behr
Labor-Technik

# Heavy metal digestion with aqua regia

## behrotest® digestion apparatus

www.behr-labor.com

**Quality** made in Germany

# Heavy metal digestion with aqua regia

With studies on elements of environmental relevance, it is generally not the total content that is of interest but rather their maximum possible release.

That is why many rules for determining element contents in waste specify establishment of the element contents that are soluble in aqua regia or can be extracted:

These rules quote the following procedures:

- EN 13657:2003-01 Characterisation of waste – digestion for subsequent determination of the portion of elements in waste that are soluble in aqua regia
- EN 13346:2001-04 Characterisation of sludges – Determination of trace elements and phosphorus extraction methods with aqua regia

## behrotest® apparatus for heavy metal digestion

With behrotest® equipment for heavy metal digestion with aqua regia, the user can be sure of working in compliance with standards and moreover of using a very practical, safe and durable product.

The behrotest® digestion units with external controller and lift offer an extensively programmable digestion process and render time-consuming interventions by the user largely unnecessary.

The classic SMA programme from behr with purely manual operation extends from the compact apparatus for one sample through to the workstation with 12 sampling points. In each case, conical ground joints with large contact surfaces ensure an optimal seal in the glass fuming tract.

The unique behrotest® coolant distribution with parallel supply to all sampling points and practical design of all components guarantees the user analytical reliability and easy handling.

# behrotest® SMA digestion units, 8, 12 or 20 sample positions, with external controller and lift

- Stable metal housing
- Sample rack and condenser cassette in non-rusting stainless steel
- Automatic digestion of up to 8, 12 or 20 samples simultaneously
- Programmable
- The sample rack and condenser cassette can be moved up and down independently of each other, making them very easy and safe to operate.
- Easy and safe handling of the samples by separation of the sample rack and condenser cassette
- Easy to programme with the “behr one-button operation”
- Menu navigation also in your language
- External controller

## COD - Chemical Oxygen Demand (ISO 6060)

- If the user removes the AS 1 behrotest® absorption vessels, the unit is also suitable for COD digestion. To this end, the unit has the unique COD programme, which guarantees standard-compliant sample digestion in accordance with ISO 6060 etc. (148 °C in the sample vessel, 148 °C is reached within 10 minutes).

## behrotest® SMA digestion units

| Type | Product description | Art. No. |
|---|---|---|
| CSB/SMA 8 L | 8 sample positions with lift | B00541046 |
| CSB/SMA 12 L | 12 sample positions with lift | B00606544 |
| CSB/SMA 20 L | 20 sample positions with lift | B00657448 |

CSB/SMA 12 L

## behrotest® SR 6 digestion glass

Digestion glass with round base and round ground joint for use in behrotest® digestion units CSB/SMA 8 L, CSB/SMA 12 L and CSB/SMA 20 L

| Type | Art. No. |
|---|---|
| SR 6 | B00540934 |

SR 6

AS 1

## behrotest® RFK 6 ball return condenser

Ball return condenser with round ground joint for use in behrotest® digestion units CSB/SMA 8 L, CSB/SMA 12 L and CSB/SMA 20 L

| Type | Art. No. |
|---|---|
| RFK 6 | B00540933 |

## behrotest® AS 1 absorption vessel

Absorption vessel for heavy metal digestion with aqua regia, suitable for ball return condensers SFK 50 and RFK 6

| Type | Art. No. |
|---|---|
| AS 1 | B00217964 |

Compact system

# behrotest® compact apparatus for heavy metal digestion with aqua regia

Complete compact system for heavy metal digestion with aqua regia, with base frame, heating device, mounting, hoses and glass apparatus.

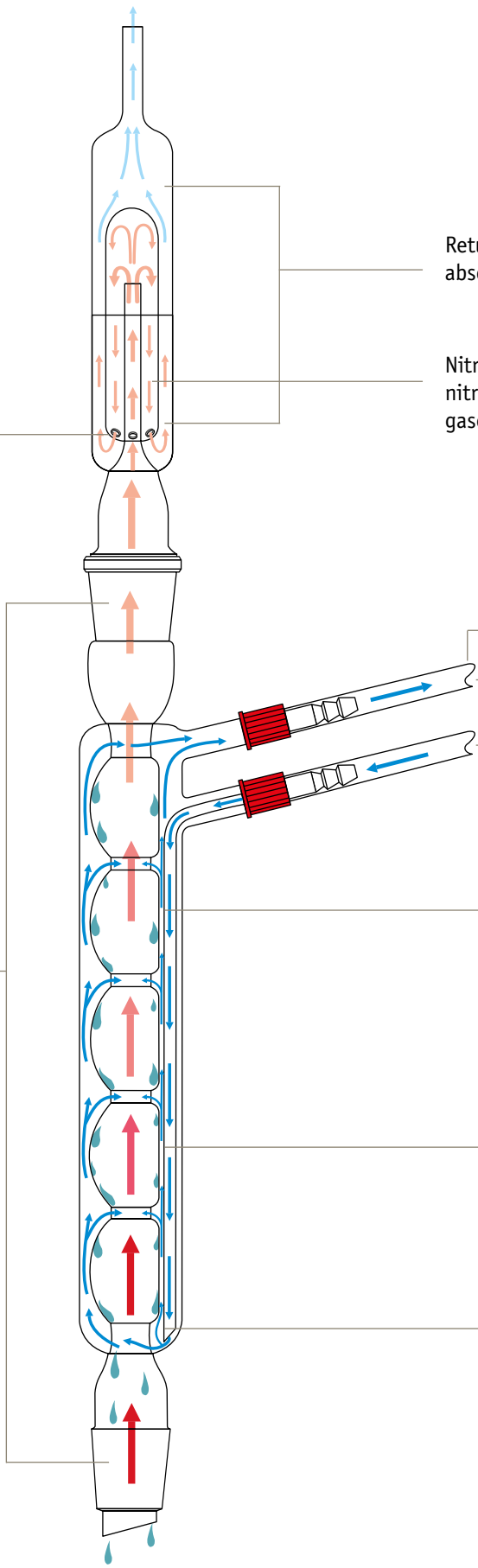
KSMA

## KSMA technical data:

| | |
|---|---|
| Voltage | 230 VAC |
| Frequency | 50/60 Hz |
| Current consumption | 3 A |
| Power consumption | 450 W |
| Weight | approx. 6.0 kg |
| Dimensions in cm (W x D x H) | approx. 23 x 33 x 80 |

| Type | Art. No. |
|---|---|
| KSMA | B00217712 |

# Optimal heavy metal digestion



Exhaust gas with no nitrous content

Return-proof absorption vessel

Nitrous acid also removes the last nitrous residues from the exhaust gases. Return protection

Openings for optimal distribution and filter effect

Coolant outlet at the highest point

Coolant connections on top: short hoses, easy handling

**Conical ground joint:**
Large contact surfaces ensure absolutely sealed connections

**Ball condenser:**
Larger surface for better cooling, simultaneously easy and thorough cleaning. Unimpeded condensate return

**Coolant intake on condenser base:**
Optimal filling and optimal cooling effect

# behrotest® workstations for heavy metal digestion with aqua regia

BASIC

SMA-ARB 6

## behrotest® SMA-ARB

The behrotest® SMA-ARB workstations offer the complete basic equipment for heavy metal digestion with aqua regia in 6 or 12 samples simultaneously.

### The components

- SMA precision heating block with 6 or 12 sampling points for round-based digestion glasses of Ø 41.8 mm, temperature range 20 to 300°C
- ET 2 external controller, temperature range 20 to 450°C, times adjustable from 10 to 999 minutes or constant heating mode
- 6 or 12 SR 2 round-based digestion glasses, 250 ml, with standard ground joint NS 29 and PVDF vessel ring
- 6 or 12 SFK 50 ball return condensers
- 6 or 12 AS 1 absorption vessels
- SG/B application/attachment frame in non-rusting stainless steel for 6 or 12 reaction vessels
- Base frame with coolant distribution and condenser holder for 6 or 12 sample positions

SMA-ARB 12

### Technical Data:

| | SMA-ARB 6 | SMA-ARB 12 |
|---|---|---|
| Weight: | approx. 30 kg | approx. 39 kg |
| Dimensions in cm (W x D x H): | approx. 45 x 65 x 100 | approx. 45 x 65 x 100 |

| Type | Product description | Art. No. |
|---|---|---|
| SMA-ARB 6 | For heavy metal digestion with aqua regia in a maximum of 6 samples simultaneously. Basic equipment | B00218411 |
| SMA-ARB 12 | For heavy metal digestion with aqua regia in a maximum of 12 samples simultaneously. Basic equipment | B00218412 |

# behrotest® SMA-ARM

The behrotest® SMA-ARM workstation is equipped with a programmable, microprocessor-governed controller and a hood to collect the nitrous gases. For the user, this means greater ease of use and functionality in the everyday life of a laboratory.

## As SMA-ARB 12 but

- TRS 300 external microprocessor-governed temperature and time control unit instead of the ET 2 controller, temperature range 20 to 399°C, times adjustable from 1 to 999 minutes, comparison of target and actual temperature/time during digestion, up to 10 freely programmable temperature-time levels prevent foaming of samples.

## Plus

- PTFE sleeves for glass components
- SG/B application/attachment frame in non-rusting stainless steel for 6 or 12 reaction vessels
- TS transport stand for sample preparation and sample transport
- Base frame with coolant distribution and condenser holder for 6 or 12 sample positions
- Hood AH 6-SMA or AH 12-SMA for deriving the nitrous gases from 6 or 12 samples, with the option of connecting a suitable suction and cleaning unit (e.g. AFR2)
- If the user removes the AS 1 behrotest® absorption vessels, the unit is also suitable for COD digestion. To this end, the unit has the unique COD programme, which guarantees standard-compliant sample digestion in accordance with ISO 6060 etc. (148 °C in the sample vessel, 148 °C is reached within 10 minutes).

COMFORT

SMA-ARM 12

## Technical Data:

| | SMA-ARM 6 | SMA-ARM 12 |
|---|---|---|
| Weight: | approx. 35 kg | approx. 44 kg |
| Dimensions in cm (W x D x H): | approx. 45 x 65 x 100 | |

| Type | Product description | Art. No. |
|---|---|---|
| SMA-ARM 6 | for heavy metal digestion with aqua regia in a maximum of 6 samples simultaneously. Microprocessor-governed controller | B00218413 |
| SMA-ARM 12 | for heavy metal digestion with aqua regia in a maximum of 12 samples simultaneously. Microprocessor-governed controller | B00218414 |

# Temperature and time controllers for heavy metal digestion

BASIC

## behrotest® ET 2 temperature and time controller

### Controller for behrotest® precision heating blocks

Connection of consumers up to 2200 W via an integrated appliance socket. Temperature of 20... 450 °C digitally adjustable with a membrane keypad. PID controller with anti-drift controller. Time adjustable at 1... 999 minutes or constant heating.

### Technical Data ET 2

| | |
|---|---|
| External dimensions in cm (W x H x D) | approx. 14.0 x 10.0 x 27.0 with fold-out front feet approx. 14.0 x 13.5 x 27.0 |
| Weight | approx. 1.7 kg |
| Voltage | 220 V/50 Hz, max. 2200 W |
| Switching capacity | max. 2200 W resistive load |
| Connection of heating devices | Power supply socket on the back of the device (four-pole special plug with screw closer) |
| Measuring sensor | PT 100 – three-wire circuit, connection via three-pole diode plug with screw connection |
| Control performance | PID with anti-drift controller |
| Temperature control range | 20 – 450 °C, digitally adjustable in stages of 1 °C |
| Control accuracy | ±1 K |
| Time adjustment range | 1 – 999 min, digitally adjustable with no limit in stages of 1 min (constant heating) |

ET 2

| Type | Product description | Art. No. |
|---|---|---|
| ET 2 | Temperature and time controller, microprocessor-governed | B00217814 |

### Programmable controller for behrotest® precision heating blocks

# Programmable TRS 300 temperature and time controller

COMFORT

behr one-button operation for very easy and quick programming. Menu navigation in local language. 10 freely configurable programmes for block temperature and digestion time for digestion of samples that are foaming slightly.

Integrated safety functions switch off the connected devices in the event of a short circuit and interruption of the temperature sensor.

## Technical Data TRS 300

| | |
|---|---|
| Dimensions in cm (W × D × H)<br>Unit height with handle | approx. 15.0 x 17.5 x 32.0<br>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<br>(4-pole special plug with screw coupling) |
| Sensor | PT 100 – three-wire circuit,<br>connection via three-pole diode plug |
| Temperature control range | 0 – 450 °C, digitally adjustable |
| Zeiteinstellbereich | 1 – 999 min, digitally adjustable |
| Programs | 11 (with default COD program) |
| Display | LCD |

| Type | Product description | Art. No. |
|---|---|---|
| TRS 300 | Temperature and time controller, microprocessor-controlled unit, option of programming up to 10 temperature-time profiles | B00217820 |

TRS 300

# Precision heating blocks and accessories for heavy metal digestion

SMA 6

SMA 12

## behrotest® SMA precision heating blocks for heavy metal digestion with 6 or 12 sample positions

- Panel heating for very even temperature distribution to all sample positions
- Housing in powder-coated steel and non-rusting stainless steel
- The extensive insulation of the heating block ensures harmless temperatures on the surface of the housing.

### Technical Data:

| | SMA 6 | SMA 12 |
|---|---|---|
| Sample positions: | 6 | 12 |
| Maximum temperature: | 299 °C | 299 °C |
| Power consumption: | 800 W | 1500 W |

| Type | Product description | Art. No. |
|---|---|---|
| SMA 6 | Precision heating block thermostat for 6 reaction vessels, 20... 299 °C | B00217838 |
| SMA 12 | Precision heating block thermostat for 12 reaction vessels, 20... 299 °C | B00217840 |

# behrotest® SG 6/B and SG 12/B application/attachment frames

behrotest® application/attachment frames with 6 or 12 sample positions, suitable for the SMA precision heating blocks for heavy metal digestion

The behrotest® SG 6 B und SG 12 B application/attachment frames are made of non-rusting stainless steel.

They offer safe holding of the behrotest® reaction vessels of type SR and allow safe insertion of the samples into the behrotest® SMA precision heating blocks for heavy metal digestion. The application/attachment frames ensure safe sample handling – the user does not come into contact with the reaction vessels – and allow transport of the samples in the TS transport stand.

| Type | Product description | Art. No. |
|---|---|---|
| SG 6/B | behrotest application/attachment frame for 6 vessels in the SMA block | B00218006 |
| SG 12/B | behrotest application/attachment frame for 12 vessels in the SMA block | B00218008 |

SG 6 B

SG 12 B

# behrotest® TS 12/SM transport stand

Stand for safe transport of the SR reaction vessels into the SG application/attachment frames

| Type | Product description | Art. No. |
|---|---|---|
| TS 12/SM | Transport stand for SG 6 B and SG 12 B application frames | B00217999 |

TS 12 SM

SMA

## Parallel supply to the individual condensers through coolant distribution

## An easily removable plastic tub in the support panel

# behrotest® coolant distributions

behrotest® coolant distributions KV 6-N and KV 12-N are made of corrosion-resistant, powder-coated stainless steel.

They offer the user the following advantages in the everyday life of a laboratory:

- In contrast with series supply to several condensers connected in series, parallel supply to the individual condensers with the behrotest® coolant distribution ensures absolutely even cooling in all sample positions.
- The stable base plate ensures safe positioning of the behrotest® precision heating block.
- After digestion, the condensers find safe positioning in the practical support panel, and the user has unimpeded access to the samples.
- Plastic holders in the support panel protect the condenser bases from breaks and splintering.
- An easily removable plastic tub in the support panel catches any condensate that drips from the condensers.

| Type | Product description | Art. No. |
|---|---|---|
| KV 6-N | behrotest® coolant distribution for precision heating block SMA 6 | B00619618 |
| KV 12-N | behrotest® coolant distribution for precision heating block SMA 12 | B00619621 |

KV 12-N

# behrotest® extraction hood AH 6-SMA, AH 12-SMA and AH 20-SMA

| Type | Product description | Art. No. |
|---|---|---|
| AH 6-SMA | behrotest® PVC extraction for 6 places | B00645376 |
| AH 12-SMA | behrotest® PVC extraction for 12 places | B00645377 |
| AH 20-SMA | behrotest® PVC extraction for 20 places | B00728324 |

AH 6-SMA

AH 12-SMA

# behrotest® suction unit AF 1000

With connection option to AH 6-SMA or AH 12-SMA for discharging the nitrous gases into the neutralization collection bottle.

| Type | Product description | Art. No. |
|---|---|---|
| AF 1000 | behrotest® suction unit with membrane vacuum pump, 1 L collection bottle and hoses | B00800249 |

AF 1000

# behrotest® SR 2 digestion glass

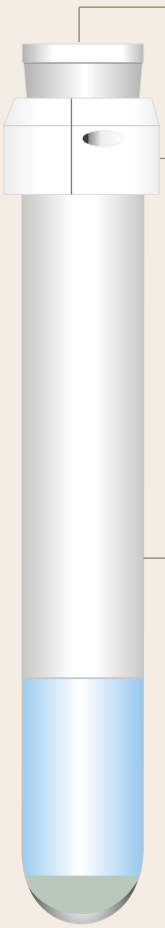
Digestion glass with round base and conical ground joint for use in behrotest® SMA precision heating blocks SMA 6 and SMA 12

A PVDF vessel ring ensures safe holding in the SG application/ attachment frame and protects the user from burns.

behrotest® digestion glasses are produced with very low tolerances and guarantee an optimal temperature transition into the behrotest® precision heating blocks.

| Type | Art. No. |
|---|---|
| SR 2 | B00217946 |

## behrotest® SR 2 digestion glass:



**Conical ground joint:**
Large surface, safe and absolutely sealed connection with the ball condenser

**PVDF vessel collar**
1. Safe holding of digestion vessels in the SG application/ attachment frame

2. Insulates and protects the user from burns

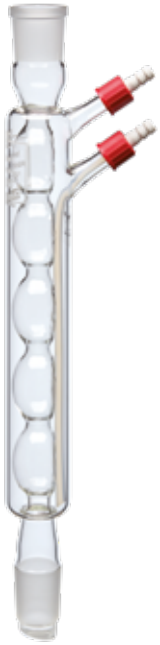
3. No constrictions or bulges in the vessel wall that could result in contamination or incorrect findings

**behrotest® digestion glasses** are produced with very low tolerances and guarantee an optimal temperature transition into the behrotest® precision heating blocks.

# behrotest® SFK 50 ball condenser

Ball return condenser with conical ground joint for use in behrotest® SMA precision heating blocks SMA 6 and SMA 12

| Type | Art. No. |
|---|---|
| SFK 50 | B00217957 |



SFK 50

# behrotest® absorption vessel AS 1

Absorption vessel for heavy metal digestion with aqua regia suitable for ball return condensers SFK 50 and RFK 6

| Type | Art. No. |
|---|---|
| AS 1 | B00217964 |

AS 1

# behrotest® PTFE sleeves

SMA

| Type | Product description | Art. No. |
|---|---|---|
| PTFE 29 | PTFE sleeves for RG 2, SR 2 and SR 2 Q, set for 12 pieces | B00217905 |

## Use of the PTFE sleeve

# USEFUL INFORMATION:

If you operate a KSMA or SMA-ARB workstation with no AS 1 absorption vessel, you have a reflux distillation apparatus that can be used universally.

Made in Germany

260201

ISO 9001
BUREAU VERITAS
Certification

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