

Kjeldahl Method of Nitrogen Determination

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The behr programme for determining nitrogen in accordance with the Kjeldahl method

The behr program for determining nitrogen in accordance with the Kjeldahl method offers the user individually configurable complete solutions for the laboratory.

• Digestion Units

The digestion units for the behrotest® InKjel model series are equipped with efficient infrared heating.

The quality and positioning of the behr infrared heaters guarantee the user identical heating phases and digestion temperatures throughout all sample places. This also applies to the double-row arrangement in insertable stands for 12 samples.

The direct sample heating by infrared heaters avoids the tortuously long heating times of conventional heating block systems.

This makes the behrotest® InKjel the ideal rapid digestion system for determining nitrogen in accordance with the Kjeldahl method and other

high temperature digestions.

• Steam distillation units

behr steam distillation units from the S series are the optimum complement to the InKjel rapid digestion systems.

Depending on the requirement, the user can choose between one manual and two automatic steam distillation units. These are identical in basic design but differ in terms of ease of operation and degree of automation.

All behr steam distillation units have the following in common:

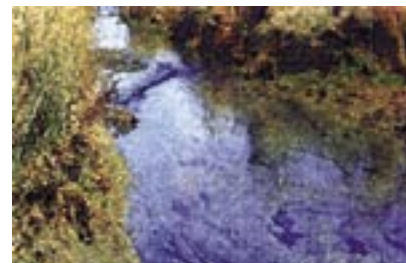
- high performance and speed
- suitability for practical use and user friendliness
- exemplary safety and reliability
- favourable cost-performance ratio

• Process suction system

The two-stage behrosog process suction system – precipitator plus safety back-up stage – ensures that the environment is not polluted by any of the acid vapours.

• Titration stations

The behrotest® manual titration station STI and also the automatic titrator provide reliable, safe and fast titration up to the conclusion of the nitrogen determination.



Exemplary safety during water vapour distillation

behr steam distillation units are not only efficient and reliable partners in everyday laboratory work; the user's safety was also an essential concern during the development and design of the devices.

Therefore, all steam distillation units (S 1, S 3 and S 4) have

- a circuit breaker as a main power switch which is automatically activated in the event of overload and short circuit
- a mechanical pressure-relief safety valve to prevent too much pressure building up in the water vapour generator
- vessel monitoring (distillation can only take place if a vessel is inserted)
- a resettable excess temperature thermostat (in the event of insufficient water in the water vapour generator)
- cooling circuit monitoring by means of pressure switches
- **temperature-controlled water vapour heating-up phase and pressure control by means of a solenoid valve**

The S 3 and S 4 steam distillation units also have

- automatic heating current monitoring of the water vapour generator

behr Steam Distillation Units

behr steam distillation units from the S series are identical in basic design but differ in terms of ease of operation and degree of automation.

The advantages of the behr steam distillation units

- User-friendly design
- S 3 and S 4: simple single button operation
- S 3 and S 4: menu guidance in many languages
- Automatic steam generator
- Pressure monitoring
- Automatic level monitor for the supply tanks
- Glass components for distillation mounted in full view behind transparent guard
- Automatic, time-controlled program flow (S 3 and S 4)
- Error diagnosis with visual (S 1, S 3, S 4) and acoustic indicators (S 3 and S 4)
- „Standby“ function for low consumption of power and cooling water
- RS232 interface for data acquisition and control (S 3 and S 4)

S 3 and S 4: Programming Takes no Time, Menu Guidance and Information at a Glance - in Your Own Language, too

- The behr steam distillation units S 3 and S 4 are extremely easy to program. You need only use one single button (rotary pulse encoder):
Turn the button to move to the menu item and select by pressing the button. Set the parameters by turning and confirm by pressing the button. It couldn't be easier.
- We provide menus and information displays in almost every left-to-right scripts (Latin, Cyrillic, Greek etc.) and in your native language too.
That guarantees greater safety and makes it easier for you to program and retrieve information.



behr S 1 manual Steam distillation unit



behr S 1

Simple steam distillation unit for a small number of samples.

NaOH is added and distillation started and ended at the touch of a button.

Distillation time 2 ... 3 minutes.

Including set of canisters for H₂O and NaOH

behr S 3

Semiautomatic steam distillation unit for a large number of samples.

Choice of manual or automatic addition of H₂O and NaOH.

One distillation program.

Automatic removal of sample residues by suction.

Distillation time 2 ... 3 minutes.

behr S 4

Fully automatic steam distillation unit for a large number of samples and difficult sample matrices.

Choice of manual or automatic addition of H₂O, NaOH and H₃BO₃.

Up to 99 distillation processes are freely programmable.

Automatic removal of sample residues by suction.

Distillation time 2 ... 3 minutes.



behr S 4 Automatic Steam distillation unit

behrosog Process Suction System

The two cleaning stages in the behrosog process suction system – precipitator plus safety back-up stage – ensure that the environment is not polluted by any of the acid vapours.

The centrifugal suction washer in the compact process suction system extracts aggressive acid vapours during the digestion. Here an upstream series-connected two-stage precipitator washes out and separates the noxious contents.

The behrosog is distinguished by its extremely favourable operating costs:

- power consumption 150 W/h
- water usage 30 l/h



The advantages of the behrotest® set of canisters for steam distillation unit

- Hazardous material polyethylene canisters with UN approval
- Tubes routed through the screw cap i.e. no risky boring through the canister wall

Features	S 1	S 3	S 4
Manual addition of H ₂ O	-	+	+
Manual addition of NaOH	+	+	+
Manual addition of H ₃ BO ₃	-	+	+
Automatic addition of H ₂ O	-	+	+
Automatic addition of NaOH	-	+	+
Automatic addition of H ₃ BO ₃	-	-	+
Programmable reaction time	-	+	+
Programmable distillation time	-	+	+
Automatic steam generation	+	+	+
Variable steam generating capacity (40% - 100%)	-	+	+
Automatic removal of sample residues by suction	-	+	+
Number of programs	0	1	99
Display language can be chosen by the user	-	+	+
Visual error reports	+	+	+
Acoustic error reports	-	+	+
Serial interface (RS232)	-	+	+
Standby operation between the distillations	+	+	+
Level monitoring for the set of canisters	+	+	+
Various behrotest® digestion glassware types can be used	+	+	+

Article no.	Model	Description
Steam distillation units		
804849001	S 1	Steam distillation unit manual operation, distilling time approx. 2 - 3 minutes
804849003	S 3	Steam distillation unit, partly automated, distilling time approx. 2 - 3 minutes
804849004	S 4	Steam distillation unit, fully-automatic, distilling time approx. 2 - 3 minutes
804849030	KAS 30	Set of canisters for S 3, consisting of 3 20-l canisters, including float switch
804849040	KAS 40	Set of canisters for S 4, consisting of 4 20-l canisters, including float switch
Catalyst tablets for the Kjeldahl digestion		
804840100	KT 1	Catalyst tablets (5.0 g K ₂ SO ₄ ; 0.5 g CuSO ₄), tin with 1,000 pcs
804840101	KT 2	Catalyst tablets (5.0 g K ₂ SO ₄ ; 0.15 g CuSO ₄ ; 0.15 g TiO ₂), tin with 1,000 pcs
Process Suction System		
804840000	behrosog	Process suction system

Technical data	S 1	S 3	S 4
Nominal voltage:	230 V~, 50 Hz	230 V~, 50 Hz	230 V~, 50 Hz
Power consumption:	1700 W	1700 W	1700 W
Cooling water consumption:	approx. 3 l/min	approx. 3 l/min	approx. 3 l/min
Distillation time:	approx. 2 to 3 min per sample	approx. 2 to 3 min per sample	approx. 2 to 3 min per sample
Storage container:	any size	any size, recommendation: behrotest® set of canisters	
Interface:	-	RS232	RS232
Display:	-	LCD	LCD
Programs:	-	1	99
Dimensions (W x H x D in mm):	410 x 675 x 410		
Weights:	32 kg	35 kg	35 kg

behrotest® InKjel Infrared Rapid Digestion Units

The basic units in the behrotest® InKjel model series hold insertable frames for different combinations of vessels:

- 6 reaction vessels with 250 ml capacity in InKjel 625 (M or P)
- 12 reaction vessels with 250 ml capacity in InKjel 1225 (M or P)
- 4 reaction vessels with 500 ml capacity in InKjel 450 (M or P)
- 4 reaction vessels with 750 ml capacity in InKjel 475 (M or P)

If required, the user can re-equip his system himself very easily with different digestion boxes (insertable frame with suction extraction apparatus) for other sample glassware.

The behrosog process suction system is available to extract vapours during digestion.

All InKjel systems are completely equipped with tiered console, suction system, insertable frame and digestion glass vessels.

behrotest® InKjel M: The Economical Solution

The behrotest® InKjel M series devices conform to the common basic concept in the InKjel series:

- The samples are heated directly by means of the infrared heaters.
- The basic unit can hold insertable frames for different combinations of vessels

The energy for the behrotest® InKjel M is regulated manually by means of a control dial on the device.

The advantages of the InKjel M series are

- Fast direct sample heating with infrared heaters.
- Versatile applications: insertable frames for 250-ml, 500-ml and 750-ml reaction vessels
- With 500-ml and 750-ml vessels also suitable for determining nitrogen in water
- Simple re-equipment for different vessel sizes by replacing the digestion cassette (insertable frame with suction apparatus).
- Simple to operate.
- Very favourable price/performance ratio.

Technical data

Nominal voltage:	230 VAC/ 50 Hz
Power:	1500 W
Dimensions (W x H x D):	approx. 540 x 750 x 440 mm
Weight:	approx. 20 kg
Energy setting range:	0 ... 100 %, manual



behrotest® InKjel 625 M infrared digestion unit

behrotest® InKjel P: The programmable solution

The InKjel P's modern microprocessor control allows up to 99 digestion programs to be entered and stored. Each program can cover up to 10 energy/time combinations facilitating rapid and easy digestion even with difficult samples.

A unique feature is the possibility of doubling the capacity of every InKjel P by connecting a corresponding InKjel PE expansion module. As the expansion module does not require any expensive control electronics, this is a particularly economic way to expand capacity.

The InKjel P also offers:

- 99 storage spaces each with a maximum of 10 freely programmable energy/time combinations for difficult sample matrices.
- Simple and economical capacity doubling by connecting a PE expansion module.

Technical data

Nominal voltage:	230 VAC/ 50 Hz
Power:	1500 W
Dimensions (W x H x D):	approx. 540 x 750 x 440 mm
Weight:	approx. 20 kg
Programs:	a maximum of 99
Time setting range:	0 ... 199 min., in steps of 1 min
Energy setting range:	0 ... 100 %, in steps of 1%



Programmable infrared digestion system
behrotest® InKjel 625 P

Article no.	Model	Description
804849998	InKjel 625 M	Manually variable infrared rapid digestion system for 6 glass vessels for 250 ml
804849999	InKjel 1225 M	Manually variable infrared rapid digestion system for 12 glass vessels for 250 ml
804849450	InKjel 450 M	Manually variable infrared rapid digestion system for 4 glass vessels for 500 ml
804849475	InKjel 475 M	Manually variable infrared rapid digestion system for 4 glass vessels for 750 ml
804850001	InKjel 625 P	Programmable infrared rapid digestion system for 6 glass vessels for 250 ml
804850002	InKjel 1225 P	Programmable infrared rapid digestion system for 12 glass vessels for 250 ml
804850003	InKjel 450 P	Programmable infrared rapid digestion system for 4 glass vessels for 500 ml
804850004	InKjel 475 P	Programmable infrared rapid digestion system for 4 glass vessels for 750 ml
804849225	InKjel 1225 PE	Expansion module without control for extending the InKjel 1225 P to 24-sample capacity, including insertable frame, suction system and reaction vessels P to 24-sample capacity, including insertable frame, suction system and reaction vessels
804849445	InKjel 450 PE	Expansion module without control for extending the InKjel 450 P to 8-sample capacity, including insertable frame, suction system and reaction vessels P to 24-sample capacity, including insertable frame, suction system and reaction vessels
804849446	InKjel 475 PE	Expansion module without control for extending the InKjel 475 P to 8-sample capacity, including insertable frame, suction system and reaction vessels P to 24-sample capacity, including insertable frame, suction system and reaction vessels

Titration: Manual or automatic

For final titration when determining the nitrogen content, the user can choose at behr between manual and automatic titration systems.

The **STI manual titration station** consists of

- a burette with digital display and
- magnetic stirrer with accurately fitting holder for the Erlenmeyer flask. A screen serves as a neutral background and allows the user to decide exactly on the colour change at the end of titration.



The **automatic titrator** assures fast and simple titration: Shortly after pressing the start key, the user can read the result on the large display.

10 different titration methods – including the Kjeldahl titration – can be called up directly.

The valve in the automatic titrator consists of highly resistant material, which is resistant to all known aqueous and non-aqueous titration solutions.

The automatic titrator is complete with: titrator with metering attachment, titration tip, stand rod, titration tip holder, magnetic stirrers as well as pH combination electrodes and buffer set.

Titration stations

Article no.	Model	Description
742712848	TLE 230	Automatic Kjeldahl Titrator, 230 V
742712831	TLE 115	Automatic Kjeldahl Titrator, 115 V
804842020	STI	Manual titration station for Kjeldahl nitrogen analysis

Accessories for the Kjeldahl determination

Article no.	Model	Description
804841015	SR 3i	Round-bottom digestion vessel without standard ground joint for InKjel infrared digestion devices
804851051	KJ 500	Round-bottom digestion vessel, 500 ml, for InKjel
804851076	KJ 750	Round-bottom digestion vessel, 750 ml, for InKjel
804849983	EG 6	Insertable frame for 6 reaction vessels with 250 ml capacity in InKjel 625
804849984	EG 12	Insertable frame for 12 reaction vessels with 250 ml capacity in InKjel 1225
804849982	EG 4/500	Insertable frame for 4 reaction vessels with 500 ml capacity in InKjel 450
804849978	EG 4/750	Insertable frame for 4 reaction vessels with 750 ml capacity in InKjel 475
804849986	AE 6	Fume removal unit for InKjel 625
804849987	AE 12	Fume removal unit for InKjel 1225
804849985	AE 4	Fume removal unit for InKjel 450 and InKjel 475