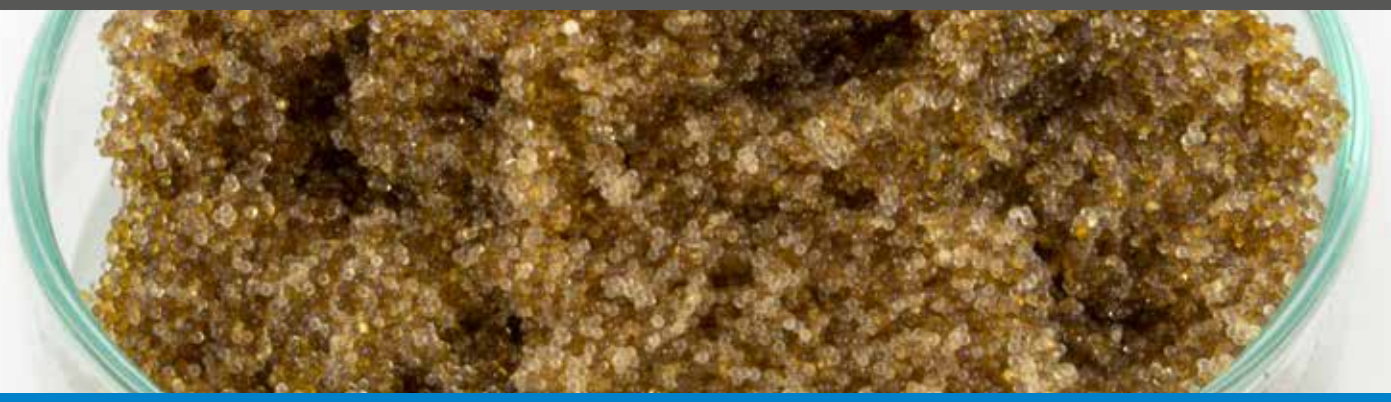


Mixed bed ion-exchange resins

for deionization of heating water

Water treatment for modern heating systems

The recommended water quality for the operation of modern heating systems is described in guidelines, such as the VDI 2035 or the SWKI BT 102-01. Among other things, a filling and circulation water with low-salt content and therefore with a low electrical conductivity of $<100\ \mu S/cm$ is recommended.

A heating water with such a low conductivity can be realized by deionization (demineralization) of the filling water or the circulation water by use of mixed bed ion-exchange resins.

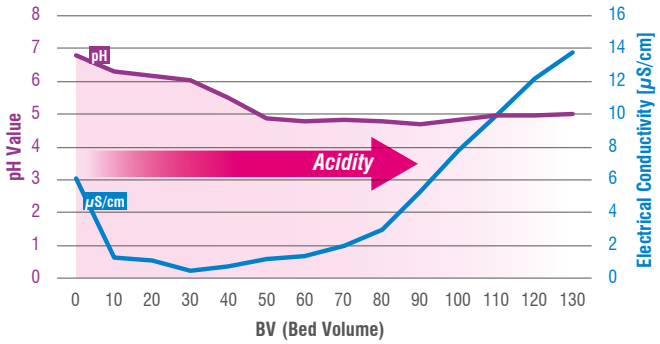
Unsuitable and Suitable mixed bed ion-exchange resins

Once heating water is treated by use of mixed bed ion-exchange resins, the quality of the water resulting from the treatment depends on the type and the composition of the mixed bed resin. Mixed bed resins are available in various variants and for a wide range of applications. However, not all types are equally suitable for the treatment of heating water.

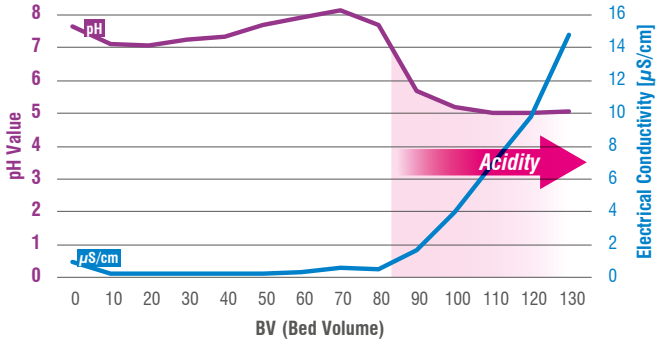
Mixed bed ion-exchange resins with a mixing ratio of approximately 50% cation resin and 50% anion resin are certainly the least suitable for heating water treatment. These mixed bed resins are designed for applications where high cation exchange capacity, eg. for the removal of water hardness, is required. The exchange capacity for carbonic acid is very low in these resins. Thus, an ingress of acids at a pH <7 over the entire capacity of the mixed bed resin can not be avoided. (Fig. 1)

In contrast, there are mixed bed resins with a mixing ration of about 40% cation and 60% anion resins. These ion exchange resins provide significantly better exchange capacity towards acids and aggressive salts and are widely used for the treatment of boiler feed water in power plants and other areas where the pH is a critical factor. These mixed bed resins are well suited for heating water treatment, provided that the user pays close attention to the capacity end point. This is usually set at 10 $\mu S/cm$, even if the salts of carbonic acid slip through the mixed bed even at a much lower conductivity.

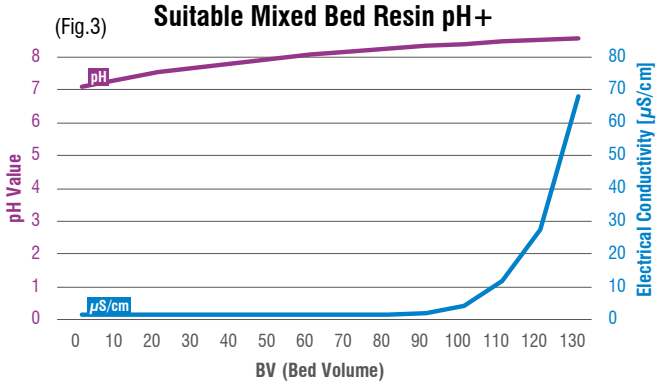
(Fig.1) **Unsuitable Mixed Bed Resin**



(Fig.2) **Suitable Mixed Bed Resin**



(Fig.3) **Suitable Mixed Bed Resin pH+**



Comment: 1 BV (Bed volume) = 1 liter of water per liter of mixed bed resin.

In case of these resins a measurable decrease of the pH usually takes place from a conductivity of 2-5 μS/cm. (Fig. 2)

At the top of the suitability for heating water treatment there are mixed bed ion-exchange resins, which have been specially developed for this kind of application. These resins have an anion resin content of >65%. In some cases, the cation resin is also subject to a special treatment, so that a deliberate ingress of alkaline salts into the water is assured. These mixed bed resins have the attribute to produce a low-salt water and to prevent a decrease of the pH in the acidic range at a conventional composition of the raw water. Of course, these resins have a capacity end point beyond a certain electrical conductivity as well. Experience has shown that this is at a level between 50-100 μS/cm, which means that the heating water corresponds to the low-salt range according the guideline recommendations. (Fig. 3)

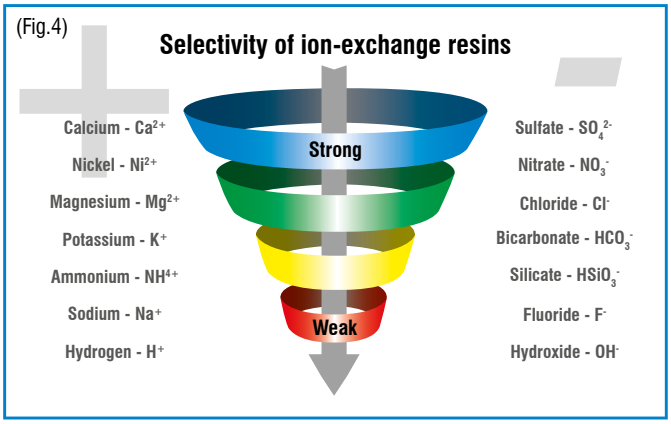
Why is DI water to equal to DI water?

There is one thing in common for all mixed bed ion-exchange resins available on the market – they are able to produce a low salt water with a low electrical conductivity of <100 μS/cm. Usually at the beginning of the operation with a conductivity level of <1 μS/cm, then increasing with increasing load of the mixed bed resin, until it has reached the end point of the capacity as specified by the manufacturer.

The electrical conductivity of the water, measured behind the ion exchange cartridge, is determined by the dissolved salts that slip through the mixed bed. These can be both acid-forming and alkaline salts, whereby the low-salt water has either an acidic or alkaline character.

The essential property of ion exchange resins is to hold certain salts more firmly than others. These **differences in selectivity** depend on the type of the resin, their chemical treatment and the overall composition of the mixed bed resin. Based on these selectivity differences, it can be determined in advance, which harmful salts or acids will break through the mixed bed resin in the first place. (Fig. 4)

(Fig.4)



The mixing ratio of the resins is crucial!

In addition to the selectivity differences the mixing ratio of the so-called cation resin, these are the resin beads to remove the positively charged ions (eg, calcium, magnesium and sodium), and the anion resin, the resin beads to remove the negatively charged ions (eg, the salts of carbonic acid, chlorides, sulfates), is an essential distinctive feature.

The use of ion exchange mixed bed resins for the demineralization (deionization) of water has been around for a long time. However, the application for deionization of heating water is relatively young in this field. Accordingly, the user has a wide variety of resins in different mixing rations available. Not all are equally suitable for deionization of heating water.

It is most advisable to select the ion exchange resin for deionization of the heating water deliberately and to use only those in the best possible way, which prevent an unnecessary ingress of acids into the heating system.

Quality mixed bed resins by elector

For the treatment of heating water we offer only mixed bed resins with an anion content of 60% and higher.

We regularly check our resins for quality and suitability – *that is our quality promise.*

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