GENERAL INTRODUCTION

SHOT BLASTING PROCESS

CYM MATERIALES S.A.
INDUSTRIAL SOLUTIONS

INTRODUCTION

Shot blasting is a surface treatment process by impact using high velocity abrasive. It is a method through which it is possible to obtain excellent cleaning and, at the same time, a correct surface finish on a wide range of metallic and non-metallic parts.

Shot blasting is commonly used for:

- Sand and scale removal from ferrous and non-ferrous castings, forgings, etc.
- Mechanical descaling of wire, bars, sheets, plates, etc.
- Shot peening, a process that increases the fatigue resistance of springs, leaf springs, gears, etc.
- Cleaning and preparation of surfaces where coatings will subsequently be applied (paint, rubber, etc.).
- Shot blasting of concrete floors for coating application, or rubber removal on airport runways.

In general, shot blasting projects abrasive particles at high speed (65-110 m/second) in a controlled manner at the material, thereby removing surface contaminants through abrasive impact.

Initially, in the 1930s, the shot blasting process used compressed air for propelling the steel shot. This method remains in use today for certain work, such as the maintenance of metal frames and weldments.

Shot blast production lines, both manual and automated systems, became possible with the introduction of centrifugal wheel blast machines. The system of shot blasting by centrifugal wheel is more productive than by compressed air and achieves a better, more uniform surface finish.

The criteria used for selecting the type of shot blasting system depend on the size and shape of the parts, the condition of the surface to be cleaned, the final surface finish specification and the overall process required. At CYM Materiales these four factors define the equipment to be proposed. In some cases other cleaning methods may be required before and after shot blasting to achieve better coating results.

SHOT BLASTING MACHINE COMPONENTS

Shot blasting systems are comprised of six basic subsystems:

1. Abrasive delivery method — by compressed air or by centrifugal wheel
2. Blast cabinet
3. Abrasive recovery and cleaning system
4. Dust collector system
5. Part movement and support system
6. Controls and instrumentation

1. ABRASIVE DELIVERY METHOD

There are two ways of accelerating the abrasive: by compressed air or by centrifugal force.

1.1 By compressed air

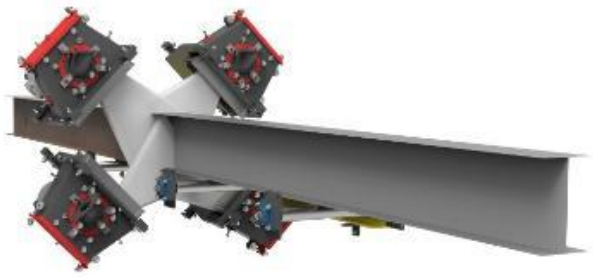
This system is suitable for lower production applications where maximum flexibility is needed, or for the surface preparation of complex or large structures, replacing hand tools.

These systems are very flexible in that the shot can be delivered in any direction through a rubber hose and nozzle assembly. In recent years, equipment with CNC manipulators and robots has been developed, allowing localized work on specific areas of the parts.

For production lines this is an expensive process compared to centrifugal wheel blasting. For example, to deliver shot at a rate of 1,100 kg per minute, a 1,650 HP compressor and 33 operators are needed, using 10 mm diameter nozzles delivering 6.5 kg/cm^2. On the other hand, the same task using centrifugal wheel turbines only requires a total of 100 HP distributed between one or several turbines housed in the same machine, controlled by one or two operators depending on the machine design.

1.2 By centrifugal wheel

Centrifugal wheel blasting is the more common blast cleaning technique, as well as the most economical and environmentally friendly method.



The turbine delivers abrasive by centrifugal force in a specific and controlled direction, speed and quantity. The function of the turbine is similar to that of a fan or a centrifugal pump.

Shot blasting machines may use one or a multitude of turbines positioned in such a way that the abrasive blast pattern covers the entire surface of the material to be cleaned. The shape and size of the parts determine the number of turbines used in a machine.

Power of the turbine motor is based on the degree of cleaning needed and the throughput speed of the material, in a single pass.

1.3 Comparison of the two methods

The same task — delivering 1,100 kg of abrasive per minute — solved by each system:

Detail	Compressed air	Centrifugal wheel
Installed power	1,650 HP (compressor)	100 HP (in one or several wheels)
Operators	33, with 10 mm nozzles at 6.5 kg/cm^2	1 or 2 depending on design
Best suited for	Large or complex structures, site work	Automatic continuous production

2. BLAST CABINET

The machine cabinet contains dust and abrasive in suspension. A machine mounted dust collector reduces the air pressure inside the cabinet, thereby preventing dust from escaping into the shop environment. Material access openings at the entrance and exit of the machine are fitted with seals to prevent abrasive spillage.

Cabinets are built from low carbon steel with an inner shell made of abrasion resistant materials, including rubber compounds, synthetic components and cast alloy plates. In the areas that are subject to direct high velocity shot, cast alloy plates (64 HRC) are used, which have much more abrasion resistance than other more commonly used materials.

3. ABRASIVE RECOVERY AND CLEANING SYSTEM

Recirculating and cleaning the abrasive is required to maintain a continuous cleaning operation.

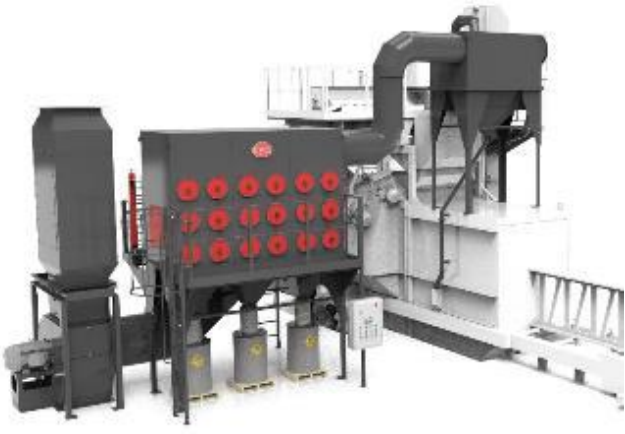
In conventional shot blasting equipment, after the shot hits the part the abrasive falls into the collection hopper under the machine. The shot is then carried by gravity or by a screw conveyor to a bucket elevator. The elevator carries the shot, mill scale, oxides and other contaminants to an air wash separator located in the upper portion of the machine.

A combination of strainers and deflector plates, together with the air flow through the abrasive curtain, separates the contaminants, the dust and the abrasive particles that have become too small to be effective. The cleaned abrasive is contained in an upper hopper and is subsequently fed into the blast wheel by gravity.

The recirculating and cleaning capacity of each machine is related to the compressed air projection system or to the blast power installed in the wheels. An incorrectly operating system will cause premature wear to the machine and will affect both the effectiveness of the process and the abrasive consumption.

4. DUST COLLECTOR SYSTEM

Dust produced during shot blasting is withdrawn from the machine cabinet and from the continuously recirculating abrasive by a dust collector. The most commonly used dust collector is the paper cartridge type, which not only evacuates the dust within the machine but also keeps the surrounding area clean and dust free.



The dust collector produces an air flow through the machine cabinet and the separator. Changes in airflow will reduce collector efficiency and therefore result in lower cleaning power, dust in the immediate production area, and fine contaminants in the operating abrasive mix.

5. SYSTEM FOR HOLDING AND TRANSPORTING PARTS

The need to blast parts ranging from screwdrivers and engine blocks to pipes, plates, rails and even railway wagons gives an idea of the wide variety of part handling and holding systems available.

For bulk materials (screwdrivers, brake drums, pulleys, etc.) tumblast machines are used.

For larger and heavier parts (engine blocks, bicycle frames, cluster castings, etc.) spinner hanger machines are used.

For the shot peening of gears (surface hardening) and for special applications, rotary table machines are used.

6. CONTROLS AND INSTRUMENTATION

This is the system providing the control and instruction for starting and stopping all functions, such as mechanisms, elevators, dust collector, turbines and part handling systems, as well as ammeters and hour meters for the turbine motors, all placed in a central console.

The control panel is designed with sequential startup to assure that the different systems are energized in the proper sequence.

Almost all machines can be automated for continuous processing, which increases production, allows operation by non-specialized personnel and makes it possible to work under strict safety standards.

ABRASIVES

Compressed air blasting equipment works with any type of abrasive, metallic or mineral, allowing the most suitable abrasive to be selected for each type of work.

Centrifugal wheel equipment uses metallic abrasive exclusively — carbon or stainless steel shot of different diameters according to the type of work to be done.

Indoors, metallic abrasive is extremely advantageous over other known abrasives. The main advantages are:

- Higher productivity
- Lower abrasive cost per surface blasted
- Reduced maintenance costs
- Better quality of the work performed (uniformity, roughness, cleanliness)
- Less waste and dust generated
- No risk of silicosis, unlike abrasives containing free silica
- Lower investment in dust collection systems
- Less environmental pollution
- Better operator visibility

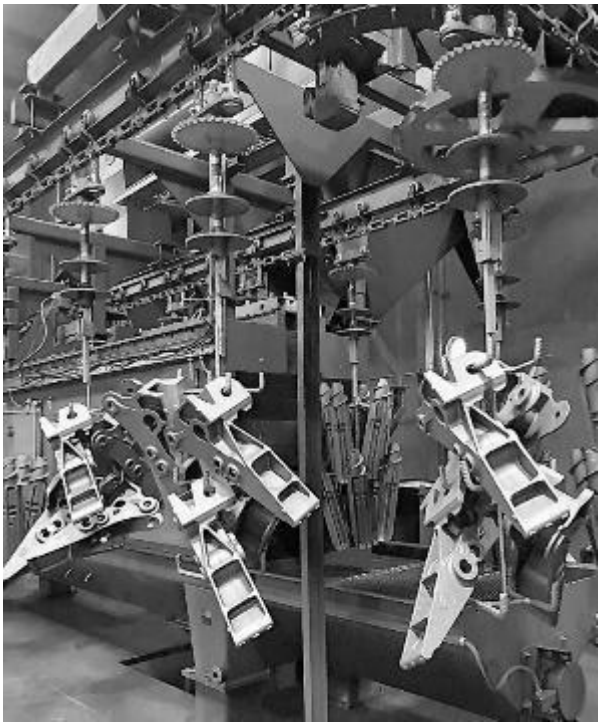
INDUSTRIES USING SHOT BLASTING PROCESSES

Shot blasting equipment is used in a wide range of industries, such as:

- Agricultural machinery
  - Cleaning and scale removal from plough discs
  - Cleaning and surface preparation of sheets, profiles and equipment before painting
  - Cleaning and surface preparation of agricultural wheels before painting
  - Removal of mill scale and weld spatter

- Aluminum
  - Cleaning of cathodes and anodes
- Shipyards
  - Cleaning and surface preparation of sheets and profiles before painting
  - Portable machines for the maintenance of ship hulls
- Automotive components
  - Cleaning of gears, gearboxes, mechanical transmissions, connecting rods, etc.
  - Shot peening of stabilizer bars, coil springs and leaf springs, gearbox gears, pistons, connecting rods, etc., to increase fatigue resistance
  - Cleaning and surface preparation of car and truck wheels before painting
  - Blasting of brake shoes and clutches
  - Cleaning of reconditioned engine components (blocks, pistons, etc.)
  - Mechanical descaling of screws from metric 3 for coating application (Dacromet)
- Aviation
  - Portable machines for rubber removal and friction restoration on airport runways
  - Shot peening of aircraft parts to increase fatigue resistance
  - Aircraft paint stripping
- Bicycles and motorcycles
  - Cleaning and surface preparation of bicycle frames, motorcycles and wheels before painting

- Rubber
  - Cleaning and surface preparation of steel parts before rubber application
- Concrete, ceramics, marble and porcelain tile
  - Blasting to produce non-slip floors
  - Artistic blasting
- Coach builders
  - Cleaning and surface preparation of truck bodies before painting
- Denim jeans
  - Localized wear of garments (jeans)
- Welded steel structures and profiles
  - Cleaning and surface preparation of sheets and profiles before painting
- Forging
  - Removal of mill scale from forgings
  - Surface homogenization
- Foundries
  - Steel, iron, aluminum and bronze castings
  - Cleaning and sand removal from castings
  - Surface homogenization
- Dairy, meat processing and food industries
  - Cleaning and surface preparation of stainless steel parts for surface homogenization
- Paint shop installations
  - Cleaning of paint system hooks
  - Paint removal from the part load hooks of paint systems
- Metallizing
  - Cleaning and surface preparation before thermal spraying



- Molds
  - Cleaning of rubber, glass and aluminum extrusion molds, etc.
- Metal furniture
  - Cleaning and surface preparation of metal furniture before painting
- Metalworking
  - Cleaning and surface preparation of industrial machinery before painting
- Oil and gas
  - Cleaning and surface preparation of oil and gas pipes before painting
  - Cleaning and surface preparation of LPG and CNG cylinders and stationary gas and oil tanks before painting
  - Blasting and shot peening of oil sucker rods
  - Blasting of sucker rod couplings before metallizing
- Concrete floors
  - Portable machines for the preparation of industrial concrete floors before coating
  - Cleaning of airport runways
- Iron and steel industry
  - Mechanical descaling of round, hexagonal and square bars before wire drawing
  - Mechanical descaling of wire coils
  - Mechanical descaling of sheets and strips
  - Mechanical descaling of welded and seamless tubes
  - Descaling of hot-rolled billets
  - Blasting of rolling mill rolls
- Railways
  - Cleaning and surface preparation of trains and wagons before painting
- Metal drums
  - Cleaning and surface preparation of metal drums, inside and outside, before painting

- Heat treatment
  - Cleaning and preparation of parts after heat treatment
- Electrical transformers
  - Cleaning and surface preparation of electrical transformers before painting
- Glass
  - Glass frosting
  - Artistic blasting

EQUIPMENT

CYM Materiales designs and manufactures in Argentina both centrifugal wheel and compressed air shot blasting equipment: spinner hanger machines, rotary table machines, tumblast machines, roller conveyor machines, bar and wire machines, cylinder and tube machines, blast rooms and blast cabinets, continuous blasting and painting lines, shot peening equipment, industrial dust collection systems and abrasives.

The Engineering department also develops custom equipment based on a technical survey of the customer's process.

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