

## DURAQUENCH™ WATER MIST FIRE SUPPRESSION FOR GAS TURBINES

### Introduction

Gas combustion turbines are mission critical assets used by utilities, industrial facilities, pipelines and independent power producers, none of whom can afford the disruption and cost of unplanned generator downtime. DuraQuench provides an environmentally sound, low-cost, FM-approved means of mitigating the risk of fire in a turbine enclosure.

This application profile provides an understanding of the possible hazards associated with gas turbines and application of Fike's DuraQuench water mist system in mitigating those hazards. This document is intended to be a guideline and is not applicable to all situations. Fike's DuraQuench Design, Installation and Maintenance Manual and NFPA 750 shall be referred to when designing DuraQuench systems. If you have any questions, please contact Fike Technical Services or your Fike Regional Sales Manager.

### The Problem: Flammable Liquid Fires

The primary fire hazard associated with the gas turbine compartments is failure of the fuel or lubrication systems. If either of these systems leaks during turbine operation, the flammable liquid may come into 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 leak on equipment surfaces and/or the floor of the enclosure
- Fuel sprays due to a rupture of pressurized fuel line
- Potential Class "A" involvement caused by ignition of fuel soaked materials

Historically, gas turbine generators were protected against fire with either CO<sub>2</sub> 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.

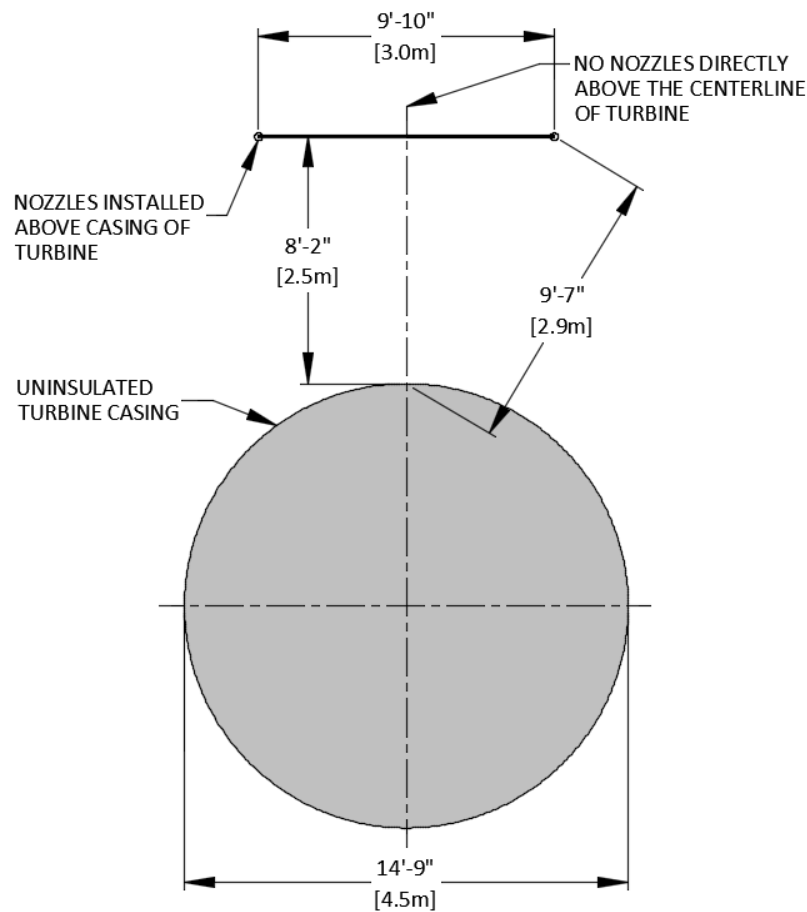
### The Solution: Total Compartment Protection

Total compartment protection is implemented when protecting gas turbine generators even though gas turbine enclosures typically have open and/or forced ventilation for keeping equipment cool during operation. In gas turbine generator applications, heat is generated by the operation of the turbine and ventilation is necessary to keep the



*DuraQuench is pumped water mist system, providing the potential for unlimited discharge times and quick, easy recommissioning.*

equipment relatively cool. It is good fire protection practice to shut down all ventilation and close all openings prior to system operation. Fuel supplies should 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 DuraQuench nozzle arrangement for the gas turbine enclosure is designed to eliminate any concern of warping or cracking of the turbine casing. When the turbine is in operation, temperatures on 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 DuraQuench Deluge System Manual (p/n 06-791) provides specific instruction on how to orient nozzles so as not to directly impinge on the turbine casing. This entails making sure that there are no nozzles directly above the centerline of the turbine casing and that minimum clearances are maintained between the nozzles and the turbine casing (Figure 1).



**Figure 1 – Nozzle Spacing for Exposed Turbine Casing**

When a fire is detected in the turbine enclosure, the DuraQuench releasing panel initiates a signal to close doors and dampers, shutoff the ventilation system and shut down the flow of flammable

liquids. An alarm is also sounded to warn personnel of the impending discharge. The releasing panel signals the system's control valve to open, allowing water to flow through the valve and into the pipe and nozzle network. At the same time, the releasing panel sends a signal to the DuraQuench pump controller, causing it to initiate startup of the DuraQuench fire pump. The discharge continues until the DuraQuench pump is manually stopped at the fire pump controller.

Refer to the DuraQuench Deluge System Manual (p/n 06-791) for more details on system operation.

### **Detection and Control**

Gas turbine generators generate a great deal of heat which is controlled through use of large ventilation systems. For this reason, fire detection is usually accomplished through the use of heat detectors set at 325°F (162.7°C). Additional heat detectors may be needed near the floor where fire hazards are present, and where ventilation would not allow for sufficient heat buildup around ceiling-mounted heat detectors. DuraQuench is designed for use with the Fike Cheetah® Xi, Cybercat, or other compatible releasing panels.

### **The DuraQuench Advantage**

The DuraQuench water mist system is ideal for the protection of gas turbine enclosures because:

- Water is among the most environmentally friendly suppressing agents
- System recommissioning is quick and easy
- DuraQuench's centrifugal pump and lower system pressures mean greatly reduced costs and more flexibility vs. competing high pressure water mist systems.