



TANK CLEANING

SPRAY NOZZLE SOLUTIONS FOR
TANK & EQUIPMENT CLEANING



TABLE OF CONTENTS

3 The BETE Advantage

4-5 Tank Cleaning Product Selection Guide

6-11 Tank Cleaning Considerations

- Soil Classifications
- Types of Operating Principles
- Mechanical Cleaning Action
- Static vs Rotational Spray

12-15 Planning Guide for Effective Tank Cleaning

16-34 Spray Nozzles for Tank Cleaning

35 Tank Cleaning Lances

36-37 Manufacturing & Engineering Services

38-40 Case Studies

PERFORMANCE SPRAY ENGINEERING

BETE's decades of experience providing innovative tank and equipment cleaning solutions translates to **expert engineering that you can count on when it matters most.**

We design and manufacture a wide range of tank cleaning nozzles to precisely clean and sanitize tanks, drums, totes, and other vessels of all sizes in the food, beverage, pharmaceutical, and chemical processing industries. We design our rotational spray devices to optimize your cleaning process. They clean faster and consume less water and solvents than standard spray balls while reducing effluent discharge to save energy and resources.

BETE's mission goes beyond just selling spray nozzles. It is to provide engineered spray process solutions that exceed customer expectations in every detail. Our patented spray technologies are quality-inspected and field-proven to meet the high standards of third-party certifiers.

We make tens of thousands of different products, including automatic spray nozzles, air atomizing nozzles, misting nozzles, tank cleaning nozzles, spray dry nozzles, spray lances, and automated spray systems. Expect world-class customer support to help you choose the right solution and **make your tank cleaning project an efficient success.**



Spray Nozzles



Spray Fabrications



Spray Systems

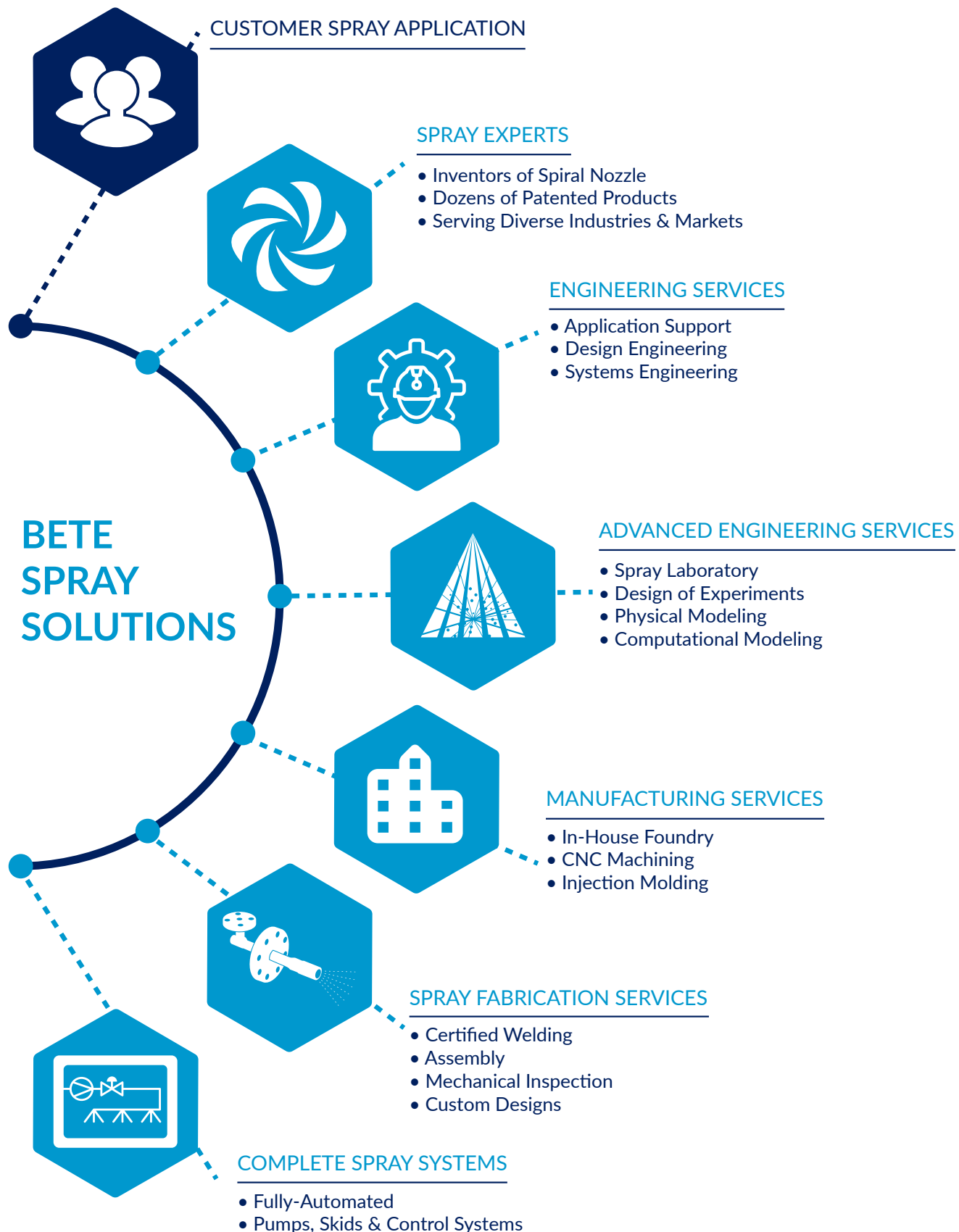


Applications Engineering



Spray Research

THE BETE ADVANTAGE



TANK CLEANING PRODUCT SELECTION GUIDE

Product Name				Small Tank Up to 6.5 ft. dia.	Mid-Size Tank 4.5 - 20 ft. dia.	Large Tank 25-100+ ft dia.	Flow Rate GPM	Pressure PSI	Minimum Entry Diameter	NPT Connection	Clip-On Connection	FDA Compliant	Spray Coverage	Max Temp.	Filtration
	Stationary	Reactionary Force	Rotary Jet	Light to Moderate Soil	Moderate Soil	Heavy Soil									
 HydroWhirl® Mini PVDF				Max Range 3.5 ft.			3 to 9	10 to 60	1.2"	1/2"		PVDF	360°	194°F	0.3mm/ 50 mesh
 HydroWhirl® Mini SS				Max Range 6 ft.			3 to 9	10 to 60	0.84" to 1"	3/8"	3/4"	316L SS	360°	266°F	0.3mm/ 50 mesh
 TW				Max Range 8 ft.			3 to 163	10 to 400	0.87" to 1.31"	3/8", 1/2" 1"			180°, 270°	550°F	
 LEM				Max Range 8 ft.			3 to 163	10 to 100	4.5" to 5.3"	3/4", 1"			360°	550°F	
 CLUMP				Max Range 10 ft.			7 to 81	10 to 80	5.75"	3/4", 1"			360°	550°F	
 HydroClaw®				Max Range 10 ft.			33 to 112	25 to 40	2.4" to 2.9"	3/4", 1"	1", 1.5"	316L SS	360°	550°F	
 HydroWhirl® Disc				Max Range 11 ft.			27 to 60	10 to 60	3.9"	1"		316L SS	360°	194°F	
 HydroWhirl® Stinger				Max Range 12 ft.			1 to 102	10 to 60	0.63" to 1.9"	1/8", 3/8", 1/2", 3/4", 1"	3/8", 1/2", 3/4", 1"	316L SS	360°	200°F	0.10mm/ 150 mesh
 HydroWhirl® Poseidon				Max Range 25 ft.			4 to 82	10 to 60	1.7" to 3.3"	3/8", 1/2" 3/4", 1", 1.5"		PTFE	180°, 360°	200°F	0.2mm/ 80 mesh
 HydroWhirl® Orbitor 100				Max Range 56 ft.			12 to 52	45 to 145	3.35"	3/4", 1"		316L SS	180°, 360°	200°F	0.015mm/ 35 mesh
 HydroWhirl® Orbitor				Max Range 130 ft.			21 to 160	45 to 145	5"	1.5"		316L SS	180°, 360°	200°F	0.3mm/ 50 mesh

SPRAY TECHNOLOGY FOR RELIABLE TANK CLEANING

Tank cleaning is an essential process for many industries and can be time-consuming and expensive without the correct solution for the given application. Cleaning tanks before and after storage or manufacturing processes is typical to avoid cross-contamination. BETE tank cleaning nozzles maximize cleaning efficiency by ensuring proper distribution of the cleaning media and maximizing impact from the system's available flow rate and pressure.

Our rotating spray devices clean more efficiently than traditional static spray balls and are proven to reduce effluent discharge, consume less water, and reduce waste. They save significant time and money over cleaning alternatives, such as "fill and drain" or manual entry, especially in hazardous environments. BETE specializes in spray technology for industrial and hygienic tank cleaning applications by offering a complete line of products for every size tank and soil type.



COMMON APPLICATIONS

- Bright Beer Tanks
- Brew Kettles
- Fermentations Tanks
- Mixers
- Cooking Kettles
- Large Commercial Ovens & Freezers
- Reactors
- Process Vessels
- Oil & Gas Storage Tanks
- Chemical Processing Tanks
- Spray Drying Tanks
- Totes, Drums, & Barrels
- Tanker Trucks & Railcars

TANK CLEANING CONSIDERATIONS

Tank cleaning applications vary by tank size and the type of soil. BETE offers a range of tank cleaning nozzles to fit these requirements. The following considerations will help determine which spray device is best for your application. Our engineering spray experts can assist with recommending solutions for achieving optimal cleaning performance and reliability.

SOIL CLASSIFICATIONS

Soil is an essential factor to consider when choosing a tank cleaning nozzle. BETE classifies soils into three classes ranging from light soil, moderate soil, and heavy soil. Every tank cleaning nozzle is assigned a soil classification, making it easier to select the right one. In some cases, a nozzle can have more than one class.

Class 1 - Light Soil

A liquid residue or light powder not anchored to the surface and that easily rinses away.

Examples: Powder mixes, light chemicals, oil-free liquids

Class 2 - Moderate Soil

Soil anchors to the surface and requires repetitive spray impact, temperature, and chemicals to remove.

Examples: Beverage concentrates, foods, light oils, dyes, flavorings

Class 3 - Heavy Soil

Soil heavily cakes onto the surface, and a longer dwell time is required to aid in the cleaning process. Solid jet streams work effectively on heavy soils.

Examples: Paint, asphalt, peanut butter, tar, heavy chemicals, tartrates, oils

OPERATING PRINCIPLES

We define BETE tank cleaning nozzles by three types of operating principles: stationary, reactionary force, and rotary jet. Each principle affects cleaning performance differently depending on the nozzle design.



STATIONARY

Stationary nozzles, also known as static nozzles, have no moving parts. The low-maintenance designs of our innovative HydroClaw and spiral TW provide sizable free passage superior to standard static spray balls. The TW series' versatile size range and narrow form ensure compatibility with small vessel openings, including bottles.



TW



LEM



CLUMP



HydroClaw®



REACTIONARY FORCE

These fluid-driven tank cleaning nozzles use the spray media's reaction force to drive the nozzle head's rotation. These provide complete 360° coverage and efficient cleaning through impact and repetition. Rotating nozzles increase tank washing efficiency over static spray balls, saving time and money by reducing water and cleaning agent consumption while decreasing downtime.



**HydroWhirl®
Mini SS**



**HydroWhirl®
Mini PVDF**



**HydroWhirl®
Stinger**



**HydroWhirl®
Disc**



**HydroWhirl®
Poseidon**



ROTARY JET

Rotary jets use the spray media flowing through internal gears on the body to rotate sets of high-impact jet nozzles through an efficient 2-axis orbital pattern, providing complete 360° coverage. The jet pattern nozzles on these assemblies provide significantly more impact and impingement force than other styles of tank cleaning nozzles, making them ideal for hard-to-clean residues and larger vessels.



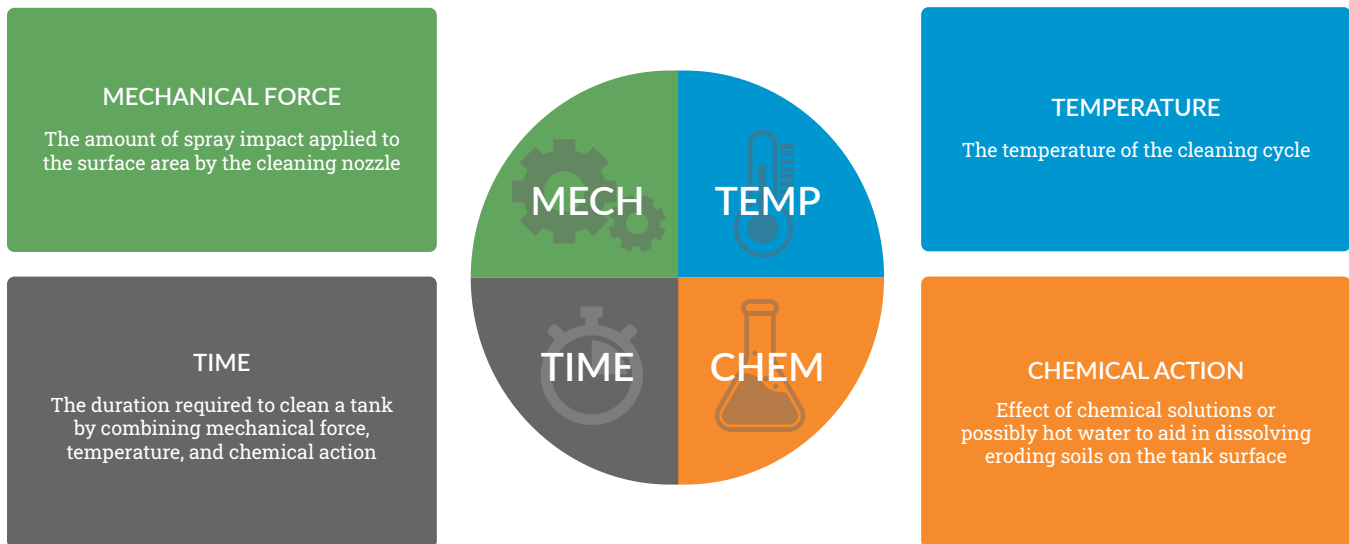
HydroWhirl® Orbitor



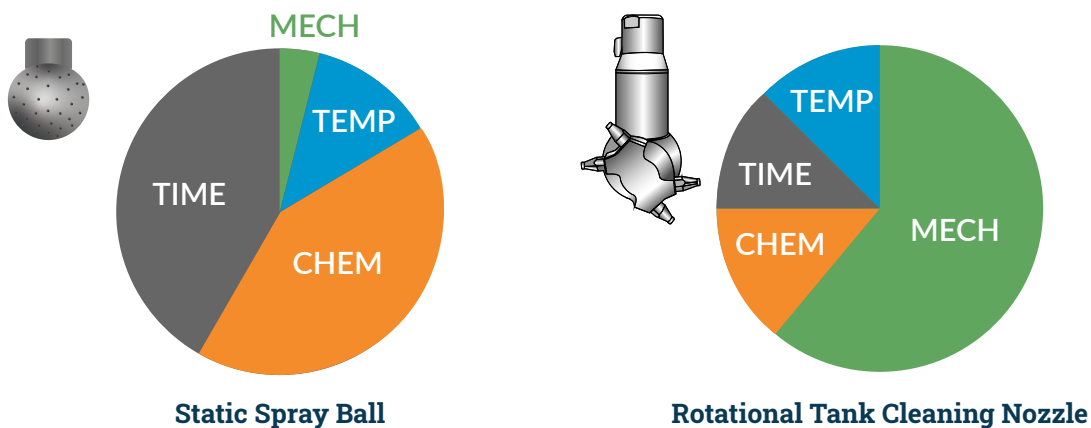
HydroWhirl® Orbitor 100

FUNDAMENTALS OF CLEANING TECHNOLOGY

The fundamentals of cleaning technology use the relationship between time, temperature, chemical action, and mechanical force. Mechanical force plays a vital role in this relationship and defines the spray impact applied to the surface by the tank cleaning nozzle.



The greater mechanical force applied to the cleaning process will reduce time, temperature, and chemicals resulting in less water consumption and effluent discharge. The illustration below compares the mechanical force of a static spray ball with that of a rotary tank cleaning nozzle.



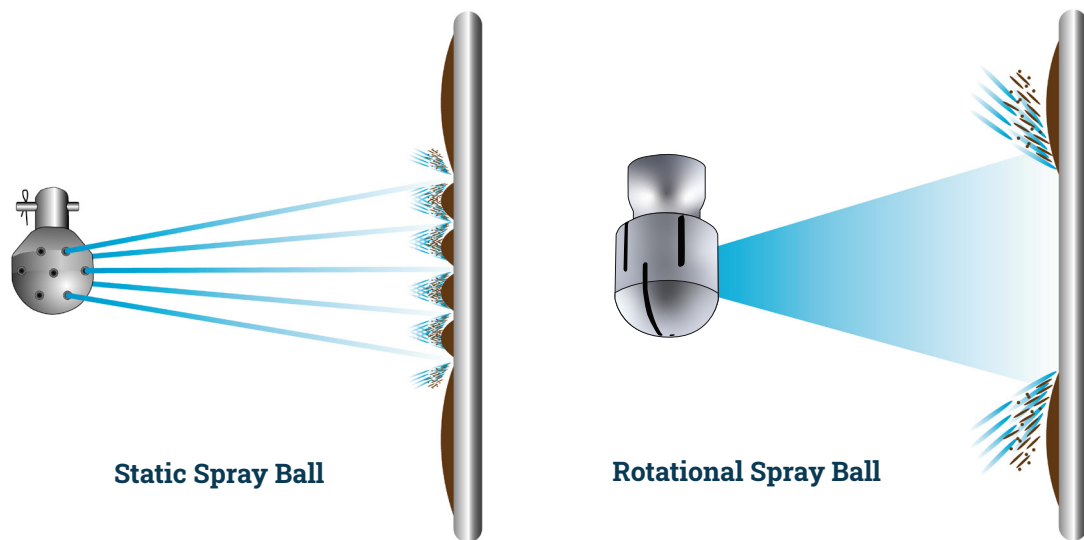
Static spray balls require more time to clean because they produce very little mechanical force and consume more chemicals and water, producing extra waste and increasing costs. Rotary tank cleaning nozzles provide greater mechanical force requiring less time for cleaning and benefiting from increased production and cost savings.

SPRAY IMPACT

STATIC VS ROTATIONAL SPRAY

Static spray balls are basic, economical, and less effective at cleaning than rotating spray devices. The jet streams produced by a static spray ball only penetrate a concentrated spot, and the remaining surface areas rely on shear stress for soil removal.

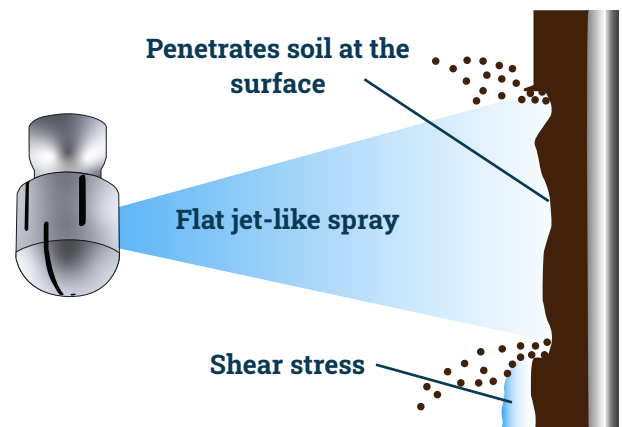
Rotating cleaning nozzles spray the entire tank surface in a fan-like pattern and provide better spray coverage with less reliance on shear stress, which helps to rinse but doesn't provide the economic benefits of impact. The fluid consumption for static spray balls is significantly greater than for rotational spray nozzles.



FLAT JET VS SOLID JET SPRAY

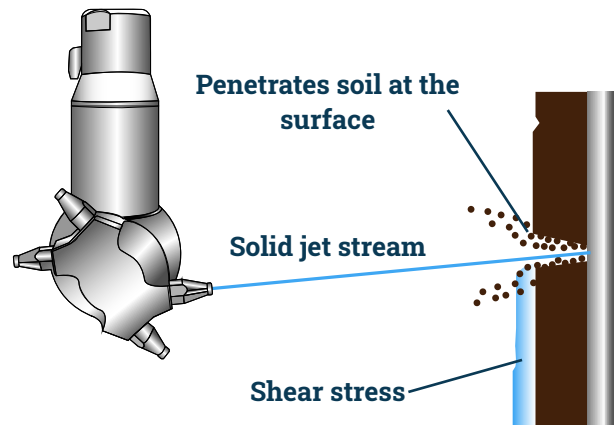
Reactionary force tank cleaning nozzles that produce flat, jet-like sprays form large droplets ideal for removing light to moderate soils.

These tank cleaning nozzles will cover more immediate surface area with shear stress and greater cascading action.



Rotary jet tank cleaning machines deliver the best impact for removing heavy soils. These tank cleaning machines operate on two or four-axis points that sweep the entire tank systematically to ensure complete surface coverage. The solid jet sprays, complemented with controlled rotation, allow for a longer spray dwell time that aids in penetrating difficult soils directly at the surface.

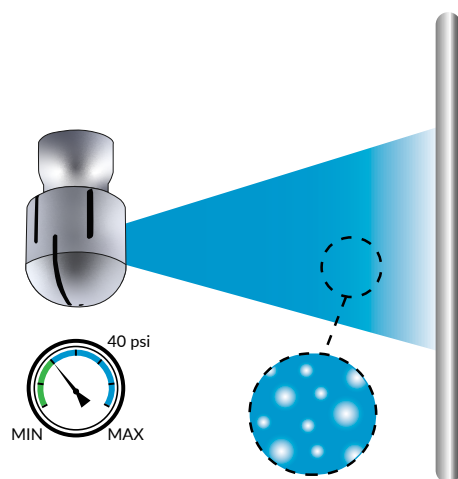
Rotary jet tank cleaning machines provide the greatest mechanical force for reducing cycle times, temperature, and chemical solvents.



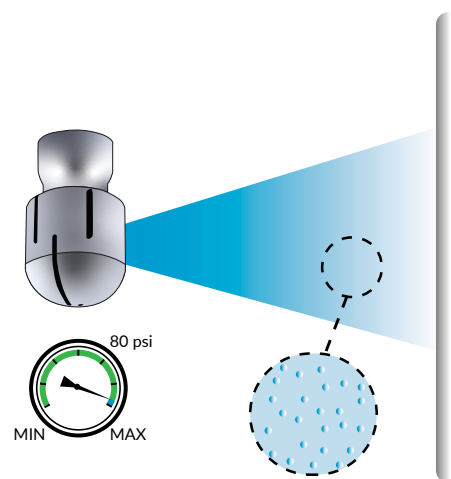
OPERATING PRESSURE VS SPRAY IMPACT

The operating pressure and distance between the nozzle and surface wall influence the formation of larger droplets with fluid-driven tank cleaning nozzles. These tank cleaning nozzles use the spray media's reaction force to drive the nozzle head's rotation to produce flat jet-like patterns that form large droplets at recommended pressures. Large droplets deliver more significant impact and spray coverage when cleaning the surface area of a tank.

If the operating pressure is too high, smaller droplets will produce less impact and result in atomization. For optimal cleaning performance, rotational spray nozzles must use the recommended pressures.



Operating at recommended pressure (40 psi/2.8 bar) larger droplets are formed.



Operating above recommended pressure (80 psi/5.5 bar) small droplets produce atomization.

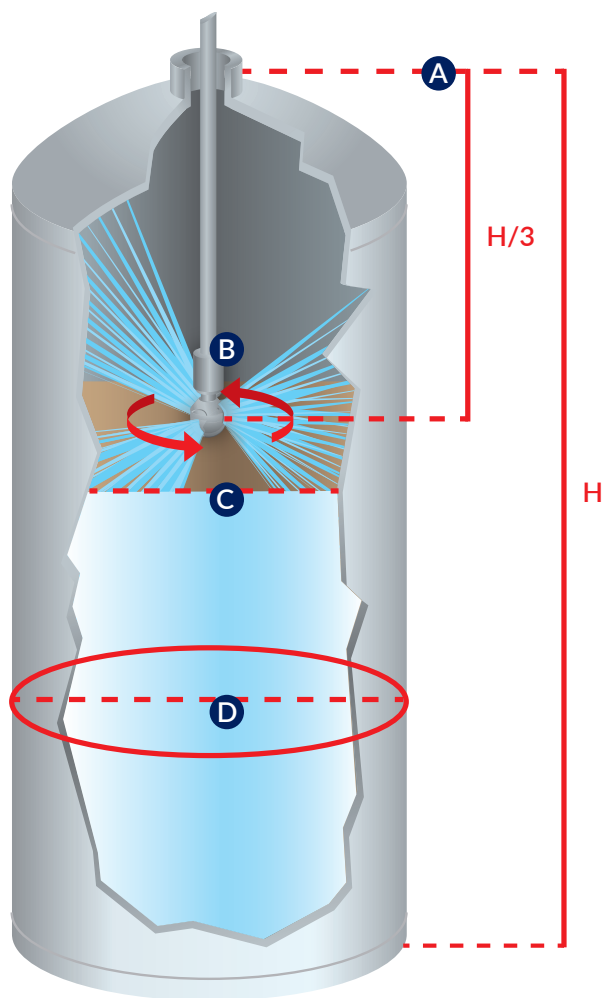


PLANNING GUIDE FOR EFFECTIVE TANK CLEANING

There are several factors to consider for effective tank cleaning. Tank size, pump capacity, and nozzle arrangement are just as important as selecting the best spray device for your cleaning application. Horizontal tanks have different cleaning challenges than vertical tanks and require engineered tank cleaning solutions.

This guide will help identify any challenges and provide recommendations to ensure your cleaning process is reliable. These simple strategies could reduce waste and resources, providing significant cost savings and increased productivity.

Our technical engineers' tank cleaning experience can recommend solutions with new or existing processes to help you obtain the optimum cleaning performance.



A. NOZZLE PLACEMENT

The nozzles should be positioned in the upper part of the tank when possible. However, nozzles placed too close to the ceiling of the tank will deflect off the tank ceiling, losing the cleaning impact.

Guideline for nozzle placement
(H/3) Nozzle = 1/3 Overall Tank Height (H)

C. FILL LINE

When permanently mounting nozzles inside the tank, position them above the fill line. This prevents the nozzle from coming in contact with the product where bacteria buildup and cross-contamination can result. After the cleaning cycle, the nozzle should be removed because bacteria can adhere to the crevices.

B. PUMP CAPACITY & SIZE

The pipe size depends on the required flow rate and should be selected to ensure the pressure losses in the pipe system are as low as possible. The required static operating pressure must be directly available at the nozzle and match the pump power. Too much pressure loss in the pipe system may cause poor nozzle performance.

D. TANK DIAMETER SIZE

Tanks come in various sizes and shapes. Selecting a suitable tank cleaning device depends on the soil type and the vessel's diameter. BETE offers tank cleaning nozzles designed to clean tanks up to 100+ ft in diameter. Use our Tank Cleaning Product Selection Guide on pages 4 and 5 to check the cleaning diameter for each nozzle and match your tank size.

DRAIN HOLE SIZE

The tank drainage by gravity rate is selected to prevent the liquid from rising during cleaning. Ensure the drain can handle whatever fluid volume enters the tank. In some cases, a recirculating pump may be advantageous if draining is problematic. The chart below indicates the capacity of fluid that the size of the drain hole can handle.

DRAIN HOLE SIZE (IN)	DRAIN HOLE SIZE (MM)	CAPACITY
1	25.4	6 Gal/Min
1 ½	38.1	13 Gal/Min
2	51	23 Gal/Min
2 ½	63.5	35 Gal/Min
3	76.2	50 Gal/Min
4	101.6	87 Gal/Min
5	127	140 Gal/Min
6	152.4	204 Gal/Min

SPRAY SHADOWS

Agitators, baffles, and pipes prevent the spray from reaching the areas behind them, known as spray shadowing. Installing multiple nozzles will provide the necessary coverage to clean these areas. Position the nozzles, so the sprays overlap and ensure proper cleaning.

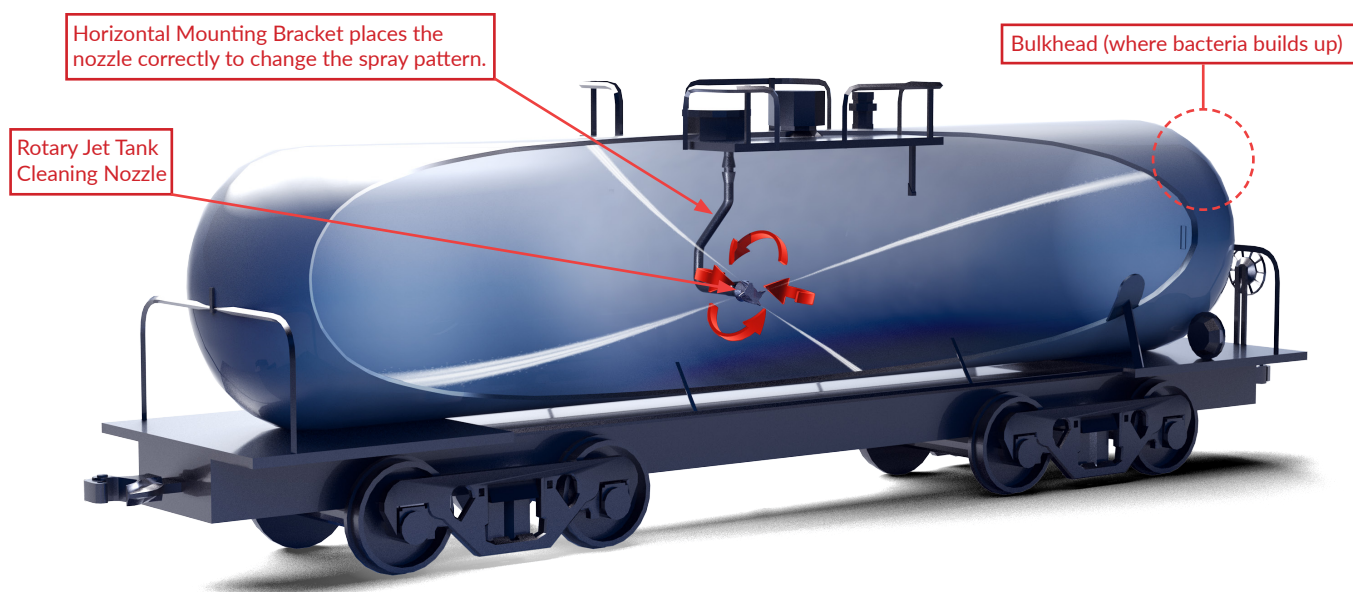




CLEANING SOLUTIONS FOR HORIZONTAL TANKS

Installing tank cleaning nozzles vertically inside horizontal tanks can make cleaning cycles inefficient. The spray concentration remains at the tank's center and doesn't reach the tank's bulkhead. These areas will require manual cleaning, which can be hazardous to workers and result in bacteria buildup if not adequately cleaned.

BETE's tank cleaning mounting adapter positions the HydroWhirl Orbitor tank cleaning machine horizontally inside the tank, optimizing the direction of the spray pattern to effectively clean the bulkheads and reduce the cycle time by 50 percent. Because of their powerful solid jet streams, we recommend rotary jet tank cleaning machines for cleaning large horizontal tanks, rail cars, and tanker trucks.





SPRAY NOZZLES FOR TANK CLEANING

BETE uses the latest spray technology for designing tank cleaning nozzles to ensure reliable and effective cleaning performance. Depending on the application, both stationary and rotating spray devices are offered because one nozzle's operating principle and design could be more effective than the other.

PREVENT DOWNTIME BY USING CLOG-RESISTANT NOZZLES

When particulates and filtration are a problem, we recommend stationary tank cleaning nozzles because they contain no moving parts and are resistant to clogging. A rotary spray device has internal mechanisms and could seize if any particulates become lodged inside the nozzle. The HydroClaw tank cleaning nozzle is ideal for passivating agents, such as nitric and citric acid, used in fermentation tanks.



HydroClaw

SPRAY TECHNOLOGY DESIGNED TO DO MORE WITH LESS

For more difficult soils, rotating spray devices provide superior spray impact and consume 50% less water than static spray balls. These spray devices operate as free-spinning or controlled rotation. Rotary Jet tank cleaning machines have internal gears that slow the rotation of the nozzles, producing a longer dwell time on the surface for effective soil removal.

REDUCED WATER, WASTE, & ENERGY

- **50% water savings compared to static spray balls**
- **40% faster cleaning using less energy**
- **Less effluent discharge consumes fewer resources**
- **Precise and reliable cleaning prevents batch contamination**



HydroWhirl® Stinger

Whether you have a small or large tank and require a simple rinse or heavy soil penetration, BETE offers a stationary or rotating tank cleaning nozzle for your application.

OPERATING PRINCIPLE SYMBOLS

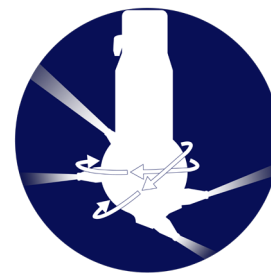
BETE tank cleaning nozzles are categorized by operating principle and soil class, specified on each product page. Use these symbols to identify the type of operating principle for each tank cleaning nozzle.



Stationary



Reactionary Force



Rotary Jet



HYDROWHIRL® MINI (HWM)

PVDF & STAINLESS STEEL REACTIONARY FORCE

Soil Class: 1 & 2

The HydroWhirl Mini nozzle directs the cleaning spray media or fluid through a rotating head at the tip of the spray assembly. The spray head produces a vigorous moving spray action impinging all surfaces inside the tank. The specially designed orifice produces a fan spray pattern that effectively breaks up and removes contaminants.

DESIGN FEATURES

- Compact design perfect for cleaning tight areas inside equipment and tanks up to 3 feet
- Cleans more quickly, uses less water, spray media, or fluid, and requires lower pressure than static spray balls
- Low flow and pressure require a smaller pump size resulting in lower operating costs
- Low maintenance bearing design is self-cleaning
- Available in corrosion-resistant PVDF material and FDA-Compliant 316L Stainless Steel material
- Hydrostatic wear-free slide bearing in PVDF material
- Unfilled PEEK slide-bearing provides greater longevity for stainless steel nozzle and is suitable for food and beverage applications

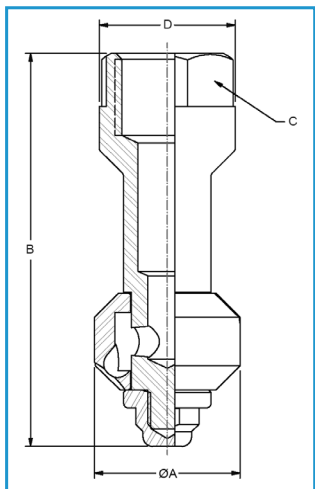
SPRAY CHARACTERISTICS

Spray Angles: Complete 360° spray

Max. Temperature: 194° F (PVDF) / 266° F (Stainless Steel)

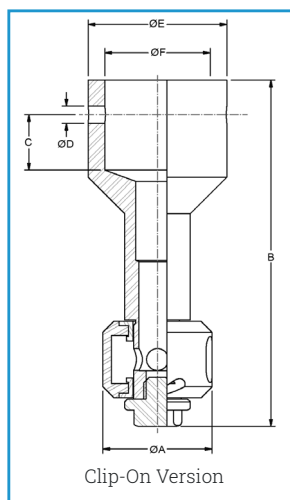
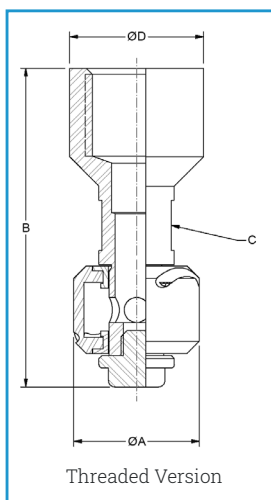
Flow Rates: 3.4 to 9.0 GPM (PVDF) / 3.6 to 9.2 GPM (Stainless Steel)

Suggested Filtration: Line strainer with a mesh size of 0.012 in/50 mesh



DIMENSIONS IN INCHES

Pipe Size	A	B	C	D	Weight (oz)
1/2"	1.19	3.19	0.94	1.10	1.1



DIMENSIONS IN INCHES (CLIP-ON)

Tube Size	A	B	C	D	E	F	Weight (oz)	Min. Entry Dia
3/4"	0.81	2.50	0.38	0.10	1.00	0.75	1.8	1.25

DIMENSIONS IN INCHES (THREADED)

Pipe Size	A	B	C	D	Weight (oz)
3/8"	0.81	2.00	0.44	0.70	2.6

HYDROWHIRL® MINI FLOW RATES

Materials: PVDF

Female Connection Type	Nozzle Number	Spray Angles	Flow Rate (GPM) @ Differential Pressure (psi)						Maximum Free Passage	Coverage Dia @ 40 psi
			10	20	30	40	50	60		
			psi	psi	psi	psi	psi	psi		
1/2" FNPT	HWM-7.2	360°	3.41	4.95	6.16	7.20	8.12	8.96	0.08	3

HYDROWHIRL® MINI FLOW RATES

Materials: 316L Stainless Steel Body, PEEK Slide-Bearing

Female Connection Type	Nozzle Number	Spray Angles	Flow Rate (GPM) @ Differential Pressure (psi)						Maximum Free Passage	Coverage Dia @ 40 psi
			10	20	30	40	50	60		
			psi	psi	psi	psi	psi	psi		
3/8" FNPT 3/4" Tube Clip-On	HWM-7.5	360°	3.64	5.22	6.45	7.50	8.43	9.27	0.06	6

Flow rates represent threaded connections with a 360° spray angle.



HYDROWHIRL® STINGER (HWS2)

SLOTTED SPRAY NOZZLE

Soil Class: 1 & 2

The fluid-driven HydroWhirl Stinger uses the reaction force of the spray media to drive the nozzle head. An innovative bearing assembly design provides improved balance and spray propagation for superior cleaning performance in a compact nozzle size.

DESIGN FEATURES

- Patent-pending no-weld design eliminates weak points and uneven surfaces
- Bearing assembly is centered within the spray head for improved balance and spray propagation
- Compact size with industry-leading flow rates fits 3/4"-2" Tri-Clamp openings
- Maintain better spray uniformity at lower pressures
- Unique patent-pending pipe thread technology flushes to reduce contamination and bacteria growth
- Ceramic Bearings for long service life and extreme chemical resistance
- Operates in any orientation

SPRAY CHARACTERISTICS

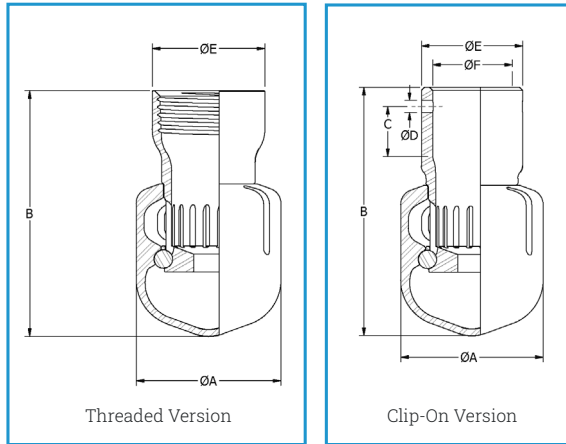
Spray Angles: Complete 360° spray

Max. Temperature: 200° F

Flow Rates: 1.1 to 102 GPM

Suggested Filtration: Line strainer with a mesh size 0.004 in/150 mesh for HWS2-4 and smaller. Line strainer with a mesh size 0.003 in/200 mesh for HWS2-7.5 and larger.

Note: HWS2 model will replace the original HWS model. Contact BETE for replacement part numbers.



DIMENSIONS IN INCHES (CLIP-ON)

Tube Size	A	B	C	D	E	F	Weight (oz)	Min Tank Entry Dia
1"	1.85	3.40	0.85	0.156	1.32	1.00	12	1.85
3/4"	1.35	2.84	0.49	0.086	1.06	0.75	7	1.35
1/2"	0.85	1.91	0.50	0.086	0.84	0.50	3	1.19
3/8"	0.60	1.38	0.34	0.086	0.56	0.38	0.8	0.90

DIMENSIONS IN INCHES (THREADED)

Pipe Size	A	B	E	Weight (oz)	Min Tank Entry Dia
1"	1.85	3.13	1.44	10.5	1.85
3/4"	1.35	2.75	1.15	5.2	1.35
1/2"	1.35	2.38	0.95	4.7	1.35
3/8"	0.85	1.81	0.75	1.4	0.85
1/8"	0.60	1.25	0.50	1	0.60

HYDROWHIRL® STINGER FLOW RATES

Materials: 316L Stainless Steel Body, Ceramic Bearings

Female Connection Type	Nozzle Number	Spray Angles	Flow Rate (GPM) @ Differential Pressure (psi)						Maximum Free Passage	Coverage Dia @ 40 psi
			10	20	30	40	50	60		
			psi	psi	psi	psi	psi	psi		
1/8" FNPT, BSP 3/8" Tube Clip-On	HWS2-2.1	360°	1.09	1.51	1.83	2.10	2.33	2.54	.025	2
	HWS2-4		2.05	2.86	3.48	4.00	4.46	4.87	.039	7
	HWS2-7.5		3.84	5.37	6.53	7.50	8.35	9.12	.063	7
3/8" FNPT, BSP 1/2" Tube Clip-On	HWS2-10	360°	4.94	7.03	8.64	10.0	11.2	12.3	.024	8
	HWS2-12		6.22	8.64	10.5	12.0	13.3	14.5	.039	10
	HWS2-17		8.59	12.1	14.8	17.0	19.0	20.8	.079	10
1/2" FNPT, BSP	HWS2-20	360°	10.2	14.3	17.4	20.0	22.3	24.3	.039	10
	HWS2-26		12.9	18.3	22.5	26.0	29.1	31.9	.064	10
3/4" FNPT, BSP 3/4" Tube Clip-On	HWS2-20	360°	10.2	14.3	17.4	20.0	22.3	24.3	.039	10
	HWS2-26		12.9	18.3	22.5	26.0	29.1	31.9	.064	10
1" FNPT, BSP 1" Tube Clip-On	HWS2-33	360°	16.6	23.4	28.6	33.0	36.8	40.3	.031	11
	HWS2-55		27.6	39.0	47.7	55.0	61.5	67.3	.064	12
	HWS2-66		33.4	46.9	57.3	66.0	73.7	80.6	.094	12
	HWS2-84		43.2	60.2	73.2	84.0	93.5	102	.125	12

Flow rates represent threaded connections with a 360° spray angle.

Flow rates may vary for other connection types and spray angles.



HYDROWHIRL® DISC (HWD)

POWERFUL SUBMERSIBLE ROTATING TANK CLEANER

Soil Class: 1 & 2

The HydroWhirl Disc nozzle directs the cleaning spray media or fluid through a rotating head at the tip of the spray assembly. This reactionary force produces a vigorous moving spray action impinging all surfaces inside the tank. The HydroWhirl Disc is clog-resistant and can be entirely submersed while providing powerful cleaning action.

DESIGN FEATURES

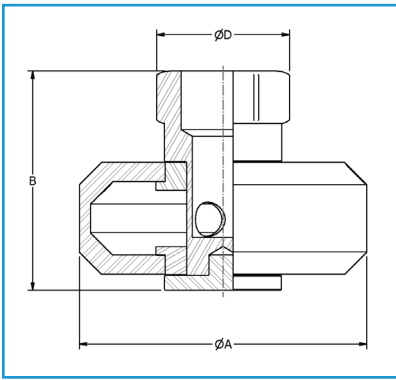
- Fluid-driven, self-flushing
- Fully submersible, clog-resistant
- Powerful flat spray nozzles
- Hydrostatic wear-free PTFE slide bearing for longer life
- Made from FDA-compliant, 316L SS
- For cleaning medium-sized tanks

SPRAY CHARACTERISTICS

Spray Angles: Complete 360° spray

Max. Temperature: 194° F

Flow Rates: 25.3 to 61.1 GPM



DIMENSIONS IN INCHES

Pipe Size	A	B	D	Weight (oz)
1"	3.88	2.94	1.56	41

HYDROWHIRL® DISC FLOW RATES

Materials: 316L Stainless Steel Body, PEEK Slide-Bearing

Female Connection Type	Nozzle Number	Spray Angles	Flow Rate (GPM) @ Differential Pressure (psi)						Maximum Free Passage	Coverage Dia @ 40 psi
			10	20	30	40	50	60		
			psi	psi	psi	psi	psi	psi		
1" FNPT	HWD-50	360°	25.3	35.5	43.4	50.0	55.8	61.1	0.13	11



HYDROWHIRL® POSEIDON (HWP)

PTFE REACTIONARY FORCE

Soil Class: 2 & 3

The HydroWhirl Poseidon nozzle directs the cleaning spray media or fluid through a rotating head at the tip of the spray assembly. This nozzle design produces a slow-moving, high-impact spray action against the tank's internal surfaces. The HydroWhirl Poseidon nozzle head uses impact and repetition to break up and wash away contamination quickly.

DESIGN FEATURES

- Durable PTFE material construction withstands extreme chemical and elevated temperature environments
- Cleans more quickly, uses less water, spray media, or fluid, and requires lower pressure than static spray balls
- Slow rotation speed enables longer spray dwell time, increasing spray impact along with efficient cycle times
- Easy to disassemble, inspect, and reassemble with basic hand tools

SPRAY CHARACTERISTICS

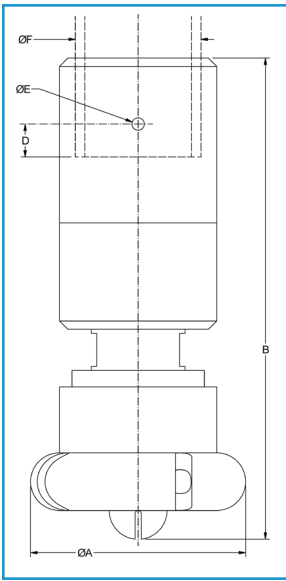
Spray Angles: Complete 360° spray

Max. Temperature: 200°F

Flow Rates: 4.25 to 82.4 GPM

Suggested Filtration: Line strainer with a mesh size of 0.002 in/50 mesh

DIMENSIONS IN INCHES



Nozzle Number	Female Connection Size	A	B	D	E	F (Pipe)	F (Tube)	F (DN)	Weight (oz)
HWP-10	1/4" FNPT, BSP, Pipe Clip-On, DN10	1.68	3.94	0.50	0.09	0.54		0.51	3
	3/8" FNPT, BSP, Pipe Clip-On, DN15					0.68		0.75	
	1/2" FNPT, BSP, Pipe/Tube Clip-On, DN15					0.84	0.50	0.75	
	3/4" Tube Clip-On						0.75		
HWP-23 HWP-28	3/8" FNPT, BSP, Pipe Clip-On, DN15	1.95	4.12	0.50	0.16	0.68		0.75	4
	1/2" FNPT, BSP, Pipe Clip-On, DN20					0.84		0.91	
	3/4" FNPT, BSP, Pipe/Tube Clip-On, DN20					1.05	0.75	0.91	
	1" Tube Clip-On						1.00		
HWP-32 HWP-37	1/2" FNPT, BSP, DN20	3.00	6.40	0.50	0.19	0.84		0.91	21
	3/4" FNPT, BSP, Pipe Clip-On, DN25					1.05		1.14	
	1" FNPT, BSP, Pipe/Tube Clip-On, DN25					1.32	1.00	1.14	
	1 1/4" Tube Clip-On						1.25		
HWP-48 HWP-55 HWP-65 HWP-73	1" FNPT, BSP, Pipe Clip-On, DN40	3.30	7.30	0.50	0.19	1.32		1.61	29
	1 1/4" FNPT, BSP, Pipe Clip-On, DN40					1.66		1.61	
	1 1/2" FNPT, BSP, Pipe/Tube Clip-On, DN40					1.90	1.50	1.61	
	1 3/4" Tube Clip-On						1.75		

HYDROWHIRL® POSEIDON® FLOW RATES

Materials: PTFE Body, 316 Stainless Steel Retaining Clip

Female Connection Type	Nozzle Number	Spray Angles	Flow Rate (GPM) @ Differential Pressure (psi)						Maximum Free Passage	Coverage Dia @ 40 psi
			10	20	30	40	50	60		
			psi	psi	psi	psi	psi	psi		
1/4" FNPT, BSP, Pipe Clip-On, DN10 3/8" FNPT, BSP, Pipe Clip-On, DN15 1/2" FNPT, BSP, Pipe/Tube Clip-On, DN15 3/4" Tube Clip-On	HWP-10	360°	4.25	6.31	7.75	8.96	10.0	11.0	0.06	9
3/8" FNPT, BSP, Pipe Clip-On, DN15 1/2" FNPT, BSP, Pipe Clip-On, DN20 3/4" FNPT, BSP, Pipe/Tube Clip-On, DN20 1" Tube Clip-On	HWP-23	360°	9.42	13.4	16.5	19.0	21.3	23.4	0.06	11
	HWP-28		10.7	15.2	18.6	21.5	24.0	26.3		14
1/2" FNPT, BSP, DN20 3/4" FNPT, BSP, Pipe Clip-On, DN25 1" FNPT, BSP, Pipe/Tube Clip-On, DN25 1 1/4" Tube Clip-On	HWP-32	360°	11.7	16.8	20.8	24.1	27.1	29.8	0.06	14
	HWP-37		15.1	21.6	26.5	30.8	34.5	37.9		16
1" FNPT, BSP, Pipe Clip-On, DN40 1 1/4" FNPT, BSP, Pipe Clip-On, DN40 1 1/2" FNPT, BSP, Pipe/Tube Clip-On, DN40 1 3/4" Tube Clip-On	HWP-48	360°	20.6	29.3	36.0	41.7	46.8	51.3	0.06	24
	HWP-55		23.5	33.4	41.1	47.6	53.3	58.5		
	HWP-65		30.7	43.4	53.3	61.6	68.9	75.5	0.09	25
	HWP-73		33.4	47.4	58.2	67.2	75.2	82.4		

Flow rates represent threaded connections with a 360° spray angle.

Flow rates may vary for other connection types and spray angles.



HYDROWHIRL® ORBITOR 100 (HWO100)

HIGH-IMPACT ROTARY JET TANK CLEANING MACHINE

Soil Class: 3

The HydroWhirl Orbitor 100 is a compact, powerful, versatile tank cleaning machine designed to meet the high standards required in the food, beverage, and chemical processing industries. Rotary jet tank cleaning machines use the spray media flowing through internal gears on the body to rotate sets of high-impact jet nozzles through an efficient 2-axis orbital pattern, providing complete 360° coverage.

DESIGN FEATURES

- Self-cleaning, Self-lubricating
- Ideal for small to medium tanks with heavy soils.
- Easily fits through Ø4" (100 mm) openings or Ø3.35" (85 mm) when the nozzle head is vertically aligned
- Easy to repair and maintain on-site
- Designed with fewer moving parts to ensure extended operating life
- Solid stream jets provide high impact
- Available in four nozzle configurations

SPRAY CHARACTERISTICS

Spray Angles: Complete 360° spray

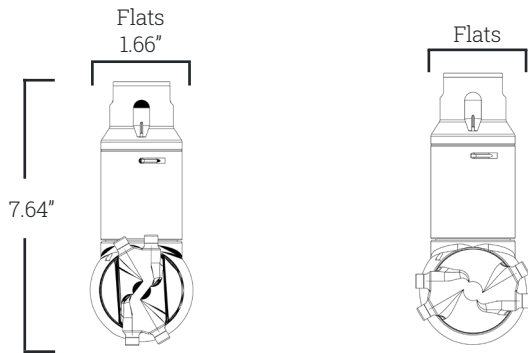
Max. Temperature: 200°F

Flow Rates: 12.0 to 52.4 GPM

Suggested Filtration: Line strainer with a mesh size of 0.003 in/80 mesh

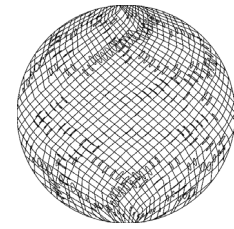


All HydroWhirl Orbitor 100 tank cleaning machines are available with ATEX approval



Vertical Nozzle Head Alignment Horizontal Nozzle Head Alignment
Clearance Diameter: 3.35" Clearance Diameter: 3.94"

Max. Working Temp.: 200° F (95 °C)
Max. Ambient Temp.: 285° F (140 °C)
Weight: 5.5 lbs
Materials:
Housing and Nozzle Head: 316L
Gears: PEEK + 316 SS
Bushings/Seals: Carbon Filled PTFE



Orbitor 4 nozzle
spray pattern

HYDROWHIRL® ORBITOR 100 - 4 NOZZLE FLOW RATES

Nozzle Number	4 X 3 mm			4 X 4 mm			4 X 5 mm			4 X 6 mm		
Female Connection Size	3/4" and 1" FNPT, BSP			3/4" and 1" FNPT, BSP			3/4" and 1" FNPT, BSP			3/4" and 1" FNPT, BSP		
Pressure (psi)	Flow (GPM)	Jet Length (ft)	Cycle Time (min)	Flow (GPM)	Jet Length (ft)	Cycle Time (min)	Flow (GPM)	Jet Length (ft)	Cycle Time (min)	Flow (GPM)	Jet Length (ft)	Cycle Time (min)
45	12.0	3.30	6.00	17.8	6.60	5.40	23.7	8.20	4.40	30.6	9.80	3.90
60	13.9	4.90	5.40	20.3	8.20	4.70	26.7	9.80	3.90	34.0	11.5	3.40
75	15.8	6.60	4.80	22.7	9.80	4.10	29.6	11.5	3.40	37.3	13.1	3.00
90	17.6	6.60	4.30	25.1	9.80	3.60	32.3	11.5	3.00	40.6	13.1	2.60
100	18.8	8.20	4.00	26.6	11.5	3.30	34.1	13.1	2.80	42.8	14.8	2.40
115	20.5	8.20	3.60	28.9	11.5	2.90	36.7	13.1	2.40	46.0	14.8	2.10
130	22.2	9.80	3.20	31.2	13.1	2.70	39.1	14.8	2.20	49.2	16.4	1.90
145	23.9	11.5	2.90	33.4	13.1	2.50	41.4	14.8	2.00	52.4	16.4	1.70

Performance may vary with ATEX models.



HYDROWHIRL® ORBITOR 100 XC

HIGH-IMPACT SLOW ROTATION TANK CLEANING MACHINE

Soil Class: 3

The HydroWhirl Orbitor 100 XC (Extreme Clean) tank cleaning machines yield high impact with slower rotation. The longer dwell time on the surface area is ideal for the effective removal of heavy residues.

DESIGN FEATURES

- High impact and slower rotation yield longer spray dwell time on the target surface for effective soil removal
- All models available with ATEX approval
- Easily field-serviced to reduce maintenance costs
- Minimum moving parts extend operating life
- Self-cleaning; self-lubricating
- Ideal for small to medium tanks, easily fits through Ø4" (100 mm) openings or Ø3.35" (85 mm) when nozzle head vertically aligned

SPRAY CHARACTERISTICS

Spray Angles: Complete 360° spray

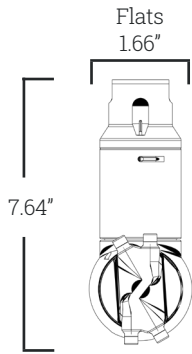
Max. Temperature: 200°F

Flow Rates: 12.9 to 52.4 GPM

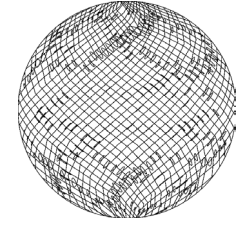
Suggested Filtration: Line strainer with a mesh size of 0.003 in/80 mesh



All HydroWhirl Orbitor 100 tank cleaning machines are available with ATEX approval



Max. Working Temp.: 200° F (95 °C)
Max. Ambient Temp.: 285° F (140 °C)
Weight: 5.5 lbs
Materials:
 Housing and Nozzle Head: 316L
 Gears: PEEK + 316 SS
 Bushings/Seals: Carbon Filled PTFE



Orbitor 4 nozzle
spray pattern

Vertical Nozzle Head Alignment Horizontal Nozzle Head Alignment
 Clearance Diameter: 3.35" Clearance Diameter: 3.94"

HYDROWHIRL® ORBITOR 100 XC - 4 NOZZLE FLOW RATES

Nozzle Number	4 X 3 mm			4 X 4 mm			4 X 5 mm			4 X 6 mm		
Female Connection Size	3/4" and 1" FNPT, BSP			3/4" and 1" FNPT, BSP			3/4" and 1" FNPT, BSP			3/4" and 1" FNPT, BSP		
Pressure (psi)	Flow (LPM)	Jet Length (mm)	Cycle Time (min)	Flow (LPM)	Jet Length (mm)	Cycle Time (min)	Flow (LPM)	Jet Length (mm)	Cycle Time (min)	Flow (LPM)	Jet Length (mm)	Cycle Time (min)
45	48.8	1.00	19.5	62.5	2.00	25.5	91.6	2.50	16.3	115	3.00	21.5
60	53.8	1.50	16.8	72.7	2.50	21.6	102	3.00	14.1	127	3.50	18.7
75	59.4	2.00	14.6	85.5	3.00	18.3	112	3.50	12.2	138	4.00	16.3
90	65.1	2.00	12.8	91.6	3.00	15.7	122	3.50	10.9	152	4.00	14.3
100	69.3	2.50	11.8	97.3	3.50	14.2	128	4.00	10.2	163	4.50	13.2
115	76.1	2.50	10.7	106	3.50	12.5	137	4.00	9.60	175	4.50	11.8
130	82.9	3.00	10.0	113	4.00	11.5	146	4.50	9.50	187	5.00	10.8
145	90.1	3.50	9.70	120	4.00	11.0	155	4.50	9.80	198	5.00	10.3



HYDROWHIRL® ORBITOR (HWO)

HIGH-IMPACT ROTARY JET TANK CLEANING MACHINE

Soil Class: 3

The HydroWhirl Orbitor is a versatile tank cleaning machine designed for the most challenging cleaning applications in the food, beverage, and chemical processing industries. Rotary jet tank cleaning machines use the spray media flowing through internal gears on the body to rotate sets of high-impact jet nozzles through an efficient 2-axis orbital pattern, providing complete 360° coverage.

DESIGN FEATURES

- Self-cleaning, Self-lubricating
- Ideal for use in large tanks for difficult-to-remove soils
- Easy to maintain and repair on-site
- Designed with minimum moving parts to ensure extended operating life
- Solid stream jets provide high impact
- Two-axis orbital spray pattern provides controlled rotation for complete 360° spray coverage
- Available in 2 or 4 nozzle configurations

SPRAY CHARACTERISTICS

Spray Angles: Complete 360° spray

Max. Temperature: 200°F

Flow Rates: 22.6 to 160 GPM

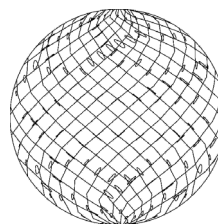
Suggested Filtration: Line strainer with a mesh size of 0.015 mm/35 mesh



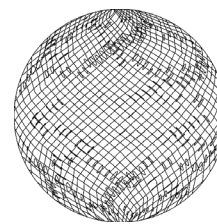
All HydroWhirl Orbitor tank cleaning machines are available with ATEX approval

Max. Working Temp.: 200 °F (95 °C)
Max. Ambient Temp.: 285 °F (140 °C)
Weight: 16.5 lbs
Materials:
Housing and Nozzle Head: 316L
Gears: PEEK + 316 SS
Bushings/Seals: Carbon Filled PTFE

Minimum opening size is 5" for either
2-nozzle or 4-nozzle standard-capacity
model with jets vertically aligned.



Orbitor 2 nozzle
spray pattern



Orbitor 4 nozzle
spray pattern

HYDROWHIRL® ORBITOR - 4 NOZZLE FLOW RATES

Nozzle Number	4 X 4.2 mm			4 X 5 mm			4 X 6 mm			4 X 7 mm			4 X 8 mm		
Female Connection Size	1" and 1 1/2"			1" and 1 1/2"			1 - 1/2" FNPT, BSP			1 - 1/2" FNPT, BSP			1 - 1/2" FNPT, BSP		
Pressure (psi)	Flow (GPM)	Jet Length (ft)	Cycle Time (min)	Flow (GPM)	Jet Length (ft)	Cycle Time (min)	Flow (GPM)	Jet Length (ft)	Cycle Time (min)	Flow (GPM)	Jet Length (ft)	Cycle Time (min)	Flow (GPM)	Jet Length (ft)	Cycle Time (min)
45	22.6	9.50	11.0	31.4	13.1	13.0	38.6	17.4	15.5	59.1	21.3	11.4	68.3	23.6	15.5
60	26.5	9.80	9.30	36.4	13.8	10.8	45.7	18.7	12.9	67.7	23.3	9.80	79.0	26.2	12.9
75	30.0	11.5	7.90	40.8	15.4	9.40	52.1	20.3	11.0	75.2	25.3	8.70	88.4	29.5	11.1
90	33.3	13.1	6.90	44.8	17.1	8.00	58.0	23.0	9.50	81.9	27.9	8.10	96.9	32.5	9.50
100	35.3	16.4	6.30	47.2	20.7	7.30	61.8	26.2	8.40	86.0	30.8	7.50	102	34.8	8.50
115	38.1	20.3	5.80	50.8	24.6	6.80	67.0	30.8	7.60	91.9	33.8	7.10	110	36.7	7.80
130	40.8	23.3	5.60	54.0	27.9	6.50	72.1	33.8	7.00	97.3	36.7	6.90	117	40.0	7.00
145	43.4	25.6	5.50	57.2	29.5	6.40	76.8	36.7	6.90	102	39.4	6.60	123	42.6	6.90

HYDROWHIRL® ORBITOR - 2 NOZZLE FLOW RATES

Nozzle Number	2 x 6 mm			2 X 7 mm			2 X 8 mm			*2 X 10 mm			*2 X 12.5 mm		
Female Connection Size	1 - 1/2" FNPT, BSP			1 - 1/2" FNPT, BSP			1 - 1/2" FNPT, BSP			1 - 1/2" FNPT, BSP			1 - 1/2" FNPT, BSP		
Pressure (psi)	Flow (GPM)	Jet Length (ft)	Cycle Time (min)	Flow (GPM)	Jet Length (ft)	Cycle Time (min)	Flow (GPM)	Jet Length (ft)	Cycle Time (min)	Flow (GPM)	Jet Length (ft)	Cycle Time (min)	Flow (GPM)	Jet Length (ft)	Cycle Time (min)
45	21.5	18.0	33.0	26.1	21.3	37.5	33.5	23.6	25.7	59.1	32.1	41.0	89.4	33.1	26.8
60	25.4	19.7	27.2	31.3	23.6	31.6	39.3	26.2	22.9	68.7	34.4	34.2	103	36.7	24.0
75	28.8	20.7	24.7	36.0	25.9	28.2	44.4	29.5	20.5	77.2	37.7	30.5	115	39.7	21.7
90	31.9	23.0	22.6	40.4	27.9	25.8	49.1	32.5	18.9	84.9	41.7	28.0	126	44.0	19.8
100	33.9	26.2	21.0	43.2	29.2	24.0	52.0	34.8	17.5	89.8	45.6	26.0	133	48.5	18.4
115	36.7	29.5	19.5	47.2	30.2	22.3	56.2	36.7	16.4	96.6	49.9	24.5	143	53.8	17.2
130	39.4	33.5	18.4	51.1	37.0	21.0	60.1	40.0	15.6	103	55.8	23.2	152	60.0	16.3
145	41.9	37.7	17.4	54.7	40.4	20.0	63.8	42.6	14.9	109	61.7	22.0	160	65.9	15.5

Performance may vary with ATEX models.

*High Capacity Jet Machine



HYDROCLAW® (HC)

SUPERIOR CLOG-RESISTANT STATIONARY NOZZLE

Soil Class: 1 & 2

The unique HydroClaw design has no moving parts. It allows the passage of particles over 1/4", three times the free passage of a comparable spray ball while providing a more significant spray impact. This stationary tank cleaning nozzle operates on low pressure/high flow for faster cleaning and reduced cycle times using less water and solvents.

DESIGN FEATURES

- Patented, clog-resistant
- Made from FDA-compliant 316L SS material
- Clip-on nozzles include a low-profile retaining pin for secure connection
- Laser welded for durability
- Ideal for passivating agents, such as nitric and citric acid, used in fermentation tanks.

SPRAY CHARACTERISTICS

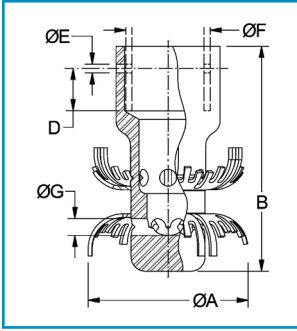
Spray Angles: Complete 360° spray

Max. Temperature: 550°F

Flow Rates: 33.4 to 112 GPM



DIMENSIONS IN INCHES



Nozzle Number	Female Connection Type	A	B	D	E	F	Weight (oz)
HC-42	3/4" FNPT	2.38	3.59				15
	3/4" G	2.38	3.59				15
	1" Tube Weld-On	2.38	3.59				12
	1 1/2" Tube Clip-On	2.88	4.00	0.75	0.16	1.50	15
	1" Tube Clip-On	2.38	3.59	0.75	0.16	1.00	14
	3/4" Pipe Clip-On	2.38	3.59	0.75	0.16	1.05	14
	DN20 Tube Clip-On					0.91	15
HC-100	1" FNPT	2.38	4.00				23
	1" G	2.38	4.00				22
	1 1/2" Tube Weld-On	2.88	4.00				15
	1 1/2" Tube Clip-On	2.88	4.00	0.75	0.16	1.50	18
	DN40 Tube Clip-On	2.88	4.00	0.75	0.16	1.57	15
	1" Pipe Clip-On	2.88	4.00	0.75	0.16	1.32	21

HYDROCLAW® FLOW RATES

Materials: 316L Stainless Steel

Female Connection Type	Nozzle Number	Spray Angles	Flow Rate (GPM) @ Differential Pressure (psi)				Maximum Free Passage	Coverage Dia @ 30 psi
			25	30	35	40		
			psi	psi	psi	psi		
3/4" FNPT, G	HC-42	360°	33.4	36.6	39.5	42.0	0.25	8
1" Tube Weld-on			33.4	36.6	39.5	42.0		
1" Tube Clip-On			35.7	38.9	42.0	44.8		
1 1/2" Tube Clip-On			35.7	38.9	42.0	44.8		
3/4" Pipe Clip-On			35.7	38.9	42.0	44.8		
DN20 Tube Clip-On			35.7	38.9	42.0	44.8		
1" FNPT, G	HC-100	360°	79.0	86.5	93.5	100	0.30	10
1 1/2" Tube Weld-on			79.0	86.5	93.5	100		
1 1/2" Tube Clip-On			88.5	96.9	105	112		
1" Pipe Clip-On			88.5	96.9	105	112		
DN40 Tube Clip-On			88.5	96.9	105	112		

For additional connection sizes available contact BETE.



TW

STATIONARY SPIRAL

Soil Class: 1 & 2

DESIGN FEATURES

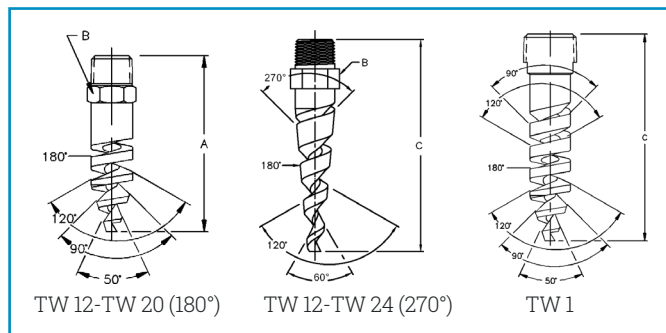
- Clog-resistant spiral design
- Greater spray impact than traditional static spray balls
- Can be used for steam injection and passivation
- Compact design fits in small openings
- Unique patterns that spray in opposing directions

SPRAY CHARACTERISTICS

Spray Angles: 180°, 270°

Flow Rates: 3.0 to 163 GPM

Max Temperature: 550° F



DIMENSIONS IN INCHES

Pipe Size	A 180°	B	C 270°	Wt. (oz)
3/8"	2.88	0.75	3.63	1.7
1/2"		0.88	4.25	6.4
1"		1.13	5.75	10.5

TW FLOW RATES

Materials: Brass, 316 Stainless Steel

Male Connection Type	Nozzle Number	Spray Angles	K Factor	Flow Rate (GPM) @ Differential Pressure (psi)										Approx. Orifice Dia	Approx. Free Pass Dia	Scrubbing Dia	Rinsing Dia
				10	20	30	40	50	60	80	100	200	400				
				psi	psi	psi	psi	psi	psi	psi	psi	psi	psi				
3/8" NPT/BSP	TW-12	180° 270°	0.95	3.00	4.24	5.20	6.00	6.71	7.35	8.49	9.49	13.4	19.0	0.19	0.13	1	3
	TW-14	180° 270°	1.28	4.05	5.73	7.01	8.10	9.06	9.92	11.5	12.8	18.1	25.6	0.22	0.13	1	4
	TW-16	180° 270°	1.68	5.30	7.50	9.18	10.6	11.9	13.0	15.0	16.8	23.7	33.5	0.25	0.13	2	5
	TW-20	180° 270°	2.61	8.20	11.7	14.3	16.5	18.4	20.2	23.3	26.1	36.9	52.2	0.31	0.13	3	7
1/2" NPT/BSP	TW-24	270°	3.81	12.1	17.0	20.9	24.1	26.9	29.5	34.1	38.1	53.9	76.2	0.41	0.17	4	9
1" NPT/BSP	TW-1	270°	8.06	26.0	36.0	45.0	51.0	57.0	63.0	72.0	80.6	115	163	0.56	0.20	8	20

Flow Rate (GPM) = $K\sqrt{PSI}$

Spray angle performance varies with pressure. Contact BETE for specific data on critical applications.



CLUMP

STATIONARY MANIFOLD

Soil Class: 1 & 2

DESIGN FEATURES

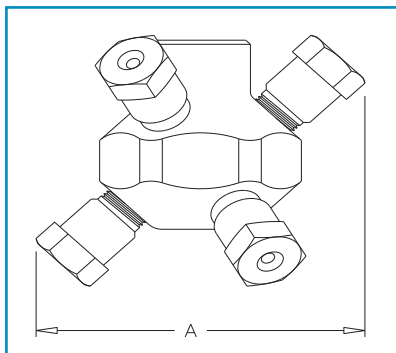
- Each nozzle in the stationary manifold is a BETE MaxiPass® clog-resistant full cone nozzle
- Other BETE nozzles can be used
- Six nozzles arranged to project spray in all directions for complete coverage

SPRAY CHARACTERISTICS

Spray Angles: 360°

Flow Rates: 7.4 to 80.6 GPM (Special flow rates available)

Max Temperature: 550° F



DIMENSIONS IN INCHES

Pipe Size	Overall Diameter A	Weight (oz)	
		Metal	Plastic
3/4"	4.75	36.3	4.8
1"	5.75	69.6	9.3

CLUMP FLOW RATES

Materials: 316 Stainless Steel and Brass.

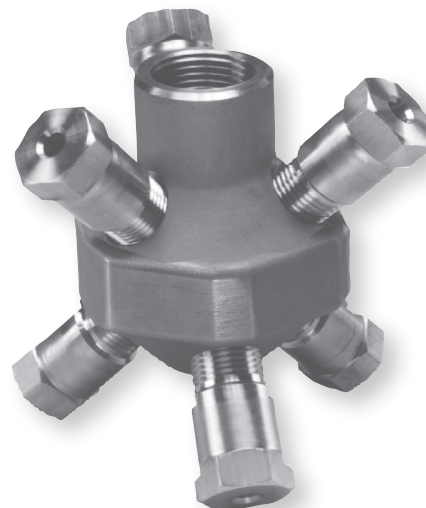
Female Connection Type	Nozzle Number	Spray Angles	K Factor	Flow Rate (GPM) @ Differential Pressure (psi)							Scrubbing Dia ft	Rinsing Dia ft
				10	15	20	30	40	60	80		
				psi	psi	psi	psi	psi	psi	psi		
3/4" FNPT/BSP	CLUMP-125	360°	2.50	7.36	8.91	10.2	12.3	14.1	17.1	19.6	4	8
	CLUMP-156		3.96	11.7	14.2	16.2	19.6	22.4	27.1	31.1	4	12
	CLUMP-187		5.72	16.9	20.4	23.4	28.3	32.4	39.2	44.9	6	14
1" FNPT/BSP	CLUMP-187	360°	5.72	16.9	20.4	23.4	28.3	32.4	39.2	44.9	6	14
	CLUMP-218		9.10	26.9	32.5	37.2	45.0	51.5	62.3	71.4	8	14
	CLUMP-250		10.3	30.3	36.7	42.0	50.8	58.2	70.4	80.6	10	16

Flow Rate (GPM) = K PSI

Spray angle performance varies with pressure. Contact BETE for specific data on critical applications.

For special flow rates contact BETE.

Other materials available on request.





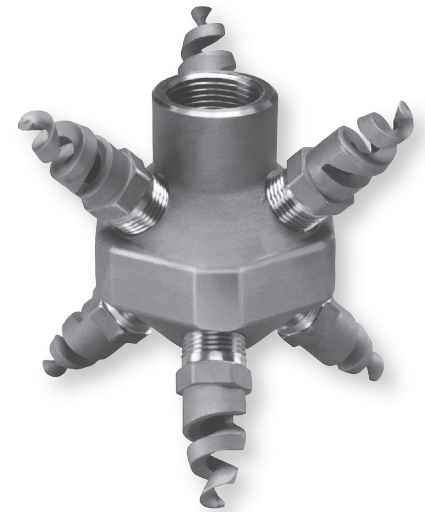
LEM

STATIONARY MANIFOLD

Soil Class: 1 & 2

DESIGN FEATURES

- Each nozzle in the stationary manifold is a BETE TF clog-resistant spiral nozzle
- Other BETE nozzles can be used
- Six nozzles arranged to project spray in all directions for complete coverage

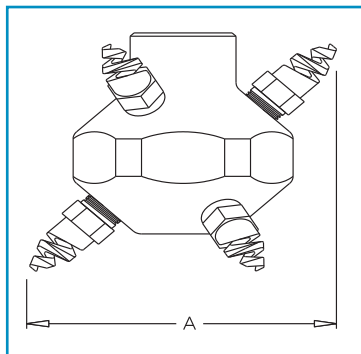


SPRAY CHARACTERISTICS

Spray Angles: 360°

Flow Rates: 4.2 to 157 GPM (Special flow rates available)

Max Temperature: 550° F



DIMENSIONS IN INCHES

Pipe Size	Overall Diameter A	Weight	
		Metal (lbs)	Plastic (oz)
3/4"	4.50	2.3	6
1"	5.25	4.1	11

LEM FLOW RATES

Materials: Brass, 316 Stainless Steel

Female Connection Type	Nozzle Number	Spray Angles	K Factor	Flow Rate (GPM) @ Differential Pressure (psi)							Scrubbing Dia ft	Rinsing Dia ft
				10	20	30	40	60	80	100		
				psi	psi	psi	psi	psi	psi	psi		
3/4" FNPT/BSP	LEM-6	360°	1.33	4.20	5.94	7.27	8.40	10.3	11.9	13.3	2	3
	LEM-8		2.53	8.00	11.3	13.9	16.0	19.6	22.6	25.3	3	6
	LEM-10		3.95	12.5	17.7	21.7	25.0	30.6	35.4	39.5	5	9
1" FNPT/BSP	LEM-12	360°	5.69	18.0	25.5	31.2	36.0	44.1	50.9	56.9	6	13
	LEM-14		7.68	24.3	34.4	42.1	48.6	59.5	68.7	76.8	7	13
	LEM-16		10.0	31.5	44.5	54.6	63.0	77.2	89.1	99.6	7	14
	LEM-20		15.7	49.5	70.0	85.7	99.0	121	140	157	8	16

Flow Rate (GPM) = $K/\sqrt{PSI}$

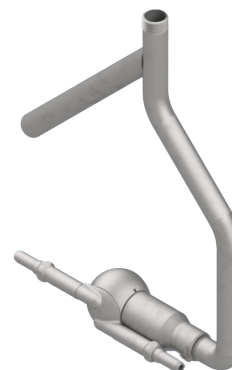
Spray angle performance varies with pressure. Contact BETE for specific data on critical applications.

For special flow rates and nozzle tips contact BETE.



TANK CLEANING MOUNTING ADAPTER

ACCESSORY FOR EFFECTIVELY CLEANING TANKER TRUCKS AND RAILCARS



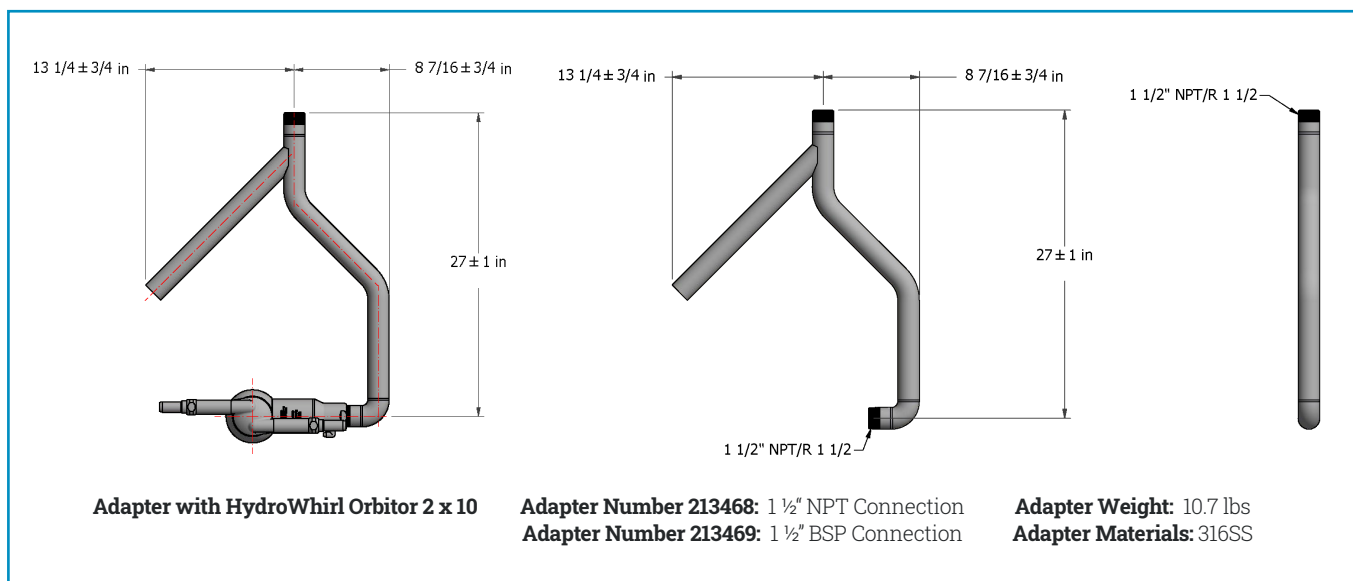
The tank cleaning mounting adapter positions the HydroWhirl® Orbitor horizontally to optimize the spray pattern's direction to clean the bulkheads repeatedly and effectively.

DESIGN FEATURES

- Reduces cleaning cycle times by up to 50%
- Easy to repair and maintain on-site
- Eliminates the need for manual cleaning
- Designed to protect the nozzle from damage upon insertion and removal
- Designed to fit HydroWhirl Orbitor 1 1/2" NPT/BSP connection sizes

SPRAY CHARACTERISTICS

Spray Angles: Complete 360° spray



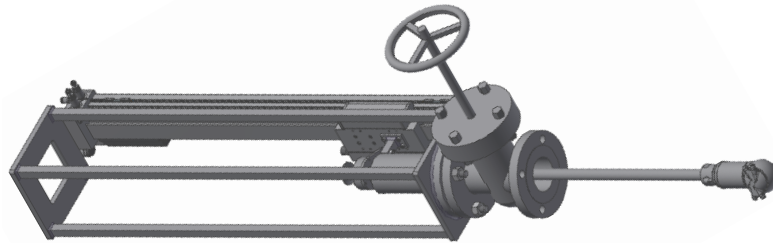
* For flow rate information refer to HydroWhirl® Orbitor datasheet

TANK CLEANING LANCES

CUSTOM SPRAY TECHNOLOGY FABRICATIONS FOR OPTIMAL NOZZLE PLACEMENT

BETE tank cleaning lances provide a custom engineered solution for optimal placement of a tank cleaning nozzle inside a tank. All lances are custom designed and fabricated at BETE to ensure close coordination through all phases for optimal nozzle performance.

Lance designs can be symmetrical or asymmetrical and may include a retractable feature for Clean-In-Place (CIP) or Clean-Out-of-Place (COP) applications. Add a customized lance for any BETE tank cleaning nozzle option.



RETRACTABLE LANCES

Retractable lances allow you to withdraw your tank cleaning nozzle, isolate it from the process, and remove it entirely for servicing without stopping your production process.

DESIGN & FABRICATION

Our engineers start by incorporating all your project specifications to ensure we meet your design requirements and validate any industry codes that must be compliant.

BETE can provide assemblies manufactured to ASME B31.3 Code for Process Piping and other applicable ASME Codes/Standards. If you require certain certifications or require your assembly to comply with applicable codes, please contact BETE.

Materials of Construction

- PVDF, PTFE, 316SS, 316L SS, nickel alloys, and other exotic alloys
- Polished finish for sanitary requirements



CHOOSE THE RIGHT PARTNER FOR YOUR TANK CLEANING REQUIREMENTS

Understanding nozzle performance and how a spray behaves in your tank cleaning application is critical. Every phase from design and manufacturing to testing and quality assurance is performed in-house, ensuring close coordination through each stage to meet all mechanical and performance requirements.

MANUFACTURING SERVICES

Our state-of-the-art manufacturing facility utilizes various manufacturing processes to produce standard or custom nozzles and tailored spraying solutions for specific application requirements. We attribute the driving force behind all of this to our highly qualified employees. They respond to the needs of our customers – ensuring that performance, quality, and delivery expectations are all met.

SPRAY FABRICATION SERVICES

Many industries have counted on BETE's nozzle engineering expertise for decades to supply fabricated spray assemblies designed from the nozzle up. Starting with the process conditions, we recommend the most appropriate nozzle and incorporate it into a fabricated tank cleaning lance.

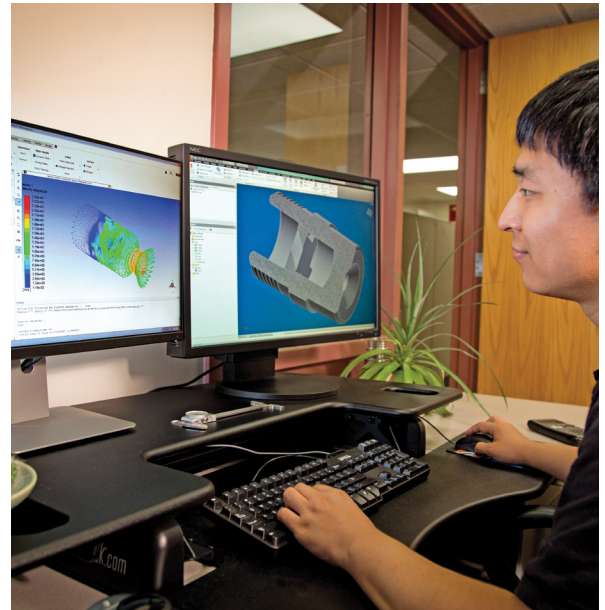


Working with BETE as your primary fabricator ensures all components fit and work together seamlessly. Our welding department, which is fully qualified to ASME B & PV Code Section IX, has made a specialty of joining dissimilar metals.

ENGINEERING SERVICES

APPLICATIONS ENGINEERING

BETE Applications Engineers can assist you when your application requires a custom-designed nozzle, involves precise spray performance, or unusual operating conditions. Our engineers have decades of combined experience in nozzle design and process specification.

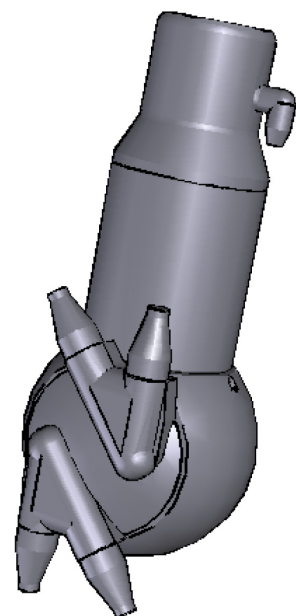


DESIGN ENGINEERING

BETE's advanced CIM (Computer Integrated Manufacturing) environment links our in-house design engineering team's CAD workstations with a CAM part programming system and CNC machine tools. The spray engineering group works with our manufacturing and design engineering teams to help you design your process or solve your spray problem. Through cross-department collaboration, we ensure that the result is manufacturable and cost-effective.

3D CAD MODELS

Accelerate your design time and improve engineering accuracy with our free, on-demand 3D CAD solid models configuration available on our website for select nozzle series. Choose from over 100 CAD formats and versions to download a 3D spray nozzle and virtually test it within your design



CASE STUDIES

FOOD PROCESSING INDUSTRY

A popular premium soups and sauces producer contacted BETE to improve their kettle cleaning process, hoping to minimize maintenance and downtime. The facility has 12 kettles where intense production and cleaning occur 17 times daily for each kettle. The kettles cook for one hour, and cleaning takes forty minutes using two controlled rotational tank cleaning machines.

The tank cleaning machines require rebuilding every three months with new spare parts and gearboxes costing \$1,500 per unit. It was evident to the customer a new tank cleaning solution could reduce repair costs and increase productivity.



► TANK CLEANING SOLUTION - HYDROWHIRL® ORBITOR

During an initial visit and inspection of the customer's process and spray device, BETE proposes the HydroWhirl Orbitor tank cleaning machine for its powerful high-impact jet streams and ease of repair. The controlled rotation of the nozzles provides a longer dwell time on the surface for removing difficult soils in cooking kettles.

The Orbitor is designed with minimal moving parts to ensure extended operating life and reduced downtime. Repairs for these units are easily done on-site in minutes. Unlike the competitor's model, the hygienic design has no external screws or rough surface areas that require manual cleaning to prevent bacteria growth.

► RETURN ON INVESTMENT

- **BETE's tank cleaning solution saved the customer \$144,000 annually in costly repairs**
- **Massive reduction in maintenance time from every fiscal quarter to every third fiscal quarter**
- **Increased productivity time**
- **Lower water consumption**

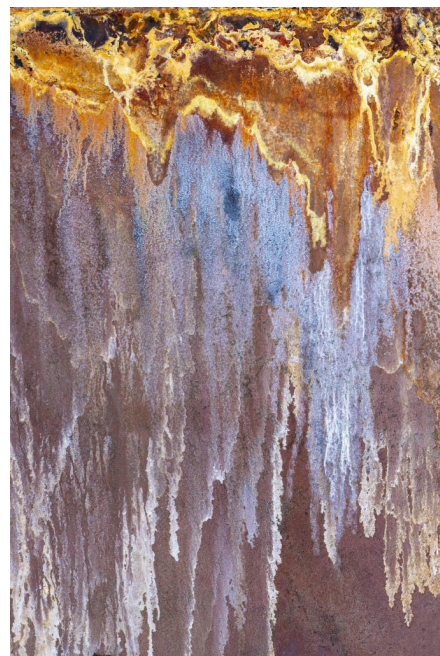


CHEMICAL PROCESSING INDUSTRY

Hydrofluoric acid (HF) is well known for its ability to dissolve many materials, including glass. Many traditionally “chemically resistant” materials, including stainless steels, are not suitable for use in an environment where HF exposure is likely.

To make matters worse, HF can cause crystallization of waste products onto surfaces in many applications – which may clog the nozzle and increase downtime. A chemical processing plant approached BETE to procure a tank cleaning system for such an environment.

The tanks were quite large for this type of application, requiring a cleaning diameter of four meters. Static nozzles are generally not a feasible solution in this case, and the crystallization problem is likely to cause frequent clogging in the small orifices found in many nozzle designs. Most spinning or rotary tank cleaners could achieve the required reach, but metallic components will not last very long in the tanks.



► SOLUTION - HYDROWHIRL® POSEIDON

The HydroWhirl Poseidon (HWP) is one of the unique rotary tank cleaning nozzles designed for slower rotation. With no metal parts, the HWP's PTFE construction is resistant to higher concentrations of HF. PTFE also has the advantage of having one of the lowest friction coefficients in any material.

For this type of application, the HWP is the perfect solution for resolving the environmental challenges encountered and the cleaning task.



► RESULTS

- **Slow rotation provides longer dwell time on the surface to remove difficult soils**
- **PTFE ultimate corrosion resistant material**
- **Non-adhesive surfaces limits bearding and residue deposits**
- **Compatible with a variety of caustic agents**
- **Complete 360° spray coverage**

WINE INDUSTRY

A premier winery in Napa Valley contacted BETE to help improve their tank cleaning process. They had tried both rotating tank wash machines and traditional static spray balls, but they weren't satisfied with either option. Even with a preliminary rinse before the cleaning process, leftover grape debris in the fermentation tanks such as seeds, stems, and skins had a habit of finding its way into the nozzles during recirculation cleaning cycles – causing the nozzles not to perform.

► SOLUTION - HYDROCLAW®

BETE engineers went to work to develop a solution for this problem that plagues not only the winemaking industry but also brewing, food processing, and many other applications that involve cleaning tanks with high solids content. The new HydroClaw nozzle provides complete 360 degree spray coverage and three times the free passage of a static sprayball. The nozzle has no moving parts and requires no maintenance.



Before

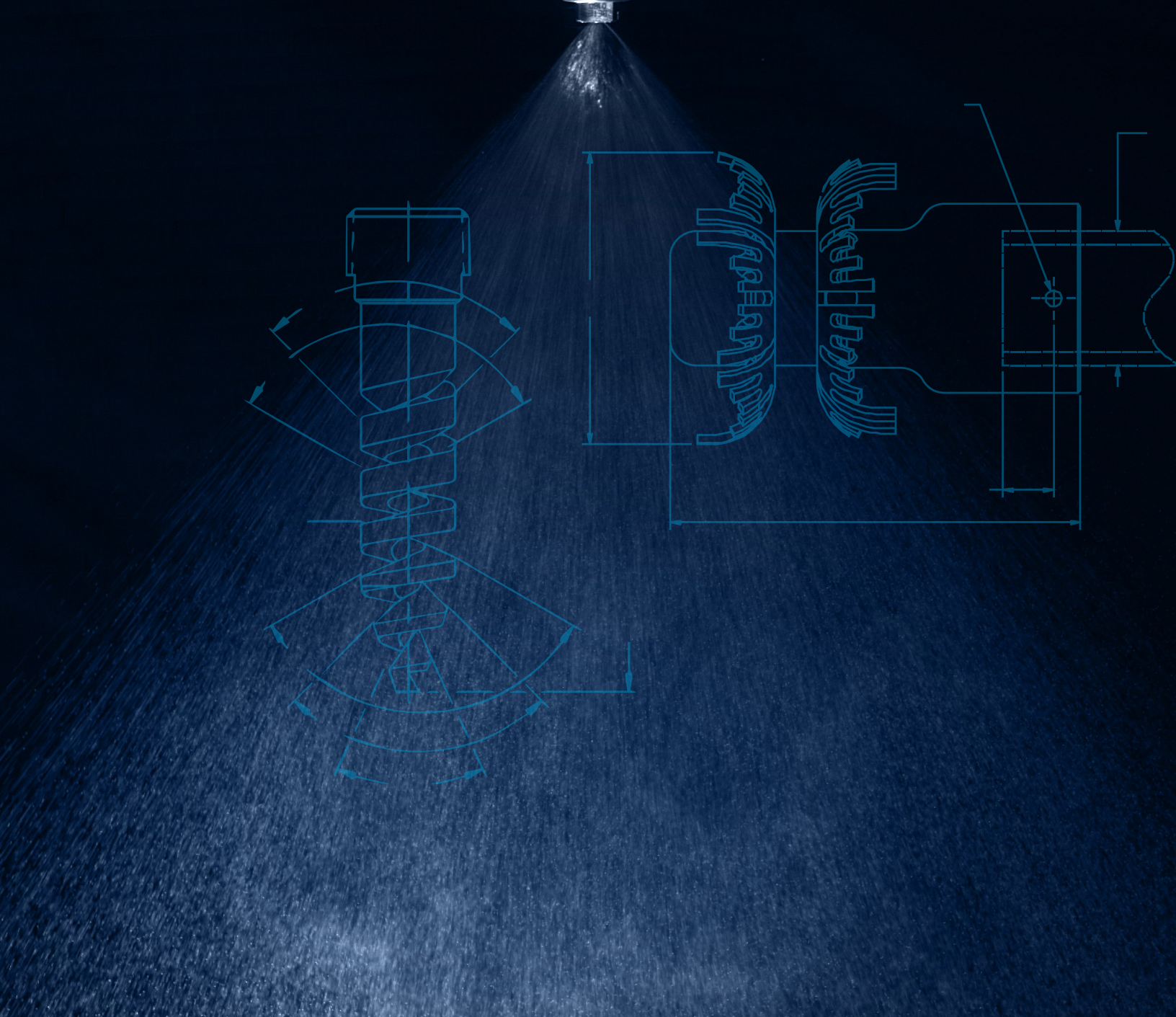


After

► RESULTS

After trialing the unit, the customer was so pleased with the cleaning performance and clog resistance of the HydroClaw that they used it exclusively to clean their tanks during the busy harvest crush season.

- **Higher flow rates allow for pre-rinsing of tanks using less water consumption**
- **Improved cleaning cycle times**
- **Reduction in maintenance and downtime**
- **No clogging issues**



BETE Fog Nozzle, Inc.

50 Greenfield Street, Greenfield | MA 01301 USA
413-772-0846 | www.BETE.com | sales@BETE.com



Spray
Nozzles



Spray
Fabrications



Spray
Systems



Applications
Engineering



Spray
Research