Blasting Basics

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Blasting Basics: Cabinet Capabilities

Air-Blast Cabinet Capabilities

Air-blast cabinets excel in a multitude of surface-treatment jobs ranging from cleaning to peening. A short list of the most common applications follows.

Finishing

- Add matte or satin finish, or decorative frost
- Remove glare or imperfections
- Blend marks
- Hone and burnish
- Mark identifications

Cleaning and Removal

- Chemical impurities
- Coatings
- Paint
- Sealants and adhesives
- Carbon deposits
- Scale
- Excess brazing
- Casting materials
- Flashing
- Burrs
- Rust
- Oxidation

Surface Treatment and Preparation

- Strengthen
- Add fatigue resistance
- Reduce design weights, porosity or friction
- Boost resistance to corrosion
- Improve lubrication
- Expose flaws for inspection
- Etch for bonding and adhesion
- Cut

Never use silica sand in any Empire equipment.

Operating Principles of Air-Blast Cabinets

Air-blast cabinets use one of two operating systems: pressure or suction.

As shown in the drawing to the right, pressure systems apply compressor power all the way from the media storage hopper to the nozzle outlet, resulting in faster work, more precise control at both high and low pressures and, in many applications, more efficient use of compressed air than is possible with suction systems.

Suction systems, which rely on a venturi effect to draw media from the storage hopper, offer the enticements of lower capital costs and easier deployment of multiple blast guns.

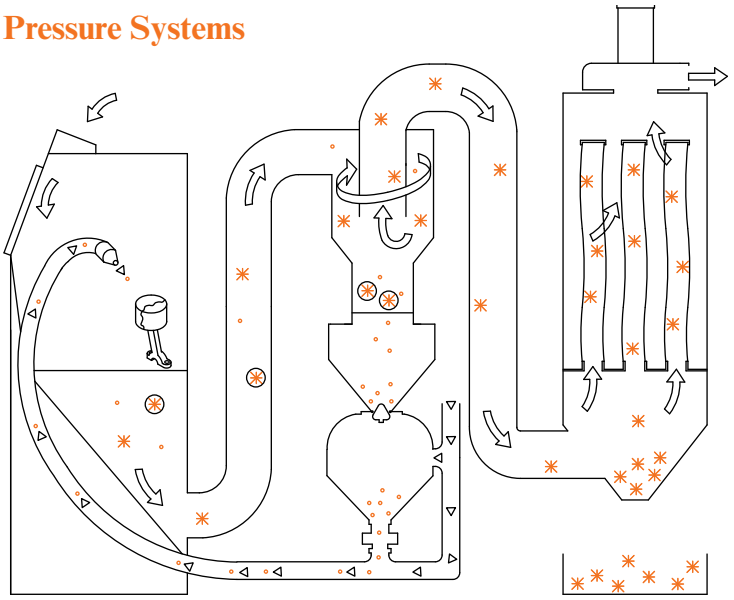
Tunable reclaimers (see right) recycle media of various densities. By adjusting a fine-tuning band on the reclaimer, the amount of air introduced into the system can be controlled to assure precise separation of functional media from dust and other unwanted debris.

As spent media, dust and debris are pulled by air flow to the reclaimer inlet, incoming air and media spiral in a downward vortex, throwing larger particles against the outer reclaimer wall. An air stream forms an upward counter vortex through the center tube, which carries out dust while heavier particles drop into the storage hopper below for reuse. A screen catches any oversized debris.

Dust and undersized debris are drawn from the reclaimer into the bottom of the dust collector. Sudden expansion forces heavier dust particles to the bottom. Remaining fine dust is pulled to the surface of the dust filters. Clean air can then be discharged to the work area.

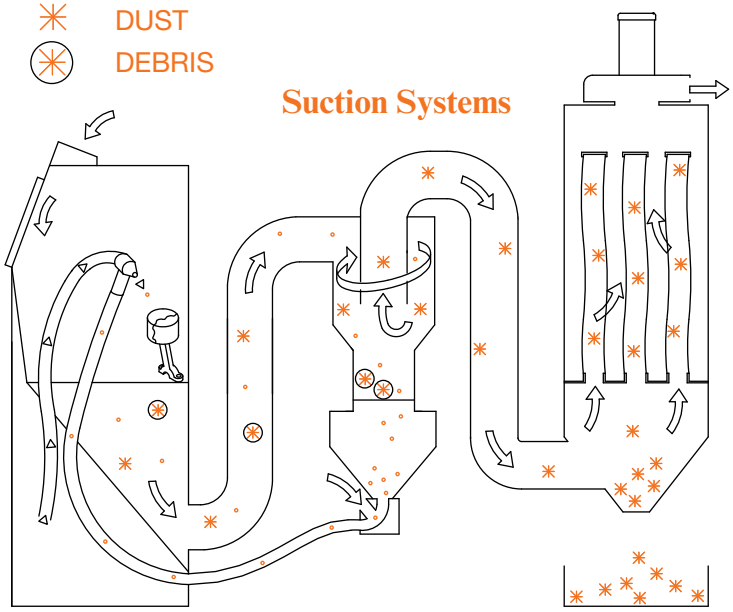
NOTE: The CFM of Empire reclaimers is rated at nominal static working pressure of 6" water, with the exception of the 1200 CFM model, rated at 10" static pressure. Competitive units may appear to achieve higher CFM due to ratings based on inadequate working static pressure.

Pressure Systems



DIRECTION OF AIR FLOW
COMPRESSED AIR
MEDIA
DUST
DEBRIS

Suction Systems

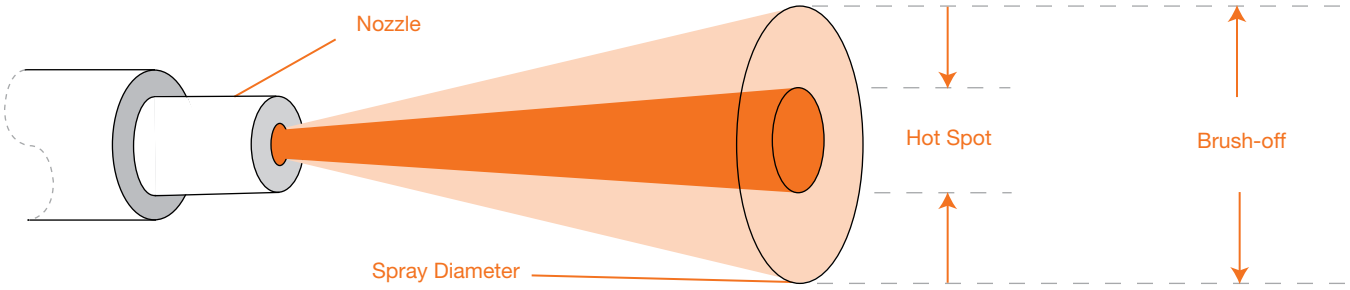


Media/Reclaimer Compatibility

RECLAIMER CFM	GLASS BEADS	ALUMINUM OXIDE	STEEL GRIT	STEEL SHOT
400	ALL	46	120	S-70
600	ALL	36	80	S-110
900	ALL	36	80	S-110
1200	ALL	30	40	S-170

Chart shows the maximum media sizes recoverable with single-gun/nozzle systems. Multiple guns, larger nozzles, operation at altitudes above 5000 feet, or use of a 50 Hz electrical supply may require a larger reclaimer and dust-collector blower. **Larger sizes may be used. Consult factory.**

Blasting Basics: Pressure-System Nozzles



Pressure-Blast Air Requirements (SCFM)

Pressure (PSI)	20	30	40	50	60	80	100	120
⅛" nozzle	6	8	10	13	14	17	20	25
3⁄16" nozzle	15	18	22	26	30	38	45	55
¼" nozzle	27	32	41	49	55	68	81	97
5⁄16" nozzle	42	50	64	76	88	113	137	152
⅜" nozzle	55	73	91	109	126	161	196	220

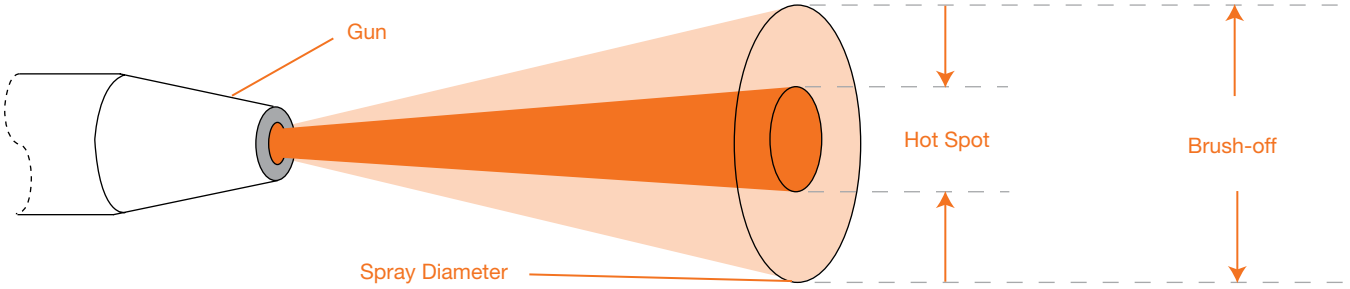
4 SCFM = 1 horsepower

Compressors should be sized to the next larger nozzle to allow for nozzle wear.

Pressure-Blast Spray Diameters

Nozzle ID	Distance from Workpiece 6"		12"		18"	
⅛"	¾"	1"	1"	1½"	—	1⅛"
3⁄16"	1¼"	1⅜"	1½"	2"	1⅝"	2½"
¼"	1¼"	1½"	1⅞"	2¼"	2⅛"	2¾"
⅜"	1⅝"	1¾"	2"	2¼"	2¼"	3"
	Brush-off				Hot Spot	

Blasting Basics: Suction-System Nozzles



Suction-Blast Air Requirements (SCFM)

Pressure (PSI)	30	40	50	60	70	80	90	100
¼" nozzle, 3⁄32" air jet	6	7	8	10	11	12	13	15
¼" nozzle, ⅛" air jet	10	12	15	17	19	21	23	26
5⁄16" nozzle, 5⁄32" air jet*	15	19	23	27	31	37	38	42
7⁄16" nozzle, 7⁄32" air jet	31	38	45	52	59	66	73	80

4 SCFM = 1 horsepower

Suction-Blast Spray Diameters

Nozzle ID	Distance from Workpiece 6"		12"		18"	
¼"	1⅜"	2⅝"	—	2¾"	—	1"
5⁄16"	1½"	3½"	1¾"	4½"	—	3¾"
7⁄16"	2"	3¾"	2"	4½"	—	3¾"
	Brush-off				Hot Spot	

Never use silica sand in any Empire equipment.

Blasting Basics: Media Guide

Media Guide

	Glass Bead	Ceramic Shot	Stainless Cut Wire	Steel Shot	Steel Grit	Aluminum Oxide	Silicon Carbide	Bicarb of Soda	Crushed Glass	Plastic Media	Agri Shell
Finishing	YES	YES	YES	YES	YES	YES	YES	YES	YES	NO	NO
Cleaning/Removal	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Peening	YES	YES	YES	YES	NO	NO	NO	NO	NO	NO	NO
Surface Profiling (Etch)	NO	NO	YES	NO	YES	YES	YES	NO	YES	YES	YES
Working Speed	MED	MED	MED	MED	MED-HIGH	HIGH	VERY-HIGH	LOW	HIGH	MED-HIGH	LOW-HIGH
Recyclability	HIGH-LOW	HIGH	HIGH	VERY-HIGH	VERY-HIGH	MED-HIGH	MED-LOW	NONE	MED-LOW	MED	LOW
Probability of Metal Removal	VERY LOW	VERY LOW	VERY LOW	VERY LOW	MED	MED-HIGH	MED-HIGH	NONE	LOW-MED	VERY LOW	VERY LOW
Hardness, MOH Scale (Rockwell RC)	5.5	7 (57-63)	6-7.5 (35-55)	6-7.5 (20-66)	8-9 (40-66)	8-9	9	2.5	5.5	3-4	1-4.5
Bulk Density (lb/cu. ft.)	100	150	280	280	230	125	95	60	100	45-60	40-80
Mesh Size	30-440	8-46	20-62	8-200	10-325	12-325	36-220	70-220	30-400	12-80	MANY
Typical Blast Pressures (psi)	20-55	20-90	20-90	20-90	20-90	20-90	20-90	40-80	20-50	20-60	10-40
Shapes: ☒ Angular; ● Spherical	●	●	●	●	☒	☒	☒	☒	☒	☒ or ●	☒

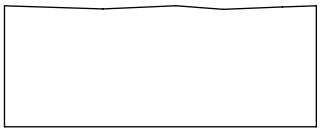
NOTES: Above information is intended as a general reference guide. Consult your authorized Empire distributor for more specific guidance.
1) Sodium bicarbonate must be treated with a flow agent.
2) Do not use silica sand in any Empire blast equipment.
3) See **"Media/Reclaimer Compatibility"** chart on Page H2 for mesh sizes compatible with reclaimer systems.

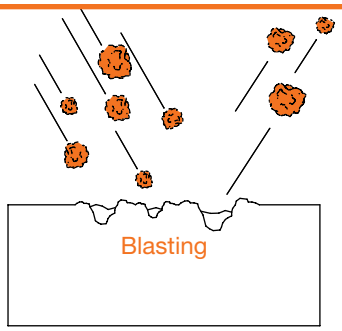
Blasting Basics: Surface Profile

Profile: A Critical Aspect of Surface Prep

Blast Class defines surface cleanliness. **Surface Profile** describes surface shape. For coatings—and the parts they protect—to perform successfully, surfaces must be clean **and properly profiled.**

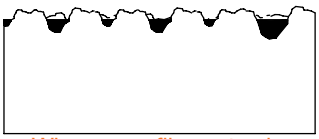
In the blasting process, grains of abrasives carry kinetic energy to the work surface. Upon impact, the grains of aggressive abrasives dig out holes, creating a "mountain & valley" texture on the surface.



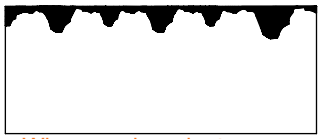


The texture created affects the appearance and friction coefficients of "finished" parts (those requiring no coating) most directly, but profile plays a major roll in the performance of coated surfaces as well.

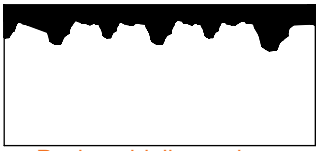
Tailor Profiles to Coatings



When a profile protrudes through the primer, the surface soon rusts.



When a primer just covers the profile, little room remains for error.

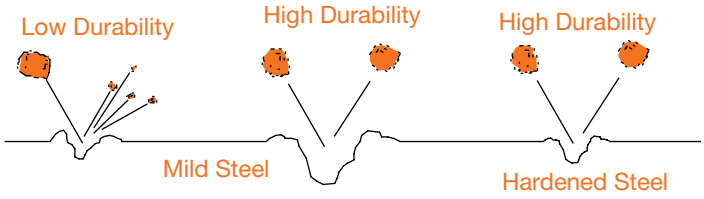


Basic guidelines, shown below, provide a good start for best coating results.

Guide 1: Profile height should not exceed the dry-film-thickness (DFT) of the primer coat.
Guide 2: Profile height should not exceed a third of the total coating system's dry-film-thickness (DFT).
Note: Consult the coating supplier for surface-profile specifications.

Blasting Basics: Surface Profile

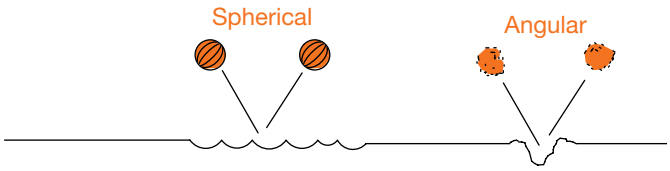
Blast Factors Affecting Surface Profile



Abrasive Durability & Surface Hardness

More durable abrasives dig a deeper profile more quickly than less durable media, which waste kinetic energy in the process of fracturing.

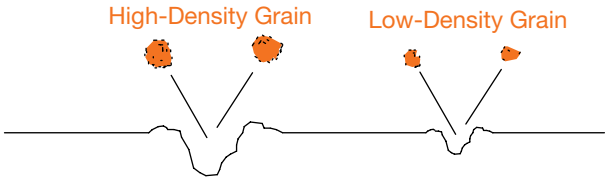
Harder surfaces resist the action of the abrasives more than softer ones.



Abrasive Shape

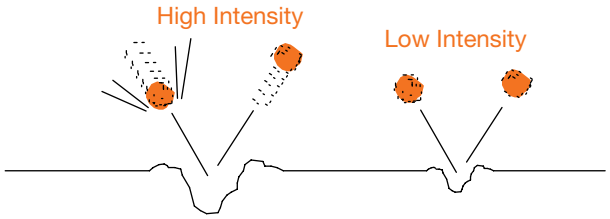
Spherical media produce a dimpled/peened profile that normally enhances part strength.

Angular media cut a jagged profile receptive to coatings.



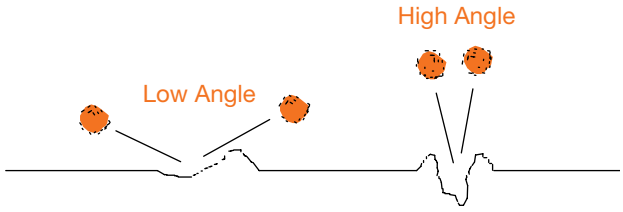
Abrasive Density

High-density grains dig a deeper profile than low-density grains when all other blast factors remain constant.



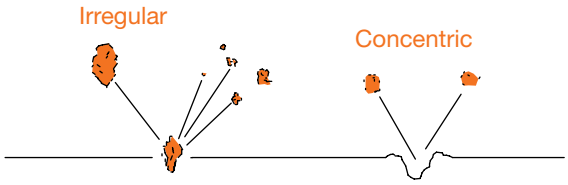
Blast Intensity

The maximum amount of work a particle can perform on a surface depends on its energy, a function of its mass and velocity. When all other variables — including fracture rates, shape, and density remain constant — faster moving particles dig a deeper profile.



Impact Angle

Abrasives arriving at steep angles to the work surface dig deeper than those arriving at lower trajectories.



Embedment

Larger, irregular, friable abrasives can embed in work surfaces, leading to poor results. Smaller, regular, more durable media reduce the risk.

For more information, contact Empire's *Applications' Engineering Department.*

Never use silica sand in any Empire equipment.