aalberts hydronic flow control

white paper

The Advantages of using DZR Brass in Hydronic HVAC Applications

In most modern hydronic heating and/or cooling systems, one can find a variety of different valves with unique applications. Some valves are simply for isolation, while others have more advanced requirements and applications. We also find that these valves are manufactured using a variety of different metals and alloys. One of the most prevalent alloys used in hydronic systems is brass.

While brass is commonly used in the manufacture of valves and fittings, the specific type of alloy can vary depending upon the manufacturing method or the intended application of the valve or fitting. In this paper, we will take a closer look at brass and more specifically the benefits of dezincification resistant brass also known as DZR.

What is Brass and why do we use it?

Brass is an alloy of copper and zinc. Copper is used because it is malleable and corrosion resistant, zinc is used for its strength and ductility. Brass is a very popular choice for hydronic applications for three key reasons:

1. Machinability – Brass can be forged, pressed, and cut without compromising its structural integrity; this allows for complex components to be produced quickly and with consistently high quality.
2. Highly Malleable – Brass is highly malleable making it easy to work with and less prone to fractures under high stress.
3. Corrosion Resistance – Brass is much less susceptible to corrosion than other popular pipe materials. Since oxygenated water by nature is very corrosive, this is arguably the most important factor in why it is used.

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In addition, studies have shown that copper and copper alloys such as brass are effective at killing a variety of microorganisms within a couple of hours.

Although brass has great corrosion resistance, the zinc part of the alloy makes it vulnerable to a process called dezincification, a form of corrosion.

Types of Brass

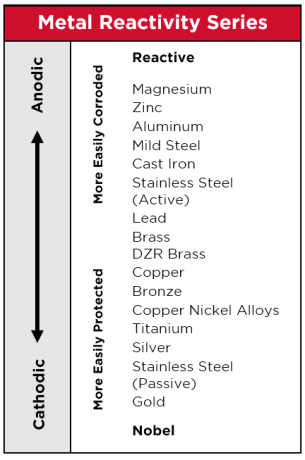
There are over 60 different types of brass in use today. Metals are combined in different proportions to achieve an alloy with varying mechanical, electrical, and chemical properties.

Some common brass types include:

Brass Type	Properties/Uses
Aluminum Brass	Improved corrosion resistance, used in heat exchangers and condenser tubes.
Leaded Brass	Addition of lead improves the machinability of brass, leaded brasses are commonly used in hydronic system components and fittings.
Lead-Free Brass	Contains less than 0.25% lead (by weight), used in potable water systems (drinking systems) for system components and fittings.
DZR Brass	Lower in zinc content making it less susceptible to dezincification corrosion, used in hydronic systems for system components and fittings.
Lead-Free DZR Brass	Combines the benefits of both Lead-Free and DZR brass into one specific alloy. Can be used in a variety of hydronic or potable applications.

What is Dezincification?

Dezincification is a form of corrosion and weakening of brass objects in which zinc is dissolved out of the brass alloy. Zinc is a highly reactive metal as shown by the "metal reactivity series". Through the dezincification process the active zinc is leached from the brass leaving behind a porous mass. The strength of the resulting brass is significantly lowered.



This happens as part of a 3-step process:

Step 1: Copper and zinc become dissolved in the system water

Step 2: Zinc stays in solution

Step 3: Copper re-plates onto the metal surface

Types of Dezincification

There are generally two types of Dezincification to be aware of, Layered Dezincification and Plug Dezincification.

Layered Dezincification refers to a uniform surface corrosion which has minor consequential damage. A thin layer of porous copper forms on the brass surface; this may eventually lead to more serious plug dezincification occurring. (See Figure 1)

Figure 1 - Layered Dezincification

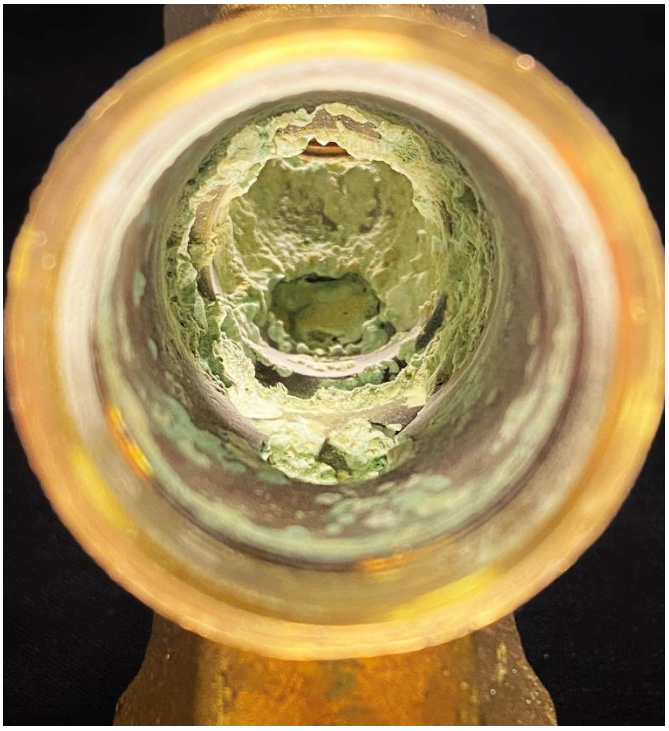


Figure 2 – Plug Dezincification

Notice in figure 1 above, the sample component on the top exhibits layers of corrosion both internally and externally. Without dezincification, the part on the top should be as clean and shiny as the part on the bottom.

Plug Dezincification is a more concentrated attack on a specific area which can result in pitting and eventual failure of the component body. Notice in Figure 2 the substantial build up on the component as a result of dezincification.

Conditions that encourage dezincification

- Highly oxygenated water
- Elevated temperatures
- High chloride content
- Stagnant or low velocity water

Common signs that dezincification is occurring in your system

- White deposit of loosely adhering zinc oxide found on the exterior
- Water seeping from fittings or pipe unions
- Mineral staining on the outer surface of the component

What is DZR brass?

DZR (dezincification resistant) brass, is a type of brass that is lower in zinc content making it resistant to dezincification. DZR brass often also undergoes a heat treatment which works to further strengthen its protection from corrosion.

DZR brass is much less prone to common issues such a stress corrosion cracking and leaking which are common failures on standard brass components and fittings. As a result, DZR brass will often have an increased component life and experience greater consistency in performance, especially under corrosive conditions.

Where is DZR brass used?

DZR brasses are growing in use in hydronic systems as a way to improve corrosion resistance and reduce potential component failure. A system is only as strong as its weakest component; as efforts are made to extend system life and prevent downtime, DZR brass has become the preferred brass for use on hydronic system components.

Due to strict laws governing potable water, there are restrictions in place for the lead content of all system components. For this reason, lead-free versions of brass have been developed. Dezincification remains an issue for potable water systems due to the high oxygen content found naturally in water, for this reason lead-free DZR brass is highly recommended for use on these systems.

DZR brass can be used in any situation you would normally use standard brass components such as valves, air vents and pipe connections. There is no disadvantage from switching from standard brass to DZR brass.

Conclusion

Brass has been in constant use for hundreds of years. As its use continues to expand and develop, considerations must be made to the applications and conditions the metal alloy is exposed to.

Different brass alloys have been developed over the years to help brass perform well in a wide variety of environments. In wetted systems, the biggest threat to the lifespan of brass components stems from its high zinc content compromising its corrosion resistance.

DZR brass has emerged as a compelling solution to counteract the negative effects experienced as a result of dezincification, maintaining all the positives of why brass is employed today and strengthening its weaknesses. DZR brass is an excellent choice for hydronic systems while lead-free DZR is ideal for potable water applications.