

# TEST CHAMBER FOR MEASUREMENTS IN PYROTECHNICS AND SOLID PROPELLANTS

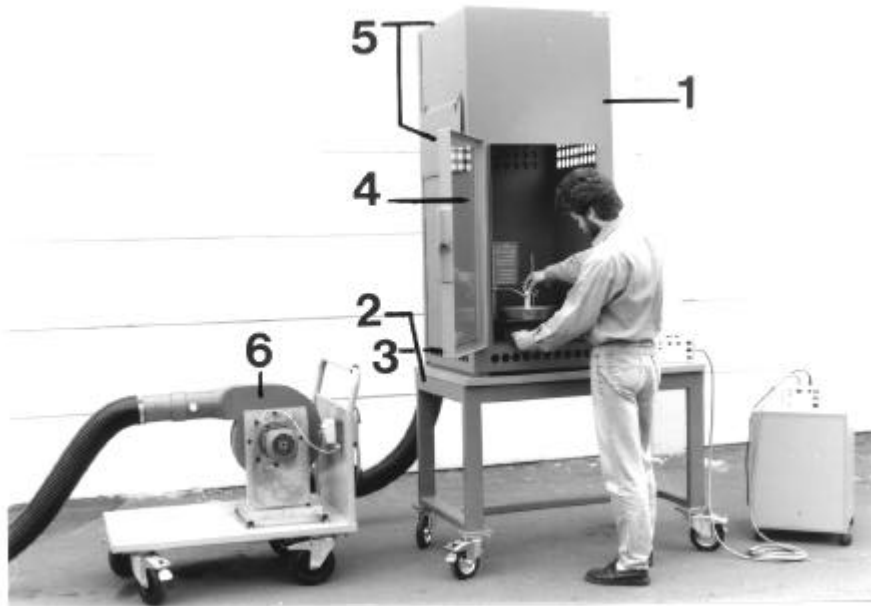


Fig.1 Test Chamber for pyrotechnical experiments, opened for preparation of charge

## 1. PURPOSE

When pyrotechnical demonstration and measuring charges are tested, great am of smoke, hot particles and flares of a high temperature are produced. Emissions have a strong influence on the combustion behaviour, the optic effect the radiation spectra of the measuring charges. For this reason they must be exhausted in a way which is as free from turbulence as possible. A high-performance exhaust system sucks the disturbing gases off the reaction zone while, at the same time, the flow of air inside the chamber is guided in a special way, thus preventing the inner walls of the chamber and front window from being covered with smoke or combustion residues. The large chamber volume as well as the supplied over pressure protection permits the combustion of low-speed burning charges of up to 50g. A large front window with a great spectral transparency consisting of shatterproof glass (thickness 19mm) serves for a visual and spectroscopic evaluation of the tested charges.



# TEST CHAMBER FOR MEASUREMENTS IN PYROTECHNICS AND SOLID PROPELLANTS

The following tests can be carried out:

- ?? pyrotechnical signal charges with flames of any colour;
- ?? smoke charges, screening charges and camouflage charges;
- ?? infrared radiation of absorbing smoke charges
- ?? flash charges (5g maximum);
- ?? solid propellant rocket motors type 0 (max. charge weight appr. 60g) for demonstrations and measurements in propellant and motor technology.

The mobile test chamber can be mounted in any laboratory provided with a free window surface of at least 3 m<sup>2</sup>. Large test charges or charges with rapid reaction behaviour, however should be observed through another protection window or by means of a TV-camera.

## 2. CONSTRUCTION

The test chamber consists of the test chamber itself (1) and the mobile support system equipped with a working plate (2). For reasons of weight and height, the chamber and the support system are delivered apart and mounted directly at side at the customer.

The test chamber is made of steel sheet (3 mm) and is fitted with suitably formed air channels (3), which serve for providing a non-turbulent flow of air inside the chamber. The test charges are combusted on the vertical axis of the chamber. In this position, the test specimen is placed exactly in the covering flow of circulating air that prevents the inner wall from getting into contact with the generated smoke gases and particles. Due to this special air guidance a pollution of the front window (4) can be avoided to a large extent.

## 3. Combustion methods:

The test chamber is equipped with two exhaust connections (diameter 125 mm) which permit two different combustion methods:

### ***3.1. Combustion with an upward current of the smoke gases (standard equipment)***

The test specimen is positioned in such a way that the combustion products rise together with the flow of heat and the circulating air, so that they can be exhausted from the upper smoke outlet 1. This method is applied whenever signal charges/flares or solid propellant rocket motors are tested and the combustion product cannot have any disturbing effect on the measuring procedure.



# TEST CHAMBER FOR MEASUREMENTS IN PYROTECHNICS AND SOLID PROPELLANTS

## **3.2. Combustion with falling smoke gas (optional)**

The test specimen is positioned in such a way that the circulating air in the downward direction vertically evacuates the combustion products so that they can be exhausted from the lower smoke outlet 2. Since the hot particles are consolidated in a sand bed they have no disturbing effect on the light emission and the combustion behaviour of the test specimen. This method is preferably applied for measuring radiation spectra and determining the performance of pyrotechnical flares/signals).

Safety aspects:

Exhaust performance: The applied exhaust system has a performance which permits even smoke charges with a diameter of 50 mm for measurements.

Overpressure protection: The chamber is made of steel sheet (3 mm). Safety flaps (5) on both sides of the chamber as well as a safety lock on the top of the chamber provides rapid pressure relief. The front window is not fitted with a simple locking device but with a magnetic lock which, in the case of over pressure releases and thus opens the window. Protection from shatters is guaranteed by the safety front window made of multilayer glass (thickness 19 mm) and furthermore by an internal shatter protection in the upper area of the chamber. In addition to that special protection plates are used when the test motor type O (charge weight appr. 60g) is examined.

## **4. DATA**

### **4.1 TEST CHAMBER**

Mechanical dimensions (for mounted unit)	appr. 1250 x 800 x 2500 mm (L x W x H)
Weight:	appr. 310 kg
Maximum charge weight:	50 g
(for low-speed burning charges; no explosive reaction!)	

### **4.2 EXHAUST (6) (see Fig. 1)**

Mechanical dimensions:	appr. 1200 x 600 x 800 mm
Weight:	appr. 80 kg
Exhaust performance:	appr. 600 m <sup>3</sup> /h / 900 Pa
Connection diameter of the exhaust conduct:	125 mm



# TEST CHAMBER FOR MEASUREMENTS IN PYROTECHNICS AND SOLID PROPELLANTS

Materials Testing & Laboratory Equipment

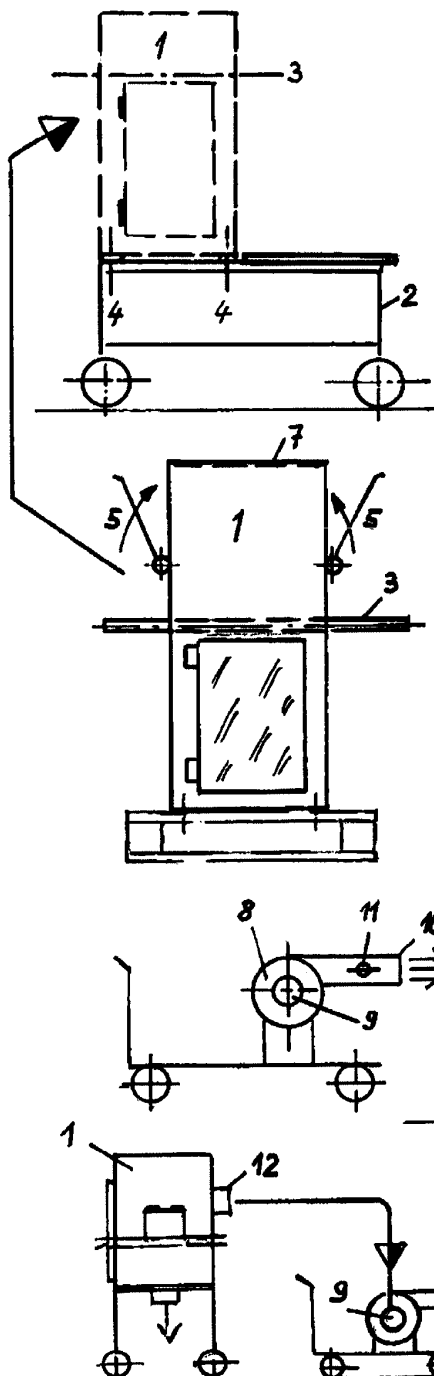
Page 4

Mains voltage: 220/380V, 0.37 kW  
System of protection: IP 54



# TEST CHAMBER FOR MEASUREMENTS IN PYROTECHNICS AND SOLID PROPELLANTS

## 5. INSTALLATION/APPLICATION



**Installation:** The chamber is delivered in two pieces (test chamber and mobile support system). Both parts must be transported into the provided room before they can be mounted (Note: total height of the system: appr. 2.50 m). In order to mount the chamber (1) onto the mobile support system (2), the supplied transport rods (3) (set of two) must be slid into the upper bore holes of the pressure relief device. At least 4 persons are required for lifting the chamber into the mounting position.

The chamber is fixed by means of the supplied screws (4). Then mount the pressure relief flaps (5) and remove the transport screws of the upper flap (7).

**Connection:** Switch the exhaust unit on after it has been connected to mains voltage 3x220 / 380V/50Hz. Check the sense of rotation of the motor. When the polarity is correct, a strong intake at (9) and a strong exhaust at (10) occurs (open the choke (11)!). Connect the suction tube to (12) and (9) and the exhaust tube to (10) and to the wall outlet (13).

Gas emissions that might occur at the pressure relief flaps during the rapid combustion of specimen are sucked out with the aid of the ventilating device (14), which is mounted near the ceiling.

# TEST CHAMBER FOR MEASUREMENTS IN PYROTECHNICS AND SOLID PROPELLANTS

