Industrial Sandblasting and Shot Blasting Equipment Technology and Application White Paper

In modern industrial manufacturing systems, the surface quality of metal components and equipment directly determines product lifespan, coating adhesionstrength, structural strength, and appearance quality. As core processes for industrial surface pretreatment, sandblasting and shot blasting are widely appliedin key sectors such as heavy machinery, shipbuilding, aerospace, rail transit, steel structures, wind power, and nuclear energy.

Sandblasting and shot blasting equipment utilize high-speed abrasive projection or throwing to achieve surface functions such as rust removal, oxide scale removal, deburring, stress relief, and surface roughening, enhancing coating quality, extending anti-corrosion cycles, and strengthening structural integrity. With continuously improving environmental requirements, safety standards, and production efficiency, traditional open sandblasting and simple shot blasting equipment are progressively upgrading toward enclosure, automation, intelligence, and environmental protection.Through high-speed abrasive projection or throwing, sandblasting and shot blasting equipment accomplish surface rust removal, oxide scale removal, deburring, stress relief, and increased surface roughness—essential for improving coating quality, extending anti-corrosion cycles, and strengthening structural integrity.With increasingly stringent environmental requirements, safety standards, and production efficiency demands, traditional open sandblasting and simple shot blasting equipment are progressively upgrading toward enclosed, automated, intelligent, and environmentally friendly solutions.With increasingly stringent environmental requirements, safety standards, and production efficiency demands, traditional open sandblasting and simple shot blasting equipment are progressively upgrading toward enclosed, automated, intelligent, and environmentally friendly solutions.

This white paper systematically expounds the working principles, equipment types, structural characteristics, process selection, system configuration, environmental support, installation and maintenance, and typical industry applications of sandblasting and shot blasting equipment.It provides comprehensive, clear, and actionable technical references for enterprise equipment selection, process planning, production line upgrading, and environmental transformation,

helping enterprises achieve efficient production, safe production, and green production.helping enterprises achieve efficient, safe, and green production.helping enterprises achieve efficient, safe, and green production.

1. Value and Application Scope of Sandblasting and Shot Blasting Processes

Sandblasting and shot blasting are the most widely used and versatile physical treatment methods in industrial surface treatment, distinguished from chemical processes such as acid pickling, offering advantages of no environmental pollution, uniform treatment effects, and wide material applicability.No environmental pollution, uniform treatment effects, and wide material applicability.

After sandblasting or shot blasting treatment, surface rust, oxide scale, oil, sand mold, welding slag, and other impurities on workpieces can be thoroughly removed, creating a uniformly rough surface that greatly improves the adhesion of paints, coatings, spray plastics, galvanizing, and other coatings, doubling or more the anti-corrosion lifespan.greatly improving the adhesion of paints, coatings, spray plastics, galvanizing, and other coatings, making anti-corrosion lifespan multiply.making anti-corrosion lifespan multiply.making anti-corrosion lifespan multiply.

These two process types cover virtually all industries requiring surface pretreatment, including various steel structural components, ship hulls, construction machinery, automotive parts, castings, forgings, containers, wind power towers, flanges, pipes, aerospace components, and rail transit vehicles.Including various steel structural components, ship hulls, construction machinery, automotive parts, castings, forgings, containers, wind power towers, flanges, pipes, aerospace components, and rail transit vehicles. Whether large workpieces, small parts, complex structures, or batch standard parts, stable treatment can be achieved through corresponding sandblasting or shot blasting equipment.Whether large workpieces, small parts, complex structures, or batch standard parts, all can be stably treated through corresponding sandblasting or shot blasting equipment.all can be stably treated through corresponding sandblasting or shot blasting equipment.

Against the backdrop of tightening environmental policies, enclosed sandblasting rooms, automatic recovery sandblasting systems, and dust-integrated shot blasting machines have become industry mainstream, improving treatment quality while achieving centralized dust collection and compliant emission discharge, improving working environments and ensuring operator occupational

health.Enclosed sandblasting rooms, automatic recovery sandblasting systems, and dust-integrated shot blasting machines have become industry mainstream, improving treatment quality while achieving centralized dust collection and compliant emissions.improving treatment quality while achieving centralized dust collection and compliant emissions, improving working environments and ensuring operator occupational health.

2. Sandblasting Equipment Working Principles and Type Characteristics

Sandblasting equipment uses compressed air as power to spray abrasive at high speed through nozzles onto workpiece surfaces, utilizing the impact and cutting action of abrasives to complete surface cleaning and strengthening.

Depending on the degree of automation, abrasive recovery method, and enclosure type, equipment can be divided into open sandblasting, pressure sandblasting, mechanical recovery sandblasting rooms, and pneumatic recovery sandblasting rooms.Depending on the degree of automation, abrasive recovery method, and enclosure type, equipment can be divided into open sandblasting, pressure sandblasting, mechanical recovery sandblasting rooms, and pneumatic recovery sandblasting rooms.

Open sandblasting equipment is simple with low investment but causes severe dust diffusion, suitable for temporary, simple, and non-continuous operation scenarios.Industrial-scale production generally adopts enclosed sandblasting rooms, placing workpieces inside enclosed spaces for operation, equipped with automatic abrasive recovery, recycling, centralized dust purification, achieving efficient, environmentally friendly, and continuous operation.achieving efficient, environmentally friendly, and continuous operation.

Mechanical recovery sandblasting rooms use mechanical structures such as belts and scrapers to complete abrasive collection, conveying, screening, lifting, and recycling, offering high treatment efficiency and stable operation, suitable for medium to large workpieces and heavy-duty batch processing.Mechanical recovery sandblasting rooms use mechanical structures such as belts and scrapers to complete abrasive collection, conveying, screening, lifting, and recycling, offering high treatment efficiency and stable operation, suitable for medium to large workpieces and heavy-duty batch processing.Pneumatic recovery sandblasting rooms rely on wind negative pressure for abrasive recovery, with simple structure,

convenient maintenance, and moderate investment, suitable for small to medium workpieces and multi-variety, small-batch production scenarios.suitable for small to medium workpieces and multi-variety, small-batch production scenarios.

A sandblasting system typically consists of a sandblasting main unit, pressure tank, sandblasting gun, nozzle, enclosed chamber, abrasive recovery system, screening system, dust removal system, lighting, and electrical control system.The chamber adopts a steel structural frame with fireproof sealing materials, ensuring sturdy structure, good sealing, and long service life. Internal lighting, observation windows, and protective plates ensure operational safety and visibility.ensuring operational safety and visibility.ensuring operational safety and visibility.

Sandblasting processes can select different abrasives according to requirements, such as quartz sand, emery, steel grit, steel shot, glass beads, ceramic beads, etc. Different abrasives correspond to different surface roughness, treatment efficiency, and workpiece application scenarios.Different abrasives correspond to different surface roughness, treatment efficiency, and workpiece application scenarios.Proper abrasive selection and pressure matching can ensure treatment quality while reducing abrasive consumption and equipment wear.

3. Shot Blasting Equipment Working Principles and Type Characteristics

Shot blasting equipment uses high-speed rotating blast wheels to throw steel shot, steel grit, and other abrasives at extremely high speeds onto workpiece surfaces, achieving powerful cleaning, rust removal, oxide scale removal, casting cleaning, and surface strengthening.achieving powerful cleaning, rust removal, oxide scale removal, casting cleaning, and surface strengthening. Shot blasting treatment efficiency is far higher than manual sandblasting, suitable for large-volume, continuous, automated production lines.suitable for large-volume, continuous, automated production lines.

The blast wheel is the core component of the equipment, consisting of impellers, separator wheels, directional sleeves, and wear plates. High-speed rotation generates strong centrifugal force to accurately throw abrasives onto workpiece surfaces.generating strong centrifugal force to accurately throw abrasives onto workpiece surfaces. The equipment interior is equipped with high-wear-resistant wear plates to withstand continuous abrasive impact and extend service life.to withstand continuous abrasive impact and extend service life.

According to workpiece form and conveying method, commonly used industrial shot blasting equipment can be divided into hook type, crawler type, overhead chain type, roller conveyor type, and turntable type.Hook-type shot blasting machines are suitable for hoisting-type workpieces, box parts, welded structures, and complex structural components, enabling multi-angle uniform treatment.Crawler-type shot blasting machines are suitable for small castings, forgings, and batch standard part cleaning, with automatic flipping and automatic unloading, offering consistent treatment quality.offering consistent treatment quality.

Roller conveyor shot blasting machines are specifically designed for continuous surface treatment of steel plates, section steel, steel structures, plates, and profiles. Workpieces pass through at uniform speed with multiple blast wheels operating synchronously from multiple angles, offering high treatment efficiency and uniform surface.offering high treatment efficiency and uniform surface.Overhead chain-type shot blasting machines are suitable for continuous production lines, enabling simultaneous loading/unloading and shot blasting, adapting to large-scale manufacturing of automotive parts and construction machinery accessories.

adapting to large-scale manufacturing of automotive parts and construction machinery accessories.

Shot blasting equipment is equipped with complete dust removal systems. Abrasives achieve automatic circulation, screening, and purification, removing dust and broken abrasives to ensure stable shot blasting effects.Abrasives achieve automatic circulation, screening, and purification, removing dust and broken abrasives to ensure stable shot blasting effects. The entire system uses PLC control, enabling automatic start-stop, automatic feeding, fault alarms, and energy monitoring, offering stable operation, simple operation, and convenient maintenance.offering stable operation, simple operation, and convenient maintenance.

4. Sandblasting and Shot Blasting Equipment System Components and Configuration Key Points

Industrial sandblasting and shot blasting equipment are not single main units but complete systems integrating chamber, conveying, blasting/sandblasting, abrasive circulation, screening, dust removal, electrical control, lighting, and protection.Industrial sandblasting and shot blasting equipment are not single main units but complete systems integrating chamber, conveying, blasting/sandblasting,

abrasive circulation, screening, dust removal, electrical control, lighting, and protection.Proper system configuration directly determines treatment efficiency, product quality, environmental compliance, and operating costs.

Chamber structure adopts high-strength section steel welding with strong sealing and sound insulation/dust prevention. Interior is lined with wear-resistant rubber plates or manganese steel wear plates to withstand abrasive impact and extend equipment life.to withstand abrasive impact and extend equipment life. Observation windows, lighting, maintenance doors, and safety interlock devices ensure operational safety.ensure operational safety.

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

The abrasive circulation system handles collecting, lifting, conveying, screening, and purifying abrasives, separating broken particles and dust, ensuring that abrasives entering the sandblasting or shot blasting main unit are clean, uniform, and meet particle size requirements.ensuring that abrasives entering the sandblasting or shot blasting main unit are clean, uniform, and meet particle size requirements, improving treatment quality and reducing abrasive consumption.improving treatment quality and reducing abrasive consumption.

The dust removal system is key to environmentally compliant operation, typically equipped with cartridge filters or bag filters to centrally collect and efficiently purify dust generated during sandblasting and shot blasting, ensuring dust-free workshops and compliant emissions.ensuring dust-free workshops and compliant emissions. Equipment layout can place dust collectors indoors or outdoors, flexibly adapting to site conditions.flexibly adapting to site conditions.

The electrical control system uses PLC + touch screen control with automatic operation, manual debugging, fault diagnosis, safety protection, and energy monitoring functions.The electrical control system uses PLC + touch screen control with automatic operation, manual debugging, fault diagnosis, safety protection, and energy monitoring functions, enabling one-button startup, automatic cycling, and abnormal shutdown alarms.enabling one-button startup, automatic cycling, and

abnormal shutdown alarms, improving equipment intelligence level and reducing manual operation intensity.

5. Equipment Selection Criteria and Process Planning Principles

Selection of sandblasting and shot blasting equipment needs comprehensive determination considering workpiece dimensions, weight, material, shape, treatment requirements, production efficiency, site conditions, and environmental standards.considering workpiece dimensions, weight, material, shape, treatment requirements, production efficiency, site conditions, and environmental standards.

Workpiece size directly determines the effective internal space of equipment. Large steel structures, ship components, and wind power parts require large-sized sandblasting rooms or pass-through shot blasting machines.Large steel structures, ship components, and wind power parts require large-sized sandblasting rooms or pass-through shot blasting machines.Small parts are suitable for crawler-type, turntable-type, or hook-type equipment. Treatment requirements determine process direction. Simple rust removal can use conventional parameters; surface strengthening requires increasing shot blasting speed and impact force.Simple rust removal can use conventional parameters; surface strengthening requires increasing shot blasting speed and impact force. Precision parts can select gentle sandblasting processes.

Production rhythm and batch size determine the level of automation. Single-piece small-batch production can use semi-automatic equipment.Single-piece small-batch production can use semi-automatic equipment. Large-batch production lines are recommended to configure fully automatic, continuous equipment to improve efficiency and reduce labor costs.

Environmental and safety requirements must be included in planning. Enclosed structures, efficient dust removal systems, explosion-proof configuration, noise control, and safety interlocks are all essential basic configurations for modern industrial equipment, ensuring compliance with safety and environmental regulations.ensuring compliance with safety and environmental regulations.

Site space, building height, floor load-bearing capacity, and power/air supply conditions also affect equipment structural form and installation plans. Proper layout

can reduce modification investment and improve space utilization.Proper layout can reduce modification investment and improve space utilization.

6. Environmental and Safety Design Key Points

Sandblasting and shot blasting operations are accompanied by dust and noise, making environmental and safety design indispensable parts of equipment. Enclosed structures suppress dust diffusion at the source.Enclosed structures suppress dust diffusion at the source, working with efficient dust removal systems to achieve clean workshops and compliant emissions.

Dust removal systems select cartridge or bag filter types based on dust concentration, air volume, and working conditions, ensuring purification efficiency while having automatic dust cleaning, collection, and unloading functions for convenient operation and maintenance.Dust removal systems select cartridge or bag filter types based on dust concentration, air volume, and working conditions, ensuring purification efficiency while having automatic dust cleaning, collection, and unloading functions for convenient operation and maintenance.Equipment operating noise is controlled within reasonable limits through structural optimization, vibration reduction, and sound insulation treatment, improving workshop working environments.

In terms of safety, equipment is configured with safety door interlocks, emergency stop buttons, overload protection, and limit devices to prevent risks from misoperation.In terms of safety, equipment is configured with safety door interlocks, emergency stop buttons, overload protection, and limit devices to prevent risks from misoperation. Electrical systems have short circuit, overload, phase loss, and overheating protection to ensure long-term stable operation.ensuring long-term stable operation.

For environments with flammable and explosive dust, anti-static, explosion-proof, spark detection, and extinguishing devices can be configured to improve safety levels.Abrasive circulation and screening systems can reduce abrasive splashing and waste, lower operating costs, and prevent secondary dust diffusion. The overall design follows environmental protection, safety, and energy-saving concepts, complying with national standards and industry specifications.

7. Installation, Debugging, Operation and Maintenance

Equipment installation requires standardized foundation construction, positioning and fixing, pipe connections, and electrical wiring to ensure chamber sealing, smooth conveying, unimpeded dust removal, and vibration-free operation.Equipment installation requires standardized foundation construction, positioning and fixing, pipe connections, and electrical wiring to ensure chamber sealing, smooth conveying, unimpeded dust removal, and vibration-free operation.During debugging, tests are conducted sequentially including no-load testing, abrasive circulation testing, dust removal testing, and shot blasting or sandblasting linkage testing, gradually optimizing parameters to bring equipment to optimal treatment condition.

Daily maintenance focuses on blast wheels, wear plates, bearings, drive chains, filter cartridges, and pulse valves as wearing parts. Regular inspection of wear conditions and timely replacement are essential.Abrasives need regular replenishment and screening to remove broken abrasives and impurities, ensuring stable treatment effects.ensuring stable treatment effects.

Dust removal systems require regular dust cleaning, inspection of dust cleaning mechanisms to ensure normal resistance and non-declining purification efficiency.Dust removal systems require regular dust cleaning, inspection of dust cleaning mechanisms to ensure normal resistance and non-declining purification efficiency. Electrical and control systems should be kept dry and clean to avoid dust entry causing failures.avoiding dust entry causing failures.

8. Typical Industry Applications

In the steel structure and construction engineering field, sandblasting rooms and roller conveyor shot blasting machines can efficiently treat section steel, steel plates, space frames, and support components, removing rust layers and oxide scale to improve anti-corrosion coating quality.removing rust layers and oxide scale to improve anti-corrosion coating quality.

In the shipbuilding and offshore equipment industry, large enclosed sandblasting rooms and pass-through shot blasting machines are suitable for ship hull sections, hatch components, deck fittings, and other large workpieces, meeting high-standard surface pretreatment requirements.meeting high-standard surface pretreatment requirements.

In the construction machinery and automotive manufacturing industry, hook-type, crawler-type, and overhead chain-type shot blasting machines are widely used for batch cleaning and strengthening of excavation components, frames, boxes, castings, and forgings.widely used for batch cleaning and strengthening of excavation components, frames, boxes, castings, and forgings.

In the casting industry, shot blasting equipment achieves casting cleaning, rust removal, and deburring, greatly improving downstream processing and coating efficiency.In the casting industry, shot blasting equipment achieves casting cleaning, rust removal, and deburring, greatly improving downstream processing and coating efficiency.In high-end equipment fields such as aerospace, wind power, and nuclear energy, where surface quality and stress relief requirements are stringent, high-precision sandblasting and shot blasting systems can meet demanding process standards.

Regardless of workpiece dimensions, production volume, or process requirements, customized sandblasting or shot blasting solutions can achieve stable, efficient, and environmentally friendly surface treatment.Regardless of workpiece dimensions, production volume, or process requirements, customized sandblasting or shot blasting solutions can achieve stable, efficient, and environmentally friendly surface treatment.

9. Technology Development Trends

Future industrial sandblasting and shot blasting equipment will develop toward higher automation, intelligence, and greenization.Future industrial sandblasting and shot blasting equipment will develop toward higher automation, intelligence, and greenization.Automated production lines combined with robot loading and unloading will achieve unmanned operation, improving efficiency and stability.

Intelligent monitoring systems can real-time monitor blast wheel status, abrasive consumption, dust removal resistance, and treatment quality, achieving predictive maintenance.Energy-saving design reduces fan and blast wheel motor energy consumption, optimizes airflow and projection angles, and improves abrasive utilization.Environmental performance continues to upgrade, with ultra-low emissions, noise control, and zero dust diffusion becoming standard. Equipment modularization and standardization improve, with shorter delivery cycles, faster installation, and simpler maintenance.

10. Conclusion

Sandblasting and shot blasting equipment are indispensable surface pretreatment equipment in modern industrial manufacturing, directly affecting product quality, service life, anti-corrosion capability, and production efficiency.Sandblasting and shot blasting equipment are indispensable surface pretreatment equipment in modern industrial manufacturing, directly affecting product quality, service life, anti-corrosion capability, and production efficiency.With industrial upgrading and tightening environmental requirements, enclosed, automated, intelligent, and environmentally friendly complete equipment has become the mainstream industry choice.

This white paper provides comprehensive technical references and application guidance. Enterprises can combine their own workpiece characteristics, process requirements, site conditions, and environmental standards to select suitable sandblasting or shot blasting solutions.This white paper provides comprehensive technical references and application guidance. Enterprises can combine their own workpiece characteristics, process requirements, site conditions, and environmental standards to select suitable sandblasting or shot blasting solutions to achieve comprehensive goals of quality improvement, efficiency enhancement, cost reduction, safety, and environmental protection.to achieve comprehensive goals of quality improvement, efficiency enhancement, cost reduction, safety, and environmental protection.