

Fire Precautions and Fire Fighting

Fire Precautions

Preventative fire precautions are particularly important in dealing with metal alkyls and their preparations. Plants in which metal alkyls are used should therefore be designed and controlled in such a way as to help prevent further spillage of alkyls or spreading of fire in the case of an accident (automatic partitioning or closing of valves from a safe position).

Metal alkyl stores and blending stations should be built at a safe distance from the production plant.

The width of protective strips of ground, which are specified according to the German "Verordnung brennbare Flüssigkeiten" for combustible liquids with the lowest flash point, are the minimum requirements for safety distances.

It should be kept in mind that burning metal alkyl can develop the same amount as or even more heat than petrol, particularly radiant heat. However, cooling of storage tanks in the immediate vicinity with water is often not possible, as with petrol fires. Fire resistant partition walls are therefore necessary to isolate the heat of combustion.

Supports of upright and horizontal tanks must resist fire for at least 30 minutes (fire resistance class F30) in order to prevent static collapse through falling over of the tanks, and thus breaking away of piping.

Tanks should be protected against rain by a lightweight roof with strip lighting elements (e.g. plastic made from acrylic resin or similar material).

The foundations of storage tanks should be made of concrete, with a gradual slope to the combustion ditch or burning pit; this should be situated sufficiently far away to allow spilled metal alkyl to burn off safely.

Alternatively, double walled tanks can be used as storage tanks. These are more expensive, but safer. However, they do not give greater protection, if the flames come from below, since the heat can then cause tension in the space between the double walls. Therefore in this case too, special construction of the

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foundation is necessary (solid ground, e.g. composite paving with a slope). The space between the double walls should be filled with nitrogen and fitted with a probe for detecting leakage of metal alkyl and giving an immediate alarm. Pipe fittings should be constructed of fire resistant material (fire safe design). Important valves should be automatically turned to a safe position if a fire breaks out, so that any further escape of metal alkyl is prevented. Pneumatically controlled valves are particularly suitable for this purpose if they go “safe” when the air control is shut off. To achieve this the air control lines should be made of plastic, which melts in a fire thus cutting off the air control.

Storage tanks must be fitted with safety devices to prevent overfilling. Furthermore, operating instructions should also include measures to be taken in case of an accident or for warding off danger. Further details and preventative fire precautions are described in the document “Transferring and Storage.”

Fire Fighting

Extinguishing powders of fire class ABC or BC are suitable for firefighting metal alkyl fires. These may be special powder types for glowing fires or normal types, e.g. based on ammonium phosphate/ ammonium sulfate or sodium bicarbonate, potassium bicarbonate and potassium sulfate.

The aim in fighting a metal alkyl fire is to prevent access of air to the burning surface, in order to reduce the rate of reaction and the radiant heat, and to allow controlled burning and reaction of the leaking product. Approximately 3 to 6 kg of extinguishing powder are required per kilogram of metal alkyl, in order to ensure controlled burning. When using extinguishers with fine nozzles (for small fires), care should be taken that movement of air over the burning surface is kept to a minimum. If possible the powder should be applied to the burning surface using a wide nozzle. For fighting larger fires high performance extinguishers which are effective at longer range must be available (rate of delivery 5 -50 kg/sec).

Small surface fires can be extinguished by covering with fire blankets made of metal coated boro-silicate material. Vermiculite, Kieselgur or dry sand are also suitable for smothering a fire. Vermiculite, an expanded, porous mica, forms a floating layer owing to its low density and also absorbs a large amount of liquid product owing to its high specific surface area. This effectively reduces the reaction dynamics. Care is still required however since the metal alkyl, although covered, is still reactive.

If small quantities of metal alkyl escape from leaking flange connections or pump shaft seals, dilution of the alkyl with a machine oil of low combustibility can help.

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Carbon dioxide is suitable for small fires, and has the advantage that the surroundings are not soiled.

Halogenated hydrocarbons should not be used for metal alkyl fires since they give off dangerous reaction products with these products.

Water reacts extremely violently with metal alkyls, and should not therefore be used for direct extinguishing of concentrates.

Under no circumstances should hot metallic surfaces be sprayed. Furthermore, spray water should never be used, if metal alkyl is already spilled on the ground.

In special cases spray water can be used as a protective shield, in order to cool neighboring equipment (e.g. other storage tanks).

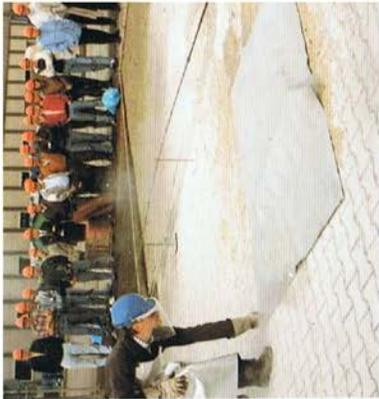
With a spillage involving metal alkyl solutions or higher metal alkyls which do not spontaneously ignite, there is a danger, not always immediately apparent, that potentially explosive mixtures can be formed, which, if the ignition conditions are suitable, can cause explosive flames or explosive reactions. In such cases, owing to the danger of explosion, the endangered area should be evacuated immediately (safe distance). The potential danger of an explosion is greater in enclosed areas, therefore adequate ventilation must be provided here.

It should be noted that in cases of leakage of metal alkyl solutions, the rate of evaporation of the solvent is increased through the heat of the reaction. In this case the pyrophoric limit may be reached.

In order to minimize the danger of explosion, the spilled product should be covered with dry extinguishing powder or dry sand.

If a non-pyrophoric metal alkyl solution should catch fire, through external ignition, both dry extinguishing powder and carbon dioxide can be used. In such cases, contrary to normal practice, water and foam, preferably as a fire spray, can also be used, thus avoiding greater damage by decomposing the metal alkyl more quickly, and at the same time cooling the source of the fire and surrounding area.

Fire Fighting



Fires can be immediately extinguished using fire blankets



Vermiculite type 3-6mm in a plastic bag covers most of the surface after the bag has melted.



The effect can be improved by spreading with a shovel.

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Small fires can also be extinguished with CO₂ extinguishers



Stationary powder extinguishing system with temperature sensor



Compared with conventional powder extinguishers, this powder extinguisher with applicator reduces air turbulences over the source of the fire and in this way improves the extinguishing effect.