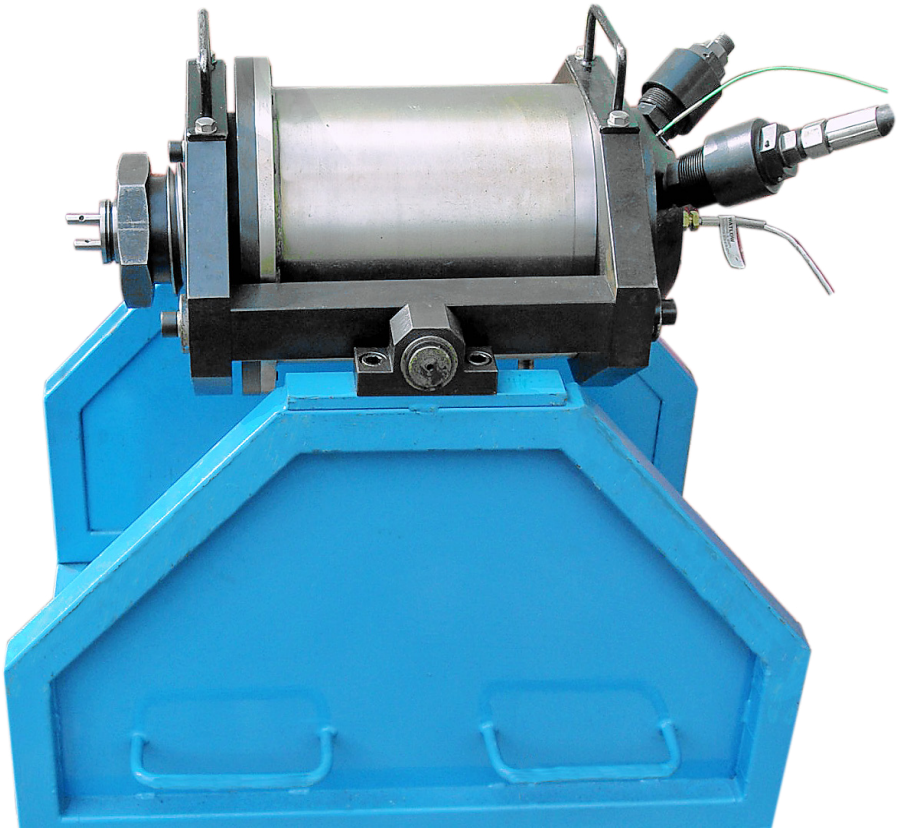
OZM RESEARCH
Instruments & Technologies for Energetic Materials

CLOSED VESSEL RB SERIES
MEASUREMENT OF BALLISTIC PARAMETERS OF GUN PROPELLANT
Product Datasheet

Closed vessel **RB Series** is a part of pyrostatical testing measuring workplace. In combination with piezo-electrical pressure transducer it is used for measuring of pressure increase curve during burning of different propellant types in constant volume. From the values measured it is possible to obtain other information (force, quickness, etc) about the tested propellant using recording and evaluation device with special software. Data obtained from tests in closed vessel can be used at the development of new propellants and at the checking of regular powder types, too.



DEVICE DESCRIPTION

RB Series is high pressure closed vessel constructed from high strength steel with cooling jacket on the outer surface. It is equipped with temperature sensor, piezo-electrical pressure transducer, two outlet valves and specially-sealed breech screw. The breech screw is equipped by ignition device – either electrical or mechanical – providing possibility of both types of ignition. Closed vessel is supported by a stand, which allows position change and fixation in the range of 180°. Stand is fixed on mobile chassis with antistatic modification.

DEVICE MAIN PARAMETERS

Volumes	40, 80, 200, 400, 500 or 700 ccm
Working pressure	up to 500 MPa (5000 bar)
Testing pressure	600 MPa (6000 bar)
Material	high strength steel
Loading density	usually 0.1 - 0.25 g/ccm according to STANAG 4115
Ignition	electrical - for pressure up to 500 MPa mechanical - for pressure up to 300 MPa
Cooling jacket	
Transducer reduction	

SCHEME

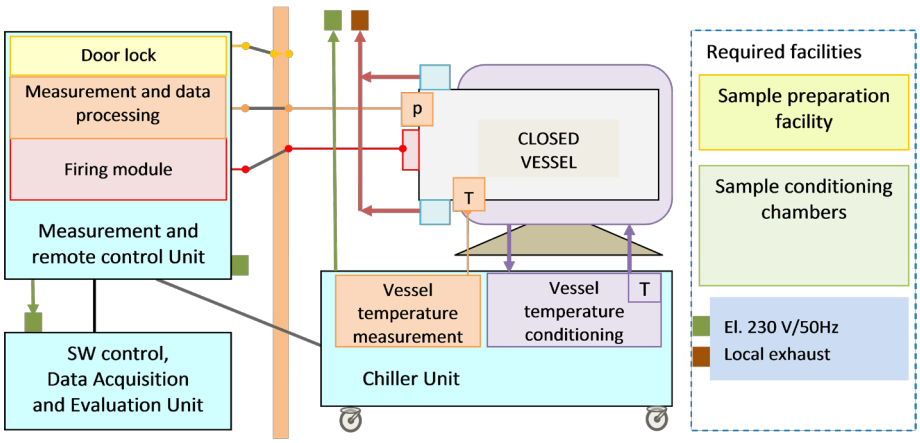


Fig. 1-1: Schematic diagram of CLOSED VESSEL instrumentation

OZM Research s.r.o
Bližňovice 32, 538 62 Hrochův Týnec, Czech Republic, European Union
Tel: +420 608 742 777, Fax: +420 469 692 882, E-mail: ozm@ozm.cz
www.ozm.cz

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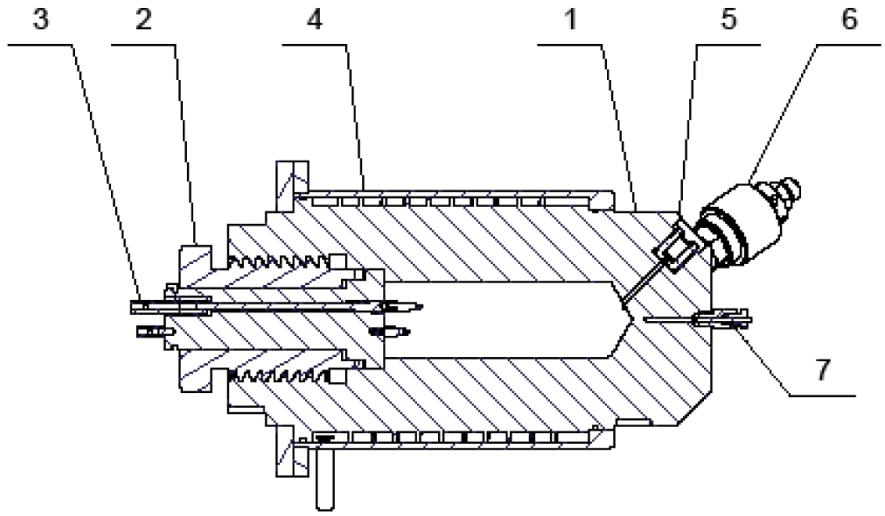
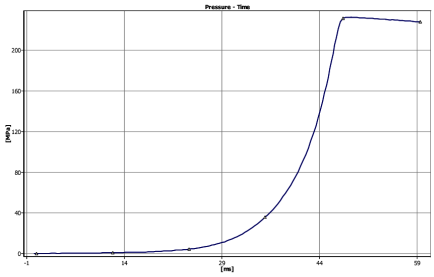
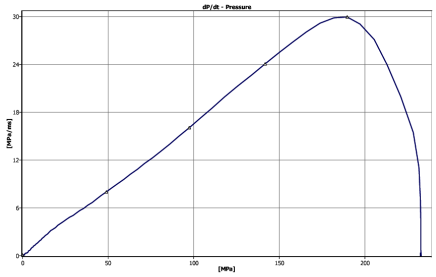
LONGITUDINAL SECTION

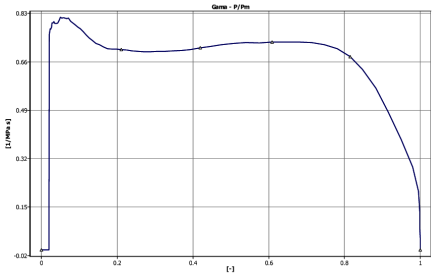


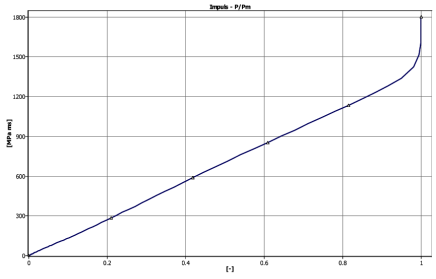
1. Pressure vessel 2. Breech screw 3. Electrical ignition 4. Water cooling jacket
5. Pressure transducer 6. Outlet valves 7. Temperature sensor

GRAPHS


Pressure - Time


dp/dt - Pressure


Vivacity - p/p_{max}


Impulse - p/p_{max}

EVALUATION PROCEDURE

Propellant characteristics calculated from measured values via MIL-STD-286 or STANAG 4115 procedure:

• pressure	p = f(t) pmax
• time of burning	t
• vivacity	L = f(p/pmax) average L
• pressure gradient	dp/dt = f(p) average dp/dt max. dp/dt
• impulse	
• force	
• covolume	
• burn rate	

MEASUREMENT

Pressure range	up to 500 MPa (5000 bar)
Accuracy	1 %
Samples tested	all propellant types

CONDITION OF DELIVERY

- Delivery consists of complete closed vessel with stand, spare parts, set of tools and all consumables needed.
- Other accessories - measuring device, evaluation software, PC, cooling unit - are optional.

SHIPPING DATA

Package dimensions (W x L x H):	TBD
Package gross weight:	TBD
Custom code:	9031 20 00

EXPORT LICENSE

Export of CLOSED VESSEL instrument is subject to export license for military goods from the Czech Republic. The apparatus can only be exported after having received the approval of the licensing authority concerned. To apply for the valid export license, international import certificate or end-user certificate is required.

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STANDARD INSTRUMENT PARTS

RB-CVXXX	Closed vessel RBXXX - volume according to vessel part number (e.g. RB-700 is for vessel of volume 700 ccm) - max. working pressure 5000 bar - breech screw with el. ignition - pressure transducer fitting - gas release valve - cooling jacket - stand - starting set of consumables - equipment and tools for assembling
RB-CU	Chiller unit - Mobile working table with chiller for cooling jacket, temperature sensor
RB-MU	Measurement and remote control unit - high speed DAQ - PC communication - pressure transducer conditioner - leading and measurement cables - thermometer - current ignition - safety input
RB-PPK6000	Pressure transducer, min. 550 MPa
RB-APPT	Accessories set for pressure transducer (installation kit, cables, silicon paste, transport box, torque wrench, socket)
DAEU-17	Intel Pentium Dual Core Processor 2.0 GHz, Microsoft Windows 10 x64, 4 GB RAM, 17" display, 500 GB HDD, DVD RW, WLAN 802.11 b/g/n, LAN 10/100/1000, USB 2.0/3.0
RB-ABSW	Control, measurement and evaluation software ABSW2

SPARE PARTS FOR CLOSED VESSEL

RB-EP	Spare electrode
RB-RV	Spare release valve
RB-EIBXXX	Spare breech screw with electrical ignition
RB-IAPT	Spare interchangeable adapter for piezo electric transducer including each one copper sealing
RB-TA	Thermometer accessories

OPTIONAL ACCESSORIES

RB-MBSXXX	Set for mechanical ignition (pressure up to 3200 bars ~ 0.2g/ccm): breech screw with mechanical ignition, O-rings, joints and cartidges covering 1000 rounds, accelerometer
RB-PRCAL	Pressure calibrator set (range up to 500 MPa)

INSTALLATION REQUIREMENTS

Space requirements:
W x L x H: min 150 x 150 x 160 cm;
Net weight: according to vessel volume, approx. from 100 to 310 kg

Space requirements (Chiller unit):
W x L x H: 60 x 100 x 100 cm; Net weight: 150 kg
Space requirements (MU unit):
W x L x H: 30 x 60 x 60 cm; Net weight: 10 kg
Space requirements (Data acquisition unit):
W x L x H: 41 x 32 x 32 cm; Net weight: 5 kg
Stable electric power source: 230 V / 50 Hz, 2500 W

Tap water source

Fume hood or local exhaust

Bunker or fragment impact resistant structure equipped by safety door (21 °C +/-5 °C, RH 30 - 70%)

The instrument must be placed on a safe place and controlled remotely to protect the operator

Measurement room for operators (21 °C +/-5 °C, RH 30 - 70 %)
max. 5 m away from bunker, with tables, chairs and light

Laboratory for sample preparation (21 °C +/-2 °C, RH 30 - 70 %)
- with measuring equipment for weight and dimensions measurement of samples and with sample processing capability by cutting, drilling

Place for sample temperature conditioning - protected room with temperature chambers for required temperature range, max. 10 m away from testing bunker

Recommendation
Measurement of barometric pressure, laboratory humidity and temperature

Pressure calibration
(source and measurement, range 25 - 500 MPa, min. accur. 0.5 % FS)

Digital multimeter set for service maintanance (min. 600 V, 5 A, 5 MOhm, etc.)

Two operators trained in basic ballistics with knowledge of on-site laws

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