



Phi-TEC I

Adiabatic Reaction Calorimeter

From the process safety experts

The **PHI-TEC** is a computer controlled adiabatic calorimeter that can be used to determine the heat evolved and pressure developed during an uncontrolled exothermic runaway reaction. It enables the user to understand what may happen during a worst case scenario arising from mal-operation.

Specifically, the following information can be obtained:

- Exotherm 'onset' temperature with sensitivity of 0.02 °C/minute as standard (0.005 C/minute with extended calibration)
- Heat release (or temperature rise)
- Pressure increase
- Global reaction kinetics
- Time to maximum rate (TMR)
- SADT (used in storage / transportation studies)



The entry level Phi-TEC I uses high pressure cells, or bombs, of between 7-11ml volume to determine the heat evolved and pressure developed during the reaction. Sample sizes from 0.5 to 5g are typical.

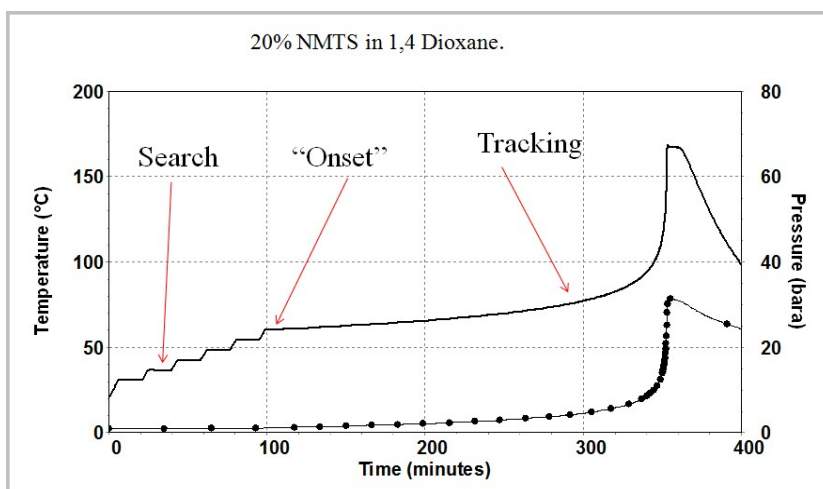
Two standard tests are normally performed:

Heat-Wait-Search

This is the classic test for detailed sample evaluation initially developed by Dow Chemicals for the original 'ARC'. The sample is heated in small steps and at the end of each, the software 'searches' for an exotherm within the sensitivity of the instrument.

Rapid Screening

For preliminary screening of chemicals it is possible to ramp the sample temperature until an exotherm is induced. This simulates a large scale DSC but with the added advantage of being able to measure the pressure and stir the sample.





Safety and Calorimetry

Adiabatic Reaction Calorimeter

Ideal for sample safety testing

Phi-TEC I is simple to use and safe enough to sit in a normal chemistry laboratory – combined with its low operating cost, it is an ideal workhorse for sample safety testing.

Sample Agitation

Magnetic stirring, controlled by the software, is a standard feature of Phi-TEC.

This is useful in many situations but absolutely essential when non-homogenous or immiscible samples are tested. To enable simple and inexpensive use of this feature, special non-standard test cells are supplied.



Test Cells

Uses common glass, stainless steel & Hastelloy test cells, typically 7-11 ml volume.

Custom test cell designs available.



Compact Design

Phi-TEC I is compact enough to fit in the corner of a small fume hood – it even fits a glove box. This is down to attention to detail combined with experience in both hazard assessment and instrument design, based on HEL's many years of equipment development for the chemical and pharmaceutical industry.



Direct Temperature Sensing

Traditional designs of the 'ARC' system attach the thermocouple to a clip on the outside wall of the test cell. The Phi-TEC I design allows direct temperature sensing, giving a more representative measurement and greater sensitivity.

Footprint 30cm x 37cm x 50cm



Auto-calibration

The Phi-TEC I self-calibrates each time a test is performed, making operation easier and giving the best results. In contrast, classic "ARC" calorimeters need a day or more for regular calibration each time and this must be repeated for different sizes and shapes of test cells and "false exotherms" can be a common problem.

Operating Safety

The design has been tested with nitro toluene and found to be perfectly sound and hence can be used in a standard fume hood.

Background to Adiabatic Testing

Accelerating Rate Calorimeter' ('ARC') was the first commercial adiabatic device, developed by Dow Chemicals. Dow's device has been out of production for many years now, but the name 'ARC' has been coined in the industry. The principles of the original 'ARC' have been duplicated and technically exceeded by HEL for over 15 years.

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