APPLICATION PROFILE

MICROMIST® WATER MIST FOR COMPARTMENTALIZED GAS TURBINES

TYPICAL INDUSTRIES SERVED

- Standby Power
- Buildings/Institutions
- Distributed Power
- Cogeneration
- Utility Peaking
- Industrial Processing

INTRODUCTION

Compartmentalized gas turbines are used for power generation and gas pipeline transmission. Compartmentalized turbines are more common than larger gas turbines used in high capacity electric co-generation plants. Compartmentalized gas turbines are generally built, packaged, sent to the job site, and placed in service with little on-site construction.

The purpose of this application profile is to provide an understanding of the possible hazards associated with compartmentalized gas turbines and protection solutions utilizing the Fike Micromist Water Mist Extinguishing System. This document is intended to be a guideline and is not applicable to all situations. Fike's Micromist Design, Installation, and Maintenance Manual and NFPA 750 shall be referred to when designing Micromist systems. If you have any questions, please contact the Fike Technical Services group, or our regional sales manager in your area.

THE PROBLEM: FLAMMABLE LIQUID FIRES

The fire hazard associated with the gas turbine compartments is failure of the fuel and lubrication systems. If the fuel or lubrication systems for the turbine leak during operation, the flammable liquid may come in contact with a surface that has a temperature well above the auto-ignition temperature of the fuel and cause a fire. In most cases, the fire threat is identified as the ignition of Class "B" fuels in the following configurations:

- Pools of fuel leakage on equipment surfaces and/or the floor of the enclosure
- Fuel sprays due to a rupture of pressurized pipes
- Potential Class "A" involvement caused by ignition of fuel soaked materials

A majority of gas turbine generators have been protected against fire with either carbon dioxide systems or Halon 1301. In a study on gas turbine fires conducted by R.E. Dundas, a 49% failure rate for total flooding Halon 1301 or carbon dioxide systems was reported. Thirty-seven percent of these failures were attributed to the gaseous agent leaking from the protected enclosure through open doors or ventilation.

THE SOLUTION: TOTAL COMPARTMENT PROTECTION

Total compartment protection is implemented when protecting gas turbine generators even though gas turbine enclosures typically have open and/or forced ventilation for keeping the areas cool during operation. In gas turbine generator applications, heat is generated by the operation of the turbine and ventilation is necessary to keep the equipment relatively cool. Although the Fike Micromist system is very flexible when dealing with ventilation, it is good fire protection practice to shut down all ventilation and close all openings prior to system operation. The use of damper in ventilation ducts is not required when using a Micromist system. The fuel supply shall also be shut down before system operation. This will shut down the turbine and eliminate the spread of fuel in case of a fuel system leak.

The Micromist nozzle arrangement for the gas turbine enclosure is designed to make system maintenance on the turbine more accessible as well as eliminate any concern of warping or cracking of the turbine casing. When the turbine is in operation, temperatures of the outer surface of the combustion chamber and turbine expander approach 900°F (482°C).

When the water mist is discharged, it cools these outer surfaces by heat transfer, turning the water droplets into steam. The nozzle pattern of the Fike Micromist system utilizes end wall nozzles to supply the water mist to the enclosure. The Factory Mutual test protocol includes a test where the Micromist nozzles are discharged onto a simulated turbine casing and heat transfer measurements are taken to verify the casing is not adversely affected during discharge.

Water mist is a desirable agent for use in protection of gas turbine generator enclosure hazards because of:

- Minimal clean up associated with a system discharge
- The removal of the life safety concern
- No environmental impact
- Availability of agent for recharge

The Fike Micromist Water Mist Extinguishing System has been tested by Factory Mutual for protection of gas turbine generator enclosures up to 9,175 ft^3 (260 m^3). A Factory Mutual approved Micromist system protecting a gas turbine generator is shown in the illustration on page 2.

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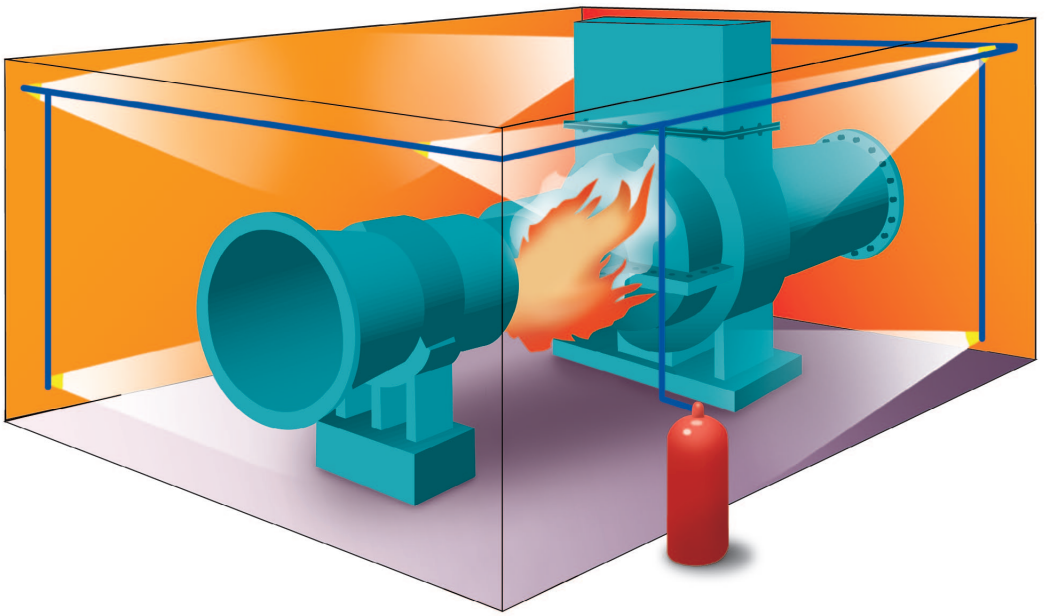

"Gas Turbine Generator" Protected by a Fike Micromist Extinguishing System

When a fire is detected in the protected hazard, the first actions are to shut down the process, close off the flow of flammable liquid, shut down ventilation and close all doors. An alarm is also sounded to warn personnel of the impending discharge. At this point, solenoid valves are operated at the nitrogen cylinder(s) and the water cylinder to start the flow of water to the nozzles. The nitrogen cylinder(s) proves the force to drive the water through the piping network to the system nozzles. The Micromist system utilizes relatively short durations of water discharges called cycling to aid in the extinguishment of fires. The cycling time for protection of gas turbine generator enclosures provides enough water for 20 minutes of protection. Refer to the Micromist Design, Installation, and Maintenance Manual for more details on cycling.

DETECTION AND CONTROLS

For detection inside gas turbine generators where there is a great deal of heat generated from the turbine and a large amount of ventilation is induced to help keep the turbine cool, heat detectors at a setting of 325°F (162.7°C) are recommended. Additional heat detectors may be needed near the floor where fire hazards are present, and ventilation would not allow for sufficient heat build up at the ceiling mounted heat detectors. The Fike Cheetah®/Cheetah® Xi control panel shall be used to interface with the fixed temperature heat detectors and operate the Micromist system.

References
1.Biggens, J.B., (1997). Fire Protection Handbook, 18th Edition, NFPA. Quincy, MA: R.R. Donnelly & Sons.
2.Dundas, R.E., (1990). ASME Paper NO. 90-GT-375, Gas Turbine and Aeroengine Congress and Exposition. Brussels, Belguim

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