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GB

Quick Choice of

Temperature Controls

Sizing of Valves and Actuators

Clorius
Controls A/S

- ensures reliable control of heating, cooling and ventilation systems.

Quick Choice of Temperature Controls

Ever since 1902 we have produced reliable temperature controls for nearly all forms of water, oil and steam systems.
The experience thereby gained has formed the basis of the present control and valve programme, which makes it possible to determine the optimal combination of valve and actuator.

Control types

Self-acting Temperature Controllers

- Work on the liquid expansion principle without any auxiliary energy
- P-controls
- Reliable under all conditions
- Secured against over-temperature

Electronic Temperature Controllers

- Low energy consumption
- PID-controls
- Adjustable PID-values
- Many adjustment possibilities

Control Valves

All of our control valves fulfil the demands for seat leakage as per VDI/VDE 2174, i.e. the flow through the closed valve is less than the percentage of full flow (by same Δp_V) indicated in this table:

Type of valve	Max. seat leakage
Single seated	0,05%
Single seated, balanced	0,05%
Double seated	0,5%
3-way	0,5%

Regarding the control characteristics and general characteristics of the valves, please refer to the corresponding data sheets. We can deliver the valves with certificates from the maritime classification companies.

Control valves larger than DN 80 mm should be installed in horizontal pipe lines and be mounted with a vertical spindle. This limits wear and tear and prolongs the lifetime. At high temperatures, a cooling unit should be used (see diagram 3.)

Sizing of Controls

General points

The diagrams have been worked out to obtain the optimal combination of valve and thermostat etc.
In order to secure stability in the control circuit the following points should be observed:
The valve is to be sized according to load and pressure – over sizing (too big valve) corresponding to a large proportional band (PB) may cause unstable control.
In case of thermostat control with large load variations a small proportional band should be avoided. The proportional band (PB) is calculated as the rated travel (mm) of the valve divided by the amplification of the thermostat (mm/°C) = the two last figures of the type description of the V-thermostat. It is strongly recommended to calculate the PB.

Example: 20 M1F valve (rated travel 6.5 mm) with V4.05 thermostat:
PB= 6,5/0,5 = 13°C
Experience shows that a PB-value in the green field, 8-13°C, is often to be preferred:

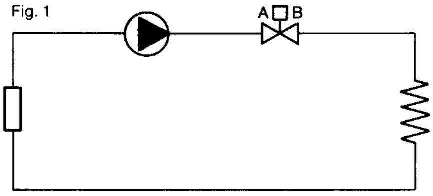
Load variation	Proportional band (PB)	Colour
Small	4-8 °C	Red
Medium	8-13 °C	Green
Large	Above 13 °C	Yellow

To avoid noise as well as wear and tear the sizing pressure drop Δp_V across control valves for water should not exceed 1 bar in domestic premises. Otherwise the control should be distributed on more valves.

Δp_V must be at least 10% of the total pressure drop of the control circuit.

Control circuits with 2-way valves should be sized so that the pressure drop across the valve $\Delta p_{A \to B}$ is 30-50% of the total pressure drop of the control circuit ($\Delta p_{A \to B} + \Delta p_{B \to A}$), fig. 1.

Fig. 1



Control circuits with 3-way valves should be sized so that the following rules are observed:

1. The pressure drop across the valve port A and AB ($\Delta p_{A \to AB}$) is more than 50% of the pressure drop across the section C-A ($\Delta p_{C \to A}$), fig. 2 and 3.
2. The pressure drop across the section C-A ($\Delta p_{C \to A}$) should be less than 25% of the pump pressure H, fig. 2 and 3.
3. The pressure drop across the section C-A ($\Delta p_{C \to A}$) should be equal to the pressure drop across the section C-B ($\Delta p_{C \to B}$), fig. 2 and 3.

Fig. 2

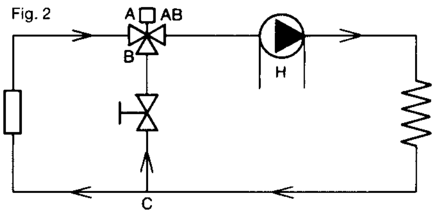
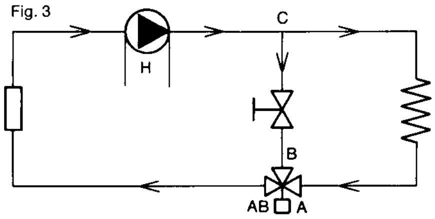


Fig. 3



Control Systems for Water

Necessary sizing values:

1. Max. water flow: G m^3/h (e.g. G = 3,0 m^3/h)
2. Pressure drop Δp_V in bar across valve at G m^3/h (e.g. Δp_V = 0,1 bar).
3. Pressure drop Δp_L in bar across closed valve (e.g. Δp_L = 5,0 bar)
4. The working pressure of the system p bar (e.g. p = 5 bar)
5. The working temperature of the system T °C (e.g. T = 90°C)
6. Load variation of the system (e.g. medium = green field)

In diagram 1 the correct valve size is determined by the intersection between the lines for the water flow G and the pressure drop Δp_V (e.g. 32 mm valve).

The required proportional band (green field) and the max pressure Δp_L, against which the controller is to close, is decisive for the choice of thermostat etc. which can be found from the table – e.g. 32 mm single seated valve + V8.09 thermostat (Δp_L = 6,8 bar) or 32 mm M3F valve + V4.10 thermostat (Δp_L = 12 bar).

When controlling cooling systems with V-thermostat and 2-way valve, reverse acting valves type L2SR, M2FR, G2FR or H2FR should always be used. See data sheet.

Control Systems for Steam

Only 2-way valves should be used for steam.
Necessary sizing values:

1. Max. steam flow: G ton/h (e.g. G = 1,5 ton/h)
2. Inlet pressure (saturated steam) p_1 bar absolute (e.g. p_1 = 10 bar)
3. Steam temperature T at p_1 bar (e.g. T = 179°C)
4. Variation of load in the system (e.g. medium = green field)

In diagram 2 the vertical line for the actual inlet pressure p_1 should be followed to the intersection with the line for $\delta = 0{,}42$ (or below if a smaller δ is specified).
The intersection between the horizontal line from this point and the line for steam flow G lies in the field for the optimal valve size (e.g. 40 mm valve).
The required proportional band (green field) and the max pressure Δp_L, against which the controller is to close, is decisive for the choice of thermostat etc. which can be found from the table – e.g. 40 mm single seated balanced M1FB valve + V8.09 thermostat (Δp_L = 11 bar).

Valve Material

The necessary valve material is determined by diagram 3 at the intersection for the actual temperature and pressure lines.

Control Systems for Other Media

Oil systems with viscosity v_k in:
If actual cSt $< 35 \cdot \sqrt{G} \cdot \sqrt{\Delta p}$ should be sized as water systems. The flow G measured in m^3/h. If measured in kg/h, G will have to be divided by the density of the oil (in kg/m^3) before entering diagrams.
When sizing other oil systems – or systems for other media – please contact our company.

Ordering of Controls

Control Valves

When ordering control valves, valve size and type should be indicated:

Example:	25	M	1	F	B
Valve size 4 (15/4) to 300 mm	25				
L = Gunmetal valve M = Cast iron valve G = Nodular cast iron H = Cast steel valve		M			
1 = Single seated 2 = Double seated 3 = 3-way			1		
S = Threaded ends F = Flanged ends				F	
B = Balanced R = Reverse-acting					B

V-Thermostats

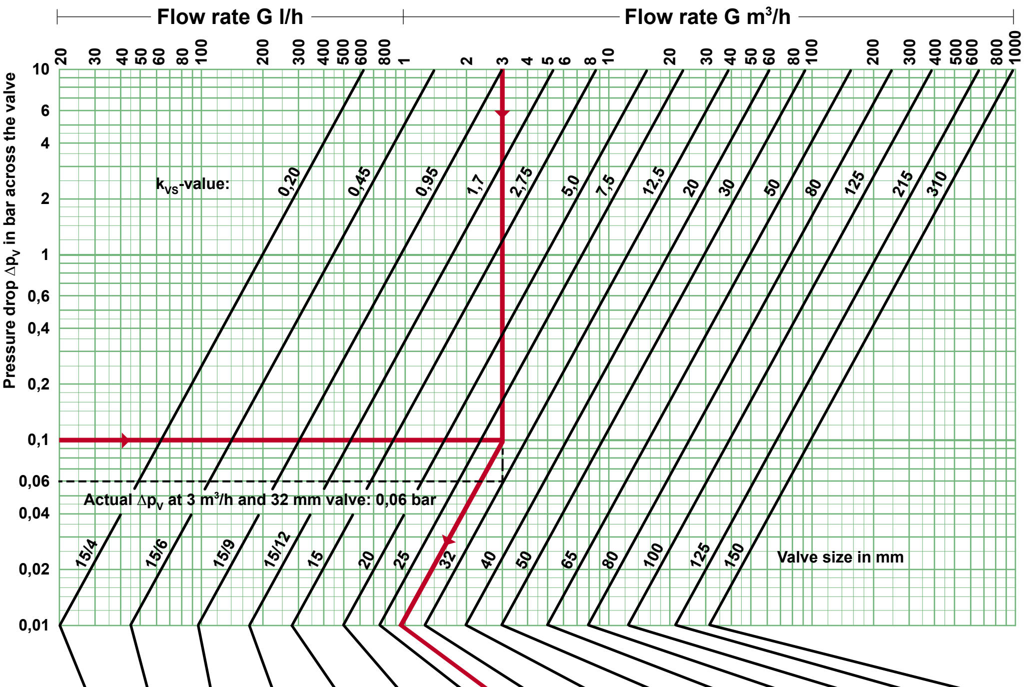
When ordering thermostats the following data should be stated:
Type of thermostat (e.g. V4.05)
Temperature range (e.g. 0-120 °C)
Length of capillary tube (e.g. 3 m)
Material of capillary (e.g. copper)
Type of sensor (e.g. bulb sensor)
Sensor material (e.g. copper)

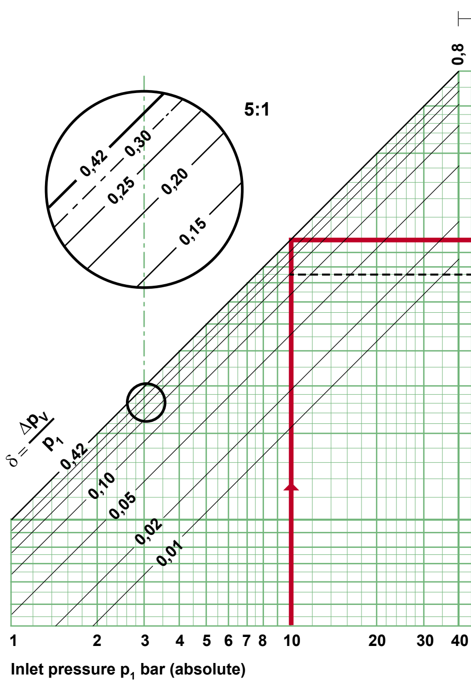
See also the data sheets:

3.4.xx V-thermostats
3.9.xx Pressure differential controls
4.6.xx Electronic controllers
4.8.xx Valve motors.

Sizing for Water

Diagram 1



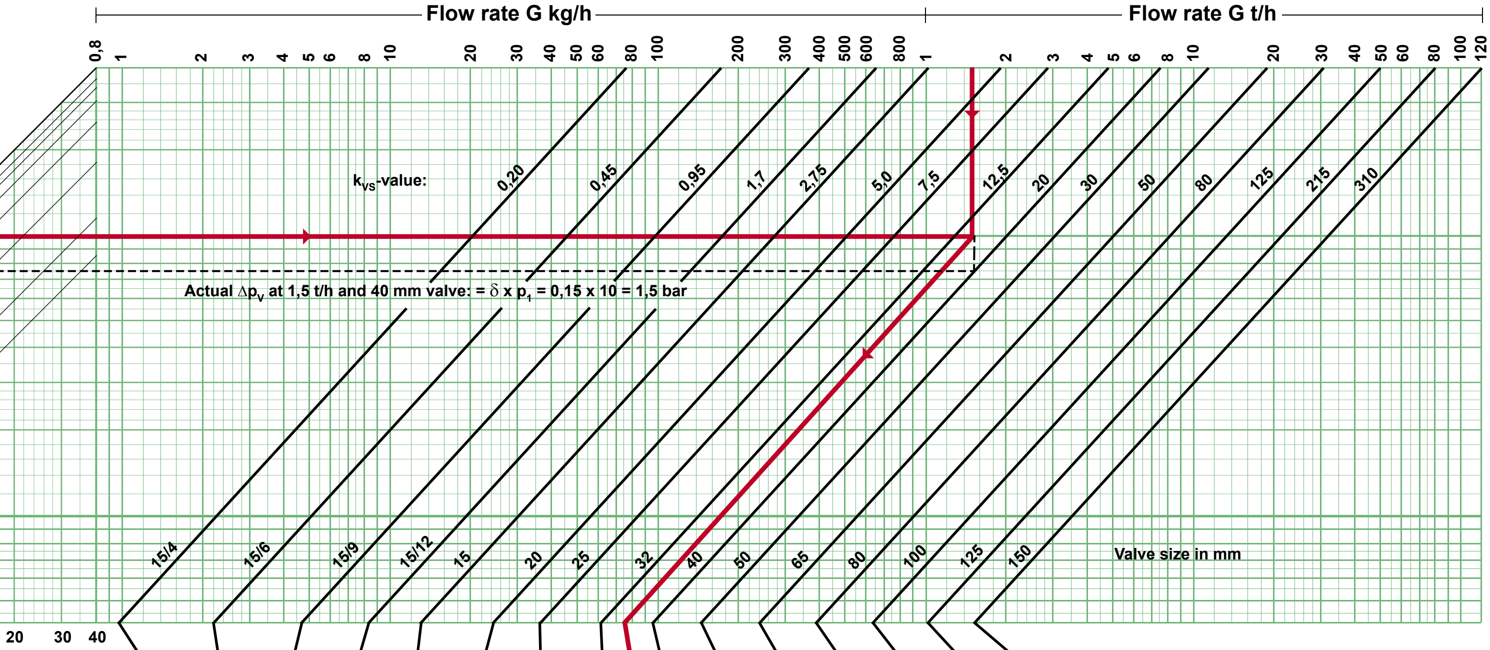


15/4	15/6	15/9	15/12	15	20	25	32	40	50	65	80	100	125	150	Valve size in mm		
Max. pressure in bar (Δp_L), against which the control can close 1)															Type of valve 3)		Actuator
	16	16	11	6,7	3,8	6									L1S / L1SB	single seated	Type V2.05
21	21	13	10	6,1	2,8	1,8	0,9								M1F, G1F, H1F		
					16	13	7,8	3,5	2,5						L2S	double seated	
					16	14	7,9	4,3	3,3						M2F, G2F, H2F		
				5,4	5,4										4) L3S	3-way	
				2,2	1,9										5) L3S		(200 N)
	16	16	16	16	9,8	16									L1S / L1SB	single seated	2) Type V4.05, TD-58, TD-66-4
40	40	38	25	16	7,6	5	2,8	1,8	1,4						M1F, G1F, H1F		
						15	12	8,8	6,5						M/G/H1FB	single seated,bal.	
					40	40	25	21	14	9,2	7,3	5,7	3,8	2,7	L2S, M/G/H2F	double seated	
				10	10	9,2	9,2	6,6	6,6	4,2	3,7	2,9			4) L3S, L3F	3-way	
				2,2	1,9	10	10	6,2	6,2	3,3	2,9	2,1			5) L3S, L3F		
						14	12	8	6,8	5,4	3,7	2,9			4) M3F		
						19	16	9,1	7,7						4) G3F, H3F		
						14	10	8	6,3	4	2,9	2,1			5) M3F, G3F, H3F		(400 N)
	16	16	16	16	9,8	16									L1S / L1SB	single seated	2) Type V4.10, TD-58, TD-66-4
40	40	38	25	16	7,6	5	2,8	1,8	1,4						M1F, G1F, H1F		
						15	12	8,8	6,5						M/G/H1FB	single seated,bal.	
					40	40	25	21	14	9,2	7,3	5,7	3,8	2,7	L2S, M/G/H2F	double seated	
				10	10	9,2	9,2	6,6	6,6	4,2	3,7	2,9			4) L3S, L3F	3-way	
				2,2	1,9	10	10	6,2	6,2	3,3	2,9	2,1			5) L3S, L3F		
						14	12	8	6,8	5,4	3,7	2,9			4) M3F		
						19	16	9,1	7,7						4) G3F, H3F		
						14	10	8	6,3	4	3,9	2,1			5) M3F, G3F, H3F		(400 N)
40	40	40	40	36	17	11	6,8	4,3	3,3						L1S, M/G/H1F	single seated	2) Type V8.09 and type TD-66-8
						22	20	14	12	10	5,2				M/G/H1FB	single seated,bal.	
					40	40	40	40	40	25	20	17	11	9,3	L2S, M/G/H2F	double seated	
				10	10	10	10	10	10	10	10	10	5,9	5,9	4) L3S, L3F	3-way	
				2,2	1,9	10	10	6,2	6,2	3,3	2,9	2,1	3,2	3,2	5) L3S, L3F		
						40	40	25	22	16	10	10	6	4,3	4) M3F, G3F, H3F		
						14	10	8	6,3	4	2,9	2,1	3,3	2,1	5) M3F, G3F, H3F		(800 N)
40	40	40	40	36	17	11	6,8	4,3	3,3						L1S, M/G/H1F	single seated	2) Type V8.18 and type TD-66-8
						22	20	14	12	10	5,2				M/G/H1FB	single seated,bal.	
					40	40	40	40	40	25	20	17	11	9,3	L2S, M/G/H2F	double seated	
				10	10	10	10	10	10	10	10	10	5,9	5,9	4) L3S, L3F	3-way	
				2,2	1,9	10	10	6,2	6,2	3,3	2,9	2,1	3,2	3,2	5) L3S, L3F		
						40	40	25	22	16	10	10	6	4,3	4) M3F, G3F, H3F		
						14	10	8	6,3	4	2,9	2,1	3,3	2,1	5) M3F, G3F, H3F		(800 N)
				16	11,3										L1UP, L1IP	single seated	Valve motor type MT40/A (450 N)
	16	16	16	16	16	16									L1S / L1SB	single seated	Valve motor type VB, VBA
40	40	40	40	40	27	18	10								M1F, G1F, H1F		
						22	20								M/G/H1FB	single seated,bal.	
					40	40	40								L2S, M/G/H2F	double seated	
				10	10	10	10								4) L3S, L3F	3-way	
				2,2	1,9	10	10								5) L3S, L3F		
						40	40								4) M3F		
						40	40								4) G3F, H3F		
						14	10								5) M3F, G3F, H3F		(1200 N)
40	40	40	40	40	27	18	10	6,8	5,3						L1S, M/G/H1F	single seated	3) Valve motor type V, AV
						22	20	14	12	10	7/3,8				M/G/H1FB	single seated,bal.	
					40	40	40	40	40	25	25/17	25/14	19/7	16/5,3	L2S, M/G/H2F	double seated	
				10	10	10	10	10	10	10	10	10	10	10	4) L3S, L3F	3-way	
				2,2	1,9	10	10	6,2	6,2	3,3	2,9	2,1	3,2	3,2	5) L3S, L3F		
						40	40	40	40	16	10	10	10	9,4	4) M3F, G3F, H3F		
						14	10	8	6,3	4	2,9	2,1	3,3	2,1	5) M3F, G3F, H3F		(1200 N)

1 bar = 100 kPa = 10,2 mVS = 0,99 Atm. = 1,02 kp/cm² 1 cSt = 0,01 St = 10-6 m²/sec. °E into cSt: $v_k \cong 7,6 \times °E \cdot (1-1/°E^3)$

Sizing for Steam

Diagram 2



15/4	15/6	15/9	15/12	15	20	25	32	40	50	65	80	100	125	150	Valve size in mm		
Max. pressure in bar (Δp_L), against which the control can close 1)															Type of valve 2)		Actuator
	16	16	10	6	2,9	5									L1S / L1SB	single seated	Type V2.05
20	20	13	9,3	5,3	1,9	0,9									M1F, G1F, H1F		
					15	13	7,3	3,8	2,7						M2F, G2F, H2F	double seated	(200 N)
	16	16	16	16	9	16									L1S / L1SB	single seated	Type V4.05
40	40	38	24	15	6,7	4,1	1,9	0,8	0,4						M1F, G1F, H1F		
						15	12	8,1	5,7						M/G/H1FB	single seated, bal.	(400 N)
					40	40	24	20	17	8,4	6,5	4,9	2,9	1,8	M2F, G2F, H2F	double seated	
	16	16	16	16	9	16									L1S / L1SB	single seated	Type V4.10
40	40	38	24	15	6,7	4,1	1,9	0,8	0,4						M1F, G1F, H1F		
						15	12	8,1	5,7						M/G/H1FB	single seated, bal.	(400 N)
					40	40	24	20	17	8,4	6,5	4,9	2,9	1,8	M2F, G2F, H2F	double seated	
	16	16	16	16	16	13									L1S	single seated	Type V8.09
40	40	40	40	35	16	10	5,8	3,3	2,3						M1F, G1F, H1F		
						18	14	11	8,7	6,4	4,3				M/G/H1FB	single seated, bal.	(800 N)
					40	40	40	40	40	24	19	16	10	8,4	M2F,G2F, H2F	double seated	
	16	16	16	16	16	13									L1S	single seated	Type V8.18
40	40	40	40	35	16	10	5,8	3,3	2,3						M1F, G1F, H1F		
						18	14	11	8,7	6,4	4,3				M/G/H1FB	single seated, bal.	(800 N)
					40	40	40	40	40	24	19	16	10	8,4	M2F,G2F, H2F	double seated	
				16	10,4										L1UP, L1IP	single seated	Valve motor type MT40/A (450 N)
	16	16	16	16	16	16									L1S	single seated	Valve motor 3) type V, AV
40	40	40	40	40	26	17	9,8	5,8	4,3						M1F, G1F, H1F		
						18	14	11	8,7	6,4	5,1/2,8				M/G/H1FB	single seated, bal.	
					40	40	40	40	40	25	25/16	25/13	19/6	15/4,4	M2F, G2F, H2F	double seated	(1200 N)

1) As Δp_L is normally decreasing by increasing inlet pressure p_1, all Δp_L values for water are calculated for $p_1 = \Delta p_L$ - and for steam as max allowable inlet pressure (pos. pressure) on the basis of vacuum behind the valve.
For 15/4 and 15/6 mm valves where Δp_V is increasing by increasing inlet pressure (p_1 is minimum by $\Delta p_V = 0$), Δp_L is, however, in both cases calculated as the max. allowable inlet pressure p_1 by $\Delta p_V = 0$.

2) Colour code (PB) is only valid for thermostats. The other type designations apply to pressure differential controls – with the same tabular values.

3) Tabular values preceded by a slanted stroke (e.g. 4,9/0,5) apply for motors with spring return – in cases where Δp_L is reduced.

4) Tabular values valid for mixing valves by closing port A(2) – and for diverting valves by opening port B(3). See also: 5).

5) For mixing valves by closing port B(3) and for diverting valves by opening port A(2) - Δp_L is independent of actuator.

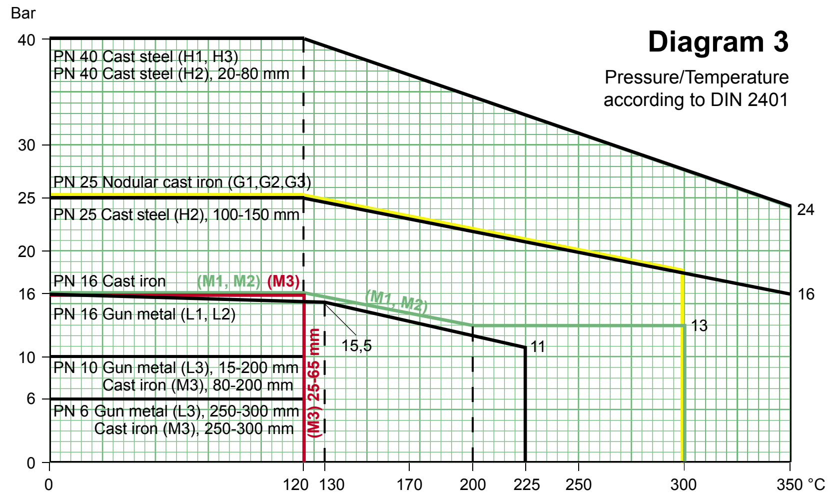
The sizing chart for steam is based on saturated steam. For superheated steam increase the required flow rate by the percentage shown in this table before entering the chart:

Superheat	Increase flow by
10°C	1%
50°C	5%
100°C	9%

We reserve the right of changes without notice.

Diagram 3

Pressure/Temperature according to DIN 2401

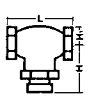


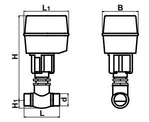
Thermostat down:	Without Cooling Unit	Cooling Unit KS-4	Cooling Unit KS-5/KS-6
Thermostat up:	Without Cooling Unit	Must be avoided	Must be avoided

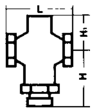
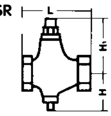
Dimensions and Weights of Valves

All flange connections according to EN standard.
All actuator connections shown downwards.

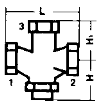
Type		Valve Size	15 ½"	20 ¾"	25 1"	32 1¼"	40 1½"	50 2"	15 ½"	20 ¾"	25 1"	32 1¼"	40 1½"	50 2" mm
L1S (15-20 mm) L1SB (25 mm) L1UP L1IP	L1S L1SB	L	85	95	100				85	95				
		H	65	67	80				220	225				
		H_1	20	23	53				20	23				
		L_1							122	122				
		B							92	92				
		kg	0,7	0,8	1,6				0,7	0,8				
L2S L2SR	L2S	L		90	100	113	129	153	75	87	99	113	129	153
		H		82	80	82	118	122	43	45	50	55	65	70
		H_1		48	53	58	68	71	80	80	80	80	90	94
		kg		1	1	1,6	2,9	3,8	1	1	1	1,5	3	4



L1UP/MT40
L1IP/MT40



L2SR


Type		Valve Size	15 ½"	20 ¾"	25 1"	32 1¼"	40 1½"	50 2"	65	80	100	125	150 mm
L3S	Size 15 20	L	110	110	140	140	185	185					
		L_1			70	70	95	95					
		H	60	60	145	145	150	150					
		H_1	55	55	80	80	105	105					
		kg	1	1	4,4	4,4	8,3	7,7					
M1F G1F H1F		L	130	150	160	180	200	230					
		H	80	85	95	105	110	125					
		H_1	60	65	70	75	85	95					
	M1F	kg	3,1	4,2	5,5	8,1	9,7	14,7					
	G1F	kg	3,1	4,2	5,5	8,1	9,7	14					
	H1F	kg	3,4	4,6	6,1	9	10,8	15,5					
M1FB G1FB (25-50 mm) H1FB		L			160	180	200	230	290	310			
		H			180	195	205	225	260	275			
		H_1			70	75	85	95	110	115			
	M1FB	kg			6	9	13	16	23	38			
	G1FB	kg			6	9	13	16					
	H1FB	kg			6	9	13	16	23	38			
M2F G2F (20-50, 100-150 mm) H2F	Size 20-80	L		150	160	180	200	230	290	310	350	400	400
		H		85	95	105	110	125	135	145	185	205	240
		H_1		70	77	82	92	102	120	165	209	224	244
	M2F	kg		5	6,5	9	11	16	21	26	37	73	76
	G2F	kg		5	6,5	9	11	16					
	H2F	kg		5	6,5	9	11	16	21	35	38	73	76
M2FR G2FR (20-50, 100-150 mm) H2FR	Size 20-80	L		150	160	180	200	230	290	310	350	400	400
		H		63	70	75	85	95	110	155	145	160	180
		H_1		112	117	151	155	169	180	195	240	260	293
	M2FR	kg		5	6,5	9	11	16	21	35	39	75	77
	G2FR	kg		5	6,5	9	11	16					
	H2FR	kg		5	6,5	9	11	16	21	35	44	80	83
L3F		L							240	260	350	400	400
		L_1							120	130	175	240	240
		H							175	185	195	245	245
		H_1							120	125	145	180	180
		kg							22,5	30	55	91	95
M3F G3F, H3F (25-50 mm)	Size 25-65	L			160	180	200	230	290	310	350	400	480
		L_1								155	175	240	270
		H			130	150	160	190	220	180	195	245	280
		H_1			70	75	85	95	110	127	141	171	189
		kg			7	10	14	18	26	35	49	79	111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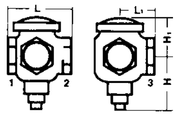
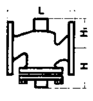
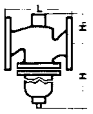
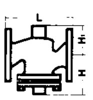
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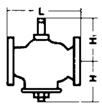
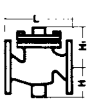
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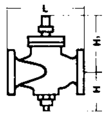
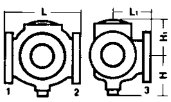
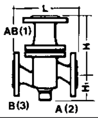
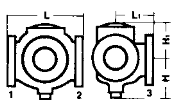
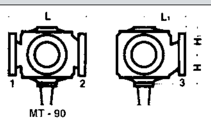




M3F Size 80-150


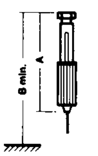
3-way valves for MT90 M motor	Type Size	M3FM (80-300), G3FM (100-300) 80	100	125	150	200	250	300	L3FM 200	250	300 mm
	L	310	350	400	480	600	850	850	550	850	850
	L_1	155	175	240	270	325	450	450	300	450	450
	H	117	132	181	216	238	305	305	235	305	305
	H_1	127	141	171	189	238	305	305	235	305	305
	kg	35	49	79	111	160	300	290	179	450	460

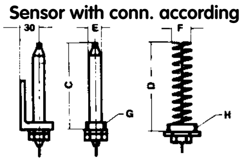


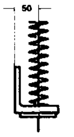
Dimensions and Weights of Thermostats

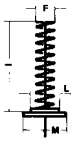
Dimensions G and H are Pipe threads according to ISO 7/1.
Other dimensions are mm. Weight: net.

C = Sensor of copper S = Sensor of high alloy stainless steel		Type V2.05 C	S	Type V4.05 C	S	Type V4.10 C	S	Type V8.09 C	S	Type V8.18 C	S
Adjusting cylinder	A	305	305	385	385	385	385	560	560		560
	B	405	405	525	525	525	525	740	740		740
Weights: see below	Setting range for standard thermostats °C	0-60 30-90 60-120		0-120 40-160		0-60 30-90 60-120		0-120 40-160		0-60 30-90 60-120	
	Setting ranges from -30 to +280 °C										
Sensor with conn. according to ISO 7/1	C	210	190	390	380	490	515	710	745		800
	D	235	170	235	250	325	325	425	435		810
	E	22	22	22	22	28	25	28	25		34
	F	49	49	49	49	49	49	49	49		49
	G	R ¾	R ¾	R 1	R 1	R 1	R 1	R 2	R 2		R 2
	H	R 2	R 2	R 2	R 2	R 2	R 2	R 2	R 2		R 2
With G conn.	kg	1,8	1,8	2,6	2,6	3,3	3,3	6,3	6,3		7,3
With H conn.	kg	2,3	2,3	3,1	3,1	3,8	3,8	6,3	6,3		7,3
Sensor with air duct flange	F	49		49		49		49			
	I	420		420		420		450			
	L	60		60		60		60			
	M	95		95		95		95			
	kg	1,8		2,6		3,3		5,8			









Other sensors and connections can be supplied.
Subject to changes without notice.

Capillary tube is supplied in Copper: 3 - 6 - 9 - 12 - 15 - 18 and 21 m
Stainless steel: 3 - 4,5 -6 -7,5 - 9 - 10,5 -12-13,5-15-16,5 and 18 m

Complete control systems

Clorius Controls offers a complete range of tested and reliable equipment for control of heating, cooling and ventilation systems, all with the purpose of achieving the highest reliability and saving energy.

Controllers

Clorius Controls offers a wide range of electronic controllers for heating, cooling and ventilation systems. The controllers are available for systems in the maritime industry, general industry, institutions and residences. Clorius Controls offer controllers for simple stand-alone solutions or for larger BMS-plants.

Control valves

Clorius valves are simple and reliable for regulation of temperature and pressure differences in heating, cooling and ventilation systems for maritime industry, general industry, institutions and residences.

Motors

Clorius Controls offers a large program of conventional regulation motors and analogue motors. This includes special motors for maritime use, which are designed to withstand vibrations.

Balancing valves

With Ballorex balancing valves the amount of water in the individual heating circuits can be balanced and regulated.

Thermostats

Self-acting thermostats from Clorius Controls function directly and are available with sensors for air or liquids. They are also available as safety thermostats for the protection of secondary pipe installations.

Pressure differential controllers

The controllers from Clorius Controls lower large and variable pump pressure to stabilize the flow in the plant.

Service

Clorius Controls has an international network of service engineers who perform commissioning and trouble shooting in heating and ventilation plants. We are available 24 hours a day, 365 days a year.
We offer service contracts including preventive maintenance for all brands of regulating equipment.
We are also ready to help in case of urgent problems.

Clorius Controls' products can also be found on **Tribon.com**.

on Tribon.com

Vendor:

Clorius Controls A/S

Clorius Controls A/S
Tempovej 27
DK-2750 Ballerup
Denmark
Tel.: +45 77 32 31 30
Fax: +45 77 32 31 31
www.cloriuscontrols.com