



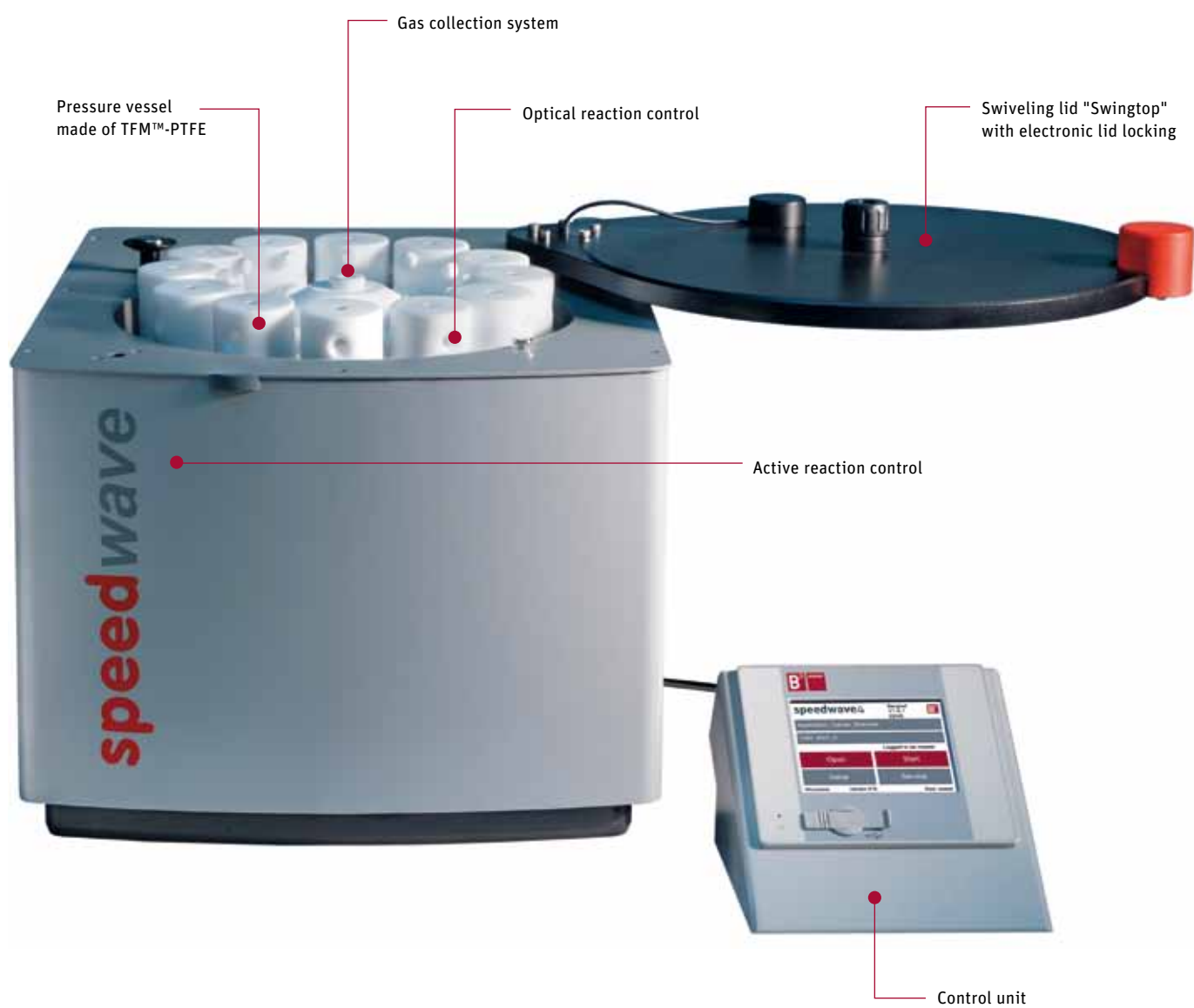
LABORATORY EQUIPMENT

Microwave digestion

Uncomplicated and straightforward

Speedwave Four

Features



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02



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The innovative overall concept behind Speedwave Four is customised to the requirements of the modern laboratory. On the one hand by simple handling as a result of the intelligent top-loading design, which makes individual loading of the microwave oven possible. On the other hand the complete dispensing of reference vessels as a result of the highly-developed sensor technologies. A clearly perceptible additional benefit for customers productivity and efficiency.

Highest degree of safety and convenient handling due to the swing top with electronic lid locking

The top-loader microwave Speedwave Four offers unsurpassed safety regarding pressure digestion due to the stable swing top with electronic locking. The microwave door cannot be opened manually during operation. The roomy sample chamber, which can be easily accessed from above, makes it possible to insert and remove the digestion vessels in the rotor.

Safe digestions thanks to optical reaction control

The patented optical process for temperature and pressure measurement of each individual sample guarantees active and safe reaction control. The contact-free sensor technology means that the complicated connecting of sensors to samples or reference vessels is a thing of the past.

Safety as a result of active reaction control

The Speedwave Four is controlled by the continuous adjustment of microwave power. A prerequisite in order for this is a delay-free measurement of temperature and a continuous monitoring of pressure development in all pressure vessels within milliseconds. Only in this way can spontaneous reactions be effectively intercepted and safe control of the reaction be achieved. With each rotation of the turntable the temperature and pressure of the sample in each vessel are registered contact-free and the power of the microwave is simultaneously and continuously adjusted. This regulation concept results in reproducible heating curves and as a result in reproducible digestion results.

Venting system prevents emissions and corrosion

All digestion vessels are firmly connected to a gas collection system which, even if the rupture disc breaks, collects all nascent gases and discharges them without risk. The oven chamber is permanently evacuated during operation in order to eliminate possible emissions of gases and acid fumes.

Simple operation and documentation

The external control unit provides the greatest possible operating convenience and flexibility. The operating software is clearly structured and intuitive. Temperature and pressure data from all samples are displayed in real time and saved. An Ethernet interface in the control unit permits connection of the microwave digestion system to a network. Any computer on the network can be used for operations. Data transfer and documentation are thus extremely simple. As an alternative, all data can be transferred via the USB interface on the front.

Suitable pressure vessels for every application

For all fields of application pressure vessels of various capacities made of high-quality TFM™-PTFE are available. They are distinguished by their outstanding safety and long service life coupled with easy manual handling. The material and equipment concept is of particular interest to the purchaser since Berghof includes the vessels in the warranty for the unit.

Stainless steel housing with PFA coating that retains its value

The high-quality PFA coating of the stainless steel oven effectively protects the Speedwave Four from corrosion and ensures that the system retains its value.

01 All digestion vessels are entirely manufactured from high-quality TFM™-PTFE.

02 The vessels are simple to handle.

03 The gas collection system collects nascent gases and discharges them at no risk.

Small, handy, but still safe. All pressure vessels are made completely of TFM™-PTFE and consist of only a few parts. The vessels can be opened and closed with-out tools. The residual pressure is released in a controlled manner during opening providing safety for the user. The generous internal diameter makes cleaning a matter of child's play.





Flexibility in use

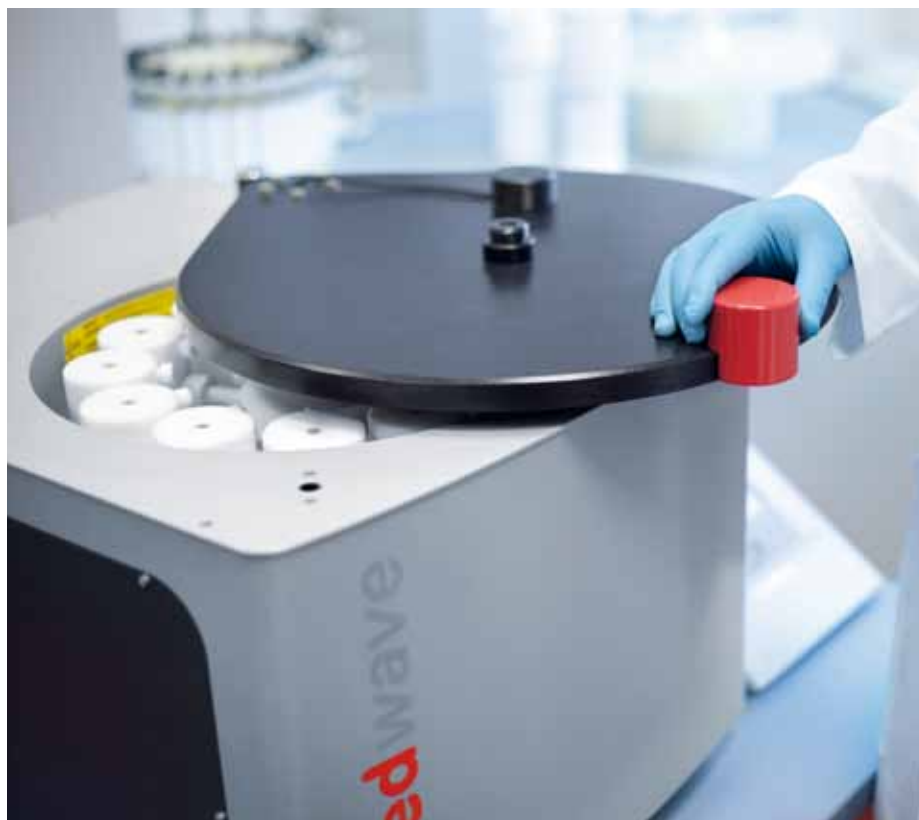
Microwave digestion must work and have to deliver dependable results. The innovative concept behind the vessels also provides solutions for dealing with the most difficult sample materials. The digestion vessels and rotor are independent components, making it possible to place the pressure vessels individually in the oven chamber and to remove them. After just a short cooling down period vessels can be exchanged without the need to ventilate the system beforehand. This flexibility permits a high sample throughput rate and outstanding productivity.

Moreover, a multitude of requirements (EPA 3051, EPA 3052 or EPA 3015, for example) can be satisfied with the pre-installed and easily retrievable standard programs.

Fields of application

- DAP-40+ digestion vessels for a high flow rate of samples in foodstuff, environmental and medical analytics.
- DAP-30+ small-capacity vessel for the digestion of inorganic samples
- DAP-60+ | DAP-100+ standard vessels for a wide range of environmental, foodstuff and inorganic samples such as those involving oxides, metals and alloys
- DAK-100/4 high pressure vessels for difficult to digest inorganic samples and polymers as well as high samples weights or organic material for food and pharmaceutical industry

The innovative safety, sensor and control concept of the Speedwave Four provides the greatest possible safety for all operating conditions. The risk of spontaneous reactions is reduced to a minimum.



01

Reliable reaction control

For a safe and dependable reaction control it is necessary to head off spontaneous reactions effectively.

This is actively achieved by:

- instantaneous temperature and pressure monitoring of all samples in real time
- shut-down in case of critical operating conditions
- excess temperature switches for monitoring the oven chamber and electronics

- controlled release of the residual pressure when opening the digestion vessels

As well as passively by:

- safeguarding from excess pressure by reliable rupture protection
- integrated gas collection system for the effective prevention of emissions
- robust, pressure-resistant, PFA coated stainless steel oven chamber
- top-loading design with electronic safety locking

01 Speedwave Four with innovative top-loading design for safety

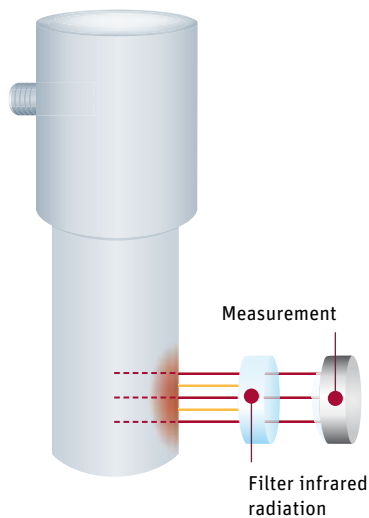
02 Large metallic rupture discs ensure rapid and reliable pressure relief



02

Sensors

- no sensors in the sample vessel, significantly simplifying handling of the vessels. No risk is posed regarding damage or wear as a result of frequent mounting and disassembly, nor regarding contamination of the samples
- absolute chemical resistance of the sensors in the oven chamber
- no interference caused by microwave radiation. All sensors and their circuits are located outside the microwave field

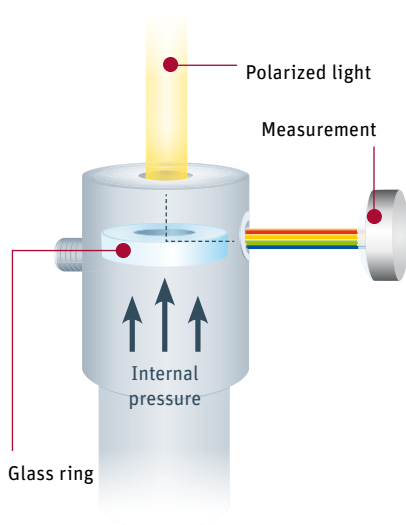


speedwave®DIRC

Sample temperature registered directly, contact-free and in real time

With its patented Speedwave DIRC thermometer Berghof is taking a new direction. Thermal radiation in the mid infrared range in which TFM™-PTFE and quartz materials cannot absorb the radiation are measured contact-free. Filtering out of infrared radiation from the surface of

the pressure vessels makes this process very precise and reliable. This permits the direct and real time detection of the temperature of each individual sample. Based on the temperature information the magnetron output is continually adjusted, thus achieving effective temperature control.



speedwave®OPC

Optical, contact-free pressure measurement

The patented Speedwave OPC optical pressure measurement and control process specially developed by Berghof for microwave digestions functions completely contact-free. A glass ring, on which the vessel's internal pressure acts, is used here as a sensor element. The glass ring firmly integrated in the lid of the pressure vessel is illuminated by a beam of

polarised light. The colour change in the polarised light resulting from the effect of the pressure is measured, so that the pressure in each vessel can be directly detected. The information of increased pressure is incorporated in the power control system and the magnetron output continuously adjusted. This hinders activation of the rupture disc and prevents loss of samples.

Speedwave Four

Technical specifications

Speedwave Four	
Power supply	230 V / 50 Hz
Magnetron performance	1,450 W (DAP-60+: 121 W per digestion vessel)
Frequency	2,450 MHz
Power control	Continuously 0-100%
Weight/ Dimensions	Basic unit approx. 65 kg / 530 x 630 x 420 mm (w x d x h) Control unit: approx. 3 kg / 220 x 240 x 150 mm (w x d x h)
Oven diameter	Circular microwave oven for homogeneous distribution of microwaves Uniform heating of all samples Approx. 25 L / (d x h) 360 x 250 mm
Coating	90 µm PFA (fired at least 350°C)
Internal diagnostics	Magnetron status, magnetron temperature, oven temperature, high voltage transformer, lid block
Noise level	< 60 dB
Control unit	Coloured touchscreen
Interfaces	USB, RS-232, Ethernet
Languages	German, English, French, Italian, Spanish, Polish
Temperature measurement	Patented DIRC thermometer for individual temperature measurement in each single digestion vessel, measurement range 50-260°C, 1°C precision at 200°C
Pressure measurement	Patented OPC sensor for individual pressure measurement in each single digestion vessel, measurement range 0-100 bar, accuracy < 5 bar (depending on vessel type)
Turntable function	Continuous clockwise rotation
Vessel material	Isostatically molded TFM™-PTFE
Vessel types	DAP-40+: 40 mL, 40 bar (580 psi), 24 vessels per turntable DAP-30+: 30 mL capacity, 80 bar (1,160 psi), 12 vessels per turntable DAP-60+: 60 mL capacity, 40 bar (580 psi), 12 vessels per turntable DAP-100+: 100 mL capacity, 40 bar (580 psi), 12 vessels per turntable DAK-100/4: 100 mL, 100 bar (1,450 psi), 8 vessels per turntable
Safety testing	CE conformity complies with EN 335-25, DIN EN 61010-1, DIN EN 61326-1, DIN EN 61326-2
Warranty	12 months, including digestion vessels

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