

sentenso PeenBots

Advanced Peening Technology



PeenBot

PeenBot

 **sentenso**
Smart Peening Solutions

sentenso PeenBots – Advanced Peening Technology

sentenso PeenBots are highly automated, extremely innovative and user-friendly air peening systems with nozzles manipulated by robots. PeenBots represent the logical transformation of our experience from 15 years of process engineering practice and customer-oriented product development. Our best ideas, products and systems have been incorporated into a machine concept that is not oriented towards the improvement of known designs, but rather pursues approaches that are actually obvious - the uncompromising control of all process-related variables, the concentration of the system technology on what is necessary, as well as flexible, repeatable and, if desired, offline programmable movements of the nozzles.

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

PeenLean
Lean Process Management

PeenGreen
Resource-Saving Machine Technology

PeenClean
Clean and Safe Machine Operation

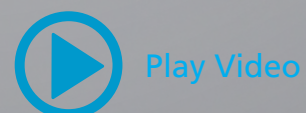
In addition, the latest Industry 4.0 technologies are used for digital process management, which provides the recording, collection and evaluation of process data for the digital twin of the peened component. The data can be used to obtain further information for effective machine management, including predictive maintenance.

PeenSmart
Advanced Peening Process Management



sentenso PeenBots – Smart Peening

New concepts and technologies for lean, energy-saving and clean peening processes allow for increased efficiency, resource conservation and operational safety.



PeenSmart

Lean Process Management

Lean peening is the latest trend in modern peening process management. To implement this principle of optimised process management, the PeenBot process technology is based on an innovative peening system, a flexibly programmable nozzle path and an intelligent system control. The PeenBot thus allows lean, fast and yet fully controlled processes with perfect consistency and efficiency:

- Scalable **peening system** with full control of compressed air and media flow, optionally with particle speed measurement via high-speed camera and VelocityEasy evaluation software, vector:on Media Speed Management or flux:on Media Flow Management.
- Latest **robot technology** from various manufacturers, optionally with rotary table and integration as a seventh robot axis, offline programming of nozzle paths and peening sequences or vision system for recognition of part and position.
- Innovative system control with intuitive and clearly arranged **user interface**, sequentially programmable process control and Intensity development with IntensityEasy evaluation software, optionally with remote function and long-term data storage.

This opens up a wide field of efficient, cost- and time-optimised process control without, however, restricting flexibility in the process.

sentenso PeenBots are predestined for lean peening processes.
Reliable process management for full control of all process parameters and shot peening within tight tolerances, compliant with SAE AMS 2432.



Resource-saving Machine Technology

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 should be rethought, instead of just identifying potential savings. With the PeenBot, this is mainly achieved by:

- Application-oriented use of efficient, low-wear and optionally flow-optimised **peening nozzles** with pressure and air flow monitoring, special geometries for hard-to-reach component areas, optionally with automatic nozzle change.
- Minimisation of **compressed air consumption** achieved by short air paths and small air volumes, differential-pressure-controlled cartridge cleaning as well as use of high-quality piping and sealing technology.
- Minimisation of **power consumption** achieved by ventilation of peening cabinet as demanded and energy-saving, speed-controlled fan, plus energy monitoring as a standard with recording and analysis of compressed air and power consumption.

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.

sentenso PeenBots enable energy-saving peening processes.

Downsizing as a basic principle of machine and process design for the economical use of resources such as compressed air, electricity and peening media.



Clean and Safe Machine Operation

Clean peening is the concept of ensuring a safe working environment for the machine operators, peened components as clean as possible and a peening cabinet that avoids deposits of media particles and dust:

- Minimisation of **dust emissions** achieved by optimised airflow in the peening cabinet avoiding dust deposits on peened components and cabinet surfaces as well as dust leakage, incorporating a secondary HEPA filter for exhaust air recirculation into the workshop.
- **Cleanliness** and safety in the peening process achieved by efficient removal of dust and particles, permanent view into the cabinet through its fabric-protected door window, effective LED lighting as well as a precise undersize media separation with electronical fine adjustment of air flow, optionally with media sieving.
- Distinct **occupational safety** due to safety-oriented system control, ergonomic system design, avoidance of slip hazards from particles escaping when opening the doors, filter system with earthed cartridges made of conductive filter fleece as well as effective sound insulation.

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



sentenso PeenBots allow clean and safe peening processes.
Effective machine technology for the cleanliness of peened components and operation as well as for the health protection of the employees.

Advanced Peening Process Management

sentenso PeenBots stand for intelligent peening processes. These come along with the digital recording of all process data synchronously with the process sequence for systematic and component-related documentation.

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.

- Systematic digital recording of all available **sensor data**, in particular air pressure, air flow rate, media flow rate, plus data of all movements and drives as well as status messages of all machine components.
- Mapping of the digital database in a **digital twin** of the peened component, including documentation of all individual peening sequences, output of a process documentation in accordance with the aviation standards SAE AMS 2430 and 2432.
- Digital **process data management** for machine diagnosis and predictive maintenance, and in future also using artificial intelligence (AI) for process analysis, optimised process control and automated process development.

In this way, sentenso PeenBots meet all of today's requirements for flexible system operation. Production in quantity 1, small or large series - peening processes are processed variably, reproducibly and traceably.

Target Functions of Industry 4.0

Traceability

Documentation of the peening process to enable complete data recording of peened components

Predictive Maintenance

Projection of maintenance requirements

Cause and Effect Chain Analysis

Obtaining technical correlations between machine behaviour and peening results

sentenso PeenBots stand for intelligent peening processes.

Digital recording of all process data synchronised with the process sequence for systematic and part-related documentation.

Basic Equipment

Scalable sentenso Efficiency Peening System

- Media recirculation with highly efficient vacuum pump or alternative suction systems
- Blast media - air separation with cyclone
- Suction air cleaning with dust class M filter
- Precise undersize media separation with electronically finely adjustable air flow
- Separator air cleaning with dust class M filter
- Peening media supply above the blast pot
- Suitably sized blast pot with optimised outlet and level monitoring
- Compressed air quality of classes 1:4:2
- Scalable in terms of peening media, number of nozzles, nozzle size and media flow rate

Peening Cabinet

- Peening cabinet in a sturdy steel frame and panel construction
- Low-joint and drain-compatible design of interior geometry, doors and fixtures to minimise particle deposits
- Permanent view through two fabric-protected door windows and non-blinding LED lighting
- Effective sound insulation system for sound reduction to below 78 dB(A)
- (Comparative value for typical peening application with round steel medium, diameter 0.6 mm, cylindrical peening nozzle, diameter 6 mm and peening pressure 4 bar)

Six-Axis Industrial Robot

- Compact robots from various manufacturers in the required configuration
- Robot control according to manufacturer standards with PROFINET/PROFIsafe connection to the machine control system
- Robot protection sleeve made of 2.5 mm thick, extremely stretchable vulcanised natural rubber with rotary decoupler for the sixth axis
- Prepared robot positions
 - Safe home position
 - Safe waiting position
 - Wizard for setting of Tool Centre Point (TCP)

Peening System Control

- PLC Siemens S7-1500 F (Safety)
- Safety-related machine control, incl. verification and validation
- Modern capacitive touch panel PC
- Attractive and innovative user interface
- Workpiece-related process data acquisition and archiving (process data log, digital twin)
- Process data monitoring and documentation compliant to standards SAE AMS 2432
- Definable switch-off conditions when process limit values are undercut/exceeded
- Intensity development with IntensityEasy evaluation software
- Sequential/cyclic programming wizard for peening parameters and robot movements
- Preventive Maintenance Assistant
- Remote access via Virtual Private Network (VPN)

Basic Equipment / Options

Dust Collector for Peening Cabinet

- Speed-controlled filter fan for dust extraction from the peening cabinet as required
- Grounded filter cartridges of dust class M with conductive filter fleece as well as secondary HEPA filter for exhaust air recirculation into the workshop
- Compressed air control and air flow monitoring for each peening nozzle

Process Equipment

- Peening media supply with inductive/electromagnetic, alternatively capacitive/electropneumatic flow rate control for each peening nozzle
- Compressed air control and air flow monitoring for each peening nozzle

Optional Process Equipment

- Double blast pot for continuous peening
- Second peening system for different peening media (e.g. dual peening)
- Hose crack monitoring outside the peening cabinet
- Screening deck for separation of undersize particles
- Spiral separator for separation of broken grains
- flux:on Media Flow Management with blast cyclone and weighing system for automatic media flow rate measurement as well as adjustment and calibration of the media flow rate control system
- vector:on Media Speed Management with media velocity measurement via high-speed camera and VelocityEasy evaluation software as well as automated pressure adjustment for setting the desired media velocity
- Particle velocity measurement via high-speed camera and VelocityEasy evaluation software
- Workpiece fixtures, clamping system or rotary table as required
- Rotary table with integration as seventh robot axis for synchronised path control
- Endlessly rotating jet nozzle
- Sixth robot axis in hollow shaft design
- Automatic determination of the Tool Centre Point (TCP)
- Automatic jet nozzle exchanging system
- Component identification by code scanner
- Component feed and discharge with automation
- Vision system for part or position recognition
- Online access to machine data via web client

Engineering Package as Required

- Part fixation
- Peening process management
- Peening process simulation
- Robot programming
- Automation of part loading and unloading
- Shop floor planning
- Data preparation
- System integration



Flexibility Enabled by Modular Design

Enabled by the modular principle, **sentenso PeenBots** allow an extreme range of system variants without unnecessarily extending the engineering effort. In particular the following equipment features can be varied according to requirements:

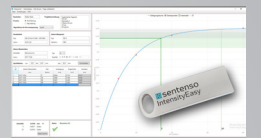
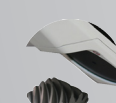
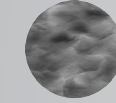
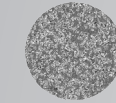
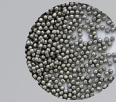
- Width, depth and height of the peening cabinet
- Arrangement and design of windows and doors, e.g. swing door or lift door
- Arrangement and design of workpiece carriers, e.g. holding mandrels or prisms, clamping device, rotary table, satellites etc.
- Arrangement and design of handling devices for nozzle movement, e.g. articulated arm robot, gantry robot or free combination of linear and rotary axes
- Robot manufacturers and robot types
- Automatic peening nozzle exchange
- Scalability of the peening system concerning number of nozzles, peening media and flow rate
- Integration of conveyor technology for workpiece infeed and outfeed



Extensions for Quality Management

The optimised process management of sentenso PeenBots can be extended by flexible measuring systems for quality management after peening, according to specific requirements and with software support:

- Screening and visual inspection of peening media regarding particle size and shape
- Monitoring of shot peening Intensity with Almen measurement devices and technology
- Visual and camera-supported determination of shot peening coverage
- Tactile and microscopic determination of surface topography
- X-ray analysis of hardness variance on the surface
- X-ray analysis of residual stresses, stationary or mobile, in laboratory and production with extended automation functions



About sentenso

Since 2009, sentenso has been providing innovative solutions for process and quality management in shot blasting and shot peening. The targets are systematic, reliable and efficient process control as well as specific, significant and simple quality testing.

Take advantage of our individually adapted product and system solutions to achieve your goals in the areas of process development and peening media, process control and machine technology as well as in measuring and testing technologies.

Secure the sustainability of your investment with our advanced services such as engineering, automation, digitalisation, maintenance and training.



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