Data sheet

Differential pressure controller
AVPL 1.0 / 1.6

Description / Application

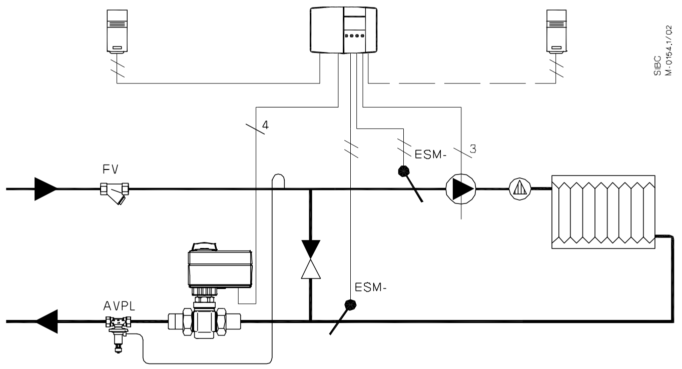
AVPL is used to control the differential pressure in district heating systems as well as the differential pressure on the primary side of house substations for smaller systems such as one and two-family houses.

The AVPL must be mounted in the return.

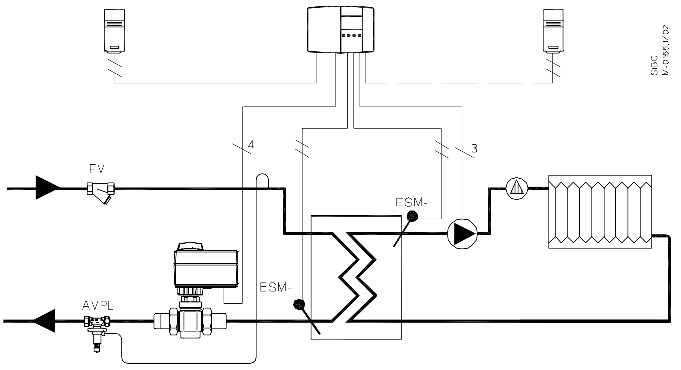
The AVPL is used to control the differential pressure across radiator systems and similar systems to keep a constant differential pressure even with a variable system resistance k_{va} and/or supply pressure dp_0.

AVPL can be set at any differential pressure between 5 kPa and 25 kPa (0.05 bar and 0.25 bar). The pre-set factory setting of the controller is 10 kPa (0.1 bar).

The AVPL has an external thread. Screwed connections with tailpieces with external thread and weld-on fittings are available as accessories. Impulse tube with nipples and O-rings for pressure connection is supplied with the product.



Directly connected heating system



Indirectly connected heating system

Function

AVPL is a proportional controller which operates according to the following principle: The degree of opening of the control valve /k_v value is proportional to the deviation between the controlled and set differential pressure, Δp_a-Δp_s. Thus the resistance/k_v value is adjusted to the actual differential pressure Δp_v and accordingly, the flow Q is adjusted so that the desired differential pressure Δp_a is obtained across the actual resistance k_{va} in the system.

Differential pressure across the system

$$\Delta p_a = (Q/k_{va})^2$$

Differential pressure across the controller

$$\Delta p_v = (Q/k_{vv})^2$$

Differential pressure from the district heating

$$\Delta p_o = \Delta p_a + \Delta p_v$$

Rewritten the flow can be expressed as

$$= \sqrt{}[\Delta p_o/(1/(k_{va})^2+1/(k_{vv})^2)]$$

The max. flow is limited by the min. differential pressure of the district heating $\Delta p_{o_{min}}$, the max. capacity of the system $k_{va_{max}}$, and of the max. capacity of the controller k_{vvs}.

Max. system flow:

$$Q_{max} = \sqrt{}[\Delta p_{o_{min}}/(1/(k_{va_{max}})^2+1/(k_{vvs})^2)]$$

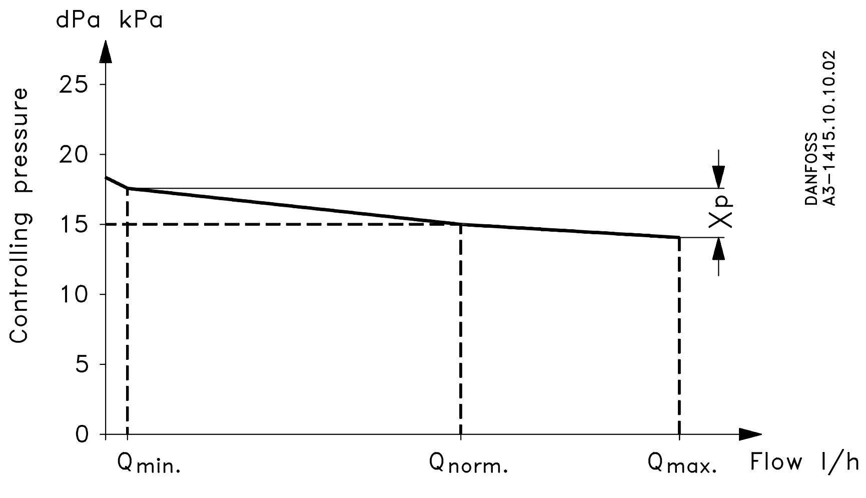
Settings

AVPL can be set to any differential pressure within the range 5 kPa to 25 kPa (0.05 bar to 0.25 bar). The factory pre-setting of the AVPL is 10 kPa (0.1 bar), 1 kPa for each turn.

As mentioned above, the proportional effect depends on the correlation between the controller valve's degree of opening and the deviation between the controlled and set differential pressure. Furthermore, the deviation depends on the actual differential pressure across the control valve and the actual control setting.

The chosen deviation is large enough to ensure a stable control and small enough to keep the controlled differential pressure within acceptable limits.

The controller is designed in such a way that the controlled and the set differential pressures are equal when the flow is about 250 l/h for AVPL 1.0 and 400 l/h for AVPL 1.6 at nominal differential pressure 50 kPa (Δp_v). At min. and max. flow the controlled differential pressure deviates from the set pressure with ±1…3 kPa, depending on the actual differential pressure and setting.



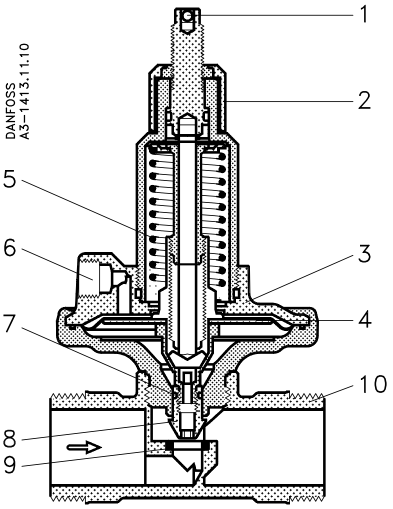
Set pressure

Mounting

AVPL must be mounted in the return with the flow in the direction of the arrow. The impulse tube must be mounted in the flow.

Design

1. Spindle for the setting of the differential pressure
2. Bushing
3. Diaphragm element
4. Control diaphragm
5. Reference spring
6. Connection for impulse tube
7. O-ring
8. Pressure-relieved valve cone
9. Seat
10. Valve body



Materials

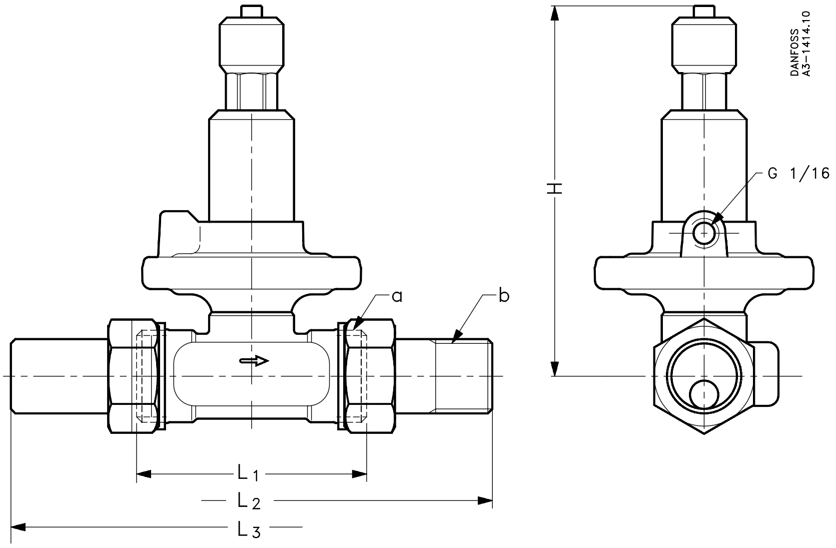
Parts in contact with water

Valve body, spindle etc.	Brass
Cone, seat and spring	Stainless steel
Diaphragm and O-ring	EPDM rubber

Pressure and temperature

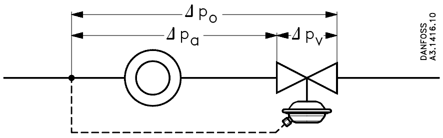
Max. operating pressure	1600 kPa (16 bar)
Test pressure	2500 kPa (25 bar)
Max. differential pressure across the valve	450 kPa (4.5 bar)
Max. flow temperature	120 °C

Dimensions



Type	L_1 mm	L_2 mm	L_3 mm	H mm	D mm	a ISO 228/1	b ISO 7/1
AVPL	65	131	139	104	63	G$^{3}/_{4}$ A	R$^{1}/_{2}$

Sizing



Considering the correlation between the capacity of the system k_{va}, the system flow Q and the differential pressure Δp_a, the controller setting Δp_i is determined by:

$$\Delta p_i = \Delta p_a = (Q/k_{va})^2$$

Based on the stated differential pressure of the district heating Δp_o and the calculated differential pressure of the system Δp_a, the differential pressure across the controller valve is expressed as:

$$\Delta p_v = \Delta p_o - \Delta p_a$$

Finally, a check is required to ensure that the actual capacity of the controller k_{vv} is smaller than its max. capacity k_{vs}

$$k_{vv} = Q / \sqrt{\Delta p_v} \leq k_{vs}$$

Example:

A heating system with a number of parallel hot surfaces.
Required flow: Q = 0.24 m³/h .
Total capacity of the system determined to be k_{va} = 0.6 m³/h.

Calculation of the differential pressure across the system:

$$\Delta p_a = (Q/ k_{va})^2 = (0.24 /0.6)^2$$
$$= 0.160 \text{ bar } (16 \text{ kPa})$$

The differential pressure from the district heating is stated to be:

$$\Delta p_o = 0.5 \text{ bar } (50 \text{ KPa}) \text{ min.}$$

Calculation of the differential pressure across the controller valve:

$$\Delta p_v = \Delta p_o - \Delta p_a = 0.5 \text{ bar} - 0.16 \text{ bar}$$
$$= 0.34 \text{ bar } (34 \text{ kPa})$$

In this example the capacity of the controller valve is

$$k_{vv} = Q/\sqrt{\Delta p_v} = 0.24/\sqrt{0.34} = 0.412 \text{ m}^3\text{/h}$$

which is less that the max. capacity of the controller = k_{vs} = 1 m³/h.

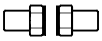
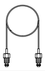
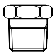
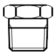
Ordering

AVPL controller incl. impulse tube with nipple and O-ring packing as well as tailpiece socket $G^1/_{16}$ - $R^3/_8$ for pressure connection

Product

Type	DN	PN bar	k_{vs} m³h	Setting range bar	External thread ISO 228/1	**Code No.**
AVPL 1.0	15	16	1.0	0.05 - 0.25	$G^3/_4$ A	**003L5030**
AVPL 1.6	15	16	1.6	0.05 - 0.25	$G^3/_4$ A	**003L5031**

Accessories and spare parts

Type		DN	Connection	Remarks	**Code No.**
Tailpiece with external thread		DN 15	G¾ A		**003N5070**
Weld-on fittings		DN 15	G¾ A		**003N5090**
Impulse tube				1.5 m - AVPL 1.0	**003L8152**
				2.5 m - AVPL 1.6	**003L5043**
Tailpiece socket			$G^1/_{16}$ - $R^3/_8$		**003L5042**
Tailpiece socket			$G^1/_{16}$ - $R^1/_4$		**003L8151**

EPP insulation cap [1]	DN 15			**003L8170**

[1] The material for the insulation cap is approved according to the fire hazard classification B2, DIN 4102.