# Surface Treatment Sandblasting and Shot Blasting Equipment Technical Solutions

Surface treatment is a critical process in the modern industrial manufacturing system that determines product lifespan, coating adhesion, structural strength, and appearance quality. As the most widely used physical surface treatment methods, sandblasting and shot blasting have become indispensable core equipment in machinery heavy industry, shipbuilding, steel structures, aerospace, rail transit, wind power, automotive, casting, and other industries, thanks to their advantages of stable treatment effects, wide application range, no chemical pollution, and ability to handle both cleaning and strengthening.

With tightening environmental policies, improved production efficiency, and upgraded safety standards, traditional open and simple sandblasting and shot blasting equipment is rapidly upgrading toward enclosed, automated, intelligent, and environmentally integrated directions. Enterprises urgently need a complete, professional, and actionable technical solution during equipment selection, production line planning, process optimization, and environmental transformation.

This solution provides systematic elaboration on the process principles, equipment types, system composition, selection logic, environmental supporting facilities, installation and maintenance, and typical industry applications of sandblasting and shot blasting equipment. It provides enterprises with full-process technical support from single machine configuration to entire line planning, from conventional treatment to special strengthening, from efficient production to environmental compliance, and from equipment selection to long-term maintenance, helping enterprises achieve comprehensive goals of quality improvement, efficiency enhancement, cost reduction, safety, and environmental protection.

## 1. Surface Treatment Process Value and Application Scenarios

Both sandblasting and shot blasting use high-speed moving abrasives to impact and cut workpiece surfaces to achieve functions such as rust removal, oxide scale removal, weld slag cleaning, sand cleaning, deburring, stress relief, and surface roughness improvement. They are standard processes for coating pretreatment, corrosion protection engineering, and structural component strengthening.

After proper treatment, workpiece surfaces can be thoroughly cleaned of impurities, forming uniform and consistent roughness that greatly improves coating adhesion and multiplies corrosion protection lifespan. Shot blasting can also effectively eliminate residual stress from casting, welding, and forging, improving workpiece fatigue resistance and structural reliability and extending the service life of key components.

Both processes adapt to most metal materials and structural forms. From small standard parts and precision castings to large wind power towers, ship hull sections, and heavy steel structures, stable treatment can be achieved through corresponding equipment. Against the backdrop of increasingly stringent environmental requirements, enclosed operations, abrasive recycling, and centralized dust purification have become industry standards, ensuring both production efficiency and compliance with occupational health and emission requirements.

## 2. Sandblasting Equipment Technical Principles and Type Characteristics

Sandblasting uses compressed air as power to eject abrasives at high speed through nozzles onto workpiece surfaces to complete cleaning and roughening. Industrial large-scale production widely uses enclosed sandblasting rooms with automatic abrasive recovery and dust removal systems to achieve continuous, environmental, and stable operations.

According to abrasive recovery methods, sandblasting systems can be divided into two main types: mechanical recovery and pneumatic recovery. Mechanical recovery uses belts, scrapers, and other mechanisms to collect, convey, screen, and circulate abrasives with high processing efficiency and stable operation, suitable for medium and large workpieces and continuous production scenarios. Pneumatic recovery relies on negative pressure pneumatic conveying for abrasive circulation with simple structure and convenient maintenance at moderate investment, suitable for small and medium workpieces and multi-variety, small-batch operations.

Sandblast room main bodies use welded steel frame structures with sealed protective structures. Interior lighting, observation windows, wear-resistant lining, and safety interlocks ensure operational safety and equipment durability. Systems

can be equipped with manual spray guns and mechanical arm automatic spray guns to meet both conventional treatment and precision touch-up needs. Abrasives can select steel grit, steel shot, quartz sand, emery, ceramic sand, glass beads, etc. Different materials correspond to different surface effects and processing efficiency, flexibly selectable according to workpiece material and process requirements.

## 3. Shot Blasting Equipment Technical Principles and Type Characteristics

Shot blasting uses high-speed rotating shot blasters to generate centrifugal force and forcefully eject steel shots, steel grit, and other abrasives onto workpiece surfaces. With higher treatment intensity and faster efficiency, it is suitable for large-batch, continuous, and automated production lines. As a core component, shot blasters use high-wear-resistant materials and optimized structures to ensure uniform ejection force, reasonable energy consumption, and stable lifespan.

According to workpiece conveying and carrying forms, commonly used industrial shot blasting equipment can be divided into hook type, crawler type, roller conveyor type, overhead chain type, and turntable type. Hook type is suitable for box parts, welded parts, and special-shaped parts with multi-angle flipping treatment and comprehensive coverage without dead angles. Crawler type is suitable for small castings, forgings, and standard parts with automatic tumbling, uniform treatment, and automatic unloading, suitable for batch continuous production. Roller conveyor type is specifically designed for steel plates, section steel, and steel structural parts. Workpieces pass through at uniform speed with multiple shot blasters operating simultaneously for high treatment efficiency and good surface consistency. Overhead chain type is suitable for pipeline-scale production. Loading, unloading, and shot blasting proceed simultaneously with stable rhythm, widely used in automotive parts and construction machinery accessories manufacturing scenarios.

Shot blasting systems are all equipped with complete abrasive circulation, screening, and purification devices that separate broken abrasives from dust, ensuring clean and uniform abrasives entering shot blasters to improve treatment quality and reduce consumable loss. Supporting dust removal systems can collect operational dust in real-time to achieve workshop cleanliness and emission compliance.

# 4. Complete Equipment System Composition and Configuration Key Points

Sandblasting and shot blasting equipment are not single main units but complete systems integrating operation rooms, conveying and carrying systems, power execution, abrasive circulation, screening and purification, dust removal and environmental protection, intelligent control, and safety protection. Reasonable configuration directly determines treatment effects, production efficiency, operating costs, and environmental compliance.

Room structures use high-strength welded steel with strong sealing and sound insulation, internally lined with high-wear-resistant plates to withstand continuous abrasive impact and extend equipment service life. Observation windows, lighting, maintenance doors, and safety interlocks ensure operational convenience and operational safety.

Conveying and carrying systems are customized according to workpiece dimensions, weight, and production rhythm. Hooks, chains, rollers, crawlers, and trolleys come in various forms to ensure smooth workpiece entry and exit, precise positioning, and stable operation.

Abrasive circulation systems are responsible for collecting, lifting, conveying, screening, and purifying abrasives, removing broken particles and dust impurities to ensure recycled abrasives have qualified particle size and cleanliness, stabilizing treatment quality and reducing loss.

Dust removal systems are core for environmental compliance operation, typically selecting cartridge or bag filters for efficient purification of high-concentration dust. Equipped with pulse automatic ash cleaning and dust collection and unloading devices, they achieve stable operation and convenient maintenance. Equipment can be arranged indoors or outdoors to flexibly adapt to site spatial conditions.

Electrical control systems use PLC and touch screen operation with functions of automatic operation, manual debugging, fault diagnosis, safety protection, and energy consumption monitoring. They can achieve one-key start-stop, automatic cycling, and abnormal alarms, improving equipment intelligence level and reducing manual operation intensity.y

# 5. Equipment Selection Logic and Solution Planning Principles

Selection of sandblasting and shot blasting equipment requires comprehensive consideration of workpiece characteristics, process requirements, production efficiency, site conditions, environmental and safety standards, and other multi-dimensional factors to ensure precise adaptation and economic rationality.

Workpiece size and weight determine equipment effective space and carrying capacity. Large components need large-size sandblast rooms or pass-through shot blasting machines. Small accessories can use compact single machine equipment. Workpiece material and shape affect process selection. Complex special-shaped parts are suitable for sandblasting or hook-type shot blasting. Regular plate and section materials are suitable for roller conveyor type shot blasting. Batch small parts are suitable for crawler-type shot blasting.

Treatment requirements determine process parameters. For simple rust and oxide scale removal, conventional configuration can be used. For surface strengthening and stress relief, ejection force and treatment time need to be increased. For precision parts, mild sandblasting processes are selected. Production rhythm and batch determine automation level. Small batches can use semi-automatic equipment. Large-scale pipeline production is recommended to configure fully automatic continuous operation systems to improve efficiency and reduce labor costs.

Environmental protection and safety are essential elements of modern equipment. Enclosed structures, efficient dust removal, explosion-proof configuration, noise control, and safety interlocks must all be incorporated into solution planning to ensure compliance with relevant national regulations. Site space, building height, floor bearing capacity, and power and air source conditions also affect equipment layout and installation forms. Reasonable planning can reduce transformation investment and improve space utilization.

## 6. Environmental and Safety Design Specifications

Sandblasting and shot blasting operations are accompanied by dust and noise, making environmental and safety design important parts of equipment solutions. Enclosed structures suppress dust dispersion at the source. Combined with efficient dust removal systems, they achieve dust-free workshops and compliant emissions.

Dust removal systems are reasonably selected according to airflow, concentration, and dust characteristics to ensure purification efficiency and long-term stable operation.

Equipment operational noise is controlled within reasonable ranges through optimized structure, shock absorption, and sound insulation treatment to improve workshop working environment. Safety aspects are equipped with safety door interlocks, emergency stop buttons, overload protection, and limit devices to prevent misoperation risks. Electrical systems have short circuit, overload, phase failure, and overheating protection to ensure continuous production stability and reliability.

For combustible dust environments such as aluminum-magnesium, wood, and chemical powder materials, anti-static filter media, explosion relief devices, spark detection and extinguishing systems, explosion-proof electrical equipment, and reliable grounding can be configured. This comprehensively improves safety levels and meets explosion-proof specification requirements. Abrasive circulation and screening systems can reduce splashing and waste, lower operating costs, and avoid secondary dust dispersion to achieve green production.

## 7. Installation, Commissioning, and Operation Maintenance Key Points

Equipment installation requires standard construction of foundations, positioning and fixation, pipeline connection, and electrical wiring to ensure room sealing, smooth conveying, unobstructed dust removal, and vibration-free operation. During commissioning, empty load testing, abrasive circulation testing, dust removal testing, and linked operation testing are conducted in sequence to gradually optimize parameters and bring the system to optimal treatment status.

Daily maintenance focuses on vulnerable parts such as shot blasters, lining plates, bearings, transmission parts, cartridges, and pulse valves. Regularly check wear conditions and replace promptly. Abrasives need regular replenishment and screening to remove broken particles and impurities and ensure stable treatment effects. Dust removal systems should regularly clean accumulated dust and check ash cleaning mechanisms to ensure normal resistance and non-degrading purification efficiency.

Electrical and control systems should be kept clean and dry to avoid dust intrusion causing faults. Establish equipment maintenance records with regular

maintenance and periodic inspections. This can greatly extend equipment service life, reduce unplanned downtime risks, and ensure continuous and stable production line operation.

## 8. Typical Industry Complete Solutions

In the steel structure and construction engineering field, roller conveyor shot blasting machines or large enclosed sandblast rooms can be configured to efficiently treat section steel, steel plates, grids, and support components, meeting rust removal, roughening, and corrosion protection pretreatment requirements.

The shipbuilding and offshore engineering equipment industry uses large sandblast rooms and dedicated shot blasting equipment to adapt to heavy workpieces such as ship hull sections, hatch components, and deck fittings, meeting high-standard surface pretreatment and long-term corrosion protection requirements.

The construction machinery and automotive manufacturing industry mainly uses hook-type, crawler-type, and overhead chain-type shot blasting machines to achieve batch cleaning and strengthening of excavator components, vehicle frames, castings and forgings, and parts, improving product quality and lifespan.

The casting industry uses shot blasting equipment to complete casting cleaning, rust removal, and deburring, simplifying subsequent processes and improving processing and coating efficiency. High-precision sandblasting and shot blasting systems are used in aerospace, wind power, nuclear energy, and other high-end equipment fields to balance surface quality and stress relief requirements and meet stringent process standards.

Customized complete solutions can be provided for different industries, different workpieces, and different outputs to achieve efficient, stable, environmental, and economic surface treatment goals.

## 9. Technology Development Trends

In the future, sandblasting and shot blasting equipment will continue to upgrade toward automation, intelligence, green development, and energy saving. Automated production lines with robot loading and unloading and automatic spray gun coordinated operations will gradually achieve unmanned production, improving stability and consistency. Intelligent monitoring systems can monitor shot blaster status, abrasive consumption, dust removal resistance, and treatment quality in

real-time, supporting predictive maintenance and remote operation and maintenance.

Energy-saving design optimizes fan and shot blaster motor energy consumption and improves abrasive utilization to reduce operating costs. Environmental performance continues to upgrade with ultra-low emissions, noise optimization, and zero dust dispersion becoming standards. Equipment modularization and standardization levels continuously improve with shorter delivery cycles, faster installation, and simpler operation and maintenance, better adapting to enterprise rapid upgrading and flexible production needs.

## 10. Conclusion

Sandblasting and shot blasting equipment are core fundamental equipment for industrial surface treatment, directly affecting product quality, service life, corrosion resistance, and production efficiency. Against the backdrop of stricter environmental requirements and manufacturing upgrades, enclosed, automated, intelligent, and environmentally integrated complete solutions have become mainstream industry choices.

This technical solution provides systematic, professional, and actionable references around full-process requirements. Enterprises can create customized solutions adapted to their own production based on their workpiece characteristics, process requirements, site conditions, and compliance standards to achieve high-quality development goals of quality improvement, efficiency enhancement, safety and environmental protection, and long-term stability.