

# sentenso PeenBots: Machines for Process Excellence

*sentenso PeenBots are highly automated, extremely innovative, and user-friendly air peening systems with nozzles manipulated by robots. Efficient and reliable execution of peening processes on a small footprint and with full process control are the core features of the new design.*

**SENTENSO IN GERMANY** has been providing products and solutions for process and quality management in shot peening for more than a decade now. New concepts and technologies for lean, energy-saving and clean peening processes allow for increased efficiency, resource conservation and operational safety. With the development of the new PeenBots, sentenso has put its focus on excellent controllability and reliability in the shot peening process, featuring flux:on Media Flow Management, vector:on Media Speed Management and offline robot programming tools.



Figure 2: Lean Peening of a spring curl

programmable peening nozzle motion and intelligent system control. The PeenBot thus allows lean, fast and yet fully controlled processes with perfect consistency and efficiency.

This opens up a wide field of efficient, cost- and time-optimised process control without, however, restricting flexibility in the process. This orientation includes reliable process management for shot peening within tight tolerance limits according to the requirements of the SAE AMS 2432 and beyond.

## PEEN GREEN

Green Peening is the consistent implementation of the commitment to reduce energy and resource consumption to the necessary minimum. To achieve this, process and machine technology for media acceleration and control must be rethought instead of just uncovering potential savings. Thus, downsizing is a basic principle of the system and process design for the economical use of resources such as compressed air, electricity and peening media.

This ensures an efficient, cost-optimised peening process. In addition, the PeenBots are individually adaptable, flexible in their installation and, due to their small footprint, use the valuable resource of installation space extremely efficiently.



Figure 1: The new PeenBot design

Based on the approaches above, several basic principles of advanced shot peening technology can be implemented.

## PEEN LEAN

Lean Peening is one of the most important targets in modern peening process management. To implement this principle of optimised process management, the PeenBot process technology is based on an efficient peening system, flexible



Figure 3: Efficient peening with specified nozzles and peening media



Figure 4: Peening of a turbine disk

### PEEN CLEAN

Clean Peening is the concept for ensuring a safe working environment for the system operators, peened components that are as clean as possible, and a peening cabinet largely free of deposits of media grains and dust. The exhaust air from the machine can be returned to the workshop without any worries thanks to the integrated HEPA secondary filter.

This means that PeenBots can be easily integrated into a wide range of production environments.

### PEEN SMART

Smart Peening offers the latest Industry 4.0 technologies for digital process management, providing the capture, collection and evaluation of process data for the digital twin of the peened component. From the data, further information can be obtained for effective machine management, including predictive maintenance.

In this way, senso PeenBots meet all of today's requirements for flexible system operation. Production can be a quantity of one, or a small or large series. In any case, processes are managed variably, reproducibly, and with the required traceability.

The smart peening features incorporate some of the most advanced systems to control the key parameters for shot peening, media flow rate and media velocity.

### FLUX:ON MEDIA FLOW MANAGEMENT

As one of the essential process parameters, the media flow rate for all nozzles of a shot peening system must be kept within close tolerances. The sensors and control valves available for this purpose must be adjusted and calibrated to the respective media types.

With flux: on, senso offers a reliable solution for process management of the media flow. The system actively meets the biggest challenge of reliable media flow control—the occurrence of systematic measurement errors with system operation in progress. The crucial advantage: changing media properties or changes to the sensor-actuator system are compensated by performing adjustment and calibration procedures directly on the system. These can be repeated at any time and as often as required.

This system, according to U.S. Patent 10513010 B2 and European Patents, consists of a machine-integrated blast cyclone to directly catch the media coming from the nozzle under real process conditions. The media is separated from the air flow and drops into a weighing bin below the machine cabinet. In here the media flow rate is continuously monitored during the testing cycle. The StreamEasy evaluation software takes care of the correlation between flow sensor data and real flow rate measurements and will thus automatically perform the sensor adjustment. The additional calibration procedure will bring out the system tolerances and document these in a calibration certificate.

The entire adjustment and calibration procedure runs completely automatically and usually requires no intervention by the operator. These procedures can be called up at any time and thus ensure maximum process reliability in media flow management.

### VECTOR:ON MEDIA SPEED MANAGEMENT

The media particle velocity is one other key parameter of the shot peening process which cannot be controlled directly. Instead, the operator has to adjust the peening pressure to any value that corresponds with a certain media impact and



Figure 5: flux:on system components



Figure 6: vector:on system components

thus the Intensity of the media stream. The problem is that peening pressure cannot remain constant as blast hoses and nozzles wear out. Pressure is not a fixed parameter to define the kinetic media energy.

vector:on is a control system which, with the aid of a high-speed camera, a high-power LED illumination unit and the associated sentenso VelocityEasy evaluation software, generates characteristic correlation curves of media velocities depending on different peening pressure settings fully automatically. In this adjustment procedure the respective curves are being stored in the system control.

In the normal peening process, a PLC then takes over the setting of the peening pressure required for the desired media velocity—taking the media flow rate into account, which also influences the media acceleration in the nozzle. All components are integrated into the shot peening machine.

Thus the adjustment and calibration can be performed live and directly at the peening machine and under real operating conditions and are repeatable at any time.

### **FLEXIBILITY AND MODULAR DESIGN**

sentenso PeenBots' modular principle allows for an extreme range of system variants without unnecessarily extending the engineering effort. In particular, equipment features such as size, arrangement and design of windows and doors, robot arrangements and types, design of the peening system, component handling, loading and unloading can be varied according to the users' preferences and requirements.

Offline programming tools avoid ongoing teaching procedures and can extremely reduce the time to process, especially for changing part geometries. Control systems can be kept simple or with extended functions for the highest requirements.

For more information and a product video, please scan the QR code or go to [https://www.sentenso.com/en/Machine-Technology/Compressed-Air-Peening-Machines/Robot-Peening-Machines/PeenBot.html?force\\_sid=17cnek0prc87knrfgka2rc2107](https://www.sentenso.com/en/Machine-Technology/Compressed-Air-Peening-Machines/Robot-Peening-Machines/PeenBot.html?force_sid=17cnek0prc87knrfgka2rc2107).



Figure 7: PeenBot design flexibility