

Determination of nitrogen with the Kjeldahl method



The behr Programme for the Determination

of Nitrogen with the Kjeldahl Method

The behr programme for determination of nitrogen with the Kjeldahl method provides the user with individually configurable complete solutions for the laboratory

Digestion units

Kjeldahl block digestion systems

Block digestion systems with high grade corrosion-resistant block casings of stainless steel. Manual or with automatic lift.

Standard systems

- Digestion vessels with volumes of 250 ml (8, 12 or 20 sample positions)

Micro Kjeldahl systems

- Digestion vessels with volumes of 100 ml (16, 24 or 40 sample positions)
- High power heater and extraction hood with exhaust gas collector
- behr one-button operation for extremely simple and fast programming
- Menu designed in language of the country
- 10 freely configurable programmes for block temperature and digestion time
- Applications storable
- Available with 230 V ~/50-60 Hz and 115 V ~/50-60 Hz

Infrared digestion systems

The digestion units of the behrotest® InKjel series are fitted with a highly efficient infrared heater.

The quality and positioning of the behr infrared radiator guarantees the user identical heating phases and digestion temperatures at all sample positions. This also applies to double row arrangement in sample racks for 12 samples.

Direct sample heating by infrared radiator eliminates long heating up times with conventional heating block systems.

The behrotest® InKjel is therefore an ideal fast digestion system for determination of nitrogen with the Kjeldahl method and for other high temperature digestion processes.

Steam distillation units

behr steam distillation units of the S series are an optimum supplement to the behr Kjeldahl block digestion systems as well as the behrotest® InKjel infrared rapid digestion units.

Depending on requirements the user can choose between one manual and four automatic steam distillation units. These are identical in basic construction but differ in operating comfort and degree of automation.

All behr steam distillation units have the following common features:

- efficiency and quickness
- practical suitability and user comfort
- exemplary safety and reliability
- favourable cost-effectiveness

Process extraction system

The two-step behrosog process extraction system - preseparator plus safety step - keeps all acid vapours completely away from the environment.

Titration station

The behrotest® hand titrating station STI or an automatic titrator ensure reliable, safe and fast titration at the end of the nitrogen determination.

Exemplary safety during steam distillation

behr steam distillation units are not only highly efficient and reliable partners in everyday laboratory work. Safety of the user was also an important consideration during the development and construction of these units.

Therefore all steam distillation apparatuses are provided with

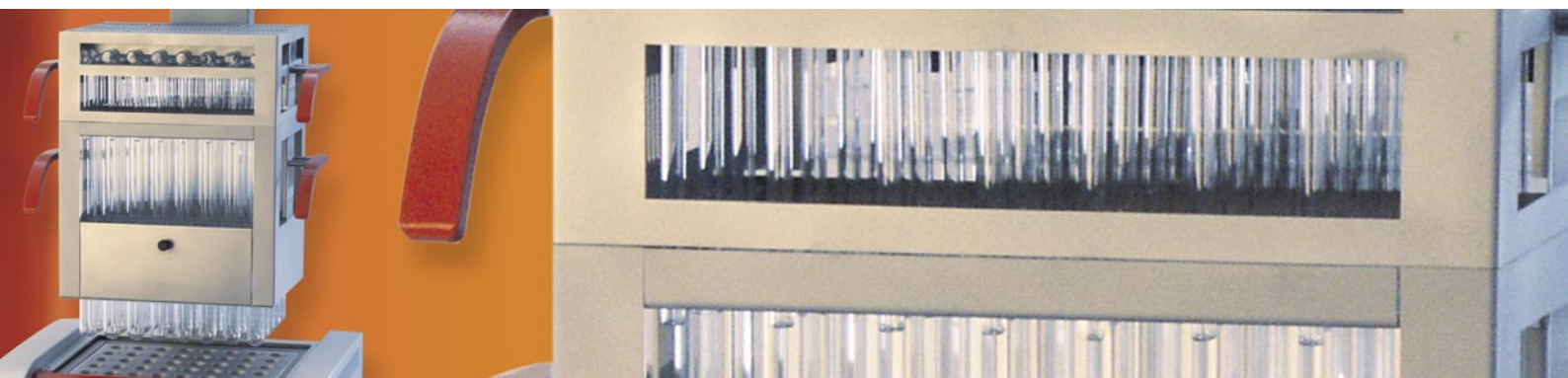
- a protective (safety) switch as the main switch, which is automatically triggered in case of overloading and short-circuiting
- a mechanical excess pressure safety valve to prevent too high a pressure in the steam generator
- a vessel monitor (distillation is not possible without a vessel being inserted)
- A door contact switch, which switches the distillation units off automatically when the door is opened
- a resettable excess temperature thermostat (in case of water deficiency in the steam generator)
- a cooling cycle monitor by means of a pressure switch
- temperature controlled steam heating phase and pressure control via a solenoid valve

Steam distillation units S 2, S 3, S 4 and S 5 are also provided with

- an automatic heating current monitor for the steam generator

Kjeldahl Digestion

behr Kjeldahl Block Digestion Systems



K 40

Standard Kjeldahl block digestion systems behr K 8, K 12 and K 20

Block digestion systems with high grade corrosion-resistant block casing of stainless steel. With 8, 12 or 20 sample positions for standard Kjeldahl digestion vessels of volume 250 ml. High power heater and extraction hood with exhaust gas collector.

- behr one-button operation for extremely simple and fast programming
- Menu designed in language of the country
- 10 freely configurable programmes for block temperature and digestion time
- Applications storable

The supplied Windows software permits the user to transfer time/temperatures profiles, which are specifically for the application, via the RS232 interface in both directions between one or more units (K 8, K 12 and K 20) and a PC. A library with common applications is already included on the CD. Temperature data can also be transmitted from the unit to the PC via the RS232 interface while operating. The user can save them if necessary and print them out as graphics.

Stable, robust construction. Both the block casing and the rack for the digestion vessels, as well as the extraction hood, are made of acid-resistant, stainless steel. Complete systems with digestion vessels, rack and extraction hood are available.

Available with 230 V ~/50-60 Hz and 115 V~/50-60 Hz.

Standard Kjeldahl block digestion systems

Model	Article description	230 V~ Art.-No.	115 V~ Art.-No.
K 8	With 8 sample positions, for digestion vessels of volume 250 ml	804849100	8048491005
K 12	With 12 sample positions, for digestion vessels of volume 250 ml	804849101	8048491015
K 20	With 20 sample positions, for digestion vessels of volume 250 ml	804849102	8048491025
K 8 B	With 8 sample positions, for digestion vessels of volume 500 ml	804849110	8048491105



K 12

Micro Kjeldahl block digestion systems behr K 16, K 24 and K 40

Block digestion systems with high grade corrosion-resistant block casing of stainless steel. With 16, 24 or 40 sample positions for micro Kjeldahl digestion vessels of volume 100 ml. High power heater and extraction hood with exhaust gas collector.

- behr one-button operation for extremely simple and fast programming
- Menu designed in language of the country
- 10 freely configurable programmes for block temperature and digestion time
- Application storable

The supplied Windows software permits the user to transfer time/temperatures profiles, which are specifically for the application, via the RS232 interface in both directions between one or more units (K 16, K 24 and K 40) and a PC. A library with common applications is already included on the CD. Temperature data can also be transmitted from the unit to the PC via the RS232 interface while operating. The user can save them if necessary and print them out as graphics.

Stable, robust construction. Both the block casing and the rack for the digestion vessels, as well as the extraction hood, are made of acid-resistant, stainless steel. Complete systems with digestion vessels, rack and extraction hood are available

Available with 230 V ~/50-60 Hz and 115 V~/50-60 Hz.

Micro-Kjeldahl block digestion system

Model	Article description	230 V~ Art.-No.	115 V~ Art.-No.
K 16	With 16 sample positions, for digestion vessels of volume 100 ml	80 48 49150	80 48 491505
K 24	With 24 sample positions, for digestion vessels of volume 100 ml	80 48 49151	80 48 491515
K 40	With 40 sample positions, for digestion vessels of volume 100 ml	80 48 49152	80 48 491525



K 20

Technical data for behr Kjeldahl block digestion systems

	K 8		K 12		K 16/K 24		K 20/K 40	
Voltage	230 VAC/115 VAC							
Frequency	50/60 Hz							
Power consumption	1000 W		1500 W		1500 W		2200 W	
Voltage	230 V	115 V	230 V	115 V	230 V	115 V	230 V	115 V
Current consumption	5 A	10 A	8 A	16 A	8 A	16 A	10 A	20 A
Weight approx. (incl. vessels)	approx. 28 kg		approx. 30 kg		approx. 30 kg		approx. 34 kg	
Dimensions in cm (W x D x H)	approx. 42 x 51 x 76,5				approx. 48 x 51 x 76,5			
Temperature Range	450 °C							

behr Kjeldahl block digestion systems with fully automatic lift

behr Kjeldahl block digestion systems of the L series are fitted with a fully automatic lift. This relieves the user of handling the heavy sample unit and hot chemicals. The software controls both the sample lift and the behrosog 3, thus enabling practically fully automatic digestion to be carried out.

At the end of the digestion, the lift drives up the complete unit with the framework and suction hood. After a RAM-programmed cooling/suction time, it raises the suction hood and drives it into the final position.

- The temperature profiles and starting time are freely programmable
- behr one-button operation for extremely simple and fast programming

The supplied Windows software permits the user to transfer time/temperatures profiles, which are specifically for the application, via the RS232 interface in both directions between one or more units (K 12 L, K 20 L, K 24 L and K 40 L) and a PC. A library with common applications is already included on the CD. Temperature data can also be transmitted from the unit to the PC via the RS232 interface while operating. The user can save them if necessary and print them out as graphics.

Available with 230 V ~/50-60 Hz and 115 V~/50-60 Hz.

behr Kjeldahl block digestion systems with fully automatic lift

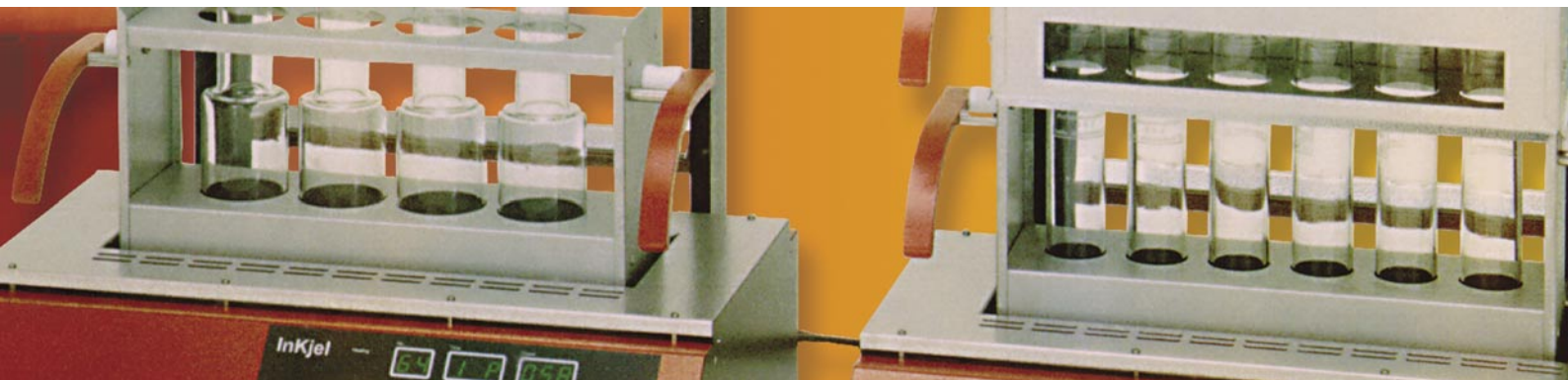
Model	Article description	230 V~ Art.-No.	115 V~ Art.-No.
K 12 L	Automatic Kjeldahl block digestion system with lift. 12 sample positions, for digestion vessels of volume 250 ml	80 48 49160	80 48 491605
K 20 L	Automatic Kjeldahl block digestion system with lift. 20 sample positions, for digestion vessels of volume 250 ml	80 48 49161	80 48 491615
K 24 L	Automatic micro Kjeldahl block digestion system with lift. 24 sample positions for digestion vessels of volume 100 ml	80 48 49162	80 48 491625
K 40 L	Automatic micro Kjeldahl block digestion system with lift. 40 sample positions for digestion vessels of volume 100 ml	80 48 49163	80 48 491635



K 40 L

Kjeldahl Digestion

Infrared Rapid Digestion Units



Digestion units

Digestion units of the behrotest® InKjel series are fitted with a high power infrared heater. The quality and positioning of the behr infrared heater guarantees the user identical heating phases and digestion temperatures at all sample positions. This also applies to the double-row arrangement in racks for 12 samples. The glass digestion vessels are suspended in the rack and are not deposited on the bottom of the digestion unit. Therefore the digestion vessels are less susceptible to breakage than in an aluminium heating block.

- Direct heating of the samples through the infrared radiator eliminates the endlessly long heating times required using conventional heating block systems
- High-quality quartz radiators, instead of the usual steel tubular heating elements, ensure particularly uniform heating at all sample positions
- behr one-button operation for extremely simple and fast programming
- Menu designed in language of the country

Therefore the behrotest® InKjel is the ideal digestion system for nitrogen determination with the Kjeldahl method and other high temperature digestion processes. In the Kjeldahl digestion the temperature is adjusted through the boiling point of sulphuric acid.

The basic units of the behrotest® InKjel series can accommodate racks for various vessel combinations:

- 12 reaction vessels of 100 ml in the InKjel 1210 (M or P)
- 6 reaction vessels of 250 ml in the InKjel 625 (M or P)
- 12 reaction vessels of 250 ml in the InKjel 1225 (M or P)
- 4 reaction vessels of 500 ml in the InKjel 450 (M or P)
- 4 reaction vessels of 750 ml in the InKjel 475 (M or P)

The models of the InKjel P series have 10 freely configurable programmes for power and digestion time. The supplied Windows software permits the user to transfer time/temperatures profiles, which are specifically for the application, via the RS232 interface in both directions between one or more units (InKjel P) and a PC. A library with common applications is already included on the CD. Temperature data can also be transmitted from the unit to the PC via the RS232 interface while operating. The user can save them if necessary and print them out as graphics.

If required the user can very simply convert his system for use with other glass sample vessels himself using various digestion cassettes (rack with fume extraction). The process extraction system behrosog 3 is used for extracting vapours during the digestion process. All InKjel systems are fitted completely with multi-level consoles, fume extraction unit, sample rack and glass digestion vessels.



InKjel 1225 P



InKjel 625 M

Technical data for digestion systems

	InKjel M		InKjel P	
Voltage	230 VAC/115 VAC			
Frequency	50/60 Hz			
Power consumption	1500 W		1500 W	
Voltage	230 V	115 V	230 V	115 V
Current consumption	8 A	16 A	8 A	16 A
Weight approx. (incl. vessels)	approx. 20 kg		approx. 20 kg	
Dimensions in cm (W x D x H)	approx. 54 x 44 x 75		approx. 54 x 44 x 75	
Power setting range	0...100%, infinitely variable, manually adjustable		0...100%, in steps of 1%	
Time setting range	-		0...199 min., in steps of 1 min.	
Programmes	-		10	

Digestion units

Model	Article description	230 V~ Art.-No.	115 V~ Art.-No.
InKjel 625 M	Manually adjustable infrared digestion system for 6 glass vessels of 250 ml	80 48 49998	80 48 499985
InKjel 1210 M	Manually adjustable infrared digestion system for 12 glass vessels of 100 ml	80 48 49500	80 48 495005
InKjel 1225 M	Manually adjustable infrared digestion system for 12 glass vessels of 250 ml	80 48 49999	80 48 499995
InKjel 450 M	Manually adjustable infrared digestion system for 4 glass vessels of 500 ml	80 48 49450	80 48 494505
InKjel 475 M	Manually adjustable infrared digestion system for 4 glass vessels of 750 ml	80 48 49475	80 48 494755
InKjel 625 P	Programmable infrared digestion system for 6 glass vessels of 250 ml	80 48 50001	80 48 500015
InKjel 1210 P	Programmable infrared digestion system for 12 glass vessels of 100 ml	80 48 49501	80 48 495015
InKjel 1225 P	Programmable infrared digestion system for 12 glass vessels of 250 ml	80 48 50002	80 48 500025
InKjel 450 P	Programmable infrared digestion system for 4 glass vessels of 500 ml	80 48 50003	80 48 500035
InKjel 475 P	Programmable infrared digestion system for 4 glass vessels of 750 ml	80 48 50004	80 48 500045

Kjeldahl Digestion

Accessories

Model	Article description	Art.-No.
KT 1	Catalyst tablets (5,0 g K_2SO_4 ; 0,5 g $CuSO_4$), Box of 1000 tablets	80 48 40100
KT 2	Catalyst tablets (5,0 g K_2SO_4 ; 0,15 g $CuSO_4$; 0,15 g TiO_2), Box of 1000 tablets	80 48 40101
KT 3	Catalyst tablets (3,5 g K_2SO_4 ; 0,4 g $CuSO_4$), Box of 1000 tablets	80 48 40103
AFS	Antifoam tablets, Box of 1000 tablets	80 48 40102
SIST 100	Boiling stone for Kjeldahl digestion, content 100 g	80 48 30700
WB 1	Nitrogen-free weighing boats (58 mm x 10 mm x 10 mm) for Kjeldahl digestion, 100 boats	80 48 40104

Model	Article description	Art.-No.
SR 3i	Round bottom digestion vessel, 250 ml	80 48 41015
SR 4	Round bottom digestion vessel, 100 ml for Micro Kjeldahl	80 48 41016
KJ 500	Round bottom digestion vessel, 500 ml	80 48 51051
KJ 750	Round bottom digestion vessel, 750 ml for InKjel	80 48 51076
EG 12/100	Frame for 12 reaction vessels of 100 ml in the InKjel 1210 (M or P)	80 48 49964
EG 6	Frame for 6 reaction vessels of 250 ml in the InKjel 625 (M or P)	80 48 49983
EG 12	Frame for 12 reaction vessels of 250 ml in the InKjel 1225 (M or P)	80 48 49984
EG 4/500	Frame for 4 reaction vessels of 500 ml in the InKjel 450 (M or P)	80 48 49982
EG 4/750	Frame for 4 reaction vessels of 750 ml in the InKjel 475 (M or P)	80 48 49978
AE 4	Fume extraction unit for the InKjel 450 and InKjel 475 (M or P)	80 48 49985
AE 6	Fume extraction unit for the InKjel 625 (M or P)	80 48 49986
AE 12/100	Fume extraction unit for the InKjel 1210 (M or P)	80 48 49965
AE 12	Fume extraction unit for the InKjel 1225 (M or P)	80 48 49987



behrosog 3

Process extraction system

Model	Article description	230 V~ Art.-No.	115 V~ Art.-No.
behrosog 3	Process extraction system with suction pump (40 l/h), condensation step and neutralisation step	80 48 40008	80 48 400085
ACS	Additional cooling system for behrosog 3		80 48 40009

Technical data for extraction system behrosog 3

Voltage	230 VAC/115 VAC
Frequency	50/60 Hz
Current consumption	80 W
Weight	approx. 18 kg
Dimensions in cm (W x D x H)	approx. 38 x 34 x 40
Pump capacity	max. 40 l/min without back pressure



SIMVAC

SIMVAC

Model	Article description	Art.-No.
SIMVAC	Suction device with water jet pump and neutralisation bottle incl. hose and frame	80 48 40005

Kjeldahl Distillation

behr Steam Distillation Units S 1 to S 5



S 1



S 2/S 3



S 4



S 5

Features according to your needs

behr distillation units of the S series are the ideal supplement to the InKjel and K digestion units. Depending on requirements the user can choose between five automatic steam distillation apparatuses. These are identical in the basic construction but differ in operating comfort and degree of automation. The top model behr S 5 is prepared for work with an external titrator.

The supplied Windows software permits the user to transfer distillation parameters, which are specifically for the application, via the RS232 interface in both directions between one or more units and a PC. A library with common applications is already included on the CD. Data can also be transmitted from the unit to the PC via the RS232 interface while operating. The user can save them if necessary and print them out as graphics.

All behr steam distillation units have the following common features:

- efficiency and quickness
- practical suitability and user comfort
- exemplary safety and reliability
- robust casing of polyurethane
- practical quick clamping device which the user can operate even „with his eyes shut“
- extremely simple, menu-controlled operation of the programmable units via one single operating element (behr one-button operation)
- Menu designed in language of the country
- separate rinsing programme
- Steam generating capacity adjustable from 40 % - 100 %

Equipment of the models

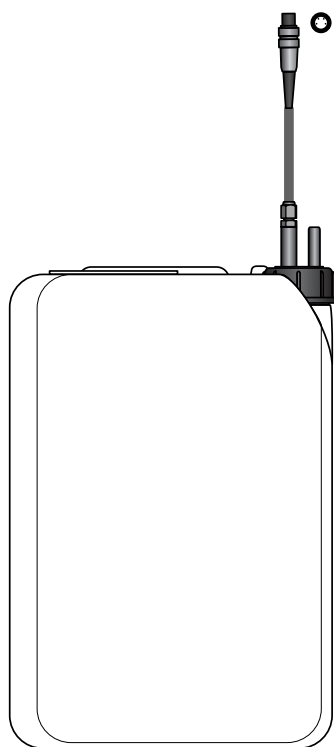
	S 1	S 2	S 3	S 4	S 5
Manual addition of H ₂ O	-	+	+	+	+
Manual addition of NaOH	+	+	+	+	+
Manual addition of H ₃ BO ₃	-	-	-	+	+
Automatic addition of H ₂ O	-	+	+	+	+
Automatic addition of NaOH	+	+	+	+	+
Automatic addition of H ₃ BO ₃	-	-	-	+	+
Programmable reaction time	+	+	+	+	+
Programmable distillation time	+	+	+	+	+
Steam generation automatic	+	+	+	+	+
Steam generating capacity adjustable (40% to 100%)	+	+	+	+	+
Automatic suction extraction of sample residues	-	-	+	+	+
Number of programmes	1	1	10	99	99
Separate rinsing programme	+	+	+	+	+
Language of display selectable	+	+	+	+	+
Optical fault alarms	+	+	+	+	+
Acoustic fault alarms	+	+	+	+	+
Door contact safety switch	+	+	+	+	+
Serial interface (RS232)	+	+	+	+	+
Stand-by operation between distillations	+	+	+	+	+
Filling level monitoring for can set	+	+	+	+	+
Various behrotest® glass digestion vessels usable	+	+	+	+	+
Connection possibility for titration	-	-	-	-	+

Steam distillation units

Type	Article description	230 V ~ Art.-No.	115 V ~ Art.-No.
S 1	Steam distillation unit, partly automated	80 48 49001	80 48 490015
S 2	Steam distillation unit, partly automated	80 48 49002	80 48 490025
S 3	Steam distillation unit, partly automated	80 48 49003	80 48 490035
S 4	Steam distillation unit, fully automatic	80 48 49004	80 48 490045
S 5	Steam distillation unit,, fully automatic, prepared for external titrator (e.g. TB 1)	80 48 49005	80 48 490055
TB 1	Titration module for connection to steam distillation unit S 5	80 48 49006	80 48 490065
Titrimo 702	Metrohm titrator	80 48 49007	80 48 490075

Technical data for steam distillation units

	S 1	S 2	S 3	S 4	S 5
Voltage	115 V~ 230 V~				
Frequency	50/60 Hz				
Power consumption	1700 W				
Current consumption	9 A/18 A				
Cooling water consumption	approx. 5 l/min				
Distillation time	approx. 3 min. per sample				
Storage vessel	Any size. Recommendation: behrotest® can set KAS				
Interface	RS232				
Display	LCD				
Programs	1	1	10	100	100
Dimensions (W x H x D in cm)	approx. 41 x 67,5 x 41				
Weight	approx. 32 kg	approx. 34 kg	approx. 35 kg	approx. 35 kg	approx. 36 kg
Connection for titrator	No	No	No	No	Yes



Can with level sensor for NaOH

Can sets

behr can sets are based on hazardous materials cans with UN approval

The level sensors form one unit with the screw caps. Therefore, if required, the user can also connect containers from the chemical industry without carrying out dangerous refilling operations.

Can sets

Model	Article description	Art.-No.
KAS 20	Can set for S 1 and S 2, consisting of 2 cans of 20 l incl. float type switch	80 48 49020
KAS 30	Can set for S 3 consisting of 3 cans of 20 l incl. float type switch	80 48 49030
KAS 40	Can set for S 4 and S 5, consisting of 4 cans of 20 l incl. float type switch	80 48 49040



STI

Manual titration station STI

The manual titration station STI consists of

- a burette with digital display and
- a magnetic stirrer with exactly fitting holder for a conical flask

A visual screen serves as a neutral background and enables the user to determine the colour change at the end of titration exactly. In this way he always carries out his titrations under similar optical conditions. This improves the accuracy and reproducibility of the results.

This is also aided by the exact positioning of the vessel in the holder on the upper side of the magnetic stirrer. The wings of the screen also protect against dazzle from the sides

Manual titration station STI

Model	Article description	230 V ~ Art.-No.	115 V ~ Art.-No.
STI	Manual titration station for nitrogen determination with Kjeldahl method	80 48 42020	80 48 420205

Technical data for manual titration station STI

Voltage	230 VAC/115 VAC
Frequency	50/60 Hz
Weight	approx. 3,5 kg
Dimensions in cm (W x D x H)	approx. 33 x 20 x 60



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Subject to technical changes and errors.