



Powder Coating Line 粉末喷涂线



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Typical Layout Plan for Horizontal Powder Coating Line (Aluminium Profiles with 6000mm Length)

卧式粉末喷涂线平面图 (6000毫米长铝合金型材)

一、什么是粉末喷涂？

粉末喷涂是用喷粉设备(静电喷塑机)把粉末涂料喷涂到工件的表面,在静电作用下,粉末会均匀的吸附于工件表面,形成粉状的涂层;粉状涂层经过高温烘烤流平固化,变成效果各异(粉末涂料的不同种类效果)的最终涂层;粉末喷涂的喷涂效果在机械强度、附着力、耐腐蚀、耐老化等方面优于喷漆工艺,成本也在同效果的喷漆之下。

二、粉末喷涂的优点是什么？

与传统的油漆工艺相比,粉末涂装的优点是:

- 1、高效:由于是一次性成膜,可提高生产率30-40%
- 2、节能:降低能耗约30%
- 3、污染少:无有机溶剂挥发(不含油漆涂料中甲苯、二甲苯等有害气体)。
- 4、涂料利用率高:可达95%以上,且粉末回收后可多次利用。
- 5、涂膜性能好:一次性成膜厚度可达50-80 μ m,其附着力、耐蚀性等综合指标都比油漆工艺好。
- 6、成品率高:在未固化前,可进行二次重喷。粉末涂装工艺种类较多,常见的有静电喷粉和浸塑两种。

What is Powder Coating?

Powder coating is an advanced method of applying a decorative and protective finish to a wide range of materials and products that are used by both industries and consumers. The powder used for the process is a mixture of finely ground particles of pigment and resin, which is sprayed onto a surface to be coated. The charged powder particles adhere to the electrically grounded surfaces until heated and fused into a smooth coating in a curing oven. The result is a uniform, durable, high-quality, and attractive finish. Powder coating is the

fastest-growing finishing technology in China representing over 10% of all industrial finishing applications.

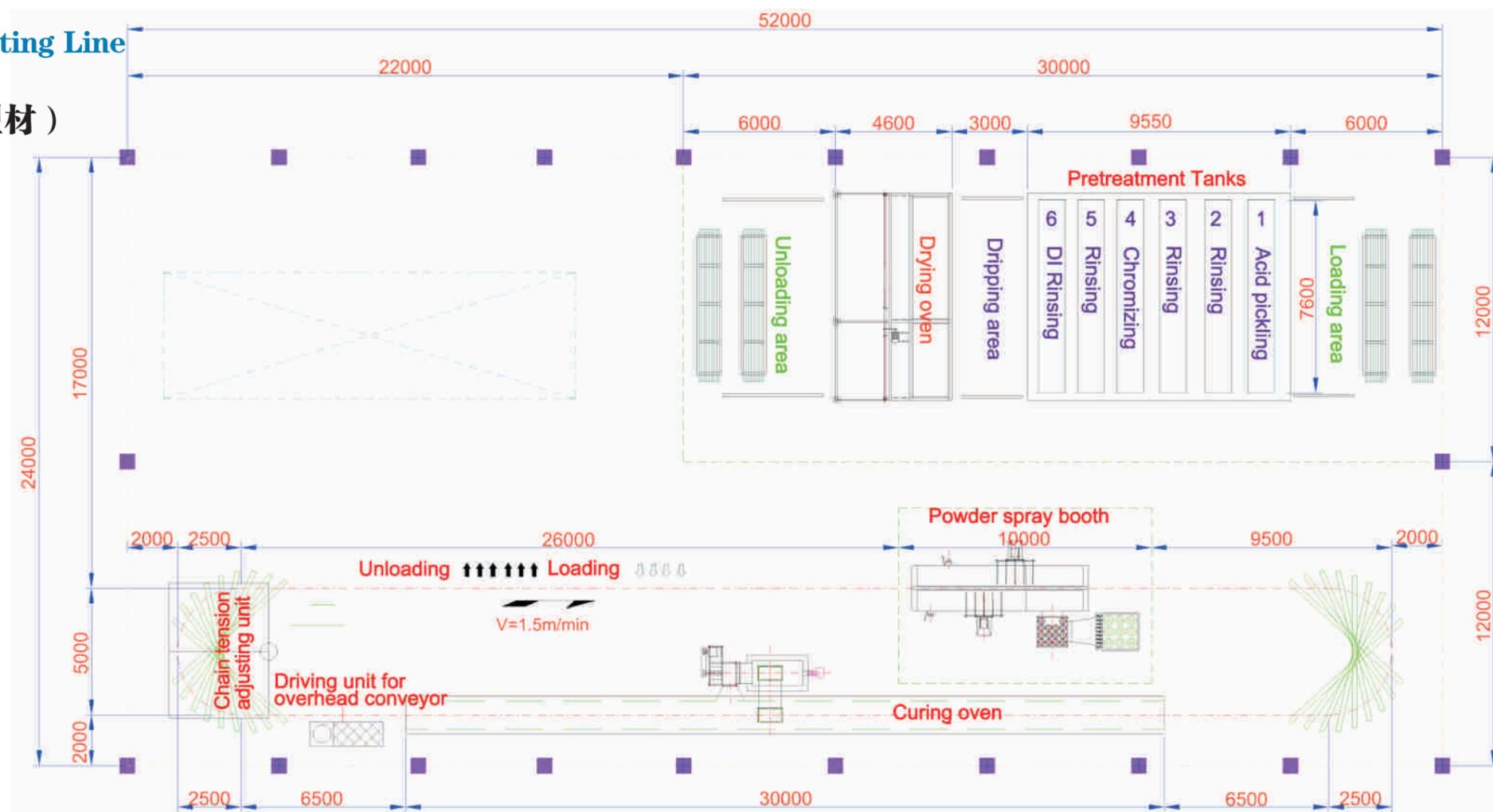
What are its advantages?

More Durable
Powder coating gives consumers, businesses, and industry one of the most economical, longest-lasting, and most colour-durable quality finishes available. Powder coated surfaces are more resistant to chipping, scratching, fading, and wearing than other finishes. Color selection

is virtually unlimited with high and low gloss, metallic, and clear finishes available. And colours stay bright and vibrant longer.

Protects the Environment
Powder coating is also highly protective of our environment. While liquid finishes contain solvents which have pollutants known as volatile organic compounds (VOCs), powder coating contains no solvents and releases negligible amounts, if any, of VOCs into the atmosphere. Thus, there is no longer a need for finishers to buy costly pollution control equipment. In addition, most

powder coating overspray that does not adhere to the part can be retrieved and reused, virtually eliminating the waste commonly found in liquid finishing processes.
Saves Money
Elimination of VOCs and reduction of wastes saves money and helps companies comply more easily with Government environmental legislation. In fact, one of the major elements in expanding the market for powder coating has been the implementation over the past 10 years of stringent air pollution control legislation.

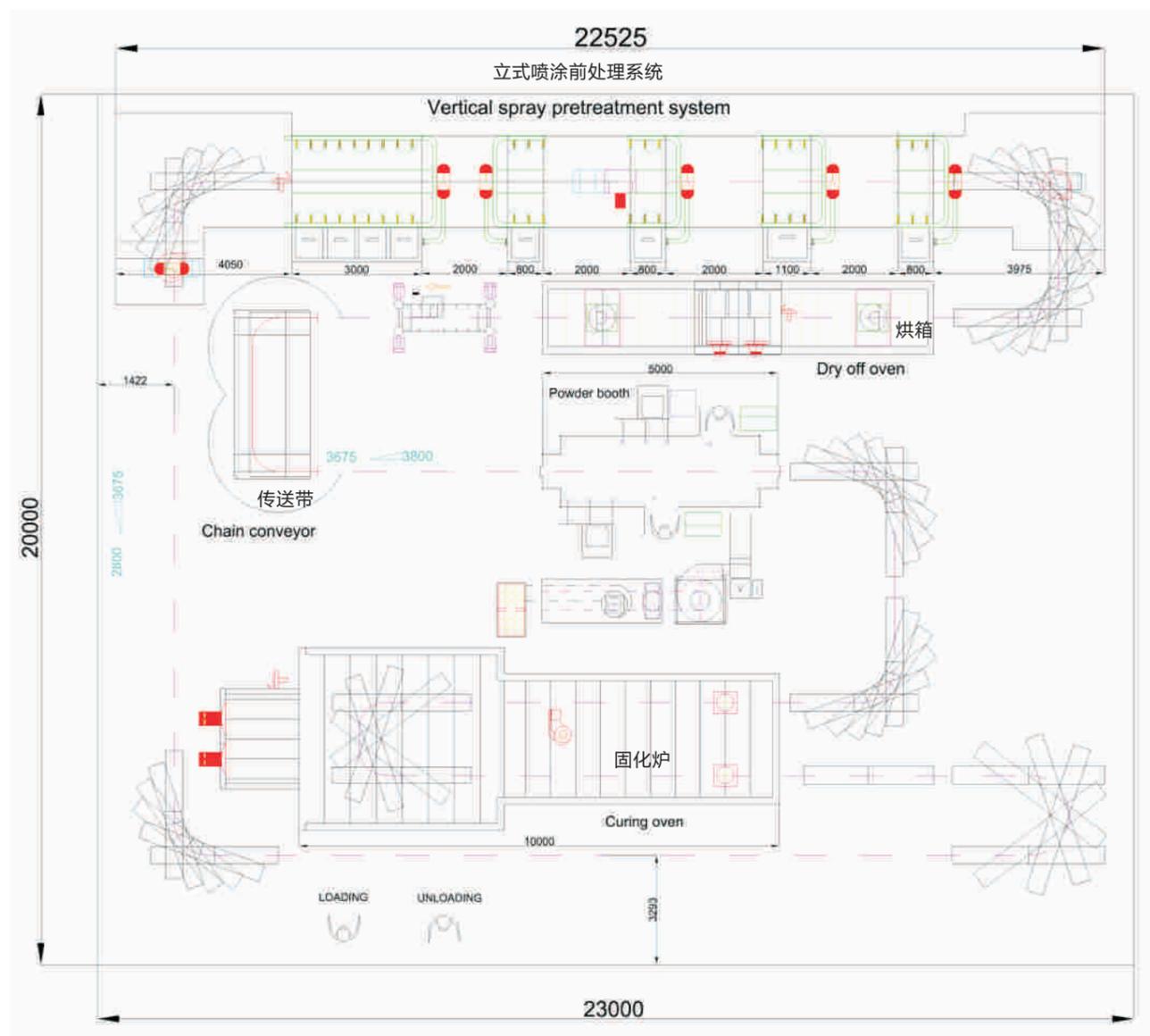


粉末喷涂线

Powder coating line

Typical Layout Plan for Vertical Powder Coating Line

典型立式粉末喷涂线平面图



粉末喷涂的应用领域有哪些？

A 家电

粉末涂料在家电行业的应用: 炉灶, 冰箱, 洗衣机的顶部和盖子, 机鼓正面和侧面板, 空调柜, 热水器, 洗碗机架, 微波炉腔。在许多洗衣机和烘干机的零件中粉末涂料也取代了搪瓷。

B 汽车

汽车行业使用粉末喷涂的有: 车轮, 保险杠, 毂盖, 门拉手, 装饰条和影音零件, 卡车床, 散热器, 过滤器, 以及众多的发动机部件。粉末面漆已发展到保护汽车车身。

C 建筑/大厦

建筑和建筑市场中粉末涂料的应用: 粉末涂层铝门窗及型材、组合家具框架。许多公路和建设项目使用灯柱, 护栏, 标志等。

D 日常用品

如照明设备, 灯具、天线和电子元件产品。拖拉机和农用设备涂层。健身爱好者使用的高尔夫球俱乐部和高尔夫球车, 滑雪杖, 雪地摩托, 自行车和健身器材也是粉末涂层。店内有粉末涂层展示架, 货架, 储存装置, 以及自动售货机。办公室工作人员使用的金属家具, 电脑柜, 自动铅笔和钢笔, 图钉, 桌子和其他配件, 也是粉末涂层。粉末涂层婴儿车, 婴儿床, 金属玩具和旅行车。家庭草坪割草机, 烤肉架, 庭院家具, 园艺工具, 电子元器件, 浴室秤, 工具箱等。



3 stage stainless steel spray pretreatment system

三阶段不锈钢喷涂前处理系统

Where is Powder Coating Used?

• Appliances

The appliance industry benefits from powder coating on front and side panels of ranges and refrigerators, washer tops and lids, dryer

drums, air-conditioner cabinets, water heaters, dishwasher racks, and cavities of microwave ovens. Powder coating has also replaced porcelain enamel on many washer and dryer parts.

• Automotive

The automotive industry uses powder coating on wheels, bumpers, hubcaps, door handles, decorative trim and accent parts, truck beds, radiators, filters, and numerous engine parts. A clean powder

topcoat has been developed to protect auto bodies.

• Architecture/Building

The architectural and building market powder coats aluminium extrusions used on frames for windows and doors and modular furniture.

Many highway and building projects use powder coating on light poles, guard rails, signs, posts, and fencing.

• Everyday Products

There are also innumerable everyday uses for powder coated products such as lighting fixtures, antennas, and electrical components.

Farmers have powder coated tractors and farm equipment. Fitness buffs use golf clubs and golf

carts, ski poles and bindings, snowmobiles, bicycles, and exercise equipment that are powder coated. Shop owners have powder coated display racks, shelves, store fixtures, and vending machines. Office workers use metal furniture, computer cabinets, mechanical pencils and pens, thumbtacks, and other desk accessories that are powder coated. Parents have powder coated baby strollers, cribs, metal toys, and wagons. And home owners have lawn mowers, barbecue grills, patio furniture, garden tools, electronic components, bathroom scales, tool boxes, and fire extinguishers which benefit from a powder coated finish.

预处理

Pretreatment

Immersion pretreatment baths with overhead crane (7 stages)

槽浸式前处理



Immersion pretreatment together with auto conveyor system
Less labour needed ,Easy operation
Cement tanks pretreatment system
4mm PVC lining to prevent from chemical corrosion . Economical choice for new investor.
External heater for phosphate bath
easy in cleaning & precipitate



水泥槽预处理系统
4mm聚氯乙烯内涂层,可防止化学腐蚀,更经济的选择。
自动输送系统沉浸预处理
更少的人力
操作便捷
外部加热器磷酸洗
便于清洗沉淀



Internal pipeline & nozzles within spray washer
Adjustable spraying direction of nozzles to improve the efficiency of pretreatment chemicals

内部管道及机内喷雾喷嘴
喷嘴方向可调式,有效提高化学预处理效率



Various kinds of spray nozzles
Made of high temperature engineering plastic for long service life.
各种喷淋嘴
耐高温工程塑料制造,使用寿命更长。



Vertical spray pretreatment washer
The washing housing is made of stainless steeling sheets and assembled with cold riveting
Seal booth construction to avoid leaks
Side suction solution pumps

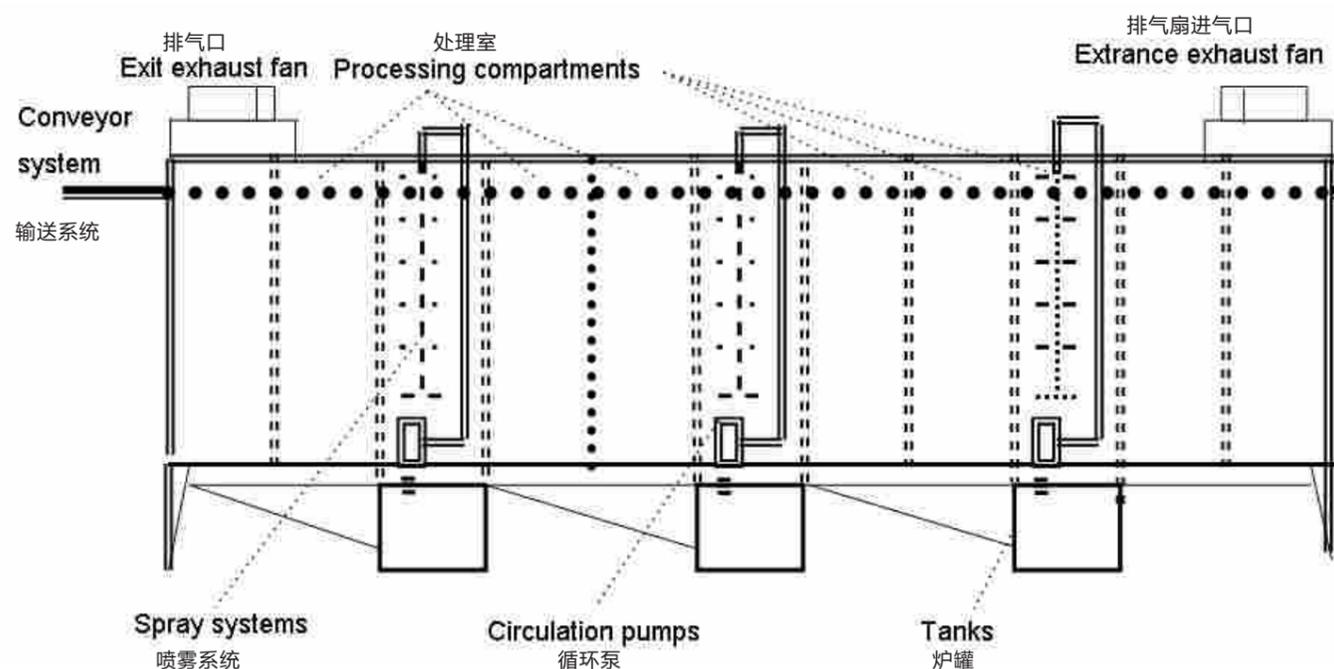
立式喷洗预处理
清洗室外壳由不锈钢板组装。
密封室建设,避免泄漏。
侧吸溶液泵。



前处理

Pretreatment

Simplified Drawing of Vertical Spray Pretreatment System 垂直喷雾预处理系统



Immersion Pretreatment System

Advantages	Disadvantages
Low cost installation.	Not easy to automate.
Can be off (space saving).	Slow processing.
Better protection in difficult areas. Small components easily batched.	Tends to give dusty coating large tanks require long heat up time.
Simple to maintain.	Use more energy.
Flexible chemistries can be used.	Quality can vary as manual operation is used.

浸入式前处理系统

优点	缺点
安装成本低	不易实现自动化
可拆卸 (节省空间)	处理速度慢
复杂区域得到保护	粉末中易混入尘土
小零件易成批	大型罐需较长加热时间
维护简单	高能耗
灵活使用化学原料	需手动操作以提高产品质量

Pretreatment system: preparation for powder adhesion

Proper surface preparation is the single most important aspect of a powder finishing system should you wish to maximise powder performance. The procedure required to obtain a suitably prepared surface depend heavily on the type of substrate but in most cases the following steps are required:

- 1. Cleaning**
The cleaner will depend on both the substrate and the soils to be removed e.g. synthetic draw lubricants are much easier to remove than a buffing or polishing compound. Metaloxides (rust) need to be removed at this point as they will act as a barrier to powder coating film adhesion. This is normally achieved by

- 2. Conversion Coating**
Conversion coatings are materials and processes that impart corrosion resistance better adhesion properties to a metal substrate. The type of conversion coating depends heavily on the nature of the substrate as well as the desired properties of the coating.
Aluminium - The aluminium surface is treated with a chromate conversion coating to produce a surface layer that comprises of both aluminium and chrome oxides. This is a smooth uniform surface that is chemically inert and allows good adhesion of the organic coating.
Iron & Steel - Zinc Phosphate or Iron Phosphate is used depending on the mechanical

- 3. Passivation**
A passivator (seal rinse) is applied over a zinc or iron phosphate to increase the corrosion resistance of the coating and to improve adhesion of paint and organic finishes. Passivation is important if components are going to be stored or transported between chemical treatment and powder coating.
- 4. Rinsing**
The work pieces are rinsed between stages to prevent cross contamination of process solutions and to reduce chemical consumption. The final rinse prior to drying is to remove any unreacted chemical or salts that could adversely affect adhesion.

Vertical Spray Pretreatment System

Advantages	Disadvantages
Can be easily automated.	Higher investment and maintenance cost.
Plant can be built in line with application of powder coating.	More difficult to protect deep recesses or difficult shapes.
Better cleaning.	Small items pre-treated less efficiently.
Lower chemical cost.	Troubleshooting with more expertise.
Increased throughput.	
Less energy for heating.	

立式喷涂前处理系统

优点	缺点
易自动化处理	需较高的投入和维修费用
可建立符合喷涂线的生产车间	难于保护深凹处和复杂形状的地方
易清洁	
低耗料	小件器具预处理效率低
高效率	
低能耗	故障排除需更多专业知识

Typical Pretreatment Example

Process	Temperature	Time
Pre-degreasing	50-65°C	1min
Degreasing	50-65°C	2min
Cold water rinse	Room temp	1min
Cold water rinse	Room temp	1min
Surface conditioning	Room temp	1min
Conversion coating Chromizing for Aluminium; Phosphating for Steel	35-45°C	2.5min
Cold water rinse	Room temp	1min
DI water rinse	Room temp	1min
Dry off oven	100-120°C	10min

典型预处理案例

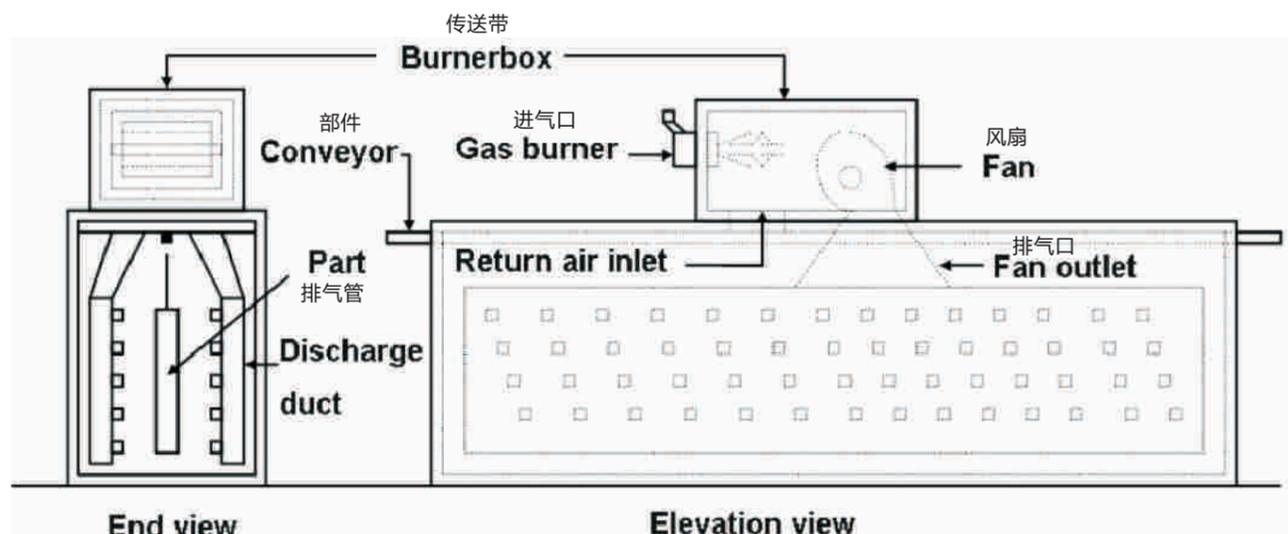
Process	Temperature	Time
预脱脂	50-65°C	1min
脱脂	50-65°C	2min
冷水洗	室温	1min
冷水洗	室温	1min
表面处理	室温	1min
转化膜 渗铝 磷化钢	35-45°C	2.5min
冷水洗	室温	1min
清水冲洗	室温	1min
烘干箱	100-120°C	10min

Note: The above pretreatment examples are only for reference. We advise consulting your chemical supplier to obtain the correct conditions to meet the required specifications. We stress that all chemical pretreatment processes must be maintained to the chemical suppliers specification to ensure continuous quality powder coating.
注: 上述预处理例子仅供参考。我们建议咨询您的化工产品供应商获取正确的条件, 以满足所需的规格。我们强调, 所有化学处理过程必须规范, 以确保化学品供应商保证粉末涂料的质量。

干燥&固化炉

Dry off & Curing oven

Dry Off & Curing Oven With Recirculating Fan 干燥和带循环风机固化炉



Dry off Oven - After passing all pretreatment zones by means of the conveyor system, residual humidity is eliminated in the dry off oven to make sure the adhesion of coming powder application.

Curing Oven - Subsequent to the powder application, the workpieces must be transferred directly into the curing oven to polymerize the powder into smooth protection layer.

原料由输送系统经过所有预处理区后，在脱水烘干炉中烘干，确保塑粉可以牢固附着。

固化炉用于塑粉固化，工件被直接送入固化炉，粉末硫化成光滑平整的保护层。

脱水烘干炉和固化炉都带有热风循环系统的入口和出口。基本部件

Both the dry off and curing oven is an enclosure with an entrance and exit that has heated air circulating through a supply duct and returning to the fan to be recirculated. The basic components are the insulated walls, supply duct, and burner box (fan and heat source). The heat energy produced by natural gas (or fuel, electricity, coal, etc.) in combustion chamber is directly conveyed to oven. Then with the help of circulating blower, the

有：隔热墙、供气管道和燃烧室（包括风扇和热源）。燃烧室里面的燃料燃料可以是天然气、电或者是煤，产生的热能被直接送到烘道内。

在循环风机的作用下，烘道内温度很容易达到均匀。

燃烧器采用意大利进口设备，使用寿命更长。

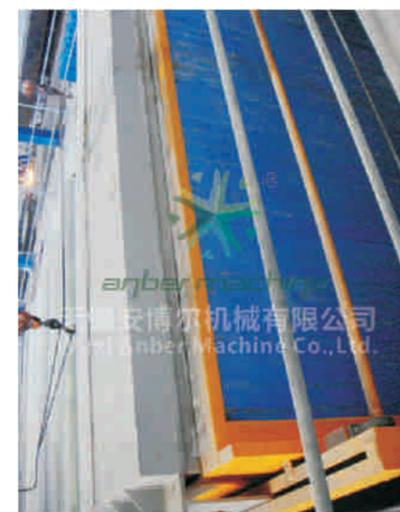
inside temperature can easily reach an uniformity. The burner is imported from Italy for longer service life.

The benefits of using air impingement to help dry parts are;

- * Energy savings
- * Little fluctuation in temperature
- * Faster warm-up time
- * No damage to phosphate coating & powder coating
- * Less floor space required.

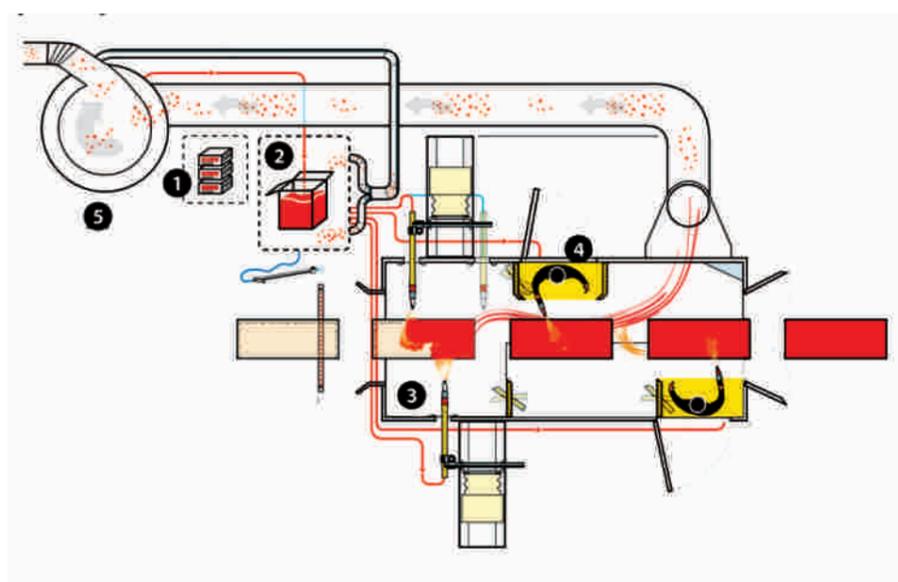
使用空气循环系统帮助烘干工件的优点：

- * 节约能源
- * 温度波动小
- * 更快的预热时间
- * 没有破坏磷化膜和粉末涂料
- * 占地面积少。



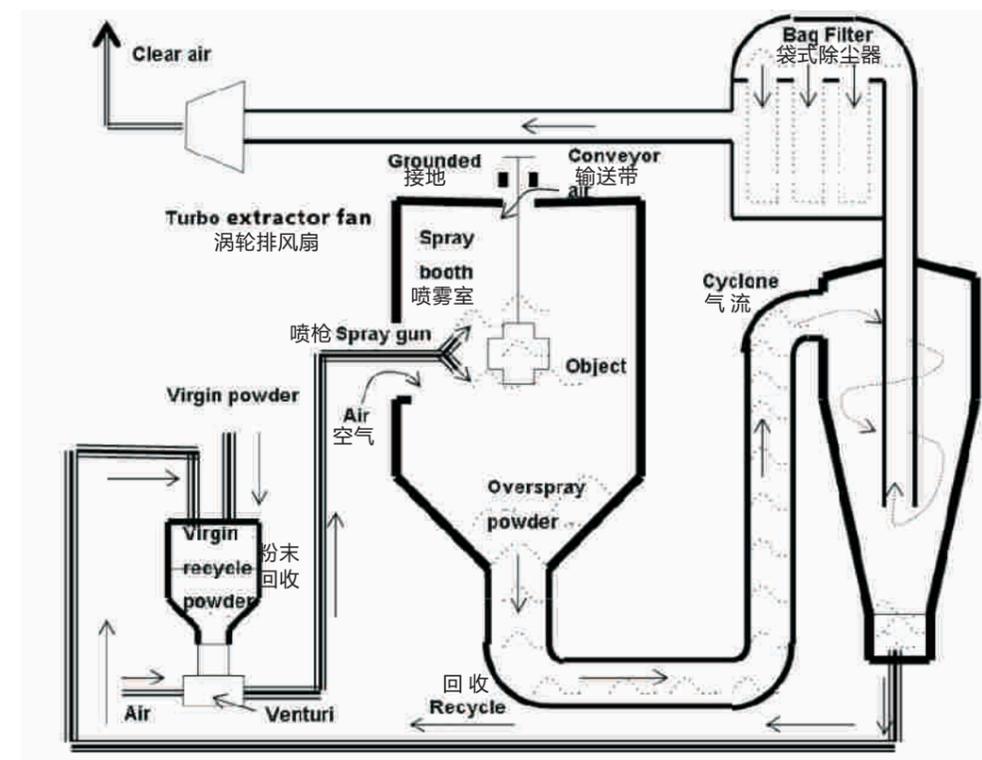
喷涂室

Spray booth



1. Control cabinet
2. Powder feed centre
3. Automatic application zone (1 slot on right-hand side and 2 on left-hand side)
4. Manual stations for pre and repowdering
5. Extraction cyclone (overspray powder recycling)

1. 电控柜
2. 粉末输送中心
3. 自动调节区 (右侧1槽、左侧2槽)
4. 预喷涂站立区
5. 提取气旋(过喷粉末回收)



Schematic flow-diagram of powder application and recovery system

Powder spray booth

The powder that is not deposited onto the objects in the spray booth (overspray) is not wasted. It is recovered and re-used in the process. A spray booth should ensure that the overspray powder is contained, transferred and collected efficiently for recycling into the feed system. As such, the combination of these procedures ensures the optimum efficiency of the entire powder application operation. This recovery process is driven by an exhaust air ventilator that provides an airstream powerful enough to flow through the related extractor equipment such as a cyclone and filters.

Cyclone collectors for overspray powder

The input to the cyclone is connected to the booth while the output is connected to a suitable exhaust fan. The overspray powder arrives at the cyclone inlet at a velocity of about 20 metres per second. On entering the cyclone chamber tangentially the air/powder mixture is given a rotary motion which creates a centrifugal force on the particles. The larger and heavier particles tend to be ejected to the outside walls of the chamber and fall to the bottom where they are collected. The lighter fractions will stay suspended in the air stream which on reaching the bottom is deflected by a conical tail air/powder mix into a rising spiral

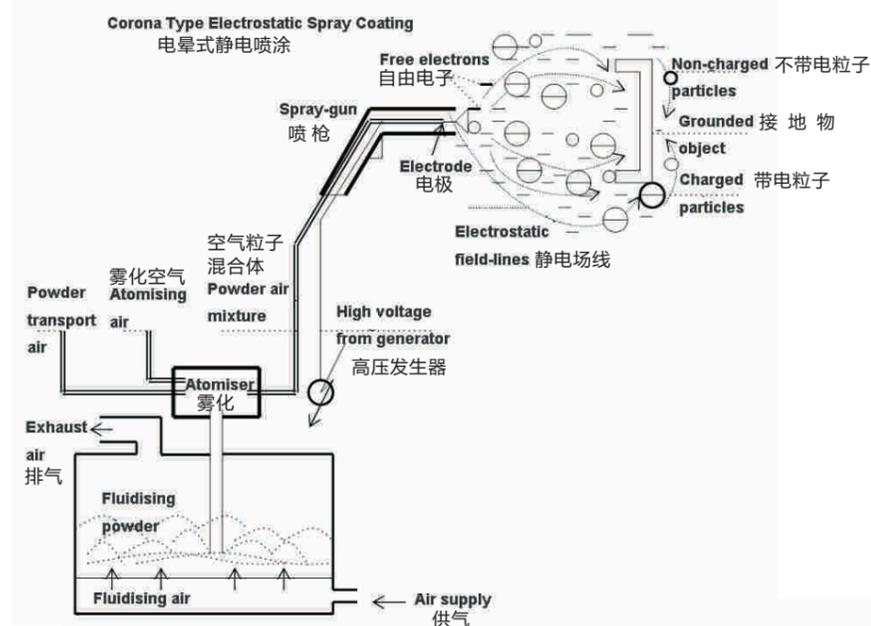
which is then carried through the central stack to a filter collector. For a standard powder the recovery efficiency can be as high as 90%. For lines that have a high percentage of particles <10µm in the recovered powder the recovery efficiency will be reduced (as low as 75%). Inevitably therefore a cartridge filter is used in conjunction with a cyclone solely to prevent discharge of the fine powder to the atmosphere. An additional advantage of cyclone recovery, with particular reference to colour change, is that due to frictional contact of powder particles, one with another and 'bounce-back', little or no adherence of powder particles occurs on the cyclone wall. This means that in many cases only the powder collection hopper need be thoroughly cleaned between colour changes.





喷枪应用

Powder application gun



Auto reciprocator:
stroke from 500-3500mm
自动往复
(摆动范围500-3500mm)



Powder application guns

Powder application - For most coating requirements powder is sprayed and charged electrostatically through spray guns onto the workpiece. Our powder gun, adopting the corona charging method, makes use of a high voltage generator (80-100 kv) to bring an

electronic charge (mostly negative) onto the powder particles through the intermediate process of creating oxygen ions.

Advantages

- 1) Strong electrostatic field results in effective charging and higher deposition.
- 2) Electrostatic field lines support

- the powder particles to move toward the workpiece.
- 3) Simple repairs of the powdered surface are possible.
- 4) Light, robust spray gun.
- 5) Accepts different types of powder materials and particle sizes.
- 6) Film thickness can be simply changed by voltage variations.
- 7) Simple construction is suited for fast color changes.

喷粉枪的应用

对于大多数喷涂设备来说,粉末涂料都是在静电作用下通过喷粉枪喷涂到工件上的。

我们的喷粉枪,采用静电控制方法,用高压发生器(80-100千伏),通过产生氧离子的中间过程使带电粒

子(主要是负电荷)到达粉末上。

优点:

- 1) 有效的静电控制和粒子沉积造成强静电场;
- 2) 静电场线引导粉末粒子到达工件表面;
- 3) 可用于工件表面粉末的简单修

补;

- 4) 重量轻;
- 5) 可适应不同粒子大小的粉末;
- 6) 通过控制电压可以改变喷涂厚度;
- 7) 结构简单,适合于快速的颜色变化;



输送系统

Conveyor system



At the start of the line the product is manually loaded onto the overhead conveyor then it is transported at high level through chromate or phosphate pretreatment then through dry off oven and finally through the powder coat application and into the curing oven. After a cool off zone the product could be offloaded and transported to the packing and despatch areas. Empty hooks are then sent through a burn off process to avoid build up

of powder and returned to the start of the line ready for the process to start over.
 1. The convey chain is forced by driving unit to make it go along track. When it comes to different sections of track, it can automatically make corresponding changes on convey height and direction. The driving units equipped with safety pin protection for overloading.
 2. Temperature expansion joint: when the convey track comes

across drying furnace, the high temperature may cause thermal deformation on convey chain. Thus we design expansion joint at both ends of high-temperature zone for compensation.
 3. The lubrication unit is helpful in drop oiling for axis pin, cross head and roller for regular maintenance.
 4. Stepless regulation of convey speed for easy control and auto failure alarm for safety production.

在该生产线的开端物件是由人工手动放到传送带上，在传送过程中通过铬酸盐或磷酸盐前处理，然后通过烘箱干燥，最后再通过粉末喷涂并进入固化炉。经过冷却区的产品可以被卸载，运到包装和发货地区。空钩被送入焚烧处理，避免过程中带上粉末，然后回到生产线开始准备下一个

循环。
 1. 输送机链条被传动装置迫使其沿着轨道。当涉及到不同的轨道，它可以自动作出相应的传达高度和方向上的变化。传动设备配备过载保护装置。
 2. 温度伸缩缝：当传送轨道遇到烘干炉，高温可能导致传递链变形。

因此，我们设计的伸缩缝在高温区的两端进行填补。
 3. 润滑设备对销轴，交叉头和轴辊的上油及维护提供便捷帮助。
 4. 传动设备无极调速易于控制和故障自动报警为安全生产提供了保障。



成品 Finished products

客户需求单 Requirement List

日期 (Date):
 客户 (Custom):
 记录员 (Recorder):



客户联系方式 (Your Contact Details)			
姓名 Name	_____	国家 Country	_____
公司 Company	_____	职位 Title	_____
邮箱 E-mail	_____	电话 Telephone	_____
项目性质 (Project)			
新建项目 (First purchase of powder coating line)		扩展项目 (Expanding plan on current powder coating line)	
待喷粉工件规格 (Workpiece need to be coated)			
工件名称 Name of workpiece	_____		
材质 Material	铝件 Aluminium: _____	铁件 Steel: _____	其余 Other: _____
大小尺寸 Size	长 Max.length: _____ mm	宽 Max.width: _____ mm	高 Max.height: _____ mm
工件重量 Weight	_____ kg per piece		
喷粉原料 Powder coatings	热固型粉末涂料 Thermoset powder coatings: (<input type="checkbox"/> 环氧 Epoxy <input type="checkbox"/> 聚酯 Polyester <input type="checkbox"/> 丙烯酸酯 Acrylates) 热塑性粉末涂料 Thermoplastic powder coatings: (<input type="checkbox"/> 聚氯乙烯 PVC <input type="checkbox"/> 聚乙烯 PE <input type="checkbox"/> 聚偏氯乙烯 PVDF <input type="checkbox"/> 尼龙 Nylon) 氟树脂粉末涂料 Fluoroethylene powder coatings <input type="checkbox"/> 聚四氟乙烯 PTFE <input type="checkbox"/> 聚三氟氯乙烯 PTFCE <input type="checkbox"/> 聚偏氟乙烯 PVDF 其他 Others		
涂层厚度 Coating thickness	_____ um (1mm=1000um)		
车间规格 (Coating workshop)			
尺寸 Dimensions	Length: _____ mm	Width: _____ mm	Height: _____ mm
	支撑柱数量 NO. of supporting pillar: _____ pcs 间隔距离 Distance interval: _____ mm		
地面承重 Ground bearing capacity	_____ kgs per square meter		
	地面挖掘 Ground excavation: <input type="checkbox"/> Yes with digging depth: _____ mm <input type="checkbox"/> No		
	行车 Overhead Crane: <input type="checkbox"/> Available <input type="checkbox"/> Not available		
	水源 Water supply: <input type="checkbox"/> Available <input type="checkbox"/> Not available		
使用电源 Power supply	_____ V _____ Hz 可用电力 Available electricity capacity: _____ Kw		
空气污染标准 Atmospheric emission	污染物排放浓度 Concentration of discharged pollutants: _____ mg/m ³		
具体喷粉要求 (Detailed coating requirements)			
前处理 Pretreatment:	<input type="checkbox"/> 抛丸机 Shot blasting machine (Recommend for large workpiece with a thickness above 3mm) <input type="checkbox"/> 立式喷淋 Vertical spray washer <input type="checkbox"/> 槽浸式 Immersion bath system (Construction <input type="checkbox"/> Cement tanks with plastic lining <input type="checkbox"/> Stainless steel tanks with plastic lining) (Lifting crane <input type="checkbox"/> Yes, _____ T <input type="checkbox"/> No)		
产量 Expected output	_____ Tons per month 运转时间 Operation schedule: _____ hours per day _____ shifts operation 输送速度 Conveying speed: _____ meters per minute 注具 Loading capacity on each conveying hanger: _____ piece(s) _____ kg		
加热方式 Heating source	<input type="checkbox"/> 天然气 Natural gas 热值 Fuel value: _____ J/kg (Burner brand: <input type="checkbox"/> Riello <input type="checkbox"/> Batur) <input type="checkbox"/> 煤 Coal 比热 Specific heat: _____ J/(kg·°C) <input type="checkbox"/> 电力 Electricity (Type: <input type="checkbox"/> 热风循环 Forced convection <input type="checkbox"/> 红外辐射 Infrared radiation)		
自动化程度 Degree of automation	<input type="checkbox"/> 全自动 Full-automation (Requires vertical washer pretreatment system) <input type="checkbox"/> 半自动 Semi-automation (Needs manually transfer workpieces from pretreatment to powder coating line)		
电控系统 Electrical control	电气元件 Electrical element: <input type="checkbox"/> 施耐德 Schneider <input type="checkbox"/> 欧姆龙 Omron <input type="checkbox"/> ABB PLC: <input type="checkbox"/> 三菱 Mitsubishi <input type="checkbox"/> 西门子 Siemens		
控制方式 Controlling mode	<input type="checkbox"/> 集中控制 Central control <input type="checkbox"/> 分开控制 Separate control		
外购件喷枪 Outsourcing Spray guns	<input type="checkbox"/> 瑞士金马 ITW Gema <input type="checkbox"/> 美国诺信 Nordson <input type="checkbox"/> 德国瓦格纳 Wagner		
设备安装培训服务 Facility installation & training	<input type="checkbox"/> Yes <input type="checkbox"/> No		
(Please note that travelling and living expense for our technicians who sent to aboard will be borne by buyer. The buyer should also pay their wage: USD100 per day per person.)			
付款方式 (Payment)	50% of total amount by T/T at the time of order confirmation Other 50% of total amount by T/T before shipment of Powder Coating Line		
报价方式 Payment terms	<input type="checkbox"/> FOB <input type="checkbox"/> C&F <input type="checkbox"/> CIF		
交货时间 Delivery time	_____ days		