The Next Generation

High Pressure

highpreactor

BR-25
BR-100
BR-300
BR-1000
BR-4000

Reactors

BERGHOF
PRODUCTS + INSTRUMENTS
ZUNDEL Holding Enterprise

realizing your ideas.

The Next Generation

Greater Value

BERGHOF high pressure reactors are constructed of the highest quality materials. Each reactor is the product our experience in laboratory instrument design and construction, gained in over 25 years. Continuous product evaluation and innovative development mean that BERGHOF high pressure reactors are up-to-date products.

THE NEXT GENERATION stands for both the expansion of our product line to include smaller volumes (down to 25ml) as well as for more flexibility of essential product features. For the first time, all high pressure reactors are now available as pure stainless steel or Hastelloy reactors, as well as with complete PTFE lining; a feature unique to BERGHOF. All fittings are also available in these materials.

Thanks to the high quality of the employed materials and the high precision during manufacturing, BERGHOF high pressure reactors offer above average service lives.

All reactor vessels are individually tested and certified.
Naturally, individual customer needs will continue to be met with special designs.

This is “added value” you can comprehend: technically safe and reliable; economical in use, and; simple with regard to handling.

Greater Stirring Force

The selection ranges from economical magnetic bar stirrers for low-volume high pressure reactors, up to magnetic couplings with a variety of drives and torque levels.
Special designs with torque values up to 12 Nm are also available for use with particularly viscous media such as melts.
The magnetic couplings are made of either stainless steel or Hastelloy and can be outfitted with PTFE, stainless steel, or Hastelloy stirrers in a wide variety of shapes and designs.

Greater Comfort

The high pressure reactors are equipped with clamping rings or clamping chains for quick and easy opening without the need for tools.

All fittings are designed to have no dead spaces. Cross- and T-pieces are no longer required. This results in a significant reduction of the contamination risk and makes the high pressure reactors easy to handle and to maintain.
The user can easily remove and reinstall all fittings for cleaning and service.

Greater Safety

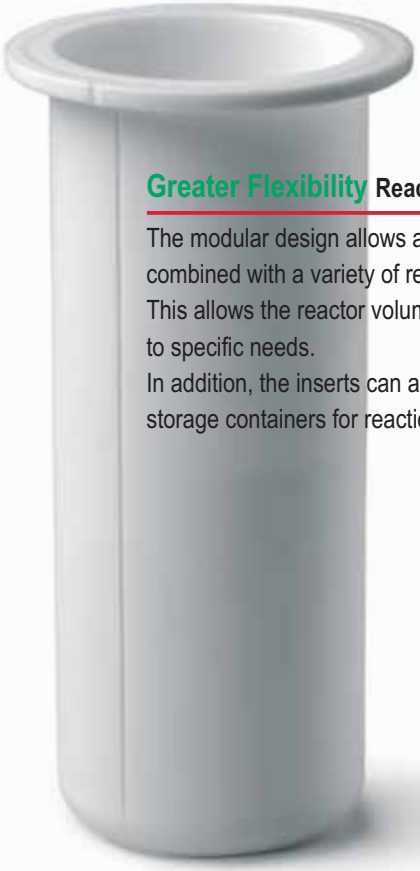
The reactor vessels, made of either stainless steel or Hastelloy, are individually tested and certified.

Greater Flexibility Fittings

With regard to the various fittings used with high pressure reactors, the choice is yours: Aside from the wide selection of standard fittings, special fittings are also available, for example, for liquid injection under operating pressure or for electrode connections. The modular design allows these to be supplemented by additional fittings at any time.
All fitting components are available in either stainless steel or Hastelloy.

Greater Flexibility Materials

The integrated material concept of BERGHOF high pressure reactors makes it easy to find the material best suited for any reaction medium.
The high pressure reactors and fittings come in either pure stainless steel or Hastelloy.
The outstanding characteristic of BERGHOF high pressure reactors lies in the unique, complete PTFE lining of the reactor vessels and lids.
The heavy-walled, several millimeter thick inserts and linings offer effective protection against even the most corrosive materials such as acids and bases.



Greater Flexibility Reactor Vessels

The modular design allows any reactor head to be combined with a variety of reactor vessels and inserts. This allows the reactor volume to be optimally adapted to specific needs.
In addition, the inserts can also serve as practical storage containers for reaction solutions.

The Next Generation

The Details

BERGHOF high pressure reactors come in a wide range, allowing you to individually configure your particular reactor system. The flexibility when it comes to reactor selection combined with the available material combinations guarantee that the right reactor system can be configured for practically any reaction mixture and preparation size.

BERGHOF offers a well-rounded reactor program: A comprehensive line of accessories such as heaters, temperature controllers, stirrers offering a variety of torque levels, stand systems, data loggers, software, and much more make laboratory work easier and more comfortable.

Authorized dealers provide knowledgeable advice in the selection of just the right products. Our technical service offers rapid response and assistance for any questions.

We use workshops and individual demonstrations to impart the necessary “know-how”. Our web pages contain application examples for downloading.

Safety

BERGHOF high pressure reactors are designed, built, and tested in compliance with the 97/23/EG equipment guideline, based on the AD-2000 body of regulations.

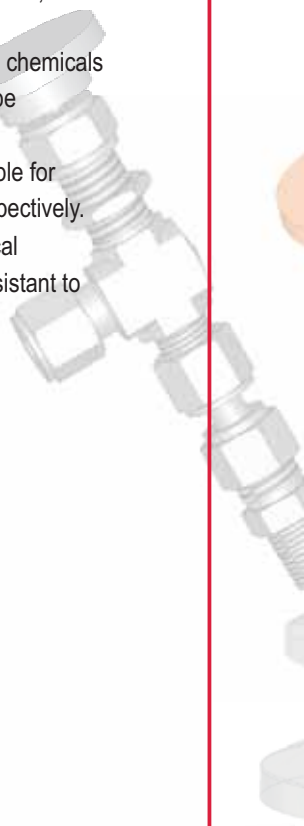
Acting as an independent specialist, the TÜV inspects the design and carries out pressure testing where required for CE qualification.

Each BERGHOF high pressure reactor is hydrostatically pressure-tested at 1.6-times its maximum operating pressure and undergoes a leak test with nitrogen. Only after passing these tests and prior to delivery do BERGHOF high pressure reactors receive the associated plant certificate to document their faultless function. On request we can also provide explosion-proof pressure sensors and manometers.

BERGHOF Products + Instruments GmbH is certified in accordance with DIN EN ISO 9001:2000.

Sealing

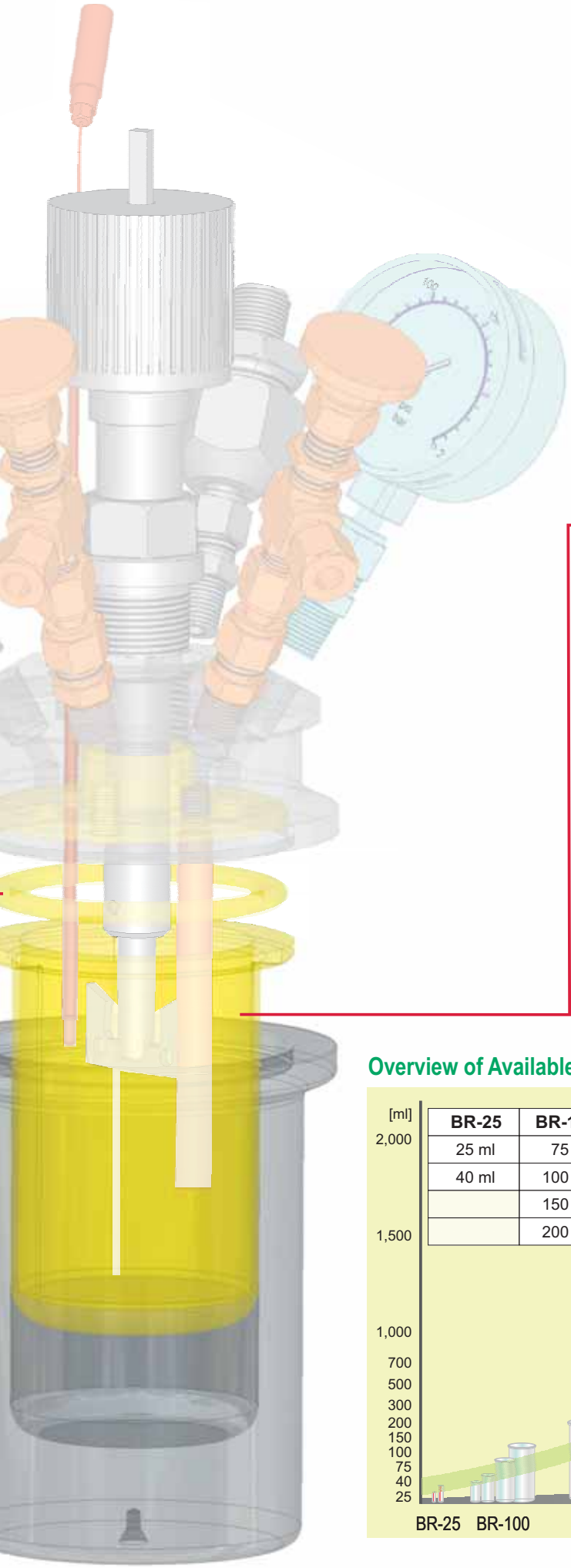
Reliable reactor sealing is provided by a conical flange lock and an O-ring made of PTFE, Viton® , or Kalrez®.
Easy-to-use, quick-release clamping chains or clamping rings are used for tool-free opening and closing.
The various materials used for the O-rings have different, application-specific characteristics:
PTFE offers unsurpassed resistance to practically all chemicals and permits operating temperatures up to 230°C to be employed.
Viton® and Kalrez® are true elastomers and are suitable for operating temperatures up to 230°C and 300°C, respectively.
In contrast to PTFE, Viton® has a very limited chemical resistance while, as a fluoro-elastomer, Kalrez® is resistant to most chemicals.



Reactor Vessels

All BERGHOF high pressure reactor vessels are available in either stainless steel or Hastelloy.
Stainless steel reactors are ideally suited for applications involving organic solvents and most organic acids.
These reactors can be fully lined with PTFE.
The lining consists of a removable PTFE insert with a wall thickness between 1.6 mm and 7.4 mm together with an at least 3.7 mm-thick PTFE liner in the reactor lid.
Together, these provide effective corrosion protection for all reactor components which come into contact with the medium.

We recommend reactors and fittings made entirely of Hastelloy to provide corrosion protection for applications involving strong mineral acids or aggressive gases.



Inserts

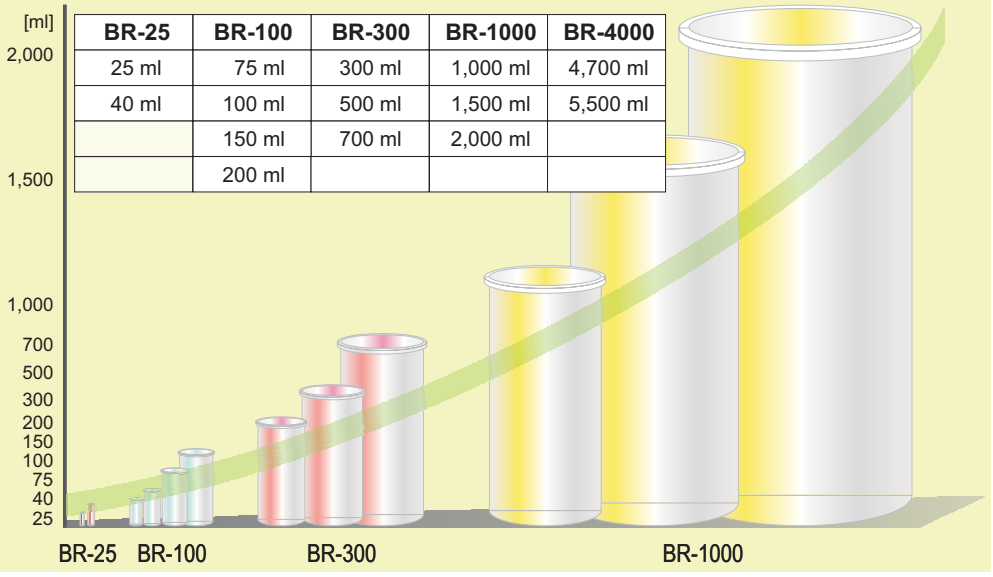
Only BERGHOF high pressure reactors offer the optional PTFE lining feature for corrosion protection. For this feature, a PTFE insert with a wall thickness between 1.6 mm and 7.4 mm is placed in the reactor vessel.

The variable insert wall thicknesses also permit precise graduation of the reactor volume.

Tip: The PTFE inserts can also serve as practical storage containers for reaction solutions.

Overview of Available PTFE Inserts

BR-25	BR-100	BR-300	BR-1000	BR-4000
25 ml	75 ml	300 ml	1,000 ml	4,700 ml
40 ml	100 ml	500 ml	1,500 ml	5,500 ml
	150 ml	700 ml	2,000 ml	
	200 ml			



The Next Generation

Standard Fittings

All standard fittings are available in either stainless steel or Hastelloy.
A standard fitting consists of a gas valve to vent the reactor and a rupture disc to provide protection against over-pressure.
Optionally, an overflow valve can also be installed as a redundant over-pressure protection device. The over-pressure valves are equipped with a coupling for pressure lines to harmlessly carry off released gases and vapors.

Standard fittings can be modified for connection to systems for liquid and gas sampling.

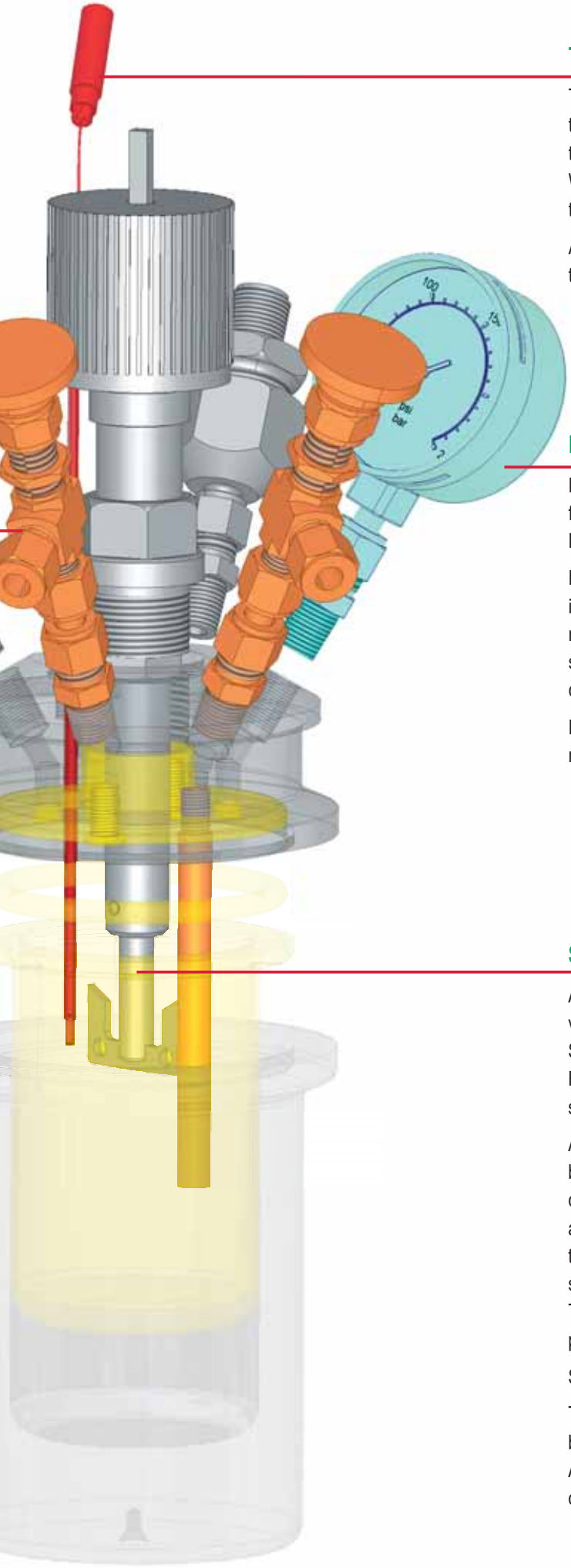
All fittings are equipped with smoothly operating, screw-on clamping rings. This makes BERGHOF high pressure reactors extremely service and maintenance friendly.

Special Fittings

Special fittings available on request include systems for liquids and solids injection at operating pressure, electrode inserts, and view ports.
In addition, test reactors can be adapted to include cameras and interior lighting for material testing.

Reactor Lids

The reactor lid is made of stainless steel and can be effectively protected against corrosion by means of an at least 3.7 mm-thick PTFE lining.
For applications involving strong mineral acids or aggressive gases, we recommend that all components which come into contact with gases (fittings), or even the entire reactor be made of Hastelloy.



Temperature Sensing and Regulation

The internal reactor temperature is continuously measured with the aid of a temperature probe. The temperature probe is inserted into a submersion tube made of stainless steel, stainless steel with a PFA jacket, or Hastelloy. We offer a freely programmable PID temperature controller for heater control.

A second, independent temperature probe can also be installed to protect the reactor against overheating.

Pressure Measurement

Either a manometer or an electric pressure sensor can be factory-installed for pressure measurement.
Manometers for a variety of pressure ranges are available.

Pressure transducer made of either stainless steel or Hastelloy can be installed to protect the pressure measuring system against aggressive media. The pressure transducer transfers the reactor pressure to the sensor or the manometer, without these components themselves having to come into direct contact with the aggressive media.

Explosion-proof pressure sensors and manometers are also available on request.

Stirrer Technology

A variety of stirring techniques are employed, depending on the vessel volume and the medium being stirred.
Small-volume reactors are stirred with the aid of magnetic bar stirrers. Reactors with volumes greater than 300 ml are stirred by means of a stirrer shaft.

A variety of paddle shapes permit an effective adaptation to the media being stirred. Stirring force is transferred via a removable magnetic coupling in the reactor lid. In turn, this coupling is mechanically coupled to an external stirrer motor. With available torque levels ranging from 20 Ncm to 90 Ncm, solutions with viscosities of up to 4000 m Pa s can be easily stirred.
The product line is rounded out by a number of stirrer motors in various power classes, together with their matching mounting stands.

Special models are available if higher torque values are required.

The rotational speed of the working shaft which is held by a sliding bearing made of PTFE / carbon is measured by a contactless sensor.
An additional valve can also be installed for cleaning the internal magnetic coupling.

The Next Generation

The "Little One“ from BERGHOF:

Ideal for the smallest test samples using raw materials which are expensive or difficult to produce.

Stainless Steel SS 316TI:	25 ml or 40 ml
Hastelloy C-4:	25 ml or 40 ml
Stainless Steel SS 316TI with PTFE Insert:	25 ml or 40 ml
Max. operating pressure:	200 bar / 2,900 psi
Max. temperature:	230°C PTFE and Viton® seal 300°C FFPM seal (e.g. Kalrez®)
Stirring:	Magnetic stirrer
Heating:	Hot plate BLH-800 + Heater block

Brief Description

The high pressure reactor is available in Stainless Steel SS 316TI, Hastelloy C-4 , or Stainless Steel SS 316TI with a PTFE insert and with no lid liner.

The useable reactor volume can be varied by the employment of different reactor vessels ranging from 25 ml to 40 ml. Smaller volumes are available on request.

To close the reactor, the vessel is simply screwed into the lid by hand.

The reactor is sealed by means of a conical flange lock and an O-ring made of PTFE, Viton®, or Kalrez®.

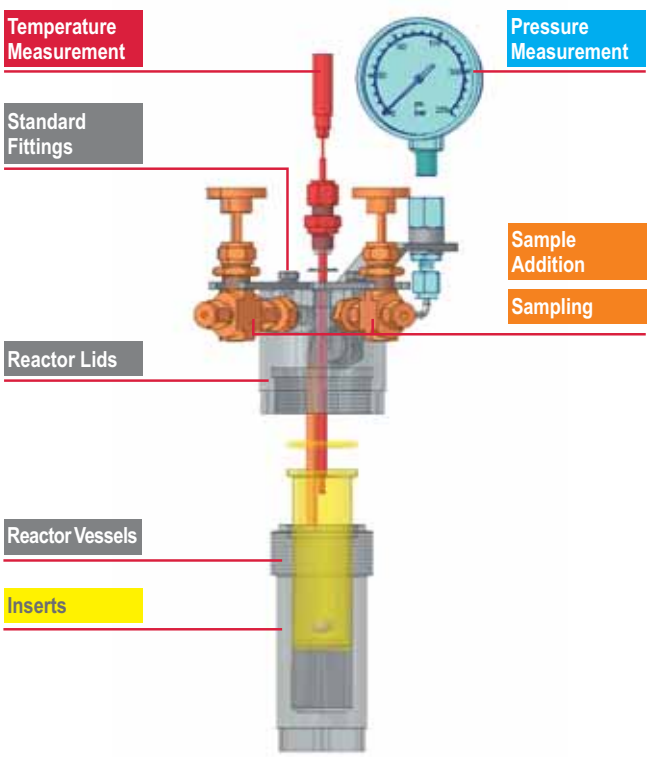
The matching fittings sets are available in Stainless Steel SS 316TI or Hastelloy C-4.

The lid offers a total of six connections which can be employed as follows:

- 1 x temperature probe submersion tube;
- 1 x metal rupture disc to safely limit the maximum pressure;
- 1 x pressure indicator;
- 1 x pressure relief valve;
- 2 x for any other purpose, e.g., a gas sampling valve or liquid sampling.

Temperature regulation is by means of a temperature probe in a submersion tube to measure the internal reactor temperature.

Optionally, a second temperature probe can be employed to provide over-temperature protection.



The “Handy One” from BERGHOF:

The standard reactor for day-to-day laboratory applications.

Brief Description

The high pressure reactor is available in Stainless Steel SS 316TI, Hastelloy C-4, or Stainless Steel SS 316TI with a PTFE lining closed on all sides.

The reactor is locked with a quick-lock chain that is manually applied, without the need for tools.

The reactor is sealed by means of a conical flange lock and an O-ring made of PTFE, Viton®, or Kalrez®.

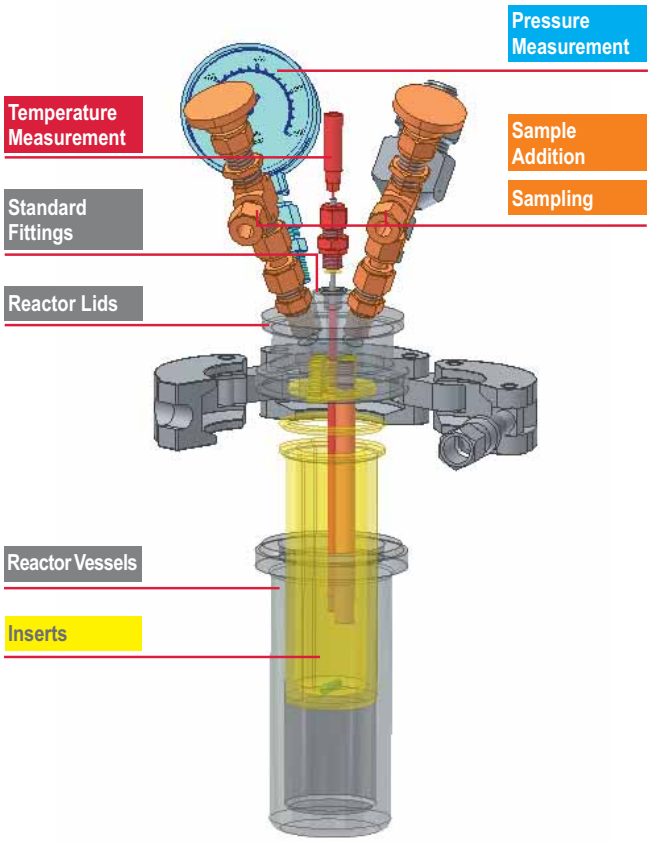
The matching fittings sets are available in Stainless Steel SS 316TI or in Hastelloy C-4.

The lid offers a total of six connections which can be employed as follows:

- 1 x temperature probe submersion tube;
- 1 x metal rupture disc to safely limit the maximum pressure;
- 1 x pressure indicator;
- 1 x pressure relief valve;
- 2 x for any other purpose, e.g., a gas sampling valve or liquid sampling.

Temperature regulation is by means of a temperature probe in a submersion tube to measure the internal reactor temperature. Optionally, a second temperature probe can be employed to provide over-temperature protection.

Stainless Steel SS 316TI:	150 ml or 200 ml
Hastelloy C-4:	150 ml or 200 ml
Stainless Steel SS 316TI with PTFE Insert:	75 ml, 100 ml, 150 ml or 200 ml
Max. operating pressure:	200 bar / 2,900 psi
Max. temperature:	230°C PTFE and Viton® seal 300°C FFPM seal (e.g. Kalrez®)
Stirring:	Magnetic stirrer
Heating:	Hot plate BLH-800 + Heater block



The Next Generation

The “Universal One” from BERGHOF:

Persuasive with its wide variety of stirring and heating options.

Stainless Steel SS 316TI:	350 ml, 600 ml or 900 ml
Hastelloy C-4:	350 ml, 600 ml or 900 ml
Stainless Steel SS 316TI with PTFE Insert:	300 ml, 500 ml or 700 ml
Max. operating pressure:	200 bar / 2,900 psi
Max. temperature:	230°C PTFE and Viton® seal 300°C FFPM seal (e.g. Kalrez®)
Stirring:	Magnetic stirrer or Magnetic coupling
Heating:	Hot plate BLH-800 + Heater block Heating jacket BHM-300, BHM-500, BHM-700 Thermostatic jacket BTM-300, BTM-500, BTM-700

Brief Description

The high pressure reactor is available in Stainless Steel SS 316TI, Hastelloy C-4, or Stainless Steel SS 316TI with a PTFE lining closed on all sides.

The reactor is locked with a quick-lock clamp that is manually applied, without the need for tools.

The reactor is sealed by means of a conical flange lock and an O-ring made of PTFE, Viton® or Kalrez®.

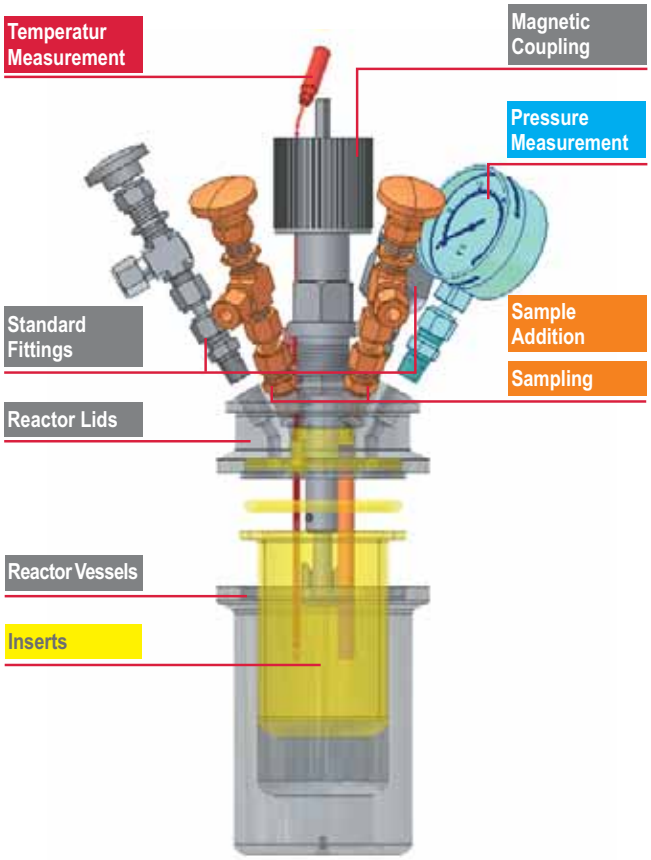
The matching fittings sets are available in Stainless Steel SS 316TI or in Hastelloy C-4.

The lid offers a total of six connections which can be employed as follows:

- 1 x temperature probe submersion tube;
- 1 x metal rupture disc to safely limit the maximum pressure;
- 1 x pressure indicator;
- 1 x pressure relief valve;
- 2 x for any other purpose, e.g., a gas sampling valve or liquid sampling.

Temperature regulation is by means of a temperature probe in a submersion tube to measure the internal reactor temperature. Optionally, a second temperature probe can be employed to provide over-temperature protection.

A matching stand system is available for mounting the stirrer drive.



The “Big One” from BERGHOF:

Exactly right for larger test samples.

Stainless Steel SS 316Tl:	1,100 ml, 1,700 ml or 2,300 ml
Hastelloy C-4:	1,100 ml, 1,700 ml or 2,300 ml
Stainless Steel SS 316Tl with PTFE Insert:	1,000 ml, 1,500 ml or 2,000 ml
Max. operating pressure:	200 bar / 2,900 psi
Max. temperature:	230°C PTFE and Viton® seal 300°C FFPM seal (e.g. Kalrez®)
Stirring:	Magnetic coupling
Heating:	Heating jacket BHM-1000, BHM-1500/2000 Thermostatic jacket BTM-100, BTM-1500/2000

Brief Description

The high pressure reactor is available in Stainless Steel SS 316Tl, Hastelloy C-4 or Stainless Steel SS 316Tl with a PTFE lining closed on all sides.

The reactor is locked with a quick-lock chain that is manually applied, without the need for tools.

The reactor is sealed by means of a conical flange lock and an O-ring made of PTFE, Viton® or Kalrez®.

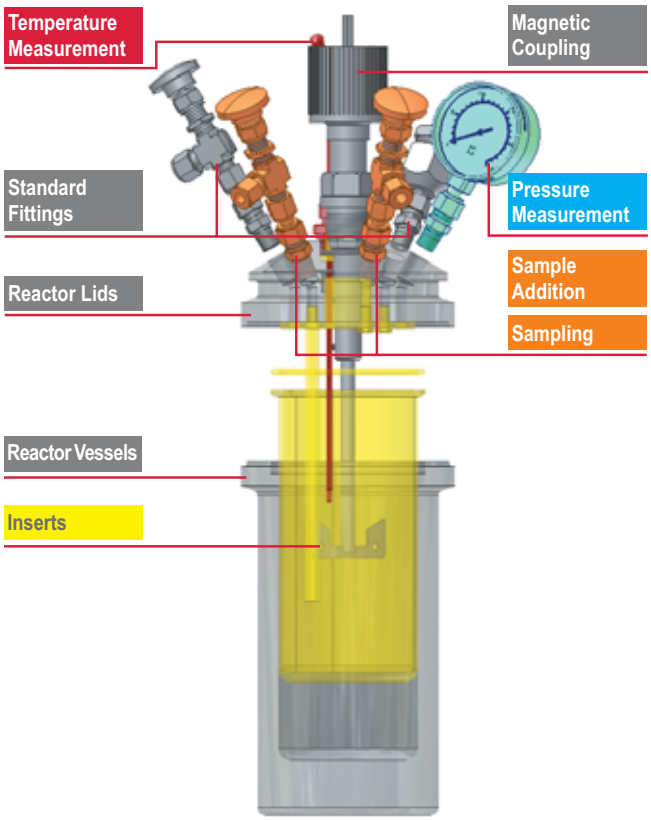
The matching fittings sets are available in Stainless Steel SS 316Tl or in Hastelloy C-4.

The lid offers a total of six connections which can be employed as follows:

- 1 x temperature probe submersion tube;
- 1 x metal rupture disc to safely limit the maximum pressure;
- 1 x pressure indicator;
- 1 x pressure relief valve;
- 2 x for any other purpose, e.g., a gas sampling valve or liquid sampling.

Temperature regulation is by means of a temperature probe in a submersion tube to measure the internal reactor temperature. Optionally, a second temperature probe can be employed to provide over-temperature protection.

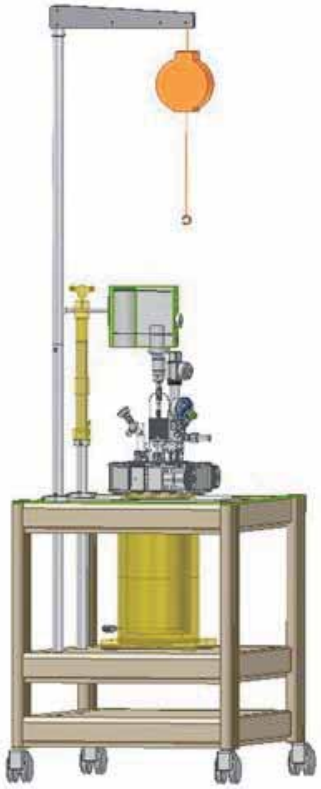
A matching stand system is available for mounting the stirrer drive.



The Next Generation

The “Strong One” from BERGHOF:

Exactly right for your kilo-lab.



Stainless Steel SS 316Tl:	5,500 ml
Hastelloy C-4:	on request
Stainless Steel SS 316Tl with PTFE Insert:	4,700 ml
Max. operating pressure:	150 bar/2,175 psi
Max. temperature:	230°C FPM and Viton® seal 300°C FFPM seal (e.g. Kalrez®)
Stirring:	Magnetic coupling
Heating:	Heating jacket BHM-4000
	Thermostatic jacket BTM-4000
	Internal heating/cooling coil

Brief Description

The high pressure reactor is available in Stainless Steel SS 316Tl, Hastelloy C-4 or Stainless Steel SS 316Tl with a PTFE lining closed on all sides.

The reactor is locked with a quick-lock chain that is manually applied.

The reactor is sealed by means of a conical flange lock and an O-ring made of Viton® or FPM sheathed Viton®.

The matching fittings sets are available in Stainless Steel SS 316Tl or in Hastelloy C-4 on request.

The lid offers a total of eight connections which can be employed as follows:

- 1 x temperature probe submersion tube;
- 1 x metal rupture disc to safely limit the maximum pressure and exhaust ventilation;
- 1 x pressure indicator;
- 1 x pressure relief valve;
- 2 x Heating/cooling coil;
- 2 x for any other purpose, e.g., a gas sampling valve or liquid sampling.

Temperature regulation is by means of a temperature probe in a submersion tube to measure the internal reactor temperature. Optionally, a second temperature probe can be employed to provide over-temperature protection.
Reactor is mounted on a laboratory cart with crane and stand system for mounting the stirre drive.

BERGHOF offers a variety of heating systems. They are all matched to the volumes of the various reactors.

For small reactors up to 300 ml, economical laboratory hot plates with heating block attachments can be employed. Reactors with a nominal volume of 300 ml or greater are heated by means of heating jackets in the form of either an electric or thermostat-equipped jacket connected to a recirculating thermostat.

The BTC-3000 universal regulating unit with integrated data logging function provides process security and secure access as the process progresses.

The reactor systems up to 2 liters are designed as easily operated tabletop units with a stand on which to mount stirrer motors.

Electric Heating Jackets BHM-300 to BHM-4000

The electrically heated BERGHOF heating jackets are equipped with an insulated hood made of coated stainless steel.

This allows the removable reactors to be efficiently and economically heated up to their maximum internal temperature.

The overtemperature protection built into the heating jacket can be adjusted to temperatures between 50°C and 300°C.

Temperature regulation

The temperature progression of a BERGHOF high pressure reactor is guided based on the reactor's internal temperature as measured by the thermal element in the reactor's immersion tube.

The temperature is controlled and monitored by the BTC-3000 temperature controller. All process data can be saved to an external PC.

Power supply:	230V / 50Hz
Output:	
BHM-300, BHM-500, BHM-700	1,000 W
BHM-1000, BHM-1500/2000	2,000 W
BHM-4000	3,000 W
Operating temperature:	0 – 350 °C

Overtemperature protection:	50 – 300 °C, adjustable
Temperature probe:	NiCrNi, DIN 43710
Heater connection:	To the controller, 230 V / 50 Hz using a 3-pin plug-in connector
Protection:	IP 54

Heating and Stirring

BLH-800 Laboratory Hot plate
With Built-In Magnetic Stirrer for Small Reactors

Heating block attachments have no active heating elements. Heating is by means of a laboratory hot plate. The heating block's insulating hood is made of coated stainless steel.
It permits the reactors to be efficiently heated up to their maximum internal temperature without excessive radiant heat.

The magnetic stirrer integrated into the laboratory hotg plate permits touch-free control of the magnetic stirring rod in the reactor.

Temperature regulation
In the simplest case, the temperature is regulated by adjusting the temperature of the laboratory hot plate. In such cases, the reactor's internal temperature should be monitored with an optionally available temperature display. The internal temperature can, however, be controlled and regulated much more precisely using the BTC-3000 temperature controller.

Power supply:	230 V / 50 Hz
Output:	850 W
Speed:	0 – 1,250 rpm
Temperature probe:	NiCrNi, DIN 43710
Dimensions (L x W x H):	200 x 230 x 250 mm
Hot plate diameter:	145 mm
Weight:	approx. 4,000 g

Thermostatic Jacket
BTM-300 to BTM-4000

Thermostatic jackets do not have any active heating elements. The stainless steel double jackets are heated or cooled by means of liquid flowing between the jacket sections. The reactors are not welded to the thermostatic jackets. Instead, they are simply placed into them and can thus be removed at any time. This results in a significant decrease in the weight of the reactor and the double jacket. Handling is also correspondingly simplified.

Temperature regulation
The temperature is regulated by means of a recirculating thermostat. This thermostat is not part of the standard delivery.

Thermostatic jackets are preferable to electric heating jackets wherever constant heating or cooling is required but where heating programs are not necessary.

Operating temperature: -20 – +350°C

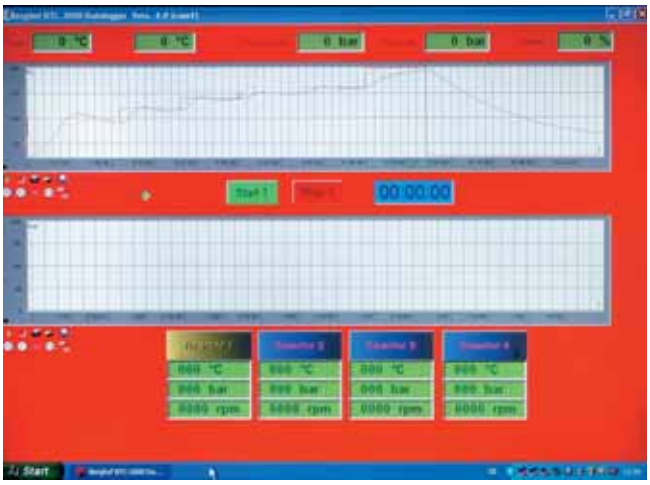
BTC-3000 Temperature Controller

Power supply:	90 - 240 V
Max. switching current:	16 A
Max. heat output:	3,000 W
Fusing:	Automatic cutout in the mains power plug
Temperature probe:	NiCrNi, DIN 43710
Temp. probe break indicator:	Yes
Measuring range:	0 to 500 °C, depending on the employed sensor
Display accuracy:	+/- 1 °C
Measuring accuracy:	+/- 3 °C across the entire measurement range
Type of regulation:	PID controller
Temperature program:	Max. of six steps comprising warm-up time, hold time and setpoint temperature, pressure monitoring
Max. program duration:	400 hr or approx. 17 days
Pressure sensor signal input:	0 – 20 mA or 4 20 mA
Pressure sensor break indicator:	Yes, for 4 – 20 mA sensors
Display accuracy Pressure signal:	+/- 1 bar

The easy-to-use BERGHOF temperature controller unites all control and regulating parameters in a single, compact unit. All process parameters are easily accessible. The built-in data logger allows the parameters to be documented on a PC.

- The heating programs are programmed and controlled in up to six steps comprising warm-up time, hold time and temperature. The PID (Proportional Integral Derivative) controller's regulating parameters are freely programmable. The temperature progression can be graphically monitored on the built-in display.
- The BTC-3000 regulating unit can be employed as a universal temperature controller for devices with a power consumption of up to 3,000 W.
- The actual stirring speed can also be regulated. A REED relay provides touch-free measurement and regulation of the speed of the internal stirrer.
- Connecting a second temperature probe allows a second, independent overtemperature protection to be implemented. An own temperature sensor and a separate, independent electronic circuit allow the greatest possible degree of process security to be obtained.

The software included as part of the standard delivery permits data from up to eight channels to be recorded to an external PC. The software can be used, for example, to record the temperature and pressure progression of up to four reactors while simultaneously regulating the temperature. Or the temperature and pressure progression of two reactors can be recorded together with the stirring speed.



Overtemperature protection:	Preset at: 300 °C 50 – 300°C, adjustable
Speed:	0 – 2,000 rpm
Display:	62 x 42 mm, 128 x 64 pixels sw LCD
External dimensions (L x W x H):	280 x 170 x 125 mm
Weight:	approx. 1,600 g

The Next Generation

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Overview: Reactor – Heating systems – Temperature Controller BTC-300

	BR-25	BR-100	BR-300	BR-1000	BR-4000
Laboratory hot plate w. built-in magnetic stirrer	X	X	X (300 ml only)		
Electric heating jacket w. controller unit for temperature, stirring and pressure			X	X	X
Thermostatic jacket			X	X	X

X = Possible reactor and heating method combination

= Regulation using the BTC-3000 is possible

Customer/Operator's Responsibility

The greatest care has been taken in the manufacture and testing of all BERGHOF high pressure reactors in order to ensure safe operation within their specified range of characteristics.

However, the customer/operator must still exercise proper care in the employment of BERGHOF high pressure reactors.
The customer/operator is solely responsible for the selection of the proper reactor. The customer/operator must ensure that the reactor is adequately dimensioned for the intended application and that the employed materials are suitable.

BERGHOF will be happy to advise you on these and any other questions and, on request, will be pleased to provide appropriate informational material.

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BERGHOF realizing your ideas.
PRODUCTS + INSTRUMENTS
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