

Technical Article

Precision Cleaning of Optical Parts for the Medical Industry

Cleanliness Guarantees a Conclusive Image

In medical endoscopy, a reliable diagnosis depends on clear, detailed imagery of exceptional quality. A decisive factor is the cleanliness of the optical lens systems used. A well-known manufacturer of coated precision optics relies on UCMSmartLine for the final cleaning step. The ultrasonic multi-chamber immersion cleaning system based on standardized modules is connected directly to a cleanroom.

Diagnostic and therapeutic endoscopy has made huge advances in recent years. As a result, enhanced imaging technologies enable exquisitely detailed and razor-sharp insights into the human body. The manufacturing precision and cleanliness of the optical rod lens systems used play a major role in this respect. Exceptional requirements in terms of residual particulate and film-type contamination must be met when cleaning such precision optics prior to their assembly in the cleanroom.

Focus on cleanliness requirements and throughput

The high cleanliness specifications were one criterion that a well-known endoscope manufacturer placed on the new plant for the final cleaning of coated lens systems with a diameter of less than two to ten millimeters and a length ranging between 1.5 and 40 millimeters. Other criteria included the design of the cleaning process and the continued use of existing workpiece carriers. In addition, the new system had to be able to meet annual throughput targets in the upper five-digit range.

Demand-oriented cleaning implemented cost-efficiently

The company opted for UCMSmartLine from the Swiss company UCM AG, the division of the SBS Ecoclean Group which specializes in ultra-fine and precision cleaning. UCMSmartLine is an ultrasonic immersion system with automated parts transport. It is based on standardized, freely configurable modules for washing, rinsing and drying processes as well as loading and unloading. Electronics and control components are integrated into each individual unit, so no extra space is needed for a control cabinet. Compared with custom-designed ultrasonic fine cleaning systems frequently used for this task, the variable modular principle means more cost-effective production and faster system availability.

Extensive trials were carried out in the equipment manufacturer's cleanroom-compliant Technology Centre before the contract was awarded. The focus was on whether the high cleanliness and throughput requirements could be met with this type of system and whether the existing part carriers could still be used.

The chemical side of the process for cleaning the different optical lenses was designed together with the respective manufacturers, as was the water treatment.

Future-oriented equipment for robust cleaning processes

The standard automated transport system for conveying parts through the cleaning line is fitted with a servo drive. An additional roll-over unit enables the part carriers to oscillate vertically at different speeds during the washing, rinsing and drying processes.

To clean the parts, the fully enclosed system has a total of six wet stations with tanks sized 370 x 420 x 390 mm (L x W x H), four of which are fitted with ultrasonics. The two-sided overflow developed by UCM, which comes as standard, further contributes to the consistently good cleaning result: media are introduced from below and transported to the top where they overflow on two sides. This creates a permanent flow that not only promotes intensive treatment of the parts but also makes sure that detached particles and other residues are immediately removed from the baths, thus minimizing the risk of parts becoming recontaminated when they are lifted out or moved. The parts are dried with hot air; and an empty station attached immediately downstream of the dryer can be used if necessary, to integrate a second dryer - infrared, vacuum, or hot air - at a later stage.

Fully automatic cleaning with direct transfer to the cleanroom

The lens systems are automatically placed batch-wise at four positions on the loading station. The appropriate cleaning program stored in the machine controller is selected by scanning a barcode, which in addition contains the article code and order number as well as other information.

The parts are cleaned by ultrasonics in the first and third baths, with the cleaning action being enhanced through rotary movements at around 200 rpm. For the rinsing process in the second and fourth baths, permeate water is used, with the parts oscillating at up to 500 rpm. Likewise, the following two ultra-fine rinsing processes, the first with ultrasonics. Here, deionized water is used, which is cascaded and fed to the water treatment system in the same way as the water from the two previous rinse tanks. After the last rinse, a part-specific lift-out or spinning at up to 1,500 rpm effectively pre-dries the parts before they are advanced to the hot-air dryer, which dries them completely and spotlessly. HEPA filters and two laminar flow boxes above the drying station and the unloading station, which has four spaces, ensure cleanroom-compliant environmental conditions. The precision optics are then discharged directly into a cleanroom with batch information being displayed on an additional control panel. These data are also transmitted to the company's MES via an interface of the PC-based machine controller.



To prevent the coated precision optics from becoming damaged during the cleaning process, in which they are rotated at speeds of up to 1,500 rpm, they are placed in special holders.



The cleaned lens systems are discharged into a cleanroom for full inspection and subsequent assembly.



The machine, which is based on standardized modules for washing, rinsing, and drying, not only meets exceptional cleanliness requirements for final cleaning but is also extremely cost-efficient.



The standard two-sided overflow creates an uninterrupted flow that enhances the intensive treatment of the parts. It also ensures that cleaned-off contaminants are immediately removed from the baths.



The standard integrated transport system with servo drive means that a lift-out device can be installed for pre-drying the parts after the last rinse cycle if desired.

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Photo credit: UCM AG/Ecoclean GmbH

About SBS Ecoclean

The SBS Ecoclean Group develops, produces, and markets forward-looking machinery, systems and services for applications involving industrial parts cleaning and degreasing, ultrasonic precision parts cleaning, high-pressure water jet deburring, surface preparation and surface treatment. Its globally leading solutions help companies around the world in conducting efficient and sustainable manufacturing to high quality standards. The client base comes from a broad range of market sectors like the industrial mass and precision manufacturing, the automotive industry with its suppliers, the aircraft & aerospace industry, medical technology and medical device, optics, and the high-tech and high purity sector. The Group's success is based on innovation, cutting-edge technology, sustainability, closeness to the customer, diversity, and respect. The Group employs a workforce of around 900 at its 12 sites in nine countries worldwide.

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