Меню

Type series booklet
7540.1/6-10

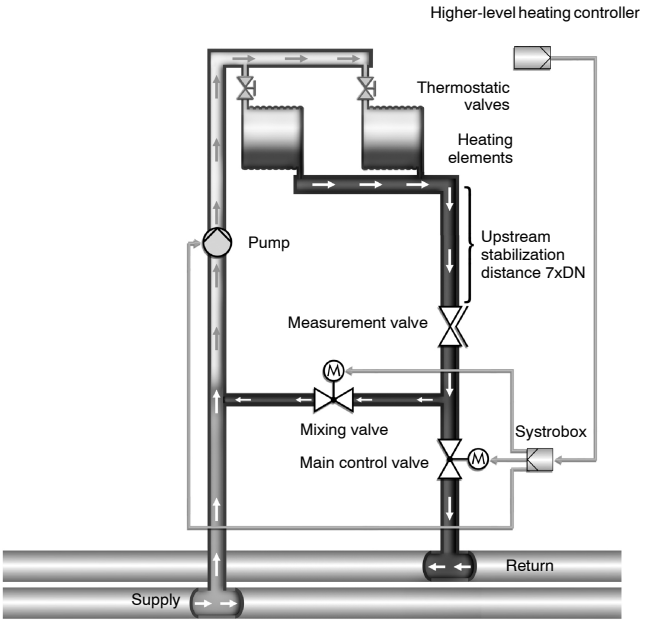
BOA® -Systronic

Energy-saving automation system for weather-dependent supply temperature control of static heating circuits

Application

BOA®-Systronic improves supply temperature control in constant-flow static heating circuits.
The system replaces the control and balancing valve used in conventional heating circuits while retaining the higher-level controller.

Volume flow rates	0.5 < Q < 185 m^3/h
Temperature differentials	10/15/20/25/30/35 K
Nominal sizes	DN20 - DN200
Line connection	External thread DN20
	Flanges DN25-DN200
Pressure classes	PN 6/10/16
Heating medium	Water up to 120 °C
Suitable for:	Installed systems (upgrading)
	New systems
	Boiler / District heating systems
	All main feed manifolds
	All control systems
	All supply temperatures
Heating elements:	All kinds of radiators
	Underfloor heating systems



Hydraulic schematics of BOA®-Systronic

TÜV CERT PED 97/23/EC

CE

KSB

Scope of supply and installation

Nominal system diameter DN 20

Qty.	Component
1x	Control ball valve DN20 with electric actuator for controlling inflow / outflow, with pre-assembled and operational Systrobox control unit. The valve is fitted in the supply or return line of the heating circuit as per operating instructions. The control unit can also be mounted in and operated from a control cabinet or any other suitable location.
1x	Control ball valve DN15 with electric actuator for controlling the volume flow rate in the mixing line. The valve is installed in the mixing line as per operating instructions and replaces the swing check valve.

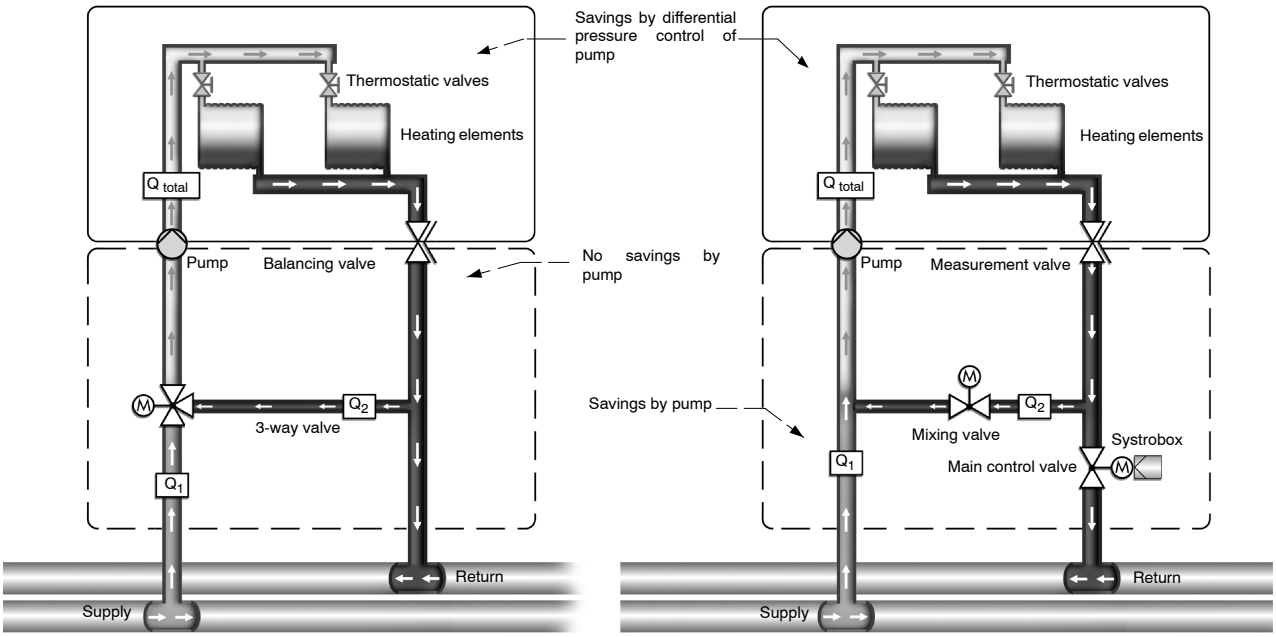
Nominal system diameter DN 25 - DN 200

Qty.	Component
1x	Main control valve: BOA®-CVE control valve with electric actuator for controlling inflow / outflow, with pre-assembled and operational Systrobox control unit. The valve is fitted in the supply or return pipe of the main feed manifold as per operating instructions. The control unit can also be mounted in and operated from a control cabinet or any other suitable location.
1x	Mixing valve: BOA®-CVE control valve with electric actuator for controlling the volume flow rate in the mixing line (mixing valve). The valve is installed in the mixing line as per operating instructions and replaces the swing check valve.
1x	BOA-Control® IMS measurement valve for measuring the volume flow rate during commissioning. The valve is installed in the return line of the heating circuit before the mixing line branches off (seen in flow direction). Laminar flow conditions are required to ensure correct measurements. The following minimum upstream stabilization distances (free from any source of potential interference) must, therefore, be provided: - at least 7 x DN between BOA-Control® IMS and fittings such as 90° bends or open shut-off valves - at least 30 x DN between BOA-Control® IMS and tubulence-producing elements in the piping system, e. g. pumps or control valves. - Any sources of potential interference in the upstream stabilization area (such as, for example, immersion sensors or non-standardized seal elements) must be avoided. - A downstream stabilization distance is not required! - Flow through the valves must be in the direction indicated by the embossed arrow on the valve body. - **Vertical installation position:** for installation in vertical piping, **no restrictions** apply with regard to the installation position of the valves. - **Horizontal installation:** for installation in horizontal piping, it is important to ensure that the sensor is permanently in contact with the fluid. For this reason, installation with “sensor on top” (air bubbles) or “sensor below” (deposits) is not allowed.

Note: The pump is not included in KSB’s scope of supply!

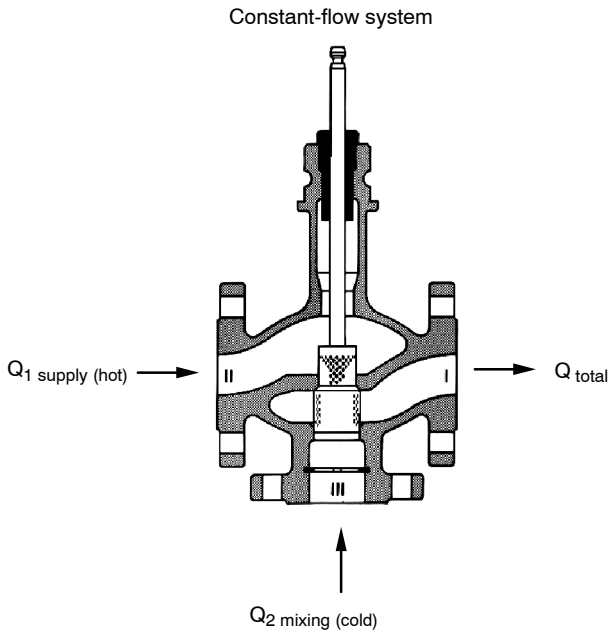
Summary description

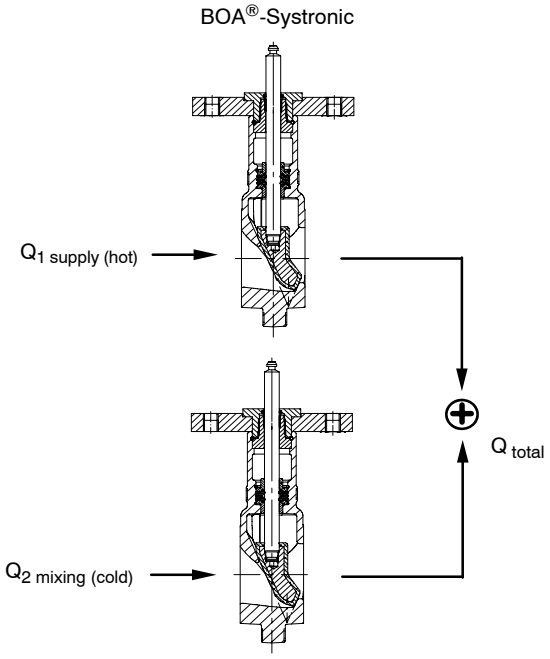
BOA®-Systronic is an energy-saving automation system which supports the weather-dependent supply temperature control process of static heating circuits by systematically controlling the volume flow rate in the heating circuit (secondary side) in that it constantly matches circulator and control valve operation.
The system comprises two control valves for mixing the heating medium, one measurement valve for measuring the volume flow rate, and an electronic control unit which issues the requisite control signals simultaneously to both control valves and to the circulator of the heating circuit. Systems of nominal size DN 20 are supplied without measurement valve. The system can be operated with all variable-speed pumps which can process the discharge head transmitted via LON. The heating controller signal serves as input signal for the system.
With BOA®-Systronic, the conventional system with its constant volume flow rate is transformed into a variable flow system with reduced volume flow rates. For this purpose, the supply temperature must be increased by a defined value with the help of the heating curve of the higher-level controller. BOA-Systronic provides the consumers of the heating circuit with the same thermal output as a conventional, constant-flow system. The pump, however, is operated according to ambient temperature on the basis of the piping characteristic determined for the heating circuit. This results in an average reduction of up to 70% in power consumption and thus reduced operating costs for the circulator, while on the primary side, energy consumption of the boiler remains unchanged.
The savings realised by BOA®-Systronic result from knowledge about the hydraulic conditions in the heating circuit. They are completely independent from differential pressure control of the circulator pump.
Note: BOA®-Systronic does not replace the higher-level controller.



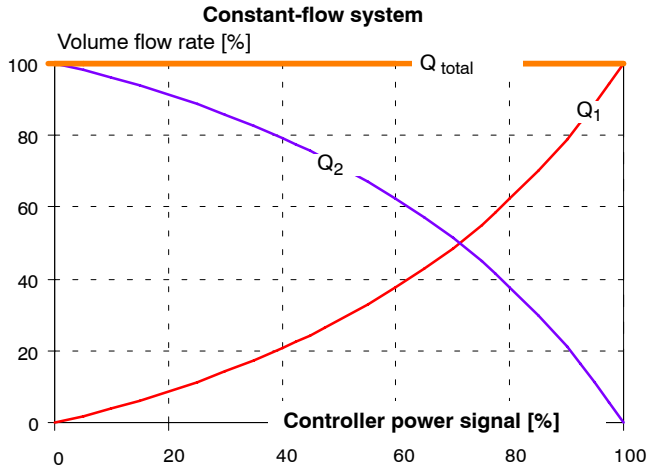
Volume flow rates

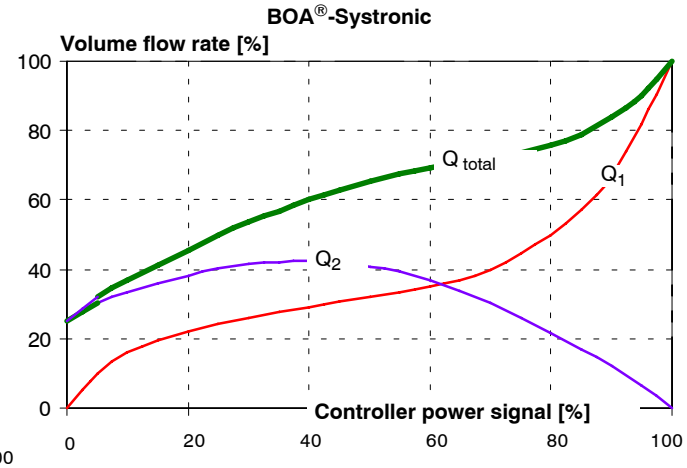
In a constant-flow system the two partial volume flows Q_1 and Q_2 are interdependent due to the hydraulic configuration (e.g. 3-way valve). The control valve always supplies the nominal flow rate (design point) for all load conditions, i.e. irrespective of the external temperature and the power signal provided by the higher-level controller. Thermal output of the heating circuit can only be regulated via the temperature differential (difference between supply and return temperature) and thus via the supply temperature. As a result, predominantly cold return water is pumped through the heating circuit under part-load conditions. Only when the volume flow is reduced by the control function of the thermostatic valves (external heat input) will the pump respond in accordance with the set pump curve. Supply temperature is controlled by the higher-level controller in conjunction with the control valve. With the help of the two control valves, BOA®-Systronic adjusts the mixing ratio of the volume flows Q_1 and Q_2 required for the part-load conditions, thus supplying a reduced volume flow to the heating circuits. As a result, the circulator pump only delivers the amount of hot water that is actually required in the heating circuit.
During commissioning, the BOA-Control® IMS measurement valve (DN25-DN150) can optionally measure the volume flow rate delivered by the pump in order to parameterize the system curves. It valve remains fully open at all times and replaces the balancing valve of constant-flow systems. Due to its very low zeta-coefficient it acts just like a piece of pipe.



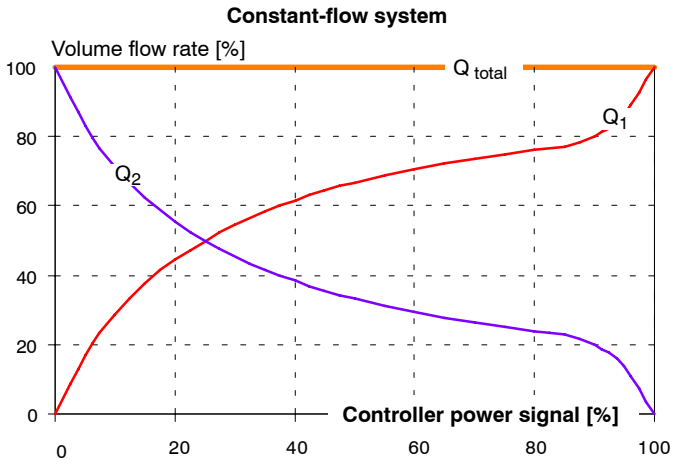


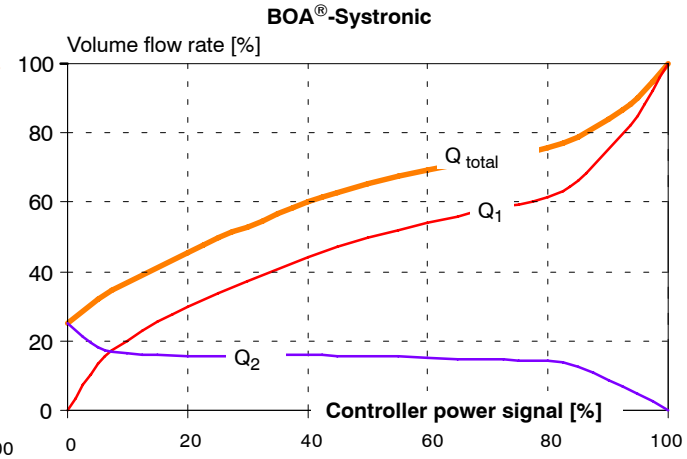
Volume flow rates for constant boiler temperature





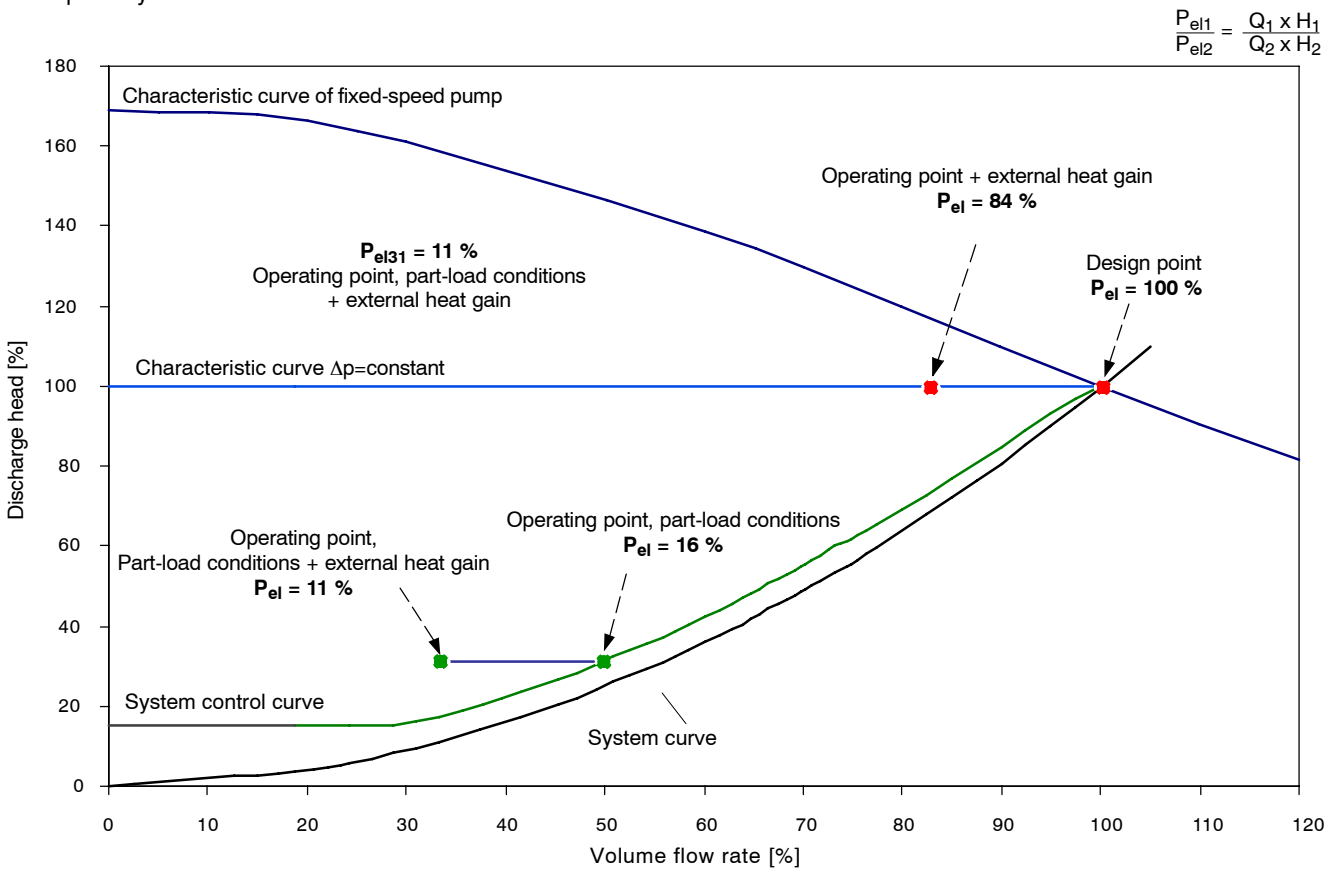
Volume flow rates for weather-dependent boiler temperature





Discharge heads

In constant-flow systems, the pump responds to reduced volume flow rates resulting from the control function of the thermostatic valves and adjusts its operating point in accordance with the set pump curve (Δp=constant or Δp=variable), resulting in energy savings (external heat input).
BOA®-Systronic, by contrast, uses system knowledge about the hydraulic conditions in the heating circuit. It actively adjusts the pump's operating point to the best efficiency point (system control curve), resulting in a weather-dependent reduction in pump head. Excessive discharge heads are prevented, and flow noises are avoided. Under the influence of external heat, the pump's operating point **also moves along the pump curve**. Depending on the pump curve set, the discharge head either remains constant (Δp=constant) or decreases with decreasing volume flow rate (Δp=variable). The figures in the following diagram are for example only.



Commissioning

Commissioning of the system is carried out automatically with the help of specifically developed software. The pump's operating point is adjusted in accordance with the system curve measured, thus optimizing the hydraulic operation of the heating circuit. With the data stored, BOA®-Systronic generates the system control curve for the pump as well as the two valve control curves for all part-loaded conditions. This can optionally be effected by volume flow measurement (DN25-DN150). Hydraulic balancing of heating circuits is performed automatically at the main manifold during commissioning. On request, commissioning can be ordered as a service job from KSB. The BOA®-Systronic MS commissioning software is available free of charge.

Interface between control system and pump

The Systrobox control unit, via its LON interface, transmits the **discharge head setpoint** to the pump's LON communication module. **All** variable-speed pumps which can receive and process the discharge head via LON can be integrated into the system. In this case, the appropriate LON module for the frequency inverter of the pump must be ordered (see pump documentation). During system commissioning, *binding* of the LON variables must be performed between the Systrobox control unit and the pump. On request, a user manual for the *binding* procedure using the LonMaker software is available free of charge. Information about interfaces and communication options of the pump used is given in the technical literature of the pump concerned.
Pre-initialized LON communication modules are available for wet-rotor pump types KSB-Riotec®/Riotec® Z and WILO Top-E. In this case, *binding* of the LON variables will not be required during commissioning.

Interface between control system and higher-level controller

The control signal provided by the higher-level controller is applied to the two input terminals of the Systrobox control unit. 3-point signals 230VAC oder 24VAC can be converted into a continuous (0-10 V) signal with the help of signal converters (see accessories). The supply temperature is increased with the help of the heating curve in the higher-level controller (see operating instructions).

Selection

The system can be selected by means of the selection software, which is available free of charge.
Alternatively, selection can be performed manually in a single step as a function of volume flow rate / thermal output and temperature differential (difference between supply and return temperature) at design point.

Parameter		Unit	Value
Thermal output of heating circuit at design point	$P_{thermal}$	kW	
Temperature differential of heating circuit at design point	ΔT	K	

The volume flow rate at the design point is calculated as follows

$$Q^{S}_{nom.} = \frac{P_{thermal}}{1.163 \times \Delta T} = 0.86 \times \frac{P_{thermal}}{\Delta T} = 0.86 \times \frac{\text{..... [kW]}}{\text{..... [K]}} = 0.86 \times \text{..... [m}^3\text{/h]} = \text{..... [m}^3\text{/h]}$$

By parallel shift of the heating curve, the volume flow rate at design point can be reduced by 24.5 %:

$$Q^{S}_{nom.} = 0.755 \times \frac{P_{thermal}}{1.163 \times \Delta T} = 0.65 \times \frac{P_{thermal}}{\Delta T} = 0.65 \times \frac{\text{..... [kW]}}{\text{..... [K]}} = 0.65 \times \text{..... [m}^3\text{/h]} = \text{..... [m}^3\text{/h]}$$

Parameter		Unit	Value
⇒ Calculated volume flow rate at design point	$Q_{nom.}$	m^3/h	

BOA®-Systronic ident. Nos.

				System components		
Volume flow rate $Q_{nom.}$ [m^3/h]		Nominal system diameter	Ident. number	**Main control valve**	**Mixing valve**	**BOA-Control® IMS**
0.5 ...	1.5	DN 20	48 014 003	DN 20	DN 15	not fitted
1.0 ...	2.7	DN 25	48 013 287	DN 25	DN 25	DN 25
2.3 ...	4.2	DN 32	48 013 288	DN 32	DN 25	DN 32
3.6 ...	6.7	DN 40	48 013 289	DN 40	DN 25	DN 40
5.7 ...	10.6	DN 50	48 013 290	DN 50	DN 32	DN 50
9.5 ...	15.1	DN 65	48 013 291	DN 65	DN 40	DN 65
13.7 ...	22.7	DN 80	48 013 292	DN 80	DN 50	DN 80
20.3 ...	37.8	DN 100	48 013 293	DN 100	DN 65	DN 100
31.8 ...	53.0	DN 125	48 013 294	DN 125	DN 80	DN 125
45.0 ...	95.0	DN 150	48 013 731	DN 150	DN 100	DN 150
80.0 ...	185.0	DN 200	48 013 732	DN 200	DN 125	DN 200

The volume flow limits apply to velocities of approx. 1.5 m/s in the piping.

Example:
Thermal output at design point: $P_{thermal}$ = 300 kW
Temperature differential at design point: ΔT = 20K
Slope modification of heating curve:
=> Volume flow rate at design point: **Q = 12.9 m3/h**
=> Nominal system diameter BOA®-Systronic: **DN 65**
Parallel shift of heating curve:
=> Volume flow rate at design point: **Q = 9.7 m3/h**
=> Nominal system diameter BOA®-Systronic: **DN 50**

Accessories

Signal converter

Signal converters are available for converting the 3-point control signal of the higher-level controller into a continuous signal. The converters are snapped onto an NS35 mounting rail.

Accessories	Ident. number	Description		
Signal converter	48 013 320	Input: Output:	24 VAC (0-10)VDC	3-point continuous
Signal converter	48 013 321	Input: Input:	230 VAC 24 VAC	3-point 3-point

LON communication module

Communication between the Systrobox control unit and the pump's frequency inverter is via LON. The appropriate LON communication module is required, depending on the pump type used (see technical literature of pump used). Pre-initialized LON communication modules are available for wet-rotor pump types KSB-Riotec® and Riotec® Z and WILO Top-E. As a result, LON binding is not required on these pumps.
Note: LON binding between the Systrobox and the pump's LON module can be performed using the "LON-Maker" software and associated hardware. Instructions can be provided free of charge.

LON module for pump type	Ident. number	Description
KSB Riotec® / Riotec® Z WILO Top-E	48 013 319	Pre-initialized
KSB Rio-Eco / Rio-Eco Z WILO Stratos	01 081 037	Not initialized, binding required on commissioning
Etaline PumpDrive / Etaline PumpDrive Z	47 106 600	Plug-in card with FTT 10 A hardware driver for free topology (bus or star wiring); installation disk for integration into LON network included.

Flow meter

For volume flow measurement with BOA-Control® IMS (DN25 - DN150/200 only), to optimally adjust the control curves to the hydraulic conditions in the heating circuit. With the help of an integrated sensor, the measurement valve determines the volume flow rates and transmits the measuring signal to the BOATRONIC® M-420 measuring computer, where it is converted into an analog current signal (4-20)mA and transmitted to the Systrobox control unit for further processing. The 4-core cable required is pre-assembled to the measuring computer, wired and equipped with a plug for connection to the Systrobox. The cable also supplies the measuring computer with 24VDC supply voltage.
Note: The sensor in the measuring valve requires servicing. The orange-coloured data cable connecting the sensor in the measurement valve with the measuring computer accounts for part of the measuring resistance and must not be altered or removed!

Accessories	Ident. number	Description
Flow meter	48 013 496	BOATRONIC®-M420 measuring computer with pre-assembled 4-core communication cable, pre-configured with plug

RS232 / USB data cable

The system configuration is transmitted to the Systrobox control unit by data cable via the RS232 interface (socket). The data cable can be connected to a USB port of the laptop using the USB adapter.

Accessories	Ident. number	Description
RS232 data cable	48 013 499	Pre-configured with plug and socket
USB adapter	48 013 498	Pre-configured for connection to RS232 data cable

Commissioning case

The set contains the hardware and software required for commissioning in conjunction with Riotec®/Riotec® Z pumps. If other pumps are to be integrated into the system, please note that suitable hardware and software will be required to carry out the necessary LON binding on site.

Note: The pump must be able to receive and process the discharge head transmitted via LON. LON binding between the Systrobox and the pump's LON module can be performed using the "LON-Maker" software and associated hardware, for example. Instructions can be provided free of charge.

Accessories	Ident. number	Description
Commissioning case	48 013 495	- 1 x flow meter with pre-configured cable for connection to Systrobox control unit - 1 x RS232 data cable - 1 x USB adapter for RS232 data cable - 1 x BOA®-Systronic MS commissioning software on CD-ROM

Balancing of branch circuits

Balancing of branch circuits can be performed very easily and rapidly using the BOATRONIC® M-2 measuring computer and BOA-Control® IMS measurement valve (see BOA-Control® IMS literature).

Note: The sensor in the measuring valve requires servicing. The orange-coloured data cable connecting the sensor in the measurement valve with the measuring computer accounts for part of the measuring resistance and must not be altered or removed!

Measuring computer variant	Ident. number	Description	
BOATRONIC® M-2	46 000 119	Application: Power supply: Data interface:	Balancing of branch circuits; not suitable for commissioning BOA®-Systronic battery none

Technical data

Power supply	24 VAC ± 10 % / 50Hz
Inputs	1x (0-10) VDC, input resistance 17kΩ, (Hz+, Hz–)
	1x (4-20) mA, input resistance 120Ω, (Q+, Q–)
Outputs	2x (2-10) VDC / max. 10mA
	2x 24 VAC / max. 3A
	1x 24 VDC / max. 0.2A
Communication	1x RS232
	1x LON, FTT10 transceiver
Enclosure	IP54 to EN60529
Type of protection	II as per EN 60730
Interference immunity	as per EN 61000-6-1 and -2
RFI emission	as per EN 61000-6-3 and -4
Electromagnetic compatibility	89/336/EEC
EC directive on low-voltage equipment	73/23/EEC
Power input	DN20-DN50: 22VA
	DN65-DN80: 52VA
	DN100-DN125: 85VA
Weight (control unit only)	approx. 0.2 kg
Operating temperature	(0 to 50) °C
Transport / Storage temperature	(–20 to +70) °C

LON variables

Input variables (Standard Network Variable Type)

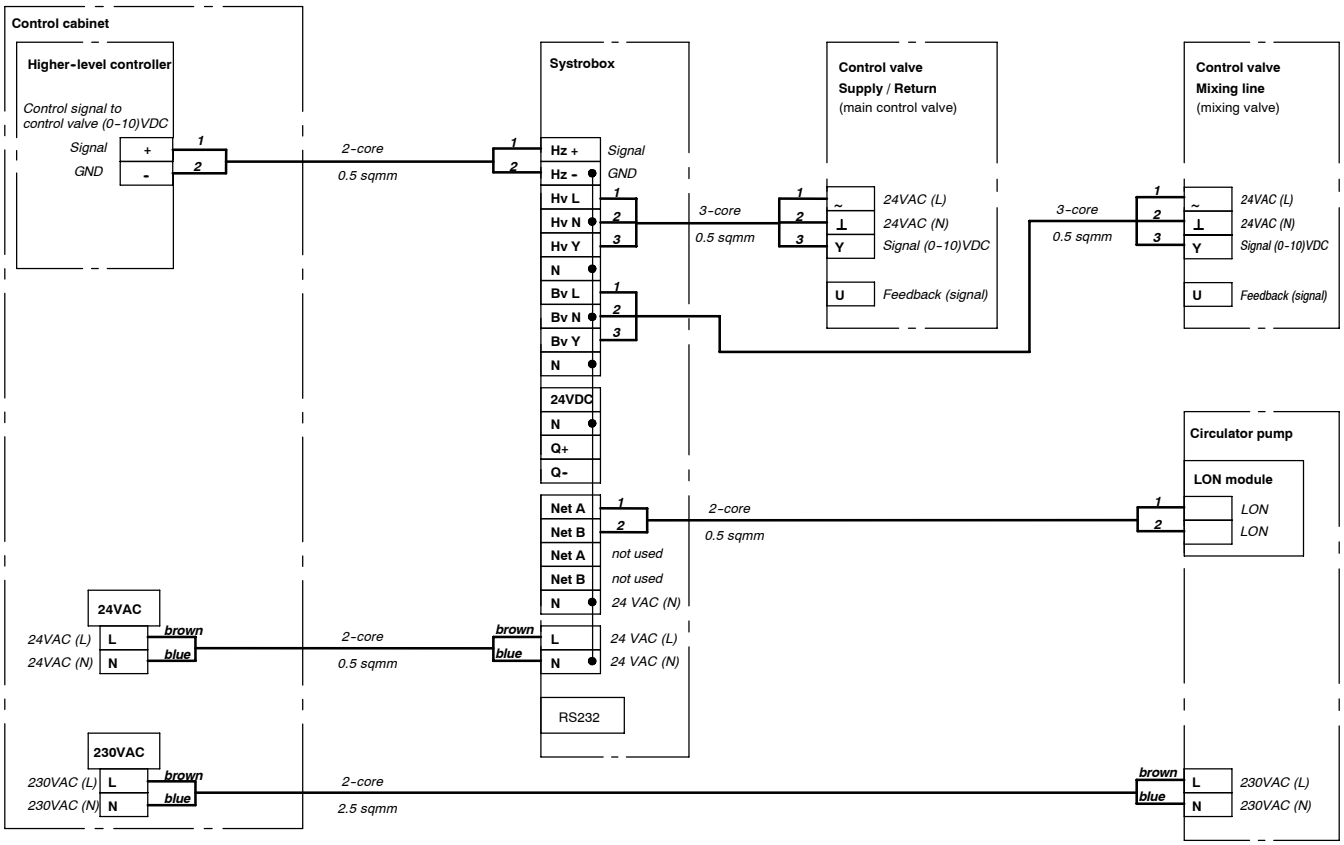
Variable	Description
nvi_setpoint_lei.value	The variable contains the differential pressure in per cent of maximum pressure. Values from 0-100 % (0x0-0xC8) are valid. If the value is outside this range, the input will not be identified.
nvi_setpoint_lei.state	If *state=0,* control of the operating unit is not effected, and the actuators assume the position for emergency operation. The value of *nvi_setpoint_lei.value* is transmitted to the pump. nvi_setpoint_lei must be updated every second.

Output variables (Standard Network Variable Type)

Variable	Description
nvo_setpoint.state	State=0: the pump stops State=1: the pump is operated with the value nvo_setpoint.value
nvo_setpoint.value	Differential pressure in per cent of maximum value (0-100 %, 0x0-0xc8)
nvo_contr_mode	After a reset, the variable is set to 1 (constant pressure)
nvo_op_mode	After a reset, the variable is set to 0 (HVAC-AUTO)

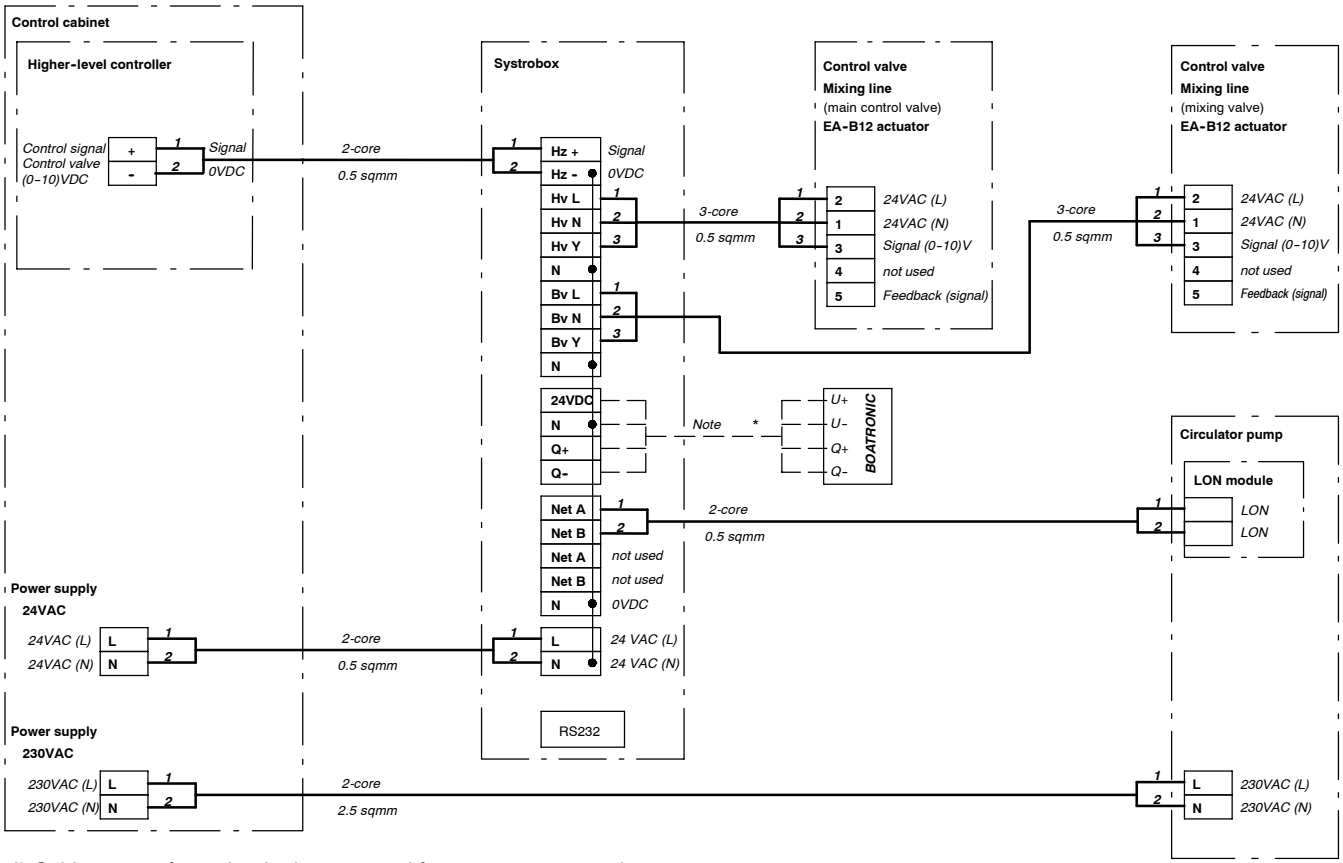
Connection to power supply

Logic diagram for nominal diameter DN20



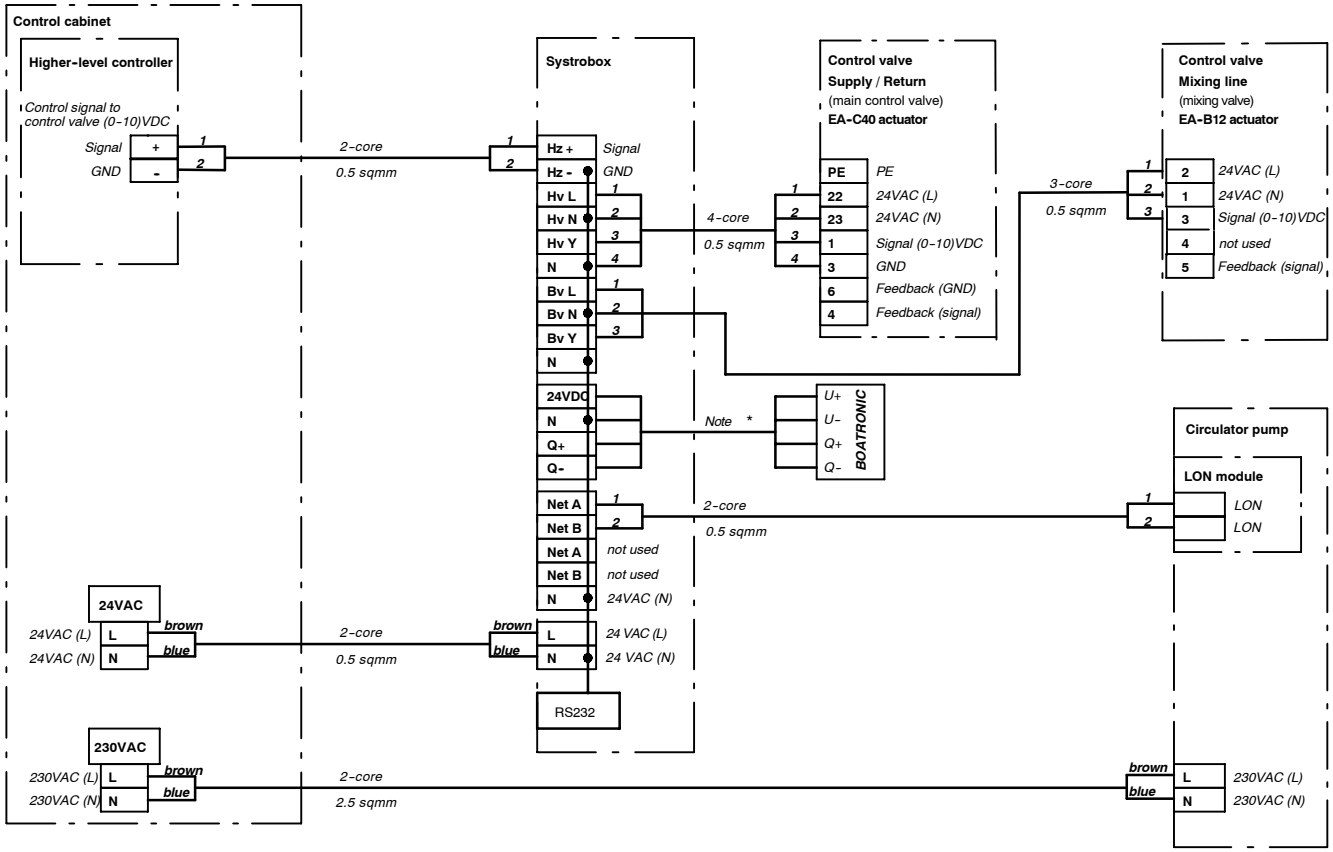
*) Cable pre-configured with plug, required for commissioning only

Logic diagram for nominal diameters DN25 up to and including DN50

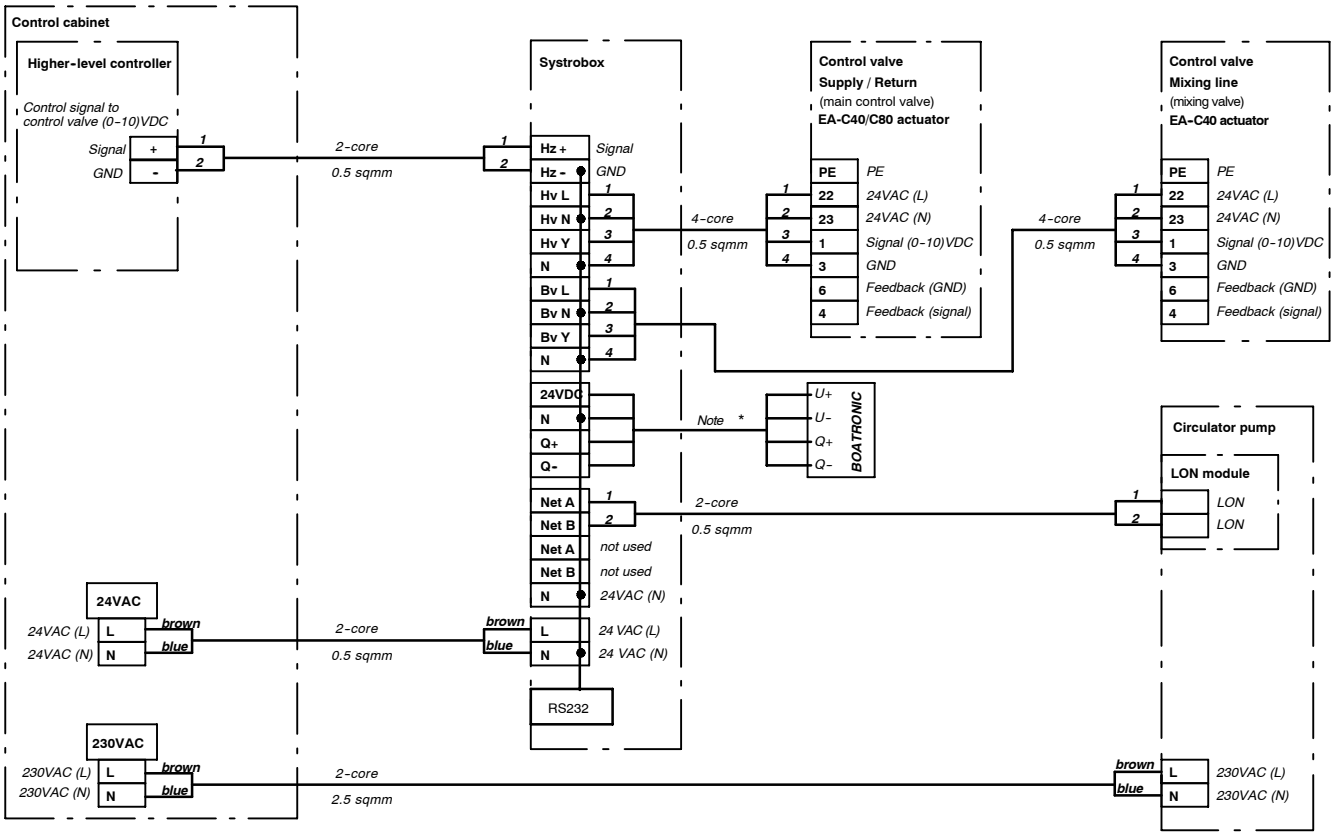


*) Cable pre-configured with plug, required for commissioning only

Logic diagram for nominal diameters DN65 and DN80

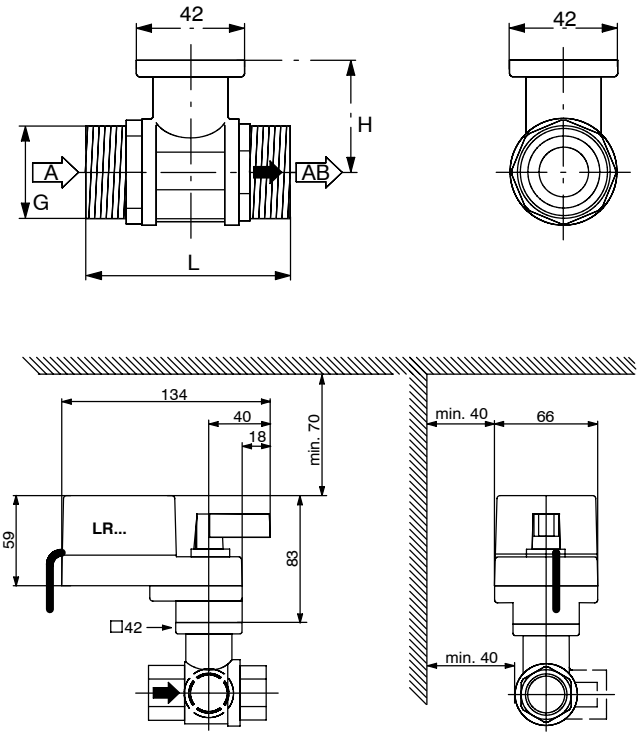


Logic diagram for nominal diameters DN100 to DN200



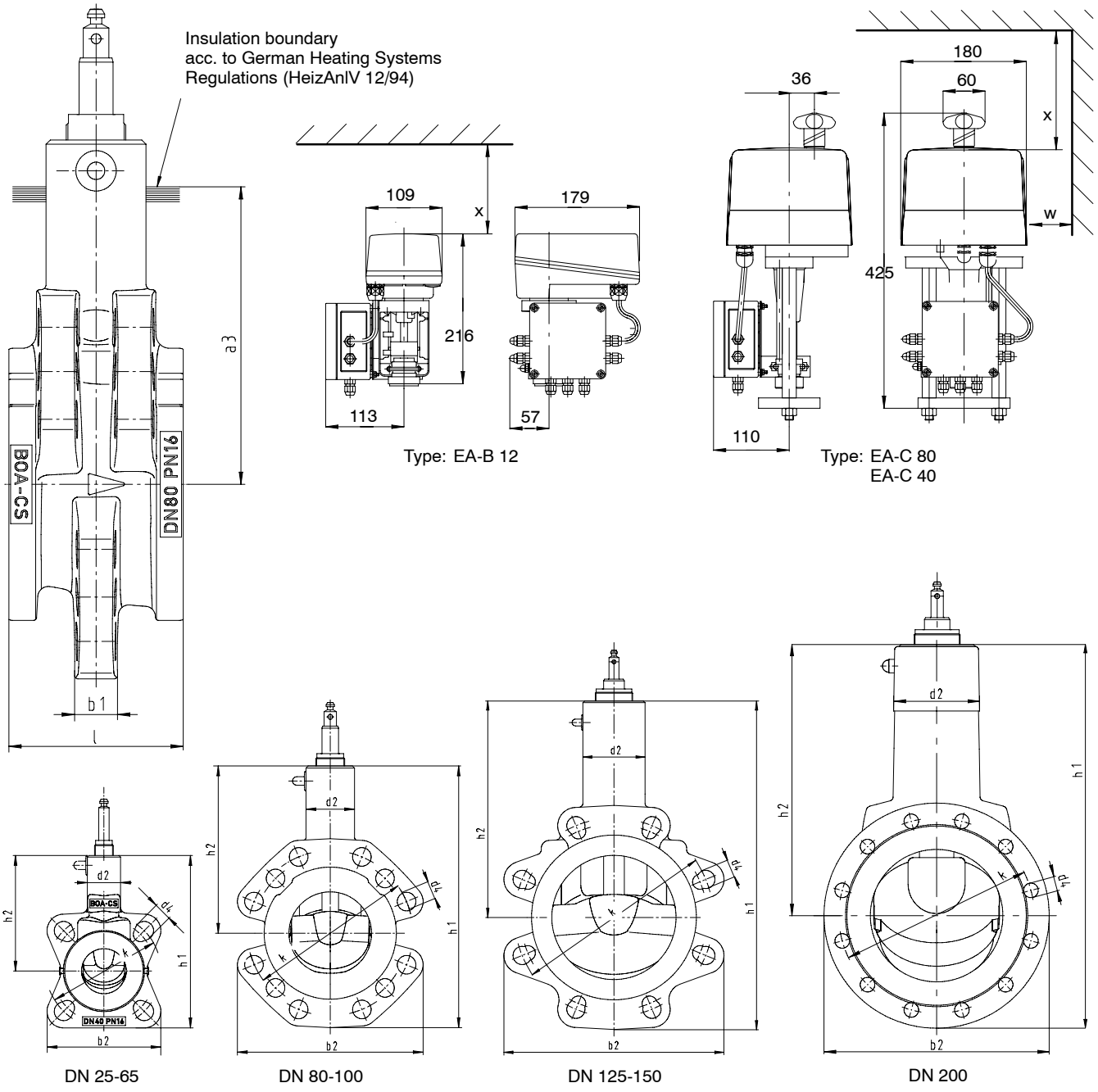
Dimensions

Nominal system diameter DN20: control ball valve with external thread



DN	Dimensions		Thread	Weight
	L	H	G	
[mm]	[mm]	[mm]	[Inch]	[kg]
15	74	44	1 ”	0.6
20	85.5	46	1 1/4”	0.8

Nominal system diameters DN25-DN200: BOA®-CVE SuperCompact control valve with Systrobox



Dimensions (mm)						PN 6		PN 10		PN 16						**Weight** approx. kg	
DN	l	h_1	h_2	d_2	a_3	k	n x d_4	k	n x d_4	k	n x d_4	b_1	b_2	x	w	EA-B12	EA-C...
25	25	129	87	30	72.5	75	4 x 11	85	4 x 14	85	4 x 14	13	85	100	100	2.8	–
32	32	163	112	32	85	90	4 x 14	100	4 x 18	100	4 x 18	16	103	100	100	3.5	–
40	40	166	112	32	95	100	4 x 14	110	4 x 18	110	4 x 18	16	110	100	100	4.0	–
50	50	186	126	40	107.5	110	4 x 14	125	4 x 18	125	4 x 18	20	120	150	110	5.0	–
65	65	233	166	44	125	130	4 x 14	145	4 x 18	145	4 x 18	24	135	150	120	–	13.5
80	80	254	162	47	140	150	4 x 18	160	8 x 18	160	8 x 18	20	180	150	140	–	16.5
100	100	303	200	58	160	170	4 x 18	180	8 x 18	180	8 x 18	20	203	150	150	–	19.5
125	125	365	248	75	175	200	8 x 18	210	8 x 18	210	8 x 18	23	230	150	170	–	23.5
150	150	397	261	75	192.5	225	8 x 18	240	8 x 22	240	8 x 22	23	266	150	170	–	29.5
200 [1])	230	575	405	120	220	280	8 x 18	295	8 x 22	295	12 x 22	30	340	150	170	–	76.5

[1]) Flange thickness and diameter PN 16

Literature

Type series booklets

Document	Reference number
BOA®-Systronic	7540.1
BOA®-CVE SuperCompact	7520.1
BOA-Control® IMS	7128.1
BOATRONIC® M-2 / M-420 / M-LON	7134.1

Operating instructions

Document	Reference number
BOA®-Systronic	7540.8
BOA®-CVE SuperCompact	7520.8
BOA-Control® IMS	0570.88
BOATRONIC® M-2 / M-420 / M-LON	7134.8

Price sheets

Document	Reference number
Valves price list, Germany	0570.6

Product features – to our customers' benefit

Reduced investment costs
Your benefit:
- When upgrading an existing or installing a new heating circuit, investment costs for the pump and valves can normally be reduced.

Cost saving and environment friendly
Your benefit:
- Electricity must be available at the exact moment when it is needed. Burning fossil fuels produces CO_2 emissions of roughly 0.5 kg per 1 kWh of electrical energy produced. Circulator pumps operated in conjunction with BOA®-Systronic consume up to 70 % less electricity than in conventional systems, reducing both system operating costs and CO_2 emissions.

Reduced planning costs, increased planning reliability
Your benefit:
- Time-saving selection procedure of the heating circuit; no selection of control valve required.

Reduced commissioning costs
Your benefit:
- The pump's operating point is adjusted in accordance with the system curve, thus optimizing the hydraulic operation of the heating circuit. Hydraulic balancing of heating circuits is performed automatically by the pump during commissioning.

Increased comfort of use
Your benefit:
- No flow noises thanks to optimally adjusted operating point of the pump.

Short payback period
Your benefit:
- Compared to conventional systems, investment in BOA®-Systronic (without circulator pump) will pay back in less than 2 years.

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