

Bromine/chlorine Bromine versus chlorine

The advantages of the ozone-bromine method compared to conventional chlorine-based methods:

- High skin compatibility, especially for sensitive skins. This is why this process is also frequently used in therapeutic baths.
- Low-odour pool water – there is no typical swimming pool odour
- Oxygen-rich pool water since oxygen is produced as a by-product during disinfection and dissolves in the water, thus giving the pool water a fresh, sparkling quality
- No handling and storage of hazardous chemicals required for disinfection
- High disinfectant content also present in the filter, thus preventing filter contamination

Like chlorine, bromine is a halogen. As exact equivalent disinfectants for water maintenance, their activated forms are primarily used as hypobromous acid HOBr (free bromine) and hypochlorous acid HOCl (free chlorine).

These two strongly disinfecting acids produce equilibrium reactions with hypobromite BrO^- and hypochloride ClO^- through autoprotolysis in the usual pH range for swimming pool water.

With a pH value of 7, bromine contains almost exclusively hypobromous acid (still around 94% at pH=7.5). In the case of chlorine, this is only about 75% hypochlorous acid. When the pH equals 7.5, this percentage quickly drops to around 50%.

Seawater and thermal water usually already contain enough bromide. In the case of fresh water, the required bromide content is adjusted by adding a small amount of sodium bromide salt into the pool water. Bromide is oxidised with ozone to produce hypobromous acid. The required amount of disinfectant is adjusted by regulating the dose of ozone.

Bromine has a neutral pH effect and thus requires fewer chemical additives to correct the pH value. Moreover, there is no intrusive "swimming pool smell" produced by nitrogen trichloride, which also causes irritation to the eyes and respiratory tract.

Note on bromine tablets:

The ozone-bromine method is **completely different** to the use of bromine granules or bromine tablets.

Bromine tablets contain 1-bromo-3-chloro-5.5-dimethylhydantoin (BCDMH). They release free bromine and free chlorine water during slow dissolution. When free bromine oxidises with dissolved matter (oxygen release), bromide is left behind, which is then partly converted into free bromine by free chlorine. The effect only lasts a short while.

Development of the ozone-bromine method

When and why was the ozone-bromine method developed?

Up until 1974/1975, there was no simple chlorine-free method to treat pool water. Dosing with bromine was very complex, prone to failure and not without hazards.

There was no efficient, chlorine-free treatment process for private and public pools available on the market until Hydro-Electrics developed the ozone-bromine method. The method is based on the reaction of ozone with bromide ions.

The initially patented process has been standardised as part 5 of DIN 19643 since April 2021.

It is also now generally accepted that any water containing bromide, as found in many thermal and, especially, seawater baths, is disinfected with free bromine as the disinfectant. The reason is that both ozone and chlorine react immediately with bromide ions, thus forming free bromine, which remains in the water as the disinfectant hypobromous acid.

Premium partner

Why be a premium partner and how do I become one?

Premium partners are selected, certified companies that supply, install, commission and maintain swimming pool technology for pool operators and private individuals.

The ozone-bromine method differs substantially from the chlorine-based standard process. With the high-quality HYDROZON compact filter systems, we offer the user an excellent water treatment package for optimal integration into the pool water circuit. Optional upgrades also provide a wide range of configuration options for controlling components commonly found in swimming pools today.

For this reason, our premium partners are specially trained, familiarised with the process technology's unique features and given detailed knowledge of the compact filter systems' functions. This ensures that every certified premium partner is able to install and commission systems correctly, instruct the user in their operation and perform regular maintenance.

Both the theoretical and practical training sessions are conducted in small groups. Duration about 1 day, depending on the required scope.

Session dates on request, several times per year as required.

All premium partners will receive a certificate after successful completion of the training.

Are you interested in becoming a premium partner? If so, we look forward to hearing from you.

Conversion from chlorine to ozone-bromine

Can an existing chlorine-based treatment system be converted to use the ozone-bromine method?

Basically, yes. The HYDROZON Oxidator units in the POX series can be integrated into both new systems and existing systems. The oxidators contain all the components required for operation and are inspected and ready to be connected upon delivery. When we receive an enquiry about installation, we also ask about the materials used in the water-conducting system (filters/piping/fittings). Existing control and control components can be used as a general rule.

Ozone release in swimming pools

Can ozone be emitted during the HYDROZON process?

The hyperstoichiometric content in sodium bromide salt in the pool water circuit ensures that all ozone is oxidized with sodium bromide to form hypobromous acid. The actual ozone reaction takes place upstream of the filter. Hypobromous acid passes through the filter and acts as a disinfectant in the pool area.

When the disinfectant reacts with the dissolved matter, oxygen is released, which, together with the oxygen introduced by ozoning, ensures that the water has a fresh quality.

Material compatibility

Do ozone and bromine corrode components such as pipelines, tiles and valves?

Ozone is only present in the ozone generator, the HYDROZON treatment system mixing section and in the reaction zone upstream of the filter. The materials and seals used there are made of high-quality, ozone-resistant materials (EPDM, FKM, stainless steel).

Bromide ions are present in very low concentrations in the water. As described previously, ozone reacts to form hypobromous acid when bromide ions are present. This acid is comparable with conventional disinfectants with regards to corrosive properties. There is normally no need to restrict the choice of materials and any materials habitually used in swimming pools are suitable.

Warning

You must avoid adding a pH reducer or acid directly to the pool water containing disinfectant, regardless of whether chlorine or bromine is used as the disinfectant. The sharp drop in the pH value in the mixing section can trigger a strong shift in the equilibrium reaction and thus lead to elemental chlorine (in chlorine pools) or bromine (in bromine pools) being released, causing severe irritation. Elemental chlorine and bromine are harmful to health and can corrode materials.

A stable pH value is thus highly important in swimming pools.

Indoor air

Dehumidification, ventilation, fresh air

The unavoidable evaporation of water increases the air humidity in indoor swimming pools, creating humid, unpleasant indoor air. The water vapour content in the air can also damage the building fabric.

An automatic ventilation system in continuous operation must provide the necessary air exchange, dehumidification and a pleasant temperature in the swimming pool facility.

Thanks to modern ventilation systems with heat recovery, most of the thermal energy can be retained in the swimming pool loop.

Advantages of the ozone-bromine method

What advantages does the HYDROZON process offer over conventional chlorine treatment processes?

Nowadays, more is expected of a swimming pool than just being able to swim in it. A swimming pool is supposed to be a haven of peace where you can quickly forget everyday stress, a place where the mind and soul can relax and recover and the body can recharge.

The core element in a pool is and always will be the water. Its quality is the decisive **feel-good factor** as it has a direct impact on our senses. The water should be odourless, visually clear, and gentle on our eyes and our largest organ of perception, our skin. Water should thus be at a comfortable temperature, should not cause irritations and should feel delicately bubbly. The

chlorine-free ozone-bromine method transforms treated water into a highly pleasant wellness water which is eminently suitable for sensitive skin.

This is why the HYDROZON process is also frequently used in therapeutic baths.

Bathers appreciate the fact that it does not emanate a typical swimming pool odour.

Another advantage is that the disinfectant is produced upstream of the filter and flows through the entire filter, thus preventing filter contamination.

From a technical perspective, HYDROZON systems ideally combine function with a compact design. The space-saving, fully automatic compact systems feature all control and monitoring functions with the option of remote access from mobile end devices.

There is no need for handling and storing hazardous chemicals for the pH-neutral HYDROZON process, which is extremely beneficial for staff.

DIN 19643

Is the ozone-bromine method an approved DIN process?

The DIN 19643 standard series regulates the treatment of bathing and swimming pool water in the public sector in Germany. The ozone-bromine method has been specified as part 5 in the regulations since April 2021. Hydro-Elektrik GmbH, the company which opened the way to chlorine-free pool water treatment 40 years ago, initiated the application for standardisation and has developed the process in practical use on a continuous basis. The result of this development is the optimised HYDROZON compact filter systems.

Bromine measurement**How is the free bromine quantified?**

The disinfectant identified as free bromine is measured in the same way as for standard chlorine methods, photometrically with the DPD method (DPD 1) or comparing colours manually with the bromine colour disc.

Bromine limit value**Is there a limit value for bromine?**

Since both bromine and monobromamine react with DPD, the method does not differentiate between free and bound bromine. Moreover, no differences have been observed in the chemical and biological efficacy between free and bound bromine, as is also the case with chlorine. Separate identification thus makes no or only a little sense in practice. For this reason, a limit value is not relevant in this case either.

Parameter comparison**Are the parameters lower for chlorine disinfection?**

DIN 19643 specifies values between 0.3 and 1.0 mg/l for free chlorine, depending on the pool. The values for the free bromine of 0.5-1.5 mg/l are outwardly higher. The reason is that the atomic weight of bromine at 79.9 lies more than twice as high as that of chlorine at 35.45.

This regularity can also be observed when determining the reaction by-products (e.g. haloforms). The disinfection contents can thus be compared directly with each other.

Determining oxidisability**What needs to be taken into account when determining oxidisability?**

As a measurement of water's exposure to organic substances, oxidisability is influenced by the bromide content in water since bromide consumes KMnO_4 . This determines a higher oxidation potential than is attributed to the actual organic load. This is because hypobromous acid is formed due to bromide reacting with potassium permanganate. The bromide content must therefore be taken into account when determining oxidisability in the HYDROZON process. This is generally achieved by correcting the measured values.

Bromofloc®**What is Bromofloc®?**

Bromofloc® is a chemical-physical agent (flocculant) developed especially for the HYDROZON process. It is a solution consisting of poly-aluminium chloride with sodium bromide as an additive. Bromofloc® is not considered a hazardous material under transport regulations.

Bromine versus chlorine – hazards?**How dangerous is bromine?**

In the HYDROZON process, the bromide content is between 20 and 40 mg/l and is therefore well below the natural bromide content in seawater and brine swimming pools, which can contain up to 70 mg/l. Bromine and chlorine are corrosive and toxic in their elemental form. Both are halogens and are considered excellent disinfectants. Their effect mechanisms are comparable with regard to their disinfection capacity in the pool section (hypobromite and hypochlorite). This also applies to the possible formation of anorganic compounds (THM). The use of bromine in swimming pools is thus no more hazardous than the use of chlorine in this respect. Unlike chlorine, the flocculant Bromofloc® is **not** a hazardous material.



Made in Germany **Are HYDROZON systems manufactured in Germany?**

All HYDROZON systems are produced and tested in Germany in compliance with the applicable national and European legislation and regulations.