Technical White Paper on Core Differences and Selection Guidelines for Industrial Spray Painting Booths and Sandblast Booths

1. Introduction

Surface treatment is a critical process to ensure workpiece quality and extend product lifespan. As core equipment, the rationality of spray painting booths and sandblast booths directly affects production efficiency, product quality, and overall operating costs.Currently, the manufacturing industry is transitioning toward refinement, automation, and environmental protection. Some enterprises face issues such as equipment mismatches, substandard quality, environmental violations, and investment waste due to confusion between the two types of equipment.To address these issues, this white paper, combined with industry standards and practical experience, systematically outlines equipment functions, parameters, and application scenarios, proposes scientific selection solutions, and provides support for enterprise procurement decisions.

This white paper follows the principles of "scientific rigor and practical feasibility," covering core content such as equipment differences, parameter comparisons, selection guidelines, and operation and maintenance recommendations. It applies to multiple industries including manufacturing, automotive repair, heavy industry, and precision manufacturing.It serves equipment procurement, process engineering, and equipment management personnel, and can also be used as a reference for enterprise process planning and job training.

2. Scope and Referenced Standards

2.1 Applicable Scope

This white paper applies to the differentiation, selection decision-making, and process adaptation of various industrial spray painting booths and sandblast booths.It covers manual, semi-automatic, and fully automatic models, including common types such as electrostatic spray painting booths, high-pressure airless spray painting booths, and centrifugal sandblast booths. It can serve as a core reference for enterprise equipment procurement, process planning, and operation and maintenance.It adapts to multi-industry surface treatment and coating needs and can also be used for relevant job skills training and assessment.

2.2 Referenced Standards

This white paper primarily references the following national and industry standards. Equipment selection, process implementation, and safety and environmental protection must strictly comply with:

GB6514-2008 "Safety Regulations for Painting Operations - Safety and Ventilation Purification for Paint Spraying Processes"

GB/T11373-2008 "Thermal Spraying of Zinc, Aluminum and Their Alloys on Metal and Other Inorganic Coatings"

GB24409-2020 "Limits for Hazardous Substances in Automotive Coatings"

GB12367-2006 "Safety Regulations for Painting Operations - Safety for Electrostatic Spray Painting Processes"

GB/T8923.1-2019 "Preparation of Steel Substrates Before Application of Paint and Related Products - SurfaceCleanliness Assessment - Part 1"

JB/T10242-2016 "Spray Painting Rooms"

JB/T8355-2014 "Sandblasting Machines"

3. Core Differences Analysis of Spray Painting Booths and Sandblast Booths

The core differences between spray painting booths and sandblast booths are reflected in functional positioning, working principles, core advantages, and key indicators.They correspond to different stages of surface treatment and adapt to different production needs, as follows:

3.1 Functional Positioning Differences (Core Differences)

The core functions of the two are completely different, forming a complete process chain of "surface pretreatment - precision coating." Specific positioning is as follows:

3.1.1 Spray Painting Booths: Focusing on Precision Coating, Creating High-Standard Surface Protection and Appearance

Spray painting booths are enclosed equipment specifically designed for workpiece coating. Their core function is to provide a clean and controllable spraying

environment, achieve precise paint application, impart uniform paint films to workpieces, and ensure environmental compliance.Their core positioning is "post-coating," performing precision spraying on workpieces pretreated by sandblasting, phosphating, etc., to meet surface aesthetics, flatness, and protection requirements.

Spray painting booths are widely used in fields with high surface quality requirements such as automotive manufacturing and repair, precision instruments, electronic products, furniture and appliances, and medical devices.Their core value lies in ensuring defect-free paint films through environmental control and precision spraying, effectively treating paint mist and VOC, and meeting environmental requirements.

3.1.2 Sandblast Booths: Focusing on Surface Pretreatment, Removing Impurities to Build a Solid Coating Foundation

Sandblast booths are specialized equipment for surface pretreatment before coating. Their core function is to use high-speed abrasive ejection (steel grit, brown fused alumina, etc.) for physical impact on workpiece surfaces to remove rust, oxide scale, oil contamination, and other impurities, while creating uniform roughness to enhance coating adhesion and lay a foundation for high-quality coating.

Sandblast booths are widely used in heavy industry, steel structures, shipbuilding and repair, hardware products, and old equipment refurbishment.Their core value is solving problems such as poor paint film adhesion and easy peeling, extending product lifespan, and improving subsequent coating efficiency and quality.

3.2 Working Principle Differences

3.2.1 Spray Painting Booth Working Principles

Spray painting booths adopt the "enclosed environment + directional airflow + precision control" mode, with three core stages: First, environmental purification through primary, medium, and high-efficiency three-stage filtration to ensure dust particle size in incoming air is ≤0.3μm;Second, spraying operation using spray guns to atomize paint, equipped with constant temperature and humidity devices (20-25°C, 50-70%) to ensure paint adhesion and drying speed;Third, pollution treatment using

dry or wet purification systems to collect paint mist and adsorb VOC, ensuring compliant emissions.

According to paint mist treatment methods, spray painting booths are divided into dry type (filter cotton adsorption) and wet type (water curtain adsorption), with wet type widely used in medium and large enterprises due to high purification efficiency.

3.2.2 Sandblast Booth Working Principles

Sandblast booths adopt the "high-speed ejection + dust recovery" mode, with two core stages: First, sandblasting operation using air compressors to generate high-pressure airflow, ejecting abrasive from sandblast guns to impact workpiece surfaces, removing impurities and creating rough surfaces;Second, dust recovery using pulse jet dust collectors to collect dust and waste abrasive, achieving compliant emissions and abrasive recycling to reduce consumable costs.

According to sandblasting methods, sandblast booths are divided into pressure feed type (high-pressure airflow conveyance, suitable for large workpieces) and centrifugal type (centrifugal force conveyance, energy-saving and efficient, suitable for batch small and medium workpieces).

3.3 Core Advantages and Key Indicator Differences

3.3.1 Spray Painting Booth Core Advantages and Key Indicators

Spray painting booth core advantages focus on "precision, environmental protection, and controllability." Key indicators comply with industry standards, as follows:

High coating precision: Paint film uniformity reaches above 98%, with no defects such as sagging or pinholes, meeting Class A surface treatment requirements and adapting to high-end product coating;

Environmental compliance: VOC emissions ≤50mg/m³, complying with relevant standards; dry paint mist purification efficiency ≥98%, wet type (Venturi water curtain) reaches 99.2%;

Controllable environment: Constant temperature and humidity devices precisely control temperature and humidity to ensure strong paint adhesion and uniform drying, avoiding paint surface defects;

Flexible adaptation: Adapts to various paint types, supports multiple spraying modes, and can process workpieces of different sizes and precision levels.

3.3.2 Sandblast Booth Core Advantages and Key Indicators

Sandblast booth core advantages focus on "efficiency, thoroughness, and energy saving." Key indicators meet stringent pretreatment requirements, as follows:Excellent cleaning effect: Surface roughness Ra12.5-100μm is adjustable; rust removal level reaches Sa2.5 level or above, thoroughly removing surface impurities;Efficient operation: Sandblasting efficiency 15-30㎡/h, improving labor efficiency by 5-8 times compared to manual grinding, significantly reducing labor costs;Environmental and energy-saving: Dust recovery rate ≥99%, abrasive recovery rate ≥85%, achieving compliant emissions and consumable recycling;Wide adaptability: Can process various materials such as steel and aluminum, adapting to workpieces of different sizes and shapes.

Contrasting dimensions	Painting room	Sand blasting room	Notes (Selection Reference)
Working pressure	0.3-0.6MPa	0.6-1.2MPa	High pressure gas required for sand blasting room Source, small businesses need to consider the cost
Power consumption	25-40kW/h (including drying Roasting, constant temperature and humidity)	15-25kW/h (main is the energy) consumption of the air compressor)	The energy consumption of the paint spray room is slightly higher, and long-term operating costs need to be accounted for.
Noise:	≤75dB	≥85dB	The sand blasting room needs to be soundproofed

			Reason, avoid excessive noise
Maintenance cycle	Change the filter cotton every month, change the high efficiency filter for 3-6 months	Weekly inspection of sand blasting nozzles, 1- Replace the blast nozzle for 2 months	The wearing parts of the sand blasting room are frequently replaced, and the cost of consumables needs to be calculated.
Core Consumables	Paint, Diluent, Over Filter cotton, seals	Abrasives, sand blasting nozzles, removal Dust filter element	Combine production batch accounting Long-term consumable costs
Environmental protection requirements	Control VOC emissions, paint Fog treatment	Control dust emission, grinding Material Recovery	Must comply with local environmental regulations Measures to avoid violations
Operating environment	Clean and dry, temperature control required Humidity	Dust is allowed and needs to be sealed Recycle	Both need to be zoned, Avoid interacting with each other

3.4 Core Technical Parameter Comparison

For intuitive differentiation and precise selection, combined with industry standards, the core technical parameters of both are compared below for key reference during procurement:

4. Industry Adaptation and Selection Strategies

Core selection principle: With process requirements as the core, combined with industry standards, production volume, environmental requirements, and operating costs, prioritize equipment that adapts to your own scenarios, avoiding "over-equipping" or "insufficient adaptation," to maximize equipment value.

4.1 Scenarios Prioritizing Spray Painting Booths

Applicable to fields requiring high workpiece surface aesthetics, flatness, and protection, needing precision coating. Key recommendations:

Precision instruments, electronics, and medical device industries: Requiring Class A surface treatment, prioritize fully automatic spray painting booths equipped with high-precision filtration systems and constant temperature and humidity devices. Use electrostatic rotary bell spraying equipment with VOC-free environmental coatings to comply with industry environmental and hygiene standards.

Automotive manufacturing and 4S shop industries: Body spraying and component repair requiring high flatness and adhesion. When using 3C1B process, select large fully automatic spray painting booths equipped with infrared flash cure lamps and constant temperature and humidity systems; 4S shops can select small semi-automatic spray painting booths for flexibility and cost-effectiveness.

Furniture, home appliances, and decorative building materials industries: Requiring uniform coating and color consistency, prioritize spray painting booths with constant temperature and humidity and color difference control systems. Furniture industry can choose dry type; home appliance industry recommends wet type to improve paint mist purification efficiency.

Food packaging container industry: Requiring food-grade standards, use spray painting booths with VOC-free coatings, high-efficiency purification systems, and

food-grade sealing materials to ensure no harmful substance residues and pass relevant certifications.

4.2 Scenarios Prioritizing Sandblast Booths

Applicable to surface pretreatment before coating, requiring rust removal and coating adhesion enhancement. Key recommendations:

Steel structure and bridge industries: Requiring Sa2.5 level or above rust removal, prioritize centrifugal sandblast machines (energy-saving 30%, abrasive utilization rate improved by 25%), equipped with high-power dust recovery systems; outdoor operations can choose mobile sandblast booths.

Ship repair and marine engineering industries: With severe workpiece corrosion, require high-pressure pressure feed sandblast booths, equipped with corrosion-resistant abrasive and high-power dust recovery systems. Implement equipment corrosion protection for outdoor or large workshop adaptation.

Hardware and mechanical parts industries: Requiring increased surface roughness, small manual/semi-automatic sandblast booths can meet needs; batch production can choose fully automatic models to improve efficiency.

Old equipment refurbishment industry: Requiring removal of old paint films and rust layers, select small mobile sandblast booths for flexible adaptation to workpieces of different sizes, reducing investment costs.

4.3 Composite Solutions (Sandblast-Spray Painting Integration)

With industrial intelligent upgrading, "sandblast-spray painting integrated chambers" have become the preferred choice for large enterprises, achieving "pretreatment-coating" one-stop operations to improve efficiency and reduce costs.

4.3.1 Typical Cases

A heavy industry enterprise specializing in large machinery housings and steel structural components previously faced problems such as low transfer efficiency and secondary pollution. After adopting the integrated solution, efficiency improved significantly: front-end robot automatic sandblasting with repeat positioning accuracy ±0.1mm, efficiency improved by 40%, rust removal level stably reaching Sa2.5 level;mid-stage phosphating treatment + high-pressure blowing to enhance adhesion and remove residual dust;rear-end electrostatic rotary bell spraying with paint transfer

efficiency reaching 85%, equipped with constant temperature and humidity and high-efficiency purification systems to ensure effects and environmental compliance.

4.3.2 Solution Advantages and Applicable Scenarios

Core advantages: Transfer time reduced by 70%, production efficiency improved by 50%, product qualification rate reaching above 99%, reducing labor costs and operational errors, and achieving process standardization.

Applicable scenarios: Investment increases by 400,000-600,000 RMB compared to single equipment, suitable for large enterprises with large production volumes, complex workpieces, and pursuing automation. Professional operation and maintenance personnel are required.

5. Selection Precautions

To ensure scientific selection and avoid investment waste and environmental violations, the following matters require special attention:

Prioritize environmental compliance: Confirm equipment VOC and dust emissions meet standards, reserve environmental upgrade space, and adapt to future policy adjustments.

Match production scale: Small enterprises select manual/semi-automatic equipment; large enterprises select automated and integrated equipment, balancing cost and efficiency.

Consider subsequent operation and maintenance: Prioritize equipment with easily procurable consumables and convenient maintenance. Confirm manufacturer after-sales service, spare parts supply, and technical support.

Reserve upgrade space: Reserve automation and environmental upgrade interfaces during procurement to avoid secondary investment.

Comprehensive cost accounting: Consider long-term costs including procurement, consumables, energy consumption, and operation and maintenance. Prioritize equipment models with reliable quality and good reputation.

Fit process requirements: Combine workpiece materials, dimensions, and processing requirements to select adaptive equipment types and parameters.

6. Equipment Operation and Maintenance Management Recommendations

Scientific operation and maintenance is key to extending equipment lifespan and ensuring stable operation. Combined with equipment characteristics, recommendations are as follows:

Spray painting booths: Regularly replace filter cotton and high-efficiency filters, clean paint mist recovery systems, calibrate constant temperature and humidity devices, and check spray guns, pipelines, and electrical explosion-proof and grounding conditions.

Sandblast booths: Regularly check and replace sandblast nozzles, clean dust recovery systems, check air compressors, high-pressure pipelines, and abrasive purity, and implement sound insulation and corrosion protection.

Establish operation and maintenance files: Record equipment operation, maintenance, and consumable consumption information. Regularly analyze data to optimize maintenance cycles.

Personnel training: Strengthen skills training for operators and maintenance personnel to familiarize them with equipment principles, operating specifications, and safety precautions.

7. Conclusion

Spray painting booths and sandblast booths have complementary functions and distinct positioning. The rationality of selection directly affects enterprise production efficiency, product quality, and operating costs.This white paper, based on industry standards and practices, systematically elaborates on their differences, selection strategies, and operation and maintenance recommendations to provide professional guidance for enterprise procurement decisions.

Enterprises should base themselves on their own process requirements, scientifically distinguish equipment functions, and avoid hazards caused by improper selection. At the same time, they should emphasize equipment operation and maintenance to achieve standardized, efficient, and environmentally friendly development of surface treatment processes.This white paper will be timely revised and improved in combination with technological development and policy adjustments to support high-quality development of the manufacturing industry.