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Comprex – the Efficient Way to Clean Pipelines

Cleaning is the essential way of maintaining water pipelines in good condition. The word "disinfection" is always present in the minds of many people. In reality, the flushing out of pollution is the basis for optimal disinfection of both supply lines and drinking water itself. The German Water Regulation and Standardization emphasizes this fact. The previous title of the DVGW W 291 in the eighties was "Disinfection of Water Supply Systems". Since 1999 cleaning has taken on first priority. The new title is "Cleaning and Disinfection of Water Distribution Systems". Now the second part of this Standard, relating to tap water, is under revision. Here the distinction will be made between newly-installed and already existing networks.

The reason for cleaning

Cleaning of pipelines in water supply networks aims to remove contamination, sediments and other unwanted material. These substances can cause a permanent increase in micro-organisms on surfaces with water contact and thus increase the amount of micro-organisms in the water. These materials must be mobilized as a first step and further be removed completely from the system. They are not allowed to settle again at a different location under any circumstances and thus cause adverse effects to the water. During the cleaning process it must be distinguished between newly installed and already existing pipelines.

Newly installed pipelines contain aids as lubricants and also unintended pollution. These must be mobilized in any case and be removed. In case of „accidents" such as unexpected and unplanned events like intrusion of mud from a rainstorm during installation, an intensive flushing is recommended. Microorganisms and most of all nutrient media for microorganisms must be removed from the pipeline. The more thoroughly the cleaning is performed the more efficient and successful the following disinfection measures will be.

In existing pipelines substances will deposit over time. These deposits have an adverse effect on hydraulics in the pipelines and on the function of the valves. At increased water demand high flow speeds in the pipelines will cause partial mobilization of the deposits which will cloud the water and stress filters in buildings.

Sometimes the water condition will be influenced by incidents, extraordinary events or cases of emergency. Examples are failures during water treatment procedures, intrusion of foreign parts into the drinking water line by leakages or unintended connection with pipelines not carrying drinking water. The German Federal department for environmental protection offers recommendations for providing sufficient disinfection capacities in such cases. After locally limited disinfection of the drinking water from mobile systems the cause of the impurity must be detected. Following rehabilitation the concerned pipeline has to be cleaned thoroughly. Since very resistant pollutions are normally involved, very efficient cleaning methods should be used.

With pipeline systems in buildings the cause of hygienic problems may be inexpert installation and inadequate operating conditions. At this point the problems with legionella should be remembered. In many cases deposits in circulation lines have an adverse effect on hydraulics. A thermal adjustment did not take place or became impossible which means that the required warm water temperature will not be achieved. Warm water temperatures which are too low as well as increased temperatures of cold water during stagnation periods will accelerate the development of biofilms in the pipelines and valves of the building.

Contrary to drinking water distribution systems where hygiene has top priority, the problems in other ▶▶

Table 1. Problem solving by Comprex in industrial fields.

Applications	Problems	Problem solving
Drinking water lines	Germ development, hygiene	Removing of biofilms
	Hydraulics, pump energy	Removing of deposits
Pipelines for river water, well water, industrial water	Hydraulics, pump energy	Removing of deposits
Pipelines and heat exchangers in closed cooling circuits	Hydraulics, heat transition	Removing of deposits and fouling
Pipelines and heat exchangers in open circuits to cooling towers	Hydraulics, heat transition	Removing of deposits and fouling
	Immission of microorganisms	Removing of biofilms
Wastewater pressure lines	Hydraulics, pump energy	Removing of deposits
Fire fighting lines	Obstructions by detached particles	Removing of deposits
Product and process water lines	Hydraulics, heat transition	Removing of deposits and cleaning

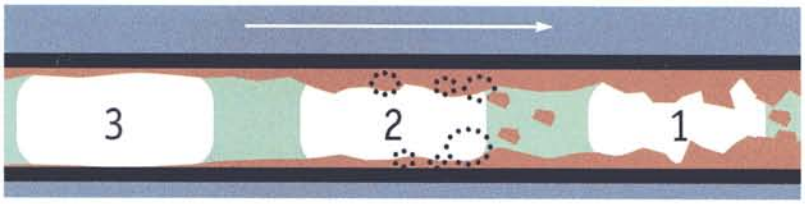

Fig. 1. Comprex – Water and air work together to remove deposits.

water supply lines are different. Frequently hydraulics and heat transition zones are affected adversely. Examples of this are raw water pipelines and well pipelines, wastewater pressure lines, industrial pipelines and heat exchangers.

Raw water lines tend to get obstructed due to specially high contents of iron or manganese in the water. Depending on operating conditions and the type of raw water involved, traces of dissolved oxygen may lead to oxidation precipitation already prior to the water treatment. In order to maintain the performance level of these pipelines, maintenance works at regular intervals are required.

Wastewater pressure lines are operated intermittently. During downtimes deposits can develop. Intermittent flow and quantities of decreasing wastewater on the one hand, and existing pipelines and pump stations designed for wastewater handling in the past on the other hand will cause longer retention of wastewater in the pressure lines. Suspended matter will deposit and has time to become solid. Flow speed is no longer adequate to ensure self cleaning occurs. Lengthy presence of remaining wastewater will lead to the introduction of microbiologic procedures. The "wastewater treatment plant" in the pipeline creates unwanted gas type metabolic products. Sand deposits or abrasives from the road and sewer slime will reduce the cross section and have an adverse effect on the wastewater pressure lines. The risk of obstructions increases if larger parts of this conglomerate detach.

Industrial pipelines serve various tasks. They transport fluids, frequently water for different purposes. In connection with heat exchangers they provide transportation of heat. The use of pipelines with water varies. However, for all applications there is a problem: deposits and biofilms in the pipelines and distribution systems. **Table 1** details applications and problems in industrial pipelines **(Tab. 1).**

Comprex, the modern and effective cleaning technique

The Comprex process[1] is based on a controlled pulse-like supply of compressed pure air within a defined pressure reduced flushing section **(Fig. 1).** Depending on the flushing programme air bubbles will develop with defined lengths. They fill the complete pipe cross section and move as air blocks with the water through the flushing section. Cleaning of the pipelines takes place at the interfacing surfaces of the air bubbles, water and pipe wall. Here turbulent swirls occur at flow speeds of more than 10 m/s. Local cavitation appearances cause an effective detachment of all movable deposits from the pipe walls. The Comprex process maintains the pulse pressure below the rated pipe line pressure in order not to stress the pipe line system more than during normal operation **(Fig. 2).**

Cleaning is carried out frequently whilst water is flowing through the system. In the case of drinking water pipelines hygienic pure water serves to flush the system. With non-drinking water for cleaning industrial water supply lines or well lines with cooling circuits, hygiene floodgates serve to safeguard the high quality Comprex units.

The advantage compared with water flushing is the high efficiency at low water consumption **(Tab. 2).** Side effects, such as clouding or pressure loss in adjacent networks, are avoided. Pipelines up to DN 1200 can be cleaned by combining several Comprex units **(Fig. 3).** Due

Table 2. Reduced water consumption by Comprex.

Water consumption (m³/h)			
pipe diameter	Conventional flushing		Comprex® flushing system (approximate value)
	2m/sec	3m/sec	
80	36	54	5 – 15
100	56	84	8 – 25
125	88	132	10 – 30
150	127	190	20 – 38
200	226	339	35 – 70
250	353	530	42 – 85
300	508	763	50 – 100
400	904	1357	90 – 150
500	1413	2120	140 – 230
600	2035	3053	220 – 330
800	3619	5428	430 – 660
1000	5654	8482	700 – 1000
1200	8143	12214	820 – 1220

[1] See the short film "Living Comprex" at www.hammann-gmbh.de.

Fig. 2. Comprex – An effective way to clean pipelines without chemicals.

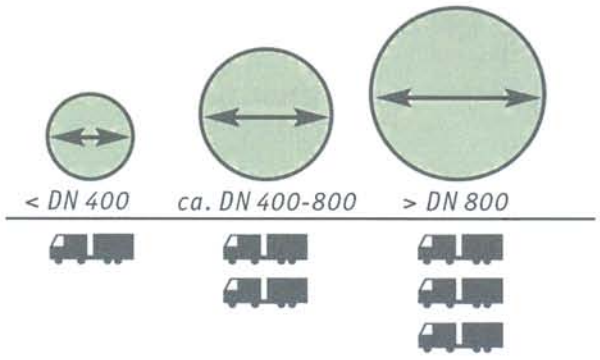

Fig. 3. Cleaning pipelines up to DN 1200 by combining of several Comprex units.

to the higher water need in pipelines at a larger diameter cleaning is frequently only possible with the Comprex process. This cleaning is however so efficient, that disinfection is not required in most cases.

Standard applications

The major application of the Comprex process is the flushing of pipelines. It serves for maintenance works on pipelines and provides clean water supply networks. With water consumption as low as possible not only can pipelines be cleaned thoroughly, but also sticky valves and non-functioning valves can be rehabilitated after inspection of valves and hydrants.

In past years the cleaning of drinking water supply lines in buildings by means of the Comprex process has become more and more significant, especially in connection with the problem of legionella, where an effective process is required in order to remove deposits and biofilms. During regular cleaning intervals cold and warm water lines are flushed individually. The Comprex process is well proven. It expands the time frame between cleaning intervals prior to rehabilitation and creates permanently hygienic impeccable conditions after rehabilitation of the drinking water system.

New applications

New applications have been noticed recently in industrial fields. Table 1 demonstrates problem solving by means of the Comprex process. Here the removal of deposits for improving heat transfer plays an important role. Air pipeline pigs adapt themselves even to very complex geometries. Contrary to other methods, pipeline systems can be cleaned without the need of extensive dismantling and reassembly. A reduction of both work and downtimes is therefore achieved. Cleaning is always performed mechanically without addition of chemicals. The removed deposits can be separated very simply for example by decantation and disposed as the case may be.

Comprex has also been applied in the field of agriculture and in medicine. With livestock breeding there is a high risk that water supply systems may develop germs. Expenses for disinfection agents or antibiotics for protecting the health of animals are significant. Comprex cleaning at regular intervals will help to reduce the use of chemicals to a minimum. There are also interesting applications in medicine to increase the efficiency of disinfection by means of Comprex cleaning. Examples are the cleaning of endoscope hoses or water supply systems in dental consulting rooms. Further new applications are near at hand in many fields of water supply systems and transportation means, such as airplanes, trains or seagoing vessels.

Comprex can be combined with other processes. It is thus possible to increase the efficiency of cleaning in the case of resistant pollution by adding solids such as ice cubes.

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