in Nm³/h (at 15°C and 1 bar a)</div> <div>ṁ = Flowrate of gas in in kg/h</div> <div>T_{so} = Superheating of steam in °C (Temperature of superheated steam - Temperature of saturated steam)</div> <div>ṁ_s = Flowrate of steam in kg/h</div> <div>Note: These equations are only a simplified version of the original sizing equations of the ISA and IEC regulations. The results are sufficiently close for practical use. There could be a maximum error of 8% in the transition of non-choked flowrate to choked flowrate.</div>	Sub-critical flow	Critical flow
	<div>When:</div> <div>ΔP < 0.5 F_L² P₁</div> <div>For gases (volumetric flowrate)</div> <div>$C_v = \frac{\dot{V}}{295} \sqrt{\frac{pr T}{P_1^2 - P_2^2}}$</div> <div>For gases (mass flowrate)</div> <div>$C_v = \frac{\dot{m} \sqrt{T}}{360 \sqrt{(P_1^2 - P_2^2) pr}}$</div> <div>For saturated steam</div> <div>$C_v = \frac{\dot{m}_s}{13.81 \sqrt{P_1^2 - P_2^2}}$</div> <div>For superheated steam</div> <div>$C_v = \frac{\dot{m}_s (1 + 0.00126 T_{so})}{13.81 \sqrt{P_1^2 - P_2^2}}$</div>	<div>When:</div> <div>ΔP > 0.5 F_L² P₁</div> <div>For gases (volumetric flowrate)</div> <div>$C_v = \frac{\dot{V}}{257} \frac{\sqrt{pr T}}{F_L P_1}$</div> <div>For gases (mass flowrate)</div> <div>$C_v = \frac{\dot{m} \sqrt{T}}{311 F_L P_1 \sqrt{pr}}$</div> <div>For saturated steam</div> <div>$C_v = \frac{\dot{m}_s}{11.95 F_L P_1}$</div> <div>For superheated steam</div> <div>$C_v = \frac{\dot{m}_s (1 + 0.00126 T_{so})}{11.95 F_L P_1}$</div>

C_V values for reduced bore (RB) valves (K_V values = C_V x 0.86)

Valve size	Pipe size	Rotation										
		0°	9°	18°	27°	36°	45°	54°	63°	72°	81°	90°
½"	½"	0.00	0.00	0.22	0.36	0.58	0.88	1.47	2.17	3.50	5.53	7.00
	¾"	0.00	0.00	0.22	0.36	0.58	0.88	1.45	2.12	3.29	4.80	5.66
	1"	0.00	0.00	0.22	0.36	0.58	0.87	1.44	2.09	3.20	4.53	5.23
¾"	¾"	0.00	0.00	0.37	0.62	0.99	1.50	2.52	3.72	6.00	9.48	12.00
	1"	0.00	0.00	0.37	0.62	0.99	1.50	2.50	3.69	5.87	8.98	11.03
	1¼"	0.00	0.00	0.37	0.62	0.99	1.50	2.49	3.65	5.73	8.52	10.21
	1½"	0.00	0.00	0.37	0.62	0.99	1.49	2.48	3.64	5.68	8.35	9.91
1"	1"	0.00	0.00	0.98	1.64	2.61	3.95	6.64	9.80	15.80	24.96	31.60
	1¼"	0.00	0.00	0.98	1.64	2.61	3.94	6.59	9.63	15.10	22.45	26.91
	1½"	0.00	0.00	0.98	1.64	2.60	3.93	6.55	9.62	14.70	21.20	24.83
	2"	0.00	0.00	0.98	1.64	2.60	3.92	6.50	9.36	14.15	19.63	22.41
1¼"	1¼"	0.00	0.00	1.47	2.46	3.90	5.91	9.93	14.66	23.65	37.37	47.30
	1½"	0.00	0.00	1.47	2.46	3.90	5.90	9.88	14.50	23.00	34.95	42.66
	2"	0.00	0.00	1.47	2.46	3.89	5.88	9.80	14.24	22.00	31.72	37.14
	2½"	0.00	0.00	1.47	2.46	3.89	5.87	9.75	14.09	21.47	30.18	34.74
1½"	1½"	0.00	0.00	2.54	4.26	6.77	10.25	17.22	25.42	41.00	64.78	82.00
	2"	0.00	0.00	2.54	4.26	6.76	10.21	17.03	24.83	38.65	56.53	66.91
	2½"	0.00	0.00	2.54	4.25	6.75	10.18	16.89	24.40	37.08	51.94	59.65
	3"	0.00	0.00	2.54	4.25	6.74	10.15	16.75	23.97	35.63	48.16	54.12
2"	1½"	0.00	0.00	3.72	6.24	9.90	15.00	25.20	37.20	60.00	94.80	120.00
	2½"	0.00	0.00	3.72	6.24	9.89	14.98	25.10	36.88	58.70	89.92	110.53
	3"	0.00	0.00	3.72	6.24	9.88	14.94	24.93	36.33	56.56	82.73	97.93
	4"	0.00	0.00	3.72	6.23	9.87	14.90	24.73	35.75	54.43	76.46	87.97
2½"	2½"	0.00	0.00	6.08	10.19	16.17	24.50	41.16	60.76	98.00	154.84	196.00
	3"	0.00	0.00	6.08	10.19	16.16	24.46	40.99	60.22	95.79	146.53	179.90
	4"	0.00	0.00	6.08	10.18	16.14	24.38	40.60	59.01	91.13	131.31	153.72
	6"	0.00	0.00	6.08	10.17	16.11	24.28	40.16	57.67	86.43	118.31	133.91
FL		-	-	0.96	0.94	0.92	0.88	0.82	0.75	0.68	0.62	0.50



TI-P133-47
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M45 ISO

Ball Valve for Control of Fluids

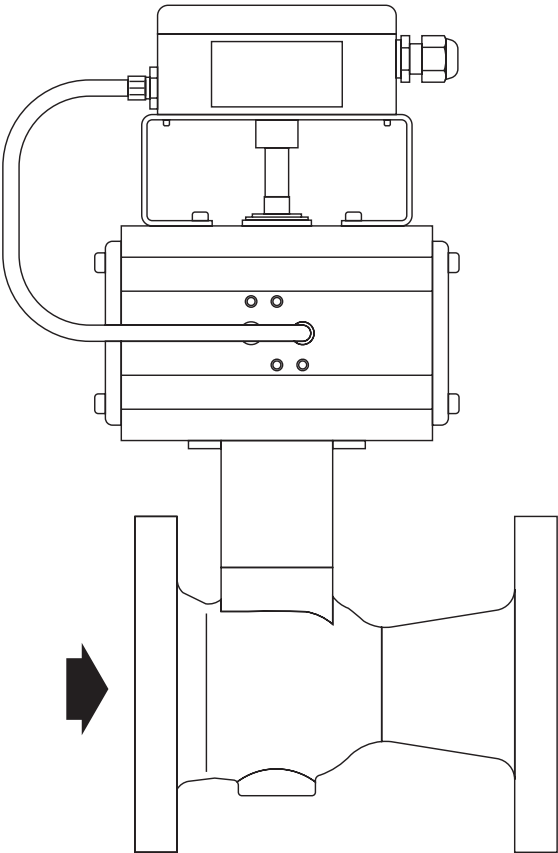
Sizing Sheet

Description

The M45 ISO ball valve is ideal for control applications. Both ball and seat are manufactured in chrome plated metal which ensures a long life, even with applications that constantly modulate the flow of the fluid. The valve is actuated by a double or single acting pneumatic actuator. The actuator is regulated by an electropneumatic positioner that receives a 4 - 20 mA signal from the process.

Advantages:

- Inherent equal percentage flow characteristic with high rangeability (32:1).
- Suitable for fluids that contain solids in suspension.
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Pipeline ancillaries
Ball valves

Sizing

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- 2. Calculate the diameter of the pipe for maximum flow within the limits of velocity and pressure drop for the fluid.
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- 5. It is recommended not to use a ball valve with a diameter less than half the pipe diameter, because of excessive tension that can produce vibrations.

Simplified equations for sizing (K_v values = $C_v \times 0.86$)

For liquids		
Where:	Sub-critical flow	Critical flow
ΔP_m = Maximum ΔP for sizing, When $P_2 > P_v$ use $\Delta P_m = F_L^2(P_1 - P_v)$ When $P_2 > P_v$ use $\Delta P_m = P_1 - \left[0.96 - 0.28 \sqrt{\frac{P_v}{P_c}} \right] P_v$ C_v = Flow coefficient of the valve F_L = Pressure recovery factor pr = Density at inlet temperature (water = 1.0 at STP) P_1 = Upstream pressure (bar a) P_2 = Downstream pressure (bar a) P_v = Vapour pressure of the liquid at inlet temperature (bar a) P_c = Thermodynamic critical pressure (bar a) \dot{V} = Flowrate in m^3/h \dot{m} = Flowrate in kg/h	When: $\Delta P < \Delta P_m$ Volumetric flowrate $C_v = 1.16 \dot{V} \sqrt{\frac{pr}{\Delta P}}$ Mass flowrate $C_v = \frac{\dot{m}}{865 \sqrt{\Delta P pr}}$	When: $\Delta P \geq \Delta P_m$ Volumetric flowrate $C_v = \frac{1.16 \dot{V}}{F_L} \sqrt{\frac{pr}{\Delta P_m}}$ Mass flowrate $C_v = \frac{\dot{m}}{865 F_L \sqrt{pr \Delta P_m}}$

Simplified equations for sizing (K_v values = C_v x 0.86)

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Pipeline ancillaries
Ball valves

Cv values (Kv values = Cv x 0.86)

Valve size	Pipe size	Rotation										
		0°	9°	18°	27°	36°	45°	54°	63°	72°	81°	90°
DN25	25 mm	0.00	0.00	0.96	1.61	2.56	3.88	6.51	9.61	15.50	24.49	31.00
	32 mm	0.00	0.00	0.96	1.61	2.56	3.87	6.48	9.50	15.06	22.85	27.86
	40 mm	0.00	0.00	0.96	1.61	2.56	3.87	6.45	9.42	14.73	21.75	25.92
	50 mm	0.00	0.00	0.96	1.61	2.55	3.86	6.41	9.29	14.24	20.27	23.52
DN40	40 mm	0.00	0.00	2.94	4.93	7.82	11.85	19.91	29.39	47.40	74.89	94.80
	50 mm	0.00	0.00	2.94	4.93	7.81	11.81	19.74	28.86	45.28	67.26	80.57
	65 mm	0.00	0.00	2.94	4.92	7.80	11.78	19.57	28.33	43.30	61.23	70.77
	80 mm	0.00	0.00	2.94	4.92	7.79	11.74	19.38	27.77	41.39	56.16	63.24
DN50	50 mm	0.00	0.00	3.41	5.72	9.08	13.75	23.10	34.10	55.00	86.90	110.00
	65 mm	0.00	0.00	3.41	5.72	9.08	13.74	23.05	33.94	54.33	84.33	104.92
	80 mm	0.00	0.00	3.41	5.72	9.07	13.71	22.93	33.57	52.85	79.08	95.30
	100 mm	0.00	0.00	3.41	5.72	9.06	13.69	22.80	33.15	51.26	74.04	86.83
DN65	65 mm	0.00	0.00	7.15	11.99	19.02	28.81	48.41	71.46	115.25	182.10	230.50
	80 mm	0.00	0.00	7.15	11.99	19.00	28.74	48.09	70.45	111.15	167.10	202.12
	100 mm	0.00	0.00	7.15	11.97	18.96	28.60	47.44	68.43	103.70	144.56	165.48
	150 mm	0.00	0.00	7.14	11.96	18.91	28.44	46.71	66.31	96.71	127.22	140.79
DN80	80 mm	0.00	0.00	8.99	15.08	23.93	36.25	60.90	89.90	145.00	229.10	290.00
	100 mm	0.00	0.00	8.99	15.07	23.91	36.17	60.53	88.71	140.16	211.30	256.20
	150 mm	0.00	0.00	8.99	15.06	23.86	36.00	59.74	86.30	131.20	183.85	211.18
	200 mm	0.00	0.00	8.98	15.06	23.84	35.93	59.40	85.27	127.65	174.44	197.26
DN100	100 mm	0.00	0.00	17.36	29.12	46.20	70.00	117.60	173.60	280.00	442.40	560.00
	150 mm	0.00	0.00	17.35	29.10	46.10	69.66	116.00	168.58	260.27	374.87	438.72
	200 mm	0.00	0.00	17.35	29.08	46.03	69.40	114.81	164.97	247.56	339.58	384.87
	250 mm	0.00	0.00	17.35	29.06	45.98	69.24	114.10	162.89	240.69	322.47	360.47
DN150	150 mm	0.00	0.00	23.25	39.00	61.88	93.75	157.50	232.50	375.00	592.50	750.00
	200 mm	0.00	0.00	23.25	38.99	61.85	93.66	157.07	231.12	369.29	570.71	707.20
	250 mm	0.00	0.00	23.25	38.99	61.82	93.55	156.53	229.43	362.50	546.56	662.73
	300 mm	0.00	0.00	23.25	38.98	61.80	93.47	156.18	228.32	358.16	532.04	637.31

FL		-	-	0.96	0.94	0.92	0.88	0.82	0.75	0.68	0.62	0.50
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