TECHNICAL SPECIFICATION T-2409-OZM4

LABORATORY DETONATION CHAMBERS
KV-150M1 KV-250M3

This technical specification describes KV-150M1 and KV-250M3 – two types of laboratory detonation chambers 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.

1 Technical description

KV-150M1 and KV-250M3 are steel detonation chambers designed to withstand **repeated detonations with TNT equivalent of up to 150 grams** (KV-150M1) **or 250 grams** (KV-250M3). Service life of the detonation chambers is calculated in **10,000s detonations** when operation procedures and requirements are carefully fulfilled.

The chambers are equipped with **two windows** covered with steel discs, which can be used for installing various **optical or electrical measuring instruments** for investigating detonation processes.

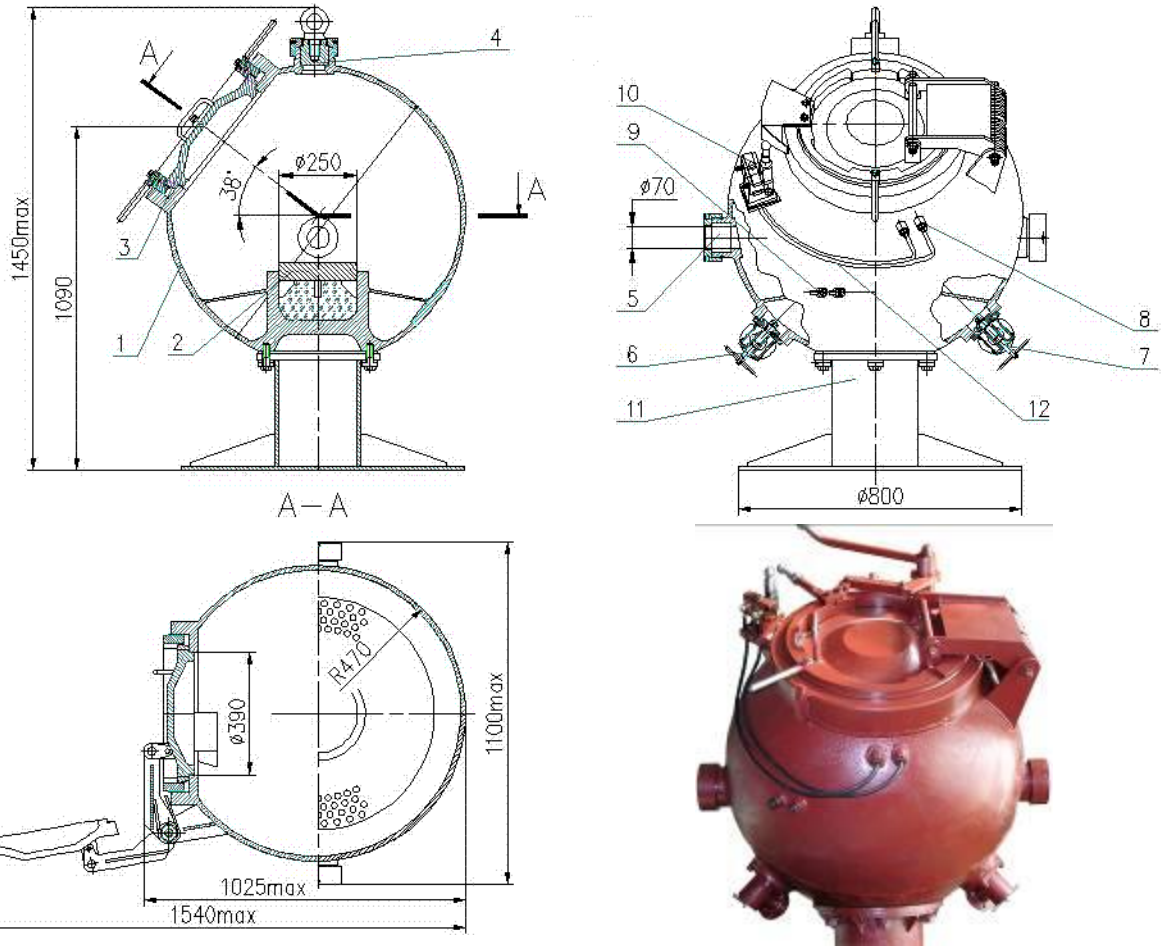
The chambers contain **two additional entries** with manually operated valves for ventilation. The first valve serves as **input of compressed gases** for inertization or flushing of the chamber. The second, output valve is used for **sampling and evacuation** of the post-explosion gases. Source of the compressed gases and/or flexible hose with a ventilating fan with exhaust taken outside the test area shall be provided for operation of the chamber by the purchaser.

The chambers are closed by a **main lid** equipped with a **bayonet lock** tightened by rubber sealing. Lid of KV-250M3 opens to right hand side, while lid of KV-150M1 moves upwards using a spring-assisted arm. KV-250M3 contains additional **service lid** opposite to a main lid, which can also be used for installation of measuring systems.

Lids of both chambers contain **blocking mechanism** of a firing circuit which prevents electric firing when the lid is not completely closed. Contacts of the electric firing circuit inside the chamber are appropriately protected from damage by the explosion effects.

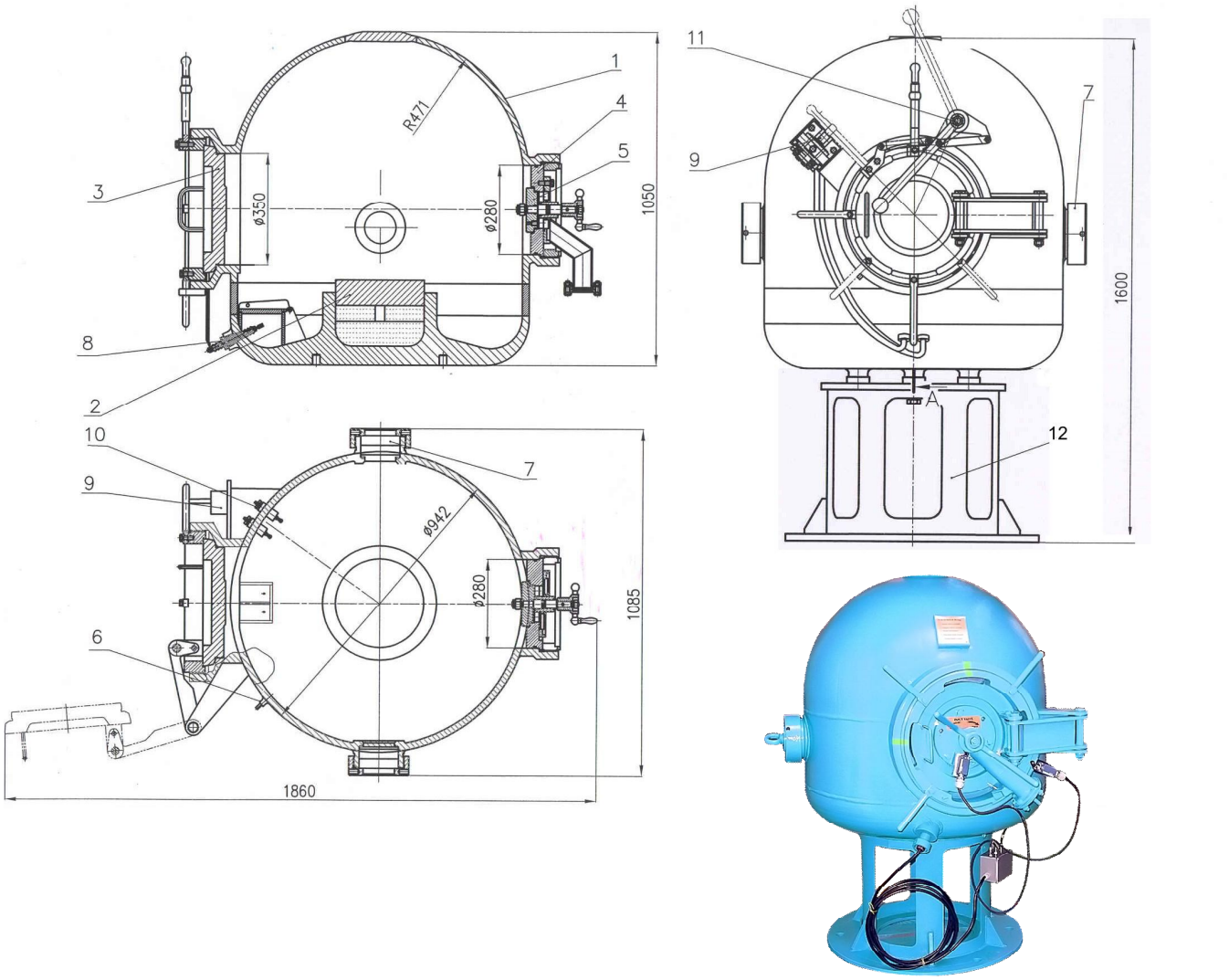
The charge is placed inside the chamber on a steel **working table** filled with shock-absorbing material. The chamber is placed on a **steel support** with additional shock-absorbing materials. As a result, no special foundations are necessary for installation and operation of the chambers except those capable to withstand static load of the chambers. **KV-150M1** detonation chamber weights about **800 kg**, **KV-250M3** about **1400 kg**. Main dimensions of the chambers are provided at the following drawings.

1.1 KV-150M1



KV-150M1 descriptions:
1 – chamber body, 2 – working table, 3 – main lid, 4,5 – windows, 6 – input valve, 7 – output valve, 8 – firing input, 9 – electric measuring input, 10 – blocking mechanism, 11 – support, 12 – cable

1.2 KV-250M3



KV-250M3 descriptions:

1 – chamber body, 2 – working table, 3 – main lid, 4 – service lid, 5 – output valve, 6 – input valve, 7 – optical windows, 8 – firing input, 9 – blocking mechanism, 10 – measuring input, 11 – bayonet closing mechanism, 12 - support

2 Operation

In operation of the laboratory detonation chambers, the explosive charge is installed above a steel working table filled with shock-damping material (placed on replaceable steel sheets or paper boxes providing a gap protecting the working table) or it can be hanged to the geometrical centre of the chamber.

Electric detonator is connected to two firing contacts on the chamber. A heavy steel lid is tightly closed via a bayonet lock. The input and output valves are manually closed.

Firing of the electric detonator is carried out using a standard blasting machine (*not part of the delivery*) 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 fresh air by either opening the main lid or 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.

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 synthetized 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.

4 Manufacturer's and supplier's experience

The laboratory detonation chambers are manufactured by Design and Technology Branch of **Lavrentyev Institute of Hydrodynamics, Russian Academy of Sciences** – Siberian Division, which is represented by OZM Research for the countries outside Russian Federation. The Institute is a **leading Russian scientific base for confined explosion effects** and their industrial applications having **more than 40 years of experience** in designing and manufacturing detonation chambers for scientific and industrial use, ranging from 100 grams to 16 kilograms of TNT equivalent. Several dozens of these chambers are used in the Russian Federation, eight of them also in the countries of European Union. Laboratory detonation chambers were already delivered to Poland (KV-150), Germany (KV-250), Romania (KV-250M), Singapore (KV-150M) and Georgia (KV-250M).

OZM Research is a knowledge-based company formed by **experienced explosives scientists and engineers** with advanced academic degrees in this very special branch of chemical engineering. The company business consists of three core areas – **testing instruments, technologies and expert services for energetic materials** (explosives, propellants, pyrotechnics) and ammunition. The company is a leading supplier of special testing instruments for energetic materials in the European Union. Since 1997 the company exported its products to many countries of the **European Union, the United States, Asia and Latin America**. Our major clients include military R&D and testing centres, special police departments, universities, explosives and ammunition manufacturers, nuclear power plants and other related industries.