WEBER ULTRASONICS

CLEANING WITH ULTRASOUND

PaceTec

USER REPORT

RELIABLE ULTRASONIC CLEANING OF GOODS HOLDERS IN CLEAN-ROOM APPLICATIONS

Explosion-protected version of the fully automated cleaning unit for cleanroom applications

EX-PROTECTED ULTRASONIC CLEANING SOLUTION FOR THE PHARMACEUTICAL INDUSTRY

HIGH DEGREE OF PROCESS RELIABILITY AND IMPROVED CLEANING QUALITY THANKS TO SOPHISTICATED SYSTEM DESIGN WITH OPTIMALLY MATCHED ULTRASONIC TECHNOLOGY

Due to the numerous potential contamination risks, a great deal of attention is required when planning a cleaning unit in the pharmaceutical industry. The quality requirements of sector-specific process equipment are strict. Indeed, extremely strict cleanliness and hygiene requirements also apply to production accessories such as goods holders to eliminate any risk of contaminating the sensitive products.

"We can integrate ultrasound control, a process which requires a lot of data to be exchanged, into the HMI of our system via the PROFINET interface. System and process data management can also be simplified via this interface."

Philipp Bauer, Technical Sales, Pace-Tec

REQUIREMENT – FOR IMPROVED CLEANING QUALITY AND PROCESS RELIABILITY IN CLEANROOM APPLICATIONS

Set against this background, a renowned pharmaceutical company with international operations faced the decision of replacing its current goods holder cleaning equipment with a trendsetting solution. During manufacturing, parts of pharmaceutical products are transported in the goods holders, themselves produced from plastic and stainless steel. The first thing to take into consideration during the conceptual design phase was the fact that the cleaning unit would be used in a Class D cleanroom as per GMP guidelines. In addition to this, the system required the use of ethanol and isopropanol as cleaning media, as well as ultrasound equipment. This combination placed special requirements on the explosion protection of the system.

On the lookout for suitable partners for the conceptual design and implementation of the new cleaning system, the global player decided to go with Pace-Tec GmbH. This company, which is based in the South German city of Furtwangen, specializes in custom engineering solutions for wet chemical manufacturing processes. With tailor-made solutions, the machine builder supplies companies from high-tech sectors such as semiconductor and solar technology, medical engineering and the pharmaceutical industry.

SOLUTION – APPROACH TO FULLY AUTOMATED CLEANING PROCESS IN CLEANROOM APPLICATIONS

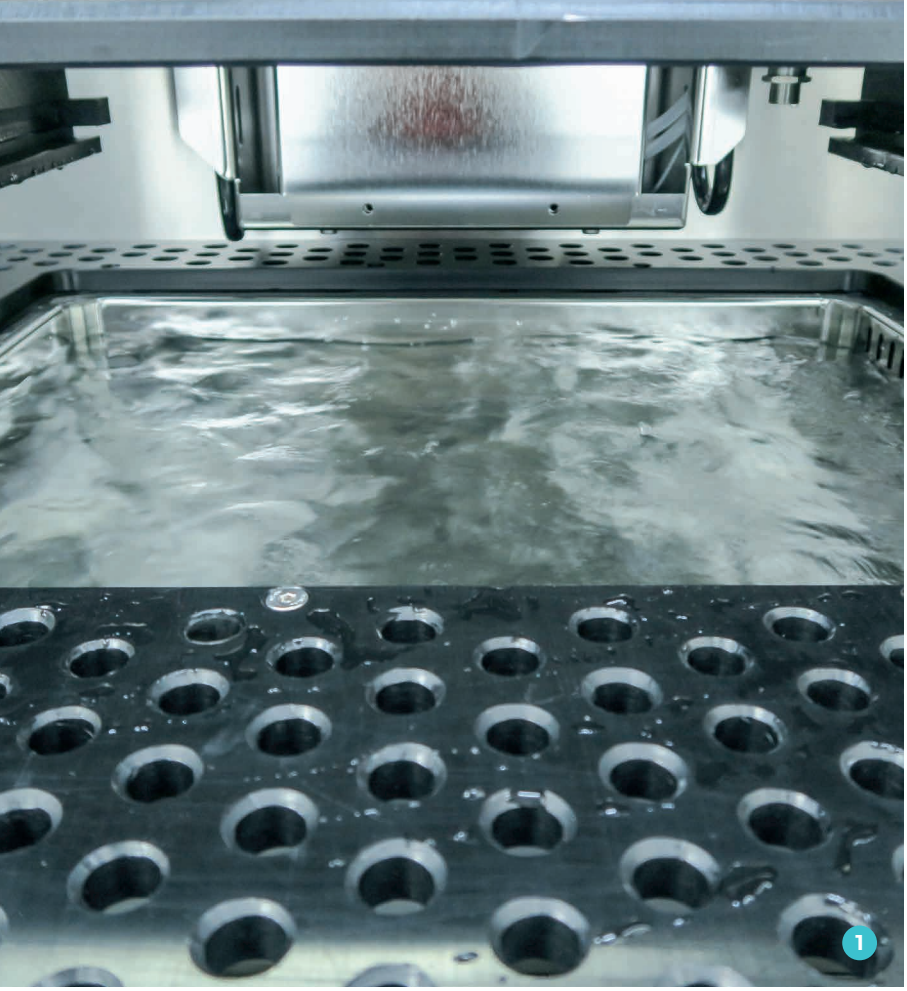
Depending on the size, the goods holders are cleaned as bulk material or set goods. Transport to and from the cleanroom, as well as through the airlock, is automated, while the cleaning unit loading and unloading processes are manual. Once the cleaning program has been selected, the process runs automatically with the defined parameters. In combination with the cleaning media, themselves selected for the specific task at hand, and the media temperature, the perfectly matched ultrasonic components ensure that the requisite cleanliness is achieved stably, quickly and efficiently.

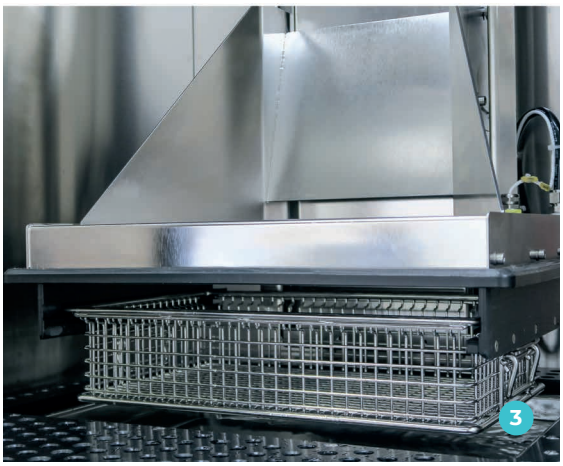
OVERVIEW OF REQUIREMENTS

- **QUALITY:**
  Very strict cleanliness requirements in the pharmaceutical industry
  Cleanroom in line with Class D as per GMP
  Improvement in cleaning quality
- **PROCESS RELIABILITY:**
  Explosion-protected version of the system
  Solvent-based ethanol / isopropanol media in combination with ultrasonic technology
- **PROFITABILITY:**
  High power density in a small space
  Limited tank installation space
- **INTERFACE / INTEGRATION:**
  Control of the ultrasound via the system's HMI

INTELLIGENT DESIGN FOR A HIGH DEGREE OF PROCESS RELIABILITY

The cleaning unit has three stations. Two tanks, each with a volume of around 25 liters, are used for cleaning with the two solvents. Drying is performed in the third station. The geometric design of the system and the intelligent airflow ensure the required explosion





protection. The partial nitrogen purging, as well as the use of suitable sensors and actuators provide additional safety. Both cleaning tanks are equipped with ultrasound. One challenge revolved around the limited installation space of the tanks and, at the same time, the high power density required in this small space.

TAILORED ULTRASONIC TECHNOLOGY

The design of all the ultrasonic technology used was drafted on the basis of the stipulated frequency of 40 kHz and power output of 2,400 W per cleaning station. Some 48 truncated cone transducer elements, each delivering 50 W, were installed on the floor of each tank here. Difficult-to-reach areas were also equipped with elements. Following completion of the first tank, Weber Ultrasonics performed tests at its own test laboratory to ensure that the desired high power density had been reached.

Digital frequency generation and control are performed by two 4th generation SonoPower 3S generators. Extremely homogeneous sound fields are produced thanks to the innovative combination of frequency and amplitude modulation. This leads to a significantly faster and more efficient cleaning process. Consistent ultrasonic output is achieved through use of the SonoScan. This automatically determines the operating frequency without any load and prior to ultrasonic output. It then sets up the system independently, as well as continuously monitoring and automatically adapting the frequency. This means that the system then always works at the most efficient power output, even when operating conditions change, such as temperature fluctuations or media changes. In addition to this, the generators are equipped with an optional PROFINET interface.

The system concept provided by Pace-Tec fulfils all of the pharmaceutical company's requirements and makes an essential contribution to product safety and efficiency in the cleaning process under GMP conditions. Alongside the cleaning medium and the overall concept of the system, the ultrasonic technology makes a key contribution to achieving optimum cleaning results and the desired process reliabilit. ▼▼

CUSTOMER BENEFITS

- **VERY STRICT CLEANLINESS REQUIREMENTS**
  Optimum matching of ultrasound, temperature & cleaning media.
  Cleanroom Class D as per GMP
- **HIGH DEGREE OF PROCESS RELIABILITY THANKS TO FULL AUTOMATION**
  Automatic process flow
  Consistent ultrasonic output
  Explosion protection implemented
- **PROFITABILITY**
  High power output of 2,400 W per tank
  More efficient cleaning processes thanks to homogeneous ultrasound effect
- **CONTROL VIA HMI**
  Using the PROFINET interface on the SonoPower 3S generator

1 Even and dense sound distribution thanks to 48 transducer elements fitted on the floor of the tank.

2 The ultrasonic technology control system is integrated into the HMI of the overall system via the PROFINET interface incorporated in the generator.

3 The goods holders are fed as bulk materials or set goods in the stainless steel basket.

THE ULTRASONIC SYSTEM

INNOVATIVE 4TH GENERATION SONOPOWER 3S GENERATOR SYSTEMS OFFER COMBINED FREQUENCY AND AMPLITUDE MODULATION, THEREBY SECURING MORE EFFICIENT CLEANING PROCESSES

2,400 W
POWER OUTPUT

Scan/sweep/amplitude
PATENT-PENDING FUNCTIONS

40 kHz
FREQUENCY

Profinet
FIELDBUS INTERFACE

Two SonoPower 3S generators in 40 kHz single frequency version equipped with PROFINET interfaces.

Each cleaning tank made available by customers is equipped with 48 ultrasonic elements.

Other designs and models available: Plate and submersible transducers suitable for frequencies up to 250 kHz.

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