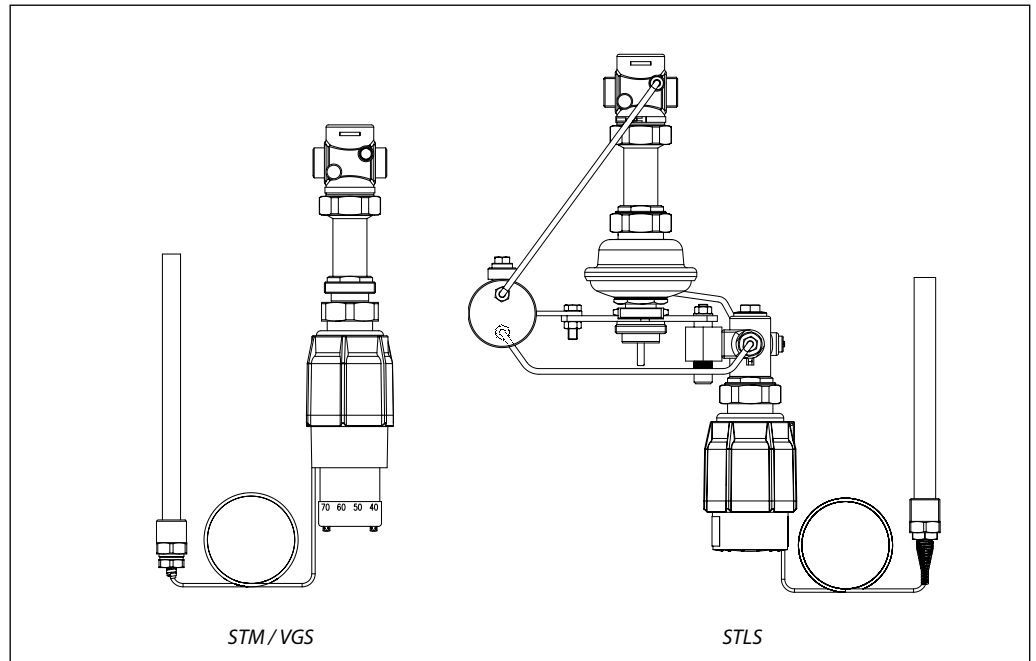# Data sheet

Temperature controller AVT with safety temperature monitor STM / VGS and safety temperature limiter STLS for steam (PN 25)

STM / VGS / (AVT)   - safety temperature monitor for steam
STLS / (AVT)   - safety temperature limiter for steam

Description

STM / VGS   STLS

The controllers STM / VGS and STM / AVT / VGS are self-acting proportional temperature controllers used for temperature control and temperature monitoring primarily in steam or hot water applications for temperatures up to 200 °C.

The controllers STLS and STLS / AVT are self-acting proportional temperature controllers used for temperature control and temperature limitation primarily in steam or hot water applications for temperatures up to 200 °C.

STLS safety temperature limiter consists of a pressure balanced valve VGS, seal pot and safety temperature limiter (actuator) STL. STL consist of pressure actuator, regulating valve, safety thermostat and two impulse tubes. Valve VGS closes (by means of pressure actuator) when the limit temperature is exceeded .

VGS - valve with external thread

Controller closes on rising temperature.

The controllers are:
- Type-tested acc. to EN 14597

and protect against exceeding temperatures:
- 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 - 25
- k_{vs} 1.0 - 6.3 m³/h
- PN 25
- Setting ranges:
  - STM monitor:
    20 … 75 °C / 40 … 95 °C / 30 … 110 °C
  - STL limiter:
    45 … 95 °C / 60 … 110 °C
  - AVT thermostat:
    −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
- Temperature:
  - Circulation water / glycolic water up to 30%:
    2 … 150 °C
  - Steam: 2 … 200 °C
- Connections:
  - Ext. thread (weld-on, thread and flange tailpieces)

Data sheet

Temp. controller AVT with safety temp. monitor STM / VGS and safety temp. limiter STLS for steam (PN25)

Ordering

*Example 1 - **STM / VGS** controller:*
Safety temperature monitor for steam, DN 15, k_{vs} 1.6, PN 25, limit range 30 … 110 °C, t_{max} 200 °C, ext. thread

- 1× VGS DN 15 valve
  Code No: **065B0787**
- 1× STM monitor, 30 … 110 °C
  Code No: **065-0608**

Option:
- 1× Weld-on tailpieces
  Code No: **003H6908**

All products will be delivered separately. The valve VGS will be delivered (assembled) together with an adapter M34 × M45.

*Example 2 - **STM / AVT / VGS** controller:*
Temperature controller with safety temperature monitor for steam, DN 15, k_{vs} 1.6, PN 25, limit range 30 … 110 °C, setting range 40 … 90 °C, t_{max} 200 °C, ext. thread

- 1× VGS DN 15 valve
  Code No: **065B0787**
- 1× STM monitor, 30 … 110 °C
  Code No: **065-0608**
- 1× AVT thermostat, 40 … 90 °C
  Code No: **065-0598**
- 1× K2 combination piece
  Code No: **003H6855**

Option:
- 1× Weld-on tailpieces
  Code No: **003H6908**

All products will be delivered separately. The valve VGS will be delivered (assembled) together with an adapter M34 × M45.

*Example 3 - **STLS** controller:*
Safety temperature limiter for steam, DN 15, k_{vs} 4.0, PN 25, limit range 60 … 110 °C, t_{max} 200 °C, ext. thread

- 1× STLV limiter, 60 … 110 °C
  Code No: **065-0575**

Option:
- 1× Weld-on tailpieces
  Code No: **003H6908**

The controller will be delivered completely assembled, inclusive impulse tubes, seal pot and adapter M34 × M45 between valve and actuator.

VGS valve [1]

Picture	DN (mm)	k_{vs} (m³/h)	$t_{max.}$ (°C)	PN	Connection		Code No.
	15	1.0	200	25	Cylindrical external thread acc. to ISO 228/1	G ¾ A	065B0786
		1.6					065B0787
		3.2					065B0788
	20	4.5				G 1 A	065B0789
	25	6.3				G 1¼ A	065B0790

[1] Adapter M34 × M45 for connection to STM safety temperature monitor (actuator) and AVT thermostat (actuator) is delivered (assembled) together with the valve.

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 ¾" [1]	065-0608
		20 … 75		065-0609
		40 … 95		065-0610

[1] conic male thread EN 10226-1

STLS Safety temperature limiter (controller)

Picture	DN (mm)	k_{vs} (m³/h)	Connection		Temp. sensor with brass imm. pocket, length, connect.	Limit range (°C)	Code No.	Limit range (°C)	Code No.
	15	3.2	Cylindr. ext.thread acc. to ISO 228/1	G ¾ A	210 mm, R ¾" [1]	45 - 95	065-0572	60 - 110	065-0575
	20	4.5		G 1 A			065-0573		065-0576
	25	6.3		G 1¼ A			065-0574		065-0577

[1] conic male thread EN 10226-1

AVT thermostat (actuator)

Picture	For valves	Setting range (°C)	Temperature sensor with brass immersion pocket, length, connection	Code No.
	DN 15 - 25	-10 … +40	210 mm, R ¾" [1]	065-0600
		20 … 70		065-0601
		40 … 90		065-0602
		60 … 110		065-0603
		10 … 45	255 mm, R ¾" [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

Data sheet   Temp. controller AVT with safety temp. monitor STM / VGS and safety temp. limiter STLS for steam (PN 25)

Ordering *(continuous)*

Example 4 - **STLS / AVT** *controller: Temperature controller with safety temperature limiter for steam, DN15, k_{vs} 4.0, PN 25, limit range 60 … 110 °C, setting range 40 … 90 °C, t_{max} 200 °C, ext. thread*

- *1× STLV limiter, 60 … 110 °C*
  Code No: **065-0575**
- *1× AVT thermostat, 40 … 90 °C*
  Code No: **065-0598**

Option:
- *1× Weld-on tailpieces*
  Code No: **003H6908**

The controller STLS will be delivered completely assembled, inclusive impulse tubes, seal pot and adapter M34 × M45 between valve and actuator. Thermostat AVT will be delivered separately.

Accessories for valves

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 ½″	**003H6902**
		20		R ¾″	**003H6903**
		25		R 1″	**003H6904**
	Flange tailpieces	15	Flanges PN 25, acc. to EN 1092-2		**003H6915**
		20			**003H6916**
		25			**003H6917**

Accessories for thermostats

Picture	Type designation	For controllers	Material	Code No.
	Immersion pocket	AVT / VGS STM / VGS STLS	Brass	**065-4416***
			Stainless steel, mat. No. 1.4435	**065-4417***
	Adapter**	M34 × 1.5 mm / M45 × 1.5 mm		**003H6927**
	Combination piece K2			**003H6855**
	Combination piece K3			**003H6856**

*   *Not for AVT thermostat code numbers:* **065-0604, 065-0605, 065-0606, 065-0607**
** *Adapter for VGS combinations with thermostat AVT (actuator), temperature monitors STM and temperature limiters STL*

Service kits

Picture	Type designation	for valves DN / k_{vs}	Code No.
	Stuffing box	15/3.2, 20/4.5, 25/6.3	**003H6877**
	Sensor stuffing box set	**for sensors**	
		AVT R ¾″	**065-4421**
	Type designation	**Limit range** (°C)**, sensor pocket material**	
	STL thermostat *	45 … 95, Brass	**065-0611**
		60 … 110, Brass	**065-0612**
	Control unit STL **	45 … 95, Brass	**065-0614**
		60 … 110, Brass	**065-0615**
		45 … 95, Stainless steel	**065-0619**
	Seal pot, 0.3 l, with two compression fittings Ø6 x 1 mm		**003H0277**

*   *Consists of a pressure actuator, regulating valve, thermostat and impulse tube between pressure actuator and thermostat.*
   Impulse tube between thermostat and valve is not included. Seal pot has to be ordered separately.
** *Consists of a regulating valve and thermostat.*

Technical data

VGS valve

Nominal diameter	**DN**	**15**			**20**	**25**
k_{vs} value	m³/h	1.0	1.6	3.2	4.5	6.3
Cavitation factor z *		≥ 0.6				
Leakage acc. to standard IEC 534		0.05				
Nominal pressure	PN	25				
Max. differential pressure	bar	10				
Medium		Steam / Circulation water / glycolic water up to 30%				
Medium pH		Min. 7, max. 10				
Medium temperature		2 … 200 ˚C				
Connections	valve	Thread				
	tailpieces	Weld-on, external thread and flange				
Materials						
Valve body		Red bronze CuSn5ZnPb (Rg5)				
Valve seat		Stainless steel, mat. No. 1.4571				
Valve cone		Stainless steel, mat. No. 1.4122				

* k_v/k_{vs} ≤ 0.5 at DN 25 and higher

Data sheet

Temp. controller AVT with safety temp. monitor STM / VGS and safety temp. limiter STLS for steam (PN25)

Technical data *(continuous)*

STM Safety temperature monitor (actuator)

Limit range X_s	°C	30 … 110 °C / 20 … 75 °C / 40 … 95 °C	
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	
Perm. amb. temperature at sensor		0 … 70 °C	
Nominal pressure sensor	PN	25	
Capillary tube length		5 m	
Materials			
Temperature sensor		Cooper / Brass	
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	

STL Safety temperature limiter (actuator)

Limit range X_s	°C	45 … 95 °C / 60 … 110 °C	
Time constant T acc. to EN 14597	s	max. 100	
Gain K_s	mm/°K	0.3	
Max. adm. temperature at sensor		50 °C above maximum setpoint	
Perm. amb. temperature at sensor		0 … 70 °C	
Nominal pressure sensor	PN	25	
Capillary tube length		5 m	
Materials			
Temperature sensor		Cooper / Brass	
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	

AVT Thermostat (actuator)

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

* for sensor 210 mm

Data sheet

Temp. controller AVT with safety temp. monitor STM / VGS and safety temp. limiter STLS for steam (PN 25)

Application principles

Combinations

AVT / VGS
- temperature controller

STM / VGS
- safety temperature monitor

STLS
- safety temperature limiter

STM / AVT / VGS
- temperature controller with safety temperature monitor

STM / AVT / AVT / VGS
- two temperature controllers with safety temperature monitor

STLS / AVT
- temperature controller with safety temperature limiter

STLS / AVT / AVT
- two temperature controllers with safety temperature limiter

Data sheet

Temp. controller AVT with safety temp. monitor STM / VGS and safety temp. limiter STLS for steam (PN25)

Installation positions

Temperature controller and safety temperature monitor
Up to medium temperature of 160 °C temperature controller AVT / VGS and safety temperature monitor STM / VGS can be installed in any position.
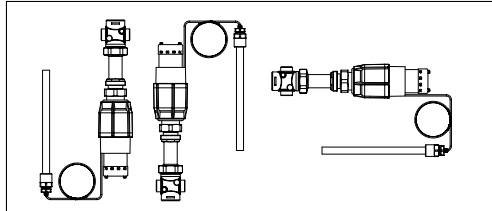
For higher temperatures temperature controller AVT / VGS and safety temperature monitor STM / VGS have to be installed horizontal and in horizontal pipelines with the actuator oriented downwards.
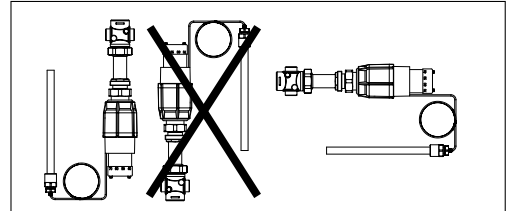
Safety temperature limiter
Up to medium temperature of 100 °C safety temperature limiter STLS can be installed in any position.
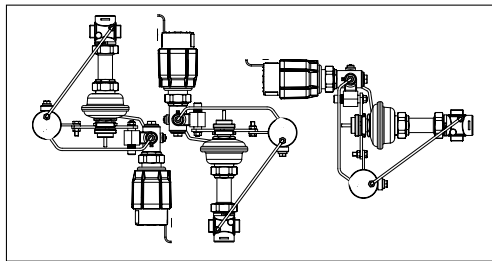
For higher temperatures safety temperature limiter STLV have to be installed in horizontal pipes only, with a pressure actuator oriented downwards.
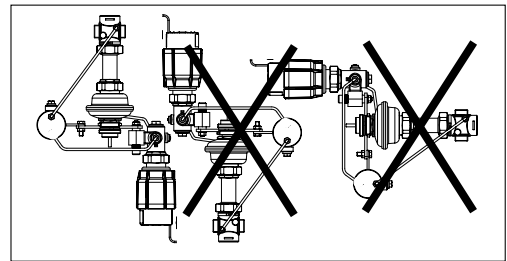
Temperature sensor
The place of installation must be chosen in a way that the temperature of the medium is directly taken without any delay. Avoid overheating of temperature sensor. The temperature sensor must be immersed into the medium in its full length.
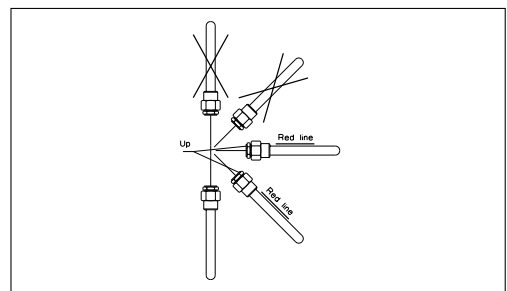
Temperature sensor 210 mm R¾"
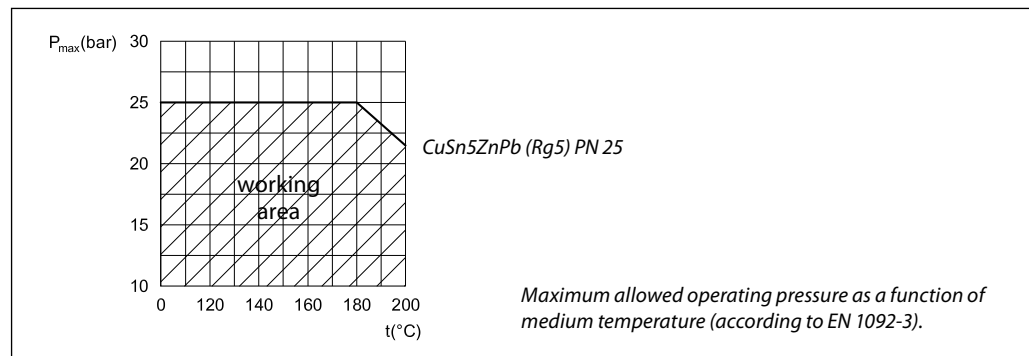- The temperature sensor may be installed in any position.
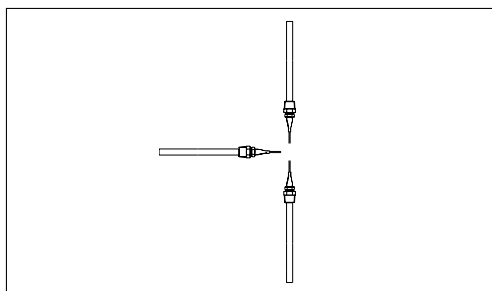
Temperature sensor 255 mm R¾"
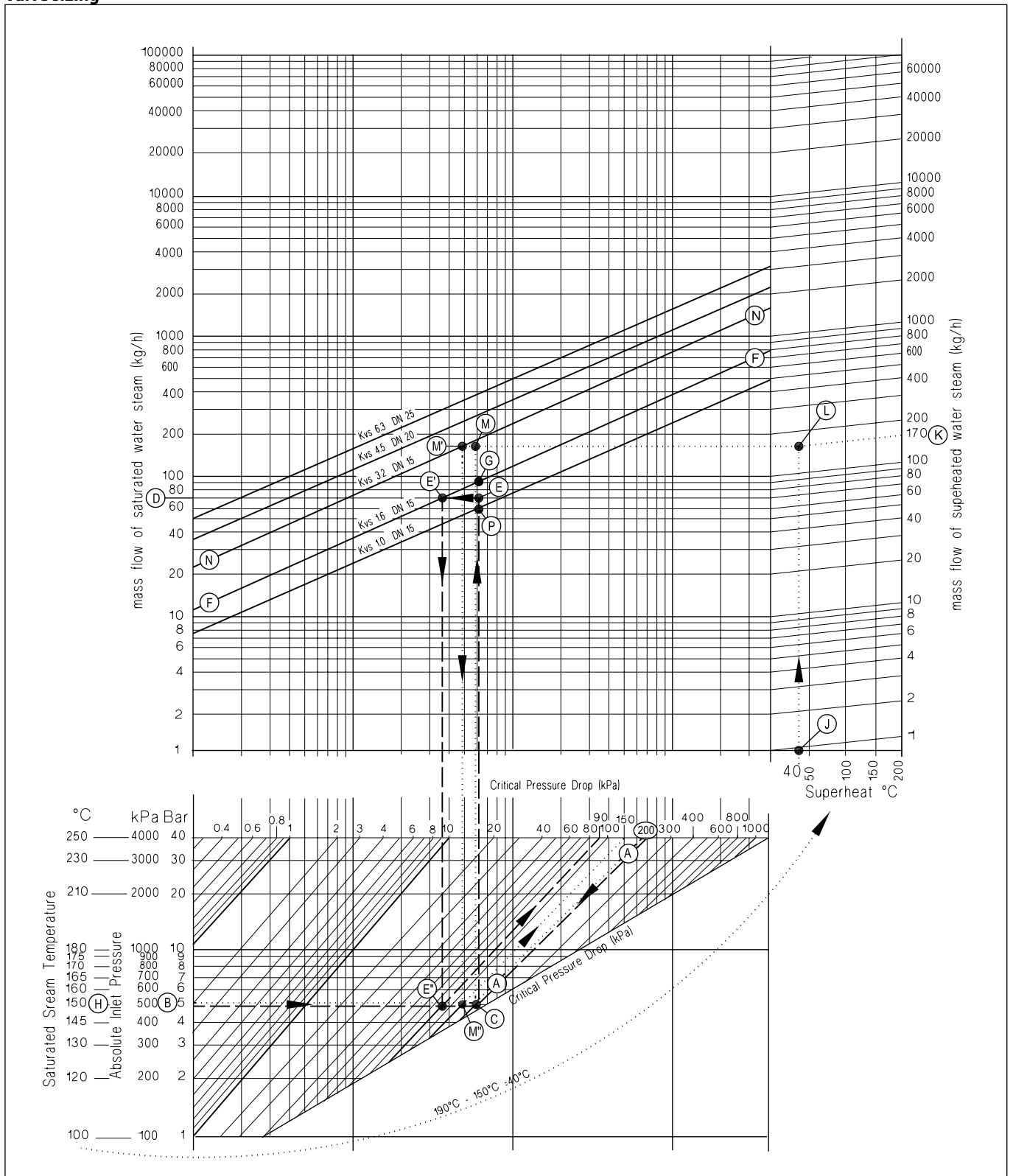- The temperature sensor must be installed as shown on the picture.

Pressure temperature diagram

CuSn5ZnPb (Rg5) PN 25

Maximum allowed operating pressure as a function of medium temperature (according to EN 1092-3).

Valve sizing

Steam valve sizing is based on 40 % drop of the steam pressure across the valve when fully open. At this condition the steam is travelling at or close to its critical velocity (approx. 300 m/s) and throttling would occur over the full valve stroke.

If the steam is travelling slower than this, then the first part of the valve stroke would merely increase the velocity of the steam without reducing the volumetric flow.

Data sheet

Temp. controller AVT with safety temp. monitor STM / VGS and safety temp. limiter STLS for steam (PN25)

Valve sizing *(continuous)*

1. For saturated steam

Given data:
Flow rate: 70 kg/h
Absolute inlet pressure: 5 bar (500 kPa)

Remark:
For this example follow dashed line

The absolute inlet pressure is 500 kPa. Critical pressure drop (40% of 500 kPa) is 200 kPa. Locate the diagonal line corresponding to the pressure drop of 200 kPa (line A - A).

Read the absolute inlet pressure on the lower left hand scale (point B), and draw a horizontal line across until it meets the pressure drop diagonal A - A at point C.

From this point C extend a vertical line upwards until it meets the horizontal line representing the steam flow of 70 kg/h from point D. The intersection of this is point E.

The nearest diagonal k_{vs} line above this is line F - F with a k_{vs} of 1.6. If the ideal valve size is not available the next largest size should be selected to ensure design flow.

The pressure drop through valve at the flow rate is found by the intersection of the 70 kg/h line with F - F (point E') and dropping a vertical line downwards; this actually hits the horizontal line for 500 kPa absolute inlet pressure (point E'') at a pressure drop diagonal of 90 kPa. This is only 18 % of the pressure drop accross the valve and the control quality will not be good until the valve has partially closed. As with all steam valves this compromise is necessary since the next smaller valve would not pass the required flow (maximum flow would be about 60 kg/h; point P).

The maximum flow for the same inlet pressure is found by extending the vertical line (C - E) through point E until it crosses the k_{vs} 1.6 line F - F (point G) and reading off the flow (90 kg/h).

2. For superheated steam

Given data:
Flow rate: 170 kg/h
Absolute inlet pressure: 5 bar (500 kPa)
Steam temperature: 190 °C

Remark:
For this example follow dotted line

The procedure for superheated steam is much the same as for saturated steam, but uses a different flow scale which slightly elevates the readings according to the degree of superheat.

As before, the diagonal critical pressure drop line A - A is located at 40 % of 500 kPa (200 kPa). The horizontal inlet pressure line through point B is now extended to the left to read off the corresponding saturated steam temperature at point H (150 °C). The difference between the saturated steam temperature and the superheated steam temperature is 190 °C − 150 °C = 40 °C (see point J).

The superheated steam flow 170 kg/h is found on the upper right hand scale (point K). From here the diagonal line is followed down until it meets a vertical line from the steam temperature elevation (40 °C, point J) at point L.

As before, the horizontal line through point B is drawn to cut line A - A at point C. The point where the vertical line from point C meets the horizontal line from point L is the operating point (point M). This horizontal line, L - M, is the corrected flow line. The nearest diagonal line above this is line N - N with a k_{vs} 3.2. A vertical line dropped from the intersection of L - M line with line N - N (point M') intersects the 500 kPa absolute inlet pressure line (point M'') at a pressure drop diagonal of about 150 kPa. This is about 30% of the pressure drop accross the valve which will give reasonable control quality (compared to recommended ratio of 40 %).
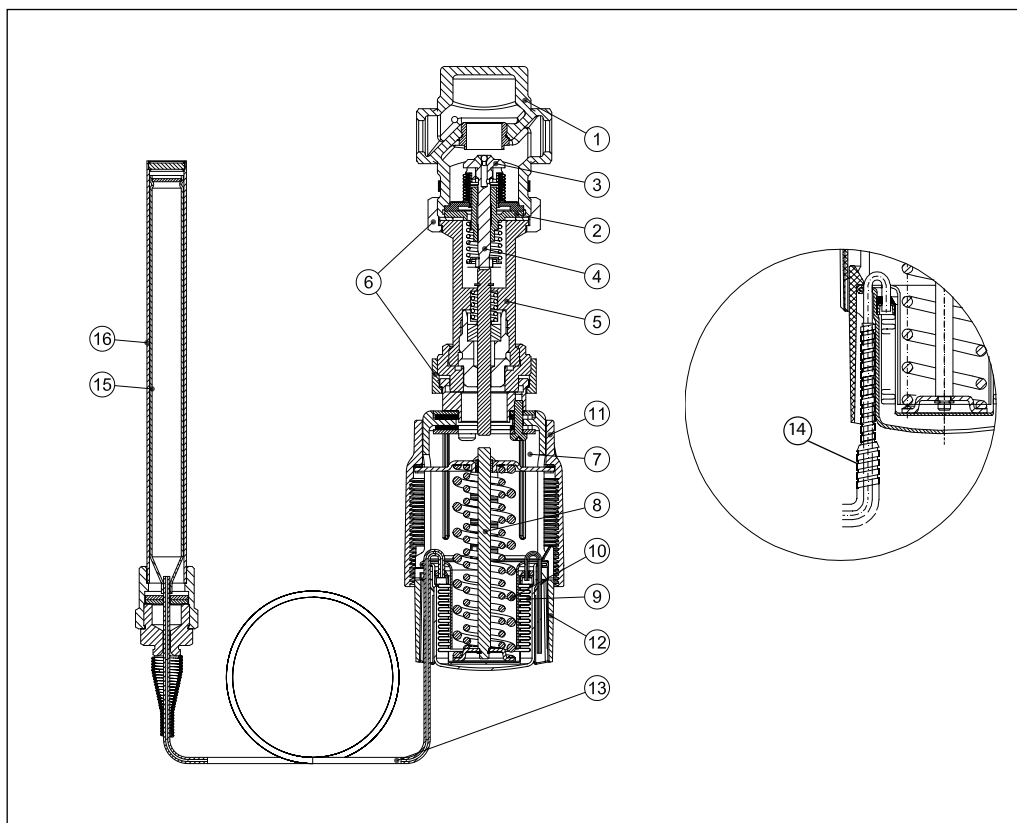
Design

STM / VGS

1. Valve VGS
2. Valve insert
3. Pressure relieved valve cone
4. Valve stem
5. Valve body extension for steam valves
6. Union nut
7. Safety temperature monitor STM
8. Thermostat stem
9. Setting spring for temperature control
10. Handle for limit setting, prepared for sealing
11. Scale carrier
12. Capillary tube
13. Temperature sensor
14. Immersion pocket
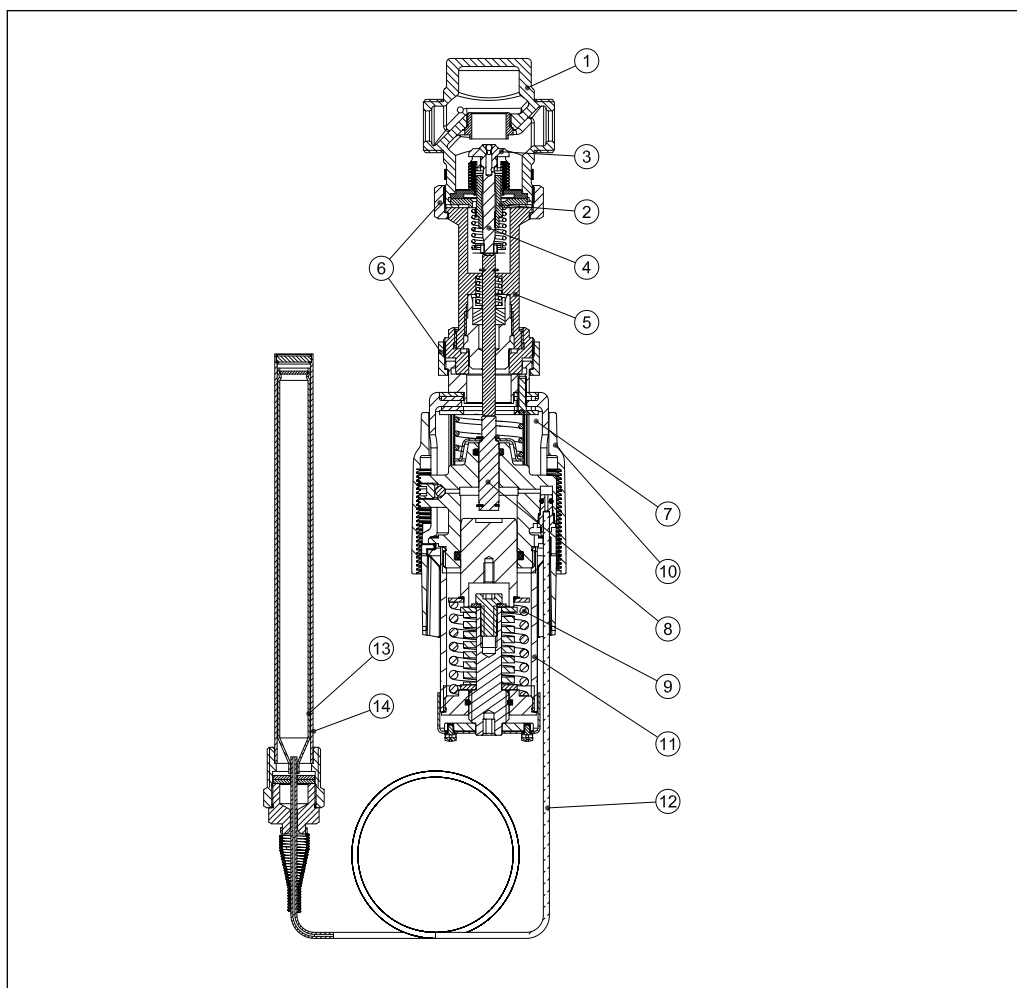
AVT / VGS

1. Valve VGS
2. Valve insert
3. Pressure relieved valve cone
4. Valve stem
5. Valve body extension for steam valves
6. Union nut
7. Thermostat AVT
8. Thermostat stem
9. Bellows
10. Setting spring for temperature control
11. Handle for temperature setting, prepared for sealing
12. Scale carrier
13. Capillary tube
14. Flexible protected pipe (at 255 mm only)
15. Temperature sensor
16. Immersion pocket

Danfoss

Data sheet   **Temp. controller AVT with safety temp. monitor STM / VGS and safety temp. limiter STLS for steam (PN25)**

Design (continuous)

STLS
 1. Valve VGS
 2. Valve insert
 3. Pressure relieved valve cone
 4. Valve stem
 5. Valve body extension for steam valves
 6. Union nut
 7. Safety thermostat
 8. Pressure actuator
 9. Thermostat stem
10. Bellows
11. Setting spring for temperature control
12. Handle for limit setting, prepared for sealing
13. Scale carrier
14. Capillary tube
15. Temperature sensor
16. Immersion pocket
17. Impulse tube
18. Regulating valve
19. Releasing screw
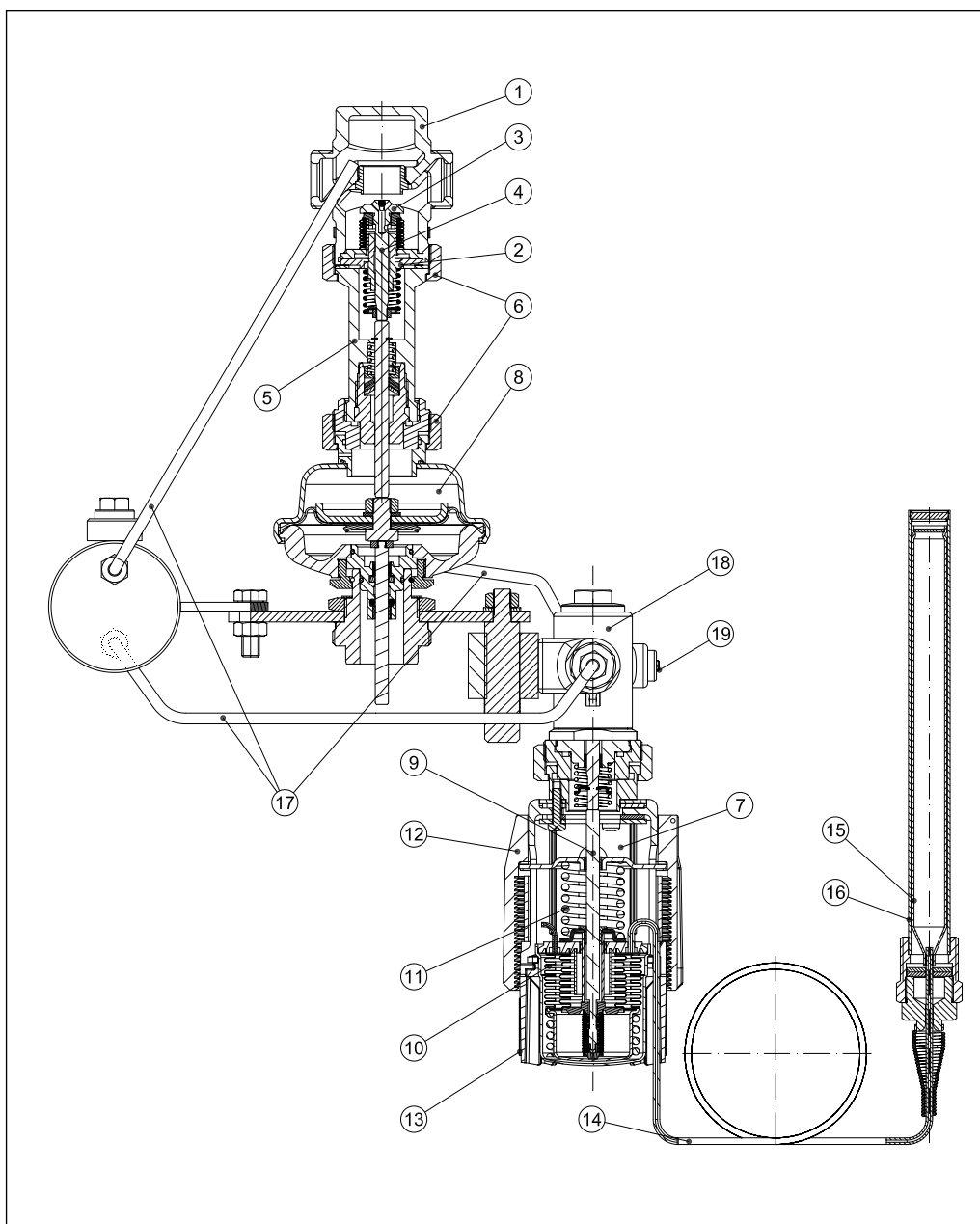
Function

Mode of Operation
The safety temperature monitor and safety temperature limiter are proportional temperature controllers which control the temperature and protects the system against exceeding temperatures. The valve cone is pressure balanced.

Safety Temperature Monitor (STM/VGS)
- Function
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 is closed by a pressure 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 bellow are filled with liquid. As the temperature at the temperature sensor rises, the liquid expands, the thermostat stem moves out and closes the valve.

Safety Temperature Limiter (STLS)
- In case the temperature at the temperature sensor exceeds the adjusted set point, safety temperature limiter interrupts energy supply by closing the valve.

  The valve remains closed:
  - until the temperature, at the temperature sensor, decreases below the adjusted set point - regulating valve closes.
  - manual reset is done

  Manual reset is done by opening of a releasing screw - medium from pressure actuator is being transferred out. Before manual resetting pressure actuator has to be cooled down. Medium in it might be hot.

  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 safety thermostat, the regulating valve opens. The pressure of the medium before the valve is being transferred to the lower chamber of pressure actuator and closes the valve. In this case safety temperature limiter (actuator) must be replaced.

- Physical Function Principle
The safety temperature monitor operates in accordance with the adsorption principle. In case the temperature at the temperature sensor exceeds the adjusted set point, safety thermostat moves thermostat stem out and opens regulating valve. The pressure of the medium before the valve is being transferred to the lower chamber of pressure actuator and closes the valve.

Temperature Controller (AVT / VGS)

- 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 bellow. Bellow moves thermostat stem and opens or closes the valve.
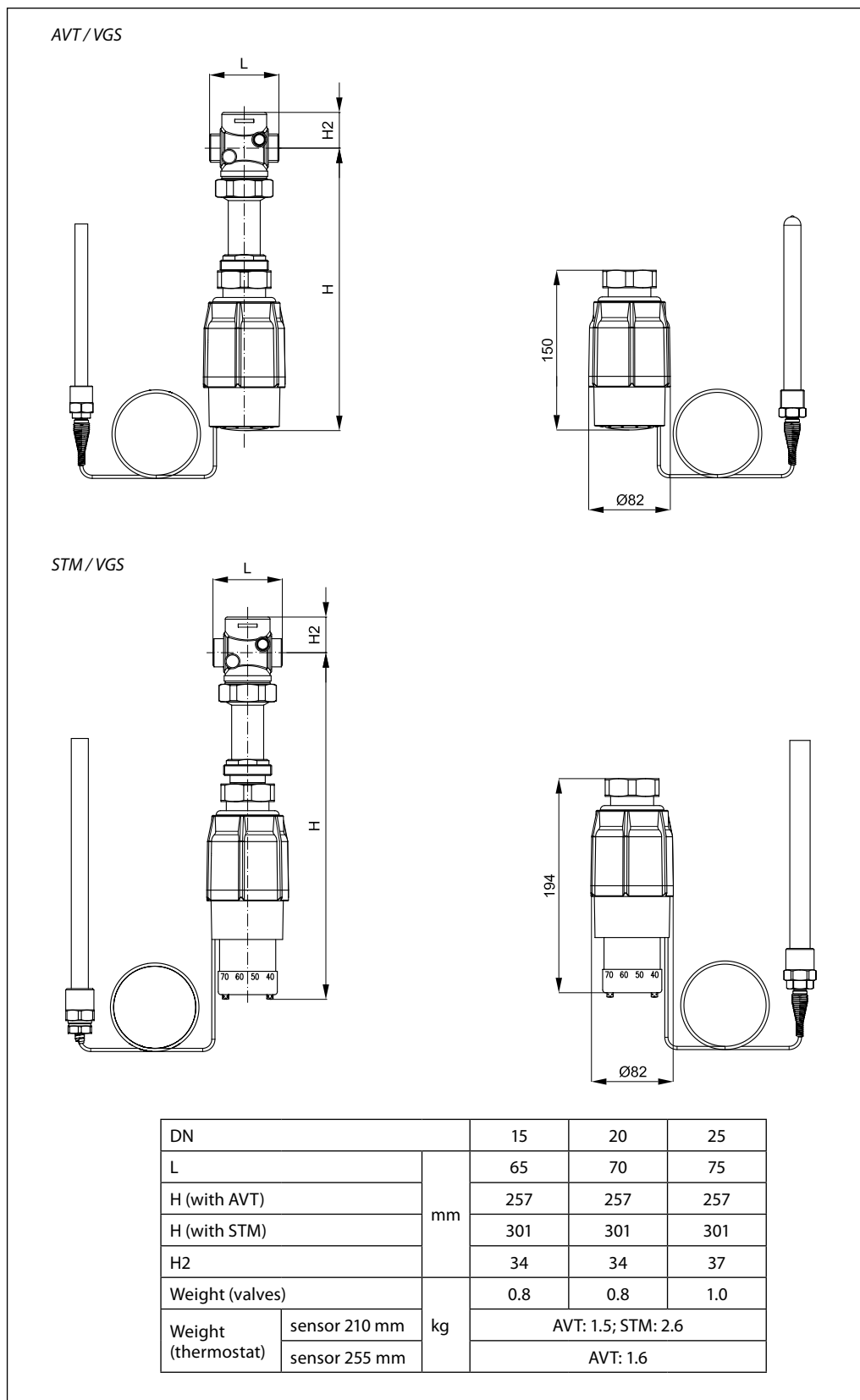
Data sheet

Temp. controller AVT with safety temp. monitor STM / VGS and safety temp. limiter STLS for steam (PN25)
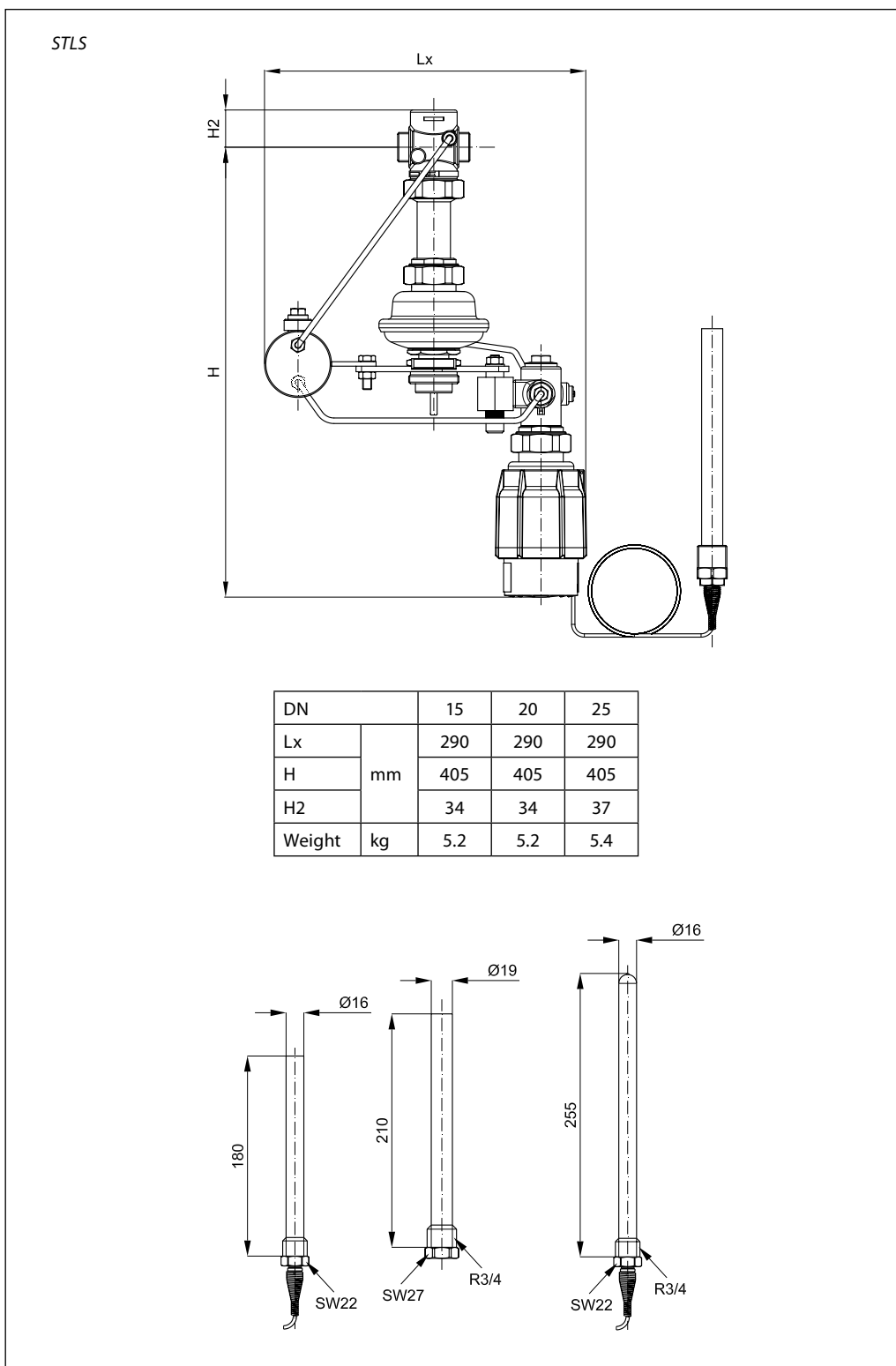
Settings

Temperature setting (AVT)
Temperature setting is being done by the adjustment of the setting spring for temperatature control.

Limit setting (STM / VGS, STLS)
Limit setting is being done by the adjustment of the setting spring for temperatature control.

Dimensions

AVT / VGS

STM / VGS

DN		15	20	25
L		65	70	75
H (with AVT)	mm	257	257	257
H (with STM)		301	301	301
H2		34	34	37
Weight (valves)	kg	0.8	0.8	1.0
Weight (thermostat)	sensor 210 mm		AVT: 1.5; STM: 2.6		
	sensor 255 mm		AVT: 1.6		

Dimensions (continious)

STLS

DN		15	20	25
Lx		290	290	290
H	mm	405	405	405
H2		34	34	37
Weight	kg	5.2	5.2	5.4

Data sheet

Temp. controller AVT with safety temp. monitor STM / VGS and safety temp. limiter STLS for steam (PN25)

Dimensions *(continuous)*

VGS

DN			15	20	25
VGS	L	mm	65	70	75
	H		178	178	178
	Weight	kg	0.7	0.8	0.9

DN		15	20	25
SW		32 (G ¾A)	41 (G 1A)	50 (G 1¼A)
d		21	26	33
R [1]		½	¾	1
L1 [2]		130	150	160
L2	mm	131	144	160
L3		139	154	159
k		65	75	85
d_2		14	14	14
n		4	4	4

[1] Conical ext. thread acc. to EN 10226-1
[2] Flanges PN 25, acc. to EN 1092-2

Combination piece K2

Combination piece K3

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DH-SMT/SICO