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Case Study: Implementation of Water-Mist System in 132/11kV Substation Transformer Room

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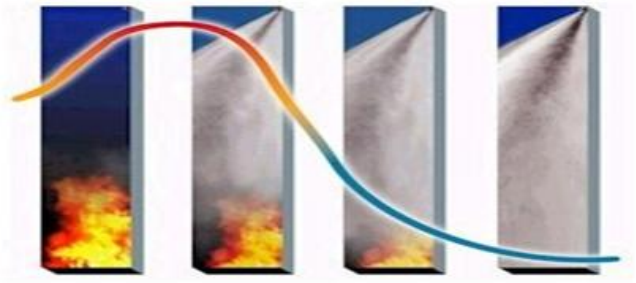
Abstract: ***This paper is to provide general overview of modern application of Water-mist fire protection concept for Power Transformers. Also briefed how a Water-mist firefighting system works in comparison with a prevailing Sprinkler/Deluge system.***

Keywords: Power transformer, Water-mist system, Fire-fighting system

1. Introduction

Water-mist technology is not new, which is known since 1930 and its practical application is relatively new.

Water-mist system is a fire protection system using very fine water spray with 99% of droplets less than 1mm to suppress or extinguish fire.



- Low Design Density
- Uses approximately 30% less water
- Small water droplets- Effective heat absorption.
- Smothering effect
- Smaller bore pipe/tubes

Minimal contamination
Water-mist system has advantages over other water based firefighting systems, where water- mist system absorbs heat, reduces oxygen, blocks radiant heat transfer and cools combustion gases.

Though the Water-mist system has been tested for some of the applications but for others specific fire test protocol has to be developed and full scale fire has to be conducted to prove the performance and effectiveness of the system for the protection of specified hazard.

Different certification and code writing bodies has developed codes, approval standards and test protocols for Water-mist system based on various hazard application.

Different makes of Water-mist system have varying system pressure between about less than 12 bar and 35 bar or more.

Water-mist System for Outdoor Transformers of 132/11kV Substations
The substation transformers are oil filled and about 50 MVA capacity with approximately dimensions of 8.4 meters x 5.7 m with 5.4 m height. The transformer enclosure is of three side RCC walls, open at front with mesh and truss top.

Currently, no generic design method is recognized for outdoor transformer water mist protection systems.

The water mist system performance had to be full scale fire tested following the requirements of NFPA 750 and CEN TS 14972 standards.

The challenge for using Water-mist system was that there was no available test protocol or approval standards for outdoor Transformer application. Though, there were evidence that the Water-mist system is in practice for outdoor Transformer fire protection.

To step in various Water-mist system manufacturers are invited for discussion and received feedback and design options.

Since there was no design method available for outdoor Transformer protection, it was obvious the requirement was to prepare a test protocol and tested at internationally recognized fire testing laboratories.

- The test protocols should be based on a fire protection engineering and with evaluation of the fire hazard, the compartment conditions, and the performance objectives for the system.
- The test protocols should be developed, carried out, and interpreted by internationally recognized fire testing laboratories.

The individual Water-mist system manufacturers obliged to prepare a test protocol and conduct the fire test at internationally recognized fire testing laboratories.

On the basis of fire test, the design criteria for water mist system for Transformer is developed. This include Pump capacity, distance between nozzles and size of section valve etc. As a pilot project the water-mist system has been implemented in some of the DEWA Substations.