ST POWDER COATING EQUIPMENT CO., LTD.

Technical Proposal — Painting Production Line

A. About the Manufacturer — Jinan ShengTai Painting Equipment

Company Profile

Jinan ShengTai specializes in the planning, design, manufacture, installation, and after-sales service of liquid coating, powder coating, electrophoretic (e-coat) coating, and peripheral surface treatment systems. We deliver complete turnkey solutions — from a single piece of equipment to full factory fit-outs — and have built a strong track record across automotive, heavy equipment, agricultural machinery, and consumer goods industries.

Our guiding principles are customer focus, technology leadership, and service excellence. By integrating advanced automation and enterprise resource planning (ERP) tools, we ensure that both our own operations and our clients' production targets run efficiently. We pursue low-cost, high-return, and environmentally responsible outcomes, and we are confident in our ability to help every client achieve superior production results.

Products & Services We Supply

- Pre-treatment systems (spray, immersion, and combination pre-treatment lines)
- Automatic and manual powder coating systems
- Automatic and manual liquid painting systems (including robotic and waterborne)
- Automotive wheel hub coating systems
- Aluminium profile & curtain wall fluorocarbon coating systems
- UV curing ovens and box-type baking ovens
- High-temperature PTFE (Teflon) coating systems
- Automated conveyor and material handling systems
- Clean rooms, HVAC fresh-air systems (10,000-class)
- Wastewater and exhaust gas treatment systems
- Thermal curing equipment
- Coating accessories and consumables

B. Process Design Principles

B-1. Basic Design Conditions

Workpiece	Automotive components (steel rear axles)
Material	Steel
Maximum workpiece size	L 2,500 × W 1,000 × H 1,000 mm

Maximum workpiece weight	≤ 500 kg / piece
Production schedule	8 hours / shift
Line speed	0.1 – 4 m/min (variable)
Coating process	Liquid painting with pre-treatment
Energy sources	Electricity + Natural gas
Power supply	3-phase: 380 VAC, 50 Hz (±10%) | Single-phase: 220 VAC, 50 Hz (±10%)
Compressed air	4 – 6.0 kg/cm²
Hanger type	Dual-point suspension
Hanger height	600 mm from rail top to workpiece upper face
Conveyor chain	XT160 heavy-duty — 500 kg single-point capacity
Hanger pitch	640 mm (transverse); hangers loaded to full pitch
Line speed (design)	V = 0.8 m/min (adjustable 0.1 – 4 m/min via VFD)
Key equipment	Pre-treatment spray system, paint spray booths, drying & curing ovens, gas burners, overhead conveyor, electrical control, exhaust treatment

B-2. Process Flow

Loading → Hot-water Wash 1 → Degreasing → Hot-water Wash 2 → Hot-water Wash 3 → Draining → Water-removal Drying → Primer Spraying → Topcoat Spraying → Flash-off / Levelling → Curing Oven → Unloading

B-3. Process Parameter Table

No.	Process Step	Method	Time (min)	Temp. (°C)	Notes
1	Loading	Manual	—	Room temp.	
2	Hot-water Wash 1	Spray	1	30 – 40	Recirculated hot water
3	Degreasing	Spray	3	30 – 40	Recirculated hot water
4	Hot-water Wash 2	Spray	1	30 – 40	Recirculated hot water
5	Hot-water Wash 3	Spray	1	30 – 40	Recirculated hot water
6	Draining	Auto	3	Room temp.	
7	Water-removal Drying	Auto	20	80 – 120	Gas-fired hot-air circulation
8	Primer Spraying	Manual	—	—	
9	Topcoat Spraying	Manual	—	—	
10	Flash-off / Levelling	Auto	—	—	

11	Curing Oven	Auto	29	80 – 120	Gas-fired hot-air circulation

C. Equipment Specifications

C-1. Pre-Treatment Spray System

Overall dimensions: 19,800 × 1,800 × 2,200 mm (L × W × H)

The pre-treatment system uses a four-stage spray rinse process (degreasing + three hot-water washes) to remove surface grease and contaminants before painting, ensuring uniform film adhesion after drying.

Construction details

- Spray chamber body fabricated from 1.2 mm stainless steel; base frame from square hollow section, full-perimeter welded.
- Storage tanks manufactured from 2 mm stainless steel in rectangular form, with sealed top covers, overflow and supply inlets, sloped floor with drain valve (DN 63 mm) connected to wastewater treatment.
- Spray nozzles arranged in alternating offset pattern at 300 mm pitch along and across the chamber, delivering PPR V-type nozzles with strong flushing action.
- Adjacent wash stages share a counter-flow water replenishment system, improving wash quality while reducing water consumption.
- The conveyor slot opening (100 mm wide) at the top of the chamber is sealed with bristle brushes to prevent liquid splash-out.
- A 300,000 kcal/h gas-fired hot-water boiler supplies all four heated stages via plate heat exchangers and hot-water circulation pumps installed in each tank.
- Spray piping is PPR throughout; the system is designed with zero leakage.

Technical parameters — spray pumps

- Wash pumps: CTL-50VK-3 | Flow: 25 m³/h | Head: 20 m | Power: 2.2 kW
- Degreasing pump: CTL-100VK-15 | Power: 15 HP

C-2. Water-Curtain Paint Spray Booths

Three water-curtain spray booths are supplied: a primer booth (double-sided), a topcoat booth (double-sided), and a below-line single-sided touch-up booth. The water-curtain design offers high overspray capture efficiency, long-term stability, and simple maintenance — well-suited to large automotive components with complex geometry.

Primer booth (double-sided)	5,000 × 3,000 × 4,500 mm (L × W × H) | 1.5 mm stainless steel | Qty: 1
Topcoat booth (double-sided)	5,000 × 3,000 × 4,500 mm (L × W × H) | 1.5 mm stainless steel | Qty: 1
Touch-up booth (single-sided)	5,000 × 3,000 × 4,500 mm (L × W × H) | 1.5 mm stainless steel | Qty: 1
Water curtain plate	1.5 mm 304 stainless steel overflow trough + curtain plates
Mist capture stages	Front water-curtain (primary) → high-pressure atomising nozzles

	(secondary) → 3-layer baffles (tertiary)
Exhaust method	Natural fresh-air supply from top; bottom exhaust draw
Baffle material	Galvanised steel, bolt-mounted — quarterly cleaning cycle
Grating floor	Steel grating, t ≥ 4 mm flat bar, uniform and interchangeable
Circulation pump	ISG50-125(I) vertical inline | 25 m³/h | Head: 20 m | 2.2 kW

C-3. Flash-off / Levelling Room

Dimensions: 15,500 × 1,400 × 3,200 mm (L × W × H)

Installed between the spray booths and the curing oven to allow the wet film to level and stabilise before baking, preventing sagging and surface defects. Constructed from structural steel frame with 50 mm rockwool composite panel inserts.

C-4. Drying & Curing Ovens

Water-removal drying oven	22,000 × 1,400 × 2,400 mm | Effective heating length: 20 m | Drying time: 20 min
Curing oven	32,000 × 1,400 × 2,400 mm | Effective heating length: 30 m | Curing time: 30 min
Oven type	Straight-through (pass-through) with air-curtain at both entry and exit
Heat source	Natural gas combustion — hot-air recirculation
Operating temperature	80 – 120 °C (adjustable)
Warm-up time	≤ 45 min from 15 °C ambient to set temperature, under full load
Air circulation	2 – 3 volumes/min

Panel construction

- Outer cladding: 0.6 mm colour-coated steel (cream/white)
- Inner liner: 0.5 mm galvanised steel
- Insulation: 120 mm rockwool slab, density 100 kg/m³ — pre-formed panels for rapid site assembly
- Outer corner trim: 1.5 mm powder-coated galvanised steel
- Inner corner trim: 1.2 mm galvanised steel
- Oven structural frame: 100 × 100 × 2.5 mm square hollow section

The panel system uses a slot-rail interlocking assembly concept: lightweight, easy to transport, quick to install, and simple to expand or reconfigure in future.

Automatic temperature control

PID temperature controllers with digital display regulate burner and fan operation to maintain set-point temperature. The system provides automatic over-temperature alarm, heater short-circuit protection, and fan

interlock (fans must pre-run before burner ignites; fans run-down after burner shuts off to cool elements before stopping).

Exhaust gas collection

Smoke collection hoods are installed at the entry and exit of the curing oven and connected to the exhaust gas treatment system for discharge at elevation above the workshop roof.

C-5. Gas-Fired Heating Systems

Water-removal oven heater	Capacity: 200,000 kcal/h | Unit: 3,500 × 1,500 × 1,300 mm | Circulating fan: 4-72-6C, 11 kW
Curing oven heater	Capacity: 300,000 kcal/h | Unit: 4,500 × 1,500 × 1,300 mm | Circulating fan: 4-72-6C, 15 kW

Each heating unit consists of an imported burner, stainless steel heat exchanger, combustion chamber, high-temperature circulating fan, and duct work. The chamber body uses 100 × 100 hollow section frame, 100 mm aluminium silicate fibre fill, 1.5 mm galvanised outer cladding, and 3 mm SUS304 stainless inner lining. Access doors provided for maintenance.

Hot air is supplied from the bottom of the oven and returned from the top (bottom-supply / top-return circulation), with adjustable dampers at inlets and outlets to balance airflow and temperature uniformity. Air curtains at oven entry/exit minimise heat loss.

C-6. Overhead Conveyor System

Chain type	XT160 heavy-duty drop-forged conveyor chain
Single-point capacity	500 kg
Total rail length	~180 m
Rail section	GB 16# I-beam
Rail support post	100 × 100 × 3 mm square hollow section
Design line speed	0.8 m/min (VFD adjustable: 0.1 – 4.0 m/min)
Hanger pitch	640 mm
Drive	Linear drive unit | Motor: 5.5 kW | Cycloidal reducer
Take-up	Counterweight tensioner
Horizontal bends	R 1,500 mm — roller-turn units at all horizontal curves
Vertical curves	R 2,000 mm
Thermal expansion	Expansion joints fitted at all oven traverses to accommodate thermal growth of rail and chain
Safety	Overload protection; emergency stop stations at loading, unloading, and spray positions
Operation	Smooth, continuous — no juddering or jamming

C-7. Exhaust Gas Treatment System

Exhaust gases generated during pre-treatment, spray painting, and curing are collected and treated before discharge at a minimum height of 15 m above ground level.

Treatment sequence

Collection hoods (at spray booths & oven entry/exit) → Cyclone tower → Dry/wet filter unit → Activated-carbon adsorption → Induced-draft fan → Discharge at 15 m height

No.	Equipment	Specification / Model	Power	Qty
1	Cyclone tower	60,000 m³/h | 201 stainless steel	—	1 unit
2	Dry/wet filter unit	3,100 × 1,100 × 1,300 mm | 201 SS | G4 filter bags × 32 | glass wool × 8 | activated-carbon pads × 8	—	1 set
3	Activated-carbon adsorption boxes	3,100 × 1,100 × 1,300 mm | 100 × 100 / 1,000 pcs waterproof carbon blocks | 201 SS | 1.2 mm	—	2 sets
4	Collection hoods & ductwork	2,000 × 1,000 mm hoods | 1.0 mm SS duct	—	2 sets
5	Main discharge ductwork	Ø 800 mm | 3 mm carbon steel	—	1 set
6	Induced-draft fan	4-72-12C centrifugal	75 kW	1 unit
7	Electrical control cabinet	Parallel to main electrical system	—	Included

Total airflow handled: 60,000 m³/h
System resistance: 300 Pa
Power supply: 380 V, 50 Hz

C-8. Electrical Control System

The electrical system is designed around five principles: reliability, ease of operation, maintainability, value for money, and technical advancement. Control is distributed — individual control cabinets are located at each equipment zone for local operation and observation.

Key control functions

1. Paint spray system cabinet: controls spray booth exhaust fans, recirculation system, and lighting.
2. Curing oven cabinet: controls gas burner, hot-air recirculating fans, and automatic temperature hold. The fan-interlock logic (fans start first, heater energises after delay; heater shuts off first, fans coast down to cool) protects heating elements and ensures safe shutdown.
3. Temperature control: PID digital display controllers with auto over-temperature alarm and automatic heater cut-out on fault.
4. Emergency stops: provided at loading position, unloading position, and spray stations.
5. All control components: premium domestic and imported brands.

D. Total Installed Power Summary

No.	Equipment / System	Model	Power
1	Wash spray pumps	CTL-50VK-3	2.2 kW × 3
2	Degreasing pump	CTL-100VK-15	11.2 kW × 1
3	Hot-water circulation pumps	—	3 kW × 4
4	Air curtain blowers	—	3 kW × 4
5	Water-curtain circulation pumps	—	3 kW × 2
6	Fresh-air supply fans	—	1.1 kW × 4
7	Water-removal oven circulating fan	4-72-6C	11 kW × 1
8	Curing oven circulating fan	4-72-6C	15 kW × 1
9	Conveyor drive	—	5.5 kW × 1
10	Circulation pump (spray booth)	—	2.2 kW × 1
11	Spray pump (spray booth)	—	5.5 kW × 1
12	Exhaust gas induced-draft fan	4-72-12C	75 kW
13	Wastewater treatment (client scope)	—	~9 kW
14	Miscellaneous	—	5 kW
TOTAL INSTALLED POWER			**~180.6 kW**

E. Complete Equipment Bill of Materials

No.	Item	Specification / Description	Unit	Qty
I. Pre-Treatment Spray System — 19,800 × 1,800 × 2,200 mm				
1	Chamber body	1.5 mm 304 stainless steel, bent and bolted assembly	set	1
2	Drain/drip tray	2.0 mm 304 stainless steel, welded	set	1
3	Hot-water wash tanks	2,500 × 1,000 × 1,000 mm | 2 mm 304 SS | bent & welded	set	3
4	Degreasing tank	2,500 × 2,000 × 1,000 mm | 2 mm 304 SS | bent & welded	set	1
5	Wash spray pumps	CTL-50VK-3	unit	3
6	Degreasing pump	CTL-100VK-15	unit	1
7	SS bag filters & pipework (wash stages)	20 T rating	set	3
8	SS bag filter & pipework (degreasing)	100 T rating	set	1
9	Gas-fired hot-water	300,000 kcal/h	set	1

	boiler			
10	Plate heat exchangers	In-tank type with insulation	set	4
11	Hot-water circulation pumps & pipework	—	unit	4
12	Spray system, nozzles, manifolds, valves & pipework	PP nozzles | PPR manifolds | PPR pipework	lot	1
13	Bristle seal strips	Pig-bristle conveyor slot seal — 40 m total	m	40
14	Drain trough	304 SS 1.5 mm with support frame	m	3
II. Water-Removal Drying Oven — 22,000 × 1,400 × 2,400 mm				
1	Rockwool insulated panels	Outer: 0.6 mm colour-coated steel | Inner: 0.5 mm GI | Core: 120 mm rockwool	set	1
2	Oven corner trim	Outer: 1.5 mm GI powder-coated | Inner: 1.2 mm GI	set	1
3	Air-curtain sections	Air-curtain blower + supply/return ductwork	set	2
III. Curing Oven (Primer + Topcoat) — 32,000 × 1,400 × 2,400 mm				
1	Rockwool insulated panels	Outer: 0.6 mm colour-coated steel | Inner: 0.5 mm GI | Core: 120 mm rockwool	set	1
2	Oven corner trim	Outer: 1.5 mm GI powder-coated | Inner: 1.2 mm GI	set	1
3	Air-curtain sections	Air-curtain blower + supply/return ductwork	set	2
IV. Primer Spray Booth (Double-Sided Water Curtain) — 7,000 × 3,700 × 3,700 mm				
1	Chamber wall panels	5,000 × 3,700 × 3,700 mm | Rail height: 3,200 mm | 1.5 mm SS body & curtain plates	lot	1
2	Water storage pit	Client civil works (refer to foundation drawing)	—	Client
3	Circulation water pump	With filter	set	1
4	Overflow troughs & drip plates	—	set	2
5	Floor grating	Steel grating, t ≥ 4 mm flat bar, uniform & interchangeable	set	1
6	Supply air fans	—	unit	2
7	Plenum chamber (pressure equalisation)	Filter pad assembly with frame	set	1
8	Exhaust system	1.5 mm 201 SS ductwork with adjustable dampers	set	1
V. Topcoat Spray Booth (Double-Sided Water Curtain) — 7,000 × 3,000 × 3,700 mm				
1	Chamber wall panels	7,000 × 3,000 × 3,700 mm | Rail height: 3,200 mm | 1.5 mm SS	lot	1
2	Water storage pit	Client civil works	—	Client
3-8	Pumps, troughs, grating, fans, plenum, exhaust	Same specification as primer booth	sets	—
VI. Flash-off / Levelling Room — 15,500 × 1,400 × 3,200 mm				
1	Flash-off room	50 mm rockwool panels | structural steel frame	set	1

VII. Water-Removal Oven Gas Heating System — 3,500 × 1,500 × 1,300 mm				
1	Combustion chamber body	Frame: 3 mm SS inner | 1.2 mm GI outer | 100 mm Al-silicate fill	set	1
2	Recirculating fan	4-72-6C | 11 kW	set	1
3	Gas burner	200,000 kcal/h	set	1
4	Recirculation ductwork	1.2 mm galvanised steel	set	1
VIII. Curing Oven Gas Heating System — 4,500 × 1,500 × 1,300 mm				
1	Combustion chamber body	Frame: 3 mm SS inner | 1.5 mm GI outer | 100 mm Al-silicate fill	set	1
2	Recirculating fan	4-72-6C | 15 kW	set	1
3	Gas burner	300,000 kcal/h	set	1
4	Recirculation ductwork	1.2 mm galvanised steel	set	1
IX. Overhead Conveyor System — XT160 Heavy-Duty				
1	Drop-forged conveyor chain	XT160	m	180
2	Load trolleys	640 mm pitch	set	282
3	Straight track sections	GB 16# I-beam	m	168
4	Drive unit	5.5 kW | cycloidal reducer	set	1
5	Tensioner	R 1,500 × 180° roller-turn with counterweight	set	1
6	180° horizontal bend track	R 1,800 — roller-turn unit	set	1
7	Oven expansion joints	4 positions	set	4
X. Overhead Rail & Oven Support Steelwork				
—	Support columns, rail brackets, oven frames	120 × 120 mm square hollow section throughout	lot	1
XI. Below-Line Touch-up Spray Booth (Single-Sided Water Curtain) — 7,000 × 3,000 × 3,700 mm				
1-8	All sub-components	Same specification as topcoat booth (item V), single-sided water curtain configuration	sets	—
XII. Exhaust Gas Treatment System — 60,000 m³/h capacity				
1-7	Full system	Cyclone tower + dry/wet filter + activated-carbon adsorption × 2 + collection hoods + ductwork + 75 kW ID fan + control cabinet	set	1
XIII – XIX. Additional Line Items				
XIII	Wastewater pre-treatment dosing unit	pH adjustment + biological treatment + MBR | 5 T/day capacity	set	1
XIV	Automatic spray robots	Full-auto, pump-integrated	set	2
XIV-1	Manual spray guns	With paint pump	set	4
XV	Electrical control system	Control cabinets, cable trays, wiring	set	1

XVI	Paint materials & labour	—	—	1 item
XVII	Miscellaneous consumables	—	—	1 item
XVIII	Installation labour	—	—	1 item
XIX	Freight & logistics	—	—	1 item

F. Responsibilities of Each Party

F-1. Client Responsibilities (Party A)

6. Provide factory floor plans, workpiece drawings, and other relevant documents within 10 days of contract signing, to enable ST Powder Coating to proceed with engineering design.
7. Supply primary utilities (water, power, compressed air) to the installation boundary as specified in the equipment layout drawings.
8. Responsible for all civil and structural works, including foundation design and construction, wall penetrations, and waterproofing (ST Powder Coating provides required dimensions and drawings).
9. Provide a 5-ton forklift and personnel for equipment unloading on delivery day.
10. Supply water, electricity, and compressed air during installation and commissioning; provide a tool and materials storage room on site.
11. Permit use of available lifting equipment on site (subject to not disrupting normal production).
12. Provide site lighting during installation.
13. Provide 4 × 10-litre foam fire extinguishers on the construction site.
14. Manufacture secondary hanger/fixture tooling.
15. Provide free meals and accommodation for ST Powder Coating installation and commissioning personnel.
16. Supply pre-treatment chemicals, workpieces, paint materials, utilities, and fuel for commissioning.

F-2. ST Powder Coating Responsibilities (Party B)

17. Deliver foundation layout drawings, 'five-utility' (water, power, steam, compressed air, gas) connection point drawings, roof/wall penetration drawings, and energy parameters within 10 days of contract signing, to allow the client to prepare foundations and utilities in advance.
18. Design, manufacture, install, and commission all equipment strictly in accordance with the technical specification and commercial contract.
19. Designate a site superintendent responsible for construction supervision, quality, and schedule reporting; cooperate fully and without reservation with any client corrective action requests.
20. Provide all required software documentation as per contract.
21. Supply spare parts as specified in the contract.
22. Provide engineering design for secondary hanger/fixture tooling.

G. Quality Assurance & Acceptance

All critical technical documents — overall process flow, equipment floor layout, and total design package — must

be jointly confirmed and signed by both parties before taking effect.

Acceptance criteria

23. Pre-treatment quality: workpieces must meet cleanliness and adhesion requirements specified in the technical agreement after passing through the pre-treatment system.
24. Oven exterior: surfaces must be flat, smooth, and visually consistent; no hot gas leakage at panel joints; average outer wall temperature must not exceed ambient temperature by more than 15 °C.
25. Oven fans: smooth and reliable operation, noise within national standards.
26. All oven performance parameters to comply fully with the technical specification.
27. Workpieces must meet quality requirements after passing through both the water-removal drying oven and the curing oven.
28. Overhead conveyor: under full line load at curing temperature, chain must travel smoothly with no vibration or juddering.

Two-stage acceptance: preliminary acceptance upon completion of installation and commissioning, followed by formal final acceptance after operational validation. The 12-month warranty runs from the date of formal final acceptance.

H. Project Schedule

No.	Activity	Duration (days)
1	Engineering design	3
2	Material procurement & preparation	7
3	Equipment manufacture	30
4	Delivery / shipping	—
5	On-site installation	15
6	Initial commissioning	—
7	Final commissioning & acceptance	—
	TOTAL	**55**