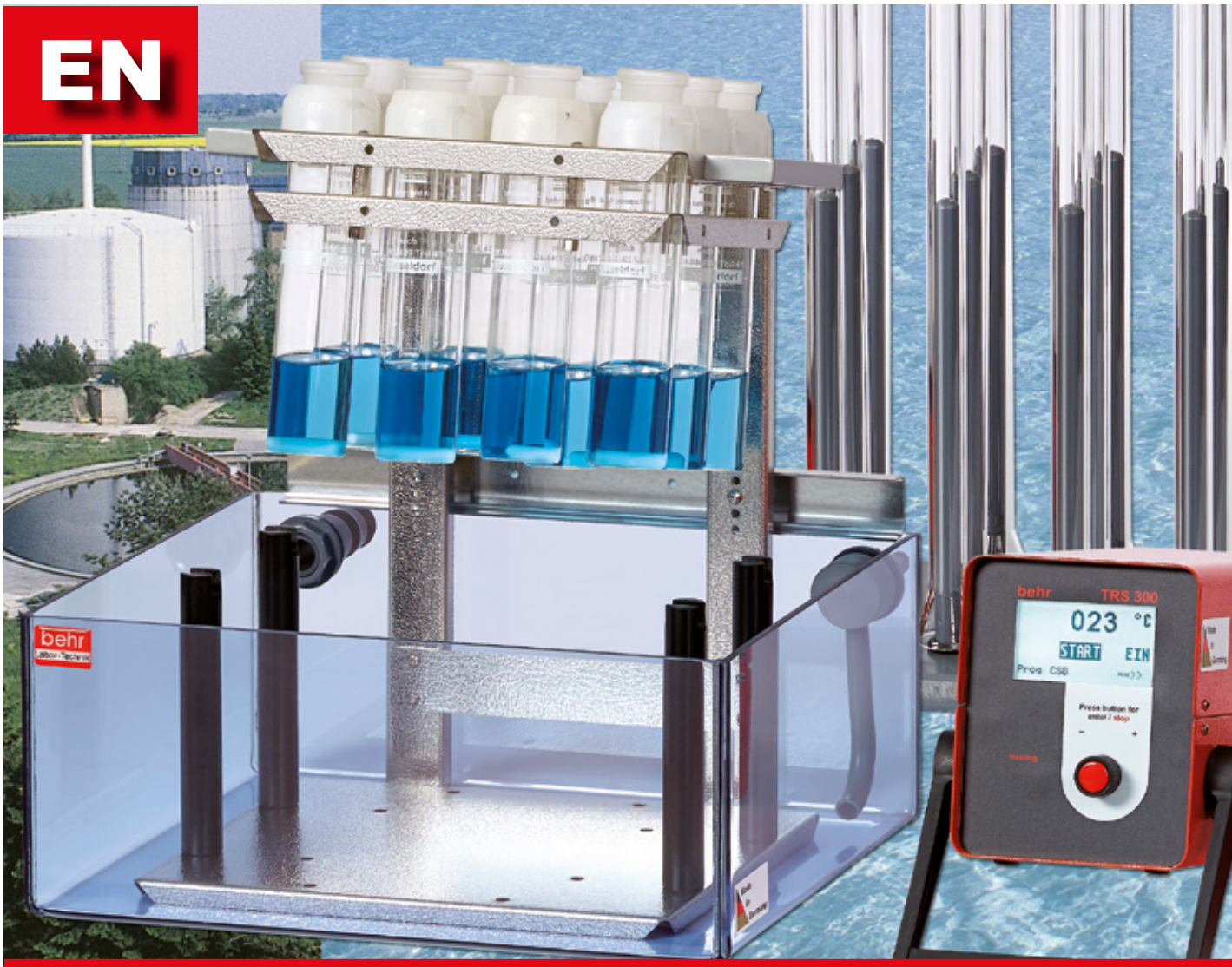
behr
Labor-Technik

The Standard

behrotest® Equipment for COD Determination

EN



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Quality made in Germany

The COD determination
Reliable analysis according to recognized standards

The determination of chemical oxygen demand (COD) is a key parameter in environmental analysis. In Germany, it is carried out in accordance with DIN/DEV 38409 – H 41, as stipulated in the Waste Water Levy Act (AbwAG) and the Framework Waste Water Ordinance to § 7a WHG.

International and national equivalents of this method can be found in, among others:

- the ÖNORM M 6265 (Austria),
- ISO 6060 (international),
- as well as ASTM D 1252 (USA).

behr & COD – The ideal partnership for precise environmental analysis

When determining the COD value in Germany in accordance with DIN/DEV, users are highly likely to rely on our proven systems. Our COD workstations stand for reliability, compliance with standards, and efficiency.

We offer you standard-compliant solutions for CSB determination according to:

- DIN/DEV 38409 – H 41 (1+2) for concentrations above 15 mg/l
- DIN/DEV 38409 – H 44 for the range from 5 to 50 mg/l

Our complete workstations are available in versions for 6 or 12 sample positions and cover the entire process – from digestion to titration.

For special requirements, such as complex sample matrices or high sample throughput, we offer customized device configurations with suitable accessories.

Standard configurations for nearly every application:
behrotest® COD digestion systems and complete workstations for COD determination

COD digestion systems PA-CSB
for sample digestion

Equipment configuration for simultaneous digestion of up to 6 or 12 COD samples according to DIN/DEV, EN and ISO.

A digestion system consists of the following components:

- Microprocessor-controlled time and temperature controller TRS 300 with COD program
- Precision block heater COD/E for RG 2 reaction vessels
- Sample rack / rack attachment E/B for RG 2 reaction vessels
- Cooling bath KW/N with mounting and rack for E/B
- RG 2 Reaction vessels
- LK 1 COD air cooler
- LS Air cooler stand for COD LK air coolers

PA-CSB 12

COD digestion units:

Type:	Art. No.
PA-CSB 6	B00218405
PA-CSB 12	B00218406

PB-CSB 12/M

PB-CSB/M COD workstations
for COD analysis

Complete workstations for simultaneous determination of a maximum of 6 or 12 samples in accordance with DIN/DEV, EN and ISO.
Manual dispensing and titration.

A workstation comprises:

- Microprocessor-controlled time and TRS 300 temperature controller with COD program
- Precision block heater COD/E for RG 2 reaction vessels
- Sample rack insert / rack attachment E/B for RG 2 reaction vessels
- KW/N cooling trough with holder and stand for E/B
- SM 12/N serial magnetic agitator for sample rack insert / rack attachment E 12/B (PB-CSB 12/M only)
- RG 2 reaction vessels
- MRST 2 magnetic agitator bar set, pack of 12
- SIST 100 boiling stones, package content 100 g
- LK 1 COD air cooler
- LS Air cooler stand for COD LK air coolers
- PTFE sleeves PTFE 29 for LK 1, set of 12
- TS COD vessel holding frame for E/B sample rack / rack attachment
- HTI 1 manual titration station

COD workstations:

Type	Art. No.
PB-CSB 6/M	B00218407
PB-CSB 12/M	B00218408

Individual components for COD digestion
For COD digestion, you require the following

- a heating block
- a TRS 300 time and temperature controller

CSB 6/E

CSB 12/E

CSB 24/E

COD heating blocks

Precision heating block for 6, 12 or 24 samples. Heating panel for particularly even temperature distribution over all sample positions
Enclosure made of powder-coated steel and stainless steel.
The elaborate heating block insulation ensures that housing temperatures stay within safe temperature ranges.

Continuous grooves at the bottom of the boreholes simplify sample handling and increase user safety:

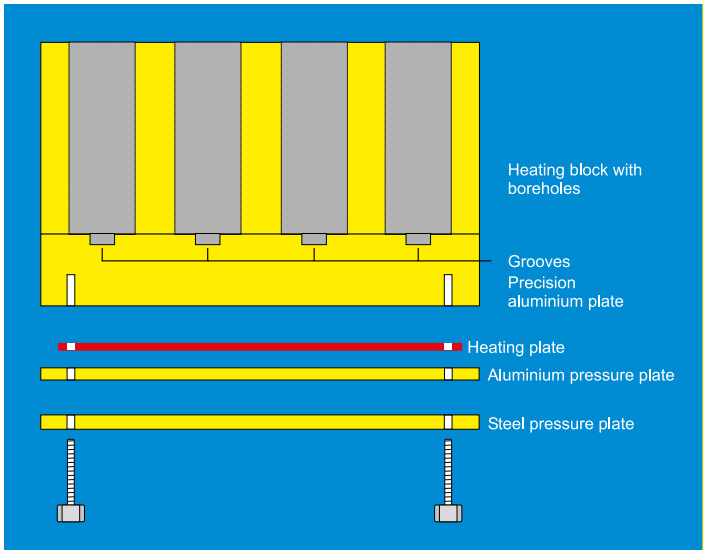
- The grooves allow for pressure equalisation when the sample vessels are inserted. This way, even precisely fitting vessels can be smoothly inserted in the boreholes for user-friendly handling of the sample rack inserts.
- Remaining fluid on the outside of the reaction vessel instantly evaporates when the samples are inserted in the heated block. The grooves serve to discharge the vapour, thus preventing the breakage of glass due to glass vessel rupture.
- In case of vessel overflow, the sample will drain off through the grooves, reducing the risk of acid damaging the heating block.

Technical Data:

	CSB 6/E	CSB 12/E	CSB 24/E
Sample positions:	6	12	24
Maximum temperature:	299 °C	299 °C	299 °C
Power consumption:	800 W	1500 W	2000 W

Type	Product description	Art. No.
CSB 6/E	Precision heating block thermostat for 6 reaction vessels RG, 20 ... 300 °C	B00217822
CSB 12/E	Precision heating block thermostat for 12 RG, reaction vessels, 20 ... 300 °C	B00217826
CSB 24/E	Precision heating block thermostat for 24 reaction vessels RG, 20 ... 300 °C	B00217830

Layout of a behr precision heating block



The sophisticated design ensures precise and uniform temperature values for all sample positions.

TRS 300

Programmable temperature and time controller TRS 300

Programmable controller for behrotest® digestion blocks

behr single-button operation for particularly fast and easy programming. Menu navigation in local language. 10 freely configurable programs for block temperature and digestion time.

The TRS 300 features a special factory-set COD program. In "COD" mode, it heats to a temperature 20°C above the specified setpoint temperature. After sample insertion, the setpoint temperate increased by 20°C is retained for another 6 minutes This procedure ensures compliance with the ISO specification of heating to 148°C within 10 minutes and outstanding temperature stability during the subsequent reaction process.

The built-in safety features shut down the connected devices in case of short circuit and temperature sensor failure.

Product description	Art. No.
Temperature and time controller, microprocessor-controlled unit, option of programming up to 10 temperature-time profiles	B00217820

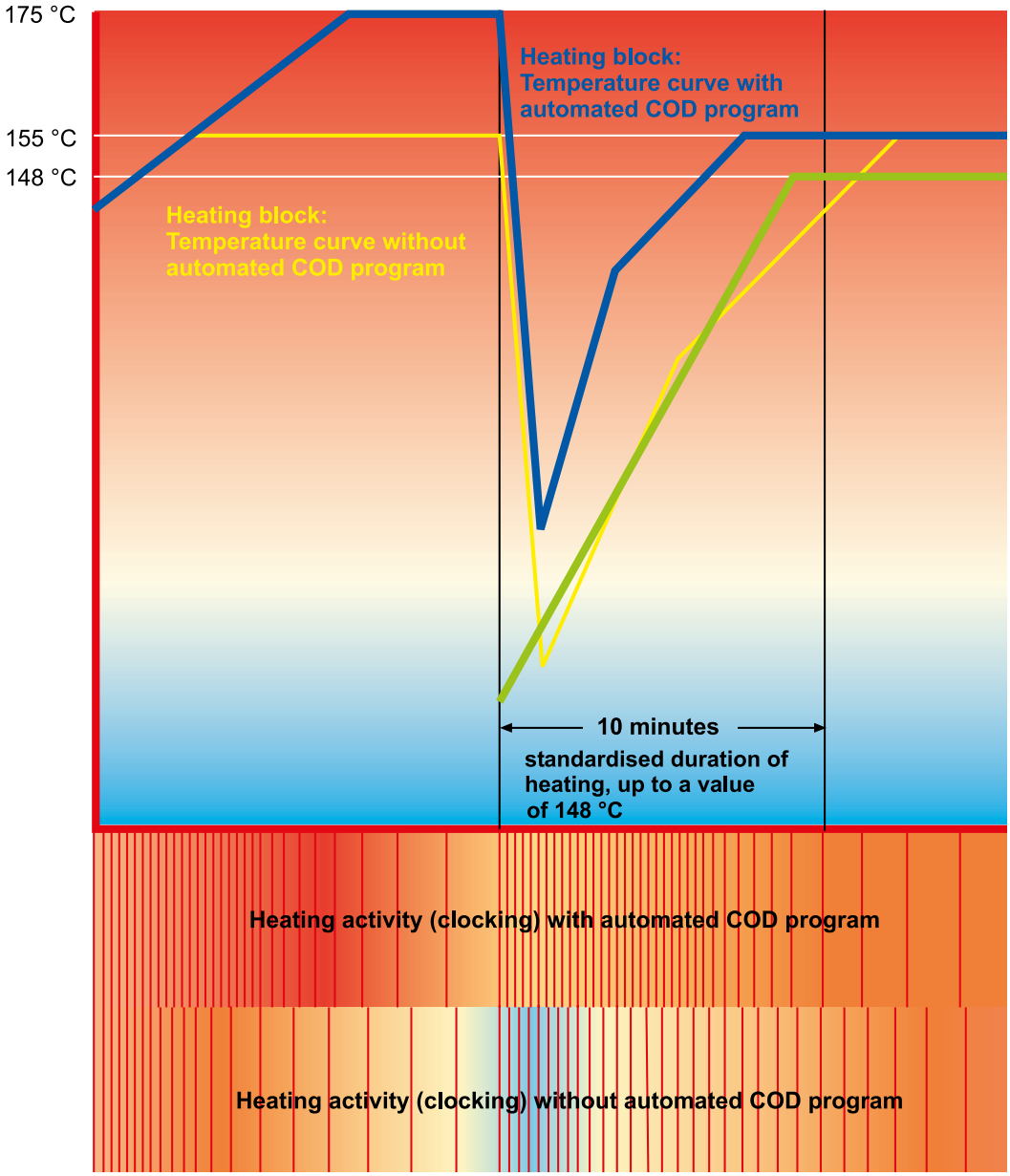
TRS 300 Technical Data

Dimensions in cm (W × D × H) **Unit height with handle**	approx. 15.0 x 17.5 x 32.0 Stand and carrying handle can be locked in place in 30° increments
Weight	approx. 3.2 kg
Voltage	220 V/50 Hz
Switching capacity	max. 2200 W ohmic load
Connection of heaters	Power supply socket on back of unit (4-pole special plug with screw coupling)
Sensor	PT 100 – three-wire circuit, connection via three-pole diode plug
Temperature control range	0 – 450 °C, digitally adjustable
Time setting range	1 – 999 min, digitally adjustable
Programs	11 (with default COD program)
Display	LCD

TRS 300 controller: Automatic COD mode

As required by international and national standards, samples inserted in the heating block must be heated up to a digestion temperature of 148 ±3 °C within 10 minutes with subsequent slight boiling (no excess heating) and further digestion.

Only behr offers you the special COD automatic control system with the ability to adjust the heating block temperature both up and down as required. Thanks to this automatic control system with integrated compensation for heat loss between the heating and the sample, behrotest® workstations guarantee standard-compliant digestion for CSB determination.



COD titration in accordance with your requirements:

Manual or automatic – Reliability and precision with behrotest® devices

HTI 1

behrotest® HTI 1 Manual Titration Station

The HTI 1 manual titration station consists of:

- a burette with digital display and
- a magnetic agitator with a precisely fitting holder for COD reaction vessels.

A screen serves as a neutral background and enables the user to precisely determine the colour change at the end of titration. This feature ensures titrations are always carried out under similar visual conditions. This way, results are more accurate and reproducible.

The precise positioning of the reaction vessel in the holder on top of the magnetic agitator also contributes to this. In addition, the laterally arranged screen panels serve as a shield from incident light from the side. COD in accordance with ISO, EN and DIN.

Technical Data:

Voltage	230 VAC
Frequency	50/60 Hz
Weight	approx. 3.5 kg
Dimensions in cm (W × D × H)	approx. 33 x 20 x 60

Type	Product description	Art. No.
HTI 1	Manual titration station, with digital burette and magnetic agitator	B00217907

DS 20 automatic COD dispenser

Dispensing unit for automated, rapid dispensing of potassium dichromate solution and sulphuric acid for COD sample preparation. Simultaneous dispensing into a maximum of 12 samples Integrated magnetic series agitator with 12 sample positions.

- Time-optimised intermittent dispensing: Sulphuric acid is dispensed in several cycles, with samples being constantly cooled and stirred. This method accelerates sample preparation and prevents a non-standard overheating of samples during the dispensing process.
- Operator safety: Thanks to the automated reagent dispensing process, the operator is not exposed the chemical substances at any time.
- Practice-oriented and user-friendly software: Programming of the behr DS 20 is simple and user-friendly thanks to the Windows user interface.

Type	Product description	Art. No.
DS 20	for simultaneous dispensing into a maximum of 12 samples, with burettes and cooling trough	B00217853

DS 20

Fully automatic DT 20 dispensing/titration unit

Dispension:

Time-optimised intermittent COD dispensing. Sulphuric acid is dispensed in several cycles, with samples being constantly cooled and stirred. This method accelerates sample preparation and prevents a non-standard overheating of the samples during the dispensing process.

Titration:

Freely programmable "methods", such as end point titrations, equivalence point titrations, linear, dynamic and quasi-dynamic titrations. Different password-protected user levels. Graphic printout with 1st and 2nd derivative. Freely selectable printout of sample data. The "methods" functionality ensures compliance with all national COD standards.

Instead of the customary over-titration, the behr-specific dynamic titration guarantees a precise end-point identification even in the presence of a typical COD slope steepness, thus obtaining particularly accurate measurement results.

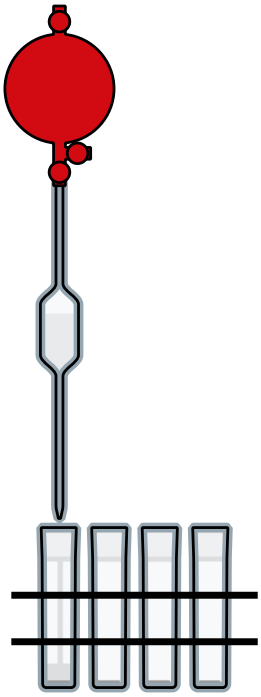
Operator safety: Thanks to the automated reagent dispensing process, the operator is not exposed the chemical substances at any time.

- Practice-oriented and user-friendly software: Programming of the behr DT 20 is simple and user-friendly thanks to the Windows user interface.

Type	Product description	Art. No.
DT 20	Fully automatic dispensing and titration for COD determination in accordance with DIN/EN/ISO. Simultaneous dispensing and titration for a maximum of 12 samples Automatic extraction of the titrated samples. Particularly easy and user-friendly system handling via Microsoft Windows user interface with an Access database for further processing of sample data.	B00217855

DT 20

Automated COD determination
with behr



1. Dispensing of samples

1.

Dispensing of samples

The sample vessels are positioned in the sample rack, ready for sample dispensing, in the same arrangement they will be placed in the dispensing titration unit and heating block. This prevents mistakes.

2.

Dispensing reagents

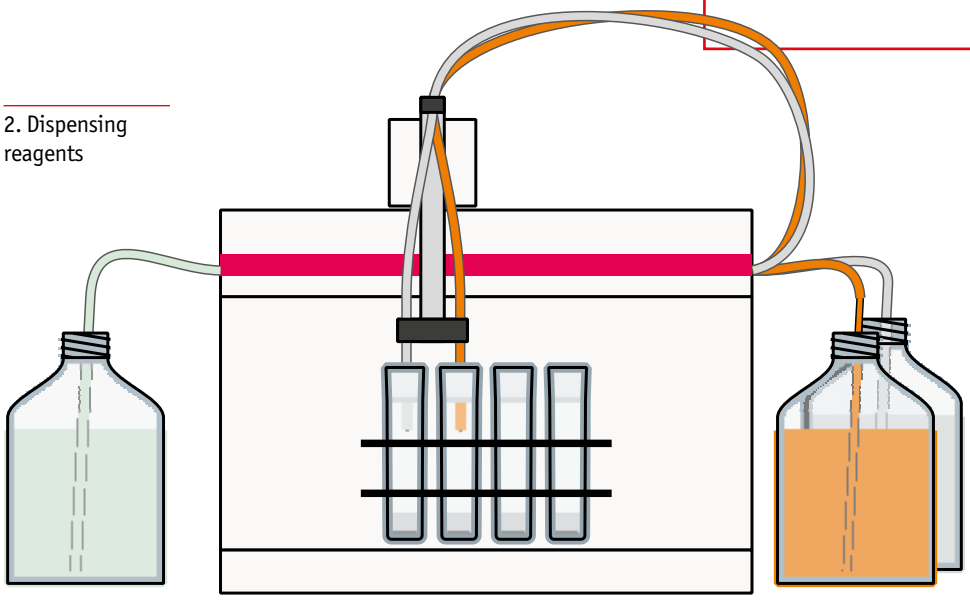
The samples and sample rack are placed in the DT 20 dispensing / titration unit, where the reagents required for COD determination are dispensed. These usually are

- potassium chromate solution, containing silver sulphate, in precisely measured quantities and
- concentrated sulphuric acid, containing silver sulphate.

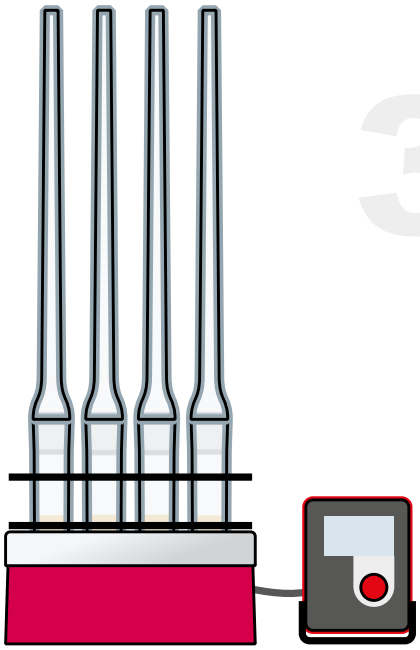
The sample arm is equipped with the two dispensing lances for potassium dichromate and sulphuric acid. The spacing between the arms is equivalent to the distance between two rows of sample vessels in the sample tray. Consequently, if the potassium chromate dispensing lance is positioned above the second row, the sulphuric acid lance is above the first row.

In order to prevent excessive sample heating, sulphuric acid can be dispensed in three batches ("intermittent dispensing").

The samples are placed in a cooling trough rinsed with water to dissipate the heat generated by adding sulphuric acid. In order to prevent excessive sample heating, sulphuric acid can be dispensed in three batches ("intermittent dispensing").



2. Dispensing reagents



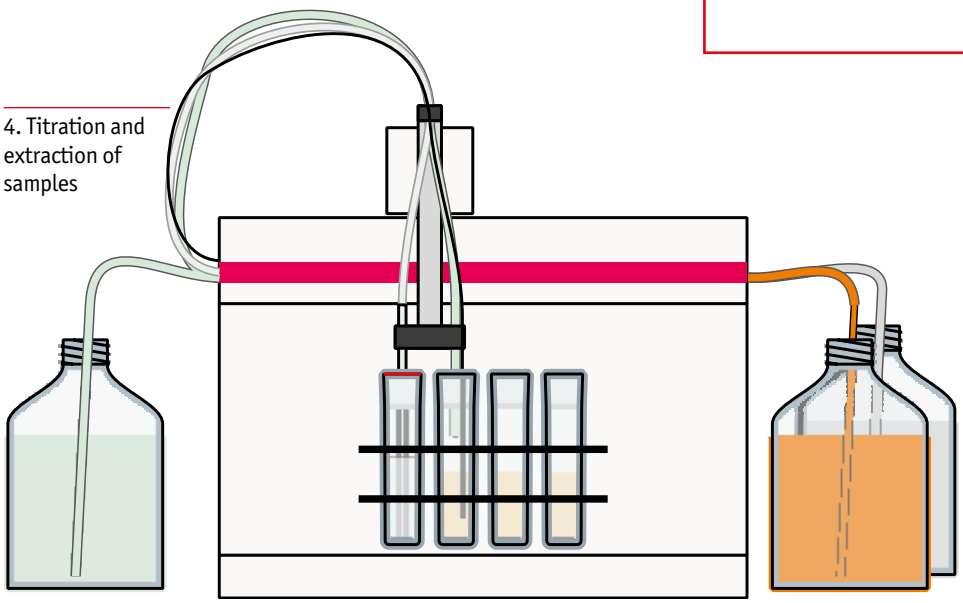
3. Sample heating

3. Sample heating

Using a handle, the rack and prepared samples are placed in the heating block. The temperature program is started and the air cooler is fitted on the sample vessels. Now, the samples are heated up for the specified time (usually this is 2 hours) to the boiling temperature of the water / sulphuric acid mixture.

4. Titration and extraction of samples

For titration purposes, the rack filled with samples is once again placed in the DT 20. Instead of the dispensing head that was used for reagent dispensing during sample preparation, the sample arm is now equipped with the titration head. It contains the titration lance and Redox electrode for end point titrations and an extraction lance for the titrated samples.



4. Titration and extraction of samples

From practice - for practice:
Special application-oriented behrotest® equipment for COD determination

KW 12/N

COD cooling trough

The cooling trough prevents excessive heating of COD samples during the critical addition of sulphuric acid. In addition, it is used for cooling the samples after the heating cycle.

Type	Product description	Art. No.
KW 6/N	Cooling trough for sample rack insert E 6/B	B00217870
KW 12/N	Cooling trough for sample rack insert E 12/B	B00217871
KW 24/N	Cooling trough for 2 sample rack inserts E 12/BV	B00217872
DOS 10	Universal dispenser for potassium chromate dispensing, 2 ... 10 ml	B00217809
DOS 50	Universal dispenser for sulphuric acid dispensing, 5 ... 50 ml	B00217810

IMR 10 CSB

COD magnetic agitator

The infinitely variable magnetic series agitator with 12 agitating positions serves to stir the samples during the dispensing process. With its water-proof encapsulation, external power supply and control, the agitator is suited for fully submerged applications.

Type	Product description	Art. No.
SM 12/N	Magnetic series agitator for sample rack insert E 12/B.	B00217875
IMR 10 CSB	COD magnetic agitator for 1 reaction vessel	B00441223

DT 30

COD dispensing hopper

COD dispensing hopper for top-mounting on COD reaction vessels facilitates simultaneous dispensing of sulphuric acid into several samples. The user fills the dispensing hopper with a standard volume of 30 ml. This can be handled far quicker than direct dispensing into the sample. Via a spindle stopcock, sulphuric acid is added to the sample drop by drop. After initial adjustment, the user can swiftly dispense sulphuric acid into a multitude of samples without time-consuming procedures.

COD dispensing hopper with cooling trough and magnetic series agitator provide for increased safety in COD determination and a significant reduction of workload.

Type	Product description	Art. No.
DT 30	Dispensing hopper, 30 ml, for sulphuric acid	B00217901

HCl absorber

- for driving off chlorine in case chloride contents are in excess of 1000 mg and COD ranges above 50 mg
- in excess of 300 mg for the 5-50 mg COD range

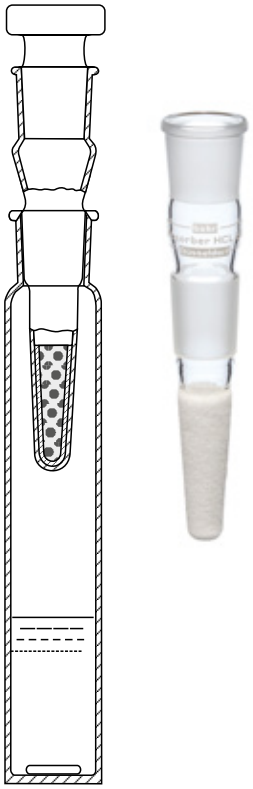
Prior to insertion into the reaction vessel, either fill the filter cartridge with absorbent material (calcium hydroxide) or soak it with distilled water. The solution is either stirred for several hours on the standalone magnetic agitator or on the magnetic series agitator with 12 positions, then to be driven off as Cl.

Type	Product description	Art. No.
HCl 29	HCl absorber for driving off chloride (no plug)	B00217890

RG 2 reaction vessel

Reaction vessel, 175 ml, with 50 and 100 ml scale marks for easy filling prior to titration. Flat bottom for improved heat transfer. With PVDF collar for insulation purposes and gentle transport in EG rack insert.

Type	Product description	Art. No.
RG 2	Reaction vessel with vessel adapters, NS 29 and 100 ml scale mark	B00217863



HCl 29 mit RG 2

COD sample rack/rack attachments

COD sample rack/rack attachments ensure safe handling of samples, protect the operator from being exposed to reaction vessels and allow transportation of samples in a TS vessel holding frame.

Type	Product description	Art. No.
E 6/B	Sample rack insert/rack attachment for COD 6/E	B00217857
E 12/B	Sample rack insert/rack attachment for COD 12/E	B00217858
E 12/BV	Sample rack insert/rack attachment for COD 24/E and automatic reagent dosing and titration DT 20	B00217859

E 12/B

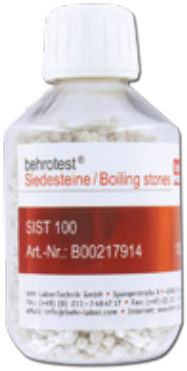
Vessel holding frame

Vessel holding frame for safe handling of RG 2 reaction vessels in EG sample rack inserts/rack attachments.

Type	Product description	Art. No.
TS 12 CSB	Vessel holding frame for sample rack insert E 6/B, E 12/B, E 12/BV	B00217894

TS 12 CSB

LS 12 with LK 1



SIST 100

CSB-PRUEF 2

Air cooler stand

Stand for safe storage of the LK 1 air cooler. Provided with rubber liners to avoid breakage of glass when placing glassware in the stand

Type	Product description	Art. No.
LS 6	Stand for 6 COD air coolers	B00217880
LS 12	Stand for 12 COD air coolers	B00217881
LK 1	COD air cooler	B00217868

Boiling stones

behrotest® boiling stones are made from ceramic material. The advantage over conventional boiling stones made of glass is that they provide optimum protection against boiling delay due to their porosity and shape, even with badly blended samples.

behrotest® boiling stones are chemically pure and guarantee unbiased results in COD analysis.

Type	Product description	Art. No.
SIST 100	Boiling stones, package content 100 g	B00217914

Accessories for COD determination

Type	Product description	Art. No.
CSB-PRÜF 2	Test unit for heating temperature control	B00696767
PTFE 29	PTFE sleeves for RG 2, SR 2 and SR 2 Q, set of 12	B00217905
MRST 2	Magnetic agitator bar set for RG, pack of 12	B00217915

DOS 50

Type	Product description	Art. No.
DOS 10	behrotest® dispenser for dosing sulfuric acid, adjustable from 2.5 to 25 ml without bottle	B00217809
DOS 50	behrotest® dispenser for dosing 30 ml of silver sulfate-containing sulfuric acid, adjustable from 5-50 ml without bottle	B00217810

Water-cooled COD units
with external controller and lift functionality

CSB/SMA 8 L

COD digestion units, 8 or 12 sample positions, with external controller and lift functionality

- Rugged metal enclosure
- Sample rack and cooler cassette made from stainless steel
- Automated and simultaneous digestion of up to 8 or 20 samples
- Programmable
- The sample rack and cooler cassette can be moved up and down independent of each other for particularly simple and safe handling
- Simple and safe sample handling due to separation of sample rack and cooler cassette
- Easily programmable thanks to "behr single-button operation "
- Menu navigation in local language.
- The unique behr COD range ensures standardised sample digestion as required by ISO 6060 etc. (148 ± 3° C in sample vessel, temperature of 148 ± 3 °C is achieved within 10 minutes)
- External controller
- When used with behrotest® AS 1 absorption vessels, the unit qualifies for aqua regia digestion of heavy metal samples

COD digestion units:

Type	Product description	Art. No.
CSB/SMA 8 L	8 sample workstations, with lifting functionality	B00541046
CSB/SMA 12 L	12 sample workstations, with lifting functionality	B00606544

IMR 10 SR

behr IMR 10 SR magnetic agitator

Inductive magnetic agitator for SR 6 COD digestion vessels with round bottom and spherical joints.

Type	Product description	Art. No.
IMR 10 SR	COD magnetic agitator for 1 SR 6 digestion vessel	B00606547

COD cooling trough

The cooling trough prevents excessive heating of COD samples during the critical addition of sulphuric acid. Moreover, it is used for cooling the samples after the heating cycle.

The trough bottoms of the KW 8/N is provided with guide groove for positioning within the SM 12/N magnetic series agitator. This ensures precise positioning of the sample vessels in their stirring positions after the sample rack is mounted in the cooling/stirring position of the multi-purpose panel at the back of the cooling trough.

If the user inserts the sample rack in the draining holder of the multi-purpose panel, the rack is slightly tilted from the vertical. This promotes better draining off of cooling water residue left on digestion vessels

Type	Product description	Order no
KW 8/N	Cooling tray with multi-purpose console and positioning guides for SM 12/N	B00606551
SM 12/N	Magnetic series agitator for sample rack insert E 12/B	B00217875

KW 8/N with DT 30 SR

DT 30 SR

Dispensing hopper with adapter cover to be used with SR 6 digestion vessel.

Type	Product description	Art. No.
DT 30 SR	Dispensing hopper with adapter cover	B00606549

KW 8/N

behrotest® HTI 5 Manual Titration Station

The HTI 5 manual titration station consists of:

- a burette with digital display,
- a magnetic agitator with a precisely fitting holder for SR 6 reaction vessels.

A screen serves as a neutral background and enables the user to precisely determine the colour change at the end of titration. This feature ensures titrations are always carried out under similar visual conditions. This way, results are more accurate and reproducible.

The precise positioning of the reaction vessel in the holder on top of the magnetic agitator also contributes to this. In addition, the laterally arranged screen panels serve as a shield from incident light from the side. COD in accordance with ISO, EN and DIN

Type	Product description	Art. No.
HTI 5	Manual titration station, with digital burette and magnetic agitator	B00645374

HTI 5

PTFE sleeves

Type	Product description	Art. No.
PTFE 29	PTFE sleeves for 30 ml extractors	B00217905
PTFE 34	PTFE sleeves for 60 ml extractors	B00602392
PTFE 45	PTFE sleeves for 100 ml and 250 ml extractors	B00217909
PTFE 60	PTFE sleeves for 500 ml extractors	B00602391
PTFE 71	PTFE sleeves for 1000 ml extractors	B00602374

Use of the behrotest® PTFE sleeve

behr Labor-Technik GmbH
Development, Manufacturing and Sale

behr Labor-Technik – more than 60 years of experience in the development, manufacture and sale of laboratory equipment. Over time, the company has grown from a small family-run business to an internationally active corporation. Today, customers all over the world appreciate the quality, reliability and practical suitability of our equipment.

Our main focus lies on the production of laboratory equipment for environmental and food analysis: behr Labor-Technik has ranked for many years among the leading German suppliers of equipment for water, waste water and sludge analysis applications. Our offer ranges from cost-effective compact equipment to fully automated workstations for standardised analyses in accordance with national and international standards (DIN/DEV, ISO/EN etc.).

Our product range is complemented by analytical instruments for the determination of organic halogens, carbon and sulphur.

Made in Germany

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ISO 9001
BUREAU VERITAS
Certification

behr Labor-Technik GmbH • Spangerstraße 8 • 40599 Düsseldorf/ Germany
Tel.: (+49) (0) 211 – 7 48 47 17 • e-mail: info@behr-labor.com
Internet: www.behr-labor.com

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