



Baunach

rendeMIX

Multi-path mixing distributor

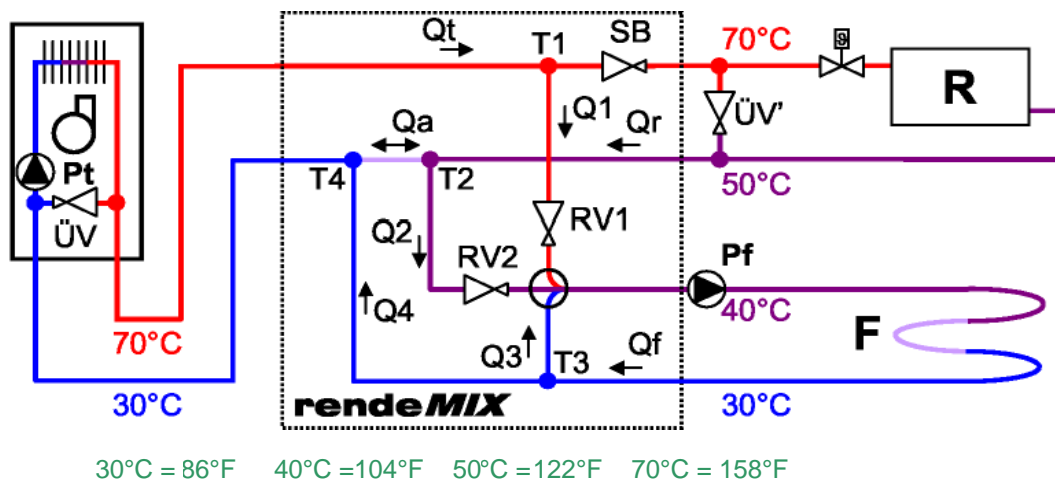
The new patented rendeMIX multi-path mixing valve is the perfect solution for your two temperature systems. Today's complex heating environments sometimes require heating system with two loops each supporting different temperatures, for example one loop for radiators and another loop for floor heating. The higher temperature is generated directly by the boiler whereas the lower temperature is obtained by mixing. Existing mixing valves use the hot supply water exclusively and mix it with the cold return water of the floor heating system. The remaining hot water usually still hot enough to be used for the radiant loop, goes back, however unused, to the boiler.

What is the impact of this?

A condensing boiler is a heat generator that extracts additional heat from the hot flue gases by condensing the steam contained in the hot flue gases on to a heat exchanger. Due to the fact that this kind of condensation only happens below a certain temperature (the dew point), the efficiency of these boilers depends strongly on their return temperature.

Solution

The new patented rendeMIX multi-path mixing valve uses the heat of the return from the radiator loop and thus cools down the return to the boiler much more than traditional mixing systems do, which results in an increase of efficiency up to 5 to 8 %. The mixing valve has three inlets (hot, warm, and cold) and two outlets. Depending on the desired setting, one single control unit connects two of the three inlets with the outlet, in order to mix only hot with warm or warm with cold water. Together with the supplied piping system it also replaces the traditional primary/secondary piping needed for hydraulically separating the two loops. There are more advantages when combining the system with solar collectors, buffer tanks or heat pumps.



R=radiator loop F=floor heat loop

Pt: circulator in Boiler

SB: gravity break

ÜV: safety (overflow) valve

* Only necessary if requested by manufacturer of heat generator (minimum circulation safety)

Qt: flow volume Boiler

Qa: flow volume bypass segment

Q1: flow volume inlet hot

Q3: flow volume inlet cold

Pf: circulator floor heat system

RV: check valve

ÜV': safety (overflow) valve not supplied*

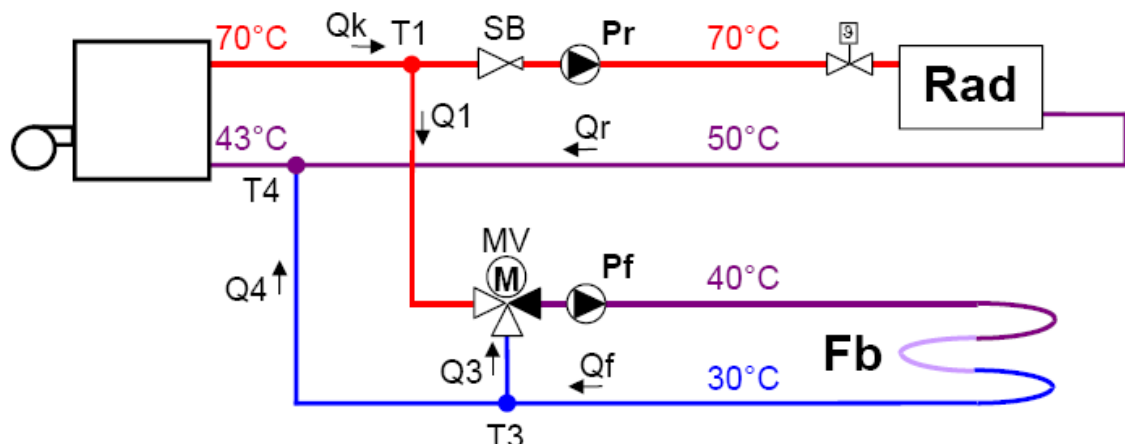
Qr: flow volume radiators

Qf: flow volume floor heat system

Q2: flow volume inlet warm

Q4: flow volume inlet mixing

Have you ever asked yourself the question: “why not feed the sufficiently hot return water of the radiator loop into the floor heat loop when you have a two-temp system instead of sending the warm water back to the boiler unused and taking the boiler out of condensing?” In a typical system, hot boiler water is mixed with mostly cold return water from the floor heat loop therefore sending mostly hot return water back to the boiler. (See example below) Did you also come to the conclusion that if piped only to the return of the radiator loop the temperature of the return is hot enough most of the time, but not always? Wouldn't you therefore be interested in a mixing valve that can do both; feed the mixing circuit preferably from the radiator loop return and still supply a sufficiently mixed output? Isn't it obvious that such a device would improve considerably the efficiency of the entire installation, especially in combination with a condensing boiler, a buffer tank, a solar collector, or a heat pump?



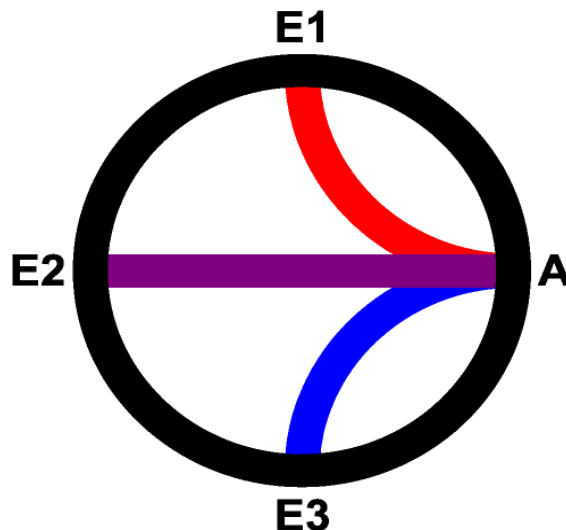
30°C = 86°F 40°C = 104°F 50°C = 122°F 70°C = 158°F

- | | |
|-----------------------------------|------------------------------|
| SB: gravity break | MV: 3-way mixing valve |
| QK: flow volume boiler | Qr: flow volume radiators |
| Qf: flow volume floor heat system | Q1: flow volume inlet hot |
| Q3: flow volume inlet cold | Q4: flow volume inlet mixing |

Fig. 1: 2-loop system with conventional 3-way mixing valve

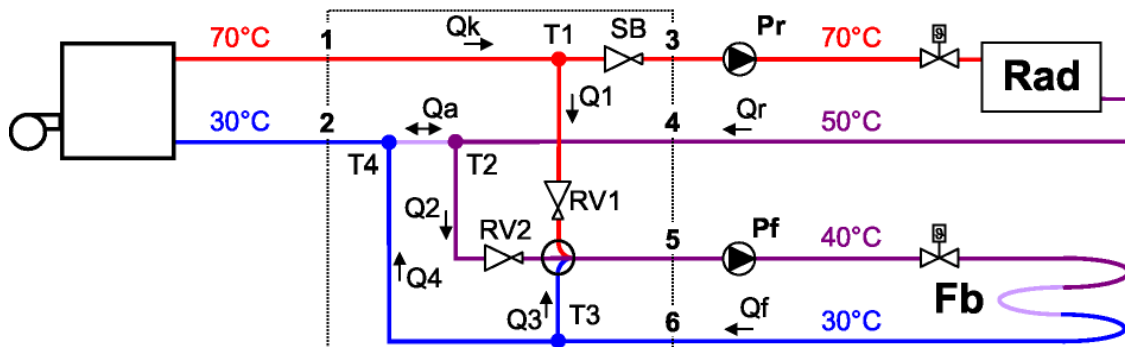
What would such a unit look like?

Imagine you had a mixing valve with three inlets and one outlet designed in such a way that either inlets E1 and E2 were connected to outlet A, or inlets E2 and E3, with any mixing ratio; the respective third inlet would be closed. Depending on the positioning of the control unit, inlets E1 and E2 work as a 3-way valve towards the outlet or inlets E2 and E3.



What does the connection to a boiler look like?

The first inlet is connected to the boiler flow (hot=red), the second inlet with the return of the radiator loop (warm=purple), and the third inlet with the return of the floor heat loop (blue=cold); the outlet is connected to the flow of the floor heat loop.



30°C = 86°F 40°C = 104°F 50°C = 122°F 70°C = 158°F

Pr: circulator radiators	Pf: circulator floor heat loop
SB: gravity break	RV: check valve
QK: flow volume boiler	Qr: flow volume radiators
Qf: flow volume floor heat system	Qa: flow volume compensation segment
Q1: flow volume inlet hot	Q2: flow volume inlet warm
Q3: flow volume inlet cold	Q4: flow volume inlet mixing

Fig. 2: rendeMIX 2-pipe installation with a boiler

Should the temperature from return of the radiator loop not be sufficient to satisfy the call for heat of the floor heating loop, the mixing valve will open to the hot boiler flow and thus elevate the temperature to the floor heat loop (see operating mode IV through II). Should the return temperature of the radiator loop be too high, the mixing valve closes and lowers it to the desired flow temperature level of the floor heat loop by adding water from the cold return of the floor heat loop (see operating mode II through 0). Between the withdrawal of the warm return of the radiator loop at T2 and the feeding of the cold return of the floor heat loop at T4 there is a small bypass segment. If the return of the radiator loop brings more hot water than is withdrawn from the floor heat loop, hot return water of the radiator loop goes back to the boiler (see all operating modes b), in the reverse case cold return water of the floor heat loop is taken back to the flow of the mixing valve (see all operating modes a). The check valves RV1 and RV2 in the circuit leading to the mixing circuit prevent a nonsensical circuit flow or the return of heating water under all circumstances.

Can any supply temperature be set to the floor heat loop of the installation?

Normally the supply temperature of the boiler is higher than the return temperature of the radiator, and that temperature is higher than the return temperature of the floor heat loop. So the desired floor heat temperature must be between the two temperatures mentioned first or between the two temperatures mentioned last. Let's call these two cases *heavy load* and *light load*. They correspond respectively to the activity of one of the fore-mentioned mixing valves that are combined in this unit. At heavy load mode the floor heat loop is fed with a mixture from the boiler supply (hot) and the radiator return (warm) (see operating mode III), at light load with a mixture from the return water of the radiator loop (warm) and the return of the floor heat loop (cold) (see operating mode I). It is also possible to operate the floor heat loop only (see operating mode I), by fully opening the mixing valve or the radiator loop, by shutting it off entirely (see operating mode 0).

Are the two loops hydraulically separated?

The best answer to this question is to imagine, that one of the two loops is shut off and then to figure out what consequences this could have for the respective other loop. So let's shut off figuratively.

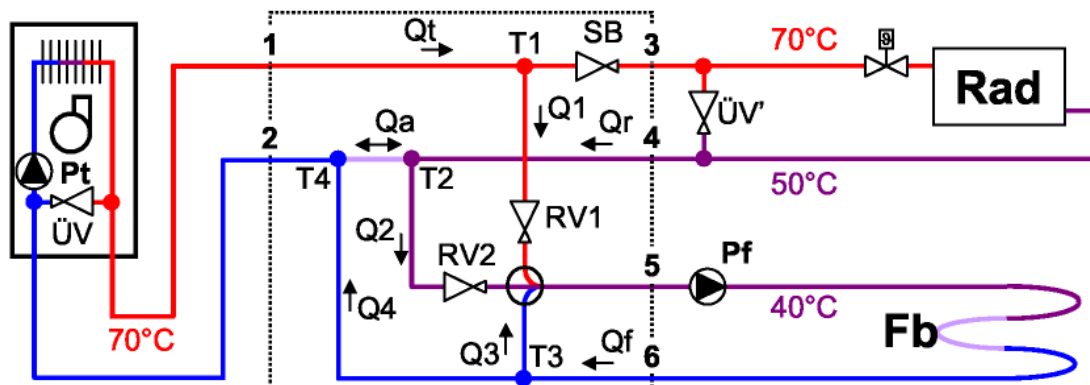
1. The radiator circulator P_r in fig. 2a. $Q_r = 0$ because the gravity break SB acts as a check valve; Q_k would be equal Q_1 . As the hydraulic resistance of the boiler is small Q_1 would barely change under heavy load operation, under light load operation Q_1 would be close to zero anyway. Q_2 , Q_3 , and Q_4 remain unchanged, too, because the bypass segment between T2 and T4 works like an internal switch and balances the altered pressure ratio. The only consequence of a lack of water in the return of the radiator loop is a slump of the temperature in the floor heat loop, because in this situation colder water gets into inlet E2 through the bypass segment (bypass: return flow from the return of the floor heat loop, (see all operation modes a). Consequently the actuator will keep opening the mixing valve, until the desired floor heat loop temperature will be reached, by mixing water from the boiler supply with water from the floor heat return. In other words: we'll have the same operation as with the traditional 3-way valve (mixing of hot and cold). The same applies when there is lack of water due to shut-off or turned down radiators (see operation mode IIIa).

2. Let's imagine we would shut-off the circulator P_f to the floor heat loop, then Q_f would equal zero, Q_1 and Q_2 would also equal zero, because the check valve RV1 would prevent a return of direction (sucking back by the radiator loop pump). Consequently Q_4 must equal zero also, whereas Q_r would be unaffected. Only the temperature of the boiler return rises, but that will be counterbalanced by the control of the boiler.

As you can see, the hydraulic loops are entirely separated and without any need for a low-loss header or primary/secondary piping with additional boiler circuit pump. The flow volume of the individual loops becomes independent through the bypass segment which works like an internal switch, independent of the flow volume in the respective other loop.

What does the connection to a wall hung boiler with a built in circulator look like?

The only difference between a connection to a wall hung boiler and a free standing boiler is that instead of a circulator for the radiator loop P_r a boiler pump P_t is installed.



30°C = 86°F 40°C = 104°F 50°C = 122°F 70°C = 158°F

PT: circulator instantaneous water heater
 ÜV: safety (overflow) valve incorporated or
 SB: gravity break

* Only necessary if requested by maker of heat generator (minimum circulation safety)

Qt: flow volume instantaneous water heater
 Qa: flow volume compensation segment
 Q1: flow volume inlet hot
 Q3: flow volume inlet cold

Pf: circulator floor heat loop
 ÜV: safety (overflow) valve to be added*
 RV: check valve

Qr: flow volume radiators
 Qf: flow volume floor heat system
 Q2: flow volume inlet warm
 Q4: flow volume inlet mixing

Fig. 3: rendeMIX 2-pipe installation with an wall hung boiler

In this configuration RV2, instead of RV1, prevents – floor heat loop circulator Pf is shut off and mixing valve is open. With a condensing boiler the circulator of the unit should be set to a very low capacity in order to allow for a maximum delta-t and to prohibit activation of the by-pass valve. Some boilers have their own internal by-pass valves; other manufacturers request or recommend that these be added by the contractor. If a by-pass valve is to be added it should be installed in the radiator loop in order to continue to use the return which would be impossible if the by-pass valve were installed in the boiler circuit. The rendeMIX unit itself does not need a minimum flow!

Can the two heating circuits be operated individually?

Yes they are completely separated; the two circuits can be operated individually. That means that different reset schedules are possible without any restriction, or that the floor heat loop can operate when the boiler is loaded.

How much do you gain with a condensing boiler and the use of hot return water by rendeMIX?

In an installation where the radiator and floor heat loop collect the same amount of heat respectively, the floor heat loop is based on 40°/30°C (84°/106°F) with a 3-way mixing valve (Fig. 1) the radiator loop on 70°/50°C (158°/122°F) the mathematical boiler return temperature is 43,3°C (110°F), because only part of the 70°C (158°F) hot supply water is mixed with three parts of 30°C (86°F) cold floor heat loop water in order to obtain 4 parts water for the desired supply temperature of 40°C (104°F) (purple) for the floor heat loop. Because of the requested distribution of load the flow through the radiator loop - due to its delta t that is twice as high (70°-50° = 20°C, 40° – 30°=10°C) (158°-122° = 68°F) must be half of the flow in the floor heat loop. Then, if the flow of the floor heat loop – as assumed – has 4 parts of water, one of which will be returned directly to the heating circuit, this part will mix with two parts of return water of the radiator loop of 50°C (122°F). This is how the fore-mentioned return temperature to the boiler is 43.3C (110°F) (purple) is reached. With these temperatures the efficiency of a gas condensing boiler is approximately 93%.

With the rendeMIX multi-path mixing valve (Fig. 2 & 3) the supply of the floor heat loop is fed either with a mix from the boiler supply and the radiator loop return (hot + warm = heavy load) – or from the return of the radiator loop and the floor heat loop (warm + cold = light load), depending on the call for heat. In the previous example we have thermal light load because two parts of return water of the radiator loop of 50°C (122°F) and two parts of return water of the floor heat loop of 30°C (86°F) results in to four parts of supply water for the floor heat loop with a temperature of 40°C (104°F). Thus the entire return water from the radiator loop (two parts) is fed into the floor heat loop, consequently return water to the boiler comes entirely from the floor heat loop with a temperature of 30°C(86°F). With these temperatures the efficiency of a gas condensing boiler is 98%. The boiler is feed entirely with the return of the floor heat loop – there isn't a better distribution of load.

With identical hydraulic and thermal conditions in both loops a reduction of the return temperature of 13.3°C (56°F) (43.3°C – 30°C) (110°F - 86°F) has been reached, that corresponds to a rise in efficiency of 5%. Considering that in some installations with primary/secondary piping, hot boiler supply water goes directly into the return of the unit, the increase in efficiency can easily rise to 7-8%!

Are there more advantages of rendeMIX in combination with low mass condensing boilers?

Another problem that we often encounter with low water volume boilers is short cycling. This is also solved, in an elegant way, by rendeMIX. These short cycles originate from the fact that after the burner starts, hot water often gets back from the radiators to the boiler and then the burner is shut off after the radiator loop is hot. A rise the on/off deferential does not really solve the problem, as this decrease the performance of space temperature considerably. The rendeMIX multi-path mixing valve however, feeds the heating water from the return of the radiator loop, first into the floor heat loop, which makes the temperature of the boiler return water rise much more slowly and increases the operation time of the burner. Once the floor heat loop is satisfied however, it acts as a buffer tank and feeds it residual heat slowly back into the heating circuit. Frequent burner starts do not only lead to lower efficiency but also to greater wear and tear and thus to higher operating cost.

What effect has rendeMIX on a buffer or stratification tank?

The usable heat of a buffer tank acts corresponding to the product of its volume and the delta-t of the installation (temperature difference between supply/return). Relating to the previously mentioned boiler temperature of 70°C (158°F) in the supply and 43.3°C (110°F) (3-way mixing valve) or 30°C (86°F) (rendeMIX) in the return. The delta-t is 26.7°C (79°F) and 40°C (104°F). The relation between these numbers is 2/3 thus showing that the cubic capacity of the buffer tank in combination with a rendeMIX multi-path mixing valve is 50% higher than that of a tank of the same size combined with a 3-way mixing valve. An added bonus is that the stratification is considerably stable with a greater delta-t. To control the radiator loop a conventional 3-way mixing valve can be installed before or after the rendeMIX mixing valve.

What effect has rendeMIX on a solar collector?

The release of radiation capacity acts corresponding to the fourth potency of the absolute temperature of the surface. The medium temperature of a 70°C/43.3°C (158°F/110°F) collector surface is 56.7°C (169°F); the absolute temperature is thus 330K. In contrast in the 70°C/30°C (158°F/86°F) system it is 50°C or 323K. The ratio of the fourth potency of both numbers (330/323)⁴ (potency) equals 1.09 or expressed differently: The radiation loss of a 70°C/43.3°C (158°F/110°F) collector consequently is 9% over the loss of a 70°C/30°C (158°F/86°F) system. That means that even on cloudy days with diffuse sun radiation a significantly higher heat gain can be obtained, which can have extensive consequences for the annual efficiency of the solar installation.

Does rendeMIX require special controls?

If the actuator turns the rendeMIX multi-path mixing valve in one direction, the supply temperature in the mixing loop raises, if it is turned in the opposite direction the temperature drops. Hence the mixing valve acts like typical 3-way mixing valve and thus can be controlled with any standard mixing valve circuit control with a 24V floating signal (actuator open-stop-closed). The necessary mixed supply temperature sensor for the mixing valve circuit is part of the controls. We recommend using the controls from the boiler producer (if available) because these do not only guarantee an optimal interaction of the two loops but also need only one outside sensor.

Is it difficult to install the rendeMIX multi-way mixing valve?

For a mixing valve with its 45x45 cm (17¾"x17¾") (outside dimensions of the pre-formed insulation body) the rendeMIX constitutes a very compact module, not wider than any wall hung unit. Furthermore it can be supplied in six basic versions: for a boiler circuit turning clockwise or counter-clockwise (model **R/L**) and for the heating or boiler circuit outlet to the mixing circuit or **TWIN** for a compact unit in a double cascade (model **H/K/T**). All connections are equipped with flat sealing screw joints G1½ "and associated connecting ball valves with 1" female connections.

Can multiple mixing circuits be operated with rendeMIX?

By connecting two modules in series, very compact cascades can be produced. There is still only one circulator per load circuit. Due to its compact measurements a **rendeMIX TWIN** is only 90 cm (35 3/8") long (from flange to flange without circulators and connecting ball valves). To do this any model of the type T is flanged to a corresponding model (**R** or **L**) of the **H** type. The mixing circuit with the lower temperature should be installed closer to the boiler.

The Advantages of rendeMIX at one Glance!

- Compact assembly of manifold, mixing valve, and actuator
- High quality materials, made for the trade, numerous models available
- Integrated flow check and check valves (opening pressure ≤10cm water column)
- No valve setting, no hydraulic balancing between the load circuits
- Direct cascading (**TWIN** for two mixing valve loops)
- Can be connected to any three-point control with 24V floating signal
- Longer burner operation through higher circulation time
- Actuator with display and manual adjustment (240°/200s)
- Complete with 6 thermometers and 6 connecting ball valves G 1½ (flat) to R1"
- No additional circulator needed for boilers with integrated circulator. (providing it is proper size)
- In most cases no primary/secondary pumps and piping needed.
- Due to small flow volumes no swirling in buffer or stratification tanks
- Low radiation loss with solar collectors due to low return temperature
- Good tank utilization ratio due to greatest possible delta t
- Highest utilization of condensation due to lowest return temperature

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