BEX SPRAY NOZZLES • CATALOG NO. 60

BEX® SPRAY NOZZLES

WELCOME TO BEX SPRAY NOZZLES

With over 50 years of design and manufacturing experience, BEX is a leader in spray nozzle and tank mixing eductor technology. Our sales specialists, engineers, and technical support staff are capable and willing to help solve the toughest of application problems in industries ranging from cleaning, rinsing, and washing to food and beverage, from chemical processes to dust control, and many more.

Innovative Design and Flexibility of Use

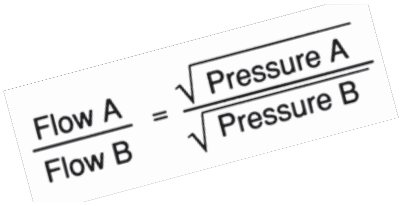
BEX's commitment to innovation has made us an industry leader. At BEX we are constantly expanding and improving our product line. This catalog shows the most popular of spray nozzles and tank mixing eductor products. However, BEX also makes a wide range of specialty products to each customer's own demanding specifications.

BEX is known not just for our exceptional quality, but also for our industry leading delivery and customer service.

Featured Products:

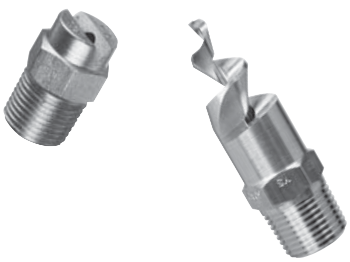
Table of Contents

This catalog lists the most popular models of BEX spray nozzles and accessories. Many others are available, often in special materials.
PLEASE NOTE THAT SPECIFICATIONS ARE SUBJECT TO CHANGE WITHOUT NOTICE.



DESIGN AND ENGINEERING INFORMATION

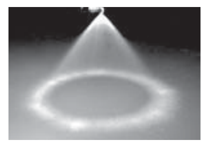
Nozzle selection
Technical information
Conversion factors
Preventing Nozzle Problems
Common Causes of Nozzle Problems

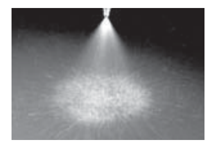


THREADED NOZZLES

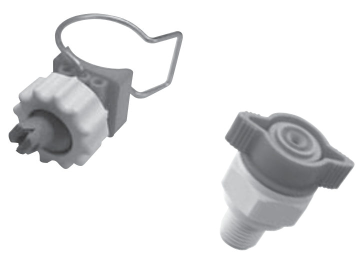
Includes:


Flat Spray


Hollow Cone

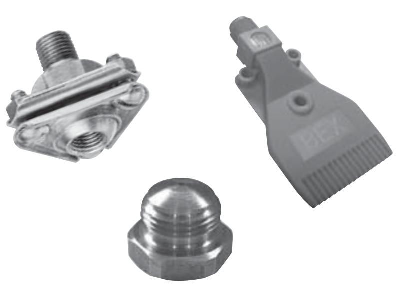

Full Cone

And much more.



QUICK DISCONNECT

Including BEX Zip-Tip and K-Ball Clip-On Nozzles



OTHER TYPES OF NOZZLES

Includes: Industry specific nozzles
Rotating nozzles
Accessories
Much more

AIR ATOMIZING

Includes: Various spray set-ups
Connection types
Extensions
Much more

For a detailed listing of parts please see the index on page 102.

Selection Guide

This section describes some of the questions to be considered when selecting spray nozzles. In addition, answers for uncomplicated situations are provided where possible. In some applications, because of the large number of variables involved, accurate answers are not always possible except through actual testing or simulation. Our technical staff, however, may be able to lend assistance in their areas of expertise. Please feel free to give us a call.

WHAT SPRAY NOZZLE CONSTRUCTION DO I REQUIRE?

The basic elements of spray nozzle construction are assembly configuration, spray pattern, flow rate, connection size, physical dimensions, and material of construction.

ASSEMBLY CONFIGURATION refers to the mechanical style of the nozzle, It could be a pipe thread, a clip-on nozzle, or a nozzles that has no thread at all, such as nozzles with flanges. This aspect of nozzle selection is often determined by the industry or application.

PIPE CONNECTION is described by type, size, male, female, or flange. Nozzles described in this catalog have NPT threaded pipe connections (BSPT are also available for most models).
SIZE - Standard sizes from 1/8 NPT to 4" NPT, or as indicated.
MALE AND FEMALE connections are available where indicated.

The images on page 5 will help you determine the size of each specified pipe thread. Please note that the name of the thread, for example 1/4, does not refer to the threads actual dimensions.

PHYSICAL DIMENSIONS are listed throughout this catalog for each specific style of nozzle.

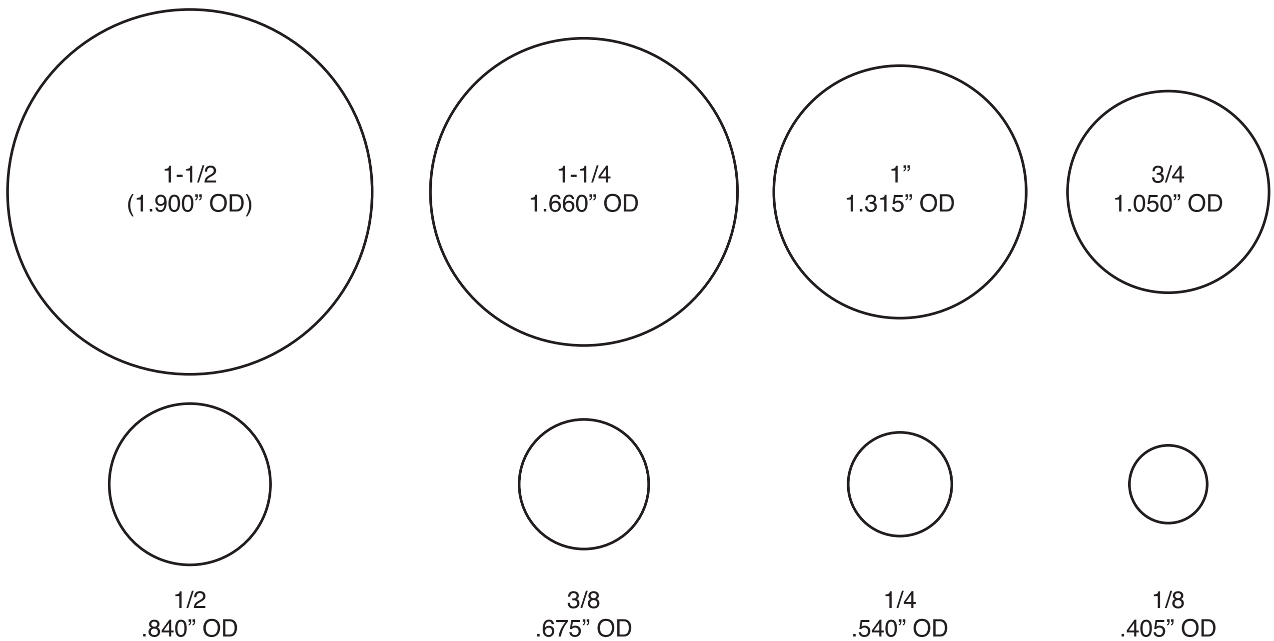
MATERIAL OF CONSTRUCTION
Standard materials are available as noted in this catalog. In addition, many models are available in special materials. Our technical staff will be pleased to discuss your special material requirements with you. BEX nozzles have been produced in the following materials:

Materials	Material Codes
Brass	B
Steel/Cast Iron	I
303 Stainless Steel	3
316 Stainless Steel	6
316L	R
Hastelloy®	E
Titanium	N
Monel®	O
Carpenter 20®	C
PVC	V
CPVC	A
Glass Reinforced Polypropylene (GRP)	L
	LL (molded green)
	LN (molded natural)
PVDF/Kynar	K
	KK (molded red)
	KN (molded natural)
Teflon	T

WHAT TYPE OF CONNECTION DO I REQUIRE?

BEX spray nozzles are available in many different connection styles. The most common connection types depend on the industry where the nozzles are being used. Generally, however, the most common connection is the standard tapered, or NPT, pipe thread. The outside diameters of NPT threads are shown below. Most BEX nozzles are also available with BSPT threads. The chart below can also be used for those.

Other common connections include the quick disconnect style, or BEX Zip-Tip®, which is a bayonette style of connection whereby a tip is inserted into a threaded body, and the BEX clip-on K-Ball® series, which is a style of nozzle which connects to a pipe by means of a heavy duty stainless steel clip and eliminates the need for threaded connectors.



WHAT SPRAY CHARACTERISTICS DO I REQUIRE?

A spray may be characterized by describing it’s spray pattern, flow rate, atomization and spray angle. This catalog describes these characteristics for the listed nozzles, for spraying water under controlled conditions.

SPRAY PATTERN: Common spray patterns (flat, full cone, hollow cone) are all described in this catalog. The spray pattern of a nozzle will generally travel further under higher fluid pressures. However, fine mist-like sprays are very susceptible to air movement, and may be carried away by such movement of air.

FLOW RATE: The flow rates listed in this catalog are for water in U.S. gallons per minute, unless otherwise indicated. “--” in the capacity table means “not recommended at this pressure.”

ATOMIZATION: Atomization is primarily dependent on pressure and viscosity, and varies from point to point within a spray pattern. A range of particle sizes is produced, with some average value which varies according to conditions. For this reason, spray droplet sizes are not listed in this catalog. If you require spray droplet information for critical applications, BEX will be pleased to provide you with measurements, using our in-house laser doppler anemometry equipment.

SPRAY ANGLES: The spray angles listed in this catalog are for water spray under controlled conditions. Under low pressure, the sides of the spray may curve in due to the acceleration of gravity. Spray angles may also be reduced due to the tendency of spray patterns to interfere with themselves or with spray patterns from adjacent nozzles. Table 1 on page 7 lists theoretical spray coverage for a variety of spray angles at various distances from the nozzle.

WHAT FACTORS WILL AFFECT MY SPRAY CHARACTERISTICS?

When the conditions controlling spray nozzle performance change, the spray characteristics may change. This section lists conditions which may vary, and how those conditions may affect the spray characteristics.

PRESSURE: The flow rate of a liquid is proportional to the square root of the pressure difference between the pressure liquid and external (usually atmospheric) conditions, thus higher pressure generally results in finer spray atomization, greater spray impact, and greater spraying distance.

$$\frac{\text{Flow A}}{\text{Flow B}} = \frac{\sqrt{\text{Pressure A}}}{\sqrt{\text{Pressure B}}}$$

VISCOSITY: Spraying liquids with higher viscosity than water generally results in reduced atomization, and impact. Spray angle will usually decrease.

SPECIFIC GRAVITY: Flow rates shown in this catalog are for water. (The specific gravity of water is 1.0). For liquids with a different specific gravity, flow is given by the formula:

$$\text{Flow} = \text{Water Flow} \times \frac{1}{\sqrt{\text{Spec. gravity}}}$$

SURFACE TENSION: An increase in surface tension generally results in an increase in spray droplet size, and a reduction in spray angle.

SPRAY DROP SIZE (Atomization)

One Inch = 25,400 Microns

- 500 Microns
- 1,200 Microns
- 5,500 Microns

IMPACT

Spray impingement, or “spray impact” as it is otherwise known, can be calculated using several different methods. The most widely used value with regards to nozzle performance is “impact per square inch.” However, it is dependent on spray pattern and spray angle. In order to calculate the impact per square inch for a given nozzle, you must first determine the theoretical total impact using the formula below:

Next, using the chart to the right, find the relevant Percent Impact per sq. in of the theoretical total impact and multiply this by the theoretical total. The result of this equation is the spray impact in pounds per square inch. The greatest impact in pounds per square inch is attained by solid stream nozzles and can be calculated using the formula:

1.9 x (spraying pressure, psi)

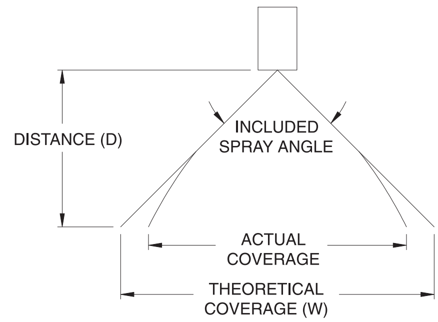
Theoretical Total Impact Spraying Water (pound-force) =

$$.0526 \times (\text{gpm at spraying pressure}) \times \sqrt{\text{spraying pressure, psi}}$$

Spray Pattern Type	Spray Angle	Percent Impact per sq. in. of Theoretical Total Impact
Flat Fan	15°	30%
	25°	20%
	35°	15%
	40°	12%
	50°	10%
	65°	7%
	80°	5%
Full Cone	15°	10%
	30°	2%
	50°	1%
	65°	0.5%
	80°	0.2%
	100°	0.1%
Hollow Cone	70°	1.5%

At a distance of 12” from nozzle.

INCLUDED SPRAY ANGLE	W/D RATIO	Theoretical coverage (W) at various distances (D) from the nozzle — Distance (D) inches									
		2	**3**	**4**	**6**	**8**	**12**	**16**	**24**	**34**	**48**
5°	0.087	0.2	0.3	0.3	0.5	0.7	1.0	1.4	2.1	3.0	4.2
10°	0.175	0.3	0.5	0.7	1.0	1.4	2.1	2.8	4.2	5.9	8.4
15°	0.263	0.5	0.8	1.1	1.6	2.1	3.2	4.2	6.3	9.0	12.6
20°	0.353	0.7	1.1	1.4	2.1	2.8	4.2	5.6	8.5	12.0	16.9
25°	0.443	0.9	1.3	1.8	2.7	3.5	5.3	7.1	10.6	15.1	21.3
30°	0.536	1.1	1.6	2.1	3.2	4.3	6.4	8.6	12.9	18.2	25.7
35°	0.631	1.3	1.9	2.5	3.8	5.0	7.6	10.1	15.1	21.4	30.3
40°	0.728	1.5	2.2	2.9	4.4	5.8	8.7	11.6	17.5	24.7	34.9
45°	0.828	1.7	2.5	3.3	5.0	6.6	9.9	13.3	19.9	28.2	39.8
50°	0.933	1.9	2.8	3.7	5.6	7.5	11.2	14.9	22.4	31.7	45
55°	1.04	2.1	3.1	4.2	6.2	8.3	12.5	16.7	25.0	35.4	50
60°	1.15	2.3	3.5	4.6	6.9	9.2	13.9	18.5	27.7	39.3	55
65°	1.27	2.5	3.8	5.1	7.6	10.2	15.3	20.4	30.6	43	61
70°	1.40	2.8	4.2	5.6	8.4	11.2	16.8	22.4	33.6	48	67
75°	1.53	3.1	4.6	6.1	9.2	12.3	18.4	24.6	36.8	52	74
80°	1.68	3.4	5.0	6.7	10.1	13.4	20.1	26.9	40	57	81
85°	1.83	3.7	5.5	7.3	11.0	14.7	22.0	29.3	44	62	88
90°	2.00	4.0	6.0	8.0	12.0	16.0	24.0	32.0	48	68	96
95°	2.18	4.4	6.5	8.7	13.1	17.5	26.2	34.9	52	74	105
100°	2.38	4.8	7.2	9.5	14.3	19.1	28.6	38.1	57	81	114
110°	2.86	5.7	8.6	11.4	17.1	22.9	34.3	46	69	97	137
120°	3.46	6.9	10.4	13.9	20.8	27.7	42	55	83	118	166
130°	4.29	8.6	12.9	17.2	25.7	34.3	51	69	103	146	206
140°	5.49	11.0	16.5	22.0	33.0	44	66	88	132	187	264
150°	7.46	14.9	22.4	29.9	45	60	90	119	179	254	358



Spray coverages shown in Table 1 are based on straight sided spray patterns. At low pressures the sides may curve in, as shown at the right, because of the acceleration due to gravity.

To find the width of a spray (W) at any distance (D), multiply the W/D ratio by the distance.

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Viton® is a registered trademark of E.I. DuPont de Nemours and Company
TWK Patent No. 5,316,218
ZIP-TIP Patent No. 5,421,522 – other patents pending

Preventing Nozzle Problems

Monitor Nozzle Performance

Flow rate

Flow rate can be measured by connecting a flowmeter in series with the nozzle, or collecting the output from the nozzle in a container of known volume over a measured period of time. If the flow rate is higher than the nozzle specifications then it is possible that the orifice has partially corroded or eroded away. If the flow rate is lower than specified then the nozzle could be clogged or caked. Such problems are often accompanied by a change in spray pattern or distribution.

Pressure

A decrease in your system pressure could indicate excessive nozzle wear, due to corrosion or erosion. An increase in pressure could indicate clogging of your spray nozzles.

Distribution

All nozzles have a specified spray pattern, distribution, and spray angle. If any one of these is not as you expect it could indicate that the nozzles are worn or clogged.

Finished Product Quality

Sometimes nozzles are difficult to see while in use because they are in enclosed systems which are difficult to monitor. If the products coming out of these systems, such as a washer, are not as expected, it could indicate that the nozzles are not performing as expected. A closer inspection is recommended.

Methods to Maintain Peak Performance and Reduce Potential Problems

Alternative Materials

Some materials are better suited than others for certain applications. The incorrect material can wear very quickly due to both corrosion and erosion, given the proper chemicals, temperature, or pressure. If this is the case you should check with your chemical supplier or system desginer to determine the best possible nozzle material.

Clean Nozzles Regularly

Regular nozzle inspection will help identify nozzles which need cleaning. Be careful to clean nozzles only with soft tools or the orifice or other important edges and surfaces could be damaged. Remember, however, that a new nozzle will perform better that a cleaned nozzle and could save thousands of dollars.

Change Nozzle Type or Size

If the same problems keep occurring then a change in the style of nozzle might be the best solution.

Decrease Operating Pressures or Temperatures

Higher operating pressures can result in higher wear. With plastic nozzles temperature can also have a significant effect on nozzle life. While your process may require such operating conditions, it may also be possible that either pressure or temperature could be reduced.

Reduce Amount of Abrasives in the System

Nozzles will often wear out prematurely as a result of excessive abrasion. Without proper filtration a system may have unexpected abrasives in the fluids which cause excessive wear on not just the spray nozzles but also piping and pumps.