



WATER MIST DESIGN GUIDE

DIESEL ENGINES

The *Diesel Engine Application Profile* (AP 005) provides guidance on fire protection requirements of Stationary Diesel Engines. In the event of a fire, the Fike Micromist Water Mist Extinguishing System will provide protection for highly relied upon equipment, and will also provide a safe working environment.

This Design Guide provides a step by step design process of a Fike Micromist Water Mist Extinguishing System. It is intended to be a sample and is not applicable to all Diesel Engine Applications. Fike's Micromist Design, Installation, and Maintenance Manual should be referenced when designing systems.

The sample provided in this design guide will include an engine room enclosure, 24 ft (7.32m) long x 16 ft (4.88m) wide x 16 ft (4.88m) high.

STEP #1 - DETERMINE THE HAZARD VOLUME

The first step required in the design of a Fike Micromist Fire Extinguishing System for Diesel Engine Enclosures is to calculate the volume of the space being protected. The volume of the enclosure must be less than 9,175 ft³ (260 m³).

The volume is determined by multiplying: length x width x height.
Volume = 24 ft x 16 ft x 16 ft = 6,144 ft³ (7.32m x 4.88m x 4.88m = 174.3 m³)

The volume of the enclosure is less than the 9,175 ft³ (260 m³) maximum protected volume allowed for the Fike Micromist Fire Extinguishing System.

STEP #2 - DETERMINE THE NOZZLE GRID

To determine how many nozzles are needed for the length and width of the room, divide the length and width of the room by 8 ft (2.44 m), the maximum spacing allowed between nozzles. Round the result up to the next higher whole number.

ENGLISH UNITS	METRIC UNITS
LENGTH: 24 ft ÷ 8 = 3.0 Number of nozzles required for this length = 3	LENGTH: 7.32 m ÷ 2.44 = 3.0 Number of nozzles required for this length = 3
WIDTH: 16 ft ÷ 8 = 2.0 Number of nozzles required for this width = 2	WIDTH: 4.88 m ÷ 2.44 = 2.0 Number of nozzles required for this length = 2

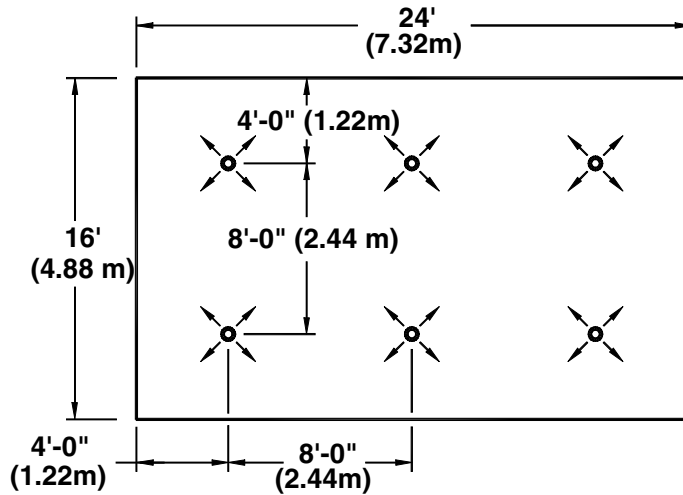
Therefore, the required nozzle grid is 3 x 2 nozzles or 6 nozzles total.

STEP #3 - DETERMINE THE NOZZLE SPACING

To determine the required distance between nozzles for the length / width of the grid, take the room length / width and divide it by the number of nozzles required for the length / width. Nozzle spacing from the wall to the nearest nozzle for the length / width of the room would be ½ of the nozzle spacing.

Example of nozzle spacing calculation: From our example with a nozzle grid of 3 x 2.

ENGLISH UNITS	METRIC UNITS
LENGTH: Nozzle spacing is $24 \text{ ft} \div 3 = 8.0 \text{ ft}$ Spacing from wall to nozzle is $8.0 \div 2 = 4.0 \text{ ft}$	LENGTH: Nozzle spacing is $7.32\text{m} \div 3 = 2.44 \text{ m}$ Spacing from wall to nozzle is $2.44 \div 2 = 1.22 \text{ m}$
WIDTH: Nozzle spacing is $16 \text{ ft} \div 2 = 8.0 \text{ ft}$ Spacing from wall to nozzle is $8.0 \div 2 = 4.0 \text{ ft}$	WIDTH: Nozzle spacing is $4.88 \text{ m} \div 2 = 2.44 \text{ m}$ Spacing from wall to nozzle is $2.44 \div 2 = 1.22 \text{ m}$



STEP #4 - DETERMINE THE SIZE OF MICROMIST SYSTEM

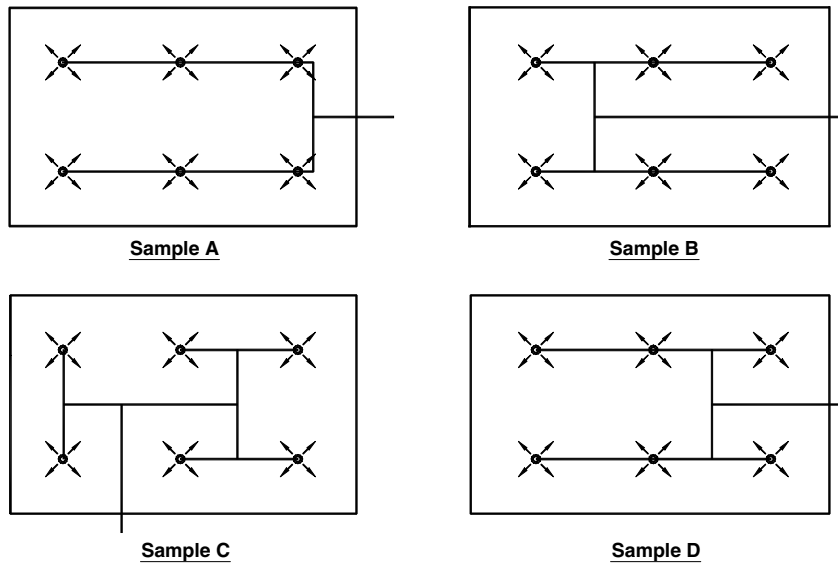
The size and number of Micromist Systems required to protect a Machinery Space is based on the number of nozzles required.

- Nozzle grids containing 6 or less nozzles require a 70 Gallon (265 Liter) Micromist System.
- Nozzle grids containing 7 to 9 nozzles require a 107 Gallon (405 Liter) Micromist System.

Our example has 6 nozzles. Therefore, a 70 Gallon (265 Liter) Micromist System is required.

STEP #5 - DETERMINE THE PIPING LAYOUT

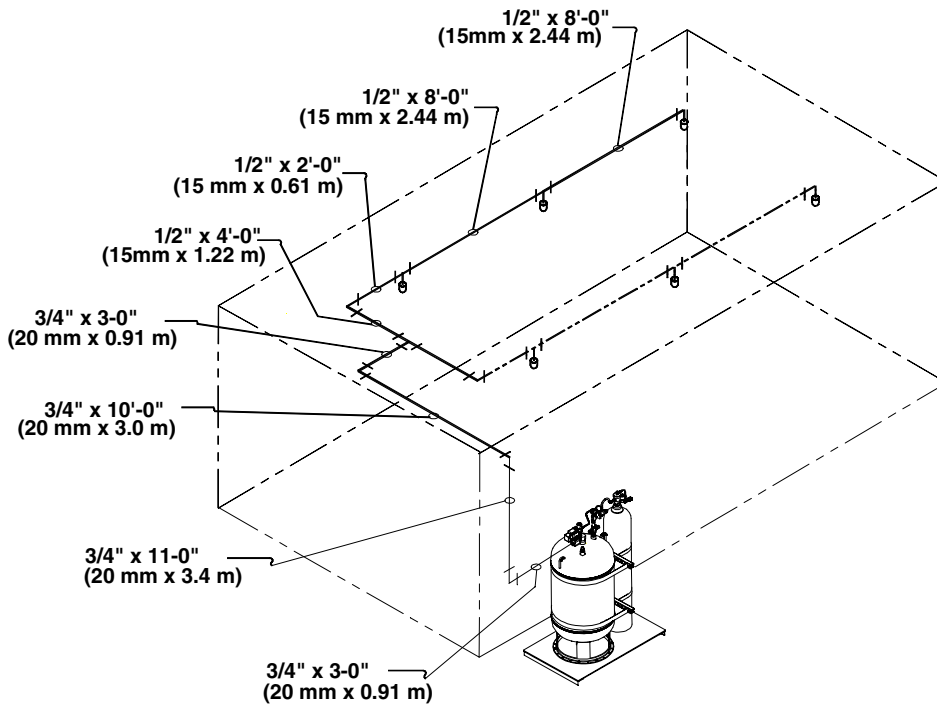
After the number and location of nozzles have been determined, they must be connected with a piping network that provides the nozzles with the proper flow of water at the proper pressure. There are several different “correct” layouts for every enclosure. The following figure shows four possible piping networks for our example.



Possible piping layouts

STEP #6 – DETERMINE THE PIPE SIZE

The pipe size for the entire piping system is first estimated, then calculated to assure proper pressure will be supplied to the nozzles. Choose the pipe type and estimate pipe sizes for each section of piping. For our example, Schedule 40 pipe was selected with the lengths and sizes as shown in the following figure.



Example of Nozzle Piping System

Starting at the nozzle farthest from the Water Storage Tank, determine the equivalent length of each section of pipe. The equivalent length for a section of pipe is determined by adding the straight length of pipe to the equivalent length of all the fittings in the section.

The section of pipe supplying the last nozzle consists of a 8'-0" (2.44 m) length of ½" (15 mm) pipe as well as a ½" (15 mm) thru tee and a ½" (15 mm) 90° elbow. Therefore, the equivalent length for this first pipe section is:

ENGLISH UNITS		METRIC UNITS	
Single Nozzle Flow		Single Nozzle Flow	
8'-0" of ½" pipe	= 8.0 ft	2.44 m of 15 mm pipe	= 2.44 m
1pc. ½" 90° elbow	= 1.7 ft	1pc. 15 mm 90° elbow	= 0.52 m
1pc. ½" thru tee	= <u>1.0 ft</u>	1pc. 15 mm thru tee	= <u>0.30 m</u>
Total	= 10.7 ft	Total	= 3.26 m



NOTE: The thru tee is counted in this section because the water flowing thru this tee supplies a single nozzle.

Proceed to the next section of pipe. This section is supplying two (2) nozzles. This section has a 8'-0" (2.44 m) length of ½" (15 mm) pipe and a ½" (15 mm) thru tee. Therefore, our equivalent lengths are:

ENGLISH UNITS		METRIC UNITS	
Two (2) Nozzle Flow		Two (2) Nozzle Flow	
8'-0" of ½" pipe	= 8.0 ft	2.44 m of 15 mm pipe	= 2.44 m
1pc. ½" thru tee	= <u>1.0 ft</u>	1pc. 15 mm thru tee	= <u>0.30 m</u>
Total	= 9.0 ft	Total	= 2.74 m

The next pipe section has three (3) nozzle flow. The pipe is a 6'-0" (1.82 m) length of ½" (15 mm) pipe. Fittings consist of a ½" (15 mm), 90° elbow and a ½" (15 mm) side tee. The equivalent lengths are:

ENGLISH UNITS		METRIC UNITS	
Three (3) Nozzle Flow		Three (3) Nozzle Flow	
6'-0" of ½" pipe	= 6.0 ft	1.82 m of 15 mm pipe	= 1.83 m
1pc. 1/2" 90° elbow	= 1.7 ft	1pc. 15 mm 90° elbow	= 0.52 m
1pc. ¾" side tee	= <u>4.5 ft</u>	1pc. 20 mm side tee	= <u>1.37 m</u>
Total	= 12.2 ft	Total	= 3.72 m

The last section of pipe is for six (6) nozzle flow:

ENGLISH UNITS		METRIC UNITS	
Six (6) Nozzle Flow		Six (6) Nozzle Flow	
27'-0" of ¾" pipe	= 27.0 ft	8.23 m of 20 mm pipe	= 8.23 m
3pc. ¾" 90° elbows	= <u>6.6 ft</u>	3pc. 20 mm 90° elbows	= <u>2.01 m</u>
Total	= 33.6 ft	Total	= 10.24 m

Now, calculate the total pressure drop for the piping system. The equivalent lengths calculated above are each multiplied by their appropriate pressure drop factor, found in paragraph 2.2.2.2 of the Design Section.

This calculation is shown below.

<u>ENGLISH UNITS</u>		<u>METRIC UNITS</u>	
Total Pressure Drop		Total Pressure Drop	
½" @ 1 nozzle flow – 10.7' x 0.02 =	0.21	15mm @ 1 nozzle flow – 3.26m x 0.066 =	0.21
½" @ 2 nozzle flow – 9.0' x 0.08 =	0.72	15mm @ 2 nozzle flow – 2.74m x 0.262 =	0.72
½" @ 3 nozzle flow – 12.2' x 0.18 =	2.20	15mm @ 3 nozzle flow – 3.72m x 0.591 =	2.20
¾" @ 6 nozzle flow – 33.6' x 0.16 =	<u>5.38</u>	20mm @ 6 nozzle flow – 10.24m x 0.525 =	<u>5.38</u>
Total Pressure Drop, psi =	8.51	Total Pressure Drop, psi =	8.51

The final consideration is the pressure drop/rise due to elevation changes. Pressure is changed 0.43 psi per foot (1.41 psi per meter) of drop/rise. The net elevation change in our example is an 11.0 foot (3.4 m) rise. This results in a pressure rise of 11.0 ft x 0.43 = 4.73 psi (3.4 m x 1.41 = 4.8 psi). This value is added to the Total Pressure Drop determined above to find a total system pressure drop. The Total Pressure Drop, from the Water Storage tank to the farthest nozzle is 8.51 psi, from above, plus the 4.73 psi, from the rise, equals 13.24 psi (91.29 kPa).

Therefore, our example system meets the requirement of a total pressure drop less than 20 psi (138 kPa).



NOTE: - Stainless Steel Tubing

The same method is used to determine the total pressure drop for stainless steel tubing as was used for pipe. The only difference is the equivalent lengths and pressure drop factors. The tables in Design, Installation, and Maintenance Manual, Section 2, Paragraph 2.2.3.2, list the equivalent lengths for tubing, bends, fittings and the pressure drop factors for various sizes of tubing.

STEP #7 DEVELOP A FIKE MICROMIST PARTS LIST

Fike Micromist <i>Sample</i> Parts List – Diesel Engine Application		
Quantity	Description	Part Number
1	70 (265liter) Gallon System w/LPS	73-001
6	Machinery Space Nozzles	73-0024
1	Cheetah Control System, 110VAC	10-052-R-1
1	Battery Assembly, 7AH	10-2190-1
2	225° Thermal Detectors	60-018
1	Manual Release Station	10-1638
2	Horn/Strobe Device, 15/75 Candela	20-098
5	Fast Response Contact Module (FRCM)	55-019
1	Supervised Output Module (SOM)	55-021
1	Solenoid Releasing Module (SOM)	55-022
1	Dual Relay Module (R2M)	55-023

