

## Process Safety regulations, thermal stability testing methods and standards

### 1. Process Safety regulation

Local and continental regulations define the scope of Process Safety and reactive substances management in the chemical or pharmaceutical industries. For instance, **OSHA 29CFR 1910.119** in the USA requires industrial sites to provide information pertaining to the hazards of the highly hazardous chemicals used or produced by a process. The information includes toxicity, physical, reactivity or **thermal stability data** of the chemicals.

In Europe, the **2012/18/EU "Seveso III" Directive** obliges the operators of establishments where dangerous substances are present in significant quantities to provide the competent authorities with risks analysis, and possible **major-accident scenarios**. It includes the classification of any substance involved or likely to be present on the site into categories such as "explosives" or "self-reactive substances". Any new substance used or produced on the plant thus requires **thermal stability testing** to check whether it has to be listed in a dangerous substance category.

China's State Administration of Work Safety passed in 2010 the **Process Safety Management regulation AQ/T 3034-2010** that requires the assessment of hazard information of chemicals, which include reaction characteristics, such as **decomposition reaction and polymerization reaction, thermal stability**, and potential reactions after mixing.

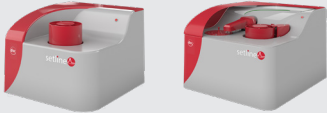





### 2. Thermal Stability testing

So globally, the **Process Safety testing laboratory** is fundamental to any facility using or producing chemicals. Whether synthesizing small or large amounts of material, each process step and compound needs assessing for thermal stability. Although the testing methods and tools are up to the discretion of the operator, experience and good practice in the industry have led to a multi-step process: quick screening, thermal stability testing with pressure and evolved gas, process understanding, and adiabatic tests, all being supported by software modelling. **Differential Scanning Calorimetry (DSC), rapid screening calorimetry, adiabatic calorimetry, and Calvet calorimetry** are key methods used at each step of the testing process. A number of national or international standards support these testing methods, like the ones mentioned in the table below.

KEP Technologies with its SETARAM brand offer a choice of solutions for each step of the process, with thermal analyzers and calorimeters that provide experimental control, instrument versatility and quality results.

**The instruments are listed in the table in the second page.**

**Further information and more detailed examples of applications are available in our Process Safety applications brochure.**

TESTING STEP	MAIN TESTING METHODS	MAIN TYPES OF MEASUREMENT	RELATED TESTING STANDARDS	RELATED OR COMPLIANT INSTRUMENTS	INSTRUMENT PHOTO
<b>Quick screening</b>	Differential Scanning Calorimetry (DSC)	Decomposition temperature, heat and kinetics of reaction and decomposition	ASTM E537 The Thermal Stability of Chemicals by DSC ASTME2160 Heat of Reaction of Thermally Reactive Materials by DSC	SETLINE DSC, SETLINE DSC+	
	Calvet Calorimetry	Decomposition temperature, more accurate heat of reaction and decomposition, larger scale samples		CALVET, CALVET HT	
<b>Thermal stability testing with pressure and evolved gas</b>	Rapid Screening Calorimetry	Decomposition temperature and pressure, larger scale samples		RSC-400 AS	
	Calvet Calorimetry	more accurate heat of reaction and decomposition, larger scale samples, more accurate heat capacity measurements		CALVET, CALVET CRYO, CALVET HT	
<b>Process understanding</b>	Calvet Calorimetry	more accurate heat of reaction and decomposition, larger scale samples, more accurate heat capacity measurements		CALVET, CALVET CRYO	
<b>Adiabatic tests</b>	Adiabatic Calorimetry	Decomposition temperature and pressure, larger scale samples, adiabatic (process-like) conditions	ASTM E1981 Standard Guide for Assessing Thermal Stability of Materials by Methods of Accelerating Rate Calorimetry	TAC-500 AS	

Switzerland – France – China – United States – India – Hong Kong - [www.setaramsolutions.com](http://www.setaramsolutions.com) - [setaram@kep-technologies.com](mailto:setaram@kep-technologies.com)

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