



ExoCAL ProEX Bomb Calorimeter for Explosives

ExoCAL ProEX is a professional bomb calorimeter for precise determination of energy liberated by combustion or decomposition of solid and liquid samples. The design of ExoCAL units is optimised for testing of ignitable energetic materials. Provided accessories fulfil demanding requirements of high-performance QA and precise R&D applications.

Application

The heat of combustion and heat of explosion are essential parameters of any ignitable and combustible material. Their determination is a sensitive, precise, reliable and reproducible method for routine quality inspection or state-of-the-art research. The heat of combustion of pure compounds is exactly given and any deviation signs on present impurities. Results of mixtures is a summation of combustion heats of individuals partially lowered with respect to their concentration.

The heat of explosion investigation of energetic materials is limited on samples which can be ignited by heating wire and burns without a presence of oxygen. Vacuum environment or additional support of pressurized inert gas is a standard for this kind of measurements. The calorimetric performance of propellants and pyrotechnics is influenced by many factors and deviations in production quality often cannot be determined by another method.



Principle

Oxygen combustion produces energy in the form of heat as well as burning or deflagration of energetic materials in inert gas or vacuum. This heat is absorbed by the calorimetric system and registered as temperature difference before sample ignition and after complete heat distribution in all parts of the system. The system is calibrated by burning of standard material for calorimetric measurements and referenced to standard bomb conditions. As a reliable reproducible and available calorimetric standard was accepted high purity benzoic acid which is used pressed into pellets. High purity oxygen is recommended and the results are compensated on heat lost by chemical reaction followed burning (formation of nitric or sulphuric acid).

Testing of energetic materials requires vacuum or strictly inert atmosphere. A presence of oxygen strongly influences results. Some types of bombs for QA application accepts testing in air and oxygen influence is carefully implemented

Specifications

Range of measured energy	1 - 60 kJ
Temperature resolution	0.00001 °C
Result resolution	0.1 J
Repeatability / Reproducibility	up to 0.05 % RSD
Operation temperature	15 - 30 °C
Ignition current range	0.1 - 4 A
Test cycle time	8 - 10 min
Water content	5 liters
Sample weight (recommended)	500 - 5000 mg

Compliance

DIN 51900, ISO 1928, ASTM D240, ASTM D4809, ASTM D5865, ASTM D1989, ASTM D5468, ASTM E711

Energetic Materials
Stability & Compatibility
Heating Blocks





ExoCAL ProEX

Bomb Calorimeter for Explosives

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Description

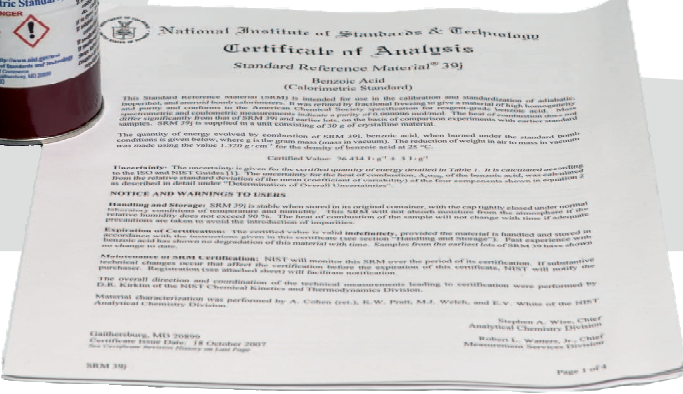
ExoCAL ProEX is a compact and standalone instrument with rigid construction and optimised design. Excellent precision in combination with applicability in harsh environments is achieved by means of an isoperibolic jacket with smart temperature controlling and environmental separating shell. It comprises of

- inbuilt controlling unit for automated operation
- colour LCD interface for easy operation
- precise temperature measuring and data acquisition unit
- programmable ignition power supply (variable current and time)
- measurement of real ignition energy
- double section water tank for improved performance
- powerful piezoelectric water cooling/heating heat exchangers
- shield for protection of sensitive part against laboratory environment
- precise water dosing system with excellent reproducibility
- automatic gas filling for 2 gases with pressure determination
- automatic evacuation with vacuum level determination

The most important technology of ExoCAL ProEX is a set of evaluation algorithms which are referenced to complex factory settings. This allows for simple onsite calibration and verification. The instrument is fully automated and operated via LCD user interface. It includes LAN, USB and RS232 interface for connection of other equipment (printer or balance). Internal memory provides almost unlimited storage capacity. The system is easy to operate and supports operation of multiple combustion vessels. It is ready for continuous operation and excellent productivity.

Advantageous features

- Standalone device with colour LCD touch screen interface
- Rigid design for testing of energetic materials
- Block design of components for easy service or maintenance
- Remote access to the system via LAN (optional)
- Excellent precision in variable laboratory conditions
- Inbuilt water chilling system for high performance operation
- Fully automatic water dosing and extraction
- Automatic gas management (oxygen filling, evacuation)
- Bombs for testing in oxygen, air, vacuum and inert gas



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Precise solution for smart people



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Description

Testing vessel **OXY300** is designed for precise testing of fuels, waste, polymers, food and agricultural products, metals and other combustible materials. It is made of high strength stainless steel and equipped with bottom valve bayonet lid for easy manipulation and higher testing performance.

Testing of materials (eg. PVC, PTFE) producing corrosive products (eg. HCl, HF) is limited and requires corrosion resistant vessel **OXY300R** which is made of high nickel alloy. These vessels use a set of crucibles for variable experiment setup and filling arrangement for safe oxygen filling.

Vessel volume	300 ml
Oxygen pressure limit	50 bar
Operation pressure limit	250 bar
Operation temperature limit	50 °C
Oxygen testing	Yes
Air testing	No
Vacuum testing	No
Inert testing (nitrogen, argon)	Yes
Sample weight (typical)	0.1- 3 g

Vessel EXO300

Testing vessel **EXO300** is designed for precise testing of nitrocellulose, single or double base propellants and other explosives ignitable by hot wire. It is made of high strength stainless steel and equipped with threaded bottom needle valve lid for increase safety.

Testing of materials producing iron (thermites) and substances creating corrosive products (eg. HCl, HF) is limited. Composite propellants or other samples producing corrosive burning products shall be tested in vessel **EXO300R** which is made of high nickel alloy.

Vessel volume	300 ml
Oxygen pressure limit	50 bar
Operation pressure limit	350 bar
Operation temperature limit	50 °C
Oxygen testing	Yes
Air testing	No
Vacuum testing	Yes
Inert testing (nitrogen, argon)	Yes
Sample weight (typical)	0.1- 5 g



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