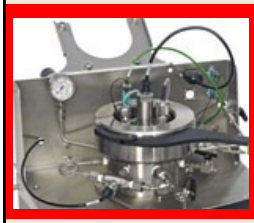

Safety and Calorimetry News

News and updates from HEL Group

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June 2013 Volume 1 issue 2

Can Adiabatic Calorimetry Prevent Boeing Dreamliner Type Accidents

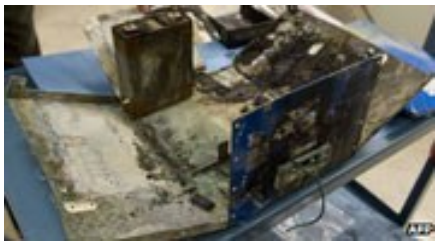
FACT FILE

BTC Fast Facts:

- ◊ Test batteries up to 50cm or larger size of any type/shape.
- ◊ Perform thermal runaway test or integrate cyclers for discharge/overcharge limit determination.
- ◊ Built inside a steel pressure chamber with cylindrical walls 2.5cm thick.
- ◊ Includes mechanical relief valves and software actuated inert purge/quench, in the event of a problem.

The fire involving a Li-ion battery in January 2013 which resulted in the grounding of the entire fleet operated by Japan Airlines, could have been foreseen and prevented with testing methods that have been around for over 30 years.

The lack of appropriate testing is all the more surprising when you consider that most modern high energy batteries, not only Li-ion, contain highly reactive and potentially explosive chemicals.



Photograph of Boeing Dreamliner Battery Enclosure after Fire

The use of HEL's Battery Testing Calorimeter (BTC) which is a specially constructed "adiabatic calorimeter", can be used to define safe battery working limits: safe temperature, maximum discharge current and maximum safe voltage. Yet many of these parameters are often missing on battery data sheets and the even when they are quoted, there is little supporting evidence.

The United States' FAA has listed 132 previous aircraft incidents between 1991 and 2012 that involved "smoke, fire, extreme heat or explosion" in which battery powered devices were implicated and 62 of these incidents involved Li-ion batteries. The result of the Boeing incident was mostly confined to the battery enclosure and though expensive for the companies involved, it did not lead to any injuries.

For further information, please contact us at marketing@helgroup.com

Adiabatic Calorimeters – how and why?

Adiabatic calorimetry was developed in the late 1970s by Dow Chemical Company for testing the fire and explosion potential of chemicals. The importance of it lies in the fact that it represents a reasonable but worst case situation. It's a way of determining "what if something goes wrong" – in a controlled laboratory experiment. When a test is done to examine limits of battery overcharging, without such a device, the hazard is understated and might even imply the absence of any risk. HEL uniquely produces three forms of adiabatic calorimeters:

HEL's Phi-TEC II

- Phi-TEC I, the basic adiabatic calorimeter which is essentially an updated form of the "ARC" device, which is used for testing liquid and powder samples, typically from 0.5 to 5g in size. It is still widely used in many industries.
- Phi-TEC II, a totally different design to phi-Tec I and adds an important dimension to classic "ARC "capability. The difference relates to the fact that this instrument enables low phi factor testing, a feature which in the laboratory, mimics runaway reactions in large scale chemical reactors.
- BTC, which takes the "ARC" adiabatic concept to a larger scale and through innovative features developed by HEL, enables different sizes and shapes of batteries to be reliably tested in the same device.

HEL's Phi-TEC I

These calorimeters allow the heat generated by the malfunction of a battery to be retained within the battery so that its temperature rises in proportion to the heat liberated and thus enables the consequences of malfunction to be realistically measured.

UK Head Office Address
HEL Ltd
9-10 Capital Business Park
Manor Way
Borehamwood, Herts
WD6 1GW, United Kingdom

Email: marketing@helgroup.com
URL: http://www.hazards.co
Tel: +44 (0)20 8736 0640
Fax: +44 (0)20 8736 0641

Subscribe to our newsletter
@ www.hazards.co

Other contacts

US Office
HEL Inc
Lawrenceville, New Jersey,
Tel: +1 609 912 1551
Fax: +1 609 912 1552
E-Mail: info@hel-inc.com

China Office

Beijing
HEL Ltd. Beijing Office
Haidian District, Beijing
Tel : +86-10-82101033
Fax: +86-10-82168022
E-Mail: harry.yang@helgroup.com

HEL Ltd. Shanghai Office
Jin Hong Industrial Park, Shanghai
Tel: +86(0)21 5417 3068
Fax +86(0)21 5417 3065
E-mail: SHO@helchina.com

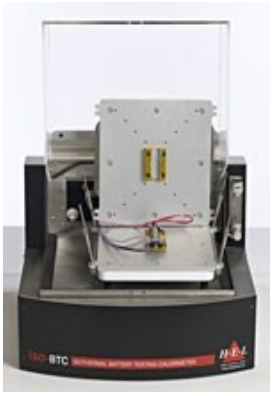
India Office
HEL India
Ghodbunder Road, Thane
Tel: +91-22-22927171
Fax: +91-22-25975116
Email: info@helindia.com

Isothermal Calorimeters—how and why?

Battery assembled for iso-BTC experiment

While knowing the worst-case consequences of battery and chemical explosions is extremely useful, it does not directly help to prevent such disasters. That is where ISOTHERMAL calorimetry comes in.

An explosion can occur for example if a battery is discharged too fast. The same discharging event in an isothermal calorimeter would be safely handled. Importantly though, this calorimeter will report how hard it was working, in order to prevent the explosion. It would in fact calculate and display the amount of heat which it removed, in order to keep the battery safe. This information would be used to design a thermal management system, which is an important part of all modern re-chargeable batteries.



ISO-BTC with a battery ready for testing

Coming Events: Visit http://www.hazards.co/events

Presented at APACT 2013

HEL presented at APACT 2013 in Chester in April 2013. Developments in reaction calorimetry undertaken by HEL was presented, which allow PAT implications. This follows from HEL's implementation of power compensation more widely, including it's use in small and parallel reactors as well as the development of real-time, on-line generation and display of data similar to the way that a PAT probe would provide.

Visit us at the following events this year

- 24-28 June, Advanced Automative Batteries Conference, Strasbourg, France
- 17-19 June, The Battery Show, Beijing, China
- 28 August , PlugVolt Webinar , 'Determination of Heat Generation Rate and Thermal Runaway Risk of Li-ion (and similar) Batteries using different Calorimetry Methods'.

Please visit our hazards website for further details or for further information, please contact us at marketing@helgroup.com