

Data sheet

Differential pressure, flow and temperature controller (PN 25) AVPQT - return mounting, adjustable setting

Description



The AVPQT is a self-acting differential pressure, flow and temperature controller primarily for use in district heating systems. The controller closes on rising differential pressure or temperature, or when set max. flow is exceeded.

AVPQT controller can be combined with AVT or STM thermostatic actuators.
The AVPQT controller have a control valve with adjustable flow restrictor, combination piece with connection neck for thermostat, an actuator with two control diaphragms and handle for differential pressure setting.

The controllers combined with AVT and STM thermostats are type-tested acc. to EN 14597.

Controllers combined with STM thermostats protect systems against exceeding temperatures.

Applications:

- District heating systems acc. to DIN 4747
- Heating systems acc. to EN 12828 (DIN 4751) and EN 12953-6 (DIN 4752)
- Water heating systems for drinking and industrial waters acc. to DIN 4753.

Main data:

- DN 15-50
- k_{vs} 4.0-25 m³/h
- Flow range: 0.07-15 m³/h
- PN 25
- Setting range: 0.2-1.0 bar
- Flow restrictor Δp_b : 0.2 bar
- Setting ranges:
 - AVT:
-10 ... 40 °C / 20 ... 70 °C / 40 ... 90 °C / 60 ... 110 °C
and
10 ... 45 °C / 35 ... 70 °C / 60 ... 100 °C / 85 ... 125 °C
 - STM:
20 ... 75 °C / 40 ... 95 °C / 30 ... 110 °C
- Temperature:
 - Circulation water / glycolic water up to 30 %:
2 ... 150 °C
- Connections:
 - Ext. thread (weld-on, thread and flange tailpieces)
 - Flange

Ordering

Example:

AVT (or STM) / AVPQT controller:
Differential pressure; flow and temperature controller; return mounting; DN 15; k_{vs} 4.0; PN 25; setting range 0.2-1.0 bar;
 T_{max} 150 °C; ext. thread;

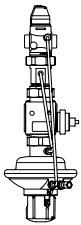
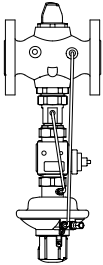
- 1x AVPQT DN 15 controller
Code No: **003H6807**
- 1x AVT thermostatic actuator, 40 ... 90 °C
Code No: **065-0598**
- 1x Impulse tube set AV R 1/8
Code No: **003H6852**

Option:

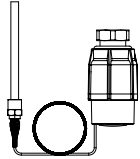
- 1x Weld-on tailpieces
Code No: **003H6908**

The controller AVPQT will be delivered completely assembled, inclusive combination piece and impulse tubes between valve and actuator. Thermostatic actuator AVT will be delivered separately. External impulse tube (AV) must be ordered separately.
In case of safety temp. monitoring STM should be ordered instead of AVT.

AVPQT Controller (return mounting)

Picture	DN (mm)	k_{vs} (m ³ /h)	Connection	Δp setting range (bar)	Code No.
	15	4.0	Cylindr, ext, thread acc, to ISO 228/1	0.2-1.0	003H6807
	20	6.3			003H6808
	25	8.0			003H6809
	32	12.5	Flanges PN 25, acc, to EN 1092-2	0.2-1.0	003H6810
	40	20			003H6811
	50	25			003H6812

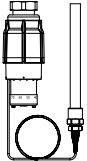
AVT Thermostatic actuator

Picture	For valves	Setting range (°C)	Temperature sensor with brass immersion pocket, length, connection	Code No.
	DN 15-25	-10 ... +40	170 mm, R 1/2 ¹⁾	065-0596
		20 ... 70		065-0597
		40 ... 90		065-0598
		60 ... 110		065-0599
	DN 32-50	-10 ... +40	210 mm, R 3/4 ¹⁾	065-0600
		20 ... 70		065-0601
		40 ... 90		065-0602
		60 ... 110		065-0603
	DN 15-50	10 ... 45	255 mm, R 3/4 ^{1) 2)}	065-0604
		35 ... 70		065-0605
		60 ... 100		065-0606
		85 ... 125		065-0607

¹⁾ conic male thread EN 10226-1

²⁾ without immersion pocket



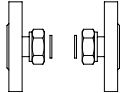
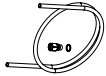


STM Safety temperature monitor (actuator)

Picture	For valves	Limit range (°C)	Temperature sensor with brass immersion pocket, length, connection	Code No.
	DN 15-50	30 ... 110	210 mm, R 3/4 ¹⁾	065-0608
		20 ... 75		065-0609
		40 ... 95		065-0610

¹⁾ conic male thread EN 10226-1

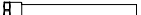

Ordering (continuous)

Accessories for AVPQT

Picture	Type designation	DN	Connection		Code No.
	Weld-on tailpieces	15	-		003H6908
		20			003H6909
		25			003H6910
	External thread tailpieces	15	Conical ext. thread acc. to EN 10226-1	R 1/2	003H6902
		20		R 3/4	003H6903
		25		R 1	003H6904
	Flange tailpieces	15	Flanges PN 25, acc. to EN 1092-2		003H6915
		20			003H6916
		25			003H6917
	Impulse tube set AV	Description: - 1x copper tube Ø6 x 1 x 1500 mm - 1x compression fitting ¹⁾ for imp. tube connection to pipe Ø6 x 1 mm		R 1/8	003H6852
				R 3/8	003H6853
				R 1/2	003H6854
	¹⁾ 10 compression fittings for imp. tube connection to pipe, Ø6 x 1 mm R 1/8				003H6857
	¹⁾ 10 compression fittings for imp. tube connection to pipe, Ø6 x 1 mm R 3/8				003H6858
	¹⁾ 10 compression fittings for imp. tube connection to pipe, Ø6 x 1 mm R 1/2				003H6859
	¹⁾ 10 compression fittings for imp. tube connection to actuator, Ø6 x 1 mm G 1/8				003H6931
	Shut off valve Ø6 mm				003H0276

¹⁾ Compression fitting consists of a nipple, compression ring and nut.

Accessories for thermostats

Picture	Type designation	For controllers	Material	Code No.
	Immersion pocket PN 25	AVT / AVPQT DN 15-25	Brass	065-4414 ¹⁾
			Stainless steel, mat. No. 1.4571	065-4415 ¹⁾
		AVT / AVPQT DN 32-50 STM / AVPQT DN 15-50	Brass	065-4416 ¹⁾
			Stainless steel, mat. No. 1.4435	065-4417 ¹⁾
	Combination piece K2			003H6855
	Combination piece K3			003H6856

¹⁾ Not for AVT thermostatic actuator code numbers: 065-0604, 065-0605, 065-0606, 065-0607

Service kits

Picture	Type designation	DN	k _{vs} (m ³ /h)	Code No.
	Valve insert	15	2.5	003H6864
			4.0	003H6865
		20	6.3	003H6866
		25	8.0	003H6867
		32 / 40 / 50	12.5 / 20 / 25	003H6868
	Type designation	Δp setting range (bar)		Code No.
	Actuator with adjustable handle	0.2-1.0		003H6842
	Housing of sensor stuffing box	for sensors		
		AVT R 1/2		065-4420
		AVT R 3/4		065-4421

Technical data

Valve

Nominal diameter			DN	15	20	25	32	40	50
k _{vs} value			m³/h	4.0	6.3	8.0	12.5	20	25
Range of max. flow setting	Δp _b ¹⁾ = 0.2 bar	from		0.07	0.16	0.2	0.4	0.8	0.8
		to		2.2	3.0	3.5	8.0	10	12
		to ³⁾		2.4	3.5	4.5	10	12	15
Cavitation factor z			≥ 0.6		≥ 0.55		≥ 0.5		
Leakage acc. to standard IEC 534			% of k _{vs}	≤ 0.02			≤ 0.05		
Nominal pressure			PN	25					
Min. differential pressure			bar	see remark ²⁾					
Max. differential pressure				20			16		
Medium			Circulation water / glycolic water up to 30 %						
Medium pH			Min. 7, max. 10						
Medium temperature			°C	2 ... 150					
Connections	valve		External thread			Flange			
	tailpieces		Weld-on, external thread and flange			-			
Materials									
Valve body	thread		Red bronze CuSn5ZnPb (Rg5)				-		
	flange		-				Ductile iron EN-GJS-400-18-LT (GGG 40.3)		
Valve seat			Stainless steel, mat. No. 1.4571						
Valve cone			Dezincing free brass CuZn36Pb2As						
Sealing			EPDM						
Pressure relieve system			Piston						

¹⁾ Δp_b - differential pressure over flow restrictor

²⁾ Depends on the flow rate and valve k_{VS}: For Q_{set} = Q_{max} -> Δp_{min} ≥ 0.5 bar; For Q_{set} < Q_{max} -> Δp_{min} = $\left(\frac{Q}{k_{VS}}\right)^2 + \Delta p_b$
³⁾ Higher max flow are achieved at higher differential pressures over AVPQT controller. In general at Δp > 1-1.5 bar

Actuator

Type		AVPQT
Actuator size	cm ²	54
Nominal pressure	PN	25
Flow restrictor diff. pressure, Δp _b	bar	0.2
Diff. pressure setting ranges and spring colours		0.2-1.0
		yellow
Materials		
Actuator housing	Upper casing of diaphragm	Stainless steel, mat. No.1.4301
	Lower casing of diaphragm	Dezincing free brass CuZn36Pb2As
Diaphragm		EPDM
Impulse tube		Copper tube Ø6 × 1 mm

AVT Thermostatic actuator

Setting range X _s	°C	−10 ... 40 / 20 ... 70 / 40 ... 90 / 60 ... 110 10 ... 45 / 35 ... 70 / 60 ... 100 / 85 ... 125
Time constant T acc. to EN 14597	s	max. 50 (170 mm, 210 mm), max. 30 (255 mm)
Gain K _s	mm/°K	0.2 (170 mm), 0.3 (210 mm), 0.7 (255 mm)
Max. adm. temperature at sensor		50 °C above maximum setpoint
Max. amb. temperature at thermostat	°C	0 ... 70
Nominal pressure sensor	PN	25
Nominal pressure immerison pocket		
Capillary tube length		5 m (170 mm, 210 mm), 4 m (255 mm)
Materials		
Temperature sensor		Cooper
Immersion pocket ¹⁾	Ms design	Brass, nickel-plated
	Stainless steel design	Mat. No. 1.4571 (170 mm), mat. No. 1.4435 (210 mm)
Handle for temp. setting		Polyamide, glass fiber-reinforced
Scale carrier		Polyamide

¹⁾ for sensor 170 and 210 mm

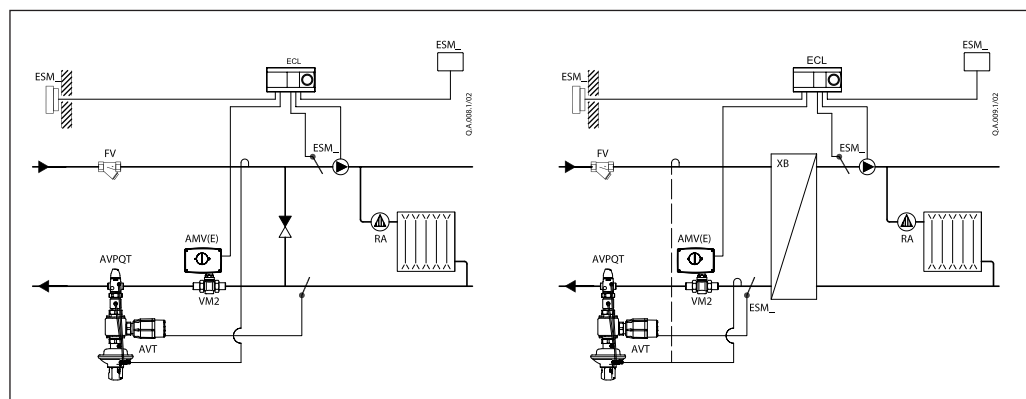
Technical data (continuous)

STM Safety temperature monitor (actuator)

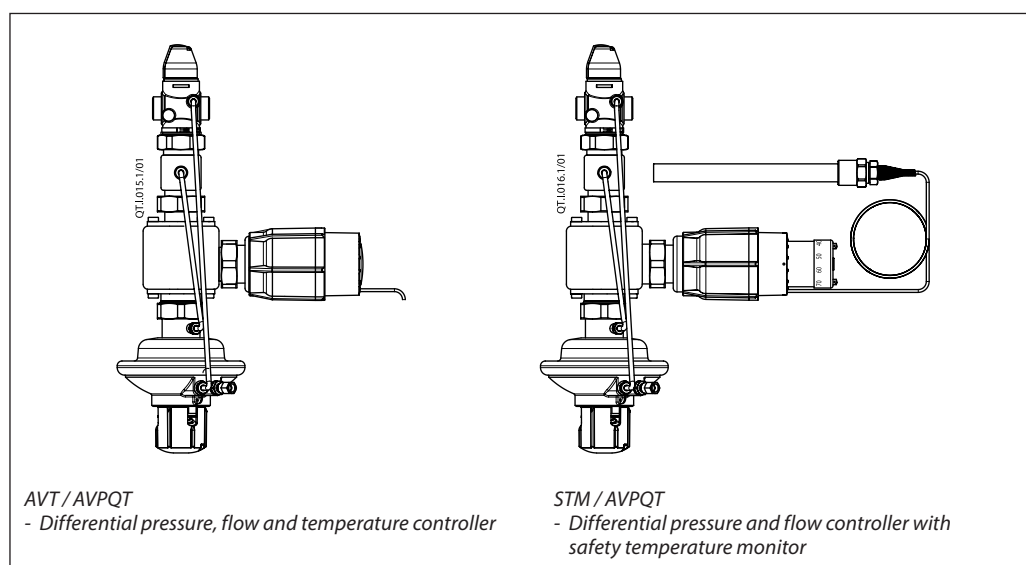
Limit range X_s	°C	20 ... 75 / 40 ... 95 / 30 ... 110
Time constant T acc. to EN 14597	s	max. 100
Gain K_s	mm/°K	0.3
Max. adm. temperature at sensor		80 °C above maximum setpoint
Max. amb. temperature at thermostat	°C	0 ... 70
Nominal pressure sensor	PN	25
Nominal pressure immersion pocket		
Capillary tube length	m	5
Materials		
Temperature sensor		Cooper
Immersion pocket	Ms design	Brass, nickel-plated
	Stainless steel design	mat. No. 1.4435
Handle for temp. setting		Polyamide, glass fiber-reinforced
Scale carrier		Polyamide

Application principles

The controller must be installed in the return pipe only.



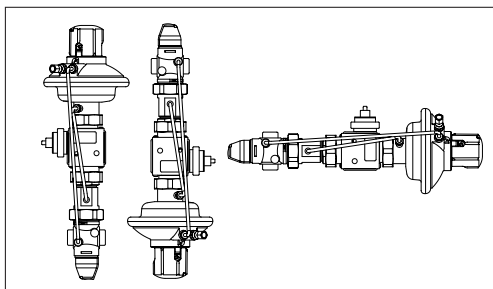
Combinations



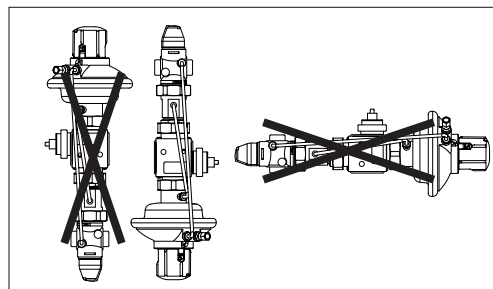
Installation positions

Differential pressure, flow and temperature controller

Up to medium temperature of 100 °C the controllers can be installed in any position.



For higher temperatures the controllers have to be installed in horizontal pipes only, with a pressure and temperature actuator oriented downwards.

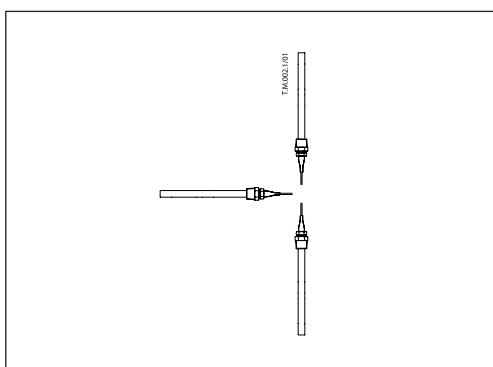


Temperature sensor

The place of installation must be chosen in a way that the temperature of the medium is directly taken without any delay. Avoid overheating of temperature sensor. The temperature sensor must be immersed into the medium in its full length.

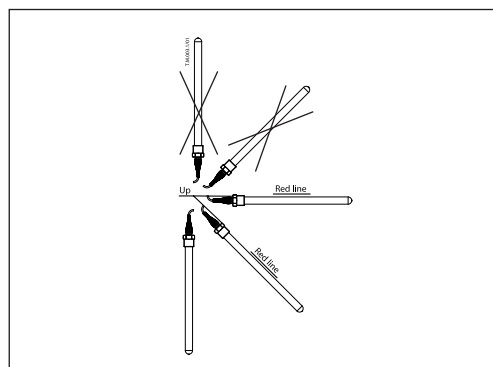
Temperature sensors 170 mm R $\frac{1}{2}$ and 210 mm R $\frac{3}{4}$

- The temperature sensor may be installed in any position.

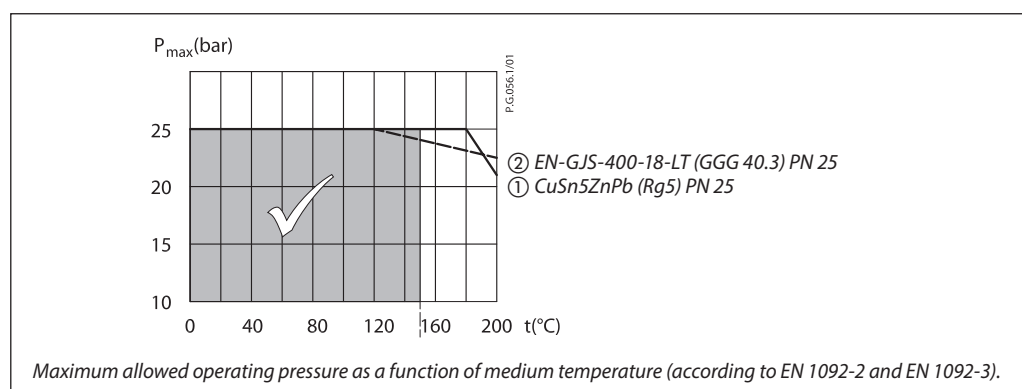


Temperature sensor 255 mm R $\frac{3}{4}$

- The temperature sensor must be installed as shown on the picture.



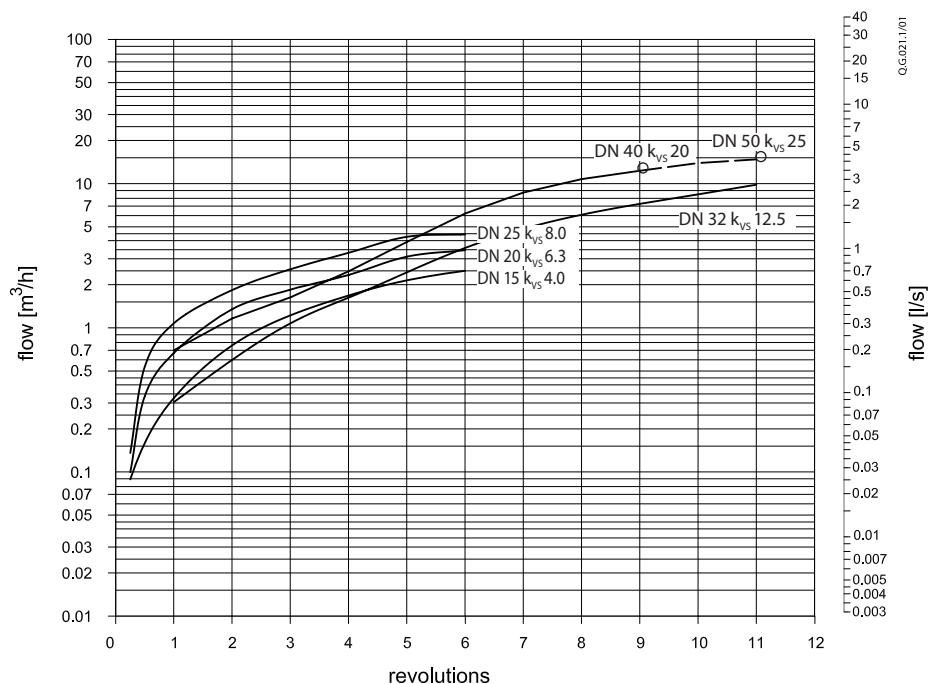
Pressure temperature diagram



Flow diagram

Sizing and setting diagram

Relation between actual flow and number of revolutions on flow restrictor. Values given are approximate.



1 = 360°

Flow can be adjusted by turning flow restrictor screw counter-clockwise as shown in this diagram.
Water flow shown at differential pressure across flow

restrictor 0.2 bar (20 kPa) and across the controller from 0.5 bar (50 kPa) to 16/20 bar (1600/2000 kPa).

Remark:

Controllers DN 40 and DN 50 have the same curve up to 9 revolutions.

Sizing

- indirectly connected heating system

Example

Motorised control valve (MCV) for indirectly connected heating system requires differential pressure of 0.3 (30 kPa) bar and flow less than 1150 l/h. Return temperature is limited to 70 °C.

Given data (AVPQT):

$$\begin{aligned} Q_{\max} &= 1.15 \text{ m}^3/\text{h} \text{ (1150 l/h)} \\ \Delta p_{\min} &= 1.0 \text{ bar (100 kPa)} \\ \Delta p_{\text{exchanger}} &= 0.05 \text{ bar (5 kPa)} \\ \Delta p_{\text{MCV}} &= 0.3 \text{ bar (30 kPa) selected} \\ \Delta p_b^{1)} &= 0.2 \text{ bar (20 kPa)} \end{aligned}$$

Remark:

¹⁾ Δp_b is differential pressure over flow restrictor

The differential pressure set value is:

$$\begin{aligned} \Delta p_{\text{set value}} &= \Delta p_{\text{exchanger}} + \Delta p_{\text{MCV}} \\ \Delta p_{\text{set value}} &= 0.05 + 0.3 \\ \Delta p_{\text{set value}} &= 0.35 \text{ bar (35 kPa)} \end{aligned}$$

The total pressure loss across the controller is:

$$\begin{aligned} \Delta p_{\text{AVPQT}} &= \Delta p_{\min} - \Delta p_{\text{exchanger}} - \Delta p_{\text{MCV}} \\ \Delta p_{\text{AVPQT}} &= 1.0 - 0.05 - 0.3 \\ \Delta p_{\text{AVPQT}} &= 0.65 \text{ bar (65 kPa)} \end{aligned}$$

Possible pipe pressure losses in tubes, shut-off fittings, heatmeters, etc. are not included.

k_v value is calculated according to formula:

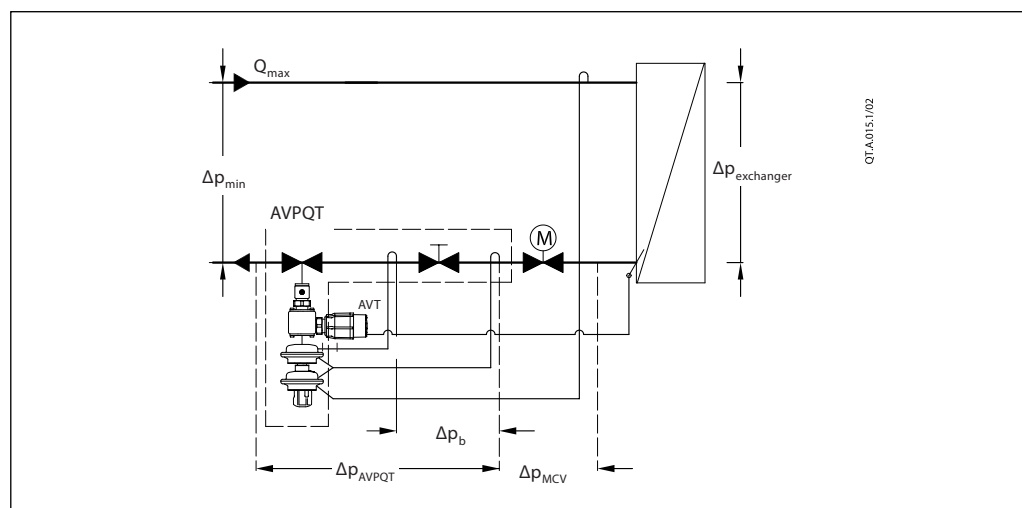
$$k_v = \frac{Q_{\max}}{\sqrt{\Delta p_{\text{AVPQT}} - \Delta p_b}} = \frac{1.15}{\sqrt{0.65 - 0.2}}$$

$$k_v = 1.7 \text{ m}^3/\text{h}$$

Solution:

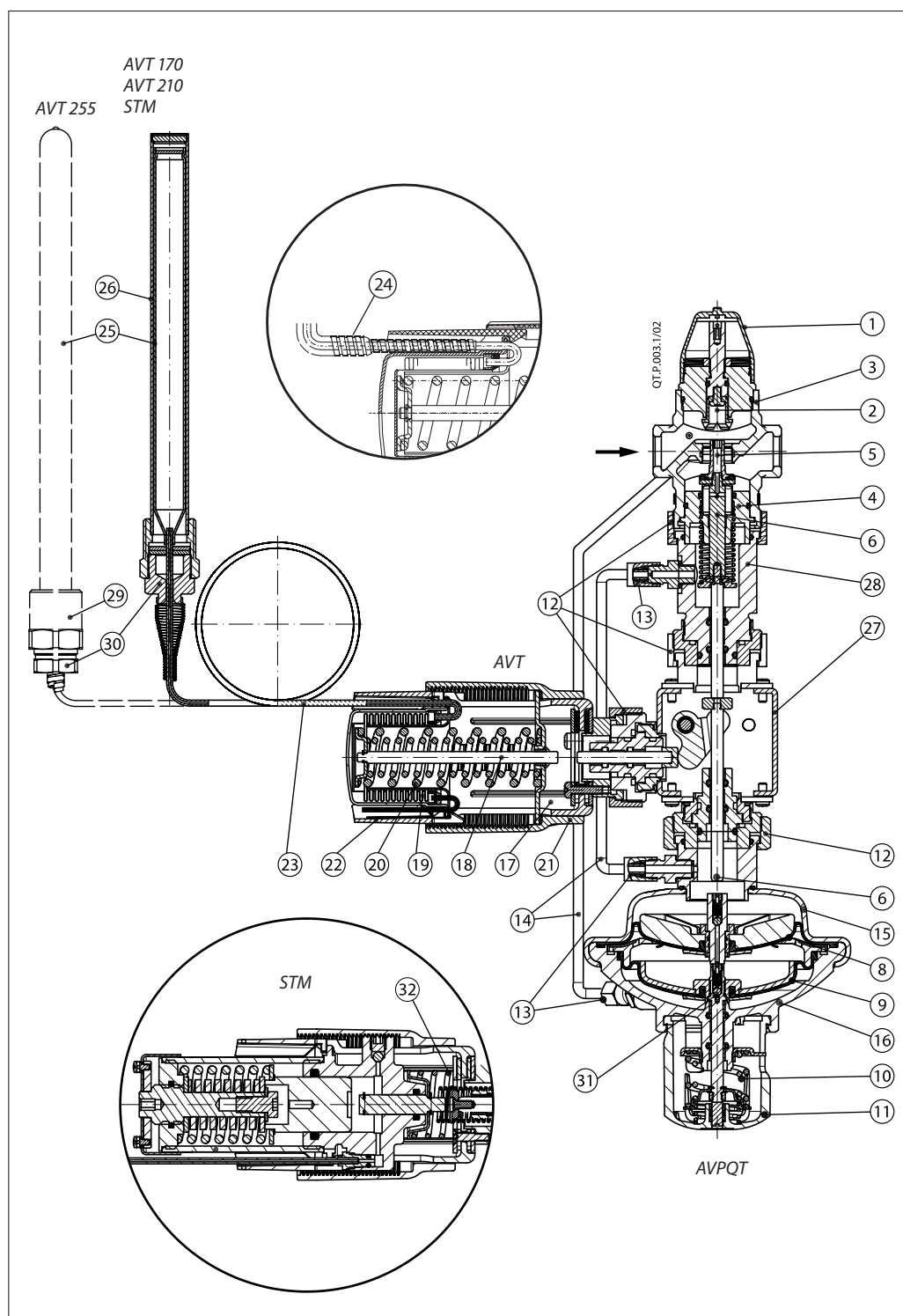
The example selects:

- AVPQT DN 15, k_{vs} value 4.0, with differential pressure setting range 0.2-1.0 bar, flow setting range 0.15-1.4 m³/h and
- AVT 170 mm, temperature setting range 40 ... 90 °C.



Design

1. Cover
2. Adjustable flow restrictor
3. Valve body
4. Valve insert
5. Pressure relieved valve cone
6. Valve stem
7. Control drain
8. Control diaphragm for flow control
9. Control diaphragm for diff. pressure control
10. Setting spring for diff. pressure control
11. Handle for diff. pressure setting, prepared for sealing
12. Union nut
13. Compression fitting for impulse tube
14. Impulse tube
15. Upper casing of diaphragm
16. Lower casing of diaphragm
17. Thermostatic actuator AVT, STM
18. Thermostat stem
19. Bellows
20. Setting spring for temperature control
21. Handle for temperature setting, prepared for sealing
22. Scale carrier
23. Capillary tube
24. Flexible protected pipe (at 255mm only)
25. Temperature sensor
26. Immersion pocket
27. Combination piece K2
28. Connection piece V
29. Sensor stuffing box
30. Housing of sensor stuffing box
31. Eccess pressure safety valve
32. Safety spring



Function

Differential pressure, flow and temperature controller

Flow volume causes pressure drop across the adjustable flow restrictor. Resulting pressures are being transferred through the impulse tubes and/or control drain in the actuator stem to the actuator chambers and act on control diaphragm for flow control. The flow restrictor diff. pressure is controlled and limited by means of built-in spring for flow control. Control valve closes on rising differential pressure and opens on falling differential pressure to control max flow.

Pressure changes from flow and return pipes are being transferred through the impulse tubes to the actuator chambers and act on control diaphragm for diff. pressure control. The diff. pressure is controlled by means of setting spring for diff. pressure control. Control valve closes on rising differential pressure and opens on falling differential pressure to maintain constant differential pressure.

Controller is equipped with excess pressure safety valve, which protects control diaphragm for diff. pressure control from too high differential pressure.

Safety Temperature Monitor (STM)

- Function
The safety temperature monitor is proportional temperature controller which controls temperature and protects the system against exceeding temperatures. The valve cone is soft sealed and pressure relieved.

In case the temperature at the temperature sensor exceeds the adjusted set point, safety temperature monitor interrupts energy supply by closing the valve. As soon as the temperature at the temperature sensor drops, the valve opens automatically.

Handle for limit setting can be sealed.

- Extended safety function
If there is a leakage in the area of the temperature sensor, the capillary tube, or the thermostat, the valve closes by a safety spring in the safety thermostat. In this case safety temperature monitor (actuator) must be replaced.

- Physical Function Principle

The safety temperature monitor operates in accordance with the liquid expansion principle. The temperature sensor, the capillary tube and the bellows are filled with liquid. As the temperature at the temperature sensor rises, the liquid expands, the thermostat stem moves out and closes the valve.

Temperature Controller (AVT)

- Function
By increasing of medium temperature valve cone moves towards the seat (valve closes), by decreasing of medium temperature valve cone moves away from the seat (valve opens).

Handle for temperature setting can be sealed.

- Physical Function Principle

Medium temperature changes cause pressure changes in temperature sensor. Resulting pressure is being transferred through the capillary tube to the bellows. Bellows moves thermostat stem and opens or closes the valve.

Settings

Flow setting

Flow setting is being done by the adjustment of the flow restrictor position. The adjustment can be performed on the basis of flow adjustment diagram (see relevant instructions) and/or by the means of heat meter.

Differential pressure setting

Differential pressure setting is being done by the adjustment of the setting spring for diff. pressure control. The adjustment can be done by means of handle for diff. pressure setting and/or pressure indicators.

Temperature setting (AVT)

Temperature setting is being done by the adjustment of the setting spring for temperature control. The adjustment can be done by means of handle for temperature setting and/or temperature indicators.

Limit setting (STM)

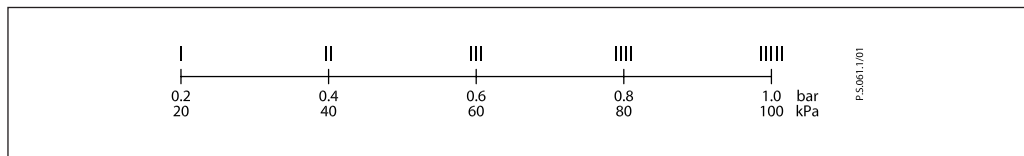
Limit setting is being done by the adjustment of the setting spring for temperature control. The adjustment can be done by means of handle for limit setting and/or temperature indicators.

Adjustment diagram

Differential pressure setting

Relation between scale figures and differential pressure.

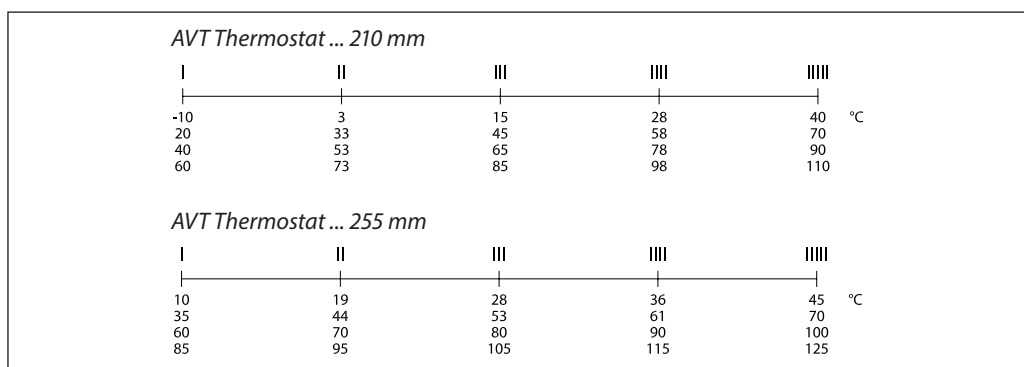
Note: The values given are approximate



Temperature setting

Relation between scale numbers 1-5 and closing temperature.

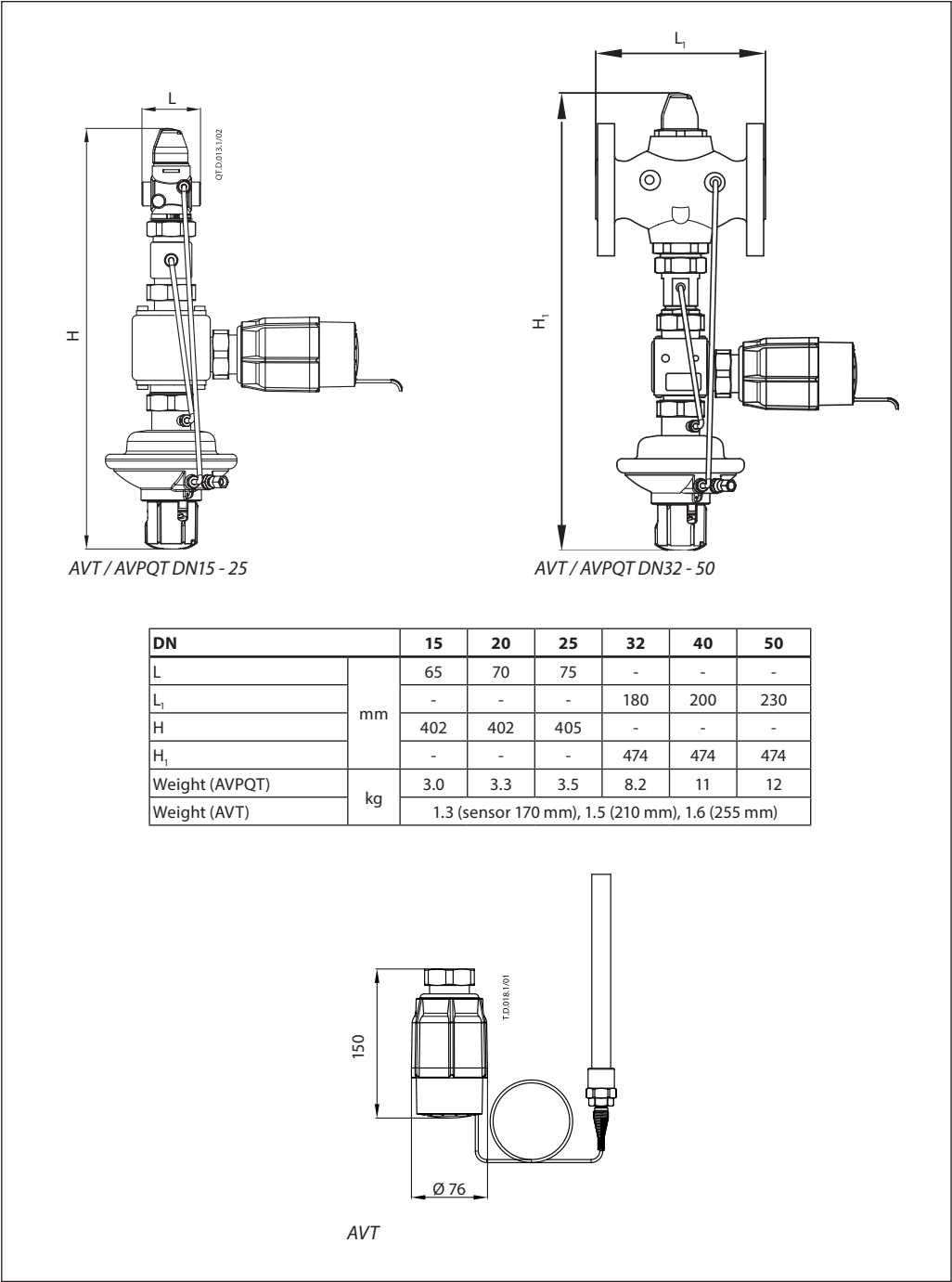
Note: The values given are approximate



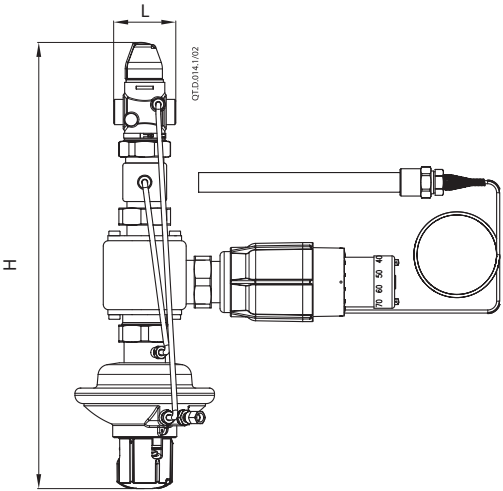
Note:

STM Safety temperature monitor (actuator):
temperature scale is already written on the product

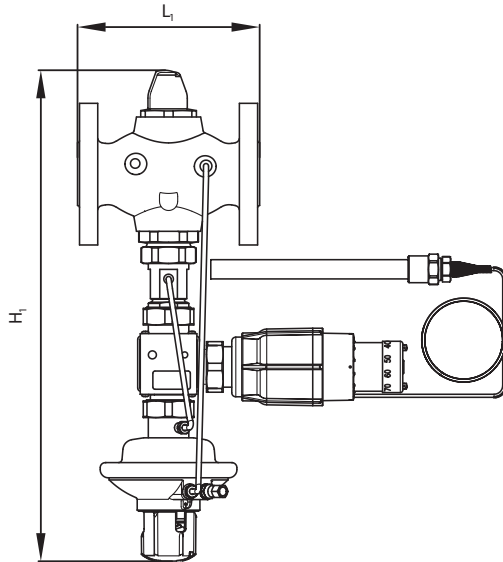
Dimensions



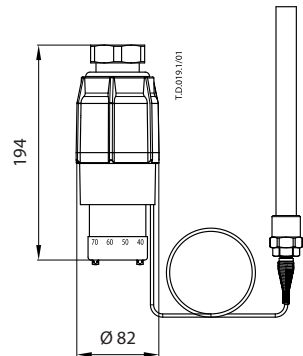
Dimensions (continuous)



STM / AVPQT DN15 - 25



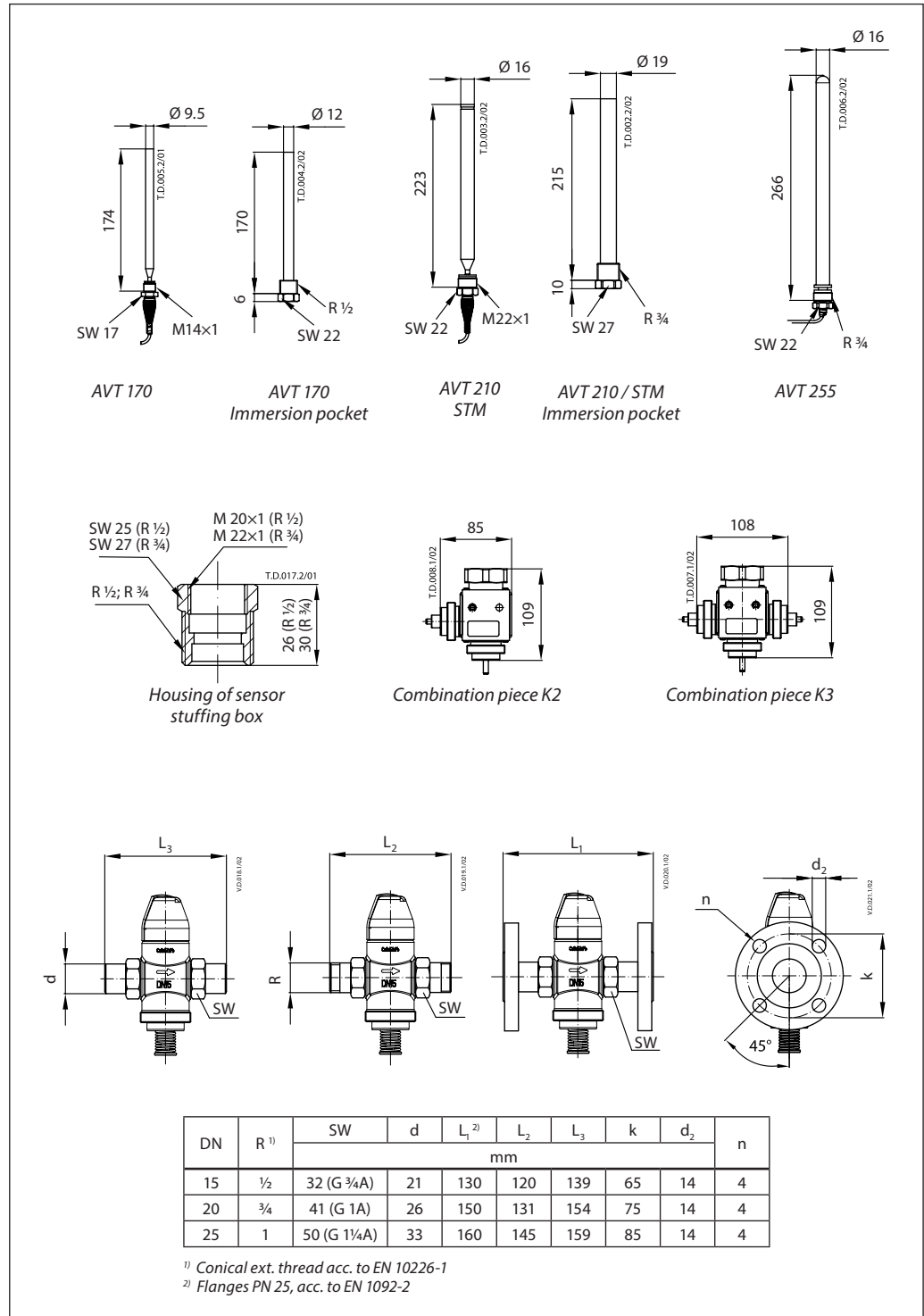
STM / AVPQT DN32 - 50



STM

DN		15	20	25	32	40	50
L	mm	65	70	75	-	-	-
L ₁		-	-	-	180	200	230
H		402	402	405	-	-	-
H ₁		-	-	-	474	474	474
Weight (AVPQT)	kg	3.0	3.3	3.5	8.2	11	12
Weight (STM)		2.6 (sensor 210 mm)					

Dimensions (continuous)



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