

cpp

CHEMICAL PRODUCTION PLANTS PROCESSES

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Mobile pipe cleaning system for BASF

Nothing but air and water

Pipe systems require cleaning at regular intervals, especially multi-purpose product pipelines. Existing processes such as the use of pigs require complex additional installations. Intensive water rinsing results in large quantities of waste water and therefore in high costs for discharge. By contrast, the Complex process needs only a small amount of water and can be integrated into existing pipe systems easily. Finally the compressed air is used to dry the system after cleaning process.

Product changes are inevitably associated with significant effort and interrupted production. The requirements vary according to the plant and the products. In any case, the pipe system has to be cleaned carefully before it is used for another product. If the product is water-based (e. g. aqueous solutions, emulsions and dispersions), the pipeline is usually rinsed with pure water. Depending on the desired level of cleanliness, more or less waste water has to be discharged. Another possible cleaning process involves the use of pigs. Pig gates must

allow the pig to be inserted into the pipeline and removed again after cleaning. Changes of geometry (e. g. changes to the pipe diameter and fittings) are highly problematic for this process. Pumps, valves and backflow preventers cannot be cleaned at all using pigs and have to be removed from the piping system before cleaning.

Cleaning with air and water

The Complex pipe cleaning system developed by Hammann is based on the controlled injection of compressed air into a

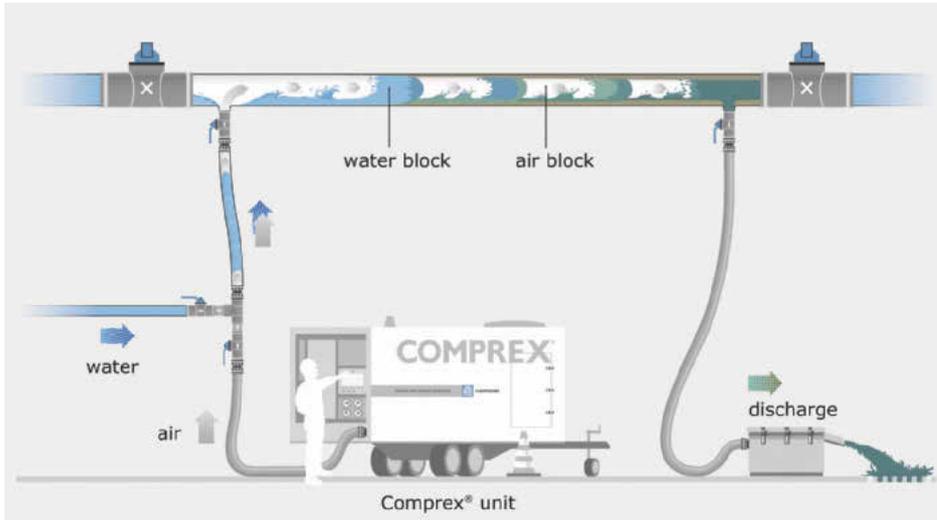
pipeline that is partially filled with water. These compressed air impulses lead to the formation of water blocks that are accelerated to high velocities of up to 20 m/s. As a result, impurities, product residues and fouling material are mobilised and removed.

Production plants in the chemical industry often contain hazardous material. For this reason, the waste water resulting from the cleaning process is also hazardous and has to be discharged into containers prior to further cost-intensive treatments. Compared



Pictures: Hammann

Prototype of the mobile Complex unit as it is used in the BASF agricultural production plant



Scheme of the Complex process: The compressed air pulses lead to the formation of water blocks that remove impurities, product residues and fouling material.



The Complex system is operated by touch-screen

to conventional water rinsing, the Complex process needs only about one tenth of the quantity of water. Moreover, Complex units can be adjusted to individual needs.

Development and testing period

BASF's agricultural production plant in Ludwigshafen has high requirements as regards the cleanliness of piping systems after product changes. Special measures are in place to prevent cross contamination by product residues or microbial growth. The piping system was traditionally rinsed using large quantities of de-ionised water. BASF therefore decided to test the Complex process, which promised lower water consumption. The following basic conditions had to be considered:

- Numerous product changes per year
- Different product pipelines of various lengths
- Minimal construction work on existing plants
- Mobile solution for the whole factory
- Simple process workflow with intuitive handling by operators
- Cleaning using compressed air and water from existing supply networks
- Piping system to be dried after cleaning
- Lower operating costs due to less waste water and downtime

In 2017, several tests were successfully performed using Complex units. Compared to water rinsing, water consumption was reduced by between 50 and 75 % – an enormous potential saving due to the thermal disposal of the waste water. Following the test period, Hammann developed and constructed a customised prototype of the Complex system.

Adapted to the customer's needs

The customised unit – internally named A8700 – uses electricity, water and compressed air from the respective BASF supply systems. The machine's control system is based on software developed by Hammann and adapted to the customer's needs. Cleaning tests verified the potential for added value and enabled refinements to the requirements for the final Complex unit. These included:

- Mobile design for different injection points
- Components and materials according to BASF's specifications
- Special encoded couplings to prevent connection errors
- Vessel size suitable for 1000 l of compressed air
- Internal control of compressed air and water
- Specific cleaning programmes for every pipe section at the factory
- Easy touch-screen operation based on icons and visualisation of all relevant information
- Automatic cleaning with documentation of each cleaning procedure, including air and water consumption
- Option of adding cleaning agents

The development of the specific software for the agricultural production plant as well as the engineering and construction of the components according to BASF's requirements were completed at the beginning of 2018, so that delivery was possible in spring the same year. A few minor software adjustments were performed together with the customer following an initial period of operation in the summer. The system has

been operating reliably and successfully since the end of 2018. The operating staff were highly satisfied after the first few weeks of operation. Thanks to Complex cleaning, the quantity of contaminated waste water was reduced by 70 % on average – an important step towards sustainability. The costs for disposing of waste water were significantly reduced, as were CO₂ emissions resulting from the thermal treatment of waste water. A comparison of the cleaning results with laboratory samples showed them to be consistently below the threshold. Further potential was identified for optimising water consumption and more fine adjustments to the cleaning process are therefore planned in the near future.

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