# Internal pipe cleaning process for biological contamination

Deposits including biofilms in drinking water installations are not only a breeding ground and refuge for legionella and other drinking water-relevant bacteria, but also often the cause of turbidity in drinking water. The Comprex process presented below makes it possible to eliminate them. It is also a good method for cleaning newly installed pipes before they are put into operation.

Picture 1
Discharge of deposits from a sink mixer during the cleaning process

Like any food, was-
fresh for a limited time only and edible. With prolonged stagnation, z. Water quality can be impaired by the proliferation of bacteria, e.g. due to low water consumption, oversized pipes and hot water tanks, disused taps, dead pipes, etc. Especially when using galvanized steel pipes, corrosion processes also cause turbidity and reddish-brown discoloration of the drinking water.

## Microbiological contamination

Positive results from microbiological sampling of the drinking water installation usually come as a complete surprise to the operators of building services systems and, as a rule, are not always available.

the right time. You are familiar with the situa
The local authorities are overwhelmed by the situation, but want a quick solution so that the drinking water system can continue to operate and does not have to be shut down.

The causes of microbiological contamination are usually to be found in constructional, operational and procedural defects. It is important to identify and rectify these. However, this requires a lot of time. Time during which the facility cannot be used if it is closed by the health authorities. This is an unacceptable situation for owners of hotels, production facilities, retirement homes, hospitals and swimming pools, for example.

Although the concentration of microorganisms in the water coming from the waterworks is absolutely harmless, the water is of course not sterile. The bacteria it contains can
The environmental conditions that are favorable for them will allow them to multiply and adhere to suitable surfaces. Deposits, e.g. due to corrosion, favor this process. The adhesions grow and form biofilms, which in turn build up and are partially torn apart by the water flow. This means that high concentrations of bacteria can get directly into the drinking water. It should always be borne in mind that approx. 95 % of the bacteria present in the drinking water system are found in the biofilm.

Many operators trust in the problem thermal or chemical disinfection. Although the bacteria are largely killed by these measures, they are not removed. The biofilm itself is only insufficiently attacked and, crucially, not flushed out. These methods therefore only solve the problem temporarily. Rapid recontamination is to be expected.

## Turbidity in the drinking water installation

In terms of water quality, corrosion is the problem most frequently encountered by users and operators of domestic drinking water installations. This is due to the fact that drinking

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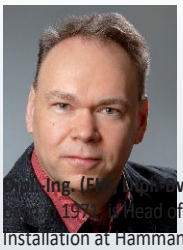

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Picture 2
Connecting the pulse flush box to a riser pipe

water pipes in old buildings consist to a large extent of hot-dip galvanized pipes. The visible results are clouding and reddish-brown discoloration of the drinking water (Fig. 1). Further problems arise when filters, strainers, aerators or angle valves become clogged, reducing the flow rate.

The cross-section of circulation pipes also decreases, causing stagnation and ultimately creating ideal conditions for bacteria such as legionella pneumophila to multiply in these pipe sections. Due to the connection between the circulation pipe, water heater and hot water system, the contamination spreads rapidly throughout the entire system.

## Clean new installations before commissioning

According to DIN EN 806-4 [1], drinking water installations must be flushed promptly after installation and pressure testing and immediately before commissioning in order to remove all foreign matter. Heating, cooling and fire extinguishing systems should also be cleaned.

The purpose of cleaning is to

- Safeguarding the quality of drinking water
- Ensuring function, especially for fire extinguishing systems
- Prevention of corrosion damage
- Avoidance of malfunctions on appliances and fittings While pipes with low

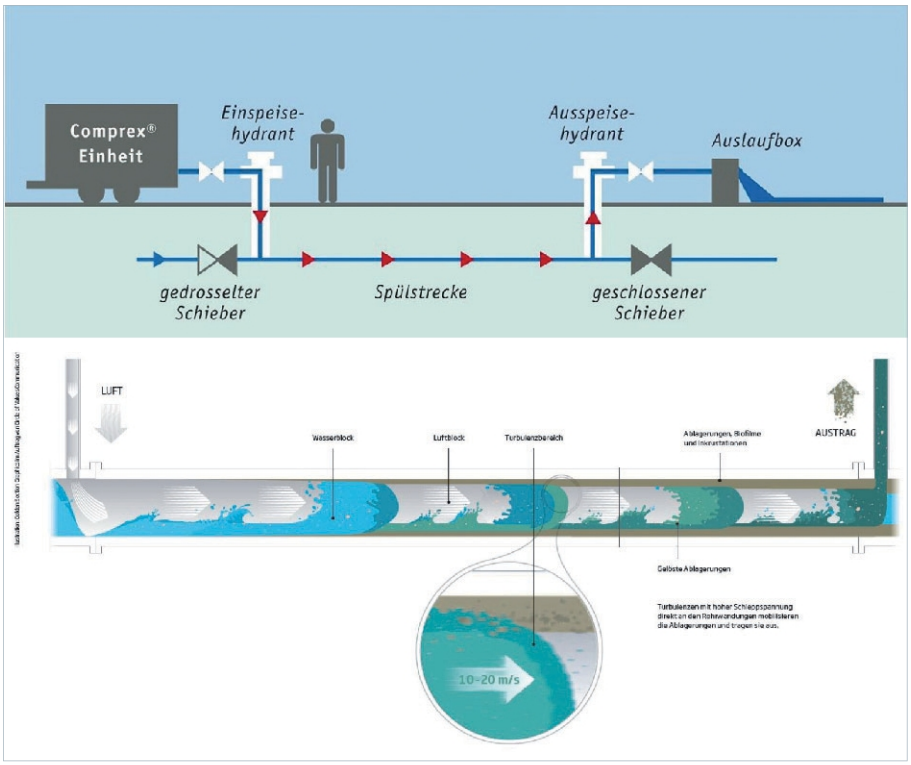
diameters can be flushed with the traditional air/water mixture, cleaning larger DN is more difficult. The cleaning effect of the classic air/water flushing is no longer sufficient to achieve the purpose of these flushes.

## Mechanical cleaning as an important solution

Biofilms and deposits in drinking water

water or non-drinking water system can only be removed and discharged from the system by mechanical means. However, normal water flushing or air/water flushing only achieve a very low cleaning performance. Since 1998, the impulse flushing process Comprex from Ham

Picture 3
Principle of the Comprex process




mann GmbH offers a mechanical cleaning process that has an extraordinarily high cleaning performance even with very large nominal diameters (up to DN 1200). It has also been used in domestic installations since 2005 (Fig. 2).

## Description and further development of the patented process

The cleaning process is a further development of the **patented process.** development of the classic air-water flush. Air blocks, which are introduced into the water flow, fill the entire cross-section of the pipe and move alternately with water through the pipes, creating cavitation phenomena and turbulence at the interfaces with the pipe wall up to a speed of 20 m/s (Fig. 3). The high flow velocities are therefore exactly where they are needed: on the inner pipe wall.

All mobilizable deposits are shaved off and rinsed out without destroying the hard surface layer. As the air is added in pulses within a pressure-reduced rinsing section, this is referred to as the impulse rinsing process.

Picture 4
Discharges from drinking water installations in buildings

The Comprex pulse flushing process has now been further developed. The air pulses and pulse sequences are now computer-controlled, modulated and optimally adapted to the respective pipe characteristics. Ham- mann GmbH was awarded a patent for these improvements in summer 2014. This also changed the name of the process from "Comprex pulse flushing process" to "patented Comprex process".

## Mechanical cleaning as a recognized rule of technology

The new DVGW worksheet W 557 [2] "Cleaning and disinfection of drinking water installations" was published in October 2012. Under "Basic principles" on page 12, it now explicitly states: "The first step in eliminating contamination is always cleaning. This also applies to microbial contamination."

It goes on to say: "In addition, deposits promote the proliferation of microorganisms, which can lead to microbial damage. To prevent this, cleaning is required if deposits are present."

## Advantages of the patented Comprex process

*1. quick recommissioning after a shower ban:*

The rapid use of cleaning with optional disinfection removes the deposits/biofilms. In most cases, the taps are available for use again after re-testing. The basis for hygiene has been laid. The sustainable elimination of the system defects should be carried out promptly.

*2. greater comfort:*

Removing the deposits generally leads to an increased flow rate and higher temperatures in the hot water and circulation system, depending on the thickness of these deposits. The improved flow through the circulation pipes also means that hot water reaches the taps more quickly.

*3. hygienic benefit:*

The turbidity problems are eliminated. To ensure this in the long term, the subsequent installation of a phosphating/silicate system is recommended. By removing deposits and biofilms (Fig. 4), the retreat areas and food sources for bacteria have also been eliminated. If a permanent disinfection system is installed, its effect is increased as there is less consumption of the disinfectant after cleaning.

*4. qualitatively superior system:*

During cleaning, all shut-off valves in the system are actuated, Their function is checked and, if possible, made operational again, or the upper parts are replaced. This ensures proper functioning and safe shut-off of sections if necessary.

*5. economic benefit:*

Cleaning the system can increase the service life of the system or extend the time window for extensive refurbishment.

By reducing the flow resistances in the pipes after cleaning, the use of an otherwise possibly more powerful circulation pump can be dispensed with.

## Conclusion

Mechanical cleaning of domestic installations is now state of the art. The patented Comprex process presented here removes the deposits and biofilms that can be mobilized. If this potential is used together with chemical disinfection, the best conditions are created to prevent rapid recontamination after contamination. However, constructional, operational and procedural measures must not be disregarded to ensure that the result is sustainable. All in all, cleaning with the patented Comprex process is a decisive building block for successful remediation.

## *Literature*

*[1] DIN 806-4: Beuth-Verlag GmbH, 2012.*
*[2] DVGW W 557, Technical Rules, 2012.*