

LABORATORY DETONATION CHAMBERS

Laboratory detonation chambers are designed for **scientific investigations, research, development and testing** in the area of energetic materials, confined explosions and related applications (**explosive forming of metals**, safe **disposal of explosive wastes**, safe temporary **storage of unstable explosive substances**, etc.) in explosives laboratories.

Laboratory detonation chambers are steel vessels designed to withstand **repeated detonations with TNT equivalent of up to 150 grams (KV-150M1) or 250 grams (KV-250M)**. Service life of the detonation chambers is calculated in **$10^4 - 10^5$ detonations** when operation procedures and requirements are carefully fulfilled.



KV-150M1



KV-250M

The chambers are equipped with **multiple windows** covered with steel discs and **additional entries** (one of which is a **lid** for inserting the explosive charge), which can be used for installing various **optical or electrical measuring instruments** for investigating the detonation processes.

Two gas-tight manually operated **valves** are installed in two of the entries. The first valve serves as **input of compressed gases** for inertization, pressurization or flushing of the chamber. The second, output valve is used for **sampling and evacuation** of the post-explosion gases.

The chambers are closed by a **lid** equipped with a **bayonet lock** and a **blocking mechanism**. Contacts of the electric firing circuit are appropriately protected from damage by the explosion effects. The charge is placed inside the chamber on a steel **working table** filled with shock-absorbing material. The chamber is placed on a **steel support** with additional shock-absorbing materials. As a result, no special foundations are necessary for installation and operation of the chamber.

In operation, the explosive charge is installed on a steel working table filled with shock-damping material or it can be hanged to the geometrical centre of the chamber. Electric detonator is connected to two firing contacts under a lid. A heavy steel lid is tightly closed via a bayonet lock. The gas sampling and evacuation valves are manually closed. Firing of the electric detonator is carried out using a standard blasting machine following standard operation procedures for blasting works as applied in the country of use. After explosion, the gases are sampled or evacuated to the exhaust manually opening the output valve connected to the ventilating fan. The interior of the chamber is then flushed with outside air by opening the input valve. The flushing can be assisted by connecting source of compressed air (compressor, pressure bottle) to the input valve. After appropriate time of flushing, the lid of the chamber can again be opened, remains after explosion removed from interior of the chamber and a next charge installed in.

Detonation chamber	KV-150M1	KV-250M
Nominal capacity [g TNT]	150	250
Maximum length [mm]	1540	1800
Maximum width [mm]	1100	1200
Maximum height [mm]	1450	1630
Maximum weight [kg]	800	1250

3 Possible applications in testing of energetic materials

Laboratory detonation chambers can be used for a number of various experimental performance, sensitivity and stability tests of energetic materials involving their full-scale detonations. Furthermore, the chambers can be used as **safe temporary storage vessels** for newly synthesized and potentially unstable explosive samples, for **safe destruction of explosive wastes** or special applications (such as **explosive forming of metals**). Short non-exhaustive list of the typical tests follows:

Performance tests

- Detonation velocity
- Detonation pressure
- Pressure – time measurements of confined explosions
- Temperature (heat flow) – time measurements of confined explosions
- Brisance by lead block compression test (Hess test)
- Brisance by Kast's method
- Brisance by plate dent test
- Brisance by sand test
- Explosive power by lead block expansion test (Trauzl test)
- Mass velocity of detonation products by flash X-ray photography
- Propagation of the shock wave using high-speed cameras



Sensitivity tests

- Sensitivity to shock wave by small-scale gap test
- Sensitivity to heat by slow cook-off test
- Large-scale electrostatic discharge sensitivity test
- Sensitivity to electron beam and laser
- Transmission of detonation between charges
- Sensitivity to initiation by detonator
- Critical diameter test
- Deflagration to detonation transition test

Stability tests

- Large-scale long-term stability tests

Notes: Applicability of these tests is subject to limit of maximum TNT equivalent per a shot, inside dimensions of the chamber and charge reductions when using Plexiglas replacing steel discs in optical measurements (40 % of maximum TNT equivalent). Chamber walls shall be protected from metal fragments by appropriate means (e.g. replaceable shields) if encased explosives are detonated.