

PROCESS WATER

Intelligent process water management for protecting the environment

Every investment in a mass finishing system demands serious consideration of the handling of the process water.

This whitepaper is intended to provide basic knowledge about the subject – for example, when process water recycling is possible or flow-through cleaning of the process water and sending it to drain is more suitable. There is a clear answer: The treatment method for the process water always depends on the respective mass finishing application.

The purpose of the mass finishing technology is the controlled removal of material from the work piece surface. Besides the motion of media and work pieces in the machine the addition of water and suitable compounds play a key role in the finishing process. The water, called process water, discharges the fine particles removed from the work pieces and media out of the processing bowl of the finishing machine. In addition, the water also removes oil and grease carried into the process, as well as chelated metals. However, this poses the question: “What must be done with this contaminated water?”

We at Walther Trowal are guided by a basic principle for responsible environmental protection: “Prevention is always better than disposal!” Whenever it is technically feasible, the process water should be handled in a closed recycling system. In other words: If no waste water is produced, no extra cleaning operation is necessary. However, if the process water goes to drain, it must be clean, and the degree of cleanliness must follow government regulations.

- **Which process water treatment system is most suitable for which finishing applications.**
- **What needs to be done to fulfill the requirements of individual customers.**
- **What steps need to be taken to ensure environmental protection.**

Process water recycling: A proven process for many applications

Practically 9 out of 10 mass finishing applications allow process water recycling:

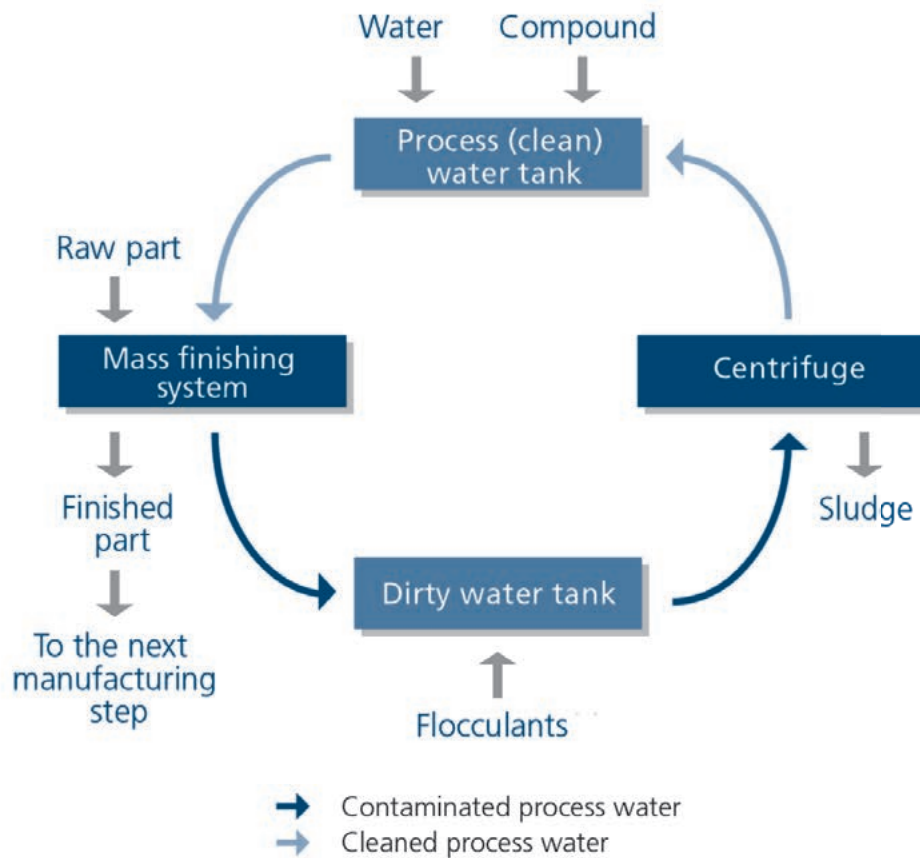
In a closed system the process water is continuously cleaned and then returned to the processing bowl of the mass finishing machine for re-use. The cleaning system consists of a centrifuge that removes all solid contaminants from the process water. This helps not only to drastically reduce the consumption of valuable water resources but also allows the re-use of the utilized compounds by up to 90 %. Moreover, the users do not need approval by the water authorities to dump the process water to drain. And finally, because of lower sludge quantities the users also save costs for sludge disposal. All this results in an eco-friendly and cost-efficient operation with, at the same time, excellent surface finishes.



The contaminated process water coming from two rotary vibrators is cleaned and recycled back to the mass finishing operation.

Recycling saves costs

For the above reasons, whenever technically possible, we recommend a process water recycling system. Removal of solids from the process water with centrifuges is a purely mechanical process. This protects the environment and, at the same time, reduces the investment expenses as well as operating and disposal costs.



” Whether it is a closed recycling system or a system to continuously clean and discharge the process water to drain – in both cases the process water is recycled. The flow-through cleaning and disposal system may seem expensive to users because of the perceived “consumption” of fresh water and compounds. However, it is actually quite economical and eco-friendly. In flow-through cleaning and disposal systems the used process water is not “consumed”: It is only used for the finishing operation and, after having undergone a cleaning operation, it is returned to nature with a degree of drinking water.”

Dr. Andreas Funk

Product manager process water management and consumables

THE RESULT:

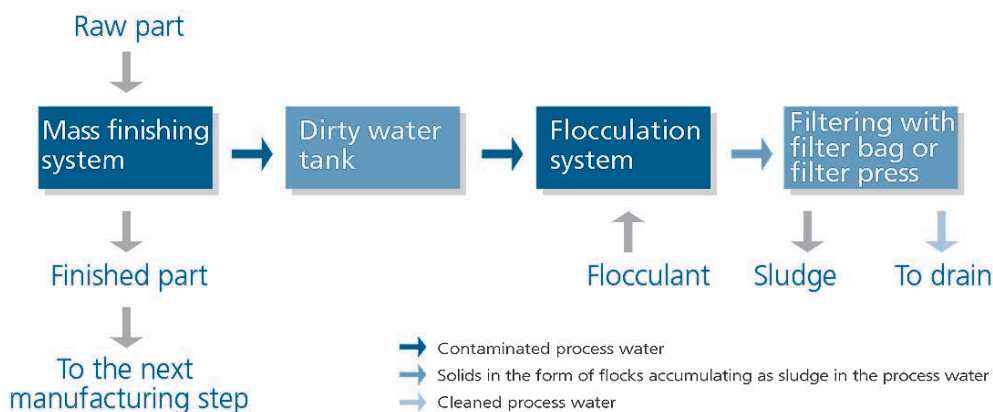
Eco-friendly and cost-efficient operation with, at the same time, excellent surface finishes

Flow-through process water cleaning and disposal: For special finishing applications

Whenever

- the surface of the finished work pieces must be exceptionally clean,
- different compounds are used in multi-step finishing operations,
- special pastes are used for polishing operations,

the continuous cleaning and disposal method – the flocculation of the dirty process water and sending the cleaned water to drain – is the best, safest and most cost-efficient alternative.



After coming from the finishing machine the dirty process water undergoes a cleaning process that includes a flocculation and filtering operation. It leaves the treatment system absolutely clean and, since it fully complies with legal cleanliness standards, it can be sent to drain.

Multiple steps in one single process

Since with flow-through cleaning and disposal systems the process water is passing through the mass finishing machine only one time, the water characteristics – for example, foaming or cleaning effect – can be individually controlled for practically every single work piece batch. Moreover, the consumption of cleaning compounds and other additives is lower.

The flow-through cleaning mode also allows the use of different compounds for different finishing stages in the same mass finishing machine. Thus, the finishing process can be operated with the compounds that are most suitable for the respective finishing task.

Example: In a first step the work pieces undergo a smoothing operation with grinding media and a suitable compound. In a second step the work pieces are then polished to a mirror finish with polishing media and a special paste.

Guaranteed compliance with operational audits

Flow-through cleaning and disposal systems are also the preferred choice, whenever customers must comply with especially stringent demands for process safety: The fresh water from the public water network has the same quality and temperature, day-in and day-out. Therefore, the finishing process always runs with the same operational characteristics. This helps prevent any process fluctuations – a very important aspect, for example for operational audits

Top priority – environmental protection

Initially, some users felt that, with its apparently high “use” of fresh water and compounds, the flow-through cleaning system was very expensive. However, in fact it is as cost-efficient as a recycling system. The used water is not really “consumed”! It is only used for the finishing operation and then returned to its natural environment in drinking water quality.

In both systems – recycling or flow-through mode – the process water is re-used, either in a closed recycling loop or by discharging it to drain in drinking water quality. In either case the environment is the winner.

Free of microplastics

In recycling systems the process water remains in a closed loop. Whenever the recycling water must be replaced, its professional disposal ensures that no micro particles can escape into the environment.

The same is true for flow-through cleaning systems. Since all particles are collected during the flocculation process, separated from the clear water in the filtration unit and then disposed professionally, no micro particles can get into the environment.

In flow-through treatment systems the contaminated process water from mass finishing operations is flocculated and filtered.



Centrifuges – purely mechanical cleaning

Basket centrifuges have a space-saving, compact design and run semi-automatically.



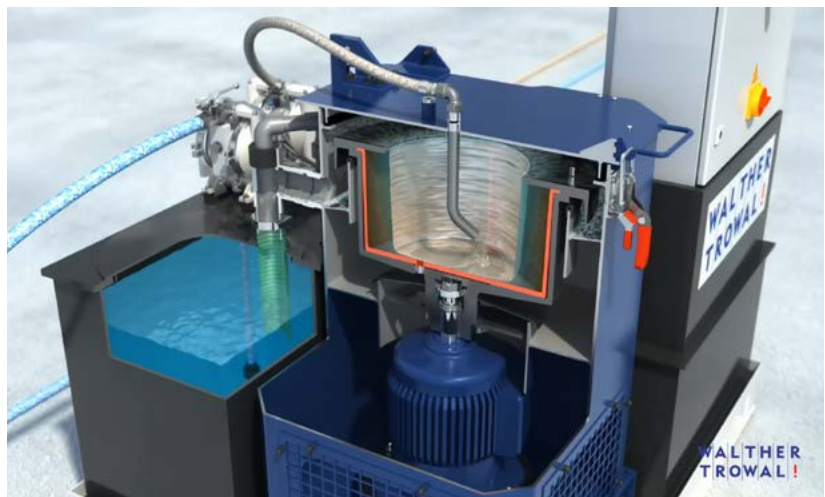
The centrifuges in process water recycling systems are separating solids from the water with centrifugal force that is equivalent to two thousand times of the earth's acceleration. The solid particles are deposited on the inside wall of the rotating drum. The now clean water/compound mixture is returned to the processing bowl of the mass finishing machine ... a typical recycling operation!

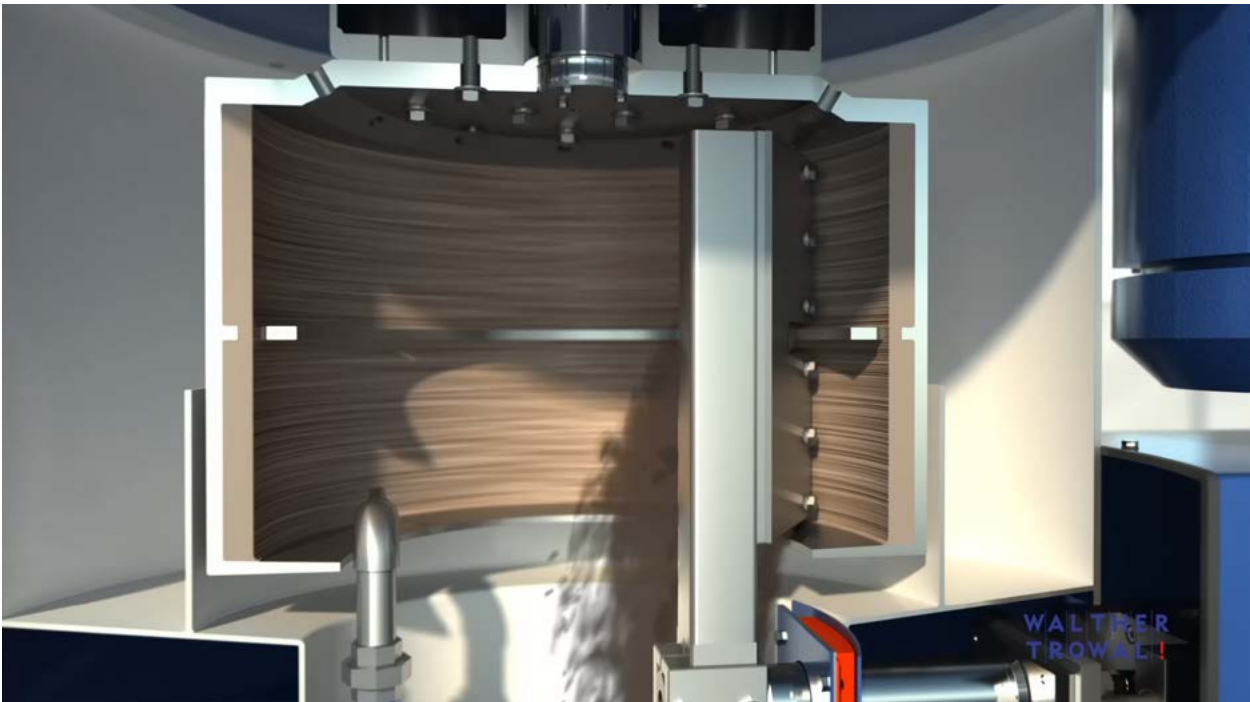
The centrifugal water cleaning technology represents convincing proof that environmental protection can reduce operational costs. By switching from flow-through cleaning to recycling mode with centrifuges the users will reduce their compound consumption by up to 80 % and their water usage by up to 98 %.

A simple process that requires no special knowledge

Centrifugal cleaning of liquids is a straightforward, simple mechanical technology that does not demand any special chemical knowledge. The centrifuge is simply turned on and off – that is all. Once the recycling operation has been calibrated during the commissioning phase, the process parameters remain constant. This guarantees a very high degree of process stability.

The centrifugal force of the rotating drum deposits the sludge on the wall of the drum insert. The cleaned process water is returned to the mass finishing equipment.





Sludge removal – by hand or automatically?

In basket centrifuges the sludge is collected in the rotating basket. Once the basket is full, it is manually removed and emptied, and a new basket is inserted. This is very cost-efficient in cases with small sludge quantities where relatively few basket changes are required. In many mass finishing applications the sludge generated in a month fits easily into one single big bag.

For applications generating larger sludge quantities so-called peeling centrifuges are recommended. In these systems the sludge is automatically peeled from the drum wall at preset time intervals and dumped into a movable high-volume sludge container that only needs to be emptied infrequently.

In so-called peeling centrifuges the sludge is automatically scraped from the wall of the rotating drum and discharged.

The limits of the centrifugal cleaning technology

Of course, centrifugal cleaning and recycling cannot be used for every mass finishing application. In some processes the process water cannot be re-used. For example, in pickling operations with acidic compounds it is difficult to maintain a constant pH-value. In such cases the process water always contains substances like acids, additives and residual soap, which are extremely difficult to control. This makes the precise, targeted compound replenishment practically impossible. For such complicated processes a flow-through cleaning system with a continuous flow of fresh water is recommended.

The same applies to multi-stage processes where different compounds are used for the various process stages. In such instances the process water must be cleaned with a flocculation system and then discharged to drain. A good example of such a multi-stage process is the high gloss polishing of automotive wheels.



In PLC controlled flocculation systems up to 3,000 liters of process water can be cleaned per hour.

Chemical water treatment systems – crystal clear results

In flow-through cleaning systems only fresh water is used for the finishing operation. The process water coming from the finishing machine, now contaminated with residual compound, media and metal fines, etc., is cleaned in a chemical water treatment system. Such systems operate fully automatically. For example, batches of “dirty” water can also be cleaned during the night.

Flocculation systems

In a first step the process water is pumped into a flocculation unit. There, specially developed Trowalpur flocculation compounds are added combining the solid particles, oil and grease into larger “flocs”. Moreover, if present, chelated metals are also removed from the water. After a short while the flocs are floating to the bottom of the flocculation tank.

Upon completion of the flocculation process the crystal-clear water in the upper portion of the tank is so clean that – after a final control of the pH value – it can be discharged to drain in full compliance with all legal requirements.

A major technical characteristic of the Walther Trowal water treatment systems is their clear water drain. Compared to conventional treatment systems it substantially reduces the time for the cleaning operation, because only a portion of the cleaned water must pass through the chamber filter press.

The design feature, allowing the early clear water discharge, includes a "cone hat". This is a cone that separates the sludge collection section in the tank from the clear water section. It prevents the mixing of sludge and clear water when the pump is running.

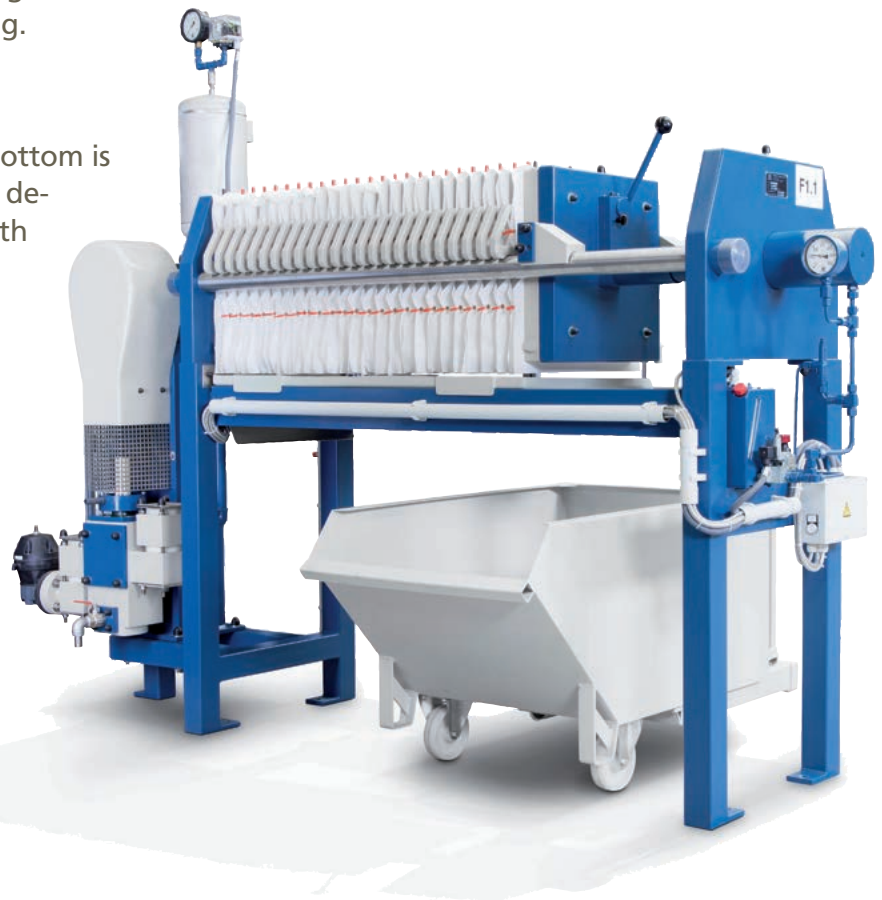
Filter presses

The sludge that collects at the tank bottom is pumped to a chamber filter press for de-watering. The resulting filter cake with low residual water content can be disposed of as non-hazardous waste or recycled. The filtered, now clean water is discharged to drain.

Example

Initially, a user, operating several mass finishing machines, was utilizing a process water recycling system. This represented the most economical water handling for the work piece range at the time the recycling system was purchased. Over time, with a growing work piece spectrum and stricter work piece cleanliness specifications, the change to a flow-through system with fresh water proved to be technically advantageous, more flexible and more cost-efficient.

Today all of the user's 20 mass finishing machines are connected to one single flocculation system that cleans up to 70 m³ of process water per day. A major feature of the treatment system is the "cone hat", a cone that separates the sludge collection section of the tank from the clear water section. Compared to conventional treatment systems it substantially reduces the time for the cleaning operation, because only a portion of the cleaned water must pass through the chamber filter press.



Chamber filter presses are removing a large portion of the water from the sludge. The cleaned water is discharged to drain, and the de-watered sludge is disposed of.



Compounds support the finishing operation. At the same time they have a cleaning, degreasing and corrosion protection function.

The compounds – for everyday and special applications

Walther Trowal offers a broad range of soap-free compounds that were specially developed for mass finishing applications. Based on non-ionic surfactants, these compounds are increasingly used in process water recycling operations. Contrary to soap-based compounds their function is not affected by the water hardness – an important aspect for process stability and ease of operation. They can be universally used, create very little foam and do not contain secondary amines or other hazardous substances.

Trowal offers all-round compounds for use with work pieces made from different materials as well as compounds that were developed for special finishing applications. For example, there are compounds that remove oil and grease from the work piece surface or provide special corrosion protection. Other compounds are specifically used for non-ferrous die-castings or for generating bright and shiny surface finishes.

Grinding & polishing media, as well as compounds, are all developed and produced in-house.

Among other services the Walther Trowal application engineers support their customers by running processing trials to determine the most suitable compounds for their mass finishing operations.



Waste disposal – easy and economical

Process water recycling systems demand a minimum of disposal efforts. The process water remains in a closed loop, nothing must be discharged to drain. Of course, some of the water evaporates or is carried out with the work pieces. But these losses amount to just a few liters per week and can be easily replenished with automatic dosing systems.

The utilized compound does not evaporate and remains more or less completely in the recycling loop. A small portion of the compound/water mix is carried out with the work pieces. Such minimal losses are automatically replenished from time to time.

The sludge generated in recycling and flow-through systems must be disposed of in compliance with legal requirements. Essentially the sludge consists of media fines, metal ions, colloids, fines from the work pieces and, occasionally, debris from burs, gates and risers and other contaminants. Frequently, the sludge also contains oil removed from the work piece surface.

Walther Trowal collects the sludge from its customers in Germany and disposes of it in an eco-friendly manner. Therefore, according to the guiding principle "Recycling before polluting the environment" we make a valuable contribution towards environmental protection. Since we are licensed as a responsible disposal company, transporting the sludge from the customer site to our facility in Haan requires no special transport permits.



Walther Trowal disposes of, respectively, recycles the sludge from mass finishing operations in an eco-friendly manner.



In our test & training center we run processing trials with the work pieces from our customers and conduct training seminars for users of the mass finishing and shot blasting technology.

How to get help with particularly challenging finishing tasks?

In such cases our customers can rely on the support of our experts in Haan. For most finishing applications they have developed solutions that allow the cleaning and recycling of the process water by centrifuge. As needed, they analyze process water samples from the customers to finetune the entire finishing process.

Whenever the parameters of a finishing operation are changing, for example, because of an altered work piece spectrum or a different finishing process, the users can contact the experts at Walther Trowal. They recalibrate and finetune the recycling system to the changed parameters. With the annual maintenance of the centrifuges per accident prevention regulations we also offer a regular customer service per prevailing legal requirements.

ABOUT WALTHER TROWAL

Since 1931 Walther Trowal has been developing and producing systems for the refinement of surfaces. Initially focusing exclusively on mass finishing – the term “Trowalizing” originated from the company’s cable address “Trommel Walther” – Walther Trowal has continuously expanded its product portfolio.

Over time the company has developed a broad range of machinery and systems for mass finishing, shot blasting and coating of mass-produced small components.

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