

6790 Detonation Calorimeter

The Parr Instrument Company Technical Staff is available to assist in the design, selection and integration of components for custom calorimeter systems. One such example is the design of the Parr 6790 Detonation Calorimeter.

Ordinary oxygen bomb combustion calorimetry is used to measure the heat of combustion or reaction of materials in oxygen or inert atmospheres. Even for high strength vessels, such as the Parr 1104 Oxygen Combustion Bomb, the conditions necessary to detonate small amounts of highly reactive materials are often difficult to achieve and can result in unpredictable consequences. For example, the conventional heat of combustion of pentaerythritol tetranitrate (PETN) [C₅H₈N₄O₁₂] in oxygen is 1957 cal/g while the heat of detonation in vacuum is 1490 cal/g (a 24 percent difference).

Additionally, it is well known that the degree of confinement of explosive materials significantly influences the released energy. For unconfined or lightly confined charges, the released energy is largely retained in the products. When the charge is heavily confined, the detonation energy, for the most part, is converted to kinetic and internal energy of the confining case. For example, the conventional heat of combustion of 2,4,6-trinitrotoluene (TNT) in oxygen is 3590 cal/g. The heat of detonation for TNT at a charge density of 1.53 g/cc is 1093 cal/g and at a charge density of 0.998 g/cc is 870 cal/g. In contrast, an unconfined reaction yields approximately 600 cal/g.

Precise fundamental information about the detonation process can be obtained by combining calorimetric and dynamic pressure measurements. These measurements can be used ultimately to predict explosives



Detonation Calorimeter with the Parr Detonation Calorimeter Bomb stored in its rack.

performance. The Parr Detonation Calorimeter has been designed to aid research in this area.

Parr Instrument Company's heat of detonation calorimeter accepts up to a 25 g high explosive charge with a nominal total energy release per charge of ~160 kJ. The detonation is initiated using a small commercial EBW style detonator incorporating 80 mg of PETN and 450 mg of RDX with a binder. Detonators are fired using a one-microfarad – 4000 V capacitance discharge firing set. A complete calorimetric measurement can be made in a few hours with a precision of several tenths of a percent.



The Parr Detonation Calorimeter Bomb being lifted using the hoist.

The bomb can be optionally fitted with a high-speed pressure transducer that allows the user to gain further insight into the dynamics of the detonation process.

SPECIFICATIONS

Model Number:
6790

Tests per hour:
1

Operator Time Per Test:
20 Minutes

Jacket Type:
Continuously Compensated

Oxygen Fill:
Manual

Bucket Fill:
Manual

Bomb Wash:
Manual

Bomb Model Options:
A500A

Balance Communication:
USB

Printer Communication:
USB

Network Connection:
TCP/IP via Ethernet