

## Laboratory Technology

### Legal Requirements **high**preactor

Within the European Union, 97/23/EG (pressure equipment guideline) and 87/404/EG (guideline for simple pressure vessels) bring the various national technical requirements into line. In the German Code, these have been included in the 6th and 14th Equipment Safety Laws. This enacted harmonized characteristics requirements. However, harmonized technical rules or adapted national construction requirements (e.g., AD-2000 in the FRG) may also apply.

**Manufacturers of pressure equipment are free to select among these regulations based on their countries!**

If the pressure vessel was manufactured in accordance with the German AD-2000 body of rules, recurring inspection is only required every 5 years. If the pressure vessel was manufactured in accordance with the national regulations of the countries listed below, the following inspection periods apply.

Countries	D	F	B	I	L	NL	GB	S
Recurring inspections in years	5	1.5-3	1-3	1-2	5	4	2.17	3

Operation of pressure equipment is regulated by the European Union's individual member states. In Germany, this is regulated by the industrial safety code, supplemented by a secondary body of technical rules.

**The operator must comply with all locally applicable operating regulations. With regard to the recurring inspections, operators within the European Union may choose to abide by either their national requirements or by the German requirements. This is possible because the reactor has been manufactured in accordance with the AD-2000 body of rules and these rules are recognized throughout the EU. Therefore, an inspection period of 5 years applies to all Berghof high-pressure laboratory reactors employed within the European Union.**

### Operating Regulations and Characteristics Requirements

Characteristics of Pressure Equipments		Operation of Pressure Equipment	
<b>EG</b>	EC Guideline 97/23/EG (Pressure Device Guideline))	EC-Guidelines 89/655/EG, 95/63/EG, 2001/45/EG (Employment of Work Equipment)	
<b>BRD</b>	§3, Para. 1 Equipment and Product Safety Code (GPSG)	§§18, 19 Occupational Safety Code	§§2(7), 14 GPSG (Equirement Requiring Inspection)
	14. GPSGV Pressure Equipement V	Occupational Safety Code	

Due to the particular hazards related to pressure vessels and their use, they have been classified as "equipment requiring inspection" under the German equipment and occupational safety code (GPSG, January 6, 2004)

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## Categories

The reason for this classification lies in the energy stored in the pressure vessel. This energy can be expressed as the pressure content product. Pressure equipment is subdivided into the following categories on the basis of this pressure content product and the charging media (fluid):

**1. Pressure content product:**  $P \cdot V = [\text{bar} \cdot \text{l}]$ ; (1 bar  $\cdot$  l for gases, this corresponds to approx. 100 Joule)

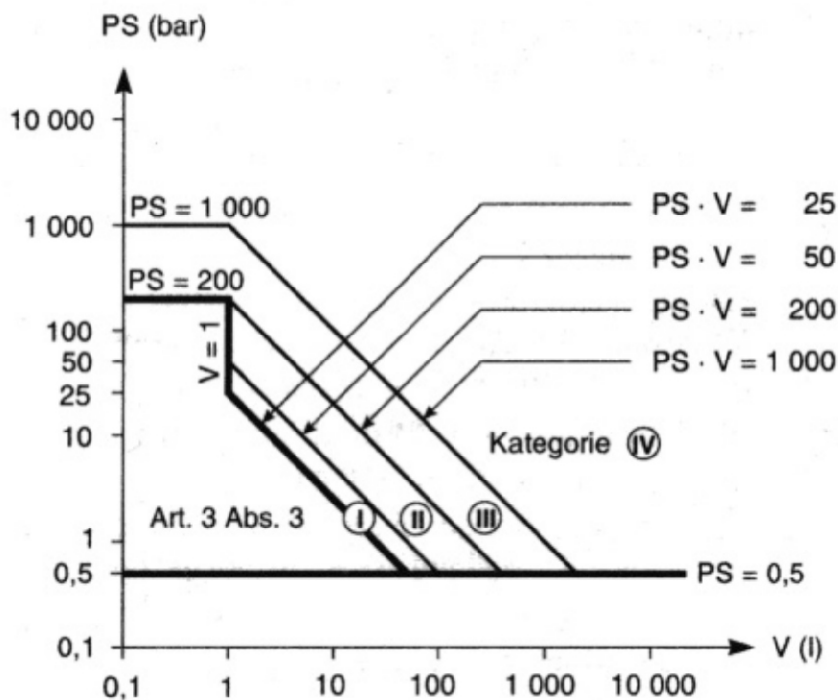
**2. Charging medium (fluid):** Gases store a greater amount of energy than liquids. However, liquids heated beyond their boiling point store additional energy in the form of heat.

Fluids are divided into two groups: Group 1, hazardous fluids (potentially explosive, flammable, oxidizing, and toxic materials); Group 2 (all other fluids).

**Because the high-pressure laboratory reactors described in this manual are intended for use in chemical laboratories, they generally fall under Group 1 Hazardous Fluids!**

As the following diagram illustrates, Berghof high-pressure laboratory reactors with a volume of up to 1,000ml and a max. operating pressure of 200bar cannot be assigned to any specific category. These must be designed, manufactured, and tested in accordance with Art. 3, Para. 3 (DGRL 97/23/EG). Such reactors do not require CE certification and may not carry a CE symbol.

As the diagram further illustrates, high-pressure laboratory reactors with a content of 1,000ml (max. operating pressure: 150 or 200bar) are classified as Category III units. These must bear the CE symbol and be designed, manufactured, and tested accordingly.



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## TÜV/CE symbols

The minimum requirements for the conformity evaluation procedure can be deduced from this category. Berghof Products + Instruments applies the following process for this purpose:

**EC type examination test** By the TÜV as an authorized testing center;

**Conformity with design** Pressure test of every reactor by the TÜV as an authorized testing center;

This methodology ensures that all reactors are designed, manufactured, and tested in accordance with the 97/23/EG pressure equipment guideline and the AD body of rules. This is confirmed by the TÜV seal, the conformity declaration and, to the extent that the reactors may be so designated, by the CE symbol.

## Reactor operation

Based on the classification into the above-cited categories, the following obligations arise for the operator (§17 and Appendix 5 (19), of the operational safety code of January, 2004; §12 and Appendix II (38) of the pressure vessel code of July, 1999):

1. The recurring inspections of high-pressure laboratory reactors must be performed by a certified monitoring center if the product of the maximum permissible pressure, P, and the relevant volume, V, is greater than 100 bar\*liter.
2. The recurring inspections must be performed at least every 5 years.

Aside from this and in accordance with the technical regulations related to the pressure vessel ordinance, TRB 801, No. 38, the following applies to test autoclaves:

3. An inspection by a competent individual must be performed after every use.
4. Inspection prior to commissioning and the recurring, external inspections need not be performed.

Test autoclaves within the context of TRB 801, No. 38 are pressure vessels employed for testing purposes whose anticipated pressures and temperatures are not known for certain.

In other words, Berghof high-pressure laboratory reactors with a pressure/content product  $> 100 \text{ bar} * \text{ l}$  must undergo a new pressure test at least every five years. This test may only be performed by a certified testing center (TÜV). The test comprises:

- An examination of the documentation (manufacturing documents, inspection log);
- An interior inspection (as a rule, a visual inspection of the condition of the pressure-bearing components);
- An examination of functional capability;
- A pressure test.

If the anticipated pressures and temperatures are not known for certain, the high-pressure laboratory reactor is to be viewed as a test autoclave and the operator must perform an inspection of the unit after each use. This inspection comprises:

- An interior inspection (as a rule, a visual inspection of the condition of the pressure-bearing components);
- An examination of functional capability;
- A pressure test.

Setup and operation of pressure vessels is regulated by TRB 700 and TRB 701 and, for test autoclaves, by TRB 801 Nr. 38.

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## Other Applicable Documentation

<b>EC:</b>	Pressure equipment guideline Body of rules	97/23/EG AD-2000
<b>Germany:</b>	Pressure vessel code, DruckbehV, of July, 1999 Operational safety code, BetrSichV, of January, 2004 Technical regulations governing pressure vessels (TRB)	
<b>Other nations:</b>	Corresponding national requirements.	



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