fomtec
Fire Fighting Foams & Equipment

Fomtec Technical Advices
FTA No. 70

Application Rates and Application Times

General

Application rate and times for foam discharge is essential in order to get control over a fire. Different application rates are needed for different types of fire. Parameters such as type of fuel, surface area on fire, depth of fuel and application type are examples of factors influencing application rate.

Some international design standard, such as NFPA 11, are recommending application rates depending on situation. The initial standard application rate given by NFPA 11 is 4,1 litre per minute and m^2 for hydrocarbon (water insoluble) fuels 6,5 litre per minute and m^2 for polar (water soluble) fuels. From these values the application rate is adjusted depending on the situation.

If the application rate is too low the foam layer will never be able to cover the surface inflames and not be able to get control and extinction of the fire. This is valid for all kind of foam types and regardless of their firefighting rating. Most standards for assessing firefighting foams the fire test is made at a lower application rate than recommended by e.g. NFPA 11.

Determining Application Rates for Different Fuel Types

To exactly know the application rate needed the foam should be tested on each and every flammable liquid. Obviously, this is not possible to achieve due to the amount of fuels and the cost for doing fire testing. Instead, foam manufacturers give recommendations on application rates based on the fire performance obtained in different fire tests with different application rates and combined with the properties of the fuel. Example of fuel properties are: flash point, chemical structure, water solubility, heat generated by the fire, vapour pressure etc. With these data it is possible to make a good estimate of the application rate needed.

Spill Fire

A spill fire is relatively small area and with a depth of just a few centimetres. Typical spill fires is leakage from vehicles fuel tanks or from tank trucks. This can be considered as the "standard" fire where the standard application rates and times are used. In such cases the application time is decided to 15 minutes and the application rate is depending on the type of fuel. For a fire in hydrocarbon fuels the application rate is 4,1 $l/m^2 \cdot min$ and for a polar fuel 6,5 $l/m^2 \cdot min$.

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Tank Fire

A tank fire involves normally a lot more fuel and fuel in depth compared to spill fires. The heat build-up in such fires can be huge and the extinction operation is more difficult. For a fire in hydrocarbon fuels the application rate is 4,1 l/m²·min and for a polar fuel 6,5 l/m²·min. For polar fuels the recommended application rate is 6,5 l/m²·min.The recommendation for application time depends on the flash point of the fuel and the breakpoint is 38°C. Above 38°C the application time is 30 minutes and below the application time is recommended to be 55 minutes.

Other Extraordinary Installations

Other installations that are assessed to be more hazardous according to NFPA 11 and thereby requires special application requirements are given below with recommended application rates and times.

- **Firefighting in diked area with monitors**
  Application Rate: 6,5 l/m²·min
  Application Time: 30 minutes

- **Foam application on top of a rim seal in a tank**
  Application Rate: 12,2 l/m²·min
  Application Time: 20 minutes

- **Application below of rim seal in a tank**
  Application Rate: 12,2 l/m²·min
  Application Time: 20 minutes

Sub-surface Foam Application

In this application method the foam is introduced below the surface of the fuel and is eventually transported to the surface. Depending on the fuel depth, the foam is exposed for huge amount of fuel and may pick up of lot in the foam structure. The foam may also be destroyed by the fuel exposure, this is especially significant for foam injected in tanks with polar fuels. The technique for applying foam beneath the fuel surface in a storage tanks was developed for about 40 years ago and designed for foam liquids that have good fuel repellence, e.g. protein based film forming foam (FFFP:s) and AFFF:s containing PFOS. These foam types were quite stable and did not accumulate a lot of fuel in the foam.

However, the modern AFFF:s and FFFP:s does not contain any PFOS or other long-chain fluoro-surfactants that have a strong fuel rejection. Instead they are built up from short-chain (C6) fluoro-surfactants that are not tested fully in such applications and thereby may be useless. Another foam type that has become more common today is the fluorine free foam liquids with high fire performance. These types are loaded with surfactants in order to obtain the fire performance but that also means that they are extremely prone to pick up fuel in the foam structure. They are also known to be less stable when subjected to fuel.

With this knowledge we highly recommend to do in-depth risk analysis concerning sub-surface applications. A more reasonable application method could be semi sub-surface techniques where the foam is transported via a hose from the bottom of the tank to the surface without being exposed to fuel.

Recommendation

Make risk assessments to ensure the right type of foam is selected and that the system is designed to give the correct application rate and application times. Contact suppliers to get as much information as possible to ensure correct design.

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