QBE European Operations

# Heated Plastic Tanks

Technical guide

Surface finishing and coating processes are common in a wide range of industries including aerospace, automotive, electroplating, metal finishing and electronics. The corrosive nature of some of the liquid coating solutions means that plastic or plastic lined tanks are common and it is not unusual for the contents to be heated.

There is a very obvious hazard if the solutions are flammable or combustible but there are also many, well documented, losses resulting from fires due to ignition of the tank or liner and subsequently the extract systems above them. These losses are often exacerbated by the corrosive nature of smoke from the plastic fire which damages equipment and causes contamination well beyond the fire area. Often these operations are specialist in nature and are a critical part of the production process. This means that it is not easy to find alternative capacity and the impact of loss on delivering product is significant until the activity is reinstated.

According to trade group BSTSA (British Surface Treatment Suppliers Association), there were 22 serious fires recorded over a seven year period in surface treatment facilities, with most of these being attributed to heating of plastic / plastic lined tanks.

## What causes fires in heated plastic tanks?

Many fires involve tanks that have electric immersion heating systems and these generally occur when their elements directly heat the plastic materials that form, or line, the tank. These conditions can arise due to reasons of poor system design, installation, maintenance, and often when the liquid level in the tank drops below normal, resulting in the heating element becoming exposed to air and subsequently reaching excessive temperatures.

If a heating element is fitted too close to the tank wall or is not properly secured (so it can come into close contact with the tank wall), then the risk of ignition is greatly enhanced.

As liquids used in the processes can be corrosive, key system components (including safeguards) can be prone to failure. Failure of control systems could result in excessive temperatures being reached and/or other upset conditions going unnoticed (eg low liquid level) and will greatly increase the risk of fire.

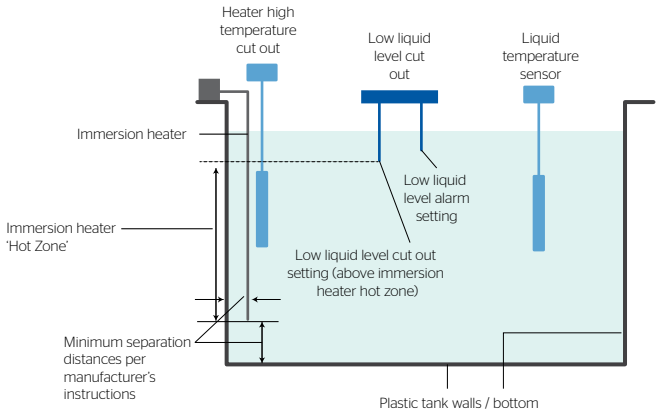
Low liquid levels can occur as a result of tank leakage or of prolonged over-temperature conditions causing liquid evaporation.

## What can be done to mitigate the risk?

On existing systems (especially important for electric immersion heaters), the following basic safeguards should be provided / observed:

- The heating elements should be permanently fixed in position to maintain minimum clearance distances to the tank walls and base (as defined by the manufacturer's recommendations). Portable or temporary heating systems should not be used.
- Interlocks **that are separate from normal process controls** should be provided that give an alarm signal and shut down the heating systems in the event of:
  - A low liquid level condition (set to activate if any part of the hot zone of the heating element is exposed).
  - A high temperature condition. Two independent control systems should be provided. Firstly, one that monitors the *liquid* temperature and is set to activate if it reaches 15 deg C higher than the normal operating temperature. Secondly, one that monitors the temperature of the *heating element*.

### Schematic showing arrangement of plastisc tank immersion heating and system safeguards



A common cause of loss is failure of the normal thermostatic control and the heater being continually powered. Normally the liquid high temperature sensor would operate and shut the heater down. Should this fail and the liquid 'boil off' then the low liquid level cut out would shut the heater down before any of the tank within the heating zone is exposed to air. It is not unusual for the normally thermostatic control to be improperly located such that the liquid level drops and it becomes exposed to the cool air. A similar scenario occurs with the heater being constantly powered.

- A robust programme of maintenance and testing of process controls and safeguards should be observed. This should include checks of heater fixing arrangements and the interlocks mentioned above – the frequency of these checks should be per the manufacturer's recommendations or quarterly, whichever is the more frequent. Operators / maintenance personnel should receive specific training in conducting these checks.
- Heating systems should be isolated when the process is idle or unoccupied.
- Timing devices that start up the heating system automatically should not be used.
- Fixed automatic fire protection systems within the general area of the tanks and inside plastic ducts. The most suitable and reliable means of protection should be sought, taking into account local operating conditions such as the corrosiveness of the environment and the potential need to avoid contamination of the tank contents. Most likely options include sprinkler protection or a gaseous / clean agent suppression system. Any such systems should be designed in accordance with relevant and recognised codes (LPC, FM Global, NFPA etc).
- Avoid routing exhaust ductwork through adjacent areas.
- A fire emergency plan for an incident in the area housing the operations referred to in this document should be developed in conjunction with the Fire Brigade.

For new installations, the following points should be observed:

- Where feasible, use an indirect heating system incorporating the use of non-combustible heat transfer fluids. Where the use of an electric immersion heater is considered the only feasible option, a low watt density unit should be used (in conjunction with the other safeguards mentioned previously).
- Tanks and exhaust hoods / ductwork systems that are non-combustible (eg stainless steel) or that use plastics which have improved fire performance characteristics (eg FM Global Approved products).
- Construction features in the areas housing these processes should be entirely non-combustible, with 1 hour fire rated separation to adjacent areas.

## Other Resources

**FPA RC45 – Fire Safety in the Electroplating Industry**

**FM Global Data Sheet 7-6 Heated Plastic and Plastic Lined Tanks**

**HSE Ref SIM 03/2006/10 – Fires in Metal Finishing Premises From Electric Process Heaters**

## Disclaimer



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