

BETE®

ENGINEERED
SPRAYING SOLUTIONS

NOZZLES FOR FIRE PROTECTION



PERFORMANCE THROUGH ENGINEERING

www.bete.com

BETE Fire Protection Nozzle Experience

Water Deluge

A customer was designing a water deluge system to protect an 11' x 40' x 8' high chemical tank. They needed complete coverage from 2 headers running parallel to the 40' long side.

BETE Applications Engineers provided several spray trajectories and the N series

was recommended because it offered the proper combination of coverage and droplet size, as well as industry approvals, such as Factory Mutual and UL.

BETE N series fire protection nozzles are recognized across the petroleum and chemical processing industries as the

first choice in dry, fixed fire suppression systems. BETE N series nozzles are used routinely in dry fire protection systems protecting offshore drilling rigs, LPG tanks, and LNG tanks, as well as other types of vessels containing flammable liquids.

Marine

BETE N series nozzles are Factory Mutual and Lloyd's Register approved for fire protection, a requirement for operation out of U.S. ports. These nozzles are used on ships with water systems, often replacing older CO₂ based systems.

N series nozzles are also used to protect outdoor escape routes onboard tankers and offshore oil-drilling platforms. Predicted spray patterns and trajectories provide estimated nozzle coverage under various wind conditions. Using this data, our customers are able to determine

the correct nozzle mounting locations.

BETE has supplied "Deck Edge" nozzles for U.S. Navy applications. The 3/4" NF300-80X and the 3/4" NF300-80 have been used in spraying Aqueous Film Forming Foam on the decks of aircraft carriers.

The 1/2" TF29-180 was developed for Navy magazine sprinkling on ships; it meets Military Specification MIL-S-24660 (SH). The 180° full cone pattern reduces the vertical clearance required between sprinklers and ordinance from 18" to 4"!



Requirements for thermal radiation screening for personnel protection on ships have been met most effectively with the TF170 or TF150 series nozzles. The TF nozzles provide better absorption of thermal energy and dissipates the heat and energy from the fire. The multiple concentric cones provide a barrier to air reentering the fire while also minimizing spray wind drift.

Tunnel Fire Protection

BETE Applications Engineers supplied spray pattern trajectory data for the fire suppression system in the 1.8 mile long Burnley Highway Tunnel in Melbourne, Australia. The data included different wind velocities to ensure that the nozzles specified

would offer sufficient coverage over a number of different wind velocities in the tunnel to control a fire. The system uses a combination of BETE N7W and N8W nozzles constructed in type 316 stainless steel.

In March of 2007, a serious auto accident occurred that resulted in a fire in the tunnel. The sprinkler system was activated and BETE N series nozzles succeeded in controlling the fire.

Water Wall

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 amount of heat generated.

BETE Applications Engineers suggested a wide angle spiral would be appropriate, specifi-



cally, the N5W to match the specified flow rate. To confirm spacing, 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.

BETE...high performance nozzles for fire protection systems.

Fire Protection Nozzle Experience:

Since its inception in 1950, BETE Fog Nozzle, Inc. has been recognized as an expert in the fire protection industry. BETE's high-performance nozzles continue to be the premier choice for offshore drilling and production platforms; petroleum storage and transfer stations; LNG tanks; and in a wide variety of industrial and commercial applications.

Product Performance:

BETE's wide range of fire protection nozzles meet industry approvals - *U.S. Coast Guard, Factory Mutual System, Underwriters Laboratories and Lloyd's Register* - and are considered to be the standard for critical spraying applications. We take advantage of the latest developments in materials technology and continue to work with companies to create the most efficient fire protection nozzles.

U.S. Coast Guard
Approved



Engineering Expertise:

Our proven success is a result of our ability to find creative solutions to difficult spraying challenges. BETE Applications Engineers can apply their years of expertise to recommend a nozzle design to deliver the specific spray performance necessary for your fire protection requirements. Our state-of-the-art spray laboratory is designed to provide a wide range of testing capabilities to accommodate emerging industry trends.



BETE[®]

BETE Product Performance

Water Wall – Water is used as a barrier to shield against radiant heat, harmful gases, and flames to provide protection for personnel and equipment.

Nozzles: TF150/170, N, FF, NF

TF150/170 – spiral nozzles with high flow rates, wide coverage in close proximity, multiple concentric cones; more effective than a fan

N – spiral with narrower angles than the TF150/170; regulatory approvals for fire protection applications

FF – provides a wide, single sheet spray with a 145° angle. Less effective cooling and barrier protection than spiral-type (TF, N) nozzles

NF – greater choice of angles than FF (15° up to 120°)

Water Deluge – There are two general categories for water deluge fire protection systems.

1 Direct Extinguish - Large quantities of water are sprayed over the flames to control the blaze and extinguish the fire.

2 Cooling - Water is sprayed onto the exterior surface of vessels that are under pressure and/or contain volatile materials, cooling the vessel and preventing explosion.

Nozzles: N, MaxiPass, TFXP, TF150, TFXPW, FF

N, TFXP, TF150, TFXPW – all spirals provide a spectrum of drop sizes with concentric rings of larger droplet, high momentum spray containing fine droplets between the rings. The high momentum, large drop rings punch through the flame while the smaller drops vaporize quickly, combining maximum flame penetration and heat transfer. This multiple cone strategy minimizes wind drift and prevents oxygen from reentering the spray area

N – spiral nozzle with advantages listed above plus tighter tolerances to meet insurance approvals. Protective blow-off covers available

MaxiPass – used when coverage diameter is more important than atomization and headroom is adequate. The MaxiPass produces larger droplets than an equivalent flow rate spiral causing improved wind resistance. High-pressure operation narrows the spray angle for greater penetration and resistance to crosswinds

TFXP – spiral nozzle with advantages listed above but with maximum free passage

FF – used for surface or equipment protection when relying on rundown for protection is acceptable

Marine – Marine applications include deluge, foam, and water wall systems where the nozzles are subject to extreme weather conditions and exposure to seawater.

Nozzles: TF29-180, SRWM, in addition to water wall and water deluge nozzles

TF29-180 – very wide coverage for limited headspace areas (such as storage rooms on ships)

SRWM – pop-up operation for deck cooling/protection/decontamination; used where a permanently exposed nozzle would be an obstruction

Halon Replacement – Professionals are turning to fine water mist systems in lieu of environment-damaging Halon systems. Exceptionally fine water droplets are sprayed over the fire where they evaporate and displace the oxygen, extinguishing the fire. The low volume flow and high evaporation rate minimize water damage to sensitive equipment.

Nozzles: MicroWhirl, L, PJ, P, MicroWhirl Head

MicroWhirl - high-pressure nozzle producing very low flow, extremely fine, misting protection

P, PJ – higher flows than the MicroWhirl; produces a very fine mist by means of an external impingement pin

L - higher flows than the PJ with fine atomization

MicroWhirl Head – standard, stock manifold for up to seven (7) individual MicroWhirl nozzles

Foam – The nozzles are used to spray low-expansion foam, such as AFFF, onto ship decks and in smaller enclosed areas to help subdue the fire.

Nozzles: TF, N, NF, NFX

TF, N – spiral nozzles are placed so that the spray is perpendicular to the surface to be covered

NF, NFX – flat fan nozzles are oriented to spray parallel and very close to the surface to be protected

Tunnel Fire Protection – A well-designed fixed fire suppression system in a traffic tunnel protects against 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.

Nozzles: N, TFXP, TF150, TFXPW

N, TFXP, TF150, TFXPW – all spirals provide a spectrum of drop sizes with concentric rings of larger droplet, high momentum spray containing fine droplets between the rings. The high momentum, large drop rings punch through the flame while the smaller drops vaporize quickly, combining

maximum flame penetration and heat transfer. This multiple cone strategy minimizes wind drift and prevents oxygen from reentering the spray area

N – spiral nozzle with advantages listed above plus tighter tolerances to meet insurance approvals. Protective blow-off covers available

TFXP – spiral nozzle with advantages listed above but with maximum free passage

Water Mist – Water mist systems use a finely atomized, low flow water spray to extinguish fire. They are ideal for protecting assets that would otherwise be destroyed by water damage in deluge systems.

Nozzles: MicroWhirl, L, PJ, P, MicroWhirl Head

MicroWhirl - high-pressure nozzle producing very low flow, extremely fine, misting protection

P, PJ – higher flows than the MicroWhirl; produces a very fine mist by means of an external impingement pin

L - higher flows than the PJ with fine atomization

MicroWhirl Head – standard, stock manifold for up to (7) individual MicroWhirl nozzles

Toxic Gas Mitigation – Water spray systems are used to remove water soluble, toxic gases from the air in the event of an accidental leak. These systems prevent the spread of hazardous vapor clouds. BETE TF16FCN and TF20FCN nozzles were chosen for mitigation systems of accidental releases of hydrofluoric acid (HF) by the Industry Cooperative Hydrogen Fluoride Mitigation Assessment Program.

Nozzles: TF, TFXP, N

TF/TFXP - finer spray nozzles with standard flow rates; good for scrubbing chemicals

N - spiral nozzle with advantages listed above plus tighter tolerances to meet insurance approvals. Protective blow-off covers available

Dust explosion protection – Water spray systems are used to 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: MicroWhirl, L, PJ, TF, SRWM

MicroWhirl, L, and PJ – fine mist with no wetting. Increases humidity and lowers static discharge risk

TF – adding enough moisture to prevent/knock down dust

SRWM – installs flush to the vessel wall and extends when activated; used in extremely dirty or dangerous areas where an exposed nozzle would be destroyed

BETE Product Specifications

N

Spray Characteristics

- Two spray cones—an outer, wide angle cone and a narrower inner cone—combine to give full cone effect
- Fine atomization

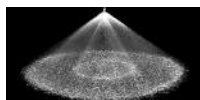
Spray Patterns: Full Cone

Spray angles: 90° and 120° standard

Flow rates: 3.0 to 534 gpm (9.67 to 1720 L/min)



Full Cone 120°



TF29 – 180

Spray Characteristics

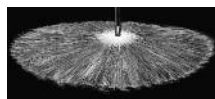
- Wide spray coverage
- Fine atomization

Spray Patterns: Circular sheet with maximum coverage and excellent atomization

Spray Angles: 180° extra-wide angle



Full Cone 180°



MicroWhirl™ /MWH

Spray Characteristics

- Mist at low pressure; fog at high pressure

Spray pattern: Cone-shaped Fog

Flow rates: 0.009 to 0.151 gpm (0.032 to 0.517 L/min) per nozzle



MicroWhirl™



MWH - manifold of 7

Fog



TFXP

Spray Characteristics

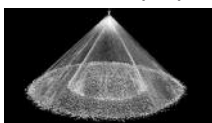
- Wide range of flow rates
- Fine atomization • Clog resistant

Spray Patterns: Full Cone (Hollow Cone available by special order)

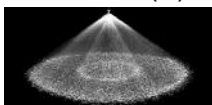
Spray Angles: 90° and 120°

Flow rates: 3.0 to 3320 gpm (9.67 to 10700 L/min)

Full Cone 90° (XPN)



Full Cone 120° (XP)



TF 150/170

Spray Characteristics

- Wide spray angles
- Fine atomization

Spray Patterns: Full Cone and Hollow Cone

Spray Angles: 50° to 180°

Flow rates: 0.5 to 3320 gpm (2.26 to 10700 L/min) (Higher flow rates available)



Full Cone 150/170°



PJ

Spray Characteristics

- Finest mist of any direct pressure nozzle
- Produces high percentage of droplets under 50 microns

Spray pattern: Cone-shaped Fog

Spray angles: 90°. For best 90° pattern, operate nozzle at or above 60 psi (4 bar)

Flow rates: 0.013 to 1.4 gpm (0.043 to 5.34 L/min)



Fog



TFXPW

Spray Characteristics

- Wide coverage
- Fine atomization

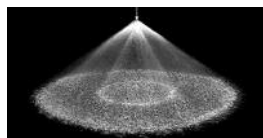
Spray Patterns: Full Cone

Spray Angles: 150°

Flow rates: 33.6 to 534 gpm (181 to 1720 L/min)



Full Cone 150°



L

Spray Characteristics

- High flow misting performance at low pressure

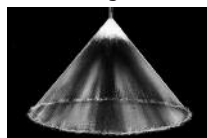
Spray Pattern: Hollow Cone Fog, nearly as fine as P series

Spray Angles: 90° standard (120° by special order)

Flow rates: 0.14 to 3.84 gpm (0.534 to 14.7 L/min)



Fog



P

Spray Characteristics

- Finest mist of any direct pressure nozzle
- Produces high percentage of droplets in the 25-400 micron range; ideal for dust suppression

Spray pattern: Cone-shaped Fog

Spray angles: 90°. For best 90° pattern, operate nozzle at or above 60 psi (4 bar)

Flow rates: 0.034 to 7.68 gpm (0.153 to 30.3 L/min)



Fog



BETE Product Certifications

BETE N series nozzles are the only spiral design nozzles in the industry that are **U.S. Coast Guard** and **Factory Mutual** approved. All N series nozzles are also **Underwriters Laboratories** and **Lloyd's Register** approved. These independent agency approvals are recognized worldwide by loss prevention system designers as important criteria for selecting nozzles that conform to stringent installation and performance standards.

**U.S. Coast Guard
Approved**



The entire N series is certified for use on ships and offshore installations by **Lloyd's Register** and complies with the **International Convention for the Safety of Life at Sea (SOLAS)**. The N3, N4, N5, N3W, N4W, and N5W models are also approved by the **U.S. Coast Guard** for tank vessel pump rooms. The BETE N9 nozzle is designed to meet FM requirements for use in fixed deluge installations protecting industrial transformers. The N6 with dust cover option is also **Factory Mutual** approved. The entire N series has **UL** approval in both stainless steel (ASTM A743) & brass (ASTM B30).

The TF24-150 nozzle is **Factory Mutual** approved. This wide spray angle design provides maximum coverage in low clearance installations. The TF29-180 series was developed by BETE for Naval Sea Systems Command to conform to Military Specification **MIL-S-24660(SH)**, for fire protection within tight quarters of densely packed ship-board magazines.

Other **UL** approved nozzles are the 3/8" FF 145° fan and the NCM1012 K-30° full cone (NCK series) in Brass (ASTM B30). The 3/8" FF 187 is also **Factory Mutual** approved.



MaxiPass™ (MP)

Spray Characteristics

- High reliability spray performance under the most difficult conditions

Spray pattern: Full Cone* (Square patterns to special order)

Spray Angles: 30°, 60°, 90° and 120°

Flow rates: 0.7 to 978 gpm (2.6 to 3540 L/min). Flow rates up to 4500 gpm (17,000 L/min) available.



Full Cone 90° (M)



SRWM

Self-retracting Wall Mount

Spray Characteristics

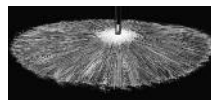
- Relatively large free passage
- Self-draining
- Pops up to spray when activated

Spray Pattern: Flat circular sheet with maximum coverage and excellent atomization

Spray Angle: 180° extra wide coverage



Hollow Cone 180°



FF

Spray Characteristics

- Extra-wide 145° spray angle
- Medium-impact spray
- Spray discharge deflected 75° from inlet axis
- Coarse atomization

Spray Pattern: Flat Fan

Spray Angles: 105° to 145°

Flow rates: 0.014 to 235 gpm (0.510 to 757 L/min)



Fan 145°



NF

Spray Characteristics

- High impact
- Uniform distribution with tapered edges for overlapping sprays

Spray pattern: Fan and Straight Jet

Spray angles: 0° to 120°

Flow rates: 0.103 to 1380 gpm (0.161 to 3430 L/min)



Fan 50°



BETE Engineering Expertise

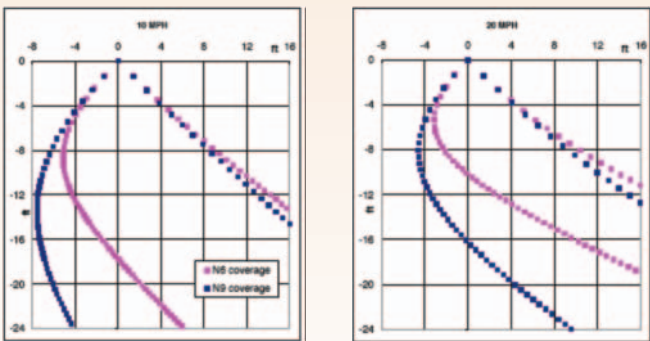
BETE ENGINEERING

At BETE Fog Nozzle, Inc., our success has always been focused on understanding our customers' business and providing effective engineered solutions to their most difficult fluid process challenges. With more than 55 years of experience designing and fabricating spray nozzles, BETE has the engineering expertise customers can count on.

BETE Applications Engineers use their expertise to assist fire protection system designers select the best nozzle for their application. Our experienced Applications Engineers are ready to analyze your conditions of supply flow rate, operating pressure, nozzle orientation, wind drift, spray coverage, and spray density.

BETE has developed proprietary software models to provide estimates of critical nozzle performance data like spray coverage trajectories. This software, based on our years of experience with spray nozzles, allows us to estimate spray coverage for various wind speeds, directions and nozzle orientations.

Spray Coverage Trajectories



Comparison of spray wind resistance for the BETE N6 and N9 Deluge Nozzles.
Operating Pressure 60 psi, spraying downward,
modeled in 10 & 20 mph crosswind
N6 DV0.9 = 990 microns N9 DV0.9 = 1411 microns

BETE SPRAY LABORATORY

The BETE Spray Laboratory is equipped to provide spray test data for a wide range of nozzles over an array of operating conditions. Our state of the art spray laboratory is used to test nozzle performance characteristics like spray pattern, coverage, spray angle and drop size distribution. Customers have also used our spray laboratory and nozzle expertise for special test programs. Whether you're working on a new application or a system modification, BETE spray testing expertise can provide an effective solution.



THE BETE DIFFERENCE

BETE's mission goes beyond just selling spray nozzles: it is to provide engineered spraying solutions that exceed customer expectations in every detail. Extensive in-house capabilities,

including integrated 3D CAD/CAM design, rapid prototyping, investment casting, CNC machining, welded fabrication, and spray testing, make it possible to offer the highest level of quality throughout every phase of production.



The BETE Difference is our unparalleled ability to respond quickly and effectively to any kind of spraying challenge anywhere in the world with the most knowledgeable customer service in the industry.

Ask BETE. We know Fire Protection Nozzles.

Our success in fire protection is built on our ability to carefully engineer our nozzle designs to deliver the specific spray performance required by fire suppression system designers to efficiently suppress and extinguish many different types of fires.

Call BETE and put our years of experience to work to select the best spray nozzle for your fire protection needs.

BETE[®]
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Since 1950, BETE's performance in designing innovative spray nozzles has earned us an enviable reputation as a world leader through its engineering and manufacturing capabilities. BETE makes over 20,000 different nozzles and over 60% of the spray nozzles shipped are customized solutions to solve the needs of our customers' spraying system challenges.

BETE is the only nozzle manufacturer with a complete in-house investment casting foundry, allowing for precise and economical ways to produce complex shapes in alloys that are difficult or too expensive to machine.

In addition, BETE offers many specialized processes such as custom welded fabrication, plasma spray coating, plating, heat treating, grinding, ceramic fabrication and filament winding of FRP.

BETE's advanced CIM (Computer Integrated Manufacturing) environment links CAD workstations, a CAM part programming system and CNC machine tools. This makes it possible to manufacture any one of thousands of products within a short time, while providing reliable delivery forecasts.

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In 2003, BETE Fog Nozzle, Inc. became the first spray nozzle company in the world with a quality management system adhering to the demanding ISO 9001:2000 standard.