

Control Valve Training Module

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What is Steam ?

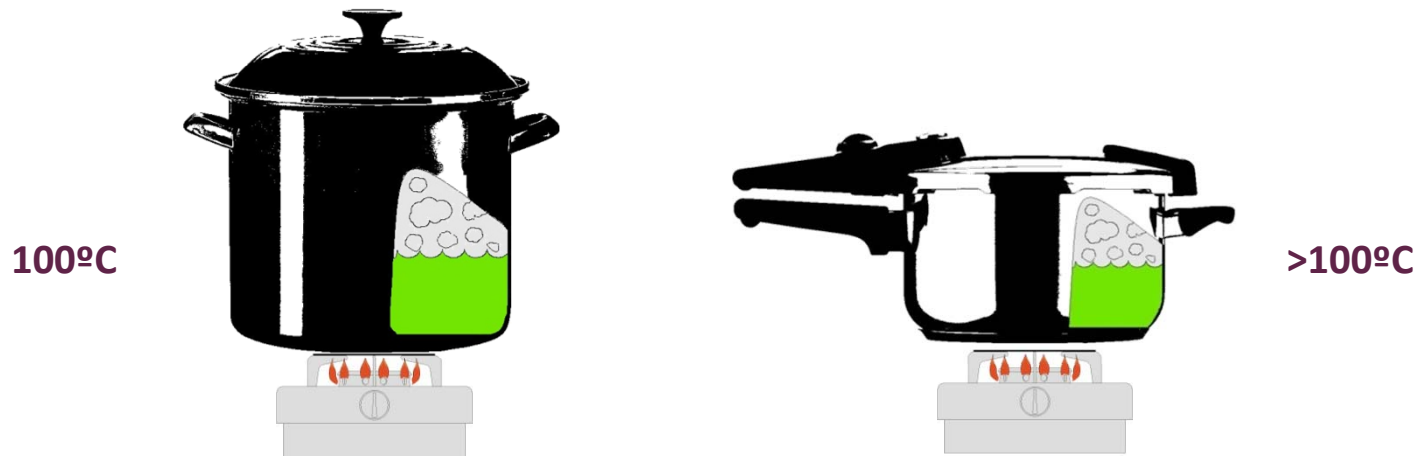
- A liquid given enough **energy** (heat) will break down the molecular bonds between molecules to form a gas.



What is Steam ?

- A liquid given enough **energy** (heat) will break down the molecular bonds between molecules to form a gas.
- Steam is a convenient and economical way of conveying large quantities of energy from one place to another.
- Steam is versatile and easy to control, made from a plentiful commodity: **water**- to which heat is added to convert it to a vapour state.

What is Steam Pressure ?



- On the open cooker the water boils at **100°C** – slowly cooking process.
- The closed pressure cooker allows a more rapid cooking with a higher temperature **>100°C**, consequence of the overpressure created by the formation of steam.

Steam Table

Pm – Gauge pressure;

Pa – Absolute pressure;

T – Temperature;

V – Specific volume;

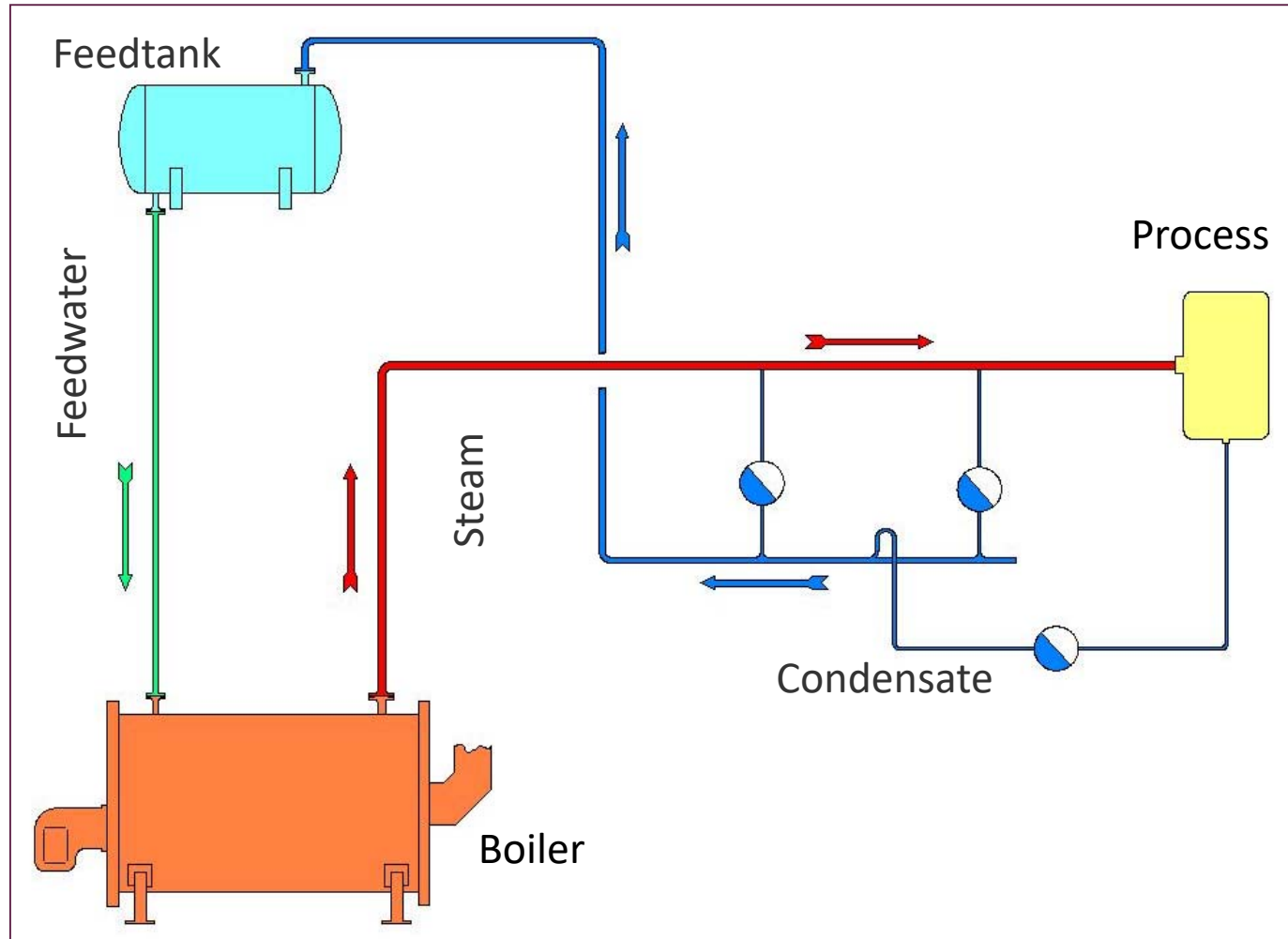
he – Specific enthalpy of liquid;

r – Specific enthalpy of vaporization;

hg – Specific enthalpy of saturated steam.

PHYSICAL PROPERTIES OF SATURATED STEAM									
Pm (bar)	Pa (bar)	T (°C)	V (m ³ /Kg)	he (Kcal/Kg)	he (KJ/Kg)	r (Kcal/Kg)	r (KJ/Kg)	hg (Kcal/Kg)	hg (KJ/Kg)
0,00	1,013	100,0	1,673	100,1	419,1	539,4	2258,4	639,5	2677,5
0,50	1,513	111,6	1,149	111,9	468,5	531,9	2227,0	643,8	2695,5
1,00	2,013	120,4	0,881	120,8	505,8	526,0	2202,3	646,8	2708,0
1,50	2,513	127,6	0,714	128,1	536,3	521,1	2181,7	649,2	2718,1
2,00	3,013	133,7	0,603	134,4	562,7	517,0	2164,6	651,4	2727,3
3,00	4,013	143,7	0,461	144,7	605,8	509,9	2134,8	654,6	2740,7
4,00	5,013	152,0	0,374	153,1	641,0	503,8	2109,3	656,9	2750,3
5,00	6,013	158,9	0,315	160,3	671,1	498,5	2087,1	658,8	2758,3
6,00	7,013	165,0	0,272	166,7	697,9	493,8	2067,4	660,5	2765,4
7,00	8,013	170,5	0,240	172,4	721,8	489,4	2049,0	661,8	2770,8
8,00	9,013	175,4	0,215	177,6	743,6	485,4	2032,3	663,0	2775,8
9,00	10,013	180,0	0,194	182,3	763,3	481,6	2016,4	663,9	2779,6
10,00	11,013	184,1	0,177	186,8	782,1	478,0	2001,3	664,8	2783,4
12,00	13,013	191,7	0,151	194,8	815,6	471,4	1973,7	666,2	2789,2
13,00	14,013	195,1	0,141	198,5	831,1	468,3	1960,7	666,8	2791,8
14,00	15,013	198,3	0,132	202,0	845,7	465,3	1948,1	667,3	2793,9
15,00	16,013	201,4	0,124	205,3	859,6	462,5	1936,4	667,8	2795,9
18,00	19,013	209,9	0,105	214,4	897,8	454,4	1902,5	668,8	2800,1
19,00	20,013	212,5	0,100	217,2	909,4	451,8	1891,6	669,0	2801,0
20,00	21,013	215,0	0,095	220,0	921,1	449,4	1881,5	669,4	2802,6
25,00	26,013	226,1	0,077	232,3	972,6	437,7	1832,6	670,0	2805,2

Basic Steam & Condensate Loop



Pasteuriser control

Temperature control

A constant pasteurisation temperature is maintained by a temperature controller acting on the steam regulating valve (ref. 2 in figure 7.2). Any tendency for the product temperature to drop is immediately detected by a sensor in the product line before the holding tube. The sensor then changes the signal to the controller, which opens the steam regulating valve to supply more steam to the water. This increases the temperature of the circulating water and stops the temperature drop in the product.

Holding

The length and size of the externally located holding tube are calculated according to the known holding time and hourly capacity of the plant and the pipe dimension, typically the same as for the pipes feeding the pasteurisation plant. Dimensioning data for the holding tube are given in chapter 6.1. Typically the holding tube is covered by a stainless steel hood to preventing people from being burnt when touching and from radiation as well.

Pasteurisation control

It is essential to be certain that the milk has in fact been properly pasteurised before it leaves the plate heat exchanger. If the temperature drops below 72°C, the unpasteurised milk must be kept apart from the already pasteurised product. To accomplish this, a temperature transmitter and flow diversion valve are fitted in the pipe downstream of the holding tube. The valve returns unpasteurised milk to the balance tank if the temperature transmitter detects that the milk passing it has not been sufficiently heated.

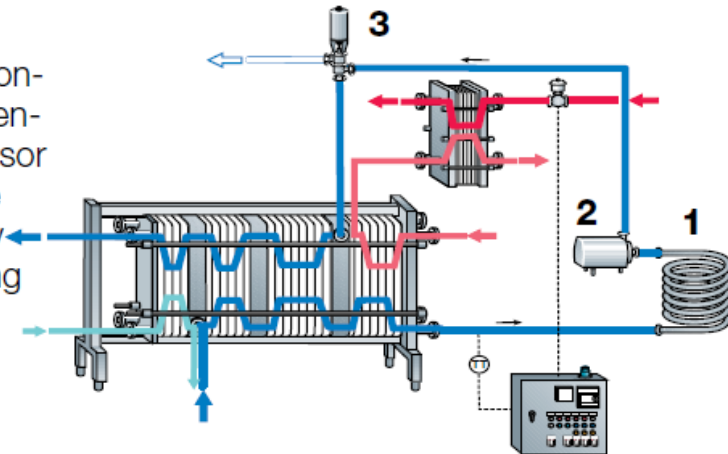


Fig. 7.3 Automatic temperature control loop.

- TT Temperature transmitter
 1 Holding tube
 2 Booster pump
 3 Diversion valve

- Product
 Steam
 Heating medium
 Cooling medium
 Diverted flow

Pasteuriser control Loop

Steam Control Loop

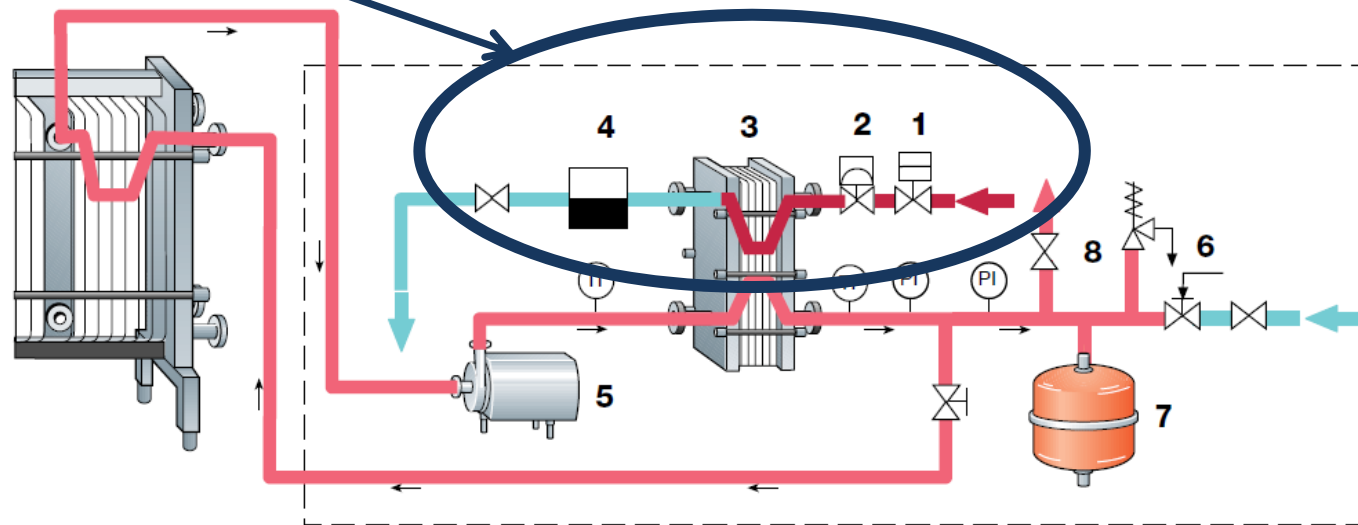


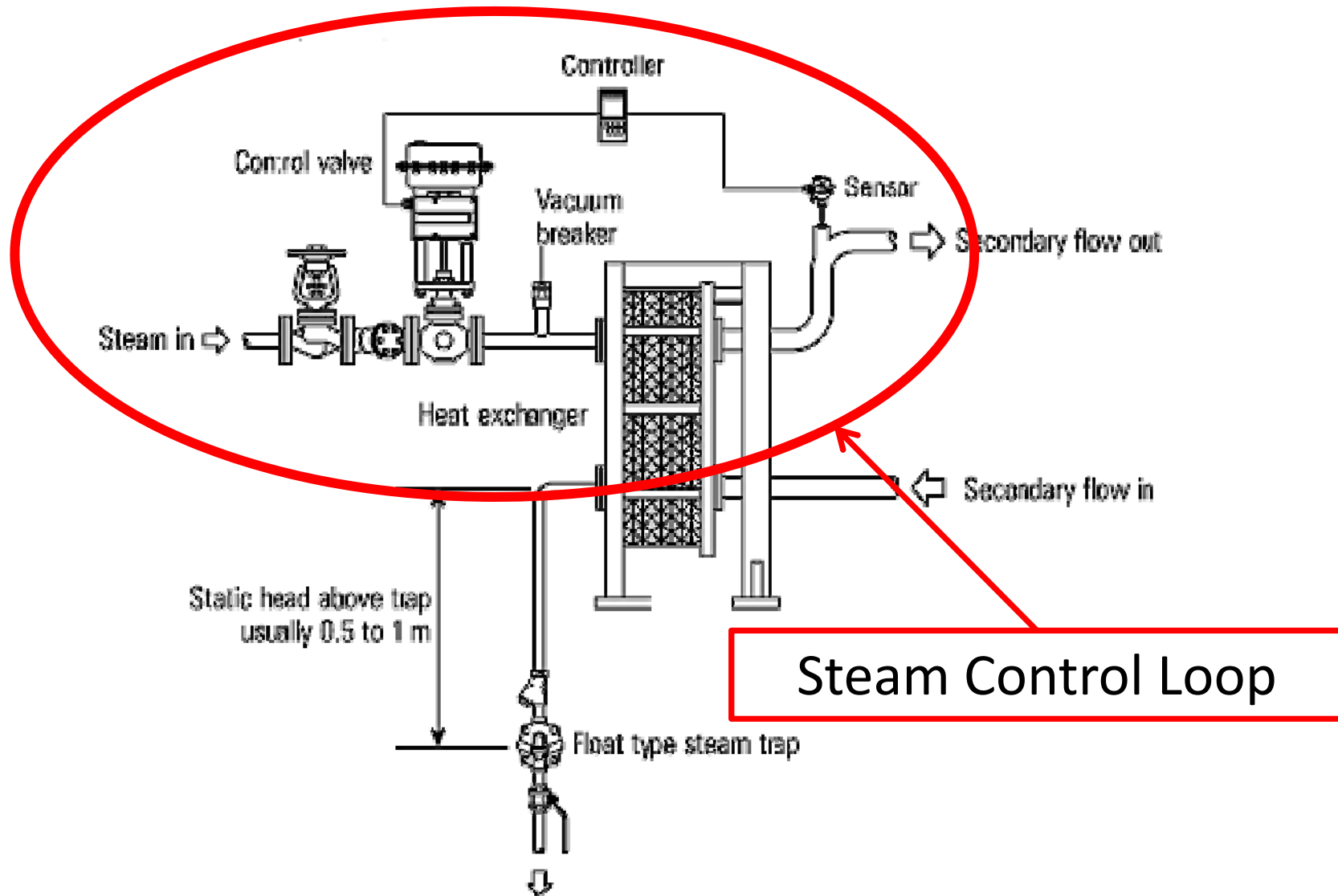
Fig. 7.2 Principle of the hot water system connected to a pasteuriser.

- 1 Steam shut-off valve
- 2 Steam regulating valve
- 3 Heat exchanger
- 4 Steam trap

- 5 Centrifugal pump
- 6 Water regulating valve
- 7 Expansion vessel
- 8 Safety and ventilation valves

- TI Temperature indicator
- PI Pressure indicator
- Steam
- Heating medium
- Water, incl. condensate

Steam control



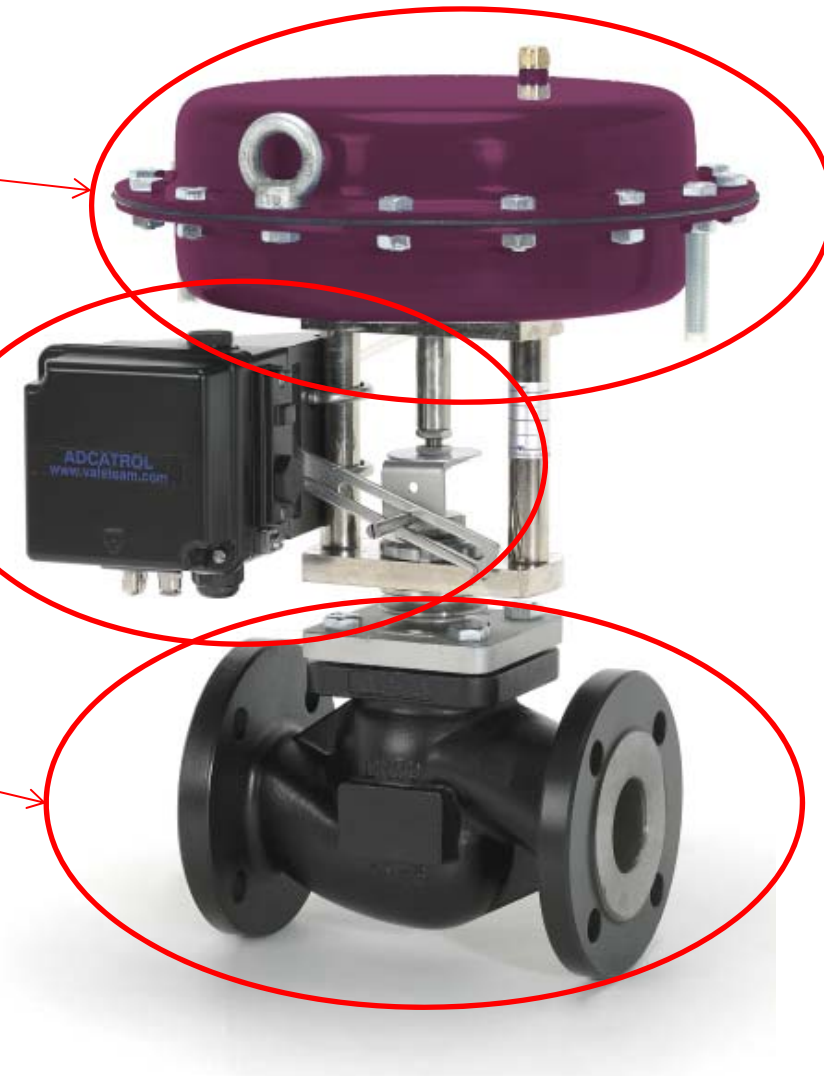
Steam Control Loop

Steam control Valve

ACTUATOR

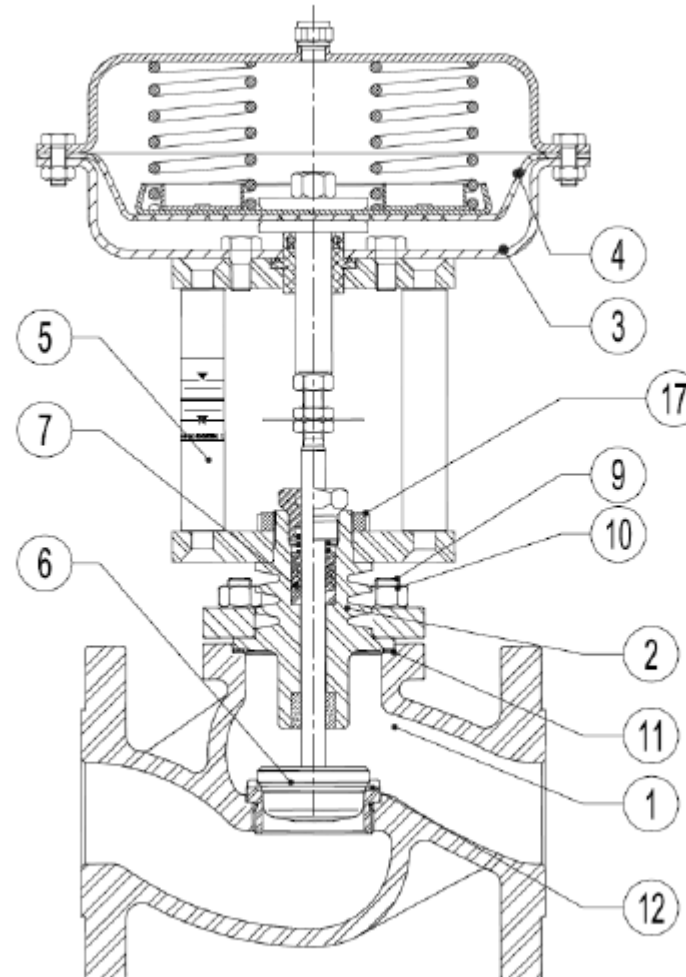
POSITIONER

VALVE BODY



Steam control Valve

POS.	DESIGNATION
1	Valve Body
2	Bonnet
3	Actuator (Steel)
	Actuator (Stainless steel)
4	*Diaphragm
5	Yoke (Steel)
	Yoke (Stainless steel)
6	*Valve plug
7	*Standard packing
8	*Metal bellows
9	Studs
10	Nuts
11	Gasket
12	Seat
13	Gasket
14	Gasket
15	Straight pin
16	Bolts
17	Lock nut

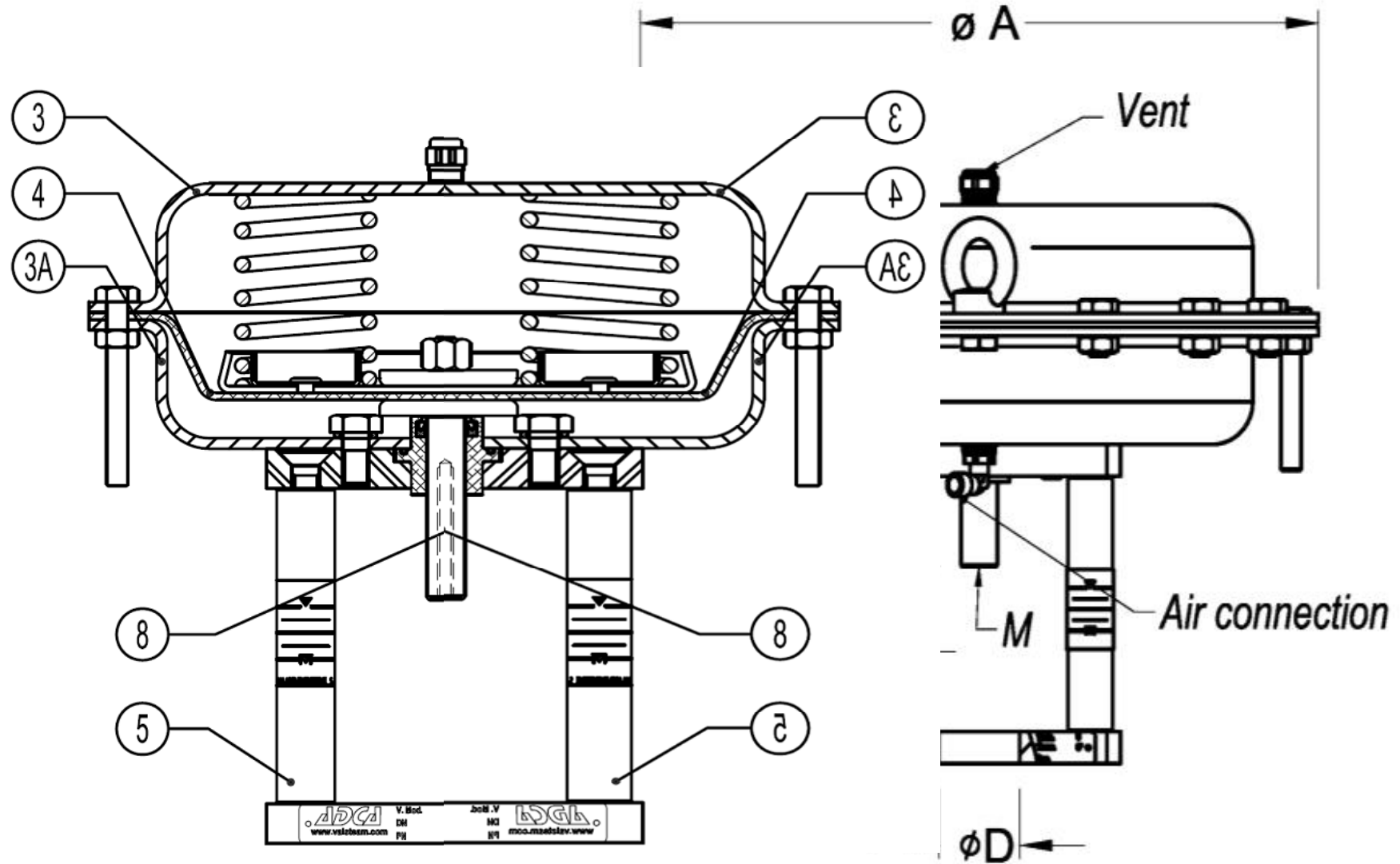


Steam control Valve -- ACTUATOR

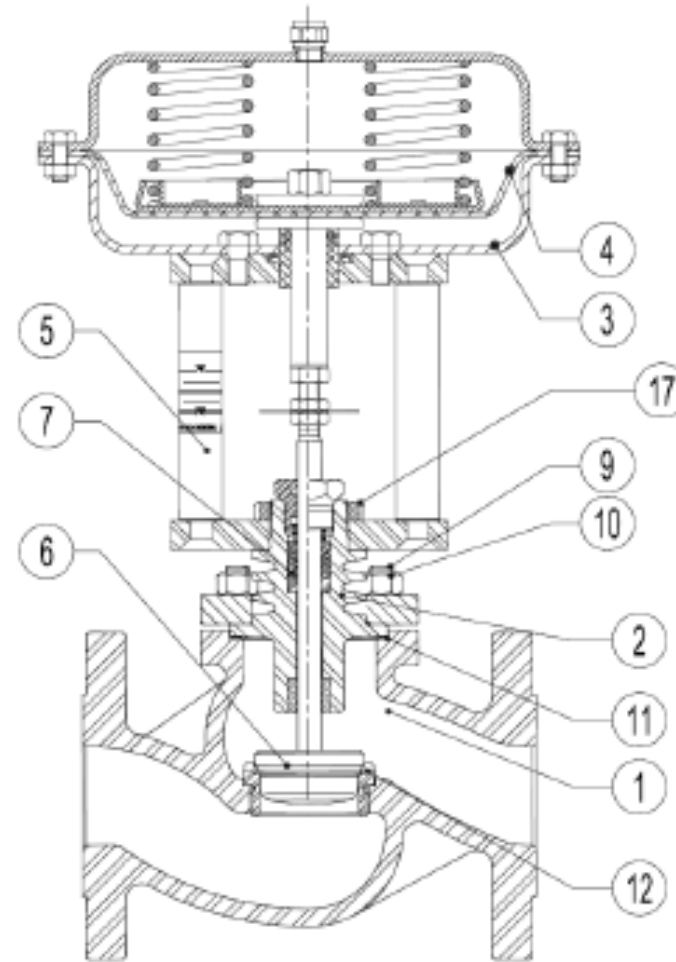
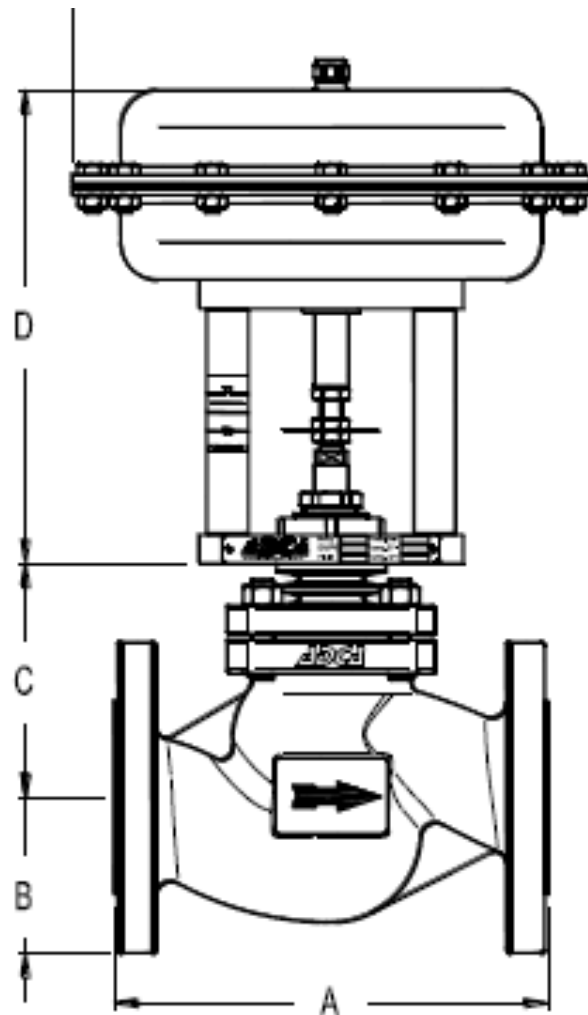
ACTUATOR



Steam control Valve -- ACTUATOR



Steam control Valve Body



Steam control Valve -- Positioner

