NORTHWESTERN UNIVERSITY
RESEARCH

Safety Issues of Hotplate Heating Controls

Background

Spontaneous and unexpected heating of hotplates has been the cause of laboratory fires and explosions.

In 2005, Lawrence Berkeley National Laboratory issued a safety advisory related to a Corning model PC 420 hot plate.

In 2007, 2011, 2012, 2014 the University of California, University of Pennsylvania, MIT, and Oak Ridge National Lab issued similar safety advisories for Corning PC-35, PC-200, PC-220, PC-351, Fisher Isoptemp and the Thermolyne Model:SP46925.

Incidents at NU

Over a ten year period, there were 1-3 hotplate related incidents per year. Incidents involved fires:

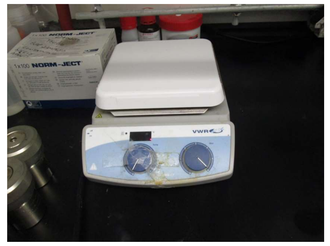
and explosions:

Without extensive forensics some causes and contributing factors could not be determined.

The reported injury experiences have been limited to injuries sustained from an attempt to extinguish a hotplate related fire.

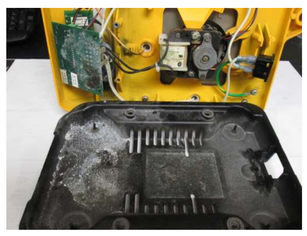
Issues found at NU

Hotplates manufactured from 1960's-1980's may still be in active use. Hotplates in disrepair may be in use.



Older hotplates with relay heater switches can spontaneously heat in the heater dial OFF position

Liquids in contact with electronics may cause shorts. Newer hotplates with TRIAC or microprocessor-controlled heater switches may spontaneously heat in the OFF position due to liquid exposure to the electronics



Potential for liquid access through front cover and/or slots in housing.

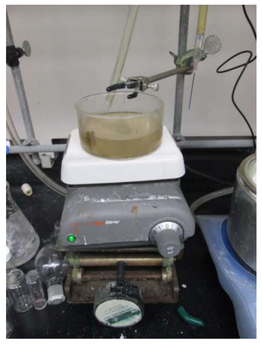
Hotplate/stirrer combinations may be used when only stirring is required.

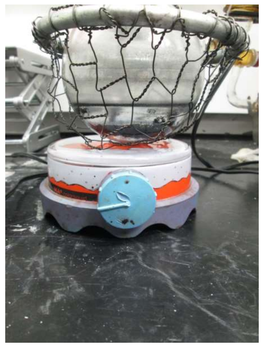
Hotplate/stirrer combinations generally stay plugged in even when inactive.

Collected Recommendations

Discard old hotplates and hotplates in disrepair. Hot plates purchased prior to 1984 do not have temperature feedback controls. These models include the Corning PC-35 and PC-351 and the Thermolyne Model:SP46925.

Where only stirring is required, acquire and use a stirrer instead of a hotplate/stirrer combination.

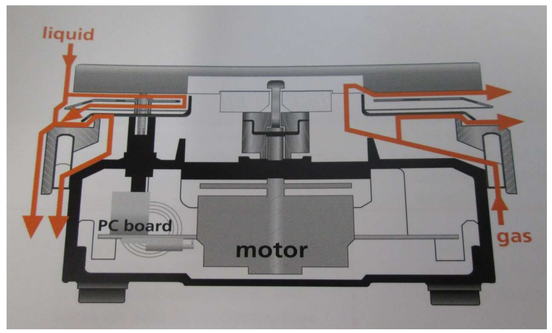




Unplug inactive hotplates or heating mantles in close proximity to oil baths, combustible or flammables material.

In the replacement and acquisition select hotplate housing designs, which are less affected by spills and aggressive environments. Where liquid spills can be anticipated (i.e. water cooled reflux) do not use hotplates that have open housing designs.

Select hermetically sealed hotplate housing to protect the electronics from liquids and gases



Additional hotplate safety features to look for are two independent temperature control circuits, which switch off heating in case of an over temperature situation.

Alternatively, a hotplate can be powered up through a separate high temperature control unit. This approach physically separates the primary and high temperature sensor and related control /switch functions.

Communicate to all lab personnel the critical importance of house keeping i.e. elimination of all combustible materials from the immediate vicinity (above, below, and on all sides) of the heat source. Consider the possibility the hotplate could spontaneously engage and heat up even when the switch is in the OFF position.

Distribute "stir" and "heat" labels for older hotplates to reduce the possibility of user error.

Sources

1. Deflagration and Fire from Malfunctioning Lab Stirrer/Hot plate , Oak Ridge National Laboratory, June, 2014
2. Hotplate Advisory! , MIT, 2010
3. Safety Alert - Lab Fire Caused by Hot Plate, Univ. Penn, 2011
4. Hot Plate and Heating Device Safety Advisory, Univ or California, 2011
5. Hotplate Study, UC Santa Cruz, April 2007
6. Hot Plate Switch Failure, Lawrence Berkeley National Laboratory Lessons Learned, 2005
7. DOW Chemical and Teledyne (Author communications)

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