A Guide To Blasting Nozzle Selection

Choosing the right blast nozzle for each application is simply a matter of understanding the variables that affect cleaning performance and job costs. There are four basic questions to answer for optimum cost/performance:

1) What blast pattern do you want?

A nozzle's bore shape determines its blast pattern. Nozzles generally have either a straight bore or a restricted, venturi bore.

Straight Bore nozzles (Figure 1, Number 1) create a tight blast pattern for spot blasting or blast cabinet work. These are best for smaller jobs such as parts cleaning, weld seam shaping, cleaning handrails, steps, grillwork, or carving stone and other materials.

Venturi bore nozzles (Figure 1, Numbers 2 and 3) create a wide blast pattern and increase abrasive velocity as much as 100% for a given pressure. Venturi nozzles are the best choice for greater productivity when blasting larger surfaces. Long venturi style nozzles like the BRUISER® blasting nozzles, for example, yield about a 40% increase in productivity compared to straight bore nozzles, while abrasive consumption can be cut approximately 40%.

Double venturi and wide throat nozzles are enhanced versions of the long venturi style nozzle.

The **double venturi** style (Figure 1, Number 4) can be thought of as two nozzles in series with a gap and holes in between to allow the insertion of atmospheric air into the downstream segment of the nozzle. The exit end is also wider than a conventional nozzle. Both modifications are made to increase the size of the blast pattern and minimize the loss of abrasive velocity.

Wide throat nozzles (Figure 1, Number 5) feature a large entry throat and a large diverging exit bore. When matched with the same sized hose they can provide a 15% increase in productivity over nozzles with a smaller throat. When wide throat nozzles also feature as larger diverging exit bore (e.g. Bazooka® nozzle), they can be used at higher pressures to yield up to a 60% larger pattern with lower abrasive use.

It's also a good idea to have angle nozzles available for tight spots like bride lattice, behind flanges, or inside pipes. Many operators waste abrasive and time waiting for ricochet to get the job done. The little time it takes to switch to an **angle nozzle** is always quickly recovered and total time on the job is reduced.

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Figure 1. Nozzle Types

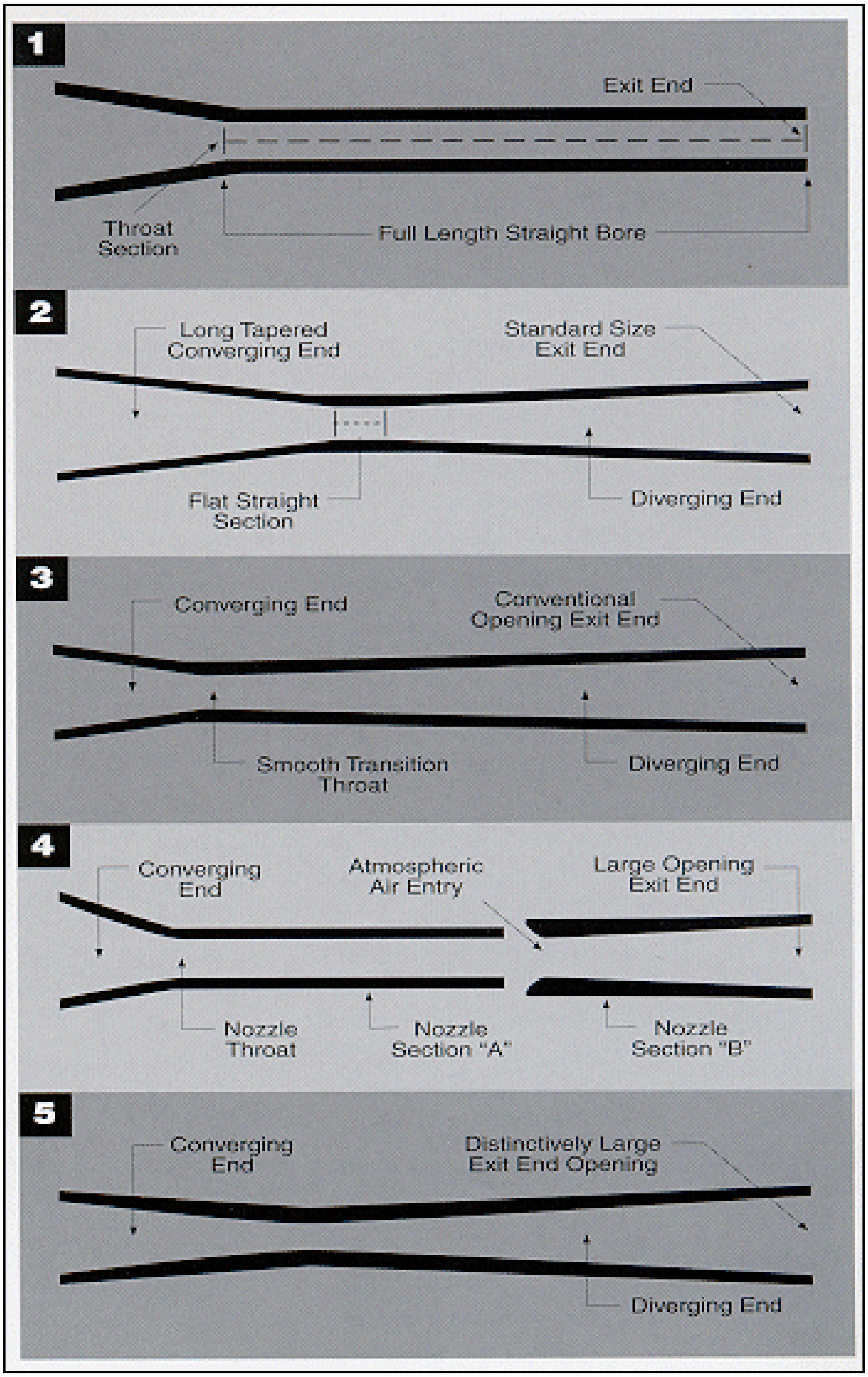
1. Straight bore

2. Conventional design long venturi

3. Laminar flow design long venturi

4. Double venturi

5. High pressure



2) Can Your Compressed Air Supply Support The Nozzle?

As a general rule, the air supply system should be able to provide at least 50% more air volume (cfm) than a new nozzle would need to develop the required working blasting pressure, whether that is 100 psi or 140 psi. This ensures a nozzle can continue to provide good service even after it is slightly worn. Remember, though, excessive wear should not be allowed or productivity decreases dramatically.

Keep in mind, too, the nozzle entry throat must match the inside diameter of your air supply hose. The wrong size combination can lead to wear points, pressure drop, and excessive internal turbulence.

Matching Nozzle Size and Compressor Size For Required Production Rate

Production rate required (sq. ft./hr)	Blast nozzle orifice	Production rate at 100 psi nozzle pressure	Production rate at 90 psi nozzle pressure	Production rate at 80 psi nozzle pressure	Compressor size CFM at 100 psi nozzle pressure
Up to 100	1/4"	100	85	70	185 cfm 40-50 h.p.
101-160	5/16"	160	136	112	250 cfm 60-75 h.p.
161-230	3/8"	230	195	161	375 cfm 75-100 h.p.
231-317	7/16"	317	270	222	450 cfm 125 h.p.
318-400	1/2"	400	340	280	600 cfm 150 h.p.

This chart is estimated and based upon use of a long venturi nozzle, SSPC-6 commercial blast specification.

Nozzle Pressure, Abrasive Velocity And Efficiency

Blast Nozzle Pressure	Estimated Abrasive Velocity	Estimated Efficiency Factor
140 psi	588 mph	160%
125 psi	525 mph	138%
110 psi	462 mph	115%
100 psi	420 mph	100%
95 psi	400 mph	93%
90 psi	365 mph	85%
85 psi	330 mph	78%
80 psi	270 mph	70%
75 psi	210 mph	63%
70 psi	190 mph	55%

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3) What Bore Size Do You Need?

For maximum productivity, select the nozzle bore size based on the desired blast pressure and the available air pressure and flow. For example, assume you are running a 375 cfm compressor at 80% capacity. In addition to the blast cleaning nozzle, the compressor is supplying air to an air helmet and other components such as air motors and pneumatic controls, leaving 250 cfm available for the nozzle. Referring to the 'Nozzle Air and Pressure Requirements' chart, you can see that 250 cfm is sufficient for a 7/16" nozzle operating at 100 psi. A larger nozzle, or a worn 7/16" nozzle, will require more air flow to maintain 100 psi. This extra flow requirement will either overwork your compressor or decrease productivity. On the other hand, choosing a nozzle with a bore smaller than your compressor can supply will result in less than maximum productivity from the system.

Nozzle Air And Pressure Requirements								
Nozzle Orifice	**Air, Power, and Abrasive Requirements**	**50 (3.45)**	**60 (4.14)**	**70 (4.83)**	**80 (5.52)**	**90 (6.21)**	**100 (6.89)**	**125 (8.65)**
1/8 inch (3.2 mm)	**Air (cu ft/min) (cu m/min)**	12 (0.34)	13 (0.37)	15 (0.42)	18 (0.51)	19 (0.54)	21 (0.59)	26 (0.74)
	Horsepower (hp) (kW)	1.75 (1.30)	2 (1.49)	2.5 (1.86)	3 (2.24)	3.5 (2.61)	4 (3.98)	6 (4.47)
	Abrasive (lb/hr) (kg/hr)	70 (32)	80 (36)	90 (41)	100 (45)	110 (50)	120 (54)	135 (61)
3/16 inch (4.8 mm)	**Air (cu ft/min) (cu m/min)**	25 (0.71)	30 (0.85)	35 (0.99)	40 (1.13)	43 (1.22)	45 (1.27)	60 (1.70)
	Horsepower (hp) (kW)	5 (3.73)	8 (5.97)	9 (6.71)	9.5 (7.08)	10 (7.46)	10.5 (7.83)	16 (11.93)
	Abrasive (lb/hr) (kg/hr)	150 (68)	170 (77)	200 (91)	215 (98)	240 (109)	260 (118)	320 (145)
1/4 inch (6.35 mm)	**Air (cu ft/min) (cu m/min)**	50 (1.42)	55 (1.56)	60 (1.70)	70 (1.98)	75 (2.12)	80 (2.27)	95 (2.69)
	Horsepower (hp) (kW)	10 (7.46)	12 (8.95)	13 (9.69)	16 (11.93)	17 (12.68)	18 (13.42)	25 (18.64)
	Abrasive (lb/hr) (kg/hr)	270 (122)	300 (136)	350 (159)	400 (181)	450 (204)	500 (227)	675 (306)
5/16 inch (8 mm)	**Air (cu ft/min) (cu m/min)**	80 (2.27)	90 (2.55)	100 (2.83)	115 (3.26)	125 (3.54)	140 (3.96)	190 (5.38)
	Horsepower (hp) (kW)	17 (12.68)	20 (14.91)	25 (18.64)	27 (20.13)	28 (20.88)	30 (22.37)	36 (26.85)

	Abrasive (lb/hr) (kg/hr)	470 (213)	530 (240)	600 (272)	675 (306)	750 (340)	825 (374)	1000 (454)
3/8 inch (9.5 mm)	**Air (cu ft/min) (cu m/min)**	110 (3.12)	125 (3.54)	145 (4.11)	160 (4.53)	175 (4.96)	200 (5.66)	275 (7.79)
	Horsepower (hp) (kW)	25 (18.64)	29 (21.63)	32 (23.86)	35 (26.10)	40 (29.83)	45 (33.56)	57 (42.50)
	Abrasive (lb/hr) (kg/hr)	675 (306)	775 (352)	875 (397)	975 (442)	1060 (481)	1100 (499)	1350 (612)
7/16 inch (11 mm)	**Air (cu ft/min) (cu m/min)**	150 (4.25)	170 (4.81)	200 (5.66)	215 (6.09)	240 (6.80)	255 (7.22)	315 (8.92)
	Horsepower (hp) (kW)	35 (26.10)	40 (29.83)	45 (33.56)	50 (37.28)	55 (41.01)	60 (44.74)	70 (52.20)
	Abrasive (lb/hr) (kg/hr)	900 (408)	1000 (454)	1200 (544)	1300 (590)	1400 (635)	1550 (703)	1800 (816)
1/2 inch (12.7 mm)	**Air (cu ft/min) (cu m/min)**	200 (5.66)	225 (6.37)	250 (7.08)	275 (7.79)	300 (8.50)	340 (9.63)	430 (12.18)
	Horsepower (hp) (kW)	45 (33.56)	50 (37.28)	55 (41.01)	63 (46.98)	70 (52.20)	75 (55.93)	95 (70.84)
	Abrasive (lb/hr) (kg/hr)	1200 (544)	1350 (612)	1500 (680)	1700 (771)	1850 (839)	2025 (919)	2525 (1145)
5/8 inch (16 mm)	**Air (cu ft/min) (cu m/min)**	300 (8.50)	350 (9.91)	400 (11.33)	450 (12.74)	500 (14.16)	550 (15.58)	700 (19.82)
	Horsepower (hp) (kW)	70 (52.20)	80 (59.66)	90 (67.11)	100 (74.57)	110 (82.03)	120 (89.48)	150 (111.85)
	Abrasive (lb/hr) (kg/hr)	1900 (862)	2200 (998)	2400 (1089)	2700 (1225)	3000 (1361)	3300 (1497)	4000 (1814)
3/4 inch (19 mm)	**Air (cu ft/min) (cu m/min)**	430 (12.18)	500 (14.16)	575 (16.28)	650 (18.41)	700 (19.82)	800 (22.66)	1100 (31.15)
	Horsepower (hp) (kW)	100 (64.57)	115 (85.76)	130 (96.94)	145 (108.13)	160 (119.31)	175 (130.50)	215 (160.33)
	Abrasive (lb/hr) (kg/hr)	2700 (1225)	3100 (1406)	3500 (1588)	3900 (1769)	4300 (1950)	4700 (2132)	5700 (2586)

This table is to be used as reference only. Actual results may vary depending on specific abrasive medium used. This table is based on sand with a bulk density of 100 pounds per cubic foot.

4) What Are The Best Nozzle Material Choices?

Nozzle material selection depends on the abrasive you choose, how often you blast, the size of the job, and the rigors of the job site. Here are general application guidelines for various materials.

Aluminum oxide "alumina" nozzles offer good service life at a lower price than other materials discussed here. They are a good choice in low usage applications where price is a primary factor and nozzle life is less important.

Tungsten carbide nozzles offer long life and economy when rough handling can't be avoided and mineral and coal slag abrasives are used. All tungsten carbide nozzles are not equal. Note that all Boride tungsten carbide nozzles feature top wear grade material and thick-wall construction.

Silicon carbide composite nozzles offer service life and durability very near tungsten carbide, but these nozzles are only about one-third the weight of tungsten carbide nozzles. Silicon carbide composite nozzles are an excellent choice when operators are on the job for long periods and prefer a lightweight nozzle.

Boron carbide nozzles provide longest life with optimum air and abrasive use. Boron carbide is ideal for aggressive abrasives such as aluminum oxide and selected mineral aggregates when rough handling can be avoided. Boron carbide will typically outwear tungsten carbide by five to ten times and silicon carbide by two to three times when aggressive abrasives are used.

Service Life Comparisons

Approximate Service Life in Hours			
Nozzle Material	**Steel Shot/Grit**	**Sand**	**Aluminum Oxide**
Aluminum oxide	20-40	10-30	1-4
Tungsten carbide	500-800	300-400	20-40
Silicon carbide composite	500-800	300-400	50-100
Boron carbide	1500-2500	750-1500	200-1000

Estimated values for comparison. Actual service life will vary depending on blast pressure, media size, and particle shape.