Checklist for Optimising the Energy Efficiency of Cleaning Systems

Fachverband industrielle Teilereinigung e.V. (FiT)
Hauptstraße 7
72639 Neuffen | Germany
Email: info@fit-online.org
Internet: www.fit-online.org

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Application of the checklist

The topic of energy efficiency is omnipresent in industrial settings and is becoming increasingly important in cleaning technology as well. Numerous users have recognised that energy consumption plays a very important role in the operating costs of a system. The increasing focus on total service life costs is therefore prompting a rethink. Users are increasingly willing to pay higher acquisition costs to ensure that the energy efficiency of their systems is optimised. This trend is becoming even more important due to efforts to improve carbon footprints.

The primary objective of cleaning technology is to establish the necessary cleanliness of parts. Hence, the optimisation of cleaning systems in regard to energy efficiency must not be at the expense of the required quality. All manufacturing steps must be taken into consideration for the optimised use of input energies.

This checklist focuses exclusively on the cleaning system. Firstly, it provides information about important aspects that must be considered for new acquisitions. Secondly, it indicates opportunities for optimising the energy efficiency of current systems. It is not always purposeful to make full use of all potential as indicated. Costs and benefits must be considered on a case-by-case basis. Amortisation periods may occasionally be very protracted.

New acquisition of systems

The greatest effect can be achieved by selecting the most suitable cleaning process and optimised system size/features. Correct system scaling and the associated low idle times are essential factors in economical and energy-efficient cleaning processes.

The software should enable the scheduling of shutdowns to accommodate idle times: Start-up times and turn-off delays for the dryer, bath and distillation heating The software will ideally include a stand-by concept that switches units on and off, depending on the restart schedule.

Miscellaneous

- Information concerning the average energy consumption can only be compared to a reference program running with the same equipment
- Make sure that energy meters are fitted
- Make sure that water meters are fitted

Pumps and auxiliary drives

- At present, the use of energy-efficient IE-3/IE-4 motors only delivers a small return on investment
- as the cycle times for the cleaning programs are usually too short to compensate the high-energy start-up phase of the efficient motors. Delivery times are also long. The pump and unit suppliers carry the legal responsibility in this regard, and many of them have not yet made the switch.
- Power adjustment for the main flow pumps and vacuum pumps, e.g. by means of frequency converters or pole-changing motors
- Optimisation of start-up times and turn-off delays for unit, e.g. the hot air drying or
- vacuum pumps
- Software modifications to adjust the power for bath care measures, depending on
- capacity utilisation of the system

Pipe installations

- Make sure that nominal diameters of pipe installations are scaled correctly. Larger pipe cross sections reduce the flow speed to a lesser extent and therefore require lower pump power and therefore less energy.

Cleaning programs

- Optimisation of process times
- Optimisation of treatment temperatures with due consideration of downstream drying. It must be noted that only a heated part can be dried efficiently and that this part should be heated using the liquid due to the improved heat transfer.
- Smart stand-by scheduling
- Intermediate rinsing at reduced temperatures to keep evaporation losses low.
- Adjustable power for distillation in solvent systems
- Installation of a weekly time activation clock that is easy to program

Insulation

- Insulate pipe installations, except where radiation losses are preferably used for cooling
- (e.g. in solvent systems).
- A great deal of energy escapes with rising water vapour, so measures are recommended
- to reduce the functional surfaces, e.g. use of bogies with sealing capabilities
- Complete insulation of system sections carrying heat and cold is purposeful (e.g. 20 mm to
- approx. 40 mm insulation layer at 60°C)
- Optimisation of energy conservation during downtimes by insulating the treatment baths
- Separation of hot and cold lines/systems

Energy supply and recovery

- Check the use of alternative heating systems for large installations, e.g. gas, combined heat and power, heat pumps, steam generators.
- IInternal energy recovery and heat exchange between media at different temperatures to reduce heating and cooling power. Suitable measures include heat exchangers, as well as treatment and distillation systems with heat recovery.
- Assessment of the available energy for bath heating and cooling.
- System cooling should be designed from the perspective of ensuring the greatest possible energy efficiency
- Consideration of the effects of waste heat from plants, e.g. What happens to the environment?/ Is the environment strongly heated?

Manufacturing chain

- Check: Can intermediate cleaning steps be eliminated or are they necessary from a technical perspective?
- Can pre-cleaning of the parts take place directly at the machining centre to reduce the quantity of dirt entering the cleaning system?
- Inclusion of the expected average energy costs as a factor in the operating costs
- Raise staff awareness for energy consumption in the cleaning systems
- If the parts for cleaning are heated in the pre-process, it is advisable to use this energy, for instance in a directly subsequent cleaning process.

Drying

- Compare energy consumption of vacuum drying versus hot air drying or compressed air drying. Discuss potential alternatives with the system manufacturer.
- Check: Can a steam condenser with active cooling be eliminated? Or can the steam condenser be optimised for use of the condensate in (intermediate) rinsing without significant additional heating?