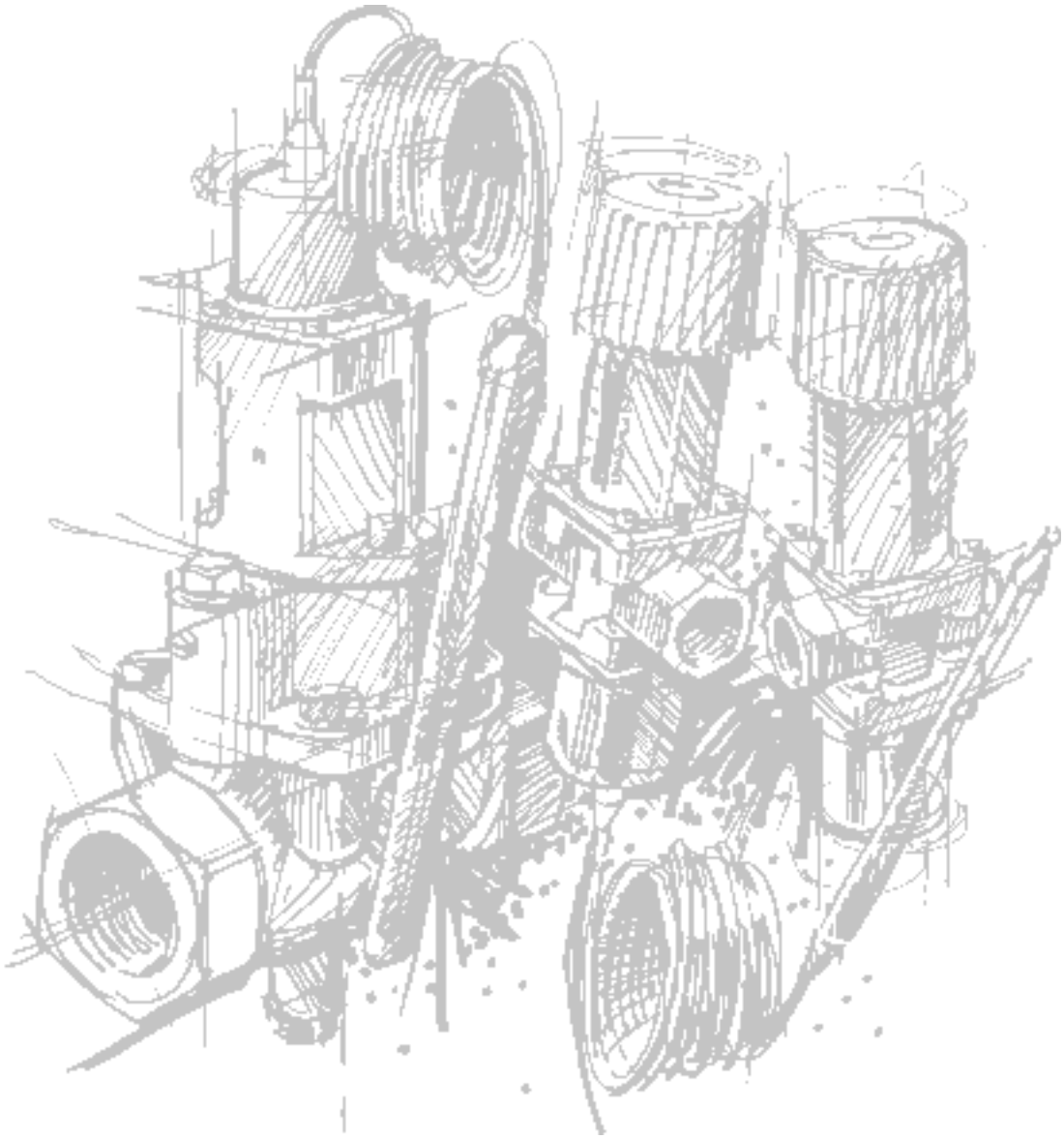
Data sheet



Thermostatically operated cooling water valves

Type AVTA

September 2000

DKACV.PD.500.A2.02
520B0664

Contents

Page

Introduction ... 3
Technical data ... 3

AVTA for neutral media ... 4
Ordering ... 5
Dimensions and weights ... 6

AVTA DZR for slightly aggressive media ... 7
Ordering ... 8
Dimensions ... 9

AVTA SS for aggressive media ... 10
Ordering ... 11
Dimensions ... 11

Installation ... 12
Sensor installation ... 12
Spare parts and accessories ... 13

Sizing ... 14
Diagrams ... 15

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Type AVTA

Introduction

Thermostatically operated valves are used for the infinite, proportional regulation of flow quantity, depending on the setting and the sensor temperature.

The Danfoss range of thermostatic valves includes a series of industrial products for both refrigeration and heating regulation. The valves are self-acting, i.e. they operate without the supply of auxiliary energy such as electricity or compressed air.

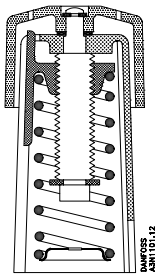
Because the valves constantly match flow quantity to demand, they are especially suitable for temperature regulation.
The required temperature is maintained constant with no overconsumption of:
- cooling water in cooling systems,
- hot water or steam in heating systems.

Thus operating economy is always reasonable.

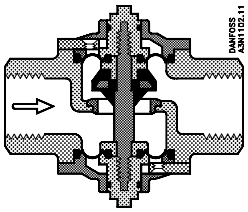
For further information on thermostatically operated valves for heating regulation (AVTB), please contact Danfoss.

Technical data

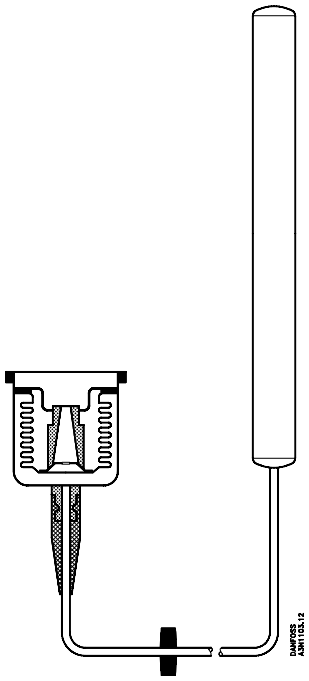
General
Thermostatic valves consist of three main elements:



Setting section with knob, reference spring and setting scale



Valve body with orifice, closing cone and sealing elements.



Hermetically sealed thermostatic element with sensor, bellows and charge.

Function
When the three elements are built together, the valve is installed and the sensor is located at the point where the temperature is to be regulated, the function sequence is as follows:

1. A temperature-dependent pressure - charge vapour pressure - builds up in the sensor.
2. This pressure is transferred to the valve via the capillary tube and bellows and acts as an opening or closing force.
3. The knob on the setting section and the spring exert a force that acts counter to the bellows.
4. When balance is created between the two opposing forces, the valve spindle remains in its position.
5. If the sensor temperature - or the setting - is changed, the point of balance becomes displaced and the valve spindle moves until balance is re-established, or the valve is fully open or closed.
6. On sensor temperature change, the flow quantity change is approximately proportional.

The illustrations show an AVTA cooling water valve, but the function principle applies to all types of thermostatic valves.

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Type AVTA

Application



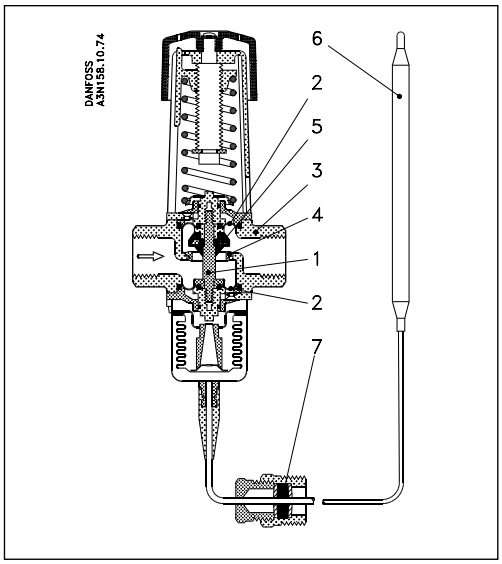
AVTA
for neutral media

Self-acting AVTA cooling water valves are widely used for temperature regulation in many different machines and installations where cooling is a requirement. AVTA always opens to admit flow on rising sensor temperature. The valve can be installed either in the cooling water flow line or return line.

Typical applications:
- Injection moulding machines
- Compressors
- Vacuum pumps
- Dry cleaning machines
- Distillation plant
- Printing machines
- Hydraulic systems
- Rollers/mills

AVTA with NPT connection, please contact Danfoss for North American data sheet.

Specifications and product overview



- Opens on rising sensor temperature
- Media temperature –25 → + 130°C
- Differential pressure 0 → 10 bar
- Max. working pressure 16 bar
- Max. test pressure 25 bar
- Max. pressure on sensor 25 bar
- The valves are pressure-relieved, i.e. the degree of opening is not affected by differential pressure Δp (pressure drop).
- The regulation range is defined for the point at which the valve begins to open.

AVTA valves are available with three different types of charge (see pages 4 and 5):

A: Adsorption charge
B: Mass charge
C: Universal charge

Materials - parts in contact with the medium, AVTA

No.	Description	Material	
1	Spindle	Brass	W.no. 2.0401
2	Diaphragms	Rubber - ethylene - propylene (EPDM)	
3	Valve body and other metal parts	Forged brass	W.no. 2.0402
4	Valve cone	Nitrile rubber (NBR)	
5	Valve seat	Stainless steel	W.no. 1.4305 / AISI 303
6	Sensor	Copper	W.no. 2.0090
7	Capillary tube gland	Nitrile rubber (NBR) Brass	 W.no. 2.0321 / 2.0401

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Ordering AVTA with adsorption charge

The charge consists of active carbon and CO_2 which is adsorbed on falling sensor temperature and thereby produce pressure changes in the element.

Special characteristics
- Wide regulating range
- Can be installed in any position as far as orientation and - temperature are concerned
- Withstands up to +130°C sensor temperature
- Small sensor dimensions - ∅ 9,5 × 160 mm
- Max. pressure on sensor 25 bar

Connection	Regulating range	k_v value (m^3/h at Δp = 1 bar)	Capillary tube length [m]	Type	**Code no.** [1]
G 3/8	+10 → +80°C	1.4	2.3	AVTA 10	**003N1144**
G 1/2		1.9		AVTA 15	**003N0107**
G 3/4		3.4		AVTA 20	**003N0108**
G 1		5.5		AVTA 25	**003N0109**

[1] Code no. covers complete valve incl. capillary tube gland.

Immersion sensors, see “Spare parts and accessories”, page 13.

Ordering AVTA with universal charge

The charge is liquid/gas where the liquid surface (regulating point) is always inside the sensor. Which charge medium is used depends on the temperature range.

Special characteristics
- Sensor dimensions ∅ 18 × 210 mm
- Sensor can be installed colder or warmer than the valve
- Sensors must be orientated as shown in the sketch on page 12
- Max. pressure on sensor 25 bar

Regulation range 0 → +30°C, max. sensor temperature +57°C

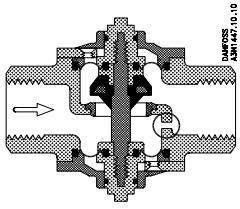
Connection	k_v value (m^3/h at Δp = 1 bar)	Capillary tube length	Type	**Code no.** [1]
G 3/8	1.4	2 m	AVTA 10	**003N1132**
G 1/2	1.9		AVTA 15	**003N2132**
G 3/4	3.4		AVTA 20	**003N3132**
G 1	5.5		AVTA 25	**003N4132**

[1]) Code no. covers complete valve incl. capillary tube gland.

Regulation range 25 → +65°C, max. sensor temperature +90°C

Connection	k_v value (m^3/h at Δp = 1 bar)	Capillary tube length	Type	**Code no.** [1]
G 3/8	1.4	2 m	AVTA 10	**003N1162**
G 1/2	1.9	2 m	AVTA 15	**003N2162**
		2 m (armoured)		**003N0041**
G 3/4	3.4	2 m	AVTA 20	**003N3162**
		5 m		**003N3165**
		2 m (armoured)		**003N0031**
G 1	5.5	2 m	AVTA 25	**003N4162**
		2 m (armoured)		**003N0032**
		5 m		**003N4165**

[1]) Code no. covers complete valve incl. capillary tube gland.



Valve body with bypass

Regulation range +50 → +90°C, max. sensor temperature +125°C

Connection	k_v value (m^3/h at Δp = 1 bar)	Capillary tube length [m]	Type	**Code no.** [1]
G 3/8	1.4	2	AVTA 10	**003N1182**
G 1/2	1.9		AVTA 15	**003N2182**
G 3/4	3.4		AVTA 20	**003N3182**
G 1	5.5		AVTA 25	**003N4182**
		3		**003N4183**[2]

[1]) Code no. covers complete valve incl. capillary tube gland.
[2]) A ∅ 2 mm bypass is drilled in the valve body.

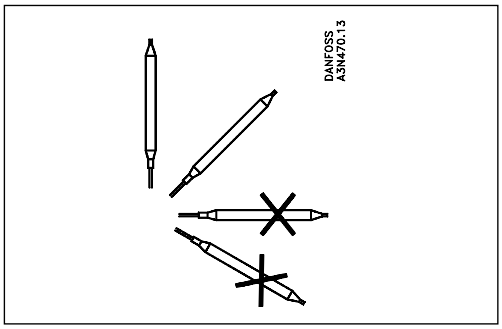
Immersion sensors, see “Spare parts and accessories”, page 13.

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Type AVTA

Ordering
AVTA with mass charge

The charge is liquid/gas. Because of the volumetric conditions the liquid surface (regulation point) can be either in the sensor or the bellows, depending on the temperature conditions.



Special characteristics
- Small sensor dimensions (∅ 9.5 × 190 mm)
- Short time constant
- Sensor must always be installed warmer than the valve
- Max. pressure on sensor 25 bar

Regulation range 0 → +30°C
Max. sensor temperature +57°C

Connection	k_v value (m^3/h at Δp = 1 bar)	Capillary tube length [m]	Type	**Code no.** [1]
G 1/2	1.9	2	AVTA 15	**003N0042**
G 3/4	3.4		AVTA 20	**003N0043**

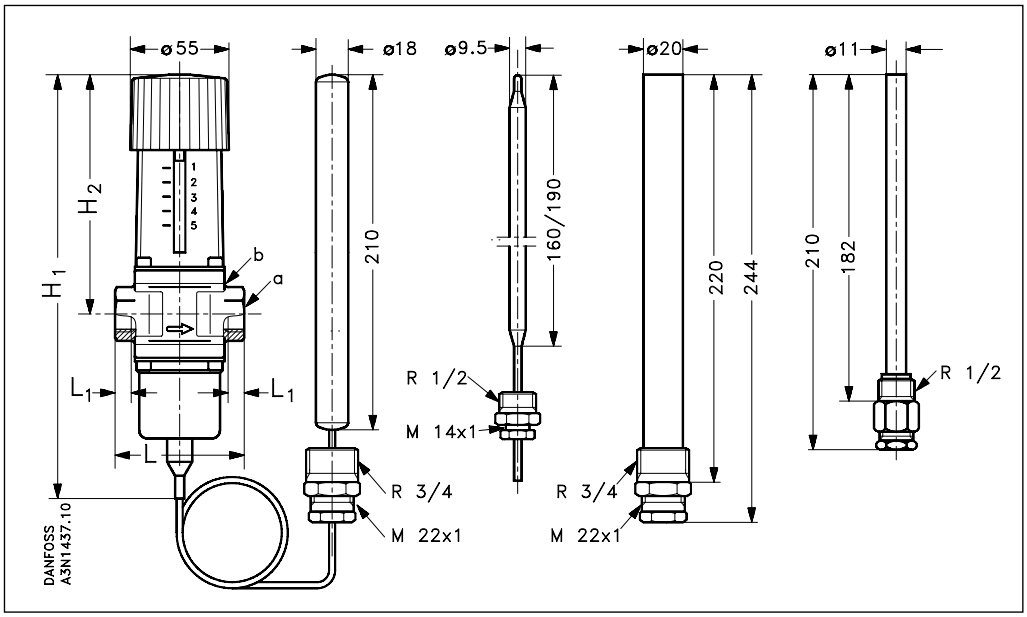
[1] Code no. covers complete valve incl. capillary tube gland.

Regulation range +25 → +65°C
Max. sensor temperature +90°C

Connection	k_v value (m^3/h at Δp = 1 bar)	Capillary tube length [m]	Type	**Code no.** [1]
G 1/2	1.9	2	AVTA 15	**003N0045**
		2 (armoured)		**003N0299**
		5		**003N0034**
G 3/4	3.4	2	AVTA 20	**003N0046**
G 1	5.5		AVTA 25	**003N0047**

[1] Code no. covers complete valve incl. capillary tube gland.

Dimensions and weights



Type	H_1 [mm]	H_2 [mm]	L [mm]	L_1 [mm]	a	b [mm]	Weight [kg]
AVTA 10	240	133	72	14	G 3/8	⎔ 27	1.45
AVTA 15	240	133	72	14	G 1/2	⎔ 27	1.45
AVTA 20	240	133	90	16	G 3/4	⎔ 32	1.50
AVTA 25	240	138	95	19	G 1	⎔ 41	1.65

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Type AVTA

Application

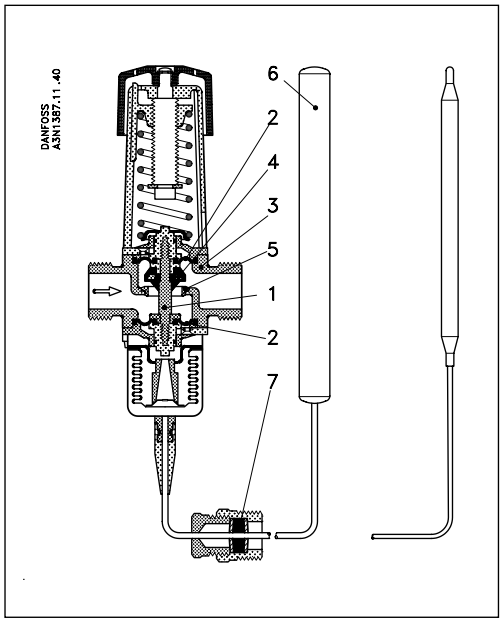


AVTA DZR
for slightly aggressive media

A valve body in dezincification-resistant brass means that the valve can be used for neutral and slightly aggressive media.
External thread gives easy valve installation and removal.
Pressure stage PN 16; max. +130°C.

AVTA DZR valves are available with two different types of charge: Adsorption charge and universal charge.
AVTA DZR can also be supplied with mass charge (please contact Danfoss).

Specifications and product overview



- Opens on rising sensor temperature
- Media temperature -25 → +130°C
- Differential pressure 0 → 10 bar
- Max. test pressure 25 bar
- Max. pressure on the sensor 25 bar
- The valves are pressure-relieved, i.e. the degree of opening is not affected by differential pressure Δp (pressure drop).

Materials - parts in contact with the medium

No.	Description	Material	
1	Spindle	Dezincification-resistant brass	CuZn36Pb2As / BS2874 / CZ132
2	Diaphragm	Rubber - ethylene - propylene (EPDM)	
3	Valve body	Dezincification-resistant brass	CuZn36Pb2As / BS2874 / CZ132
4	Valve cone	Nitrile rubber (NBR)	
5	Valve seat	Stainless steel	W.no. 1.4305 / AISI 303
6	Sensor	Copper	W.no. 2.0090
7	Capillary tube gland	Nitrile rubber (NBR) Brass	 W.no. 2.0321 / 2.0401

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Type AVTA

Ordering

AVTA DZR with adsorption charge

The charge consists of active carbon and CO_2 which is adsorbed on falling sensor temperature and thereby produce pressure changes in the element.

Special characteristics
- Wide regulating range
- Withstands up to +130°C sensor temperature
- Can be installed in any position as far as orientation and temperature are concerned
- Small sensor dimensions - ∅9,5 × 160 mm
- Max. pressure on sensor 25 bar

Connection [°C]	Regulation range	k_v value (m^3/h at Δp = 1 bar)	Capillary tube length [m]	Type	**Code no.** [1]
G $^3/_4$ A	+10 → +80°C	1.9	2.3	AVTA 15	**003N2134**
G 1 A		3.4		AVTA 20	**003N3134**
G $1^1/_4$ A		5.5		AVTA 25	**003N4134**

[1] Code no. covers complete valve incl. capillary tube gland.

Immersion sensors, see “Spare parts and accessories”, page 13.

Ordering

AVTA DZR with universal charge

AVTA with universal charge
The charge is liquid/gas where the liquid surface (regulation point) is always inside the sensor. The charge medium used depends on the temperature range.

Special characteristics
- Sensor dimensions ∅ 18 × 210 mm
- Sensor can be installed colder or warmer than the valve
- Sensors must be orientated as shown in the sketch on page 12
- Max. pressure on sensor 25 bar

Regulation range 0 → +30°C
Max. sensor temperature +57°C

Connection	k_v value (m^3/h at Δp = 1 bar)	Capillary tube length [m]	Type	**Code no.** [1]
G $^3/_4$ A	1.9	2	AVTA 15	**003N2135**
G 1 A	3.4		AVTA 20	**003N3135**
G $1^1/_4$ A	5.5		AVTA 25	**003N4135**

Regulation range +25 → +65°C
Max. sensor temperature +90°C

Connection	k_v value (m^3/h at Δp = 1 bar)	Capillary tube length [m]	Type	**Code no.** [1]
G $^3/_4$ A	1.9	2	AVTA 15	**003N2136**
G 1 A	3.4		AVTA 20	**003N3136**
G $1^1/_4$ A	5.5		AVTA 25	**003N4136**

Regulation range +50 → +90°C
Max. sensor temperature +125°C

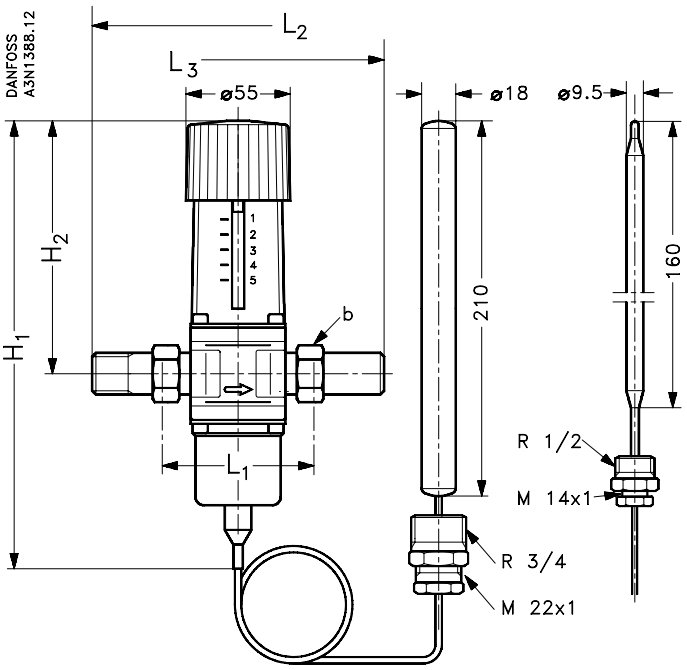
Connection	k_v value (m^3/h at Δp = 1 bar)	Capillary tube length [m]	Type	**Code no.** [1]
G $^3/_4$ A	1.9	2	AVTA 15	**003N2137**
G 1 A	3.4		AVTA 20	**003N3137**
G $1^1/_4$ A	5.5		AVTA 25	**003N4137**

[1] Code no. covers complete valve incl. capillary tube gland.

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Type AVTA

Dimensions
AVTA DZR



Type	H_1 [mm]	H_2 [mm]	L_1 (standard) [mm]	L_2 w. threaded conn. [mm]	L_3 w. weld conn. [mm]	b ISO 228/1
AVTA 15	217	133	75	141	149	G $^3/_4$ A
AVTA 20	217	133	80	152	164	G 1 A
AVTA 25	227	138	83	167	167	G $1^1/_4$ A

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Type AVTA

Application

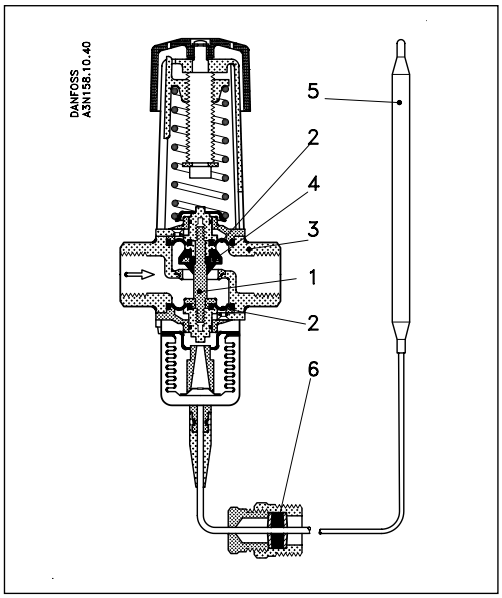


AVTA SS
for aggressive media

A valve body in stainless steel means that the valve can be used for aggressive media in such applications as the marine sector and the chemical industry.
Pressure stage PN 16; max. +130°C.
For extremely aggressive media the valve can be supplied in titanium (please contact Danfoss).

AVTA SS valves have an adsorption charge as standard.
AVTA SS can also be supplied with mass charge or universal charge (please contact Danfoss).

Specifications and product overview



- Opens on rising sensor temperature
- Media temperature -25 → +130°C
- Differential pressure 0 → 10 bar
- Max. test pressure 25 bar
- Max. pressure on sensor 25 bar
- Valves are pressure-relieved, i.e. the degree of opening is not affected by differential pressure Δp (pressure drop).

Materials - parts in contact with the medium

No.	Description	Material
1	Spindle	Stainless steel W.no. 1.4539 (EN10088); UNS N 08904
2	Diaphragms	Rubber - ethylene - propylene (EPDM)
3	Valve body	Stainless steel W.no. 1.4581 (EN10214-4); AISI 318
4	Valve cone	Nitrile rubber (NBR)
5	Sensor	Copper (DIN 1787) W.no. 2.0090
6	Capillary tube gland	Nitrile rubber (NBR), brass (DIN 17660) W.no. 2.0321 and W.no. 2.0401

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Type AVTA

Ordering
AVTA with adsorption charge

The charge consists of active carbon and CO_2 which is adsorbed on falling sensor temperature and thereby produce pressure changes in the element.

Special characteristics

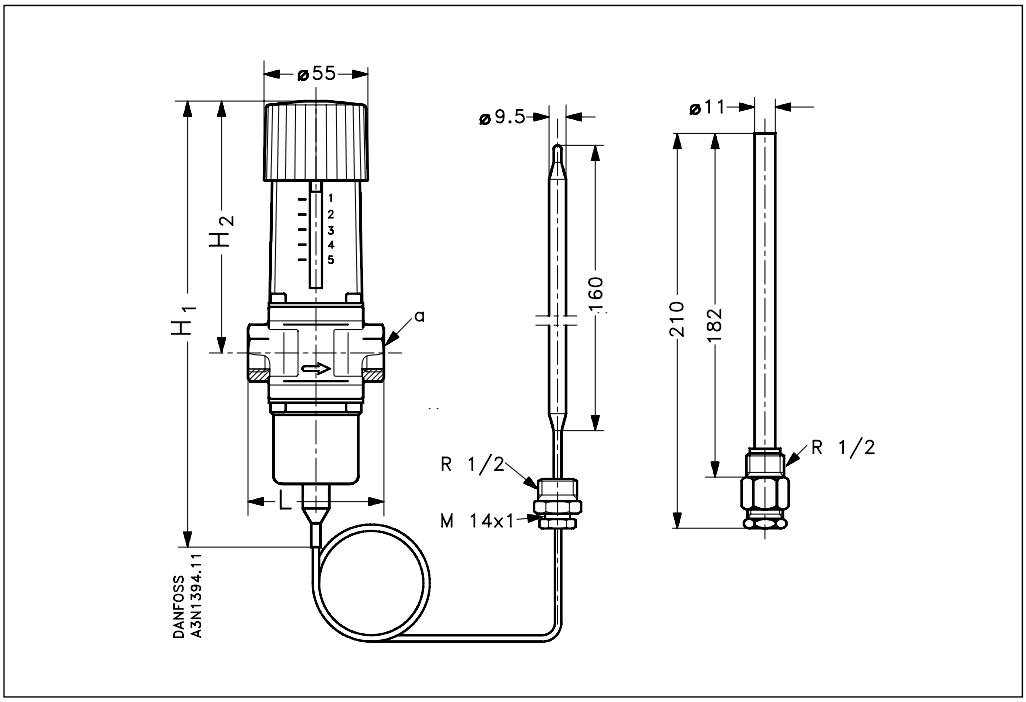
- Wide regulating range
- Can be installed in any position as far as orientation and temperature are concerned
- Withstands up to +130°C sensor temperature
- Small sensor dimensions - ∅ 9.5 × 160 mm
- Max. pressure on sensor 25 bar

Connection	Regulation-range	k_v value (m^3/h at Δp = 1 bar)	Capillar-tube length [m]	Type	**Code no. [1])**
G ½	+10 → +80°C	1.9	2.3	AVTA 15	**003N2150**
G $^3/_4$		3.4		AVTA 20	**003N3150**
G 1		5.5		AVTA 25	**003N4150**

[1]) Code no. covers complete valve incl. capillary tube gland.

Immersion sensors, see “Spare parts and accessories”, page 13

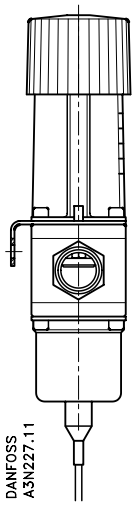
Dimensions
AVTA SS



Type	H_1 [mm]	H_2 [mm]	L [mm]	a ISO 228/1
AVTA 15	240	133	72	G ½
AVTA 20	240	133	90	G $^3/_4$
AVTA 25	250	138	95	G 1

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Installation



AVTA with mounting bracket

The valves can be installed in any position.
An arrow on the valve body indicates the direction of flow.
AVTA valves are also marked so that the letters RA can be read straightforwardly when the valve is held as shown.
The installation of an FV filter ahead of the valve is recommended - see separate data sheet DKACV.PD.600.B.

Capillary tube
Install the capillary tube without sharp bends (no “kinks”). Relieve the capillary tube at the ends. Relief is important where vibration might occur.

Note
Where AVTA is used, the sensor must be able to react to variations in cooling water temperature on system start.
Therefore a bypass line with a shut-off valve might be necessary to ensure flow at the sensor during start-up.

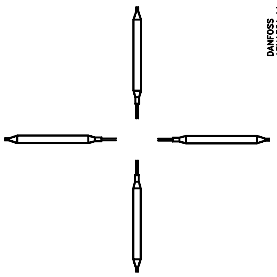
If a mounting bracket is used - see “Spare parts and accessories”, page 13 - it must always be between valve body and setting section (see illustration).

Sensor installation

If an immersion sensor is installed, the use of heat-conductive compound is recommended. This will reduce reaction time. See “Spare parts and accessories”, page 13.

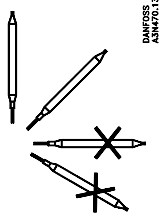
AVTA with small sensor (∅ 9.5 × 190 mm) must always be installed in the flow line, where the regulated liquid is coldest (“sensor warmer”).

Adsorption charge



Sensor ∅ 9,5 × 160 mm
(Sensor warmer or colder)

Mass charge



Sensor ∅ 9.5 × 190 mm
(Sensor warmer)

Universal charge



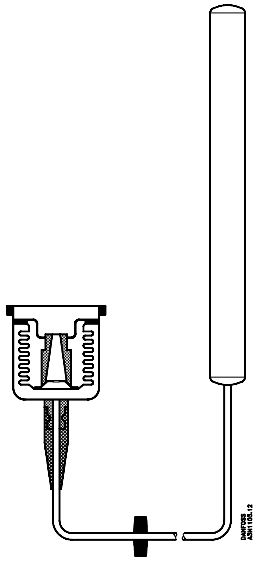
Sensor ∅ 18 × 210 mm
(Sensor warmer or colder)

“Up” = upwards



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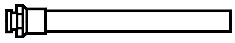
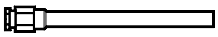
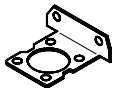
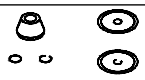
Spare parts and accessories



Service elements for AVTA

	Temperatur range [°C]	Capillary tube length [m]	Code no.
Adsorption charge - sensor ∅ 9.5 × 160 mm	+10 → +80	2.3	**003N0278**
Universal charge - sensor ∅ 18 × 210 mm	0 → +30	2	**003N0075**
		5	**003N0077**
	+25 → +65	2	**003N0078**
		5	**003N0080**
		2 (armoured)	**003N0063**
		3	**003N0079**
	+50 → +90	2	**003N0062**
		3	**003N0089**
Mass charge - sensor ∅ 9.5 × 190 mm	0 → +30	2	**003N0066**
	+25 → +65	2	**003N0091**
		2	**003N0068**

Accessories

	Designation	Description	Code no.
	Immersion sensor max. pressure 25 bar L = 220 mm	Brass for ∅ 18 sensor G $^3/_4$	**003N0050**
		Brass for ∅ 18 mm sensor $^3/_4$ - 14 NPT	**003N0051**
		18/8 steel[1] for ∅ 18 sensor G $^3/_4$	**003N0192**
	Immersion sensor max. pressure 25 bar L = 182 mm	Brass for ∅ 9.5 sensor G $^1/_2$	**017-4367**
		18/8 steel[1] for ∅ 9.5 sensor G $^1/_2$	**003N0196**
	Mounting bracket	For AVTA	**003N0388**
	Heat-conductive compound	5 gram tube	**041E0110**
		0.8 kg	**041E0111**
	1 nitrile diaphragm for mineral oil	For AVTA 10/15 For AVTA 20 For AVTA 25	**003N0445** **003N0446** **003N0447**
	Capillary tube gland	G $^1/_2$ G $^3/_4$ $^3/_4$ -14 NPT	**017-4220** **003N0155** **003N0056**
	2 o-rings 2 diaphragms Valve cone	For AVTA 10/15 For AVTA 20 For AVTA 25	**003N400600** **003N400700** **003N400800**

[1] W1.4301

Accessories for AVTA, DZR version

Threaded connectors

Contents of set	DN	Code no.
2 Unions, 2 nipples and 2 seals	15	**003N5070**
	20	**003N5071**
	25	**003N5072**

Weld connectors

Contents of set	DN	Code no.
2 Unions, 2 nipples and 2 seals	15	**003N5090**
	20	**003N5091**
	25	**003N5092**

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Sizing

When sizing and selecting thermostatic valves, it is most important to ensure that the valve is able to give the necessary quantity of cooling water at any time, irrespective of the load. Therefore, to select a suitable size of valve it is necessary to know the precise amount of cooling required. On the other hand, to avoid the risk of unstable regulation (hunting), the valve should not be oversized. The type of charge must be selected on the basis of the temperature to be maintained, and on an assessment of the characteristics of each type, as described in the foregoing.

In general the aim should be to select the smallest valve capable of giving the required flow.

It is also recommended that the temperature range be chosen so that the required sensor temperature lies in the middle of the regulation range.

To help fine-setting the valve, a thermometer should be installed near the sensor.

Valve size
The following data are used when selecting valve size:
- Required cooling water flow, Q [m^3/h]
- Temperature rise in cooling water, [Δt] (°C)
- Differential pressure across valve, [Δp] (bar).
  With fully open valve the differential pressure should be around 50% of the total pressure drop across the cooling system.

The diagrams on page 15 are intended to make valve sizing easier.

Fig. 1 - Relation between heat quantity [kW] and cooling water quantity
Fig. 2 - Graphs of k_v values
Fig. 3 - Valve operating range
Fig. 4 - Flow quantities as a function of pressure drop [Δp]

Example
A cooling water valve must be selected for the temperature regulation of a vacuum pump.

Since direct regulation of the oil temperature is required, an AVTA valve is suitable. The sensor position is horizontal - and small dimensions are desired.

Given data:
- Necessary cooling at full load 10 kW.
- Oil temperature to be maintained constant at +45°C
- Cooling water p_1 = 3 bar
- Outlet p_3 = 0 bar
- Cooling water temperature t_1 = +20°C
- Outlet temperature t_2 = +30°C

1. The graphs in fig. 1 can be used to find the necessary cooling water quantity at Δt = 10 °C (+30°C - +20°C) to 0.85 m^3/h.

2. The graphs in fig. 2 show the necessary k_v value for 0.85 m^3/h with

   Δp = 1.5 bar $\left(\frac{3-0}{2}\right)$ for 0.7 m^3/h.

3. The columns in fig. 3 show that all four ATVA valves can be used, but in practice an ATVA 10 or 15 should be selected.

The above considerations apply to both AVTA and FJVA valve types.

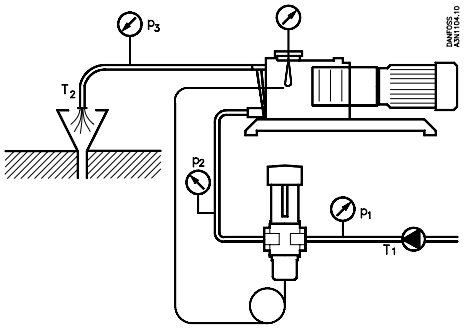


Fig. 4

Operating conditions and other product requirements in this example mean that a valve with adsorption charge is the correct choice.
The temperature range +10 → +80°C is in order.

The table at the top of page 4 shows AVTA 10, code no. 003N1144, or AVTA 15, code no. 003N0107. Both fulfil the requirements named.

In many applications, installation conditions make the use of sensor pockets advisable.

“Accessories” on page 13 gives the code nos. for sensor pockets for ∅ 9.5 mm sensors in brass and stainless steel: 993N3569 and 003N0196, respectively.

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Sizing

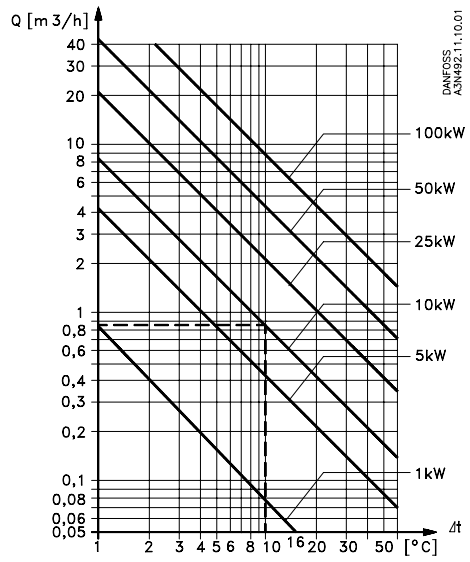


Fig. 1
Heating or cooling with water.
Example: Necessary cooling output 10 kW, with Δt = 10 °C.
Required flow 0.85 m³/h.

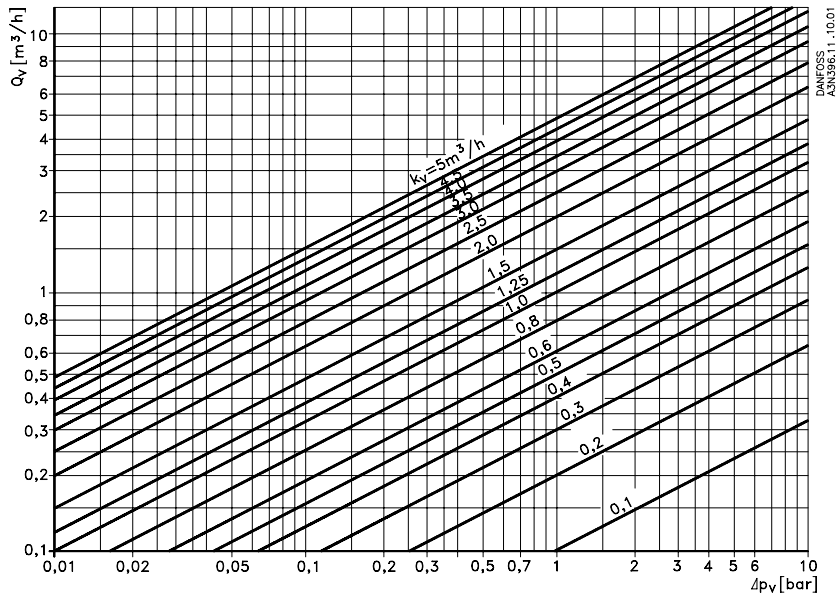


Fig. 2
Relation between water quantity and pressure drop across valve.
Example: Flow 0.85 m³/h with a pressure drop of 1.5 bar.
The k_v value becomes 0.7 m³/h.

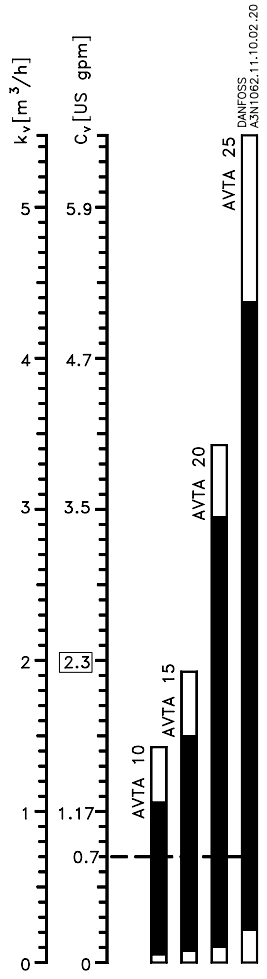


Fig. 3
Nomogram showing the valve k_v ranges. k_v values are always given for the water flow in m³/h with a pressure drop Dp of 1 bar. The valve should be selected so that the necessary k_v value lies in the middle of the regulation range.
Example: AVTA 10 and 15 are the most suitable for a k_v value of 0.7.

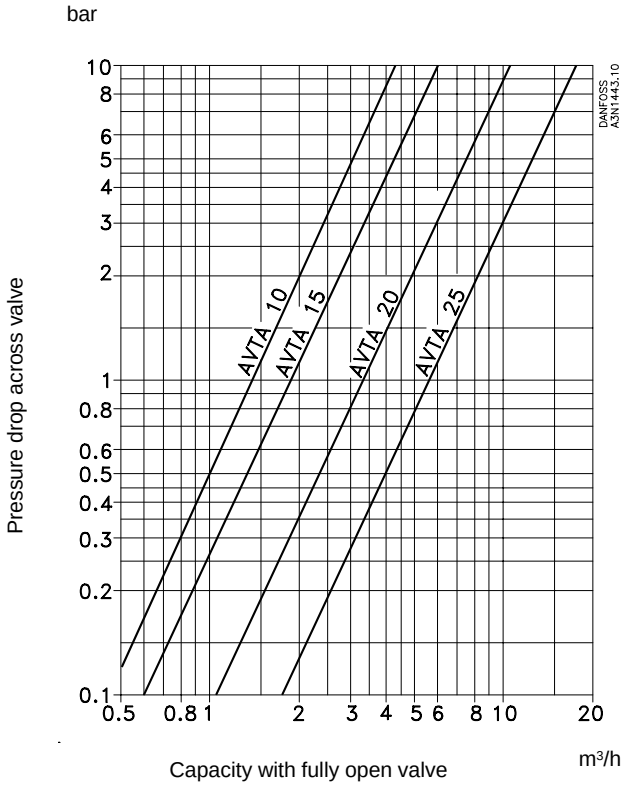


Fig. 4
Valve flow quantity in fully open position, as a function of pressure drop Dp.

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