Protection of outdoor transformer

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Key questions

Why is fire protection so important?

Where is the hazardous area?
Transformer fire can be disastrous for people, economy and environment. A transformer contains up to 50 tons oil. Burn or leakage of such an amount of oil is a serious environmental hazard.

Normally fire appears because of a short-circuit in the transformer winding system. The consequence is that it will significantly increase the heat, create gas and internal pressure in the oil system.

This high pressure can damage the pipe connection, gasket or seals in the radiators and cause oil leakage.
Transformer without fire protection

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Requirements and Standards

- There is no standard test procedure for fire protection of transformers and the requirements for fire protection of transformers are unclear and may vary between countries.

- **NFPA 15** is a standard for:
  Water Spray Fixed Systems for Fire Protection

- According to paragraph 1-3-2 :

  Water spray protection is acceptable for the protection of hazards involving each of the following groups:

  -(2) Electrical hazards such as transformers, oil switches, motors, cable trays, and cable runs
According to NFPA 15:

**7.4.4.1** Transformer protection shall provide complete water spray impingement on all exposed exterior surfaces.

**7.4.4.2** Where there is insufficient space to install water spray nozzles underneath transformers such that the water spray cannot directly impinge upon the bottom surfaces, it shall be permitted to protect the surfaces underneath the transformer by horizontal projection or by nozzles directed to cool the area below the transformer projections.
Prevention of fire in Taiwan Province of China

• WM was released at a temperature of 45°C for cooling the oil therefore preventing any risk for high pressure in the oil piping.

• We installed micro nozzles in a row. They are released automatically, without shut down of the main power.
Typical oil cooled transformer

Power plant Poland
Background for the test

- EXPO 2010
- 30 m. underground power station with several transformers
Transformer in the test facility in Shanghai

- The ceiling and one side of the facility are open
Structure of piping installation
Nozzle arrangement
Pump unit with 3 high pressure PAH 63 Danfoss and Position of oil pit
Design Data

- Open Nozzle 7-01-56-5-12-00, flow rate 11.9 L/Min.
- Micro nozzle 1934, flow rate 2.38 L/Min. with 0.5 m, spacing and 0.5 m height.
- Local Application nozzles were used in the top and micro nozzles were installed in an adapter and welded to a pipe to protect the oil pool in the bottom of the transformer.
Fire Test in open air

- 6 MW spray fire at top
- 4X2 MW fire under transformer
Fire Test in open air

continued

• After 10 seconds
Result:

• Water consumption 258 l/min. fire extinguished after 33 seconds.
Oil transformer test

Click above to start video
Thank you
Question?