Technical Information

Application of Mixing Sets

SUMX mixing sets ensure continuous output control (proportional control using analogue voltage signal of 0-10 V) and protection of the water heater. Output control is ensured by the change in the water output temperature at constant water discharge. A mixing set connected to the control unit and antifreeze protection system components can effectively protect the heater against freezing followed by its destruction. Below-mentioned information can also be suitably used for integration of the mixing sets into the cooling system equipped with a water cooler.

Operating Conditions

The water running through the mixing set must not contain impurities, solids or chemicals aggressive to copper, brass, stainless steel, zinc, plastics, rubber and cast iron.The feed line of the heating system must always be provided with **sludge and cleaning filters**. The mixing set is not allowed to be operated without these filters.
Max.allowed operating parameters of heating water:

- Max. allowed water temperature +110 °C
- Max. allowed water pressure SUMX 1-12 .... 0.8 MPa
- Maxi. allowed water pressure SUMX 18 ..... 0.3 MPa
- Max. allowed water pressure SUMX 28-90 .. 0.6 MPa

In installations with water temperature up to 130°C it is possible to place the pump in the return pipe, the so-called "inverse mixing set arrangement", while ensuring the maximum allowed temperature of hot water in the outlet of the heater is not exceeded. It is advisable to consult this option with the manufacturer.

- If water is used as the heat carrying medium, then the mixing set can be situated only in an indoor environment where the temperature never falls below freezing point.
- Outdoor use is acceptable only if antifreeze solution is used as the heat carrying medium.
- In cases where chilling of the primary circuit or interference of primary and secondary circuit pumps (unwanted change of heating water flow through the heater) must be avoided, we recommend connecting the bypass (respectively the thermo-hydraulic splitter) to the primary circuit. The bypass should be situated as close as possible to the connection point of the mixing set.

The heating water bypass increases the temperature of the return water; therefore, the bypass (respectively the thermo-hydraulic splitter) may not be used when connected to modern condkensing boilers. The same applies if the supplier of the heating water does not allow the uncooled water to be returned.
Since the mixing set pump overcomes just the head losses in the secondary circuit (i.e. of the heater circuit) the primary circuit pump must be dimensioned to cover all head losses up to the mixing set at the nominal water flow projected for the heater. No other heat consumers should be connected to the heater circuit. Furthermore, it is necessary to equip the primary circuit (both inlet and outlet) with closing ball valves, and the feeding line with sludge and cleaning filters (again, it is advisable to use a closing valve).

- **The mixing set must not be operated without sludge and cleaning filters**.
- Components of the primary circuit are not the subject of the delivery from REMAK a.s.

Position and Location

When designing the layout of the mixing set location, we recommend observing the following principles:

- The mixing set must be positioned so that the shaft of the pump will always be in the horizontal position.
- The mixing set must be situated in a position in which its air venting is possible.
- If the mixing set is covered by a ceiling, it is necessary to ensure access to the whole mixing set.
- The mixing set is connected to the heater via corrosion-proof hoses (resp. pipes). It is advisable to minimize the length of connecting hoses/pipes; the longer the hoses, the later the control response.
- The mixing set can be mounted using an integrated holder or clamps while the weight of the mixing set may never be transferred onto the heater.
- The flange versions of mixing sets are delivered disassembled. The connecting piping is not the subject of the delivery from REMAK a.s.

Materials

The mixing sets are made of materials and components commonly used in heating engineering, i.e. brass, stainless steel or cast iron, and to a minor degree galvanized steel or steel. The sealing components are made of rubber or plastics.
The construction materials are thoroughly checked to ensure high reliability and long service life.

Dimensional Range and Design

The mixing sets are delivered in 12 output types. Eight of them are equipped with screw couplings including connecting hoses, and four of them are equipped with

Table 1 – mixing sets overview

Type	Pump	3-way valve	Delivery head	Actuator
A design with screwed components				
SUMX 1	UPS 25-40	3MG 15-1	4 m	LMC24A-SR
SUMX 1,6	UPS 25-40	3MG 15-1,6	4 m	LMC24A-SR
SUMX 2,5	UPS 25-40	3MG 15-2,5	4 m	LMC24A-SR
SUMX 4	UPS 25-60	3MG 20-4	6 m	LMC24A-SR
SUMX 6,3	UPS 25-60	3MG 20-6,3	6 m	LMC24A-SR
SUMX 8	UPS 25-80	3MG 25-8	8 m	LMC24A-SR
SUMX 12	UPS 25-80	3MG 25-12	8 m	LMC24A-SR
SUMX 18	UPS 32-80	3MG 32-18	8 m	LMC24A-SR
A design with flanged components				
SUMX 28	UPS 40-60	3F 32	6 m	LMC24A-SR
SUMX 44	UPS 40-60	3F 40	6 m	LMC24A-SR
SUMX 60	UPS 65-60	3F 50	6 m	NM24A-SR
SUMX 90	UPS 65-60	3F 65	6 m	NM24A-SR

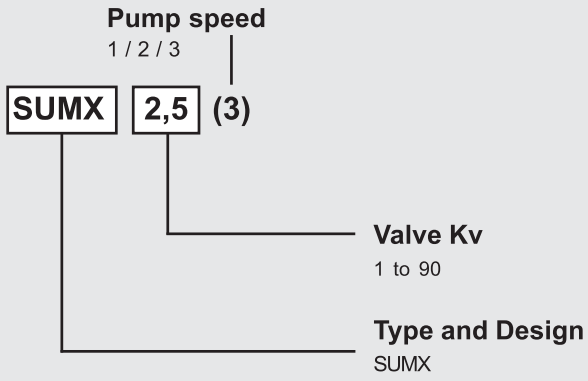
Technical Information

flange connections without connecting hoses. The flange-connected mixing sets are delivered disassembled. The connecting hoses are not included in the delivery.

Mixing Set Type

The rate of flow and pressure of heating respectively cooling medium in the mixing set is given by the size of the pump and three-way mixing valve with Kv value from 1.0 to 90 according to table # 1. The mixing set type selection and allocation to the heater is performed automatically by the AeroCAD design software.

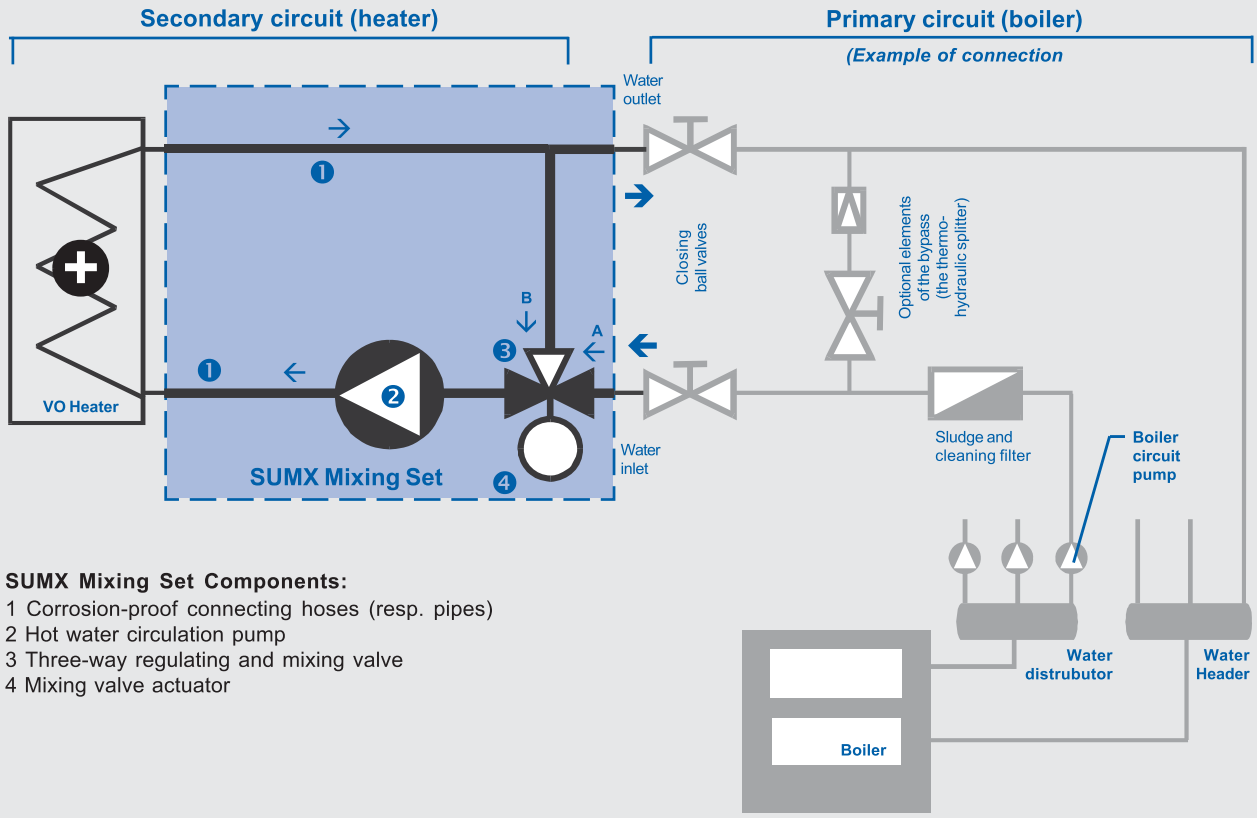
Figure 1 - Type designation



Mixing Set Designation

The type designation of mixing sets in projects and orders is defined by the key in figure # 1.
The project must also include the pump speed, which is set during the course of installation. The pump speed is indicated in the parenthesis behind the mixing set type code.

Figure 2 - Connecting scheme of the heater and mixing set in a heating system



SUMX Mixing Set Components:
1 Corrosion-proof connecting hoses (resp. pipes)
2 Hot water circulation pump
3 Three-way regulating and mixing valve
4 Mixing valve actuator

Technical Information

For basic layouts of mixing sets, refer to figures #3a to #4b and table #4. Connection dimensions are in table #1. Technical and electrical parameters of pumps and actuators are in tables #2 and #3.

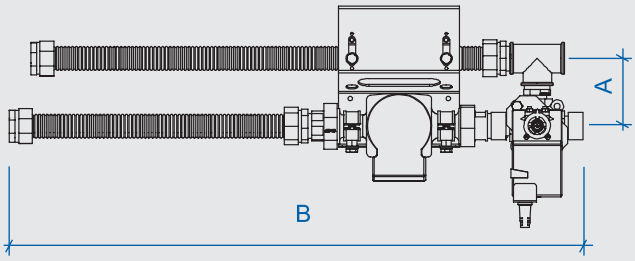
Table 2 – pump parameters

Pump	Input power	Current max.	Supply voltage	Protection
	W	A	V	IP
25-40	60	0,3	1 x 230 AC	44
25-60	90	0,3		
25-80	245	1		
32-80	245	1,1		
40-60/4F	340	1,3		
65-60/4F	640	3,2		

Table 3 – actuator parameters

		LMC24A-SR	NM24A-SR
Supply voltage	V	24 AC / DC	24 AC / DC
Degree of protection	IP	54	54
Input power	W	1	2
Dimensioning	VA	2	4
Rotation angle	°	max. 95	max. 95
Rotation time	sec	35	150
Torque	Nm	5	10
Control signal	V	DC 0-10	DC 0-10

Figure 3a – Basic layout of mixing sets



❶ Connecting hose ❷ Circulation pump
❸ Three-way regulating valve ❹ Valve actuator
❺ Integrated holder

Figure 3b – Basic layout of mixing sets

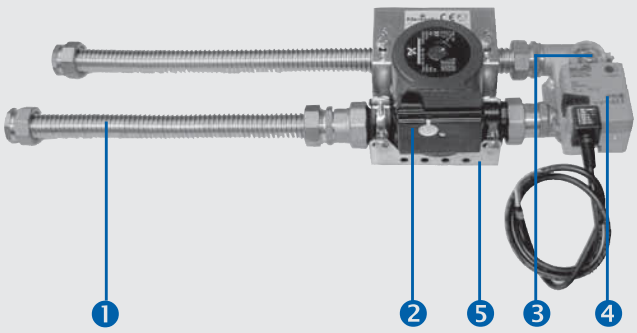
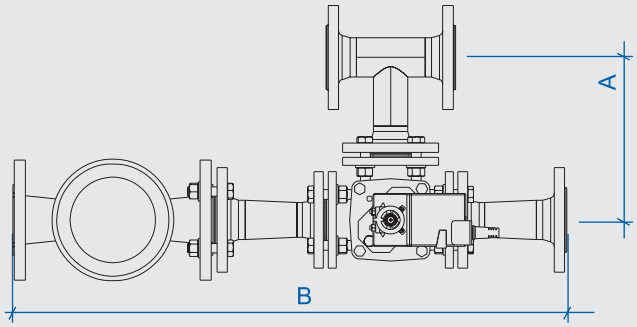
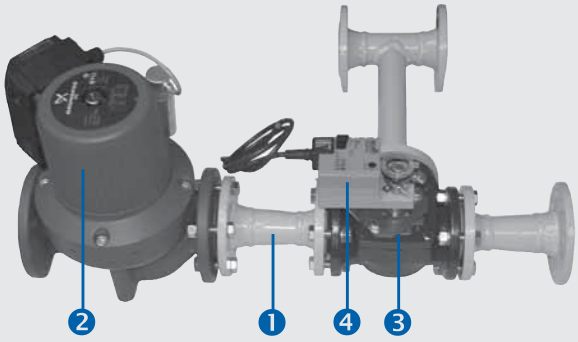


Figure 4a – Basic layout of mixing sets



❶ Connecting fittings ❷ Circulation pump
❸ Three-way regulating valve ❹ Valve actuator

Figure 4b – Basic layout of mixing sets



One or two connecting fittings are used depending on the diameter of the mixing set

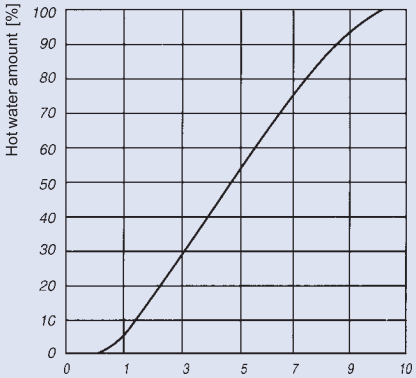
The mixing characteristic of three-way valve related to the actuator shaft position angle is marked in graph #1. Numbers 0-10 indicate positions marked on the three valve's plate.
The 0 position corresponds to 0% heating output, and the 10 position corresponds to 100% heating output.
ESBE valves feature excellent tightness. Thanks to minimum clearance, the maximum leakiness is 1% of the flow-rate

Table 4 – Dimensions

Type	Width A* (mm)	Length B* (mm)	Mixing set connection	Weight (kg)
SUMX 1	90	860	G1	7
SUMX 1,6	90	860	G1	7,5
SUMX 2,5	90	860	G1	7,5
SUMX 4	90	860	G1	7,5
SUMX 6,3	90	860	G1	7,5
SUMX 8	90	810	G1	8,5
SUMX 12	100	830	G1	8,5
SUMX 18	110	830	G1 1/4	11,5
SUMX 28	350	690	DN 40	41
SUMX 44	350	570	DN 40	39
SUMX 60	350	875	DN 65	62
SUMX 90	350	710	DN 65	59

* ± 20 mm

Graph 1 - Mixing characteristics



The valve setting on the valve's scale-plate
(0 - closed, 10 - fully open)

Operating Characteristics

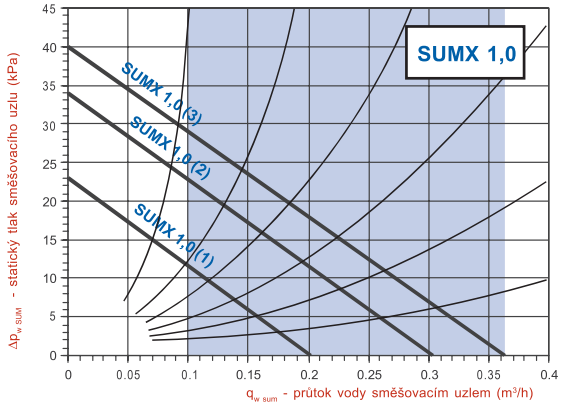
Mixing Set Characteristics and Dimensioning

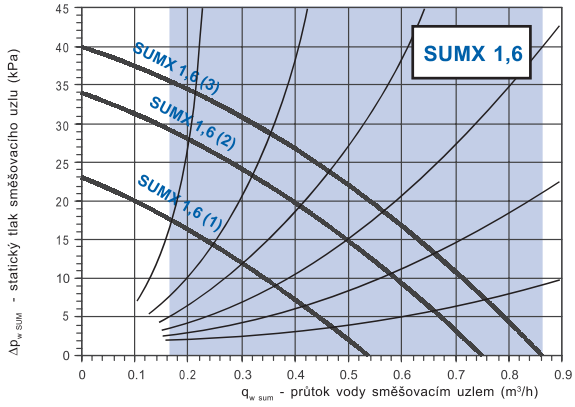
The proper dimensioning of the mixing set is essential for stepless control of the water heater. The mixing set selection is critical for optimal operation of the heating system.
The graph of each mixing set includes three characteristics related to the pump speed (1), (2), (3). The mixing set working characteristic is given by the correlation of the mixing set water discharge (qw sum) and pressure (Dpw sum) at the selected speed (revolutions) of the pump.
The mixing set calculation and dimensioning is performed automatically by the AeroCAD design software. The below-mentioned procedure is recommended if the air-handling device is completely designed using the AeroCAD design software.

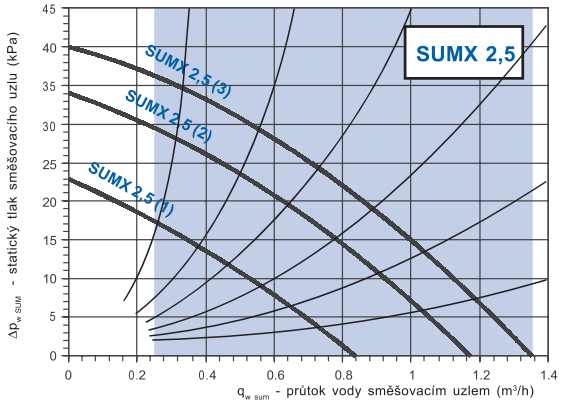
Design of the VO and SUMX Assembly - Example
Input variables:
VO 60-35 water heater, Air flow rate 2.800 m3/h, Water temperature gradient +90/+70 °C, Design outdoor air temperature -15 °C, Required outlet air temperature +22 °C.

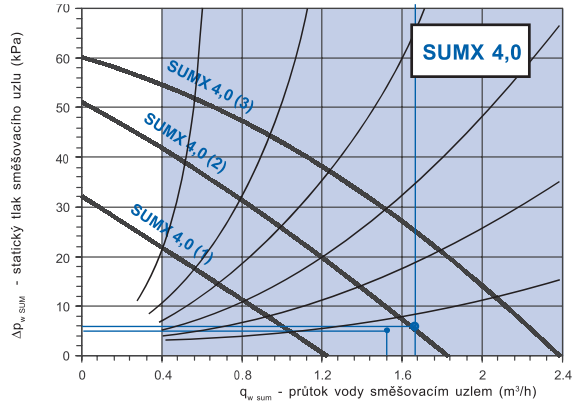
Design and calculation:

- Maximum outlet air temperature of +39 °C at output of 40 kW and water discharge of 1.80 m3/h for pre-assigned air flow rate of 2.800 m^3/h, heater input air temperature of -15 °C and water temperature gradient of +90/+70 °C can be determined in the VO 60-35 heater nomogram (the chapter Water heaters).
- As the maximum outlet air temperature is higher than the required temperature, the heater meets the output condition with a margin.
- To get the pre-assigned (lower) outlet air temperature, it is necessary to decrease the heater's output. The adjusted output results from the output calculation for the pre-assigned air temperature gradient -15/+22 °C:
Q = m*c*Δ t = (2800/3600*1.2)*1010*(22-(-15)) = 34.9kW
- Water discharge of 1.56 m^3/h needed for output of 35 kW (rounded 34.9 kW) can be determined in the VO 60-35 / 2R heater nomogram on page # 162 or in the aggregate graph valid for all heaters on page 143, and the water pressure loss in the VO 60-35 / 2R heater will be Dpw = 5 kPa.
- The SUMX 4,0 (2) mixing set suits best for water discharge of 1.56 m3/h at pressure loss of 5 kPa, see the graph on page # 181.
- The heater-mixing assembly effective working point will lie on the SUMX 4,0 (2) curve with qw sum = 1.65 m^3/h and Δpw sum = 6 kPa.

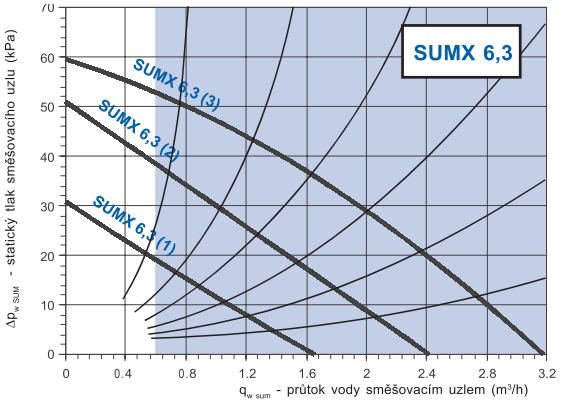


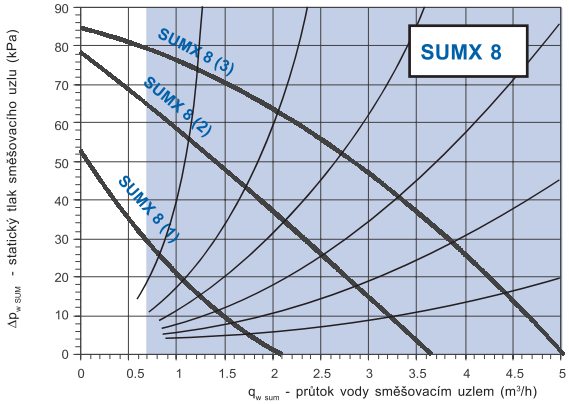


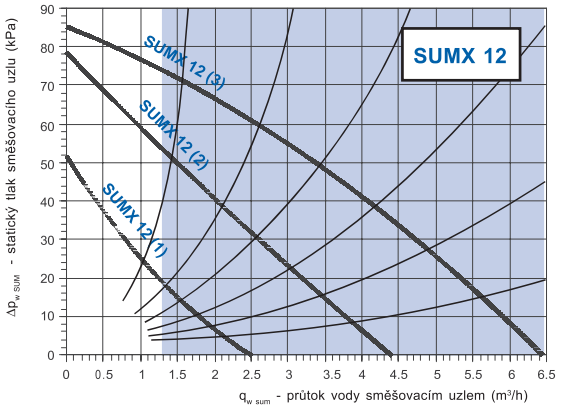


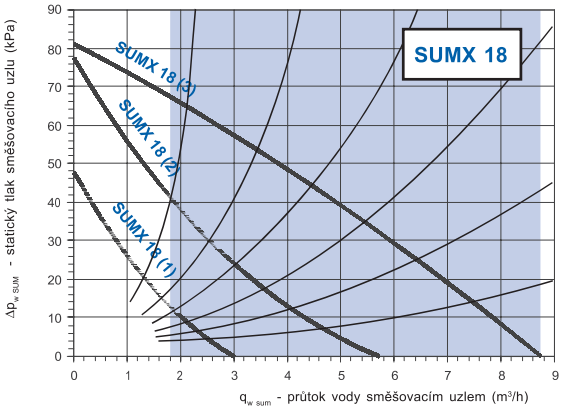


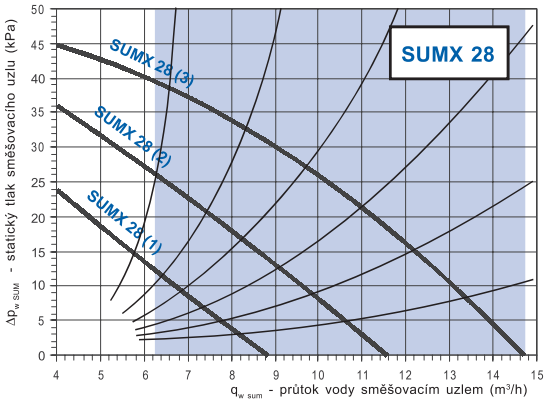
Operating Characteristics

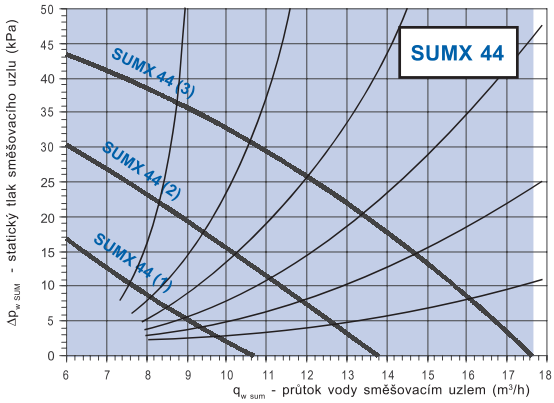


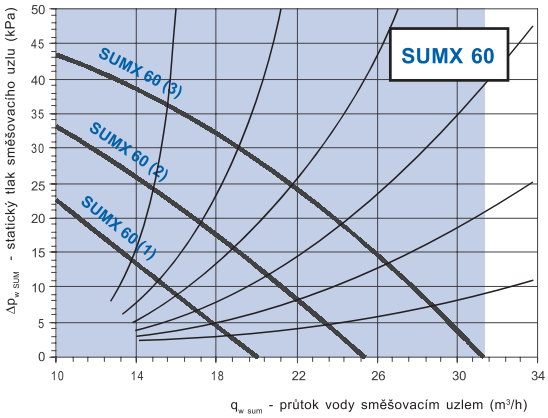


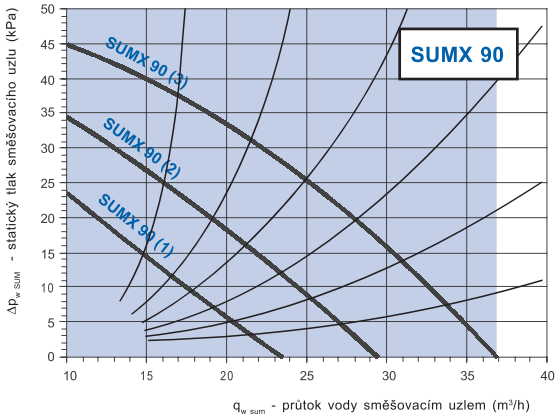












Installation, maintenance, service

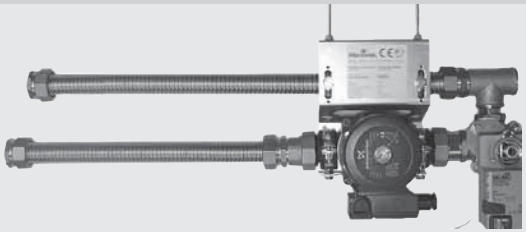
Heater Output Control

Pump ❷ ensures the constant water flow (circulation) through the water heater. Three-way mixing valve ❸ controlled by actuator ❹ controls the heater's output by mixing the return water from the heater and heating water from the boiler. If the control system requires full output of the heater, the water will flow in the so-called big circuit, i.e. from the boiler through the heating water distributor, sludge and cleaning filter, service and closing valve, SUMX intake, three-way mixing valve ❸ (only A direction), pump ❷, water heater, SUMX water outlet, service and closing valve in to the heating water header. If full output of the is not required, three-way valve ❸ will start letting through some quantity of the water from the B direction, and thus decreasing the water temperature flowing through the heater. If no heating output is required, the water will only circulate within the heater circuit, i.e. three-way mixing valve ❸ will only let the water through in the B direction..

Installation

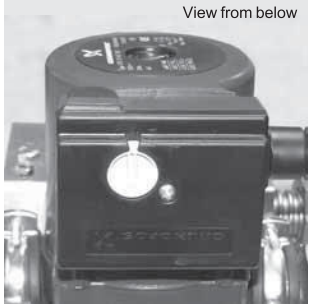
- SUMX 1-18 mixing sets are connected directly to the heater via corrosion-proof hoses. If needed, the hoses can be cut to the desired length before installation.
- The mixing set must not be exposed to any strain or torsion caused by the connected pipe line.

Figure 5 - Installation using suspension rods



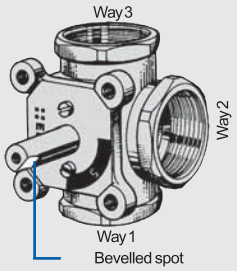
- The mixing sets can be mounted on separate suspensions using an integrated holder, or using clamps (see figure # 5).
- If the mixing set is covered by a ceiling, it is necessary to ensure access to the whole mixing set to enable electric cable connections, checking and maintenance.
- SUMX 28 - 90 flange-connected mixing sets can be connected to the heat exchangers using standard heating engineering procedures; among others it is necessary to ensure adaptation to threaded connections of the heat exchangers - refer to the heat exchanger technical details. It is advisable to use clamps to connect the flange-connected mixing sets to the suspensions or supporting brackets.

Figure 6



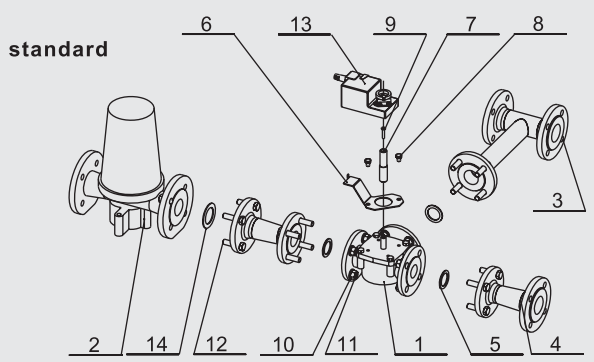
- The mixing set must be installed in such a way that the air in the piping will be able to run to the air-venting valves of the heater or boiler piping. Especially the connecting corrosion-proof hoses must be shaped after installation so as not to create an air trap.
- The mixing set must be positioned so that the shaft of the circular pump motor will always be in the horizontal position!

Figure 7

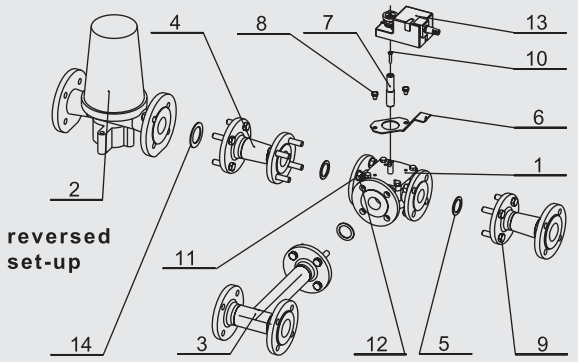


- The circular pump must be vented after the system has been filled with water in accordance with the manufacturer's instructions.
- The speed of the circular pump is indicated in the project behind the type code of the mixing set. For example, the mixing set SUM 6,3 (3) is equipped with the pump UPS 25-60 which is set to speed 3, the number in parentheses (3). The speed of the pump can be adjusted by the plastic wheel on the pump during installation (see figure # 6).
- When connecting the mixing set, it is necessary to check the correctness of the adjustment of the three-way valve and actuator. One way of the three-way valve, to which the bevelled spot on the valve shaft is directed, is always closed (see fig. # 7).

Figure 8 - Exploded view of the mixing set



(1) valve, (2) pump, (3) T joint, (4) making-up piece, (5) sealing, (6) actuator holder, (7) D18/81 adaptor, (8), M8x10 screw, (9), M5x25 screw, (10) washer 13, (11) M12 nut, (12) M12x45 screw, (13) actuator, (14) sealing



(1) valve, (2) pump, (3) T joint, (4) making-up piece, (5) sealing, (6) actuator holder, (7) D18/81 adaptor, (8), M8x10 screw, (9), M12x45 screw, (10) M12x45 screw, (11) washer 13, (12) M12 nut , (13) actuator, (14) sealing

Installation, maintenance, service

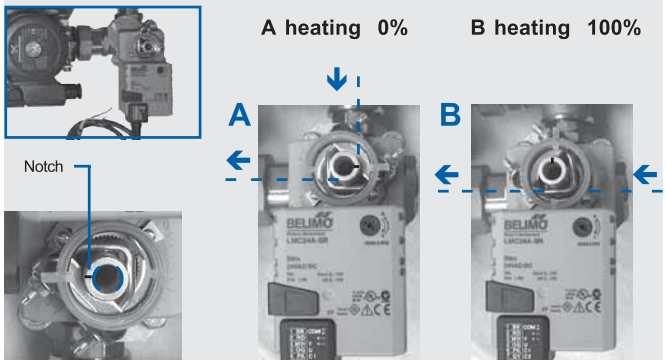
If the mixing set is assembled then the valve adjustment is indicated by the position of the notch on the shaft adaptor face.
This adaptor serves as a coupling which is fixed to the actuator sleeve (see fig. #9).
This notch is always directed to the closed way.
Warning! The position of the notch is always relevant, not the position of the plastic ring, which can be freely turned.

- The mixing sets are delivered disassembled, the mixing set must be assembled following figure # 8.
- The A and B positions are the extreme positions of the actuator (see fig. #9). If the actuator works incorrectly, just change the direction of rotation turning the switch to the other position.

Warning! The position of the notch is always relevant, not the position of the plastic ring, which can be freely turned.

- The mixing sets are delivered disassembled, the mixing set must be assembled following figure # 8.
- The A and B positions are the extreme positions of the actuator (see fig. #9). If the actuator works incorrectly, just change the direction of rotation turning the switch to the other position

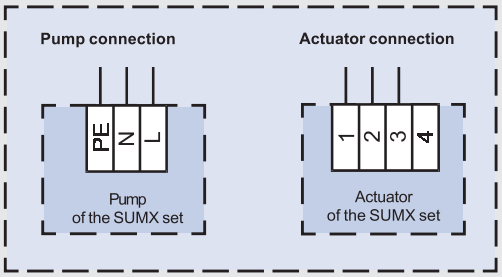
Figure 9 - Extreme positions of the actuator



The Wiring

- The wiring can be performed only by a qualified worker licensed in accordance with generally valid regulations.
- The pump must be connected via the terminal box in accordance with its manual. The actuator is provided with a cable which must be connected in a wiring box (not included in the delivery).
- The mixing set pump and actuator are supplied and controlled by the control unit.
- The Mixing set wiring diagram is shown in figure #10.
- The principle diagram of the connection to the control unit is shown in figure #11.
- After connecting the mixing set, it is necessary to check the correctness of the actuator function depending on the control signal (heating - no heating).
- After turning the pump on, it is necessary to measure the feed current, which must not exceed the allowed current $I_{max.}$ stated on the pump rating plate.

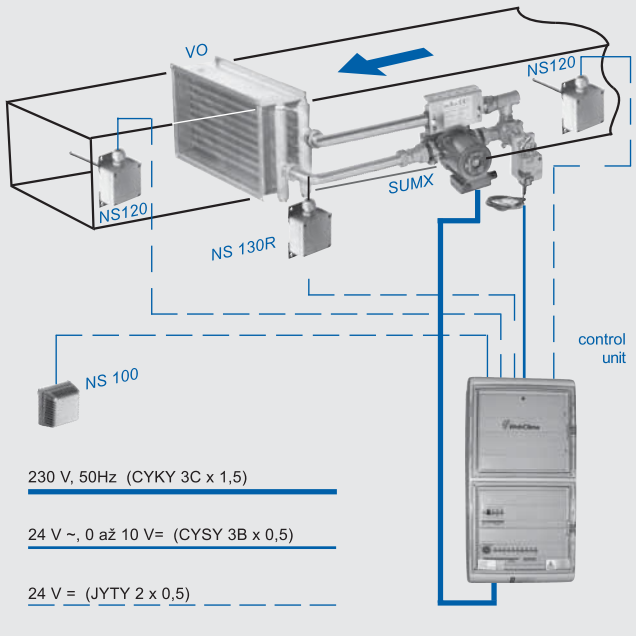
Figure 10 - Mixing set wiring diagram



1 x 230V + PE + N +I
PE . protective conductor terminal
N ... neutral conductor
L .... phase conductor

1....grounding terminal
2....24 V AC
3....control signal
4....measuring voltage

Figure 11 – diagram of the mixing set connection



Installation, maintenance, service

Operation, Maintenance and Service

■ The water and mixing set requires regular maintenance at least at the beginning and end of the heating season.

■ During operation, it is necessary to check proper air venting and water leaking. It is necessary to supervise pump and actuator operation, and keep the mixing set's filters clean. If the air-handling system is stopped due to the action of the antifreeze protection, the reason must be found and removed, refer to the chapter "Troubleshooting".

All important system protection functions, including antifreeze protection of the mixing sets and heaters, must be permanently controlled by the control unit.

Attention! During the winter season the control unit must not be disconnected from the power supply for too long! Power supply failure during the air-handling system operation is especially dangerous!

Troubleshooting

When activating the air-handling system, you can face some undesirable situations. The following text includes the most common problems and their removal:

■ **Permanently low output air temperature**
- Low hot water flow or pressure in the boiler piping
- Low water temperature in the boiler piping
- Low air temperature adjusted on the control unit
- Low speed of the pump in the SUMX mixing set
- Clogged screen in the SUMX mixing set
- Wrong adjustment of the three-way valve and actuator
- Aerated pump (resp. whole system)
- Wrong design of the VO and SUMX assembly

■ **Permanently high output air temperature**
- Too high water flow and pressure in the boiler piping
- Too high air temperature adjusted on the control unit
- Wrong adjustment of the three-way valve and actuator
- Wrong design of the VO and SUMX assembly

■ **The output air temperature fluctuates**
- Too high water flow and pressure in the boiler
- Wrong adjustment of the three-way valve and actuator
- Wrong design of the VO and SUMX assembly

■ **Repeated activation of an antifreeze protection**
- Low hot water flow or pressure in the boiler piping
- Low water temperature in the boiler piping
- Low air temperature adjusted on the control unit
- Low speed of the pump in the SUMX mixing set
- Clogged screen of the SUMX mixing set
- Wrong adjustment of the three-way valve and actuator
- Aerated pump (resp. whole system)
- Wrong design of the VO and SUMX assembly

Repeated activation of the antifreeze protection can also be caused by too high temperature amplitudes. The reasons are listed in the paragraph above.

If the output water temperature is permanently above +30oC, the problem can be caused by failure of the control system or sensor.