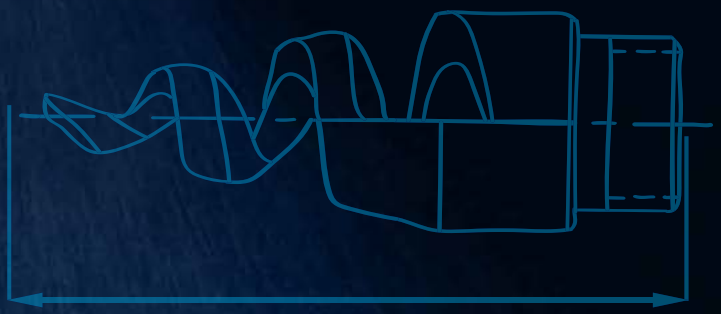
SprayNozzle ENGINEERING
Total Spraying Solutions

BETE®
PERFORMANCE SPRAY ENGINEERING



FIRE PROTECTION

SPRAY NOZZLE SOLUTIONS FOR INDUSTRIAL FIRE SUPPRESSION

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PERFORMANCE SPRAY ENGINEERING

BETE is a fourth-generation family-owned company with decades of experience providing innovative spray solutions for the fire protection industry. We make tens of thousands of products, including fog and misting nozzles, tank cleaning devices, and open-type deluge nozzles.

We know that selecting the correct nozzle is critical to your process and requires reliable performance for the safety of others. Our fire protection nozzles undergo testing, evaluation, and approval by third-party certifiers, including Factory Mutual (FM), and Underwriters Laboratories (UL). These parties verify that our nozzle manufacturing and performance meet the highest standards.

Our solutions-focused engineers and customer support teams work with you to find the best spray nozzles for your fire protection applications. For more challenging and critical spray problems, BETE offers Advanced Spray Engineering Services for testing and spray modeling.

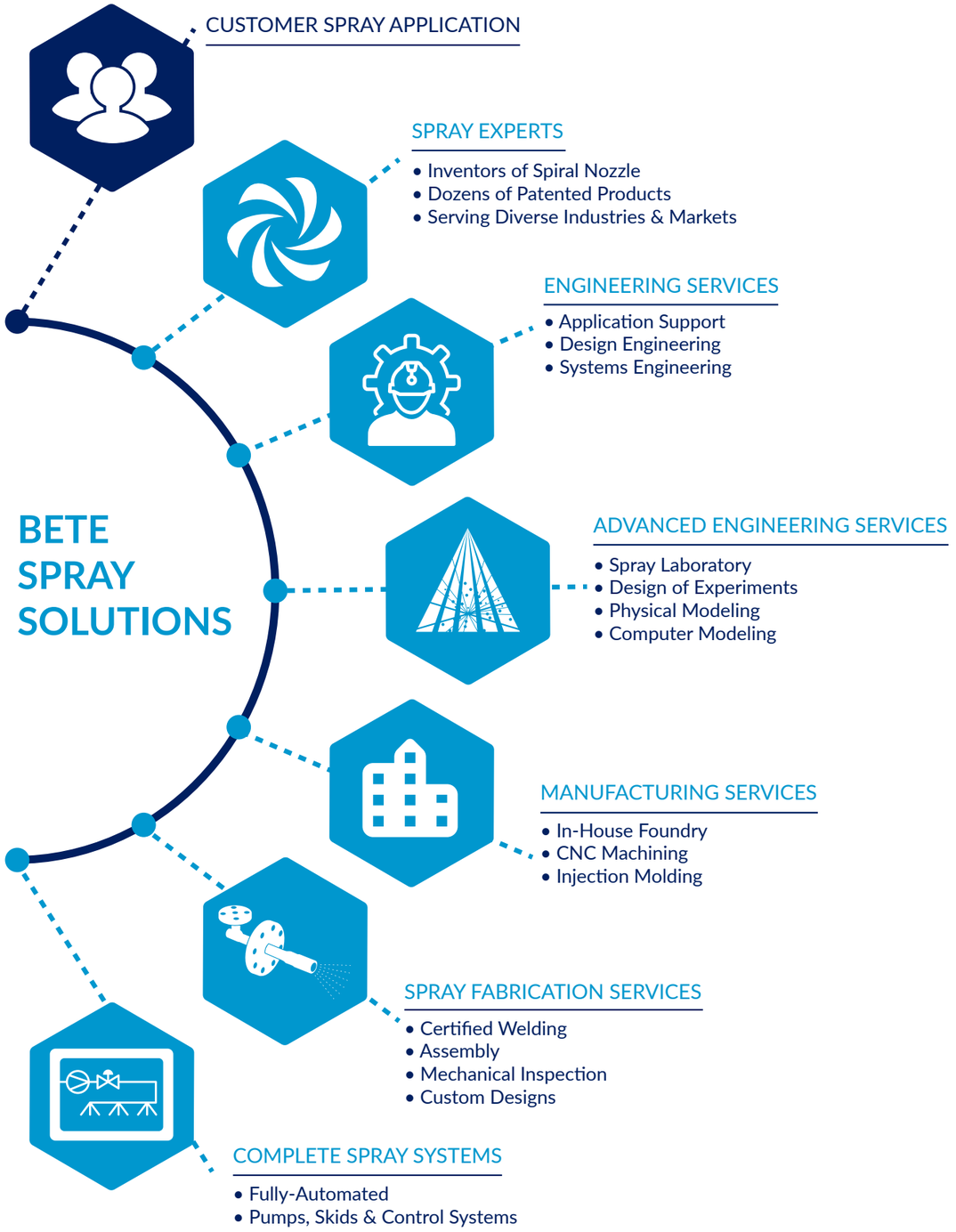
BETE's mission goes beyond just selling spray nozzles. It is to provide engineered spray process solutions that exceed customers' expectations in every detail. From initial discussions to design, fabrication, and ongoing service – we will make your project a success.

BETE® PERFORMANCE SPRAY ENGINEERING

BETE ISO 9001: 2015 QUALITY SYSTEMS

Spray Nozzles | Spray Fabrications | Spray Systems | Applications Engineering | Spray Research

THE BETE ADVANTAGE



COMMON SPRAY NOZZLE SOLUTIONS FOR FIRE PROTECTION

	FAN			FULL CONE							MISTING			
APPLICATION	NF	FF	AFF	TF	TFXP	TFXPW	TF29-180	N	MPL	MaxiPass®	MicroWhirl®	P	PJ	L
Water Deluge		■	■	■	■	■	■	■		■				
Water Wall	■	■	■	■	■	■		■						
Water Mist									■		■	■	■	■
Traffic Tunnel				■	■	■	■	■						
Offshore	■	■	■	■	■	■	■	■						
Halon Replacement									■		■	■	■	■
Foam	■			■			■	■						
Dust Explosion Protection				■					■		■	■	■	■
Toxic Gas Mitigation				■	■	■	■	■						

CERTIFIED FIRE PROTECTION NOZZLES

N SERIES
UL Approved
FM Approved

AFF SERIES
FM Approved

TF24-150
FM Approved

TF8NN, TF8FCN, TF10-170 (Brass Material)
FM Approved

FF187, FF196, FF209, FF218, FF221 (Brass Material)
UL Approved

TF29-180 (Brass Material)
NAVSEA MIL-S-24660 (SH)

N3, N3W, N4, N4W, N5, N5W
US Coast Guard 46CFR

BETE offers high-performance nozzles ideal for open-type deluge, water wall, and water mist types of fire protection systems. Proven to work in the most demanding and mission-critical environments to protect offshore drilling and production platforms, petroleum storage and transfer stations, LNG tanks, industrial complexes, and equipment.

FIRE PROTECTION CERTIFIED

We utilize the latest material technology developments and continuously work with third-party certifiers to ensure the most reliable and effective fire protection nozzles. These rigorous certification systems test, evaluate, and approve our nozzles; including Factory Mutual (FM), Underwriters Laboratories (UL), and the U.S. Coast Guard; to confirm they are manufactured and perform to the highest standards. These agencies are recognized worldwide by loss prevention system designers as essential criteria for selecting nozzles that conform to stringent installation and performance standards. For a complete list of fire protection nozzle approvals, refer to pages 4 - 5.

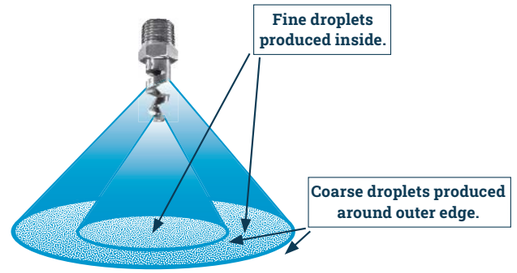
FM APPROVED

UL®

SPIRAL NOZZLES EXCLUSIVELY DESIGNED FOR FIRE PROTECTION

BETE's high-performance nozzles provide optimum droplet size and peak spray performance to efficiently suppress and extinguish many different types of fires. With their fine droplet size and large free passage, the BETE N series spiral nozzles are exceptionally reliable in outdoor fire protection systems.

The full cone spiral nozzle produces multiple concentric cones, which form two to three bands of relatively coarse droplets surrounding broad bands of finer droplets. The tiny droplets are ideal for cooling, while the large droplets are ideal for wind resistance and heat removal.



N
Full Cone Spiral

BETE's N series is the only spiral nozzle design approved by both FM & UL agencies for fire protection. The entire N series is certified for use on ships and offshore installations and complies with the International Convention for the Safety of Life at Sea (SOLAS). The N nozzle has an optional blow-off cover to prevent injury, build-up, and clogging in open orifices and piping while not in use.

SPRAY NOZZLE CONSIDERATIONS

BETE has over 70 years of knowledge and experience in the fire protection industry. Our engineers can review your unique application requirements and recommend the best nozzle selection. Here are some guidelines for considering the ideal nozzle for your spray application.

- Size and shape of the target object or spray area
- Required type of protection: extinguish, containment, or cooling
- Necessary flow rates and spray coverage
- Allowable run-down
- Potential for wind drift
- Nozzle material requirements
- Available nozzle mounting locations
- Available pressure drop (ΔP) across the nozzle

SPRAY APPLICATION SOLUTIONS

BETE is known as an expert in the fire protection industry. Offshore drilling platforms, petroleum storage tanks, LNG tanks, and highway tunnels worldwide use BETE high-performance nozzles to ensure exceptional safety standards. This section explores which nozzles provide the best spray solution for various fire protection systems.

WATER DELUGE

Open-type water spray protection systems are typically designed per NFPA 1 or similar design standards, acceptable for protecting flammable or combustible materials, electrical hazards, and fuels.

Open-type deluge nozzles and systems typically maintain dry supply piping. With the use of heat, smoke, or flame detection equipment, a deluge valve opens and supplies water and pressure to the nozzle for operation.

TYPES OF WATER DELUGE

Cooling

- Water sprays the exterior surface of vessels under pressure or containing volatile materials. The water keeps the contents cool, thereby preventing an increase in pressure. Cooling is commonly used in tank farms or on any vessel where catastrophic failure could occur from overheating.

Evaporation

- Misting nozzles extinguish or control fires by spraying fine droplets onto the flames, which rapidly evaporate, cool, and displace oxygen.

Wetting

- Water sprays to control the spread of a fire without extinguishing it. This type of deluge is a standard method for gas leak situations where the leaking gas needs to be consumed by the flame until operators can turn off the flow. Extinguishing such fires before turning off the source causes a build-up of flammable gas that may lead to an explosion.

CASE STUDY

A customer is designing a water deluge system to protect an 11' x 4' x 8' storage tank for the chemical industry. They require complete coverage from two spray headers parallel to the 40' long side of the tank. BETE engineers provide several spray trajectories and recommend the N series nozzle to supply the necessary spray coverage and droplet size. BETE's N nozzles are UL listed and FM-approved, affirming they perform to these third-party agencies' rigorous standards. The two spray headers with BETE N nozzles provide a reliable fire protection system for the chemical storage tank.

RECOMMENDED NOZZLES:

FF
Extra-Wide Angle
Flat Fan Nozzle

AFF
FM Approved
Flat Fan Nozzle

TF
Spiral
Full Cone Nozzle

TFXP
Largest Free Passage
Full Cone Spiral

TFXPW
Wide-Coverage
Full Cone Spiral

TF29-180
Ultra-Wide
Full Cone Spiral

N
FM & UL Approved
Full Cone Spiral

MaxiPass®
Maximum Free Passage
Full Cone Nozzle

WATER WALL

Water that is sprayed to act as a barrier to shield personnel and equipment against radiant heat, harmful gases, and flames is called a water wall. The more water sprayed to form the suppression wall, the better the fire protection and shielding. High pressure and flow rates project water faster and farther to form a larger buffer between the heat source and the protected areas.

Flat fan and full cone spray patterns are typically used for water wall systems. Flat fan style nozzles can produce an adequate barrier for some applications. However, full cone nozzles, particularly wide coverage spiral nozzles, are usually superior as they form a cone of liquid rather than a very thin plane of liquid.

CASE STUDY

A customer was developing a new water wall protection system on an oil rig to protect equipment and personnel from the extreme heat generated by the natural gas flare. The current system consisted of a few nozzles on the flare boom but was inadequate for the heat generated. BETE Applications Engineers suggested a wide-angle spiral, specifically the N5W, to match the specified flow rate.

BETE modeling software was used to determine spray coverage trajectories from each nozzle when sprayed horizontally outward. These trajectories provided the customer the confidence that the new design would be more than sufficient to protect the rig.

RECOMMENDED NOZZLES:

NF
High Impact Flat Fan Nozzle

FF
Extra-Wide Angle Flat Fan Nozzle

TF
Spiral Full Cone Nozzle

TFXP
Largest Free Passage Full Cone Spiral

TFXPW
Wide-Coverage Full Cone Spiral

AFF
FM Approved Flat Fan Nozzle

N
FM & UL Approved Full Cone Spiral

WATER MIST

Water mist protection systems are typically designed per NFPA 750 or similar design standards, which provide minimum requirements for mist systems that extinguish, contain, or cool applicable fire or hazards by absorbing heat, displacing oxygen, or blocking radiant heat.

BETE water mist nozzles can effectively fill a contained area with the fine water droplets required by water mist systems for effective operation. The heat of fire easily vaporizes the low volume flow and high evaporation rate of water mist sprays. Water misting absorbs heat and displaces oxygen, which suppresses the fire while minimizing damage to water-sensitive equipment or other assets, that would otherwise be destroyed by water damage in high flow deluge systems.

RECOMMENDED NOZZLES:

MicroWhirl®
Atomizing Misting Nozzle

P
Fine Atomization Misting Nozzle

PJ
Impingement Misting Nozzle

L
Low Flow Misting Nozzle

OFFSHORE FIRE SUPPRESSION

Offshore applications include deluge, foam, and water wall systems where the nozzles are subject to extreme weather conditions and exposure to seawater. BETE N series nozzles are Factory Mutual approved, a fire protection requirement for operation out of U.S. ports. These nozzles are often used to replace older CO_2 - based systems on ships with water systems.

CASE STUDY

BETE has supplied "Deck Edge" nozzles for US Navy applications. The ¾" NF300-80X and the ¾" NF300-80 have been used to spray aqueous film-forming foam on the decks of aircraft carriers to extinguish fires, preventing damage.

The ½" TF29-180 was developed for Navy magazine sprinkling on ships. These nozzles meet Military Specification MIL-S-24660 (SH). The 180° full cone spray pattern reduces the vertical clearance required between sprinklers and ordinance from 18" to 4".

RECOMMENDED NOZZLES:

NF
High Impact Flat
Fan Nozzle

FF
Extra-Wide Angle
Flat Fan Nozzle

AFF
FM Approved
Flat Fan Nozzle

TF
Spiral
Full Cone Nozzle

TFXP
Largest Free Passage
Full Cone Spiral

TFXPW
Wide-Coverage
Full Cone Spiral

TF29-180
Ultra-Wide
Full Cone Spiral

N
FM & UL Approved
Full Cone Spiral

MaxiPass®
Maximum Free Passage
Full Cone Nozzle

HALON REPLACEMENT

Halon systems can be very harmful to the environment, and authorities switch over to fine water mist systems. These provide exceptionally fine water droplets over the fire, where they evaporate and displace oxygen, extinguishing the fire. The low volume flow and high evaporation rate minimize water damage to sensitive equipment.

RECOMMENDED NOZZLES:

MicroWhirl®
Atomizing Misting
Nozzle

P
Fine Atomization
Misting Nozzle

PJ
Impingement
Misting Nozzle

L
Low Flow
Misting Nozzle

TOXIC GAS MITIGATION

BETE nozzles are used worldwide in toxic gas mitigation spray systems to remove water-soluble, toxic gases from the air in an accidental leak. Toxic mitigation prevents the spread of hazardous or poisonous vapor clouds into the atmosphere by producing a cloud of small droplets capable of capturing and containing the leak.

Mitigating accidental releases of these gases can often be done with water sprays using nozzles with small average droplet sizes, maximizing the surface area to volume ratio and providing the greatest contact between the water and the toxic, corrosive gas.

CASE STUDY

A major oil refiner contacted BETE to install a Hydrogen Fluoride (HF) mitigation system. HF is considered the most dangerous chemical known to man and is frequently used in the refining process to produce alkylate, which is used to blend gasoline. The BETE 3/8" TF20FCN spiral nozzle performs well for HF mitigation and is recognized by the Industry Cooperative Hydrogen Flouride Mitigation Assessment Program and the U.S Department of Energy.

For this application, engineers determined that a total of 144 TF spiral nozzles be spaced 3'3" (1 m) apart on four headers and the headers spaced equally about the HF line, positioned 24' away. This would provide complete spray coverage and the desired flow rate to effectively mitigate the HF in the event of a leak. The suggested material was 316 stainless steel.

RECOMMENDED NOZZLES:

TF
Spiral
Full Cone Nozzle

TFXP
Largest Free Passage
Full Cone Spiral

TFXPW
Wide-Coverage
Full Cone Spiral

TF29-180
Ultra-Wide
Full Cone Spiral

N
FM & UL Approved
Full Cone Spiral

FOAM

Nozzles are used to spray low-expansion foam, such as aqueous film-forming foam (AFFF), onto ship decks and in smaller enclosed areas to help subdue fires. The foam concentrate is mixed with the correct proportion of water to form a foam solution. The foam solution is then agitated with air to produce foam.

FOAM EXTINGUISHES FLAMMABLE OR COMBUSTIBLE LIQUID FIRES IN FOUR WAYS

1. Excludes air from flammable vapors.
2. Eliminates vapor release from fuel surface.
3. Separates the flames from fuel surface.
4. Cools fuel surface and surrounding metal surfaces.

RECOMMENDED NOZZLES:

FF
Extra-Wide Angle
Flat Fan Nozzle

TF
Spiral
Full Cone Nozzle

TF29-180
Ultra-Wide
Full Cone Spiral

N
FM & UL Approved
Full Cone Spiral

TRAFFIC TUNNEL

A strategically designed fixed fire suppression system in a traffic tunnel protects against the loss of human life and minimizes structural damage in the case of a fire or explosion. **Spiral nozzles can be more effective than traditional sprinkler systems due to higher flame penetration by the multiple cones.** This multiple cone strategy minimizes wind drift and prevents oxygen from reentering the spray area.

CASE STUDY

BETE Applications Engineers supplied spray pattern trajectory data for the fire suppression system in Melbourne, Australia's 1.8-mile-long Burnley Highway Tunnel. The data considered different wind velocities to ensure that the nozzles specified would offer sufficient coverage over several different wind velocities in the tunnel to control a fire.

The system uses a combination of BETE N7W and N8W nozzles constructed in 316 stainless steel. In March of 2007, a serious auto accident occurred in the tunnel resulting in a fire. The sprinkler system was activated automatically and BETE N series nozzles succeeded in controlling the fire.

RECOMMENDED NOZZLES:

TF
Spiral
Full Cone Nozzle

TFXP
Largest Free Passage
Full Cone Spiral

TFXPW
Wide-Coverage
Full Cone Spiral

TF29-180
Ultra-Wide
Full Cone Spiral

N
FM & UL Approved
Full Cone Spiral

DUST EXPLOSION

Water spray systems prevent explosive combustion triggered by dust build-up or static electricity in storage tanks and transfer conveyors for items such as coal and grain. Nozzles that produce a fine mist with no wetting are used to increase humidity and lower static discharge risk. Spiral nozzles add enough moisture to prevent and knockdown dust.

RECOMMENDED NOZZLES:

TF
Spiral
Full Cone Nozzle

MicroWhirl®
Atomizing Misting
Nozzle

P
Fine Atomization
Misting Nozzle

PJ
Impingement
Misting Nozzle

L
Low Flow
Misting Nozzle

CHOOSE THE RIGHT PARTNER FOR YOUR SPRAY REQUIREMENTS

Understanding nozzle performance and how a spray behaves in your fire protection system is critical. Our spray engineering group works with every resource at BETE to help you design your process or solve your spray problem. Every phase from design and manufacturing to testing is performed at our main facility, ensuring close coordination through each stage to confirm all mechanical and performance requirements are met.

MANUFACTURING SERVICES

Our state-of-the-art manufacturing facility utilizies various manufacturing processes to produce standard nozzles and tailored spray 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.

Investment casting offers a precise and economical way to produce complex shapes in alloys that are difficult or expensive to machine.

BETE is the only nozzle manufacturer with an in-house casting foundry, with various alloys on hand that offer excellent corrosion and abrasion resistance properties. Our engineers can help you select materials for maximum effectiveness and operating life in your spray application.

ENGINEERING SERVICES

APPLICATIONS ENGINEERING

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

DESIGN ENGINEERING

BETE's advanced Computer Integrated Manufacturing (CIM) 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 model 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.

ADVANCED SPRAY ENGINEERING SERVICES

We offer Advanced Spray Engineering Services (ASES) to solve more challenging and critical problems, including the ability to do CFD studies and physical testing. At each stage of a contracted project, we work with you to ensure we're solving the right problem within the given constraints.

SPRAY LABORATORY SERVICES, TESTIN AND MODELING

- Droplet Analysis
- Spray Pattern Analysis
- Design of Experiments
- Physical Modeling
- Computer Modeling

Outdoor test of wind drift effect on fire protection nozzles' spray coverage.

SprayNozzle ENGINEERING

Total Spraying Solutions

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