Calorimeter basics and brief history

A bomb calorimeter is used to measure the heat created by a sample burned under an oxygen rich atmosphere in a closed vessel, which is surrounded by water, under controlled conditions. The measurement result is called the combustion-, calorific- or BTU-value. The result allows to make certain important quality, physiological, physical and, as well as financial conclusions about the product.

The term “calorimeter” was first mentioned by Josef Black in 1770. One of the first calorimeters (ice-calorimeter) was designed by Lavoisier and Laplace around 1780. The calorimetric bomb is also called “Berthelotsche Bomb”. Marcellin Berthelot developed the combustion of samples in a closed pressure resisting vessel into a standard method. He was the first to use pure oxygen at higher pressures to get a faster and more complete combustion (1885). In 1892 the first patent for a pure oxygen at higher pressures to get a faster and more complete combustion (1885). In 1892 the first patent for a calorimeter to measure the heating value of gaseous fuel was given to Hugo Junkers a German inventor and aircraft engineer. IKA® introduced their first bomb calorimeter in the 1920′s. Since then our calorimeters have been continuously developed according to the latest standards and technologies.

There are many different types of calorimeters available on the market: Solution-, DSC-Differential-Scanning-, Titrati- on-, Gas- and Reaction Calorimeters.

IKA® manufactures so called bomb- or combustion calorimeters.

About 1g of solid or liquid matter is weighed into a crucible and placed into a stainless steel container. The decomposition vessel or bomb is filled with 30 bar of oxygen (quality 3.5%, technical oxygen 99.95%). The sample is ignited for example through a cotton thread connected to a solid ignition wire inside the decomposition vessel and burned. During the combustion the core temperature in the crucible can reach 1,000 °C, and the pressure max as well. All organic matter is burned and oxidized under these conditions.

The heat created during the burning process can be determined using the isoperibol, adiabatic or dynamic measurement procedure.

Adiabatic calorimeter

In an adiabatic calorimeter the temperature in the outer vessel (Tov) is kept constant throughout the experiment. This does not allow a “perfect isolation”. There are still small temperature exchanges into account. This does not allow a “perfect isolation”. There are still small temperature exchanges into account. A correction factor (Regnault-Pfaundler = ξ) will be calculated after the experiment that takes these temperature exchanges into account.

Isoperibol calorimeter

In an isoperibol calorimeter the temperature in the outer vessel (Tov) is kept constant throughout the experiment. This measurement result is compared to the isoperibolic calorimeter.

Dynamic calorimeter

The dynamic IKA® designed modes are basically short versions of the original adiabatic and/or isoperibolic measuring modes. The measurement results often still conform to the required Relative Standard Deviation (RSD) of the official standards.

Calorimeter certificates awarded to IKA®

GB/T 213-2008 Calorie testing method of coal
ASTM - D240 Standard test method for heat of combustion of liquid hydrocarbon fuels by bomb calorimeter
ASTM - D4809 Standard test method for heat of combustion of liquid hydrocarbon fuels by bomb calorimeter (precision method)
ASTM - D5865 Standard test method for gross calorific value of coal and coke
ASTM - D5468 Standard test method for gross calorific and ash value of waste materials
ASTM - E711 Standard test method for gross calorific value of refuse-derived fuel by bomb calorimeter
JIS M 8814 Coal and coke: determination of gross calorific value by the bomb calorimetric method, and calculation of net calorific value
ISO 1928 Solid mineral fuels Determination of gross calorific value by the bomb calorimetric method, and calculation of net calorific value
ISO 1716 Reaction to fire tests for building products
DIN EN ISO 9631 Animal feeding stuffs, animal products - feces or urine determination of gross calorific value
DIN EN 14582:2007 Characterization of waste - halogen and sulfur content oxygen combustion in closed systems and determination methods
DIN EN 14582-1 Testing of solid and liquid fuels - determination of gross calorific value by the bomb calorimeter and calculation of net calorific value Part 1: Principles, apparatus, methods
DIN EN 14582-2 Method using isoperibol or static, jacket calorimeter
DIN EN 14582-3 Method using adiabatic jacket
**Analytical line C 200**

Compact low cost combustion calorimeter to determining calorific values of liquid and solid samples. Suitable for teaching and training (e.g. technical schools, universities) and for industrial laboratories with less need for analyses.

- In the manual mode (learning mode) the user triggers ignition and the end of measurement. The temperature changes are recorded at minute intervals. All calculations are manual.
- In the other operating modes ignition and calculation of calorific values are automatic. The calorific value is shown on the display. Acid correction of the calorific value and calculation of the heat values are performed manually.

- The C 5010 decomposition vessel can be equipped to use C 14 disposable crucible.
- Special halogen resistant vessel for quantitative decomposition of halogens and sulfur.
- The C 200 can also be operated with the "CalWin C 5040" calorimeter software. This enables control of up to eight C 200 measurement cells from a PC.

**Technical data**

- Input power max. 120 W
- Rated voltage 24 V DC, 5 A
- Fuse 1 x 2.5 AT
- Max. On-time continuous operation: up to 17 min
- Measuring mode / Measuring time
  - isoperibol up to 17 min
  - dynamic up to 6 min
  - manual (isoperibol) up to 17 min
- Time-controlled up to 14 min
- Reproducibility based on analysis of 1 g benzoic acid NBS 39: 0.1 % RSD
- Operating oxygen pressure: 30 bar

**General data**

- Dimensions (W x D x H): 400 x 400 x 400 mm
- Weight: 21 kg
- Protection class: IP 21
- Interfaces: 1 x serial (RS 232) / 1 x parallel (Centronics)
- Ambient temperature: 20 – 25 °C (constant)
- Ambient humidity: 80 %
- Protection class according to DIN EN 60529: IP 21

**Universities and Research Institutes**

- Teaching thermodynamics
- Enthalpy studies
- Airplane covering
- Ecological studies
- Rats

- Bio-fuels

**Agriculture (Fodder)**

- Forage crops
- Fodder for cats, dogs, cows, sheep, pigs, chicken
- Animal urine and droppings

**Construction and Building Materials**

- Fleece
- Insulation material
- Styrofoam
- Mortar
- Rock wool

**Food**

- Noodles
- Dried fruit
- Fish
- Milk
- Chocolate
- Cheese

**Biomass**

- Wood
- Wood pellets
- Saw dust
- Hay
- Glass
- Corn
- Bio-fuels

**Power Plants**

- Anthracite coal
- Hard coal
- Brown coal
- Bituminous coal
- Coke

**Coal and Coke**

- Anthracite coal
- Hard coal
- Brown coal
- Bituminous coal
- Coke

**Petroleum**

- Jet fuel
- Kerosene
- Liquid fuels
- Gasoline
- Oil
- Bio-fuels

**Cement**

- Coke
- Ties
- Animal flour
- Mixed waste material

**Power Plants**

- Anthracite coal
- Hard coal
- Brown coal
- Bituminous coal
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**Food**

- Noodles
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- Fish
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- Cheese
C 2000 basic, C 2000 control, C 2000 basic high pressure and C 2000 control high pressure

The C 2000 basic and C 2000 control calorimeters are the tried and tested systems from IKA® for determining gross calorific values of liquid and solid samples. A high level of automation with extremely simple handling characterizes these instruments. In addition to the isoperibolic measurement procedure (static jacket), a dynamic (reduced-time) working method is also available. Halogen-resistant decomposition vessels of the C 5012 series for quantitative decomposition of sulfur and halogens in parallel to determining gross calorific values are available. To provide the calorimeters with cooling water, they need to be connected to a thermostat, e.g. IKA® KV 600 or a firmly installed water supply. The C 2000 basic is equipped with a very convenient console to operate the unit. The C 2000 control is delivered with the proven C 5040 CalWin calorimeter-software in order to control the system via PC. Network connection and special configuration for data exchange with LIMS can be implemented at any time. The C 2000 basic is designed for simple handling with a multi-serial plug-in card.

Functions:
- Automatic water handling system includes tempering, filling and emptying of calorimeter inner vessel
- Automatic oxygen filling of decomposition vessel
- Automatic decomposition vessel identification
- Automatic sample ignition
- GOST-certified
- Operating methods: isoperibol, measurement time: approx. 22 min
- Compact, integrated modular design for convenient operation
- Cooling water supply via thermostat, e.g. KV 600 or firmly installed water supply (C 25 pressure regulating valve recommended)
- Interface connections for each of the following: scale, printer, monitor and sample rack
- User-friendly software C 5040 CalWin for controlling the calorimeter and administering measured data
- LIMS integration is possible
- Special halogen-resistant vessel for quantitative decomposition of halogens and sulfur
- The decomposition vessel can be changed to use disposable crucible C 14
- Up to 8 calorimeters can be controlled by a single PC, using a multi-serial plug-in card

Technical data:

<table>
<thead>
<tr>
<th>Input power max.</th>
<th>1.8 kW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power ON-time continuous operation</td>
<td>40,000 J</td>
</tr>
<tr>
<td>Range of measurement</td>
<td>40,000 J</td>
</tr>
<tr>
<td>Repeatability</td>
<td>0.05 % RSD</td>
</tr>
<tr>
<td>based on analysis of 1 g</td>
<td>0.1 % RSD</td>
</tr>
<tr>
<td>Working modes / Start temperature</td>
<td>25 °C / 30 °C</td>
</tr>
<tr>
<td>Measurement time</td>
<td>isoperibol 22 min, dynamic 15 min</td>
</tr>
<tr>
<td>Operating oxygen pressure</td>
<td>0.3 bar</td>
</tr>
<tr>
<td>Cooling medium</td>
<td>tap water</td>
</tr>
<tr>
<td>Idx. Plus info</td>
<td>65/11</td>
</tr>
</tbody>
</table>

C 2000 basic Version 1
Consisting of:
- C 2000 basic
- C 5010 Decomposition vessel, standard

C 2000 basic Version 2
Consisting of:
- C 2000 basic
- C 5012 Decomposition vessel, halogen resistant

C 2000 basic high pressure
Consisting of:
- C 2000 basic
- C 62 Decomposition vessel, high pressure
- C 60 Conversion set

C 2000 control
Consisting of:
- C 2000 control
- C 5010 Decomposition vessel, standard
- C 5040 CalWin, calorimeter software

C 2000 control Version 1
Consisting of:
- C 2000 control
- C 5010 Decomposition vessel, standard
- C 5040 CalWin, calorimeter software

C 2000 control Version 2
Consisting of:
- C 2000 control
- C 5012 Decomposition vessel, halogen resistant
- C 5040 CalWin, calorimeter software

C 2000 control high pressure
Consisting of:
- C 2000 control
- C 62 Decomposition vessel, high pressure
- C 60 Conversion set
- C 5040 CalWin, calorimeter software

A PC is required to operate the C 2000 control.

C 2000 Extension device
Consisting of:
- C 2000 control (without calorimeter software, without decomposition vessel), C 5041.10 Connection cable (for 8 x interface box)
The IKA® calorimeter C 5000 is the only calorimeter in the world that offers 3 working methods. Thus, it is possible to perform determinations of gross calorific values of liquid and solid samples in adiabatic (approx. 14 - 18 min), isoperibolic (approx. 22 min) and dynamic (reduced time: approx. 10 min) mode.

A high level of automation in addition to an extensive range of accessories leaves nothing more to wish for.

**Functions:**
- Automatic water handling system includes tempering, filling and emptying of calorimeter inner vessel
- Automatic oxygen filling and degassing of the decomposition vessel
- GOST-certified
- Interface connections for each of the following: scale, printer, monitor and sample rack C 5020
- User-friendly software C 5040 CalWin for controlling the calorimeter and administering measured data
- LIMS integration is possible
- Special halogen resistant vessel for quantitative decomposition of halogens and sulfur
- The decomposition vessel can be changed over to use disposable crucible C 14 burns during measuring

**C 5000 control Package 1/10**
Consisting of:
- C 5000 Controller
- C 5003 Measurement cell
- C 5010 Decomposition vessel, standard
- C 5001 Cooling system

**Technical data**
- Input power max: 1.3 kW
- Power ON-time: continuous operation
- Range of measurement: 40,000 J
- Reproducibility:
  - based on analysis of 1 g benzoic acid NBS 39i
    - adiabatic/isoperibol: 0.05 % RSD
    - dynamic: 0.1 % RSD
- Working modes:
  - adiabatic/isoperibol:
    - measurement time:
      - up to 15 min
      - up to 22 min
  - dynamic:
    - measurement time:
      - up to 10 min
- Operating oxygen pressure: 30 bar
- Cooling medium (C 5004): tap water
- Flow rate: 18 - 42 l/h
- Temperature: 15 - 25 °C
- Max. / min. temperature: 10 / 18 °C
- Min. pressure at the tap: 5 bar

**C 5000 control Package 1/12**
Consisting of:
- C 5000 Controller
- C 5003 Measurement cell
- C 5012 Decomposition vessel, halogen resistant
- C 5004 Heat exchanger

**C 5000 control Package 2/10**
Cooling water supply via thermostat KV 600 or firmly installed water connection.
Consisting of:
- C 5000 Controller
- C 5003 Measurement cell
- C 5010 Decomposition vessel, standard
- C 5004 Heat exchanger

**C 5000 control Package 2/12**
Cooling water supply via thermostat KV 600 or firmly installed water connection.
Consisting of:
- C 5000 Controller
- C 5003 Measurement cell
- C 5012 Decomposition vessel, halogen resistant
- C 5004 Heat exchanger

**Technical data**
- Input power max: 1.3 kW
- Power ON-time: continuous operation
- Range of measurement: 40,000 J
- Reproducibility:
  - based on analysis of 1 g benzoic acid NBS 39i
    - adiabatic/isoperibol: 0.05 % RSD
    - dynamic: 0.1 % RSD
- Working modes:
  - adiabatic/isoperibol:
    - measurement time:
      - up to 15 min
      - up to 22 min
  - dynamic:
    - measurement time:
      - up to 10 min
- Operating oxygen pressure: 30 bar
- Cooling medium (C 5004): tap water
- Flow rate: 18 - 42 l/h
- Temperature: 15 - 25 °C
- Max. / min. temperature: 10 / 18 °C
- Min. pressure at the tap: 5 bar

**General Data**
- Dimensions: 800 x 400 mm
- Weight: 61 kg
- Ambient temperature: 20 - 25 °C (constant)
- Ambient humidity: 80 %
- Protection class according to DIN EN 60529: IP 21
C 7000

The C 7000 is the first IKA® calorimeter with a completely dry system for measuring the gross calorific value of solid and liquid samples. The temperature is measured directly in the decomposition system. This results in measurement times in the range of 3 to 7 minutes (depending on the sample). The system can manage up to 8 different decomposition vessels using a code ring scheme.

Functions:
- High sample frequency
- Precise and reproducible determination of gross calorific values according to ISO 1928
- Reduction of routine task through automatic identification of halogens and sulfur
- The decomposition vessel can be changed to use disposable crucibles C 14

C 7000 basic equipment set 1

Consisting of:
- C 7000 Measurement cell
- C 7010 Decomposition vessel, standard
- C 7000 Cooling system
- C 48 Oxygen station

C 7000 basic equipment set 2

Consisting of:
- C 7000 Measurement cell
- C 7012 Decomposition vessel, halogen resistant
- C 7002 Cooling system
- C 48 Oxygen station

C 5040 CalWin

CalWin is a control and evaluation software for all IKA® calorimeters (C 2000, C 4000, C 5000, C 7000). PC operating system requirements: Windows 95 / 98 / ME / NT / 2000 or XP, at least one free serial interface and 50 MB of available disc space.

- Control, monitor and view operational procedures
- Print and save measurement protocols
- Identify and record samples
- Administration of sample racks
- Flexible administration and evaluation of calibrations

Technical data:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating oxygen pressure</td>
<td>30 bar</td>
</tr>
<tr>
<td>Temperature</td>
<td>-20 – 40 °C</td>
</tr>
<tr>
<td>Temperature setting</td>
<td>Digital</td>
</tr>
<tr>
<td>Temperature display</td>
<td>Digital</td>
</tr>
<tr>
<td>Temperature sensor interval</td>
<td>FT 100</td>
</tr>
<tr>
<td>Resolution of display</td>
<td>0,1 K</td>
</tr>
<tr>
<td>Temperature instability at -10 °C</td>
<td>1 K</td>
</tr>
<tr>
<td>Refrigerating capacity at 15 °C</td>
<td>0,3 kW</td>
</tr>
<tr>
<td>at 0 °C</td>
<td>0,2 kW</td>
</tr>
<tr>
<td>at -10 °C</td>
<td>0,14 kW</td>
</tr>
<tr>
<td>at -20 °C</td>
<td>0,07 kW</td>
</tr>
<tr>
<td>Refrigerant</td>
<td>R134a</td>
</tr>
<tr>
<td>Max. delivery capacity of pressure pump</td>
<td>12 l/min</td>
</tr>
<tr>
<td>Delivery pressure (head)</td>
<td>max. 0,2 bar</td>
</tr>
<tr>
<td>Delivery suction pressure (head)</td>
<td>max. 0,1 bar</td>
</tr>
<tr>
<td>Pump connection</td>
<td>M 16 x 1</td>
</tr>
<tr>
<td>Pump connection (hose)</td>
<td>NW6 x 12</td>
</tr>
<tr>
<td>Bath volume</td>
<td>4 l</td>
</tr>
</tbody>
</table>

C 26 Prep stand

Provides a quick and more efficient sample preparation process when loading the C 5010 and C 5012 decomposition vessels. The lid of the decomposition vessel containing the electrodes and crucible holder is fastened with a clamp. This allows the user the freedom to use both hands while feeding the cotton thread through the electrode and into the crucible.

KV 600 digital

KV 600 digital is an active condenser with air-conditioned refrigeration featuring a user-friendly microprocessor controller with large temperature display. The temperature consistency is ± 1 K. The heat injection rate and flow rate of the KV 600 are customized to the IKA® Calorimeter C 2000, C 5000 control pack 2, and C 7000.
### Calorimeters accessories

#### for C 200

<table>
<thead>
<tr>
<th>Item</th>
<th>Ident. No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>C 5010 Decomposition vessel, standard</td>
<td>7114000</td>
<td>C 5010 Decomposition vessel, standard</td>
</tr>
<tr>
<td>C 5012 Decomposition vessel, halogen resistant</td>
<td>7215000</td>
<td>C 5012 Decomposition vessel, halogen resistant</td>
</tr>
<tr>
<td>C 5010.4 Attachment for combustible crucible C 14 (for C 5010 / C 5012)</td>
<td>3016900</td>
<td>C 5010.4 Attachment for combustible crucible C 14 (for C 5010 / C 5012)</td>
</tr>
<tr>
<td>C 5010.5 Crucible holder, big (for C 5010 / C 5012)</td>
<td>3055900</td>
<td>C 5010.5 Crucible holder, big (for C 5010 / C 5012)</td>
</tr>
<tr>
<td>C 5030 Venting station (for C 5010 / C 5012) with gas wash bottle acc. to DIN 12596 (for gas absorption)</td>
<td>7198000</td>
<td>C 5030 Venting station (for C 5010 / C 5012) with gas wash bottle acc. to DIN 12596 (for gas absorption)</td>
</tr>
<tr>
<td>C 5040 CalWin</td>
<td>3045000</td>
<td>C 5040 CalWin</td>
</tr>
<tr>
<td>C 5041.10 Connection cable (PC / Calorimeters)</td>
<td>3036000</td>
<td>C 5041.10 Connection cable (PC / Calorimeters)</td>
</tr>
<tr>
<td>C 21 Pelleting press</td>
<td>1605300</td>
<td>C 21 Pelleting press</td>
</tr>
<tr>
<td>C 26 Prep stand</td>
<td>8804000</td>
<td>C 26 Prep stand</td>
</tr>
<tr>
<td>C 29 Pressure gauge, oxygen</td>
<td>0750200</td>
<td>C 29 Pressure gauge, oxygen</td>
</tr>
<tr>
<td>C 288 Oxygen station</td>
<td>0752000</td>
<td>C 288 Oxygen station</td>
</tr>
<tr>
<td>C 200.1 Measuring cup 2.000 ml</td>
<td>3048900</td>
<td>C 200.1 Measuring cup 2.000 ml</td>
</tr>
<tr>
<td>C 200.2 Conversion kit for C 5012</td>
<td>4028800</td>
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</tr>
</tbody>
</table>

#### for C 2000

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<td>7198000</td>
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</tr>
<tr>
<td>C 5020 Sample rack</td>
<td>7198000</td>
<td>C 5020 Sample rack</td>
</tr>
<tr>
<td>C 5040 CalWin</td>
<td>3045000</td>
<td>C 5040 CalWin</td>
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<tr>
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<td>3036000</td>
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<td>1605300</td>
<td>C 21 Pelleting press</td>
</tr>
<tr>
<td>C 26 Prep stand</td>
<td>8804000</td>
<td>C 26 Prep stand</td>
</tr>
<tr>
<td>C 29 Pressure gauge, oxygen</td>
<td>0750200</td>
<td>C 29 Pressure gauge, oxygen</td>
</tr>
<tr>
<td>C 288 Oxygen station</td>
<td>0752000</td>
<td>C 288 Oxygen station</td>
</tr>
<tr>
<td>C 200.1 Measuring cup 2.000 ml</td>
<td>3048900</td>
<td>C 200.1 Measuring cup 2.000 ml</td>
</tr>
<tr>
<td>C 200.2 Conversion kit for C 5012</td>
<td>4028800</td>
<td>C 200.2 Conversion kit for C 5012</td>
</tr>
</tbody>
</table>

### Consumables for all Calorimeters

#### for C 7000

<table>
<thead>
<tr>
<th>Item</th>
<th>Ident. No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>C 5003.1 Aqua Pro stabilizing agent (20 ml)</td>
<td>7207700</td>
<td>C 5003.1 Aqua Pro stabilizing agent (20 ml)</td>
</tr>
<tr>
<td>C 710.4 Cotton thread, cut to length (500 pieces)</td>
<td>1483700</td>
<td>C 710.4 Cotton thread, cut to length (500 pieces)</td>
</tr>
<tr>
<td>C 5010.3 Ignition wire, spare (5 pieces)</td>
<td>7128800</td>
<td>C 5010.3 Ignition wire, spare (5 pieces)</td>
</tr>
<tr>
<td>C 5012.3 Ignition wire, platinum (2 pieces)</td>
<td>2994900</td>
<td>C 5012.3 Ignition wire, platinum (2 pieces)</td>
</tr>
<tr>
<td>C 4 Quartz dish</td>
<td>1695900</td>
<td>C 4 Quartz dish</td>
</tr>
<tr>
<td>C 5 Set of Vö combustion crucibles (25 pieces)</td>
<td>1749500</td>
<td>C 5 Set of Vö combustion crucibles (25 pieces)</td>
</tr>
<tr>
<td>C 6 Quartz dish, big</td>
<td>0355100</td>
<td>C 6 Quartz dish, big</td>
</tr>
<tr>
<td>C 710.2 Set of Vö combustion crucibles, big (15 pieces)</td>
<td>1483700</td>
<td>C 710.2 Set of Vö combustion crucibles, big (15 pieces)</td>
</tr>
<tr>
<td>C 9 Gelatine capsules (100 pieces)</td>
<td>0749900</td>
<td>C 9 Gelatine capsules (100 pieces)</td>
</tr>
<tr>
<td>C 10 Acetobutyrate capsules (100 pieces)</td>
<td>0750000</td>
<td>C 10 Acetobutyrate capsules (100 pieces)</td>
</tr>
<tr>
<td>C 12 Combustion bags 40 x 35 mm (100 pieces)</td>
<td>2201400</td>
<td>C 12 Combustion bags 40 x 35 mm (100 pieces)</td>
</tr>
<tr>
<td>C 12 A Combustion bags 70 x 40 mm (100 pieces)</td>
<td>2201500</td>
<td>C 12 A Combustion bags 70 x 40 mm (100 pieces)</td>
</tr>
<tr>
<td>C 14 Combustible crucible (150 pieces)</td>
<td>7224600</td>
<td>C 14 Combustible crucible (150 pieces)</td>
</tr>
<tr>
<td>C 15 Paraffin strips (100 pieces)</td>
<td>3131100</td>
<td>C 15 Paraffin strips (100 pieces)</td>
</tr>
<tr>
<td>C 16 Paraffin, 1.000 x 0.5 mm</td>
<td>3801100</td>
<td>C 16 Paraffin, 1.000 x 0.5 mm</td>
</tr>
<tr>
<td>C 17 Paraffin, liquid, 30 ml</td>
<td>3801200</td>
<td>C 17 Paraffin, liquid, 30 ml</td>
</tr>
<tr>
<td>C 43 Benzoic acid NIST.391 (50 g)</td>
<td>0750600</td>
<td>C 43 Benzoic acid NIST.391 (50 g)</td>
</tr>
<tr>
<td>C 723 Benzoic acid, blister package (50 pieces)</td>
<td>3243000</td>
<td>C 723 Benzoic acid, blister package (50 pieces)</td>
</tr>
<tr>
<td>AOD 1.11 Control standard for sulfur and chlorine (50 ml)</td>
<td>3046000</td>
<td>AOD 1.11 Control standard for sulfur and chlorine (50 ml)</td>
</tr>
<tr>
<td>AOD 1.12 Control standard for fluoride and bromine (50 ml)</td>
<td>3080200</td>
<td>AOD 1.12 Control standard for fluoride and bromine (50 ml)</td>
</tr>
<tr>
<td>C 58 Set of wearing parts for C 2000 high pressure</td>
<td>3296300</td>
<td>C 58 Set of wearing parts for C 2000 high pressure</td>
</tr>
<tr>
<td>C 59 Combustion crucibles for C 62 (for C 2000 high pressure)</td>
<td>3260000</td>
<td>C 59 Combustion crucibles for C 62 (for C 2000 high pressure)</td>
</tr>
<tr>
<td>C 08 Pure iron ignition wire (for C 2000 high pressure) (200 m coil)</td>
<td>0749600</td>
<td>C 08 Pure iron ignition wire (for C 2000 high pressure) (200 m coil)</td>
</tr>
<tr>
<td>AOD 1.11 Control standard for sulfur and chlorine (50 ml)</td>
<td>3046000</td>
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</tr>
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<td>C 58 Set of wearing parts for C 2000 high pressure</td>
<td>3296300</td>
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</tr>
<tr>
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<td>0749600</td>
<td>C 08 Pure iron ignition wire (for C 2000 high pressure) (200 m coil)</td>
</tr>
</tbody>
</table>
AOD 1 Decomposition system

Consisting of:
- AOD 1.1 Decomposition vessel C 48 Oxygen station
- AOD 1.2 External ignition unit
- AOD 1.11 Control standard (50 ml)

Technical data:
- Decomposition time < 3 min
- Core temperature > 1,200 °C
- Max. operating temperature 210 °C
- Max. operating pressure 195 bar
- Volume of decomposition vessel 210 ml
- Oxygen pressure 30 bar

Important information:
If protective device AOD 1.3 is not used, an AOD 1.13 remote ignition head is required.

AOD 1.3 Protective device
For use with decomposition vessel AOD 1.1 operated in accordance with Pressure Vessel Directive 97/23/EC.

The controls venting of the combustion gases after decomposition. Complete with DIN 12596 gas wash bottle. For use with decomposition vessels AOD 1.1, C 7010 and C 7012.

Decomposition system accessories

<table>
<thead>
<tr>
<th>Ident. No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>3303000</td>
<td>AOD 1.1 Decomposition vessel</td>
</tr>
<tr>
<td>3348000</td>
<td>AOD 1.2 External ignition unit</td>
</tr>
<tr>
<td>3348100</td>
<td>AOD 1.13 Remote ignition head (required where AOD 1.3 is not used)</td>
</tr>
<tr>
<td>3308000</td>
<td>AOD 1.3 Protective device</td>
</tr>
<tr>
<td>1650100</td>
<td>C 21 Pelleting press</td>
</tr>
<tr>
<td>0750200</td>
<td>C 29 Pressure gauge, oxygen</td>
</tr>
<tr>
<td>3013300</td>
<td>C 48 Oxygen filling station</td>
</tr>
<tr>
<td>3016900</td>
<td>C 5010.4 Attachment for combustible crucible, C 14</td>
</tr>
<tr>
<td>3013300</td>
<td>C 7030 Venting station</td>
</tr>
</tbody>
</table>

Decomposition system consumables

<table>
<thead>
<tr>
<th>Ident. No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1695500</td>
<td>C 4 Quartz dish</td>
</tr>
<tr>
<td>0749900</td>
<td>C 9 Gelatine capsules (100 pieces)</td>
</tr>
<tr>
<td>0750000</td>
<td>C 10 Acetobutyrate capsules (100 pieces)</td>
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</tr>
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<td>3131100</td>
<td>C 15 Paraffin strip (60 pieces)</td>
</tr>
<tr>
<td>3243000</td>
<td>C 723 Benzoic acid, blister package (Combustion aid) (50 pieces)</td>
</tr>
<tr>
<td>3717400</td>
<td>C 723 Benzoic acid, blister package (450 pieces), big pack</td>
</tr>
</tbody>
</table>

Venting station C 7030
With DIN 12596 gas wash bottle, for gas absorption (not included with delivery)
Ident. No. 3013300

External ignition unit AOD 1.2
Ignition triggered by pressing the Ignite button
Cable length: 5 m
Ident. No. 3348000

Decomposition vessel AOD 1.1
High-alloy, halogen-resistant stainless steel
Ident. No. 3303000

Protective device AOD 1.3
As per Pressure Vessel Directive 97/23/EC (not included with delivery)
Ident. No. 3308000

Oxygen filling station C 48
For filling decomposition vessel with oxygen, 30 bar
Ident. No. 1560000

Control standard AOD 1.11 (without fig.)
For sulfur and chlorine
Ident. No. 3044000

Important information:
If protective device AOD 1.3 is not used, an AOD 1.13 remote ignition head is required.

AOD 1.1 Decomposition vessel
C 48 Oxygen station
AOD 1.2 External ignition unit
AOD 1.11 Control standard (50 ml)

- Oxidative decomposition of solid and liquid organic samples under pressure in a closed system
- Quantitative decomposition of all halogens, sulfur as well as volatile metals, e.g. As and Hg
- Absorption of the combustion products in an aqueous medium
- Catalytic support of the oxidation process with auto-regenerating catalytic inside walls of the decomposition vessel
- Pressure vessel of high-grade stainless steel
- Decomposition temperature up to 1,200 °C
- Max. operating pressure during decomposition 195 bar
- Decomposition time < 3 min
- The decomposition vessel can be changed to use disposable crucibles C 14
- Control standards for Cl, S, F and Br
- Introduction of the combustion gases into the absorption solution via venting station C 7030

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Important information:
If protective device AOD 1.3 is not used, an AOD 1.13 remote ignition head is required.
Hotlines

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Subject to technical changes.