Surface preparation is a primary part of the coating application process. Before metal products can be powder coated or sprayed with liquid paint, the part surface should be cleaned and prepped for the specific coating application. Proper surface preparation is essential to ensuring powder or paint adheres properly to products. It also lays the groundwork for consistent, quality finishes and prevents corrosion from forming on products.

Which method of surface preparation is required depends on the condition of the substrate and performance requirements of your coating — including appearance, durability, adhesion and corrosion resistance. By understanding what is needed to pretreat your product, you can ensure optimal results.

Surface preparation requirements for metal parts range from simple to complex. Manufacturers typically work with coating suppliers, who recommend appropriate surface preparation prior to coating application. There is a range of surface preparation processes for parts:

- **Simple**: The surface of the parts is already prepped/primed. Parts require minimal prep – manual blow off, wipe off or power cleaning – to remove road grime, dust or oils.

- **Advanced**: Parts that are low-volume production (batch order) require minimal adhesion and corrosion specifications. Some manual surface preparation is still required, with options including a chemical wipe, sand/grind/wire brushing, light blasting and spraying with a cleaner and/or pretreatment/conversion.

- **Complex**: Manufacture of high-production parts with high-performance coating specifications. Typical automated processes include surface blasting and surface pretreatment/conversion.

Commonly Used Pretreatment Methods and Recommended Environments

**SPRAYING METHODS**

When metal products are manufactured or transported, they are often covered in grease, oils or dirt. For powder or paint to adhere to a product, it must be washed to remove the contaminants. Otherwise, a majority of powder or paint that is sprayed will not adhere to the product. Even if powder or paint does adhere, the finish quality will be less than ideal.
Washing and cleaning requires soaps or specialty chemicals, such as alkaline, solvent and acidic cleaners. Steam cleaning or hot water helps break down the soils and can reach difficult spots or gaps in the surface. Detergent is usually used to clean metal containing oils, waxes, polishing compounds or other substances that prevent the coating from sticking to the metal.

For part surfaces (substrates) that require increased performance beyond what cleaning the surface can provide, chemical processes improve coating adhesion and corrosion protection performance. Phosphate and non-phosphate chemical processes provide a seal between porous paint and the metal surface, greatly increasing corrosion protection.

The most common chemical pretreatment applications include:

**Iron Phosphate:** Used on steel and aluminum

**Zinc Phosphate:** Used on steel and aluminum; typical in higher salt spray protection

**Zirconium:** New phosphate-free chemistry with equivalent salt spray of iron phosphate but no heat required

**ENVIRONMENTS**

Manual wash processes require an open face or enclosed booth with a drain in the floor (known as wash booths), depending on pressures and the chemicals to be contained. Parts are sprayed (liquid blasted) with cleaning and rinsing solutions, then dried with ambient air or in an oven before coating application. Low-temperature ovens with recirculating air movement typically range from 110 to 180 degrees Fahrenheit to rapidly dry the parts.

Pretreatment washers have significant advantages over wash booths, most notably:

- Parts can be cleaned with more chemicals
- Pretreatment washers provide a more thorough clean, with nozzles that blast parts from dozens of different angles
- A shop’s low-temperature oven is not tied up for drying the parts, preventing production bottlenecks
- Water costs are lower because of the efficiency of pretreatment washers
- Additional labor is not required to manually wash the parts
ABRASIVE BLASTING

METHODS

Abrasive grit blasting, also known as sandblast cleaning, is a surface treatment process widely used in a variety of industries, with many diverse purposes. If the surface you are coating has any rust, a previous coating or scale on it, abrasive blasting the product is critical to help achieve the highest quality finish. Failure to remove rust, paint or scale from the surface prior to coating can cause the coating to not adhere properly, often resulting in rework.

With abrasive blasting, an abrasive media is accelerated through a blasting nozzle using compressed air. The abrasive used varies based on the surface treatment required. Common abrasives include steel shot, steel grit, glass bead, crushed glass, aluminum oxide, silicon carbide, plastic, ceramic grit and copper slag. Media selection is a crucial decision in the engineering of abrasive blasting processes. The different media types have different hardness, shape and density, and each is available in a wide range of particle sizes.

A form of abrasive blasting is wet blasting, in which water moves the abrasives. The water traps the dust produced and lubricates the surface, cushioning the impact on the surface and reducing the removal of sound material. A wet machine has the ability to eliminate the frictional heat that can damage certain materials.

Most common in large-scale operations, shotblasting has a different pressurizing system than sandblasting, using spherical shot as an abrasive media and a centrifugal wheel for propulsion. Shotblasting works by propelling round materials, known as shot media, against a surface, which removes the contaminants of the surface. Shotblasting is a more aggressive technique than sandblasting, ideal for larger and more difficult objects that need a strong application force and denser media material to clean and prepare a surface.

The Society for Protective Coatings (SSPC) specifies four standards of blasting:

- **Brush-Off Cleaning**: Cleaning of everything on a product, other than tightly adhering residues of mill scale, rust and old coatings, which exposes numerous evenly distributed flecks of underlying metal. Acceptable in non-corrosive environments where long-term coating life is not expected.
- **Commercial Blast**: Cleaning until at least two-thirds of the surface is free of visible residues. Ideal for applications where tightly adhering contaminants are allowable on the surface, for products with lower quality standards and for non-corrosive environments.
- **Near-White Metal Blast**: Removes at least 95 percent of visible residues. Used for harsh environments in which the product is exposed to heavy usage.
- **White Metal Blast**: Removes all visible rust, mill scale, paint and foreign matter. Used for conditions where corrosion resistance is very important and the environment is highly corrosive.
SANDING & GRINDING

METHODS

Sanding and grinding resembles less aggressive abrasive blasting. This process requires the surface to be free of all visible oil, grease, dirt, dust, rust, coating, oxides, mill scale and other foreign matter when viewed without magnification.

ENVIRONMENTS

There are numerous environments to perform abrasive blasting. Among the most common:

- **Blast Booths**: Provide a safe, efficient environment for abrasive blasting. Prevent blast media from exiting the enclosure, keeping your shop free of contaminants.

- **Blast Cabinets**: Metal boxes with openings, windows and attached gloves, which allow you to use sand or another abrasive media form to smooth rough surfaces, remove imperfections in metal and scrape off old paint or rust.

- **Portable Blast Pots**: Pressurized, tank-like containers, filled with abrasive material. Allows an adjustable amount of blasting grit into the main blasting line.

Grinding can be dry or wet, in which water or another wetting agent provides a smoother surface to wash away dust. The purpose of grinding is to remove burrs and debris on the surface of the substrate and to eliminate the roughness and unevenness of the coated surface.

Cleaning with power tools provides an adequate profile for a paint system to adhere to. Painting should be performed as soon as possible after power tool cleaning or surface grinding.

ENVIRONMENTS

Using the right equipment when sanding or grinding is especially important because of the increased risk of dust overtaking your shop. Keeping dust off surrounding surfaces promotes cleaner paint jobs and protects your employees from breathing in unhealthy air.
Clean metal alone may not produce the superior performance and weathering characteristics desired for your product. Surface preparation enables your coating to better bond to the metal and withstand exterior weathering, in addition to preventing flash rust prior to coating.

GFS is experienced at designing and building high-quality surface preparation equipment that is custom engineered to meet your business’ needs, as standalone units or as part of a complete finishing system. Investing in surface preparation equipment can pay dividends for your business by ensuring proper powder or paint adhesion, increasing consistency in finish quality and keeping your production running smoothly.

Sanding and grinding can be safely and effectively performed in dust collection booths that are engineered to capture dusty air, filter it and recirculate clean air back out. Most sanding and grinding booths also have built-in lighting, giving workers better visibility of the products they are pretreating and saving on energy costs.

Global Finishing Solutions' Sanding and Grinding Booths provide a safe, effective way for manufacturers to contain dust. Air is pulled into the dust collection module with the help of a direct-drive fan and motor, then passes through a high-efficiency cartridge filtration system featuring MERV 13-rated redundant filters. This allows the air to be cleaned before it is exhausted back into the shop. The module essentially functions as a vacuum and an air purifier for manufacturers needing to contain dust.